



Manufacturing Execution System

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# Welcome to Manufacturing and Execution System (MES) 2023

AVEVA Manufacturing Execution System (MES) enables manufacturers to optimize production procedures. It provides real-time access into production activities, allowing companies to see and manage production procedures and make data-driven decisions.

MES is composed of a number of modules that interact to gather and process data from diverse production environment sources, such as production equipment, sensors, and employees. The performance, quality, and efficiency of the production process are then examined using this data. Operations Management, Quality Management, Performance Management, and Maintenance Management are key MES modules.

- **Operations Management** — Offers real-time visibility into production activities. It helps producers keep an eye on and manage manufacturing processes and make decisions on the information obtained.

The module has features for labor management, recipe management, material monitoring, and production scheduling. In addition, it offers up-to-date data on quality problems, machine downtime, and production status. It enables manufacturers to streamline their production procedures, cut down on waste and downtime, and boost productivity.

- **Quality Management** — Offers resources for organizing quality assurance procedures, monitoring flaws, and studying quality data. Supported activities include everything from the inspections of raw materials through to the testing of the completed product.

The module enables producers to monitor and manage quality throughout the production process and provides real-time quality data so that producers can see quality problems and address them promptly. This allows manufacturers to maintain consistent product quality via quality management, minimize scrap and rework, and adhere to industry norms and rules.

- **Performance Management** — Assists manufacturers in finding manufacturing process bottlenecks and inefficiencies.

The module gathers and evaluates information on production efficiency, including cycle times, equipment downtime, and Overall Equipment Effectiveness (OEE). It provides manufacturers real-time access into production performance, allowing performance tracking and enabling prompt response and correction. This allows producers to maximize equipment utilisation, decrease downtime, and boost throughput and productivity using performance management.

- **Maintenance Management** — Assists manufacturers in improving their maintenance operations.

The module offers resources for planning maintenance projects, monitoring maintenance progress, and studying maintenance information. It supports the management of predictive, corrective, and preventive maintenance tasks. It provides access to real-time data on equipment status and upkeep requirements, allowing producers to efficiently plan and complete maintenance tasks. This allows producers to optimize maintenance resources, save downtime, and prolong the life of their equipment.

## Legal information

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# Install and Configure MES

As a Manufacturing and Execution System (MES) installer, you are responsible for the installation and initial configuration and deployment of the product. You work with the administrator to prepare the system for the first implementation of the MES as well as implementing upgrades and hotfixes to the product.

## Deploy

When implementing a Manufacturing Execution System (MES) solution you should consider the following topics prior to installing the product:

• <a href="#">General Server Requirements</a>	Software and hardware configurations supported by and required by MES.
• <a href="#">Components of an MES Solution</a>	Description of the components that can be included in an MES solution.
• <a href="#">Designing an MES Solution</a>	Description of the recommended topology of an MES solution.
• <a href="#">MES Backup and Recovery Strategy</a>	Description of historical backup and recovery strategies for an MES solution.

## Getting Started

The information in this manual provides guidance to help you deploy a Manufacturing Execution System (MES) (MES) solution.

The guide includes:

- Typical server topologies for different scenarios
- The roles of different servers and what should be running on each
- Sizing recommendations
- Server configuration best practices
- Scalability and redundancy considerations

One of the main differences between this document and the *MES Installation Guide* is that this document provides guidelines on how to architect your system while the *MES Installation Guide* describes how to install it.

For a complete listing of the MES documentation library, see the Readme file that is provided with the current version of the software or go to the MES page of the [AVEVA Wonderware Knowledge and Support Center](#).

## System Sizes Referred to in This Guide

Throughout this guide, guidelines and configuration information for small, medium, and large system sizes are referred to.

However, to simplify the discussion, this guide focuses on a medium-size system that has been qualified to determine the performance levels that could be achieved. Key configuration parameters for the various MES servers are provided for medium-sized systems similar to this performance-qualified system.

The qualification testing methods and the performance results for the performance-qualified system are provided in [A Performance-Qualified Medium-Size System](#) and Performance Test Results. This performance information can assist you with determining the system configuration parameters that you would choose to deploy an MES system that meets your performance requirements within the system resources that are available to you.

## General Server Requirements

Complete system requirements for the current MES release are available in the MES Readme file, which is included with the MES installation software. The Readme file is also available on the Global Customer Support website.

### To access a copy of the Readme file on the Global Customer Support website

1. Log in to the [AVEVA Wonderware Knowledge and Support Center](#).
2. Go to the Product Hub page.
3. On the Product Hub page, use the filter to list the MES documents, which will include the Readme file for the current release.

## CPUs

The CPU is one of the most important determinants of performance. The following are guidelines associated to choosing the correct CPUs:

- Validate the Operating Systems (OS) restrictions on the number of CPUs.  
For CPU restrictions for current Windows releases, see the Memory Limits for Windows and Windows Server Releases page on the Microsoft MSDN web site.
- Validate the Microsoft SQL Server database software licensing restriction on the number of CPUs
- The CPU performance target is to have less than 30% average CPU usage. CPU usage is based on 100% – (% Idle Time). For example, if the % Idle Time = 75%, then CPU usage is considered to be 25%.
  - If you take the CPU Time for Idle Process and divide by the running time of the machine, you will get the average percent idle time. The average CPU usage is just 1 minus the average idle time.
- For the CPU Time you can use Task Manager:
  - Select Processes > View menu > Select Columns.
  - Choose the CPU Time column.

## Memory

For memory requirements, refer to the Readme file that is provided with the current version of the MES software. See System Requirements in the MES Readme File.

On a running system, there should be at least 30% available memory. Use a performance monitor to track memory usage over time to detect possible problems with memory usage.

On the database server, SQL Server has configuration options to limit the maximum amount of memory it can consume. The database server will be the largest consumer of memory in a MES solution. See the SQL Server documentation to learn about limits based on the version being used. SQL Server might require its own node without any other applications running on it for larger systems or if IT has such a requirement.

## Hard Drives

Proper planning of hard drive architecture will help to maintain performance and prevent unnecessary outages. There are performance counters available for monitoring disk usage and disk performance. These can be used to determine if the disk is being heavily used, which might cause slower overall system performance.

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**Note:** To properly plan the hard drive architecture, you should have a basic understanding of RAID (Redundant Array of Independent Disks; see the RAID entry on Wikipedia.

---

The following are guidelines:

- Separate the operating system (OS) and program files from the data and backups. The following table shows the recommended configuration for each.

Drive	Used for	Type	RAID
C:	OS and program files	Internal	1 (mirrored)
D:	Database files	External	1+0 (or 10), or 0+1 or 5
E:	Backup	External	RAID is typically not used on a backup drive

- To aid the performance for systems that require a large amount of data be stored for long periods of time or have a high number of MES transactions, you might consider placing the Logs and TempDB on a separate array of disks (RAID 0, 5 or 10).
- For database drives, it is recommended to use RAID 1+0 (sometimes called RAID 10). RAID 5 is also an acceptable approach; however, RAID 10 is recommended as its benefits outweigh the additional costs.
- External storage units are recommended [SAN (storage area network) or SATA (Serial Advanced Technology Attachment)] for everything but the OS. External storage also supports a clustering design if needed in the future.
  - Hardware-based RAID arrays (not software) should be used, with all drives being hot-swappable.

## MES Networks

Conceptually, the MES network comprises the following network types:

- Controls network
- Plant Production network
- Business network
- Corporate wide area network (WAN)

Not every plant will have these network distinctions, and the separation between the networks will vary from site to site and company to company.

The following topics describe each of these networks. It is important to understand the reasons for these network distinctions so that you know how to design the MES solution. See [Designing an MES Solution](#) for example topologies with these network types identified.

## Controls Network

The Controls network contains all machine controllers [PLC (programmable logic controller), DCS (distributed control system), SCADA (supervisory control and data acquisition), etc.]. It might contain several segments distributed throughout the plant and it is not necessarily an Ethernet network.

This network allows separation of the controls system from the rest of the network for security and bandwidth issues. It is characterized by a high volume of traffic, usually more or less constant.

Access to this network is strictly controlled. Generally, supervisory control systems (InTouch) or MES clients should not be on the Controls network. However, the Operation Integration Servers (OIS) should be on the Controls network. The OIS must also be able to connect to your Application Server.

## Plant Production Network

The Plant Production network is the main MES network. It will host or provide access to all MES servers. Also the direct access clients (Engineering station, Supervisor station, and Operator stations) usually will be on this network.

This network allows controlled access to the shop floor systems. Office users are not on this network, as they might download large files that could interfere with data acquisition or access to the system. This network is characterized by relatively few clients, controlled access, and moderate traffic. It is usually on the Internet but might have some restrictions.

## Plant Business Network

The Plant Business network is the main network for most non-direct production staff. Some users will require access to the MES Report Server. See [Network Interconnections](#) for different methods of providing access. In some circumstances, the Engineering Stations and Supervisor Stations will be on the Plant Business network.

This network is characterized as open, with many clients and varying traffic loads that might cause it to be slow at times. It is usually placed on the other side of the firewall from the Production network. It might be part of the corporate WAN with or without a firewall.

## Corporate Wide Area Network (WAN)

The Corporate WAN is distinguished by its physical location, which is usually off site but connected through a direct or dedicated line. The ERP (enterprise resource planning) system (e.g., SAP) will reside on the Corporate

WAN or Business network. The Database Server (for the ERP interface) requires access to it, usually through the firewall.

The Corporate WAN is characterized by a slower connection. However, it is generally a stable and reliable connection.

## Network Interconnections

Assuming your MES servers are all on the Plant Production network, the following servers will require access to servers outside this network:

- Database Server: Plant Business Network or Corporate WAN for the ERP interface
- Application Server/OI Servers: Controls the network for the PLC data acquisition
- Database Server: Plant Business network or Corporate WAN for user reports access

Getting data outside your domain or on a different network might cause issues related to crossing the firewall and users rights on both networks.

The basic idea is to have the server placed on the network where it is most used and have a router that connects the network or network segments. This router would allow cross network communications while isolating traffic and limiting access based on configuration.

## Typical Deployment Options

Four typical network interconnect solutions using the Report Server are provided here as examples.

The office users need access to the Report Server from the Plant Business network. The Report Server requires access to the Database Server (on the Plant Production network) to get the data for the reports.

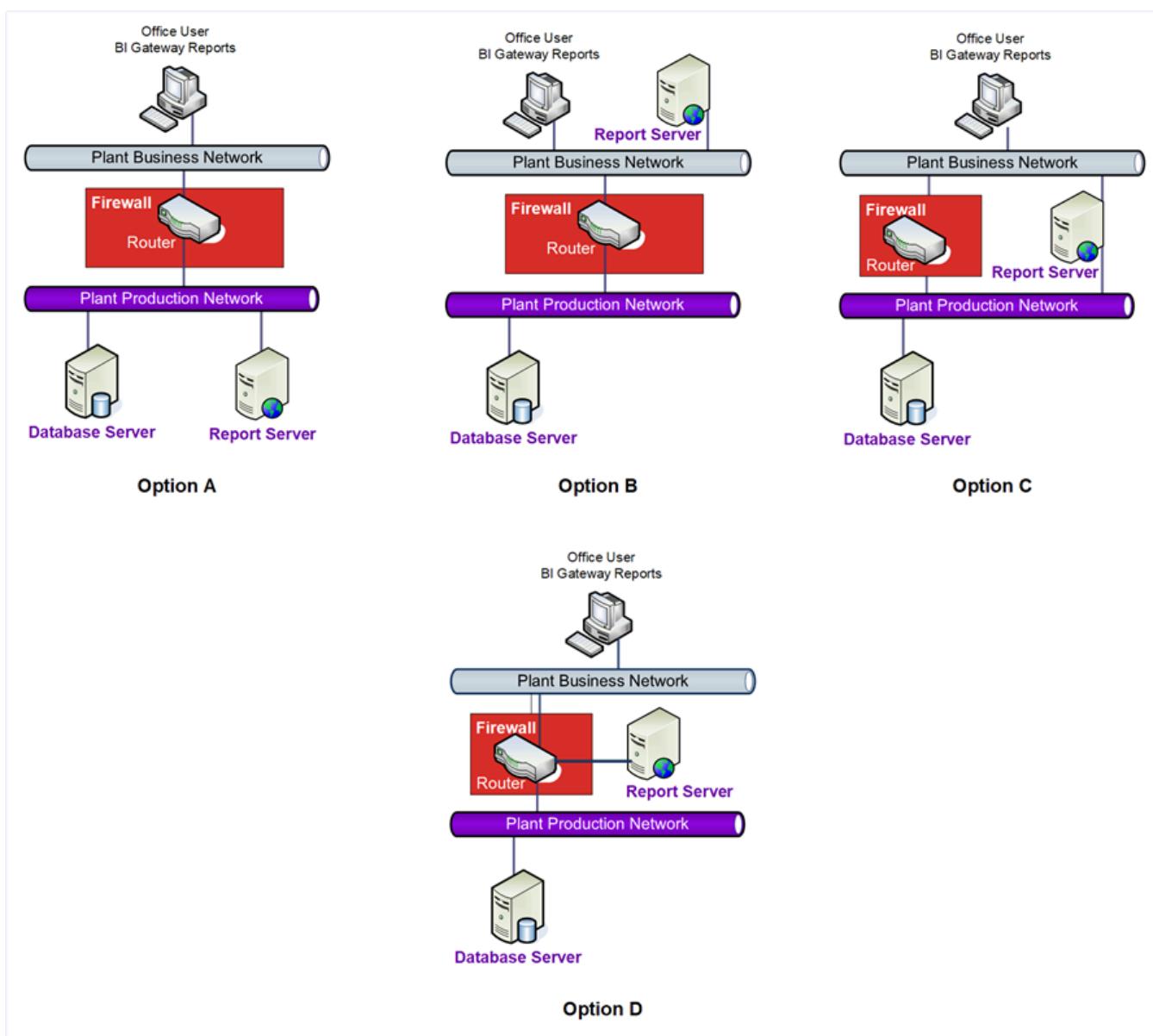
- Place the Report Server on the Plant Production Network. The networks are connected via a router that is configured to isolate traffic to its own subnet while allowing communication to devices on other subnets based on configuration. This may simply consist of opening access to port 80 of the Report Server.

**Note:** To achieve better system performance, set up an Archive/Report server rather than have Reporting run directly from the Production database.

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- For the link between the Application Server and the PLC, a smart switch can be used. It connects to the router and allows configuring a virtual network where traffic between servers connected to the smart switch is performed directly without being broadcast on the main Plant Production backbone.
- Setup the Report Server on the office network and provide access to the Database Server. This might require communication between the Database Server and the Report Server through the firewall. Other access might be needed if other AVEVA server features are used (such as viewing InTouch graphics). The following are some typical approaches to support the Report Server communication:
  - Dual network cards in the Report Server (however, this might violate security policies).
  - Placing the Report Server in a DMZ between the Business network and the Production network [for information about a network DMZ, see *DMZ (computing)* in Wikipedia]. A DMZ separates the server from the two networks that need to be separated from each other for security reasons. This will allow communication to occur from the Business network to the Report Server and from the Production network to the Report Server, but not between the Business network and the Production network. Routers that include firewalls with multiple ports are commercially available.

The following figure illustrates the four network deployment approaches.



## Network Security

Anti-virus software has been known to interfere with MES.

Make sure you follow the recommendations regarding anti-virus software defined in the antivirus topics in the Readme and *System Platform Installation Guide* that are provided with the current version of System Platform.

## Operating System Requirements

For information about operating system requirements, see the System Requirements section in the Readme file that is provided with the current version of the MES software.

## Supported Databases and Database Requirements

For information about the supported databases and their requirements, see the System Requirements section in the Readme file that is provided with the current version of the MES software.

## Compatibility with Other AVEVA Products

For information about compatibility with other AVEVA products, see the Product Compatibility section in the Readme file that is provided with the current version of the MES software.

## Virtualization and High Availability

For guidelines on how to configure a MES system that supports virtualization and high availability, see the *MES Virtual Implementation Guide*.

## Documenting the Installation and Change Control

During the installation procedure and as changes and patches or hotfixes are added to the system, it is important that you keep good records.

The spreadsheet shown on the following page is an example of an installation and change control record. Note how it identifies all major software components and identifies where they are installed.

It is also important to document any AVEVA hotfixes or patches that are installed. These typically do not appear in the Windows Add/Remove Programs Control Panel dialog box.

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**Note:** Having complete installation records will help ensure that the components that are installed on your system are communicated to support engineers when troubleshooting problems or when determining whether a new hotfix that is being requested is compatible. For MES, most hotfixes as well as the current version information is stored in the db\_status table.

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This spreadsheet is intended to be used with the system topology diagram to provide a complete picture of the system. For an example of a system topology diagram, see [Typical Medium-Size Plant](#).

Any one of these servers can be duplicated to scale out the solution. For example, there are often two database servers with one dedicated to the production databases and one for reporting databases. Other examples include a second Work Task Server for load balancing or multiple servers of the same type for load balancing.

The key to the servers listed in the columns is shown below.

- DB: Database Server
- AS: Application Server for System Platform-related software
- TS: Terminal Server for client applications
- WT: Work Tasks Server
- WEB: Web Server
- DEV: Development machine

Software	Version	DB01	AS01	TS01	WT01	WEB01	DEV01
Windows Components							
Windows Server	<insert version number>	X	X	X	X	X	
Windows							X
Terminal Server/ Licensing Server		X		X			
Activate Windows Licensing		X	X	X	X	X	X
IIS (Internet Information Services)						X	
.NET Framework		X	X	X	X	X	X
Microsoft Message Queuing			X			X	
Additional Microsoft Software							
Microsoft Office							X
Microsoft SQL Server		X					X
Microsoft SQL Server - Reporting Services Standard		X					
SharePoint						X	
AVEVA Software							
System Platform IDE							X

<b>Software</b>	<b>Version</b>	<b>DB01</b>	<b>AS01</b>	<b>TS01</b>	<b>WT01</b>	<b>WEB01</b>	<b>DEV01</b>
Application Server Galaxy Repository (GR)							X
Application Server Boot strap			X		X		X
System Management Server [supports AVEVA Identity Manager (AIM)]			X				
OMI (Operations Management Interfaces) and InTouch TSE				X			
OMI and InTouch Failover System TSE				X			
Historian and its Runtime database		X					X
MES Database		X					X
MES Middleware		X	X		X	X	X
MES Middleware Proxy		X	X	X	X	X	X

<b>Software</b>	<b>Version</b>	<b>DB01</b>	<b>AS01</b>	<b>TS01</b>	<b>WT01</b>	<b>WEB01</b>	<b>DEV01</b>
MES Reports		X					X
MES Client and applications				X			X
MES Web Portal						X	
Work Tasks Engine					X		
Work Tasks Enterprise Console						X	
Work Tasks Farm and repository databases		X					
Work Tasks Extension and Connector for MES					X		
MES model-driven application content					X	X	
Rabbit MQ and AMQP (Advanced Message Queuing Protocol)					X		
BI Gateway						X	
BI Gateway Database		X					
Enterprise Integration		X				X	

Software	Version	DB01	AS01	TS01	WT01	WEB01	DEV01
Operation Integration (OI) Server for communication with Programmable Logic Controllers (PLCs)			X				
License Server (can be located on any node except DEV01)							NO
License Manager (can be located any node, except DEV01, that has external Internet access to the AVEVA Activation Server)							NO

## Components of an MES Solution

The components that can be included in an MES solution are described here.

### Standard Hardware

For each of the servers, standard hardware is recommended in the Server topics in this chapter based on the following load:

- Operations and Performance on 50 lines or machines (pieces of equipment), each with 2 application objects (100 MES application objects total)

- Utilization events are generated at a rate of 1 event per minute per machine
- OEE is calculated for each machine
- 1 job is created per hour per machine
- Inventory is received once per hour per machine
- 1 item consumption event and 2 item production events are generated each minute for each machine
- Discrete production is being collected

This standard hardware recommended here is just a guideline to help with purchasing decisions for new equipment. As each site is different, care must be taken to allow for expansion as needed.

Either Windows Server Standard or Data Center can be used.

## Production Database Server

The Production Database Server is usually the most critical server relating to performance in an MES System.

The Production Database Server holds the MES database and is the central repository for the MES data. The MES database is supported on SQL Server. The Production Database Server, especially in large implementations, should be dedicated to MES due to high transaction volumes. There should be no ERP databases, etc. on the same server.

If you are going to use virtualization software for your Production Database Server, make sure you size it appropriately for the additional overhead that virtualization brings.

## Key Parameters

The following table describes the recommended key parameters to use for the Production Database Server in a medium-size system. For an example of a medium-size system, see [Typical Medium-Size Plant](#).

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"><li>• 64 GB RAM</li><li>• 1-TB Disk RAID 10 for data. The amount of disk space necessary depends on the frequency of data collected (number of work orders, operations, production quantities, etc.) and the amount of data kept online in the Production database.</li></ul>
Microsoft Components	<ul style="list-style-type: none"><li>• Microsoft Distributed Transaction Coordinator</li></ul>
MES Components	<ul style="list-style-type: none"><li>• MES database</li><li>• MES Middleware Proxy</li><li>• MES Middleware, if Enterprise Integration or Supply Chain Connector (SCC) databases are</li></ul>

Parameter	Comments
	installed
Other AVEVA Components	<ul style="list-style-type: none"><li>• Work Tasks Farm and repository databases</li><li>• Historian Runtime database</li><li>• Enterprise Integration or Supply Chain Connector (SCC) databases</li><li>• Recipe/Batch Management databases</li></ul>
Scalability	<ul style="list-style-type: none"><li>• Try to keep the Database Server on one machine, if possible.</li><li>• Take the following steps to improve server performance:<ul style="list-style-type: none"><li>• Add additional memory. The memory on a Database Server is not linear and at a certain point adding more memory will not help.</li><li>• Add additional CPUs. The CPU usage is most significantly based on the number of transactions, which is usually related to the number of users. If CPU performance is affected and there are many users connected, then increasing the number of CPUs will help. If the CPU is limited by large transactions then adding additional CPUs may not help.</li><li>• Move the MES middleware, Work Tasks Farm and repository databases, and Historian Runtime database to other servers.</li><li>• Use Database Cluster technology.</li></ul></li><li>• To accommodate these potential performance solutions, use a server whose CPUs and memory are expandable, and use the Enterprise edition of SQL Server.</li><li>• Weekly or monthly, monitor the database for index and table fragmentation. Fragmentation levels greater than 30% will cause performance degradation.</li></ul>
High Availability/Fault Tolerance	<p>Recommended with:</p> <ul style="list-style-type: none"><li>• Windows fail-over cluster</li></ul>

Parameter	Comments
Key Measures	<ul style="list-style-type: none"> <li>• CPU usage &lt; 30%</li> <li>• Memory stable with 1 GB free</li> </ul>
Data Storage Requirements	<ul style="list-style-type: none"> <li>• C: OS: 80 GB available RAID 0.</li> <li>• D: Data: 300 GB available RAID 10.</li> <li>• E: Backup: 300 GB, no RAID.</li> <li>• Optional: You can keep the logs and tempDB on a separate physical disk to improve performance.</li> <li>• F: Logs: 40 GB available RAID 10. Monitor the transaction log file to ensure that it is not constantly growing, which can be a sign of missed backups or other issues.</li> </ul>
Other Databases	<p>The Production Database Server typically runs the following databases.*</p> <ul style="list-style-type: none"> <li>• MES database</li> <li>• Work Tasks Farm and repository databases</li> <li>• Historian Runtime database</li> <li>• Enterprise Integration databases</li> </ul> <p>In a typical solution, it does not run the following:</p> <ul style="list-style-type: none"> <li>• Galaxy repository databases</li> <li>• BI Gateway database</li> <li>• ReportServer database</li> </ul>

\* Ideally, these databases should be run on their own server. However, in practice, if the Historian Runtime database is being used only for MES, then it can be run on the Production Database Server. The Work Tasks databases should be separated in an implementation with many workflow transactions.

## Database Disk Space Requirements

The volume of transactions that occur on a daily basis at any one site should be considered when estimating the amount of disk space that will be required for the databases.

Tables that hold the system configuration, items, processes, bills of material, and so on can be considered static after doing the initial setup and load of process-related data.

Tables that hold work orders, jobs, labor, production, consumption, and so on can be considered dynamic in that they will continue to grow based on the number of transaction that occur on a daily basis.

To determine initial and growth requirements for disk space:

- Estimate the amount of data required to build a system for production go-live.

- Estimate the amount of daily transactions.

Consideration should be given to the number of days that historical job data is required to remain in the database. With archiving implemented, closed work orders and all related data can be moved to an off-line database for reporting purposes. Archiving will ensure that the performance of the production system does not decline over time due to a buildup of historical data in the Production database.

Instead of trying to plug all these factors into an equation, it is recommended that you start with a moderate-size system (say 300 GB of free space) and monitor the data growth. A typical setup would have one year of on-line data in the MES database.

After you have created or migrated the database, it is recommended that you adjust the file sizes. Observe the following guidelines when adjusting the file sizes:

- Large files should be created when the disk is clean so that the file is stored on contiguous sectors.
- Choose an initial file size that is the expected size when the database is fully loaded. For example, if the expected size when fully loaded is 200 GB, then set the initial size to 200 GB.
- For the default 10% growth, you might consider changing to an absolute growth of, say, 1024 MB.
- Make sure that these files are on your Data drive; they should never be on the C: drive.

The following table shows an example of the MES database file sizes for SQL Server.

File Group	File Type	Initial Size	Auto Growth
FI_Primary	Data	100 MB	100 MB
FI_Data	Data	100 MB	100 MB
FI_Data_2	Data	100 MB	100 MB
FI_Index	Data	100 MB	100 MB
FI_Index_2	Data	100 MB	100 MB
FI_Large	Data	102400 MB	1024 MB
FI_Large_Index	Data	51200 MB	1024 MB
<b>Simple Recovery Mode</b>			
FI_Log	Log	100 MB	100 MB
<b>Full Recovery Mode</b>			
FI_Log	Log	10240 MB	1024 MB

This setup uses about 150 GB (160 GB for Full Recovery Mode) of disk space. You can always use the Disk Usage report provided within SQL Server Management Studio to see the actual space used.

You must also implement a database maintenance plan that includes re-indexing, truncation of transaction logs, and shrinking of files.

## Backup and Recovery Strategy

All MES systems should have a good and validated backup and recovery strategy. For recommendations on creating a backup and recovery strategy, see [MES Backup and Recovery Strategy](#).

Some key points are:

- Have a local backup drive and store all your backups on it.
- Use the correct SQL Server Recovery Model to match the backups you are doing.
- Do complete backups at least once per day.
- Implement truncation of transaction logs as part of the backup strategy to minimize the amount of storage they use.
- Validate your backup/restore procedure.

## Application Server

The Application Server hosts System Platform-related applications, services, and components. These include applications and components to support integration with MES and Work Tasks.

### Key Parameters

The following table describes the recommended key parameters to use for the Application Server in a medium-size system.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"><li>• 8 GB RAM</li><li>• 250-GB disk</li></ul>
AVEVA Components	<ul style="list-style-type: none"><li>• System Platform Application Server</li><li>• System Management Server, which supports AVEVA Identity Manager (AIM)</li><li>• MES Middleware Proxy</li><li>• MES Middleware</li><li>• MES Entity Model Builder</li><li>• MES Application Objects</li><li>• MES .NET controls</li><li>• Work Tasks Extension and Connector for System Platform</li></ul>
Other Components	<ul style="list-style-type: none"><li>• Operation Integration (OI) Server for</li></ul>

Parameter	Comments
	communication with Programmable Logic Controllers (PLCs)
Scalability	Typical scaling is to add additional Application Servers when hosting additional MES Objects above the maximum listed later in this document. Split the objects being hosted by the server across multiple application engines.

## Work Tasks Server

The Work Tasks Server hosts the Work Tasks application software, also referred to as the Work Tasks Engine. It also hosts components to support integration with MES model-driven application content.

The Work Tasks Farm and repository databases should be hosted on a different server, such as the Database Server or the Reports Server.

### Key Parameters

The following table describes the recommended key parameters to use for the Work Tasks Server in a medium-size system. For additional information about Work Tasks database sizing, see "Guidelines for Sizing Database" in the Administration section of the Work Tasks online help.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"> <li>• Minimum 32 GB RAM, typically 64 GB RAM</li> <li>• 1-TB disk</li> </ul>
AVEVA Components	<ul style="list-style-type: none"> <li>• Work Tasks application software, also referred to as the Work Tasks Engine</li> <li>• MES Middleware Proxy</li> <li>• MES Middleware</li> <li>• Work Tasks Extension and Connector for MES</li> </ul>
Scalability	Typical scaling is based on the number of workflows that are executing, and pending and waiting actions.

## Report Server

The Report Server provides the content to operators in the plant, office users, and corporate users. Its source of information is from the Production Database Server. Typically your Production Database Server is on the Plant

Production Network while the office users are on the Plant Business Network and it is not uncommon for a firewall to be between them.

Your network administrator needs to provide access to the Report Server for both groups of users. See [Network Interconnections](#) for more details.

The Report Server is not considered a production server. That is, it can go down without interruptions to production and without losing production data.

Installations that run large reports or do data mining on the MES database should perform these operations on an Archive database and not the actual Production database. This will prevent large queries from using resources that are required for production transactions. For information about the Archive database, see [Archive Server](#).

Included with the MES software is a limited version of BI Gateway to be used as the Report Server. The BI Gateway service extracts data from the MES production database and stores that data in the BI Gateway database. The provided MES reports query the data in the BI Gateway database. For more information, see the [MES BI Gateway Reports Guide](#).

## Key Parameters

The following table describes the recommended key parameters to use for the Report Server in a medium-size system.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"><li>• Minimum 16 GB RAM, typical 32 GB RAM</li><li>• 2-TB disk, RAID 10 – For Data</li><li>• 500-GB disk, no RAID – For Backups</li></ul>
Microsoft Components	<ul style="list-style-type: none"><li>• SQL Server</li><li>• SQL Server Reporting Services</li><li>• Microsoft .NET Framework</li><li>• IIS</li></ul>
MES Components	<ul style="list-style-type: none"><li>• MES BI Gateway Reports</li><li>• Custom Reports</li></ul>
BI Gateway Components	<ul style="list-style-type: none"><li>• BI Gateway</li></ul>
Scalability	Typically only one server is needed. Additional servers are added in a load balance approach with different groups of users linked to different servers.

Parameter	Comments
High Availability/Fault Tolerance	This server does NOT require High Availability. If the server is completely lost, it can be rebuilt without the loss of production data.
Key Measures	<ul style="list-style-type: none"> <li>• CPU usage &lt; 30%</li> <li>• Memory stable with 1 GB free</li> </ul>
Data Requirements	<p>Moderate-size system</p> <p>C: OS - 120 GB available, RAID 0</p> <p>D: Data - 2-TB available, RAID 10</p> <p>E: Backup - 500 GB, no RAID</p>
Other Databases	<p>The Report Server typically will have the following databases:</p> <ul style="list-style-type: none"> <li>• BI Gateway database</li> <li>• Galaxy repository databases</li> <li>• ReportServer database</li> </ul> <p>In a typical plant, it would not have any of the following Production databases:</p> <ul style="list-style-type: none"> <li>• MES database</li> <li>• Work Tasks Farm and repository databases</li> <li>• Historian Runtime database</li> </ul>

## Web Server

The Web Server hosts the web pages for both configuring and operating equipment line performance monitoring using, for example, MES Web Portal and MES model-driven application content accessed on Work Tasks Enterprise Console. If using Enterprise Integration, the Web Server also hosts the corresponding configuration and monitoring web pages for Enterprise Integration.

This server can reside in the corporate domain or plant domain depending on its usage. This server should have a dedicated MES middleware for managing all the client transactions. The MES middleware also provides access to the MES Web API.

### Key Parameters

The following table describes the recommended key parameters to use for the Web Server in a medium-size system.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"> <li>• 16 GB RAM</li> <li>• 250-GB disk, RAID 10 – For Data</li> <li>• 250-GB disk, no RAID – For Backups</li> </ul>
Microsoft Components	<ul style="list-style-type: none"> <li>• Microsoft .NET Framework</li> <li>• IIS</li> </ul>
AVEVA Components	<ul style="list-style-type: none"> <li>• MES Web Portal</li> <li>• Work Tasks Enterprise Console</li> <li>• MES Middleware Proxy</li> <li>• MES Middleware</li> </ul>
Scalability	<p>Typically only one server is needed.</p> <p>Additional servers are added in a load balance approach based on the number of users, with different groups of users linked to different servers.</p>
High Availability/Fault Tolerance	<p>This server does NOT require High Availability.</p> <p>If the server is completely lost, it can be rebuilt without the loss of production data.</p>
Key Measures	<ul style="list-style-type: none"> <li>• CPU usage &lt; 30%</li> <li>• Memory stable with 1 GB free</li> </ul>
Data Requirements	<p>Moderate-size system</p> <p>C: OS - 80 GB available, RAID 0</p> <p>D: Data - 250 GB available, RAID 10</p> <p>E: Backup - 250 GB, no RAID</p>

## Galaxy Repository (GR) Node Server

The GR Node is the computer where the Galaxy Repository resides. It is a SQL Server database in which all of the galaxy configuration data is stored.

When deciding where to deploy it, consider:

- When deploying a Galaxy, high-sustained CPU usage will occur on the node running the associated SQL Server.
- The GR should be available to the Galaxy.

For this reason, it is recommended that the GR Node Server be on the Report Server or on the Engineering station. It is recommended that the GR Node Server not be on any of the production servers (Production Database Server, Application Server, or Terminal Server).

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**Note:** The GR is not needed at runtime. With the GR node, an object or a view node subscribing for an object attribute is made significantly faster because the GR node knows where everything is located. Otherwise the node with the subscription request has to ping all other nodes's engines to determine whether they host this object's attribute.

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## Archive Server

It is recommended the Archive database reside on its own server.

The Archive database holds a copy of the production MES database.

Data is copied on a regular basis from the MES database to the Archive database on a time and Work Order basis. This data then can be used in reports or to restore most of the production data if the production server is lost.

A typical setup would be:

- Year 1: online data in the Production database or MES database
- Years 2 to 5: online data in the Archive database
- Years > 5: offline in files

## Key Parameters

The following table describes the recommended key parameters to use for the Archive Server in a medium-size system.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"><li>• 16 GB RAM</li><li>• 1-TB disk, RAID 10 – For Data</li><li>• 1-TB disk, no RAID – For Backups</li></ul>
Microsoft Components	<ul style="list-style-type: none"><li>• Microsoft Distributed Transaction Coordinator</li></ul>
MES Components	<ul style="list-style-type: none"><li>• MES Archive database</li></ul>
System Platform Components	None.
Scalability	Typically only one server is needed. If additional servers are needed, they would be configured to hold different "years" of data.

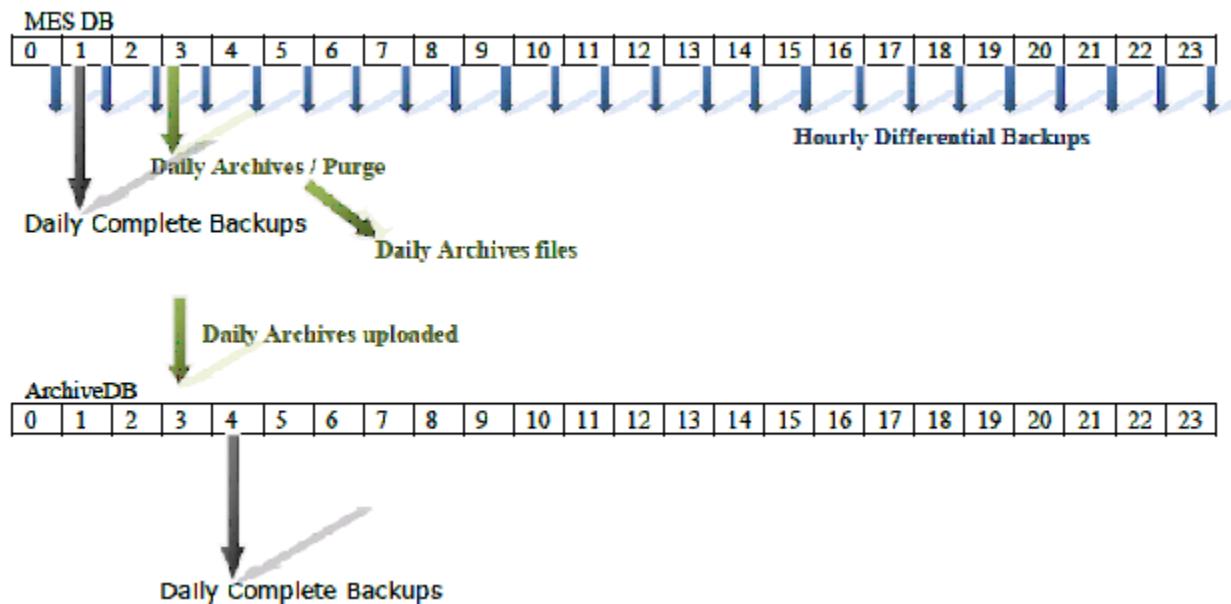
Parameter	Comments
High Availability/Fault Tolerance	This server does NOT require High Availability (for more details, see <a href="#">High Availability/Fault Tolerance</a> ).
Key Measures	<ul style="list-style-type: none"> <li>CPU usage &lt; 30%</li> <li>Memory stable with 1 GB free</li> </ul>

## High Availability/Fault Tolerance

The Archive Server should not need High Availability. This is because the archives are only uploaded once per day. The risk for data loss is only between that upload period and the Archive database backup procedure. The archive procedure also supports archiving to files. This allows two versions of the data to be stored on two different servers, making your data safe.

**Note:** Archive and Purge was tested in both VMware and Hyper-V virtualized environments during controlled Live Migration and Fail-over scenarios due to power failure or network failure. Both operations fully recovered and no data loss was observed. For more information, see the *MES Virtual Implementation Guide*.

The following diagram illustrates a suggested plan for scheduling Archiving and backups on the various servers so that potential data loss is minimized. This is accomplished by making sure that the Daily MES database Complete Backup and the Daily Archive Database Backup are not performed at the same time as the Archives/Purge. Also, the Daily Archive Database Backup should be performed after the daily archive data has been received.



## Terminal Server

A common MES application deployment method when those applications are based on AVEVA OMI and AVEVA InTouch HMI is to use Terminal Servers.

The usage of Terminal Server and a thin client architect over a client server architecture with so-called fat clients

is a user decision. AVEVA OMI and InTouch HMI applications support both deployment methods.

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**Note:** Terminal Servers are used only with OMI and InTouch HMI applications. They are not required or recommended for use with Work Tasks and MES model-driven application content.

Terminal Server has the following advantages:

- It provides ease of setup and maintenance of applications. Instead of installing the MES client on many systems, you install it once on the Terminal Server.
- The clients operate in a controlled Windows environment. All the clients run under the same version of Windows and same patch level.
- It can reduce hardware costs.
- It should reduce maintenance costs.
- It provides the ability for redundancy.
- Resources are shared, so if your clients need a significant number of resources, they are available. This typically applies to the CPU for which full capacity is not needed all the time.
- It is very scalable. Although there is a limit to the number of clients per server based on the application, you can add additional memory or CPUs to the server until you reach your limit. Then additional Terminal Servers can be added to meet your needs.

## Terminal Server Considerations

- Resource limitations. There is a limited amount of memory, CPU capacity, and other resources (such as handles) that limit the number of clients per machine.
- There are client session-configurable parameters that administrators need to be aware of to make sure some sessions do not use excessive CPU or memory.
- If you operate without a fail-over mechanism and the system goes down or needs maintenance, then all clients go down.
- You are not using all the resources of your client PCs. This is also an advantage as you do not need very expensive PCs or you can use thin client devices.

## Other Considerations

- With InTouch Clients, you will need to set the CPU Affinity (download the InTouch Affinity Control or InTouch View Affinity Server from the Product Hub area of the Global Customer Support web site).
- You will need a special Terminal Server license to run InTouch.
- InTouch also has a feature that allows it to keep its Windows in memory. When using Terminal Servers, this feature is typically turned off as it can use too much memory.
- For more information on recommendations related to deployments of Terminal Servers, refer to the various terminal services-related tech notes and FAQs available in the Knowledge Base on the Global Customer Support web site.

## Key Parameters

The following table describes the recommended key parameters to use for the Terminal Server in a medium-size system.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"> <li>• 16 GB RAM</li> <li>• 250-GB disk</li> </ul>
Microsoft Components	<ul style="list-style-type: none"> <li>• Remote Desktop Services</li> </ul>
MES Components	<ul style="list-style-type: none"> <li>• MES Operator</li> <li>• MES Client</li> <li>• MES Middleware Proxy</li> <li>• MES Middleware</li> </ul>
System Platform Components	<ul style="list-style-type: none"> <li>• OMI</li> <li>• InTouch</li> </ul>
Key Measures	<p>You need to measure CPU and memory requirements on a per client basis. You then need to scale that by the number of clients. A rule of thumb is each MES client will require about 150 MB of RAM.</p> <p>The CPU on a Terminal Server machine is typically used more than on other servers. This is desired as you want to utilize the resource fully. You need to check peak demand time (such as at shift changes) to ensure that there is sufficient free capacity and, if a redundant pair is being used, that CPU usages never exceeds 50%. As a starting point on a new system, plan for 12 clients per CPU.</p> <ul style="list-style-type: none"> <li>• For redundant pair: CPU usage &lt; 50%</li> <li>• For standalone: CPU usage &lt; 80%</li> <li>• Memory should be stable with 1 GB free</li> </ul>

## Engineering Stations

An Engineering station is a system that is configured by someone with expert knowledge of the system. The activities range from:

- Configuring the systems
- Performing maintenance and system shutdowns
- Adding users

- Deploying Operator stations
- Debugging problems
- Changing configuration
- Adding content
- Setting import/export schedules

## Applications Used

- MES Client
- System Platform IDE
- InTouch WindowMaker and WindowViewer
- OMI Application Manager
- MES Application Objects
- MES .NET Controls
- MES Entity Model Builder
- Work Tasks Enterprise Console
- BI Gateway Server Administrator features
- Web browser to access MES Web Portal, if used

The GR Node (the GR database) can be run on the Engineering station. This frees up resources on the Report Server. However, this makes the Engineering station a Production Database Server and therefore it will require server-class hardware and database maintenance (e.g., regular backups).

## Key Parameters

The following table describes the recommended key parameters to use for an Engineering station in a medium-size system.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"><li>• 8 GB RAM</li><li>• 500-GB Disk</li></ul>
Microsoft Components	<ul style="list-style-type: none"><li>• SQL Server (if GR is to be installed)</li></ul>

Parameter	Comments
AVEVA Components	<ul style="list-style-type: none"> <li>• MES Client</li> <li>• Web browser to access Work Tasks Enterprise Console, MES BI Gateway Reports, and MES Web Portal, if used</li> <li>• MES Supervisor</li> <li>• MES Data Editor</li> <li>• MES Operator</li> <li>• MES Middleware Proxy</li> <li>• MES Middleware</li> <li>• BI Gateway (if it is used from this station) With System Platform:           <ul style="list-style-type: none"> <li>• System Platform IDE</li> <li>• OMI</li> <li>• InTouch</li> <li>• Galaxy repository (optional)</li> <li>• MES Application Objects</li> <li>• MES .NET Controls</li> <li>• MES Entity Model Builder</li> </ul> </li> </ul>
Scalability	Typical scaling is 1 Engineering station/20 to 30 lines.

## Supervisor Stations

A Supervisor station is where users with a supervisor role schedule work orders and monitor other activities that are performed by operators.

Supervisors are different from the office users in that their PCs are close to the shop floor and have direct access to the MES-related servers (i.e., no firewall).

A Supervisor station is different from an Operator station in that in addition to the operator-role applications (MES model-driven application content, MES Operator, OMI, or InTouch), the Supervisor station has access to the MES Client and additional MES model-driven application content forms.

## Applications Used

- MES Client
- MES Operator (or custom Operator UI), if used
- Web browser to access MES model-driven application content, MES Web Portal, and MES BI Gateway reports, if used
- MES Supervisor

- OMI Application Manager, if used
- InTouch Application, if used

## Key Parameters

The following table describes the recommended key parameters to use for the Supervisor station in a medium-size system.

Parameter	Comments
Standard Configuration	<ul style="list-style-type: none"><li>• 4 GB RAM</li><li>• 500-GB disk</li></ul>
AVEVA Components	<ul style="list-style-type: none"><li>• MES Client</li><li>• Web browser to access MES model-driven application content, MES Web Portal, and MES BI Gateway reports</li><li>• MES Supervisor</li><li>• MES Operator</li><li>• MES Middleware Proxy</li><li>• BI Gateway (if it is used from this station)</li></ul> <p>With System Platform:</p> <ul style="list-style-type: none"><li>• OMI</li><li>• InTouch</li></ul>
Scalability	Typical scaling is 1 Supervisor station/10 to 20 lines.

## Operator Stations

Operator stations are the PC or thin clients used by users with an operator role to control, monitor, or record information about the process.

Both client server (so-called *fat clients*) and thin client architectures are fully supported, with one not recommended over the other. See [Terminal Server](#) for a description of the benefits of using thin clients.

## Key Parameters

The following table describes the recommended key parameters to use for the Operator station in a medium-size system.

Parameter	Comments
Standard Configuration	<p>Fat Client:</p> <ul style="list-style-type: none"> <li>• 4 GB RAM</li> <li>• 500-GB disk</li> </ul> <p>Thin Client:</p> <ul style="list-style-type: none"> <li>• One that can support the terminal server session</li> </ul>
AVEVA Components	<ul style="list-style-type: none"> <li>• MES Operator</li> <li>• MES Middleware Proxy</li> <li>• Web browser to access MES model-driven application content forms and MES Web Portal, if used</li> </ul> <p>With System Platform:</p> <ul style="list-style-type: none"> <li>• OMI</li> <li>• InTouch</li> </ul>
Scalability	Typical scaling is 1 Operator station/line.

## MES Middleware

The MES middleware is a process that handles two categories of tasks:

- Scheduled tasks that are referred to generally as maintenance services
- Client application transactions with the MES database

A system can have more than one MES middleware host.

The MES Middleware Proxy provides access to the MES middleware for clients. The proxy is installed on each client station and on all MES middleware hosts.

## MES Service Tasks Moved to the MES Middleware

In previous releases, the MES Service was connected to the MES middleware through the proxy layer. Starting with MES version 7.0, the MES Service is part of the MES middleware. Since the MES Service is now part of the MES middleware, the database maintenance activities are performed as part of the middleware, but on different threads.

## Maintenance Services

The MES middleware that is currently handling the maintenance services performs the following scheduled tasks:

- Cleaning up stale sessions
- Running the Supply Chain Connector (SCC) schedules
- Managing entity shift changes
- Changing utilization reasons for entities for reasons that have elapsed
- Generating future quality samples for time, shift, and production unit count frequencies
- Changing quality sample states based on the passage of time

These tasks are critical to having consistent OEE and downtime data. In an active system, it is recommended to designate a specific MES middleware to run these background tasks. This MES middleware should be dedicated to these background tasks and not have additional clients directing transactions through it. For more information, see the *MES Middleware User Guide*.

## Client Application Database Transactions

Each active MES middleware can process client application calls to perform MES database transactions. The middleware supports the following call endpoints:

- Synchronous
- Asynchronous
- Web API
- Event Broker

## MES Middleware Deployment Guidelines

The typical locations on which to run the MES middleware host are either the Application Server (with System Platform) or standalone (no System Platform). It is recommended that the MES middleware host not be run on the Production Database Server except to host specific Production Database Server tasks such as Enterprise Integration or SCC.

In a production environment, it is recommended that the MES middleware host run on the Application Server to address the following:

- It is best to not load the Production Database Server with additional process tasks.  
The MES middleware host can be run on the Production Database Server if you are trying to keep the hardware footprint to a minimum. This is usually only applicable to small systems (an example small system is one for OEE and Downtime with 12 entities collecting downtime).
- Load balancing of the MES middleware across multiple Application Servers might be required based on the implementation size and production load. See [Load Balancing of the MES Middleware](#).

If the MES Web Portal is used, then the IIS server hosting the MES Web Portal is recommended to have the MES middleware.

## Recommended Number of MES Middleware Hosts for Medium-Size System

The recommended number of MES middleware hosts for a medium-size system are:

- One for each Application Server
- One for each Work Tasks Server
- One for each Terminal Server
- One for each Web Server with MES Web Portal; the MES middleware on this server hosts the MES Web API
- One for Enterprise Integration or Supply Chain Connector (SCC), typically on the Database Server

## Scaling

When scaling, scale by process area. Servers running System Platform Application Server engines that host MES application objects must have a local MES middleware host. This is required for performance on high-transaction volume systems.

## Components That Require an MES Middleware Connection

The following table lists the different components that require a connection to the MES middleware with some deployment guidelines.

Components	Comments/Deployment Guidelines
MES client applications (OMI, InTouch, Operator, MES Web Portal, etc.)	<ul style="list-style-type: none"><li>• 50 to 100 user interface (UI) clients/MES middleware host. This guideline is based on performance and isolation considerations. Applications will vary by the number of transactions they will generate per second, minute, or hour. One additional advantage of having more than one MES middleware server is not just to distribute the load but to also eliminate a single point of failure. For example, if you have 80 demanding clients, then you might consider two servers. However, if you have 60 average clients, one server would be enough. Once you reach the 100-client range, it is recommended that the MES middleware host be split between two servers.</li><li>• For each client you configure the Middleware Proxy to access one or more MES middleware hosts.</li><li>• These connections have a low load on the server.</li></ul>
Work Tasks Engine and MES model-driven application content	<ul style="list-style-type: none"><li>• If using the Work Tasks Connector for MES, one MES middleware host will be required on the node on which the Work Tasks Engine is running. Otherwise, if MES model-driven application content is using MES Web API V3, the middleware</li></ul>

Components	Comments/Deployment Guidelines
	host can be located on another node.
System Platform Application Server with MES Application Objects	<ul style="list-style-type: none"><li>• No more than 100–150 MES application objects per platform.</li><li>• No more than 30–50 MES application objects per engine.</li><li>• Local MES middleware to handle MES application object transactions.</li><li>• Usually, API calls to MES middleware from the Application Server objects are not included in the calculation because the load is significantly less.</li><li>• Utilization Capability Object (UCO) - The complexity of the expression evaluations and the number of raw reason codes to evaluate will affect the total number of UCOs that can run on an engine. Look for any scan overrun messages in the Logger and the average engine execution time to determine the maximum load. Since utilization events have a minimum resolution of 1 second, the engine scan time should be 1 second or greater.</li><li>• Operations Capability Object (OCO) - The more functionality included in the object, the more time it will take to execute the object. Multiple job positions, many specifications, and many consumption counters will affect the number of objects hosted on an engine. Look for any scan overrun messages in the Logger and the average engine execution time to determine maximum load.</li><li>• Sample Recording Object (SRO) - The number of characteristics being captured is the main determining factor for the SRO. The following configuration has been tested: 15 objects capturing data for 10 variable characteristics (each with 5 measurements) against 2 samples per minute for each entity. Look for any scan overrun messages in the Logger and the average engine execution time to determine maximum load.</li></ul>

Components	Comments/Deployment Guidelines
Enterprise Integration, Supply Chain Connector (SCC), MES Middleware to run Maintenance Services	<ul style="list-style-type: none"> <li>One MES middleware runs maintenance services. This includes cleanup for shifts and sessions as well as running the Supply Chain Connector (SCC) schedules. For more details, see the <i>MES Middleware User Guide</i>.</li> <li>This MES middleware also manages the creation of future Quality samples and changes in sample status based on passage of time. Quality sampling should not be used as a historian to record large volumes of data at high rates. Samples for each entity are expected to be no faster than every 10 minutes and the total rate for the MES middleware should be no more than 100 per minute.</li> <li>Enterprise Integration or SCC is used to transfer data between MES and other business systems.</li> <li>Even on a large or demanding interface, a separate MES middleware host would NOT be required. It is only separated to isolate database traffic when troubleshooting.</li> </ul>
Archive, Purge, and Restore (APR)	<ul style="list-style-type: none"> <li>The Database Maintenance Server application defines where the APR will run.</li> <li>Usually the Archive database is on its own server and has its own dedicated MES middleware host.</li> </ul>

These MES processes will use the MES middleware defined by the MES middleware proxy where they are running. This means all MES processes running on a computer will use the same proxy and thus are all connected to the same MES middleware.

For example, if your setup is as follows:

- Database Server
  - MES Middleware Proxy configured to connect to the MES middleware on the Application Server
  - Enterprise Integration or Supply Chain Connector
- Application Server
  - MES middleware host

Then Enterprise Integration or the Supply Chain Connector would be using the MES middleware on the Application Server.

If you require one server for the MES clients and one server for the Application Server objects, it is a good practice to split the load and put half your MES clients and half your Application Server objects on one server and the other half on another server. This allows for:

- Application Server redundancy
- Isolation by process area. That is you can put all objects and MES middleware for 1 process area on 1 server.
- Better use of the hardware.

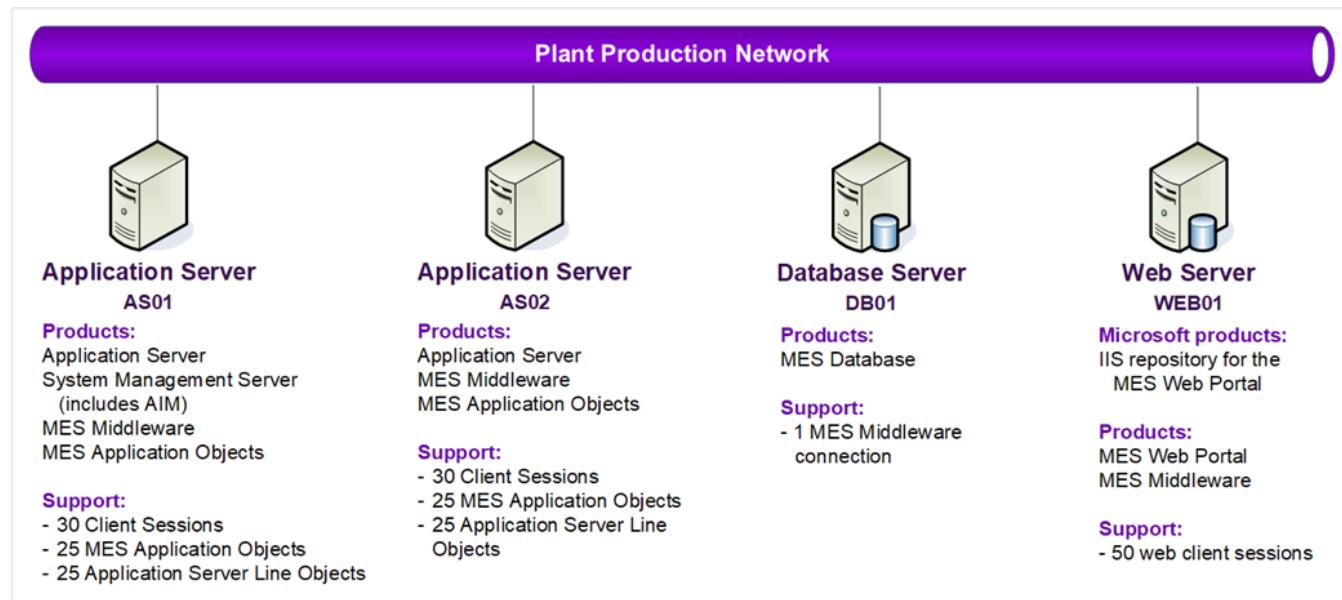
For additional information about load balancing, see [Load Balancing of the MES Middleware](#).

The restriction of 50 to 100 UI client MES middleware connections is based on the performance of the MES middleware. There is still capacity available on the server that can be used.

The following are operating parameters for a typical medium-size plant with:

- 50 lines with 100 MES application objects
- 60 Operator Clients (InTouch)
- Enterprise Integration or Supply Chain Connector – small load

This plant could be configured with 2 Application Servers, each supporting 25 lines, a Production Database Server, and an MES Web Portal Server. Note that this system **does not** include Work Tasks. The following figure shows the architecture for this medium-size system with respect to the MES middleware.



A medium-size system has been qualified to determine the performance levels that could be achieved. For information about this system and the performance results, see [A Performance-Qualified Medium-Size System](#).

## Load Balancing of the MES Middleware

The availability of the MES middleware is critical in keeping the production applications available to the end users. The MES middleware load can be distributed by installing the MES middleware on multiple servers. Each client is set up to connect to one MES middleware with an option to define additional MES middleware hosts in case of failure.

If the system includes the recommended one MES middleware host for each Application Server, Work Tasks Server, Terminal Server, Web Server, and Enterprise Integration, then the system will inherently be load-balanced.

If a client machine only has the MES Middleware Proxy installed and directs transactions to an MES middleware

on another machine, fail-over can be configured by pointing the MES middleware proxy to multiple MES middleware hosts. To guarantee automatic fail-over of the MES middleware host, you can set up the software to take advantage of High Availability provided by both Hyper-V and VMware virtualized environments. For higher availability, a Windows Cluster Server can be used for the MES middleware host.

If the system includes the recommended one MES middleware host for each Application Server, Terminal Server, Web Portal Server, and Enterprise Integration or SCC, then there is no need to fail over.

If you are using Extensibility Hooks, they must be set up for each MES middleware host.

## MES Middleware Host Licensing

Usually the more MES middleware hosts there are in the system, the better the system will perform.

Where possible, have the MES middleware host running locally. However, note that each MES middleware host requires a license.

The MES middleware is fully multi-threaded and uses multiple CPUs. However, other restrictions related to handling transactions limit the number of sessions that one MES middleware host can support.

Starting with MES 2017, each MES middleware host acquires an MES Middleware count from the License Server. Depending on the size of the license purchased, the number of MES middleware instances that are licensed will start at 6 and increase with larger size licenses. The number available and in use is shown in the License Manager. Additional MES middleware licenses can be purchased as an add-on to any system.

For example, a system with the following servers and five MES Middleware licenses would include a local MES middleware host on each server:

- 1 Applications Servers
- 1 Work Tasks Server
- 1 Web Server
- 2 Terminal Servers

## Designing an MES Solution

A description of the topology for an MES solution and a case study example are presented here to provide guidance when designing an MES solution.

## Topology Overview

A server topology is a diagram that shows the following:

- All servers used in the solution
- The location of the server on the network. Servers that connect to multiple networks should be indicated accordingly.
- Server name or type
- Firewalls or other network traffic security or isolation devices

Optionally it can show:

- The basic server specifications (OS, RAM, CPU, and disk spaces of database servers)
- Windows or Microsoft key software installed
- MES key software installed

This document provides the following sample topologies:

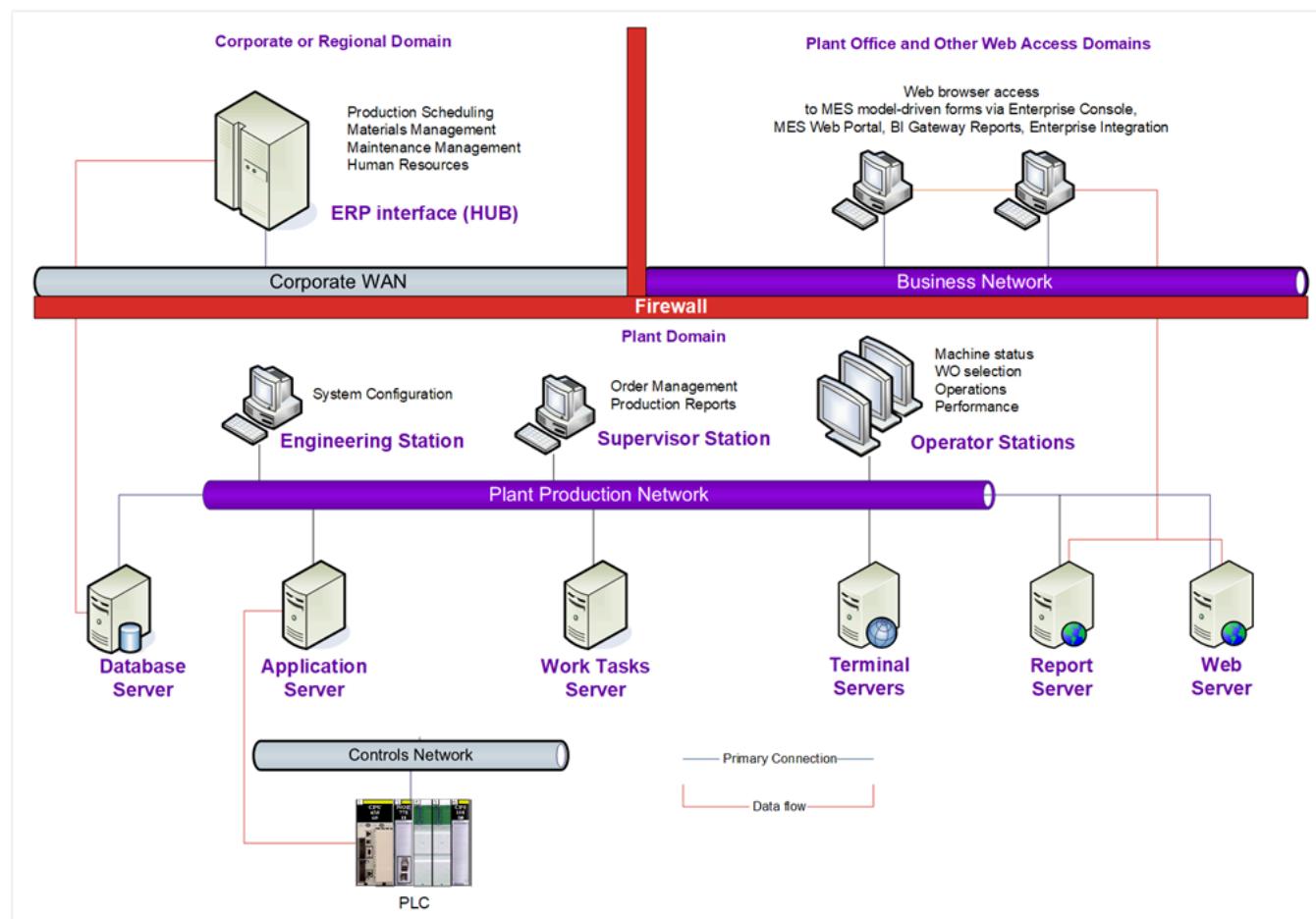
- Standard Architecture
- Typical Medium-Size Plant
- Scaling the Standard Architecture

The diagrams provided here do not represent a complete architecture documentation set. For your system you should include:

- Topology Overview
- Topology Production Network Details
- Installation Change Control spreadsheet (see [Documenting the Installation and Change Control](#))

## Standard Topology Overview

The following diagram shows an overview of the standard topology. For a description of what applications are run on the various servers, see [Components of an MES Solution](#).



This system includes MES with System Platform and Work Tasks. It uses the Standard Configuration as described in [Standard Hardware](#).

The Application Server has the following connections:

- To the Controls Network, to communicate with the process equipment. This is typically done via Operation Integration (OI) Servers. It is very common to have a separate OI Server.
- To the Plant Production Network, to access other MES servers.

The Database Server has the following connections:

- To the Corporate WAN, to provide access to the ERP system.
- To the Plant Production Network, to access other MES-related servers.

The Report Server and Web Server also include multiple logical connections, as office users and remote users need to connect to them and they need to connect to MES-related servers.

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**Note:** If you anticipate that the number of thin-client Operator stations will be high and possibly impact network traffic on the Plant Production network, consider creating a separate network for the Operator stations and connecting them to the Plant Production network through a Terminal Server. For examples of network topologies that use Terminal Servers to support thin clients, see *Tech Note 662: Remote Access Technologies for Industrial Applications*, which is available in the Knowledge Base on the Global Customer Support web site.

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## Standard Architecture with Scaling Factors

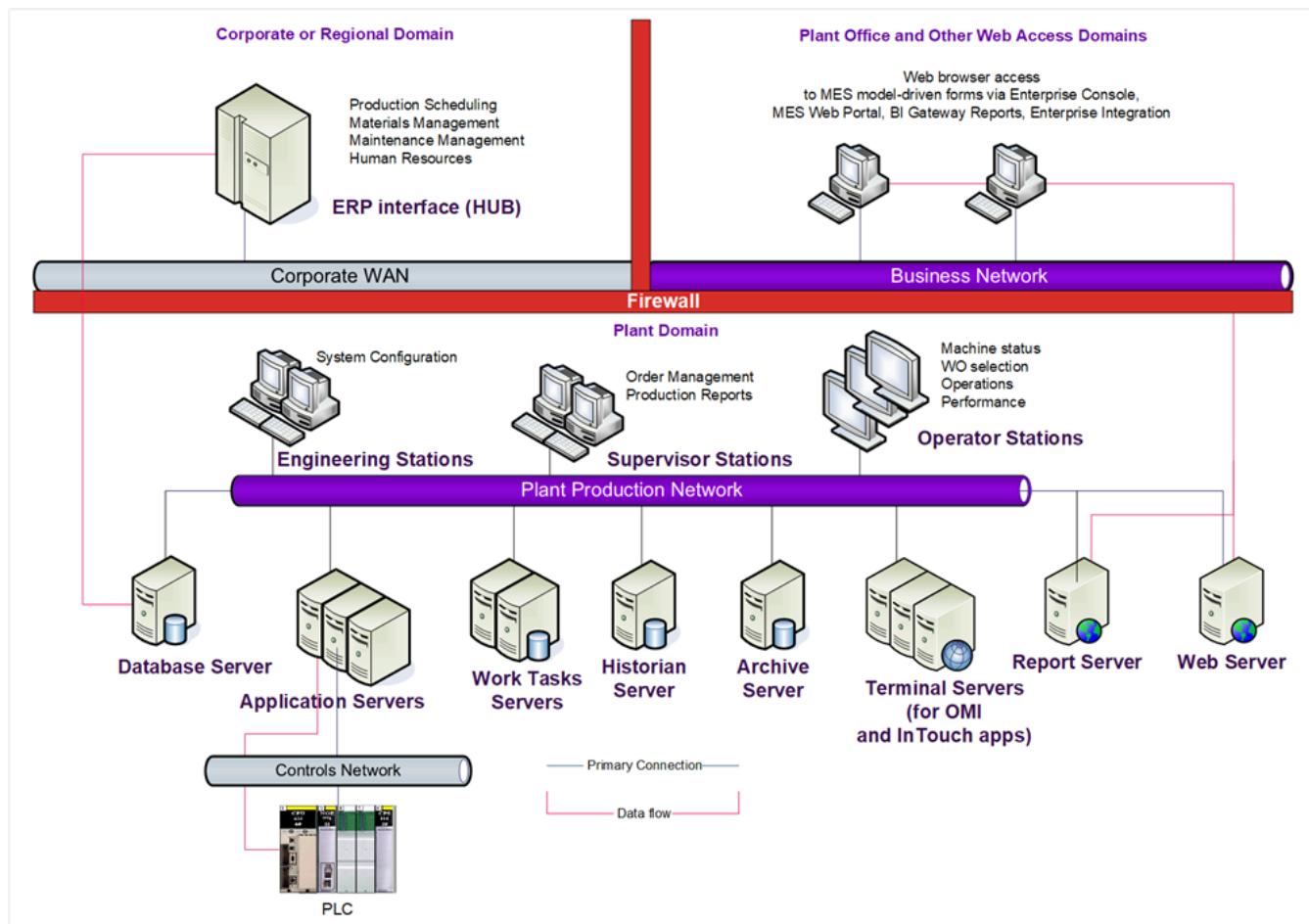
Every production environment is different. A solution architect would need to fully evaluate the customer requirements and respective load to estimate a server sizing.

The basis for scaling the system is based on the collection of performance data on the system. This data includes CPU and memory usage, as well as server-specific data such as scan overruns for the Application Server (see the Key Measures for each server type in General Server Requirements). The ideal source of this data is the actual production system. Alternatively, you can use the test system.

You will have to determine the best way to scale the system. Whether the scaling is based on lines, equipment, or number of users depends on your application.

The performance data provided in Performance Test Results, along with the scaling information provided for each server type in [Components of an MES Solution](#), should provide enough information to determine how to scale the system.

The following diagram shows an example of the scaling up of standard MES architecture with System Platform.



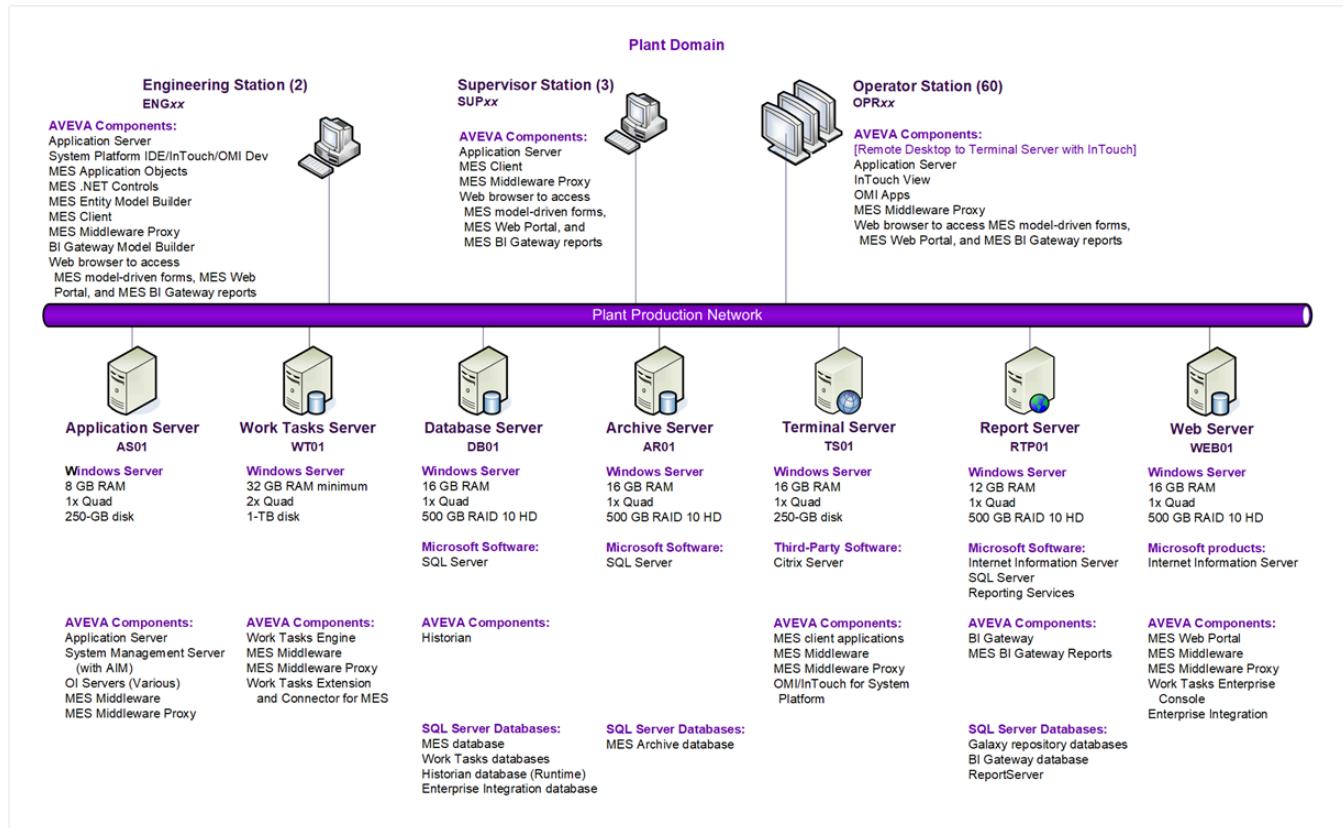
In this example, the system was scaled by:

- Adding multiple Application Servers to handle more transactions and System Platform objects (see the Middleware guidelines in [MES Middleware](#). In this example, the Application Server was scaled by process area.
- Separating the Historian and Archive databases to run on separate servers.
- Adding a second Work Tasks Server to accommodate increased number of workflows that are executing concurrently.
- Adding multiple Terminal Servers (Load-Balanced Server Farm), each with their own MES middleware host, to handle increased number of OMI and InTouch app users.
- Increasing in the number of Engineering stations. Engineer user access can also be provided through permissions and MES clients installed on non-Engineering stations.
- Increasing in the number of Supervisor stations. A suggested guideline is that 1 Supervisor station is required for every 10 to 20 lines.
- Adding additional CPUs and memory to the Database, Archive, and Report Servers.

## Topology Production Network Details

## Typical Medium-Size Plant

The following diagram shows an example of a medium-size plant with MES and System Platform.



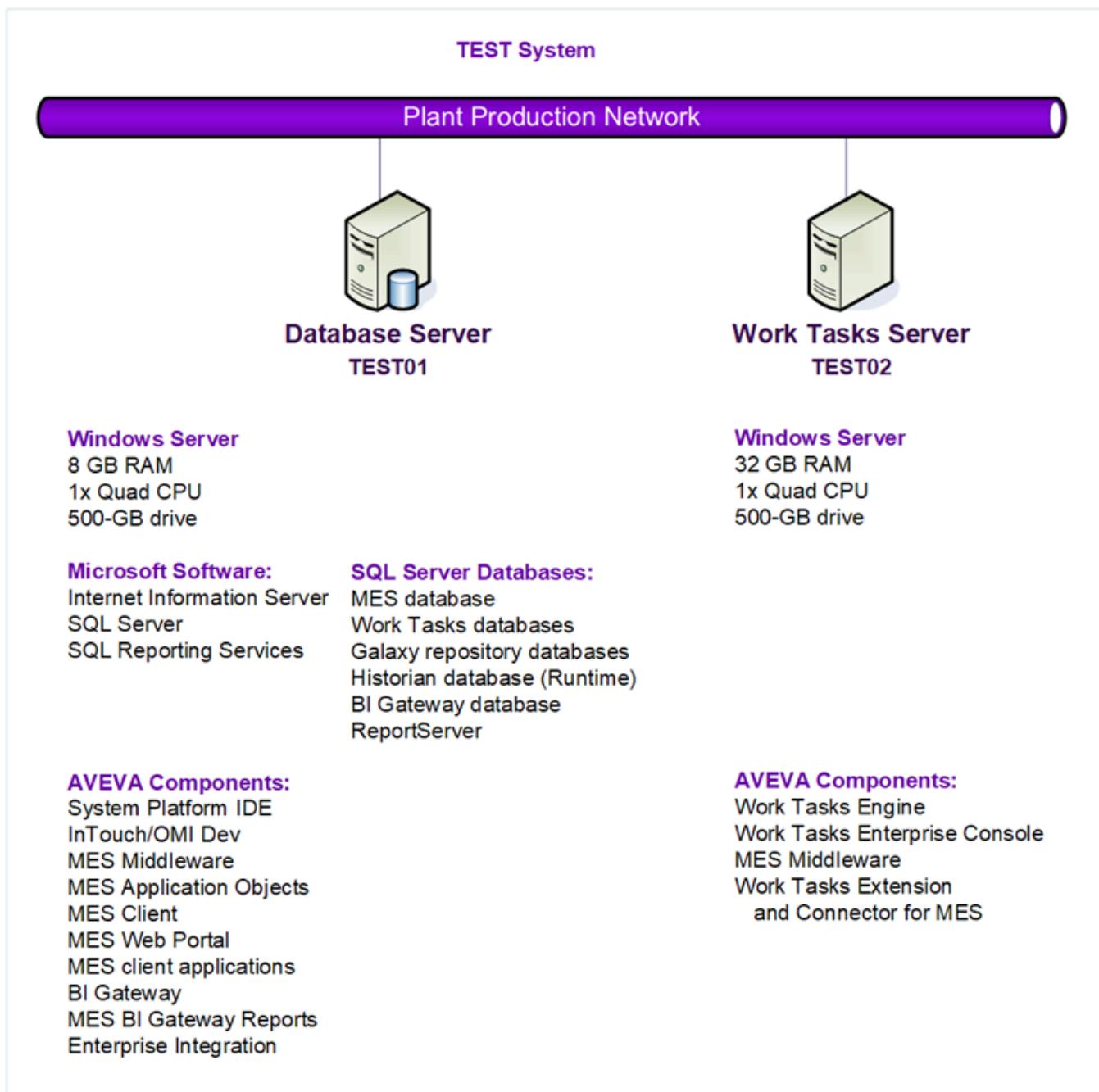
See [Standard Hardware](#) for a description of the load of a typical medium-size system. In this example, only the Plant Production Network is shown.

**Note:** Each production environment will vary based on many factors, starting with volume of ERP data and down to MES, then production execution, IO collection and triggers, to roll up and transfer back to ERP. This also varies by industry and the method of data collection (manual versus automated).

## Test System

A test system for the MES solution is highly recommended. The test system will allow you to test changes, verifying they have the desired effect before implementing them in production.

The typical test system can run on less expensive hardware, as shown in the following diagram.



The three general types of test systems and the components they would typically include are described below.

## Typical Test System

- Database Server
- Work Tasks Server

This type of test system will typically not have the following:

- Archive Server (this server can be tested on the Database Server)
- Terminal Server (the Operator stations are tested directly from the Database and Work Tasks Servers)

- Direct IO

## Advanced Test System

- Archive Server and Terminal Server
- Simulated IO
- Test ERP and other business system interfaces used by MES

## Full Test System

A full test system will have all of the components of the production system. A full test system (i.e., with all servers) can expose issues related to areas such as licensing, security, and performance that might not be seen on smaller test systems.

## Demonstration System

It is possible to run a MES solution on a single PC to demonstrate the software.

Note the following about a demonstration system:

- A single-server configuration would not make a good choice for a production system due to performance limitations.
- If the demonstration system is using Workgroups for user management, see the *MES Installation Guide* for details about how to configure MES and Workgroup user accounts. If using Work Tasks with MES model-driven application content, then Active Directory is required (Workgroups is not supported).

On this PC (usually a laptop), the following is installed:

- MES database
- MES middleware
- MES Client
- MES Web Portal
- Application Server, System Platform IDE, OMI, and InTouch with a Galaxy repository database
- Historian and its Runtime database
- Work Tasks and its Farm and repository databases, Work Tasks Extension and Connector for MES, and MES model-driven application content
- An Operator application
- BI Gateway, the BI Gateway database, and MES BI Gateway reports

A demonstration system might include a very simple simulation and would not have connections to any other systems.

The following figure shows the minimum hardware for a demonstration system.



## Demonstration System

### DEMO01

#### Windows Server

16 GB RAM  
1x Quad CPU  
500-GB disk

#### Microsoft Software:

Internet Information Server  
SQL Server  
SQL Reporting Services

#### SQL Server Databases:

MES database  
Work Tasks databases  
Historian database  
(Runtime)  
Galaxy repository  
databases  
BI Gateway database  
ReportServer

#### Products:

MES Middleware  
MES Middleware Proxy  
MES Application Objects  
MES Client  
MES Web Portal  
MES BI Gateway Reports  
MES Operator  
MES Supervisor  
System Platform IDE, OMI, InTouch  
Historian  
Work Tasks  
Work Tasks Extension and Connector for  
MES  
MES model-driven application content  
BI Gateway

## Case Study: Scaling the System

A case study is helpful to see an example of the scaling of the system.

In this case study, the plant had been operating for 1 year with 12 lines. They want to know the server requirements for 60 lines, 120 lines, and 200 lines. The estimates provided are not exact, as even within a plant loading will vary. It is recommended to determine the scaling in stages and to reevaluate the system after each stage.

In this example, a Line consisted of 6 objects, including the UCO. It does Downtime and OEE with work order management.

The following steps were performed to evaluate the server specifications:

- The current CPU and memory usages were evaluated and a loading was determined in terms of CPU/line and memory/line for each server. This evaluation was both analytical and speculative.
- For the CPU, the current CPU profile was analyzed and then the desired CPU/line was speculated.
- For the memory, the memory usage of the applications was divided by the number of lines.

From this evaluation, the following table shows the scaling that was performed by number of lines and the resulting CPU and memory sizing results.

Server	CPU				RAM			
12 lines	60	120	200	12	60	120	200	
Database	15 line/CPU				8 GB Base + 150 MB/Line			
	2	4	8	12	9.8	17	26	38
Historian	50 line/CPU				4 GB Base + 5 MB/Line			
	1	1	2	4	4.1	4.3	4.6	5
Application	12 line/CPU				8 GB Base + 20 MB/Line			
	1	5	10	17	8.24	9.2	10.4	12
Terminal	12 line/CPU				4 GB Base + 150 MB/Line			
	1	5	10	17	5.8	13	22	34
Report	20 line/CPU				8 GB Base + 50 MB/Line			
	1	3	6	10	8.6	11	14	18

Next, some logical adjustments were performed based on the following:

- Database loading is not linear
- Application and Terminal Server loading is linear
- Requirements are rounded to appropriate purchasable sizes

Server	CPU				RAM			
12 lines	60	120	200	12	60	120	200	
Database	2	4	8	12	8	16	24	40
Historian	1	1	2	4	4	4	4	4
Application	1	4	8	16	8	8	12	12
Terminal	1	4	8	16	8	16	24	32

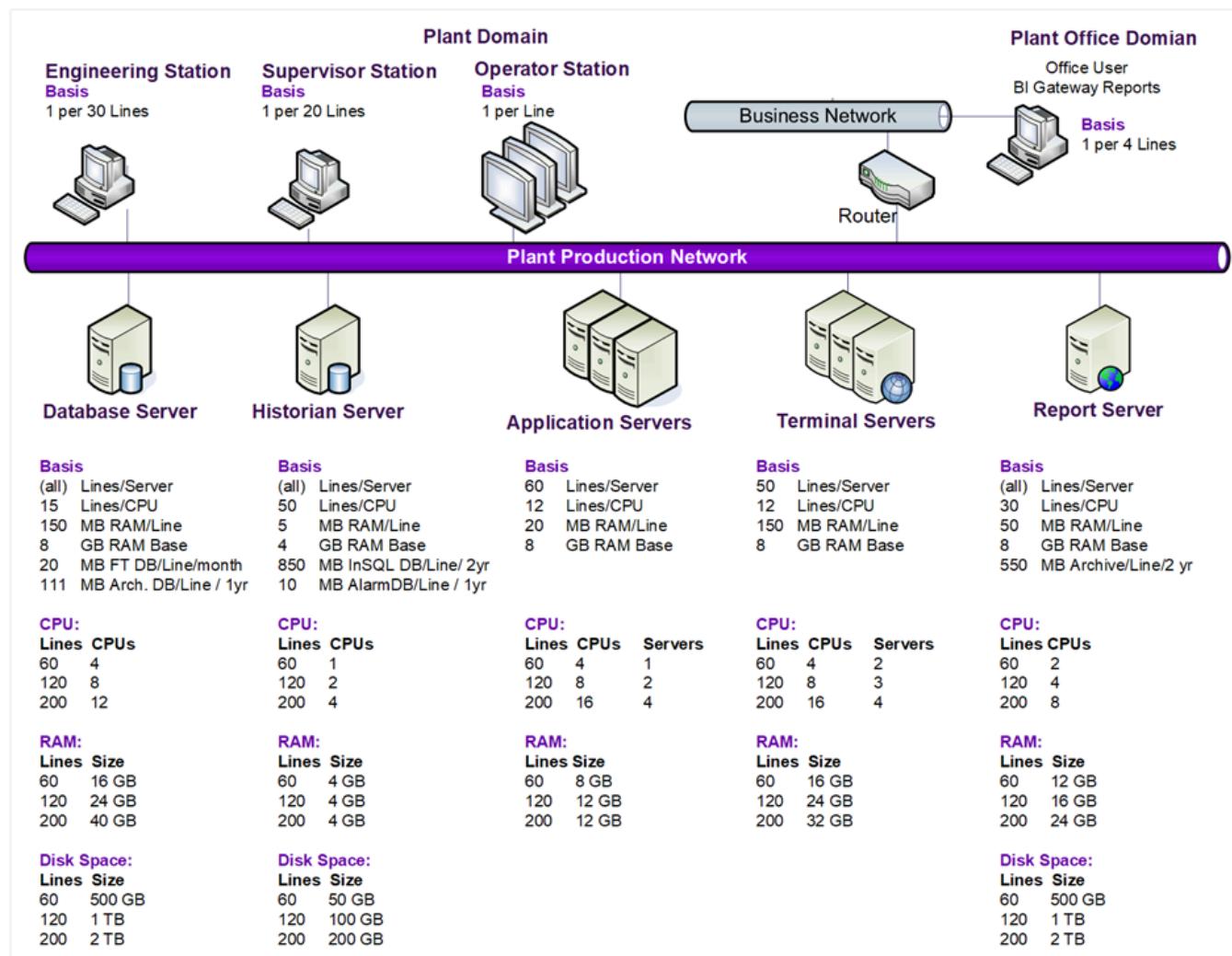
Server	CPU				RAM			
Report	1	2	4	8	8	12	16	24

The number of servers was determined and the load was split, making sure to not split the database, Historian, or Report Server. Application Servers were scaled by the number of MES objects. A standard server with 8 GB of RAM was used for scaling the Terminal Servers.

Server	Number of Servers			
<b>12</b>	<b>60</b>	<b>120</b>	<b>200</b>	
Database	1	1	1	1
Historian	1	1	1	1
Application	1	1	2	4
Terminal	1	2	3	4
Report	1	1	1	1

The hard disks were also scaled using this method.

The following diagram shows the resulting topology.



## MES Backup and Recovery Strategy

An MES system typically consists of real time and historical data. The backup and recovery strategy described here focuses on the historical data in an MES system environment.

A typical environment consists of:

- Real time connections to the plant floor (System Platform Application Server)
- Process Data Historian (AVEVA Historian)
- Operator Displays (AVEVA System Platform OMI or AVEVA InTouch HMI)
- Report Portal (AVEVA BI Gateway)
- SQL Server MES database
- A backup and recovery strategy must ensure that you can recover from a catastrophic failure in a timely manner. Any strategy must weigh the costs against the associated risks. The information in this chapter provides a balanced approach with reasonable costs and limited system downtime.

Before you design your backup and recovery strategy, consider the following recommendations:

- In systems where production continues regardless of the status of MES (e.g., switching to manual data collection), any strategy will result in a loss of information. This is called lack-of-service data loss.
- Implement truncation of transaction logs as part of the backup strategy to minimize the amount of storage they use.
- The more data you try to recover, the longer it will take to recover.
- You should design your backup and recovery strategy with an estimated time to recovery from a Standard and Disaster scenario.
  - The Standard scenario is typical when you have all backup media on hand and only need to restore the data.
  - Disaster recovery means all on-site equipment and information is lost.
- People must be trained, available, and willing to use the recovery strategy. System administrators are often more concerned with getting the system up and running than with restoring all the data. Once they have restored the last full backup, they might not want to use the Differential or Transaction log backup.
- The database size impacts the backup and recovery time in a production environment. Therefore an archive strategy should be considered to keep the online MES production database at an acceptable size.
- It is a good practice to have a test environment. Not only can it be used as an interim production system in the event a disaster occurring, it can be used to test the recovery plan.

## Backup and Recovery Strategy Components

The content in this chapter is not a backup and recovery strategy. Instead it outlines what is needed in such a strategy, namely:

- Complete list of software installed per server, including versions and patch levels
- Strategy for handling Windows updates, software updates, and application updates
- Licenses backup
- Archiving plan (archiving is part of backup and recovery)
- Application Deployment Guide that describes how to install the system from the source media and backups
- Backup plan, including system configuration and process data
- Recovery plan and recovery tests
- Offsite storage plan (backup media should be taken off site and rotated)
- Security requirements of the users administering the plan and the security of the data; this includes encrypting the database backups

## Task 1: Define What You Have

This sounds simple enough but, as time goes on, it can become less uncertain what is actually running at the site. Following are some simple tools to help you maintain a list of what is running on the system.

### System Architecture Diagram

Have an architecture diagram that shows an overview of what is running and where. The key point here is that it is an overview and should at a glance let people know what is running. Guidelines for the architecture are:

- Make it graphical so it's easier to see where components are in the system topology.
- Include all servers and include locations on network segments.
- Include the clients as a group, such as Operator Stations, Engineering Stations, and Office Users.
- Include the networks and firewalls.
- Include where the major components are running and the names of database instances.
- Generally do not include versions. An exception would be for key component versions that would require an update to the architecture diagram (e.g., the OS version).
- Try to keep the diagram to one page if possible.
- For examples, see the architecture diagrams in [Designing an MES Solution](#).

## Software Installation Report

Use this report to maintain a detailed list of all components installed on each server or client class in the system. This document should be updated as patches or updates are applied (this does not include automatic updates). Include the following elements for each component:

- Software name, version and patch level
- License requirements
- Server or client nodes on which the software is installed

For more information and an example report, see [Documenting the Installation and Change Control](#).

## Change Control Procedure

The Change Control Procedure should include:

- Updating the Software Installation Report.
- Saving copies of software and updates as part of the backup.

## Task 2: Define Your Database Recovery Model

Critical to a backup and recovery strategy for SQL Server databases is the SQL Server setting for Recovery Model. The Microsoft MSDN website provides a good definition of the different backup options. The following are excerpts from the website. For more information, see the topic "Recovery Models (SQL Server)" on the Microsoft SQL Server Docs website.

### Recovery Model

- **Backup Under the Simple Recovery Model** The database can be restored only to the end of the most recent backup. All data between the start of the last backup and when the system goes down is lost.  
The transaction log is automatically truncated to remove any inactive virtual log files. Truncation usually occurs after each checkpoint (completed transactions).
- **Backup Under the Full Recovery Model** The database can be restored to the end of the most recent transaction log backups. Also known as point-in-time recovery.

The potential data loss exposure is narrowed to the time between when the database is damaged and the most recent regular log backup (typically 10 minutes to 1 hour).

- **Backup Under the Bulk-Logged Recovery Model** For a database that regularly uses the full recovery model, you can optimize certain bulk operations by temporarily using the bulk-logged recovery model. The bulk-logged recovery model incurs several restrictions that make it not suitable for day-to-day operations.

## Backup Type

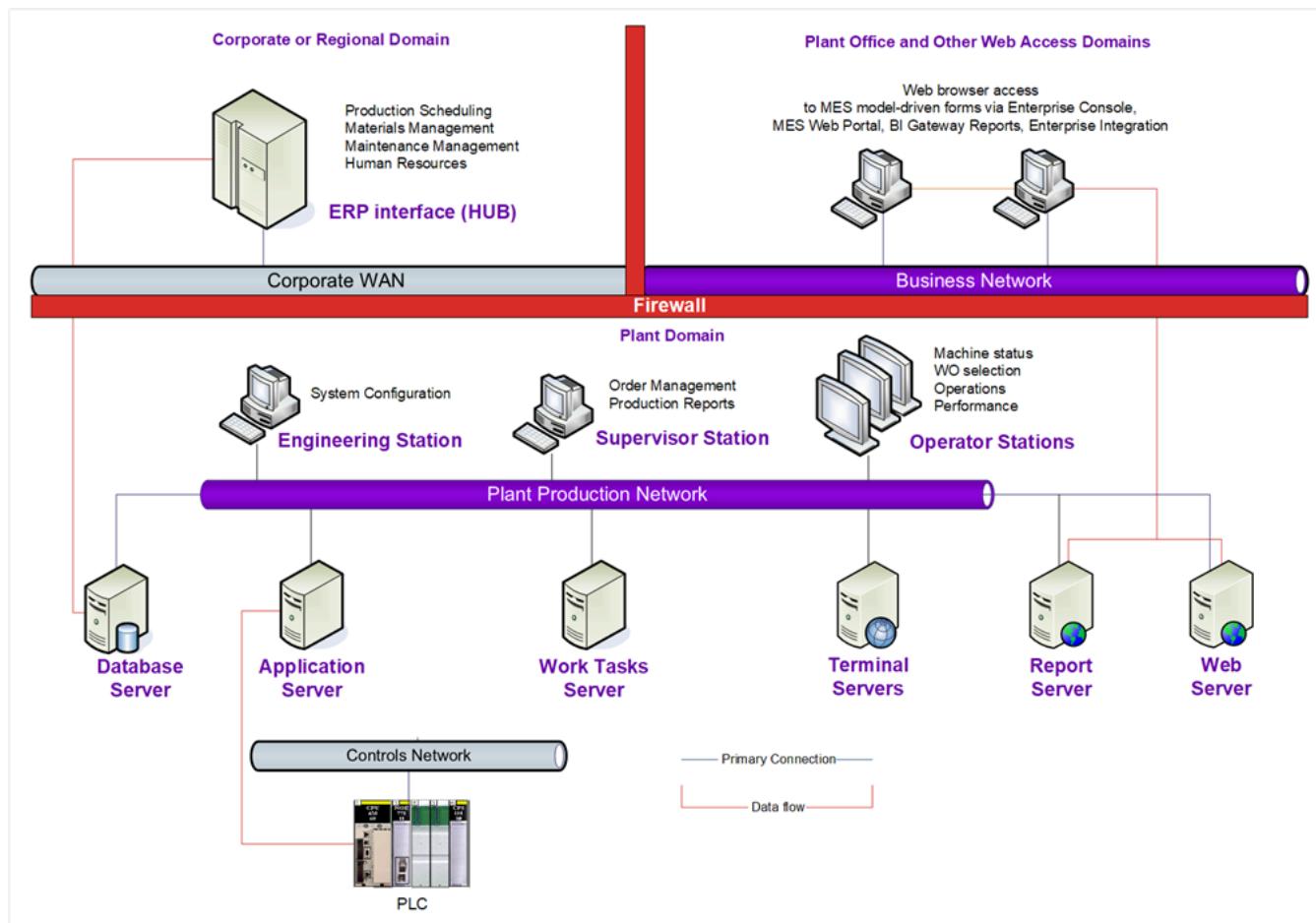
- **Full Database Backup** A full backup of the whole database up to the last completed transaction.
- **Differential Backup** Contains only the differences (as extents) since the last full backup.
- **Transaction Log Backup** Contains only the differences (as transactions) since the last full or differential backup.

## Recommendations

- Have a local backup drive and store all backups on it. Copy the backups to a remote or removable medium. This has the advantage of all backups being available locally for quick and easy restore but also available off site in the event of a disaster.
- Encrypt all backups for security.
- For backups other than transaction log backups, consider using the compression option when backing up to make it easier to transfer the backup files.
- The system for remote or removable medium backup does not have to treat database backups differently than any other files.
- Removable backup media should be moved to a safe offsite storage location and regularly rotated back in, ideally following well-established procedures for other valuable plant data.
- Use transaction log backups where appropriate and transferred to backup media at the same frequency as the backup. If you only transfer to backup media on a daily basis, then you need to be aware that under a disaster scenario the transaction log backups would not be available.
- You might consider backing up the transaction log directly to the backup media.
- For most situations, daily complete backups and hourly differential backups is sufficient. In this case, use the Simple Recovery Model.
- If you use the Full Recovery Model, make sure you schedule transaction log backups so your transaction log does not continually grow. In this context, a good strategy is daily full backups, hourly differential backups, and 10-minute transaction log backups.

## Task 3: Know What to Backup

The table below provides an overview of what needs to be backed up for the following sample system.



It uses the following directory structure:

- **C: OS Partition** Holds the operating system and program files.
- **D: Data Partition** Holds the variable data (SQL Server databases).
- **M: Backup Partition** Only for the database server to hold the database backups.

Server	Items	Type	Directory
<b>Application Server</b>			
	Operating System	Not backed up	(none)
	Software Media	File backup	D:\Backup\Software
	Applications	File backup	D:\Backup\Applications
	Data	(none)	(none)
<b>Work Tasks Server</b>			
	Operating System	Not backed up	(none)
	Software Media	File backup	D:\Backup\Software

<b>Server</b>	<b>Items</b>	<b>Type</b>	<b>Directory</b>
	MES model-driven application content	File backup	D:\Backup\Work Tasks
Database Server			
	Operating System	Not backed up	(none)
	Software Media	File backup	D:\Backup\Software
	Applications	File backup	D:\Backup\Applications
	SQLServer Databases:		
	master	Weekly Full	M:\Backup\Database
	msdb	Weekly Full	M:\Backup\Database
	MES database	Daily Full and hourly Differential	M:\Backup\Database
	Historian (Runtime) database	Daily Full and hourly Differential	M:\Backup\Database
	Work Tasks Farm database	Weekly Full	M:\Backup\Database
	Work Tasks repository databases	Daily Full	M:\Backup\Database
Report Server			
	Operating System	Not backed up	(none)
	Software Media	File backup	D:\Backup\Software
	Applications	File backup	D:\Backup\Applications
	SQLServer Databases:		
	master	Weekly Full	M:\Backup\Database
	msdb	Weekly Full	M:\Backup\Database
	BI Gateway database	Weekly Full	M:\Backup\Database
	ReportServer	Weekly Full	M:\Backup\Database
	Galaxy repository databases	Weekly Full	M:\Backup\Database
Engineering Station			

Server	Items	Type	Directory
	Operating System	Not backed up	(none)
	Software Media	File backup	D:\Backup\Software
	Applications	File backup	D:\Backup\Applications
	Data	(none)	(none)

## Operating System Backup

The first thing to consider is the operating system. A typical scenario is to have controlled releases of service packs and Windows updates. Under this scenario you would not backup or restore Windows but reinstall to the appropriate patch and Windows update.

Strategies that use a complete system image for the backup are much harder to implement, test, and validate. Even with this strategy you still need database backups to handle non-disaster recovery (for which you do not lose the operating system) and to handle the differential or transaction log backups (which are required at a higher frequency than is reasonable from an image backup). For these reasons, in most situations, image backups are not recommended.

## Installation Software Backup

Typically forgotten in a backup strategy is to backup the application installation software, including all patches, hot fixes, and licenses. Ideally your installation software media is in the form of an ISO image file. This file format allows you to handle it like all other files. If your software media is on removable media, the media should be stored in both an onsite and an offsite location. It's recommended to store the installation software on the backup drive in a format such as:

```
D:\Backup\Application
  \Patch #
    \HotFix_Date
```

For example:

```
D:\Backup\MES 2023
  \Patch 1
    \HF10849876
  \Patch 2
    \HF18223456
```

Remember to update the Software Installation Report.

## Applications Backup

Applications are different from software in terms of software versioning and identification. This makes them harder to track and be assured that you have the latest version when you install it. For this reason we recommend you put your Application code on the backup drive and install it from there and include a `readme.txt` file to document the installation.

For example:

D:\Backup\MyApp\MyApp\_v1\_28\_Sept\_2022.aaPKG  
  \MyApp\_v1\_28\_Sept\_2022.readme.txt  
  \MyApp\_v1\_patch1\_5\_Dec\_2022.aaPKG  
  \MyApp\_v1\_patch1\_5\_Dec\_2022.readme.txt

Remember to update the Software Installation Report.

## Database Backup

When backing up the product-specific databases, make sure you also backup the master and msdb databases. The database backups should be stored on the backup drive in the **Database\dbName** folder.

In SQL Server Management Studio, use the Maintenance Plan feature to create a maintenance plan that includes the following subplans.

Backups	Database	Schedule
Configuration Database Backups	master, msdb, ReportServer, BI Gateway database, Galaxy repository databases	Weekly and executed on demand whenever there are configuration changes
Full Backups	MES database, Historian (Runtime) database, Work Tasks Farm database and repository databases	Daily at a time of low activity (not midnight)
Differential Backups (optional)	MES database, Historian database (Runtime)	Hourly on the half hour
Transaction Log Backups (optional)	MES database	Hourly on the half hour

## Recommended Settings for All Database Backup Plans

- Set the backup schedule to never expire
- Backup to disk

## Recommended Settings for Full Backups

- Include a Maintenance Cleanup Task that follows the Back Up Database Task in the Full Backup subplan to delete all the differential and transaction log backups.
- If you want to keep only one backup on the hard disk, use the **Backup databases across one or more files** option in the backup task properties and use one task per database so you can give each database its own name. Also, you should select **Overwrite** for the **If backup files exist** option.
- If you want to keep multiple backup versions on the hard disk, select the **Create a backup file for every database** and **Create a sub-directory for each database** options. This will allow you to make one task for many databases and put the database name and timestamp as part of the file name. You should also include a Maintenance Cleanup Task to cleanup these files.

## Recommended Settings for Differential Backups

- Use the **Create a backup file for every database** and **Create a sub-directory for each database** options. Make sure you select **Differential** for the **Backup type** option.
- Have the Maintenance Cleanup Task in the Full Backup subplan delete the differential backup files after the full backup is performed.

## Recommended Settings for Transaction Log Backups

- Use the **Create a backup file for every database** and **Create a sub-directory for each database** options. Make sure you select **Transaction Log** for the **Backup type** option.
- Have the Maintenance Cleanup Task in the Full Backup subplan delete the transaction log backup files after the full backup is performed.
- Implement truncation of transaction logs as part of the backup strategy to minimize the amount of storage they use.

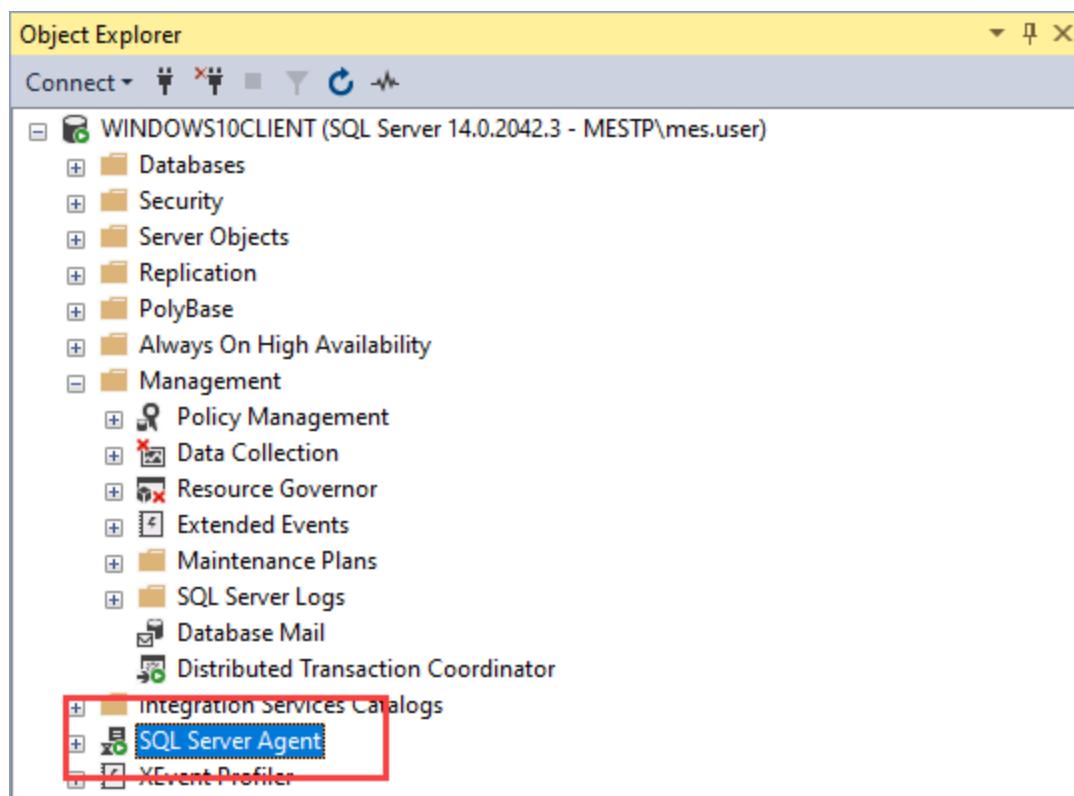
## Other Notes

- The **Verify backup integrity** setting is optional as it will take additional time to perform.
- Provide an appropriate name for the maintenance plan and the subplans. The following model is recommended: one maintenance plan for all backups, subplans for each scheduled period, and backup tasks for each database.

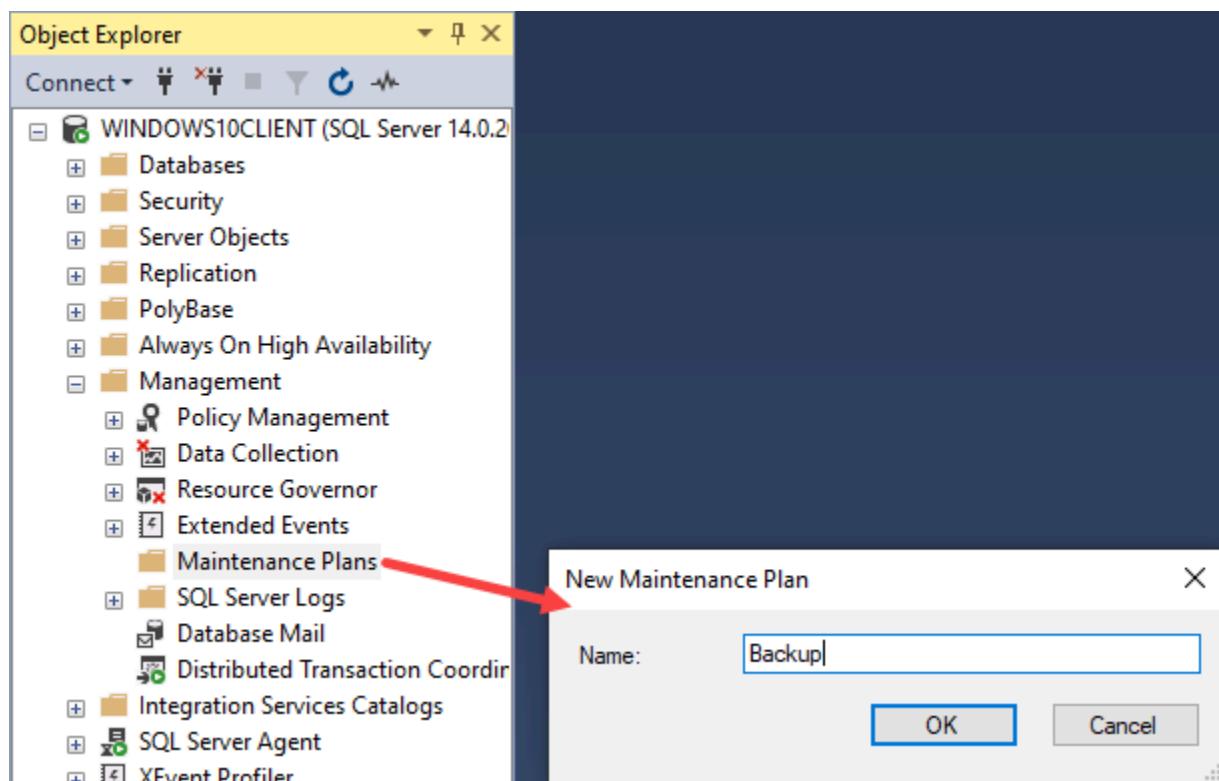
## Creating a SQL Database Maintenance Plan for Backups

Following is the procedure for creating a database maintenance plan for an example system that includes System Platform, Historian, MES, and BI Gateway databases.

1. Make sure the SQL Server Agent is running.



2. Create a new Maintenance Plan and name it **Backup**.



3. Add sub-plans for each scheduled period. In this case:

- Weekly

- Daily
- Hourly

The screenshot shows the 'Backup [Design]' window. At the top, there are buttons for 'Add Subplan' (with a plus icon), 'Delete' (with a minus icon), 'Save' (with a checkmark icon), 'Cancel' (with a cross icon), 'Manage Connections ...', and 'Servers ...'. Below this is a table with columns: Subplan, Description, Schedule, and Run as. There are three rows:

Subplan	Description	Schedule	Run as
Weekly	Weekly backups	Not scheduled (O...)	SQL Server Agent service account
Daily	Daily backups	Not scheduled (O...)	SQL Server Agent service account
Hourly	Hourly backups	Not scheduled (O...)	SQL Server Agent service account

4. Set the Schedule for each subplan.

The screenshot shows the 'New Job Schedule' dialog box. It has several sections:

- Name:** Backup Weekly
- Schedule type:** Recurring (selected) and Enabled (checked)
- One-time occurrence:** Date: 11/ 2/2022, Time: 11:15:33 AM
- Frequency:**
  - Occurs: Weekly
  - Recurs every: 1 week(s) on
    - Monday
    - Wednesday
    - Friday
    - Tuesday
    - Thursday
    - Saturday
    - Sunday (selected)
- Daily frequency:**
  - Occurs once at: 2:00:00 AM
  - Occurs every:
    - 1 hour(s)
    - Starting at: 12:00:00 AM
    - Ending at: 11:59:59 PM
- Duration:**
  - Start date: 11/ 2/2022
  - End date: 11/ 2/2022
  - No end date selected
- Summary:** Description: Occurs every week on Sunday at 2:00:00 AM. Schedule will be used starting on 11/2/2022.

At the bottom are buttons for OK, Cancel, and Help.

 New Job Schedule

Name:  Jobs in Schedule

Schedule type:   Enabled

One-time occurrence

Date:  Time:

Frequency

Occurs:

Recurs every:

Daily frequency

Occurs once at:

Occurs every:   Starting at:

Ending at:

Duration

Start date:   End date:

No end date:

Summary

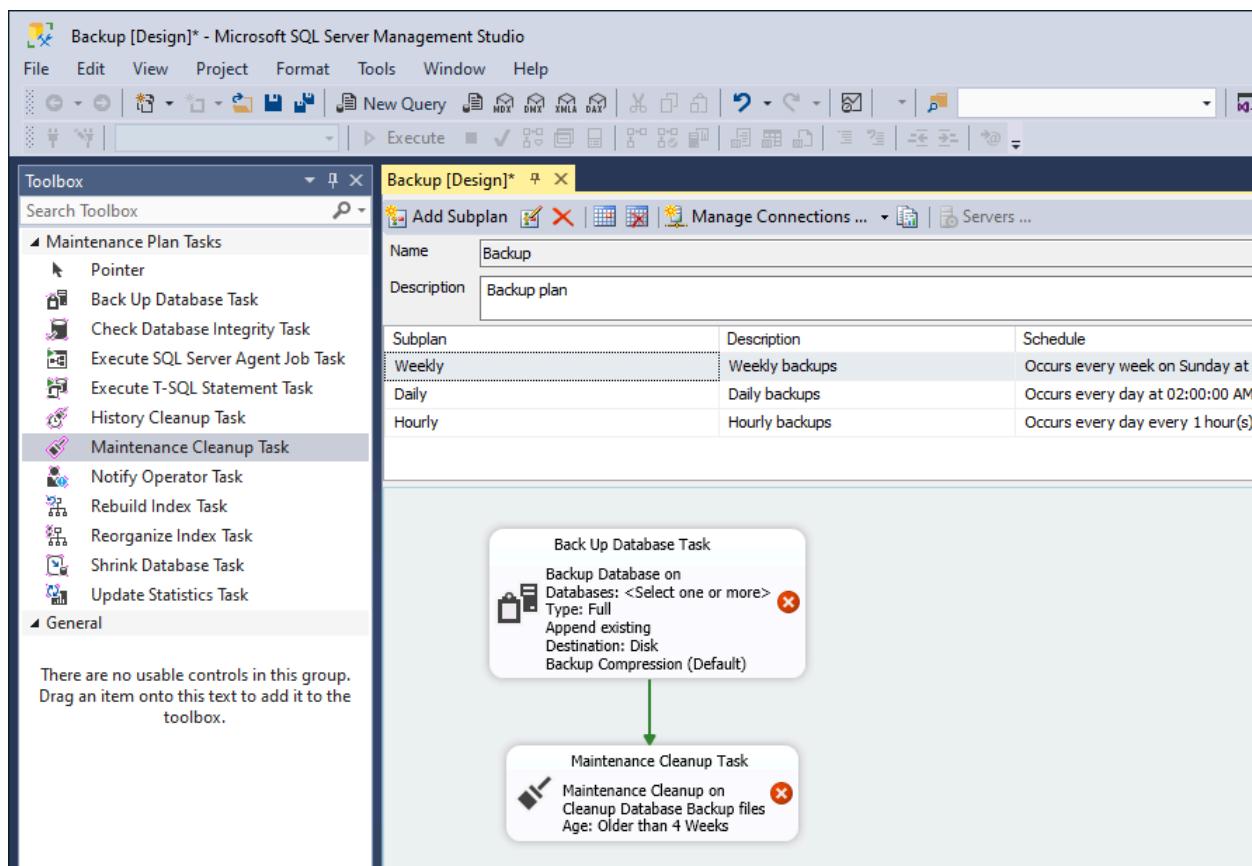
Description:

...

New Job Schedule

Name:	Backup Hourly	Jobs in Schedule
Schedule type:	Recurring	<input checked="" type="checkbox"/> Enabled
One-time occurrence		
Date:	11/ 2/2022	Time: 11:15:33 AM
Frequency		
Occurs:	Daily	
Recurs every:	1	day(s)
Daily frequency		
<input type="radio"/> Occurs once at:	2:00:00 AM	
<input checked="" type="radio"/> Occurs every:	1 hour(s)	Starting at: 12:30:00 AM
		Ending at: 11:30:00 PM
Duration		
Start date:	11/ 2/2022	<input type="radio"/> End date: 11/ 2/2022
		<input checked="" type="radio"/> No end date:
Summary		
Description:	Occurs every day every 1 hour(s) between 12:30:00 AM and 11:30:00 PM. Schedule will be used starting on 11/2/2022.	
<input type="button"/> OK <input type="button"/> Cancel <input type="button"/> Help		

5. For each subplan, add the maintenance plan tasks from the Toolbox window as suggested below.
- Weekly: Back Up Database Task of type Full, followed by a Maintenance Cleanup Task that deletes the backups that preceded the full backup by a specified time period.



- Daily: Back Up Database Task of type Differential, followed by a Maintenance Cleanup Task that deletes the backups that preceded the differential backup by a specified time period.
  - Hourly: Back Up Database Task of type Differential.
6. Specify the databases to be included in the full database backup tasks as follows:
- Database Server, Weekly: Galaxy repository databases, Work Tasks repository databases
  - Database Server, Daily: MES database, Work Tasks Farm database, Historian (Runtime) database
  - Report Server, Weekly: master, msdb, ReportServer, BI Gateway database
7. Specify the databases to be included in the Differential Database Backup as follows:
- Database Server, Hourly: MES database, Historian (Runtime) database

## System Platform IDE Backups

The System Platform IDE is backed up from the Operations Control Management Console (OCMC). This backup is required because it includes the security settings of the Galaxy and all installed components (script function libraries) that are not contained in the regular SQL Server backup.

In addition to the OCMC backup, we recommend SQL Server backups because they can be scheduled. You can also export Galaxy components from the IDE. These exports are used for different purposes as explained below.

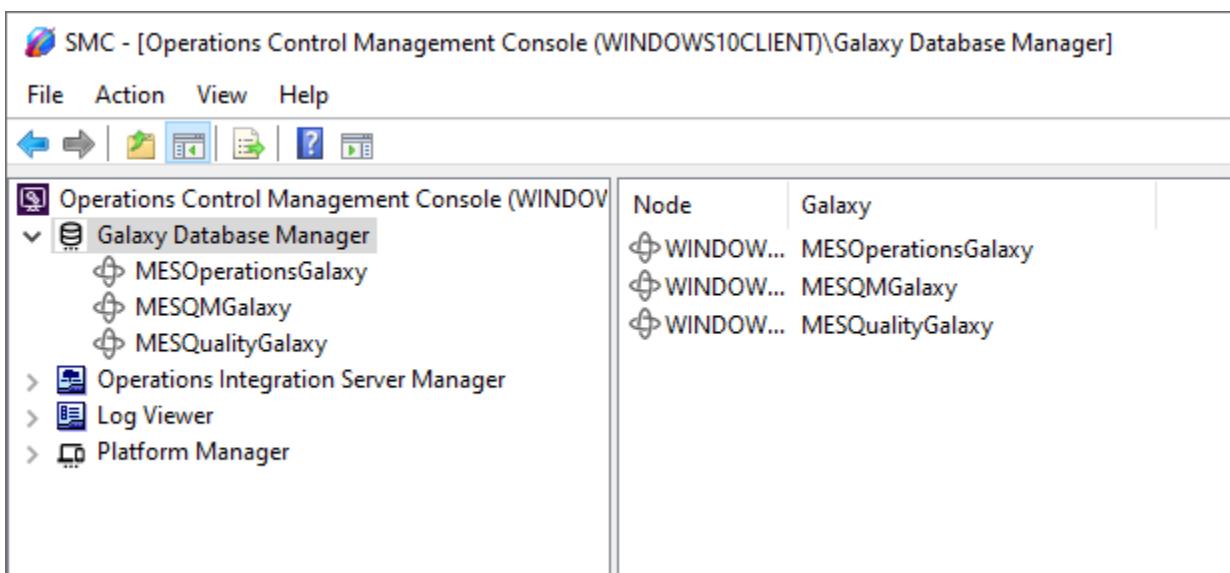
Galaxy Export	Description	Export To
Galaxy	Creates a .cab file that contains the entire Galaxy.	D:\Backup\System Platform

All Automation Objects	Creates a .aaPKG file that contains all of the Galaxy's templates and objects.	D:\Backup\System Platform\Templates
Galaxy Dump	Creates a .csv file that contains the selected objects' configuration that can be opened and edited before re-importing.	D:\Backup\System Platform\Objects
Script Function Library	Creates .aaSLIB files for each of the script library files that are selected for export.	D:\Backup\System Platform\Scripts

## Back Up Galaxies

Galaxy backups should be performed whenever changes are made or daily if changes are constantly being made.

1. In the Operations Control Management Console, expand the **Galaxy Database Manager** node to see the list of Galaxies.



2. Right-click the Galaxy and on the context menu click **Backup**.
3. Click **Yes** to proceed.
4. Specify the backup location as **D:\Backup\System Platform**.  
This generates a .cab file containing the entire Galaxy. This operation also backs up the Galaxy security settings.
5. Click **Close** and verify that no errors occurred.

## Backup all Templates and Objects

This backup should be performed when all changes have been completed.

1. From the System Platform IDE ribbon, select **Galaxy**, then **Export**.
2. Select **Objects**, then **All objects**.
3. Save the .aaPKG package file to **D:\Backup\System Platform\Templates**.

The saved package file will contain all of the Galaxy's templates and objects.

### Backup Objects to a CSV File

This backup should be performed whenever changes are made to objects.

1. In the System Platform IDE, select all of the objects to be backed up.
2. From the System Platform IDE ribbon, select **Galaxy**, then **Export**.
3. Select **Objects**, then **Selected as CSV**.
4. Save the .csv file to **D:\Backup\System Platform\Objects**.

The saved CSV file will contain the selected objects' configuration.

### Backup the Script Function Libraries

This backup should be performed initially and subsequently when other libraries have been imported.

This backup is not as important as the other Galaxy backups since the script function libraries are not changed by the configuration.

1. From the System Platform IDE ribbon, select **Galaxy**, then **Export**.
2. Select **Script Library**.
3. Select the libraries to be exported.
4. Specify the **D:\Backup\System Platform\Scripts** folder to which to export the selected script library files and click **Save**.

The corresponding script library .aaSLIB files are saved to the destination folder.

### Work Tasks-Related Backups

#### Work Tasks Databases

The Work Tasks Farm and repository backups are performed from SQL Server. Note that restoring Work Tasks databases requires special handling. For complete information on how to back up and restore these databases, see the Work Tasks help.

#### MES Model-Driven Application Content

The MES model-driven application content can be backed up by exporting the content from Work Tasks and then copying the exported files to the **D:\Backup\Work Tasks** folder.

Content that can be exported include:

- Process definitions
- Workflows
- Lists
- Forms
- Package templates

For complete information on how to export this content, see the Work Tasks help.

### BI Gateway Database Backup

The BI Gateway database backups should follow the same schedule as the MES database backups.

## Task 4: Define the Recovery Plan

A backup strategy is not complete without a Recovery Plan. All recovery plans must be tested to ensure they work. The Recovery Plan should include recovery for the following scenarios:

- A **Standard** scenario, which is typically when all backup media are available and only a data restore is needed.
- A **Disaster** scenario, which means all on-site equipment and information is lost (that is, a complete server rebuild is required).

The following components are required for a successful Recovery Plan:

- A complete recovery procedure is documented and followed for all servers and workstations (for example, Operator and Engineering).
- Personnel are trained on the Recovery Plan and they have the skills to execute it.
- The Backup Plan is well documented and clearly identifies the locations of all backup media.
- The Recovery Plan has been tested, with the recovery time from a disaster and standard scenario recorded.
- The Recovery Plan is tested at least once per year.
- There is a procedure for the shop floor to follow during the recovery downtime. This can range from stopping work to manual data collection. Optionally, there is a procedure for manual data entry for data collected during outages.

## A Performance-Qualified Medium-Size System

A multi-node system with just the MES components in a medium-size system has been qualified to determine the performance levels that could be achieved.

The following topics describe how the qualification testing was carried out and the performance test results.

### Component Deployment

MES 2023 was installed on the following separate systems.

**Database/Middleware Server**

Processor cores: 8

Memory: 16 GB

Operating System: Windows Server

Installed components: MES Middleware; MES Database; Microsoft SQL Server

**Web Server**

Processor cores: 4

Memory: 8 GB

Operating System: Windows Server

Installed components: MES Middleware (Web API calls to simulate MES Web Portal and MES model-driven application calls from Work Tasks workflows)

**Application Server**

Processor cores: 8

Memory: 8 GB

Operating System: Windows Server

Installed components: Application Server, InTouch, MES Application Objects, MES Middleware, Microsoft SQL Server 2019

**Galaxy Repository**

Processor cores: 4

Memory: 8 GB

Operating System: Windows Server

Installed components: System Platform, Galaxy, Entity Model Builder

## Test Loads

Load was placed on the system from two sources: System Platform application objects and MES Web API tests.

### System Platform Application Objects

In System Platform, load was generated using 50 entities, each with 1 OCO and 1 UCO, for a total of 50 OCOs and 50 UCOs. An additional 5 SROs were used for quality data. The entities were deployed to 4 Application Engines on a single platform. The following load was generated:

- Each entity generated 1 utilization event per minute except for a 4-minute period of inactivity each hour. Thus, there were 56 utilization events produced per entity per hour.
- Each entity generated 2 item production events (1 good production and 1 scrap production) per minute except for a 4-minute period of inactivity each hour. Thus, there were 112 item production events (56 x 2) produced per entity per hour. The system was set to collect distinct production, so each item production event generated a new record in the database.
- Each entity generated 1 item consumption event per minute except for a 4-minute period of inactivity each hour. Thus, there were 56 item consumption events produced per entity per hour. The system was not set to collect distinct consumption, so the item consumption data was accumulated in existing records rather than having a new record for each consumption event.
- Each entity with an SRO recorded a quality result every minute except for a 4-minute period of inactivity each hour. Thus, there were 56 result records produced per entity per hour. New samples were generated by

the system every 5 minutes with 5 characteristics in each sample.

- Each hour, the following processing took place for each entity, in the order shown:
  - The current job was stopped
  - The machine state was changed to down (generating a utilization event)
  - A new job was created
  - The item lot was changed
  - Inventory was received
  - The new job was started
  - The machine state was changed to running (generating a utilization event)

## MES Web Portal

From an MES client system, load was generated from 50 virtual users, half performing MES Web Portal functions and the other half performing quality functions. The MES Web Portal tests simulated this activity by making the same Web API calls that the MES Web Portal makes from the page being tested. The following load was generated:

- 9 users simulated loading the following MES Web Portal pages. Each user loaded one of these pages at random every 30 seconds:
  - Home page
  - Line Collection page
  - Line Work Order page
  - Line Entity page
  - Entity Work Queue page
  - Utilization Event History page
  - Production History page
  - Entity Monitor page
  - Line Monitor page
- 16 users simulated activities that might be performed by a line operator. Some of these activities were page loads, while others involved data generation. Each user performed one of these activity at random every 60 seconds:
  - Line Collection page load
  - Line Entity page load
  - Line Work Order page load
  - Add utilization event
  - Add item production
  - Create work order
  - Line Monitor page load

## MES Quality Testing

25 users simulated activities that might be performed by a line operator. Some of these activities were requesting data, while others involved recording results or modifying sample context data. Each user performed one of these activities at random every 60 seconds:

- Update sample context data
- Pull or finalize sample
- Read sample and result data
- Record results

## Other Test Information

The settings in the **FactMES.Server.Host.exe.config** file were all left at their default values. No other MES applications were run during the tests. The Operations Control Management Console Log Viewer was checked for error or warning messages; no messages occurred during the test.

## Performance Test Results

The following tables show the results generated from a 48-hour performance test. The test consisted of load from the System Platform application objects and simultaneous load from the MES Web Portal tests. No data loss occurred during testing; all data was successfully stored in the MES database.

Database Size at Start of Testing	
Table	Records
Work orders	29,000
Jobs	52,500
Entities	1,400
Utilization events	6,500,000
Item production	3,200,000
Item consumption	3,200,000
Shift changes	18,000
Quality samples	1,800,000
Quality results	6,800,000

Intervals Between Record Creation			
Target (sec)	Average (sec)	Min (sec)	Max (sec)

Production	60	59.70	59.00	61.00
Utilization	60	59.60	59.00	61.00
<b>MES Middleware Calls</b>				
	Total Executions	Avg Exec Time (sec)	Min Exec Time (sec)	Max Exec Time (sec)
Minutely	2800	0.004	0.001	0.030
Hourly	48	0.090	0.014	0.488
<b>Soak Test Results</b>				
Transaction		Average Transaction Time (sec)		
Add Event		0.25		
Add Production		0.36		
Line Collection page load		0.21		
Line Entity page load		0.21		
Line Monitor page load		1.56		
Line Work Order page load		0.19		
Add Work Order		0.90		
Page load, Entity Monitor page		0.50		
Page load, Entity Work Queue page		0.46		
Page load, Landing page		0.05		
Page load, Line Collection page		0.11		
Page load, Line Entity page		0.19		
Page load, Line Monitor page		0.26		
Page load, Line Work Order page		0.13		
Page load, Production History page		0.05		
Page load, Utilization Event History page		0.06		
Page load, Work Order Collection page		0.58		
Quality Management, Bulk Result Generation		0.98		

Quality Management, Read Bulk Data	0.34
Quality Management, Pull and Finalize	0.72
Quality Management, Update QM Data	0.03
<b>Average</b>	<b>0.42</b>

## System Resource Usage

The average disk and processor usage for the systems used in the performance tests are listed below.

### Database/Middleware Server

Available Memory: 1 GB

**Note:** SQL Server memory usage was limited to leave 2 GB available to the operating system.

Disk Usage: 2.77%

Processor Time: 20%

### Web Server

Available Memory: 4 GB

Disk Usage: 1%

Processor Time: 6%

### Application Server

Available Memory: 4 GB

Disk Usage: 3%

Processor Time: 24%

### Galaxy Repository

Available Memory: 4 GB

Disk Usage: 1%

Processor Time: 1%

## Install

MES installation tools and configuration editors enable you to install and customize your MES installation.

To install Manufacturing Execution System (MES) complete the following activities, as applicable:

1. Before you begin:
  - [Preparing to Install MES](#)
  - [Preparing to Upgrade MES](#)
2. [Installing MES](#)
3. [Activating the MES Product Licenses](#)
4. [Activating the MES Product Licenses](#)
5. [Configuring MES Components](#)
6. [Implementing Secure Communication with System Management Server](#)

7. Creating or Migrating MES Databases
8. Configuring MES Middleware Communication with MES Databases
9. Configuring the MES Middleware Proxy
10. Configuring and Deploying MES BI Gateway Reports
11. MES Service Monitor
12. Running MES Install and Configurator from a Command Line
13. Upgrading MES Development Components
14. Modifying, Repairing, and Uninstalling MES

## Preparing to Install MES

Before you begin the installation, you should:

- Make sure that the nodes on which MES will be installed meet the hardware and software requirements.
- Understand user security and permissions that are related to the installation. See [Notes About Security and Permissions](#).
- Identify which MES products and components will be installed on each node in the system. For assistance with this task, see [MES Components](#), the *MES Deployment Guide*, and the *MES Virtual Environment Implementation Guide*.
- With the products and components to be installed on the nodes identified, determine which MES role-based installation groups will be installed on each node. See [MES Role-Based Installation](#).
- Make sure that the prerequisite software for the planned products and components is installed on each node. See [MES Prerequisite Software](#).

## Hardware and Software Requirements

For hardware, software, operating system, and database requirements to install the MES software, see the MES Readme, System Requirements section.

For updates to this information, see the AVEVA Knowledge and Support Center website.

## Notes About Security and Permissions

Note the following about security and permissions when running an MES installation:

- The user performing the installation must have administrator privileges for the Windows operating system on the node on which the software is being installed.
- Beginning with the MES 2014 R3 (version 5.3) release, MES no longer uses the System Platform User Account (also known as Admin User) for its inter-node communication. Instead, during the installation, a service account named WCFHostService for the MES middleware service is created. When configuring the MES DB/MW Communications component, you can select an option that will provide the necessary permissions to the MES database server for this service account. See [The Middleware Service Windows User Account and Automatically Setting Database Access](#).
- When installing in a workgroup environment, permissions to access the MES database must be granted

manually to the MES middleware service's user account.

- Beginning with MES 2020, the MES Middleware Web API uses AVEVA Identity Manager to authenticate users. This requires that the MES Security Mode in MES Client be set to either OS Group or OS User and that the AVEVA System Management Server component in the post-install Configurator be configured.
- Other access to the MES middleware for remote users (e.g., using the Stateless API) should be secured through a VPN connection. It is also recommended that the Windows Firewall be used to limit the users who are authorized to access the middleware.

## MES Firewall Exceptions List and Firewall Ports

The firewall ports and exception white list entries specific to MES applications are created during the MES DB/MW Communication component configuration. The default HTTPS, HTTP, and SQL Server firewall ports that are required by MES applications are opened by default on Windows or by installing SQL Server.

The default port numbers that MES uses are listed in the following table.

Component	Port		Changeable?	
	HTTP	HTTPS	HTTP	HTTPS
MES Middleware Proxy			Y	N
MES Middleware Web API	80	443	Y	N
MES Web Portal			N	Y
System Management Server	N/A		N	Y

For a list of the firewall ports used by other AVEVA products with which MES works, refer to their documentation:

- License Server and Manager: *Enterprise Licensing Guide*
- System Platform: System Platform Readme and *Application Server User Guide*
- Work Tasks: *Work Tasks Administrator Guide*
- BI Gateway: *BI Gateway Installation Guide* and *BI Gateway Web Configuration Guide*

For SQL Server and similar third-party products, refer to the appropriate product documentation.

## MES Components

The following topics describe the components that can be installed or added during the MES installation.

## Server Components

### Database

The MES database is a centralized repository for the MES data.

The Database component also includes the OS Group SID utility, which is used to import Windows Active Directory group SIDs into the MES database.

To optimize performance on a system that will also be running BI Gateway, the MES database should be installed on a separate server from the BI Gateway database.

### Middleware

The MES middleware:

- Enables communication between the client components and the MES database
- Allows the node to support executing archive, purge, and restore (APR) jobs for MES database maintenance
- Changes shifts
- Generates and changes the status of quality samples
- Cleans up stale sessions
- Runs schedules of Supply Chain Connector

The Middleware component also includes:

- The Service Monitor utility, which is used to start, stop, and restart the MES middleware host service from the Service Monitor icon in the Windows system tray
- The MES Web API, which can be used to develop custom applications
- The MES Clear Parameter Cache utility, which is used to clear the middleware stored procedure parameter cache
- A License Client API for accessing the License Server

### MES Web Portal

MES Web Portal is a web application that provides web-based access to MES.

## Client Components

The client components can run on non-server nodes and interact with the server components on the server nodes.

### MES Client

MES Client is used to configure almost all aspects of the MES system, and interact with operational information. You can:

- Configure system utilization states, reason groups, and reason codes
- Configure users, user groups, privileges, entity access, and user certifications
- Configure languages
- Configure physical entities
- Configure shift patterns and schedules and assign them to entities
- Set up system-wide values such as job states, document types, defaults for file extensions, labor departments, and labor categories
- Configure General Parameters
- Configure items, BOMs, operations, and processes
- Configure archive, purge, and restore (APR) jobs for database maintenance
- Configure quality specifications, sample plans, and characteristics
- Create and manage work orders and jobs
- Set up data collection
- Store customer information and processing sales orders

For more information, see the *MES Client User Guide* or online help.

## Application Objects

The Application Objects components include:

- The Operations Capability Object (OCO), which extends the System Platform IDE equipment model to trigger production events and log associated production data in the MES database.
- The Utilization Capability Object (UCO), which extends the System Platform IDE equipment model to monitor machine performance.
- The Sample Recording Object (SRO), which extends the System Platform IDE equipment model to monitor quality samples for an entity.

For more information about these objects, see [Application Objects](#).

## Entity Model Builder

Entity Model Builder is a System Platform IDE extension. Therefore, the System Platform IDE must be installed before attempting to install Entity Model Builder.

You can use Entity Model Builder to perform the following tasks:

- Creating entities from your System Platform equipment model that use the UCO for configuring utilization/OEE support, the OCO for configuring production related entity support, and/or the SRO for capturing quality data.
- Exporting the existing System Platform users and roles to MES to create corresponding MES users and groups.

If you install Entity Model Builder, you must also install the MES Application Objects component and import at least one of these objects into a System Platform galaxy. Running Entity Model Builder without having an MES

application object installed and imported is not a supported scenario.

For more information, see the *MES Entity Model Builder User Guide*.

## Supervisor

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**Note:** MES Supervisor will be removed in a future release.

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You can use MES Supervisor to manage:

- Inventory
- Storage entities
- Supply Chain Connector import and export schedules

For more information, see the *MES Supervisor User Guide* or the MES Help online help.

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**Note:** MES Supervisor is not selected by default for installation. It must be manually selected using the **Custom Installation** option during the installation process.

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## Data Editor

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**Note:** MES Data Editor will be removed in a future release.

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You can use MES Data Editor to filter, insert, and modify historical data from the MES database, such as:

- Item production and consumption
- Labor use and entity use
- Step data
- Lot information

For more information, see the *MES Data Editor User Guide* or the MES Help online help.

## Operator

You can use MES Operator to control processes as an operator on the factory floor, such as:

- Executing jobs
- Claiming produced quantities and reporting consumption
- Entering data for steps, specifications, and the data logger
- Capturing machine utilization and labor data

For more information, see the *MES Operator User Guide* or the MES Help online help.

## .NET Controls

The .NET controls are part of the client components' user interface. You can use these controls as building blocks for System Platform graphical interfaces and Operations Management Interfaces (OMI).

When the .NET Controls component is installed, the .NET control files and the **MESControls.aaPKG** file are

installed in the <MES program files path>\Wonderware\MES\Controls folder. The **MESControls.aaPKG** file, which contains all of the DLLs, can be imported into the System Platform IDE. The **MES Controls** folder can be imported as an OMI app.

## Middleware Proxy

The MES middleware proxy is required by client components installed on remote nodes to access the MES middleware service. These include, for example, nodes that have an application object (that is, a OCO, UCO, or SRO) deployed on them.

### Application Objects

#### Operations Capability Object (OCO)

The OCO extends the System Platform IDE equipment model to trigger production events and log associated production data in the MES database.

Once you have deployed the OCO, you can:

- Create jobs running on the entity
- Start, pause, and end jobs on the entity
- Add production and consumption for jobs running on the associated entity.

A single instance of the OCO supports the following Production Events Module (PEM) events of the associated equipment in the equipment model:

- Material events related to consumption, production, and movement
- Status events related to equipment, production data and operators

The Entity Model Builder (EMB) uses the information that is configured in the OCO to create entities in the MES database.

You must import the OCO extension that is provided with this version of MES after you complete the installation. The previous version of OCO will not work correctly with this version of MES. For more information about how to install the OCO, see the *Operations Capability Object User Guide*.

#### Utilization Capability Object (UCO)

The UCO extends the System Platform IDE equipment model to monitor machine performance. The information that is configured in the UCO is used to configure entities using the Entity Model Builder. Once you have deployed the UCO, you can:

- Monitor machine performance and log utilization events on entities associated with it
- Set production attributes for jobs running on the associated entities

You must import the UCO extension that is provided with this version of MES after you complete the installation. The previous version of UCO will not work correctly with this version of MES. For more information about how to install the UCO, see the *Utilization Capability Object User Guide*.

## Sample Recording Object (SRO)

The SRO extends the System Platform IDE equipment model to monitor quality samples for the entity. Once you have deployed the SRO, you can:

- Monitor samples and characteristics within the samples
- Update sample information
- Update sample characteristic information
- Record sample characteristic result data

You must import the SRO extension that is provided with this version of MES after you complete the installation. The previous version of SRO will not work correctly with this version of MES. For more information about how to install the SRO, see the *Sample Recording Object User Guide*.

## MES BI Gateway Reports Components

If the system includes BI Gateway, you can install the MES BI Gateway Reports component.

If the system does not include BI Gateway but you want to use MES BI Gateway Reports, you can also install the BI Gateway Server, BI Gateway Model Builder, and BI Gateway Data Adapters components to support those reports. To optimize performance, the MES database should be on a separate server from the BI Gateway database.

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**Note:** During the installation, selecting the Report Server role option will install only the MES BI Gateway Reports component. To install the BI Gateway Server, BI Gateway Model Builder, and BI Gateway Data Adapters components as part of the MES installation, you have to choose the **Customize Installation** option in the Setup tool and then manually select these components.

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For information about using the MES BI Gateway Reports, see the *MES BI Gateway Reports User Guide*.

## Development Library (API DLLs)

The Development Library component installs the MES API DLLs to support third-party application development. These DLLs comprise the MES Stateless and Stateful APIs.

If you are upgrading a MES system that have scripts that use the MES Stateless or Stateful API DLLs, you must also upgrade the DLLs to the current version. After the installation and configuration, see the procedure in [Upgrading MES .NET Controls for AVEVA InTouch HMI Applications](#).

The API DLLs that are included in the component are:

- Fact.Client.Common.dll
- Fact.Common.dll
- Fact.Common.Interfaces.dll
- FactMES.API.Commerce.dll
- FactMES.API.Common.dll
- FactMES.API.Core.dll
- FactMES.API.EnProd.dll
- FactMES.API.Labor.dll

- FactMES.API.Prod.dll
- FactMES.API.Quality.dll
- FactMES.API.Util.dll
- FactMES.Client.COM.dll
- FactMES.Client.Common.dll
- FactMES.Client.Interfaces.dll
- FactMES.Client.MiddlewareAccess.dll

For more information about using these DLLs in scripts, see the MES Stateless and Stateful API Reference online help files.

## PDF Documentation

The PDF Documentation component installs the MES user documentation PDFs and online help files.

### MES Deployment Guide

Provides guidance on deploying a MES solution.

### MES Virtual Environment Implementation Guide

Provides information to assist with implementing MES in a virtualized environment.

### ReadMe

Provides information about software and hardware requirements, known issues, licensing, and documentation.

### MES Installation Guide and online help

Provides information about installing MES applications.

### MES Client User Guide and online help

Provides information about customizing and maintaining the plant floor information.

### MES Dynamic Routing User Guide

Provides information required to set up dynamic routing of operations through a process defined in MES.

### MES .NET Controls Developer Guide

Provides information about the properties and methods of the MES .NET controls for use in custom applications and System Platform graphics.

### MES Application Object (OCO, UCO, SRO) Help

Provides information about run-time behavior, configuration, and run-time attributes of UCO, OCO, and SRO application objects. This help is accessed from the Object Editor **Help** menu in the System Platform IDE.

### Operation Capability Object (OCO) User Guide

Provides information about installing, configuring, and using the Operations Capability Object to track production transactions against equipment.

### Sample Recording Object (SRO) User Guide

Provides information about installing, configuring, and using the Sample Recording Object to collect and store values for samples.

### Utilization Capability Object (UCO) User Guide

Provides information about installing, configuring, and using the Utilization Capability Object to collect equipment performance data.

**MES Entity Model Builder User Guide**

Provides information about creating entities from the System Platform equipment model.

**MES Stateless API Reference online help**

Provides information about using the Stateless API within the System Platform IDE to develop and customize System Platform scripts.

**MES Stateful API Reference online help**

Provides information about using the Stateful API within the System Platform IDE to develop and customize System Platform scripts.

**MES Web API V1 Reference online help**

Provides information about using the MES Web API V1 to develop custom applications.

**MES Web API V3 Reference online help**

Provides information about using the MES Web API V3 to develop custom applications.

**MES Operator User Guide**

Provides information about executing production processes at the plant floor using the Operator application.

**MES Web Portal User Guide and online help**

Provides information about using the web browser-based MES Web Portal to customize and maintain the MES system and execute jobs at the plant floor.

**MES Middleware User Guide**

Provides information about how to configure the MES middleware and what regularly scheduled tasks it performs in the MES system. Also provides information about how to use middleware extensibility hooks to perform custom actions before or after a specific middleware event is executed.

**MES BI Gateway Reports User Guide**

Provides information about running and viewing MES BI Gateway Reports.

**MES Help**

Provides online information about MES Operator.

## BI Gateway, Licensing, and AVEVA Single Sign-On Components

The MES installation software also includes the following components:

- BI Gateway, which must be installed if MES BI Gateway Reports are going to be used.  
**Note:** To install the Quality Characteristic Detail report's SPC Chart control, the MES BI Gateway Reports component must be installed and configured on the same node as the BI Gateway Datastore and SQL Server Reporting Services (SSRS).
- The License Server and Manager. The licensing components must be installed so that MES product licenses can be added to the system.
- AVEVA Single Sign-On. The AVEVA Single Sign-On service provides secure access to MES when using MES Web Portal or the MES Web API in custom applications.

It is possible that these components have already been installed in the system. However, if they are not installed, then they can be selected during the MES installation using the custom installation feature.

In addition to these two licensing components, there is also a Licensing API that is automatically installed when

the MES Middleware or Web Portal components are installed. The licensing API can also be installed during an MES command line (silent) installation by specifying **LicAPI32** in the response file.

## MES Role-Based Installation

The MES Setup tool allows you to select role-based groups of products and components for installation on a node. The Setup tool also allows you to customize the installation by selecting specific components.

Role-based installation provides a combination of MES features specific to a node's role in a multi-node system. For example, if the node is going to be located on the production floor for use only by production operators, then only the Operator role's set of components needs to be installed.

Note that more than one role can be selected for installation on a node, to support nodes that will be running a number of MES clients or services. Although the MES installation software includes a limited version of BI Gateway Server, none of the MES roles will install BI Gateway. During the installation, you have to select the customize option to manually select the BI Gateway components.

It is recommended that you identify the appropriate role for each node before starting the installation. For information about planning what components to install on the MES nodes, see the *MES Deployment Guide*.

The following roles are available for selection. Note that all roles include the entire library of MES user documentation by default.

### Database Server with MES

Select this role to install the MES database on the node.

This role includes the following components:

- MES Database
- MES Middleware
- MES Middleware Proxy

To optimize performance on a system that will also be running BI Gateway, the MES database should be installed on a separate server from the BI Gateway database.

### Operator Client

Select this role if production operators, application objects, or third-party applications will be using the node to record production, utilization, or quality management data.

This role includes the following components:

- MES Operator
- MES .NET controls
- MES Development Library (API DLLs)
- MES Middleware Proxy

## Web Portal

Select this role to install the MES Web Portal web application on the node.

This role includes the following components:

- MES Web Portal
- MES Middleware Proxy

## Report Server

Select this role to install support for deploying MES BI Gateway Reports.

This role includes the following component:

- MES BI Gateway Reports

If you want to deploy MES BI Gateway Reports but BI Gateway has not been installed on the network, you can customize the installation to include the BI Gateway Server, BI Gateway Model Builder, and BI Gateway Data Adapters.

## MES Middleware/DB Maintenance Server

Select this role to install the MES middleware service on the node, or to support executing Archive/Purge/Restore jobs to maintain the MES database.

This role includes the following components:

- MES Middleware
- License Client API for accessing the License Server
- MES Middleware Proxy

To distribute the client load, a system can have multiple MES Middleware components installed. All five-equipment licenses include two MES Middleware components. All larger equipment licenses include six MES Middleware components. Additional MES Middleware components can be purchased separately. Dedicated MES Middleware components are recommended for enterprise integration, MES Application object/scripting servers, Work Tasks .NET workflow integration, and nodes making heavy use of the MES API through custom applications.

## Configuration Client

Select this role if MES administrators, supervisors, or developers will be performing configuration or supervisory tasks from the node.

This role includes the following components:

- MES Client
- MES Data Editor
- MES Middleware Proxy

## System Platform Development

Select this role if MES developers will be using System Platform and MES application objects to develop or run MES applications on the node.

This role includes the following components:

- Application Objects (OCO, SRO, UCO)
- MES .NET Controls
- MES Entity Model Builder
- MES Development Library (API DLLs)
- MES Middleware Proxy

## .NET Development

Select this role if MES developers will be using .NET Controls to develop or run custom MES applications on the node.

This role includes the following components:

- MES .NET Controls
- MES Development Library (API DLLs)
- MES Middleware Proxy

## MES Prerequisite Software

During the installation process, the MES Setup tool analyzes the software installed on the node and includes any software that is required but not currently installed with the MES components that are being installed. This analysis is based on the MES role-based installation groups or the custom list of components that are selected to be installed.

The prerequisite software is listed below, based on the MES role-based installation groups.

If your organization is using MES with System Platform, System Platform 2023 is required and should be installed or upgraded to prior to installing MES.

### All roles require:

- Microsoft .NET Framework 4.8
- Microsoft .NET Core Runtime 6.0

### Database Server with MES role requires:

- Microsoft Message Queue (MSMQ) Server
- Safenet Sentinel License Driver version 7.6.8 or higher

**Operator Client role requires:**

- Microsoft MSMQ Server

**Web Portal role requires:**

- Microsoft MSMQ Server
- Microsoft Internet Information Services (IIS) version 7.5 or higher

**Report Server role requires:**

- The version of the Microsoft Visual Studio C++ 4 x64 Runtime Redistributable that is compatible with the Windows server software that running on the node

**MES Middleware/DB Maintenance Server role requires:**

- Microsoft MSMQ Server
- Safenet Sentinel License Driver version 7.6.8 or higher

**Configuration Client role requires:**

- Microsoft MSMQ Server

**System Platform Development role requires:**

- Microsoft MSMQ Server
- Application Server version compatible with the current version of MES

**.NET Development role requires:**

- Microsoft MSMQ Server

**MES and SQL Server**

Note the following about MES and SQL Server:

- If the SQL Server compatibility setting is for SQL Server releases before 2016, it should be changed to 2016 compatibility.
- MES supports SQL Server transport encryption.

## Datetime and Decimal Separator Requirements for Windows Regional Settings and Custom Applications

### Windows Regional Settings

MES supports the default settings for datetimes and the decimal separator for any of the Windows regional formats. This is because the MES client middleware proxy converts regional datetimes to universal time and any decimal separator to a period (.) before the call is processed by the middleware.

However, changing the datetime format or the decimal separator from their default Windows regional format is not supported. If custom formats are used, datetimes and doubles might not be stored in the MES database with expected values or be displayed properly in client applications.

### Custom Applications That Pass Datetimes and Decimal Separators in Strings

Custom applications that pass datetimes in strings using the MES Web or Stateless API in any format other than according to the ISO 8601 standard must pass them in the universal format—that is, **yyyy-MM-dd HH:mm:ss** (note that MES does not support milliseconds). Also, doubles should use a period as the decimal separator. Examples would include passing datetimes and decimal separators in XML strings directly to the middleware using the Web API DirectAccess or MiddlewareAccess operations or the Stateless API DirectAccess methods.

## Running MES in a 2-Node Failover Cluster Environment

There are special installation and configuration considerations when running MES in a 2-node failover cluster environment.

A typical MES cluster environment would have MES server software running (that is, the MES middleware) on the two cluster nodes with the MES database on a separate database server.

### Installation and Setup Requirements for the Cluster Nodes

In a cluster environment, observe the following installation and setup requirements:

- When configuring the quorum for the cluster, set the quorum mode to **Node and Disk Majority**.
- For both nodes, set the domain firewall to Off.
- Install any MES licenses on the license server. See [Activating the MES Product Licenses](#). (Trial licenses have to be installed on both cluster nodes.)
- Install only the MES server components on both cluster nodes.
- Start the MES middleware service on the host node.

### Cluster Environment Considerations During MES Server Component Installation

When configuring the MES Database Setup component in the post-install Configurator for the cluster nodes:

- Use the same database configuration settings for both cluster nodes.
- Use the same database connection string settings for both cluster nodes.

- Use the single exposed public IP address for the cluster when configuring the Middleware Proxy component.

## Preparing to Upgrade MES

To prepare for upgrading MES to the latest version, you need to be aware of the upgrade requirements and information about migrating the MES database.

### Upgrade Requirements

Observe the following requirements when upgrading MES:

- You cannot upgrade to the current version of MES from a version older than 3.5. To upgrade from a version older than 3.5 to the current version, you must first uninstall the previous version, and then install the new version.
- If you are upgrading from version 3.5 or older, it is recommended that you change all passwords, since the encryption scheme used in the older versions is not as secure as the newer encryption scheme.
- If your organization is using MES with System Platform, System Platform 2023 is required. If the system has a previous version installed, it must be upgraded to System Platform 2023 prior to installing MES.
- If your organization is using MES .NET controls in System Platform, you have to first remove the previous version of the MES .NET controls before upgrading to the current version of the controls. For the procedure, see [Upgrading MES .NET Controls for AVEVA InTouch HMI Applications](#).
- Any deployed System Platform client controls using MES (for example, MES application objects, API scripting, .NET controls) should be undeployed from the node prior to upgrading.

### Migrating an MES Database to the Current Release

- Make a backup of the existing database prior to upgrading it in case any issues occur during the upgrade process.
- Make sure that you have enough disk space available on your computer before you start to migrate the MES database to the latest version. The amount of disk space should be at least equal to the size of your MES database or 30 GB, whichever amount is larger. Also, in the case of large databases, reduce the size of the database and the transaction log file before you perform the upgrade. Then reduce the size of the transaction log after the upgrade is complete.
- If the existing MES database has custom indices and keys that reference core MES tables, they must be dropped before migrating the database to the current release. If they are not dropped, the database migration will fail. They can be added back after the migration is complete.
- Migration of MES databases from version 4.0 and later is supported. If you are migrating from versions earlier than version 4.0, it is recommended to first migrate the database to version 4.0.

Another option is to record the contents of the **FactIntelligence.cfg** file prior to the upgrade and then use that information to configure the new database in the post-install Configurator application (the database connection information will not be automatically populated in Configurator). You can see the settings to record by running the MES Database Connection String Editor on the old MES version.

Custom modifications to any version of the MES database might not be supported by the post-install Configurator and might prevent migration. For more information on migrating an existing MES database, see

the procedure in [Migrating or Overwriting an Existing MES Database](#).

- If you are migrating an MES database from a release prior to version 5.0, it will not have index optimization that was available starting with the version 5.0. To apply this index optimization to the migrated MES database, see [MES Database Index Optimization Script](#).
- If you are migrating an MES database from version 5.3 or earlier, the migration of the utilization table structure to the new structure can take a long time. A rough estimate is provided prior to migrating it. As a precaution, all the original data remains in the database in tables labeled *tablename\_deprecated*. Once you are satisfied that the migration was successful, these tables can be deleted.

## Migrated Shift Schedules

When upgrading MES from MES 2020 (6.2) or a prior version to the current version, the shift schedules and their entity links are migrated to shift patterns, shift schedules, and shift pattern-entity links.

- Shift patterns created from migrated shift schedules are named **MES DB n.n Upgrade Pattern – n**.
- The shift pattern will have the same entity assignments as the shift schedule on which it was based.
- The shift pattern will have assigned to it any shifts that were defined in the shift schedule on which it was based.
- The migrated shifts will retain their descriptions.
- Shift exceptions are not migrated during the upgrade. Therefore, any existing shift exceptions might have to be re-configured.

For more information about shift patterns and schedules, see the *MES Client User Guide* or help.

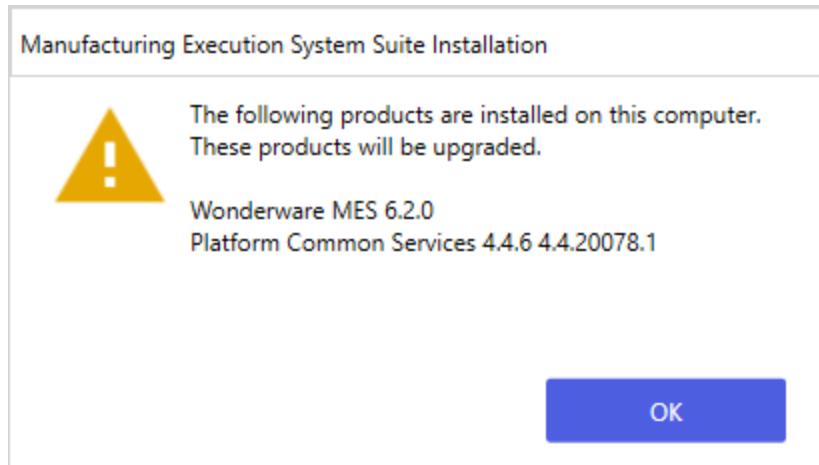
## Installing MES

Note the following before starting the installation:

- To install MES, you must have administrator privileges for the Windows operating system on the node on which the software is being installed.
- It is recommended that you install the required Microsoft .NET Framework release, version 4.8.
- It is recommended that you install all MES product and component prerequisite software before starting the installation. For more information, see [MES Prerequisite Software](#).

### To install MES products and components

1. Locate the installation folder on the MES installation media that has been loaded or copied to the local node.
2. Run the **Setup.exe** file in the root directory of the installation folder.
  - If a version of System Platform prior to System Platform 2023 is installed, a message appears that instructs you to uninstall the previous version before continuing with the MES installation. If this is the case, upgrade to System Platform 2023 or later before installing MES. Note that you do not have to uninstall the existing version of System Platform; you can perform an upgrade.
  - If previous releases of MES and its related products are already installed on the node, a message appears that identifies the version and that the product will be updated.



**Note:** If a version of the License Server and License Manager prior to 3.5 is listed to be updated, it might not install properly. Refer to step 11 for more information. Note that the License applications might be identified as AVEVA or Schneider Electric products.

3. Click **OK** to close the messages.

If the required release of .NET Framework is not installed, you are prompted to install it.

Click **Yes** to install the required release of .NET Framework. At the conclusion of the .NET Framework installation, you might be prompted to restart the system. If so, restart the system and then rerun the MES Setup tool to continue with the MES installation.

Otherwise, the Setup tool opens and the Welcome to MES Setup message appears.

4. Click **Next**.

The End User License Agreement (EULA) appears.

5. Use the options to read the general EULA content and the specific schedules for each of the software components available in the installation software.

You can use the controls above the license agreement box to print the agreement or adjust how it is displayed.

6. To continue with the installation, select the **I have read and accept the terms ...** option, then click **Agree**.

If you are upgrading MES and any MES applications are running, you are prompted to close them.

The roles by which the MES components are grouped appears. Information about the highlighted role appears in the description box on the right. For more information about these roles and which products and components are installed with them, refer to [MES Role-Based Installation](#).

Manufacturing Execution System Suite Installation

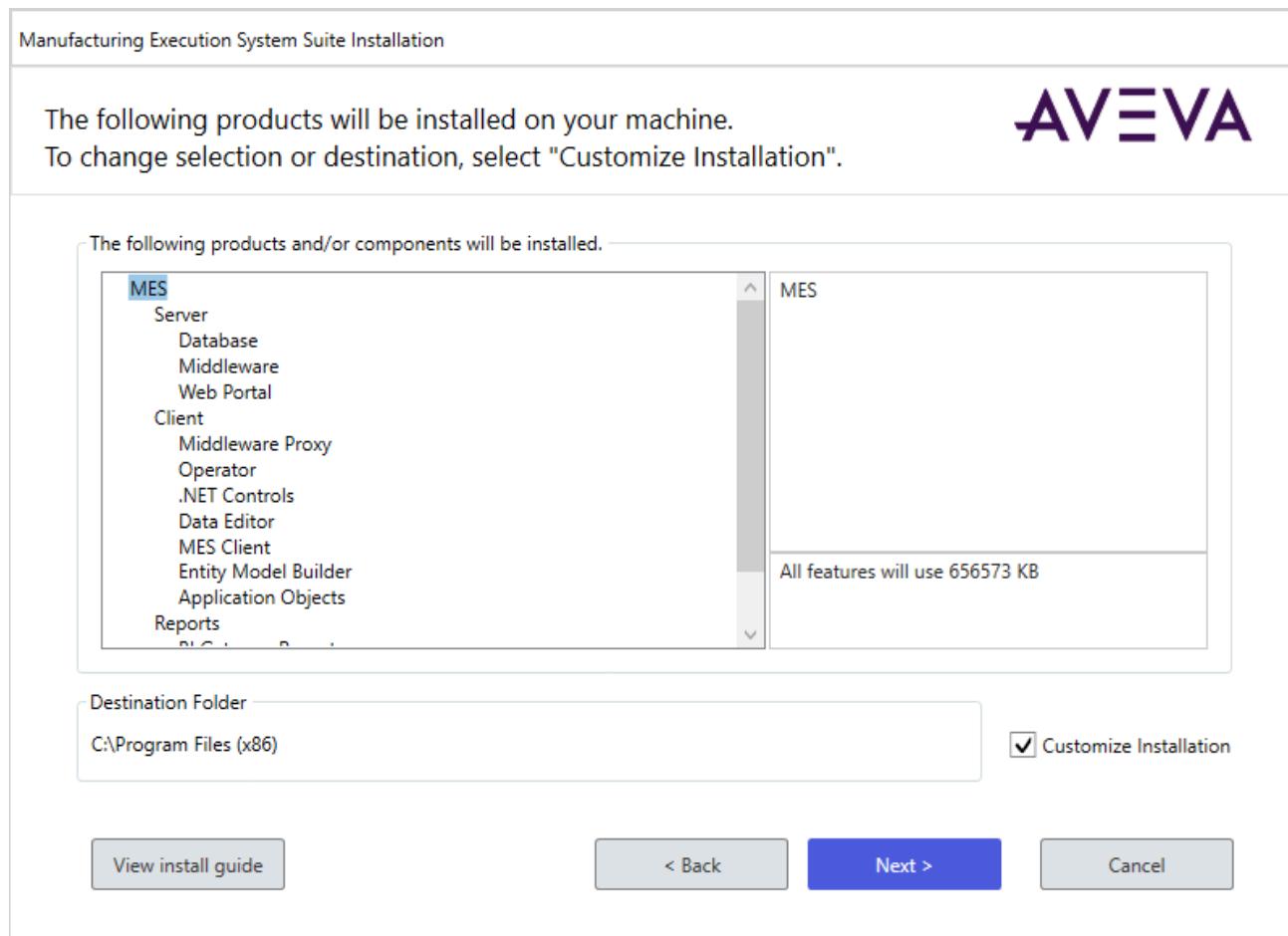
Select the option(s) you would like to install.

Select the computer role(s) to be Installed

- Database Server with MES
- Operator Client
- Web Portal
- Report Server
- MES Middleware/DB Maintenance Server
- Configuration Client
- System Platform Development
- .NET Development

[View install guide](#)    < Back    [Next >](#)    [Cancel](#)

7. Select the roles whose products and components you want to install on the local node and click **Next**.  
A list of the products and components that will be installed appears.



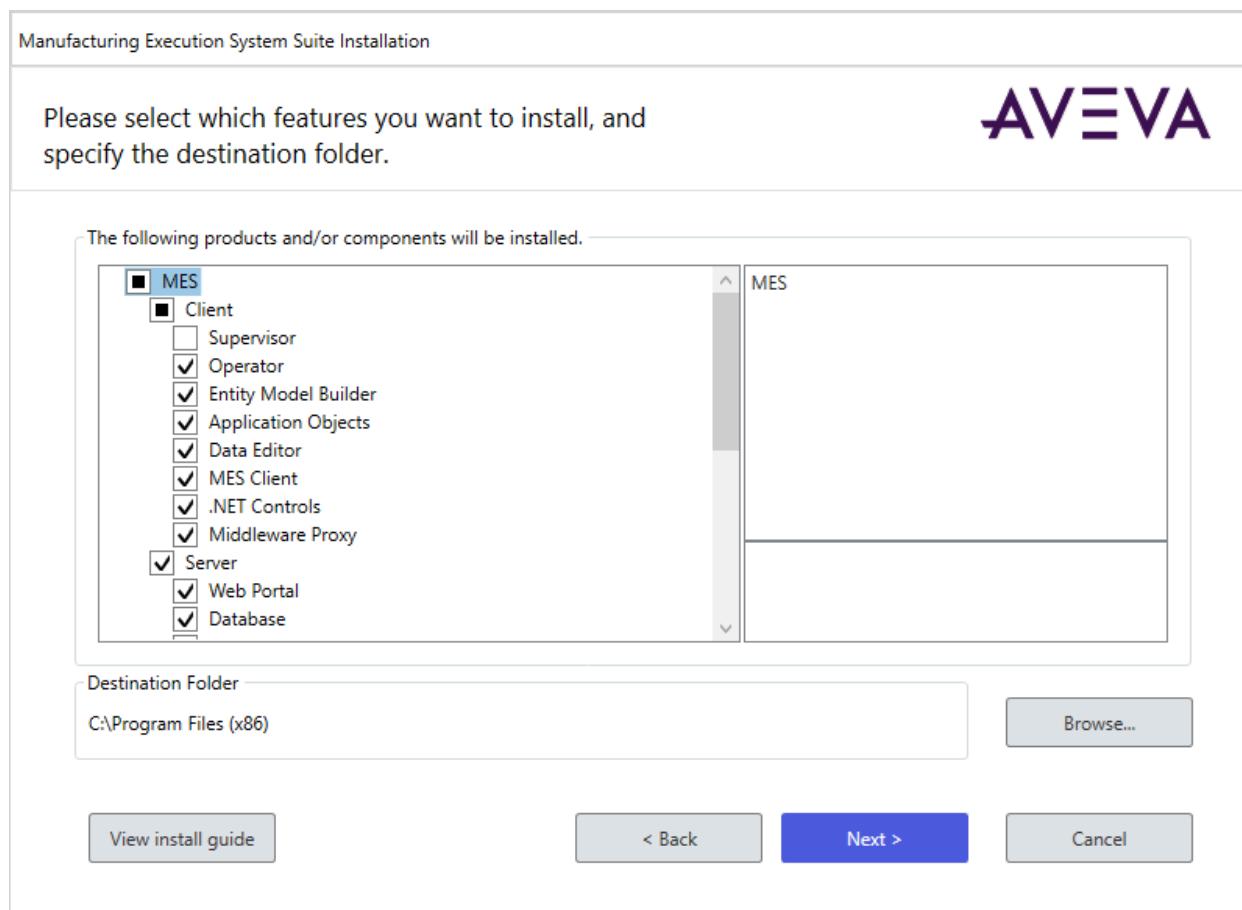
8. Do one of the following, depending on whether you want to customize which products and components will be installed or change the destination install folder:

- To install the default sets of products and components for the roles you selected and use the default install destination folder (**C:\Program Files (x86)**), leave the **Customize Installation** check box cleared and click **Next**.

A list of the prerequisite software that must be installed on the node prior to performing the MES installation appears. Go to step 11.

- To customize the sets of products and components for the roles you selected, or to change the install destination folder, select the **Customize Installation** check box and click **Next**.

The list of products and components appears. The products and components are selected based on the roles selected in step 7. Information about the selected component appears in the description box on the right. Go to step 9.



**Note:** To install the following components as part of the MES installation, you have to choose the **Customize Installation** option and then manually select the components: License Server and Manager components; MES Supervisor; BI Gateway components.

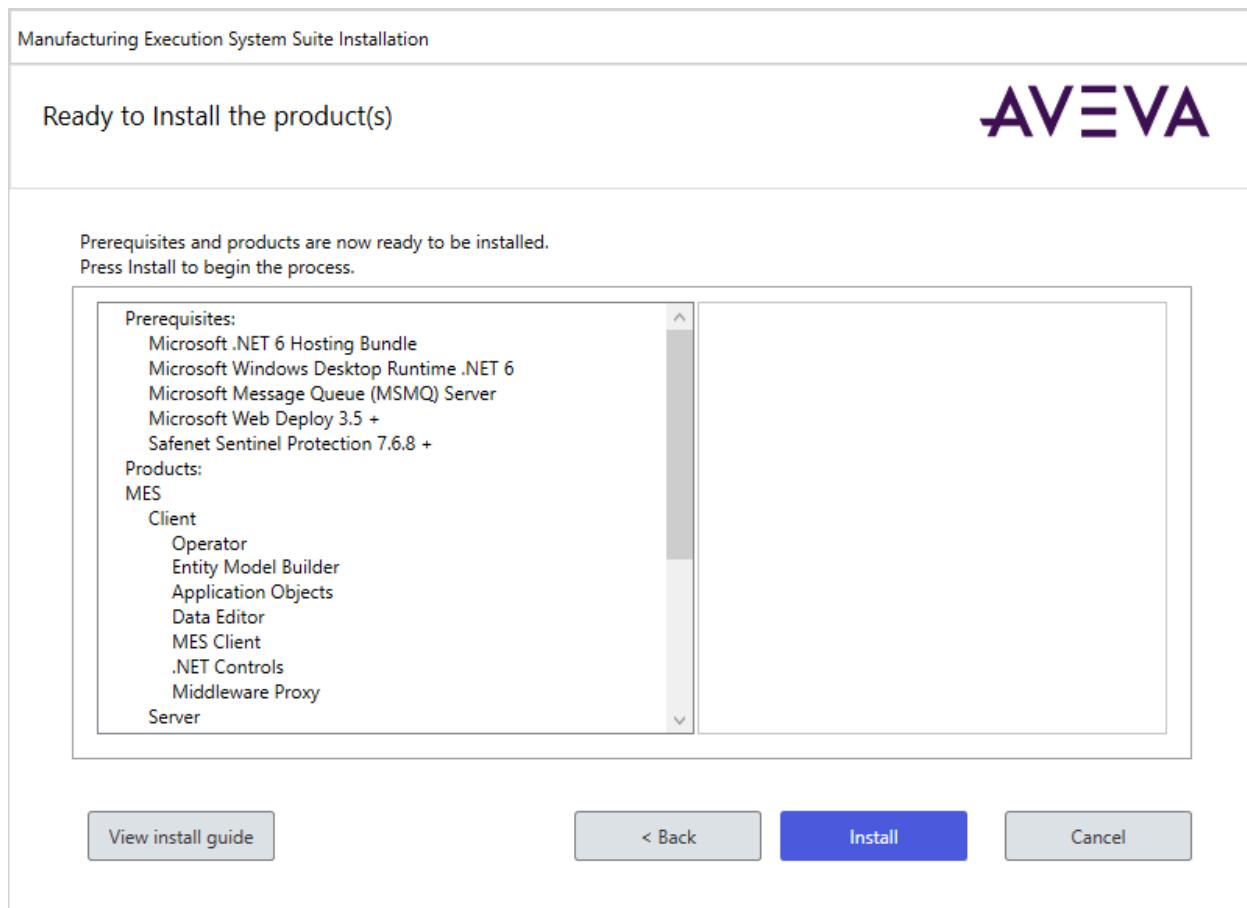
**Note:** To install the Quality Characteristic Detail report's SPC Chart control, the MES BI Gateway Reports component must be installed and configured on the same node as the BI Gateway Datastore and SQL Server Reporting Services (SSRS).

9. To change the install destination folder, click the **Browse** button and then navigate to and select the desired folder.
10. To change the products or components to be installed, select the check boxes of only those products or components that you want to install and click **Next**.

Note the following:

- If any prerequisite software cannot be installed by the MES installation, it will be identified in a message. Install this software before proceeding.
- If you are using MES with System Platform, System Platform 2023 or later is required. You will be prompted to install the Application Server component of System Platform 2023 or later if you selected the Entity Model Builder.

MES is ready to be installed. A list of the products and components that will be installed appears. Also, any prerequisite software that the MES installation can install is listed under **Prerequisites**:



11. Click **Install**.

If any applications that might conflict with the installation are running, a list of them appears.

You have the following options:

- Close the conflicting applications and then click the **Try Again** button to see if there are still any conflicts.
- Click **Next** to continue with the installation.

If any conflicting applications are still running when you click **Next**, the Configurator tool will tell you if you need to restart the system when you have finished the MES configuration.

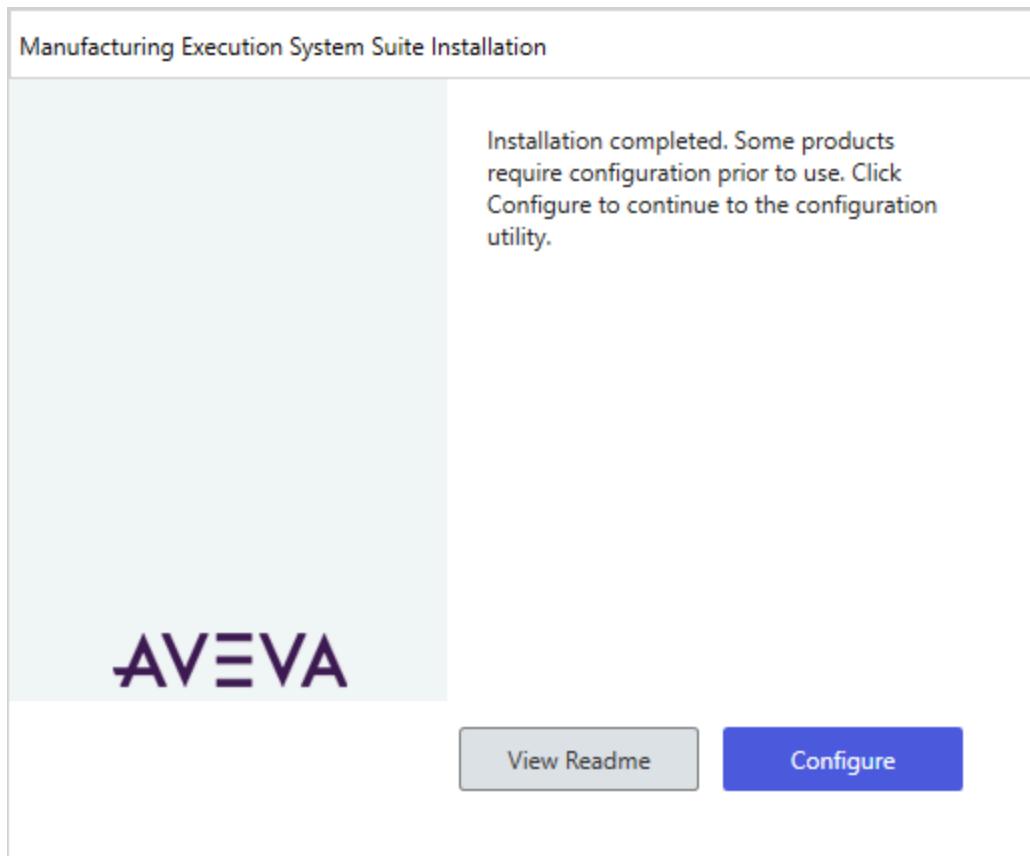
Once the installation begins, the progress status appears.

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**Note:** If the installation is updating a version of License Server and License Manager prior to 3.5, the following error message might appear, indicating that it did not install properly: *Service 'License Server Agent Service' (License Server Agent Service) could not be deleted. Verify that you have sufficient privileges to remove system services.* To resolve this error, see the instructions below in "Recovering from the License Manager Installation Error."

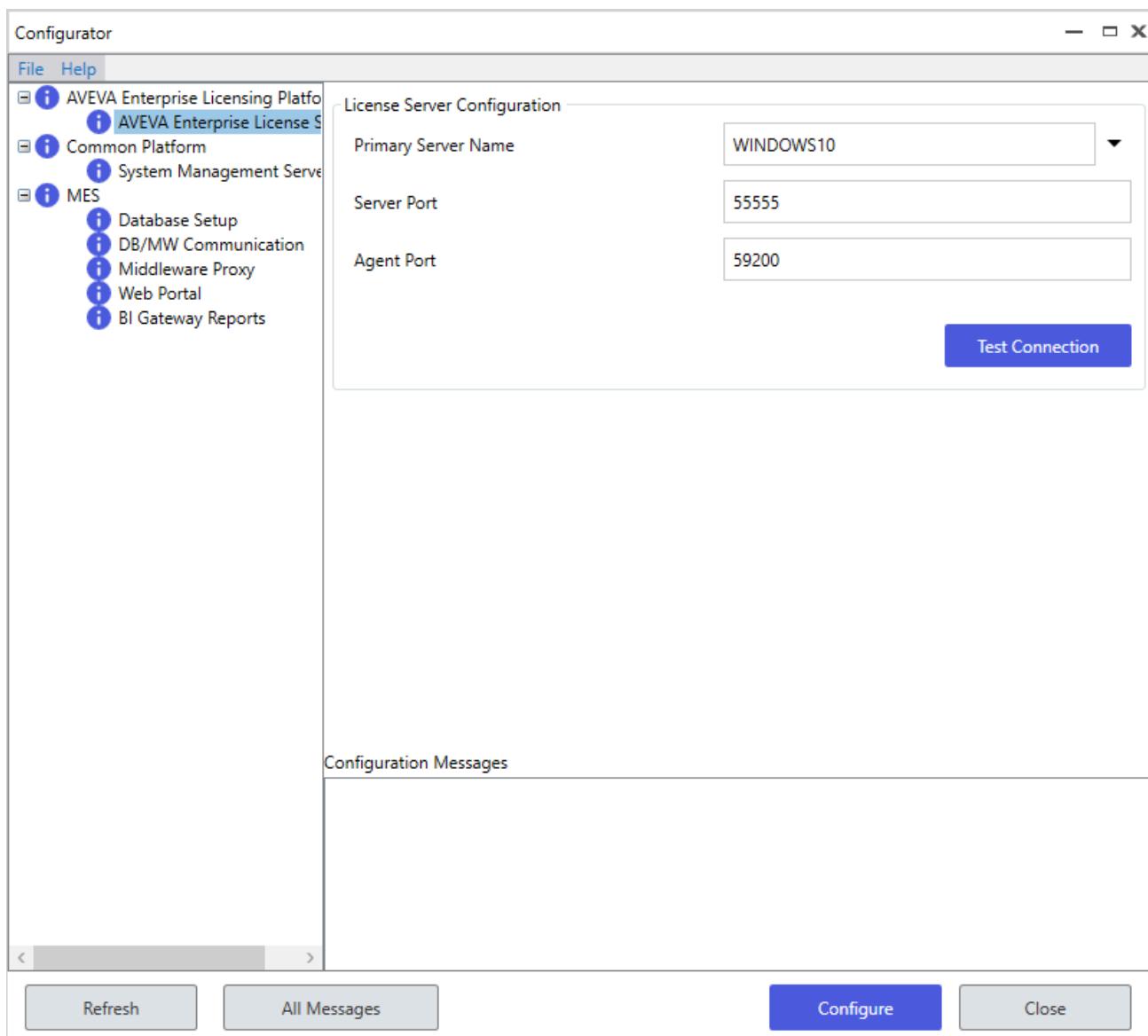
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When the installation is finished, you are prompted to configure products and components that require configuration before they can be used.



12. To start the Configurator, click **Configure**.

The post-install Configurator application opens.



Initially, it is possible that not all of the components on which MES is dependent will appear in the Configurator or will be available to be configured. For this reason, close the Configurator. The necessary components will appear properly the next time you open the Configurator. However, before using the Configurator to configure the MES components, see the instructions below in "Next Steps."

## Next Steps: Activating the MES Product Licenses and Configuring AVEVA Single Sign-on

Before configuring the MES components in the post-install Configurator:

- The MES product licenses must be activated so that the MES middleware can be started. See [Activating the Product Licenses](#).
- If the Single Sign-on Service was installed as part of the MES installation, its component in the Configurator, System Management Server, has to be configured. See [Implementing Secure Communication with System Management Server](#).

## MES Service Monitor

If the MES Middleware component was installed on the node, the MES Service Monitor is installed and its icon (shown below) is added to the system tray.



The Service Monitor allows users to start, stop, and restart the MES middleware host. For more information, see [MES Service Monitor](#).

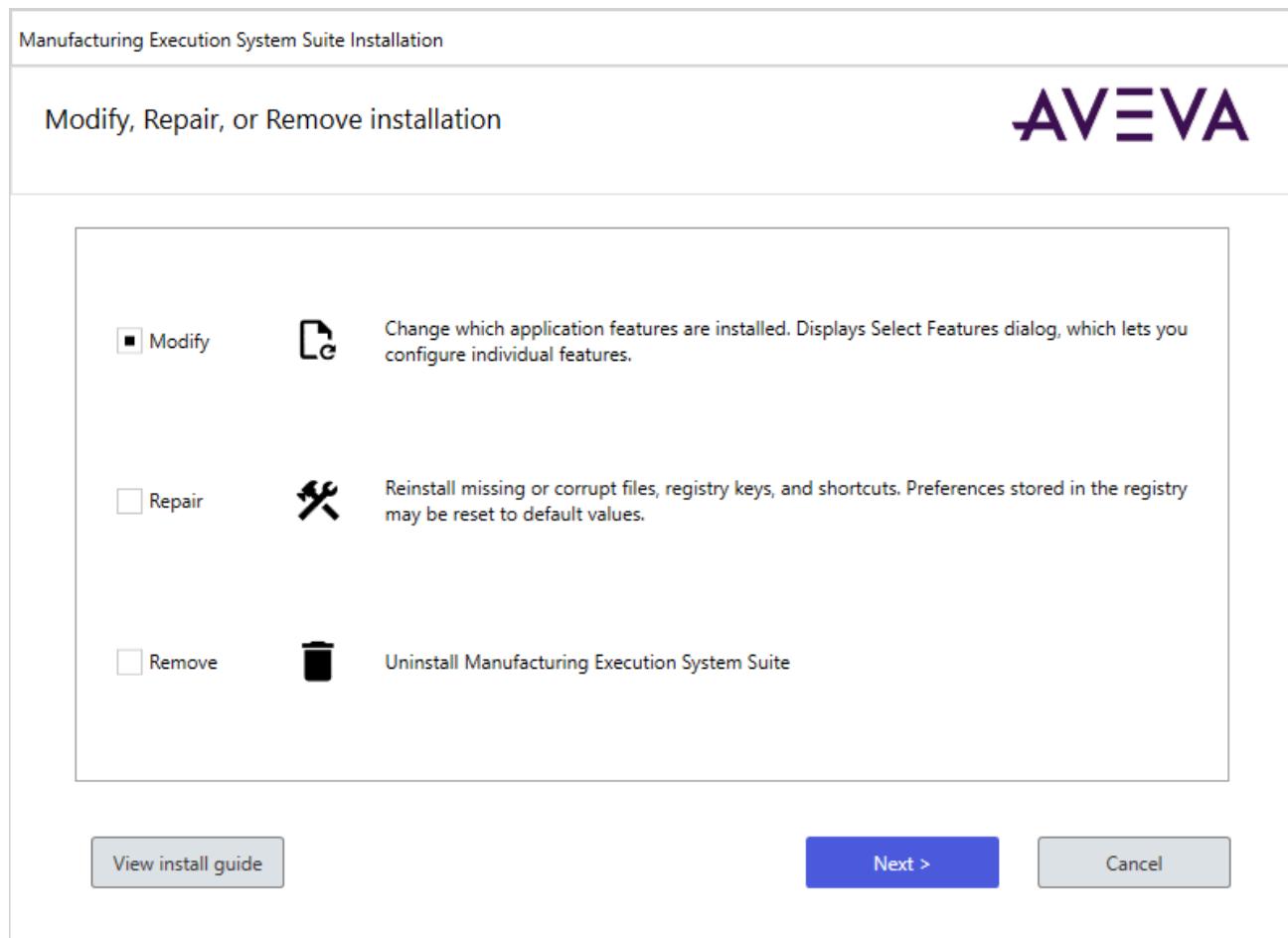
## MES Shortcuts in the Startup Menu

On the Start screen, MES application shortcuts will appear in the Manufacturing Execution System group. MES user documentation shortcuts will appear in the AVEVA Documentation group. If you do not see these groups in the Start screen, they should appear after restarting the node.

## Recovering from the License Manager Installation Error

1. If the post-install Configurator application is open at the conclusion of the MES installation, close it.
2. Reboot the system.
3. Do one of the following:
  - In the Control Panel Programs and Features applet, select **Manufacturing Execution System** and click **Change or Uninstall/Change** on the toolbar.
  - Run the **Setup.exe** file in the MES installation root folder.

The Setup tool options appear.

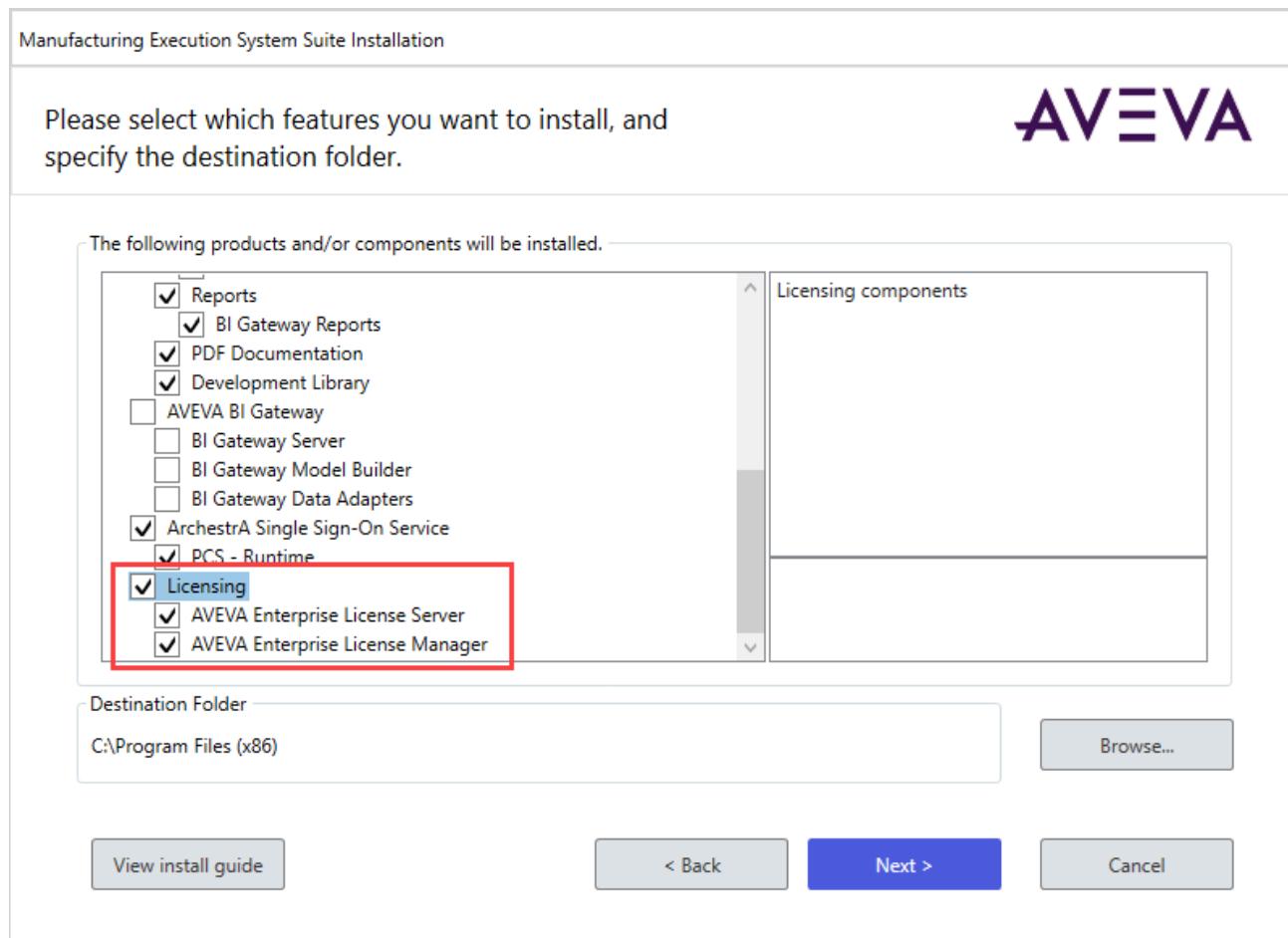


4. Select **Modify**, and then click **Next**.

The list of MES products and components appears. The check boxes of products and components that are currently installed are selected by default.

5. Select the three Licensing product options:

- Licensing
- AVEVA Enterprise License Server
- AVEVA Enterprise License Manager



6. Click **Next**.
7. When you are prompted that the Licensing features are currently installed and will be upgraded, click **OK** to proceed with their installation.

## Activating the MES Product Licenses

The MES product licenses must be activated before configuring the MES components with the post-install Configurator application so that the MES services can be started.

The product license files would have been emailed once an order was placed for the MES product.

### To activate the MES product licenses

1. If the License Server has not already been configured, use the post-install Configurator tool to configure it. See [Configuring the License Server Component](#).
2. Use the License Manager to activate your MES product licenses. See [Activating the Product Licenses](#).

With License Manager, you can also:

- View the MES product license usage.
- For an environment in which there are multiple MES systems running and using the same License Manager Server (for example, separate test and production systems), you can reserve licenses for a specific MES

server.

- Deactivate MES product licenses.

The following topics cover general information for performing these tasks. For more detailed information about using the License Manager, see the *License Manager Guide* and the online help.

For more information on licensing requirements for MES, contact your distributor.

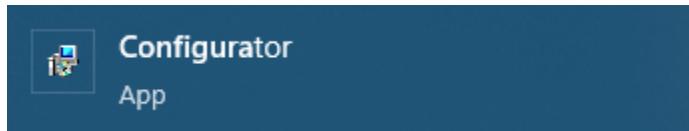
## BI Gateway Product Licensing

The BI Gateway product uses the Licensing component and activation.

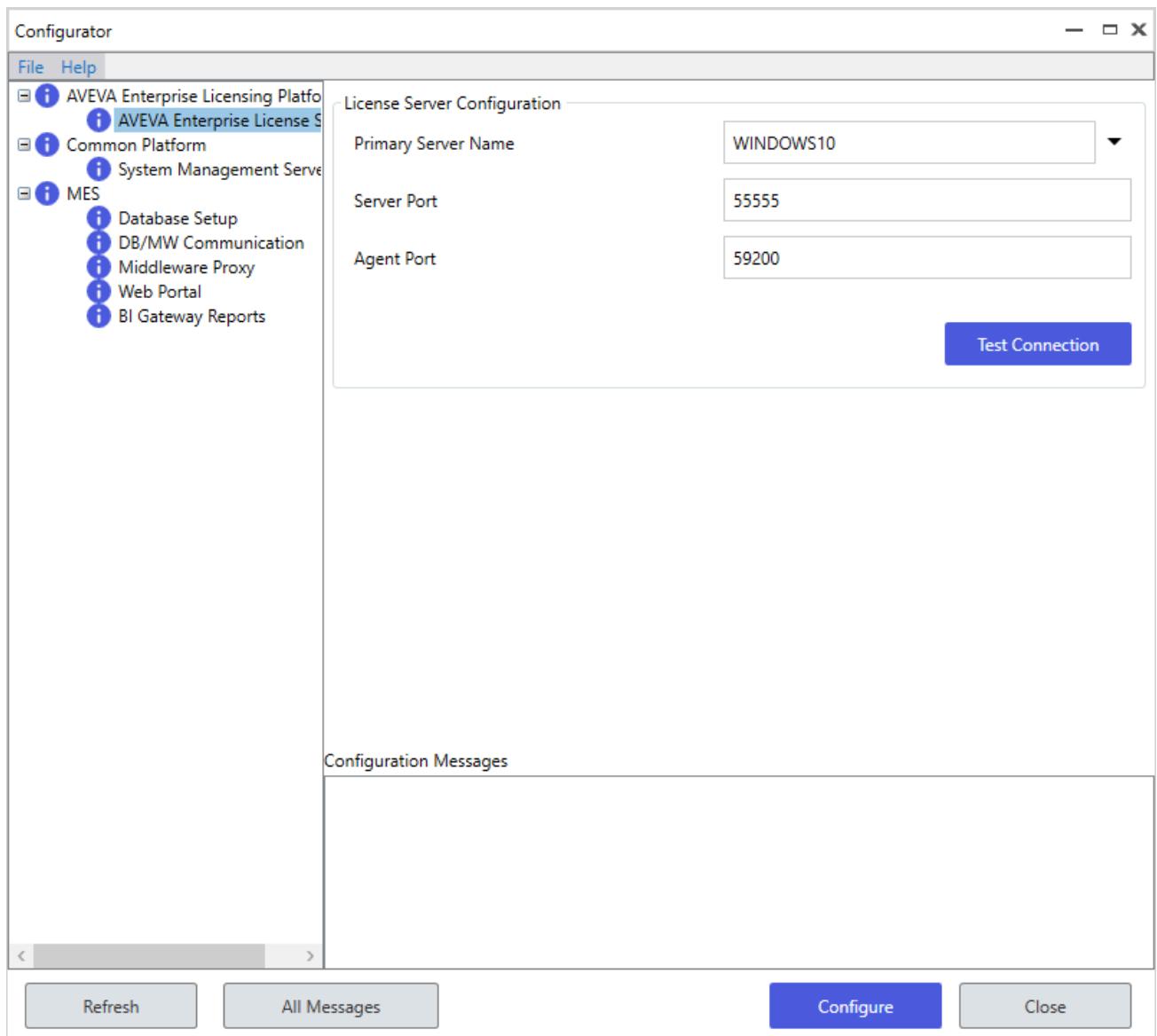
- If using BI Gateway for the MES Reporting content and for additional functionality, follow the licensing guidelines provided by the BI Gateway documentation.
- If BI Gateway is only being used as the reporting database for MES BI Gateway Reports, then the BI Gateway Service does not require a license to be activated. The reporting solution only allows a connection to the MES reporting source. In this scenario, BI Gateway can work with one deployed data source only—the MES reporting database.

## Configuring the License Server Component

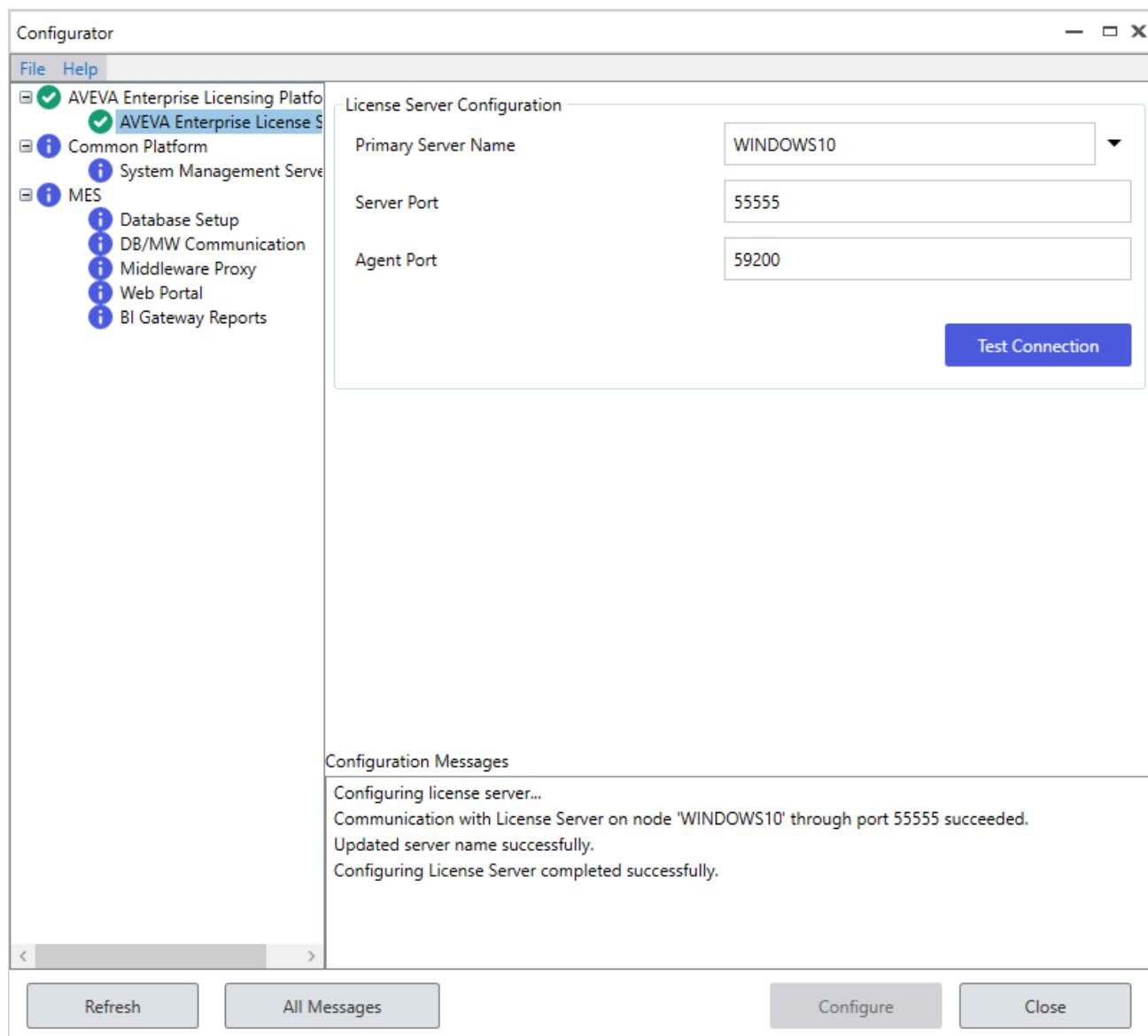
1. If the post-install Configurator is not already open, from the Start screen of the node on which MES was installed, open the **Configurator** app.



2. In the post-install Configurator, select the License Server component.



3. Enter the server name of the node and click the **Test Connection** button to verify connectivity to the server.
4. If the test was successful, click the **Configure** button.  
If the License Server was properly configured, a success message appears in the **Configuration Messages** box. Also, the License Server status indicator changes to a green check mark.



## Activating the Product Licenses

The following procedure is specific to activating MES product licenses. For complete information about activating and managing product licenses, see the *Enterprise License Manager User Guide* or help.

1. Do one of the following:
  - From the Start men, open the **Enterprise License Manager** website.
  - In a web browser, enter the URL **localhost/AELicenseManager**.

License Manager opens and the License Server tile should be shown.

2. Click the License Server tile.  
The server's license page appears with the License Summary tab selected.

3. Click **Add License**.  
The License Activation dialog appears.

4. Click the **Browse license file** browse button and then navigate to and select an MES product license.

The license file would have been emailed once an order was placed for the MES product.

The license appears in the license grid.

5. Browse to and add any other MES product licenses to be activated.
6. Select the check boxes for the MES product licenses and click **Activate**.

The dialog closes and the licenses are listed on the License Summary tab.

The screenshot shows the AVEVA Enterprise License Manager application. At the top, there's a navigation bar with 'Servers' (selected), 'Remove', 'Refresh', 'Manage', and 'Sync' buttons. To the right, it shows 'MESTP\user' and a profile icon. Below the navigation is a breadcrumb trail: 'WINDOWSCLIENT'. On the left, there's a 'Description' section. On the right, it displays 'License Server ID: WINDOWSCLIENT\_X156' and 'Status: Running'. Below this, there are tabs for 'License Summary' (selected), 'Usage Summary', 'Usage Details', 'Device Reservation', and 'User Reservation'. Under 'License Summary', there are buttons for '+ Add License', 'Deactivate', and 'Details'. A search bar is also present. The main area is a table showing license details:

Quantity	Component Name	Part Number	Serial Number	Expiry Date	Status	Comment
1	AVEVA AdvDev Studio 2023 Unlimited, 30day Demo Consign	AdvStd-35-P-23	T220808	9/30/2022	Activated	

At the bottom left of the table area, it says '1 License(s) found'.

You can now continue configuring the MES components.

- To understand how to use the post-install Configurator, see [Configuring MES Components](#).
- To begin configuring the MES components, see [Creating or Migrating MES Databases](#).

## How MES Product Licenses Are Managed

### During MES Middleware Startup

During startup, the MES middleware performs the following steps to acquire licenses:

1. When the middleware starts, it attempts to contact the License Server.
2. If the License Server is found, the middleware attempts to acquire an MES middleware license.
  - If a middleware license is not found, the middleware stops.
  - If a middleware license has been obtained, then the middleware attempts to acquire licenses for Operations, Performance, and Quality. If no such licenses are found, only the freely licensed features will be active.

- If the License Server is in Grace Period, the middleware stops.
3. The middleware requests the License Server for an MES middleware count by node name.
  4. The middleware requests all entity counts by a name built from the MES database server name and MES database name.

---

**Note:** When entering the server name during MES middleware configuration, use either the host name or IP address. Be consistent in this when configuring MES middleware on different nodes, as the system will not know that a host name and IP address point to the same server. See Specifying the MES Production Database Connection String. If you enter **localhost**, it will be converted to the local server name when building the database connection string.

For example, it might request 20 Operations entities, 10 Performance entities, 5 Quality entities, 35 Production entities, and 205 Storage entities (Inventory).

Note that the name can be altered to remove any characters that are not allowed in the naming of Windows files and directories, since the License Server uses the name to create a directory on the server itself.

- If any counts cannot be acquired, the middleware reports warnings but still starts.
  - If another MES middleware already has these licenses but by a different name, there will be an error and the middleware will not start.
  - If another MES middleware already has these licenses using the same name (that is, both are configured against the same database Server/database name), then the middleware will start with the same counts as the already running middleware.
5. If using Enterprise Integration, the Enterprise Integration service first attempts to acquire the professional feature and then the standard feature. Either feature enables MES Supply Chain Connector functionality

## During Run Time

- During run time, the middleware validates its connection to the License Server every hour. If it fails to contact the License Server, warnings are logged but all calls will continue to be executed.

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**Note:** Do not attempt to restart the middleware without a connection to the License Server as the middleware will not start.

- If a license expires, the middleware will log a warning within one day of expiration and then every day for two weeks before no longer allowing calls to pass through.
- When a middleware shuts down, it releases the Middleware count feature. If it is the last middleware to shut down (that is, no other middleware features are in the acquired state), then the middleware also releases the Operations, Performance, Quality, Production, and Inventory features. This behavior is relevant only if the middleware is sharing licenses with other MES middleware instances. Note that sharing means that the various middleware instances are configured to use the same database server node and database.

## Viewing MES Product License Information

### Summary Information on the Usage Summary Tab

You can view summary information about each of the features of the activated product licenses on the Usage Summary tab.

The screenshot shows the AVEVA Enterprise License Manager interface. At the top, there's a navigation bar with 'Servers' (dropdown), 'Remove', 'Refresh', 'Manage', 'Sync', and a cloud icon. On the right, it shows 'MESTPUser' and 'Status Running'. Below the navigation bar, the title 'WINDOWSCLIENT' is displayed above a 'Description' section. To the right, 'License Server ID' is listed as 'WINDOWSCLIENT\_X156' and 'Status' is 'Running'. Below this, tabs for 'License Summary', 'Usage Summary' (which is selected), 'Usage Details', 'Device Reservation', and 'User Reservation' are shown. A search bar with the text 'mes' is positioned at the top right. The main content area is a table with columns: Feature, Part Number, License Type, Version, Quantity, Reservation, and In Use. The table data is as follows:

Feature	Part Number	License Type	Version	Quantity	Reservation	In Use
AV Reports for Operations MES	AdvStd-35-P-23	Server	2023 (23.0)	1	0	0
MES - Middleware Instances	AdvStd-35-P-23	Server	2023 (7.0)	18	0	1
MES Operations Functional Entities	AdvStd-35-P-23	Server	2023 (7.0)	1000	0	1000
MES Performance Functional Entities	AdvStd-35-P-23	Server	2023 (7.0)	1000	0	1000
MES - Entities which can run jobs	AdvStd-35-P-23	Server	2023 (7.0)	10000	0	10000
MES Quality Functional Entities	AdvStd-35-P-23	Server	2023 (7.0)	1000	0	1000
MES - Inventory Entities	AdvStd-35-P-23	Server	2023 (7.0)	200000	0	200000

**P** 7 of 45 License(s) found

The **Usage Summary** tab shows the combined count of a specific feature. In this example, the license server has a 1000-equipment count license for Operations, Performance, and Quality. Each of these provide 6 middleware counts for a total of 18. They each also provide a total count of 10,000 production entities that can run jobs. The Operations license provides for a total of 20,000 inventory entities. In this example, there are no licenses reserved, 1 MES Middleware license in use, and all functional entities acquired.

## Detail Information on the License Details Panel

You can view details about a product license, such as the quantities available for each feature included in the license, from the License Summary tab.

1. On the License Summary tab, select the check box of the product license.
2. Click **Details**.

	Quantity	Component Name
<input checked="" type="checkbox"/>	1	AVEVA AdvDev Studio 2023 Unlin Demo Consign

The License Details panel appears.

Feature	Quantity	Version
AV Reports for Operations Development Seat	1	23.0
AV Reports for Operations 10000 Tags, All Connectors	1	23.0
AV Reports for Operations Life Science	1	23.0
AV Reports for Operations MES	1	23.0
AV Reports for Operations SPC	1	23.0
AV Reports for Operations Tagcount	10000	23.0

You can also view details about MES product license feature usage on the License Manager Usage Details tab.

Feature	Part Number	Type	Version	In Use/Total	Device	User	Expected return
Intelligence Server Enterprise Edition	AdvStd-35-P-23	Server	2023 (3.1)	1/1	WINDOWSCLIENT		9/30/2022 11:59:59 PM
MES - Middleware Instances	AdvStd-35-P-23	Server	2023 (7.0)	1/18	WINDOWSCLIENT		9/30/2022 11:59:59 PM
MES Operations Functional Entities	AdvStd-35-P-23	Server	2023 (7.0)	1000/1000	WINDOWSCLIENT_MESDB		9/30/2022 11:59:59 PM
MES Performance Functional Entities	AdvStd-35-P-23	Server	2023 (7.0)	1000/1000	WINDOWSCLIENT_MESDB		9/30/2022 11:59:59 PM
MES - Entities which can run jobs	AdvStd-35-P-23	Server	2023 (7.0)	10000/10000	WINDOWSCLIENT_MESDB		9/30/2022 11:59:59 PM
MES Quality Functional Entities	AdvStd-35-P-23	Server	2023 (7.0)	1000/1000	WINDOWSCLIENT_MESDB		9/30/2022 11:59:59 PM
MES - Inventory Entities	AdvStd-35-P-23	Server	2023 (7.0)	200000/200000	WINDOWSCLIENT_MESDB		9/30/2022 11:59:59 PM

The features that are available from the activated product licenses are listed. Included in the information is to what device they are currently assigned and the In Use/Total counts.

## Reserving Licenses When Multiple MES Systems Are Deployed

If you have multiple MES deployments (that is, multiple MES databases) and are managing their product licenses through one License Server, you can use the Reservation feature to reserve features for a particular deployment. Although this is possible, it is recommended to use separate license servers for each when possible.

Using the Reservation feature through one License Server requires that there be two or more license counts available. So, for example, if the license server has both a 10-count Performance license and a 100-count Performance license installed, it is possible to reserve the 10-count license for a development/test server and the 100-count license for a Production server.

When configuring reservations, only reserve the functional features (MES Operations Functional Entities, MES Performance Functional Entities, and MES Quality Functional Entities). The production entities and inventory entities are automatically calculated from the functional features acquired and do not require separate reservations. You can also reserve middleware instances but note that they are acquired by node name and must be reserved by the node name. If there is no concern about running out of middleware instances, then there is no reason to reserve them.

Reservations can be released.

While reserving licenses is possible, it does cause the system to behave slightly different with releasing feature counts. Since middleware instances share licenses and only the last middleware to shut down will release its feature counts, there will be features indicating they are still in use even after all systems are shut down. As an example: Two reservations are made for MESDB A and MESDB B. A middleware for MESDB A starts and acquires its feature counts and then a middleware for MESDB B starts and acquires its features counts. The License Manager shows the two different devices and the licenses acquired. The middleware for MESDB A shuts down but sees that there is still a remaining middleware license in use and does not release its feature counts. The middleware for MESDB B shuts down and, being the last middleware, releases its licenses. The licenses from MESDB A still remain and would show in use even though there are no middleware instances running. In general, this will not cause a problem as the next time a middleware from MESDB A starts, it will get the same licenses that it had previously.

### To reserve MES features for a MES server:

1. On the Device Reservation tab, click **Add Device**.

The **Add Device** dialog appears.

Add Device

Device Name:  Comment:

x 🔍

	Count	Feature	Part Number	Version	Expiry	Total Available
<input type="checkbox"/>	0	AV Reports for Operations MES	AdvStd-35-P-23	2023 (23.0)	9/30/2022	1
<input type="checkbox"/>	0	MES - Middleware Instances	AdvStd-35-P-23	2023 (7.0)	9/30/2022	18
<input checked="" type="checkbox"/>	500	MES Operations Functional Entities	AdvStd-35-P-23	2023 (7.0)	9/30/2022	1000
<input type="checkbox"/>	0	MES Performance Functional Entities	AdvStd-35-P-23	2023 (7.0)	9/30/2022	1000
<input type="checkbox"/>	0	MES - Entities which can run jobs	AdvStd-35-P-23	2023 (7.0)	9/30/2022	10000
<input type="checkbox"/>	0	MES Quality Functional Entities	AdvStd-35-P-23	2023 (7.0)	9/30/2022	1000
<input type="checkbox"/>	0	MES - Inventory Entities	AdvStd-35-P-23	2023 (7.0)	9/30/2022	200000

< >

Close Add

- In the **Device Name** field, enter the device name as the MES server name and the MES database name with an underscore (\_) character between them.  
The server name cannot contain any special characters that are not allowed in the naming of Windows files and directories.
- For each feature to be reserved for this device, select the feature and enter the count to be reserved In the **Count** column.
- Click **Add**.

## Deactivating MES Product Licenses

You can deactivate an MES product license for use on another MES deployment.

- On the License Summary tab, select the check boxes of the product licenses to be deactivated.
- Click **Deactivate**.  
The product licenses are now available for use on another deployment.

## Configuring MES Components

MES configuration is performed by configuring the MES components in the post-install Configurator application.

The topics in this section:

- Describe the Configurator

- Explain how to specify SQL Server user authentication in Configurator, which is required for several of the MES components
- Explain closing Configurator and whether the node needs to be restarted to complete the configuration
- Discuss post-configuration tasks

Details about how to configure the MES components are described in the following sections. The sections are in the recommended order for configuring them.

- [Implementing Secure Communication with System Management Server](#)
- [Creating or Migrating MES Databases](#)
- [Configuring MES Middleware Communication with MES Databases](#)
- [Configuring the MES Middleware Proxy](#)
- [Configuring MES Web Portal](#)
- [Configuring and Deploying MES BI Gateway Reports](#)

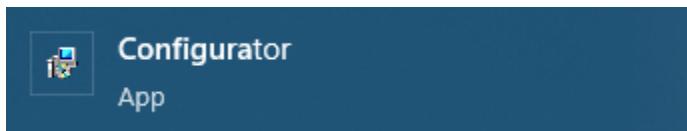
## About the Post-Install Configurator

MES configuration is performed using the same post-install Configurator application that is used by other AVEVA software components that are installed with the common installation mechanism.

To run the Configurator, you must have Windows administrator privileges on the node.

### To start the Configurator

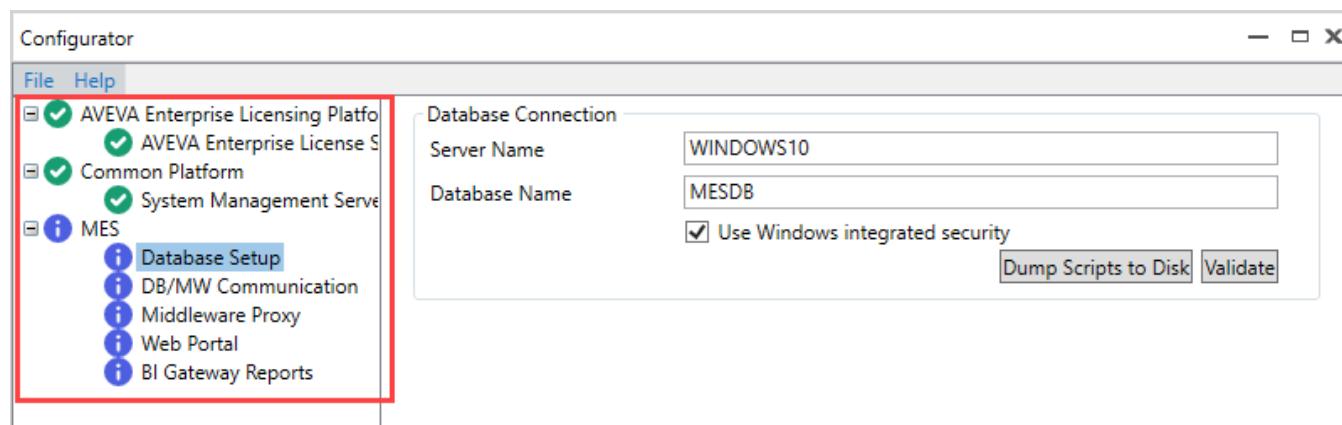
- Do one of the following:
  - On the last screen of the MES Setup tool, click the **Configure** button.
  - From the Start menu, open the **Configurator** app.



- Launch the Configurator application file from Windows Explorer. The default path is:  
**C:\Program Files (x86)\Common Files\ArchestrA\Configurator.exe**

### Product Tree

The post-install Configurator includes a product tree that lists the components for each of the products that require post-installation configuration.



If Configurator has been launched from the **Configure** button on the last page of the MES Setup tool, then only the MES-related components are listed in the product tree. Otherwise, all products and components that can be configured are listed.

The MES components are listed in the order in which they are recommended to be configured. This starts with creating or migrating the MES database, configuring the MES middleware and security settings to access the MES database, and finishing with the Middleware Proxy, Web Portal, and BI Gateway Reports components.

## Configuration Status

The status of each product or feature configuration is indicated by the following icons.



An error occurred during configuration.



The component is installed but not configured.



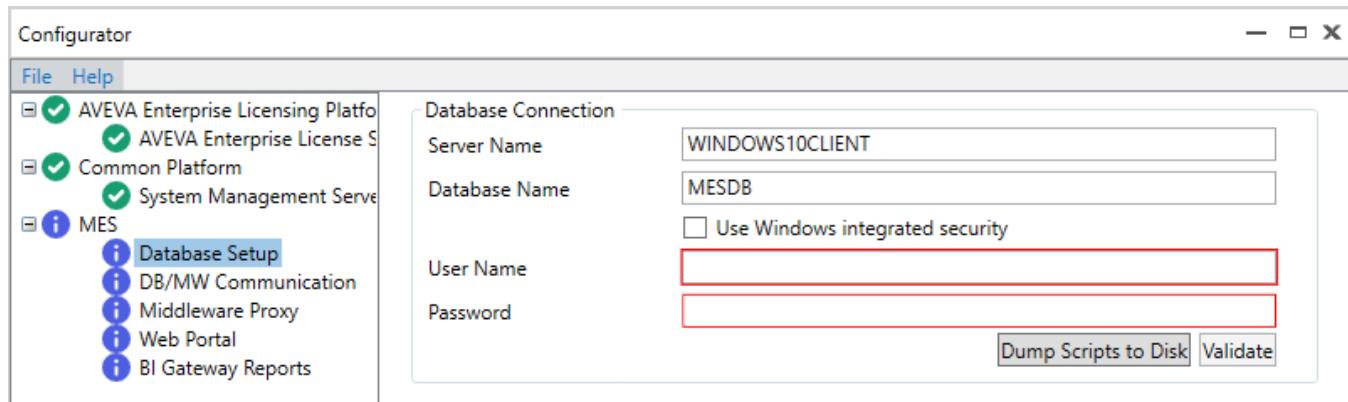
The configuration is complete, but with warnings.



The configuration completed successfully.

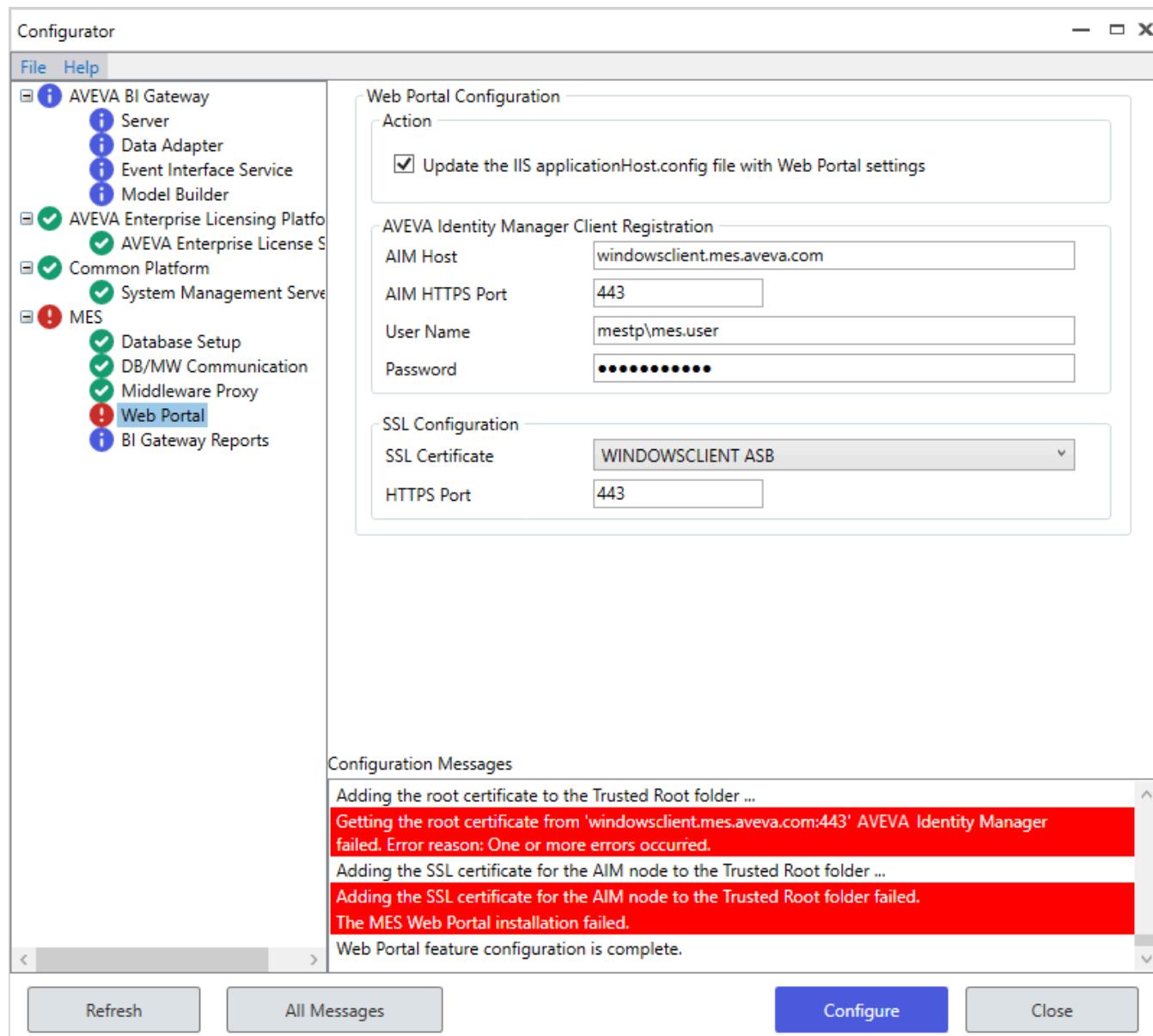
## Required or Invalid Entries

Boxes that have no entry but are required or have an invalid entry are outlined in red to indicate the condition, as shown below.



## Configuration Messages

As you perform configuration tasks, messages appear in the **Configuration Messages** box. Messages indicating errors are highlighted in red.



### To view additional information about a message

- Double-click the message.  
A dialog box appears with the additional information.

Message Detail View

Date:	8/26/2022	Time:	4:41:21 PM
User Name:	mes.user		
Product Name:	MES		
Feature Name:	Web Portal		
Action:	Check the following: the AIM host is valid, accessible, and configured with a fully qualified name if required for the certificate; the AIM HTTPS...		
Message:	Getting the root certificate from 'windows10client.mes.aveva.com:443' ArchestrA Identity Manager failed. Error reason: One or...		
Message Details:			
<div style="border: 1px solid #ccc; padding: 5px;"><p>Check the following: the AIM host is valid, accessible, and configured with a fully qualified name if required for the certificate; the AIM HTTPS port is valid and it matches the web port configured for the System Management Server on the AIM host; the System Management Server is configured: the user has proper permissions to access the</p></div>			

### To view the entire Configurator message log

- Click the **All Messages** button.

The message list appears in a new window.

To save the list of messages in the Configurator Messages Lists window to a text file

- Click the **Export to file** button.

## Specifying SQL Server User Authentication

Several of the product components require you to specify a user account to access SQL Server. The MES components use a common interface that might look slightly different from other product components. For the MES components, the two user account options are described below.

- To use the currently logged-in Windows user account, select the **Use Windows integrated security** option. No user name or password entry is required.

Database Connection

Server Name	MESTP
Database Name	MESDB
<input checked="" type="checkbox"/> Use Windows integrated security	
<input type="button" value="Dump Scripts to Disk"/> <input type="button" value="Validate"/>	

- To use SQL Server Authentication, clear the the **Use Windows integrated security** option. Enter the appropriate SQL Server Authentication user name and password.

Database Connection

Server Name	MESTP
Database Name	MESDB
<input type="checkbox"/> Use Windows integrated security	
User Name	<input type="text"/>
Password	<input type="password"/>
<input type="button" value="Dump Scripts to Disk"/> <input type="button" value="Validate"/>	

If using this option, make sure that the SQL user account has been created. If the user account is being used to access the MES production or restore database, make sure that it is assigned the appropriate database roles. See [Manually Adding a SQL Server Login for the Middleware Service](#).

## Closing Configurator

After completing the configuration tasks in Configurator, you can close it. Depending on what components were configured, you might have to restart the node to finalize the configuration and start the required services at startup.

### To close Configurator

- Click the **Close** button.

If configured components require a node restart, you are prompted to restart the computer.

- Click one of the buttons to restart the node now or later.

If you click the **Restart Later** button, you will have to restart the node before attempting to use MES on it.

## Post-Configuration Tasks

After you have configured the MES components, depending on which components were installed and configured you might have to perform the following tasks:

- If the Application Objects component was installed, you will have to import the updated objects into the System Platform IDE. For more information, refer to the object guides.
- If the Development Library was installed and a previous version of the MES Client API script libraries was on the Application Server, you will have to upgrade them. See [Upgrading the MES Client API Script Libraries](#).
- If the MES .NET Controls component was installed and a previous version of them was being used in the System Platform IDE, you will have to upgrade them in the System Platform IDE. See [Upgrading MES .NET](#)

[Controls for AVEVA InTouch HMI Applications.](#)

- If MES BI Gateway Reports were installed, they must be deployed. See [Configuring and Deploying MES BI Gateway Reports](#).

## Implementing Secure Communication with System Management Server

Security measures for System Platform network topology are enabled through the System Management Server and the AVEVA Identity Manager (AIM). These measures include secure encrypted communications between nodes, AVEVA Single Sign On (SSO), and certificate management. The System Management Server stores shared security certificates and establishes a trust relationship between nodes in the System Platform network topology. These security components together make up the common platform security measures.

If not already installed as part of a System Platform installation, System Manager Server and AIM are installed when any of the following MES components are installed: MES Middleware, MES Middleware Proxy, and MES Web Portal.

To implement secure communication with the MES middleware and for user authentication with the MES Web API, the System Management Server must be configured prior to configuring the MES components in the post-install Configurator. If MES is being upgraded, then the MES components must be reconfigured to implement the latest security measures. In addition, all MES nodes on the network must be able to communicate with the System Management Server.

---

**Note:** MES does not support Azure AD in the System Platform configuration of System Manager Server.

There should only be a single System Management Server in your System Platform network topology (additional redundant single sign-on servers can be configured). However, each node in the network has a System Management Server component that must be configured using the post-install Configurator.

---

**Note:** System Management Server's Redundant Single-Sign On capability is not supported by the MES middleware or MES Web Portal.

The System Management Server component settings include:

- Specifying whether the System Management Server is on the local node or a remote node.
- If on the local node, specifying the HTTPS port for the System Management server. This port number also serves as the HTTPS port number for the local node's common platform communication over web ports.
- If on a remote node, specifying the HTTPS port used by the local node for common platform communication over web ports. Generally, this will be the same as the HTTPS port number for the System Management Server, but it could be different.

For complete information about configuring System Management Server, refer to the topic "System Management Server Configuration" in the *System Platform Installation Guide*.

The procedures for configuring the MES components will refer to the System Management Server settings as needed.

## MES Settings Affected When the System Management Server HTTPS Port Is Changed

If the System Management Server or common platform **HTTPS Port** number is changed, the following MES components are affected and need to be reconfigured in the post-install Configurator.

## DB/MW Communication

- If the System Management Server **HTTPS Port** number is changed, on the **AVEVA Identity Manager** tab change the **AIM HTTPS Port** number to match it and reconfigure the DB/MW Communication component. See [Configuring AVEVA Identity Manager Client Registration](#).
- If the System Management Server and MES middleware are on different nodes and the common platform **HTTPS Port** number is changed on the MES middleware node, reconfigure the DB/MW Communication component on that node. See [Reconfiguring the DB/MW Communication Component If the Common Platform HTTPS Port Number Is Changed](#).

## Middleware Proxy

- If the System Management Server and MES middleware are on the same node and the **HTTPS Port** number is changed, change the proxy **HTTPS Port** number to match it and reconfigure the Middleware Proxy component.
- If the System Management Server and MES middleware are not on the same node and the common platform **HTTPS Port** number for the MES middleware node is changed, change the proxy **HTTPS Port** number to match it and reconfigure the Middleware Proxy component.

See [Configuring the MES Middleware Proxy](#).

## Web Portal

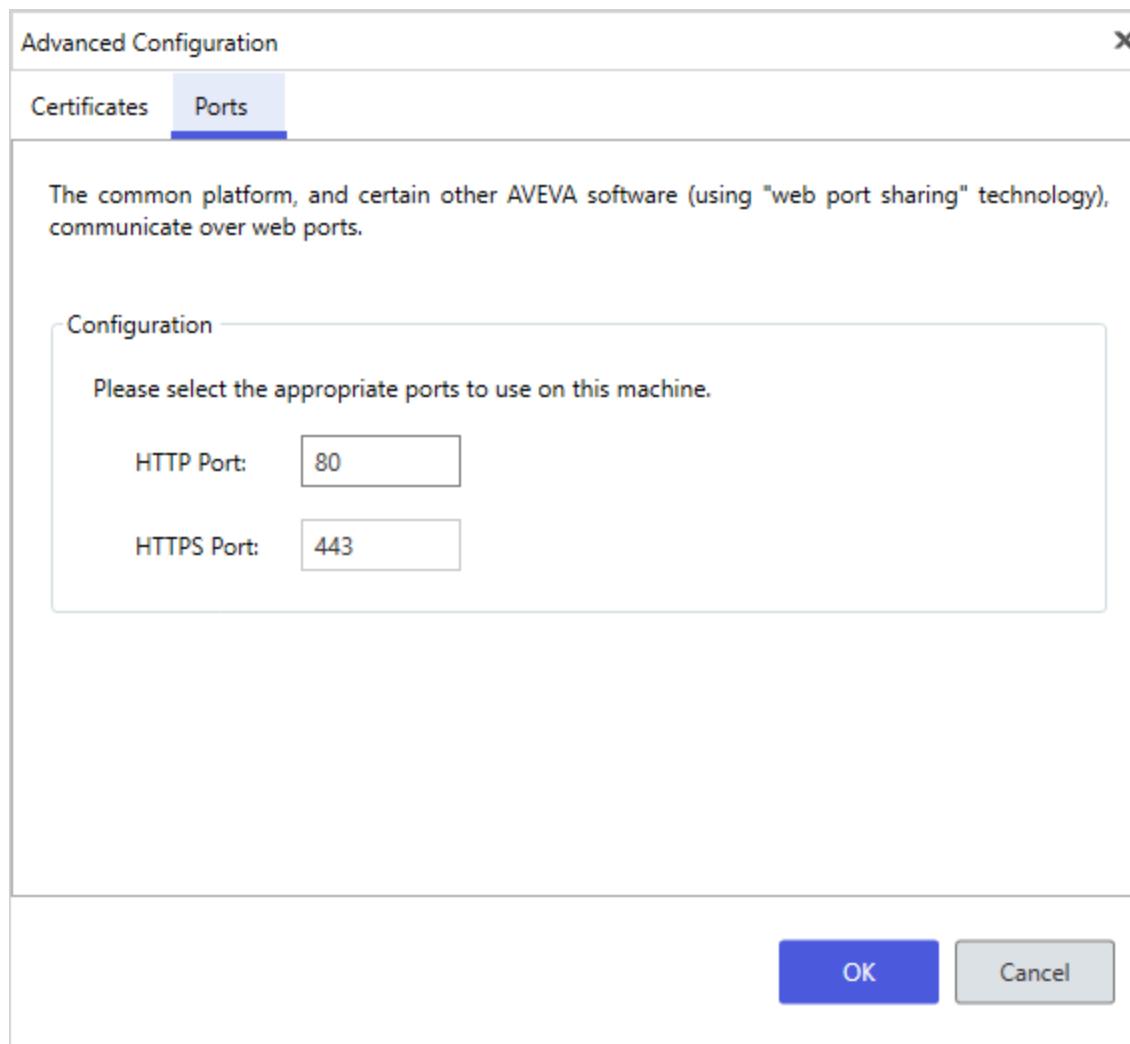
If the System Management Server **HTTPS Port** number is changed, change the **AIM HTTPS Port** number to match it and reconfigure the Web Portal component.

See [Configuring the MES Web Portal Component](#).

## System Management Server and Local Node Common Platform HTTPS Port Settings

The common platform HTTPS and HTTP port settings that the System Management Server uses are on the **Ports** tab of the System Management Server component's **Advanced Configuration** dialog.

- If the System Management Server is on the **local** node, the port settings can be changed from their default values on this tab.
- If the System Management Server is on a **remote** node, they are shown on this tab but cannot be edited. They can only be changed from the remote node.



## Creating Client IDs to Obtain AIM Access Tokens

Custom client applications require an AIM token to access MES. When a valid client ID and client secret are passed to AIM, an AIM access token is returned. This token is then required to be passed to access MES for the current client application user session.

The MES installation software includes a PowerShell script that can be used to create the client IDs. You can create as many AIM client IDs as are needed to support the MES custom client applications.

The PowerShell script creates a service-to-service flow.

- For service-to-service, the MES middleware uses the default background user configured for the **User ID for background tasks** system attribute (configured in MES Client; attr\_id 199 in the System\_Attr table). The default entry for this system attribute is **Default Background User**.
- By default, the lifetime of the token is 24 hours. To change this setting, you can edit the PowerShell script.

### To create an AIM client ID

- Open a user session on the node on which the System Management Server is running.

2. In the MES installation software on that node, open the **\InstallFiles\CD-MES\AIMRegistration** folder.
3. As an admin user, open the PowerShell script file **RegisterAIMServiceClient.ps1**.
4. Complete the prompts for the following input:

**Client ID**

The client ID to be used by the custom client application.

**Client Secret**

A secret, or password, for the client ID.

**User Name (domain\user) and Password**

A user name and password that has login access to AIM.

After completing entries to these prompts, the client ID registration is performed and you should see a message indicating that the client has been registered successfully. This client ID and client secret can now be used by client applications to obtain AIM access tokens.

## Using an AIM Client ID to Obtain an Access Token

A client application initiates a user session with MES by first obtaining an AIM access token.

The following client ID information must be provided:

- Client ID
- Client Secret

For example:

- When using MES Web API calls, the client ID and secret must be passed when obtaining an AIM access token. For an example of an Application Server-based script that passes this information when obtaining a token, see the topic "Application Server Usage Example" in the *MES Web API V3 Reference* help.
- When using the MES Web API with MES model-driven application content and service-to-service token access, the client ID and token information is provided in the Work Tasks **Edit Web API List Item** form. For more information, see the topic "Configuring User Access Token Mode for the MES Web API" in the *MES Web API V3 Reference* help.

## Creating or Migrating MES Databases

The first step in configuring a new MES system is to create the MES database. This step requires a SQL Server database server to be available on the network or local node. A Windows or SQL Server user account with access to the server and rights to create a database must be known to successfully configure the Database Setup component.

The MES Database Setup component settings in the Configurator allow you to:

- Create the MES production database, and optionally a restore database, for a new installation
- Migrate an existing MES database to the current MES version
- Dump the MES database scripts to disk, so they can be customized and used to create a custom MES database

## Fixing Database Table Fragmentation

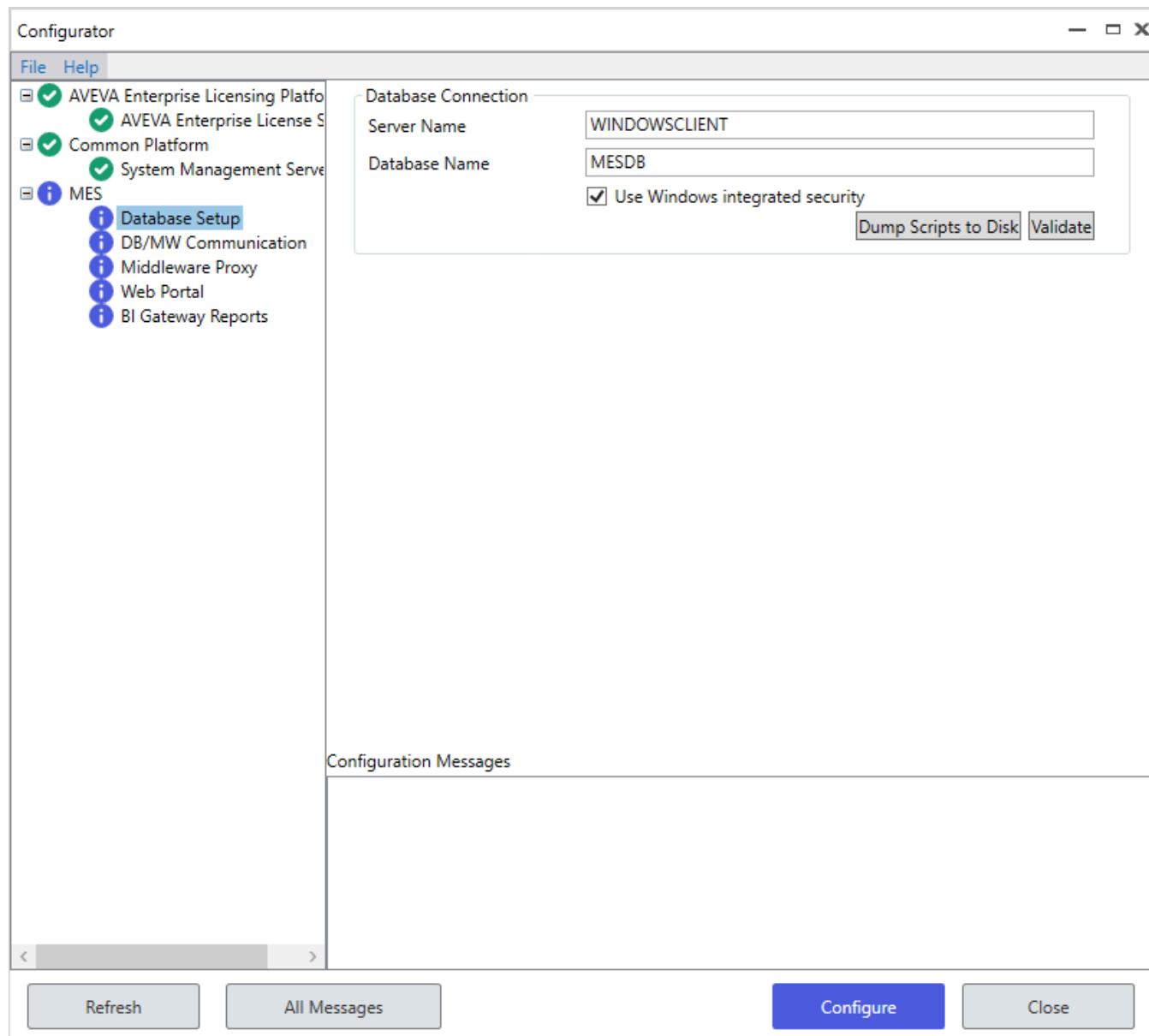
To fix table fragmentation, any MES database that has a page count of 1,000 or greater will be automatically evaluated for reindexing when it is created or migrated.

- If an index's fragmentation is greater than 5% but less than or equal to 30%, the index will be reorganized.
- If an index's fragmentation is greater than 30%, the index will be rebuilt.

## Creating an MES Database

The Database Setup component can be used to create as many MES databases as are needed. The databases can be on the same or different SQL Server database servers to support production, restore, test, development, and other types of databases.

The initial MES Database Setup component settings and controls are shown in the following figure.



## To create an MES database

1. Complete the database server and MES database name settings:

### Server Name

The name of the server that is hosting the MES database. The server name defaults to the local server. Supported server names include IP names (IPv4 and IPv6), SQL server named instance conventions, cluster names, and SQL Server Availability Groups.

When using a Failover or Availability Group naming convention, the configuration must be performed when the primary node is active.

### Database Name

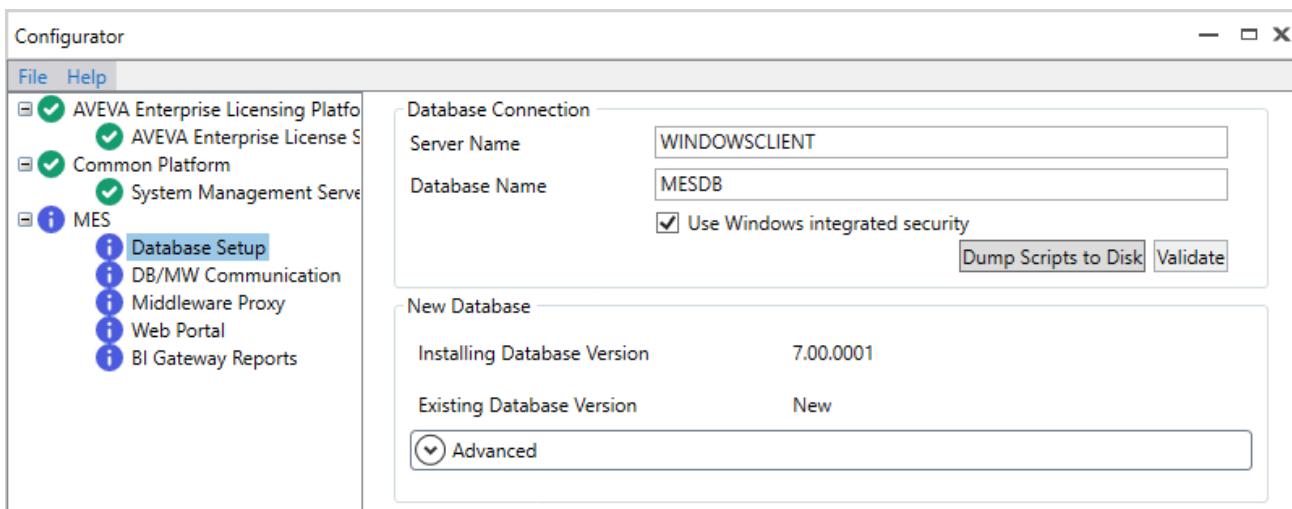
The name of the MES database. The name defaults to **MESDB**.

2. Specify the user account to use to access SQL Server.

For more information about specifying a user account, see [Specifying SQL Server User Authentication](#).

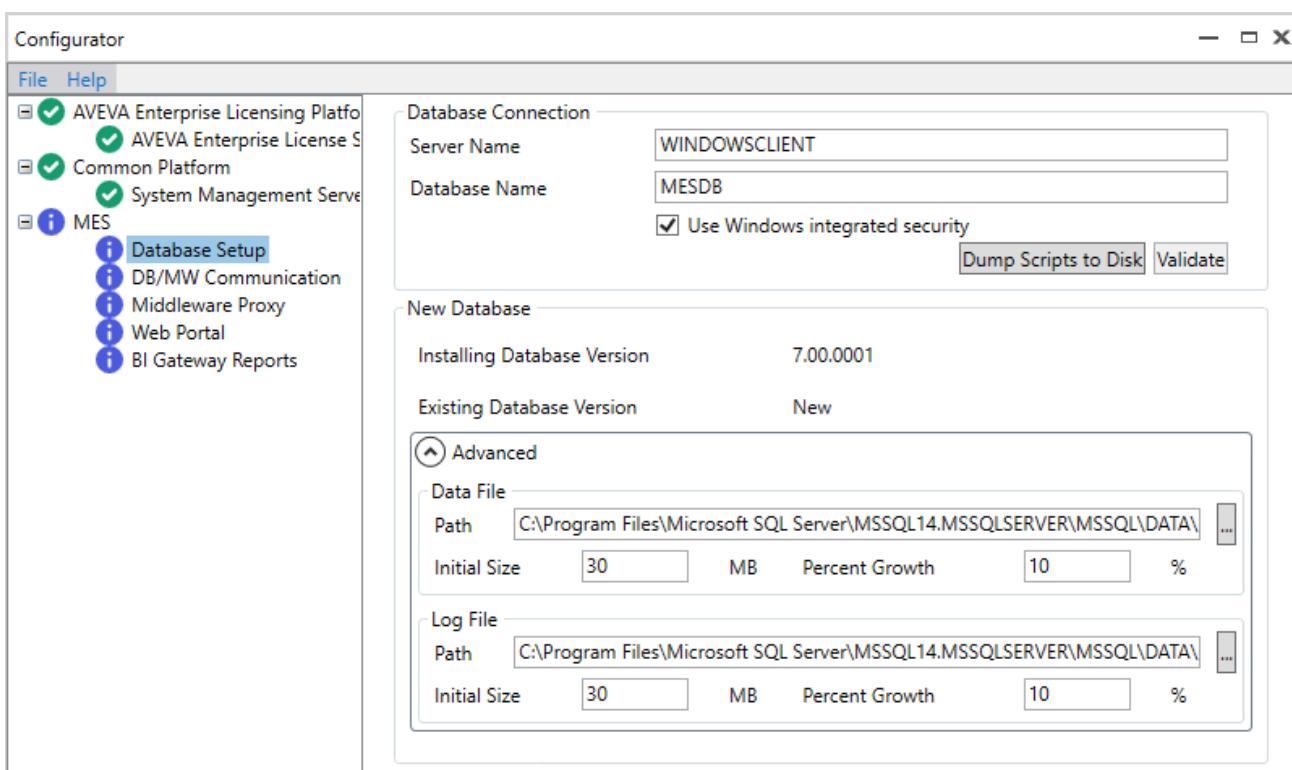
3. To access SQL Server and check for the existence of the specified database, click **Validate**.

If the validation is successful and the named database does not exist, the **New Database** settings appear.



If the named database exists but is not an MES database, an error message appears.

4. Optionally, to set the path, initial size, or percentage growth of either the MES database's data file or log file, click the **Advanced** settings title to expand the settings.



### Path

The path of the data or log file.

### Initial Size

The initial size, in MB, of the data or log file.

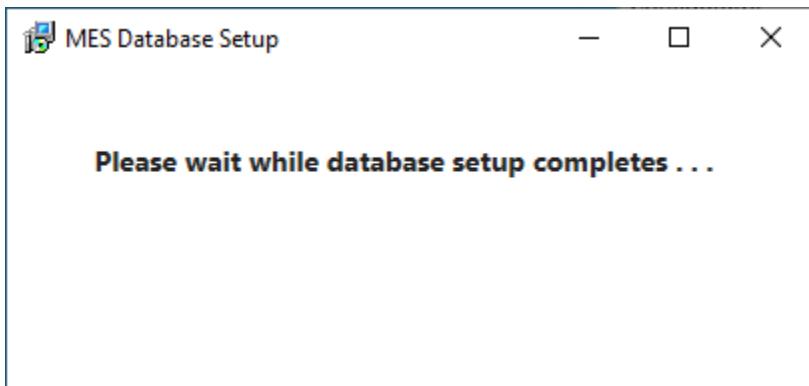
### Percent Growth

The percent by which to limit the percent growth of the data or log file.

When you have completed validating the SQL Server connection and optionally entering any advanced database settings, you are ready to create the MES database.

5. Click **Configure**.

The SQL scripts that create the database run. A message appears, asking to wait while the database configuration is performed.



Progress information and any errors, if they occur, appear in the **Configuration Messages** box.

If the database creation completes successfully, a success message appears in the **Configuration Messages** box. Also, the MES Database Setup status indicator changes to a green check mark.

If errors are encountered, check the Operations Control Management Console Log Viewer for details. To enable additional details, enable the Log Script Execution log flag in the Log Viewer and run the Configure operation again.

## Migrating or Overwriting an Existing MES Database

If you are upgrading MES and there is an existing MES database, you have the following options:

- Migrate the existing database to the new MES version.
- Overwrite the existing database with a new MES database.
- Keep the existing database and not run the MES Database Setup configuration. Note that this option leaves the database unusable, as the current version of MES will not work with a previous version of the database.

### To migrate or overwrite an existing MES database

1. Complete the database server and MES database name settings:

#### Server Name

The name of the server that is hosting the existing MES database. The server name defaults to the local server. Supported server names include IP names (IPv4 and IPv6), SQL server named instance conventions, cluster names, and SQL Server Availability Groups.

When using a Failover or Availability Group naming convention, the configuration must be performed when the primary node is active.

#### Database Name

The name of the existing MES database. The name defaults to the existing database, if one is found.

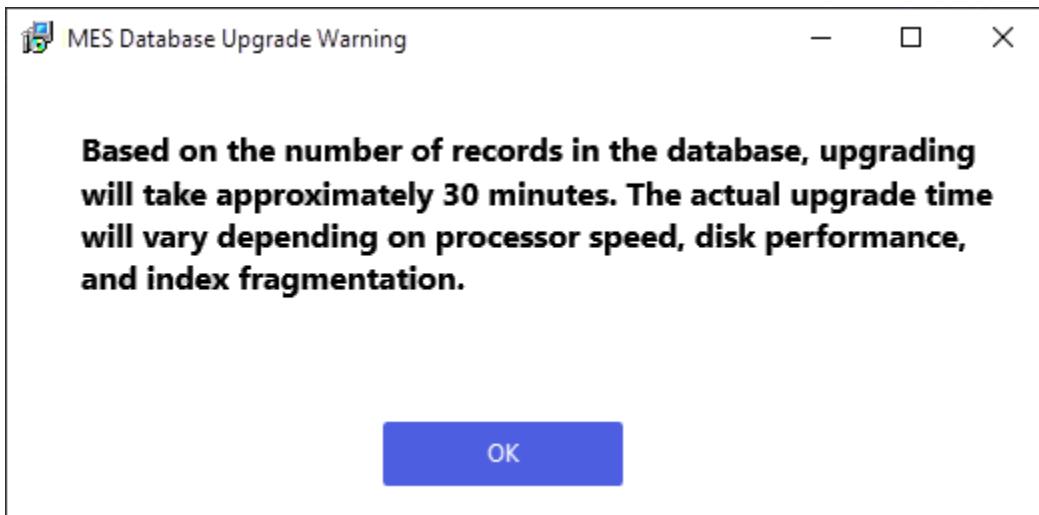
2. Specify the user account to use to access SQL Server.

For more information, see [Specifying SQL Server User Authentication](#).

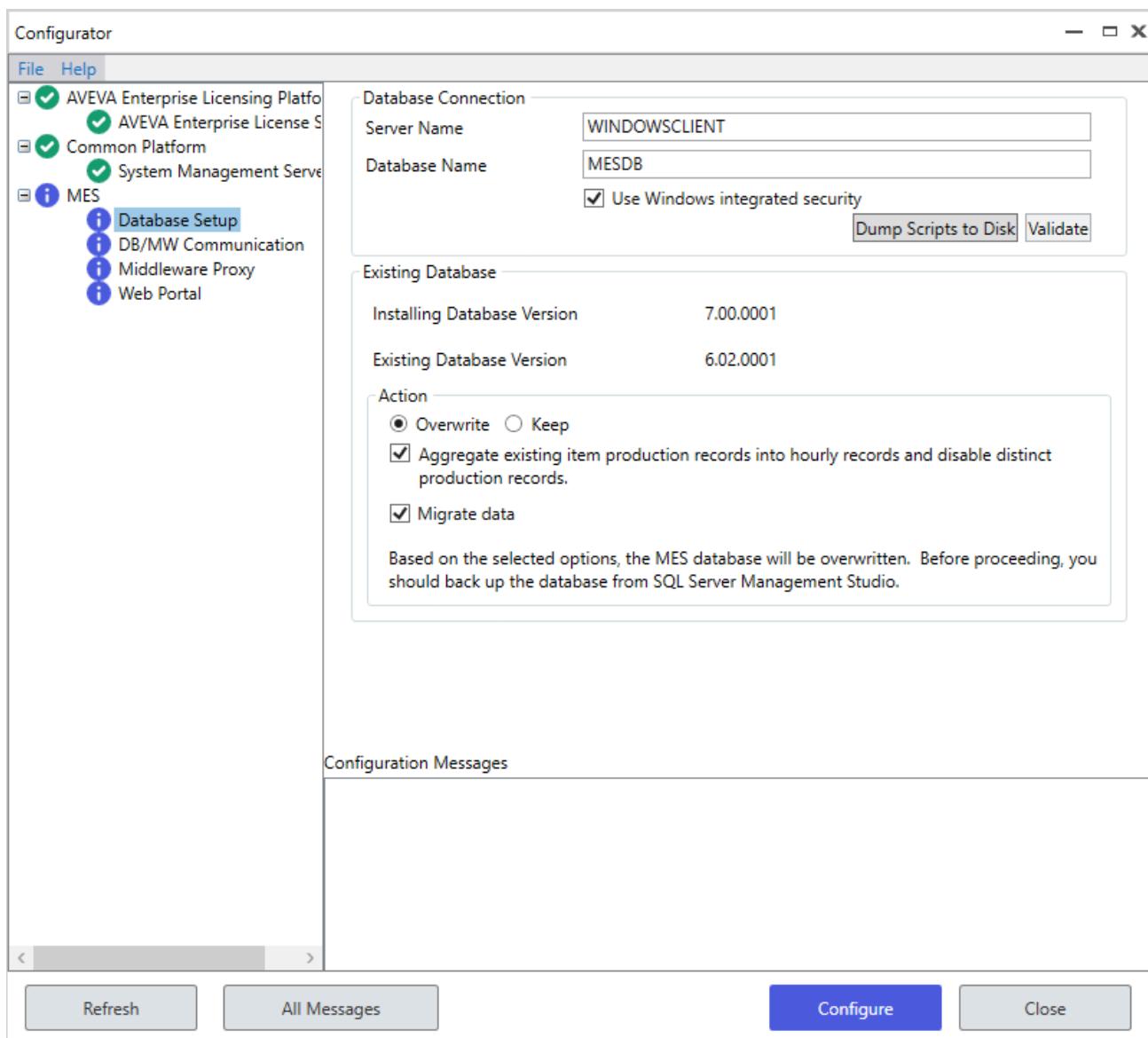
For the Database Setup component, the user account provided must have adequate rights on SQL Server to create a database.

3. To check that the user account you have specified can access the specified SQL server and MES database, click **Validate**.

As part of the validation, an estimate is calculated for how long upgrading the existing database will take. If the estimate is more than 10 minutes, the estimated time is displayed in a message box.



If the validation is successful, the **Existing Database** settings appear.



If the specified database is not found, then the settings for creating a new database appear. Try entering the correct name for the existing database and clicking the **Validate** button again.

4. Do one of the following:

- To migrate the existing database to the new release, select the **Overwrite** and **Migrate data** options. Then go to step 6.
- To overwrite the existing database with a new MES database, select the **Overwrite** option but clear the **Migrate data** option. Then go to step 5.

When the **Overwrite** option is selected and the **Migrate data** option is cleared, the **Advanced** settings title appears with the settings collapsed.

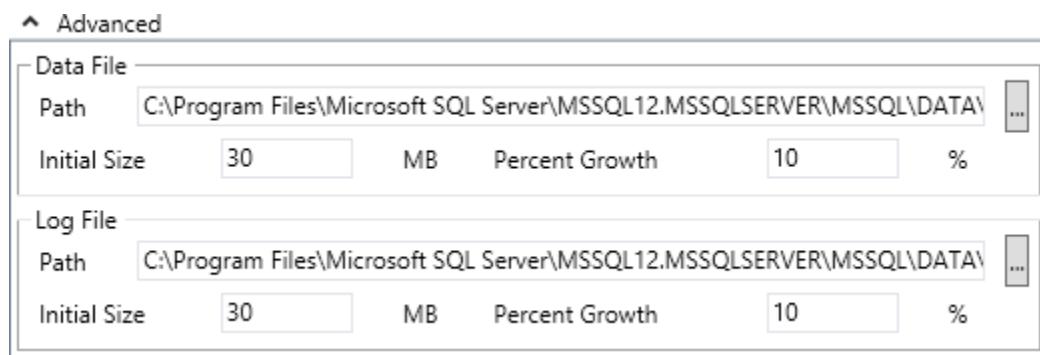
- To keep the existing database and not run the Database Setup configuration, select the **Keep** option.

---

**Note:** If you choose to overwrite or migrate the existing MES database, it is strongly recommended that you back up the existing database before proceeding in case you need to recover its content. You can back up the database from SQL Server Management Studio.

5. Optionally, to set the path, initial size, or percentage growth of either the new MES database's data file or log

file, click the **Advanced** settings title to expand the settings and enter them. Then go to step 7.



#### Path

The path of the data or log file.

#### Initial Size

The initial size, in MB, of the data or log file.

#### Percent growth

The percent by which to limit the percent growth of the data or log file.

6. If the existing MES database that you are migrating has the system parameters for recording distinct production records set but instead you want to aggregate these records into hourly records and disable distinct production records, select the **Aggregate existing item production records** option.

If the existing MES database already has the system parameters for recording distinct production records set to False, then the setting of this option has no effect.

It is recommended to aggregate production records into hourly buckets, as this will improve the overall system performance for recording production and reporting on production data. In versions prior to MES version 4.5, recording distinct production records was required for reporting hourly KPIs, but this is no longer the case. You might still want distinct production records for other reasons, in which case do not select this option.

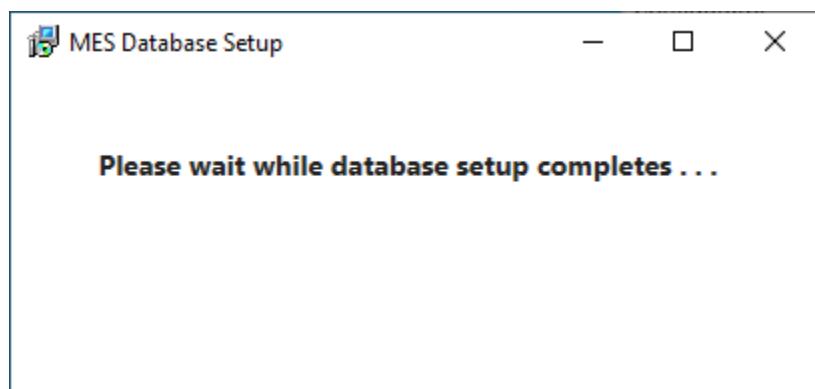
7. To migrate or overwrite the existing MES database, click **Configure**.

---

**CAUTION:** While the database is being migrated from a prior version, the Configurator application cannot be closed or switched to a different component's configuration. If the Configurator application is stopped prematurely (such as closing the application or shutting down the computer), the MES database will be in an inconsistent state and might not function correctly.

---

The SQL scripts that migrate or create the database run. A message appears, asking to wait while the database configuration is performed.



Progress information and any error messages appear in the **Configuration Messages** box.

If the database migration or creation completes successfully, a success message appears in the **Configuration Messages** box. Also, the MES Database Setup status indicator changes to a green check mark.

During migration, if the database is configured to use OS Group security and does not already have the OS Group SIDs in the MES database, the configure operation will attempt to create them. If the domain is not available, then use the OS Group SID Utility to update them later when the domain is available. See Importing Windows Active Directory Group SIDs into the MES Database.

If migrating from MES 2014 R3 (version 5.3) or earlier, the migration process creates new tables for tracking utilization data and moves the existing data into these new tables. The original tables still remain in the database but have been renamed to util\_log\_deprecated, job\_util\_log\_link\_deprecated, and tpm\_stat\_deprecated. These deprecated tables can be deleted once the migration is deemed to have completed successfully. New views are created with the original table names of util\_log, job\_util\_log\_link, and tpm\_stat to ensure any existing queries or reports continue to function after migration.

## Creating a Customized MES Database Using Modified Database Scripts

You can dump all of the embedded resources in the database configuration, including the database scripts, to the **FactDbResources** folder from the MES Database Setup component in the Configurator. You can then modify the scripts and use them to create a customized MES database.

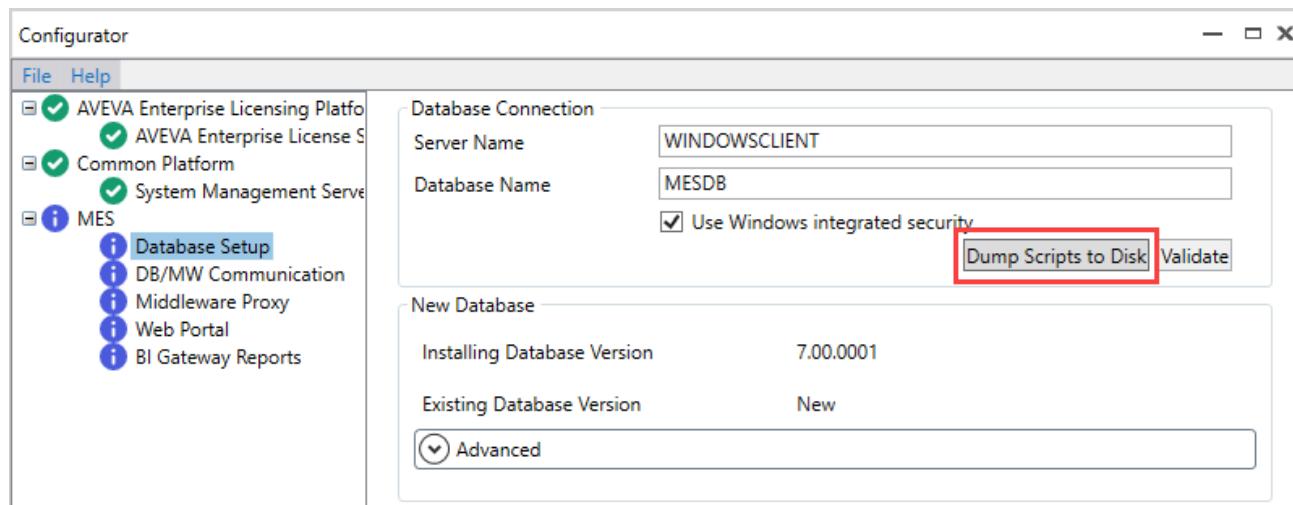
This option is useful when you run into specific problems during the execution of the default database script files. However, great care must be taken in modifying the script files, as Technical Support might not support an installation for which the core MES scripts have been modified.

---

**Note:** You cannot run the scripts manually to create an MES database. You must configure the MES Database Setup component in the Configurator to create the database, which will run the scripts in the **FactDbResources** folder by default.

### To dump the database scripts

- In the MES Database Setup configuration settings, click the **Dump Scripts to Disk** button.



The database scripts are dumped to the folder **FactDBResources\{v.v.v}**, where {v.v.v} is the MES version (for example, 5.03.0001). This folder is located in the installed MES Database folder, whose default path is **C:\Program Files (x86)\Wonderware\MES\Database**.

Also, the button label changes to **Overwrite Scripts on Disk**. Clicking this button causes the scripts in the **FactDbResources** folder to be overwritten with the default scripts.

### To create a customized MES database using modified database scripts

1. Modify the scripts as needed.
2. In the MES Database Setup component settings, enter the server and database names and then click the **Validate** button.

The Configurator checks for access to SQL Server and the existence of the specified database to see if the database will be created or migrated.

3. If the validation is successful, complete the necessary database settings.

For details, see either [Creating an MES Database](#) or [Migrating or Overwriting an Existing MES Database](#).

4. Click the **Configure** button to create the customized database.

Script modifications that result in an error will be logged as the script is executed.

### Restoring the Default Database Scripts

Whenever you configure the MES Database Setup component after dumping the scripts, the component configuration always uses the scripts in the **FactDBResources\{v.v.v}** folder to create the database. If needed, you can overwrite the modified scripts with the default unmodified scripts to create a standard MES database. Or you can delete the **FactDBResources\{v.v.v}** folder and configure the Database Setup component to create or migrate the database.

### To restore the default unmodified database scripts

- In the MES Database Setup configuration settings, click the **Overwrite Scripts on Disk** button.

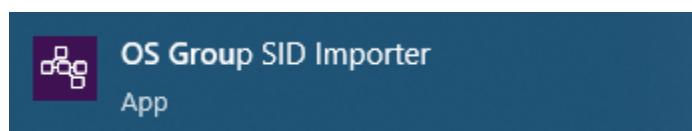
### Importing Windows Active Directory Group SIDs into the MES Database

If an existing MES database has the *MES Security Mode* system parameter set to OS Group and there is connectivity to the Windows Active Directory (AD) domain controller, then the group SIDs are updated automatically during the database migration process. (For information about setting the *MES Security Mode* system parameter, see the *MES Client User Guide* or online help.)

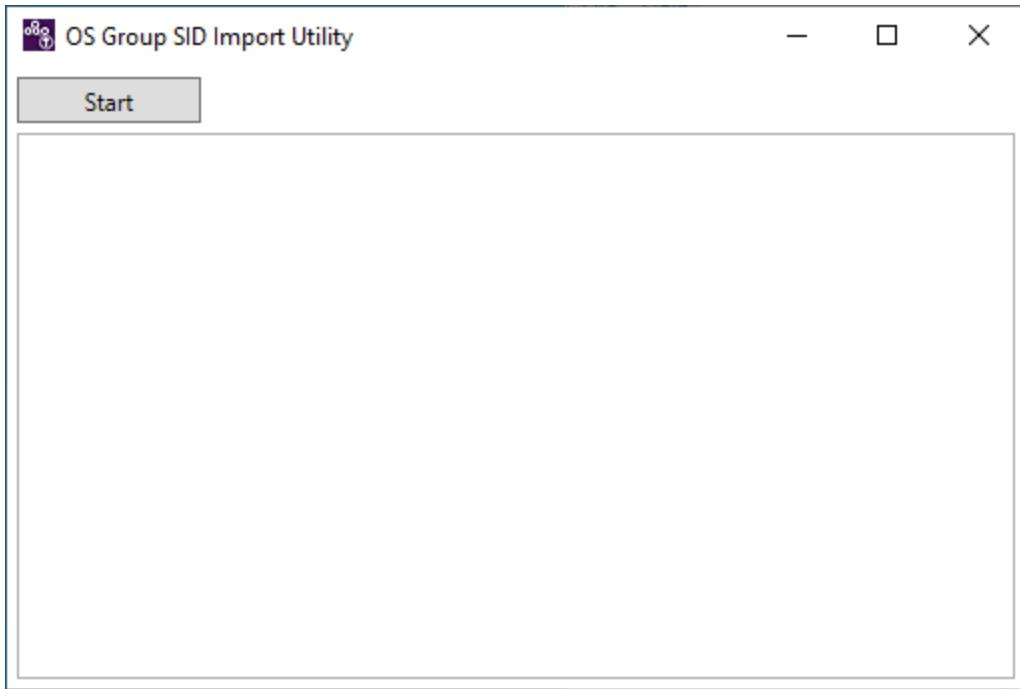
However, if the AD domain controller was temporarily not able to be contacted at the time of the upgrade, a message indicating that the server could not be contacted will appear in the Configurator **Configuration Messages** box. This is because the AD domain controller from which to retrieve the SIDs could not be found. When contact with the AD domain controller is restored, the group SIDs can be retrieved and updated in the MES database using the following procedure.

### To import the Windows AD group SIDs into the MES database

1. From the Start menu, open the **OS Group SID Importer** app.



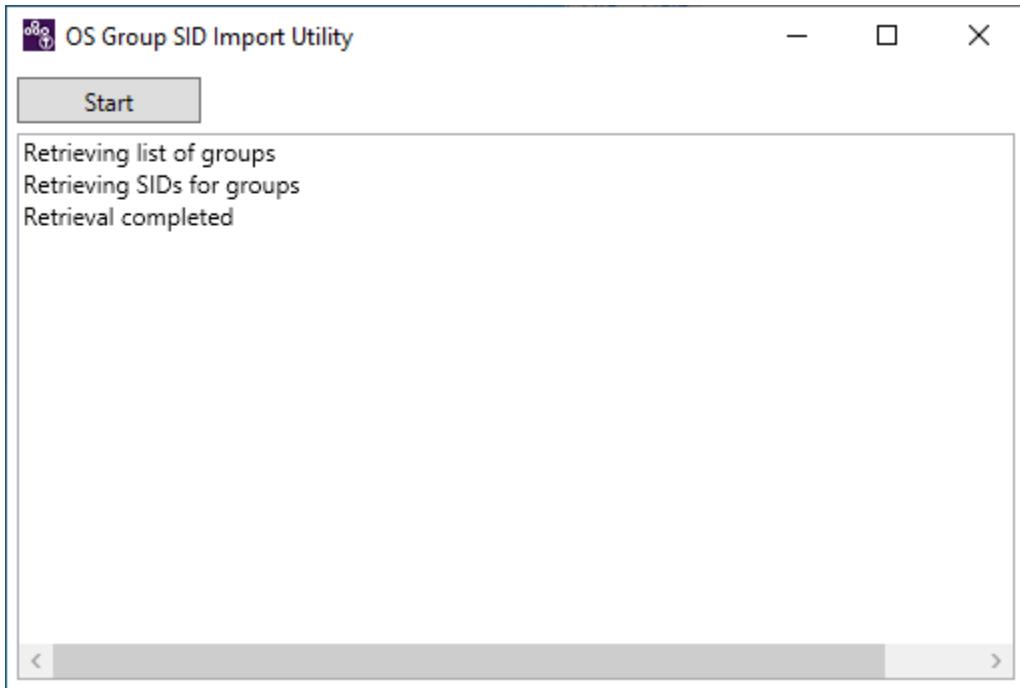
The OS Group SID Import Utility window appears.



2. Click **Start**.

The SID import progress appears. During the import process, the **Start** button becomes a **Stop** button to allow you to stop the import. The utility will retrieve only the SIDs for any group that does not have a SID in the database. This might happen so quickly that you cannot detect the button label transitioning from **Start** to **Stop** and back to **Start**.

When the import is complete, the completion status appears in the window.



3. Check the status messages to see if any groups have errors. These errors will have to be addressed and the utility run again to correct the errors.
4. Click the window's Close button to close the utility.

## Recommendations for Optimizing the MES Database

For MES version 5.0, the MES database structure was optimized by adding new indices and removing other indices that were no longer needed. A fresh installation of MES version 5.0 or later will include the optimized index scheme.

However, these optimizations are not automatically applied when migrating MES databases for versions prior to version 5.0. This approach was used to prevent custom index optimizations that might have been applied to the MES database from being overwritten.

If your MES database has not had custom index optimizations and you would like to incorporate the version 5.0 optimization scheme, you can run an index optimization script that is installed as part of the MES database installation.

The following topics describe the optimization script and provide some additional optimization recommendations.

### MES Database Index Optimization Script

If your MES database has not had custom index optimizations and you would like to incorporate the version 5.0 optimization scheme, you can run an index optimization script.

The index optimization script is stored in a SQL directory in the following directory path:

...\\Wonderware\\MES\\Database\\Optional Scripts\\SQL Server

The script is called **Version 5.0 Index Changes**.

### Monitoring Actual System Usage

The optimal set of indexes is strongly dependent on the actual usage of the system; that is, how frequently data is:

- Added
- Changed
- Read
- Deleted or moved to offline storage (and thus in conjunction with the how frequently data is added, how big various tables can become)

So actual statistics about the usage of the database should drive the choice of indexes.

Be careful to collect statistics during a wide enough period of time so that the results are representative of the way the system operates as a whole. Traffic at a shift change, for example, might be very different from that in the middle of a shift. Also, be sure to catch the generation of any large sets of periodically-generated reports.

Monitoring system activity should be an ongoing database administration task. As the system grows and its usage changes over time, new statistics should be obtained and indexes should be re-examined.

### How Many Indexes to Use

Indexes typically help to speed up retrieving data but slow down writing data. The optimal amount of indexes depends on your actual system activity. Putting indexes on everything or having no indexes at all are probably

extremes to be avoided—though having many bad indexes is worse than not having any.

### Frequency of Index Rebuilding and Reorganizing

Periodic rebuilding or reorganizing of indexes is a normal part of maintaining a database. There are rules of thumb (though not hard and fast numbers) for the points at which these should occur. Consult SQL Server web resources for more information.

### Choosing What to Index

Choosing what to index depends on the structure of your typical query statements. For example, to be used for SELECT statements, indexes have to match at least the beginning of the WHERE clause. A simple index on column A would not be usable for the SELECT statement "WHERE B = 6 and A = 99"; neither would a composite index on columns A and B. A simple index on just column B would be usable; so would a composite index on columns B and C. Best of all, from the standpoint of that specific query, would be an index on columns B and A. It would not matter (again from the standpoint of this specific query example) whether it also included other columns after those.

### Additional Assistance

There are automated tools available to help you find missing indexes that ought to be added, as well as identifying unused indexes that can be dropped. A web search on "SQL Server index optimization" will result in numerous links to such tools.

You can also consult web resources for SQL Server database maintenance for specific information about those databases. For more information, see the Microsoft SQL Server web site.

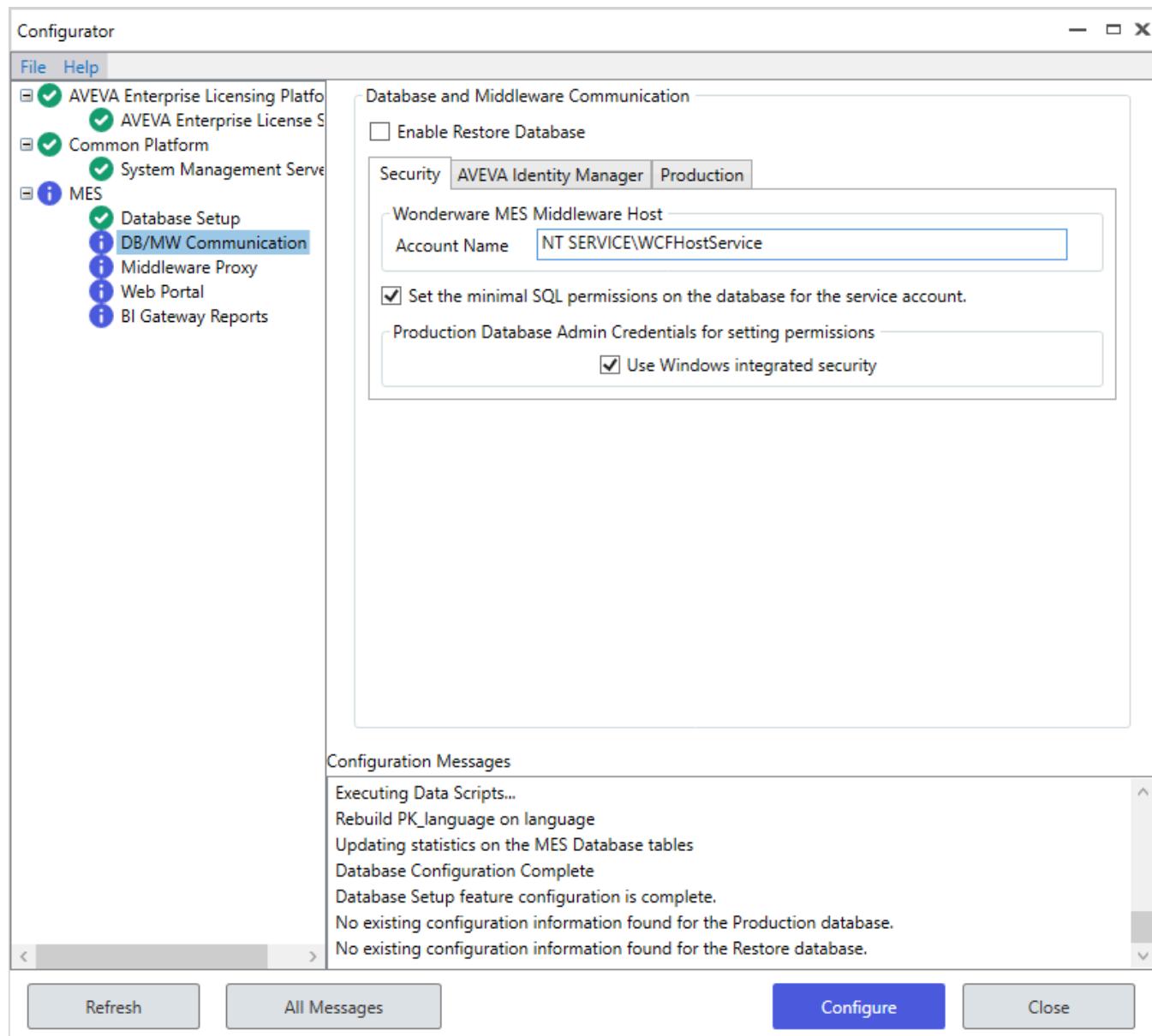
## Configuring MES Middleware Communication with MES Databases

The DB/MW Communication component is used to create the database connection strings that the MES middleware service uses to access MES databases. In addition:

- It is used to create a firewall inbound rule exception to allow the MES middleware proxies to communicate securely with the MES middleware.
- It is used to register the MES middleware with the AVEVA Identity Manager (AIM) for the MES Web API authentication.
- It can also be used to assign the minimal SQL permissions required to access and query an MES database to the MES middleware service's Windows user account. Otherwise, the SQL permissions have to be assigned manually.

If the MES middleware and the MES database are on separate nodes, the Microsoft Distributed Transaction Coordinator service (MSDTC) must be added to the Windows Firewall exception list on both nodes to allow them to communicate.

The **Security** tab of the DB/MW Communication component is shown below.



The **Security**, **AVEVA Identity Manager**, and **Production** tabs, and optionally the **Restore** tab if the **Enable Restore Database** option is selected, need to be completed before clicking the **Configure** button to configure the component. The order in which they are completed does not matter. The next few topics describe the **Production** and **Restore** tabs first, and then the **Security** and **AVEVA Identity Manager** tabs.

- Database connection string information is entered on the **Production** and **Restore** tabs.
- The MES middleware service's Windows user account is shown on the **Security** tab. If this user account will be used to access the MES database using Windows integrated security, then the option to automatically create a SQL Server login for that account is also provided on this tab.
- The **AVEVA Identity Manager** client registration information for the MES middleware on this node is entered on the **AVEVA Identity Manager** tab.

## Using Windows Integrated Security vs. SQL Authentication to Access the MES Database

The MES middleware service must be assigned to a SQL Server login that has the proper permissions to access the MES database.

Unless Workgroups is being used to manage user accounts and the middleware is on a different node than the MES database, the MES middleware service can use Windows integrated security to access the MES database. If this approach is chosen, the MES DB/MW Communications component **Security** tab includes an option to automatically add the middleware service Windows user account as a SQL Server login when the MES DB/MW Communications component is configured.

If Windows integrated security is not or cannot be used, then the middleware service must use an existing SQL Server login with the appropriate access to the MES database. See [Manually Adding a SQL Server Login for the Middleware Service](#).

### **Manually Adding a SQL Server Login for the Middleware Service**

If the MES middleware service is going to use SQL authentication to access the MES database, a SQL Server database administrator must create the middleware service SQL Server login and grant the roles and minimal permissions described in this topic to it.

Proper permissions are granted by assigning the following SQL Server database roles to the SQL Server login.

#### **Alter**

Required to add attributes that will be seen in the work queue and the inventory grid, which alters tables in the MES database.

#### **Connect**

Required to connect to the MES database.

#### **Delete**

Required to be able to delete records from the MES database.

#### **Execute**

Required to execute SQL commands on tables in the MES database.

#### **Insert**

Required to be able to insert records into the MES database.

#### **Select**

Required to be able to do selections on the MES database.

#### **Update**

Required to be able to update records in the MES database.

It is important that you do not grant these database roles to the SQL Public server role. Instead, they should be granted to the middleware service SQL Server login. This login should be assigned the Public server role, as described in the following procedure.

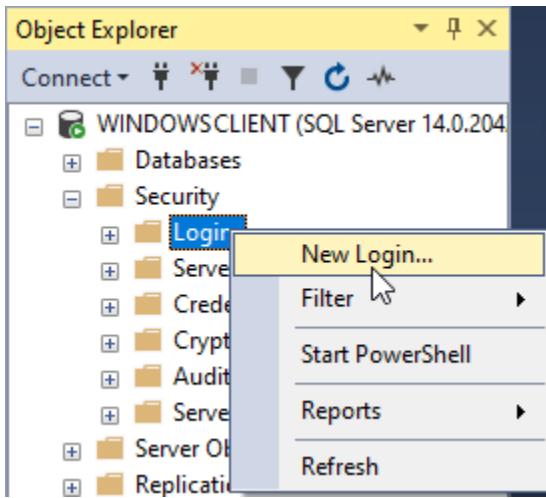
The screen shots in this procedure are based on SQL Server Management Studio 18. Depending on what version you are using, the steps and screens might be different.

#### **To create the MES middleware service SQL Server login**

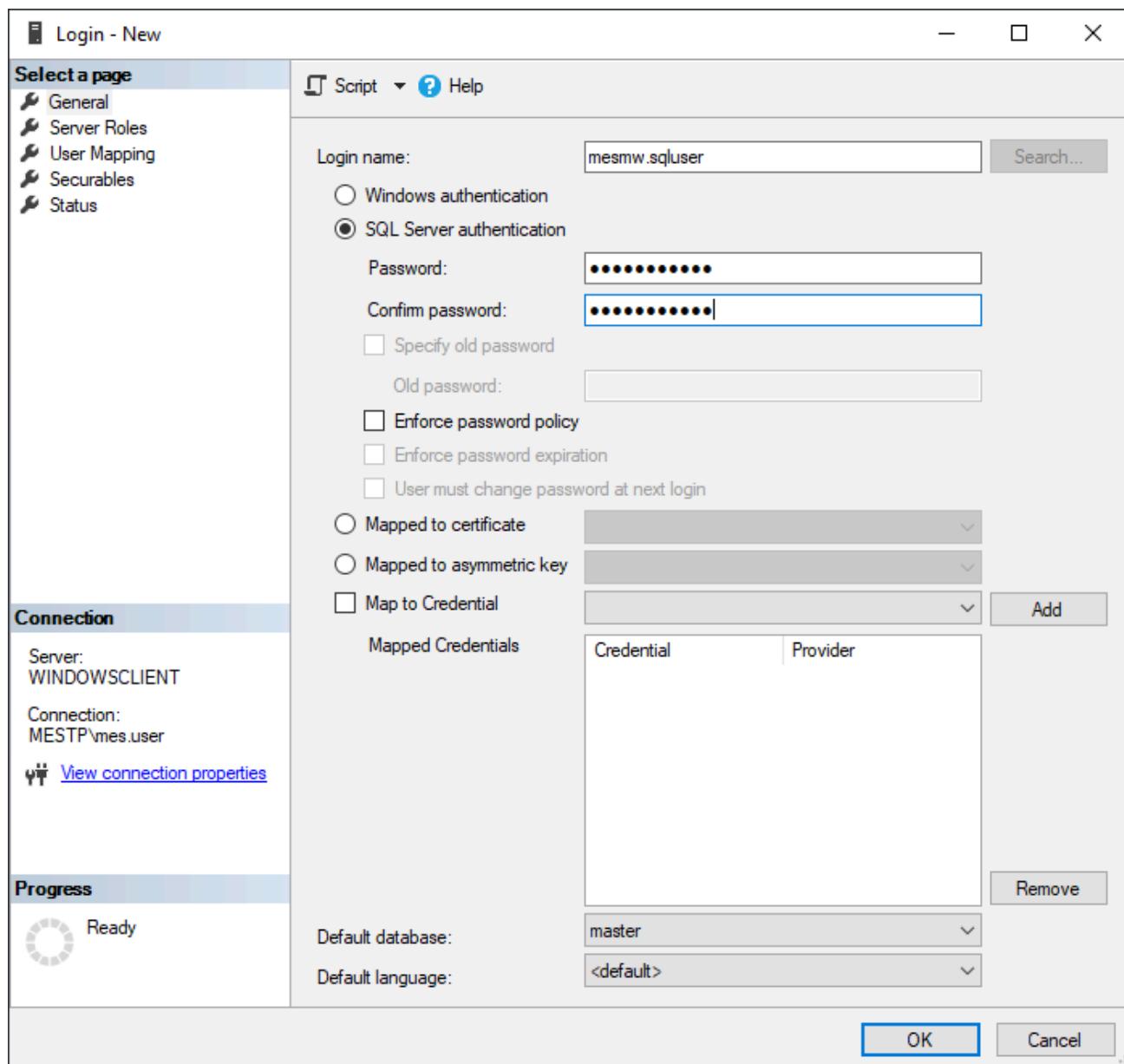
1. If the MES database has not been created yet, run the MES installation and configure the MES Database

Setup component in the post-install Configurator to create it.

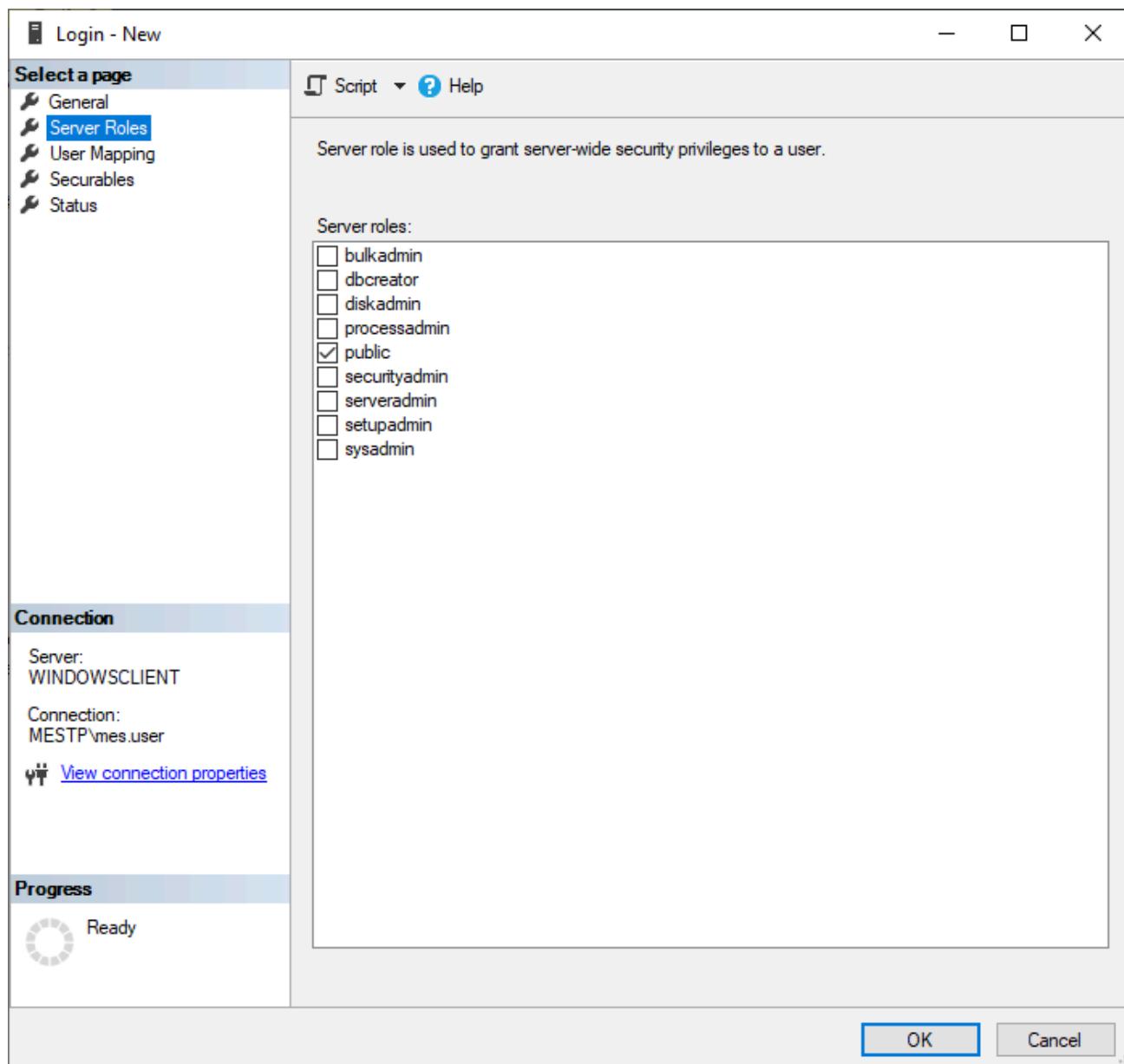
2. Log into SQL Server Management Studio as a user with administrator rights.
3. In the Object Explorer window, create a SQL Server login by right-clicking **Logins** under **Security** and then clicking **New Login**.



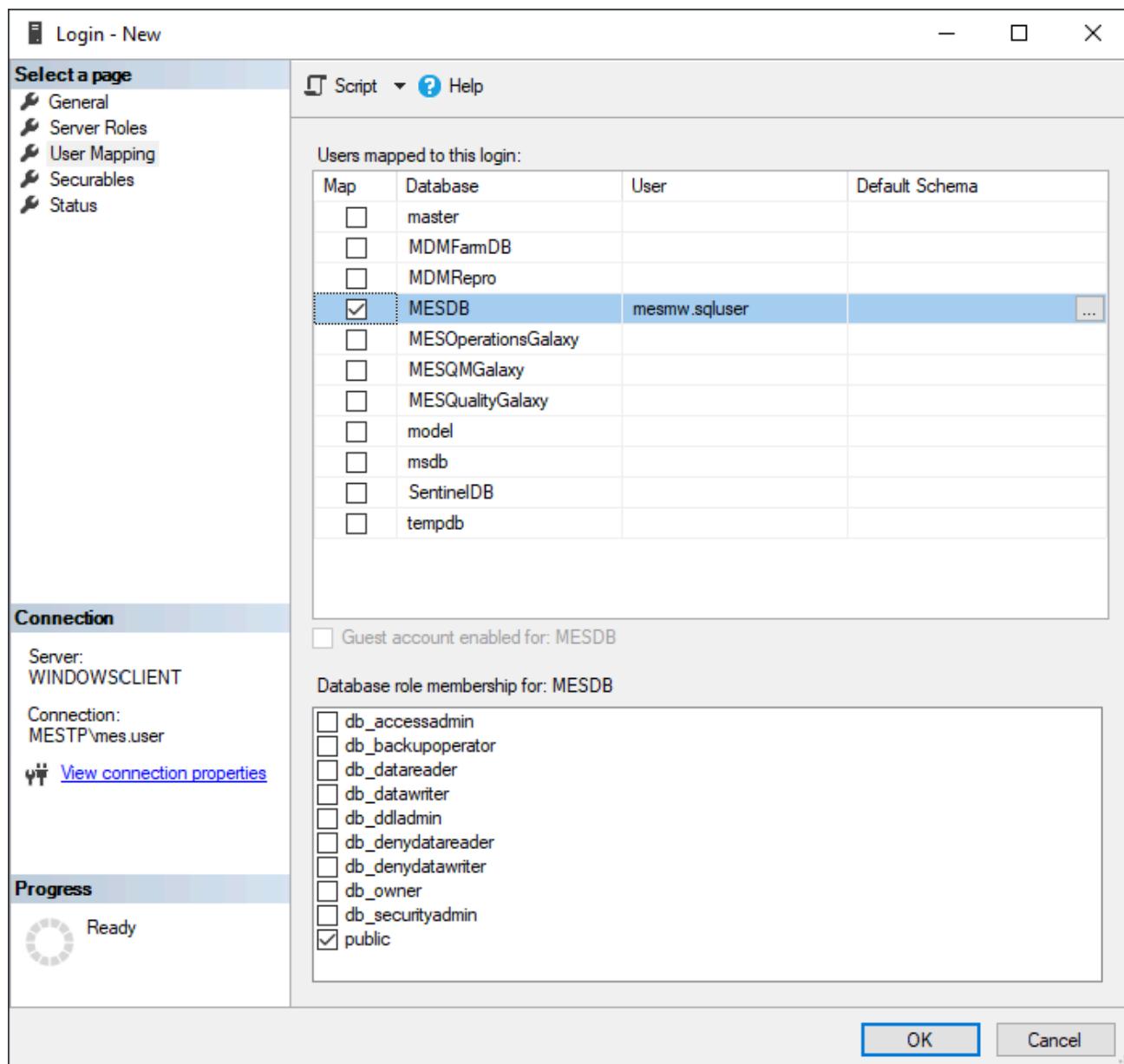
The Login - New dialog appears.



4. In the **General** settings, select **SQL Server authentication**, enter the login name and password, and clear **Enforce password policy**.
5. In the **Server Roles** settings, assign the MES middleware service login only the Public server role, as shown below.



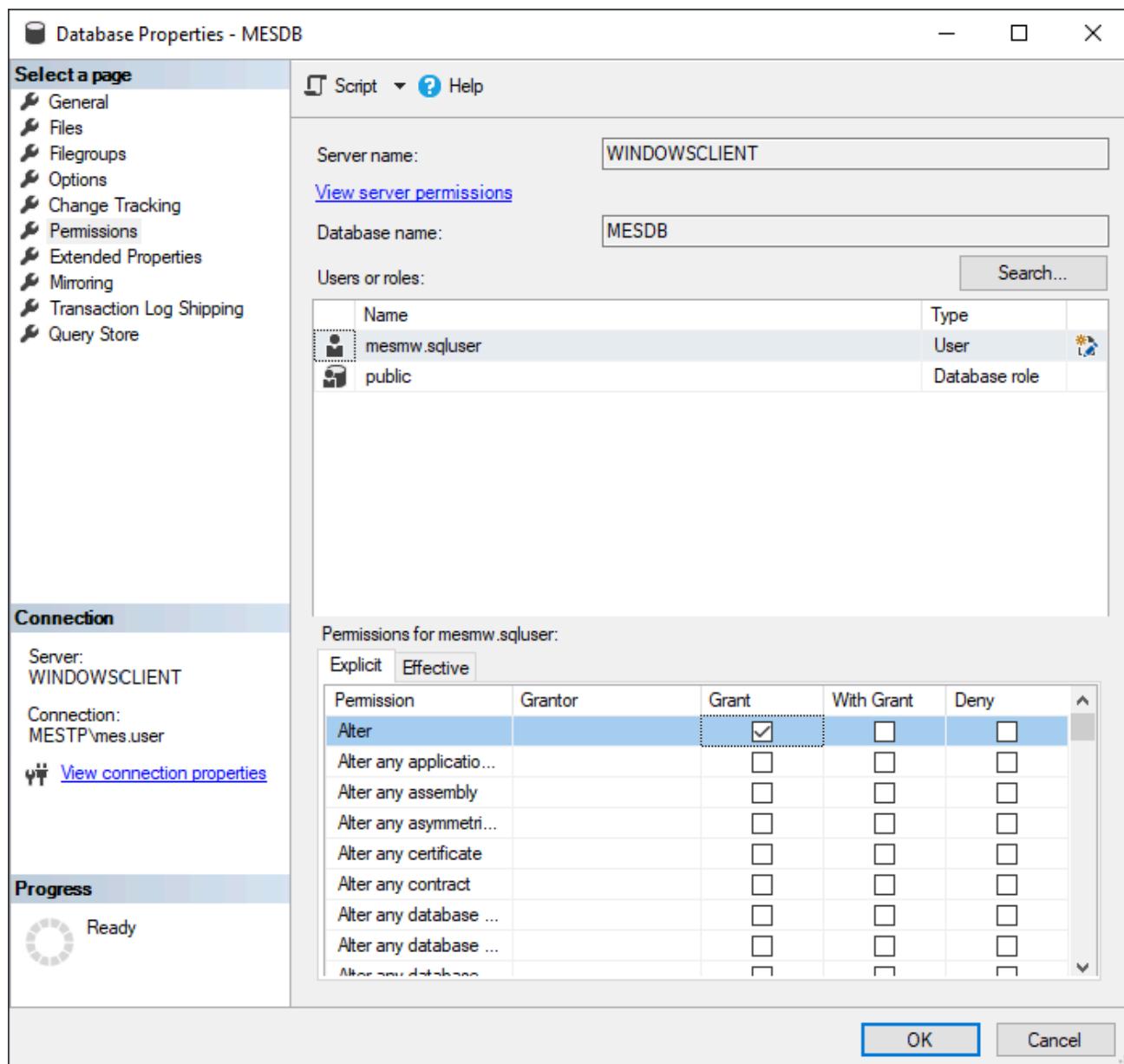
6. In the **User Mappings** settings, select the MES database and any other database to which the MES middleware service requires access, as shown below.



- Click **OK** to save the SQL login.

The dialog closes and the login is added to the list in **Logins** under **Security** in the Object Explorer window.

- In the Object Explorer window, under **Databases** right-click the MES database and click **Properties**.  
The Database Properties window appears.
- In the **Permissions** settings, select the MES middleware service SQL Server login you just created in the **User or roles** list.
- Select the **Grant** check box for each of the required database roles: Alter, Connect, Delete, Execute, Insert, Select, and Update.



11. Click **OK** to save the assignments.

You can now use the username and password of this SQL Server login for the **Database Connection** settings of the DB/MW Communications component **Production** and **Restore** tabs.

## Specifying the MES Production Database Connection String

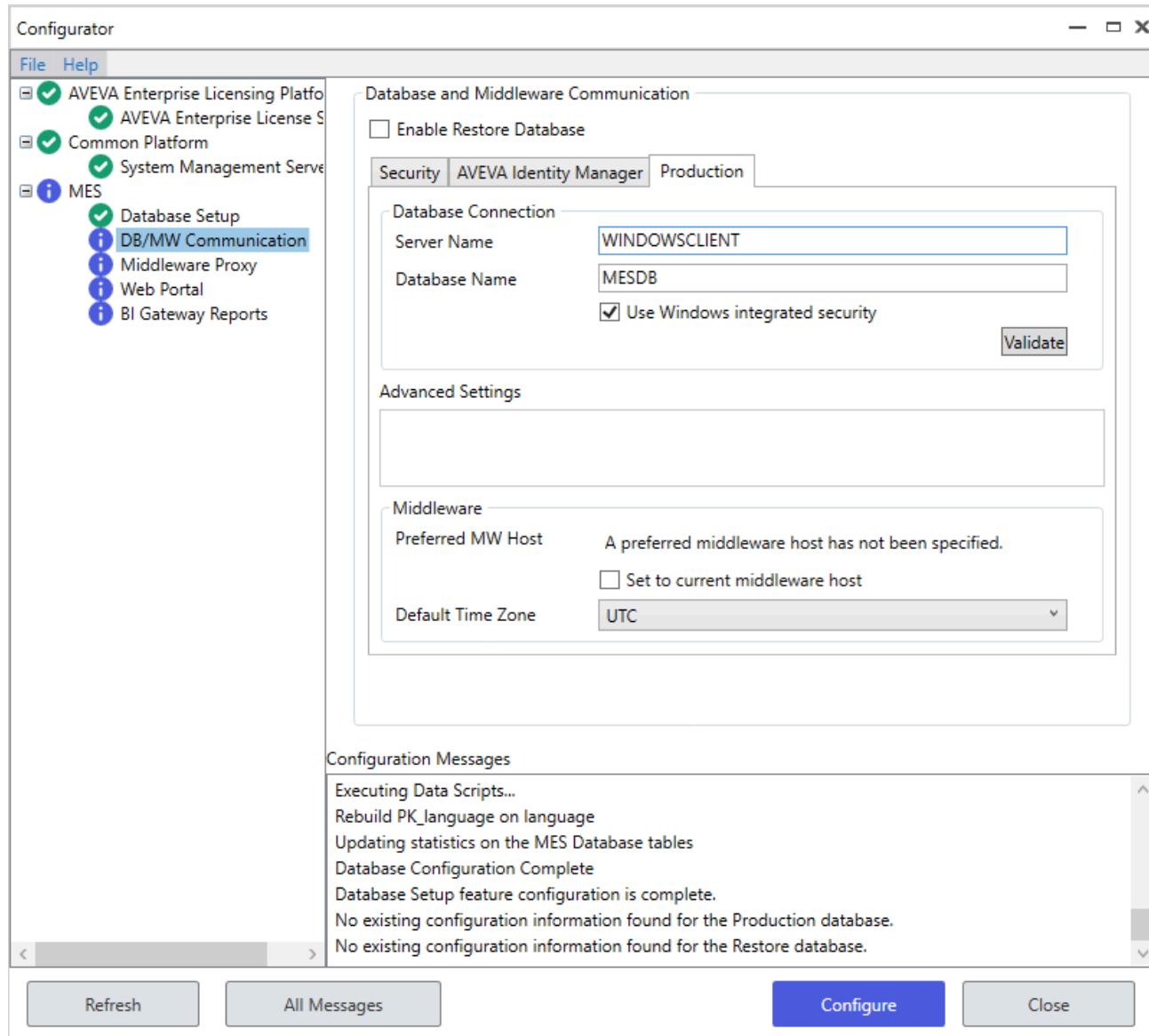
The production database connection string information is entered on the **Production** tab. The connection string specifies which MES database to use as the production database, the user account for accessing it, and any additional advanced connection settings.

When configuring the MES production database, consider the following:

- The restore database must be a different database than the production database and already exist in SQL

Server.

- If the collation of the MES database is different than the collation of the SQL Server where the MES database resides, there may be compatibility issues when running transactions on the MES database. Always create a new SQL Server instance with a collation that is same as the MES database collation and connect to that SQL Server instance.



### To specify the MES production database connection string:

- Complete the database server and MES database name settings:

#### Server Name

The host name or IP address of the server that is hosting the MES production database. The server name defaults to the node's host name if a connection string was not previously saved or to the server name entered for the previously saved connection string. Supported server name entries include IP addresses (IPv4 and IPv6), SQL server named instance conventions, cluster names, and SQL Server Availability Groups. When using a Failover or Availability Group naming convention, the configuration must be performed when

the primary node is active.

**Note:** For the server name, enter either the host name or IP address. Be consistent in this when configuring MES middleware on different nodes, as the system will not know that a host name and IP address point to the same server. If you enter **localhost**, it will be converted to the local server name when building the database connection string.

#### Database Name

The name of the MES production database.

If this is a new installation and the connection string has not been created yet, the name defaults to **MESDB**. If the connection string has been previously created or the database was migrated from a previous release, the actual database name appears.

2. Specify the user account that the MES middleware service will use to access the MES production database.  
If the **Use Windows integrated security** option is selected, then the MES middleware will use the MES Middleware Host user account that appears on the **Security** tab. Otherwise, the MES middleware will use the SQL Server login entered here.

When using SQL Server credentials, the login entered here must have appropriate rights and access to the MES database. This configuration component will not grant privileges to a SQL Server login. See [Manually Adding a SQL Server Login for the Middleware Service](#).

For more information about entering a user account, see [Specifying SQL Server User Authentication](#).

3. (Optional) Configure the connection string's **Advanced Settings**.

The advanced settings allow you to set properties that affect the database connection behavior, such as tuning the connection to your environment or setting up database mirroring. For example, entering **Connect Timeout=300** would cause the connection to attempt to connect to the database for up to 300 seconds.

For a list of the SQL database connection properties that can be set, see the **SqlConnectionStringBuilder** Class topic in the Microsoft online documentation.

Any advanced settings will be appended to the database connection string.

4. Click the **Validate** button.

The system checks the database connection using the entered settings. It also returns the **Preferred MW Host** and the **Default Time Zone** settings that are currently set in the MES database. When the Database Setup component is configured, the time zone is set to the local time zone of the server where the MES database is installed.

5. (Optional) If multiple MES middleware hosts are running in a multi-node environment, select the **Preferred MW Host: Set to current middleware host** check box to specify the local middleware host as the preferred middleware host for the MES system.

The preferred MES middleware host handles all scheduled tasks, such as:

- Executing minutely, hourly, and daily tasks for the management of shifts and utilization reasons
- Cleaning up stale sessions
- Running Supply Chain Connector (SCC) schedules
- Generating future quality samples.

If a preferred MES middleware host is not specified for the system, the first available middleware host will be used to perform scheduled tasks.

Clearing the **Preferred MW Host: Set to current middleware host** check box will remove the designation of a preferred MES middleware host in the system.

6. (Optional) To change the default time zone for the database, select it in the **Default Time Zone** list.

---

**Note:** If you click the **Validate** button before clicking the **Configure** button, the **Preferred MW Host** and **Default Time Zone** settings will be reset to those currently in the database.

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Next:

- If using an MES restore database, you are ready to specify the MES restore database connection string. See [Specifying the MES Restore Database Connection String](#).
- If not using an MES restore database, you are ready to configure the MES middleware user account's access to the database. See [The Middleware Service Windows User Account and Automatically Setting Database Access](#).

## Specifying the MES Restore Database Connection String

The restore database connection string information is entered on the **Restore** tab. The connection string specifies which MES database to use as the restore database, the user account for accessing it, and any additional advanced connection settings.

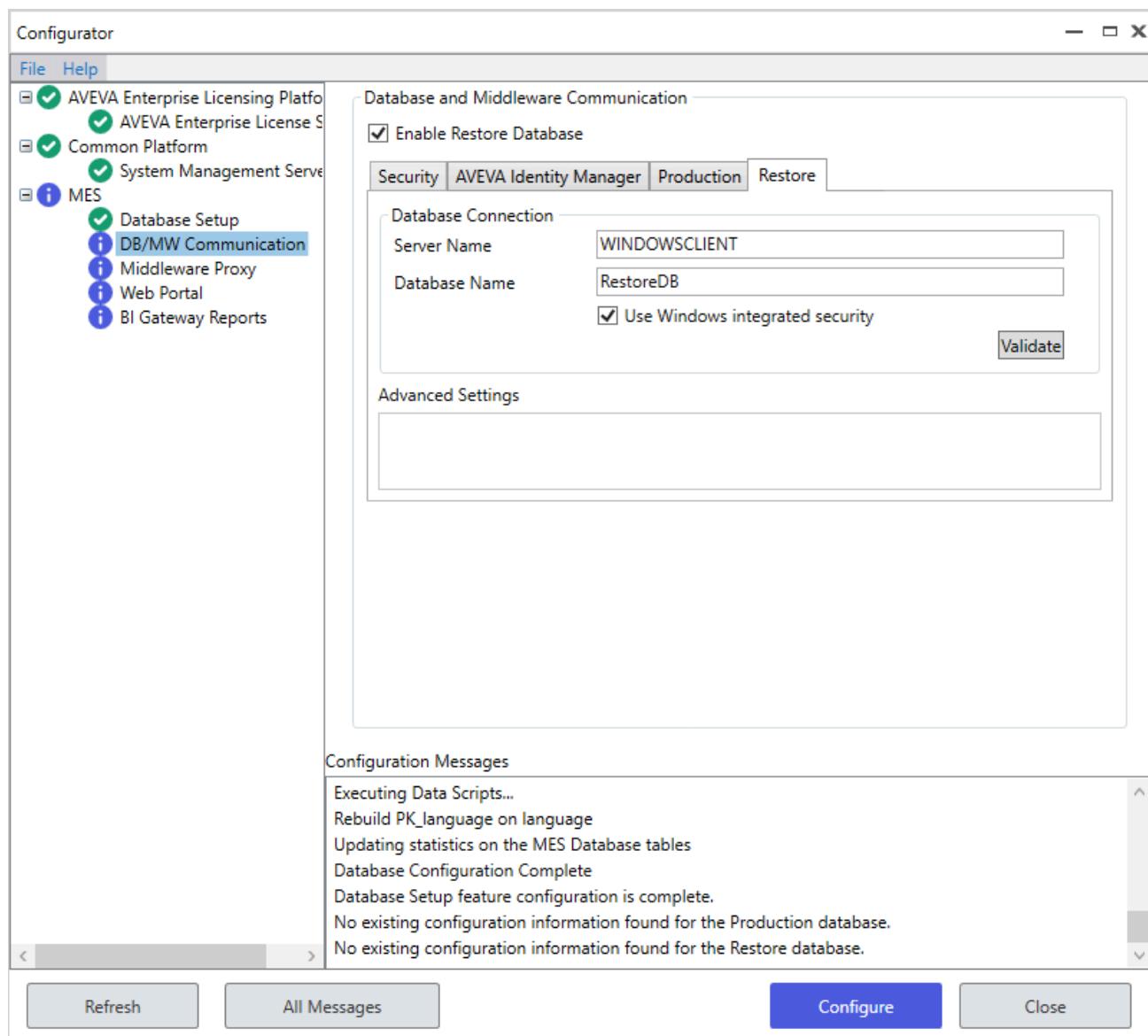
When configuring the MES restore database, consider the following:

- The restore database must be a different database than the production database and already exist in SQL Server.
- If the collation of the MES database is different than the collation of the SQL Server where the MES database resides, there may be compatibility issues when running transactions on the MES database. Always create a new SQL Server instance with a collation that is the same as the MES database collation and connect to that SQL Server instance.

### To specify the MES Restore database connection string:

1. If MES is going to support a restore database, make sure that the restore database has already been created. If it has, select the **Enable Restore Database** option.

The **Restore** tab appears.



During an MES upgrade, if a restore database was previously configured, the **Enable Restore Database** option will be selected by default, even if the restore database no longer exists.

2. Complete the database server and MES database name settings:

#### Server Name

The host name or IP address of the server that is hosting the MES restore database. The server name defaults to the node's host name if a connection string was not previously saved or to the server name entered for the previously saved connection string. Supported server name entries include IP addresses (IPv4 and IPv6), SQL server named instance conventions, cluster names, and SQL Server Availability Groups. When using a Failover or Availability Group naming convention, the configuration must be performed when the primary node is active.

**Note:** For the server name, enter either the host name or IP address. Be consistent in this when configuring MES middleware on different nodes, as the system will not know that a host name and IP address point to the same server. If you enter **localhost**, it will be converted to the local server name when building the database connection string.

### Database Name

The name of the MES restore database.

If this is a new installation and the restore database connection string has not been created yet, the name defaults to **RestoreDB**. If a restore database connection string has been previously created or the database was migrated from a previous release, the actual database name appears.

3. Specify the user account that the MES middleware service will use to access the restore database.

If the **Use Windows integrated security** option is selected, then the MES middleware will use the MES Middleware Host user account that appears on the **Security** tab. Otherwise, the MES middleware will use the SQL Server login entered here.

When using SQL Server credentials, the login entered here must have appropriate rights and access to the MES database. This configuration component will not grant privileges to a SQL Server login. See [Manually Adding a SQL Server Login for the Middleware Service](#).

For more information about entering a user account, see [Specifying SQL Server User Authentication](#).

4. (Optional) Configure the connection string's **Advanced Settings**.

The advanced settings allow you to set properties that affect the database connection behavior, such as tuning the connection to your environment or setting up database mirroring. For example, entering **Connect Timeout=300** would cause the connection to attempt to connect to the database for up to 300 seconds.

For a list of the SQL database connection properties that can be set, see the [SqlConnectionStringBuilder Class](#) topic in the Microsoft online documentation.

Any advanced settings will be appended to the database connection string.

5. Click the **Validate** button.

The system checks the database connection using the entered settings.

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**Note:** If you click the **Validate** button before clicking the **Configure** button, the **Preferred MW Host** and **Default Time Zone** settings on the **Production** tab will be reset to those currently in the database.

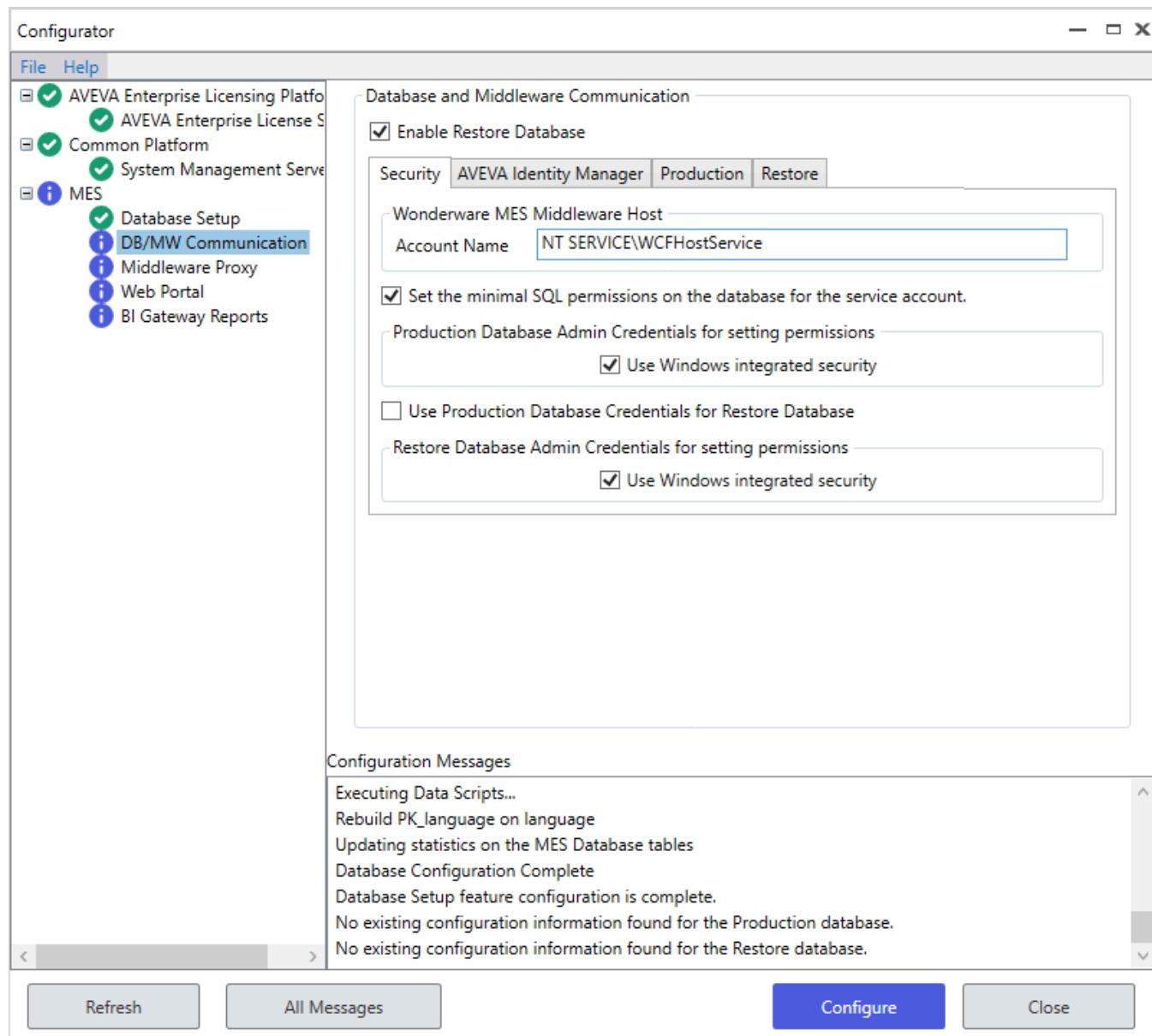
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Next, you are ready to configure the MES middleware user account's access to the database. See [The Middleware Service Windows User Account and Automatically Setting Database Access](#).

## The Middleware Service Windows User Account and Automatically Setting Database Access

The **Security** tab shows the Windows user account that is currently assigned to the MES middleware service.

If you are using Windows integrated security for the database connection strings on the **Production** and **Restore** tabs, you can select the **Set the minimal SQL permissions on the database for the service account** option. This will cause the middleware service Windows user account to automatically be added as a SQL Server login when the DB/MW Communications component is configured. This login will have the permissions to perform transactions with the MES database.



## Account Name

A read-only field that shows the Windows user account that is currently assigned to the MES middleware service. The default user account is **NT Service\WCFHostService**, which is created during the MES Middleware component installation. This is a virtual service account that is based on using Active Directory (AD) for user account management.

- If AD is being used to manage user accounts, you can leave the default user account or change it to another AD user account.
- If Workgroups is being used to manage user accounts, you **must change** the middleware service's user account to a local Workgroups user account. Also, if the MES database is on a remote server, the Workgroups user account must also be set up on the remote node where the database is located.

Changing the user account should be performed prior to the MES DB/MW Communication component configuration.

### To change the user account

1. Open the Services control panel applet and locate the MES Middleware Host service.
2. Right-click the service entry and click **Properties**.
3. Enter the new user account on the **Log On** tab.

If you change the user account after the MES DB/MW Communication component has been configured, perform the configuration again. For additional information about changing the service's Windows user account if the MES middleware and database are on different server nodes, see [Guidelines for the MES Middleware Service Windows User Account](#).

### Set the minimal SQL permissions on the database for the service account

Select this option to automatically add the middleware service Windows user account as a SQL Server login when the DB/MW Communications component is configured.

This option can be used in the following two scenarios:

- AD is being used to manage user accounts.
- Workgroups is being used to manage user accounts and the MES middleware service is running on the same node as the MES database server.

Both of these scenarios also require that the database connection strings on the **Production** and **Restore** tabs are set to use Windows integrated security.

If Windows integrated security is not or cannot be used, then the middleware service must use an existing SQL Server login with the appropriate access to the MES database. See [Manually Adding a SQL Server Login for the Middleware Service](#).

If you run the DB/MW Communication configuration and the middleware service user account was not given the minimum SQL permissions to access the MES database, sample SQL statements to provide authorization are logged in the output window. You can also run these SQL statements manually to provide the minimum SQL permissions to the local user account.

### Production Database Admin Credentials for setting permissions

This setting only appears if the **Set the minimal SQL permissions** option is selected.

The user account specified here is used to create the SQL Server login for the middleware service Windows user account for the MES production database. Therefore, the user must have the SQL Server administrator credentials required to add a SQL Server login and assign it access to the MES production database.

- To use the currently logged-in Windows user account, select the **Use Windows integrated security** option.
- To use a SQL Server login, clear the **Use Windows integrated security** option and enter the SQL Server login username and password.

For more information about specifying the user account to access SQL Server, see [Specifying SQL Server User Authentication](#).

Note that if a SQL Server login is provided for this option, the account information is not persisted by the Configurator.

## Use Production Database Credentials for Restore Database

This setting only appears if the **Enable Restore Database** option and the **Set the minimal SQL permissions** option are selected.

Select this option to use the same user account to create the SQL Server login for the MES restore database as the one being used for the production database.

If not selected, the **Restore Database Admin Credentials for setting permissions** option appears.

## Restore Database Admin Credentials for setting permissions

This setting only appears if the **Set the minimal SQL permissions** option is selected and the **Use Production Database Credentials for Restore Database** option is not selected.

The user account specified here is used to create the SQL Server login for the middleware service Windows user account for the MES restore database. Therefore, the user must have the SQL Server administrator credentials required to add a SQL Server login and assign it access to the MES restore database.

- To use the currently logged-in Windows user account, select the **Use Windows integrated security** option.
- To use a SQL Server login, clear the **Use Windows integrated security** option and enter the SQL Server login username and password.

For more information about specifying the user account to access SQL Server, see [Specifying SQL Server User Authentication](#).

Note that if a SQL Server login is provided for this option, the account information is not persisted by the Configurator.

## Next Step

After configuring the middleware security settings, you are ready to register the MES middleware with the AVEVA Identity Manager. See [Configuring AVEVA Identity Manager Client Registration](#).

## Guidelines for the MES Middleware Service Windows User Account

If the MES middleware and database are on different server nodes, use the following guidelines to change the MES middleware service's Windows user account from the default account. This will ensure that the MES middleware user account has proper SQL permissions for the MES database.

Note that changing the MES middleware service's user account should be performed prior to configuring the DB/MW Communication component.

## Using a Domain User Account

If the account used by the MES middleware service is a valid domain account (for example, **ourDomain\mesuser**), then that domain account can be used when the minimum SQL permissions are set during the DB/MW Communication component.

MW Communication component configuration.

## Using a Virtual Service Account

If the account used by the MES middleware service is a virtual service account (for example, **NT Authority\Network Service** or **NT Authority\Local Service**), then the minimum SQL permissions that are set during the DB/MW Communication component configuration will be given against the domain and the MES Middleware server node (for example, **ourDomain\MESMWNode\$**).

## Using a Local User Account

If the account used by the MES middleware service is a valid local account (for example, **MESMWNode\mesuser**), then that user account will **not** be given the minimum SQL permissions during the DB/MW Communication component configuration. Sample SQL statements to provide authorization are logged in the output window. You can run these SQL statements manually to provide the minimum SQL permissions to the local user account.

## Configuring AVEVA Identity Manager Client Registration

The MES middleware's Web API is implemented using the security measures for System Platform that are enabled through the System Management Server. These measures include secure encrypted communications between nodes, AVEVA Single Sign On (SSO), and certificate management. The AVEVA Identity Manager (AIM) manages the SSL certificates.

Regardless of whether the MES Web API is going to be used, the MES middleware must be registered with the Identity Manager.

When you configure the MES DB/MW Communication component:

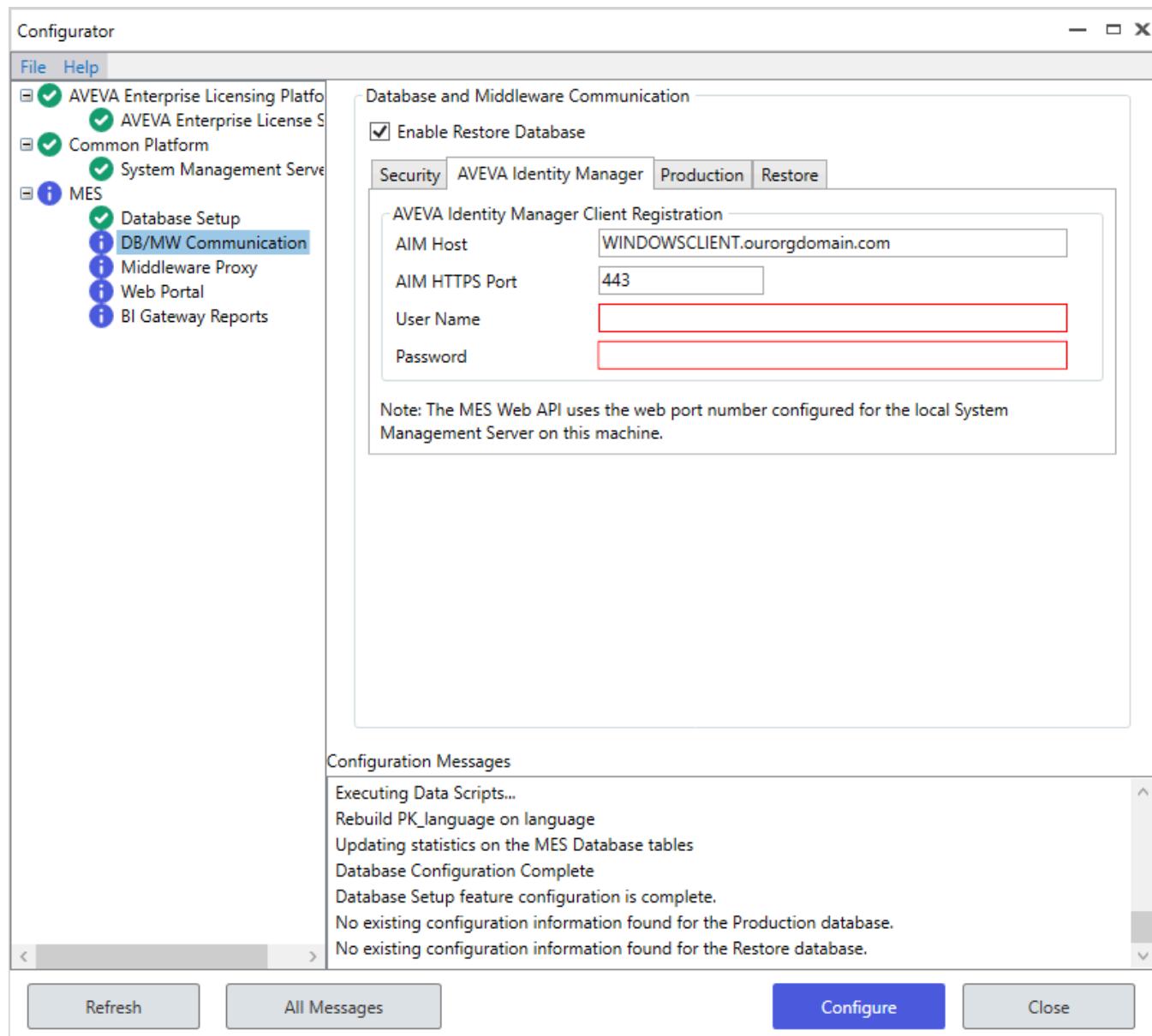
- The MES middleware fetches the SSL certificate from the Identity Manager Server and adds the information to the local node's Trusted Root folder.
- The MES middleware is registered with the Identity Manager.
- A Windows firewall inbound rule exception is created to allow the MES middleware proxies to communicate securely with the MES middleware.

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**Note:** System Management Server's Redundant Single-Sign On capability is not supported by the MES middleware or MES Web Portal.

---

The Identity Manager client registration information for the MES middleware is entered on the **AVEVA Identity Manager** tab.



- Complete the client registration settings:

#### **AIM Host**

The fully qualified domain name of the node on which the Identity Manager is running.

**Note:** IP addresses are not supported.

#### **AIM HTTPS Port**

The port number for the Identity Manager. The port number defaults to the default HTTPS port (443).

The Identity Manager port number must match the System Management Server's HTTPS port number, which can be viewed or set on the System Management Server component's **Advanced Configuration** settings (see [System Management Server and Local Node Common Platform HTTPS Port Settings](#)).

#### **User Name and Password**

The user name and password of an admin account on the node on which the Identity Manager is running. If user accounts are managed with Windows Active Directory, the **User Name** entry must include the domain

and user name in the format **domain\username**.

## Next Step

After completing the Identity Manager registration information, you are ready to test the database connection settings and save them. See [Testing and Saving the Database Connection Settings](#).

## Testing and Saving the Database Connection Settings

When you have finished specifying the MES middleware and database connection settings on the **Security**, **Production**, **AVEVA Identity Manager**, and optionally the **Restore** tab, you are ready to test and save them.

### To test and save the database connection settings

- Click the **Configure** button.

During the configuration, the following occurs:

- If the **Set the minimal SQL permissions** option on the **Security** tab was selected, the minimal SQL permissions to the databases for the MES middleware service Windows user account are granted. This is performed regardless of whether the connection string tests are successful.
- The local Trusted Root folder is checked to see if the SSL certificate from the Identity Manager already exists.
- The MES middleware client registration with the Identity Manager is performed.
- The database connection strings are tested and saved.
- MES middleware custom performance monitor counters are installed. For more information about these counters, see [MES Middleware Performance Counters](#).
- MES middleware service user account access to the Archive root directory is set, to support MES database Archive/Purge/Restore operations.
- The Archive root directory is specified by the *Archive root directory path* system parameter, which can be modified in MES Client. The default path is <MES application folder path>\MES\Archives.
- The MES Async Private Message Queue—**mesasyncqueue**—is created, with the following permission settings:
  - Everyone: Send Message
  - Anonymous Logon: Send Message
  - MES Middleware Service user account: Receive Message and Peek Message
  - Users in the local Administrators group: Full control
- The MES middleware service user account access to the HTTPS port is set so that the MES middleware can open a secured HTTPS connection on this port.
- A Windows inbound firewall rule exception for the configured TCP port is added so that the middleware proxy on a client node can connect to the middleware without having to disable the Windows Firewall on the MES middleware node. TCP information required to add the rule exception is read from the middleware configuration file. Note that changes to the middleware configuration file should only be performed using the Middleware Configuration Editor.
- The MES middleware is started.

## Reconfiguring the DB/MW Communication Component If the Common Platform HTTPS Port Number Is Changed

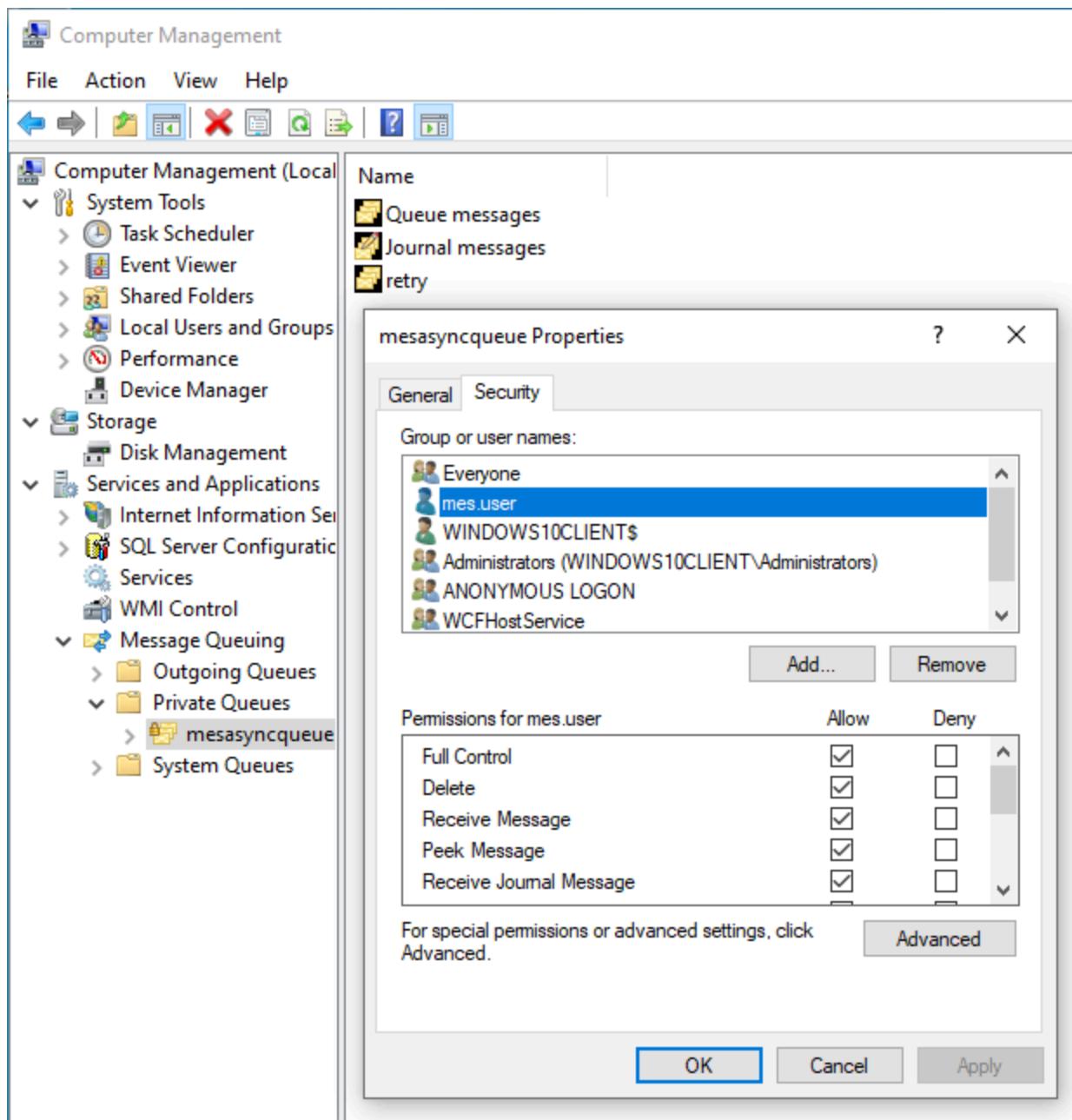
The MES Web API uses the HTTPS port that is specified in the common platform **HTTPS Port** setting of the System Management Service component's **Advanced Configuration** dialog (see [System Management Server and Local Node Common Platform HTTPS Port Settings](#)).

If the common platform **HTTPS Port** number is changed in the System Management Server component for the node on which the MES middleware is configured, reconfigure the DB/MW Communication component on that node so that the MES Web API uses the appropriate port.

## Addressing MES Middleware Configuration Issues

### **Access to Message Queuing system message is denied**

If the message *Access to Message Queuing system message is denied* appears in the **Configuration Messages** box, the current Windows user does not have the required permissions to access the MSMQ MESAsyncQueue. The appropriate permissions—all permissions except Special permissions—can be assigned on the **Security** tab of the MESAsyncQueue Properties dialog box, accessed in the Control Panel Computer Management applet. See the example below for the user **mesadmin**.



## Please remember to restart your middleware service to utilize new connection strings

If the message *Please remember to restart your middleware service to utilize new connection strings* appears in the **Configuration Messages** box, the middleware failed to restart. You will have to start the middleware manually for the database connection setting changes to take effect. See [Starting, Stopping, and Restarting the MES Middleware Host](#).

## Database Connection Fails

If any of the database connections fail, correct the settings that caused the failure and click the **Configure** button again. Once the connections are successful, the MES middleware service is started (or restarted) so that it is

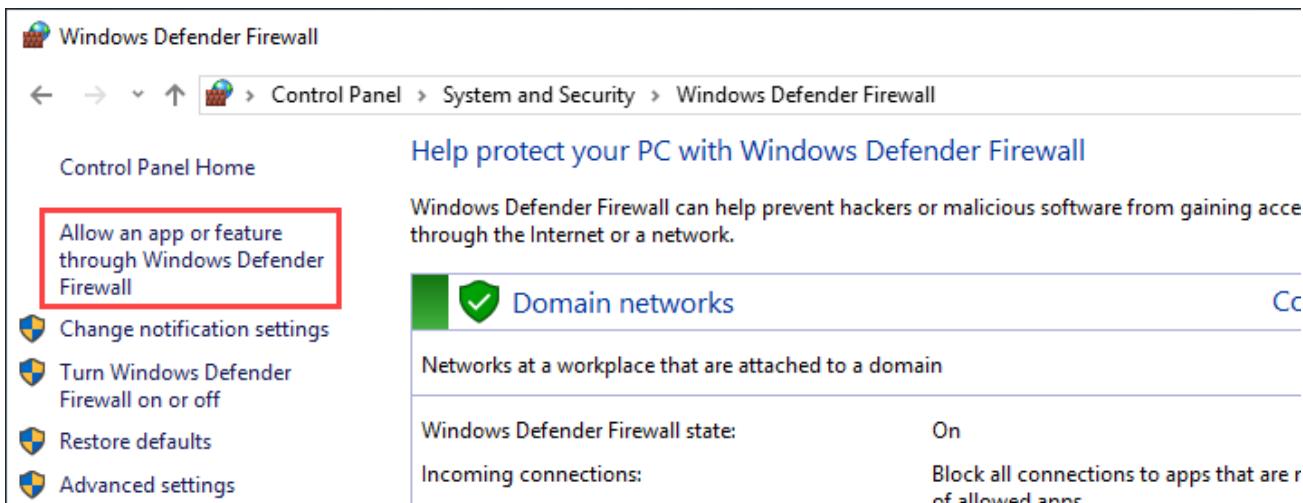
using the most recent settings. The success or failure of the restore database connection does not affect the starting of the MES middleware service.

## Adding MSDTC Firewall Exception for Remote MES Middleware to Database Communication

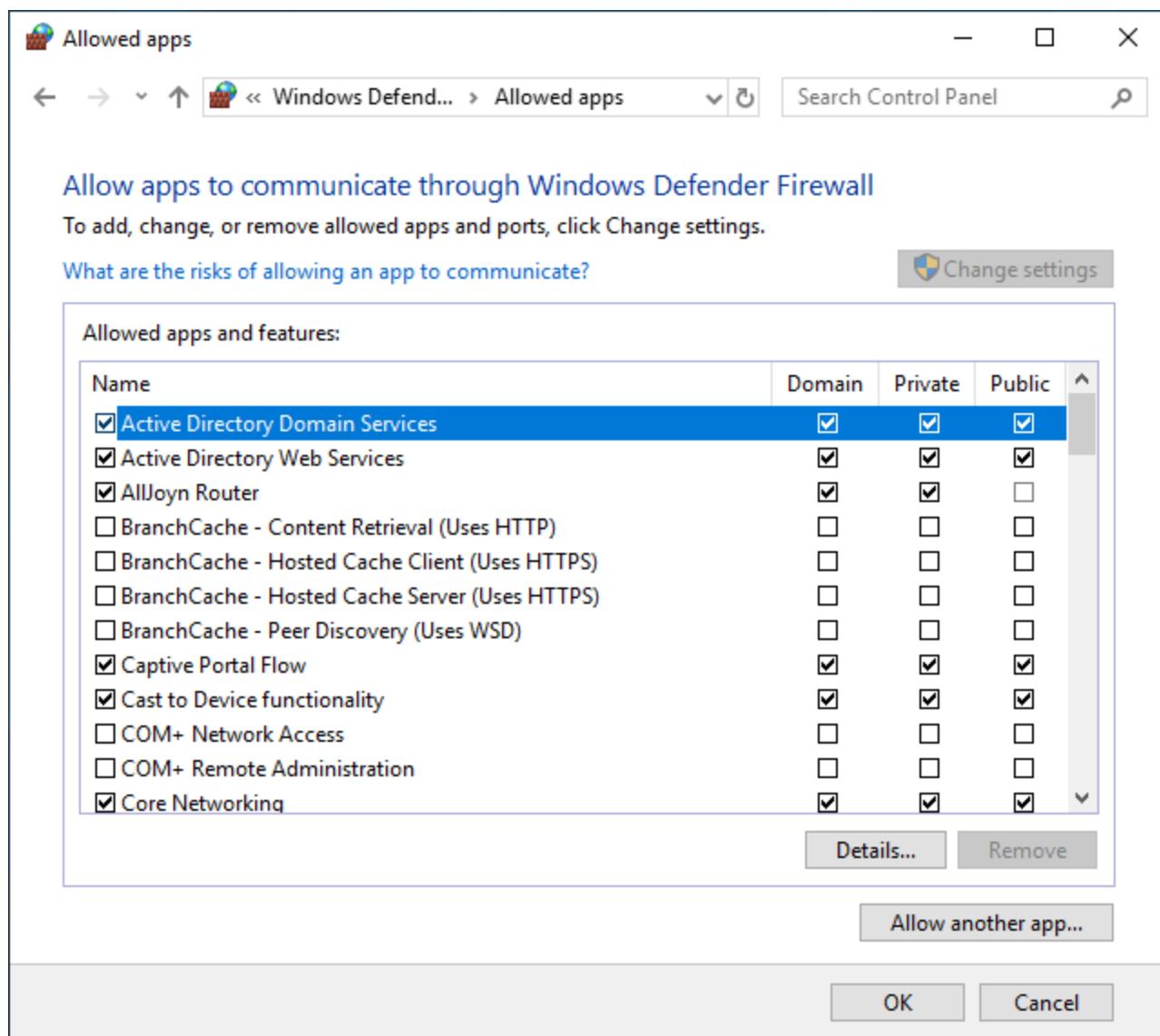
If the MES middleware service and the MES database are on separate nodes, the Microsoft Distributed Transaction Coordinator service (MSDTC) must be included in the Windows Firewall exception list on both nodes to allow them to communicate.

This procedure is based on Windows Server 2019; depending on what Windows version you are using, the steps and screens might be different.

1. On the node, navigate to the **Windows Defender Firewall** settings in the Control Panel.
2. Click the **Allow an app through Windows Firewall** link.

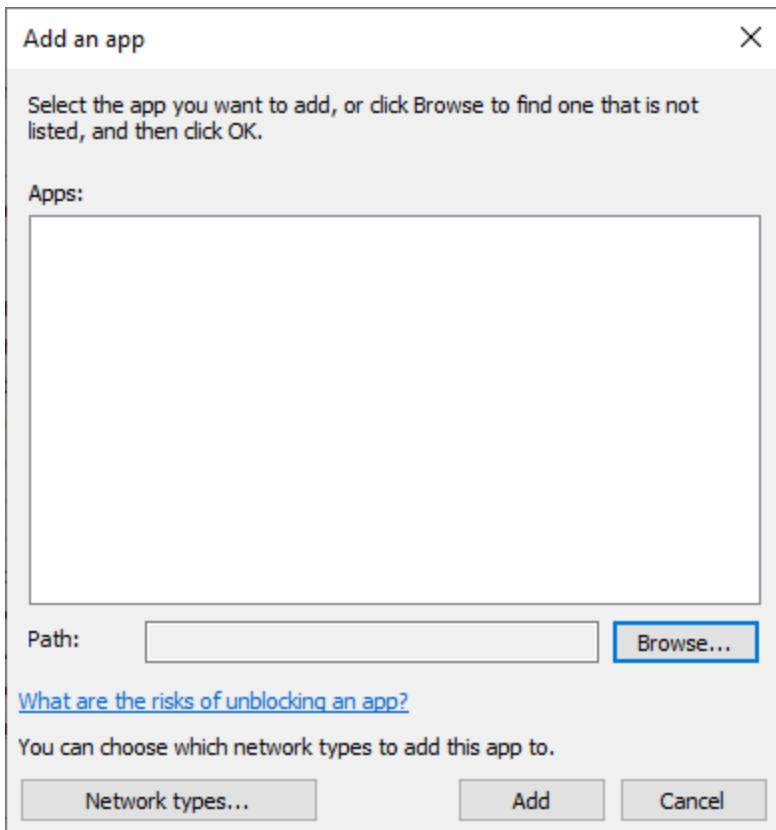


The Allow Apps settings and controls appear.

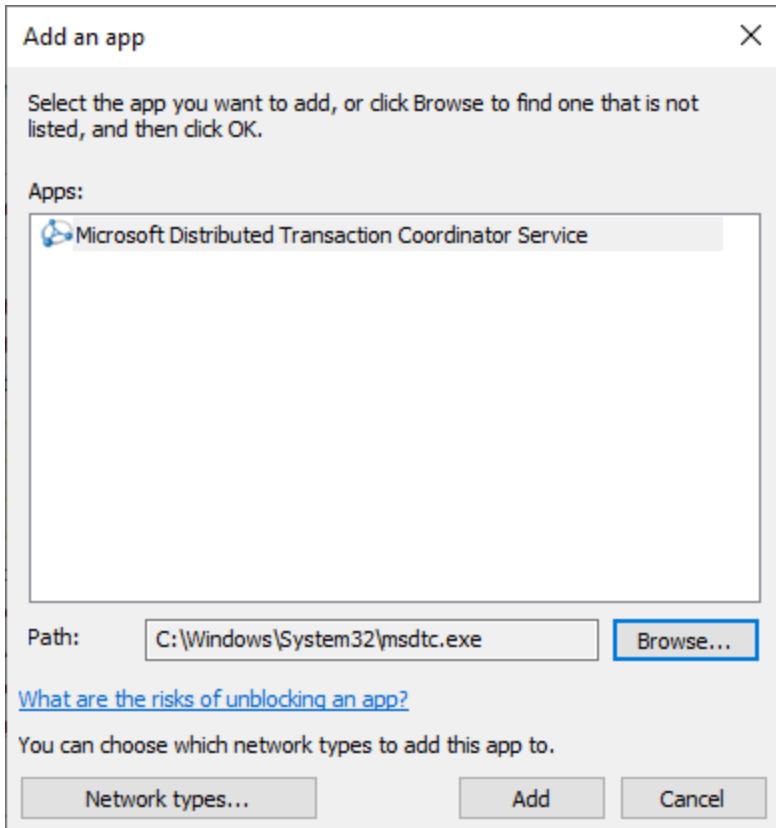


3. Click the **Allow another app** button.

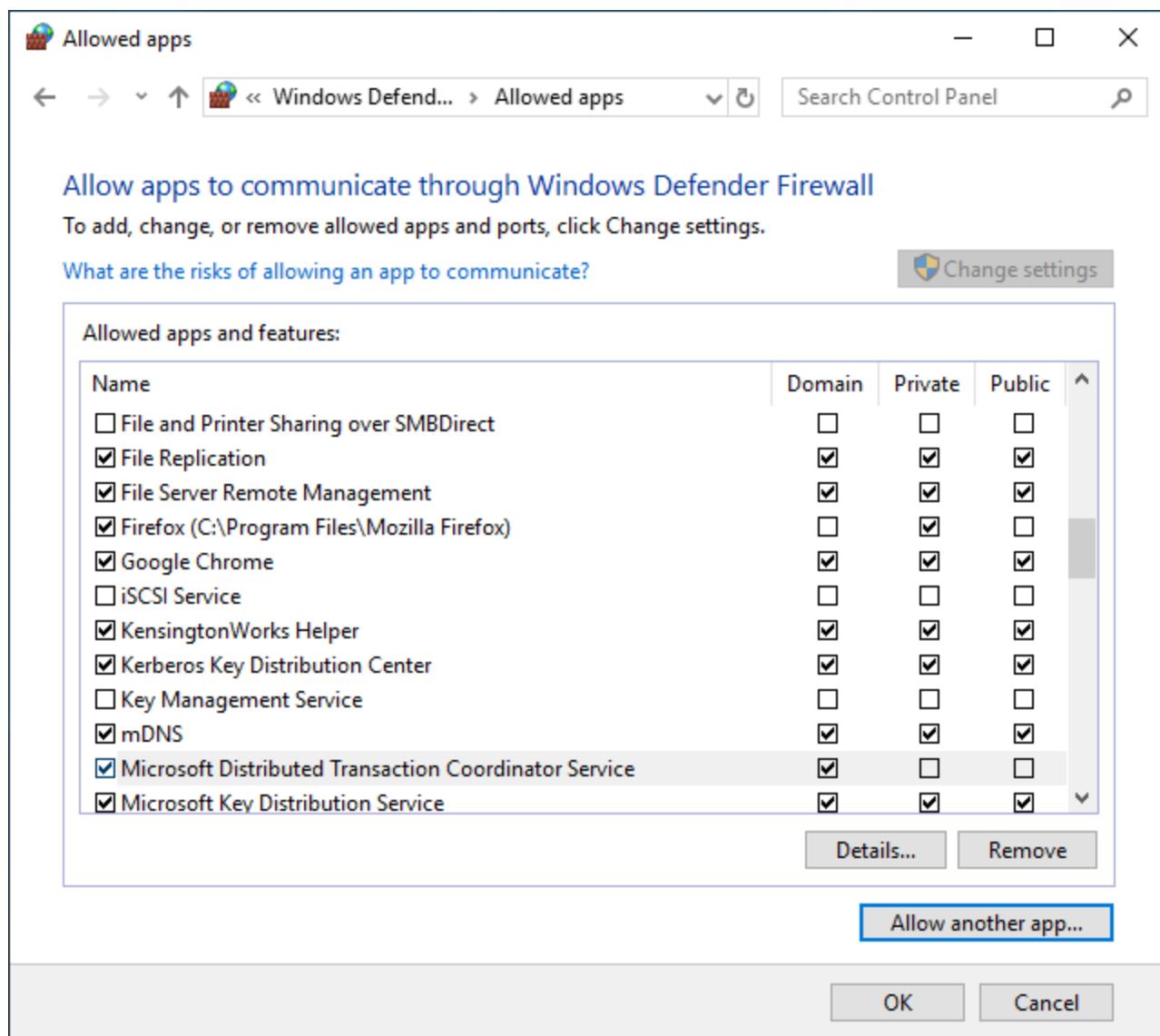
The Add an app dialog box appears.



4. Click the **Browse** button, select the **msdtc.exe** file in the folder **C:\WINDOWS\system32**, and click **Open**.  
The MSDTC service is added to the apps list.
5. Select the MSDTC service and click **Add**.



The MSDTC service is added to the apps list.



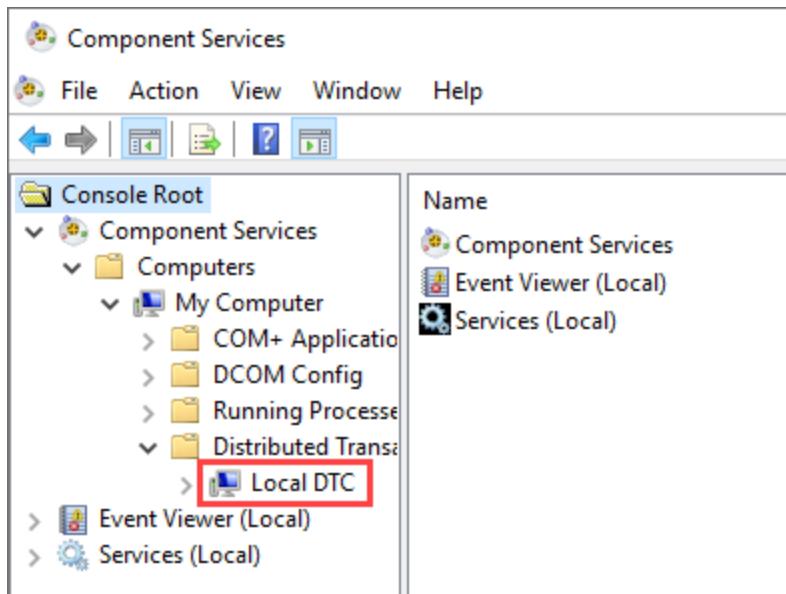
- Click **OK** to close the Allow Apps settings and controls and save the addition of the MSDTC service to the exceptions list.

## Configuring the MSDTC Component Services

If the MES middleware service and the MES database are on separate nodes, you must configure the MSDTC component services on both nodes to allow them to communicate.

The following procedure is based on Windows Server 2019; depending on what Windows version you are using, the steps and screens might be different.

- On the node, in the Administrative Tools section of the Control Panel, open **Component Services**.  
The Component Services window appears.
- In the left pane, expand **Component Services**, **Computers**, **My Computer**, and **Distributed Transaction Coordinator**.

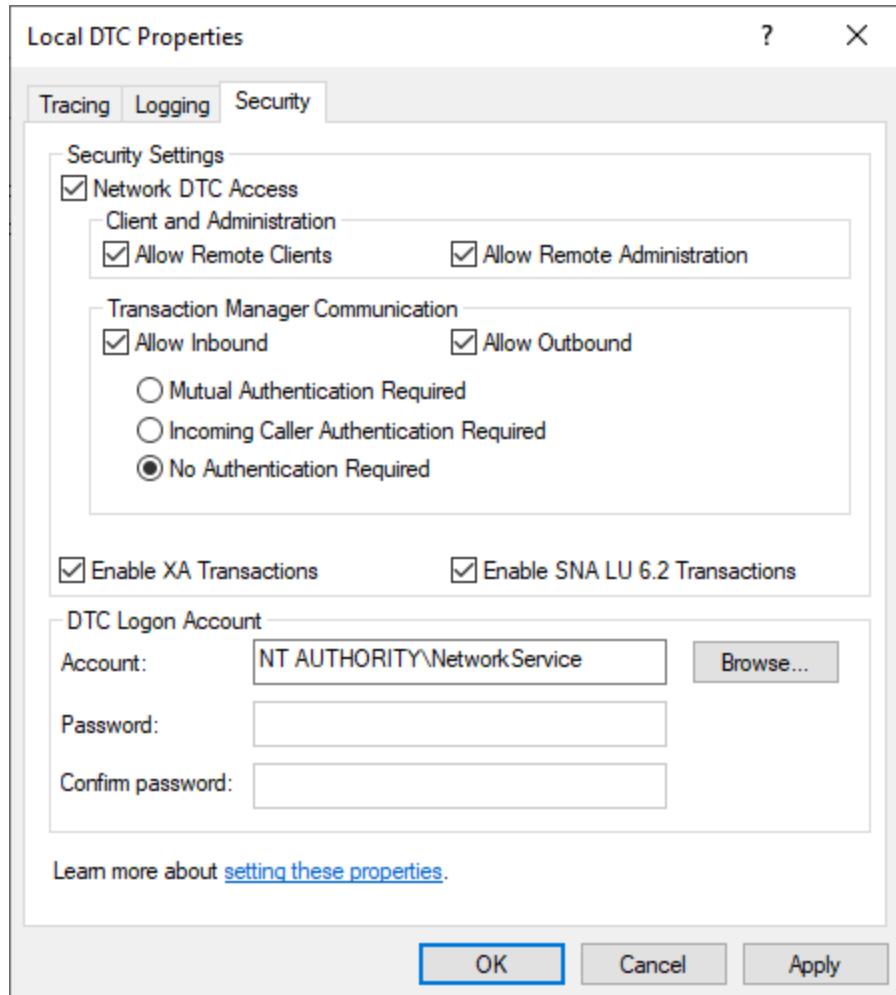


3. Right-click **Local DTC**, and then click **Properties**.

The Local DTC Properties dialog box appears.

4. On the Security tab, select the following options:

- **Network DTC Access**
- In the **Client and Administration** section, **Allow Remote Clients** and **Allow Remote Administration**.
- In the **Transaction Manager Communication** section, **Allow Inbound** and **Allow Outbound**.
- **No Authentication Required**.
- **Enable XA Transactions**



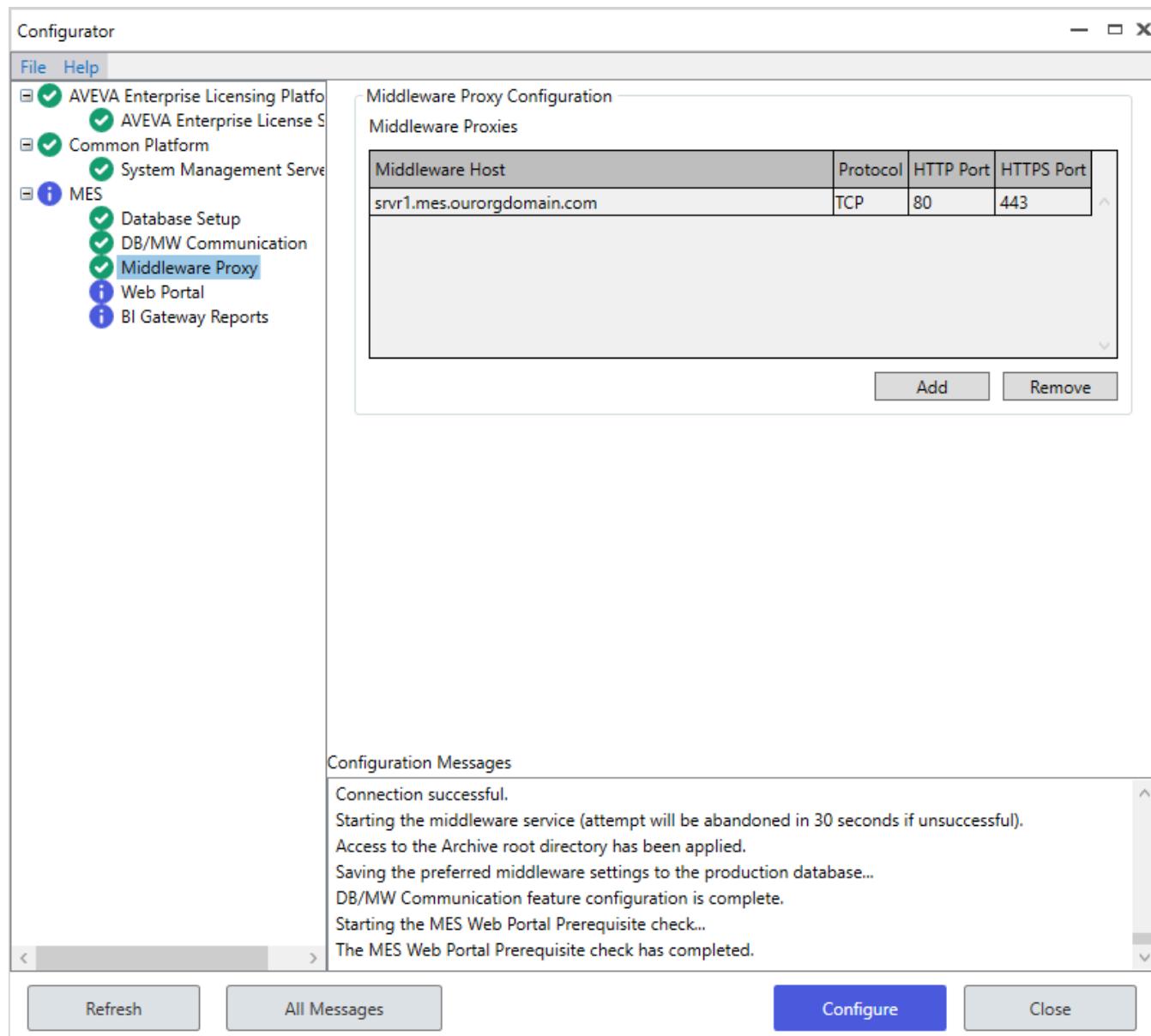
5. Click **OK** to close the window and save your changes.

## Configuring the MES Middleware Proxy

You can access a MES middleware server from remote nodes on which MES client products or components are running by configuring the MES middleware proxy on the remote nodes.

- You must install the MES middleware proxy on all remote nodes on which OCOs, UCOs, or SROs are configured (e.g., using System Platform Object Editor or through GR-Access) or deployed to run. For high-transaction MES objects, it is recommended that a full MES Middleware component be installed on the node hosting MES objects.
- If you are configuring the MES middleware proxy on a node, make sure that you have installed, configured, and started the MES middleware service on the remote server before configuring the MES middleware proxy.
- In a multi-node system that has multiple MES middleware servers installed, each middleware server can be configured for the proxy to use. This allows the proxy to move communications to another middleware server if its current middleware server stops running. If this occurs, the proxy will attempt to connect to the next middleware server according to their order in the list.

The MES Middleware Proxy component is shown in the following figure.

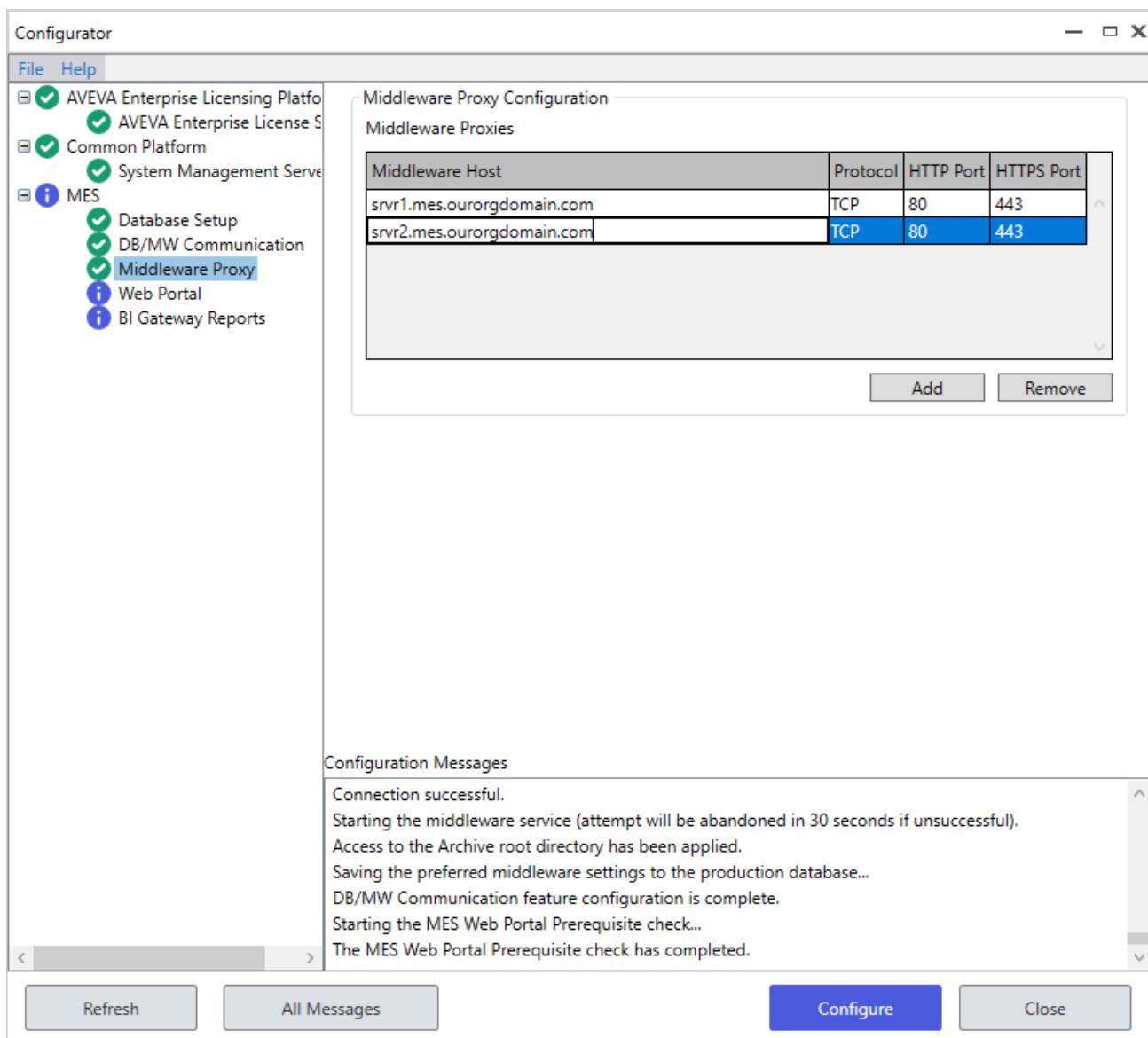


The default proxy connection information that is set here is used by all client applications running on the computer. An individual application can override the information with its own connection information.

### To configure the MES middleware proxy

1. To add a middleware server to the list, click **Add**.

A server entry is added to the list.



- Enter the proxy settings for each middleware server:

#### Middleware Host

The fully qualified domain name of the node on which the middleware service is running.

#### Protocol

The communication protocol, TCP or HTTP, to use for communications with the MES middleware service. The default is **TCP**.

HTTP is typically used when the Middleware Server and client nodes are not located in the same building.  
TCP is typically used when the Middleware Server and client nodes are located in the same building.

#### HTTP Port

The HTTP port number used by the MES middleware's WCFHostService account for sending asynchronous messages, such as for MSMQ and EventBroker.

If the **Security Mode for HTTP Communication** setting in the Middleware Configuration Editor is set to **NONE** and HTTP is being used rather than TCP for communication between the middleware server and client middleware proxies, this is also the HTTP port number that the MES middleware server and proxies will use.

The default value is 80, which is the default port number for HTTP. The port number entered here must match the **HTTP Port** setting in the Middleware Configuration Editor.

The HTTP port is always used to retrieve the middleware configuration settings regardless of the **Protocol** setting. You must change this value only when you cannot access port 80 through the firewall.

#### HTTPS Port

The port number for the MES Web API.

The default value is 443, which is the default for HTTPS.

The port number entered here must match the common platform **HTTPS Port** setting of the node on which the MES middleware is running. On the MES middleware node, this setting is on the System Management Service component's **Advanced Configuration** dialog (see [System Management Server and Local Node Common Platform HTTPS Port Settings](#)).

3. Click **Configure**.

If the middleware proxy can communicate with a middleware service successfully, a success message appears in the **Configuration Messages** box.

If the proxy could not successfully communicate with a middleware service, a failure message appears in the message box.

The MES Middleware Proxy component configuration status changes according to the following conditions:

- If the proxy was able to successfully communicate with all of the middleware servers, the indicator changes to . Client applications on the node can now communicate with any of the middleware servers.
- If communication failed with one or more middleware servers but succeeded with at least one, the indicator changes to . Client applications on the node can now communicate with any of the middleware servers for which communication succeeded.
- If communication failed with all of the middleware servers, the proxy component configuration fails and the indicator changes to . Communication with at least one of the middleware servers will have to be established before client applications on the node can use the MES proxy.

#### To remove one or more middleware servers from the list

1. Select the server entries.
2. Click **Remove**.

### Reconfiguring the Middleware Proxy If the MES Middleware HTTPS Port Number Is Changed

- If the System Management Server and MES middleware are on the same node and the **HTTPS Port** number is changed, change the proxy **HTTPS Port** number to match it and reconfigure the Middleware Proxy component.
- If the System Management Server and MES middleware are not on the same node and the common platform **HTTPS Port** number for the MES middleware node is changed, change the proxy **HTTPS Port** number to match it and reconfigure the Middleware Proxy component.

## Implementing Middleware Server and Proxy Communication When Using Windows Workgroups

To make user account setup easier for small systems (for example, for demo or proof-of-concept systems), MES supports using Windows Workgroups instead of Active Directory to manage user accounts. Refer to the following subtopics to ensure proper communication between the MES middleware and client middleware proxies when using Workgroups.

### Adding Client Node User Accounts to the MES Middleware Server Node

If your network is using Windows Workgroups to manage user accounts rather than an Active Directory domain controller, MES user accounts on the client nodes must also be added to the node where the MES Middleware Server is located. This will allow those MES users on the client nodes to perform operations through the MES middleware.

You can add users to the MES Middleware Server node using the **Computer Management** applet, which can be accessed from the **Administrative Tools** applet in the Control Panel. In the **Computer Management** applet, go to **System Tools, Local Users and Groups**, and then **Users or Groups**. You can right-click **Users or Groups** and then select **Help** to get more information on adding a user account and assigning it to a group.

After adding the client user accounts to the Middleware Server node, restart all affected nodes.

### Reinstating TCP Communications Between Nodes

If TCP is being used for middleware-to-middleware proxy communication and the TCP connection is lost between a client node and the Middleware Server node, try restarting both nodes. This should reinstate the TCP connection.

### Addressing a "Proxy Failed to Connect to Middleware Server" Error

If communication with the MES middleware is down and the Logger shows the message *Proxy failed to connect to Middleware Server service endpoint*, perform the following steps to verify that the middleware configuration is correct.

1. From the command prompt on the client application node, use the **ping** command to verify that there is TCP/IP connectivity with the Middleware Server node.
2. On the Middleware Server node:
  - In the post-install Configurator, verify that the **MES DB/MW Communication** component is installed correctly and its status is Configured (green indicator).
  - From the Windows Services app or from the Service panel, verify that the Wonderware MES Middleware Host service is running.
  - Verify that a firewall inbound rule exception has been added to Windows Defender Firewall **Allowed Apps** page with the name **MES Middleware TCP NetBinding** and that its **Domain** and **Private** check boxes are selected. Or verify that the Windows Domain Networks firewall status is off.
3. If the **MES middleware and client middleware proxy are on different nodes**, then in the post-install Configurator on each node verify that the HTTP and HTTPS port numbers configured for the MES Middleware Proxy component on the client proxy node match those configured for the MES Middleware

Proxy component on the Middleware Server node.

If the **MES Middleware and client middleware proxy are on the same node**, then in the post-install Configurator verify that the HTTPS port number configured for the MES Middleware Proxy component is the same HTTPS port number configured for the System Management Server (click **Advanced** and refer to the **Ports** tab on the **Advanced Configuration** dialog).

4. If the MES middleware and client middleware proxy are on different nodes, then in the post-install Configurator verify the following about the System Management Server:
  - If the System Management Server configuration on the Middleware Server node is set to **This node is the System Management Server**, then the System Management Server configuration on the client middleware proxy node should be set to **Connect to an existing System Management Server** and point to the Middleware Server node.
  - If the System Management Server configuration on the Middleware Server node is set to **Connect to an existing System Management Server** and the configured target node is different than the client middleware proxy node, then the System Management Server configuration on the client middleware proxy node should use the option **Connect to an existing System Management Server** and use the same target node name of the System Management Server that is configured on the Middleware Server node. That is, the target node being pointed to as the location of the existing System Management Server should be the same on the Middleware Server and client middleware proxy nodes.
  - If the System Management Server configuration on the Middleware Server node is set to **Connect to an existing System Management Server** and the configured target node is same as the client middleware proxy node, then the System Management Server configuration on the client middleware proxy node should be set to **This node is the System Management Server**.
5. In the post-install Configurator on the node where the System Management Server resides, verify that the System Management Server status is Configured (green indicator).

## Configuring MES Web Portal

MES Web Portal configuration includes the following:

- To set up MES Web Portal, you must configure the MES Web Portal component in Configurator. The configuration process:
  - Installs the MES Web Portal web site in Internet Information Services (IIS) and creates the required directories and files on the server node.
  - Performs the Identity Manager client registration for the MES Web Portal
  - Sets the SSL certificate and HTTPS port for the MES Web Portal.
- See [Configuring the MES Web Portal Component](#).
- Once the component is configured, you can change the Web Portal user session cache refresh rate. See [Setting the Web Portal User Session Cache Refresh Rate](#).
- Changing MES Security Mode requires that the MES middleware be restarted. See [Restarting the MES Middleware If MES Security Mode Is Changed](#).

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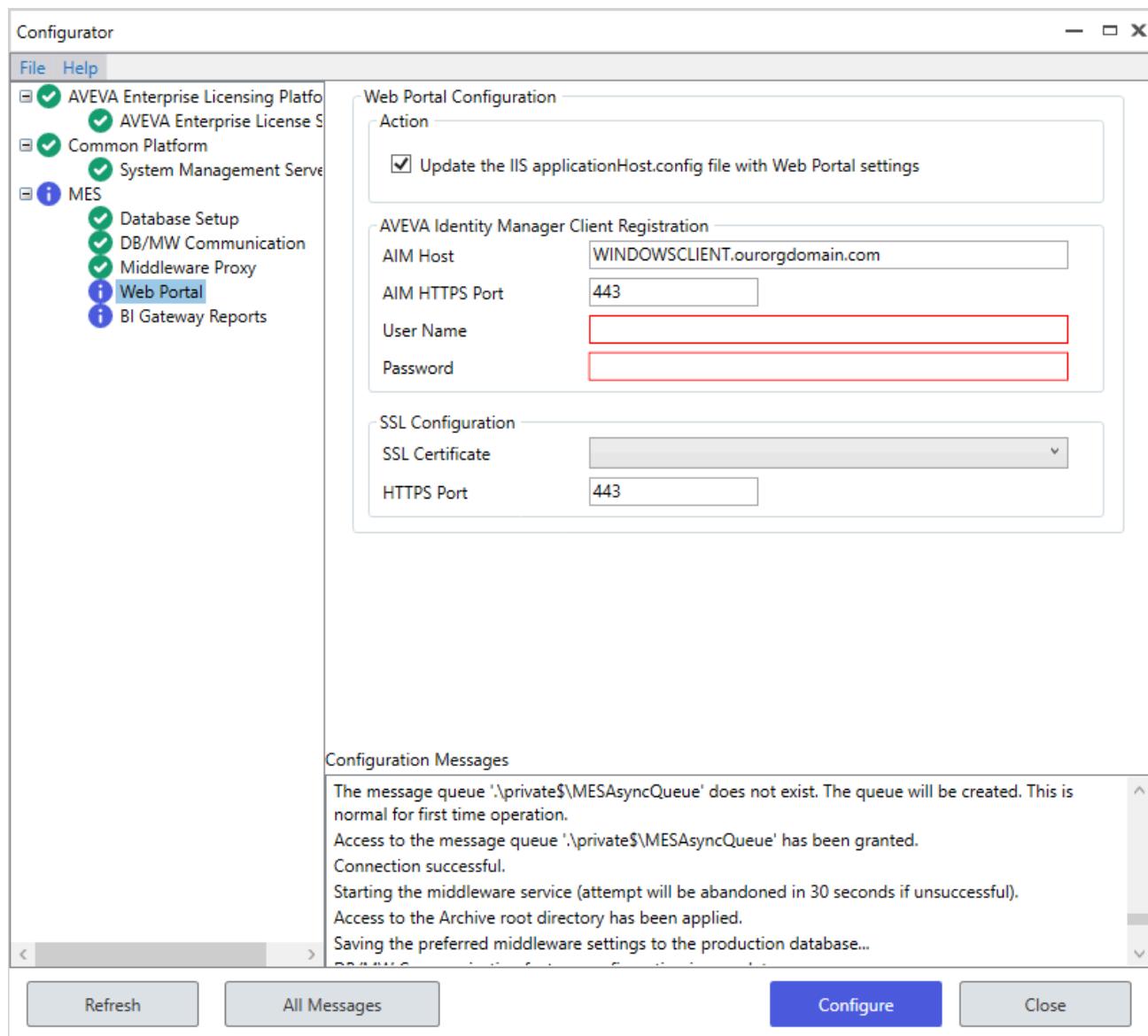
**Note:** System Management Server's Redundant Single-Sign On capability is not supported by the MES middleware or MES Web Portal.

## Configuring the MES Web Portal Component

**Note:** The MES Web Portal configuration requires that the IIS default web site be called **Default Web Site**. If this name has been changed (for example, to **Default Website** with no space in **Website**), then the configuration will fail.

The MES Web Portal component, shown in the following figure, includes Identity Manager settings. These settings specify:

- The Identity Manager client registration for the MES Web Portal
- The SSL certificate and HTTPS port for the MES Web Portal



### To configure the MES Web Portal

1. Decide whether to select the **Update** option. See [Addressing IIS Feature Delegation Conflicts](#).
2. Complete the Identity Manager client registration settings:

### AIM Host

The fully qualified domain name of the node on which the Identity Manager is running.

If you enter **localhost** or the standard host name, it will be converted to the fully qualified domain name during configuration.

### AIM HTTPS Port

The port number for the Identity Manager.

The default value is 443, which is the default for HTTPS.

The Identity Manager port number must match the System Management Server's HTTPS port number, which can be viewed or set on the System Management Server component's **Advanced Configuration** settings (see [System Management Server and Local Node Common Platform HTTPS Port Settings](#)).

### User Name and Password

The user name and password of an admin account on the node on which the Identity Manager is running. If user accounts are managed with Windows Active Directory, the **User Name** entry must include the domain and user name in the format **domain\username**.

3. Complete the SSL configuration settings:

### SSL Certificate

The SSL certificate for MES Web Portal.

If you switch from an SSL certificate that has already been configured to a different certificate, you will get a warning prompt indicating that the HTTPS port is already configured with the thumbprint of the current certificate. To proceed with replacing the currently configured certificate, click **Yes**. To cancel the replacement of the currently configured certificate, click **No**.

Note the following about assigning an SSL certificate to MES Web Portal:

- MES Web Portal can be assigned a wildcard SSL certificate, which can cover multiple subdomains of your domain. For example, the wildcard certificate that is issued for **\*.yourdomain.com** could cover **plantA.yourdomain.com**, **plantB.yourdomain.com**, and so on.
- The certificate that is assigned to MES Web Portal can be different than the certificate that is assigned to the System Management Server.

### HTTPS Port

The port number for MES Web Portal.

The default value is 443, which is the default for HTTPS.

This port number does not need to match the System Management Server **HTTPS Port** number.

4. Click **Configure**.

The Configurator checks for IIS feature delegation conflicts. If any IIS feature delegation conflicts are found, a message is logged that feature delegations were detected that must be added to the IIS configuration to support MES Web Portal. For more information, refer to [Addressing IIS Feature Delegation Conflicts](#).

When the MES Web Portal configuration is complete, a success message appears in the **Configuration Message** box. Also, the MES Web Portal status indicator changes to a green check mark.

## Reconfiguring the Web Portal If the System Management Server HTTPS Port Number Is Changed

If the System Management Server **HTTPS Port** number is changed, change the **AIM HTTPS Port** number to match it and reconfigure the Web Portal component.

## Addressing IIS Feature Delegation Conflicts

IIS feature delegation allows a web administrator to manage certain web configuration features. Web configuration is also handled by a web application's **web.config** file.

If some of the web feature delegation settings are locked in IIS (that is, their delegation is set to Read Only), then MES Web Portal cannot automatically include those configuration settings in the MES Web Portal **web.config** file.

There are two options for handling this conflict:

- Select the **Update** option and click the **Configure** button. The Configurator will update the IIS **applicationHost.config** file with the proper MES Web Portal configuration settings, and remove those settings from the MES Web Portal **web.config** file. (The feature settings can only be included in one of these files, but not both. Otherwise, the MES Web Portal web site will not run.)
- Do not select **Update** option and click the **Configure** button. The Configurator does not update the IIS **applicationHost.config** file and leaves the conflicting feature settings in the **web.config** file. A message is logged that feature delegations were detected that must be added to the IIS configuration to support MES Web Portal.

To allow the MES Web Portal web site to run, a web administrator must then either:

- Change the setting for the conflicting feature delegations to Read/Write in IIS Manager, or
- Edit the IIS **applicationHost.config** file manually to set the feature settings to the appropriate MES Web Portal values and remove those settings from the MES Web Portal **web.config** file.

For instructions about how to set feature delegations in IIS Manager and how to manually modify the **applicationHost.config** file, refer to the IIS Feature Delegation topics on the Microsoft TechNet web site.

## IIS Feature Settings for MES Web Portal

Following is a list of the IIS feature delegations whose settings must be specified either in the MES Web Portal **web.config** file (if the feature delegation in IIS Manager is set to Read/Write) or the IIS **applicationHost.config** file (if the feature delegation in IIS Manager is set to Read Only). The headings in the list are the actual names of the feature delegations, which are listed in the Features Delegation screen of IIS Manager.

If any of the MES Web Portal configuration settings are specified in the IIS **applicationHost.config** file, then they must be removed from the MES Web Portal **web.config** file.

### Authentication – Anonymous

Conflicts with **web.config** section:

```
<security>
    <authentication>
        <anonymousAuthentication enabled ="false">
            </anonymousAuthentication>
        </authentication>
    </security>
```

### Authentication – Windows

Conflicts with **web.config** section:

```
<authentication mode="Windows"></authentication>
```

## MIME Types

Conflicts with web.config section:

```
<staticContent>
  <remove fileExtension=".svg" />
  <mimeMap fileExtension=".svg" mimeType="image/svg+xml" />
  <remove fileExtension=".json" />
  <mimeMap fileExtension=".json" mimeType="application/json" />
</staticContent>
```

## Handler Mappings

Conflicts with web.config section:

```
<handlers>
  <remove name="WebDAV" />
  <remove name="ExtensionlessUrlHandler-ISAPI-4.0_32bit" />
  <remove name="ExtensionlessUrlHandler-ISAPI-4.0_64bit" />
  <remove name="ExtensionlessUrlHandler-Integrated-4.0" />
</handlers>
```

## Modules

Conflicts with web.config section:

```
<modules runAllManagedModulesForAllRequests="true"
runManagedModulesForWebDavRequests="true">
  <remove name="RoleManager" />
  <remove name="WebDAVModule" />
</modules>
```

## Default Document

Conflicts with web.config section:

```
<defaultDocument>
  <files>
    <remove value="default.aspx" />
    <remove value="iisstart.htm" />
    <remove value="index.htm" />
    <remove value="Default.asp" />
    <remove value="index.html" />
    <remove value="Default.htm" />
    <remove value="index.cshtml" />
    <add value="MES.cshtml" />
  </files>
</defaultDocument>
```

## Error Pages

```
<httpErrors>
  <clear/>
</httpErrors>
```

## Making the Root SSL Certificate Available to MES Web Portal Users

A Root SSL certificate is a certificate issued by a trusted certificate authority (CA). By default, the Windows Trusted Root Certification Authorities certificate store is configured with a set of public CAs that has met the requirements of the Microsoft Root Certificate Program.

The System Management Server has a private CA that can be used to issue self-signed certificates for use by HTTPS connections to nodes in the System Platform network topology. The root certificate for this private CA is installed in the Trusted Root Certification Authorities certificate store. The root certificate name for a self-signed certificate that was issued by the System Management Server includes the host name of the node on which the AVEVA Identity Manager is running followed by **ASB Root CA** (e.g., **MESTP ASB Root CA**).

If the Identity Manager and MES Web Portal are installed on different nodes, the root certificate file for the certificate that was assigned to MES Web Portal must be installed in Windows on client machines of Web Portal users. This enables the client machines to trust and allow the HTTPS connection to MES Web Portal. You have to provide the root certificate file to those users. Instructions for exporting the root certificate to a file are provided below. The *MES Web Portal User Guide* and help include instructions for how to install the Root certificate file in Windows on a client machine.

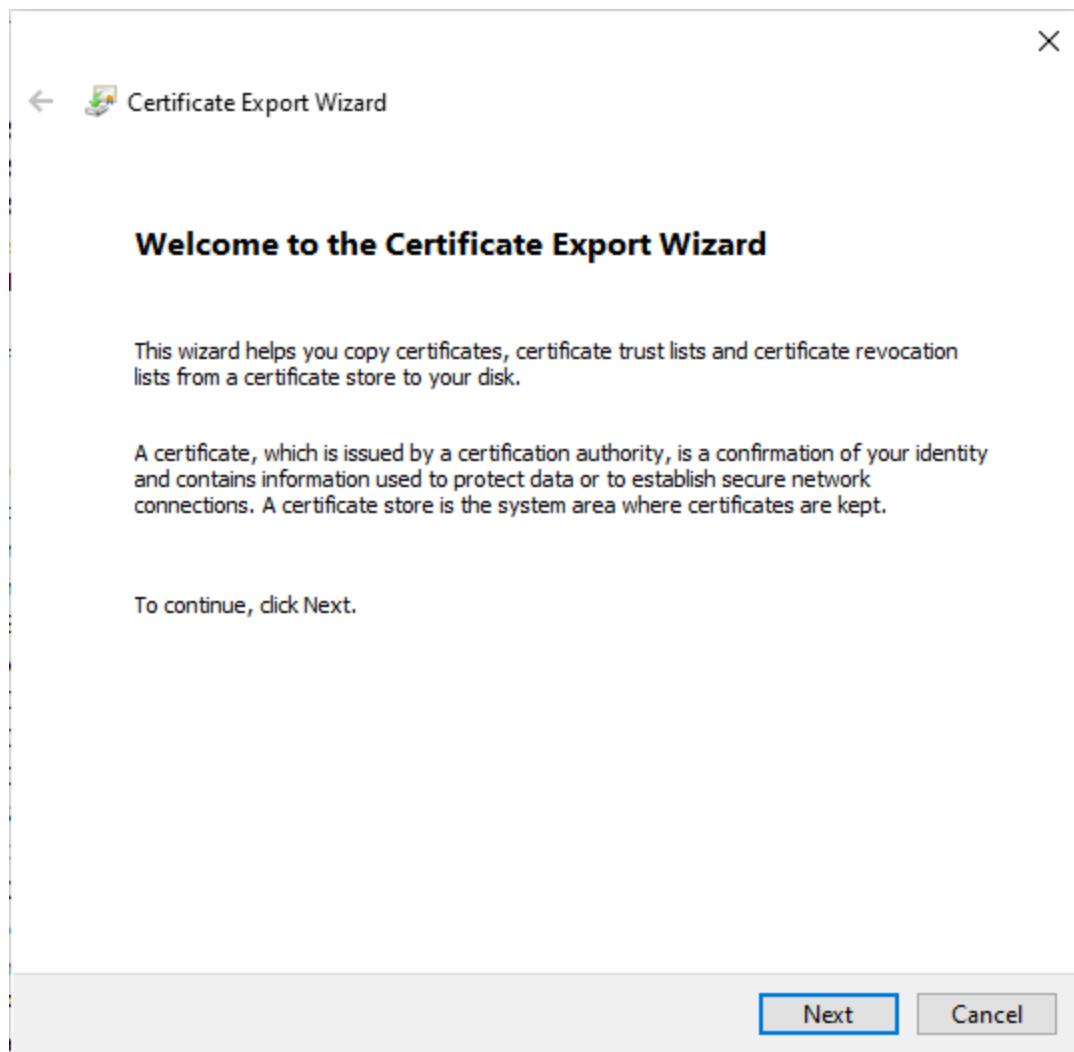
### To export the root certificate to a file

1. On the node on which the Identity Manager is running, open Microsoft Management Console (open the Run application and type **mmc**).  
A console window appears.
2. On the **File** menu, click **Add/Remove Snap-in**.
3. On the Add or Remove Snap-ins dialog, select **Certificates** and click **Add >**.
4. On the Certificates snap-in dialog, leave the default selection and click **Finish**.
5. On the Add or Remove Snap-ins dialog, click **OK**.
6. In the console window navigation panel, expand **Certificates**, expand **Trusted Root Certification Authorities**, and select **Certificates**.  
The trusted root certificate CAs are listed.
7. Locate the root certificate CA for the certificate that was assigned to MES Web Portal.  
The CA selected in the figure below is an example of a private CA used by System Management Server.

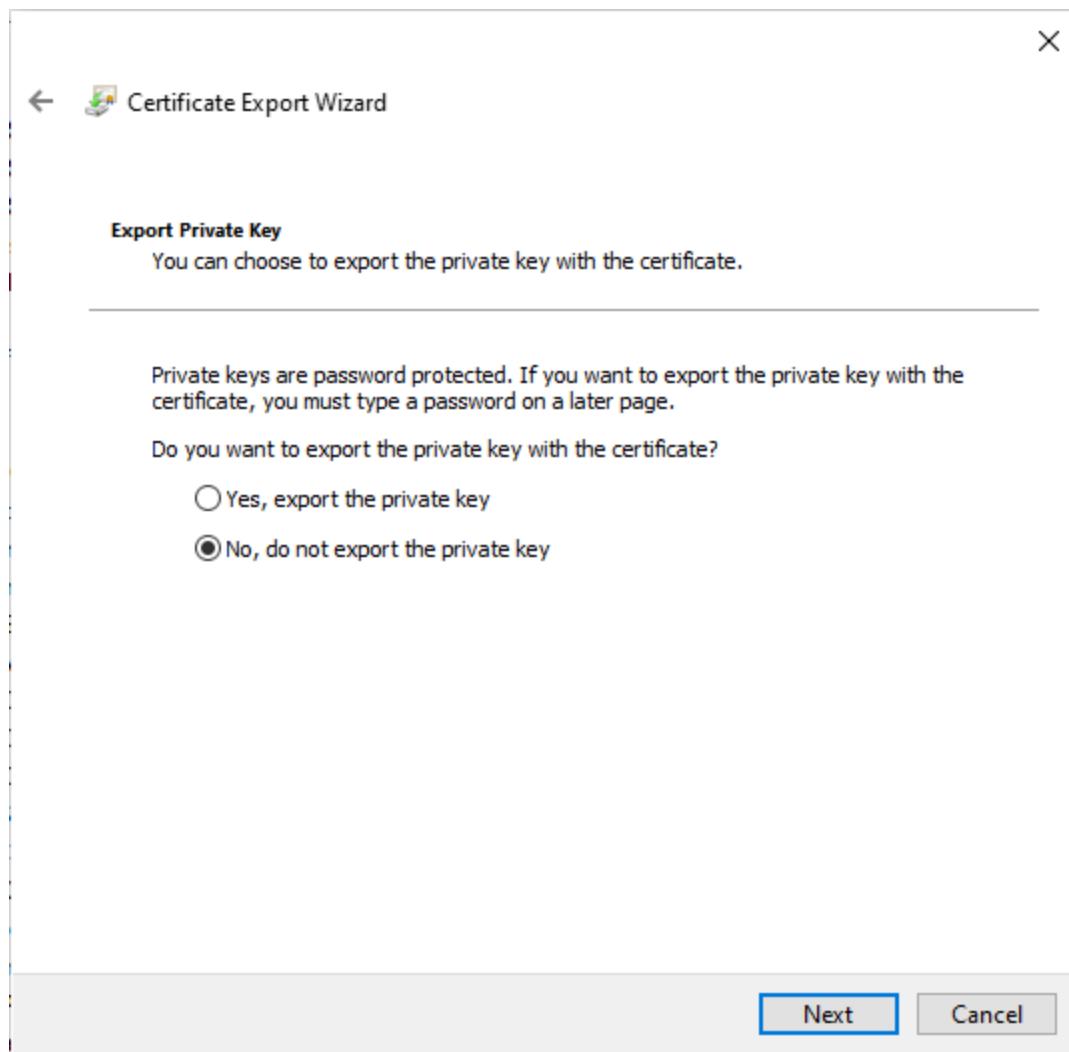
Console1 - [Console Root\Certificates - Current User\Trusted Root Certification Authorities\Certificates]					
File	Action	View	Favorites	Window	Help
Console Root					
Certificates - Current User					
Personal					
Trusted Root Certification Authorities					
Certificates					
Enterprise Trust					
Intermediate Certification Authorities					
Active Directory User Object					
Trusted Publishers					
Untrusted Certificates					
Third-Party Root Certification Authorities					
Trusted People					
Client Authentication Issuers					
Smart Card Trusted Roots					
Issued To	Issued By	Expiration Date	Intended Purposes	Friendly N	
DigiCert Assured ID Root CA	DigiCert Assured ID Root CA	11/9/2031	Client Authenticati...	DigiCert	
DigiCert Global Root CA	DigiCert Global Root CA	11/9/2031	Client Authenticati...	DigiCert	
DigiCert Global Root G2	DigiCert Global Root G2	1/15/2038	Client Authenticati...	DigiCert G	
DigiCert Global Root G3	DigiCert Global Root G3	1/15/2038	Client Authenticati...	DigiCert G	
DigiCert High Assurance EV Root CA	DigiCert High Assurance EV Root ...	11/9/2031	Client Authenticati...	DigiCert	
DigiCert Trusted Root G4	DigiCert Trusted Root G4	1/15/2038	Client Authenticati...	DigiCert Tr	
DST Root CA X3	DST Root CA X3	9/30/2021	Client Authenticati...	DST Root C	
Entrust.net Certification Authority (20...	Entrust.net Certification Authority...	7/24/2029	Client Authenticati...	Entrust (20	
GlobalSign	GlobalSign	3/18/2029	Client Authenticati...	GlobalSig	
GlobalSign	GlobalSign	12/15/2021	Client Authenticati...	Google Tr	
GlobalSign Root CA	GlobalSign Root CA	1/28/2028	Client Authenticati...	GlobalSig	
Hotspot 2.0 Trust Root CA - 03	Hotspot 2.0 Trust Root CA - 03	12/8/2043	Client Authenticati...	Hotspot 2.	
Microsoft Authenticode(tm) Root Aut...	Microsoft Authenticode(tm) Root...	12/31/1999	Secure Email, Code ...	Microsoft	
Microsoft ECC Product Root Certificat...	Microsoft ECC Product Root Certi...	2/27/2043	<All>	Microsoft	
Microsoft ECC TS Root Certificate Aut...	Microsoft ECC TS Root Certificate ...	2/27/2043	<All>	Microsoft	
Microsoft Root Authority	Microsoft Root Authority	12/31/2020	<All>	Microsoft	
Microsoft Root Certificate Authority	Microsoft Root Certificate Authori...	5/9/2021	<All>	Microsoft	
Microsoft Root Certificate Authority 2...	Microsoft Root Certificate Authori...	6/23/2035	<All>	Microsoft	
Microsoft Root Certificate Authority 2...	Microsoft Root Certificate Authori...	3/22/2036	<All>	Microsoft	
Microsoft Time Stamp Root Certificate...	Microsoft Time Stamp Root Certif...	10/22/2039	<All>	Microsoft	
NO LIABILITY ACCEPTED, (c)97 VeriSig...	NO LIABILITY ACCEPTED, (c)97 Ve...	1/7/2004	Time Stamping	VeriSign Ti	
Starfield Class 2 Certification Authority	Starfield Class 2 Certification Auth...	6/29/2034	Client Authenticati...	Starfield C	
Symantec Enterprise Mobile Root for ...	Symantec Enterprise Mobile Root ...	3/14/2032	Code Signing	<None>	
Thawte Timestamping CA	Thawte Timestamping CA	12/31/2020	Time Stamping	Thawte Tir	
VeriSign Class 3 Public Primary Certific...	VeriSign Class 3 Public Primary Ce...	7/16/2036	Client Authenticati...	VeriSign	
VeriSign Universal Root Certification A...	VeriSign Universal Root Certificati...	12/1/2037	Client Authenticati...	VeriSign U	
WINDOWSCLIENT ASB Root CA	WINDOWSCLIENT ASB Root CA	8/26/2042	Server Authenticati...	WINDOWS	

8. Right-click the root certificate CA, click **All Tasks**, and then click **Export**.

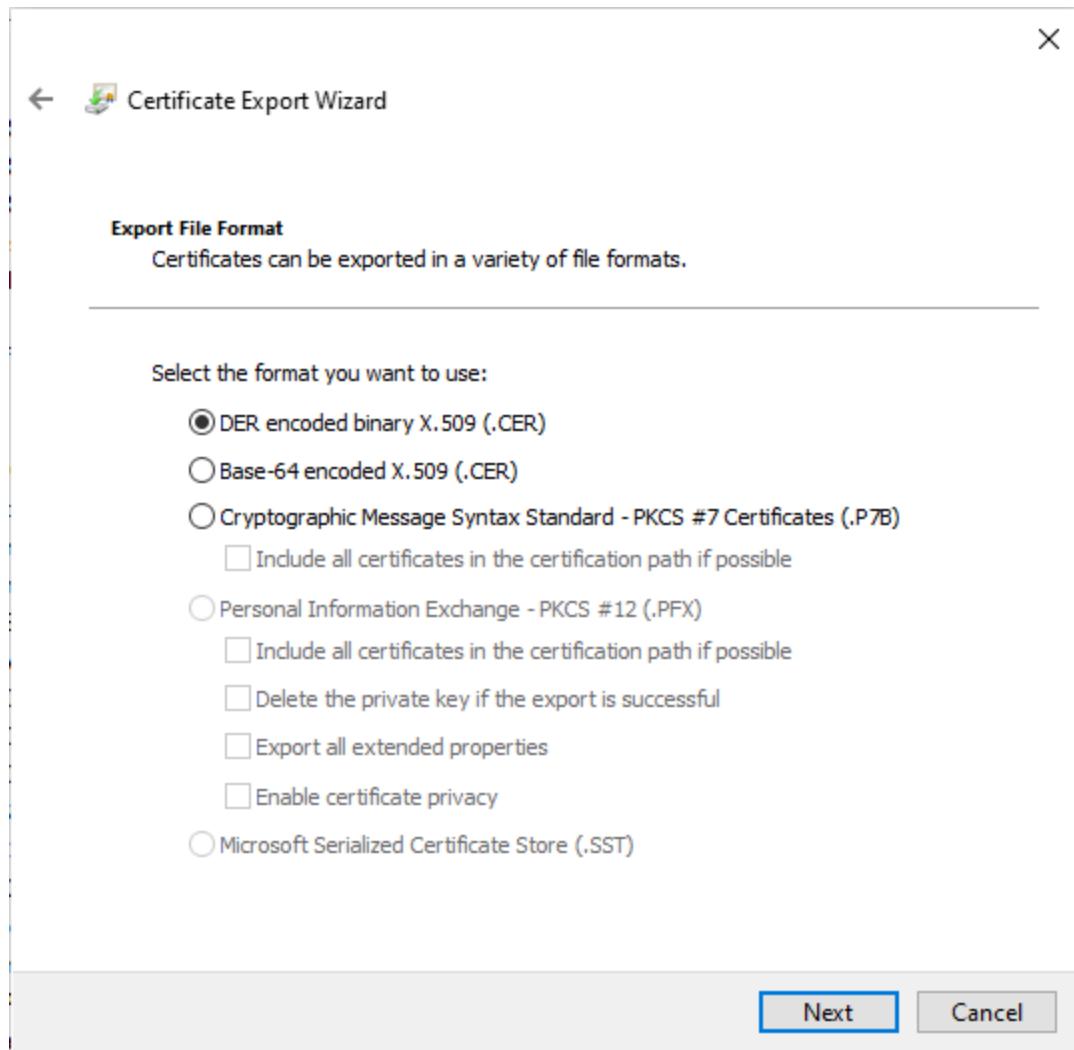
The Certificate Export Wizard appears.



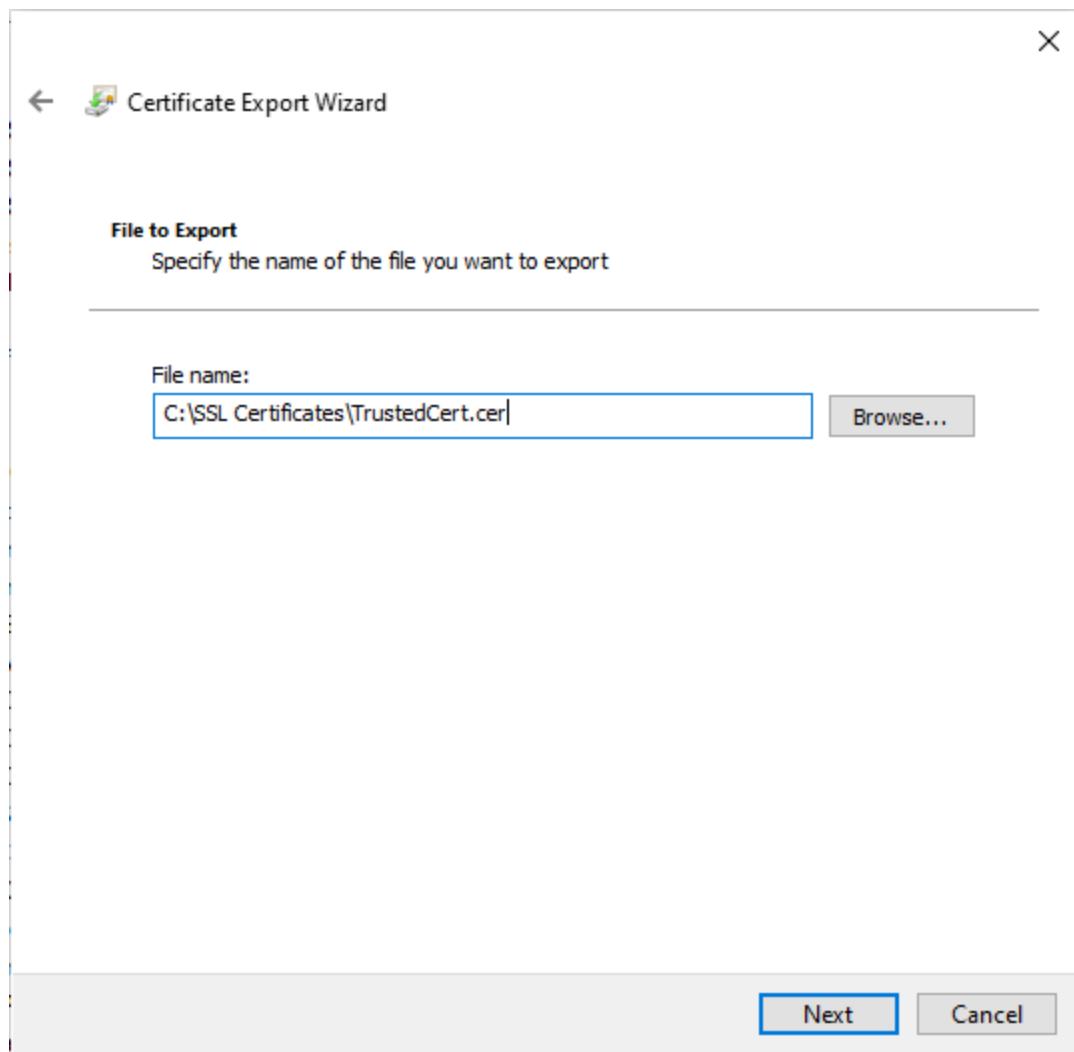
9. Click **Next**.



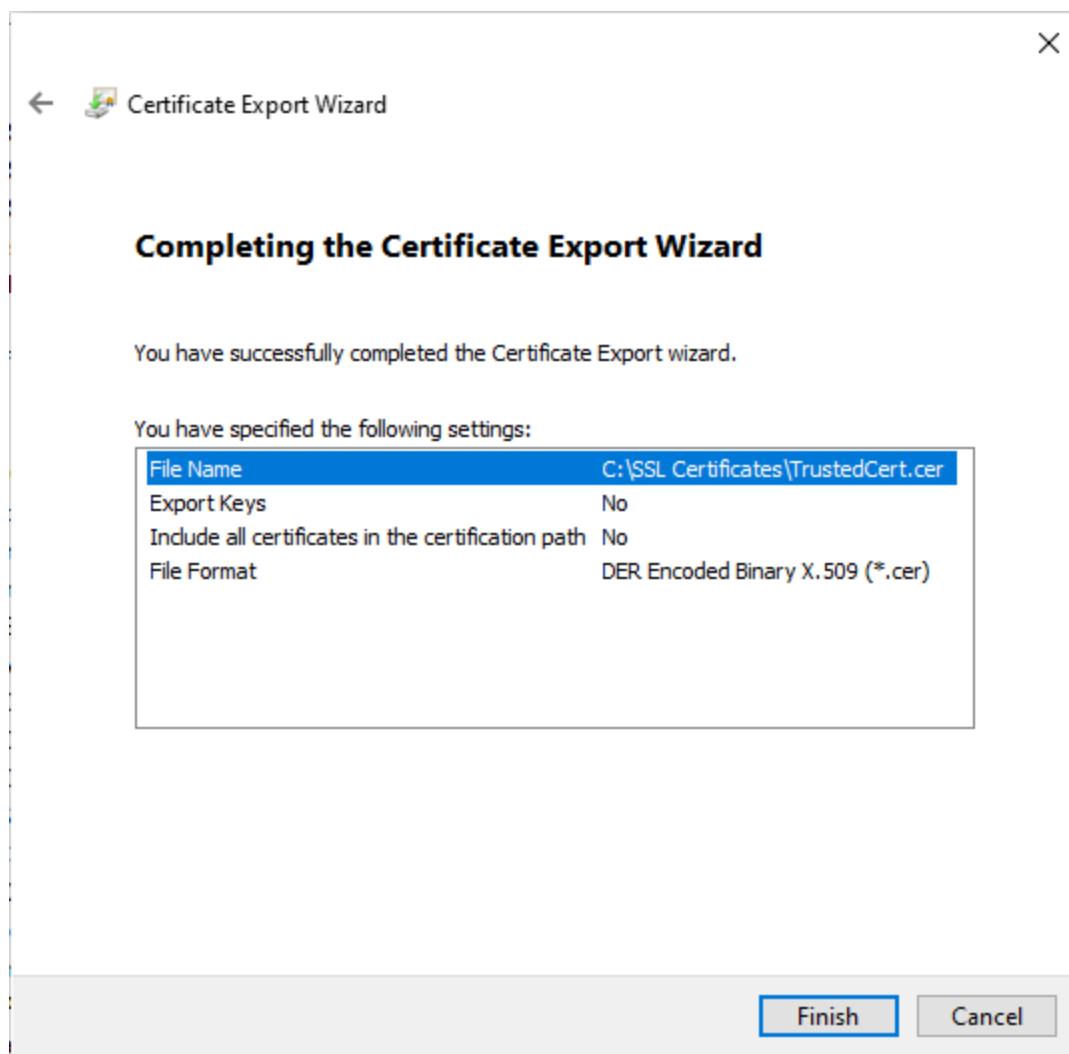
10. Leave the default **No, do not export the private key** option selected and click **Next**.



11. Leave the default **DER encoded binary** file format option selected and click **Next**.



12. Enter a file path and file name for the certificate file, then click **Next**.



13. Review the file settings and click **Finish**.

## Restarting the MES Middleware If MES Security Mode Is Changed

If the MES Security Mode is changed (by changing the *Security Mode* system parameter in MES Client), you have to restart the MES middleware. This causes the security mode change to be implemented for MES Web Portal.

## Setting the Web Portal User Session Cache Refresh Rate

There are two configuration settings in the <appSettings> section of the MES Web Portal **web.config** file for setting the cache reset rate for an MES Web Portal user session:

- *LongLivedCacheExpirationMinutes*. This setting is used for the license setting and for the security mode. The default is 60 minutes.
- *ShortLivedCacheExpirationSeconds*. This setting is used for all other cached values, which include the user's settings, privileges, entity access, and line access. The default is 2 seconds.

Entering a value of 0 turns off the cache completely for that cache setting.

If you change a cache refresh setting, you must restart the MES Web Portal web site in IIS for the change to take effect.

## What Happens to MES Web Portal Customization Files During an Uninstall

If you uninstall MES on a node on which the MES Web Portal is installed, during the uninstall operation the existing MES Web Portal content will be backed up to save any custom web files. This option allows web files that might have been added to the **MES** directory for MES Web Portal customization to be retained.

The MES Web Portal content will be backed up to the **<MES program files path>\Wonderware\MES\Web Portal\MES (archive <timestamp>)** folder, where **<timestamp>** is the date and time when the uninstall was completed. Any custom web files are stored in this directory.

## Updating the **Funcs.GetTranslations** Method for Server-Side String Translations

Most of the MES Web Portal pages use the **Funcs.GetTranslations** method for string translations.

If any of the Web Portal pages have been customized, the method must be updated to pass the following required parameters: middlewareHost, token, languageId.

An example implementation is shown below.

```
@using MES.Web;
@{
    int[] stringsToTranslate = { 15, 1053, 2489, 7736 };
    var token = Request.Headers.Get("mes-token");
    var middlewareHost = Request.Headers.Get("mes-middleware");
    var languageId = Request.Headers.Get("mes-language");
    var translatedStrings = Funcs.GetTranslations(middlewareHost, token,
languageId, stringsToTranslate);
}
```

## Configuring and Deploying MES BI Gateway Reports

The MES reporting content defaults to using the BI Gateway database as the source for the report data. The BI Gateway model includes content from Performance, Operations, and Quality data tables.

This section describes how to configure and deploy the MES BI Gateway reports. There are multiple steps involving software components other than MES [that is, BI Gateway and SQL Server Reporting Services (SSRS)].

The MES installation software includes a limited version of BI Gateway Server that can be used solely with MES BI Gateway reports. The MES BI Gateway reports will also work with a full version of BI Gateway.

The configuration and deployment of the MES BI Gateway reports includes the following procedures:

1. If not already performed, configuring the BI Gateway components and MES Database Setup component.
2. Importing and deploying the MES BI Gateway model.
3. Deploying the SSRS MES reports against the BI Gateway database.
4. Configuring the security policies for the Quality Characteristic Detail report.

## Prerequisites

Prior to configuring and deploying MES BI Gateway reports, note the following prerequisites:

- For BI Gateway, MES only supports the use of a local SQL Server and not Azure SQL.
- Prior to configuring and deploying the MES BI Gateway reports, verify that the SSRS Report Server has been configured using the Report Server Configuration Manager. This configuration creates the Report Server database and the Report Server Web Service and Web Portal URLs. Also verify that the SSRS service is running.
- To install the Quality Characteristic Detail report's SPC Chart control, the MES BI Gateway Reports component must be installed and configured on the same node as the BI Gateway Datastore and SSRS.

## Upgrading the MES BI Gateway Model

- The MES 2023 BI Gateway Model is the same as the MES 2017 R2 and MES 2020 Intelligence Model. If you upgraded from MES 2017 R2 or MES 2020 to MES 2023, there is no need to upgrade the MES Intelligence Model.
- If you are upgrading from MES 2014 R3 (version 5.3) or MES 2017 (version 6.0), and Intelligence 2014 R3 (version 2.1), perform the procedure in [Upgrading to the MES 2020 Intelligence Model](#).

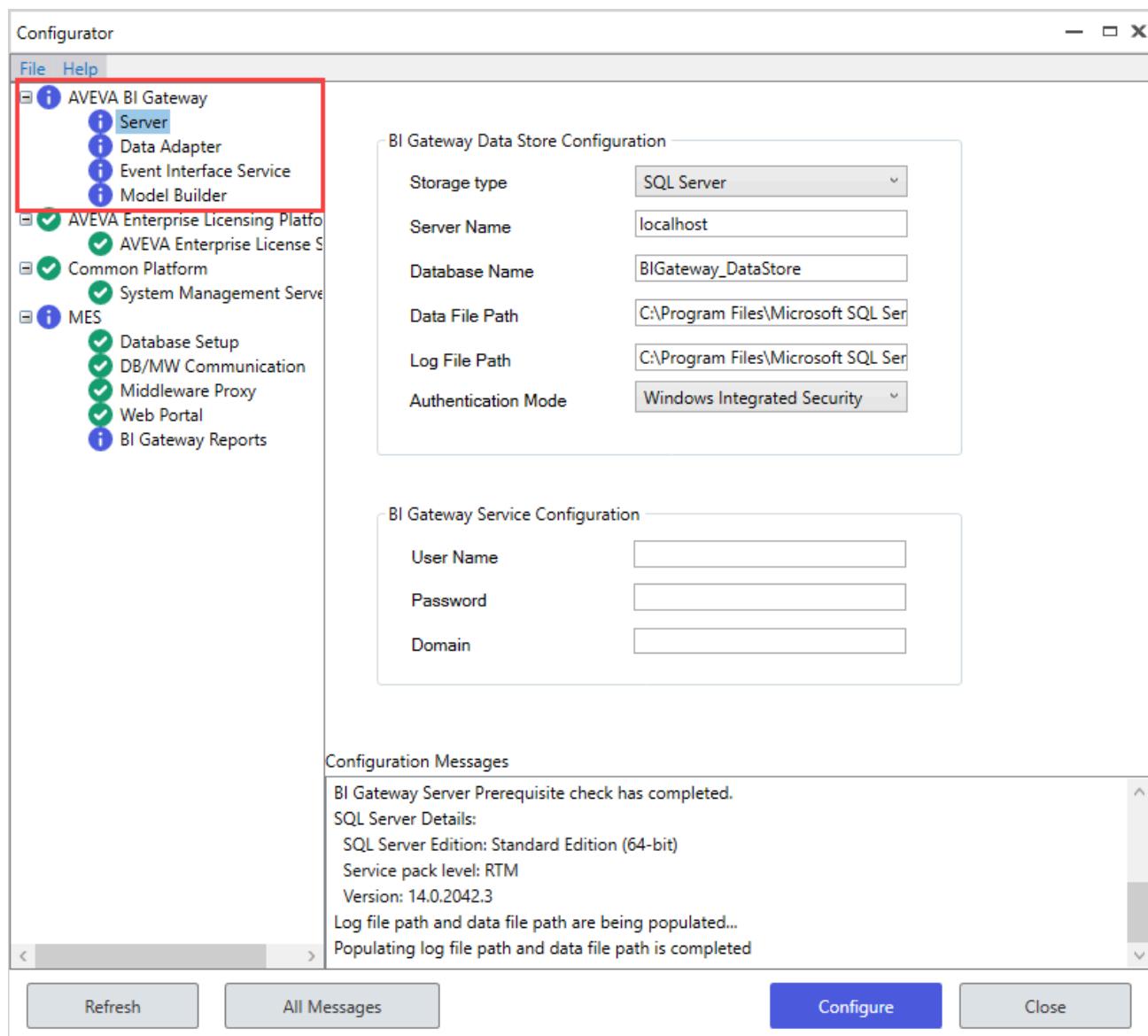
## Configuring BI Gateway and MES Database Setup Components

If not previously performed, the BI Gateway and MES Database Setup components must be configured in the post-install Configurator.

If you have an existing MES 2014 R3 or Line Performance Suite 1.x Intelligence Reporting database, it is recommended to create a new BI Gateway database with this release as the new model does not support migration/upgrade from the older model. If all the source data exists in the MES database, an alternative is to delete the existing Intelligence database and regenerate the data.

1. On the node on which BI Gateway is installed, open Configurator and configure the BI Gateway components.

The following screen shot is from the MES installation and shows only the options provided in the limited version of BI Gateway Server. BI Gateway must be configured before configuring the MES BI Gateway Reports component. However, the MES database can be set up prior to or after configuring the BI Gateway components.



For more information about the BI Gateway components, see the *BI Gateway Software Installation Guide*.

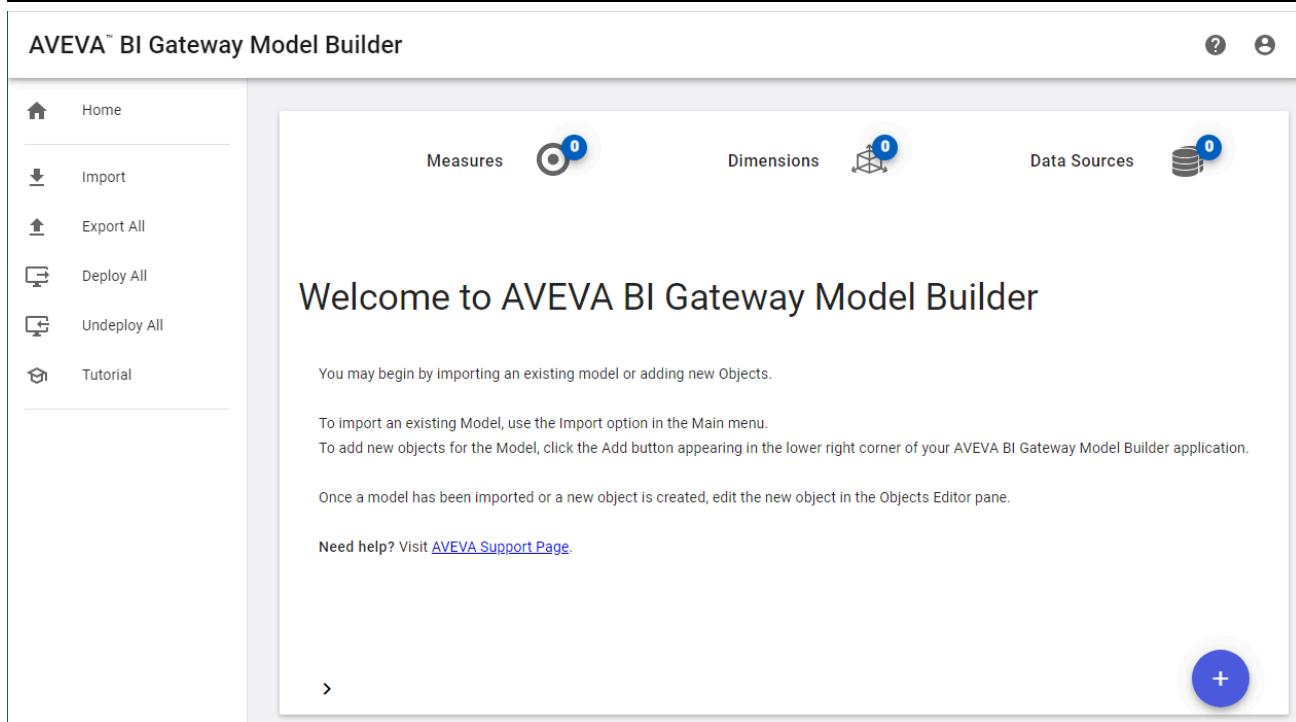
**Note:** If you have upgraded from Intelligence to BI Gateway, the BI Gateway component status indicators might incorrectly show that they have already been configured. You must still configure each component.

2. On the node on which the MES Database Server component was installed, use Configurator to configure the MES Database Setup component and create the MES database or migrate an existing one to the current version.  
See [Creating or Migrating MES Databases](#).
3. After completing the configuration tasks, click **Close** to close the Configurator.  
You are prompted to reboot the computer for the configuration changes to take effect.
4. Reboot the computer.  
You must reboot the computer to avoid BI Gateway permission issues.
5. After the reboot is complete, continue to the next task of importing the MES BI Gateway model.

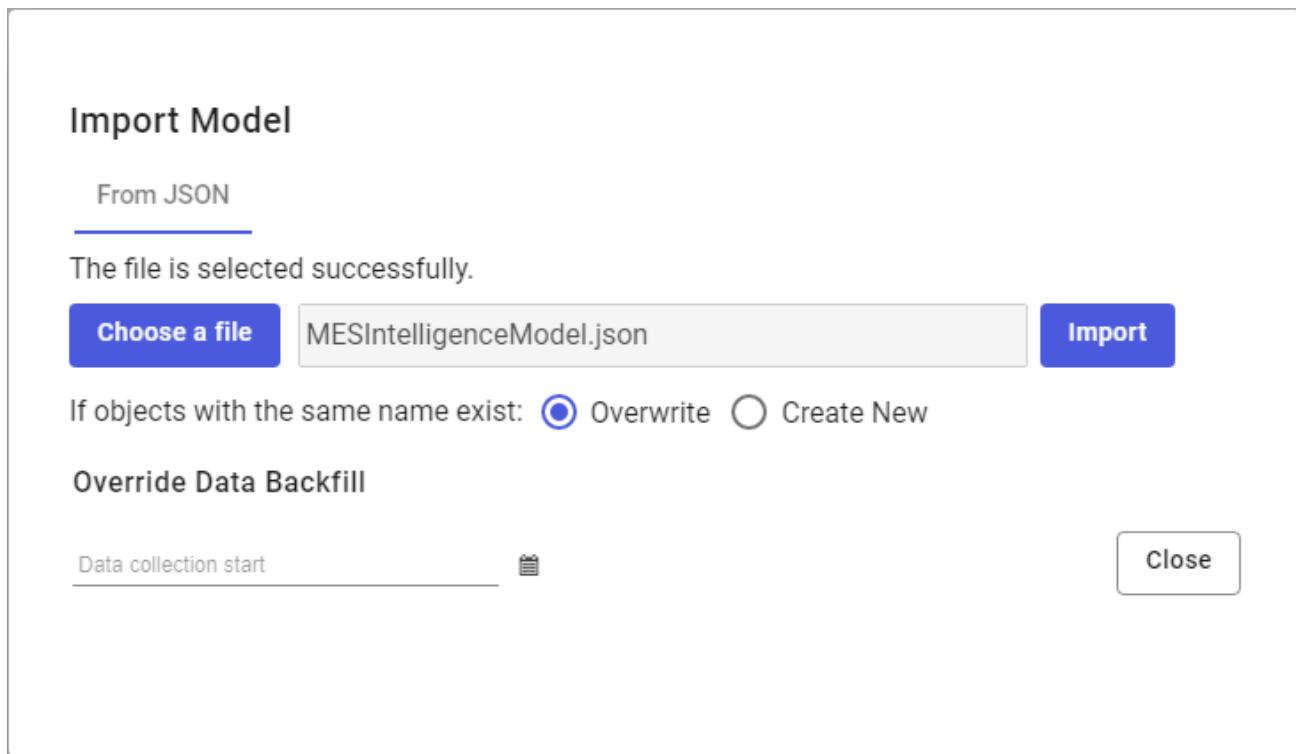
## Importing and Deploying the MES BI Gateway Model

- When the computer has rebooted after completing the configuration tasks, open the BI Gateway Model Builder in a web browser by entering the URL <https://localhost:61075>.

**Note:** The BI Gateway Model Builder supports only Chrome web browser.



- On the main menu, click **Import**.  
The Import Model screen appears.
- Click the **Choose a File** button, then navigate to and select the **MESIntelligenceModel.json** file.  
The file is stored in the **BI Gateway Reports** folder within the MES application folder.



4. Select the **Overwrite** option.

If the **Overwrite** option is not selected, duplicated MES objects will be created.

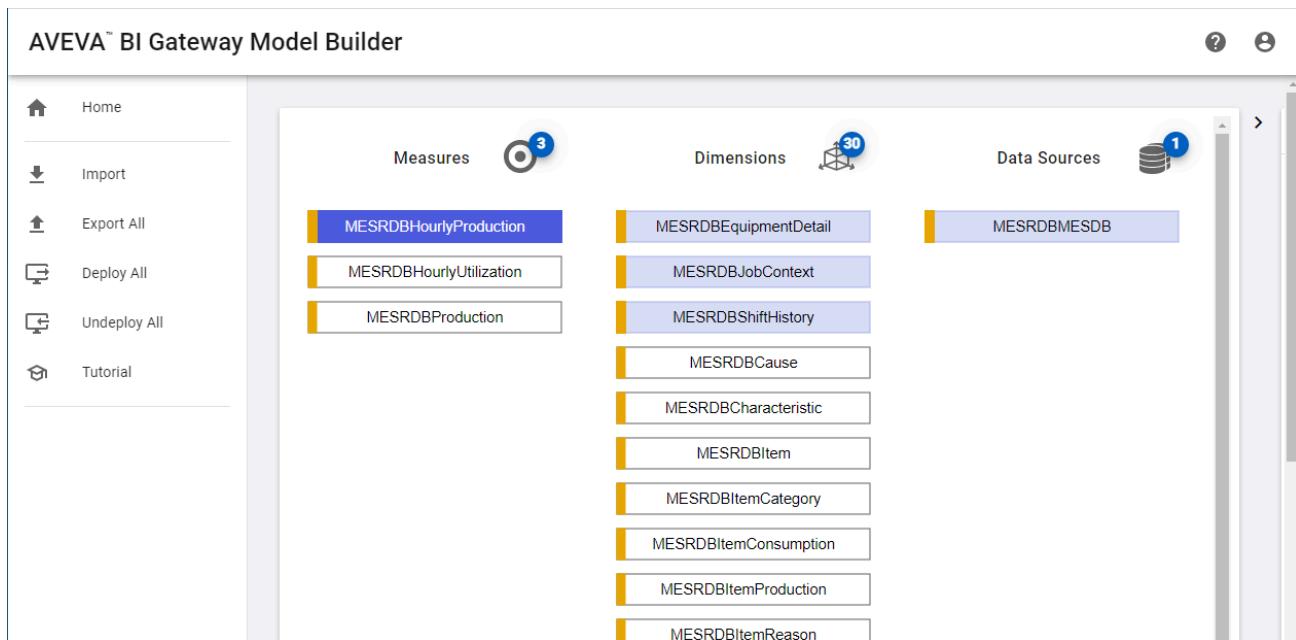
5. Optionally, enter a date for the **Override Data Backfill**.

If no value is provided here, then the Backfill dates defined in the JSON model file for each dimension will apply.

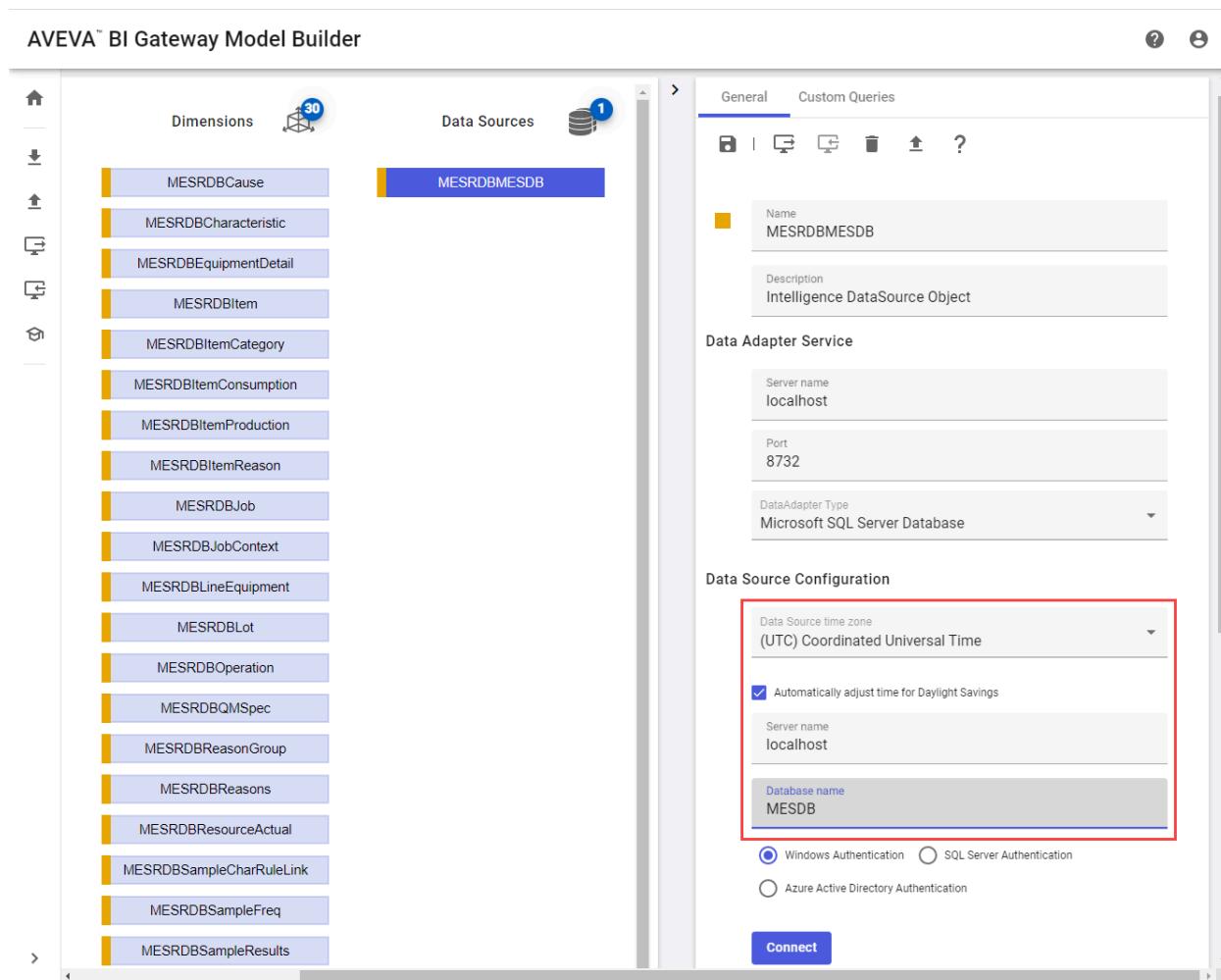
6. Click **Import**.

7. When the import is completed, click **Done**.

The measures, dimensions, and data source appear. They are tagged in yellow, indicating that they are not deployed.

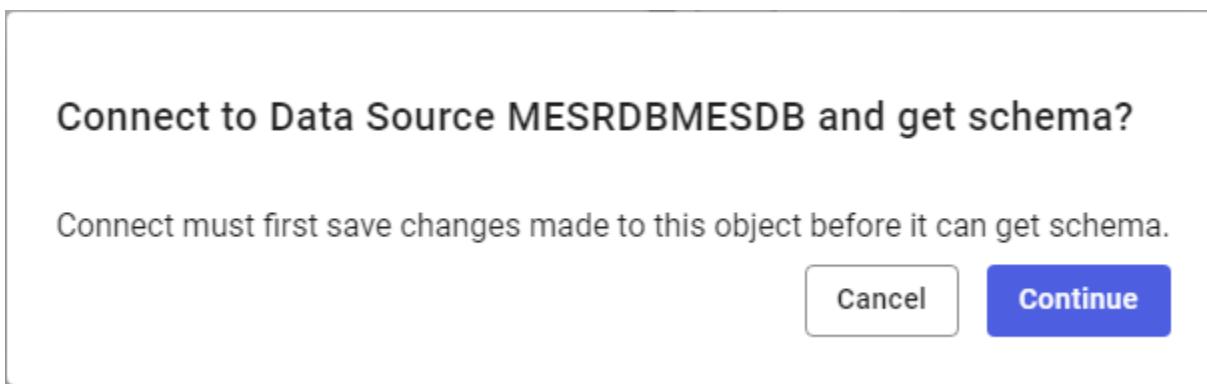


8. To configure the MES BI Gateway Reports data source, select the **MESRDBMESDB** data source object.
9. In the **General** tab in the right panel:
  - In the **Data Source time zone** field, select **(UTC) Coordinated Universal Time**.
  - In the **Server name** field, enter the host name of the node where the MES database is stored.
  - In the **Database name** field, enter the MES database name.



10. Click **Connect**.

You are prompted whether you want to continue to connect to the data source and get the schema.



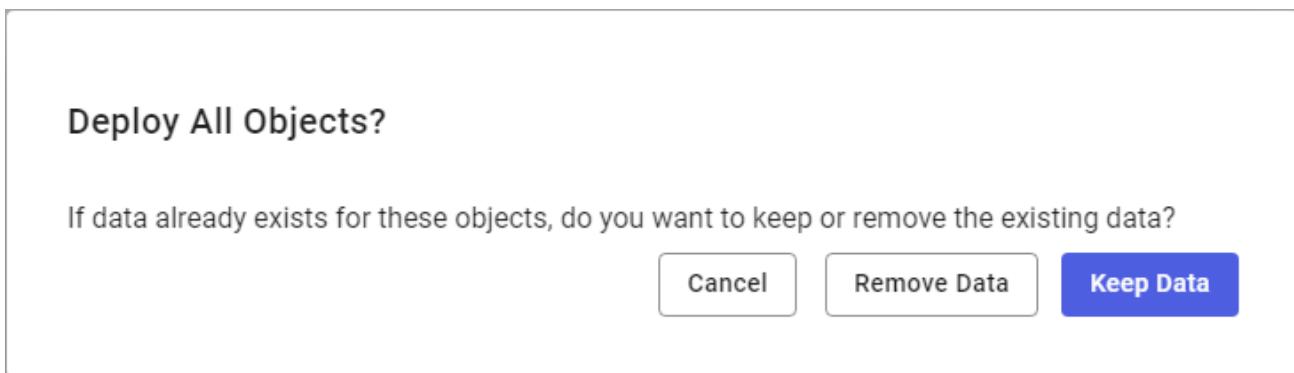
11. Click **Continue**.

12. When the schema has been retrieved, click **Done**.



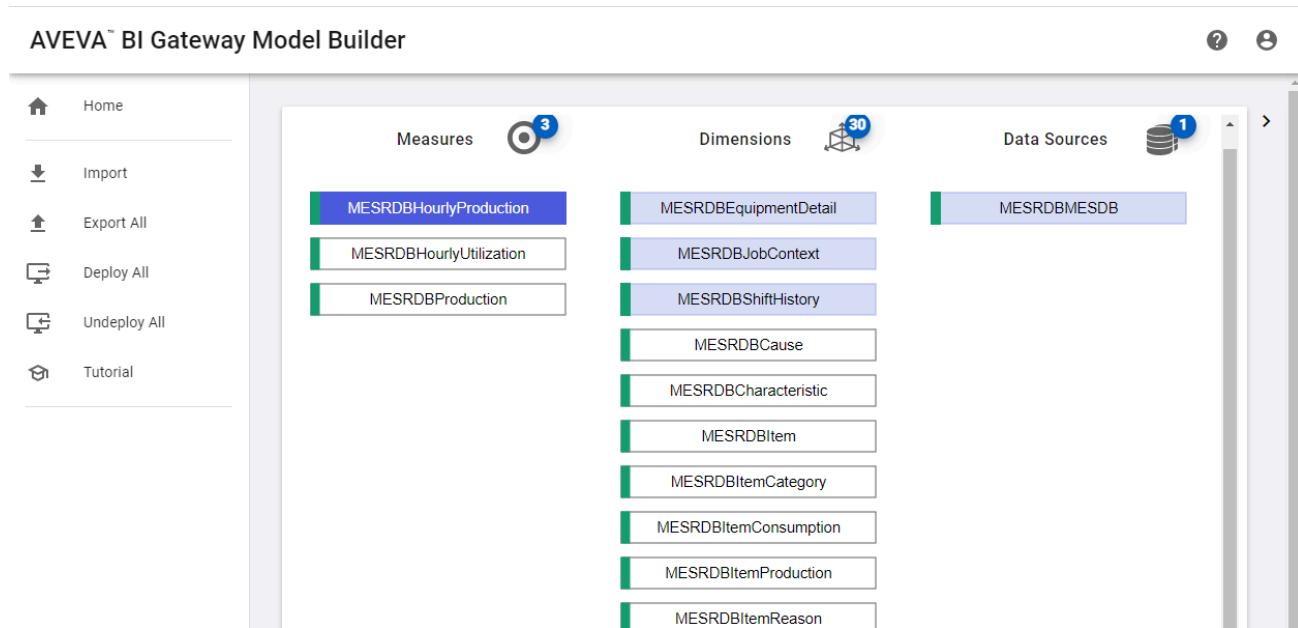
13. In the Windows Services tool on the node on which BI Gateway is installed, make sure the Intelligence Service is running.
14. On the main menu, click **Deploy All**.

You are prompted whether you want to deploy all objects.



15. Click **Keep Data**.
16. When the objects have been deployed, click **Done**.

The measures, dimensions, and data source are tagged in green, indicating that they are deployed.

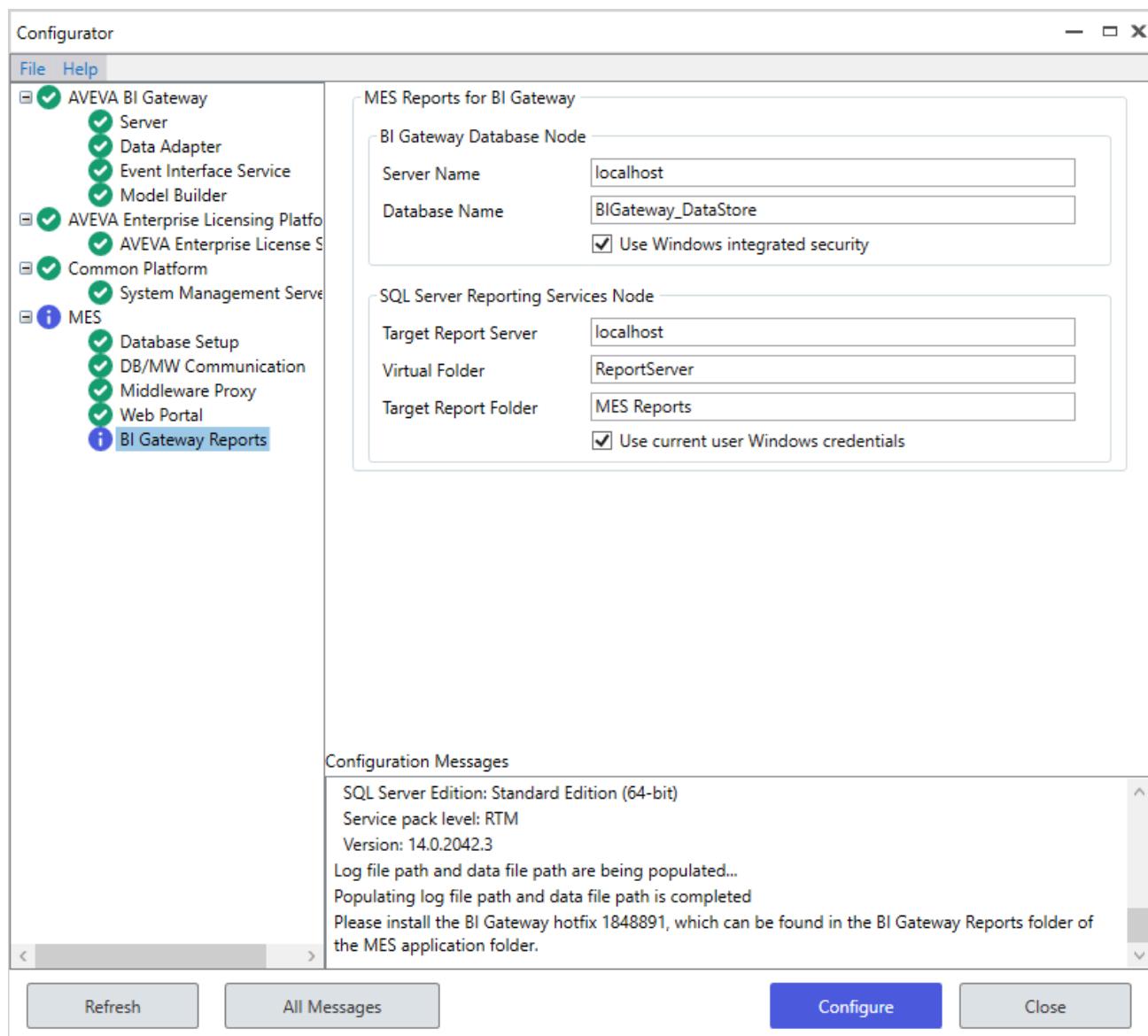


17. You can close BI Gateway Model Builder.

## Deploying the SSRS MES Reports Against the BI Gateway Database

**Note:** To install the Quality Characteristic Detail report's SPC Chart control, the MES BI Gateway Reports component must be installed and configured on the same node as the BI Gateway Datastore and SQL Server Reporting Services (SSRS).

1. In the Windows Services tool on the node on which SSRS and BI Gateway is installed, make sure the SSRS service is running.
2. Open Configurator and select the MES BI Gateway Reports component.



A message in the Configuration Messages box prompts you to install the BI Gateway hotfix.

3. Install BI Gateway hotfix HF\_2172196, which can be found in the **BI Gateway Reports** folder within the **MES** application folder. This is a cumulative hotfix that also includes BI Gateway HF\_1848891. Refer to the instructions in the hotfix Readme file.
4. In Configurator, change the MES BI Gateway Reports configuration settings from the default entries as needed.

#### BI Gateway Database Node

- **Server Name:** The server name on which the BI Gateway database is stored. This can be **localhost** or the local node's host name.
- **Database Name:** The name of the BI Gateway database.

**Note:** If BI Gateway was upgraded from a previous version of Intelligence, make sure that the database name entered here matches the existing Intelligence database name (and **not** the BI Gateway default name **BIGateway\_DataStore**). Also, the name of the existing Intelligence database cannot be changed.

- **User account information:** The user account for accessing the BI Gateway database. See [Specifying SQL](#)

[Server User Authentication](#). The user account specified here requires read access to the BI Gateway database.

#### SQL Server Reporting Services Node

- **Target Report Server:** The name of the report server on which SSRS is running. This can be **localhost** or the local node's host name.
- **Virtual Folder:** The name of the report server's virtual folder.
- **Target Report Folder:** The name of the target report folder that will be created by the configuration operation for the MES reports.
- **User account information:** The user account for accessing the report server on which to deploy the MES reports. See [Specifying SQL Server User Authentication](#).

#### 5. Click **Configure**.

The data source to connect to the BI Gateway database, the MES reports folder, and the MES BI Gateway reports are created on the SSRS server.

#### 6. From the Reporting Services Configuration Manager application, verify that the MES Reports have been deployed and that their links are accessible from the MES Reports - Report Manager web page.

The screenshot shows the SSRS Report Manager interface. At the top, there is a navigation bar with icons for Favorites, Browse, New, Upload, Manage folder, Tiles, and Search, along with a user name 'mes.user'. Below the navigation bar, the title 'SQL Server Reporting Services' is displayed. The main content area is titled 'MES Reports' and shows a breadcrumb trail 'Home > MES Reports'. Under the 'Folders' section, there is one folder named 'Images'. Under the 'PAGINATED REPORTS' section, there are 15 reports arranged in a grid. The reports are: GenealogyByLot, GenealogyByWorkOrder, LineProduction, MTBFRReport, MTTRReport, OEEAnalysis, PerformanceDashboard, ProductionbyEntity, QualityCharacteristicData, QualitySummary, UtilizationAnalysis, UtilizationAnalysisWaterfa, UtilizationByEntity, and UtilizationTimeline. Each report has a preview icon and three dots indicating more options.

#### 7. Verify that the following views, stored procedures, and functions were created in the BI Gateway database.

Object Explorer

Connect ▾

Databases

- + System Databases
- + Database Snapshots
- BIGateway\_DataStore
  - + Database Diagrams
  - + Tables
  - Views
    - + System Views
    - + Config.ViewBoundItemsForDataSource
    - + Config.ViewBoundItemsForDimensionDataItems

Config.ViewSourceDataItemVersions

- + dbo.MESRDB\_VW\_GENEALOGY\_DATA
- + dbo.MESRDB\_VW\_LOSTTYPE
- + dbo.MESRDB\_VW\_QM\_CHARACTERISTICDETAILEDCOLUMNS
- + dbo.MESRDB\_VW\_QM\_SAMPLEFREQUENCYTYPE
- + dbo.MESRDB\_VW\_QM\_SEVERITY
- + dbo.MESRDB\_VW\_QM\_SPEC
- + dbo.MESRDB\_VW\_QM\_STATISTICSCOLUMNNS
- + dbo.MESRDB\_VW\_RESOURCE\_ACTUAL\_INTERNAL
- + dbo.MESRDB\_VW\_SAMPLE\_RESULTS
- + dbo.MESRDB\_VW\_UTILREASGRP
- + dbo.viewEventQueue
- dbo.vwEventQueue

dbo.vwHourlyUtilization

- + dbo.vwOEEAnalysis
- + dbo.vwOEEAnalysisGrouping
- + dbo.vwProduction
- + dbo.vwShifts
- + dbo.vwTimeperiod
- + dbo.vwTimeperiod\_sorted
- + dbo.vwUtilization

External Resources

The screenshot shows the Object Explorer window of a SQL Server Management Studio (SSMS) session. The left pane displays a tree view of the database structure under the 'BIGateway\_DataStore' database. The 'Views' node is expanded, showing various system and configuration views. Two specific groups of views are highlighted with red boxes:

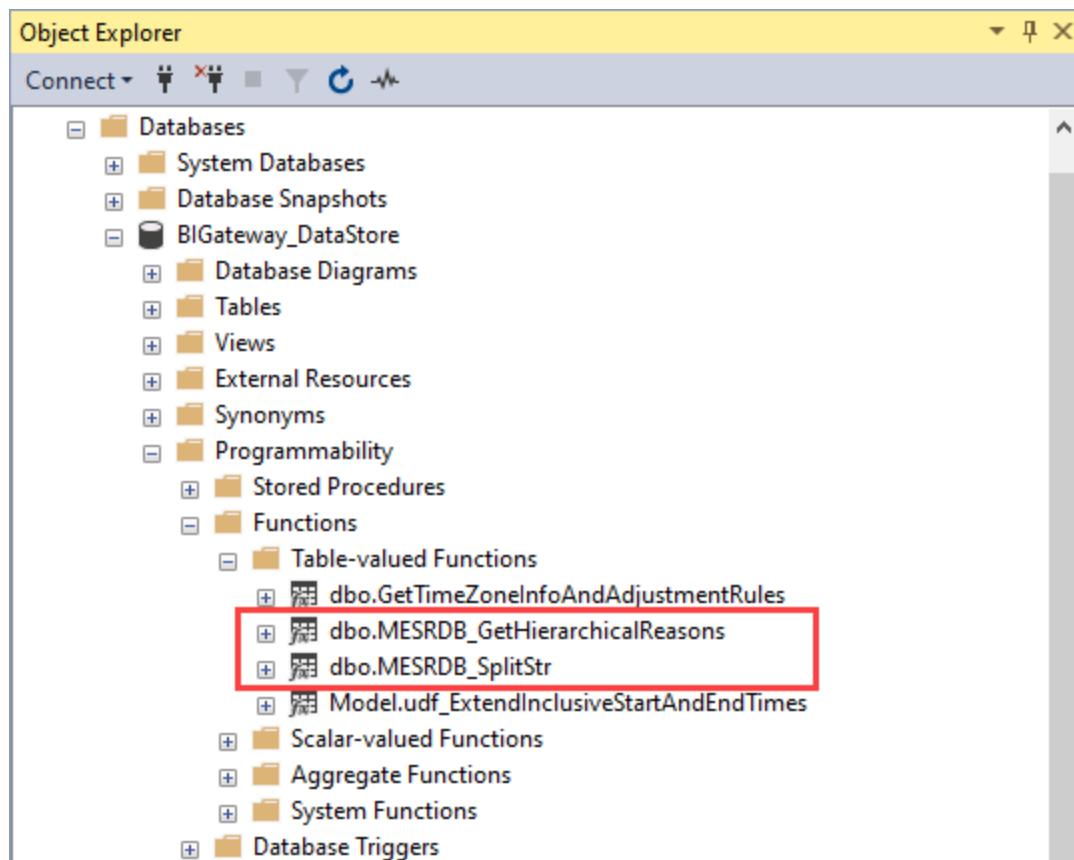
- Views under 'Config' node:** Config.ViewSourceDataItemVersions, followed by a list of approximately 10 views starting with 'dbo.MESRDB\_VW\_'. This group includes views like GENEALOGY\_DATA, LOSTTYPE, CHARACTERISTICDETAILEDCOLUMNS, SAMPLEFREQUENCYTYPE, SEVERITY, SPEC, STATISTICSCOLUMNNS, RESOURCE\_ACTUAL\_INTERNAL, SAMPLE\_RESULTS, and UTILREASGRP.
- Views under 'vw' node:** dbo.vwHourlyUtilization, followed by a list of approximately 8 views starting with 'dbo.vw'. This group includes OEEAnalysis, OEEAnalysisGrouping, Production, Shifts, Timeperiod, Timeperiod\_sorted, and Utilization.

The right pane of the Object Explorer shows the details of the selected view, including its definition and properties. The status bar at the bottom indicates the connection is 'Localhost (SAP)'.

Object Explorer

Connect ▾

- + Synonyms
- + Programmability
  - + Stored Procedures
    - + System Stored Procedures
    - + Config.usp\_Cleanup
    - + Config.usp\_CloneDimensionDataItem
    - + Config.usp\_CloneMeasureDataItem
    - + Config.usp\_CloneSourceDataItems
    - + Config.usp\_DeleteDataSource
    - + Config.usp\_DeleteDataSourceVersion
    - + Config.usp\_DeleteDimensionDataItemVersion
    - + Config.usp\_DeleteMeasureDataItem
    - + Config.usp\_DeleteMeasureDataItemVersion
    - + Config.usp\_DeleteSourceDataItem
    - + Config.usp\_DeployOrder
    - + Config.usp\_GetLatestDataSourceWithChildren
    - + Config.usp\_GetRelatedObjectsDeployOrder
    - + Config.usp\_GetRelatedParentObjects
    - + Config.usp\_SyncDimensionBaseLink
    - + Config.usp\_SyncDimensionRelationships
    - + Config.usp\_SyncMeasureRelationships
    - + Config.usp\_SyncSourceDataItemRelationships
    - + Config.usp\_UndeployOrder
    - + Config.usp\_UpdateDatasourceOnDeploymentCompletion
    - + Config.usp\_UpdateDatasourceOnUndeploymentCompletion
    - + Config.usp\_UpdateDimensionOnDeploymentCompletion
    - + Config.usp\_UpdateDimensionOnUndeploymentCompletion
    - + Config.usp\_UpdateMeasureOnDeploymentCompletion
    - + Config.usp\_UpdateMeasureOnUndeploymentCompletion
    - + dbo.diagnostics\_Trace\_AddEntry
  - + dbo.MESRDB\_CharacteristicDetail
  - + dbo.MESRDB\_ConvertToImage
  - + dbo.MESRDB\_EventsChrono
  - + dbo.MESRDB\_EventsCountPieChart
  - + dbo.MESRDB\_EventsDetail
  - + dbo.MESRDB\_EventsDetail\_MLReasGrp
  - + dbo.MESRDB\_EventsDurationPieChart
  - + dbo.MESRDB\_EventsPareto
  - + dbo.MESRDB\_GetGenealogy
  - + dbo.MESRDB\_GetGenealogyIdGenealogy
  - + dbo.MESRDB\_GetLotGenealogy
  - + dbo.MESRDB\_GetNextReportBasisList
  - + dbo.MESRDB\_GetReverseGenealogy
  - + dbo.MESRDB\_GetReverseGenealogyIdGenealogy
  - + dbo.MESRDB\_GetReverseLotGenealogy
  - + dbo.MESRDB\_GETSTARTENDTIMES
  - + dbo.MESRDB\_GetUtilWhereClause
  - + dbo.MESRDB\_Quality\_Data
  - + dbo.MESRDB\_QualitySummary\_SummaryData
  - + dbo.sp\_CompareDimensionRecords



## Loading of MES Data into the BI Gateway Database

Once all the configuration steps have been completed, the BI Gateway services extract data from the MES database, transform it, and populate the newly created tables in the BI Gateway database.

The initial loading of the BI Gateway database might take some time, depending on either:

- The Override Data Backfill date entered in the Import Model dialog of the BI Gateway Model Builder when importing the model
- The Data Collection Start date entered in the BI Gateway Model Builder

While the backfill process continues, the BI Gateway service will start collecting current data for the reports. Wait at least an hour after deployment for the MES data to be loaded into the BI Gateway database before attempting to run any MES BI Gateway reports.

Some of the reports will not show data until the second run of the BI Gateway service to update the dimensional data. Unless specifically changed by an end user, this can take up to an hour.

If there is no MES data in the BI Gateway database, then verify that the BI Gateway services are running. Also check the System Management Console error log of BI Gateway.

## Configuring Security Policies for the Quality Characteristic Detail Report

The MES Quality Characteristic Detail report includes a subreport containing a .NET control for displaying the SPC Chart. This report requires that certain security policy settings for Reporting Services are configured to display

the .NET control.

To configure these security policy settings, follow the instructions provided in the **Reporting Services Security Configuration.txt** file that is located in the **BI Gateway Reports\Reports** folder of the MES application folder.

## Upgrading to the MES 2020 Intelligence Model

**Note:** MES 2023 does not support directly upgrading the MES Intelligence model from MES 2017 or earlier. This section is retained from the MES 2020 documentation to describe the upgrade process to be completed prior to upgrading to MES 2023.

Perform the following procedure to upgrade the MES Intelligence model from MES 2014 R3 (version 5.3) or MES 2017 (version 6.0) to the MES 2020 (version 6.2) model. This procedure also performs the required upgrade of Intelligence 2014 R3 (version 2.1) to Intelligence 2017 U1 (version 3.1).

**Note:** The MES 2020 Intelligence Model is the same as the MES 2017 R2 Intelligence Model. So there is no need to upgrade the model from MES 2017 R2 to MES 2020. If not already installed, you can install Intelligence 2017 U1 (version 3.1) as part of the MES 2020 installation or upgrade.

1. Depending on which MES release you are upgrading from, do one of the following:
  - MES 2014 R3 (version 5.3): Go to step 2.
  - MES 2017 (version 6.0): Go to step 3.

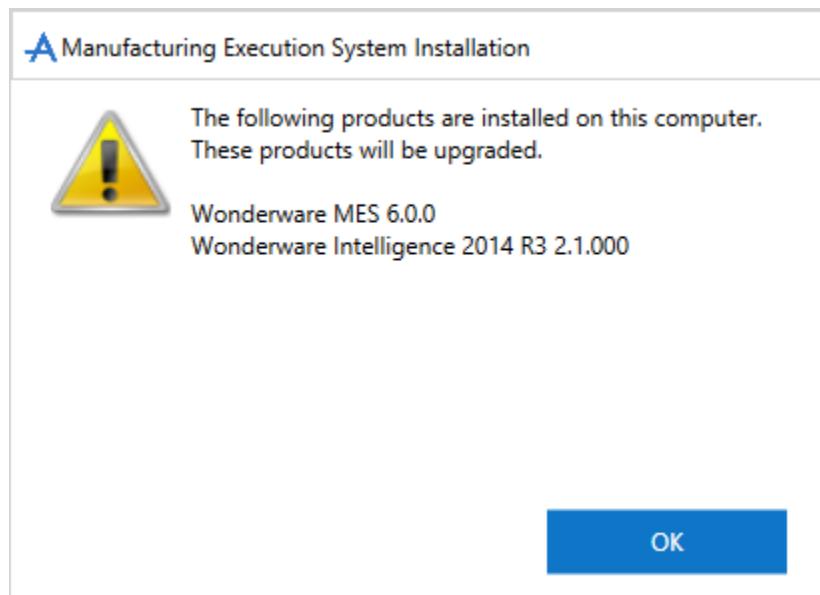
2. Install the MES 2014 R3 P02 patch.

For installation instructions, refer to the patch Readme file.

During the patch installation, the Intelligence report database and the obsolete dimension MESRDBEquipment is deleted. This dimension, if not deleted, would cause a problem when importing the MES 2020 JSON model into Intelligence Model Builder. If the MES database does not contain all the source data to repopulate the Intelligence database, then the existing MES 2014 R3 report database should be kept and a new Intelligence reporting database should be used.

3. To start the upgrade to MES 2020, run the **Setup.exe** file in the root directory of the installation folder.

You are prompted that MES and Intelligence will be upgraded.

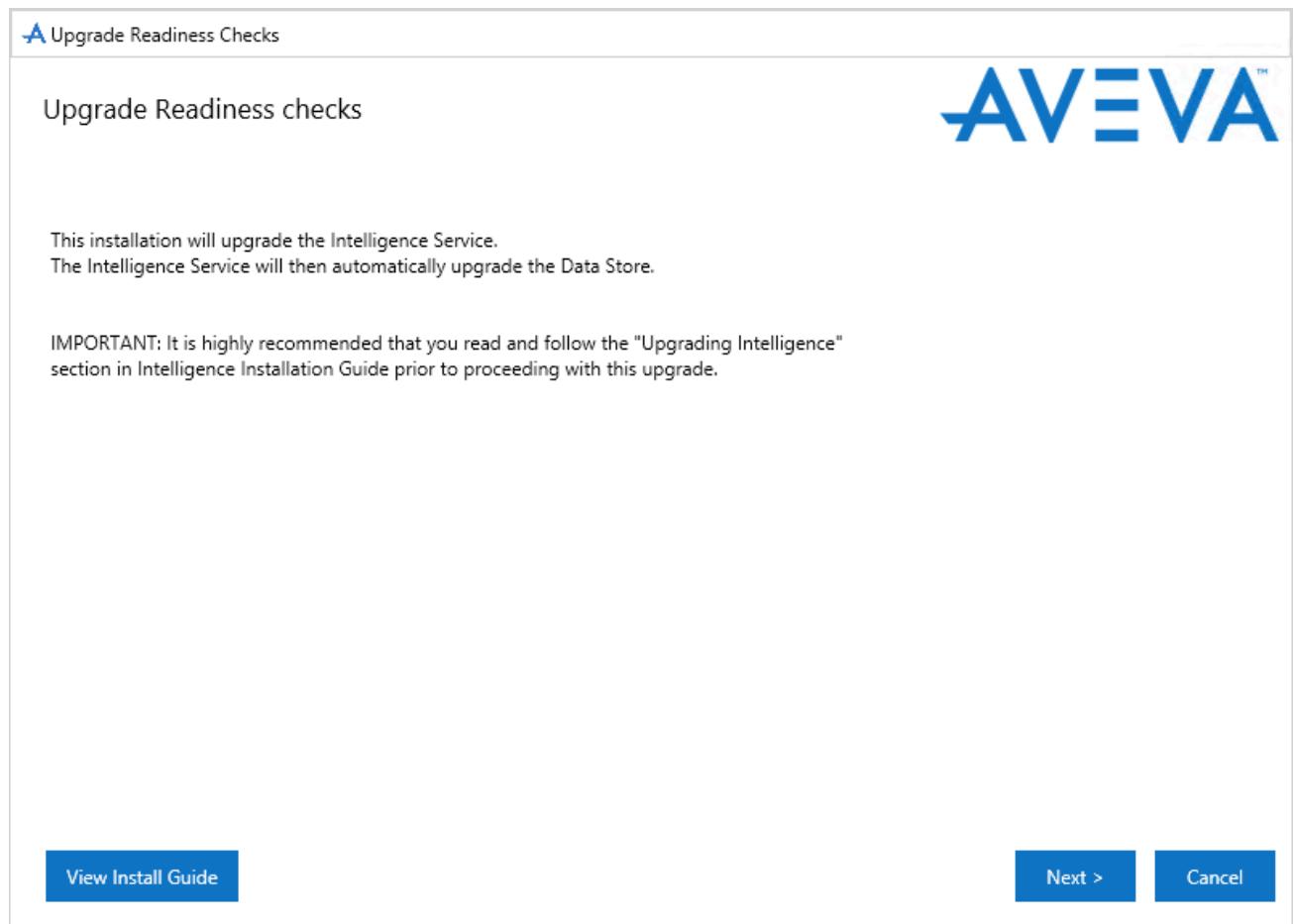


4. Click **OK**.

The License Agreement screen appears.

5. Review the license agreement, select the **I have read and accept the terms ...** option, then click **Agree**.

The MES Setup tool runs an upgrade readiness check on the Intelligence installation software.



6. As the important message on this screen recommends, review the "Upgrading Intelligence" section of the *Intelligence Installation Guide* to familiarize yourself with the Intelligence upgrade process.

7. When you are ready to continue, click **Next**.

The Export Model screen appears, showing the Intelligence datastore server name and datastore name that were configured.

 [Export Model](#)

Verify Datastore Server Name and Datastore Name given below. After that, click Next button to start model migration. Only Intelligence objects in deployed state will be migrated.

Datastore Server Name:

Datastore Name:

[Next >](#) [Cancel](#)

8. Click **Next**.

The existing model is exported to a JSON model file format. The upgraded JSON model file **Data.json** is stored in the **\Bin\MigrationFiles** folder of the Intelligence application folder.

The Undeploy All Intelligence Objects screen appears.

 **A Undeploy all Intelligence objects**

Model has been exported to JSON file. Now undeploy Intelligence objects (with "Remove existing data" equal to "No"), before proceeding further.

[Next >](#) [Cancel](#)

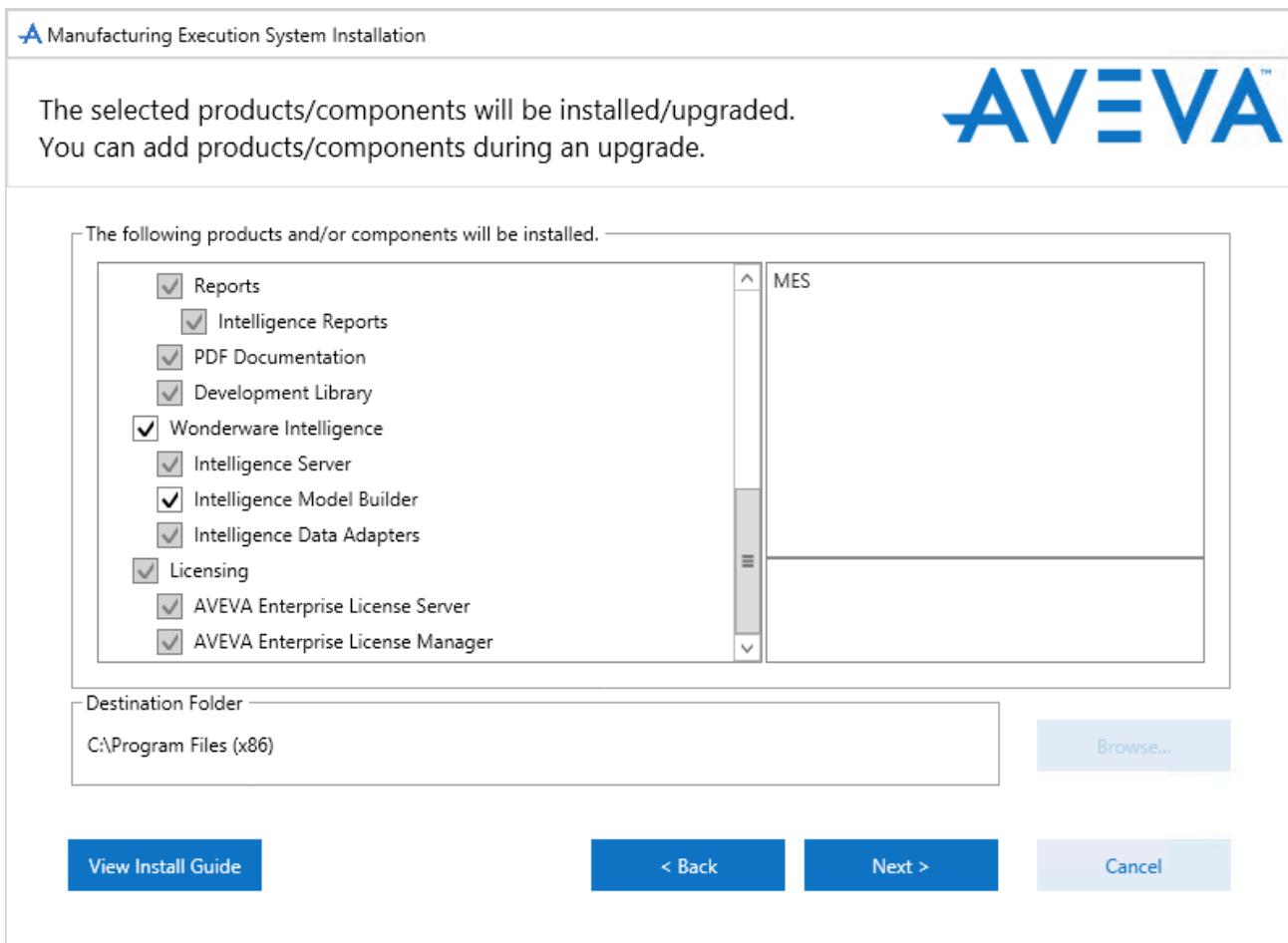
The message on this screen explains that you have to undeploy all Intelligence objects before proceeding.

9. To undeploy all Intelligence objects, do one of the following:
  - If you used the Intelligence Model Builder utility to deploy the Intelligence 2014 R3 Patch 2 model, it does not have a control to undeploy the model. You must manually run the following SQL script against the Intelligence database to undeploy the model.

```
truncate table [Model].SourceDataItems
GO
UPDATE Model.DataItems
SET IsDeployed = 0,
SerializedConfiguration = REPLACE(SerializedConfiguration,
'<DeployState>Deployed</DeployState>',
'<DeployState>NotDeployed</DeployState>')
GO
```

- If you used the System Platform IDE to deploy Intelligence 2014 R3 Patch 2 model, then undeploy the Intelligence model from the System Platform IDE.
10. After undeploying the Intelligence objects, return to the MES Setup tool and click **Next**.

The list of the components that are selected for installation or upgrading appears.



Because you are performing an upgrade of Intelligence 2014 R3, the Intelligence installation components, including the new Intelligence Model Builder utility, are automatically selected to be installed.

11. Click **Next**.  
The Ready to Install the Application screen appears.
12. Click **Install**.
13. After the installation completes, use the post-install Configurator to configure the following components:
  - MES Database Setup
  - MES DB/MW Communication
  - MES Middleware Proxy
  - Intelligence Server
  - Intelligence Data Adapter
  - Intelligence Model Builder
14. After completing the configuration tasks, click **Close** to close the Configurator.  
You are prompted to reboot the computer for the configuration changes to take effect.
15. Reboot the computer.  
You must reboot the computer to avoid Intelligence permission issues.
16. After the reboot is complete, open the Intelligence Model Builder in a web browser by entering the URL <https://localhost:61075>.

**Note:** The Intelligence Model Builder supports only Chrome web browser.

After the Intelligence Model Builder opens, it shows the upgraded JSON model from the MES 2014 R3 P02 or MES 2017 installation. The measures, dimensions, and data source are tagged in yellow, indicating that they are not deployed.

The screenshot shows the AVEVA BI Gateway Model Builder interface. On the left is a navigation sidebar with icons for Home, Import, Export All, Deploy All, Undeploy All, and Tutorial. The main area is divided into three sections: Measures, Dimensions, and Data Sources. The Measures section contains three items: MESRDBHourlyProduction (yellow), MESRDBHourlyUtilization (orange), and MESRDBProduction (orange). The Dimensions section contains ten items: MESRDBEquipmentDetail (light blue), MESRDBJobContext (light blue), MESRDBShiftHistory (light blue), MESRDCause (orange), MESRDBCharacteristic (orange), MESRDBItem (orange), MESRDBItemCategory (orange), MESRDBItemConsumption (orange), MESRDBItemProduction (orange), and MESRDBItemReason (orange). The Data Sources section contains one item: MESRDBMESDB (light blue).

17. To configure the MES Intelligence Reports data source, select the **MESRDBMESDB** data source object.
18. In the **General** tab in the right panel, enter the MES database name in the **Database name** field.

AVEVA® BI Gateway Model Builder

Dimensions 30

Data Sources 1

General Custom Queries

Name: MESRDBMESDB

Description: Intelligence DataSource Object

Data Adapter Service

Server name: localhost

Port: 8732

DataAdapter Type: Microsoft SQL Server Database

Data Source Configuration

Data Source time zone: (UTC) Coordinated Universal Time

Automatically adjust time for Daylight Savings:

Server name: localhost

Database name: MESDB

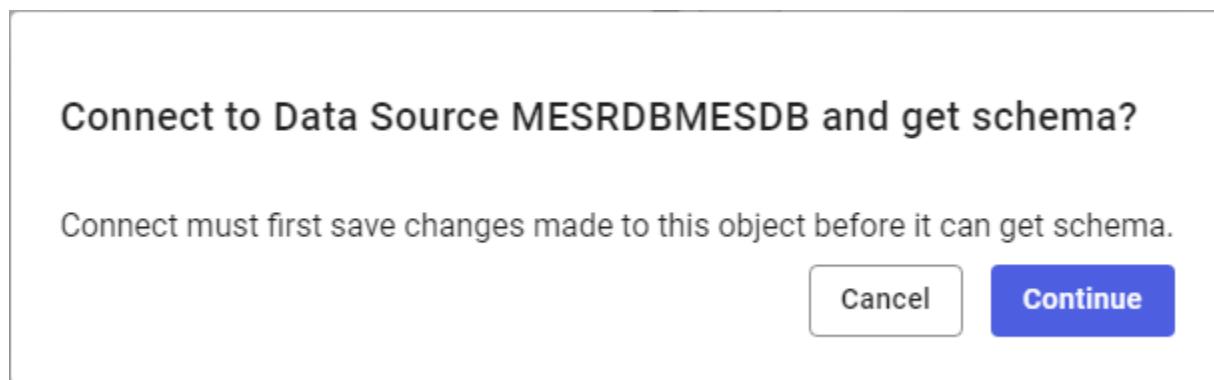
Windows Authentication    SQL Server Authentication

Azure Active Directory Authentication

Connect

19. Click **Connect**.

You are prompted whether you want to continue to connect to the data source and get the schema.



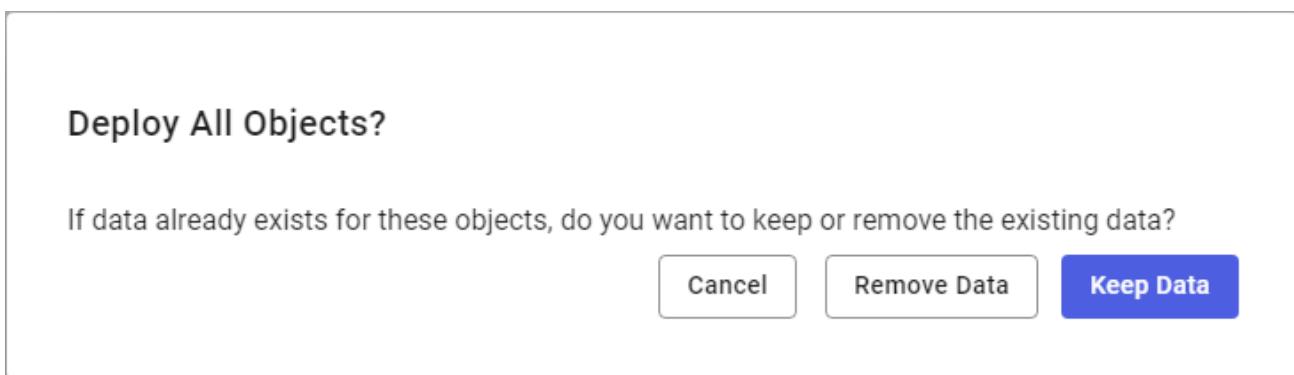
20. Click **Continue**.

21. When the schema has been retrieved, click **Done**.



22. In the Windows Services tool on the node on which Intelligence is installed, make sure the Intelligence Service is running.
23. On the main menu, click **Deploy All**.

You are prompted whether you want to deploy all objects.



24. To deploy all of the MES objects in the upgraded model and keep existing report data, click **Keep Data**.  
Note that if any custom changes were made to the dimensions or measures, Intelligence will remove the data and recreate it. This will be indicated by a message in the Operations Control Management Console Logger similar to the following:  
*Intelligence.Com... Measure MESRDBHourlyUtilization has been modified to the extent that its data will be deleted.*
25. When the objects have been deployed, click **Done**.

## Deploy All Objects

Deployment started for Measure MESRDBHourlyUtilization  
Deployment completed for Measure MESRDBHourlyUtilization  
Deployment preparation started for Measure MESRDBProduction  
Deployment preparation completed for Measure MESRDBProduction  
Deployment started for Measure MESRDBProduction  
Deployment completed for Measure MESRDBProduction  
Deployment completed successfully.

34/34

DONE

The measures, dimensions, and data source are tagged in blue, indicating that they are deployed.

### AVEVA® BI Gateway Model Builder

The screenshot shows the AVEVA BI Gateway Model Builder interface. On the left is a navigation sidebar with options: Home, Import, Export All, Deploy All, Undeploy All, and Tutorial. The main area is divided into three sections: Measures, Dimensions, and Data Sources. The Measures section contains three items: MESRDBHourlyProduction, MESRDBHourlyUtilization, and MESRDBProduction. The Dimensions section contains ten items: MESRDBEquipmentDetail, MESRDBJobContext, MESRDBShiftHistory, MESRDBCause, MESRDBCharacteristic, MESRDBItem, MESRDBItemCategory, MESRDBItemConsumption, MESRDBItemProduction, and MESRDBItemReason. The Data Sources section contains one item: MESRDBMESDB. Each item has a small colored icon next to it, and some have a blue border, indicating they are deployed.

26. You can close Intelligence Model Builder.

## MES Service Monitor

You can use the MES Service Monitor to start, stop, or restart the MES middleware host.

If the Work Tasks Connector for MES has been installed, it can also be started, stopped, or restarted from the Service Monitor.

## Starting and Exiting the Service Monitor

If the MES Middleware component was installed on the node, the MES Service Monitor is installed and its icon (shown below) is added to the system tray.



The Service Monitor allows users to start, stop, and restart the MES middleware host. If the Work Tasks Connector for MES has also been installed on the node, its service can also be started and stopped from the MES Service monitor. See [Starting, Stopping, and Restarting the MES Middleware Host](#).

### To exit the Service Monitor and remove it from the system tray

- Right-click the Service Monitor icon and click **Exit**.

Note that exiting the Service Monitor does not affect the state of the MES middleware host.

### To start the Service Monitor and add it to the system tray

- From the **Start** menu, open the **Service Monitor** app.



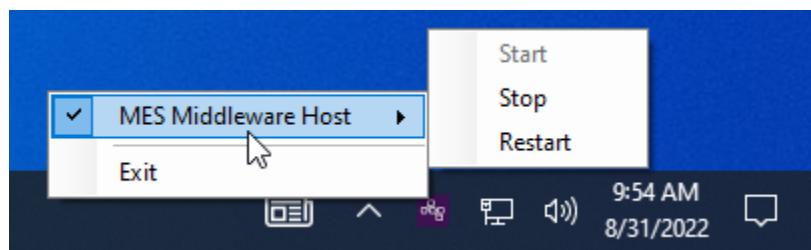
## Starting, Stopping, and Restarting the MES Middleware Host

You can manually start, stop, and restart the MES middleware host.

- Right-click the System Monitor icon on the system tray.



- Click **MES Middleware Host** and then click **Start**, **Stop**, or **Restart**.



## Running MES Install and Configurator from a Command Line

The MES install and Configurator commands allow you to install MES and configure the installed components from a command line. Installation and configuration settings are passed to the commands using XML-formatted

response files. The uninstall command allows you to uninstall MES from a command line.

To understand how these commands work, it is recommended that you read [Installing Wonderware MES](#) and [Configuring MES Components](#) to see how the MES installation and configuration is performed from a user interface.

Note the following about the MES install, Configurator, and uninstall commands:

- The commands must be run by a user with a Windows Administrator user account.
- Only a new MES install, an upgrade from a previous version, or an uninstall can be run from a command line. To modify or repair MES software, you must use either the Control Panel Programs and Features applet or the MES Setup tool.
- If you are upgrading MES using the install command, any MES applications that are currently running will be stopped before the installation is performed. Also, see the topics in [Preparing to Upgrade MES](#).
- Localization of the response files used with the install and Configurator commands is not supported.

## Prerequisite Software

During the installation process, the MES installation analyzes the software installed on the node. The installation will attempt to install missing prerequisite software, but some missing software might have to be installed manually. Any issues with prerequisite software will be entered in the Logger file for the MES product. See [Checking Installation Results in the MES Installation Logger File](#).

To avoid issues with missing prerequisite software during a command line installation, it is recommended that you install all prerequisite software before running the MES installation. For more information, see [MES Prerequisite Software](#).

## Command List File

The MES install folder **\InstallFiles\ResponseFiles** includes the file **Silent Installation\_Commands.txt**. This file includes entries that show the syntax of the MES install and uninstall commands, and Configurator command.

## MES Install Command

The MES install command syntax is:

`Setup.exe /silent /mingui install_response_file`

where

- **Setup.exe** is the file path (if needed) and file name of the MES Setup tool executable file.
- **/silent** is the switch that causes the installation to run in the background without a user interface.
- **/mingui** is an optional switch that, if included, runs the installation with minimum GUI.
- ***install\_response\_file*** is the file path (if needed) and file name of the XML response file that specifies what MES components to install. Only one response file can be entered.

For example:

```
C:\CD-MES>Setup.exe /silent response.txt
```

The command must be run by a user with a Windows Administrator user account.

## Install Response File XML Syntax

The install response file includes the following XML tags.

**<responsefile> </responsefile>**

The header tag that marks the file as a response file.

**<install> </install>**

The install tag includes the list of install settings.

Note the following about the install response file:

- Localization of the response file is not supported.
- Comment lines in the response file must be preceded by the hash (#) character.

## Install Settings

Install settings are included within the `<install>` tag. The install settings have the format:

*setting name=value*

The available settings are described below.

**FeatureForm.SInstallDir**

Optional. Specifies the target installation directory. If not included, the default installation directory is `C:\Program Files (x86)`.

**FeatureForm.SFeatureList**

The following values are supported:

- **All:** All MES components are installed.
- **A component list:** A list of the components to install, separated by commas. See [Install Response File Component Entries](#).

## Install Response File Component Entries

**MES.PDFDocs**

The MES user documentation PDF and help files.

**MES.Development**

The MES API DLLs.

**Client.Supervisor**

The MES Supervisor application.

**Client.Operator**

The MES Operator application.

**Client.EntityModelBuilder**

The MES Entity Model Builder.

**Client.AppObjects**

The MES application object files.

**Client.DataEditor**

The MES Data Editor application.

**Client.ClientFramework**

The MES Client application.

**Client.NETControls**

MES .NET controls.

**Client.MiddlewareProxy**

The MES middleware proxy.

**Server.WebPortal**

The MES Web Portal.

**Server.FactDB**

The MES database.

**Server.FactMiddle**

The MES middleware service.

**Reports.IntelligenceReports**

MES BI Gateway Reports.

**AVEVA BI Gateway.EMIAdapterCommon**

The BI Gateway Data Adaptors.

**AVEVA BI Gateway.EMIRuntime**

The BI Gateway Server.

**AVEVA BI Gateway.EmiModelConfig**

The BI Gateway Model Builder.

**AVEVA BI Gateway.PDFDocumentation**

The BI Gateway PDF documentation files.

**LicAPI32, LicAPI64**

The Licensing APIs.

**Licensing.AELicenseServer**

The License Server.

**Licensing.AELicenseManager**

The License Manager.

**AVEVA Single Sign-On Service.ASBRuntime**

The AVEVA Single Sign-On Service.

**AVEVA Single Sign-On Service.ASBServiceRepository**

The AVEVA Single Sign-On Service repository.

## Sample Install Response Files Provided

The MES install folder **\InstallFiles\ResponseFiles** includes the following sample response XML files. You can use these as a basis for the install response files required by the MES nodes on your system.

## Response\_AllProduct\_Install.txt

This response file installs all MES components.

```
<responsefile>
  <install>
    FeatureForm.SFeatureList=ALL
  </install>
</responsefile>
```

## Response\_SelectedFeatures.txt

This response file is a template for installing selected MES components.

```
<responsefile>
<install>
FeatureForm.SInstallDir=<Install directory>
FeatureForm.SFeatureList=<Feature list>
# Each feature name in the feature list should be in the format
ParentFeatureName.ChildFeatureName, separated by commas. For a complete list of feature names, see
the commented list below.
# List of features
# MES.PDFDocs, MES.Development,
# Client.Supervisor, Client.Operator, Client.EntityModelBuilder, Client.AppObjects,
Client.DataEditor, Client.ClientFramework, Client.NETControls, Client.MiddlewareProxy,
# Server.WebPortal, Server.FactDB, Server.FactMiddle,
# Reports.IntelligenceReports,
# AVEVA BI Gateway.EMIAdapterCommon, AVEVA BI Gateway.EMIRuntime, AVEVA BI Gateway.EmiModelConfig,
AVEVA BI Gateway.PDFDocumentation
# LicAPI32, LicAPI64
# Licensing.AELicenseServer
# Licensing.AELicenseManager
# AVEVA Single Sign-On Service.ASBRuntime
# AVEVA Single Sign-On Service.ASBServiceRepository
</install>
</responsefile>
```

## Checking Installation Results in the MES Installation Logger File

The installation results are recorded in the MES installation Logger file. The default location for this file is:

C:\Program Files (x86)\Common Files\ArchestrA\Install\
{3F836811-8203-46B1-9815-E1A27A78CFFE}\Log\{timestamp}.log

## MES Uninstall Command

The uninstall command syntax is:

Setup.exe /silentuninstall {3F836811-8203-46B1-9815-E1A27A78CFFE}

where

- **Setup.exe** is the file path (if needed) and file name of the MES Setup tool executable file.
- **/silentuninstall** is the switch that causes the uninstall to run in the background without a user interface.

- 3F836811-8203-46B1-9815-E1A27A78CFFE is the MES product GUID for the current version of MES.

The command must be run by a user with a Windows Administrator user account.

**Note:** Uninstalling MES from the command line will uninstall BI Gateway if the limited version of BI Gateway Server was installed as part of the MES installation. However, it does not uninstall License Manager. If you want to uninstall License Manager, it has to be uninstalled separately.

## Configurator Command

The Configurator command format is:

Configurator.exe /silent=true /action=add /feature=<component\_list> /response=Configurator\_response\_file  
where

- **Configurator.exe** is the post-install Configurator executable file. The default path for this file is:  
C:\Program Files (x86)\Common Files\ArchestrA.
- **/action=add** is the switch that causes the components to be configured.
- **/feature=component\_list** is the switch that specifies which components are being configured.
- **/response=Configurator\_response\_file** is the switch that specifies the file path (if needed) and file name of the response file that specifies the settings for the components being configured.

For example:

```
C:\Program Files (x86)\Common Files\ArchestrA\Configurator.exe /silent=true /action=add  
/feature=MES:WebPortal,MES:MiddlewareProxy /response=C:\response.txt
```

The command must be run by a user with a Windows Administrator user account.

## Configurator Response File XML Syntax and Component Properties

The Configurator response file includes the following XML tags.

**<responsefile> </responsefile>**

The header tag that marks the file as a response file.

**<configurator> </configurator>**

The Configurator tag includes the list of Configurator component properties. For the list of properties, see [MES Component Properties](#).

Note the following about the Configurator response file:

- Localization of the response file is not supported.
- Comment lines in the response file must be preceded by the hash (#) character.

## MES Component Properties

The MES component properties described in the following topics are included within the **<configurator>** tag of the Configurator response file. Properties are required unless they are indicated as optional.

The component property entries have the format:

*component\_property=value*

## MES Database Setup Component Properties

### Database Server, Name, and Authentication

#### **MES.FactDB.ServerName**

The name of the server that is hosting the MES database.

If this property is not specified, the server name defaults to the local server.

Supported server names include IP addresses (IPv4 and IPv6 addressing is supported), SQL server named instance conventions, and cluster names.

#### **MES.FactDB.DatabaseName**

The name of the MES database. If this property is not specified, the name defaults to **MESDB**.

#### **MES.FactDB.UseIntegratedSecurity**

Values are:

- **True:** Use Windows Integrated Security. The currently logged-in Windows user account will be used to access SQL Server. No user name or password has to be specified in the response file.
- **False:** Use SQL Server Authentication. Specify the appropriate SQL Server Authentication user name and password with the **UserName** and **DatabasePassword** properties.

When False, the **UseIntegratedSecurity** property must always precede the **UserName** and **DatabasePassword** properties. Otherwise, the False setting of this property will cause the values of the **UserName** and **DatabasePassword** properties to be cleared.

The default value True is used if this property is not specified.

#### **MES.FactDB.UserName**

If SQL Server Authentication is being used, the SQL user name.

#### **MES.FactDB.DatabasePassword**

If SQL Server Authentication is being used, the SQL user password.

### Advanced Properties

These properties are optional and apply only to new MES databases.

#### **MES.FactDB.DataFilePath**

The file path of the data file. See the installed version of SQL Server for the default data file path that is used if this property is not specified.

#### **MES.FactDB.DataFileSize**

The initial size, in MB, of the data file. The default value 30 is used if this property is not specified.

#### **MES.FactDB.DataFilePercentGrowth**

The percent by which to limit the percent growth of the data file. The default value 10 is used if this property is not specified.

#### **MES.FactDB.LogFilePath**

The file path of the log file. See the installed version of SQL Server for the default log file path that is used if this

property is not specified.

#### **MES.FactDB.LogFileSize**

The initial size, in MB, of the log file. The default value 30 is used if this property is not specified.

#### **MES.FactDB.LogFilePercentGrowth**

The percent by which to limit the percent growth of the log file. The default value 10 is used if this property is not specified.

## **Upgrading Properties**

These properties apply only when upgrading to a new version of MES.

#### **MES.FactDB.Overwrite**

Values are:

- **True:** If the MigrateData property is set to True, migrate the existing MES database to the new release.  
If the MigrateData property is set to False, overwrite the existing database with a new MES database.
- **False:** Keep the existing MES database with no changes. You might use this setting in case, for example, the named MES database already exists but was not expected to be there. The database would not be overwritten, but the upgraded MES would not be usable until a new MES database was created or the existing one was migrated.

The default value True is used if this property is not specified.

#### **MES.FactDB.MigrateData**

Values are:

- **True:** If the MES.FactDB.Overwrite property is True, migrate the existing MES database to the new release.
- **False:** If the MES.FactDB.Overwrite property is True, overwrite the existing database with a new MES database.

The default value True is used if this property is not specified.

#### **MES.FactDB.AggregateItemProduction**

Applies only if the Overwrite and MigrateData properties are set to True. Values are:

- **True:** If the existing MES database that you are migrating has the system parameters for recording distinct production records set, aggregate these records are aggregated into hourly records and distinct production records are disabled.
- **False:** Do not aggregate distinct production records.

The default value True is used if this property is not specified.

It is recommended to aggregate production records into hourly buckets, as this will improve the overall system performance for recording production and reporting on production data. In versions prior to MES version 4.5, recording distinct production records was required for reporting hourly KPIs, but this is no longer the case. You might still want distinct production records for other reasons, in which case set this property to False.

## MES DB/MW Communication Component Properties

### MES Production Database Connection String Properties

These properties specify the connection string that the MES middleware service will use to connect to SQL Server and the MES production database.

#### **MES.FactMiddle.ProductionServerName**

The name of the server that is hosting the MES production database.

If this property is not specified, the server name defaults to the node name if a connection string was not previously saved or to the server name entered for the previously saved connection string.

#### **MES.FactMiddle.ProductionDatabaseName**

The name of the MES production database.

If this property is not specified:

- If this is a new installation and the connection string has not been created yet, the name defaults to **MESDB**.
- If the connection string has been previously created or the database was migrated from a previous release, the actual database name is used.

#### **MES.FactMiddle.ProductionUseIntegratedSecurity**

Specifies which security method should be used to connect to the production database.

Values are:

- **True:** Use Windows Integrated Security. The currently logged-in Windows user account will be used to connect to SQL Server and the MES database. No user name or password has to be specified in the response file.
- **False:** Use SQL Server Authentication. Specify the appropriate SQL Server Authentication user name and password with the ProductionUserName and ProductionDatabasePassword properties.

When False, the ProductionUseIntegratedSecurity property must always precede the ProductionUserName and ProductionDatabasePassword properties. Otherwise, the False setting of this property will cause the values of the ProductionUserName and ProductionDatabasePassword properties to be cleared.

The default value True is used if this property is not specified.

#### **MES.FactMiddle.ProductionUserName**

If SQL Server Authentication is being used, the SQL user name.

#### **MES.FactMiddle.ProductionDatabasePassword**

If SQL Server Authentication is being used, the SQL user password.

#### **MES.FactMiddle.ProductionAdvancedSettings**

Optional. Used to append advanced settings to the database connection string.

The advanced settings allow you to set properties that affect the database connection behavior, such as tuning the connection to your environment or to set up database mirroring. For example, entering **Connect Timeout=300** would cause the connection to attempt to connect to the database for up to 300 seconds.

For a list of the SQL database connection properties that can be set, see the Microsoft [MSDN SqlConnectionStringBuilder Class](#) topic.

#### **MES.FactMiddle.ProductionSetPreferredMiddlewareHost**

Optional. If multiple MES middleware hosts are running in a multi-node environment, you can designate which one is the preferred middleware host for this database. To use the local middleware host, if one is installed, set this property to True. The default is False.

#### **MES.FactMiddle.ProductionDefaultTimeZoneId**

Optional. To change the time zone for the database, use this property to specify the new time zone. Unless it has been changed, the time zone defaults to that of the server on which the database is installed.

The time zone entry must be in the standard Windows time zone format [e.g., **(UTC-08:00) Baja California**]. You can see a list of time zones and their proper format using the following methods:

- In the post-install Configurator, in the **Default Time Zone** list on the **Production** tab of the MES DB/MW Communication component
- By running the following command in a Windows Command Prompt window: `tzutil /l`

### **MES Restore Database Connection String Properties**

These properties specify the connection string that the MES middleware service will use to connect to SQL Server and the MES restore database.

#### **MES.FactMiddle.EnableRestoreDatabase**

If MES is going to support a restore database, set this property to True. If not, set it to False.

If set to True, make sure that the restore database has already been created.

The default value False is used if this property is not specified.

#### **MES.FactMiddle.RestoreServerName**

The name of the server that is hosting the MES restore database.

If this property is not specified, the server name defaults to the node name if a connection string was not previously saved or to the server name entered for the previously saved connection string.

#### **MES.FactMiddle.RestoreDatabaseName**

The name of the MES restore database.

If this property is not specified:

- If this is a new installation and the connection string has not been created yet, the name defaults to **RestoreDB**.
- If the connection string has been previously created or the database was migrated from a previous release, the actual database name is used.

#### **MES.FactMiddle.RestoreUseIntegratedSecurity**

Specifies which security method should be used to connect to the restore database

Values are:

- **True:** Use Windows Integrated Security. The currently logged-in Windows user account will be used to connect to SQL Server and the MES database. No user name or password has to be specified in the response file.
- **False:** Use SQL Server Authentication. Specify the appropriate SQL Server Authentication user name and password with the **RestoreUserName** and **RestoreDatabasePassword** properties.

When False, the **RestoreUseIntegratedSecurity** property must always precede the **RestoreUserName** and **RestoreDatabasePassword** properties. Otherwise, the False setting of this property will cause the values of

the RestoreUserName and RestoreDatabasePassword properties to be cleared.

The default value True is used if this property is not specified.

#### **MES.FactMiddle.RestoreUserName**

If SQL Server Authentication is being used, the SQL user name.

#### **MES.FactMiddle.RestoreDatabasePassword**

If SQL Server Authentication is being used, the SQL user password.

#### **MES.FactMiddle.RestoreAdvancedSettings**

Optional. Used to append advanced settings to the database connection string.

The advanced settings allow you to set properties that affect the database connection behavior, such as tuning the connection to your environment or to set up database mirroring. For example, entering **Connect Timeout=300** would cause the connection to attempt to connect to the database for up to 300 seconds.

For a list of the SQL database connection properties that can be set, see the Microsoft [MSDN SqlConnectionStringBuilder Class](#) topic.

## **MES Middleware Service User Account Properties**

These properties specify:

- Whether to automatically set the minimum SQL permissions on the MES databases for the MES middleware service Windows user account
- If permissions will be set automatically, the admin user accounts that are authorized to set the permissions on the MES databases

#### **MES.FactMiddle.SetMinimalSqlPermissions**

Set this property to True to have the minimal SQL permissions set to allow the MES middleware service user account to perform the required operations on the MES databases.

If set to False, then you will have to manually set up the SQL permissions and assign them to the MES middleware service user account using the SQL Server Management Studio. For more information about the minimal SQL permissions that are needed, see [Assigning SQL Server Database Roles to the MES Middleware Service User Account](#).

The default value True is used if this property is not specified.

#### **MES.FactMiddle.ProductionAdminUseIntegratedSecurity**

Applies only if the SetMinimalSqlPermissions property is set to True.

Values are:

- **True:** Use Windows Integrated Security. The currently logged-in Windows user account will be used to set the MES middleware service user account SQL permissions for the MES production database. The user must have administrator privileges to set SQL permissions.
- **False:** Use SQL Server Authentication. Specify the appropriate SQL Server Authentication user name and password with the ProductionSecuritySqlUserName and ProductionSecuritySqlPassword properties.

When False, the ProductionAdminUseIntegratedSecurity property must always precede the ProductionSecuritySqlUserName and ProductionSecuritySqlPassword properties. Otherwise, the False setting of this property will cause the values of the ProductionSecuritySqlUserName and ProductionSecuritySqlPassword properties to be cleared.

The default value True is used if this property is not specified.

**MES.FactMiddle.ProductionSecuritySqlUserName**

If SQL Server Authentication is being used, the user name of the SQL user account that has administrator privileges to set SQL permissions for the MES production database.

**MES.FactMiddle.ProductionSecuritySqlPassword**

If SQL Server Authentication is being used, the password of the SQL user account that has administrator privileges to set SQL permissions for the MES production database.

**MES.FactMiddle.UseProductionCredentialsForRestore**

Applies only if the EnableRestoreDatabase property is set to True.

Values are:

- **True:** Use the same user account to set the MES middleware user service account SQL permissions for the MES restore database as the one being used for the production database.
- **False:** Use the user account specified by the RestoreAdminUseIntegratedSecurity, RestoreSecuritySqlUserName, and RestoreSecuritySqlPassword properties.

The default value True is used if this property is not specified.

**MES.FactMiddle.RestoreAdminUseIntegratedSecurity**

Applies only if the SetMinimalSqlPermissions property is set to True and the UseProductionCredentialsForRestore is set to False.

Values are:

- **True:** Use Windows Integrated Security. The currently logged-in Windows user account will be used to set the MES middleware service user account SQL permissions for the MES restore database. The user must have administrator privileges to set SQL permissions.
- **False:** Use SQL Server Authentication. Specify the appropriate SQL Server Authentication user name and password with the RestoreSecuritySqlUserName and RestoreSecuritySqlPassword properties.

When False, the RestoreAdminUseIntegratedSecurity property must always precede the RestoreSecuritySqlUserName and RestoreSecuritySqlPassword properties. Otherwise, the False setting of this property will cause the values of the RestoreSecuritySqlUserName and RestoreSecuritySqlPassword properties to be cleared.

The default value True is used if this property is not specified.

**MES.FactMiddle.RestoreSecuritySqlUserName**

If SQL Server Authentication is being used, the user name of the SQL user account that has administrator privileges to set SQL permissions for the MES restore database.

**MES.FactMiddle.RestoreSecuritySqlPassword**

If SQL Server Authentication is being used, the password of the SQL user account that has administrator privileges to set SQL permissions for the MES restore database.

**MES.FactMiddle.AIMHost**

The fully qualified domain name of the node on which the AVEVA Identity Manager is running.

**MES.FactMiddle.AIMHttpsPort**

The HTTPS port number for the Identity Manager.

The default HTTPS port number 443 is used if this property is not specified.

**MES.FactMiddle.ClientRegistrationUserName and MES.FactMiddle.ClientRegistrationUserPassword**

The user name and password of an admin account on the node on which the Identity Manager is running.

## Middleware Proxy Component Properties

**MES.MiddlewareProxy.MiddlewareHost**

The fully qualified domain name of the node on which the MES middleware is running.

If this property is not specified, it defaults to **localhost**, which is changed to the server name of the node during configuration.

**MES.MiddlewareProxy.HttpPort**

The HTTP port number for the MES middleware's WCFHostService account.

The default value 80 is used if this property is not specified.

The HTTP port is always used to retrieve the configuration settings regardless of the **MES.MiddlewareProxy.Protocol** property. You must change this value only when you cannot access port 80 through the firewall.

**MES.MiddlewareProxy.Protocol**

The communication protocol type used by the MES middleware communications. Values are **TCP** (the default if this property is not specified) or **HTTP**.

**MES.MiddlewareProxy.HttpsPort**

The HTTPS port number for the MES Web API.

The default HTTPS port number 443 is used if this property is not specified.

If you want to include multiple MES middleware servers with which the proxy will be able to communicate, include their settings for each property line separated by semi-colons, as shown below.

```
# Middleware Proxy Configuration
MES.MiddlewareProxy.MiddlewareHost=Srvr1.MES.ourorgdomain.com;Srvr2.MES.ourorgdomain.com
MES.MiddlewareProxy.HttpPort=80;80
MES.MiddlewareProxy.Protocol=TCP;TCP
MES.MiddlewareProxy.HttpsPort=443;443
```

## MES Web Portal Component Properties

### Update Feature Delegation Settings Property

**MES.WebPortal.UpdateFeatureDelegationSettings**

Specifies whether MES Web Portal delegate feature settings are retained in the MES Web Portal configuration file or updated in the **applicationHost.config** file.

Values are:

**True**

The Configurator will update the IIS **applicationHost.config** file with the proper MES Web Portal configuration settings, and remove those settings from the MES Web Portal **web.config** file. (The feature settings can only be included in one of these files, but not both. Otherwise, the MES Web Portal web site will not run.)

**False**

The Configurator does not update the IIS **applicationHost.config** file and leaves the conflicting feature settings in

the **web.config** file.

The default value True is used if this property is not specified.

If the setting is False, the configuration finishes but, to allow the MES Web Portal web site to run, a web administrator must then either:

- Change the setting for the conflicting feature delegations to Read/Write in IIS Manager, or
- Edit the IIS **applicationHost.config** file manually to set the feature settings to the appropriate MES Web Portal values and remove those settings from the MES Web Portal **web.config** file.

For instructions about how to set feature delegations in IIS Manager and how to manually modify the **applicationHost.config** file, refer to the IIS Feature Delegation topics on the Microsoft TechNet web site.

## Identity Manager Client Registration Properties

### **MES.WebPortal.AIMHost**

The fully qualified domain name of the node on which the Identity Manager is running.

### **MES.WebPortal.AIMHttpsPort**

The HTTPS port number for the Identity Manager.

A value for this property is required. The default entry is 443.

### **MES.WebPortal.ClientRegistrationUserName and MES.WebPortal.ClientRegistrationUserPassword**

The user name and password of an admin account on the node on which the Identity Manager is running.

### **MES.WebPortal.ExistingCertificateName**

The SSL certificate for MES Web Portal.

This entry is case-sensitive. The entry must match the capitalization of the actual certificate name.

### **MES.WebPortal.HttpsPort**

The HTTPS port for MES Web Portal.

The default HTTPS port number 443 is used if this property is not specified

### **MES.WebPortal.OverwriteSslCertificate**

A flag that indicates whether the SSL certificate should be overwritten for the HTTPS port number (true, the default) or not (false).

## MES BI Gateway Reports Component Properties

### **MES.IntelligenceReports.ServerName**

The server name on which the BI Gateway database is stored.

### **MES.IntelligenceReports.DatabaseName**

The name of the BI Gateway database.

### **MES.IntelligenceReports.UseIntegratedSecurity**

Values are:

- **True:** Use Windows Integrated Security. The currently logged-in Windows user account will be used to access SQL Server. No user name or password has to be specified in the response file.
- **False:** Use SQL Server Authentication. Specify the appropriate SQL Server Authentication user name and

password with the IntelligenceNodeUserName and IntelligenceNodePassword properties.

The default value True is used if this property is not specified.

**MES.IntelligenceReports.IntelligenceNodeUserName**

If SQL Server Authentication is being used, the SQL user name.

**MES.IntelligenceReports.IntelligenceNodePassword**

If SQL Server Authentication is being used, the SQL user password.

**MES.IntelligenceReports.TargetReportServer**

The server name on which the target report server is running.

**MES.IntelligenceReports.VirtualFolder**

The name of the report server's virtual folder.

**MES.IntelligenceReports.TargetReportFolder**

The name of the target report folder for the MES reports.

**MES.IntelligenceReports.UseCurrentUserWindowsCredentials**

Values are:

- **True:** The currently logged-in Windows user account will be used to access the report server on which to deploy the MES reports. No user name or password has to be specified in the response file.
- **False:** The Windows user account specified by the ReportingServicesNodeDomain, ReportingServicesNodeUserName, and ReportingServicesNodePassword properties will be used to access the report server on which to deploy the MES reports.

The default value True is used if this property is not specified.

**MES.IntelligenceReports.ReportingServicesNodeDomain**

If UseCurrentUserWindowsCredentials is False, the domain for the SQL user account.

**MES.IntelligenceReports.ReportingServicesNodeUserName**

If UseCurrentUserWindowsCredentials is False, the SQL user name.

**MES.IntelligenceReports.ReportingServicesNodePassword**

If UseCurrentUserWindowsCredentials is False, the SQL user password.

## Licensing Component Properties

**AVEVA Enterprise Licensing Platform.LicAPI2.NewServerName**

The host name of the License Server node. The default value is localhost.

**AVEVA Enterprise Licensing Platform.LicAPI2.NewPortNumber**

The License Server port number. The default value is 55555.

**AVEVA Enterprise Licensing Platform.LicAPI2.NewAgentPortNumber**

The License Server Agent port number. The default value is 59200.

## System Management Server Properties for AVEVA Single Sign-On Service

**Common Platform.ASBRuntime.HttpPort**

The common platform HTTP port that is used to communicate with certain AVEVA software. The default is 80.

**Common Platform.ASBRuntime.HttpsPort**

The common platform HTTPS port that is used to communicate with certain AVEVA software. The default is 443.

**Common Platform.ASBRuntime.ManagementServerPort**

The port used to communicate with the System Management Server. The default entry is 443.

**Common Platform.ASBRuntime.ManagementServerName**

The fully qualified domain name of the System Management Server.

**Common Platform.ASBRuntime.AsbManagedCertificates**

A flag that indicates whether the System Management Server will manage certificates. The default is true.

**Common Platform.ASBRuntime.BindingCertificateThumbprint**

Optional. The thumbprint of the binding certificate. This property is required only if **AsbManagedCertificates** = false. Otherwise, remove this property.

**Common Platform.ASBRuntime.UserName and Common Platform.ASBRuntime.Password**

Optional. The user name and password of a user account that has access to System Management Server.

These properties are not required if the currently logged-in user is authorized to access the System Management Server. You can remove these two properties if they are not required.

**Common Platform.ASBRuntime.IsRedundantSsoServer**

A flag that indicates that, if the System Management Server is on a remote machine, configure this machine as a redundant SSO server. The default is true.

**Common Platform.ASBRuntime.SuitelinkMixedModeEnabled**

A flag that, if false, indicates that SuiteLink accepts only encrypted connection requests. If true, it indicates that SuiteLink accepts both encrypted and unencrypted connection requests (recommended only during upgrade scenarios or for supporting legacy applications). The default is false.

**Common Platform.ASBRuntime.NmxAllowAllUsers**

A flag that, if false, indicates that only authorized users can use NMX. If true, indicates that all users can use NMX (not recommended). The default is false.

## BI Gateway Components

### BI Gateway Server

**AVEVA BI Gateway.EMIRuntime.StorageType**

Data store storage type. The default and only option supported by MES is **SQL Server**.

**AVEVA BI Gateway.EMIRuntime.DSServerName**

The name of the server on which the BI Gateway database is stored. The default is **localhost**.

**AVEVA BI Gateway.EMIRuntime.DatabaseName**

The name of the BI Gateway database. The default is the name of the existing BI Gateway database. Otherwise, the default is **BIGateway\_DataStore**.

**AVEVA BI Gateway.EMIRuntime.AuthenticationMode**

The default and only option is **Windows Integrated Security**. The currently logged-in Windows user account will be used to access SQL Server. No user name or password has to be specified in the response file.

**AVEVA BI Gateway.EMIRuntime.DataFilePath**

The file path at which to store the datalog file. The default path depends on the version of SQL Server. An example is C:\Program Files\Microsoft SQL Server\MSSQL11.MSSQLSERVER\MSSQL\DATA.

**AVEVA BI Gateway.EMIRuntime.LogFilePath**

The file path at which to store the log file. The default path depends on the version of SQL Server. An example is C:\Program Files\Microsoft SQL Server\MSSQL11.MSSQLSERVER\MSSQL\DATA.

**AVEVA BI Gateway.EMIRuntime.UserName**

The username of the user account under which the BI Gateway Server service runs.

**AVEVA BI Gateway.EMIRuntime.Password**

The password of the user account under which the BI Gateway Server service runs.

**AVEVA BI Gateway.EMIRuntime.Domain**

The domain of the user account under which the BI Gateway Server service runs.

## Data Adapter

**AVEVA BI Gateway.EMIAdapterCommon.RuntimeServicePort**

The number of the service port over which the BI Gateway Server and Data Adapter will communicate. The default is **8732**.

**AVEVA BI Gateway.EMIAdapterCommon.UserName**

The username of the user account under which the BI Gateway Data Adapter service runs.

**AVEVA BI Gateway.EMIAdapterCommon.Password**

The password of the user account under which the BI Gateway Data Adapter service runs.

**AVEVA BI Gateway.EMIAdapterCommon.Domain**

The domain of the user account under which the BI Gateway Data Adapter service runs.

## BI Gateway Model Builder

**AVEVA BI Gateway.EmiModelConfig.ModelApiPortNo**

The number of the service port over which the BI Gateway Event API service will communicate. The default is **61076**.

**AVEVA BI Gateway.EmiModelConfig.ModelBuilderPortNo**

The number of the service port over which the BI Gateway Model Builder service will communicate. The default is **61075**.

**AVEVA BI Gateway.EmiModelConfig.AddIntelligenceModelConfigUserToGroup**

Values are:

- True:** The default. The currently logged-in user will be added to the aaIntelligenceConfigAdmin Windows group, which has Read/Write access to BI Gateway Model Builder. If additional users need to run BI Gateway Model Builder, they can be manually added to this group.
- False:** The currently logged-in user will not be added to the aaIntelligenceConfigAdmin Windows group. If this option is selected, one or more users will have to be manually added to this group so that they can run BI Gateway Model Builder.

## Template Configurator Response File for MES

The MES install folder **\InstallFiles\ResponseFiles** includes the template Configurator response file **Response\_Silent\_Configuration.txt**. You can use the contents of this file as a basis for the Configurator response files required by the MES nodes on your system.

## Upgrading MES Development Components

To support using MES in custom applications, the MES development components must be upgraded when upgrading MES from a previous version.

## Upgrading the MES Client API Script Libraries

The MES Client API Wrapper is delivered in the following files.

### **aaFactMES.aaSLIB**

This file contains the Stateful API Wrapper.

### **aaMES.aaSLIB**

This file contains the Stateless API Wrapper.

You can import these files into Application Server so that the Client API Wrappers can be used in Application Server scripting. Wrapper files from any previous version can be upgraded.

The Application Server does not fully support upgrading the MES Client API (aaFactMES) script library. To upgrade from a previous version, you must manually upgrade the library on the Application Server. You must also ensure that all the deployed objects that are using these scripts are properly upgraded.

### **To upgrade the MES Client API script library on the Application Server**

1. In the System Platform IDE, undeploy the AppEngine that contains objects that are using an earlier version of the aaFactMES or aaMES script libraries.

For detailed information on managing objects in the System Platform IDE, refer to the System Platform IDE help.

2. To import the script library file, do the following:

- a. Click the **Galaxy** menu, point to **Import**, and then click **Script Function Library**.

The Import Script Function Library dialog box appears.

- b. In the MES application folder, browse to the **Controls** folder.

If the MES .NET Controls component was not installed on this node, you can copy the wrapper files from another node on which it was installed to the local **MES\Controls** folder.

- c. In the File Type list to the right of the **File name** box, select **Script Library Files (\*.aaSLIB)**.

- d. Click the **aaFactMES.aaSLIB** file, and then click **Open**.

The script library is imported and a success message appears.

You must import **aaMES.aaSLIB** file using the same procedure.

- e. Click **OK**.

3. Right-click the corresponding template or object, and then click **Validate**.

You must validate all the objects that are using the script library. The derived templates that use the script library must be validated first.

4. Redeploy the AppEngine and associated objects.

## Upgrading MES .NET Controls for AVEVA OMI Apps

If your System Platform IDE includes an OMI App that contains MES .NET controls, that OMI App must be deleted and recreated using the current version of the MES .NET controls.

1. Perform the MES version upgrade, which should include the .NET controls.
2. In the System Platform IDE Graphic Toolbox, locate the OMI App object that contains MES .NET controls and delete it.
3. In Windows File Explorer, navigate to the **MES** application folder.
4. Locate the MES .NET controls folder that was the source folder used during the .NET controls import for the OMI App.

Typically, this folder was created by making a copy of the **MES\Controls** folder and naming it with the name of the OMI App for which it was created (e.g., **MESControlsForOMI**).

5. Delete this .NET controls folder.
6. In the System Platform IDE, perform the Import OMI App operation and select the new OMI App folder with the updated MES .NET controls—**MES\MES OMI Controls**— to recreate the OMI App object with those controls.

## Upgrading MES .NET Controls for AVEVA InTouch HMI Applications

If your organization is using MES .NET controls in System Platform for InTouch HMI applications, you have to first remove the previous version of the MES .NET controls before upgrading to the current version of the controls.

1. Perform the MES version upgrade.
2. Open the System Platform IDE and make a list of the MES controls in the toolbox folder that are being used in each galaxy.
3. Delete the MES controls from the toolbox folder in each galaxy.

The MES .NET control DLLs are removed from the default System Platform application folders in which they were stored. These folders are:

- **\ArchestrA\Framework\Bin**
  - **\ArchestrA\Framework\FileRepository\<galaxy\_name>\Vendors**
4. Exit the System Platform IDE.
  5. In Windows Explorer, perform a recursive search for the names of the MES .NET controls within the **\ArchestrA** application folder to make sure that they were deleted.

For example, if you deleted the SampleViewer control, search for the name of the control, **SampleViewer**. Each imported control will have a folder with a name in the format **Invensys\_Systems\_\_Inc\_\_FactMES.Controls.<control\_name>**.

6. Delete any of the MES .NET control DLL folders that are found in the **\ArchestrA** application folder but **not** the DLL files in the **\MES\Controls** installation folder.

7. Restart the System Platform IDE.
8. Import the MES controls package that was installed with the new release into each galaxy.

By default, the MES .NET controls are installed at in the **Controls** folder of the **MES** application folder. All the DLL files present in the **MES\Controls** directory are enclosed in the **MESControls.aaPKG** file. You can import individual DLL files or import all the .NET controls into the System Platform IDE by importing the **MESControls.aaPKG** file.

For detailed information about importing .NET controls into System Platform IDE, see the *MES .NET Controls Developer Guide*.

9. If using the MES Stateless or Stateful APIs, reimport these script libraries.

## Modifying, Repairing, and Uninstalling MES

You can modify which MES products or components are installed, repair the MES installation, or uninstall MES.

### Modifying What MES Products or Components Are Installed

You can add and/or remove products or components by modifying the installation.

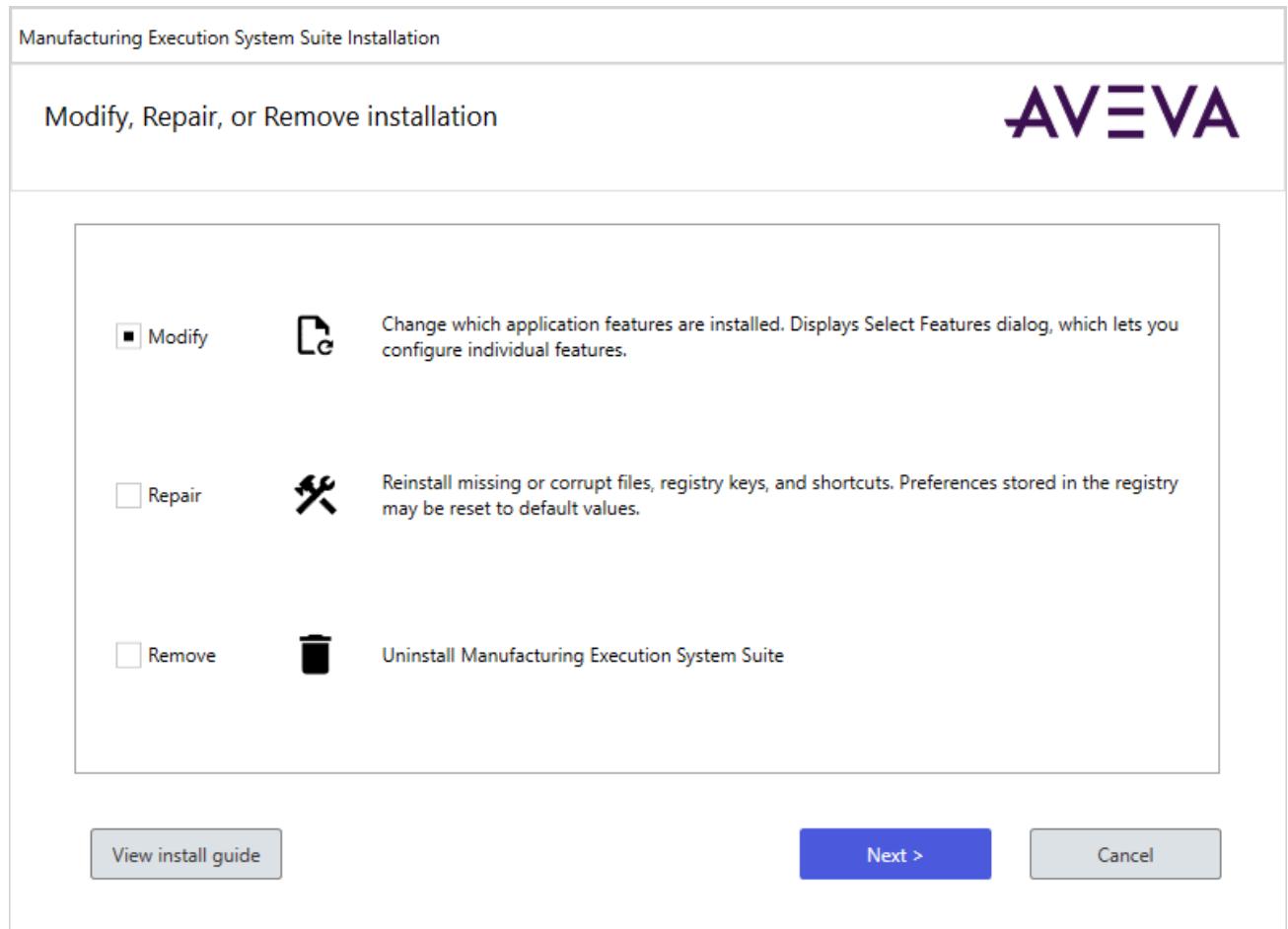
To remove MES from the node entirely, see [Uninstalling MES](#).

If you remove MES Web Portal, the existing Web Portal content will be backed up to save any custom web files. For more information, see [What Happens to MES Web Portal Customization Files During an Uninstall](#).

#### To add or remove MES products or components

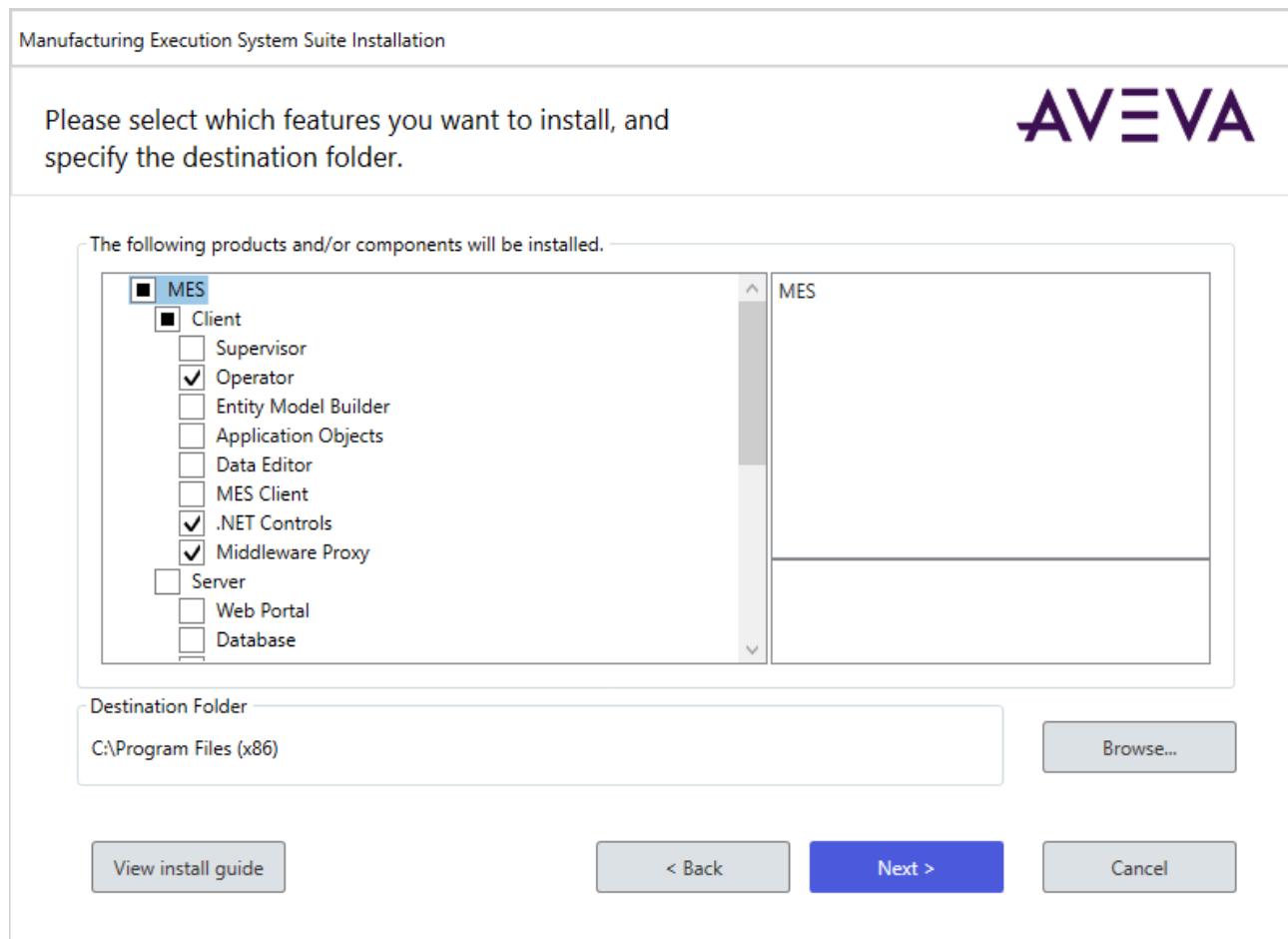
1. From the node, do one of the following:
  - In the Control Panel Programs and Features applet, select **Manufacturing Execution System** and click **Change or Uninstall/Change** on the toolbar.
  - Run the **Setup.exe** file in the MES installation root folder.

The Setup tool options appear.



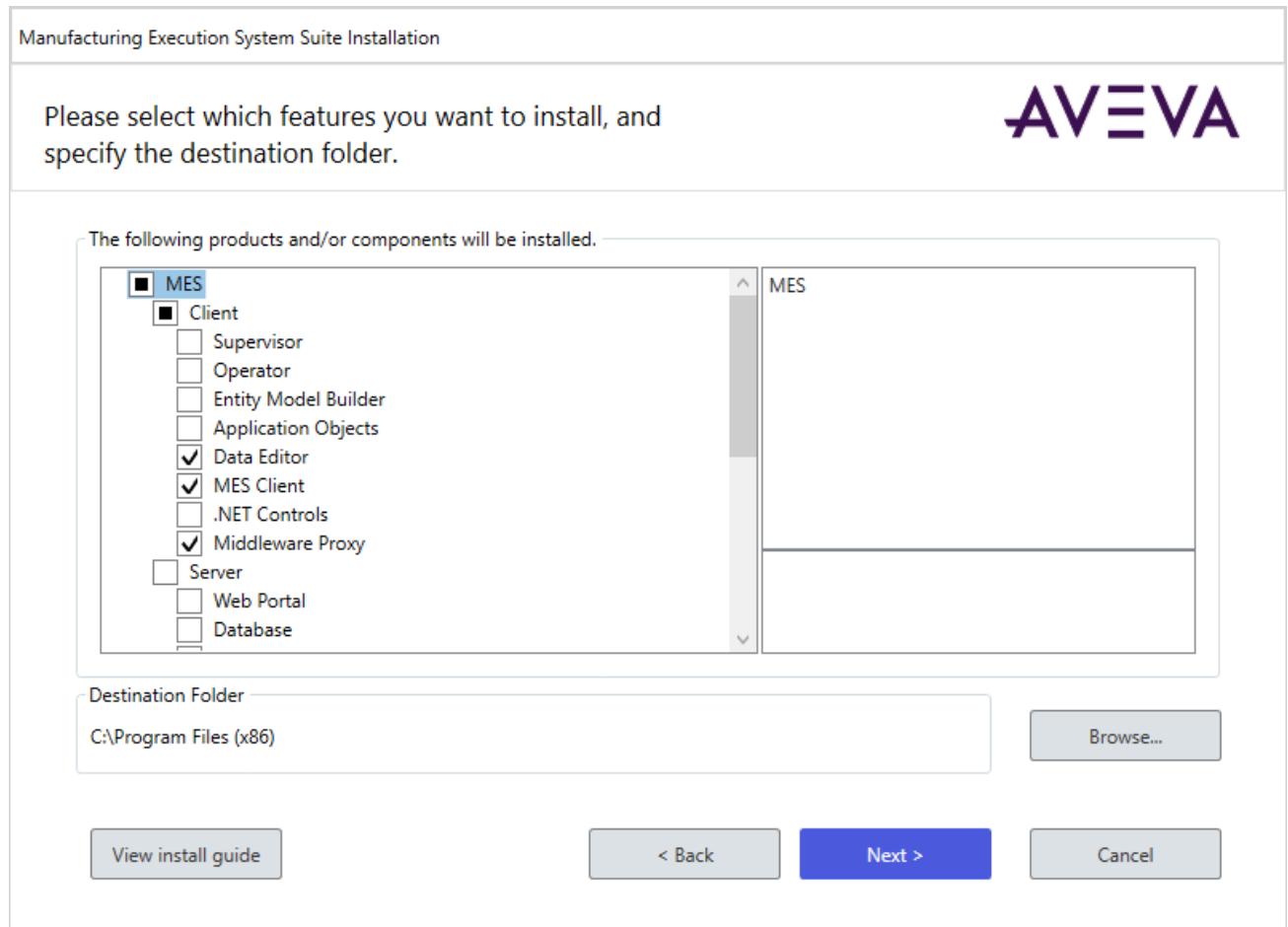
2. Select **Modify**, and then click **Next**.

The list of MES products and components appears. The check boxes of products and components that are currently installed are selected by default. For example, the figure below indicates that only the Operator Client role components are currently installed.



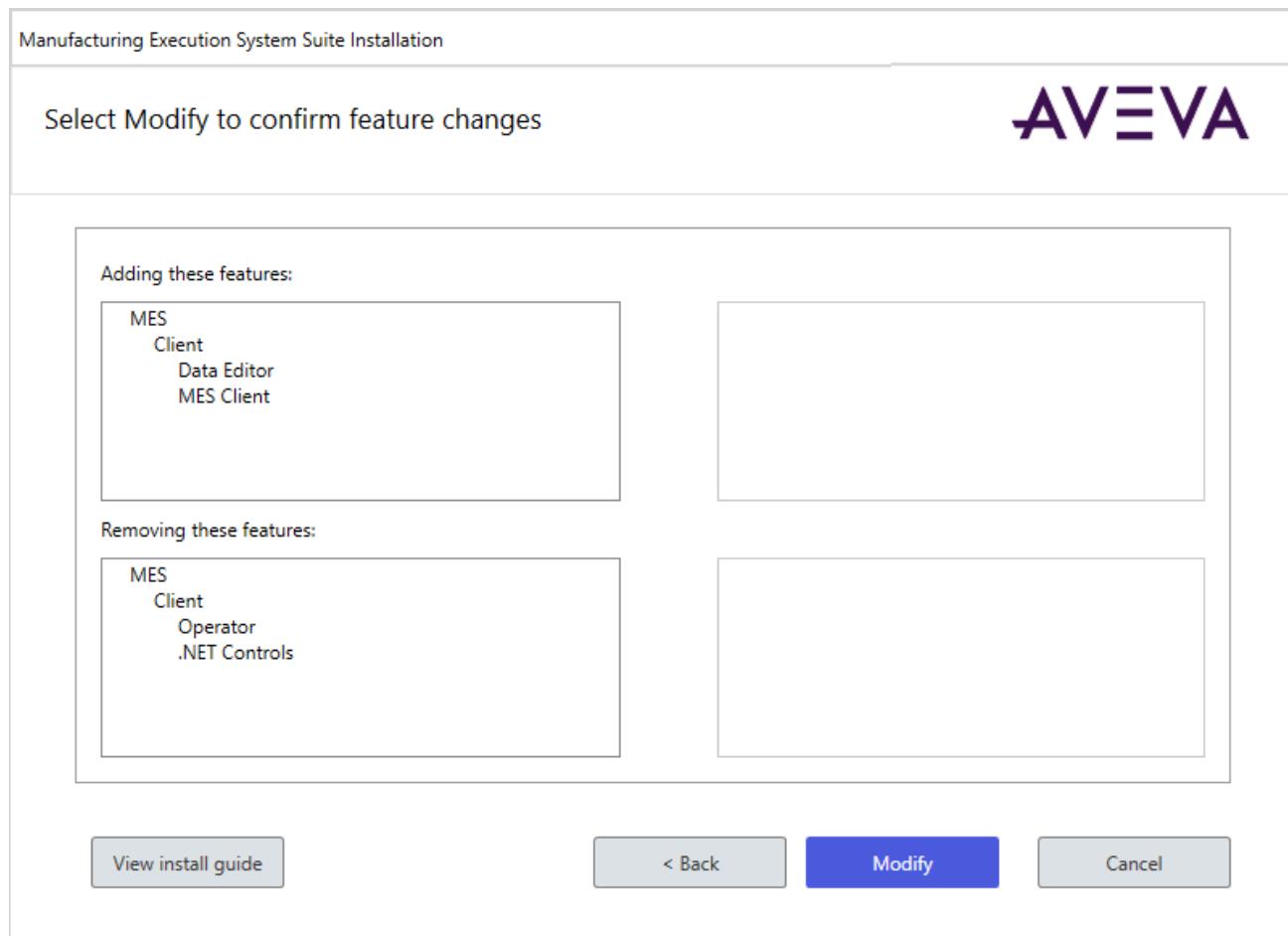
3. Select the check boxes of only those products and components that you want to have installed at the conclusion of the Modify operation.

Only those products and components that have been selected will be installed. If a product or component was previously installed but you have cleared its check box here, that product or component will be uninstalled. Following the example provided in the previous step, the figure below indicates that the Operator Client role components will be uninstalled while components related to the Configuration Client role will be installed.



- When you have finished selecting the products and components to be installed or remain installed, click **Next**.

The Modify confirmation screen appears.



5. To continue with the installation modification, click **Modify**.

A list of the prerequisite software that must be installed on the node prior to performing the MES installation modification appears.

6. If any of the required software is not installed on the local node, click the **Install Prerequisites** button to install them.

If you have not installed the prerequisite software for certain MES features that the Setup tool cannot install automatically for you, a message appears to indicate this condition. You must click **Cancel** to exit the MES Setup tool and install the prerequisite software before modifying the MES software. For more information about prerequisite software, see [MES Prerequisite Software](#).

7. If all prerequisite software is installed on the local node, click **Next**.

If any applications that might conflict with the installation are running, a list of them appears.

Manufacturing Execution System Suite Installation

## Close Running Applications

The following applications are using files which the installer must update. Close the applications and click "Try Again". Click "Next" when there are no conflicts so that the installer continues the installation and replaces system files when your system restarts.

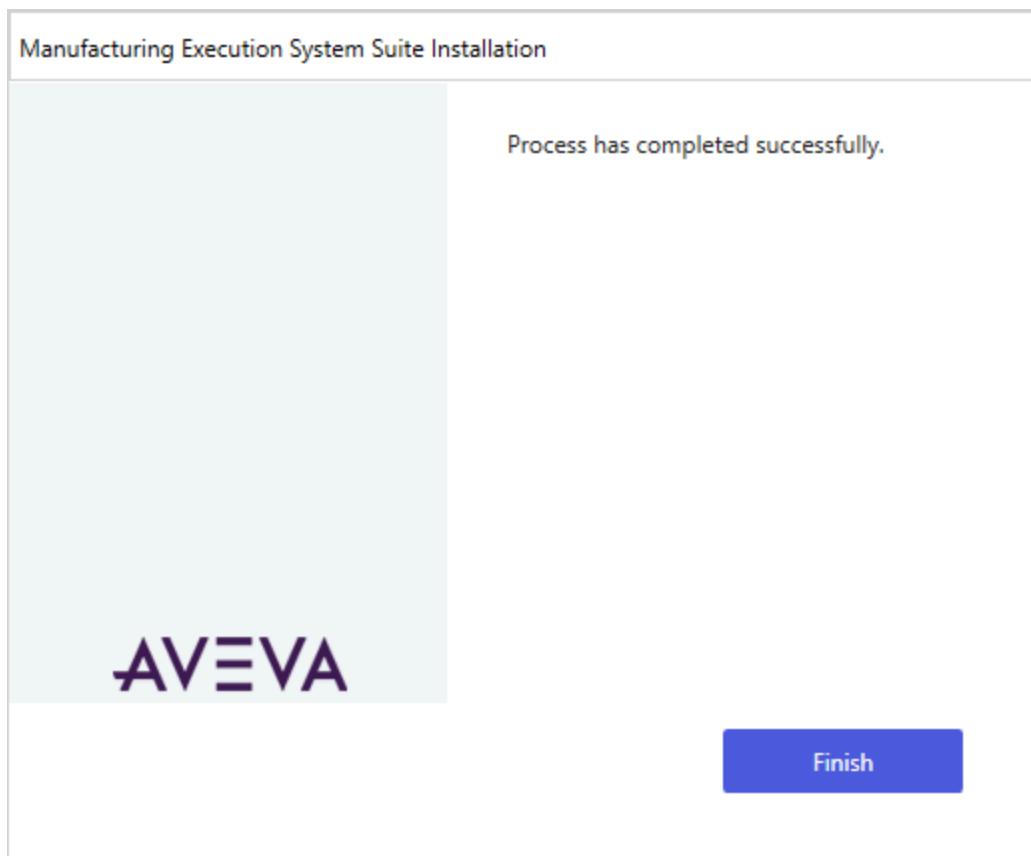
Process Name	Description	Id
ServiceMonitor	MES Service Monitor	4148
FactMES.Server.Host	MES Middleware Host	5852

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[View install guide](#) [Try Again](#) [Next >](#) [Cancel](#)

8. Close the applications, then click the **Try Again** button to see if there are still any conflicts.
  - If there are still conflicting applications running, close them and click the **Try Again** button.
  - If there are no conflicting applications, click **Next**.

The installation modification begins. The following screen appears when it completes successfully.



9. To close the Setup tool, click **Finish**.

If you installed any of the following components, you must configure them using the Configurator:

- MES Database
- MES Middleware
- MES Middleware Proxy
- MES Web Portal
- Report Server components

For information about how to configure the MES components, refer to the appropriate topics in [Configuring MES Components](#).

## Post-Uninstall Tasks

For possible post-uninstall tasks you might have to perform, see [Tasks to Perform After MES Components Have Been Removed](#).

## Repairing the Installation

If files or registry entries of an installed instance of the software are corrupted or missing, you can repair the installation.

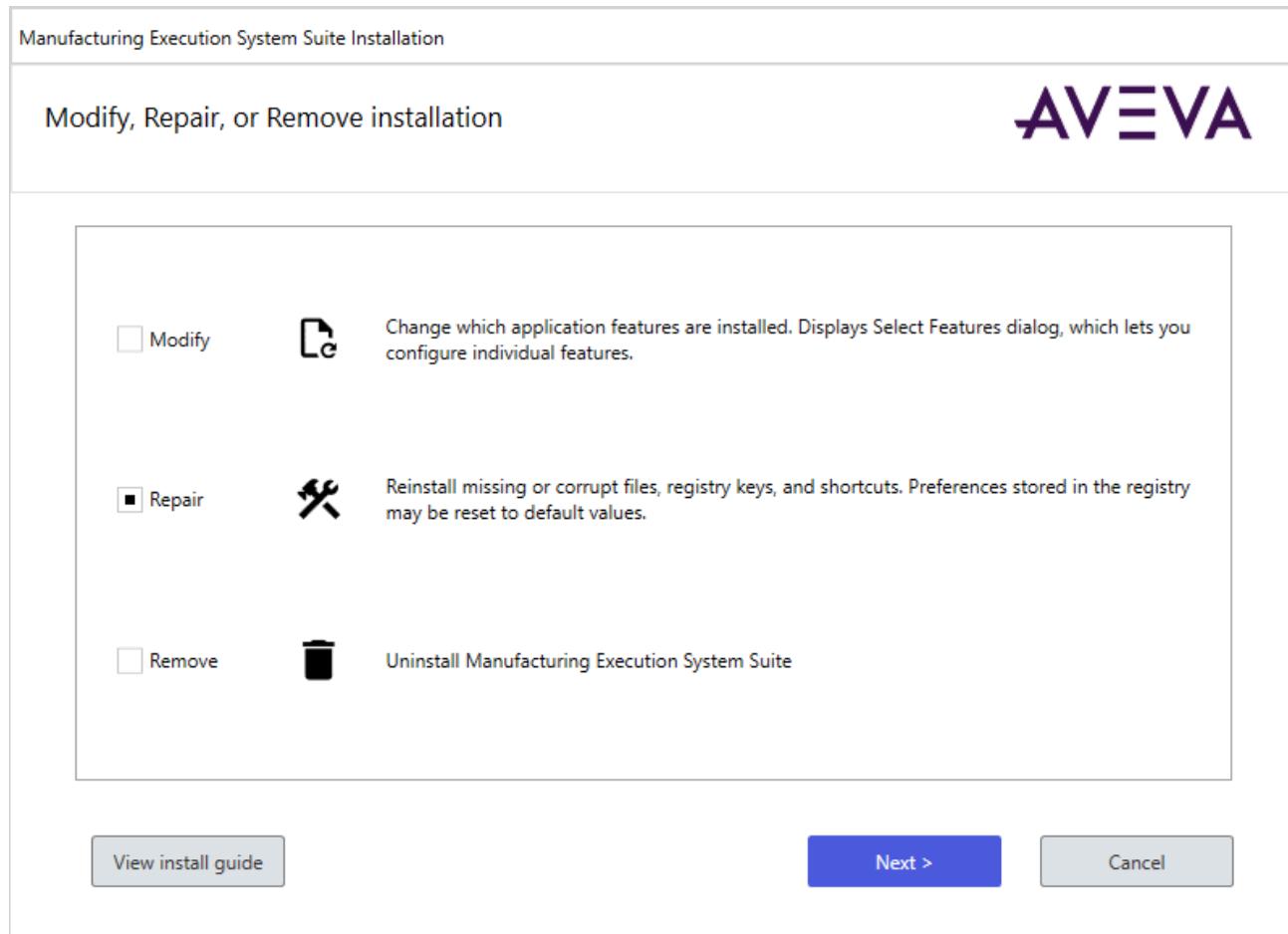
## To repair the MES installation

- From the node, do one of the following:

- In the Control Panel Programs and Features applet, select **Manufacturing Execution System** and click **Repair or Uninstall/Change** on the toolbar.
- Run the **Setup.exe** file in the MES installation root folder.

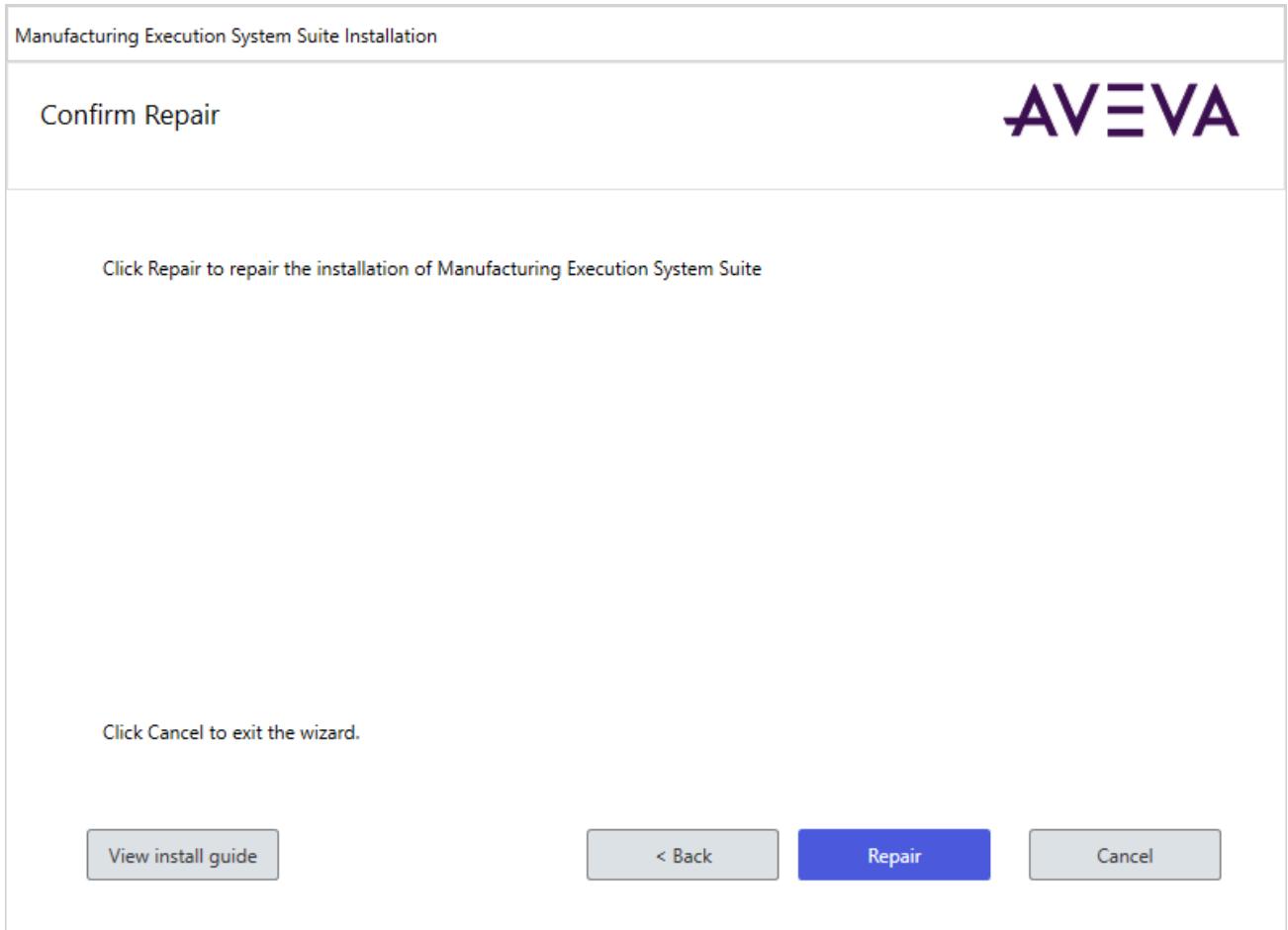
**Note:** If you have installed BI Gateway from the MES Setup tool, you must run the Repair operation from the Control Panel Programs and Features applet. Running the Repair operation from the **Setup.exe** file will not successfully repair the installation.

The Setup tool options appear.



- Select **Repair**, and then click **Next**.

The Repair confirmation screen appears.



3. Click **Repair**.

If any applications that might conflict with the installation repair are running, a list of them appears.

Manufacturing Execution System Suite Installation

## Close Running Applications

The following applications are using files which the installer must update. Close the applications and click "Try Again". Click "Next" when there are no conflicts so that the installer continues the installation and replaces system files when your system restarts.

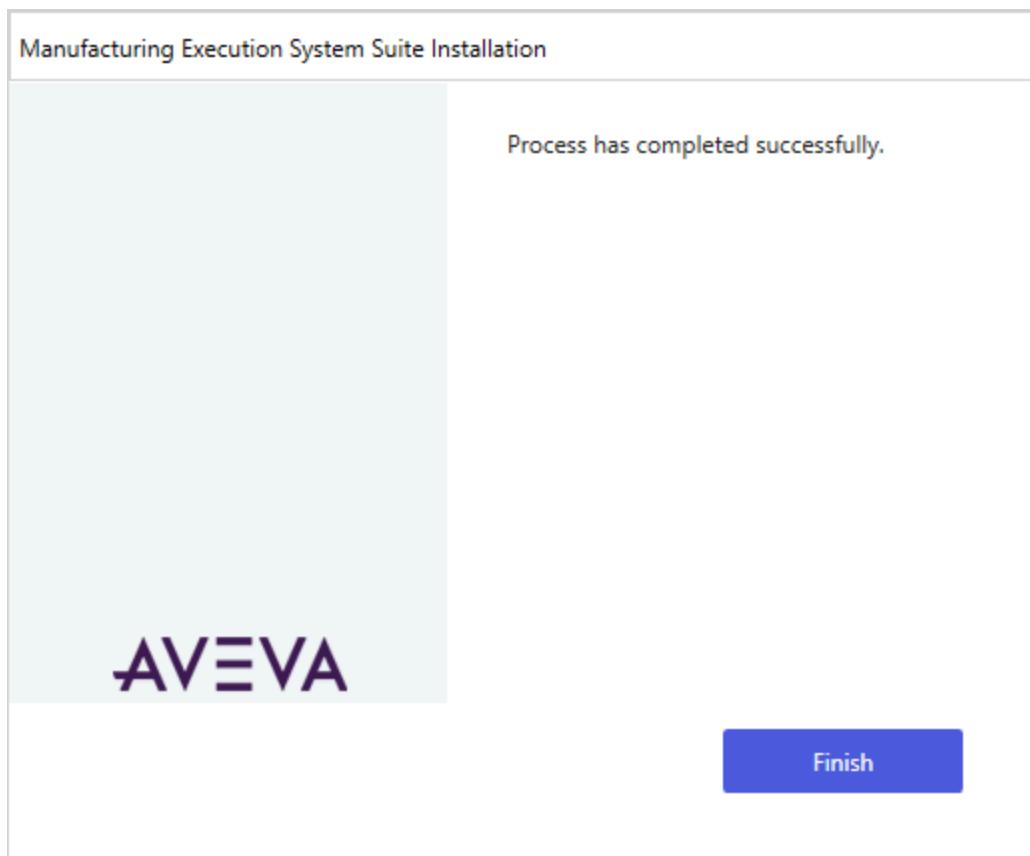
Process Name	Description	Id
ServiceMonitor	MES Service Monitor	4148
FactMES.Server.Host	MES Middleware Host	5852

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4. Close the applications, then click the **Try Again** button to see if there are still any conflicts.
  - If there are still conflicting applications running, close them and click the **Try Again** button.
  - If there are no conflicting applications, click **Next**.

The installation repair begins. The following screen appears when it completes successfully.



5. To close the Setup tool, click **Finish**.

## Uninstalling MES

You can remove all the MES products and components installed on a node.

To remove only certain products or components on the node, see [Modifying What MES Products or Components Are Installed](#).

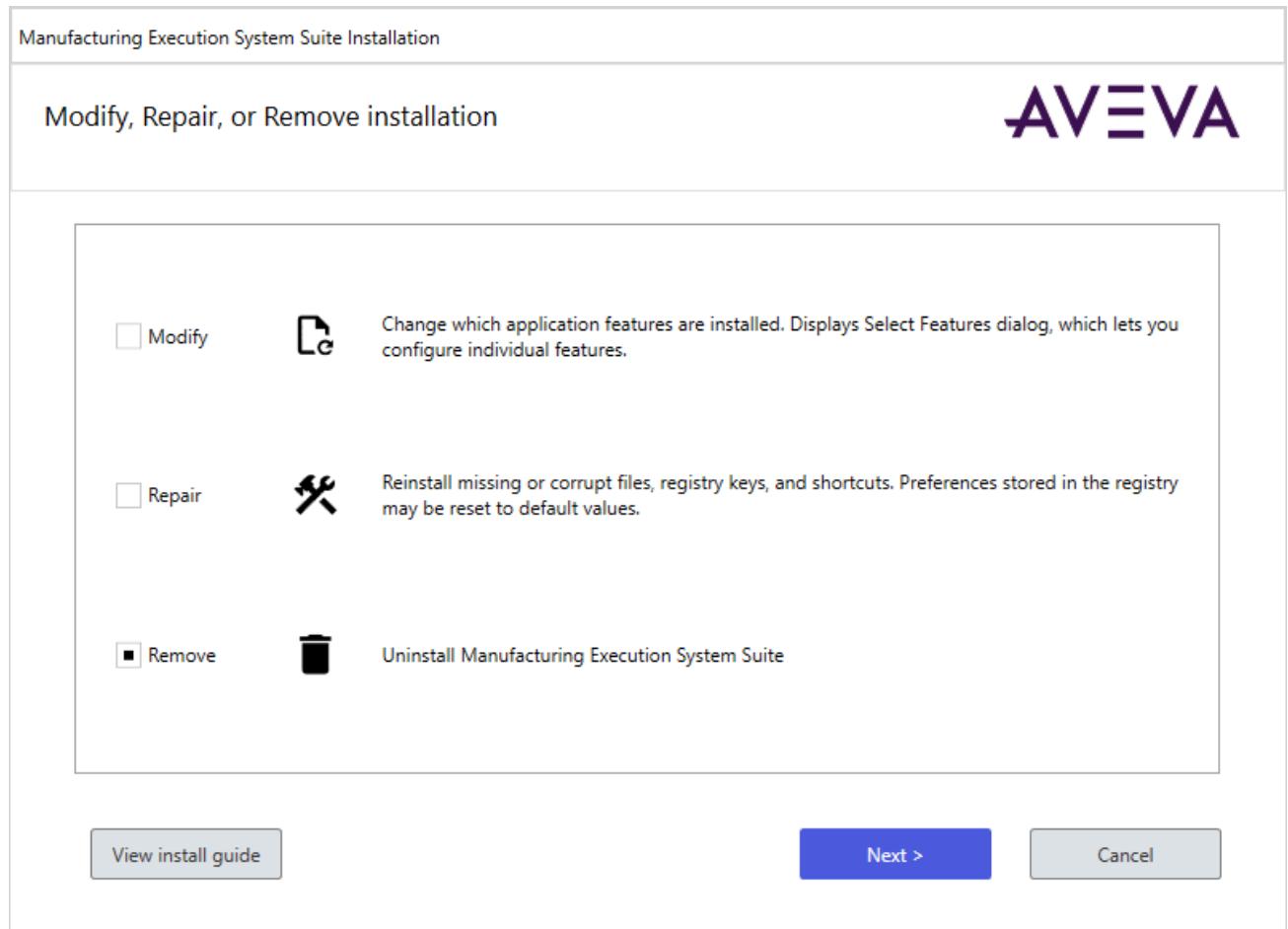
**Note:** Uninstalling MES from the Control Panel or using the Setup tool does not uninstall License Manager or BI Gateway. If you want to uninstall those products, they have to be uninstalled separately.

### To uninstall MES on a node

1. From the node, do one of the following:

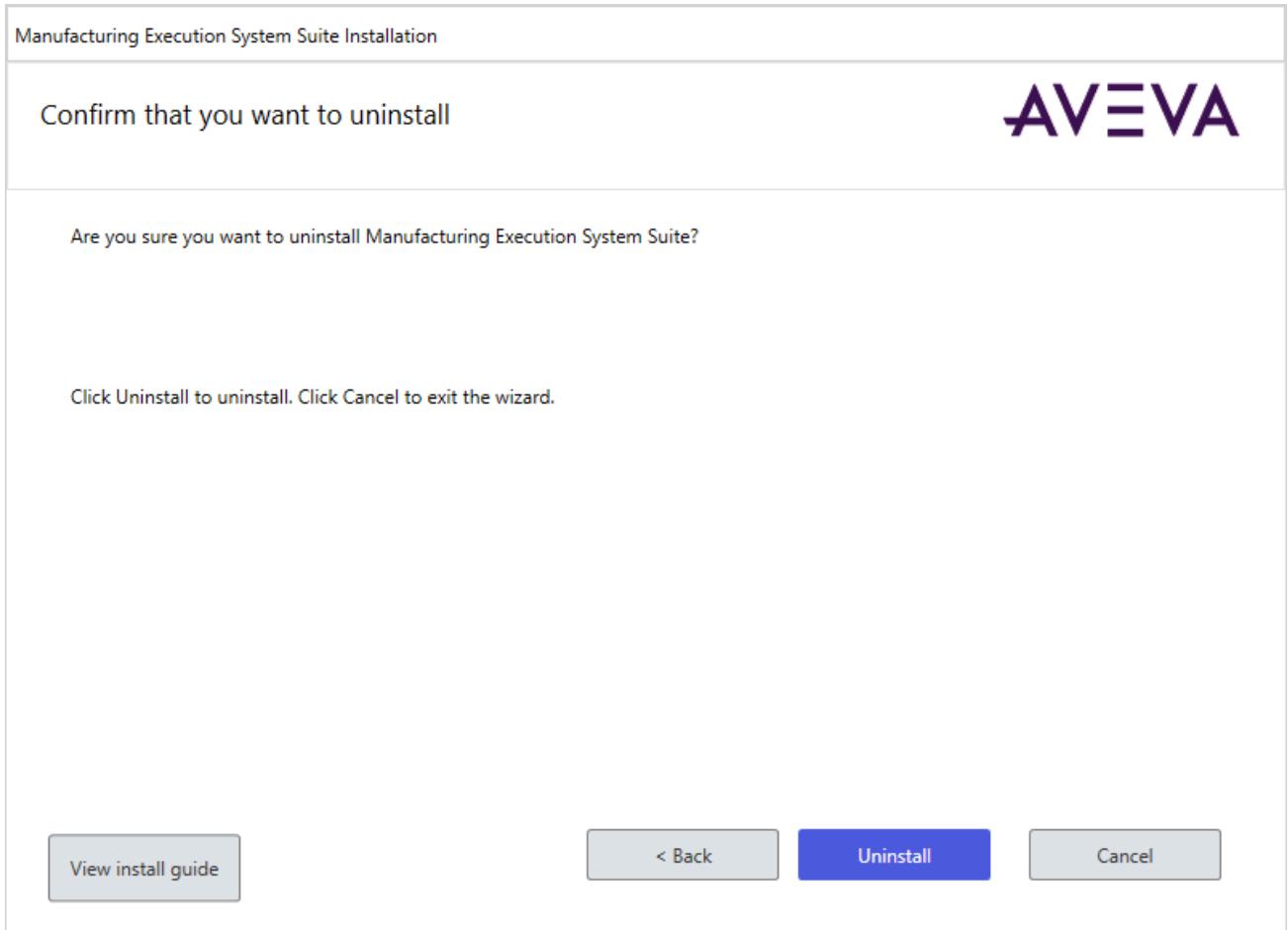
- In the Control Panel Programs and Features applet, select **Manufacturing Execution System** and click **Uninstall** or **Uninstall/Change** on the toolbar.
- Run the **Setup.exe** file in the MES installation root folder.

The Setup tool options appear.



2. Select **Remove**, and then click **Next**.

The Uninstall confirmation screen appears.



3. To continue with the uninstall process, click **Uninstall**.

If any applications that might conflict with the uninstall are running, a list of them appears.

Manufacturing Execution System Suite Installation

## Close Running Applications

The following applications are using files which the installer must update. Close the applications and click "Try Again". Click "Next" when there are no conflicts so that the installer continues the installation and replaces system files when your system restarts.

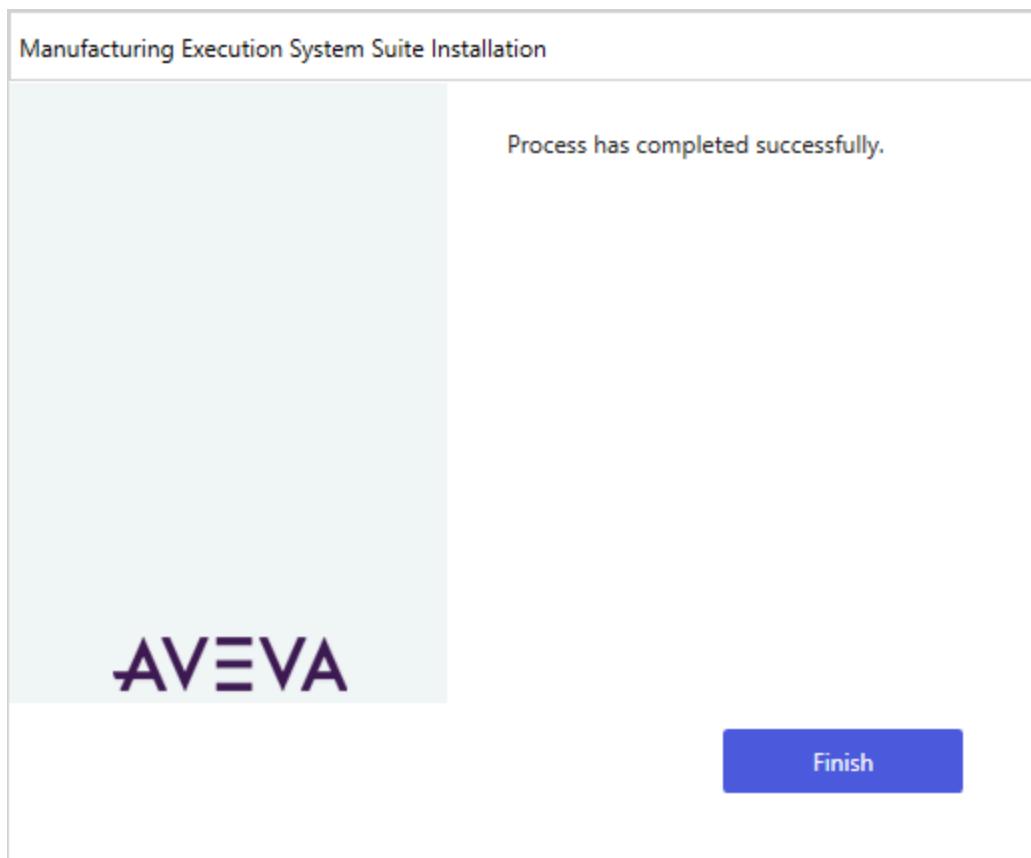
Process Name	Description	Id
ServiceMonitor	MES Service Monitor	4148
FactMES.Server.Host	MES Middleware Host	5852

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[View install guide](#) [Try Again](#) [Next >](#) [Cancel](#)

4. Close the applications, then click the **Try Again** button to see if there are still any conflicts.
  - If there are still conflicting applications running, close them and click the **Try Again** button.
  - If there are no conflicting applications, click **Next**.

The uninstall begins. The following screen appears when it completes successfully.



5. To close the Setup tool, click **Finish**.

## Tasks to Perform After MES Components Have Been Removed

- If MES BI Gateway Reports were deployed but the MES BI Gateway Reports feature has been removed, the deployed reports are not removed from SSRS during a modification or uninstall. The reports must be removed manually.
- If the MES Database component was removed, the MES database is not deleted and the MES middleware service user account SQL permissions are not removed as part of the modification or uninstall. The database must be removed manually and SQL permissions must be changed or the SQL login deleted manually.
- If you remove the MES Web Portal component, during the remove operation the existing MES Web Portal content will be backed up to save any custom web files. For more information, see [What Happens to MES Web Portal Customization Files During an Uninstall](#).

## Virtual Environment Implementation

Implement MES in a virtual environment to enable a high availability MES solution.

## Getting Started

Virtualization technologies are becoming a high priority for IT administrators and managers, software and

systems engineers, plant managers, software developers, and system integrators.

Mission-critical operations in both small- and large-scale organizations demand availability—defined as the ability of the user community to access the system—along with dependable recovery from natural or man-made disasters. Virtualization technologies provide a platform for High Availability solutions.

The purpose of this guide is to help you to implement Manufacturing Execution System (MES) in a virtualized environment, including:

- Implementing High Availability (Live Migration and Failover) using VMware technology
- Implementing High Availability (Live Migration and Failover) using Windows Server virtualization technologies such as Hyper-V

This chapter introduces and defines virtualization concepts.

Subsequent chapters describe how MES was configured in a virtualized environment for a High Availability qualification. They also describe test results for the suggested configurations using both VMware and Hyper-V technology.

Subsequent chapters also provide test and performance metrics for a wide variety of system configurations, including Recovery Time Objective (RTO) and Recovery Point Objective (RPO).

## Understanding Virtualization

Virtualization is the creation of an abstracted or simulated—virtual, rather than actual—version of something, such as an operating system, server, network resource, or storage device. Virtualization technology abstracts the hardware from the software, extending the life cycle of a software platform.

In virtualization, a single piece of hardware, such as a server, hosts and coordinates multiple guest operating systems. No guest operating system is aware that it is sharing resources and running on a layer of virtualization software rather than directly on the host hardware. Each guest operating system appears as a complete, hardware-based OS to the applications running on it.

## Definitions

This implementation guide assumes that you and your organization have done the necessary research and analysis and have made the decision to implement MES in a virtualized environment that will replace the need for physical computers and instead run them in a virtualized environment. Such an environment can take advantage of advanced virtualization features, including High Availability. In that context, we'll define the terms as follows:

- Virtualization in MES terms can be defined as creating a virtual, rather than real, server for one of the MES servers, including the Middleware server and the Application Object server, as well as the network resources to support the server.
- High Availability in MES can be defined as the way to make any of the MES servers available without interruption during production operations. In this virtualization testing, we chose the most critical server—the MES Middleware server.

While these definitions are general and allow for a variety of High Availability designs, this implementation guide focuses on virtualization as an indispensable element in creating the redundancy necessary for highly available MES solutions.

The virtualized environment described in this guide is based on Microsoft Hyper-V technology incorporated in the Windows Server 2008 R2 operating system, and on VMware's virtualization platform vSphere 5.0.

MES is tested on newer versions of vSphere as updates are released by VMware. Microsoft Hyper-V is not routinely tested. As the virtualization technology is invisible to the MES software, there is no specific version support statement for VMware vSphere or Microsoft Hyper-V. The timing tests as described in this document have not been re-run on newer versions of either virtualization platform.

## Application Configuration

To test the MES High Availability implementation in a virtualized environment, a predictable MES application was developed. A description of the application used for the validation and testing of the virtualized environments described in this guide—a machine shop application—is provided in the following topics.

## Events

The machine shop application was based on a set of System Platform object templates with pre-configured scripts that trigger events at regular intervals. This made the events, and thereby the data logged in the MES database, predictable. Any values related to events (e.g., good production) are set to a constant value.

The following events were triggered by the machine shop application.

### Hourly Events

- Change state of machine to a running state
- Create job
- Receive inventory
- Stop job
- Reset event commands if in error
- Reset stop job commands if in error
- Start job
- Change state of machine to a running state

### Minutely Events

- Add good production
- Add bad production
- Add consumption
- Reset various event commands if in error

This configuration guarantees that at any given second one of each minutely event will be triggered if there is a corresponding MES object for that second. This ensures that when migration (Live Migration/failover) is triggered, the configured events are being exercised.

Also, the MES database was pre-populated with one year's worth of data prior to running through the various scenarios to ensure that the test scenarios were run on a typically loaded system.

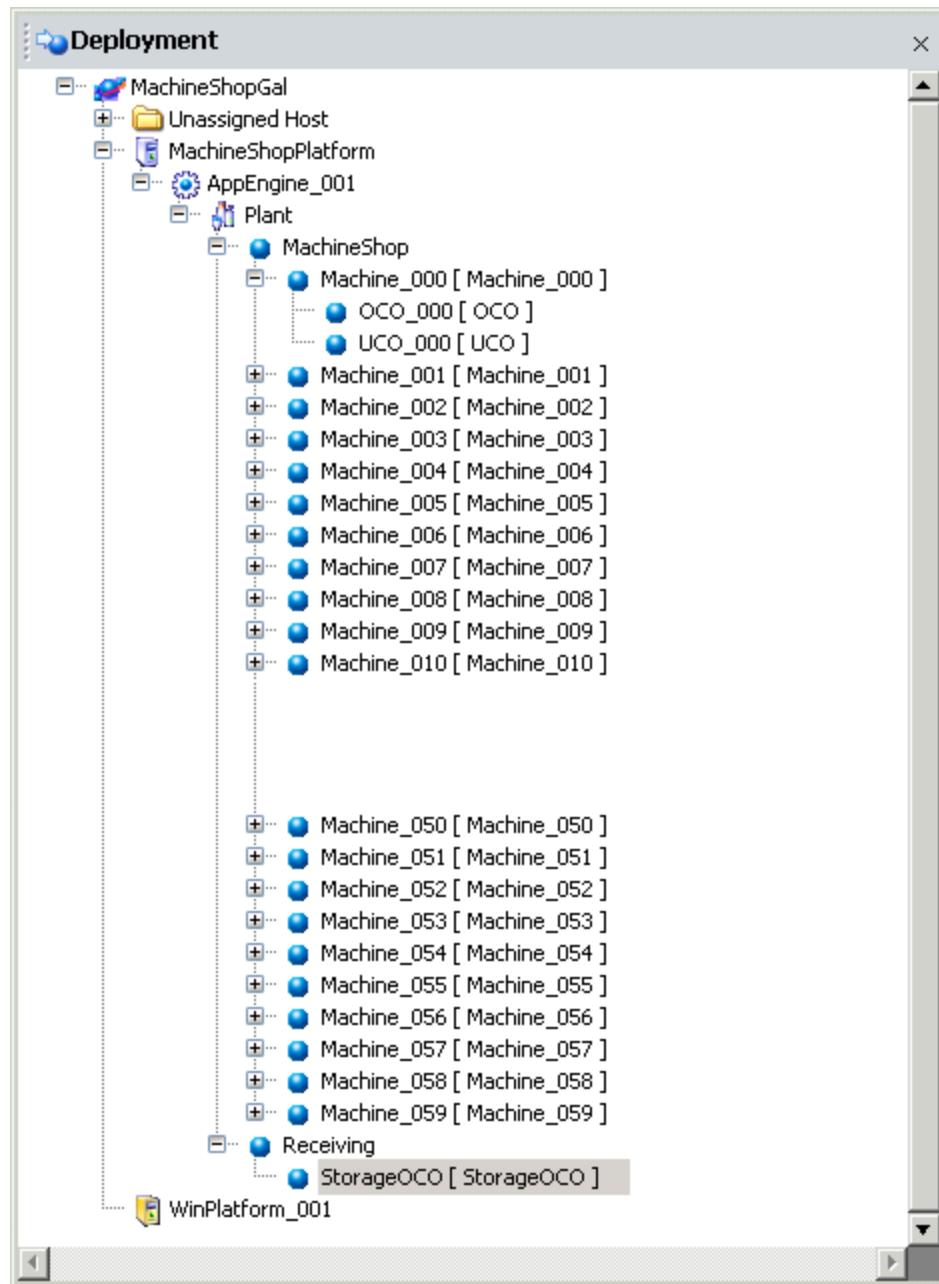
## Application Server Configuration Details

- Total number of engines: 1
- Number of objects under engine: 182:
  - 61 UDOs (user-defined objects)
  - 61 OCOs (MES operations capability objects)
  - 60 UCOs (MES utilization capability objects)

There were a total of 60 machines (each machine/MES entity has one UCO, one OCO) used in the VMware environment setup and 40 machines used in the Hyper-V environment setup.

Due to different hardware, a different number of entities was used in the Hyper-V and VMware environments to establish sustained load for the test prior to executing the scenarios. However, this does not imply a difference in performance for Hyper-V and VMware.

The following figure shows the Deployment view for the machines set up for the testing. The specifics of the machines varies, but this figure shows the basic structure.



## Recovery Time Objective and Recovery Point Objective

For this testing, two key performance indicators (KPIs) were used to define the performance of the test scenarios:

- The Recovery Time Objective (RTO) is the duration of time within which the virtualized server must be restored to its service level after a disaster or other disruption to avoid a break in plant operations.
- A Recovery Point Objective (RPO) is defined in business continuity planning. It is the maximum tolerable period in which data from the virtualized server might be lost due to a major incident.

The RTO and RPO depend on factors of the host server such as storage I/O performance, CPU utilization, memory

usage, and network usage at the time of failover/migration activity.

The following topics describe how RTO and RPO were measured for the MES middleware virtualized server configuration.

## RTO Measurement

The RTO measurement is the time interval during which the MES Middleware server is not available:

$$\text{RTO} = \text{RTO (T2)} - \text{RTO (T1)}$$

where

- T1 = The time-stamp when the MES Middleware service cannot be detected. This also can be the time-stamp for when the "fault" is introduced into the system (e.g., Live Migration cutover, power off, network disabled or an operating system failure).
- T2 = The time-stamp when the MES Middleware service is detected on the target machine (by using the services log on the target machine to determine T2).

If more than one clock is involved, be sure to either synchronize the clocks or understand the offset. In addition, MES Middleware service was monitored using Windows Performance Monitor (PerfMon).

## RPO Measurement

The RPO measurement is the time interval during which there is no data being entered in the MES database.

$$\text{RPO} = \text{RPO (T2)} - \text{RPO (T1)}$$

where

- T1 = The time-stamp of the last record entered in the MES database at or before RTO (T1); that is,  $(\text{RPO (T1)} \leq \text{RTO (T1)})$ .
- T2 = The time-stamp of the first record entered in the MES database at or after RTO (T2); that is,  $(\text{RPO (T2)} \geq \text{RTO (T2)})$ .

It is possible that RPO is less than RTO, since there is a client middleware layer that allows for serialization of events while the MES Middleware service is unavailable. If RPO = 0, this implies that no events were missed.

Custom SQL queries were developed and run against the MES database to determine the time-stamp of the "last" record before an HADR fault and the "first" record following an HADR fault.

## Configuration Information for a VMware Environment

The following information is provided to help you set up and implement High Availability for MES using VMware.

For basic procedures about how to install VMware products, see product support and user documentation at <http://www.vmware.com/>.

For detailed procedures to implement High Availability in a VMware environment with System Platform, refer to the *System Platform in a Virtualized Environment Implementation Guide*.

## Host Hardware for VMware Servers

Two VMware Servers were used to configure the failover cluster for this qualification.

Processor	2.79-GHz Intel Quad Core E5405 processors (hyper-threaded)
Operating System	VMware ESXi 5.0
Memory	48 GB
Storage	SAN with a 1-TB storage disk (single SCSI Disk with virtual partition)
NIC	Four Broadcom NetXtreme II BCM5709 1000 BaseT cards
Network	4 network adaptors [1 virtual machine (VM) network, 1 VMotion network, 1 management network, and 1 unused network]
Storage controller	Dell SAS 5/E Adapter. Data transfer rate: Up to 300 MBps per link in each direction.

## Guest Operating Systems (Virtual Machines)

### Virtual Machine 1: MES Middleware Server

Processor	Intel Xeon X5560 @ 2.80GHz, 2.79 GHz (2 processors)
Operating System	Windows Server 2008 R2 Standard, SP1 64-bit
Memory	4 GB
Storage	39.8 GB

Product Installed	MES 2012 (Middleware, MES Client, MES Operator, and MES Supervisor)
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**Virtual Machine 2: Application Server**

Processor	Intel Xeon X5560 @ 2.80 GHz, 2.79 GHz (2 processors)
Operating System	Windows Server 2008 Standard SP2 32-bit
Memory	4 GB
Storage	39.9 GB
Product Installed	Application Server - ASP2012 - IDE and Bootstrap, Application Server Runtime, and deployed MES application objects

**Shared Disk Storage/SAN**

Base Unit	PowerVault MD3000 external RAID array with 2 dual-port controllers
Hard Drive Controller	Four SAS 5/E Host bust adapters PCI Express

**Physical Machines (External)**

The physical machines used and their configurations are provided below. Virtualization of these machines could have been done, but we chose to keep them on real machines to concentrate the testing on the MES middleware and Application Server hosting MES objects.

**Physical Machine 1: Application Server Galaxy Repository**

Processor	Intel Core 2 Quad CPU Q9400 @ 2.66 GHz, 2.66 GHz
Operating System	Windows Server 2008 Standard SP2 32-bit
Memory	4 GB
Storage	149 GB
NIC	Intel 82567LM-3 Gigabit Network Adapter
Network	LAN

Product Installed	Application Server – ASP2012, Galaxy Repository, IDE and SQL Server 2008 SP3
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## Physical Machine 2: MES Database

Processor	CPU Intel Xeon CPU E7340 @ 2.40 GHz, 2.39 GHz (4 processors)
Operating System	Windows Server 2008 Standard, SP2 64-bit
Memory	128 GB
Storage	2 disks, 48.8 GB/1.0 TB
NIC	Intel PRO/1000 MT Network Adapter
Network	LAN
Product Installed	MES database, SQL Server 2008 SP3

## Scenarios and Observations in the VMware Virtual Environment

The machine hosting the MES Middleware server, and the machine hosting the Application Object Server running the machine shop application, were subject to Live Migration and failover. The various scenarios, measurements, and observations are provided in the following topics.

### Live Migration (Using vMotion)

Applications	Scenario	RTO (sec)	RPO (sec)
MES Middleware server	Top of the minute	1	0
MES Middleware server	Top of the hour	1	0
MES Middleware server	Top of the day	1	0
MES Middleware server	During shift change	1	0
MES Middleware server	When an archive job is in progress	0	0
MES Middleware server	When a purge job is in progress	1	0

Applications	Scenario	RTO (sec)	RPO (sec)
Application Server hosting the machine shop application	During normal execution	1	0

## Observations

- After the migration, the MES transactions continued to execute correctly.
- There were no errors/warnings in the Operations Control Management Console Log Viewer, Windows Events Log, or SQL Server loggers after Live Migration.
- There was no transaction/data loss after Live Migration.
- Both MES Client and the objects retained the connection to the MES middleware after the Live Migration.

## Failover (Triggered by Powering Off the Host Machine)

Applications	Scenario	RTO (sec)	RPO (sec)
MES Middleware server	Top of the minute	138	180
MES Middleware server	When an Archive job is in progress	145	180
MES Middleware server	When a Purge job is in progress	138	240
Application Server hosting the machine shop application	During normal execution	138	300
MES Middleware server and Application Server hosting the machine shop application	During normal execution	144 (AppObject) 308 (middleware)	*

\*The RPO is undefined as the Application Server Objects had to be redeployed before they were functional.

## Notes

- The RTO is also influenced by the Windows delay during start up, during which the system waits approximately 30 seconds for the user to select normal or safe mode start up.

## Observations

While the MES middleware alone fails over, the System Platform log on the Application Server machine logs warnings and errors indicating the inability of the objects to communicate with the middleware while the middleware is unavailable. However, the MES objects recover after the failover and no more errors/warnings are reported in the Logger.

- The Archive operation is aborted after the middleware failover and the same is indicated against the job in the client and the System Platform log on the MES Middleware server.
- The Purge operation is aborted after the middleware failover and the same is indicated against the job in the client and the System Platform log on the MES Middleware server.
- The database is left undisturbed.
- When the Application Server alone fails over, the middleware logs *Lost connection to subscription* warnings. There are a few warnings and errors in the Application Server machine; however, the Application Server stabilizes eventually (as defined by the RTO).
- When both the Application Server and the middleware fail over, the middleware comes back online and does not log any warnings or errors. However, the Application Server is unable to recover with multiple warnings and errors logged to the Logger.

## Configuration Information for a Hyper-V Environment

The following configuration information is provided to help you set up and implement High Availability for MES using Hyper-V.

For detailed procedures about how to implement High Availability in a Hyper-V environment with System Platform, refer to the *System Platform in a Virtualized Environment Implementation Guide*.

## Host Machines

### Primary Hyper-V Machine

Processor	Intel Xeon x5650 @ 2.67 GHz, 2.67 GHz
Operating System	Microsoft Windows Enterprise 2008 R2 SP1
Memory	96 GB
Storage	1 TB storage disk (External Machine)
NIC	Two BroadCom NetXtreme Gigabit Ethernet adapters Two Intel PRO/1000 PT Dual Port Server Adapter cards
Network	4 network adaptors (2 public/virtual networks; 1 iSCSI; and 1 private)

## Secondary Hyper-V Machine

Processor	Intel Xeon x5650 @ 2.67 GHz, 2.67 GHz
Operating System	Microsoft Windows Enterprise 2008 R2 SP1
Memory	96 GB
Storage	1 TB storage disk (external machine)
NIC	Two BroadCom NetXtreme Gigabit Ethernet adapters Two Intel PRO/1000 PT Dual Port Server Adapter cards
Network	4 network adapters (2 public/virtual networks; 1 iSCSI; and 1 private)

## Notes

- For the Hyper-V hosts to function optimally, the server should have the same processor, RAM, storage, and service pack level. Though the different host machine configurations are supported, they will impact the performance during failovers.
- Two Hyper-V hosts were used to configure the failover cluster.

## Virtual Machines

### Virtual Machine 1: MES Middleware Server

Processor	Intel Xeon x5650 @ 2.67 GHz, 2.67 GHz
Operating System	Microsoft Windows 2008 ENT SP2
Memory	8 GB
Storage	80 GB
Products Installed	MES 2012 (MES Middleware, MES Client, MES Operator, and MES Supervisor)

### Virtual Machine 2: Application Server

Processor	Intel Xeon x5650 @ 2.67 GHz 2.67 GHz
Operating System	Microsoft Windows 2008 ENT SP2
Memory	4 GB

Storage	100 GB
Products Installed	Application Server – ASP2012 R2 - IDE & Bootstrap, GR and Application Server Runtime, and deployed MES application objects

## Physical Machines

The configurations of the physical machines that were used are provided in the following topics.

Virtualization of these machines could have been done, but it was decided to keep them on real machines to concentrate the qualification on the virtualized MES functionality.

### Physical Machine 1: Galaxy Repository

Processor	Intel Core2 Quad CPU Q9400 @2.66 GHz, 2.66 GHz
Operating System	Microsoft Windows 2008 R2 Standard SP1
Memory	4 GB
Storage	150 GB
NIC	Intel 82567LM-3 Gigabit Network Adapter
Network	LAN
Products Installed	ASP2012 R2, Galaxy Repository, IDE, and SQL Server 2008 R2 SP1

### Physical Machine 2: MES Database

Processor	Intel Xeon CPU E7340 @2.40 GHz, 2.40 GHz
Operating System	Microsoft Windows 2008 Standard 32-bit
Memory	128 GB
Storage	1 TB
NIC	Broadcom BCM5708C NetXtreme II GigE Network Adapter
Network	LAN
Products Installed	MES Database, SQL Server 2008 ENT R2 SP2

## Scenarios and Observations in the Hyper-V Virtual Environment

The machine hosting the MES Middleware server, and the machine hosting the Application object server running the machine shop application, were subject to Live Migration and failover. The various scenarios, measurements, and observations are provided in the following topics.

### Live Migration

Applications	Scenario	RTO (sec)	RPO (sec)
MES Middleware server	Top of the minute	14	0
MES Middleware server	Top of the hour	12*	0
MES Middleware server	Top of the day	4	0
MES Middleware server	During shift change	12	0
Application Object Server hosting the machine shop application	During normal execution	4	0
MES Middleware server	When an archive job is in progress	9	0
MES Middleware server	When a purge job is in progress	11	0

\*There was one warning in Operations Control Management Console Log Viewer immediately following the Live Migration at top of the hour:

Had trouble closing connection on Dispose - The socket transfer timed out after 00:00:05. You have exceeded the timeout set on your binding. The time allotted to this operation may have been a portion of a longer timeout.

There were two warnings in the Middleware node Operations Control Management Console Log Viewer immediately following the Live Migration at top of the hour:

SyncCmdSvc.ExecCmd - clientId [MiddlewareVM.DefaultDomain.28] --> Violation of PRIMARY KEY constraint 'PK\_tpm\_stat'. Cannot insert duplicate key in object 'dbo.tpm\_stat'.... .

### Failover (Triggered by Powering Off the Host Machine)

Applications	Scenario	RTO (sec)	RPO (sec)
MES Middleware server	Top of the minute	88	60

## Observations

- It is recommended that you segregate the network traffic between the failover cluster and the virtual machines.
- The MES objects recovered and managed to reestablish connectivity with the MES Middleware server on the remote node and resumed normal operational rhythm.
- The following representative log entries indicate communication issues observed after the failover and before the objects recovered:
  - Data cannot be read from the MES Middleware, the communications to the MES Middleware could be broken.
  - Proxy failed to connect to Middleware server service endpoint.
  - Counter:JobPos0.Prod.Bad1 encountered an error calling AddProd, error:Proxy failed to connect to Middleware server service endpoint.

## Failover (Triggered by Disconnecting the Host Machine from the Network)

Applications	Scenario	RTO (sec)	RPO (sec)
MES Middleware server	Top of the minute	80	60
MES Middleware server	When an Archive job is in progress	78	60
MES Middleware server	When a Purge job is in progress	88	120
Application Server hosting the machine shop application	During normal execution	N/A	240

## Observations

- All jobs were terminated following the Application Server VM failover event and due to the application design. Full operation required one hour to resume.
- The following log entry was made for each entity indicating communication issues related to the failover of the Application Server VM:

LOST Connection to subscription: [<some GUID>], TableOrView:[ent.getstatusinfobynname] – Error: The communication object, System.ServiceModel.Channels.ServiceChannel, cannot be used for communication because it has been Aborted.
- The Archive operation is aborted after the MES middleware failover. This is indicated against the job in the client and the System Platform log on the MES Middleware server. The database is not affected.
- The Purge operation is aborted after the MES middleware failover. This is indicated against the job in the client and the System Platform log on the MES Middleware server. The database is not affected.

## MES Middleware

MES middleware manages scheduled tasks as maintenance services and client application transactions with the MES database.

### Introduction to the MES Middleware

The MES middleware is a process that handles two categories of tasks:

- Scheduled tasks that are referred to generally as maintenance services
- Client application transactions with the MES database

The MES middleware is fully multi-threaded and uses multiple CPUs. However, other restrictions related to handling transactions limit the number of sessions that one MES middleware host can support. For additional information about licensing, see the *MES Deployment Guide*.

### Multiple MES Middleware Hosts

A multi-node environment can have more than one MES middleware host installed.

Any of the middleware hosts can handle client application database transactions. However, only one MES middleware at a time will be handling maintenance services. When configuring the MES DB/MW Communication component in the post-install Configurator, a middleware can be selected as the preferred middleware to handle the maintenance services. For more information, see [Determining the MES Middleware Host to Run Maintenance Services](#).

Note that each MES middleware host acquires an MES Middleware count from the License Server.

### MES Service Tasks Moved to the MES Middleware

In previous releases, the MES Service was connected to the MES middleware through the proxy layer. Starting with MES version 7.0, the MES Service is part of the MES middleware. Since the MES Service is now part of the MES middleware, the database maintenance activities are performed as part of the middleware, but on different threads.

### Maintenance Services

The MES middleware that is currently handling the maintenance services performs the following scheduled tasks:

- Cleaning up stale sessions
- Running the Supply Chain Connector (SCC) schedules
- Managing entity shift changes
- Changing utilization reasons for entities for reasons that have elapsed
- Generating future quality samples for time, shift, and production unit count frequencies
- Changing quality sample states based on the passage of time

These tasks are critical to having consistent OEE and downtime data. For detailed information, see [Maintenance Services](#).

## Client Application Database Transactions

Each active MES middleware can process client application calls to perform MES database transactions. The middleware supports the following call endpoints:

- Synchronous
- Asynchronous
- Web API
- Event Broker

For more information, see [Client Application Database Transactions](#).

## MES Middleware Proxies

An MES middleware proxy provides access to the MES middleware for clients. The proxy is installed on each client machine and on all MES middleware host server machines. By default, the communication between the MES middleware proxy and the MES middleware host is encrypted.

The middleware proxy allows code on a client machine to make a call across the network as if it was making the call on the server machine. For synchronous calls, the proxy communicates directly with the middleware. For asynchronous calls, the proxy puts messages onto an available middleware server's message queue, from which they are pulled and processed by the middleware. After the proxy makes the call, it waits for the command to be processed. If the middleware is too busy, the command can timeout and the proxy will report an error.

The MES Stateful and Stateless APIs use the MES middleware proxy. Client applications that make a call to the event broker endpoint to register for notifications of data changes also use the proxy.

MES Web API calls do not use an MES middleware proxy.

## User Account Associated with Middleware Background Tasks

The Windows user account that is assigned to the MES Middleware Host service will be the user associated with executing middleware background tasks. By default, this account is **NT Service\WCFHostService**. The user account can be changed on the service's Properties dialog box in the Services control panel applet. To see the current user account assignment, see the MES Middleware Host service entry in the Services control panel applet.

The exception to this is the user that executes Supply Chain Connector (SCC) transactions. That user can be specified by system parameter 199 (User ID for background tasks<1866>). If the user configured in this system attribute does not exist in the `user_name` table, then the system defaults to the user account that is assigned to the MES Middleware Host service.

## MES Middleware Host Service Startup Type

The **Startup Type** of the MES Middleware Host service is set to **Automatic (Delayed Start)**. That is, it waits for other services, such as SQL Server, to be started first before starting itself. However, if required, this setting can be changed to **Automatic**.

## Client Application Database Transactions

Each active MES middleware can process client application calls to perform MES database transactions. The middleware supports the following call endpoints.

### Web API

The middleware listens for HTTPS calls (for encrypted communication) or HTTP calls (for unencrypted communication) on a specified port that's configurable. By default, HTTPS uses port 443 and HTTP uses port 80. These port assignments can be changed when configuring the System Management Server in the post-install Configurator.

All versions of the MES Web API go through this endpoint.

### Synchronous

When the client application makes a call, the transaction is attempted and the response is returned immediately. All Stateful API calls and most Stateless API calls go through this endpoint.

### Asynchronous

When the client application makes a call, the transaction is attempted but no response is returned. If the requested transaction does not occur, an entry is added to the Rejected Message table. These entries can be viewed in MES Client, where the user can attempt to fix the request message and resubmit it.

- Asynchronous Stateless API calls go through this endpoint.
- The Utilization Capability Object (UCO) makes asynchronous calls to set the current utilization reason.
- The Operations Capability Object (OCO) makes asynchronous calls when configured in Without Response mode.

### Event Broker

The Event Broker allows client applications to subscribe to MES database changes. For example, MES Client uses this service to keep its editors current. If two MES Client instances are running and an a database change is made from one, the editor data displayed in the other instance will be updated by this service.

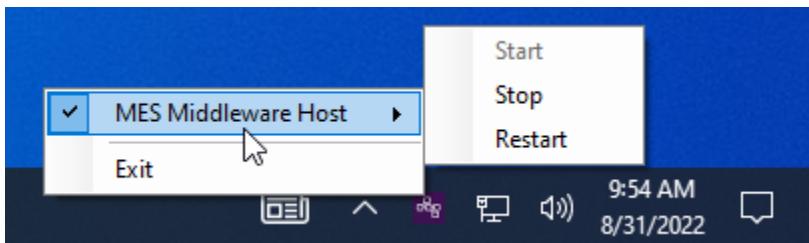
## Starting, Stopping, and Restarting the Local MES Middleware Host

You can manually start, stop, and restart the MES middleware host service from the MES Service Monitor icon in the system tray. The MES Service Monitor icon will be installed on the system tray for any node on which the MES Middleware component is installed.

1. Right-click the MES Service Monitor icon on the system tray.



2. Click **MES Middleware Host** and then click **Start**, **Stop**, or **Restart**.

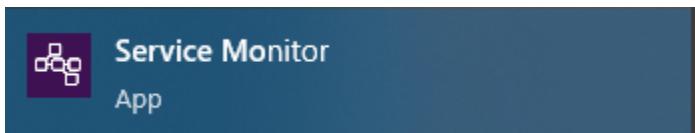


## Starting and Closing the MES Service Monitor

If the MES Service Monitor is not currently running, you can start it.

### To start the MES Service Monitor and add it to the system tray

- On the **Start** menu, locate and select **Service Monitor** (the tile is shown below).



The icon is added to the system tray.

### To close the MES Service Monitor and remove it from the system tray

- Right-click the MES Service Monitor icon and click **Exit**.

Note that closing the MES Service Monitor does not affect the state of the MES middleware host service.

## Maintenance Services

Whenever at least one MES middleware is active, one middleware will perform background maintenance services. The MES middleware that is currently handling the maintenance services performs the scheduled tasks described below, with additional information about shift and Quality Management (QM) sample generation in following chapters. There are Operations Control Management Console Log Viewer flags that can be enabled to record when these maintenance services are executed (see [Log Flags for Server-Side Diagnostics](#)).

If the middleware that is performing the maintenance services stops running and there is no other middleware host available to take over those services, then all of the maintenance services are terminated.

### Every Minute

The MES middleware performs the following tasks at the start of every minute:

- Updates the current shifts for each entity that has a shift change scheduled at this time. This might generate new QM samples.  
If any change in shift configuration is detected, the projected shifts for the next 7 days are re-calculated for

all affected entities.

For more information about shift generation, see [Shift Generation](#).

- Runs the `sp_BG_Minutely_Tasks` stored procedure to do the following:
  - End stale sessions.
  - Update the projected finish time for jobs.
  - Record any dataset to be collected on a periodic basis.
  - Complete steps that have a fixed time duration, after the time has elapsed.
- Checks for current utilization reasons that are elapsed. If the current reason has a non-null maximum duration and a non-null new reason code configured and it elapses (that is, the duration of the current utilization event related to the reason has passed its configured maximum duration), then the current reason is changed to the configured new reason.
- For QM, if the *Frequency to call sample updates (in seconds)* system parameter is set to 0, generates samples. If this system parameter is set to a value other than 0 (the default value is 30 seconds), the middleware generates samples according to that value. For more information about the middleware and sample generation, see [QMI Sample Generation and Status Update for Quality Specifications](#).
- Performs Supply Chain Connector (SCC) imports and exports based on time (for those that have a trigger type of daily, weekdays, weekly, or every *n* minutes), the existence of a file (for imports), the existence of data in a table (for imports), or a change in internal MES data (for exports).
- Performs SCC exports based on the ending of a job or a shift. The exports are queued up and processed every minute by the MES middleware, and not by the process causing these events.

## Every Hour

The MES middleware performs the following tasks at the start of every hour:

- Runs the `sp_BG_Hourly_Tasks` stored procedure to ready the first jobs of a work order if its release date and time has passed. The MES middleware archives the stored procedures, when it is time to do so. For more information on archiving, see the topic "Running an Archive or Purge Job Automatically" in the *MES Client User Guide* or help.

The MES middleware only checks for jobs to ready (where the release date/time has elapsed) during hourly background tasks. So, if at 8:05 you create a job to be released at 8:20, the job will not go to ready right at 8:20; it will go to ready at 9:00 when the hourly tasks run.

The following conditions must be met for a job to be readied on the hour:

- The system attribute 310, *Prevent automatic readying of first jobs*, is set to false
- The state of the job is New
- The job's release time in UTC is older than the current time in UTC
- The `first_job` property of the job is set to true or the system attribute 254, *Ready all new jobs of a work order together*, is set to true, which will ready all the jobs in the work order if the conditions above are met

For all the jobs that are currently running on the entities that can track OEE, the MES middleware creates the hourly buckets (in the `job_hour_history` table) for the new hour. For all the jobs that are currently running on the entities, the MES middleware updates the statistics (runtime, downtime, idletime, `qty_good`, `qty_reject`) in the `job_hour_history` table for the hour that is 2 hours in the past from the current UTC time.

- Asks the License Manager for the current licensing and updates the internal licensing structures. If any

licenses are activated, deactivated, or expired, this allows any operational actions that are covered by those licenses to be correctly carried out or denied.

- If the custom stored procedure `sp_BG_Hourly_Tasks_Custom` exists, the middleware executes it on an hourly basis to perform any custom transactions. The `sp_BG_Hourly_Tasks` and `sp_BG_Hourly_Tasks_Custom` stored procedures are executed under separate transactions.

## Every Day

The MES middleware performs the following tasks at the start of every day:

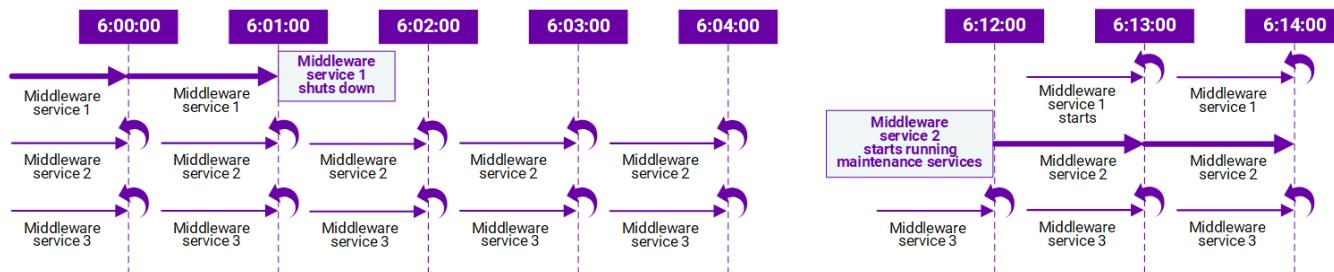
- Projects the entities' shift schedules for the next 7 days.
- Cleans up the QM context data that is older than the value specified in the *How long to keep old context information (in days)* general parameter.
- If the custom stored procedure `sp_BG_Daily_Tasks_Custom` exists, the middleware executes it on a daily basis to perform any custom transactions. The `sp_BG_Daily_Tasks` and `sp_BG_Daily_Tasks_Custom` stored procedures are executed under separate transactions.

## Reassignment of the Middleware That's Handling Maintenance Services

In an environment that has multiple middleware hosts, if the middleware that is currently handling the maintenance services goes offline for some reason, the system waits for a predefined amount of time before another middleware is assigned to handle those services. This allows the original middleware to resume handling the services in case the issue is temporary. However, if this time interval is exceeded, then another middleware is assigned to take over these services.

The time interval is defined by the `wait_time_before_takeover` value in the `db_status` table. The default is 2 minutes, which is also the minimum value, but this value can be changed by updating the table.

The following diagram illustrates how this reassignment is handled, assuming that the wait time is set to 10 minutes.



## Determining the MES Middleware Host to Run Maintenance Services

The middleware that will be running the maintenance services is determined as follows:

- If a preferred middleware host has been specified, that middleware will perform the maintenance services.
- If a preferred middleware is not specified, then the first middleware to start up will handle the maintenance services.
- If the middleware that is currently handling the maintenance services stops running, then the next available middleware based on their startup order takes over the maintenance services.

The db\_status table has the name of the most recent MES middleware to execute the maintenance services.

The preferred MES middleware host is specified using the **Preferred MW Host** setting for the **DB/MW Communication** component in the post-install Configurator application. For more information, see the *MES Installation Guide* or help.

All MES middleware hosts can handle transactions from client applications directed to the MES middleware from an MES middleware proxy.

## Shift Generation

The MES middleware that is currently handling maintenance services will generate shifts for entities based on the shift patterns to which the entities are assigned or inherit from a parent entity.

Each shift pattern includes one or more shifts that make up a shift schedule. Shift patterns and schedules are defined in MES Client. This allows the start and end time of each shift to be determined independently for any set of entities. Note that shifts in MES are not directly associated with personnel.

## Shift Patterns and Schedules

A shift pattern includes one or more shifts. These shifts make up the shift schedule that is associated with the pattern. Entities are assigned to shift patterns, which determines an entity's shift schedule. For information about configuring shift patterns and assigning entities to them, see the "Shift Patterns and Schedules" chapter of the *MES Client User Guide* or help.

### Shift Pattern Types

A shift pattern can be one of the following types:

- A **regular** pattern, which includes multiple shift definitions each having up to three break periods
- An **overtime** pattern to add additional shifts to an existing pattern
- A **holiday** schedule to indicate no-shift periods for holidays, maintenance, or other types of downtime periods.

Overtime or holiday shift patterns indicate exceptions to an entity's regular shift pattern.

## How Entity Shift Assignments Are Determined

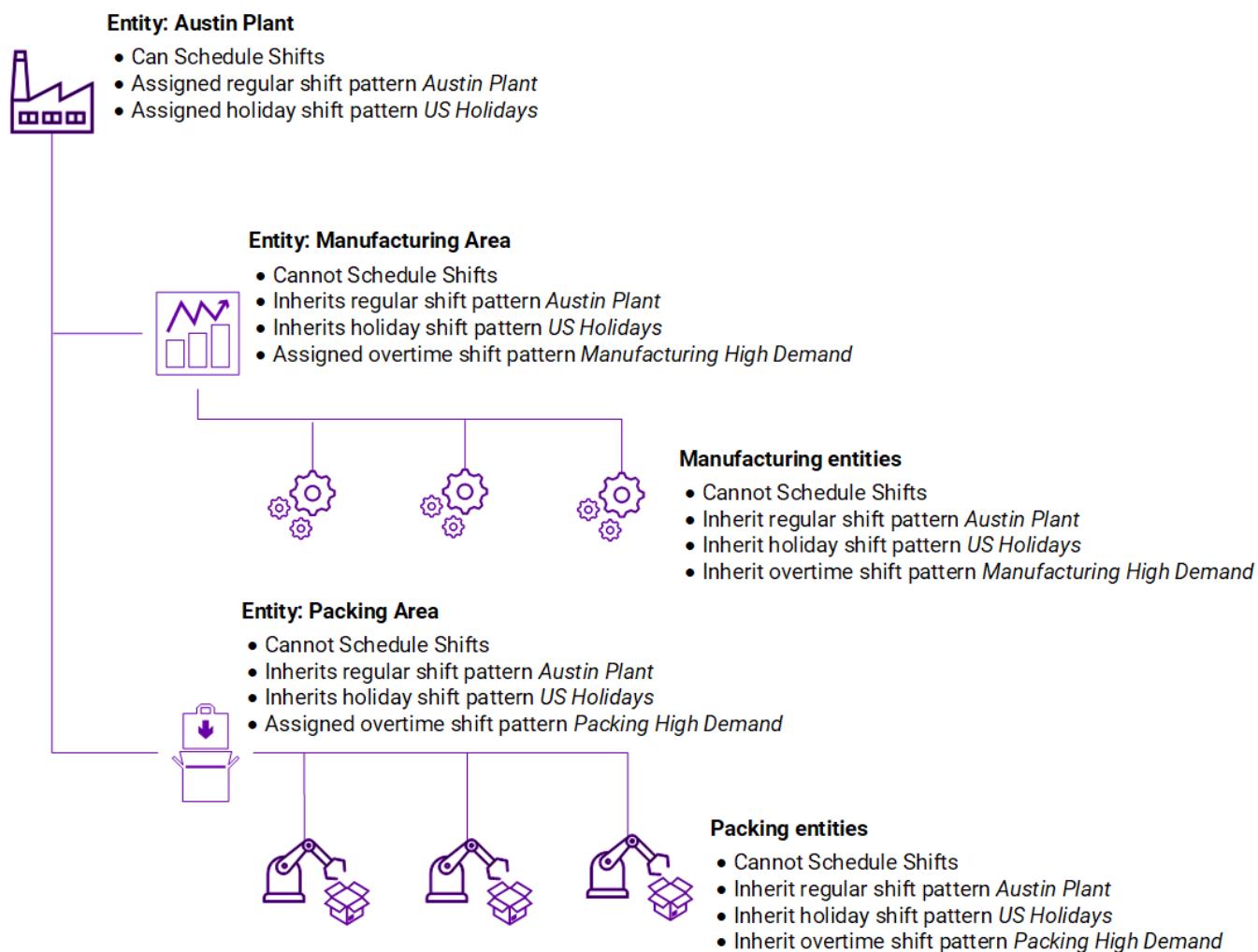
Note the following behaviors about how entity shift assignments are determined.

- When an entity is assigned to a shift pattern, that shift pattern is inherited by any child entities that don't have the capability to schedule their own shifts.
- Entities that can schedule shifts do not inherit shifts from their parent entities. They must be directly assigned to shift patterns.
- Entities that can schedule shifts can be directly assigned to **regular** shift patterns.
- Entities that can schedule shifts or that have a parent entity that can schedule shifts can be assigned to **overtime** or **holiday** shift patterns.

- An entity can be assigned to multiple shift patterns of the same type as long as those shifts do not overlap.
- If an entity is directly assigned to one or more shift patterns of a particular type, its shift schedule is based on those shift patterns. Any shift patterns of that type from a parent entity are ignored.  
For example, if an entity is directly assigned to a holiday shift pattern, any holiday shift patterns from a parent entity will be ignored.
- If an entity isn't directly assigned to a shift pattern of a particular type, it will inherit shift patterns of that type from the nearest parent entity that is directly assigned to a shift pattern of that type.  
For example, If an entity is not directly assigned to a holiday shift pattern, then it will inherit its holiday shift patterns from the nearest parent entity that is directly assigned to a holiday shift pattern.
- During periods when a shift is not scheduled for an entity, the entity is assigned a shift with the ID 0. If no active shift patterns or schedules are found in the future for the entity, then the end time of that shift is set to 9999-12-30 (YYY-MM-DD format). During these periods, shift changes are not considered for the entity.
- When no shift schedules are configured for an entity, then:
  - The entity is assigned the shift ID 0
  - The shift start time is set to 1900-01-01, indicating that this entity never had a valid shift schedule
  - The shift end time is set to 9999-12-30, indicating that there is no shift end defined  
The entity will be assigned the shift with an ID of 0 until a change in its shift configuration is detected.
- Shift patterns cannot be assigned to an entity that cannot schedule shifts and has no parent entities that can schedule shifts.

## Example of Shift Pattern Assignment Inheritance

The following figure shows an example of shift pattern inheritance based on the entity hierarchy.



## Precedence of Shifts for Entities That Have Multiple Shift Patterns Assigned

An entity can be assigned to more than one shift pattern either by direct assignment or by inheritance. This can result in shifts from different assigned shift patterns to overlap.

For shifts that overlap, which shift has precedence is determined by the following shift pattern type order:

1. Holiday
2. Overtime
3. Regular

The following figure demonstrates the resulting shift schedule when shift patterns of multiple types have been assigned.



## Entities and Time Zones

To simplify the determination of start and end times for shifts, the system assumes that an entity that is capable of scheduling shifts and its child entities are in the same time zone. Therefore, shift changes are processed in the local time of the parent entity that is capable of scheduling shifts.

For example, say a shift pattern is assigned to entities in Singapore and New York and it includes a shift that starts at 6 am. For entities in Singapore, the shift will start at 6 am in the Singapore time zone (SGT). For entities in New York, the shift will start at 6 am in the New York time zone (EST).

The time zone of an entity that is capable of scheduling shifts is determined as follows:

- If the entity is linked to a site, its time zone is the time zone set for the site.
- If the entity is not linked to a site, its time zone defaults to the time zone of the MES database server.

## Changing Shifts

At its initial startup, the MES middleware that is currently handling the maintenance tasks checks whether it is time to change any shifts. If it is time, the middleware checks for the shift changes that are due (because the period, during which the MES middleware was off, might have exceeded the time for which future shifts had been projected). It also updates the `shift_to_go` table with the projected shift schedules for the next 7 days for each entity that has shifts. Finally, it creates a record in the `dx_queue` table to process SCC schedules against the shift change.

After the initial startup, the middleware handles the shift change process on a minute-by-minute basis (at the start of the minute) as follows:

- For each entity that is assigned to a shift pattern, the MES middleware checks if it is time to change shifts. If it is, then those shifts will be changed for the entity and any of its child entities that inherits those shifts. If there are many entities changing shifts at the same time, the MES middleware might take several seconds to complete the shift change process.
- If a shift ends on an entity and there is no following shift, then the MES middleware changes the entity's shift property to No Shift (which has a shift ID of 0).

The shift information for all the entities that have shifts assigned to them, either directly or inherited, is recorded in the shift\_history table. This table is updated automatically as a part of the shift change process. If a shift pattern or schedule is changed, the MES middleware will change the shift information during the next minutely task execution.

The shift change process also does the following:

- If the entity did not have a shift start time after the supplied shift start time, the supplied (intended) shift start time is applied. Otherwise, the current datetime is used.

For example, say the regular shift schedule is 6 am to 2 pm.

- Scenario1:

The middleware maintenance service was down between 6–11:30 am, so the shift change was not recorded in the database. At 11:30 am, the middleware is restarted. Since the entity did not have a shift change after 6 am, the shift change is processed and the shift start is set to 6 am for the entity. The last shift start time was prior to 6 am.

- Scenario2:

The middleware maintenance service was down between 6–11:30 am, so the shift change was not recorded in the database. However, client-side code called a stored procedure directly and not through the middleware (which is not recommended) to start the shift at 10 am and so the entity shift was changed at 10 am. The middleware starts again at 11:30 am and intends to put the shift start time at 6 am, but finds that the entity is in a 10 am shift (which is after 6 am). So the entity is put into an 11:30 am shift if the 6 am shift information is different than the 10 am shift that was processed directly in the database.

In summary, if the shift start time is in the past and if there are shifts later, then the middleware won't go back in the past. Instead, the current datetime is set as the shift start.

- After the shift change transaction is completed successfully, any incorrect shift information in the item\_prod, item\_cons, data\_log, and labor\_usage tables is updated. This includes any transactions that happened during the shift change process that have the previous shift information recorded.

## Projecting Future Shifts

On a daily basis, for each entity that has a shift schedule, the middleware creates projected shift records for the next 7 days in the shift\_to\_go table. Each record includes the start and end time of the projected shift.

If any shift pattern changes have caused existing projected future shifts to be out-of-date, those records are updated. But updates are made only to shift records for the next 7 days. Records for shifts that occurred prior to the current day are never updated.

These shift projections are performed only for compatibility with legacy Stateful and Stateless API methods. They are not used internally by the system to actually manage shifts.

## Shift Changes and Utilization Events

- If an entity that captures utilization reasons is changing to a non-zero shift and there is a shift start reason code configured for the entity, then a new utilization event is generated for the entity. The new utilization event will use the configured shift start reason code and the shift start time as the event start time. The shift start reason code takes precedence over a shift end reason code.
- If an entity that captures utilization reasons has a shift end reason code configured, the shift end reason code is used in the following conditions when a new utilization event is created with the event timestamp equal to the shift start time:
  - The entity is changing to a non-zero shift and there is no shift start reason code configured.
  - The entity is changing to a zero shift (no shift).
- If a shift start or shift end reason code is not configured for an entity that captures utilization events, the utilization reason that was generated earlier is continued in the current shift. That is, a new utilization event is not generated for the change of shift.

## Shift Changes and QM Samples

The middleware maintenance service generates new QM samples that are based on the shift, where either the sample plan frequency type is Shift or no value is specified for generating future samples. The shift change takes more time to allow samples to be generated up to 5 minutes in the past. This ensures that events scheduled at the beginning of the shift are generated before the shift change process is complete.

## Shift Events That Cause an Entity's Shift Change Process to Terminate

The MES middleware terminates the shift change process for an entity and any child entities that inherit its shift patterns in the following cases. This is done because shift generation depends on correct shift information.

- If updating the entity's past shift fails.
- If the entity's normal shift change fails 15 times in a row.
- If there was a deadlock/timeout during the entity's shift change, then the middleware retries the transaction for up to 6 times (default configuration) before terminating the process. Any failed transactions other than deadlocks/timeouts will be terminated immediately (i.e., retries are not performed).

The shift changes for entities that are not affected by these failures will be attempted on a fresh shift change transaction.

## When Changes That Affect Shifts Are Applied

Changes to the following will be applied at the top of the minute that follows when the change occurred:

- Entity name
- Entity site assignment, which could cause a change in the entity's time zone
- Shift pattern
- Shift schedule
- Entity assignment to a shift pattern

The following will occur:

- The shift schedule based on the detected change will be processed in the next minute.
- The shift projections (in the shift\_to\_go table) will be completely removed and re-populated for 7 days in the future from the current time when the changes are detected.
- When there is a change in the day (on a daily basis based on the time zone of the MES database server), the shift projections will be completely removed and repopulated for 7 days in the future.
- When a downstream entity is not assigned to any holiday or overtime shift pattern, then by default it inherits the shift patterns of those types that are assigned to its nearest parent entity that can schedule shifts. Therefore, no projections will be populated for the downstream entity in the shift\_to\_go table. However, if a downstream entity is assigned to a holiday or overtime shift pattern, then the consolidated shift schedules are populated for 7 days in the future for the downstream entity.

## Diagnosing Issues with Shifts

The Operations Control Management Console Logger flags that are available for the FactMES.Server.MaintenanceService assembly can be used to trace the shift change process, including pre- and post-shift changes. See [Log Flags for Server-Side Diagnostics](#).

You can also check the last\_edit\_comment field in shift-related records to see why shift change times did not occur when expected.

- For diagnosing issues with completed shifts, the last\_edit\_comment field of the corresponding shift\_history record contains context information about the shift change, including what conditions were satisfied, the time the shift change took place, and what transaction type (MES or custom) processed the shift change.

For example:

```
MES.Shift.ProcessShiftChangeAsync;ShiftEntId=1;  
ShiftChangedAtUTC=2021-11-09 18:31:00.233;  
Case0:NewShiftStart>CurShiftStart=>UseNewShiftStart.  
NewShiftStart[2021-11-09 18:30:00]>CurrShiftStart[2021-11-09 17:00:00] =>  
EntShiftStart=NewShiftStart;ExclusionEntList=;  
(U):PrevPatternId=0,PrevShiftId=0
```

From the example above, the shift change fell into Case 0. The supplied new shift start time is later than the current shift start time on the entity. Therefore, the shift change process is using the supplied new shift start time to change the shift. In this example, the supplied shift start time of 2021-11-09 18:30:00 is later than 2021-11-09 17:00:00.

- The last\_edit\_comment field of a shift\_to\_go record indicates why a change was made to the configured shift. For example, a regular shift that normally starts at 8 am now starts at 10 am after coming back from an overtime shift that ended at 10 am. This would cause the regular shift record's start time to be changed from 8 am to 10 am. The last\_edit\_comment for the corresponding shift\_to\_go record contains the information about why the shift start time was adjusted.

## QM Sample Generation and Status Update for Quality Specifications

The MES middleware maintenance service periodically checks all entities that can capture QM data to determine if new future samples need to be created. It also checks if existing future samples can be changed to ready

samples. It updates the state of previously readied samples, if they are canceled or not complete, once the warning time or expiration time is reached.

The purpose of collecting a sample is to measure the quality of a produced item or a process parameter. Future samples are generated at defined intervals till the end of a shift, or the configured time period in the future. This allows you to view the projected samples of a shift and to measure the quality of samples when they are ready.

## QM Functions

The MES middleware maintenance service performs the following QM-related functions:

- Generates future samples for frequency types shift and calendar time by entity
- Adjusts future sample times from a production count frequency when the reported production falls behind the expected rate.
- Determines which QM specifications are active
- Determines the order of specificity of active applicable QM specifications based on context
- Generates sample names, potentially using replaceable parameters
- Readies samples
- Updates sample status

## Generating Samples

The MES middleware maintenance service initiates a stored procedure to generate future samples in the database. The future sample generation logic is complex and depends on the configuration of the MES Client. If no MES middleware is running, samples are not created. The MES middleware maintenance service does not create samples in the past if it loses connection with the database or is shutdown for a period of time.

The frequency of sample generation is based on the *Frequency to call sample updates (in seconds)* system parameter, which is located in the Data Entry group. This system parameter has a default value of 30 seconds (the minimum). If the value is set to 0, then sample generation is called as part of the minutely task.

All future samples are regenerated as per the current date and time if any of the following configuration data changes:

- A QM specification
- The set of characteristics linked to a QM specification
- A sample plan
- A sample plan frequency

If one action takes an inordinately long time, a separate thread starts for the tasks at each frequency so that the effect on other actions is minimized.

## Eligible Entities

First, the sample generation functionality determines which entities are eligible to have samples generated for them.

You can collect samples for an entity if its *Can collect QM data* setting is selected in the entity **Properties** pane.

For more information on the *Can collect QM data* capability, see the *MES Client User Guide* or online help. The corresponding sample plan frequency and QM characteristics are ignored if the *Can collect QM data* setting has not been selected for the entity.

## Sample Generation and QM Specifications

A QM specification can have multiple versions. But at a given time, only one version can be active and generate future samples. If there are more than one version of a QM specification (and all share the same specification name and context information), the active version is the one that has the following:

- The start effectivity is either current or in the past, and it is the highest (most recent) specification with the same specification name and context.
- The end effectivity is either Null or in the future.

The samples are generated for an entity using the active QM specification in the following scenarios:

- If the *Can capture QM data* entity setting is set to True for an entity and an active QM specification is directly assigned to this entity, samples are generated from an active QM specification.
- If the *Can capture QM data* entity setting is set to True for an entity and there is no QM specification assigned or if the assigned one is not active, the next higher ancestor entity in the hierarchy (which has an active QM specification) is used to generate the samples for an entity.

If no such active QM specification is found, no future samples will be generated by using the specifications at the current time.

For each QM specification with a sample frequency of *Shift* or a *Calendar*, *Equipment run time*, or *Equipment production* count linked to it, the MES middleware generates future samples for the entity. The sample frequency is linked through the sample plan at the QM specification level or characteristic override level.

## Sample Generation and Shifts

If the value of the current shift is none (0), the system cannot generate future or ready samples for the *Shift* frequency type. Samples are generated based on the *Future Sample Generation* parameter for the *Calendar*, *Equipment run time*, or *Equipment production* count frequencies:

- If the setting is Null, then no future samples are generated when no shift is defined.
- If the setting has some value, then future samples are generated up to the time limit specified even when no shift is defined.

When defined, a shift frequency generates samples up to the end of the current shift. If the setting for *Future Sample Generation* is Null for the *Calendar*, *Equipment run time*, or *Equipment production* count frequencies, then future samples are generated up to the end of the current shift, otherwise they are generated up to the setting for *Future Sample Generation*.

If multiple QM specifications have the same sample plan at a given time, a sample is generated with all characteristics of the specifications.

## Order of Specificity

If there is a QM specification that has all the characteristics already linked to other QM specifications with higher precedence, no samples will be generated for that QM specification.

When multiple active QM specifications for an entity have the same characteristics within them, then the system determines which QM specification takes precedence. Each sample is linked to certain QM specifications, which are considered in the order of specificity of their contexts.

The point in determining the precedence of QM specifications is that any given characteristic can only be represented by a single QM specification when it is time to actually capture data, whichever one is linked to it that has the greatest specificity.

The context fields are as follows, listed in order of increasing specificity:

- Entity/Entity class (*ent\_id*).
- Item (*item\_id*).
- Item Category (*item\_category\_id*).
- Process and Operation (*process\_id* and *oper\_id*). The *process\_id* is only considered for work orders instantiated from a process.

For the purpose of determining specificity, the process and operation are collectively considered as a single field, which is referred as operation in the following discussion. The order of specificity is based on the following criteria.

### Context Fields

Specifications with more context fields with non-null values are preferred over specifications with fewer context fields with non-null values. For example, a specification with three context fields is always more specific than a specification with two context fields.

### Operation

Operation is considered more specific than entity, item, or item category.

### Item

Item is considered more specific than item category.

### Item/Item Category

Item or item category are considered more specific than the entity.

### Entity

Lower-level entities are considered more specific than the higher-level entities, such as entity classes.

### Combination Contexts with No Common Elements

The levels of specificity of combinations of two fields, where one in common is decided by the one that is not common. For example, a combination of operation and item is considered more specific than a combination of item and entity, because the operation is more specific than the entity.

### Operation and Item Category

The levels of specificity of combinations of two fields, where none are in common are decided by the single field which is the most specific. For example, a combination of operation and item category is considered more specific than a combination of item and entity, because the operation is more specific than the item or entity.

If the context fields for multiple QM specifications are the same, then the precedence is set first by the specification effective start date (*start\_eff\_utc*), and then alphabetically by the specification name.

## Frequency Type Shift

If a sample plan frequency is configured to generate future samples for a shift, the active QM specification using this frequency generates future samples up to the end of the shift. If a QM specification becomes effective during a shift, samples are generated based on the shift frequency definition, but no samples are generated in the past.

Shift samples are calculated based on the following:

- The shift start and end times.
- The frequency configuration options of start offset and end offset.
- The time between samples and number of samples.

The first sample is based on the shift start time and the start offset setting. No samples are generated at the end of the shift minus the end offset time.

- If the number of samples is provided and the time between samples is not provided (Null), then the available shift time is split equally among the number of samples. For example, if the number of samples is 1, then only the first sample is created. If the number of samples is 2, then only the first and final samples are created.
- If the time between samples is provided and the number of samples is not provided, the first sample is created and future samples are created adding the time interval until the end of the shift.
- If the number of samples and time interval are both provided, the first sample is generated. The following samples are generated by adding the time between samples to the previous sample time. If the number of samples is small enough that this number of samples is reached before the end of the shift, the set of samples in this shift ends early. Regardless of how large the number of samples becomes, though, no samples are generated beyond the shift end.

For more information, see the *MES Client User Guide* or online help.

## Frequency Type Calendar Time

If a sample plan frequency is configured to generate future samples for a calendar time frequency, the active QM specification using this frequency generates future samples either to the end of the shift or the time specified in the future sample generation property. If no previous sample is available for an entity in this context, then a Ready sample is immediately generated if the start delay setting is 0. Otherwise, the first sample is generated after the start delay period has passed. The start delay is applicable only to calendar frequency and jobs that have started on entities that use that frequency. In that case, the first sample is delayed by the configured interval of time.

If a calendar frequency has no offset start value, samples are generated at the defined frequency. The reference time for the first sample is based on the time at which the MES middleware starts. If the MES middleware maintenance service is offline for a time period greater than the interval time, the sample generation starts when the middleware is online again and not at the previously defined frequency. Samples that would have been generated during the period when the middleware was down will not be created.

If the offset start is configured for a frequency, the samples can be generated at a time relative to midnight (local time) of any day or midnight (local time) of that Sunday. Subsequent, samples can be timed relative to this sample time; otherwise, the sample request times are calculated as described previously.

## Interval Unit Is Hours

If the interval unit for a calendar frequency is set to hours (enumeration value of 2), and if the offset start and the offset start unit configured for this frequency is not null, then the first sample for a day is offset from the midnight of that day. This offset is generated using the value in the offset\_start and offset\_start\_unit configured for that frequency. If the interval time between samples goes past the end of that day (that is, 11:59:59pm), then the first sample for the following day is again offset from the midnight (12:00am) of the following day.

## Interval Unit Is Days

If the interval unit for a calendar frequency is set to days (enumeration value of 3), and the offset start and offset start unit configured for this frequency is not null, then the first sample for a week is offset from the midnight of the Sunday of that week. The offset is generated using a value in the offset\_start and offset\_start\_unit configured for that frequency. If the interval time between samples goes past the end of Saturday (that is, 11:59:59pm) of that week, then the first sample for the following week is again offset from the midnight (Sunday, 12:00am) of the following week.

## Interval Unit Is Weeks

If the interval unit for a calendar frequency is set to weeks (enumeration value of 4), and offset start and offset start unit configured for this frequency is not null, then the first sample for a week is offset from the midnight of Sunday of that week. The offset is generated using the offset\_start and offset\_start\_unit configured for that frequency.

A sample is generated when the time between the last sample (collected for the entity with the frequency) and the offset from midnight Sunday of the current week is greater than the interval time configured for the frequency. The sample is generated for the current week, at the time specified by the offset.

The following table shows how sample times (in local time) are calculated with different offset units corresponding to an interval unit.

Frequency ID	Interval	Interval Unit	Offset Start	Offset Start Unit	Sample Times
1	3	2 (hours)	10	1 (minutes)	12:10am, 03:10am, 06:10am, 09:10am, 12:10pm, 03:10pm, 06:10pm, 09:10pm, 12:10am (day+1), 03:10am (day+1), and so on.
2	1	2 (hours)	20	2 (hours)	08:00pm, 09:00pm, 10:00pm, 11:00pm, 08:00pm (day+1), 09:00pm (day+1), 10:00pm (day+1), 11:00pm (day+1), 11:00pm (day+2), and so on.
3	1	3 (days)	25	1 (minutes)	12:25am (Sun), 12:25am (Mon), 12:25am (Tue), 12:25am (Wed), 12:25am (Thu), 12:25am (Fri), 12:25am (Sat), 12:25am (Sun, week+1), 12:25am (Mon, week+1), and so on.

Frequency ID	Interval	Interval Unit	Offset Start	Offset Start Unit	Sample Times
4	1	3 (days)	62	2 (hours)	02:00pm (Tue), 02:00pm (Wed), 02:00pm (Thu), 02:00pm (Fri), 02:00pm (Sat), 02:00pm (Tue, week+1), 02:00pm (Wed, week+1), 02:00pm (Thu, week+1), and so on.
5	1	4 (weeks)	40	1 (minutes)	12:40am (Sun), 12:40am (Sun, week+1), 12:40am (Sun, week+2), and so on.
6	1	4 (weeks)	66	2 (hours)	06:00pm (Tue), 06:00pm (Tue, week+1), 06:00pm (Tue, week+2), and so on.
7	2	4 (weeks)	66	2 (hours)	06:00pm (Tue), 06:00pm (Tue, week+3), 06:00pm (Tue, week+5), and so on.

## Frequency Type Production Unit Count

If a sample plan frequency is configured to generate future samples for a production count frequency—that is, the sample plan frequency type is Production—and the frequency is configured to count individual units, the active QM specification using this frequency generates future samples either to the end of the shift or the time specified in the future sample generation property. If the production count frequency is configured to count any setting other than units, then it behaves as an event trigger frequency and no future samples are generated. For samples to be generated for this frequency, a job must be running on the entity.

The job's production rate is used to estimate the time when future samples will be generated. For example, a production unit count frequency of every 50 units in effect when a job with a production rate of 10 batches per

hour and a batch size of 20 units per batch will create future samples 15 minutes apart.

$$50 \text{ units} / (10 \text{ batches/hour} * 20 \text{ units/batch}) * 60 \text{ minutes / hour} = 15 \text{ minutes}$$

Samples will be predicted when the job starts on the entity and any remaining future samples will be deleted when the job stops. Future samples will be predicted to the end of the shift if there is no *Future sample generation* setting; otherwise, samples will be generated up to the "future sample generation" interval. In either case, samples will be predicted to cover only the starting quantity of the job plus one additional sample for over production. Using the above frequency example, if a job is started with a start quantity of 225 units, then 5 samples will be generated every 15 minutes apart. If the *Future sample generation* setting is 0, then no future sample are generated and the frequency behaves as an event frequency generating samples with the production of a sufficient quantity of units.

Unlike the calendar and shift frequencies, future production unit count samples are readied (moved to the sample table) only when the required number of units have been produced instead of based on the future sample request time. Both good and bad counts of production are considered when readying a sample. As production counts are recorded against the job, the total is maintained in a context table in the database. This includes when the production quantity is reduced. When a production transaction causes the total to equal or exceed the frequency interval units, then the next available future sample will be readied by the MES middleware maintenance service during the next update of sample status. This might take up to the time period specified by the system parameter *Frequency to call sample updates (in seconds)*, which has a default of 30 seconds. Using the above example of a frequency with 50 units:

Time	Production Units Reported	Context Table Count	Sample Generated
10:03	10	10	No
10:06	10	20	No
10:09	10	30	No
10:12	10	40	No
10:15	10	0	Yes

Once a sample is generated, it cannot be deleted through a reduction of production. In this case, the context table becomes negative and the following sample will be readied once the additional amount has been produced. A production transaction that amounts to a total count that exceeds the frequency interval, even if it exceeds it by a factor of 2 or more, will still only generate a single ready sample. Using the same example, a production transaction of 100 units will only generate a single ready sample, not two, and the excess multiple of the interval (50 in this case) will be ignored.

Prediction of the request time for the first sample may take into consideration production counts from previous jobs. The context of the active QM Specification is used to determine if any existing quantities in the context table should be used in predicting the initial requested time. In a simple case, the previous example of a job with 225 units is run and, at the completion of the job, there are 25 units remaining in the context table. Another job is started following the first for 225 more units using the same QM specification. The leftover 25 units will be used in the estimation of the first sample, so the first sample request time will be 7.5 minutes in the future instead of the normal 15 minutes since 25 of the required 50 units have already been produced by the previous job and are used in the estimation of this job. The usage of previous context information is configurable based on the *Production Reset* option in the production count frequency definition. The available *Production Reset* options choices are described below.

### Never

Always use all applicable context records matching the context of the active QM Specification. In certain cases, this will be more than one record.

### The job changes

When a new job is run on an entity, all applicable context records are set to 0.

### Main item produced changes

All applicable context records are set to 0 if either of the follow occurs:

- A new job is started on an entity that is producing a different item from the previous item run on the entity.
- Production is reported against a substitute item for the same job.

### Shift changes on entity

At the completion of a shift change, all applicable context records are set to 0. This will impact the sample request times for samples based on the current job.

If the quantity of all previous context records applicable to the context of a new job started on an entity is equal to or greater than the production count frequency interval, then the first predicted sample is based on the amount of time it will take to produce enough units to match the maximum setting for all the included characteristic's minimum sample size.

As production is recorded, sample request times will be updated as part of the production transaction. However, if production is not recorded, then the MES middleware maintenance service will adjust sample request times based on the setting of the system parameter *Sample wait time for delayed production (in minutes)*.

- If this parameter is set to 0, then there are no adjustments to future sample request times and it is possible for a "future" request time to have a value in the past. When there are two future samples with a request time in the past, then the first one will be deleted by the MES middleware maintenance service.
- If this parameter is set to a non-zero value, then when a future sample's requested time is in the past, all *sample\_to\_go* records for the entity and for the production count frequency will have their requested times increased by the specified number of minutes. If this causes any samples to be pushed forward into the next shift and the *Future sample generation* setting is Null, those samples pushed into the next shift will be deleted.

## Entity Context

The future samples for an entity are generated only if all of the following conditions are satisfied:

- Context field *ent\_id* contains a non-null value
- The *item\_id*, *item\_category\_id*, *process\_id*, and *oper\_id* context fields contain null values
- There are no future samples already generated for this entity and characteristic

The future samples are generated for a characteristic at each interval time defined per the sample plan frequency. However, a characteristic is ignored if it has already been used for a certain time period by some other frequency linked to a sample plan.

If an entity identified in the context is an entity class, or has descendant entities, then a separate sample request is generated for each descendant entity whose *Can Collect QM Data* setting is selected. Sample requests are generated for each entity at regular time intervals defined in the frequency definition.

The future samples generated in the context of an entity may be deleted in the future. This is done if a job is started on this entity has a QM specification applicable to its context that has a higher specificity than the current QM specification.

## Shift Change

Future samples in the previous shift are deleted. This also includes the samples with specificity other than entity. Future samples are generated if the entity is linked to a sample plan frequency and QM specification. The samples are generated for an entity till the end of the current shift, using the entity specific context information. If there is a job running on the entity, and a QM specification that matches the job's context, the QM specification, and not the one whose context is solely that of the entity, is used to generate future samples. This is because the entity-only context has the lowest possible specificity, so a specification matching any other context information must necessarily have a higher specificity than this. The future samples are generated up to the end of the current shift in the following cases:

- If the sample plan frequency and QM specification have context information other than an entity, which includes or excludes the entity context information.
- If there is a job running on the entity whose operation or the item is equal to the context information in the QM specification.
- If there are no future samples for the sample plan frequency and QM specification.

## Context Other Than Entity

The future samples generated from this category are related to an action performed on a job.

## Job Start

Future samples are generated for a job when it is started. If there exists an effective QM specification that,

- If the item context is not null, matches the main item being produced by the job, and
- If the operation context is not null, matches the job's operation, and
- If the item category context is not null, has a context of item category to which the main item the job produces belongs, and
- If the process context is not null and the work order to which the job belongs was instantiated from a process, has a process context of the process from which the work order was instantiated, and
- If the entity context of the QM specification it is not null, has an entity context matching either the entity on which the job is being run or one of its ancestors.

The future samples are generated for each QM specification at each interval time defined, and the context directly or indirectly matches the operation, item, and/or entity of a running job. If a characteristic is already accounted for by some other QM specification context having higher specificity than the current context, then it is ignored.

When a job is started and if the context is linked to a calendar frequency that has a start\_delay configured, then the first sample after the job starts is delayed by the configured amount of time. The subsequent samples using calendar frequency will be generated based on the configured interval after delaying the first sample after the

job start.

If a sample exists for a time frame linked to a QM specification context that has a lower specificity than the current context, then the existing samples are deleted before the new samples are generated for the current context.

When a shift change occurs, the future samples for the next shift are regenerated up to the end of the next shift. The regenerated samples are generated for item that is linked to a sample plan frequency and QM specification, and the context has the highest specificity than others.

## Job End, Job Paused, or Job Status Change from Running to Another State

When a job is ended, paused, or the status is changed to any other state except running, the future samples for the sample plan frequency and QM specifications for the operation or item are deleted for the current shift. This is done as long as the operation and item are not used by other jobs on the same entity.

If the future samples related to the current context are deleted, new future samples are generated for the current shift. To generate the future samples for the current shift, the sample plan frequency and QM specification needs to have the closest specificity preceding the current context.

## Generating Sample Names by Using Replaceable Parameters

To easily identify the group of samples by a template name in a report, a Replaceable Parameter is used to generate sample names. When a sample is generated, the actual sample name (sample.sample\_name) is derived from the template sample name (sample\_plan.sample\_name) that is configured for the sample plan from which the sample is generated.

Sample names are generated as a frequency type is evaluated in the sample generation code. In the order of evaluation, shift frequencies are evaluated before calendar frequencies. If sample names have an incremental octothorpe, and samples are generated for shift and calendar frequencies, the sample name numbering will not be in time order.

The following table shows a list of replaceable parameters that can be successfully replaced from the template sample name. The following table shows examples, that use the current date by default (10/27/2015 local date).

Replaceable Parameter (Case Insensitive)	Value Returned	Example
[YYYY]	Year	2015
[MM]	Month of the year (integer)	10 (with leading zeros)
[MONTH]	Name of the month	October
[DD]	Day of the month	27 (includes leading zeros)
[WW]	Week of the year	44 (includes leading zeros)
[DAY]	Day (in full) of the week	Tuesday
[WD]	Day of the week	3
[DY]	Day of the year	298 (includes leading zeros)

Replaceable Parameter (Case Insensitive)	Value Returned	Example
[EntityName]	Name of the entity	Blender
[WorkOrderID]	Work Order ID	WO123456
[OperationID]	Operation ID	BlendingOperation
[SequenceNumber]	Job Sequence Number	0
[ItemID]	Item ID	Item123456
[CharacteristicName]	Characteristic Name  If a sample contains more than one characteristic, the name from the first characteristic that is added to this sample is returned.	Viscosity
[QMSpecName]	QM Specification Name	QMSpecA
[FrequencyName]	Frequency Name	FrequencyA
[SamplePlanName]	Sample Plan Name	SamplePlanA
[SegmentRequirementID]	Segment Requirement ID	SegmentRequirement
[SegmentResponseID]	Segment Response ID	SegmentResponse
[#####]	Integer value returning the next highest number. If none is found, it returns 1, including leading zeros. If the maximum is reached, then the maximum value is retained.  The number of octothorpes is not limited for a template sample plan name.	0001 (includes leading zeros)

## Readyng Samples

For calendar, shift, and equipment runtime frequencies, the MES middleware maintenance service sets a sample to the Ready status by moving future samples from the sample\_to\_go and sample\_char\_link\_to\_go tables to the sample and sample\_char\_link tables. This happens when the current time (in UTC) is greater than or equal to the *requested\_time\_utc* in the sample\_to\_go table.

For production unit count frequencies, samples will either be pushed further into the future or will be skipped based on the system parameter setting *Sample wait time for delayed production*.

## Updating Sample Status

The MES middleware maintenance service updates the status of a sample based on the following conditions.

### Ready Warning

When the current time is at or later than the requested sample time and the warning interval for a ready sample; the *pulled\_time\_utc* is null (i.e., the sample has not been pulled); and no data has been collected for the sample.

### Missed

When the current time is at or later than the requested sample time and the expiry interval for a sample; the *pulled\_time\_utc* is null (i.e., the sample has not been pulled); and no data has been collected for the sample.

### Late

When the current time is at or later than the requested sample time and the expiry interval for a sample, and:

- The *pulled\_time\_utc* is null (i.e., the sample has not been pulled) and some but not all the required data has not been collected  
OR
- The *pulled\_time\_utc* is not null (i.e., the sample has been pulled) but all required data has not been collected

When a measurement data is recorded in the database, the status is updated based on the following conditions.

### In Progress

Specifies the current time is between the requested and expiration time, and that at least one measurement is recorded in the result table for the sample.

### Complete

Specifies the measurement time for all the characteristics for a sample that are less than the sample expiration time, and the sample size for each characteristic within the sample is at least equal to the defined minimum sample size.

### Complete Late

Specifies at least one measurement time that is greater than the expiration time, and the sample size for each characteristic within the sample is at least equal to the minimum sample size.

## Customizing the MES Middleware

You can use the Middleware Configuration Editor to configure the custom mapping file that the middleware uses while processing commands. The following items can be configured:

- Settings that affect the MES middleware communication with client applications and MES databases
- Command (SP) timeouts
- Custom database SP mappings
- Custom batch SP mappings
- Extensibility hooks

After changing and saving settings in the Middleware Configuration Editor, you will have to restart the MES middleware service to have the changes take effect. See [Starting, Stopping, and Restarting the Local MES Middleware Host](#).

In some cases, you will also have to restart any running clients.

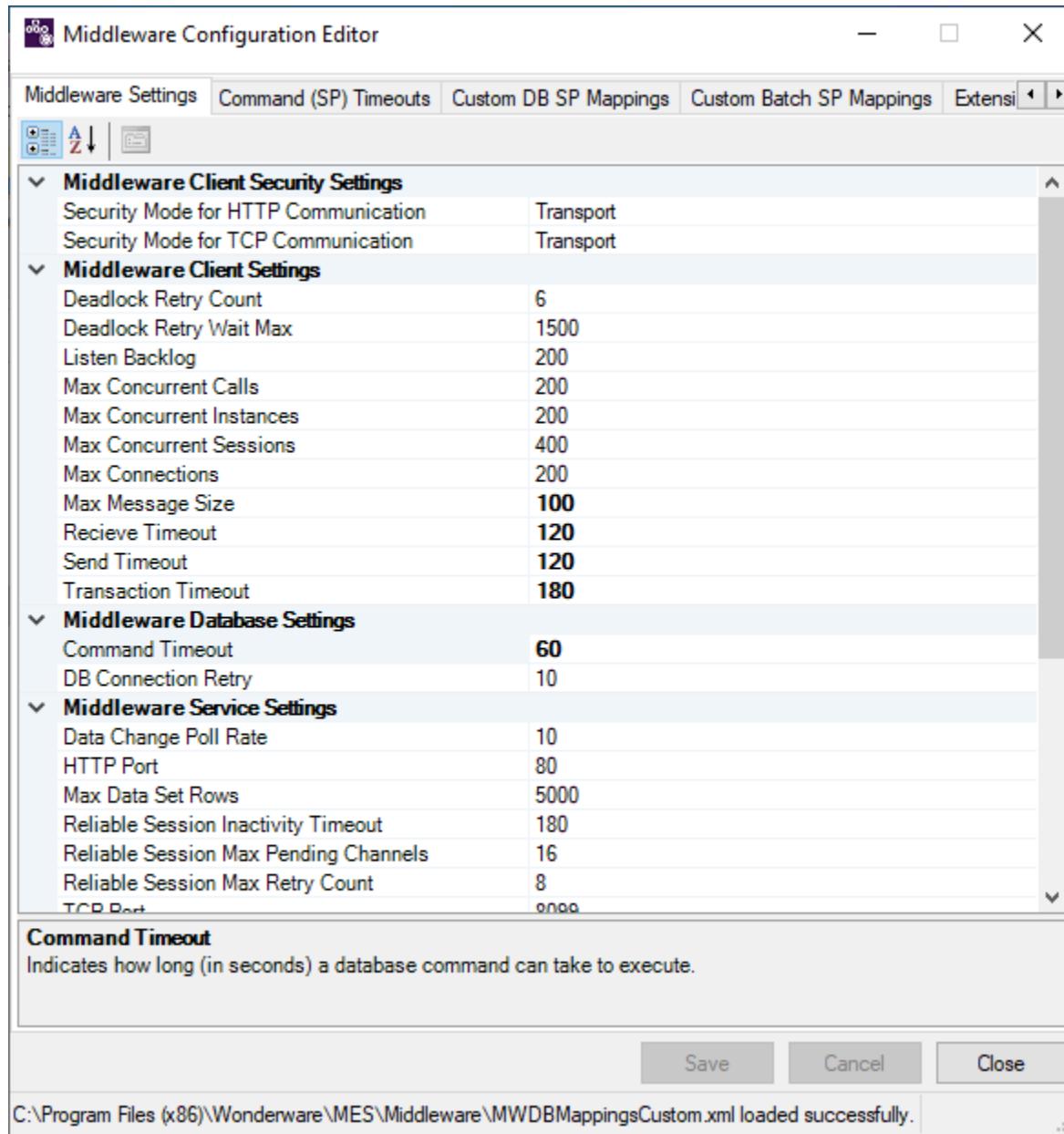
**Note:** Changes to the middleware configuration file should only be performed using the Middleware Configuration Editor.

## Opening the Middleware Configuration Editor

### To open the Middleware Configuration Editor

- On the Start menu, select **Middleware Configuration Editor**.

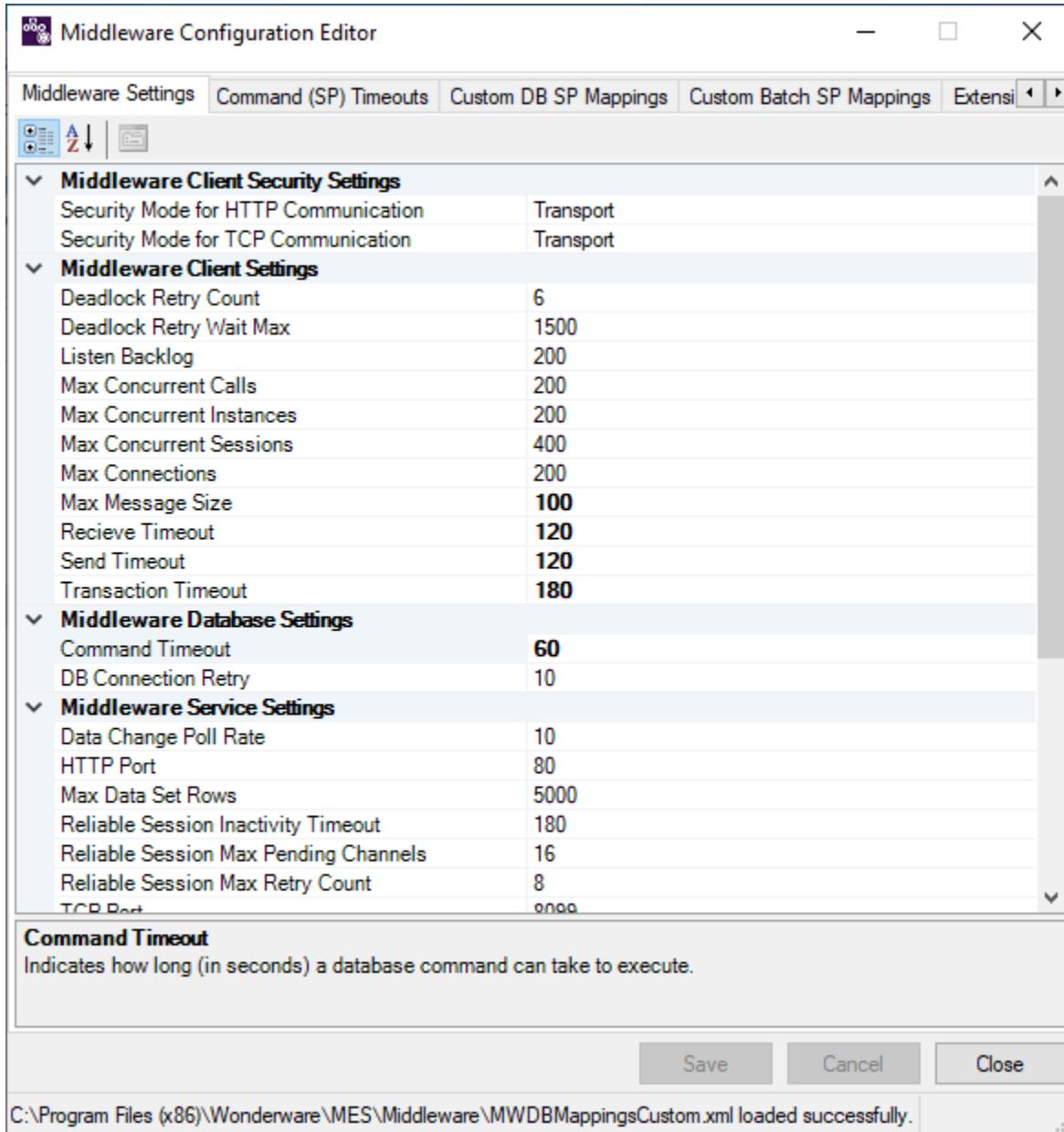
The Middleware Configuration Editor dialog box appears.



See the following topics for descriptions of what settings can be configured on each tab.

## Middleware Settings Tab

The settings on this tab affect the communication of the MES middleware service with the client applications and the MES database.



You can view a description of the selected option at the bottom of the window.

You can configure security, client, database, service, and tracing settings on the middleware.

**Note:** When any changes are made to the Client Settings, all running clients must be restarted before they detect the changes. Also, changes to the HTTP or TCP Ports requires all running clients to be restarted.

### Middleware Client Security Settings

Starting with MES version 7.0, synchronous communications between the MES middleware and client

components are encrypted by default. The following settings allow for disabling encryption.

#### Security Mode for HTTP Communication

The default and recommended setting is TRANSPORT for secure communication using HTTPS. Select NONE (not recommended) for unsecured communication using HTTP.

#### Security Mode for TCP Communication

The default and recommended setting is TRANSPORT for secure communication. Select NONE (not recommended) for unsecured communication.

Communications between the MES middleware and the middleware proxies on client nodes can use either HTTPS/HTTP or TCP. HTTPS/HTTP is typically used when the Middleware Server and client nodes are not located in the same building. TCP is typically used when the Middleware Server and client nodes are located in the same building. This selection is based on the middleware proxy's **Protocol** setting for the MES Middleware Proxy component in the post-install Configurator.

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**Note:** If the security mode for TCP is enabled and the user under which the middleware service is running is changed from a Windows service account to a domain user account, communication with that middleware service from client machines will fail. For secure TCP communication (i.e., Security Mode for TCP Communication set to TRANSPORT), the MES middleware service must run under a virtual service account. To avoid this condition, use either HTTP communication or, to continue using TCP, disable the TCP security mode and in the post-install Configurator reconfigure the MES Middleware Proxy component.

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### Middleware Client Settings

#### Deadlock Retry Count

The number of times a deadlock scenario must be retried before returning an error to the caller.

#### Deadlock Retry Wait Max

The maximum time (in milliseconds) a deadlock must wait before retrying. The default wait time is randomly chosen between 0 and the configured maximum wait time.

#### Listen Backlog

Specifies the number of pending accept requests to be queued. If the listen backlog queue fills up, new socket requests will be rejected.

#### Max Concurrent Calls

A Windows Communication Foundation (WCF) throttling setting that limits the number of calls that can be made against the MES middleware host.

#### Max Concurrent Instances

A WCF throttling setting that limits the number of instances that can be made against the MES middleware host. It is recommended that this value be set to 100 x the number of processors on the server. For example, if the server has eight processors, the value of this setting should be 800.

#### Max Concurrent Sessions

A WCF throttling setting that limits the number of sessions that can be made against the MES middleware host.

#### Max Connections

The maximum number of connections allowed to be pending dispatch on the MES middleware server.

#### Max Message Size

The maximum size of the message (in MB) that you can exchange between the client and the server.

**Receive Timeout**

The amount of time in seconds that the client must wait before receiving data from the server.

**Send Timeout**

The amount of time in seconds that the client must wait when sending a command to the server.

**Transaction Timeout**

The maximum time that a transaction may take to execute (in seconds). All the commands within the transaction must complete within this time.

## Optimizing MES Middleware Client–Host Communication

The defaults for the settings Listen Backlog, Max Concurrent Calls, Max Concurrent Instances, Max Concurrent Sessions, and Max Connections have been selected to optimize the reliability of communication between the MES middleware client proxies and the MES middleware host. The defaults are the recommended settings for medium and large systems, and also work without causing communication issues for small systems.

If these settings are changed to lower values, transaction processing issues might occur, as indicated by the following error message: *TCP Provider: No connection could be made because the target node actively refused it.*

For example, the WCF throttling settings limit the number of calls, sessions, and instances that can be made against a service. Setting limits on these helps to avoid DOS (denial of service) attacks as they help to prevent the server from being overwhelmed. However, if the setting values are too low, the server can be underutilized.

To further ensure optimal communication between MES middleware proxy clients and the middleware host, it is recommended that there be no devices between the client and host nodes, such as load balancers or NATs (network address translators).

## Middleware Database Settings

**Command Timeout**

The time (in seconds) for a database command to execute.

**DB Connection Retry**

The number of times that the middleware will attempt to connect to the MES database. The default value is 10.

## Middleware Service Settings

**Data Change Poll Rate**

The data change poll rate value to specify the frequency at which the database is checked for changes which is sent to the subscribed clients.

**HTTP Port**

The HTTP port number used by the MES middleware's WCFHostService account for sending asynchronous messages, such as for MSMQ and EventBroker.

If, in the **Middleware Client Security Settings**, the **Security Mode for HTTP Communication** setting is set to NONE and HTTP is being used rather than TCP for communication between the middleware server and client middleware proxies, this is also the HTTP port number that the MES middleware server and proxies will use.

**Max Data Set Rows**

The maximum data set rows value that is returned to the client that subscribe to data changes.

**Reliable Session Inactivity Timeout**

The duration of inactivity before the session times out, in seconds.

This and the other reliable session channel settings allow you to customize the reliable messaging channel behavior. The default values allow more clients to simultaneously establish reliable sessions to the MES middleware service and reduce *server too busy* errors (which are logged to the WCF service log) when a burst of requests occurs.

**Reliable Session Max Pending Channels**

The maximum number of pending channels.

**Reliable Session Max Retry Count**

The maximum number of retries to establish a channel connection.

**TCP Port**

If the middleware is configured to use TCP rather than HTTP for communication between the middleware server and client middleware proxies, this is the TCP port number that the MES middleware server and proxies will use. If the TCP port number is changed, the Middleware Configuration Editor will update the existing inbound firewall exception to the new port number (used by MES Middleware Service). For the firewall exception update to take effect and allow middleware proxies to communicate with the middleware, the middleware has to be restarted.

## Middleware Tracing Settings

**File Name**

The name of the file to log the trace.

**File Path**

The location to save the log file.

**Include SP Parameter Values While Logging**

The frequency of including SP parameter values while logging. Selecting this option logs all the parameter values and the stored procedure calls in an output file.

**Log Source Type**

The file type to log the .NET middleware calls.

**Log XML Input**

Specifies whether to log the XML input source based on the configuration settings.

**Log XML Result**

Specifies whether to log the XML results based on the configuration settings.

**Trace MES MWCalls**

Specifies whether to trace the middleware calls of the MES application.

This property degrades the performance of the application. Only enable this property while analyzing an issue.

**Trace Specific Commands Only**

Specifies whether the .NET middleware must trace all the MES calls.

**Wait Time Between Each Log Writes**

The wait time in seconds between each log write. The middleware waits for the specified x seconds before each log write. If you specify the value as 0, the middleware logs the result immediately.

**XML Request Type To Trace**

The XML type to trace. If you specify All, all types of requests are traced. For example, Data retrievals through GetDS and DataWrites through ExecCommand.

## Stored Procedure Naming Conventions

For standard database operations on a single table (i.e., Add, Delete, GetAll, GetSpecific, Update), MES stored procedure names have the following format:

`sp_operationtype_tablename`

where *operationtype* is one of the following:

- **I** for an Add
- **D** for a Delete
- **SA** for a GetAll
- **S** for a GetSpecific
- **U** for an Update

For example:

Add an item:	<code>sp_I_Item</code>
Delete a site:	<code>sp_D_Site</code>
Get all customers:	<code>sp_SA_Cust</code>
Get a specific cause:	<code>sp_S_Cause</code>
Update an attribute:	<code>sp_U_Attr</code>

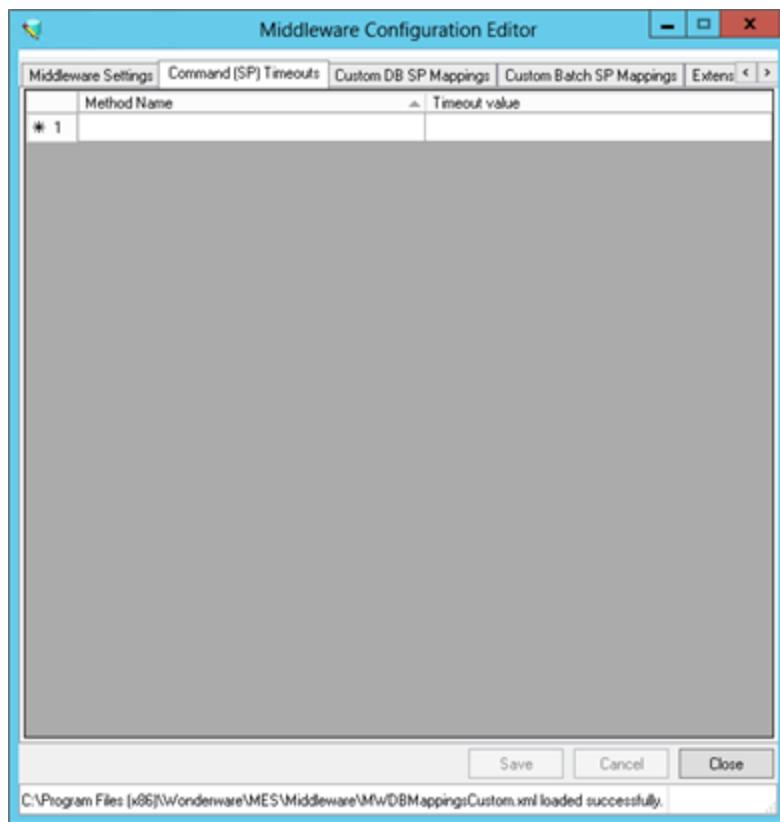
For other database operations, the stored procedure name includes the object being acted on and the action.

For example:

- To transfer items, `sp_U_Item_Transfer`
- To add item consumption after a job has been run, `sp_I_IC_AddConsPostExecByName`

## Command (SP) Timeouts Tab

On this tab, you can configure a longer command timeout value for specific methods in the MES database. This is necessary for procedures that runs longer than the default command time. If clients consistently get timeout errors from the database when calling a specific middleware method, they may have to increase the timeout for the specific method.



This tab shows the stored procedures or methods and the corresponding timeout values under the **Method Name** and **Timeout value** columns respectively.

A method name is a two-part *object.command* name that the middleware maps to a stored procedure name. The method name is derived from the Object/Cmd/MsgType elements in the XML message sent to the middleware. If the MsgType is *exec* or *getspec*, then the method name is created by combining the Object and Cmd with a period (for example, *ent.add*). If the MsgType is *getall*, *getbykey*, or some other value, then the method name is created by combining the Object and the MsgType with a period (for example, *ent.getbykey*).

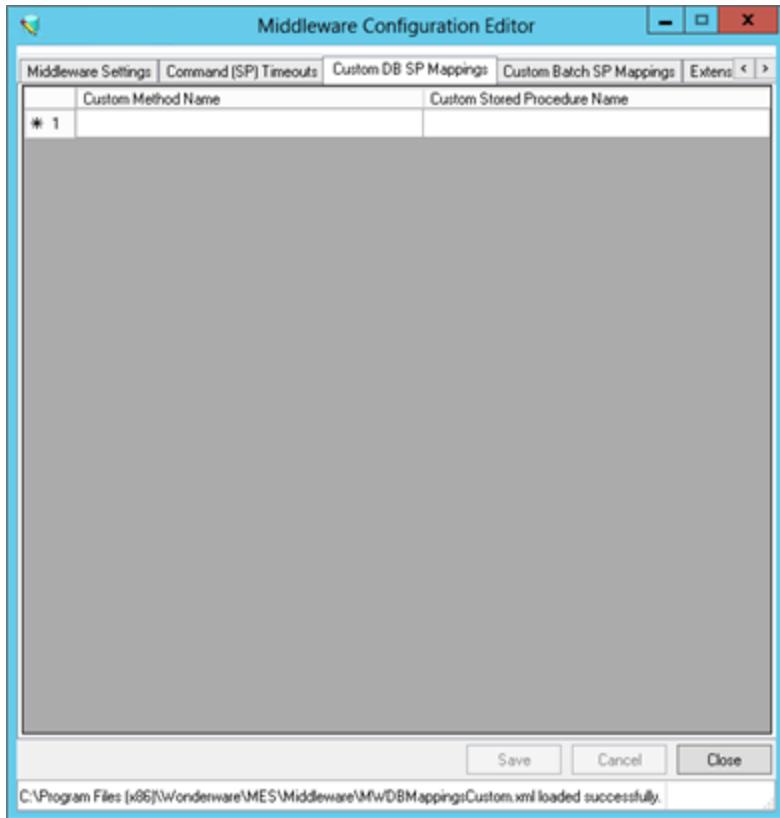
This automatic mapping rule also applies to Custom DB and Custom Batch SP Mappings.

### To configure the Command (SP) Timeouts

1. Double-click and type the method name you want to configure in the **Method Name** column.
2. Type the timeout value (in seconds) in the **Timeout value** column.
3. Click **Save**.

## Custom DB SP Mappings Tab

On this tab, you can configure the custom mapping for stored procedures in the MES database. The MES Middleware Service accepts the XML commands that have the Object/Command/MsgType identifier.



This tab shows the method names and the corresponding stored procedure names in the **Custom Method Name** and **Custom Stored Procedure Name** columns respectively.

#### To configure the Custom DB SP Mappings

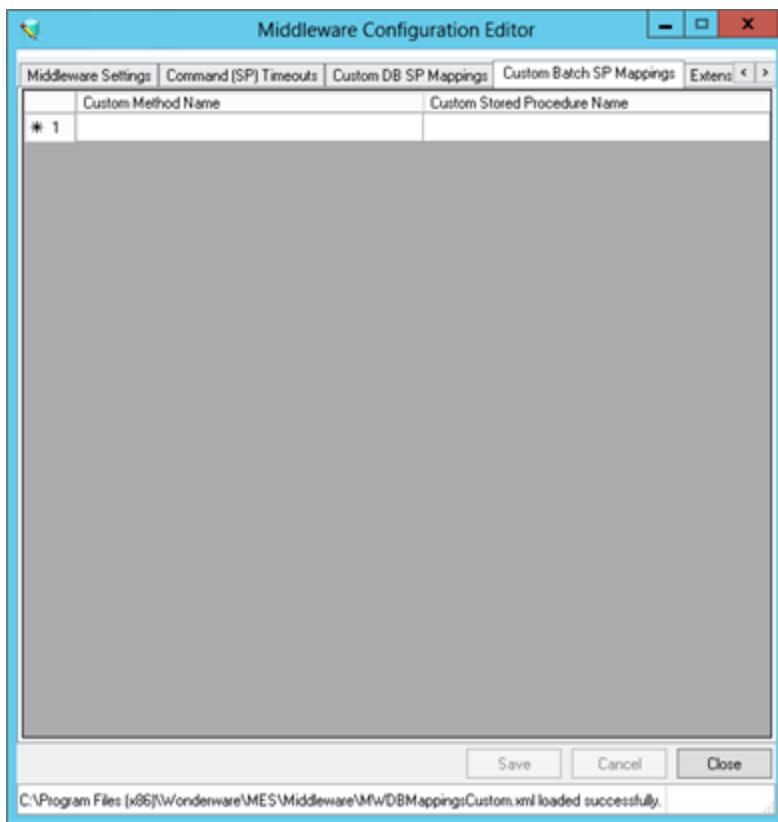
1. Click and type the method name you want to configure in the **Custom Method Name** column.
2. Type the stored procedure name in the **Custom Stored Procedure Name** column.
3. Click **Save**.

You can redirect only custom method names to a different stored procedure, and not standard middleware methods.

#### Custom Batch SP Mappings Tab

On this tab, you can configure the custom mapping for the custom batch-oriented stored procedures in the MES database.

These custom stored procedures accept XML as their first parameter and process the XML internally. The stored procedures process the XML commands in batches.



This tab lists the method names and the corresponding stored procedure names in the **Custom Method Name** and **Custom Stored Procedure Name** columns respectively.

### Mapping the Identifiers and Stored Procedures in Batches

The difference between this mapping and the mapping defined by the Custom DB SP Mapping tab is that the stored procedures that are defined here must have an input parameter named *xml\_source* or *in\_xml\_source*. The stored parameter is passed for the entire XML command.

#### To map the identifiers and stored procedures in batches

1. Click the custom method name you want to configure in the **Custom Method Name** column.
2. In the **Custom Stored Procedure Name** column, type the corresponding stored procedure name.
3. Click **Save**.

### Extensibility Hooks Tab

On this tab, you can configure extensibility hooks.

Extensibility indicates that the system functionality is extendable without making any major changes to the system architecture. Extensibility hooks are used for the following:

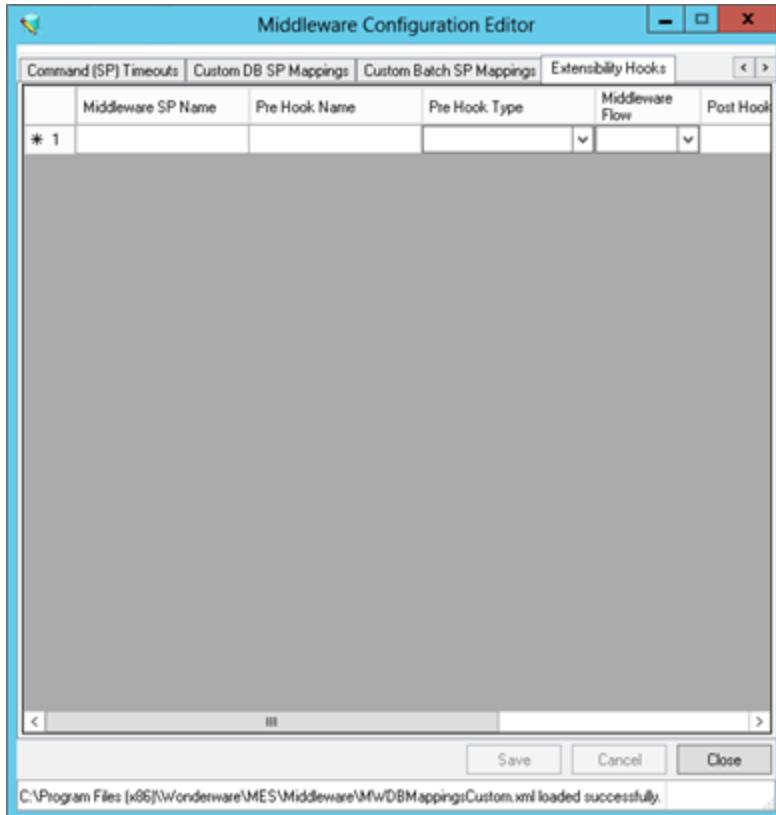
- Extend the middleware functionality by executing custom code
- Replace the current middleware stored procedure if you want to perform some different action

Custom code can be executed before or after a method with middleware code. Extensibility hooks can be .NET assemblies or stored procedures. You can configure extensibility hooks as a part of a custom mapping file that the middleware uses while processing commands. You can configure the following extensibility hooks:

- Pre hook - Calls custom code to execute before executing a middleware stored procedure.
- Post hook - Calls custom code to execute after executing a middleware stored procedure.

You can configure one pre hook and one post hook for a middleware stored procedure. You can also configure the flow of the middleware after execution of configured hooks.

A middleware flow specifies the status of the middleware after executing a hook.



The extensibility hook settings are described below.

#### **Middleware SP Name**

The middleware stored procedure for which you want to configure a hook.

#### **Pre Hook Name**

The name for the pre hook.

#### **Pre Hook Type**

**SP or ASSEMBLY.**

#### **Middleware Flow**

The required middleware flow for the pre hook: **STOP**, **STOP ON ERROR**, or **CONTINUE EVEN ON ERROR**.

#### **Post Hook Name**

The name for the post hook.

#### **Post Hook Type**

SP or ASSEMBLY.

#### Middleware Flow

The required middleware flow for the post hook: **STOP ON ERROR** or **CONTINUE EVEN ON ERROR**.

The following topics provide an overview for configuring a pre hook and post hook. For details, see [MES Middleware Extensibility Hooks](#).

## Configuring a Pre Hook

The pre hook is configured for the specified middleware method.

When you configure a pre hook, the pre hook is mapped to the middleware. The pre hook is called before executing the middleware code. If the pre hook is of type **SP**, then the same parameter list from the middleware SP is passed to the custom SP.

The middleware flow after executing the pre hook can be one of the following:

- The flow stops when the pre hook is called. A value is returned to the calling method and any changes or updates made with the transaction are not committed. The middleware does not call the current method or any other post hooks. The pre hook replaces the current middleware method in this case.
- The flow stops in case of any error and an error message is returned to the calling method. The middleware does not call the current middleware method or any post hooks.
- The flow always continues to the middleware code irrespective of any errors. A warning message is returned to the calling method in case of any error.

## Configuring a Post Hook

The post hook is configured for the specified middleware method.

When you configure a post hook, the post hook is mapped to the middleware. The post hook is called after executing the middleware code. If the post hook is of type **SP**, then the same parameter list from the middleware SP is passed to the custom SP.

The middleware flow after executing the post hook can be one of the following:

- The flow stops in case of any error. No changes are saved and no information is returned to the calling method except a generated error message.
- The flow always continues to the middleware code irrespective of any errors. A transaction is committed irrespective of any error and a warning message is returned to the calling method.

## Clearing the Middleware Stored Procedure Parameter Cache

For performance reasons, the MES middleware caches the parameter list of a stored procedure the first time the stored procedure is called. If a custom stored procedure's parameter list is subsequently changed, the middleware might not correctly call the stored procedure until the cache is cleared.

For example, a developer is modifying a custom stored procedure by adding a new parameter and is calling this stored procedure with the **ExecSP()** API method. Or, a supply chain connector has an import/export schedule already defined and then a developer makes changes to their stored procedure signature. Continuing to call the custom stored procedure or using the old signature without clearing the cache could cause unexpected results or issues.

To use the new parameter in the API call, the developer can either restart the MES middleware, call the **ClearSpParameterCache()** API method to clear the parameter cache, or use the MES Clear Parameter Cache utility to clear the parameter cache.

When putting changes to stored procedures into production, the MES Clear Parameter Cache utility can be used to clear the stored procedure parameter cache for the middleware. This must be performed on each middleware node to ensure that the changed stored procedures can be called from all clients.

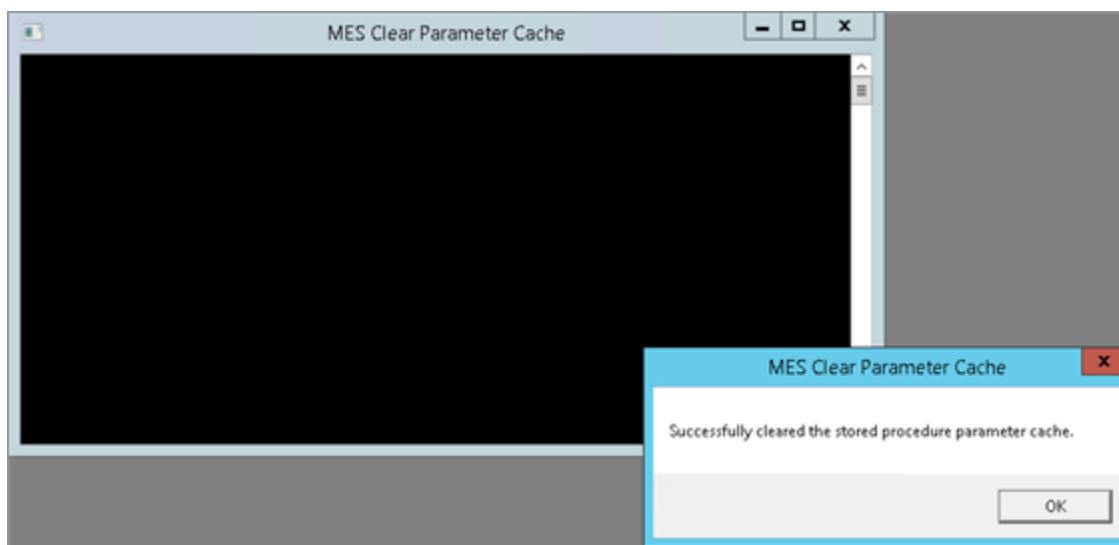
The procedure described here clears the parameter cache for all stored procedures (custom and MES-specific stored procedures). To clear the parameter cache for a specific custom stored procedure, the **ClearSpParameterCache(string)** API method must be used.

### To clear the middleware stored procedure parameter cache

1. Make sure the MES middleware service is running.
2. On the **Start** menu, locate and select **MES Clear Parameter Cache**.



A message appears, indicating that the cache has been cleared.



3. Close the message and the MES Clear Parameter Cache window.

## MES Middleware Performance Counters

The custom performance monitor counters that are described below are available for the MES middleware service via the MES Middleware Performance Object found in Windows Performance Monitor (PerfMon).

### AsyncCmd Active Calls

Number of asynchronous calls that are currently active. This counter is incremented and decremented when a method is entered and exited (server object is processing).

### AsyncCmd Active Instances

Number of asynchronous objects currently instantiated. This counter is incremented and decremented when an object is created and disposed. Includes objects that have been created but might be waiting to be active.

**AsyncCmd Completed Msgs/sec**

Number of asynchronous messages that completed successfully this second.

**AsyncCmd Messages/sec**

Number of asynchronous messages which started to process this second.

**AsyncCmd Retries/sec**

Number of retries due to asynchronous messages this second.

**AsyncCmd Total Duration/sec (ms)**

Total number of milliseconds spent executing methods due to asynchronous messages this second. This counter includes only durations of successful calls.

**AsyncCmd Total Retries**

Total number of retries due to asynchronous messages since the middleware started.

**Event Notifications/sec**

Number of event notifications that were raised this second.

**Number of Historical Subscriptions**

Historical subscriptions are subscriptions that are pulling data from the past (in chunks). They will eventually catch up to the current time and be switched to regular subscriptions.

**Number of Subscription Groups**

A subscription group is all the subscriptions for a specific table

**Number of Subscriptions**

The number of subscriptions that are currently active.

**SyncCmd Active Calls**

Number of synchronous calls that are currently active. This counter is incremented and decremented when a method is entered and exited (server object is processing).

**SyncCmd Active Instances**

Number of synchronous objects currently instantiated. This counter is incremented and decremented when an object is created and disposed. Includes objects that have been created but may be waiting to be active.

**SyncCmd Completed Msgs/sec**

Number of synchronous messages that completed successfully this second.

**SyncCmd Deadlocks/sec**

Number of deadlocks due to synchronous messages this second.

**SyncCmd Messages/sec**

Number of synchronous messages that started to process this second.

**SyncCmd Rows/sec**

Number of DataSet rows returned by synchronous messages this second.

**SyncCmd Total Deadlocks**

Total number of deadlocks due to synchronous messages since the middleware started.

**SyncCmd Total Duration/sec (ms)**

Total number of milliseconds spent executing methods due to synchronous messages this second. This counter includes only durations of successful calls.

## Log Flags for Troubleshooting the MES Middleware

You can set various log flags in the Operations Control Management Console Log Viewer to help troubleshoot potential MES middleware issues. For information about the Log Viewer, see the Operations Control Management Console help and the Log Flag Editor help.

Errors will always be reported by the MES middleware service and proxy. These errors will be highlighted in red in the Log Viewer. If your client application is running on the node on which the MES middleware service is running, you will see errors logged twice.

## Log Flags for Server-Side Diagnostics

The most common place to enable better diagnostic logging is on the node on which the MES middleware service is running. Use the following log flags on the specified assemblies.

### **FactMES.Server.Host Assembly**

#### ***Start-Stop***

When this flag is turned on, all the steps that are executed when starting the middleware host service are logged. The step log entries contain the context data at each step. The context data can help with diagnosing any startup issues and identify at what point the startup is failing.

### **FactMES.Server.Services Assembly**

#### ***LogAsyncDetails***

Async messages are stored in the message queue for the middleware to process later. Messages in the queue are assigned a sequence key and sequence number. Turning on this flag logs when the message was added to the queue along with the sequence key and a sequence number.

#### ***LogCmdStats***

For retrieved datasets, logs the retrieval duration, the number of rows and columns in the dataset, and the XML retrieval request.

#### ***LogDataChangeEvent***

Logs each EventBroker subscription group query and subscription data change events.

#### ***LogDeadlocks***

Logs each deadlock error. Normally these are not logged because they will be retried.

#### ***LogErrorStackTrace***

A commonly used flag. Logs a verbose stack trace for each error.

#### ***LogErrorXML***

A commonly used flag. Logs the XML content for XML messages that fail.

#### ***LogSequenceDetails***

Logs the sequence key and sequence number of a message that is being processed asynchronously.

#### ***LogValidationError***

Logs the message that was submitted if its validation fails when the synchronous or asynchronous command fails

or when the event broker subscription fails.

#### **Trace**

Shows every XML message and its response as they go through the MES middleware service. It also shows all EventBroker subscriptions.

## **FactMES.Server.Communication Assembly**

#### ***LogExtraXmlElements***

Logs a message when an element exists in the source XML that was not needed by the stored procedure. Setting this flag helps to detect messages if problems exist because the XML and the stored procedure do not match as expected.

#### ***LogLicenseInfo***

License acquisition and release events are always logged whenever the middleware is started, restarted, or stopped. Turning on this flag additionally logs the hourly license renewals.

#### ***LogRegionUpdates***

Logs information about the region when an entity is associated to a site.

#### ***LogSPandSQLCalls***

Logs every stored procedure or SQL call in a format compatible with the current database. You can often cut and paste this log content into a query window and execute the SQL command outside of the middleware. This is similar to using SQL Profiler to capture SQL statements.

To use the LogSPandSQLCalls flag you must also use the Middleware Configuration Editor to set the *Trace MES MWCalls* parameter (in the **Middleware Tracing Settings** group on the **Middleware Tracing Settings** tab) to True. After changing the setting, restart the middleware (see [Starting, Stopping, and Restarting the Local MES Middleware Host](#)). The Middleware Tracing settings can provide more powerful tracing capabilities than the Logger. For more information about these settings, see [Middleware Tracing Settings](#).

#### **Trace**

Shows miscellaneous events during message processing.

## **FactMES.Server.MaintenanceService Assembly: General**

#### ***LogAdditionalInfo***

Logs a message when the system is in the middle of processing an activity while the middleware is shut down.

Applies to the following events:

- Shift projections when there is nothing to project
- Shift changes are halted when the middleware is shutting down
- Sample updates are halted when the middleware is shutting down
- Middleware startup activities

#### ***LogTransactionComplete***

Logs the activity information and how long the activity took to complete after processing the middleware call successfully.

For a single activity transaction, the transaction complete is based on the single call to the middleware. When an

activity contains more than one middleware call (e.g., a shift change for each entity), then the transaction complete is logged after finishing the shift change on all entities.

Applies to the following events:

- Scheduled tasks: daily, hourly, minutely, daily custom, hourly custom.
- SCC Check for Triggers.
- SCC Handle Event Changes.
- Creating utilization shift links on an hourly basis.
- Creating and updating job hourly buckets.
- QM sample, ready, update, and extend events, when all these three activities are completed for all the entities that can capture QM data.
- When the Regenerate Samples flag (regen\_samples in the db\_status table) is reset to false.

When QM configuration elements that are related to sample generation are changed, the Regenerate Samples flag is set to true. This indicates that the middleware has to regenerate samples because there is a change in the configuration. Changes to the following cause this flag to be set to true: QM specifications, characteristics, QM specification-characteristic links, and sample frequencies.

When the next minutely tasks after the change occurred are being executed and this flag is true, the middleware regenerates the samples for all the entities using the new configuration and then resets this flag back to false.

- Sample generation is complete.
- Post shift change on all entities.
- Completion of the shift change for all entities.
- Completion of a post shift change process update.
- Completion of shift projections for all entities.

#### ***LogXMLRequest***

Logs XML requests. The XML payload is logged before the request is sent to the middleware so that the XML request is captured and can be referred to in case the request fails.

Applies to the following events:

- Getting MES Service Identity to verify whether the host machine can run the maintenance tasks or not
- Clearing MES Host Identify upon middleware shutdown
- Scheduled tasks: daily, hourly, minutely, daily custom, hourly custom
- SCC Check for Triggers
- SCC Handle Event Changes
- Creating utilization shift links on an hourly basis
- Creating and updating job hourly buckets
- Startup activities

## **FactMES.Server.MaintenanceService Assembly: Shifts**

#### ***LogPostShiftChange***

Logs the events that are processed after a successful shift change, such as sample generation and production and

consumption fixes. Messages are logged only when there is a successful shift change on the entity.

#### ***LogShiftDecisionPoints***

For each entity for which a shift change is being performed, logs a message at each point when the system is taking a decision to determine the type of shift schedule that is applicable to the entity.

The LogShiftDecisionPoints logs fewer messages for an entity when compared to TraceShiftChange flag. Although these two flags can be independently enabled or disabled, when turning on the TraceShiftChange flag it is recommended to also turn on the LogShiftDecisionPoints flag to get comprehensive shift change information.

#### ***LogShiftProjectionDecisionPoints***

For each entity for which projected shifts are being changed, logs a message at each point when the system is taking a decision to determine the type of shift schedule that is applicable to the entity.

#### ***LogXMLRequestShiftChange***

For each entity, logs the XML payload containing the shift change information that is sent to the middleware for the shift change. The trace messages for the TraceShiftChange, LogShiftDecisionPoints, and LogPostShiftChange flags only provide information about how the shifts are determined for the entity, but not necessarily the final XML that is sent to the middleware. The XML payload is logged before the request is sent to the middleware so that the XML request is captured and can be referred to in case the request fails.

#### ***LogXMLRequestShiftProjections***

For each entity, logs the XML payload containing the shift projection information that is sent to the middleware. The XML payload is logged before the request is sent to the middleware so that the XML request is captured and can be referred to in case the request fails.

#### ***TraceShiftChange***

For each entity for which a shift change is being performed, logs a message that provides more details about the shift change.

#### ***TraceShiftProjections***

For each entity for which projected shifts are being changed, logs a message that provides details about the shift projections.

## **FactMES.Server.MaintenanceService Assembly: Quality Management Samples**

#### ***LogSampleDecisionPoints***

For each entity that is processing samples, logs any change in the event processing. Examples include when events such as sample generation or updates are skipped as a result of changing shifts or when sample updates are stopped because the middleware was shutting down.

#### ***LogSampleOverRuns***

Logs a message when the total amount of time to ready samples, to extend samples, or to update sample status for all entities exceeds the amount of time configured in the system attribute 417, *Frequency to call sample updates (in seconds)*.

Note that a message will be logged only when the total amount of time exceeds this configured amount of time and not simply each time the sample is updated or extended.

#### ***LogXMLRequestSampleGeneration***

Logs the XML request for each entity for which samples are being readied or extended and for each entity for which sample status is being updated. The XML payload is logged before the request is sent to the middleware so that the XML request is captured and can be referenced in case the request fails.

***TraceSampleGeneration***

After successful completion of the sample generation middleware call for an entity, logs each sample ready, update, or extend request for the entity. Also, logs additional tracing information when the middleware is shut down, the Regenerate Samples flag is reset to false, readying samples for all entities has been completed, or there are no entities in the MES database that can capture QM data and so there is no need to process sample updates.

## Log Flags for MES Web API Diagnostics

Use the following flags to log MES Web API diagnostic information.

### **FactMES.Server.TransactionAdaptor Assembly**

Most flags in this assembly are common to trace the calls originating from the MES Web API or from database maintenance activities.

***LogDeadlocksAndTimeouts***

Logs the information when the transaction is deadlocked (intermediate transactions) or timed out. This logging applies to calls that originate from the MES Web API or from the middleware maintenance services. While the XML request might be retried several times and is finally successful, enabling this flag logs the intermediate failures and retries.

***LogMesServiceCalls***

Logs the information about the calls that originated from the database maintenance service. This logging applies to calls that are requesting datasets or the calls that change data in the database.

***LogTimeZoneConversionAmbiguities***

Logs time zone conversion ambiguities.

When converting the local time to UTC, the local time could be ambiguous when the local region is changing between standard time and daylight savings time. For example, in the U.S.:

- When changing from daylight savings time to standard time, there will be two instances of the hour from 1–2 am.
- When changing from standard time to daylight savings time, there will be no hour from 2–3 am.

The middleware will identify these ambiguities and adjust the times accordingly. Turning this flag on will log the adjustment information.

***LogTransactionCompleteExecCmdTransId***

Logs the information only when the execution (data write) is successful from the middleware. This logging applies to calls that originate from the MES Web API or from the middleware maintenance services. The information contains how long the execution took to complete the transaction along with the XML request.

***LogTransactionCompleteGetDSTz***

Logs the information only when the dataset (data read) is successfully retrieved (post) from the middleware. This logging applies to calls that originate from the MES Web API or from the middleware maintenance services. The information includes how long the execution took to retrieve the dataset, how long the execution took to convert the UTC times into time zone of the client, and the XML request to the middleware.

## MES.WebApi Assembly

### ***LogIncomingRequestBody***

Logs the request body for MES Web API calls.

### ***LogIncomingRequestHeaders***

Logs the headers for MES Web API calls. For authorization headers, only the first 5 characters of the bearer token are included for security reasons. They are included to confirm that a bearer token was provided for the call.

### ***LogIncomingRequestUri***

Logs the URI for MES Web API calls.

## MES.WebApi.MiddlewareAdaptor Assembly

### ***LogDeadlocks***

Logs the number of deadlock retries and the database error information.

### ***LogTransactionCompleteGetDS***

Logs the information that indicates whether the dataset request was successful. The information includes how long the call took to retrieve data, how long it took to serialize data into Json format, and how long it took to convert the data into JArray format.

### ***LogXmlForWebApi***

Logs the information that indicates whether the execution request was successful. The information includes how long the execution took to complete the entire round-trip.

## Log Flags for Client-Side Diagnostics

The client middleware proxy can be enabled to log additional diagnostic information. In some cases this information is redundant with the MES middleware service logging on the server side. However, setting client-side log flags can be useful if you are working at the client or if the node on which the middleware service is running is logging too many log entries to make sense of them.

## FactMES.Server.Proxies Assembly

### ***LogDataChangeEvent***

Logs each data change event, including error events.

### ***LogDeadlocks***

Logs each deadlock retry. Errors resulting from exceeding the retry count are always logged.

### ***LogErrorXML***

Logs the XML content for XML messages that fail.

### ***LogEvtBrokerHeartbeat***

Logs subscriptions, when subscriptions are canceled, when the heartbeat is refreshed, and when subscriptions are processed.

### ***LogSequenceDetails***

For a call being made from the client, logs the sequence key and sequence number of the message that is being

processed asynchronously.

#### **LogValidationError**

For a call being made from the client, logs the message that was submitted if its validation fails when the synchronous or asynchronous command fails or when the event broker subscription fails.

#### **Start-Stop**

When this flag is turned on, the steps that are executed when connecting the client middleware proxy to the middleware are logged. The step log entries contain the context data at each step. The context data can help with diagnosing connection issues.

**Note:** It is strongly recommended to turn on this flag only for diagnostic purposes. This is because when this flag is on, several messages will be logged by the Logger every time that the client middleware proxy pings the middleware to verify that the connection is working.

---

#### **Trace**

Logs every XML message and its response as they go through the WCF Proxy. It also shows all EventBroker subscriptions and re-subscriptions.

## Addressing a "Proxy Failed to Connect to Middleware Server" Error

If communication with the MES middleware is down and the Logger shows the message *Proxy failed to connect to Middleware Server service endpoint*, perform the following steps to verify that the middleware configuration is correct.

1. From the command prompt on the client application node, use the **ping** command to verify that there is TCP/IP connectivity with the Middleware Server node.
2. On the Middleware Server node:
  - In the post-install Configurator, verify that the **MES DB/MW Communication** component is installed correctly and its status is Configured (green indicator).
  - From the Windows Services app or from the Service panel, verify that the Wonderware MES Middleware Host service is running.
  - Verify that a firewall inbound rule exception has been added to Windows Defender Firewall **Allowed Apps** page with the name **MES Middleware TCP NetBinding** and that its **Domain** and **Private** check boxes are selected. Or verify that the Windows Domain Networks firewall status is off.
3. If the **MES middleware and client middleware proxy are on different nodes**, then in the post-install Configurator on each node verify that the HTTP and HTTPS port numbers configured for the MES Middleware Proxy component on the client proxy node match those configured for the MES Middleware Proxy component on the Middleware Server node.  
If the **MES Middleware and client middleware proxy are on the same node**, then in the post-install Configurator verify that the HTTPS port number configured for the MES Middleware Proxy component is the same HTTPS port number configured for the System Management Server (click **Advanced** and refer to the **Ports** tab on the **Advanced Configuration** dialog).
4. If the MES middleware and client middleware proxy are on different nodes, then in the post-install Configurator verify the following about the System Management Server:
  - If the System Management Server configuration on the Middleware Server node is set to **This node is the System Management Server**, then the System Management Server configuration on the client middleware proxy node should be set to **Connect to an existing System Management Server** and point

to the Middleware Server node.

- If the System Management Server configuration on the Middleware Server node is set to **Connect to an existing System Management Server** and the configured target node is different than the client middleware proxy node, then the System Management Server configuration on the client middleware proxy node should use the option **Connect to an existing System Management Server** and use the same target node name of the System Management Server that is configured on the Middleware Server node. That is, the target node being pointed to as the location of the existing System Management Server should be the same on the Middleware Server and client middleware proxy nodes.
  - If the System Management Server configuration on the Middleware Server node is set to **Connect to an existing System Management Server** and the configured target node is same as the client middleware proxy node, then the System Management Server configuration on the client middleware proxy node should be set to **This node is the System Management Server**.
5. In the post-install Configurator on the node where the System Management Server resides, verify that the System Management Server status is Configured (green indicator).

## MES Middleware Extensibility Hooks

An MES Extensibility Hook is a mechanism for invoking an assembly or a stored procedure to perform custom actions before and/or after a specific middleware event is executed.

The topics in this section describe how the hooks function with the middleware, explain how to configure hooks, and provide configuration and execution examples.

Middleware Extensibility Hooks allow end users to execute custom functionalities, such as invoking a System Platform-based workflow, calling a custom stored procedure, or calling a method in an assembly, before or after processing the middleware event. This allows the end user to use their custom functionalities to check for specific conditions or perform certain processes beyond those supported by standard MES functionality.

The Extensibility Hooks configuration is stored in the middleware folder, and it is loaded into the MES middleware host's memory to execute the hooks when a corresponding middleware event is made to the MES middleware.

The middleware can be configured for a set of one or more hooks against a single middleware event. That is, when the Extensibility Hooks are configured for a middleware event, the MES middleware executes the pre-hook before the middleware event is processed, processes the middleware event, and then executes the post-hook after the middleware event. The hook configurations provide an option to cancel the entire middleware event, including the executions of pre- and post-hook in case of an error. The pre-hook configuration also provides an option for an end user to stop processing the middleware event, if the standard middleware functionality is embedded inside the custom implementation.

## Definitions

- A middleware event is a method exposed by the MES middleware and that method can be invoked by the client layer (e.g., stateless API, etc.) to perform some action in the MES database.
- A hook represents a custom functionality implemented by the end user in the form of a stored procedure, assembly, workflow, etc. A pre-hook represents a custom functionality implemented by the end user to execute that functionality before the middleware event is executed. A post-hook represents a custom functionality implemented by the end user to execute that functionality after the middleware event is processed.

## Custom Action Scenarios Using Hooks

There are many scenarios where the extensibility hooks can be used to check for specific conditions, process custom actions to control the flow of middleware event, and so on. The examples listed in the table below explain how the hooks can be used to perform custom actions.

Hook Intercept	Condition/Process	Hook Type	Example Scenarios
sp_U_Process_CheckIn (Process.CheckIn)	Process Status changed from or to Certified.  Changing the status of a process from or to Certified requires a user to have special permission/privilege.	Pre-Hook	A pre-hook can intercept the incoming middleware call (e.g., Process.CheckIn) to validate whether the user has a special permission to change the process status from/to certified, and act based on the outcome from the custom validation.
sp_I_Cert_User_Link (Cert_User_Link.Add)	A visual inspection of user's certification is required before the certification is attached to the user.	Pre-Hook	A pre-hook can intercept the incoming middleware call (e.g., Cert_User_Link.Add) to send an email (using workflow) to the factory supervisor for authorization before the certification can be attached to the user.
sp_U_Job_Exec_StartDataEntryJob (Job_Exec.StartDataEntryJob)	Creating a new work order that is not instantiated from a process requires authorization from the supervisor.	Pre-Hook	A pre-hook can intercept the incoming middleware call (e.g., Job_Exec.StartDataEntryJob) to initiate a workflow for the supervisor to authorize the transaction before the data entry job is created in the MES database.
sp_U_Storage_Exec_AddInv (Storage_Exec.AddInv)	Push the inventory quantities to the ERP.	Post-Hook	A post-hook can do the post processing on the Storage_Exec.AddInv call to push the inventory quantities to an external application/database.

## Pre-Hook and Post-Hook Configuration

A pre-hook and the post-hook can be configured for a single middleware event to invoke one or more stored procedures (if more than one stored procedure call is embedded inside the single custom stored procedure configured into an Extensibility Hook; see the second note below for more details) or they can be configured to invoke a .NET assembly to handle more complex activities. When invoking a stored procedure, the custom (hook) stored procedure must exist in the MES database targeted by the Middleware Server. Similarly, when invoking a .NET assembly, the assembly must exist in the specified path (see [Assembly](#) for more details about assembly configuration).

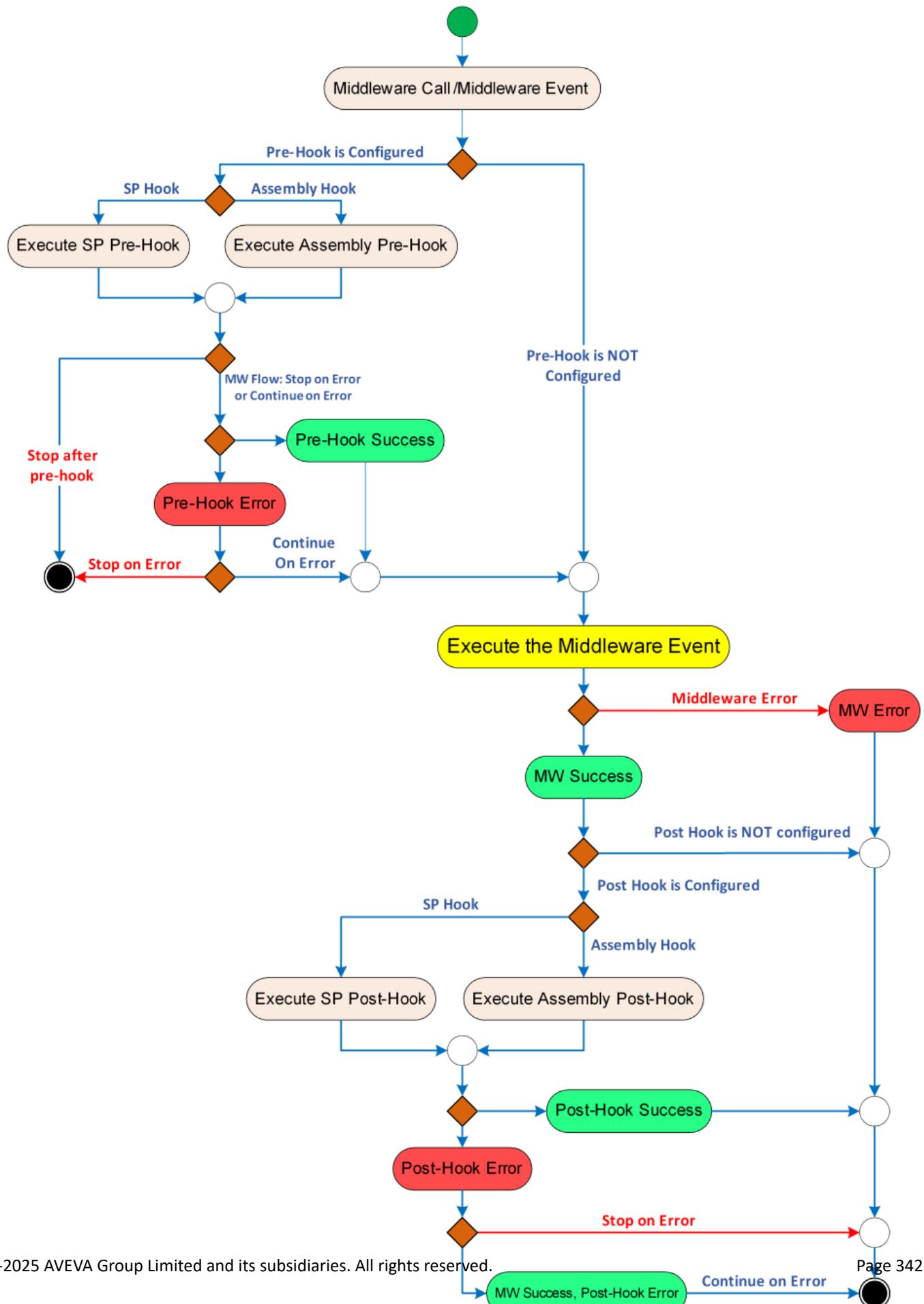
Both pre- and post-hooks can be configured to either continue or stop if an error is encountered. Pre-hooks can also be configured to stop after executing and not allow the normal stored procedure to be called, even in the absence of an error. See [Middleware Flow \(Pre-Hook/Post-Hook\)](#) for more information.

### Notes

- A single middleware event can have only one pre-hook and one post-hook.
- To execute more than one stored procedure for a single middleware event, all the custom stored procedures must be invoked from inside the custom stored procedure named in the hook. Similarly, to invoke more than one assembly for a single middleware event, all the intended assemblies must be invoked inside that single custom assembly named in the hook.
- If a pre-hook or a post-hook is not linked to a middleware event, then that middleware event is not affected by any custom hook implementations inside or outside the MES database.

## Execution Flow Diagram

The following diagram illustrates the flow of the pre-hook, middleware event, and the post-hook.



## Transaction Control

If pre- and/or post-hooks are configured, then the flow of the middleware event (i.e., whether to commit or rollback, stop or continue with the flow) is controlled by the Middleware Flow parameter [see [Middleware Flow \(Pre-Hook/Post-Hook\)](#) for more information]. If an exception is raised from the pre- or post-hooks or from the middleware event itself, and Middleware Flow is set to Stop on Error, then the current transaction is rolled back, including the transactions from pre- and post-hooks. The end user is responsible for determining when to raise an error from the stored procedure/assembly and for controlling the flow of the middleware event.

The stored procedures/assemblies involved for the pre- and post-hooks are executed as a part of the middleware transaction that corresponds to the middleware event. In general, the stored procedures/assemblies involved for the pre- and post-hooks are executed as a part of the middleware transaction that corresponds to the middleware event. The total transaction time allotted for the middleware event is split among the pre-hook, middleware event, and the post-hook. However, if the Middleware Flow parameter is set to Continue Even on Error, then each event (i.e. pre-hook, normal middleware event, post-hook) is executed in a separate transaction. In this case, the transaction time-out that is configured applies to each transaction.

### Stored Procedure

The transaction that corresponds to the middleware event needs to complete executing the custom stored procedure configured for the pre-hook, complete executing the middleware stored procedure, and complete executing the custom stored procedure configured for the post-hook. All three of these stored procedures must be executed within the allotted transaction time; otherwise, the middleware raises a timeout exception to the caller.

It is not recommended to have an autonomous transaction or nested transactions inside custom stored procedures, because that might affect the transaction flow built inside the MES product.

### Assembly

A transaction started by the middleware event needs to be completed within the allotted time. The amount of time allotted for the middleware transaction time includes the time the middleware takes to execute custom pre-hook assembly, custom post-hook assembly, and the middleware call itself. Therefore, end users must be cautious when writing custom assembly hooks such that they do not cause any performance bottlenecks when executing the actual middleware call. If the code in the assembly involves processing the files or executing long running transactions, then it is recommended to execute those processes on a background thread, so that the pre- or the post-hook processes do not block the main thread. However, the transactions started on a separate thread (e.g., background thread) are not part of the transaction started on the main thread (i.e., Middleware Event thread). Therefore, the success or failure on the secondary thread does not affect the transaction on the main thread as long as they do not create deadlocks.

## Configuring Pre-Hooks and Post-Hooks

The following sections provide information on how to configure pre-hooks and post-hooks.

### Installation Location

The Middleware Extensibility Hooks mechanism is installed as a part of standard MES installation on machines

where the MES middleware is installed. If default location was used for the MES installation, this application/editor (MWDBMappingEditor.exe) can be found in the following folder on the machine that is hosting the MES host (i.e., the machine that is hosting the Middleware Server):

C:\Program Files\Wonderware\MES\Middleware\

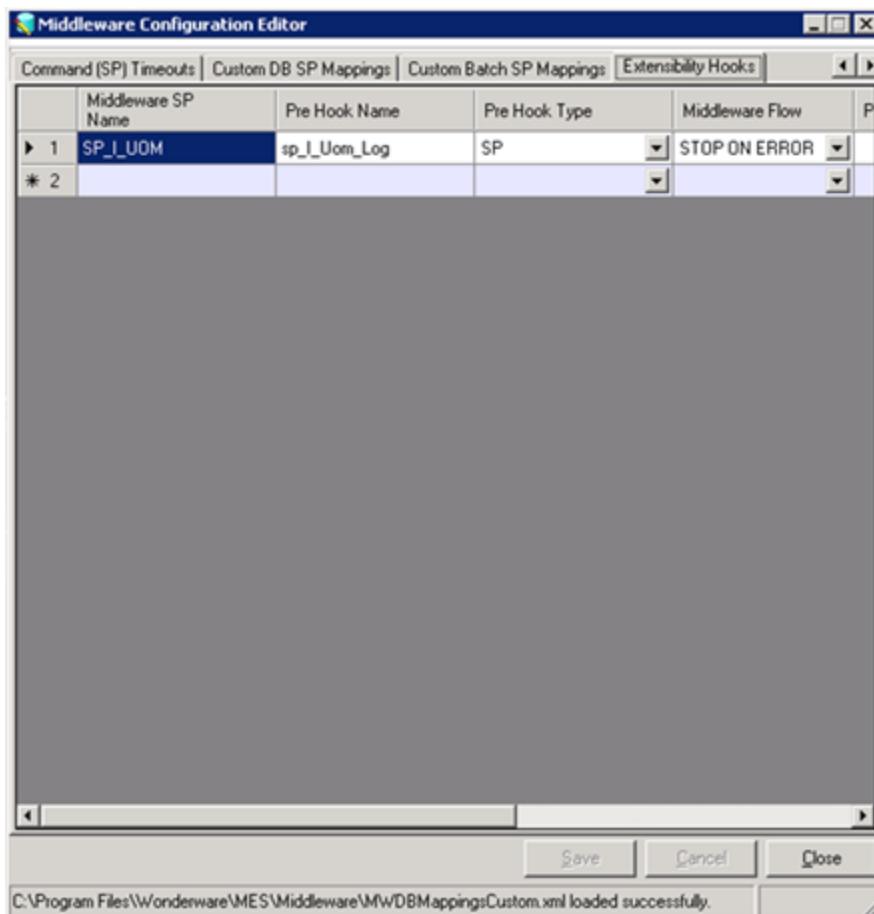
However, the installation path can vary if the MES middleware (MES Host) is installed on a different drive or in a different folder. Therefore, look for this application in your corresponding installation path, which typically ends with \MES\Middleware\.

## Opening the Middleware Configuration Editor

### To open the Middleware Configuration Editor

- On the Start menu, click the **Middleware Configuration Editor** tile.

The Middleware Configuration Editor window appears.



The configuration information entered in the Middleware Configuration Editor is stored in the file **MWDBMappingsCustom.xml** file specified in [Installation Location](#).

### Middleware SP Name

This column in the Middleware Configuration Editor represents a unique stored procedure name for which a

post-hook or a pre-hook can be configured.

**Note:** No stored procedure name can be used more than once.

The stored procedure name is the name of a valid stored procedure that exists in the MES database to which the MES middleware connects. The end user is responsible for finding the correct stored procedure name by manually looking at the stored procedure names in the MES database.

Whenever this stored procedure (configured in this column) is invoked, by virtue of calling an equivalent middleware method from the client, the middleware determines whether there are any pre- or post-hooks configured for this stored procedure and execute them according to the Extensibility Hook configuration.

The hooks configured for a stored procedure can be removed or deleted by highlighting the row in the grid.

### Mappings to New MES Version 6.0 Stored Procedures

The utilization optimization improvements that were implemented in the MES version 6.0 database schema included removed and replaced utilization-related stored procedures. The following table lists the affected pre-6.0 stored procedures and the 6.0 stored procedures that replaced them, if applicable.

If any of these pre-6.0 stored procedures were configured for extensibility hooks, the hooks should be reconfigured with the new stored procedures so that they will work properly with the current schema.

Pre-6.0 Stored Procedure	Replacement 6.0 Stored Procedure	Comments
sp_D_Job_Util_Log_Link	sp_D_Job_History	When deleting a record in the previous schema, a portion of job duration was deleted. In the current schema, the duration of the entire job runtime is deleted.
sp_D_Tpm_Stat	sp_D_Job_Hour_History	In the current schema, Job_Start_Utc is required to identify a unique row.
sp_D_Util_Log	sp_D_Util_History	In the current schema, Ent Id + EventTimeUtc is required, in place of log_id that used in the previous schema.
sp_D_Util_Log_DelUtilEvent	sp_D_Util_History	
sp_I_Job_Util_Log_Link	sp_I_Job_History	A portion of job duration was added in the previous schema. In the current schema, a history record represents an entire job runtime (duration).
sp_I_Tpm_Stat	sp_I_Job_Hour_History	In the current schema, Job_Start_Utc is required to identify a unique row.
sp_I_Util_Log	sp_I_Util_History	In the current schema, Ent Id + EventTimeUtc is required, in place of log_id that used in the previous schema.
sp_I_Util_Log_AddUtil	sp_U_Util_History_	

	AddEvent	schema.
sp_I_Util_Log_AddUtilEvent	sp_U_Util_History_ AddEvent	
sp_S_Job_Util_Log_Link	sp_S_Job_History	A portion of job duration was returned in the previous schema. In the current schema, the entire job duration is returned.
sp_S_Tpm_Stat	sp_S_Job_Hour_History	In the current schema, Job_Start_Utc is required to identify a unique row.
sp_S_Util_Log	sp_S_Util_History	In the current schema, Ent Id + EventTimeUtc is required, in place of log_id that used in the previous schema
sp_SA_Job_Util_Log_Link	sp_SA_Job_History	A portion of job duration was returned in the previous schema. In the current schema, the entire job duration is returned.
sp_SA_Tpm_Stat	sp_SA_Job_Hour_History	In the current schema, Job_Start_Utc is required to identify a unique row.
sp_SA_Util_Log	sp_SA_Util_History	
sp_U_Job_Exec_ AdjustJobDur	N/A	In the current schema, times are calculated on demand, so these procedures are obsolete.
sp_U_Job_Exec_ CloseCurrEvents		
sp_U_Job_Util_Log_Link	sp_U_Job_History	A portion of job duration was updated in the previous schema. In the current schema, the duration of the entire job runtime is affected.
sp_U_Job_Util_Log_Link_ Join		
sp_U_JULL_AdjustJobUtil		
sp_U_Oee_Exec_ SetCurrentOEE	N/A	This is an internal stored procedure and should not have been used by the extensibility hooks.
sp_U_Tpm_Stat	sp_U_Job_Hour_History	In the current schema, Job_Start_Utc is required to identify a unique row.

sp_U TPM Stat NewEvent	N/A	These are internal stored procedures and should not have been used by the extensibility hooks.
sp_U TPM Stat NewJob		
sp_U TPM Stat NewShift		
sp_U TPM Stat RefreshCurrVals		
sp_U TPM Stat UpdateDurations		
sp_U TPM Stat UpdDur		
sp_U TPM Stat UpdQtys		
sp_U UL UpdateDurationByName	N/A	In the current schema, times are calculated on demand, so this procedure is obsolete.
sp_U Util Exec NewEvent	N/A	These are internal stored procedures and should not have been used by the extensibility hooks.
sp_U Util Exec NewJob		
sp_U Util Exec NewJobEvent		
sp_U Util Exec NewShift		
sp_U Util Exec SetCurrentUtil		
sp_U Util Log	sp_U Util History	In the current schema, Ent Id + EventTimeUtc is required, in place of log_id that used in the previous schema.
sp_U Util Log AdjustDuration		
sp_U Util Log AdjustEvents		
sp_U Util Log MergeLogs	N/A	This is an internal stored procedure and should not have been used by the extensibility hooks.
sp_U Util Log SplitLogs	N/A	To split or merge events, use sp_U Util History AddEvent or sp_U Util History UpdateEvent.
sp_U Util Log UpdAllDurations	N/A	In the current schema, times are calculated on demand, so these procedures are obsolete.
sp_U Util Log UpdateDuration		

sp_U_Util_Log_UpdateUtil	sp_U_Util_History_UpdateEvent	In the current schema, Ent Id + EventTimeUtc is required, in place of log_id that used in the previous schema. However, the sp_U_Util_History_UpdateEvent is backward compatible to use with the local times and log_id.
--------------------------	-------------------------------	--

### Mappings to New MES Version 7.0 Stored Procedures

The shift schedule improvements that were implemented in the MES version 7.0 database schema include removing and replacing shift-related stored procedures. The affected previous stored procedures are listed in the following table. For example:

- The shift\_sched stored procedures were replaced with shift\_schedule stored procedures. Shift schedules are now linked to shift patterns (which are linked to entities) instead of shift schedules being linked directly to entities.
- The shift\_exc stored procedures are replaced with shift\_pattern stored procedures. Shift exceptions are now modeled as shift patterns of type holiday or overtime.
- The MES middleware maintenance service now handles tasks that were performed by several other shift-related stored procedures that have been removed. There are no replacement stored procedures for these.
- Some shift-related stored procedures that were removed were meant for internal use only and should not have had extensibility hooks configured for them. These are identified in the table in their comments section.

If any of the pre-7.0 stored procedures that were configured for extensibility hooks have a replacement stored procedure, the hooks should be reconfigured with the new stored procedures so that they will work properly with the current schema.

Pre-7.0 Stored Procedures That Were Replaced or Removed	Replacement 7.0 Stored Procedure	Comments
sp_I_Shift_Sched	sp_I_Shift_Schedule	Adds a shift schedule linked to a shift pattern. To link a shift schedule to an entity, call the MES Stateless API <b>ShiftPatternEntLink.Add()</b> method.
sp_D_Shift_Sched	sp_D_Shift_Schedule	Removes a shift schedule, which implicitly removes the link from all the entities linked to the pattern.
sp_S_Shift_Sched_GetSched	N/A	The previous stored procedure returned the shift schedules for an entity. Now, similar information can be obtained by querying the shift_sched view.

Pre-7.0 Stored Procedures That Were Replaced or Removed	Replacement 7.0 Stored Procedure	Comments
sp_U_Shift_Sched	sp_U_Shift_Schedule	Updates a shift schedule, which implicitly updates the schedule for all the entities linked to the pattern.
sp_I_Shift_To_Go	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks. Records in the shift_to_go table are internally handled by the MES middleware maintenance service.
sp_D_Shift_To_Go	N/A	Records in the shift_to_go table are now maintained by the MES middleware maintenance service.
sp_D_Shift_To_Go_DelBetWDates	N/A	This was an internal stored procedure and should not have been configured with an extensibility hook.
sp_S_Shift_To_Go_GetCurShifts sp_S_Shift_To_Go_GetSched	Sp_SA_Shift_To_Go	The previous stored procedures returned the projected shift schedules from the shift_to_go table for a given entity based on the time filter. Now, the same information can be queried directly using sp_SA_Shift_To_Go.
sp_U_Shift_To_Go	N/A	Now an internal function performed by the MES middleware maintenance service and cannot have extensibility hooks.
sp_I_Shift_Exc	sp_I_Shift_Pattern	The previous stored procedure created only shift exceptions. The new stored procedure can create exception (overtime and holiday) shift patterns as well as regular shift patterns.
sp_D_Shift_Exc	sp_D_Shift_Pattern	The previous stored procedure deleted only shift exceptions. The new stored procedure can delete exception (overtime and holiday)

Pre-7.0 Stored Procedures That Were Replaced or Removed	Replacement 7.0 Stored Procedure	Comments
		shift patterns as well as regular shift patterns.
sp_S_Shift_Exc sp_SA_Shift_Exc	sp_S_Shift_Pattern sp_SA_Shift_Pattern sp_S_Shift_Schedule sp_SA_Shift_Schedule	The previous stored procedures retrieved only shift exceptions. The new stored procedures can retrieve exception (overtime and holiday) shift patterns and schedules as well as regular shift patterns and schedules.
sp_S_Shift_Exc_GetExc sp_SA_Shift_Exc_GetExceptions	sp_S_Shift_Pattern_Ent_Link sp_SA_Shift_Pattern_Ent_Link	The previous stored procedures retrieved only shift exceptions given the entity or its descendants. The new stored procedures can retrieve exception (overtime and holiday) shift patterns as well as regular shift patterns.
sp_U_Shift_Exc	sp_u_Shift_Pattern	The previous stored procedure updated only shift exceptions. The new stored procedure can update exception (overtime and holiday) shift patterns as well as regular shift patterns.
sp_SA_Ent_GetShiftBreaks	N/A	Entity shift breaks are now calculated internally.
sp_U_Ent_AddShiftsForTheDay	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks.
sp_U_Ent_ApplyAdditiveShiftExc	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks.
sp_U_Ent_ApplyShiftExceptions	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks.
sp_U_Ent_ApplySubShiftExc	N/A	This was an internal stored procedure and should not have

Pre-7.0 Stored Procedures That Were Replaced or Removed	Replacement 7.0 Stored Procedure	Comments
		been configured with extensibility hooks.
sp_U_Ent_ClearBreaksAnd0Shifts	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks.
sp_U_Ent_CopyShifts	sp_U_Shift_Pattern_Ent_Link_AddMany	The previous model linked shift schedules to entities. The new model links shift patterns to entities.
sp_U_Ent_CreateShiftsToGo	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks.
sp_U_Ent_DoAutoShifChngsByNa me	sp_U_Ent_StartShiftCustom	The previous stored procedures used the entity name. Now, the entity ID is required by the stored procedure. When an entity is linked to a shift pattern, then shift changes for that entity and its descendants are managed by the MES middleware maintenance service. When an entity is not linked to a shift pattern, then it is expected that the shift changes are managed externally from MES. Therefore, the external implementation can call the new stored procedure to change shifts in MES.
sp_U_Ent_DoAutoShiftChanges		
sp_U_Ent_DoAutShifChangsByNa me		
sp_U_Ent_DoPastShiftChanges		
sp_U_Ent_RefreshShiftSched	N/A	Now an internal function performed by the MES middleware maintenance service and cannot have extensibility hooks.
sp_U_Ent_ScheduleShifts	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks.
sp_U_JSE_DropTempShiftExc	N/A	This was an internal stored

Pre-7.0 Stored Procedures That Were Replaced or Removed	Replacement 7.0 Stored Procedure	Comments
		procedure and should not have been configured with extensibility hooks.
sp_U_JSE_RefreshTempShiftExc	N/A	This was an internal stored procedure and should not have been configured with extensibility hooks.

## Pre-Hook/Post-Hook Name

The name of the Extensibility Hook is configured in this column.

**Note:** If the name is left blank (or empty), the middleware assumes that the Extensibility Hook is not configured.

## Stored Procedure

A valid stored procedure name from the MES database, if the type of Extensibility Hook is stored procedure.

The parameter names, data types, and presence of default values in the custom (hook) stored procedure must match exactly those of the parameter names, data types, and presence of default values in the middleware stored procedure (stored procedures configured in the Middleware SP Name column). However, there can be additional parameters in the custom (hook) stored procedure that might not be matching the parameters in the middleware stored procedure, but those additional parameters must be defaulted to NULL in the custom stored procedure. If they are not defaulted to NULL, an exception might be raised by the database layer for not supplying enough values for those additional parameters. It is recommended that the list of stored procedure parameters, data types, and default values (if any) be copied from the middleware stored procedure to the custom stored procedure to ensure all these properties are identical between them. However, the default values for the custom (hook) stored procedure do not have to exactly match the default values in the middleware stored procedure.

The values supplied for the middleware stored procedure (configured in the Middleware SP Name column) are the same values supplied to the custom (hook) stored procedure.

## Assembly

The hook method in the assembly has a single string parameter that accepts the XML message from the middleware event. The XML message is the exact XML generated for the middleware event to process. The end user is responsible for parsing the XML message and extracting the relevant data from the XML message. See the Stateless API help for more details about the XML structure. The middleware calls impersonate the System Platform Network User; therefore, the custom (hook) assembly is invoked as that user.

The assembly name can be configured in two ways:

- If the assembly is added to the GAC, then the detailed information about the assembly version, public key token, etc. must be specified.
- However, if the assembly is not added to the GAC, then the physical location of the assembly must be

specified.

In both of these cases, the class name and the method name must be specified by separating them by a semi-colon (;).

---

**Note:** The configured Extensibility Hook method can accept only one string parameter.

---

## Assembly Is Not Added to the GAC

If the assembly is not currently added to the GAC, the user is required to specify the physical location of the assembly itself to load the assembly from the specified path.

For example,

C:\Temp\TestHooks\TestHooks\bin\Debug\  
TestHooks.dll;TestHooksNamespace.TestHooksClass;TestHooksMethod

represents the assembly name as **TestHooks.dll**, located at the path **C:\Temp\TestHooks\TestHooks\bin\Debug\**, and that has the namespace **TestHooksNamespace**, class name **TestHooksClass**, and the method name **TestHooksMethod**.

## Assembly Is Added to the GAC

If the assembly is currently added to the GAC, the user is required to specify the public key token, assembly version, and so on, to load the right assembly from the GAC.

---

**Note:** The assembly must be signed with a strong name.

---

For example,

TestHooks,version=1.0.0.0,culture=neutral,processorarchitecture=MSIL,PublicKeyToken=23106a86e706d0ae;TestHooksNa

represents the assembly name as **TestHooks.dll**, version as 1.0.0.0, public key token as 23106a86e706d0ae, and that has the namespace **TestHooksNamespace**, class name **TestHooksClass**, and the method name **TestHooksMethod**.

### Pre-Hook and Post-Hook Type

A single middleware event can either execute a stored procedure or invoke an assembly for a pre-hook and a post-hook. No other types besides the following are allowed in the current release.

- **Stored procedure.** Indicates that the configured hook type is a stored procedure. In other words, the name configured in the corresponding Pre-Hook Name or Post-Hook Name column is considered to be a stored procedure. Therefore, the configured custom stored procedure in the MES database is invoked before or after the middleware call depending upon the pre-hook or post-hook configuration.
- **Assembly.** Indicates the configured hook type is an assembly. In other words, the name configured in the corresponding Pre-Hook Name or Post-Hook Name column is considered to be an assembly. Therefore, the configured custom assembly is invoked before or after the middleware call depending upon the pre-hook or post-hook configuration.

## Middleware Flow (Pre-Hook/Post-Hook)

This column in the Middleware Configuration Editor represents the type of flow that is desired while processing the middleware event. The following sub-sections explain the different types of middleware flow supported by the MES middleware.

### Stop

This option indicates that the flow of the middleware execution will stop after completing the current execution, regardless of whether the current execution succeeds or not. In other words, when the pre- or the post-hook is configured with this option, the execution stops with the current call and returns the result to the caller, regardless of whether the current transaction was successful or not (i.e., committed or rolled back). If an error occurs, the error message is returned to the caller.

The table below describes the flow of the middleware call after the pre-hook or post-hook execution is completed with the Middleware Flow parameter set to Stop.

Hook Type	Hook Success	Hook Error
Pre-Hook	<p>Stop. The pre-hook call is completed successfully.</p> <p><b>Note:</b> The data modified on tables for the pre-hook call is committed. The normal middleware call will never be executed.</p>	<p>Stop. The pre-hook call resulted in an error. The error message is returned to the end user or the error message is logged in the Logger.</p> <p><b>Note:</b> The data modified on table for the pre-hook call is rolled back. The normal middleware call will never be executed.</p>
Post-Hook	Not applicable; this option cannot be configured for post-hooks.	Not applicable; this option cannot be configured for post-hooks.

### Stop on Error

This option indicates that the flow of the middleware execution will stop only if it encounters an error while processing the current execution. As long as there is no error while executing the pre-hook, post-hook, or the middleware event, the execution continues.

The table below describes the flow of the middleware call after the pre-hook or post-hook execution is completed with the Middleware Flow parameter set to Stop on Error.

Hook Type	Middleware Execution		Hook Error
	Status	Hook Success	
Pre-Hook	Not applicable.	The pre-hook call completed successfully.  <b>Note:</b> The data modified on tables for the pre-hook call is committed. The middleware continues to execute the normal middleware call.	Stop. The pre-hook call resulted in an error. The error message is returned to the caller.  <b>Note:</b> The data modified on tables for the pre-hook call is rolled back. The normal middleware call will never be executed.
Post-Hook	The normal middleware call/transaction has succeeded.	The data modified on tables for the normal middleware call and for the post-hook are committed.	The data modified for the normal middleware call and for the post-hook are both rolled back. The error message is returned to the caller.
Post-Hook	Stop.  The normal middleware call/transaction has failed or rolled back.  The error message is returned to the caller.	Not applicable.  <b>Note:</b> The post-hook will never be executed, because the normal middleware call/event/transaction has failed or rolled back.	Not applicable.  <b>Note:</b> The post-hook will never be executed, because the normal middleware call/event/transaction has failed or rolled back.

### Continue Even on Error

This option indicates that the flow of the middleware execution will continue even when an error is encountered in any part of the execution sequence.

The table below describes the flow of the middleware call after the pre- or post-hook execution is completed with the Middleware Flow parameter set to Continue Even on Error.

Hook Type	Middleware Execution		
	Status	Hook Success	Hook Error
Pre-Hook	Not applicable.	The pre-hook call is completed successfully.  <b>Note:</b> The data modified on tables for the pre-hook call is committed. The middleware continues to execute the normal middleware call.	Continue even on error.  The pre-hook call resulted in an error. The generated error message is ignored by the middleware.  <b>Note:</b> The data modified on tables for the pre-hook call is rolled back. The middleware continues to execute the normal middleware call.
Post-Hook	The normal middleware call/transaction has succeeded.	The database transactions started for the normal middleware call and for the post-hook call are committed.	The data modified on tables for the normal middleware call is committed, but the data modified on tables for the post-hook is rolled back.  The error message generated by the post-hook transaction is ignored by the middleware.
Post-Hook	The normal middleware call/transaction has failed or rolled back.	Stop. The error message is returned to the caller.  <b>Note:</b> The post-hook will never be executed, because the normal middleware call/event/transaction has failed or rolled back.	Not applicable.  <b>Note:</b> The post-hook will never be executed, because the normal middleware call/event/transaction has failed or rolled back.

## Loading the Configuration and Hooks

After the Extensibility Hooks are configured and saved in the Middleware Connection Editor, the MES Host/MES Middleware must be restarted to reload all the configuration details and the Extensibility Hooks into its memory. If there are multiple MES middleware hosts in a multi-node environment, then the same configuration changes will have to be applied to each middleware in the system. This will allow each middleware to execute the extensibility hooks. See [Configuring Extensibility Hooks on Multiple Middleware Servers](#).

## Examples of Middleware Hook Configurations and Executions

The examples in the following sections illustrate how the Extensibility Hooks can be configured and used using

different options provided in the Middleware Configuration Editor.

### Custom Stored Procedure Hook

This example illustrates how a custom stored procedure can be configured as a hook that can be invoked when executing a standard stored procedure in the MES middleware.

The following example configuration is added to the Middleware Configuration Editor.

Configuration Parameter	Example Entry	Description
Middleware SP Name	sp_I_UOM	The actual stored procedure name, supplied out-of-the box, from the MES database.
Pre-Hook Name	sp_I_Uom_Log	The custom stored procedure created by the end user in the MES database after installing the MES database.
Pre-Hook Type	SP	Indicates that the type of this hook is a stored procedure
Middleware Flow	STOP ON ERROR	Indicates to the middleware to stop the execution if there was an error while executing the sp_I_Uom_Log stored procedure.

## Content of the Custom Stored Procedure **sp\_I\_Uom\_Log**

```

CREATE PROCEDURE sp_I_Uom_Log
(@description nvarchar(40)
,@abbreviation nvarchar(20)
,@last_edit_comment nvarchar(254)
,@my_arg nvarchar(40) = null
,@last_edit_at datetime OUT
,@uom_id int OUT
) AS
BEGIN
    SET NOCOUNT ON
    DECLARE @logged_at DATETIME
    --Call other SPs if needed.
    SET @logged_at = GETDATE()
    INSERT INTO error_log (logged_at, severity, instance_info
        , object_name, object_section, description, system_msg)
    VALUES (@logged_at, 0, @abbreviation
        , @description, @description, @description, @description)
    SET @uom_id = SCOPE_IDENTITY()

```

```
--Call other SPs if needed.  
END
```

As can be seen from its content, the stored procedure `sp_I_Uom_Log` contains all the parameters and their properties that `sp_I_Uom` has, and an additional parameter containing more contextual information. This additional parameter has a NULL default value as it will not be provided any value when called from the MES middleware as a pre-hook. The custom stored procedure can completely ignore the input parameters and the code inside the "begin and end" block can be customized for individual needs. The statements in bold indicate that one or more custom stored procedures can be called from this custom stored procedure. The concept described above is also applicable to configuring the post-hook of type stored procedure.

## Action

When a new unit of measurement (UOM) is added from the MES Client application or by using a System Platform script to add the UOM, the middleware typically uses the `sp_I_Uom` stored procedure to add the new unit of measurement. As explained in Functional Overview, the middleware first verifies whether any pre-hook is configured for the `sp_I_Uom` stored procedure. Since there is a pre-hook `sp_I_Uom_Log` configured for this case, the middleware first executes the stored procedure `sp_I_Uom_Log` and then evaluates the result before processing the standard middleware call `sp_I_Uom` to create a new unit of measurement in the MES database.

### Custom Stored Procedure Hook Raises an Error (Middleware Flow: Stop)

This example illustrates how a custom stored procedure can be configured as a hook that can be invoked when executing a standard stored procedure in the MES middleware.

The following example configuration is added to the Middleware Configuration Editor.

Middleware SP Name	Pre-Hook Name	Pre-Hook Type	Middleware Flow
<code>sp_I_UOM</code>	<code>sp_I_Uom_Log</code>	SP	STOP

## Content of the Custom Stored Procedure `sp_I_Uom_Log`

```
CREATE PROCEDURE sp_I_Uom_Log
(@description nvarchar(40)
,@abbreviation nvarchar(20)
,@last_edit_comment nvarchar(254) = NULL
,@my_arg nvarchar(40) = null
,@last_edit_at datetime OUT
,@uom_id int OUT
) AS
BEGIN
    SET NOCOUNT ON
    DECLARE @logged_at DATETIME
    --Call other SPs if needed.
    SET @logged_at = GETDATE()
```

```

INSERT INTO error_log (logged_at, severity, instance_info
, object_name, object_section, description, system_msg)
VALUES (@logged_at, 0, @abbreviation
, @description, @description, @description, @description)
SET @uom_id = SCOPE_IDENTITY()
--Call other SPs if needed.
raiserror('Error message from the custom hook stored procedure - sp_I_Uom_Log', 16,
1)
END
GO

```

## Action

In this case, when a new UOM is added from the MES Client application or by using a System Platform script to add the UOM, the middleware executes the stored procedure `sp_I_Uom_Log`, and evaluates the result before actually processing the standard middleware call `sp_I_Uom` to create a new unit of measurement in the MES database. Since the Middleware Flow parameter is set to Stop after executing the custom (pre-hook) stored procedure, the sequence of execution stops and returns the following error to the client:

Error message from the custom hook stored procedure - `sp_I_Uom_Log`

Note that even if there are no errors in the custom hook stored procedure, the normal middleware call will never be processed in this case, because the the Middleware Flow parameter is set to Stop after executing the pre-hook call. That is, in this case, the middleware never adds the unit of measurement.

### Custom Assembly That Is Not in the GAC

This example illustrates how a custom assembly that is not in the GAC can be configured as a hook and invoked when executing a standard stored procedure in the MES middleware.

The following example configuration is added to the Middleware Configuration Editor.

Middleware SP Name	Pre-Hook Name	Pre-Hook Type	Middleware Flow
<code>sp_I_UOM</code>	C:\Temp\TestHooks\ TestHooks\bin\ Debug\ TestHooks.dll;TestHooksN amespace. TestHooksClass;TestHooks Method	ASSEMBLY	STOP ON ERROR

The configuration in the pre-hook name can be interpreted as below:

Assembly Name/DLL Name: `TestHooks.dll`

Namespace: `TestHooksNamespace`

Class Name: `TestHooksClass`

Method Name: `TestHooksMethod`

# Content of the Code in the TestHooksClass.cs

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
namespace TestHooksNamespace
{
    public class TestHooksClass
    {
        public TestHooksClass()
        { }
        public void TestHooksMethod(string xmlSource)
        {
            // Compose a string that consists of three lines.
            string lines = string.Format("DateTime: {0}, XMLSource: {1}",
                DateTime.Now.ToString(), xmlSource);
            // Write the string to a file.
            using (System.IO.StreamWriter file = new
                System.IO.StreamWriter("c:\\Temp\\UomLog.txt", true))
            {
                file.WriteLine(lines);
            }
        }
    }
}
```

The value for the `xmlSource` parameter contains the XML message for the normal middleware event. The structure of the XML message used for this case is listed below:

```
<?xml version='1.0'?>
<request>
    <object>uom</object>
    <msgtype>exec</msgtype>
    <cmd>add</cmd>
    <uom>
        <session_id>119</session_id>
        <description>Unit_001</description>
        <abbreviation>ssss</abbreviation>
        <last_edit_comment></last_edit_comment>
    </uom>
    <validate>1</validate>
</request>
```

The text output is written to the text file `UomLog.txt` in the format below:

```
DateTime: 1/2/2013 11:34:44 AM, XMLSource:
<?xmlversion='1.0'?><request><object>uom</object>
<msgtype>exec</msgtype><cmd>add</cmd><uom><session_id>119
</session_id><description>Unit_001</description>
<abbreviation>ssss</abbreviation><last_edit_comment>
</last_edit_comment></uom><validate>1</validate></request>
```

The concept described above is also applicable to configuring the post-hook of type assembly.

# Action

When a new UOM is added from the MES Client application or by using a System Platform script to add the UOM, the middleware typically uses the sp\_I\_Uom stored procedure to add the new unit of measurement. As explained in Functional Overview, the middleware first verifies whether any pre-hook is configured for the sp\_I\_Uom stored procedure. Since there is a pre-hook TestHooks.dll configured for this case, the middleware first executes the method TestMethod in the TestHooks.dll assembly and then evaluates the result before actually processing the standard middleware call sp\_I\_Uom to create a new unit of measurement in the MES database.

## Custom Assembly Is Added to the GAC

This example illustrates how a custom assembly that has been added to the GAC can be configured as a hook and invoked when executing a standard stored procedure in the MES middleware. The expectation is that the assembly is signed with a strong-name.

The following example configuration is added to the Middleware Configuration Editor.

Middleware SP Name	Pre-Hook Name	Pre-Hook Type	Middleware Flow
sp_I_UOM	TestHooks,version=1.0.0.0 ,culture=neutral, processorarchitecture=MSIL,PublicKeyToken=231 06a86e706d0ae;TestHook sNamespace.TestHooksCla ss; TestHooksMethod	ASSEMBLY	STOP ON ERROR

The configuration in the pre-hook name can be interpreted as below:

Assembly Name/DLL Name: TestHooks.dll

Namespace: TestHooksNamespace

Class Name: TestHooksClass

Method Name: TestHooksMethod

## Content of the Code in the TestHooksClass.cs

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
namespace TestHooksNamespace
{
    public class TestHooksClass
    {
        public TestHooksClass()
        {
        }
        public void TestHooksMethod(string xmlSource)
```

```

    {
        // Compose a string that consists of three lines.
        string lines = string.Format("DateTime: {0}, XMLSource: {1}",
            DateTime.Now.ToString(), xmlSource);
        // Write the string to a file.
        using (System.IO.StreamWriter file = new
            System.IO.StreamWriter("c:\\Temp\\UomLog.txt", true))
        {
            file.WriteLine(lines);
        }
    }
}

```

The concept described above is also applicable to the post-hook of type assembly.

## Action

When a new UOM is added from the MES Client application or by using a System Platform script to add the UOM, the middleware typically uses the sp\_I\_Uom stored procedure to add the new unit of measurement. As explained in Functional Overview, the middleware first verifies whether any pre-hook is configured for the sp\_I\_Uom stored procedure. Since there is a pre-hook TestHooks.dll configured for this case, the middleware first executes the method TestMethod in the TestHooks.dll assembly and then evaluates the result before actually processing the standard middleware call sp\_I\_Uom to create a new unit of measurement in the MES database.

## Configuring Extensibility Hooks on Multiple Middleware Servers

The Middleware Extensibility Hooks are configured in the **Extensibility Hooks** tab in the Middleware Configuration Editor, and the hooks configurations are stored in the same folder in the file **MWDBMappingsCustom.xml**. The MES Middleware Server loads the Extensibility Hooks only if the hook parameters are configured in the **MWDBMappingsCustom.xml** file in its folder. When there is more than one Middleware Server configured to connect to the same MES database, then the end user is responsible for managing the hook configurations and keeping them in sync across all the Middleware Servers.

For example, let's say Middleware Server 1 has a pre-hook configured for the sp\_I\_Uom (Uom.Add) to perform a pre-action before the actual sp\_I\_Uom is executed. Middleware Server 2 has a pre-hook configured for the sp\_U\_Job\_Exec\_StartBatchJobs (Job\_Exec.StartJob) to perform a pre-action before the actual sp\_U\_Job\_Exec\_StartBatchJobs is executed. These two Middleware Servers are configured to connect to the same MES database, and these two are the only two hooks configured in their respective middleware directories.

The table below explains how the pre-hook commands are processed by both the Middleware Servers using the example above:

	Middleware Server1		Middleware Server2	
Middleware SP Name	Pre-Hook Loaded	Execute Pre-Hook	Pre-Hook Loaded	Execute Pre-Hook
sp_I_UOM	Yes	Yes	No	No

	<b>Middleware Server1</b>	<b>Middleware Server2</b>
sp_U_Job_Exec_StartBatchJobs	No	No Yes Yes

The Middleware Server 1 processes the pre-hook for sp\_I\_UOM before calling the sp\_I\_Uom stored procedure on the MES database, but does not process the pre-hook for sp\_U\_Job\_Exec\_StartBatchJobs before calling this stored procedure, because Middleware Server 1 does not know anything about the pre-hook for sp\_U\_Job\_Exec\_StartBatchJobs, since the XML file in its folder does not have any information about the hook for sp\_U\_Job\_Exec\_StartbatchJobs.

Similarly, the Middleware Server 2 processes the pre-hook for sp\_U\_Job\_Exec\_StartBatchJobs before calling the sp\_U\_Job\_Exec\_StartBatchJobs stored procedure on the MES database, but does not process the pre-hook for sp\_I\_UOM before calling this stored procedure.

## Frequently Asked Questions

### **What are hooks? What is the purpose of having hooks configured in the MES middleware?**

A hook represents a custom functionality implemented by the end user in the form of a stored procedure, assembly, workflow, and so on. The purpose of having a hook is to allow a custom functionality to be integrated as a part of standard MES event and execute that functionality as a part of standard MES event.

### **How do you determine the name of a stored procedure that corresponds to a specific middleware event?**

In most cases, the name of the MES middleware event matches the name of the MES stored procedure. If not, they are configured in the **MWDBMappings.xml** file under the db\_objects section. This XML file is in the **Middleware** folder of the MES application folder of a server on which the MES middleware was installed. It is recommended to first look in this file to find the name of the stored procedure that corresponds to the name of the middleware event.

The mappings in the **MWDBMappings.xml** file have the format

```
<object name="object_name" value="sp_name" />
```

Middleware events that correspond to Add, Delete, GetAll, GetSpecific, and Update actions on one table are not included in the **MWDBMappings.xml** file. These events are resolved automatically by the middleware without referring to that file. For information about the naming conventions for the MES stored procedures, see Stored Procedure Naming Conventions.

### **Can stored procedure names configured in the custom database mappings tab in the Middleware Configuration Editor be used as part of hooks? How are those stored procedures related to hooks?**

Yes, the stored procedures (names) configured in the custom database mappings can be used to configure the stored procedure hooks. The custom database mappings is a separate mechanism that allows to map a custom stored procedure created by an end user, and that allows an end user to call that custom stored procedure from the client applications using the standard XML structure used by the middleware.

**Does the Middleware Server need to be restarted if a hook configuration is modified?**

Yes, whenever a hook configuration is modified, the Middleware Server needs to be restarted to reload the changes in its memory. Otherwise, the changes are not effective until the Middleware Server is restarted.

**If there is more than one Middleware Server, does the hook information need to be copied to more than one Middleware Server?**

Yes. It is the responsibility of the end user to copy and synchronize the hooks configurations on all the Middleware Servers.

**Does the pre-hook or the post-hook mechanism support the UpdateSpecific() method in the middleware to perform pre- or post-processing?**

No. The UpdateSpecific() method in the middleware uses dynamic SQL (a SQL Update statement generated when needed and not pre-compiled) to update the data in the MES database. Since there are no stored procedures involved with the UpdateSpecific() method, pre- and post-hooks cannot be configured and executed against this method.

**Under what user name is the custom (hook) assembly executed?**

Like other the background tasks, the user account that is associated with the MES Middleware Host service that is running the middleware and processing the maintenance services will be the user associated with the custom (hook) assembly execution.

**Do the extensibility hooks (i.e., custom stored procedures and custom DLLs) automatically upgrade when the standard MES product is upgraded?**

No. The end user is responsible for upgrading the custom stored procedures and custom DLLs to synchronize the methods and parameters in the custom hooks with the methods and parameters in the standard MES product.

# Use MES

As a Manufacturing and Execution System (MES) user, you might interact with the application as an administrator, operator, or developer.

## Administer

As Manufacturing Execution System (MES) administrator, you are responsible to set up and manage an MES solution. You are responsible for managing the database, performing daily checks, correcting system errors, and maintaining the integrity of the product.

## MES Client

Use Manufacturing Execution System (MES) Client application to configure and monitor your plant model and production processes.

## Getting Started

The Manufacturing Execution System (MES) Client application provides a user interface to configure and monitor your plant model and production processes.

The MES Client application gives you the ability to configure items, operations, processes, specifications, labor, certifications, work orders, and jobs. You can configure the collection of data related to the plant floor equipment performance information for determining the Overall Equipment Effectiveness (OEE) and its components—Availability, Performance, and Quality. You can also configure sample frequencies, characteristics, and test plans to collect quality-related data.

The information configured in the MES Client application is used to collect your plant process information from operators and production equipment on the plant floor. The information collected and stored from your production processes gives you the information needed to control and improve the overall operation management and performance of the plant.

## About MES Client

The MES Client application is a collection of modules, grouped by function and role of the user, to allow the configuration and monitoring of your plant operations.

You can use the MES Client application to:

- Define users and user groups. This includes assigning passwords, privileges, user certifications, and entity access rights to different users to limit their access to different areas of the MES Client application
- Define global system parameters.
- Configure language strings.
- Configure physical entities.

- Configure sites.
- Configure shift patterns and their shift schedules for entities.
- Define generic data collection groups and the data log values within those groups.
- Define utilization states for machines (such as Running or Idle) and the utilization reasons for those states (such as Meal Break).
- Define categories for use with quality management (QM) specifications and causes.
- Modify the names and colors associated with job and step states.
- Define custom attributes.
- Define file extensions for document files and web pages that can be assigned to MES components such as entities, work orders, and jobs to provide information and instructions to operators.
- Configure items and item classes.
- Specify units of measure (UOMs) for items and characteristics.
- Specify item states, grades, and reasons.
- Configure global specifications that can be assigned to an operation, process, or job.
- Define labor departments and labor categories to provide context for entities that can track labor data.
- Define certifications that can be assigned to items, operations, operation steps, and job steps to restrict user access to related tasks or require sign-offs to complete those tasks for auditing purposes.
- Configure a process, operation, standard operation, and dynamic routing processes.
- Configure work orders and jobs.
- Manage jobs in the job queue.
- Maintain the MES database.
- Edit and resubmit rejected messages.
- Configure serialization to assign specific serial numbers to produced items.
- Configure QM sample plan frequencies.
- Configure QM sample plans.
- Configure variable and attribute characteristic definitions for QM to allow an aspect of an item, process, or entity to be measured.
- Configure quality specifications
- Define causes, and cause groups, to allow a cause to be assigned to a characteristic sample.

## Installing MES Client

The MES Client application is installed during the complete installation. For more information on installation, see the *MES Installation Guide* or help.

## Starting MES Client for the First Time

If you are starting the MES Client application for the first time, the login dialog box does not appear because users are not yet defined in the MES database.

The first task you must perform after starting MES Client for the first time is to create a user or an OS user group with the security privileges *May run configuration tools* and *May edit user settings* enabled. This user or a

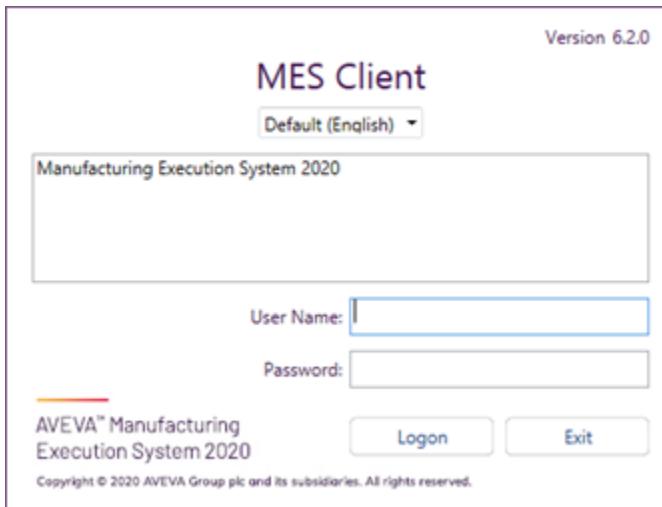
member of the OS user group can subsequently log into MES Client and other MES applications with configuration privileges.

For more information, see [Creating the Initial MES User or OS Group with the Minimum Required Privileges](#).

## Starting MES Client

1. On the **Start** menu, click the **MES Client** tile.

The **Loading MES Client** screen appears. Then, if your Windows user account has been configured as an MES user and the *Automatic Login* system parameter has been set to Yes, MES Client opens without prompting for user authentication. Otherwise, the login dialog box appears.



2. In the **Language** list, click the language in which you want the login dialog box to appear.

You can select only those languages that are configured in the MES Client application. If you restart the application, the language setting resets to the default language. The default language is set by the Display system parameter *Default Language*. For more information on the Display system parameters, see [System Parameters Reference](#).

3. In the **User Name** and **Password** boxes, type your username and password.

- If the MES user Security mode is set to Native, you can obtain the username and password from the MES administrator who set up users in MES Client.
- If the Security mode is set to OS User or OS Group, enter your Windows username, including the domain.

4. Click **Logon**.

The MES Client application opens.

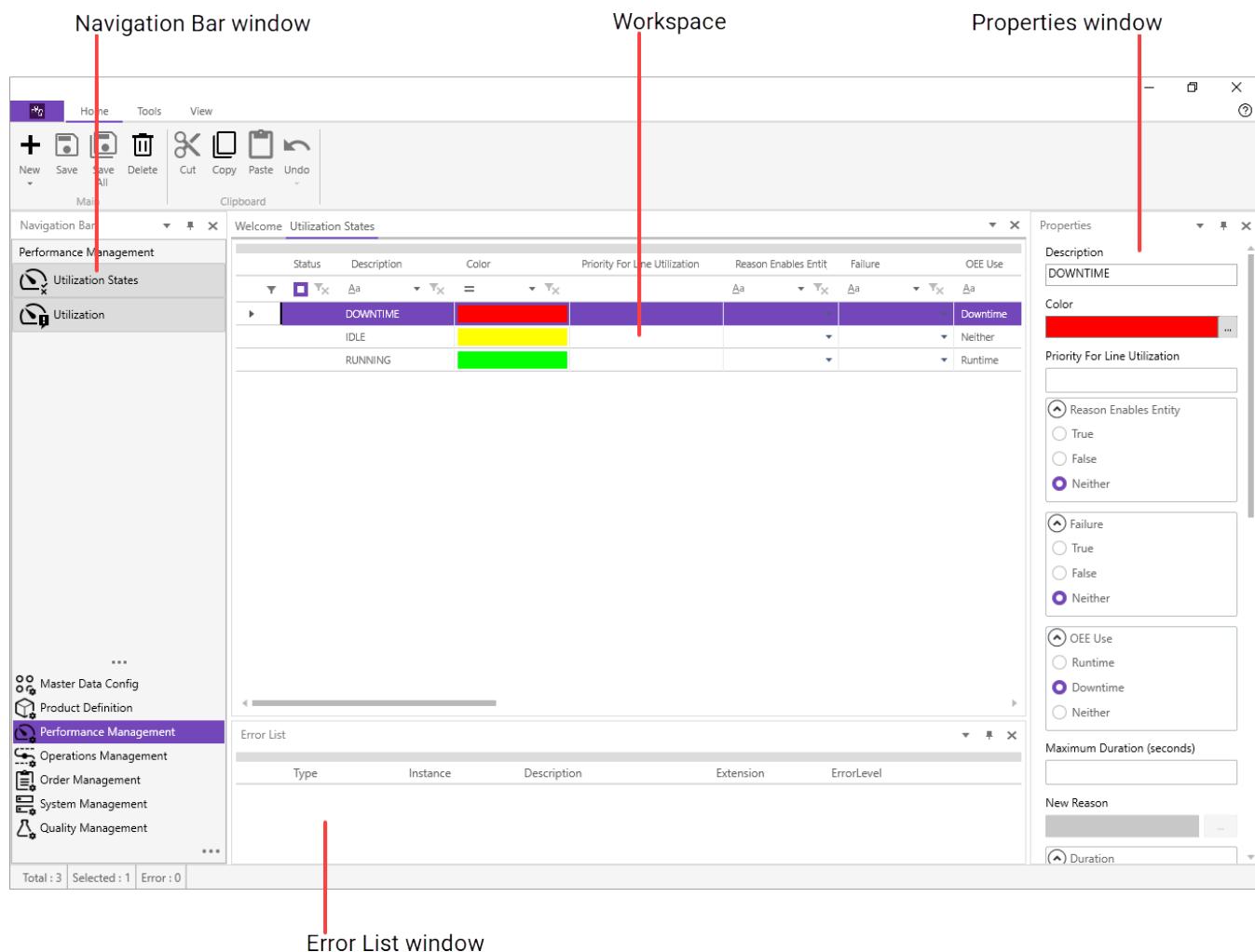
**Note:** If the MES user Security mode is set to OS Group and the username you entered is not a member of a Windows user group that has been added to the MES database, the following error message appears: *OS User group is not configured*. For more information, see [Setting Up User Groups and Users in OS Group Security Mode](#).

## Navigating in MES Client

The MES Client application can display large amount of data in an organized way. You can modify the application workspace as per your requirements, such as docking and undocking the tool windows, switching between

opened tabs in the workspace window, showing/hiding the tool windows, and so on.

The following figure shows the layout MES Client window.



## Navigation Bar

You can select a group in the Navigation window to show the associated modules underneath. For more information on working with groups, see [Groups and Modules](#).

## Tabbed Workspace

When you click a module listed in the Navigation Bar, its tab appears in the workspace.

## Properties Window

When you click an item in the workspace, its properties appear in the Properties window and can be configured here.

## Error List Window

The Error List window shows the errors occurred during configuration.

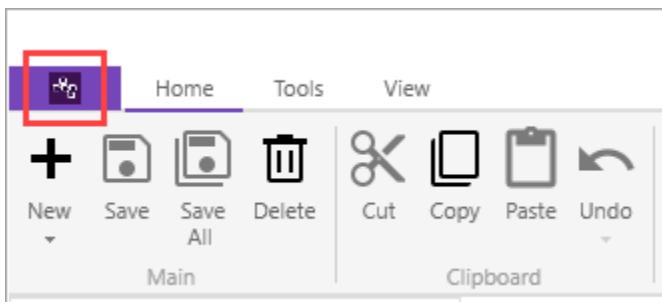
The Navigation Bar, Properties, and Error List windows are dockable. You can undock and move them to the top, bottom, right, or left of the workspace.

## Closing Module Tabs

You can close the current module tab or all open module tabs.

### To close the current module tab

- Click the **Application** button, shown below, and then click **Close**.



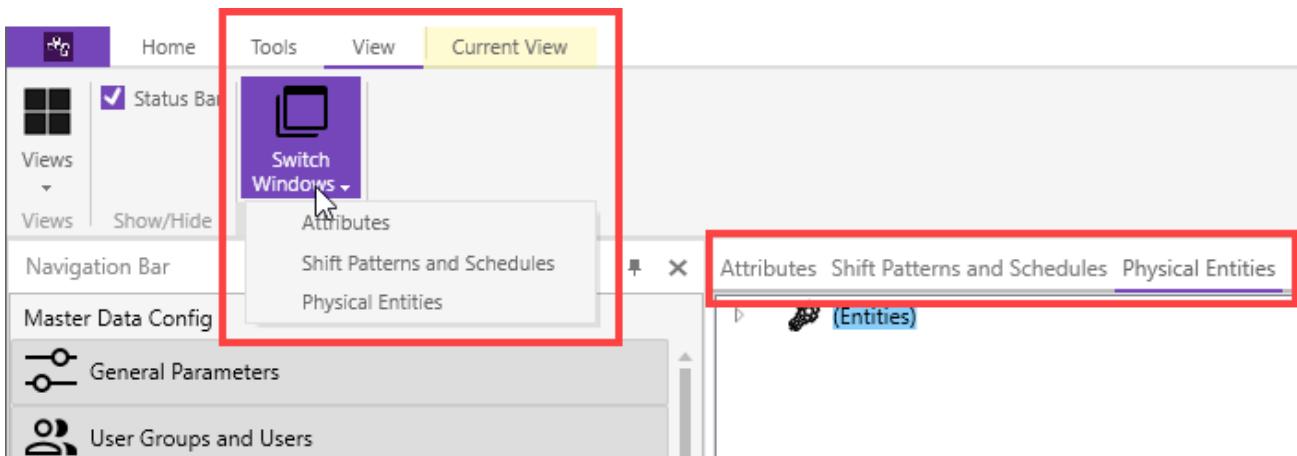
### To close all module tabs

- Click the **Application** button and then click **Close All**.

## Switching Between Module Tabs in the Workspace

### To switch between module tabs, do either of the following

- Click the module tab.
- On the ribbon, go to the **View** tab. In the **Window** group, open the **Switch Window** menu and click the name of the module tab.



## Working with Objects

An object is a specific element that is maintained in the modules of MES Client application. For example, an object could be a physical entity, an item, a user, a process, a work order, a lot, or an attribute.

## Creating an Object

- On the ribbon, go to the **Home** tab. In the **Main** group, click **New**.

After creating a new object, you can configure it using the property settings in the **Properties** window.

## Special Characters in Object Names and IDs

The following special characters that are used in SQL Server calls to the MES database should not be used for MES object names and IDs:

- % (percent)
- \_ (underscore)
- ^ (carat)
- [ or ] (square brackets)

MES objects can be a physical entity, a line, an item, a work order, a lot, an attribute or other objects that can be added to the MES database.

Using these characters can cause unexpected behavior when retrieving records from the MES database, such as missing or extra objects being returned.

Specifically, these special characters are used by SQL Server calls that use the LIKE operator. For more information about this operator and how these characters are used in a LIKE expression, see the [LIKE \(Transact-SQL\) topic](#) in the Microsoft SQL Reference document.

## Undoing Changes

You can undo multiple actions on an object and revert it to the original state before saving the changes. This functionality will not work once the changes are saved.

### To undo the last change

- On the ribbon, go to the **Home** tab. In the **Clipboard** group, click **Undo**.

### To undo all changes

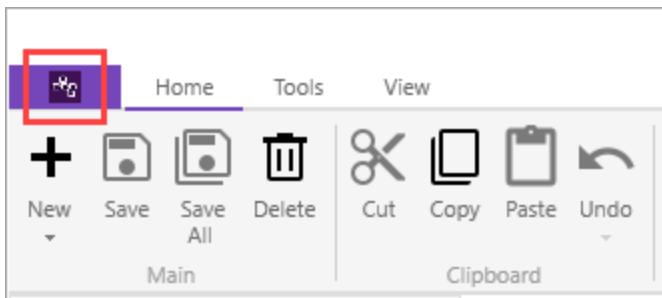
- On the ribbon, go to the **Home** tab. In the **Clipboard** group, click **Undo All**.

## Saving Changes

You can save the changes that you have made to the objects on the module tabs that are opened in the workspace.

### To save changes to objects on the currently selected tab, do any one of the following:

- Click the **Application** button, shown below, and then click **Save**.



- On the ribbon, go to the **Home** tab. In the **Main** group, click **Save**.

**To save changes to objects on all tabs, do any one of the following:**

- Click the **Application** button and then click **Save All**.
- On the ribbon, go to the **Home** tab. In the **Main** group, click **Save All**.

### Cutting, Copying, and Pasting Information

You can cut, copy, and paste information within a module. For example, you can copy an existing item state and modify the state as per your requirements to create a new item state.

#### To cut information

1. Select the text that you want to cut.
2. On the ribbon, go to the **Home** tab. In the **Clipboard** group, click **Cut**.

#### To copy information

1. Select the text that you want to copy.
2. On the ribbon, go to the **Home** tab. In the **Clipboard** group, click **Copy**.

#### To paste information

1. Click the location where you want to paste the information.
2. On the ribbon, go to the **Home** tab. In the **Clipboard** group, click **Paste**.

### Deleting an Object

1. On the ribbon, go to the **Home** tab.
2. In the **Main** group, click **Delete**.

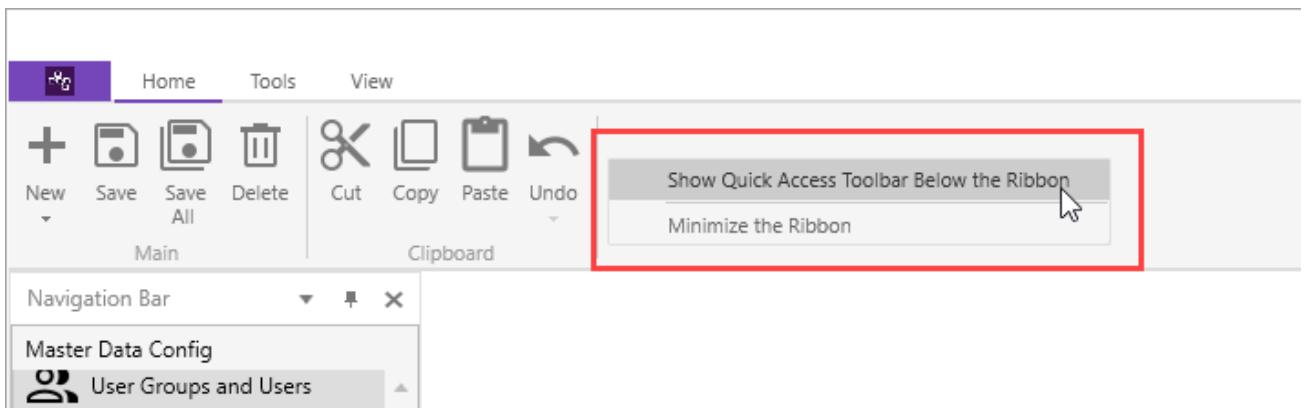
### Using Quick Access Toolbar

You can use the Quick Access toolbar to have commonly-used actions available regardless of what main ribbon tab is currently selected.

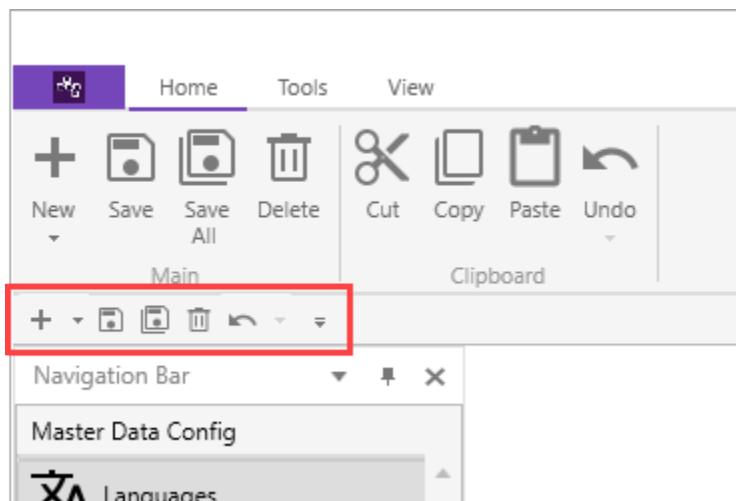
By default, the Quick Access toolbar is hidden.

**To show the Quick Access toolbar**

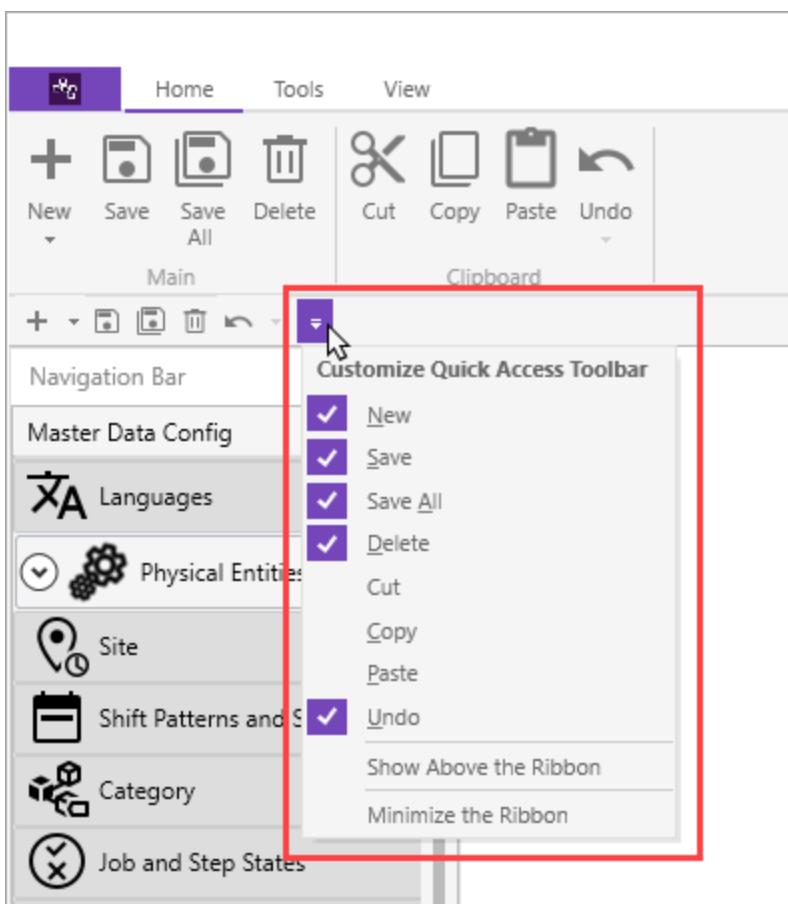
- Right-click the open area on the right side of the ribbon and click **Show Quick Access Toolbar Below the Ribbon**.



The Quick Access Toolbar appears.

**To customize what actions appear on the Quick Access toolbar**

- Click the menu icon at the right side of the toolbar and then select the actions to include.



From this menu you can also show the toolbar above the main ribbon or minimize the ribbon.

## Archiving, Purging, and Restoring Data

You can archive, purge, and restore the data saved in the MES database. For more information on database maintenance, see [Database Maintenance](#).

For more information on list of Historical database tables that you can archive, purge, or restore, see [Historical Database Tables](#).

## Switching Languages at Run Time

You can change the language for the MES Client application at run time.

1. On the ribbon, go to the **Tools** tab.
2. In the **Language** group, click **Languages**.
3. In the **Language** list, click the language that you want to apply to the MES Client application.

Languages that are configured in the language string table are displayed in the **Languages** list. For more information on configuring languages, see [Language Strings](#).

## Viewing Error Information

Within a module, active configuration errors are displayed in the **Error List** window.

**Note:** Runtime errors are not available in the **Error List** Window. All runtime errors are displayed in the System Management Console Log Viewer.

For any configuration error, the following information is displayed in the **Error List** window:

### Type

Describes the type of error.

### Instance

Describes the reason for the error.

### Description

Shows the description for the error.

### Extension

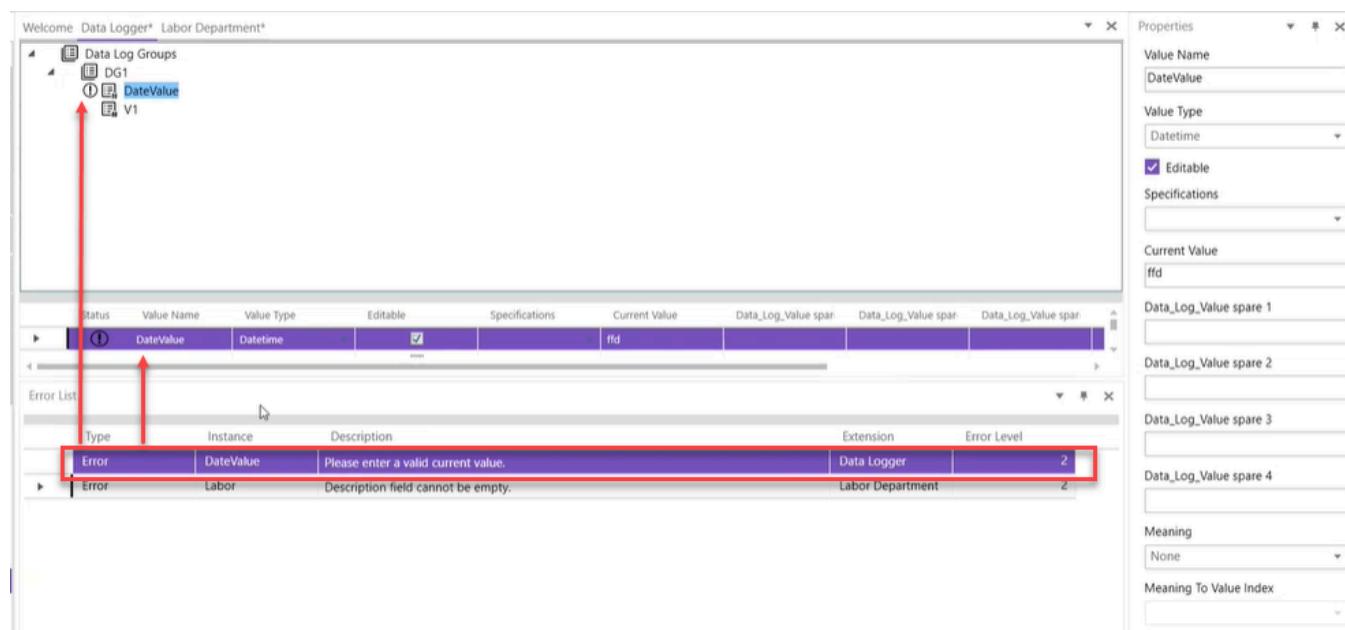
Shows the name of the module of the error.

### Error Level

Shows the severity level of the error. For example, whether the error is critical or it is warning.

## Opening Workspace Entries by Selecting the Error Message

Selecting an active error message will automatically open the associated entry in the module workspace. In the following example, selecting the error message associated with the **DateValue** data log entry automatically opens the associated data logger entry in the Data Logger workspace.



## Customizing What You See in MES Client

You can customize the MES Client application per your requirements.

## Showing/Hiding the Status Bar

### To show the status bar

- On the ribbon, go to the **View** tab. In the **Show/Hide** group, click **Status Bar** so that a check mark appears.

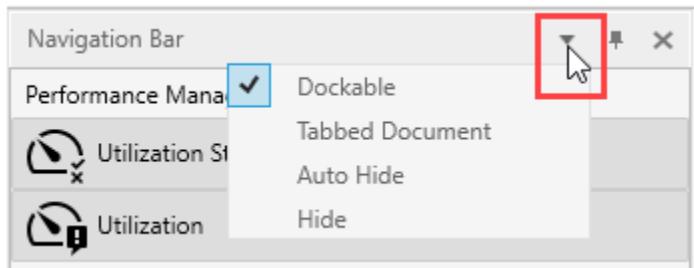
### To hide the status bar

- On the ribbon, go to the **View** tab. In the **Show/Hide** group, click **Status Bar** to clear the check mark that appeared.

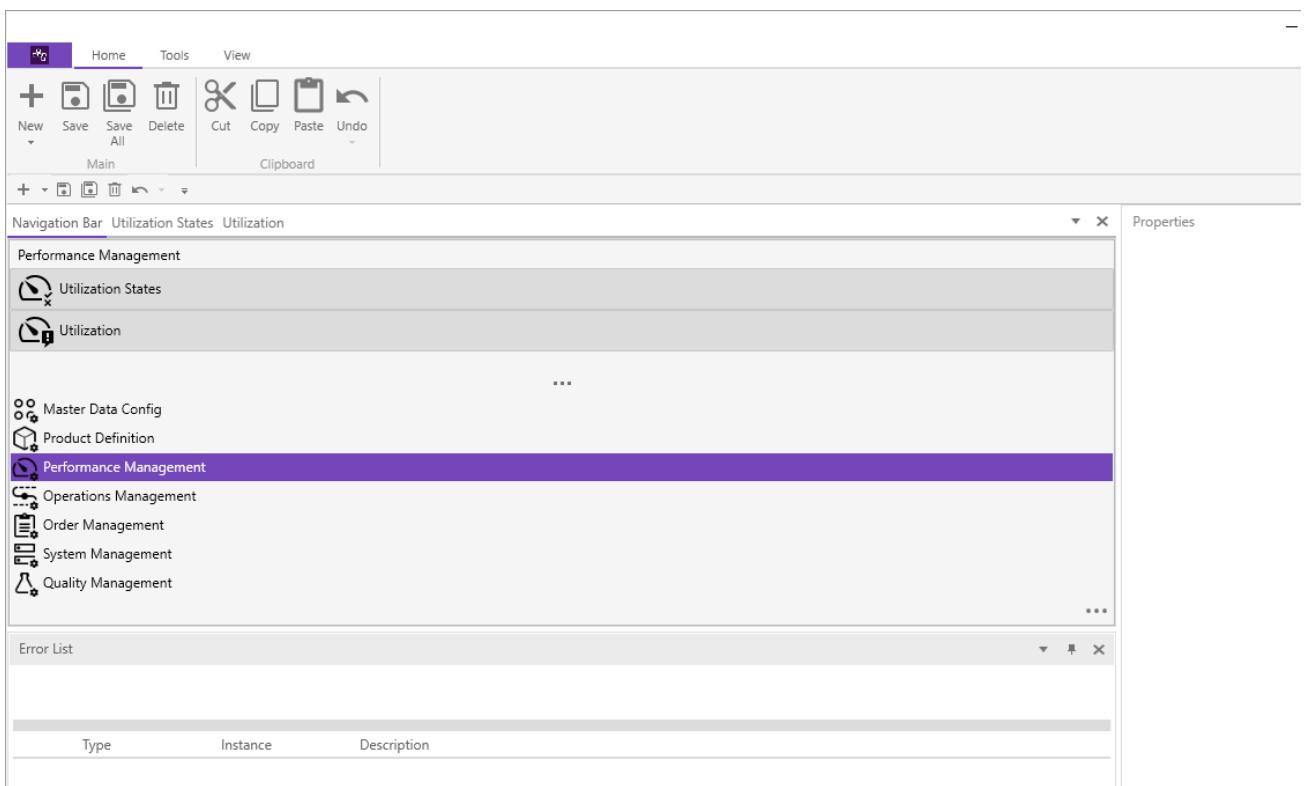
## Showing/Hiding the Navigation Bar, Properties, and Error List Windows

The **Navigation Bar**, **Properties**, and **Error List** windows have standard actions for adding them as another tab in the tabbed workspace, auto-hiding them, or closing them.

These actions are available from the context menu on the window's title bar, shown below.

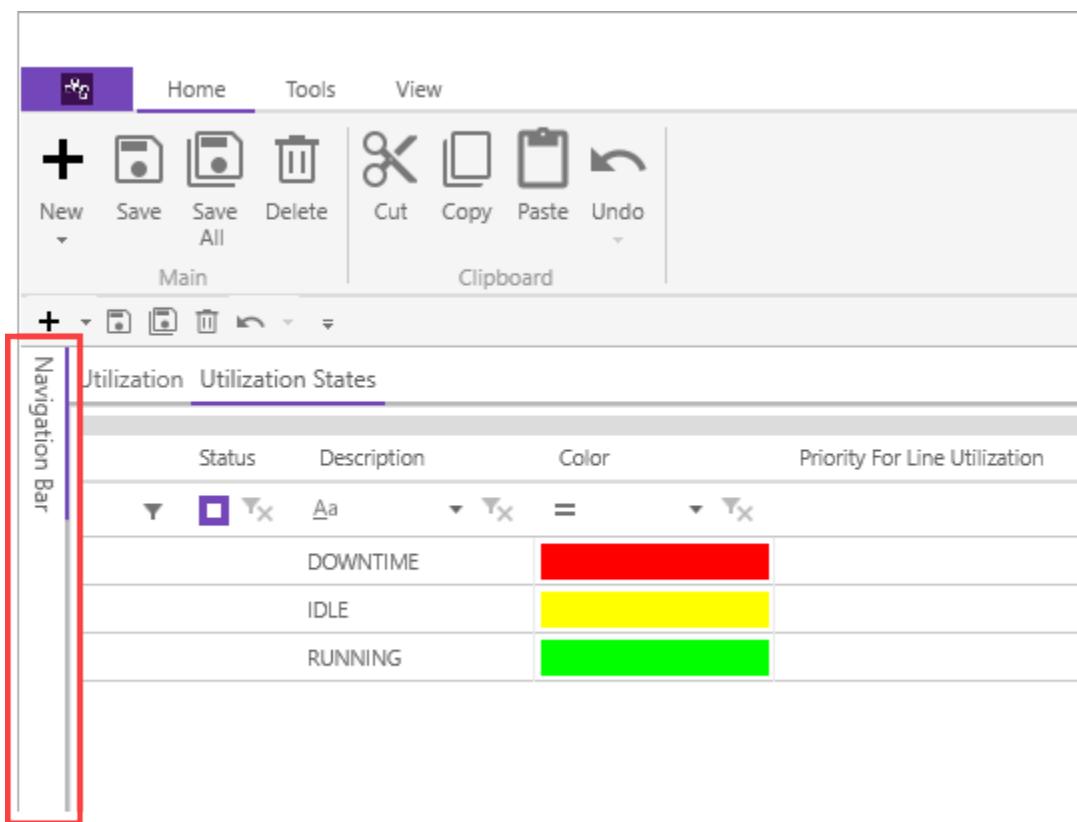


- Dockable** Puts the window in a dockable state, in which it can be dragged to dockable locations in the application window. See [Docking Windows](#).
- Tabbed Document** Changes the window to a tab in the tabbed workspace, as shown below.



To return the window to the default location, right-click its tab and click **Dockable**.

- **Auto Hide** Collapses the window to a bar. You can also auto-hide a window by clicking the push pin icon in its title bar.

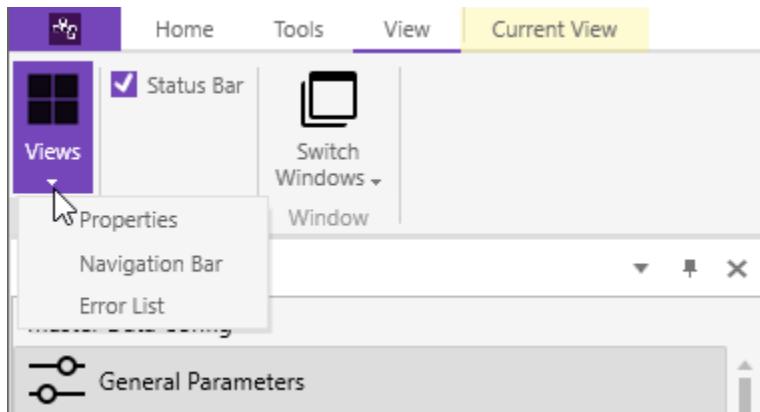


To temporarily open the window, click the title on the bar. When you then select an action on the window or click somewhere else in the application window, the window auto-hides again.

To turn off auto-hiding and return the window to its previous display state, on the window's context menu click **Auto Hide** to clear its selection or click the unpin icon in the window's title bar.

- **Hide** Closes the window .

To open a closed window, go to the **View** ribbon. Open the **Views** menu and click the window name.

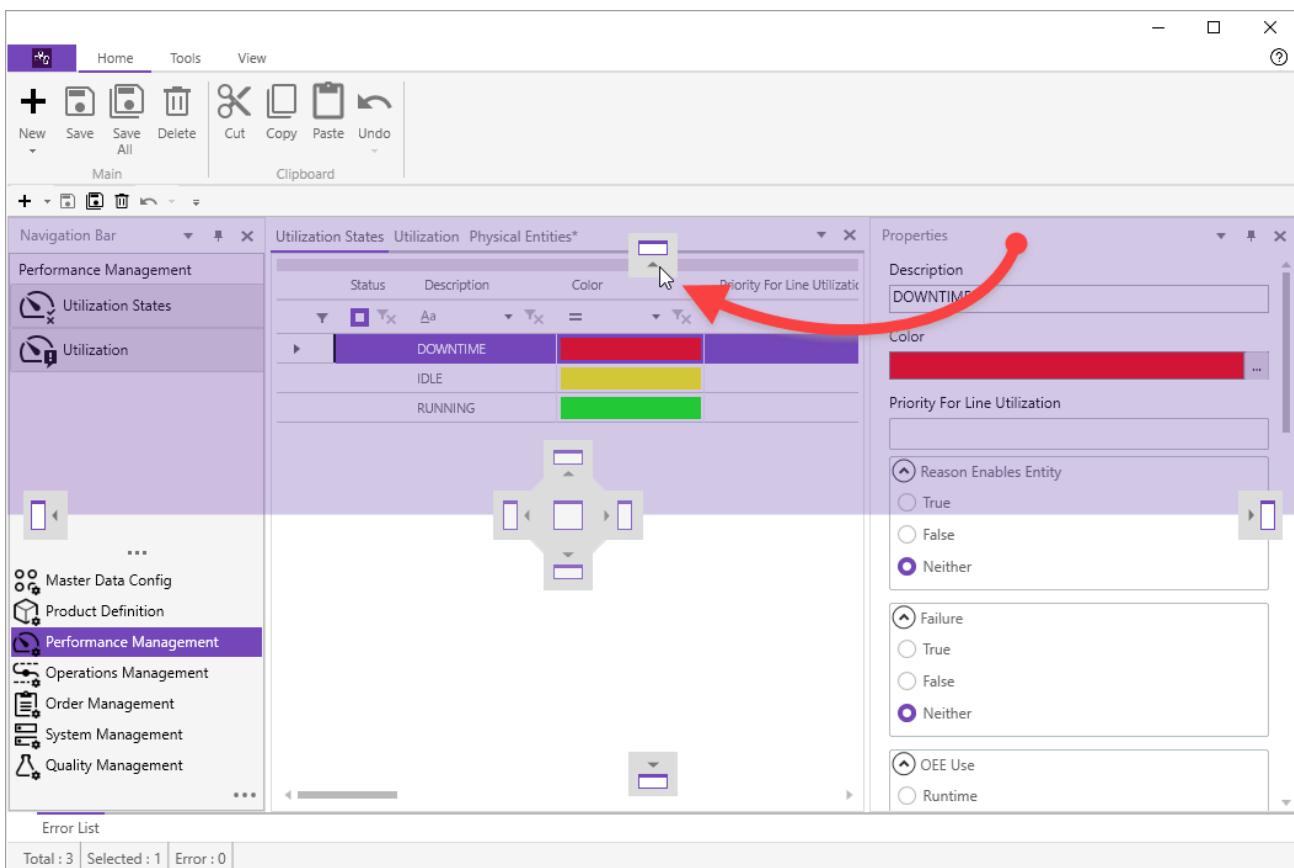


## Docking Windows

When a window is in the Dockable or Tabbed Document state, you can change its docked location to the left, right, top, or bottom of the application window.

1. Drag the window title bar or, if it's a tab in the workspace area, drag the tab.

As you drag the title bar or tab, target location icons appear where you can dock the window.



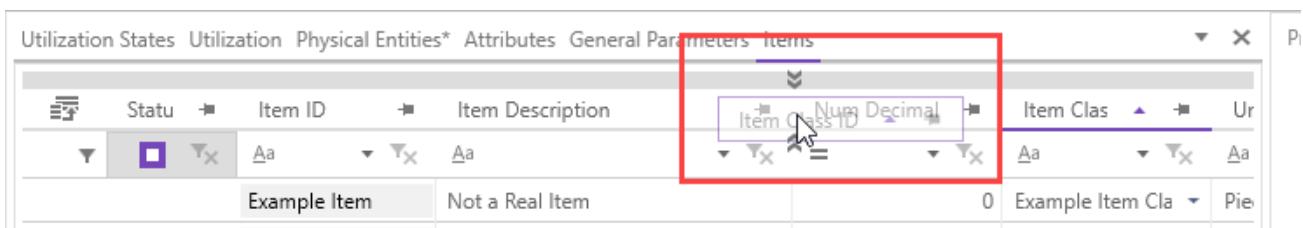
- Drop the window onto the target location icon.

## Reordering and Stacking Columns in Grids

For grids that appear in the workspace, the Properties window, and dialog boxes, you can reorder and stack their columns.

### To reorder a column

- Drag the column heading to the new location in the column heading area. When up and down arrows appear on top and bottom of the new location, drop the column.



### To stack columns

- Drag the column heading of the subordinate column onto the column heading of the target column. When the left and right arrows appear on both sides of the target column, drop the subordinate column.

Utilization States Utilization Physical Entities* Attributes General Parameters Items			
Status	Item ID	Item Description	Item Class
<input checked="" type="checkbox"/>	AMD-BLK	Almonds in Bulk	Raw Materi
<input checked="" type="checkbox"/>	BMX-BBQ	Bag of Mixed Nuts - BBQ	Finished Gc

The column data now appears in the target column in order that they were stacked.

Utilization States Utilization Physical Entities* Attributes General Parameters Items					
Status	Item ID	Item Description	Item Class ID	Num Decimal	Units
<input checked="" type="checkbox"/>	AMD-BLK	Almonds in Bulk	Raw Materials	3	Kilograms
<input checked="" type="checkbox"/>	BMX-BBQ	Bag of Mixed Nuts - BBQ	Finished Goods	0	Pieces
<input checked="" type="checkbox"/>	BBQ-FLA	BBQ Flavoring	Raw Materials	3	Kilograms
<input checked="" type="checkbox"/>	BAG-BBQ	BBQ Mixed Nuts Bag - Empty	Raw Materials	0	Pieces

### To unstack a column

- Drag the column heading to a target location in the column heading area, similar to reordering a column.

### Sorting, Pinning, and Grouping in Grids

For grids that appear in the tabbed workspace, the Properties window, and dialog boxes, you can sort the grid by columns, pin columns to freeze them when scrolling horizontally across the grid, and group the grid data by columns.

### To sort a by column

- Click the column heading. Click it again to change the sort order.  
A grid can only be sorted one column at a time.

### To pin a column

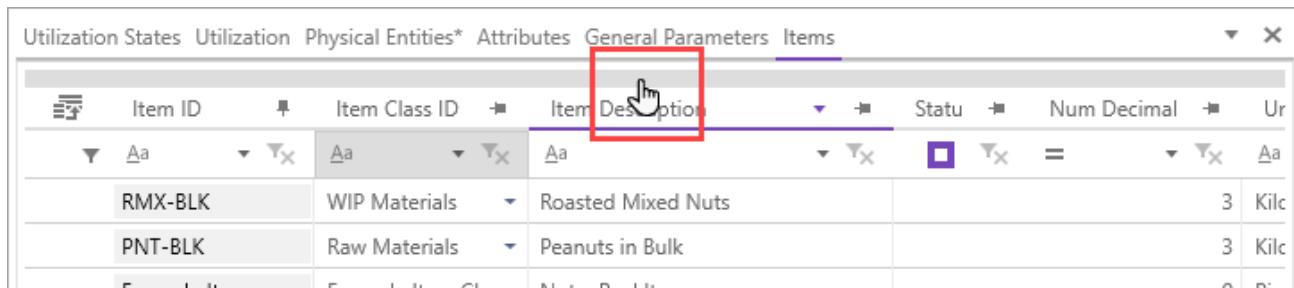
- Click the push pin icon in the column heading.  
The column moves to the left side of the grid. The column will now be visible if you scroll the grid horizontally.  
You can pin multiple columns.

### To unpin a column

- Click its push pin icon.
- The column moves to the right and is no longer pinned.

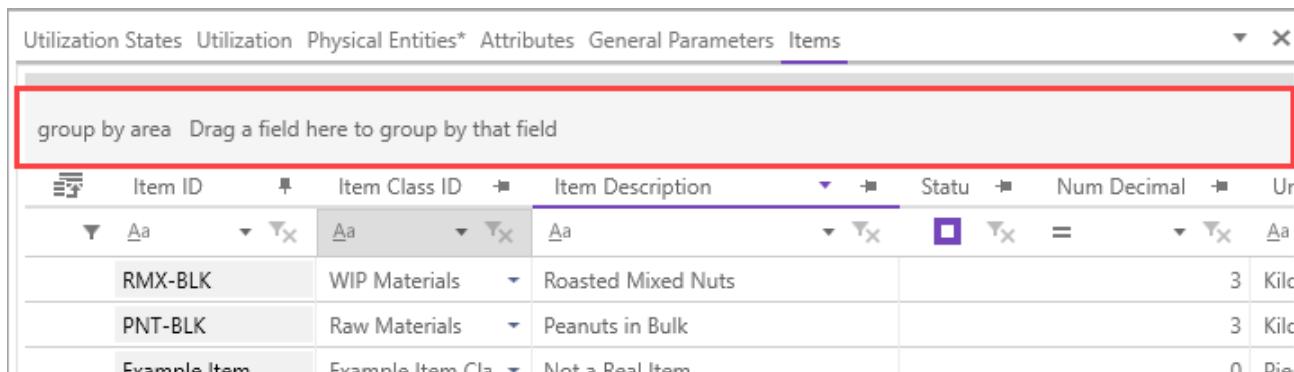
### To group the grid data by columns

- Click the thick group by area bar that is directly above the column headings.



Item ID	Item Class ID	Item Description	Status	Num Decimal	Ur
RMX-BLK	WIP Materials	Roasted Mixed Nuts		3	Kilc
PNT-BLK	Raw Materials	Peanuts in Bulk		3	Kilc
Example Item	Example Item Class	Not a Real Item		0	Die

The group by area appears.



Item ID	Item Class ID	Item Description	Status	Num Decimal	Ur
RMX-BLK	WIP Materials	Roasted Mixed Nuts		3	Kilc
PNT-BLK	Raw Materials	Peanuts in Bulk		3	Kilc
Example Item	Example Item Class	Not a Real Item		0	Die

- Drag and drop a column heading on the group by area.

The grid entries are grouped by the data in that column. For example, the following grid is grouped by the **Item Class ID** column data.

The screenshot shows a software interface for managing item classes. At the top, there are tabs: Utilization States, Utilization, Physical Entities\*, Attributes, General Parameters, and Items. The Items tab is selected. Below the tabs is a header row with columns: Item Class ID, Item ID, Item Class ID, Item Description, Status, and Num Decimal. The Item Class ID column is currently active, indicated by a purple underline. The Item ID column has sorting arrows (up, down, and filter) above it. The Item Description, Status, and Num Decimal columns have filter icons (magnifying glass, checkmark, and equals sign) to their right. The Status column contains a checkbox icon. The Num Decimal column contains a dropdown arrow. The main area displays a hierarchical list of item classes. Under "Raw Materials (6 items)", there are six entries: AMD-BLK, BAG-BBQ, BBQ-FLA, CSW-BLK, OIL-LQD, and PNT-BLK. Each entry includes the Item ID, Item Class ID, Item Description, Status, and Num Decimal fields. To the left of the main list, there are expandable sections for "Example Item Class (1 item)" and "Finished Goods (1 item)". At the bottom left, there is a section for "WIP Materials (2 items)". The bottom right of the interface features scroll bars.

You can continue to add column headings to group by. The groupings are nested according to the order that you drag the column headings.

### To remove a grid data grouping

- Drag it off the group by area.

### Filtering Grid Data

For grids that appear in the tabbed workspace, the Properties window, and dialog boxes, you can filter the rows that appear in the grid by its column data. The rows can be filtered by one or more columns.

Each column in the grid has a filter control, as shown below.

The operator menu.  
Select an operator to determine how to evaluate the entered search value.

The operand field.  
Enter a value to search on here or select one from the list.

QM Specification Definition		Utilization States		Utilization		General Parameters		Items		Characteristic Definition		Items	
Status	Item ID	Item Class ID	Item Description	Num Decimal	Unit								
<input type="button" value="Tx"/>	<input checked="" type="checkbox"/>	<input type="button" value="Tx"/>	Aa	raw	<input type="button" value="Tx"/>	Aa				=			Aa
AMD-BLK	Raw Materials		Almonds in Bulk								3	Kilogram	
BAG-BBQ	Raw Materials		BBQ Mixed Nuts Bag - Empty								0	Pieces	
BBQ-FLA	Raw Materials		BBQ Flavoring								3	Kilogram	
CSW-BLK	Raw Materials		Cashews in Bulk								3	Kilogram	
OIL-LQD	Raw Materials		Coating Oil								3	Liters	
PNT-BLK	Raw Materials		Peanuts in Bulk								3	Kilogram	

## Selecting an Operator

The operator determines how the content to be searched will be evaluated.

An icon that indicates the currently selected operator appears here. Click the operator icon to open the menu of available options.

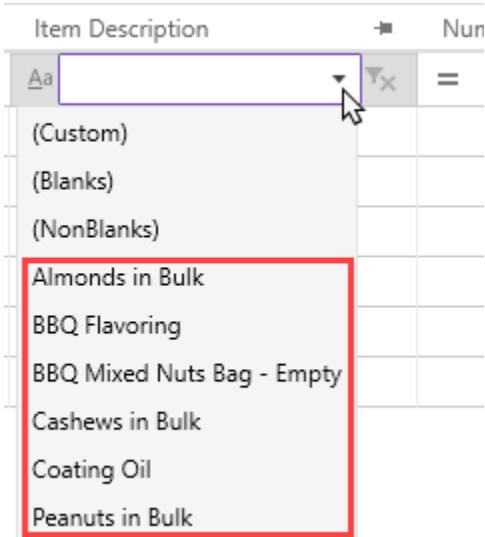
The screenshot shows a search interface with a dropdown menu for selecting an operator. The menu is divided into sections: A (Greater than or equal, Contains, Does not contain, Like (wildcards), Not like (wildcards), Match (regular expression), Does not match (regular expression)), B (Starts with, Does not start with, Ends with, Does not end with), C (IN In, Not in). The 'Starts with' option is highlighted with a purple background. To the right of the menu, a list of search results is displayed, starting with 'Almonds in Bulk'.

Item ID	Item Class ID	Item Description	Num
Aa	raw	Aa	
A ≥ Greater than or equal		Almonds in Bulk	
B Contains		BBQ Mixed Nuts Bag - Empty	
B Does not contain		BBQ Flavoring	
C Like (wildcards)		Cashews in Bulk	
O Not like (wildcards)		Coating Oil	
P Match (regular expression)		Peanuts in Bulk	
PI Does not match (regular expression)			
<b>Starts with</b>			
A Does not start with			
E Ends with			
D Does not end with			
IN In			
NI Not in			

## Entering the Content to Search On

You can enter the content to search on in the following ways:

- **By typing the content.** As you enter content, the rows are filtered automatically to those that match what you have entered so far.
- **By selecting one of the existing values in the column.** Open the operand menu to see this list. Column values are listed following the **(Custom)**, **(Blanks)**, and **(NonBlanks)** options.



- **By filtering the rows on whether they have a value in the column.**

To filter on rows that **do not** have a value in the column, in the operand menu click **(Blank)**.

To filter on rows that **do** have a value in the column, in the operand menu click **(NonBlanks)**.

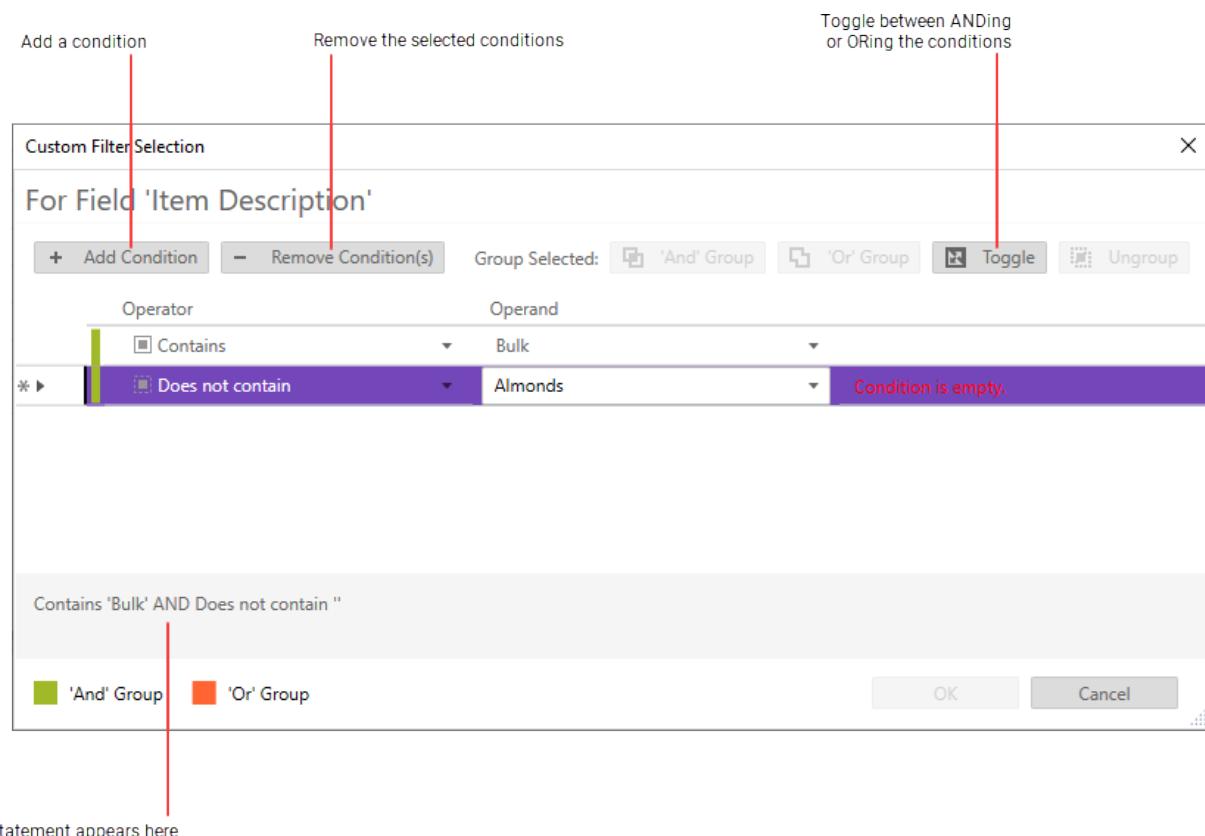
- **By building a custom filter.** See the following subtopic.

## Building a Custom Filter

For a given column, you can create a custom filter that has more than one filter condition.

1. On the operand menu, click **(Custom)**.

The Custom Filter Selection dialog appears.



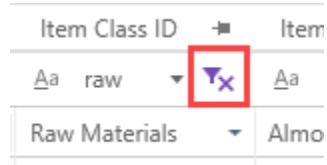
The filter statement appears here as you add conditions

**Note:** The condition grouping functions are not available.

2. Click **Add Condition** to add a condition and set its operator and operand.  
You can delete conditions by selecting them and clicking **Remove Conditions**.
3. If there's more than one condition, determine whether they are ANDed or ORed by clicking **Toggle**.
4. To save your changes to the custom filter, click **OK**.

## Clearing a Filter

Click the filter's clear icon, highlighted below.

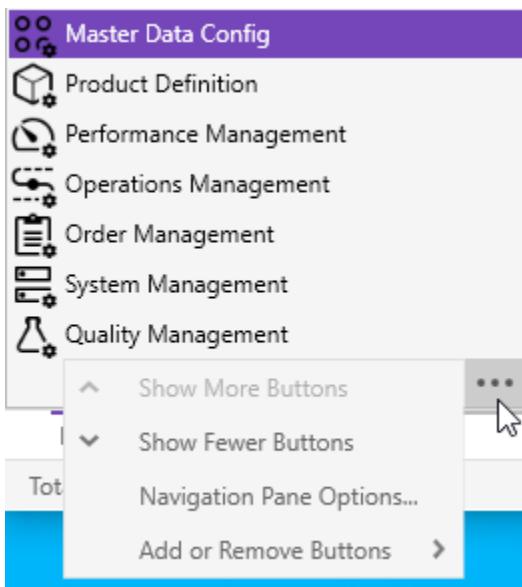
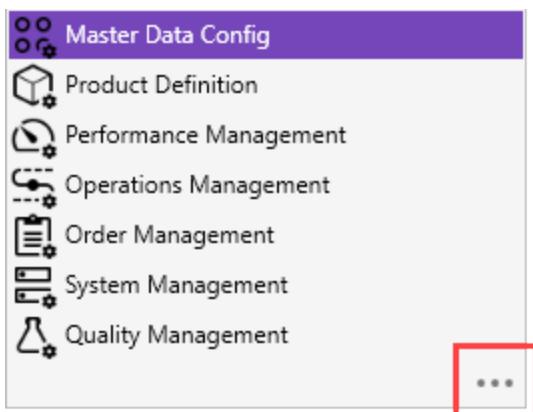


## Managing the Groups in the Navigation Bar

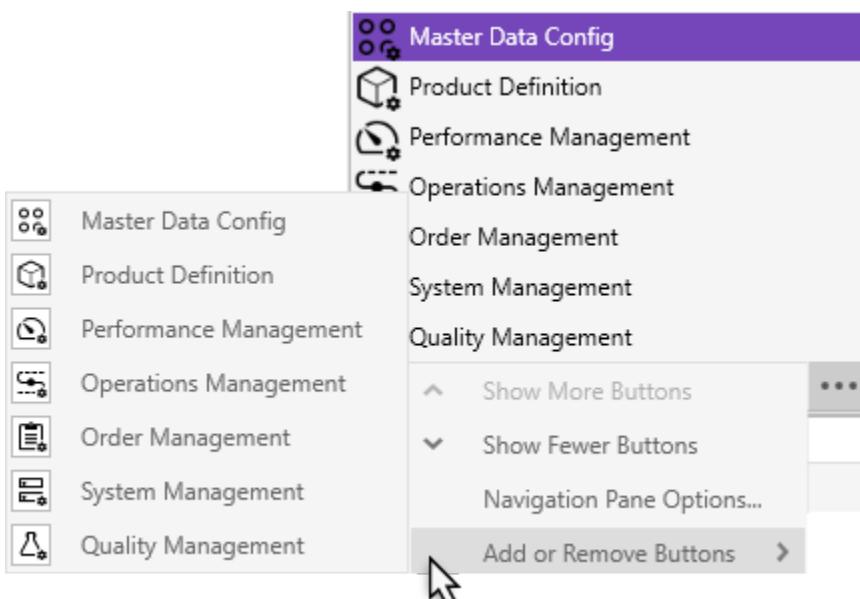
You can add or remove a group in the Navigation Bar. You can also minimize their buttons to icons and change their order.

### To add or remove a group

1. Click the menu icon at bottom right of the Navigation Bar.



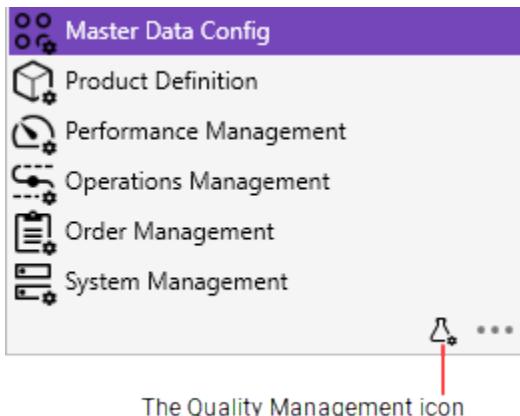
2. Point to **Add or Remove Buttons**, and then click the group you want to add to or remove from the Navigation Bar.



### To minimize a group's button to an icon

1. On the Navigation Bar menu, click **Show Fewer Buttons**.

The button for the last group in the list is removed and its icon appears.



2. Continue clicking **Show Fewer Buttons** to minimize additional group buttons to icons.

### To restore group buttons

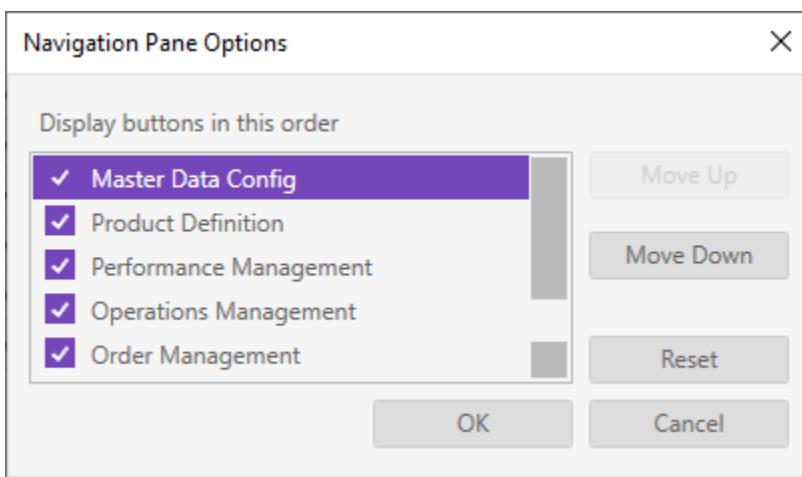
- On the Navigation Bar menu, click **Show More Buttons**.

The button for the last group that was minimized to an icon is restored.

### To change the order of the groups

1. On the Navigation Bar menu, click **Navigation Pane Options**.

The Navigation Pane Options dialog appears.



2. Select a group, and then click **Move Up** or **Move Down** to move it up or down in the order.
3. Click **Reset** to revert to the default settings.
4. Click **OK** to save the changes.

## Groups and Modules

The MES Client application includes modules that enables you to configure and maintain plant information. The modules in the MES Client application are grouped based on their functionality.

The following are the module groups available in the MES Client application:

- Master Data Config
- Product Definition
- Performance Management
- Operations Management
- Order Management
- System Management
- Quality Management

### Master Data Config Modules

#### **General Parameters**

Allows you to specify the system parameters for the MES applications.

#### **User Groups and Users**

Allows you to configure users and user groups and provide privileges and access rights to the specified user groups.

#### **Languages**

Allows you to configure languages for the MES applications.

#### **Physical Entities**

Allows you to create and maintain entity definitions in the system.

#### **Site**

Allows you to configure sites and the region details for an entity.

#### **Shift Patterns and Schedules**

Allows you to configure shift patterns and their shift schedules, which determine the shift days, timings, and shift breaks for an entity and any child entities that don't have their own shift pattern assigned to them.

#### **Category**

Allows you to assign items to item categories. This enables the same QM specification to be shared by multiple items that are in the same category.

#### **Job and Step States**

Allows you to view the job and step states that are available in the system, and to change their name and associated color.

#### **Attributes**

Allows you to specify the attribute of an item, item class, work order, job, and so on. You can also specify its data and entry types.

#### **File Extensions**

Allows you to define file extensions for document files and web pages that can be assigned to MES components

such as entities, work orders, and jobs to provide information and instructions to operators.

#### **Data Logger**

Allows you to define data log groups and data log values. Data log groups can then be assigned to entities, jobs, job steps, operations, and operation steps, which allows users to collect data related to item production as a work order is fulfilled.

### **Product Definition Modules**

#### **Items**

Allows you to specify an item. You can also apply filters to the item classes.

#### **Item Classes**

Allows you to configure an item class and specify details of an item class, such as produced, consumed, and obsolete.

#### **Units of Measure**

Allows you to specify the units of measure for an item.

#### **Item Grades**

Allows you to specify various grades of an item, such as approved, on hold, or rejected. You can select and apply different colors to each grade.

#### **Item States**

Allows you to specify the state of an item, such as work in progress and finished goods. You can select and apply different colors to each state.

#### **Item Reasons**

Allows you to configure item reason for an item. You can link BOM version, BOM item, and entities to the specified reason. You can also create a group of item reasons and link the classes and entities to the item reasons group.

#### **Attributes**

Allows you to specify the attribute of an item and item class. You can also specify its data and entry types.

### **Performance Management Modules**

#### **Utilization States**

Allows you to define possible utilization states that can be applied to entities on the plant floor.

#### **Utilization (Reason Groups and Reasons)**

Allows you to define utilization reasons for an entity entering a utilization state and associate the state to its possible reasons. Reasons are organized into reason groups.

### **Operations Management Modules**

These modules require an Operations license for them to be enabled.

#### **Global Specifications**

Allows you to specify global specifications for an entity class, item class, entity, or item.

#### **Labor Departments**

Allows you to create labor departments that can be assigned to MES users and job operations. Labor departments can provide contextual information about the time that MES users spend working on entities that have the ability to track labor.

**Labor Categories**

Allows you to create labor categories that can be assigned to MES users and job operations. Labor categories can provide contextual information about the time that MES users spend working on entities that have the ability to track labor.

**Certifications**

Allows you to define certifications that can be assigned to items, operations, operation steps, and job steps to restrict user access to related tasks or require sign-offs to complete those tasks for auditing purposes.

**Processes**

Allows you to configure a processes, operation, and data log properties. You can link processes to items. You can specify specification, steps, and attributes for an operation. You can also assign certification to an operation.

**Dynamic Routing Usage**

Allows you to configure a dynamic routing process.

**Standard Operations**

Allows you to configure a standard operation and data log properties. You can specify specification, steps, and attributes for a standard operation. You can also assign certification to a standard operation.

**Attributes**

Allows you to specify the attributes for operations and processes.

## Order Management Modules

**Work Orders and Jobs**

Allows you to configure a work order and job state. You can add files and URLs to a work order. You can also configure steps and step groups for a job.

**Queue (Job)**

Allows you to view all jobs configured in MES in their desired order of execution, and to change that ordering. You can split jobs and view a flow diagram. You can also link different jobs so they start and end together.

**Attributes**

Allows you to specify the attributes for the work order and jobs. You can also select its data and entry type.

## System Management Modules

**Database Information**

Allows you to maintain the MES database version details, historical table details, and database server.

**Database Maintenance**

Maintains the MES database. Creates and executes archive, purge, and restore jobs.

**Rejected Message (Viewer)**

Allows you to view, edit, resubmit, and delete MES command messages that are rejected by the middleware while using the Without Response communication mode.

## Quality Management Modules

These modules require a Quality license for them to be enabled.

### Sample Plan Frequency

Allows you to define sample plan frequencies, which are used to determine when the samples are collected.

### Sample Plan

Specifies a group of sample plan frequencies that apply to one or more QM specifications.

### Characteristic (Definition, for Variables and Attributes)

Allows you to define characteristics, the parameters of a product or process that has to be measured. Two types of characteristics include variables and attributes.

Variables are measurements that can assume any value, limited by an upper and/or lower bound. Attributes always occur in integer amounts.

### QM Specification

Specifies a set of values that applies to characteristics with a defined context in which these values are applicable.

### Causes

Allows you to define cause groups and causes. This module allows you to define the values of a sample.

### Attributes

Allows you to specify sample attributes that can be linked to a QM specification and result attributes that can be linked to a QM characteristic.

## General Parameters

You can use the **General Parameters** module to modify the existing system parameter values of the MES applications.

The **General Parameters** module is in the **Master Data Config** group in the **Navigation Bar**. For information on groups and modules, see [Groups and Modules](#).

## System Parameters

The system parameters contain the settings and actions that the MES applications can perform. For more information on definition and explanation of the values for each parameter, see [System Parameters Reference](#). The parameters are separated into the following groups:

### Archive

In the **Archive** group, you can define the archive query window size (in hours), archive root directory path, and archive server host.

### Data Editor

In the **Data Editor** group, you can define the system parameters for item production, item consumption, labor usage, item lots, job steps, and entity utilization.

You can specify the following warnings and alerts for users:

- Whether you want the system to display a prompt message before deleting data in the data editor.
- Whether a user should restrict the number of work orders that can be displayed in a list.

- Whether you want to use the previously saved editor filter settings for entity usage, item consumption editor filter settings, item production, job step data, and labor usage in the data editor.
- The warning level for opening a specified number of records in the Item Lot, Entity Usage, Item Cons, Item Prod, Job Step Data, and Labor Usage editors.

### Data Entry

In the **Data Entry** group, you can define the system parameters for the data entries in the MES database. You can do the following:

- Specify when the database data should be archived.
- Specify a different consumption or production record whenever the data is changed.
- Specify how frequently the MES middleware maintenance service should generate new samples and when to remove old sample context data.
- Specify the work order that should be archived and when it should be archived.
- Specify the quantity provided by the user to be verified whenever a new entry is added in the MES Client application.

### Display

In the **Display** group, you can define system parameters to display the MES applications.

You can do the following:

- Specify the colors for common errors, critical errors, informational messages, and warning messages.
- Specify whether to display the details about customers, items, item classes, and users.
- Specify the default language for the MES Client application.
- Specify whether a user must filter the items.
- Specify colors used within the Sample Viewer control for different sample states and result states.
- Specify whether to display the file extension along with the file name.
- Specify whether to allow a user to restrict the number of storage entities that are displayed in a list.

### Dynamic Routing

In the **Dynamic Routing** group, you can do the following:

- Specify whether to combine rework from multiple work orders into a new common work order.
- Specify whether all the remaining jobs from the original work order must be copied to the end of the new rework work order.
- Define a description for the rework jobs or work order.
- Specify whether the rework count should be differentiated based on the item reason, job sequence number, operation ID, rework process, and work order ID.
- Specify whether the lot number for the rework work order should change.

A rework work order is created when rework for a job is identified.

### Folders

In the **Folders** group, you can do the following:

- Specify whether changes to the date, time, and size of any of the files in the folder should put the folder on design hold.
- Specify whether all files or only download files be copied to the manufacturing directory when a folder Copy Contents action is performed.

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**Note:** Downloading folders to a physical entity is no longer supported, so this system parameter no longer

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applies.

- Specify whether the system must log the file type or description changes.
- Specify the revision justification for the folder, so that they are ordered properly.

### General

In the **General** group, you can do the following:

- Specify whether to pass the time zone information to the middleware.
- Specify whether a user can report less than or more than the total amount of time he is present.
- Specify the entity access to inventory.
- Specify whether a user can delete a certification data, log data, physical entities, folders, items, item classes, spec data, users, and work orders.
- Specify the general settings for the MES Client application. For example, job priority, labor rate, email attachment root, log consumption and production counters, and so on.

These are examples and not the complete list.

### Operator

In the **Operator** group, you can do the following:

- Specify whether a user can log on to an inactive entity from a different PC than the one originally used.
- Specify whether a user can minimize the MES Operator window.
- Specify whether the job should start automatically when a user logs on to the MES application by identifying the job rather than the entity.
- Specify whether the subscribed data must be refreshed whenever the current labor information, current OEE information, current job information, storage status or characteristics, or current utilization information for an entity is modified.
- Specify whether the child entity inherits the current utilization reason from its parent entity.
- Specify whether and how utilization events can be merged.
- Specify the general settings for the MES Operator, such as file information display, tab orientation, auto bypass a step, and so on.

### Reports

In the **Reports** group, you can specify what is considered to be the start of the production day for MES BI Gateway Reports. The production day start can be specified as the 24 hours from the start of a shift, the end of a shift, or a particular time of day. For more information, see the *MES BI Gateway Reports User Guide*.

### Security

In the **Security** group, you can do the following:

- Specify whether log on by default to selected entities.
- Specify whether you want a specific user to log in by default.
- Specify the security mode for a user and user group.
- Specify automatic log on for a OS user and user group.
- Define the default privilege level for BOM substitutions.
- Define the default document download level, print level, and view level.
- Define the default reports view level and specification access level.
- Specify whether the user password should be unique or non-unique and specify the minimum password

length.

- Specify the number of days for which user's password will be active.
- Specify the number of unsuccessful log on attempts for users before they are automatically deactivated.

You cannot change the security settings for a user if a process is checked out.

### Supervisor

In the **Supervisor** group, you can do the following:

- Specify the number of days that you want to display of the supply chain connector information.
- Specify whether jobs are instantiated from a process that end up with 0 quantity (usually because there is nothing flowing into them from an upstream job).
- Specify whether you want the system to prompt you for check-in the checked out process before closing.
- Specify the display for the file information.

## Controlling How the System Parameters Are Listed

When you open the **General Parameters** module, the **Current View** menu appears on the ribbon.

The following commands are available:

### By Category

Displays the System Parameter list by category in the workspace (for example, by DataEditor).

### Alphabetical List

Displays the System Parameter list in an alphabetical order in the workspace.

By default, the system parameters are displayed **By Category**.

## System Parameters Reference

System Parameters	Value Description
<b>Archive</b>	
Archive query window size (hours)	Numeric field. The time span (in hours) used to divide the amount of records being archived and purged at one time into smaller sets. This strategy helps to reduce the amount of data that is being retrieved and so lessen the impact of archiving and purging on database performance for production.  The queries that are used to retrieve the data records to archive or purge will ask only for data within the hourly window, based on the last_edit_at datetime in the data records. For example, if the window value is set to 6 hours, the first data retrieval will retrieve the first 6 hours of data records and archive or purge them. When that operation is complete, the next 6 hours of data records will be retrieved and processed, and so on until the final records are reached.

System Parameters	Value Description
Archive root directory path	<p>Free-form text field. Contains the root directory path (relative to the server) to which archived data is saved and from which archive data is restored.</p> <p>The default path is <b>C:\Program Files\Wonderware\MES\Archives</b>.</p> <p>Note the following:</p> <ul style="list-style-type: none"> <li>• The archive root directory path must be the absolute path, including the drive letter.</li> <li>• The path cannot be <b>c:, c:\</b>, or blank. If it is, it will revert to the default path.</li> <li>• Make sure that any users who are performing archive and restore jobs have access to the archive directory.</li> <li>• If the archive directory is changed, configure the MES DB/MW Communication component again with the post-install Configurator to grant the MES middleware's Windows user account access to the new directory location.</li> </ul>
Archive server host	<p>Free-form text field. Contains the name of the archive server host where the archive files are located.</p> <p>If blank, the local host is assumed.</p> <p>If the archive server host is changed, configure the MES DB/MW Communication component again with the post-install Configurator to grant the MES middleware's Windows user account access to the new directory location.</p>
<b>Data Editor</b>	
Perform auxiliary updates in Item Production Editor	Update inventory, consumption, and/or performance information (whatever would have been normally updated by the equivalent action in Operator) in addition to production.
Prompt for confirmation of deletions in Data Editor	Yes/No drop-down list. If Yes, provides a dialog box requesting confirmation before a deletion requested in Data Editor is executed in the database.
Require filter for work orders?	If Yes, the user is prompted to restrict the number of work orders displayed in a list if there is no filtering by default.
Use saved filters in Entity usage Editor	If Yes, the previously saved Entity Usage Editor filter

System Parameters	Value Description
	settings will be used for the current user.
Use saved filters in Item Consumption Editor	If Yes, the previously saved Item Consumption Editor filter settings will be used for the current user.
Use saved filters in Item Production Editor	If Yes, the previously saved Item Production Editor filter settings will be used for the current user.
Use saved filters in Job Step Data Editor	If Yes, the previously saved Job Step Data Editor filter settings will be used for the current user.
Use saved filters in Labor Usage Editor	If Yes, the previously saved Labor Usage Editor filter settings will be used for the current user.
Warning level (number of nodes) for filter in Item Lot Editor	When applying a filter setting, if the number of nodes that will be returned exceeds this number, the user is warned that a large set of data will be displayed in the Item Lot Editor.
Warning level (number of records) for filter dialog in Entity Usage Editor	When applying a filter setting, if the number of nodes that will be returned exceeds this number, the user is warned that a large set of data will be displayed in the Entity Usage Editor.
Warning level (number of records) for filter dialog in Item Cons Editor	When applying a filter setting, if the number of records that will be returned exceeds this number, the user is warned that a large set of data will be displayed in the Item Consumption Editor.
Warning level (number of records) for filter dialog in Item Prod Editor	When applying a filter setting, if the number of records that will be returned exceeds this number, the user is warned that a large set of data will be displayed in the Item Production Editor.
Warning level (number of records) for filter dialog in Job Step Data Editor	When applying a filter setting, if the number of records that will be returned exceeds this number, the user is warned that a large set of data will be displayed in the Job Step Data Editor.
Warning level (number of records) for filter dialog in Labor Usage Editor	When applying a filter setting, if the number of records that will be returned exceeds this number, the user is warned that a large set of data will be displayed in the Labor Usage Editor.
<b>Data Entry</b>	
Day to archive data	This parameter is no longer used.

System Parameters	Value Description
Days to keep data (0=never delete)	This parameter is no longer used.
Frequency to call sample updates (in seconds)	Specifies the interval at which sample information (creating new future samples, readying samples, or updating the sample state), is updated. The default is 30 seconds.
How long to keep old context information (in days)	Specifies the number of days to keep context information that is no longer current. In case the context information becomes current again (e.g., as may happen when a suspended job is restarted), sampling may pick up where it left.
Maintain distinct consumption records	Yes/No drop-down list. If Yes, writes a new record in the Item_cons table for any changes made to consumption records.
Maintain distinct good production records	Yes/No drop-down list. If Yes, writes a new record in the Item_Prod table for any changes made to good records.
Maintain distinct reject production records	Yes/No drop-down list. If Yes, writes a new record in the Item_Prod table for any changes made to reject records.
Required WO status for archiving	Drop-down list containing Complete and Closed. Determines, by status, which work orders will be archived.
Sample wait time for delayed production (in minutes)	<p>For samples based on a units-of-production frequency, the MES middleware maintenance service will adjust sample request times based on the setting of this parameter.</p> <p>If this parameter is set to 0, then there are no adjustments to future sample request times and it is possible for a future request time to have a value in the past.</p> <p>If this parameter is set to a non-zero value, then when the time for a future sample passes without there being enough production reported to warrant it, all future samples for the entity and for the production count frequency will have their requested times increased by the specified number of minutes, thereby keeping them in the future.</p>
Time to archive data (HH:MM)	This parameter is no longer used.

System Parameters	Value Description
Verify quantity entry	Yes/No drop-down list. If Yes, the quantities entered by a user of the Operator module will be verified by a Yes/No prompt.
<b>Display</b>	
Color for automatic collection column	Allows you to set/modify the column heading colors in Sample Viewer, for characteristics that are collected automatically.
Critical error color	Selection field. Allows you to set/modify the color used for critical errors throughout the system.
Customer display	Drop-down list. Defines which combination of Customer ID and/or Customer Name will be displayed in the Customers window.
Default language	The language that appears on the initial log on screen before a user logs in.
Dismiss production dialog upon entry	Yes/No drop-down list. If Yes, the Add Production dialog in the Operator module closes automatically after the user clicks Save and the production is successfully recorded. If No, the user of the Operator module must click Close to dismiss the Add Production dialog.
Error color	Selection field. Allows you to set/modify the color used for the text of error messages throughout the system.
Information message color	Selection field. Allows you to set/modify the color used for informational messages throughout the system.
Item class display	Drop-down list. Defines which combination of Item Class ID and/or Item Class Desc(ription) will be displayed.
Item display	Drop-down list. Defines which combination of Item ID and/or Item Desc(ription) will be displayed.
Items require filtering	If Yes, a user will first be prompted to restrict the number of items displayed in a list. If No, the user will not be prompted to restrict the number of items displayed in a list.

System Parameters	Value Description
Cut-off time in days to limit the number of samples while calculating process statistics from the samples (0 = Include all samples)	Upper bound on the age of sample data used to calculate process statistics. This time range is applied to the sample's requested time. Use this parameter to exclude sample data that is considered too old to be relevant. For example, setting this parameter to a value of 2 would mean that only the last 2 days of sample data would be used to calculate process statistics.
Number of samples to consider calculating process statistics	Maximum number of samples to include when calculating process statistics. Use this parameter to tune the performance of the system so that there is not too much data being analyzed.
Re-use concurrent link values to aid color coding	Yes/No drop-down list. Refers to the 16 colors used to color-code link #s in the Supervisor/Queue window. If Yes, new links will be given an unused number between 1 & 16, to simplify color-coding. If No, a new link will be given the next highest number (a color will still be reused).
Sample Result Good Color	For the .NET Sample Viewer control, indicates a sample characteristic with all variables and attributes within normal range.
Sample Result OOC Color	For the .NET Sample Viewer control, indicates a sample characteristic with at least one variable or attribute out of the SPC control, and no variables or attributes out of specification.
Sample Result OOC Critical Color	For the .NET Sample Viewer control, indicates a sample characteristic with at least one variable or attribute with a severity setting of critical, that is out of the SPC control, and no critical variables or attributes out of specification.
Sample Result OOC Key Color	For the .NET Sample Viewer control, indicates a sample characteristic with at least one variable or attribute with a severity of key out of the SPC control, no critical or key variables or attributes out of specification, and no critical variables or attributes out of control.
Sample Result OOS Color	For the .NET Sample Viewer control, indicates a sample characteristic result with at least one variable or attribute out of specification. This color indicates individual variable characteristics.

System Parameters	Value Description
Sample Result OOS Critical Color	For the .NET Sample Viewer control, indicates a sample characteristic result with at least one variable or attribute with a severity setting of critical, that is out of specification.
Sample Result OOS Key Color	For the .NET Sample Viewer control, indicates a sample characteristic result with at least one variable or attribute with a severity setting of key, that is out of specification.
Sample Result Pending Color	For the .NET Sample Viewer control, indicates a sample characteristic with some variables and attributes that are waiting to be collected. The collected variables and attributes are within normal range.
Sample Status Cancelled Color	For the .NET Sample Viewer control, indicates a sample for which measurements are not taken.
Sample Status Complete Color	For the .NET Sample Viewer control, indicates a sample where the recorded time at which the minimum number of original results in the sample is less than or equal to the sample expiration time, and there are enough results for every characteristic linked to the sample.
Sample Status Complete Late Color	For the .NET Sample Viewer control, indicates a sample where the recorded time for at least one original result in the sample at or below the minimum number is greater than the sample expiration time, and there are enough results for every characteristic linked to the sample.
Sample Status Future Color	For the .NET Sample Viewer control, indicates a sample for which measurement results are to be collected at a future date.
Sample Status In Progress Color	For the .NET Sample Viewer control, indicates a sample that has a requested time less than or equal to the current time, and an expiration time greater than or equal to the current time. The sample does not have enough results for at least one of the characteristics linked to it. The sample pulled time is either Not Null or there is at least one result.

System Parameters	Value Description
Sample Status Late Color	For the .NET Sample Viewer control, indicates a sample that has an expiration time less than or equal to the current time, and does not have enough results for every characteristic linked to it. Either the sample pulled time is Not Null or there is at least one result.
Sample Status Missed Color	For the .NET Sample Viewer control, indicates a sample that has an expiration time less than or equal to the current time, the sample pulled time is Null, and there are no results.
Sample Status Ready Color	For the .NET Sample Viewer control, indicates a sample where the current time is greater than or equal to the requested time of the sample, and less than or equal to the expiration time of the sample. If the warning interval is Not Null, or less than the sample requested time and the warning interval, the sample pulled time is Null, and there are no results collected for the sample.
Sample Status Ready Warning Color	For the .NET Sample Viewer control, indicates a sample where the current time is greater than or equal to the requested time of the sample, and less than or equal to the expiration time of the sample. If the warning interval is Not Null, and the current time is greater than the sample requested time, the sample pulled time is Null, and there are no results collected for the sample.
Serious error color	Selection field. Allows you to set/modify the color used for serious errors throughout the system.
Show only file name	Yes/No drop-down list. If Yes, shows only the name of a file and not the complete path in all modules that display file information.
Storage entities require filtering	If Yes, a user will first be prompted to restrict the number of storage entities displayed in a list. If No, the user will not be prompted to restrict the number of storage entities displayed in a list.
User display	Drop-down list. Defines which combination of user ID and/or user description will be displayed.
Warning color	Selection field. Allows you to set/modify the color used for warnings throughout the system.

System Parameters	Value Description
Warning level number of records for the Sample Characteristic filter dialog in SRO	Specifies the maximum number of records to be returned in this dialog, before the operator is prompted to narrow the filter criteria.
<b>Folders</b>	
Check file date/time/size for design hold	Yes/No drop-down list. If Yes, allows the user to check folder date, time and size for putting on design hold.
Copy to manufacturing directories	Drop-down list containing <b>All files in folder</b> and <b>Download files only</b> . Determines which files in a folder are copied to the manufacturing directory.  <b>Note:</b> Downloading folders to a physical entity is no longer supported, so this system parameter no longer applies.
Log changes to file type or description	Yes/No drop-down list. If Yes, the system will log changes to file types or file descriptions.
Revision justification	Drop-down list containing Right and Left. Determines the justification of a revision to a folder.
<b>General</b>	
Allow clients from multiple time zones on the same Middleware server	If Yes, time zone information must be passed to the Middleware server from each client. If No, the middleware server's time zone is assumed to be the same as that of its clients.
Allow user to account for less than 100% of his time	Yes/No drop-down list. If Yes, allows a user to account for less than his complete shift.
Allow user to account for more than 100% of his time	Yes/No drop-down list. If Yes, allows a user to account for more than his complete shift.
Apply entity access to inventory	Yes/No drop-down list. If Yes, limits the logged in user to "view only" for those inventory locations that the user has not been granted access. This would apply to both Supervisor inventory window and operator inventory control.
Apply grade code preference when consuming from inventory	Yes/No drop-down list.
Automatically generate process version numbers	Yes/No drop-down list. If Yes, automatically generates a version number when a new process is created.

System Parameters	Value Description
Automatically update scheduled finish time for running jobs	Yes/No drop-down list. If Yes, automatically updates the scheduled finish time for running jobs, to reflect the expected time to produce the remaining required quantity, every minute. If No, the scheduled finish time, once determined, is not recalculated.
May not delete or modify components of a certified process	Yes/No drop-down list. If Yes, a user would not be permitted to make any changes or deletions of certified processes.
Category for labor not to be applied	Specifies the labor category that will always have a percent to apply value of 0 to captures of applied labor for inactive jobs. If the No value is specified, then no labor category will take on this characteristic.
Cloned certified process status if only one certified process is allowed	Drop-down list containing <b>Experimental</b> and <b>Approved</b> . Determines the status given to a process that is cloned from a certified process, if only one certified process is allowed in a process class.
Days to keep SCC logs –0 = no logging	Numeric field. Defines the total number of days the SCC log file will be maintained. An entry of zero 0 means the log file is never created. Ex: 10
Default Item Class ID	Free-form text field. Determines the default item class ID.
Default Item ID	Free-form text field. Determines the default item ID.
Default job priority	Numeric field. Defines the default priority of a job if the priority is not set in Supervisor when the job is created.
Default labor rate	Currency field. Defines the default labor rate for a user if No labor rate is entered. Ex: \$15
Default Operation ID	Free-form text field. Determines the default operation ID.
Default percent to start	Numeric field. Assume an operator is going to produce 1,000 of an item in operation 10. If this default percentage is set to 50, then when 500 parts have been completed in operation 10, operation 20 (or the next operation) may begin.
Default Unit of Measure for Items	Free-form text field. Determines the default UOM for

System Parameters	Value Description
	an item.
Default Work Order ID	Free-form text field. Determines the default work order ID.
Description for automatically-generated (Kanban) work orders	Free-form text field. Determines the standard description for automatically-generated work orders.
Disallow deletes of BOMs and BOM dependent data	Yes/No drop-down list. If Yes, a user would not be permitted to delete BOMs or data that is dependent on the BOM.
Disallow deletes of certification data	Yes/No drop-down list. If Yes, a user would not be permitted to delete certification data that was previously entered into the system.
Disallow deletes of data log data	Yes/No drop-down list. If Yes, a user would not be permitted to delete any Data Log data that was previously entered into the system.
Disallow deletes of entities	Yes/No drop-down list. If Yes, a user would not be permitted to delete physical entities.
Disallow deletes of folder data	Yes/No drop-down list. If Yes, a user would not be permitted to delete Folders data that was previously entered into the system.
Disallow deletion of items and classes	Yes/No drop-down list. If Yes, a user would not be permitted to delete items or item classes from the system.
Disallow deletion of spec data	Yes/No drop-down list. If Yes, a user would not be permitted to delete spec data that was previously entered into the system.
Disallow deletion of users	Yes/No drop-down list. If Yes, a user would not be permitted to delete (other) users previously entered into the system.
Disallow deletes of WO created from a certified process	Yes/No drop-down list. If Yes, a user would not be permitted to delete a work order created from a certified process.
Error log level 0 (highest) to 4	Numeric field. Determines the error log level setting, logging errors of the specified value and more critical. 0 = Critical errors - significant, may crash system 1 = Serious errors - will affect operation and data 2 = Partial errors - some data will be wrong

System Parameters	Value Description
	<p>3 = Trivial errors - small adverse effect on some data</p> <p>4 = Events - will not affect data or operation, information only</p>
How to automatically downgrade a certified process version	Drop-down list containing Experimental and Approved. Indicates what level a certified process should be set to when a new certified process is added to a process class and the process class may have only one certified process in it.
Limit schedulable entities on Jobs window	Yes/No drop-down list. Defines which entities are displayed when changing the Schedule to or Can Schedule to fields. If Yes, the user will only be able to select from entities defined in the process, including the entities' child entities. If No, the user may select from all defined entities.
Limit schedulable entities on Queue Window	Yes/No drop-down list. Defines which entities are displayed when changing the Schedule to or Can Schedule to fields. If Yes, the user will only be able to select from entities defined in the process, including the entities' child entities. If No, the user may select from all defined entities.
Log certification sign off as job events	Yes/No drop-down list. If Yes, job event records are inserted into the job_event table when an audit certification is approved.
Log consumption transactions as job events	Yes/No drop-down list. If Yes, job event records are inserted into the job_event table when an item is consumed during a job.
Log inventory transfers	Yes/No drop-down list. If Yes, records are inserted into the item_transfer table when an inventory item is transferred, shipped, received, or scrapped.
Log job state changes as job events	Yes/No drop-down list. If Yes, job event records are inserted into the job_event table when a job state is altered from one state to another.
Log production transactions as job events	Yes/No drop-down list. If Yes, job event records are inserted into the job_event table when an item is produced during a job.
Log spec changes during job execution as job events	Yes/No drop-down list. If Yes, job event records are inserted into the job_event table when the value of a defined job spec is altered.

System Parameters	Value Description
Log step completions as job events	Yes/No drop-down list. If Yes, job event records are inserted into the job_event table when a job step's status is changed to Completed.
Log storage entity changes	Yes/No drop-down list. If Yes, records are inserted into the job_event table when a storage entity's definition is changed.
Lot number format (#=number to increment)	Free-form text field. Defines the format mask for auto-incrementing lot numbers. Example: LOT-AB#, shows as LOT-AB1, LOT-AB2, ...
Lowest level process that can be instantiated	Drop-down list containing Experimental, Approved, and Certified. Defines the minimum process level that is needed to create a work order. Experimental is the lowest possible level. If Experimental, processes of all 3 types may be instantiated. If Approved, Approved and Certified processes may be instantiated. If Certified, only Certified processes may be instantiated.
Max. number of decimals for batch size entry	Numeric field. Determines the maximum number of decimal places that may be used when entering a batch size. The range is 0 - 7. The default is 3.
Max. number of decimals for BOM configuration	Numeric field. Determines the maximum number of decimal places that may be used when entering BOM configuration setting values. The range is 0 - 7. The default is 7.
Max. number of decimals for good piece part entries	Numeric field. Determines the maximum number of decimal places that may be used when reporting good production. The range is 0 - 7. The default is 0.
May have only one certified process in a process class	Yes/No drop-down list. If Yes, a process class is limited to having only one certified process.
May start and stop multiple jobs for a WO concurrently	Will be implemented in a future release.

System Parameters	Value Description
Minimum traceable inventory amount	<p>The smallest amount of inventory that is kept track of for genealogy purposes when consuming from an entity in which lots are indistinguishable.</p> <p>This parameter can be used with the physical entities Storage parameter <b>Multiple lots/items stored here become indistinguishable</b> in the following way: If the <b>Multiple lots/items stored here become indistinguishable</b> parameter is selected and the <b>Minimum traceable inventory amount</b> parameter has a value entered, then once the quantity for a lot drops below that value, the balance of the item quantity for that lot (that is, the quantity set as the minimum traceable inventory) will be distributed across the other lots, and the quantity for that lot will be set to 0.</p>
Path to Form program	<p>When opening a form, a flag that identifies that the first value in the comma-separated list being supplied specifies the Forms program to launch, as a fully qualified path. This program is used to open any defined forms attached to a step or to the Open Form button on the various controls. The parameters to pass are specified in the <i>Default parameters to pass to Forms program</i> system parameter.</p>
PO ID number format (# = number to increment)	<p>Free-form text field. Defines the format mask for auto-incrementing PO numbers.</p> <p>Example: PO-AB#, shows as PO-AB1, PO-AB2, ...</p>
Prevent automatic readying of first jobs.	<p>Yes/No drop-down list. Sets the default job state for the first job created for a work order. If Yes, the first job will not start automatically until manually changed.</p>
Process approver and editor must be different users	<p>Yes/No drop-down list. If Yes, a user may not approve processes he edited.</p>
Process version number format (# = number to increment)	<p>Free form text field. Defines the format mask for auto-incrementing process version numbers.</p> <p>Example: P-AB#, shows as P-AB1, P-AB2, ...</p>
Prompt for job status notes	<p>Yes/No drop-down list. If Yes, provides a dialog box allowing the user to enter notes whenever a job status is changed.</p>
Allowable deviation above start quantity (%); -1 if no limit	<p>Numeric field. This is the allowable percentage above a job's starting quantity that an operator can report as produced. A value of -99 is viewed as unlimited.</p>

System Parameters	Value Description
Allowable deviation below start quantity (%)	Numeric field. This is the allowable percentage below a job's starting quantity that an operator may report as produced.
Ready all new jobs of a work order together	Yes/No drop-down list. If Yes, the status of all jobs in a work order will be changed automatically to Ready after the release date/time. If No, only the first job's status will be changed automatically to Ready after the release date/time.
Ready downstream jobs automatically	If Yes, jobs receiving material from an upstream job are changed from new to ready automatically once sufficient material has been produced upstream. If No, jobs receiving material from an upstream job are not changed from new to ready automatically once sufficient material has been produced upstream.
Report time zone difference from GMT(min.)	Numeric field. This is the amount, in minutes, of the difference between your local time zone and UTC (previously, Greenwich Mean Time).
	<b>Note:</b> The default local time zone is now set at the MES DB/MW Communication component in the post-install Configurator, so this system parameter no longer applies.
Require notes upon process check-in	Yes/No drop-down list. If Yes, provides a dialog box for the user to enter notes when checking-in a process.
Schedule work to lowest level	Applies only if you have a license for Scheduler.
Sort job state by	Drop-down list containing Code number and State description. Determines the key field by which the job states will be sorted.
Storage entity serial number format (# = number to increment)	Free-form text field. Defines the format mask for auto-incrementing entity serial numbers. Example: Bin #, shows as Bin 1, Bin 2.
Time window for SCC time-based triggers (min.)	Numeric field. This is the time minutes for SCC triggers.
Time zone to use for storage	Drop-down list containing GMT (UTC) and Local time. If GMT (UTC), all time data will be stored as Greenwich Mean Time Zone values, but will be displayed in the modules as local time (Report Time zone difference from GMT Parameter). If Local time, all time data will be stored and displayed using local time zone values.

System Parameters	Value Description
	<b>Note:</b> The default local time zone is now set at the MES DB/MW Communication component in the post-install Configurator, so this system parameter no longer applies.
Use check-in/check-out for processes	If Yes, processes must be checked out in order to be modified. If No, processes do not need to be checked out to be modified.
User ID for background tasks	Free-form text field. This is the user ID which will be used for background tasks.
Work order ID format (# = number to increment)	Free-form text field. Defines the format mask for auto-incrementing work order ID numbers. Example: WO-AB#, shows as WO-AB1, WO-AB2, ...
XML encoding style	Free-form text field. Defines the encoding standard to be used. If blank, defaults to the U.S. standard. As an example, for Russian: encoding=iso-8859-1
<b>Operator</b>	
Allow inactive entity log-on to move between PCs	Yes/No drop-down list. If Yes, a user that has logged on to an entity and is inactive can then log back on to that entity from another machine.
Allow to minimize	Yes/No drop-down list. If Yes, the user may utilize Windows' Minimize function for the MES Operator's window.
Auto start jobs when using job based login	This system attribute will only apply to users who have a job-based log on. If Yes, the Start Some button and Start Job button are disabled. Only the Log on button is enabled; however, the Log on button will join an operator to a running job, start jobs that are not running, and will automatically create new split jobs if one does not exist for the selected entity.  The Log on button will only be enabled when the selected job can be started based on operator privileges and possible run on entities are accessible to logged in operator.
Default parameters to pass to Forms program	Defines the replaceable parameters to be used, if not otherwise defined, when invoking a third-party form tool in the Steps control. The entry is a comma-separated string with the first value being the forms program to run, followed by additional parameters

System Parameters	Value Description
	such as the form name. Whether the string includes the forms program to be launched is specified by the <i>Path to Form program</i> system parameter.
How to handle comments when merging utilization events	<p>When merging two utilization events, specifies whether and, if so, how the merge will occur if the comments for the two events are different. The options are:</p> <ul style="list-style-type: none"><li>• Do not merge if comments differ. The events will not be merged.</li><li>• Merge using the comment from the earlier event. The events will be merged, and the comment from the earlier event will be used as the comment for the merged event.</li><li>• Merge using the comment from the later event. The events will be merged, and the comment from the later event will be used as the comment for the merged event.</li></ul>
How to handle raw reason codes when merging utilization events	<p>When merging two utilization events, specifies whether and, if so, how the merge will occur if the raw reason codes for the two events are different. The options are:</p> <ul style="list-style-type: none"><li>• Do not merge if raw reason codes differ. The events will not be merged.</li><li>• Merge using the raw reason code from the earlier event. The events will be merged, and the raw reason code from the earlier event will be used as the raw reason code for the merged event.</li><li>• Merge using the raw reason code from the later event. The events will be merged, and the raw reason code from the later event will be used as the raw reason code for the merged event.</li></ul>
Include labor in updates to subscribed data	<p>This option will be implemented in a future release.</p> <p>Determines if changes to the current labor information for an entity will refresh the subscribed data.</p>
Include OEE in updates to subscribed data	<p>This option will be implemented in a future release.</p> <p>Determines if changes to the current OEE information for an entity will refresh the subscribed data.</p>

System Parameters	Value Description
Include running jobs in updates to subscribed data	<p>This option will be implemented in a future release.</p> <p>Determines if changes to the current job information for an entity will refresh the subscribed data.</p>
Include storage in updates to subscribed data	<p>This option will be implemented in a future release.</p> <p>Determines if changes to the storage status or characteristics of an entity will refresh the subscribed data.</p>
Include utilization in updates to subscribed data	<p>This option will be implemented in a future release.</p> <p>Determines if changes to the current utilization information for an entity will refresh the subscribed data.</p>
Logging out of the last job on an entity logs the user off the entity	Yes/No drop-down list. If Yes, logging out of the last job on an entity logs the user off the entity.
Operator file display	Drop-down list. Defines which combination of File name and/or Description will be displayed to the user of the Operator module.
Operator tab orientation	Drop-down list, containing Top and Left. Provides a choice on the default location of the entity tabs in Operator's window.
Operator tab text orientation	Drop-down list, containing Normal and Horizontal. Provides a choice of how the entity text is shown on the entity selection tabs in the Operator's window.
Prevent job with unapproved data log from being finished	Yes/No drop-down list. If Yes prevents job with unapproved data log from being finished.
Prompt for alternate user	Yes/No drop-down list. If Yes, log on screen will be displayed when current user does a switch user, preventing a return to the Windows' interface.
Prompt for production quantities on log off/exit	Yes/No drop-down list. If Yes, the <b>Add Production</b> window will be displayed when a user logs out of or exits Operator. The user can then enter production quantities.
Ready only downstream jobs that have input percent greater than zero	If a job normally receives no material from an upstream job, it is never automatically readied.
Seconds between checks for updates to data subscriptions	The number of seconds between checks for changes to an entity that could initiate a refresh.
Step auto bypass operator name	The user to which the action of bypassing a step be

System Parameters	Value Description
	attributed if the step bypass occurs automatically.
Use original button icons	Yes/No drop-down list. If Yes, the original icons will be used for Operator.
<b>Reports</b>	System parameters used by MES BI Gateway Reports to specify what constitutes the start of the production day. For more information, see the <i>MES BI Gateway Reports User Guide</i> .
Production Day Start	<p>Specifies when the 24 hours of the production day starts:</p> <ul style="list-style-type: none"> <li>• ShiftStart: The production day starts with the first shift that starts in the day. For example, if the first shift that starts in the day starts at 08:00:00, then the production day starts at 08:00:00 of the current calendar day and ends at 07:59:59 of the next calendar day. If the current calendar day is December 1, then the production day would be from December 1 at 08:00:00 to December 2 at 07:59:59.</li> <li>• ShiftEnd: The production day ends with the last shift that ends in the day. For example, if the last shift that ends in the day ends at 23:00:00, then the production day starts at 23:00:00 of the previous calendar day and ends at 22:59:59 of the current calendar day. If the current calendar day is December 1, then the production day would be from November 30 at 23:00:00 to December 1 at 22:59:59.</li> <li>• TimeOfDay: The production day starts with the first shift that occurs after the cut-off time specified by the <i>Production Day Start (Hours)</i> the <i>Production Day Start (Minutes)</i> parameters. For example, if the cut-off time is defined to be 06:00:00 and the first shift that starts after that time starts at 07:00:00, then the production day starts at 07:00:00 of the current calendar day and ends at 06:59:59 of the next calendar day. If the current calendar day is December 1, then the production day would be from December 1 at 07:00:00 to December 2 at 06:59:59.</li> </ul>
Production Day Start (Hours)	If the <i>Production Day Start</i> parameter is set to Time of Day, specifies the hour portion of the cut-off time for

System Parameters	Value Description
	the production day. The valid range of values is 0 (the default) to 23.
Production Day Start (Minutes)	If the <i>Production Day Start</i> parameter is set to Time of Day, specifies the minute portion of the cut-off time for the production day. The valid range of values is 0 (the default) to 59.
<b>Rework</b>	
Combine dynamic routing from the same operations of different work orders	If Yes, instead of instantiating a separate rework job for additional production requiring rework, add it into existing rework jobs, provided they are not started and the jobs that would have been created differ only in the work order and operation from those to which the rework is to be added.  This is enabled only if <i>Dynamic Routing is a separate WO from original</i> is True, as otherwise rework from different work orders stays within the original work order.
Copy remaining jobs to end of WO created for dynamic routing	If Yes, when a job is identified as needing rework and a new work order is created for the rework, all subsequent jobs are copied to the end of the new work order.
Differentiate rework count by item reason	If Yes, the dynamic processing count is differentiated based on the item reason.
Differentiate rework count by job sequence number	If Yes, the dynamic processing count is differentiated based on the job sequence number.
Differentiate rework count by operation ID	If Yes, the dynamic processing count is differentiated based on the operation ID.
Differentiate rework count by process	If Yes, the dynamic processing count is differentiated based on the rework process.
Differentiate rework count by WO ID	If Yes, the dynamic processing count is differentiated based on the work order ID.
Dynamic Routing is a separate WO from original	If Yes, jobs from dynamic routing become associated with a new work order with an automatically generated ID.  If No, rework jobs are associated with the original work order and the reworked parts can be merged back into the original flow of jobs.

System Parameters	Value Description
Label for work orders created by a dynamic route	Defines the description used if a separate work order or job is created for dynamic routing.
Modify lot numbers of dynamic routes	Defines whether the lot numbers of the parts to be dynamically routed remain the same always, are always changed to new automatically generated values, or are changed to new values only if the quantity being reworked is less than the total quantity for that lot (as defined by inventory). This parameter applies only if the lot numbers are not the serial numbers.
Redo job originating dynamic routing at end of dynamic process	Defines whether a copy of the current job is appended to the end of the set jobs created in the mini-process when rework or alternate processing is required at the current job. For example, after reworking, items may require inspection.
Use label in dynamic routing work order or operation IDs	<p>If Yes, the operation ID for rework jobs are appended with a dash immediately followed by the value specified in <i>Description for rework work orders</i> immediately followed by incremental numbers.</p> <p>For example, a rework job consisting of operations A, B, and C would create jobs identified as A-Rework1, B-Rework1, and C-Rework1 the first time the job was added to a work order and A-Rework2, B-Rework2, and C-Rework2 the second time the job was added to a work order.</p>
Security	
Allow default entity logon	Yes/No list which defaults to No. If set to Yes, shows a check box on the entity logon dialog entitled 'Always log on to these entities'. If checked, on subsequent logs on the entities which are selected will be automatically logged into.

System Parameters	Value Description
Automatic Login	<p>Controls whether the current Windows user will be automatically logged in to MES Client when the Security mode is set to OS User or OS Group.</p> <p>If set to Yes and both of the following conditions are true, the user is automatically logged in to MES Client:</p> <ul style="list-style-type: none"> <li>The <i>Security Mode</i> parameter is set to OS User or OS Group.</li> <li>In OS User mode, the current Windows user has been added to the MES database or, in OS Group mode, the current Windows user is a member of a Windows user group that has been added to the MES database.</li> </ul> <p>If set to No, MES Client prompts for a user name and password.</p> <p>If this parameter is set to Yes, the <i>Security Mode</i> parameter is set to OS Group, and the current Windows user is not a member of one of the Windows user groups that have been added to the MES database, the following error message appears if the user attempts to log in to MES Client: <i>OS User group is not configured</i>. After dismissing the message, the MES Client Login window appears.</p> <p>This parameter is not used for MES Web Portal auto-logins, which is controlled by Windows system and web browser settings.</p>
Default BOM substitution level	Numeric field. Defines the initial security level when a substitution item is created.
Default document download level	Numeric field. Defines the initial security level for downloadable documents.
Default document edit level	Numeric field. Defines the initial security level for editing documents.
Default document print level	Numeric field. Defines the initial security level for printing documents.
Default document view level	Numeric field. Defines the initial security level for viewing documents.
Default specification access level	Numeric field. Defines the initial security level when a specification is assigned to an operation or item.

System Parameters	Value Description
Maximum duration in minutes which constitutes consecutive logins (0=forever)	Numeric field. Defines the time window during which failed log on attempts are to be considered consecutive. For example, if a user attempts to log on Monday and his log on attempt failed due to an incorrect password and then he attempts to log back in on Tuesday, this would not be considered consecutive if this parameter were less than 1440 (that is, 1 day).
Minimum password length	<p>Numeric field. The fewest number of characters a password may contain.</p> <p><b>Note:</b> This parameter applies to Native security mode only.</p>
Number of days a password is valid (0 = passwords are always valid)	Numeric field. The number of consecutive days for which a user's password will be active; after that, a new password must be selected.
Number of failed login attempts before deactivation (0=never)	<p>Numeric field. The number of attempts a user may enter an incorrect password before he is terminated from the program.</p> <p><b>Note:</b> This parameter applies to Native security mode only.</p>
Seconds of inactivity before automatic logoff (0=never)	<p>Numeric field. The number of seconds of inactivity before the user is automatically logged off the module. Applies to all MES programs a user log into except Operator.</p> <p>You must restart the application after changing these settings.</p>
Seconds of inactivity before automatic switch user (Operator; 0 = never)	<p>Specifies the number of seconds of inactivity before a user is deactivated in Operator. The Operator displays the Switch User window and the user enters his password before returning to the Operator screen.</p> <p>You must restart the Operator after changing these settings.</p>

System Parameters	Value Description
Security Mode	<p>Specifies which Security Mode to use to authenticate MES users when they attempt to log in to an MES application:</p> <ul style="list-style-type: none"> <li>• Native: The MES database user account is used.</li> <li>• OS Group: The user's Windows Active Directory (AD) user group is used.</li> <li>• OS User: The user's Windows AD user account is used.</li> </ul> <p>You cannot change the Security Mode if a process is checked out. Otherwise, the process will not be able to be checked in.</p> <p>MES Web Portal requires either OS Group or OS User security mode.</p>
Switch user requires password	Yes/No drop-down list. If Yes, a user must re-enter his password before his session in Operator is reactivated.
<b>Supervisor</b>	
Days of SCC logs to display	The number of days of Supply Chain Connector information to display. 0 = all.
Include jobs with 0 quantity when creating work orders	If Yes, a job with no starting quantity can be created from a process. If No, a job with no starting quantity cannot be created from a process.
Prompt for check in when closing Process window?	Drop-down list, containing No, Yes, Default None Selected, and Yes, Default All Selected. If Yes, provides a dialog box when exiting the Process window for the user to check-in processes that he currently has checked out, with the requested number of processes automatically selected (All or None). The user may change the selections before closing the dialog box.
Show entity tree in Supervisor queue window	Yes/No drop-down list. If Yes, shows the entity tree on the left-hand side of Supervisor's <b>Queue</b> window. This will allow for filtering, and dragging and dropping of queued jobs from one entity to another.
Supervisor file display	Drop-down list. Defines the combination of file name and/or description that will be displayed to the user.

## Managing General Parameters

The workspace displays a list of all the existing system parameters.  
You can modify the values of a system parameter in the workspace.  
You cannot add or delete a system parameter.

### Modifying a System Parameter

Each parameter has a different type of data entry field.

#### To modify system parameters

- Select a system parameter and modify the value.

#### To view the last modified system parameters

- Select the **Status** check box.

For the information on filtering the data, see [Filtering Grid Data](#).

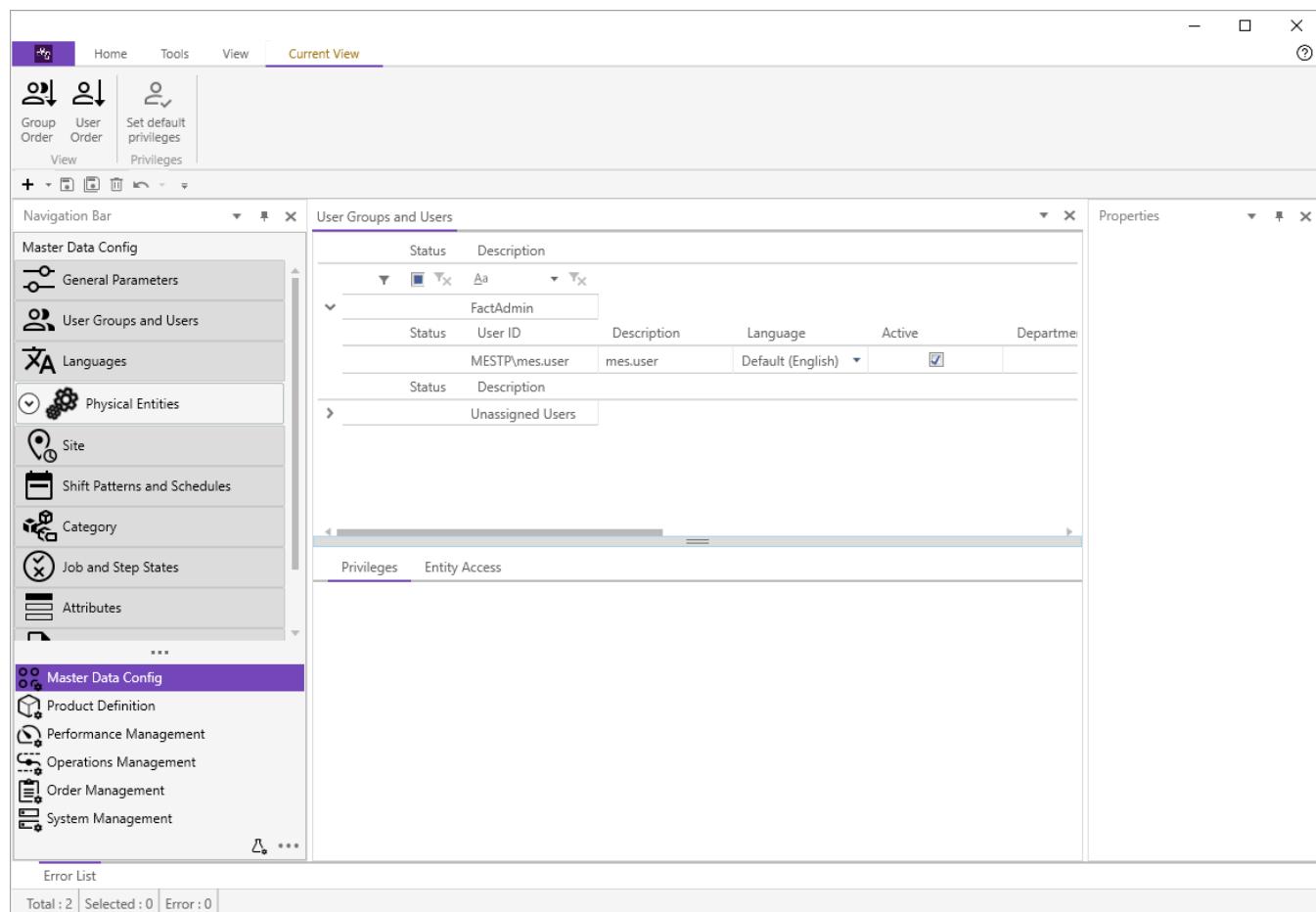
## User Groups and Users

You use the **User Groups and Users** module to provide access to the MES system to users, and to assign to the users their appropriate application privileges and entity access rights.

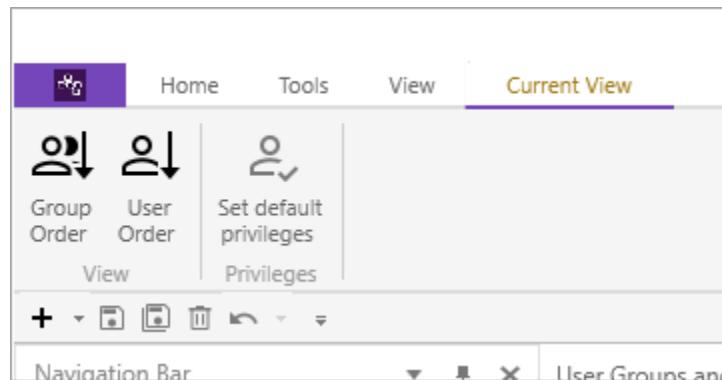
Application privileges and entity access are assigned through user groups. Every user is a member of at least one user group or is in the Unassigned Users list. A user can be a member of multiple groups. Users inherit the application privileges and entity access rights of the user groups to which they belong. Application privileges and entity access rights are additive. This means that a user will have the privileges available in all the groups and will have the maximum entity access rights of all the groups of which they are a member.

When you open the **User Groups and Users** module, a list of all the existing user groups is shown in its workspace tab. A user group shows a list of all the users assigned to that group.

The **User Groups and Users** module is grouped under the **Master Data Config** group in the Navigation Bar. For more information on groups and modules, see [Groups and Modules](#).



When you open the **User Groups and Users** module, the **Current View** tab appears on the ribbon.



In the **View** group, the following commands are available:

#### **Group Order**

Shows a list of all the users by group. When you click **Group Order**, the group ID and description for all the available groups is shown in its workspace tab. Click the plus (+) symbol to expand and view the list of users under a group.

#### **User Order**

Shows a list of all the users in the workspace tab. When you click **User Order**, the status, user name, description, language, and active status are shown in workspace tab. Click the plus (+) symbol to expand and view the groups assigned to a user.

In the **Privileges** group, the following command is available:

#### Set default privileges

Selects all the privilege check boxes and sets access level for all access level entries.

## Security Modes

There are three security modes that determine the basis for MES application user logins. The mode is set by the *Security Mode* system parameter in the **Security** group of the **General Parameters** module.

#### Native

The user groups and users are created in MES Client. This is the default security mode.

#### OS User

The user groups are created in MES Client, and existing Windows Active Directory (AD) user accounts are added to the native MES user groups.

#### OS Group

Existing Windows AD user groups are added to the MES database. This allows any existing Windows AD user accounts within each user group to have access to MES, according to the privileges and entities assigned to the user group.

In OS Group security mode, a user logging into MES Client must be a member of a Windows user group that has been added to the MES database. Otherwise, the following error message appears: *OS User group is not configured*. For more information about logging in to MES Client, see [Starting MES Client](#).

For the most secure configuration, the security mode should be set to one of the Operating System (OS) options. One of the OS options is also required for using the MES Web Portal. When deciding between OS User and OS Group, consider whether or not individual users need different default language settings. When in OS Group mode, all users will have the default language set by the global system parameter.

## Additional Information About OS Group Mode

In OS Group mode, the groups and not the individual users are configured. The MES system does not load all current OS users from the group into the MES database. The MES system also doesn't have any mechanism to periodically synchronize with Active Directory to update the list of users in MES with the users in the OS group. This is by design as some customers have thousands of OS users and only a small percent of those are MES users.

Instead, the MES system adds users to the user\_name table in the database during the initial successful login by a user. This initial login requires validation with the OS for user credentials. This can occur when logging in to MES Client, Enterprise Console (when used with MES model-driven application content), MES Operator, or MES .NET controls. Even when configured for automatic login (e.g., MES Client or .NET controls), there will be a one-time requirement to enter user credentials. Once the user\_name record has been created, all future connections for the user will automatically log in to MES.

Note that logins to MES Web Portal will not result in the user being added to the user\_name table. MES Web Portal logins use AVEVA Identity Manager (AIM) tokens to access MES.

## Changing the Security Mode and MES Web Portal

If you change the security mode by changing the *Security Mode* system parameter, you have to restart the MES middleware. This causes the security mode change to be implemented for MES Web Portal.

## The FactAdmin User Group and Unassigned Users List

The following user group and user list are included by default. These apply when using Native and OS User security modes.

### FactAdmin

This group is intended for users who are MES administrators, such as users who will use MES Client to set up the MES system. By default, this user group is assigned all application privileges.

### Unassigned Users

This list is intended for adding users who will be assigned to user groups that have not been created yet or whose user group is undetermined. Users in this list have no application privileges and no access to entities. For example, if you want to begin adding users before creating user groups, you can do so by adding them to this list.

## Creating the Initial MES User or OS Group with the Minimum Required Privileges

When the MES Client application is opened for the first time, the login dialog box does not appear because users are not yet defined in the MES database.

The first task you must perform after opening MES Client for the first time is to create a user or OS Group with the following **Configurator** security privileges enabled:

- *May run configuration tools*. If this privilege is not enabled, you will not be able to log in to MES Client.
- *May edit user settings*. If this privilege is not enabled, you will be able to log in to MES Client but you will not be able to create any other users or user groups. You will also not be able to assign entity access to any users.

With these privileges enabled, the initial user or a member of the OS user group can subsequently log into MES Client and other MES applications with configuration privileges.

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**Note:** If the initial user or OS Group is added without the privileges *May run configuration tools* and *May edit user settings* enabled, you will have to ask the database administrator to delete the user or OS Group from the users table in the MES database. You can then open MES Client without being prompted to log in and create a user or OS Group with these minimum required privileges.

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The procedure you use to create the initial MES user depends on the Security mode you plan to use for MES application user logins. For more information on the available Security modes, see [Security Modes](#).

## Creating the Initial MES User if Using Native or OS User Security

1. In the **Security** group of the **General Parameters** module, set the *Security Mode* system parameter to Native (the default) or OS User.
2. Depending on the Security mode selected, do one of the following:
  - Create a native user in a user group. See [Setting Up User Groups and Users in Native Security Mode](#).
  - Add a Windows user account to a user group. See [Setting Up User Groups and Users in OS User Security Mode](#).
3. In the **User Groups and Users** workspace tab, select the user group to which you want to assign the privileges.

4. On the **Privileges** tab, expand the **Configurator** privileges group.
5. Make sure the *May run configuration tools* and *May edit user settings* check boxes are selected to enable them. For more information, see [Assigning Privileges to User Groups](#).

## Creating the Initial MES User Group if Using OS Group Security

1. In the **Security** group of the **General Parameters** module, set the *Security Mode* system parameter to OS Group.
2. Add a Windows user group. See [Setting Up User Groups and Users in OS User Security Mode](#).
3. In the **User Groups and Users** workspace tab, select the user group to which you want to assign the privileges.
4. On the **Privileges** tab, expand the **Configurator** privileges group.
5. Make sure the *May run configuration tools* and *May edit user settings* check boxes are selected to enable them. For more information, see [Assigning Privileges to User Groups](#).

## Setting Up User Groups and Users in Native Security Mode

In Native security mode, you create user groups and users in MES Client. These users and user groups are not Windows AD user accounts, but are specific to MES.

You can first create the user groups and then create users and assign them to groups. Or, you can create the users and then create user groups and assign users to the group.

### To create a user group in Native security mode

1. In the **User Groups and Users** module, do one of the following:
    - On the ribbon, click **New User Group** in the **New** list.
    - In the blank space below the **Unassigned Users** group entry, right-click and click **New User Group**.  
A new user group record appears in the workspace.
  2. In the user group's **Properties** window, complete the following settings:  
**Description**  
A unique name for the user group.  
**User ID**  
Lists all the users currently in the MES database. Select or clear the check box next to the user's name to add or remove a user from the user group.
3. On the ribbon, click **Save** in the **Main** group to save the changes.

### To create a user in Native security mode

1. In the **User Groups and Users** module, select a user group to which you want to assign the new user.
  2. Do one of the following:
    - On the ribbon, click **New User** in the **New** list.
    - Right-click the user group name and click **New User**.
- The user is added to the user group.

3. In the user's **Properties** window, complete the following settings:

**User ID**

A unique ID for the user; for example, the employee ID of the user. The user will use this ID to log in to MES applications.

**Description**

A description of the user; for example, the user's full name.

**Language**

The language for the user. The default is English.

**Active**

Specifies whether the user is active. It allows you to deactivate the user without deleting the user from the database.

**Department**

The default labor department to which to assign the user.

**Category**

The default labor category to which to assign the user.

**Hourly Cost**

The hourly cost to assign the user.

**User\_Name spare 1 to 4**

Additional information about this user account.

**NewPassword**

A new password for the user.

**RepeatPassword**

The new password, entered again to confirm that it is entered correctly. If the new password and repeat password values are not the same, you will be prompted to re-enter them.

**Groups**

Lists all the user groups currently in the MES database. Select one or more user groups to which to assign the user. User group membership determines a user's access privileges in the MES system.

4. On the ribbon, click **Save** in the **Main** group to save the changes.

## Assigning Privileges and Entity Access to User Groups

After setting up user groups, you can assign user privileges and entity access to them. See [Assigning Privileges to User Groups](#) and [Providing Entity Access to User Groups](#).

## Setting Up User Groups and Users in OS User Security Mode

In OS User security mode, you create native user groups in MES Client and add Windows AD user accounts to the user groups.

You can first create the user groups and then add Windows users and assign them to groups. Or, you can add the Windows users and then create user groups and assign users to the group.

## To create a user group in OS User security mode

1. In the **User Groups and Users** module, do one of the following:
  - On the ribbon, click **New User Group** in the **New** list.
  - In the blank space below the **Unassigned Users** group entry, right-click and click **New User Group**.

A new user group record appears in the workspace.

2. In the user group's **Properties** window, complete the following settings:

### Description

A unique name for the user group.

### User ID

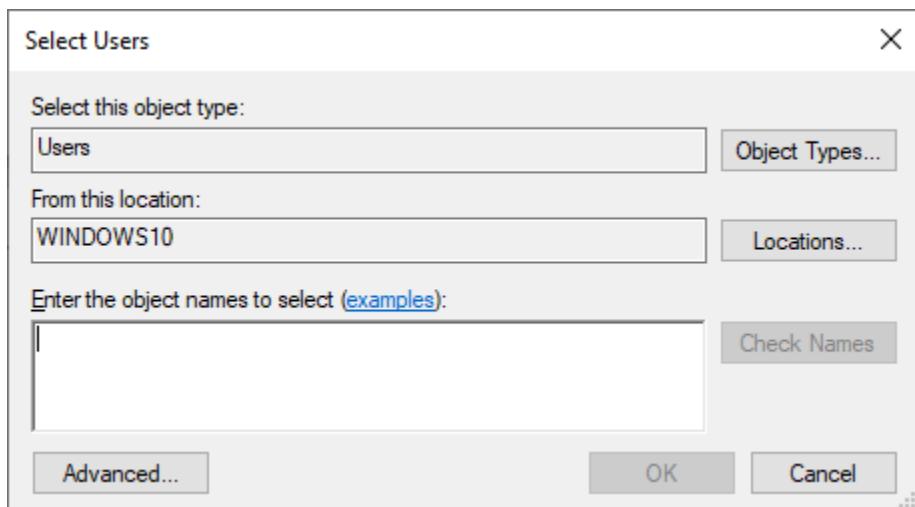
Lists all the Windows user accounts that have been added to the MES database. Select or clear the check box next to the user's name to add or remove a user from the user group.

3. On the ribbon, click **Save** in the **Main** group to save the changes.

## To add Windows users to a user group in OS User security mode

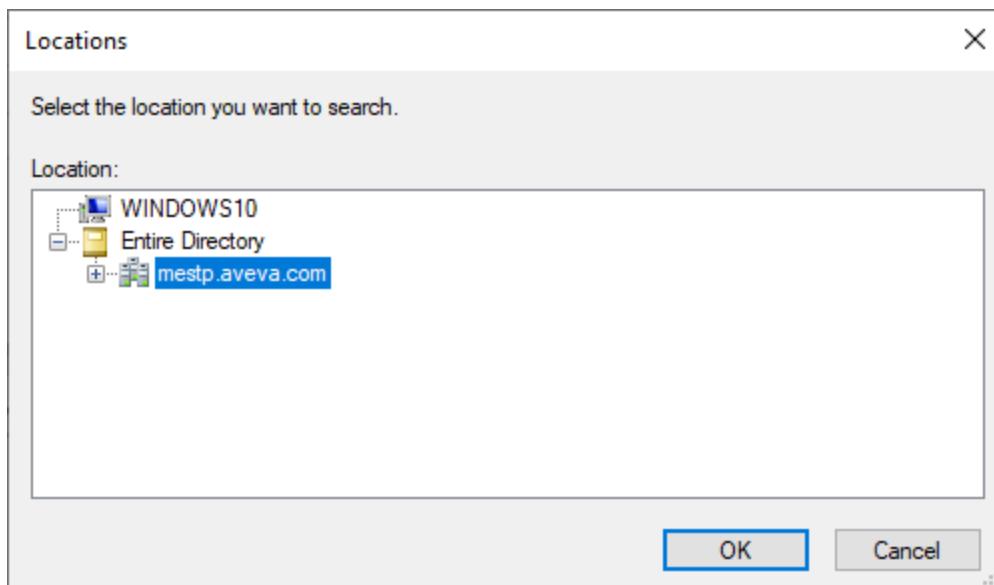
1. In the **User Groups and Users** module, select a user group to which you want to assign the new user.
2. Do one of the following:
  - On the ribbon, click **New User** in the **New** list.
  - Right-click the user group name and click **New User**.

The **Select Users** dialog box appears. This is a Microsoft control and as such will not reflect the MES language switching option.



3. Click the **Locations** button.

The Locations dialog box appears.



4. Select the location (domain) of the users to be added and click **OK**.

The selected location appears in the **From this location** box on the **Select Users** dialog box.

5. Do one of the following:

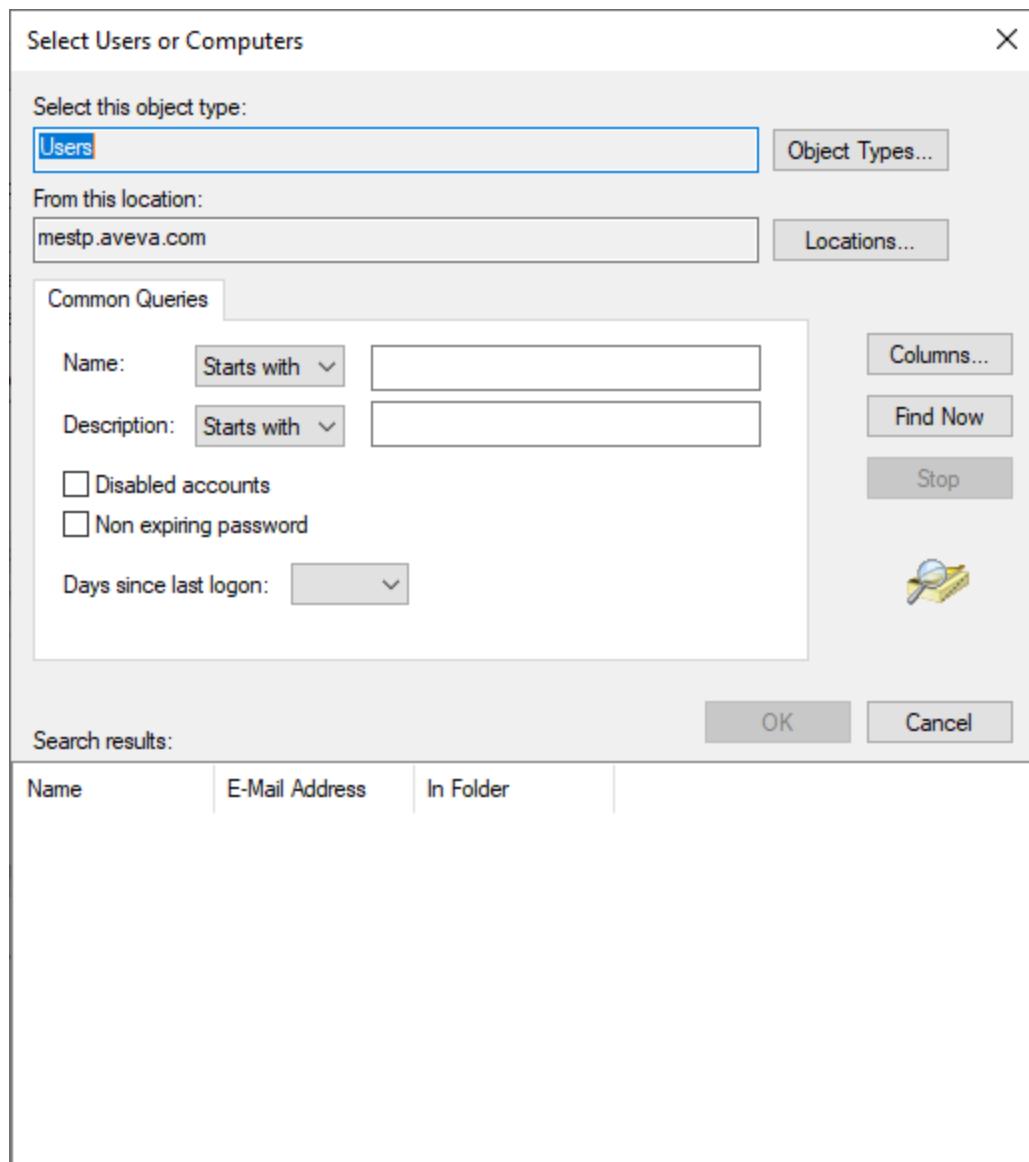
- If you know the names of the users to be added, enter them in the **Enter the object name to select** box, separated by semicolons.

To verify that the users you entered are actually in the domain, click the **Check Names** button. If more than one user name matches your entry, a Multiple Names Found dialog box appears. You can select one or more names in this dialog box to add to the **Enter the object name to select** box.

When you have finished entering users from the selected domain, go to step 9.

- To search for users, click the **Advanced** button.

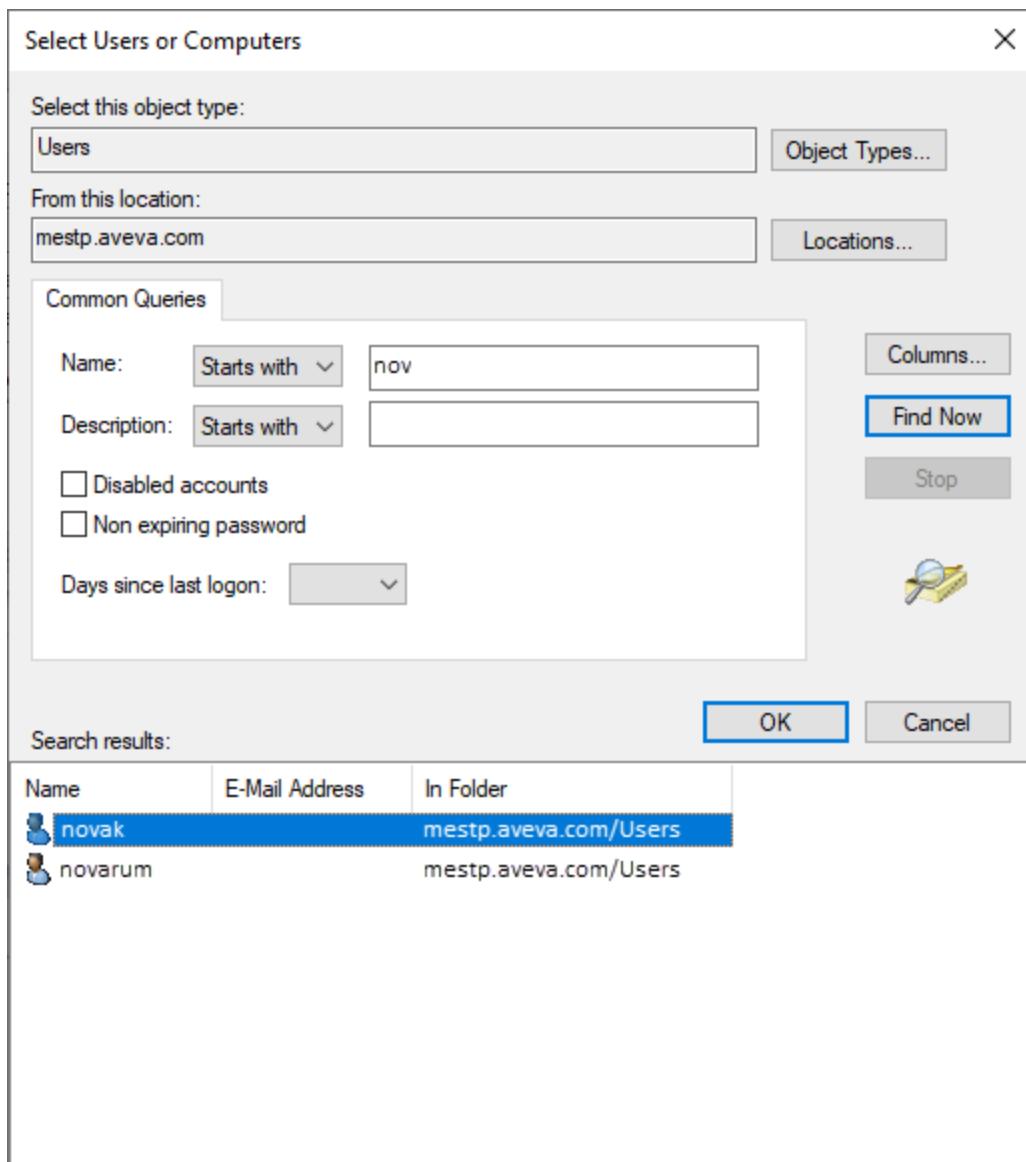
The Select Users advanced dialog box appears.



6. Use the **Common Queries Name or Description** box to filter the search results for the users to retrieve. Leave these boxes empty to return all users in the domain.

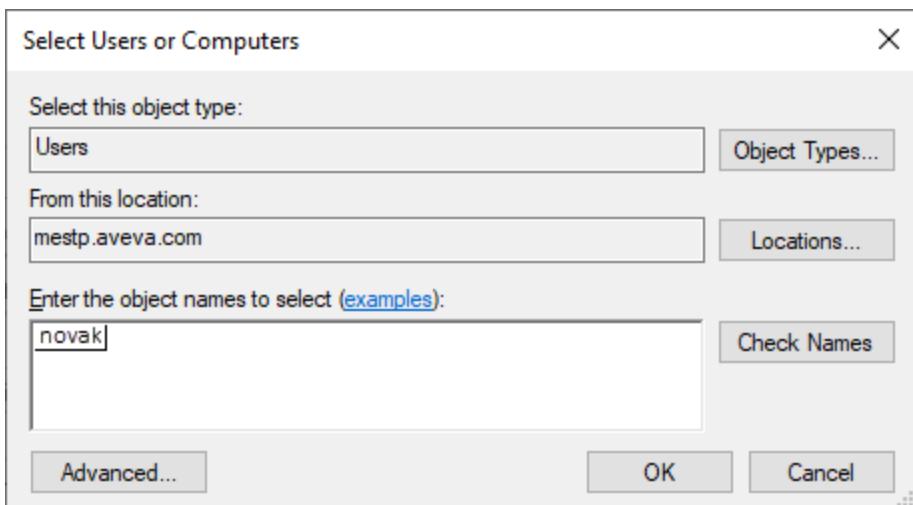
7. Click the **Find Now** button.

The available users appear in the **Search results** list box.



8. Select one or more users to add and click **OK**.

The dialog box closes. The selected users are added to the **Enter the object names to select** box.



- To add users from another domain, select the new location (domain), then enter the users from this domain as you did before.

If you enter user names directly in the **Enter the object names to select** box, you must click the **Check Names** button (which verifies the existing entries) to enable the **Locations** button.

- When you have finished entering the users to add, click **OK**.

The users appear in the **User Groups and Users** module under the selected user group.

User Groups and Users*					
Status	Description				
▼	<input checked="" type="checkbox"/> □ ▲ ▼				
▼	FactAdmin				
Status	User ID	Description	Language	Active	Depar
	MESTP\mes.user	mes.user	Default (English)	<input checked="" type="checkbox"/>	
Status	Description				
▼	Unassigned Users				
Status	User ID	Description	Language	Active	Depar
►	✳ MESTP\novak	Bobi Novak	Default (English)	<input checked="" type="checkbox"/>	

- Select each user and, in the **Properties** window, complete the following settings:

#### Description

A description of the user. Defaults to the Windows full name of the user.

#### Language

The language for the user. The default is English.

#### Active

Specifies whether the user is active. Clearing this option allows you to deactivate the user without deleting the user from the database.

#### Department

The default labor department to which to assign the user.

**Category**

The default labor category to which to assign the user.

**Hourly Cost**

The hourly cost to assign the user.

**User\_Name spare 1 to 4**

Additional information about this user account.

**Groups**

Lists all the user groups currently in the MES database. Select one or more user groups to which to assign the user. User group membership determines a user's access privileges in the MES system.

12. Save the changes.

## Assigning Privileges and Entity Access to User Groups

After setting up user groups, you can assign user privileges and entity access to them. See [Assigning Privileges to User Groups](#) and [Providing Entity Access to User Groups](#).

### Setting Up User Groups and Users in OS Group Security Mode

In OS Group security mode, you add Windows user groups to the MES database. This provides MES application access to all Windows AD user accounts that are members of those user groups.

The management of which users are in the user groups is handled using Windows user security tools, not within MES Client.

Windows users who are members of one of the added user groups are added to the MES database the first time they log into an MES application.

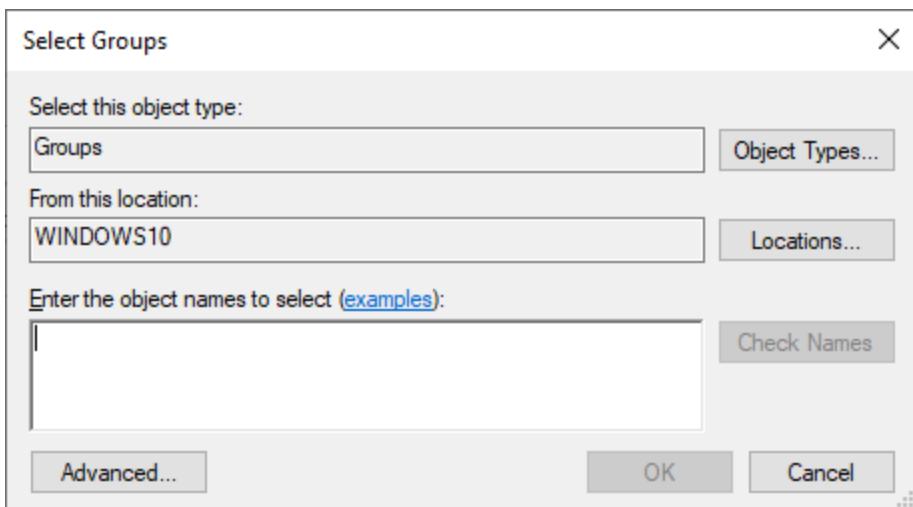
Unlike MES Native or OS User user accounts, OS Groups cannot be assigned default labor departments, default labor categories, hourly costs, or spare fields. However, OS Group users can select labor departments and labor categories in any application that uses the MES .NET Labor control, such as MES Operator.

#### To add a Windows user group and its users in OS Group security mode

1. In the **User Groups and Users** module, do one of the following:

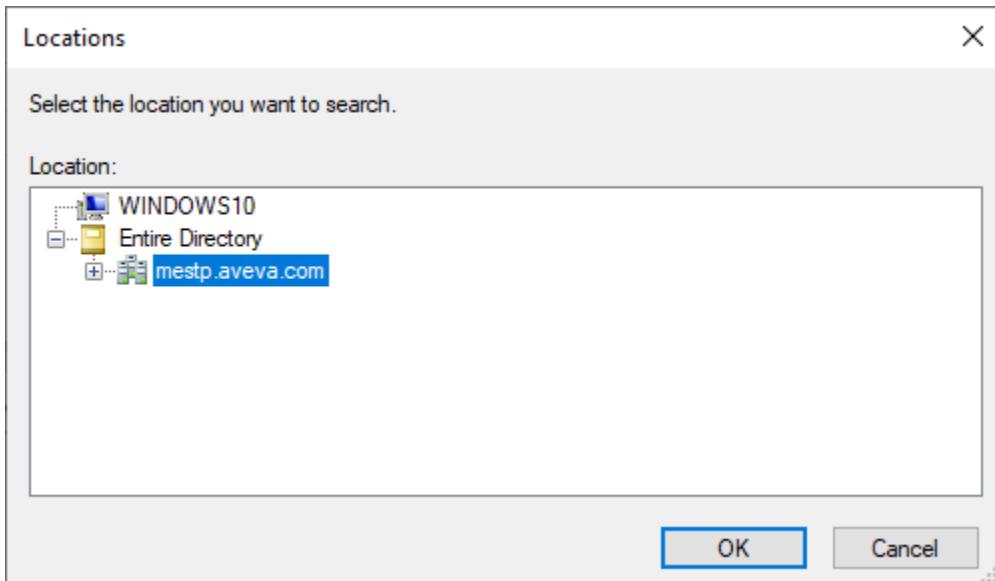
- On the ribbon, click **New User Group** in the **New** list.
- In the blank space below the **Unassigned Users** group entry, right-click and click **New User Group**.

The **Select Groups** dialog box appears. This is a Microsoft control and as such will not reflect the MES language switching option.



2. Click the **Locations** button.

The Locations dialog box appears.



3. Select the location (domain) of the user groups to be added and click **OK**.

The selected location appears in the **From this location** box on the **Select Groups** dialog box.

4. Do one of the following:

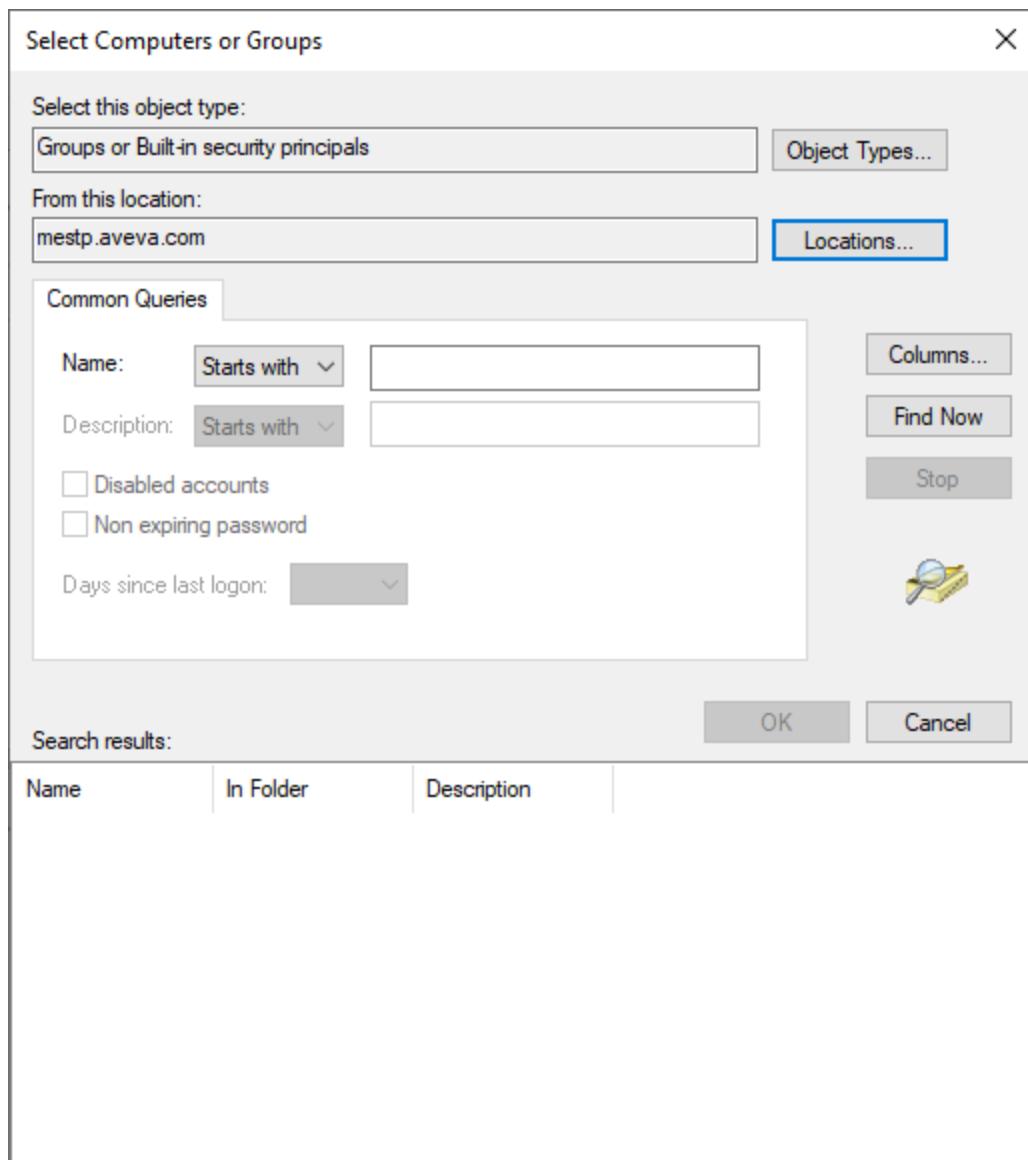
- If you know the names of the user groups to be added, enter them in the **Enter the object name to select** box, separated by semicolons.

To verify that the user groups you entered are actually in the domain, click the **Check Names** button. If more than one user group matches your entry, a Multiple Names Found dialog box appears. You can select one or more names in this dialog box to add to the **Enter the object name to select** box.

When you have finished entering user groups, go to step 8.

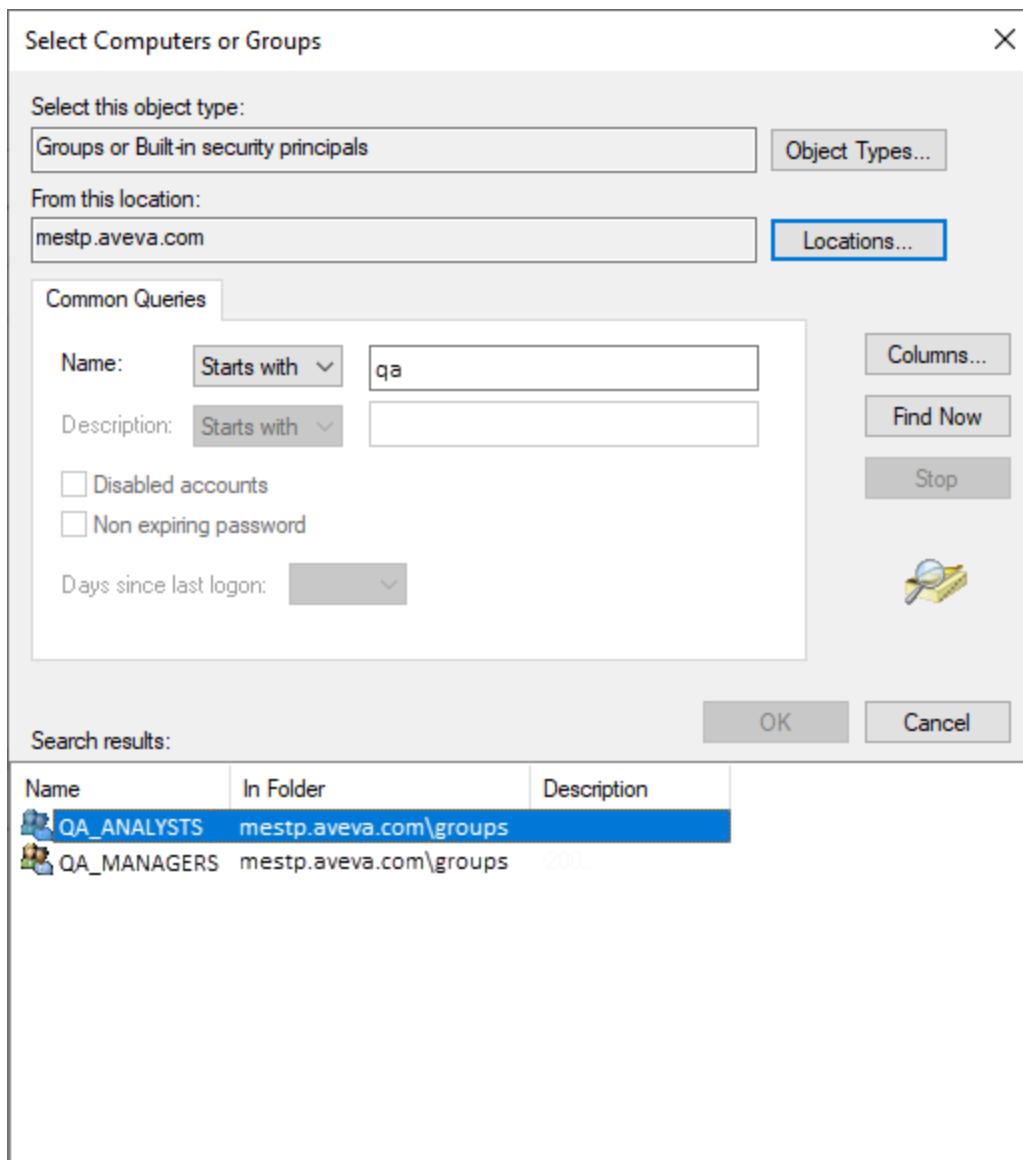
- To search for user groups, click the **Advanced** button.

The Select Groups advanced dialog box appears.



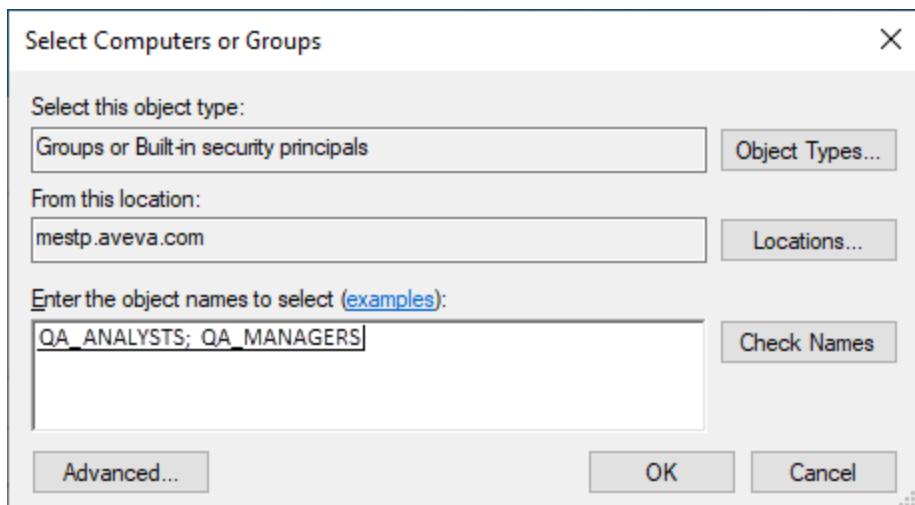
5. Use the **Common Queries Name or Description** box to filter the search results for the user groups to retrieve. Leave these boxes empty to return all user groups in the domain.
6. Click the **Find Now** button.

The available user groups appear in the **Search results** list box.



7. Select one or more user groups to add and click **OK**.

The dialog box closes. The selected user groups are added to the **Enter the object names to select** list box.



8. To add user groups from another domain, select the new location (domain), then enter the user groups from this domain as you did before.

If you enter user group names directly in the **Enter the object names to select** box, you must click the **Check Names** button (which verifies the existing entries) to enable the **Locations** button.

9. When you have finished entering the user groups to add, click **OK**.

The user groups appear in the **User Groups and Users** module.

Status	Description
	MESTP\QA_ANALYSTS
	MESTP\QA_MANAGERS

10. Save the changes.

## Assigning Privileges and Entity Access to User Groups

After setting up user groups, you can assign user privileges and entity access to them. See [Assigning Privileges to User Groups](#) and [Providing Entity Access to User Groups](#).

## Importing System Platform Users into the MES Database

Although Entity Model Builder is not a comprehensive user/role synchronization tool, you can use it to export System Platform users and roles into corresponding MES users and groups in the MES database. For more information, see the *MES Entity Model Builder User Guide*.

## Assigning Privileges to User Groups

Privileges define the actions that a user can perform. Privileges are assigned at the user group level.

A user group must have the specific privileges to access the corresponding component in MES applications such as MES Web Portal, MES Operator, MES Supervisor, and MES Data Editor. There are also general privileges that define privileges such as file, view, edit, and download levels.

Application privileges are additive. This means that a user will have the privileges available in all the groups of which they are a member.

The **Privileges** tab in the **User Groups and Users** module shows a list of all the available privileges and their associated values. For more information on user privileges, see [User Privileges](#).

### To assign privileges to a user group

1. In the **User Groups and Users** workspace tab, select the user group to which you want to assign the privileges.
2. Click the **Privileges** tab.

Privileges			Entity Access		
Status	Privilege Name		Privilege Value		
▼	Supervisor (42 items)	▲	▼	▲	▼
▶	Scheduler (8 items)				
▶	Rejected Message Viewer (1 item)				
▶	Operator (39 items)				
▶	General (13 items)				
▶	File (3 items)				
▶	Data Editor (9 items)				
▶	Configurator (14 items)				
▼	Archive (3 items)	▲	▼	▲	▼
Status	Privilege Name		Privilege Value		
	May configure archive/purge/restore jobs	▼	<input checked="" type="checkbox"/>		
	May run archive/purge jobs	▼	<input checked="" type="checkbox"/>		
	May run restore jobs	▼	<input checked="" type="checkbox"/>		

3. To assign or set a privilege, do one of the following:
  - Select the required check box to assign a privilege or change a privilege value.
  - On the **Current View** ribbon, click **Set default privileges** in the **Privileges** group to select all the privilege check boxes and set the access level for all access level entries.
4. Save the changes.

### Assigned Privileges Example

Suppose you want to allow certain users to be able to create or modify work orders but have no other privileges

in MES Client.

A solution would be to create a user group that has only the privileges that are required for those tasks and assign the users to that user group. Those privileges would be:

- Access to MES Client.
- Access to the **Order Management** group in the Navigation Bar, which includes the **Work Order and Jobs** module.
- The ability to create and modify work orders.

### To create a user group that can only create or modify work orders

1. Create a new user group and enter a descriptive name for the user group, such as "Order Management," in its **Description** box.
2. Select the new user group.

User Groups and Users					
Status	Description				
▼	FactAdmin				
▼	Order Management				
Status	User ID	Description	Language	Active	Depar
	MESTP\gary.sam	Gary Sam	Default (English)	<input checked="" type="checkbox"/>	
Status	Description				
►	Unassigned Users				

3. In the **Privileges** tab, do the following:

- To give the user group access to MES Client, in the **Configuration** section, select the **May run configuration tools** check box.

Privileges			Entity Access	
Status	Privilege Name	Privilege Value	Status	Privilege Name
▼	may run		▼	may run
►	Supervisor (1 item)		►	Supervisor
►	Scheduler (1 item)		►	Scheduler
►	Operator (2 items)		►	Operator
►	Data Editor (1 item)		►	Data Editor
▼	Configurator (1 item)			
	Status	Privilege Name	Status	Privilege Name
►	May run configuration tools		►	<input checked="" type="checkbox"/>
►	Archive (2 items)			

- To give the user group access to the **Order Management** group in the Navigation Bar, in the **Supervisor** section, select the **May run supervisor** check box.

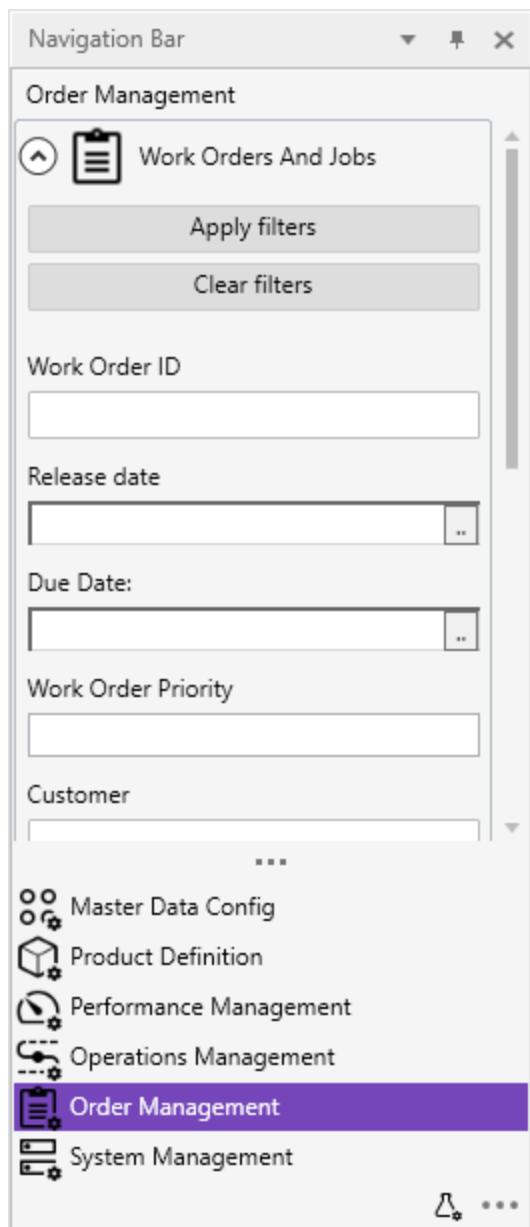
Privileges		Entity Access	
Status	Privilege Name	Privilege Value	
TX [ TX Δa	may run	TX	Δa
▼ Supervisor (1 item)			
*	May run supervisor	TX	Δa
Scheduler (1 item)			
Operator (2 items)			
Data Editor (1 item)			
Configurator (1 item)			
Archive (2 items)			

- To allow the user group to create and modify work orders, in the **Supervisor** section, select the **May create jobs** check box.

Privileges		Entity Access	
Status	Privilege Name	Privilege Value	
TX [ TX Δa	may create	TX	Δa
▼ Supervisor (1 item)			
*	May create jobs	TX	Δa

4. Save the changes.

Now, when a user who is only a member of this user group logs into MES Client, they will be able to create and modify work orders in the **Order Management** group in the Navigation Bar, shown below. However, they will only have access to this feature.



## User Privileges

The user privileges that can be assigned to a user group are organized into the following privilege groups:

- Supervisor
- Scheduler
- Rejected Message Viewer
- Operator
- General
- File
- Data Editor

- Configurator
- Archive

## User Privileges Reference

User Privileges	Value Description
<b>Supervisor</b>	
May run supervisor	Check box. Provides the ability to run the Supervisor module.
May edit QM specifications	Check box. Provides the ability to add, delete, modify, or copy QM specifications, as well as to create, update, or delete a link from a characteristic or control rule to a QM specification.
May edit sample plan settings	Check box. Provides the ability to add, delete, modify, or copy sample plans and associate frequencies to the sample plan.
May edit sample plan frequency settings	Check box. Provides the ability to add, delete, or modify sample plan frequencies.
May edit characteristic settings	Check box. Provides the ability to add, delete, or modify characteristics.
May edit categories	Check box. Provides the ability to add, delete, or modify categories, as well as to link items, cause groups, and categories to a category.
May edit causes	Check box. Provides the ability to add, delete, or modify cause groups and causes.
May add sample results	Check box. Provides the ability to add new results to a sample for a particular characteristic.
May edit samples	Check box. Provides the ability to edit sample/characteristic link information or result information.
May set/clear sample final flags	Check box. Provides the ability to mark a sample as final or to remove the final mark from a sample.
May edit BOMs	Check box. Provides the ability to create, modify, and delete Bills of Materials (BOMs).
May edit processes	Check box. Provides the ability to create, modify, and delete processes and their operations.

User Privileges	Value Description
May edit specs	Check box. Provides the ability to create, modify, and delete specifications and specification groups (must also have May edit processes privilege).
May edit steps	Check box. Provides the ability to create, modify, and delete steps and step groups (must also have May edit processes privilege).
May create jobs	Check box. Provides the ability to create and delete work orders from processes.
May edit queues	Check box. Provides the ability to change the entries on an entity's job queue, if that entity is capable of having jobs scheduled to it and the logged in user has access to that entity.
May edit inventory	Check box. Provides the ability to edit the inventory screen.(Receive, ship & modify existing inventory entries, limited by user's entity access definitions.)
May edit folders	Check box. Provides the ability to create, delete, and modify folders.
May edit supply chain connector	Check box. Provides the ability to edit and configure the Supply Chain Connector.
May edit data logging	Check box. Provides the ability to create, edit, and delete data log group definitions and data log values in the MES Client Data Logger module.
May edit files	Check box. Provides the ability to create, define, and edit files.
May edit shift patterns and schedules	Check box. Provides the ability to create, delete, and edit shift patterns and schedules.
May delete error logs	Check box. Provides the ability to delete error logs.
May copy folders to manufacturing directories	Check box. Provides the ability to manipulate manufacturing directories.
May change status of a process	Check box. Provides the ability to change the status of a process.
May save queue sequence	Check box. Provides the ability to sort/filter the queue and store the results.

User Privileges	Value Description
May uncomplete a job	Check box. Provides the ability to reopen a completed job, changing the job's state back to, for example, Ready or Running.
May edit customers	Check box. Provides the ability to modify pre-defined customer information.
May edit sales orders	Check box. Provides the ability to modify pre-defined sales orders in the Customer window.
May change work order state	Check box. Provides the ability to change a work order's status.
May override the minimum shippable grade	Check box. Provides the ability to ship an item that does not meet minimum shippable grade requirements.
May override the minimum shippable state	Check box. Provides the ability to ship an item that does not meet minimum shippable state requirements.
May append process notes	Check box. Provides the ability to add notes onto the end of existing process notes but not edit previously entered notes.
May replace process notes	Check box. Provides the ability to replace, add, and/or edit existing process notes with new information.
May reclassify inventory	Check box. Provides the ability to reclassify an inventory items Grade, State, and Expiry date.
May edit standard operations	Check box. Provides the ability to create, modify and delete standard operations.
May override preferred BOM version	Check box. Provides the ability to use a BOM version other than the preferred one.
May override preferred Spec. version	Check box. Provides the ability to use a specification version other than the preferred one.
May change operator's queue display	Check box. Provides the ability to select <b>Save Queue sequence and filter</b> in the Queue window, which determines how an entity's queue is shown in the Operator module.
May assign a work order to a line	Check box. Provides the ability to assign and reassign work orders to a line in MES Web Portal.
<b>Scheduler</b>	

User Privileges	Value Description
The privileges in this section apply only if you have a license for Scheduler.	
May run scheduler	Check box. Provides the ability to run the Scheduler module.
May apply tentative schedule	Check box. Provides the ability to select and apply a tentative schedule from the Scheduler drop-down window.
May change work order priority and due/release dates/times	Check box. Provides the ability to change the work order's priority, release/due dates/times in Scheduler's Edit window.
May change job time standards and whether pinned	Check box. Provides the ability to change time standards in Scheduler's Edit window and lock in those times (pinned).
May change entity queue date/time	Check box. Provides the ability to change the entity queue duration in Scheduler's Edit window.
May set resource availability	Check box. Provides the ability to modify resource quantities available in Scheduler.
May set job's resource usage	Check box. Provides the ability to add, modify, or delete resources assigned to a job.
May schedule overtime/downtime	Check box. Provides the ability to select overtime and downtime within Scheduler.
<b>Rejected Message Viewer</b>	
May re-submit failed asynchronous messages	Check box. Provides the ability to re-submit the failed messages.
<b>Operator</b>	
May run operator	Check box. Provides the ability to run the Operator module.
May configure operator	Check box. Provides the ability to customize the Operator module with respect to screen shows, buttons, switches, tabs, etc. Screen configurations are user-specific.
May run jobs	Check box. Provides the ability to start a Ready job or re-start a Suspended job.
May override queue	Check box. Provides the ability to start a job out of the pre-defined queue sequence.

User Privileges	Value Description
May ready job	Check box. Provides the ability to change a job's state from New to Ready.
May append job notes	Check box. Provides the ability to add on to existing job notes while working on a job.
May append WO notes	Check box. Provides the ability to add on to existing work order notes while working on a job.
May Replace Job notes	Check box. Provides the ability to replace existing job notes with new information while working on a job.
May Replace WO notes	Check box. Provides the ability to replace existing work order notes with new information while working on a job.
May exit operator	Check box. Provides the ability to exit the Operator module. If not checked, Operator's Log on screen will persist after the user has logged out.
May use job from unrelated queue	Check box. Provides the ability run a job scheduled on another queue in Operator.
May append item notes	Check box. Provides the ability to add on to existing item notes while working on a job.
May end a job	Check box. Provides the ability to change a job's state to Complete.
May replace item notes	Check box. Provides the ability to replace existing item notes with new information while working on a job.
May cancel a job	Check box. Provides the ability to change a job's state to Cancelled.
May unrelease a job	Check box. Provides the ability to change a job's state to OnHold.
May override logons	Check box. Provides the ability for an operator to override a logon by another operator
Button execution level	Numeric field. Determines button access in other modules. A user in this group may use buttons assigned this execution level value or below, and will be prevented from using buttons with higher execution levels. Execution levels are assigned to individual buttons in the other modules.

User Privileges	Value Description
Queue lookahead (number)	Numeric field. Determines the total number of jobs a user of Operator would be able to see in their queue.
Allow user to change the default screen configuration	Check box. Provides the ability to alter the way Operator shows the positioning of the entity tabs, grid columns, job summary fields, and buttons.
May edit another user's step data	Check box. Provides the ability to modify step data entered by another user.
May execute steps out of sequence within a step group	Check box. Provides the ability to complete steps within the same step group in any order.
May execute steps out of sequence across step groups	Check box. Provides the ability to complete any steps from any step group in any order.
May append folder notes	Check box. Provides the ability to add on to existing notes for a folder while working on a job.
May replace folder notes	Check box. Provides the ability to replace existing notes for a folder with new information while working on a job.
May override manufacturing dirs	Drop-down list, containing No, Yes, local drives only, Yes, network drives only, and Yes, any drive. Provides the ability to search directories other than MES directories when searching for files.
May access file maintenance functions	Check box. Provides the ability to use advanced file and file directory creation and editing functions within Operator.
May override entity	Check box. Provides the ability to download from or upload to a different entity's directories.
May edit specification value	Check box. Provides the ability to change the minimum and maximum specification values, and the spec value from Operator.
Require job based login	Check box. Provides the ability to log into Operator by work order ID and/or operation ID, automatically selecting the entity.
May log in/out as group	Check box. For future release.
BOM substitution level	Numeric field. Determines the authority level of the user for consumption of substitute items within the

User Privileges	Value Description
	BOM tab.
May view other entities' inventory	Check box. Provides the ability to access the inventory that is located on entities that the user is currently not logged into.
May override inventory allocations	Check box. Provides the ability to consume inventory from or produce inventory to an inventory location that was not predefined for that job.
May modify batches	Check box. Not yet implemented.
May re-sort the queue	Check box. Provides the ability to change the pre-defined queue sequence.
<b>General</b>	
May edit items	Check box. Provides the ability to create, modify, and delete items.
May edit jobs	Check box. Provides the ability to modify a previously-created work order.
May modify set of lot attributes	Check box. Provides the ability to modify attribute definitions that may be assigned to lots.
May modify value of lot attributes	Check box. Provides the ability to enter and modify the values of lot attributes when entering/changing inventory information.
May change hold status	Check box. Provides the ability to change the hold status of a job to any state except for Complete or running.
Specification access level	Numeric field. Determines the access level for specifications. If the specification's access level is higher than this value, access will be denied.
May edit minimum/maximum specification limits	Check box. Provides the ability to change the minimum and maximum specification limit values.
May configure transport	Check box. Provides the ability to select the method for communication with the MES middleware.

User Privileges	Value Description
May override hard pegged and linear flow	Allows for drop down work order to be enabled. Provides the ability to change the From location on the Select and Transfer dialog box, to produce a serial number that was previously produced on a different work order, and to override the linear flow of serial numbers on the Select and Transfer dialog box and Data Editor.
May add serial numbers	Add button. Provides the ability to add serial numbers on the Add/Assign dialog box.
May uncomplete serial numbers	Provides the ability to incomplete serial numbers on the Add Production dialog box.
May assign or unassign serial numbers	Arrow buttons. Provides the ability to assign/unassign serial numbers on the Add/Assign dialog box.
May delete unassigned serial numbers	Delete button. Provides the ability to delete serial numbers on the Add/Assign dialog box.
<b>File</b>	
File edit level	Numeric field. The Document type Edit level for the file would need to have a number equal to or higher than this number to be able to make changes.
File download level	Numeric field. The Document type Download level for the file would need to have a number equal to or higher than this number to be able to download the file. Also the Document type for the file must be marked as downloadable.
File view level	Numeric field. The Document type View level for the file would need to have a number equal to or higher than this number to be able to view the file.
<b>Data Editor</b>	
May run data editor	Check box. Provides the ability to run the Data Editor module.
May Edit Step Data	Check box. Provides the ability to modify step data within the Data editor Module.
May edit production data	Check box. Provides the ability to modify production data, such as quantity produced.
May edit consumption data	Check box. Provides the ability to modify consumption data, such as amount consumed.

User Privileges	Value Description
May Edit Audit Log	Check box. Provides the ability to modify inventory data.
May edit utilization data	Check box. Provides the ability to modify utilization data. For example, if an operator were to forget to log off of a job, this capability would allow for the total time he spent on the job to be modified.
May edit labor usage data	Check box. Provides the ability to edit labor usage from within Data Editor.
May edit data log	Check box. Provides the ability to edit data log values from within Data Editor.
May edit lot data	Provides the ability to access the Item Lot Editor.
<b>Configurator</b>	
May run configuration tools	Check box. Provides the ability to run the configuration tools.
May edit system settings	Check box. Provides the ability to change system settings (all options on System menu except Languages & Resources).
May edit languages	Check box. Provides the ability to create, modify, and delete languages.
May edit user settings	Check box. Provides the ability to create, modify, and delete users, user groups, and entity access.
May edit user certifications	Check box. Provides the ability to create, modify, and delete certifications, and to change certification assignments to users.
May edit entity settings	Check box. Provides the ability to create, modify, and delete entities (all options on the Entities menu in MES Client; all entity configuration functionality in MES Web Portal).
May edit item settings	Check box. Provides the ability to create, modify, and delete item settings (all options on Items menu except Units of Measure).
May edit attributes	Check box. Provides the ability to create, modify, and delete attributes. Attributes may be assigned to items, item classes, physical entities, lots, jobs, work orders, operations, and processes.

User Privileges	Value Description
May edit user privileges	Check box. Provides the ability to modify privileges assigned to user groups (i.e., this menu).
May edit UOMs and conversions	Check box. Provides the ability to add, modify, and delete units of measure and their conversions.
May edit entity files	Check box. Provides the ability to add, modify, or delete the files associated with an entity.
May edit lines	Check box. Provides the ability to add, modify, or delete lines in MES Web Portal.
May edit utilization states	Check box. Provides the ability to add, modify, or delete utilization states in MES Web Portal. This privilege applies to MES Web Portal only.
May edit utilization reasons and groups	Check box. Provides the ability to add, modify, or delete utilization reason groups and reasons in MES Web Portal. This privilege applies to MES Web Portal only.
<b>Archive</b>	
May configure archive/purge/restore job	Check box. Provides the ability to configure archive, purge, and restore jobs.
May run archive/purge jobs	Check box. Provides the ability to run archive and purge jobs.
May run restore jobs	Check box. Provides the ability to run restore jobs.

## Providing Entity Access to User Groups

An entity refers to a component within the system that a user logs into and manipulate its data. An entity can be a building, a location within a building, a single machine, an assembly line, and so on.

You can determine the entities that the members of a user group can access in the MES applications, specifically the Inventory Management form in the MES model-driven application content for Work Tasks, the Queue module in MES Client, and the Entity Login window in MES Operator application. You can provide entity access only to a user group and not to an individual user.

Entity access rights are additive. This means that a user will have the maximum entity access rights of all the groups of which they are a member.

The **Entity Access** tab shows all the entities that are defined in the MES Client application. The entities are displayed in a tree structure in the workspace tab.

### To provide entity access to a user group

1. Select the user group to which you want to provide entity access rights.

2. Click the **Entity Access** tab.

```
graph TD; Production[Production] --> Bagger[Bagger]; Production --> Bagger001[Bagger_001]; Production --> Boxer001[Boxer_001]; Production --> Coater[Coater]; Production --> ProductionStorage[ProductionStorage]; Production --> Roaster[Roaster]; Production --> Roaster001[Roaster_001]; Receiving[Receiving]
```

3. Select the entities to which the user group will have access.
4. Save the changes.

## Providing Line Access to User Groups

The creation, configuration, and operation of lines is supported in MES Web Portal.

A line is an ordered set of entities that models a production line, manufacturing line, or assembly line.

You can determine the lines that the members of a user group can access in MES Web Portal. For information about how to assign user group access to lines, see the configuration topics in the *MES Web Portal User Guide* or help.

## MES Web Portal User Authentication and Privileges

The following topics include conceptual and configuration information specific to MES Web Portal user authentication and privileges for MES Web Portal functionality.

### User Authentication

The default Security Mode for MES installations is Native mode. However, MES Web Portal requires the use of your system's Windows Active Directory (AD) user groups or user accounts for logging in. Therefore, to support MES Web Portal users, the Security Mode must be changed to either OS Group or OS User. Also, AD user groups or users must be added to the MES database using MES Client, depending on the security mode.

# Using OS Group vs. OS User Security Mode

Refer to the following descriptions to help you determine which Security Mode—OS Group or OS User—to use for MES Web Portal user authentication in your system environment:

- In OS Group mode, the AD groups to which a user belongs are checked and the user's AD user account is checked to verify their authentication to log in to an MES Web Portal session. If the user belongs to an AD group that has also been configured as an OS group in the MES database, then the user is allowed to open a session. If an MES user account does not already exist for that user, then one is automatically created. For information about adding AD user groups as OS groups in the MES database, see [Setting Up User Groups and Users in OS Group Security Mode](#).
- In OS User mode, the user's AD user account is checked to verify their authentication to log in to an MES Web Portal session. If the user's AD user account has also been configured as an OS user in the MES database, then the user is allowed to open a session. For information about adding AD user accounts as OS users in the MES database, see [Setting Up User Groups and Users in OS User Security Mode](#).

**Note:** If you change the security mode, you have to restart the MES Web Portal service in Internet Information Services (IIS).

## MES Web Portal OS Group Security and Multiple Active Directory Domains

If your network is configured with multiple Windows AD domains, and you intend to use OS Group security with MES Web Portal, you must select only Global and Universal domain groups when configuring MES groups. This is because MES Web Portal will not authenticate users in local groups if the system is part of multiple domains.

As an example, say your network has multiple domains and you pick a local domain group to be an MES group. You configure that group to have access to an entity, to run Operator, and to not allow editing of entity settings. A user who belongs to that local domain group (and does not belong to any other groups configured to be an MES group) would be able to log into the entity in MES Operator and perform operations on that entity. However, the same user would not see the entity in MES Web Portal because MES Web Portal will not authenticate the user from that domain local group.

You should only select local domain groups if you are sure that your network has only one domain. Consult your network administrator if you are unsure about whether your network has multiple domains or if you are unsure about whether a domain group is local, global, or universal.

## Authentication Checks Performed When a User Logs In

The following conditions are checked when a user attempts to log in to MES Web Portal:

1. The user's AD username and password are checked by the web browser.
2. The MES Security Mode must be either OS Group or OS User. If it is MES Native mode, the login will fail.
3. The user's AD user group or user account, depending on whether the MES Security Mode is set to OS Group or OS User, must be mapped to an MES user group or user account in the MES database. One or more of the user's AD user groups can be mapped to MES groups.
4. If OS User mode is being used, the user's AD user account must map to an MES user account in the MES database.

If OS Group mode is being used and the AD user group maps to at least one MES user group, an MES user account for the user is automatically added to the MES database.

5. The MES user account must be active. (MES Client includes an **Inactive** check box option to allow a user account to be made inactive.)
6. The user has to be a member of at least one MES user group that has at least one privilege setting assigned to it.

If no privileges are assigned to any of the MES user groups to which the user belongs, a message indicating insufficient privileges to use the application appears. The only available tasks that the user can perform are accessing the online help and logging out.

If at least one privilege for one of the MES user groups to which the user belongs is set, then even if that privilege is not related to MES Web Portal functionality, the user will be able to access the MES Web Portal application. However, only the Work Orders tile will be shown in the home page and only the Work Order option will appear in the navigation menu.

7. MES licensing is checked. If the appropriate licensing is not available, a licensing message appears and the user will not have access to the application.
8. Once logged in, the user will see the MES Web Portal pages and functionality as defined by their MES user groups' privilege and access settings.

## Privilege and Access Settings

MES Web Portal uses MES user groups to check for user privileges to perform tasks or view information and to allow user access to lines and entities. Except for line access, which is set in MES Web Portal, all MES user group privilege and access settings are set in MES Client.

- Privilege settings allow configuration and operation tasks to be performed, such as creating lines, entities, utilization states, and utilization reason groups and reasons; assigning work orders to lines; and changing work order status. These tasks are controlled through the privileges assigned to MES user groups.
- Access settings allow operation tasks to be performed on a line or entity. This includes viewing and performing operation tasks related to work orders and jobs, entities, and utilization events. These tasks are controlled by assigning line or entity access to MES user groups.

A user will inherit all privileges and access that are permitted inclusively in all MES user groups of which they are a member. So, if a user is a member of more than one MES user group and any of those MES user groups has a particular privilege (for example, *May edit lines*), the user will have that privilege even if other user groups of which they are a member do not have that privilege.

The following table describes the privilege and access settings that are available.

Setting	Setting Type	Where Specified	Allows Users to:
May edit lines	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.  See <a href="#">Assigning Privileges to User Groups</a> .	Create, configure, modify, and delete any lines, regardless of line access settings.  If this privilege is not assigned, the user will see only those lines to which they have line access. And for those lines, the user will not see the line <b>Configuration</b> tab or subtabs.  If this privilege is assigned but the user has not been assigned access to a line, the user can configure the line but will not see the line's <b>Work Orders</b> or <b>Entities</b> tabs. So the user will not be able to view the line or its entities and work orders.
Line access	Operation	MES Web Portal, in the line's <b>Configuration</b> tab, <b>Line Access</b> subtab.  See the topic "Assigning Line Access to Users" in the <i>MES Web Portal User Guide</i> or help.	View lines, including their work orders and entities.  Line access is assigned individually for each line.  If access to a particular line is not assigned, the user will be able to see work orders on the <b>Work Orders</b> collection page, even if those work orders are assigned to that line. However, any links in MES Web Portal to that line's pages will be disabled.  If a user cannot edit lines and has not been assigned access to any lines, they will not see the <b>Lines</b> tile on the home page or the <b>Lines</b> option in the navigation menu.

Setting	Setting Type	Where Specified	Allows Users to:
May edit entity settings	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.  See <a href="#">Assigning Privileges to User Groups</a> .	Create, configure, modify, and delete any entities, regardless of the user's line access setting for the line to which an entity is assigned.  If this privilege is not assigned, the user will see only those entities to which they have been assigned access. And for those entities, the user will not see the entity <b>Configuration</b> tab or subtabs.
Entity access	Operation	MES Client, in the MES user group's <b>Entity Access</b> tab.  See <a href="#">Providing Entity Access to User Groups</a> .	The user will be able to see and perform operation tasks for only those entities that have been assigned to the MES user groups of which the user is a member.  If a user cannot edit entities and has not been assigned access to any entities, they will not see the <b>Entities</b> tile on the home page or the <b>Entities</b> option in the navigation menu. On the line <b>Entities</b> page, they will see the entity tiles and bottleneck information, but the entity tiles will not include operation-related icons.  One exception is that, even if the user does not have access to an entity, if that entity has the <i>Can Store</i> capability selected, the user can select that entity in the <b>To Storage Location</b> list in the <b>Add Production and Reduce</b>

Setting	Setting Type	Where Specified	Allows Users to:
<b>Production dialog boxes.</b>			
May assign a work order to a line	Operation	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Supervisor</b> group.  See <a href="#">Assigning Privileges to User Groups</a> .	Assign a work order to any line, regardless of the user's line access authorization.  If a user cannot assign work orders to a line, then they cannot create work orders, because the line assignment is required for a new work order. The user can edit an existing work order, but regarding the line assignment, the user can only reassign the work order to no line.
May change work order state	Operation	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Operator</b> group.  See <a href="#">Assigning Privileges to User Groups</a> .	Change the status of a work order, regardless of the user's line access authorization for the line to which the work order is assigned.  If a user cannot change the status of work orders, then they cannot create

Setting	Setting Type	Where Specified	Allows Users to:
			work orders, because the status assignment is required for a new work order. The user can edit an existing work order, but cannot change its status.
May edit utilization states	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.  See <a href="#">Assigning Privileges to User Groups</a> .	Create, configure, modify, and delete utilization states. This privilege applies to MES Web Portal only.
May edit utilization reasons and groups	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.  See <a href="#">Assigning Privileges to User Groups</a> .	<p>Create, configure, modify, and delete utilization reason groups and reasons. This privilege applies to MES Web Portal only.</p> <p>Typically, the two utilization edit authorizations are either both set or not set for a user group.</p> <p>If a user has neither of the two utilization edit authorizations, they will not see the <b>Utilization</b> tile on the home page or the <b>Utilization</b> option in the navigation menu.</p> <p>However, if they have entity access, they will be able to assign utilization reasons to events for those entities.</p>

## Example Roles and Privilege Settings

The table below shows suggested privilege settings for the following example MES Web Portal user roles:

- An Application Engineer who is configuring the system but does not require access to operations related to lines, work orders, entities, and entity events.
- An Operations Supervisor who needs requires access to all lines, work orders, and entities but no access to configuration tasks.
- An Operator who requires access to specific lines and entities.

Setting	Application Engineer	Operations Supervisor	Operator
May edit lines	Yes	No	No
Line access	No	Yes, to all lines	Yes, but only to lines on which they will perform tasks
May edit entity settings	Yes	No	No
Entity access	No	Yes, to all entities	Yes, but only to those entities on which they will perform tasks
May assign a work order to a line	No	Yes	Optional, depending on whether operators for your site are allowed to start work orders
May change work order state	No	Yes	Optional, depending on whether operators for your site are allowed to change work order status
May edit utilization states	Yes	No	No
May edit utilization reasons and groups	Yes	No	No

## Language Strings

MES includes the following default languages:

- English
- Chinese Simplified
- French
- German
- Japanese
- Russian

- Spanish

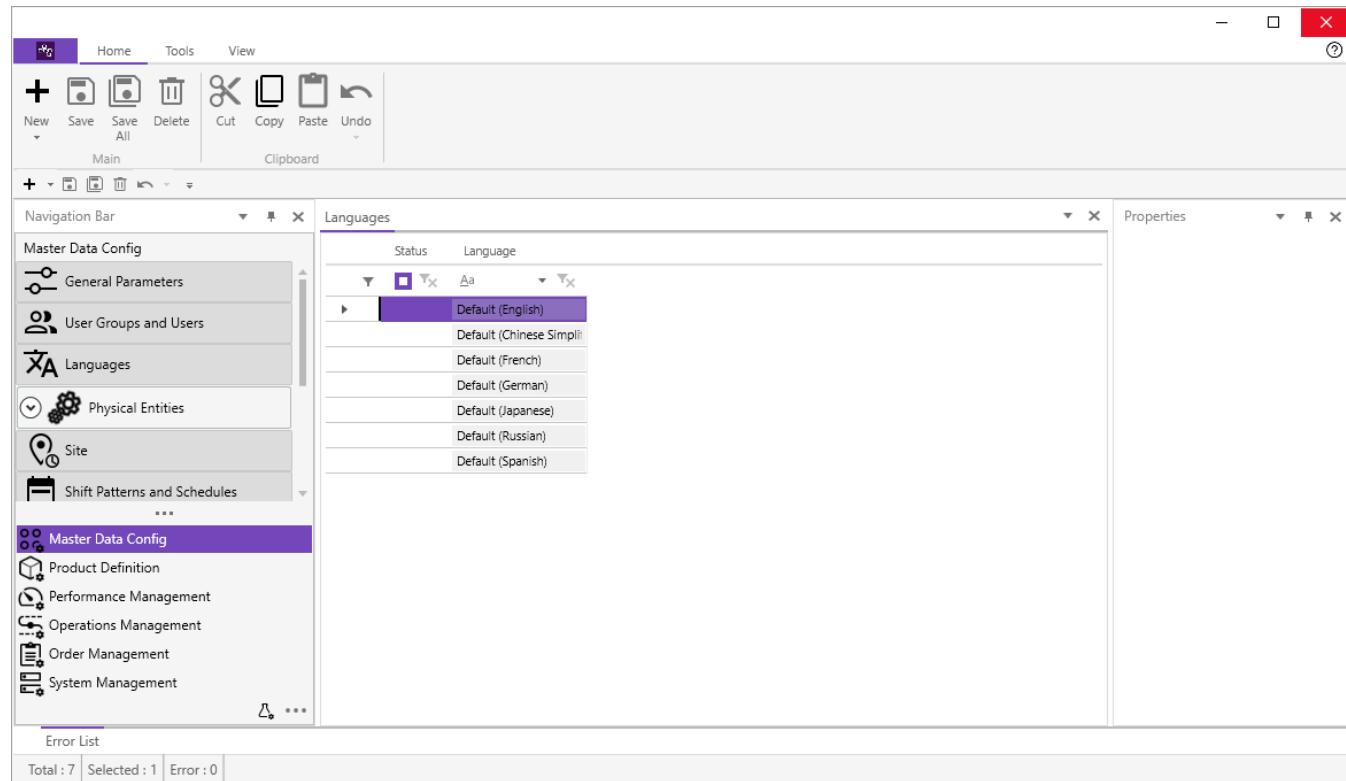
You can use the **Languages** module to define language strings for additional languages. This includes copying one of the default languages to customize the text string for plant-specific information or dialect variations for the shop floor operators. You can create an unlimited number of additional languages and the individual strings to customize the strings used in the MES applications.

**Note:** The first 100,000 string IDs are reserved for MES internal use.

When you open the **Languages** workspace tab, a list of the existing languages is shown.

The **Languages** module is grouped under the **Master Data Config** group in the Navigation Bar. For information on groups and modules, see [Groups and Modules](#).

The **Languages** module allows you to define and customize individual text strings in the language table. The language table contains all the words and phrases that are utilized in the four core programs of the system. Every user is assigned one language or dialect in the **User Groups and Users** module. For more information on user groups and users, see [User Groups and Users](#).



## Creating an Additional Language

You can create, edit, or delete an additional language. However, you cannot edit or delete any of the default languages.

You can also set which language will be used by default in the MES client applications. For more information, see [Switching Languages at Run Time](#).

### To create an additional language

1. Do one of the following:

- Right-click in the **Languages** workspace tab and click **New**.
- On the ribbon, click **New Language** in the **New** list.

A new language record appears in the workspace tab. The language ID appears in the **Language** box.

2. In the **Language** box, enter the name of the language.
3. Save the changes.

## Editing a Language's Strings

1. In the **Languages** workspace tab, right-click the language whose strings you want to edit, and then click **Edit**.

The language's string tab appears.

Status	String ID	Reference	Edit
1	Default (English)	Polish	
2	Yes	Yes	
3	No	No	
4	Print	Print	
5	Print Preview	Print Preview	
6	@@@Print Setup...	@@@Print Setup...	
7	@@@Reset Registry	@@@Reset Registry	
8	@@@Send...	@@@Send...	
9	@@@E-mail...	@@@E-mail...	
10	Exit	Exit	
11			

2. On the ribbon, go to the **Current View** tab and select a reference language in the **Reference Language** list.

The reference language allows you to choose which language to use as a reference when making changes in the new language. The reference language string is the original word or phrase. Strings for the reference language are shown in the **Reference** column in the tab and, for the selected string record, in the **Reference** box in the **Properties** window.

3. Select the language string that you want to edit.
4. In the **Edit** box in the **Properties** window, type the new language string that corresponds to the reference language string shown in the **Reference** box.
5. Save the changes.

## Finding and Replacing a Language String

1. In the **Languages** workspace tab, right-click the language whose strings you want to edit and then click **Edit**.  
The language's string tab appears.
2. On the ribbon, go to the **Current View** tab and click **Replace** in the **Edit** group.  
The **Replace** dialog box appears.



3. In the **Replace** dialog box, complete the following settings:

### Find what

Type the text that you want to search.

### Replace

Type the text with which you want to replace the old text.

### Match case

Specifies whether to enable a case-sensitive search.

4. Click **Replace All**.

The text is replaced at all occurrences.

5. Save the changes.

## Viewing Language Details

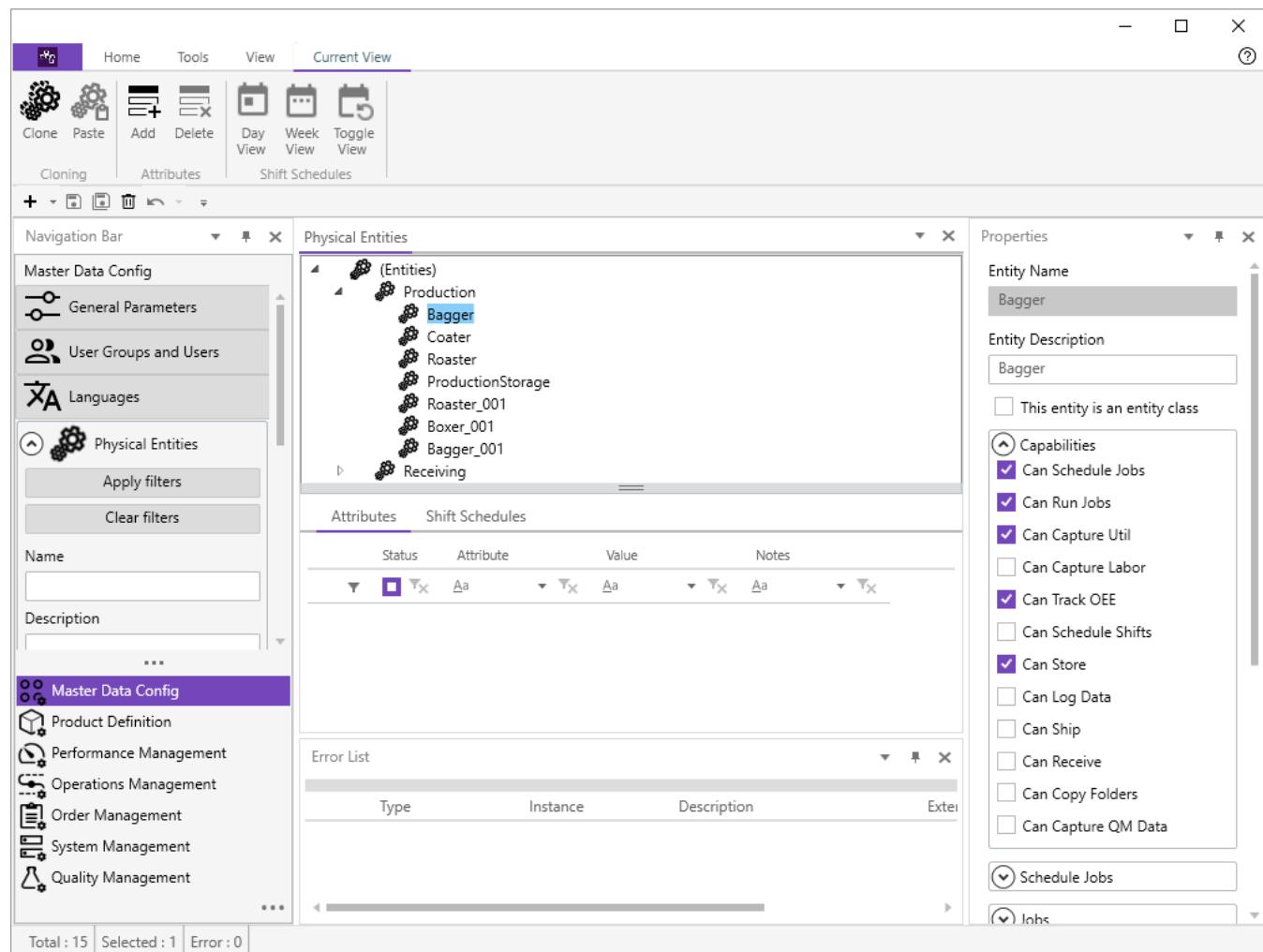
1. In the **Languages** workspace tab, right-click the language and then click **Edit**.  
The language's string tab appears.
2. On the ribbon, go to the **Current View** tab.
3. In the **Categories** group, do one of the following:
  - Select the **General** check box to view the strings used in MES Client, MES Supervisor, and MES .NET controls.
  - Select the **Compact** check box for a compact view.
4. Save the changes.

## Physical Entities

You can use the Physical Entities module to create and maintain entity definitions in the system. You can also create entities from Entity Model Builder (EMB) in the Application Server for objects containing a Utilization Capability Object (UCO), Operation Capability Object (OCO), or Sample Recording Object (SRO).

**Note:** If you update MES Client, the changes are not reflected on the objects in the Application Server. A re-synchronization of the server from EMB might overwrite changes made in MES Client. See the *MES Entity Model Builder User Guide* for more information.

When you open the **Physical Entities** workspace tab, the entity tree contains the defined entities. The **Properties** window displays detailed information, capabilities, and capability parameters of specific entities. The **Attributes** tab allows you to assign attributes to the selected entity.



Physical entities are the components of the system that you log on to. An entity might be a building, a location within a building, a production line, a single machine, a storage location or a bin. It can be defined in a tree structure with child entities that inherit default values (like shift schedules) from the parent.

The entity tree allows you to define all the entities, along with any detailed information and inter-relationships specific to those entities.

The entity tree can include two types of entity nodes:

- A standard entity node, indicated this icon:
- An entity class node, indicated by this icon:

For more information about the difference between standard and entity class entities, see [Entity Classes](#).

The root node **Entities** is neither an entity class or an entity. It serves as the starting point for the rest of the

entity tree.

The **Properties** window includes several group of properties that can be accessed by expanding them. See [Entity Properties](#).

To modify an entity's properties, select the entity in the entity tree, make the required changes, and save the changes.

By default, the **Physical Entities** module is grouped under the **Master Data Config** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

## Restrictions on Entities Assigned to Lines in MES Web Portal

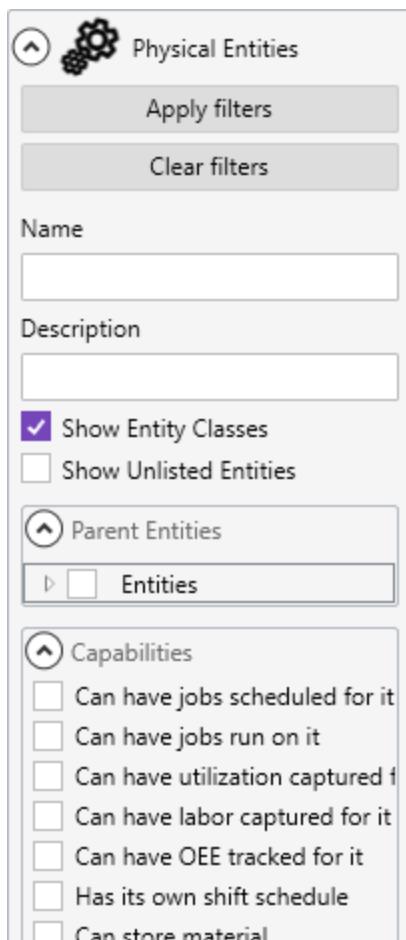
Entities can be assigned to lines in MES Web Portal. Note the following MES Client restrictions for entities that have been assigned to a line in MES Web Portal:

- You cannot delete an entity that is assigned to a line.
- You cannot change entity capabilities that are required when they are assigned to a line (*Can Schedule Jobs, Can Run Jobs, Can Capture Utilization, Can Track OEE*).
- You cannot remove the entries for the *Default Production Rate, Default Batch Size, or Default Standard Item* parameters.

## Opening the Physical Entities Workspace Tab

When opening the **Physical Entities** workspace tab, the **Apply Filter** function allows you to filter list of entities in the tab to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Master Data Config** group open the **Physical Entities** section.



2. To not filter the entities, don't enter any search terms.

To filter the entities, enter search terms in the following available filter options.

#### Name

Name of the physical entity.

#### Description

Description of the physical entity.

#### Show Entity Classes

Specifies whether entity classes to which other entities are grouped should be displayed. Select the option to include entity classes and entities in the result set.

#### Show Unlisted Entities

Specifies whether storage entities marked as Unlisted will be included in the entity list. For example, filtering out movable storage entities in this way can shorten the entity list and simplify entity management.

#### Parent Entities

Parent of the physical entity. Select the **Entities** option in this section.

#### Capabilities

Capability of an entity. You can select one or more capabilities.

3. Click **Apply Filter**.

The **Physical Entities** workspace tab opens, listing the entities that match the filter search terms.

## Creating a Physical Entity

You can create a physical entity to maintain entity definitions in the system. You can also delete a physical entity from the database. To perform these tasks, you must have the privileges to edit physical entity settings.

### To create a physical entity

1. Open or go to the **Physical Entities** tab.
2. Select the entity tree node under which you want to add the entity.
3. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click the node and on the context menu click **New Physical Entity**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Physical Entity**.
  - On the ribbon, go to the **Current View** tab and click **Add**.

A new physical entity is added below the selected entity tree node.

4. In the new entity's **Properties** window, complete the following settings:

#### Entity Name

A unique name for the physical entity.

#### Entity Description

A description of the physical entity.

#### This item is an entity class

Specifies whether to define the entity as an entity class. An entity class is indicated in the entity tree by this icon:  For more information about using entity classes, see [Entity Classes](#).

5. Save the changes.

## Entity Classes

Unlike entities that are created using MES Client, entities that are created from Entity Model Builder have only one direct parent. If you would like to organize entities from a System Platform IDE model into groups in the same way as parent entities can be used to group entities created directly in MES Client, you can create *entity classes*. You can then copy the entities from System Platform IDE model to entity class branches in the MES Client entity tree.

An entity class is an additional hierarchy for grouping like entities together even though they might reside in different locations within the entity hierarchy. For example, you might have multiple cartoners that you want to group together within an entity class called "Cartoners." While the cartoners might exist in different areas or work centers in the entity hierarchy, including them in the Cartoner entity class provides an easy way to find them all. For more information about the uses for grouping entities by assigning them to multiple parents, see [Entities with Multiple Parents](#).

Entity classes that are created in MES Client are just like any other parent entities. They can be assigned the same properties and can be parents and children of other entities. However, unlike standard parent entities, entity classes are protected from being altered by Entity Model Builder. If an entity class has the same name as an entity in System Platform, Entity Model Builder is prevented from importing that entity or otherwise changing the similarly-named entity class.

## Entity Properties

The entity **Properties** window includes of several configuration groups, which are described in the following topics.

### Capabilities

The **Capabilities** configuration group defines the functions an entity can perform.

Capabilities
<input checked="" type="checkbox"/> Can Schedule Jobs
<input checked="" type="checkbox"/> Can Run Jobs
<input checked="" type="checkbox"/> Can Capture Util
<input type="checkbox"/> Can Capture Labor
<input checked="" type="checkbox"/> Can Track OEE
<input type="checkbox"/> Can Schedule Shifts
<input checked="" type="checkbox"/> Can Store
<input type="checkbox"/> Can Log Data
<input type="checkbox"/> Can Ship
<input type="checkbox"/> Can Receive
<input type="checkbox"/> Can Copy Folders
<input type="checkbox"/> Can Capture QM Data

#### Can Schedule Jobs

Specifies whether the entity can schedule jobs.

#### Can Run Jobs

Specifies whether the entity can run jobs.

#### Can Capture Util

Specifies whether the entity can capture utilization data.

#### Can Capture Labor

Specifies whether the entity can capture labor data.

#### Can Track OEE

Specifies whether the entity can capture OEE statistics.

#### Can Schedule Shifts

Specifies whether the entity can schedule shifts.

#### Can Store

Specifies whether the entity can serve as a storage location.

#### Can Log Data

Specifies whether the entity can log data.

**Can Ship**

Select the check box if you want to enable the entity for shipment.

**Can Receive**

Select the check box if you can receive materials at this entity.

**Can Copy Folders**

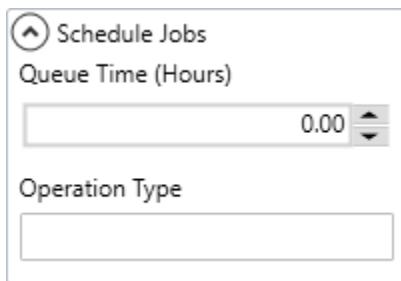
**Note:** Downloading files to physical entities is no longer supported. So the **Can Copy Folders** capability no longer applies to the system.

**Can Capture QM Data**

Specifies whether the entity can capture QM data.

**Schedule Jobs**

When the **Can Schedule Jobs** capability is selected, the **Schedule Jobs** group becomes available in the **Properties** window.

**Queue Time (Hours)**

Additional time in hours allocated to the entity when scheduling, for tasks such as preparation work or moving material.

**Operation Type**

A brief description of the type of operation performed at this entity.

**Jobs**

When the **Can Run Jobs** capability is selected, the **Jobs** group becomes available in the **Properties** window.

The **Jobs** configuration group allows the selected entity to run jobs, and is available in MES Operator's Entity Logon window.

<b>Jobs</b>	Start next sequence for current W...
Identical Job Execs	Manually
1	
<input type="checkbox"/> Allow only next job to be started	Start next job
Confirming Prompt	Manually
Store output in	End job
	Manually
Receive input from	<input type="checkbox"/> Show both item class and entity
	<input checked="" type="checkbox"/> Must all steps be completed/by
Default production reason	<input type="checkbox"/> The required quantity must be j
Good Production	<input checked="" type="checkbox"/> Run without operator
Default consumption reason	<input type="checkbox"/> Suppress 'Start Some Quantity'
Good Consumption	<input type="checkbox"/> Allow Zero Quantity Split
Default lot number	<input type="checkbox"/> Auto-allocate Quantity to Runn
Default subplot number	Job_Exec spare 1
<input type="checkbox"/> Automatically load job specifica	Job_Exec spare 2
	Job_Exec spare 3
	Job_Exec spare 4

### Identical Job Execs

The number of jobs that you can run simultaneously on an entity. The value of 0 or 1 indicates that only one job is running at a time.

### Allow only next job to be started

Specifies whether to start and complete jobs in the sequence of the job queue.

### Confirming Prompt

**Note:** This functionality has not yet been implemented.

### Store output in

The default storage location for produced items.

### Receive input from

The default storage location for consumed items.

### Default production reason

The default production reason in the **Production** tab of the operator.

**Default consumption reason**

The default consumption reason in the **BOM** tab of the operator.

**Default lot number**

The default value for the lot that is used during production.

**Default subplot number**

The default value for the subplot that is used during production.

**Automatically load job specification**

Select the check box so that job specifications are automatically loaded when a job starts.

**Start next sequence for current w/o and op**

Specifies how the next operation in the current work order starts. You can do this manually using the MES Operator. You can do it automatically if the created jobs have the same sequence numbers and operation numbers.

**Start next job**

Specifies how the next job starts. In MES Operator, click the **Start Job** button in the **Work Queue** tab to manually start the next job when a running job is completed. If you select **As soon as ready**, the next job that is ready in the entity's queue starts automatically after a running job is completed.

**End job**

Specifies when the job ends. In MES Operator, click the **Stop Job** button in the **Work Queue** tab to manually change the job's status when the job is completed. If you select **When quantity done meets required quantity**, the job's status is automatically set to Complete after the required quantity is produced.

**Show both item class and entity reasons**

Specifies whether to show item class reasons and the entity reasons for the jobs.

**Must all steps be completed/bypassed to end job**

Specifies whether to ensure that all the steps are completed or bypassed before the job is marked Complete.

**Must required quantity be produced to end job**

Specifies whether to ensure the required quantity that is produced before the job is marked Complete.

**Run without operator**

Specifies whether an operator needs to remain logged on while a job is running. By default, no operator needs to remain logged on while a job is running.

**SUPPRESS 'Start Some Quantity' prompt**

Specifies whether a dialog box should appear for entering quantities while performing a job. If this option is selected, the dialog box does not appear, and by default the value of start quantity becomes 1. If the **Allow zero quantity split** option is selected, by default the value of start quantity becomes 0.

**Allow zero quantity split**

Specifies whether to allow the creation of a job with 0 quantity when you split it.

**Auto-allocate quantity to running job**

The overages in reported quantities that are to be covered by moving the job from a scheduled to a running job. An error appears if there are no available overages in the scheduled job.

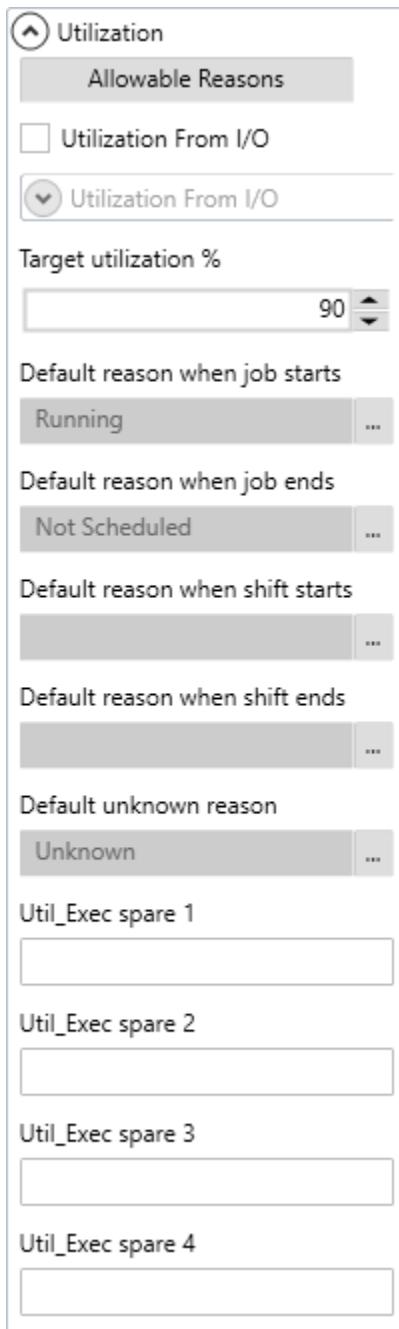
**Job\_Exec spare1, Job\_Exec spare2, Job\_Exec spare3, Job\_Exec spare4**

For additional information about the job.

## Utilization

When the **Can Capture Util** capability is selected, the **Utilization** group becomes available in the **Properties** window.

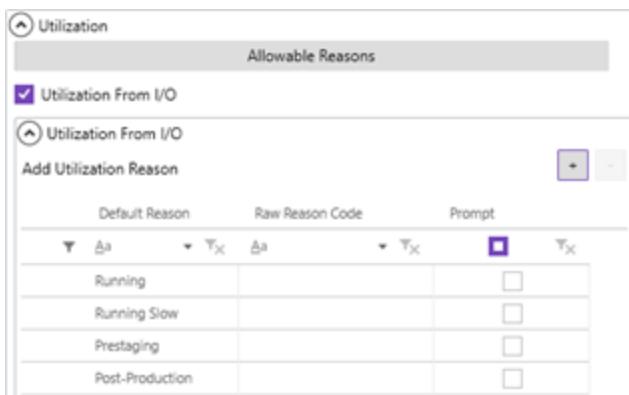
The **Utilization** configuration group includes the utilization reason settings for the entity.



### Allowable Reasons

Specifies the allowable reasons when you attempt to change the current utilization reason for an entity. By default, all the reasons are available.

### Utilization From I/O



If utilization reasons are being collected in the form of raw reason codes from external sources (like PLC) through a Utilization Capability Object, then select this option.

With this option selected, you can define a default final reason to which the entity changes automatically when that raw reason occurs. However, you can and typically should define other utilization reasons to map to the raw reason code as options from which the operator can select in case that default reason is not applicable. This is especially true for downtime, for which the PLC might not be able to identify everything that can go wrong, but the operator can. When you assign multiple utilization reasons for a raw reason code, they will be listed as options in a selection dialog box that appears for the operator when that raw reason occurs.

For each raw reason code, add one or more entries by doing the following:

1. Click the + button.
2. In the **Reason Selection** dialog box, select a utilization reason to which the raw reason code will be mapped, and then click **OK**.
3. In the **Raw Reason Code** column, enter the raw reason code.
4. In the **Prompt** column, select the check box if you want the operator to be prompted to manually select a utilization reason from the list of allowable reasons when a new raw reason code becomes active.

If there is no raw reason code coming from the PLC, then do not select the **Utilization From I/O** option.

When changing the entity's utilization reason, an operator will be able to select from the reasons that are defined using the **Allowable Reasons** button.

#### Target utilization%

Specifies the target utilization percentage identified for an entity.

#### Default reason when job starts

Specifies the default utilization reason for the entity when a job starts.

#### Default reason when job ends

Specifies the default utilization reason for the entity when a job ends.

#### Default reason when shift starts

Specifies the default utilization reason for the entity when a shift starts.

#### Default reason when shift ends

Specifies the default utilization reason for the entity when a shift ends.

#### Default unknown reason

Specifies the default reason when the entity utilization reason is unknown.

#### Util\_Exec spare1, Util\_Exec spare2, Util\_Exec spare3, Util\_Exec spare4

For additional information about the entity utilization.

## Labor

When the **Can Capture Labor** capability is selected, the **Labor** group becomes available in the **Properties** window.

The screenshot shows a configuration panel titled "Labor". It includes fields for "Department" (dropdown), "Category" (dropdown), and "Number of Simultaneous Operators (0 = unlimited)" (input field with value "0"). Below these are four sections labeled "Labor\_Exec spare 1" through "Labor\_Exec spare 4", each with its own input field.

Category
Department
Category
Number of Simultaneous Operators (0 = unlimited)
0
Labor_Exec spare 1
Labor_Exec spare 2
Labor_Exec spare 3
Labor_Exec spare 4

### Department

The default labor department for a user working on this entity.

### Labor Category

The default labor category for a user working on this entity.

### Number of Simultaneous Operators (0 = unlimited)

The total number of users allowed to be active, at the same time, on this entity.

### Labor\_Exec spare 1 to 4

For additional information about labor for this entity.

## OEE

When the **Can Track OEE** capability is selected, the **OEE** group becomes available in the **Properties** window.

The **OEE** (Overall Equipment Efficiency) configuration group allows you to establish targets that are to be achieved during production, and compare the actual results with the targets.

The screenshot shows the 'OEE' configuration screen. At the top, there are two dropdown menus: 'Production Data from' and 'Utilization Data from', both currently set to 'Bagger'. Below these are three rows for 'OEE Item' and 'Target': 'OEE %', 'Performance', and 'Quality'. Each row has a dropdown menu icon (Aa, Tx, =) and a horizontal scroll bar. At the bottom, there is a 'Default Production Rate' section with a dropdown menu ('minutes/batch') and an input field containing the value '5'.

### Production Data from

Specifies an entity that contains production data for calculating the overall equipment efficiency. If you select an entity, you will receive the production data for OEE calculation from that entity.

### Utilization Data from

Specifies an entity that contains utilization data for calculating the overall equipment efficiency. If you select an entity, you will receive the utilization data for OEE calculation from that entity.

The OEE items are as follows:

OEE Items	Target%	Actual%
OEE	Specifies the target OEE percentage identified for an entity.	Specifies the actual OEE percentage for a selected entity.
Performance	Specifies the target performance percentage identified for an entity.	Specifies the actual performance percentage for a selected entity.
Quality	Specifies the target quality percentage identified for an entity.	Specifies the actual quality percentage for a selected entity.

### Default Production Rate

Specifies the default production rate for the entity.

The estimated production rate must be greater than 0. An entry of 0 will cause an error.

# Understanding Batches and Lots for OEE and Estimated Times

It is important to understand the difference between batches and lots so that your OEE results are within expected ranges.

- A lot is generally used to uniquely identify a group of consumed or produced items for tracking purposes.
- A batch is an amount of product that is processed simultaneously. A batch is used to determine the standard production time for a given amount of product. Standard production times are expressed either in time per batch, or batches per time.

For example, assume that you want to track all of the cookies that are baked during a shift as a group, and that you want to determine the cookie production's OEE. A unique lot number can be assigned to the group of cookies produced during the shift. But the lot size has nothing to do with the OEE calculation. That calculation would be based on the batch size and the batch production rate. If a batch size is 100 cookies and it takes 20 minutes to bake a batch of cookies, then up to 24 batches of cookies could be baked during an 8-hour shift, or a maximum of 2,400 cookies in a lot.

Also, note that the amount of production might not be an integral number of batches. This is because the standard production time for a batch will be constant, regardless of whether the batch actually includes the maximum number of items for the batch. For example, if the oven capacity, and thus a batch, is 100 cookies, it takes as long to bake 90 cookies as it does to bake 100. The performance component of OEE factors in this nonlinear behavior. So, for OEE to be reported accurately, it is important that the batch size be set according to the way production actually occurs.

The other usage of batch size is with estimated job start and end times. When creating a work order with a required finish time, the batch size and production rate is used to determine the start and end times for each operation in the process to determine the required start time of the initial job. Incorrect batch size and production rates can create unattainable start times and even overflow date/time calculations in the database.

## Storage

When the **Can Store** capability is selected, the **Storage** group becomes available in the **Properties** window.

The **Storage** configuration group defines the capabilities of the storage entity.

Storage

Type

Delete inventory when quantity reaches 0

Allow negative quantities

Allow multiple items

Allow multiple lots

Moveable

Allow a dirty state

Multiple lots/items stored here become indistinguishable

Unlisted

Status

Available

Max. Cap. (0 = unlimited)

0

Scannable ID

Location

Storage\_Exec spare 1

Storage\_Exec spare 2

Storage\_Exec spare 3

Storage\_Exec spare 4

**Type**

Specifies the type of entity. This field is for custom use.

**Delete inventory when quantity reaches 0**

Specifies whether the inventory record in the database is deleted when the remaining quantity of an item reaches zero.

**Allow negative quantities**

Specifies whether the storage entity can store negative quantity for an item in an entity.

The *Allow negative quantities* parameter will not have an effect if the Storage parameter *Multiple lots/items stored here become indistinguishable* has also been selected and there are still items available in other lots. This is because subtracting an item from a lot will never allow the quantity to fall below zero if there are enough items in other lots to meet the quantity used. Instead, the item quantity will be removed proportionately from the other lots. (That is, the system prorates the subtraction of quantities across all of the lots, so the quantities in a given lot will not become negative unless there are no items remaining in any other lot.)

#### **Allow multiple items**

Specifies whether the storage entity stores different items at the same time.

#### **Allow multiple lots**

Specifies whether the storage entity stores different lots for an item at the same time.

#### **Moveable**

Specifies whether you can relocate an entity. If you select this option, the **Location** field is enabled.

#### **Location**

Identifies where a movable entity is currently located. You can modify this field when the **Moveable** option is selected.

#### **Scannable ID**

This field can be used primarily with movable storage entities that may be barcoded (e.g., a pallet). It provides an alternative way to uniquely identify a storage entity, such as a pallet.

---

**Note:** Currently the base product does not contain any interface to barcode scanners, so there is no internal use for this field.

#### **Allow a dirty state**

Specifies whether you can select the current status of a storage entity as Dirty. You cannot use this entity for storage until you change its status to available.

#### **Multiple lots/items stored here become indistinguishable**

Specifies an item cannot be distinguished from other items when you select it.

The *Multiple lots/items stored here become indistinguishable* parameter can be used with the General system parameter *Minimum traceable inventory amount* in the following way: If the *Multiple lots/items stored here become indistinguishable* parameter is selected and the *Minimum traceable inventory amount* parameter has a value entered, then once the quantity for a lot drops below that value, the balance of the item quantity for that lot (that is, the quantity set as the minimum traceable inventory) will be distributed across the other lots, and the quantity for that lot will be set to 0.

#### **Unlisted**

If selected, this entity will not be included in the entity list if the **Show Unlisted Entities** option on the **Apply Filter** function is not selected. This is useful if you don't want to see movable storage entities in the list to simplify entity management.

#### **Status**

Specifies the current status of the storage entity, whether it is available, used or dirty.

#### **Maximum Capacity**

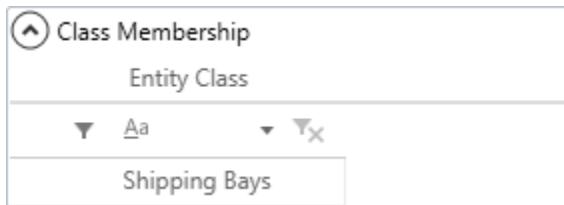
Specifies the maximum quantity of an item that can be stored in an entity.

#### **Storage\_Exec spare1, Storage\_Exec spare2, Storage\_Exec spare3, Storage\_Exec spare4**

For additional information about the entity storage.

## Class Membership

The **Class Membership** configuration group displays the list of entity classes associated with the entity being configured.



The entity classes are the parents of the selected entity. For more information about entity classes, see [Entity Classes](#).

## Data Log Groups

You can assign data log groups to an entity to allow users to collect data about the entity.

See [Assigning Data Log Groups to an Entity](#).

## Files

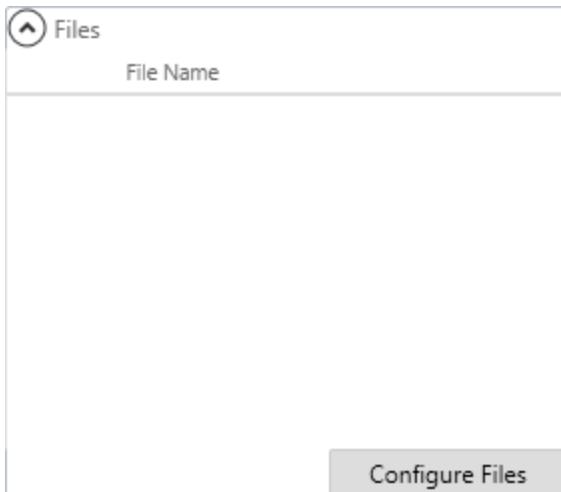
You can add files and web pages to an entity to support the operator using that entity during production. For example, a file or web page can contain information relative to setting up, operating, or maintaining the entity. When a user is recording the execution of jobs on the entity using an application such as MES Operator, the files and web pages will be available to them for viewing.

See [Adding Files and Web Pages to an Entity](#).

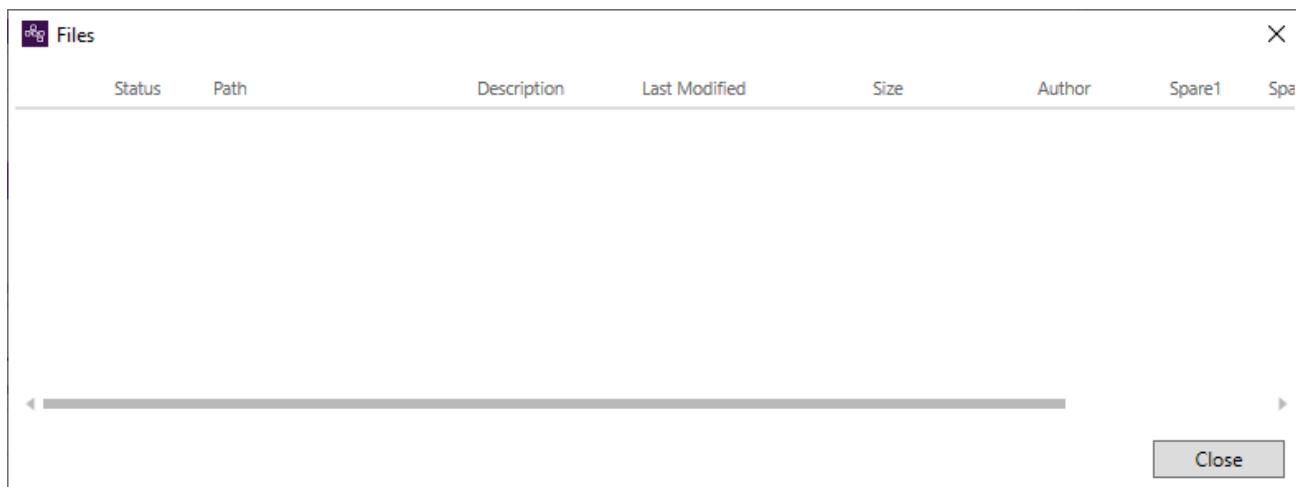
# Adding Files and Web Pages to an Entity

## To add files to the entity

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



2. Right-click in the dialog box, and then click **Add files**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the files to be added, and then click **Open**.

The selected files are listed in the Files dialog box.

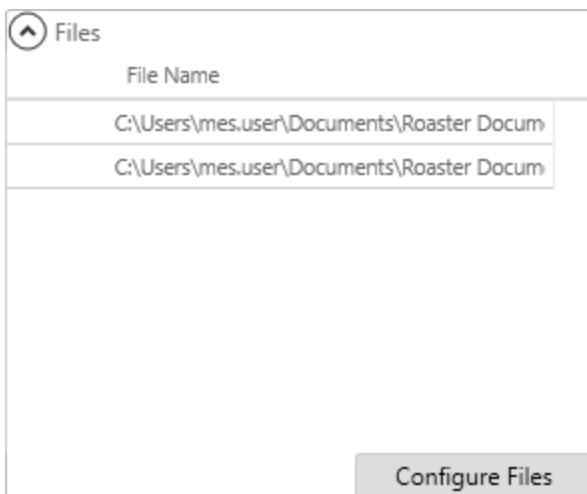
Status	Path	Description	Last Modified	Size	Author	Spare1	Spare2
*	C:\Users\mes.user\Documents		06/30/2022 12:13:07 PM	834,396	▼		
*	C:\Users\mes.user\Documents		06/30/2022 12:13:39 PM	834,421	▼		

5. Optionally, add a description for each file in the **Description** column.

6. Add other files (or web pages) as needed.

7. When you are finished adding files, click **Close**.

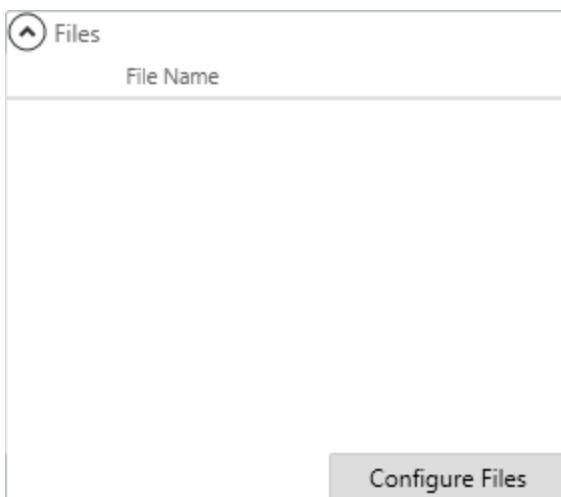
The files are listed in the **Files** property group.



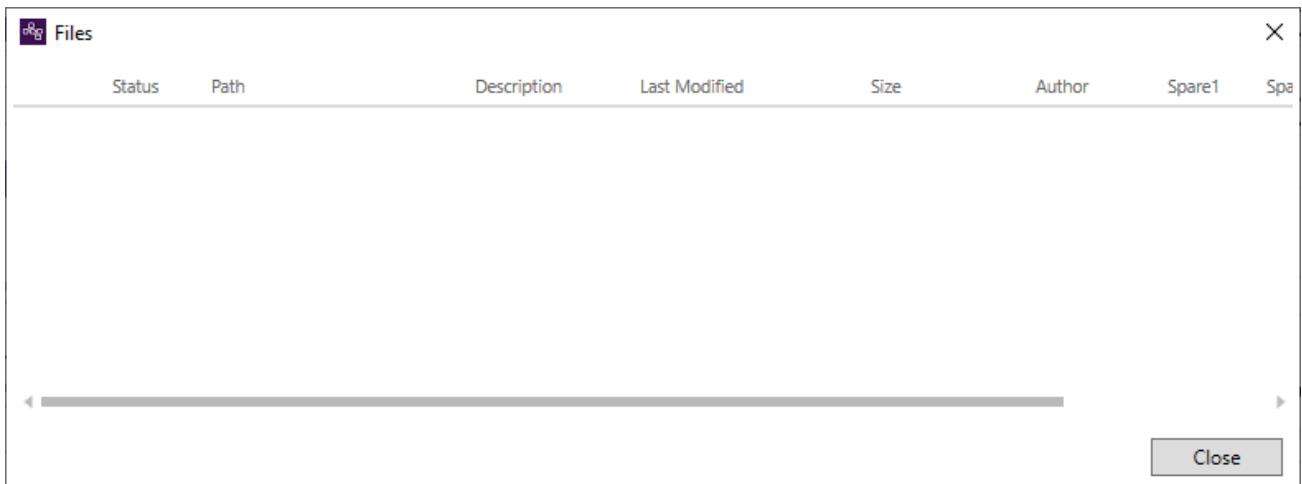
8. Save the changes.

### To add a web page to the entity

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



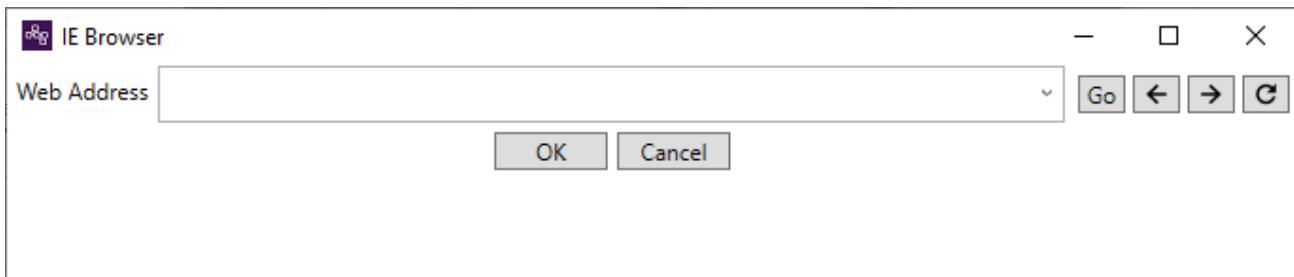
2. Right-click in the dialog box, and then click **Add URL**.

The Add URL dialog box appears.



3. Enter the URL and a description of the web page.

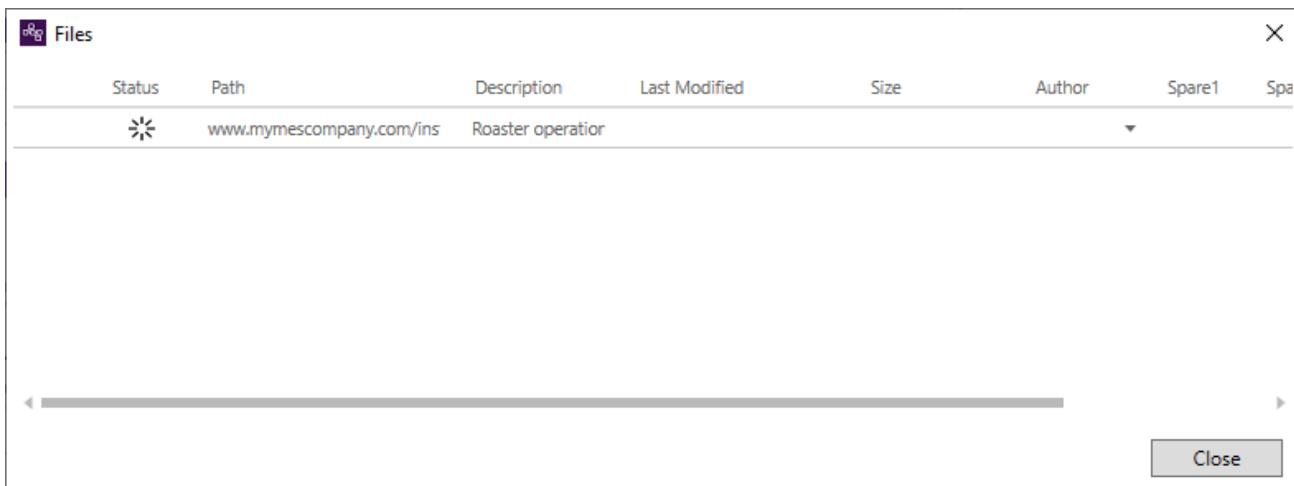
Instead of manually entering the URL, you can click the Browse button at the right of the URL box and use the mini-browser window that appears to navigate to the web page.



Click **OK** and that web page's URL is entered on the Add URL dialog box.

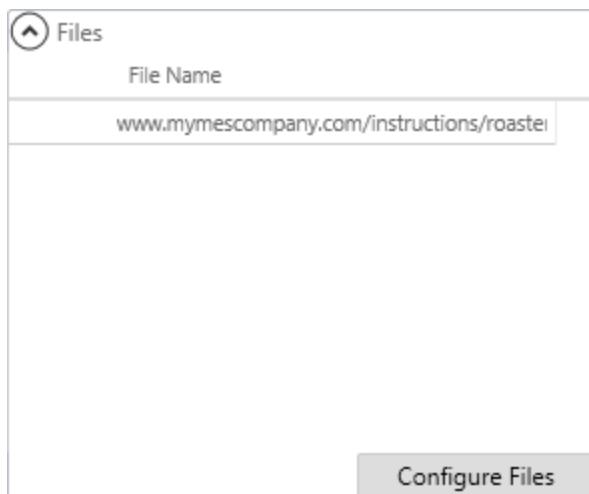
4. When you have finished entering the URL and description, click **Close**.

The URL is listed in the Files dialog box.



5. Add other web pages (or files) as needed.
6. When you are finished adding web pages, click **Close**.

The web page URLs are listed in the **Files** property group.



7. Save the changes.

#### To remove a file or URL

1. In the **Files** property group, click **Configure Files**.  
The Files dialog box appears.
2. Right-click the file or URL, and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.

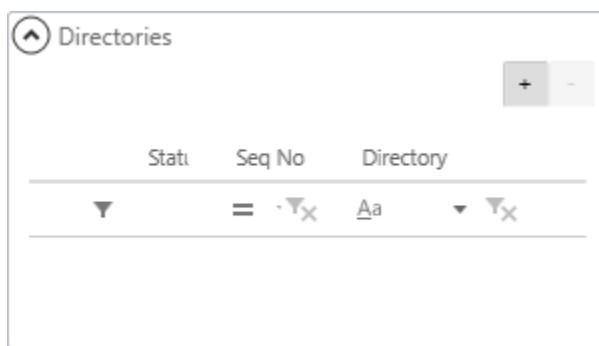
#### Directories

You can add directories to an entity to support Folders functionality. See [Adding Directories to an Entity](#).

## Adding Directories to an Entity

#### To add a directory to an entity

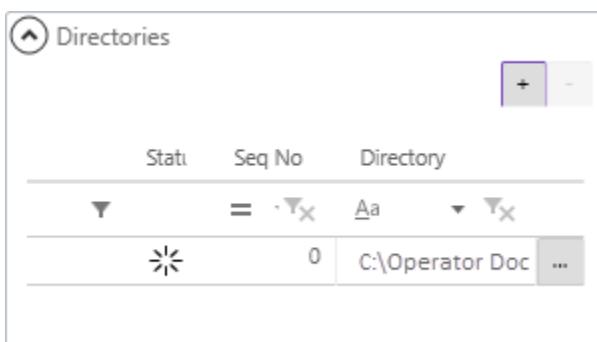
1. Open the **Directories** group.



2. Click the **+** button.  
The **Browse for Folder** dialog box appears.

3. Navigate to and select the folder to be added, and then click **OK**.

The folder is added to the list in the **Directories** group.



4. Save the changes.

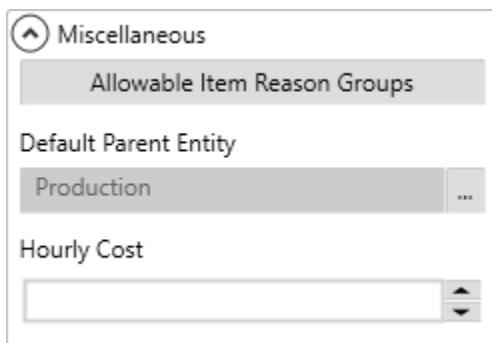
If there are multiple directories in the list, you can change their order by dragging and dropping them.

#### To remove a directory

1. Select the directory.
2. Click the – button.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Save the changes.

### Miscellaneous

The **Miscellaneous** configuration group contains additional options.



#### Allowable Item Reason Groups

Specifies the allowable item reason groups for the entity. This allows you to restrict the reasons that can be applied to item production or consumption for jobs running on this entity. See [Assigning Item Reason Groups to an Entity](#).

#### Default Parent Entity

Specifies the preferred parent of the entity, relative to inheriting a parent's associations. See [Entities with Multiple Parents](#).

#### Hourly Cost

Specifies the cost to run the entity for an hour.

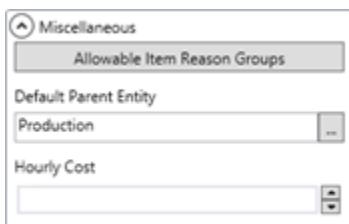
## Assigning Item Reason Groups to an Entity

To restrict the reasons that can be applied to item production or consumption for jobs running on the entity, you can specify the allowable item reason groups for the entity.

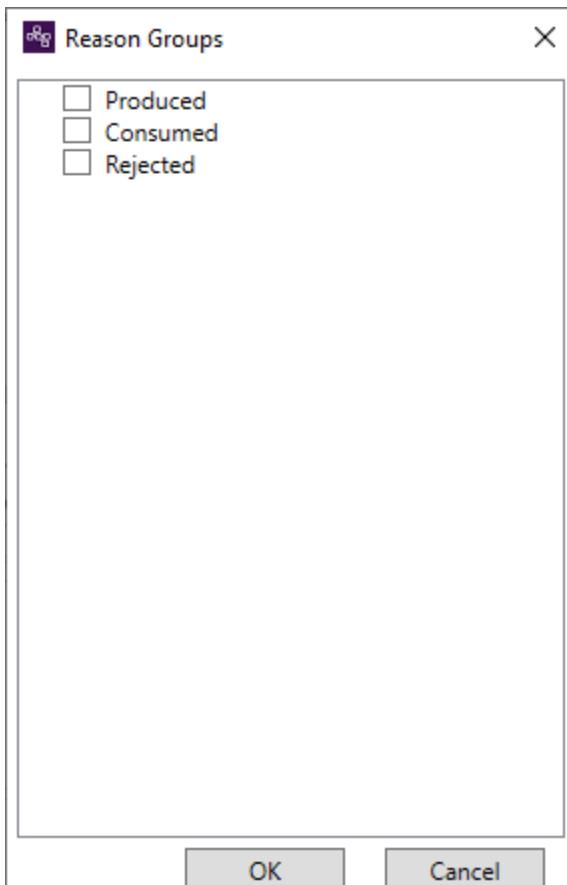
If no allowable item reason groups are specified, then all item reasons will be available when producing or consuming items while running jobs on the entity.

### To assign reason groups to the entity

1. In the **Miscellaneous** group, click **Allowable Item Reason Groups**.



The Reasons Groups dialog box appears.



2. Select the item reason groups, and then click **OK**.
3. Save the changes.

## Assigning Attributes to an Entity

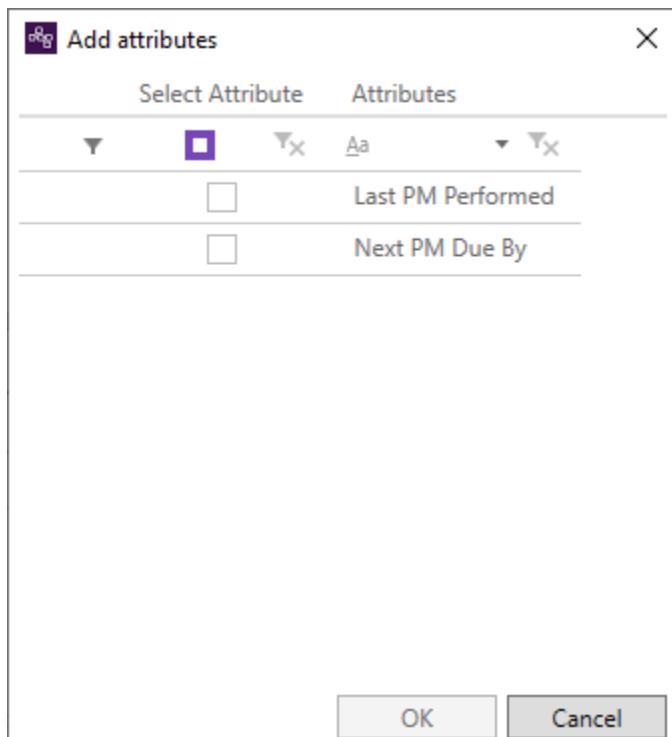
An attribute is an additional user-defined property. You can assign attributes to an entity that allows operators to provide additional information about the entity.

Physical entity attributes must first be created using the **Attributes** module. See [Attributes](#).

### To assign attributes to an entity

1. In the entity tree, select the entity.
2. Click in the **Attributes** tab.
3. Do one of the following:
  - On the **Current View** ribbon, click **Add**.
  - Right-click in the **Attributes** tab, and then click **Add**.

The **Add attributes** dialog box appears. Entity attributes that have not been assigned to the entity are listed.



4. Select the attributes to assign to the entity, and then click **OK**.

The attributes are added to the **Attributes** tab.

Attributes		Shift Schedules	
Status	Attribute	Value	Notes
▼	>Last PM Performed		
►	Next PM Due By		

5. For each attribute, enter a value specific to this entity and optionally add a note.
6. Save the changes.

### To remove an attribute from the entity

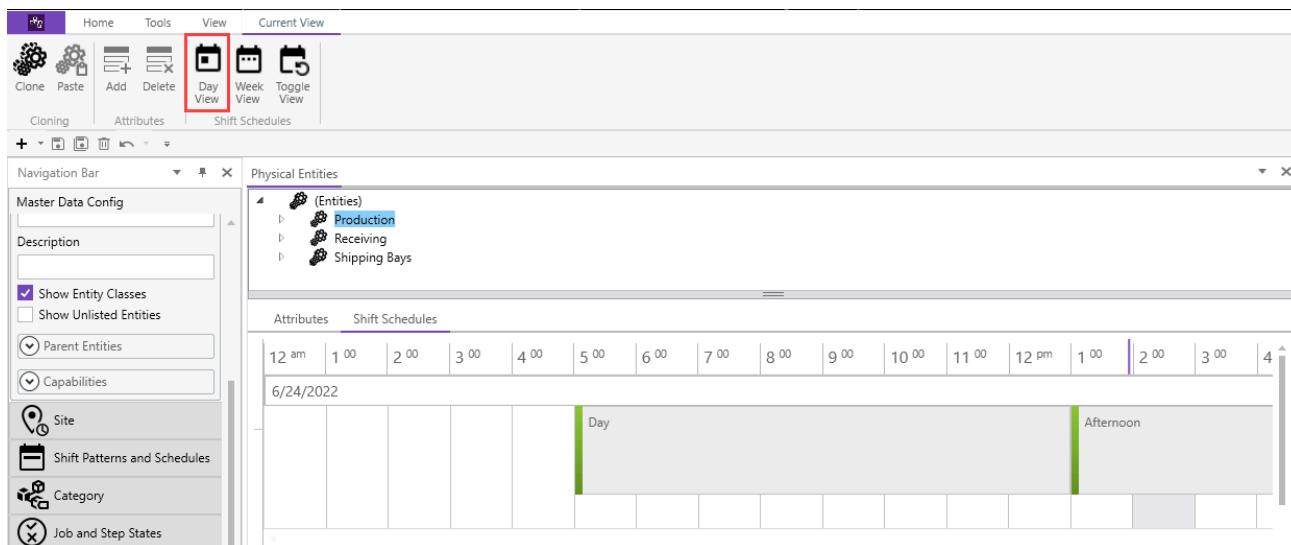
1. Right-click the attribute and click **Delete**.  
You are prompted to confirm the deletion.
2. Click **Yes**.

### Viewing the Shift Schedule for an Entity

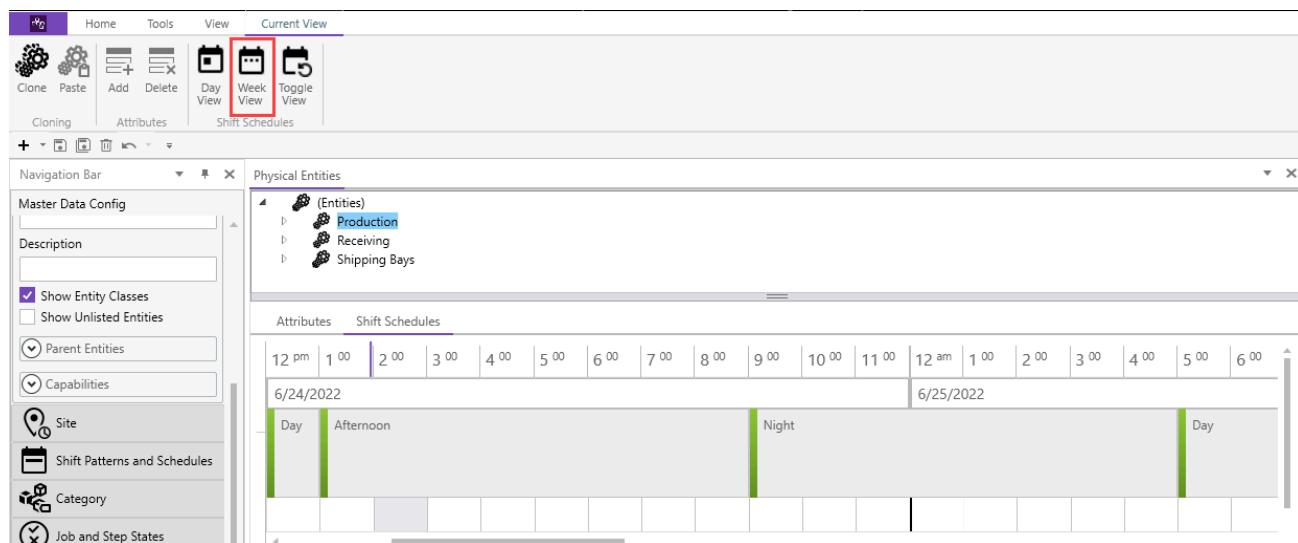
On the **Shift Schedules** tab of the **Physical Entities** workspace tab, for the selected entity you can view the shift schedule for today or the next 7 days.

On the ribbon, you can use the **Shift Schedules** buttons on the **Current View** tab to change the scope and format of the view:

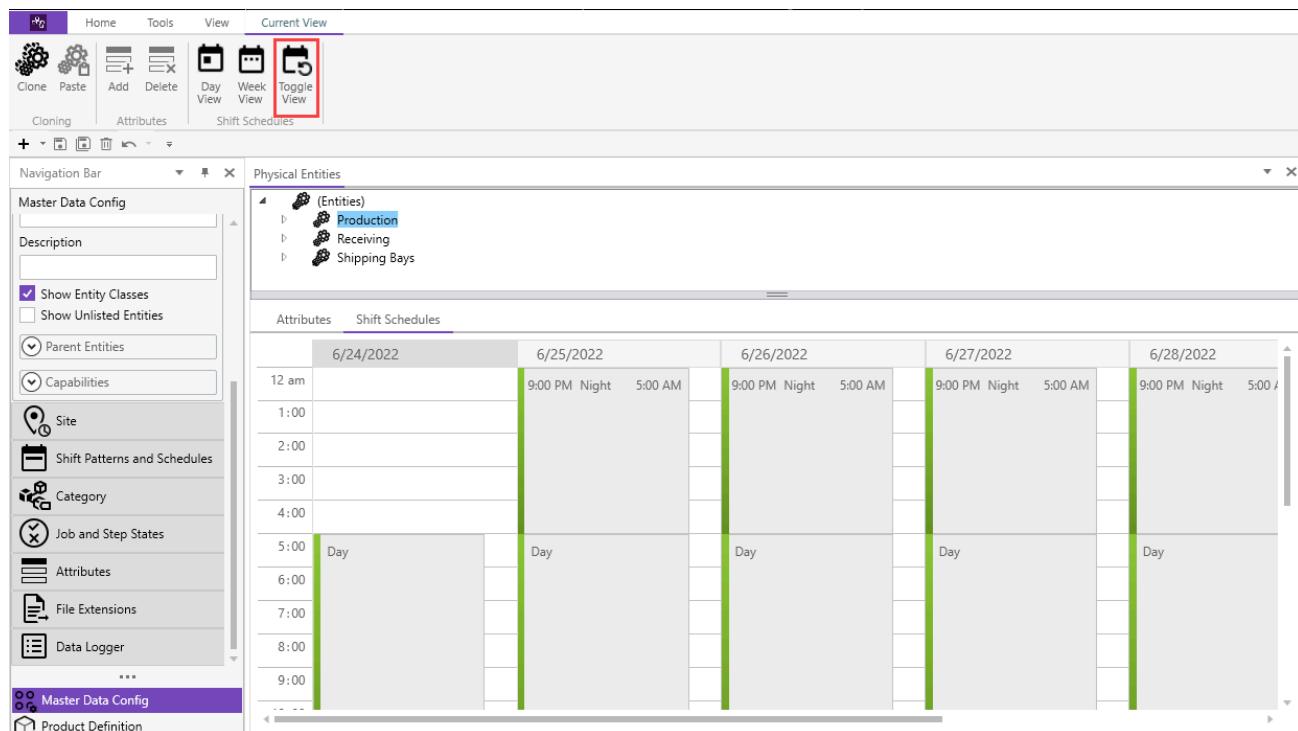
- The **Day View** shows today's schedule in a timeline format.



- The **Week View** shows the next 7 days schedule in a timeline format.

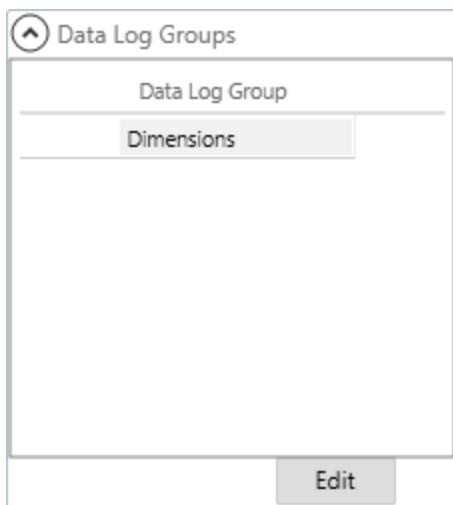


- The **Toggle View** toggles the format of the next 7 days schedule between the timeline format shown above and the calendar format shown below.



## Assigning Data Log Groups to an Entity

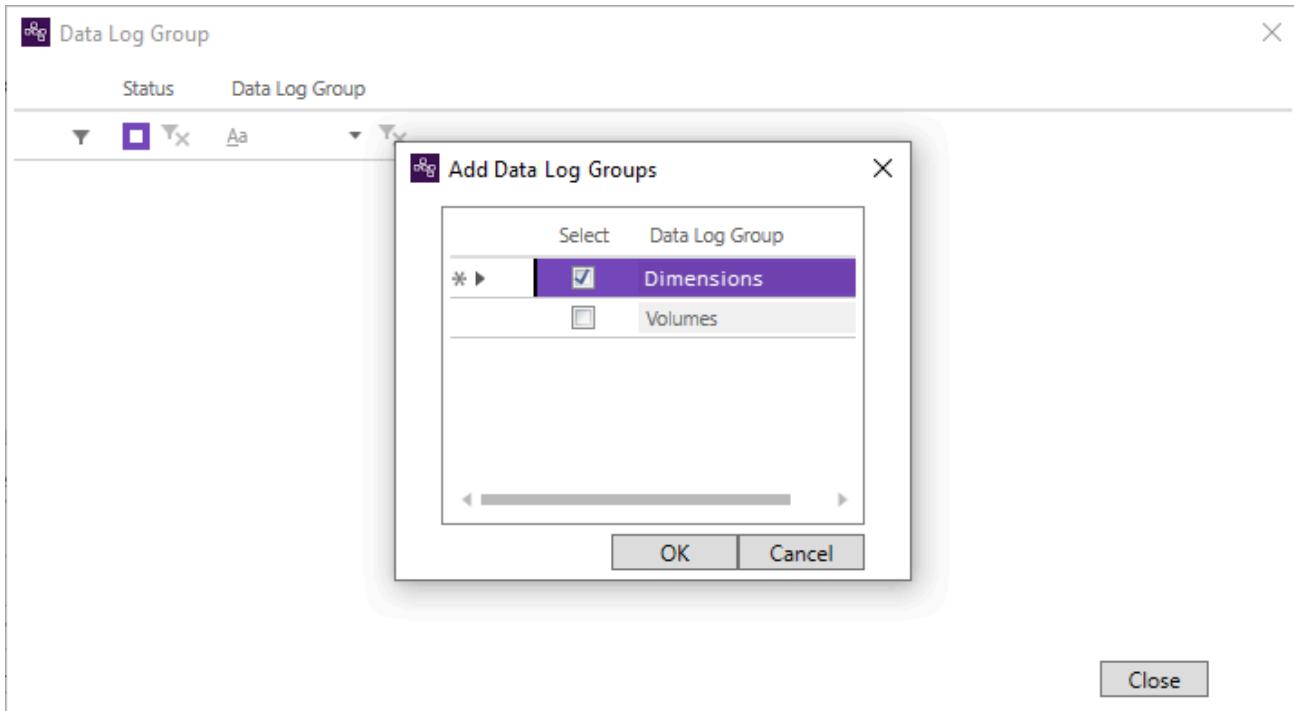
If the entity's Can Log Data capability has been selected, then you can assign data log groups to the entity in the **Data Log Groups** property group. For information about adding and managing data log groups, see [Data Logger](#).



The data log groups would be those than can be used to collect data about the entity during production.

#### To assign data log groups to an entity

1. With the entity selected, in the **Data Log Groups** property group, click **Edit**.  
The Data Log Group dialog appears.
2. Right-click in the dialog and click **Add**.  
The Add Data Log Groups dialog appears.
3. Select the data log groups to be assigned.



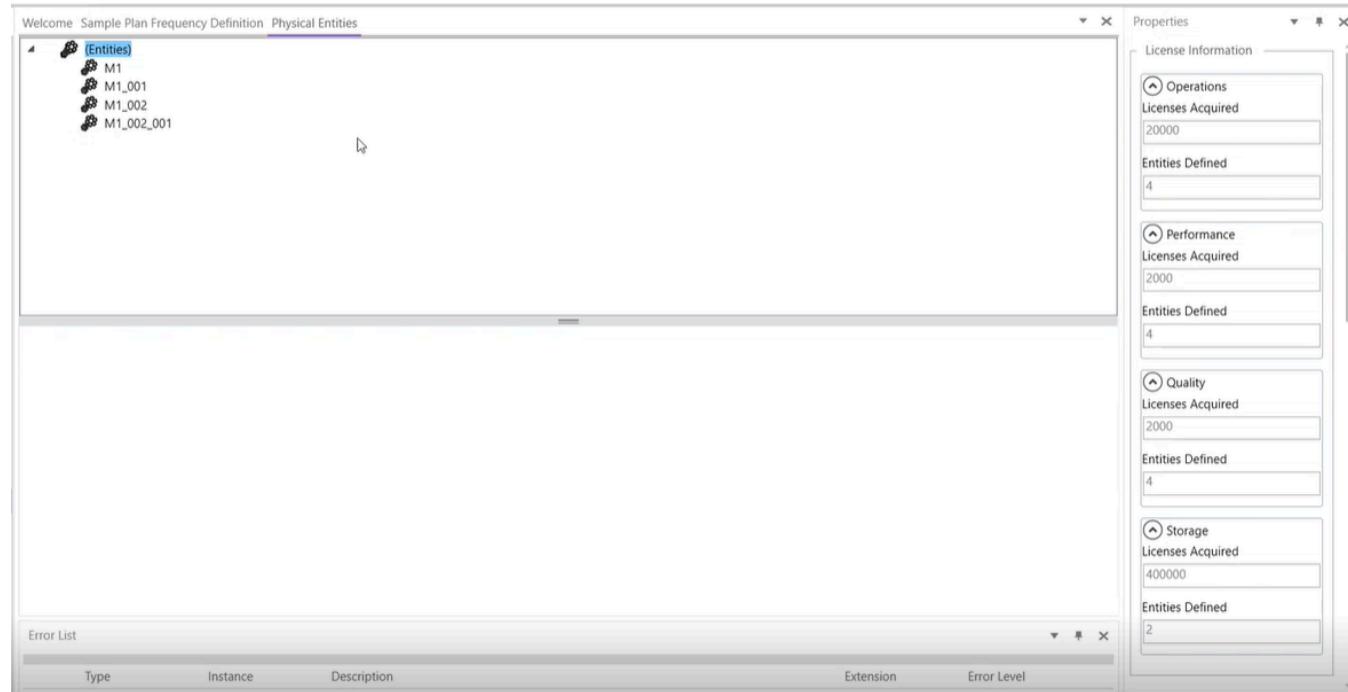
4. Click **OK**.  
The groups are added to the list in the Data Log Group dialog.
5. Click **Close**.  
The groups are added to the list in the **Data Log Groups** property group.

### To unassign a data log group from the entity

1. With the entity selected, in the **Data Log Groups** property group, click **Edit**.  
The Data Log Group dialog appears.
2. Select the data log group to be unassigned.
3. Right-click in the dialog and click **Delete**.  
You are prompted to confirm the removal of the group assignment.
4. Click **Yes**.  
Click **Close** to close the Data Log Group dialog.

### Viewing Entity Licensing Information

You can view the licensing information for the selected entity tree on the **Physical Entities** tab of the **Master Data Config** module group.



The Properties window displays the acquired licenses and current license usage counts, organized by feature, for the selected entity tree.

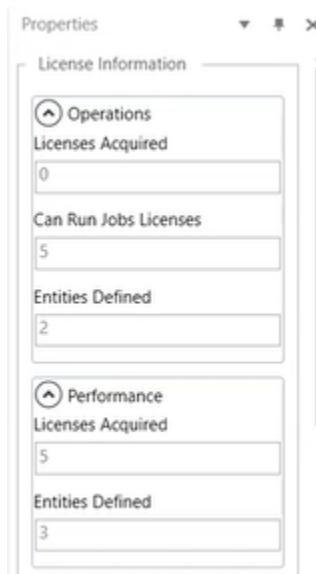
**Note:** The license usage count depends on the currently selected capabilities of the physical entities for the tree node. For more information on entity capabilities, see [Capabilities](#).

### To view entity licensing information:

1. Open or go to the **Physical Entities** tab.
2. Select the entity top level tree node you want to view.



The entity License Information appears in the **Properties** window.



**Note:** If the Operations feature is not licensed, the Operations **Licenses Acquired** field will display zero and the **Can Run Jobs Licenses** field will display the number of Performance feature licenses available.

## Managing Entities

### Add an Entity to a Parent Entity

An entity can have more than one parent. You can do this using the Copy and Paste functions. For more information about entities with multiple parents, see [Entities with Multiple Parents](#).

1. Copy the entity using one of the following methods:
  - Right-click the entity and on the context menu select **Copy**.
  - Select the entity and press **Ctrl-C**.
2. Add the entity to the parent entity by doing one of the following:
  - Right-click the parent entity and on the context menu select **Paste**.
  - Select the parent entity and press **Ctrl-V**.

A reference to the entity is added to the parent entity you selected. Notice that now, when you select the entity or one of its references, it and all of its reference entities are selected.

With the entity still on the clipboard, you can continue to use the Paste function to add references to it to other parent entities.

## Remove an Entity from a Non-Preferred Parent Entity

An entity that has more than one parent can be removed from any parents that are not the preferred parent (for information about the preferred parent, see [Entities with Multiple Parents](#)).

1. Right-click the entity under the parent whose link you want to remove and on the context menu select **Delete Link**.  
You are prompted to confirm deleting the link.
2. Click **Yes** to continue with deleting the link.  
The entity's reference to the parent entity is removed.

## Move an Entity to Another Parent Entity

You move an entity to another parent entity using the Cut and Paste functions.

1. Cut the entity using one of the following methods:
  - Right-click the entity and on the context menu select **Cut**.
  - Select the entity and press **Ctrl-X**.The entity is copied to the clipboard and removed from its current location in the hierarchy. Any reference entities are deleted.
2. Add the entity to a parent entity by doing one of the following:
  - Right-click the parent entity and on the context menu select **Paste**.
  - Select the parent entity and press **Ctrl-V**.The entity is added to the parent entity you selected.

## Clone an Entity

You duplicate an entity, which is an exact copy of the entity, using the Clone function.

1. Put a copy of the entity on the clipboard using one of the following methods:
  - Right-click the entity and on the context menu select **Clone**.
  - Select the entity and on the **Current View** tab select **Clone**.
2. Add the copy of the entity to a parent entity by doing one of the following:
  - Right-click the parent entity and on the context menu select **Paste**.
  - Select the parent entity and press **Ctrl-V**.

A copy of the entity is added to the parent entity you selected.

With the copy of the entity still on the clipboard, you can continue to use the Paste function to add copies of it to parent entities.

## Delete an Entity

You can delete any entity that does not have child entities.

1. Right-click the entity and on the context menu select **Delete**.

You are prompted to confirm the deletion.

2. Click **Yes** to continue with the deletion.

The entity and any of its reference entities are deleted.

## Parent Entities and Inheritance

The entity tree structure in the **Physical Entities** module allows you to create a hierarchical model of the entities in your organization that represents the actual relationships of entities in your plant.

In addition to allowing you to model the structure and locations of the entities in your plant, the parent-child relationship between entities also provides an inheritance of certain associations of the parent entity to its child entities. This allows you to control aspects of your entities more easily by simply changing the association at the parent level—which changes will be inherited by its child entities—instead of having to make the changes individually for each child entity. It can also allow jobs that are queued to a parent entity to be run on any of its available child entities.

## Associations Inherited from a Parent Entity

An entity can inherit the following associations from a parent entity:

- A shift pattern and its shift schedule, if the entity does not have the *Can Schedule Shifts* capability.
- Jobs queued to run on the parent
- If a specification has been assigned to a parent entity, and the same operation is assigned to the parent and child but with 0% flow to the parent (and so no job is created for the parent), the child entity will inherit the specifications of the parent operation
- If a QM specification has been assigned to a parent entity, any child entity that has the *Can Capture QM Data* capability will inherit the QM specification.
- Serial numbers, if the entity is producing serialized items

## Entities with Multiple Parents

In the entity tree, entities can have multiple parents under the following conditions:

- The entity's tree branch includes ancestors; that is, the child's immediate parent and any other parent entities higher up in the same branch of the hierarchy.
- The entity has been copied to one or more parents in addition to the parent under which it was originally created.

Copying an entity to another parent is different than cloning the entity. Copying the entity does not create a new entity. It is the method used to assign an additional parent to the entity to either better model the plant entity structure, to make it easier to identify similar entities, or so that the new parent's associations can be inherited. Cloning an entity creates a completely new entity with the same properties as the source entity.

The ability to copy entities to other parent entities allows entities to be grouped by common attributes for operational purposes. For example, say you have a machine shop with a number of lathes that are located in three distinct areas of a shop floor. To model the physical layout in the MES Client entity tree, an entity is created

for each shop floor area and the lathe entities are created under the shop floor area entity in which they are located. However, you also want to group lathes by length, throw, or horsepower so that jobs that require a certain value for one of these attributes can be run on any of the lathes that meet that requirement, regardless of its location. In this case, you would create parent entities for each classification of attributes that is required and then copy the lathe entities to the parent entities whose requirements they meet.

Note that entity classes or standard entities can be used to provide this grouping functionality.

## Resolving Inheritance for Entities with Multiple Parents

If an entity has more than one parent, certain inheritance conflicts are resolved as follows:

- The preferred parent is specified by the entity's *Default Parent Entity* setting in the **Miscellaneous** configuration group. The system will look at this parent first when determining the entity's inherited associations.
- For shift patterns and their shift schedules, only the preferred parent or the preferred parent's preferred ancestors can be the source for the child entity's shift pattern. Therefore, if neither the entity nor any of its preferred ancestors have their own shift pattern, then the entity does not get a shift schedule, even if a non-preferred ancestor has one.
- For operation specifications, if the preferred parent does not have a specification of the same name, the system goes up through the preferred parent's ancestors and uses the first specification that it finds with the same name.
- If an entity has the capability *Can Capture QM Data* and there is no QM specification assigned or if the assigned one is not active, the next higher ancestor entity in the hierarchy (which has an active QM specification) is used to generate the samples for the entity.

## Sites

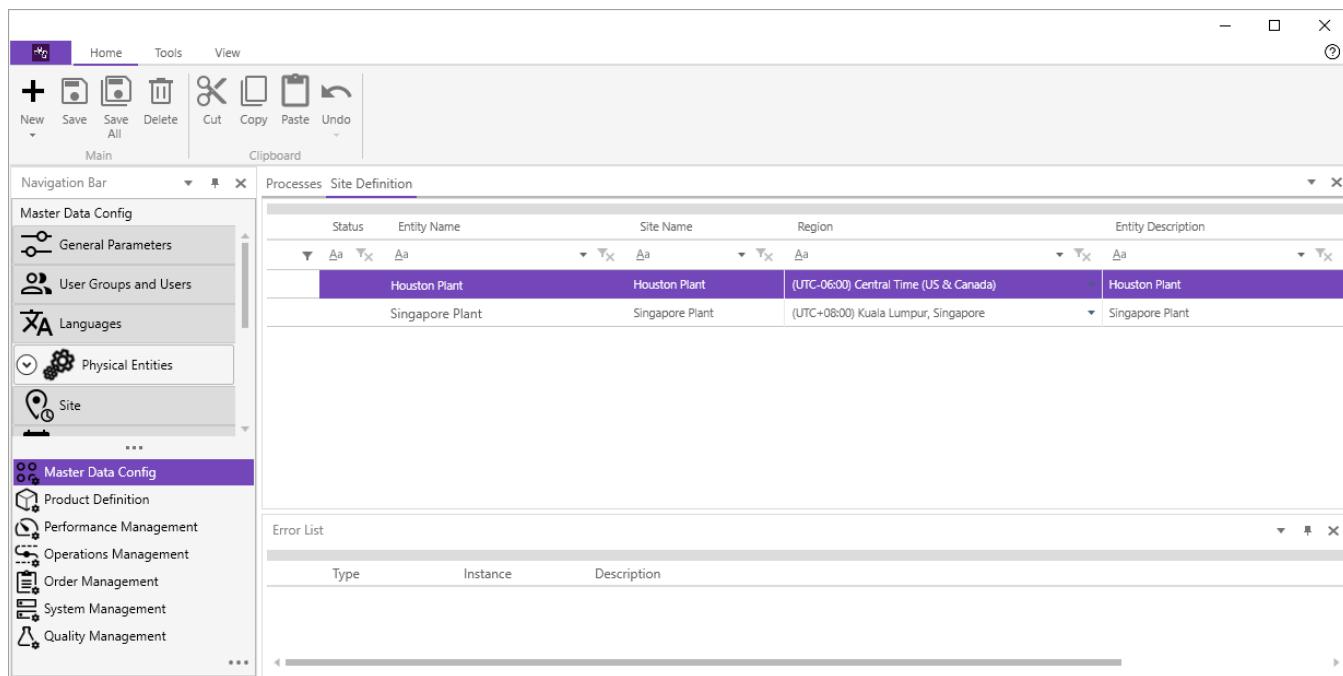
You can use the **Site** module to specify location of an entity as per the time zone. An entity can belong to one site. All the child entities of that entity will also belong to that site.

The site information is used while saving information about an event that happened on an entity. The system stores the date and time in UTC and in the local time for the entity.

When the MES middleware service starts a shift, the system records the start time of the shift in UTC and in the local time of the entity (not in the local time of the background process). The site provides the time zone information of the entity and this information is used to record the correct local time for the entity in the database.

When you open the **Site** module, a list of all the existing sites is shown in the **Site Definition** workspace tab.

By default, the **Site** module is grouped under the **Master Data Config** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).



## Creating a Site

You can assign a site to an entity. Children entities inherit the parent entity's site.

### To create a site

1. Open or go to the **Site Definition** workspace tab.
  2. Do one of the following:
    - Press the **Ctrl+N** keys.
    - Right-click in the tab and on the context menu click **New**.
    - On the ribbon, go to the **Home** tab and on the **New** menu click **New Site**.
- A new site is added.
3. In the new site's **Properties** window, complete the following settings:

#### Entity Name

Click the **Browse** button. The Entity Window dialog box appears. Select the entity for which you want to create the site from the entity tree.

#### Site Name

An additional name for the site. This is an optional field.

#### Region

The time zone to which this entity belongs. All transactions against entities within the site will use the site's region to convert between local times and UTC.

#### Entity Description

A brief description of the selected entity.

4. Save the changes.

## Shift Patterns and Schedules

You can use the **Shift Patterns and Schedules** module to define unlimited shift patterns to customize the shift schedules of your organization depending on entity shift requirements. A shift pattern includes an option to define the time period when the pattern is active. This allows for defining high and low seasonal demand patterns or alternating weekly patterns.

### Shift Pattern Types

A shift pattern is one of the following types:

- A **regular** pattern, which includes multiple shift definitions each having up to three break periods
- An **overtime** pattern to add additional shifts to an existing pattern
- A **holiday** schedule to indicate no shifts are active during the time window

### Shift Pattern-Entity Assignments

An entity with the Can Schedule Shifts capability can be linked to regular shift patterns. Any entity can be assigned to an overtime or holiday shift pattern to indicate exceptions to the regular shift pattern.

Once an entity is assigned to a shift pattern, the shift schedules in the shift pattern will apply to all of its child entities unless a child is assigned a different shift pattern.

If there is no linkage between an entity and a shift pattern, then that entity will not be considered for a shift change.

### Parent and Child Entities Should Be in the Same Time Zone

An entity that is capable of scheduling shifts and its child entities are expected to be in the same time zone. This is because when the entity that is changing its shift, the shift change will also be applied to the child entities that are inheriting the parent's shift pattern.

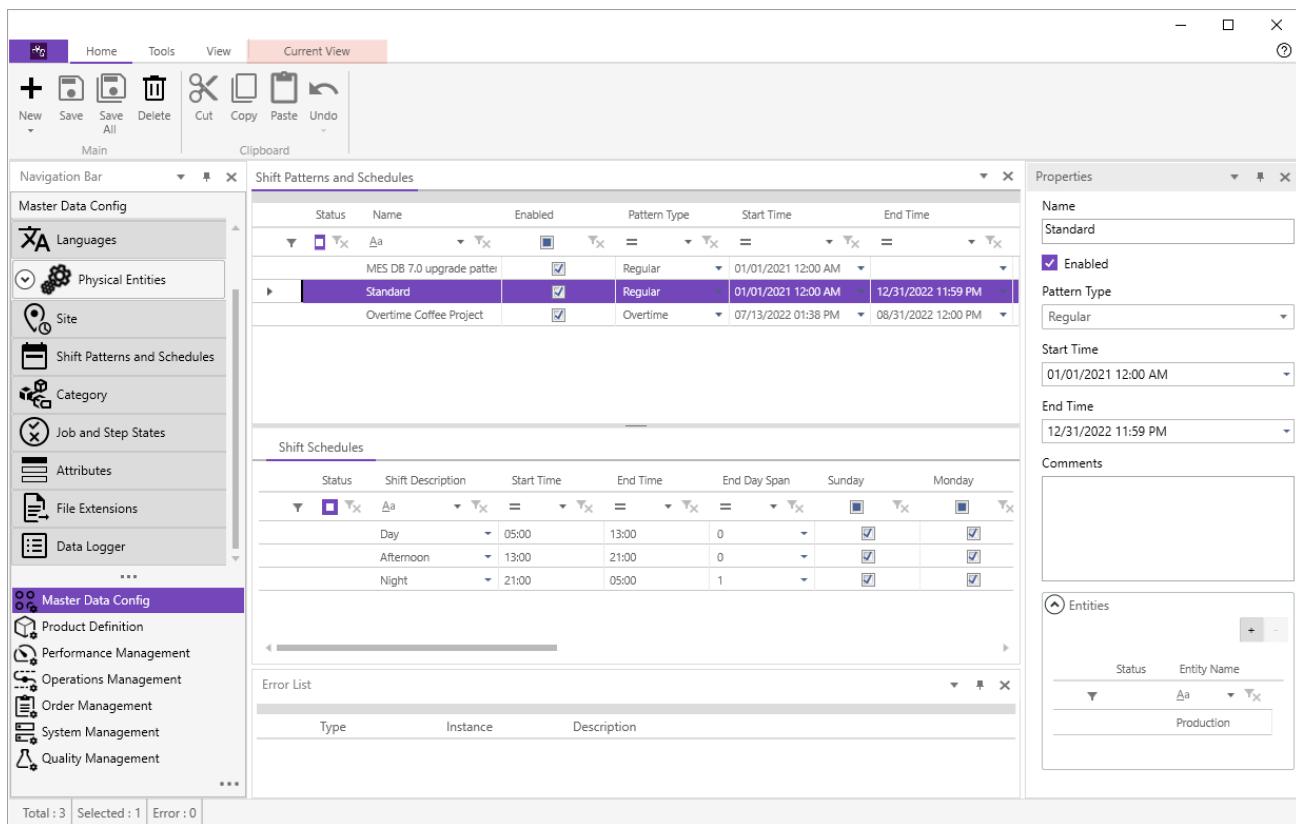
### Shift Pattern Configuration

Because you assign entities to a shift pattern, you should create entities that can schedule shifts before creating shift patterns. See [Creating a Physical Entity](#).

By default, the **Shift Patterns and Schedules** module is grouped under the **Master Data Config** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Shift Patterns and Schedules** module, the following appear in its workspace tab:

- A list of all the existing shift patterns
- For the selected regular or overtime shift pattern, a list of its shifts
- For the selected shift pattern, in the **Entities** group in the **Properties** window, a list of the entities assigned to the shift pattern



## Creating a Shift Pattern

### To create a shift pattern

1. Open or go to the **Shift Patterns and Schedules** tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Shift Pattern**.
- A new shift pattern is added.
3. In the new shift pattern's **Properties** window, complete the properties described in [Shift Pattern Properties](#).
4. Save the changes.

## Shift Pattern Properties

### Name

A name for the shift pattern.

### Enabled

Determines whether the shift pattern is active or not.

### Pattern Type

- **Regular** For standard shift schedules. The shift pattern is recurring within the pattern's effective time period. A regular shift pattern also includes assigned shifts.
- **Overtime** For ad hoc overtime schedules. Overtime shifts are in addition to regular work shift schedules. They will override regular shift schedules if their time periods overlap. The shift pattern is recurring within the pattern's effective time period. An overtime shift pattern also includes assigned shifts.
- **Holiday** To block out a single period of time from shifts in regular and overtime shift patterns. A holiday shift pattern is not recurring and doesn't have assigned shifts. No shift activity will be recorded during a holiday period for entities assigned to the shift pattern. In shift schedules they appear as "No Shift."

#### *Start and End Time*

Specifies the time period when the shift pattern is in effect. See [About Shift Pattern Effective Dates](#).

Enter times using the standard format for your locale.

For regular shift patterns, the end time can be blank. A regular shift pattern with no end time defined is applicable forever (i.e., it never ends) and repeats week after week.

#### *Comments*

Comments about the shift pattern. These comments will appear in the shift\_history table.

#### *Entities*

Use this panel to assign entities to or unassign entities from shift patterns (see [Assigning Entities to Shift Patterns](#)).

## Managing Shift Patterns

### To edit a shift pattern

- Select the shift pattern in the list and then modify the properties in the **Properties** window as needed (see [Shift Pattern Properties](#)).

### To copy a shift pattern

You can copy an existing shift pattern to use it as the basis for a new shift pattern.

1. Put a copy of the shift pattern on the clipboard using one of the following methods:
  - Select the shift pattern and press the **Ctrl-C** keys.
  - Right-click the shift pattern and on the context menu click **Copy**.
  - Select the shift pattern. On the ribbon, go to the **Home** tab and click **Copy**.
2. Paste the copy of the shift pattern by doing one of the following:
  - Right-click the shift pattern list area and on the context menu click **Paste**.
  - Click in the shift pattern list area and press the **Ctrl-V** keys.
  - On the ribbon, go to the **Home** tab and click **Paste**.

A copy of the shift pattern is added to the list.

With the copy of the shift pattern still on the clipboard, you can continue to use the Paste function to add copies of it.

## Delete a shift pattern

1. Do one of the following:
  - Select the shift pattern and press the **Delete** key.
  - Right-click the shift pattern and on the context menu click **Delete**.
  - On the ribbon, go to the **Home** tab and click **Delete**.
- You are prompted to confirm the deletion.
2. Click **Yes** to continue with the deletion.

## About Shift Pattern Effective Dates

## What Shift Pattern Is In Effect

The precedence of what active shift pattern is in effect is determined by the following rules:

1. A holiday shift will override that portion of any active regular or overtime shifts that overlaps with the time period of the holiday shift.
2. An overtime shift will override that portion of any active regular shift that overlaps with the time period of the overtime shift. The overtime shift will be used for any job activity on the entity during that overlap time.
3. If none of the above conditions exist, then the current shift of the active regular shift pattern for the entity will be in effect.

Regarding an entity that has more than one enabled shift pattern of the same type whose time periods overlap:

- The shift pattern with the most recent start time will be in effect.
- If any of these shift patterns have the same start time, then the pattern whose name is first in alphabetical order will be in effect.

## When the First Shift for a New Effective Shift Pattern Starts

On the exact day a new shift pattern becomes enabled and in effect, there won't be a new shift generated from midnight until the next defined shift. In this scenario the system will continue to use the last determined shift from the previous shift pattern (if one existed). For example, if there are shifts defined for each day of the week starting at 06:00 and 18:00, on the effective date the 06:00 shift will be the first shift recorded. There will not be a shift recorded at midnight of the effective date from the 18:00 shift.

## Multiple Shift Patterns Example

The shift pattern **Start Date** and **End Date** properties allows you to make calendar-based shift pattern assignments to entities.

For example, say additional shifts are required annually during a location's higher production schedule from June 1 through August 31 and the current year is 2022.

- Initially, the Standard Production shift pattern's effective date range would be from September 1 2022 to May 31 2023. It would be in effect until the High Production shift pattern's effective date.

- The High Production shift pattern's effective date range would be set from June 1 2023 to August 31 2023.
- To have the Standard Production shift pattern start again on September 1 2023, sometime during the High Production period you would set the Standard Production shift pattern's effective start date to that date.
- To have the High Production shift pattern start again on June 1 2024, sometime during the Standard Production period that started on September 1 2023 you would set the Standard Production end date to May 31 2024 and the High Production start date to June 1 2024.

You can also make unplanned shift schedule changes as needed by setting the effective date range for a new or existing shift pattern to the schedule change date range. Once the temporary shift pattern is over (the date passes the end effective date of the temporary shift pattern), the normal shift schedule will resume.

## Adding Shifts

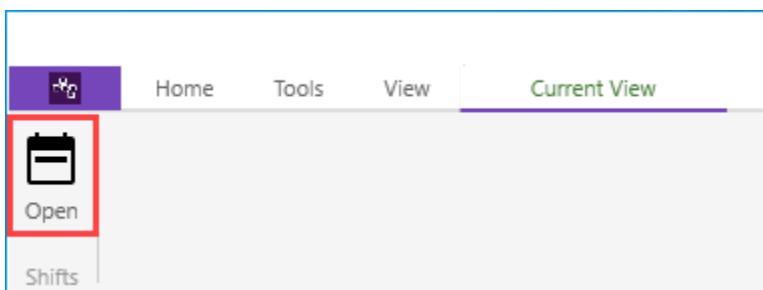
You can use the **Shifts** workspace tab to add shifts to the system. These shifts can then be assigned to shift patterns to create shift schedules. A shift can be assigned to one or more shift patterns.

A shift by itself has two properties: a description and a unique ID that is assigned by the system. When a shift is assigned to a shift pattern in the **Shift Patterns and Schedules** tab, its effective time periods and other properties relative to the shift pattern are defined for that instance of the shift.

Note that shifts can also be added from the **Shift Patterns and Schedules** tab. See [Adding Shifts to a Shift Pattern to Define the Shift Schedule](#).

### To add a shift

1. Open or go to the **Shift Patterns and Schedules** workspace tab.
2. On the ribbon, go to the **Current View** tab and click **Open**.



The **Shifts** tab appears.

Shift Patterns and Schedules Shifts		ID
Status	Description	
▼	Day	1
	Afternoon	2
	Night	3
	Overtime Monday Evening	4
	Morning	5
	Overtime Tuesday Evening	6
	Overtime Wednesday Evening	7
	Evening	8
	Overtime Sunday	9
	Overtime for Coffee Order	10

3. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Shift**.

A new shift is added.

4. Enter a description for the shift.
5. Save the changes.

### To delete a shift

1. Remove the shift from any shift patterns to which it is currently assigned. See [Managing Shifts Added to a Shift Pattern](#).
  2. From the **Shifts** workspace tab, do one of the following:
    - Select the shift and press the **Delete** key.
    - Right-click the shift and click **Delete**.
    - Select the shift. On the ribbon, go to the **Home** tab and click **Delete**.

You are prompted to confirm the deletion.
  3. Click **Yes** to continue with the deletion.
- The shift is deleted.

The shift is removed from the **Shifts** tab. However, it is retained in the MES database to keep its historical data.

Note that you can create a new shift using the same name, as the new shift will have a unique ID to differentiate it in the database from the deleted shift with the same name.

If a shift was still assigned to a shift pattern when it was deleted, the shift entry on the pattern's Shift Schedule list on the **Shift Patterns and Schedules** tab will remain in the list. However, the shift description entry will be

blank, as shown below. You should either:

- Remove this shift entry from the shift pattern.
- Select another shift for the entry.
- Enter a name to create a new shift for the entry.

Status	Name	Enabled	Pattern Type	Start Time	End Time	Comments
	MES D8 7.0 upgrade pattern -	<input type="checkbox"/>	Regular	01/01/2021 12:00 AM	05/21/2022 06:00 AM	
	Coffee Project Overtime	<input checked="" type="checkbox"/>	Overtime	05/16/2022 10:00 PM	05/21/2022 06:00 AM	
	Low Production Shift	<input type="checkbox"/>	Regular	04/03/2022 12:00 PM	07/31/2022 12:00 PM	
	High Production Shifts	<input type="checkbox"/>	Regular	08/01/2022 02:00 AM	12/19/2022 02:00 AM	
	Standard Production Shifts	<input checked="" type="checkbox"/>	Regular	01/03/2022 02:00 AM	04/03/2022 12:00 PM	
	Thanksgiving	<input checked="" type="checkbox"/>	Holiday	11/23/2022 10:00 PM	11/27/2022 10:00 PM	

Status	Shift Description	Start Time	End Time	End Day Span	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		22:00	23:30	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>					

## Adding Shifts to a Shift Pattern to Define the Shift Schedule

You add shifts to a shift pattern to define the shift schedule for that pattern.

Shifts can be added to regular and overtime shift patterns, but not to holiday shift patterns.

1. Select the shift pattern.
2. Do one of the following:
  - Right-click in the **Shift Schedules** tab and click **Add**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Shift Schedule**.

A new shift is added to the **Shift Schedules** tab.

3. In the new shift's **Properties** window, complete the properties described in [Shift Properties When Added to a Shift Pattern](#).
4. Save the changes.

### Shift Properties When Added to a Shift Pattern

#### Shift Description

A description of a shift that is to be assigned or has been assigned to the shift schedule. You can select an existing shift or manually enter a description to add a new shift. If you add a new shift, it will also be added to the list in the **Shifts** tab.

#### Start and End Time

Specifies the time period for the shift.

- Times must be entered using the 24-hour format.

- Shift time periods can't overlap with other shifts in the shift pattern.
- Using the **End Day Span** property value, a shift can span over 2 to 7 days.

**Note:** Shift history records are generated based on the entity's local time. During the end of daylight savings time when clocks are moved back one hour, the local time for the hour will occur twice. If a shift schedule is configured to occur during this hour, the first time will generate a shift change, but the second time will update the shift history record to the latest time. Ultimately, the shift history table will only show the final shift change and not the intermediate change. The recommendation is to not define shift schedules that will fall in the middle of the hour when daylight savings time ends.

#### *End Day Span*

For a shift that spans one or more days, this property specifies the number of days beyond the start day of the day the shift ends. A shift can span up to 6 additional days. If the shift does not span into another day, set the value to 0.

For example, say a shift begins at 20:00 on Monday and ends at 04:00 on Tuesday. To implement this shift, you would set the **End Day Span** to 1 to indicate that the time period spans over to the next day. If the time period starts on Monday and ends on Wednesday, you would set **End Day Span** to 2, and so on.

#### *Days of the Week*

The days of the week to which the shift applies.

#### *Break1 to Break3*

These properties allow you to define up to 3 breaks in the shift (e.g., for morning, lunch, and afternoon breaks). Times must be entered using the 24-hour format and must be within the shift time period.

Break time periods are not included in shift time calculations.

#### *User Defined Shift\_Schedule spare 1 to 6*

User-defined information about the shift. These properties are for configuration information only. They are not copied to shift\_history table.

### Managing Shifts Added to a Shift Pattern

You can edit, copy, and remove shifts that have been added to a shift pattern in the **Shift Patterns and Schedules** workspace tab.

#### To edit the properties of an added shift

- Select the shift in the **Shift Schedules** tab and then modify its properties in the **Properties** window as needed (see [Shift Properties When Added to a Shift Pattern](#)).

#### To copy an added shift

You can copy an added shift to use it as the basis for adding another shift to the pattern.

- Right-click the shift and on the context menu select **Copy**.
- Right-click in the **Shift Schedules** tab and press **Ctrl-V**.

A copy of the shift is added to the list. Change its properties as needed.

With the copy of the shift still on the clipboard, you can continue to use the Paste function to add copies of it.

## To remove an added shift from the shift pattern

1. Right-click the shift and on the context menu select **Delete**.

You are prompted to confirm the deletion.

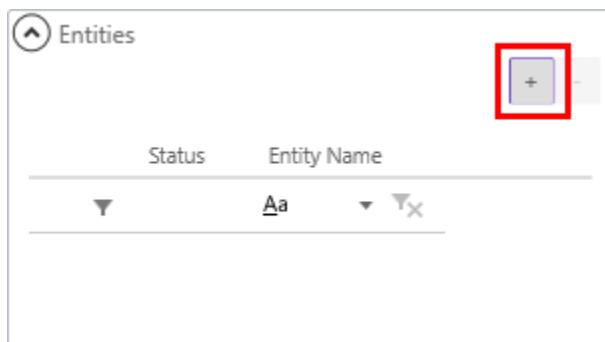
2. Click **Yes** to continue with the deletion.

The shift is no longer listed in the shift pattern. However, the shift still exists in the system and will still be listed in the **Shifts** tab.

## Assigning Entities to Shift Patterns

When an entity is assigned to a shift pattern, that shift pattern is inherited by its child entities unless a child entity has been assigned to a different shift pattern. To simplify entity assignments, you should assign only entities at the top of an entity hierarchy to a shift pattern. This will allow you to manage only one shift pattern for a group of entities that share the same shift requirements.

1. Select the shift pattern.
2. In the **Properties** window, open the **Entities** group.
3. Click the + button.

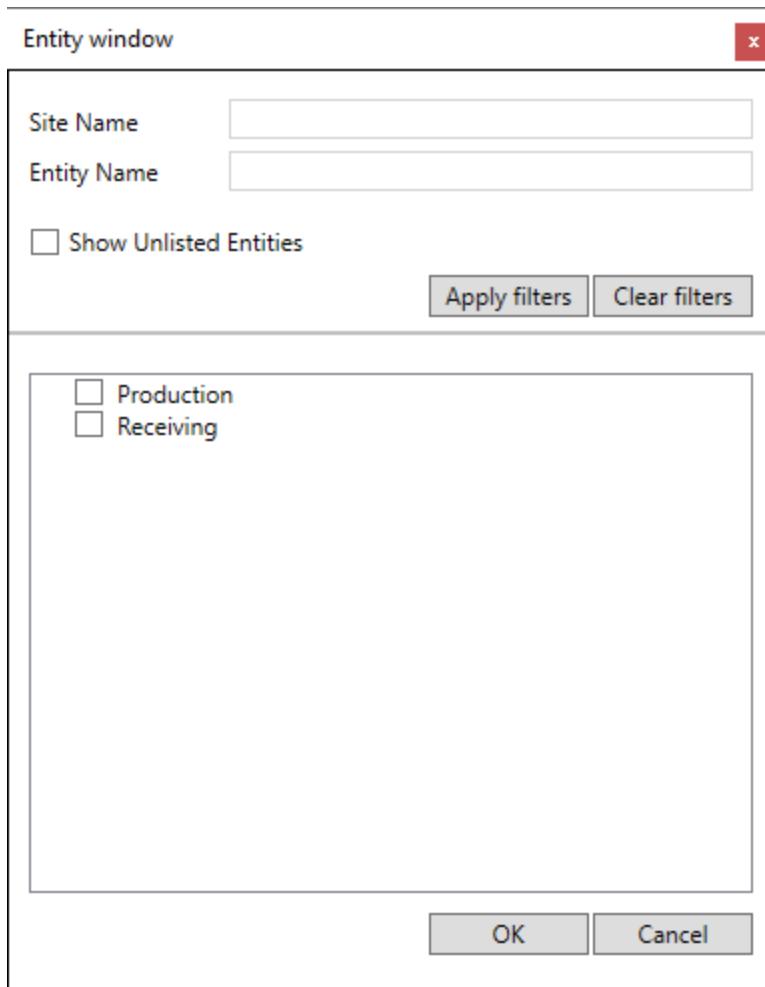


The **Entity** dialog appears. In this dialog you choose which entities to assign to the shift pattern. For a regular shift pattern, only entities that have the capability to schedule shifts will be included for selection. For an overtime or holiday shift pattern, any entities that can schedule shifts or that have a parent entity that can schedule shifts will be included for selection.



4. If needed, enter filter criteria in the **Site Name** and **Entity Name** fields (partial matches are supported). Otherwise, to list all eligible entities, leave these fields blank.
5. (Optional) To show storage entities that have been marked as unlisted, select the **Show Unlisted Entities** option.
6. Click **Apply Filters**.

The matching entities are listed.



7. Select the entities to be assigned and click **OK**.

The entities are added to the list in the **Entities** group.

Entities	
Status	Entity Name
▼	Aa ▼ ▷X
✳	Production

8. Save the changes.

### Unassigning Entities from a Shift Pattern

1. Select the shift pattern.
2. In the **Entities** group on the **Properties** window, select the entity.
3. Click the – button.

You are prompted to confirm the deletion.

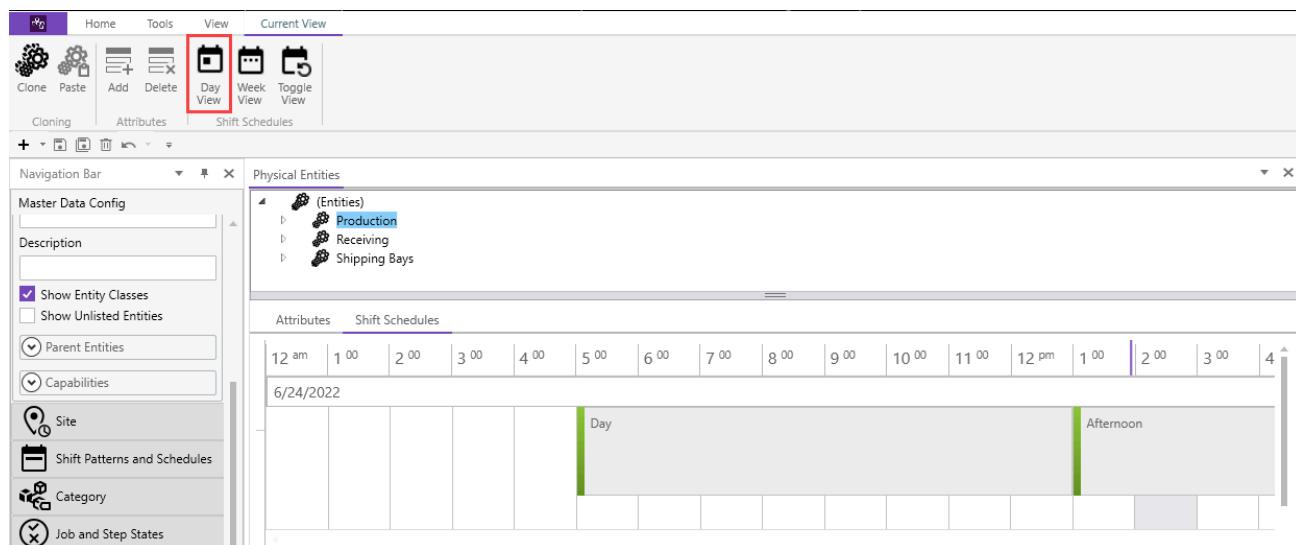
4. Click **Yes**.
5. Save the changes.

## Viewing the Shift Schedule for an Entity

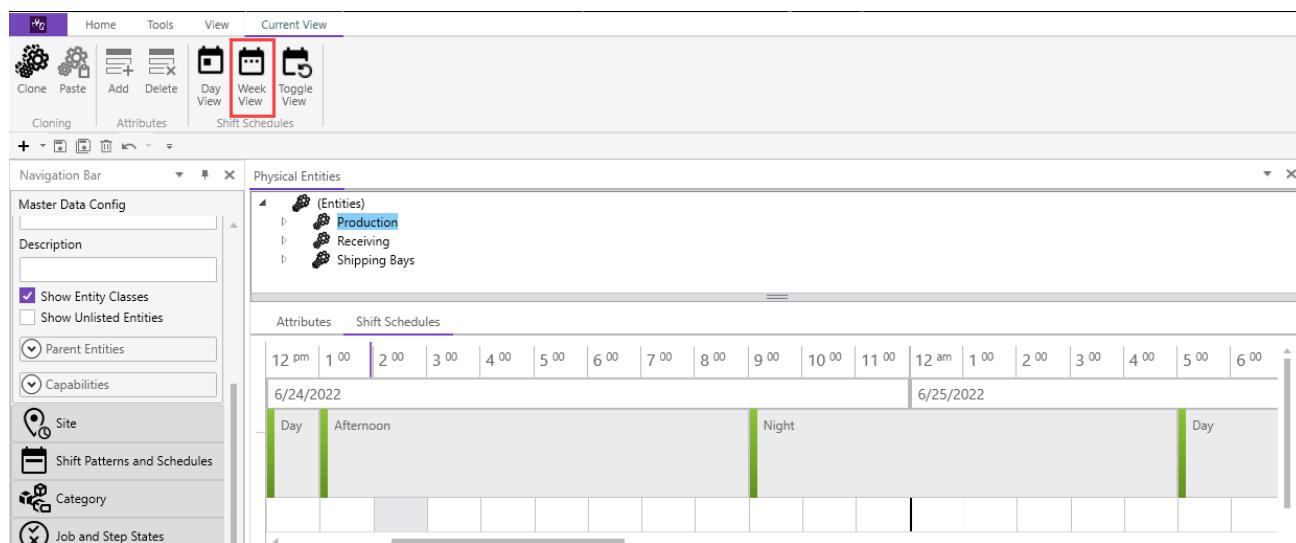
On the **Shift Schedules** tab of the **Physical Entities** workspace tab, for the selected entity you can view the shift schedule for today or the next 7 days.

On the ribbon, you can use the **Shift Schedules** buttons on the **Current View** tab to change the scope and format of the view:

- The **Day View** shows today's schedule in a timeline format.



- The **Week View** shows the next 7 days schedule in a timeline format.



- The **Toggle View** toggles the format of the next 7 days schedule between the timeline format shown above and the calendar format shown below.

The screenshot shows the AVEVA Manufacturing Execution System interface. The top navigation bar includes Home, Tools, View, and Current View. Under View, there are icons for Day View, Week View, and Shift Schedules, with 'Shift Schedules' highlighted by a red box. The main area is titled 'Physical Entities' and shows a tree structure under '(Entities)' with Production, Receiving, and Shipping Bays expanded. On the left, a 'Navigation Bar' pane lists various entity types: Master Data Config, Description, Show Entity Classes (checked), Show Unlisted Entities, Parent Entities, Capabilities, Site, Shift Patterns and Schedules, Category, Job and Step States, Attributes, File Extensions, Data Logger, and Master Data Config. The 'Shift Patterns and Schedules' option is also listed here. Below the navigation bar is a 'Shift Schedules' grid for the week of June 24-28, 2022. The grid shows five columns for each day from 6/24 to 6/28. Each column has a header row with time slots from 12 am to 9:00 PM. The grid is divided into three vertical sections: Night shifts (9:00 PM - 5:00 AM), Day shifts (5:00 AM - 6:00 PM), and Night shifts (6:00 PM - 9:00 PM). The days are labeled 6/24/2022, 6/25/2022, 6/26/2022, 6/27/2022, and 6/28/2022.

## Shift Pattern Examples

The following topics provide examples of the three types of shift patterns.

### Regular Shift Patterns

The following examples show how you would set up three shift patterns to accommodate shifts required for three levels of production.

### Standard Production

Standard production requires three shifts each weekday, but no shifts on weekends. The work week starts Monday at 06:00 and ends Saturday at 06:00.

Shift Patterns and Schedules							
Status	Name	Enabled	Pattern Type	Start Time	End Time	Comments	
▼	MES DB 7.0 upgrade pattern - 1	<input type="checkbox"/>	Regular	01/01/2021 12:00 AM	▼		▼
▼	Coffee Project Overtime	<input checked="" type="checkbox"/>	Overtime	05/16/2022 10:00 PM	▼	05/21/2022 06:00 AM	▼
▼	Low Production Shifts	<input type="checkbox"/>	Regular	04/03/2022 12:00 PM	▼	07/31/2022 12:00 PM	▼
▼	High Production Shifts	<input type="checkbox"/>	Regular	08/01/2022 02:00 AM	▼	12/19/2022 02:00 AM	▼
▶	<b>Standard Production Shifts</b>	<input checked="" type="checkbox"/>	Regular	01/03/2022 02:00 AM	▼	04/03/2022 12:00 PM	▼
▼	Thanksgiving	<input checked="" type="checkbox"/>	Holiday	11/23/2022 10:00 PM	▼	11/27/2022 10:00 PM	▼

Shift Schedules													
Status	Shift Description	Start Time	End Time	End Day Span	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Shift	
▼	Morning	06:00	14:00	0	▼	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
▼	Evening	14:00	22:00	0	▼	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
▼	Night	22:00	23:59	0	▼	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					

## High Production

High production requires three shifts each day of the week.

Shift Patterns and Schedules							
Status	Name	Enabled	Pattern Type	Start Time	End Time	Comments	
▼	MES DB 7.0 upgrade pattern - 1	<input type="checkbox"/>	Regular	01/01/2021 12:00 AM	▼		▼
▼	Coffee Project Overtime	<input checked="" type="checkbox"/>	Overtime	05/16/2022 10:00 PM	▼	05/21/2022 06:00 AM	▼
▼	Low Production Shifts	<input type="checkbox"/>	Regular	04/03/2022 12:00 PM	▼	07/31/2022 12:00 PM	▼
▶	<b>High Production Shifts</b>	<input type="checkbox"/>	Regular	08/01/2022 02:00 AM	▼	12/19/2022 02:00 AM	▼
▼	Standard Production Shifts	<input checked="" type="checkbox"/>	Regular	01/03/2022 02:00 AM	▼	04/03/2022 12:00 PM	▼
▼	Thanksgiving	<input checked="" type="checkbox"/>	Holiday	11/23/2022 10:00 PM	▼	11/27/2022 10:00 PM	▼

Shift Schedules													
Status	Shift Description	Start Time	End Time	End Day Span	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Shift	
▼	Morning	06:00	14:00	0	▼	<input checked="" type="checkbox"/>							
▼	Evening	14:00	22:00	0	▼	<input checked="" type="checkbox"/>							
▼	Night	22:00	06:00	1	▼	<input checked="" type="checkbox"/>							

## Low Production

Low production requires two shifts each weekday, with no weekday night shifts and no shifts on weekends. The work week starts Monday at 06:00 and ends Friday at 22:00.

Shift Patterns and Schedules						
Status	Name	Enabled	Pattern Type	Start Time	End Time	Comments
▼	MES DB 7.0 upgrade pattern - 1	<input type="checkbox"/>	Regular	01/01/2021 12:00 AM	▼	▼
▼	Coffee Project Overtime	<input checked="" type="checkbox"/>	Overtime	05/16/2022 10:00 PM	▼	05/21/2022 06:00 AM
▶	<b>Low Production Shifts</b>	<input type="checkbox"/>	Regular	04/03/2022 12:00 PM	▼	07/31/2022 12:00 PM
	High Production Shifts	<input type="checkbox"/>	Regular	08/01/2022 02:00 AM	▼	12/19/2022 02:00 AM
	Standard Production Shifts	<input checked="" type="checkbox"/>	Regular	01/03/2022 02:00 AM	▼	04/03/2022 12:00 PM
	Thanksgiving	<input checked="" type="checkbox"/>	Holiday	11/23/2022 10:00 PM	▼	11/27/2022 10:00 PM

Shift Schedules													
Status	Shift Description	Start Time	End Time	End Day Span	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Shift	
▼	Morning	06:00	14:00	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>						
	Evening	14:00	22:00	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>						

## Overtime Shift Pattern

The following example shows an overtime shift pattern that is in effect for one week in May and has one night shift for Monday through Friday.

Shift Patterns and Schedules						
Status	Name	Enabled	Pattern Type	Start Time	End Time	Comments
▼	MES DB 7.0 upgrade pattern - 1	<input type="checkbox"/>	Regular	01/01/2021 12:00 AM	▼	▼
▼	<b>Coffee Project Overtime</b>	<input checked="" type="checkbox"/>	Overtime	05/16/2022 10:00 PM	▼	05/21/2022 06:00 AM
	Low Production Shifts	<input type="checkbox"/>	Regular	04/03/2022 12:00 PM	▼	07/31/2022 12:00 PM
	High Production Shifts	<input type="checkbox"/>	Regular	08/01/2022 02:00 AM	▼	12/19/2022 02:00 AM
	Standard Production Shifts	<input checked="" type="checkbox"/>	Regular	01/03/2022 02:00 AM	▼	04/03/2022 12:00 PM
	Thanksgiving	<input checked="" type="checkbox"/>	Holiday	11/23/2022 10:00 PM	▼	11/27/2022 10:00 PM

Shift Schedules													
Status	Shift Description	Start Time	End Time	End Day Span	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Shift	
▼	Overtime for Coffee Order	22:00	23:30	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>						

## Holiday Shift Pattern

The following example shows a holiday shift pattern that is in effect for four days. Holiday shift patterns do not have shifts assigned to them.

Shift Patterns and Schedules							
Status	Name	Enabled	Pattern Type	Start Time	End Time	Comments	
<input type="checkbox"/>	MES DB 7.0 upgrade pattern - 1	<input type="checkbox"/>	Regular	01/01/2021 12:00 AM			
<input checked="" type="checkbox"/>	Coffee Project Overtime	<input checked="" type="checkbox"/>	Overtime	05/16/2022 10:00 PM	05/21/2022 06:00 AM		
<input type="checkbox"/>	Low Production Shifts	<input type="checkbox"/>	Regular	04/03/2022 12:00 PM	07/31/2022 12:00 PM		
<input type="checkbox"/>	High Production Shifts	<input type="checkbox"/>	Regular	08/01/2022 02:00 AM	12/19/2022 02:00 AM		
<input checked="" type="checkbox"/>	Standard Production Shifts	<input checked="" type="checkbox"/>	Regular	01/03/2022 02:00 AM	04/03/2022 12:00 PM		
<input checked="" type="checkbox"/>	Thanksgiving	<input checked="" type="checkbox"/>	Holiday	11/23/2022 10:00 PM	11/27/2022 10:00 PM		

## Categories

You can use the **Category** module to configure categories. Categories are used with QM specifications and causes.

There are two types of categories:

### Item Categories

Link items to a category so that different items can share the same QM specification. If an item category has been selected in a QM specification, then at run time samples will be collected for an entity that is producing an item in that item category.

### Characteristics and Cause Group Categories for Quality Management

Link cause groups with characteristics. The cause groups that are linked to a characteristic will be the cause groups and causes that are presented to an SPC chart user when they select an SPC chart point to assign a cause for that characteristic's samples.

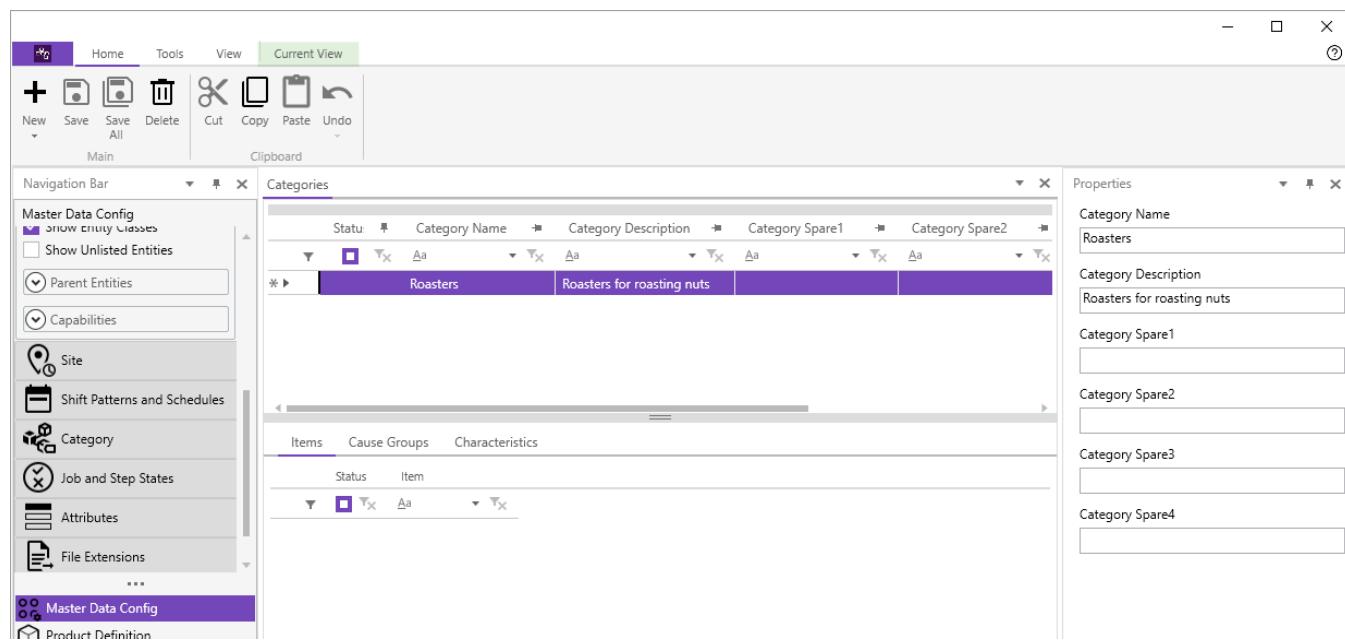
For information about selecting an item category in a QM specification, see [Creating a QM Specification](#).

For information about assigning a cause to a sample characteristic in the SPC chart control, see the topic "Working with the Characteristics Tab" in the *Sample Recording Object User Guide* or help.

## Category Module Layout

By default, the **Category** module is in the **Master Data Config** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Categories** workspace tab, the top pane lists all of the categories. The tabs in the bottom pane list the items, cause groups, and characteristics for the category that is currently selected.



## Creating a Category

You can create a category to group items or to link cause groups to characteristics.

You must have the privileges to edit categories.

### To create a category

1. Open or go to the **Categories** tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Category**.

A new category is added.

3. In the new category's **Properties** window, complete the following settings:

#### Category Name

A unique name for the category.

#### Category Description

A brief description for the category.

#### Category Spare1–Spare4

User-defined information about the category.

4. Save the changes.

An error message appears if the category cannot be created. Modify the category, as needed, to correct the error.

## Linking Items to an Item Category

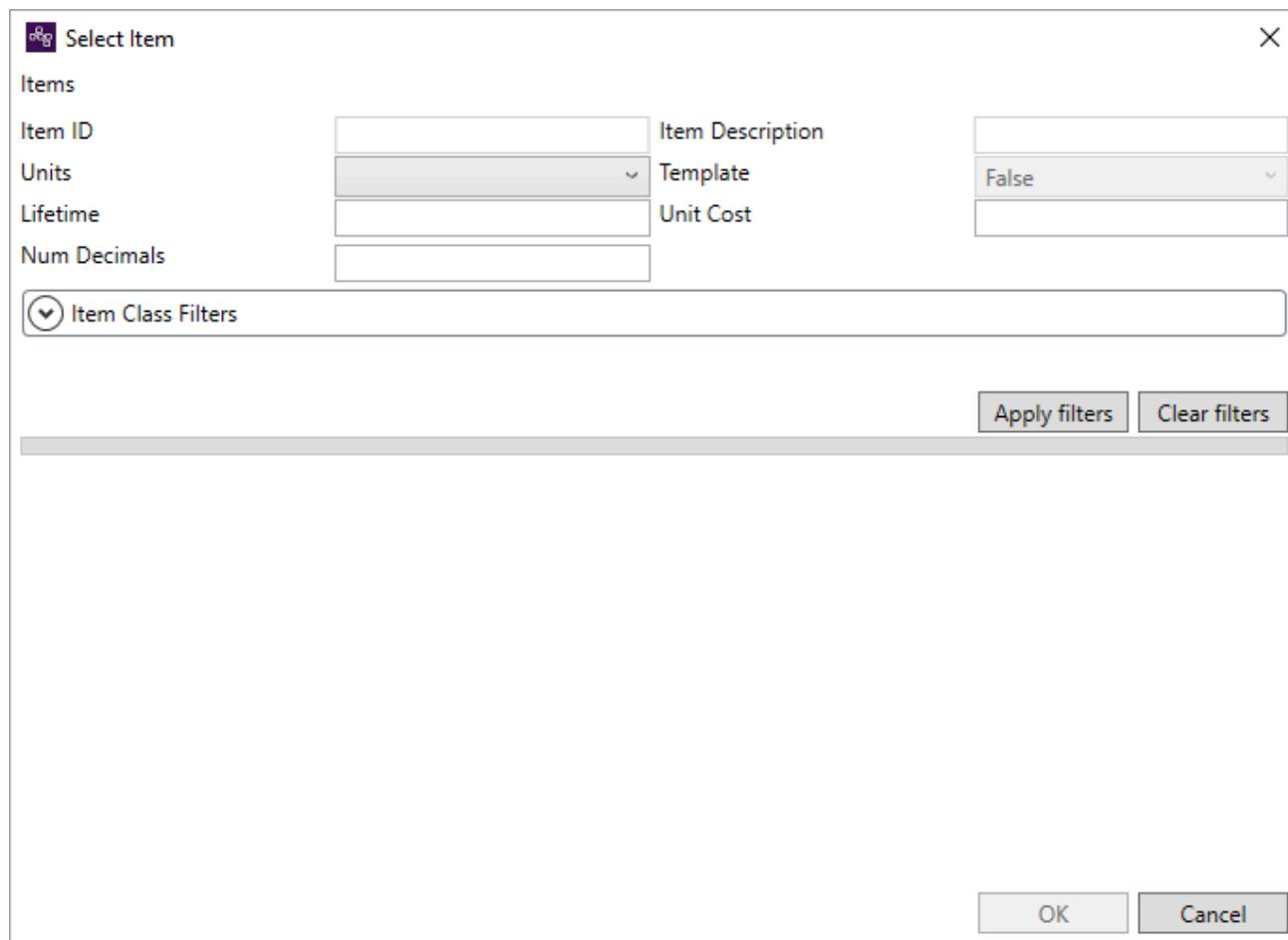
An item is a material that is produced or consumed in MES. An item can belong to multiple categories.

It is recommended that you use a given category to only link items or to only link cause groups to characteristics.

### To link items to a category

1. Select the category to which you want to assign the items.
2. In the bottom pane, go to the **Items** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add Link**.
  - On the ribbon, go to the **Current View** tab and in the **Items** group click **Add Link**.

The Select Item dialog box appears.



4. Optionally enter filter criteria to filter the list of items from which you want to choose or leave the criteria blank to list all available items.
5. Click **Apply filters**.

The items that match the filter criteria are listed.

Select Item

Items

Item ID		Item Description	
Units		Template	
Lifetime		Unit Cost	
Num Decimals			

Item Class Filters

Apply filters    Clear filters

Select Item	Item	Item Class
<input type="checkbox"/>	BMX-BBQ(Bag of Mixed Nuts - BBQ)	Finished Goods(Finished goods)
<input type="checkbox"/>	MTL-DEV(Metal device)	Finished Goods(Finished goods)
<input type="checkbox"/>	FMX-BBQ(Flavored Mixed Nuts - BBQ)	WIP Materials(Intermediate materials)
<input type="checkbox"/>	RMX-BLK(Roasted Mixed Nuts)	WIP Materials(Intermediate materials)

OK    Cancel

Select Item	Item	Item Class
<input type="checkbox"/>	BMX-BBQ(Bag of Mixed Nuts - BBQ)	Finished Goods(Finished goods)
<input type="checkbox"/>	MTL-DEV(Metal device)	Finished Goods(Finished goods)
<input type="checkbox"/>	FMX-BBQ(Flavored Mixed Nuts - BBQ)	WIP Materials(Intermediate materials)
<input type="checkbox"/>	RMX-BLK(Roasted Mixed Nuts)	WIP Materials(Intermediate materials)

6. Select the items to assign to the category and click **OK**.

The selected items are added to the **Items** tab.

7. Save the changes.

## Linking Cause Groups to Characteristics

Causes can be assigned to characteristic samples. Related causes are organized into cause groups. When a cause group is linked to a characteristic by linking both of them to the same category, an SPC chart user will be able to select from that group's causes when assigning a cause to a sample of that characteristic.

You can link one or more cause groups to one or more characteristics using one category. Also, a cause group or characteristic can be included in multiple categories.

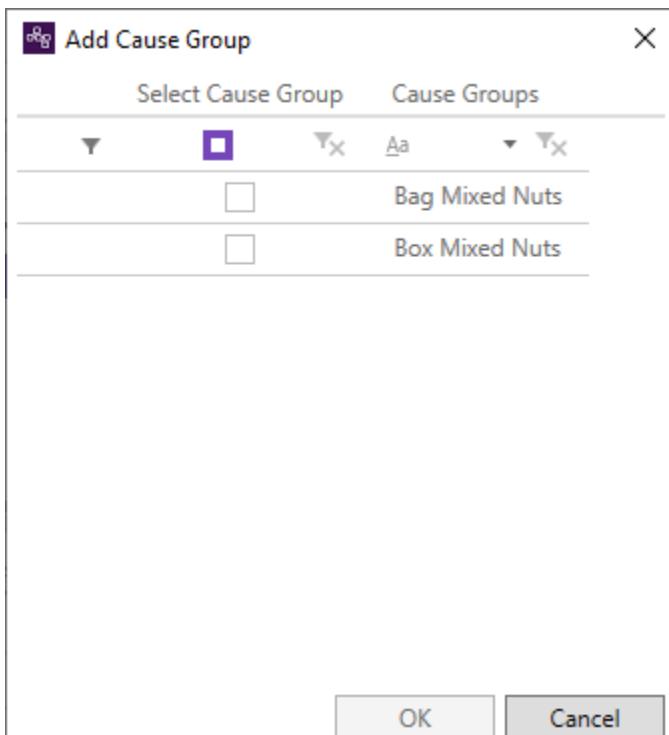
It is recommended that you use a given category to only link items or to only link cause groups to characteristics.

### To link cause groups to characteristics

1. Select the category to which you want to assign a cause group.

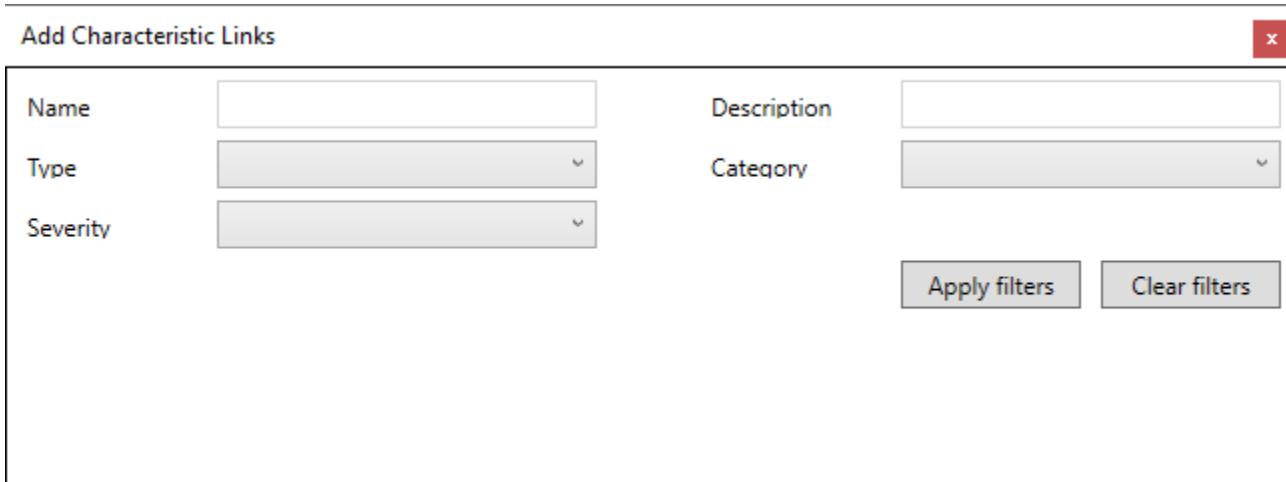
2. In the bottom pane, go to the **Cause Groups** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add Link**.
  - On the ribbon, go to the **Current View** tab and in the **Cause Groups** group click **Add Link**.

The Add Cause Group dialog box appears.



4. Select the cause groups you want to link to characteristics and click **OK**.
5. In the bottom pane, go to the **Characteristics** tab.
6. Do one of the following:
  - Right-click in the tab and on the context menu click **Add Link**.
  - On the ribbon, go to the **Current View** tab and in the **Characteristics** group click **Add Link**.

The **Add Characteristic Links** dialog box appears.



7. Optionally enter filter criteria to list the set of characteristics from which you want to choose or leave the criteria blank to list all characteristics.
8. Click **Apply filters**.

Add Characteristic Links

Name	<input type="text"/>	Description	<input type="text"/>
Type	<input type="text"/>	Category	<input type="text"/>
Severity	<input type="text"/>	<input type="button" value="Apply filters"/> <input type="button" value="Clear filters"/>	
Characteristic Name	Characteristic Description		
<input type="checkbox"/> BagWeight	Weight of Bag		
<input type="checkbox"/> NutQuality	Quality of Roasted Nuts		
<input type="checkbox"/> BagQuality	Quality of the Bags		
<input type="button" value="OK"/> <input type="button" value="Cancel"/>			

9. Select the characteristics to which you want to link the cause groups and click **OK**.
10. Save the changes.

## Deleting Category Links

Item, cause group, or characteristic links in a category can be deleted.

### To delete category links

1. Select the category whose links you want to delete.
2. In the bottom pane, go to the appropriate tab.
3. Do one of the following:
  - Right-click the link entry and click **Delete Link**.
  - On the ribbon, go to the **Current View** tab and in the corresponding group click **Delete Link**.

A confirmation dialog box appears.

4. To continue with the deletion, click **Yes**.

5. Save the changes.

## Deleting Categories

### To delete a category

1. Select the category to delete.
2. Do one of the following:
  - Press the **Delete** key.
  - Right-click category and on the context menu click **Delete**.
  - On the ribbon, go to the **Home** tab and click **Delete**.

A confirmation dialog box appears.

3. To continue with the deletion, click **Yes**.
4. Save the changes.

## Job and Step States

A job represents an operation being performed on an entity, and a step represents a phase of a job. For more information about jobs and steps, refer to [Work Orders and Jobs](#).

Job and step states indicate the status of jobs and steps that are being performed at an entity. For example, a job that has been started is in the Running state, and a step that is waiting to be started is in the Ready state.

The available job and step states are predefined in the system and are identified by a unique code. These predefined states cannot be deleted, and new states cannot be added. However, you can modify the names of the states and their associated color.

You can view and modify the states in the **Jobs and Step States** module. This module is in the **Master Data Config** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Job and Step States** workspace tab, a list of the job and step states is shown.

Status	Code	Name	Color	Type
1	1	NEW	Cyan	Job or Step
2	2	READY	Yellow	Job or Step
3	3	RUNNING	Green	Job or Step
4	4	COMPLETE	Blue	Job or Step
5	5	SUSPENDED	Red	Job
6	6	ONHOLD	Red	Job
7	7	CANCELED	Red	Job
8	8	BYPASSED	Grey	Step
9	9	SUPERSEDED	Red	Step

## Available Job and Step States

There are four states available to both jobs and steps.

### New

A job in the New state indicates that the job is scheduled to be run but is not yet ready to start for one of the following reasons:

- Upstream jobs need to be completed first.
- For the first job of a work order that is assigned to a line, the work order is still in the New state.

Depending on the user's privileges, this state might restrict a user from starting the job in MES Operator. A step in the New state indicates that the step is preceded in the job step sequence by a step that is in the Ready or Running state.

### Ready

The job or step is capable of being started. This indicates that the requirements for running this job or step have been met. For example, this can indicate that an upstream job has met the pieces produced requirement to start this job, or that this is the first job of a work order and all consumable BOM (Bill of Material) components are available.

### Running

The job or step is currently running.

### Complete

The job or step has finished running. For example, for a job this can indicate that required quantity to be produced has been met, that all steps have been completed, and that all required data has been entered.

There are three states available only to jobs.

### Suspended

The job is paused temporarily. For example, a user at a shift change can suspend a job so that the next shift user can log in and continue running the job.

### Onhold

The job is paused indefinitely. For example, this can indicate that there are material or machine issues.

### Canceled

The job was started but then stopped before completion. For example, this can indicate that a customer canceled a work order for a job that had already been scheduled and started running.

There are two states available only to steps, to record the atypical execution of job steps.

### Bypassed

The step within a job was skipped, allowing the next step to run. For example, if a setup step is not needed on a particular machine, it can be bypassed and the next step can be started.

### Superseded

The step within a job was reopened to run again. For example, this can indicate that the produced item needed to be reworked. This would allow the data from the original attempt to be retained and not over-written by the new production data.

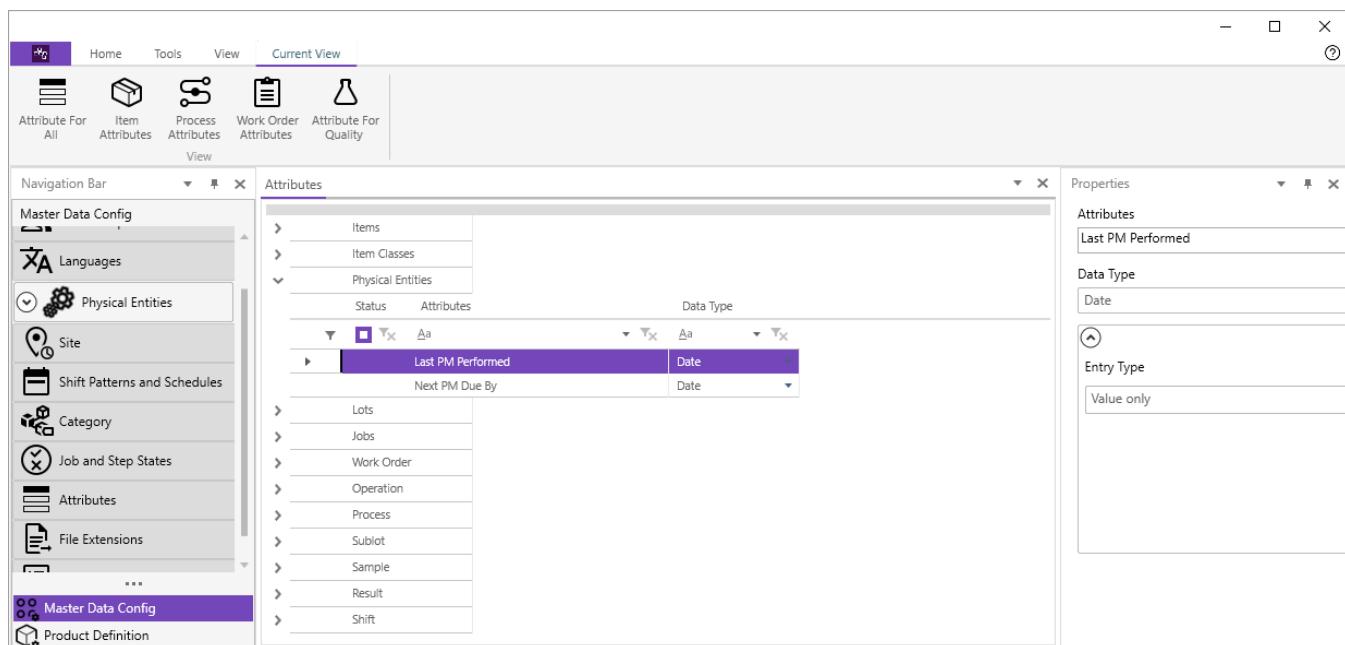
## Modifying a Job or Step State

1. Open or go to the **Job and Step States** workspace tab.
2. Select the state.
3. In the **Properties** window, change the name or color associated with the state.
4. Save your changes.

## Attributes

You can use the **Attributes** module to create and maintain attributes for reporting or conveying information to the plant floor.

You can access the **Attributes** module in the **Navigation Bar** from the **Master Data Config** group or from the **Product, Operations, Order, or Quality Management** groups. For more information on groups and modules, see [Groups and Modules](#).



You can create attributes for the following groups:

- Items
- Item Classes
- Physical Entities
- Lots
- Jobs
- Work Order
- Operation
- Process
- Sublots
- Sample

- Result
- Shifts

Attributes for all objects can be displayed or filtered by selecting the **All**, **Item**, **Process**, **Work Order**, or **Quality** group buttons on the **Current View** tab on the ribbon. The filter buttons show groups as follows:

- Item: Items and Item Classes
- Process: Operations and Processes
- Work Order: Jobs and Work Orders
- Quality: Sample and Result

## Attribute Properties

Attributes have the following properties.

### Attributes

The attribute name. An attribute name must be unique within its group because it identifies the attribute in the data records.

### Data Type

Specifies the type of data that is associated with the attribute. The description of data types is as follows:

- **Currency:** A monetary value.
- **Date:** A date and time value.
- **Drop Down:** The value is selected from a drop-down list. The possible values are defined in the adjoining field. The **Possible Values** pane lists the text entries that are available as value choices for an attribute of drop-down type. The values in the list can be reordered by dragging and dropping a value to a new sequence position in the list.
- **Floating Point:** A decimal value.
- **Integer:** A whole, numeric value.
- **Item Reason:** An item reason is only available for lot attributes. For more information on lot attributes, see [Understanding Lot Attributes](#). The **Limit to reasons in group** box indicates which reasons for the item reason group are available as value choices. If you do not enter a value, no limitations are placed on the item reasons available as value choices.
- **Text:** A user-defined string.

### Entry Type

Specifies whether the user defines a value for the attribute.

- **Value only:** Contains the value assigned to the attribute for this item class. This field is inaccessible if the attribute is defined as a Notes Only type.
- **Notes only:** Contains user-defined information about the attribute for this item class. This field is inaccessible if the attribute was defined as a Value Only type.
- **Value/Notes:** Contains the value assigned to the attribute or the user-defined information about the attribute for this item class.

**In Queue Grid**

Select this check box to display the attribute as a column in the queue. This option is available only for item, job, and work order attributes.

**In Inventory Grid**

Select this check box to display the attribute as a column in the inventory. This option is available only for item and lot attributes.

## Creating an Attribute

The workspace shows the status and the description of existing attributes.

**To create an attribute**

1. Open or go to the **Attributes** workspace tab.
2. Select the attribute type of the attribute that you want to create.
3. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click the attribute type and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Attribute**.

A new attribute is added to that attribute type group.

4. In the new attribute's **Properties** window, complete the following settings:

**Attributes**

The name of the attribute.

**DataType**

The data type for the attribute.

**Entry Type**

Edit information and select the applicable configuration options for the data type selected. For more information on data type, see [Attribute Properties](#).

5. Save the changes.

## Assigning (Linking) Attributes

Assigning, or linking, an attribute allows you to assign values or notes to the following groups:

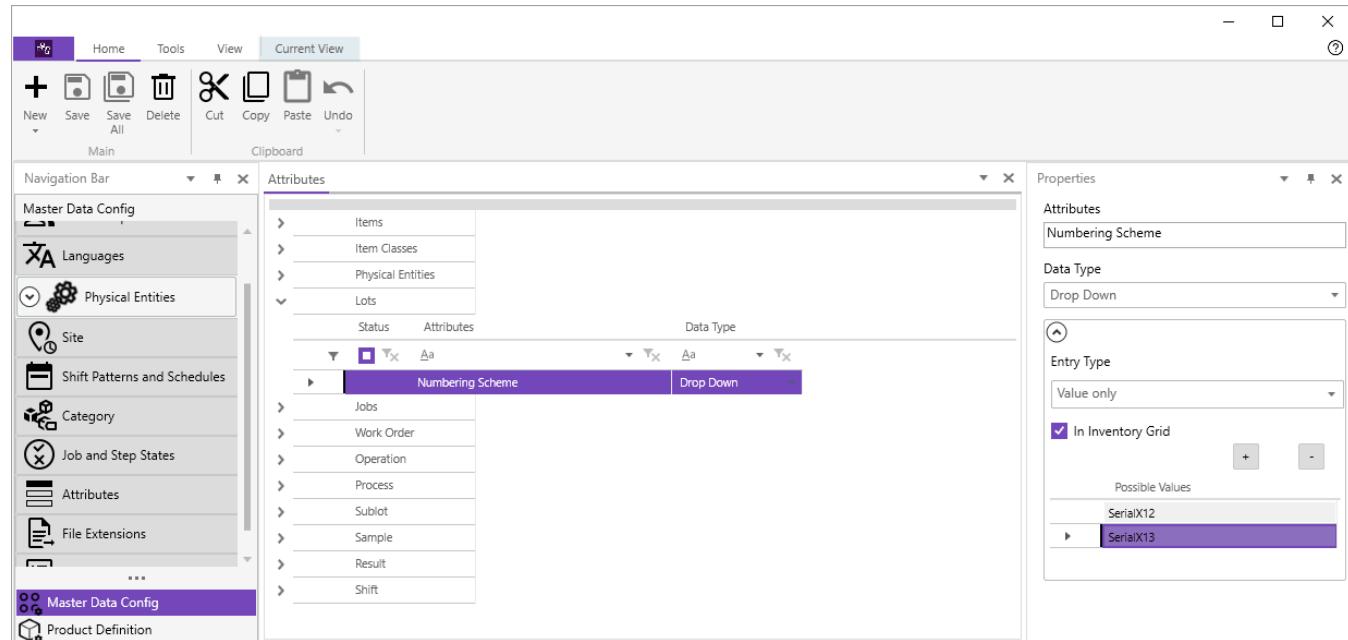
- Items. See [Assigning Attributes to an Item](#).
- Item classes. See [Assigning Attributes to an Item Class](#).
- Entities. See [Assigning Attributes to an Entity](#). Entities can also be assigned attributes in MES Web Portal and using the **Core.EntAttr** class methods in the MES Stateless API.
- Lots. Lots can be assigned attributes from client applications using MES .NET controls, such as MES Operator.
- Jobs. See [Assigning Attributes to a Job](#).
- Work order. See [Assigning Attributes to a Work Order](#).
- Operation. See [Assigning Attributes to a Standard Operation](#) and [Assigning Attributes to an Operation](#).

- Process. See [Assigning Attributes to a Process](#).
- Sublots. Sublots can be assigned attributes using the **Prod.SubLotAttr** class methods in the MES Stateless API.
- Samples. See [Assigning an Attribute to a QM Specification](#).
- Results. See [Assigning an Attribute to a Characteristic](#).
- Shift. Shifts can be assigned attributes using the **Core.ShiftAttr** class methods in the MES Stateless API.

Certain linked attributes are then available based on the definition of the attribute in the **In Queue** (item, job, and work order attributes) or **In Inventory** grids (item and lot attributes).

## Understanding Lot Attributes

Lot attributes are used to implement multiple hold reasons for an item lot. During production, the produced items, organized by lot number, are assigned to an item grade and state through the use of an item reason. This grade and state information is used to determine if that lot meets the defined minimal shipping requirements. At the same time, attributes may be added to the production lot. An attribute of type Item Reason allows the assignment of another grade and state to the same lot. Both grade and state combinations are considered before shipment of an item from which production lot is permitted. If used as a Hold Reason, whenever the Hold situation is corrected, the lot attribute can be changed or removed, thereby allowing the grade and state originally assigned to the lot to take precedence.



For example, a lot can be produced with the item reason of Good Production, which is linked to an item grade of Approved and an item state of Finished Goods. Both of these values have a preference of 1. The lot attribute Hold Reason can be assigned to the lot and given the value of Hold for Customer, which is linked to an item grade of Hold-Good and an item state of Finished Goods. The Hold for Customer state has a preference of 10. If the minimal shipping grade of this item is defined as 2, the lot attribute prevents this lot of the item from being shipped. When the customer is ready for the shipment, the lot attribute can be removed and the item grade of Approved becomes relevant.

## File Extensions

MES facilitates the distribution of online documentation to the shop floor. The system also supports URLs for web-based documentation. For example, files and web pages can include instructions about how to prepare an entity for running a job, checklists when performing preventive maintenance, or details about how to execute an operation or step.

The system supports any file type that can be associated with a program on the client's Windows machine to view, edit, or print files of that type.

The **File Extensions** module is in the **Master Data Config** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **File Extensions** workspace tab, a list of all the existing file extension entries is shown.

The screenshot shows the AVEVA MES software interface. The top navigation bar includes Home, Tools, and View tabs. Below the toolbar, the Navigation Bar displays the Master Data Config group, which contains Language, Physical Entities, Site, Shift Patterns and Schedules, Category, Job and Step States, Attributes, and File Extensions. The File Extensions workspace is open, showing a table of file extensions with columns: Status, Extension, Description, Edit Level, View Level, and Edit Arguments. The table lists .csv (CSV files), .pdf (PDF files), .htm (Web pages), .html (Web pages), and .docx (Word files). To the right of the table is a Properties panel. The properties for .csv are displayed: Extension (.csv), Description (CSV files), Edit Level (1), View Level (1), Edit Arguments, View Arguments, and Print Arguments. The status bar at the bottom indicates 'File Extensions'.

## Objects That Can Be Assigned Files and Web Pages

Files and web pages can be assigned to:

- Entities (see [Adding Files and Web Pages to an Entity](#))
- Folders (see [Directories](#))
- Items (see [Adding Files and Web Pages to an Item](#))
- Operations (see [Adding a File or Web Page to an Operation](#))
- Operation steps (see [Adding Files and Web Pages to an Operation Step](#))
- Work orders (see [Adding Files and Web Pages to a Work Order](#))
- Jobs (see [Adding a File or Web Page to a Job](#))
- Job steps (see [Adding Files and Web Pages to a Job Step](#))
- Job specifications (see [Adding a File or Web Page to a Job Specification](#))
- Entity, BOM, and item specifications that are being added to a operation (See [Adding a File or Web Page to a](#)

(Specification Being Added to an Operation)

## How to Open Files and Web Pages That Are Assigned to an Object

Files and web pages that are assigned to the following objects can be opened in MES Operator:

- Entities
- Entity folders
- Items
- Job steps

To open files and web pages for other objects, and also for those whose files and web pages that can be opened in MES Operator, you can use the following MES Stateful API **Documents** class methods in a custom application:

- **EditFile()**
- **PrintFile()**
- **ViewFile()**

When a user selects a file to view, edit, or print, the default Windows application that is associated with that file type will launch and perform the corresponding operation with the file. URLs will be opened in the default Windows web browser.

## Adding a File Extension

For a file to be viewed, edited, or printed from within MES, its file extension must be added to the system. This can be done in the following ways:

- By manually adding the file extension in the **File Extensions** workspace tab.
- When assigning a file to an MES object, if the file extension has not already been defined, it is automatically added. The extension is determined by the characters that follow the last period in the file name or URL. The file extension can then be viewed and its properties edited in the **File Extensions** workspace tab. By default, the file extension's Edit and View Levels are set to 1, and all other properties are blank.

When adding a file extension, you can manage which users have permission to view or edit files of that file type. This is implemented using the *File edit level* and *File view level* user privileges parameters.

### To add a file extension

1. Open or go to the **File Extensions** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **Add**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New File Extension**.

A new file extension is added.

3. In the new file extension's **Properties** window, complete the property settings.

#### Extension

The file extension, including the leading period. For example, **.docx** would be entered for a Word document. The extension entry is not editable after the file extension definition is first saved.

#### Description

A description of the file type related to this file extension.

#### Edit Level

Defines the minimum *File edit level* value required for a user to edit a file of this type. The user's user group privilege, assigned in MES Client in the **Users Privileges:General** group, must be set to this value or higher.

#### View Level

Defines the minimum *File view level* value required for a user to view a file of this type. The user's user group privilege, assigned in MES Client in the **Users Privileges:General** group, must be set to this value or higher.

#### Edit, View, and Print Arguments

The arguments to be passed to the default application for the file extension.

4. Save your changes.

### To delete a file extension

1. Select the file extension to delete.
2. Do one of the following:
  - Press the **Delete** key.
  - Right-click the file extension and on the context menu click **Delete**.
  - On the ribbon, go to the **Home** tab and click **Delete**.
3. Click **Yes**.

## Data Logger

The Data Logger allows users to collect data related to item production as a work order is fulfilled.

The data logs are configured based on the following structure:

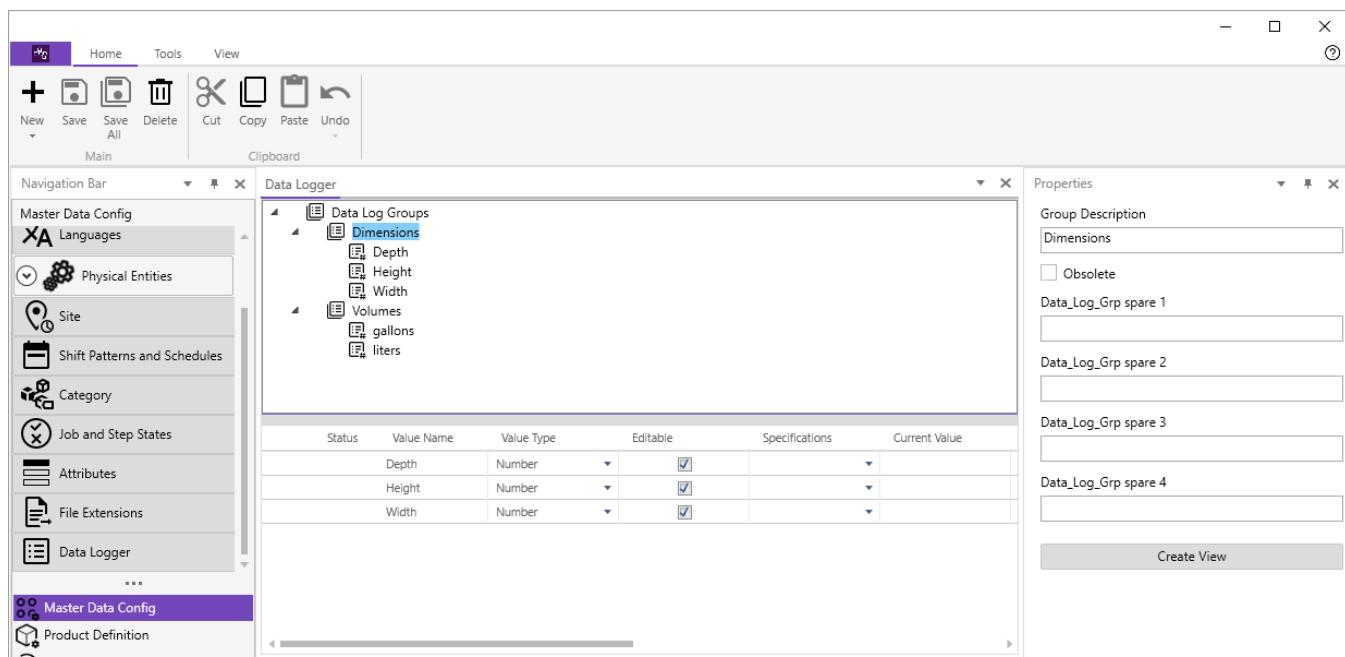
- **Data log groups** represent categories of data. These groups can be assigned to entities, operations, operation steps, jobs, and job steps to allow operators to record data specific to those entities and their activities as a work order is processed.
- **Data log values** are the specific types of data to be collected within each group. For example, if a data log group applies to a process for which dimensions of sample items needs to be recorded, the group would include the data log values Height, Width, and Depth.

During run time, operators can record the actual data values, which are stored as **data logs**.

The Data Logger module defines and organizes the data log values that will be measured during production.

The **Data Logger** module is in the **Master Data Config** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Data Logger** workspace tab, a list of all the existing data log group and data log value entries is shown.



## Adding a Data Log Group

A data log group organizes related data log values that will be collected and stored together in the same data log table.

You must have the *May edit data logging* user privilege to add, edit, and delete data log groups.

### To add a data log group

1. Open or go to the **Data Logger** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New Data Log Group**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Data Log Group**.

The new group is added to the bottom of the list.

3. In the new group's **Properties** window, complete the following settings:

#### Group Description

Describes the grouping of data log values.

#### Obsolete

When selected, indicates the data log group is obsolete. This means it may not be used to collect data or its definition modified.

#### Data\_Log\_Grp spare 1-4

Optional, user-definable fields for this data log group.

4. Save the changes.

You can use the Copy and Paste functions to copy one or more data log groups. You can use the Delete function to delete one or more groups.

## Creating a Database View of a Data Log Group

Database views of a data log group's values and collected data can be created for analysis and reporting.

The view name is **vw\_data\_log\_GroupDescription**. The view will have column names that match the data log value names and the columns are cast to the defined data type of the data log value. Unused values are also returned as strings with the column names **ValueN**. If the group description or a data log value has a space in the name, the space will be removed in the view name and column name.

If changes are subsequently made to the data log values within the group, the view can be recreated. If the group name is changed, a new view will be created with the new name and the existing view will have to be deleted from the database using SQL Server.

You must have the *May edit data logging* user privilege to create data log group views.

### To create or recreate a data log group database view

1. Select the data log group.
2. In the **Properties** window, click the **Create View** button.

A message confirms that the view was created and shows the name of the view.

## Adding a Data Log Value to a Group

A data log group organizes related data log values that will be collected and stored together in the same row of the data log table.

You must have the *May edit data logging* user privilege to add, edit, and delete data log values.

### To add a data log value to a group

1. Open or go to the **Data Logger** workspace tab.
2. Select the group or one of that group's existing data log value entries.
3. Do one of the following:
  - Right-click the group or value entry and on the context menu click **New Data Log Value**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Data Log Value**.

The new value is added to the bottom of the group's list.

4. In the new value's **Properties** window, complete the following settings:

#### Value Name

The name of the data log value. The name should be unique within a data log group so the created view does not have duplicate column names. However, it does not have to be unique across data log groups.

#### Value Type

The type of data measured by this data log value.

- **String**
- **Number**
- **Logical**
- **Datetime**

#### Editable

When selected, allows the data log value to be modified by an operator. This would typically not be

selected only if the data log value is being entered through scripting and an MES API and you wanted to prevent an operator from entering or changing the value.

### Specifications

The global specification to which this data log value is linked. Global specification groups may be defined using the **Create Global Specification Group** option on the context menu of a Spec. Ver. node in the Process window or a Specs node in the Jobs window.

### Current Value

The last measured value for this data log value or defines the upper or lower limit value.

### Data\_Log\_Value spare1-4

Optional, user-definable fields for this data log value.

### Meaning

The purpose of this data log value, in relation to other data log values.

The system allows for defining reasonable limits for data log values that can be used in custom interfaces for recording data records. For more in-depth data collection, refer to the MES Quality characteristics and specifications capabilities.

- **None:** This value is independent of other values; it represents data to be collected.
- **Upper Reasonable Limit:** This value will be used as the Upper Reasonable Limit for the value indicated in the **Meaning To Value Index** field. If the measured value exceeds this limit, a warning is generated by Data Logger.
- **Lower Reasonable Limit:** This value will be used as the Lower Reasonable Limit for the value indicated in the **Meaning To Value Index** field. If the measured value exceeds this limit, a warning is generated by Data Logger.

### Meaning To Value Index

The data log value, belonging to the same data log group, to which this value will be applied as a limit.

## 5. Save the changes.

You can use the Copy and Paste functions to copy one or more data log values to the same data log group or to another group. You can use the Delete function to delete one or more values.

## Assigning Data Log Groups to Enable Data Logging During Production

Once the necessary data log groups and their values have been configured, you can assign the groups to the appropriate entities, operations, operation steps, jobs, and job steps. This allows users to log data for production activities or entities during production.

For information about how to assign the data log groups, see the following topics.

- [Assigning Data Log Groups to an Entity](#)
- [Assigning Data Log Groups to an Operation](#)
- [Assigning Data Log Groups to an Operation Step](#)
- [Assigning Data Log Groups to a Job](#)
- [Assigning Data Log Groups to a Job Step](#)

## Items

You can use the **Items** module to create and maintain an item.

By default, the **Items** module is in the **Product Definition** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

Items are the basic units produced or consumed during production. Items can be referred to as a part, component, piece, and so on in different manufacturing environments.

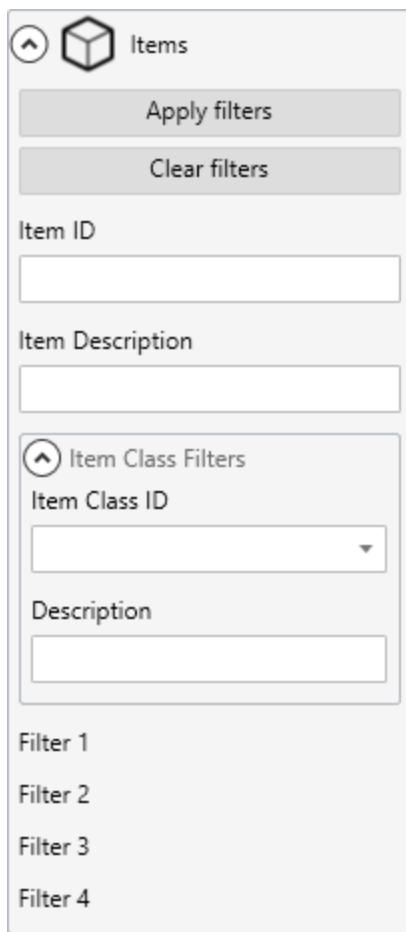
Item ID	Item Class ID	Item Description	Num Decimal
AMD-BLK	Raw Materials	Almonds in Bulk	
BAG-BBQ	Raw Materials	BBQ Mixed Nuts Bag - Empty	
BBQ-FLA	Raw Materials	BBQ Flavoring	
BMX-BBQ	Finished Goods	Bag of Mixed Nuts - BBQ	
CSW-BLK	Raw Materials	Cashews in Bulk	

You must define all products, components, and by-products as items for use in the MES system.

### Opening the Items Workspace Tab

When opening the **Items** workspace tab, the **Apply Filter** function allows you to filter the list of items in the tab to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Product Definition** group open the **Items** section.



2. To not filter the items, don't enter any search terms.

To filter the items, enter search terms in the following available filter options.

#### **Item ID**

Unique ID of the item.

#### **Item Description**

Name or brief description of the item.

#### **Item Class Filters: Item Class ID**

Unique ID of the item class

#### **Item Class Filters: Description**

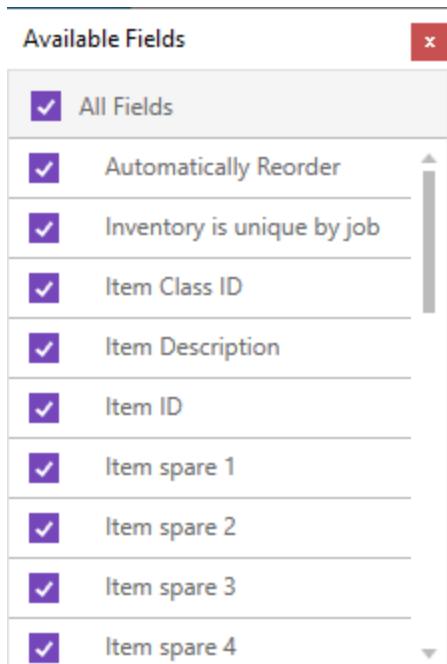
Name or brief description of the item class

3. Click **Apply Filter**.

The **Items** workspace tab opens, listing the items that match the filter search terms.

#### **Showing and Hiding Columns in the Items Workspace Tab Grid**

1. Click the **Available Fields** icon  at the top left of the grid on **Items** workspace tab.  
The **Available Fields** dialog box appears.



2. Select or clear a check box to show or hide a column.
3. Close the dialog box.

## Creating an Item

You can create an item and assign it to an item class. You can also move an item from one class to another and define certifications for an item.

You can associate a file with an item. These files are available to the users of the MES Operator application on the **Folders** tab. You can also assign a certification to an item.

### To create a new item

1. Open or go to the **Items** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Item**.

A **New Item** workspace tab appears for the new item.

3. In the new item's **Properties** window, complete the settings described in [Item Properties](#).
4. Save the changes.

The **New Item** workspace tab closes and the new item is added to the **Items** workspace tab.

You can modify the properties of an existing item in its **Properties** window.

## Item Properties

### General Properties

#### Item ID

A unique ID or name for the item. The item ID identifies the item in the MES data records, so it must be unique and is not editable after the item definition is first saved.

#### Item Class ID

The item class ID to which you want to assign the item.

You can also create a new item class. For more information on creating a new item class, see [Creating an Item Class](#).

#### Item Description

A brief description or a name for the item.

#### Units

The unit of measure (UOM) for the item. UOMs are defined in the **Units of Measure** module. For more information on creating a new UOM, see [Creating a Unit of Measure](#).

#### Num Decimals

The number of decimals allowed when entering quantity of an item.

### BOM

Use the **BOM** tab to create a BOM for the item. See [Creating BOMs for an Item](#).

### Substitutes

Use the **Substitutes** tab to create substitutes for the item. See [Creating an Item Substitute](#).

### Processes Linked to Item

Use the **Processes Linked to an Item** tab to view the processes that can produce the item. See [Viewing the Processes Linked to an Item](#).

### States and Grades

#### Minimum Shippable State

The minimum state of the item, which allows the item to be shipped. For more information on item states, see [Item States](#).

#### Minimum Shippable Grade

The grade for the item. For more information on item grade, see [Item Grades](#).

### Inventory Handling

#### Lifetime

The lifetime of item in number of days. This value is used when receiving shipments in the Inventory Management form of the MES model-driven application content for Work Tasks. For more information, see the Inventory Management form help.

#### Serial Number Level

A serial level for the item. This indicates that the item is serialized. Select **Lot Number** if you want the serial number to be the same as lot number.

#### Lot Number Format

A default string for generating lot numbers.

#### Sub Lot Number Format

A default string for generating sub-lot numbers.

#### Inventory is unique by job

Specifies whether the inventory assigned to a job can be used only with that job. The **Inventory is Unique by Job** check box is disabled if the inventory is not licensed.

## User Defined

#### Item spare 1 to Item spare 4

User-defined information about the item.

You can modify the **Spare** field name in the **Languages** module by editing its language string. For more information on language strings, see [Editing a Language's Strings](#).

## Advanced

#### Unit Cost

The unit cost of the item. Unit cost defines the cost of one unit of the item.

#### Template

- **Actual:** The item is a specific item.
- **Template:** The item can be used as a template or pattern for creating other item.

#### Obsolete

Specifies whether the item is obsolete. This indicates that this item cannot be used in any job or process.

#### Must Complete All Steps

Specifies whether the item must complete all the required steps to complete the job during production. This indicates that all steps defined in production process of the item must be completed and should marked as Complete in the MES Operator application. This is for produced items only.

#### Must Produce Reqd Qty

Specifies whether the required quantity must be produced to complete the job during production. This indicates that the quantity produced must be equal to or greater than the required quantity for a job producing this item to be marked Complete in the MES Operator application. The *Quantity deviation above start quantity* system parameter in MES Client application must be greater than 0% for this to take effect. This is for produced items only. For more information on general system parameters, see the "General" section of the table in [System Parameters Reference](#).

## Notes

Additional information or notes about the item.

## Automatic Reordering

### Min. Inventory Level

The minimum inventory level for the item. Minimum inventory level defines the smallest amount of the item that should be in inventory or currently scheduled to be made through a work order. This is for produced items only.

### Min. Reorder Amount

The minimum amount of the item that can be reordered. Minimum reorder amount defines the smallest amount of the item that should be made or reordered. This is for produced items only.

### Automatically Reorder

Select this check box to have MES Client application create a work order or purchase order for the specified *Min. Reorder Amount* whenever the inventory quantity falls below the *Min. Inventory Level*. If an existing work order is there for this item but its quantity is below the *Min. Reorder Amount*, the new work order amount is the difference between the existing work order amount and the *Min. Reorder Amount*. This is for produced items only.

## Certification

For assigning access certifications to the item.

Only access certifications can be assigned to an item. If an access certification is assigned to an item, any users who have been assigned to the certification and have the required certification level for the item can run a job that produces the item.

For more information, see [Assigning Access Certifications to an Item](#).

## Files

For adding files and web pages to an item to support the operator during production. For example, a file or web page can contain material handling information or specific packaging instructions that are relative to the item being produced. When a user is recording the production of the item from an application such as MES Operator, the files and web pages will be available to them for viewing (for example, from the MES Operator **Folders** tab). For more information, see [Adding Files and Web Pages to an Item](#).

## Assigning Access Certifications to an Item

You can assign access certifications to an item to manage who can run jobs that produce the item and whether a sign-off is required to complete the recording of the item's production.

If an access certification has been assigned to an item, a user cannot start a job that produces the item unless the following conditions have been met:

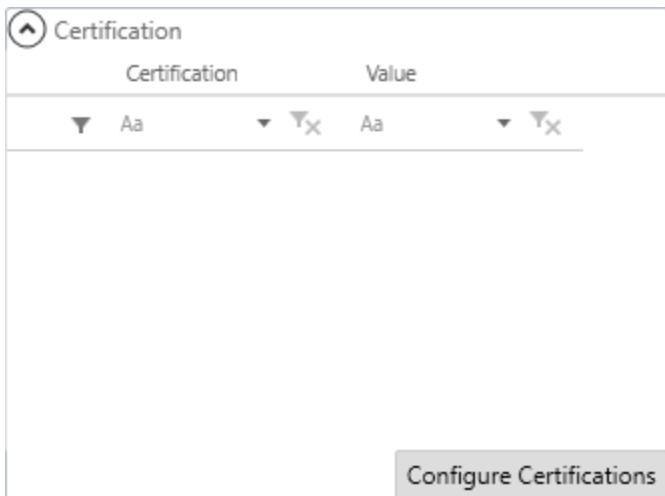
- The user has been assigned to the certification.
- The user's certification level is at or higher than the level specified when the certification was assigned to the

item.

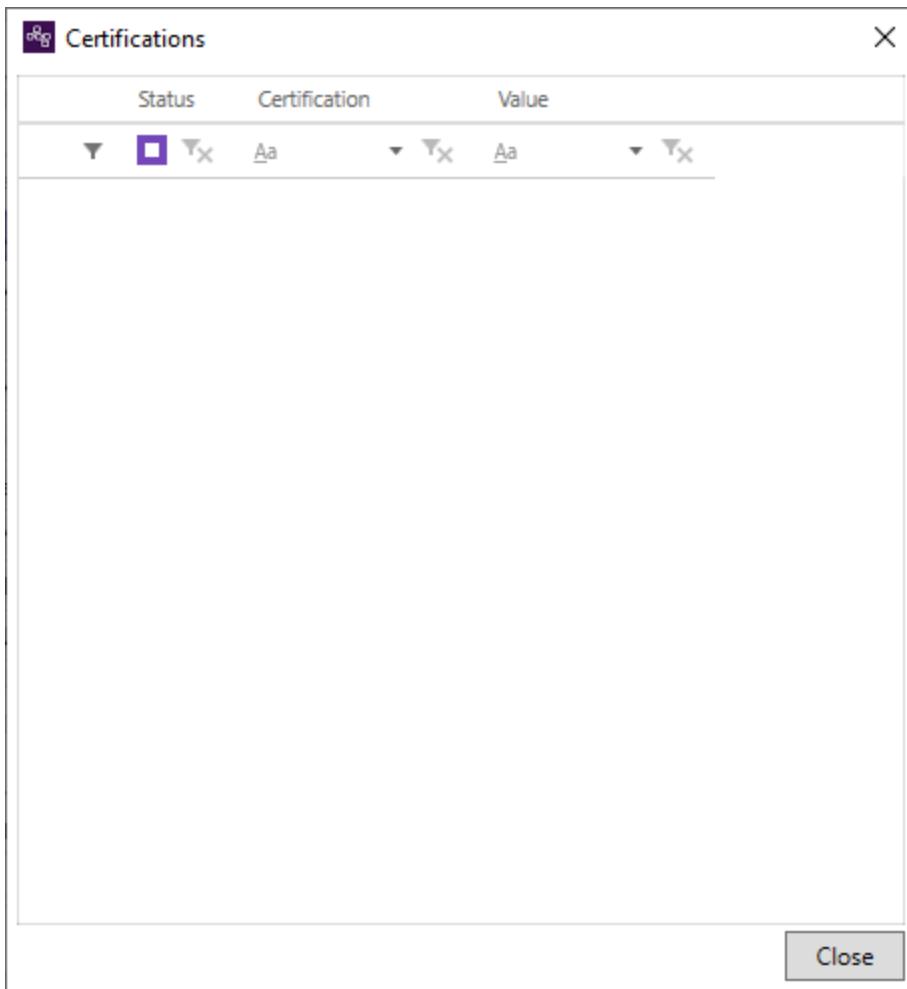
For information about certifications and how to create them, see [Certifications](#).

### To assign access certifications to an item

1. In the Items workspace tab, select the item.
2. In the **Certification** group In the **Properties** window, click **Configure Certification**.



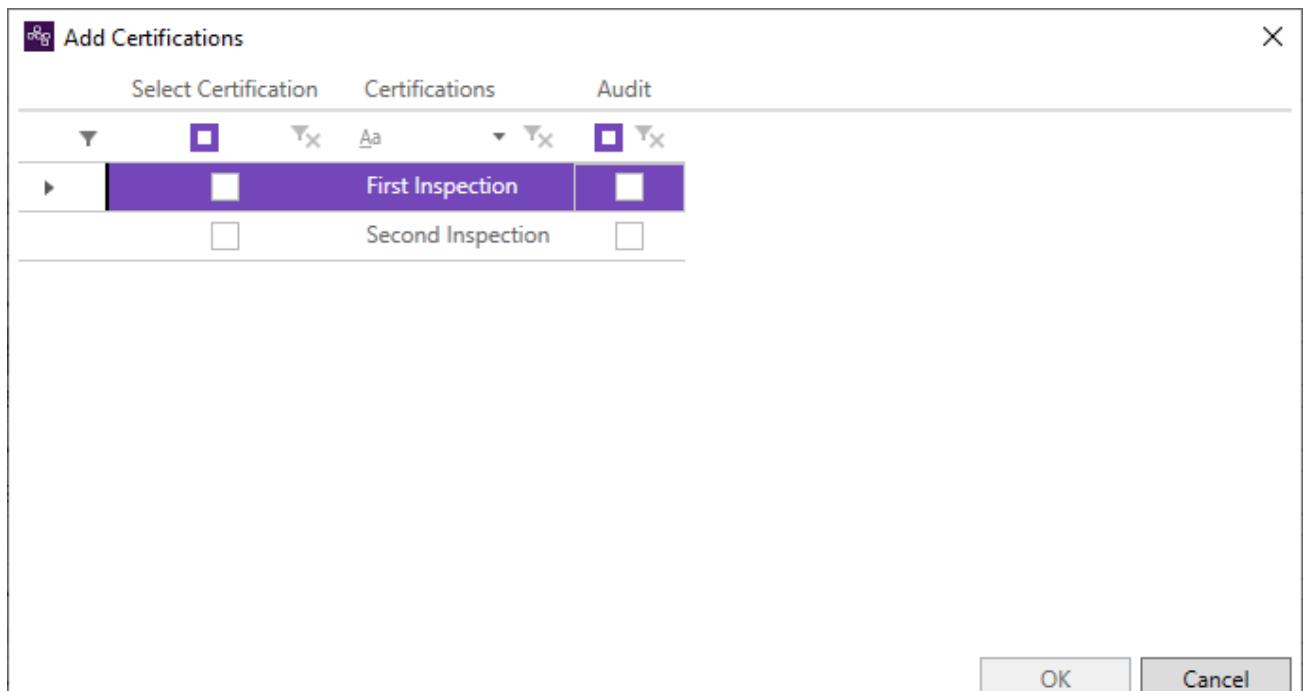
The **Certifications** dialog box appears.



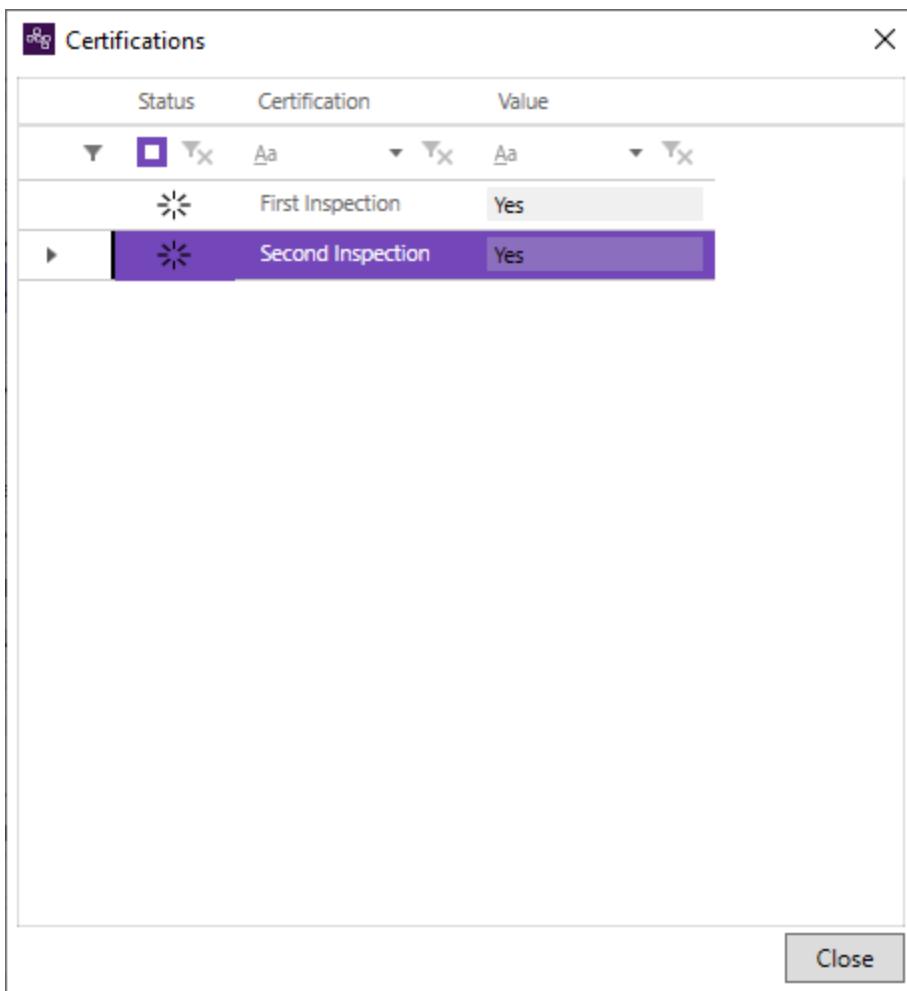
3. Right-click in the **Certifications** dialog box, and then click **Add**.

The Add Certifications dialog box appears. Any access certifications that have been configured to be applicable to items are listed.

**Note:** The **Audit** column is read-only. The check box not being selected indicates an access certification.



4. Select the certifications that you want to assign to the item and click **OK**.  
The selected certifications are listed on the Certifications dialog box.



5. For each certification, select the level required for this item in the **Value** list.

If the level is Yes or No, it is not editable because the certification has only one level. Instead, these values indicate whether the current user has been assigned to the certification.

6. Click **Close** to close the Certifications dialog box.

The selected certifications are listed in the **Certification** group.

Certification	
Certification	Value
First Inspection	Yes
Second Inspection	Yes

7. Save the changes.

### To edit the level of certifications

1. Click the **Configure Certification** button to open the Certifications dialog box.
2. Modify the levels as needed, then click **Close**.
3. Save the changes.

### To remove a certification assignment from the item

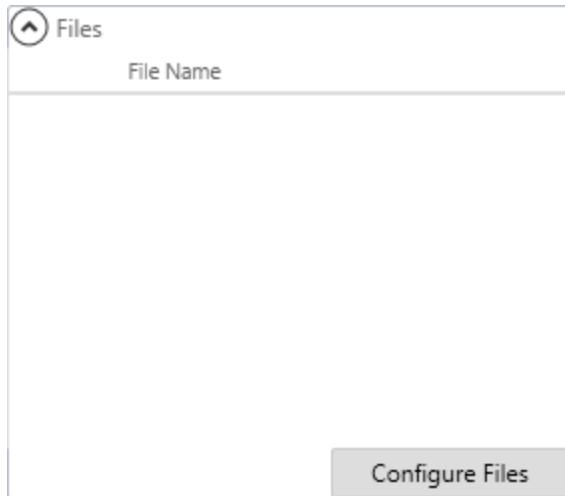
1. Click the **Configure Certification** button to open the Certifications dialog box.
2. Right-click the certification and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Click **Close** to close the Certifications dialog box.
5. Save the changes.

## Adding Files and Web Pages to an Item

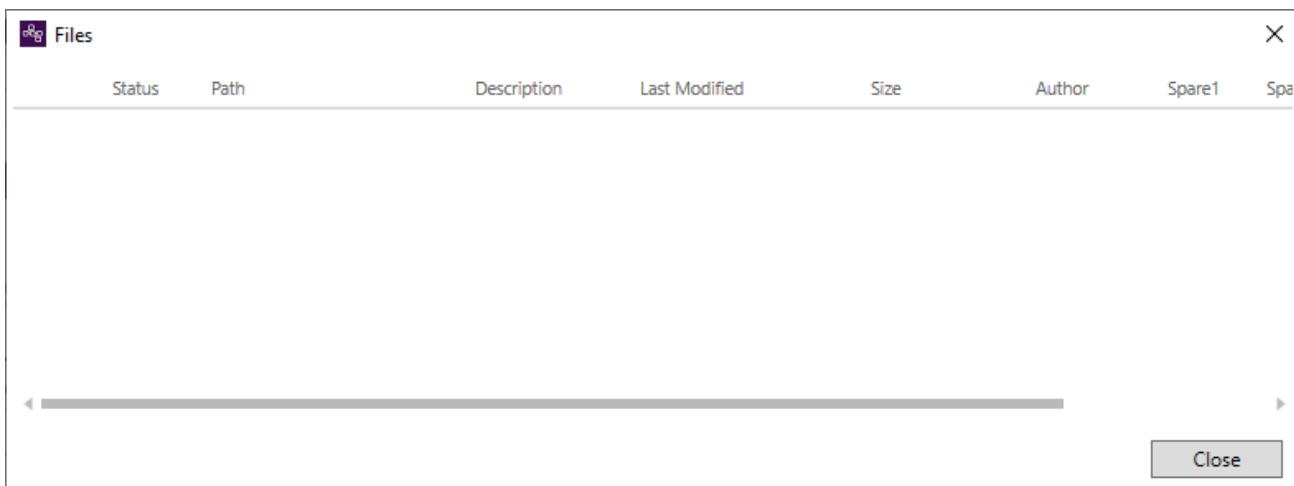
You can add files and web pages to an item to support the operator during production. For example, a file or web page can contain material handling information or specific packaging instructions that are relative to the item being produced. When a user is recording the production of the item from an application such as MES Operator, the files and web pages will be available to them for viewing (for example, from the MES Operator **Folders** tab).

### To add files to an item

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



2. Right-click in the dialog box, and then click **Add files**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the files to be added, and then click **Open**.

The selected files are listed in the Files dialog box.

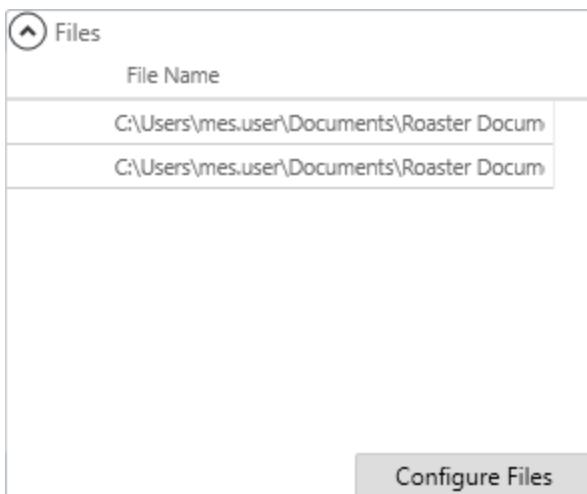
Status	Path	Description	Last Modified	Size	Author	Spare1	Spare2
...	C:\Users\mes.user\Documents		06/30/2022 12:13:07 PM	834,396	▼		
...	C:\Users\mes.user\Documents		06/30/2022 12:13:39 PM	834,421	▼		

5. Optionally, add a description for each file in the **Description** column.

6. Add other files (or web pages) as needed.

7. When you are finished adding files, click **Close**.

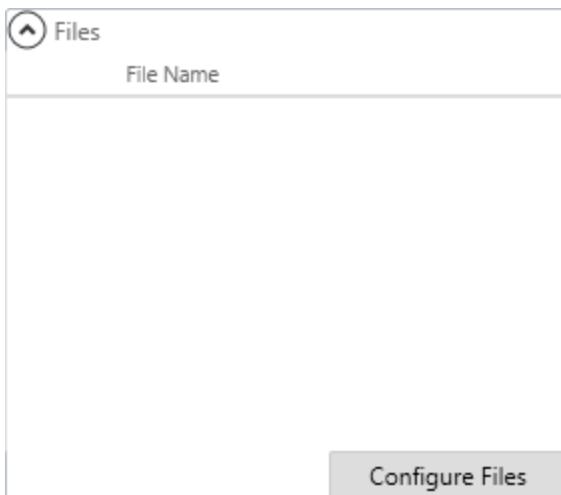
The files are listed in the **Files** property group.



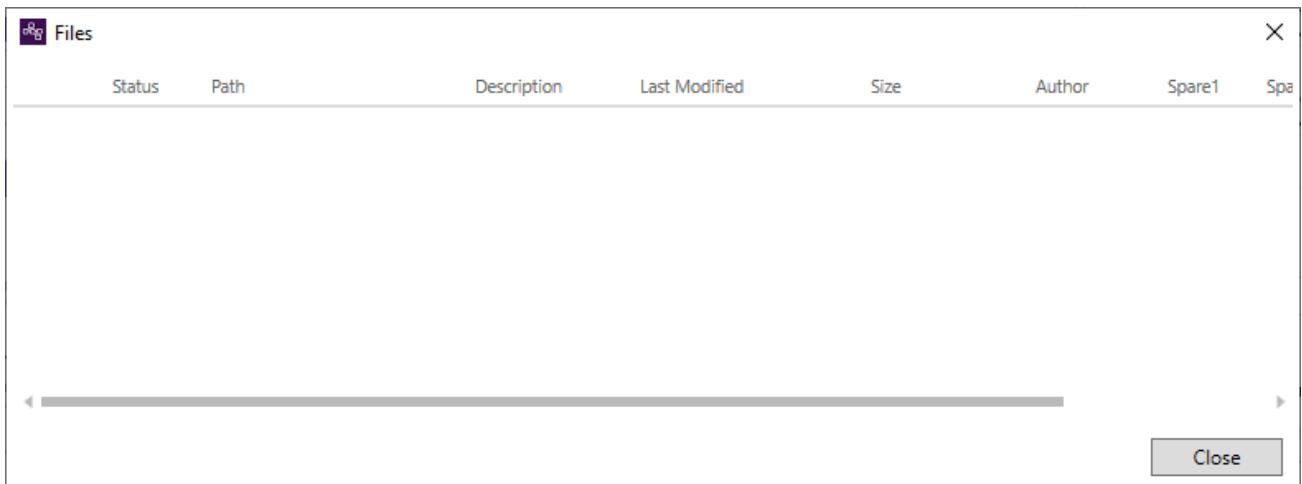
8. Save the changes.

### To add web pages to an item

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



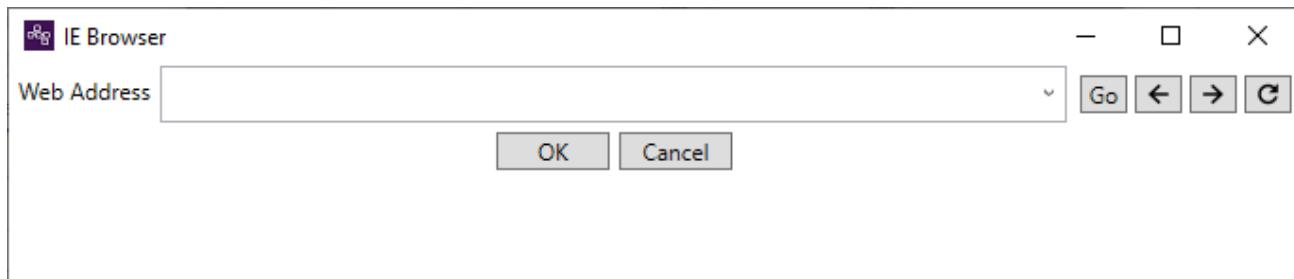
2. Right-click in the dialog box, and then click **Add URL**.

The Add URL dialog box appears.



3. Enter the URL and a description of the web page.

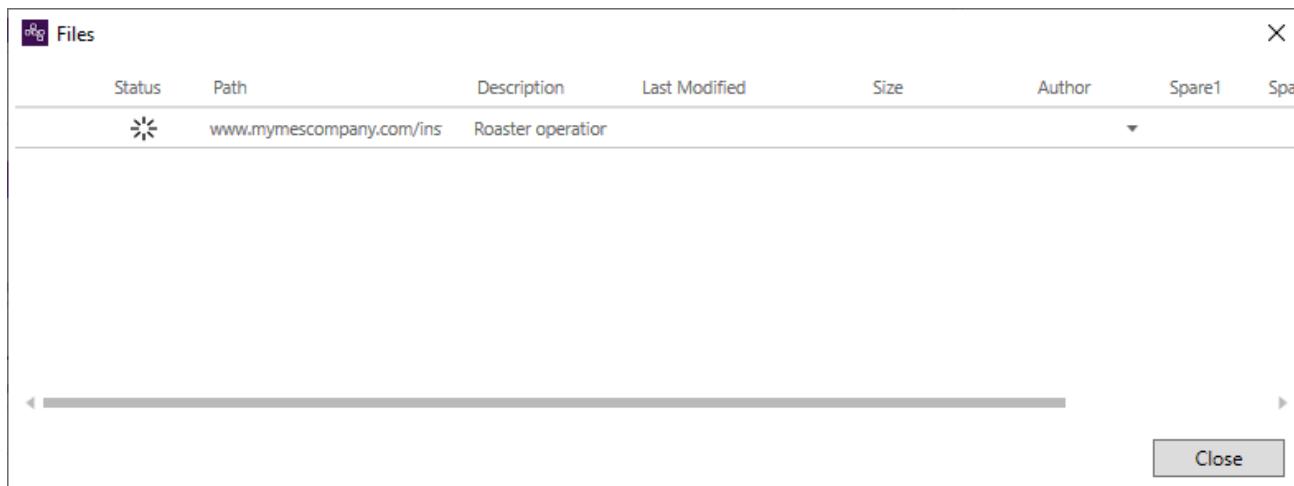
Instead of manually entering the URL, you can click the Browse button at the right of the URL box and use the mini-browser window that appears to navigate to the web page.



Click **OK** and that web page's URL is entered on the Add URL dialog box.

4. When you have finished entering the URL and description, click **Close**.

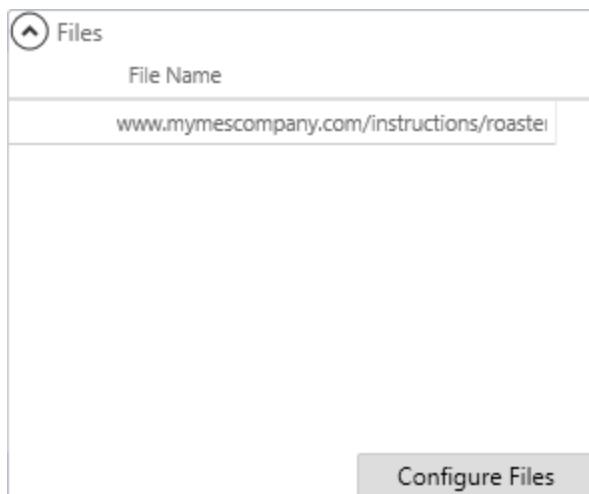
The URL is listed in the Files dialog box.



5. Add other web pages (or files) as needed.

6. When you are finished adding web pages, click **Close**.

The web page URLs are listed in the **Files** property group.



7. Save the changes.

#### To remove a file or URL

1. In the **Files** property group, click **Configure Files**.  
The Files dialog box appears.
2. Right-click the file or URL, and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.

#### Creating BOMs for an Item

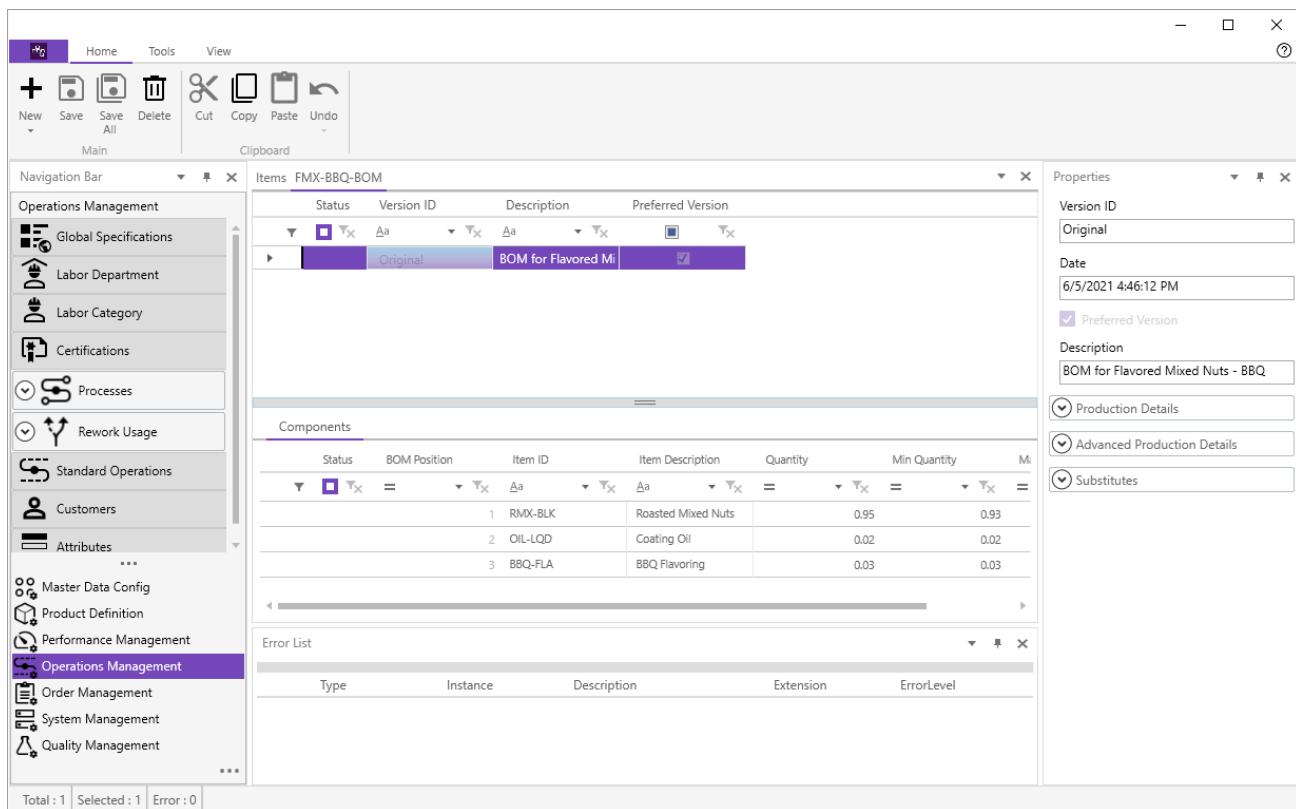
A Bill of Material (BOM) contains the basic information and production details for the selected BOM version. A BOM represents a list of the components or by-products of the production of the parent item. The components and by-products that are to be included in the BOM must be previously defined as items, which can then be assigned to the BOM.

A BOM version specifies the components that are consumed to produce the parent item, any by-products of that production, and default values for several production settings. A BOM adds production-specific details for usage of the items in the current BOM version.

An item can have multiple BOM versions, but you can define only one version as the preferred version. The preferred BOM version is used automatically whenever a process is defined to produce the parent item.

#### To create a BOM version

1. In the Items workspace tab, select the item for which you want to create a BOM.
2. In the **BOM** group on the **Properties** window, click **Configure BOMs**.  
A tab for the item's BOM versions appears.



3. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Item BOM**.

A new BOM version is added.

4. Specify the components and by-products for the BOM version on the **Components** tab. For more information, see [Specifying BOM Components and Byproducts for a BOM Version](#).
5. Complete the other property settings for the BOM version in its Properties window. See [BOM Properties](#).
6. Save the changes.
7. Continue adding BOM versions for the item as needed.

When you are finished adding BOM versions and close the BOM tab, the BOM versions are listed in the **BOM** group on the item's **Properties** window.

## BOM Properties

### General Properties

#### Version ID box

A unique version for the BOM. BOM version ID identifies the BOM version in the MES data records, so must be unique, within the current item, and is not editable after the version information is first saved.

#### Date

The date and time when the BOM was created.

#### Preferred Version

Specifies whether this version is a preferred version.

Once a BOM is specified as being a preferred version, you cannot clear the **Preferred Version** check box. You can clear this check box by selecting another BOM version as the preferred version.

#### Description

A brief description for the BOM.

### Production Details

#### Default Prod Code

The default production code for the BOM. The default production code indicates the default reason for producing the parent item in MES Operator. An operator can select other production reasons for this item.

#### Default Lot

The default value for the parent item's lot number. This lot number is also used to report the production of the item in the MES Client application.

#### Required Grade

The minimum grade (or physical condition) that the parent item must have to report the status as consumed, WIP, or produced.

#### To Storage Location

Click the **Browse** button. The **Entity** dialog box appears. Select the entity and click **OK**. The storage location that you select here is the default storage entity to place produced quantities of this produced item.

#### Scaling Factor

The multiplier used to calculate the consumed/produced quantity of the item. For example, if the inventory tracks "pieces" but an operator work with "cases", the scaling factor might be 12. In case when a user reports consuming/producing 2 "cases", inventory records is updated by 24 "pieces".

#### Backflush

Specifies whether the consumption of the WIP parent item must be recorded automatically in the MES Operator application. For example, to make a bottled water bottle, if backflush for the BOM is enabled, the consumption of the bottle, bottle cap, wrap label, and water is automatically posted. If the **Update Inventory** check box is selected, then the inventory record for the parent item will update automatically.

#### May Create New Lots

Specifies whether a user can create new lot numbers while reporting the production of the parent item.

#### May choose alternate inventory location

Specifies whether an operator can select an inventory location for this item other than the default inventory.

#### Update Inventory

Specifies whether the records must update when a user reports production of this item.

#### Must Consume From Inventory

Specifies whether the WIP parent item, required grade, lot number, and quantity must exist in the inventory records before an operator reports the consumption of the item (or production of the parent item if the **Backflush** option is enabled).

#### Must Consume From WIP

Specifies whether to restrict consumption of the work in progress (WIP) parent item to previously produced work order and associated work orders.

## Advanced Production Details

### Instructions

Additional instructions for the BOM version or instructions for assembly/fabrication that is available to an operator.

### BOM\_Item spare 1–4

User-defined information about the BOM.

## Substitutes

Create a new item substitute. For more information on creating an item substitute, see [Creating an Item Substitute](#).

## Specifying BOM Components and Byproducts for a BOM Version

### To specify BOM components and byproducts for a BOM version

1. In the item's BOM tab, select the BOM version for which you want to specify the components and byproducts.
2. Right-click in the **Components** tab and on the context menu click **Insert Component/ByProduct**.  
A new component/byproduct is added.
3. In the component/byproduct's **Properties** window, complete the property settings. See [BOM Component Properties](#).

- Save the changes.

## BOM Component Properties

### BOM Position

The position of this BOM in the BOM list.

You cannot edit a BOM position after the BOM item definition is saved. When you add an item to a BOM, select a positive position number to indicate a component, which needs to be consumed; and a negative position number to indicate a by-product, which needs to be produced. 0 is reserved to indicate the final product.

### Items

Click the **Browse** button to locate the item for this BOM.

### Required Grade

The minimum grade that this substitute item must have to allow consumption of the parent item

### Default Reason

The default reason for the BOM position.

### Quantity box

The quantity of the substitute item to be consumed or produced for each unit of the parent item that is produced using this version.

### To Storage Location

Click the **Browse** button to locate the entity or entity group to which you want to assign the item. This indicates the default storage entity to place the produced quantities of this substitute item.

You can select the entity in the **To Storage** location box only for the produced items.

**Min Quantity**

The minimum consumption amount of this consumed item that is required for producing a unit of the parent item.

You can select minimum consumption amount only for the consumed items. The **Must Consume Before Production Allowed** check box gets enabled only when you specify the minimum consumption amount in the **Min Quantity** box.

**Max Quantity**

The maximum consumption amount of this consumed item that is permitted for producing a unit of the parent item.

You can select minimum consumption amount only for the consumed items.

**Backflush Consumption**

Specifies whether the consumption of the consumed item is recorded automatically whenever the production of the parent item is recorded. For example, to make a bottled water bottle, if backflush for the BOM is enabled, the consumption of the bottle, bottle cap, wrap label, and water is automatically posted.

You should not report consumption manually if you select the **Backflush Consumption** check box. You should only report exceptions to standard consumption as defined by the BOM. When **Update Inventory** check box is selected, inventory records for the WIP parent item automatically updates.

**Update Inventory**

Specifies whether the records must update when a user reports production of this substitute item.

**Must Consume Before Production Allowed**

Specifies whether a user must report consumption of this consumed item before reporting production of the parent item.

You can select this check box only for the consumed items.

**Must Consume From Inventory**

Specifies whether the consumed item, required grade, lot number, and quantity must exist in the inventory records before a user reports the consumption or production of the parent item.

**May Create New Lots**

Specifies whether a user can create new lot numbers when reporting the production of this consumed item. A user can create new lots only for the produced items.

**Must Consume From WIP**

Specifies whether to restrict the consumption of WIP parent item to previously produced work order and associated work orders.

**May Choose Alternate Inventory Location**

Specifies whether a user can select an inventory location for this consumed item other than the default inventory.

**Constant Quantity**

Specifies whether the consumption quantities of this consumed item depends on the number of produced parent items.

Consumed quantity value is absolute, as defined in the **Quantity** box. You can select the **Constant Quantity** check box only for the consumed items.

**Default Lot**

The default value for the consumed item's lot number. This refers to the lot from which items must be consumed. This lot number is also used to report the production of an item.

**Instructions**

Additional notes or instructions for using the item consumed.

**Units**

The unit of measure used by this consumed item. For more information on UOM, see [Units of Measure](#).

**Scaling Factor**

The multiplier used to calculate the consumed/produced quantity of the item. For example, if the inventory tracks pieces but the users of MES work with cases, the scaling factor might be 12. If a user reports consuming/producing 2 cases, inventory records are updated by 24 pieces.

**BOM\_Item\_Spare1–4**

User-defined information for this BOM.

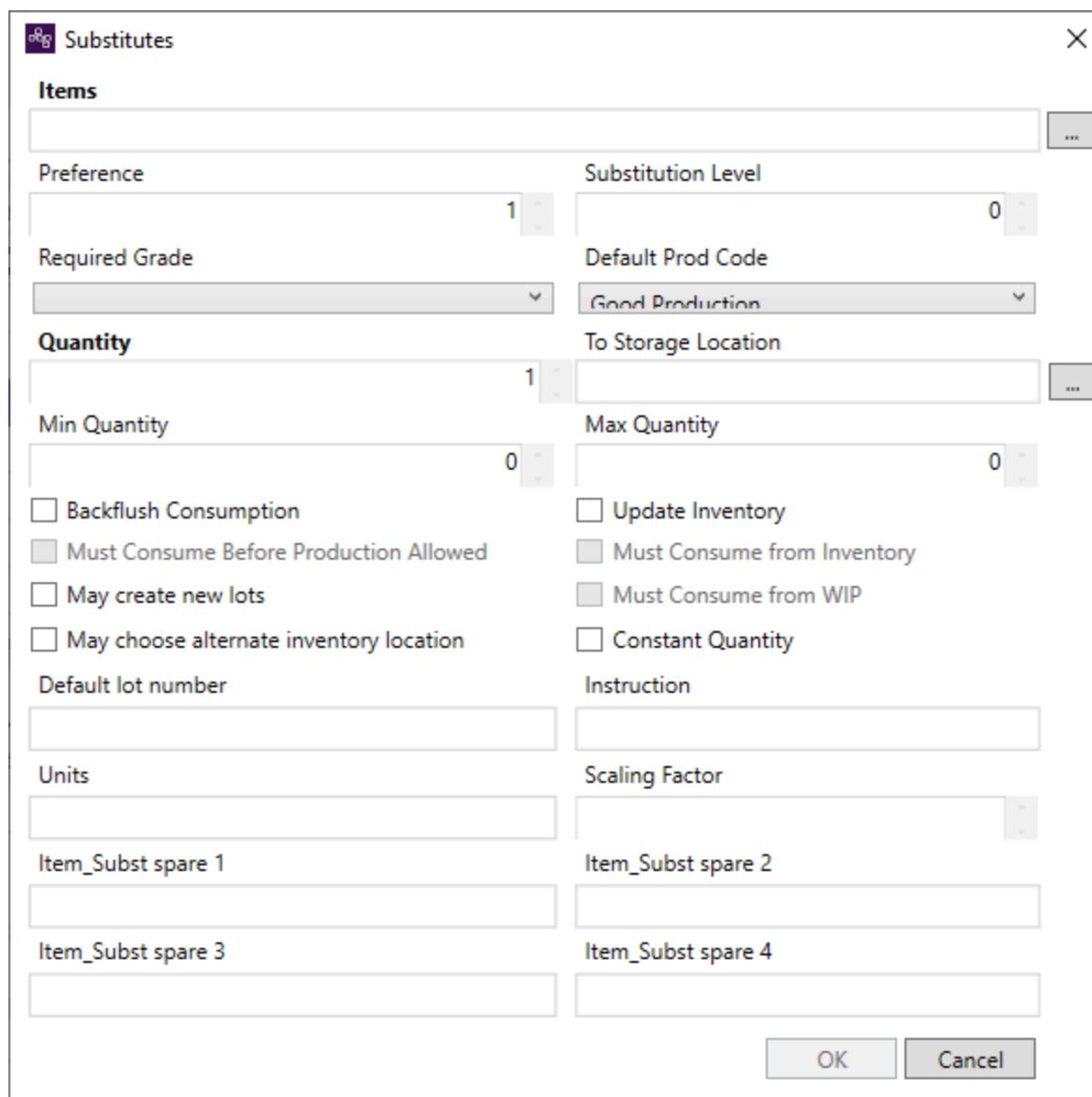
## Creating an Item Substitute

You can specify items that can be used in place of the selected item, and also any restrictions on their usage. Substitutions specified for a BOM version are available to a user whenever its parent item is produced using the same BOM version.

**To create an item substitute**

1. In the Items workspace tab, select the item for which you want to create a substitute.
2. In the **Substitutes** group on the **Properties** window, click **+** to add a substitute.

The **Substitutes** dialog box appears.



3. Complete the property settings in the **Substitutes** dialog box. For a description of the properties, see [Item Substitute Properties](#).
4. Save the changes.

## Item Substitute Properties

### Items box

Click the **Browse** button to locate the item for which you want to create a substitute.

### Preference

A preference for the item substitute. It indicates the priority of this item during a substitution. A value of 1 is the most preferred. Substitute items are shown in the **BOM** tab of the MES Operator application in the sequence of most desirable to least (smallest preference number to largest).

### Substitute Level

The substitute level to limit the usage of this substitute.

Only those whose user privileges have a BOM substitution level greater than or equal to this value can report consumption or production of this substitute item in place of the selected item.

**Required Grade**

The minimum grade that this substitute item must have to report as consumed or produced as a WIP.

**Default Prod Code**

The default reason for producing this substitute item. An operator can select other production reasons for the item.

You can select the default production code only for the produced items.

**Quantity**

The quantity of the substitute item to be consumed or produced when used in place of the selected item.

**To Storage Location**

Click the **Browse** button to locate the default storage entity at which to place the produced quantities of this substitute item.

You can select the entity in the **To Storage Location** box only for the produced items.

**Min Quantity**

The minimum consumption amount of this substitute item that is required for producing a unit of the parent item.

You can select minimum consumption amount only for the consumed items. The **Must Consume Before Production Allowed** check box is available only when you specify the minimum consumption amount in the **Min Quantity** box.

**Max Quantity**

The maximum consumption amount of this substitute item that is permitted for producing a unit of the parent item.

You can select minimum consumption amount only for the consumed items.

**Backflush Consumption**

Specifies whether the consumption of the consumed item must record automatically whenever the production of this substitute parent item is recorded. For example, to make a bottled water bottle, if backflush for the BOM is enabled, the consumption of the bottle, bottle cap, wrap label, and water is automatically posted.

Users should not report the consumption of the substitute item manually. When the **Update Inventory** check box is selected, inventory records for the WIP parent item will update automatically.

**Update Inventory**

Specifies whether the records must update when a user reports production of this substitute item.

**Select the Must Consume Before Production Allowed**

Specifies whether a user must report consumption of this substitute item before reporting production of the parent item.

You can select this check box only for the consumed items.

**Must Consume From Inventory**

Specifies whether the WIP parent item, required grade, lot number, and quantity must exist in the inventory records before a user reports the consumption or production of the parent item.

**May Create New Lots**

Specifies whether you can create new lot numbers when reporting the production of this substitute item. You can create new lots only for the produced items.

**Must Consume From WIP**

Specifies whether to restrict the consumption of WIP parent item to previously produced work order and associated work orders.

#### **May Choose Alternate Inventory Location**

Specifies whether a user can select an inventory location for this substitute item other than the default inventory.

#### **Constant Quantity**

Specifies whether the consumption quantities of this substitute item do not depend on the number of produced parent items.

Consumed quantity value is absolute, as defined in the **Quantity** box. You can select the **Constant Quantity** check box only for the consumed items.

#### **Default Lot box**

The default value for the substitute item's lot number. This refers to the lot from which items must be consumed. This lot number is also used to report the production of an item.

#### **Instructions**

Additional notes or instructions for using the item substitute.

#### **Units**

The unit of measure used by this substitute item. For more information on UOM, see [Units of Measure](#).

#### **Scaling Factor**

The multiplier used to calculate the consumed/produced quantity of the item. For example, if the inventory tracks pieces but the users of the MES Client application work with cases, the scaling factor might be 12. If a user reports consuming/producing 2 cases, inventory records are updated by 24 pieces.

#### **Item\_Subst Spare1–4**

User-defined information for this item substitute.

### **Assigning Attributes to an Item**

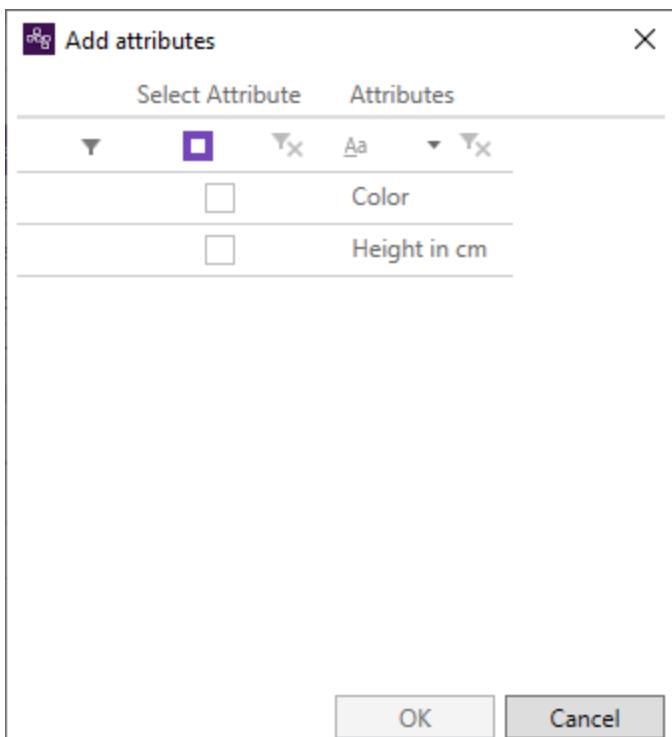
An attribute is an additional user-defined property. You can assign attributes to an item provide additional information about items.

Item attributes must first be created using the **Attributes** module. See [Attributes](#).

#### **To assign attributes to an item**

1. In the Items workspace tab, select the item to which you want to assign attributes.
2. Go to the **Attributes** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add**.
  - On the ribbon, go to the **Current View** tab and click **Add**.

The **Add attributes** dialog box appears.



4. Select the attributes to assign to the item and click **OK**.

The selected attributes are added to the **Attributes** tab.

The screenshot shows the "Items" list view and its Properties window. The Items list displays several items with their details. In the Properties window, the "Attribute" field is set to "Color", and the "Value" and "Notes" fields are empty. The "Color" attribute is also listed in the Attributes tab of the Items list.

5. In each attribute's Properties window, complete the **Value** and **Notes** as needed.
6. Save the changes.

## Assigning a Storage Entity for an Item

A storage entity can be a building, a location within a building, a movable bin or container, and so on. You can assign multiple storage entities to an item and also specify the inventory requirements for an item per storage entity.

## To define and assign a storage entity to an item

1. In the Items workspace tab, select the item to which you want to assign a storage entity.
2. Go to the **Storage** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Insert**.
  - On the ribbon, go to the **Current View** tab and click **Insert**.

A new entity entry is added.

The screenshot shows the AVEVA Manufacturing Execution System. On the left, the 'Items' workspace tab is active, displaying a list of items with columns for Item ID, Item Class ID, Item Description, and Num Decimal. An item named 'AMD-BLK' is selected. Below this is the 'Storage' tab, which has columns for Status, Entity, Min. Inventory Level, and Min. Reorder Amount. A new entity entry is being inserted, indicated by a purple selection bar at the top of the Storage table. On the right, the 'Properties' window is open, showing fields for Entity, Min. Inventory Level, and Min. Reorder Amount. The Entity field is currently empty.

4. In the new entity entry's **Properties** window, complete the following settings:

### Entity

Click the browse button to locate the entity or entity group to which you want to assign the item.

### Min. Inventory Level

The minimum amount of the item that should be available in the inventory at this storage entity or currently scheduled to be made through a work order.

You can define the minimum inventory level only for the produced items.

### Min. Reorder Amount

The minimum amount of the item that should be reordered for this storage entity.

5. Save the changes.

## Viewing the Processes Linked to an Item

You can view the processes that linked to an item. This indicates that the process can produce the item. For how to link an item to a process, see [Assigning Items to a Process](#).

### To view processes linked to an item

1. In the Items workspace tab, select the item for which you want to view the linked process.
2. In the **Properties** window, open the **Processes Linked To Item** group.

A list of processes linked to the selected item appears.

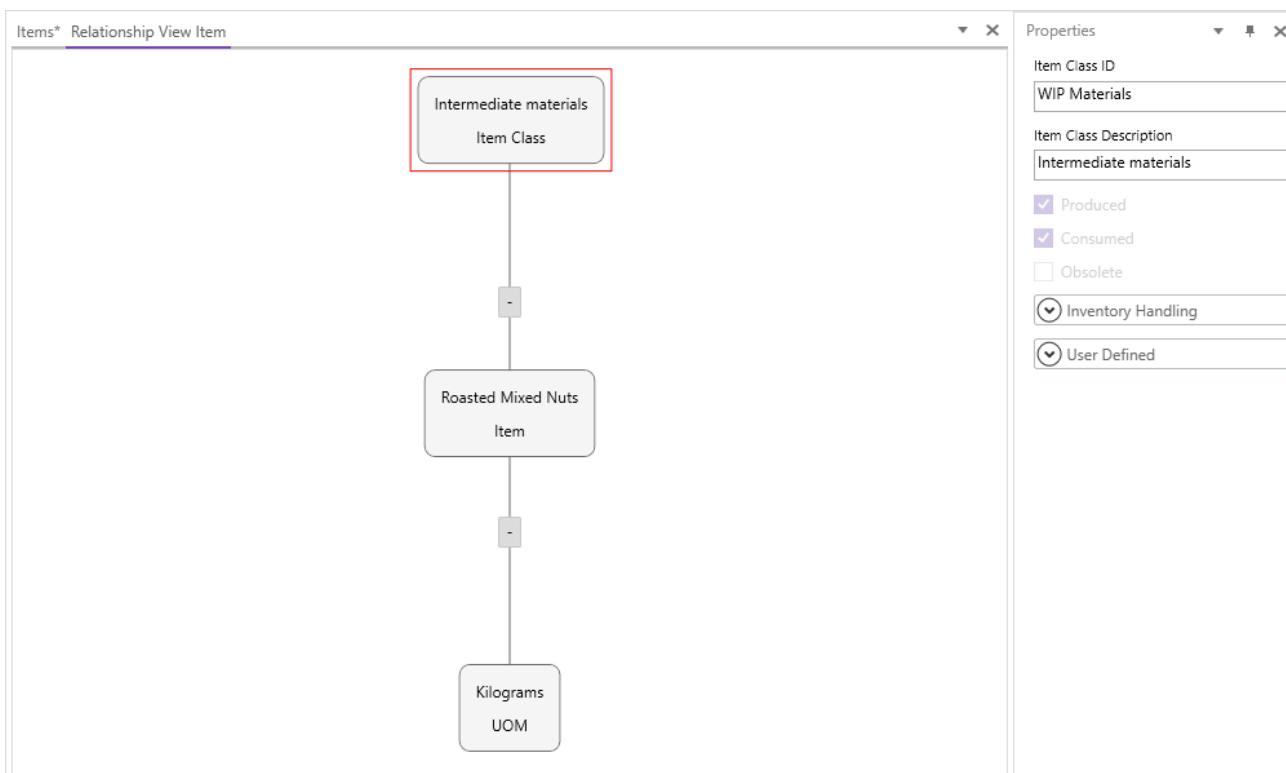
## Viewing the Relationship Diagram

You can view a graphical representation of the relationship between an item and its assigned item class and unit of measure.

### To view the relationship diagram

1. In the Items workspace tab, select the item.
2. Do one of the following:
  - Right-click the item and on the context menu click **View Relationships**.
  - On the ribbon, go to the **Current View** tab and click **View Relationships**.

The **Relationship View Item** tab appears in the workspace.



3. Click an item, item class, or UOM in the diagram to view its properties.

### To collapse and expand the relationship

- Click the – icon to collapse the relationship groups within the relationship view.
- Click the + icon to expand the relationship groups within the relationship view.

## Item Classes

You can use the **Item Classes** module to create and maintain an item class.

When you open the **Item Classes** workspace tab, a list of all the existing item classes is shown.

By default, the **Item Classes** module is in the **Product Definition** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

An item class is a logical grouping of items that share common characteristics, such as physical properties and whether they are produced, consumed, or both.

An item class contains all similar items. For example, the class **Packaging Material** can contain all items that are packed in Area 1 at the plant floor.

Status	Item Class ID	Item Class Desc	Produced	Consumed	Obsolete
Example Item Class	Not a Real Item Class				
	Finished Goods	Finished goods	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Raw Materials	Raw materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	WIP Materials	Intermediate materials	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

## Creating an Item Class

All items in a class share the same produced/consumed status and the same production/consumption reasons.

To create item classes, you must have the General privilege *May edit items*.

### To create an item class

1. Open or go to the **Item Classes** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Item Class**.

A new item class is added.

3. In the new item class' **Properties** window, complete the settings. For a description of the properties, see [Item Class Properties](#).
4. Save the changes.

You can modify the properties of an existing item class in the **Properties** window.

## Item Class Properties

### Item Class ID

The item class ID to which you want to assign the item.

You can also create a new item class. For more information on creating a new item class, see [Creating an Item Class](#).

### Item Class Description

A brief description or a name for the item class.

### Produced

Specifies whether items in this item class are to be produced by a production process in your company. For more information on processes, see [Processes](#).

### Consumed

Specifies whether items in this item class are to be consumed in a production process in your company. The items in this item class are consumed in a BOM. For more information, see [Creating BOMs for an Item](#). An item class may be both produced and consumed.

### Obsolete

Specifies whether the item class is obsolete. Specifying a class as obsolete marks all items within the class as obsolete. This indicates that the items will not be available for BOMs or processes configuration.

### Inventory Handling: Inventory is unique by job

Specifies whether the inventory assigned to a job can be used only with that job. This check box is not available if the inventory is not licensed.

If inventory is being transferred to another storage entity and the following conditions are true:

- The destination item is configured to identify the inventory quantities uniquely by job
- The inventory is being moved to a downstream job
- The work order's *Override Serialization* option is not selected

Then the inventory information of the job that produced the serial number will be updated to match those of any job immediately preceding the first job identified by the work order and operation that produces the item being transferred. If there are no such upstream jobs, then the inventory information for the job that produced the serial number are left unchanged.

### Inventory Handling: Serial Number Level

A serial number level for the item class. Select **Lot Number** if you want the serial number to be the same as lot number.

### Inventory Handling: Lot number format and Sublot number format

The format of the lot number and sub-lot number for the items in the item class.

For example, Lot-AB# is displayed as Lot-AB1, Lot-AB2, and so on.

### User Defined: Spare1–4

User-defined information about the item class.

### Item Reason Groups Linked to Item Class

For linking item reason groups to an item class. See [Linking Item Reason Groups to an Item Class](#).

## Linking Item Reason Groups to an Item Class

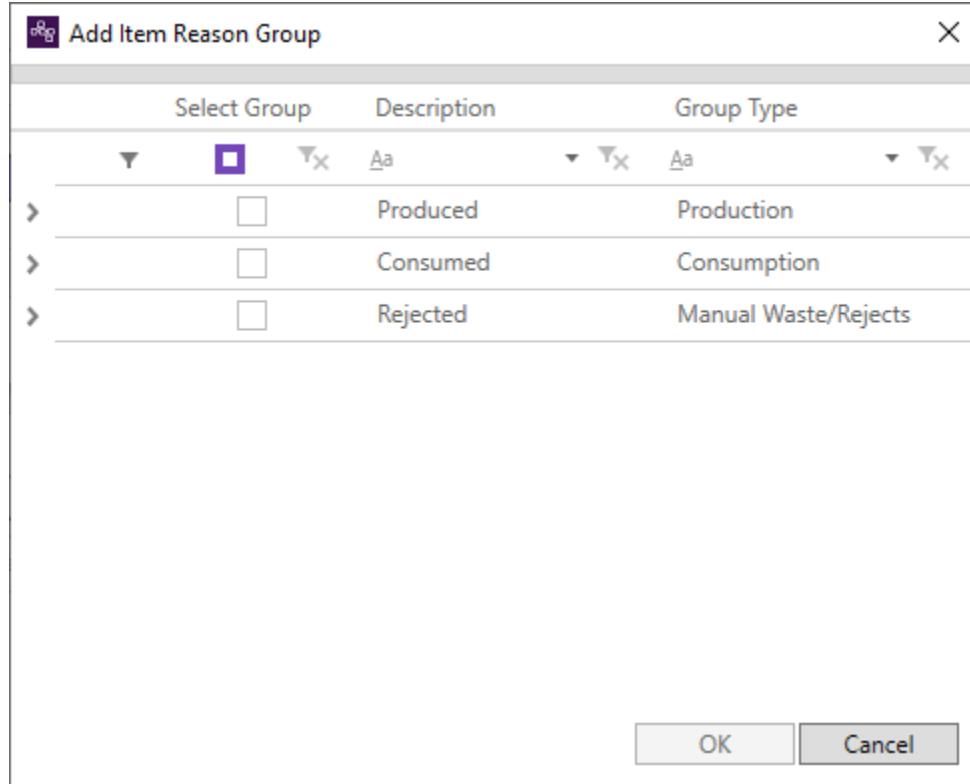
Item reasons are used to define the condition of an item. For example, item grade and state (physical condition/status). Item reason groups are used in the MES Operator application for reporting consumption and production. Item classes are organized into related item reason groups.

You can link item reason groups to an item class. You can specify which reason groups (and their reasons) are most appropriate for the selected item class. For more information on creating an item reason group, see [Item Reasons](#).

### To link item reason groups to an item class

1. In the Item Classes workspace tab, select the item class to assign item reason groups.
2. In the **Item Reason Groups Linked to Item Class** section of the **Properties** window, click +.

The **Add Item Reason Group** dialog box appears.



3. Select the item reason groups that you want to assign to the item class and click **OK**.  
The selected item reason groups are added to the **Item Reason Groups Linked to Item Class** section.
4. Save the changes.

## Assigning Attributes to an Item Class

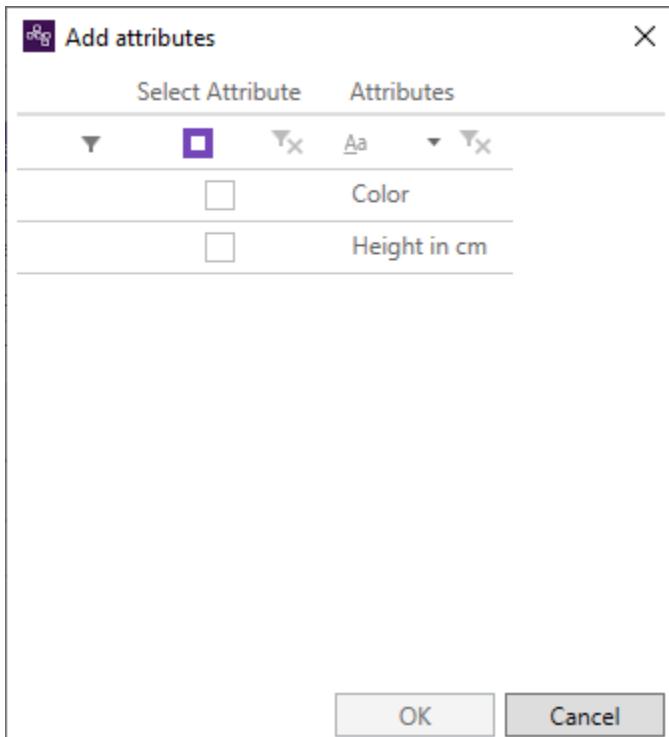
An attribute is an additional user-defined property. You can assign attributes to an item class to provide additional information about item classes.

Item class attributes must first be created using the **Attributes** module. See [Attributes](#).

## To assign attributes to an item class

1. In the Item Classes workspace tab, select the item class to which you want to assign attributes.
2. Go to the **Attributes** tab.
3. Right-click in the tab and on the context menu click **Add**.

The **Add attributes** dialog box appears.



4. Select the attributes to assign to the item class and click **OK**.

The selected attributes are added to the **Attributes** tab.

The screenshot shows the 'Item Classes' workspace with the 'Attributes' tab selected. The 'Color' attribute is selected in the list. A properties panel on the right shows the attribute details: Attribute: Color, Value: (empty), Notes: (empty).

5. In each attribute's Properties window, complete the **Value** and **Notes** as needed.
6. Save the changes.

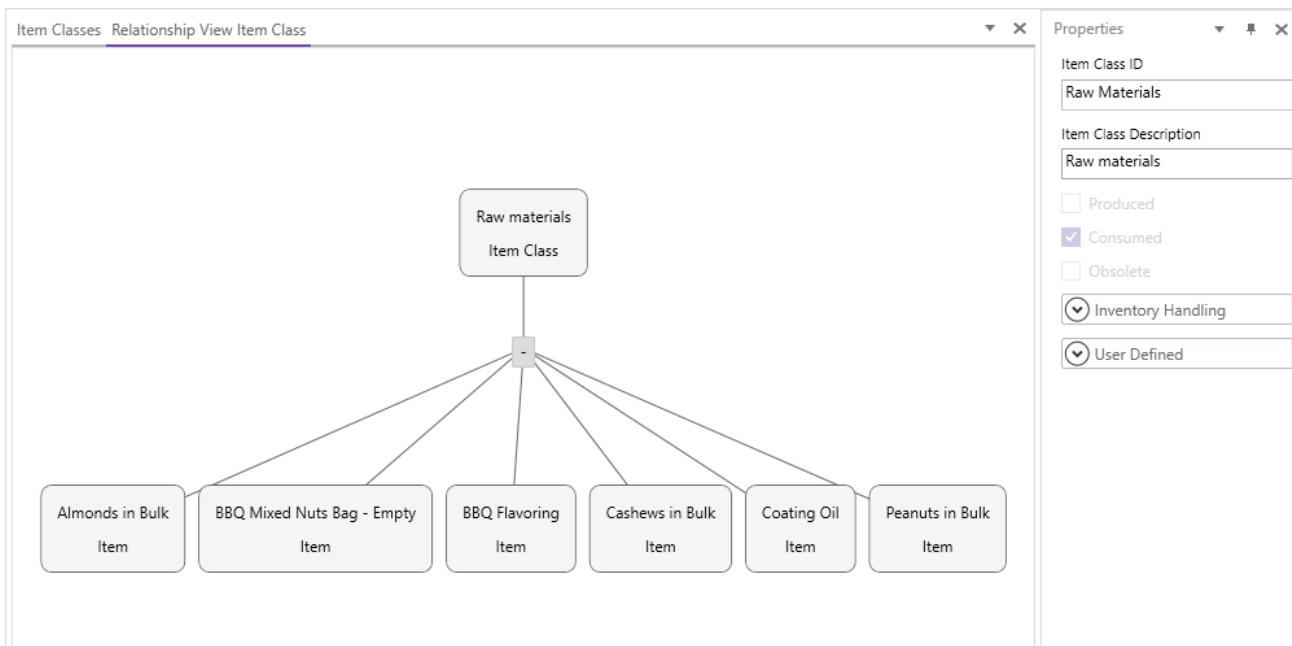
## Viewing the Relationship Diagram

You can view a graphical representation of the relationship between an item, an item class, and a unit of measure.

### To view the relationship diagram

1. In the Item Classes workspace tab, select the item class.
2. Do one of the following:
  - Right-click the item class and on the context menu click **View Relationships**.
  - On the ribbon, go to the **Current View** tab and click **View Relationships**.

The **Relationship View Item Class** tab appears in the workspace.



3. Click an item or item class in the diagram to view its properties.

### To collapse or expand the relationship

- Click the – symbol to collapse the relationship groups within the relationship view.
- Click the + symbol to expand the relationship groups within the relationship view.

## Copying an Item Class

Copying an item class does not copy the items of the original item class or the attributes and reason groups associated with the original item class.

### To copy an item class

1. In the Item Classes workspace tab, select the item class to copy.
2. To copy the item class to the clipboard, do one of the following:
  - Press the **Ctrl+C** keys.

- Right-click in the tab and on the context menu click **Copy**.
  - On the ribbon, go to the **Current View** tab and click **Copy**.
3. To paste the copied item class, do one of the following:
- Press the **Ctrl+V** keys.
  - Right-click in the tab and on the context menu click **Paste**.
  - On the ribbon, go to the **Current View** tab and click **Paste**.
- A copy of the item class is added.
4. Complete the property settings for the new item class and save the changes.

## Units of Measure

You can use the **Units of Measure** module to create and maintain the Units of Measure (UOM). The UOM describes the quantities of items or the measurement units of characteristics in the MES Client application. You can also define a conversion method between two UOMs.

When you open the **Units of Measure** workspace tab, a list of all the existing UOMs is shown.

By default, the **Units of Measure** module is in the **Product Definition** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

Status	Description	Abbreviation
Pieces	Pcs.	
Kilograms	k	
Grams	g	
Liters	l	
Boxes	Bx	

## Creating a Unit of Measure

You can define the UOMs that are used to describe quantities of the items in the MES Client application.

By default, the *pieces* UOM is included in the UOM list.

### To create a UOM

1. Open or go to the **Units of Measure** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Unit of Measure**.

A new unit of measure is added.

3. In the new unit of measure's **Properties** window, complete the following settings:

#### Description

A description for the UOM. Because this description identifies the UOM in the data records, it must be unique.

#### Abbreviation

An abbreviation for the unit of measure.

4. Save the changes.

You can modify the properties of an existing UOM in the **Properties** window.

## Creating an Item-Specific Unit of Measure Conversion

A conversion method can be defined between any two UOMs. For example, you can convert Fahrenheit to Centigrade.

### To create an item-specific UOM conversion

1. Select the UOM for which you want to create a conversion.
2. In the **Configure Unit of Measures Conversions For** pane, click the + icon to add a new row.

Units of Measure\*

Status	Description	Abbreviation
	Kilograms	k
	Grams	g
	Liters	l
	Boxes	Bx
	Bags	Bg
►	<b>Quarts</b>	qt

Configure UOM Conversions For :Quarts

To Unit	Factor	Offset	Update Inverse Conversic	Conversion	UOM_CO
Liters	0.94635	0.00000		1 Quarts = 0.94635 Liters	

Select Item(s) for Specific UOM Conversion

- Complete the following settings:

#### To Unit

The target UOM for the conversion.

#### Factor

The number by which the quantity should be multiplied for converting the source UOM to the target UOM.

#### Offset

The value that should be added or deducted from the conversion total. It can be a negative value.

#### Update Inverse Conversion

Specifies whether to reverse the conversion. For example, if the conversion for Yards to Feet is defined and this option is selected, the Feet to Yards UOM is also converted.

If the quantity to be converted is  $x$ , the factor is  $F$ , and the offset is  $O$ , then the resulting conversion is  $Fx + O$ .

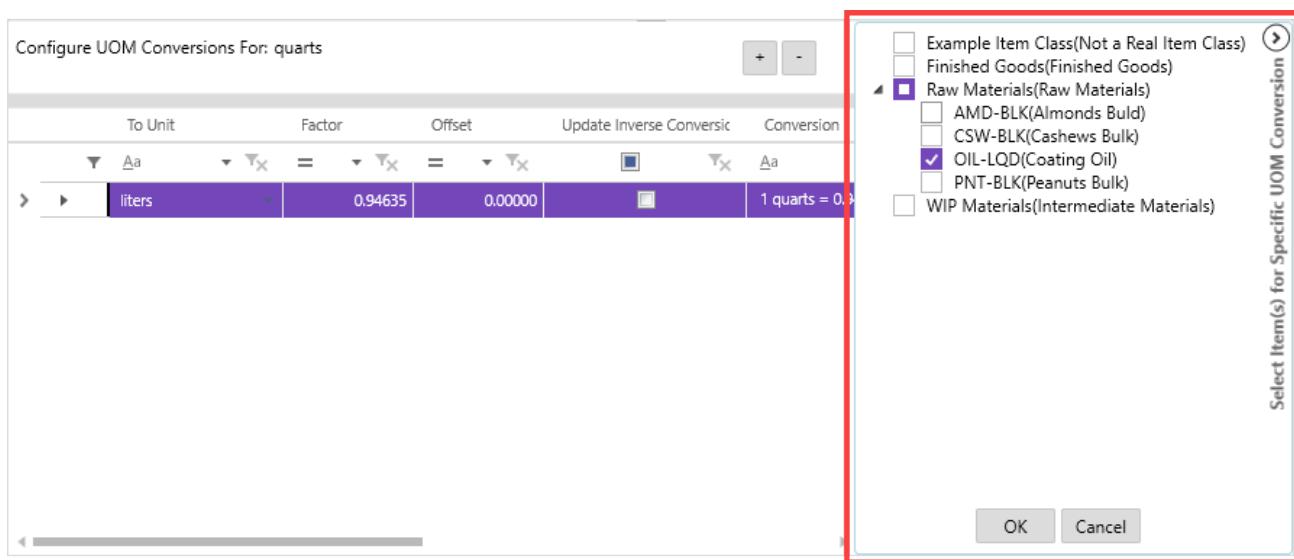
#### Conversion

Shows the converted value for the target UOM.

#### Uom\_Conv\_spare 1-4

Additional information about the conversion.

- To select the items to which the unit conversion applies, click **Select Item(s) for specific UOM Conversion** to open a list of item classes and their items.
- Select an item class to expand the selection tree.



6. Select the items to which the conversion will apply, and click **OK**.

If you need to change the items to which the conversion applies, click **Select Item(s) for specific UOM Conversion** again to open the list of item classes and items and change the item selections.

7. Save the changes.

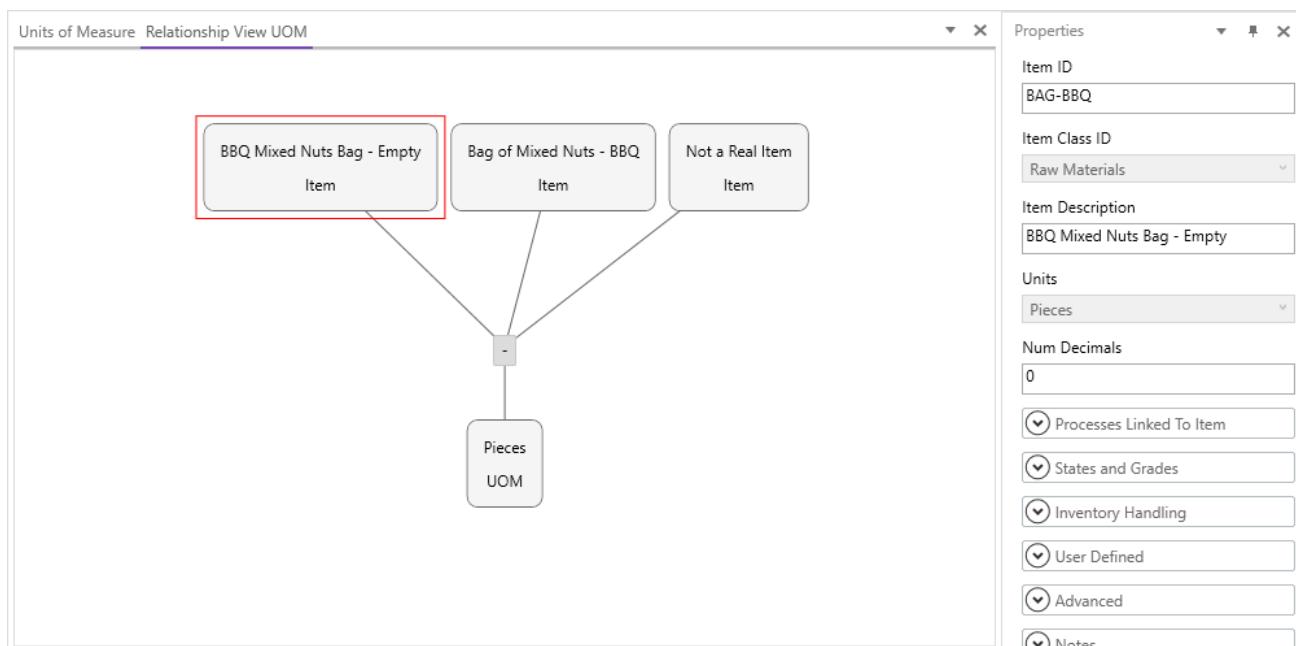
## Viewing the Relationship Diagram

You can view a graphical representation of the relationship between a UOM and the items to which it is assigned.

### To view the relationship diagram

1. In the Units of Measure workspace tab, select the UOM.
2. Do one of the following:
  - Right-click the UOM and on the context menu click **View Relationships**.
  - On the ribbon, go to the **Current View** tab and click **View Relationships**.

The Relationship View UOM tab appears.



3. Click an item or UOM in the diagram to view its properties.

### To collapse or expand the relationship

- Click the – icon to collapse the relationship groups within the relationship view.
- Click the + icon to expand the relationship groups within the relationship view.

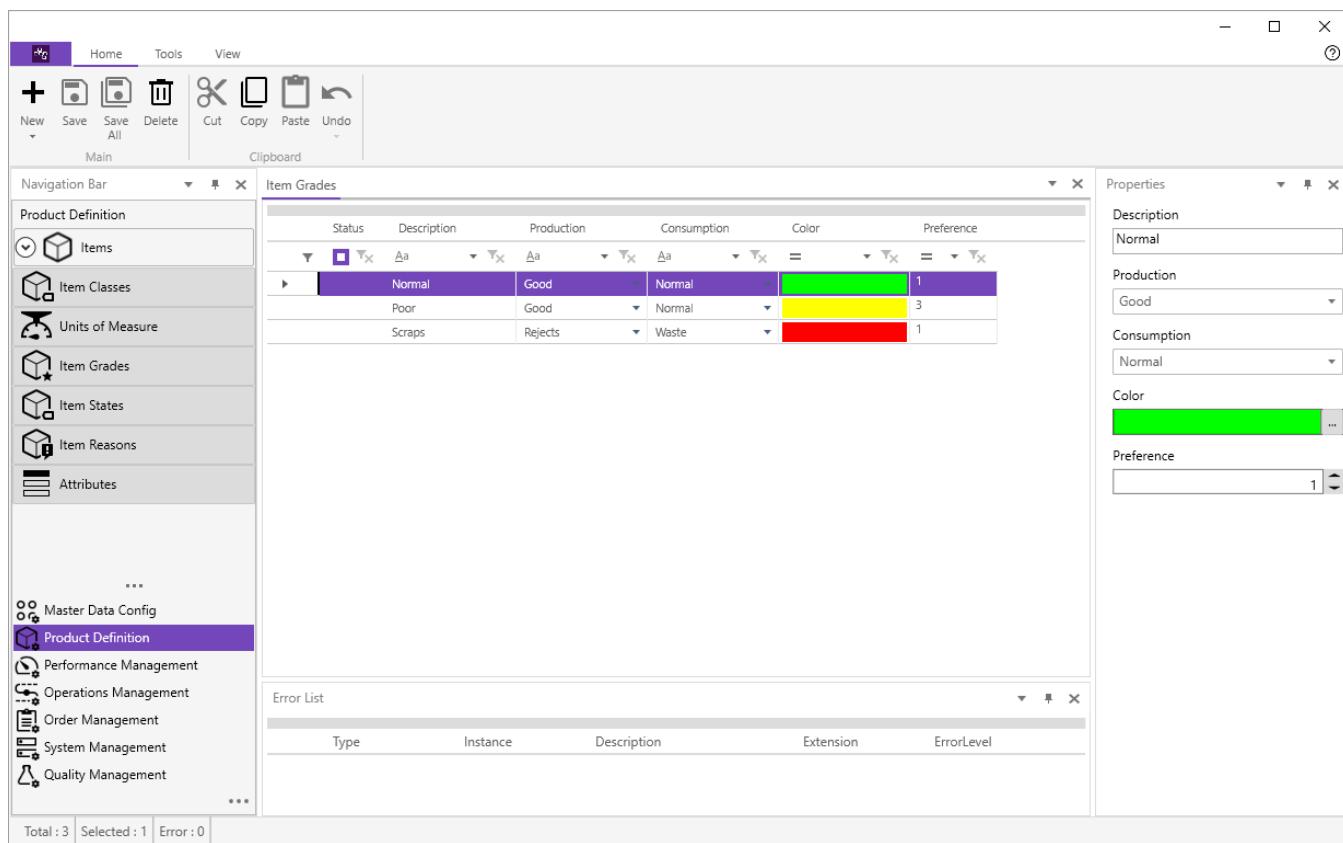
## Item Grades

You can use the **Item Grades** module to create and maintain item grades. Item grades are used in MES to restrict the consumption and shipment of materials. Item grades are closely related to item states and item reasons.

When you open the **Item Grades** workspace tab, a list of all the existing item grades is shown.

By default, the **Item Grades** module is in the **Product Definition** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

An item grade defines the physical condition of an item. You can define unlimited number of item grades. This allows you to increase the flexibility of tracking the quality of an instances of an item produced and/or consumed, such as a lot. For example, a process that produces an item must be tested to determine its grade. You can define grades as A, B, and C for the produced item.



## Creating an Item Grade

The names and colors of an item grade are user-defined.

You can create multiple grades for an item. For example, if production of an item is stopped because the consumed items were spoiled, you can give an item grade Spoiled to the consumed item class.

### To create an item grade

1. Open or go to the **Item Grades** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Item Grade**.

A new item grade is added.

3. In the new item grade's **Properties** window, complete the following settings:

#### Description

A brief description for the item grade. Because the description identifies the item grade in the data records, it must be unique.

#### Production

The production grade for the item. The production grade indicates whether the produced item grade is Good or Rejected. The grade assigned to a produced lot can be used to prevent downstream consumption or shipment from inventory.

**Consumption**

The consumption type for the item. The consumption type indicates whether the item was Normal (consumed as expected) or Waste (not consumable).

**Color**

The color to assign to the item grade.

**Preferences**

A preference for the item grade in the numeric value. This indicates the relative quality of this grade when produced and/or consumed. Smaller numbers are considered better than larger numbers. This is used to determine the minimal shippable grade of a product and the minimal consumable grade of a component.

4. Save the changes.

You can modify the properties of an existing item grade in the **Properties** window.

## Item States

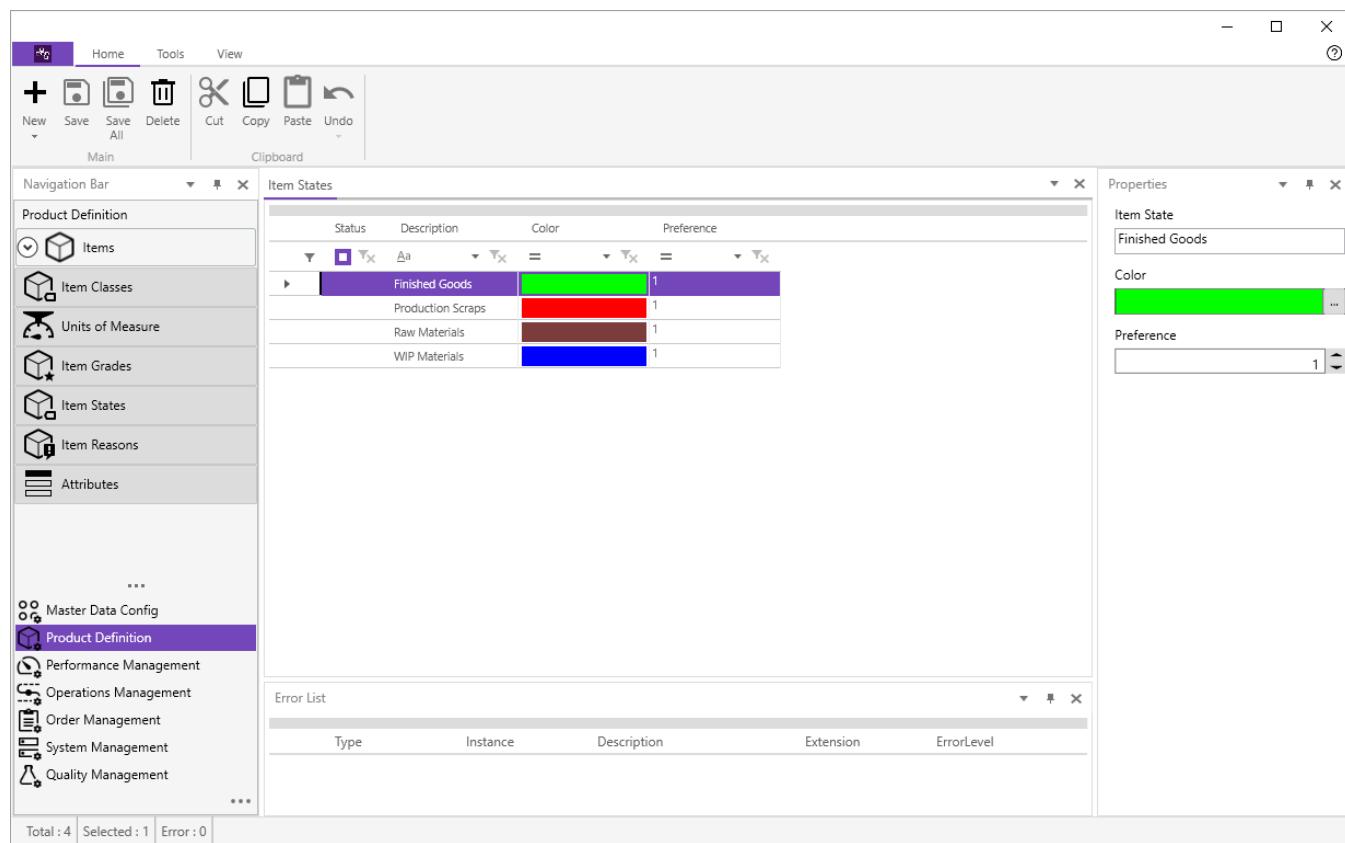
You can use the **Item States** module to create and maintain item states.

An item state defines the possible state for an instance of an item that determines its minimal shippable and/or consumable standards.

When you open the **Item States** workspace tab, a list of all existing item states is shown.

By default, the **Item States** module is in the **Product Definition** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

For example, a Finished Goods state indicates that an item is produced successfully, and a WIP (work in progress) state indicates that the item is still under production.



## Creating an Item State

The names and colors of item states are user-defined. You can create as many item states as required.

### To create an item state

1. Open or go to the **Item States** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Item State**.
3. In the new item state's **Properties** window, complete the following settings:

#### Item State

A name or brief description for the item state. Because the description identifies the item state in the data records, the state name be unique.

You can create multiple states for an item. For example, if production of an item is stopped, you can assign the Stopped item state to that item.

#### Color

The color to be associated with the item state.

#### Preference

A preference for the item state in the numeric value. This indicates the relative quality of this state. Smaller numbers are considered better than higher numbers. This is used to determine the minimal shippable state of a product.

#### 4. Save the changes.

You can modify the properties of an existing item state in the **Properties** window.

## Item Reasons

You can use the **Item Reasons** module to create and maintain item reason groups and reasons. An item reason defines a reason for an item to be in any state and grade. Item reason groups are used to organize similar reasons. An item reason is selected when production or consumption of an item is reported and then this reason determines the state and grade of the lot of an item. A reason can be selected by PLC, I/O, or an operator.

The item reason group and the reasons associated to that reason group are assigned to item classes and entities to specify which reasons are applicable to different item classes or entities.

When you open the **Item Reasons** workspace tab, a list of all the existing item reason groups and reasons is shown.

By default, the **Item Reasons** module is in the **Product Definition** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

Status	Group Description	Group Type
Produced	Production	
Good Production	0	Normal
Good WIP Production	2	Normal
Poor WIP Production	3	Poor
Overproduction	4	Scrap
Consumed	Consumption	
Rejected	Manual Waste/Re	

When you open the **Item Reasons** workspace tab, the **Current View** tab appears on the ribbon.

The **Current View** tab includes the **View** group, the **Sequence** group, and the **View Relationships** group.

In the **View** group, the following commands are available:

- **Default View:** Shows a list of all the existing item reason groups and reasons.
- **Group By Item Classes:** Shows a list of all the reasons by group. When you click **Group By Item Classes**, the group name and description of all the available reason groups class is shown.
- **Group By Entities:** Shows a list of all the reasons grouped by entities. When you click **Group By Entities**, the name and description of all the available entities is shown.

If you are using **Group by Item Class** or **Group by Entities** option, item reason groups and item reasons that are not associated with an item class or entity does not appear in the filtered list.

In the **Sequence** group, the following commands are available:

- **First:** Changes the selected item reason to the first item reason.
- **Up:** Moves the selected item reason up.
- **Down:** Moves the selected item reason down.
- **Last:** Changes the selected item reason to the last item reason.

In the **View Relationships** group, the following command is available:

- **View Relationships:** Shows a graphical representation of the relationship between an item group, an item class, and entities.

## Creating an Item Reason Group

An item reason group contains similar item reasons. You can assign multiple item reason groups to an item class.

If no item reason group is selected, the default item reason group is assigned to an item class.

Item reason groups are user-defined groups. You can create as many item reason groups as required.

### To create an item reason group

1. Open or go to the **Item Reasons** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New Item Reason Group**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Item Reason Group**.
- A new item reason group is added.
3. In the new item reason group's **Properties** window, complete the following settings:

#### Group Description

A brief description for the item reason group. The description describes the grouping of item reasons and identifies the item reason group in the data records, so must be unique.

#### Group Type

The group type. The group type indicates the situation in which the reasons in this group is used. This limits the reason choice, when reporting the consumption or production of an item to only those appropriate for the situation. For example, only reason groups (and their reasons) of type Production are available when successful production quantities are reported. You can select the following group types:

- **Production:** Used for reporting production.

- **Consumption:** Used for reporting consumption.
- **Manual Waste/Rejects:** Used for reporting rejected quantities or waste production.

#### Classes Linked To Group

The item classes linked to this reason group. For more information on linking an item reason group to an item class, see [Linking Item Reason Groups to an Item Class](#).

#### Entities Linked To Group

The entities linked to this item reason group.

To restrict the reasons that can be applied to item production or consumption for jobs running on an entity, allowable item reason groups can be selected for the entity. If an item reason group has been assigned to any entities as an allowable reason group, those entities are listed here. See [Assigning Item Reason Groups to an Entity](#).

4. Save the changes.

You can modify the properties of an existing item reason group in the **Properties** window.

## Creating an Item Reason

You cannot define a reason for an item before defining possible resultant states and grades for that item. For more information on item states and item grades, see [Item States](#) and [Item Grades](#).

### To create an item reason

1. Open or go to the **Item Reasons** workspace tab.
2. Select the item reason group to which to assign the item reason.
3. Do one of the following:
  - Right-click the item reason group and on the context menu click **New Item Reason**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Item Reason**.A new item reason is added to the selected item reason group.
4. In the new item reason's **Properties** window, complete the following settings:

#### Reason Description

A brief description for the item reason. This describes the reason for the manner in which an item is handled and identifies the reason in the data records, so it must be unique within its reason group.

You can create a new item reason group if the existing item reason groups in the list do not fulfill the parameters of the new item reason. To create a new item reason group, see [Creating an Item Reason Group](#).

#### Item Grade

The defined item grade for the selected item. By default, the first item grade in the list is shown. For more information on item grade, see [Item Grades](#).

#### Item States

The defined item state for the selected item. By default, the first item state in the list is shown. For more information about item states, see [Item States](#).

#### Reason Code

The reason code. The code associated with this reason identifies the reason in the data records, so it must be unique and is not editable after the reason definition is first saved.

#### Default Consumption

Specifies whether to define the item reason as the default reason for the consumed items. The selected reason is specified as the default reason when reporting consumption of an item in MES. An operator can change the default reason for the item class.

#### **Default Production**

Specifies whether to define the item reason as default reason for the produced items. The selected reason is specified as the default reason when reporting production of an item in MES. An operator can change the default reason for the item class.

#### **BOM Version Linked To Reason**

The BOM versions that use this reason as their default production reason. For more information, see [Creating BOMs for an Item](#).

#### **BOM Item Linked To Reason**

The BOM items that use this reason as their default reason for production or consumption. For more information, see [Creating BOMs for an Item](#).

#### **Entities Linked to Reason**

The entities that use this reason as their default reason for item production or consumption. For more information, see [Jobs](#).

5. Save the changes.

You can modify the properties of an existing item reason in the **Properties** window.

### **Setting the Display Order of Item Reason Groups or Item Reasons in a Group**

You can set the order in which the item reason groups or item reasons within a group are displayed in the **Item Reasons** module user interface.

#### **To set the display order of the item reason groups or item reasons**

1. Select an item reason group or item reason in a group.
2. On the ribbon, on the **Current View** tab select the available sequence buttons to change the order of the selected item.

- Save the changes.

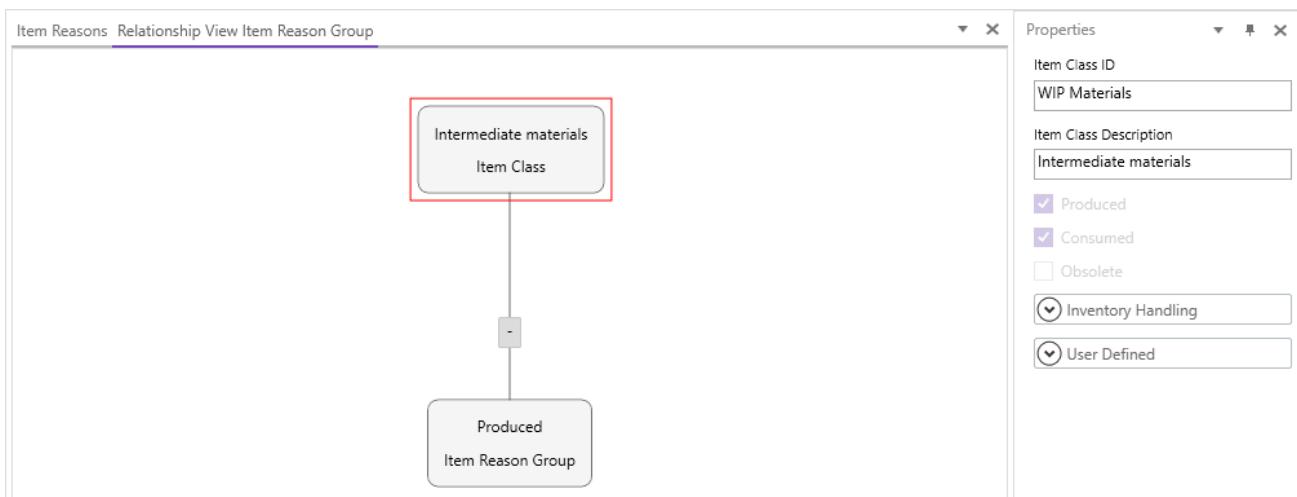
## Viewing the Relationship Diagram

You can view a graphical representation of the relationship between an item reason group and the item classes and entities to which it is assigned.

### To view the relationship diagram

- In the Item Reasons workspace tab, select the item reason group.
- Do one of the following:
  - Right-click the item reason group and on the context menu click **View Relationships**.
  - On the ribbon, go to the **Current View** tab and click **View Relationships**.

The **Relationship View Item Reason Group** tab appears in the workspace.



- Click an item reason group, item class, or entity in the diagram to view its properties.

## To collapse and expand the relationship

- Click the – icon to collapse the relationship groups within the relationship view.
- Click the + icon to expand the relationship groups within the relationship view.

## Utilization States

You can use the **Utilization States** module to define possible utilization states of an entity on the plant floor. A utilization state shows the status of an entity. For example, Running, Idle, or Down. You can define any number of utilization states for an entity.

You assign a utilization state to a utilization reason in the **Utilization** module. For more information on utilization reasons and reason groups, see [Utilization Reasons and Reason Groups](#).

By default, the **Utilization States** module is in the **Performance Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Utilization States** workspace tab, it shows a list of all the existing utilization states. The workspace shows information about the state color, a description, and properties whose values can be used as default values for a utilization reason to which the state is assigned.

Status	Description	Color	Priority For Line Utilization	Reason Enables Entit	Failure
DOWNTIME		Red			
IDLE		Yellow			
RUNNING		Green			

Utilization states can also be configured in MES Web Portal. For more information about configuring utilization states in MES Web Portal, see the [MES Web Portal User Guide](#) or help.

System parameters that control the behavior of utilization functions are configured in MES Client. See the "Operator" section of the table in [System Parameters Reference](#).

## Creating a Utilization State

You can define a utilization state for entities. For example, you can define states such as Downtime and Running.

## To create a utilization state

1. Open or go to the **Utilization States** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Utilization State**.
- A new utilization state is added.
3. In the new utilization state's **Properties** window, complete the properties settings. See [Utilization State Properties](#).
4. Save the changes.

You can modify the properties of an existing utilization state in the **Properties** window.

## Utilization State Properties

### Description

The name of the utilization state.

### Color

The color used to indicate the utilization state.

## Properties Used As Defaults for Utilization Reasons

The following properties are used to apply their values as default property values for any utilization reason that is assigned this utilization state. See [Utilization Reason Properties](#).

### Priority for Line Utilization

The default value for the utilization reason's priority, which is used to determine the reason for a line that has two or more bottleneck entities with differing reasons. The reason with the highest-numbered priority value is used as the line's utilization reason.

The default is 1. A value must be entered, and 0 is not allowed. If 0 entered, the value defaults to 1.

### Reason Enables Entity

The default setting for the utilization reason's **Reason Enables Entity** property.

#### True

If selected, specifies that any entity with this reason is enabled for production.

#### False

If selected, any entity with this reason is not automatically enabled for production. If an entity is in a disabled state, then its production rate is not used in the calculation of the bottleneck line position.

#### Neither

No default setting is applied for the utilization reason's **Reason Enables Entity** property.

#### Failure

The default setting for the utilization reason's **Failure** property.

#### True

If selected, specifies that any time that the entity spends in the utilization reason is considered failure time. Failure time is used in the calculation of Mean Time Between Failures (MTBF) and Mean Time to Repair (MTTR).

**False**

If selected, the utilization reason's event is not considered failure time.

**Neither**

No default setting is applied for the utilization reason's **Failure** property.

**OEE Use**

The default setting for the utilization reason's **OEE Use** property.

**Runtime**

If selected, specifies that an event with this utilization reason counts toward runtime. Runtime events contribute to the calculation of Availability and Performance.

**Downtime**

If selected, specifies that an event with this utilization reason counts toward downtime. Downtime events contribute to the calculation of Availability.

**Neither**

If selected, specifies that an event with this utilization reason does not count toward runtime or downtime. Therefore, this utilization reason time is excluded from the calculation of OEE.

**Maximum Duration**

The default value for the utilization reason's **Maximum Duration** property. Specifies the maximum duration, in seconds, that is used with setting a Severe flag or with the New Reason parameter.

- If the New Reason functionality is not being used (that is, there is no entry in the New Reason column) and the maximum duration is exceeded, the reason is marked as being Severe and the event is considered to be in a severe condition. The Severe flag is typically used with downtime events.
- If the New Reason functionality is being used (that is, there is an entry in the New Reason column) and the maximum duration is exceeded, the utilization reason for the entity is changed to the new reason specified in the New Reason column.

A value of 0 is not allowed. If 0 is entered, the value defaults to 1.

If Maximum Duration is not being used, leave this field blank, which disables the feature.

**New Reason**

A default entry for the utilization reason's **New Reason** property. The utilization reason that this reason should change to when the maximum duration is exceeded.

For example, if a Jam condition exceeds a maximum duration of 5 minutes, then the entity would change to the new reason Mechanic Assistance Required. Note that this has the same effect as manually entering a new reason of Mechanic Assistance at the 5-minute mark. The new reason (Mechanic Assistance Required) starts at that time, and the Jam utilization event ends at that time. However, because utilization is only updated once a minute, the actual transition may be up to 59 seconds after the maximum duration of the original event (Jam in this example) was reached.

This setting is not available unless a value is entered for Maximum Duration.

**Duration**

The default values for the utilization reason's **Duration** properties.

**Standard Time**

The standard amount of time, in minutes, that an entity is expected to be in this utilization reason. Entered

values are rounded to two decimal places.

#### **Minimum Time**

The minimum amount of time, in minutes, that an entity is expected to be in this utilization reason. Entered values are rounded to two decimal places.

#### **Maximum Time**

The maximum amount of time, in minutes, that an entity is expected to be in this utilization reason. Entered values are rounded to two decimal places.

#### **Cost As**

The default setting for the utilization reason's **Cost As** property.

##### **Fixed**

If selected, specifies that an event with this utilization reason is costed as fixed time.

##### **Variable**

If selected, specifies that an event with this utilization reason is costed as variable time.

##### **Neither**

If selected, specifies that an event with this utilization reason is not costed as fixed time or variable time.

#### **Setup Time**

The default setting for the utilization reason's **Setup Time** property.

##### **True**

If selected, specifies that an event with this utilization reason counts toward setup time.

##### **False**

If selected, specifies that an event with this utilization reason does not count toward setup time.

##### **Neither**

No default setting is applied for the utilization reason's **Setup Time** property.

#### **Teardown Time**

The default setting for the utilization reason's **Teardown Time** property.

##### **True**

If selected, specifies that an event with this utilization reason counts toward teardown time.

##### **False**

If selected, specifies that an event with this utilization reason does not count toward teardown time.

##### **Neither**

No default setting is applied for the utilization reason's **Teardown Time** property.

#### **Category 1–4**

Default selections for the utilization reason's user-defined category entries.

#### **Util\_Reas spare 1–4**

Default entries for the utilization reason's user-defined spare fields.

## Utilization Reasons and Reason Groups

You can use the **Utilization** module to define a utilization reason and associate a utilization state to the reason.

Utilization reasons and utilization states are used to monitor and report performance activities of each entity.

Utilization reasons describe the current condition of an entity and associate each reason with a utilization state. A reason group is a category of reasons. For example, the reason "Bottle Jam" can belong to the reason group "Bottle Descrambler Down", and results in a "Downtime" utilization state. On the production floor, a reason can be set by the Utilization Capability Object (UCO) from a PLC or I/O, set by code through an API call, or set by a user through MES Operator, MES Web Portal, or a .NET control.

The reasons are grouped by reason groups. Initially, you must create a utilization reason group before creating the first utilization reason.

By default, the **Utilization** module is in the **Performance Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Utilization** workspace tab, a list of the reason groups and their reasons are shown.

Status	Reason Description	Utilization States	Priority For Line Utilization	Reason Enables Entity	Failure
	Running	RUNNING	1	<input checked="" type="checkbox"/>	
	Running Slow	RUNNING	1	<input type="checkbox"/>	
	Prestaging	RUNNING	1	<input type="checkbox"/>	
	Post-Production	RUNNING	1	<input type="checkbox"/>	

The order of the reason groups in the reason tree, and the order of the reasons within each group, is used in the MES Operator application when a user selects a utilization reason.

Utilization reason groups and reasons can also be configured in MES Web Portal. For more information about configuring and using utilization reason groups and reasons in MES Web Portal, see the *MES Web Portal User Guide* or help.

System parameters that control the behavior of utilization functions are configured in MES Client. See the "Operator" section of the table in [System Parameters Reference](#).

## Creating a Utilization Reason Group

A utilization reason group contains reasons with similar attributes.

You can create up to 10 sub-levels of a utilization reason group. For example, you can have a utilization reason group with nine parent groups. You can define reasons for a reason group at any level.

## To create a utilization reason group

1. Open or go to the **Utilization** workspace tab.
2. To add the reason group at the top level, do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New Reason Group**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Reason Group**.

To add the reason group under another reason group, select the parent reason group and then do one of the following:

- Right-click the parent reason group and on the context menu click **New Reason Sub Group**.
- On the ribbon, go to the **Home** tab and on the **New** menu click **New Reason Sub Group**.

A new reason group is added.

3. In the new reason group's **Properties** window, type the name of the reason group in the **Description** box. The reason group name describes the grouping of utilization reasons and identifies the utilization reason group in the data records, so it must be unique.
4. (Optional) Enter values for the spare fields.
5. Save the changes.

You can modify the properties of a utilization reason group in the **Properties** window.

## Creating a Utilization Reason

You can assign multiple reasons to a utilization state.

### To create a utilization reason

1. Open or go to the **Utilization** workspace tab.
2. Select the utilization reason group to which to assign the reason.
3. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click the reason group and on the context menu click **New Reason**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Reason**.
4. In the new reason's **Properties** window, complete the property settings. See [Utilization Reason Properties](#).
5. Save the changes.

## Utilization Reason Properties

### Description

The name of the utilization reason. The reason description describes the utilization condition of an entity and identifies the utilization reason in the data records, so it must be unique within its reason group.

### Utilization State

Select an existing utilization state or click **Browse** button to create a new utilization state. The utilization state

indicates the state that is appropriate for this utilization reason. For more information on creating a new utilization state, see [Creating a Utilization State](#).

#### Apply Defaults

Click this button to apply the default values specified for the selected utilization state to the utilization reason's properties.

#### Priority for Line Utilization

Used to determine the reason for a line that has two or more bottleneck entities with differing reasons. The reason with the highest-numbered priority value is used as the line's utilization reason.

The default is 1. A value must be entered, and 0 is not allowed. If 0 entered, the value defaults to 1.

#### Reason Enables Entity

If selected, specifies that any entity with this reason is enabled for production.

#### Failure

If selected, specifies that any time that the entity spends in the utilization reason is considered failure time. Failure time is used in the calculation of Mean Time Between Failures (MTBF) and Mean Time to Repair (MTTR).

#### OEE Use

#### Runtime

If selected, specifies that an event with this utilization reason counts toward runtime. Runtime events contribute to the calculation of Availability and Performance.

#### Downtime

If selected, specifies that an event with this utilization reason counts toward downtime. Downtime events contribute to the calculation of Availability.

#### Neither

If selected, specifies that an event with this utilization reason does not count toward runtime or downtime. Therefore, this utilization reason time is excluded from the calculation of OEE.

#### Maximum Duration

Specifies the maximum duration, in seconds, that is used with setting a Severe flag or with the New Reason parameter.

- If the New Reason functionality is not being used (that is, there is no entry in the New Reason column) and the maximum duration is exceeded, the reason is marked as being Severe and the event is considered to be in a severe condition. The Severe flag is typically used with downtime events.
- If the New Reason functionality is being used (that is, there is an entry in the New Reason column) and the maximum duration is exceeded, the utilization reason for the entity is changed to the new reason specified in the New Reason column.

A value of 0 is not allowed. If 0 entered, the value defaults to 1.

If Maximum Duration is not being used, leave this field blank, which disables the feature.

#### New Reason

The utilization reason that this reason should change to when the maximum duration is exceeded. For example, if a Jam condition exceeds a maximum duration of 5 minutes, then the entity would change to the new reason Mechanic Assistance Required.

If you are using the Maximum Duration setting to set a Severe flag, then leave this setting blank. This setting is not available unless a value is entered for Maximum Duration.

#### Duration

**Standard Time**

The standard amount of time, in minutes, that an entity is expected to be in this utilization reason. Entered values are rounded to two decimal places.

**Minimum Time**

The minimum amount of time, in minutes, that an entity is expected to be in this utilization reason. Entered values are rounded to two decimal places.

**Maximum Time**

The maximum amount of time, in minutes, that an entity is expected to be in this utilization reason. Entered values are rounded to two decimal places.

**Cost As****Fixed**

If selected, specifies that an event with this utilization reason is costed as fixed time.

**Variable**

If selected, specifies that an event with this utilization reason is costed as variable time.

**Neither**

If selected, specifies that an event with this utilization reason is not costed as fixed time or variable time.

**Scheduling Use****Setup Time**

If selected, specifies that an event with this utilization reason counts toward setup time.

**Teardown Time**

If selected, specifies that an event with this utilization reason counts toward teardown time.

**Category 1–4**

Specify user-defined entries that describe categories.

---

**Note:** These category entries are currently not integrated with MES Category definitions.

---

**Util\_Reas spare 1–4**

Specify user-defined entries for the utilization reason.

## Moving and Copying a Utilization Reason to Another Group

You can move an existing utilization reason from one group to another group, copy a reason to multiple reason groups, and change the order of reasons in a group.

### To move an existing utilization reason to another group

- Do one of the following:
  - Cut the utilization reason and paste it on the destination utilization reason group.
  - Drag the utilization reason to the destination reason group to make it the first reason in the group, or to the reason in the group that should precede it.

### To copy an existing utilization reason to another group

- Copy the utilization reason and paste it on the destination utilization reason group.

### To change the order of a utilization reason within a group

- Drag the utilization reason to the reason in the group that should precede it.

## Global Specifications

You can use the **Global Specifications** module to create and maintain global specifications. You can use the specifications defined in the Global Specifications module in the **Processes** and **Work Orders** modules to add specifications to a specification version of an operation, a process, and a job.

Global specifications are not used for capturing quality data. See [QM Specifications](#) for quality functionality.

Specifications represent a collection of values for settings that can be used during an operation for a process when producing an item for a work order. Specifications are used for setting values (with an optional minimum and maximum) that should be used at run time during the execution of an operation. These are also known as operating setpoints. For example: When you run a job on an entity doing a mixing operation, the specifications for the operation can be used by the Operation Capability Object (OCO) to load the setpoints in a PLC where the setpoints are different when different items are produced.

You can assign multiple specification versions to an operation. For more information on specification versions, see [Assigning Specifications to an Operation](#). However, you can define only one version as the preferred version. The preferred specification version is used when a work order is created from a process. All operations in a process use that same specification version.

A specification version can contain multiple specifications. When you create a work order from a process, the preferred version is chosen for the job. You can also change the specification version for the job if you have the privilege to edit the specification version.

The entity and step specifications assigned to a process operation are shown below.

The Global Specifications workspace tab displays a list of existing specifications. The central grid shows columns for Status, Group, Spec, Description, Data Type, and Units. The 'Specs' tab is selected, showing a table with rows for 'RoastTemp' and 'RoastTime'. The 'Properties' pane on the right shows details for 'RoastTemp', including its description as 'Roasting temperature' and data type as 'Floating Point'. The 'Entity Specifications' section also lists 'RoastTemp' and 'RoastTime'.

When you open the **Global Specifications** workspace tab, a list of the existing specifications is shown.

The **Global Specifications** module is in the **Operations Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

The Global Specifications workspace tab displays a list of existing specifications. The central grid shows columns for Status, Group, Spec, Description, Data Type, and Units. The 'Specs' tab is selected, showing a table with rows for 'Roaster Specs' and 'RoastTime'. The 'Properties' pane on the right shows details for 'Roaster Specs', including its group as 'Roaster Specs', spec as 'RoastTemp', description as 'Roasting temperature', data type as 'Floating Point', and units as 'degC'.

A global specification group organizes specifications, which are defined template-style. When a specification is

assigned to an operation's specification version, it is given the specific values relevant to that item/operation/entity combination.

The global spec groups display no detailed information because they exist in name only, to organize the specifications.

## Creating a Global Specification

A global specification group organizes specifications that have a pre-defined template style. When a specification is assigned to an operation's specification version, it is given the specific values relevant to that item, operation, or entity combination. These specifications are assigned to specification groups that are valuable when the specifications are used for a Process or in the Operation Capability Object (OCO).

When a specification is assigned to an Operation's Specification Version, it is given the values relevant to that Item, Operation, Entity, or Bill of Material (BOM) combination. For more information, see [Adding Specification Versions to a Standard Operation](#).

You must have the privileges to configure a specification.

### To create a global specification

1. Open or go to the **Global Specifications** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Global Specification**.
3. In the new global specification's **Properties** window, complete the following settings:

#### Group

The group name for the global specification.

#### Spec

The name of the global specification. The specification name identifies the specification in all MES records, so a specification must be unique and is not editable after the specification is saved.

#### Description

The description of the global specification.

#### Data Type

The data type for the global specification that indicates the data type of the selected specifications' values.

- **String:** User-definable text string.
- **Floating point:** User-definable decimal value.

#### Units

The units to be used for the global specification.

#### Display Sequence

Indicates the position in which the selected spec appears within the global spec group in the specification tree.

#### Spec spare 1–4

User-defined information for the global specification.

4. Save the changes.

You can modify the properties of an existing global specification in the **Properties** window.

## Using Specifications in the Operations Capability Object

In the Operation Capability Object (OCO), you can use the **Specifications** tab to browse and select the globally configured specifications from the MES database.

The screenshot shows the AVEVA Operations Capability Object (OCO) Properties window with the **Specifications** tab selected. The window is divided into several sections:

- Specification Name:** Roasting\_Temperature
- Specifications:** A list of available specifications, with "Roasting\_Temperature" selected. Other items in the list include "Roasting\_Temp\_for\_Extended\_Roas..." and "Roasting\_Nuts Temp".
- Global Spec Attributes:** A group of input fields:
  - Spec Group Id: Roasting Nuts Temp
  - Spec Id: Roasting Temperature
  - Units: degC
  - Data Type: MxDouble
- Extendable Spec Attributes:** A section for mapping object attributes to specification attributes.
- General Attributes:** A section for managing general attributes.
- Inherited Specifications:** A list of inherited specifications, with "Name" selected.
- Attribute Mapping Table:** A table for mapping attributes:

Attribute Name	Use Input Output Source	Input Output
Spec Id	<input type="checkbox"/>	
Spec Group Id	<input type="checkbox"/>	

In the OCO, when you enable the **Specifications** tab in the object editor via the **Enable Specifications** check box in the **General** tab, it allows you to map the specification properties such as value, minimum value, and maximum value with object attributes.

Attribute Name	Use Input Output Source	Input Output Source	Working Attribute
Units	<input checked="" type="checkbox"/>	MyContainer.Specs.Roasting_Temperature.	
Spec Value	<input checked="" type="checkbox"/>	MyContainer.Specs.Roasting_Temperature.	
Min Value	<input checked="" type="checkbox"/>	MyContainer.Specs.Roasting_Temperature.	
Max Value	<input checked="" type="checkbox"/>	MyContainer.Specs.Roasting_Temperature.	
Spare1	<input type="checkbox"/>		
Spare2	<input type="checkbox"/>		
Spare3	<input type="checkbox"/>		
Spare4	<input type="checkbox"/>		

When you execute the specifications commands in the OCO, the specifications that have been mapped as attributes in the galaxy are made available for the OCO at the run time. The mapped specification values are retrieved from the database for the OCO's currently running job or a future job.

When you execute the Load Running Job Specs command in the OCO, the specifications for the currently running job on the parent entity of an OCO are loaded. In case of the Load Job Specs command, the OCO uses the values of work order, operation, and sequence number for a job that might be run in future to setup the specifications for later use on that job.

Attribute Name	Use Input Source	Value or Input Source
Work Order	<input checked="" type="checkbox"/>	MyContainer.Specs.WorkOrder
Operation	<input checked="" type="checkbox"/>	MyContainer.Specs.Operation
Sequence Number	<input checked="" type="checkbox"/>	MyContainer.Specs.SequenceNumber
Step Number	<input checked="" type="checkbox"/>	MyContainer.Specs.StepNumber
Job Position	<input checked="" type="checkbox"/>	MyContainer.Specs.JobPosition

The step number is used to enable loading of the specifications for a single step, if a number greater than 0 is in the attribute or the number -1 causes the OCO to retrieve the specifications for all steps for an operation on a job.

Inside the OCO, two sets of attributes are created for every specification. The shop floor user can change specification properties after loading them from the database and before uploading them to external input or output sources. The attributes are as follows:

- The Working attributes, which are used to let a shop floor user change the setpoints value within the maximum and minimum limit values specified.
- The Target attributes, which are used to represent the values currently loaded into a device like a PLC on the shop floor.

Attribute Filter

Name/Desc/EU/Value contains:

Source:

- User defined
- Inherited
- Built-in
- User extended

Visibility:

- Not hidden
- Hidden

Enabled features:

- I/O: Read
- I/O: Read/Write
- I/O: Write
- History
- Limit alarms
- ROC alarms
- Deviation alarms
- State alarm
- Bad value alarm
- Statistics
- Log change

Attributes

<input type="checkbox"/>	Specs.Roasting_Temperature.Target.Units
<input type="checkbox"/>	Specs.Roasting_Temperature.Target.Units.InputOutput.Reference
<input checked="" type="checkbox"/>	Specs.Roasting_Temperature.Target.Units.ReadStatus
<input type="checkbox"/>	Specs.Roasting_Temperature.Target.Units.UseInputOutputSource
<input checked="" type="checkbox"/>	Specs.Roasting_Temperature.Target.Units.WriteStatus
<input type="checkbox"/>	Specs.Roasting_Temperature.Units
<input type="checkbox"/>	Specs.Roasting_Temperature.Working.MaxValue
<input type="checkbox"/>	Specs.Roasting_Temperature.Working.MinValue
<input type="checkbox"/>	Specs.Roasting_Temperature.Working.Spare1
<input type="checkbox"/>	Specs.Roasting_Temperature.Working.Spare2
<input type="checkbox"/>	Specs.Roasting_Temperature.Working.Spare3
<input type="checkbox"/>	Specs.Roasting_Temperature.Working.Spare4

958 of 1044 displayed. 1 selected.

## Understanding Specification Capabilities

The OCO **Specifications** tab displays specification commands during the run time.

Runtime Commands

Runtime Commands

Load Job Specs Command:  
 Use Input Source MyContainer.Specs.LoadJobSpecsCmd ... 🔓 🔍

Load Running Job Specs Command:  
 Use Input Source MyContainer.Specs.LoadRunningJobSpecs ... 🔓 🔍

Load Download Job Specs Command:  
 Use Input Source MyContainer.Specs.LoadDownloadJobSpec ... 🔓 🔍

Load Download Running Job Specs Command:  
 Use Input Source MyContainer.Specs.LoadDownloadRunning ... 🔓 🔍

Save Command:  
 Use Input Source MyContainer.Specs.SaveCmd ... 🔓 🔍

Download Command:  
 Use Input Source MyContainer.Specs.DownloadCmd ... 🔓 🔍

Upload Command:  
 Use Input Source MyContainer.Specs.UploadCmd ... 🔓 🔍

Reset Command:  
 Use Input Source MyContainer.Specs.ResetCmd ... 🔓 🔍

You can trigger the following specification commands during the run time:

### Load Job Specs

Loads the specifications for a job that is not necessarily running on the parent entity of an OCO. When you trigger this command, the OCO uses the values of work order, operation, and sequence number in the run time job filter to load the specifications.

### Load Running Job Specs

Loads the specifications for the currently running job on the parent entity of an OCO. You must specify the job position to retrieve the specifications. When you trigger this command, the OCO uses the values of the work order, operation, and sequence number for the job position instead of the values in the run time job filter to load the specifications.

### Download

Copies the values of the working attributes to the target attributes while applying the *Scaling Factor DB To IO* for each specification.

### Save

Writes the working value of specifications for each specification to the MES database.

### Upload

Reads the value that is configured for the *Actual Specification Value* attribute and updates the *Target Specification Value* at the run time. The target attribute value is written to the working attribute *Working Spec Value Actual* while applying the scaling factor *Scaling Factor IO To DB*.

### Load Download Job Specs

Executes both the Load Job Specs command and the Download command.

### Load Download Running Job Specs

Executes both the Load Running Job Specs command and the Download command.

## Labor Departments

If your MES has entities with the ability to track labor, you can use labor departments to provide contextual information about the time that MES users spend working on those entities. Labor departments are assigned to MES users in the **User Groups and Users** module. In MES Operator, labor departments can also be changed from the user's default department for the current operation running on an entity.

You use the **Labor Department** module to create and maintain labor departments. This module is in the **Operations Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Labor Department** workspace tab, a list of the existing labor departments is shown.

Status	Department ID	Description	Labor_Dept spare 1	Labor_Dept spare 2
dept1	Example Labor Department			
	Raw Materials Receiving	Responsible for receiving raw material		
	Mixed Nuts Processing	Responsible for processing items for		
	Mixed Nuts Packaging	Responsible for packaging mixed nuts		

## Creating a Labor Department

1. Open or go to the **Labor Department** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Labor Department**.A new labor department is added.
3. In the new labor department's **Properties** window, complete the following settings:  
**Department ID**

A unique ID for the labor department. The ID is not editable after the labor department record is first saved.

#### Description

A brief description of this labor department.

4. Save your changes.

You can modify the properties of an existing labor department in the **Properties** window.

## Labor Categories

If your MES has entities with the ability to track labor, you can use labor categories to provide contextual information about the time that MES users spend working on those entities. Labor categories are assigned to MES users in the **User Groups and Users** module. In MES Operator, labor categories can also be changed from the user's default category for the current operation running on an entity.

You use the **Labor Categories** module to create and maintain labor categories. This module is in the **Operations Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Labor Category** workspace tab, a list of the existing labor categories is shown.

Status	Code	Description	Color	Time
0	Idle		Neither	
1	Cleanup		Variable	
2	Maintenance		Variable	
3	Production		Variable	
4	QA Inspection		Variable	

Properties

Code	0
Description	Idle
Color	Red
Time	Neither
Standard Crew Size	

Error List

Type	Instance	Description	Extension	ErrorLevel

## Creating a Labor Category

1. Open or go to the **Labor Category** workspace tab.
2. Do one of the following:

- Press the **Ctrl+N** keys.
- Right-click in the tab and on the context menu click **New**.
- On the ribbon, go to the **Home** tab and on the **New** menu click **New Labor Category**.

A new labor category is added.

3. In the new labor category's **Properties** window, complete the following settings:

#### **Code**

The unique identifier for the labor category. This code is not editable after the labor category record is first saved.

#### **Description**

A brief description of this labor category.

#### **Color**

The color to assign to this category.

#### **Time**

Specifies how to classify time associated with the labor category:

##### **Fixed**

Labor actions for which the exact time for completion is known.

##### **Variable**

Labor actions for which the exact time for completion is not known.

##### **Neither**

Labor time that is neither Fixed nor Variable.

#### **Standard Crew Size**

The standard crew size for this labor category.

4. Save your changes.

You can modify the properties of an existing labor category in the **Properties** window.

## Certifications

Certifications can be applied to certain MES actions to control which users can perform those actions and which actions require a sign-off to complete the action. The actions include operations, operation steps, item production and consumption, and data logging.

There are two types of certifications:

- Access, or non-audit, certifications, which can restrict access to the actions to which they are assigned
- Audit certifications, which require one or more user sign-offs to complete the action to which they are assigned

You use the **Certifications** module to create certifications and assign users to them. You then use other modules to assign the certifications to the target actions.

The **Certifications** module is in the **Operations Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Certifications** workspace tab, a list of the existing certifications is shown.

## How Access Certifications Work

Access (non-audit) certifications can be applied to actions to require that only users at or above a predefined certification level can perform the action. Access certifications can restrict access to the following actions:

- Running a job that has been instantiated from an operation to which the certification has been assigned
- Running a job that will produce an item to which the certification has been assigned
- Performing a job step that has been instantiated from an operation step to which the certification has been assigned

## How Audit Certifications Work

Audit certifications can be assigned to certain actions to require that one or more users at or above a predefined certification level sign off on the action to complete it. Sign-offs can be required to:

- Approve running a job that has been instantiated from an operation to which an audit certification has been assigned.
- Approve performing a job step that has been instantiated from an operation step to which an audit certification has been assigned.
- Approve the recording of a data log. Data log certifications can be assigned to a data log group that is being assigned to:
  - An operation, to enable data logging for any jobs that are instantiated from the operation

- An operation step, to enable data logging for any job steps that are instantiated from the operation step
- A job directly. Such a job could have been instantiated from an operation that does not have a data log group assigned to it, or a job that was manually added to a work order.
- A job step directly. Such a job step could have been instantiated from an operation step that does not have a data log group assigned to it, or a job step that was manually added to a job.

## Certification Levels

Certification levels work as follows:

- A maximum level is defined for a certification. This value determines how many certification levels there are for the certification. A value of 5 means that users can be assigned a level of 1 through 5 for the certification.
- Each user that is assigned to a certification is assigned a level for that certification.
- When a certification is assigned to an action, the certification level that is required to perform that action (for an access certification) or to sign off on the action (for an audit certification) is defined.

For example, say level 2 is defined for an access certification when it is assigned to an item that can be produced. Only users who are at level 2 or higher for that certification will be able to run a job that can produce that item.

Or, say level 3 is defined for an audit certification when it is assigned to an operation step. Only users who are at level 3 or higher for that certification will be able to sign off on a job step that is instantiated by the operation step to complete it.

To illustrate with a practical example, let's say there is a Goods Inspection audit certification for item production and that there are three levels of users who could possibly perform the inspection, depending on the item: Associate Operator (level 1), Operator (level 2), and Senior Operator (level 3).

- When the Goods Inspection certification is assigned to items for which the inspection is less critical, the level might be set at 1. This would allow Associate Operators, Operators, or Senior Operators to sign off on the production.
- When the Goods Inspection certification is assigned to items for which the inspection is more critical, the level might be set at 2. This would allow only Operators or Senior Operators to sign off on the production.
- When the Goods Inspection certification is assigned to very critical items, the level might be set at 3. This would require that a Senior Operator sign off on the production.

## Creating a Certification

1. Open or go to the **Certifications** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Certification**.A new site is added.
3. In the new certification's **Properties** window, complete the property settings.  
For a description of the properties, see [Certification Properties](#).

4. Save your changes.

## Certification Properties

### Name

The unique name for the certification.

The name cannot be edited once the certification is added and saved.

### Max level

Defines the maximum number of qualification levels for this certification.

A value of 1 means that there is one level: any users that are assigned to the certification are qualified. This is because any user that is assigned to a certification must have at least the minimum value of **1** defined as their level.

A value of 2 or more means that different levels of user qualification can be applied to an action that has the certification.

### Audit

Controls whether the certification is an access or audit certification.

If **not selected**, the certification is an access certification. It restricts user access to performing certain actions, as described in [How Access Certifications Work](#).

Also, if the **Audit** option is not selected, the sign-off properties are hidden, the **Available to Attributes** property is available, and the **Available to Log Data** property is not available.

If **selected**, the certification requires that the action to which it is assigned requires one or more users to perform a sign-off to complete the action, as described in [How Audit Certifications Work](#).

Also, if the **Audit** option is selected, the sign-off properties appear, the **Available to Attributes** property is not available, and the **Available to Log Data** property is available.

### Permanent

If selected, the qualification for any users who are assigned to this certification never expires.

If not selected, the **Expires after** property appears.

### Expires after (days)

Appears only if the **Permanent** option is not selected.

The maximum number of days at which the certification expires for a user once the certification is assigned to the user.

The actual expiration date for the user is entered in the user's **Expiry** column on the **Users** tab. The actual date can be any date between the current date and the date that is the number of days entered here after the current date. For example, if the value entered here is 365, then the certification's expiry date for a user that is assigned on May 1 can be any date from May 1 to April 30 of the following year.

### Available to Operations

If selected, this certification can be assigned to operations.

### Available to Operation Steps

If selected, this certification can be assigned to operation steps.

### Available to Producing Items

If selected, this certification can be assigned to items that are produced.

### Available to Consuming Items

If selected, this certification can be assigned to items that are consumed.

---

**Note:** Consuming Items certifications are currently not implemented.

---

**Available to Attributes**

Available only if the **Audit** option is not selected.

---

**Note:** Attribute certifications are currently not implemented.

---

**Available to Log Data**

Available only if the **Audit** option is selected.

If selected, this certification can be assigned to a data log group when it is assigned to an operation, operation step, or job step created for a job.

**Number of Signoffs Required**

Appears only if the **Audit** option is selected.

Defines how many qualified users must sign off on an action to which this certification is assigned for the action to be completed.

**Requires Signoff Comment**

Appears only if the **Audit** option is selected.

If selected, a user that is signing off on an action to which this certification is assigned must enter comments to complete the certification sign-off.

**Signoff Notes**

Appears only if the **Audit** option is selected.

Enter notes here that will be displayed in the certification sign-off window for the user to read prior to signing off. An example is a description of the requirements that must be met to qualify the action for sign-off.

**Cert\_Type spare 1 to Cert\_Type spare 4**

Optional, user-definable fields for this certification.

## Assigning a Certification to Users

1. In the **Certifications** workspace tab, select the certification to be assigned.

2. Do one of the following:

- In the **Users** tab, right-click and click **Add Link**.
- On the **Current View** ribbon group, click **Add Link**.

The Select User dialog appears. The MES users who have not already been assigned to the certification are listed.

If using OS Group security mode, you can add other users to this list by clicking the **Add** button. This function is similar to the functionality for adding users as described in [Setting Up User Groups and Users in OS Group Security Mode](#). The selected user will be added to the MES database. However, there is no verification that the user belongs to a valid MES OS Group. If the selected user is not a member of an OS Group defined in the MES database, the user will not be able to log into any MES application.

3. Select the users to which to assign the certification.

4. Click **OK**.

The selected users are listed in the **Users** tab.

5. For each user entry, complete the property settings.

**Level**

Defines the user's qualification level for this certification.

**Expiry**

Defines the date when the user's certification expires. The date entered can be from the current date up to the number of days from the current date, specified by the **Expires after (days)** property entry for the certification.

This property is blank for permanent certifications.

6. Save your changes.

### To remove a certification from a user

- Right-click the user in the **Users** tab and click **Delete Link**.

## Assigning Certifications to Actions

Once certifications have been added and assigned to users, you can assign them to the following:

- Operations. See [Assigning Certifications to an Operation](#).
- Operation steps. See [Assigning Certifications to an Operation Step](#).
- Items that are produced or consumed. See [Assigning Access Certifications to an Item](#). Note that items can only be assigned access certifications.
- For audit certifications only, data logging for an operation, operation step, or job step. See [Assigning Data Log Groups to an Operation](#), [Assigning Data Log Groups to an Operation Step](#), or [Assigning Data Log Groups to a Job Step](#).

## Deleting a Certification

Deleting a certification also removes it from any operation, operation step, item, or data log group to which it is assigned.

1. Select the certification.
2. Do one of the following:
  - Right-click the certification and click **Delete**.
  - Press the **Delete** key.
  - On the **Home** ribbon group, click **Delete**.
3. Click **Yes**.  
You are notified that the certification record was deleted from the system.
4. Click **OK**.

## Processes

You can use the **Processes** module to create and maintain a process and an operation. A process is a logical representation of the performance of one or more operations utilizing one or more physical entities for the purpose of producing an item. You can create a process to define the production method to produce an item, and instantiate the work orders.

A process describes operations and steps required to manufacture an item. Processes are not used directly to

manufacture an item. Processes are used to create work orders that are instances of a process. Work orders are used to manufacture an item. The use of processes in MES is optional as you can create a work order directly using the **Work Orders and Jobs** module. Processes are required in the MES Client application to assign certifications as you cannot assign a certification to a work order.

By default, the **Processes** module is in the **Operations Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

A process is a method of producing an item. A process links an item that needs to be produced with operations, steps, specifications, entities, and routings. A process determines the flow of material between entities and operations.

Status	Process Class ID	Process ID	Description	Version
Approved	BAG-MXN	BAG-MXN-1	Bag of Mixed Nuts Proc	1
	100-RST	Roasting		1
	200-COA	Coating		2
	300-BAG	Bagging		3

Status	Attribute	Value	Notes

Type	Instance	Description	Extension	Error

When you open the **Processes** workspace tab, the **Current View** tab appears on the ribbon.

The **Current View** tab includes the **View** group and the **Diagrams** group.

In the **View** group, the following commands are available:

#### **Standard View**

Shows the standard view. When you click **Standard View**, a list of all the available processes is shown.

#### **Group By Item**

Shows a list of all the processes by item. When you click **Group By Item**, a list of item IDs of all the available items is shown. Click the plus (+) symbol to expand an item and view the list of processes assigned to that item.

#### **Group By Process Class**

Shows a list of all the processes by class. When you click **Group By Process Class**, a list of the process class IDs of all the available process classes is shown. Click the plus (+) symbol to expand a process class and view the list of processes assigned to that class.

#### **Group By Level**

Shows a list of all the processes grouped by their level. Three levels are available for a process, General, Site, or Master. You can assign group level to a process while creating a process. For more information on creating a process, see [Creating a Process](#).

#### **Group By Status**

Shows a list of all the processes grouped by their status. Four statuses are available for a process: Disabled, Experimental, Approved, or Certified. You can assign status to a process while creating a process. For more information on creating a process, see [Creating a Process](#).

In the **Diagrams** group, the following commands are available:

#### **View Relationships**

Shows a graphical representation of the relationship between a process, an operation, a standard operation, an item, and a process class.

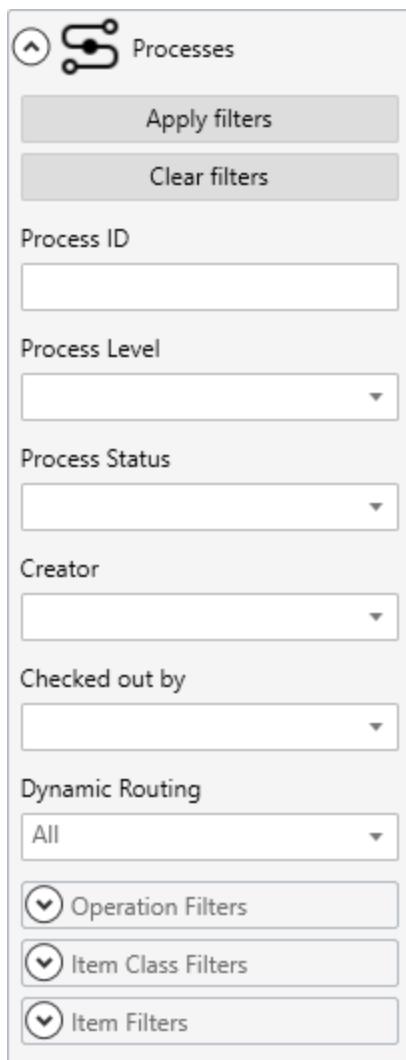
#### **View Route Map**

Shows a graphical representation of the process with boxes for Operations, entities within the Operations, and the associated entities. For more information on viewing job route diagram, see [Viewing a Job's Route Diagram](#).

### **Applying Filters**

When opening the **Processes** workspace tab, the **Apply Filter** function allows you to filter the list of processes in the tab to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Operations Management** group open the **Processes** section.



2. To not filter the processes, don't enter any search terms.

To filter the processes, enter search terms in the following available filter options.

In the **Process** section, the following filter options are available:

#### **Process ID**

Unique ID of the process.

#### **Process Level**

Level of the process.

#### **Process Status**

Status of the process.

#### **Creator**

Name of the operator who created the process.

#### **Checked out by**

Name of the operator who checked out the process.

#### **Dynamic Routing**

Specifies whether to include dynamic routing processes in the resulting process list. The following options

are available:

**All** All processes including dynamic routing processes and normal processes.

**True** All dynamic routing processes.

**False** All normal processes.

#### **Operation Filters: Operation ID**

The unique ID of an operation within a process.

#### **Operation Filters: Entity**

An entity assigned to an operation of a process.

#### **Item Class Filter: Item Class ID**

The unique ID of the produced item class that is linked to a process.

#### **Item Class Filter: Item Class Description**

A description of the produced item class that is linked to a process.

#### **Item Filters: Item ID**

The unique ID of the produced item that is linked to a process.

#### **Item Filters: Item Description**

A description of the produced item that is linked to a process.

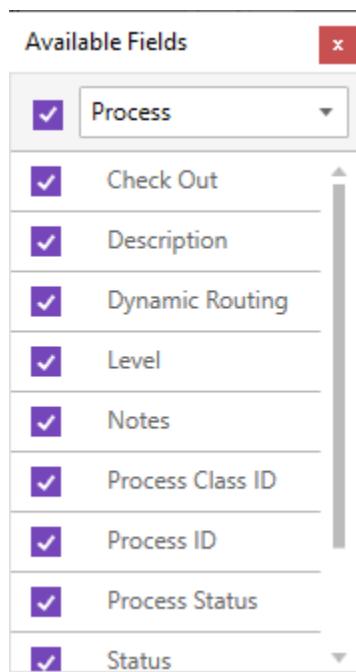
3. Click **Apply Filter**.

The **Processes** workspace tab opens, listing the processes that match the filter search terms.

### **Showing and Hiding Columns in the Processes Tab Grid**

1. Click the **Available Fields** icon  at the top left of the grid on **Process** workspace tab.

The **Available Fields** dialog box appears.



2. Select or clear a check box to show or hide a column.

3. Close the dialog box.

## Workflow for Creating Processes

The workspace shows the process ID, process description, process class, and so on, for all the existing processes.

Following is the workflow to create a new process:

1. [Creating a Process Class](#)
2. [Creating a Process](#)
  - a. [Setting the Process Level](#)
  - b. [Setting the Process Status](#)
3. [Assigning Items to a Process](#)
4. [Assigning Attributes to a Process](#)
5. [Adding an Operation to a Process](#)
6. [Adding a Standard Operation to a Process](#)
7. [Assigning an Entity to an Operation](#)
8. [Adding a File or Web Page to an Operation](#)

You do not need to perform this step if you are adding a file or web page.
9. [Assigning a BOM to an Operation](#)

You do not need to perform this step if you are creating an item with no BOM.
10. [Assigning Certifications to an Operation](#)

You do not need to perform this step if you are not using certifications.
11. [Assigning Data Log Groups to an Operation](#)

You do not need to perform this step if you are not collecting data.
12. [Assigning Steps to an Operation](#)

You do not need to perform this step if you are not using steps.
13. [Assigning Specifications to an Operation](#)

You do not need to perform this step if you are not assigning operation specifications.
14. [Assigning Attributes to an Operation](#)

You do not need to perform this step if you are not assigning operation attributes.
15. [Creating a Route Map](#)

Repeat 7 to 14 for each operation in your process. Steps 8 to 14 are optional.

## Creating a Process Class

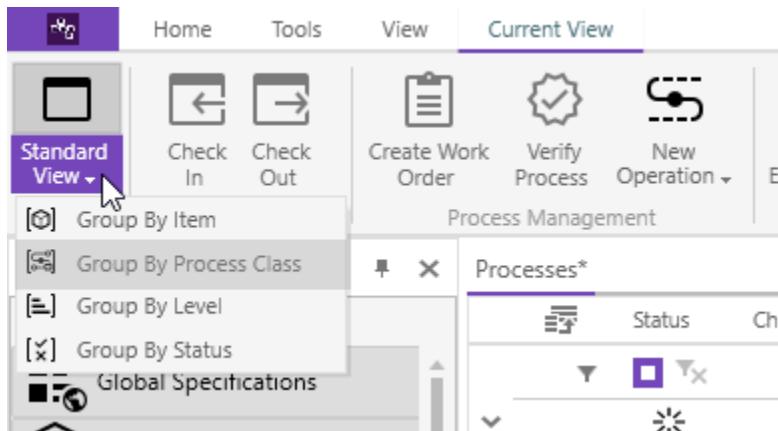
A process class contains processes with similar attributes.

You can create a new process class while creating a new process by specifying a process class ID for a process.

For more information on creating a process, see [Creating a Process](#).

## To create a process class

1. Open or go to the **Processes** workspace tab.
2. On the ribbon, click the **Current View** tab.
3. In the **Standard View** list, click **Group By Process Class**.



The grid entries are grouped by process ID.

4. Right-click in the top pane and on the context menu click **Insert Process Class**.  
A new process class is added.
5. In the **Process Class ID** box on the **Properties** window, type a unique ID for the process.
6. Save the changes.

## Creating a Process

A process is a plan or template, which can be used to create work orders. For more information on work order, see [Work Orders and Jobs](#).

### To create a process

1. Open or go to the **Processes** workspace tab.
2. Do one of the following:
  - Right-click in the top pane and on the context menu click **New Process**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Process**.

A **New Process** tab appears.

3. In the new process **Properties** window, complete the property settings. See [Process Properties](#).
4. Save the changes.
5. Close the **New Process** tab.
6. The new process is added to the grid in the **Processes** workspace tab.

You can modify the properties of an existing process in the **Properties** window.

## Process Properties

### Process Class ID

The ID of the process class to which you want to assign the process. You can also type a new process class name.

### Process ID

A unique ID for the process. Process ID identifies the process in all MES data records, so must be unique and is not editable after the process definition is first saved.

### Description

A brief description or common name for the process.

### Version

A version for the process. This property is used only in conjunction with the process class ID to implement versioning.

Type the name that identifies your process in the **Process Class ID** box, and then enter the required version in the **Version** box. Select the **Process ID** box and MES combines those two values into a unique process ID.

### Level

The level at which to organize the processes. For more information on levels, see [Setting the Process Level](#).

### Status list

The status for the process. For more information on statuses, see [Setting the Process Status](#).

### Notes

Additional information about this process.

### Dynamic Routing

Specifies whether this process is for produced items that require dynamic routing.

A dynamic routing process is used to create jobs and work orders required to handle dynamic routing. Dynamic routing processes are normally not complete processes that can create a product from beginning to end, but rather "mini-processes" that are intended to correct a specific sort of defect from one or more specific operations in the normal process used to create a product. For more information on dynamic routing, see [Dynamic Routing](#).

Once the process is saved, the **Other Process Property** section is available. It includes the following properties:

### Creator

The name of the user who created the process.

### Approver

The name of the person who approved the process.

### Created At

The date and time when the process was created.

### Last Editor

The name of the user who last edited the process.

### Last Edit At

The date and time when the process was last edited.

### Last user to change status

The name of the user who last changed the status of the process.

### Last status change at:

The date and time when the status of the process was last changed.

#### Checked out by

The name of the user who currently has the process checked out.

## Setting the Process Level

- In the **Properties** window, select the level at which to organize the processes in the **Level** list.

Process levels are predefined. The following options are available in the list:

#### General

For processes with no limitations (top-level and overall usage). By default, **General** is selected. General level processes consists of operations and steps with no entities assigned to the operation. You can clone the General operations and assign entities to them to create site level processes. You can also assign other entity specific properties to the process such as entity specification.

#### Site

For site-specific variations (plant, region, and so on). You can clone the Site level Processes and assign items to the process to create master level processes that can be instantiated into jobs.

#### Master

For equipment-specific variations (cell, manufacturing line, set of entities, and so on).

---

**Note:** General and Site processes should not be instantiated into work orders.

---

## Setting the Process Status

### To set the status for a process

- On the **Properties** window, select the status for the process in the **Status** list.

Process statuses are predefined. This also determines, whether this process can be used as a work order in conjunction with system parameters (Lowest level process that can be used). By default, **Disabled** is selected. For more information, see the description for the General system parameter *Lowest level process that can be instantiated* in the table in [System Parameters Reference](#).

The following options are available in the list:

#### Disabled

Status level that cannot instantiate a work order. When you create a process, the default status of a process is Disabled. You cannot instantiate a disabled process.

#### Experimental

Lowest status level that can instantiate a work order. Instantiation can be excluded by the system settings.

#### Approved

Middle status level that can instantiate a work order. Instantiation can be excluded by the system settings.

#### Certified

Highest status level that can instantiate a work order at all installations. System parameter settings can prevent editing and deletion of certified processes and limit a process class to one certified process.

You can configure the following General system parameters that are related to the process certification level:

- *May not delete or modify the components of a certified process*
- *Disallow deletion of a process that derives from a certified process*
- *May only have one certified process in a process class*
- *Cloned certified process status if only one certified process is allowed*
- *How to automatically downgrade a certified process version*

For more information on General system parameters, see the table in [System Parameters Reference](#).

## Assigning Items to a Process

A process can be instantiated into a work order. A process must have the following:

- At least one linked item
- At least one operation with one entity assigned to the operation
- A routing specified if there is more than one operation

Each item that is linked to a process has its own process status. By default, the status of a linked item is the same as the status of a process. The status of an item must have the minimum required status before a work order is created from the process to produce the item as defined in the *Lowest level process that can be instantiated* parameter. An item can have the status as certified for the process while another item has the status as experimental.

You can link multiple items to a process to produce an item.

### To assign items to a process

1. Check out the process to which you want to assign items. For more information on checking out a process, see [Checking Out and Checking In a Process](#).
2. On the **Items to Produce** section of the **Properties** window, click the + icon to add an item to the process. The Add Item dialog box appears.
3. On the top pane, optionally create a filter to limit the number of items returned. Leaving the filter blank will return all available items.  
To reset the filter, click **Clear Filters**.
4. Click **Apply Filters**

**Add Item**

Items

Item ID	<input type="text"/>	Item Description	<input type="text"/>
Units	<input type="text"/>	Unit Cost	<input type="text"/>
Lifetime	<input type="text"/>	Num Decimals	<input type="text"/>

**Item Class Filters**

**Apply filters**   **Clear filters**

Select Item	Item	Item Class
<input type="checkbox"/>	FMX-BBQ(Flavored Mixed Nuts - BBQ)	WIP Materials(Intermediate materials)
<input type="checkbox"/>	RMX-BLK(Roasted Mixed Nuts)	WIP Materials(Intermediate materials)

**OK**   **Cancel**

5. On the bottom pane, select the items and then click **OK**.

The selected items are added to the **Items to Produce** section in the Properties window.

**Items to Produce**

Add Item

Item ID	Status	Process Rank	Last Edit Comment
BMX-BBQ	Approved	1	

6. In each item's **Status** list, select its appropriate status.

By default, status of a process is assigned to an item. You cannot assign a higher status to an item than the status of linked process. If the status of a process is lower than status of the linked item, then status of all items that have higher status is lowered to match the status of the process. For example, if you change status of the process from Approved to Disabled, then status of all the items associated to that process is changed

to Disabled regardless of the original status.

7. In the **Process Rank** list, click the rank for the process.

A process rank specifies the capability of a process to produce an item. If an item is linked to more than one process, the process with lowest rank for that item is considered as the most preferred process for producing the item.

8. Save the changes.

## Assigning Attributes to a Process

An attribute is an additional user-defined property. You can add attributes to a process to provide more information about the process to the users of the MES system.

### To assign attributes to a process

1. In the Processes workspace tab, select the process to which you want to assign attributes.
2. Check out the process.
3. Go to the **Attributes** tab.
4. Do one of the following:
  - Right-click in the tab and on the context menu click **Add**.
  - On the ribbon, go to the **Current View** tab and click **Add Attributes**.

The **Add attributes** dialog box appears.

5. Select the attributes to assign to the process and click **OK**.  
The selected attributes are added to the **Attributes** tab.
6. In each attribute's Properties window, complete the **Value** and **Notes** as needed.
7. Save the changes.

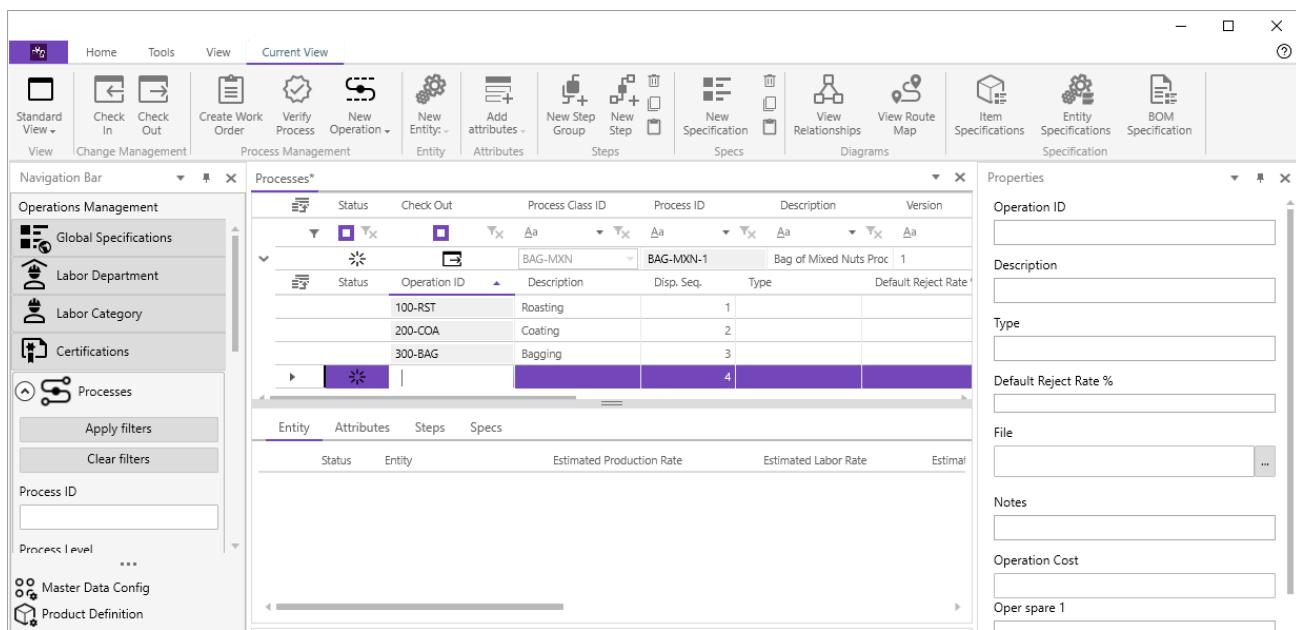
## Adding an Operation to a Process

An operation represents a phase of a process and specifies the consumption and production proportion. One or more entities are utilized to perform an operation. An operation can have specifications and sub-operation step groups.

### To create an operation

1. In the Processes workspace tab, select the process to which you want to add an operation.
2. Check out the process.  
For more information on checking out a process, see [Checking Out and Checking In a Process](#).
3. Do one of the following:
  - Right-click the process and on the context menu click **New**.
  - On the ribbon, go to the **Current View** tab and click **New Operation**.

A new operation is added to the process.



4. In the new process **Properties** window, complete the properties. See [Operation Properties](#).
5. Save the changes.

You can modify the properties of an existing operation in the **Properties** window.

## Operation Properties

### Operation ID

A unique ID for the operation. Operation ID identifies the operation in the MES data records, so must be unique within operations. Operation ID is not editable after the operation definition is first saved.

### Description

A brief description or a name for the operation.

### Type

Additional information to classify the operation.

### Default reject rate%

The percentage of the production quantity that is estimated to be rejected during this operation (that is, the percentage of produced material that fails to meet production requirements). This percentage is used to calculate the jobs' starting quantity given the work order starting quantity. A value of 10 is interpreted as 10%.

### File

You can add a file or a web page to an operation to support the operator during production. For example, a file or web page can contain information relative to performing the jobs that are instantiated from the operation. When a user is running a job using an application such as MES Operator, the files and web pages will be available to them for viewing.

See [Adding a File or Web Page to an Operation](#).

### Notes

Additional notes about this operation.

### Operation Cost

The cost for this operation. Operation cost defines the estimated cost of completing this operation in monetary units.

#### Oper spare 1 to Oper spare 4

User-defined information about the operation.

#### Dynamic Routing Code

The dynamic routing code for this operation. The dynamic routing code links jobs instantiated from this operation to a dynamic routing process via a dynamic routing usage entry in the **Dynamic Routing** module. If unit rework is required, the link allows these jobs to initiate a dynamic routing process for that rework. The corresponding dynamic routing usage entry specifies which dynamic routing process to initiate for the rework. The dynamic routing code entered here can also be used as a re-entry code to identify at what operation in the process the reworked material will be returned.

---

**Note:** To avoid arbitrary apportioning of rework quantities across multiple jobs for an operation, the system requires that there be only one job for the operation at which rework is returned into the originating routing.

If the jobs instantiated by this operation are to support dynamic routing, select an existing code in the list or type a new dynamic routing code. If you type a new code, you will also have to create or modify a dynamic routing usage entry in the **Dynamic Routing** module that specifies the same dynamic routing code to allow rework or to be used as re-entry point for the reworked material.

For more information about using dynamic routing processes for rework, see Dynamic Routing and the *MES Dynamic Routing User Guide*.

#### Display Sequence

The sequence in which you want to display this operation within the process diagram.

#### BOM

You can configure the BOM information for an operation if you have an item or items assigned to the process that have BOMs associated with them. You can select the item being produced by the operation, which can be different from the item produced by the process.

See [Assigning a BOM to an Operation](#).

#### Certification

You can assign certifications to an operation to manage who can run jobs that are instantiated from the operation and whether a sign-off is required to complete a job.

See [Assigning Certifications to an Operation](#).

#### Data Log Groups

You can assign one or more data log groups to an operation to allow users to collect measurement data about production when running jobs that are instantiated from the operation.

See [Assigning Data Log Groups to an Operation](#).

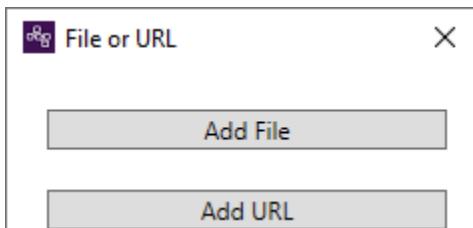
## Adding a File or Web Page to an Operation

You can add a file or a web page to an operation to support the operator during production. For example, a file or web page can contain information relative to performing the jobs that are instantiated from the operation. When a user is running a job using an application such as MES Operator, the files and web pages will be available to them for viewing.

## To add a file

1. Click the Browse button to the right of the **File** property box.

The File or URL dialog box appears.



2. Click **Add File**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the file to be added, and then click **Open**.

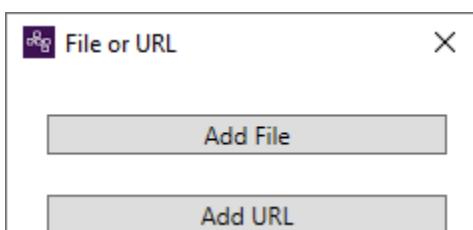
The file is entered in the **File** property box.



## To add a web page

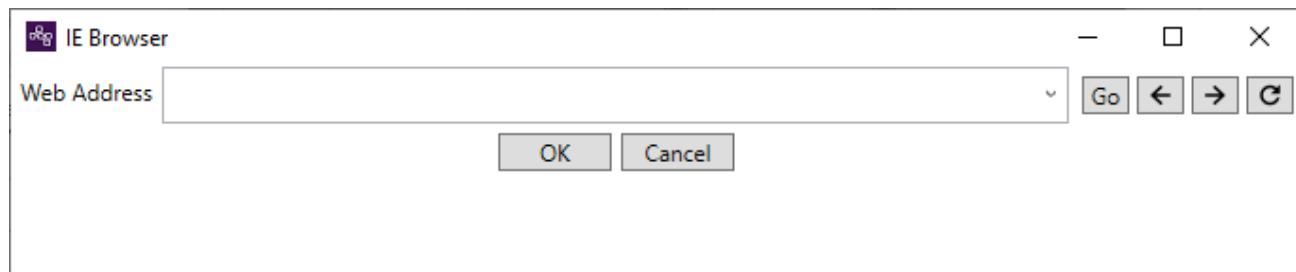
1. Click the Browse button to the right of the **File** property box.

The File or URL dialog box appears.



2. Click **Add URL**.

A mini-web browser appears.



3. Enter or navigate to the web page, and then click **OK**.

The URL is entered in the **File** property box.



# Assigning a BOM to an Operation

You can configure the BOM information for an operation if you have an item or items assigned to the process which have BOMs associated with them. You can select the item being produced by the operation, which can be different from the item produced by the process.

**Note:** The last operation in the process must produce the item as defined to be produced by the process.

You can also configure the consumption information for an operation. You can specify consumed items and the consumed quantity of an item during an operation. If more than one item is linked to the process, then you need to set up the BOM information for each item separately.

You can link a BOM item to an operation to specify where the BOM components are consumed. When you link a BOM item to an operation, all produced items, BOM versions, and BOM components of that BOM item are linked to that operation. You can link multiple BOM items to an operation.

You must create a BOM in the **Items** module before configuring the BOM in the **Processes** module. For more information on creating a BOM, see [Creating BOMs for an Item](#).

You cannot delete a BOM component from the **Processes** module. If you want to delete a BOM component, you can use the **Items** module. For more information on items, see [Items](#).

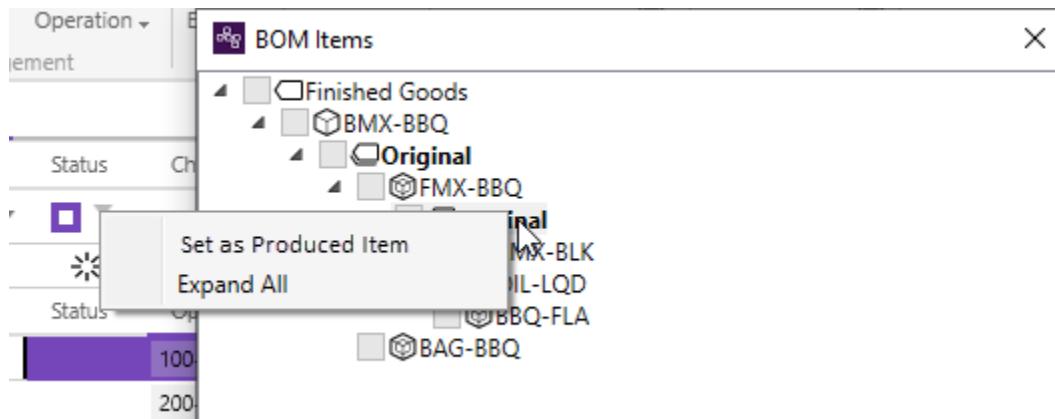
## To configure an operation BOM

1. Select the operation.
2. On the **Properties** window, click **BOM**, and then click **Configure Operation Output**.

The **BOM Items** dialog box appears. The **BOM Items** dialog box shows the BOM items that are linked to the selected process.

You must link an item to the process in the **Processes** module before configuring an operation BOM link. For more information on linking an item to a process, see [Assigning Items to a Process](#).

3. Right-click a BOM item on the **BOM Items** dialog box, and then click **Set as Produced Item**.



You must have more than one produced item in the BOM tree.

4. On the **Properties** window, click **Configure Operation BOM**.  
The BOM dialog box appears.

Status	BOM Positio	Component Item	Quantity	Qty at Operation	Remaining
	1	PNT-BLK (Peanuts in Bulk)	0.4740000	0.4740000	0.0000000
	2	CSW-BLK (Cashews in Bulk)	0.2370000	0.2370000	0.0000000
	3	AMD-BLK (Almonds in Bulk)	0.2630000	0.2630000	0.0000000

- On the BOM dialog box, complete the following settings:

**Item Produced in this Operation**

The item and BOM version that you want to configure. The BOM positions for the items that make up the BOM are listed.

**Percent to Start**

The percentage quantity of items that must be reported as produced by the previous operation before this operation's job state is set to Ready.

Note that this value will affect the latest start time by when an operation's production should begin to meet a work order's required finish time. For example, say an operation is able to begin production with its available start quantity being less than 100%. This will contribute to the latest production start time for that operation and upstream operations being later than if the operation required 100% of its start quantity to begin production. For more information on this affect, see [How the Default Latest Start Times for Operations Are Determined](#).

**BOM Position**

Read-only. The BOM position of the components or by-products for the selected item or BOM version.

**Quantity**

Read-only. The quantity of the BOM item to be consumed or produced during the selected process per unit of production.

**Qty at Operation**

The quantity of the BOM item to be consumed or produced during the selected operation per unit of production.

**Remaining**

Read-only. The quantity of the BOM item that can be consumed or produced by other operations per unit of production.

- Save the changes.

# Assigning Certifications to an Operation

You can assign certifications to an operation to manage who can run jobs that are instantiated from the operation and whether a sign-off is required to complete a job that is instantiated from the operation.

If an **access certification** has been assigned to an operation, a user cannot start a job that is instantiated from the operation or start a work order that is created from a process that includes the operation unless the following conditions have been met:

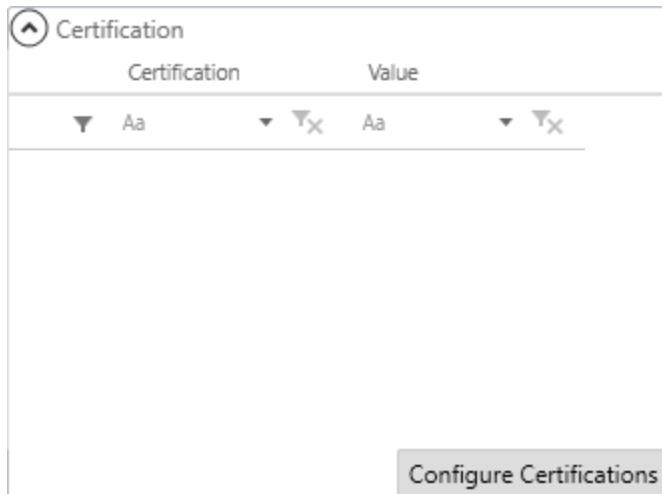
- The user has been assigned to the certification.
- The user's certification level is at or higher than the level specified when the certification was assigned to the operation.

If an **audit certification** has been assigned to an operation, then one or more user sign-offs will be required to complete any jobs instantiated from the operation. Only users whose certification level is at or higher than the level specified when the certification was assigned to the operation can perform a sign-off.

For information about configuring certifications, see [Certifications](#).

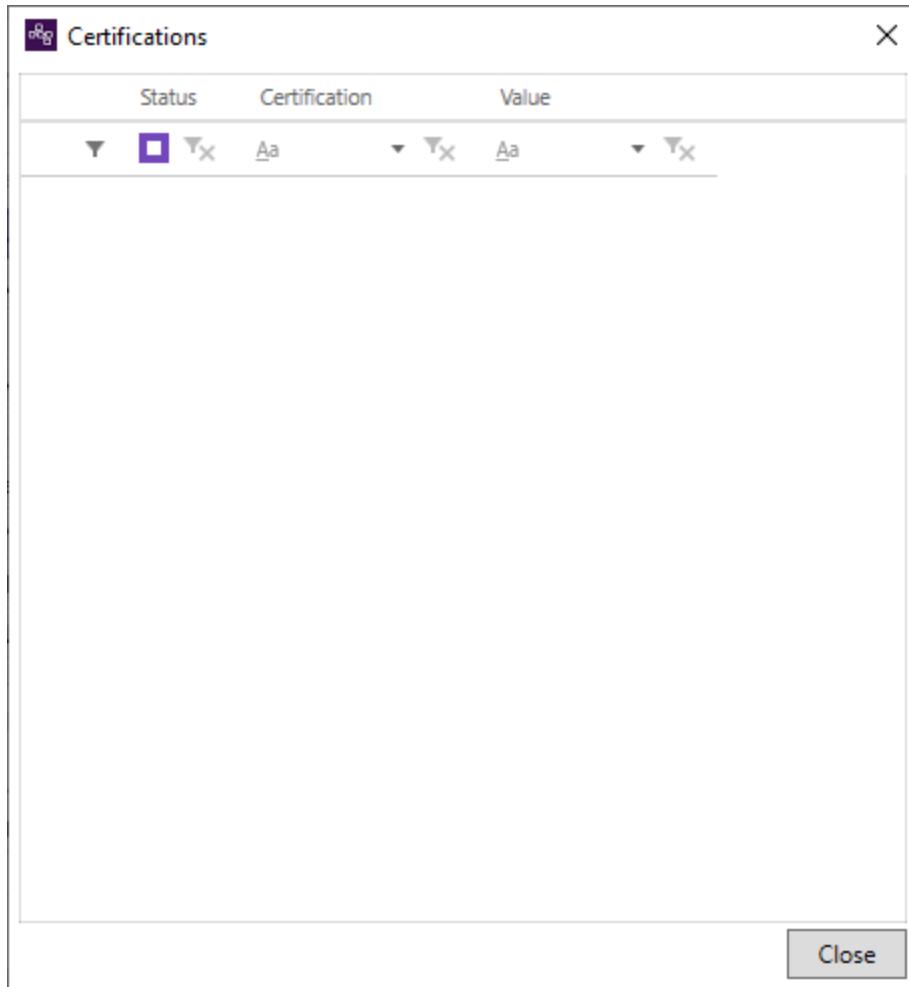
## To assign a certification to an operation

1. Select the operation.
2. In the **Properties** window, open the **Certification** section.



3. Click the **Configure Certifications** button.

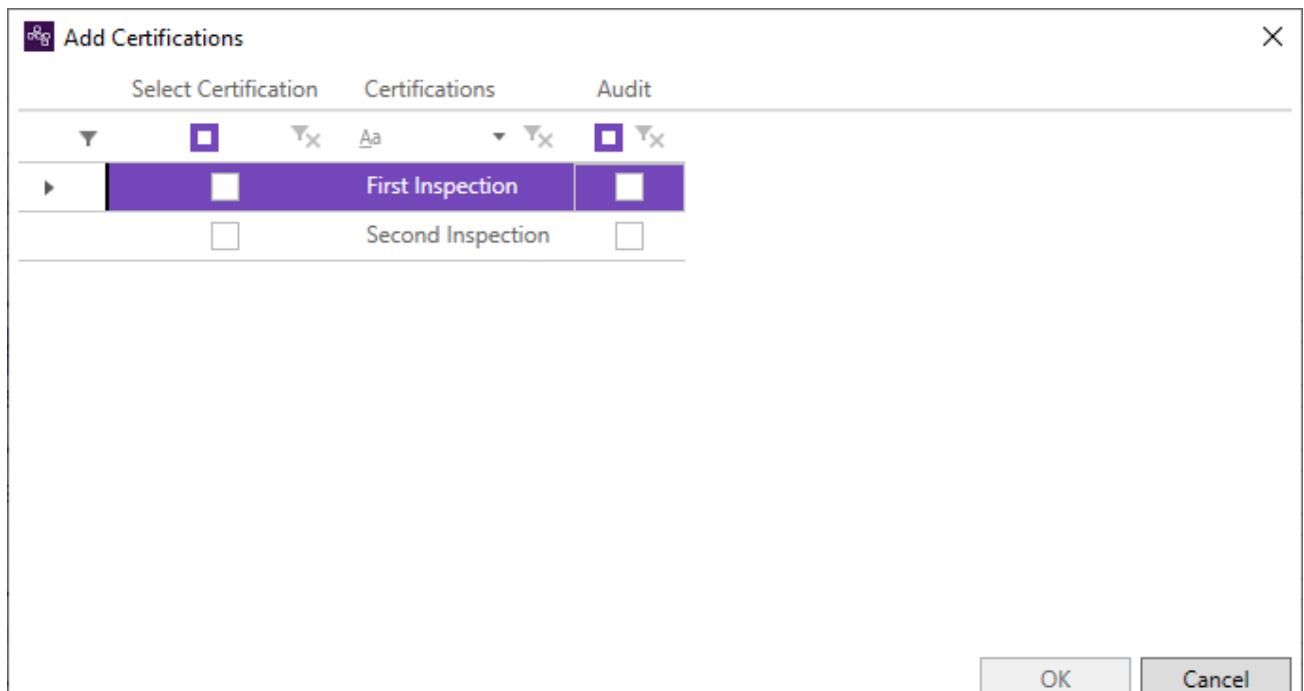
The **Certifications** dialog box appears.



4. Right-click in the **Certifications** dialog box, and then click **Add**.

The Add Certifications dialog box appears. Any certifications that have been configured to be applicable to operations are listed.

The **Audit** column is read-only. If the check box is selected, the certification is an audit certification. If not, it is an access certification.



5. Select the certifications to be assigned to the operation and click **OK**.  
The selected certifications are listed on the Certifications dialog box.

Certifications		
Status	Certification	Value
First Inspection	Yes	
Second Inspection	Yes	

**Close**

- For each certification, select the level required for this operation in the **Value** column list. If the level is Yes or No, it is not editable because the certification has only one level. Instead, these values indicate whether the current user has been assigned to the certification.
- Click **Close** to close the Certifications dialog box.  
The selected certifications are listed in the **Certification** property group.

Certification	
Certification	Value
First Inspection	Yes
Second Inspection	Yes

**Configure Certifications**

- Save the changes.

### To edit the level of certifications

1. Click the **Configure Certifications** button to open the Certifications dialog box.
2. Modify the levels as needed, then click **Close**.
3. Save the changes.

### To remove a certification assignment from the operation

1. Click the **Configure Certifications** button to open the Certifications dialog box.
2. Right-click the certification and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Click **Close** to close the Certifications dialog box.
5. Save the changes.

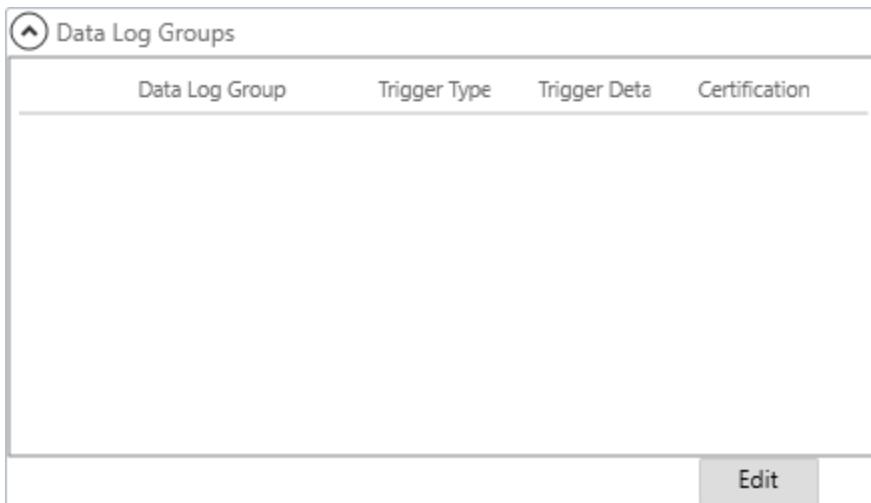
## Assigning Data Log Groups to an Operation

You can assign one or more data log groups to an operation to allow users to collect measurement data about production. For information about adding and managing data log groups, see [Data Logger](#).

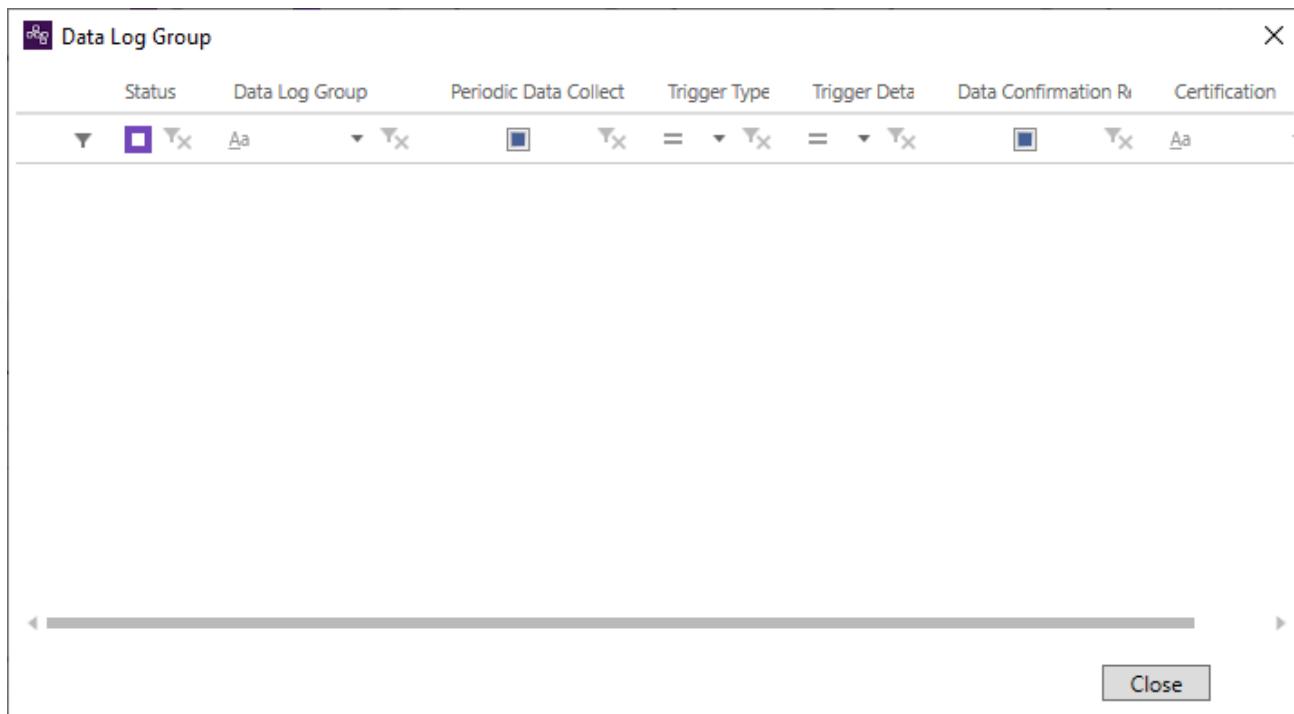
When assigning a data log group to an operation, you can configure the group to acquire periodic data. You can also assign an audit certification to a data log group to require one or more qualified users to sign off on the data being logged.

### To assign data log groups to an operation

1. Select the operation.
2. In the **Properties** window, open the **Data Log Groups** section.

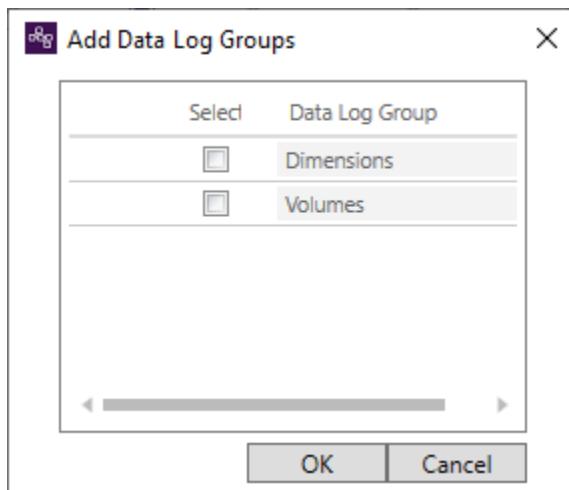


3. Click the **Edit** button.  
The **Data Log Group** dialog box appears.



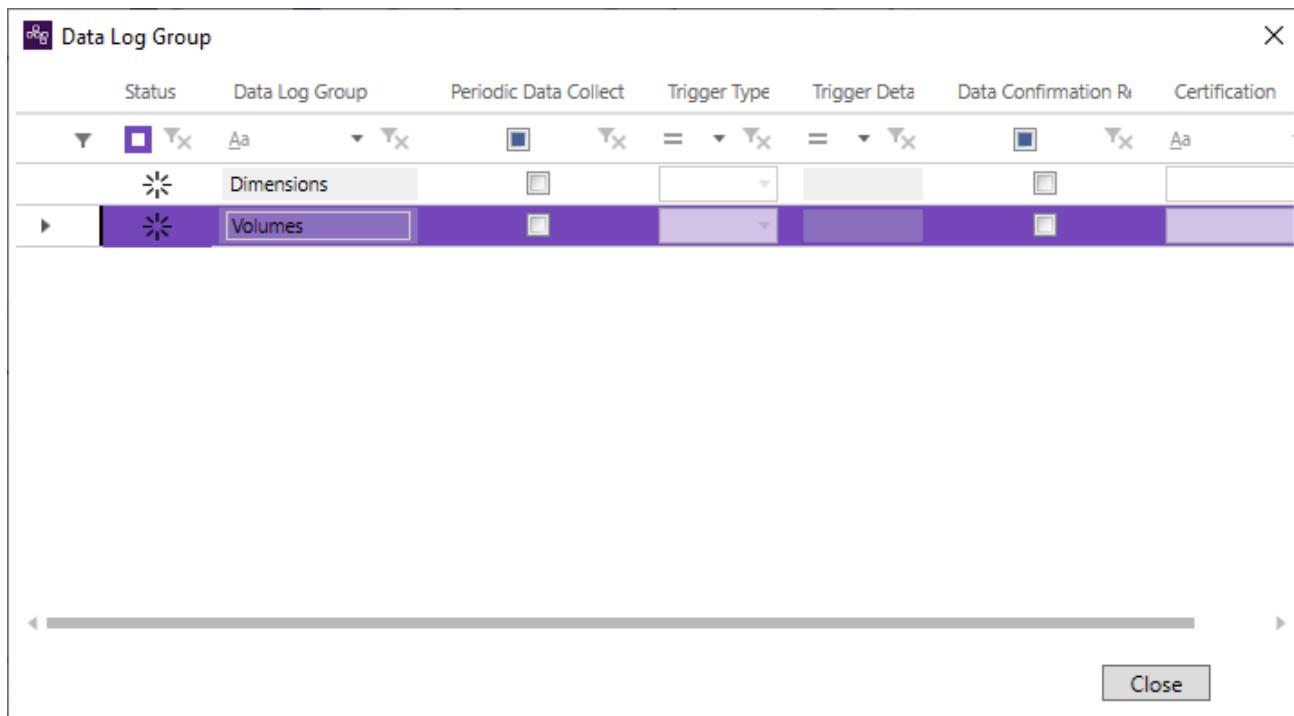
4. Right-click in the **Data Log Group** dialog box, and then click **Add**.

The **Add Data Log Groups** dialog box appears. Available data log groups are listed. Groups that have been previously assigned to the operation are already selected.



5. Select the groups to be assigned to the operation and click **OK**.

The selected groups are listed on the **Data Log Group** dialog box.



6. For each group, complete the property settings.

#### Periodic Data Collection

Specifies whether periodic updates of data are enabled. If selected, data is collected periodically at the trigger period that is defined.

#### Trigger Type

Available only if the **Periodic Data Collection** check box is selected.

The trigger type for periodic data collection. Select whether the collection period is in minutes or hours (hourly).

#### Trigger Detail

Available only if the **Periodic Data Collection** check box is selected.

The number of minutes or hours to wait between each periodic data collection operation.

#### Data Confirmation Required

Specifies whether data collection requires a certification for sign-off.

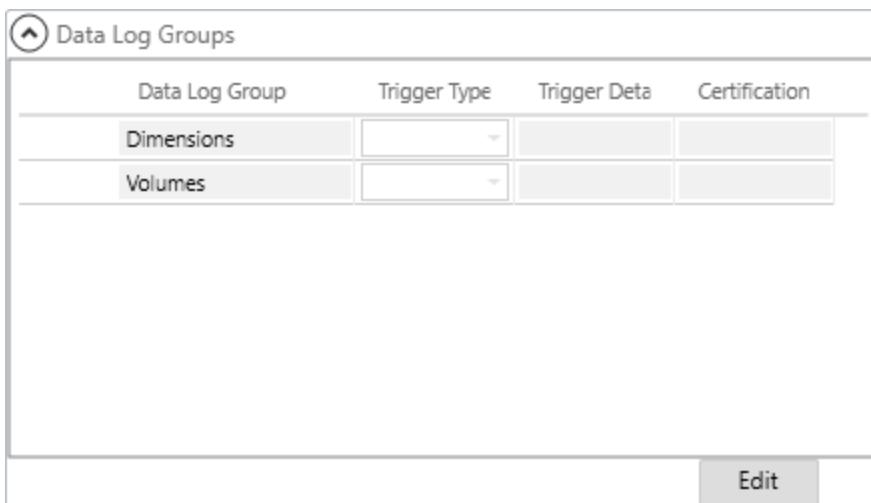
#### Certification

Available only if the **Data Confirmation Required** option is selected. Select the audit certification for the data log group.

If an audit certification is selected here, then one or more qualified users will be required to sign off to complete the data logging.

7. Click **Close** to close the Data Log Group dialog box.

The selected groups are listed on the **Data Log Groups** property group.



8. Save the changes.

#### To edit data log group properties

1. Click the **Edit** button to open the **Data Log Group** dialog box.
2. Modify any of the group properties as needed, then click **Close**.
3. Save the changes.

#### To remove a data log group from the operation

1. Click the **Edit** button to open the Data Log Group dialog box.
2. Right-click the group and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Click **Close** to close the **Data Log Group** dialog box.
5. Save the changes.

#### Assigning an Entity to an Operation

You must assign at least one entity to an operation.

You must also set the estimated production rate for each entity assigned to an operation.

**Note:** The estimated production rate must be greater than 0. An entry of 0 will cause an error.

The estimated production rate is used with the batch size to schedule an entity while creating a work order from a process. The required finish date is assigned to the jobs in the last operation and then the estimated production rate, batch size, and work order quantity are used to determine the start time of a job. The same process runs until all jobs get a start and finish date. If an operation is the first operation in a process, the batch size specifies the initial amount that is sent to an entity if there is more than one entity in the operation. For additional information about batch size, see [Understanding Batches and Lots for OEE and Estimated Times](#).

#### To assign an entity to a operation

1. Select the operation and go to the **Entity** tab.

2. Do one of the following:

- Right-click on the **Entity** tab and on the context menu click **New**.
- On the ribbon, go to the **Current View** tab and click **New Entity**.

A new entity entry is added in the **Entity** tab.

The screenshot shows the AVEVA Manufacturing Execution System interface. On the left, the 'Processes\*' window displays a list of operations: 100-RST (Roasting), 200-COA (Coating), and 300-BAG (Bagging). The 'Entity' tab is selected in the bottom navigation bar. On the right, the 'Properties' window is open, showing settings for the selected entity. The 'Entity' section has a dropdown set to 'Roaster'. Under 'Estimated Production Rate', the value '1' is entered with 'hours/batch' as the unit. Other sections include 'Estimated Labor Rate', 'Estimated Entity Setup Hours', 'Estimated Entity Teardown Hours', 'Estimated Fixed Labor Hours', 'Estimated Transfer Time', 'Batch Size' (set to '1'), and 'Initial Production % Required' (set to '100').

3. In the **Properties** window, complete the following settings:

#### Entity

Click the **Browse** button to locate the entity that you want to assign to the operation.

#### Estimated Production Rate

The estimated production rate for this job. It defines the estimated production rate of entity usage required by this operation to produce a single batch of the item on this entity. You also set the production rate UOM that can be in hours/batch, minutes/batch, and seconds/batch, or batches/hour, batches/minute, and batches/second format.

The estimated production rate must be greater than 0. An entry of 0 will cause an error.

#### Estimated Labor Rate

The estimated number of labor hours required to produce a single batch of the item in the selected entity.

#### Estimated Entity Setup Hours

The estimated number of hours for setting up the entity.

#### Estimated Entity Teardown Hours

The estimated number of hours required to tear down this entity after a production run.

#### Estimated Fixed Labor Hours

The estimated number of fixed labor hours required to produce a single batch of the item in the selected entity. This fixed rate is the work required that does not depend on the number of batches.

#### Estimated Transfer Time

The estimated number of hours required to move the produced items from the selected entity to the next entity.

**Batch Size**

The batch size. The batch size defines the number of production units in a single batch for this item, based on the company standards. For additional information about batch size, see [Understanding Batches and Lots for OEE and Estimated Times](#).

**Initial Production% Required**

The percentage of the initial quantity of material that will be allocated to this entity for a production to run. The total percentage for all entities assigned to the first operation should be equal to 100%. A value of 25 in this field means 25%.

4. Save the changes.

**Assigning Steps to an Operation**

You can assign steps to an operation so that tracking of the discrete operator work or actions within an operation can be controlled and sequenced.

Individual steps are assigned to step groups. These step groups can be defined as repeatable so that an operator is allowed to perform the steps multiple times if necessary and the system will track the events for the individual steps within the step group. Non-repeatable step groups contain steps that only need to be performed once in the operation, such as setup and teardown steps. Repeatable step groups contain steps that must be performed for every batch or group of work against a job at an operation.

Processes						
Status	Check Out	Process Class ID	Process ID	Description	Version	
		BAG-MXN	BAG-MXN-1	Bag of Mixed Nuts Proc	1	
Status	Operation ID	Description	Disp. Seq.	Type	Default Reject Rate %	
▶	100-RST	Roasting	1		0	
	200-COA	Coating	2		0	
	300-BAG	Bagging	3		0	

Entity		Attributes	Steps	Specs
Status	ID	Description	Sequence	Repeatability
▼	=	1 Setup	1	<input type="checkbox"/>
Status	Step No.	Step Name	Step Sequence	Description
	1	Feed Area Inspection	1	Check/clean feed area c
	2	Roaster Temperature	2	Enter roasting temperal
Status	ID	Description	Sequence	Repeatability
▶		2 Roast	2	<input type="checkbox"/>
▶		3 Cleaning	3	<input type="checkbox"/>

An additional feature of the steps functionality is a sequence number for the steps and the step groups. You must specify an order by providing the sequence number for the step groups and steps. This sequence number controls the order that the work must be performed. A higher numbered step cannot start until a lower numbered step within a step group is completed. This sequence also controls the same control of ordering for step groups. In the case where step groups have the same sequence number, then steps in the groups can be performed in any order. The same applies to the case where steps have the same sequence number; the steps can then be performed in any order.

## Creating an Operation Step Group

A step group represents a set of one or more sub-operation steps. You can define multiple step groups for an operation.

### To create an operation step group

1. Select the operation for which you want to create a step group and go to the **Steps** tab.
2. Do one of the following:
  - Right-click on the **Steps** tab and on the context menu click **New Step Group**.
  - On the ribbon, go to the **Current View** tab and click **New Step Group**.
3. In the new step group's **Properties** window, complete the following settings:

#### ID

The unique ID of the operation step.

#### Description

A brief description for the step group.

#### Sequence

The sequence for the step group. The sequence number determines the order in which step groups are executed. All steps in a lower number step group must be completed or bypassed before any step in a higher number step group starts. You can assign the same sequence number to step groups that can be performed simultaneously.

#### Repeatability

Specifies whether the steps contained in this step group can be repeated for each lot produced.

4. Save the changes.

## Creating an Operation Step

A step represents a phase of an operation. A step definition can include the production of a by-product, consumption of a component, a data collection, an attached file, a certification, or instructions to exclude a step when the operation is running on a specific entity, and so on.

Steps are added to step groups, so you must create a step group before creating a step. For more information, see [Creating an Operation Step Group](#).

### To create a step

1. Select the operation for which you want to create a step and go to the **Steps** tab.
  2. Select the step group to which to assign the step.
  3. Do one of the following:
    - Right-click the step group and on the context menu click **New Step**.
    - On the ribbon, go to the **Current View** tab and click **New Step**.
- A new step is added to the group.
4. In the new step's **Properties** window, complete the property settings. See [Operation Step Properties](#).
  5. Save the changes.

## Operation Step Properties

### Number

The unique number for the step.

### Name

A unique name for the step.

### Sequence

The sequence number for the step. The sequence number determines the order in which the step is performed within the step group.

### SPC Char

The SPC characteristic that needs to be measured at this step.

### Form Name

Click the **Browse** button to locate the name of the form linked to this step, if any.

### Reorder Step Sequence

Specifies whether to reorder the current step sequence automatically. The reorder step sequence allows you to insert a step into an existing set of steps. All steps with a sequence number equal to or greater than this step will have their sequence number increased by one.

### Description

A brief description for the step.

### Action Type

The action that this step needs to perform. The following options are available in the list:

- **Normal:** No specific action is performed.
- **Log Data:** Selects the **Data Log** tab to facilitate data collection.
- **Add Production:** Allows you to add production details for this step to facilitate the reporting of production quantities.
- **Add Consumption:** Allows you to add consumption details for the first component assigned to this step.
- **Operator Acknowledge:** Displays the step description and requires the operator to acknowledge this prompt before continuing work.

- **Enter Form Data:** Allows you to fill details in a specific form.
- **Enter SPC Data:** Allows an operator to add SPC data when the operator logs onto this step.

### Complete When

The circumstance in which the current step are automatically marked as Complete. The following options are available in the list:

- **Standard Time Elapsed:** When the time entered in the **Standard Time** box is elapsed counting from the beginning of the step.
- **Operator Accepts:** When an operator marks the step as Accepted/Complete.
- **Dismiss Message:** This option is available if the Action is set to Operator Acknowledge. The step ends when the operator dismisses the dialog.

### Standard Time

The standard completion time for this step.

### Step Occurrence%

The number how many times the step must be done for a run of production. For an operation's step, it is percent because there is no fixed amount of production you are doing. For a job's step, the step occurrence is a fixed number. When a work order is created from a process, the required quantity is multiplied by the step occurrence percentages to get the step occurrences for the job.

### Step Grp ID

The step group ID to which you want to assign the step.

### Allow Bypass

Specifies whether this step can be skipped.

### Enter Data

Specifies whether the user must enter text into the **Data** box before changing the state of the step as Accepted or Complete. If you select this option, you must also specify how the data will be entered in the **Advanced Options** section.

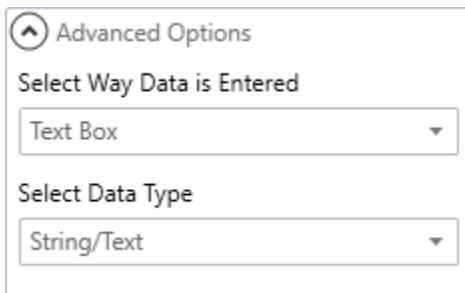
### Advanced Options: Select Way Data Is Entered

The method to use to enter the required data: text box, radio buttons, check box, or combo box.

This setting is enabled if the **Enter Data** check box is selected.

Depending on which element is selected, another property setting appears for specifying the data entry choices.

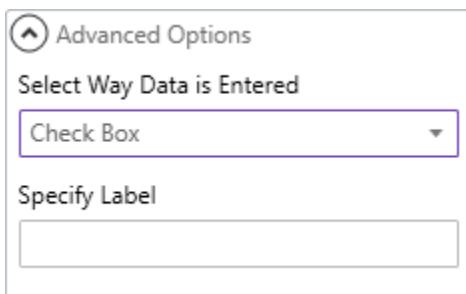
- If **Text Box** is selected, the **Select Data Type** list appears. It has the following options: String/Text, Analog, and DateTime.



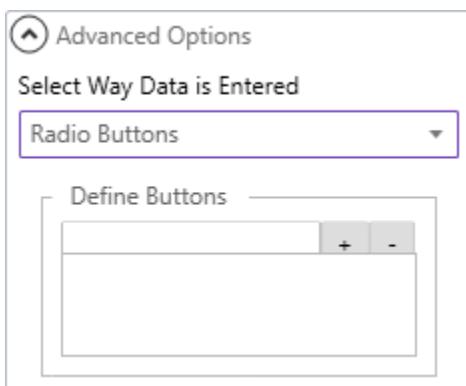
If you select the **Analog**, you also need to define the high and low limits to specify whether an alert should

be issued when the value is outside these limits.

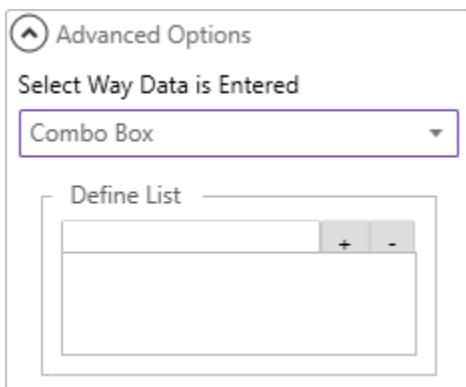
- If **Check Box** is selected, the **Specify Label** box appears. Type the label for the check box option.



- If **Radio Buttons** is selected, the **Define Buttons** section appears. Type a name for a radio button option and then click the + button to add that option. Multiple radio button options can be included. To remove an option, select it and then click the – button.



- If **Combo Box** is selected, the **Define List** section appears. Type the name of an entry to add to the combo box list and then click the + button to add that entry to the list. Multiple list entries can be included. To remove an entry, select it and then click the – button.



### Spare Fields: Spare1–6

User-defined information about the step.

### Certification

You can assign certifications to an operation step to manage who can perform the job steps that are instantiated from the operation step and whether a sign-off is required to complete a job step.

For more information, see [Assigning Certifications to an Operation Step](#).

### Exclusions

The entities that you want to exclude from this step. When you create a work order from a process, jobs are created for each entity linked to an operation and job steps are created for all the jobs for all the steps assigned to the operation. If you specify that an entity is excluded from a step, that step is not included in a job for the excluded entity.

#### Files

You can add files and web pages to an operation step to support the operator during production. For example, a file or web page can contain information relative to performing the job steps that are instantiated from the operation step. When a user is performing the job step using an application such as MES Operator, the files and web pages will be available to them for viewing.

For more information, see [Adding Files and Web Pages to an Operation Step](#).

#### Data Log Groups

You can assign one or more data log groups to an operation step to allow users to collect measurement data about production when performing job steps that are instantiated from the operation step.

For more information, see [Assigning Data Log Groups to an Operation Step](#).

## Assigning Certifications to an Operation Step

You can assign certifications to an operation step to manage who can perform the job steps that are instantiated from the operation step and whether a sign-off is required to complete a job step.

If an **access certification** has been assigned to an operation step, a user cannot start or work on the instantiated job step unless the following conditions have been met:

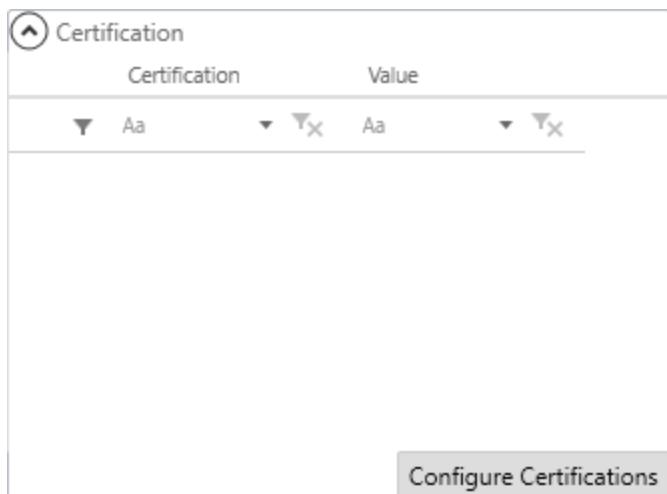
- The user has been assigned to the certification.
- The user's certification level is at or higher than the level specified when the certification was assigned to the step.

If an **audit certification** has been assigned to an operation step, then one or more user sign-offs will be required to complete the instantiated job step. Only users whose certification level is at or higher than the level specified when the certification was assigned to the step can perform a sign-off.

For information about configuring certifications, see [Certifications](#).

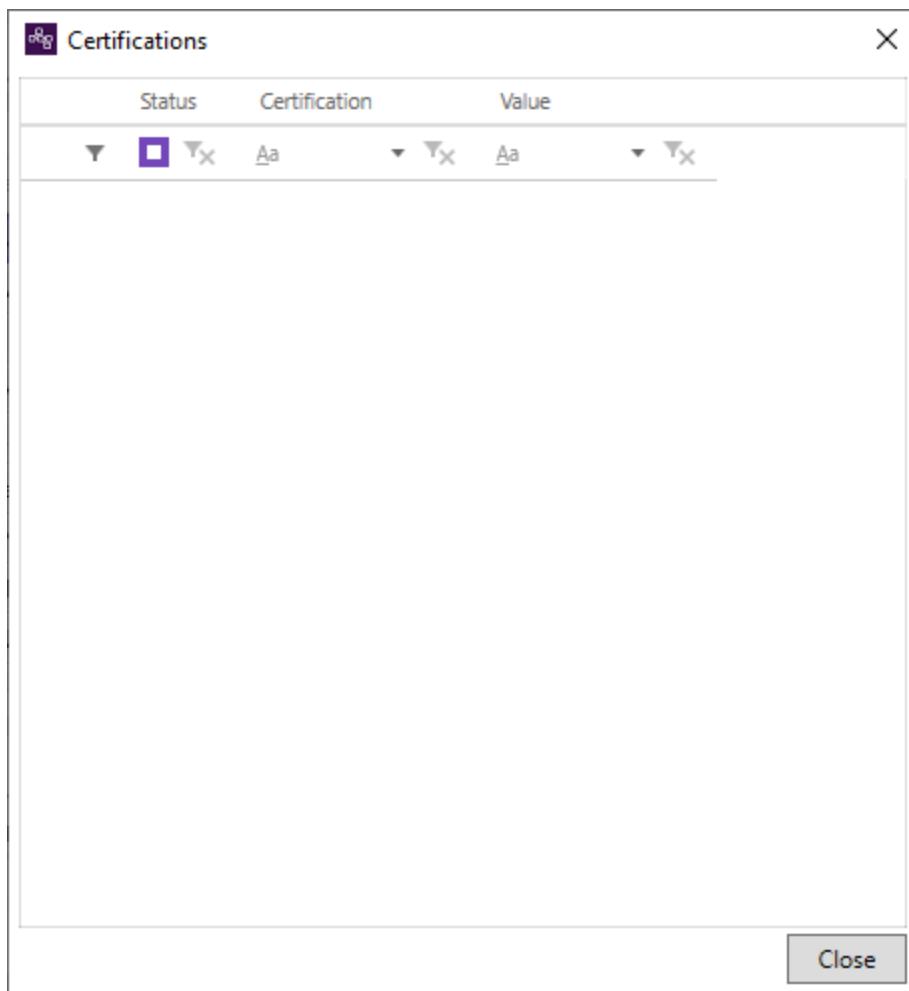
#### To assign a certification to an operation step

1. Select the operation step.
2. Open the **Certification** section in the **Properties** window.



3. Click the **Configure Certification** button.

The **Certifications** dialog box appears.

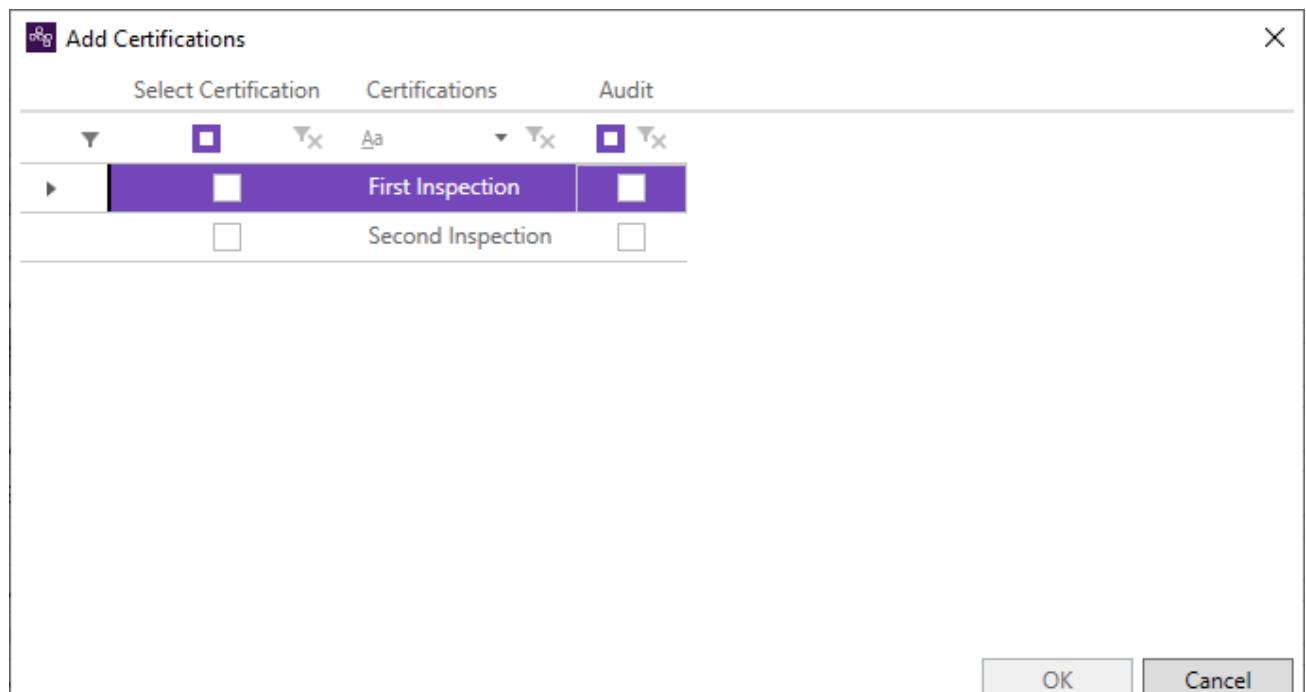


4. Right-click in the **Certifications** dialog box, and then click **Add**.

The Add Certifications dialog box appears. Any certifications that have been configured to be applicable to operation steps are listed.

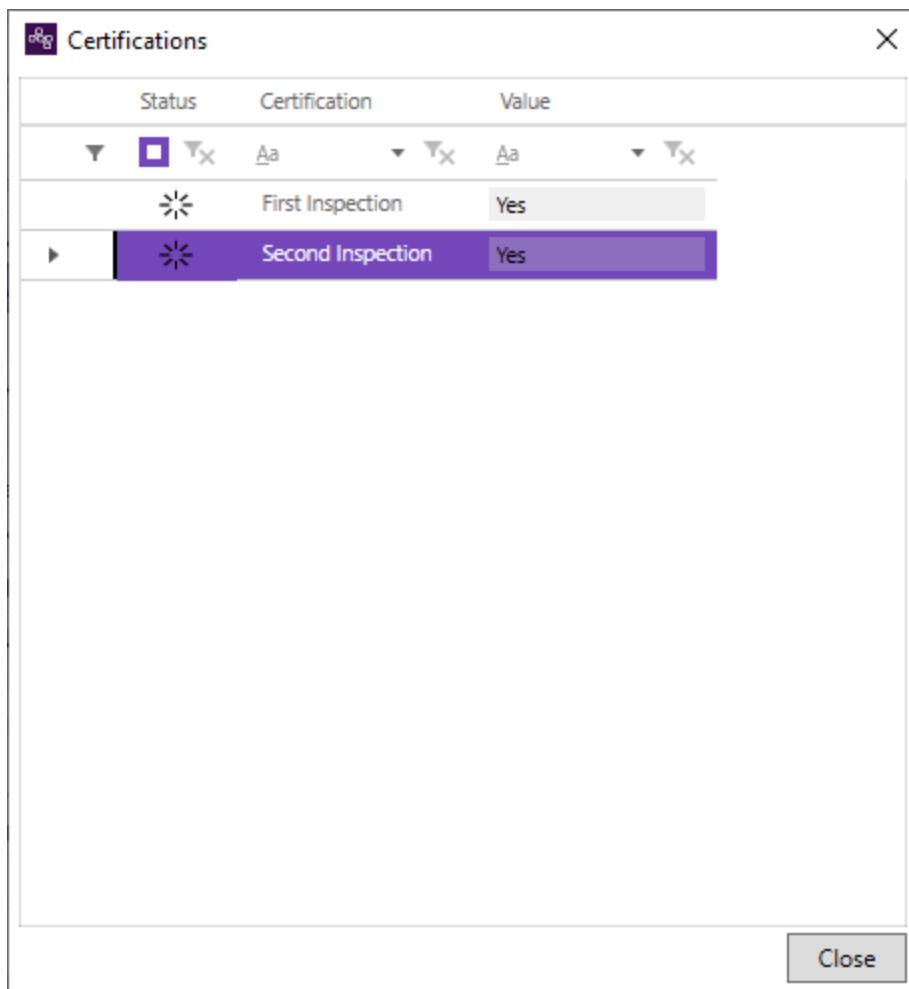
The **Audit** column is read-only. If the check box is selected, the certification is an audit certification. If not, it

is an access certification.



5. Select the certifications that you want to assign to the operation step and click **OK**.

The selected certifications are listed on the Certifications dialog box.



- For each certification, select the level required for this operation step in the **Value** column list. If the level is Yes or No, it is not editable because the certification has only one level. Instead, these values indicate whether the current user has been assigned to the certification.
- Click **Close** to close the Certifications dialog box.

The selected certifications are listed on the **Certification** property group.

Certification	
Certification	Value
First Inspection	Yes
Second Inspection	Yes

**Configure Certifications**

- Save the changes.

### To edit the level of certifications

1. Click the **Configure Certification** button to open the Certifications dialog box.
2. Modify the levels as needed, then click **Close**.
3. Save the changes.

### To remove a certification assignment from the operation step

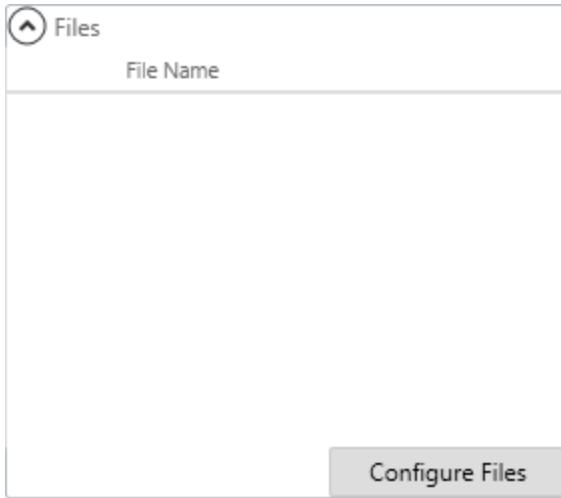
1. Click the **Configure Certification** button to open the Certifications dialog box.
2. Right-click the certification and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Click **Close** to close the Certifications dialog box.
5. Save the changes.

## Adding Files and Web Pages to an Operation Step

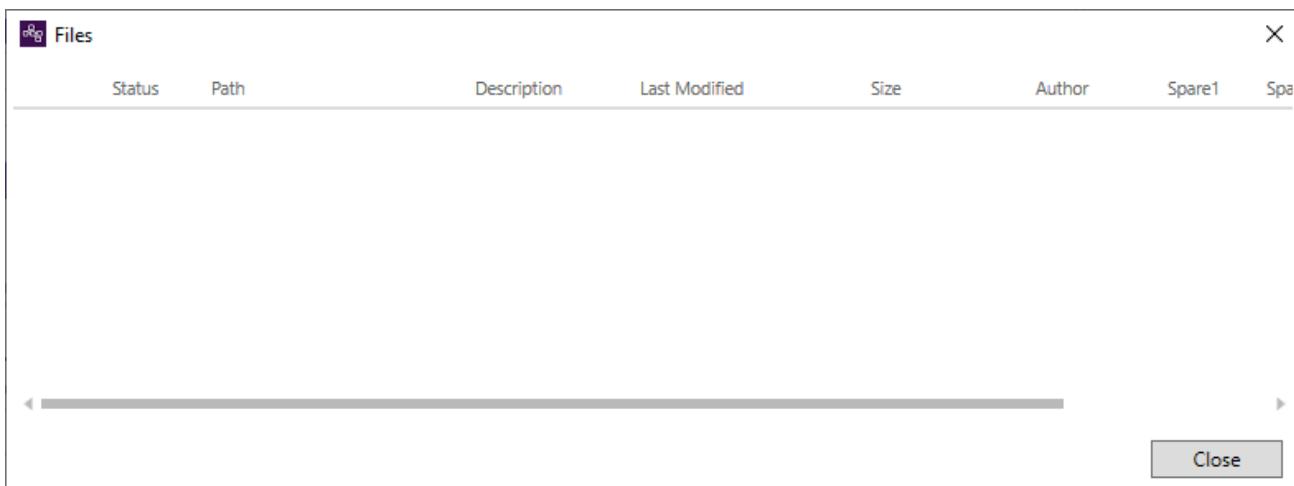
You can add files and web pages to an operation step to support the operator during production. For example, a file or web page can contain information relative to performing the job steps that are instantiated from the operation step. When a user is performing the job step using an application such as MES Operator, the files and web pages will be available to them for viewing.

### To add files to an operation step

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



2. Right-click in the dialog box, and then click **Add files**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the files to be added, and then click **Open**.

The selected files are listed in the Files dialog box.

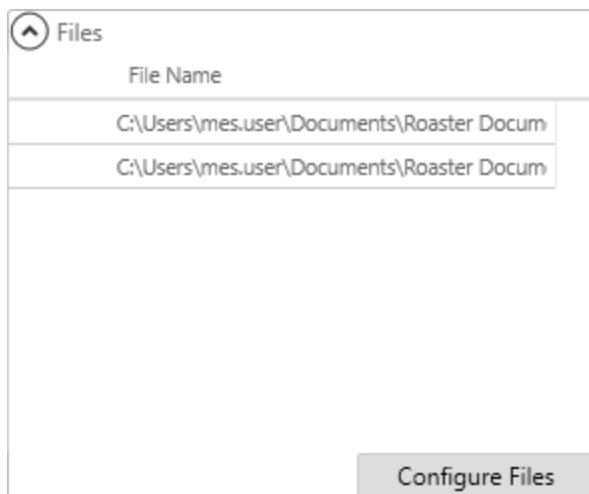
Status	Path	Description	Last Modified	Size	Author	Spare1	Spare2
...	C:\Users\mes.user\Documents		06/30/2022 12:13:07 PM	834,396	▼		
...	C:\Users\mes.user\Documents		06/30/2022 12:13:39 PM	834,421	▼		

5. Optionally, add a description for each file in the **Description** column.

6. Add other files (or web pages) as needed.

7. When you are finished adding files, click **Close**.

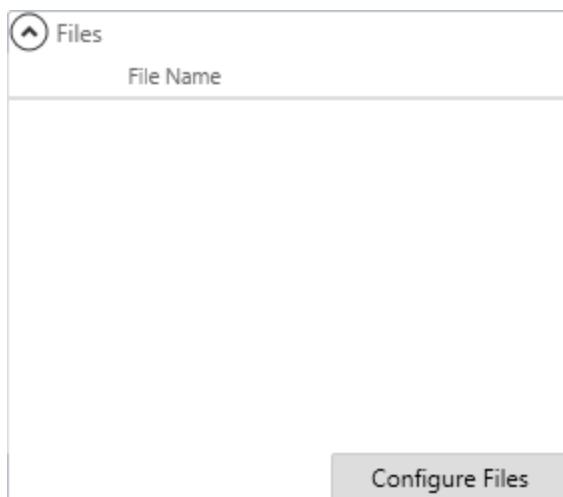
The files are listed in the **Files** property group.



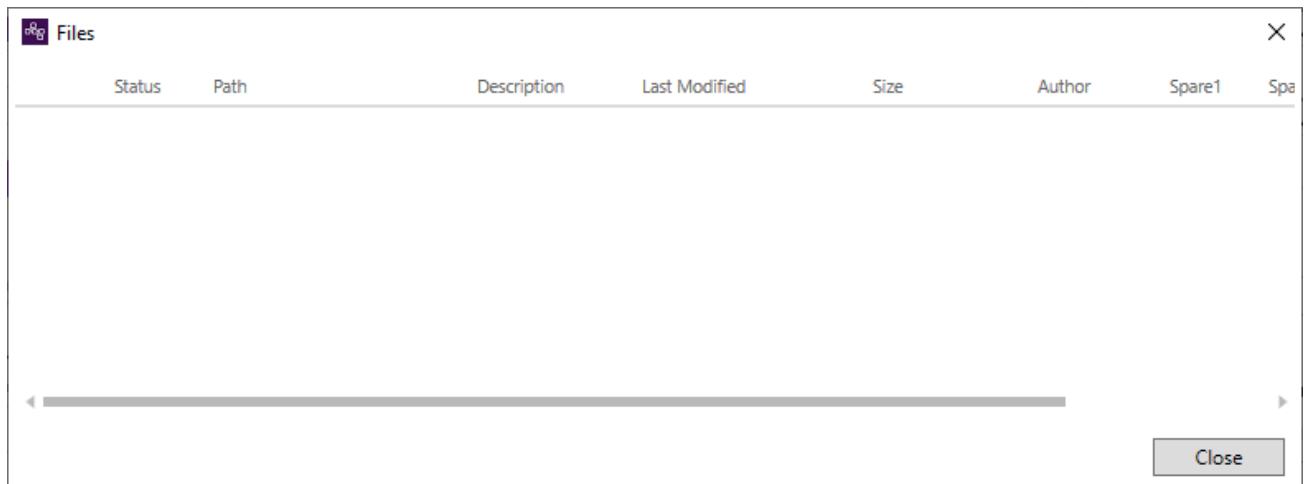
8. Save the changes.

#### To add web pages to an operation step

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



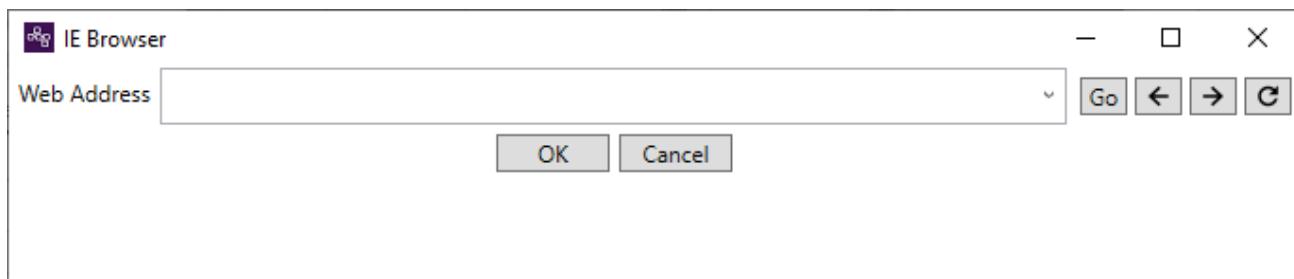
2. Right-click in the dialog box, and then click **Add URL**.

The Add URL dialog box appears.



3. Enter the URL and a description of the web page.

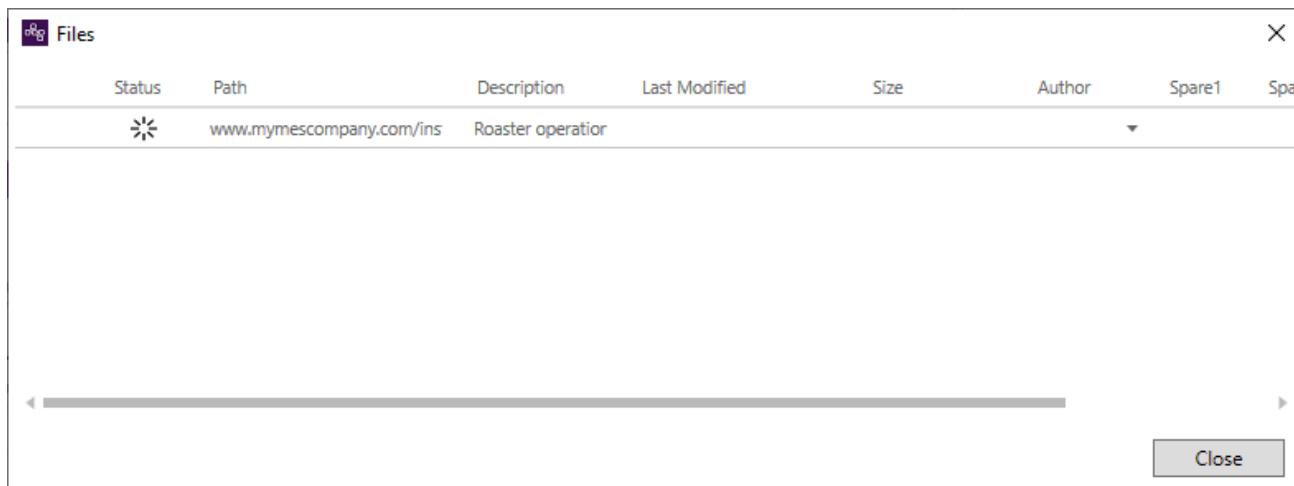
Instead of manually entering the URL, you can click the Browse button at the right of the URL box and use the mini-browser window that appears to navigate to the web page.



Click **OK** and that web page's URL is entered on the Add URL dialog box.

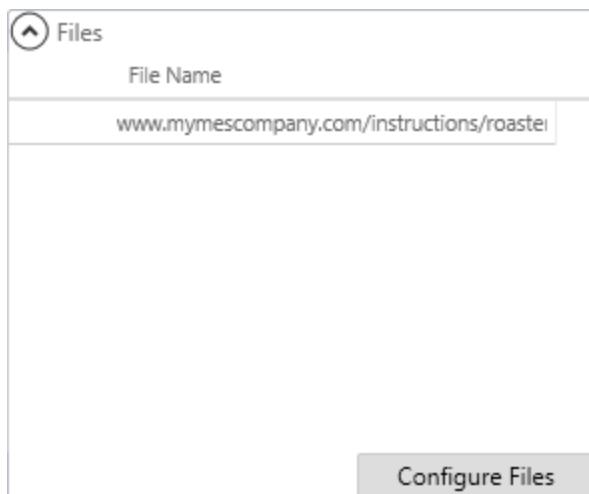
4. When you have finished entering the URL and description, click **Close**.

The URL is listed in the Files dialog box.



5. Add other web pages (or files) as needed.
6. When you are finished adding web pages, click **Close**.

The web page URLs are listed in the **Files** property group.



7. Save the changes.

#### To remove a file or URL

1. In the **Files** property group, click **Configure Files**.  
The Files dialog box appears.
2. Right-click the file or URL, and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.

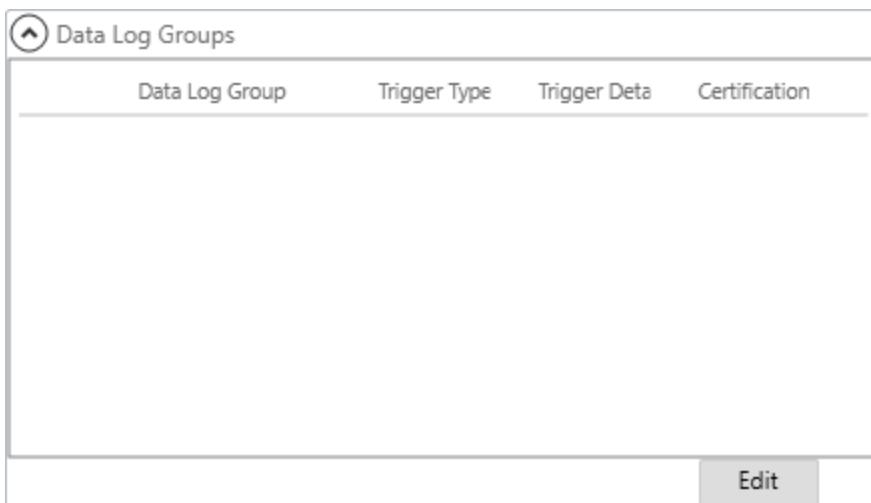
## Assigning Data Log Groups to an Operation Step

You can assign one or more data log groups to an operation step to allow users to collect measurement data about production when performing job steps that are instantiated from the operation step. For information about adding and managing data log groups, see [Data Logger](#).

When assigning a data log group to an operation step, you can configure the group to acquire periodic data. You can also assign an audit certification to a data log group to require one or more qualified users to sign off on the data being logged.

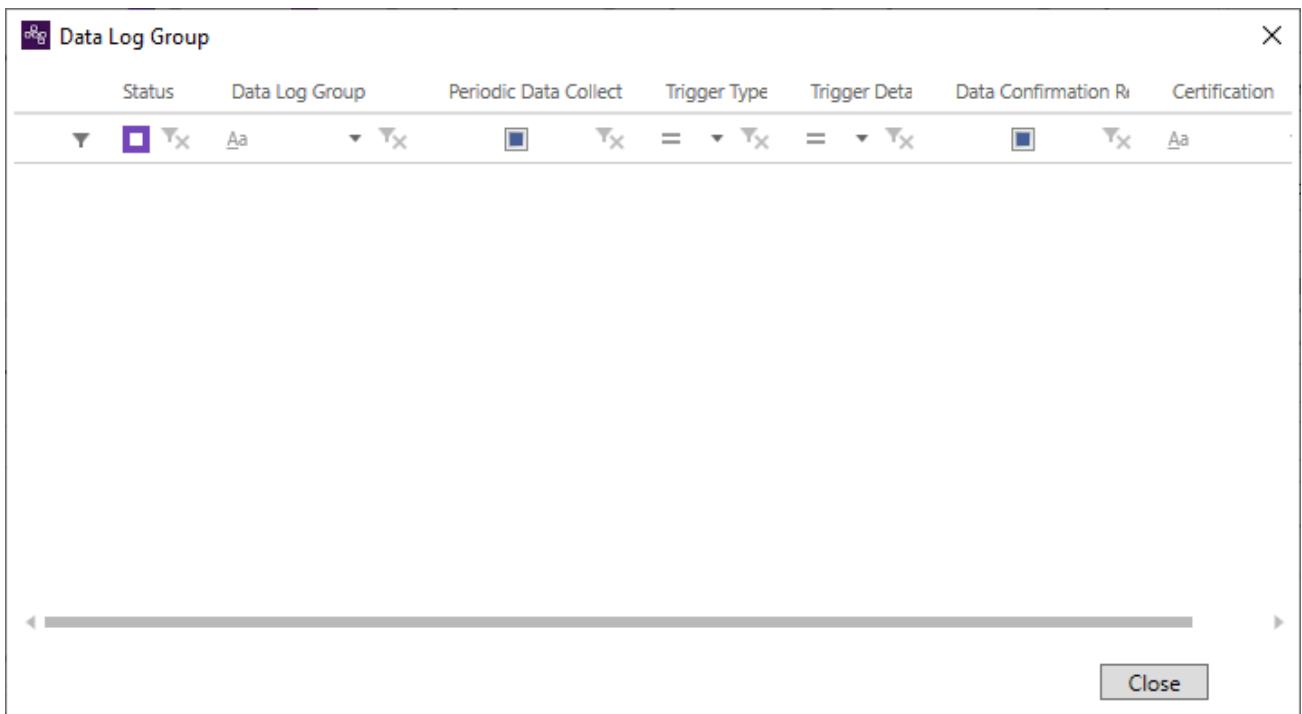
#### To assign data log groups to an operation step

1. Select the operation step.
2. Open the **Data Log Groups** section in the **Properties** window.



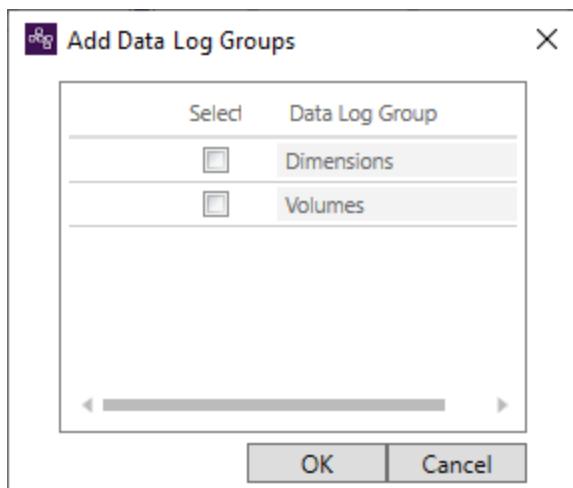
3. Click the **Edit** button.

The **Data Log Group** dialog box appears.



4. Right-click in the **Data Log Group** dialog box, and then click **Add**.

The **Add Data Log Groups** dialog box appears. Available data log groups are listed. Groups that have been previously assigned to the operation step are already selected.



5. Select the groups that you want to assign to the operation step and click **OK**.

The selected groups are listed on the **Data Log Group** dialog box.

Data Log Group							
Status	Data Log Group	Periodic Data Collect	Trigger Type	Trigger Deta	Data Confirmation R	Certification	
<input checked="" type="checkbox"/>	Dimensions	<input type="checkbox"/>					
<input checked="" type="checkbox"/>	Volumes	<input type="checkbox"/>					

6. For each group, complete the property settings.

#### Periodic Data Collection

Specifies whether periodic updates of data are enabled. If selected, data is collected periodically at the trigger period that is defined.

#### Trigger Type

Available only if the **Periodic Data Collection** check box is selected.

The trigger type for periodic data collection. Select whether the collection period is in minutes or hours (hourly).

#### Trigger Detail

Available only if the **Periodic Data Collection** check box is selected.

The number of minutes or hours to wait between each periodic data collection operation.

#### Data Confirmation Required

Specifies whether data collection requires a certification for sign-off.

#### Certification

Available only if the **Data Confirmation Required** option is selected. Select the audit certification for the data log group.

If an audit certification is selected here, then one or more qualified users will be required to sign off to complete the data logging.

7. Click **Close** to close the Data Log Group dialog box.

The selected groups are listed on the **Data Log Groups** property group.

Data Log Group	Trigger Type	Trigger Data	Certification
Dimensions	<input type="button"/>	<input type="button"/>	<input type="button"/>
Volumes	<input type="button"/>	<input type="button"/>	<input type="button"/>

**Edit**

8. Save the changes.

#### To edit data log group properties

1. Click the **Edit** button to open the **Data Log Group** dialog box.
2. Modify any of the group properties as needed, then click **Close**.
3. Save the changes.

#### To remove a data log group from the operation step

1. Click the **Edit** button to open the Data Log Group dialog box.
2. Right-click the group and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Click **Close** to close the **Data Log Group** dialog box.
5. Save the changes.

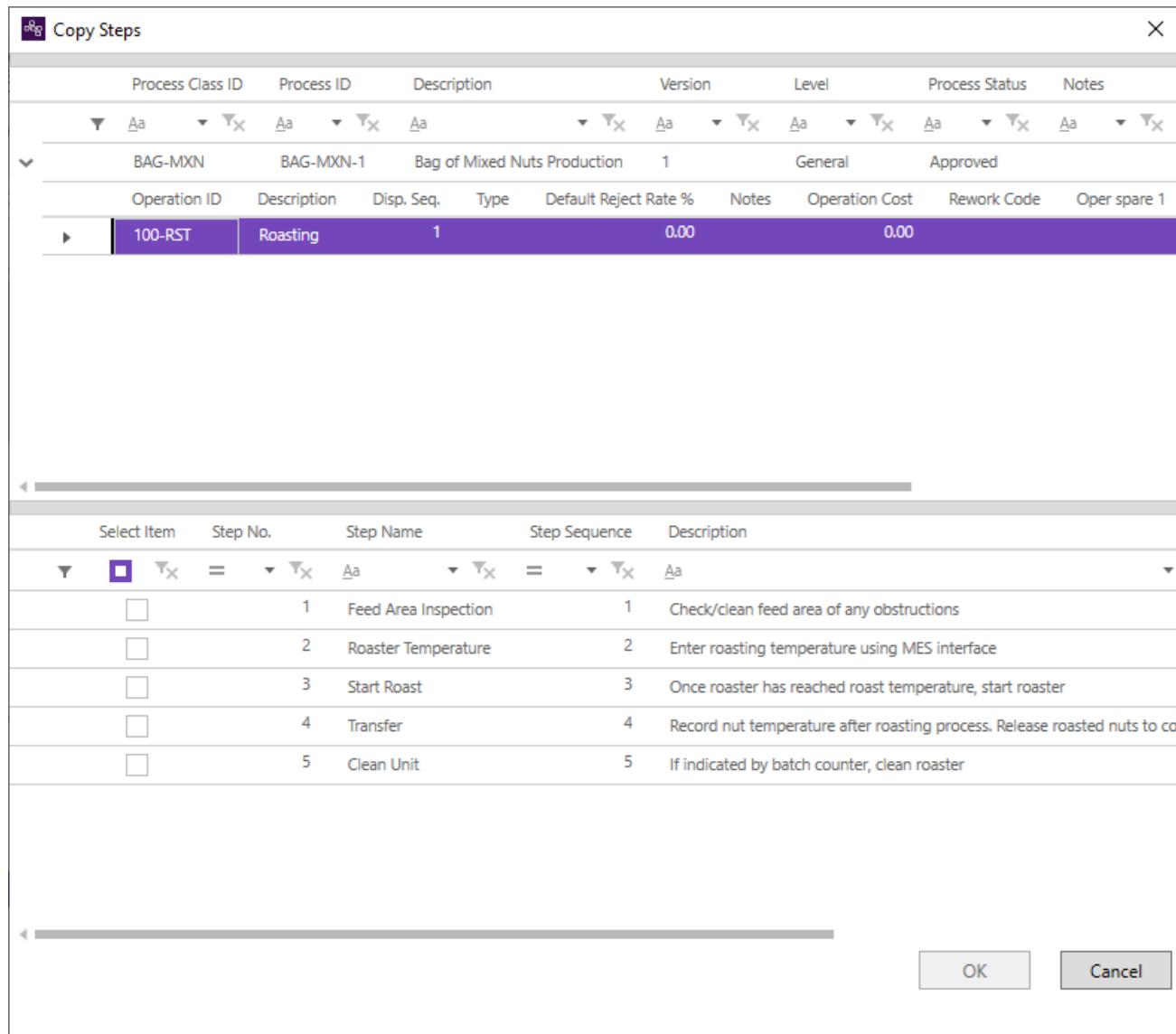
# Copying a Step

You can copy multiple steps from one operation to another.

## To copy steps

1. Select the operation to which you want to paste steps.
2. On the ribbon, go to the **Current View** tab.
3. On the **Process Management** group, open the **New Operation** menu and click **Copy Steps From**.

The Copy Steps dialog box appears.



4. On the top pane, select the operation from which you want to copy the steps.
5. On the bottom pane, select the steps you want to copy, and then click **OK**.
6. Save the changes.

## Assigning Specifications to an Operation

You can assign multiple specification versions to an operation. However, you can define only one version as the preferred version. The preferred specification version is used when a process is started. All operations in a process use that same specification version. A specification version can contain multiple specifications. While creating a work order from a process, the specifications from a specification version are used to create a job specification for the jobs.

By default, the specification version marked as the preferred version is used for an operation in the process. You can change a specification version if you have the *May override preferred spec. version* privilege.

You must create a global specification before assigning specification to a specification version.

You can assign the following specifications to an operation:

- Entity specifications
- BOM specifications
- Item and item class specifications

For more information on specifications, see [Global Specifications](#).

You can assign an entity specification to an entity. An entity specification changes to a job specification while creating a job for that entity or for a descendant of that entity. If the same specification is assigned to both a parent and a child entity, then the specification assigned to the child entity overrides the specification assigned to a parent entity while creating a job specification.

You can assign a BOM specification to a BOM position for a BOM version of an item. BOM specification changes to job specification while creating a job that uses the specified BOM version to create the specified item.

You can assign an item or item class specification to an item that is produced or consumed during an operation. You can also assign an item to an item class. Item or item class specification changes to job specification while creating a job that produces or consumes that item or an item in that item class. If the same specification is assigned to both an item and an item class, the item overrides the item class. If the same specification is assigned to both a BOM item and an item, the BOM item overrides the item.

You can add specifications for BOM items, entities, and item classes. If an operation is inserted from a standard operation and you have defined the entity specification for the standard operation, you are able to view the entity specifications in the **Processes** module. You must add specifications for a BOM or item class in the Process module once the operation is associated to a process as a standard operation does not contain BOM or item class specifications.

## Creating a Specification

1. Select the operation for which you want to create a specification.
2. On the ribbon, go to the **Current View** tab and click **New Specification**.

A new operation specification version is added in the **Specs** tab.

The screenshot shows the AVEVA Manufacturing Execution System interface. On the left, the 'Processes' window displays a hierarchical list of operations. The top node is 'BAG-MXN' (Process ID: BAG-MXN-1, Description: Bag of Mixed Nuts Proc 1). It has three children: '100-RST' (Status: Roasting, Disp. Seq: 1, Type: , Default Reject Rate %: 0), '200-COA' (Status: Coating, Disp. Seq: 2, Type: , Default Reject Rate %: 0), and '300-BAG' (Status: Bagging, Disp. Seq: 3, Type: , Default Reject Rate %: 0). Below this is a 'Specs' tab with two rows: 'Default' (Preferred Version checked) and 'Increased Roasting' (Preferred Version checked). The 'Increased Roasting' row is highlighted with a red border. On the right, the 'Properties' window is open, showing settings for the selected specification. Under 'Version', there is a checked checkbox for 'Preferred Version'. Other sections include 'Description', 'BOM Spec.' (radio button selected), 'Entity and Step Specification', and 'ItemClass and Item Specification'.

- On the specification's **Properties** window, complete the following settings:

#### **Version**

A version designation for the specification.

#### **Preferred Version**

Specifies whether to make this version of the specification the preferred version.

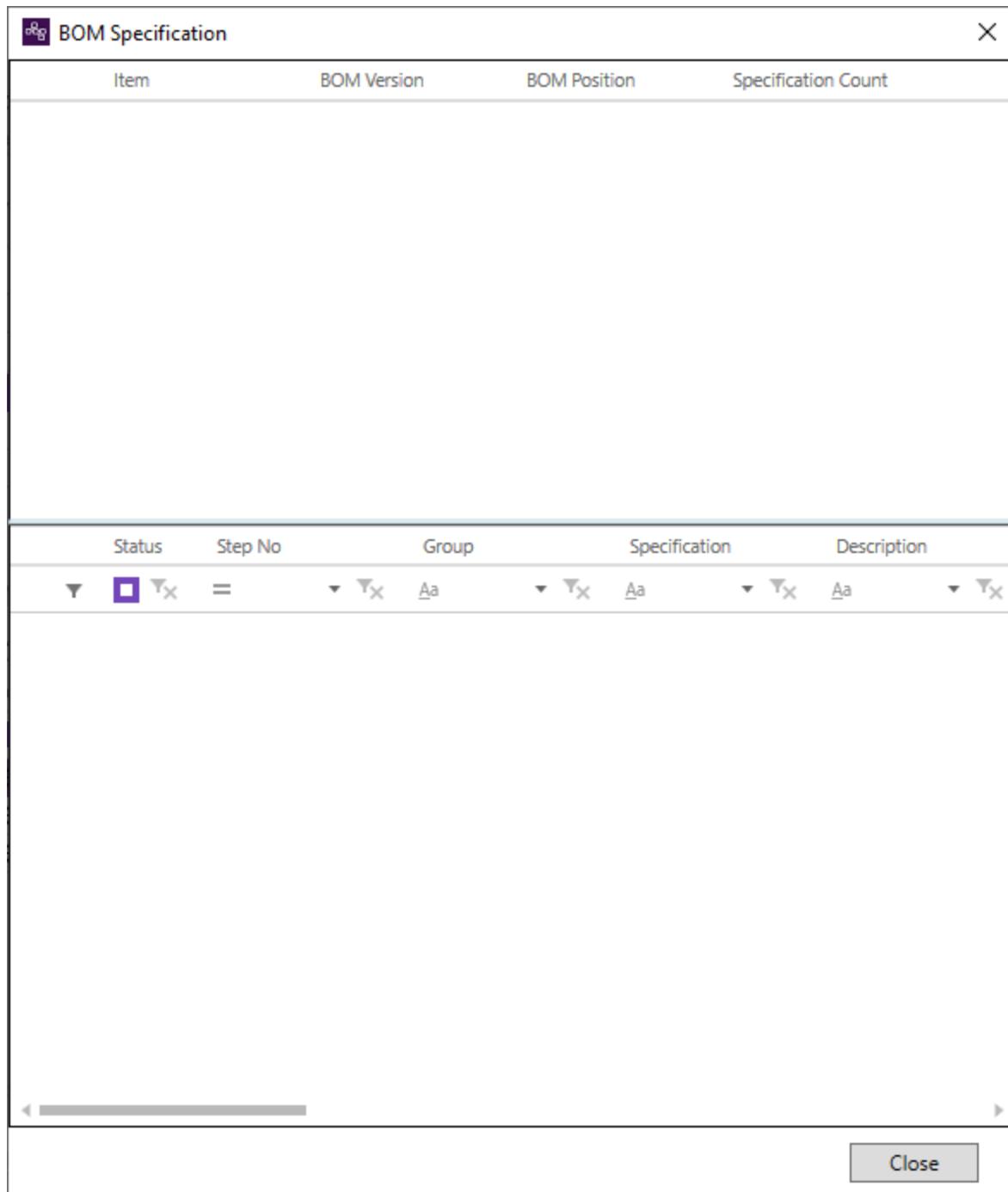
#### **Description**

A brief description for the specification version.

- Save the changes.

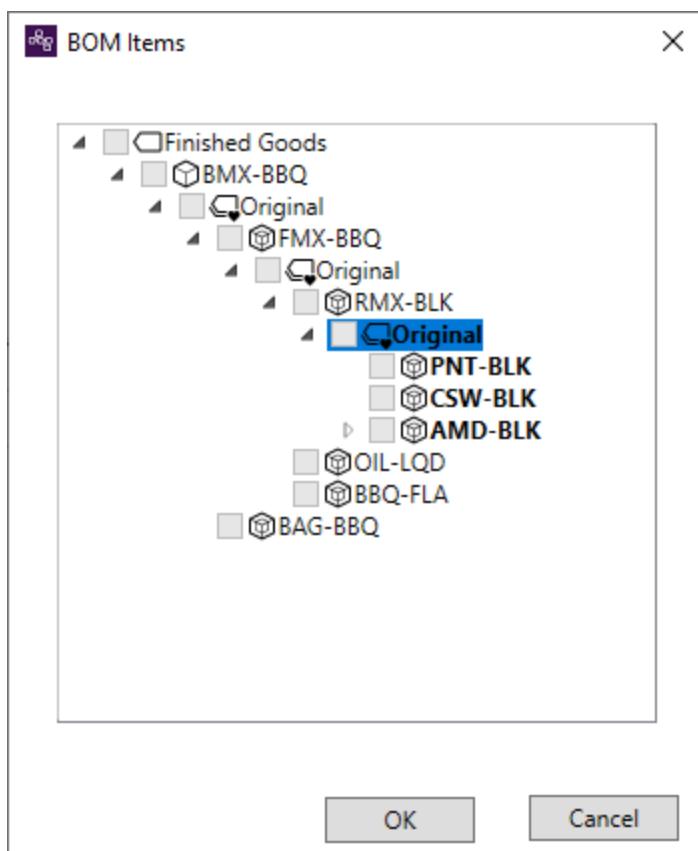
## Adding BOM Specifications

- On the **Specs** tab, select a specification.
- Do one of the following:
  - On the **Properties** window, in the **BOM Spec** section click **BOM Spec**.
  - On the ribbon, go to the **Current View** tab and click **BOM Specification**.  
The BOM Specification dialog box appears.



You select a BOM item in the top pane and the specification assigned to the selected BOM item in the bottom pane. Specifications are linked to the BOM position.

3. Right-click in the top pane of the BOM Specification dialog box, and then click **Add**.  
The BOM Items dialog box appears.



4. Select the BOM item.

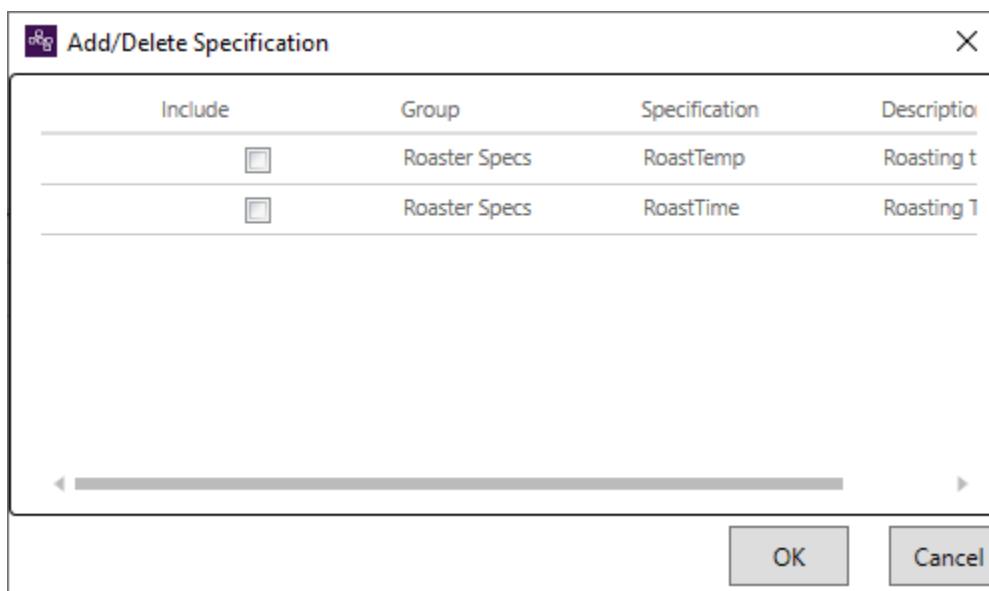
You can select any BOM item that is highlighted in the list.

5. Click **OK**.

The BOM item is added to the top pane.

6. Right-click the bottom pane of the BOM Specification dialog box, and then click **Add Specification**.

The Add/Delete Specification dialog box appears.



7. Select the specifications, and then click **OK**.

The selected specifications are added to the bottom pane.

The screenshot shows the 'BOM Specification' dialog box. At the top, there is a header row with columns: Item, BOM Version, BOM Position, and Specification Count. Below this is a main table with columns: Status, Step No, Group, Specification, and Description. The table contains two rows of data. The first row has a status icon of a star, a step number of 'No Step', a group of 'Roaster Specs', a specification of 'RoastTemp', and a description of 'Roasting temperature'. The second row has a status icon of a star, a step number of 'No Step' (highlighted in blue), a group of 'Roaster Specs', a specification of 'RoastTime', and a description of 'Roasting Time'. A horizontal scrollbar is visible at the bottom of the table area. A 'Close' button is located at the bottom right of the dialog box.

Item	BOM Version	BOM Position	Specification Count
BMX-BBQ	Original	1	0

Status	Step No	Group	Specification	Description
★	No Step	Roaster Specs	RoastTemp	Roasting temperature
★	No Step	Roaster Specs	RoastTime	Roasting Time

8. For each specification, complete the property settings. See [Specification Properties](#).

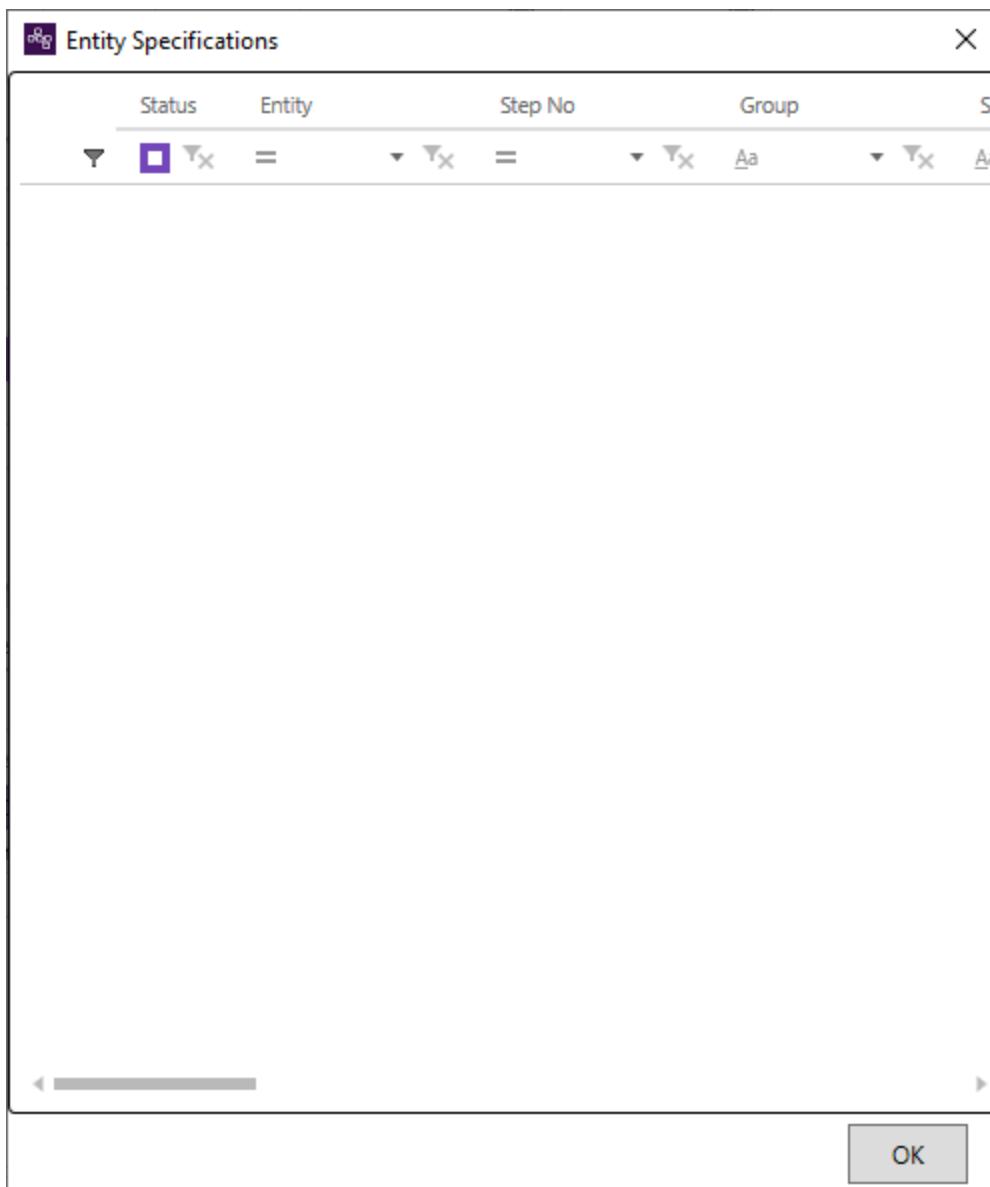
9. When you have completed the specification property settings, click **Close**.

The BOM item to which specifications have been added is listed in the **BOM Spec** section of the **Properties** window.

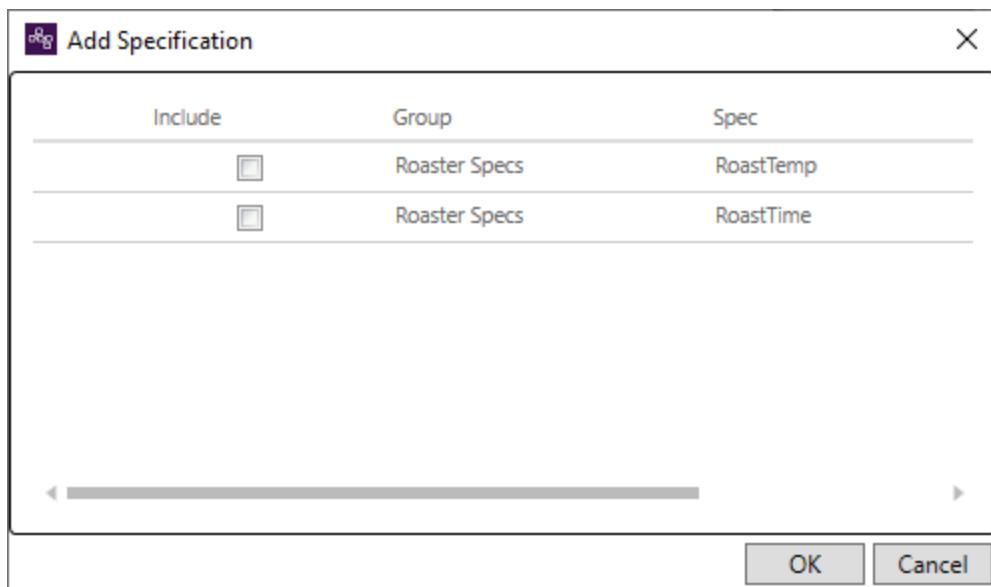
10. Save the changes.

# Adding Entity Specifications

1. On the **Specs** tab, select a specification.
  2. Do one of the following:
    - On the **Properties** window, in the **Entity and Step Specification** section click **Entity Specifications**.
    - On the ribbon, go to the **Current View** tab and click **Entity Specifications**.
- The Entity Specifications dialog box appears.



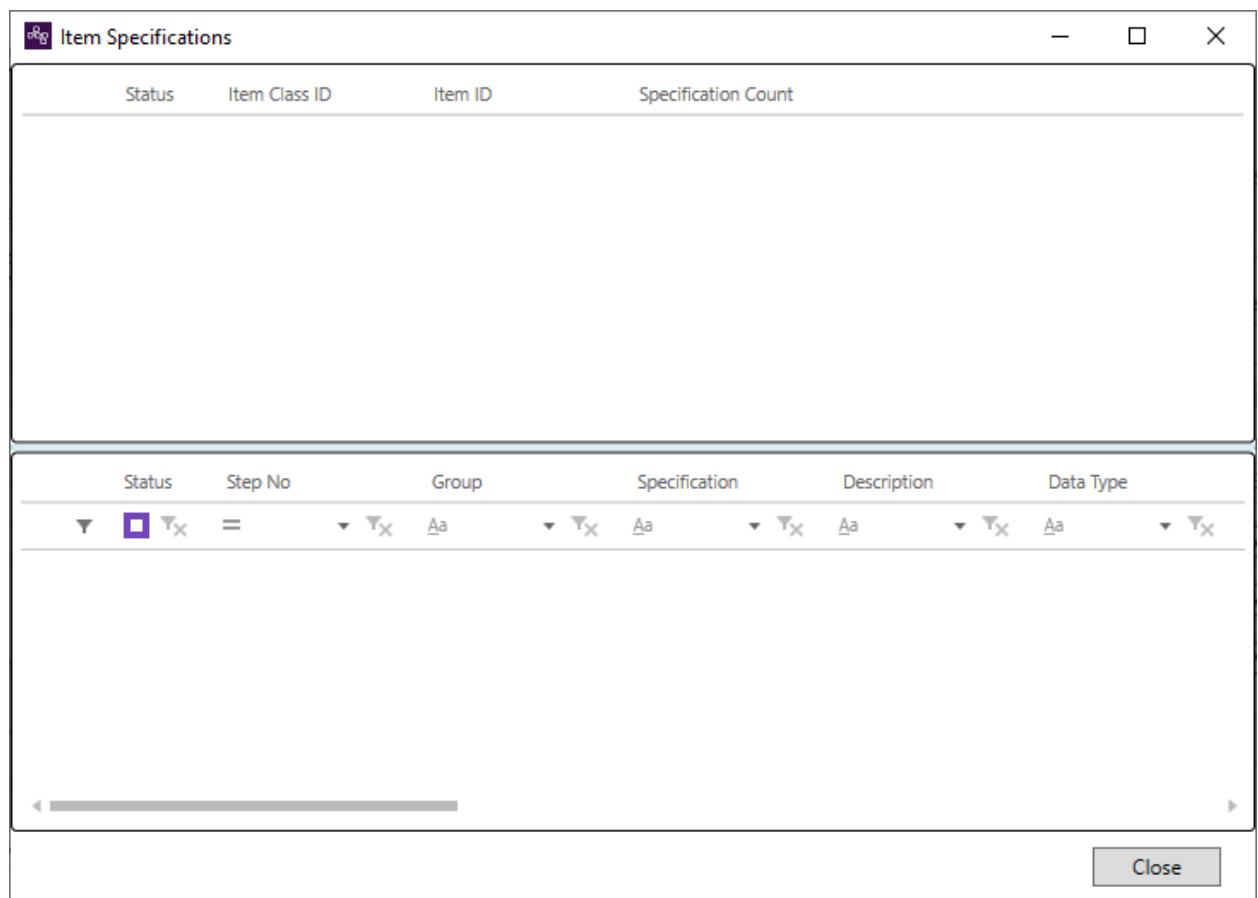
3. Right-click the Entity Specifications dialog box, and then click **New Specifications**.  
The Add Specification dialog box appears.



4. Select the specifications, and then click **OK**.  
The specifications are added to the Entity Specifications dialog box.
5. For each specification, complete the property settings. See [Specification Properties](#).
6. When you have completed the property settings, click **Close**.  
The specifications are listed in the **Entity and Step Specification** section of the **Properties** window.
7. Save the changes.

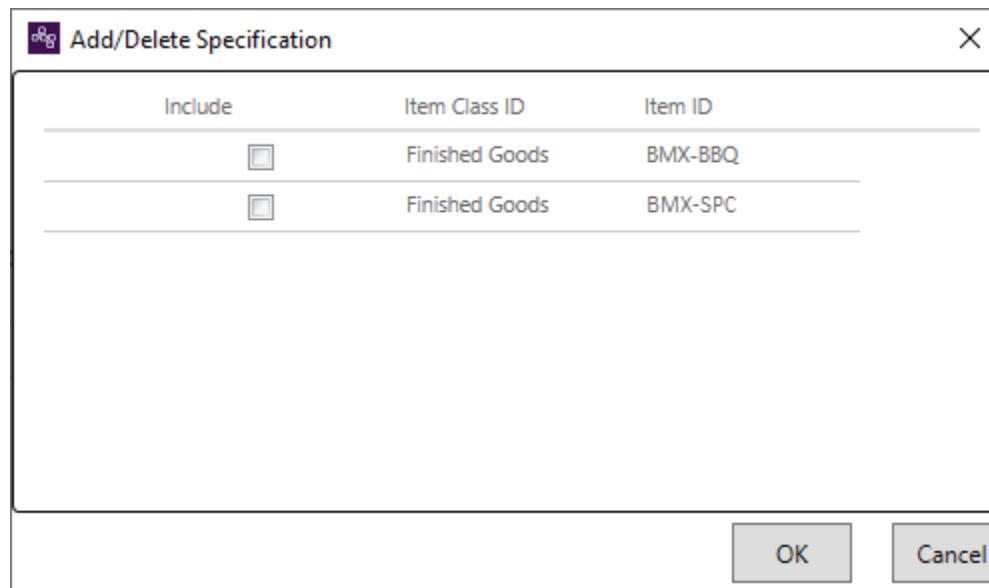
## Adding Item Specifications

1. On the **Specs** tab, select a specification.
2. Do one of the following:
  - On the **Properties** window, in the **Item Class and Item Specification** section click **Item Specifications**.
  - On the ribbon, go to the **Current View** tab and click **Item Specifications**.The Item Specifications dialog box appears.



3. Right-click in the top pane of the Item Specifications dialog box, and then click **Add**.

The Add/Delete Specification dialog box appears.



4. Select the item and item classes to which the specifications apply, and then click **OK**.

The selected items and item classes are added to the top pane.

### Item Specifications

Status	Item Class ID	Item ID	Specification Count
★	Finished Goods	BMX-BBQ	0
★	Finished Goods		0

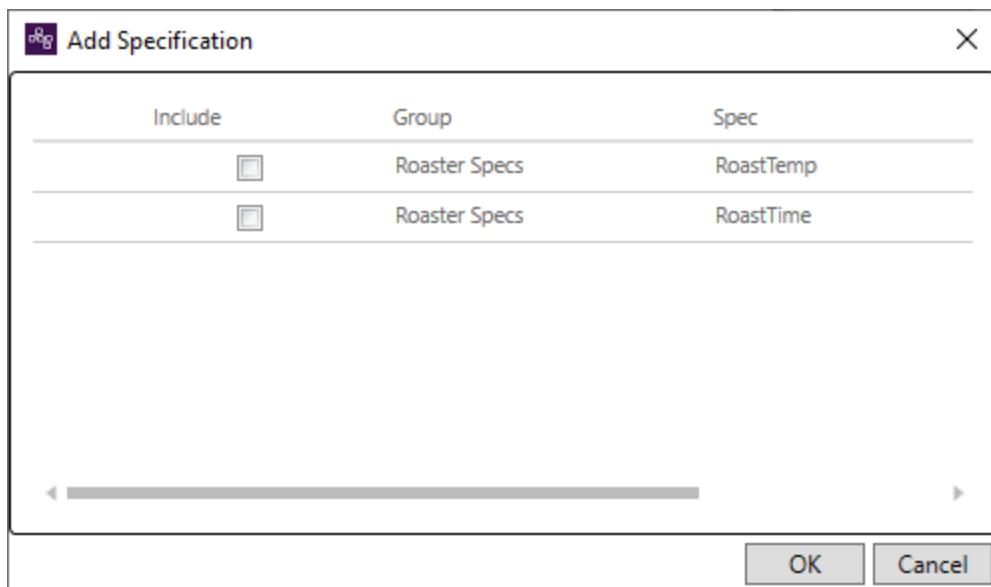
  

Status	Step No	Group	Specification	Description	Data Type
▼	■	▼x	≡	▼	▼x
Aa	Aa	Aa	Aa	Aa	Aa

◀ ▶

**Close**

5. Select one of the items or item classes.
6. Right-click the bottom pane of the Item Specifications dialog box, and then click **New Specification**.  
The Add Specification dialog box appears.



7. Select the specifications that apply to the selected item or item class, and then click **OK**.

The selected specifications are added to the bottom pane.

The screenshot shows the 'Item Specifications' dialog box. The top pane lists items by status, item class ID, item ID, and specification count. The 'Finished Goods' item under Item ID BMX-BBQ has a specification count of 0. The bottom pane displays a detailed table of specifications. The table has columns: Status, Step No, Group, Specification, Description, Data Type, Value, and Min V. Two rows are visible. The first row has 'No Step' in Step No, 'Roaster Specs' in Group, 'RoastTemp' in Specification, 'Roasting temperature' in Description, 'Floating Point' in Data Type, '0.0000000' in Value, and '0.0000' in Min V. The second row has 'No Step' in Step No, 'Roaster Specs' in Group, 'RoastTime' in Specification, 'Roasting Time' in Description, 'Floating Point' in Data Type, '0.0000000' in Value, and '0.0000' in Min V. At the bottom right of the dialog is a 'Close' button.

8. For each specification, complete the property settings. See [Specification Properties](#).
9. When you have completed the specification property settings, click **Close**.

The items and item classes to which specifications have been added are listed in the **Item Class and Item Specification** section of the **Properties** window.

10. Save the changes.

# Specification Properties

## Entity

For an entity specification, the entity to which the specification applies.

## Step No

The step number of the step to which to optionally link the specification.

You must specify the step number for the specification or select **No Step** if this specification applies to the complete operation.

## Group

The specification group.

## Specification

The specification ID.

## Description

The description of the specification.

## Data Type

The data type for the specification.

## Value

The value for the specification.

## Min Value

The minimum value for the specification.

## Max Value

The maximum value for the specification.

## Units

The units for the specification.

## File

You can add a file or web page to a specification to support an operator during production. For example, the file or web page can contain information relative to a BOM, entity, or item specification, such as how to set the setpoint value (represented by the specification) for the entity.

See [Adding a File or Web Page to a Specification Being Added to an Operation](#).

## Comments

Comments about this specification.

## Access Level

The security access level required to modify the specification.

To edit a specification, you must have Specification access level user privilege greater than or equal to the level set for the specification.

## Spec spare 1–4

User-defined information for this specification.

# Adding a File or Web Page to a Specification Being Added to an Operation

You can add a file or web page to a specification to support an operator during production. For example, the file or web page can contain information relative to a BOM, entity, or item specification, such as how to set the setpoint value (represented by the specification) for the entity.

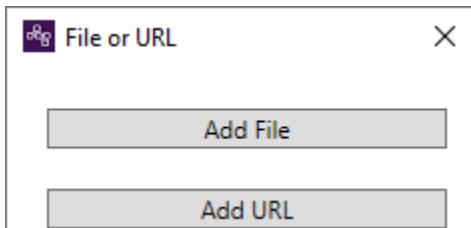
To allow users to open a file or web page that has been added to a specification, you can use the following MES Stateful API **Documents** class methods in a custom application:

- **EditFile()**
- **PrintFile()**
- **ViewFile()**

## To add a file

1. In the Specification dialog box, click the Browse button in the specification's **File** column.

The File or URL dialog box appears.



2. Click **Add File**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the file to be added, and then click **Open**.

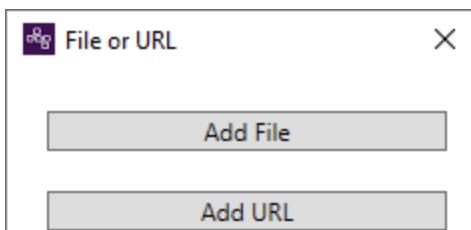
The file is entered in the **File** column.



## To add a web page

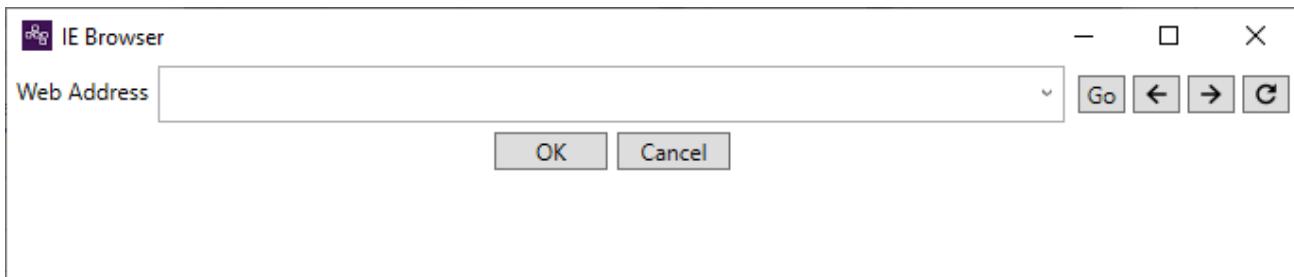
1. In the Specification dialog box, click the Browse button in the specification's **File** column.

The File or URL dialog box appears.



2. Click **Add URL**.

A mini-web browser appears.



3. Enter or navigate to the web page, and then click **OK**.

The URL is entered in the **File** column.



## Assigning Attributes to an Operation

An attribute is an additional user-defined property that provides additional information about the operation.

You must first create operation attributes in the **Attributes** module so that they can be assigned to a standard operation. For more information on creating attributes, see [Attributes](#).

An attribute that is assigned to an operation changes to an attribute on a job created from an operation if there is a corresponding job attribute. Attributes are not used directly in a process but can be used to sort and search a work queue.

### To assign an attribute to an operation

1. Select the operation.
2. Go to the **Attributes** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add**.
  - On the ribbon, go to the **Current View** tab and click **Add Attributes**.

The **Add attributes** dialog box appears. Operation attributes that have not been assigned to this operation are listed.

4. Select the attributes to assign to the operation and click **OK**.  
The selected attributes are added to the **Attributes** tab.
5. In each attribute's Properties window, complete the **Value** and **Notes** as needed.
6. Save the changes.

## Cloning an Operation

You can clone an existing operation to create a copy of the operation on which to base a new one. The operation BOM and steps linked to the existing operation are inherited by the new operation.

### To clone an operation

1. Select the operation that you want to clone.
2. On the ribbon, go to the **Current View** tab.
3. In the **Process Management** group, click **Clone** in the **New Operation** list.  
The Clone Oper To dialog box appears.
4. In the Clone Oper To dialog box, complete the following settings:

#### Process ID

The process ID for the operation.

#### Operation ID

A unique operation ID for the operation.

#### Operation Description

A brief description for the operation.

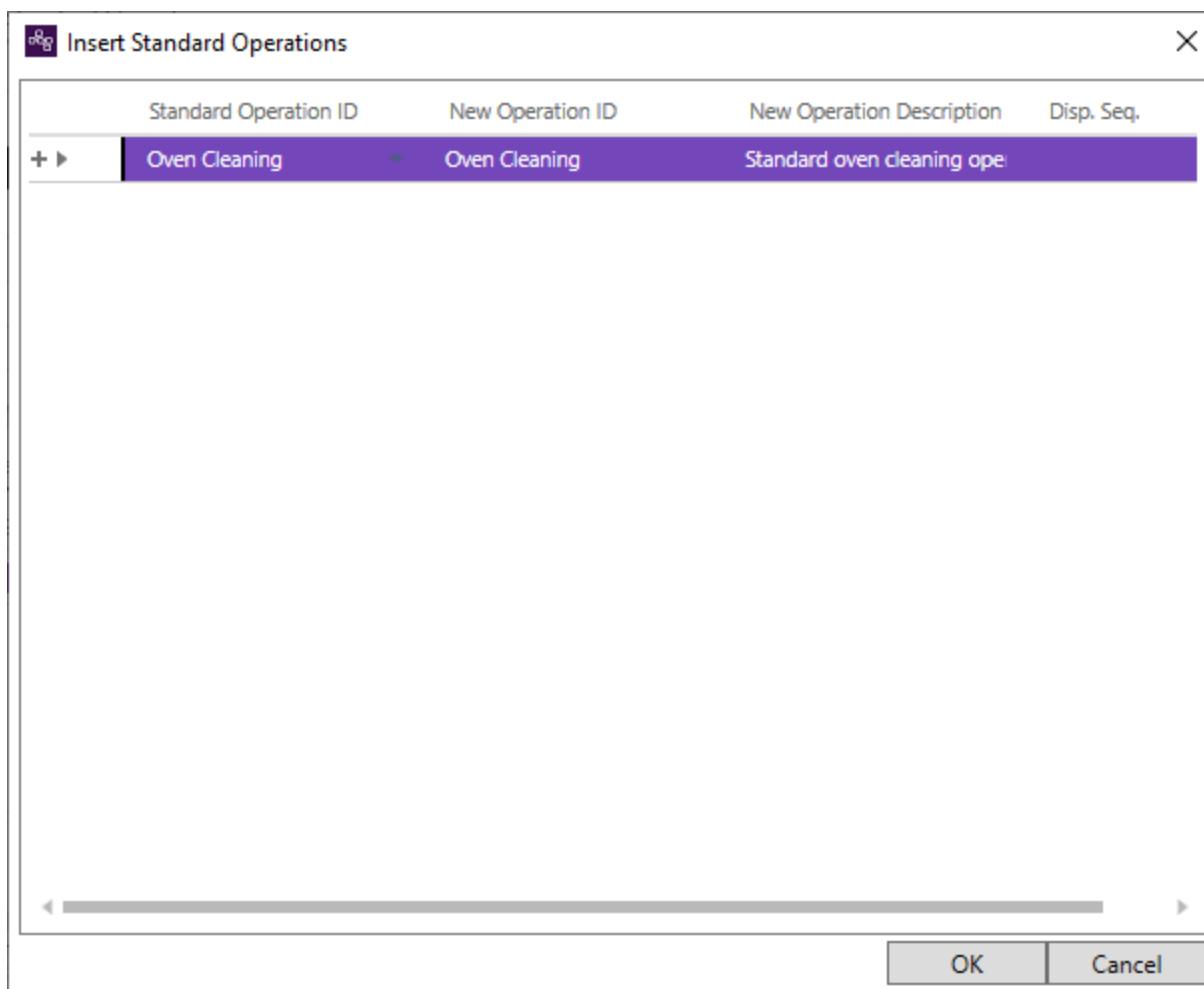
5. Click **OK**.

## Adding a Standard Operation to a Process

You can add a standard operation to a process. It creates an operation, using a standard operation as a template, for the selected process.

### To add a standard operation to a process

1. On the Processes tab, check out the process for which you want to add a standard operation.  
For more information on checking out a process, see [Checking Out and Checking In a Process](#).
2. On the ribbon, go to the **Current View** tab.
3. On the **Process Management** group, click **New Operation** and then click **Insert Standard Operations**.  
The Insert Standard Operations dialog box appears.
4. On the Insert Standard Operations dialog box, select the standard operation that you want to add to this process in the **Standard Operation ID** list.



5. In the **New Operation ID** box, type a unique operation ID for the operation.
6. In the **New Operation Description** box, type a brief description or name for the operation.
7. In the **Disp Seq** box, type the display sequence for the operation.  
To add multiple operations to a process, press **Enter**, and then add another operation.
8. Click **OK** when all standard operations are configured. For more information on operation, see [Adding an Operation to a Process](#).
9. Save the changes.

You must create a standard operation before adding standard operation to a process. For more information on creating a standard operation, see [Creating a Standard Operation](#).

## Creating a Route Map

You can view route map for a process with multiple operations. You can also view the flow of material from entities within an operation to entities within other operations. You can drag and drop an entity from one operation to the next and modify the percentages, if required.

You need to create a route map if a process contains more than one operation. A route map describes the flow of material through a process. You can create a route by drawing lines from the entities in a source operation to the entities in a destination operation. You must draw a line from every entity in the source operation to every entity

in the destination operation.

Each routing line has a percentage associated with it that determines the amount of material that flows from one entity to another. You can change the percentage of any line to any number between 0 and 100, but the total of all the lines leaving an entity must add up to 100 percent. If you have a source operation with two entities and a destination operation with two entities, you would draw four route lines. If one of the destination entities is faster, you may need to adjust the percentages leaving your source entities so that 60 percent of the material from each of the source entities goes to the faster destination and 40 percent of the material from the source entities goes to the slower entity.

You can have multiple source operations linked to one destination operation. For example, if you have a process to make filled cookies, you may have an operation to make the top of the cookie, an operation to make the filling, and an operation to make the bottom of the cookie. All these operations to make cookies run in parallel. These three operations can send their output to an operation that combines them to make a cookie.

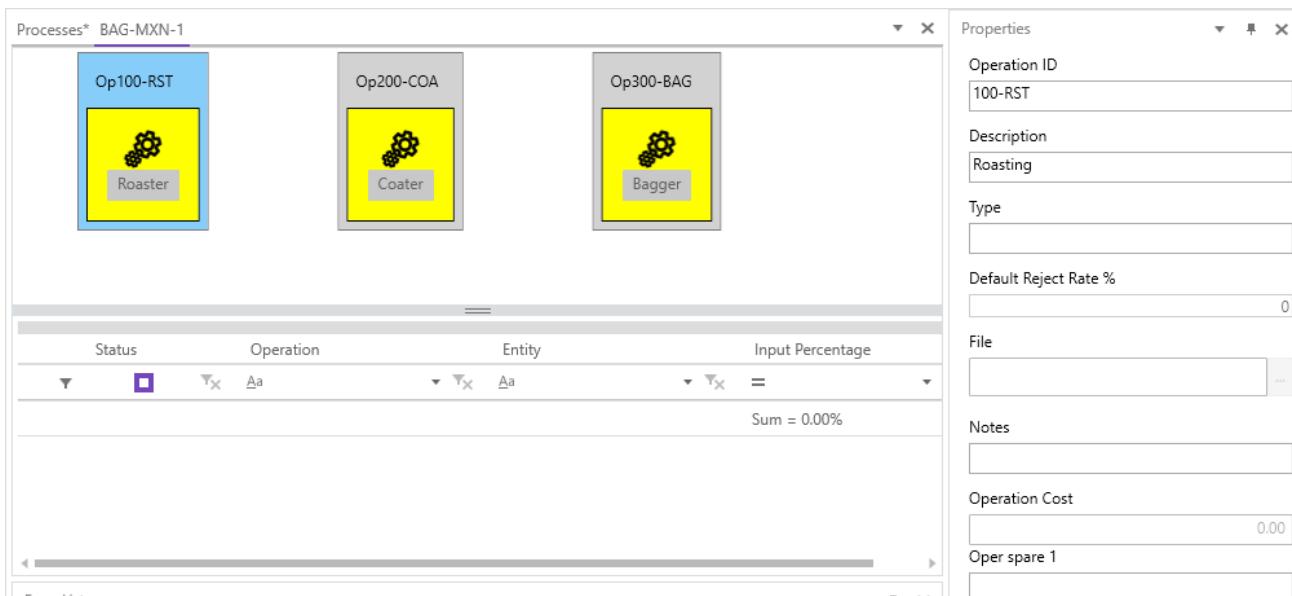
You can also have one source operation linked with multiple destination operations. If you had a process to build wagons, you may have an operation to produce wheels that feed another operation to produce the front wheel assembly and another operation that produces the rear wheel assembly.

**Note:** You must create a route map for a process before creating a work order from it.

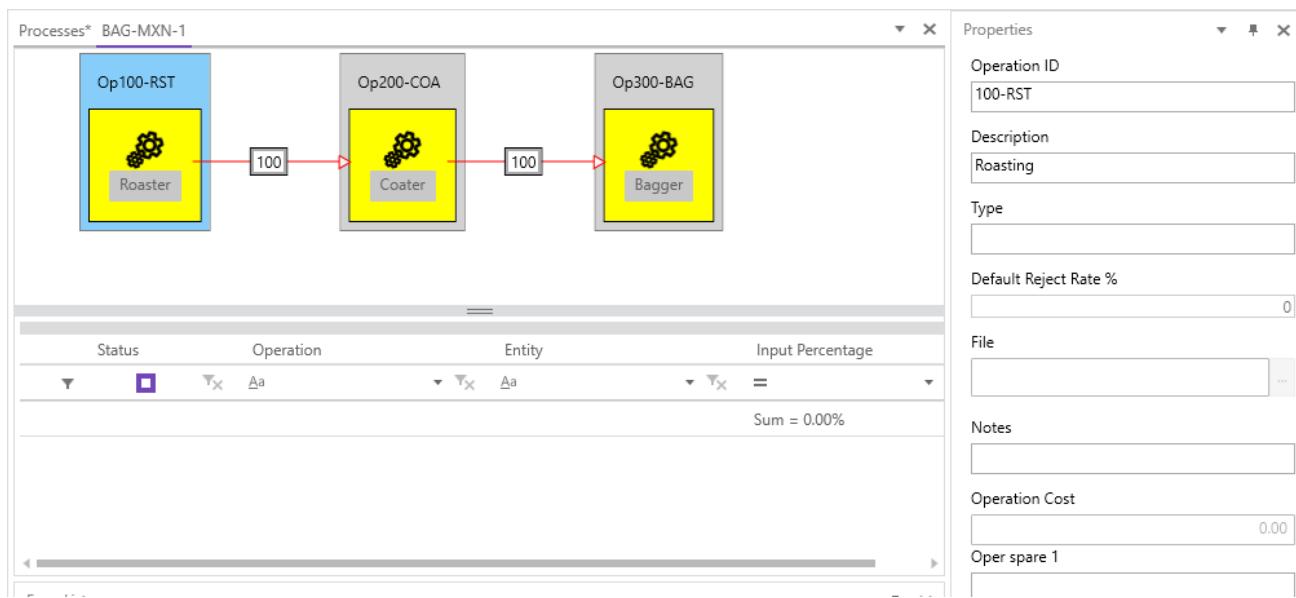
### To create a route map

1. Select the process.
2. On the ribbon, go to the **Current View** tab.
3. In the **Diagrams** group, click **View Route Map**.

The route map appears in a tab in the workspace.



4. Create a route map between two jobs in entities operations by selecting the entity in the source operation and dragging to the entity in the destination operation.



All entities in the source operation must be linked to all entities in the destination operation. If an operation sends output to more than one entity in a destination operation, you can edit the percentage of material for each route line by:

- Clicking on the box in the route line and changing the number
- Clicking on the source entity and changing the values in the grid.

The total value for all the route lines leaving an entity should be 100 percent.

## Checking Out and Checking In a Process

The General system parameter *Use check-in/check-out for process?* must be selected to enable the check in or check out feature. If it is selected, then the process must be checked out to edit it. For more information on General system parameters, see the table in [System Parameters Reference](#).

A new process is automatically checked out by the current user.

### To check out a process

1. Select the process.
2. On the ribbon, go to the **Current View** tab.
3. In the **Change Management** group, click **Check Out**.

The green icon appears in the **Check Out** column that indicates that the selected process is checked out.

### To check in a process

1. Select the process.
2. On the ribbon, go to the **Current View** tab.
3. In the **Change Management** group, click **Check In**.

The green icon is removed from the **Check Out** column that indicates that the selected process is checked in.

## Closing the Process Window with Processes Checked Out

When closing the **Process** window, if the Supervisor system parameter *Prompt for check in when closing Process window?* is selected and a process is checked out, a message appears telling you to check-in any checked-out processes. By default, this parameter is selected. For more information on Supervisor system parameters, see the table in [System Parameters Reference](#).

## Cloning a Process

You can clone an existing process to create a new process. A cloned process contains all the process properties, operations, operation steps, jobs, attributes, certifications, BOM, entities, and links associated with the parent process. You can change the values as required.

You can also copy a process. However, copying a process copies only the process properties, not the operations, operation steps, jobs, attributes, certifications, BOM, entities, and links associated with the parent process. See [Copying a Process](#).

### To clone a process

1. Select and check out the process that you want to clone.
2. On the ribbon, go to the **Current View** tab.
3. In the **Process Management** group, click **Clone** in the **New Operation** list.  
The Clone Process dialog box appears.
4. In the Clone Process dialog box, complete the following settings:

#### Process ID

A unique process ID for the process. The process ID identifies the process in the MES data records, so it must be unique and is not editable after the process definition is first saved.

#### Description

A brief description or name for the process.

#### Dissociate Items

Specifies whether to clone the process without item linkage.

If the **Dissociate Items** check box is selected, the items linked to the original process are not be linked to the cloned process.

5. Click **OK**.
6. Save the changes.
7. Check in the process.

## Copying a Process

You can copy an existing process to create a new process. A copied process contains all of the process properties. These are the properties that are included as columns in the **Processes** tab. You can change the property values as required.

Copying a process does not copy the operations, operation steps, jobs, attributes, certifications, BOM, entities, and links associated with the parent process. However you can copy these components of a process by cloning the process. See [Cloning a Process](#).

## To copy a process

1. Select and check out the process that you want to copy. For more information, see [Checking Out and Checking In a Process](#).
2. On the ribbon, click **Copy** in the **Home** group, then click **Paste**.  
A copy of the process is opened in a **New Process** tab.
3. Change the process properties as needed.
4. Save the changes.
5. Close the **New Process** tab.  
The new process is added to the list in the **Processes** tab.

## Verifying a Process

You can verify the selected process for any invalid or circular links that allow you to create a work order properly.

1. Select the process.
2. On the ribbon, go to the **Current View** tab.
3. On the **Process Management** group, click **Verify Process**.  
A confirmation message appears for the successful verified process.

An error message appears in the **Error List** window if the process is not valid. You must fix any invalid or circular links to create a valid process.

## Standard Operations

You can create standard operations for those operations that are used frequently for different operations. The standard operation can then be added to any process in which it is used (see [Adding a Standard Operation to a Process](#)). This allows you to avoid having to recreate the operation for each process and to maintain the standard operation in one place.

You use the **Standard Operations** module to create and maintain a standard operation.

With a standard operation, you can:

- Assign entities, attributes, specification versions, entity specifications, and certifications to an operation.
- Define step groups and steps for an operation.
- Edit the data log group values.

Standard operations do not have items associated with them, so you cannot assign BOM definitions, BOM item specifications, or item specifications to a standard operation.

The **Standard Operations** module is in the **Operations Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

Standard operations are used as templates to quickly and easily create similar operation definitions throughout a process.

You can add an operation directly to a process without referring to a standard operation. Standard operations save configuration time when the same operation is used multiple times within a process or the same operation

is used by multiple processes.

The **Standard Operations** workspace tab shows the operation ID, description, class, and so on for all the existing standard operations.

Status	Operation ID	Description	Type	Default Reject Rate %	Notes
	Oven Cleaning	Standard oven cleaning	Maintenance		

**Properties**

- Operation ID: Oven Cleaning
- Description: Standard oven cleaning operation
- Type: Maintenance
- Default Reject Rate %:
- File:
- Notes: Oper spare 1, Oper spare 2, Oper spare 3, Oper spare 4
- Operation Cost:

## Creating a Standard Operation

A standard operation contains the same information as an operation, except a standard operation is not attached to a specific process and does not contain a Bill Of Materials (BOM).

You can use a standard operation in the **Process** module after defining a standard operation. For more information on inserting a standard operation in a process, see [Adding a Standard Operation to a Process](#).

### To create a standard operation

1. Open or go to the **Standard Operations** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Standard Operation**.
3. In the new standard operation's **Properties** window, complete the properties. See [Standard Operation Properties](#).
4. Save the changes.

You can modify the properties of an existing standard operation in the **Properties** window.

## Standard Operation Properties

### Operation ID

A unique ID for the operation. The operation ID identifies the operation in the MES data records, so it must be unique within standard operations. The operation ID is not editable after the operation definition is first saved.

### Description

A brief description for the operation. It can be a common name for the operation.

### Type

An optional operation type grouping. This is used in custom reporting.

### Default reject rate%

The percentage of the production quantity that is estimated to be rejected during this operation (that is, the percentage of produced material that fails to meet production requirements). This percentage is used to calculate the jobs' starting quantity given the work order starting quantity. A value of 10 is interpreted as 10%.

### File

You can add a file or a web page to an operation to support the operator during production. For example, a file or web page can contain information relative to performing the jobs that are instantiated from the operation. When a user is running a job using an application such as MES Operator, the files and web pages will be available to them for viewing.

Adding a file or web page to a standard operation is similar to adding it to an operation. See [Adding a File or Web Page to an Operation](#).

### Notes

Additional notes for the standard operation. This is an optional field.

### Operation Cost

The cost for this operation. This value specifies the estimated cost of completing an operation in monetary units.

### Oper spare 1 to Oper spare 4

Additional information about the operation.

### Certification

For assigning certifications to the operation.

If an access certification is assigned to an operation, any operators who have been assigned to the certification and have the required certification level for the operation are allowed to start or work on jobs that have been instantiated from the operation. If audit certifications are assigned to the operation, all sign-offs required by the certification must be performed before the any of the jobs instantiated from it can be completed.

Assigning certifications to a standard operation is similar to assigning them to an operation. For more information, see [Assigning Certifications to an Operation](#).

### Data Log Groups

For assigning data log groups to the operation. When a data log group is assigned to an operation, a user can record data for the group's values.

Assigning data log groups to a standard operation is similar to assigning them to an operation. For more information, see [Assigning Data Log Groups to an Operation](#).

## Assigning Entities to a Standard Operation

You must assign at least one entity to a standard operation.

You must also set the estimated production rate for each entity assigned to an operation.

**Note:** The estimated production rate must be greater than 0. An entry of 0 will cause an error.

The estimated production rate is used with the batch size to schedule an entity while creating a work order from a process. The required finish date is assigned to the jobs in the last operation and then the estimated production rate, batch size, and work order quantity are used to determine the start time of a job. The same process runs until all jobs get a start and finish date. If an operation is the first operation in a process, the batch size specifies the initial amount that is sent to an entity if there is more than one entity in the operation. For additional information about batch size, see [Understanding Batches and Lots for OEE and Estimated Times](#).

### To assign an entity to a standard operation

1. Select the standard operation to which you want to assign an entity.
2. Right-click in the **Entity** tab and on the context menu click **New**.

A new entity entry is added.

The screenshot shows the AVEVA Manufacturing Execution System interface. On the left, the 'Standard Operations\*' grid displays a single row for 'Oven Cleaning' with a status of 'Active', an operation ID of '1', a description of 'Standard oven cleaning', and a type of 'Maintenance'. Below this grid is another grid titled 'Entity' with columns for Status, Entity, Estimated Production Rate, Estimated Labor Rate, and Estimated Entity. A new entry is visible in the Entity column. To the right of these grids is a 'Properties' window containing several configuration fields: Entity (with a browse button), Estimated Production Rate (set to 1 hours/batch), Estimated Labor Rate (empty), Estimated Entity Setup Hours (empty), Estimated Entity Teardown Hours (empty), Estimated Fixed Labor Hours (empty), Estimated Transfer Time (empty), Batch Size (set to 1), and Initial Production % Required (set to 100).

3. In the new entity entry's **Properties** window, complete the following settings:

#### Entity

Click the **Browse** button to locate the entity that you want to assign to the operation.

#### Estimated Production Rate

The estimated production rate for this job. It defines the estimated production rate of entity usage required by this operation to produce a single batch of the item on this entity. You also set the production rate UOM that can be in hours/batch, minutes/batch, and seconds/batch, or batches/hour, batches/minute, and batches/second format.

The estimated production rate must be greater than 0. An entry of 0 will cause an error.

#### Estimated Labor Rate

The estimated number of labor hours required to produce a single batch of the item in the selected entity.

#### **Estimated Entity Setup Hours**

The estimated number of hours for setting up the entity.

#### **Estimated Entity Teardown Hours**

The estimated number of hours required to tear down this entity after a production run.

#### **Estimated Fixed Labor Hours**

The estimated number of fixed labor hours required to produce a single batch of the item in the selected entity. This fixed rate is the work required that does not depend on the number of batches.

#### **Estimated Transfer Time**

The estimated number of hours required to move the produced items from the selected entity to the next entity.

#### **Batch Size**

The batch size. The batch size defines the number of production units in a single batch for this item, based on the company standards. For additional information about batch size, see [Understanding Batches and Lots for OEE and Estimated Times](#).

#### **Initial Production% Required**

The percentage of the initial quantity of material that will be allocated to this entity for a production to run. The total percentage for all entities assigned to the first operation should be equal to 100%. A value of 25 in this field means 25%.

4. Save the changes.

### **Assigning Steps to a Standard Operation**

You can assign steps to an operation so that tracking of the discrete operator work or actions within an operation can be controlled and sequenced.

Individual steps are assigned to step groups. These step groups can be defined as repeatable so that an operator is allowed to perform the steps multiple times if necessary and the system will track the events for the individual steps within the step group. Non-repeatable step groups contain steps that only need to be performed once in the operation, such as setup and teardown steps. Repeatable step groups contain steps that must be performed for every batch or group of work against a job at an operation.

Assigning steps to a standard operation is similar to assigning steps to an operation. For more information, see [Assigning Steps to an Operation](#).

### **Adding Specification Versions to a Standard Operation**

An operation can have multiple specification versions, but only one version can be defined as the preferred version. The preferred version is used by default to create job specification when a work order is created from a process. You must create a global set of specifications in the **Global Specifications** module before adding a specification to an operation. For more information on specifications, see [Global Specifications](#).

#### **To add specification versions to a standard operation**

1. Select standard operation.
2. Right-click in the **Specs** tab and on the context menu click **New**.

A new operation specification version entry is added.

The screenshot shows the AVEVA Manufacturing Execution System interface. On the left, the 'Standard Operations\*' window displays a list of operations. One row is selected, showing 'Oven Cleaning' with a description 'Standard oven cleaning' and type 'Maintenance'. Below this, the 'Entity Specs' window shows a list of entity specifications. One row is selected, indicating it is the 'Preferred Version'. On the right, the 'Properties' window is open, showing settings for a new specification version. Under 'Version', there is a text input field and a checked checkbox labeled 'Preferred Version'. Under 'Description', there is a text input field. Under 'Entity and Step Specification', there is a checked radio button.

3. In the new specification version's **Properties** window, complete the following settings:

#### Version

The version number for the specification.

#### Preferred Version

Specifies whether this version is the preferred version of the specification.

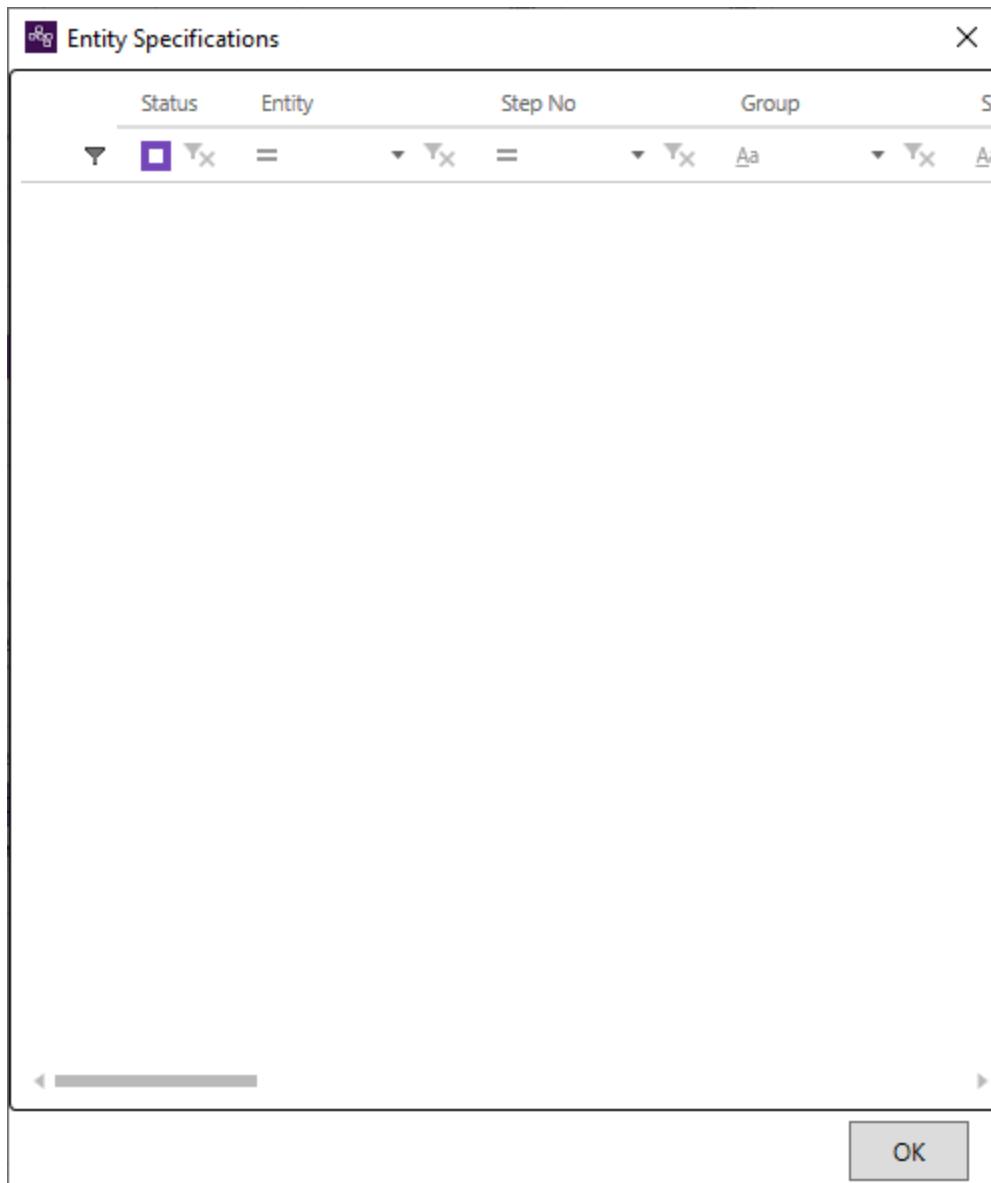
#### Description

A brief description for the specification.

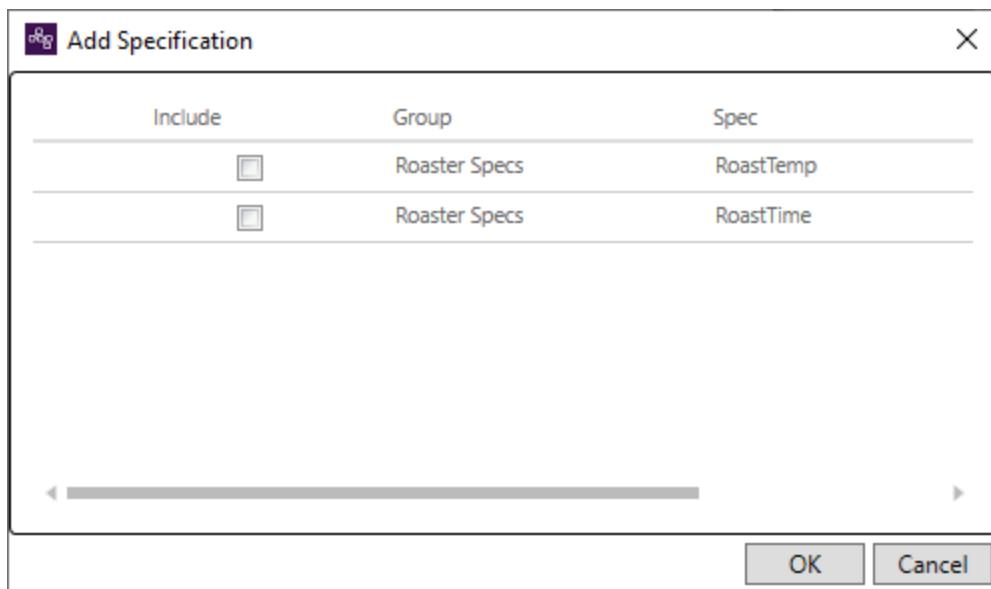
4. Save the changes.

5. In the **Entity and Step Specification** section of the Properties window, click **Entity Specifications**.

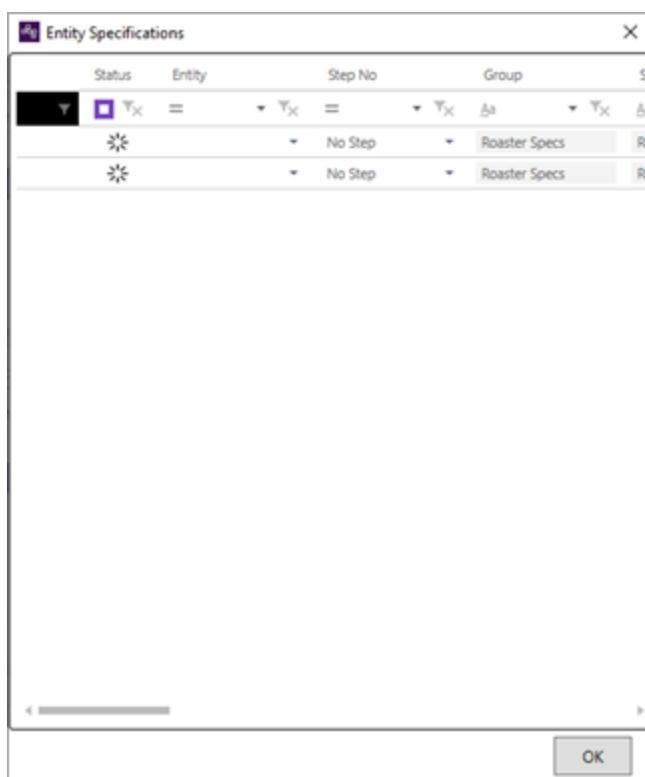
The Entity Specifications dialog box appears.



6. Right-click in the Entity Specifications dialog box, and then click **New Specification**.  
The Add Specification dialog box appears.



7. Select the specifications you want to add to this standard operation, and then click **OK**.  
The specifications are added to the Entity Specifications dialog box.



8. For each specification entry, complete the following settings:

**Entity**

The entity to which the specification applies.

**Step No**

The step number to optionally link a specification to a step. Select No Step to specify that the specification applies to complete operation.

**Group**

The specification group.

**Specification**

The specification ID.

**Data Type**

The data type for this specification.

**Value**

The value for the specification.

**Min Value**

The minimum value for the specification.

**Max Value**

The maximum value for the specification.

**Units**

The units for the specification.

**File**

You can add a file or web page to a specification to support an operator during production. For example, the file or web page can contain information relative to a BOM, entity, or item specification, such as how to set the setpoint value (represented by the specification) for the entity.

Assigning a file to a specification that is being added to a standard operation is similar to performing this task for an operation. See [Adding a File or Web Page to a Specification Being Added to an Operation](#).

**Comments**

Comments for this specification.

**Access Level**

The security access level for modifying the specification.

To edit a specification, you must have Specification access level user privilege greater than or equal to the Edit level of that specification. For more information, see [Assigning Specifications to an Operation](#).

9. When finished completing the settings for each specification, click **OK**.
10. The specifications are added to the **Entity and Step Specification** section of the Properties window.
11. Save the changes.

## Assigning Attributes to a Standard Operation

An attribute is an additional user-defined property that provides additional information about the operation.

You must first create operation attributes in the **Attributes** module so that they can be assigned to a standard operation. For more information on creating attributes, see [Attributes](#).

### To add an attribute to a standard operation

1. Select the operation.
2. Go to the **Attributes** tab.
3. Right-click in the tab and on the context menu click **Add**.

The **Add attributes** dialog box appears. Operation attributes that have not been assigned to this operation

are listed.

4. Select the attributes to assign to the operation and click **OK**.  
The selected attributes are added to the **Attributes** tab.
5. In each attribute's Properties window, complete the **Value** and **Notes** as needed.
6. Save the changes.

## Cloning a Standard Operation

You can clone an existing standard operation to create a copy of the standard operation on which to base a new one.

### To clone a standard operation

1. Right-click the standard operation that you want to clone and on the context menu click **Clone**.  
The Clone Standard Operation dialog box appears.
2. Complete the following settings for the new standard operation:

#### Operation ID

A unique operation ID for the standard operation.

#### Operation Description

A brief description for the standard operation.

3. Click **OK**.  
The new standard operation is added.
4. Save the changes.

## Customers and Vendors

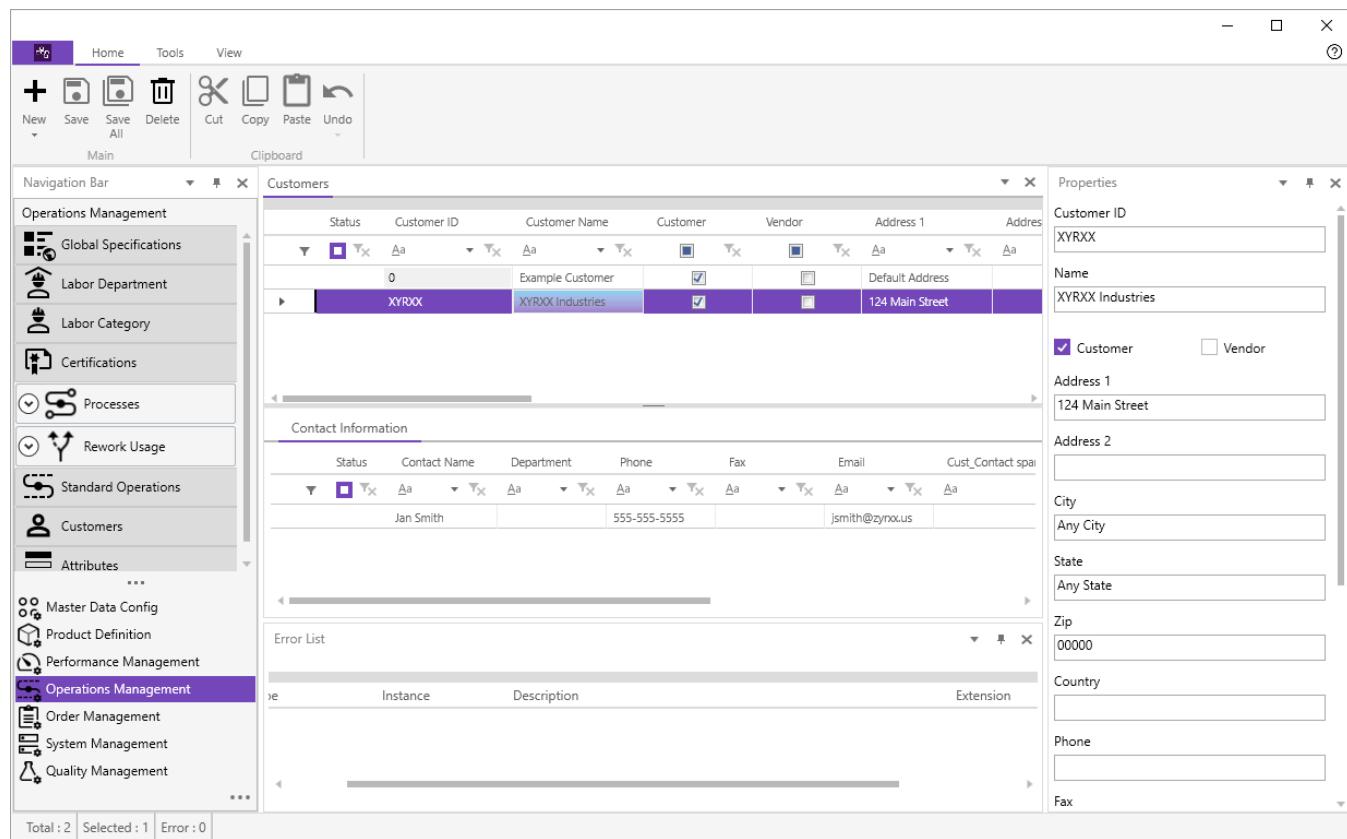
You use the **Customers** module to add customers and vendors to the system.

- Customers are assigned to sales orders and shipments using Commerce namespace methods in the MES Stateless API.
- Vendors are assigned to purchase orders and receipts using Commerce namespace methods in the MES Stateless API.

Note that a Customers entry can be designated as both a customer and a vendor.

The **Customers** module is in the **Operations Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Customers** workspace tab, a list of the existing customers and vendors is shown.



## Creating a Customer or Vendor

1. Open or go to the **Customers** workspace tab.
2. Do one of the following:
  - In the tab, right-click and click **New**.
  - Press **Ctrl+N**.
  - On the **Home** ribbon group, click **New** and then click **New Customer**.

A new customer/vendor is added.

3. In the new customer/vendor's **Properties** window, complete the property settings.

### Customer ID

A unique identifier within the MES system for the customer or vendor. This entry is not editable after the customer record is initially saved.

### Customer Name

The name for the customer or vendor.

### Customer and Vendor options

Select these options to indicate whether the entry is for a customer, vendor, or both.

### Contact Information Fields

The main address, phone numbers, and email address for the customer or vendor. Address 1 and City are required.

### Cust spare 1-4

Optional, user-definable fields for this customer or vendor.

4. Save your changes.

## Adding Customer or Vendor Contacts

You can add one or more contacts to a customer or vendor.

1. In the **Customers** workspace tab, select the customer or vendor to which you want to add a contact.
2. In the **Contact Information** tab, right-click and click **Add**.  
A new entry is added to the list.
3. Complete the property settings.

### Contact Name

The contact's name.

### Contact Information

The department, phone numbers, and email address for the contact.

### Cust\_Contact spare 1-4

Optional, user-definable fields for this contact.

4. Save your changes.

## To delete a contact

1. Right-click the contact in the **Contact Information** tab and click **Delete**.  
You are prompted to confirm the deletion.
2. Click **Yes**.  
You are notified that the record was deleted from the system.
3. Click **OK**.

## Deleting a Customer or Vendor

Deleting a customer or vendor will also delete all the sales orders and purchase orders that are associated with them. To retain existing purchase orders and sales orders but indicate that the customer or vendor is no longer active, clear both the Customer and Vendor check boxes.

### To delete a customer or vendor along with all of the sales orders or purchase orders that are associated with them

1. Select the customer or vendor.
2. Do one of the following:
  - Right-click the entry and click **Delete**.
  - Press **Delete**.
  - On the ribbon, go to the **Home** tab and click **Delete**.
3. You are prompted to confirm the deletion.
4. Click **Yes**.

You are notified that the record was deleted from the system.

4. Click **OK**.

## Job Queue

You can use the **Queue** module to manage jobs.

By default, the **Queue** module is in the **Order Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

Each row in the job queue displays a job. A job is a unique combination of work order, operation, and sequence number. A step represents a phase of a job. The **Queue** module is used to modify properties of a job, such as limited modification of the available job states and step states.

## Job and Step States

Job states report the status of a job, such as running and ready. Step states report the status of a job step or execution of job steps. The job queue is also used to prioritize work and order the list of work available to an operator.

The job state is utilized in MES Client, MES Web Portal, and MES Operator. The step state is utilized in MES Operator.

The following states are available to both jobs and steps in the MES applications:

### New

A job that is new and not started yet. Depending on the user's privileges, this might restrict a user from starting the job in the MES Operator application. A step in the job's step sequence that follows the current, Ready or Running, step.

### Ready

A job/step that is ready to start. This indicates that the requirements for running this job/step are met. For example, this may indicate that an upstream job has met the pieces produced requirement to start this job, or that this is the first job of a work order and all consumable BOM (Bill of Material) components are available.

### Running

A job/step that is currently running in production.

### Complete

A job/step that is finished. For example, this may indicate that required quantity is produced, all steps are complete, and all required data is entered.

The following states are available only to jobs:

### Suspended

A job that is paused temporarily. For example, a user at a shift change suspends a job so that the next shift user can log in and continue running the job.

### OnHold

A job that is paused indefinitely. For example, this may indicate that there are material or machine issues.

### Cancelled

A job that was created and then stopped before completion. For example, this may indicate a customer canceled a work order for a job that is scheduled and started running.

The **Queue** workspace tab provides visibility to all scheduled jobs in the system. You can find details about each job, including start and required quantities, physical entity on which a job is scheduled, and job status.

Status	Work Order ID	Operation ID	Target Scheduled Entity ID	Running On	State
	20210606.01	300-BAG	7	Bagger	COMPLETE
	20210606.01	200-COA	8	Coater	COMPLETE
	20210606.01	100-RST	9	Roaster	COMPLETE
	20210605.01	100-RST	9	Roaster	COMPLETE
	20210605.02	100-RST	9	Roaster	CANCELED
	20210605.01	200-COA	8	Coater	COMPLETE
	20210605.02	200-COA	8		CANCELED
	20210605.01	300-BAG	7	Bagger	COMPLETE
	20210605.02	300-BAG	7		CANCELED
	20220630.01	100-RST	9		READY
	20220630.01	200-COA	8		NEW
	20220630.01	300-BAG	7		NEW

When you open the **Queue** workspace tab, the **Current View** tab appears on the ribbon.

In the **View** group, the following commands are available:

#### Save as default

You can save the configured job queue layout as default for all users.

#### Save to logged-in

You can save the configured job queue layout as default for the logged in user.

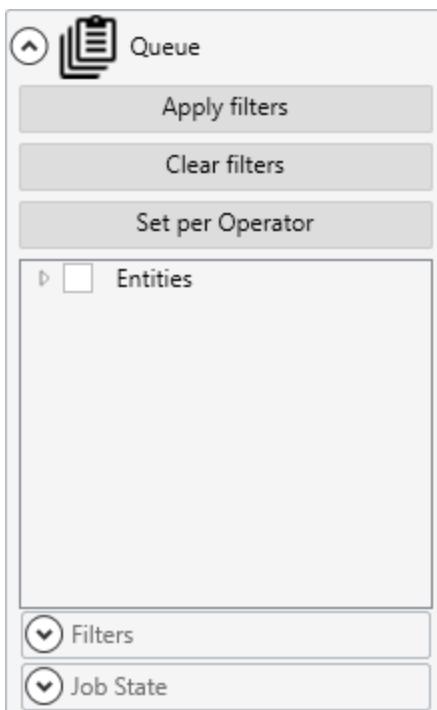
#### Revert to default

Click **Revert to default** to revert to the default settings.

### Opening the Queue Workspace Tab

When opening the **Queue** workspace tab, the **Apply Filter** function allows you to filter the list of jobs in the tab to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Order Management** group open the **Queue** section.



2. To not filter the jobs, don't enter any search terms.

To filter the jobs, enter search terms in the available filter options. See [Job Queue Filter Options](#).

3. Click **Apply Filter**.

The **Queue** workspace tab opens, listing the jobs that match the filter search terms.

## Job Queue Filter Options

You can specify filter options from the **Queue**, **Filters**, and/or **Job States** section of the filter.

In the **Queue** section, the following filter options are available:

### Set per Operator

Shows the entities to which the operator has access rights.

### Entities

When one or more entities are selected in the entity tree, job queues are shown for the jobs created for the selected entity. If no entity is selected in the entity tree, jobs from all the entities' job queues are shown.

In the **Filters** section, the following filter options are available:

### Work Order ID

Unique ID of the work order within a job.

### Operation ID

Unique ID of the operation within a job.

### Sequence No

Sequence number of the job.

### Item ID

Unique ID of the produced item within a job.

**Item Description**

Description of the produced item within a job.

**Show first jobs only**

Jobs marked as the first job (initial operation).

In the **Job States** section, the following filter options are available:

**New**

Shows new jobs.

**Running**

Shows running jobs.

**Suspended**

Shows suspended jobs.

**Cancelled**

Shows canceled jobs.

**Ready**

Shows ready jobs.

**Complete**

Shows complete jobs.

**On Hold**

Shows jobs that are on hold.

**Number of hours the jobs were last Cancelled**

Shows the jobs where the time of job cancelation is less than the number of hours specified from the current time. Jobs that have there state as Cancelled appear in the filter.

**Number of hours the jobs were last Completed**

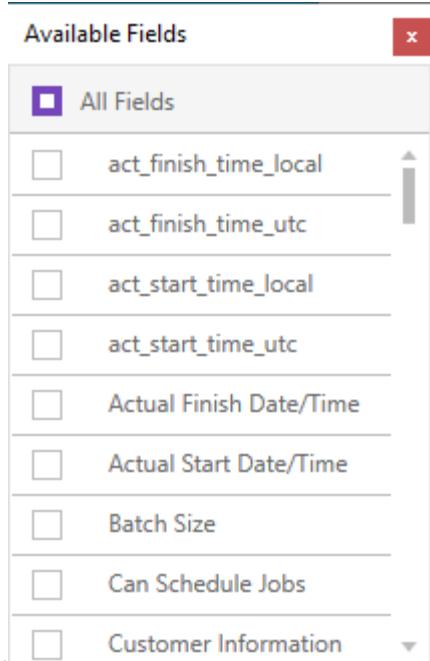
Shows the jobs where the time of job completion is less than the number of hours specified from the current time. Jobs that have there state as Complete appear in the filter.

If you select more than one job state, jobs currently in those states are shown. If no state is selected, jobs in all states are shown.

**Showing and Hiding Columns in the Queue Tab Grid**

1. Click the **Available Fields** icon  at the top of the grid on the **Queue** workspace tab.

The Available Fields dialog box appears.



2. Select or clear a check box to show or hide a column.
3. Close the dialog box.

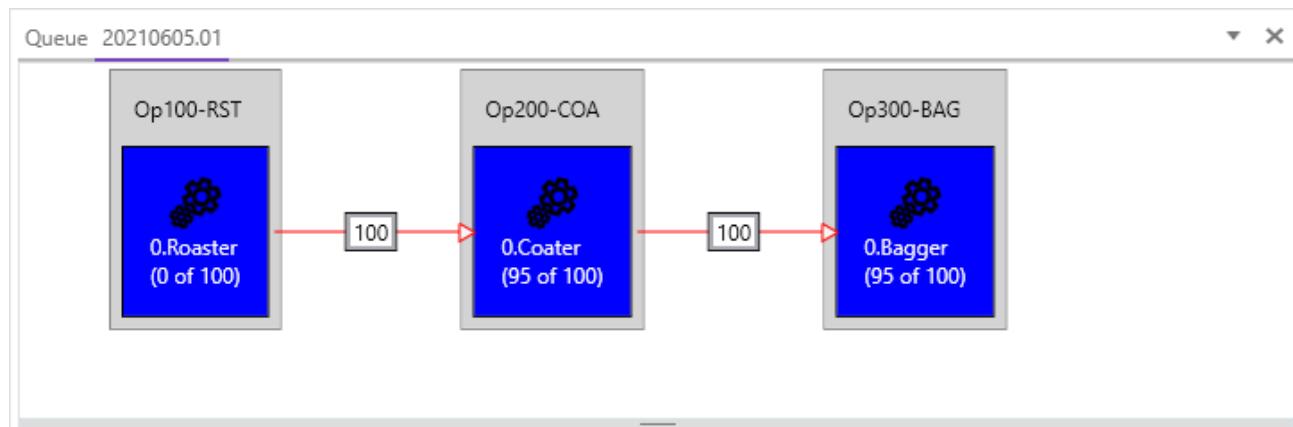
## Viewing a Job's Route Diagram

The job route diagram is the visual representation of the entire work order route in the MES Client application. A job route consists of jobs (operation and physical entity combinations), route links, and items. Jobs are color-coded based on the current job state.

### To view a job route diagram

- On the **Queue** workspace tab, right-click the job queue for which you want to view the job route diagram, and then click **View Flow Diagram**.

The **Job Route** workspace tab appears.



## Creating a Work Order from a Process from the Job Queue Module

You can create a work order from an existing process. All links and BOM versions that are part of a process are linked to a work order automatically.

### To create a work order from a process

1. Right-click in the **Queue** workspace tab and on the context menu click **Create Work Order from Process**.

The Create Work Order from Process dialog box appears.

Field	Value
Process ID	BAG-MXN-1
Spec. Version	(dropdown)
Work Order ID	20220630.02
Description	Second production phase
Item	BMX-BBQ
Bom Version	Original
Starting Quantity	1100 Pcs.
Required Quantity	1000 Pcs.
Release Date/Time	07/01/2022 12:00 AM
Due Date/Time	07/31/2022 12:00 AM
Priority	50
Customer	XRYXX Industries
Manufacturing Order	MO987654
Notes	(empty)

2. Complete the property settings for the work order. See [Work Order from Process Properties](#).
3. Click **OK**.

The work order is created. To see it, open the **Work Orders and Jobs** workspace tab. See [Work Orders and Jobs](#).

## Splitting Jobs

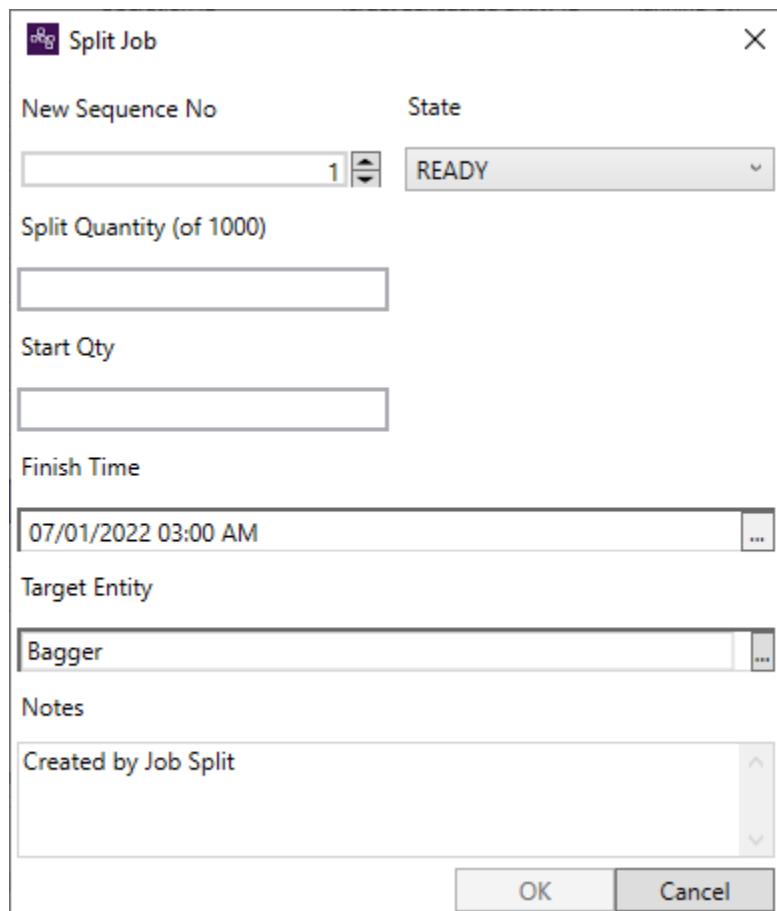
You can split a job associated with an operation. When you split a job, a new job is created for the operation and you can specify the quantities to be produced by the new job.

The specified quantities are deducted from the existing job and allocated to the new job. Splitting is done to increase efficiency and utilization of entities that execute jobs.

### To split a job

1. Right-click the job that you want to split and on the context menu click **Split Jobs**.

The Split Job dialog box appears.



2. Complete the following settings for the new job:

#### New Sequence Number

The sequence number for the new job.

#### State

The state of the new job. For more information on job states, see [Job and Step States](#).

#### Split Quantity

The production quantity you want to specify for the new job.

#### Start Qty

The starting quantity of the production for the new job.

#### Finish Time

The end time for the new job.

#### Target Entity

Click the **Browse** button to locate the entity on which the new job will run.

### Notes

Additional information about the new job.

3. Click **OK**.  
The new job is added to the grid.
4. Save the changes.

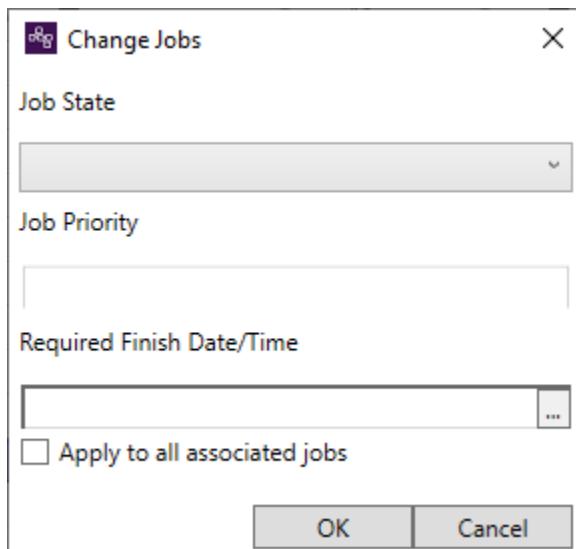
## Changing Selected Properties of Multiple Jobs at Once

You can change the job state, job priority, and required finish date/time for one or more jobs at once.

You can change the state of only those jobs that are not running, completed, or canceled.

1. Select each of the jobs to be changed.
2. Right-click in a clear area of the **Queue** workspace and on the context menu click **Change Selected Jobs**.

The Change Jobs dialog box appears.



3. Complete the following settings:

#### Job State

The job state.

#### Job Priority

The scheduling priority.

#### Required Finish Date/Time

The date and time when the jobs will be finished.

#### Apply to all associated jobs

Specifies whether to apply these changes to the jobs associated with the selected jobs.

4. Click **OK**.
5. Save the changes.

You can further modify properties of each job in its **Properties** window.

## Linking the Job States of Multiple Jobs

You can link multiple jobs together so that when the job state of one is changed to either Running, Suspended, On Hold, or Complete, all other linked jobs also change to that state at the same time.

1. Select each of the jobs to be linked together.
2. Right-click in a clear area of the **Queue** workspace and on the context menu click **Create Links**.  
All selected jobs are assigned the same link number. See the **Link #** setting in the **Properties** window.

## Deploying a Queue Sequence

You can apply the current job queue sequence (sort order) and filter (of states, work orders, and so on) to all of the entities selected in the entity tree. Queue sequence is used to control the work queue for the selected entities in the MES Operator application and MES Web Portal. For more information on sorting and filtering information, see [Reordering and Stacking Columns in Grids](#), [Sorting, Pinning, and Grouping in Grids](#), and [Filtering Grid Data](#).

If you are sorting by a column that does not exist in MES Operator's **Work Queue** tab, you will receive a warning indicating that the specified sort order cannot be displayed.

- Right-click a job in the job queue and on the context menu click **Deploy Queue Sequence and Filter**.

## Work Orders and Jobs

You can use the **Work Orders and Jobs** module to create and maintain the following:

- Work orders
- Jobs
- Job step groups
- Job steps

A work order is a collection of jobs that produce an item. A job is a list of steps or procedures that is executed to produce an item or a version of an item. Multiple jobs can be performed to produce a single item.

It is recommended to create a work order from a process or import a work order from a MRP system instead of creating the work order from scratch. After importing a work order from a MRP or creating the work order from a process, you may need to customize the work order for production. However, you can also use the **Work Orders and Jobs** module to create a work order with a process or MRP information.

When you open the **Work Orders and Jobs** workspace tab, a list of all the existing work orders is shown. Expand the work orders to see the job assigned to each of them.

By default, the **Work Orders and Jobs** module is in the **Order Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

## Restrictions on Work Orders and Jobs Created in MES Web Portal

Work orders can also be created and assigned to lines in MES Web Portal. Note the following MES Client restrictions for work orders and jobs when the work order is created and assigned to a line in MES Web Portal:

- You cannot add jobs to or delete jobs from a work order created for a line in MES Web Portal.
- You cannot reassign a job to another entity for a work order created for a line in MES Web Portal.
- You cannot change or delete the job route for a route related to a line.

## Organizing Work Orders and Jobs

The command options in the **Current View** tab allows you to organize the contents of the process tree. The following commands are available in the **Views** group to organize work orders:

### Standard View

Click **Standard View** to view all properties of a work order. By default, the standard view is shown in the **Work Orders and Jobs** tab.

### Group By Item

Click **Group By Item** to organize work orders by item. The item nodes are found in the workspace when the **Group By Item** command is selected. You can access and define related work orders by locating the appropriate produced item in the Item tree.

### Group By Mfg.Order

Click **Group By Mfg.Order** to organize work orders by manufacturing order. Work orders are grouped together if they are assigned to the same manufacturing order. Related work orders may be accessed and defined by locating the appropriate manufacturing number in the job tree.

## Applying Filters to the Work Orders List

When opening the **Work Orders and Jobs** workspace tab, the **Apply Filter** function allows you to filter the list of work orders in the tab to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Order Management** group open the **Work Orders and Jobs** section.

The screenshot shows the 'Work Orders And Jobs' filter interface. At the top is a header with a back arrow and the title 'Work Orders And Jobs'. Below the header are two buttons: 'Apply filters' and 'Clear filters'. The main area contains several input fields and dropdown menus:

- Work Order ID:** A text input field containing 'md'.
- Release date:** A date input field with a calendar icon.
- Due Date:** A date input field with a calendar icon.
- Work Order Priority:** An empty text input field.
- Customer:** An empty text input field.
- Manufacturing Order:** An empty text input field.
- Work Order State:** A dropdown menu with a visible arrow.
- Job Filters:** A collapsed dropdown menu indicated by a downward arrow.
- Item Class Filters:** A collapsed dropdown menu indicated by a downward arrow.
- Item Filters:** A collapsed dropdown menu indicated by a downward arrow.
- Process Filters:** A collapsed dropdown menu indicated by a downward arrow.
- Job State:** A collapsed dropdown menu indicated by a downward arrow.

2. To not filter the work orders, don't enter any search terms.

To filter the work orders, enter search terms in the available filter options. See [Available Work Order Filters](#).

3. Click **Apply Filter**.

The **Work Orders and Jobs** workspace tab opens, listing the work orders that match the filter search terms.

## Available Work Order Filters

In the **Work Orders and Jobs** section, the following filter options are available:

### Work Order ID

Unique ID of the work order.

### Release Date

Date and time for the release of the first job.

### Due Date Time

Planned work order completion date and time.

### Work Order Priority

Priority for the work order.

### Customer

Name or account number of the customer.

### Manufacturing Order

Manufacturing order ID.

### Work Order State

State of the work order.

In the **Job Filters** section, the following filter options are available:

### Operation ID

Unique ID of the operation within the work order.

### Scheduleable Entity

Entity to which job is initially scheduled.

### Scheduled Entity

Entity to which job is actually scheduled.

### Last entity run on

Entity on which job was executed.

In the **Item Class Filters** section, the following filter options are available:

### Item Class ID

Unique ID of the produced item class.

### Item Class Description

Description of the produced item class.

In the **Item Filters** section, the following filter options are available:

### Item ID

Unique ID of the produced item.

**Item Description**

Description of the produced item.

**Item spare1**

User-defined information.

**Item spare2**

User-defined information.

**Item spare3**

User-defined information.

**Item spare4**

User-defined information.

In the **Process Filters** section, the following filter options are available:

**Process ID**

Unique ID of the process.

In the **Job State** section, the following filter options are available:

**New**

New jobs.

**Suspended**

Jobs that are stopped.

**Complete**

Jobs that are complete.

**On Hold**

Jobs that are on hold.

**Running**

Jobs that are running.

**Cancelled**

Jobs that are canceled.

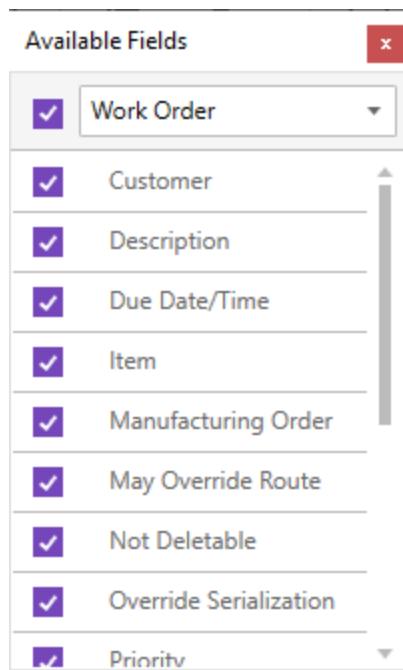
**Ready**

Jobs that are ready.

## Showing or Hiding Columns in the Work Orders and Jobs Grid

1. Click the **Available Fields** icon  at the top left of the grid on **Work Orders and Jobs** workspace tab.

The **Available Fields** dialog box appears.



2. Select or clear a check box to show or hide a column.
3. Close the dialog box.

## Workflow for Creating Work Orders and Jobs

You can create and manage work orders, jobs, job step groups, and job steps. The workspace shows the work order ID, process ID, description, and other details of an existing work order.

Following is the workflow to create and configure new work order:

1. [Creating a Work Order from a Process](#)
2. [Creating a Work Order](#)
3. [Adding Files and Web Pages to a Work Order](#)
4. [Assigning Attributes to a Work Order](#)
5. [Creating a Job](#)
6. [Creating a Job BOM](#)
7. [Assigning Steps to a Job](#)
8. [Assigning Specifications to a Job](#)
9. [Assigning Attributes to a Job](#)
10. [Assigning Data Log Groups to a Job](#)
11. [Creating a Route Map](#)

### Creating a Work Order from a Process

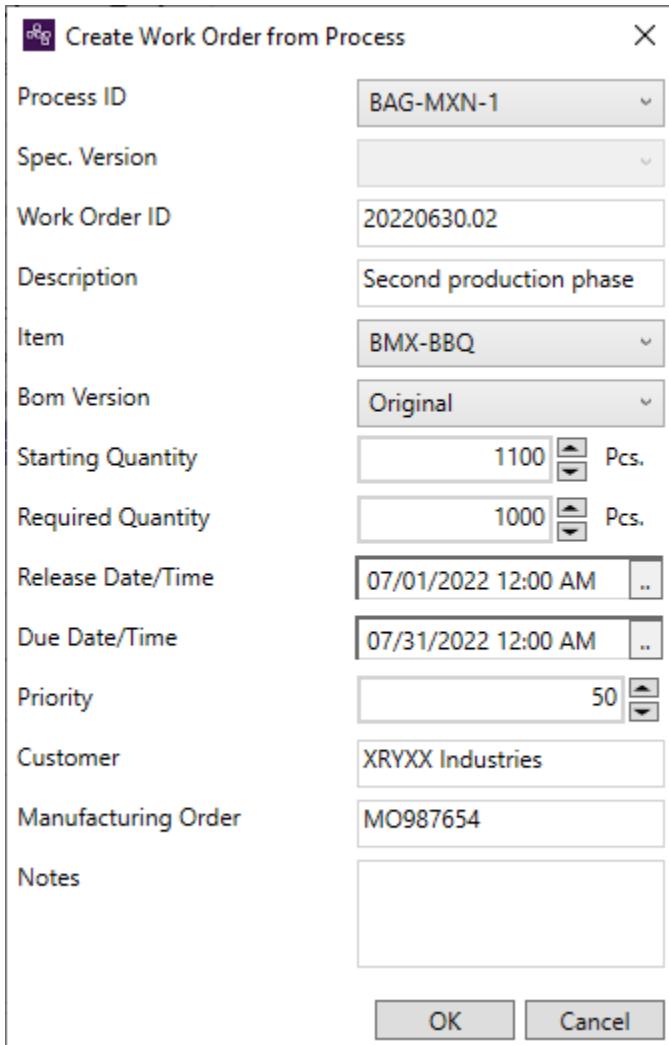
You can create a work order from an existing process. All links and BOM versions that are part of a process are linked to a work order automatically.

## To create a work order from a process

1. Do one of the following:

- Right-click in the **Work Orders and Jobs** workspace tab and on the context menu click **New Work Order From Process**.
- On the ribbon, go to the **Home** tab and on the **New** menu click **New Work Order From Process**.

The Create Work Order from Process dialog box appears.



The dialog box is titled "Create Work Order from Process". It contains the following fields:

Process ID	BAG-MXN-1
Spec. Version	
Work Order ID	20220630.02
Description	Second production phase
Item	BMX-BBQ
Bom Version	Original
Starting Quantity	1100 Pcs.
Required Quantity	1000 Pcs.
Release Date/Time	07/01/2022 12:00 AM
Due Date/Time	07/31/2022 12:00 AM
Priority	50
Customer	XRYXX Industries
Manufacturing Order	MO987654
Notes	

At the bottom are two buttons: "OK" and "Cancel".

2. Complete the property settings. See [Work Order from Process Properties](#).
3. Click **OK**.

The new work order is added to the grid.

## Work Order from Process Properties

### Process ID

The ID of the process from which you want to create a work order.

### Specification Version

The specification version for the work order.

You must have the *May override preferred spec. version* privilege and all the operations in the process must have the same spec versions for this to be available.

#### **Work Order ID**

The unique ID for the work order.

The work order ID is generated automatically if you define the work order ID format using the *Work order ID format* system parameter.

#### **Description**

A brief description of the work order.

#### **Item list**

The item that you want to add to this work order.

You must define an item as a produced item in the **Items** module. If the selected process is linked to only one item, then the item is automatically selected in the **Work Order** module. For more information, see [Creating an Item](#).

#### **BOM Version**

The BOM version for the work order.

#### **Starting Quantity**

The starting quantity is the amount of product that is intended to be made, if there were no rejects. The last operation in the work order starts with the starting quantity. If the starting quantity is left at its default of 0, and a required quantity is specified, the starting quantity will be changed to be equal to the required quantity. The maximum value that can be entered is 999,999.

#### **Required Quantity**

The required quantity of the produced items. Required quantity is the quantity that the last operation in the work order must produce to complete the operation. The maximum value that can be entered is 999,999.

#### **Release Date/Time**

The date and time for the release of the first job. Click the **Browse** button to select the date and time from the calendar. Release date and time is used by the system to change the first job in the work order from new to ready. It is also used to set the required dates for the jobs. The work order required date is assigned to the jobs during the last operation.

#### **Due Date/Time**

The planned work order completion date and time. Click the **Browse** button to select the date and time from the calendar.

#### **Priority**

The priority for the work order. It prioritizes all jobs created for the work order.

#### **Customer**

The name or account number of the customer.

#### **Manufacturing Order**

The manufacturing order ID.

#### **Notes**

Additional information about the work order.

## How the Default Latest Start Times for Operations Are Determined

The default latest start times for operations are determined by the system based on the following properties:

- The item quantities to be produced by each operation in the process
- Estimated production rate (including batch size) for each operation in the process
- The percentage of produced items coming to each operation that are required to allow that operation to start
- The work order's required finish time

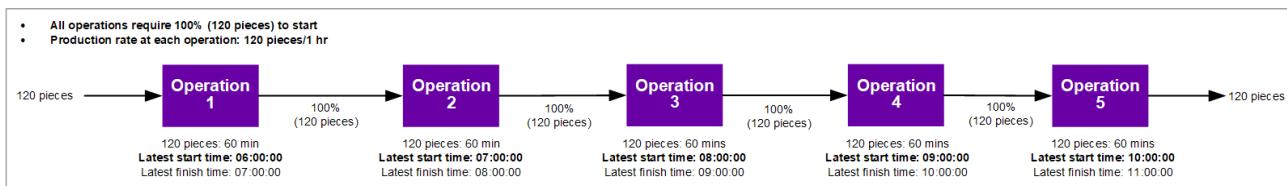
The latest start time for each operation in a process is based on the slowest path through the downstream operations in the process.

The following examples demonstrate how the earliest start times are determined.

## Process with No Parallel Operations

The following diagram shows the latest start and finish times for a process with the following characteristics:

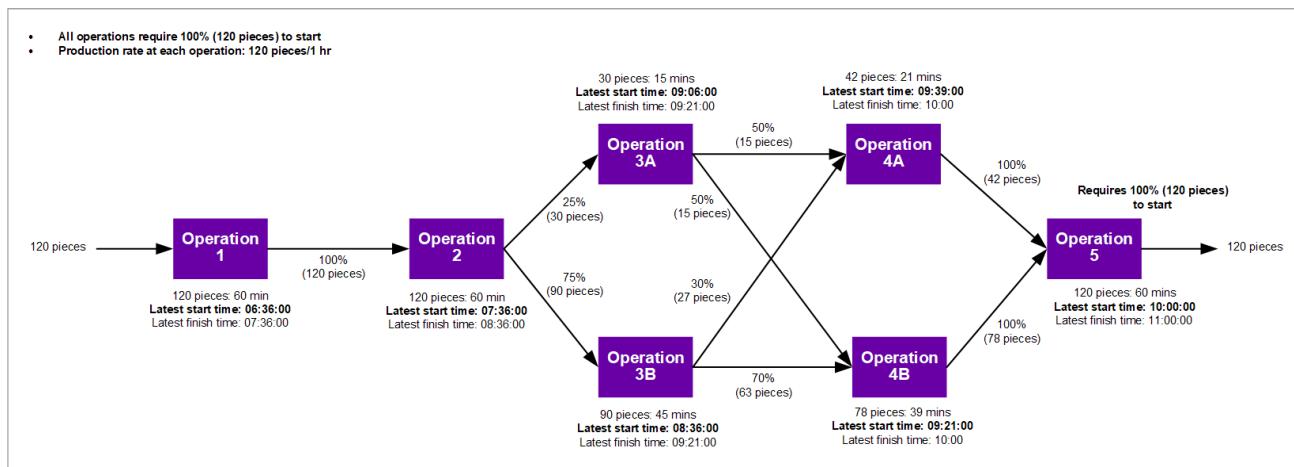
- The process has no parallel operations
- The estimated production rate for each operation is 120 pieces per hour
- The production for the work order must be completed by 11:00
- Each operation requires that 100% of the starting quantity coming from the previous operations be available to start that operation



## Process with Parallel Operations, All Requiring 100% Item Quantity to Start

The following diagram shows the latest start and finish times for a process with the following characteristics:

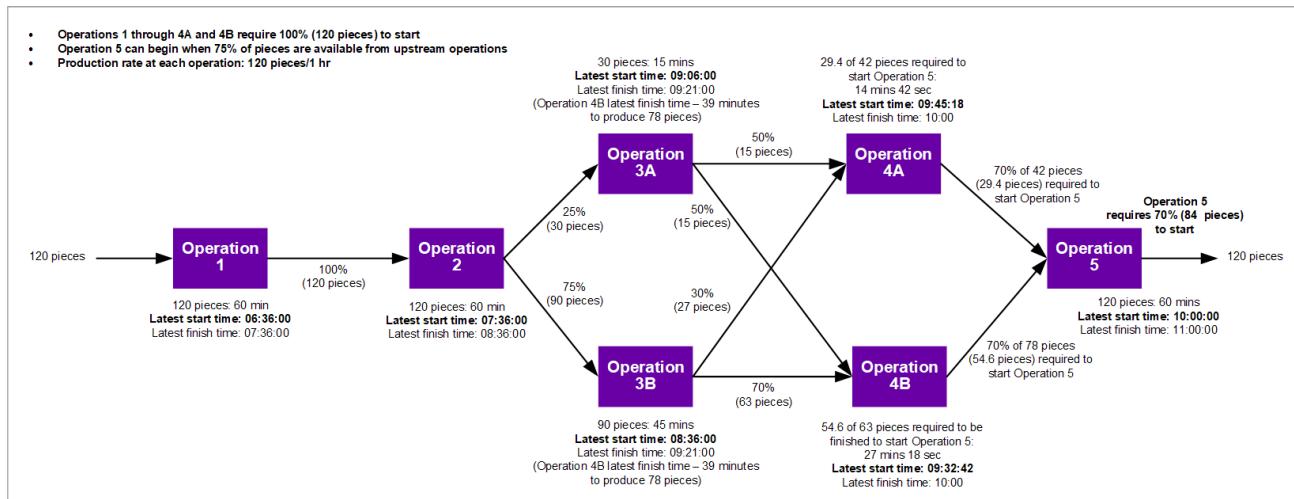
- The process has parallel operations, with the parallel operations producing different percentages of the total item quantities
- The estimated production rate for each operation is 120 pieces per hour
- The production for the work order must be completed by 11:00
- Each operation requires that 100% of the starting quantity coming from the previous operations be available to start that operation



## Process with Parallel Operations, Final Operation Only Requiring 70% Item Quantity to Start

The following diagram shows the latest start and finish times for a process with the following characteristics:

- The process has parallel operations, with the parallel operations producing different percentages of the total item quantities
- The estimated production rate for each operation is 120 pieces per hour
- The production for the work order must be completed by 11:00
- Each operation except that last one requires that 100% of the starting quantity coming from the previous operations be available to start that operation; Operation 5 requires only 70% to start.



Note that, because Operation 5 can be started with only 70% of the starting quantity being available, the latest start time for Operation 4 is based on producing 70% of the entire quantity instead of the entire 100%. Therefore, the latest start times for Operations 1 through 4 are later than for the previous example. That is, in the previous example, the first operation would have to start sooner to meet the work order's required finish time.

## Creating a Work Order

A work order indicates the task assigned by a customer to produce some quantity of an item on or before a due date. You can also create work orders for internal use, such as restocking inventory for an item that can be later used as a component for another item.

You can also create a work order from a process. Processes are templates for work orders. All entities, step groups, steps, BOM, folders, data log and certifications linked to the process becomes a part of the new work order. For more information on creating a work order from a process, see [Adding Files and Web Pages to a Work Order](#).

### To create a work order

1. Do one of the following:
  - Right-click in the **Work Orders and Jobs** workspace tab and on the context menu click **New Work Order**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Work Order**.

The **New Work Order** tab appears.

2. In the **Properties** window, complete the property settings. See [Work Order Properties](#).
3. Save the changes.
4. Close the **New Work Order** tab.
5. The work order is added to the grid in the **Work Orders and Jobs** workspace tab.

You can modify the properties of an existing work order in the **Properties** window.

## Work Order Properties

### Work Order ID

The unique ID for the work order. Identifies the work order in all MES data records, so must be unique and is not editable after the work order definition is first saved.

The work order ID is generated automatically if you define the work order ID format using the *Work order ID format* system parameter.

### Description

The work order name or a brief description of the work order.

### Item

Click the **Browse** button to locate the item that you want to add to this work order.

The **Choose Produced Item** dialog box appears.

You must define an item as a produced item in the **Items** module. If the selected process is linked to only one item, then the item is automatically selected in the work order module. For more information, see [Creating an Item](#).

Select Item

Item ID	Item Description
Units	Template
Lifetime	Unit Cost
Num Decimals	

Item Class Filters

Apply filters   Clear filters

Select Item	Item	Item Class
<input type="checkbox"/>	BMX-BBQ(Bag of Mixed Nuts - BBQ)	Finished Goods(Finished goods)
<input type="checkbox"/>	FMX-BBQ(Flavored Mixed Nuts - BBQ)	WIP Materials(Intermediate materials)
<input type="checkbox"/>	RMX-BLK(Roasted Mixed Nuts)	WIP Materials(Intermediate materials)

OK   Cancel

In the top pane, create a filter to limit the number of items returned, and then click **Apply Filters**. Click **Clear Filters** to reset the filters.

In the bottom pane, select an item, and then click **OK** to set the item produced by the work order.

### Status

The status of the overall work order. The system automatically controls the status until it reaches Completed. You must have the *May change work order status* user privilege to change the status of a work order.

The work order statuses are:

- **Released:** Indicates that the work order is complete and ready for release.
- **Started:** Indicates that the work order is in progress.
- **Completed:** Indicates that the work order is complete and delivered to the customer.
- **Closed:** Indicates that the work order is stopped or interrupted due to some reason. The work order cannot be edited if the work order status is Closed.

Note that this status is different than the work order status that is displayed in MES Web Portal. The work order

status in MES Web Portal is derived from the statuses of the work order's jobs.

#### **Starting Quantity**

The starting quantity is the amount of product that is intended to be made, if there were no rejects. The last operation in the work order starts with the starting quantity. If the starting quantity is left at its default of 0, and a required quantity is specified, the starting quantity will be changed to be equal to the required quantity. The maximum value that can be entered is 999,999.

#### **Required Quantity**

The required quantity of produced items. Required quantity is the total quantity that must be produced by all jobs in the last operation of a work order. The maximum value that can be entered is 999,999.

#### **Customer**

The name or account number of the customer who placed this order.

#### **Manufacturing Order**

The manufacturing order ID. Manufacturing order ID identifies the manufacturing order to which this work order belongs. A manufacturing order ID can be used to access related work orders (common customer, purpose, and so on) in the job tree while creating a job.

#### **Release Date/Time**

The date and time for the release of the first job. Click the **Browse** button to select the date and time from the calendar. Release date and time is used by the system to change the first job in the work order from new to ready. It is also used to set the required dates of the jobs. The work order required date is assigned to the jobs in the last operation.

#### **Due Date/Time**

The planned work order completion date and time. Click the **Browse** button to select the date and time from the calendar.

#### **Priority**

The priority for the work order. For example, for value 1, the priority of the work order will be highest. It allows you to set the priority of all jobs in the work order.

#### **Notes**

Additional information about the work order.

#### **Not Deletable**

Specifies whether the work order is locked and so cannot be deleted from the system.

#### **May Override Route**

Specifies whether the sequence of operations defined in a work order route can be overridden. If selected, an operator can work on jobs in downstream operation before completing or starting the jobs in an upstream operation.

#### **Override Serialization**

Specifies whether the serial number of the items in a work order can be overridden. If selected, you can produce a serialized item without using serialization. It is used to handle the transition phase when you first mark an item as serialized, but you already have work orders in process. You can override serialization in a work order to continue producing items without a serial number.

This option is available only if the item produced by the work order is a serialized item.

#### **Files**

You can add files and web pages to a work order to provide instructions about the work order for an operator.

When a user is recording the execution of the work order from an application such as MES Operator, the file or web page will be available to them for viewing.

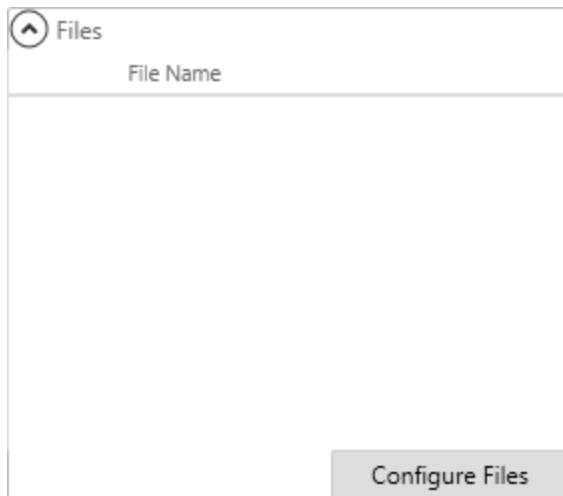
See Adding Files and Web Pages to a Work Order.

## Adding Files and Web Pages to a Work Order

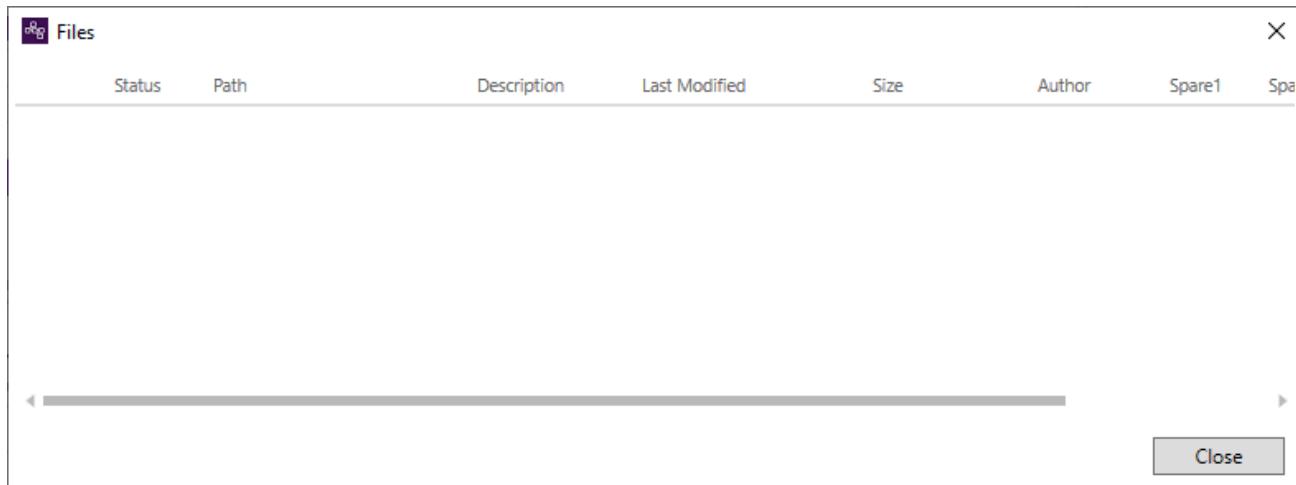
You can add files and web pages to a work order to provide instructions about the work order for an operator. When a user is recording the execution of the work order from an application such as MES Operator, the file or web page will be available to them for viewing.

### To add files to a work order

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



2. Right-click in the dialog box, and then click **Add files**.  
The Open dialog box appears.
3. In the file type list, select **All files**.
4. Navigate to and select the files to be added, and then click **Open**.  
The selected files are listed in the Files dialog box.

Files								
Status	Path	Description	Last Modified	Size	Author	Spare1	Spare2	Spare3
★	C:\Users\mes.user\Documents\		06/30/2022 12:13:07 PM	834,396	▼			
★	C:\Users\mes.user\Documents\		06/30/2022 12:13:39 PM	834,421	▼			

5. Optionally, add a description for each file in the **Description** column.
6. Add other files (or web pages) as needed.
7. When you are finished adding files, click **Close**.

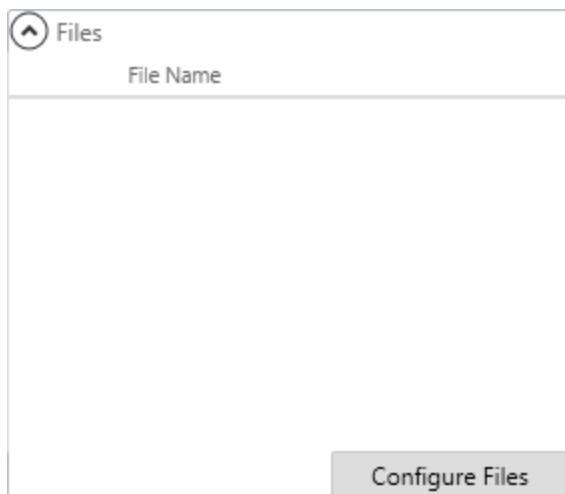
The files are listed in the **Files** property group.

Files	
File Name	
C:\Users\mes.user\Documents\Roaster Docum	
C:\Users\mes.user\Documents\Roaster Docum	

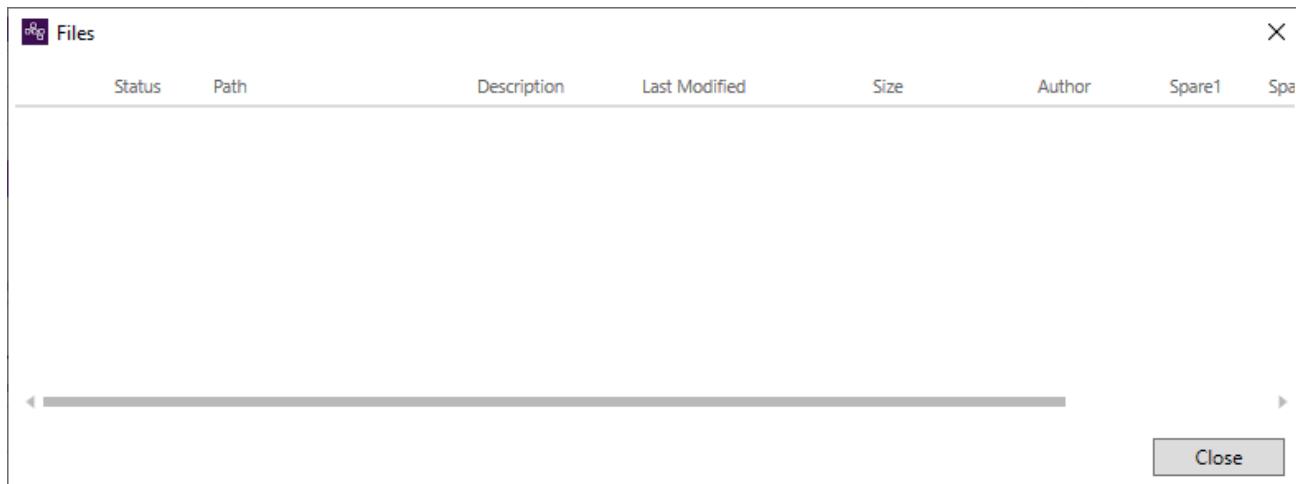
8. Save the changes.

#### To add web pages to a work order

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



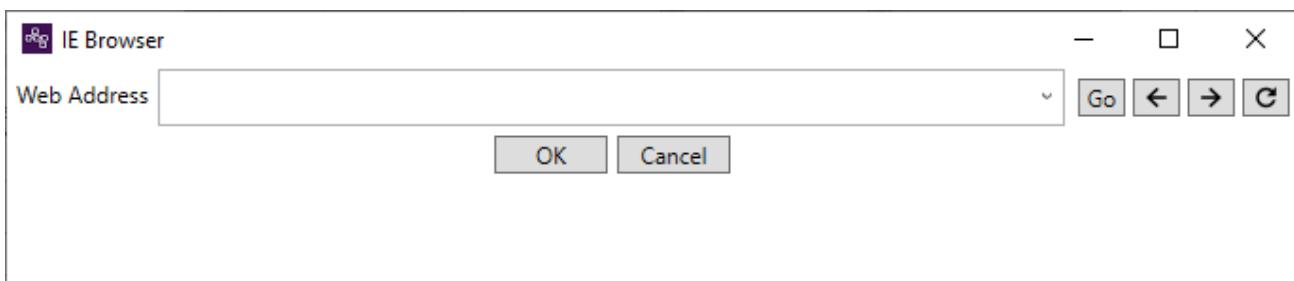
2. Right-click in the dialog box, and then click **Add URL**.

The Add URL dialog box appears.



3. Enter the URL and a description of the web page.

Instead of manually entering the URL, you can click the Browse button at the right of the URL box and use the mini-browser window that appears to navigate to the web page.



Click **OK** and that web page's URL is entered on the Add URL dialog box.

- When you have finished entering the URL and description, click **Close**.

The URL is listed in the Files dialog box.

Status	Path	Description	Last Modified	Size	Author	Spare1	Spa
	www.mymescompany.com/ins	Roaster operator					

- Add other web pages (or files) as needed.
- When you are finished adding web pages, click **Close**.

The web page URLs are listed in the **Files** property group.

File Name
www.mymescompany.com/instructions/roaster

- Save the changes.

#### To remove a file or URL

- In the **Files** property group, click **Configure Files**.

The Files dialog box appears.

2. Right-click the file or URL, and click **Delete**.

You are prompted to confirm the deletion.

3. Click **Yes**.

## Assigning Attributes to a Work Order

An attribute is an additional user-defined property. Attributes are not used directly in the manufacturing process they provide extra information about the work order. You must create an attribute for a work order in the **Attributes** module before assigning an attribute to a work order. For more information on attributes, see [Attributes](#).

### To assign attributes to a work order

1. Select the work order.
2. Go to the **Attributes** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add**.
  - On the ribbon, go to the **Current View** tab and click **Add Attributes**.

The **Add attributes** dialog box appears. Work order attributes that have not already been assigned to this work order are listed.

4. Select the attributes to assign to the work order and click **OK**.  
The selected attributes are added to the **Attributes** tab.
5. In each attribute's Properties window, complete the **Value** and **Notes** as needed.
6. Save the changes.

## Creating a Job

A job is an instance of an operation for a work order that is scheduled for a particular entity and produces an item. A job is an operation and entity combination to produce a specified quantity of an item. A job consists of steps, specifications, and components that are necessary for a particular phase of the production. Multiple jobs can be used to produce an item.

### To create a job for a work order

1. Do one of the following:
  - Right-click the work order and on the context menu click **New Job**.
  - Select the work order, right-click in a clear area of the **Work Orders and Jobs** workspace tab, and on the context menu click **New Job**.
  - Select the work order. On the ribbon, go to the **Home** tab and on the **New** menu click **New Job**.
2. In the new job's **Properties** window, complete the property settings. See [Job Properties](#).
3. Save the changes.

You can modify the properties of an existing job in its **Properties** window.

## Job Properties

There are several groups of job properties.

# General Properties

### Operation ID

The ID of the operation to be associated with the job.

### Sequence Number

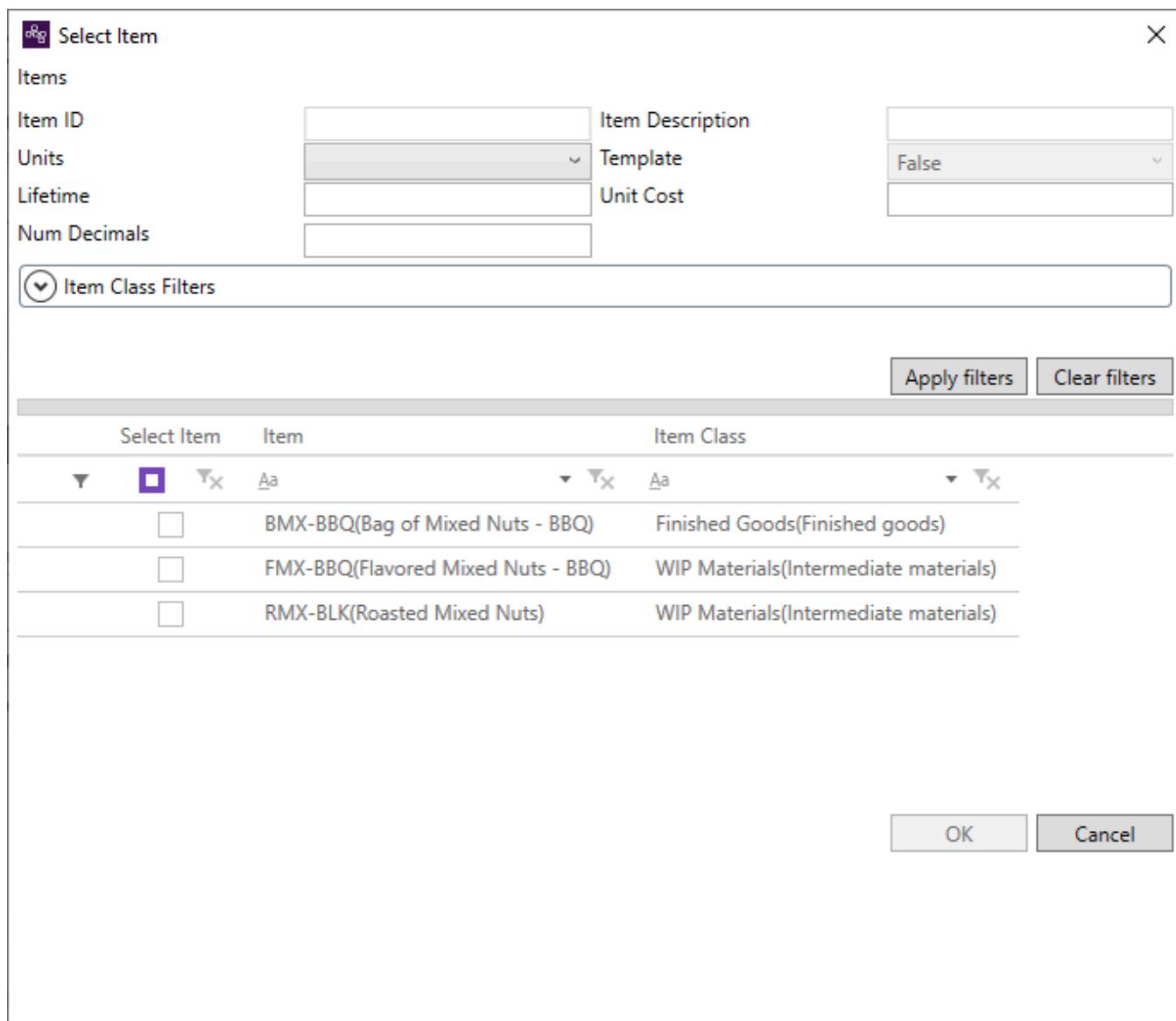
The sequence to divide a job. For example, a job can be divided into three sequence numbers so that three entities can work on that job simultaneously. The sequence number is used to differentiate multiple jobs for the same operation.

### Item

Click the **Browse** button to locate the item that you want to add for this job. You must define an item as a produced item in the Items module. If the selected process is linked to only one item, then the item is automatically selected in the work order module. For more information, see [Creating an Item](#).

The last operation in the work order must produce the item as defined in the work order.

After clicking the **Browse** button, the Select Item dialog box appears.



In the top pane, create a filter to limit the number of items returned, and then click **Apply Filters**. Click **Clear Filters** to reset the filters.

In the bottom pane, select an item and then click **OK** to set the item produced by the work order.

#### Starting Quantity

The starting quantity. Starting quantity is the number of units that are produced during the job.

#### Quantity Required

The required quantity of produced items for the job.

#### Can Schedule To

Click the **Browse** button to locate the entity or entity group on which this job can also be scheduled to run. The Entity Window dialog box appears.

Select the entity on which the job can also be scheduled, and then click **OK**.

To schedule a job on an entity, the entity's *Can schedule jobs* property must be selected. See [Capabilities](#).

#### Scheduled To

Click the **Browse** button to locate the entity or entity group on which this job is scheduled to run. The Entity

Window dialog box appears.

Select the entity on which to schedule the job, and then click **OK**.

To schedule a job on an entity, the entity's *Can schedule jobs* property must be selected. See [Capabilities](#).

#### State

The job state, which is New by default. You can change the status as Ready to make the job available on the plant floor.

#### File

You can add a file or web page to a job to support an operator during production. For example, the file or web page can contain information relative to performing the job. When a user is recording the execution of the job from an application such as MES Operator, the file or web page will be available to them for viewing.

See [Adding a File or Web Page to a Job](#).

#### Batch Size

The size of the batch. Batch size defines the number of production units in a single batch for this job. For additional information about batch size, see [Understanding Batches and Lots for OEE and Estimated Times](#).

## Adding a File or Web Page to a Job

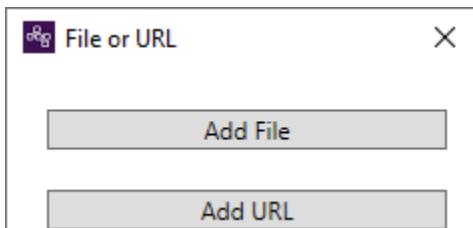
## Adding a File or Web Page to a Job

You can add a file or web page to a job to support an operator during production. For example, the file or web page can contain information relative to performing the job. When a user is recording the execution of the job from an application such as MES Operator, the file or web page will be available to them for viewing.

#### To add a file

1. Click the Browse button to the right of the **File** property box.

The File or URL dialog box appears.



2. Click **Add File**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the file to be added, and then click **Open**.

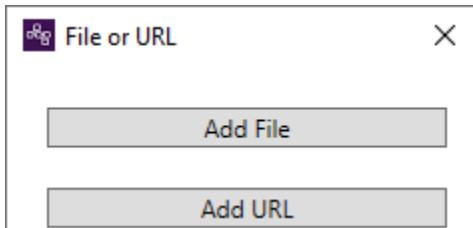
The file is entered in the **File** property box.



## To add a web page

1. Click the Browse button to the right of the **File** property box.

The File or URL dialog box appears.



2. Click **Add URL**.

A mini-web browser appears.



3. Enter or navigate to the web page, and then click **OK**.

The URL is entered in the **File** property box.



# Setup Properties

## Job Description

A brief description of the job.

## Display Sequence

The position of the operation, in which this job is shown. Display sequence is used to specify where the job will appear in the job route diagram.

## Notes

Additional information, if any, for the job.

## Folder Revision

The version of an existing folder that contains associated files assigned to this job.

For information about the Folders function and folder versions, see the topics about the Prod.Folder, Prod.FolderFile, and Prod.FolderItemOperEntLink class methods in the MES Stateless API Reference help.

## Rework

Specifies whether the job requires rework. For example, a job requires rework if the produced item is defective. You can also type a new dynamic routing rework code. For more information, see Dynamic Routing.

## Rework Code

The dynamic routing rework code for the job. This code indicates the process and operation that are used to do the rework, if required. For more information, see Dynamic Routing.

**Job Cost**

The estimated cost for completing this job.

**First Job**

Indicates whether this is the first job in the work order. The first job does not receive inputs from a previous operation. This is a read-only field.

**Final Job**

Indicates whether this is the last job in the work order. The final job does not send its production to another operation. This is a read-only field.

The work orders may have multiple first jobs and/or last jobs; however, at least one first job and one last job must be present for each work order. If there is only one job in the work order, that job is marked as both the first and the final job.

**Job spare1–4**

Type additional information for this job, if any.

## Schedule Properties

**Scheduled Start Date/Time**

The date and time when the job should be started.

**Latest Start Date/Time**

The latest date and time when the job should be started to meet the work order's required finish time.

**Scheduled Finish Date/Time**

The date and time when the job should be finished.

**Required Finish Date/Time**

The latest date and time when the job should be finished to meet the work order's required finish time.

**Schedule Pinned**

Specifies whether the start time of this job cannot be changed.

**Priority**

The priority for this job to determine the job execution order. Priority is used to rate jobs, for example, which job is most important. You can also use this information for scheduling jobs.

**Est. Setup Time**

The estimated number of hours for setting up an entity to run this job.

**Est. Production Rate**

The estimated production rate for this job.

The estimated production rate must be greater than 0. An entry of 0 will cause an error.

**Prod. Unit of Measure**

The unit of measure (UOM) that is used for the production process.

**Est. Variable Labor Rate**

The estimated number of variable labor hours required to produce a single batch of the item on the selected

entity.

**Labor Unit of Measure**

The UOM that is used for the labor involved with the production process.

**Est. Teardown Time**

The estimated number of hours required to teardown the selected entity after the production.

**Est. Transfer Time**

The estimated number of hours required to move the produced items from the selected entity to the next entity.

**Est. Fixed Labor Hours**

The estimated number of fixed labor hours required to produce a single batch of the item on the selected entity.

## Status Properties

**Status Notes**

The status of the job.

**Run On**

The entity ID on which this job is scheduled to run.

**Actual Start Date/Time**

The time when the job started. This is a read-only field.

**Actual Finish Date/Time**

The time when the job was complete. This is a read-only field.

**Quantity Produced**

The quantity of the item that is produced.

**Quantity Produced to ERP**

The produced quantity of the item that is uploaded to ERP.

**Quantity Rejected**

The quantity of the item that is rejected.

**Quantity Rejected to ERP**

The produced quantity of the item that is uploaded to ERP.

**Edited By**

The name of the user who last edited this job.

## Data Log Groups Properties

You can assign data log groups to a job to allow users to collect measurement data about production.

See [Assigning Data Log Groups to a Job](#).

## Creating a Job BOM

A job BOM represents a logical grouping of the bill of material components that are associated with a particular job. A job BOM consists of produced items, consumed items, and by-products.

When you create a job from scratch, an entry is made for BOM position 0 for the produced item. Additional BOM information is not included even if there is a BOM defined for the item being produced. You can add BOM components and by products to the job BOM. There is no check required for the produced BOM items.

### To create a job BOM

1. In the workspace, select the job for which you want to create a job BOM, and then click **Job BOM** tab.
2. On the ribbon, click the **Current View** tab.
3. In the **Job BOM** group, click **New Job BOM**.

A new job BOM record is shown in the **Job BOM** tab.

4. In the new job BOM's **Properties** window, complete the **Job BOM** property settings. See [Job BOM Property Settings](#).
5. In the **Properties** window, open the **Substitutes** section and then click **+** to add an item substitute for the job BOM.

The Substitutes dialog box appears.

**Substitutes**

**Items**

Preference	Substitution Level
1	0
Required Grade	Default Prod Code
	Good Production
<b>Quantity</b>	To Storage Location
1	
Min Quantity	Max Quantity
0	0
<input type="checkbox"/> Required start value is %	Required Start Value
<input type="checkbox"/> Backflush Consumption	<input type="checkbox"/> Update Inventory
<input type="checkbox"/> Must Consume Before Production Allowed	<input type="checkbox"/> Must Consume from Inventory
<input type="checkbox"/> May create new lots	<input type="checkbox"/> Must Consume from WIP
<input type="checkbox"/> May choose alternate inventory location	<input type="checkbox"/> Constant Quantity
Default lot number	Instruction
Units	Scaling Factor
Job_BOM_Subst spare 1	Job_BOM_Subst spare 2
Job_BOM_Subst spare 3	Job_BOM_Subst spare 4

**OK** **Cancel**

- On the Substitutes dialog box, complete the settings. See [Substitutes Settings](#).

There can be multiple substitute materials to be consumed or produced for all configured job BOM items in place of the configured BOM items.

- Save the changes.

## Job BOM Property Settings

### BOM Position

The position number (used as an ID) of this BOM item for the BOM of the current job. A negative number indicates by product, a positive number indicates a consumable item and 0 indicates items produced by the job.

### Item Description

Click the **Browse** button and select the item that is consumed or produced in the current job.

**Required Grade**

The minimal grade that this item must have to be consumed or produced.

**Instruction**

Additional instructions about this item, if any.

**Quantity**

The quantity of this item to be consumed or produced in this BOM per unit of the produced item.

**Min Quantity**

The minimum consumption quantity of this item required per unit of the produced item.

**Max Quantity**

The maximum consumption quantity of this item required per unit of the produced item.

You can define the maximum and minimum quantity per parent item only for the consumed items.

**Required Start Value Is%**

Specifies whether the value in the **Required Start Value** box should be interpreted as a percentage rather than an absolute value.

**Required Start Value**

The quantity of this item that must be available before this job state is set to Ready.

**Default Reason**

The default reason for consuming/producing this item.

**Default Lot Number**

The default value for the lot number of the item.

**Default Storage Entity**

Click the **Browse** button and select the default storage entity for this product or by-product.

**Scaling Factor**

The multiplier for scaling the consumption and/or production quantity of the item.

**Backflush Consumption**

Specifies whether the consumption of the consumed item is recorded automatically whenever the production of the parent item is recorded. For example, to make a bottled water bottle, if backflush for the BOM is enabled, the consumption of the bottle, bottle cap, wrap label, and water is automatically posted.

**Update Inventory**

Specifies whether the inventory records must update when you report production of this item.

**Must Consume from Inventory**

Specifies whether the item must be consumed from the inventory.

**Must Consume From WIP**

Specifies whether to restrict consumption of the item to lots produced by this work order.

**May Choose Alternative Inventory Location**

Specifies whether you can select an alternative inventory location for this item.

**May Create New Lots**

Specifies whether you can create new lots.

**Must Consume Before Production Allowed**

Specifies whether the item must be consumed before production.

**Constant Quantity**

Specifies whether the amount consumed for this item is fixed and does not depend on the number of parent items produced.

**Job BOM Spare1–4**

User-defined information for this job BOM.

**Substitutes Settings****Item**

Click the **Browse** button and select the item that will be produced in the current job.

**Preference**

The preference for the job BOM substitute. A value of 1 indicates the most preferred.

**Substitution Level**

The substitution level for this job BOM. This is the security setting that limits the usage of this substitute item. You must have a BOM substitution level greater than or equal to the substitutes level to use the substitute.

**Required Grade**

The grade for the job BOM substitute.

**Default Prod Code**

The default production code for the job BOM. This indicates the default reason for producing this substitute item in the MES Operator application. An operator can select other production reasons for this substitute item.

**Quantity**

The quantity of this item to be consumed or produced in this BOM per unit of the produced item.

**To Storage Location**

Click the **Browse** button and select the storage location for produced items. This indicates the default storage entity to place produced quantities of this substitute item.

**Min Quantity**

The minimum consumption quantity of this item required per unit of the produced item. This is for consumed items only.

**Max Quantity**

The maximum consumption quantity of this item required per unit of the produced item.

**Required Start Value Is%**

Specifies whether the value in the **Required Start Value** box should be interpreted as a percentage rather than an absolute value.

**Required Start Value**

The required start value.

**Backflush Consumption**

Specifies whether the consumption of the WIP parent item must record automatically whenever production of this substitute parent item is recorded. For example, to make a bottled water bottle, if backflush for the BOM is enabled, the consumption of the bottle, bottle cap, wrap label, and water is automatically posted. If **Update Inventory** is selected, inventory records for this BOM item updates automatically.

**Update Inventory**

Specifies whether the inventory records must update when you report production of this substitute item.

**Must Consume Before Production Allowed**

Specifies whether the item must be consumed before production.

**Must Consume From Inventory**

Specifies whether the item must be consumed from the inventory.

**May Create New Lots**

Specifies whether you can create new lots. This indicates that an operator can create new lot numbers when reporting the production of this substitute item. This is for produced items only.

**Must Consume from WIP**

Specifies whether to restrict consumption of the item to lots produced by this work order.

**May Choose Alternative Inventory Location**

Specifies whether you can select an alternative inventory location for this item. This indicates that an operator can select an inventory location for this substitute item other than the one supplied by default.

**Constant Quantity**

Specifies whether consumption quantities of this substitute item are not dependent on the number of produced parent items.

**Default Lot number**

The default value for the lot number of the selected substitute item.

**Instruction**

Additional instructions about this item, if any.

**Units**

The units for the job BOM substitute.

**Scaling Factor**

The multiplier for scaling the consumption and/or production quantity of the item.

**Job\_BOM\_Subst spare 1–4**

User-defined information about this job substitute.

## Assigning Steps to a Job

You can assign steps to a job. Steps decompose an operation into discreet parts. You must create step groups before creating steps. Step groups can be repeatable or non-repeatable. Non-repeatable step groups contain steps that only need to be performed once in the operation such as, setup and teardown steps. Repeatable step groups contain steps that must be performed for every batch that is produced in a job. You must specify an order for the step groups by providing sequence number. The higher numbered step must start after the lower numbered step for a group is completed. If two groups have the same sequence number, the steps in both groups can be performed in any order. You can define multiple step groups and steps for a job.

### Creating a Step Group

1. Select the job for which you want to create a step group.
2. Do one of the following:

- Right-click in the **Steps** tab and on the context menu click **New Step Group**.
- On the ribbon, go to the **Current View** tab and click **New Step Group**.

A new step group is added to the **Steps** tab.

3. In the new step group's **Properties** window, complete the following settings:

#### ID

The unique ID for the step group.

#### Description

A brief description for the step group.

#### Sequence

The sequence number for the step group. The sequence number determines the order in which step groups are executed. All steps in a lower number step group must be completed or bypassed before any step in a higher number step group starts. You can assign the same sequence number to step groups that can be performed simultaneously.

#### Repeatability

Specifies whether steps contained in this step group are repeated for each lot produced by the job.

4. Save the changes.

You can modify the properties of an existing step group in its **Properties** window.

## Creating a Job Step

1. In the **Steps** tab, select the step group to which the step will be assigned.
  2. Do one of the following:
    - Right-click the step group and on the context menu click **New Step**.
    - On the ribbon, go to the **Current View** tab and click **New Step**.
- A new step is added to the step group.
3. In the new step's **Properties** window, complete the property settings. See [Job Step Properties](#).
  4. Save the changes.

You can modify the properties of an existing step in its **Properties** window.

# Job Step Properties

## General Properties

### Number

The unique number for the step.

### Name

The unique name for the step. This is an optional field.

### Sequence

The sequence number for the step. The sequence number indicates the position of the step in the current

operation in the process tree. Sequence number specifies the order in which this step is to be performed.

#### SPC Char

The Statistical Process Control (SPC) characteristic that needs to be measured at this step.

#### Form Name

Click the **Browse** button to locate the name of the form linked to this step, if any.

#### Description

A brief description or instructions for production.

#### Action Type

The action that this step needs to perform. The following options are available in the list:

- **Normal:** No specific action is performed.
- **Log Data:** Selects the **Data Log** tab to facilitate data collection.
- **Add Production:** Allows you to add production details for this step to facilitate the reporting of production quantities.
- **Add Consumption:** Allows you to add consumption details for the first component assigned to this step.
- **Operator Acknowledge:** Displays the step description and requires the operator to acknowledge this prompt before continuing work.
- **Enter Form Data:** Allows you to fill in details in a specific form.
- **Enter SPC Data:** Allows an operator to add SPC data when the operator logs onto this step.

#### Complete When

The circumstances in which the current step is automatically marked as complete. The following options are available in the list:

- **Standard Time Elapsed:** When the time specified in the **Standard Time (In hours)** box has elapsed. This option is enabled only if you provide the elapse time in the **Standard Time (In hours)** box.
- **Operator Accepts:** When the operator marks the step as accepted/complete. This option is available when **Operator Acknowledge** is selected as action type in the **Action Type** list.

#### Standard Time (In hours)

The standard completion time in hours for this step.

#### Step Occurrence

The number of lots/sublots for which this step must be performed. 0 (the default) means it should be performed for all lots/sublots. This property applies only if the maximum lot or subplot size is 1 and the step group is repeatable.

#### Step Grp ID

The step group ID to which this step belongs.

#### Allow Bypass

Specifies whether you can skip this step.

#### Enter Data

Specifies whether you need to enter text into the **Data** box before changing the state of the step as Accepted/Complete.

## Advanced Options

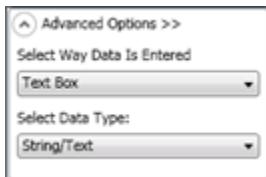
### Select Way Data Is Entered

The method to use to enter the required data: text box, radio buttons, check box, or combo box.

This setting is enabled if the **Enter Data** check box is selected.

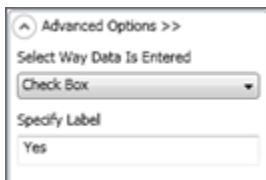
Depending on which element is selected, another property setting appears for specifying the data entry choices.

- If **Text Box** is selected, the **Select Data Type** list appears. It has the following options: **String/Text**, **Analog**, and **DateTime**.



If you select **Analog**, you also need to define the high and low limits to specify whether an alert should be issued when the value is outside these limits.

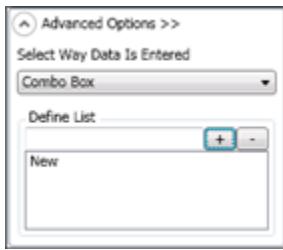
- If **Check Box** is selected, the **Specify Label** box appears. Type the label for the check box option.



- If **Radio Buttons** is selected, the **Define Buttons** section appears. Type a name for a radio button option and then click the **+** button to add that option. Multiple radio button options can be included. To remove an option, select it and then click the **-** button.



- If **Combo Box** is selected, the **Define List** section appears. Type the name of an entry to add to the combo box list and then click the **+** button to add that entry to the list. Multiple list entries can be included. To remove an entry, select it and then click the **-** button.



## Spare Fields

### Step Spare1 to Step Spare6

User-defined information for this step.

## BOM

The amount of consumption for the BOM to apply for this step.

See [Configuring the BOM Consumption Amount for the Job Step](#).

## Files

You can add files and web pages to a job step to support an operator during production. For example, the file or web page can contain information relative to performing the job step. When a user is recording the execution of the job step from an application such as MES Operator, the file or web page will be available to them for viewing.

See [Adding Files and Web Pages to a Job Step](#).

## Data Log Groups

You can assign data log groups to a job step to allow users to collect measurement data about production.

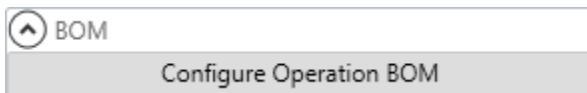
See [Assigning Data Log Groups to a Job Step](#).

# Configuring the BOM Consumption Amount for the Job Step

If consumption for the BOM is going to occur over multiple job steps, you can specify the amount of BOM consumption to apply to each job step.

### To specify the amount of BOM consumption for a job step

1. In the **Steps** tab, select the step.
2. In the **BOM** section of the step's **Properties** window, click **Configure Operation BOM**.



The BOM dialog box appears.

BOM					
Status	BOM Positio	Component Item	Quantity	Qty at Step	Remaining
	1	PNT-BLK (Peanuts in Bulk)	0.474	0.000	0.474
	2	CSW-BLK (Cashews in Bulk)	0.237	0.000	0.237
	3	AMD-BLK (Almonds in Bulk)	0.263	0.000	0.263

**Save**    **Cancel**

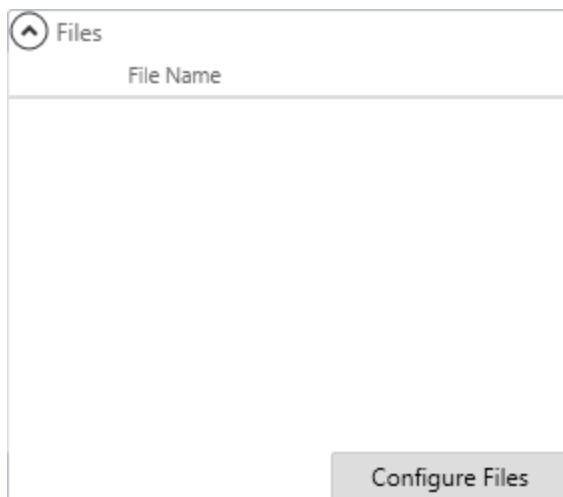
3. In the **Qty at Step** column, enter the amount of consumption for each BOM position that occurs for this step.
4. Click **Save**.
5. Close the dialog box.

## Adding Files and Web Pages to a Job Step

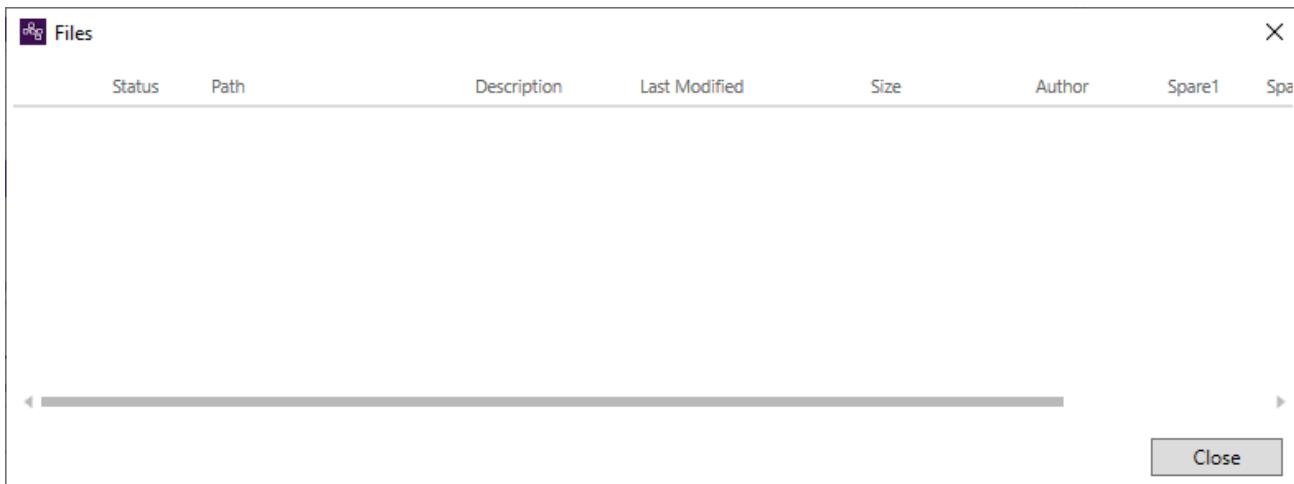
You can add files and web pages to a job step to support an operator during production. For example, the file or web page can contain information relative to performing the job step. When a user is recording the execution of the job step from an application such as MES Operator, the file or web page will be available to them for viewing.

### To add files to the job step

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



2. Right-click in the dialog box, and then click **Add files**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the files to be added, and then click **Open**.

The selected files are listed in the Files dialog box.

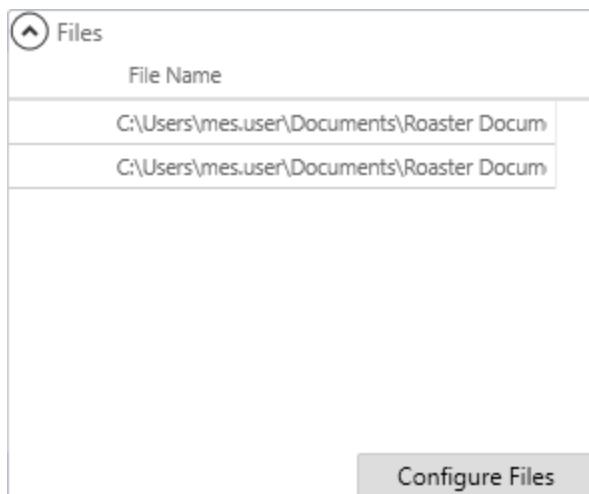
Status	Path	Description	Last Modified	Size	Author	Spare1	Spare2
...	C:\Users\mes.user\Documents		06/30/2022 12:13:07 PM	834,396	▼		
...	C:\Users\mes.user\Documents		06/30/2022 12:13:39 PM	834,421	▼		

5. Optionally, add a description for each file in the **Description** column.

6. Add other files (or web pages) as needed.

7. When you are finished adding files, click **Close**.

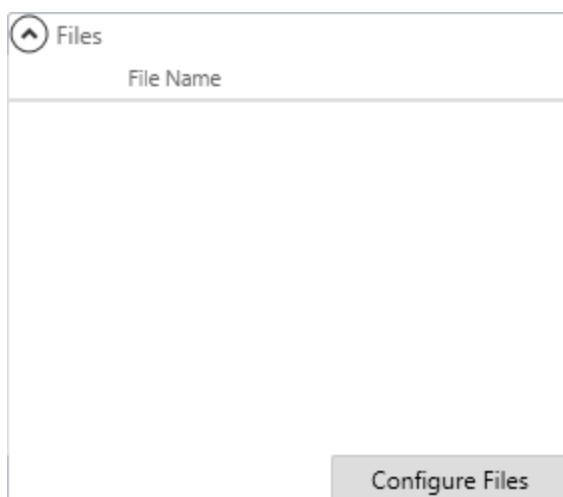
The files are listed in the **Files** property group.



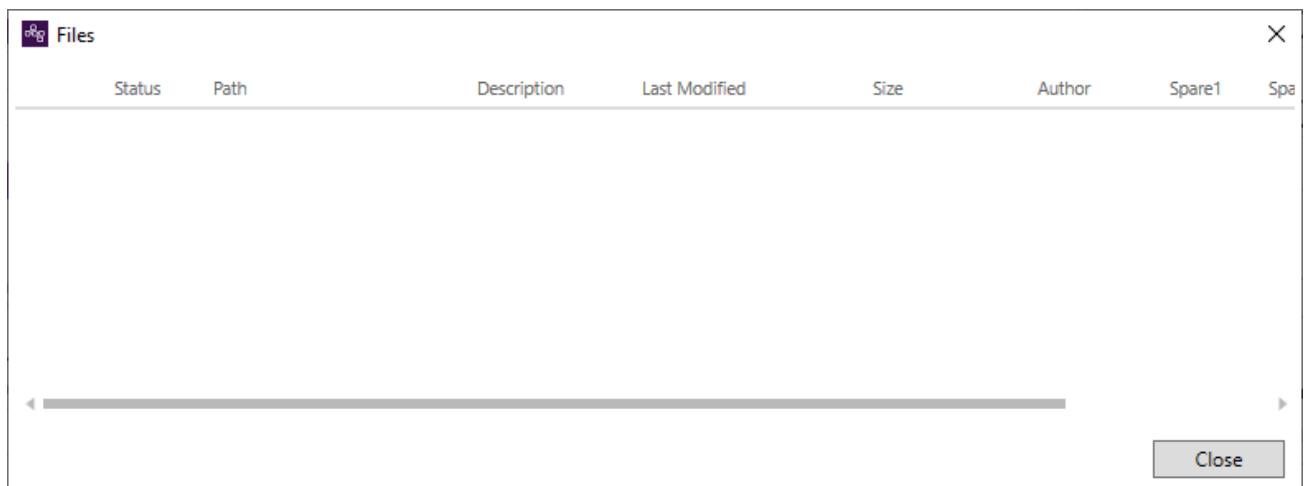
8. Save the changes.

### To add a web page to the job step

1. In the **Files** property group, click the **Configure Files** button.



The Files dialog box appears.



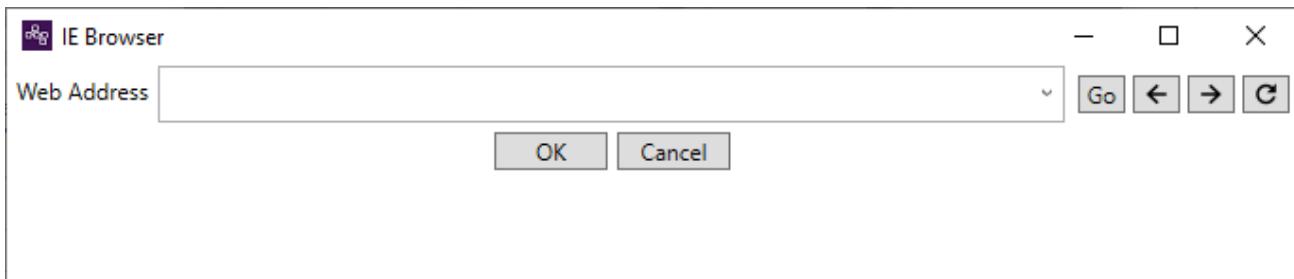
2. Right-click in the dialog box, and then click **Add URL**.

The Add URL dialog box appears.



3. Enter the URL and a description of the web page.

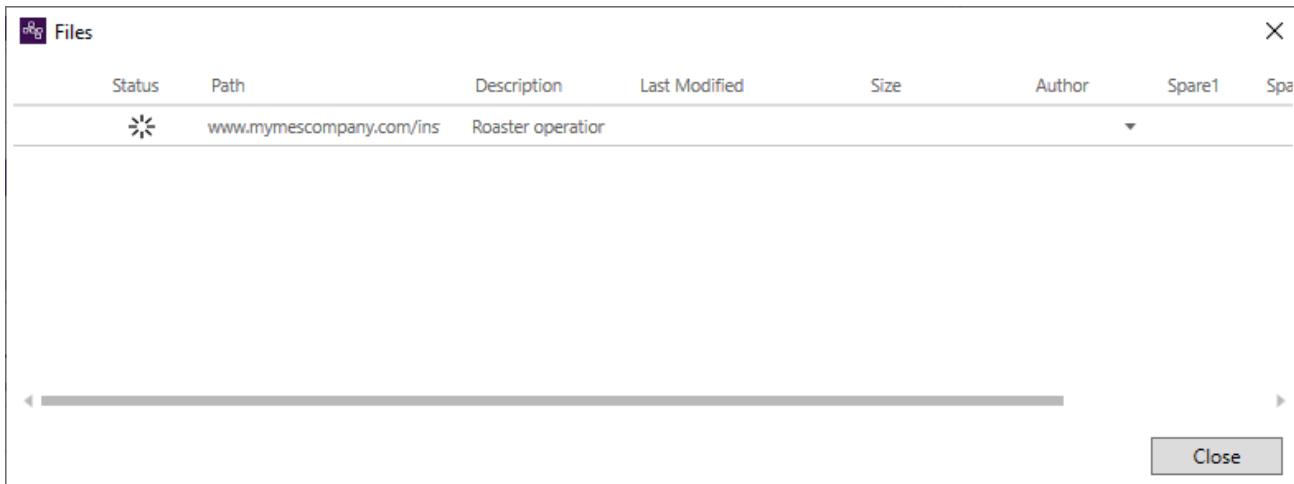
Instead of manually entering the URL, you can click the Browse button at the right of the URL box and use the mini-browser window that appears to navigate to the web page.



Click **OK** and that web page's URL is entered on the Add URL dialog box.

4. When you have finished entering the URL and description, click **Close**.

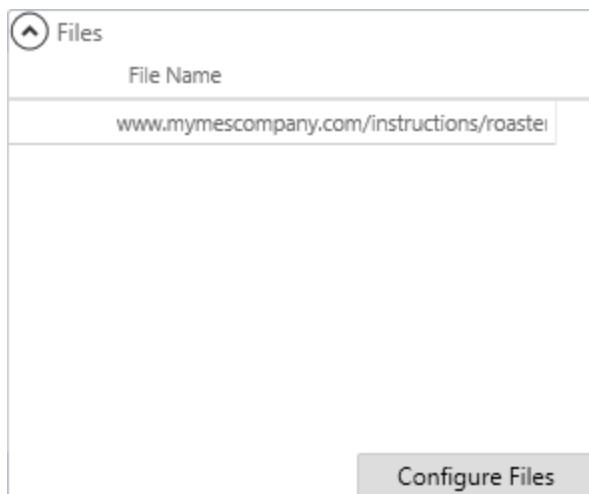
The URL is listed in the Files dialog box.



5. Add other web pages (or files) as needed.

6. When you are finished adding web pages, click **Close**.

The web page URLs are listed in the **Files** property group.



7. Save the changes.

#### To remove a file or URL

1. In the **Files** property group, click **Configure Files**.  
The Files dialog box appears.
2. Right-click the file or URL, and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.

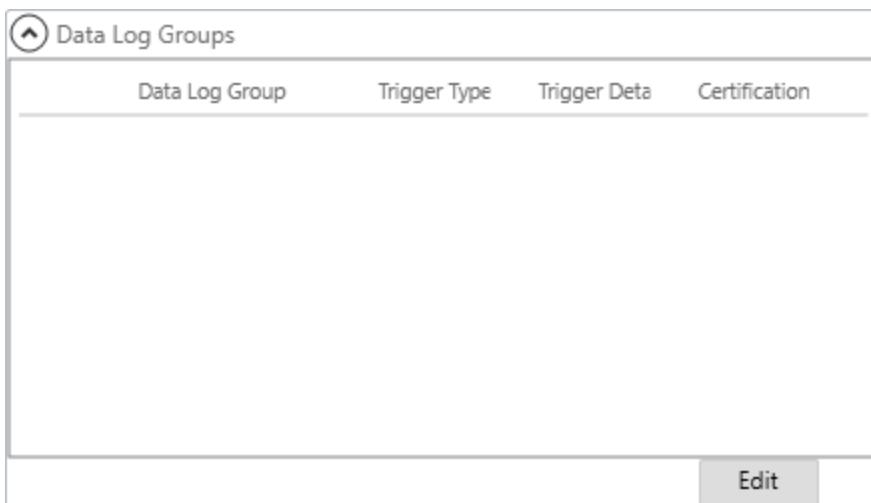
## Assigning Data Log Groups to a Job Step

You can assign one or more data log groups to a job step to allow users to collect measurement data about production. For information about adding and managing data log groups, see [Data Logger](#).

When assigning a data log group to a job step, you can configure the group to acquire periodic data. You can also assign an audit certification to a data log group to require one or more qualified users to sign off on the data being logged.

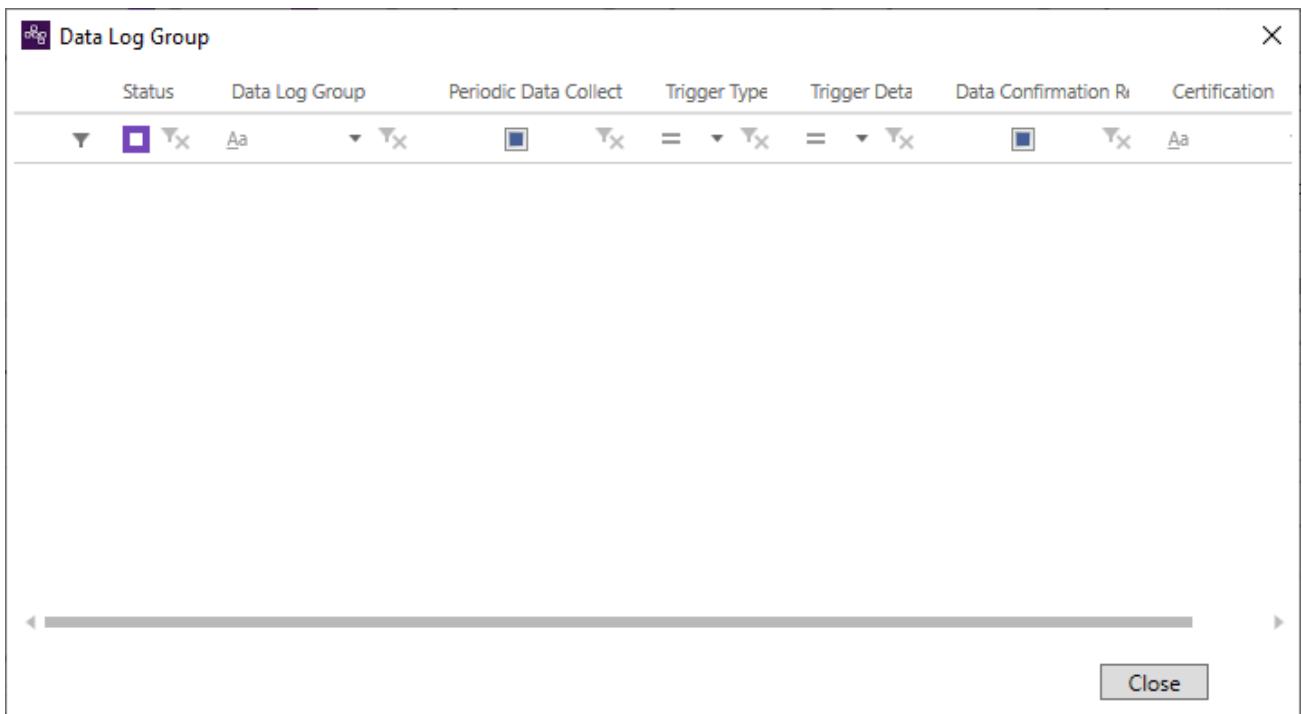
#### To assign data log groups to a job step

1. In the **Steps** tab, select the step.
2. Open the **Data Log Groups** section in the step's **Properties** window.



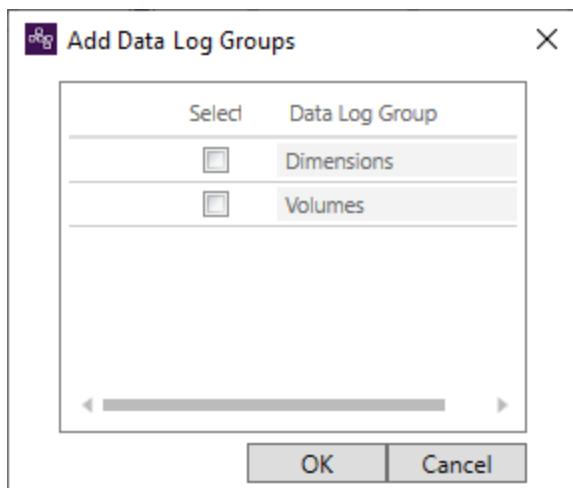
3. Click the **Edit** button.

The **Data Log Group** dialog box appears.



4. Right-click in the **Data Log Group** dialog box, and then click **Add**.

The **Add Data Log Groups** dialog box appears. Available data log groups are listed. Groups that have been previously assigned to the job step are already selected.



5. Select the groups that you want to assign to the job step and click **OK**.

The selected groups are listed on the **Data Log Group** dialog box.

Data Log Group							
Status	Data Log Group	Periodic Data Collect	Trigger Type	Trigger Deta	Data Confirmation R	Certification	
<input checked="" type="checkbox"/>	Dimensions	<input type="checkbox"/>					
<input checked="" type="checkbox"/>	Volumes	<input type="checkbox"/>					

6. For each group, complete the property settings.

#### Periodic Data Collection

Specifies whether periodic updates of data are enabled. If selected, data is collected periodically at the trigger period that is defined.

#### Trigger Type

Available only if the **Periodic Data Collection** check box is selected.

The trigger type for periodic data collection. Select whether the collection period is in minutes or hours (hourly).

#### Trigger Detail

Available only if the **Periodic Data Collection** check box is selected.

The number of minutes or hours to wait between each periodic data collection operation.

#### Data Confirmation Required

Specifies whether data collection requires a certification for sign-off.

#### Certification

Available only if the **Data Confirmation Required** option is selected. Select the audit certification for the data log group.

If an audit certification is selected here, then one or more qualified users will be required to sign off to complete the data logging.

7. Click **Close** to close the Data Log Group dialog box.

The selected groups are listed in the **Data Log Groups** property section.

Data Log Group	Trigger Type	Trigger Data	Certification
Dimensions			
Volumes			

**Edit**

8. Save the changes.

#### To edit data log group properties

1. Click the **Edit** button to open the **Data Log Group** dialog box.
2. Modify any of the group properties as needed, then click **Close**.
3. Save the changes.

#### To remove a data log group from the job step

1. Click the **Edit** button to open the Data Log Group dialog box.
2. Right-click the group and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Click **Close** to close the **Data Log Group** dialog box.
5. Save the changes.

### Assigning Specifications to a Job

Job specifications represent one or more specifications or setpoints that are referenced during a job.

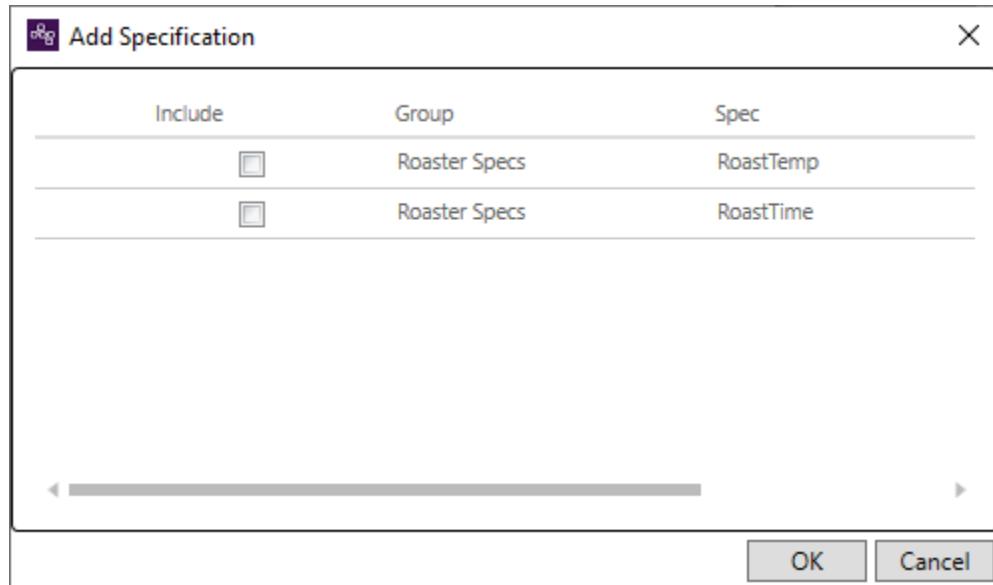
Specifications are organized within global specification groups. You can add a specification to the job or to a step within the job. You must create a global set of specifications in the **Global Specifications** module before adding a specification. For more information on specifications, see [Global Specifications](#).

To edit a specification you must have Specification access level user privilege greater than or equal to a specification.

### To add specifications to a job

1. Select the job.
2. In the **Specs** tab, do one of the following.
  - Right-click in the tab and on the context menu click **New Specification**.
  - On the ribbon, go to the **Current View** tab and **New Specification**.

The Add Specification dialog box appears.



3. Select the specifications that you want to add to the job and click **OK**.

The specifications are added to the Specs tab.

4. For each specification, in its **Properties** window complete the following settings:

#### Step No

The step number to allow a spec to optionally link to a step.

Select **No Step** if the specification applies to the complete job.

#### Group

The specification group.

#### Specification

The specification ID.

#### Data Type

The data type for this specification.

#### Specification Value

The value for the specification.

#### Min Value

The minimum value for the specification.

**Max Value**

The maximum value for the specification.

**Units**

The unit of measure for the specification value.

**Actual**

The actual value of the specification as collected while the job is running.

**File**

You can add a file or web page to a job specification to support an operator during production. For example, the file or web page can contain information relative to how to set the setpoint value (represented by the specification) for the entity.

See [Adding a File or Web Page to a Job Specification](#).

**Comments**

Comments about this specification.

**Access Level**

The security access level for modifying the specification.

To edit a specification you must have Specification access level user privilege greater than or equal to a specification.

**Spec Spare 1–4**

User-defined information for this specification.

5. Save the changes.

### **Adding a File or Web Page to a Job Specification**

You can add a file or web page to a job specification to support an operator during production. For example, the file or web page can contain information relative to how to set the setpoint value (represented by the specification) for the entity.

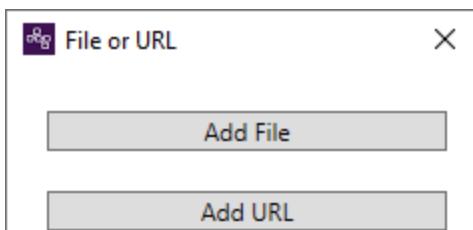
To allow users to open a file or web page that has been added to a specification, you can use the following MES Stateful API **Documents** class methods in a custom application:

- **EditFile()**
- **PrintFile()**
- **ViewFile()**

#### **To add a file**

1. Click the Browse button to the right of the **File** property box.

The File or URL dialog box appears.



2. Click **Add File**.

The Open dialog box appears.

3. In the file type list, select **All files**.

4. Navigate to and select the file to be added, and then click **Open**.

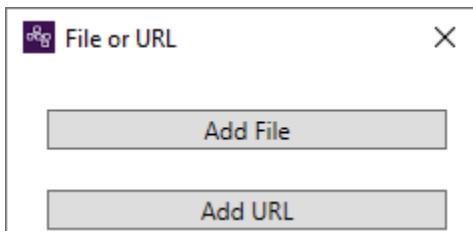
The file is entered in the **File** property box.



### To add a web page

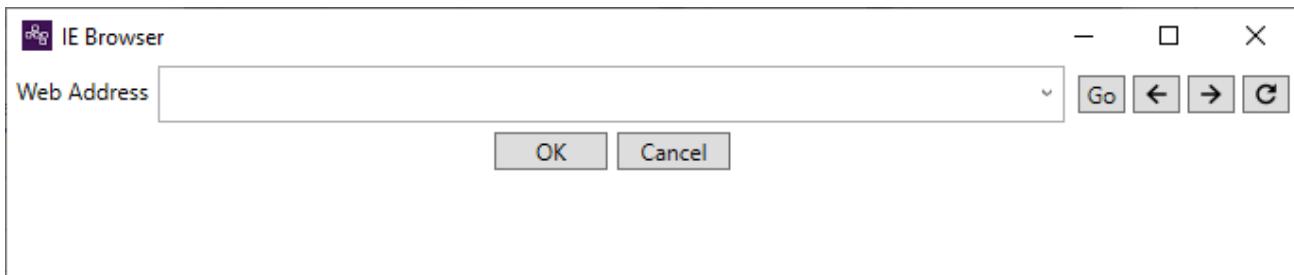
1. Click the Browse button to the right of the **File** property box.

The File or URL dialog box appears.



2. Click **Add URL**.

A mini-web browser appears.



3. Enter or navigate to the web page, and then click **OK**.

The URL is entered in the **File** property box.



### Assigning Attributes to a Job

An attribute is an additional user-defined property. Attributes are not used directly in the manufacturing process. They provide extra information about the job to the run time operator or to record more information from the

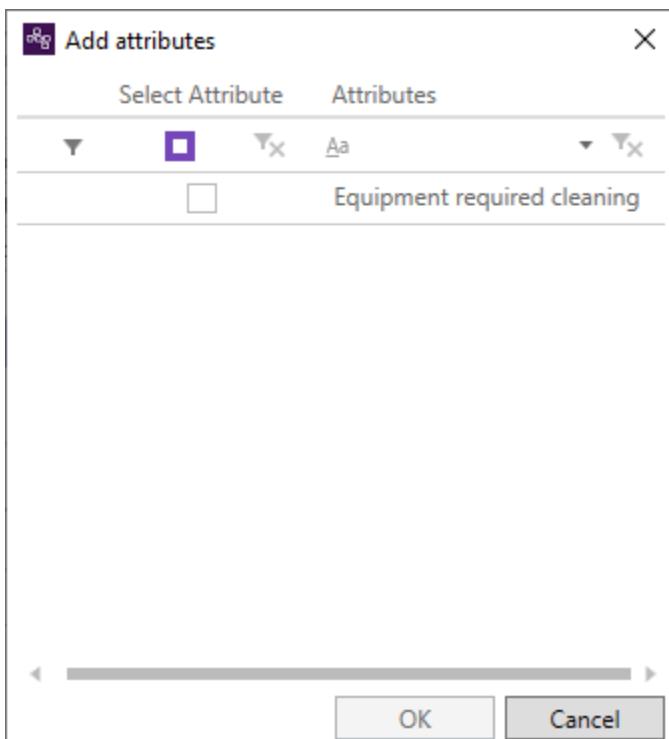
operator during execution of a job. You must create an attribute for a job in the **Attributes** module before assigning an attribute to a job. For more information on attributes, see [Attributes](#).

Attributes assigned to a job changes to attributes on the jobs created from an operation if there is a corresponding job attribute.

### To assign attributes to a job

1. Select the job to which you want to assign attributes.
2. Go to the **Attributes** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add**.
  - On the ribbon, go to the **Current View** tab and click **Add Attributes**.

The **Add attributes** dialog box appears.



4. Select the attributes to assign to the item and click **OK**.

The selected attributes are added to the **Attributes** tab.

5. For each attribute, enter a value or a note as required.

Steps	Job BOM	Specs	Attributes
Status	Attribute	Value	Notes
*	Equipment required cleaning	Yes	

6. Save the changes.

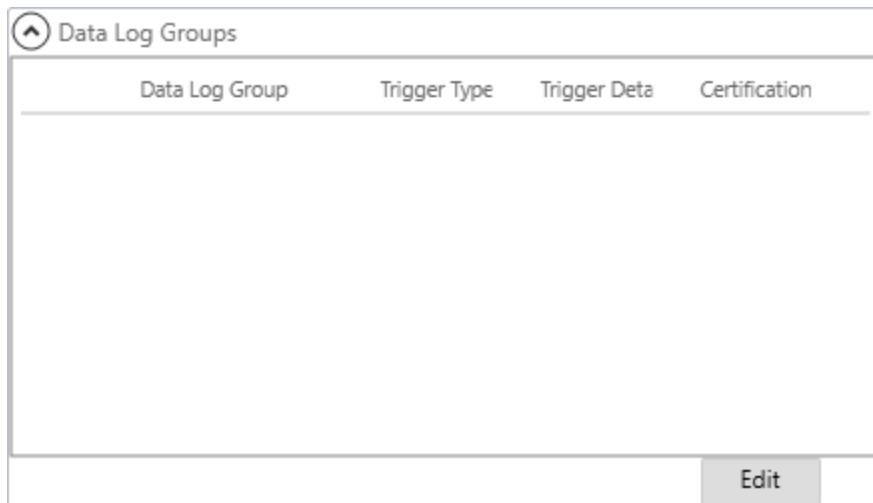
## Assigning Data Log Groups to a Job

You can assign one or more data log groups to a job to allow users to collect measurement data about production. For information about adding and managing data log groups, see [Data Logger](#).

When assigning a data log group to a job, you can configure the group to acquire periodic data. You can also assign an audit certification to a data log group to require one or more qualified users to sign off on the data being logged.

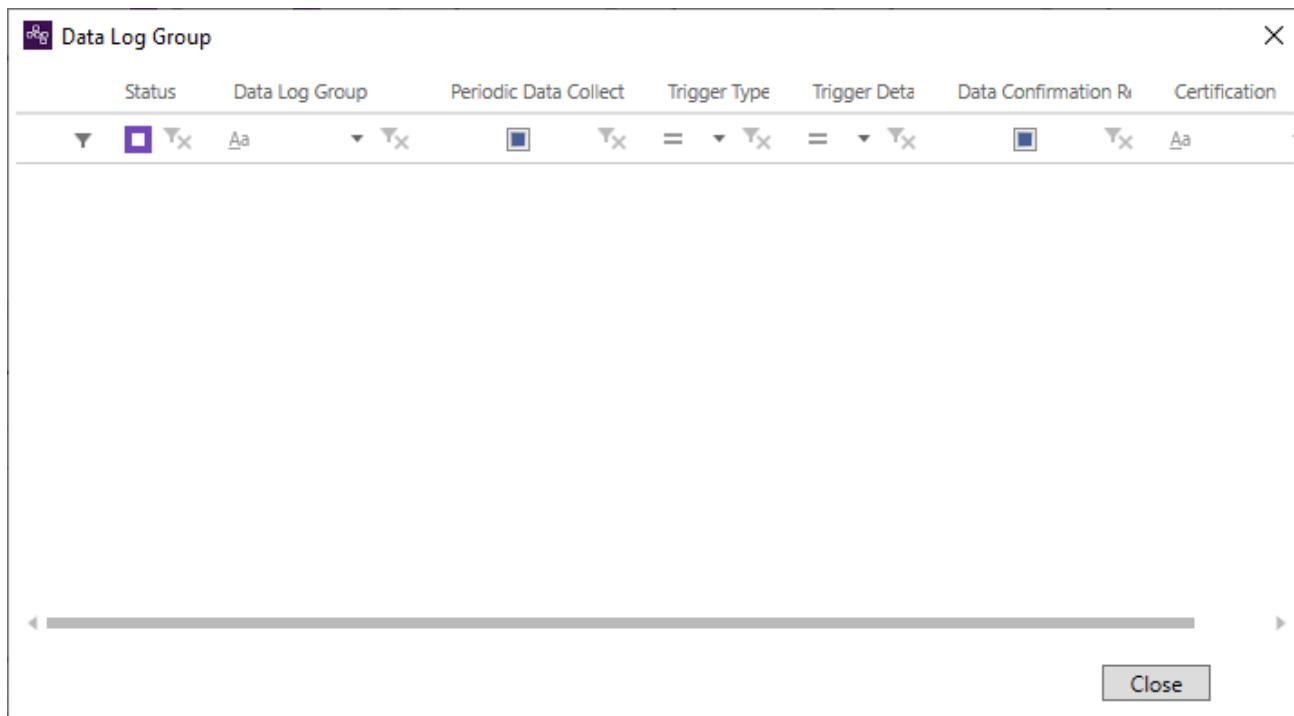
### To assign data log groups to a job

1. Select the job.
2. Open the **Data Log Groups** section in the **Properties** window.



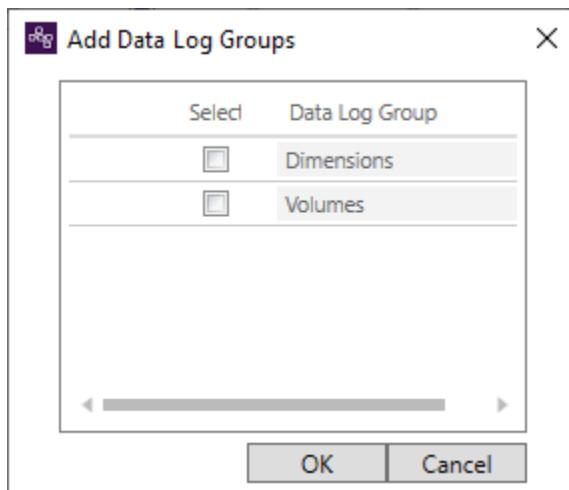
3. Click the **Edit** button.

The **Data Log Group** dialog box appears.



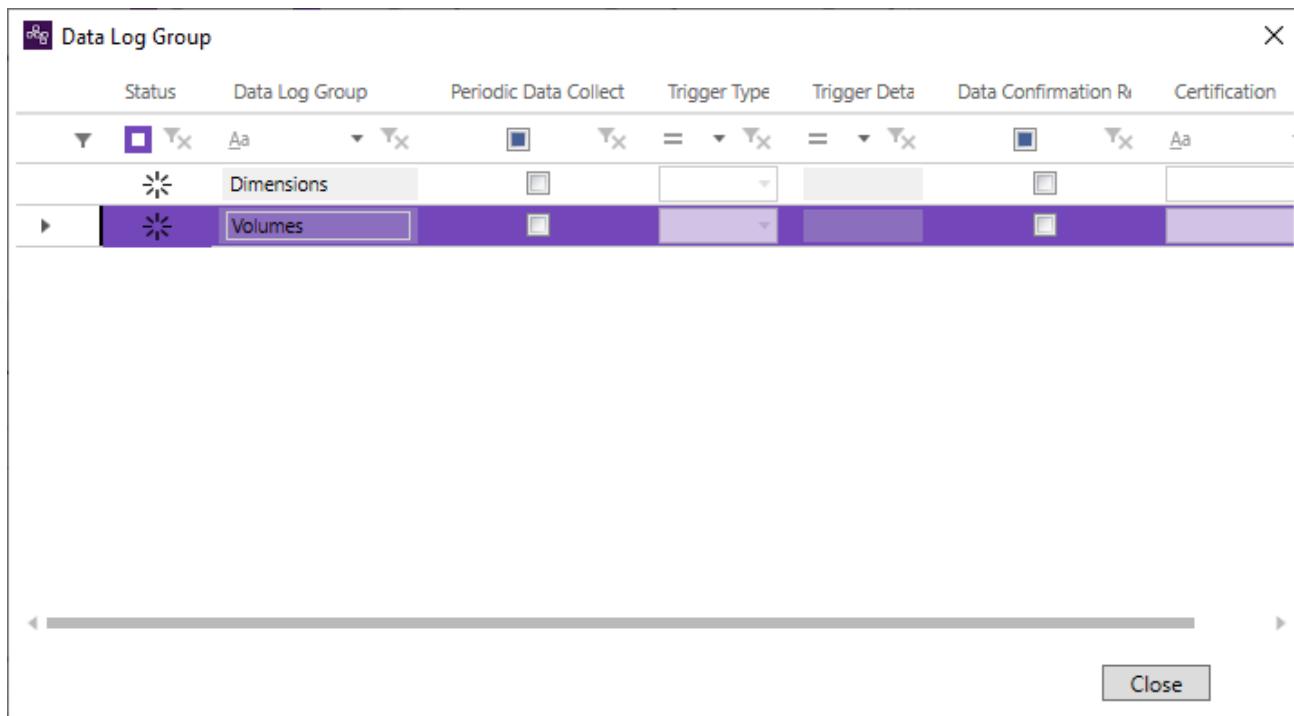
4. Right-click in the **Data Log Group** dialog box, and then click **Add**.

The **Add Data Log Groups** dialog box appears. Available data log groups are listed. Groups that have been previously assigned to the job are already selected.



5. Select the groups to be assigned to the job and click **OK**.

The selected groups are listed on the **Data Log Group** dialog box.



6. For each group, complete the property settings.

#### Periodic Data Collection

Specifies whether periodic updates of data are enabled. If selected, data is collected periodically at the trigger period that is defined.

#### Trigger Type

Available only if the **Periodic Data Collection** check box is selected.

The trigger type for periodic data collection. Select whether the collection period is in minutes or hours (hourly).

#### Trigger Detail

Available only if the **Periodic Data Collection** check box is selected.

The number of minutes or hours to wait between each periodic data collection operation.

#### Data Confirmation Required

Specifies whether data collection requires a certification for sign-off.

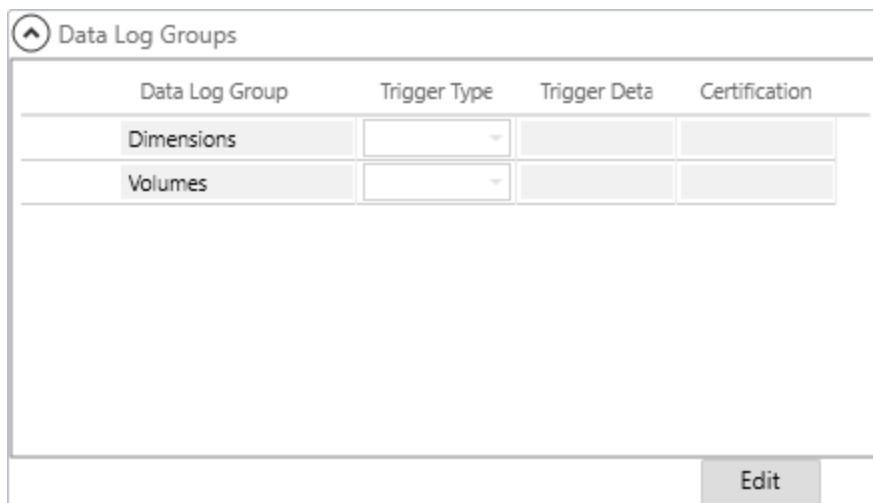
#### Certification

Available only if the **Data Confirmation Required** option is selected. Select the audit certification for the data log group.

If an audit certification is selected here, then one or more qualified users will be required to sign off to complete the data logging.

7. Click **Close** to close the Data Log Group dialog box.

The selected groups are listed in the **Data Log Groups** property section.



8. Save the changes.

#### To edit data log group properties

1. Click the **Edit** button to open the **Data Log Group** dialog box.
2. Modify any of the group properties as needed, then click **Close**.
3. Save the changes.

#### To remove a data log group from the job

1. Click the **Edit** button to open the Data Log Group dialog box.
2. Right-click the group and click **Delete**.  
You are prompted to confirm the deletion.
3. Click **Yes**.
4. Click **Close** to close the **Data Log Group** dialog box.
5. Save the changes.

### Splitting Jobs

You can split a job associated with an operation. When you split a job, a new job is created for the operation and you can specify the quantities to be produced by the new job.

The specified quantities are deducted from the existing job and allocated to the new job. Splitting is done to increase efficiency and utilization of entities that execute jobs.

#### To split a job

1. Right-click the job that you want to split and on the context menu click **Split Jobs**.  
The Split Job dialog box appears.

**Split Job**

New Sequence No	State
<input type="text" value="1"/>	READY
Split Quantity (of 1000)	
<input type="text"/>	
Start Qty	<input type="text"/>
Finish Time	
<input type="text" value="07/01/2022 03:00 AM"/>	
Target Entity	
<input type="text" value="Bagger"/>	
Notes	
<input type="text" value="Created by Job Split"/>	
<input type="button" value="OK"/> <input type="button" value="Cancel"/>	

2. Complete the following settings for the new job:

**New Sequence Number**

The sequence number for the new job.

**State**

The state of the new job. For more information on job states, see [Job and Step States](#).

**Split Quantity**

The production quantity you want to specify for the new job.

**Start Qty**

The starting quantity of the production for the new job.

**Finish Time**

The end time for the new job.

**Target Entity**

Click the **Browse** button to locate the entity on which the new job will run.

**Notes**

Additional information about the new job.

3. Click **OK**.

The new job is added to the grid.

4. Save the changes.

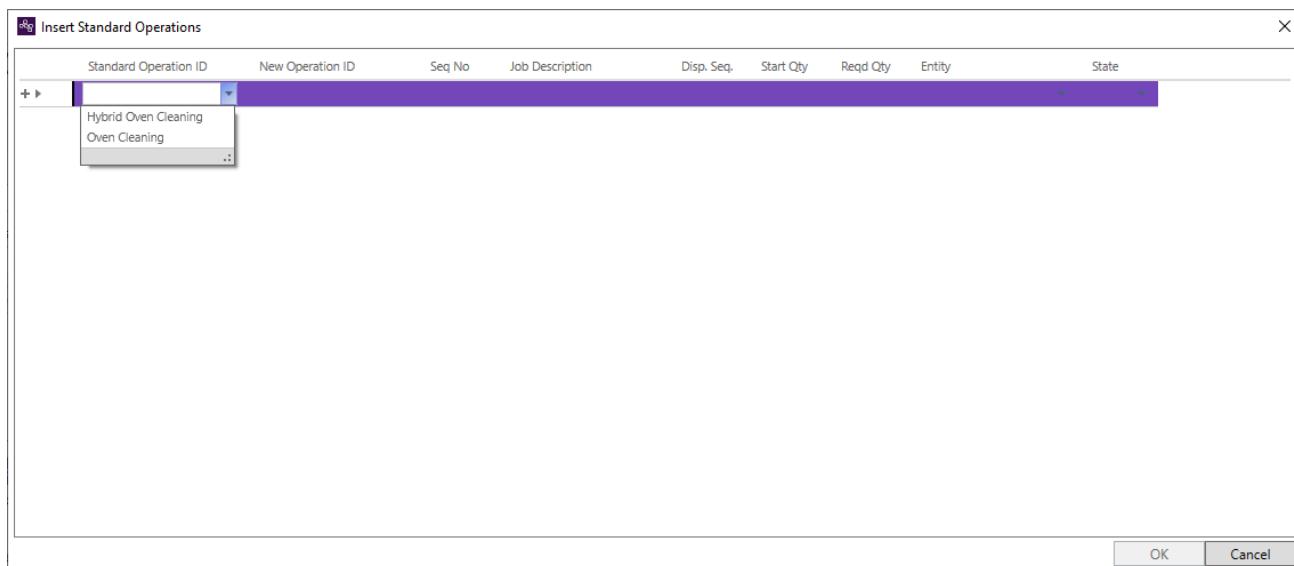
## Adding a Standard Operation to a Work Order

A standard operation is an operation definition that can be used as a template to create a job in a work order.

### To add standard operations

1. Make sure that the standard operation has already been created. For more information on creating a standard operation, see [Creating a Standard Operation](#).
2. Select the work order.
3. Do one of the following:
  - Right-click the work order or any of the jobs in the work order and on the context menu click **Insert Standard Operations**.
  - On the ribbon, go to the **Current View** tab and in the Split Job menu click **Insert Standard Operations**.

The Insert Standard Operations dialog box appears with a standard operation entry.



4. In the Insert Standard Operations dialog box, complete the following settings:

#### Standard Operation ID

The ID of the standard operation.

#### New Operation ID

The unique operation ID for the operation.

#### Seq No

The sequence number for the operation.

#### Job Description

The description or name of the job.

#### Disp Seq

The display sequence for the operation.

#### Start Qty

The quantity of material available to the first job for the final number of units to be produced.

#### Reqd Qty

The required quantity of produced items.

#### Entity

The entity associated with the job.

#### State

The state for the operation.

5. To add another standard operations to the work order, press **Enter**.  
A new standard operation entry is added to the dialog box.
6. Click **OK** once all standard operations have been added and configured.
7. Save the changes.

## Canceling All Jobs in a Work Order

You can change the job state of all jobs associated to the selected work order to Cancelled.

#### To cancel all jobs in a work order

1. Select the work order.
2. On the ribbon, go to the **Current View** tab.
3. In the **Jobs** group, on the **Split Job** menu click **Cancel All Jobs**.

The job state of all of the work order's jobs is changed to Canceled.

## Setting Job Priorities to the Work Order Priority

You can change the job priority of all jobs associated to the selected work order to match the work order priority.

#### To set job priorities to the work order priority

1. Select the work order.
2. On the ribbon, click **Current View** tab.
3. In the **Jobs** group, on the **Split Job** menu click **Set Job Priority to WO Priority**.

The priority setting of all of the work order's jobs is set to the work order's priority value.

## Creating a Route Map

You can view route map for a work order with multiple operations. You can also view the flow of material from jobs within an operation to jobs within other operations. You can drag and drop a job from one operation to the next and modify the percentages, if required.

You need to create a route map if a work order contains more than one operation. A Route map describes the flow of material through a work order. You can create a route by drawing lines from jobs in a source operation to the jobs in a destination operation. You must draw a line from every job in the source operation to every job in the destination operation.

Each routing line has a percentage associated with it that determines the amount of material that flows from one job to another. You can change the percentage of any line to any number between 0 and 100, but the total of all the lines leaving an job must add up to 100 percent. If you have a source operation with two jobs and a destination operation with two jobs, you would draw four route lines. If one of the destination jobs is faster, you

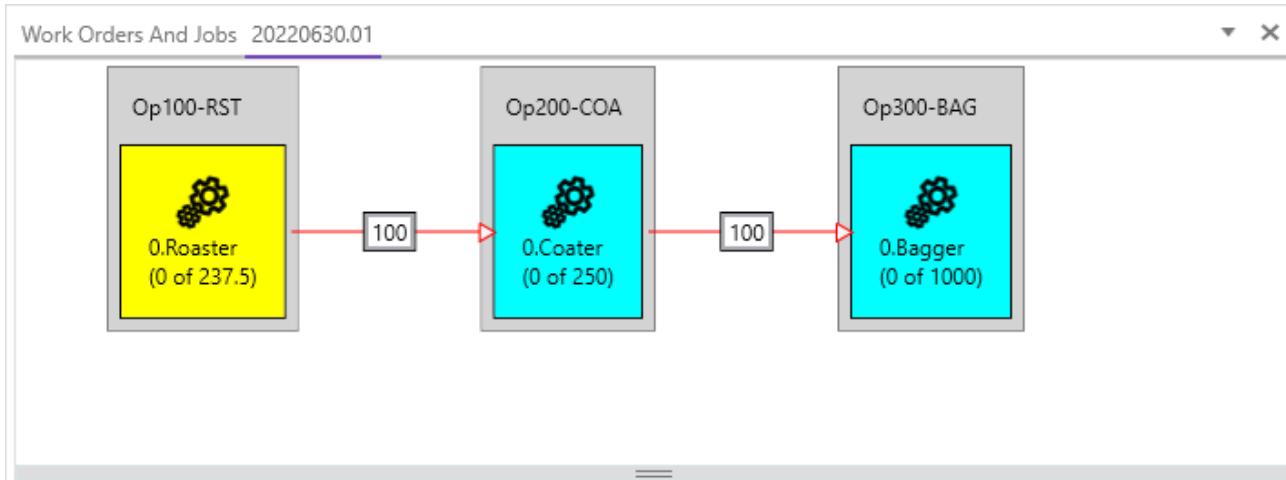
may need to adjust the percentages leaving your source jobs so that 60 percent of the material from each of the source jobs goes to the faster destination and 40 percent of the material from the source jobs goes to the slower job.

You can have multiple source operations linked to one destination operation. For example, if you have a work order to make filled cookies, you may have an operation to make the top of the cookie, an operation to make the filling, and an operation to make the bottom of the cookie. All these operations to make cookies run in parallel. These three operations can send their output to an operation that combines them to make a cookie.

You can also have one source operation linked with multiple destination operations. If you had a work order to build wagons, you may have an operation to produce wheels that feed another operation to produce the front wheel assembly and another operation that produces the rear wheel assembly.

### To create a route map

1. Select the work order to view its route map in the workspace.
2. On the ribbon, click the **Current View** tab.
3. In the **Diagrams** group, click **View Route Map**.



4. Create a route map between two jobs in two operations by selecting the job in the source operation and dragging to the job in the destination operation.

All jobs in the source operation must be linked to all jobs in the destination operation. If an operation sends output to more than one job in a destination operation, you can edit the percentage of material for each route line by:

- Clicking on the box in the route line and changing the number
- Clicking on the source job and changing the values in the grid.

The total value for all the route lines leaving a job should be 100 percent.

### Cloning Work Orders and Jobs

You can clone an existing work order or job to create a new work order or job.

A cloned work order contains the same configured information as that of the parent work order, such as operations, entities, steps, and specifications.

A cloned job contains all the specifications, job steps, job step groups, document attachments that are associated with the parent job. For more information on creating a work order and Job, see [Creating a Work Order](#) and [Creating a Job](#).

You must specify a different ID for a cloned work order or a job.

## Cloning a Work Order

### To clone a work order

1. Select the work order you want to clone.
2. On the ribbon, click the **Current View** tab.
3. In the **Jobs** group, click **Clone** in the **Split Job** list.  
The Clone Work Order dialog box appears.
4. In the Clone Work Order dialog box, complete the following settings:

#### Work Order ID

The unique ID for the new work order.

#### Description

A brief description for the work order.

#### Required Quantity

The required quantity. The maximum value that can be entered is 999,999.

#### Starting Quantity

The starting quantity is the amount of product that is intended to be made, if there were no rejects. The last operation in the work order starts with the starting quantity. If the starting quantity is left at its default of 0, and a required quantity is specified, the starting quantity will be changed to be equal to the required quantity. The maximum value that can be entered is 999,999.

#### Priority

The priority for the work order.

#### Release Date/Time

The date and time to release the work order.

#### Due Date Time

The due date and time for the work order.

#### Customer

The customer name.

#### Manufacturing Order

The manufacturing order that is associated with the work order.

#### Notes

Additional comments related to the work order.

5. Click **OK**.

## Cloning a Job

### To clone a job

1. Select the job that you want to clone.
2. On the ribbon, click the **Current View** tab.
3. In the **Jobs** group, click **Clone** in the **Split Job** list. The Clone Job dialog box appears.
4. In the Clone Job dialog box, complete the following settings:

#### New Work Order

The destination work order.

#### New Operation ID

The operation ID associated with the job.

#### New Sequence No

The sequence number to specify the position number of the job within the operation.

#### State

The current state of the job.

#### Required Quantity

The required quantity.

#### Starting Quantity

The starting quantity.

#### Finish Time

The date and time the job is scheduled to end.

#### Target Entity

Click the **Browse** button and select the entity to which to schedule the job.

#### Notes

Additional comments related to the job.

5. On the ribbon, click **Save** in the **Main** group to save the changes.

## Database Information

You can use the **Database Information** module to view the database information details of the MES database.

The **Database Information** module provides a summary of the target MES database that is retrieved from the Archive, Purge, and Restore (APR) server. The DB Maintenance Service points to the target database that is configured through its local Database Connection Editor utility.

The database information includes the following:

- Database server, instance, and catalog/user name
- Database version
- Record counts for each type of historical table available for archiving/purging
- Minimum/Maximum timestamps for each of the historical tables

By default, the **Database Information** module is in the **System Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

## To view the database information

- In the **Navigation Bar**, click **Database Information**.

The screenshot shows the AVEVA MES interface. The top navigation bar includes Home, Tools, View, and a ribbon with New, Save, Delete, Cut, Copy, Paste, Undo, and Clipboard. The left sidebar has a Navigation Bar with System Management, Master Data Config, Product Definition, Performance Management, Operations Management, Order Management, System Management (which is selected and highlighted in purple), and Quality Management. The main workspace is titled 'Database Information' and displays a table of historical database information. The table has columns for Historical Table Name, Record Count, Min Timestamp, and Max Timestamp. The data includes tables like audit\_trail, bottleneck\_history, cert\_audit\_log, data\_entry\_log, data\_log, dx\_log, db\_deleted\_log, error\_log, item\_cons, item\_transfer, labor\_usage, lot, and po. Below the table is an 'Error List' section with columns for Type, Instance, Description, and Extension.

Historical Table Name	Record Count	Min Timestamp	Max Timestamp
audit_trail	0		
bottleneck_history	2	6/6/2021 1:24:07 PM	6/6/2021 2:50:38 PM
cert_audit_log	0		
data_entry_log	0		
data_log	0		
dx_log	0		
db_deleted_log	15	6/30/2022 2:19:49 PM	6/30/2022 3:16:27 PM
error_log	5	6/5/2021 4:20:42 PM	6/8/2022 1:54:16 PM
item_cons	0		
item_transfer	0		
labor_usage	0		
lot	0		
po	0		

The **Database Information** workspace tab includes the following information:

### Database Version

The MES database version

### Historical Table Name

The name of the historical table.

### Record Count

The record count for the given historical table.

### Min Timestamp

The minimum timestamp for the historical table.

### Max Timestamp

The maximum timestamp for the historical table.

## Database Maintenance

You can use the **Database Maintenance** module to archive, purge, and restore the MES Database. This module allows you to create, run, delete, modify, and view the Archive, Purge, and Restore (APR) jobs.

By default, the **Database Maintenance** module is in the **System Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

The screenshot shows the AVEVA MES interface with the following components:

- Top Bar:** Home, Tools, View, Current View.
- Job Tools:** Run, Abort, View logs.
- Navigation Bar:** System Management (selected), Database Information, Database Maintenance, Rejected Messages.
- Main Workspace:** Database Maintenance grid. The grid has columns: Status, Name, Description, Type, Current Status, Last Execution. It contains four rows:

Status	Name	Description	Type	Current Status	Last Execution
Monthly	Monthly archive	Archive	Purge	None	
Purge	Annual Purge	Purge	Restore	None	
Restore	Restore DB	Restore	Weekly	Weekly archive	Archive
- Properties Panel:** Shows properties for the selected "Monthly" job, including Name (Monthly), Description (Monthly archive), Type (Archive), Status (checked), and Details (checked).
- Error List:** An empty table with columns: Type, Instance, Description, Extension.

## Managing the MES Database

The transactional tables within the MES database grow rapidly and continuously. To keep the size of the MES database within manageable limits, you should archive and/or purge the MES database at regular time intervals. You can archive all the data of large tables and the associated (dependency) tables and then restore them. In some selected cases, you might even purge the data from the MES database.

You can create and manage archive, purge, and restore jobs using the **Database Maintenance** module.

The **Database Maintenance** module allows you to:

- Create new jobs
- Run jobs
- View jobs
- Modify jobs
- Delete jobs
- Access job logs

## Viewing the List of APR Jobs

The grid in the the **Database Maintenance** workspace tab lists the archive, purge, and restore (APR) jobs. It

shows the list of the current set of configured and previously executed database maintenance jobs.

The grid includes the following columns:

#### Status

The status of the job. The green icon indicates that the job has been modified and the red icon indicates that the job definition has an error.

#### Name

The name of the job.

#### Description

A description for the job.

#### Type

Indicates whether the job is an archive, purge, or restore job.

#### Current Status

Indicates the current status of the job, whether the job is running. A blank value indicates that the job is not running.

#### Last Execution

The date and time when the job was last executed.

## Specifying the Archive Query Window, Root Directory Path, and Server Host

The **Archive** system parameters group in the **General Parameters** module allows you to set the following properties for archive, purge, and restore jobs.

Status	System Parameter	Value
Archive (3 items)	Archive query window size (hours)	6
	Archive root directory path	C:\Program Files\Wonderware\MES\Archives\
	Archive server host	

### Archive query window size (hours)

The time span (in hours) used to divide the amount of records being archived and purged at one time into smaller sets. This strategy helps to reduce the amount of data that is being retrieved and so lessen the impact of archiving and purging on database performance for production.

The queries that are used to retrieve the data records to archive or purge will ask only for data within the hourly window, based on the last\_edit\_at datetime in the data records. For example, if the window value is set to 6 hours, the first data retrieval will retrieve the first 6 hours of data records and archive or purge them. When that operation is complete, the next 6 hours of data records will be retrieved and processed, and so on until the final records are reached.

The default value is 6 and the minimum value is 1. If there are large amounts of data to be archived within the 6-hour window, you can lower the value so that smaller amounts of data are archived at a given time. This should help prevent performance issues such as timeouts.

### Archive root directory path

The root directory path (relative to the server) to which archived data is saved and from which archive data is restored.

The default path is **C:\Program Files\Wonderware\MES\Archives**.

Note the following:

- The archive root directory path must be the absolute path, including the drive letter.
- The path cannot be **c:**, **c:\**, or blank. If it is, it will revert to the default path.
- Make sure that any users who are performing archive and restore jobs have access to the archive directory.

### Archive server host

The name of the archive server host where the archive files are located.

If blank, the local host is assumed.

## Granting MES Middleware Access to the Archive Root Directory or Server Host

When the MES DB/MW Communication component is configured in the post-install Configurator after the initial MES installation, access to the archive root directory path is granted to the MES middleware's Windows user account. If the archive directory or server host is changed, configure the MES DB/MW Communication component again to grant the MES middleware's Windows user account access to the new directory location. For more information, see the *MES Installation Guide* or online help.

## Creating an Archive Job

You can create a new archive job to execute a defined archive operation. This job will retrieve selected records from the MES database and record them in an archive file. You can also configure the archive jobs to execute a purge operation on the archived records following the successful completion of the archive operation.

### To create an archive job

1. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and click **New**.

A new database job record is added.

2. In the new job's **Properties** window, complete the following settings:

#### Name

The unique name for the job.

#### Description

A description for the job.

#### Type

Select **Archive**.

#### Details icon

Click the **Details** icon to view and select the tables to archive from an available list.

The tables in the **Details** list are the top-level tables in the MES database and so they are independent of each other. Selecting any of these tables will not include any of the others listed here. Therefore, make sure that you select each independent table that you want to include in the archive operation. To see which dependent and related tables are included in the archive with each of these independent tables, see [Historical Database Tables](#).

You can select the Work Order State Filter status from the available options, such as Released, Started, Completed, and Closed. In case of the Sample table, you can only archive samples that have their status set to Missed, Complete, Complete Late, or Canceled or samples that have the final flag set to True.

#### Date Filter

Do any one of the following:

- Click **Relative** and specify the number of days to select the data for archiving the records. If the number of days defined is 30, it will archive the data older than 30 days from the current date.
- Click **Absolute** and then specify the **From** and **To** date to select the data for archiving the records.

#### Purge

Specifies whether to purge the archived data.

3. Save the changes.

You can modify the properties of an existing archive job in the **Properties** window.

## Creating a Purge Job

You can create a purge job to execute a purge operation. This job will remove records from an active, production MES database to free-up resources on the database server. The purge operation can be done independently or as a follow-up to an archive job.

### To create a purge job

1. Do one of the following:

- Press the **Ctrl+N** keys.
- Right-click in the tab and on the context menu click **New**.
- On the ribbon, go to the **Home** tab and click **New**.

A new database job record is added.

2. In the new job's **Properties** window, complete the following settings:

**Name**

The unique name for the job.

**Description**

A description for the job.

**Type**

Select **Purge**.

Select the categories of data to purge from a predefined list.

**Details icon**

Click the **Details** icon to view and select the tables to purge from an available list.

The tables in the **Details** list are the top-level tables in the MES database and so they are independent of each other. Selecting any of these tables will not include any of the others listed here. Therefore, make sure that you select each independent table that you want to include in the purge operation. To see which dependent and related tables are included in the purge with each of these independent tables, see [Historical Database Tables](#).

In case of the Sample table, you can only purge samples that have their status set to Missed, Complete, Complete Late, or Canceled or samples that have the final flag set to True.

**Date Filter**

Do any one of the following:

- Click **Relative** and then specify the number of days to select the data for purging the records. If the number of days defined is 30, it will purge the data older than 30 days from the current date.
- Click **Absolute** and then specify the **From** and **To** date to select the data for purging the records.

3. Save the changes.

You can modify the properties of an existing purge job in the **Properties** window.

## The Purge Process

The following steps occur during the purge process:

1. Determine the time range for each deletion cycle based on the requested time range broken into subsets, as defined by the system attribute *Archive query window size (hours)*. This is performed to avoid long-running transactions against the database.
2. Determine if the first main table has related tables. If no related tables are found, then steps 3 and 4 are skipped.
3. Copy the primary key from the main table into memory (that is, to a temporary table). For example, for the wo table, the primary key is wo\_id and the timestamp used is last\_edit\_at.
4. Delete the related table information for which the primary key matches the records in the temporary table. There is no check on the related table timestamp.
5. Delete the main table records. For example, when purging work order records, the records in the wo table would be deleted.
6. If no exception occurs, move on to the next main table (if more than one table was selected as part of the purge).

If an exception occurs, drop the temporary table, roll back deletions of any data in dependent tables (deletions of data in related tables cannot be rolled back), and move on to the next main table (if more than

one table was selected as part of the purge). If a purge is run again with the same parameters and the error has been corrected, the new purge operation will pick up what was missed on the previous purge during which the exception occurred.

## Creating a Restore Job

You can create a restore job to execute a restore operation. This job will insert records from an archive file into the MES restore database.

Before starting a restore job, the MES restore database must already exist. It is not created as part of the restore operation. To create an MES restore database, from the post-Install Configurator application:

- Create the restore database using the MES DB Setup component.
- Specify the restore database connection string using the MES DB/MW Communication component.

For more information about these MES components in the post-install Configurator application, see the *MES Installation Guide* or online help.

Before creating a restore job, make sure that an archive file is available from a previously executed archive job.

---

**Note:** You can only perform a Restore from an archive that was created with the version of MES that you are currently running. Restores using an archive from a previous version of MES are not supported and might fail.

---

### To create a restore job

1. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and click **New**.
2. In the new job's **Properties** window, complete the following settings:

#### Name

The unique name for the job.

#### Description

A description for the job.

#### Type

Select **Restore**.

#### Details icon

Click the **Details** icon and do the following:

- In the **Available Archives** list, select the archived dataset zip file from the **Database Maintenance** folder where the archived data will be restored from.
- Select the **Abort when inserting duplicate** check box if you want to abort the restore process when duplicate data is inserted in the restore database.

---

**Note:** Make sure that you do not restore to the original MES database as it will have serious performance implications.

---

#### Date Filter

Do any one of the following:

- Click **Relative** and then specify the number of days to select the data for restoring the records. If the number of days defined is 30, it will restore the data older than 30 days from the current date.
  - Click **Absolute** and then specify the **From** and **To** date to select the data for restoring the records.
3. Save the changes.

You can modify the properties of an existing restore job in the **Properties** window.

## Viewing the APR Job Configuration Details

You can view the configuration details of an existing APR job.

- Select the job.  
The configuration details of the job is shown in the **Properties** window.

## Viewing the APR Job Log

You can view the list of the available archived log files on the configured APR server using the **Database Maintenance Log** editor.

### To view the APR job log

1. Select the job.
2. Do one of the following:
  - Right-click the job and on the context menu click **View Logs**.
  - On the ribbon, go to the **Current View** tab and click **View Logs**.

The list of all available logs for the selected job appears in a new tab labeled with the job's name.

You can view the details of the selected job log using the **Log Viewer** editor. You can also select and copy the text from the log but cannot modify the content of the log.

## Running an APR Job Manually

You can manually run the archive and purge jobs on the MES database to archive and/or purge the data and run the restore jobs on the non-production database. You can manually select one of the APR jobs currently defined in the MES database for execution. When you select a job, all configuration information for that specific job is shown. You can review and modify the specifications for the job before executing it.

If you run an archive job or an archive purge job, the following is created on the DB Maintenance Service (at the configured root path):

- A directory is created with the job name, if it doesn't exists already
- Under the job directory, a time-stamped Zip file is created that contains a CSV file for each archived table. The Zip file also contains a manifest file. A log file with the same name is created alongside the Zip file.

If you run a purge job or a restore job, the following is created on the DB Maintenance Service (at the configured root path):

- A directory is created with the job name, if it doesn't already exist
- Under the job directory, a time-stamped log file is created

---

**Note:** If you run a restore job, the following warning is shown: *Restoring to an operational production database is not supported. Executing this type of restore will likely cause performance issues and possible transaction failures. Do you wish to proceed?*

---

### To run an APR job manually

1. Select the job.
2. Do one of the following:
  - Right-click the job and on the context menu click **Run**.
  - On the ribbon, go to the **Current View** tab and click **Run**.

The execution status of the job is changed to running until the job is complete or aborted.

You cannot execute an already running job.

### Running an Archive or Purge Job Automatically

You can schedule an archive or purge job using the Windows Task Scheduler on the APR server. This allows the archive or purge job to run automatically at a pre-determined time or on a regular basis, such as daily, monthly, and so on.

Restore jobs cannot be run automatically. They must be run manually.

You must configure the scheduled job on the same computer as the APR server using the Windows Task Scheduler.

The proxy must be configured to send requests to this service in order for the command line program to send its requests.

### To run an archive or purge job automatically

1. On the Database Maintenance Service computer, open the **Task Scheduler** for Windows from the **Control Panel**.
2. Double-click **Add Schedule Task**.

The **Schedule Task Wizard** appears.

3. Click **Next**, and then click the **APRSchedule.exe** to run from Windows.
4. Click **Next**, and then specify the option to run this task:

If you want to run this task at a particular date and time, only then select **One time only**.

If you want to run this task at a recurring date and time, click any one of the following:

- Daily
  - Weekly (and specify the day of week and time)
  - Monthly (and specify the date of month and time)
5. Click **Next**.
  6. In the **User Name** box, type your user name.
  7. In the **Password** box, type your password to configure the task.

8. Click **Next**
9. Select the **Open advanced properties for this task when I click Finish** check box.
10. Click **Finish**.  
The Advance Options dialog box appears.
11. Type the **Job ID** as a command line parameter.
12. Save and close all the windows.  
The job is scheduled to run.

You can manually remove any of the scheduled tasks that are not required.

## Removing an APR Job

You can remove an existing job using the **Database Maintenance** module. Before removing the job, make sure that the job is not running.

### To remove a job

1. Select the job.
2. Do one of the following:
  - Right-click the job and on the context menu click **Delete**.
  - On the ribbon, go to the **Home** tab and click **Delete**.

You are prompted to confirm the deletion.

If the selected job is an archive job, you can also remove the archived data sets.

## Historical Database Tables

The following table provides a list of independent historical database tables that you can select from the Database Maintenance **Properties** window for archive or purge.

- When archiving, other dependent tables (not listed here) will be archived with the selected independent tables.
- When purging, only the independent table will be purged, not its dependent tables, unless otherwise noted in the table below.

Internal Database Table Name	Description
audit_trail	Provides a generic audit trail of who inserted, edited, or deleted important data, and when. Used to facilitate 21 CFR Part 11 compliance.
cert_audit_log	Records certification auditing sign-offs. This table allows for sign-offs to the operation or step level.

Internal Database Table Name	Description
data_entry_log	Allows for the driving of and compliance to data collection schedules to be monitored. Database or other triggers insert rows into this table with default data when a trigger is detected. The values can then be updated and the entries_made field compared to the entries_reqd to detect non-compliance.
data_log	Stores logged data values.
db_deleted_log	Stores a record for any MES database table records that have been deleted. Each stored record includes the table name and, in XML format, the primary key for the record that was deleted.
dx_log	Supply Chain Connector log table. Captures all results and exceptions whenever any schedule is triggered to enable audit trails, error reporting, etc.
error_log	Populates system errors and events as they occur. The system can be configured to log or ignore errors of different severities which are defined as follows: 0 = Critical errors. Significant, might crash system. 1 = Serious errors. Affects operation and data. 2 = Partial errors. Some data will be wrong. 3 = Trivial errors. Small adverse effect on some data. 4 = Events. No affect on data or operation. Affects information only.
item_cons	Item consumption table. Collects component item usage and waste quantities for each BOM item by job, shift, lot, and so on. This table captures component and parent item lot numbers, which provide the genealogy breakdown by lot.
item_transfer	Stores inventory transfers, except for production and consumption transactions. This table is also used to store received raw material and finished good shipments, if required.
labor_usage	Logs the labor time for each labor category and employee ID for each of the standard domains.

Internal Database Table Name	Description
lot	<p>Allows lots and their characteristics to be defined.</p> <p>Purging this table will also purge the following dependent tables:</p> <ul style="list-style-type: none"><li>• assigned_lot</li><li>• inv_lot_attr</li><li>• item_inv</li><li>• lot_attr</li><li>• rework_count</li><li>• subplot</li><li>• subplot_attr</li></ul>
po	<p>Stores details for each purchase order.</p> <p>Purging this table will also purge the following dependent tables:</p> <ul style="list-style-type: none"><li>• po_line</li><li>• receipt</li><li>• receipt_lot</li></ul>
so	<p>Stores details for each sales order.</p> <p>Purging this table will also purge the following dependent tables:</p> <ul style="list-style-type: none"><li>• shipment</li><li>• shipment_lot</li><li>• so_line</li><li>• so_wo_link</li></ul>
sample	<p>Stores quality sample records and contextual information about the sample.</p> <p>Purging this table will also purge the following dependent tables:</p> <ul style="list-style-type: none"><li>• result, result_attr</li><li>• sample_attr</li><li>• sample_char_link</li><li>• sample_char_rule_link</li></ul>
storage_ent_transfer	Storage entity transfer table. Captures changes in the location or status of storage entities, as well as changes in their spare field values.

Internal Database Table Name	Description
util_history	<p>Captures utilization data and a chronological sequence of events for each entity that can capture utilization data. This data includes entity utilization states, utilization reasons, number of occurrences, and the timestamps when an entity's utilization state or reason changes (that is, when a new event occurs).</p> <p>Purging this table will also purge the following dependent table:</p> <ul style="list-style-type: none"><li>• corr_action_log</li></ul>

Internal Database Table Name	Description
WO	<p>Contains header data for released work orders, which includes data such as which parent item is required, what quantity and by when. This data is common to all jobs (operations) within the work order. It thus defines what work orders are scheduled to run at the facility at various times. It also records data for work orders that are currently running or have been completed or suspended.</p> <p>Purging this table will also purge the following dependent tables:</p> <ul style="list-style-type: none"><li>• assigned_lot</li><li>• cert_job_link</li><li>• cert_job_step_links</li><li>• data_log_grp_job_link</li><li>• data_log_grp_job_step_link</li><li>• item_prod</li><li>• job</li><li>• job_alloc_rule</li><li>• job_attr</li><li>• job_bom</li><li>• job_bom_step</li><li>• job_bom_subst</li><li>• job_event</li><li>• job_history</li><li>• job_hour_history</li><li>• job_prod_rule</li><li>• job_route</li><li>• job_spec</li><li>• job_step</li><li>• job_step_choice</li><li>• job_step_data</li><li>• job_step_file</li><li>• job_step_grp</li><li>• lot_attr_default</li><li>• res_job_link</li><li>• rework_count</li><li>• so_wo_link</li></ul>

Internal Database Table Name	Description
	<ul style="list-style-type: none"><li>• wo_attr</li><li>• wo_file</li></ul>

## Rejected Message Viewer

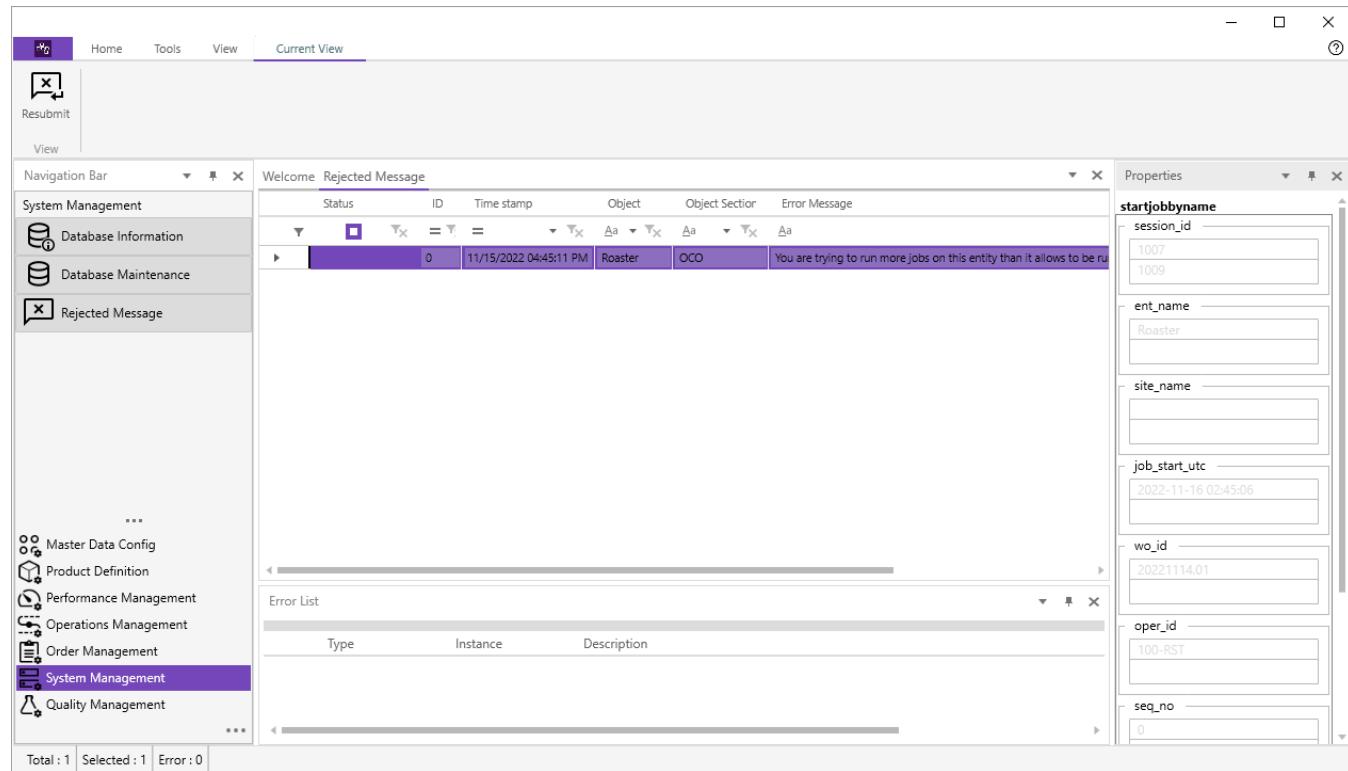
You can use the **Rejected Messages** module to view, edit, resubmit, and delete MES command messages that are rejected by the middleware while using the Without Response communication mode.

When the Without Response communication mode is used, the MES command messages, such as add production or add consumption, are stored in the Microsoft Message Queue (MSMQ). The stored messages in the MSMQ are sent to the middleware without waiting for any responses from the middleware.

The middleware can reject an MES command message due to errors, such as network errors or invalid inputs. All the rejected MES command messages are stored in the Rejected Message table in the MES database. When you open the **Rejected Message** workspace tab, a list of all the rejected messages is shown.

By default, the **Rejected Messages** module is in the **System Management** group in the **Navigation Bar**.

For more information on groups and modules, see [Groups and Modules](#).



## Viewing and Editing a Rejected MES Command Message

In the **Rejected Message** workspace tab, you can view and edit the following information of a rejected MES command message:

### Status

Shows the status of a message. The green icon indicates that the message is modified, and the red icon indicates that the message contains an error.

### ID

Shows the unique identifier number of a message.

### Time stamp

Shows the date and time when a message was recorded.

### Object

Represents an entity object that is created by configuring the OCO. The OCO sends messages to the middleware. The messages that are rejected by the middleware are shown in the Rejected Message Viewer.

### Error Message

Shows the reason for a rejected message.

### Current Status

Shows the current status of the rejected messages, such as resubmitted with success or resubmitted with error.

Users with the relevant privilege can view and edit the rejected MES command messages. For more information on providing privileges to users, see [User Groups and Users](#).

You can edit a rejected MES command message as per the error details and resubmit the message to the middleware.

### To edit a rejected message

1. Select the message.

The **Properties** window shows the command name and attributes of the message. The following text boxes are shown for each attribute.

#### Non-editable

Shows the default attribute value.

#### Editable

Shows the blank text box.

2. In the **Editable** text box, type the new value for the attribute.

The **Status** check box changes to the green icon.

You cannot edit and resubmit a message with the status as Resubmitted with Success. This message indicates that the message is already resubmitted successfully.

### Resubmitting a Rejected MES Command Message

You can resubmit a rejected MES command message after you edit the message as per the error details, such as invalid inputs. You can also resubmit a rejected message without any editing if the message was not submitted earlier due to network errors such as connectivity problems.

You can simultaneously resubmit multiple rejected messages that do not require any editing, if messages were rejected due to system errors such as database connection error.

When you resubmit multiple messages, each message is submitted in a sequence using the "With Response" communication mode. The **Rejected Messages** module waits for a response for each resubmitted message and then submits the next message in a sequence to the middleware. The status of all the messages is updated in the MES database, and you can see the new status in the workspace.

### To resubmit rejected messages

1. Select the messages that you want to resubmit.
2. Right-click one of the messages and in the context menu click **Resubmit**.

The selected messages are resubmitted to the middleware.

If the message is successfully sent to the database, the **Current Status** column shows the Resubmitted with Success status. If the message delivery fails, a new error message appears in the **Error List** window. You must fix any invalid errors to successfully resubmit a message.

## Deleting a Rejected MES Command Message

You can delete a rejected message from the MES database regardless of the message status. You can select multiple messages for deletion.

### To delete rejected messages

1. Select the messages.
2. Right-click one of the selected messages and on the context menu click **Delete**.  
A confirmation message appears.
3. Click **Yes**.

The selected command message is removed from the MES database.

## Serialization

Serialization is the process of assigning specific serial numbers to individual produced items.

Serial numbers are associated with an item in the production process using the lots functionality. That is, each serial number is essentially stored as a lot number in the system. This means that the serial-numbered lot will contain only one item.

Serial numbers are typically added to a work order prior to the work order being run. Once the work order is running, the serial numbers can be assigned to produced items as their production is recorded. Serialized items can be moved automatically or manually to downstream entities in the process. Serialized items can also be moved to storage entities for insertion at a later stage back into the production process or to the final storage location for the items when their production is complete.

Serial numbers can either be used only for a specific work order (hard-pegged) or they can be exchanged between work orders as per the flow of the manufacturing process (soft-pegged).

To manage and track a serialized manufacturing process, users must have privileges to create and edit:

- Entities
- Item classes or items
- Processes
- Work orders and jobs

To set up support for item serialization, you use MES Client to:

- Configure entities in the manufacturing process at which items can be serialized and stored.
- Configure auto-transfer operations to move the serialized items through the production process.
- An auto-transfer operation automatically transfers produced serialized items to the next entity in the routing based on an assumption that the storage capability of the entity is enabled.
- Configure item classes, items, BOMs, processes, operations, and work orders to define the type of serialization for your manufacturing environment and how it is processed on the plant floor.

Once serialization is configured, operators can use client applications such as MES Operator to execute the production process using work orders and operations to carry out the serialization of produced items.

## Setting up Serialization in MES

To setup the serialization of produced items, you must configure the following:

- Entities (see [Configuring Entities](#))
- Item classes (see [Configuring Item Classes](#))
- Items (see [Configuring Items](#))
- Processes (see [Configuring Processes](#))
- Route Map (see [Creating a Process Route Map](#))
- Work Orders (see [Creating a Work Order That Produces Serialized Items](#))

### Configuring Entities

Each entity at which serialized produced items will be processed or stored must have the following property settings configured

In the **Capabilities** property settings, select the following options:

- **Can Schedule Jobs** For any entities at which production jobs will be scheduled to be run. Not needed for entities that are strictly for storage.
- **Can Run Jobs** For any entities at which production jobs will be run. Not needed for entities that are strictly for storage.
- **Can Store** Allows serialized produced items to be stored at the entity.
- **Can Ship** Allows serialized produced items items to be viewed as inventory in MES Operator.
- **Can Receive** Allows serialized produced items items to be viewed as inventory in MES Operator.

In the **Storage** property settings, select the following option:

- **Allow multiple lots** Allows multiple serialized produced items to be stored at the entity, as each serial number is actually a unique lot number in the system.

### Configuring Item Classes

The item class serial number level is used as the default value for any item created under that item class. Once an item in that item class is created, the item class serial number level has no bearing on the item serial number level. The item serial level is set according to the item, whether it still matches the serial number level of the item class or has been changed.

To set up an item class for item serialization, configure the following settings in the item class Properties window.

#### Produced

This check box must be selected.

#### Inventory Handling: Serial Number Level

Select **Lot Number**.

## Inventory Handling: Lot Number Format or Sub Lot Number Format

The format for the automatically generated serial numbers. Which field you enter the format depends on whether the serial number should be at the lot or subplot level.

The format identifier must include # characters to represent the numeric positions of the generated serial number. For example: SN##### would produce the following serial number sequence:

- SN000001
- SN000002
- SN000003
- ...

The screenshot shows the AVEVA Manufacturing Execution System's Item Classes configuration screen. The main area displays a grid of item classes with columns for Status, Item Class ID, Item Class Desc, Produced, Consumed, and Obsolete. The 'Item Class ID' column highlights 'Finished Goods Serial Lot' and 'Finished Goods Serial None'. The 'Properties' pane on the right provides detailed settings for the selected item class, including its ID, description, and inventory handling options. A red box highlights the 'Serial Number Level' section, specifically the 'Lot Number' dropdown.

For more information on configuring item classes, see [Item Classes](#).

## Configuring Items

You can create items for the production process and assign the item class that is created for the serialization process in the **Product Definition Group**. Also, you can define the format of the serial number that is generated during an operation.

### To configure items

1. Select the item class that is defined for serialization in the **Item Class ID** list.

When you select an item class, the item automatically inherits the **Serial Number Level** and **Lot Number Format** values if they are defined for the selected item class.

Item ID	BMX-BBQ-SN
Item Class ID	Finished Goods Serial Lot
Item Description	Bag of mixed nuts BBQ serialized
Units	Pieces
Num Decimals	0
<input checked="" type="checkbox"/> BOM	
<input checked="" type="checkbox"/> Substitutes	
<input checked="" type="checkbox"/> Processes Linked To Item	
<input checked="" type="checkbox"/> States and Grades	
<input checked="" type="checkbox"/> Inventory Handling Lifetime	
Serial Number Level	
Lot Number	
Lot number format	SN#####

2. In the **Inventory Handling** section, type or change the format for the lot number or serial number in the **Lot Number Format** text box. This is an optional field that provides a default format for the generated serial numbers.

The format identifier must include # characters to represent the numeric positions of the generated serial number. For example: **SN#####** would produce the following serial number sequence:

- SN000001
- SN000002
- SN000003
- ...

For more information on configuring items, see [Creating an Item](#).

## Configuring Item BOMs

After you configure items for serialization, you can create a BOM item that adds production-specific details for the usage of the produced item.

### To configure an item BOM

1. In the item BOM **Storage Location** box, browse and select a default storage location for the item from the entities that are configured for the production process. This property is optional.

If the item BOM **May choose alternate inventory location** option is selected, the storage location that is selected here can be overridden at the job level for a specific work order in the job BOM **Default Storage Entity** property setting. Doing this for the job BOM for each job in the work order will allow you to predefine

the default path of the serialized produced items through the process route and to/from storage entities outside the process route.

2. Select the following check box options:

- May choose alternate inventory location** Optional. Allows a user to select alternate entity destinations.
- Update Inventory** This enables the other two options below.
- Must Consume from Inventory** Required.
- Must Consume from WIP** Optional. WIP is Work-in-progress. This option is used to tie serialized items to a particular work order.

If this option **is selected** (hard-pegged), this item, once serialized for a work order, cannot be transferred to another work order. Note, however, the serialized items produced in soft-pegged work orders can be transferred to hard-pegged work orders.

If it **is not selected** (soft-pegged), this item, once serialized, can be transferred between work orders as it flows through the manufacturing process.

Status	BOM Position	Item ID	Item Description	Quantity	Min Quantity
Original		FMX-BBQ	Flavored Mixed Nuts -	0.25	
		BAG-BBQ	BBQ Mixed Nuts Bag -	1	

May choose alternate inventory location  
 Update Inventory  
 Must Consume from Inventory  
 Must Consume from WIP

For more information on configuring BOMs, see [Creating BOMs for an Item](#).

## Configuring Processes

You can create a process to define the production method to produce an item and instantiate the work orders for the item from the **Processes** module in the **Operations Management** group.

1. Create the process and define a process class ID.

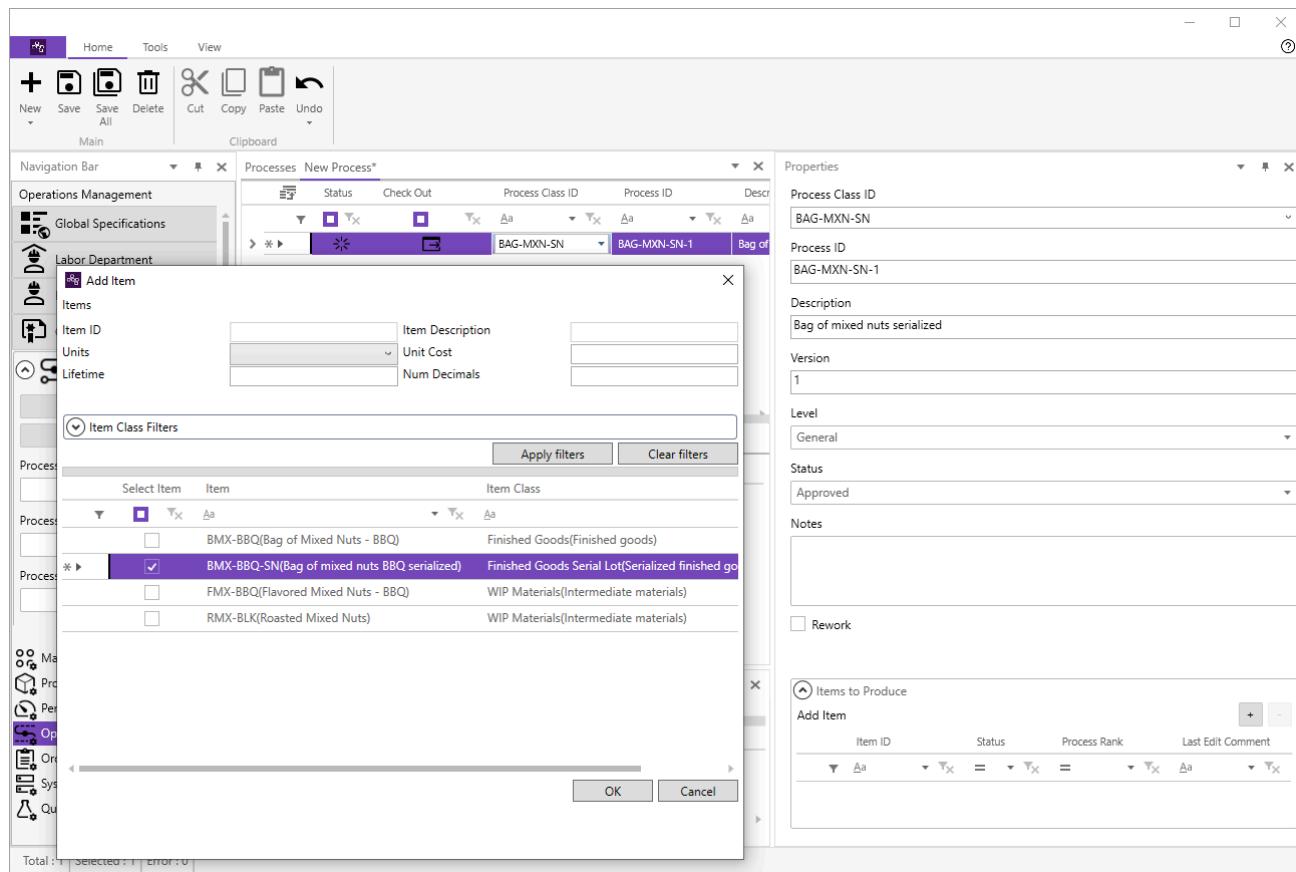
- Type a brief description about the process.

In the **Status** list, select from one of the options in the **Status** list:

- Experimental**
- Approved**
- Certified**

You must set the status of a process and an item linked to that process to at least the minimum required by the system attribute *Lowest level process that can be instantiated* before creating a work order for an item.

- From the **Items to Produce** section, add an item that is to be produced.



For more information on configuring processes, see [Creating a Process](#).

## Configuring Operations

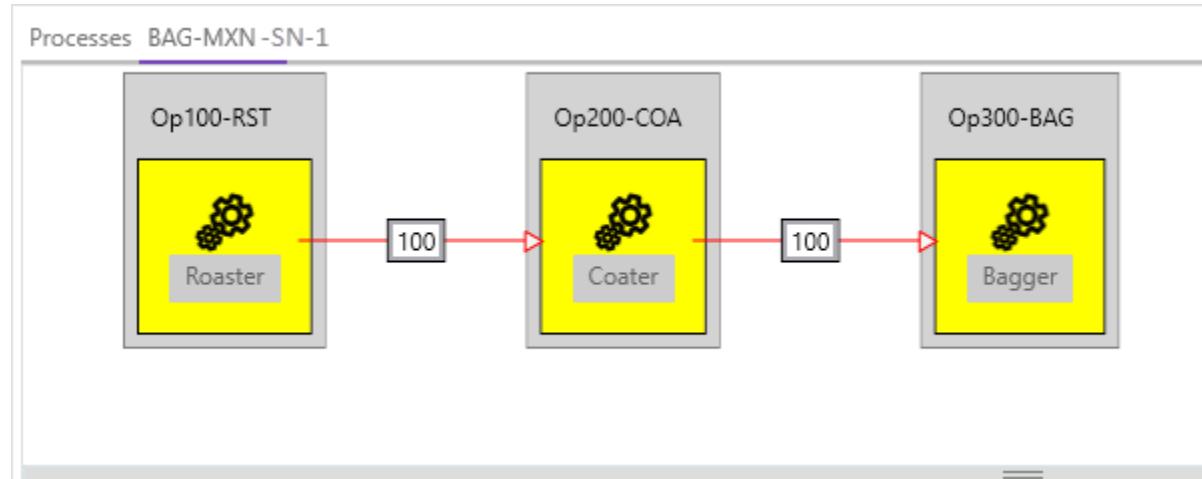
After you configure the process for the item that you are creating for serialization, you can define the operations to produce the end product.

- Select the process that you have created and configure required operations in sequence to produce the end product.
- After you configure the required operations, select and assign the entity that is associated with each operation.

For more information on configuring operations, see [Adding an Operation to a Process](#).

## Creating a Process Route Map

After you configure the required operations, create a route map to link the operations with the process.



For more information on configuring the route map, see [Creating a Route Map](#).

## Creating a Work Order That Produces Serialized Items

After you configure the item class, items to be serialized, BOM, process, operations, and route map, you can create a work order from the process that you have created to produce the serialized items.

**Create Work Order from Process**

Process ID	BAG-MXN-SN-1
Spec. Version	
Work Order ID	20220630.01
Description	Initial production phase for V
Item	BMX-BBQ-SN
Bom Version	
Starting Quantity	1100 Pcs.
Required Quantity	1000 Pcs.
Release Date/Time	06/30/2022 11:00 PM
Due Date/Time	07/01/2022 11:00 PM
Priority	50
Customer	
Manufacturing Order	
Notes	

**OK** **Cancel**

For more information on creating a work order from a process, see [Creating a Work Order from a Process](#).

You can set whether you are doing hard-pegged or soft-pegged based on a work order. You can edit the BOM 0 settings for each job and change the **Must Consume from WIP** setting.

### Job BOM Settings That Affect Serialized Items

The following work order job BOM properties affect the serialization of items in the production process.

- **Default Storage Location** Use this property to specify to which entity the produced serialized item will be moved when the job is completed. By setting the default storage entity for each job, you can control the flow of serialized items through the production process.
- **Update Inventory** This option must be selected for each job BOM in the work order.
- **Must Consume from Inventory** This option must be selected for each job BOM in the work order.
- **Must Consume from WIP** Optional. WIP is Work-in-progress. This option is used to tie serialized items to a particular work order.

If this option is **selected** (hard-pegged), serialized items produced by this job cannot be transferred to another work order. Note, however, the serialized items produced by soft-pegged work orders can be transferred to hard-pegged work orders.

If it is **not selected** (soft-pegged), serialized items produced by this job can be transferred between work orders as they flow through the manufacturing process.

Typically, this option will either be selected for all jobs in the work order or none of the jobs in the work order.

- **May choose alternate inventory location** Optional. Select this option to allow operator users to select a storage location for serialized items produced by the job other than the default storage location.

The screenshot shows the MES Client interface with several windows open:

- Work Orders And Jobs**: A grid showing multiple work orders (e.g., GP20221107.01, GP20221108.01) with columns for Status, Work Order ID, Description, Item, Work Order Status, Starting Quantity, Required Quantity, Release Date/Time, Due Date/Time, and Priority.
- Properties**: A panel on the right showing settings for a selected item. It includes fields for Job BOM, BOM Position, Item Description (Plated grill), Required Grade, Instruction, Quantity, Min Quantity, Max Quantity, and checkboxes for Required start value is %, Required Start Value, Default Reason, and Default lot number.
- Default Storage Entity**: A dropdown menu set to "Sandblaster".
- Scaling Factor**: A numeric input field set to 0.
- Checkboxes in Properties panel (highlighted with a red box)**: Backflush Consumption (unchecked), Update Inventory (checked), Must Consume from Inventory (checked), Must Consume from WIP (unchecked), May choose alternate inventory location (checked), and May create new lots (unchecked).
- Steps**: A grid showing operations (e.g., 100-MILL, 200-SAND, 300-WASH, 400-PLAT) with columns for Job BOM, Specs, and Attributes.
- Error List**: A table showing errors with columns for Type, Instance, Description, Extension, and Error Level.

## Producing Serialized Items in MES Operator

After you have created the work orders in MES Client, the work orders are available for production through the MES Operator application. MES Operator provides the necessary controls to create and manage the serial numbers of the defined items.

The serial number buttons described below become enabled on the MES Operator button bar after a work order that produces serialized items is selected in the queue.



- **Add/Assign Serial Numbers** This button is enabled when the item produced by the selected job is serialized and the job is not in a Completed or Canceled state. When selected, the Add/Assign Serial Numbers dialog box appears. In the Add/Assign Serial Numbers dialog box, users can assign serial numbers to work orders and operations per the defined required quantity.

Typically new serial numbers are added and assigned to a work order before starting the first operation. However, they can be added at other times during the production run.



- **Transfer Serial Numbers** This button is enabled when the item produced by the selected job is serialized and the job is not in a Completed or Canceled state. When selected, the Transfer Serial Numbers

dialog box appears. In the Transfer Serial Numbers dialog box, users can transfer serialized items between two work orders.

For more information about producing serialized items, see the *MES Operator User Guide*.

### Controlling the Serial Numbers Flow

By default, linear flow is enabled for both hard and soft pegged methods of serialization. The produced serial numbers continue to flow in a linear order through the route. The linear flow does not prohibit the ability to transfer produced serial numbers to other operations within the same work order or different work orders based on system configuration settings.

## Linear Flow

Linear flow enables the movement of produced serialized items through the route. The serial numbers that are produced prior to the operation are available for production.

If you configure the BOM to consume from WIP, only serial numbers that are produced and are in inventory at the next operation storage entity, are available to return to the operation where they were produced. The previous and next operations in a job route are identified using the job route links.

### Manual Transfer of Serial Numbers

You can use the Transfer Serial Numbers dialog box to find and transfer serial numbers to run on entity based on the serialization method and the level of control over the flow of serial numbers through the process routing.

### First Operation Production

A work order routing contains at least one designated first job. If you do not require linear flow for the work order, production can start through the work order at any job that uses that item.

When an item is soft pegged, MES Operator checks the local inventory for available serial numbers. If no serial numbers are found, MES Operator checks for the serial numbers that are assigned to a work order and are not in process in the Lot table. The Add Production dialog box lists all the serial numbers in local inventory and all the serial numbers in the assigned Lot table that are not started.

If an operator has permission to create a new serial number and no serial number is assigned to a work order, an operator can add serial numbers and assign them to a work order.

### Intermediate Operation Production

The Add Production dialog lists all incomplete serial numbers at the entity running the job or at its parent entity for the produced item. If a job is hard pegged, you can see the serial numbers produced for a work order to which the job is associated. You can see the serial numbers that are complete for an operation but you cannot see the list of incomplete serial numbers. This does not include serial numbers that are consumed in a downstream operation.

If the job BOM storage locations are defined as the downstream entity for the next operation or its parent for each operation in the route, the produced serial numbers are transferred by default to the entity that is

scheduled to run the next job in the work order.

If the serial numbers are not stored at the entity or its parent entity on which you are running a job, you must use the **Transfer Serial Numbers** button to manually transfer the produced serial numbers to the current job location.

### Last Operation Production

The last operation in a process is flagged and considered as last for all serialization methods and respective functionalities. When a serial number is completed in the last operation, the status field in the assigned lot table record changes to complete.

## Sample Plan Frequency

You can use the **Sample Plan Frequency** module to create, maintain, and remove sample plan frequency definitions.

When you open the **Sample Plan Frequency** module, a list of existing sample plan frequencies is shown.

A sample plan frequency is the given interval for collecting samples for measuring quality. A sample plan frequency can be associated with multiple sample plans and a sample plan can have multiple sample plan frequencies.

Sample plan frequencies are defined based on the following:

- Calendar or clock time
- Time pattern within current shift
- Production unit count
- Occurrence of specific events (job start or end, lot number change for the main item being produced)

There can be multiple sample plan frequencies at any given time.

By default, the Sample Plan Frequency module is in the **Quality Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

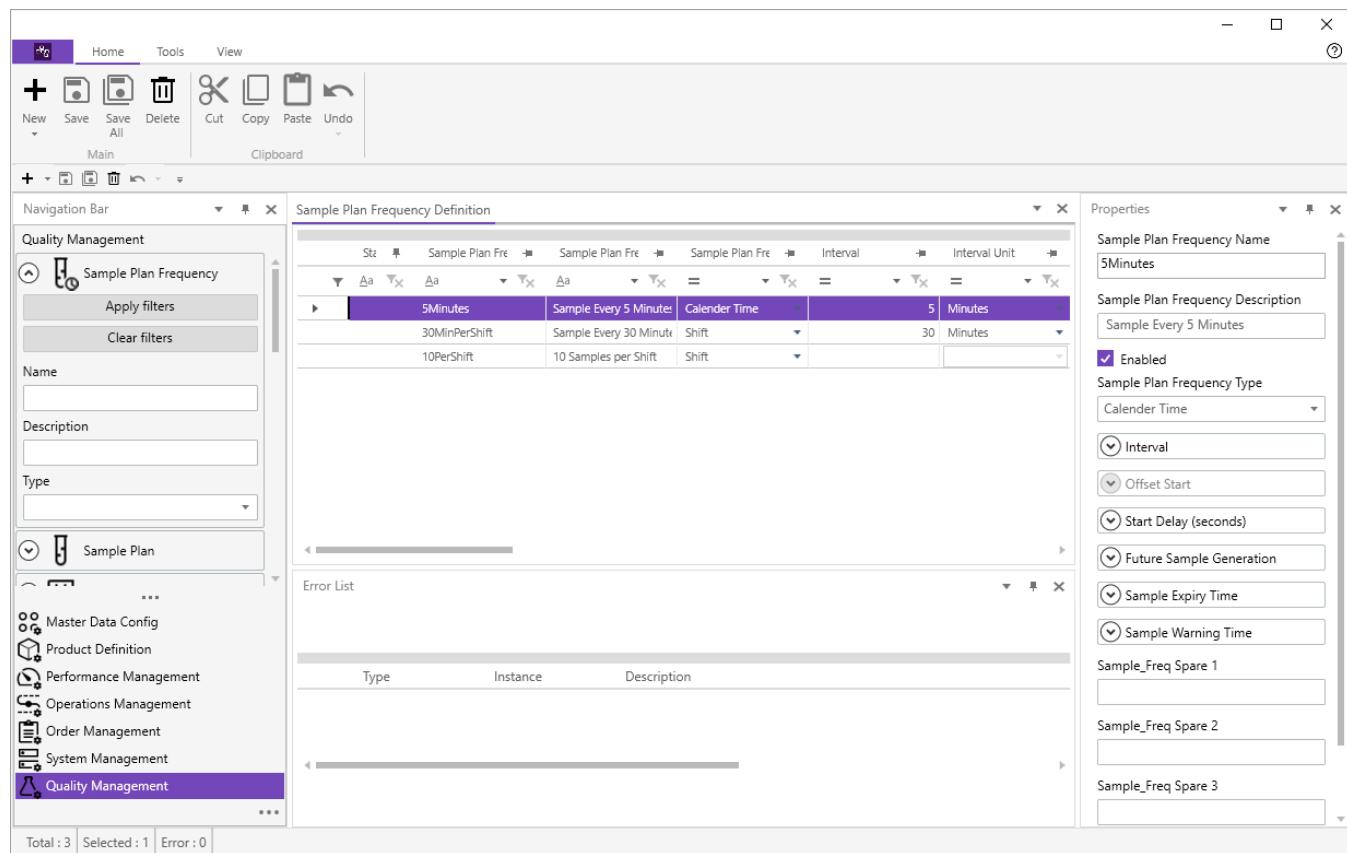
You can modify an existing sample plan frequency, except under the following conditions:

- You cannot modify the type of a sample plan frequency if it is linked to a sample plan.
- You cannot modify the Data Change event type of a sample plan frequency if it is linked to a sample plan.

You can delete an existing sample plan frequency from the MES database if it is not linked to any sample plan. For more information on deleting, see [Deleting an Object](#).

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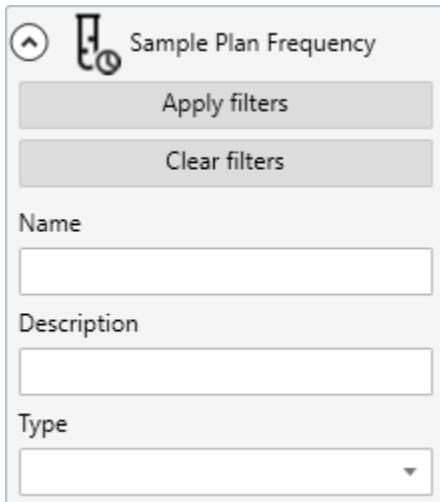
**Note:** An error message appears if the sample plan frequency cannot be saved. Modify the sample plan frequency, as needed, to correct the error and save to clear the error.



## Opening the Sample Plan Frequency Definition Workspace Tab

When opening the **Sample Plan Frequency Definition** workspace tab, the **Apply Filter** function allows you to filter the list of sample plan frequencies to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Quality Management** group open the **Sample Plan Frequency** section.



2. To not filter the frequencies, don't enter any search terms.

To filter the frequencies, enter search terms in the available filter options.

**Name**

Name of the sample plan frequency. You can type any character within the sample plan frequency name.

**Description**

Description of the sample plan frequency. You can type any character within the sample plan frequency description.

**Type**

Type of frequency.

3. Click **Apply Filter**.

The **Sample Plan Frequency Definition** workspace tab opens, listing the sample plan frequencies that match the filter search terms.

## Creating a Sample Plan Frequency

A sample plan frequency is created to determine the interval for generating samples. You can create multiple sample plan frequencies.

If you have the privileges to edit sample plan frequency settings, you can create a sample plan frequency in the **Sample Plan Frequencies** tab.

### To create a sample plan frequency

1. Open or go to the **Sample Plan Frequency Definition** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Sample Plan Frequency**.

A new sample plan frequency is added.

3. In the new sample plan frequency's **Properties** window, complete the property settings. See [Sample Plan Frequency Properties](#).
4. Save the changes.

An error message appears if the sample plan frequency cannot be created. Modify the sample plan frequency, as needed, to correct the error, and save to clear the error.

## Sample Plan Frequency Properties

There are required and optional sample plan frequency properties that apply to any sample sample plan frequency type. There are also additional optional properties that are associated with the Shift, Calendar, and Production frequency types.

# Required Properties

### Sample Plan Frequency Name

The unique name for the sample plan frequency.

**Sample Plan Frequency Type**

The type of frequency. You can select any of the following:

- Shift
- Calendar Time, the default
- Production
- Job start
- Job end
- The lot number of the main item produced changes
- Manual

## Optional Properties for Any Frequency Type

**Sample Plan Frequency Description**

A description of the sample plan frequency.

**Enabled**

Specifies whether to enable the sample plan frequency definition.

**Sample Expiry Time: Value and Unit**

The time that specifies the interval for collecting samples before the status is changed to Missed.

**Sample Warning Time: Value and Unit**

The time that specifies the interval for collecting samples before the status is changed to Ready Warning.

**Sample\_Freq\_Spare-4**

User-defined information about the sample plan frequency.

## Optional Properties for Shift Frequency

**Interval: Value and Unit**

The time interval for sampling.

You can link a sample plan frequency to QM specifications, as definitions of shifts are tied to entities, either directly or by inheritance. The QM specification must have at least the context of an entity, entity class, or item that has a shift schedule, so that the start and end of the shift can be determined.

The unit of the interval. You can select any of the following:

- Seconds
- Minutes
- Hours
- Days
- Weeks

For example, an interval of 2 hours and a shift that runs from 8:00:00 AM to 3:59:59 PM will have samples at 8,

10, 12, and 2 assuming that there are no start or end offset, and no samples per shift.

#### Offset Start: Value and Unit

The amount of time calculated from the start of a shift when the first sample is generated. For example, if the shift starts at 8:00 AM and the Offset Start is 15 minutes, then the first sample occurs at 8:15 AM.

#### Offset End: Value and Unit

The amount of time calculated from the end of a shift when the last sample is generated. For example, if the shift ends at 4:00 PM and the Offset End is 15 minutes, then the last possible sample occurs at 3:45 PM.

Depending on other settings of the shift frequency definition, there is no guarantee that a sample will occur at this time.

#### Samples Per Shift

The number of samples that are generated in every shift. The minimum value that you can type is 2. For example, a value of 2 for samples per shift, and no setting for the interval creates a sample at shift start plus offset start, and a sample at shift end minus offset end.

For more information on run time sample generation, refer the *MES Middleware User Guide*.

## Optional Properties for Calendar Frequency

#### Interval: Value and Unit

The time for which future sample requests are generated.

The available units are:

- Seconds
- Minutes
- Hours
- Days
- Weeks

#### Offset Start: Value and Unit

The time interval for generating samples at a specific time of day. This option is only available if the interval unit is hours, days, or weeks.

If the interval unit is hours, this setting is the time offset from midnight for the first sample of the day.

If the interval unit is days or weeks, this setting is the time offset from midnight on Sunday for the first sample.

#### Start Delay (seconds)

After a job has started on an entity, the amount of time to delay the generation of the first sample. This option is only applicable when Offset Start is not being used to specify a time-of-day trigger.

#### Future Sample Generation: Value and Unit

The time interval for the MES middleware maintenance service to predict future samples for this frequency. If this field is empty, the MES middleware maintenance service predicts future samples up to the end of the current shift.

# Optional Properties for Production Frequency

## Production Reset Option

The appropriate production reset option for production.

For a production frequency, prediction of the request time for the first sample may take into consideration production counts from previous jobs within the context of the active QM specification. This option determines when the production counts from previous jobs will be reset to 0. The choices are:

### Never

Always use all applicable context records matching the context of the QM specification. In certain cases, this will be more than one record.

### The job changes

When a new job is run on an entity, all applicable context records are set to 0.

### Main item produced changes

When a new job is started on an entity that is producing a different item from the previous item run on the entity, all applicable context records are set to 0.

### Shift changes on entity

At the completion of a shift change, all applicable context records are set to 0. This will impact the sample request times for samples based on the current job.

## Production: Value and Units

The number of units produced that will trigger the creation of a sample.

## Future Sample Generation: Value and Unit

The time interval for the MES middleware maintenance service to predict future samples for this frequency. When samples are generated for a specific time in the future, it does not matter whether the sample request time falls beyond the current shift's end or not. If this field is empty, the MES middleware maintenance service predicts future samples up to the end of the current shift.

For more information about using the production type sample plan frequency, refer to [Determining Frequency Type Production Count](#).

## Determining Frequency Type Shift

If a sample plan frequency is configured to generate future samples for a shift, then the QM specification that uses this sample plan frequency and has the highest specificity (and is currently effective), is used to generate future samples up to the end of the shift. If a QM specification is effective during a shift rather than at the beginning, the exact sample time is delayed until the sample frequency becomes effective.

The conditions to generate a sample plan based on the shift start offset and shift end offset are as follows:

- If the sample plan frequency contains a value for the shift start offset, then the first future sample for the current shift is generated. In this case, the sample request time is equal to the offset start from the current shift start time. Further samples are generated based on the effective time between samples.
- If the sample plan frequency contains a value for the shift end offset, then the last future sample for the current shift is generated. In this case, the sample request time is equal to the offset end from the current shift end time. The sample request time also includes the offset end from the current shift end time.
- If the number of times to take samples in a shift is specified instead of time between samples, the effective

time between samples is calculated as:

$$\frac{\text{Difference between current shift's start time} - \text{Current shift end time}}{\text{Number of time per shift} - 1}$$

- Before determining the effective time between samples, the offset\_start value and offset\_end value are added to the current shift start time and current shift end time, respectively. For example, the first sample is always requested at the beginning of the shift, if there is no offset, or at the offset start time from the beginning of the shift.

- The last sample is requested at the end of the shift, if there is no offset, or at the offset time from the end of the shift.
- The remaining sample requests are divided at equal intervals between the first sample requested time and the last sample time.
- The minimum number of samples requested for a shift must be at least 1, which will generate a single sample at the offset start time regardless of any other settings.
- If the number of times per shift and the interval are both specified, then the first sample is generated at the offset\_start value. Additional samples are generated at the time interval up to a maximum of the number of times per shift or the shift end time minus the offset\_end, whichever comes first.

## Determining Frequency Type Production Count

If a sample plan frequency is configured to generate future samples for a production count frequency—that is, the sample plan frequency type is Production—and the frequency is configured to count individual units, the active QM specification using this frequency generates future samples either to the end of the shift or the time specified in the future sample generation property. For samples to be generated for this frequency, a job must be running on the entity.

The job's production rate is used to estimate the time when future samples will be generated. For example, a production unit count frequency of every 50 units in effect when a job with a production rate of 10 batches per hour and a batch size of 20 units per batch will create future samples 15 minutes apart (for additional information about batch size, see [Understanding Batches and Lots for OEE and Estimated Times](#)).

$$50 \text{ units} / (10 \text{ batches/hour} * 20 \text{ units/batch}) * 60 \text{ minutes/hour} = 15 \text{ minutes}$$

Samples will be predicted when the job starts on the entity and any remaining future samples will be deleted when the job stops. Future samples will be predicted to the end of the shift if there is no **Future sample generation** setting; otherwise, samples will be generated up to the "future sample generation" interval. In either case, samples will be predicted to cover only the starting quantity of the job plus one additional sample for over production. Using the above frequency example, if a job is started with a start quantity of 225 units, then 5 samples will be generated every 15 minutes apart. If the **Future sample generation** setting is 0, then no future sample are generated and the frequency behaves as an event frequency generating samples with the production of a sufficient quantity of units.

Unlike the calendar and shift frequencies, future production unit count samples are readied only when the required number of units have been produced instead of based on the future sample request time. Both good and bad counts of production are considered when readying a sample. As production counts are recorded against the job, the total is maintained in a context table in the database. This includes when the production quantity is reduced. When a production transaction causes the total to equal or exceed the frequency interval units, then the next available future sample will be readied by the MES middleware maintenance service during the next update of sample status. This might take up to the time period specified by the system parameter *Frequency to call sample updates (in seconds)*, which has a default of 30 seconds.

## Data Change Frequency

Data change frequencies are not processed by the MES middleware maintenance service. These frequencies generate samples with the corresponding event through the middleware. In general, these are MES Operations type transactions that generates a new sample for an entity when the call is processed by the middleware.

### Job Start/Job End

Both these frequencies are based on a job running on an entity. When a QM specification has the context of an item (or item category) and/or operation, then a job must be active on the entity for the QM specification to be active.

- If the QM specification has a sample plan that contains a job start frequency, the job start transaction generates a new sample on the entity.
- If the QM specification has a sample plan that contains a job end frequency, the job end transaction generates a new sample on the entity.

### Lot number of main item produced changes

This frequency is based on a job running on an entity. When the call is made to change the lot number of the main item produced (JobExec.SetCurLotData API call for BOM Position 0 which is the main item produced), a new sample is generated on the entity. This event happens when the lot number is set for the job, not when the job produce transaction is called. The lot number produced is different from the previous lot number.

This event frequency is applicable only to QM specifications that have item/item category and/or process/operation contexts. A QM specification with only an entity context will not have samples generated for this frequency type.

### Manual

This frequency definition is provided as a mechanism to indicate that the Sample.GenerateSample API call will be used at run time to generate an ad-hoc sample. It is not associated to any other MES Operations or performance transaction. Since a QM specification must include a sample plan and a sample plan must include a sample plan frequency, the manual frequency is provided so that a manual QM specification can be defined in the system and used by the call.

## Sample Plans

You can use the **Sample Plan** module to configure and to associate sample plan frequencies to the sample plan. Sample plans are constructed to generate samples at run time.

A sample plan is a collection of sample frequencies and the template for naming samples at run time. The sample plan frequency is the given interval to generate samples. It is also used to define the given time when samples are collected.

When you open the **Sample Plan Definition** workspace tab, a list of existing sample plans is shown.

This module is in the **Quality Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

The screenshot shows the AVEVA Manufacturing Execution System interface. The main window is titled "Sample Plan Definition". On the left, there is a "Navigation Bar" with sections like Quality Management, Sample Plan, Characteristic, and Quality Management. The "Quality Management" section is expanded, showing sub-options like Master Data Config, Product Definition, Performance Management, Operations Management, Order Management, System Management, and Quality Management. The "Quality Management" option is highlighted. At the top, there is a toolbar with icons for Add, Copy, Paste, Link, Delete, and Link. Below the toolbar, there is a "Sample Plan Frequency Links" section with buttons for Add, Copy, Paste, Link, and Delete. The main content area contains several tables and panels:

- Sample Plan Definition Table:**

Stz	Sample Plan Na	Sample Plan De	Verified Write	Sample Naming	Numbering Res
Aa	BagWeight	Weight of Bag	<input checked="" type="checkbox"/>	[SamplePlanName]YYYY	Change in Local
	NutQuality	Quality of Roasted Nuts	<input type="checkbox"/>	[SamplePlanName]YYYY	Change in Local
	BagQuality	Quality of the Bags	<input type="checkbox"/>	[SamplePlanName]YYYY	Change in Local
- Frequencies Table:**

Frequency Name	Frequency Description	Frequency Type
5Minutes	Sample Every 5 Minutes	Calender Time
- Error List Table:**

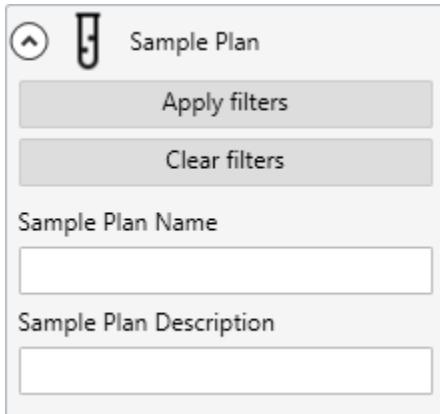
Type	Instance	Description	Extensic
- Properties Panel:**
  - Sample Plan Name: BagWeight
  - Sample Plan Description: Weight of Bag
  - Verified Write Decimals:  Verified Write
  - Sample Naming Convention: [SamplePlanName]YYYY[MM][DD]####
  - Numbering Reset Option: Change in Local Date
  - Sample\_Plan Spare 1
  - Sample\_Plan Spare 2
  - Sample\_Plan Spare 3
  - Sample\_Plan Spare 4

At the bottom left, there are status indicators: Total : 3 | Selected : 1 | Error : 0.

## Opening the Sample Plan Definition Workspace Tab

When opening the **Sample Plan Definition** workspace tab, the **Apply Filter** function allows you to filter the list of sample plans to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Quality Management** group open the **Sample Plan** section.



2. To not filter the plans, don't enter any search terms.

To filter the plans, enter search terms in the available filter options.

### Sample Plan Name

Name of the sample plan. You can type any character within the sample plan name.

### Sample Plan Description

Description of the sample plan. You can type any character within the sample plan description.

3. Click **Apply Filter**.

The **Sample Plan Definition** workspace tab opens, listing the sample plans that match the filter search terms.

## Creating a Sample Plan

A sample plan is created to collect user inputs at a given time. You can save multiple sample plans simultaneously. To save a sample plan, you need to link at least one sample plan frequency to it.

You can delete a sample plan if there is no active quality management specification linked to it.

You must have the privileges to create a sample plan.

### To create a sample plan

1. Open or go to the **Sample Plan Definition** workspace tab.

2. Do one of the following:

- Press the **Ctrl+N** keys.
- Right-click in the tab and on the context menu click **New**.
- On the ribbon, go to the **Home** tab and on the **New** menu click **New Sample Plan**.

A new sample plan is added.

3. In the new sample plan's **Properties** window, complete the settings. See [Sample Plan Properties](#).

4. Save the changes.

An error message appears if the sample plan cannot be created. Modify the sample plan, as needed, to correct the error, and save to clear the error.

## Sample Plan Properties

### Sample Plan Name

The unique name for the sample plan.

### Sample Plan Desc

A description of the sample plan.

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**Note:** In the MES 2014 SP1 release, the Verified Write setting is not enforced within the Sample Viewer control.

### Verified Write

Specifies whether a confirmation from an operator is required before saving a set of characteristics for a sample. By default, this option is not selected.

### Sample Naming Convention

The template for naming the samples when they are created at run time. The naming convention for sample plan at run time consists of replaceable parameters enclosed in square braces and/or literal text. For more information, refer to [Sample Naming Conventions and Replaceable Parameters](#).

### Numbering Reset Option

The ordinal number used in a sample plan name. Available only when the sample plan name contains an ordinal number.

The available options are:

- **Never:** The default. The number will be continually updated for every sample generated by the sample plan.
- **Change in Local Date:** The number will be reset to 1 for each day change.

### Sample Plan Spare1-4

User-defined information about the sample plan.

## Sample Naming Conventions and Replaceable Parameters

The naming convention for the sample plan at run time consists of replaceable parameters enclosed in square braces and/or literal text.

An example sample naming format is:

[SamplePlanName][YYYY][MM][DD][#####]

where

- [YYYY][MM][DD] represents the date
- ##### represents the unique ordinal number, when the rest of the name (except the date) is the same
- The SamplePlanName is taken from the plan\_id field in the database.

The available database fields that can be referenced are:

#### **plan\_name**

Specifies the name of the sample plan that is used for collecting samples.

#### **ent\_name**

Specifies the entity at which samples are being collected.

#### **wo\_id**

Specifies the work order of the job for which samples are being collected.

#### **oper\_id**

Specifies the operation for which samples are being collected.

#### **seq\_no**

Specifies the sequence number of the job for which samples are being collected.

#### **segment\_requirement\_id**

Specifies the segment requirement of the samples collected.

#### **segment\_response\_id**

Specifies the segment response of the samples collected.

#### **item\_id**

Specifies the item to which the samples collected are assigned.

#### **char\_name**

Specifies the characteristic of a QM specification to which the sample plan is associated. If there are more than one characteristic linked to the sample, only the first characteristic in the sample is used.

#### **qm\_spec\_name**

Specifies a QM specification associated with the sample plan.

#### **freq\_name**

Specifies a frequency that is linked to the sample plan.

## Replaceable Parameters

To easily identify the group of samples by a template name in a report, a replaceable parameter is used to generate sample names. When a sample is generated, the actual sample name (`sample.sample_name`) is derived from the template sample name (`sample_plan.sample_name`) that is configured for the sample plan from which the sample is generated.

Replaceable parameters must be enclosed in square brackets []; for example, as a date string [yy]-[mm]-[dd] would create a sample name of 15-01-01 on January 1, 2015. This indicates that the characters can be replaced. [YYYY][MM][DD] represents date information and these must come from the `requested_time_local` field of the sample table.

The replaceable parameter that is configured inside the square brackets for the template sample name is resolved only if the replaceable parameter exactly matches the replaceable parameter that is defined in the table below and the result contains a non-null value. Otherwise, the replaceable parameter is used exactly as it is configured in the template sample name. If the replaceable parameter contains a date parameter, the date value is resolved to the local date (`sample.requested_time_local`).

If a replaceable parameter is nested inside other replaceable parameters, the replaceable parameters that exactly match with the replaceable parameters listed in the table below are replaced. However, the replaceable parameters will not recursively resolve other replaceable parameters when a value returned from one of the replaceable parameter is same as the replaceable parameter listed in the table below.

The following table shows a list of replaceable parameters that can be successfully replaced from the template sample name. The following table shows examples that use the current date by default (10/27/2015 local date).

Replaceable Parameter (Case Insensitive)	Value Returned	Example
[YYYY]	Year	2015
[MM]	Month of the year (integer)	10 (with leading zeros)
[MONTH]	Name of the month	October
[DD]	Day of the month	27 (includes leading zeros)
[WW]	Week of the year	44 (includes leading zeros)
[DAY]	Day (in full) of the week	Tuesday
[WD]	Day of the week	3
[DY]	Day of the year	298 (includes leading zeros)
[EntityName]	Name of the entity	Blender
[WorkOrderID]	Work Order ID	WO123456
[OperationID]	Operation ID	BlendingOperation
[SequenceNumber]	Job Sequence Number	0

Replaceable Parameter (Case Insensitive)	Value Returned	Example
[ItemID]	Item ID	Item123456
[CharacteristicName]	Characteristic Name  If a sample contains more than one characteristic, the name from the first characteristic that is added to this sample is returned.	Viscosity
[QMSpecName]	QM Specification Name	QMSpecA
[FrequencyName]	Frequency Name	FrequencyA
[SamplePlanName]	Sample Plan Name	SamplePlanA
[SegmentRequirementID]	Segment Requirement ID	SegmentRequirement
[SegmentResponseID]	Segment Response ID	SegmentResponse
[#####]	Integer value returning the next highest number. If none is found, it returns 1, including leading zeros. If the maximum is reached, then the maximum value is retained.  The number of octothorpes is not limited for a template sample plan name.	0001 (includes leading zeros)

## Linking Sample Plan Frequencies to a Sample Plan

A sample plan frequency can be linked to a sample plan. Only one sample plan frequency of a given type may be linked to the sample plan, except for data change events, multiple data change events may be linked to the same sample plan.

You can add single frequencies for shift time, calendar time, entity run time, and entity production. You can add multiple frequencies for data change events to a sample plan as long as the data change events are for different events.

The **Frequencies** tab shows a list of all the sample plan frequencies linked to the selected sample plan.

### To link sample plan frequencies to a sample plan

1. Select the sample plan.
2. Go to the **Frequencies** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add Link**.

- On the ribbon, go to the **Current View** tab and click **Add Link**.

The Sample Plan Frequency Links dialog box appears.

4. Optionally, specify search terms in the top pane to filter the list of sample plan frequencies to select.

To list all available sample plan frequencies, do not specify any search terms.

5. Click **Apply Filters**.

The sample plan frequencies that are available to be linked to the QM specification and that match the filter if search terms were entered appear in the bottom pane.

6. Select the sample plan frequencies you want to assign to the sample plan and click **OK**.

7. Save the changes.

You can delete the sample plan frequencies assigned to a sample plan.

## Variable and Attribute Characteristic Definitions

You can use the **Characteristic** module to create, maintain, and remove variable and attribute characteristic definitions.

When you open the **Characteristic Definition** workspace tab, a list of existing variable and attribute characteristics is shown.

A characteristic is an aspect of an item, process, or physical entity that can be measured. You can configure characteristics for variables and attributes, and associate them with categories.

By default, the **Characteristic** module is in the **Quality Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

You can modify one or several characteristics, but you cannot modify its type such as variable, counted attribute, and binary attribute. This is because when the characteristic type is changed, the corresponding information also changes making it invalid. Once saved, you cannot modify the characteristic type.

You can delete a characteristic if it is not linked to any QM specification that is currently effective. For more information on deleting, see [Deleting an Object](#).

An error message appears if the characteristic cannot be saved. Modify the characteristic, as needed, to correct the error and save to clear the error.

The screenshot shows the AVEVA Manufacturing Execution System (MES) interface. The main workspace is titled "Characteristic Definition". The left sidebar includes a "Navigation Bar" with tabs for Home, Tools, View, and Current View. Under Quality Management, the "Characteristic" section is selected, showing options to Apply filters and Clear filters. Below this are fields for Name, Description, and Type, along with a list of system modules: Master Data Config, Product Definition, Performance Management, Operations Management, Order Management, System Management, and Quality Management (which is highlighted in purple). At the bottom of the sidebar, there are buttons for Total : 3, Selected : 1, and Error : 0.

## Opening the Characteristic Definition Workspace Tab

When opening the **Characteristic Definition** workspace tab, the **Apply Filter** function allows you to filter the list of characteristics to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Quality Management** group open the **Characteristic** section.

2. To not filter the characteristics, don't enter any search terms.

To filter the characteristics, enter search terms in the available filter options.

#### Name

Name of the characteristic. You can type any character within the characteristic name.

#### Description

Description of the characteristic. You can type any character within the characteristic description.

#### Type

Type of the characteristic.

#### Severity

Severity of the characteristic.

#### Category

A category of the characteristic.

3. Click **Apply Filter**.

The **Character Definition** workspace tab opens, listing the characteristics that match the filter search terms.

## Managing Characteristics

The workspace shows the name, description, type, severity, and other details of the variables and attributes. You can create, modify or delete a characteristic.

You must provide the following information to save either a variable or an attribute characteristic:

#### Name

The name of the characteristic.

#### Type

The type of the characteristic:

- **Variable:** Supports a floating point number to record product or process data such as temperature, pressure, diameter, etc.
- **Counted Attribute:** Used to enter a count of defects found on a unit.
- **Binary Attribute:** Used to determine whether a condition exists or whether the unit being inspected is defective. This is a count of defective units for a specific flaw.

### Unit of Measure

The unit of measure of a characteristic.

### Severity

The severity options can be modified through language strings. The default options are:

- **Unused:** Specifies the characteristic is not available for data entry at run time and is not included in the new samples that are generated. It is retained for historical reasons.
- **Not Monitored:** Specifies the characteristic is available for recording data at run time, but no run rule violations are evaluated.
- **Non-Key:** Specifies the characteristic is available for recording values and checking run rules.
- **Key:** Specifies the characteristic is available for recording values and checking run rules. If a run rule is violated and there are no out-of-control conditions for a critical characteristic nor out-of-spec conditions for either a key or critical characteristic, the result is **Out Of Control - Key**.
- **Critical:** Specifies the characteristic is available for recording values and checking run rules. If a run rule is violated and there are no out-of-spec conditions for a critical characteristic, the result is **Out Of Control - Critical**.

### Default Chart Type

The SPC charting to be used while evaluating run rule violations. The options depend on the type of characteristic.

If the characteristic type is variable, then the default chart type can have X-Bar, X-Individual, and Moving Average. If the characteristic type is binary attribute, then the default chart type can have p or np. If the characteristic type is counted attribute, then the default chart type can have c, u, and DPMO.

### Number of Decimals

The number of decimals allowed for entering variable characteristic results and the number of decimals displayed in a chart for fields like control limits (applicable to both variables and attributes).

If the characteristic type is attribute, then the decimals apply only to p, u, DPMO charts, and statistics.

### Automatic Characteristic Collection

Enables the automatic collection of data within the Sample Recording Object (SRO) and the time interval between measurements within a sample. When a sample transitions to the ready state, at run time, the SRO records all characteristics marked for automatic collection. If multiple measurements are required, an initial measurement is immediately recorded. This is followed by the measurements recorded at a specified time interval. If you select this option, you cannot manually enter data for this characteristic available in the Sample Viewer .Net control.

### Filter by options

You can filter by:

- Entity ID
- Item ID
- Work Order ID
- Operation ID
- Process ID
- Segment Requirement ID
- Segment Response ID
- Spare1, Spare2, Spare3, and Spare4

These options determine the following:

- Data that is to be returned while analyzing rule violations when new data is saved.
- Data that is to be displayed in a chart of the characteristic.

For example, if an operator enters new data for a characteristic, the new data will have contextual information of the entity and possible context of item that is produced, work order running on the entity, process and operation currently being performed, the S95 data or spare fields provided by the user. When the characteristic data is evaluated for a rule violation such as 4 of 5 outside 1 standard deviation, the software retrieves prior results for the characteristic. The **filter\_by** fields filter the returned values to only include those records which have the same value as the specified **filter\_by** fields. If entity and item are enabled as filter fields, then the query retrieves historical records having the same entity and item as the record being saved.

The optional information for defining a characteristic are: description, run rule exceptions, spare fields, and filter\_by options.

## Controlling the Amount of Data Used in Calculating Process Statistics

In addition to a characteristic's **Filter by options** settings, described in the previous topic, the following system parameters can be used to control the amount of sample data that is included in the calculation of process statistics. These parameters are included in the **Display** group of the **General Parameters** module.

### Cut-off time in days to limit the number of samples while calculating process statistics from the samples (0 = Include all samples)

Upper bound on the age of sample data used to calculate process statistics. This time range is applied to the sample's requested time. Use this parameter to exclude sample data that is considered too old to be relevant. For example, setting this parameter to a value of 2 would mean that only the last 2 days of sample data would be used to calculate process statistics.

### Number of samples to consider calculating process statistics

Maximum number of samples to include when calculating process statistics. Use this parameter to tune the performance of the system so that there is not too much data being analyzed.

These two parameters do not affect the calculation of control limits from the data, which is based on the *Samples for Control Limit* setting in the characteristic configuration.

These two parameters are used when calculating the statistics that are recorded in the stats table. They can help you to control system performance and ensure that statistic calculations use only recent data. The *Cut-off time in days* parameter allows you to exclude data that is no longer relevant. The *Number of samples to consider* parameter allows you to tune the performance of the system by placing a cap on how much data will be included in the process statistics calculation. Logically, they would be used together as follows:

- Perform the process statistics calculations on the top <Number of samples to consider> samples from those that were recorded in the last <Cut-off time in days> days.

For example, if 10 samples per day are being recorded, the cut-off time is set to 2 days, and the number of samples to consider is set to 12, then only the most recent 12 samples will be included in the process statistics calculation. However, if the number of samples to consider is set to 30, and there are 2 days worth of samples recorded, then the most recent 20 samples will be included in the process statistics calculation.

## Creating a Characteristic

You must have the privileges to create a characteristic.

### To create a characteristic

1. Open or go to the **Characteristic Definition** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Characteristic**.
3. In the new characteristic's **Properties** window, complete the property settings. See [Characteristic Properties](#).
4. Save the changes.

An error message appears if the characteristic cannot be created. Modify the characteristic, as needed, to correct the error, and save to clear the error.

## Characteristic Properties

### Name

The unique name for the characteristic.

### Description

A description for the characteristic.

### Type

The type of the characteristic.

For more information about the characteristic types and the additional property settings related to them, see [Variable Characteristic Properties](#), [Binary Attribute Characteristic Properties](#), and [Counted Attribute Characteristic Settings](#).

### Unit of Measure

The unit of measure for the characteristic.

### Severity

The enumerated value for the severity type.

### Default Chart

The enumerated value for the default chart. The value depends on the characteristic type.

### Automatic Characteristic Collect

The characteristic that needs to be collected automatically. By default, the False option is selected.

#### Time Interval

The time interval between the measurements when the sample size is greater than one and the characteristic is collected automatically. This shows the delay between measurements within a sample, and is applicable only to variable characteristics.

#### Time Interval Unit

The unit of the interval:

- Seconds
- Minutes
- Hours

#### Number of Decimals

The number of decimals that are to be displayed. By default, the number is 0.

#### Normal Sample Size

The normal number of measurements in a sample.

- If the characteristic type is a variable or an attribute with a fixed sample size, the normal number of measurements in a sample is displayed.
- If the characteristic type is a variable and normal sample size is 1, the data is not grouped.

#### Minimum Sample Size

The minimum number of measurement required in a sample. If a sample is collected and the number of measurements is less than the minimum value, the subgroup is not charted in the SPC charts. The subgroup is also not included while evaluating the run rule violations based on the SPC charts.

#### Maximum Sample Size

The maximum number of measurement required in a sample. You cannot enter more measurements than the maximum measurement value.

#### Number of Defect Opportunities

The number of defect opportunities for every tested item. This is available only for counted attributes.

#### Samples Required Before Control Limits Are Calculated

The number of samples that are required for calculating the control limits. By default, the samples before control limit value is 1.

#### Characteristic Spare1–4

User-defined information about the characteristic.

## Variable Characteristic Properties

Variable characteristics are measured as floating point numbers for parameters, such as width, weight, temperature, and hardness.

If you select a variable type characteristic, you need to provide the following additional information:

## Data Grouping

- Grouped
- Individual

The grouping of data is based on the setting for normal sample size. If the normal sample size is 1, it indicates individual data. If the normal sample size is greater than 1, it indicates grouped data. If it is grouped data, then you can enter the minimum sample size and maximum sample size, where the minimum sample size must be 2 or greater.

## Sample Size

### Normal Sample Size

Used by the Sample Viewer Control for entering manual results. The edit results dialog displays the fields for entry. This is also used by the Sample Recording Object to record automatic data when maximum sample size is Null.

### Minimum Sample Size

Used by the evaluation of control rules stored procedure. When there are several results for the characteristic, control rule violations are evaluated.

### Maximum Sample Size

Used by the Sample Viewer Control as the maximum number of results that can be manually entered for a characteristic. This is also used by the Sample Recording Object for recording automatic data. The Sample Recording Object records up to the maximum sample size.

## Moving Average Span

The number of individual results that are included in a single Moving Average point. The size is displayed in the Moving Average chart.

---

**Note:** The optional information for defining a variable type characteristic are: sample size, trend limits, standard error of regression, X Bar charts, and moving average charts.

---

## Sigma Estimate

Specifies whether the estimated sigma used in control limit calculations and Cp/Cpk calculations use the within subgroup standard deviation or the tables to look for factors to multiply by the range.

## Control Limit Source

You can obtain control limits in the following ways:

### Automatically calculate from data

Allows MES to calculate the control limits. This enables the options to enter the following:

- **Samples for Control Limit:** Specifies the number of samples that are to be included in the calculation. This parameter limits the number of samples used in the calculation of control limits and process statistics, as do the parameters **Cut-off time (in days)** and **Number of samples to consider calculating process statistics**. For

more information, see [Controlling the Amount of Data Used in Calculating Process Statistics](#).

- **Samples required before Control Limits are calculated:** Specifies the minimum number of samples that must exist before applying the calculated control limits to evaluate rule violations.

#### Compute from standard values

Specifies standard mean and standard deviation values that are used to calculate control limits adjusted for sample size (standard mean +/- 3 \* standard deviation / square root of sample size). Selecting this option makes the following parameters available:

- **Standard Mean** (Center Line) includes x-bar, x-individual, and moving average.
- **Standard Mean Is Target**, if selected, indicates that the target is used as the Center Line for the standard mean and the standard mean of the characteristic is not used.
- **Standard Deviation** (Variability Measure) includes range, and sigma.

#### Use preset values

Includes center line and upper and lower control limit values for Xbar, Range Sigma, IX (Individual), IR (Individual Range), Moving Average, Moving Range, and Moving Sigma charts. Enables the user to set control limits for each chart through the Chart and its limits list. For each chart component, you must enter the lower control limit, center line, and upper control limit. Select the **Use preset values** option to enter values for all the chart types.

## Binary Attribute Characteristic Properties

Binary attribute characteristics are measured by using integer numbers.

If you selected **Binary** attribute in the **Characteristic Type** menu, then provide the following information:

### Sample Size Source

Specifies how the sample size is determined for the attribute. The values are as follows:

#### Fixed

Specifies the fixed sample size value in the normal sample size property.

#### Entered

Enables the option to set the minimum and maximum data entry limits for the sample size.

#### Copied from previous

Specifies the same value that is entered. At run time, the Sample Viewer .Net control resets the sample size to the value that was previously saved for the characteristic. This value uses the minimum and maximum sample size properties to set the data entry limits.

**Note:** The optional information for defining a binary attribute characteristic are control limits for preset values.

### Control Limit Source

You can obtain control limits in the following ways:

#### Automatically Calculate from Data

Allows MES to calculate the control limits. This enables the options to enter the following:

- **Samples for Control Limit:** Specifies the number of samples that are to be included in the calculation. This parameter limits the number of samples used in the calculation of control limits and process statistics, as do the parameters *Cut-off time (in days)* and *Number of samples to consider calculating process statistics*. For more information, see [Controlling the Amount of Data Used in Calculating Process Statistics](#).
- **Samples required before Control Limits are calculated:** Specifies the minimum number of samples that must exist before applying the calculated control limits to evaluate rule violations.

#### Compute from standard values

Specifies standard mean and standard deviation values, which are used to calculate control limits adjusted for sample size. This includes the following:

- **Standard Average Proportion:** (Center Line) includes p and np charts. Enter the value as a fraction, such as 0.10 for 10%.
- **Standard Average Proportion Is Target**, if selected, indicates that the target is used as the Center Line for the standard average proportion and the standard average proportion of the characteristic is not used.

#### Use preset values

Includes center line and upper and lower control limit values for p and np charts. Enables the user to set control limits for each chart through the Chart and its limits list. For each chart component, you must enter the lower control limit, center line, and upper control limit.

Select the **Use preset values** option to enter values for all the chart types.

## Counted Attribute Characteristic Settings

Counted attribute characteristics are measured by using integer numbers.

If you selected **Counted attribute** in the **Characteristic Type** menu, then provide the following information:

### Sample Size Source

Specifies how the sample size is determined for the attribute. The values are as follows:

#### Fixed

Specifies the fixed sample size value in the normal sample size property.

#### Entered

Enables the option to set the minimum and maximum data entry limits for the sample size.

#### Copied from previous

Specifies the same value that is entered. At run time, the Sample Viewer .Net control resets the sample size to the value that was previously saved for the characteristic. This value uses the minimum and maximum sample size properties to set the data entry limits.

### Number of Defect Opportunities

This field is enabled for counted attributes. You must enter the number of possible defects on a single unit. For example, if a unit is inspected for a defect on each face of a box with one defect allowed per face, then the number of defect opportunities is 6.

**Note:** The optional information for defining an attribute type characteristic are defect opportunities and control limits for preset values. If the optional information is of a counted attribute type, then you must set the number of defect opportunities.

## Control Limit Source

You can obtain Control Limits in the following ways:

### Automatically Calculate from Data

Allows MES to calculate the control limits. This enables the options to enter the following:

- **Samples for Control Limit:** Specifies the number of samples that are to be included in the calculation. This parameter limits the number of samples used in the calculation of control limits and process statistics, as do the parameters *Cut-off time (in days)* and *Number of samples to consider calculating process statistics*. For more information, see [Controlling the Amount of Data Used in Calculating Process Statistics](#).
- **Samples required before Control Limits are calculated:** Specifies the minimum number of samples that must exist before applying the calculated control limits to evaluate rule violations.

### Compute from standard values

Specifies standard mean and standard deviation values, which are used to calculate control limits adjusted for sample size. This includes the following:

- **Standard Average Number per Unit:** (Center Line) includes c, u, and DPMO charts. Enter the value as a count per unit. For example, if you take 20 samples and enter the standard average number per unit as 5, then a c chart of the data would have a center line at 100.
- **Standard Average Number per Unit Is Target,** if selected, indicates that the target is used as the Center Line for the standard average number per unit and the standard average number per unit of the characteristic is not used.

### Use preset values

Includes center line and upper and lower control limit values for c and u charts. DPMO charts use the same settings as the u chart and are scaled accordingly. Enables the user to set control limits for each chart through the Chart and its limits list. For each chart component, you must enter the lower control limit, center line, and upper control limit.

Select the **Use preset values** option to enter values for all the chart types.

## Assigning an Attribute to a Characteristic

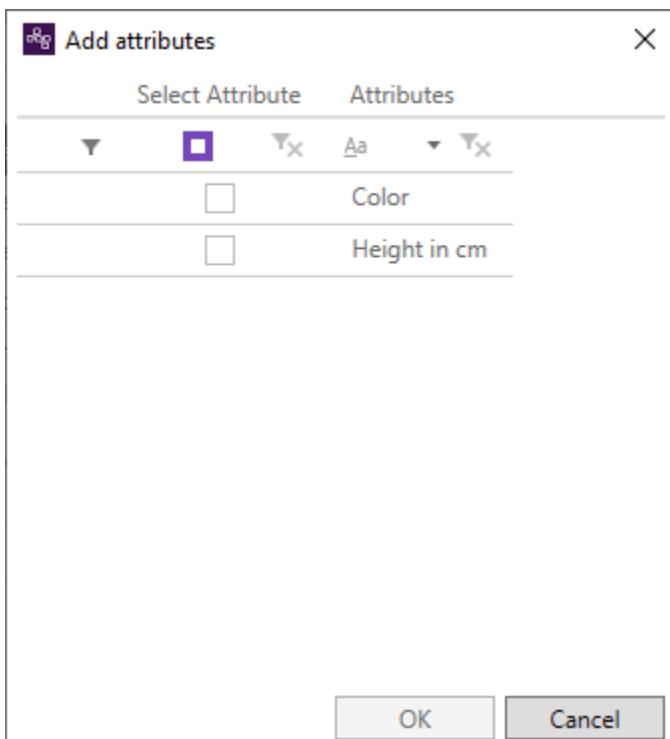
An attribute is an additional user-defined property. You can assign result attributes to a characteristic to provide more information about the runtime result recorded for the characteristic to the users of the MES system. For information about attributes, see [Attributes](#).

### To assign result attributes to a characteristic

1. Select the characteristic.
2. Go to the **Attributes** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add**.

- On the ribbon, go to the **Current View** tab and click **Add**.

The **Add attributes** dialog box appears, listing the result attributes that have not been assigned to the characteristic.



4. Select the attributes to assign to the characteristic and click **OK**.

The selected attributes are added to the **Attributes** tab. Their values are entered during runtime.

5. Save the changes.

## QM Specifications

You can use the **QM Specification** module to create, maintain, and remove quality management specifications.

When you open the **QM Specification Definition** workspace tab, the QM specifications (optionally filtered) are shown.

By default, the **QM Specification** module is in the **Quality Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

A QM specification is the specification for Statistical Process Control (SPC) analysis of various characteristics linked to it. It also specifies the way sampling has to be carried out for each of the linked characteristics.

The context data of a QM specification decides how a linked characteristic is going to be measured during run time. For example, a characteristic, such as temperature can be measured in various contexts like item, entity or operation. This means different samples have to be taken for different contexts for the same characteristic. A QM specification may have the combination of the contexts mentioned above that specifies how the samples are to be collected.

You can configure QM specifications associated to variables and attributes. You can modify QM specifications that are currently effective, and also those that are no longer effective.

You can delete a QM specification from the database. An error message appears if you delete a QM specification

that is currently effective. An error message also appears if there is a sample or characteristic linked to the QM specification. This message shows the number of sample/characteristic combinations that are assigned to the QM specification. If both the error messages appear, they are combined into a single message. The error message allows you to delete the QM specification. For more information on deleting, see [Deleting an Object](#).

An error message appears if the QM specification cannot be saved. Modify the QM specification, as needed, to correct the error and save to clear the error.

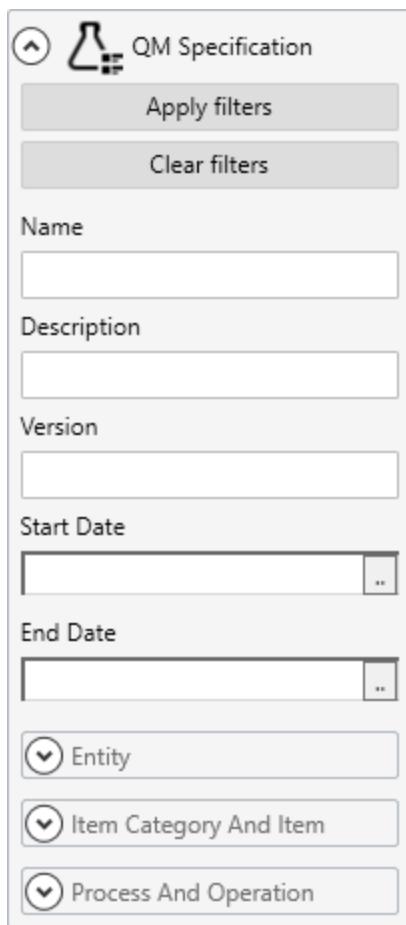
Name	Description	Edit Level	Version	Start Date
BagQuality	Quality of the Bags	1	1	06/05/2021 12:00 AM
BagWeight	Weight of Bag	1	1	06/05/2021 12:00 AM
NutQuality	Quality of Roasted Nuts	1	1	06/05/2021 12:00 AM

Characteristic N	Characteristic D	Target	Lower Specifica	Upper Specifica
BagQuality	Quality of the Bags	0.0000	0.0000	0.0500

## Opening the QM Specification Definitions Workspace Tab

When opening the **QM Specification Definition** workspace tab, the **Apply Filter** function allows you to filter the list of QM specifications to those that match the filter search terms that you enter.

1. In the **Navigation Bar**, in the **Quality Management** group open the **QM Specification** section.



The image shows a search interface titled 'QM Specification' with a magnifying glass icon. It includes 'Apply filters' and 'Clear filters' buttons, and fields for 'Name', 'Description', 'Version', 'Start Date', and 'End Date'. Below these are three dropdown menu options: 'Entity', 'Item Category And Item', and 'Process And Operation'.

2. To not filter the specifications, don't enter any search terms.

To filter the specifications, enter search terms in the available filter options.

**Name**

Name of the QM specification. You can type any character within the QM specification name.

**Description**

Description of the QM specification. You can type any character within the QM specification description.

**Version**

Version of the QM specification. You can type any alphanumeric character of the version.

**Start Date**

Effective start date of the QM specification.

**End Date**

Effective end date of the QM specification.

**Entity**

An entity that is associated with QM specifications. Click the browse button to open an entity picker window.

**Item Category and Item**

An item category or item that is associated with QM specifications. Click the browse button to open an item category and item picker window.

**Process and Operation**

A process and operation that is associated with QM specification. Click the browse button to open a process and operation picker window.

3. Click **Apply Filter**.

The **QM Specification Definition** workspace tab opens, listing the specifications that match the filter search terms.

## Managing QM Specifications

The workspace shows the name, description, version, category, and other details of the QM specification. You can create, modify or delete a QM specification. A QM specification can have multiple versions, where the active version is based on the start and end effective dates. A version is considered active if the start effective date is among the QM specification versions of same name and context and is equal to or less than the current time, and the end effective date is greater than the current time. The active QM specification must have the recent start effective date that is less than the current date.

Multiple QM specifications can be applied to various contexts, such as an entity, item, operation, or a combination of any of these. These QM specifications can be active, and samples can be generated for any of them.

## Creating a QM Specification

You can create a QM specification to define the list of variables and attribute characteristics, the control limits, and the sampling required.

You must have the appropriate privileges to edit QM specification settings.

### To create a QM specification

1. Open or go to the **QM Specification Definition** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New QM Specification**.
3. In the new specification's **Properties** window, complete the property settings. See [QM Specification Properties](#).
4. Save the changes.

If you want to save a QM specification, you must link it to at least one characteristic.

An error message appears if the QM specification cannot be created. Modify the QM specification, as needed, to correct the error, and save to clear the error.

## QM Specification Properties

### Name

The name for the QM specification.

### Description

A description of the QM specification.

#### Edit Level

The number for the required level to edit the current QM specification. The Edit Level is set within the user's group permissions. By default, the edit level value is 1.

#### Version

The version of the QM specification.

The combination of name and version number, and the combination of name and start date, must be unique.

The purpose of the **Version** box is to help you organize the data. It does not indicate whether the QM specification is active or not. The start date and end date of the QM specification determine whether it is active or not.

#### Start Date

The effective start date of the specification. By default, the start date is the current date and the start time is the current time. You can also change the start date to a value other than the current date and time.

#### End Date

The date on which the specification ceases to be effective. By default, the end date is blank.

A QM specification must have an entry in at least one of the context properties: Entity, Item Category and Item, Process and Operation. You can also have entries in multiple context properties.

#### Entity

Click the **Browse** button and select the entity context at which the samples are going to be taken. The selected context can be an entity class, an entity parent, or an end entity. The options available include all entities with the *Can Capture QM Data* capability as well as parents of those entities and entity classes of those entities.

#### Item Category and Item

Click the **Browse** button and select the item context to define the quality samples. The samples are to be collected when an entity with the *Can Capture QM Data* capability is running a job (work order) and producing an item that matches the selected item or item category.

#### Process and Operation

Click the **Browse** button and select the operation context for the QM specification. You can use this option to create quality samples when an entity is running a job (work order) at the specified operation.

#### Sample Plan Name

The default sample plan used by the characteristics within the QM specification. The sample plan has the list of sample frequencies that MES uses to generate samples against an entity within the QM specification.

#### Number of Points Per Page

The number of samples per SPC chart page. This is to ensure that all the SPC charts are displayed consistently. The value of this field must be between 5 and 800. The default value is 18.

The number that must be entered in this field is determined by the resolution of your monitor. If there are too many samples displayed on a page, the chart will not be readable.

#### Display Sequence

Determines the order in which to display this QM specification in a sample that has multiple QM specifications. QM specifications with the same display sequence value are sorted alphabetically.

#### User Defined QM Specification Spare1–4

User-defined information about the QM specification.

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**Note:** The **Description**, **Edit Level**, and **End Date**, and **User Defined QM Specification Spare** properties are

optional.

## Linking a Characteristic to a QM Specification

A QM specification determines the characteristics that are to be sampled and analyzed for various SPC charts and rules.

You can assign or link multiple characteristics to a QM specification.

At least one characteristic must be linked to a QM specification.

The screenshot shows the AVEVA Manufacturing Execution System interface. On the left, the 'QM Specification Definition' pane displays a table of specifications. One row is selected, showing 'BagQuality' with a description 'Quality of the Bags'. On the right, the 'Properties' pane shows configuration for this specification, including 'QM Specification Name' set to 'BagQuality', 'Characteristic Name' set to 'BagQuality', 'Characteristic Type' set to 'Binary attribute', and 'Target' set to '0.0000'. A red box highlights the 'Characteristics' tab in the 'QM Specification Definition' pane, and another red box highlights the 'BagQuality' row in the table below it.

### To link a characteristic to a QM specification

1. Select the QM specification.
2. Go to the **Characteristics** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add Link**.
  - On the ribbon, go to the **Current View** tab and click **Add Link**.

The Add Characteristic Links dialog box appears.

4. Optionally, specify search terms to filter the list of characteristics to select.  
To list all available characteristics, do not specify any search terms.
5. Click **Apply Filters**.

The bottom pane appears, which lists the characteristics that are available to be linked to the QM specification and that match the filter if search terms were entered appear in the bottom pane.

Add Characteristic Links

Name		Description	
Type		Category	
Severity		<input type="button" value="Apply filters"/> <input type="button" value="Clear filters"/>	
Characteristic Name	Characteristic Description		
<input type="checkbox"/> BagWeight	Weight of Bag		
<input type="checkbox"/> NutQuality	Quality of Roasted Nuts		
<input checked="" type="checkbox"/> BagQuality	Quality of the Bags		
<input type="button" value="OK"/> <input type="button" value="Cancel"/>			

6. Select the characteristics you want to assign to the QM specification and click **OK**.

The selected characteristics are added to the **Characteristics** tab.

7. For each characteristic that was added, complete the settings in its **Properties** window as needed. See [Properties for a Characteristic Linked to a QM Specification](#).  
8. Save the changes.

You can delete the characteristics assigned to a QM specification when multiple characteristics are linked to it. However, you cannot delete a characteristic when there is only one characteristic linked to a QM specification.

#### [Properties for a Characteristic Linked to a QM Specification](#)

##### **QM Specification Name**

The name of the QM specification (read only).

##### **Characteristic Name**

The name of the characteristic (read only).

##### **Characteristic Type**

The characteristic type (read only).

##### **Target**

The target value of the characteristic. This is a required field.

### Specifications/Limits

The specifications and limits of the characteristics. Specification limits are customer driven values and are applied to individual result values. You must provide at least one of the following specification limits for the MES Client to calculate capability statistics (Cp, Cpk, Pp, and Ppk):

- **Lower Specification Limit:** Specifies the lower specification limit of the characteristic.
  - **Lower Specification Is:** Specifies whether the limit entered in the previous field is a fixed value, an offset from target, or a percent offset from target. Click to select the lower specification value from the list.
  - **Upper Specification Limit:** Specifies the upper specification limit of the characteristic.
  - **Upper Specification Is:** Specifies whether the limit entered in the previous field is a fixed value, an offset from target, or a percent offset from target. Click to select the upper specification value from the list.
- Fixed value is the value that is used as the Lower Specification Limit or Upper Specification Limit. Offset refers to the value that is subtracted or added from the target value. For example, a Lower Specification Limit offset of 10 will evaluate to an actual Lower Specification Limit of 40 when the target is 50 (i.e., 50 - 10 = 40). Offset percent refers to the specification that is calculated as a percent below or above the target. For example, a Lower Specification Limit percent offset of 10 will evaluate to an actual Lower Specification Limit of 45 when the target is 50 (i.e., 50 - 0.10\*50 = 45). Specification limits are optional, so it is possible to define single sided limits.
- **Lower Data Entry Limit:** Specifies the lower data entry limit of the characteristic. Data entry limits are used to express the range of possible values that the characteristic can accept. Data entry limits are used within the Sample Viewer control which does not accept a manually entered value outside the data entry limits.
  - **Lower Data Entry Limit Is:** Specifies whether the limit entered in the previous field is a fixed value or a multiplier of the specification limit and target. Click to select the value of the lower data entry limit from the list.
  - **Upper Data Entry Limit:** Specifies the upper data entry limit of the characteristic. Data entry limits are used to express the range of possible values that the characteristic can accept. Data entry limits are used within the Sample Viewer control which does not accept a manually entered value outside the data entry limits.
  - **Upper Data Entry Limit Is:** Specifies whether the limit entered in the previous field is a fixed value or a multiplier of the specification limit and target. Click to select the value of the upper data entry limit from the list.

For single sided specifications, the Upper Data Entry Limit and Lower Data Entry Limit is calculated from the provided specification limit. For example, Lower Specification Limit is 10, Target is 20, Upper Specification Limit is 35 and the multiplier is 1.5. The Upper Data Entry Limit is  $1.5 * (Upper\ Specification\ Limit - Target) + Target = 42.5$ . And the Lower Data Entry Limit is  $1.5 * (Lower\ Specification\ Limit - Target) + Target = 5$ . For one sided specifications, the upper and lower data entry limit is calculated from the provided specification limit. For example, Target is 20, Upper Specification Limit is 35 and the multiplier is 1.5. The Upper Data Entry Limit is 42.5 as before, and the Lower Data Entry Limit is -2.5.

### Severity

The severity of the characteristic. Click to select the severity of the characteristic. The available options are:

- Unused
- Not Monitored
- Non-key

- Key
- Critical

The remaining fields are optional overrides for the settings at the characteristic level (or QM specification level for the sample plan name). For more information on these settings, see [Variable and Attribute Characteristic Definitions](#).

#### Default Chart

The default chart type of the characteristic.

#### Control Limit Source

How the control limits will be provided to the system.

#### Samples for Control Limit

The samples for control limits. This field is enabled only when you select **Automatically calculate from data** in the **Control Limit Source** property.

#### Samples required before Control Limits are calculated

The number of samples that are required before calculating the control limits. This is an optional field. By default, the samples before control limit value is Null.

The field is enabled only when you select **Automatically calculate from data** in the **Control Limit Source** property. The **Samples for Control Limit** and **Samples required before Control Limits are calculated** properties are disabled for automatic calculation from data.

#### Standard Mean

The standard mean for control limits. This field is enabled only when you select **Compute from standard values** in the **Control Limit Source** property.

#### Standard Deviation

The standard deviation for control limits. This field is enabled when you select **Compute from standard values** in the **Control Limit Source** property.

#### Charts and Its Limits

The various charts available for a characteristic with its available limits. This field is enabled only when you select **Preset Values** in the **Control Limit Source** property.

- **Chart:** Specifies the type of chart associated with a characteristic. Click to select the chart that you want to associate with a characteristic.
- **Lower Control Limit:** Specifies the lower control limit of the chart.
- **Center Line:** Specifies the center line of the chart.
- **Upper Control Limit:** Specifies the upper control limit of the chart.

#### Sample Size Source

The sample size source for the characteristic. This property is only enabled for attribute characteristics.

**Normal Sample Size:** Specifies the normal size of a sample. This field is only enabled when you select **Fixed** in the **Sample Size Source** property.

**Minimum Sample Size:** Specifies the minimum size of a sample. If you select **Entered** in the **Sample Size Source** property, you need to enter this information at run time.

**Maximum Sample Size:** Specifies the maximum size of a sample. If you select **Entered** in the **Sample Size Source** property, you need to enter this information at run time.

### Auto Collection

Specifies whether the characteristic will be collected automatically.

- **Characteristic Auto Collected:** Select **Yes** to specify that the characteristic will be collected automatically by the system. By default, the **Characteristic Auto Collected** property is set to **Use Characteristic Setting**.
- **Collection Time Interval:** Specifies the time delay between the collections of the characteristics. This field is enabled only if the characteristic is auto collected and the sample size is greater than 1.
- **Time Interval Unit:** Specifies the unit of time interval for collection of the characteristics.

### Determining the Display Order of Characteristics Within a QM Specification

The order in which the characteristics appear in the **Characteristic** tab determines their display order within a QM specification.

You can modify the order by dragging characteristics up or down in the list.

#### To move a characteristic up in the order

- Drag and drop it on the characteristic above it in the list that it should precede in the order.

#### To move a characteristic down in the order

- Drag and drop it on the characteristic below it in the list that it should follow in the order.

### Linking a Control Rule to a QM Specification

The set of control rules linked to a QM specification represents the maximum set of control rules that you can apply to a characteristic linked to the QM specification.

The control rules are linked in a grid in the **Rules** tab. The status of the new linkages is marked as Dirty. You need to save them.

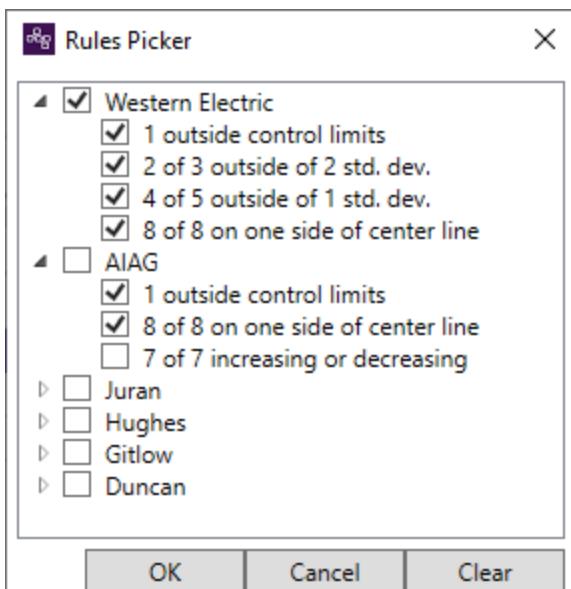
You must have the privileges to link a control rule to a QM specification.

The rule\_desc value must be displayed for the control rule linkage. You cannot modify the rule\_desc value.

#### To link control rules to a QM specification

1. Select the QM specification.
2. On the ribbon, click **Add Link** in the **Current View QM Specification Rule Links** group.

The Rules Picker dialog box appears.



3. Select the rule group to add all the rules within the group or select individual rules.
4. Click **OK**.  
The selected rules are added to the **Rules** tab.
5. Save the changes.

#### To modify which control rules are linked to a QM specification

- Open the Rules Picker dialog box as described above and change which rules are selected, then click **OK**.  
The previous set of rules that were linked are changed to those that were just selected in the Rules Picker dialog box.

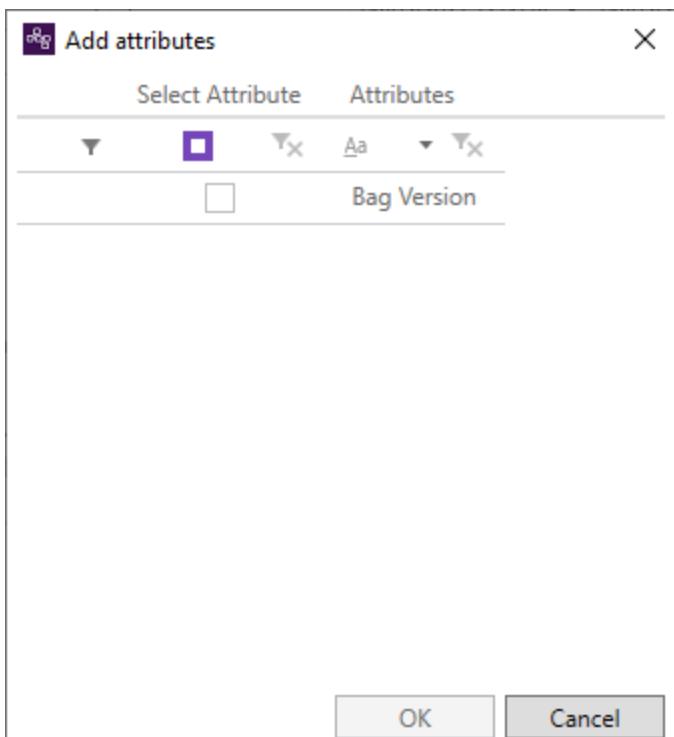
#### Assigning an Attribute to a QM Specification

An attribute is an additional user-defined property. You can assign sample attributes to a QM specification to provide more information about the runtime sample generated from the QM specification to the users of the MES system. For information about attributes, see [Attributes](#).

#### To assign result attributes to a characteristic

1. Select the QM specification.
2. Go to the **Attributes** tab.
3. Do one of the following:
  - Right-click in the tab and on the context menu click **Add Link**.
  - On the ribbon, go to the **Current View** tab and in the **QM Specification Attribute Links** group click **Add**.

The **Add attributes** dialog box appears, listing the sample attributes that have not been assigned to the QM specification.



4. Select the attributes to assign to the QM specification and click **OK**.

The selected attributes are added to the **Attributes** tab. Their values are entered during runtime.

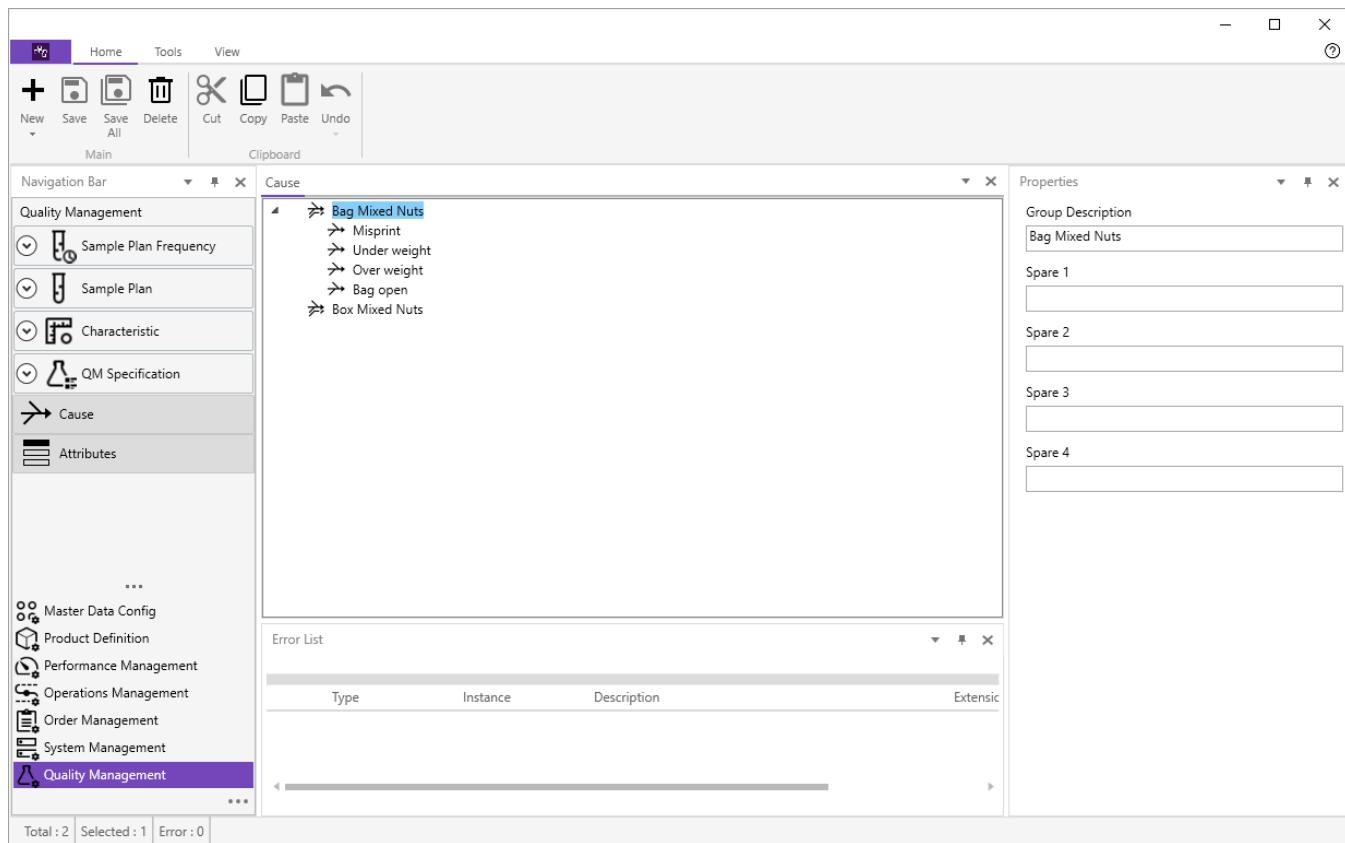
5. Save the changes.

## Causes

Causes can be assigned to characteristic samples. Causes are organized into related cause groups, and cause groups are then linked to characteristics through categories. The cause groups that are linked to a characteristic will be the cause groups that are presented to an SPC chart user when they assign a cause for that characteristic's samples. For information about how to link cause groups to categories, see [Linking Cause Groups to Characteristics](#).

You use the **Cause** module to create and maintain causes. This module is in the **Quality Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

When you open the **Cause** workspace tab, a list of the existing cause groups and causes is shown.



## Creating a Cause Group

You can create a cause group and then add causes to the group.

You must have the appropriate user privilege to edit causes.

Only one user at a time can make changes to a cause or cause group. If a user is changing a cause or cause group, other users will see an error message if they attempt to change the same cause or cause group.

The **Cause** module is in the **Quality Management** group in the **Navigation Bar**. For more information on groups and modules, see [Groups and Modules](#).

### To create a cause group

1. Open or go to the **Cause** workspace tab.
2. Do one of the following:
  - Press the **Ctrl+N** keys.
  - Right-click in the tab and on the context menu click **New Cause Group**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Cause Group**.

A new cause group is added.

3. In the new group's **Properties** window, enter a brief description for the cause group and, optionally, user-defined information in the spare fields about the group.
4. Save the changes.

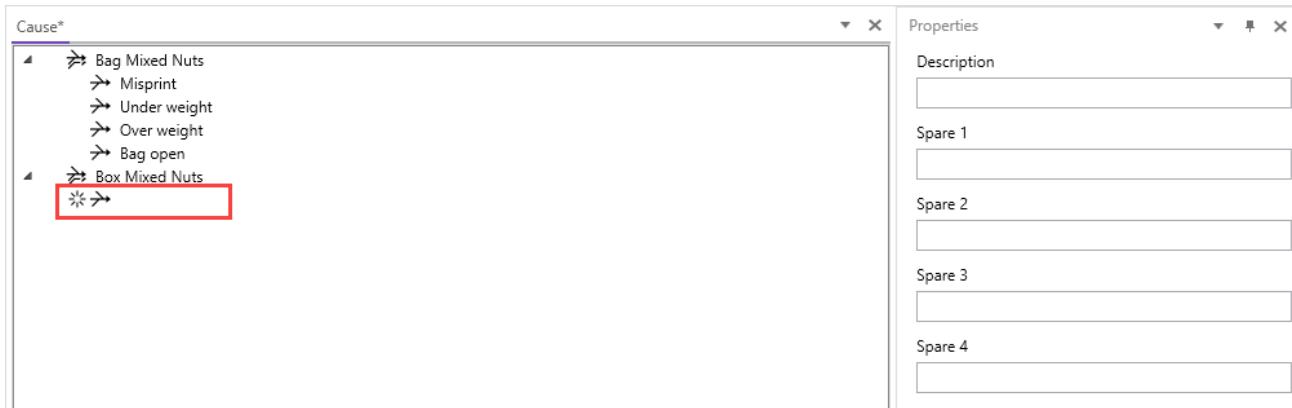
An error message appears if the cause group cannot be created. Modify the cause group, as needed, to correct

the error, and save to clear the error.

## Adding a Cause to a Cause Group

1. Select the cause group or a cause within the group to which you want to add a cause.
2. Do one of the following:
  - Right-click the selected group or cause and click **New Cause**.
  - On the ribbon, go to the **Home** tab and on the **New** menu click **New Cause**.

A new cause displays at the end of the cause group's list of causes.



3. In the new cause's **Properties** window, enter a brief description for the cause and, optionally, user-defined information in the spare fields about the cause.
4. Save the changes.

An error message appears if the cause cannot be created. Modify the cause, as needed, to correct the error, and save to clear the error.

## Arranging the Order of Cause Groups and Causes

In the **Cause** tab, the order of the cause groups and the causes in a cause group is the order that will be presented to an SPC chart user when they assign a cause to a characteristic sample. You can rearrange the order of the cause groups or causes by using drag-and-drop or cut-and-paste.

### To rearrange the order of cause groups or of a cause in a group using drag-and-drop

- Click and drag the cause group or cause to the new location in the hierarchy.

### To move one or more causes from one cause group to another using cut-and-paste

1. Select the causes.
2. On the ribbon, go to the **Home** tab and click **Cut**.
3. Select the destination cause group.
4. On the ribbon, go to the **Home** tab and click **Paste**.

The causes are added at the bottom of the target cause group.

The moving of a cause behaves as follows:

- If the cause is pasted to or dropped on a cause higher in the list of causes within the same group, the moved cause is placed above the target cause.
- If the cause is pasted to or dropped on a cause lower in the list of causes within the same group, the moved cause is placed below the target cause.
- If the cause is pasted to or dropped on a cause in a different cause group, the moved cause is placed above the target cause.
- If the cause is pasted to or dropped on a different cause group, the moved cause is placed at the bottom of the target cause group.

### Copying Causes to Another Cause Group

1. Select the causes to be copied.
2. On the ribbon, go to the **Home** tab and click **Copy**.
3. Select the destination cause group or a cause in that cause group.
4. On the ribbon, go to the **Home** tab and click **Paste**.

The cause is added at the bottom of the target cause group.

### Deleting Cause Groups and Causes

1. Select the cause groups or causes to be deleted.
2. On the ribbon, go to the **Home** tab and click **Delete**.  
A confirmation dialog box appears.
3. To continue with the deletion, click **Yes**.

## MES Supervisor

Use the MES Supervisor application to manage inventory, storage entities, and supply chain connector import and export schedules.

### Getting Started

Manufacturing Execution System (MES) Supervisor is used to perform the following activities:

- Manage inventory
- Manage storage entities
- Manage Supply Chain Connector import and export schedules

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**Note:** Configuration tasks that were in previous versions of Supervisor are now performed in MES Client and exposed through the MES Stateless API.

## User Privileges

User privileges, set in MES Client, will determine the capabilities of each user. Users may be limited to viewing data in specific areas of MES Supervisor. They may be given permission to make changes in some areas, but not others. They may be allowed to add data to or remove it from the database. Each user's experience with MES Supervisor can be customized using MES Client.

The discussion of functionality in this document assumes the ability to do everything possible with MES Supervisor.

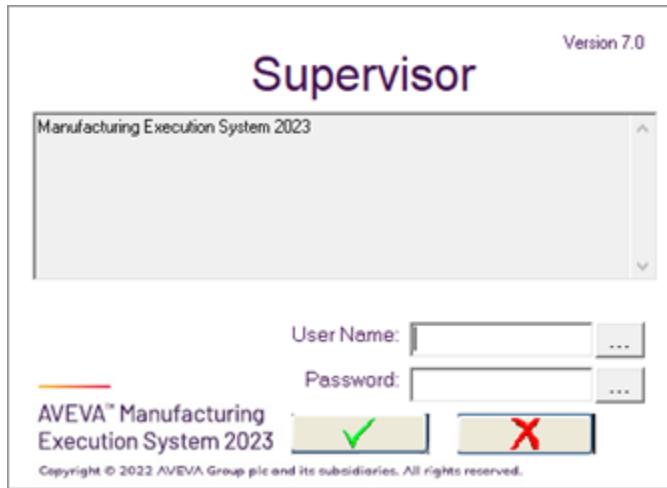
MES is designed to be a modular system of programs, so that only the functionality required by your installation needs to be purchased. Your MES license will determine which features will be available to your users. All functionality of MES Supervisor will be described in this manual, but limitations on your license may cause entire windows or options within windows to be unavailable.

## Logging in to MES Supervisor

The MES Supervisor login window will always contain at least a **Password** field. Depending on your system configuration, the window may also contain a **Login Text** view-only pane and/or a **User Name** field.

1. From the **Start** menu, open the **MES Supervisor** app.

The MES Supervisor login dialog appears.



2. Enter your username and password.

If a keyboard is not attached to the system, click the Browse (...) button next to the **User Name** or **Password** box to open a window that includes an online keyboard.

3. Do one of the following:

- To log in, click the Check Mark button.

MES Supervisor opens.

- To cancel the login attempt, click the X button.

## Managing Inventory

The Inventory window displays the current item inventory in the MES system. Items are stored in storage entities

and in specified lots, if desired. The MES inventory system will allow you to track an item's remaining quantity, grade, status, and expiration date. The current work order may be associated with produced items, to allow tracking of WIP (work in progress) items. Internal movements may be tracked, as well as recording shipments in and out of your system.

Each inventory record reflects the storage of some quantity of a unique combination of item, lot number, and storage entity. In that way, an item may be stored in multiple lots, in multiple locations, and in various grades or states in each lot and/or location. Each combination of these fields will generate its own inventory record.

Item ID	Lot	Quantity Left	Units	Item Description	Item Status Description	Location Status	Entity Name	Item Grade Desc	Expiry Date
BMX-BBQ	LOT202209...	9500	Pieces	Bag of mixed nuts - ...	GOODSTATE	USED	Bagged Mixed Nuts S...	ACCEPTABLE	9/5/2023 2:45:56 am
PNT-BLK	LOT202209...	50.000	kilograms	Peanuts bulk	BADSTATE	USED	Reject Area	BADGRADE	
PNT-BLK	LOT202209...	50.000	kilograms	Peanuts bulk	GOODSTATE	USED	Roaster	ACCEPTABLE	11/5/2022 6:28:03 am
AMD-BLK	LOT202209...	490.000	kilograms	Almonds bulk	GOODSTATE	USED	Silo 1	ACCEPTABLE	12/5/2022 5:16:45 am
CSW-BLK	LOT202209...	500.000	kilograms	Cashews bulk	GOODSTATE	USED	Silo 2	ACCEPTABLE	12/5/2022 5:27:07 am
PNT-BLK	LOT202209...	650.000	kilograms	Peanuts bulk	GOODSTATE	USED	Silo 3	ACCEPTABLE	11/5/2022 6:28:03 am
PNT-BLK	LOT202209...	300.000	kilograms	Peanuts bulk	NORMAL	USED	Silo 4	ACCEPTABLE	12/5/2022 1:28:03 am

The contents of the Inventory window may be customized to suit each user's needs. The **Arrange Columns** option allows you to choose which information from each inventory record should be displayed, and in which order. The **Filter** option allows you to choose which inventory records should be displayed. Both options are described more fully below. For a complete listing of the fields available for display in the Inventory window, see Available Inventory Columns.

Left-clicking a column heading allows you to sort the inventory display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

Left-clicking an inventory record allows you to select that record to be updated by one of the right-click context menu options. Use Ctrl+click to select multiple records for updating.

Right-clicking in the inventory display opens a context menu that contains the following options.

#### Add

Adds some quantity of an item into inventory. This option is discussed in detail in Add Item Window.

#### Transfer

Transfers some quantity of the selected item to another storage entity. This option is discussed in detail in Transfer Out Window.

#### Scrap

Removes some quantity of the selected item from inventory as scrap. This option is discussed in detail in Scrap Window.

#### Reduce

Removes some quantity of the selected item from inventory, for example, because it was damaged or it was shipped as finished goods. This option is discussed in detail in Reduce Window.

#### Lot Attributes

Assigns attributes to the selected item and lot. This option is discussed in detail in Lot Attributes Window.

#### Split Lot

Moves some quantity of the item in the selected inventory record to another lot number, storage entity, grade, and/or status. This option is discussed in detail in Split Lot Window.

#### Combine Lots

Combines some quantity of the selected item from multiple inventory records into one inventory record. This

option is discussed in detail in [Combine Lots Window](#).

#### **Reclassify**

Redefines the grade, status and/or expiration date for the selected items. This option is discussed in detail in [Reclassify Window](#).

#### **Filter**

Allows you to choose what information appears in the Inventory window. This option is discussed in detail in [Inventory Filters Window](#).

#### **Refresh**

Updates and redisplays the Inventory window to reflect any changes made in this window or elsewhere.

#### **Arrange Columns**

Allows you to choose what information from each inventory record is displayed in the Inventory window. The columns available for display are described in [Available Inventory Columns](#).

Attributes assigned to items and/or lots will be available for display in the Inventory window. The attribute names will appear in the Arrange Columns window for you to display in the location of your choice, if desired.

#### **Restore Column Settings**

Restores the column settings (which fields to include and in which order) to the original system settings.

#### **Save Inventory Sequence**

Applies the current sort order of the Inventory window to the MES Operator **Inventory** tab.

#### **Set Auto Refresh Rate**

Allows you to set the Inventory window to automatically refresh itself at the specified interval.

### **Columns Available in the Inventory Window**

Items may be stored in multiple lots, in multiple locations, and in various grades and states for each. Depending on your system configuration, storage entities may store multiple items and/or multiple lots of one item. Each inventory record reflects the storage of some quantity of a unique combination of item, lot number, storage entity, item grade, and item state.

A brief description of the columns available for display in the Inventory window follows:

#### **Date In**

The most recent date/time that a quantity of this item/lot/grade/state was received by this entity.

#### **Date Out**

The most recent date/time that the last quantity of this item/lot/grade/state was removed from storage in this entity.

#### **Entity**

The description of the entity in which this inventory quantity is stored.

#### **Entity ID**

The database ID of the entity in which this inventory quantity is stored.

#### **Entity Name**

The name of the entity in which this inventory quantity is stored.

#### **Expiry Date**

The expiration date for this inventory quantity.

**Item Class Descr**

The description of the item class for this inventory quantity. Defined on the **General** tab of an item node in the Items window.

**Item Class ID**

The item class ID for this inventory quantity. Defined on the **General** tab of an item node in the Items window.

**Item Description**

The description of the item for this inventory quantity. Defined on the **General** tab of an item node in the Items window.

**Item Grade**

The database ID of the item grade assigned to this inventory quantity.

**Item Grade Desc**

The description of the item grade assigned to this inventory quantity.

**Item ID**

The ID of the item for this inventory quantity. Defined on the **General** tab of an item node in the Items window.

**Item Status**

The database ID of the item status assigned to this inventory quantity.

**Item Status Description**

The description of the item status assigned to this inventory quantity.

**Item\_Inv Spare 1-6**

The optional, user-defined fields for this inventory quantity.

**Location Status**

The storage status of the entity used for this inventory quantity. Set automatically by MES or by users in the **Physical Entities** module in MES Client, the Storage Entity Status window of MES Supervisor, or the **Storage** tab of MES Operator.

- **Used:** The entity is currently being used for storage, of some quantity greater than 0 of an item.
- **Available:** The entity is available for storage; it is completely empty. Each entity's definition in MES Client determines whether or not inventory records for 0 quantities are displayed in the Inventory window.
- **Dirty:** If an entity's definition in MES Client allows for Dirty status, the entity's status is automatically changed to Dirty when the last item is removed from it. A Dirty entity is empty but may not be used for storage; a user must change the status to Available on the Storage Entity Status window or on the **Storage** tab of MES Operator.

**Lot**

The lot number (a user-defined string) assigned to this inventory quantity.

**Operation ID**

The ID of the operation during which this inventory quantity was produced. Supplied by MES Operator.

**Quantity Left**

The quantity of this item/lot/grade/state combination currently stored at this entity.

**Quantity Left ERP**

The inventory quantity of this item/lot/grade/state combination that has been reported to ERP.

**Sequence No**

The position number of the job in which this inventory quantity was produced (value may be greater than 0 when multiple jobs are defined within a single operation).

**Units**

The unit of measured used by the product of this job. Defined on the **General** tab of an item node in the Items window.

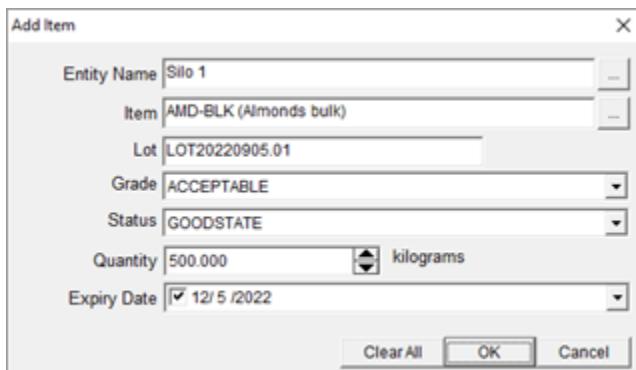
**Work Order ID**

The ID of the work order for which this inventory quantity was produced. Supplied by MES Operator.

Attributes that have been associated with items and/or lots and defined in MES Client as available to the Inventory window will also appear as available column headings. When selected, the columns will appear for every inventory record, but values will appear only as defined elsewhere.

## Add Item Window

The Add Item window allows you to add some quantity of an item into the inventory records of your system.

**Entity Name**

The entity in which the received item will be stored.

If there is already an inventory record for the selected entity in the Inventory window, then the quantity entered here will be added to the current inventory total.

If there is no inventory record for the selected entity, then clicking **OK** after completing the properties in this window will create a new inventory record.

**Item**

The item being received.

**Lot**

Optional; defines the lot number/description for the received item. Often filled with serial numbers.

**Grade**

The grade (physical condition) of the received item.

**Status**

The status of the received item.

**Quantity**

The quantity being received, in terms of the unit of measure assigned to the selected item.

**Expiry Date**

When selected, indicates the received item will have an expiration date associated with it. Click the arrow button to select an expiration date from an on-screen calendar.

An item stored with an expiration date should also be stored with a unique lot number, to distinguish between multiple quantities in inventory.

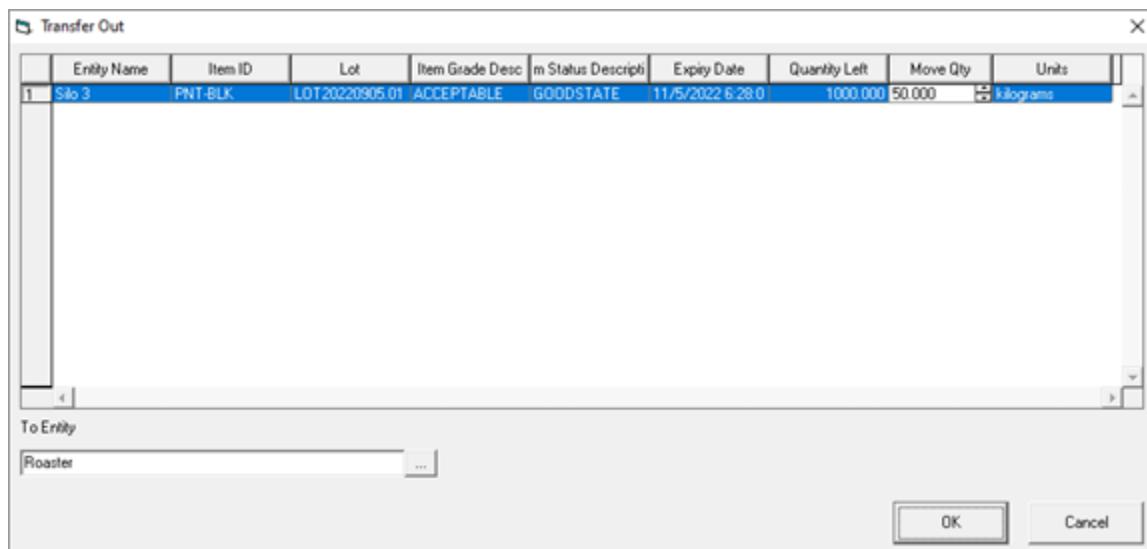
Click **Clear All** to clear all fields of default values.

Click **OK** to add the current item information into inventory records.

Click **Cancel** to close the window without changing inventory records.

## Transfer Out Window

The Transfer Out window allows you to move some quantity of one or more items from their current storage entities to another storage entity within the system. It lists information for all inventory records selected for this transfer.



### Entity Name

The entity at which the selected item is being stored.

### Item ID

The ID of the item selected to be transferred.

### Lot

The lot number of the selected item.

### Item Grade Desc

The grade of the selected item.

### Item Status Description

The status of the selected item.

### Expiry Date

The expiration date of the selected item.

### Quantity Left

The current inventory quantity of the selected item.

### Move Qty

The quantity of the selected item to be transferred.

#### Units

The unit of measure used with the selected item.

#### Location Status

The status of the location.

#### To Entity

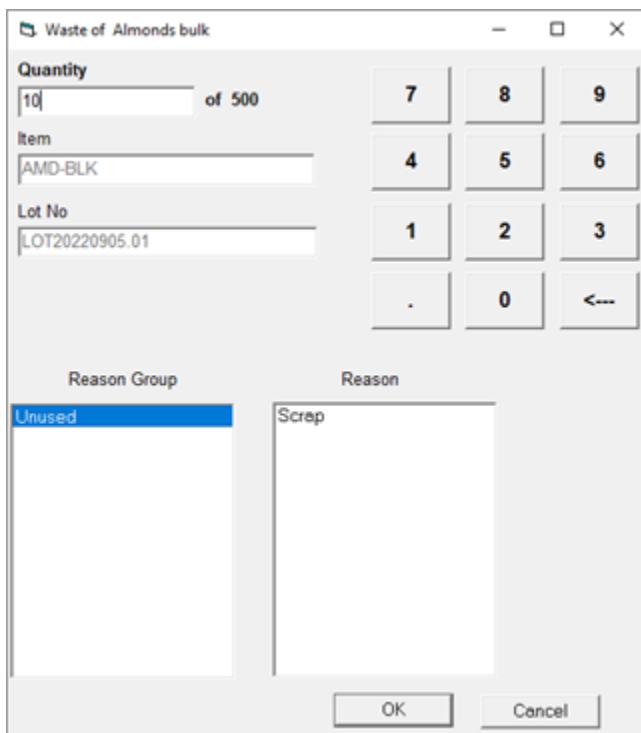
The entity to which the selected item quantities will be transferred.

Click **OK** to change the inventory records to reflect the selected transfer.

Click **Cancel** to close the Transfer Out window without changing inventory records.

## Scrap Window

The Scrap window allows you to remove some quantity of an item from inventory, to reflect the disposal of scrap materials/products. The quantity scrapped is recorded in the Item\_Cons (item consumption) table in the database, where it will be available for reports.



#### Quantity

The quantity of the selected item to be scrapped. The current quantity from the selected inventory record is displayed as the maximum scrap quantity.

#### Item

The item selected to be scrapped.

#### Lot No

The lot number of the selected item.

#### Reason Group

The groups of waste reasons available for the selected item.

#### Reason

The reasons available to explain the current scrap transaction. A reason must be selected for the scrap transaction to be completed.

Reason groups and reasons are defined in MES Client.

Click **OK** to remove the selected quantity from inventory for the selected reason.

Click **Cancel** to close the Scrap window without changing inventory records.

#### Reduce Window

The Reduce window allows you to remove some quantity of one or more items from inventory, for example, because it was damaged or it was shipped as finished goods.

	Entity Name	Item ID	Lot	Item Grade Desc	Item Status Description	Expiry Date	Quantity Left	Reduce Qty	Units
1	Bagged Mixed Nut BMX-BBQ	LOT20220905.02	ACCEPTABLE	GOODSTATE	9/5/2023 2:45:56	10000	500	<input type="text"/>	Pieces

#### Entity Name

The entity at which the selected item is being stored.

#### Item ID

The ID of the item selected to be shipped.

#### Lot

The lot number of the selected item.

#### Item Grade Desc

The grade of the selected item.

#### Item Status Description

The status of the selected item.

#### Expiry Date

The expiration date of the selected item.

#### Quantity Left

The current inventory quantity of the selected item.

#### Reduce Qty

The quantity of the selected item to be shipped.

#### Units

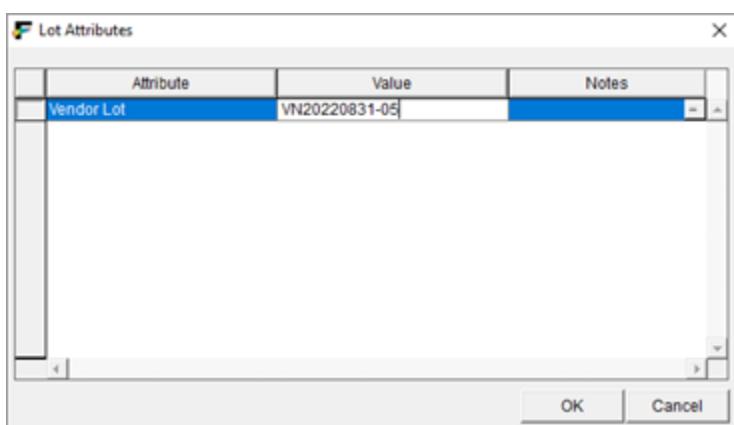
The unit of measure used with the selected item.

Click **OK** to change the inventory records to reflect the selected shipment of items.

Click **Cancel** to close the window without changing inventory records.

### Lot Attributes Window

The Lot Attributes window assigns attributes to the item in the selected inventory record (typically one specific lot). An attribute is an additional property for an item, job, entity, etc., which can supply more detail to other users of your system. All attributes must first be defined in MES Client. For each attribute, a value and/or note may be assigned as well. The ability to edit the Value and/or Notes field of a particular attribute depends on its definition. The information defined here will be available to MES Operator users, on the **Inventory** tab.



#### Attribute

The name of the attribute assigned to this item.

#### Value

The value assigned to the attribute for this item. This field will be inaccessible if the attribute was defined as a Notes Only type. If the attribute's value is of type Item Reason, the Browse (...) button opens a window containing the item reason tree to make reason selection easier. For more information about attribute values of type Item Reason, see [Lot Attributes of Type Item Reason](#).

#### Notes

User-defined information about the attribute for this item. This field will be inaccessible if the attribute was defined as a Value Only type. The Browse (...) button opens a window for easier viewing/entering of longer text. To modify an attribute assignment, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

Right-clicking in the attribute pane opens a context menu that contains the following options:

#### Add

Allows you to assign a pre-defined attribute to the selected item. Select this option to open the Add Attribute window. Mark the check boxes next to all the available attributes that you wish to assign to this item. Click **OK** to continue with the attribute assignment or **Cancel** to stop. All check marked attributes will appear in the Attributes column; you must now fill in the Value and/or the Notes fields and click **Save** to keep these changes or **Cancel** to discard them.

## Delete

Removes the assignment of the selected attribute from the selected item. You will be prompted to confirm the delete command. The attribute itself is not deleted.

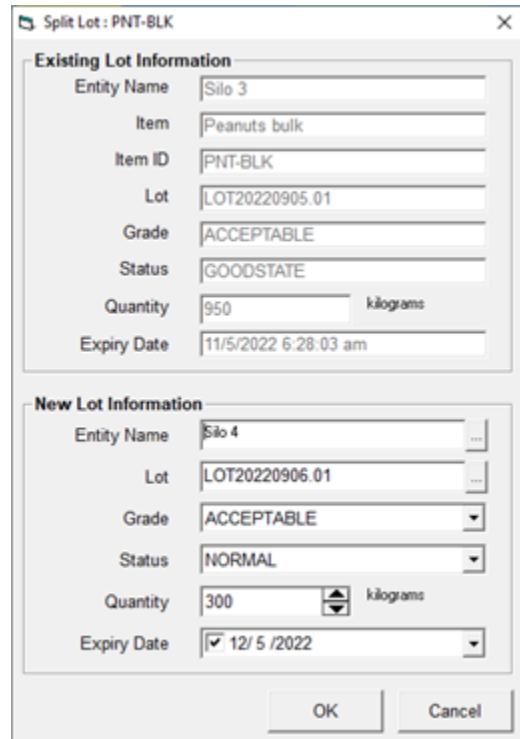
## Lot Attributes of Type Item Reason

Lot attributes, of type Item Reason, can be used to implement multiple hold reasons for an item. During production, the produced items, organized by lot number, will be assigned an item grade and state through the use of an item reason. This grade and state information is used to determine if that lot meets the defined minimal shipping requirements. At the same time, attributes may be added to the production lot. An attribute of type Item Reason would allow the assignment of another grade and state to the same lot. Both grade and state combinations would be considered before shipment of an item from that production lot would be permitted. If used as a 'hold' reason, whenever the 'hold' situation is corrected, the lot attribute would need to be changed or removed in this window to allow the grade and state originally assigned to the lot to take precedence.

For example, a lot could be produced with the item reason of Good Production, which is linked to an item grade of Approved and an item state of Finished Goods. Both of those values have a preference of 1. The lot attribute Hold Reason could be assigned to the lot and given the value of Hold for Customer, which is linked to an item grade of Hold - Good and an item state of Finished Goods. The Hold for Customer state has a preference of 10. If the minimal shipping grade of this item was defined as 2, the lot attribute would prevent this lot of the item from being shipped. When the customer was ready for the shipment, the lot attribute could be removed and the item grade of Approved would become relevant.

## Split Lot Window

The Split Lot window allows you to move some quantity of an item to another lot number, storage entity, item grade, and/or item status in the inventory records of your MES system.



The **Existing Lot Information** pane includes the data for the selected inventory record.

**Entity Name**

The entity in which the selected item is being stored.

**Item**

The description of the selected item.

**Item ID**

The ID of the selected item.

**Lot**

The lot number of the selected item.

**Grade**

The grade (physical condition) of the selected item.

**Status**

The status of the selected item.

**Quantity**

The quantity and unit of measure of the selected item.

**Expiry Date**

The expiration date of the selected item.

The **New Lot Information** pane includes data for the new inventory record.

**Entity Name list**

The entity in which the split quantity will be stored.

**Lot**

Optional; defines the lot number/description for the split quantity. Often filled with serial numbers. Click the Browse (...) button for an on-screen keyboard.

**Grade list**

The grade (physical condition) of the split quantity.

**Status list**

The status of the split quantity.

**Quantity**

The quantity being split from the original quantity, in terms of the unit of measure assigned to the selected item.

**Expiry Date**

When selected, indicates the split quantity will have an expiration date associated with it. Click the arrow button to select an expiration date from an on-screen calendar.

An item stored with an expiration date should also be stored with a unique lot number, to distinguish between multiple quantities in inventory.

Click **OK** to remove the selected quantity from the current inventory record and create the new inventory record as defined above.

Click **Cancel** to close the Split Lot window without changing inventory records.

## Combine Lots Window

The Combine Lots window allows you to combine some quantity of the selected item from multiple inventory records into one record. To enable this option, select one inventory record for the desired item. The window will automatically load all inventory records for that item.

The screenshot shows the 'Combine Lots' dialog box for item 'PNT-BLK'. The main area displays a grid of inventory records:

Entity	Lot No	Grade	Status	Expiry Date	Qty. Left	Combine Qty.	Units
Roaster	LOT20220905.0	ACCEPTABLE	GOODSTATE	11/5/2022 6:28:	50.000	0.000	kilograms
Silo 3	LOT20220905.0	ACCEPTABLE	GOODSTATE	11/5/2022 6:28:	650.000	0.000	kilograms
Silo 4	LOT20220906.0	ACCEPTABLE	NORMAL	12/5/2022 1:28:	300.000	0.000	kilograms

Below the grid is a 'New Lot Information' panel:

New Lot Information	
Entity Name	Silo 3
Lot	
Grade	
Status	
Expiry Date	9 / 5 /2022
<input type="button" value="OK"/> <input type="button" value="Cancel"/>	

The records grid lists information from all inventory records for an item.

### Entity Name

The entity in which the item is being stored.

### Lot No.

The lot number of the item.

### Grade

The grade (physical condition) of the item.

### Status

The status of the item.

### Expiry Date

The expiration date of the item.

### Qty. Left

The current quantity of the item.

### Combine Qty.

The quantity of the item from this inventory record to be combined with the other Combine Qty. values into the new record.

### Units

The unit of measure assigned to the item.

The **New Lot Information** pane includes the data for the new inventory record.

#### Entity Name

The entity in which the combined quantity will be stored.

#### Lot

Optional; defines the lot number/description for the combined quantity. Often filled with serial numbers. Click the Browse (...) button for an on-screen keyboard.

#### Grade

The grade (physical condition) of the combined quantity.

#### Status list

The status of the combined quantity.

#### Expiry Date

When selected, indicates the combined quantity will have an expiration date associated with it. Click the arrow button to select an expiration date from an on-screen calendar.

An item stored with an expiration date should also be stored with a unique lot number, to distinguish between multiple quantities in inventory.

Click **OK** to remove the defined quantities from the current inventory records and create the new inventory record as defined above.

Click **Cancel** to close the Combine Lots window without changing inventory records.

## Reclassify Window

The Reclassify window allows you to change the grade, status, and/or expiration date of one or more selected inventory records.

The Reclassify window displays a grid of inventory records. The columns are: Entity Name, Item ID, Lot, Item Grade Desc, Item Status Description, and Expiry Date. One row is visible, showing 'Roaster' as Entity Name, 'PNT-BLK' as Item ID, 'LOT 20220905.01' as Lot, 'ACCEPTABLE' as Item Grade Desc, 'GOODSTATE' as Item Status Description, and '11/5/2022 6:28:03 am' as Expiry Date. Below the grid are three input fields: 'Grade' (checkbox), 'Status' (checkbox), and 'Expiry Date' (date picker set to '9/5/2022'). At the bottom are 'OK' and 'Cancel' buttons.

	Entity Name	Item ID	Lot	Item Grade Desc	Item Status Description	Expiry Date
1	Roaster	PNT-BLK	LOT 20220905.01	ACCEPTABLE	GOODSTATE	11/5/2022 6:28:03 am

Grade      Status      Expiry Date  
9/5/2022      OK      Cancel

#### Entity Name

The entity in which the item is being stored.

#### Item ID

The item ID of the selected inventory record.

#### Lot

The lot number of the item.

**Item Grade Desc**

The current grade of the item.

**Item Status Description**

The current status of the item.

**Expiry Date**

The current expiration date of the item.

**Grade**

When selected, indicates that the grade of the selected inventory records will be replaced with the grade selected in the list.

**Status**

When selected, indicates that the status of the selected inventory records will be replaced with the status selected in the list.

**Expiry Date**

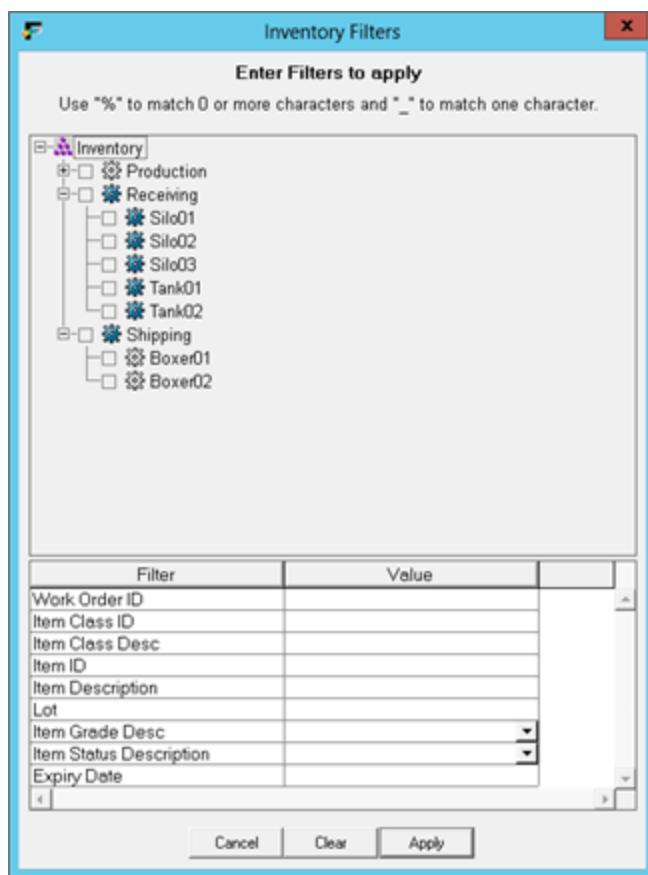
When selected, indicates that the expiration date of the selected inventory records will be replaced with the expiration date selected in the list.

Click **OK** to make the specified changes to the selected inventory records.

Click **Cancel** to close the Reclassify window without changing the inventory records.

## Inventory Filters Window

The Inventory Filters window allows you to control and limit the contents of the Inventory window. To access this feature, select the **Filter** option from the right-click context menu of the Inventory window. The Inventory Filters window appears. Changes to the inventory filter will be saved for the current user, so that each user can easily access that information necessary for his purposes.



### Entity tree

Entities capable of storage are indicated in this tree by boldface type. When one or more entities are checked, inventory records for the selected entities are displayed in the Inventory window. If no entities are checked in this tree, inventory records for all the storage entities will be displayed.

### Filter

The field by which to filter the inventory records.

### Value

The filter string for the corresponding filter field.

Enter a value in any field which you would like to use to limit the contents of the Inventory window. Most values may be specific strings (for exact matches), or may contain wildcards (for pattern-matches). Use the percent (%) character to match any number of characters or the underscore (\_) character to match one character. Some values must be chosen from a list of possible values. Any fields that should not be used by the filter must be left blank.

Click **Apply** to apply this filter to the contents of the Inventory window. The window will be refreshed so that only the selected inventory records remain.

Click **Clear** to clear the filter window of previous filtering values.

Click **Cancel** to close the window without changing the contents of the Inventory window.

## Managing Storage Entities

The Storage Entity Status window displays detailed information about all entities that were defined in MES Client

with the capability *Can Store*. It also allows you to update the storage status and/or current location of some entities.

Entity	Maximum Capacity	Status	Location
Area Temp	0.00	Available	
Bagged Mixed Nuts Storage	0.00	Used	
Bagger	0.00	Available	
Coater	0.00	Available	
Raw Nuts Receiving	0.00	Available	
Reject Area	0.00	Used	
Roaster	0.00	Used	
Scrap Area	0.00	Available	
Shipping	0.00	Available	
Silo 1	10,000.00	Used	
Silo 2	10,000.00	Used	
Silo 3	10,000.00	Used	
Silo 4	50,000.00	Used	Area Temp

### Entity

The name of the storage entity.

### Maximum Capacity

The maximum number of units that can be stored at this entity at one time. 0 indicates unlimited storage.

### Status list

The current storage status of this entity.

- **Used:** This entity is currently being used for storage, of some quantity greater than 0 of some item. This value cannot be changed here.
- **Available:** This entity is available for storage; it is completely empty. If this entity's definition in MES Client allows for Dirty status, the status may be changed from Available to Dirty here, if desired.
- **Dirty:** This entity is unavailable for storage; it is empty, but dirty. This entity's status was automatically changed to Dirty when the last item was removed from it. It may not be used again for storage until its status is changed to Available, either here or in the **Storage** tab of MES Operator.

### Location list

The current location of a movable storage entity. This value may be changed here, if desired.

Left-clicking a column heading allows you to sort the entity display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

To modify a storage entity's status or location, use the list in that field to select the desired value. Click elsewhere in this window, or close the window to save your changes.

Right-clicking in the Storage Entity Status window opens a context menu, containing the following options:

#### Refresh

Updates the window to reflect any changes made in this window or elsewhere.

#### Cancel

Cancels any unsaved changes made to the selected entity.

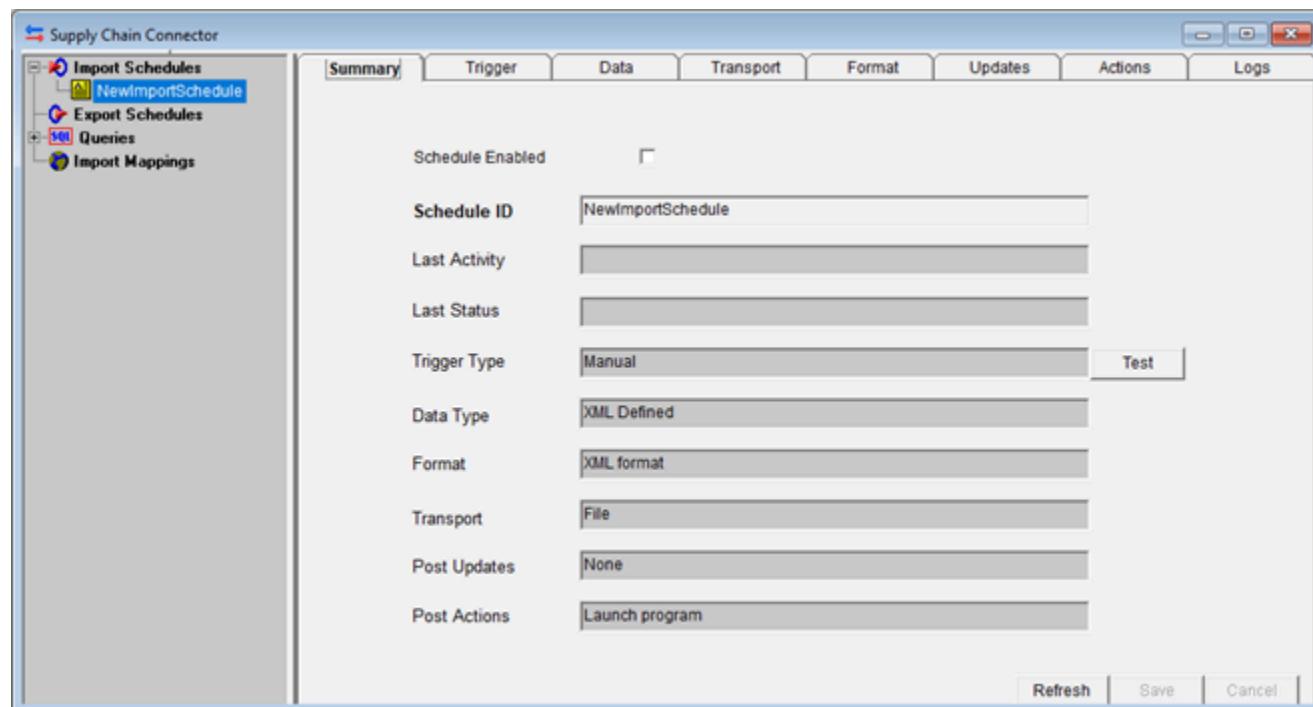
## Importing and Exporting Data Using Supply Chain Connector

Supply Chain Connector allows you to import and export data from MES system to third-party systems such as ERPs. The Supply Chain Connector links your MES system to external databases and other software packages. You may have an ERP system controlling inventory or creating work orders; this information can be passed to MES through Supply Chain Connector. Information about completed work orders and inventory changes can also be passed back to your ERP system or external database.

**Note:** The MES middleware user account must have access to the file directories that are used by Supply Chain Connector. For information about how the MES middleware user account is specified, see the *MES Installation Guide*.

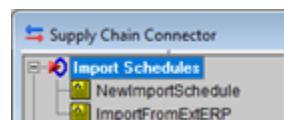
The Supply Chain Connector window in MES Supervisor is used to set up the communications that will occur through Supply Chain Connector. Import schedules, export schedules, queries (used to create the schedules), and import mappings are all defined and maintained in this window.

The window is split into two panes. The tree pane, on the left, contains a tree diagram of all schedules and queries. The detail pane on the right displays the detailed information for the node selected in the schedule tree, organized by tabs for easier access.



### Import Schedules Node

The **Import Schedules** node in the schedule tree is used to display a list of all import schedule definitions.



Right-clicking the **Import Schedules** node opens a context menu that contains the following options:

**Add Import Schedule**

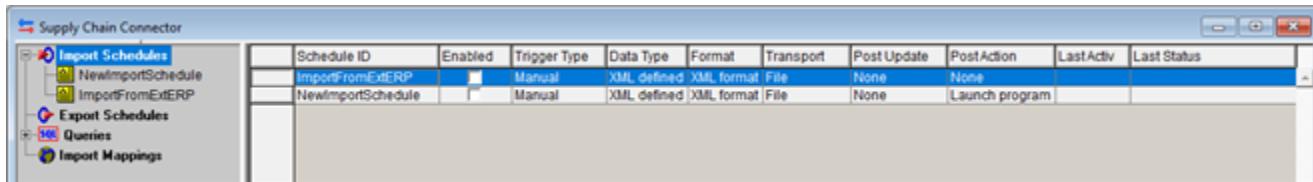
Creates a new import schedule.

#### Refresh All

Updates the entire tree to reflect any changes made in this window or elsewhere.

### Import Schedule Summary

When the **Import Schedules** node is selected in the schedule tree, the detail pane displays a summary of all defined import schedules.



The screenshot shows a software window titled "Supply Chain Connector". On the left is a tree view with nodes: Import Schedules (selected), NewImportSchedule, ImportFromExERP, Export Schedules, Queries, and Import Mappings. To the right is a table with columns: Schedule ID, Enabled, Trigger Type, Data Type, Format, Transport, Post Update, Post Action, Last Activ, and Last Status. There are two rows in the table:

Schedule ID	Enabled	Trigger Type	Data Type	Format	Transport	Post Update	Post Action	Last Activ	Last Status
ImportFromExERP	<input checked="" type="checkbox"/>	Manual	XML defined	XML format	File	None	None		
NewImportSchedule	<input type="checkbox"/>	Manual	XML defined	XML format	File	None	Launch program		

#### Schedule ID

The import schedule name.

#### Enabled

When selected, indicates that the import will be executed automatically, as determined by the selected trigger. If this check box is not selected, the import will not be executed automatically, as determined by the selected trigger.

#### Trigger

Displays when/how often the import will occur.

#### Data Type

The type of data that will be imported.

#### Format

The imported data's format (delimited text, XML, or database table).

#### Transport

The source of the imported data (file or database).

#### Post Update

The action to be taken on the source file after the import has completed.

#### Post Action

The action to take after the import has occurred.

#### Last Activity

The date and time when the import last occurred.

#### Last Status

The completion status of the last import.

Left-clicking a column heading allows you to sort the schedule display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

The schedule data in the summary pane is display only. To modify an import schedule, select the desired import schedule node in the tree and change the desired values on the appropriate tabs.

An import schedule defines the circumstances for importing data from an outside data source into the MES database. The import schedule node is color-coded to reflect the completion status of its last import.



- Yellow indicates no activity, an import schedule that is ready to run or partial activity after the last execution of the import data.
- Green indicates that the last data import was a success.
- Red indicates a failure.

Right-clicking an import schedule opens a context menu that contains the following options:

#### Delete

Deletes the selected import schedule. You will be prompted to confirm the delete.

#### Refresh All

Updates the entire tree to reflect any changes made in this window or elsewhere.

### Summary Tab

The **Summary** tab displays an overview of the selected import schedule's definition. All fields, except **Schedule ID** and the **Schedule Enabled** check box, are read-only, reflecting values defined on the appropriate tab or set by the system.

Summary		Trigger	Data	Transport	Format	Updates	Actions	Logs
Schedule Enabled	<input type="checkbox"/>							
Schedule ID	NewImportSchedule							
Last Activity								
Last Status								
Trigger Type	Manual					<input type="button" value="Test"/>		
Data Type	XML Defined							
Format	XML format							
Transport	File							
Post Updates	None							
Post Actions	Launch program							
<input type="button" value="Refresh"/> <input type="button" value="Save"/> <input type="button" value="Cancel"/>								

#### Schedule Enabled

When selected, indicates that the import will be executed automatically. If this check box is not selected, the import will not be executed automatically.

#### Schedule ID

Identifies the schedule in all MES data records. The schedule ID must be unique. You can edit this entry only when creating a new schedule. Once the schedule is saved, the schedule ID is read-only.

#### Last Activity

The date and time when the import last occurred.

#### Last Status

The completion status of the last import.

#### Trigger Type

Displays when/how often the import will occur.

#### Data Type

The type of data that will be imported.

#### Format

The imported data's format (delimited text, XML, or database table).

#### Transport

The source of the imported data (file or database).

#### Post Updates

The action to be taken on the source file after the import has completed.

#### Post Actions

The general action to be taken after the import has completed.

When defining a new import schedule or selecting/clearing the **Schedule Enabled** check box, click **Save** to save your changes or **Cancel** to discard them. To modify other parts of an import schedule, select the appropriate tab and change the desired values there.

Click **Test** to manually initiate the data import, testing the current definition.

Click **Refresh** to update the **Summary** tab to reflect any changes made in this window or elsewhere.

### Trigger Tab

The **Trigger** tab defines the duration and frequency to run the import schedule.

The screenshot shows a software interface with a top navigation bar containing tabs: Summary, Trigger, Data, Transport, Format, Updates, Actions, and Logs. The 'Trigger' tab is currently selected. Below the tabs, there are two input fields: 'Trigger Type' (set to 'Daily') and 'Trigger Time' (set to '12:00 PM'). At the bottom right of the form area are two buttons: 'Save' and 'Cancel'.

The **Trigger type** list includes the event types, described below, that will initiate the data import. Other fields will appear, as needed, for each entry in this list.

#### Manual

Schedule will not run automatically.

- **Test button:** Initiates the data import.

#### Daily

Schedule will run once each day.

- **Trigger Time:** The starting time for the data import.

### Weekdays

Schedule will run once each weekday (M, Tu, W, Th, and F).

- **Trigger Time:** The starting time for the data import.

### Weekly

Schedule will run once each week.

- **Trigger Day and Time:** The day and starting time for the data import.

### Every N minutes

Schedule will run repeatedly during the specified interval.

- **Every How Many Minutes:** The time interval between data imports.
- **Starting and Ending Time:** Defines when the first and last data imports will occur.

### File exists

Schedule will check every minute for the specified file; when the file is found, the schedule will run.

- **File Path and Name:** The path and name of the file triggering the data import. The Browse (...) button opens a file browser window.

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**Note:** The MES middleware user account must have access to the file directories that are used by Supply Chain Connector. For information about how the MES middleware user account is specified, see the *MES Installation Guide*.

---

### Table data exists

Schedule will connect to the specified database and run the specified query every minute; when data is returned the schedule will run.

- **DB Connection String:** Full connection string to access the database. For example:

```
Provider=SQLOLEDB;Data Source=1.1.1.1\MES;Initial Catalog=MESDB;Integrated Security=SSPI;
```

- **Test button:** Tests the DB Connection string, to ensure the database is accessible.
- **Query:** The database query, which will generate the import data.
- **Test button:** Tests the query.

### Completed SCC schedule

Schedule will run when another import or export schedule has finished running, if that schedule did not fail.

- **Import Schedules:** The import schedule will run.
- **Export Schedules:** The export schedule will run.
- **Trigger Schedule:** The import schedule after which the current import schedule will run.

### Completed or failed SCC Schedule

Schedule will run when another import schedule has finished running, regardless of its success or failure.

- **Trigger Schedule:** The import schedule after which the current import schedule will run.

To modify the trigger, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

## Data Tab

The **Data** tab defines the type of data which will be imported, and how that data will update the MES database. It also indicates which data fields will be come from the import source and defines default values for the others.

Summary	Trigger	Data	Transport	Format	Updates	Actions	Logs																																																																														
<div style="margin-bottom: 10px;"> <b>Import Data Type</b> <input type="text" value="Items"/> </div> <div> <b>If Rows Exist</b> <input type="text" value="Update"/> </div> <table border="1" style="width: 100%; border-collapse: collapse; font-family: monospace;"> <thead> <tr> <th style="width: 30%;">Field Description</th> <th style="width: 10%; text-align: center;">/</th> <th style="width: 60%;">Default</th> </tr> </thead> <tbody> <tr><td>auto_reorder</td><td style="text-align: center;"><input checked="" type="checkbox"/></td><td style="text-align: center;">0</td></tr> <tr><td>inv_unique_by_job</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">0</td></tr> <tr><td>item_class_id</td><td style="text-align: center;"><input checked="" type="checkbox"/></td><td></td></tr> <tr><td>item_desc</td><td style="text-align: center;"><input checked="" type="checkbox"/></td><td></td></tr> <tr><td>item_id</td><td style="text-align: center;"><input checked="" type="checkbox"/></td><td></td></tr> <tr><td>last_lot_no</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>last_sublot_no</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>lifetime</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>lot_no_format</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>max_lot_size</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>max_order_size</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>max_sublot_size</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>min_grade</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>min_inv_level</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>min_state</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>min_trace_inv</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>must_complete_steps</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">0</td></tr> <tr><td>must_prod_reqd_qty</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">0</td></tr> <tr><td>notes</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>num_decimals</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">7</td></tr> <tr><td>obsolete</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">0</td></tr> <tr><td>purchased</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">0</td></tr> <tr><td>reorder_amt</td><td style="text-align: center;"><input type="checkbox"/></td><td></td></tr> <tr><td>serial_no_M</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">-1</td></tr> <tr><td>sold</td><td style="text-align: center;"><input type="checkbox"/></td><td style="text-align: center;">1</td></tr> </tbody> </table> <div style="text-align: right; margin-top: 10px;"> <input type="button" value="Save"/> <input type="button" value="Cancel"/> </div>								Field Description	/	Default	auto_reorder	<input checked="" type="checkbox"/>	0	inv_unique_by_job	<input type="checkbox"/>	0	item_class_id	<input checked="" type="checkbox"/>		item_desc	<input checked="" type="checkbox"/>		item_id	<input checked="" type="checkbox"/>		last_lot_no	<input type="checkbox"/>		last_sublot_no	<input type="checkbox"/>		lifetime	<input type="checkbox"/>		lot_no_format	<input type="checkbox"/>		max_lot_size	<input type="checkbox"/>		max_order_size	<input type="checkbox"/>		max_sublot_size	<input type="checkbox"/>		min_grade	<input type="checkbox"/>		min_inv_level	<input type="checkbox"/>		min_state	<input type="checkbox"/>		min_trace_inv	<input type="checkbox"/>		must_complete_steps	<input type="checkbox"/>	0	must_prod_reqd_qty	<input type="checkbox"/>	0	notes	<input type="checkbox"/>		num_decimals	<input type="checkbox"/>	7	obsolete	<input type="checkbox"/>	0	purchased	<input type="checkbox"/>	0	reorder_amt	<input type="checkbox"/>		serial_no_M	<input type="checkbox"/>	-1	sold	<input type="checkbox"/>	1
Field Description	/	Default																																																																																			
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sold	<input type="checkbox"/>	1																																																																																			

### Import Data Type list

The type of the data that will be imported. The choices are pre-defined, based on the structure of the MES database.

If you select the Import from COM object option, the **If Row Exists** list and the **Data Table** are replaced by **COM Object**, **Method to Call on the COM Object**, and **Method Context Parameter** fields.

### If Rows Exist list

Indicates what action should be taken if the rows, being imported, already exist in the database.

- **Ignore:** Ignore the imported data; consider it to be a duplicate.

- **Update:** Update the database row to match the incoming data.
- **Treat as error:** Enter an error message into the log, skip that row, and continue the data import.
- **Delete:** Delete the row in the database.
- **Delete all:** Delete all rows that match with the incoming data related to the composite primary keys from the database table.
- **Ignore and treat as success:** Ignore the imported data and display the status as success in the **Log** tab.

### Data Table

If the **Import Data Type** is not **Import from COM Object** or **XML Defined**, displays the data fields available for the selected data type, identifies those fields that will be included in the import data, and allows default values to be defined for the other values. Left-clicking a column heading allows you to sort the display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

- **Field Description:** Identifies the database field into which the data will be imported. Required field names are shown in bold type.
- **Included:** When selected, indicates that data field will be found in the imported data.
- **Default:** The default value to be used if the field is not included in the imported data.

### COM Object

The name of the COM object.

### Method to Call on COM Object

The name of the method that is to be called on the COM object.

### Method Context Parameter

The value of the method context parameter. It is a single variable parameter. However, you can specify a list of values for this parameter.

For more information about COM object method calls, see Supply Chain Connector Imports and Exports via a COM Object.

To modify the data definitions, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

## Behavior of the Delete and Delete All Actions for Certain Import Data Types

The **Delete** and **Delete all** actions in the **If Rows Exist** list will be available for all import types even when the action is not applicable. The following limitations for the listed import data types are by design.

### Attribute Set

Neither **Delete** nor **Delete all** are supported.

### Entities

**Delete all** is not supported.

### Languages

**Delete all** is not supported.

### Lot Attributes

For a comma-delimited file, **Delete all** requires that at least the first two fields are supplied.

### Operation Attributes

For a comma-delimited file, **Delete all** requires that at least the first two fields are supplied.

#### SO

**Delete all** is not supported.

#### SO Line

**Delete all** is not supported.

#### Utilization Reasons

**Delete all** will delete all utilization reasons for all groups, even when a utilization reason group ID is specified, whether the utilization reason group ID is legitimate or not.

#### Import Data Types Having Only a Single Primary Key Field

For the import data types that have only a single primary key field—Customer, Item Class, Item Reasons, Items, Language Groups, Processes, Sites, Specs, Standard Operations, Utilization States, Utilization Reason Group, and Work Orders (either sort)—MES Supervisor does not allow the primary key field to be unchecked. Therefore, both the **Delete** and **Delete all** actions will delete all rows in the MES database that match the primary key field of the incoming data. The fact that the selection of the primary field for these import data types is required is intentional, as this prevents the deletion of all records of a particular data type.

### Behavior of Importing Work Orders from a Process

If **Import Data Type** is Work Orders (With Process) and **If Rows Exist** is Update, then one of the following will occur during the import of a work order from a process:

- If the work order does not exist, the work order is created.
- If the work order exists but it has jobs that are running or completed, no update is performed.
- If the work order exists and has no jobs that are running or completed, only the following work order properties are updated: the required quantity, the release and required finish times, the description, the priority, customer information, the manufacturing order, and notes.

For its jobs, the following updates are made:

- The job quantities are adjusted according to the quantities set for the work order.
- The required finish times for the last jobs are set to those of the work order.
- The required finish times of the rest of the jobs (other than the last jobs) are adjusted by the amount that the required finish times of the last jobs were changed.

### Transport Tab

The **Transport** tab identifies the source (type and location) of the imported data.

The screenshot shows the 'Transport' tab of an import dialog. The tab bar includes Summary, Trigger, Data, Transport, Format, Updates, Actions, and Logs. The Transport tab is active. It contains three input fields: 'Transport Type' set to 'File', 'Import From' containing the path '\\QAServer\ERP\Item\_master.csv', and 'Append Errors to' containing the path '\\QAServer\ERP\Item\_master.err'. At the bottom are 'Save' and 'Cancel' buttons.

The **Transport type** list includes the data source types, described below. Other fields will appear, as needed, for each entry in this list.

#### File

The imported data will be coming from a file.

- **Import From:** The location of the file that contains the import data.
- **Append Errors to:** The location of the file to append the error/comments.

---

**Note:** The MES middleware user account must have access to the file directories that are used by Supply Chain Connector. For information about how the MES middleware user account is specified, see the *MES Installation Guide*.

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#### Database Table

The imported data will be coming from a database table. The database used is the one identified on the **Trigger** tab.

- **DB Connection String:** Full connection string to access the database. For example:

```
Provider=SQLOLEDB;Data Source=1.1.1.1\MES;Initial Catalog=MESDB;Integrated Security=SSPI;
```

- **Test button:** Tests the DB Connection string, to ensure the database is accessible.
- **Query:** Defines a valid database query, which will generate the import data.
- **Test button:** Tests the query.

To modify the transport definition, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

#### Format Tab

The **Format** tab indicates the imported data's format and defines its row structure.

The screenshot shows the 'Format' tab of a configuration interface. At the top, there is a navigation bar with tabs: Summary, Trigger, Data, Transport, Format, Updates, Actions, and Logs. The 'Format' tab is currently selected. Below the tabs, there are two dropdown menus: 'Data Format' set to 'Delimited text' and 'Delimiter Character' set to 'Comma'. There is also a checked checkbox labeled 'Import File Includes Header Row'. Below these settings is a large grid table titled 'Field Description' with columns for 'Field Description', 'Field Index', and 'Mapping ID'. The table contains four rows of data:

	Field Description	Field Index	Mapping ID
1	item_id	1	
2	item_desc		
3	item_class_id		
4	uom_id		

At the bottom right of the grid are 'Save' and 'Cancel' buttons.

The **Data Format** list includes the list of format types of the data source, as described below. Other fields will appear, as needed, for each entry in this list.

## Delimited Text

### Delimiter Character list

The character that will separate rows in the import data.

### Import File Includes Header Row

Indicates whether to include or ignore the first row that represents the heading in the import data file while importing the data.

### Data Table Definition

Lists all fields selected on **Data** tab for inclusion in import data. Left-clicking a column heading allows you to sort the display by that field. Click that heading again to reverse the sort order.

- **Field Description:** Identifies the database field into which the data will be imported.
- **Field Index:** The order of that data value in the flat file. A flat file is a source file that you can use for your imports. For example, a text or CSV file.
- **Mapping ID:** Defines what mapping import, if any, is to be used to translate the imported data.

## XML Format

The screenshot shows a software interface for configuring XML data format. At the top, there are tabs: Summary, Trigger, Data, Transport, Format (which is selected), Updates, Actions, and Logs. Below the tabs, there are two dropdown menus: "Data Format" set to "XML format" and "Field Data as XML Element or Attributes" set to "Standard ADO attribute based XML". A large table below these dropdowns lists field mappings:

Field Description	XML attribute Name	Mapping ID
item_class_id	item_class_id	
item_desc	item_desc	
item_id	item_id	
uom_id	uom_id	

At the bottom right of the interface are "Save" and "Cancel" buttons.

### Field Data as XML element or attributes list

- **Standard ADO attribute based XML**
- **Element based XML**

### XML element name to contain rows

Indicates which XML element will hold the row definitions.

### Data Table Definition grid

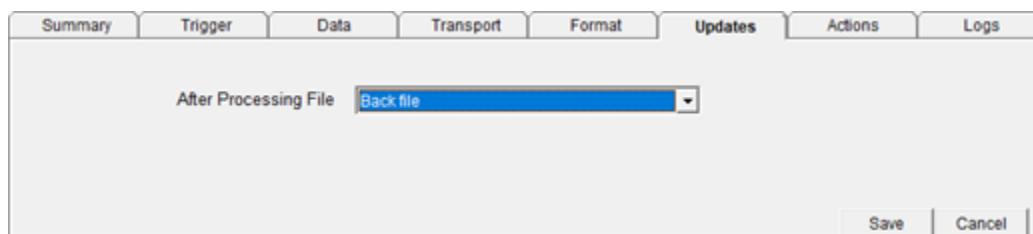
Lists all fields selected on **Data** tab for inclusion in import data. Left-clicking a column heading allows you to sort the display by that field. Click that heading again to reverse the sort order.

- **Field Description:** Identifies the database field into which the data will be imported.
- **XML attribute Name:** The name used in the XML file that maps to the database field name.
- **Mapping ID:** Defines what mapping import, if any, is to be used to translate the imported data.

To modify the format definition, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

### Updates Tab

The **Updates** tab indicates the action to be taken on the source file after the data import has completed.



The **After Processing File** list selection specifies the post-import action on the file. The options are:

#### None

Do nothing to the import file.

#### Delete File (if data source is a file)

Delete the import file.

#### Back File (if data source is a file)

Creates a file backup for the last imported file of this schedule by appending a date/time stamp.

#### Update Source Rows (if data source is a database table)

Update the source rows based on the selections for **For each row successfully imported** and **For each row where import failed**.

To modify the update action definition, select the field and change its value. Click **Save** to keep your change or **Cancel** to discard it.

### Actions Tab

The **Actions** tab defines the general action to be taken after the data import has completed.

The screenshot shows the 'Actions' configuration screen. The 'Actions' tab is active. The 'Action After Processing' dropdown is set to 'Launch program'. The 'On Success', 'On Partial Success', and 'On Error' checkboxes are all checked. The 'Pgm. Path and Parameters' field contains the value 'C:\CustomApp\EXE\sched\_id,@session\_Id'. At the bottom right are 'Save' and 'Cancel' buttons.

The **Action after processing** list selection specifies the general action to be taken after the data import has completed, as described below. Other fields will appear, as needed, for each entry in this list.

**Note:** The MES middleware user account must have access to the file directories that are used by Supply Chain Connector (for example, those specified in the E-mail **Attachment** and Launch program **Pgm. Path and Parameters** properties). For information about how the MES middleware user account is specified, see the *MES Installation Guide*.

## None

No action will be taken.

## Send E-mail

Sends an e-mail to the recipient only if the e-mail account is configured properly for the user who is triggering this schedule.

### On Success

When selected, indicates that an e-mail should be sent when the data import is successful.

### On Partial Success

When selected, indicates that an e-mail should be sent when the data import is partially successful. When

### On Error

When selected, indicates that an e-mail should be sent when the data import fails.

### E-mail to

E-mail address or user ID to receive the import status e-mail.

### Attachment

Path/filename to attach to the e-mail; often an error file. Click the Browse (...) button for a file browser.

## Launch program

Execute the specified program.

### On Success

When selected, indicates that the program should be executed when the data import is successful.

### On Partial Success

When selected, indicates that the program should be executed when the data import is partially successful.

**On Error**

When selected, indicates that the program should be executed when the data import fails.

**Pgm. Path and Parameters**

Complete path/executable, command, or batch file to run.

To modify the action definition, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

**Logs Tab**

The **Logs** tab displays the execution history of the selected import schedule.

Summary	Trigger	Data	Transport	Format	Updates	Actions	Logs
Activity at	Status	Triggered by	Rows Success	Rows Failed	Comments	Error Description	
9/5/2022 3:01:02 pm	Success	SCHEDULE E	6	[NULL]	Summary of Import Process		
9/5/2022 3:01:02 pm	Error	SCHEDULE E	0	[NULL]	Import failed while extracting XML data	Err No. 91, Desc: Object v	
9/5/2022 3:00:34 pm	Success	SCHEDULE E	7	[NULL]	Summary of Import Process		
9/5/2022 3:00:07 pm	Success	SCHEDULE E	7	[NULL]	Summary of Import Process		
9/5/2022 2:59:44 pm	Success	SCHEDULE E	8	[NULL]	Summary of Import Process		

**Activity At**

The date and time of a data import using this import schedule.

**Status**

The completion status of that data import.

**Triggered By**

The method used to trigger that data import.

**Rows Successful**

The number of rows imported successfully.

**Rows Failed**

The number of rows that could not be imported.

**Comments**

Displays any comments generated by the system during the data import.

**Error Description**

Displays any error description generated by the system during the data import.

Left-clicking a column heading allows you to sort the history display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

Click **Refresh** to update this tab to reflect any changes made elsewhere.

Click **Clear Log** to delete all log data for the selected import schedule.

Click **Delete** to delete the currently selected row from this import schedule's history log.

Right-clicking on the **Logs** tab opens a context menu that contains the following options:

**Refresh**

Refreshes the log listing.

#### **Clear Log**

Clears the log listing.

#### **Delete**

Deletes the selected log.

## **Export Schedules Node**

The **Export Schedules** node in the schedule tree is used to organize all export schedule definitions.



Right-clicking the **Export Schedules** node opens a context menu that contains the following options:

#### **Add Export Schedule**

Creates a new export schedule.

#### **Refresh All**

Updates the entire tree to reflect any changes made in this window or elsewhere.

## **Export Schedule Summary**

When the **Export Schedules** node is selected in the schedule tree, the detail pane displays a summary of all defined export schedules.

Supply Chain Connector									
	Schedule ID	Enabled	Trigger Typ	Query Description	Format	Transpc	Post Updat	Post Activ	Last Run
Import Schedules	ExportItems	<input checked="" type="checkbox"/>	Manual	Audit Trail History Reports	XML format	File	None	None	
Export Schedules	NewExportSchedule	<input type="checkbox"/>	Manual	Audit Trail History Reports	XML format	File	None	None	

#### **Schedule ID**

The export schedule name.

#### **Enabled**

When selected, indicates that the export will be executed automatically, as determined by the selected trigger. If this check box is not selected, the export will not be executed automatically.

#### **Trigger Type**

Displays when/how often the export will occur.

#### **Query Description**

The name of the query that will be used to select data for the export process.

#### **Format**

The exported data's format (delimited text or XML).

#### **Transport**

The target for the exported data (file or database).

#### Post Update

Unavailable for export schedules.

#### Post Action

The action to take after the export has occurred.

#### Last Activity

The date and time when the export last occurred.

#### Last Status

The completion status of the last export.

Left-clicking a column heading allows you to sort the schedule display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

The schedule data in the summary pane is read-only. To modify an export schedule, select the desired in the tree and change the desired values on the appropriate tabs.

There is no context menu available in the summary pane for the **Export Schedules** node.

#### Creating

The **Add Export Schedule** option is available on the context menu of the **Export Schedules** node.

#### Deleting

The **Delete** option is available on the context menu of an export schedule node.

An export schedule defines the circumstances for exporting data from your MES database to an outside data system. The export schedule node is color-coded to reflect the completion status of its last export.



- Gray indicates that the export schedule has never been executed.
- Green indicates that the last data export was a success
- Yellow indicates that the last data export was a partial success.
- Red indicates that the last data export was a failure.

#### Summary Tab

The **Summary** tab displays an overview of the selected export schedule's definition. All fields and options, except **Schedule ID** and **Schedule Enabled**, are read-only, reflecting values defined on the appropriate tab or set by the system.

<b>Summary</b>	<b>Trigger</b>	<b>Query</b>	<b>Transport</b>	<b>Format</b>	<b>Updates</b>	<b>Actions</b>	<b>Logs</b>
<p>Schedule Enabled <input type="checkbox"/></p> <p><b>Schedule ID</b> ExportItems</p> <p><b>Last Activity</b></p> <p><b>Last Status</b></p> <p><b>Trigger Type</b> Manual <input type="button" value="Test"/></p> <p><b>Query</b> Audit Trail History Reports</p> <p><b>Format</b> XML format</p> <p><b>Transport</b> File</p> <p><b>Post Updates</b> None</p> <p><b>Post Actions</b> None</p>							
<input type="button" value="Refresh"/> <input type="button" value="Save"/> <input type="button" value="Cancel"/>							

**Schedule Enabled**

When selected, indicates that the export will be executed automatically.

**Schedule ID**

Identifies the schedule in all MES data records. The schedule ID must be unique. You can edit this entry only when creating a new schedule. Once the schedule is saved, the schedule ID is read-only.

**Last Activity**

The date and time when the export last occurred.

**Last Status**

The completion status of the last export.

**Trigger Type**

Displays when/how often the export will occur.

**Query**

The name of the query that will be used to select data for the export process.

**Format**

The exported data's target format (delimited text or XML).

**Transport**

The target for the exported data (file or database).

**Post Updates**

Unavailable for export schedules.

**Post Actions**

The general action to be taken after the export has completed.

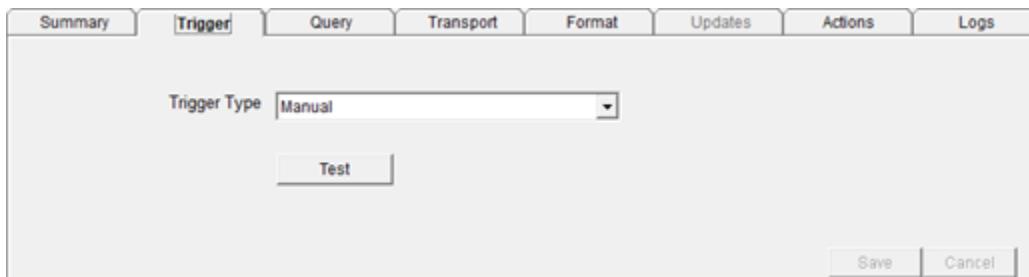
When defining a new export schedule or changing **Schedule Enabled**, click **Save** to save your changes or **Cancel** to discard them. To modify other parts of an export schedule, select the appropriate tab and change the desired values there.

Click **Test** to manually initiate the data export, testing the current definition.

Click **Refresh** to update the **Summary** tab to reflect any changes made in this window or elsewhere.

## Trigger Tab

The **Trigger** tab defines when and how often the export schedule will be run.



The **Trigger type** list includes the event types, described below, that will initiate the data export. Other fields will appear, as needed, for each entry in this list.

### Manual

Schedule will not run automatically.

- **Test button:** Initiates the data export.

### Daily

Schedule will run once each day.

- **Trigger Time:** The starting time for the data export.

### Weekdays

Schedule will run once each weekday (M, Tu, W, Th, and F).

- **Trigger Time:** The starting time for the data export.

### Weekly

Schedule will run once each week.

- **Trigger Day and Time:** The day and starting time for the data export.

### Every N Minutes

Schedule will run repeatedly during the specified interval.

- **Every How Many Minutes:** The time interval between data exports.
- **Starting and Ending Time:** Defines when the first and last data exports will occur.

### Shift End

Schedule will check every minute for a shift change on the specified entities. When a shift change occurs, the schedule will run.

- **Specify Entity List:** The entities to check for a shift change. Click the Browse (...) button to select the desired

entities from a check list.

#### Job End

Schedule will check every minute for a job status change on the specified entities. When a job has been suspended or completed, the schedule will run.

- **Specify Entity List:** The entities to check for job completion. Click the Browse (...) button to select the desired entities from a check list.

#### Data Change

Schedule will connect to the MES database and run the query defined in the **Query** field every minute. If data is returned, the schedule will process the data returned.

- **Specify Query list:** The query, defined under the **Queries** node in the schedule tree, to be used.
- **Test Query button:** Tests the query.

#### Completed SCC Schedule

Schedule will run when another export schedule has finished running, if that schedule did not fail.

- **Trigger Schedule:** The export schedule after which the current export schedule will run.

#### Completed or failed SCC Schedule

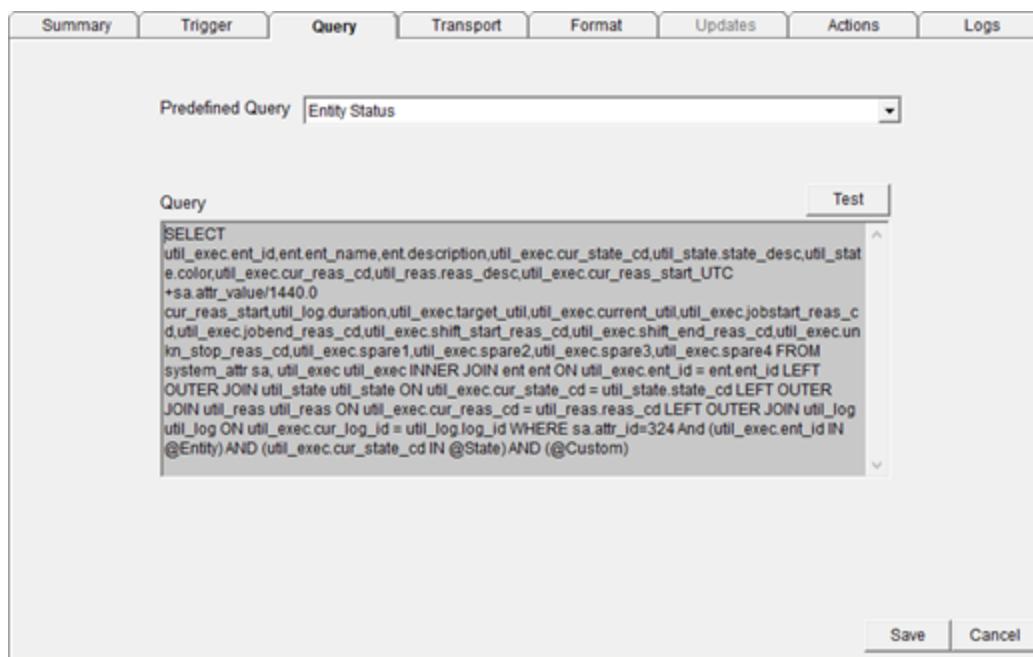
Schedule will run when another import or export schedule has finished running, regardless of its success or failure.

- **Import Schedules:** The export schedule will run.
- **Export Schedules:** The export schedule will run.
- **Trigger Schedule:** The export schedule after which the current export schedule will run.

To modify the trigger, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

#### Query Tab

The **Query** tab determines the query to use to select data for the export process.



### Predefined Query list

Indicates which query, defined under the **Queries** node in the schedule tree, will be used.

### User trigger recordset as export data

Only available when the **Data Change** trigger is selected on the **Trigger** tab. When selected, overrides the **Predefined Query** field and indicates the query that is selected on the **Trigger** tab will be used.

### Query

The selected query definition. The query definition is read-only.

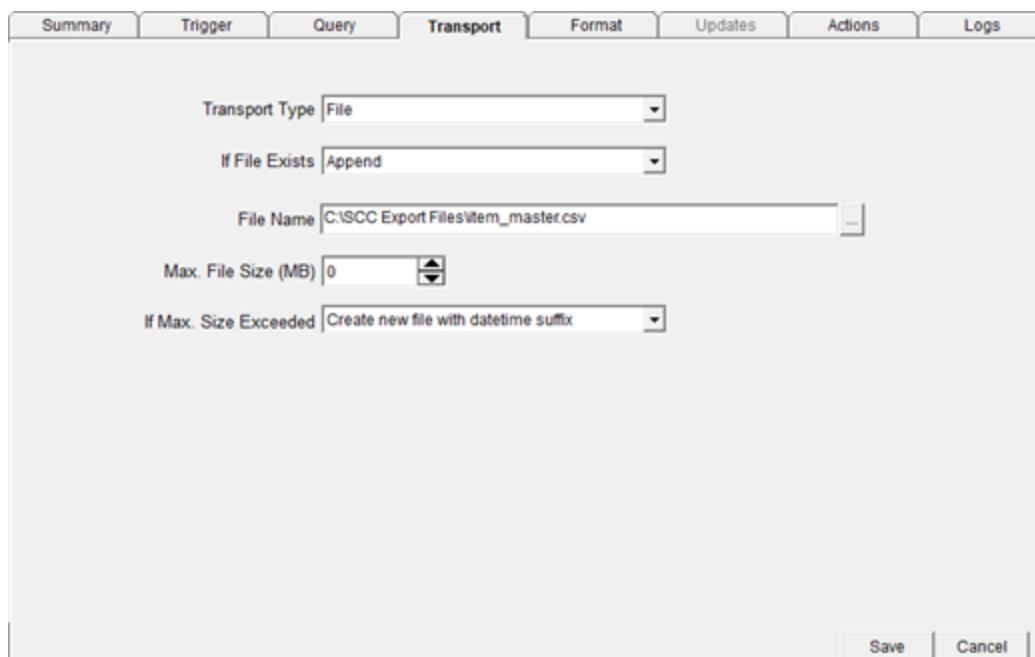
### Test button

Tests the query.

To modify the query, select the desired query node in the tree and change the desired values. Click **Save** to keep your changes or **Cancel** to discard them.

## Transport Tab

The **Transport** tab identifies the target (type and location) of the exported data.



The **Transport type** list includes the data target types, described below. Other fields will appear, as needed, for each entry in this list.

**Note:** The MES middleware user account must have access to the file directories that are used by Supply Chain Connector (for example, those specified in the **File name** properties on the **Transport** tab). For information about how the MES middleware user account is specified, see the *MES Installation Guide*.

## File

The exported data will be stored in a file.

### If File Exists list

Action to take if the file already exists in the specified location:

- **Append:** Add export data to end of existing file.
  - **Append: Max. file size (MB):** Maximum size of destination file.
  - **Append: If max size exceeded:** Action to take if the export causes the destination file to exceed the maximum file size.
- **Overwrite:** Replace existing data with export data.
- **Create new file with datetime suffix:** Create a new file, adding the current date/time to the filename, for the export data.
- **Return an error:** Enter an error message into the log and stop the data export.

### File Name

Complete path/filename for the destination file. Click the Browse (...) button for a file browser.

## Call COM Object

The exported data will be sent to a user-defined object.

**COM Object**

Name of the COM object to call.

**Method to Call on COM Object**

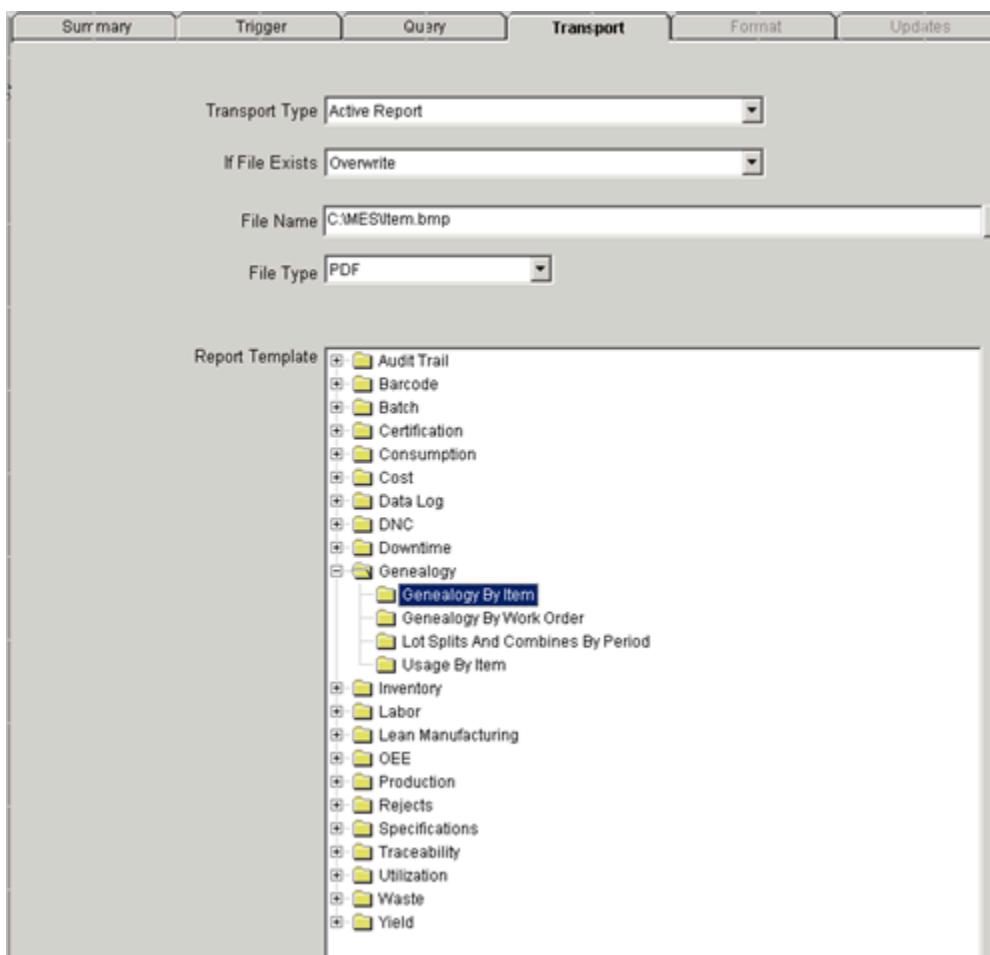
Name of the method in the COM object.

**Method Context Parameter**

See Supply Chain Connector Imports and Exports via a COM Object for details on the parameters.

## Active Report

The exported data will build a report file.

**If File Exists**

Action to take if the file already exists in the specified location.

- **Overwrite:** Replace existing data with export data.
- **Create new file with datetime suffix:** Create a new file, adding the current date/time to the filename, for the export data.
- **Return an error:** Enter an error message into the log and stop the data export.

**File Name**

Complete path/filename for the destination file. Click the Browse (...) button for a file browser.

#### File Type

The format of the destination file. File types are defined in MES Client.

#### Report Template

The desired report template, chosen from a tree of all configured system reports.

To modify the transport definition, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

### Format Tab

The **Format** tab defines the destination file's structure.

The **Data Format** list includes the list of format types of the destination file, as described below. Other fields will appear, as needed, for each entry in this list.

### XML Format

The screenshot shows the 'Format' tab of a software interface. The tab bar at the top includes 'Summary', 'Trigger', 'Query', 'Transport', 'Format', 'Updates', 'Actions', and 'Logs'. The 'Format' tab is currently active. Below the tabs, there are two dropdown menus: 'Data Format' set to 'XML format' and 'XML Type' set to 'Standard ADO attribute based XML'. At the bottom right of the form area are two buttons: 'Save' and 'Cancel'.

#### XML Type

- Standard ADO attribute based XML
- Element based XML

## Delimited Text

The screenshot shows a software interface for configuring a data format. At the top, there is a navigation bar with tabs: Summary, Trigger, Query, Transport, Format, Updates, Actions, and Logs. The 'Format' tab is currently selected. Below the tabs, there are three input fields: 'Data Format' set to 'Delimited text', 'Delimiter Character' set to 'Comma', and a checked checkbox labeled 'Include Header Row'. At the bottom right of the form are two buttons: 'Save' and 'Cancel'.

### Delimiter Character

The character that will separate fields in the destination file.

### Include Header Row

Indicates whether to ignore the first row in the import data file while importing the data.

## Text Template

Allows you to define the format of the text file.

The screenshot shows a software interface for defining a text template format. At the top, there is a navigation bar with tabs: Summary, Trigger, Query, Transport, Format, Updates, Actions, and Logs. The 'Format' tab is currently selected. Below the tabs, there is a dropdown menu labeled 'Data Format' set to 'Text template'. A text area titled 'Define Template Format (%%Column Name%% for Data Bookmarks)' contains a blank template definition. At the bottom right of the form are two buttons: 'Save' and 'Cancel'.

### Define Template Format

This field allows free form entry for the file structure (commonly used when third party systems have a predefined file format). Any portion of the string beginning with %% and ending with %%, and enclosing a valid column name, is translated as a bookmark. For each record in the output, the actual value of the bookmarked column will be substituted for the %%Column\_Name%% string.

To modify the format definition, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

## Updates Tab

The **Updates** tab is unavailable for export schedules.

## Actions Tab

The **Actions** tab defines the general action to be taken after the data export has completed.

Action After Processing: Send E-mail

On Success:

On Partial Success:

On Error:

E-mail to: [Input field]

Attachment: [Input field] ...

Save | Cancel

## Action after processing list

The general action to be taken after the data export has completed. Other fields will appear, as needed, for each choice in this field.

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**Note:** The MES middleware user account must have access to the file directories that are used by Supply Chain Connector (for example, those specified in the E-mail **Attachment** and Launch program **Pgm. Path and Parameters** properties). For information about how the MES middleware user account is specified, see the *MES Installation Guide*.

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### None

No action will be taken.

### Send Email

Send an e-mail as defined below.

- **On Success:** When selected, indicates an e-mail should be sent when the data export is successful.
- **On Partial Success:** When selected, indicates an e-mail should be sent when the data export is partially successful.
- **On Error:** When selected, indicates an e-mail should be sent when the data export fails.
- **E-mail to:** E-mail address or user ID to receive the export status e-mail.
- **Attachment:** Path/filename to attach to the e-mail; often an error file. Click the Browse (...) button for a file browser.

### Launch program

Execute the specified program.

- On Success:** When selected, indicates the program should be executed when the data export is successful.
- On Partial Success:** When selected, indicates the program should be executed when the data export is partially successful.
- On Error:** When selected, indicates the program should be executed when the data export fails.
- Pgm. Path and Parameters:** Complete path/executable, command or batch file to run.

To modify the action definition, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

## Logs Tab

The **Logs** tab displays the execution history of the selected export schedule.

Summary	Trigger	Query	Transport	Format	Updates	Actions	Logs
Activity at	Status	Triggered by	Rows Succ	Rows Failed	Comments	Error Description	
9/5/2022 2:43:00 pm	Success	SCHEDULE E	7	[NULL]	Exported Successfully		
9/5/2022 2:42:22 pm	Error	SCHEDULE E	0	[NULL]	Unknown Error	76 - Path not fou	

### Activity At

The date and time of a data export using this export schedule.

### Status

The completion status of that data export.

### Triggered By

The method used to trigger that data export.

### Rows Successful

The number of rows exported successfully.

### Rows Failed

The number of rows that could not be exported.

### Comments

Displays any comments generated by the system during the data export.

### Error Description

Displays any error description generated by the system during the data export.

Left-clicking a column heading allows you to sort the history display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

Click **Refresh** to update this tab to reflect any changes made elsewhere.

Click **Clear Log** to delete all log data for the selected export schedule.

Click **Delete** to delete the currently selected row from this export schedule's history log.

Right-clicking on the **Logs** tab opens a context menu that contains the following options:

### Refresh

Refreshes the log listing.

**Clear Log**

Clears the log listing.

**Delete**

Deletes the selected log.

**Queries Node**

The **Queries** node in the schedule tree is used to display the list of all the defined database queries.



Right-clicking the **Queries** node opens a context menu that contains the following options:

**Add Query**

Creates a database query.

**Refresh All**

Updates the entire tree to reflect any changes made in this window or elsewhere.

**Query Summary**

When the **Queries** node is selected in the schedule tree, the detail pane displays a summary of all defined database queries.

Query	Query Description	Query Type	SQL
0	Dummy Query	SQL	
2	Group Production Reports	SQL	SELECT
15	Job Reports	SQL	SELECT job.wo_id,wo.wo_desc,wo.state_cd
17	Reconciliation Reports	SQL	SELECT
22	Audit Trail History Reports	SQL	SELECT audit_trail.log_id,audit_trail.logged_at,
24	Audit Trail Summary	SQL	SELECT audit_trail.table_name,COUNT(audit_trail.log_id) as
28	Job Event Reports	SQL	SELECT je.event_time_UTC+sa.afr_value/1440.0
39	Inventory Level Reports	SQL	SELECT
40	Genealogy Hierarchy	Stored Procedure	sp_SA_Genealogy_Hierarchy_Report
46	Step Status Reports	SQL	select jsdata.wo_id, wo.wo_desc, jsdata.oper_id,
201	Entity Status	SQL	SELECT
202	TPM Status	SQL	SELECT
204	WIP Status	SQL	SELECT

**Query**

The system identifier for the query.

**Query Description**

The query descriptive name.

**Query Type**

The type of query (SQL, stored procedure, or middleware).

**SQL**

The first line of the query.

Left-clicking a column heading allows you to sort the query display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

The query data in the summary pane is read-only. To modify a query, select the desired query node in the tree and change the desired values.

Database queries are used for exporting data. Many pre-defined queries are included with every MES system. These queries may be used as-is or modified to suit your needs. New queries may be easily added to your system as well.



Right-clicking a query node opens a context menu that contains the following options:

#### Delete

Deletes the selected query. You will be prompted to confirm the delete.

#### Where Used

Opens a window listing all import & export schedules in which this query is used.

#### Refresh All

Updates the entire tree to reflect any changes made in this window or elsewhere.

## Query Detail Pane

When a query node is selected in the schedule tree, its definition appears in the detail pane.

Parameter	Parameter type	Default value
Custom	Custom	
Entity	String List	
State	String List	

## Query Description

Describes the purpose of the query to system users; MES automatically assigns an ID number to identify it in the

data records.

## Query Type list

The type of query that will be accessing the MES database.

### SQL Statement

Uses standard SQL selection syntax.

### Stored Procedure

Uses a pre-defined stored procedure.

### Middleware Method

References a call to a method compiled in the MES COM + application.

The remaining fields will appear, as needed, depending on the chosen query type.

## Query Type = SQL Statement

### SQL Statement

The query using standard SQL selection syntax. The query may contain parameter names, denoted by the @ symbol as the first character.

### Parameters grid

The parameters used in the SQL query.

- **Parameter:** The parameter name, identified in the query by the preceding @ symbol. This parameter substitutes the value to the inline query while executing the query.
- **Parameter Type list:** The data type of the parameter.
- **Default Value:** The default value to be used for a required field that is missing from the source.

## Query Type = Stored Procedure

The screenshot shows a configuration dialog for a stored procedure. At the top, 'Query Description' is set to 'Genealogy Hierarchy Reports'. The 'Query Type' dropdown is set to 'Stored Procedure', and the 'Stored Procedure' input field contains 'sp\_SA\_Genealogy\_Hierarchy\_Rep'. Below this, a 'Parameters' section displays a table of parameters:

	Parameter	Parameter type	Size	Default value
1	End_Time	Date Time	8	
2	Entity	String	2,000	
3	Item	String	2,000	
4	Start_Time	Date Time	8	
5	Work_Order	String	2,000	

At the bottom right of the dialog are 'Save' and 'Cancel' buttons.

### Stored Procedure

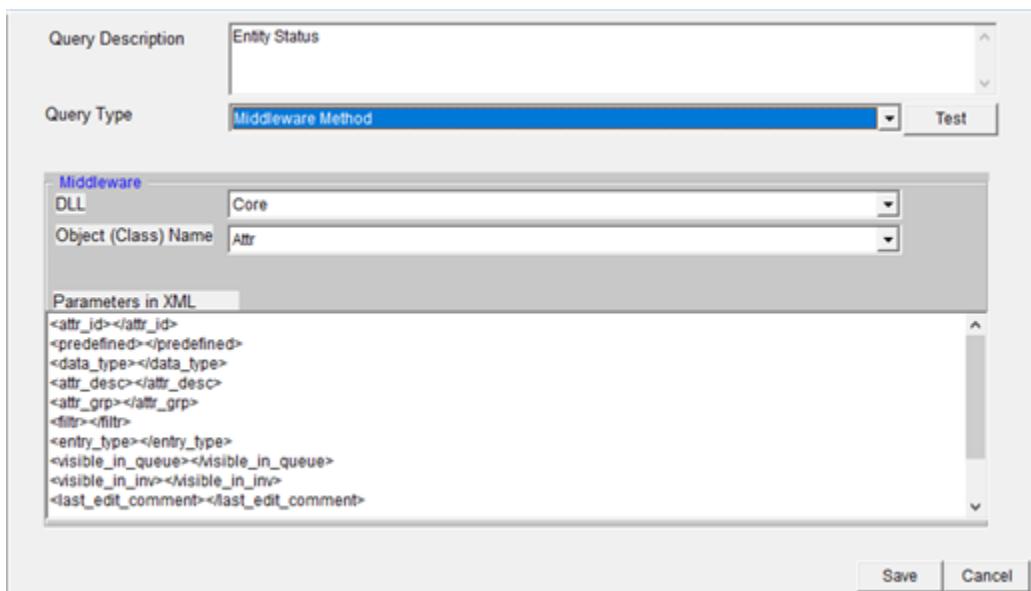
The name of the stored procedure that will be run as the query.

### Parameters grid

The parameters passed, in order, to the stored procedure.

- **Parameter:** The stored procedure parameter name.
- **Parameter type** list: The data type of the parameter.
- **Size:** The space to allocate in bytes for the parameter.
- **Default value:** The default value to be used for a required field that is missing from the source.

## Query Type = Middleware Method



### DLL list

Indicates which available MES middleware DLL will be used.

### Object (Class) Name list

Indicates which object, of those exposed by the selected DLL, will be used.

### Parameters in XML

Lists all required and optional XML tags for the selected middleware object. Allows you to assign values to these tags.

## Running the Query

Click the **Test** button to run the query. The parameters will be passed with their configured default values. The Result window appears, displaying the data returned by the query.

Result : 7 rows

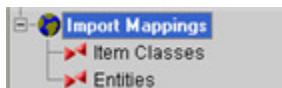
	row_id	ent_id	item_id	lot_no	sublot_no	grade_cd	status_cd	ent_name
1	4	10	BMX-BBQ	LOT20220905.02	0	2	Bagged Mixed Nuts Stor	
2	6	12	PNT-BLK	LOT20220905.05	1	1	Reject Area	
3	3	4	PNT-BLK	LOT20220905.01	0	2	Roaster	
4	0	6	AMD-BLK	LOT20220905.01	0	2	Silo 1	
5	1	7	CSW-BLK	LOT20220905.01	0	2	Silo 2	
6	2	8	PNT-BLK	LOT20220905.01	0	2	Silo 3	
7	5	14	PNT-BLK	LOT20220906.01	0	0	Silo 4	

Close

To modify the query, select the desired field and change its value. Click **Save** to keep your changes or **Cancel** to discard them.

## Import Mappings Node

The **Import Mappings** node on the schedule tree is used to organize all import mapping groups.



Right-clicking the **Import Mappings** node opens a context menu that contains the following options:

### Add Import Mapping

Creates a new import mapping group.

### Refresh All

Updates the entire tree to reflect any changes made in this window or elsewhere.

## Mapping Summary

The mapping provides a list of values that are used to map a value in the external system to the equivalent value in the internal database. However, these mappings are not automatically mapped to an import field. You need to explicitly configure the mapping for each field.

When the **Import Mappings** node is selected in the schedule tree, the detail pane displays a summary of all defined import mappings.

Supply Chain Connector

Import Schedules	Mapping ID	External Name	Internal Name
Entities	Entities	HXXSilo1	Silo1
Entities	Entities	HXXSilo2	Silo2
Items	Items	BBQMixedNuts24g	BBQ-MXN

### Mapping ID

The mapping group name.

### External Name

The external name for the mapping.

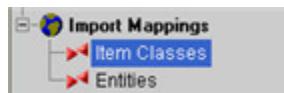
### Internal Name

The internal name for the mapping.

Left-clicking a column heading allows you to sort the mapping display by that field. Click that heading again to reverse the sort order. Ctrl+click on other headings to add secondary and tertiary sort fields.

The mapping data in the summary pane is read-only. To modify an import mapping, select the desired import mapping group node in the tree and change the desired values.

An import mapping group organizes related import mappings, for easier access in the schedule tree.



Right-clicking an import mapping group node opens a context menu that contains the following options:

#### Delete

Deletes the selected import mapping group, and all its defined mappings. You will be prompted to confirm the delete.

#### Refresh All

Updates the entire tree to reflect any changes made in this window or elsewhere.

### Import Mapping Group Detail Pane

When an import mapping group node is selected in the schedule tree, its defined mappings are displayed and accessible in the detail pane.

A screenshot of a software window titled 'Import Mapping Group Detail'. At the top left is a 'Mapping ID' label and a dropdown menu set to 'Entities'. Below is a table with two rows. The first row has 'External Name' as 'HX00Silo1' and 'Internal Name' as 'Silo1'. The second row has 'External Name' as 'HX00Silo2' and 'Internal Name' as 'Silo2'. At the bottom right are 'Save' and 'Cancel' buttons.

#### Mapping ID

Identifies the import mapping group in all MES data records, so must be unique and is not editable after the first mapping in that group is defined and saved.

#### External Name

Name used by an external system for a data value that it will send into your MES system. Identifies the import mapping in all MES data records, so must be unique and is not editable after the definition is first saved.

#### Internal Name

Name used by the MES system for that data value. The field names can be found in the MES database documentation.

To modify an import mapping, change the desired internal name. Click **Save** to keep your change or **Cancel** to discard it.

Right-clicking in the import mapping definition pane opens a context menu that contains the following options:

**Add**

Creates a new import mapping.

**Delete**

Deletes the selected import mapping. You will be prompted to confirm the delete.

## Supply Chain Connector Imports and Exports via a COM Object

For specialized data transfers in Supply Chain Connector (SCC) that require more complex functionality than a straight importing of table records, or the exporting of a query result to a file, you can write a method that is invoked via COM for greater flexibility.

### Invoking a Method of a COM-Visible Object from an SCC Schedule

Triggering an import schedule with the Import Data Type **Import from COM object** or an export schedule with the Transport Type **Call COM object** causes MES Service (or MES Supervisor, in the case when the **Test** button is clicked on the **Summary** tab) to:

- Create an instance of the object specified in the **COM Object** field using late binding.
- Call the method specified in the **Method to Call on COM Object** field.

The contents of the **COM Object** field must be a fully qualified name with the format *Namespace.Class.Version*.

For an import, the method needs to conform to the following signature:

- For Visual Basic: Public Method xxxxxxx (ByVal session\_id as long, ByVal sched\_id as string, Optional ByVal context as string) as long
- For C#: public long xxxxxxx (long session\_id, string sched\_id, string context)

For an export, the method needs to conform to the following signature:

- For Visual Basic: Public Method xxxxxxx (ByVal session\_id as long, ByVal sched\_id as string, ByVal rs as ADODB.recordset, Optional ByVal context as string) as long
- For C#: public long xxxxxxx (long session\_id, string sched\_id, ADODB.Recordset rs, string context)

The method utilizes the parameters passed to it to know what it is to do in each particular case:

- The *session\_id* parameter is the session ID of the MES Service (or MES Supervisor) that triggered the import, and is used as a parameter in most stateless API methods.
- The *sched\_id* parameter identifies the SCC schedule that triggered the import, and allows the COM object to extract additional configuration information from the dx\_sched table (and other) if required, or to use the *sched\_id* if creating additional entries in the SCC log table (dx\_log), where it is a required field.

- In the case of a method called from an export schedule, the *rs* parameter is the recordset returned by the query associated with the export schedule.
- The optional context parameter allows passing of context information to the COM object. For example, context information can be passed to allow multiple schedules to call the same COM object yet have it respond differently by passing different context values it can use to conditionalize different behaviors. It is always a string even though it is passed as a variant in Visual Basic. It is only included in the method call if it is not null and not an empty string.

The method should return a (long) 0 if the import was handled successfully or a (long) -1 if an error occurred. While SCC will create entries in its log if it is unable to invoke the method or the method caused an unhandled exception, it otherwise does not know if the intended processing succeeded. Therefore, it is up to the method to make entries in the log (the dx\_log table) if its internal processing was not successful, to provide users a record of what failed and, to the extent possible, why. Note that there are currently no stateless API methods to access the dx\_\* tables, so this must be done via a direct connection to the MES middleware.

It is up to the method called by an input schedule to actually insert records into the MES database, preferably by using the stateless API. A method called by an export schedule can either use the ADODB recordset passed to it, or it could do its own query. However, if all the required information to be exported is in the recordset, a separate query is not required.

## C# COM-Visible Example

The following C# code is an example of a COM object that contains an import method and an export method:

```
using System;
using System.Data;
using System.Data.OleDb;
using System.Runtime.InteropServices;
namespace SCCCComObjNamespace
{
    [GuidAttribute("B25215A6-CDB0-47A6-A3FD-DBDE69749198")]
    public interface ISCCCOMObjClass
    {
        long ImportMethod(long session_id, string sched_id, string context);
        long ExportMethod(long session_id, string sched_id, ADODB.Recordset rs, string
        context);
        void Close();
    }
    [ComDefaultInterface(typeof(ISCCCOMObjClass))]
    [ClassInterface(ClassInterfaceType.None)]
    [ComVisible(true)]
    [GuidAttribute("22C7350C-15CF-43E0-97C2-DE1A3150D4EE")]
    [ProgId("SCCCComObjNamespace.SCCCOMObjClass.1")]
    public class SCCCComObjClass : ISCCCOMObjClass, IDisposable
    {
        public long ImportMethod(long session_id, string sched_id, string context)
        {
            // Add processing code here
            return 0;
        }
        public long ExportMethod(long sessionId, string sched_id, ADODB.Recordset rs, string
        context)
        {
            // Following 3 lines show an easy way to create a dataset ds with the contents of
        }
    }
}
```

```
the ADODB recordset rs
OleDbDataAdapter da = new OleDbDataAdapter();
DataSet ds = new DataSet();
da.Fill(ds, rs, "ATableName");
// Add processing code here
return 0;
}
public void Close()
{
Dispose();
}
public void Dispose()
{
GC.SuppressFinalize(this);
}
}
```

The two GUIDs in the `GuidAttributes` decorating the interface and class are created using the Create GUID choice in Visual Studio's **Tools** menu and will not be the same as those shown in this example. The DLL that will result from this code needs to be registered in the GAC using REGASM (found in the latest **version** folder beneath the **Microsoft.NET\Framework** folder in the Windows folder; for example, **c:\Windows\Microsoft.NET\Framework\v4.0.3019**) using the /codebase option.

In this case the entries in the **Data** tab for the import schedule would be:

- Import Data Type: Import from COM object
- COM object: `SCCCOMObjNamespace.SCCCComObjClass.1`
- Method to Call on COM Object: `ImportMethod`
- Method Context Parameter: <as needed>

and the entries on the **Transport** tab for the export schedule would be:

- Transport Type: Call COM object
- COM object: `SCCCOMObjNamespace.SCCCComObjClass.1`
- Method to Call on COM Object: `ExportMethod`
- Method Context Parameter: <as needed>

## MES Data Editor

Use the Data Editor application to insert, edit, and delete records in the MES database. You can view and alter information related to item production and consumption, labor usage, item lots, job steps, and entity utilization.

### Getting Started

Manufacturing Execution System (MES) Data Editor is used to insert, edit, and delete data records in the MES database. Using the Data Editor, you can view and alter data for item production, item consumption, labor usage, item lots, job steps, and entity utilization.

Data Editor is organized by tabs, which separate the different types of data that can be maintained. The data

records that appear in the tabs can be filtered, to help you focus on those records that you want to view or manage.

## Precautions for Using Data Editor

Data Editor is designed for use by someone very familiar with the MES database and the information stored in the MES database tables. It is not intended for most users of the MES system, as they should have access to MES Operator, MES Client, MES Web Portal, or a custom user interface making calls through the MES API. In many cases, Data Editor directly calls the underlying stored procedures to update, delete, or insert records in the underlying table, bypassing the MES middleware. Therefore, access to Data Editor should be limited only to those with a good understanding of the underlying data. Access to Data Editor is controlled by the *May run Data Editor* user privilege, which can be enabled or disabled by user group in MES Client.

In addition, note the following:

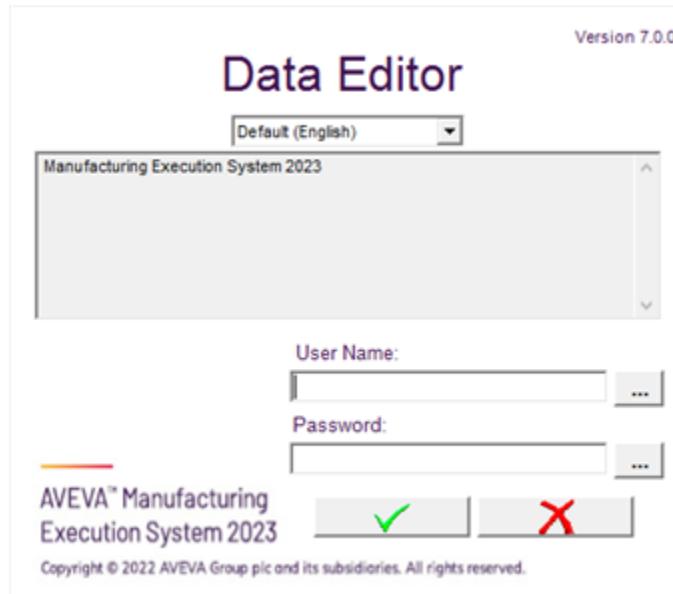
- Changes or deletions of data in Data Editor are permanently saved after the **Save** button is clicked in the corresponding dialog box. There are no rollback capabilities for the data in Data Editor.
- All data modified or inserted using the Data Editor must fulfill all MES Business Rules requirements.

## Logging In to Data Editor

Only users who are members of a user group that has been assigned the privilege *May run Data Editor* will be granted access. The Data Editor login window will always contain at least a **Password** field. Depending on your system configuration, the window might also contain a Login Text view-only pane and/or a **User Name** field.

1. On the **Start** menu, search for and select **Data Editor**.

The login dialog box appears.



2. In the **Language** list, click the language in which you want the login dialog box to appear.

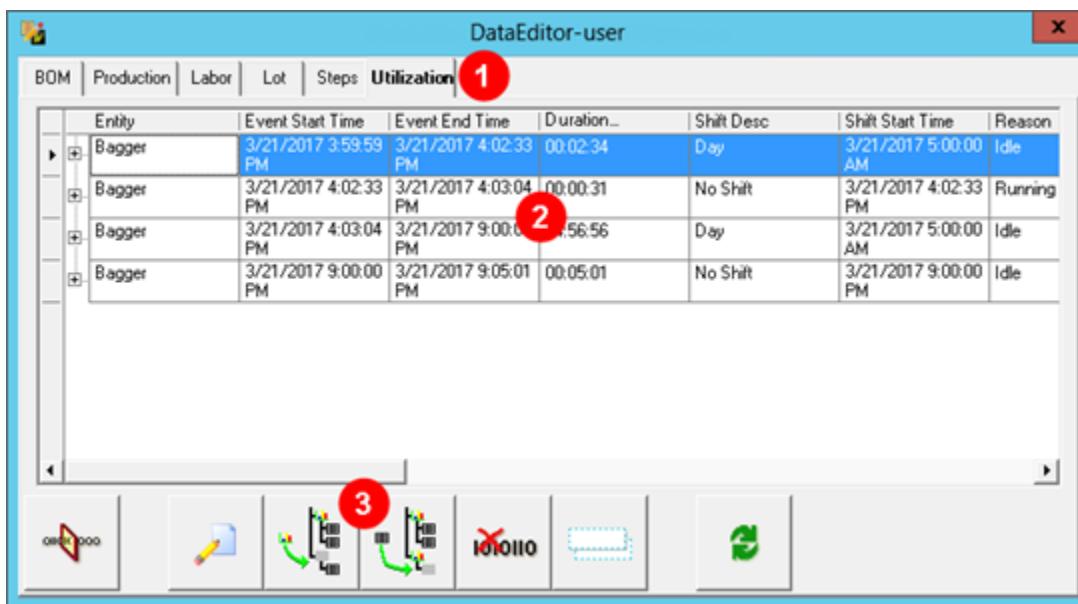
You can select only those languages that are configured in the MES Client application. If you restart the application, the language setting resets to the default language, which is specified by the Display system parameter *Default Language* in MES Client.

3. In the **User Name** and **Password** boxes, type your username and password.
  - If the MES user Security mode is set to Native, you can obtain the username and password from the MES administrator who set up users in MES Client.
  - If the Security mode is set to OS User or OS Group, enter your Windows username, including the domain.
4. Click the green check mark button.

The MES Data Editor application opens.

## Data Editor Layout and Controls

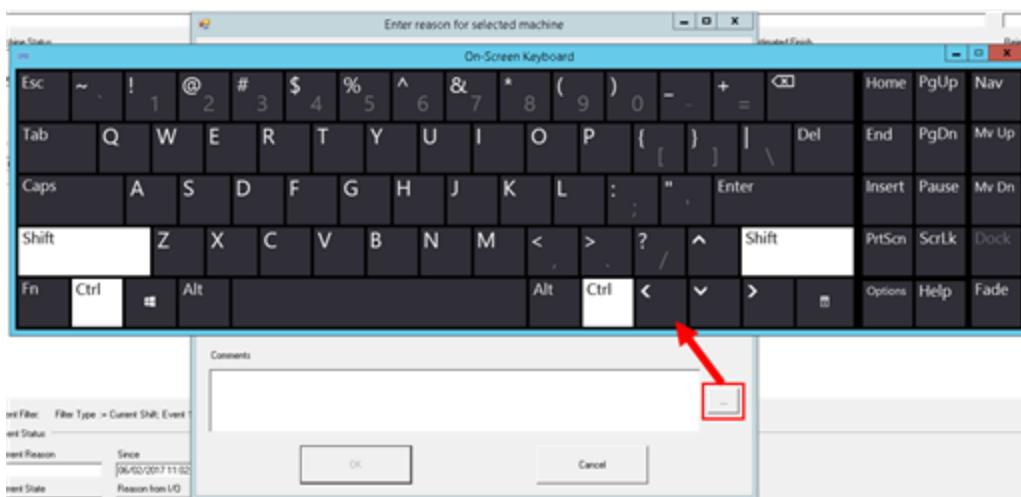
The Data Editor window layout is shown in the following figure, and the controls are described below.



1	Tabs for accessing data record areas.
2	Grid that shows the filtered list of data records, including all data columns.
3	Button controls for accessing functions that can be performed on data records, including filtering, editing, inserting, and deleting the records.

## On-Screen Keyboard

To assist users who do not have a physical keyboard attached to the local machine, text boxes in MES .NET applications, such as Operator and Data Editor, include a keyboard button. Clicking this button opens an on-screen keyboard, as shown below.



- After opening the keyboard, the focus for the text entry will be to the text box associated with the keyboard button.
- You can leave the keyboard open (either displayed or minimized). However, if the keyboard is open and you click another text box keyboard button, the focus will go to the keyboard and not to the new text box. You must first click in the new text box before typing on the keyboard to enter text into it.
- The **Enter** and **Tab** keys work just like they do on a physical keyboard.
- The keyboard can be resized by clicking and dragging an edge or corner.

Depending on the Windows version, there are additional keyboard features, such as the Fade key (making it transparent) and selectable options on the option keys. For more information about the on-screen keyboard features, see the help topic "Use the On-Screen Keyboard (OSK) to type" on the Microsoft Support web site.

### To change the keyboard language

- Open the Input Method menu on the system tray and select the language.



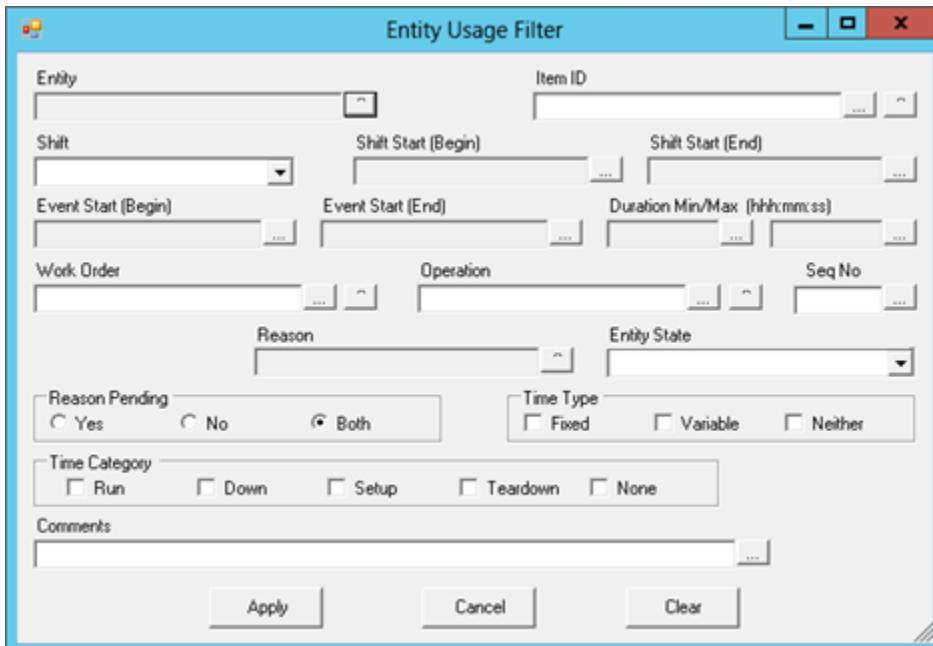
### Filtering the Grid

When you first open Data Editor, the filter dialog box for the selected tab might appear. Otherwise, you can filter the data records that appear in the tabs at any time.

**To filter the data records that appear in the tab (except for the Lots tab)**

1. Click the Filter button.

The filter dialog box appears.



2. Enter the filter criteria.

To view all records, click **Clear** to clear the filter criteria.

3. Click **Apply**.

Only the data records that match the filter criteria appear in the grid.

### Performance Checking

There are a number of areas in Data Editor where there is a potential for slow performance, depending on the number of records in certain database tables and on specified filter criteria. For example, if the Item\_Prod table contains many records and no filter criteria are entered in the Item Production Filter dialog box, clicking **Apply** on the filter dialog box could cause a long delay while the records are retrieved. Similarly, if the Item\_Prod table contains many records with different operations starting with the letter A, and the filter criteria A% is entered in the **Operation ID** field of the filter dialog box, a significant delay could occur between clicking the lookup button for the **Operation ID** field and when the lookup dialog box appears.

To limit such potential performance problems, every place where filter criteria can be entered to limit a database result set, Data Editor will first check the size of the result set to ensure that it is not too large (a system parameter determines what that size is; for example, it might be set to 5000 records). If the size of the result set exceeds the defined maximum size, a message appears, allowing you to either proceed or to cancel the request and specify different filter criteria.

### Editing a Record

Data Editor allows you to edit data records in the MES database. All data entered must still meet all MES Business

Rules requirements.

### To edit a data record

1. Select the data record in the grid that you want to edit.
2. Click the **Edit** button at the bottom of the window.

An edit window for the currently selected tab appears.

The edit window includes all editable data fields. Required fields are denoted by bold labels. If you attempt to save your changes and a required field does not have an entry, you will be prompted to complete the required field.

3. After you have completed your edits, do one of the following:

- To save your edits, click **Save**.

The edit window closes and the grid is refreshed with the updated record.

- To cancel your edits, click **Cancel**.

The edit window closes and your edits are discarded.

## Inserting a Record

Data Editor allows you to insert new records into the MES database. All data entered must still meet all MES Business Rules requirements.

### To insert a new record

1. Click the **Insert** button at the bottom of the window.

An insert window for the currently selected tab appears.

The insert window includes all editable data fields. Required fields are denoted by bold labels. If you attempt to save your changes and a required field does not have an entry, you will be prompted to complete the required field.

2. After you have completed entering data for the new record, do one of the following:

- To save the new record, click **Save**.

The edit window closes and the grid is refreshed with the new record.

- To cancel the insertion of the record, click **Cancel**.

The edit window closes and the new record is discarded.

## Copying a Record

Data Editor allows you to copy certain data records in the MES database to create a new record. All data entered must still meet all MES Business Rules requirements.

### To copy a data record

1. Select the record in the grid that you want to copy.
2. Click the **Copy** button at the bottom of the window.

An edit window for the new copied record appears.

The edit window includes all editable data fields. Required fields are denoted by bold labels. If you attempt

to save your changes and a required field does not have an entry, you will be prompted to complete the required field.

3. After you have completed your edits to the copy, do one of the following:

- To save your edits, click **Save**.

The edit window closes and the grid is refreshed with the updated record.

- To cancel your edits, click **Cancel**.

The edit window closes and your edits are discarded.

## Deleting a Record

Data Editor allows you to delete records from the MES database.

### To delete a record

1. Select the record in the grid.

2. Click the **Delete** button at the bottom of the window.

A confirmation prompt appears.

3. Click **OK** to confirm the deletion, or **Cancel** to cancel the deletion.

If you confirmed the deletion, the grid is refreshed and the record is removed.

## Refreshing the Grid

- Click the **Refresh** button at the bottom of the window.

The grid refreshes and the most recent records and data appear.

## Filter and Data Entry Controls

The following controls are used in the filter and data entry dialog boxes.

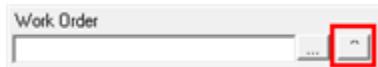
### Lists, Radio Buttons, Option Check Boxes

These are standard Windows controls.

For lists, you can:

- Open the list and select one.
- Click in the box and begin typing. A matching list entry is automatically entered in the box.

### Lookup Button



Clicking this button opens a dialog box that allows you to search for or select an entry to add to the filter or data box.

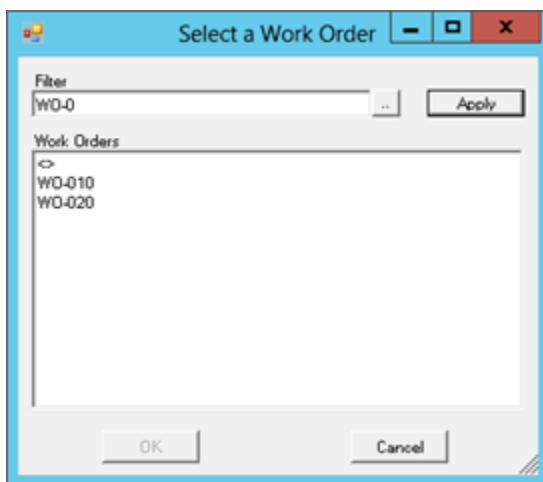
- When filtering data records, you can manually enter the filter criteria in the box or select it in the lookup dialog box.
- When creating or editing a data record, entries for these boxes can only be made by selecting one from the lookup dialog box.
- Selecting the <> entry in the lookup dialog box causes the corresponding filter or data box to be cleared.

The common lookup dialog boxes are listed below.

### Work Order

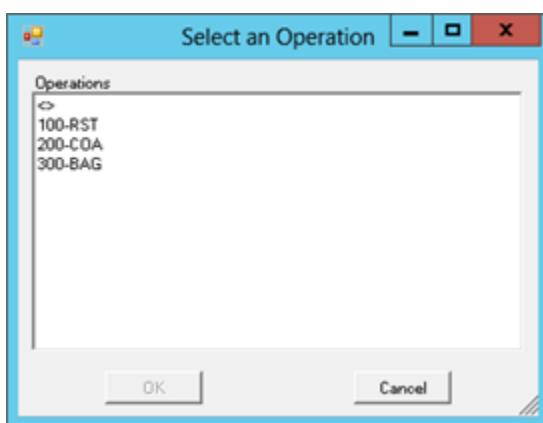
Clicking a work order box Lookup button opens the Select a Work Order dialog box.

In the **Filter** box, enter the initial characters of a partial work order ID or a complete work order ID (with or without the SQL wildcard characters % or \_) and click **Apply**. The work orders which IDs match the **Filter** box entry are listed, as shown below. Select a work order and click **OK**.



### Operation

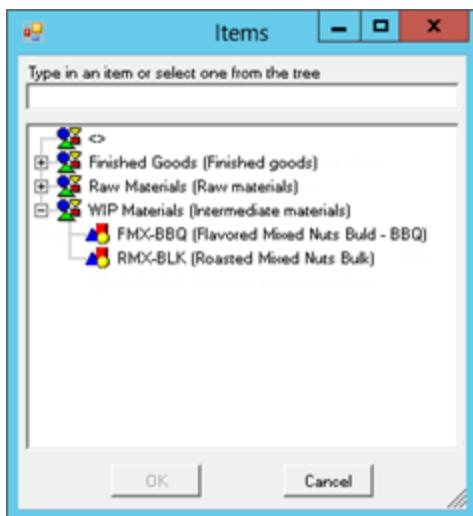
Clicking an operation box Lookup button opens the Select an Operation dialog box. Operations associated with a valid work order ID entry are listed.



Select an operation and click **OK**.

### Item

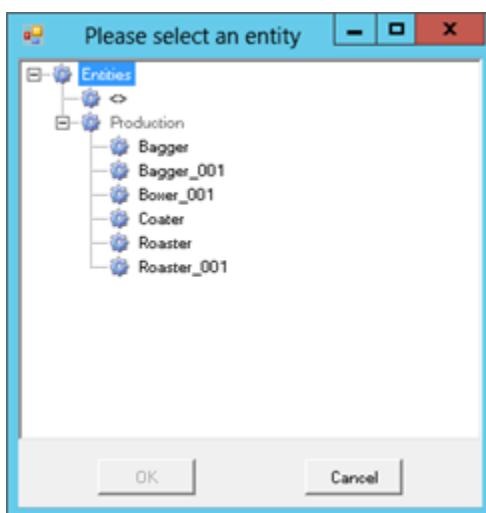
Clicking an item box Lookup button opens the Items dialog box. Items associated with a valid work order ID entry are listed.



Select an item and click **OK**.

### Entity

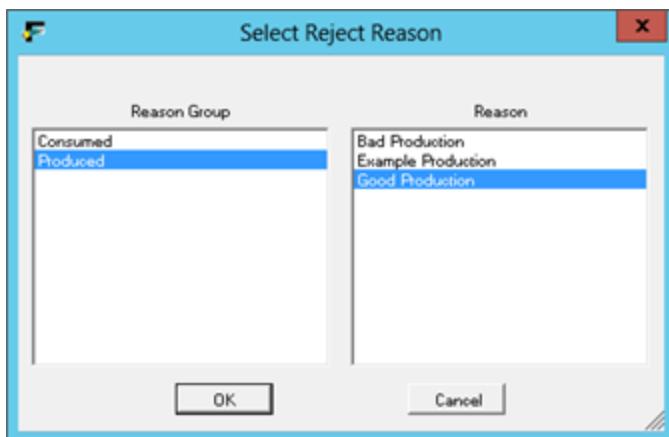
Clicking an entity box Lookup button opens the Please select an entity dialog box.



Select an entity and click **OK**.

### Reason

Clicking a reason box Lookup button opens a select a reason dialog box, such as the Select Reject Reason dialog box shown below.



Select a reason group and then a reason and click **OK**.

## Wildcard Characters in Filters

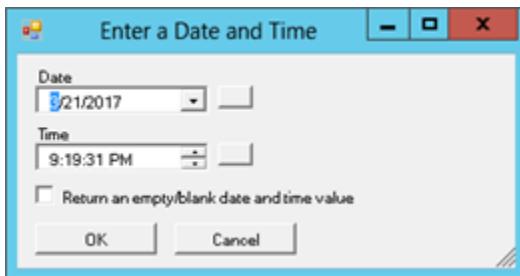
The SQL wildcard characters % and \_ (underscore) can be used in any filter box—whether in a filter or lookup dialog box—that accepts alphanumeric text.

## On-Screen Data Entry Button

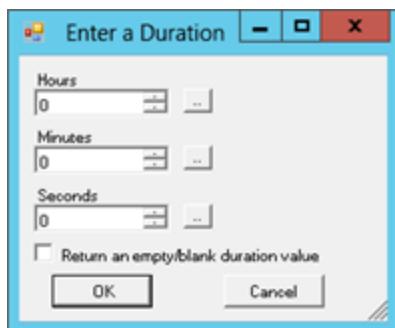
Clicking the on-screen data entry button, highlighted below, will open a dialog box to assist you with making an entry.



- For alphanumeric text boxes, the Microsoft on-screen keyboard appears. See [On-Screen Keyboard](#).
- For numeric boxes, a numeric keypad appears.
- For date/time boxes, the Enter a Date and Time dialog box appears.



- For time duration boxes, the Enter a Duration dialog box appears.



## Configuring Tab Components

You can configure the following Data Editor tab components:

- The column configuration for grids
- The toolbar buttons that appear

You can also save and reload a configuration for each tab.

## Configuring Grids

With the grids in tabs, you can:

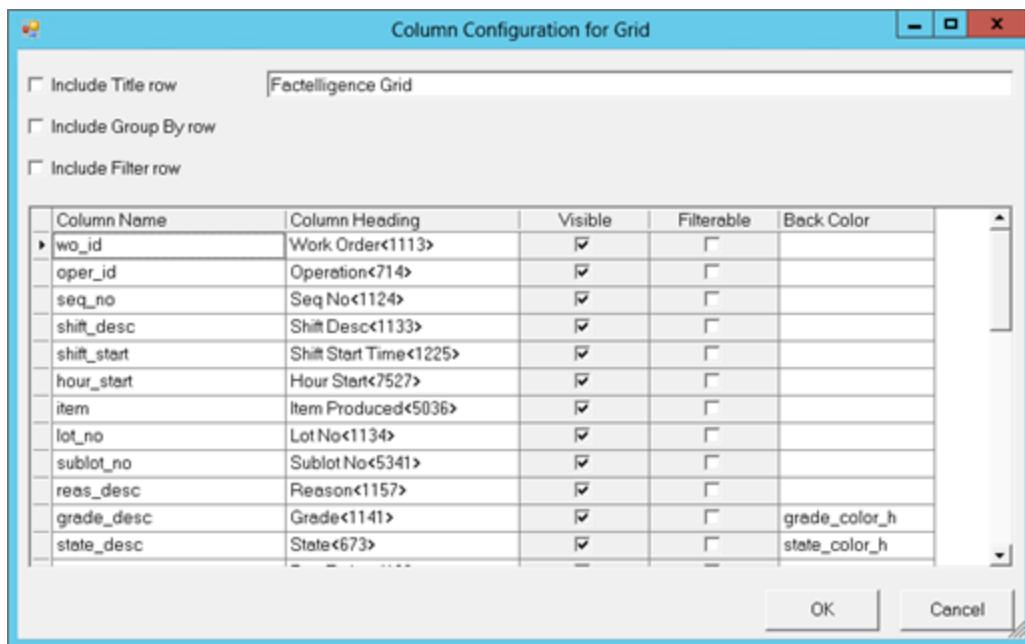
- Specify what columns and rows are displayed
- Arrange the grid rows by groups and subgroups
- Sort the grid by columns
- Arrange the order of the columns
- Filter the grid rows by a column's data

# Specifying What Columns and Rows Are Displayed

1. Right-click on the tab grid area and click **Configure**.

The Column Configuration for Grid dialog box displays.

The list of columns that are available are specific to the tab.



- Set the desired options, described below.

#### Include Title Row

Select this option to include a title row for the table, and enter the title in the accompanying box.

#### Include Group By Row

Include the Group By row in the grid, which allows you to rearrange the grid into groups and subgroups. See [Grouping Grid Data](#).

#### Include Filter Row

Include a filter row, which allows you to filter the contents of the grid. To use filtering, see [Filtering the Grid](#). Use this setting along with the Filterable check boxes to enable filtering for specific columns.

#### Visible

To make a column visible in the grid, select this option.

#### Filterable

To enable the filter cell for a column, select this option. To use filtering, see [Filtering the Grid](#).

#### Back Color

This option is not supported.

- Click **OK** to save your changes.

## Grouping Grid Data

The grid can be arranged into groups and subgroups by column data categories.

#### To group the grid data by column data categories

- Drag the column heading to the shaded area above the column headings.

DataEditor-					
BOM	Production	Labor	Lot	Steps	Utilization
Drag a column header here to group by that column.					
	Work Order		Operation		
>	W0-010		100-RST		
	W0-010		200-COA		

The rows of the grid are now grouped by that data category.

DataEditor-					
BOM	Production	Labor	Lot	Steps	Utilization
Work Order					
	Work Order		Operation		
>	W0-010		100-RST		
	W0-010		200-COA		
	W0-010		300-BAG		
>	W0-040		100-RST		
	W0-040		100-RST		

2. Drag another column heading to this area to add a subgroup.

DataEditor-					
BOM	Production	Labor	Lot	Steps	Utilization
Work Order					
	Work Order		Operation		
>	W0-010		100-RST		
	W0-010		200-COA		
	W0-010		300-BAG		
>	W0-040		100-RST		
	W0-040		100-RST		

As you add groupings, the diagram in the shaded area is updated to illustrate the order in which each grouping is applied. The data rows will also be divided into sections, reflecting the grouped method used.

### To remove a grouping

- Drag the heading of that grouping from the shaded area.

## Sorting by Columns

### To sort by a column

- Click the column heading.

**To reverse the sort**

- Click the column heading again.

**To add a secondary or tertiary sort column**

- Shift+click another column.

# Changing the Column Order

**To change the order of a column**

- Drag the column heading to the desired location in the column heading row.

# Filtering the Grid

If the filter row in the grid's column configuration has been turned on and filtering has been enabled for any of the columns, then you can filter the data rows included in the grid by those columns.

**To filter the grid by a column's data**

1. In the filter cell for the column, enter the filter criteria.

The filter criteria must include the beginning characters of the data on which you want to filter, or the entire data value. For example, if all work order IDs begin with WO-, then the filter criteria must begin with those characters. So the filter WO-3 could include rows whose work order ID begins with WO-3, WO-300, WO-301, or WO-3249. However, the filter entry 300 would not match any work order ID entry.

Filter criteria is case-sensitive.

2. Press the **Tab** key.

Only rows whose data match the entered filter criteria appear in the grid.

**To clear the filter**

- Delete the filter entry and press the **Tab** key.

## Configuring a Tab's Button Bar

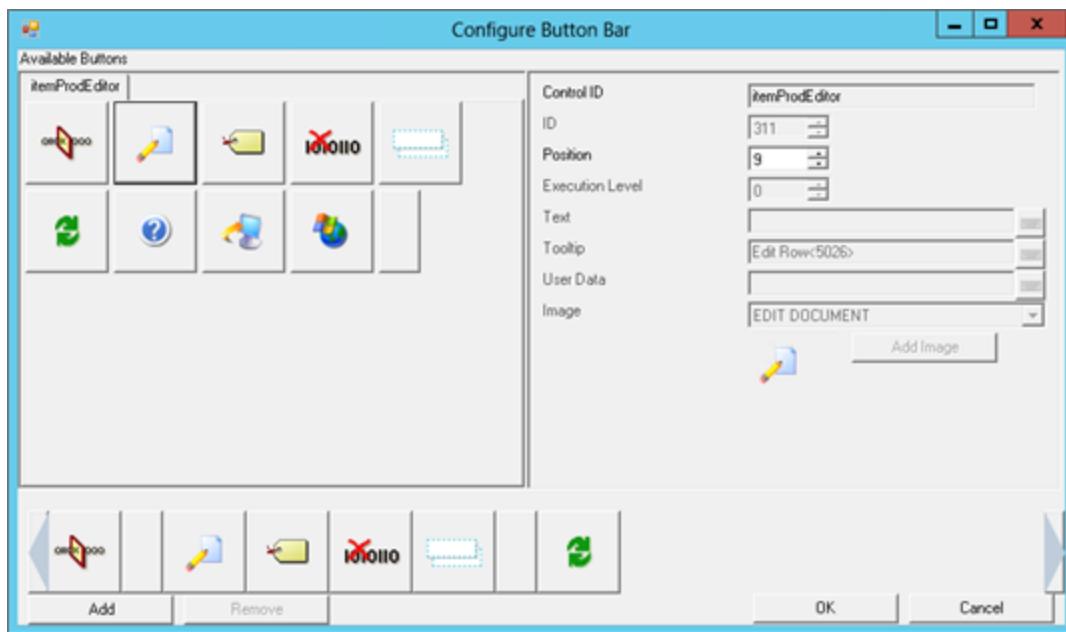
You can add and remove the buttons that are included in a tab's button bar.

Some of the available buttons are specific to the tab. Other general buttons, like the Refresh button, might also be available to be included in the button bar.

**To open the Configure Button Bar window**

- Right-click the button bar area and click **Configure**.

The Configure Button Bar window appears.



### To add a button to the button bar

1. On the Configure Button Bar dialog box, select the button in the **Available Buttons** pane.
2. Click the **Add** button.
3. In the settings pane, enter the **Position** number of the button to determine its position in the button bar.

You can add one or more space separator buttons (the rectangular button without an icon) to visually separate groups of buttons in the button bar.

### To remove a button from the button bar

1. On the Configure Button Bar dialog box, select the button in the button bar.
2. Click the **Remove** button.

The button is moved back to the **Available Buttons** pane.

### To configure a button in the button bar

You can configure settings for selected button in the button bar. These settings are described in the following table.

#### Control ID

Identifies the control (for example, window or tab) on which this button bar appears.

#### ID

Identifies the selected button (and its definition) in the database.

#### Position

Specifies the position number, or location, of the selected button in the button bar.

#### Execution Level

Specifies the minimum Button Execution Level that a user must have (a user privilege defined in MES Client) to have authorization to use the selected button.

**Text**

Defines the text, if any, that appears as a label on the selected button.

**Tooltip**

Defines the text, if any, that will appear when the cursor is hovered over the selected button .

**User Data**

Defines the external application and/or parameters that will be passed when the selected button is pressed.

**Image**

Indicates which image, if any, should be displayed on the selected button. The selected image is displayed below this list.

**Add Image button**

Not supported.

## Saving and Reloading Tab Configurations

You can save the current grid and toolbar button configuration for a tab. You can then reload the saved configuration or the default configuration.

If you do not save changes that you made to the current configuration, those changes are lost when you navigate to another tab.

You can also save the current configuration as the default configuration for the tab for all Data Editor users.

**To access the save and reload configuration options**

- Right-click anywhere on the tab area except the toolbar area, then click the desired menu command.

The menu commands are described below.

**Save Configuration**

Saves the current configuration for the active entity.

If you reload the default configuration, this saved configuration is cleared.

**Save As Default Configuration**

Saves the current configuration for this tab as the default configuration for all Data Editor users.

**Reload Configuration**

Reloads your last saved configuration for this tab.

**Revert to Default Configuration**

Reloads the default configuration for this tab. This also clears the saved configuration.

## Viewing Version Information About the MES Database

- Right-click anywhere on the tab except the toolbar area and then click **About**.

The About dialog box appears for that tab's editor. The information includes the MES database version, database server name, database name, and version information about the MES .NET controls that are used for that tab's editor.

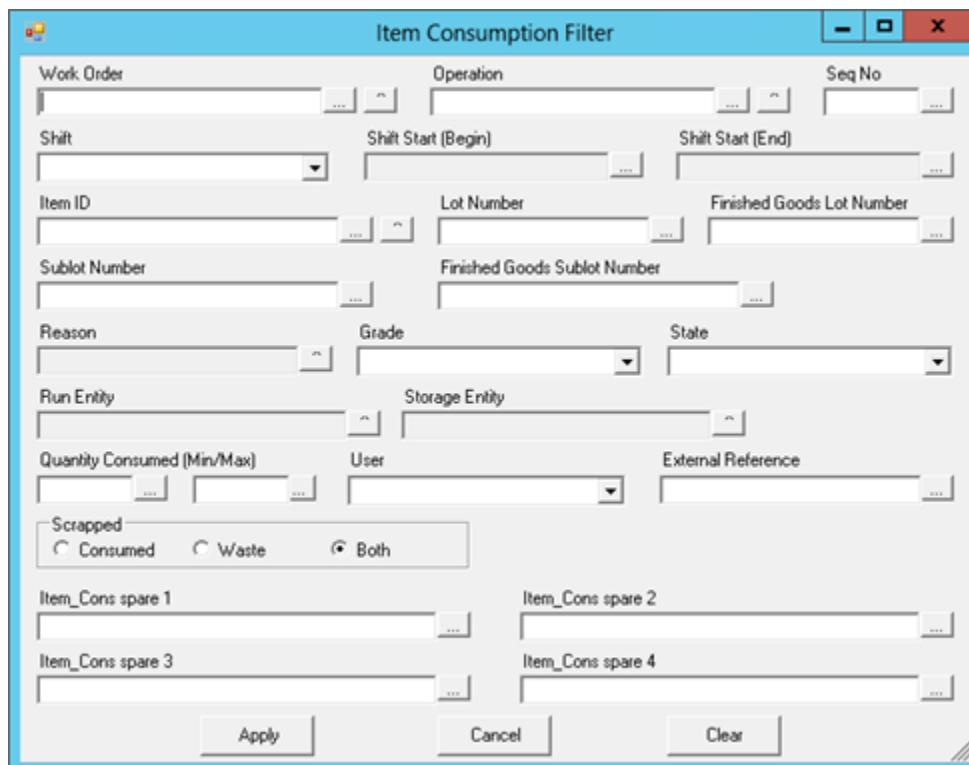
## Maintaining Item Consumption Records on the BOM Tab

The BOM tab allows data in the Item\_Cons table to be maintained. It is only available if MES Operations is licensed and the user has the *May edit consumption data* Data Editor user privilege.

The following topics describe:

- The data by which the item consumption records can be filtered
- The data that can be entered or edited for item consumption records

### Item Consumption Filter



The available filters are listed below, with additional information about using the filter provided as needed.

#### Work Order

#### Operation

#### Seq No

#### Shift

#### Shift Start (Begin)

If a Shift Start (Begin) entry that is after the Shift Start (End) entry is entered, the Shift Start (End) entry is changed to match the Shift Start (Begin) entry.

#### Shift Start (End)

If a Shift Start (End) entry that is before the Shift Start (Begin) entry is entered, the Shift Start (Begin) entry is changed to match the Shift Start (End) entry.

#### Item ID

**Lot Number****Finished Goods Lot Number****Sublot Number****Finished Goods Sublot Number****Reason****Grade****State****Run Entity****Storage Entity****Quantity Consumed (Min/Max)****User****External Reference****Scrapped****Item\_Cons spare 1 to spare 4**

## Item Consumption Data

The screenshot shows the 'Item Consumption' dialog box. The interface is organized into several sections with dropdown menus and text inputs. Key sections include 'Work Order', 'Operation', 'SeqNo', 'Shift', 'Shift Start', 'Item Consumed', 'Lot Number', 'Finished Goods Lot Number', 'Sublot Number', 'Finished Goods Sublot Number', 'Reason', 'Grade', 'State', 'Run Entity', 'Storage Entity', 'Quantity Consumed', 'User', 'External Reference', and four dropdowns for 'Item\_Cons spare 1' through 'Item\_Cons spare 4'. A 'Scrapped' checkbox is also present. At the bottom are 'Save' and 'Cancel' buttons.

The available data entries are listed below, with additional information about entering the data provided as needed. Required entries in the dialog box have bold labels.

### Work Order

A work order ID entry must be selected from the lookup dialog box. Also, a work order ID must be entered before any other data entries can be made.

When a work order ID is entered or changed, the following data is entered automatically:

- Operation, using the first available entry in the list.
- Seq No, using the first available entry in the list.
- Item Consumed, using the first available entry in the list.

**Operation**

Only operations IDs associated with the work order are included in the list.

**Seq No**

Only sequence numbers associated with the work order and operation are included in the list.

**Shift**

A shift can only be entered once a run entity is entered.

**Shift Start**

A shift start can only be entered once a run entity is entered.

**Item Consumed**

Only consumable items associated with the work order, operation, and sequence number (that is, the job) are included in the list.

**Lot Number****Finished Goods Lot Number****Sublot Number****Finished Goods Sublot Number****Reason**

The item reason must be selected from the lookup dialog box.

**Grade**

A read-only field, determined by the Reason entry.

**State**

A read-only field, determined by the Reason entry.

**Run Entity****Storage Entity****Quantity Consumed****User****External Reference****Scrapped**

A read-only field, determined by the Reason entry.

**Item\_Cons spare 1 to spare 4**

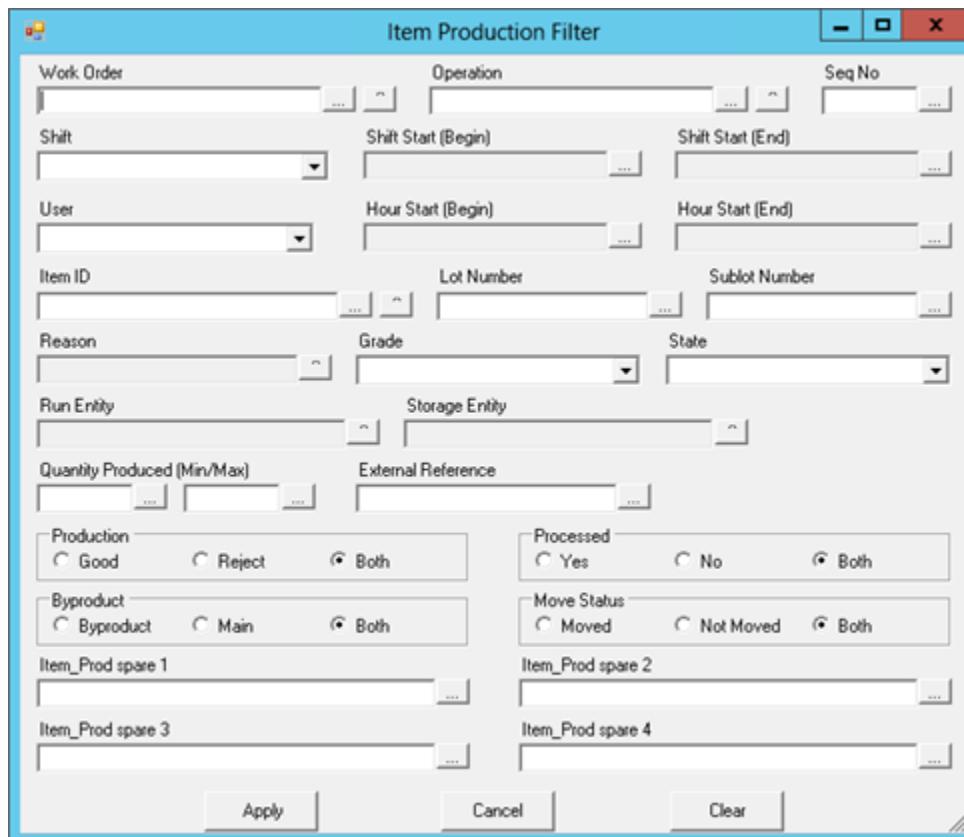
## Maintaining Item Production Records on the Production Tab

The **Production** tab allows data in the Item\_Prod table to be maintained. This tab is available if the *May edit production data* Data Editor user privilege is enabled for the user.

The following topics describe:

- The data by which the item production records can be filtered
- The item production data that can be entered or edited

## Item Production Filters



The available filters are listed below, with additional information about using the filter provided as needed.

### Work Order

### Operation

### Seq No

### Shift

#### Shift Start (Begin)

If a Shift Start (Begin) entry that is after the Shift Start (End) entry is entered, the Shift Start (End) entry is changed to match the Shift Start (Begin) entry.

#### Shift Start (End)

If a Shift Start (End) entry that is before the Shift Start (Begin) entry is entered, the Shift Start (Begin) entry is changed to match the Shift Start (End) entry.

### User

#### Hour Start (Begin)

If also entering an Hour Start (End), make sure it occurs after or on the Hours Start (Begin) entry, as these two fields are not validated prior to the filtering.

#### Hour Start (End)

If also entering an Hour Start (Begin), make sure it occurs prior to or on the Hours Start (End) entry, as these two fields are not validated prior to the filtering.

**Item ID**

**Lot Number**

**Sublot Number**

**Reason**

**Grade**

**State**

**Run Entity**

**Storage Entity**

**Quantity Produced (Min/Max)**

**External Reference**

**Production**

**Processed**

**Byproduct**

**Move Status**

**Item\_Prod spare 1 to spare 4**

## Item Production Data

The screenshot shows the 'Item Production' dialog box with the following fields:

- Work Order:** A dropdown menu.
- Operation:** A dropdown menu.
- SeqNo:** An input field.
- Shift:** A dropdown menu.
- Shift Start:** A date and time picker showing 3/18/2017 at 3:27:45 PM.
- Hour Start:** An input field.
- Item Produced:** An input field.
- Lot Number:** An input field.
- Sublot Number:** An input field.
- Reason:** An input field.
- Grade:** An input field.
- State:** An input field.
- Run Entity:** An input field.
- Storage Entity:** An input field.
- Quantity Produced:** An input field.
- User:** A dropdown menu.
- External Reference:** An input field.
- Checkboxes (bottom left):**
  - Good Production
  - Processed
  - Byproduct
  - Moved to Next Op
- Input Fields (bottom right):**
  - Item\_Prod spare 1
  - Item\_Prod spare 2
  - Item\_Prod spare 3
  - Item\_Prod spare 4
- Buttons:** Save and Cancel.

The available data entries are listed below, with additional information about entering the data provided as needed. Required entries in the dialog box have bold labels.

**Work Order**

A work order ID entry must be selected from the lookup dialog box. Also, a work order ID must be entered before any other data entries can be made.

When a work order ID is entered or changed, the following data is entered automatically:

- Operation, using the first available entry in the list.
- Seq No, using the first available entry in the list.
- Item Produced.

**Operation**

Only operations IDs associated with the work order are included in the list.

**Seq No**

Only sequence numbers associated with the work order and operation are included in the list.

**Shift**

A shift can only be entered once a run entity is entered.

**Shift Start**

A shift start can only be entered once a run entity is entered.

**Hour Start****Item Produced**

Only items associated with the work order and operation are included in the list.

**Lot Number****Sublot Number****Reason**

A reason can only be entered once a run entity is entered.

**Grade**

A read-only field, determined by the Reason entry.

**State**

A read-only field, determined by the Reason entry.

**Run Entity****Storage Entity****Quantity Produced**

If the Good Production check box is selected, the number of decimal places that can be entered here is limited to the value entered for the *Maximum number of decimals for good piece part entries* system parameter.

**User****External Reference****Good Production**

A read-only field, determined by the Reason entry.

**Processed****Byproduct****Moved to Next Op**

## Item\_Prod spare 1 to spare 4

### Maintaining Labor Usage Records on the Labor Tab

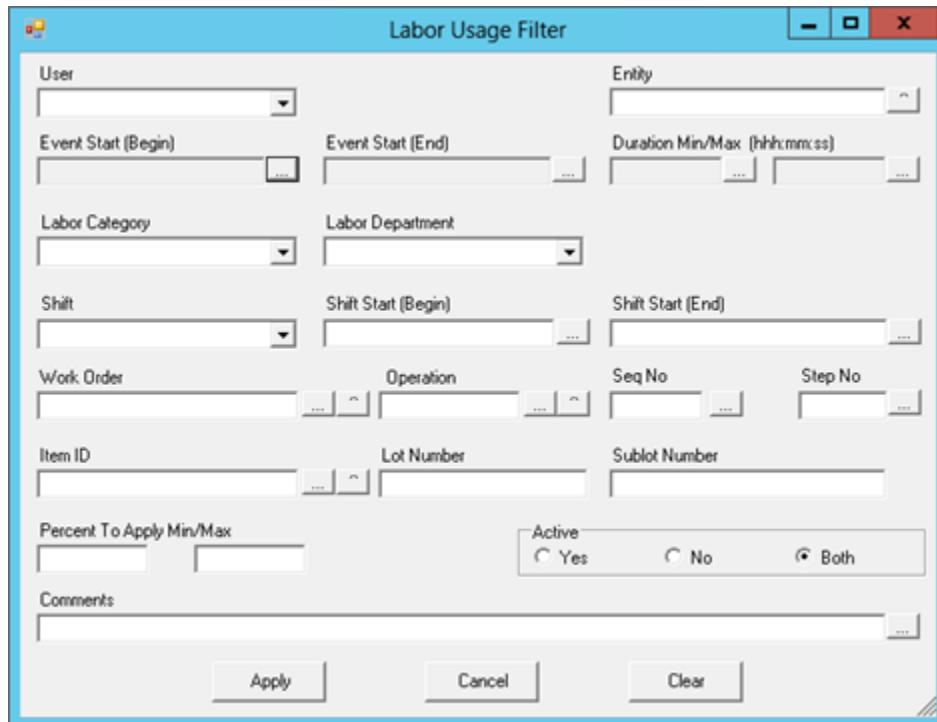
The **Labor** tab allows data in the **Labor\_Usage** table to be maintained. It is only available if MES Operations is licensed and the user has the *May edit labor usage data* Data Editor user privilege enabled.

Data Editor does not limit insertions, updates, or deletions of data in this tab based upon the *Allow user to account for less than 100% of his time* and *Allow user to account for more than 100% of his time* system parameters (since doing so would always cause problems).

The following topics describe:

- The data by which the labor usage records can be filtered
- The data that can be entered or edited for labor usage records

#### Labor Use Filter



The available filters are listed below, with additional information about using the filter provided as needed.

#### User

#### Entity

#### Event Start (Begin)

If an Event Start (Begin) entry that is after the Event Start (End) entry is entered, the Event Start (End) entry is changed to match the Event Start (Begin) entry.

#### Event Start (End)

If an Event Start (End) entry that is before the Event Start (Begin) entry is entered, the Event Start (Begin) entry is changed to match the Event Start (End) entry.

**Duration (Min/Max)**

Enter a minimum or maximum event duration, or enter both to specify an inclusive range.

**Labor Category****Labor Department****Shift****Shift Start (Begin)**

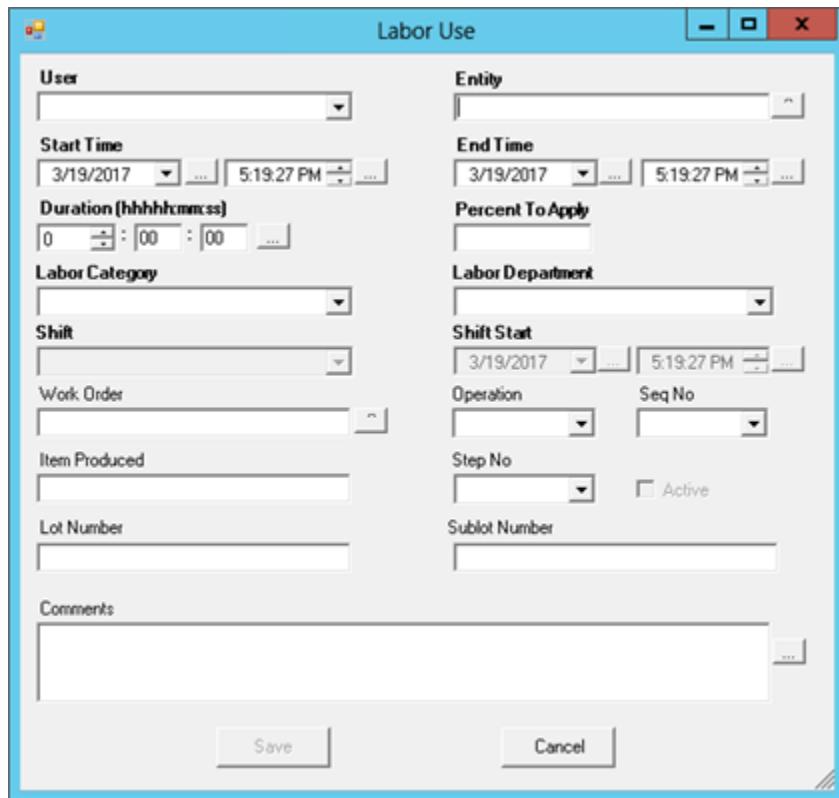
If a Shift Start (Begin) entry that is after the Shift Start (End) entry is entered, the Shift Start (End) entry is changed to match the Shift Start (Begin) entry.

**Shift Start (End)**

If a Shift Start (End) entry that is before the Shift Start (Begin) entry is entered, the Shift Start (Begin) entry is changed to match the Shift Start (End) entry.

**Work Order****Operation****Seq No****Step No****Item ID****Lot Number****Sublot Number****Percent To Apply (Min/Max)****Active****Comments**

## Labor Use Data



The available data entries are listed below, with additional information about entering the data provided as needed. Required entries in the dialog box have bold labels.

Only labor usage records that are not currently active can be edited. Currently active records can be displayed, but no changes can be made to them.

**User****Entity****Start Time****End Time****Duration****Percent To Apply****Labor Category****Labor Department****Shift**

A shift can only be entered once an entity is entered.

**Shift Start**

A shift start can only be entered once an entity is entered.

**Work Order**

A work order ID entry must be selected from the lookup dialog box.

When a work order ID is entered or changed, the following data is entered automatically:

- Operation, using the first available entry in the list.
- Seq No, using the first available entry in the list.
- Item Produced.

**Operation**

Only operations IDs associated with the work order are included in the list.

**Seq No**

Only sequence numbers associated with the work order and operation are included in the list.

**Item Produced**

A read-only field, determined by the Work Order entry.

**Step No**

Only job step numbers associated with the work order, operation, and sequence number are included in the list.

**Active**

A read-only field.

**Lot Number****Sublot Number****Comments**

## Maintaining Lot and Sublot Records on the Lot Tab

The **Lot** tab allows data in the Lot and Sublot tables to be maintained. It is only available if MES Operations is licensed and the user has the *May edit lot data* Data Editor user privilege enabled.

The following topics describe:

- The data by which the lot records can be filtered
- Inserting a new lot record
- Renaming a lot or subplot

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**Note:** Changing the parent of a lot or subplot using the the  **Change Parent** button is not supported.

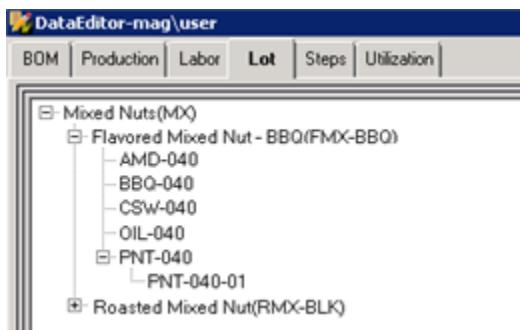
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## Lot Filter



The lot records can be filtered by entering a lot number in the **Filters** panel and clicking **Apply**. To see all lots, clear the **Lot** box before clicking **Apply**.

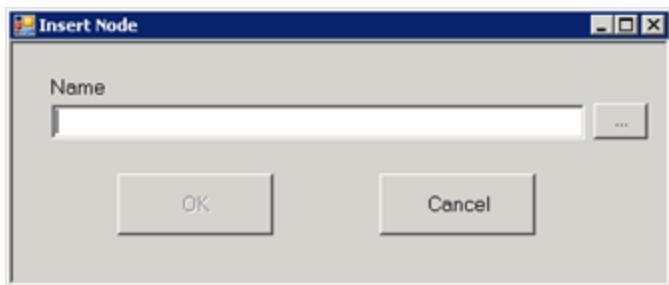
All lots whose IDs match the filter criteria are listed in an item/lot tree.



## Inserting a New Lot

1. In the item/lot tree, select the parent item for the lot.
2. Click the **Insert** button.

The Insert Node dialog box appears.

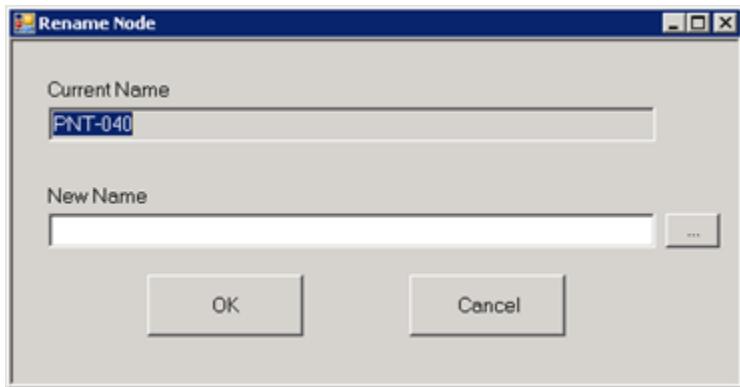


3. Enter the lot name and click **OK**.

### Renaming a Lot or Sublot

1. In the item/lot tree, select the the lot or subplot to rename.
2. Click the **Edit** button.

The Rename Node dialog box appears.



3. Enter the new name and click **OK**.

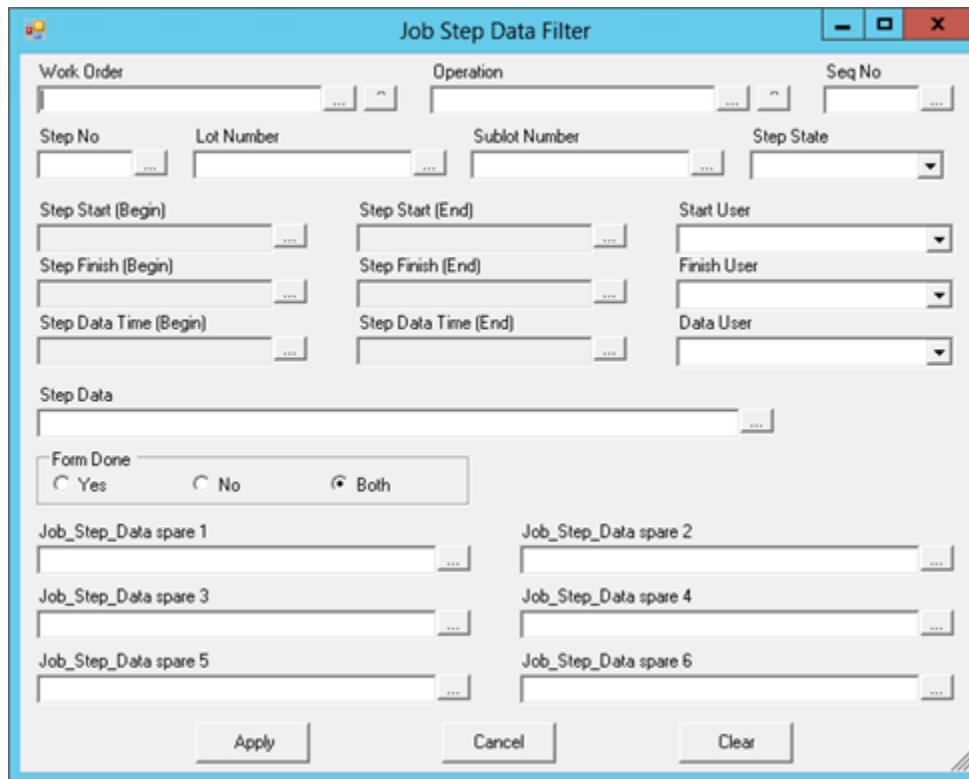
### Maintaining Job Step Data Records on the Steps Tab

The **Steps** tab allows data in the Job\_Step\_Data table to be maintained. It is only available if MES Operations is licensed and the user has the *May edit job data* Data Editor user privilege.

The following topics describe:

- The data by which the job step data records can be filtered
- The data that can be entered or edited for job step data records

## Job Step Data Filter



The available filters are listed below, with additional information about using the filter provided as needed.

### Work Order

### Operation

### Seq No

### Step No

### Lot Number

### Sublot Number

### Step State

### Step Start (Begin)

If a Step Start (Begin) entry that is after the Step Start (End) entry is entered, the Step Start (End) entry is changed to match the Step Start (Begin) entry.

### Step Start (End)

If a Step Start (End) entry that is before the Step Start (Begin) entry is entered, the Step Start (Begin) entry is changed to match the Step Start (End) entry.

### Start User

### Step Finish (Begin)

If a Step Finish (Begin) entry that is after the Step Finish (End) entry is entered, the Step Finish (End) entry is changed to match the Step Finish (Begin) entry.

### Step Finish (End)

If a Step Finish (End) entry that is before the Step Finish (Begin) entry is entered, the Step Finish (Begin) entry is

changed to match the Step Finish (End) entry.

#### Finish User

#### Step Data Time (Begin)

If a Step Data Time (Begin) entry that is after the Step Data Time (End) entry is entered, the Step Data Time (End) entry is changed to match the Step Data Time (Begin) entry.

#### Step Data Time (End)

If a Step Data Time (End) entry that is before the Step Data Time (Begin) entry is entered, the Step Data Time (Begin) entry is changed to match the Step Data Time (End) entry.

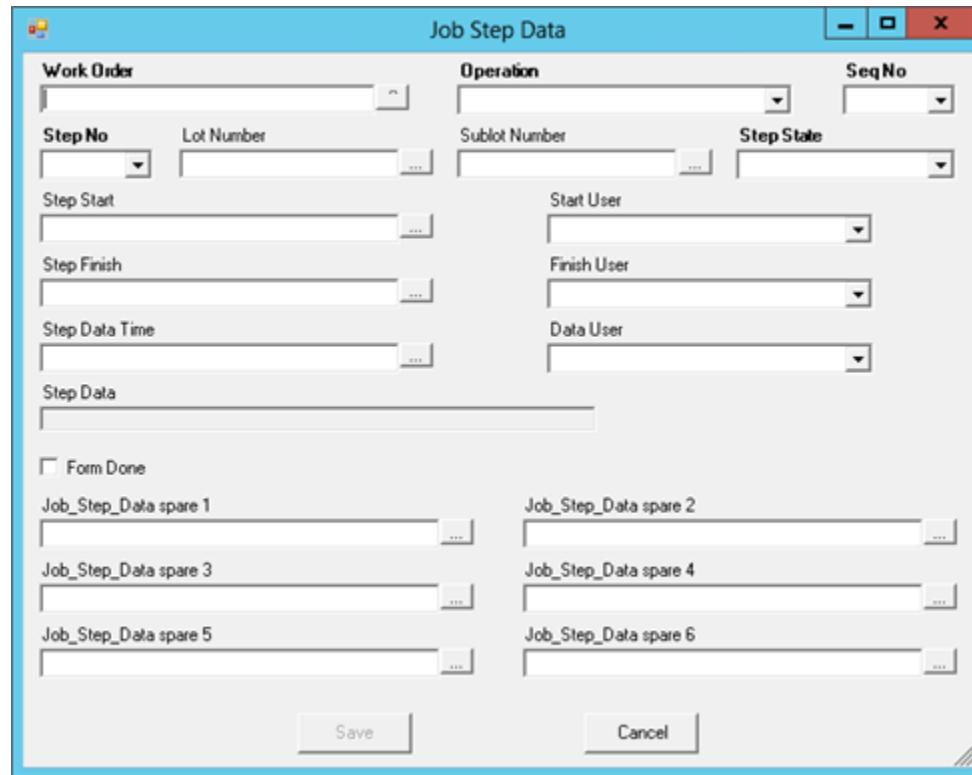
#### Data User

#### Step Data

#### Form

#### Job\_Step\_Data spare 1 to 6

### Job Step Data



The available data entries are listed below, with additional information about entering the data provided as needed. Required entries in the dialog box have bold labels.

#### Work Order

A work order ID entry must be selected from the lookup dialog box.

When a work order ID is entered or changed, the following data is entered automatically:

- Operation, using the first available entry in the list.
- Seq No, using the first available entry in the list.

**Operation**

Only operations IDs associated with the work order are included in the list.

**Seq No**

Only sequence numbers associated with the work order and operation are included in the list.

**Step Number**

Only job step numbers associated with the work order, operation, and sequence number are included in the list.

**Lot Number****Sublot Number****Step State****Step Start****Start User****Step Finish****Finish User****Step Data Time****Data User****Step Data****Form Done****Job\_Step\_Data spare 1 to 6**

## Maintaining Utilization and Job History Records on the Utilization Tab

The **Utilization** tab allows data in the Util\_History and Job\_History tables to be maintained. The Job\_Hour\_History table is also affected, as it is periodically updated with new data from the Util\_History and Job\_History tables. The **Utilization** tab is only available if MES Performance is licensed and the user has the *May edit utilization data* Data Editor user privilege.

The Util\_History table captures utilization data and a chronological sequence of utilization events for each entity that can capture utilization data. This data includes entity utilization states, utilization reasons, number of occurrences, and the timestamps when an entity's utilization state or reason changes (that is, when a new event occurs).

The Job\_Hour\_History table, which is used in the calculation of equipment performance statistics, is updated every hour as necessary to reflect Util\_History table changes, including those made from the **Utilization** tab. However, because recently entered job statistical data is considered volatile with a possibility of changing frequently, a predefined cut-off period is used to determine when equipment performance statistical data is based on data in the Job\_Hour\_History table or generated dynamically. The default cut-off period is 2 hours prior to the current hour. When the Job\_Hour\_History table is updated every hour, only event data that occurred prior to the pre-defined cut-off period is updated.

Deleting a utilization history record increments or decrements the value in the runtime, downtime, or idletime fields of the corresponding Job\_Hour\_History record, depending on the reason code of the deleted record (the reason code determines the time category). Similarly, inserting a new utilization history record increments or decrements the runtime, downtime, or idletime field of the corresponding Job\_Hour\_History record (or creates a new Job\_Hour\_History record, if no record with a key corresponding to the newly inserted utilization history record exists).

The Job\_History table captures the jobs that are run on each entity that can run jobs. Also captured are the position on which the job was running and when the job started and ended. Updates to utilization event history records do not have any impact on the Job\_History table. In the **Utilization** tab, Job\_History records are shown listed below the utilization history record to which they correspond; that is, under the following conditions:

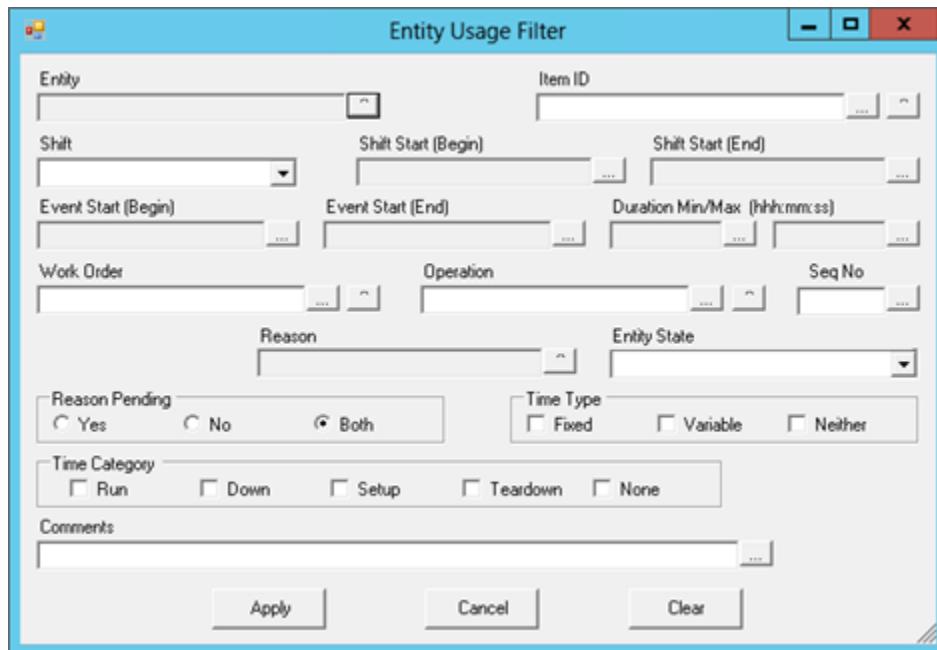
- The job start time of the Job\_History record is greater than or equal to the start time of the utilization event for the related entity
- The job end time of the Job\_History record ends before the end time of the utilization event for the related entity

When the start time or the end time of a Job\_History record is modified, the corresponding runtime, downtime, and idletime of the job in the Job\_Hour\_History table is updated. Similarly, the good and reject production counts for the affected period are also updated in the Job\_Hour\_History table.

The following topics describe:

- The data by which the utilization history data records can be filtered
- The data that can be entered or edited for utilization history data records
- The data that can be entered or edited for job history records that are associated with utilization history data records

## Entity Usage Filter



The available filters are listed below, with additional information about using the filter provided as needed.

### Entity

An entity entry must be selected from the lookup dialog box. Only entities that can run jobs, shown in bold in the dialog box, can be selected.

### Item ID

### Shift

**Shift Start (Begin)**

If a Shift Start (Begin) entry that is after the Shift Start (End) entry is entered, the Shift Start (End) entry is changed to match the Shift Start (Begin) entry.

**Shift Start (End)**

If a Shift Start (End) entry that is before the Shift Start (Begin) entry is entered, the Shift Start (Begin) entry is changed to match the Shift Start (End) entry.

**Event Start (Begin)**

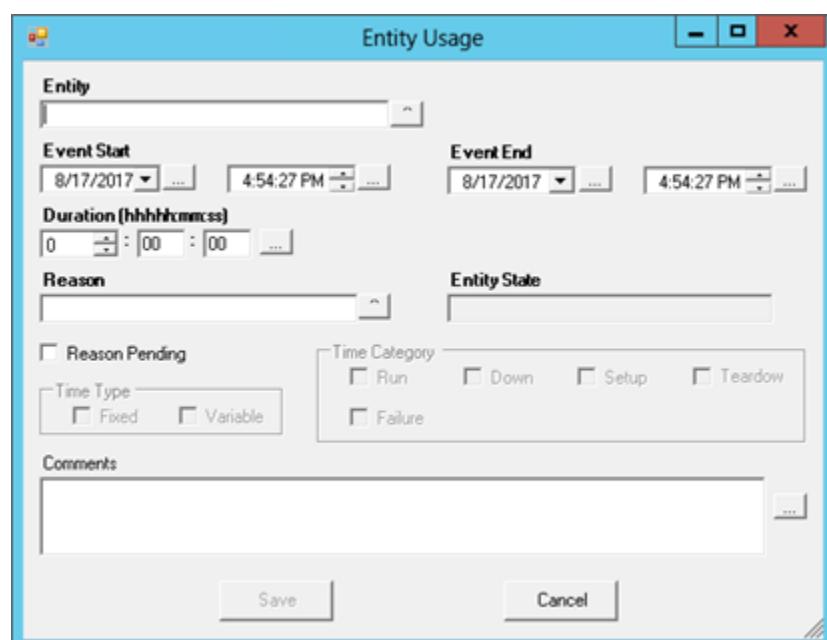
If an Event Start (Begin) entry that is after the Event Start (End) entry is entered, the Event Start (End) entry is changed to match the Event Start (Begin) entry.

**Event Start (End)**

If an Event Start (End) entry that is before the Event Start (Begin) entry is entered, the Event Start (Begin) entry is changed to match the Event Start (End) entry.

**Duration (Min/Max)**

Enter a minimum or maximum event duration, or enter both to specify an inclusive range.

**Work Order****Operation****Seq No****Reason****Entity State****Reason Pending****Time Type****Time Category****Comments****Entity Usage Data**

The available data entries are listed below, with additional information about entering the data provided as needed. Required entries in the dialog box have bold labels.

If any changes are made to event time intervals—by inserting, modifying, or deleting a utilization log record—that would cause the data to no longer consist of a contiguous sequence of event intervals, Data Editor will automatically make whatever adjustments are necessary to restore the data to a contiguous set of time intervals.

#### **Entity**

An entity entry must be selected from the lookup dialog box. Only entities that can run jobs, shown in bold in the dialog box, can be selected.

#### **Event Start**

#### **Event End**

#### **Duration**

#### **Reason**

#### **Entity State**

A read-only entry, determined by the Reason entry.

#### **Reason Pending**

#### **Time Category**

Read-only check boxes, determined by the Reason entry.

#### **Time Type**

Read-only check boxes, determined by the Reason entry.

#### **Comments**

### **Job History Data**

You can insert job history records to associate them with a utilization history record.

---

**Caution:** Extreme care should be taken when modifying job history records, especially the record for the job that is currently running on the entity.

---

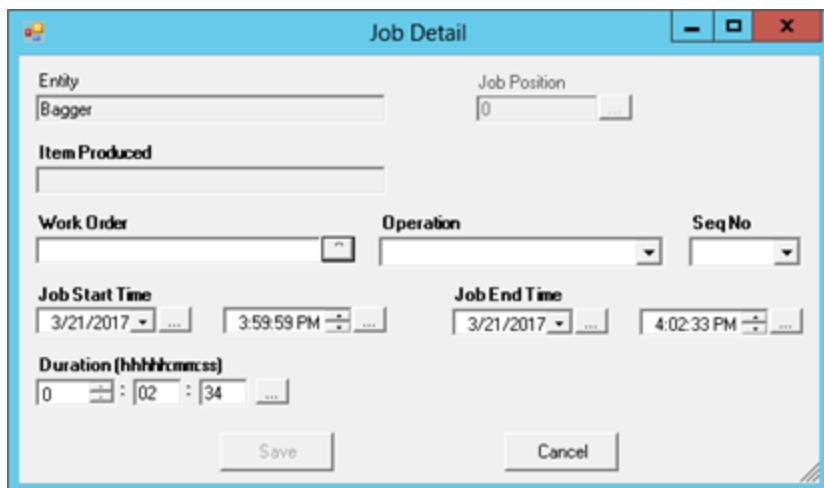
#### **To insert a job history record**

1. Select the utilization history record with which to associate the job history record.



2. Click the Insert Job Detail Row button.

The Job Detail dialog box appears.



3. Complete the job history data entries, described below.

Once inserted, you can edit the job history record just as you would any other data record.

## Job History Data Entries

### Entity

A read-only entry, determined by the associated utilization history record.

### Job Position

A read-only entry, determined by the associated utilization history record.

### Item Produced

A read-only entry, determined by the work order entered.

### Work Order

A work order ID entry must be selected from the lookup dialog box.

When a work order ID is entered or changed, the following data is entered automatically:

- Operation, using the first available entry in the list.
- Seq No, using the first available entry in the list.
- Item Produced.

### Operation

Only operations IDs associated with the work order are included in the list.

### Seq No

Only sequence numbers associated with the work order and operation are included in the list.

### Job Start Time

### Job End Time

### Duration

## MES Web Portal Administrator

Use the Manufacturing Execution System (MES) Web Portal to configure and monitor your plant model and production processes.

## MES Web Portal Concepts

To use MES Web Portal effectively, it is important to understand basic concepts.

It is recommended that you read through the explanation of these concepts before attempting to configure or use MES Web Portal.

## MES Web Portal User Authentication and Privileges

The following topics include conceptual and configuration information specific to MES Web Portal user authentication and privileges for MES Web Portal functionality.

### User Authentication

The default Security Mode for MES installations is Native mode. However, MES Web Portal requires the use of your system's Windows Active Directory (AD) user groups or user accounts for logging in. Therefore, to support MES Web Portal users, the Security Mode must be changed to either OS Group or OS User. Also, AD user groups or users must be added to the MES database using MES Client, depending on the security mode.

### Using OS Group vs. OS User Security Mode

Refer to the following descriptions to help you determine which Security Mode—OS Group or OS User—to use for MES Web Portal user authentication in your system environment:

- In OS Group mode, the AD groups to which a user belongs are checked and the user's AD user account is checked to verify their authentication to log in to an MES Web Portal session. If the user belongs to an AD group that has also been configured as an OS group in the MES database, then the user is allowed to open a session. If an MES user account does not already exist for that user, then one is automatically created. For information about adding AD user groups as OS groups in the MES database, see the *MES Client User Guide* or online help.
- In OS User mode, the user's AD user account is checked to verify their authentication to log in to an MES Web Portal session. If the user's AD user account has also been configured as an OS user in the MES database, then the user is allowed to open a session. For information about adding AD user accounts as OS users in the MES database, see the *MES Client User Guide* or online help.

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**Note:** If you change the security mode, you have to restart the MES Web Portal service in Internet Information Services (IIS).

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### OS Group Security and Multiple AD Domains

If your network is configured with multiple Windows AD domains, and you intend to use OS Group security with MES Web Portal, you must select only Global and Universal domain groups when configuring MES groups. This is

because MES Web Portal will not authenticate users in local groups if the system is part of multiple domains.

As an example, say your network has multiple domains and you pick a local domain group to be an MES group. You configure that group to have access to an entity, to run Operator, and to not allow editing of entity settings. A user who belongs to that local domain group (and does not belong to any other groups configured to be an MES group) would be able to log into the entity in MES Operator and perform operations on that entity.

However, the same user would not see the entity in MES Web Portal because MES Web Portal will not authenticate the user from that domain local group.

You should only select local domain groups if you are sure that your network has only one domain. Consult your network administrator if you are unsure about whether your network has multiple domains or if you are unsure about whether a domain group is local, global, or universal.

### Authentication Checks Performed When a User Logs In

The following conditions are checked when a user attempts to log in to MES Web Portal:

1. The user's AD username and password are checked by the web browser.
2. The MES Security Mode must be either OS Group or OS User. If it is MES Native mode, the login will fail.
3. The user's AD user group or user account, depending on whether the MES Security Mode is set to OS Group or OS User, must be mapped to an MES user group or user account in the MES database. One or more of the user's AD user groups can be mapped to MES groups.
4. If OS User mode is being used, the user's AD user account must map to an MES user account in the MES database.

If OS Group mode is being used and the AD user group maps to at least one MES user group, an MES user account for the user is automatically added to the MES database.

5. The MES user account must be active. (MES Client includes an **Inactive** check box option to allow a user account to be made inactive.)
6. The user has to be a member of at least one MES user group that has at least one privilege setting assigned to it.
  - If no privileges are assigned to any of the MES user groups to which the user belongs, a message indicating insufficient privileges to use the application appears. The only available tasks that the user can perform are accessing the online help and logging out.
  - If at least one privilege for one of the MES user groups to which the user belongs is set, then even if that privilege is not related to MES Web Portal functionality, the user will be able to access the MES Web Portal application. However, only the Work Orders tile will be shown in the home page and only the Work Order option will appear in the navigation menu.
7. MES licensing is checked. If the appropriate licensing is not available, a licensing message appears and the user will not have access to the application.
8. Once logged in, the user will see the MES Web Portal pages and functionality as defined by their MES user groups' privilege and access settings.

### Privilege and Access Settings

MES Web Portal uses MES user groups to check for user privileges to perform tasks or view information and to allow user access to lines and entities. Except for line access, which is set in MES Web Portal, all MES user group privilege and access settings are set in MES Client.

- Privilege settings allow configuration and operation tasks to be performed, such as creating lines, entities, utilization states, and utilization reason groups and reasons; assigning work orders to lines; and changing work order status. These tasks are controlled through the privileges assigned to MES user groups.
- Access settings allow operation tasks to be performed on a line or entity. This includes viewing and performing operation tasks related to work orders and jobs, entities, and utilization events. These tasks are controlled by assigning line or entity access to MES user groups.

A user will inherit all privileges and access that are permitted inclusively in all MES user groups of which they are a member. So, if a user is a member of more than one MES user group and any of those MES user groups has a particular privilege (for example, *May edit lines*), the user will have that privilege even if other user groups of which they are a member do not have that privilege.

The following table describes the privilege and access settings that are available.

Setting	Setting Type	Where Specified	Allows Users to:
May edit lines	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.	Create, configure, modify, and delete any lines, regardless of line access settings.  If this privilege is not assigned, the user will see only those lines to which they have line access. And for those lines, the user will not see the line <b>Configuration</b> tab or subtabs.  If this privilege is assigned but the user has not been assigned access to a line, the user can configure the line but will not see the line's <b>Work Orders</b> or <b>Entities</b> tabs. So the user will not be able to view the line or its entities and work orders.
Line access	Operation	MES Web Portal, in the line's <b>Configuration</b> tab, <b>Line Access</b> subtab.	View lines, including their work orders and entities.  Line access is assigned individually for each line.  If access to a particular line is not assigned, the user will be able to see work orders on the <b>Work Orders</b> collection page, even if those work orders

Setting	Setting Type	Where Specified	Allows Users to:
			<p>are assigned to that line. However, any links in MES Web Portal to that line's pages will be disabled.</p> <p>If a user cannot edit lines and has not been assigned access to any lines, they will not see the <b>Lines</b> tile on the home page or the <b>Lines</b> option in the navigation menu.</p>
May edit entity settings	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.	<p>Create, configure, modify, and delete any entities, regardless of the user's line access setting for the line to which an entity is assigned.</p> <p>If this privilege is not assigned, the user will see only those entities to which they have been assigned access. And for those entities, the user will not see the entity <b>Configuration</b> tab or subtabs.</p>
Entity access	Operation	MES Client, in the MES user group's <b>Entity Access</b> tab.	<p>The user will be able to see and perform operation tasks for only those entities that have been assigned to the MES user groups of which the user is a member.</p> <p>If a user cannot edit entities and has not been assigned access to any entities, they will not see the <b>Entities</b> tile on the home page or the <b>Entities</b> option in the navigation menu. On the line <b>Entities</b> page, they will see the entity tiles and bottleneck information, but the</p>

Setting	Setting Type	Where Specified	Allows Users to:
			<p>entity tiles will not include operation-related buttons.</p> <p>One exception is that, even if the user does not have access to an entity, if that entity has the <i>Can Store</i> capability selected, the user can select that entity in the <b>To Storage Location</b> list in the <b>Add Production</b> and <b>Reduce Production</b> side sheets.</p>
May assign a work order to a line	Operation	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Supervisor</b> group.	<p>Assign a work order to any line, regardless of the user's line access authorization.</p> <p>If a user cannot assign work orders to a line, then they cannot create work orders, because the line assignment is required for a new work order. The user can edit an existing work order, but regarding the line assignment, the user can only reassign the work order to no line.</p>
May change work order state	Operation	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Operator</b> group.	<p>Change the status of a work order, regardless of the user's line access authorization for the line to which the work order is assigned.</p> <p>If a user cannot change the status of work orders, then they cannot create work orders, because the status assignment is required for a new work order. The user can edit an existing work order, but cannot change its status.</p>

Setting	Setting Type	Where Specified	Allows Users to:
May edit utilization states	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.	Create, configure, modify, and delete utilization states. This privilege applies to MES Web Portal only.
May edit utilization reasons or groups	Configuration	MES Client, in the MES user group's <b>Privileges</b> tab, <b>Configurator</b> group.	Create, configure, modify, and delete utilization reason groups and reasons. This privilege applies to MES Web Portal only.  Typically, the two utilization edit authorizations are either both set or not set for a user group.  If a user has neither of the two utilization edit authorizations, they will not see the <b>Utilization</b> tile on the home page or the <b>Utilization</b> option in the navigation menu. However, if they have entity access, they will be able to assign utilization reasons to events for those entities.

### Example Roles and Privilege Settings

The table below shows suggested privilege settings for the following example MES Web Portal user roles:

- An Application Engineer who is configuring the system but does not require access to operations related to lines, work orders, entities, and entity events.
- An Operations Supervisor who needs requires access to all lines, work orders, and entities but no access to configuration tasks.
- An Operator who requires access to specific lines and entities.

Setting	Application Engineer	Operations Supervisor	Operator
May edit lines	Yes	No	No
Line access	No	Yes, to all lines	Yes, but only to lines on

Setting	Application Engineer	Operations Supervisor	Operator
	which they will perform tasks		
May edit entity settings	Yes	No	No
Entity access	No	Yes, to all entities	Yes, but only to those entities on which they will perform tasks
May assign a work order to a line	No	Yes	Optional, depending on whether operators for your site are allowed to start work orders
May change work order state	No	Yes	Optional, depending on whether operators for your site are allowed to change work order status
May edit utilization states	Yes	No	No
May edit utilization reasons or groups	Yes	No	No

## Entities

Entities are physical assets in the plant whose activity will be tracked by MES and on which information will be reported.

Entities can be:

- An entire plant
- An area of the plant, such as a production floor or a warehouse
- An organizational group of machines, such as those in a department
- A piece of equipment
- A module that makes up a piece of equipment

For information about adding and configuring entities, see [Configuring Entities](#).

## Entity Capabilities

Within MES, entities can be assigned one or more capabilities. These capabilities define what activity can occur at the entity and thus what data will be captured and included in reports. These capabilities include:

- Scheduling and running jobs

- Having its own shift schedule
- Capturing machine utilization
- Capturing labor information
- Tracking OEE (overall equipment effectiveness)
- Receiving, storing, or shipping production items
- Logging data
- Copying folders of program files, documentation, and other files regarding an item's production relative to the entity
- Capturing quality data

**Note:** MES Web Portal can be used to configure entity utilization and OEE data capture only. To configure Operational and Quality data capture, use MES Client.

## Items and Item Classes

An item is the basic unit produced or consumed during production. Items can be referred to as a part, component, piece, and so on in different manufacturing environments.

An item class is a logical grouping of items that share common characteristics, such as physical properties and whether they are produced, consumed, or both.

Items and item classes are created in MES Client.

It is helpful to understand how item entries are formatted in MES Web Portal:

- The item entry format consists of the item class designation followed by a backslash and then the item designation when both the item class and item designation are displayed on a single line.
- The item class designation is the item class ID and/or item class description, as specified by the *Item class display* System parameter.
- The item designation is the item ID and/or item class description, as specified by the *Item display* system parameter.

For more information about setting the *Item class display* and *Item display* system parameters, see the *MES Client User Guide* or online help.

## Line Management

Most manufacturers have the concept of a line, whether it is called a production line, manufacturing line, or assembly line. On a line, raw materials are converted to finished goods through various process steps to produce a final product.

Lines can be very simple, such as a linear series of machines and work areas that enhance the value of the product in an ordered manner with the previous step being completed before the next step can begin. Other lines can be more complex, with parallel equipment or even parallel segments of multiple pieces of equipment to increase throughput.

In MES, each entity of a line has a production rate based on the item being processed. As a whole, the line production rate is limited by the slowest entity or parallel entity segment, referred to as the bottleneck.

The following topics explain the main concepts of the MES implementation of line management.

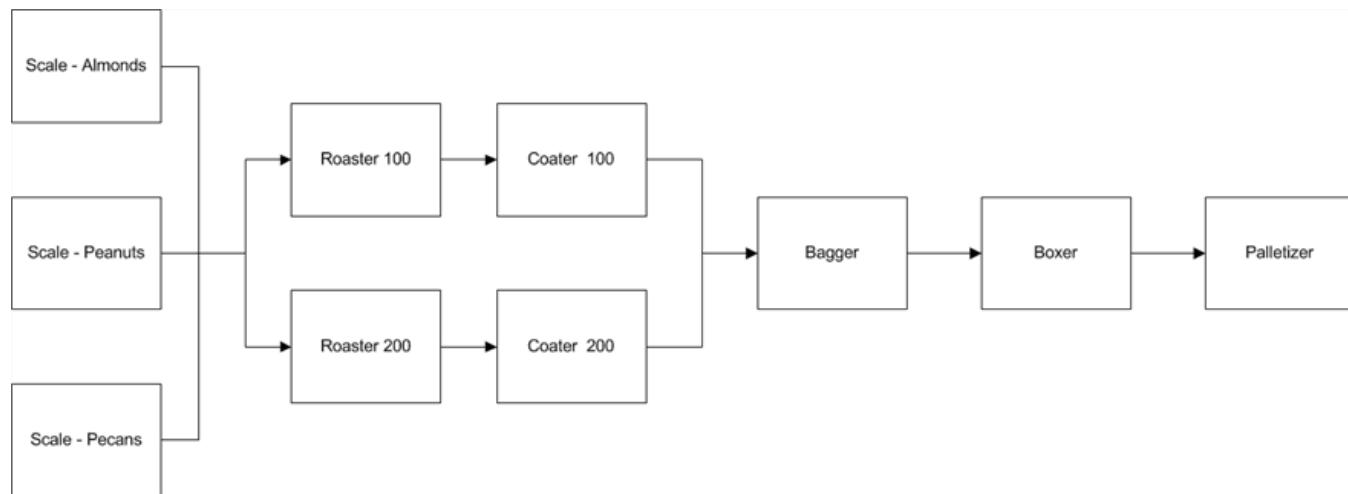
## Lines

In MES Web Portal, a line is an ordered set of entities that models a production line, manufacturing line, or assembly line. A line is ordered in the sense that each entity in the line is related to at least one other entity in the line in a directed way that indicates the flow of product.

All of the entities in the line must have the following conditions:

- Ability to schedule jobs, run jobs, capture utilization, and track OEE (overall equipment effectiveness)
- Not be allowed to have more than one Job Exec (that is, it cannot have more than one job running at a time)
- Have an OEE production rate defined
- Not be a member of another line
- Not be the parent entity of the line

The following diagram is a model for an example line that produces bags of mixed nuts.



For information about creating and configuring lines in MES Web Portal, see [Configuring Lines](#).

## Parent Entity to a Line

A line is not an entity itself. It is assigned to a parent entity, from which it inherits its shift schedule. The parent entity to a line is typically a location, such as a plant site, or an organization. Such an entity can be the parent entity to more than one line.

Entities that serve as the parent entities to lines can schedule shifts. The entities in the line can inherit their shifts from the line's parent entity.

## Line Layout

Your physical line can be modeled using the line layout tools available in MES Web Portal. See [Configuring a Line's Layout](#).

When configuring a line layout, it is important to understand several layout-related concepts:

- Serial and parallel entities
- Line segments

- Line positions

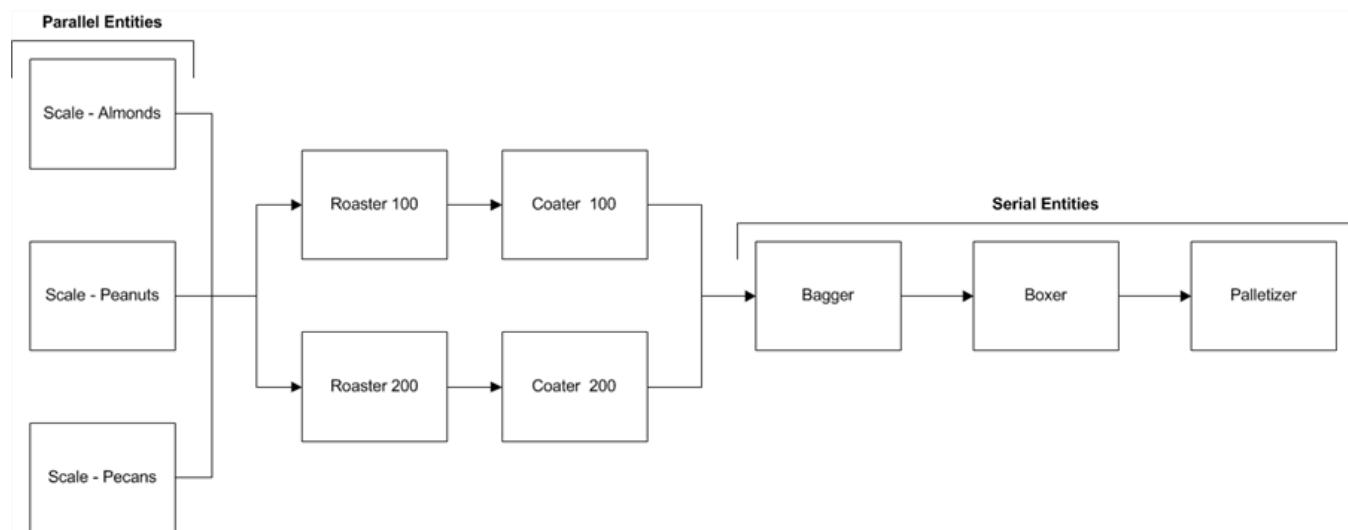
There are also some important guidelines about entities and lines that you should be aware of, explained in the topics that follow.

## Serial and Parallel Entities

A line consists of a combination of serial and, optionally, parallel entities.

Parallel entities refer to a set of two or more entities that are at the same position in a production line. Each parallel entity can receive material from the same set of entities immediately before it in the production line or line segment, and can send material to the same set of entities immediately after it in the production line or line segment.

Serial entities do not have any other entities at the same position in the production line or line segment.

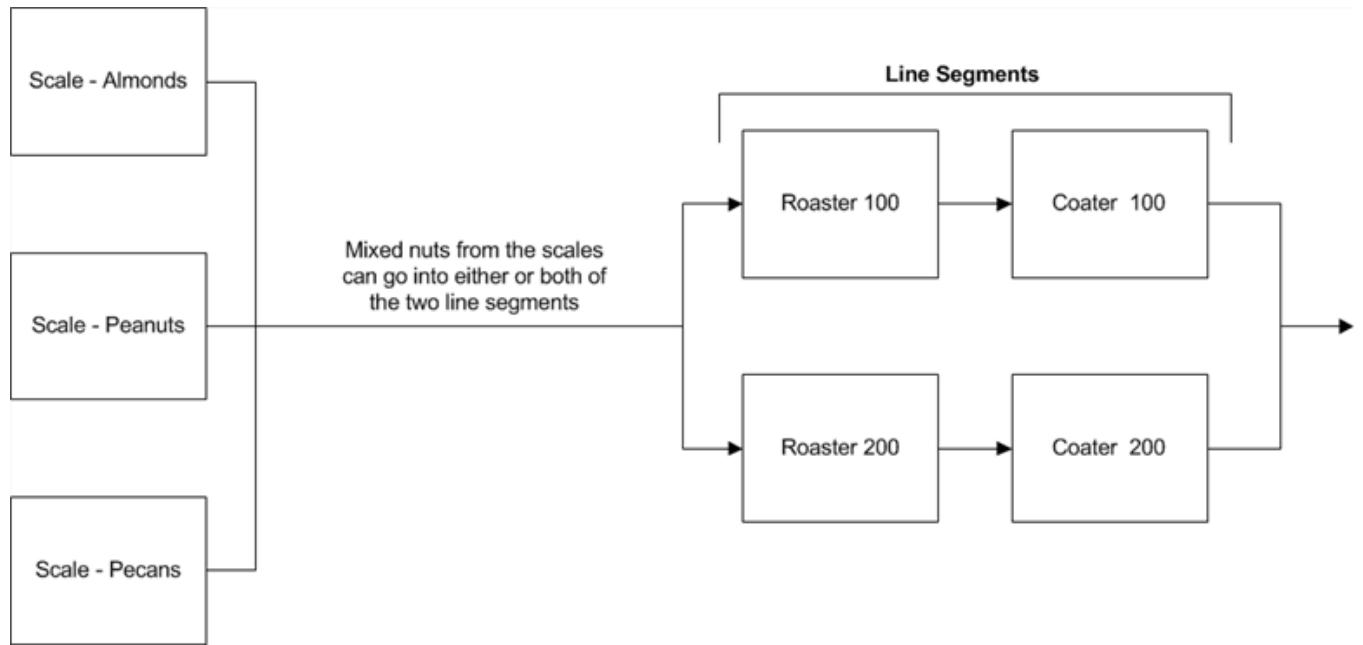


## Line Segments

A line segment is a subset of the entities in a line that acts as a line unto itself.

Line segments can consist of a combination of serial and parallel entities.

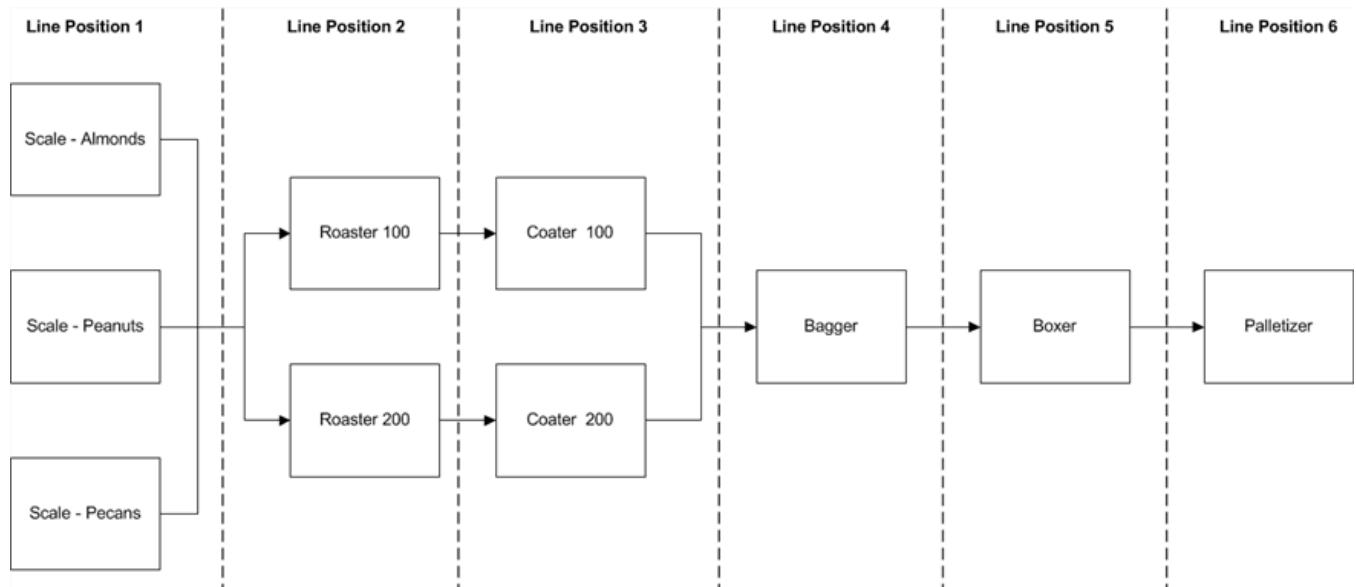
Line segments that are parallel with each other must contain the same number of entities. The corresponding entities in the parallel segments use the same line positions.



# Line Positions

Parallel entities or entities that are at the same position in parallel line segments are said to be at the same line position within the line. Which entities are at a particular line position is considered when determining the line's production rate and bottleneck entity. For example, if an entity is designated as the bottleneck, all entities at the same line position are considered bottleneck entities.

The following diagram indicates the line positions for an example line.



# Entity and Line Guidelines

- An entity can be the parent entity of more than one line.
- An entity can be placed in a given line only once, not at multiple positions.
- The same entity cannot be both a member of a line and a parent of a line.
- An entity cannot be the member of more than one line.

## Production

To understand how a line's production rate and bottleneck entity are determined, you should be familiar with the following related concepts:

- The various types of production rates that are used by the system
- The types of completion times and how they are calculated
- How line properties are used to determine production rates
- How the line's production bottleneck entity is determined
- How entity production rates are tracked internally

# Production Rates

The expected production rate for a given entity is the estimated production rate for the job running on the entity. This is also referred to as the standard production rate, as it is the rate that is set by the time standard for the job. The expected rate can default to the standard rate defined for the entity if a rate is not defined for the job.

The actual production rate is the rate derived by dividing the total production (good and reject) by the amount of time that the entity was in a running state for the job.

# Line Properties Used to Determine Production Rates

The following line properties must be defined to support the determination of the line's production rates.

### Standard Item

The standard item that is being produced on the line.

### Batch Size

The standard batch size used when producing items on the line. The default is 1.

### Production Unit of Measure

The standard production rate unit of measure for items produced on the line. The default is hours/batch.

# Determining a Line's Performance and Production Amounts

A line's performance amount is the amount of production (good and rejects) at the line's bottleneck entity (see [Bottleneck Entities](#)). If the line's bottleneck is a set of parallel entities, the performance amount for the line will be the sum of the performance amounts of the parallel entities. Rejects from entities upstream from the bottleneck entity/entities are not included in the performance amount.

A line's production amount is the amount of production (good and rejects) to be reported to resource planning systems, such as an enterprise resource planning (ERP) system. It is based on the amount of production at the entity defined as the line's production source, which is usually the last entity in the line. If there are other entities at the same line position as the entity that is defined as the production source, the production amount will be the sum of the production of all entities at that line position.

## Bottleneck Entities

A bottleneck entity is identified for each line to determine the line's performance rate. The bottleneck entity line position is the entity or set of parallel entities in a line that have the lowest expected production rate, and thus limit the rate at which the entire line can produce items.

The entity production rate can vary by whether a job is running or not and by which job is running. Therefore, the bottleneck is not necessarily a fixed entity or line position, but can be determined programmatically (either by MES Web Portal or by MES Stateless API calls) given the current production situation.

The production rate for a set of parallel entities is determined by adding the appropriate production rates of each eligible entity (that is, entities that are not disabled or that can be bottlenecks) and converting them to a common unit of measure (see [Line Configuration Settings](#)). The production rate of the bottleneck entity, or parallel entities, is used as the line's production rate, and the performance amount of the bottleneck entity, or parallel entities, is used as the line's performance amount.

## Determining Bottlenecks Manually or Automatically

The bottleneck entity can be determined in the following ways:

- Manually, by specifying a specific entity as the bottleneck entity when configuring the line. In this case, the specified entity is always used to set the line's performance amount. Note that, if there is more than one entity at the same line position as the manually-designated entity, the performance amount comes from all of the entities at that line position. See [Manually Designating the Bottleneck Entity](#).
- Automatically, by **not** specifying a specific entity as the bottleneck entity when configuring the line, but by specifying which entities can be the bottleneck. In this case, the bottleneck entity will be determined by the system's evaluation of entity performance rates for the entities that have been designated as "Can be a bottleneck." See [Configuring the Automatic Determination of Bottleneck Entities](#).

# Automatic Determination of Performance Rates and Bottleneck Entities

The following behavior governs the automatic determination of entity performance rates and which entities are bottlenecks.

- All entities at the line position with the lowest production rate are designated as the bottleneck entities.
- If entities at different line positions have the same lowest performance rate for the line, the entity (or set of parallel entities) closest to the end of the line is designated as the bottleneck entity.
- The production rate for a set of parallel entities is the sum of the production rate of all of the parallel entities that are enabled. This is true whether the entities are in a standalone set of parallel entities or are in parallel line segments and at the same line position. Note that there must be a path of enabled entities through the line or line segment.
- For an entity to be considered a bottleneck, it has to be configured as capable of being a bottleneck.
- If an entity does not have a utilization reason (meaning a utilization event was never set for the entity, perhaps because the entity was just created), then that entity is considered for the bottleneck calculation. However, if the entity has a utilization reason, then the current utilization reason for that entity must have its *Is Entity enabled when this Reason applies?* setting selected to consider that entity for the bottleneck calculation; otherwise, it will not be considered.
- To compare production rates between entities at different line positions, the line's and entities' production units of measure, batch sizes, and standard items are used to convert the rates to comparable units. This comparison, and thus the determination of the bottleneck entity, can only be performed if item production rates can be converted to comparable units.
- If an entity is running multiple jobs, the lowest production rate of all of those jobs is used for the entity's production rate value when calculating the line's performance rate.
- If an entity is not running any jobs, the next job that will be running on it is used in the performance rate calculation. The next job is determined by looking at the next upstream work order on the line that has a job for this entity. If there are no jobs for the entity in any upstream work orders, then the standard production rate defined for the entity is used (see [Configuring Entities](#)).

## Conditions When an Entity's Production Rate Cannot Be Determined

If the production rate for an entity cannot be determined, then the line's performance rate and bottleneck entity cannot be determined. Examples of this condition are:

- An entity on which no job is running, there is no upstream job source for the rate, and a default rate has not been defined for the entity.
- A job is running on an entity that produces an item that is different than the default standard item configured for a line and there is no conversion factor between the different units of measure of these two items.

# Determining Comparable Units and Production Rates

The expected production rate for a given entity is primarily the estimated production rate of the job running on the entity. To compare the production rates among the entities in a line, the rates have to be converted into comparable units. This involves the production unit of measure (UOM), the batch size, and the UOM for each standard item.

The estimated production rate can be expressed as hours, minutes, or seconds per batch, or batches per hour, minute, or second, as defined by the entity's production unit of measure.

As an example of the production rates for different entities being defined differently, one machine can be running at 20 batches per minute with a batch size of 5 and for which the item is a 64-oz bottle. Another machine might be making 30 batches of 20-oz bottles per hour with a batch size of 2.

- The production UOM and batch size factors can be handled by converting all rates to a common production UOM and batch size.
- For the item UOM conversion, the native production UOM of the item is used to convert to the native production UOM of another item. In the case of converting a 64-bottle to a 20-oz bottle UOM, the conversion factor to convert "64-oz bottle" to "20-oz bottle" would be 3.2, assuming that the operation's duration is proportional to the volume of the container.

When the item being produced by an operation is different than the items being produced at the upstream operations, there might not be a direct UOM conversion defined between the UOMs of items in successive operations. In this case, you need to define the UOM conversions in MES Client. For example, if an 8-count carton (with a certain item ID) holds 8 64-oz bottles, a unit-of-measure conversion factor of 8 must be defined between "each" or "8-ct" (the unit of measure of the carton) and "64-oz bottle".

There will always be a standard item being produced on the line whose UOM is used as the reference UOM. If a standard item for the line is defined, then its UOM will be used as the UOM to which all production rates for the individual entities are converted. If a standard item for the line is not defined, the UOM of the first item encountered when doing the production rate conversion calculation will be used as the standard to which all other UOMs are converted. The UOMs of all items being produced in the line must be able to be converted to the standard item's UOM.

## Internal Tracking of Entity Production Rates

The estimated production rate for an entity is updated whenever any of the following events occur on the entity and the production rate has changed. When automatic determination of the bottleneck is being used, any time that an entity's production rate is updated, a reevaluation of the line's bottleneck is performed. The bottleneck information is displayed in the header area of every line page in MES Web Portal.

- A job is started on the entity and the new job's production rate is different than the entity's previous production rate.
- A job is ended on the entity and the entity's projected production rate is different than that of the job that was ended. The projected production rate is determined by the next job that is expected to be run on that entity if one of the following events occurs:

- A job starting on an upstream entity from that entity, where neither that entity nor any between it and the upstream entity where the job is being started are running any jobs.
- A job ending on an upstream entity from that entity, where neither that entity nor any between it and the upstream entity where the job is being ended are running any jobs.
- A change in the production rate of a job running on the entity. Note that this can be a change in the job's production rate unit of measure, batch size, or the item being produced, as well as a change in the job's production rate value itself. (In MES Client, the UOM, batch size, or item being produced cannot be changed while a job is running on the entity. When using the Stateless API, the item being produced cannot be changed while a job is running on the entity.)
- A change in the production rate of a job that is running on an upstream entity from the entity, where neither that entity nor any between it and the upstream entity where the job's production rate is being changed are running any jobs.
- A change in the default production rate of an entity if neither that entity nor any upstream entities from it are running any jobs. This would occur if one or more of the following parameters are changed for the entity: the standard item, the batch size, or the production unit of measure. See [Configuring Entities](#).
- The entity is disabled by choosing a utilization reason for it that indicates that it is disabled (that is, a utilization reason for which the Entity Enabled flag is false) when the previously chosen utilization reason indicated that it was enabled. In this case, its production rate would go to 0.
- The entity is enabled by choosing a utilization reason for it that indicates that it is enabled (that is, a utilization reason for which the Entity Enabled flag is true) when the previously chosen utilization reason indicated that it was disabled. In this case, its production rate would probably change from 0 to some other value.

## Decimal Precision of Item Production Quantities

The number of decimals used for item production quantities displayed in MES Web Portal is based on the item's *Num Decimals* parameter. However, for good production (not rejected production), if the *Num Decimals* parameter is 0, then the number of decimals is based on the system parameter *Maximum number of decimals for good piece part entries*. For information about setting these parameters, see the *MES Client User Guide* or online help.

### Work Orders and Jobs

Production rates are calculated as jobs are executed according to work orders.

To track the progress of job execution, it is helpful to understand work order status and job states.

## Work Orders

A work order represents a request for some quantity of an item to be produced. A work order is uniquely identified by its ID number. Once completed, a work order is not intended to be executed again.

For line management, work orders can be created and assigned to lines in MES Web Portal. Work orders can also be submitted to MES from an external system, such as a manufacturing resource planning (MRP) or enterprise resource planning (ERP) system, or created in MES Client. The work orders are assigned to specific production

lines.

To be executed, the work order must comprise a set of jobs that represent the complete set of operations required to manufacture that product from ingredients or components. These ingredients or components may have been purchased or manufactured as the result of a previous work order. Creating a work order in MES Web Portal and assigning it to a line also creates the necessary jobs for all entities associated with the line. Unlike work orders created using MES Client and worked using MES Operator, there is no correlation to a process and therefore no concept of a bill of material in MES Web Portal. There is the produced item of the work order and the quantities (starting and required).

## Work Order Status

A work order has a status that is determined by the status of its member jobs. Job states are described in [Job States](#).

You can also manually change work order's status. See [Changing a Work Order's Status](#).

The status of the work order is derived based on the first condition that satisfies the following order:

1. If there is a job running, the work order status is Running.
2. If all the jobs are completed or canceled, the work order status is Complete.
3. If there is any one on-hold job, then the work order status is On Hold.
4. If there is any one suspended job, then the work order status is Suspended.
5. If there is any one ready job, then the work order status is Ready.
6. If none of the above conditions are true, the work status is New.

## Jobs

A job represents an instance of an operation for a given work order that is intended to be performed at a given entity. A job can include a list of steps or procedures that are executed to perform that operation. In turn, a work order consists of a set of jobs that are executed to produce an item.

Within the MES database, a job is characterized by a unique combination of work order ID, operation, and internal sequence number.

Jobs are executed on entities. Jobs can be controlled by:

- Starting an existing job on the entity
- Pausing or ending a job that is running on the entity

The recording of job execution data for an entity can be performed by an Operations Capability Object (OCO) instance. In the MES Web Portal, a production operator can manually start a new job or end a job (see [Starting and Ending Jobs](#)).

## Job States

### New

The job is scheduled to be run but is not yet ready to start because upstream work needs to be done first, unless the job is for a first operation of a work order. When a new work order is assigned to a line, a job is created for each entity on the line with a status of New.

### Ready

The job is ready to start; all of the requirements for running the job have been met.

### Running

The job is currently running on an entity.

### On Hold

The job has been paused indefinitely, typically because of some problem such as material or machine issues.

### Suspended

The job has been temporarily paused, typically in favor of another more important job.

### Canceled

The job has been permanently stopped before being completed; a record of it is still maintained in the MES database.

### Complete

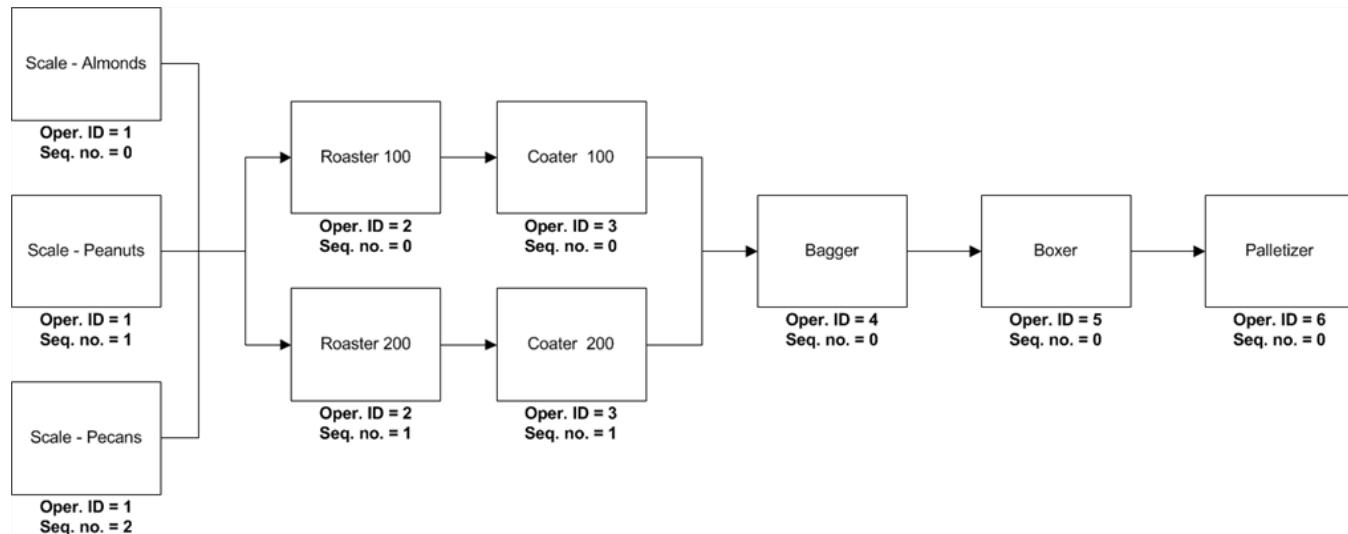
The job has finished.

## Work Order and Job Creation in MES Web Portal

When a work order is created and assigned to a line, a job is created for each entity in the line. Within the work order, each job is uniquely identified as follows:

- An operation ID is assigned, starting at 1 and incremented for each position in the line layout.
- A sequence number is assigned, starting at 0 for each parallel entity at a given location or each unique segment in the line and incremented according to the entity name or segment order in the line, respectively.

The following diagram illustrates the operation ID and sequence number assignments for jobs in a line with two segments.



Note that, for work orders created in MES Web Portal, no BOM information is associated with the work order assigned to a line, except for the produced item itself. It is assumed that for these work orders, the material consumed is the same as that produced, and in the same amounts.

For information about how to create a work order and assign it to a line, see [Creating a Work Order](#).

## Work Order Reassignment

In certain situations, it is necessary to reassign a work order to another line. This could happen when one line has equipment failure and the work order has to be moved to another line for immediate completion.

Work orders can be reassigned even if some units have already been produced against the work order. When reassigning a work order, its ID and the item being produced cannot be changed. For how to reassign a work order, see [Reassigning a Work Order to Another Line](#).

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**Note:** Only work orders created from a line can be reassigned. Work orders created from a process are not shown in MES Web Portal.

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A work order can be reassigned to another line if its status is New, Ready, Suspended, or On Hold.

A running work order, which means it has at least one job running, cannot be reassigned to another line. The running work order must first be stopped by:

- Changing its status to Suspended or On Hold, or
- Stopping or completing any of its running jobs

Reassigning a work order to another line has the following results:

- All the existing jobs are deleted and new jobs are created according to the entity configuration of the new line. To ensure job record uniqueness, the sequence numbers for the new jobs will start with the sequence number that follows the highest sequence number used for any previously existing jobs in the work order.
- Any existing production data for the work order is retained.
- The starting quantity defaults to the quantity remaining. The quantity remaining is the difference between the original starting quantity and the total good quantity produced in any job for this work order that ran on the line's production entity, and any entities in parallel with the production entity, plus the reject quantities produced in these jobs or any jobs upstream from them.
- The required quantity defaults to the original required quantity less any good quantity or 0, whichever is greater. The quantity produced is the total of any good quantity produced in any job for this work order that ran on the line's production entity plus any entities in parallel with the production entity.
- The produced and rejected quantities show the totals for the reassigned work order when a different line is selected. These totals do not include production from lines to which the work order was previously assigned. Each time the work order is reassigned these totals are reset to 0, because the starting and required quantities are being updated to just the remaining amounts for the work order on its new line.
- The starting and required quantities are updated based on the production that has already been reported for the work order, to reflect just the amounts that need to be produced on the new line. Note that starting and required quantities are based on the production at the line's production entity. For example, say there are three entities in series in a line and a work order for 1,000 units. When the work order is suspended to be reassigned, 10 units were rejected at an entity upstream from the production entity, and the production entity for the line has processed 380 units. When the work order is reassigned to another line, the starting quantities for all three entities will be 610, regardless of how many units the other two entities had

processed before the work order was suspended.

**Note:** In some situations where scrap quantities have been reported, the calculations of starting quantity and required quantity will result in a starting quantity that is less than the required quantity, which is not permitted. These jobs cannot be reassigned to another job until either the job is updated through methods outside MES Web Portal or the job is completed.

## Effects of Work Order Status Changes on Job States

- Changing the status of a work order to New will set the state of all its jobs to New. This is allowed only if no production quantities have been recorded for any jobs in the work order.
- When the status of a work order is changed from New or Suspended to Ready, the state of all of its jobs that are not Complete or Canceled will be changed to Ready if the system setting *Ready all new jobs of a work order together* has been selected. If this system setting has not been selected, then only the jobs that are not Complete or Canceled and that are not preceded by a job with a state other than Complete or Canceled will be changed to Ready.
- When the status of a work order is changed from On Hold to Ready, the state of all of its jobs that are On Hold will be changed to Ready.
- When the status of a work order is changed from In Progress to Ready, all of the running jobs are paused and their states are set to Ready.
- When the status of a work order is changed from Complete to Ready, the state of all of its jobs that are Canceled will be changed to Ready, and the state of all of its jobs that are Complete and have no production quantities recorded will also be changed to Ready.
- If the work order is assigned to a line that is configured to allow only one work order to run at a time, when the status of a work order is changed from Ready to In Progress, the state of all of its jobs that are Ready will be set to Running. If the line is configured to allow for more than one work order to run at a time, the Ready jobs that are closest to the first jobs will be set to Running.

Changing the status of a work order from a status of other than Ready to In Progress will do what first readying the work order and then changing it to In Progress does.

All running jobs from other work orders will be suspended on the entities where this work order's jobs are being started if not doing so would cause the maximum number of job positions to be exceeded. In addition, if the line is allowed to run only one work order, all running jobs from the other work order will be suspended, even if no job for the work order being started will be started on entities where the other work order is running, so that the limitation on the line's not being allowed to run more than one work order is observed. For the case of a shared entity that can run more than one job, only jobs of work orders from the same line as the work order being set to In Progress will be suspended.

- When the status of a work order is changed from any other status to Complete, the state of all of its jobs that are not Canceled will be set to Complete unless this would violate minimum or maximum consumption requirements. If it would, then the status change to Complete will not occur. Note that there is no other check (for example, that anything at all has been made) on the appropriateness of this action.
- When the status of a work order is changed from any other status to Suspended, the state of all of its jobs that are not Complete or Canceled will be set to Suspended.
- When the status of a work order is changed from any other status to On Hold, the state of all of its jobs that

are not Complete or Canceled will be set to On Hold.

- When the status of a work order is changed to Canceled, the state of all of the work order's jobs that are not Complete will be set to Canceled.

### Line Layout Reconfiguration Guidelines

A line's layout can be reconfigured, even if work orders are assigned to it. See [Editing a Line](#).

The following topics describe the guidelines under which a line with assigned work orders can be reconfigured. Note that the guidelines are different for work orders created from a line vs. work orders created from a process.

## Guidelines with Work Orders Created from a Line

You can reconfigure a line that has work orders created from a line queued to it within the following guidelines:

- You must have line editing privileges. This is assigned using the *May edit lines* Configurator privilege setting in MES Client.
- All work orders on the line must have a status of New, Ready, Suspended, or On Hold.
- If a work order is currently running, which means it has at least one job running, it must be stopped by:
  - Changing its status to Suspended or On Hold (see [Changing a Work Order's Status](#)), or
  - Stopping, canceling, or completing any running jobs. Jobs can be stopped or completed in MES Web Portal (see [Starting and Ending Jobs](#)), but can only be canceled using MES Client.
- For Suspended or On Hold work orders, the calculated starting quantity must be equal to or greater than the required quantity.

## Guidelines with Work Orders Created from a Process

In addition to being created in MES Web Portal, work orders can also be created from a process. These work orders are either created from a process defined in MES Client or imported into the system using Supply Chain Connector.

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**Note:** Work orders that are created from a process and assigned to a line will not be shown in the **Work Order** collection page.

You can reconfigure a line that has work orders created from a process assigned to it within the following guidelines:

- You must have line editing privileges. This is assigned using the *May edit lines* Configurator privilege setting in MES Client.
- All work orders on the line that were created from a process must have a status of Complete.
- If a work order is currently running, which means it has at least one job running, it must be stopped by completing or canceling any running jobs. Jobs can be completed in MES Web Portal (see [Starting and Ending Jobs](#)), but can only be canceled using MES Client:

- Changes can only be made to entities that have completed or canceled jobs. Any running jobs must be manually removed using MES Client. Changes to entities include the following:
  - Removing an entity from the line
  - Changing an entity's input percentage or the input percentage to the first entity in its segment
  - Moving an entity to a new segment.
- If an entity is added to the line, jobs for the entity must be manually created for all work orders already queued to that line that are expected to be run while the added entities are present. This includes deleting existing job routes that "span" the added entities (that is, the route runs from an entity preceding the added entity to an entity following the added entity) and adding new job routes that account for the new jobs. Failure to do this will mean that, for work orders created from a process, there will be no jobs to execute on the newly-added entities when already-queued work orders are run.

### Line Layout Reconfiguration System Behavior

Reconfiguring a line's layout essentially reassigns all the work orders created from the line as it existed prior to the modification to the same line as it exists after the modification. This means that the old jobs are completed and new jobs are created, even for entities in the line that were not directly involved with the change.

Thus, if a work order is partially run on the line, and then the line is modified and the work order is restarted, the work order will be running a different set of jobs than it was previously. The item quantities will reflect only the amount of work remaining when the line was modified. Also, if a work order is queued to the line with a non-zero required quantity and the *The required quantity must be produced to end a job* setting is selected for any of the line's entities, at least that much good production will need to have been recorded at those entities for that work order or modifying the line will not be allowed.

### Understanding Batches and Lots for OEE

It is important to understand the difference between batches and lots so that your OEE results are within expected ranges.

- A lot is generally used to uniquely identify a group of consumed or produced items for tracking purposes.
- A batch is an amount of product that is processed simultaneously. A batch is used to determine the standard production time for a given amount of product. Standard production times are expressed either in time per batch, or batches per time.

For example, assume that you want to track all of the cookies that are baked during a shift as a group, and that you want to determine the cookie production's OEE. A unique lot number can be assigned to the group of cookies produced during the shift. But the lot size has nothing to do with the OEE calculation. That calculation would be based on the batch size and the batch production rate. If a batch size is 100 cookies and it takes 20 minutes to bake a batch of cookies, then up to 24 batches of cookies could be baked during an 8-hour shift, or a maximum of 2,400 cookies in a lot.

Also, note that the amount of production might not be an integral number of batches. This is because the standard production time for a batch will be constant, regardless of whether the batch actually includes the maximum number of items for the batch. For example, if the oven capacity, and thus a batch, is 100 cookies, it takes as long to bake 90 cookies as it does to bake 100. The performance component of OEE factors in this nonlinear behavior. So, for OEE to be reported accurately, it is important that the batch size be set according to the way production actually occurs.

The number of decimals used for batch sizes displayed in MES Web Portal is based on the system parameter *Maximum number of decimals for batch size entry*. For information about setting this parameter, see the *MES Client User Guide* or online help.

## Utilization

An entity's utilization is tracked when an associated Utilization Capability Object (UCO) or production operator enters events, such as when the entity is running a job or when the entity is down for repairs or maintenance.

At all times, an entity will have a reason assigned to it. The reason can be assigned by an operator manually or determined directly from a UCO by input/output (I/O) automatically. The reason will assign a utilization state. Based on the configuration of the utilization state, the event as classified by the reason will contribute to either the Performance or Availability component of OEE, or the time will be excluded from the OEE calculation entirely.

It is important to understand that "event" does not refer to an isolated occurrence of something at the entity. All utilization events for an entity form a contiguous series from the time the entity was configured as being capable of capturing utilization to the present. In other words, one sort of event or another is always occurring at the entity.

An operator adds an event by selecting a utilization reason for the entity. The utilization reason specifies:

- The state of the entity
- A reason for that state

Operators might have to make adjustments to events that have already been entered so that they represent actual entity activity. These adjustments include:

- Reclassifying an event by selecting a different utilization reason
- Splitting an event into two events
- Merging two adjacent events
- Modifying an event's start or end time
- Modifying the comment entered about an event

## Utilization States

To support utilization tracking, entities are considered to be in utilization states, such as Running, Idle, Down, or Maintenance.

During system configuration, utilization states are assigned to utilization reasons. Therefore, an entity's state is defined when a utilization reason is assigned to an entity's event.

For information about configuring utilization states, see [Configuring Utilization States](#).

## Utilization Reasons

Utilization reasons describe the current condition of an entity and associate each reason with a utilization state. A reason group is a category of reasons. For example, the reason Bottle Jam can belong to the reason group Bottle Descrambler Down, and results in a Downtime utilization state. On the production floor, a reason can be selected by a PLC, an input/output (I/O) connection to a device, or an operator.

The utilization reasons that operators can assign to events during production are created during system configuration. For a list of the configuration settings, see [Utilization Reason Settings](#).

For information about configuring utilization reasons, see [Configuring Utilization Reasons](#).

## Raw Reason Codes

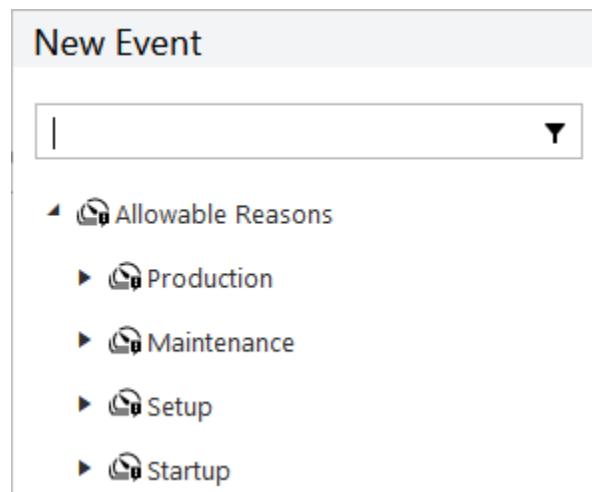
Machine utilization raw reason codes can be sent directly from an entity to MES (for example, via a UCO). Depending on how the raw reason code is configured in the UCO or in MES Client, it will create a new utilization event in the MES database, using the utilization reason to which the raw reason code was mapped.

If a raw reason code that is not configured for the entity is received, the Unknown Reason utilization reason, which is configurable in MES Web Portal, is used.

## Utilization Reason Groups

To help production operators navigate a large list of utilization reasons, reasons can be assigned to utilization reason groups during system configuration.

The reason groups are displayed as folder nodes in the reason list.



It is helpful to understand the difference between utilization states and utilization reason groups. While both terms represent an aggregation of utilization reasons, states are sets of reasons that imply something about the physical situation of the entity, with respect to the way it is operating or not operating. Utilization reason groups are strictly a navigational aid for lists of utilization reasons in the user interface.

For information about configuring utilization reason groups, see [Configuring Utilization Reason Groups](#).

## Utilization Events

A utilization event indicates the current operational state of the entity. An entity is always considered to be in a utilization event. The events that are typically of interest are those that indicate that the entity is down or when it is idle when it should be running.

If so configured, the system can set an entity's event automatically based on changes in the operational state of the entity.

Production operators can also manually change the event that an entity is in when the condition or state of the entity changes. When changing to a new event, the operator assigns a utilization reason to the new event. The

reason specifies the entity's utilization state and the reason for that state. For example, the utilization reasons Running - Normal Speed, Running - High Speed, and Running - Low Speed all indicate a utilization state of Running. However, each reason indicates a running speed.

## Standard, Minimum, and Maximum Utilization Reason Times

When configuring a utilization reason, the Standard, Minimum, and Maximum Times can be specified for it. These times can be displayed in MES Web Portal and in utilization reports to indicate expected times that an entity can be in the utilization reason.

## Maximum Duration

When configuring a utilization reason, a Maximum Duration can be specified for a utilization reason. This value can be used to do one of the following:

- Specify how long an entity can be in the utilization reason before the condition is considered Severe.  
For example, a plant might consider an entity that is undergoing maintenance for longer than 2 hours to be in a Severe condition. If so, the Maintenance utilization reason would have its Maximum Duration set for 2 hours.  
The state of the Severe flag for an entity event is shown in the **Event History** grid.
- Specify how long an entity can be in the utilization reason before it is changed to a new reason. For example, you might want a machine that is in the Jammed utilization reason for more than 5 minutes to automatically switch to the Requires Mechanic Assistance reason.

## Splitting Events

An event can be split into two events, so that one of them can be assigned a different utilization reason. For example, if it was discovered that an entity had actually been down for a portion of a Running event, the Running event can be split.

For information about how to split events, see [Splitting an Event](#).

## Merging Events

Adjacent utilization events for the same entity can be merged if it is determined that the events actually represent one event.

To merge two events for an entity, all of the following conditions must be true:

- The events are contiguous. This is, no other events have occurred between the two events.
- The events have the same utilization reason.

- The comments for the events are the same.

or

The comments for the events are different but one of the options for the system parameter *How to handle comments when merging utilization events* that allows events with different comments to be merged has been selected. (This system parameter is configured in MES Client, in the **Operator** group of the **General Parameters** module.)

- The raw reason codes for the events are the same.

or

The raw reason codes for the events are different but one of the options for the system parameter *How to handle raw reason codes when merging utilization events* that allows events with different raw reason codes to be merged has been selected. (This system parameter is configured in MES Client, in the **Operator** group of the **General Parameters** module.)

For information about how to merge events, see [Merging an Event with an Adjacent Event](#).

## OEE

The efficiency calculation implemented in the MES is based on the industry standard OEE (Overall Equipment Effectiveness) efficiency methodology.

OEE is determined as follows:

OEE = Availability x Quality x Performance

OEE as implemented by MES is described in the following topics.

### Availability

The availability component of OEE measures a system's availability during the scheduled operation time for a given time period, based on the following equation:

Availability = Runtime / Net Operating Time

### Entity Availability

In MES, a line's availability is based on the availability of the line's bottleneck entities during the given time period.

To support the determination of entity availability, utilization events are applied to each entity. A utilization event indicates the current operational state of the entity. Utilization events can be applied automatically based on an entity's default utilization settings (see [Configuring Default Utilization Reasons for Standard Events](#)) or manually by an operator.

The component of a utilization event that is used to determine entity availability is OEE Use. Each utilization event, via its utilization reason and that reason's assigned utilization state, is assigned an OEE Use value of Runtime, Downtime, or Neither. MES bases the calculation of an entity's availability by summarizing the duration of its Runtime and Downtime events in the given time period for each OEE Use. Events with an OEE Use value of Neither are not included in the calculation.

So for MES, an entity's availability is:

Entity Availability = Runtime / (Runtime + Downtime)

## Line Availability

To determine a line's availability, the system considers the Runtime and Downtime events for any entities that were designated as bottleneck entities during the given time period. This includes all entities at a bottleneck entity position in the line. Only those portions of the events that fall within the time frame in which the entities were designated as a bottleneck entity are included.

So, a line's availability is:

$$\text{Line Availability} = \text{Bottleneck Entities Runtime} / (\text{Bottleneck Entities Runtime} + \text{Bottleneck Entities Downtime})$$

In addition, for a fixed or moving bottleneck entity in a line, if the utilization source is obtained from another entity outside the line, then the utilization data is retrieved from the entity that is outside the line.

## Quality

The quality efficiency component of OEE measures a system's output quality while producing units during a given interval.

$$\text{Quality} = \text{Good Output} / \text{Total Output}$$

## Entity Quality

In MES, entity quality is:

$$\text{Quality} = \text{Good Production} / (\text{Good Production} + \text{Rejected Production})$$

where only production at the entity is considered.

## Line Quality

In MES, line quality is:

$$\text{Quality} = \text{Good Production} / (\text{Good Production} + \text{Rejected Production})$$

Good production counts for a line are captured at the line's production entity (or entities, if there is more than one entity at that line position). If an entity at a line position is not designated to capture good production counts, then the last entity in the line (based on the child order of the line) is used to collect good production counts. Rejected counts are captured at the production entity and any upstream entities during the given time period.

The production counts are normalized to the line's unit of measurement (UOM) before calculating the quality metrics. Therefore, if the UOM of the production item is different than the UOM of the line's item, a conversion factor from the production item to the line's item must be defined in the system. An error is returned if no conversion factor exists to convert the production counts to the line's UOM.

## Performance

The performance efficiency component of OEE measures a system's ability to produce at the target production rate:

$$\text{Performance} = \text{Total Output} / \text{Target Output}$$

## Entity Performance

In MES, an entity's performance during a time period is based solely on the production reported on the entity only while the entity is in a Runtime utilization state. If multiple work orders are run during the period, producing different items with different unit of measures, the performance calculation is based purely on item production counts with no effort to convert units of measure.

## Line Performance

In MES, the performance component of OEE for a line focuses on the Runtime events during a given time period. The system compares the total output as measured by production transactions during the time period to the output that would be expected if the entity or entities were producing at the target production rate while in the Runtime state.

A line's performance is:

Performance = Actual Production Count / Expected Production Count

Where:

- Actual Production Count is the total number of good units produced on the production entity during the given time period, plus the reject units produced on the production entity and all entities upstream to the production entity. All counts are converted to the unit of measure (UOM) of the line's standard item.
- Expected Production Count is calculated using the following equation:

Expected Production Count = Duration of the Bottleneck Entities During Runtime x Job Target Production Rate (in batches) x Default Entity Batch Size

If the bottleneck entity is in parallel with other entities in the same line position, then all the entities at that position in the line will be considered. Only durations for which the utilization event's *Is entity enabled when this reason applies?* setting is true are included in the calculation. The actual production counts are determined in the same way the production counts are determined for quality (see [Quality](#)).

## Determining the Line's OEE Target Values

A line's OEE target values are set as part of the line configuration (see [Creating a Line](#) and [Line Configuration Settings](#)). Target values are displayed in the KPI gauges on the line's **Monitor** tab.

## Configuring MES Web Portal

The MES Web Portal gives you the ability to configure production lines, work orders, entities, and utilization states and reasons.

Other configuration tasks can be performed using the MES Client application, which gives you the ability to configure items, operations, processes, specifications, certifications, work orders, jobs, operations data collection, and quality data collection.

The information configured in MES Web Portal and MES Client is used to convey information to operators: What do I work on next? How much do I make? It is also used to collect your plant process information from operators and production equipment on the plant floor. The information collected and stored from your production processes gives you the information needed to control and improve the overall operation management and

performance of the plant.

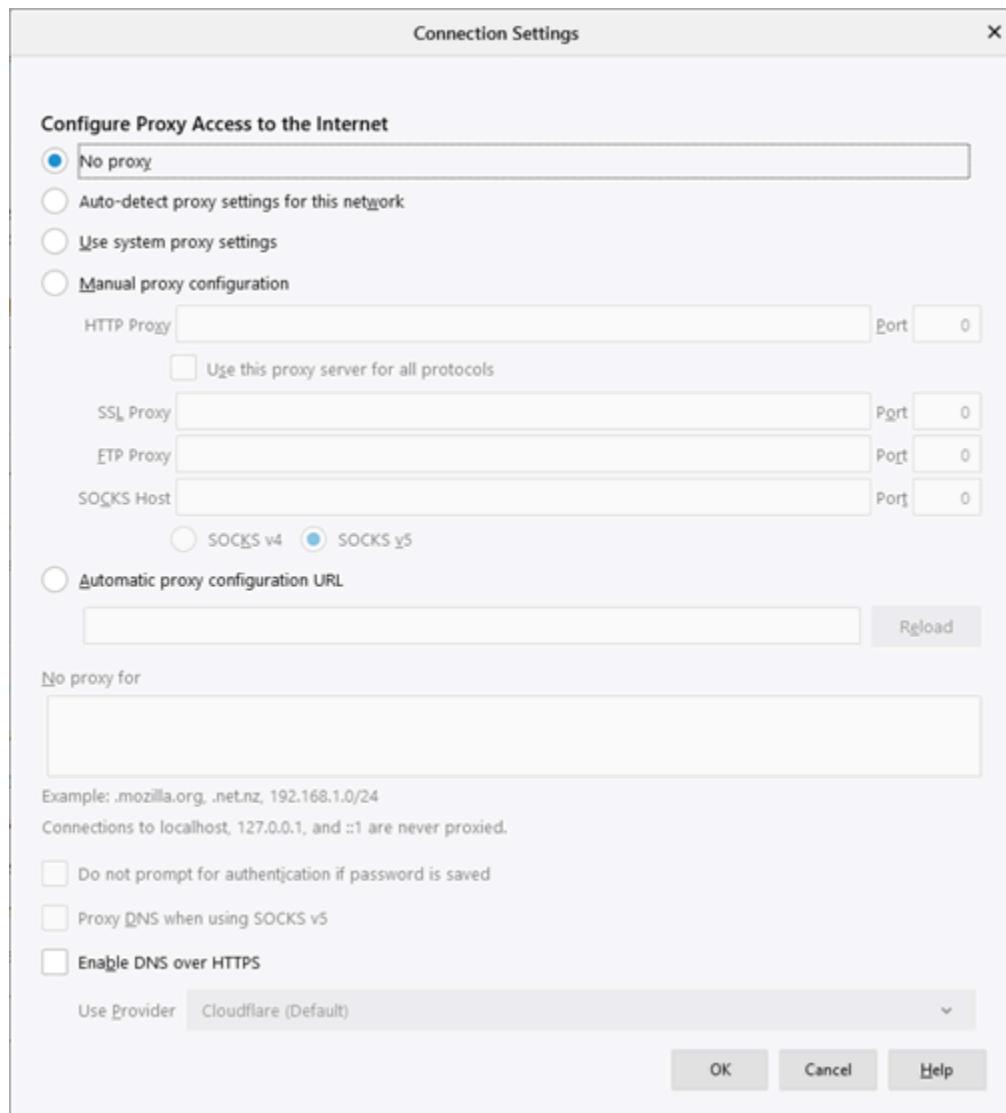
## Setting the Firefox Proxy Setting to No Proxy

If you are going to use the Firefox web browser, you have to set the Firefox proxy setting to **No proxy**.

### To set the Firefox proxy setting to No proxy (procedure based on Firefox version 72)

1. In Firefox Options, go to the **Home** tab.
2. Locate the **Network Settings** group and click **Settings**.

The Connection Settings dialog appears



3. Select **No proxy** and click **OK**.
4. Restart Firefox.

## Installing the Root SSL Certificate for MES Web Portal

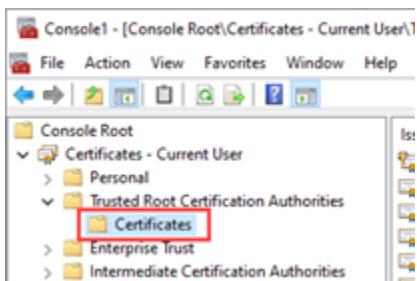
If the AVEVA Identity Manager and MES Web Portal are installed on different nodes, the Root SSL certificate file for the certificate that was assigned to MES Web Portal must be installed in Windows on client machines of Web Portal users. This enables the client machines to trust and allow the HTTPS connection to MES Web Portal.

To obtain the Root certificate file, see your MES or system administrator.

In addition, if you are going to use the Firefox web browser, you have to import the Root certificate file into Firefox.

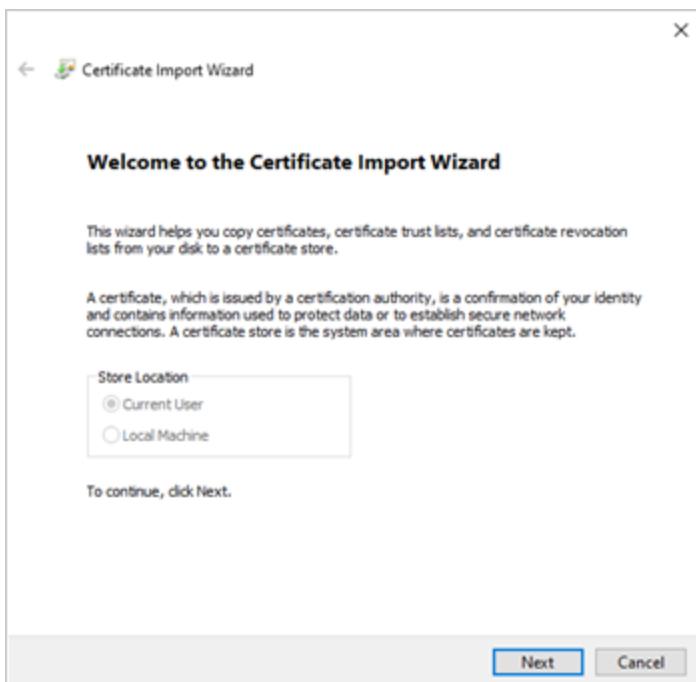
### To install the Root CA certificate to Windows

1. Place a copy of the certificate file in your local file system.
2. Open Microsoft Management Console (open the Run application and type mmc).  
A console window appears.
3. On the **File** menu, click **Add/Remove Snap-in**.
4. On the Add or Remove Snap-ins dialog, select **Certificates** and click **Add >**.
5. On the Certificates snap-in dialog, leave the default selection and click **Finish**.
6. On the Add or Remove Snap-ins dialog, click **OK**.
7. In the console window navigation panel, expand **Certificates**, then expand **Trusted Root Certification Authorities**.

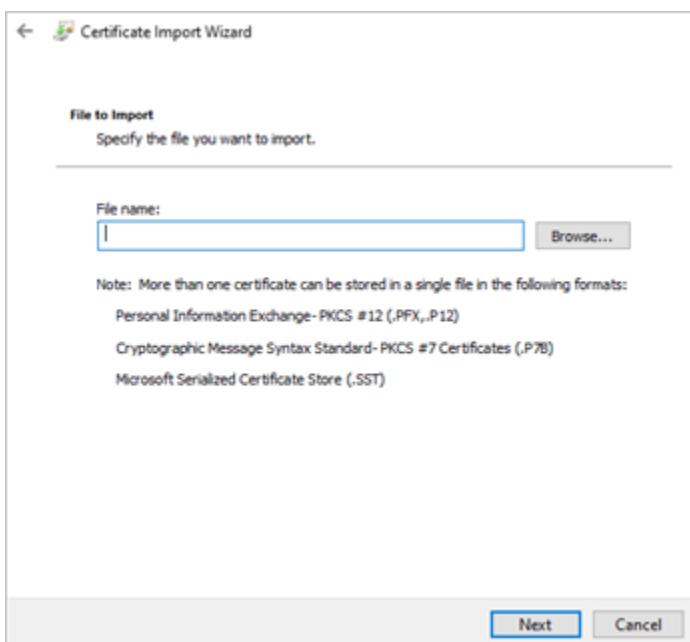


8. Right-click **Certificates**, click **All Tasks**, and then click **Import**.

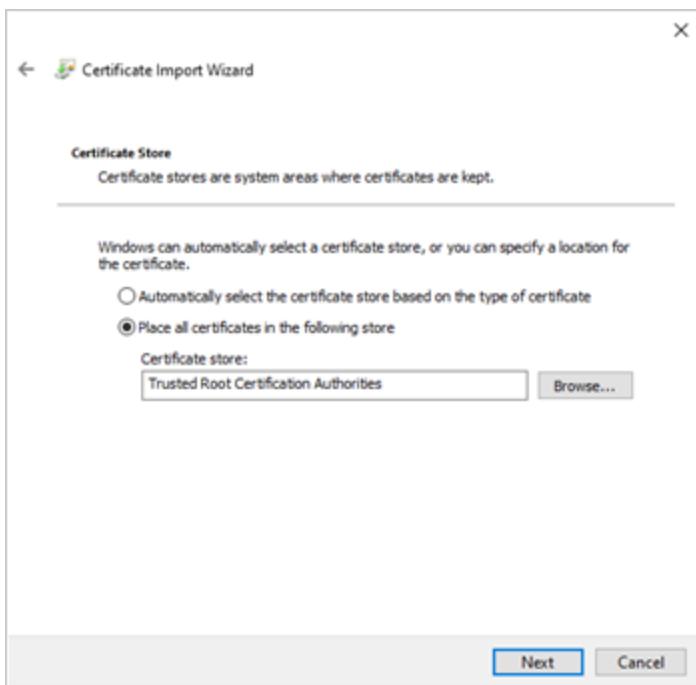
The Certificate Import Wizard appears.



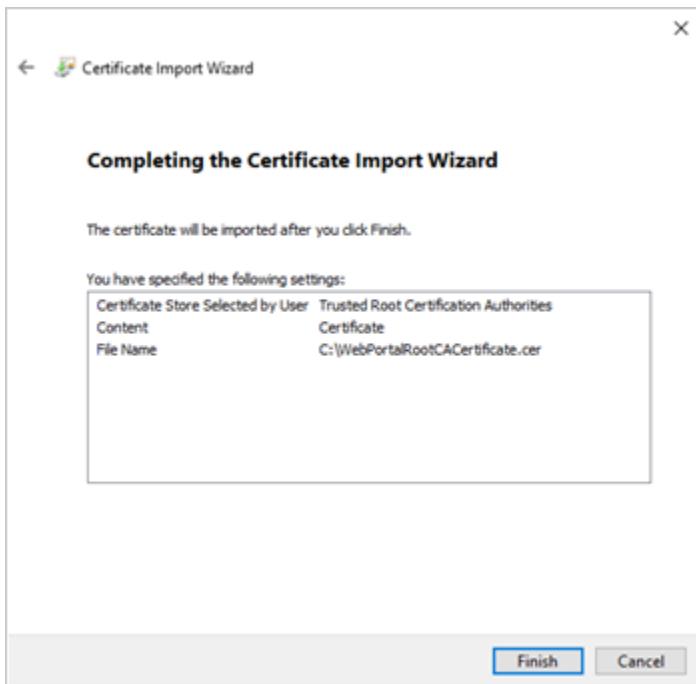
9. Click **Next**.



10. Browse to or type the file path and file name of the Root certificate and click **Next**.



11. Leave the default certificate store option selected and click **Next**.

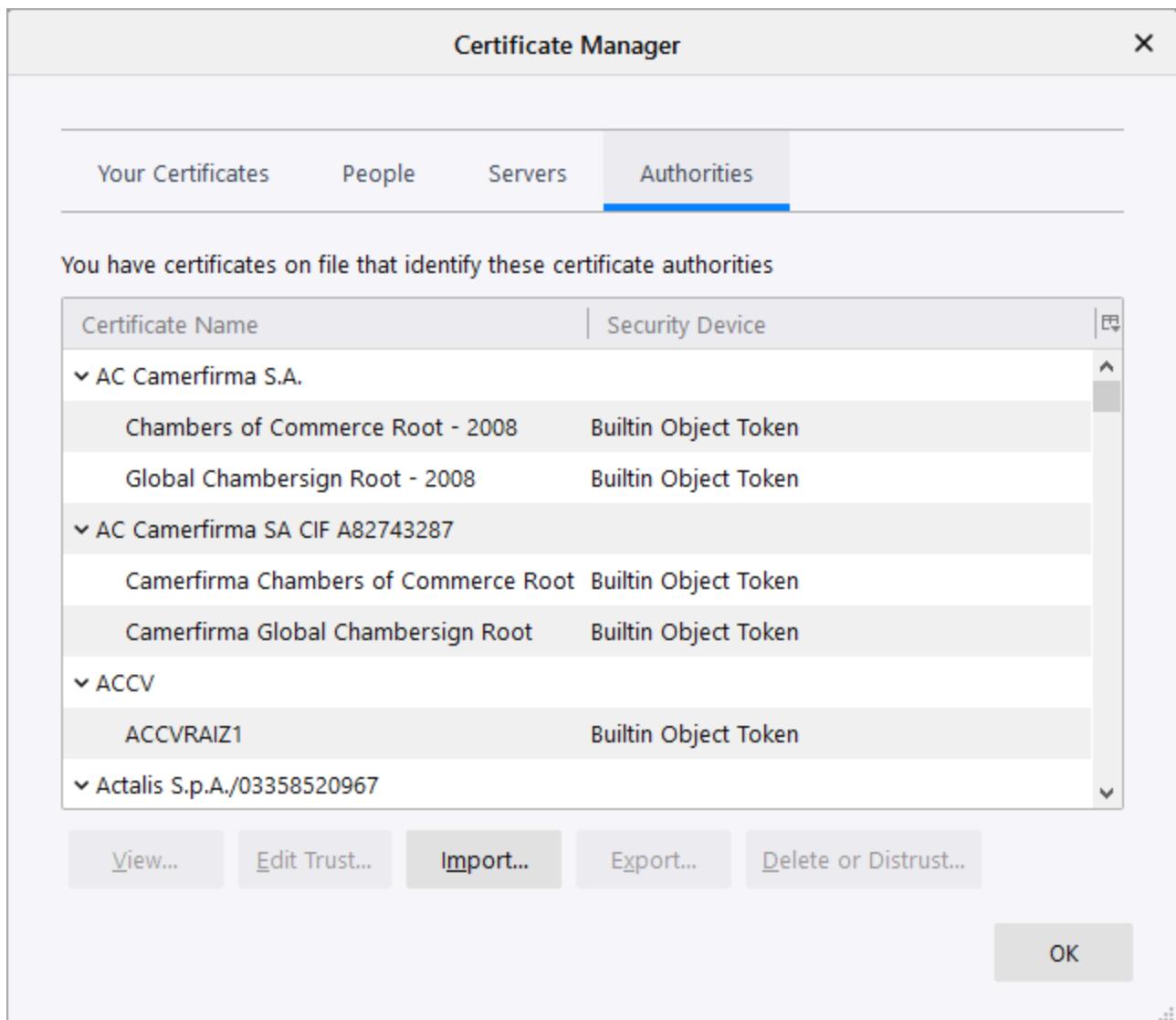


12. Review the file settings and click **Finish**.

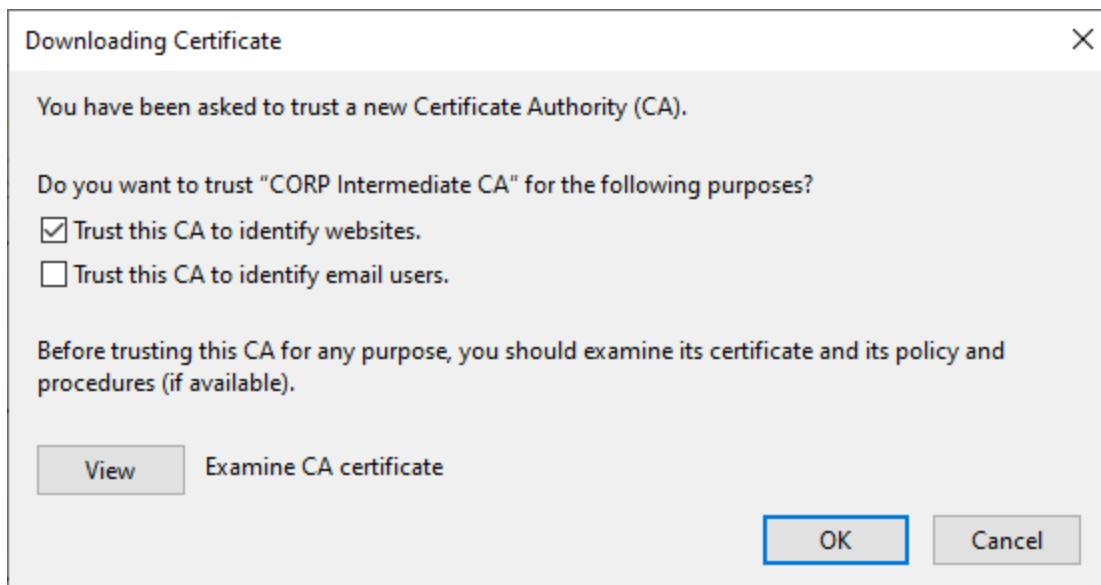
#### To import the Root certificate file into Firefox (procedure based on Firefox version 72)

1. In Firefox Options, go to the **Privacy & Security** tab.
2. Locate the **Certificates** settings and click **View Certificates**.

The Certificate Manager dialog appears.



3. Click **Import**.
  4. Browse to and select the Root certificate file and click **Open**.
- The **Downloading Certificate** dialog appears.



5. Select the **Trust this CA to identify websites** option and click **OK**.

The certificate is added to the list of trusted certificates.

6. Restart Firefox.

## Web Browser Support

The following topics provide information for optimizing MES Web Portal in the supported web browsers.

### Web Browsers Supported

The following web browsers are supported for use with MES Web Portal. Support was validated for the web browser versions that were available at the time of the current MES version release.

- Chrome
- Edge Chromium
- Firefox

### Setting the Web Browser's Preferred Language/Locale for Values and Dates

You can set your web browser's language setting to your preferred language/locale to use in the browser for values and dates. Open the browser settings and search for **Language** to access the language settings. For further instructions, see the browser help.

However, note that the language for the text in the browser is set by your MES user group or user account language setting.

### Line Layout Configuration Page Requires a Pointing Device

The Line Layout configuration page requires a pointing device to be able to drag entities onto the layout model.

## Getting Started

The Manufacturing Execution System (MES) Web Portal is a web-based application that provides a user interface to configure and monitor your plant model and production processes.

### Opening an MES Web Portal Session

You can open an MES Web Portal session from a web browser that is running on any node that has network access to the MES Web Portal host.

1. If you are using the Firefox web browser, make sure you are using the latest version.
2. Enter the URL for MES Web Portal.

Running MES Web Portal requires that you use HTTPS web communications. The default URL is:

`https://<WPhostname>:<HTTPSportnumber>/MES/`

where:

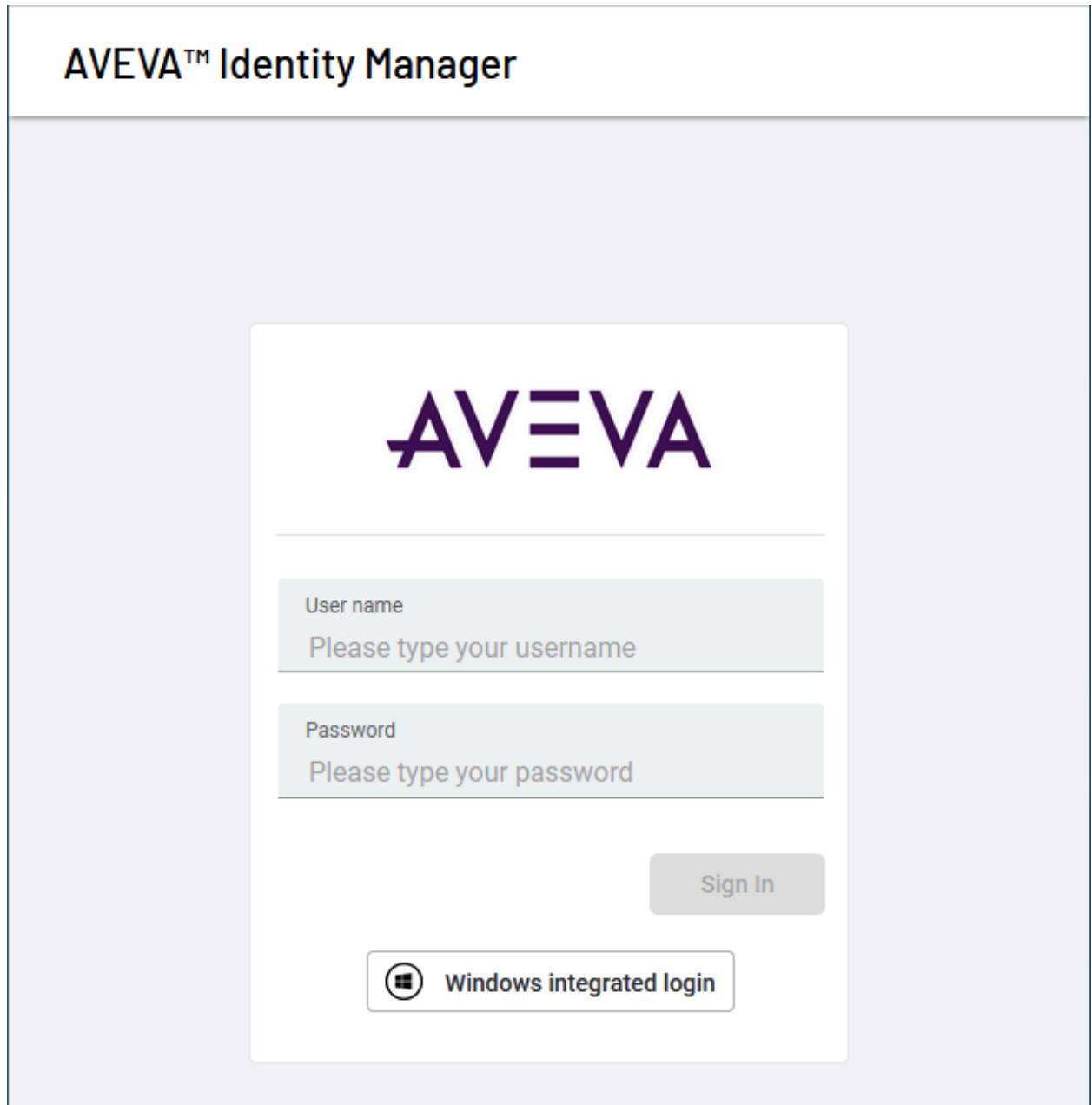
- <WPhostname> is the **fully qualified domain name** of the node on which the MES Web Portal host is running (e.g., **MESWP.yourorg.com**).
- <HTTPSportnumber> is the HTTPS port number for MES Web Portal. If the MES Web Portal port number is the default HTTPS port number 443, you do not need to include it in the URL.

See your MES or system administrator for the specific URL that is used for your installation of MES Web Portal.

Note the following when using the Firefox web browser:

- If the message *Unable to connect* appears, make sure that **No proxy** is selected as the Firefox Network proxy setting. See [Setting the Firefox Proxy Setting to No Proxy](#).
- The first time you enter the MES Web Portal URL, a warning about a potential security risk might appear. This is because Firefox does not recognize the SSL certificate being used by MES Web Portal. Click **Advanced**, then in the Advanced box click **Accept the Risk and Continue**.

The AVEVA Identity Manager login prompt appears.



3. Enter your user name and password and click **Login**.

Once logged in, the MES Web Portal home page appears.

Your access to pages and functions in MES Web Portal depends on the privileges and line and entity access that have been specified for you. For more information about user privileges and access settings, see the *MES Client User Guide* or help.

## Language Used

The language used in the MES Web Portal browser session for the text is determined by which MES Security Mode is being used (as configured in MES Client):

- If OS Group mode is used, the MES system parameter *Default language* setting is used.

- If OS User mode is used, the *Language* setting for your MES user account is used.

The display of localized values and dates is determined by the web browser's language/locale settings. See [Setting the Web Browser's Preferred Language/Locale for Values and Dates](#).

## If Privilege and Access Settings Are Changed During a Session

If your privilege or access settings are changed during an MES Web Portal session, you might see an insufficient privileges message when you attempt to navigate to or use a function to which you no longer have privileges or access. Press the **F5** key to refresh the browser; the refreshed MES Web Portal environment will reflect your new privilege and access settings.

Note that your privilege settings are cached, and the cache is automatically refreshed every 2 seconds by default. This refresh rate can be customized for your MES Web Portal host; for modifying the refresh rate, see the chapter "Configuring the MES Web Portal Host" in the *MES Installation Guide* or online help.

## Session Time-Out

For security reasons, after a pre-defined amount of time with no session activity, a log out message appears.

To keep the session open, click **OK**. Otherwise, after a short period you will be logged out of the session.

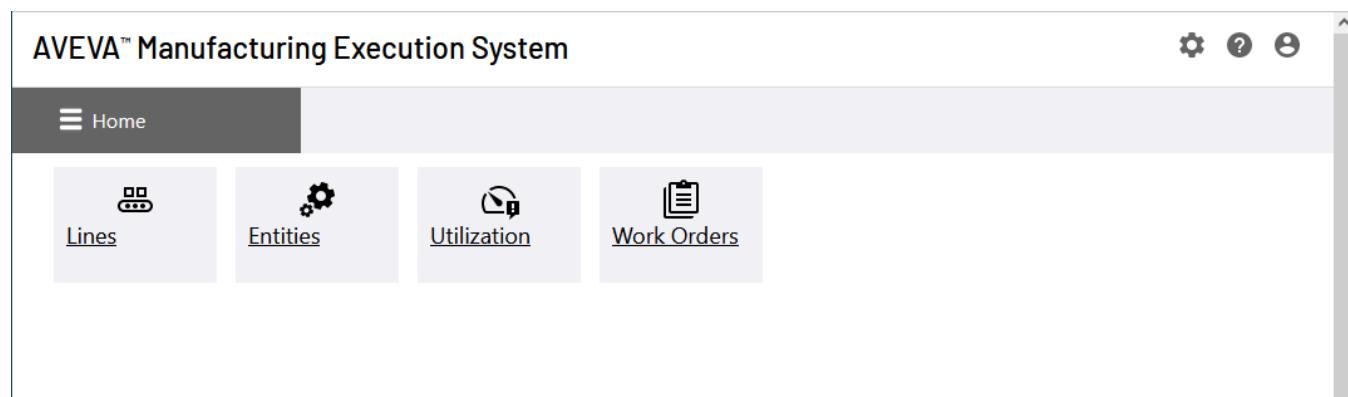
The time-out period is based on the Security system parameter **Seconds of inactivity before automatic logoff** in MES Client.

## Closing an MES Web Portal Web Session

- Click your user name at the top right of the browser window and click **Log Out**.

## Navigating in MES Web Portal

A session in MES Web Portal starts on the home page, shown below.



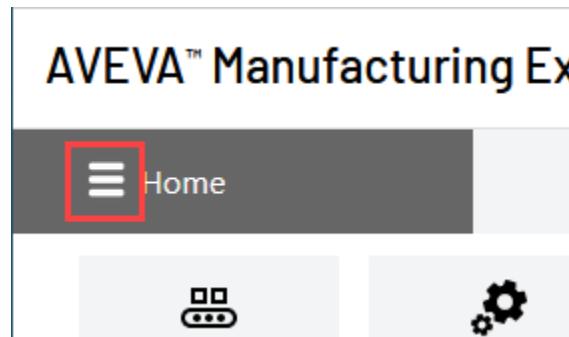
The home page includes a tile for each area of the application:

- Lines
- Entities
- Utilization

- Work orders

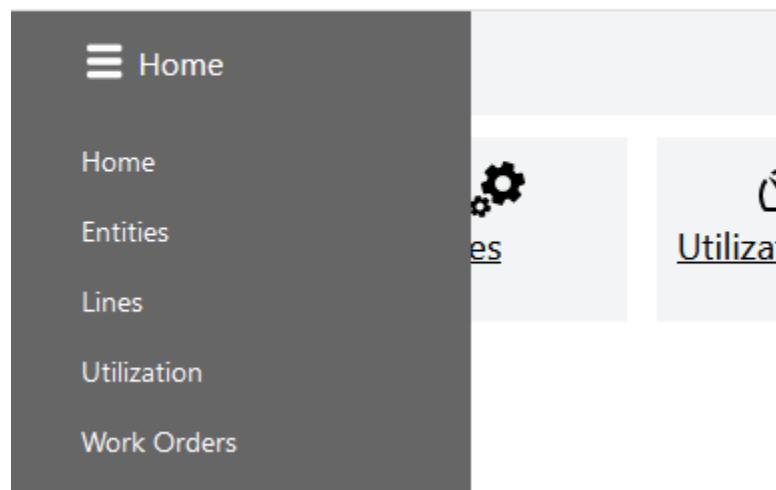
Click one of these tiles to navigate to that area.

You can also navigate to these areas from any page in MES Web Portal using the Navigation menu. To open the menu, click the  Navigation menu button at the upper left.



The Navigation menu appears.

## AVEVA™ Manufacturing Execution System



Full navigation instructions are provided in the applicable procedures under MES Web Portal Configuration and [MES Web Portal Operations](#).

**Note:** If you click a navigation menu command and receive a message saying that you do not have sufficient privileges to view that function, your user privileges might have been changed during your session. To refresh the browser and see to which navigation menu commands you now have access, press **F5**.

### Navigating to the Home Page

Perform one of the following actions:

- Click the product name on the banner that appears at the top of every page.
- Click the  Navigation menu button at the upper left of any page, then click **Home**.

## Navigating Back

To navigate back to a previous web page in your session, use the web browser's Back button.

## Working with Collection Pages

You can interact with objects such as lines, work orders, and entities on collection pages. The objects are represented by tiles.

The screenshot shows a collection page titled "Work Orders". At the top, there is a header bar with three buttons: "Work Orders" (selected), "Add Work Order" (with a plus sign icon), and "Filter" (with a magnifying glass icon). Below the header, the title "Work Orders" is displayed. The main area contains six tiles, each representing a work order:

Work Order ID	Line Assignment	Status
BP-20221014.03	Mixed Nuts Bagged	RUNNING
BP-20221014.04	Mixed Nuts Bagged	NEW
BP-20221014.05	Mixed Nuts Bagged	NEW
BP-20221014.07	Mixed Nuts Bagged	NEW
WP-20221014.02	Mixed Nuts Bagged	RUNNING
WP-20221014.06	Mixed Nuts Bagged	NEW

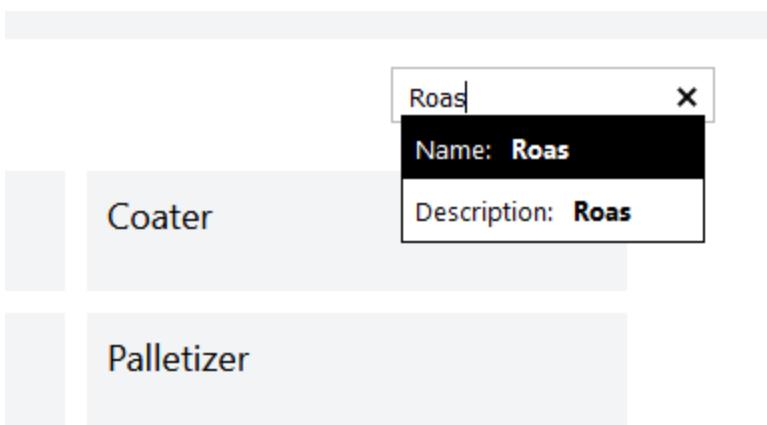
Each tile includes a blue edit icon in the top right corner. The tiles are arranged in two rows of three. The first row has a green horizontal bar at the bottom, and the second row has a blue horizontal bar at the bottom.

You can also filter objects on the Entities and Work Orders collection pages to view only those of interest to you. See [Filtering Entities on the Entities Collection Page](#) and [Filtering Work Orders](#).

## Filtering Entities on the Entities Collection Page

By default, the **Entities** collection page lists all entities in the system. The entities can be filtered by entity name or description.

1. In the filter box above the right side of the grid, enter text that matches any portion of the entity names or descriptions by which you want to filter the list. The filter menu appears.



2. Click **Name** or **Description** to specify by which criteria to filter the list.

The entity list is filtered according to your selection.

Entities	Add Entity	
Roaster	Roaster100	Roaster200
Roaster300		

The filter for the page is saved. It will persist during your session until you change or clear the filter parameters. The **Search** button that appears on the left below the object list indicates that a filter is active (see the example below).

Roaster300

---

4 Records Found

**Note:** If the web browser's "Delete Browsing History on Exit" configuration option is not selected, the entity filter will be preserved the next time you open a Web Portal browser session.

#### To clear the filter

- Click the **Clear Filter** button.

#### Filtering Work Orders

By default, the **Work Orders** collection page lists all work orders in the system that are not in a Completed state, up to a maximum of 500. Also, a line's **Work Order** tab lists all work orders assigned to that line, up to a maximum of 100. The work orders on both these pages can be filtered by work order ID, item being produced, and status.

If there are more than the maximum number of work orders to be listed, a message on the page or in the filter side sheet will indicate this condition. In this case, the most recently created work orders are retrieved, and they are listed by work order ID. To see other work orders that are not listed, you must enter or refine the filter criteria.



1. Click the **Filter** button at the upper right corner of the page.

The **Filter** side sheet appears. By default, all work order statuses except Complete are selected.

The screenshot shows the AVEVA Manufacturing Execution System interface. On the left, the 'Work Orders' page is displayed with four work order cards. Each card contains a work order ID, a blue edit icon, line assignment, item ID, and status. The first two work orders are 'RUNNING' and the last two are 'NEW'. On the right, the 'Filter' side sheet is open. It has sections for 'Work Order Information' (WO ID and Item ID input fields) and 'Work Order Status' (checkboxes for NEW, READY, RUNNING, SUSPENDED, ONHOLD, BYPASSED, and SUPERSEDED, with NEW, READY, and RUNNING checked by default). Below these are dropdowns for 'Line' and 'Category'. At the bottom are 'Close', 'Default', and 'Apply' buttons.

2. Refine the filter criteria by work order ID, item ID, work order status, and/or line.

For the work order or item ID, enter text that matches any portion of the IDs by which you want to filter the list.

In the **Line** list:

- **All** specifies all work orders, regardless of whether they have been assigned to a line or not.
- **Not Defined** specifies only those work orders that have not been assigned to a line.

3. Click **Apply** to leave the **Filter** side sheet open, or click **Close** to close the side sheet.

The work order list is filtered and the filter for the page is saved.

Work Orders

WP-20221014.02      WP-20221014.06

Line Assignment: Mixed Nuts Bagged

Item ID: BMX-BBQ      Item ID: BMX-BBQ

Status: RUNNING      Status: NEW

**Filter**

Work Order Information

WO ID: wp-

Item ID:

Work Order Status

- NEW
- READY
- RUNNING
- COMPLETE
- SUSPENDED
- ONHOLD
- BYPASSED
- SUPERSEDED

Line:

Close      Default      **Apply**

▼ 2 Records Found

The filter will persist during your session until you change or clear the filter parameters. The **Search** button that appears on the left below the object list indicates that a filter is active (see the example below). The active filter's parameters appear below the **Search** button.

▼ 2 Records Found  
Current Filter: WO ID=wp-; Status=[NEW,READY,RUNNING,SUSPENDED,ONHOLD]

---

**Note:** If the web browser's **Delete Browsing History on Exit** configuration option is not selected, the work order filter will be preserved the next time you open a Web Portal browser session.

#### To reset the filter to the default settings

- Click **Default** in the side sheet or click the  **Default** button at the upper right corner of the work order list.

#### Filtering Item Lists

When assigning items to objects in MES, such as the standard item for a line or entity, you select the item from a list. To help you find an item to select from a long list, a filter is included, such as the one shown in the following item selection side sheet.

## Default Standard Item

### Item Filters

Item ID	Item Description
<input type="text"/>	

Item Class

▼ Filter

No Item Selected

AMD-BLK  
Almonds Bulk

BAG-BBQ  
BBQ Mixed Nuts Bag - Empty

BBQ-FLA  
BBQ Flavoring

BMX-BBQ  
Bag of Mixed Nuts - BBQ

CSW-BLK  
Cashews Bulk

FMX-BBQ  
Flavored Mixed Nuts - BBQ

OIL-LQD

Cancel

By default, the list includes all items in the system, up to a maximum of 100. If there are more than 100 items to be listed, only the first 100 items sorted alphabetically are listed. A message on the page or in the filter side sheet will indicate this condition. The item identifier by which the items are sorted and selected for inclusion in the list is the identifier specified by the *Item display* system parameter (which is set in MES Client): a combination of the item ID and/or the item description.

To help you identify an item in a long list or to see other items that are not listed, you must enter or refine the filter criteria.

**To enter or refine the filter criteria and select an item**

1. Enter the filter criteria using the **Item ID** box, **Item Description** box, and **Item Class** list.

2. Click the  **Filter** button to the right of the **Item Class** list.

The items that match the filter criteria are listed, and the  **Filter** button changes to an  clear filter button.

3. Select the item and click **OK**.

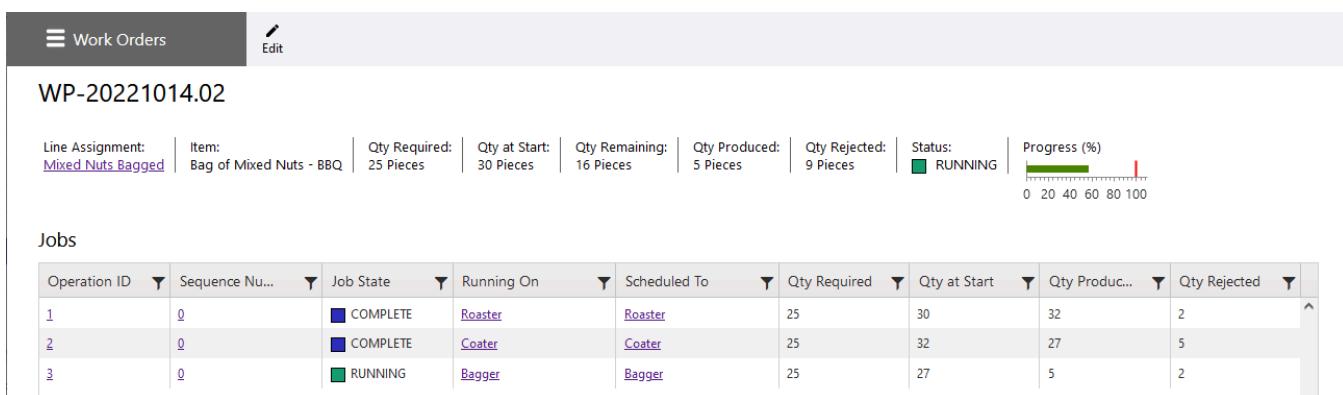
Note that the unique filter for each of the item lists in the system persists for your session.

#### To clear the filter

- Click the  clear filter button to the right of the **Item Class** list.

## Working with Grids

MES Web Portal includes grids of information, such as the **Jobs** grid shown below.



You can sort and filter information in the grid based on different columns.

#### Sorting the Grid by a Column

Click the column heading. The sort icon appears next to the heading label.

 Start Time 	Utilizatio
10/14/2022 4:03:30 PM	 RUNN
10/14/2022 11:55:16 AM	 STOPP

Clicking the heading cycles through:

- Ascending order
- Descending order
- Sorting on this column is off

Sorting is supported for one column at a time.

#### Filtering the Grid by a Column

In the column heading cell, click the  **Filter** button. The filter panel appears.

There are filter variations for text columns:

The screenshot shows a table with columns: Reason Description, End Time, Duration, and Severity. The Reason Description column contains items like 'Running', 'Idle', 'Unplanned Stop', etc. The End Time column shows dates and times. A context menu is open over the first row of the Reason Description column, specifically over the 'Running' entry. The menu title is 'Show items with value that:' followed by 'Is equal to'. There is also an 'And' option and two more 'Is equal to' dropdowns below it. At the bottom of the menu are 'Filter' and 'Clear' buttons.

Date/time columns:

The screenshots show three separate tables or views of data. Each has an 'End Time' column. The first view shows a single row with the value '10/14/2022 11:21:14 AM'. The second view shows a date range from '10/14/2022 11:21:14 AM' to '10/14/2022 9:53:21 AM'. The third view shows a dropdown menu with time values: 12:00 AM, 12:30 AM, 1:00 AM, 1:30 AM, 2:00 AM, 2:30 AM, and 3:00 AM. In the second and third views, there are context menus open with 'Is equal to' filter options.

Duration columns (accepts integer or 2-decimal numbers):

The screenshot shows a data grid with columns: Duration, Severe, and Standard Time. A filter dialog is overlaid on the grid, specifically targeting the 'Severe' column. The filter dialog contains the following fields:

- Show items with value that:
- Is equal to (selected condition)
- And (operator)
- Is equal to (second condition)
- Filter (button)
- Clear (button)

And true/false (check box) columns:

The screenshot shows a data grid with columns: Severe, Standard Time, and Sh. A filter dialog is overlaid on the grid, specifically targeting the 'Severe' column. The filter dialog contains the following fields:

- Show items with value that:
- is true    is false (radio buttons)
- Filter (button)
- Clear (button)

For text, date/time, and duration columns, you can enter up to two filter criteria for the data in the column. You can also filter on two or more columns to further refine the records that are displayed in the grid.

---

**Note:** Using the **Has no value** filter option for a column overrides any filters applied to other columns. Because of this behavior, the **Has no value** filter option should only be used when filtering on a single column.

---

### To apply a filter for a text, date/time, or duration column

1. Select a condition from one or both of the lists to configure the search. By default, the **Is equal to** option is selected.
2. If you are using two filter criteria:
  - Select **And** to filter on results that fulfill both search conditions.
  - Select **Or** to filter on results that fulfill either of the search conditions.
3. Enter the search criteria in the filter boxes.
  - If only using one filter criterion, leave the second filter box blank.
4. Click **Filter**.

Only the entries whose data in the column on which you are filtering match the filter criteria are included in the grid.

If the search criteria entry is not valid for the filter type, the filter is not applied.

### To apply a filter for a true/false column

1. Select the **is true** or **is false** option.

2. Click **Filter**.

Only the entries that match the true (check box selected) or false (check box cleared) condition on which you are filtering are included in the grid.

**To clear the filter**

- Click **Clear**.

**Filtering a Grid by the Last N Hours of Activity**

By default, entries that occurred in the previous 8 hours are shown in certain grids, such as the **Event History** and **Production History** grids, regardless of the shift. You can change this setting to filter events from the last 1 to 168 hours (7 days).

**To change the number of previous hours by which the grid is being filtered**

1. In the **Last N Hours** box above the right side of the grid, enter the number of previous hours on which to filter the list.

Last N Hours 8		
Time	Shift	Comment
	No Shift	
	No Shift	

2. Click the **Apply Filter** button or button.

This filter will not affect the actual Start Time and Duration of events in the grids so that you can see the actual data.

**Other Basic Operations**

The following topics describe other basic Web Portal operations.

**Working with the Action Bar**

Many of the MES Web Portal pages have an action bar that includes command buttons.

Entities

■ +

End Job Add Production Reduce Production

## Roaster

Utilization Events | **Work Queue** | Monitor | Configuration

**Job Queue**

BP-20221014.03

Operation: 1  
Qty at Start: 110 Pieces  
Qty Produc... 50 Pieces  
Qty Rejected: 0 Pieces  
Job State: RUNNING

**Job Detail**

Job Status	Entity	Item	Qty Required	Qty Remaining	Qty at Start
<span style="color: green;">RUNNING</span>	<a href="#">Roaster</a>	BMX-BBQ	100	60	110

**Production History**

Created Date ↓ Shift

Click a button in the action bar to initiate the selected action.

The buttons that are available on the action bar will change to indicate what options are available based on the currently selected object or action being performed.

For example, when a job is running on an entity, the **End Job**, **Add Production**, and **Reduce Production** buttons appear, as shown above.

### Truncated Information

If the name of a tile or an entry in a grid is too large to fit, ellipses (...) indicate that it is truncated. To see the full name in a tile, hover the cursor over it, as shown below. In a grid, widen the column.

WP-20221406253...

Line Assignment: [Mixed Nuts Bagged](#)

Item ID: FMX-BBQ

Status: NEW

If summary information at the top of the page is too large to fit, a chevron appears to indicate that it is truncated, as shown below. To see the hidden information, click the chevron.

+ Add Work Order

Filter

Current Reason	Bottleneck	Standard Item	Batch Size
<span style="color: green;">Running</span>	<a href="#">Roaster</a>	BMX-BBQ(Bag of Mixed Nuts - BBQ)	100.000 Pieces

## Implied Wildcard Characters and Case Sensitivity in Filter Boxes

### Wildcard Characters

Filters are included on several pages and side sheets in MES Web Portal, for example, the **Work Order** and **Entities** collection pages and **Standard Item** side sheets. The filter entry boxes have implied wildcard characters placed before and after your text entry. This causes the list to be filtered by any list entries that contain your text entry.

For example, if you enter pec, the following list entries would match:

- Feeder - Pecans
- Pallet - Pecans
- Scale - Pecans

All of the filter boxes, except the **Available Entities** filter box on the line configuration **Layout** tab, allow you to specify a range of characters using square brackets. [a-z] indicates a single alphabetic character, and [0-9] indicates a single numeric character.

For example, if you enter pallet[0-9], the following list entries would match:

- Pallet1
- Pallet80

However, the following list entries would not match:

- T101- Pallet
- Pallet-100

### Case Sensitivity

Text entries in filter boxes are case insensitive, except the **Available Entities** filter box on the line configuration **Layout** tab, which is case sensitive.

### Required Entries

Boxes and options that require entries are indicated by an asterisk (\*) following the box's or option's label.

### Responding to Messages

If the system detects a problem as a result of an action you performed, a message bar appears across the current page. The message can be an error, warning, or informational message.



The message should provide information about the problem and how to correct it. You will not be able to perform any other task in Web Portal until you acknowledge the message by clicking **Close**.

## Information Data Refresh

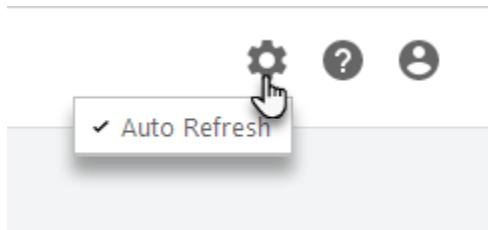
By default, information data, such as data displayed in status grids, is refreshed automatically every 60 seconds.

Note the following additional refresh behavior:

- After a refresh, the grid is reset to the first item in the grid.
- The timer for the refresh is reset when scrolling through the grid.
- The automatic refresh is disabled when modifying a record in a grid.

### To toggle the Auto Refresh behavior off and on for those pages that support it

- In the Settings menu, click **Auto Refresh**.



## Developer Notes

When developing customized MES Web Portal pages, refer to the following notes.

## Special Characters in Object Names and IDs

The following special characters that are used in SQL Server calls to the MES database should not be used for MES object names and IDs:

- % (percent)
- \_ (underscore)
- ^ (carat)
- [ or ] (square brackets)

MES objects can be a physical entity, a line, an item, a work order, a lot, an attribute or other objects that can be added to the MES database.

Using these characters can cause unexpected behavior when retrieving records from the MES database, such as missing or extra objects being returned.

Specifically, these special characters are used by SQL Server calls that use the LIKE operator. For more information about this operator and how these characters are used in a LIKE expression, see the [LIKE \(Transact-SQL\) topic](#) in the Microsoft SQL Reference document.

## Updating the `Funcs.GetTranslations` Method for Server-Side String Translations

Most of the MES Web Portal pages use the `Funcs.GetTranslations` method for string translations.

If any of the Web Portal pages have been customized, the method must be updated to pass the following required parameters: middlewareHost, token, languageId.

An example implementation is shown below.

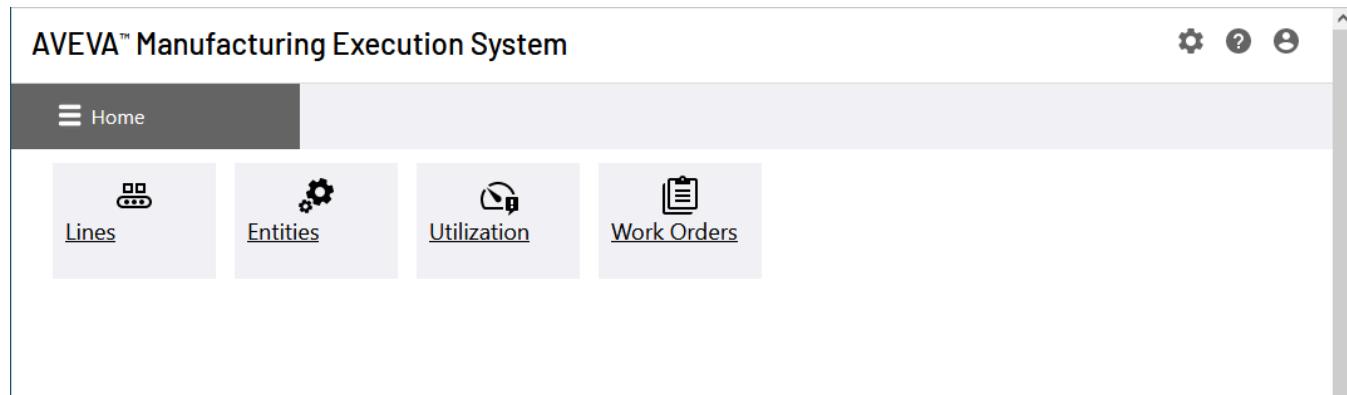
```
@using MES.Web;
 @{
    int[] stringsToTranslate = { 15, 1053, 2489, 7736 };
    var token = Request.Headers.Get("mes-token");
    var middlewareHost = Request.Headers.Get("mes-middleware");
    var languageId = Request.Headers.Get("mes-language");
    var translatedStrings = Funcs.GetTranslations(middlewareHost, token,
languageId, stringsToTranslate);
}
```

## Configuring MES Web Portal Components

You can create and configure the following components that are used in MES Web Portal:

- Utilization states, reason groups, and reasons (see [Configuring Utilization States and Reasons](#))
- Entities (see [Configuring Entities](#))
- Lines (see [Configuring Lines](#))
- Work orders (see [Creating a Work Order](#))

Access to each of the configuration pages starts at the Home page, shown below. The procedures in the topics referenced in the previous bullet list provide detailed steps for navigating to the appropriate configuration pages.



Note that, because utilization states and reasons are specified for entities, and entities need to exist in the system to create lines, the suggested order for configuring components is:

1. Configure utilization states, reason groups, and reasons that will be used with the entities.
2. Configure the entities that will be used in the lines.
3. Configure the lines.
4. Create work orders

## Configuring Utilization States and Reasons

To implement entity utilization tracking, you must configure utilization states, reason groups, and reasons.

For conceptual information about utilization states and reasons, see [Utilization](#).

### Configuring Utilization States

#### To add a utilization state

1. On the home page, click the **Utilization** tile.

The **Utilization** page appears.

2. Click the **States** tab.
3. Click the **Add State** button.

A new state entry is added to the grid.

Utilization States*	Color	Priority	OEE Use	Cost As	Failure	Entity Enabled
DOWNTIME			Downtime	Variable	<input type="checkbox"/>	
RUNNING			Downtime	Neither	<input type="checkbox"/>	
STOPPED			Runtime	Neither	<input type="checkbox"/>	
			Neither	Neither	<input type="checkbox"/>	

4. Enter the state's configuration settings. See [Utilization State Settings](#).
5. To save the settings, click the **Save** button.

#### To edit a utilization state

- In the grid on the **States** tab, modify the state's configuration settings and then click the **Save** button.

#### To delete a utilization state

- In the grid on the **States** tab, click the state entry to select it and then click the **Delete** button.

A utilization state that is linked to a utilization reason cannot be deleted. You must first link the utilization reason to another utilization state before attempting to delete it.

### Unsaved Changes Indicator and Behavior

If you make changes to a state's setting, the unsaved state of the setting is indicated by a red hash mark in the upper left corner of the field, as shown below.

Utilization States*	Color
BLOCKED	
DOWNTIME	

You can make changes to more than one setting and to more than one record before deciding to save them all. You can also delete utilization states without affecting the unsaved state of other setting changes.

## Utilization State Settings

Each utilization reason is assigned a corresponding utilization state. In addition to the state's description and background color, the utilization state includes utilization default settings. These default settings can then be applied to the utilization reason when it is being added or edited.

### Utilization State

Required. The unique name for the state.

### Color

The state's background color in the user interface. A color is assigned by default, which can be changed. Enter the color's hex code or name.

### Priority

A default setting for the utilization reason's priority, which is used to determine the reason for a line that has two or more bottleneck entities with differing reasons. The reason with the highest-numbered priority value is used as the line's utilization reason.

The default is 1. A value must be entered, and 0 is not allowed. If 0 entered, the value defaults to 1.

### OEE Use: Runtime

If selected, specifies that an event with this utilization reason counts toward runtime. Runtime events contribute to the calculation of Availability and Performance.

### OEE Use: Downtime

If selected, specifies that an event with this utilization reason counts toward downtime. Downtime events contribute to the calculation of Availability.

### OEE Use: Neither

If selected, specifies that an event with this utilization reason does not count toward runtime or downtime. Therefore, this utilization reason time is excluded from the calculation of OEE.

### Cost As

A default setting for the utilization reason's Cost As setting, which is used to determine whether an event with this utilization reason is to be costed as fixed time, variable time, or neither.

### Failure

A default setting for the utilization reason's Failure flag. If selected, specifies that any time that the entity spends in the utilization reason is considered failure time. Failure time is used in the calculation of Mean Time Between

Failures (MTBF) and Mean Time to Repair (MTTR).

#### **Entity Enabled**

A default setting for the utilization reason's Entity Enabled flag. If selected, specifies that any entity with this reason is enabled for production. If an entity is in a disabled state, then its production rate is not used in the calculation of the bottleneck line position.

#### **Maximum Duration**

A default setting for the utilization reason's Maximum Duration value. Specifies the maximum duration, in seconds, that is used with setting a Severe flag or with the New Reason parameter.

- If the New Reason functionality is not being used (that is, there is no entry in the New Reason column) and the maximum duration is exceeded, the reason is marked as being Severe and the event is considered to be in a severe condition. The Severe flag is typically used with downtime events.
- If the New Reason functionality is being used (that is, there is an entry in the New Reason column) and the maximum duration is exceeded, the utilization reason for the entity is changed to the new reason specified in the New Reason column.

A value of 0 is not allowed. If 0 entered, the value defaults to 1.

If Maximum Duration is not being used, leave this field blank, which disables the feature.

#### **New Reason**

A default setting for the utilization reason's New Reason entry. The utilization reason that this reason should change to when the maximum duration is exceeded.

For example, if a Jam condition exceeds a maximum duration of 5 minutes, then the entity would change to the new reason Mechanic Assistance Required. Note that this has the same effect as manually entering a new reason of Mechanic Assistance at the 5-minute mark. The new reason (Mechanic Assistance Required) starts at that time, and the Jam utilization event ends at that time. However, because utilization is only updated once a minute, the actual transition may be up to 59 seconds after the maximum duration of the original event (Jam in this example) was reached.

This setting is not available unless a value is entered for Maximum Duration.

#### **Standard Time**

A default setting for the utilization reason's Standard Time value. The standard amount of time, in minutes, that an entity is expected to be in this utilization reason.

Entered values are rounded to two decimal places.

#### **Minimum Time**

A default setting for the utilization reason's Minimum Time value. The minimum amount of time, in minutes, that an entity is expected to be in this utilization reason.

Entered values are rounded to two decimal places.

#### **Maximum Time**

A default setting for the utilization reason's Maximum Time value. The maximum amount of time, in minutes, that an entity is expected to be in this utilization reason.

Entered values are rounded to two decimal places.

#### **Setup Time**

A default setting for the utilization reason's Setup Time flag. If selected, specifies that an event with this utilization reason counts toward setup time.

#### **Teardown Time**

A default setting for the utilization reason's Teardown Time flag. If selected, specifies that an event with this

utilization reason counts toward teardown time.

#### Category 1–4

Default settings for the utilization reason's category entries. Specifies a user-defined entry that describes a category.

### Configuring Utilization Reason Groups

Utilization reason groups are used to organize utilization reasons. Therefore, during configuration, utilization reasons are added to reason groups.

To create a grouping hierarchy, a utilization reason group can be created in another utilization reason group. There can be up to 10 levels of groups.

#### To add a utilization reason group

1. On the home page, click the **Utilization** tile.

The **Utilization** page appears and the **Reasons & Groups** tab should load by default.

2. Add the reason group:

- To add a reason group at the highest level of the reason group hierarchy, in the **Reasons & Groups** tab, select the **Utilization** node in the tree.
- To add a reason group as a child to an existing reason group, select the existing reason group in the tree.

3. Click the **Add Group** button.

The **Group Info** pane appears.

The screenshot shows the Utilization page with the 'Reasons & Groups' tab selected. The left sidebar displays a hierarchical tree structure under the 'Utilization' node, with 'Production', 'Setup', 'Startup', and 'Maintenance' as children, and a new group 'Spare' being added. The right pane contains the 'Group Info' configuration panel. It includes a 'Description' field set to 'Util\_Reas\_Grp spare 1' and four 'Spare' input fields, each containing 'Util\_Reas\_Grp spare 2', 'Util\_Reas\_Grp spare 3', and 'Util\_Reas\_Grp spare 4' respectively.

4. Enter the reason group's configuration settings:

- a. In the **Description** box, type the name of the reason group.
- b. Optionally, in the **Spare** boxes, type custom data.

5. To save the settings, click **Save**.

The new reason group appears in the tree.

#### To edit a utilization reason group

1. On the **Reasons & Groups** tab, select the reason group.  
The **Group Info** pane appears.
2. Make your changes, then click **Save** to save them.

#### To delete a utilization reason group

- On the **Reasons & Groups** tab, select the reason group and then click the **Delete** button.  
A confirmation message appears.

To delete a reason group that contains other reason groups, you must first delete the reason groups it contains.  
All reasons in a reason group are deleted when the group is deleted.

### Configuring Utilization Reasons

#### To add a utilization reason

1. On the home page, click the **Utilization** tile.  
The **Utilization** page appears and the **Reasons & Groups** tab should load by default.
2. On the **Reasons & Groups** tab, select the reason group with which the reason should be associated.

---

**Note:** Reasons must be associated with a reason group. However, reasons cannot be directly associated to the **Utilization** node at the top of the tree, as that node is not a reason group. Only reason groups can be created directly under the **Utilization** node.

---

3. Click the **Add Reason** button.  
The **Reason Info** panel appears.

**Utilization**

**Reasons & Groups** | **States**

- Utilization
- Production
- Setup
- Lubrication
- Startup
- Maintenance

**Reason Info**

Description \*

Utilization State \*

DOWNTIME

Priority For Line Utilization

1

Is Entity enabled when this Reason applies?

Failure

Maximum Duration (seconds)

Standard Time (minutes)

Minimum Time (minutes)

Maximum Time (minutes)

**OEE Use**

Runtime

Downtime

Neither

**Scheduling Use**

Setup Time

Teardown Time

**Categorization**

Category 1

Category 2

Category 3

Category 4

**Cost As**

Fixed

Variable

Neither

- Enter the reason's configuration settings. See [Utilization Reason Settings](#).
  - To apply the default reason settings defined for the currently selected utilization state, click **Apply Defaults**.
- To save the settings, click **Save**.

#### To edit a utilization reason

- On the **Reasons & Groups** tab, select the reason.  
The **Reason Info** pane appears.
- Make your changes, then click **Save** to save them.

#### To delete a utilization reason

- On the **Reasons & Groups** tab, select the reason and then click the **Delete** button.  
A confirmation message appears.

# Utilization Reason Settings

## Description

The unique description for the reason.

## Utilization State

The state with which the utilization reason is associated.

## Priority for line utilization

Used to determine the reason for a line that has two or more bottleneck entities with differing reasons. The reason with the highest-numbered priority value is used as the line's utilization reason.

The default is 1. A value must be entered, and 0 is not allowed. If 0 entered, the value defaults to 1.

## Is entity enabled when this reason applies?

If selected, specifies that any entity with this reason is enabled for production.

## Failure

If selected, specifies that any time that the entity spends in the utilization reason is considered failure time. Failure time is used in the calculation of Mean Time Between Failures (MTBF) and Mean Time to Repair (MTTR).

## Maximum Duration

Specifies the maximum duration, in seconds, that is used with setting a Severe flag or with the New Reason parameter.

- If the New Reason functionality is not being used (that is, there is no entry in the New Reason column) and the maximum duration is exceeded, the reason is marked as being Severe and the event is considered to be in a severe condition. The Severe flag is typically used with downtime events.
- If the New Reason functionality is being used (that is, there is an entry in the New Reason column) and the maximum duration is exceeded, the utilization reason for the entity is changed to the new reason specified in the New Reason column.

A value of 0 is not allowed. If 0 entered, the value defaults to 1.

If Maximum Duration is not being used, leave this field blank, which disables the feature.

## New Reason

The utilization reason that this reason should change to when the maximum duration is exceeded. For example, if a Jam condition exceeds a maximum duration of 5 minutes, then the entity would change to the new reason Mechanic Assistance Required.

If you are using the Maximum Duration setting to set a Severe flag, then leave this setting blank.

This setting is not available unless a value is entered for Maximum Duration.

## Standard Time

The standard amount of time, in minutes, that an entity is expected to be in this utilization reason.

Entered values are rounded to two decimal places.

## Minimum Time

The minimum amount of time, in minutes, that an entity is expected to be in this utilization reason.

Entered values are rounded to two decimal places.

## Maximum Time

The maximum amount of time, in minutes, that an entity is expected to be in this utilization reason.

Entered values are rounded to two decimal places.

**OEE Use: Runtime**

If selected, specifies that an event with this utilization reason counts toward runtime. Runtime events contribute to the calculation of Availability and Performance.

**OEE Use: Downtime**

If selected, specifies that an event with this utilization reason counts toward downtime. Downtime events contribute to the calculation of Availability.

**OEE Use: Neither**

If selected, specifies that an event with this utilization reason does not count toward runtime or downtime. Therefore, this utilization reason time is excluded from the calculation of OEE.

**Scheduling Use: Setup Time**

If selected, specifies that an event with this utilization reason counts toward setup time.

**Scheduling Use: Teardown Time**

If selected, specifies that an event with this utilization reason counts toward teardown time.

**Categorization: Category 1–4**

Specifies a user-defined entry that describes a category.

---

**Note:** These category entries are currently not integrated with MES Category definitions.

---

**Cost As: Fixed Time**

If selected, specifies that an event with this utilization reason is costed as fixed time.

**Cost As: Variable Time**

If selected, specifies that an event with this utilization reason is costed as variable time.

**Cost As: Neither**

If selected, specifies that an event with this utilization reason is not costed as fixed time or variable time.

## Configuring Entities

### To add an entity

1. On the home page, click the **Entities** tile.  
The **Entities** page appears.
2. Click the **Add Entity** button.  
The **General** configuration tab appears.

The screenshot shows the 'Entities' configuration page in the AVEVA Manufacturing Execution System (MES). The 'General' tab is selected. The 'Basic Info' section contains fields for 'Name \*' (with a required asterisk), 'Description', and 'Identical Job Execs'. The 'Capabilities' section lists various permissions with checkboxes: Can Schedule Jobs, Can Run Jobs, Can Capture Util, Can Capture Labor, Can Track OEE, Can Schedule Shifts, Can Store, Can Log Data, Can Ship, Can Receive, Can Copy Folders, and Can Capture QM Data. Below the basic info, there is a 'Spare' section with four input fields labeled 'Ent spare 1' through 'Ent spare 4'.

3. On the configuration tabs, enter the entity's configuration settings.
4. To save the settings, click **Save**.

Initially, the page has two tabs, **General** and **Attributes**, on which you specify general settings and add attributes to the entity. As you select the entity's capabilities, additional tabs appear:

- If the entity can run jobs, you configure job settings on the **Job** tab.
- If utilization data can be captured for the entity, you configure utilization settings on the **Utilization** and **Allowable Reasons** tabs.
- If OEE data can be tracked for the entity, you configure OEE settings on the **OEE** tab.

## Configuring Entity Basic Information and Capabilities

The screenshot shows the 'Entities' configuration screen. The 'General' tab is active. In the 'Basic Info' section, there are three input fields: 'Name' (with a required asterisk), 'Description', and 'Identical Job Execs'. In the 'Capabilities' section, there is a list of checkboxes for entity permissions:

Can Schedule Jobs	Can Store
<input type="checkbox"/>	<input type="checkbox"/>

On the **General** tab, you specify:

- Basic information about the entity
- The entity's capabilities

**Note:** If an entity is a member of a line, then its *Can Schedule Jobs*, *Can Run Jobs*, *Can Capture Util*, and *Can Track OEE* capability options cannot be cleared. If you attempt to clear any of these options, an error message will appear.

The General entity settings are:

### Name

Required. The entity name. The name must be unique within a given site.

### Description

A description of the entity.

### Identical Job Execs

The number of jobs that can be run simultaneously on the entity.

A value of 0 (the default) or 1 indicates that only one job can run at a time.

---

**Note:** For entities that are in a line, MES currently allows only one job to be running at a time.

---

#### Spare fields

Can be used to specify custom general information about the entity.

#### Can Schedule Jobs

The entity can have jobs scheduled to it.

This option is required for an entity to be a member of a line.

This option is useful when jobs are initially scheduled to a parent entity (for example, from an ERP download of a work order) and then the running entity (which has the *Can Run Jobs* capability) is a child of the parent and set by the plant person.

#### Can Run Jobs

The entity can run jobs.

Select this option if the entity is a member of a line.

This capability is required so that the individual jobs for a specific entity that are associated to the work order running on the line can be started and completed.

#### Can Capture Util

The entity can capture utilization data.

Select this option if the entity is a member of a line.

This capability is required because the production rate calculation for determining a line's bottleneck uses the entity's utilization reason to determine whether an entity is enabled and so should be used in the rate calculation.

#### Can Capture Labor

The entity can capture labor data.

#### Can Track OEE

The entity can capture OEE statistics.

Select this option if the entity is a member of a line.

This capability is required because it allows for a default production rate to be assigned to the entity. The production rate is used in the calculation that determines a line's bottleneck when no job is running on the entity and the next one cannot be inferred.

#### Can Schedule Shifts

The entity has its own shift schedule and will not inherit shifts from any parent.

Select this option if the entity will be the parent entity of a line, unless shift information for the line is inherited from an entity above the line's parent entity in the entity hierarchy.

Do not select this option if shifts for this entity are managed at a higher-level entity within the entity hierarchy.

#### Can Store

The entity can serve as a storage location.

#### Can Log Data

The entity can log data to one of the data log tables defined separately. This option is not required for Quality data collection.

#### Can Ship

The entity can serve as a shipment location.

#### Can Receive

The entity can serve as a location that can receive materials.

### Can Copy Folders

Copies of files in a folder (program files, documentation, and other files regarding an item's production relative to the entity) can be made specifically for this entity.

### Can Capture QM Data

The entity can have QM Samples generated for it and record results.

## Adding Attributes to the Entity

Attributes provide a way to assign additional properties to an entity, which can then be tracked in the MES database, entered by or displayed for operators, and included in reports. For example, entity attributes could be:

- Location (example attribute value: Aisle 6)
- Capacity (example attribute value: 5000 gal)
- Processing capability (example attribute value: Max. Temp. 500C)
- Manufacturer (example attribute value: Acme Nuclear Reactors Ltd.)
- Maintenance information (example attribute value: Align monthly)

Attributes must be defined using MES Client before they can be added to an entity in MES Web Portal.

Note that when entering date/times as an attribute value, the entry is converted to a string when stored in the MES database according to the format of the web browser's language setting. For this reason, make sure that the web browser language setting matches the MES Client language setting so that the date/time format is consistent for both.

### To add an attribute to an entity

1. On the Attributes tab, click the **Add Attribute** button. A new attribute row is added to the grid.

Attributes	Value	Notes	
Roasting Temperature			

2. In the **Attributes** column, select the attribute.
3. In the **Value** column, enter the value of the attribute. Depending on the attribute selected, this entry can be selected from a list, picked from a Date/Time control, or manually typed.
4. Enter notes in the **Notes** column.

The **Value** and **Notes** columns behave as follows:

- If the attribute is configured for a value only, a value must be entered and notes cannot be entered.

- If the attribute is configured for notes only, notes must be entered and a value cannot be entered.
- If the attribute is configured for a value and notes, entering a value or notes is optional.

### To remove an attribute from the entity

- Click the attribute entry's **Delete** button. A confirmation message appears.

## Configuring Job Settings

Palletizer

Configuration

General | Utilization | OEE | **Job \*** | Allowable Reasons | Attributes

**Default production reason:** Produced\Example Production

**Default consumption reason:** Consumed\Example Consumption

**Start next sequence for current W/O and operation:** Manually

**Start next job:** Manually

**End job:** Manually

Show both item class and entity reasons

The required quantity must be produced to end a job

Run without operator

Suppress 'Start Some Quantity' Prompt

**Spare**

Job\_Exec spare 1

Job\_Exec spare 2

Job\_Exec spare 3

Job\_Exec spare 4

If the entity can run jobs, you specify the following job-related settings for the entity on the **Job** tab.

### Default production reason

The default production reason that will be entered for the entity, unless a user overrides it with a production reason in the **Add Production** side sheet.

### Default consumption reason

The default consumption reason that will be entered for the entity, unless a user overrides it with a consumption reason in the **Add Consumption** side sheet.

**Note:** This setting is currently not used in MES Web Portal.

### Start next sequence for current W/O and operation

Specifies how the next sequence in the current work order starts.

- **Manually:** An operator must start the next sequence.
- **When previous done:** The next sequence number within a work order starts automatically. This requires multiple jobs having the same work order and operation but different sequence numbers queued at the entity. Otherwise, the next job must be started manually.

#### Start next job

Specifies how the next job starts.

- **Manually:** An operator must start the next job when a running job is completed.
- **As soon as ready:** The next job that is ready in the entity's queue starts automatically after a running job is completed. Otherwise, the next job must be started manually.

#### End job

Specifies what ends a job.

- **Manually:** An operator must change the job status to Completed when a running job is completed.
- **When quantity done meets required quantity:** The job status is changed to Completed when the required item quantity is produced.

#### Show both item class and entity reasons

Select the check box to show item class reasons and the entity production and consumption reasons for the jobs.

#### The required quantity must be produced to end a job

Select the check box to ensure that the required quantity is produced before the job is marked Complete.

#### Run without operator

Clear the check box to ensure that an operator must remain logged on while a job is running. By default, no operator must be logged on while a job is running.

---

**Note:** This setting does not currently apply to MES Web Portal.

#### SUPPRESS 'START SOME QUANTITY' PROMPT

Specifies whether a side sheet should appear for entering start quantities for a job that is being split. If this check box is selected, the side sheet does not appear and, by default, the value of the start quantity is 1. If the **Allow zero quantity split** check box is selected, the value of start quantity is 0 by default.

---

**Note:** This setting does not currently apply to MES Web Portal.

#### Job\_Exec Spare fields

Can be used to specify custom information about the entity's capability to run jobs.

## Configuring Default Utilization Reasons for Standard Events

The screenshot shows the configuration interface for a 'Palletizer' entity. The top navigation bar includes 'Entities' and a 'Delete' option. Below the title 'Palletizer' is the 'Configuration' tab, which is currently active. The 'Utilization' tab is also visible. The configuration area is divided into two main sections: 'Utilization' and 'Spare'.

**Utilization:**

- Default reason when job starts
- Default reason when job ends
- Default reason when shift starts
- Default reason when shift ends
- Unknown reason
- Target Util %

**Spare:**

- Util\_Exec spare 1
- Util\_Exec spare 2
- Util\_Exec spare 3
- Util\_Exec spare 4

If utilization data can be captured for the entity, you can optionally specify default utilization reasons on the **Utilization** tab for the following actions:

- When the job starts
- When the job ends
- When a shift starts
- When a shift ends
- When a raw reason code that has not been configured for the entity is received (that is, if utilization is coming from a UCO)

You can also enter:

- A value for the **Target Util %**. This value appears on the KPI Availability gauge as the target percentage of availability that the entity should achieve. See [Viewing KPI Gauges](#).
- Custom utilization information using the **Spare** boxes.

## Specifying the Utilization Reasons That Can Be Used with an Entity

The screenshot shows the AVEVA MES interface for managing entities. At the top, there's a dark header bar with the 'Entities' button and a 'Delete' icon. Below it, the main title 'Palletizer' is displayed. Underneath the title, a navigation bar includes tabs for 'Configuration', 'General', 'Utilization', 'OEE', 'Job', 'Allowable Reasons' (which is currently selected and underlined), and 'Attributes'. The 'Allowable Reasons' section contains a hierarchical tree view of utilization reasons. The tree starts with 'Utilization', which branches into 'Production' (selected and highlighted in blue), 'Unknown', 'Running', 'Idle', 'Setup', 'Startup', and 'Maintenance'. Each reason is preceded by a checkbox.

If utilization data can be captured for the entity, you specify the utilization reasons that can be used with the entity on the **Allowable Reasons** tab. At runtime, when an operator manually adds a new utilization event for an entity, the list of reason groups and reasons will be limited to the selected allowable reasons.

Note that if no reasons are specified for an entity, all reasons are available to be selected for it. It is not possible to have no allowable reasons for an entity that can collect utilization, if there are any reasons at all configured.

### To specify allowable reasons

- Select the reason groups or individual reasons in the **Allowable Reasons** tree.

## Configuring OEE Default Data

The screenshot shows the 'Configuration' tab selected for the 'Palletizer' entity. The top navigation bar includes 'Entities' and a 'Delete' option. Below the title, there are tabs for General, Utilization, OEE (selected), Job, Allowable Reasons, and Attributes. The 'OEE' tab contains fields for Default Production Rate (empty input field), Default Production UOM (dropdown set to 'hours/batch'), Default Batch Size (input field containing '1.000'), Default Standard Item (button labeled 'No Item Selected' with a 'Configure' link), Target OEE % (empty input field), Target Perf % (empty input field), and Target Qual % (empty input field).

If OEE data can be captured for the entity, you specify the entity's OEE data default settings, described below, on the **OEE** tab.

For an explanation of how these settings are used, see [Production](#).

### Default Production Rate

Required. The default production rate for the entity.

**Note:** The default production rate must be greater than 0. An entry of 0 will cause an error.

### Default Production UOM

The default unit of measure for the production rate. The default is hours/batch.

#### Default Batch Size

If using batches during production, enter the default batch size. The default is 1.

---

**Note:** The batch size cannot be 0. If 0 is entered, it is automatically changed to the default value 1.

This setting is used when determining the line's production rate. For additional information about how batch size affects OEE results, see [Understanding Batches and Lots for OEE](#).

The decimal place resolution of the batch size is controlled by the system parameter *Maximum number of decimals for batch entry*. For information about setting this parameter, see the *MES Client User Guide* or online help.

#### Default Standard Item

The default standard item that is used for the entity when the system is determining a comparable production rate unit of measure for the different entities in the line.

---

**Note:** A default standard item must be configured for any entity that will be set as a production source for the line or that can be or is manually set to be the bottleneck for the line.

To select a standard item from a list of available items, click **Configure** and then click the item.

---

**Note:** To filter the item list in the item selection side sheet, see [Filtering Item Lists](#).

#### Target OEE %, Target Perf %, Target Qual %

The target setpoints for KPI OEE, Performance, and Quality. These values are indicated on the KPI gauges by a tick mark at the outer edge of the gauge's color band. See [Viewing KPI Gauges](#).

### Deleting an Entity

1. On the home page, click the **Entities** tile. The **Entities** page appears.
2. To filter the entities list, see [Filtering Entities on the Entities Collection Page](#).
3. Click the entity to be deleted. The entity's page appears.
4. Click the **Configuration** tab.
5. Click the **Delete** button. A confirmation message appears.

---

**Note:** If an entity is either the manually-designated bottleneck entity or the production source of a line, that entity cannot be deleted.

### Configuring Lines

When configuring lines, you can:

- Create a line (see [Creating a Line](#))
- Configure a line's settings (see [Line Configuration Settings](#))
- Configure a line's entity layout (see [Configuring a Line's Layout](#))
- Manually designate a line's bottleneck entity, or configure the automatic determination of a line's bottleneck entity (see [Manually Designating the Bottleneck Entity](#) and [Configuring the Automatic Determination of Bottleneck Entities](#))
- Delete a line (see [Deleting a Line](#))
- Assign line access to users (see [Assigning Line Access to Users](#))

## Creating a Line

1. On the home page, click the **Lines** tile.  
The **Collection** tab of the **Lines** page appears.
2. Click the **Add Line** button.  
The **Add Line** page appears.

## Lines

### Basic Info

Name \*

Labor Load (people)

Maximum Work Orders

Standard Item

No Item Selected [Configure](#)

Batch Size

Production Unit Of Measure

Parent Entity for Scheduling

### KPI Targets

Target OEE %

Target Perf %

Target Util %

Target Qual %

### Spare

Line Spare 1

Line Spare 2

Line Spare 3

Line Spare 4

3. Enter the line's configuration settings. See [Line Configuration Settings](#).
  4. To save the settings, click **Save**.
- The line **Configuration** tabs appear.

# Line Configuration Settings

## Name

Required. The unique name for the line.

## Labor Load (people)

The number of people required to run the line.

---

**Note:** This value is stored in the MES database but is not currently used.

---

## Maximum Work Orders

Required. Maximum number of simultaneous work orders permitted on the line. The default is 1. This setting affects how jobs are handled when starting a work order on a line. When Maximum Work Orders is 1, starting a work order will attempt to start all of its jobs at once. Unless the system parameter *Ready all new jobs of a work order together* in MES Client is set to Yes, only the first job(s) of a new work order will initially be ready, and this will not work. Therefore the *Ready all new jobs of a work order together* parameter must be set to Yes when there are lines having Maximum Work Orders set to 1.

## Standard Item

The standard item that is being produced on the line.

This setting is used to derive a common unit of measure for item production when determining the line's production rate. It is also the default item for work orders created for this line.

To enter the standard item, see [Entering a Standard Item \(Line Configuration Setting\)](#).

## Batch Size

Required. The standard batch size used when producing items on the line. The default is 1.

---

**Note:** The batch size cannot be 0. If 0 is entered, it is automatically changed to the default value 1.

---

This setting is used when determining the line's production rate. For additional information about how batch size affects OEE results, see [Understanding Batches and Lots for OEE](#).

The decimal place resolution of the batch size is controlled by the system parameter *Maximum number of decimals for batch entry*. For information about setting this parameter, see the *MES Client User Guide* or help.

## Production Unit of Measure

The standard production rate unit of measure for items produced on the line. The default is hours/batch. This setting is used to derive a common unit of measure for item production when determining the line's production rate.

## Parent Entity for Scheduling

The entity that is the parent of the line and from which the line and its entities inherit their shift schedules. Only entities that can schedule shifts or their descendants, which inherit the capability to schedule shifts, are included in the list. Entities that are members of a line are not included in the list.

## Line Spare 1–4

Boxes for entering custom information about the line.

## Target OEE %, Target Perf %, Target Util %, Target Qual %

The target setpoints for KPI OEE, Performance, Utilization, and Quality for the line. These values are indicated on the KPI gauges on the line's **Monitor** tab by a tick mark at the outer edge of the gauge's color band. See [Viewing KPI Measures](#).

Values must be from 0 to 100.

# Entering a Standard Item (Line Configuration Setting)

1. On the **Add Line** page, click **Configure**.  
The Standard Items side sheet appears.
2. To filter the list, see [Filtering Item Lists](#).
3. Select the standard item.
4. Click **OK**.

For an explanation of how the item designation is derived, see [Items and Item Classes](#).

## Editing a Line

---

**Note:** You cannot edit a line if a work order is currently running on it. For more information, see [Guidelines with Work Orders Created from a Line](#).

---

1. On the home page, click the **Lines** tile.  
The **Lines** collection page appears.
2. Click the line you want to edit.  
The **Work Orders** tab appears.
3. Go to the **Configuration** tab to edit the line's configuration settings (see [Line Configuration Settings](#)), layout (see [Configuring a Line's Layout](#)), or user group access (see [Assigning Line Access to Users](#)).

For information about what happens to work orders and jobs when a line's layout is reconfigured, see [Line Layout Reconfiguration System Behavior](#).

## Deleting a Line

---

**Note:** Deleting a line does not delete the entities that are members of the line.

---

**Note:** You cannot delete a line if a work order is currently running on it.

---

1. On the home page, click the **Lines** tile. The **Lines** collection page appears.
2. Click the line that you want to delete. The **Work Orders** tab appears.
3. Go to the **Configuration** tab.
4. Click the **Delete** button. A confirmation message appears.

### Configuring a Line's Layout

---

**Note:** The Line Layout configuration page requires a pointing device to be able to drag entities onto the layout model.

---

For conceptual information about lines and line layout, see [Lines](#) and [Line Layout](#).

1. Load the line for configuration either by creating the line (see [Creating a Line](#)) or loading the line to edit it (see [Editing a Line](#)).
2. Click the line configuration **Layout** tab.
3. Optionally, use the filter box at the top of the **Available Entities** list to filter the list of entities.

## Available Entities

The screenshot shows a user interface for managing entities. At the top, there is a search bar with the placeholder "Name: b" and a clear button (X). Below the search bar is a list of entities. The first entity is "Bagger", and the second entity is "Boxer". Both entities are displayed in separate gray boxes.

The filter entry will persist when you leave and return to this page. To clear the filter, click X.

4. Drag the entities in the **Available Entities** list onto the layout model. For an example layout and description of the layout components, see [Sample Line Layout](#). For examples of how to add entities for various layout configurations, see the other topics in this section.

**Note:** A line with more than 50 line positions is not supported for calculating bad counts.

5. To save the layout, click **Save**.

If you navigate away from the **Layout** tab, any changes that you made since last performing a Save operation will be discarded.

Entities can be added to a layout according to the following guidelines:

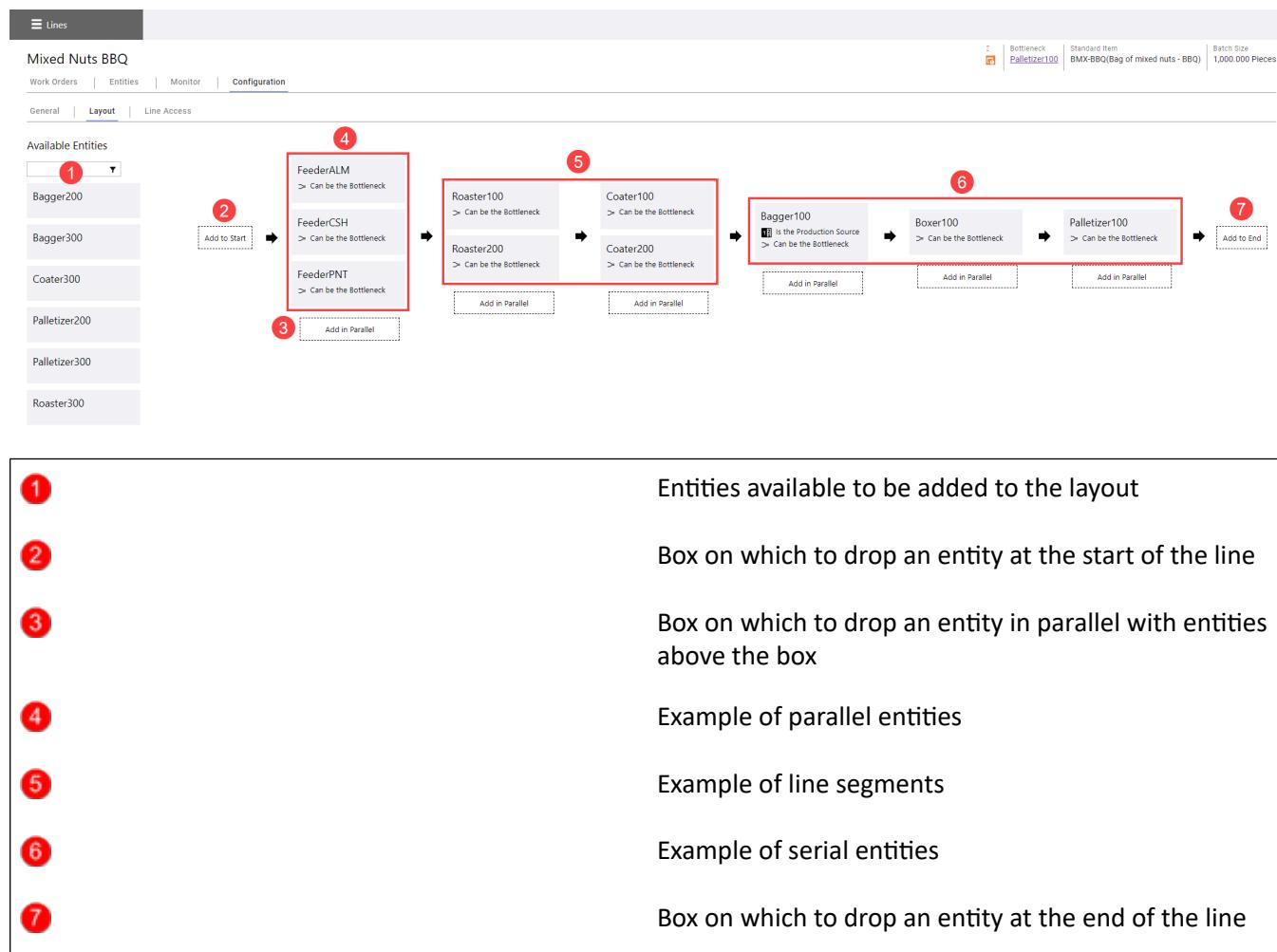
- Only entities that have the following capabilities and settings can be added to a layout: can schedule jobs, can run jobs, can capture utilization, can track OEE, have an OEE production rate defined, and have no more than one Job Exec (that is, it cannot have more than one job running at a time).
- A line's parent entity cannot be added.
- An entity that is already a member of the layout cannot be added again.

Only entities that meet these guidelines will be included in the **Available Entities** list.

**Note:** An entity that is already a member of another line should not be added to a line. That is, an entity should not be a member of multiple lines.

## Sample Line Layout

The following figure shows a sample line layout and identifies layout tools and line components.



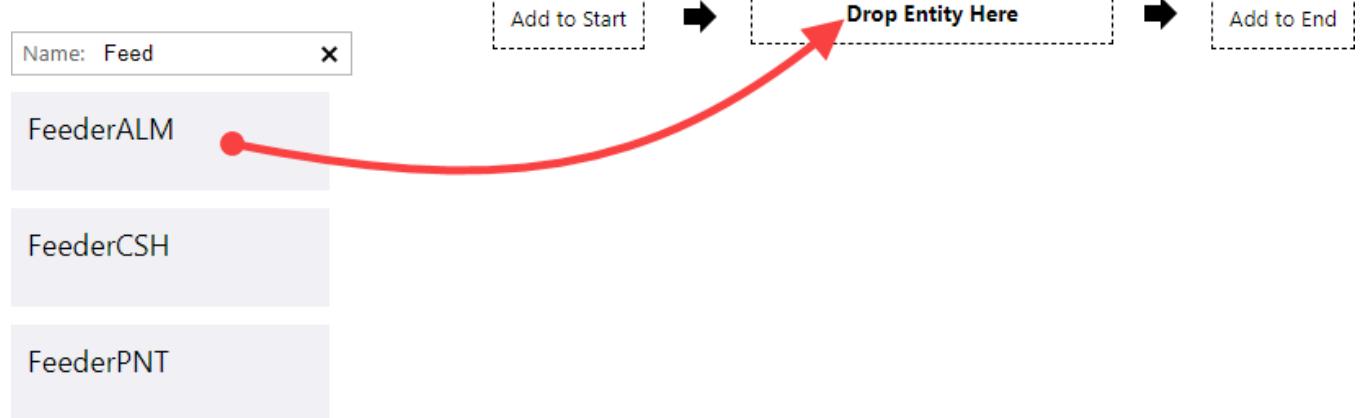
The list of available entities is determined by the following guidelines:

- Only entities that have the following capabilities and settings are included in the list: can schedule jobs, can run jobs, can capture utilization, can track OEE, have an OEE production rate defined, and have no more than one Job Exec (that is, it cannot have more than one job running at a time).
- The line's parent entity and any entities that are already in the line layout are not listed.

## Inserting the Initial Entity

Drag an entity from the **Available Entities** list to the **Drop Entity Here** box.

## Available Entities



The entity is added to the layout.

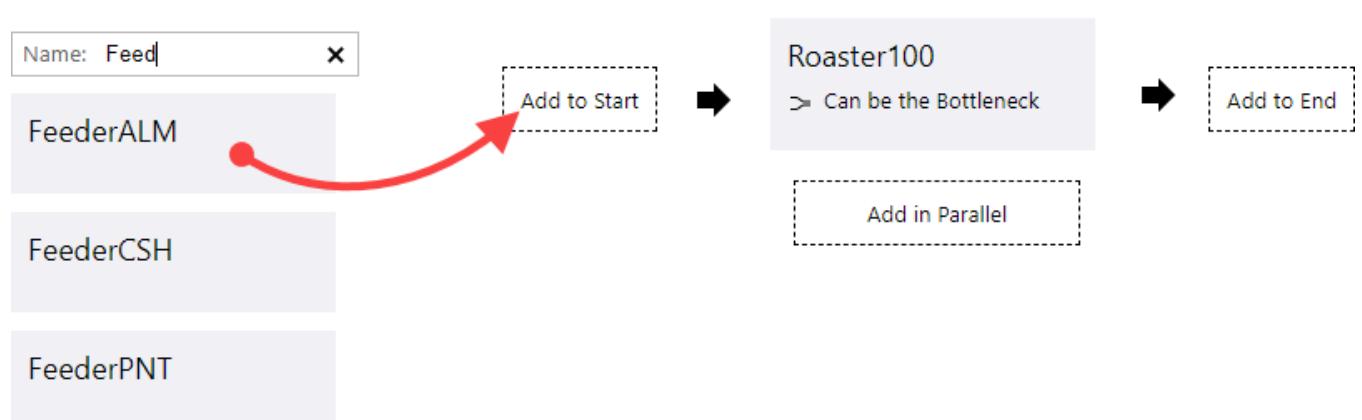
## Available Entities



## Inserting an Entity at the Start or End of a Line

Drag an entity from the Available Entities list to the Add to Start or Add to End box.

## Available Entities



The entity is added to the start or end of the layout.

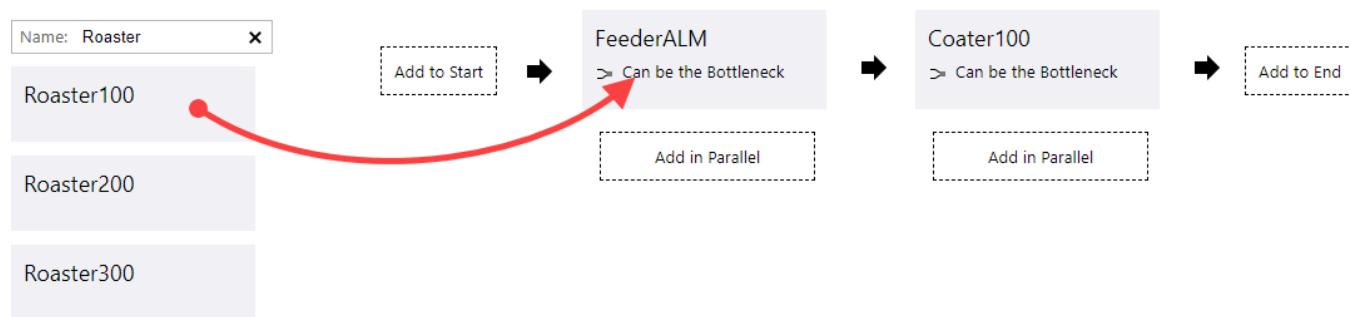
## Available Entities



## Adding Serial Entities

Drag an entity from the **Available Entities** list to the entity that will precede it in the line.

## Available Entities



The entity is added to the layout following the entity it was dropped on.

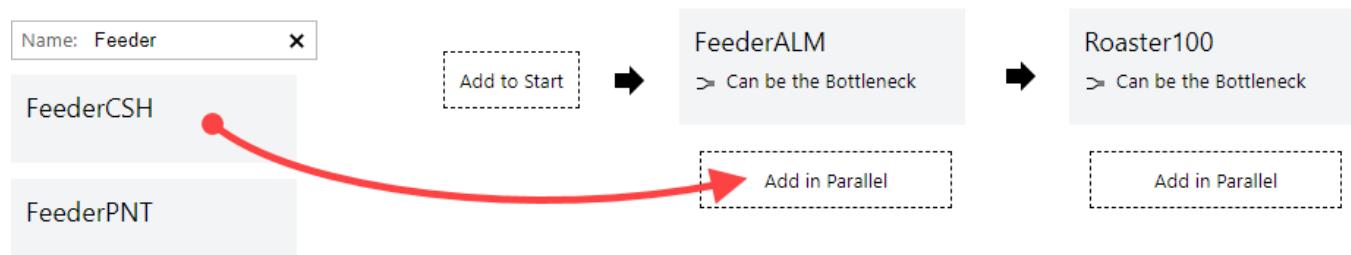
## Available Entities



## Adding Parallel Entities

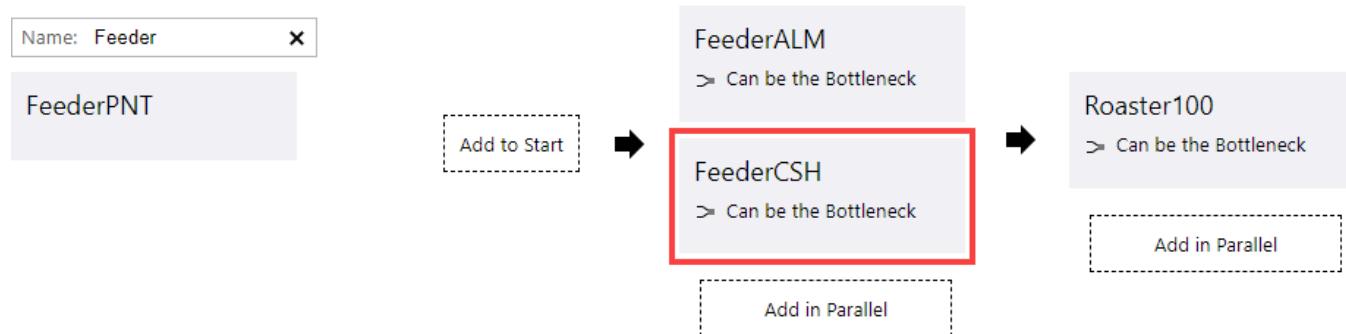
Drag an entity from the **Available Entities** list to an **Add in Parallel** box.

## Available Entities



The entity is added to the layout in parallel with other entities.

## Available Entities



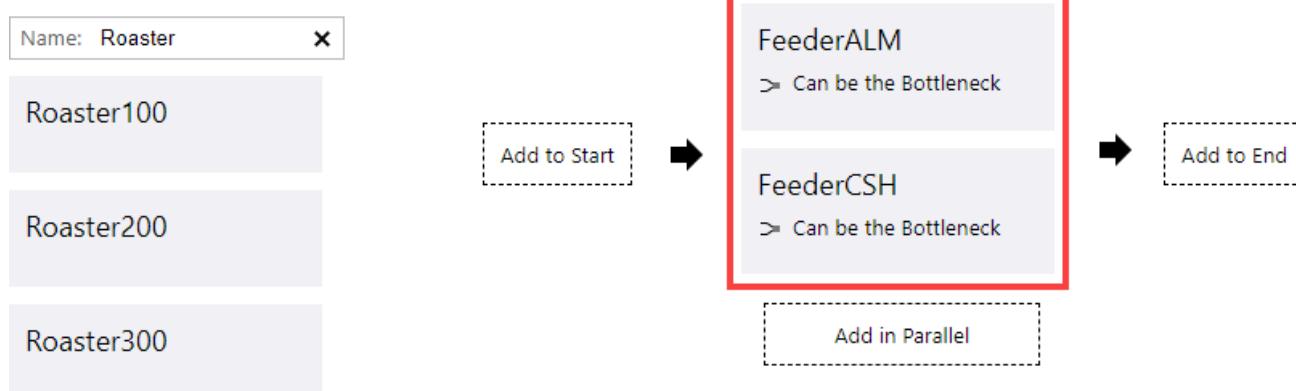
Parallel entities are listed in alphanumeric order.

## Creating a Segment

Segments are parallel subpaths in the line. So you must first set up entities that are in parallel. When creating parallel subpaths in a line, each subpath must contain the same number of entities.

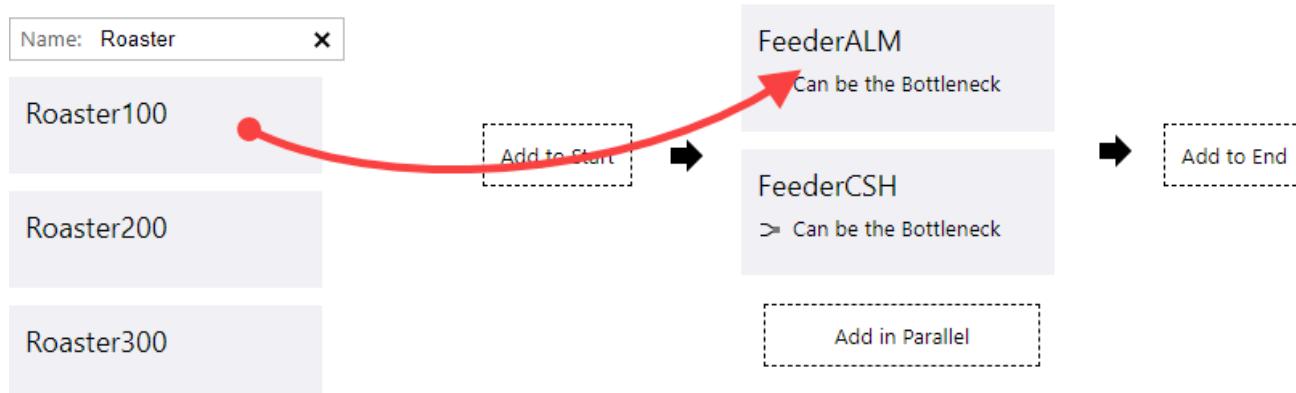
1. Create a parallel structure that includes each of the entities that are at the start of the line segments.

## Available Entities



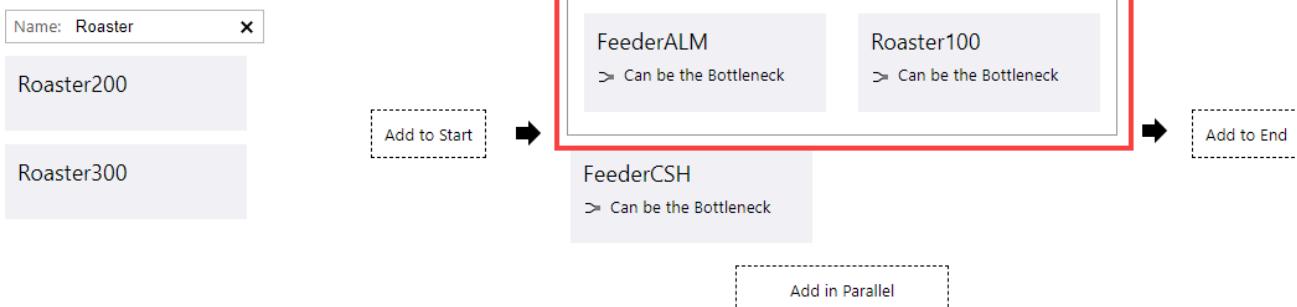
2. Drag an entity from the **Available Entities** list to the parallel entity that it should follow in the line segment.

## Available Entities



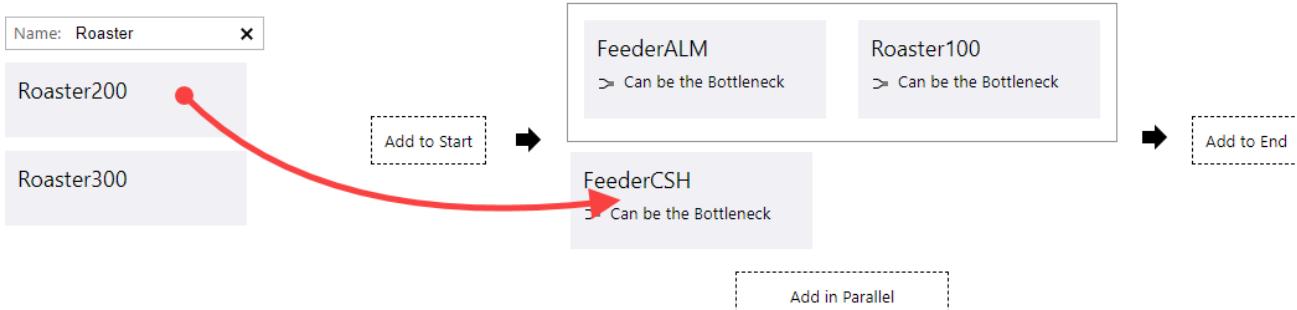
The entity is added to the line segment.

## Available Entities



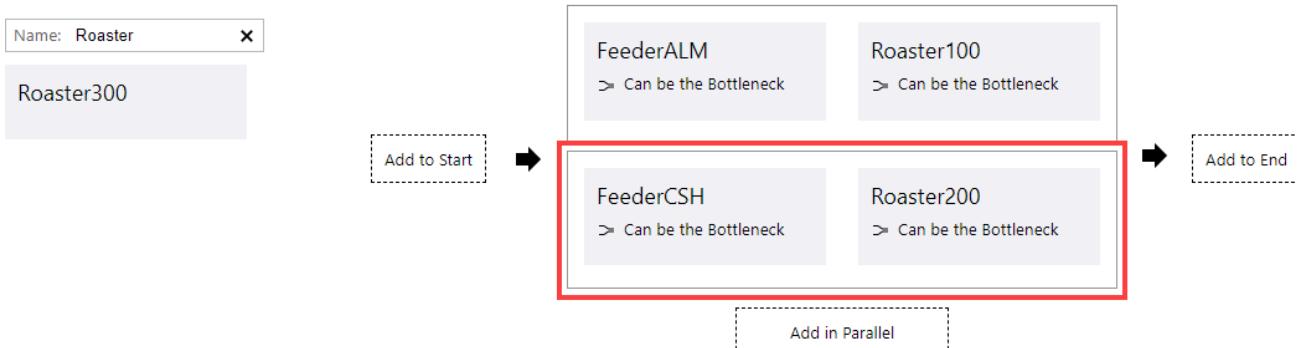
3. Drag another entity from the Available Entities list to the other initial parallel entity in the line segment.

## Available Entities



The entity is added to that line segment.

## Available Entities



4. Continue adding entities to each line segment as needed by dragging the new entity and dropping it on the last entity in the line segment.

To add an additional line segment in parallel with the others, drag an entity to the **Add in Parallel** box below the line segments. This will start another line segment to which you can add its entities.

Segments are ordered alphabetically according to the entities at the first position of the segments. Therefore, changing the first entity in a segment could cause the segments to be reordered.

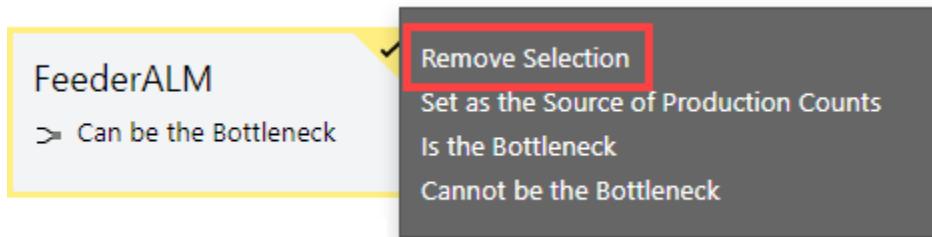
## Moving an Entity in the Layout

Drag the entity to an **Add** box or to another entity.

# Removing an Entity from a Line

Removing an entity does not delete the entity from the system. It only removes it from the current line.

1. Click the entity to be removed.  
A menu appears.
2. In the menu, click **Remove Selection**.



## Designating an Entity as the Production Source

You can designate the entity in the line from which the line's production amount is to be derived. This means that the good count comes from the designated entity's line position and the bad count comes from the designated entity's line position and all preceding entities. Only one entity in the line can be designated as the source of the line's production amount. If no entity is specifically designated as the production source, then the entity or entities in the last line position of the line are considered as the production source for the line.

If you select a parallel entity or an entity in a line segment, the production amount will include the items produced by all entities at that entity's line position.

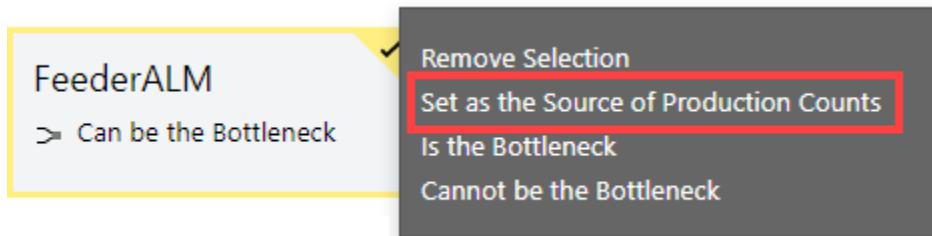
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**Note:** A default standard item must be configured for any entity that will be set as the production source. See [Configuring OEE Default Data](#).

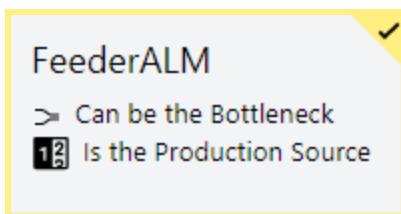
---

### To designate an entity as the production source

1. Click the entity to be designated as the production amount source for the line. A menu appears.
2. In the menu, click **Set as the Source of Production Counts**.



That entity is indicated to be the production source.



### To remove the production source

- Perform one of the following actions:
  - Select another entity as the production source.
  - In the entity menu, click **Unset as the Source of Production Counts**.

### Manually Designating the Bottleneck Entity

You can manually designate the entity in the line that will be considered the line's bottleneck entity. If the designated entity is in parallel with other entities at the same line position, then all entities at that line position are considered to be bottleneck entities. Only one line position can have entities that are designated as the bottleneck entities.

---

**Note:** A default standard item must be configured for any entity that can be or is manually set to be the bottleneck. See [Configuring OEE Default Data](#).

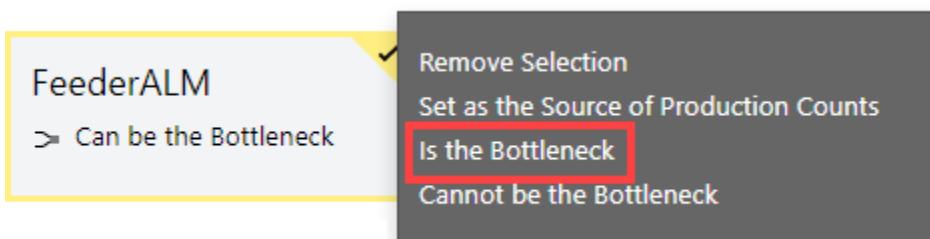
---

**Note:** Even if an entity is manually designated as the bottleneck entity, if it is not in a utilization reason code that enables it, nothing will be returned when the system is queried for which entity is the bottleneck. See [Enabling the Entity When in a Running State](#).

---

### To designate an entity as the bottleneck

1. Click the entity to be designated as the bottleneck entity for the line. A menu appears.
2. In the menu, click **Is the Bottleneck**.



3. That entity is indicated to be the bottleneck entity.



---

**Note:** When an entity is manually designated as the bottleneck entity, the **Can be the Bottleneck** setting is removed from all of the other entities to which it was assigned. Also, the **Is the Bottleneck** setting is removed if it was previously assigned to another entity.

---

**To remove the bottleneck designation from the entity**

- Perform one of the following actions:
  - Select another entity as the bottleneck.
  - In the entity menu, click **Is Not the Bottleneck**.

**Configuring the Automatic Determination of Bottleneck Entities**

To ensure that the automatic determination of a line's bottleneck entity can be performed properly, the line and the line's entities must be configured as follows.

---

**Note:** If the production rate for an entity cannot be determined, then the line's performance rate and bottleneck entity cannot be determined. Examples of this condition is an entity on which no job is running, there is no upstream job source for the rate, and a default rate has not been defined for the entity.

---

## Specifying Required Line Configuration Settings

Each of the following line configuration settings must have entries:

- Standard Item
- Batch Size
- Production Unit of Measure

These values are used to determine a common unit of measure for the item being produced by the line.

For more information, see [Line Configuration Settings](#).

## Making Sure That an Entity Is Not Manually Designated as the Bottleneck

If an entity in the line has been designated as the bottleneck, you must remove this designation. See [Manually Designating the Bottleneck Entity](#).

## Specifying That the Line's Entities Can Potentially Be a Bottleneck

Each of the entities in the line must be specified as potentially being a bottleneck.

---

**Note:** A default standard item must be configured for any entity that can be the bottleneck. See [Configuring OEE Default Data](#).

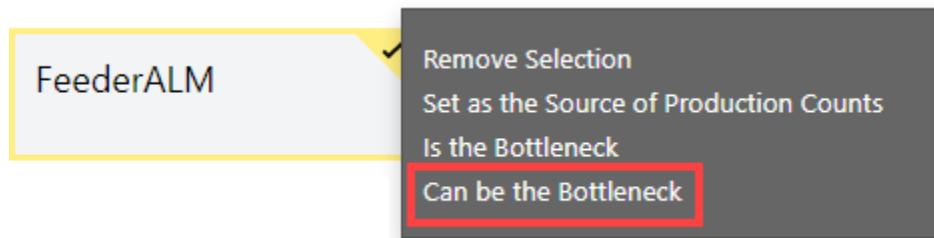
---

**To specify that an entity can potentially be a bottleneck**

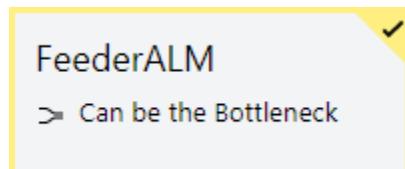
1. In the line's **Layout** tab, click the entity.

A menu appears.

2. In the menu, click **Can be the Bottleneck**.



That entity can now potentially be the bottleneck entity.



#### To remove the designation that the entity can be the bottleneck designation

- In the entity menu, click **Cannot Be the Bottleneck**.

## Assigning the Required Capabilities to the Entities in the Line

All of the entities in the line must have the following capabilities:

- Can Schedule Jobs
- Can Run Jobs
- Can Capture Utilization
- Can Track OEE (because the entity's default production rate is specified in its OEE settings)

See [Configuring Entity Basic Information and Capabilities](#).

## Specifying Required Entity OEE Configuration Settings

Each of the entities in the line must have entries for the following settings:

- Default Production Rate
- Default Batch Size
- Default Standard Item

These values are used to determine the entity's production rate if it is not currently running a job and there are no jobs for this entity in any upstream work orders.

See [Configuring OEE Default Data](#).

## Enabling the Entity When in a Running State

If an entity is disabled and it is the only entity in that line position, then a production rate for it will not be determined. Therefore, the line's production rate and bottleneck entity cannot be determined. For this reason, make sure that, for utilization reasons that will be used when the entity is producing items, the **Is entity enabled when this reason applies?** check box is selected. See [Configuring Utilization Reasons](#).

### Assigning Line Access to Users

To interact with work orders and jobs that are running on a line, users must be assigned access to the line. Access is assigned at the user group level. For information about configuring MES user groups and assigning users to them, see the *MES Client User Guide* or help.

#### To assign line access to user groups

1. On the **Lines** collection page, click the line, click the **Configuration** tab, and then click the **Line Access** tab.  
The MES user groups are listed in the tab.

The screenshot shows the MES Line Access configuration interface. At the top, there is a navigation bar with tabs: Work Orders, Entities, Monitor, Configuration, General, Layout, and Line Access. The Line Access tab is currently selected. Below the tabs, there is a table titled "User Groups" with three rows. The first row has an empty checkbox and the text "User Groups". The second row has a checked checkbox and the text "FactAdmin". The third row has an empty checkbox and the text "Operators".

2. Select the check boxes for the user groups who require access to the line.
3. Click **Save**.

**Note:** Anytime you change line access settings, press **F5** to refresh the browser so that the proper line tabs are displayed to reflect your changes.

## Advanced Concepts

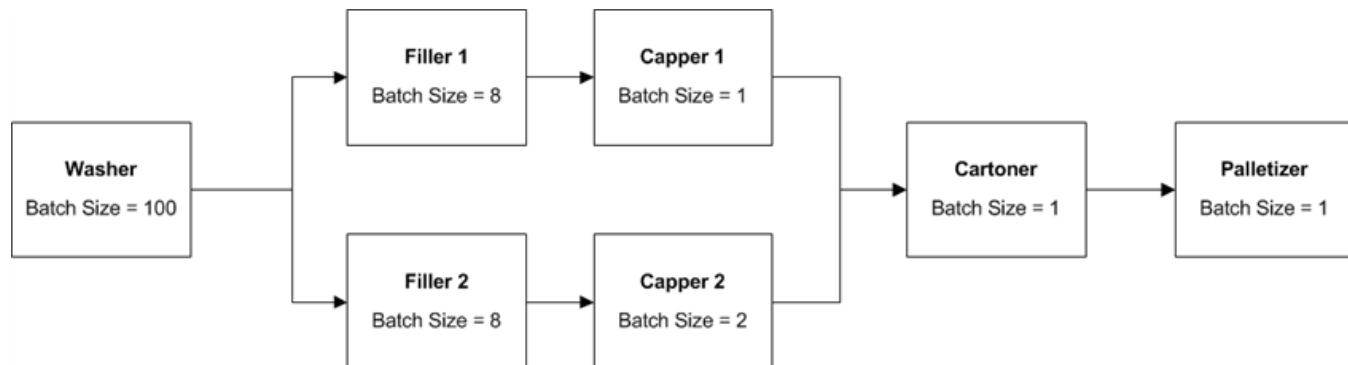
The following topics explain how comparable units for production rates are determined and how OEE calculations for line monitoring are performed.

### Determining Comparable Units and Production Rates: Examples

The examples in this topic show how comparable units are determined for production rate calculations when the entities on the line can produce different items for a work order.

These examples do not apply to work orders created in MES Web Portal. All of the jobs that are running for work orders created in MES Web Portal will produce the same item at each entity.

The line for these examples is set up as follows:



The entities in the line have following default rates and standard items.

Entity	Default Production Rate	Production UOM	Standard Item
Washer	1.2	batches/minute	Bottle of C
Filler 1	15	seconds/batch	Bottle of C
Filler 2	15	seconds/batch	Bottle of C
Capper 1	1.5	seconds/batch	Bottle of C
Capper 2	1.5	seconds/batch	Bottle of C
Cartoner	1.2	seconds/batch	Carton of C
Palletizer	1.1	minutes/batch	Pallet of C

The entity production UOMs are as follows:

Item	Production UOM
Bottle of A	16 oz. bottle
Carton of A	6 pack of 16 oz. bottles

Item	Production UOM
Pallet of A	pallet of 192 16 oz. bottles
Bottle of B	32 oz. bottle
Carton of B	6 pack of 32 oz. bottles
Pallet of B	pallet of 108 32 oz. bottles
Bottle of C	64 oz. bottle
Carton of C	4 pack of 64 oz. bottles
Pallet of C	pallet of 64 64 oz. bottles

UOM conversions are defined in MES Client. The general procedure for creating the UOM conversions for a line is:

1. Create all of the required UOMs.
2. Identify the UOM that will be used for the item that is defined as the standard item for the line.
3. Create conversion factors for each UOM so that all items can be specified in the UOM of the standard item.

For instructions about creating UOMs and defining UOM conversion factors, see the Units of Measure chapter in the *MES Client User Guide* or help.

For the example line, the UOM conversion factors listed in the following table would be used. Note that the conversions shown in italics do not need to be defined for the sake of these examples, but are shown to illustrate how some of the rest of the conversions are obtained.

From UOM	To UOM	Factor
<b><i>16 oz. bottle</i></b>	<b><i>6 pack of 16 oz. bottles</i></b>	<b><i>.16667</i></b>
<i>6 pack of 16 oz. bottles</i>	<i>pallet of 192 16 oz. bottles</i>	<i>.03125</i>
<i>16 oz. bottle</i>	<i>pallet of 192 16 oz. bottles</i>	<i>.00521</i>
<i>pallet of 192 16 oz. bottles</i>	<i>6 pack of 16 oz. bottles</i>	<i>32</i>
<i>pallet of 192 16 oz. bottles</i>	<i>16 oz. bottle</i>	<i>192</i>
<i>6 pack of 16 oz. bottles</i>	<i>16 oz. bottle</i>	<i>6</i>
<i>32 oz. bottle</i>	<i>6 pack of 32 oz. bottles</i>	<i>.16667</i>
<i>6 pack of 32 oz. bottles</i>	<i>pallet of 108 32 oz. bottles</i>	<i>.05556</i>
<i>32 oz. bottle</i>	<i>pallet of 108 32 oz. bottles</i>	<i>.00926</i>
<i>pallet of 108 32 oz. bottles</i>	<i>6 pack of 32 oz. bottles</i>	<i>18</i>

From UOM	To UOM	Factor
pallet of 108 32 oz. bottles	32 oz. bottle	108
6 pack of 32 oz. bottles	32 oz. bottle	6
<i>64 oz. bottle</i>	<i>4 pack of 64 oz. bottles</i>	.25
<i>4 pack of 64 oz. bottles</i>	<i>pallet of 64 64 oz. bottles</i>	.0625
<i>64 oz. bottle</i>	<i>pallet of 64 64 oz. bottles</i>	.01563
<i>pallet of 64 64 oz. bottles</i>	<i>4 pack of 64 oz. bottles</i>	16
pallet of 64 64 oz. bottles	64 oz. bottle	64
4 pack of 64 oz. bottles	64 oz. bottle	4
16 oz. bottle	32 oz. bottle	.5
16 oz. bottle	64 oz. bottle	.25
32 oz. bottle	16 oz. bottle	2
64 oz. bottle	16 oz. bottle	4
32 oz. bottle	64 oz. bottle	.5
64 oz. bottle	32 oz. bottle	2
<i>6 pack of 16 oz. bottles</i>	<i>6 pack of 32 oz. bottles</i>	.5
<i>6 pack of 16 oz. bottles</i>	<i>4 pack of 64 oz. bottles</i>	.375
<i>6 pack of 32 oz. bottles</i>	<i>6 pack of 16 oz. bottles</i>	2
<i>4 pack of 64 oz. bottles</i>	<i>6 pack of 16 oz. bottles</i>	2.6667
<i>6 pack of 32 oz. bottles</i>	<i>4 pack of 64 oz. bottles</i>	.75
<i>4 pack of 64 oz. bottles</i>	<i>6 pack of 32 oz. bottles</i>	1.3333
<i>6 pack of 16 oz. bottles</i>	32 oz. bottle	3
<i>6 pack of 16 oz. bottles</i>	64 oz. bottle	1.5
<i>6 pack of 32 oz. bottles</i>	16 oz. bottle	12
<i>6 pack of 32 oz. bottles</i>	64 oz. bottle	3
<i>4 pack of 64 oz. bottles</i>	16 oz. bottle	16
<i>4 pack of 64 oz. bottles</i>	32 oz. bottle	8

From UOM	To UOM	Factor
pallet of 192 16 oz. bottles	pallet of 108 32 oz. bottles	.88889
pallet of 192 16 oz. bottles	pallet of 64 64 oz. bottles	.75
pallet of 108 32 oz. bottles	pallet of 192 16 oz. bottles	1.125
pallet of 108 32 oz. bottles	pallet of 64 64 oz. bottles	.84375
pallet of 64 64 oz. bottles	pallet of 192 16 oz. bottles	1.3333
pallet of 64 64 oz. bottles	pallet of 108 32 oz. bottles	1.18519
pallet of 192 16 oz. bottles	32 oz. bottle	96
pallet of 192 16 oz. bottles	64 oz. bottle	48
pallet of 108 32 oz. bottles	16 oz. bottle	216
pallet of 108 32 oz. bottles	64 oz. bottle	54
pallet of 64 64 oz. bottles	16 oz. bottle	256
pallet of 64 64 oz. bottles	32 oz. bottle	128

Assume that there is one work order A1 running on the entire line when no entities are disabled, with the following jobs, items, and production rate information.

Entity	Operation	Item Made	Est. Prod. Rate	Prod. UOM	Batch Size
Washer	Washing	Bottle of A	2	batches/minute	100
Filler 1	Filling	Bottle of A	5	seconds/batch	8
Filler 2	Filling	Bottle of A	5	seconds/batch	8
Capper 1	Capping	Bottle of A	0.6	seconds/batch	1
Capper 2	Capping	Bottle of A	0.6	seconds/batch	1
Cartoner	Filling Cartons	Carton of A	1.5	seconds/batch	1
Palletizer	Palletizing	Pallet of A	0.9	minutes/batch	1

If the line's production UOM is batches per minute, where the batch size is 1, but there is no standard item for the line so that the item made in the job running on the first entity is used, the rates at each entity will be as follows:

Entity	Production Rate in Bottles of A per Minute
Washer	200
Filler 1	96
Filler 2	96
Capper 1	100
Capper 2	100
Cartoner	240
Palletizer	213

Since the sum of the fillers at the second position is 192, and the sum of the two cappers at the third position is 200, the slowest position on the line is the second. Thus, assuming all entities can be part of the bottleneck, the line's bottleneck comprises the two fillers, and the line's performance rate is 192 bottles of A per minute.

As work order A1 progresses, a point will be reached where its first jobs are done. If the jobs for work order A1 are completed on the washer, both fillers, and capper 1, and there is no other work order's jobs started yet on any of these entities, the rates at these entities will be set to their default values. Since no job is running at the first entity and the default item produced by it is bottles of C, all the rates will be expressed in terms of bottles of C.

Entity	Production Rate in Bottles of C per Minute
Washer	120 (from default for the washer)
Filler 1	32 (from default for Filler 1)
Filler 2	32 (from default for Filler 2)
Capper 1	40 (from default for Capper 1)
Capper 2	25 (from work order A1)
Cartoner	60 (from work order A1)
Palletizer	53.25 (from work order A1)

Since the sum of the fillers at the second position is 64, and the sum of the two cappers at the third position is 65, the slowest position on the line is the fifth. Thus, assuming all entities can be part of the bottleneck, the line's bottleneck is the palletizer, and the line's performance rate is 53.25 bottles of C per minute.

Continuing the example, as work order A1 progressed, another work order, B1, is assigned to the line and is started. If the jobs for work order A1 reach the same point as above (that is, completed on the washer, both fillers, and capper 1), and the jobs for work order B1 are as follows:

Entity	Operation	Item Made	Est. Prod. Rate	Prod. UOM	Batch Size
Washer	Washing	Bottle of B	1.5	batches/minute	100
Filler 1	Filling	Bottle of B	8	seconds/batch	8
Filler 2	Filling	Bottle of B	8	seconds/batch	8
Capper 1	Capping	Bottle of B	1.2	seconds/batch	1
Capper 2	Capping	Bottle of B	1.2	seconds/batch	1
Cartoner	Filling Cartons	Carton of B	1.6	seconds/batch	1
Palletizer	Palletizing	Pallet of B	0.8	minutes/batch	1

Then once the jobs for the washer and filler 1 are started, the operations for filler2 and capper1 from work order B1 will be used to determine the rates at those entities even though they are not yet running, because of the jobs being run at the upstream entities (the washer and filler1 respectively). So since the item produced by the first entity is now bottles of B, all the rates will be expressed in terms of bottles of B.

Entity	Production Rate in Bottles of B per Minute
Washer	150 (from work order B1)
Filler 1	60 (from work order B1)
Filler 2	60 (inferred from work order B1)
Capper 1	50 (inferred from work order B1)
Capper 2	50 (from work order A1)
Cartoner	120 (from work order A1)
Palletizer	106.5 (from work order A1)

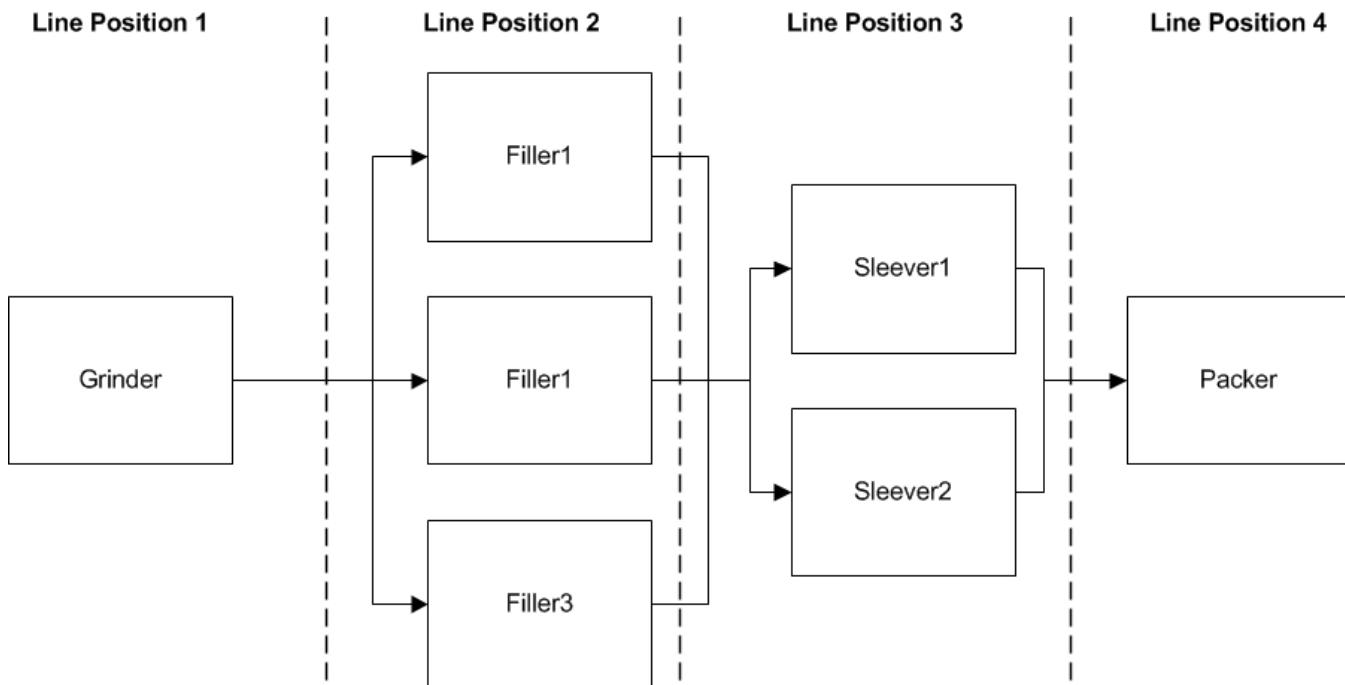
Since the sum of the fillers at the second position is 120, and the sum of the two cappers at the third position is 100, the slowest position on the line is the third. Thus assuming all entities can be part of the bottleneck, the line's bottleneck comprises the two cappers, and the line's performance rate is 100 bottles of B per minute.

## Line Monitoring and OEE Calculations

This example demonstrates how the OEE calculations for line monitoring are performed.

### Line Structure

The entities in the example line are shown in the following diagram.



### Entity Properties

In the example line, the production entity is the Packer.

The values for the production-related properties are listed in the following table.

Entity	Default Production Rate	Production UOM	Batch Size
Grinder	3.5	batches/sec	1
Filler1	1.1	batches/sec	1
Filler2	1.1	batches/sec	1
Filler3	1.1	batches/sec	1
Sleever1	2	batches/sec	1
Sleever2	2	batches/sec	1
Packer	3	batches/sec	1

In this example, the UOMs of the default items configured for the entities in this line are exactly the same as the UOM of the standard item configured for the line. Therefore, no conversion factors are used in the examples to convert the units.

### OEE Use and Bottlenecks

The following time chart shows the OEE Use durations for the utilization events that are pertinent to the OEE calculations. It also shows which entities were bottlenecks and for what time periods (for example, the Packer

was the bottleneck entity from 6 to 7 am).



Note the following about the chart:

- Bottleneck time periods that are pertinent to OEE calculations are shown in dark gray with the label "Bottleneck."
- Bottleneck time periods that are not pertinent to OEE calculations are shown in lighter gray with the label "BN-Not in OEE." For example, Filler1 was considered as a bottleneck entity from 7 to 8 am. However, it had an OEE Use designation of Neither (that is, not in Runtime or Downtime), so it was not included in OEE calculations during this time period.
- Filler3 is not considered as a bottleneck entity when the other two Filler entities are because it is configured to not be enabled during Downtime. The same is true for Sleever2.

## Production Data

The following table shows the Good and Rejected production for each entity, by the hour.

Entity	Type	Production					
		6-7 am	7-8 am	8-9 am	9-10 am	10-11 am	11-12 pm
Grinder	Good	11,500	4,100	4,100	10,500	8,000	7,100
	Reject	0	25	50	0	100	0
Filler1	Good	3,750	0	3,960	3,950	0	2,400
	Reject	0	0	40	0	0	0
Filler2	Good	3,750	3,980	0	3,750	3,900	2,400
	Reject	0	20	0	0	60	0
Filler3	Good	3,700	0	0	3,200	3,900	2,400
	Reject	0	0	0	0	60	0

Entity	Production Type	Production					
		6-7 am	7-8 am	8-9 am	9-10 am	10-11 am	11-12 pm
Sleever1	Good	5,500	1,920	2,000	5,450	7,200	7,200
	Reject	0	40	20	0	40	0
Sleever2	Good	5,500	1,920	2,000	5,450	0	0
	Reject	0	40	20	0	0	0
Packer	Good	10,800	4,000	3,900	10,800	7,350	7,200
	Reject	0	10	50	0	20	0

**OEE Calculations**

The OEE metrics for the time period from 6 am to 12 pm are calculated as follows.

Line Availability	
Line Availability	= Bottleneck Entities Runtime / (Bottleneck Entities Runtime + Bottleneck Entities Downtime)
	= ((Packer Runtime 6 am–7 am) + (Filler1 Runtime 7 am–9 am) + (Filler2 Runtime 7 am–9 am) + (Packer Runtime 9 am–10 am) + (Sleever1 Runtime 10 am–12 pm)) / ((Runtime Total + (Filler2 Downtime 8 am–9 am)))
	= (3,600 + 3,600 + 3,600 + 3,600 + 5,400) / (19,800 + 3,600)
	= 19,800 / 23,400
	= 0.84615 (84.62%)

Quality	
Quality	= Packer Good Production / ( Packer Good Production + Rejected Production at All Entities)
	= 44,050 / (44,050 + 595)
	= 0.98667 (98.67%)

<b>Performance</b>	
Performance	=  Actual Production Count / Expected Production Count for Bottleneck Entities
	=  Actual Production Count / ((Packer Expected Production 6 am–7 am) + (Filler1 Expected Production 7 am–9 am) + (Filler2 Expected Production 7 am–9 am) + (Packer Expected Production 9 am–10 am) + (Sleever1 Expected Production 10 am–12 pm))

Calculating the expected production count for each entity when it was a bottleneck entity by using the following equation:

Entity Expected Performance	=	Entity Production Rate x Runtime Duration (in seconds) x Entity Default Batch Size
-----------------------------	---	--

Yields the following:

Performance	=  44,645 / ((3 x 3,600 x 1) + (1.1 x 3,600 x 1) + (1.1 x 3,600 x 1) + (3 x 3,600 x 1) + (2 x 5,400 x 1))
	=  44,645 / 40,320
	=  1.10727 (110.73%)

<b>OEE</b>		
OEE	=	Availability x Quality x Performance
	=	0.84615 x 0.98667 x 1.1073
	=	0.9244 (92.44%)

## MES Web Portal URLs

The following topics provide a reference for the MES Web Portal URLs and information about using some MES Web Portal controls as embedded controls in other web applications.

## Page URLs

The URLs for the MES Web Portal pages are listed below. If the MES Web Portal port number is the default HTTPS port number 443, you do not need to include it in the URL.

### **Home**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/](https://<web_portal_server>:<HTTPSSportnumber>/mes/)

### **Entities**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#/entities/](https://<web_portal_server>:<HTTPSSportnumber>/mes/#/entities/)

### **Entity**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#entity/<entID>/](https://<web_portal_server>:<HTTPSSportnumber>/mes/#entity/<entID>/)

#### **Entity > Utilization Events tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#entity/<entID>/utilization](https://<web_portal_server>:<HTTPSSportnumber>/mes/#entity/<entID>/utilization)

#### **Entity > Work Queue tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#entity/<entID>/workQueue](https://<web_portal_server>:<HTTPSSportnumber>/mes/#entity/<entID>/workQueue)

#### **Entity > Monitor tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#entity/<entID>/monitor](https://<web_portal_server>:<HTTPSSportnumber>/mes/#entity/<entID>/monitor)

#### **Entity > Configuration tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#entity/<entID>/configuration](https://<web_portal_server>:<HTTPSSportnumber>/mes/#entity/<entID>/configuration)

### **Lines**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#lines/](https://<web_portal_server>:<HTTPSSportnumber>/mes/#lines/)

### **Line**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#line/<lineID>/](https://<web_portal_server>:<HTTPSSportnumber>/mes/#line/<lineID>/)

#### **Line > Work Order tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#line/<lineID>/workOrders](https://<web_portal_server>:<HTTPSSportnumber>/mes/#line/<lineID>/workOrders)

#### **Line > Entities tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#line/<lineID>/entities](https://<web_portal_server>:<HTTPSSportnumber>/mes/#line/<lineID>/entities)

#### **Line > Monitor tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#line/<lineID>/monitor](https://<web_portal_server>:<HTTPSSportnumber>/mes/#line/<lineID>/monitor)

#### **Line > Configuration tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#line/<lineID>/configuration](https://<web_portal_server>:<HTTPSSportnumber>/mes/#line/<lineID>/configuration)

### **Utilization**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#/utilization/](https://<web_portal_server>:<HTTPSSportnumber>/mes/#/utilization/)

#### **Utilization > Reasons & Groups tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#utilization/reasonsGroups](https://<web_portal_server>:<HTTPSSportnumber>/mes/#utilization/reasonsGroups)

#### **Utilization > States tab**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#utilization/states](https://<web_portal_server>:<HTTPSSportnumber>/mes/#utilization/states)

### **Work Orders**

[https://<web\\_portal\\_server>:<HTTPSSportnumber>/mes/#/workOrders/](https://<web_portal_server>:<HTTPSSportnumber>/mes/#/workOrders/)

### **Work Order**

[https://<web\\_portal\\_server>:<HTTPSportnumber>/mes/#workOrder?wo\\_id=<woID>](https://<web_portal_server>:<HTTPSportnumber>/mes/#workOrder?wo_id=<woID>)

#### Work Order > Job

[https://<web\\_portal\\_server>:<HTTPSportnumber>/mes/#job?wo\\_id=<woID>&op\\_id=<opID>&seq\\_no=<seqNo>](https://<web_portal_server>:<HTTPSportnumber>/mes/#job?wo_id=<woID>&op_id=<opID>&seq_no=<seqNo>)

The parameters to pass are represented by:

**<web\_portal\_server>**

The fully qualified domain name of the server on which MES Web Portal is running.

**<entID>**

The ID number of the entity whose page or tab is being displayed.

**<lineID>**

The ID number of the line whose page or tab is being displayed.

**<woID>**

The ID number of the work order whose page is being displayed.

**<woID>, <opID>, <seqNo>**

The work order ID, operation ID, and sequence number of the job whose page is being displayed.

## Displaying Pages Without Surrounding Page Layout Elements

If needed, the MES Web Portal pages can be displayed without the surrounding web page layout elements.

To remove the layout elements, in the page URL include **noChrome.cshtml** immediately preceding the page identifier. For example:

<https://MES.yourmesorg.com/mes/noChrome.cshtml#entities/>

The resulting Entities page is presented as shown below.

The screenshot shows a list of entities in a grid format. The top bar has a '+' icon and 'Add Entity' text. The left side has a 'Entities' label and a search/filter input field. The main area displays a grid of 20 records. Each row contains three entities: Bagger, Bagger\_001, Bagger\_002; Boxer\_001, Boxer01, Boxer02; Coater, Production, ProductionStorage; and Receiving, Roaster, Roaster\_001. A vertical scroll bar is visible on the right side of the grid. At the bottom, it says '20 Records Found'.

Bagger	Bagger_001	Bagger_002
Boxer_001	Boxer01	Boxer02
Coater	Production	ProductionStorage
Receiving	Roaster	Roaster_001

## Embedded Controls URLs

Certain MES Web Portal controls can be embedded in another web application without the surrounding web

page layout elements. These controls and their URLs are listed below. If the MES Web Portal port number is the default HTTPS port number 443, you do not need to include it in the URL.

#### **Entity Monitor**

`https://<web_portal_server>:<HTTPSportnumber>/mes/noChrome.cshtml#common/entity/monitor/monitor?entID=<entID>`

#### **Entity Utilization**

`https://<web_portal_server>:<HTTPSportnumber>/mes/noChrome.cshtml#common/entity/utilization/utilization?entID=<entID>`

#### **Entity Work Queue**

`https://<web_portal_server>:<HTTPSportnumber>/mes/noChrome.cshtml#common/entity/workQueue/workQueueHost?entID=<entID>`

#### **Line Layout**

`https://<web_portal_server>:<HTTPSportnumber>/mes/noChrome.cshtml#common/line/configuration/layout/editor?lineID=<lineID>`

#### **Line Monitor**

`https://<web_portal_server>:<HTTPSportnumber>/mes/noChrome.cshtml#common/line/monitor/monitor?lineID=<lineID>`

The parameters to pass are represented by:

**<entID>**

The ID number of the entity to associate to the control.

**<lineID>**

The ID number of the line to associate to the control.

### **Prerequisites for Using Embedded Controls**

- Custom HTML pages that include an embedded control must be hosted in the same IIS environment as MES Web Portal. Otherwise, the page will not be trusted by AVEVA Identity Manager and the control will not be accessible.
- Users of the embedded controls must perform a secure login using the Identity Manager login to be allowed access to the controls.

### **Using Embedded Controls with Work Tasks**

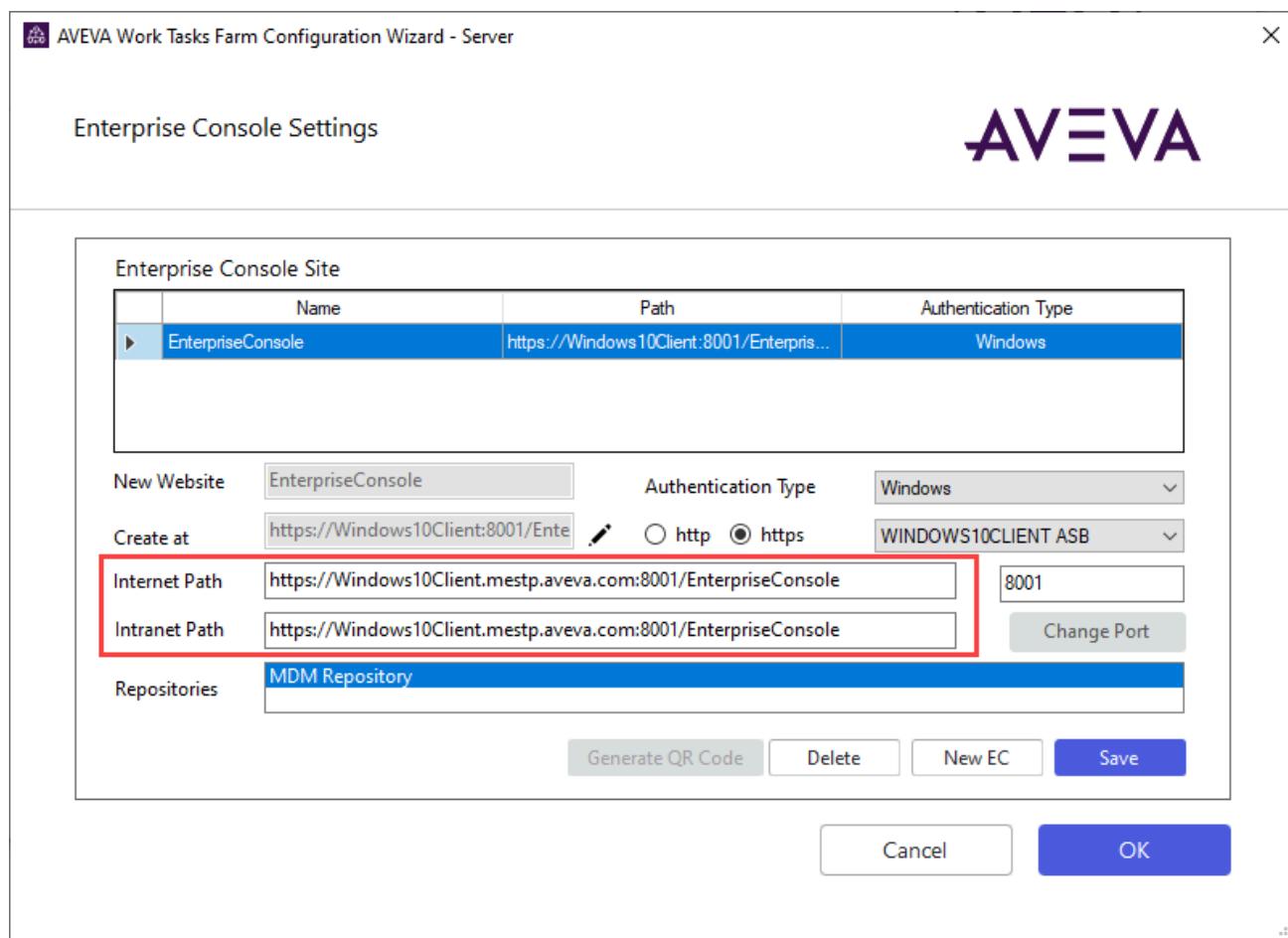
To allow an embedded control to be used in Work Tasks, fully qualified host names must be included in URLs for several areas.

### **Enterprise Console URLs in Farm Configuration Wizard**

In the farm configuration, the Enterprise Console URL must include the fully qualified domain name of the host node for Enterprise Console.

1. In the Farm Configuration Wizard, on the first page click **Next**.
2. On the **Edit Workflow Management Farm Settings** page, select **Service Settings** and click **Next**.

3. On the **Services/Global Settings** page, click the **Enterprise Console** option's Edit icon.
4. For the **Internet Path** and **Intranet Path** properties, make sure that the fully qualified domain name of the host node for Enterprise Console is used in the URL.



## Token Service Properties in Central Configuration

The URL for the **Token Service** property in Central Configuration must include the fully qualified domain name of the local host on which the AVEVA Identity Manager is running. Also, the token service user credentials must be for a user account that has access to Identity Manager.

1. Open the Central Configuration application.  
The default URL that is entered in the browser might not include the fully qualified domain name for the local host.
2. In the URL, if it's not already included, add the fully qualified domain name to the URL and press **Enter**.
3. On the main page, click **Token Service Settings**.  
The **Token Service** page appears.
4. In **Token Service URL**, make sure that the URL specifies **https://** and includes the fully qualified name of the host on which the Identity Manager is running.
5. In **User Credentials**, make sure that the username and password are for a user account that has access to Identity Manager.

Alias Name	Token Service URL
MDMToken	https://windows10client.mestp.aveva.com/identitymanager

Configure  Server Name: Windows10Client Certificate:  Password:

Token Service URL \*:  Alias Name \*:

User Credentials

Registrar User \*:  Password \*:

## Enterprise Console

The URL used to log into Enterprise Console must include the fully qualified domain name of the host on which Enterprise Console is running (e.g., <http://MESWM.mymesorg.com:8000/enterpriseconsole>).

## URL for an Embedded Control in a Form

When embedding one of the controls in a form, the control's **URL** property entry on the control's **Basic** properties tab must specify **https://** and use the fully qualified domain name of the node on which the MES Web Portal host is running (e.g., <https://MESWM.mymesorg.com/mes/<page path>>). If the MES Web Portal port number is not the default 443, it must also be included in the URL.

Also, beginning with Work Tasks 2020 U1, the MES Web Portal URL must be specified as a safe site in the Enterprise Console **web.config** file (**Work Tasks\Web\EnterpriseConsole\web.config**).

### To add the MES Web Portal URL as a safe site

1. Modify the following entry to include the MES Web Portal URL entry, shown in bold (replace "fully\_qualified\_hostname" with the host's actual fully qualified domain name):

```
<add name="Content-Security-Policy" value="default-src 'self' 'unsafe-inline' 'unsafe-eval'
ws: wss: https://fully_qualified_hostname/MES; font-src 'self' data:
https://fonts.gstatic.com;
img-src 'self' data%;" />
```

2. From IIS Manager, restart AVEVAWorkTasksSites.
3. Restart all AVEVA Work Tasks services.

## Operate

As Manufacturing Execution System (MES) operator, you are responsible for using MES to execute plant processes.

### MES Operator

Use the MES Operator application to enter data using steps, specifications, and Data Logger, claim quantities produced, and report consumption, and capture machine utilization and labor data.

#### Getting Started

Manufacturing Execution System (MES) Operator is the application that is typically used on the shop floor. It is the production employee's interface to the MES system. Operator is used to execute a process. Production employees use Operator to claim quantities produced and report consumption. They also use the application to enter data into the system using steps, specifications, and Data Logger. Operator is used to capture machine utilization and labor data. Operator supports a number of login scenarios, including multiple users logged in to one or multiple machines and a single user logged into multiple machines.

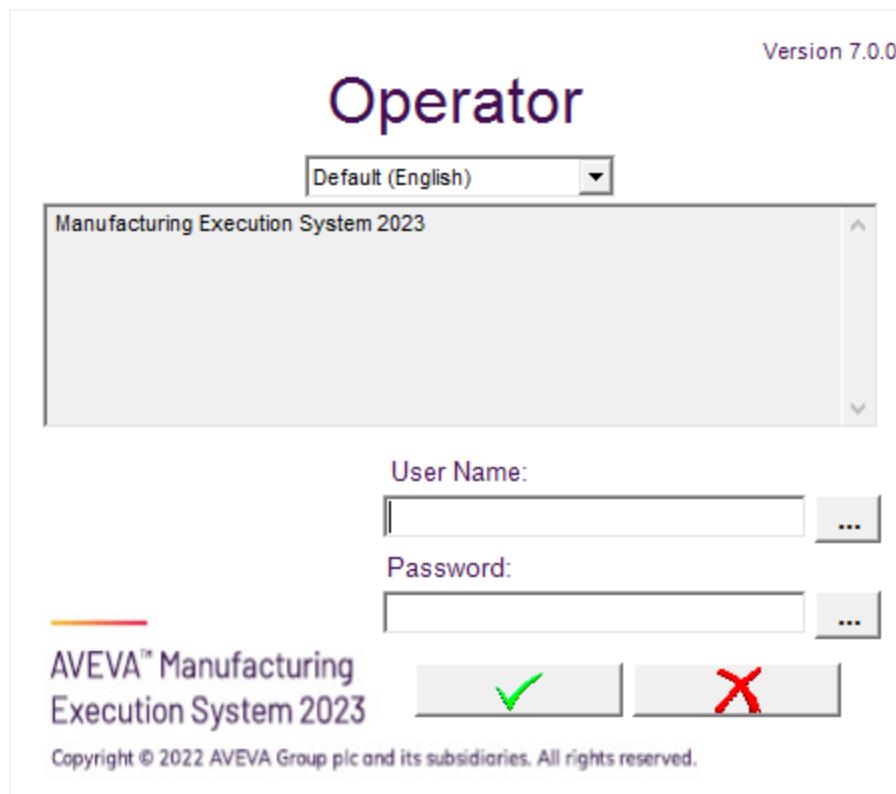
The system can be set up to require a significant amount of interaction between the production employees and the application or minimal interaction. Many of the production employee transactions with Operator can be automated by directly linking MES with shop floor PLCs.

#### Starting and Logging onto Operator

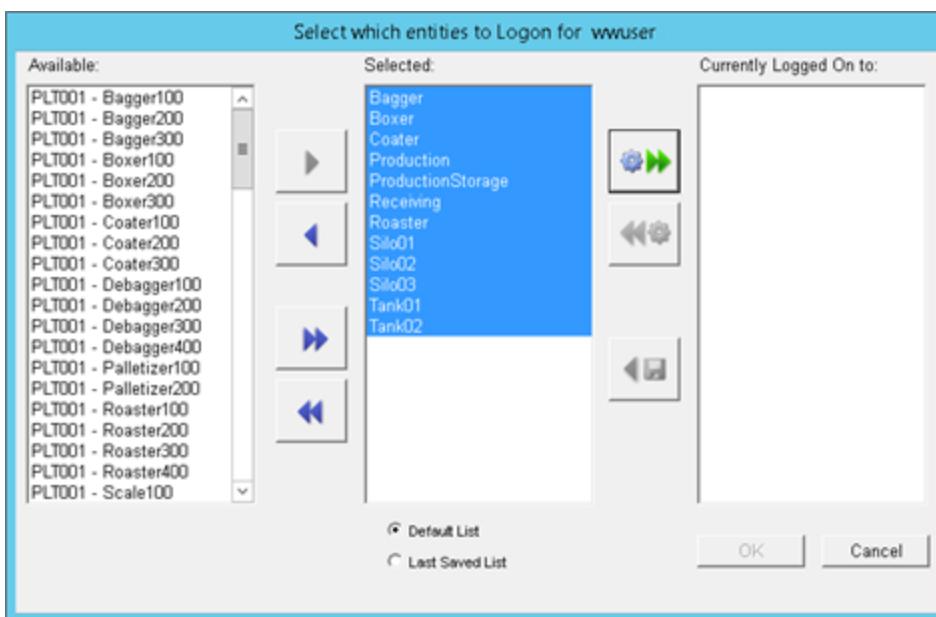
Logging on to MES Operator is a two-step process: first you log onto MES Operator, then you log onto the entities for which you will be viewing or entering data.

1. On the **Start** menu, click the **MES Operator** tile.

The MES Operator logon window appears.



2. In the **Language** list, click the language in which you want the login dialog box to appear.  
You can select only those languages that are configured in the MES Client application. If you restart the application, the language setting resets to the default language, which is specified by the Display system parameter *Default Language* in MES Client.
3. Enter your user name and password and click the green check mark button.  
If you are not using a physical keyboard, click the Browse (...) button next to the **User Name** and **Password** boxes to display the on-screen keyboard (see [On-Screen Keyboard](#)).  
If the *Password* general system parameter in MES Client is set to **Unique**, only the password field will be visible.  
Unless your user account has been set up for a job-based logon, after logging onto Operator, the Entity Logon dialog box appears. The entities that you have permission to work with are listed in the **Available** box.



If your user account has been set up for a job-based login, see [Job-Based Logon](#).

- To select the entities with which you want to work during this logon session, do one of the following:

- Select the entities in the **Available** box and then click the single right arrow button to move them to the **Selected** box.
- To include all of the entities from the **Available** box in the **Selected** box, click the double right arrow button.

You can also move entities from the **Selected** box back to the **Available** box using the single right arrow button or double right arrow button.

- When you have finished entering the entities to log on to in the **Selected** box, click the Entity Logon button.

You are logged in to the entities that were in the **Selected** list. The entities in the **Selected** list are moved to the **Currently Logged On to** list.

If you decide you have logged on to the entities in error and want to log off of them, click the Entity Logout.

- Click **OK** to close the Entity Login dialog box.

The first entity in the **Currently Logged On to** list is opened in Operator.

### Saving and Loading a Saved Logon Entity List

You can save the currently logged-on list of entities as your default list of logon entities.

You can also save another logged-on list of entities. Then, the next time you log on to Operator, you can:

- Log on to your default list of entities.
- Log on to your saved list of entities.

- Select a unique list of entities to log on to, by moving them from the **Available** box to the **Selected** box.

#### To save the list of entities in the Currently Logged On to box as your default list

1. Below the **Selected** box, select the **Default List** option
2. Click the  Save Entity List button.

#### To save the list of entities in the Currently Logged On to box as a saved list

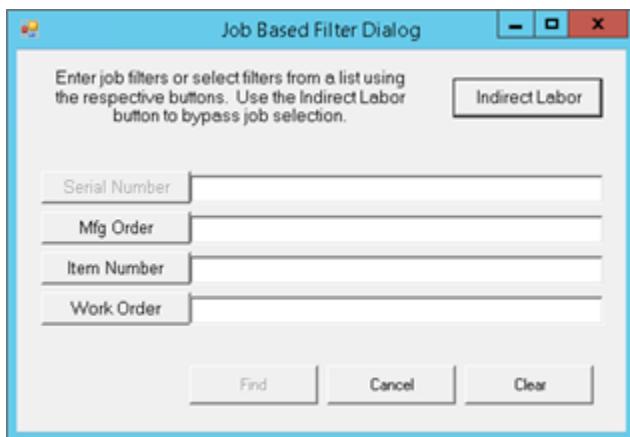
1. Below the **Selected** box, select the **Last Saved List** option.
2. Click the  Save Entity List button.

#### To select the default list or the saved list of entities to log on to

1. Below the **Selected** box, click either the **Default List** or **Last Saved List** option.
2. The default or saved list appears in the **Selected** box.

### Job-Based Logon

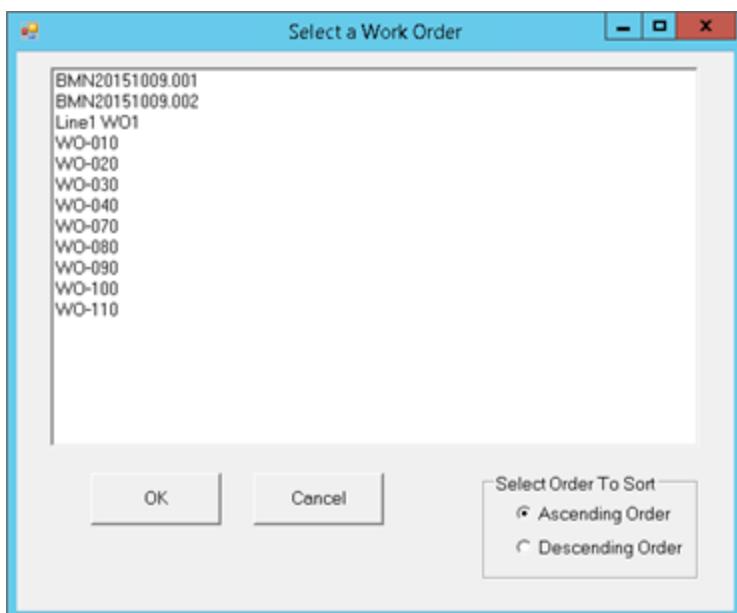
MES user accounts can be set up in MES Client to use a job-based logon. If this is the case with your user account, then the **Job Based Filter** dialog box appears after logging on at the MES Operator logon screen instead of the Entity Logon dialog box.



For a job-based logon, you are logged on to only the entity that is associated with the job. So you will not be able to work with any other entity during the current session.

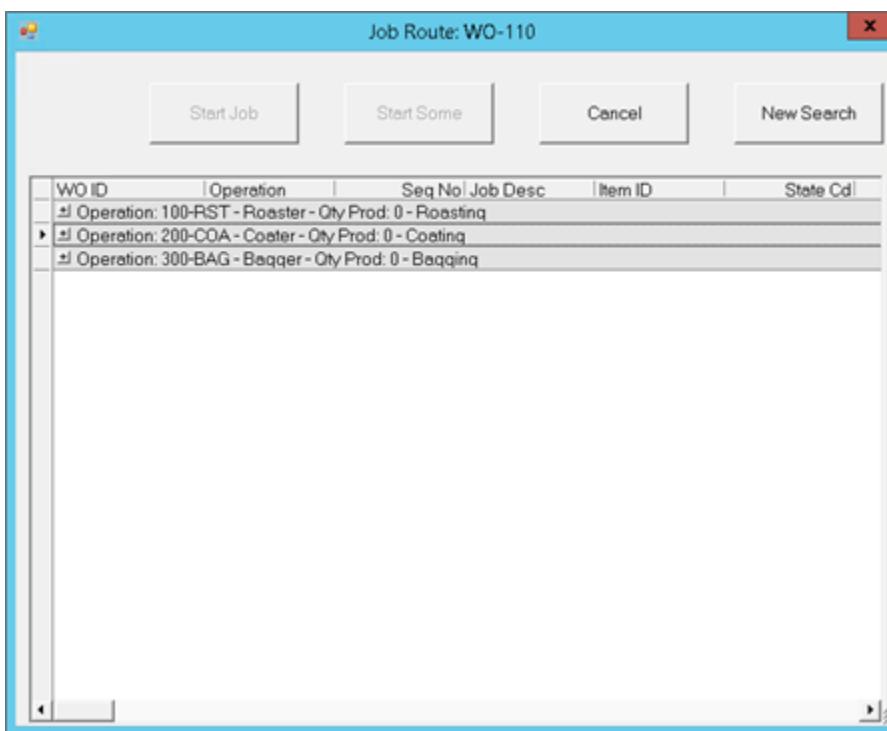
#### To perform a job-based logon

1. On the **Job Based Filter** dialog box, do one of the following:
  - Enter a valid work order ID in the work order box, then click the **Find** button.  
The **Job Route** window appears.
  - Optionally enter filter criteria in the serial (lot) number, manufacturing order ID, item number, or work order boxes (use the buttons to select entries from lists), then click the **Work Order** button.  
The **Select a Work Order** window appears, listing the work orders that match any entered filter criteria.



2. Select a work order, then click **OK**.

The **Job Route** window appears.



The buttons that appear on the **Job Route** window depend on the setting of the *Auto start jobs when using job based login* Operator system parameter (in MES Client):

- If set to Yes, a **Log On** button is shown.
  - If set to No, **Start Job** and **Start Some** buttons are shown.
3. Select the job for the entity that you want to log on to.
  4. Do one of the following:
    - If the **Log On** button is shown, click it.

You are logged onto the entity that is associated with the job. The job is started automatically if it is not already running. If the job has been queued to a group, you will be prompted to select from a list of entities on which to start or continue the job.

- If the **Start Job** and **Start Some** buttons are shown, see one of the two procedures below, depending on whether you want to set required and start quantities before logging on to the entity.

### To immediately log on to the entity that is associated with the selected job

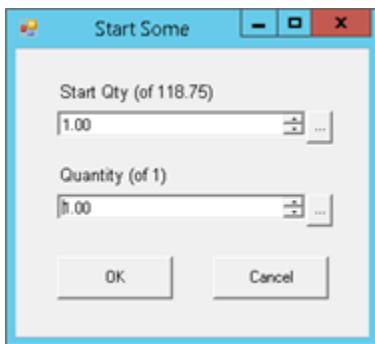
- Click **Start Job**.

You are logged on to the entity associated with the job. If the selected job has been queued to a group, you will be prompted to select from a list of entities on which to start or continue the job.

### To set required and start quantities for the job instead of using the default quantities before logging on to the entity

1. Click **Start Some**.

The **Start Some** dialog box appears.



2. In the **Start Qty** box, enter a start quantity for the job.
3. In the **Quantity** box, enter the required quantity for the job.

The **Quantity** value cannot be greater than the **Start Qty** value.

4. Click **OK**.

You are logged on to the entity associated with the job. If the selected job has been queued to a group, you will be prompted to select from a list of entities on which to start or continue the job.

## Bypassing the Job-Based Logon

You can bypass the job-based logon by clicking the **Indirect Labor** button on the **Job Based Filter** dialog box. You will then be able to select the entities to log on to as described in [Starting and Logging onto Operator](#).

## Multiple Users and Operator

Often, the machine on which Operator is running is located on the shop floor and shared by multiple users. The Switch User function allows multiple users to be logged into Operator at a time and in a controlled way.



You initiate the Switch User function by clicking the  Switch User button, which is available on most of the Operator tabs. This opens the User Functions dialog box, which is shown in the following figure. The legend

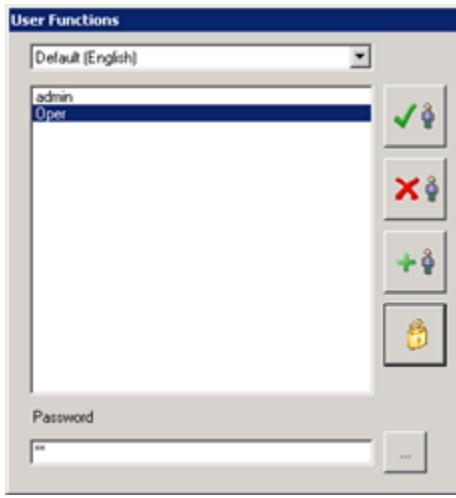
below the figure describes the button functions.



1. Log the selected user in
2. Log the selected user out
3. Log in a user not currently logged in
4. Change the selected user's password

#### Logging in During Another User's Session

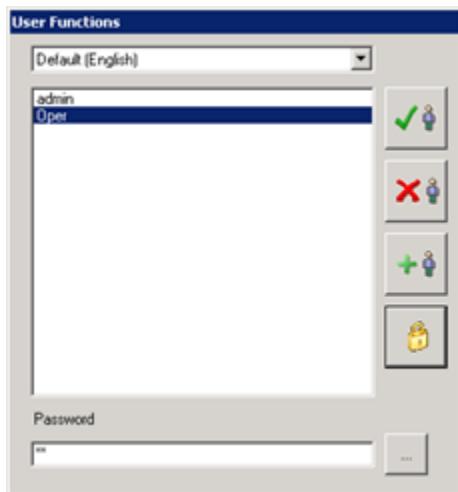
1. On a tab that includes the **Switch User** button in its toolbar, click the  Switch User button. The User Functions dialog box appears.



2. Click the  **Add a New User** button. The Operator Login screen displays.
  3. Enter your login name and password to begin your Operator session.
- Your user name will be included in the logged-on user list of the User Functions dialog box the next time it is displayed.

## Changing Your Language and Password

With the User Functions dialog box displayed, you can change the language displayed in your session of Operator and change your password.



### To change the displayed language

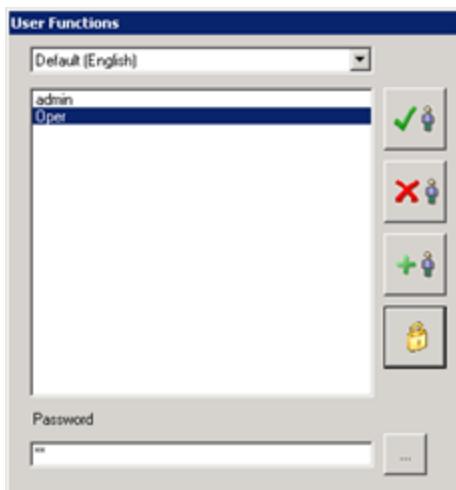
1. Select your login name.
2. Select the language in the language list at the top of the dialog box.
3. Click the **Login** button to log in to your session.

### To change your password

1. Select your login name.
2. Click the **Change Password** button. The Change Password dialog box appears.
3. Enter your old and new password, then click **OK**.
4. Click the **Login** button to log in to your session.

## Switching Users

1. On a tab that includes the **Switch User** button in its toolbar, click the **Switch User** button. The User Functions dialog box appears.

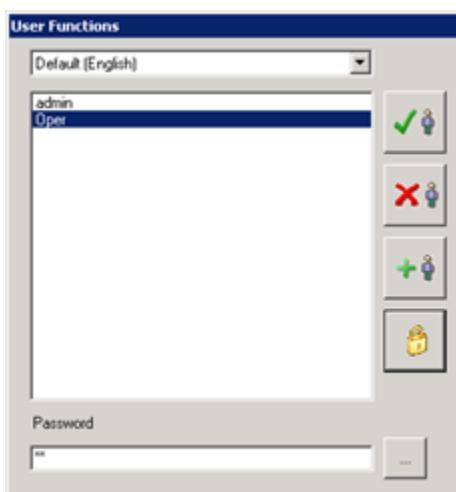


2. Select your login name.
3. Enter your password.
4. Click the **Login** button to log in to your session.

## Logging Out

### To log out of Operator using the Switch User feature

1. On a tab that includes the **Switch User** button in its toolbar, click the **Switch User** button.  
The User Functions dialog box appears.
2. Select your login name and enter your password.  
The **Logout** button becomes available.



3. Click the **Logout** button.  
You are prompted to confirm that you want to log off.
4. Click the **Yes** button to log off.

The User Functions dialog box remains displayed to allow another user to log on.

### To log out of Operator using the application Close button

1. At the upper right corner of the Operator window, click the **Close** button.

If you are the only user logged on to Operator, the application closes.

If other users are logged on to Operator, the Multiple Users Logged In dialog box appears.



2. To log off but allow the other users to log back on, click **Log Off**.

The User Functions dialog box appears.

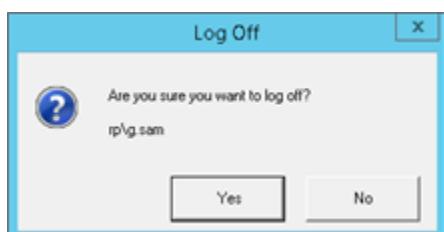
## Exiting Operator

You can exit from Operator if you have exit privileges.

### To exit Operator when you are the only user logged on

1. At the upper right corner of the Operator window, click the **Close** button.

You are prompted to confirm your log off and closing of the application.



2. Click **Yes**.

The Operator window closes.

### To exit Operator when more than one user is logged on

1. At the upper right corner of the Operator window, click the **Close** button.

The Multiple Users Logged In dialog box appears.

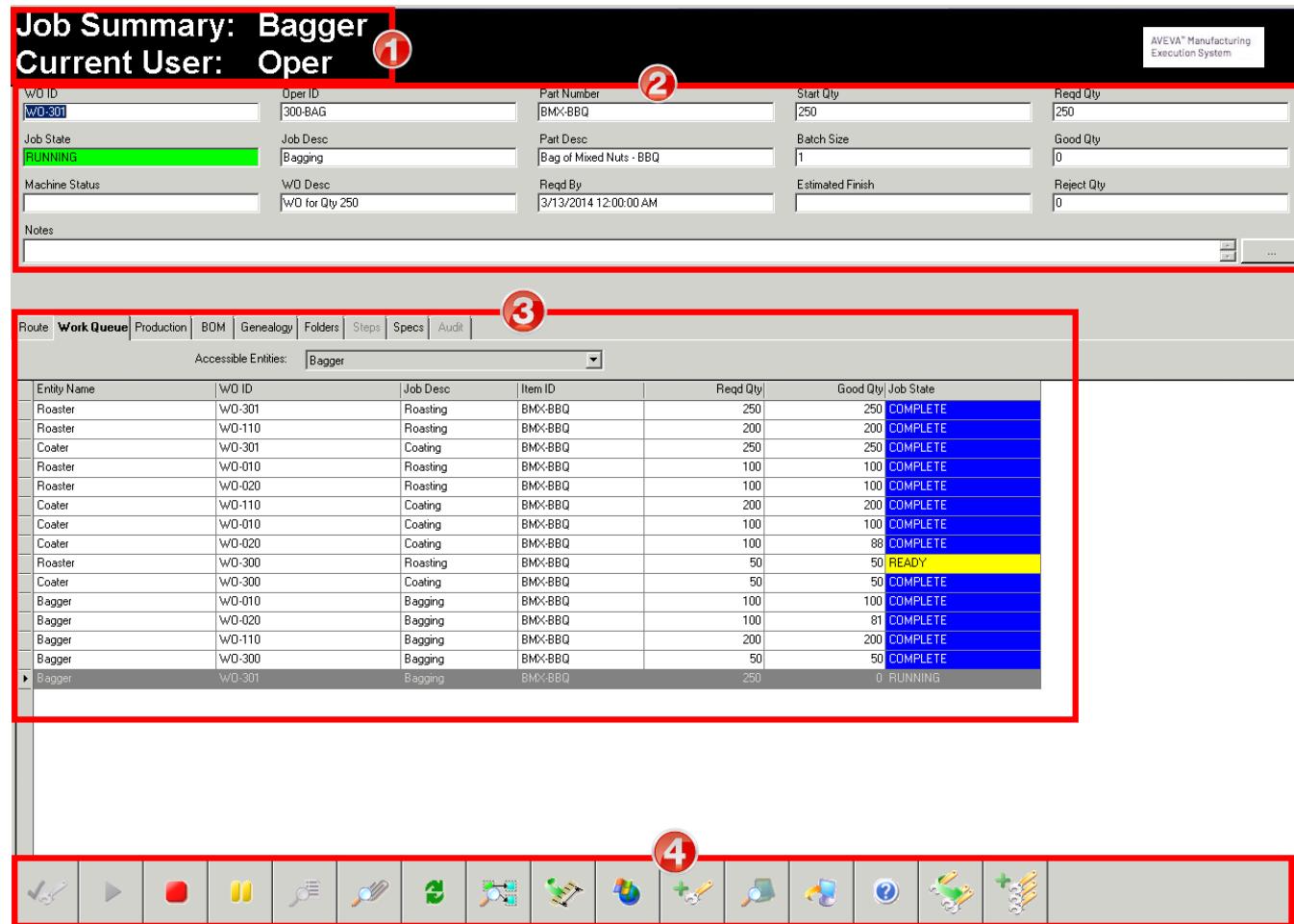


2. Click **Exit**.

All user sessions are closed and the Operator window closes. Any currently running jobs are paused.

## Operator Window

The Operator window provides access to each entity that you have logged in to, one entity at a time. The main areas of the window are called out in the following figure and described below.

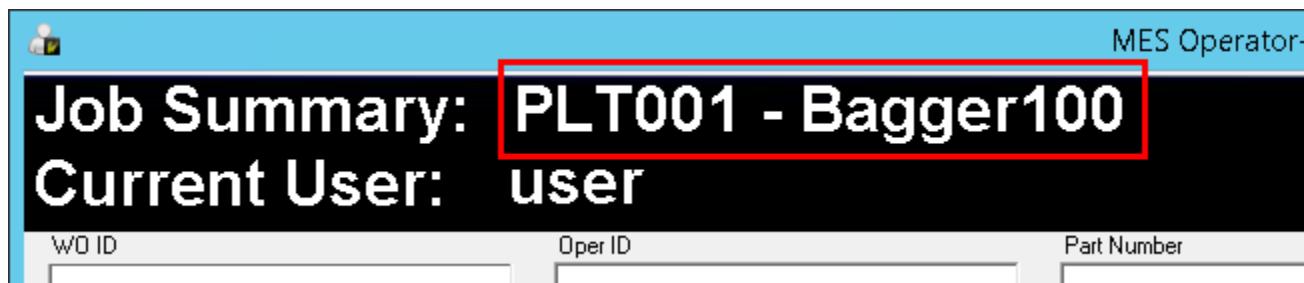


1. The **title bar** displays the name of the entity currently selected for work. This bar also allows you to switch to and work with other entities.
  2. The **job summary area** displays basic information for the jobs currently running on that entity. It also determines which job is active, so that its data can be displayed and worked with in the tab area.
  3. The **tab area** provides access to the detailed information and tasks for the active entity and its running jobs, grouped by functional tabs. Most tabs provide access to the detailed information and tasks for one currently running job only (the active job). These tabs will be unavailable if no job is running on the entity. Multiple running jobs must be accessed individually.
  4. The **button toolbar** includes buttons for performing tasks that are available with the currently displayed tab.

## Title Bar

The title bar shows the name of the logged-on entity with which you are currently working. This entity is the

active entity. The information displayed and tasks performed are relevant to this entity only.



### Entering a Final Reason for a Raw Utilization Reason

The title bar will flash to indicate that a raw machine utilization reason has come from a Utilization Capability Object (UCO) and that you need to enter a final reason.

To enter a final reason, go to the **Util/OEE** tab (see [Util/OEE Tab](#)).

The title bar will continue to flash until reasons have been entered for all reason pending utilization log entries.

### Changing the Active Entity

1. In the title bar, click the entity name.

The Please select an entity dialog box appears.



2. Select an entity to make it the active entity.
3. Click the Switch Entity button to switch to the selected entity.

### Job Summary Area

The job summary area summarizes the data for the jobs that are currently running on the active entity. When multiple jobs are running at the same time, it determines which job is active so that that job's data can be displayed and worked with in the tab area. The summary fields are automatically refreshed when job conditions change. Unwanted fields in the job summary area can be hidden, to customize your display.

For an entity capable of running only one job at a time, the data fields are spaced evenly throughout the summary area. If a job is currently running, that is the active job.

For an entity that is capable of running multiple jobs simultaneously, each job's data is displayed in one summary line in a scrollable pane.

#### To select one currently running job to be the active job

- Click its summary line.

The data that is displayed in the job summary area is described below.

**WO ID**

The ID of the work order to which this job belongs.

**Oper ID**

The ID of the operation (a portion of the work order) to be completed by this job.

**Part Number**

The ID of the item produced by this job.

**Start Qty**

The quantity of material available at the start of this job.

**Reqd Qty**

The quantity of produced items needed from this job.

**Job State**

The status of this job (New, Running, Completed, etc.).

**Job Desc**

The description of this job/operation.

**Part Desc**

The description of the item produced by this job.

**Batch Size**

The number of units that is considered to be a single batch of this produced item, based on company standards.

**Good Qty**

The quantity of acceptable items that have been produced, so far, for this job.

**Reject Qty**

The quantity of unacceptable items that have been produced, so far, for this job.

**Reqd By**

The date and time by which this job needs to be completed.

**Estimated Finish**

The estimated completion date and time for this job.

**Machine Status**

The current state of the active entity (Idle, Running, Down, etc). This data can be provided by a PLC or the user in the **Util/OEE** tab.

**WO Desc**

The description of the work order to which this job belongs.

**Sequence**

The position number of this job within the operation. This is used when multiple entities split the work load of one operation.

**Notes**

Notes about this job, work order, and item. Press the Browse button (...) to open the Notes window. Options control which notes are displayed and/or updated. All Operator users can view these notes. User privileges will determine if you can add to or overwrite the notes as well.

## Tab Area

The tab area provides access to the detailed information and tasks available for the active entity and its running jobs.

Most tabs provide access to the detailed information and tasks for one currently running job only (the active job). These tabs will be unavailable if no job is running on the active entity. Multiple running jobs must be accessed individually, by selecting the active job in the job summary area.

If you have the *May Configure Operator* user privilege, you can configure the columns in the grid. See [Configuring Grids in Tab Displays and Dialog Boxes](#).

## Button Toolbar

The button toolbar includes buttons for performing tasks that are available with the currently displayed tab.

The specific buttons that can be displayed on the toolbar relate to context of the currently displayed tab. For example, the **Work Queue** tab includes buttons related to controlling the jobs in the work queue, while the **Production** tab includes buttons related to adding, reducing, or reclassifying production counts.

Several buttons provide general functions that are not related to a specific tab, and so can be included on the toolbars of several of the tabs. These buttons are described in [Common Buttons](#).

By default, not all available buttons for a tab are included in its toolbar. To add and remove buttons from a tab's toolbar, see [Configuring a Tab's Toolbar Buttons](#).

## Common Buttons

The buttons described below provide general functions and are included on the toolbars of several tabs.

### Refresh



Updates the data displayed in the tab.

### Help



Displays the online help.

### External Program



Runs an external application. The button can be set to pass parameters or arguments to the application. See [Configuring a Tab's Toolbar Buttons](#).

### Launch Internet Browser



Launches a defined browser and a predefined page. See [Configuring a Tab's Toolbar Buttons](#).

### Switch User



Displays the User Functions dialog box, which allows you to change the active user in Operator. See [Multiple Users and Operator](#).

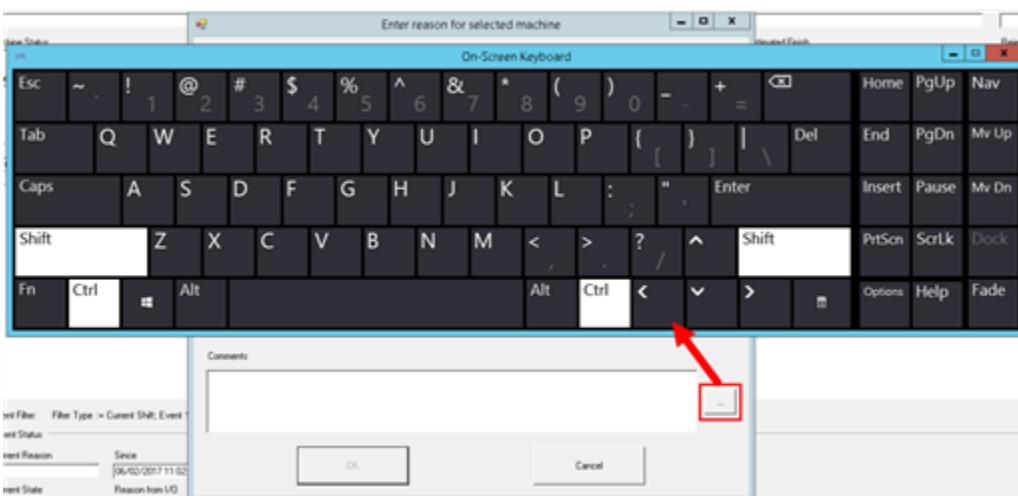
### Open Form



Opens a predefined form.

### On-Screen Keyboard

To assist users who do not have a physical keyboard attached to the local machine, text boxes in MES .NET applications, such as Operator and Data Editor, include a keyboard button. Clicking this button opens an on-screen keyboard, as shown below.



- After opening the keyboard, the focus for the text entry will be to the text box associated with the keyboard button.
- You can leave the keyboard open (either displayed or minimized). However, if the keyboard is open and you click another text box keyboard button, the focus will go to the keyboard and not to the new text box. You must first click in the new text box before typing on the keyboard to enter text into it.
- The **Enter** and **Tab** keys work just like they do on a physical keyboard.
- The keyboard can be resized by clicking and dragging an edge or corner.

Depending on the Windows version, there are additional keyboard features, such as the Fade key (making it transparent) and selectable options on the option keys. For more information about the on-screen keyboard features, see the help topic "Use the On-Screen Keyboard (OSK) to type" on the Microsoft Support web site.

### To change the keyboard language

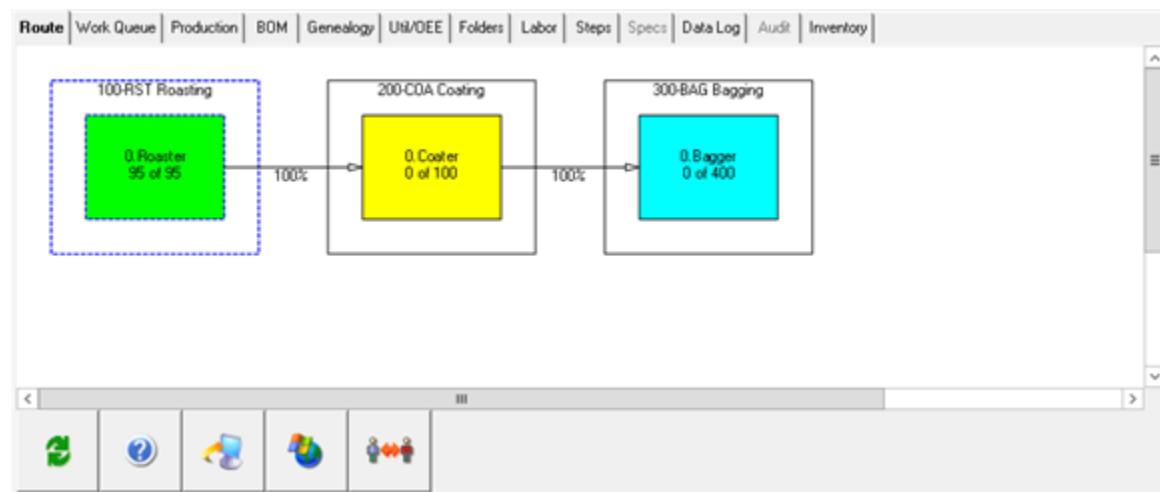
- Open the Input Method menu on the system tray and select the language.



## Operator Tabs

### Route Tab

The **Route** tab is available if a job is currently running on the entity. It is used to display the routing for the work order in progress. The flow diagram illustrates the routing and illustrates the state of each operation with the corresponding color. A dashed line surrounds the active job icon.



For a description of the buttons that are available with the **Route** tab, see [Common Buttons](#).

### Work Queue Tab

The Work Queue tab is used to manage the Job Queue for the active entity or the entity selected in the **Accessible Entities** list, and to change the state of a job at an entity. You can also use the Work Queue tab to split jobs or link jobs together.

Job sequencing can be defined in the MES Client **Queue** module and restrictions can be put on operators to enforce the desired workflow.

The Work Queue tab can also be used to view the routing of an upcoming job. The routing diagram can be viewed by double-clicking on any row in the Work Queue tab. The amount of jobs displayed in the grid is controlled by the *Queue lookahead* user privilege parameter setting for your user account in MES Client.

Route	Work Queue	Production	BOM	Genealogy	Util/OEE	Folders	Labor	Steps	Specs	Data Log	Audit	Inventory
Entity Name	W0 ID	/	Job Desc	Item ID			Reqd Qty		Good Qty	Job State		
Coater	W0-010		Coating	BMX-BBQ			100		0	COMPLETE		
Coater	W0-020		Coating	BMX-BBQ			100		100	COMPLETE		
Coater	W0-030		Coating	BMX-BBQ			100		0	COMPLETE		
Coater	W0-040		Coating	BMX-BBQ			100		89	COMPLETE		
Coater	W0-070		Coating	FMX-BBQ			100		100	COMPLETE		
Coater	W0-080		Coating	FMX-BBQ			100		100	COMPLETE		
Coater	W0-090		Coating	FMX-BBQ			50		50	COMPLETE		
► Coater	W0-100		Coating	FMX-BBQ			100		0	RUNNING		
Coater	W0-110		Coating	FMX-BBQ			100		0	NEW		
Coater	W0-120		Coating	FMX-BBQ			125		0	NEW		
Coater	W0-130		Coating	FMX-BBQ			125		0	NEW		
Coater	W0-140		Coating	FMX-BBQ			100		0	PREPARED		

If you have *May use job from unrelated queue* permission, the **Accessible Entities** list is available above the grid. You can use this list to select a different entity to display its queue in the grid without making it the active entity.

Work Queue						
Route	Production	BOM	Genealogy	Util/OEE	Folders	Labor
Steps	Specs	Data Log	Audit	Inventory		
Accessible Entities:	Coater					
Entity Name	W/O ID	/ Job Desc	Item ID	Reqd Qty	Good Qty	Job State
Coater	W/O-010	Coating	BMX-BBQ	100	0	COMPLETE
Coater	W/O-020	Coating	BMX-BBQ	100	100	COMPLETE
Coater	W/O-030	Coating	BMX-BBQ	100	0	COMPLETE
Coater	W/O-040	Coating	BMX-BBQ	100	88	COMPLETE
Coater	W/O-070	Coating	FMX-BBQ	100	100	COMPLETE
Coater	W/O-080	Coating	FMX-BBQ	100	100	COMPLETE
Coater	W/O-090	Coating	FMX-BBQ	50	50	COMPLETE
Coater	W/O-100	Coating	FMX-BBQ	100	0	RUNNING
Coater	W/O-110	Coating	FMX-BBQ	100	0	NEW
Coater	W/O-120	Coating	FMX-BBQ	125	0	NEW
Coater	W/O-130	Coating	FMX-BBQ	125	0	NEW
Coater	W/O-140	Coating	FMX-BBQ	100	0	READY

When an entity that is not the active entity is selected in the **Accessible Entities** list, the column headers are displayed in yellow. This indicates that the grid data is read-only. You have to make the entity active to make the grid data editable (see [Changing the Active Entity](#)).

Entity Name	WO ID	Job Desc	Item ID	Reqd Qty	Good Qty	Job State
► Roaster	W0-120	Roasting	RMX-BLK	118.75	0	NEW
Roaster	W0-130	Roasting	RMX-BLK	118.75	0	NEW
Roaster	W0-070	Roasting	RMX-BLK	95	95	COMPLETE
Roaster	W0-080	Roasting	RMX-BLK	95	95	COMPLETE
Roaster	W0-100	Roasting	RMX-BLK	95	0	COMPLETE
Roaster	W0-110	Roasting	RMX-BLK	95	0	COMPLETE
Roaster	W0-140	Roasting	RMX-BLK	95	95	RUNNING
Roaster	W0-090	Roasting	RMX-BLK	47.5	47.5	COMPLETE
Roaster	W0-010	Roasting	BMX-BBQ	100	0	COMPLETE
Roaster	W0-020	Roasting	BMX-BBQ	100	100	COMPLETE
Roaster	W0-030	Roasting	BMX-BBQ	100	90	COMPLETE
Roaster	W0-040	Roasting	BMX-BBQ	100	100	COMPLETE

## Work Queue Tab Buttons

The following buttons are specific to the **Work Queue** tab. For information about the other buttons, see [Common Buttons](#).

**Run**

Depending on the user's privileges, this starts the highlighted job, and, if the job is part of a batch of jobs, any other jobs that are in the batch are also started. This means that the job is now being worked on by the active user on the entity. If you have the *May Ready Job* privilege, a user can set a job to Running if the job state is Suspended, Ready, or New. If you do not have the *May Ready Job* privilege, then you can only set a Suspended or Ready job to Running.

You will not be allowed to start a job that has been assigned an access certification that you do not possess.

**Stop**

Completes a currently running or suspended job. If all required information or production quantities are not met, you will be prompted to complete all tasks before completing the job.

**Pause**

Allows you to change the state of a Running, Suspended, or Onhold job to a Paused state, or a different paused state. This indicates that work on an unfinished job has been halted or needs to be started over for some reason.

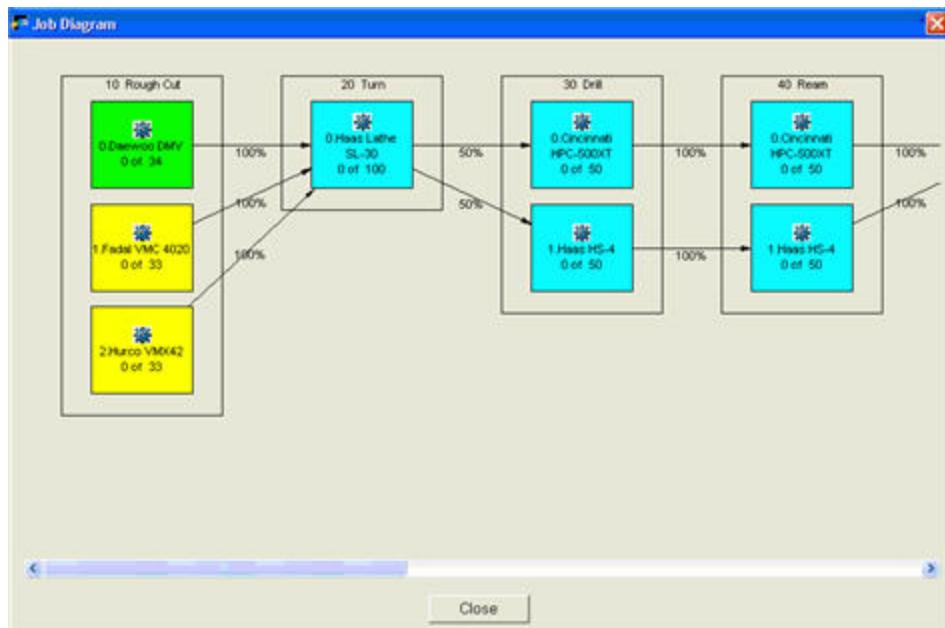
**Ready Job**

If you have the *May Ready Job* privilege, clicking this button moves the selected job's state to Ready.

**Routing Diagram**

Allows you to view the routing diagram for the selected job in the queue grid.

The diagram is always for the selected job in the queue even if there is a different job running.

**WO/Job Notes**

Displays work order, job, or item notes for the selected job in the queue. Notes are read-only. Notes displayed are always for the selected job in the queue even if there is a different job running.

The View Notes window shows a single note: "Using Larger bits for faster cuts". It includes buttons for Save, Clear, and Close.

**BOM Detail**

Displays all components needed for the selected job and relevant information about each (such as quantity, minimum grade, storage location, etc.). The BOM details that are displayed are always for the selected job in the queue even if there is a different job running.

BOM Preview						
Item_Id	Item	Reqd Grade Desc	Qty Reqd.	Consumed Qty	Default Sh	
T1002-12	Cut Bar Stock - 1" DIA, 12" LO.	APPROVED	12	0	Save 01	
P005	Box - 12" Shaft	APPROVED	12	0	Receiving Wk	
P009	Label - 12" Shaft	APPROVED	12	0	Receiving Wk	

**Create New Work Order Against Shortage**

Displays the Create Work Order-Select Item dialog box, which lists all the produced item shortages. You can select an item and manually create a work order to replenish the inventory level for that item. See [Creating a Work Order to Replenish an Item's Inventory](#).

**Job Attributes**

Displays all job attributes that are assigned to the selected job to be viewed or changed. Job attributes that are displayed are always for the selected job in the queue even if there is a different job running.

Inspect & Pack Attributes	
Attribute	Value
Operation Code	303-9066

**Item Attributes**

Allows you to view and change the attributes assigned to the item produced by the job selected in the queue grid.

**Link Jobs**



Opens the Select Jobs to Batch dialog box, which allows you to link two or more jobs together so that they are automatically readied, started, paused, and completed at the same time.

#### Split Jobs



Opens the Split Job dialog box, which allows you to split a portion of the required production from the selected job into a new job and, optionally, schedule it to another entity.

#### Start Some



Opens the Start Some dialog box, which allows you to specify an amount to pull from the required production from the selected job into a new job for the active entity. The new job is started automatically.

#### Add/Assign Serial Numbers



This button is available when the item of the selected job is serialized and the job is not in a completed or canceled state. It opens the Add/Assign Serial Numbers dialog box, which allows you to assign serial numbers to the selected job up to the required quantity defined. Usually this is performed on the first job of the work order.

#### Transfer Serial Numbers



This button is available when the item of the selected job is serialized and the job is not in a completed or canceled state. It opens the Transfer Serial Numbers to dialog box, which allows you to transfer serial numbers from another job or entity to the current job you are working on.

#### Job LogOff

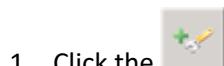


If the active user is required to use a job-based login and is logged into the job selected on the Queue grid, this button is available. It logs the user off of the selected job.

After clicking this button, a dialog box appears, prompting the user to choose between logging off the job and setting the state of the job to Paused or Completed, or to leave the job running. The entity must be able to run without an operator, or there must be another user logged into the job for the active user to make the choice to log off and leave the job running. The user must have the privilege to end a job and all of the job's requirements must be met for the user to be able to log off and end the job.

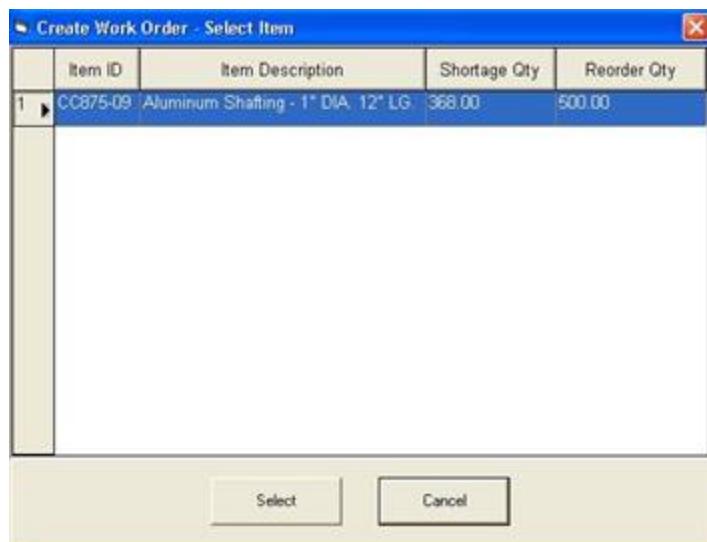
### Creating a Work Order to Replenish an Item's Inventory

You can create a new work order to replenish the inventory level for an item.



1. Click the **Create New Work Order Against Shortage** button.

The Create Work Order-Select Item dialog box appears. It lists all of the produced item shortages.



2. Select the item to replenish and click the **Select** button.

The Create Work Order from Process dialog box appears. Default information is entered in some of the fields.



3. Enter and modify the information as needed.

**Process ID**

The ID of the process from which you want to create a work order.

**Work Order ID**

The unique ID for the work order.

**Description**

A brief description of the work order.

**Item**

The item being added.

**Starting Quantity**

The starting quantity is the amount of product that is intended to be made, if there were no rejects. The last operation in the work order starts with the starting quantity. If the starting quantity is left at its default of 0, and a required quantity is specified, the starting quantity will be changed to be equal to the required quantity. The maximum value that can be entered is 999,999.

**Required Quantity**

The required quantity of the produced items. Required quantity is the quantity that the last operation in the work order must produce to complete the operation. The maximum value that can be entered is 999,999.

#### **Release Date/Time**

The date and time for the release of the first job. Click the **Browse** button to select the date and time from the calendar. Release date and time is used by the system to change the first job in the work order from New to Ready. It is also used to set the required dates for the jobs. The work order required date is assigned to the jobs during the last operation.

#### **Due Date/Time**

The planned work order completion date and time. Click the **Browse** button to select the date and time from the calendar.

#### **Priority**

The priority for the work order. It prioritizes all jobs created for the work order.

#### **Notes**

Additional information about the work order.

4. Click **OK** to save your changes.

A work order for the item is created.

### **Production Tab**

The **Production** tab is used for reporting produced items. Production can be reported as either good or rejected pieces. This tab also allows you to specify the default lot data that is used when production is being added.

Shift Start	Hour Start	Qty Produced	Lot No	Reason Desc	Grade	Status
8/10/2016 12:43:28 AM	8/10/2016 1:00:00 PM	2	123456789	Good Production	GOODGRADE	GOOD

By default, all reported production is shown in the grid.

#### **Filtering the Grid**

If the filter row in the grid's column configuration has been turned on and filtering has been enabled for any of the columns, then you can filter the data rows included in the grid by those columns.

#### **To filter the grid by a column's data**

1. In the filter cell for the column, enter the filter criteria.

The filter criteria must include the beginning characters of the data on which you want to filter, or the entire data value. For example, if all work order IDs begin with WO-, then the filter criteria must begin with those characters. So the filter WO-3 could include rows whose work order ID begins with WO-3, WO-300, WO-301, or WO-3249. However, the filter entry 300 would not match any work order ID entry.

Filter criteria is case-sensitive.

Work Queues						
Entity Name	W/O ID	Job Desc	Item ID	Reqd Qty	Good Qty	Job State
Roaster	W0-010	Roasting	BMX-BBQ	100	100	COMPLETE
Coater	W0-010	Coating	BMX-BBQ	100	100	COMPLETE
Bagger	W0-010	Bagging	BMX-BBQ	100	100	COMPLETE
Roaster	W0-020	Roasting	BMX-BBQ	100	100	COMPLETE
Coater	W0-020	Coating	BMX-BBQ	100	88	COMPLETE
Bagger	W0-020	Bagging	BMX-BBQ	100	81	COMPLETE
Roaster	W0-110	Roasting	BMX-BBQ	200	200	COMPLETE
Coater	W0-110	Coating	BMX-BBQ	200	200	COMPLETE
Bagger	W0-110	Bagging	BMX-BBQ	200	200	COMPLETE
Roaster	W0-300	Roasting	BMX-BBQ	50	50	READY
Coater	W0-300	Coating	BMX-BBQ	50	50	COMPLETE
Bagger	W0-300	Bagging	BMX-BBQ	50	50	COMPLETE
Roaster	W0-301	Roasting	BMX-BBQ	250	250	COMPLETE
Coater	W0-301	Coating	BMX-BBQ	250	250	COMPLETE
Bagger	W0-301	Bagging	BMX-BBQ	250	0	RUNNING

2. Press the **Tab** key.

Only rows whose data match the entered filter criteria appear in the grid.

Work Queues						
Entity Name	W/O ID	Job Desc	Item ID	Reqd Qty	Good Qty	Job State
Roaster	W0-300	Roasting	BMX-BBQ	50	50	READY
Coater	W0-300	Coating	BMX-BBQ	50	50	COMPLETE
Bagger	W0-300	Bagging	BMX-BBQ	50	50	COMPLETE
Roaster	W0-301	Roasting	BMX-BBQ	250	250	COMPLETE
Coater	W0-301	Coating	BMX-BBQ	250	250	COMPLETE
Bagger	W0-301	Bagging	BMX-BBQ	250	0	RUNNING

### To clear the filter

- Delete the filter entry and press the **Tab** key.

## Production Tab Buttons

The following topics describe tasks for the buttons that are specific to the **Production** tab. For information about the other buttons, see [Common Buttons](#).

### Entering Production Counts

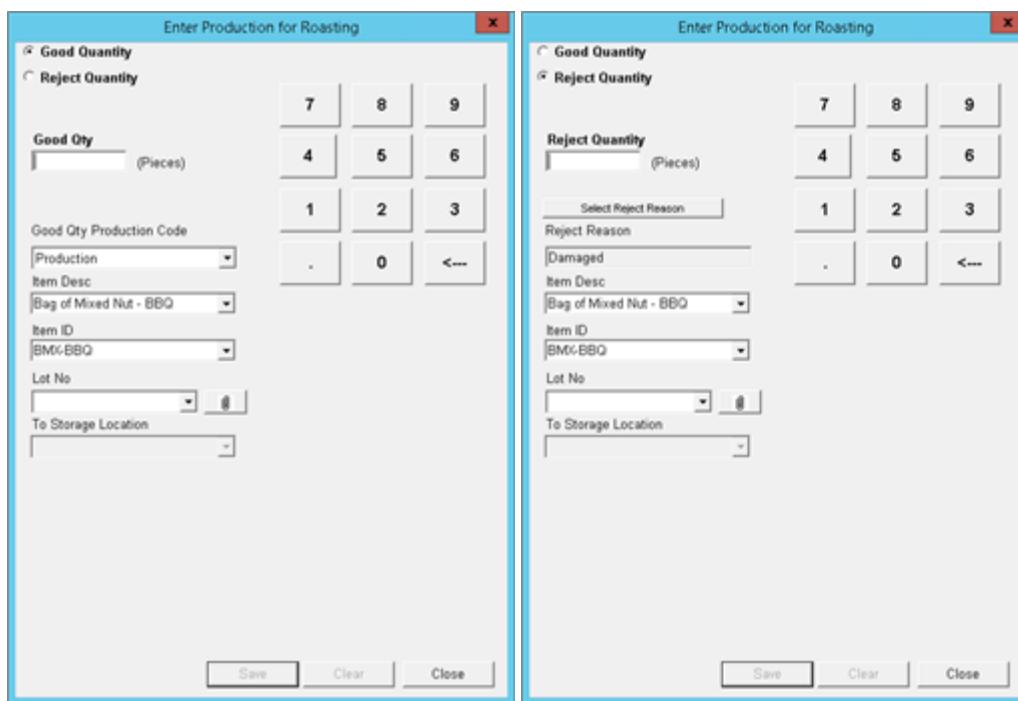


1. Click the **Add Production** button.

The Enter Production dialog box appears.

2. Select the type of production you are entering: **Good Quantity** or **Reject Quantity**.

The settings on the dialog box change depending on whether **Good Quantity** or **Reject Quantity** is selected.



3. Enter the production quantity and the corresponding production information. See [Enter Production Settings](#).  
To clear your entries, click **Clear**.
4. To save the entries, click **Save**.
5. To close the dialog box, click **Close**.

## Enter Production Settings

### Good or Reject Quantity

The amount of produced items to add.

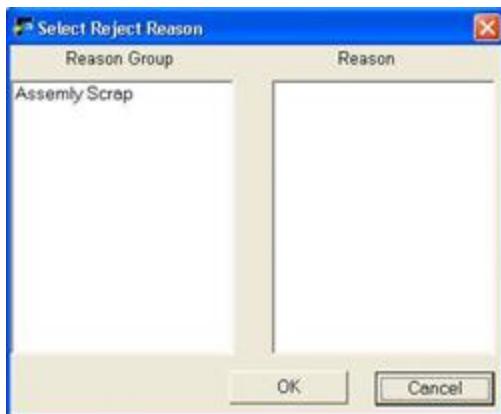
### Good Qty Production Code

The reason to assign to this Good production of the item.

### Reject Reason

The reason to assign to this Rejected production of the item.

To select from a list of available reasons, click the **Select Reject Reason** button. The **Select Reject Reason** dialog box appears.



Select the reason group and reason in the lists, then click **OK**.

#### Item Desc

The description of the item being produced. If you select a different item description, the **Item ID** value is automatically updated to reflect that item.

#### Item ID

The unique ID of the item being produced. If you select a different item description, the **Item Desc** value is automatically updated to reflect that item.

#### Lot No

If the item is associated with lots, the lot number of the item being produced. If a selected lot has sublots, the sublots are also included in the transaction even though they are not displayed.

#### To Storage Location

The storage entity to which items produced by this entity are sent. The produced items will be marked as being stored at the entity selected.

### Reducing Production

1. In the grid, select the production record whose quantity you want to reduce.
2. Click the  **Reduce Production** button.

The Reduce Production dialog box appears.



3. In the **Quantity** box, enter the amount by which to reduce the quantity.

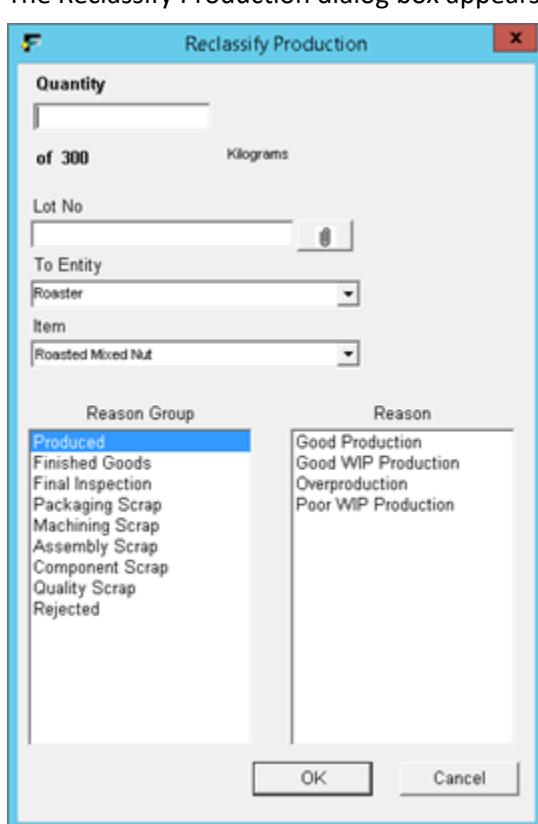
The reduced quantity cannot exceed the current quantity, which is displayed to the right of the box.

4. Click **OK**.

## Reclassifying Production

1. In the grid, select the production record that you want to reclassify.

2. Click the  **Reclassify Production** button.  
The Reclassify Production dialog box appears.



3. Enter the production quantity and corresponding production information, as described below.

**Quantity**

The amount of produced items to reclassify.

The Rejected quantity cannot exceed the current quantity, which is displayed to the right of the box.

**Lot No**

The lot number of the items being reclassified.

**To Entity**

The storage entity at which the reclassified items are to be stored.

**Item**

The item whose production is being reclassified.

**Reason Group and Reason**

The new reason group and reason for the items.

4. When you are finished entering the reclassify information, click **OK**.

### Specifying the Default Lot Data for Production

You can specify the default lot number, production code, and storage location for the current production that is being added. When production counts are being entered, the new lot number, production code, and storage location will be displayed as the defaults.

1. Click the  **Set New Lot Data** button.

The Set Lot Data dialog box appears.



2. Enter the lot information, as described below.

**Item**

The item being produced.

**Production Code**

The default reason to assign to production of the item.

**Lot No**

The default lot number of the item being produced.

### To Storage Location

The default storage entity to which items produced by this entity are sent.

3. Click **OK**.

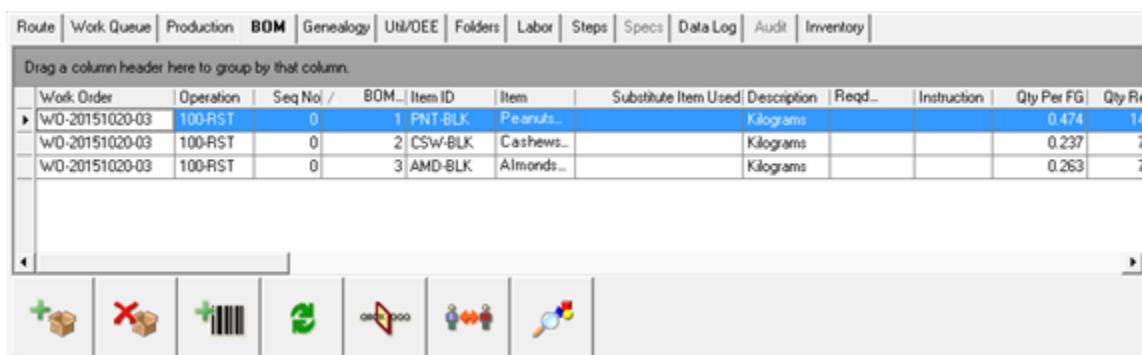
### Specifying That the Production Lot Has Been Processed

You can specify that a production lot has been processed. The lot number that is used is the default lot number that has been set in the Set Lot Data dialog box (see [Specifying the Default Lot Data for Production](#)). This information is mainly used for ERP systems.

- Click the  **Set Production Lot as Processed** button.

### BOM Tab

The **BOM** tab is used for reporting consumption against the currently running job on the active entity. The consumption can be reported for a consumable Bill of Material item that is listed in the table. This consumption can also be recorded as scrap from this tab. You can set the default lot data to be used when reporting consumption from this tab.



Work Order	Operation	Seq No /	BOM...	Item ID	Item	Substitute Item Used	Description	Reqd...	Instruction	Qty Per FG	Qty Re
W0-20151020-03	100-RST	0	1	PNT-BLK	Peanuts...		Kilograms			0.474	1
W0-20151020-03	100-RST	0	2	CSW-BLK	Cashews...		Kilograms			0.237	7
W0-20151020-03	100-RST	0	3	AMD-BLK	Almonds...		Kilograms			0.263	7

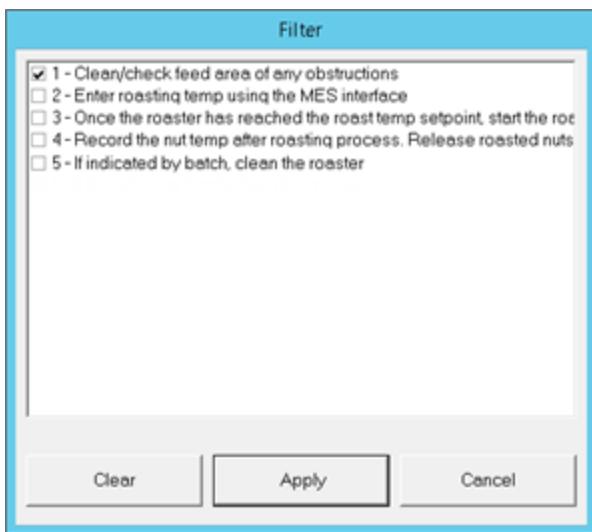
If a BOM item has substitute items defined (substitutions for an item are done in the MES Supervisor Items window), the **Item** field for that BOM item will have a list of the substitute items that can be selected. Once a substitute item is selected and is displayed in the grid, consumption and lot data can be applied.

The following topics describe tasks related to the buttons that are specific to the **BOM** tab. For information about the other buttons, see [Common Buttons](#).

### Filtering the BOM Item Records by Job Steps

1. Click the  **Filter** button.

The Filter dialog box appears. The job steps that are associated with BOM items are listed.



2. Select the check boxes of the job steps whose BOM items you want listed on the **BOM** tab.  
To clear all of the check boxes, click **Clear**.
3. When you have finished selecting the check boxes, click **Apply**.

#### Adding Consumption of a BOM Item

1. On the **BOM** tab, select the BOM item record to which you want to add item consumption.
2. Click the  **Add Consumption** button.  
The Enter Consumption dialog box appears.



3. Complete the consumption information, as described below.

**Quantity**

The quantity that was consumed.

**Consumption Code**

The reason code that indicates why the item was consumed.

**Item Desc**

Description of the item that was consumed.

**Item ID**

The unique identifier of the item that was consumed.

**Lot No**

The lot number for the item that will be consumed.

**Storage Location**

The entity at which the items to be consumed are stored.

**Expiration Date**

The calendar day that the selected lot expires.

**Work Order Id**

The work order for which the BOM item was consumed. This is verified when the consumption transaction is processed.

**Actual Qty**

Read-only. Amount previously consumed for the selected BOM item.

#### Remaining Qty

Read-only. Amount needed to meet the standard quantity scheduled for the selected BOM item.

- When you have finished entering the consumption information, click **OK**.

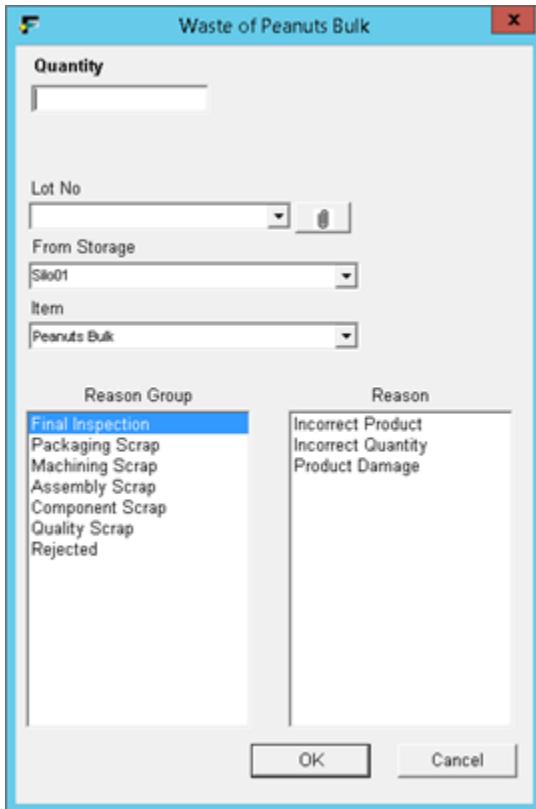
### Adding Scrap Consumption

You can record scrap of consumable items against the work order.

- On the **BOM** tab, select the BOM item record to which you want to add scrap consumption.

- Click the  **Add Scrap Consumption** button.

The **Waste of Raw Material** dialog box appears.



- Complete the scrap information, as described below.

#### Quantity

The amount of the BOM item to be scrapped.

#### Lot No

The lot number of the item being produced.

#### From Storage

The storage entity at which items to be scrapped are stored.

#### Item

The description of the item being scrapped.

### Reason Group and Reason

Select the reason group and then the reason for why the item is being scrapped.

- When you have finished entering the scrap information, click **OK**.

### Specifying the Default Lot Data for Consumption

You can specify the default lot number, production code, and storage location for the current consumption that is being added. When consumption counts are being entered, the new lot number, production code, and storage location will be displayed as the defaults.



- Click the **Set New Lot Data** button.

The Set Lot Data dialog box appears.



- Enter the lot information, as described below.

#### Item

The item being consumed.

#### Consumption Code

The default reason to assign to consumption of the item.

#### Lot No

The default lot number of the item being consumed.

#### Storage Location

The default storage entity of the item being consumed.

- Click **OK**.

### Genealogy Tab

The **Genealogy** tab shows the consumption history against the running work order.

The screenshot shows the AVEVA Manufacturing Execution System interface with the 'Genealogy' tab selected. At the top, there are two filter sections: 'Filter Genealogy By Current User' (selected) and 'All Users'. On the right, another section 'Filter Genealogy By Current Shift' (selected) and 'All' is present. Below these filters is a grid table with the following columns: Item Description, Lot No, FG Lot No, Qty Cons, Reason, Item Grade Desc, User ID, From Entity, and Status. The grid contains three rows of data:

	Item Description	Lot No	FG Lot No	Qty Cons	Reason	Item Grade Desc	User ID	From Entity	Status
1	Container X			10	Default Consumption	Acceptable	admin		Normal
2	Raw Material Y			25.000	Default Consumption	Acceptable	admin		Normal
3	Raw Material Y	12345		15.000	Default Consumption	Acceptable	admin		Normal

At the bottom of the grid area, there are four small icons: a red minus sign, a blue plus sign, a green checkmark, and a blue question mark.

By default, all reported consumption is shown in the grid.

### Filtering the Grid

#### To filter the grid to show only information for the current shift

- Select the **Current Shift** option at the top right of the tab.

#### To filter the grid by users

- Select the **Current User** or **All Users** option at the top left of the tab.

### Genealogy Tab Buttons

The following topics describe tasks related to the buttons that are specific to the **Genealogy** tab. For information about the other buttons, see [Common Buttons](#).

### Reducing Consumption

1. On the **Genealogy** tab, select the record of the item from which you want to reduce consumption.

2. Click the  **Reduce Consumption** button.

The Reduce Consumption dialog box appears.

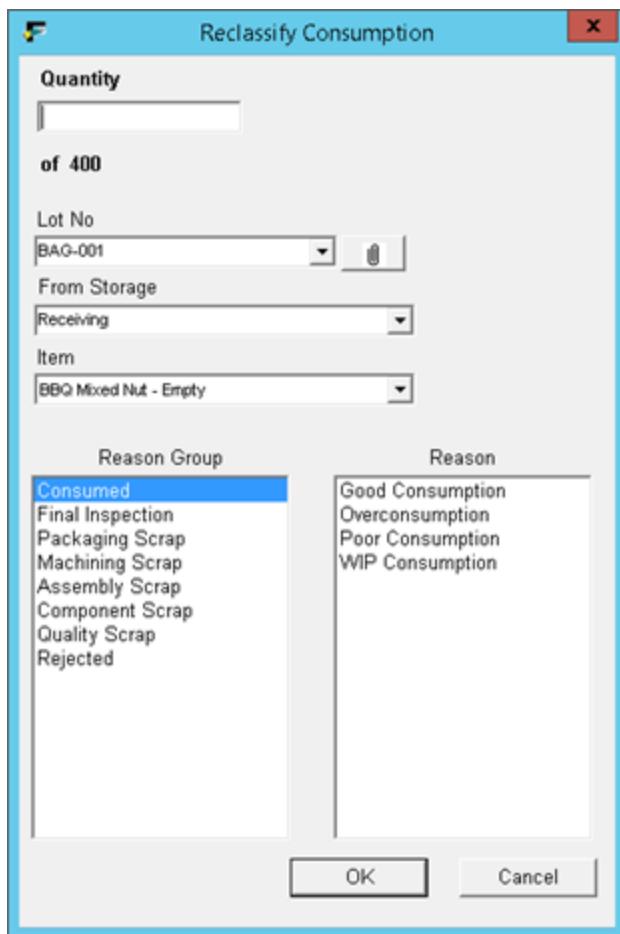


3. Enter the quantity by which to reduce consumption of the item.
4. Click **OK**.

### Reclassifying Consumption

You can reclassify a consumption record by changing its quantity, lot number, item storage location, or reason for the consumption.

1. On the **Genealogy** tab, select the record of the item whose reason you want to change.
2. Click the  **Reclassify Consumption** button.  
The Reclassify Consumption dialog box appears.



3. Complete the reclassify information, described below.

**Quantity**

The amount of the consumed item to be reclassified.

**Lot No**

The lot number to be used for the reclassified consumption.

**From Storage**

The entity at which the consumed item was previously stored.

**Item**

The item whose consumption is being reclassified.

**Reason Group and Reason**

Select the reason group and then the reason for why the item was consumed.

4. When you are finished entering the reclassify information, click **OK**.

## Util/OEE Tab

The **Util/OEE** tab displays the history of entity utilization and allows for the entry of changes to the entity state. The tab also displays some analysis data tools.

Route | Work Queue | Production | BOM | Genealogy | **Util/OEE** | Folders | Steps | Specs | Audit | Inventory |

Util									
/	Log ID	Entity Name	Shift Desc	State Desc	Reason Desc	Duration...	Reason Pending	Runtime	Dc
	20	PLT002 - Roaster100	No Shift	IDLE	Emergency Stop	00:01:01			
	21	PLT002 - Roaster100	No Shift	SETUP	Operational Check	00:01:20			
	22	PLT002 - Roaster100	No Shift	RUNNING	Running	00:13:33			
>	23	PLT002 - Roaster100	No Shift	IDLE	Idle	00:34:30			

Current Filter: Filter Type := Current Shift; Event State: = Both; Minimum Duration: = 0; Status: = All;

Current Status

Current Reason	Since	Duration [hh:mm:ss]	Good Qty	Reject Qty
Idle	10/17/2015 6:13:45 PM	00:34:30	200	10
Current State	Reason from I/O	Current OEE %	Target OEE %	
IDLE		95.24	80.00	

When displayed, any new events will be automatically shown and selected.

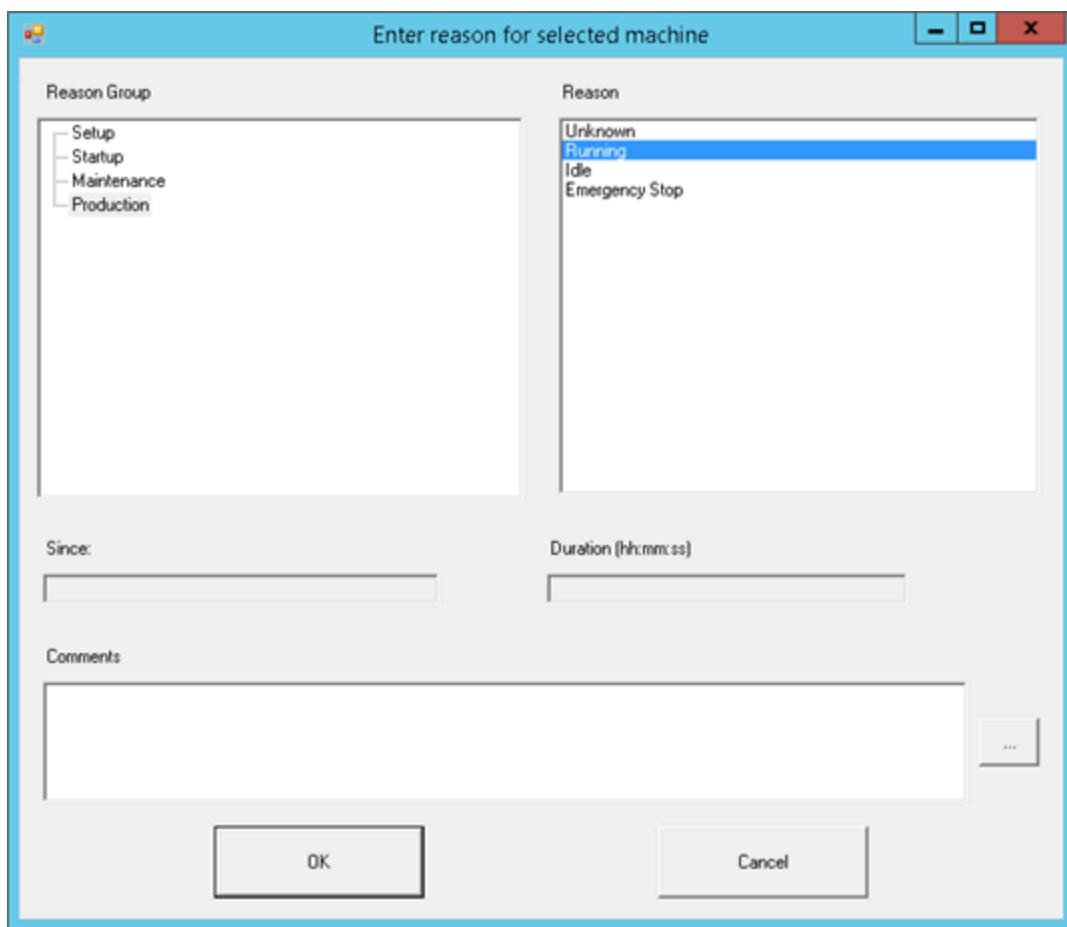
## Util/OEE Tab Buttons

The following topics describe tasks related to the buttons that are specific to the Util/OEE tab. For information about the other buttons, see [Common Buttons](#).

### Starting a New Utilization Event

You can start a new utilization event for the entity to indicate that its operating condition has changed.

1. Click the **Enter Machine Reason** button  
The Enter Reason dialog box appears.



The dialog box includes the following read-only fields.

#### Since

Displays the start time of the last utilization event. For a new event, a start time is not shown.

#### Duration

Length of the last utilization event, in the format HH:MM:SS. For a new event, a duration is not shown.

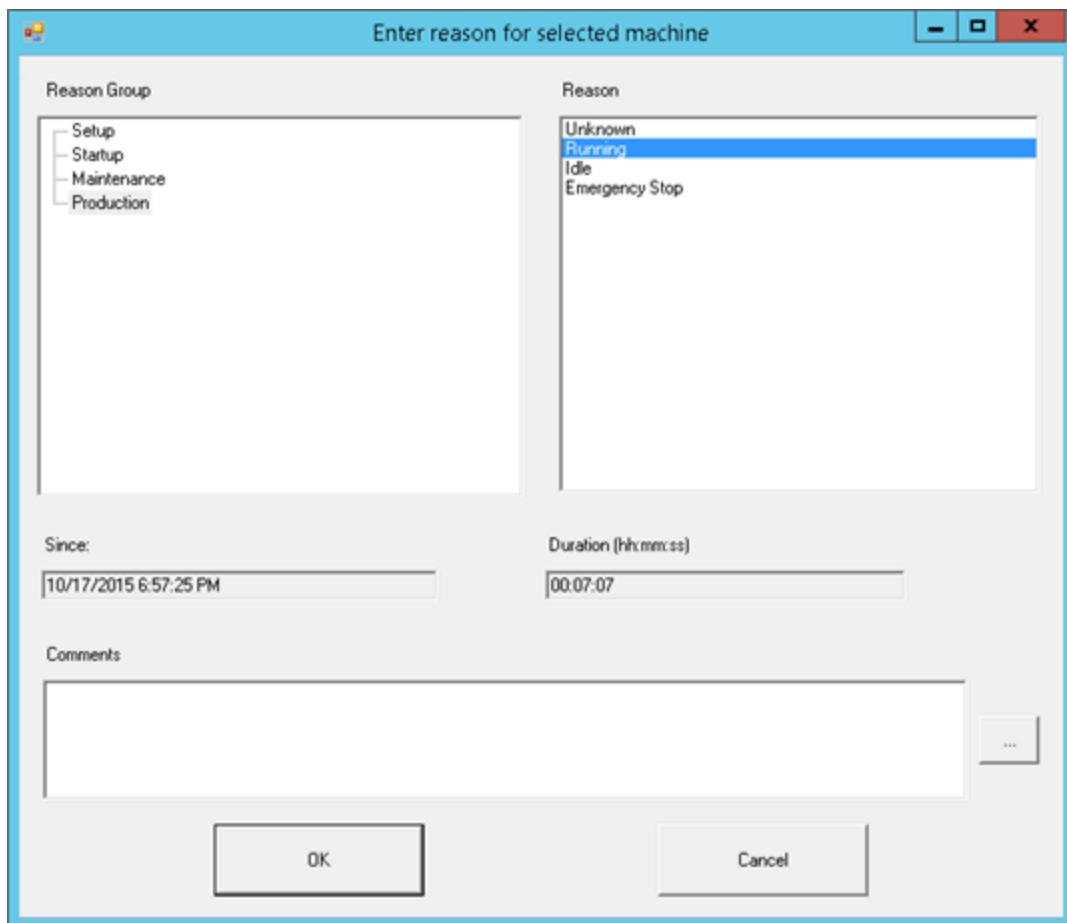
2. Select a utilization reason group and then the utilization reason for the new event.
3. Optionally, enter a comment about the new utilization event.
4. Click **OK**.

### Specifying a Utilization Reason for a Utilization Record from a UCO

You can specify a utilization reason when the entity receives a new utilization record that does not have a final reason code. This will occur when data is being sent from the machine through a Utilization Capability Object (UCO). The **Enter Past Machine Reason** button is available only when this type of entry is required.

1. Select the event record in the grid.
2. Click the  **Enter Past Machine Reason** button.

The Enter Reason dialog box appears.



The dialog box includes the following read-only fields.

**Since**

Displays the start time of the last utilization record.

**Duration**

Length of the last utilization record in the format HH:MM:SS.

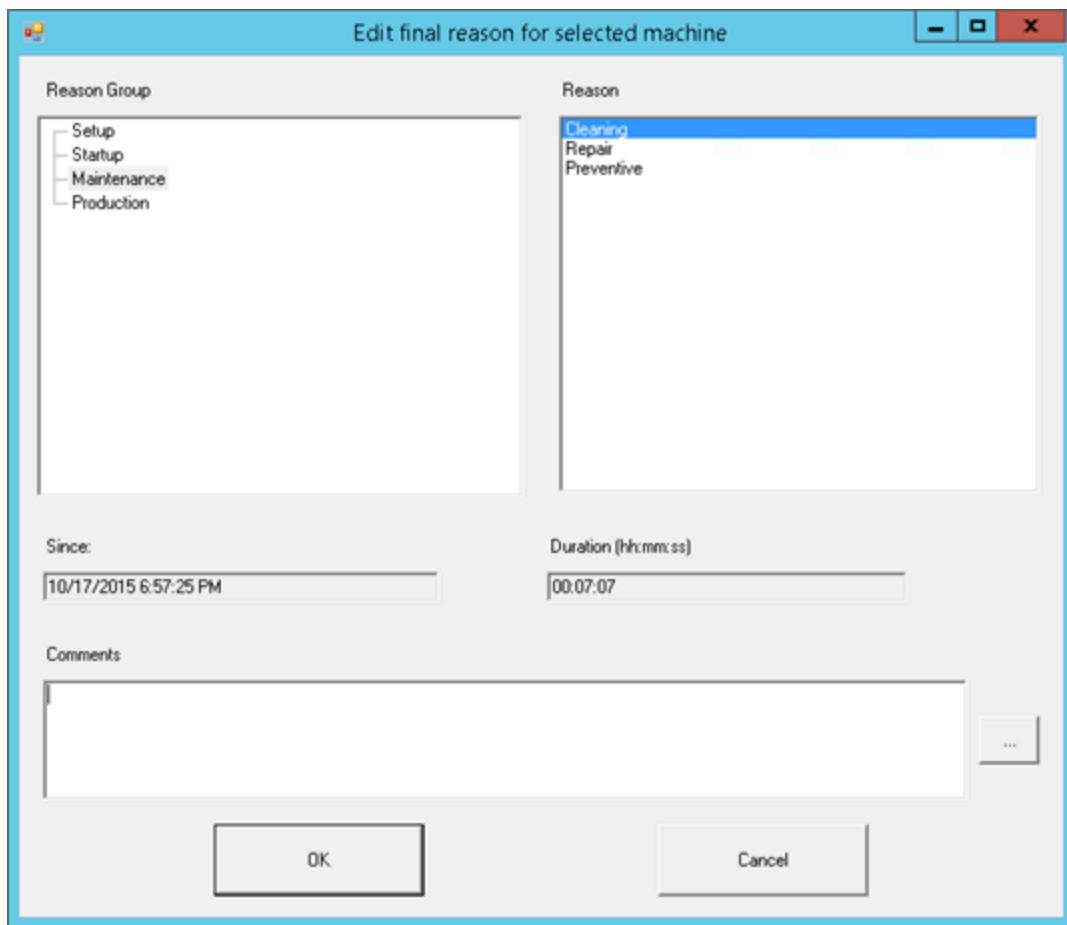
3. Select a utilization reason group and then the utilization reason.
4. Optionally, enter a comment about the event.
5. Click **OK**.

### Changing the Utilization Reason for a Utilization Event

You can change the reason assigned to a utilization event.

1. Select the event record in the grid.
2. Click the  **Edit Final Reason** button.

The Edit Final Reason dialog box appears.



The dialog box includes the following read-only fields.

#### Since

Displays the start time of the last utilization record.

#### Duration

Length of the last utilization record in the format HH:MM:SS.

3. Select a utilization reason group and then the utilization reason.
4. Optionally, enter a comment about the event.
5. Click **OK**.

Note that, if the event now has the same utilization reason as an existing event prior to or following it, the events will be merged. See [Merging an Event with an Adjacent Event](#).

## Splitting an Event

You can split an event so that the new event is added either before or after the original event that is being split.

For the event to be split into two events, either the utilization reason group:reason or the Comment entry must be different. Otherwise, the event will effectively not be split after saving the operation.

For example, if a Production:Idle event actually included some Setup:Operational Check time at the end of its duration, you could split the original event into two events, one Production:Idle and the other Setup:Operational. Or, if desired, you could split an event into two events that are assigned the same utilization

group and reason but have different comments to provide unique descriptions of what occurred during the two similar events.

### To split an event

- In the event grid, select the event to be split.

The screenshot shows the AVEVA MES interface. At the top, there is a navigation bar with tabs: Route, Work Queue, Production, BOM, Genealogy, UniOEE, Folders, Steps, Specs, Audit, and Inventory. The UniOEE tab is selected. Below the navigation bar is a table titled "Util" with columns: Log ID, Entity Name, Shift Desc, State Desc, Reason Desc, Event Start..., Duration..., Reason Pending, and Runtime. There are four rows in the table. Row 42 has "PLT002 - Bagger100" listed under Entity Name, "No Shift" under Shift Desc, "IDLE" under State Desc, and "Idle" under Reason Desc. The "Event Start..." column shows "10/9/2015 7:19:52 PM". The "Duration..." column shows "00:34:15". Row 48 has "PLT002 - Bagger100" listed under Entity Name, "No Shift" under Shift Desc, "RUNNING" under State Desc, and "Running" under Reason Desc. The "Event Start..." column shows "10/9/2015 7:54:07 PM". The "Duration..." column shows "00:34:08". Row 13 has "PLT002 - Bagger100" listed under Entity Name, "No Shift" under Shift Desc, "IDLE" under State Desc, and "Idle" under Reason Desc. The "Event Start..." column shows "10/9/2015 8:28:15 PM". The "Duration..." column shows "189:58:29". Row 26 has "PLT002 - Bagger100" listed under Entity Name, "No Shift" under Shift Desc, "SETUP" under State Desc, and "Operational Check" under Reason Desc. The "Event Start..." column shows "10/17/2015 6:26:44 PM". The "Duration..." column shows "00:00:52". Below the table, there is a message: "Current Filter: Filter Type := Current Shift; Event State: = Both; Minimum Duration: = 0; Status: = All;". Under "Current Status", there are two sections: "Current Reason" and "Current State". "Current Reason" shows "Running" with "Since 10/18/2015 4:22:00 PM", "Duration [hh:mm:ss] 01:50:27", "Good Qty 200", and "Reject Qty 0". "Current State" shows "Reason from I/O" with "Current OEE % 100.00" and "Target OEE % 90.00". Below these sections is a row of icons representing various manufacturing operations like setup, start, stop, and emergency stop.

- Click the Split or Edit Event button.

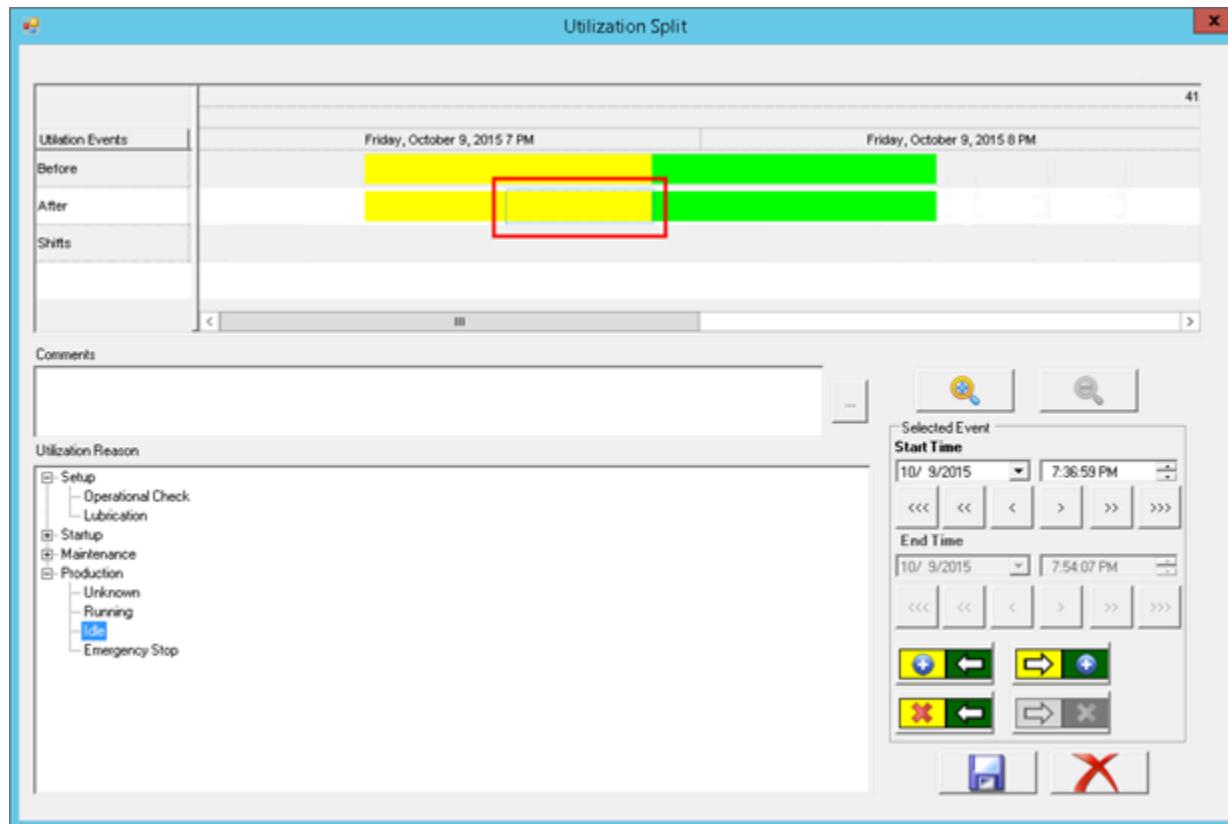
The Utilization Split dialog box appears.

The screenshot shows the "Utilization Split" dialog box. At the top, it says "Utilization Split". On the left, there is a tree view under "Utilization Events" with nodes: Before, After, and Shifts. The "Before" node is expanded, showing a timeline from "Friday, October 9, 2015 7 PM" to "Friday, October 9, 2015 8 PM". The timeline is divided into yellow and green segments. On the right side of the dialog box, there is a "Comments" section with a text input field and two search icons. Below the comments section is a "Utilization Reason" section with a list of checkboxes for reasons: Setup, Startup, Maintenance, Production (with sub-options Unknown, Running, Idle, and Emergency Stop), and Shutdown. To the right of the utilization reason list is a "Selected Event" panel with "Start Time" set to "10/9/2015 7:19:52 PM" and "End Time" set to "10/9/2015 7:54:07 PM". The "Selected Event" panel also includes navigation buttons for the timeline and a red "X" button at the bottom right.

- Do one of the following:

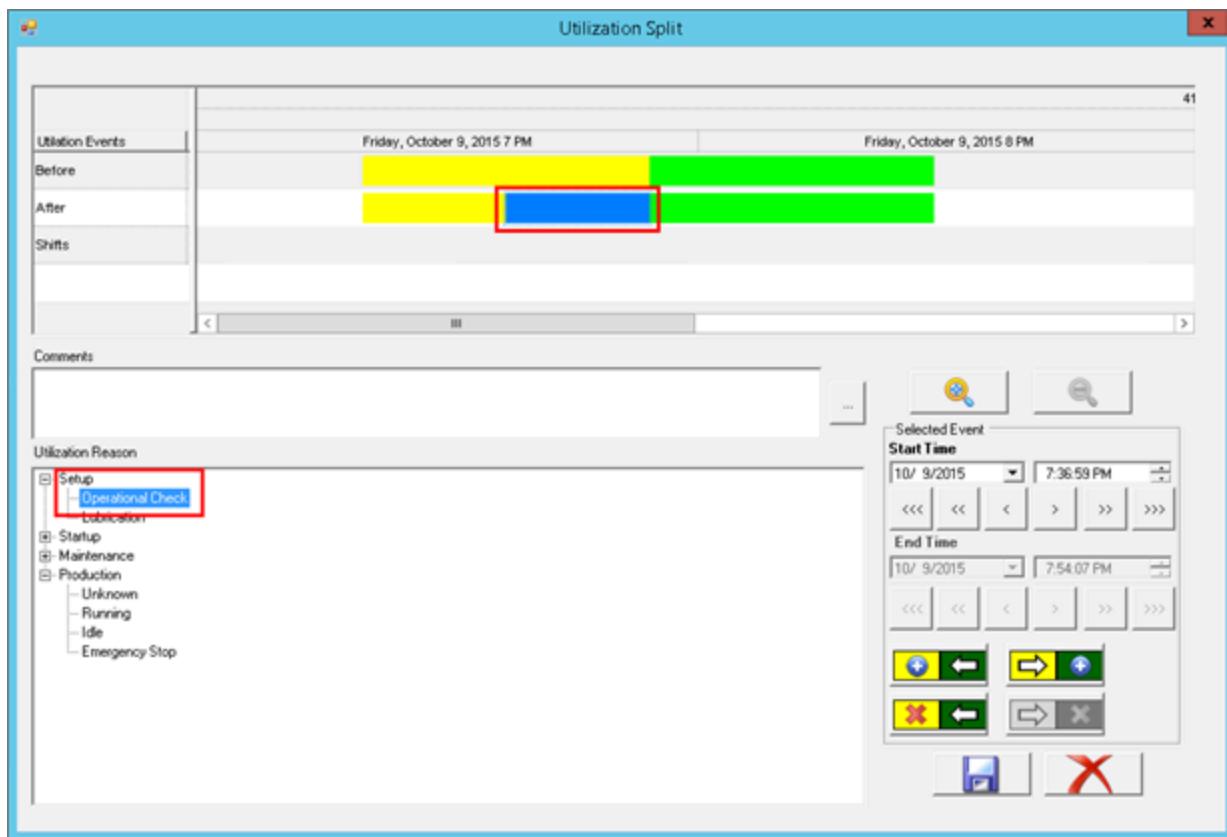
- To have the new event follow the original event (that is, occur later in time), click the  New Event Follows button.
- To have the new event occur prior to the original event (that is, occur earlier in time), click the  New Event Prior button.

The time chart at the top of the dialog box shows the new and original events in the **After** row. The new event is outlined by a dashed box. The new event defaults to the same reason and comment as the original event.

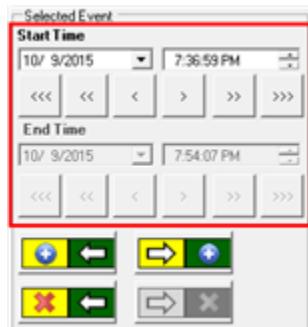


4. In the **Utilization Reason** tree, select the utilization reason for the new event.

The utilization reason is assigned to the new event. By default, the durations of both events are half of the duration of the original event.

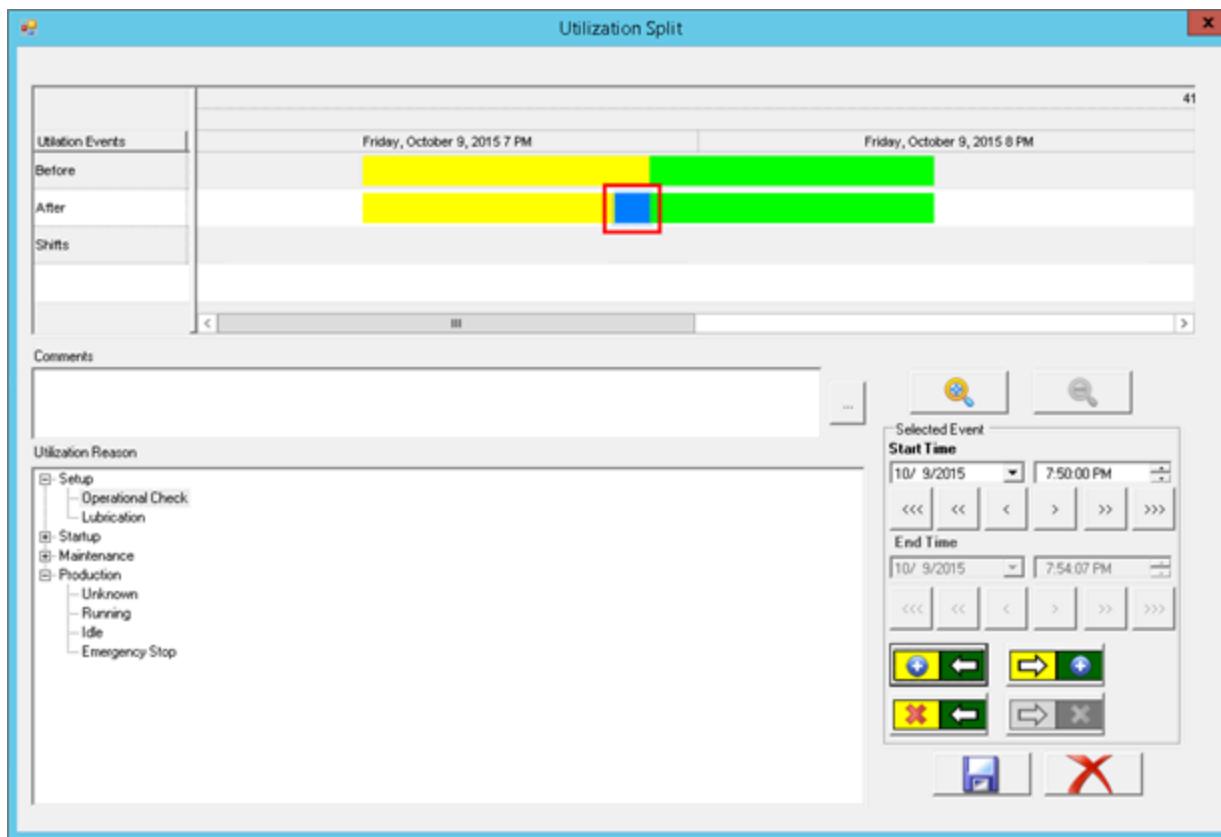


5. Using the time controls, adjust the start or end time of the new event as needed:



- If the new event follows the original event, adjust the new event's start time.  
The end time of the original event will be adjusted automatically.
- If the new event is prior to the original event, adjust the new event's end time.  
The start time of the original event will be adjusted automatically.

The duration of the new event will change in the time chart.



6. Optionally, edit the comment for the new event.
7. Click the Save button.

The dialog box closes. The new event and the original event, with its duration adjusted, appear in the grid.

Route	Work Queue	Production	BOM	Genealogy	Util/DEE	Folders	Steps	Specs	Audit	Inventory
<b>Util</b>										
Log ID	Entry Name	Shift Desc	State Desc	Reason Desc	Event Start...	/	Duration...	Reason Pending	Runtime	
42	PLT002 - Bagger100	No Shift	IDLE	Idle	10/9/2015 7:19:52 PM		00:30:08			
51	PLT002 - Bagger100	No Shift	SETUP	Operational Check	10/9/2015 7:50:00 PM		00:04:07			
48	PLT002 - Bagger100	No Shift	PRODUCTION	Running	10/9/2015 7:54:07 PM		00:34:08			
13	PLT002 - Bagger100	No Shift	IDLE	Idle	10/9/2015 8:28:15 PM		189:58:29			

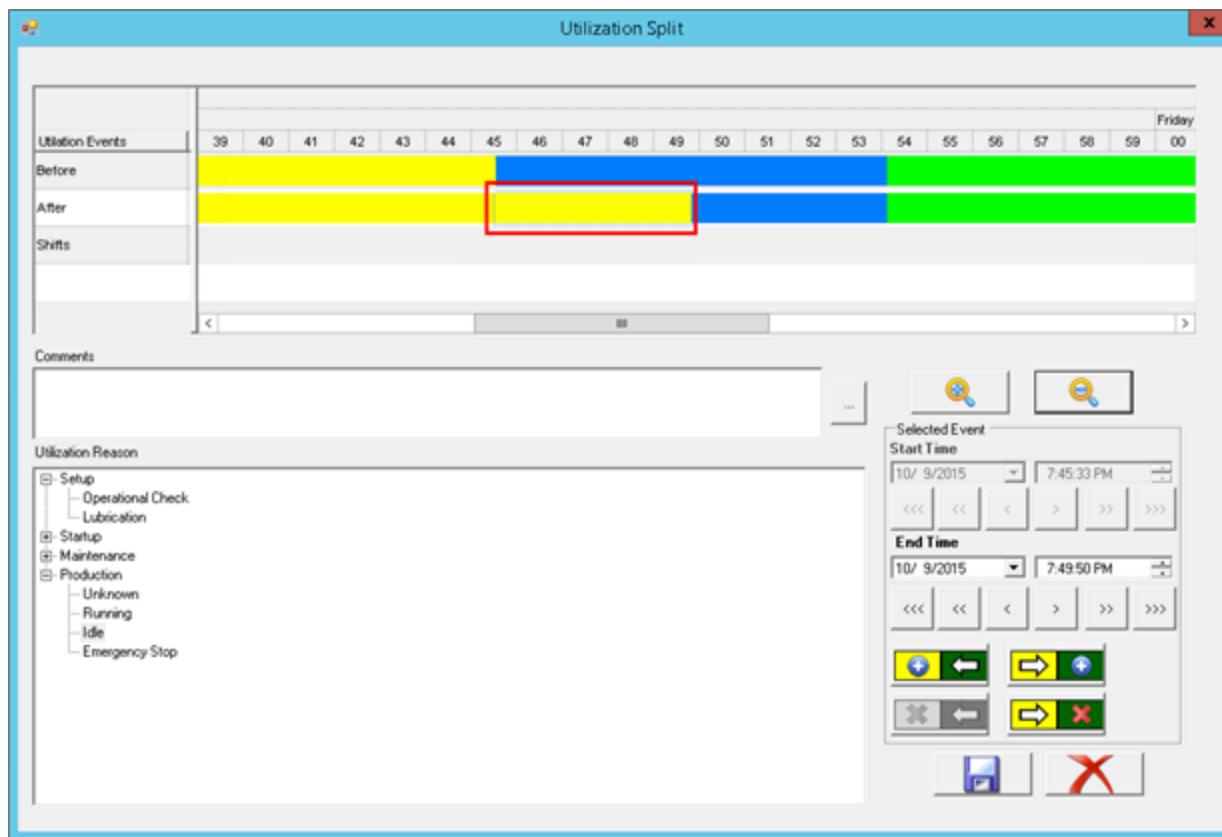
## Clearing the Split Operation

If you selected the wrong split operation or utilization reason for the new event and the dialog box is still open, you can clear your selections by clicking the active Cancel button: **Cancel New Event Follows** or **Cancel New Event Prior**. You can then restart the procedure at step 3 above.

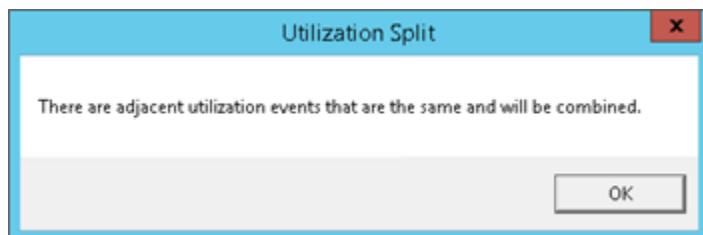
## Automatic Merging of the New Event with a Similar Adjacent Event

Note that, if the new event has the same utilization reason as an existing event prior to or following it, the events will be merged.

For example, the following screen shows an original Setup:Operational Check event that is being split with a new Production:Idle event. The new event is adjacent to a prior Production:Idle event.



In such a case, after clicking the Save button, a message appears explaining that the two adjacent events will be merged into one event:



Note that the system can also be configured in MES Client such that the comments of the events being merged must also match to allow the merge to occur.

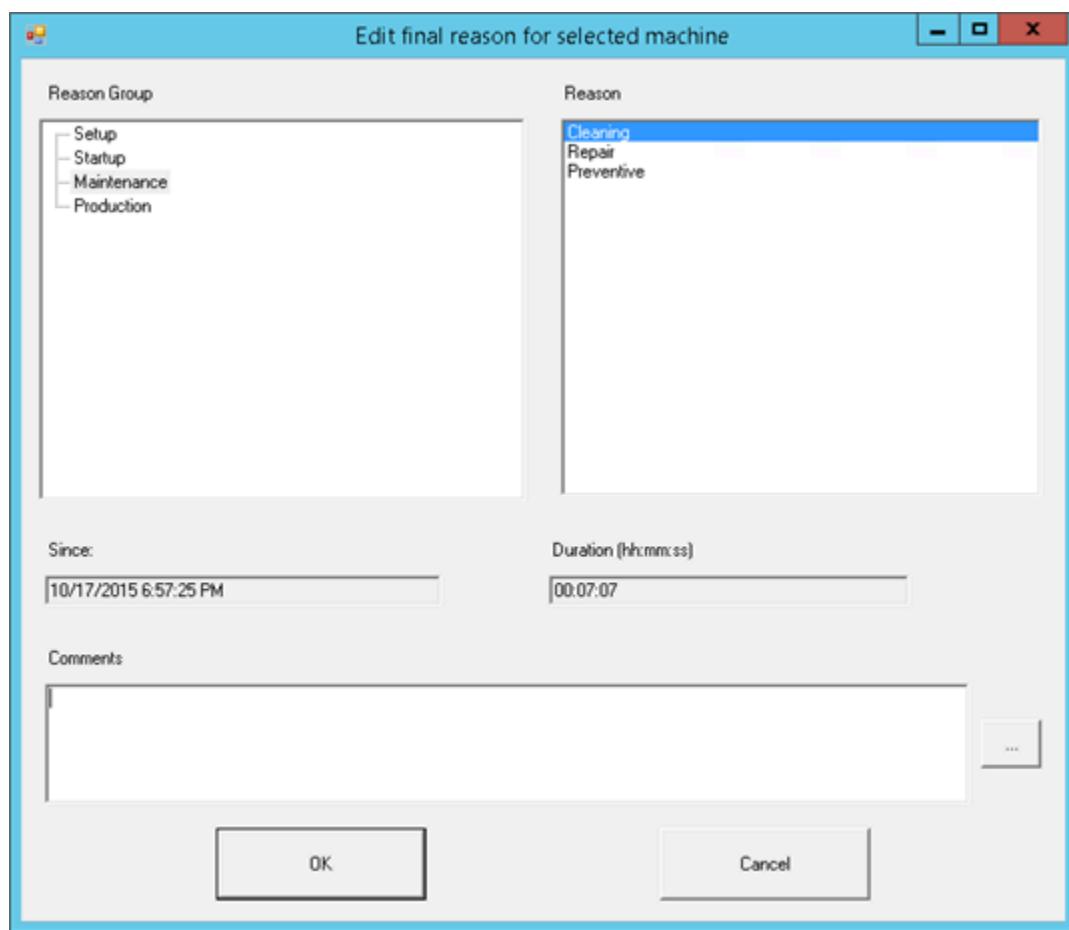
### Merging an Event with an Adjacent Event

You can use the Edit Final Reason feature to merge an event into an adjacent event.

Typically, you are merging events that should actually have the same utilization group and reason. However, the system might be configured in MES Client such that the comments of the events being merged must also match to allow the merge to occur. If this is the case, both the utilization reason group and reason, and the event comments, must be the same for the merge to occur.

1. Select the event record in the grid to be merged into an adjacent event.
2. Click the Edit Final Reason button.

The Edit Final Reason dialog box appears.



3. Select the utilization reason group and utilization reason of the adjacent event.
4. If required, modify the entry in the **Comments** box so that it matches the comments of the adjacent event.
5. Click **OK**.

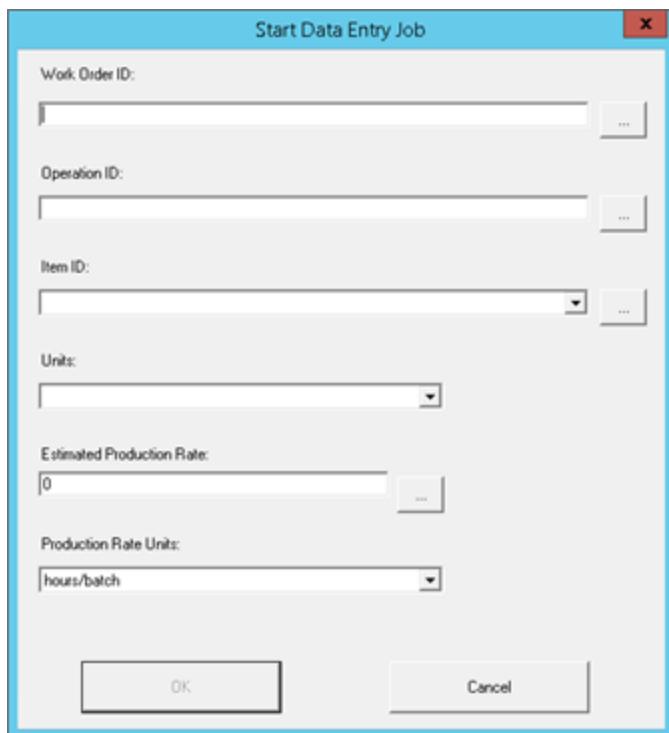
The selected event is merged into the adjacent event. The new duration is equal to the duration of the two source events.

#### Starting a Job to Enter Production Counts for OEE

You can start a job on the entity that is not based on a work order derived from a BOM. The job that is created will not contain BOM definitions or start/required quantities. The main function for this job is to collect production counts for tracking the entity's performance for OEE. This functionality is intended for applications where production and consumption are not needed and so are not being entered.

1. Click the  **Start** button.

The Start Data Entry Job dialog box appears.



- Specify the job parameters.

**Work Order ID**

The identifier that uniquely identifies the work order for the job in the system.

**Operation ID**

The identifier that identifies the job's operation.

**Item ID**

The item being produced.

**Units**

The unit of measure for the selected item.

**Estimated Production Rate**

The estimated rate at which items will be produced for this job.

**Production Rate Units**

The unit of measure for the estimated production rate.

- After entering the job parameters, click **OK**.

The job is created on the entity and started.

You can now enter production counts.

### Entering Production Counts for OEE

Entering production counts for OEE tracking similar to entering production counts for work orders that were created from a BOM. For the procedure, see [Entering Production Counts](#).

## Stopping a Production Counts Job

### To stop a job that was created to enter production counts for OEE tracking

- Click the  Stop Job button.

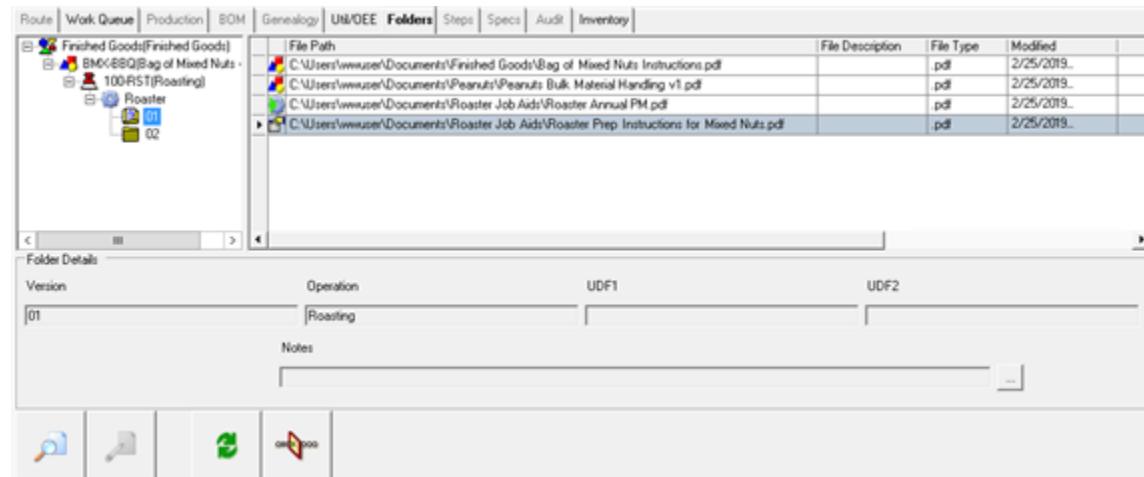
## Folders Tab

In MES, the Folders function in MES Supervisor and the file assignment functions in MES Client allow a collection of files and web pages, such as operating instructions and other documentation, to be available to operators using MES Operator. These files are typically relevant to an item's production, during a specific operation, on a specific entity (production line, machine, tool, and so on).

Using Folders in MES Supervisor, files can be assigned to items and entities. Using file assignment functions in MES Client, files and web pages can be assigned to entities, items, work orders, specifications, and operations from which jobs are instantiated.

You access folders and files on the **Folders** tab.

When a job is not running on the entity onto which you are logged, the Folders tree is shown in the left panel (see the figure below). Select a node in the tree to see which files are assigned to that node and the nodes above it. Also included in the list of documents are any files or web pages that were assigned in MES Client to the operation, item, or entity in the node tree.



File Path	File Description	File Type	Modified
C:\Users\wwwuser\Documents\Finished Goods\Bag of Mixed Nuts Instructions.pdf		pdf	2/25/2019...
C:\Users\wwwuser\Documents\Peanuts\Peanuts Bulk Material Handling v1.pdf		pdf	2/25/2019...
C:\Users\wwwuser\Documents\Roaster Job Aids\Roaster Annual PM.pdf		pdf	2/25/2019...
C:\Users\wwwuser\Documents\Roaster Job Aids\Roaster Prep Instructions for Mixed Nuts.pdf		pdf	2/25/2019...

When a job is running on the entity onto which you are logged, there is no Folders tree shown (see the figure below). The list of documents are:

- Any files or web pages that were assigned in MES Client to the item being produced or to the logged-on entity
- Any files that were assigned in Folders in MES Supervisor to the item being produced

File Path	File Description	File Type	Modified	Size	Author
C:\Users\wwwuser\Documents\Finished Goods\Bag of Mixed Nuts Instructions.pdf		pdf	2/25/2019...	522965	
C:\Users\wwwuser\Documents\Peanuts\Peanuts Bulk Material Handling v1.pdf		pdf	2/25/2019...	522965	
C:\Users\wwwuser\Documents\Roaster Job Aids\Roaster Annual PM.pdf		pdf	2/25/2019...	522965	

## Folders Tab Buttons

The following buttons are specific to the **Folders** tab. For information about the other buttons, see [Common Buttons](#).

### View File



View the selected file.

### Edit File



Edit the selected file.

## Labor Tab

The **Labor** tab displays a history of the current user's labor activity, based on logging on to and off of entities.

Buttons for logging onto and off of the current entity and changing the current entity are provided for convenience. It also allows you to change the labor category, department, and percent of labor to apply by entity and by the operations running on the current entity.

The screenshot shows the 'Labor' tab in the AVEVA Manufacturing Execution System. At the top, there's a navigation bar with links like Route, Work Queue, Production, BOM, Genealogy, Util/OEE, Folders, Labor, Steps, Specs, Data Log, Audit, and Inventory. Below the navigation bar is a filter section titled 'Filter Logs By' with three options: 'Previous Shift', 'Last 24 Hours', and 'Current Shift'. The main area contains a table with the following data:

Log ID	User ID	User	Entity ID	Entity	Work Order	Operation	Seq No	Step No	Item
1459	rp\g.sam		100	Roaster	W0-20151020-03	100-RST	0	1	RMX
1458	rp\g.sam		100	Roaster	W0-20151020-03	100-RST	0	5	RMX
1457	rp\g.sam		100	Roaster	W0-20151020-03	100-RST	0	6	RMX
1448	rp\g.sam		100	Roaster	W0-20151020-03	100-RST	0		RMX
1413	rp\g.sam		100	Roaster	W0-20151020-02	100-RST	0		RMX
1390	rp\g.sam		100	Roaster	W0-20151020-01	100-RST	0		RMX

Below the table is a section titled 'Current Labor' with tabs for 'Production' and 'Production'. It includes fields for Start Time (10/20/2015 3:38:29 PM), Duration (0:00), and Pct to Apply (20). A row of icons is also present.

The labor history entries can be filtered by the current shift, previous shift, and last 24 hours.

## Labor Tab Buttons

The following buttons are specific to the **Labor** tab. For information about the other buttons, see [Common Buttons](#).

### Log In Another User



Displays the MES Operator Login screen, to allow another user to log in to Operator.

### Logout from Operator



Logs the current user out of Operator.

### Switch User



Displays the **User Functions** dialog box, which allows another user who is already logged in to Operator to become the active user. See [Switching Users](#).

### Change Labor Category



Allows you to change the labor category, department, and percent of labor to use for entities and the operation currently running on the logged-on entity. See [Changing Labor Settings for Entities and Operations](#).

### Log Into Another Entity



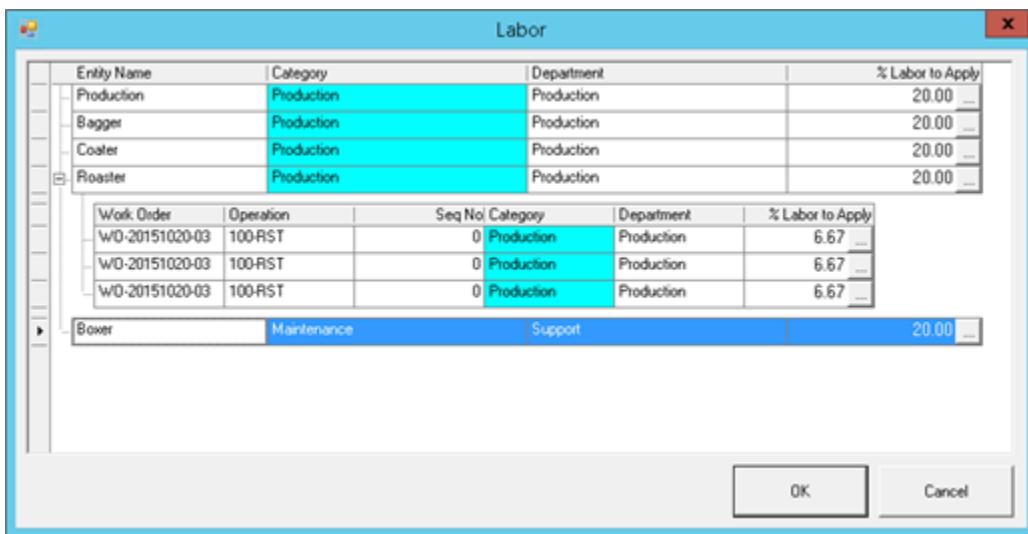
Displays the Select Which Entities to Logon dialog box, which allows you to log onto another entity or set of entities. This is the same dialog box that appears during a normal login to Operator; see [Starting and Logging onto Operator](#).

## Changing Labor Settings for Entities and Operations

You can change the labor categories, departments, and percent of labor to apply for labor data being collected for all entities that you are currently logged into.

1. Click the  **Change Labor** button.

The Labor dialog box appears.



2. Complete the labor information for each entity, as described below.

### Category

The labor category to use for the entity.

### Department

The labor department to use.

### % Labor to Apply

The percentage of labor of your total labor to apply to the entity.

3. When you are finished entering the labor information, click **OK**.

## Steps Tab

The **Steps** tab is used as a step-by-step procedure guide to the currently running job. The sequence of activities that must be performed to complete the operation are displayed on the tab.

Route | Work Queue | Production | BOM | Genealogy | Util/DEE | Folders | Labor | **Steps** | Specs | Data Log | Audit | Inventory |

Operator	Serial Number	Step Group			
rp\g.sam	-	-All-			
Step No /	Step Desc	Gp Seq /	Seq /	State	Document
1	Clear/check feed area of any obstructions	1	1	READY	
2	Enter roasting temp using the MES interface	1	2	NEW	
3	Once the roaster has reached the roast temp setpoint, start the roaster	2	3	NEW	
4	Record the nut temp after roasting process. Release roasted nuts to coater.	2	4	NEW	
5	If indicated by batch, clean the roaster	3	5	NEW	

Step Desc:  
Clean/check feed area of any obstructions

Documents

Data Edit

Status: READY Action: Normal Start: [ ] Cert Name: [ ]

Required for Step Completion: Finish: [ ]



Steps can link to a document file, require data entry, require inspector sign-off, or simply require a verification that the step was completed. Individual steps can be bypassed if you have permission to do so. Each step requires you to log in and then mark the step Completed when finished. Time stamps are recorded for the login and completion of each step. A user does not have to be logged into a step for the step to be running.

Steps can be logged into by multiple users and can be repeated over multiple lots. Use the lists located above the steps grid to select the user currently completing the steps, the serial (lot) number of the lot being processed, and the step group that is currently active.

Route | Work Queue | Production | BOM | Genealogy | Util/DEE | Folders | Labor | **Steps** | Specs | Data Log | Audit | Inventory |

Operator	Serial Number	Step Group			
rp\g.sam	-	-All-			
Step No /	Step Desc	Gp Seq /	Seq /	State	Document
1	Clear/check feed area of any obstructions	1	1	READY	
2	Enter roasting temp using the MES interface	1	2	NEW	
3	Once the roaster has reached the roast temp setpoint, start the roaster	2	3	NEW	
4	Record the nut temp after roasting process. Release roasted nuts to coater.	2	4	NEW	
5	If indicated by batch, clean the roaster	3	5	NEW	

Below the steps grid are a set of read-only data about the currently selected step.

The screenshot shows the 'Steps' tab in the AVEVA MES application. At the top, there are tabs for Route, Work Queue, Production, BOM, Genealogy, Util/DEE, Folders, Labor, Steps, Specs, Data Log, Audit, and Inventory. The 'Steps' tab is selected. Below the tabs, there are filters for Operator (rp\g.sam), Serial Number, and Step Group (-All-). The main area displays a table of steps:

Step No	Step Desc	Grip Seq	Seq	State	Document
1	Clear/check feed area of any obstructions	1	1	READY	
2	Enter roasting temp using the MES interface	1	2	NEW	
3	Once the roaster has reached the roast temp setpoint, start the roaster	2	3	NEW	
4	Record the nut temp after roasting process. Release roasted nuts to coater.	2	4	NEW	
5	If indicated by batch, clean the roaster	3	5	NEW	

Below the table, there are sections for Step Desc. (Clean/check feed area of any obstructions), Data Edit, Status (READY), Action (Normal), Start, Cert Name, Required for Step Completion (Finish), and Documents (Form Name). A red box highlights the Step Desc., Data Edit, and Status sections. At the bottom is a row of 12 buttons with icons: checkmark, X, people, green arrow, people, magnifying glass, right arrow, checkmark, right arrow, checkmark, right arrow, plus, and minus.

## Steps Tab Buttons

The following buttons are specific to the **Steps** tab. For information about the other buttons, see [Common Buttons](#).

Before using any of these buttons, select the step with which you want to work.

### Step Login



Logs the current operator into the step.

### Step Logout



Logs the current user off of the step. This does not complete the step.

### List Operators



Lists the users that are currently logged on to the step.

### View Documents



Displays the document that is attached to the step. If the step has no file attached, this button is not available.

### Step Action



Initiates the action that has been defined for the step.

### Step Complete



Changes the state of the step to Completed. All actions, if applicable, must be performed prior to marking the step as Complete.

#### Step Bypass



Skips the execution of the step and marks the step as Bypassed.

#### Authorize



Performs an authorization sign-off for a step that requires a certification audit.

#### Step Rework



Displays the Select Steps to Rework dialog box to allow you to select a completed step to be reworked. All completed steps for the current job are listed.

Select steps to Rework

Step No	Step Seq	Step Desc	Step Grp Desc	Step Grp Seq
1	1	Clean/check feed area of any obstructions	Setup	1
2	2	Enter roasting temp using the MES...	Setup	1
3	3	Once the roaster has reached the roast...	Roast	2

OK Cancel

If a step needs to be reworked, select the step and click **OK**. The original step is marked as Superseded and a copy of the step is added to the step grid. The new step will have a status of New.

#### Enter Event



Displays the Job Event dialog box, so that information about the job can be recorded. This dialog box allows a more granular description of issues related to a job.

The screenshot shows the 'Job Event' dialog box. At the top left, there is a header bar with the title 'Job Event'. Below the header, there is a table with three columns: 'Event Time', 'Event Type', and 'Done By'. The first row contains the values '10/20/2015 6:57:19 PM', 'Machine required extra cleaning', and 'rp/g.sam'. To the right of this table is a large form area with several input fields and a grid. The input fields include: 'Event Time' (10/20/2015 6:58:12 PM), 'Work Order' (WKO-20151020-01), 'Oper ID' (100-RST), 'Seq No' (0), 'Event Type' (Temperature was fluctuating), 'Lot No' (empty), 'Done By' (rp/g.sam), 'Checked By' (empty), and 'Comments' (empty). Below these fields is a grid with two columns: 'Value' and 'Value'. The 'Value' column contains nine rows labeled 'Value1' through 'Value9'. At the bottom right of the dialog box are two buttons: 'Save' and 'Cancel'.

For the **Event Type** box, you can enter an event type manually or select an event type that has already been entered from the list.

## Completing Steps

1. Select the step in the grid to be completed.
2. On the **Operator** list above the grid, select your user account.

3. Click the **Login to Step** button.

The status of the step changes to Running.

4. If a required action has been associated with the step, complete the action.

For more information, see [Additional Actions That Can Be Required by a Step](#).

5. After the step has been performed, click the **Step Accept/Complete** button.

The status of the step changes to Completed. The **Finish** time box is populated and all users are logged off of the step.

Depending on how the system is configured, the steps might be required to be completed in sequence. Steps can also be configured to allow them to be bypassed in the sequence.

## Additional Actions That Can Be Required by a Step

A step can require the user to add production, add consumption, enter data, Operator Acknowledge, or enter form data.

## Adding Production

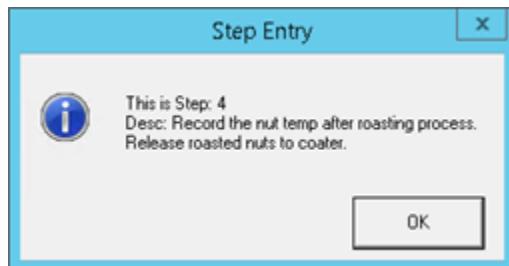
If a step has an action of Add Production, the Enter Production dialog box appears when you first log into the step or if you click the **Step Execute Action** button. Good and Rejected quantities can be added on this dialog box just as they are when adding production from the **Production** tab. See [Entering Production Counts](#).

## Adding Consumption

If a step has an action of Add Consumption, the Enter Step Consumption dialog box appears when you first log into the step or if you click the **Step Execute Action** button. Consumption quantities can be added on this dialog box just as they are when adding consumption from the **BOM** tab. See [Adding Consumption of a BOM Item](#).

## Acknowledging Step Information Before Executing the Step

If a step has the action of Operator Acknowledge, a dialog box appears when you first log into the step. The dialog box will show the step number and the step description.



## Logging Data

If a step has an action of Log Data, the DataLog dialog box appears when you click the **Step Execute Action** button. Data about the job can be added on this dialog box just as they are when logging data from the **Data Log** tab. See [Data Log Tab](#).

## Entering Form Data

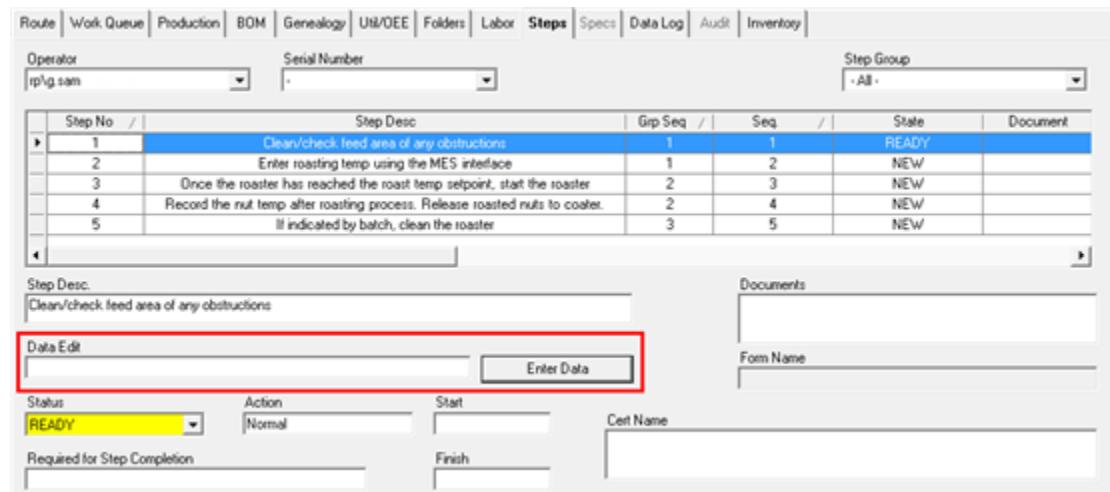
If a step has the action of Enter Form Data, a predefined form appears when you first log into the step or if you click the **Step Execute Action** button. You have to complete the form before completing the step. The form is defined in MES Client when the step is configured.

# Entering SPC Data

If a step has the action of Enter SPC Data, a dialog box appears when you first log into the step or if you click the **Step Execute Action** button. You have to enter the SPC (Statistical Process Control) data before completing the step.

# Entering Required Data

If you have to enter data for the step, the **Data Edit** box and **Enter Data** button will be available below the steps grid. For example, if the step is to record the operating temperature of an oven for the current operation, you might use this feature to enter it.

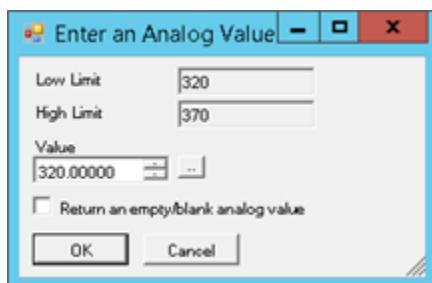


## To enter required data

1. Click the **Enter Data** button.

The Enter dialog box appears.

The entry format of the dialog box depends on the data entry format that has been configured for the step. Data entry for an analog value is shown below.



2. Enter or select the required data and click **OK**.

The data value appears in the **Data Edit** box.

## Changing a Step's Status from the Status List

If a step is in a status other than New, you can change its status from the **Status** list below the steps grid. The available statuses that the step can be changed to depend on its current status.

## Specs Tab

A specification provides guidelines for a measurement or setting that will be needed during a job. A specification can include minimum, maximum, and set point (standard or typical) values, as well as files and instructions. The actual value for this measurement or setting is recorded once for the job; it is used either at one point during the job or lasts throughout the job. (Values that vary throughout the job are recorded using the **Data Log** tab; see [Data Log Tab](#).) Specifications can also be assigned to a particular step within a job.

The **Specs** tab shows the specifications assigned to the active job, but not assigned to any particular step. Using this tab, you can consult the minimum, maximum, and set point values, as well as any attached files or comments/instructions. You enter actual values for the active job in the **Current Value** column. With the appropriate user privileges, you can also change the specification guidelines, for this job only or for all subsequent jobs.

Spec Group	Description	Value	Current Value	Minimum value	Maximum value	Access Level	Variance
Roaster Specs	RoastTemp	350	340	320	370	0	-10
	RoastTime	480	450	450	500	0	-480

## Data Area

The data area includes the:

- **Spec Group** pane
- Specs grid

## Spec Group Pane

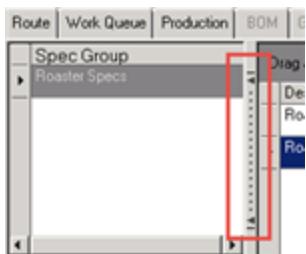
The **Spec Group** pane lists all specification groups that have been assigned to the active job, but not to a particular step.

Select a specification group to show its specifications in the specs grid.

The **Spec Group** pane can be hidden, to give the specifications more room in the window.

### To hide or show the Spec Group pane

- Click the pane's hide/show bar, highlighted in the following figure.



## Specs Grid

The specs grid shows the detailed information for all specifications in the selected group, using one row for each specification.

Note that not all columns in the pane are shown by default. For information about how to show and hide columns in the grid, see [Specifying What Columns and Rows Are Displayed](#).

The **Current Value** and **New Comments** fields are the only specification values that you can enter or change without special user privileges.

### Specs Tab Buttons

The following topics describe tasks related to the buttons that are specific to the **Specs** tab. For information about the other buttons, see [Common Buttons](#).

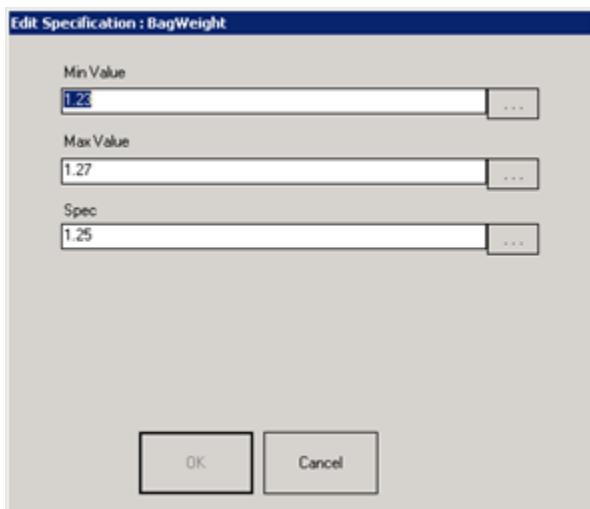
### Viewing and Editing Specs

If you have the *May Edit Specification Value* user privilege, you can change the selected specification's minimum, maximum, and set point values.



1. Click the **Edit Specs** button.

The Edit Specification dialog box appears.



2. Change the specs as needed.

**Min Value**

Defines the lower limit of the actual value that may be recorded for the selected specification.

**Max Value**

Defines the upper limit of the actual value that may be recorded for the selected specification.

**Spec**

Defines the set point, or standard value, for the selected specification.

3. When you are finished changing the specs, click **OK**.

### Updating Template Spec Values

You can copy all specification guidelines (minimum, maximum, and set point values) that are assigned to the active job back to the operation's definition, so that the changes made here can be used by subsequent jobs.



- Click the **Update Template Spec Values** button.

The **Update Template Spec Values** button is not included in the tab's toolbar by default. It, along with several of the general buttons, can be added to the **Specs** tab toolbar using the toolbar Configure option; see [Configuring a Tab's Toolbar Buttons](#).

### Audit Tab

The **Audit** tab displays all certifications required for a job to be completed. This tab also allows a user to sign off these certifications and enter comments for each.

	Certification	Level	Audited By	Date Audited	Comments
1	Inspection	1			

### Audit Tab Buttons

The following button is specific to the **Audit** tab. For information about the other buttons, see [Common Buttons](#).

**Certification Signoff Button**



Launches the Certification Login dialog box. This dialog box allows a user with the appropriate certification levels to sign off and add comments to the selected certification.

## Data Log Tab

The **Data Log** tab allows you to record information about the current job that is being run on this entity. The data log categories that are available on the tab are configured in MES Supervisor.

The data collected is typically not a value that is specified prior to running the job.

The screenshot shows the AVEVA Manufacturing Execution System (MES) interface with the 'Data Log' tab selected. At the top, there is a navigation bar with tabs: Route, Work Queue, Production, BOM, Genealogy, Util/OEE, Folders, Labor, Steps, Specs, Data Log (which is highlighted in blue), Audit, and Inventory. Below the navigation bar, there is a search bar labeled 'Oven Monitoring'. Underneath the search bar is a table with the following data:

Group Description	Sample Time	WO ID	Item	Temperature
Oven Monitoring	10/20/2015 8:50:12 PM	WO-20151020-03	Bag of Mixed Nut - BBQ	336
Oven Monitoring	10/20/2015 8:50:28 PM	WO-20151020-03	Bag of Mixed Nut - BBQ	328

Below the table is a row of nine buttons, each with a small icon:

- Green checkmark icon
- Blue checkmark icon
- Green circular arrow icon
- Red X icon
- Blue question mark icon
- Yellow exclamation mark icon
- Earth icon
- Scissors icon
- People icon

## Data Log Buttons

The following buttons are specific to the **Data Log** tab. For information about the other buttons, see [Common Buttons](#).

### New Row Button



Adds a data log record to the grid with blank data values. Before clicking this button, select the data log group to which you want to add the record from the list above the data log grid.

### Save Data Button



Saves all entered data.

### Delete Row Button

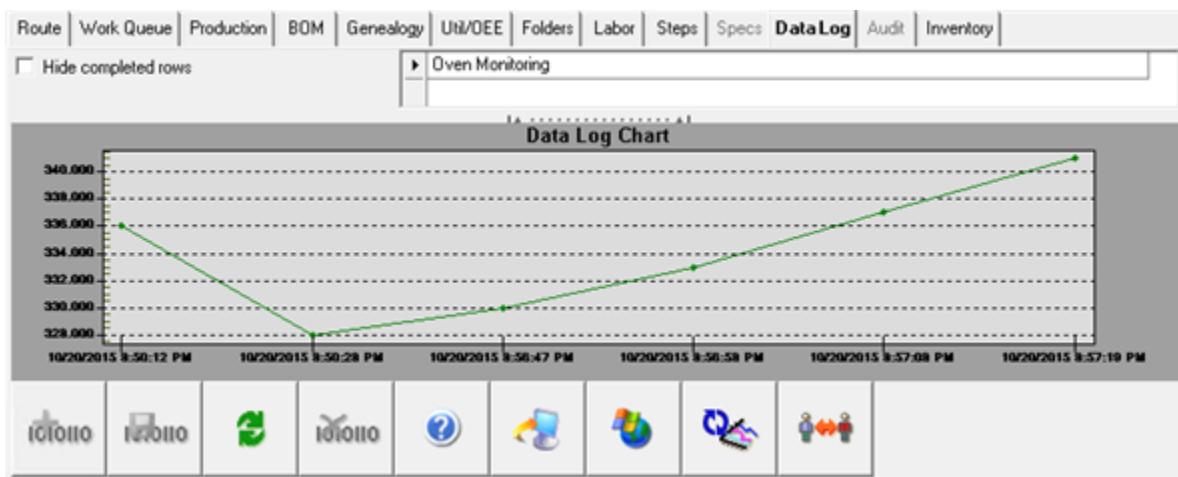


Deletes the selected row from the grid.

### Toggle Chart Button



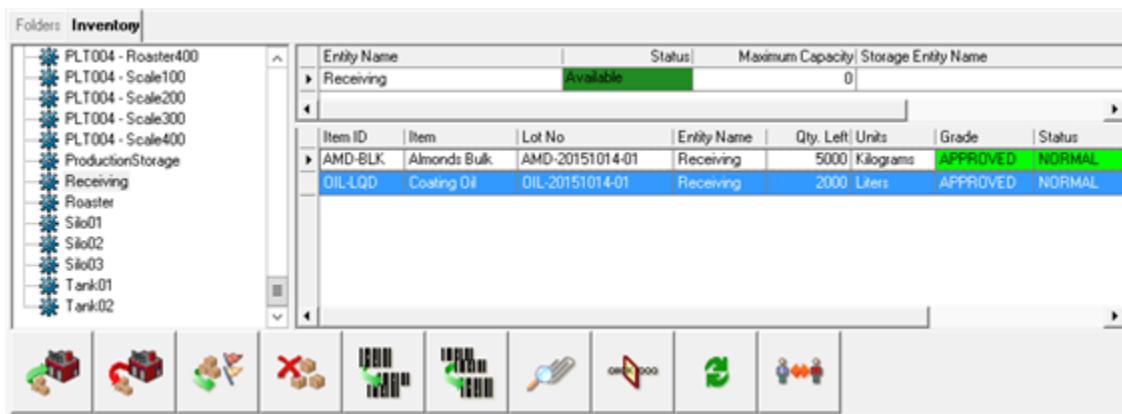
Changes the grid display to the chart display. The chart displays all of the data points of the currently selected data log group.



## Inventory Tab

The **Inventory** tab displays the current inventory status of the selected entity. This tab allows you to:

- Filter the lot records that are listed in the grid.
- Transfer in, transfer out, and reclassify inventory for the selected location entity.
- Split inventory out to another lot.
- Combine items from different inventory records into one lot.
- Manage lot attributes for an inventory record.



## Inventory Tab Buttons

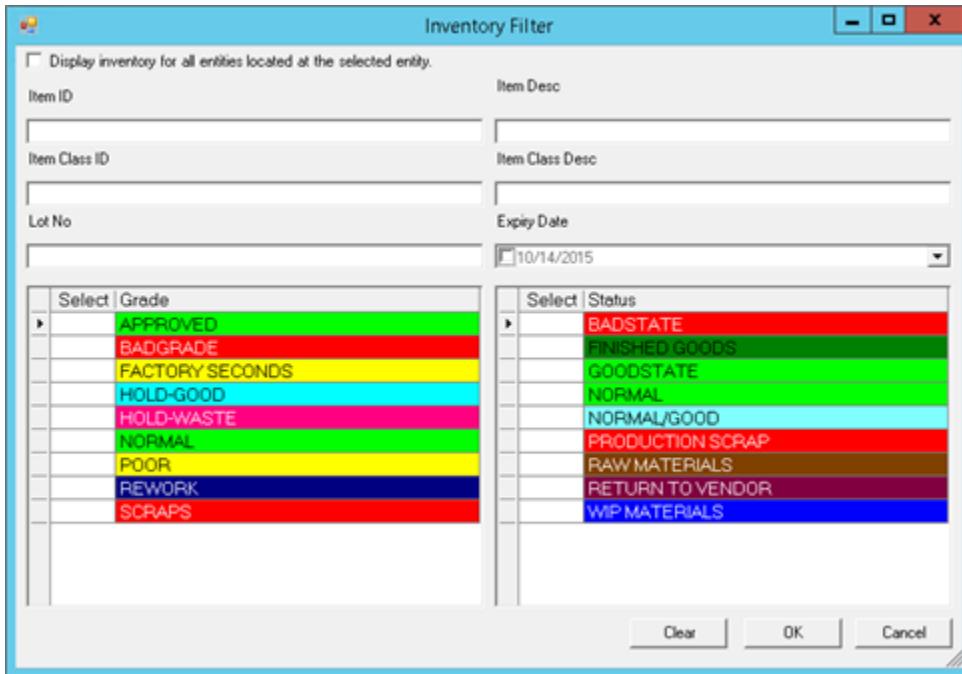
The following topics describe tasks related to the buttons that are specific to the **Inventory** tab. For information about the other buttons, see [Common Buttons](#).

## Filtering the Lot Records in the Grid

You can filter the lot records that appear in the **Inventory** tab's grid.

1. Select the location entity whose inventory records you want to appear in the grid.
2. Click the  **Filter** button.

The Inventory Filter dialog box appears.



3. Enter the filter criteria, which is described below.

You can use the wildcard character % in any of the filter text boxes.

To clear the entered filter criteria at any time, click **Clear**.

### Display inventory for all entities located at the selected entity

Select this option to include the inventory for all of the child entities of the current location entity. If this option is cleared, only the inventory of the current location entity will appear in the grid.

#### Item ID

Enter item ID criteria by which to filter the inventory records.

#### Item Desc

Enter item description criteria by which to filter the inventory records.

#### Item Class ID

Enter item class ID criteria by which to filter the inventory records.

#### Item Class Desc

Enter item class description criteria by which to filter the inventory records.

#### Lot No

Enter lot number criteria by which to filter the inventory records.

#### Expiry Date

Select the expiry dates by which to filter the inventory records.

#### Grade

Select the inventory grades by which to filter the inventory records.

#### Status

Select the inventory statuses by which to filter the inventory records.

- When you are finished entering the filter criteria, click **OK**.

Only the inventory records that match the entered filter criteria appear in the grid.

## Receiving Inventory from Another Location Entity

- In the entity list to the left of the grid, select the location entity to which you want to transfer inventory.

- Click the  **Transfer Item In** button.

The Transfer In dialog box appears.



- Optionally, select the **Current Job Items** option to filter the lots that will be listed on the dialog box to those for the current job running on the source entity.
- Complete the settings on the dialog box to specify the source entity and inventory information for the transfer.

#### Received From

The entity from which the inventory will be transferred.

#### Item

Description of the item to be transferred.

#### Item ID

Unique identifier of the item to be transferred.

#### Move Qty

The amount of the item to transfer.

- When you have finished specifying the source entity and inventory information, click **OK**.

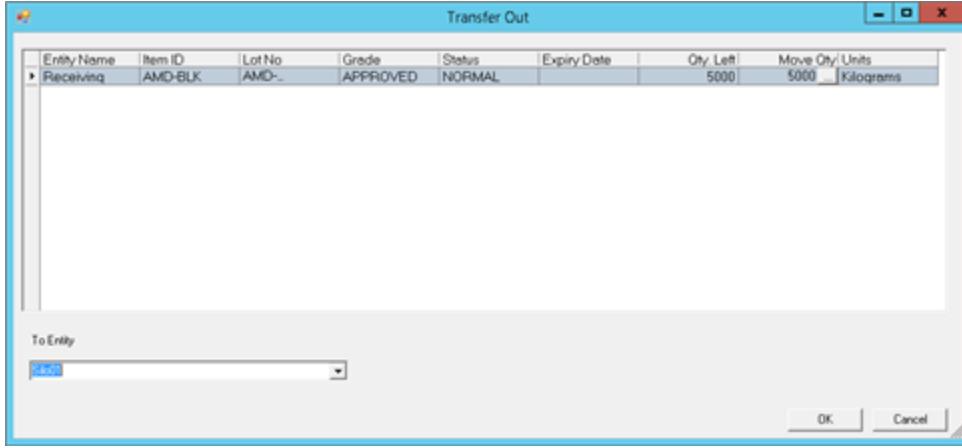
## Context Menu Commands

Right-clicking on the dialog box causes a context menu with the **Options** command to appear. Click this menu option to show or hide the filter options at the top of the dialog box

## Transferring Inventory to Another Location Entity

1. In the entity list to the left of the grid, select the location entity from which you want to transfer inventory.
2. Select one or more inventory records whose inventories you want to transfer.
3. Click the  **Transfer Item Out** button.

The Transfer Out dialog box appears.



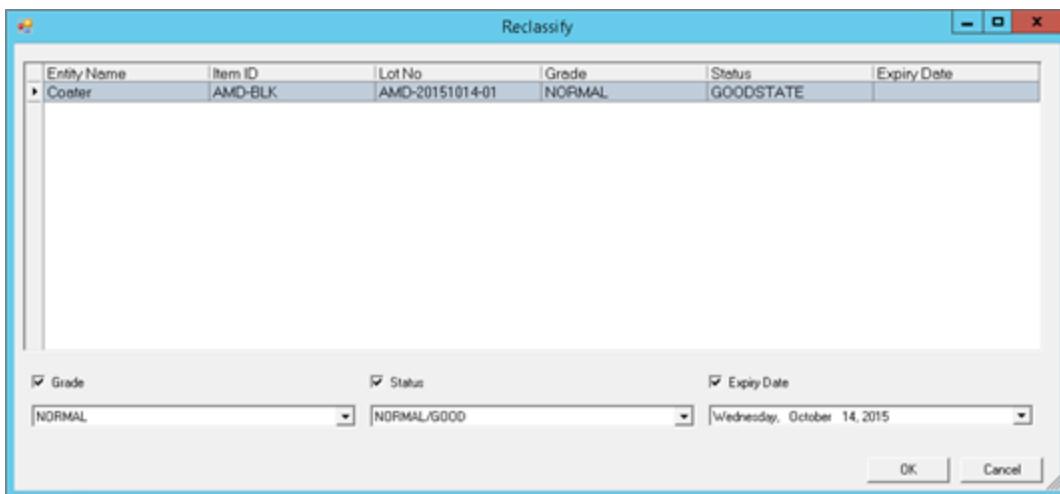
4. In the **Move Qty** box of each inventory record, enter the amount of inventory to be transferred.
5. On the **To Entity** list, select the entity to which the inventory will be transferred.
6. When you have finished specifying the inventory amounts and target entity, click **OK**.

## Reclassifying Inventory Grade, Status, and Expiry Date

You can change the grade, status, and expiry date for items of a lot.

1. In the entity list to the left of the grid, select the location entity whose inventory you want to reclassify.
2. In the grid, select one or more inventory records whose inventory you want to reclassify.
3. Click the  **Reclassify** button.

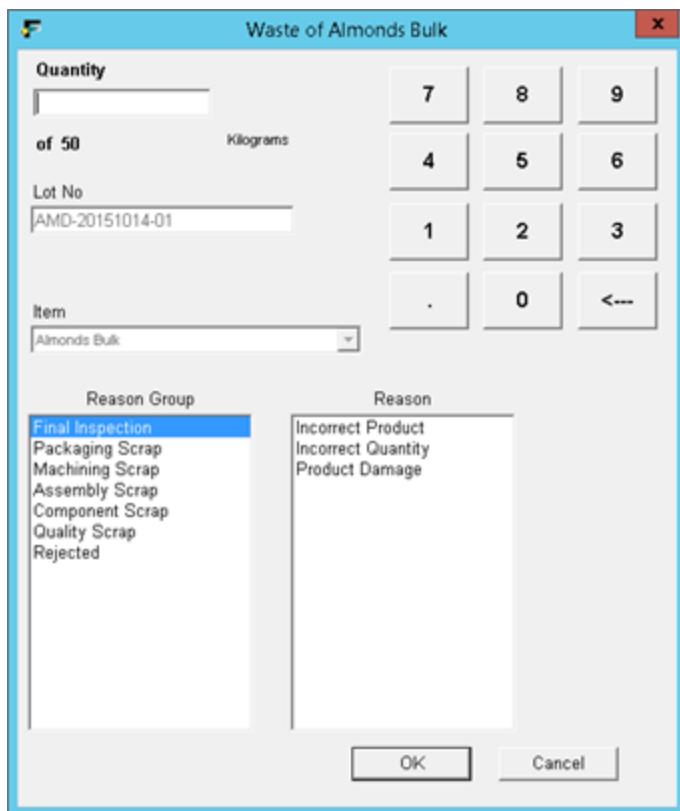
The Reclassify dialog box appears. The selected inventory records are listed.



4. To reclassify one or more of the three classification parameters for the inventory listed—grade, status, or expiry date—at the bottom of the dialog box, select the parameter's check box and select the new setting from the list.
5. When you are finished reclassifying the inventory, click **OK**.

### Scraping Inventory

1. In the entity list to the left of the grid, select the location entity whose inventory you want to scrap.
2. In the grid, select the inventory record that includes inventory that you want to scrap.
3. Click the  **Scrap** button.  
The Waste dialog box appears.



4. Complete the item scrapping information, as described below.

#### Quantity

The amount of the item to be scrapped.

#### Reason Group and Reason

Select the reason group and then the reason for why the item is being scrapped.

5. When you are finished entering the information, click **OK**.

The scrapped items will be recorded as consumed items in the MES database but will not be shown in the **Inventory** tab.

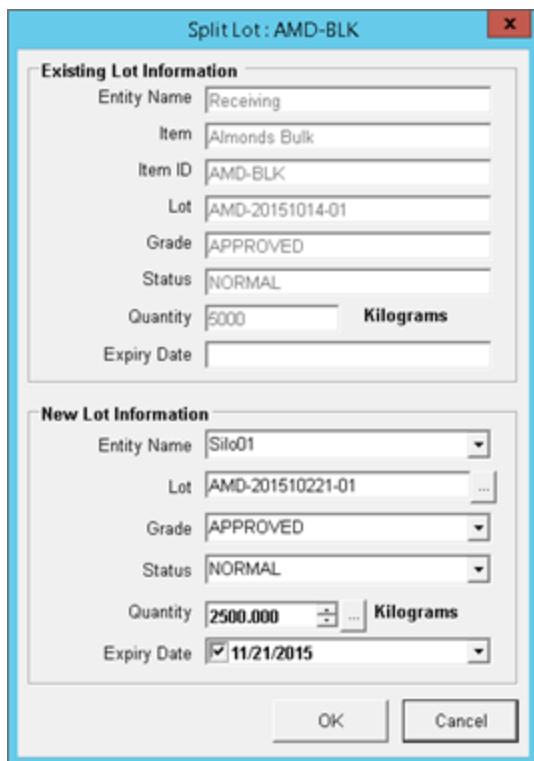
### Splitting Items Out from One Lot to Another Lot

You can split items from one lot to another lot.

1. In the entity list to the left of the grid, select the location entity whose inventory you want to split out.
2. In the grid, select the inventory record that includes inventory that you want to split out.

3. Click the  **Split Items** button.

The Split Lot dialog box appears.



4. Complete the new lot information, as described below.

**Entity Name**

The name of the entity where the new lot is stored.

**Lot**

The lot number of the lot to which the inventory is being split out.

**Grade**

The grade for the inventory that is being split out.

**Status**

The status of the inventory that is being split out.

**Quantity**

The amount of the item to be split out to the other lot.

**Expiry Date**

The expiry date for the inventory being split out.

5. When you are finished entering the information, click **OK**.

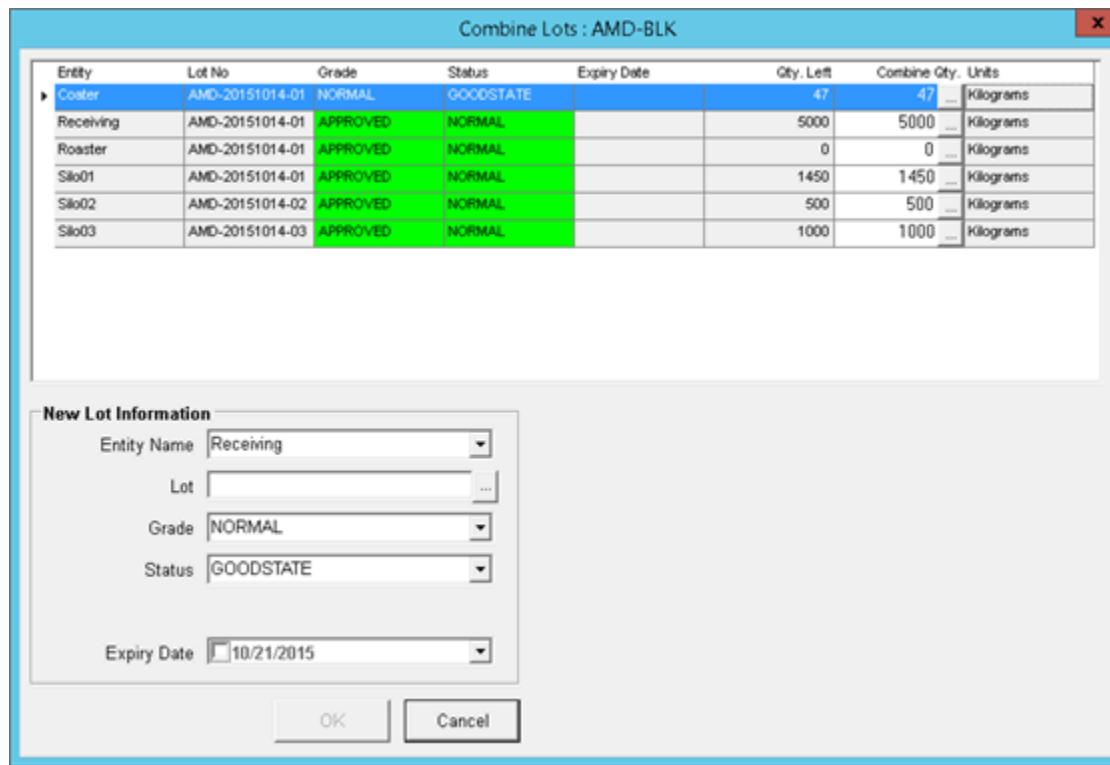
### Combining Items from Multiple Lots into a Single Lot

You can combine items from multiple lots into a single lot.

1. In the entity list to the left of the grid, select the location entity whose items you want to combine into a single lot.
2. In the grid, select any inventory record that includes the item whose inventory you want to combine.

3. Click the  **Combine Items** button.

The Combine Lots dialog box appears. Inventory records for the item are listed.



The screenshot shows the 'Combine Lots' dialog box for item 'AMD-BLK'. The main table lists inventory records with columns: Entity, Lot No, Grade, Status, Expiry Date, Qty. Left, Combine Qty., and Units. The 'Combine Qty.' column is highlighted in blue. The 'Units' column shows 'Kilograms' for all rows. The 'New Lot Information' section contains fields for Entity Name (Receiving), Lot (empty), Grade (NORMAL), Status (GOODSTATE), and Expiry Date (10/21/2015). Buttons at the bottom are 'OK' and 'Cancel'.

Entity	Lot No	Grade	Status	Expiry Date	Qty. Left	Combine Qty.	Units
Coaster	AMD-20151014-01	NORMAL	GOODSTATE		47	47	Kilograms
Receiving	AMD-20151014-01	APPROVED	NORMAL		5000	5000	Kilograms
Roaster	AMD-20151014-01	APPROVED	NORMAL		0	0	Kilograms
Silo01	AMD-20151014-01	APPROVED	NORMAL		1450	1450	Kilograms
Silo02	AMD-20151014-02	APPROVED	NORMAL		500	500	Kilograms
Silo03	AMD-20151014-03	APPROVED	NORMAL		1000	1000	Kilograms

4. For each record that includes inventory that you want to combine into another lot, in the **Combine Qty** box enter the item quantity to be combined into the other lot.
5. Complete the new lot information for the inventory being combined into the other lot, as described below.

#### **Entity Name**

The name of the entity where the target lot is stored.

#### **Lot**

The lot number of the lot to which the inventory is being combined.

#### **Grade**

The grade for the inventory that is being combined.

#### **Status**

The status of the inventory that is being combined.

#### **Expiry Date**

The expiry date for the inventory being combined.

6. When you are finished entering the information, click **OK**.

## **Managing Lot Attributes**

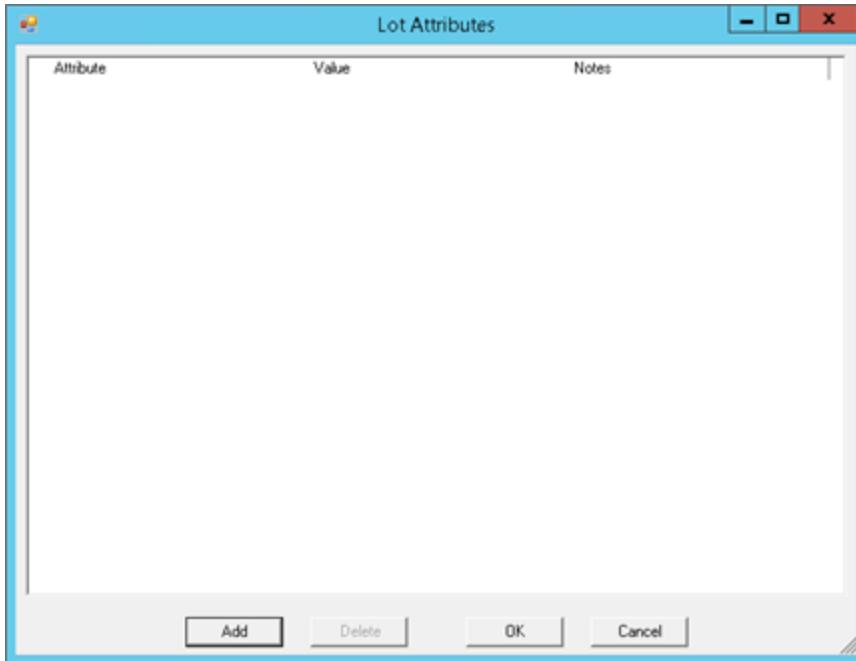
You can add attributes to a lot. You can also modify or delete a lot's attributes.

## To add attributes to a lot

1. In the entity list to the left of the grid, select the location entity that stores the lot to which you want to add attributes.
2. In the grid, select the inventory whose lot attributes you want to add.

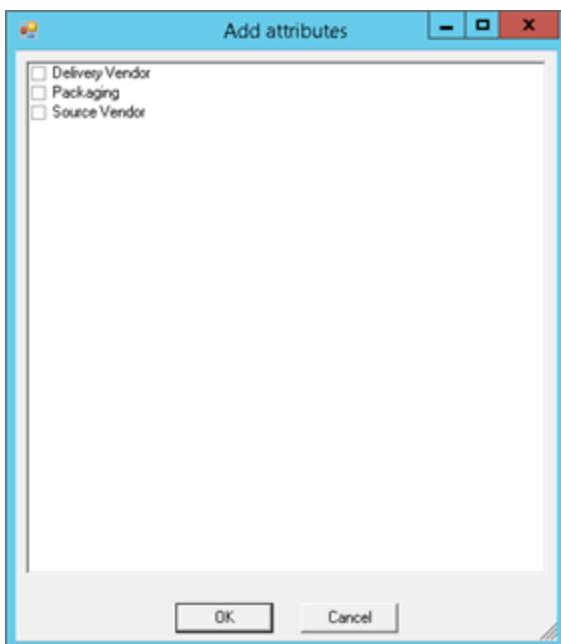
3. Click the  **Lot Attributes** button.

The Lot Attributes dialog box appears.



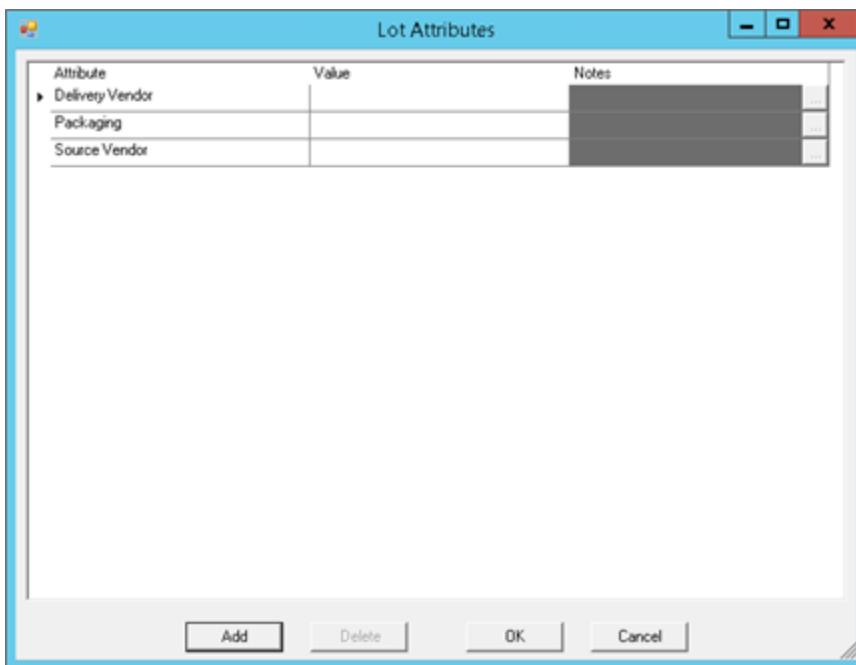
4. Click the Add button.

The Add Attributes dialog box appears. Attributes that are available to be added are listed.



5. Select the attributes to add, then click **OK**.

The attributes are listed in the Lot Attributes dialog box.



6. For each attribute that was added, enter the attribute value and, optionally, a note about the attribute.
7. When you are finished, click **OK**.

#### To modify or delete an attribute

1. Open the Lot Attributes dialog box for a lot, as described in the Add procedure above.
2. Do either of the following:
  - Modify the name or value of the attribute.
  - To delete an attribute, select it and click **Delete**.
3. When you are finished, click **OK**.

## Producing Serialized Items

Serialization is the process of assigning specific serial numbers to individual produced items.

Serial numbers are associated with an item in the production process using the lots functionality. That is, each serial number is essentially stored as a lot number in the system. This means that the serial-numbered lot will contain only one item.

Serial numbers are typically added to a work order prior to the work order being run. Once the work order is running, the serial numbers can be assigned to produced items as their production is recorded. Serialized items can be moved automatically or manually to downstream entities in the process. Serialized items can also be moved to storage entities for insertion at a later stage back into the production process or to the final storage location for the items when their production is complete.

Serial numbers can either be used only for a specific work order (hard-pegged) or they can be exchanged between work orders as per the flow of the manufacturing process (soft-pegged).

To manage and track a serialized manufacturing process, users must have privileges to create and edit:

- Entities
- Item classes or items
- Processes
- Work orders and jobs

To set up support for item serialization, you use MES Client to:

- Configure entities in the manufacturing process at which items can be serialized and stored.
- Configure auto-transfer operations to move the serialized items through the production process.
- An auto-transfer operation automatically transfers produced serialized items to the next entity in the routing based on an assumption that the storage capability of the entity is enabled.
- Configure item classes, items, BOMs, processes, operations, and work orders to define the type of serialization for your manufacturing environment and how it is processed on the plant floor.

Once serialization is configured, operators can use client applications such as MES Operator to execute the production process using work orders and operations to carry out the serialization of produced items.

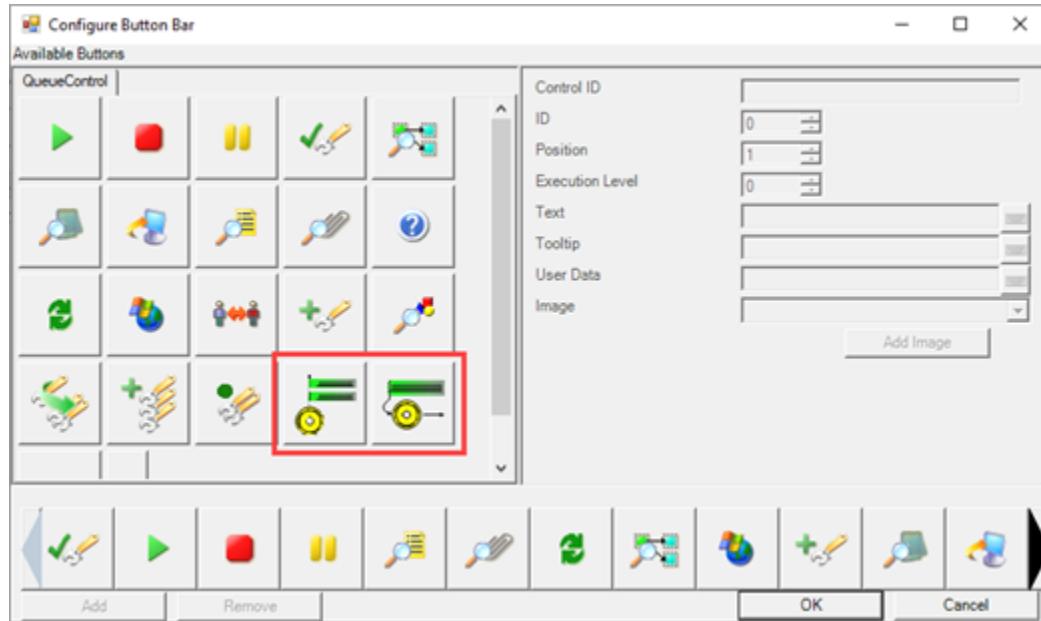
## Adding the Serialization Buttons to the Work Queue and Production Tabs

The serialization Add and Transfer buttons are available on the **Work Queue** and **Production** tab toolbar. By default, these buttons are not included on those tabs.

### To add a serialization button to the toolbar

1. Right-click the tab's toolbar area and click **Configure**.

The Configure Button Bar dialog appears. The serialization Add and Transfer buttons are highlighted below.



2. For both serialization buttons, select the button and then click **Add**.

3. Click **OK**.

The buttons are added to the tab's toolbar.

4. To save the tab's toolbar configuration with the serialization buttons added, right-click in the tab area and in the context menu click one of the **Save Configuration** options.

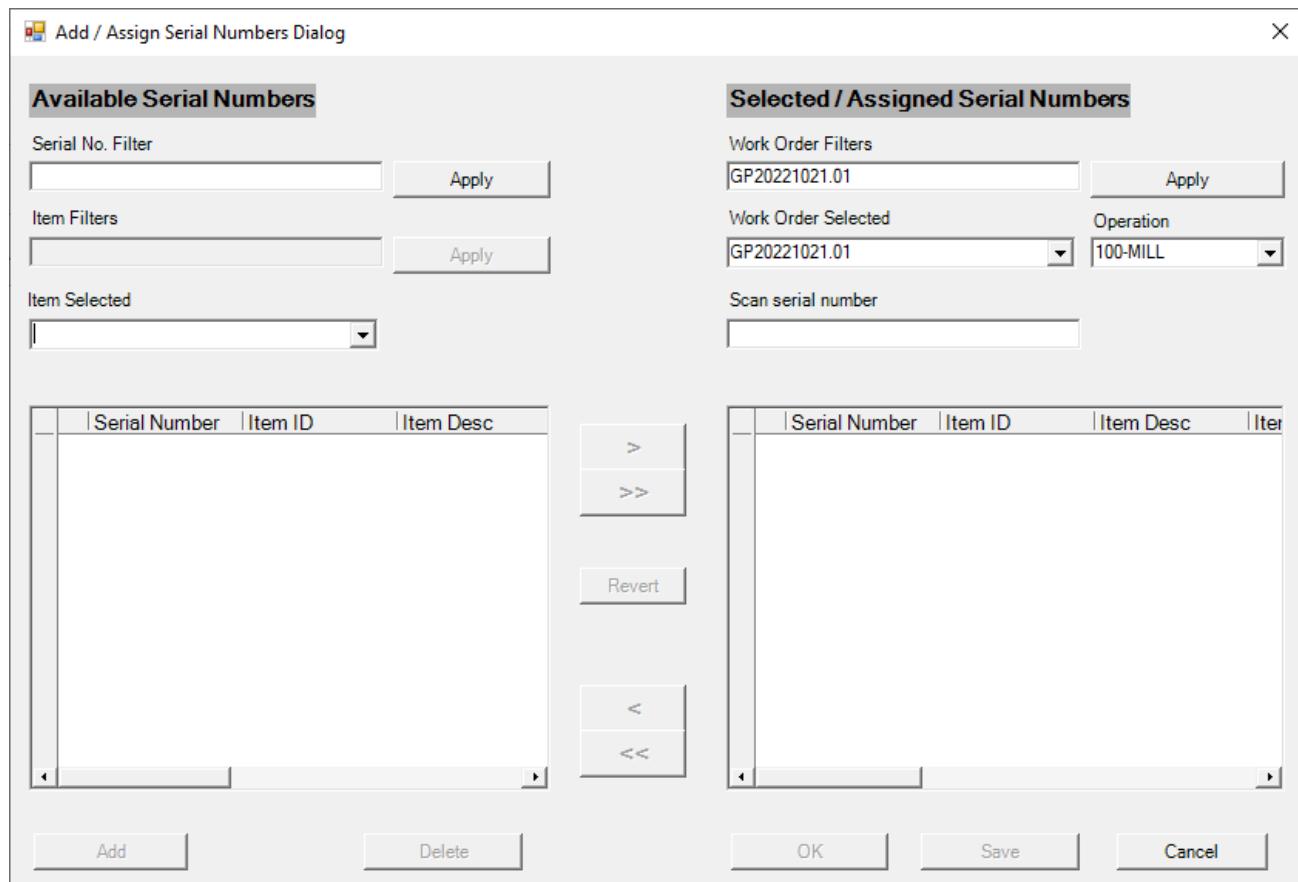
For more information about adding buttons to a tab's toolbar, see [Configuring a Tab's Toolbar Buttons](#).

## Adding Serial Numbers to a Work Order and Operation

1. In MES Operator, open an entity that has at least one job assigned to it with both of the following conditions:
  - The job is for a work order that is producing serialized items.
  - The job is not Complete or Canceled.
2. On the **Work Queue** tab or on the **Production** tab if a job in the work order is running on the entity, click the **Add/Assign SNo's** button.



The Add/Assign Serial Numbers dialog appears.



The screenshot shows the 'Add / Assign Serial Numbers Dialog' window. It has two main sections: 'Available Serial Numbers' on the left and 'Selected / Assigned Serial Numbers' on the right.

**Available Serial Numbers:** Contains fields for 'Serial No. Filter' (with an 'Apply' button), 'Item Filters' (with an 'Apply' button), and 'Item Selected' (a dropdown menu). Below these are two tables:

	Serial Number	Item ID	Item Desc

**Selected / Assigned Serial Numbers:** Contains fields for 'Work Order Filters' (set to 'GP20221021.01' with an 'Apply' button), 'Work Order Selected' (set to 'GP20221021.01'), 'Operation' (set to '100-MILL'), and 'Scan serial number' (an input field). Below these are two tables:

	Serial Number	Item ID	Item Desc

Between the two tables are several buttons: '>', '>>', 'Revert', '<', and '<<'. At the bottom of the dialog are four buttons: 'Add', 'Delete', 'OK', 'Save', and 'Cancel'.

The work order and the operation that is related to the current entity is entered by default in the **Selected/Assigned Serial Numbers** section of the dialog.

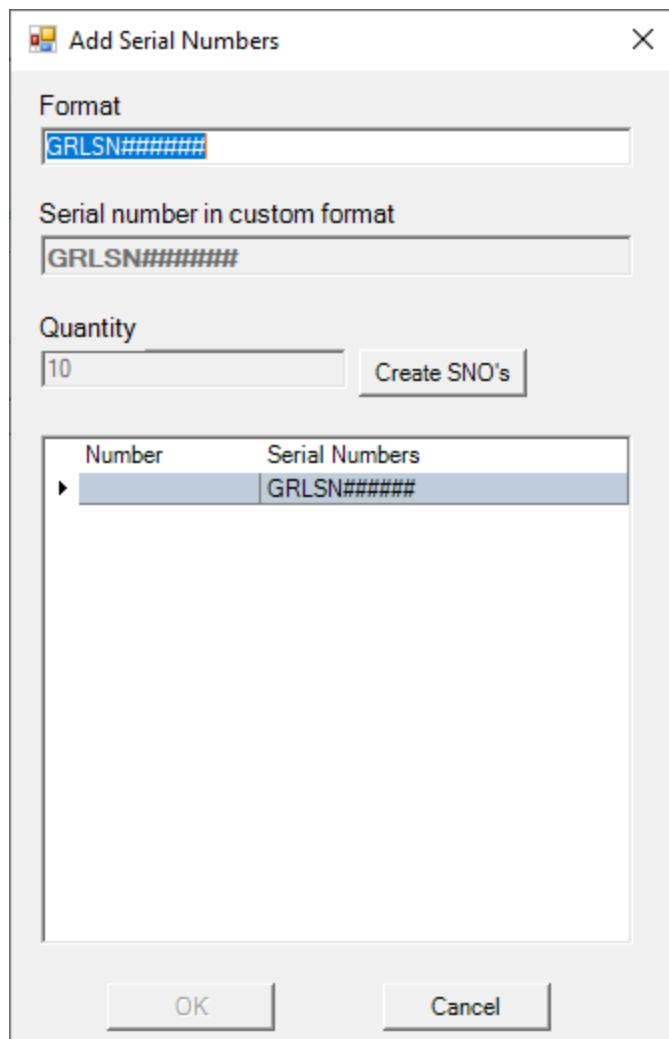
The dialog box has a title bar 'Selected / Assigned Serial Numbers'. Under 'Work Order Filters', there is a text input field containing 'GP20221021.01' and a 'Apply' button. Below that, 'Work Order Selected' shows 'GP20221021.01' and 'Operation' shows '100-MILL'. There is also a 'Scan serial number' field with a placeholder 'Scan serial number' and a large empty text area below it. At the bottom, there is a table header with columns: Serial Number, Item ID, Item Desc, and Iter.

**Note:** The **Scan serial number** field is currently not supported.

3. Select the work order and operation to which to assign the serial numbers. This will typically be the first operation in the process route at which the serialized item will be processed.
  - If you opened the Add/Assign Serial Numbers dialog from the **Work Queue** tab, you can select only the operation. The work order will default to that of the job that was selected before you opened the Add/Assign Serial Numbers dialog and cannot be changed. This behavior assumes that you are adding new serial numbers to begin the work order and so does not allow you to pull them from another work order.
  - If you opened the Add/Assign Serial Numbers dialog from the **Production** tab, you can select the work order and operation. This behavior assumes that, when producing serialized items, you might want to pull serial numbers from other work orders that have not been hard-peged.
  - If you leave the **Operation** field blank, the serial number will be assigned to the work order and not a specific operation in it. You can do this to reserve a set of serial numbers for use with only the selected work order. However, to make these serial numbers available for assignment to an item being produced, you will have to unassign them from the work order. You can then assign them to the first operation in the work order that will produce the serialized item.
  - You can enter a complete work order ID in the **Work Order Filters** field and click **Apply** to filter the **Work Order Selected** list. Note that partial entries (for a "contains" filter) and wildcard characters are not supported. To clear the filter entry, delete it and click **Apply**.
4. Select the item to be serialized in the **Item Selected** list.
5. Click the **Add** button.

If there are already enough serial numbers to cover the amount needed for the currently selected work order, you are prompted whether you want to create more.

Otherwise, the Add Serial Numbers dialog appears.

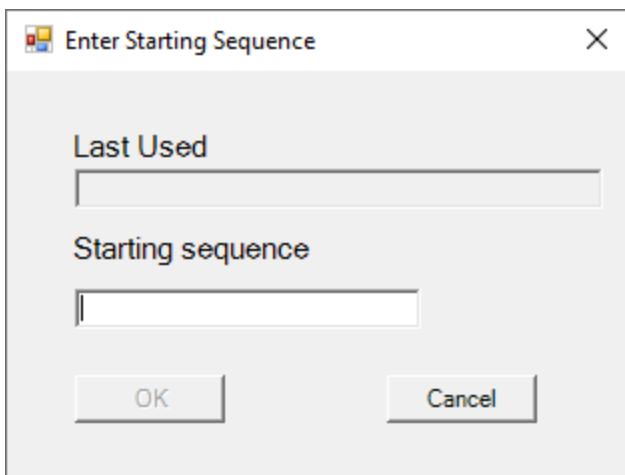


The number of serial numbers to be added is shown in the **Quantity** field. It equals the number of serial numbers that are required to cover the quantity needed for the job.

6. (Optional) To change the serial number format from the default, enter the new format in the **Format** field. Remember to use the # character to represent the sequence number in the format.
7. Click the **Create SNO's** button.

If additional serial numbers are not needed to cover the quantity needed for the job, you are prompted to enter how many to add.

Otherwise, the Enter Starting Sequence dialog appears. The **Last Used** field shows the most recent serial number that was created so you can see where the sequence left off.

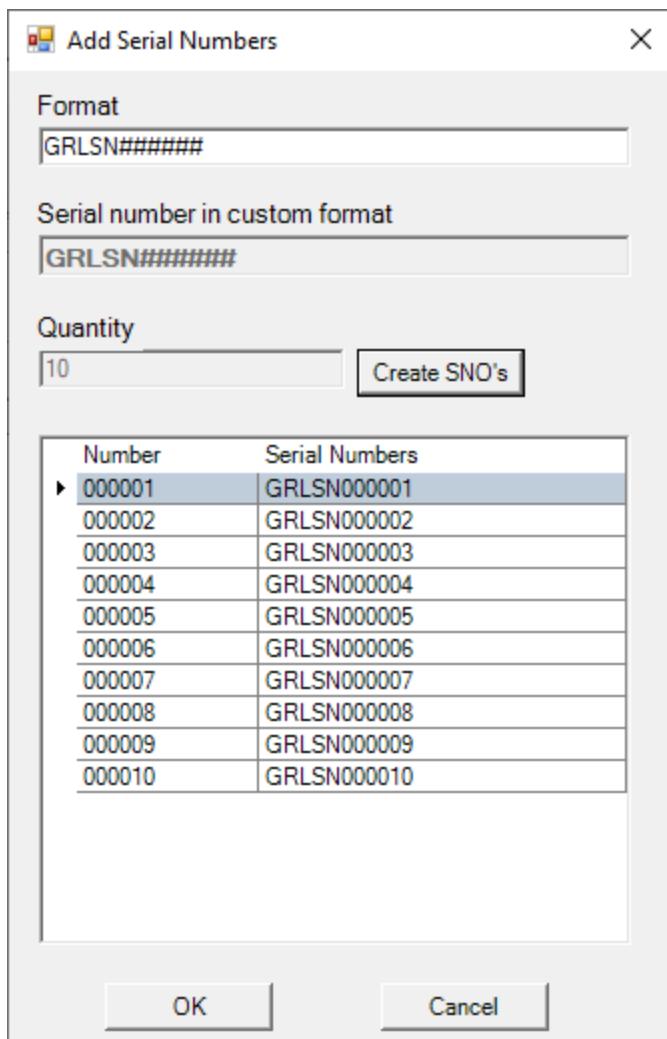


8. In the **Starting Sequence** field, enter the integer number at which to start the series for this set of serial numbers.

You do not have to enter the preceding zeros in the serial number. For example, if you want the next sequence to start at **GP000025**, you can enter **25**.

9. Click **OK**.

The serial numbers to be created appear in the Add Serial Numbers dialog.



10. Click **OK**.

The new set of generated serial numbers appears in the grid in the **Available Serial Numbers** section of the Add/Assign Serial Numbers dialog.

**Add / Assign Serial Numbers Dialog**

Available Serial Numbers			Selected / Assigned Serial Numbers																																									
Serial No. Filter <input type="text"/> <input type="button" value="Apply"/> Item Filters <input type="text"/> <input type="button" value="Apply"/> Item Selected <input type="button" value="GRL-PLT (Plated grills)"/>			Work Order Filters <input type="text" value="GP20221021.01"/> <input type="button" value="Apply"/> Work Order Selected <input type="button" value="GP20221021.01"/> Operation <input type="button" value="100-MILL"/> Scan serial number <input type="text"/>																																									
<table border="1"> <thead> <tr> <th>Serial Number</th> <th>Item ID</th> <th>Item Desc</th> </tr> </thead> <tbody> <tr><td><input type="checkbox"/> GRLSN000001</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000002</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000003</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000004</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000005</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000006</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000007</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000008</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000009</td><td>GRL-PLT</td><td>Plated grills</td></tr> <tr><td><input type="checkbox"/> GRLSN000010</td><td>GRL-PLT</td><td>Plated grills</td></tr> </tbody> </table>			Serial Number	Item ID	Item Desc	<input type="checkbox"/> GRLSN000001	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000002	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000003	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000004	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000005	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000006	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000007	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000008	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000009	GRL-PLT	Plated grills	<input type="checkbox"/> GRLSN000010	GRL-PLT	Plated grills	<table border="1"> <thead> <tr> <th>Serial Number</th> <th>Item ID</th> <th>Item Desc</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td></tr> </tbody> </table>			Serial Number	Item ID	Item Desc			
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<input type="button" value="Add"/> <input type="button" value="Delete"/>			<input type="button" value="OK"/> <input type="button" value="Save"/> <input type="button" value="Cancel"/>																																									

11. (Optional) To filter the list to a specific serial number, enter the complete serial number in the **Serial No. Filter** field and click **Apply**.

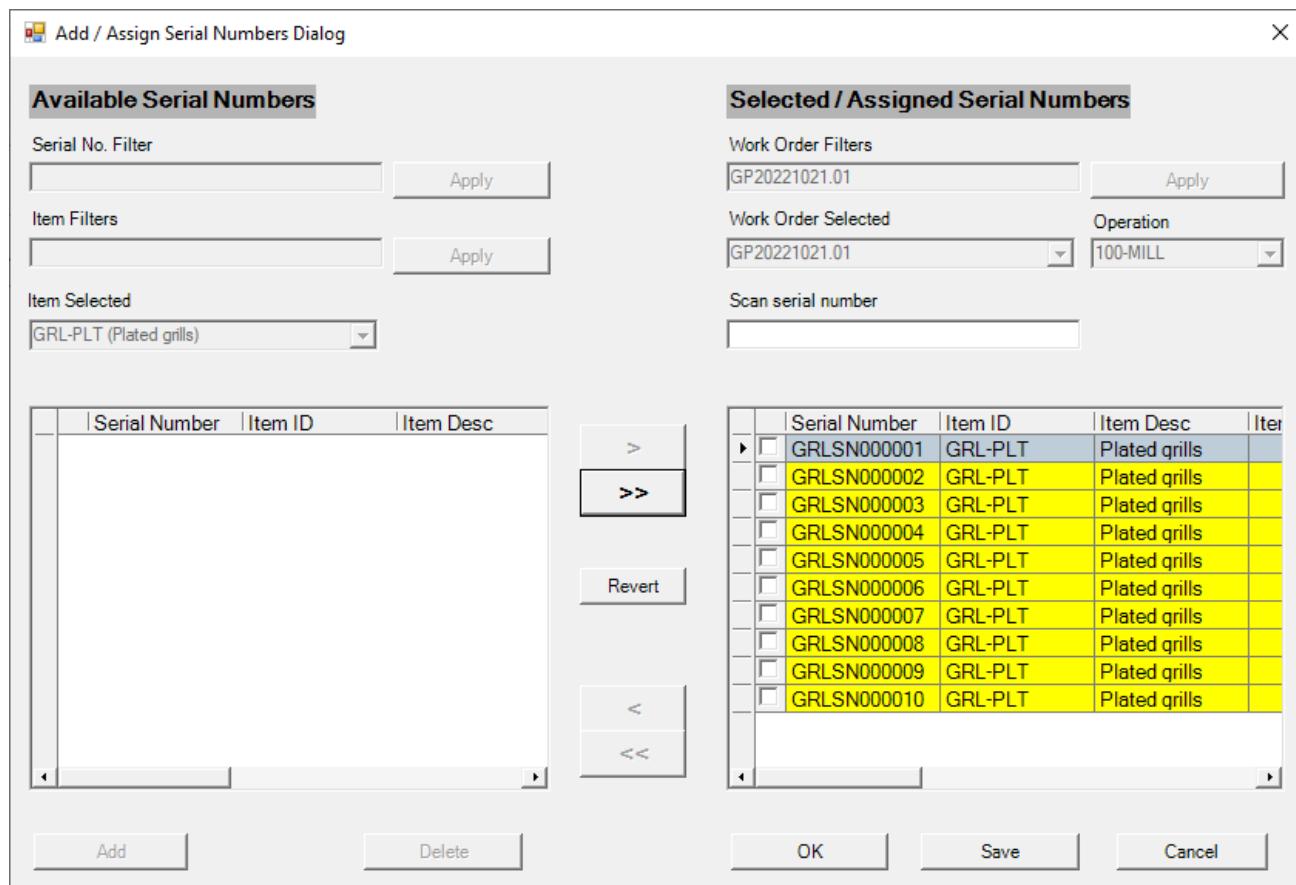
Note that partial entries (for a "contains" filter) and wildcard characters are not supported.

To clear the filter entry, delete it and click **Apply**.

12. To assign these serial numbers to the selected work order and, if one is selected, the operation, do one of the following:

- To assign specific serial numbers, select their check boxes in the grid and then click the > button.
- To assign all of the serial numbers, click the >> button.

The serial numbers are moved to the grid in the **Selected/Assigned Serial Numbers** section of the dialog. They are highlighted in yellow to indicate that their assignment to the work order has not been saved yet.



13. (Optional) Prior to saving the assignments, to unassign serial numbers and return them to the available pool of numbers, select their check boxes in the grid and then click the < button.
14. (Optional) To save the current assignment state of the serial numbers but leave the dialog open to add more or change the assignments, click **Save**.

The serial numbers that have been assigned, or unassigned, are no longer highlighted in yellow, indicating that their current state has been saved.

**Available Serial Numbers**

Serial No. Filter  Apply

Item Filters  Apply

Item Selected: GRL-PLT (Plated grills)

Serial Number	Item ID	Item Desc
GRLSN000001	GRL-PLT	Plated grills
GRLSN000002	GRL-PLT	Plated grills
GRLSN000003	GRL-PLT	Plated grills
GRLSN000004	GRL-PLT	Plated grills
GRLSN000005	GRL-PLT	Plated grills
GRLSN000006	GRL-PLT	Plated grills
GRLSN000007	GRL-PLT	Plated grills
GRLSN000008	GRL-PLT	Plated grills
GRLSN000009	GRL-PLT	Plated grills
GRLSN000010	GRL-PLT	Plated grills

**Selected / Assigned Serial Numbers**

Work Order Filters: GP20221021.01 Apply

Work Order Selected: GP20221021.01 Operation: 100-MILL

Scan serial number:

> >> Revert < <<

Add Delete OK Save Cancel

15. After saving the assignments, to unassign serial numbers, do one of the following:
  - To unassign specific serial numbers, select their check boxes in the grid and then click the < button.
  - To unassign all of the assigned serial numbers, click the << button.

Then click **Save**.

16. To save the current assignment state of the serial numbers and close the dialog, click **OK**.

The serial numbers that you have added to the work order are now available to be assigned to produced items for the work order.

## Reverting Serial Number Assignment to the Last Saved State

While the Add/Assign Serial Numbers dialog is open, you can revert the serial number assignments to their last saved state by clicking the **Revert** button.

## Unassigning Serial Numbers That Have Not Been Assigned to Produced Items

If a work order operation has serial numbers assigned to it that have not yet been assigned to produced items, you can unassign them from the work order or operation.

1. On the **Work Queue** tab or on the **Production** tab if a job in the work order is running on the entity, click the **Add/Assign SNo's** button.



The Add/Assign Serial Numbers dialog appears.

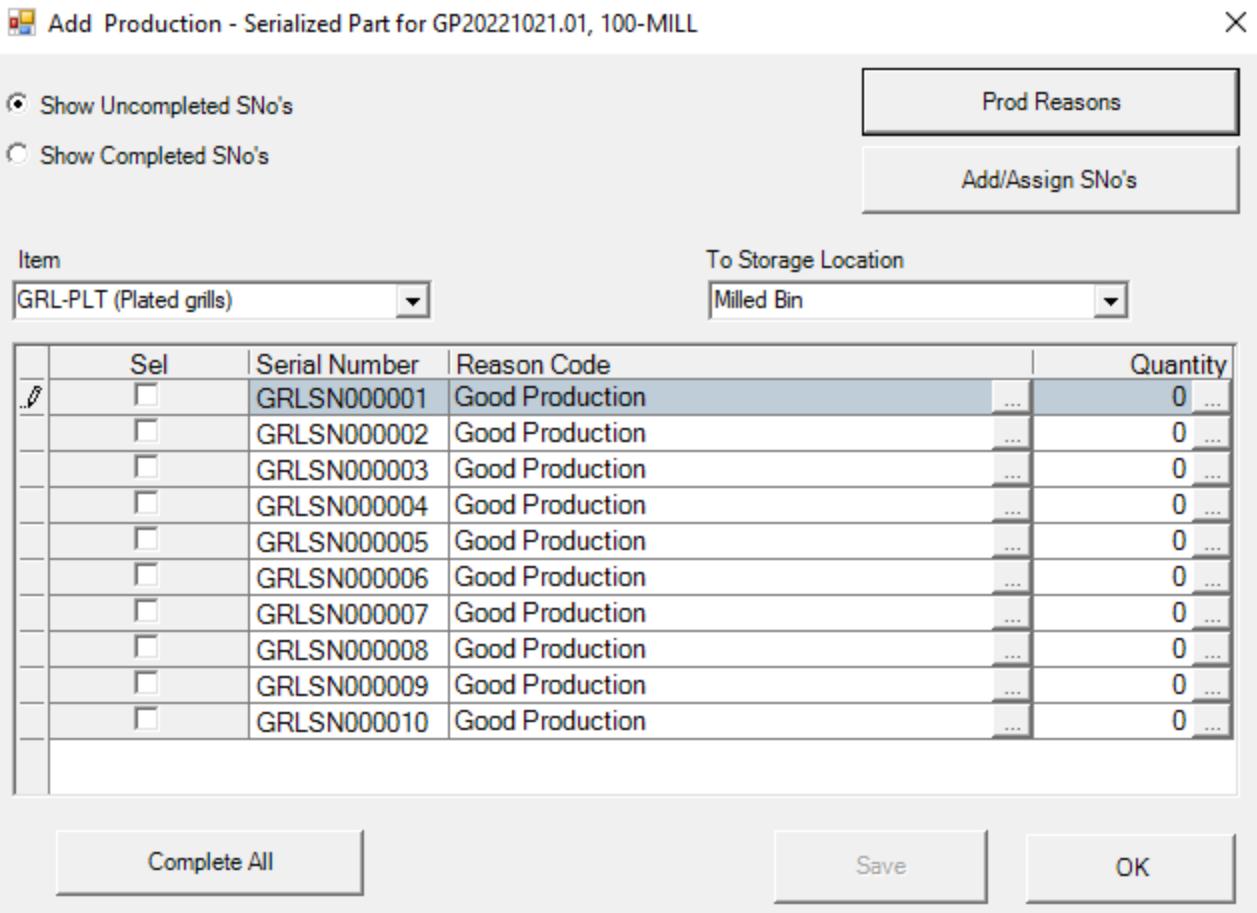
2. Do one of the following:
  - To unassign the serial numbers from the operation but leave them assigned to the work order, clear the **Operation** list.
  - To unassign the serial numbers from the work order completely, clear both the **Work Order Selected** and **Operation** lists.
3. To unassign the serial numbers, do one of the following:
  - To unassign specific serial numbers, select their check boxes in the grid and then click the < button.
  - To unassign all of the assigned serial numbers, click the << button.
4. To save the changes, click **Save** to leave the dialog open or **OK** to close the dialog.

### Assigning Serial Numbers to Produced Items

1. Open the entity of the operation at which the produced items will be assigned their serial numbers.
2. On the **Work Queue** tab, select the work order operation.
3. If it is not already running, start running the job.
4. On the **Production** tab, click the **Add Production** button.



Because the job is producing an item that is being or has been serialized, the Add Production - Serialized Part dialog appears instead of the standard Add Production dialog..

A screenshot of the 'Add Production - Serialized Part' dialog box. The title bar says 'Add Production - Serialized Part for GP20221021.01, 100-MILL'. There are two radio buttons: 'Show Uncompleted SNo's' (selected) and 'Show Completed SNo's'. On the right, there are two buttons: 'Prod Reasons' and 'Add/Assign SNo's'. Below these are dropdown menus for 'Item' (set to 'GRL-PLT (Plated grills)') and 'To Storage Location' (set to 'Milled Bin'). A large grid table lists serial numbers and their production reasons. The columns are 'Sel' (checkbox), 'Serial Number' (list box containing GRLSN000001-GRLSN000010), 'Reason Code' (list box showing 'Good Production' for all), and 'Quantity' (list box showing '0' for all). At the bottom are three buttons: 'Complete All', 'Save', and 'OK'.

Sel	Serial Number	Reason Code	Quantity
<input type="checkbox"/>	GRLSN000001	Good Production	0
<input type="checkbox"/>	GRLSN000002	Good Production	0
<input type="checkbox"/>	GRLSN000003	Good Production	0
<input type="checkbox"/>	GRLSN000004	Good Production	0
<input type="checkbox"/>	GRLSN000005	Good Production	0
<input type="checkbox"/>	GRLSN000006	Good Production	0
<input type="checkbox"/>	GRLSN000007	Good Production	0
<input type="checkbox"/>	GRLSN000008	Good Production	0
<input type="checkbox"/>	GRLSN000009	Good Production	0
<input type="checkbox"/>	GRLSN000010	Good Production	0

By default:

- The item being serialized is selected in the **Item** list.
- The default destination entity for the item is selected in the **To Storage Location** list.
- The grid lists the serial numbers that are available to be assigned to items. Also listed are serial numbers of items that have already been serialized and are stored at the currently opened entity. Once assigned, the serialized items are considered to have been produced.

Note that from this dialog, you can also:

- Select **Show Uncompleted SNo's** or **Show Completed SNo's** to toggle the grid between showing unassigned serial numbers and serial numbers that have been assigned to produced items.
  - If additional serial numbers are needed, click the **Add/Assign SNo's** button if it is enabled. This opens the Add/Assign Serial Numbers dialog, described in [Adding Serial Numbers to a Work Order and Operation](#).
  - If the job BOM **May choose alternate inventory location** property was selected, change the destination entity for the produced items in the **To Storage Location** list.
- If you need to specify or change the production reason for the serialized items, click the **Prod Reasons** button to open the Select Reason dialog.
  - (Optional) To record the progress of a serialized item at this operation, you can enter a partial value in the item's **Quantity** cell (e.g., **0.25** to indicate that an item is 25% processed).

**Note:** In a **Quantity** cell, a leading **0** must be entered first. Otherwise, an entry cannot be made in the cell. This behavior ensures that only a decimal number is entered in the cell.

The quantity values are automatically set to **1** when the items are saved to indicate that they have been produced.

7. In the grid, select the serial numbers to be assigned to produced items. To select all of the serial numbers, click the **Complete All** button.

The screenshot shows the 'Add Production - Serialized Part' dialog box. At the top, there are two radio buttons: 'Show Uncompleted SNo's' (selected) and 'Show Completed SNo's'. Below this are two buttons: 'Prod Reasons' and 'Add/Assign SNo's'. The main area contains a table with columns: Item, To Storage Location, Sel, Serial Number, Reason Code, and Quantity. The 'Item' dropdown is set to 'GRL-PLT (Plated grills)' and the 'To Storage Location' dropdown is set to 'Milled Bin'. The table has 10 rows, each with a checked 'Sel' column and a reason code of 'Good Production'. The 'Quantity' column shows values of 1 for each row. At the bottom of the dialog are three buttons: 'Complete All', 'Save', and 'OK'.

Item	To Storage Location	Sel	Serial Number	Reason Code	Quantity
GRL-PLT (Plated grills)	Milled Bin	<input checked="" type="checkbox"/>	GRLSN000001	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000002	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000003	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000004	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000005	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000006	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000007	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000008	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000009	Good Production	1
		<input checked="" type="checkbox"/>	GRLSN000010	Good Production	1

8. To save the selected entries as serialized produced items, click **Save** to leave the dialog open or **OK** to close the dialog.

The items are assigned serial numbers, recorded as being produced, and moved to the entity in the **To Storage Location** list.

## Viewing an Entity's Current Serialized Item Inventory

You can view an entity's current inventory of serialized items from the **Inventory** tab. For more information about this tab, see [Inventory Tab](#).

Route	Work Queue	Production	BOM	Genealogy	Util/OEE	Folders	Steps	Specs	Audit	Inventory	
Bagger Coater Drying Rack Mill Milled Bin Plating Tank Prepped Bin Roaster <b>Sandblaster</b> Washer	Entity Name		Status		Maximum Capacity		Storage Entity Name				
	► Sandblaster		Used		0						
	Item ID	Item	Lot No	Entity Name	Qty.	Left	Units	Grade	Status	Expiry Date	
	GRL-PLT	Plated grills	GRLSN000001	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000002	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000003	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000004	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000005	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000006	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000007	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000008	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000009	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			
	GRL-PLT	Plated grills	GRLSN000010	Sandblaster	1	Pieces	GOODGRADE	GOODSTATE			

Note the following about the inventory shown:

- All entities in the system that can store inventory will be available for selection in the entity list on the left side of the tab, regardless of whether you are logged into the entities.
  - Item serial numbers are listed as lot numbers.
  - If the **Storage: Delete inventory when the quantity reaches 0** option has not been selected for the entity in MES Client, serialized inventory that was transferred from the entity will still be listed on the **Inventory** tab, with their **Qty. Left** value set to 0. Otherwise, serialized items that have been transferred to another entity will not be listed in the entity's inventory.

## Manually Transferring Serialized Items

You can use the Transfer function to manually transfer serialized items from the entity where they are currently stored to another entity.

You can transfer serialized items between any entities that have been assigned to an item BOM and to which you have access. This even includes entities to which you are not currently logged in.

**Note:** Serialized items can be transferred **to** a hard-pegged work order (i.e., the item BOM's **Must Consume from WIP** option is selected) but cannot be transferred **from** a hard-pegged work order.

## To transfer serialized items to another entity

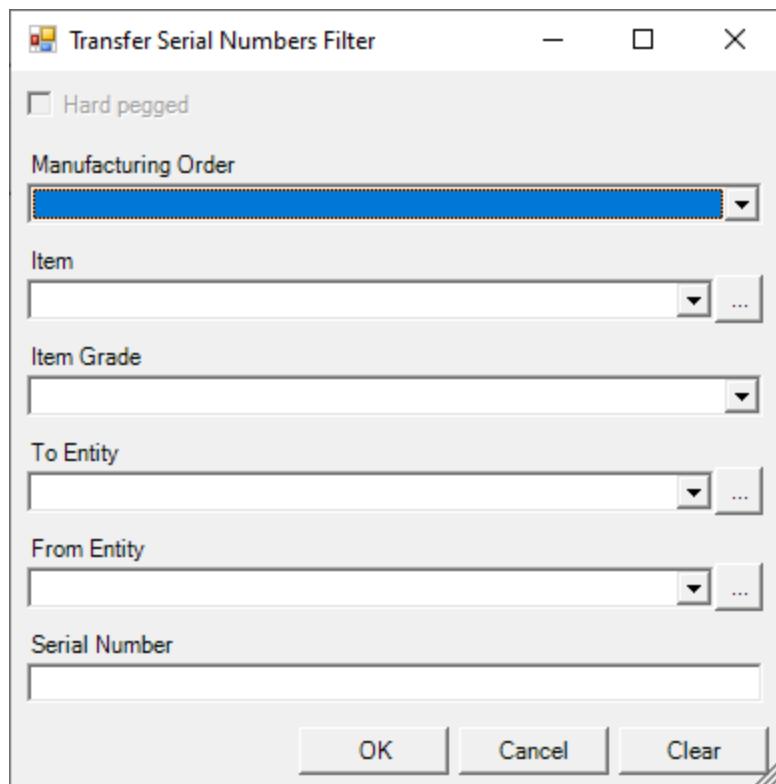
1. Open an entity that has at least one job assigned to it with the following conditions:
    - The job is not Complete or Canceled.
    - The job is for a work order that is producing serialized items.
  2. On the **Work Queue** tab or on the **Production** tab if a job in a work order is running on the entity, click the **Transfer Serial Numbers** button.



- If work orders are running on the currently opened entity, the Select and Transfer WIP Inventory dialog appears as shown in step 3.

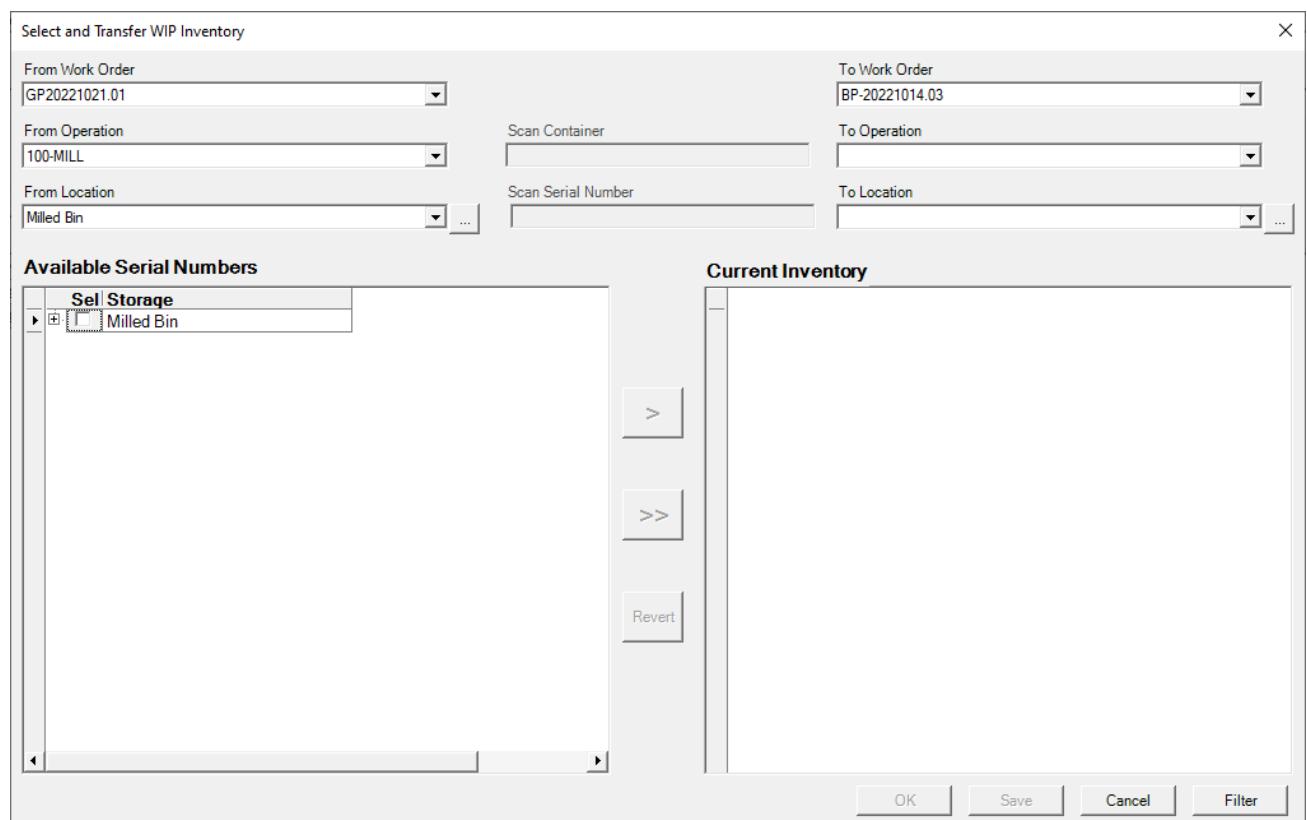
Note that the **To Work Order** selections are set to the current work order, operation, and entity and cannot be changed.

- If no work orders are running on the currently opened entity, the Transfer Serial Numbers Filter dialog appears.



3. Enter search criteria to filter the serialized items of interest or leave the filters blank to see all available serialized items, then click **OK**.

The Select and Transfer WIP Inventory dialog appears.



The **Available Serial Numbers** grid lists the serialized items that can be transferred, filtered by the **From Work Order**, **Operation**, and **Location** lists above the grid.

- To change the source entity for the transfer, use the **From Work Order**, **Operation**, and **Location** lists.

If you set the **From Work Order** and **From Operation** lists to blank entries, then any entities that currently have serialized items stored at them can be selected in the **From Location** list.

- Once an entity with serialized items is selected, expand the entity entry in the grid to see the entire list.

Sel	Storage	Item ID	Grade	Status	WO ID
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021
	Milled Bin	GRL-PLT	GOODGRADE	GOODSTATE	GP20221021

**Note:** The **Scan Container** and **Scan Serial Number** fields are currently not supported.

- Specify the destination entity using the **To Work Order**, **Operation**, and **Location** lists above the **Current Inventory** grid box.

If you set the **To Work Order** and **To Operation** lists to blank entries, then any entities that can have serialized items stored at them can be selected in the **To Location** list.

Note the following about transferring serialized items from a hard-pegged work order:

- If the **To Operation** and **To Location** lists are **set to blank entries**, serialized items cannot be transferred to any work order other than the pegged source work order.
- If the **To Operation** and **To Location** lists **do have entries**, serialized items can be transferred from the hard-pegged source work order regardless of what destination work order is selected. However, the serialized items will still be tied to the source pegged work order and not the selected destination work order. This behavior allows you to, for example, move serialized items to an entity that has replaced the original entity in the pegged work order because it is no longer operational. After such a transfer, the entity specified in the **To Location** list will now be associated with the pegged work order.

- To specify which serialized items to transfer, do one of the following:

- To transfer specific items, select them and then click the **>** button.

- To transfer all listed items, click the >> button.

The serialized items are moved to the **Current Inventory** grid. They are highlighted in yellow to indicate that their transfer has not been saved yet.

Item ID	Grade	Status	WO ID
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...
GRL-PLT	GOODGRADE	GOODSTATE	GP20221021...

8. (Optional) To undo a pending transfer prior to initiating it by clicking the **Save** or **OK** button, click the **Revert** button.

The items are moved from the **Current Inventory** grid back to the **Available Serial Numbers** grid.

9. To initiate the transfer of the items in the **Current Inventory** grid, click **Save** to leave the dialog open or **OK** to close the dialog.

You can now go to the destination entity's **Inventory** tab to see the list of serialized items that have been transferred to it.

## Configuring Operator Window Components

You can configure the following Operator window components:

- The fields that display in the Job Summary area
- The column configuration for grids in the tabs and some dialog boxes
- The toolbar buttons for the tabs
- The fields that display in certain dialog boxes
- Showing or hiding the numeric keypad in certain dialog boxes

You can also save and reload a configuration for the Job Summary area and each tab.

The Operator window configuration functions require that you have the *May Configure Operator* user privilege.

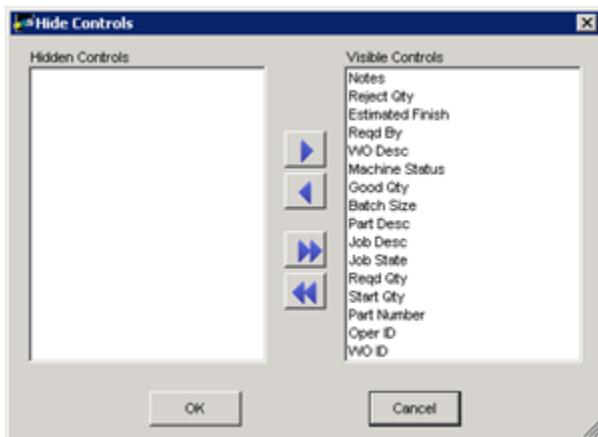
## Showing and Hiding Job Summary Fields

By default, all of the job summary fields appear in the job summary area. However, you can select which fields to show or hide.

### To show or hide job summary fields

1. Right-click in the job summary area and click **Configure**.

The Hide Controls dialog box displays.



2. Select the fields whose visibility you want to change.
3. Use the arrow buttons to move fields between the **Hidden Controls** and **Visible Controls** lists.
4. Click **OK** to save your changes.

## Saving and Reloading Job Summary Configurations

You can save the current configuration of which job summary fields are shown. You can then reload the saved configuration or the default configuration.

If you do not save changes that you made to the current configuration, those changes are lost when you log out of Operator.

### To access the save and reload configuration options

- Right-click anywhere in the job summary area, then click the desired menu command.

The menu commands are described below.

#### Save Configuration

Saves the current configuration for the active entity.

If you reload the default configuration, this saved configuration is cleared.

#### Save Configuration for All Logged On Entities

Saves the current configuration for all currently logged-on entities.

If you reload the default configuration, this saved configuration is cleared.

#### Save As Default Configuration

Saves the current job summary configuration as the default configuration for all Operator users.

#### Reload Configuration

Reloads your last saved configuration.

#### Revert to Default Configuration

Reloads the default configuration. This also clears the saved configuration.

## Configuring Grids in Tab Displays and Dialog Boxes

With the grids in tabs and some dialog boxes, you can:

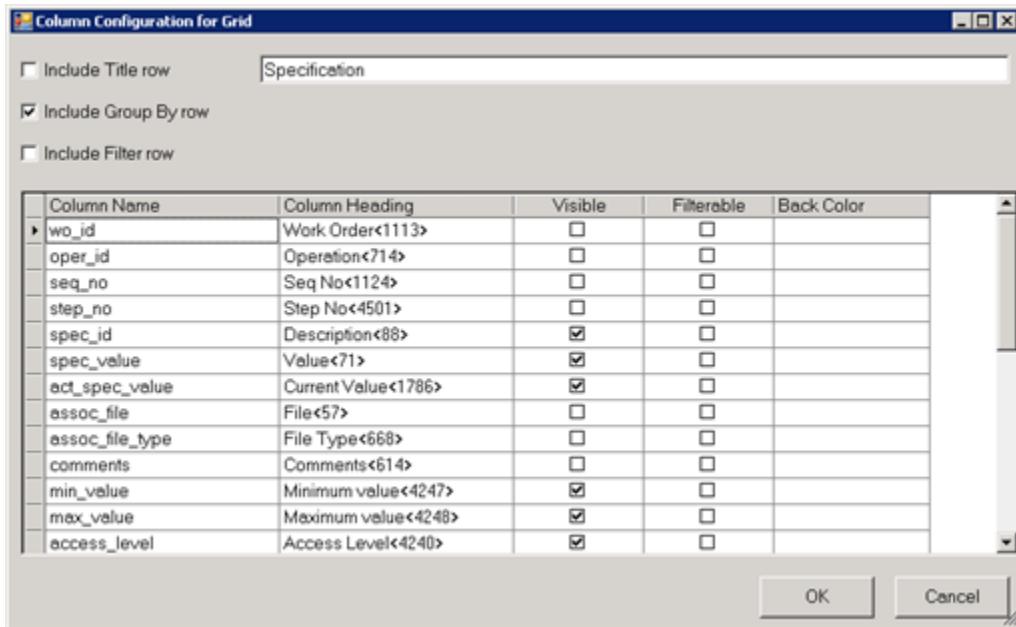
- Specify what columns and rows are displayed
- Arrange the grid rows by groups and subgroups
- Sort the grid by columns
- Arrange the order of the columns
- Filter the grid rows by a column's data

### Specifying What Columns and Rows Are Displayed

1. Right-click on the tab grid area and click **Configure**.

The Column Configuration for Grid dialog box displays.

The list of columns that are available are specific to the tab.



2. Set the desired options, described below.

#### Include Title Row

Select this option to include a title row for the table, and enter the title in the accompanying box.

#### Include Group By Row

Include the Group By row in the grid, which allows you to rearrange the grid into groups and subgroups. See

## Grouping Grid Data.

### Include Filter Row

Include a filter row, which allows you to filter the contents of the grid. To use filtering, see [Filtering the Grid](#).

### Visible

To make a column visible in the grid, select this option.

### Filterable

To enable the filter cell for a column, select this option. To use filtering, see [Filtering the Grid](#).

### Back Color

This option is not supported.

3. Click **OK** to save your changes.

## Grouping Grid Data

The grid can be arranged into groups and subgroups by column data categories.

### To group the grid data by column data categories

1. Drag the column heading to the shaded area above the column headings.

Entity Name	WD ID	Job Desc	Item ID	Re
Roaster	WD-301	Roasting	BMX-BBQ	
Roaster	WD-110	Roasting	BMX-BBQ	
Coater	WD-301	Coating	BMX-BBQ	
Roaster	WD-010	Roasting	BMX-BBQ	
Roaster	WD-020	Roasting	BMX-BBQ	
Coater	WD-110	Coating	BMX-BBQ	

The rows of the grid are now grouped by that data category.

Entity Name	WD ID	Job Desc	Item ID	Re
<b>WD ID /</b>				
Roaster	WD-010	Roasting	BMX-BBQ	
Coater	WD-010	Coating	BMX-BBQ	
Bagger	WD-010	Bagging	BMX-BBQ	
<b>WD ID : WD-010 - 3 item(s)</b>				
Roaster	WD-020	Roasting	BMX-BBQ	
Coater	WD-020	Coating	BMX-BBQ	
Bagger	WD-020	Bagging	BMX-BBQ	
<b>WD ID : WD-020 - 3 item(s)</b>				
Roaster	WD-110	Roasting	BMX-BBQ	
Coater	WD-110	Coating	BMX-BBQ	
Bagger	WD-110	Bagging	BMX-BBQ	
<b>WD ID : WD-110 - 3 item(s)</b>				

2. Drag another column heading to this area to add a subgroup.

The screenshot shows a software interface for managing work queues. At the top, there's a navigation bar with tabs: Route, Work Queue (which is selected), Production, BOM, Genealogy, Folders, Steps, Specs, and Audit. Below the navigation bar is a dropdown menu labeled "Accessible Entities" with the value "Bagger". The main area is titled "Work Queues" and contains a table with columns: Entity Name, WO ID, Job Desc, and Item ID. The data is grouped by WO ID and Job State. There are four sections of grouping:

- WO ID : WO-301 - 3 item(s)**
  - Job State : COMPLETE - 2 item(s)**

Roaster	WO-301	Roasting	BMX-BBQ
Cooker	WO-301	Cooking	BMX-BBQ
  - Job State : RUNNING - 1 item(s)**

Bagger	WO-301	Bagging	BMX-BBQ
--------	--------	---------	---------
- WO ID : WO-110 - 3 item(s)**
  - Job State : COMPLETE - 3 item(s)**

Roaster	WO-110	Roasting	BMX-BBQ
Cooker	WO-110	Cooking	BMX-BBQ
Bagger	WO-110	Bagging	BMX-BBQ
- WO ID : WO-010 - 3 item(s)**
  - Job State : COMPLETE - 3 item(s)**

Roaster	WO-010	Roasting	BMX-BBQ
---------	--------	----------	---------

As you add groupings, the diagram in the shaded area is updated to illustrate the order in which each grouping is applied. The data rows will also be divided into sections, reflecting the grouped method used.

### To remove a grouping

- Drag the heading of that grouping from the shaded area.

### Sorting by Columns

#### To sort by a column

- Click the column heading.

#### To reverse the sort

- Click the column heading again.

#### To add a secondary or tertiary sort column

- Shift+click another column.

### Changing the Column Order

#### To change the order of a column

- Drag the column heading to the desired location in the column heading row.

### Filtering the Grid

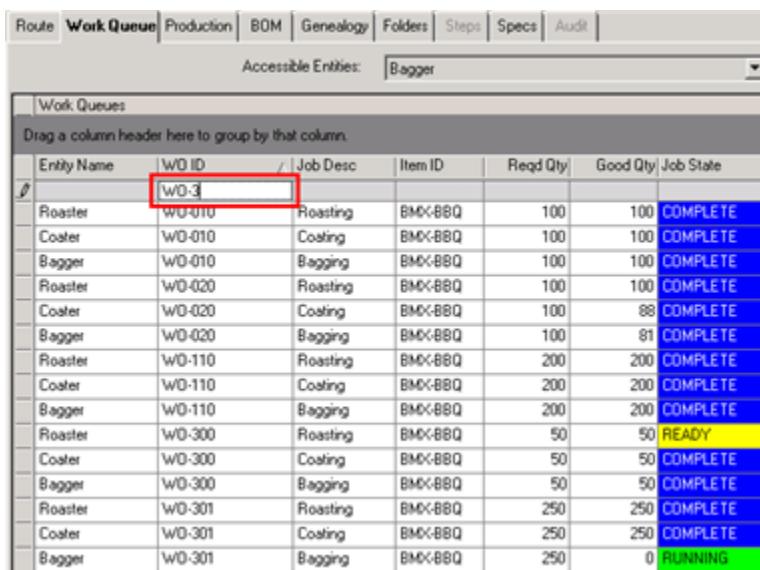
If the filter row in the grid's column configuration has been turned on and filtering has been enabled for any of the columns, then you can filter the data rows included in the grid by those columns.

## To filter the grid by a column's data

1. In the filter cell for the column, enter the filter criteria.

The filter criteria must include the beginning characters of the data on which you want to filter, or the entire data value. For example, if all work order IDs begin with WO-, then the filter criteria must begin with those characters. So the filter WO-3 could include rows whose work order ID begins with WO-3, WO-300, WO-301, or WO-3249. However, the filter entry 300 would not match any work order ID entry.

Filter criteria is case-sensitive.

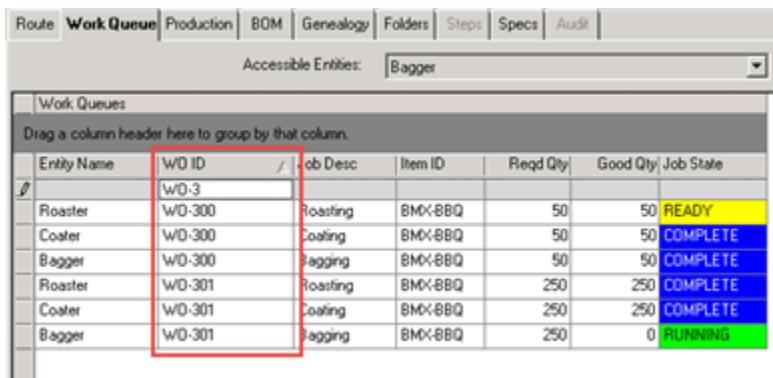


A screenshot of a software interface titled "Work Queue". The top navigation bar includes tabs for Route, Work Queue, Production, BOM, Genealogy, Folders, Steps, Specs, and Audit. The "Work Queue" tab is selected. A dropdown menu labeled "Accessible Entities" shows "Bagger". The main area is titled "Work Queues" and contains a table with columns: Entity Name, WD ID, Job Desc, Item ID, Reqd Qty, Good Qty, and Job State. The first row has a red box around the "WD ID" cell containing "WD-3". The data table lists various work items, with some rows highlighted in blue (e.g., Roaster WO-010, Bagger WO-010) and others in green (e.g., Bagger WO-301).

Entity Name	WD ID	Job Desc	Item ID	Reqd Qty	Good Qty	Job State
Roaster	WO-010	Roasting	BMX-BBQ	100	100	COMPLETE
Coater	WO-010	Coating	BMX-BBQ	100	100	COMPLETE
Bagger	WO-010	Bagging	BMX-BBQ	100	100	COMPLETE
Roaster	WO-020	Roasting	BMX-BBQ	100	100	COMPLETE
Coater	WO-020	Coating	BMX-BBQ	100	88	COMPLETE
Bagger	WO-020	Bagging	BMX-BBQ	100	81	COMPLETE
Roaster	WO-110	Roasting	BMX-BBQ	200	200	COMPLETE
Coater	WO-110	Coating	BMX-BBQ	200	200	COMPLETE
Bagger	WO-110	Bagging	BMX-BBQ	200	200	COMPLETE
Roaster	WO-300	Roasting	BMX-BBQ	50	50	READY
Coater	WO-300	Coating	BMX-BBQ	50	50	COMPLETE
Bagger	WO-300	Bagging	BMX-BBQ	50	50	COMPLETE
Roaster	WO-301	Roasting	BMX-BBQ	250	250	COMPLETE
Coater	WO-301	Coating	BMX-BBQ	250	250	COMPLETE
Bagger	WO-301	Bagging	BMX-BBQ	250	0	RUNNING

2. Press the **Tab** key.

Only rows whose data match the entered filter criteria appear in the grid.



A screenshot of the same software interface as the previous one, showing the result of pressing the Tab key after entering "WD-3" in the filter cell. The "WD ID" column header now also contains "WD-3", indicated by a red box. The data table shows the same rows as before, but the rows for WO-300 and WO-301 are now highlighted in yellow, while the others are green. The "READY" row for WO-300 is also highlighted in yellow.

Entity Name	WD ID	Job Desc	Item ID	Reqd Qty	Good Qty	Job State
Roaster	WO-300	Roasting	BMX-BBQ	50	50	READY
Coater	WO-300	Coating	BMX-BBQ	50	50	COMPLETE
Bagger	WO-300	Bagging	BMX-BBQ	50	50	COMPLETE
Roaster	WO-301	Roasting	BMX-BBQ	250	250	COMPLETE
Coater	WO-301	Coating	BMX-BBQ	250	250	COMPLETE
Bagger	WO-301	Bagging	BMX-BBQ	250	0	RUNNING

## To clear the filter

- Delete the filter entry and press the **Tab** key.

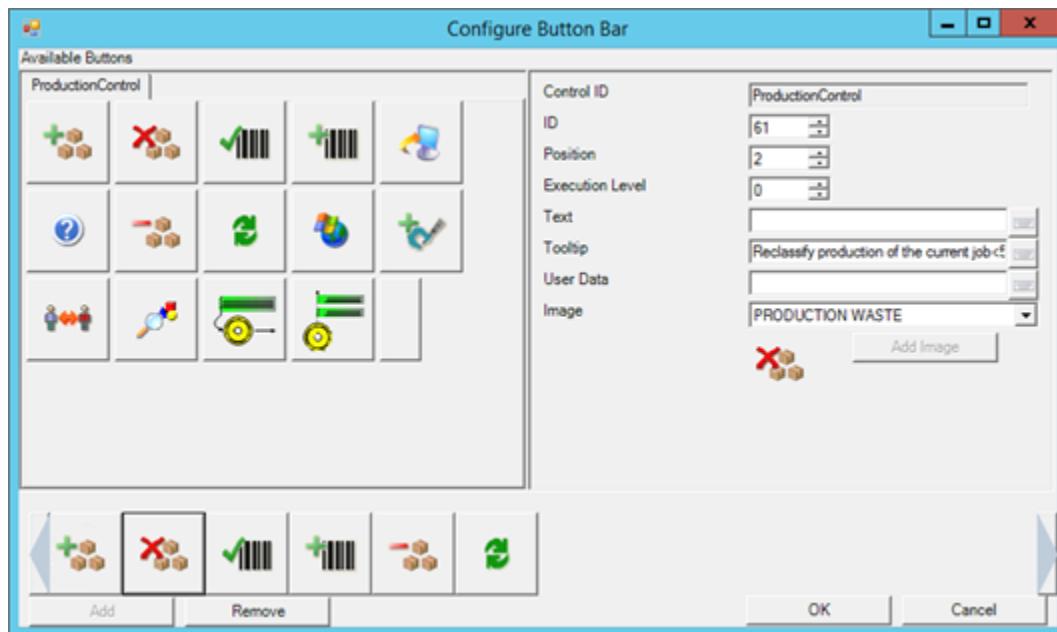
## Configuring a Tab's Toolbar Buttons

You can add and remove the buttons that are included in a tab's toolbar.

Some of the available buttons are specific to the tab. Other general buttons might also be available to be included in the toolbar; for a list of these, see [Common Buttons](#).

## Opening the Configure Button Bar Window

- Right-click the toolbar area and click **Configure**.



## Adding a Button to the Toolbar

- On the Configure Button Bar dialog box, select the button in the **Available Buttons** pane.
- Click the **Add** button.
- In the settings pane, enter the **Position** number of the button to determine its position in the toolbar.

You can add one or more space separator buttons, shown in the following figure, to visually separate groups of buttons in the toolbar.



## Removing a Button from the Toolbar

- On the Configure Button Bar dialog box, select the button in the toolbar.

2. Click the **Remove** button.

The button is moved back to the **Available Buttons** pane.

## Configuring a Button in the Toolbar

You can configure settings for selected button in the toolbar. These settings are described in the following table.

### Control ID

Identifies the control (for example, window or tab) on which this toolbar appears.

### ID

Identifies the selected button (and its definition) in the database.

### Position

Specifies the position number, or location, of the selected button in the toolbar.

### Execution Level

Specifies the minimum Button Execution Level that a user must have (a user privilege defined in MES Client) to have authorization to use the selected button.

### Text

Defines the text, if any, that appears as a label on the selected button.

### Tooltip

Defines the text, if any, that will appear when the cursor is hovered over the selected button .

### User Data

Defines the external application and/or parameters that will be passed when the selected button is pressed.

### Image

Indicates which image, if any, should be displayed on the selected button. The selected image is displayed below this list.

### Add Image button

Not supported.

## Saving and Reloading Tab Configurations

You can save the current grid and toolbar button configuration for a tab. You can then reload the saved configuration or the default configuration.

If you do not save changes that you made to the current configuration, those changes are lost when you navigate to another tab.

You can also save the current configuration as the default configuration for the tab for all Operator users.

### To access the save and reload configuration options

- Right-click anywhere on the tab area except the toolbar area, then click the desired menu command.

The menu commands are described below.

#### Save Configuration

Saves the current configuration for the active entity.

If you reload the default configuration, this saved configuration is cleared.

**Save Configuration for All Logged On Entities**

Saves the current configuration for all currently logged-on entities.  
If you reload the default configuration, this saved configuration is cleared.

**Save As Default Configuration**

Saves the current configuration for this tab as the default configuration for all Operator users.

**Reload Configuration**

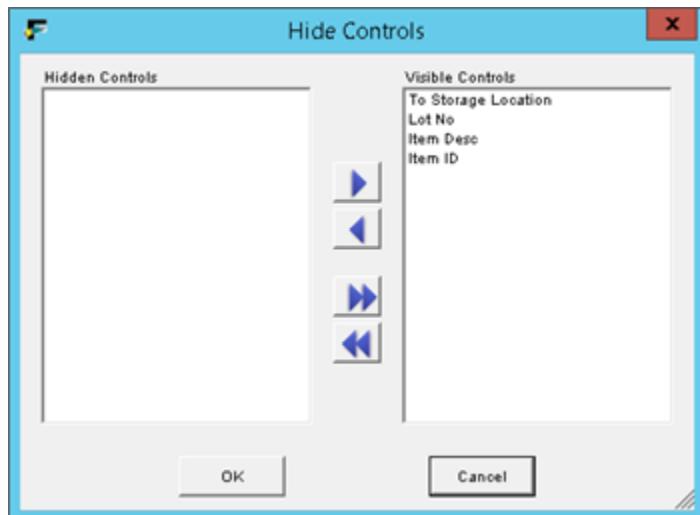
Reloads your last saved configuration for this tab.

**Revert to Default Configuration**

Reloads the default configuration for this tab. This also clears the saved configuration.

## Hiding Fields on Dialog Boxes

Right-clicking on some dialog boxes that have fields displays a context menu with a **Configure Fields** option. Selecting this option causes a dialog box to appear that allows you to control whether fields that are not required for input are hidden or visible.



## Hiding the Numeric Keypad on Dialog Boxes

Right-clicking on dialog boxes that have a numeric keypad displays a context menu with a **Hide Numeric Keypad** option. Selecting this option hides the numeric keypad.

To redisplay the keypad, right-click on the dialog box and click **Show Numeric Keypad**.

## MES Web Portal Operator

Use MES Web Portal Operations to view detailed work order, entity, job queue, production, and utilization event information. Operators can start or end jobs, add or reduce job production, complete jobs, and add, merge, or split an entity's events using the MES Web Portal Operations Portal.

## Getting Started with MES Web Portal

The Manufacturing Execution System (MES) Web Portal is a web-based application that provides a user interface to configure and monitor your plant model and production processes

### Opening an MES Web Portal Session

You can open an MES Web Portal session from a web browser that is running on any node that has network access to the MES Web Portal host.

1. If you are using the Firefox web browser, make sure you are using the latest version.
2. Enter the URL for MES Web Portal.

Running MES Web Portal requires that you use HTTPS web communications. The default URL is:

`https://<WPhostname>:<HTTPSportnumber>/MES/`

where:

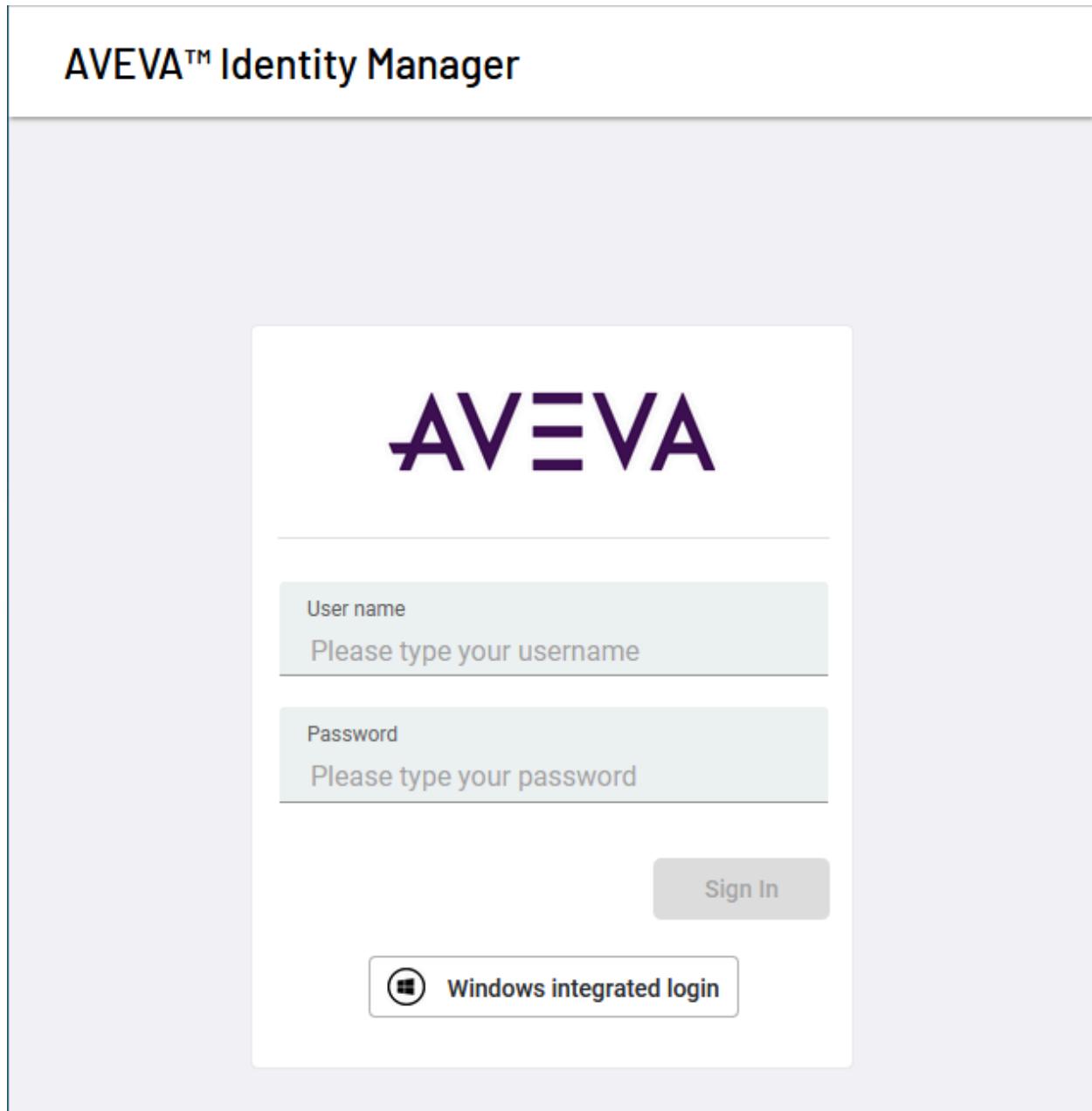
- <WPhostname> is the **fully qualified domain name** of the node on which the MES Web Portal host is running (e.g., **MESWP.yourorg.com**).
- <HTTPSportnumber> is the HTTPS port number for MES Web Portal. If the MES Web Portal port number is the default HTTPS port number 443, you do not need to include it in the URL.

See your MES or system administrator for the specific URL that is used for your installation of MES Web Portal.

Note the following when using the Firefox web browser:

- If the message *Unable to connect* appears, make sure that **No proxy** is selected as the Firefox Network proxy setting. See [Setting the Firefox Proxy Setting to No Proxy](#).
- The first time you enter the MES Web Portal URL, a warning about a potential security risk might appear. This is because Firefox does not recognize the SSL certificate being used by MES Web Portal. Click **Advanced**, then in the Advanced box click **Accept the Risk and Continue**.

The AVEVA Identity Manager login prompt appears.



3. Enter your user name and password and click **Login**.

Once logged in, the MES Web Portal home page appears.

Your access to pages and functions in MES Web Portal depends on the privileges and line and entity access that have been specified for you. For more information about user privileges and access settings, see the *MES Client User Guide* or help.

## Language Used

The language used in the MES Web Portal browser session for the text is determined by which MES Security Mode is being used (as configured in MES Client):

- If OS Group mode is used, the MES system parameter *Default language* setting is used.

- If OS User mode is used, the *Language* setting for your MES user account is used.

The display of localized values and dates is determined by the web browser's language/locale settings. See [Setting the Web Browser's Preferred Language/Locale for Values and Dates](#).

## If Privilege and Access Settings Are Changed During a Session

If your privilege or access settings are changed during an MES Web Portal session, you might see an insufficient privileges message when you attempt to navigate to or use a function to which you no longer have privileges or access. Press the **F5** key to refresh the browser; the refreshed MES Web Portal environment will reflect your new privilege and access settings.

Note that your privilege settings are cached, and the cache is automatically refreshed every 2 seconds by default. This refresh rate can be customized for your MES Web Portal host; for modifying the refresh rate, see the chapter "Configuring the MES Web Portal Host" in the *MES Installation Guide* or online help.

## Session Time-Out

For security reasons, after a pre-defined amount of time with no session activity, a log out message appears.

To keep the session open, click **OK**. Otherwise, after a short period you will be logged out of the session.

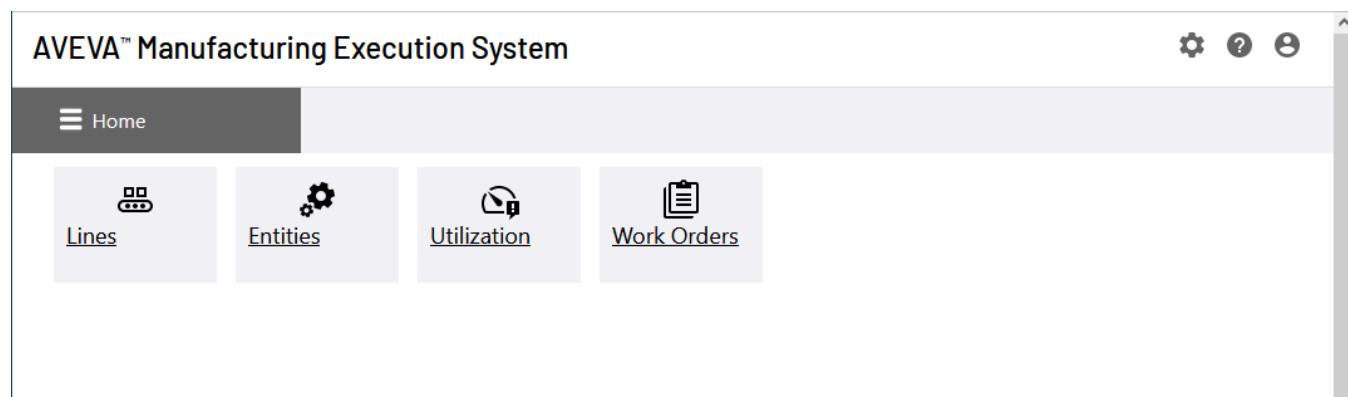
The time-out period is based on the Security system parameter **Seconds of inactivity before automatic logoff** in MES Client.

## Closing an MES Web Portal Web Session

- Click your user name at the top right of the browser window and click **Log Out**.

## Navigating in MES Web Portal

A session in MES Web Portal starts on the home page, shown below.



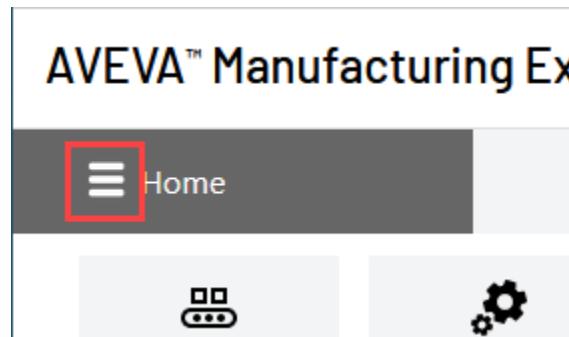
The home page includes a tile for each area of the application:

- Lines
- Entities
- Utilization

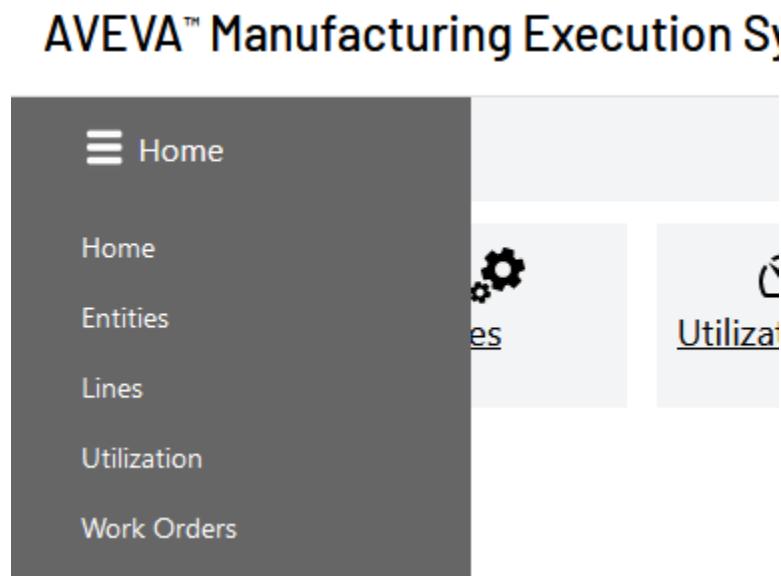
- Work orders

Click one of these tiles to navigate to that area.

You can also navigate to these areas from any page in MES Web Portal using the Navigation menu. To open the menu, click the  Navigation menu button at the upper left.



The Navigation menu appears.



Full navigation instructions are provided in the applicable procedures under MES Web Portal Configuration and [MES Web Portal Operations](#).

**Note:** If you click a navigation menu command and receive a message saying that you do not have sufficient privileges to view that function, your user privileges might have been changed during your session. To refresh the browser and see to which navigation menu commands you now have access, press **F5**.

## Navigating to the Home Page

Perform one of the following actions:

- Click the product name on the banner that appears at the top of every page.
- Click the  Navigation menu button at the upper left of any page, then click **Home**.

## Navigating Back

To navigate back to a previous web page in your session, use the web browser's Back button.

## MES Web Portal Operations

You can enter transactional data to the system through the various pages of the MES Web Portal. Depending on your privileges and line access permissions, you can create work orders, transact against the work orders and jobs within the work order, view line and entity status, enter and modify downtime events, and complete jobs.

A typical workflow, which could involve more than one user, is:

1. Create a work order on a line. (If the work order comes from an external system such as an ERP, the work order can be assigned to a line.)
2. Move a work order from one line to another line if, for example, an equipment failure occurs or work priority has changed.
3. Start a work order and/or the jobs within the work order.
4. Add and/or reduce production for a job running on an entity.
5. Add, split, or modify equipment downtime events on an entity.
6. Complete a job running on an entity.

## What Operations Can Be Performed

Operators and other MES Web Portal users can view status information about:

- Work orders (see [Viewing a Line's Work Order Status](#))
- A line's bottleneck entity ([Viewing Bottleneck Information](#))
- Jobs that are in an entity's work queue (see [Viewing Jobs in an Entity Work Queue](#) and [Viewing Detailed Job Information](#))
- Production (see [Entering Production Quantity for a Running Job](#))
- Entities (see [Viewing the Status of a Line's Entities](#))
- Utilization events (see [Viewing an Entity's Event History](#))

Operators can also:

- Start and end jobs (see [Starting and Ending Jobs](#))
- Add or reduce production for a job (see [Entering Production Quantity for a Running Job](#) and [Reducing Production Quantity](#))
- Mark jobs as complete (see [Marking a Job as Complete](#))
- Add, merge, or split an entity's events (see [Working with an Entity's Utilization Events](#))

Access to viewing information or performing operations starts at the Home page, shown below. The procedures in the topics referenced in the previous bullet list provide detailed steps for navigating to the appropriate pages.

The screenshot shows the AVEVA Manufacturing Execution System interface. At the top, it says "AVEVA™ Manufacturing Execution System". Below that is a navigation bar with a "Home" icon. Underneath the navigation bar are four main menu items: "Lines" (with a factory icon), "Entities" (with a gear icon), "Utilization" (with a clock icon), and "Work Orders" (with a clipboard icon). There are also three small icons on the right side of the header: a gear, a question mark, and a refresh symbol.

## Viewing Line Summary Information

Current Reason	Bottleneck	Standard Item	Batch Size	Performance Rate
Idle	<a href="#">Bagger100</a>	BMX-BBQ(Bag of mixed nuts - BBQ)	1,000.000 Pieces	1.000 batches/hour

A line's pages include the following summary information at the upper right of the page:

- The line's default production rate.
- The line's default batch size.
- The line's standard item, if one has been specified.
- The line's bottleneck entity, if one can be determined. If you have permission to edit entities or you have been assigned access to the entity, the entity name will be a hyperlink that will navigate to the entity's detail page.
- If a job is currently running on the line, the current utilization reason.

### Note Icon in Line Summary Information

If any of the data reported in the line summary information cannot be determined by the system, then a Note icon will appear in that block of information.

To see the reason why the data could not be determined, hover the cursor over the message icon. A tool tip appears with an explanation of the issue.

	Bottleneck	Standard Item	Batch Size	
	<a href="#">Palletizer100</a>	BMX-BBQ(Bag of mixed nuts - BBQ)	1,000.000 Pieces	
The bottleneck entity: Palletizer100 does not have a utilization reason to indicate the status of the line: Mixed Nuts BBQ.				

## Working with Work Orders

You can create work orders and assign them to a line.

Creating a work order in MES Web Portal and assigning it to a line also creates the necessary data entry jobs for all entities associated with the line. Unlike work orders created using MES Client and worked using MES Operator, there is no correlation to a process and therefore no concept of a bill of material. There is only the

produced item of the work order and the quantities (starting and required).

Once created, you can change the status of a work order (for example, from Ready to Running; see [Changing a Work Order's Status](#)). You can also reassign a work order to another line (see [Reassigning a Work Order to Another Line](#)).

## Creating a Work Order

### To create a work order and assign it to a line

1. On the **Work Order** collections page or on the line's **Work Orders** tab, click **Add Work Order** in the action bar.

The Create Work Order for a Line side sheet appears.

The screenshot shows the 'Create Work Order for a Line' side sheet. It has the following fields:

- Work Order ID \***: An input field.
- Item \***: A dropdown menu showing "Finished Goods(Finished Goods)\BMX-BBQ(Bag of mixed nuts - BBQ)". To its right is a **Configure** button.
- Starting Quantity**: An input field containing "0".
- Required Quantity**: An input field containing "0".
- Line**: A dropdown menu showing "Mixed Nuts BBQ".
- Status**: A dropdown menu showing "NEW".
- Cancel**: A button at the bottom right.

2. Specify the parameters for the work order:

#### Work Order ID

The work order ID uniquely identifies the work order in the system.

#### Item

The item that is being produced for the work order. Click the **Configure** button to display the list of items from which to choose.

To filter the item list in the item selection side sheet, see [Filtering Item Lists](#).

If you created the work order from the line's **Work Orders** tab, the line's standard item is selected by default.

### Starting Quantity

The starting quantity is the quantity that the work order is expected to produce if there is no rejected production (that is, if all production is good).

The value entered here sets the starting quantity of each of the jobs at the first entity position of the line. If there is more than one entity at the first line position, the starting quantity is equally divided among the jobs. The starting quantities for each downstream job in the line is calculated using this starting quantity and taking into account the good and rejected production reported for upstream jobs.

The number of decimal places are set according to the selected item. The maximum value that can be entered is 999,999.

While the unit of measure (UOM) for items being produced at line positions might be different, starting quantities on MES Web Portal pages are always shown in the UOM specified for the line.

### Required Quantity

The required quantity is the quantity of the line's items that are required by the work order.

The value entered here sets the quantity required to be produced by the line's designated production position.

If the *The required quantity must be produced to end a job* job setting is being used for entities in the line, the required quantities for each upstream and downstream job in the line is determined using the required quantity entered here at each line position and dividing it equally among the entities at each position.

The number of decimal places are set according to the selected item. The maximum value that can be entered is 999,999.

While the UOM for items being produced at line positions might be different, remaining quantities on MES Web Portal pages are always shown in the UOM specified for the line.

### Line

The line to which this work order will be assigned.

If you are adding the work order with the line's **Work Orders** tab displayed, the line is automatically selected and cannot be changed.

### Status

The work order status. When creating a work order, the status defaults to New and cannot be changed.

3. When you are finished specifying the work order details, click **Save**.

The work order is added to the list of work orders that are assigned to the line.

## Changing a Work Order's Status

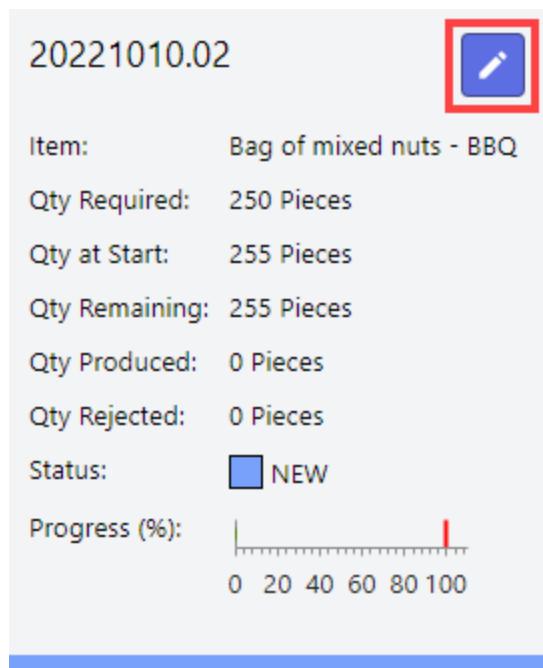
You can change a work order's status. For example, to start running a work order, you would change its status from Ready to Running.

For the effects of changing a work order's status on the state's of the work order's jobs, see [Effects of Work Order Status Changes on Job States](#).

### To change the status of a work order

1. Initiate the change from one of the following web pages:

- On the **Work Order** collections page or on a line's **Work Orders** tab, click the  **Edit** button on the tile of the work order you want to edit.



- On the work order's detail page, click the **Edit** button in the action bar.

The Edit Work Order side sheet appears.

### Edit Work Order

Work Order ID \*

Item \*

Finished Goods(Finished Goods)\BMX-BBQ(Bag of mixed nuts - BBQ)

Starting Quantity	Quantity Produced
<input type="text" value="255"/>	0
Required Quantity	Quantity Rejected
<input type="text" value="250"/>	0

Select a line to which to reassign the work order

Mixed Nuts BBQ

Status

NEW

2. Select the desired status in the **Status** list.

After selecting a different status, the **Apply** and **Save** buttons appear in the side sheet.

3. Click **Save**.

Note the following restrictions when changing a work order's status:

- You cannot change the status from Completed to Suspended, Canceled, or On Hold.
- You cannot change the status to New if there is any production recorded against any of the jobs in the work order.
- You cannot change the status from Completed to Ready or Running if all the jobs have production reported for them.

### Reassigning a Work Order to Another Line

In certain situations, it is necessary to reassign a work order to another line. This could happen when one line has equipment failure and the work order has to be moved to another line for immediate completion. The system allows for reassigning work orders that are not running to another line even if there have been some units already produced against the work order.

When reassigning a work order, all the existing jobs are deleted and new jobs are created. Existing production data is retained. For additional background information about reassigning a line, refer to [Work Order Reassignment](#).

#### To reassign a work order to another line

1. Initiate the change from one of the following web pages:

- On the **Work Order** collections page or on a line's **Work Orders** tab, click the  **Edit** button on the tile of the work order you want to edit.



- On the work order's detail page, click the **Edit** button in the action bar.

The Edit Work Order side sheet appears.

## Edit Work Order

Work Order ID \*

Item \*

Finished Goods(Finished Goods)\BMX-BBQ(Bag of mixed nuts - BBQ)

Starting Quantity	Quantity Produced
<input type="text" value="255"/>	0
Required Quantity	Quantity Rejected
<input type="text" value="250"/>	0

Select a line to which to reassign the work order

Status



---

2. Select **New** in the **Status** list.

You can also select **Ready**, **Suspended**, or **Onhold**, but then you have to click **Apply** to make the line list available.

3. In the line list, select the line to which to reassign the work order.

The starting and required quantities are updated based on the production that has already been reported for the work order, to reflect just the amounts that need to be produced on the new line. Also, the work order status is automatically changed to New.

4. Modify the start and required item quantities for the work on the new line as needed.

- ## 5. Click **Apply** or **Save**.

The work order is moved to the collection page of the line to which you reassigned it.

## Deleting a Work Order

If a work order has any status except Running, it can be deleted.

## To delete a work order

- On the work order's details page, click the **Delete** button. A confirmation message appears.

## Work Order Deletion Behavior

If you delete a work order, the work order and its jobs are deleted from the database. However, any production that has been entered for the work order is not deleted. Production history is maintained as it might be required, for example, for recall purposes.

Therefore, if a work order that had production reported against it is deleted, its production will still be included in the Total Production Count on the line Monitor page, even though it will not be included in the Work Orders in Period list.

Also, if a new work order is using the same work order ID as a deleted work order, any production that was reported against the old deleted work order will be associated with the new work order. For this reason, unless you are reinstating a work order that was deleted by mistake, you should avoid reusing work order IDs of deleted work orders.

To remove all information associated with a work order, including related production history, use the Purge function in MES Client instead of the Delete function described here.

## Viewing a Line's Work Order Status

### To view a work order's status

1. On the home page, click the **Lines** tile.

The **Lines** collection page appears.

2. Click the line whose work order you want to track.

The line's **Work Orders** tab appears, listing all of the work orders that are assigned to the line.

Work Order	Item	Qty Required	Qty at Start	Qty Remaining	Qty Produced	Qty Rejected	Status	Progress (%)
20221010.02	Bag of mixed nuts - BBQ	250 Pieces	255 Pieces	255 Pieces	0 Pieces	0 Pieces	RUNNING	0 20 40 60 80 100
WO20221010.01	Bag of mixed nuts - BBQ	250 Pieces	260 Pieces	5 Pieces	250 Pieces	5 Pieces	COMPLETE	0 20 40 60 80 100

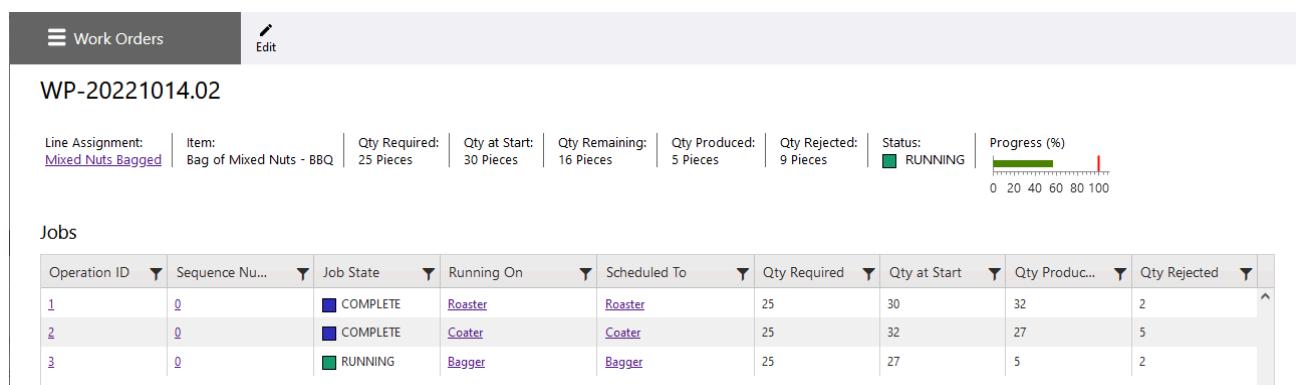
The work order tiles shown in this tab includes summary quantity data about the work order and the work order status. They also include a **Progress** chart, which shows:

$(\text{Qty Produced} + \text{Qty Rejected}) / \text{Qty Required}$

3. To view more detailed tracking information, click the work order tile.

The work order's detail page appears. This page includes summary information about the work order at the

top of the page, and a **Jobs** grid below that lists all of the jobs in the work order.



From this page, you can:

- View detailed information about each job by clicking the job's Operation ID or Sequence Number link. See [Viewing Detailed Job Information](#).
- Navigate to the entity on which a job is running or scheduled to be run by clicking the link in the Running On or Scheduled To column.
- Navigate to the line to which the work order is assigned by clicking the Line Assignment link in the summary information.

## Work Order Status Not Able to Be Shown

For work orders created from a process, if a unit of measure (UOM) conversion has not been defined between any of the items created by the work order's jobs and the item made by the work order, status information will not appear on the work order tile. Instead a message appears that indicates that the work order status cannot be determined due to UOM conversion issue.

In the Units of Measure module in MES Client, make sure that a UOM conversion exists between each item being produced by the work order's jobs and the item being produced by the work order.

### [Viewing Detailed Job Information](#)

#### To view detailed information about a job

- In the **Jobs** grid on the work order's detail page, click the job's Operation or Sequence Number link. The job's detail page appears.

Job Status	Entity	Item	Qty Required	Qty Remaining	Qty at Start	Qty Produced	Qty Rejected
RUNNING	Roaster100	BMX-BBQ	250	200	255	50	5

Created Date	Shift	Quantity	UOM	Item Reason
10/12/2022 1:57:35 PM	No Shift	5	Pieces	Bad Production
10/12/2022 1:57:20 PM	No Shift	50	Pieces	Good Production

The page includes **Job Detail** information, and the **Production History** grid.

In the **Job Detail** information:

- The job's required quantity is determined using the required quantity entered for the line's designated production position.
- The job's remaining quantity is the starting quantity at this production position minus the production (good and rejected) that has been reported at this production position.
- The job's starting quantity is calculated from the work order's starting quantity minus any good or rejected production that has occurred at upstream jobs.
- If there is more than one entity at this position, the job required, remaining, and starting quantities are equally divided among the jobs at this position.
- While the unit of measure (UOM) for items being produced at line positions might be different, item quantities on MES Web Portal pages are always shown in the UOM specified for the line.

For a description of the **Production History** grid columns, see [Production History Grid Column Descriptions](#).

From the job's detail page, you can also:

- Navigate to the entity's **Utilization** tab by clicking the Entity link in the **Job Detail** area.
- Add production quantity to a job by clicking the **Add Production** button on the action bar. See [Entering Production Quantity for a Running Job](#).
- Reduce the production of one of the job's quantity entries by clicking the **Reduce Production** button on the action bar. See [Reducing Production Quantity](#).

## Production History Grid Column Descriptions

### Created Date

The date and time that the production was recorded if the system settings *Maintain distinct good production records* and *Maintain distinct reject production records* are selected (in MES Client). Otherwise, this is the date and time that production is first recorded.

By default, the grid is sorted by descending created date.

**Shift**

The shift during which the item was produced.

**Quantity**

The quantity of the produced item that was added.

**UOM**

The unit of measure for the item that was produced.

**Item Reason**

The reason that was assigned to this production of the item.

**Navigating to the Assigned Line Details**

To navigate back to the line details from the work order's detail page

- Click the **Line Assignment** link on the work order detail page.

The screenshot shows a work order detail page. At the top, there is a header with 'Work Orders' and an 'Edit' button. Below the header, the date '20221012.01' is displayed. In the main content area, there is a table with three columns: 'Line Assignment', 'Item', and 'Qty'. The 'Line Assignment' column contains the value 'Mixed Nuts BBQ', which is highlighted with a red rectangular border. The 'Item' column contains 'Bag of mixed nuts - BBQ' and the 'Qty' column contains '250'.

Line Assignment: <u>Mixed Nuts BBQ</u>	Item: Bag of mixed nuts - BBQ	Qty 250
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**Viewing the Status of a Line's Entities**

- On the home page, click the **Lines** tile.  
The **Lines** collection page appears.
- Click the line whose entity status you want to track.  
The **Work Orders** tab of the line's page appears.
- Click the **Entities** tab.

Mixed Nuts BBQ

Current Reason: Idle

Bottleneck: [Bagger100](#)

Standard Item: BMX-BBQ(Bag of mixed nuts - BBQ)

Batch Size: 1,000,000 Pieces

Performance Rate: 1.000 batches/hour

Work Orders | Entities | Monitor | Configuration

Entity	Status	Job Details
Roaster100	Running	Work Order: <a href="#">20221012.01</a> Operation ID: 1 Sequence: 0 Item: BMX-BBQ(Bag of mixed...) Qty at Start: 255 Pieces Qty Remaining: 200 Pieces Qty Produced: 50 Pieces Qty Rejected: 5 Pieces
Coater100	Idle	No Job Running
Bagger100	Idle	No Job Running

The **Entities** tab includes a tile for each entity in the line. If the entity has an active job, the job information is displayed on the tile. Also, the color of the banner at the bottom of the tile indicates the entity's current utilization state.

### Entity Tile Functions

Roaster100

Running

Work Order: [20221012.01](#)

Operation ID: 1

Sequence: 0

Item: BMX-BBQ(Bag of mixed...)

Qty at Start: 255 Pieces

Qty Remaining: 200 Pieces

Qty Produced: 50 Pieces

Qty Rejected: 5 Pieces

Each entity tile includes buttons and a link for:

1	Adding an event. See <a href="#">Editing an Event</a> .
2	Navigating to the work order whose job is currently running on the entity.
3	Marking the job as Complete. See <a href="#">Marking a Job as Complete</a> .
4	Adding production. See <a href="#">Entering Production Quantity for a Running Job</a> .

You can also navigate to the entity's detail page by clicking the entity tile.

## Viewing Entity Summary Information

Line	Work Order	Batch Size	Default Production Rate
<a href="#">Mixed Nuts BBQ</a>	<a href="#">20221012.01</a>	1,000.000 Pounds	1.000 batches/hour

The entity detail page includes the following summary information at the upper right of the page:

- If the entity is assigned to a line, the name of the line. If you have permission to edit lines or you have been assigned access to the line, the line name will be a hyperlink that will navigate to the line's detail page.
- If a job is currently running on the entity, the ID of the job's work order. The work order ID is a hyperlink that navigates to the work order's detail page.
- The entity's default batch size.
- The entity's default production rate.

## Viewing Jobs in an Entity Work Queue

### To view the jobs in an entity's work queue

1. Display the entity's detail page using one of the following methods:
  - On the home page, click the **Entities** tile, then click the tile of the entity whose jobs you want to view.
  - Navigate to the entity tile via the **Lines** tile (see [Viewing the Status of a Line's Entities](#)) and click the entity tile.The entity's detail page appears.
2. Click the **Work Queue** tab.  
Tiles for each job in the entity's work queue are listed on the left.  
The job tile shows the operation, item quantity information related to the job, and the current state of the job.
3. To view a job's details and production history, click the job tile.  
The **Job Detail** information and **Production History** grid appear.

The screenshot shows the AVEVA MES Work Queue interface for the entity 'Roaster100'. At the top, there are buttons for 'Entities', 'End Job', 'Add Production', and 'Reduce Production'. Below this, the 'Line' is set to 'Mixed Nuts BBQ' with 'Work Order' 20221012.01, 'Batch Size' 1,000.000 Pounds, and 'Default Production Rate' 1.000 batches/hour.

The main area has tabs for 'Utilization Events', 'Work Queue' (which is selected), 'Monitor', and 'Configuration'. The 'Work Queue' tab displays a list of jobs. One job, '20221012.01', is highlighted with a yellow border. Its details are shown in a side sheet:

- Operation:** 1
- Qty at Start:** 255 Pieces
- Qty Produced:** 50 Pieces
- Qty Rejected:** 5 Pieces
- Job State:** RUNNING

**Job Detail** table:

Job Status	Entity	Item	Qty Required	Qty Remaining	Qty at Start	Qty Produced	Qty Rejected
<span style="color: green;">RUNNING</span>	Roaster100	BMX-BBQ	250	200	255	50	5

**Production History** grid:

Created Date	Shift	Quantity	UOM	Item Reason
10/12/2022 1:57:35 PM	No Shift	5	Pieces	Bad Production
10/12/2022 1:57:20 PM	No Shift	50	Pieces	Good Production

In the **Job Detail** information:

- The job's required quantity is determined using the required quantity entered for the line's designated production position.
- The job's remaining quantity is the starting quantity at this production position minus the production (good and rejected) that has been reported at this production position.
- The job's starting quantity is calculated from the work order's starting quantity minus any good or rejected production that has occurred at upstream jobs.
- If there is more than one entity at this position, the job required, remaining, and starting quantities are equally divided among the jobs at this position.
- While the unit of measure (UOM) for items being produced at line positions might be different, item quantities on MES Web Portal pages are always shown in the UOM specified for the line.

For a description of the **Production History** grid columns, see [Production History Grid Column Descriptions](#).

## Filtering the Jobs Queue

You can filter the list of tiles in the Job Queue.

- Click the Filter button at the upper right corner of the **Job Queue** list.

The screenshot shows a list titled 'Job Queue' with a single item: '20221012.01'. To the right of the list is a blue square icon with a white funnel symbol, which is the filter button. A red box highlights this filter icon.

The **Filter** side sheet appears.

**Filter**

<b>Work Order Information</b>	<b>Job State</b>
WO ID <input type="text"/>	<input checked="" type="checkbox"/> NEW <input checked="" type="checkbox"/> READY <input checked="" type="checkbox"/> RUNNING <input type="checkbox"/> COMPLETE <input checked="" type="checkbox"/> SUSPENDED <input type="checkbox"/> ONHOLD <input type="checkbox"/> CANCELED <input type="checkbox"/> BYPASSED <input type="checkbox"/> SUPERSEDED
<hr/> <div style="display: flex; justify-content: space-around;"><div><input type="button" value="Cancel"/></div><div><input type="button" value="Default"/></div><div><input style="background-color: #0070C0; color: white; font-weight: bold; border-radius: 5px; padding: 5px; margin-left: 10px;" type="button" value="Filter"/></div></div>	

2. Enter the filter criteria and click **Filter**.

**Note:** Clicking **Default** restores the filter default settings.

The Job Queue list is filtered and the filter for the page is saved.

## Other Operations

From the **Work Queue** tab, you can also:

- Navigate to the entity's **Utilization** tab and other entity tabs by clicking the Entity link in the **Job Detail** area.
- Add production quantity to a job by clicking the **Add Production** button on the action bar. See [Entering Production Quantity for a Running Job](#).
- Reduce the production of one of the job's quantity entries by clicking the **Reduce Production** button on the action bar. See [Reducing Production Quantity](#).
- End the job by clicking the **End Job** button on the action bar. See [Starting and Ending Jobs](#).

## Viewing Bottleneck Information

A line's bottleneck information is displayed at the top of its line pages, as highlighted below. In addition, the entity that is the bottleneck is indicated by the Bottleneck icon on its tile on the line's **Entities** tab, also highlighted below. If there are parallel entities at the bottleneck position, each entity will include the icon.

Mixed Nuts BBQ

Current Reason: Bottleneck: Bagger100

Standard Item: BMX-BBQ(Bag of mixed nuts - BBQ)

Batch Size: 1,000.000 Pieces

Performance Rate: 1.000 batches/hour

Work Orders | Entities | Monitor | Configuration

Entity	Status	Action
Roaster100	Running	+ (Add)
Coater100	Idle	+ (Add)
Bagger100	Idle	+ (Add)

Sequence: 0

Item: BMX-BBQ(Bag of mixed...)

Qty at Start: 255 Pieces

Qty Remaining: 200 Pieces

Qty Produced: 50 Pieces

Qty Rejected: 5 Pieces

If the bottleneck cannot be determined by the system, then a Note indicator appears in the **Bottleneck** position of the line summary information, as shown below.

Standard Item: BMX-BBQ(Bag of Mixed Nuts - BBQ)

Batch Size: 1.000 Pieces

The unit of measurement: kilograms for the default item: AMD-BLK for the entity: Feeder is different than the unit of measurement: Pieces for item: BMX-BBQ assigned to the line: Bagged Mixed Nuts, and there is no conversion factor defined to convert between the two units. A conversion factor must be defined to convert the units from: kilograms to Pieces.

To see why the bottleneck cannot be determined, hover the cursor over the message icon. A tool tip appears that explains the issue.

## Entering Production Quantity for a Running Job

As items are being produced by a currently running job on an entity, you can enter the production quantity.

### To add a production quantity

1. Navigate to the job:

- Navigate to the **Entities** tab of the line of which the entity is a member (see [Viewing the Status of a Line's Entities](#)) and click the **Add Production** button on the entity's tile, to the right of the Quantity information.
- Navigate to the job's detail page from the work order's detail page (see [Viewing Detailed Job Information](#)) and click the **Add Production** button on the action bar.
- Navigate to the job's detail page from the entity's **Work Queue** tab (see [Viewing Jobs in an Entity Work Queue](#)) and click the **Add Production** button on the action bar.

The Add Production side sheet appears.

2. Enter the production quantity and the corresponding production information. See [Add Production Quantity Settings](#).

**Add Production**

Production Type

Good  
 Rejected

Quantity (Pieces) \*

200

Production Reason

Produced\Good Production

Item ID

BMX-BBQ

Item Description

Bag of mixed nuts - BBQ

Lot Number

To Storage Location

Created At

Current Time

3. To save the entries, click **Add Production**.

The production amount shown for the job is updated. Also, the new production is added as an entry in the **Production History** grid (see [Viewing Detailed Job Information](#) or [Viewing Jobs in an Entity Work Queue](#)).

### Add Production Quantity Settings

The Add Production side sheet includes the following settings.

**Production Type**

The type of production being added.

Good production is added to the quantity produced. Rejected production is added to the quantity rejected.

These quantities are used to determine the quality component of OEE.

The selected production type affects the set of reasons available in the **Production Reason** list.

**Quantity**

The amount of produced items to add.

**Production Reason**

The reason assigned to this production of the item.

**Item ID**

The unique ID of the item being produced.

The list will include multiple items if the job can produce items in addition to the standard item, such as substitutes or byproducts.

If you select another item ID, the **Item Description** selection is updated accordingly.

**Item Description**

The description of the item being produced.

The list will include multiple items if the job can produce items in addition to the standard item, such as substitutes or byproducts.

If you select another item description, the **Item ID** selection is updated accordingly.

**Lot Number**

The lot number for the item being produced.

This can only be set if, in MES Client, the **May create new lots** option has been selected for the job bill of material (BOM) for the selected item.

**To Storage Location**

The storage entity to which items produced by this entity are sent.

This can only be set if, in MES Client, the **May choose alternate inventory location** option has been selected for the job BOM for the selected item.

**Created At**

The date and time when the quantity was added:

- **Current Time:** The current date and time is used.
- **Earlier in Current Shift:** Use the calendar and time widgets to enter the earlier time when the quantity was produced.

---

**Note:** If "No Shift" is displayed with this choice, there is no current shift. For example, if there are no shifts over the weekend, the shift description used to specify time on Saturday or Sunday is "No Shift".

---

- **During the Previous Shift:** Use the calendar and time widgets to enter the time in the previous shift when the quantity was produced.

---

**Note:** If the entity does not have a shift schedule, then this list is unavailable because there are no current or previous shifts. Production will be added using the current time.

---

Unless both of the system settings *Maintain distinct good production records* and *Maintain distinct reject production records* are selected (in MES Client), the **Created At** data and time for production with the same production reason, item, lot, and storage location will always be the first time an entry for that production was recorded.

## Reducing Production Quantity

You can reduce production quantity from a quantity entry made for an entity and job.

### To reduce the amount of production quantity from a quantity entry

1. Display one of the **Production History** grids in the system using one of the following methods:
  - Navigate to the job's **Information** tab from the work order's detail page (see [Viewing Detailed Job Information](#)).
  - Navigate to the **Job Detail** panel from the entity's **Work Queue** tab (see [Viewing Jobs in an Entity Work Queue](#)).
2. In the **Production History** grid, select the production record to reduce and click the **Reduce Production** button on the action bar.  
The **Reduce Production** side sheet appears. You can check the information in this sheet to make sure that you are reducing the quantity of the correct item.
3. In the **Quantity** box, enter the amount by which to reduce the quantity.

The reduced quantity cannot exceed the current quantity, which is displayed to the right of the box.

Reduce Production

Quantity (Pieces) \*

5 of 5

Production Reason

Produced\Bad Production

Item ID

BMX-BBQ

Item Description

Bag of mixed nuts - BBQ

Lot Number

To Storage Location

Cancel Reduce

4. To reduce the quantity, click **Reduce Production**.

## Starting and Ending Jobs

You can start and end a job. Note that ending the job is the same as marking it as Complete.

### To start or end a job on an entity

1. Display the job using one of the following methods:

- Navigate to the job's **Information** tab from the work order detail page (see [Viewing Detailed Job Information](#)).
- Navigate to the **Job Detail** panel from the entity's **Work Queue** tab (see [Viewing Jobs in an Entity Work Queue](#)).

If the job is not running, a **Start Job** button appears in the page's action bar. If the job is running, an **End Job** button appears.

The screenshot shows the AVEVA Manufacturing Execution System. At the top, there is a navigation bar with 'Work Orders' and other buttons like 'End Job' (which is highlighted with a red box), 'Add Production', and 'Reduce Production'. Below this is a date and time display: '20221012.01 1 (0)'. Underneath, there is a 'Job Detail' section for an entity named 'Roaster100'. The job status is shown as 'RUNNING' with a green square icon. The table below shows the following data:  

Job Status	Entity	Item	Qty Required	Qty Remaining	Qty at
RUNNING	<a href="#">Roaster100</a>	BMX-BBQ	250	200	

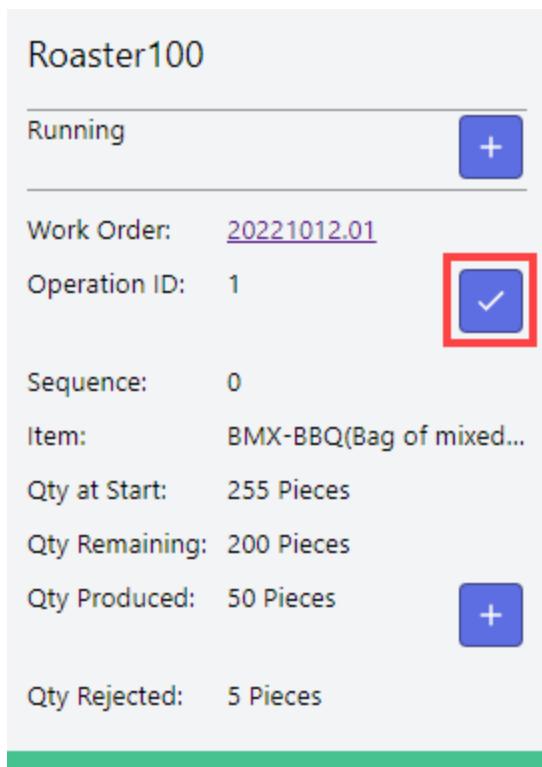
2. Click the **Start** or **End Job** button.

## Marking a Job as Complete

When the job on the entity is finished, you can mark it as Complete. Note that marking a job as Complete is the same as ending the job.

### To mark a job as Complete

1. Navigate to the line's **Entities** tab:
  - a. On the home page, click the **Lines** tile.
  - b. Click the line of which the entity is a member.
  - c. Click the **Entities** tab.
2. On the entity tile, click the Complete button, highlighted below.



A confirmation message appears. Information about the job that is currently running on the entity is included, such as the work order ID, operation ID, and sequence number.

3. Review the currently running job information in the message to verify that this is the job that you want to mark as Complete.
  4. To confirm marking the job Complete, click **OK**.
- The state of the job changes from Running to Complete.

## Working with an Entity's Utilization Events

You can view an entity's event history (see [Viewing an Entity's Event History](#)).

You can also:

- Add events (see [Adding an Event](#))
- Edit events (see [Editing an Event](#))
- Split events (see [Splitting an Event](#))
- Merge events (see [Merging an Event with an Adjacent Event](#))

## Viewing an Entity's Event History

1. On the home page, click the **Entities** tile.  
The **Entities** page appears.
2. To filter the entities list, see [Filtering Entities on the Entities Collection Page](#).
3. Click the entity tile.

That entity's page appears.

#### 4. Click the **Utilization Events** tab.

The **Utilization Events** tab includes the entity's current event status and the **Event History** grid (see [Entity Current Event Status](#) and [Event History Grid Column Descriptions](#)).

**Utilization Events**

Roaster100

Utilization Events | Work Queue | Monitor | Configuration

Current Reason

Current State	Current Reason	Duration (mins)
RUNNING	Running	84.55

Event History

Work Order ID	Start Time	Utilization State	Reason Group	Reason Description	End Time	Duration	Severe	Standard Time	Shift	Comments
20221012.01	10/12/2022 1:56:45 PM	RUNNING	Production	Running	10/12/2022 1:56:45 PM	00:00:32	<input type="checkbox"/>		No Shift	
20221012.01	10/12/2022 1:48:52 PM	STOPPED	Startup	Ramping to Setpoint	10/12/2022 1:56:45 PM	00:07:53	<input type="checkbox"/>		No Shift	
20221012.01	10/12/2022 1:48:22 PM	RUNNING	Production	Running	10/12/2022 1:48:52 PM	00:00:30	<input type="checkbox"/>		No Shift	
	10/12/2022 1:19:26 PM	STOPPED	Production	Idle	10/12/2022 1:48:22 PM	00:28:56	<input type="checkbox"/>		No Shift	

### Entity Current Event Status

The following current event status information appears at the top of the entity **Utilization** tab.

#### Current State

The utilization state associated with the current utilization reason.

#### Current Reason

The utilization reason assigned to the current event.

#### Duration

The duration of the current event.

#### Standard Time

The standard amount of time that the entity is expected to be in this utilization reason.

#### Percent of Standard Time

A bar that indicates the percentage of the event duration relative to the standard time for the utilization reason. The bar is green if the standard time, if defined, has not been exceeded. If the defined standard time is exceeded, the bar turns red.

This information is not available if the standard time for the utilization reason has not been specified.

### Event History Grid Column Descriptions

#### Work Order ID

The ID of the work order that was running during this event. If more than one work order ran during this event, only one of their IDs is displayed.

#### Start Time

The start time of the event. For events that started before the current shift, this is the actual start time and not the start of the shift.

#### Utilization State

The utilization state associated with the current utilization reason. The utilization state determines the color

associated with the utilization reason.

**Reason Group**

The reason group of the current utilization reason.

**Reason Description**

The utilization reason assigned to the event.

**End Time**

The end time of the event.

**Duration**

The total duration of the event. For events that started before the current shift, this is the actual duration and not just the duration from the start of the shift.

**Severe**

Indicates whether the event's Severe flag has been set. The Severe flag is set if the duration of the event has exceeded that utilization reason's maximum duration setting, indicating that the entity condition is severe.

**Standard Time**

The standard amount of time that an event is expected to be in the utilization reason.

**Shift**

The shift during which the event occurred.

**Comments**

Comments entered by the operator about the event.

## Adding an Event

You can add an event to an entity to indicate that its operating condition has changed.

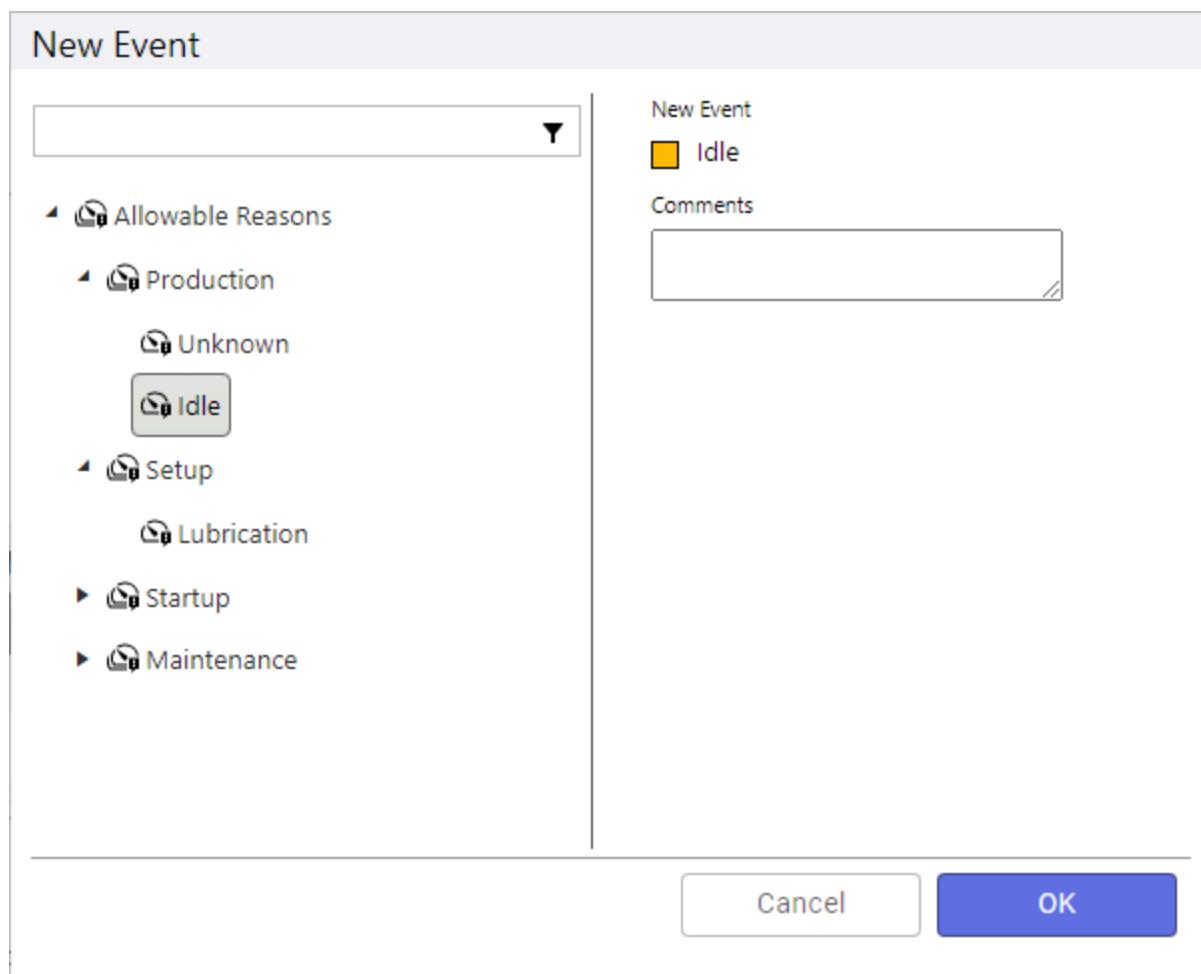
**To add an event**

1. Navigate to the entity's Utilization tab (see [Viewing an Entity's Event History](#)).
2. Click the **New Event** button on the action bar.

The New Event side sheet appears. The reasons that can be used with this entity are displayed in the utilization reason tree (see [Specifying the Utilization Reasons That Can Be Used with an Entity](#)).

3. Select the reason for the event from the tree.
  - You can use the filter box above the tree to filter the reasons that are listed. Enter the filter criteria and press the **Enter** key. To clear the filter, click the **X** button.
  - You can navigate the reason groups and reasons in the utilization reason tree using the arrow keys. Select the currently highlighted reason by pressing the **Enter** key.

After selecting a reason, the **Comments** box appears.



4. Optionally, enter a comment about the new event.
5. Click **OK**.

The event is added to the **Event History** grid.

When a new event is added, the previous event is ended.

## Editing an Event

You can edit an existing event for an entity.

### To edit an event

1. Navigate to the entity's **Utilization** tab (see [Viewing an Entity's Event History](#)).
2. In the **Event History** grid on the **Utilization** tab, select the event and then click the **Edit Event** button on the action bar.

The **Edit Event** side sheet appears.

### Edit Event

Next Event:

No Event

+≡ Split Next

Running

State: RUNNING

Group: Production

---

Duration: 01:36:17

End: 10/12/2022 3:33:02 PM

Start: 10/12/2022 1:56:45 PM

Shift: No Shift

+≡ Split Previous

Selected Event:

Utilization Reason:

Running

▶ Production

▶ Setup

▶ Startup

▶ Maintenance

Event End  
10/12/2022 3:33:02 PM

Event Start  
10/12/2022 1:56:45 PM

Comments

Cancel

3. To save your changes, click the **Save** button.

In the Edit Event side sheet, you can:

- Reclassify the event by changing the reason in the **Utilization Reason** tree. All utilization reasons are shown in this tree.

- You can use the filter box above the tree to filter the reasons that are listed. Enter the filter criteria and press the **Enter** key. To clear the filter, click the **X** button.
- You can navigate the reason groups and reasons in the **Utilization Reason** tree using the arrow keys. Select the currently highlighted reason by pressing the **Enter** key.
- Split the event (see [Splitting an Event](#)).
- Merge the event with an adjacent event (see [Merging an Event with an Adjacent Event](#)).
- Modify the event's comments.

## Splitting an Event

You can split an event so that the new event is added either before or after the event that is being split.

### To split an event

1. In the **Edit Event** side sheet, click either **Split Next** or **Split Previous**.
2. Reclassify one of the split events by selecting that event and then changing the reason in the **Utilization Reason** tree. All utilization reasons are shown in this tree.

Splitting an event has the following effects:

- For Split Previous, the new event's start time will be the source event's start time.
- For Split Next, the new event's end time will be the source event's end time.
- The new event will default to the same reason and comment as the source event.
- The duration of both events will default to half the original duration of the source event.

### To change the durations of the split events

- Perform one of the following actions:
  - If **Split Next** was chosen, select the new next event, and use the hour, minutes, and seconds buttons in the **Event Start** control to change its start time. Note that the end time of the new previous event will change as well, matching the new start time of the next event.

### Edit Event

Next Event:

No Event

[Split Next](#)

■ Running

State: RUNNING  
Group: Production

Duration: 00:48:09  
End: 10/12/2022 3:33:02 PM  
Start: 10/12/2022 2:44:53 PM  
Shift: No Shift

[Split Previous](#)

■ Running

State: RUNNING  
Group: Production

Duration: 00:48:08  
End: 10/12/2022 2:44:53 PM  
Start: 10/12/2022 1:56:45 PM  
Shift: No Shift

Selected Event:

Utilization Reason:

■ Running

[▼](#)

- ▶ ■ Production
- ▶ ■ Setup
- ▶ ■ Startup
- ▶ ■ Maintenance

Event End  
10/12/2022 3:33:02 PM

Event Start  
10/12/2022 2:44:53 PM

[-m](#) [-s](#) [s+](#) [m+](#)

Comments

[Cancel](#) [Save](#)

- If **Split Previous** was chosen, select the new previous event, and use the hour, minutes, and seconds buttons in **Event End** control to change its end time. Note that the start time of the new next event will change as well, matching the new end time of the previous event.

### Edit Event

End: 10/12/2022 3:42:03 PM  
Start: 10/12/2022 2:49:24 PM  
Shift: No Shift

+≡ Split Next

■ Running

State: RUNNING  
Group: Production

---

Duration: 00:52:39  
End: 10/12/2022 2:49:24 PM  
Start: 10/12/2022 1:56:45 PM  
Shift: No Shift

+≡ Split Previous

---

#### Previous Event:

■ Ramping to Setpoint

State: STOPPED  
Group: Startup

---

Duration: 00:07:53  
End: 10/12/2022 1:56:45 PM  
Start: 10/12/2022 1:48:52 PM  
Shift: No Shift

Selected Event:

Utilization Reason:

■ Running

▼

- ▶ ■ Production
- ▶ ■ Setup
- ▶ ■ Startup
- ▶ ■ Maintenance

Event End  
10/12/2022 2:49:24 PM

-m -s s+ m+

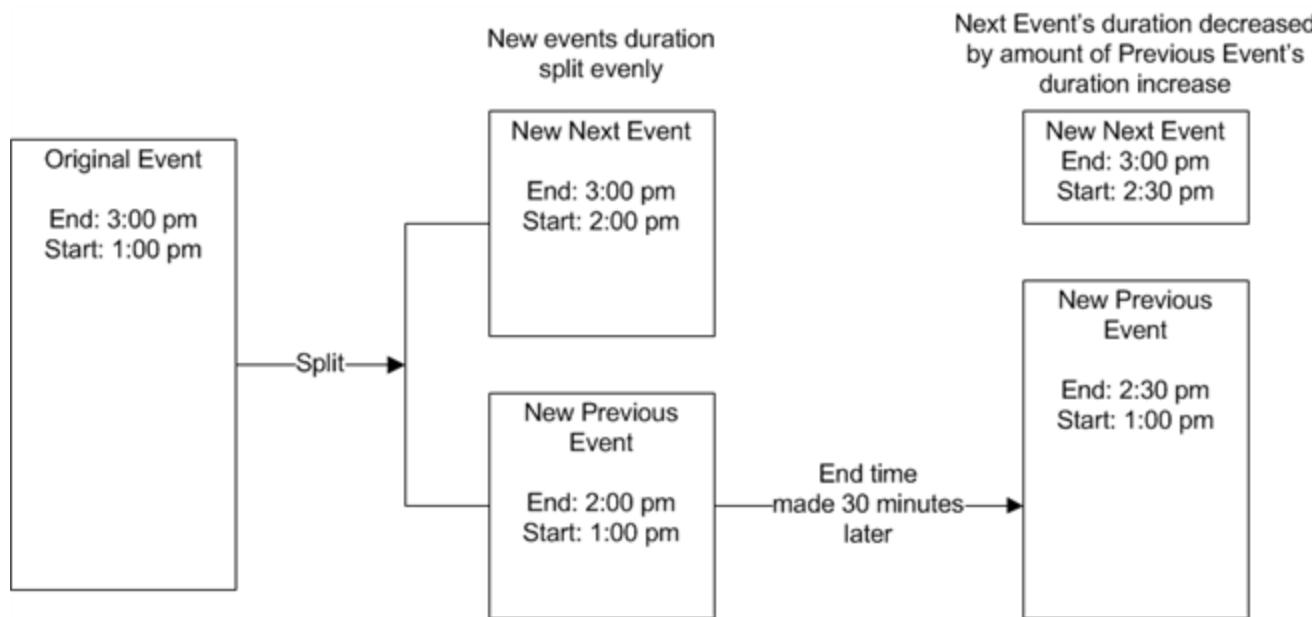
Event Start  
10/12/2022 1:56:45 PM

Comments

Cancel Save

The hours (-h, h) or minutes (-m, m) buttons might not appear in the **Event Start** or **Event End** controls, depending on the duration of the event. For example, in the previous screens the hours buttons do not appear because the duration of the original event is less than an hour.

To understand how changing an event's start and end time works, consider the time changes to an event as shown in the following diagram.

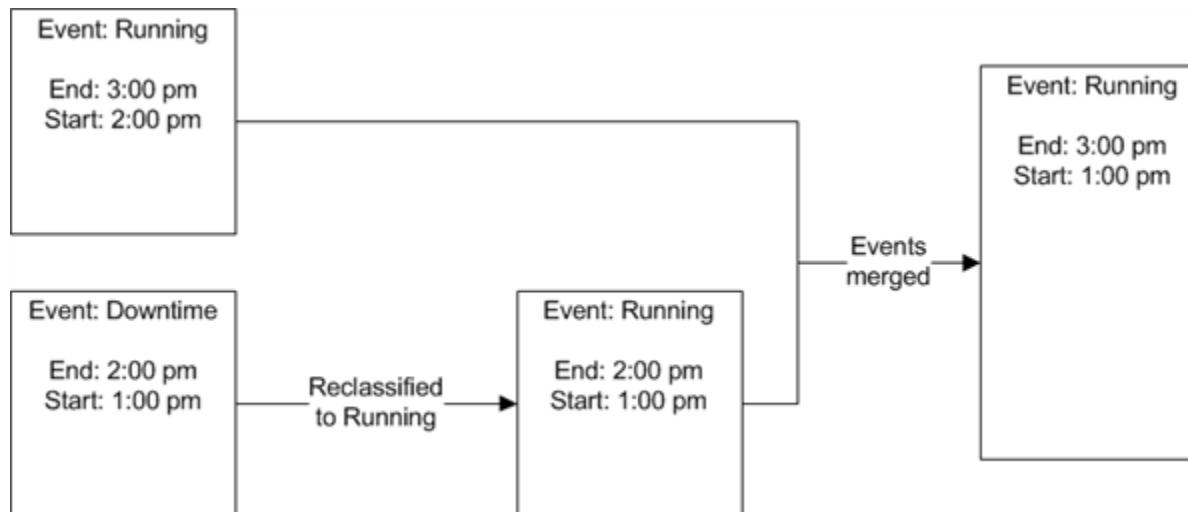


## Merging an Event with an Adjacent Event

If you determine that an event is actually a continuation of the event before or after it, you can merge the two events by making their utilization reasons match.

### To merge an event with an adjacent event

- In the Edit Event side sheet, select the reason that matches the next or previous event. The events will be merged when the event is saved. The duration of the merged event will equal the duration of the two source events, as shown in the following diagram.



The system might be configured such that the comments of the events being merged must match to allow the merge to occur. If this is the case, edit the comment so that it matches the comment of the other event.

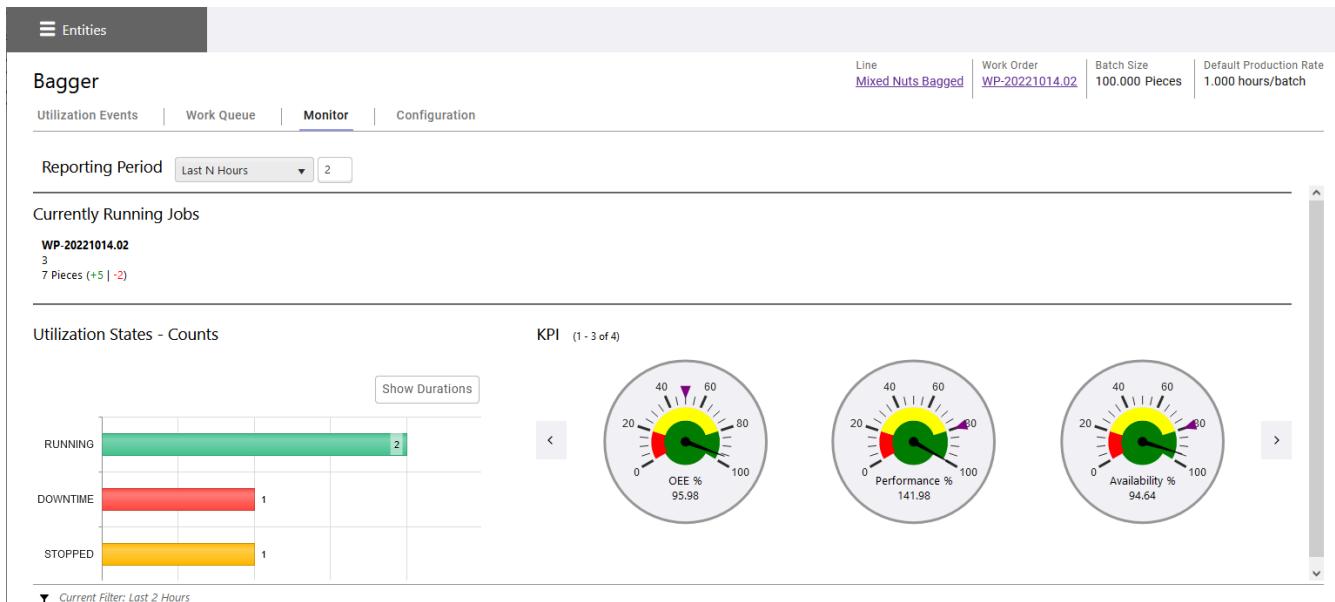
The system might also be configured such that the raw reason codes of the events being merged must match to allow the merge to occur. For a complete explanation of the restrictions regarding when events can be merged,

see [Merging Events](#).

**Note:** This merging of events with the same reasons (and comments and raw reason codes, potentially) means that if a utilization reason is split, and nothing about it is changed, the new event will automatically be merged with the event from which it was split when saved. So, it will appear as if the splitting did not happen. To avoid this, when splitting the event, you should change the reason (or possibly the comments) of the new event before saving it.

## Monitoring Entity OEE

An entity's OEE information is displayed on the entity's **Monitor** tab.



The **Monitor** tab includes the following reporting areas:

- Reporting Period
- Currently Running Jobs
- Utilization Counts or Durations
- KPI

The data on the **Monitor** tab is refreshed according the Auto Refresh rate (if the Auto Refresh setting is selected; see [Information Data Refresh](#)) or if the reporting period is changed.

## Navigating to an Entity's Monitor Tab

The entity's performance information appears on its **Monitor** tab.

You can navigate to the **Monitor** tab in the following ways:

**If you know that the entity is running jobs in the current shift**

- On the **Entities** collection page, click the entity tile, then click the **Monitor** tab.

**If you know that a work order is running**

1. On the **Work Orders** collection page, click the work order tile. The work order's detail page appears. The entities that are running jobs are listed in the **Running On** column of the Job grid.
2. Click the entity name link to open the entity, then click the **Monitor** tab.

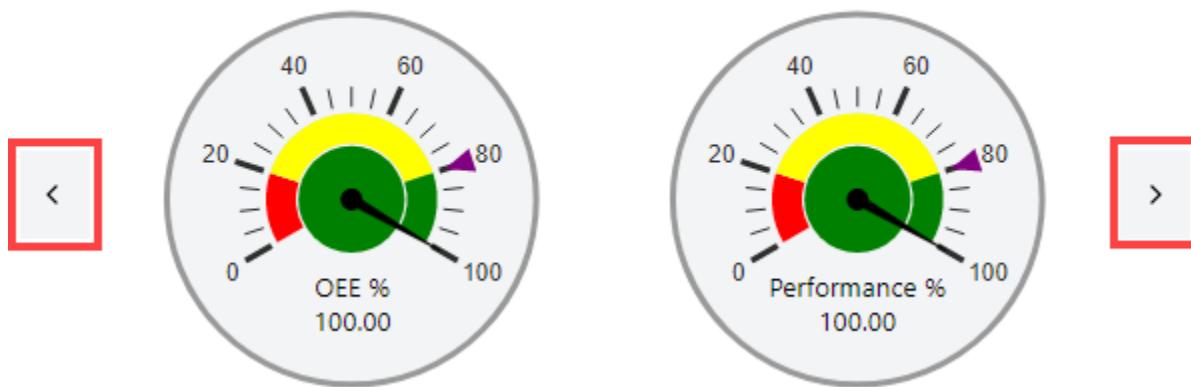
#### If you know that a line is actively running work orders

1. On the **Lines** collection page, click the line tile.
2. Perform one of the following actions:
  - On the **Work Orders** tab, click the tile of the work order of interest and proceed as described above for "If you know that a work order is running".
  - On the **Entities** tab, click the entity of interest and then click the **Monitor** tab.

#### Scrolling Through Data on the Entity Monitor Tab

If there is more data than can fit in either the Currently Running Jobs or KPI panels, use the scroll arrows that appear to scroll through the data.

KPI (1 - 2 of 4)



#### Setting the Reporting Period

##### To set the reporting period for the OEE information displayed in the Monitor tab

- Click the **Reporting Period** filter box and select the reporting period.

Reporting Period

The available periods are:

- This Hour.
- Last N Hours. If you select this option, enter the number of hours from 1 to 168 (7 days) in the accompanying box and press the **Enter** key. Entering 1 hour here is equivalent to the *This Hour* time period. The entry defaults to 1 or to the value saved in cache if one was saved.
- Current Shift.
- Previous Shift.

- Current Day.
- Yesterday.

If you change the reporting period, the content on the **Monitor** tab updates to reflect the data for that reporting period.

## Viewing Currently Running Jobs

### Currently Running Jobs

WO20221013.01

2

10 Pieces (+10 | -0)

Each currently running job appears in the **Currently Running Jobs** panel. This allows you to see the production counts that were used to determine the Quality KPI measure.

Each job entry includes the following information:

- The ID of the job's work order
- The ID of the job's operation
- The total production count for the job, and the Good and Rejected production counts in parentheses

### To view additional job information

- Click anywhere on the job entry.

The additional job information appears. It includes a work order ID link to the job's work order and an operation ID link to the job details page.

Currently Running Jobs

WO20221013.01

2

10 Pieces (+10 | -0)

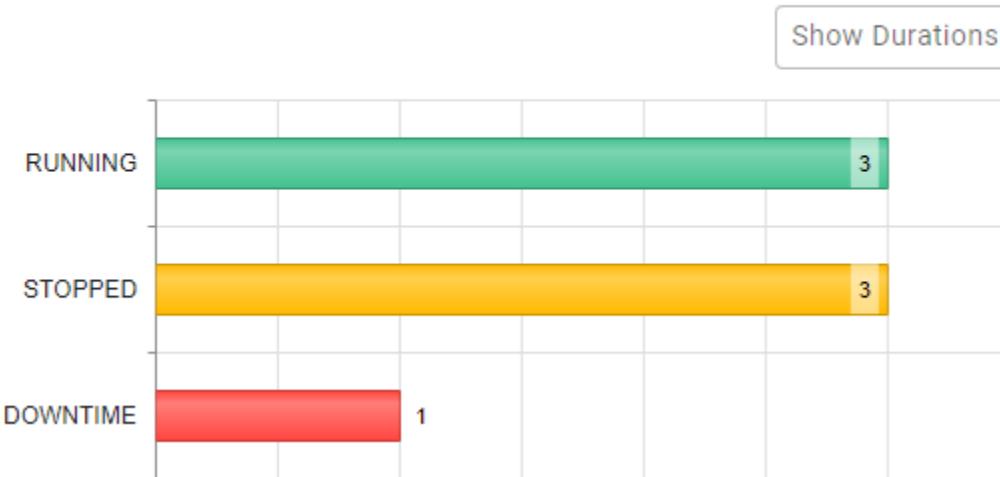
Work Order ID:	<a href="#">WO20221013.01</a>	i
Operation:	<a href="#">2</a>	
Qty at Start:	125 Pieces	
Qty Produced:	10 Pieces	
Qty Rejected:	0 Pieces	
Job State:	<span style="background-color: green; color: white;">■</span> RUNNING	

## Viewing Utilization Counts and Durations

You can view either the counts or duration of an entity's utilization states, reason groups, or reasons on the

Counts/Duration Pareto graph.

## Utilization States - Counts



The graph is refreshed whenever a change in the utilization state, reason group, or reason is detected for the entity from the MES database.

### To toggle between the two viewing modes

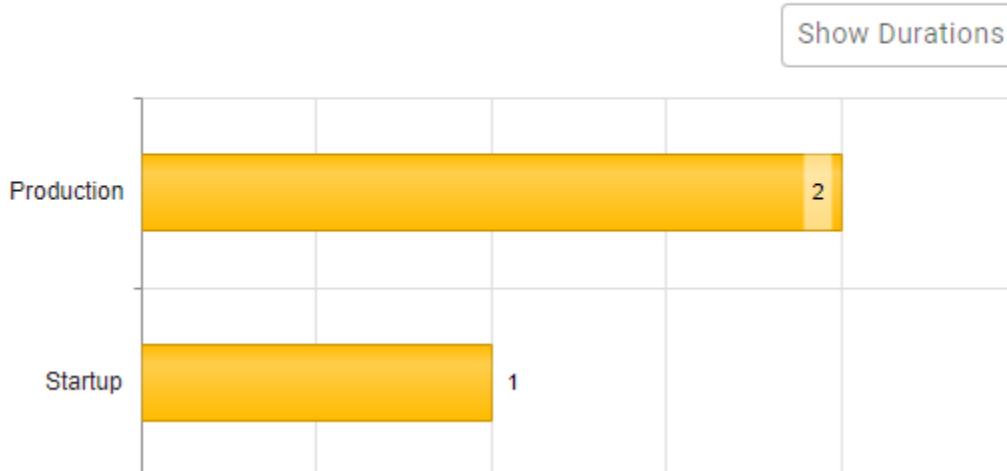
- Click the graph's Show Duration>Show Counts button.

### To drill down into the count or duration information

- Click a bar in the graph.

The drill-down sequence of information is:

- Utilization states (the initial display, shown above)
- Reason groups for the selected utilization state:  
 Reason Group - Counts  
For Utilization State: STOPPED



3. Reasons for the selected reason group:

< Reasons - Counts

For Utilization State: STOPPED  
For Reason Group: Production

Show Durations

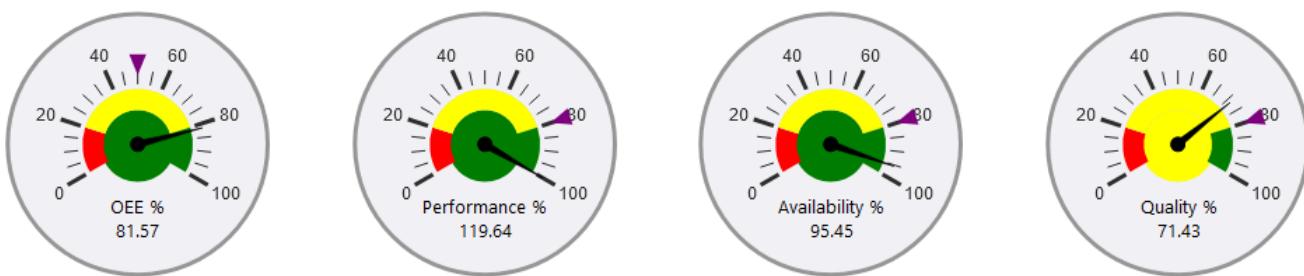


To move back up in the drill-down sequence

- Click the < Back icon to the left of the graph title.

### Viewing KPI Gauges

The KPI gauges indicate the OEE, Performance, Availability, and Quality measures for the entity. KPI



The gauges are driven by the following calculations:

- OEE** = Performance x Availability x Quality
- Performance** = Total Production Count / Predicted Count for the Entity
  - where Total Production Count = Good Production Count + Rejected Production Count
- Availability** = Entity Runtime / Entity Available Time
- Quality** = Good Production Count / Total Production Count
  - where Total Production Count = Good Production Count + Rejected Production Count

For more information about how the gauge data is determined, see the topics in [OEE](#).

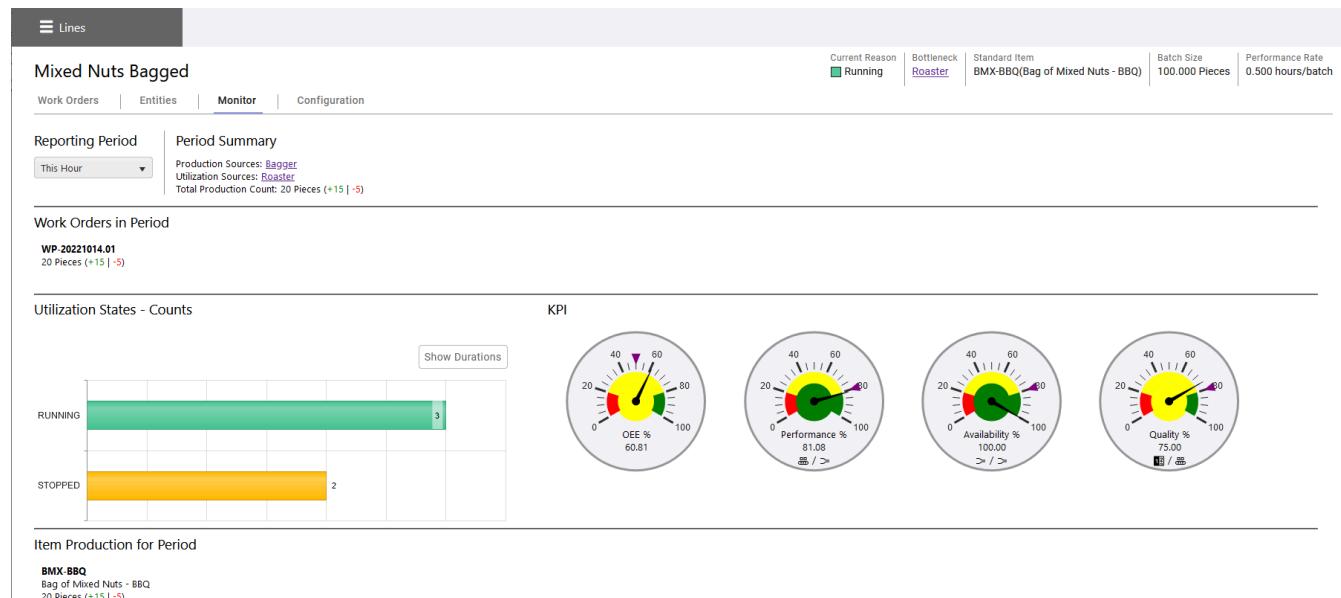
The gauges include the following status indicators:

- Three zones—red, yellow, and green—to indicate the relative status of the KPI measurement.
- Note:** For the current release, the zone values are fixed at 20% and 80%.
- A tick mark at the outer edge of the gauge's color band that points to the target value for that measurement type as configured for the entity. To configure the target values for an entity, see [Configuring Default Utilization Reasons for Standard Events](#) and [Configuring OEE Default Data](#).
  - The pointer that indicates the current value.
  - A text readout of the current value. Note that the pointer will never go beyond 100%. However, if the measurement exceeds 100%, the actual value will be displayed in this text readout.

If there is no OEE-related data for the selected time period, then Performance, Availability, and Quality will be 100%, and so OEE will be 100%. If the OEE metrics are actually 0, then OEE will be 0.

## Monitoring Line OEE

A line's OEE information is displayed on the line's **Monitor** tab.



The **Monitor** tab includes the following reporting areas:

- Reporting Period
- Period Summary
- Work Orders in Period
- Utilization Counts or Durations
- KPI
- Item Production for Period

The data on the **Monitor** tab is refreshed according the Auto Refresh rate (if the Auto Refresh setting is selected; see [Information Data Refresh](#)) or if the reporting period is changed.

## Line Monitoring Video Tutorial

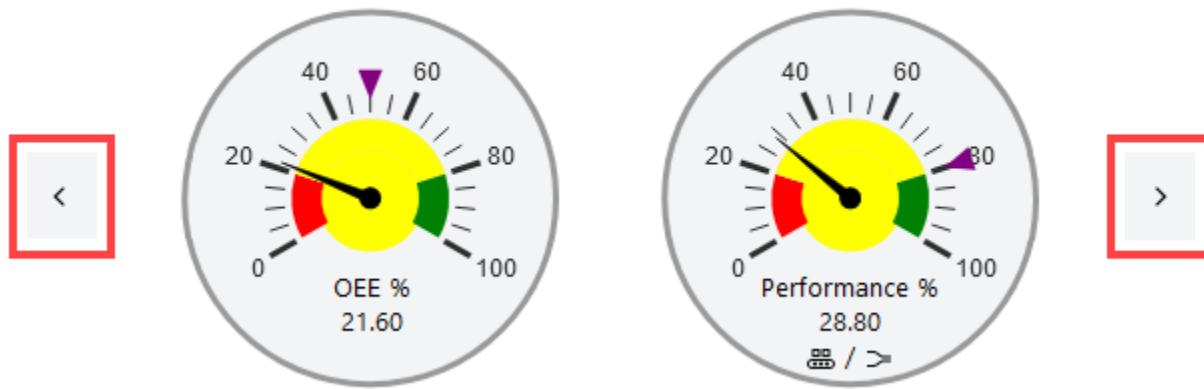
The video tutorial provided below explains how to use a line's Monitor tab to monitor work orders, production, utilization, and KPI metrics.

To view the video in full screen mode, double-click the video or use its Full Screen control, depending on the browser.

### Scrolling Through Data on the Line Monitor Tab

If there is more data than can fit in either the Work Orders in Period, KPI, or Item Production for Period panels, use the scroll arrows that appear to scroll through the data.

#### KPI



### Setting the Reporting Period

#### To set the reporting period for the OEE information displayed in the Monitor tab

- Click the Reporting Period filter box and select the reporting period.

#### Reporting Period

This Hour ▾

The available periods are:

- This Hour.
- Last N Hours. If you select this option, enter the number of hours from 1 to 168 (7 days) in the accompanying box and press the **Enter** key. Entering 1 hour here is equivalent to the *This Hour* time period. The entry defaults to 1 or to the value saved in cache if one was saved.
- Current Shift
- Previous Shift
- Current Day
- Yesterday

If you change the reporting period, the content on the **Monitor** tab updates to reflect the data for that reporting

period.

## Viewing Summary Information for the Period

### Period Summary

Production Sources: [Bagger](#)

Utilization Sources: [Roaster](#)

Total Production Count: 20 Pieces (+15 | -5)

The **Period Summary** panel includes the following information.

#### Production Sources

The entities on the line that are currently configured as the production count sources. Clicking an entity name will navigate you to the entity's **Configuration** tab. For how the line's production source entity is specified, see [Designating an Entity as the Production Source](#).

#### Utilization Sources

The entities that were utilization data sources during the selected time period. If more than one entity is shown, they are displayed in time order of when the entity first appeared as a bottleneck in the time period.

Clicking an entity name will navigate you to the entity's **Configuration** tab. For an explanation of how the entities are determined to be utilization data sources, see [Availability](#).

#### Total Production Count

The line's total production count for the selected time period. The Good and Rejected production counts are shown in parentheses. For an explanation of how the Good and Rejected production counts are determined, see [Quality](#).

The entities shown as production and utilization sources are listed in the order in which they were bottlenecks for the line during the selected time period.

## Viewing Work Order Information

### Work Orders in Period

**WP-20221013.01**

15 Pieces (+10 | -5)

**WP-20221013.02**

2 Pieces (+1 | -1)

Each work order that produced items during the selected time period appears in the **Work Orders in Period** panel. If a work order produced no items or only rejected items, it will not be listed.

Each work order entry includes the following information.

- The work order ID
- The total production count in the time period, with the Good and Rejected production counts in parentheses

#### To view additional work order information

- Click anywhere on the work order entry.

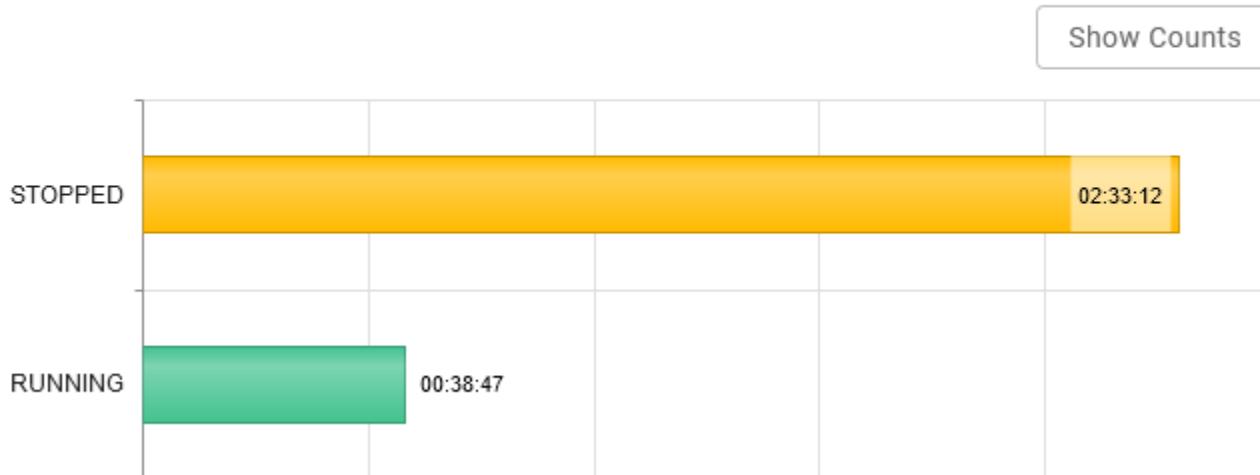
The additional work order information appears. It includes a work order ID link to the work order's page.

### Work Orders in Period

Work Order ID:	WP-20221013.01
15 Pieces (+10   -5)	WP-20221013.02
Item:	BMX-BBQ
	Bag of Mixed Nuts - BBQ
Qty at Start:	100 Pieces
Qty Required:	100 Pieces
Qty Remaining:	85 Pieces
Produced Good in Period:	10 Pieces
Total Good Produced:	10 Pieces
Rejected in Period:	5 Pieces
Total Rejected:	5 Pieces
Status:	<span style="color: blue;">█</span> COMPLETE

### Viewing Utilization Counts and Durations

#### Utilization States - Duration (hh:mm:ss)



On the Utilization Counts/Duration Pareto graph, you can view either the counts or duration of the utilization states, reason groups, or reasons for the bottleneck entities in the line that were used for OEE calculations.

Note that if there are parallel entities involved in a bottleneck position during the selected time period, then the sum of the durations for all the events will be greater than the time period duration.

Also, events for an entity that are immediately adjacent to the period during which that entity was a bottleneck

for the line are included in the graph of event counts. However, these events do not contribute any time to the graph of event durations because they do not actually extend into that period. So if an entity that is changing into or out of a utilization reason and is disabled causes the bottleneck to move to or from that entity's position on the line, that utilization event will be counted even if no additional time for it is added to the duration for its state, group, or reason.

### To toggle between the two viewing modes

- Click the graph's **Show Duration/Show Counts** button.

### To drill down into the count or duration information

- Click a bar in the graph.

The drill-down sequence of information is:

- Utilization states (the initial display, shown above)
- Reason groups for the selected utilization state
- Reasons for the selected reason group

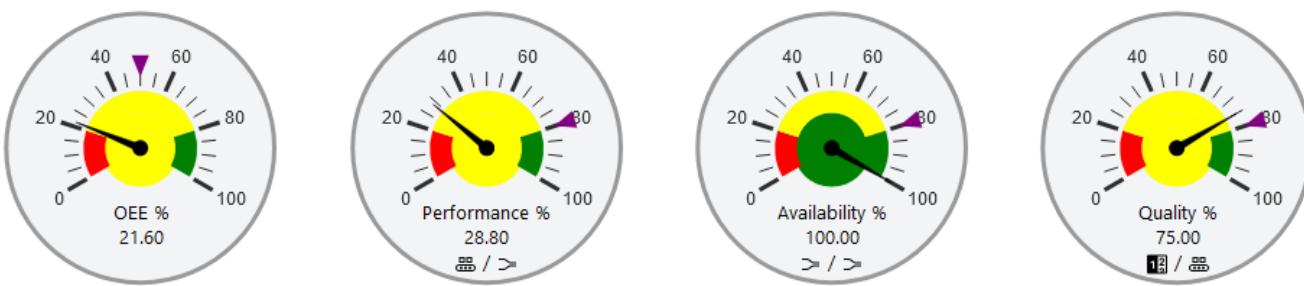
### To move back up in the drill-down sequence

- Click the Back icon to the left of the graph title.

## Viewing KPI Measures

The KPI gauges indicate the OEE, Performance, Availability, and Quality measures for the line.

### KPI



The gauges are driven by the following calculations:

- OEE** = Performance x Availability x Quality
- Availability** = Bottleneck Entities Runtime / Bottleneck Entities Available Time
  - where Bottleneck Entities Available Time = Bottleneck Entities Runtime + Bottleneck Entities Downtime
- Quality** = Good Production Count / Total Production Count
  - where Total Production Count = Good Production Count + Rejected Production Count for the line based on the production entity and all upstream entities
- Performance** = Total Production Count / Predicted Count for Bottleneck Entities
  - where Total Production Count = Good Production Count + Rejected Production Count for the line based on the production entity and all upstream entities

For more information about how the gauge data is determined, see the topics in [OEE](#).

The gauges include the following status indicators:

- Three zones—red, yellow, and green—to indicate the relative status of the KPI measurement.
- 
- Note:** For the current release, the zone boundaries are fixed at 20% and 80%.
- 
- A tick mark at the outer edge of the gauge's color band that points to the target value for that measurement type for the line. For more information, see Determining the Line's OEE Target Values.
  - The pointer that indicates the current value.
  - A text readout of the current value. Note that the pointer will never go beyond 100%. However, if the measurement exceeds 100%, the actual value will be displayed in this text readout.
  - Icons that indicate the data source calculation that drives the gauge.

If there is no OEE-related data for the selected time period, then Performance, Availability, and Quality will be 100%, and so OEE will be 100%. If the OEE metrics are actually 0, then OEE will be 0.

## Viewing Item Production for the Period

### Item Production for Period

#### BMX-BBQ

Bag of Mixed Nuts - BBQ

117 Pieces (+111 | -6)

Each item that was produced on the line during the selected time period appears in the **Item Production for Period** panel. This allows you to see the item counts that were used to determine the Quality KPI measure.

Each item entry includes the following information:

- The item ID and item description
- The total production count for the item, and the Good and Rejected production counts in parentheses

## Develop

As a Manufacturing Execution System (MES) Developer, you use exposed Application Programming Interfaces (APIs), public configuration settings, and add-ons to extend the system. These tools enable you to work with and extend the database, create custom applications, and integrate the system with applications you already use.

## MES .NET Controls

Use the MES .NET Controls topics to understand how to import MES .NET controls into a System Platform Galaxy, configure them, and use them at run time in InTouch applications.

## Using .NET Controls

This section shows you how to import the .NET controls into a Galaxy, configure them, and use them at run time

in an InTouch application.

Hereafter, the word "control" refers to any of the .NET controls.

The following list summarizes the major steps in using the .NET controls:

1. Import the .NET controls or, for InTouch OMI, import the **Controls** folder as an OMI App.
2. Embed the .NET controls into InTouch HMI symbols or, for OMI, place one of the control's OMI Apps into a pane within the OMI layout.
3. Configure the InTouch HMI symbols or OMI layout to access data and contain scripts.
4. Embed the InTouch HMI symbols into a managed InTouch HMI application or the OMI layout into an InTouch OMI application.
5. Deploy the InTouch application to one or more target computers.
6. Run InTouch WindowViewer or OMI on the target computers and interact with the software server.

You can place multiple .NET controls into one single InTouch HMI symbol. You can also place multiple instances of the same .NET control into one single InTouch HMI control. There is no limit to the number of .NET controls you can embed into an InTouch HMI symbol.

You can place only a single .NET control App in a pane within OMI. Multiple .NET control Apps in a layout requires multiple panes to host the controls. This includes a separate pane for the Button Bar control to interact with the Grid controls.

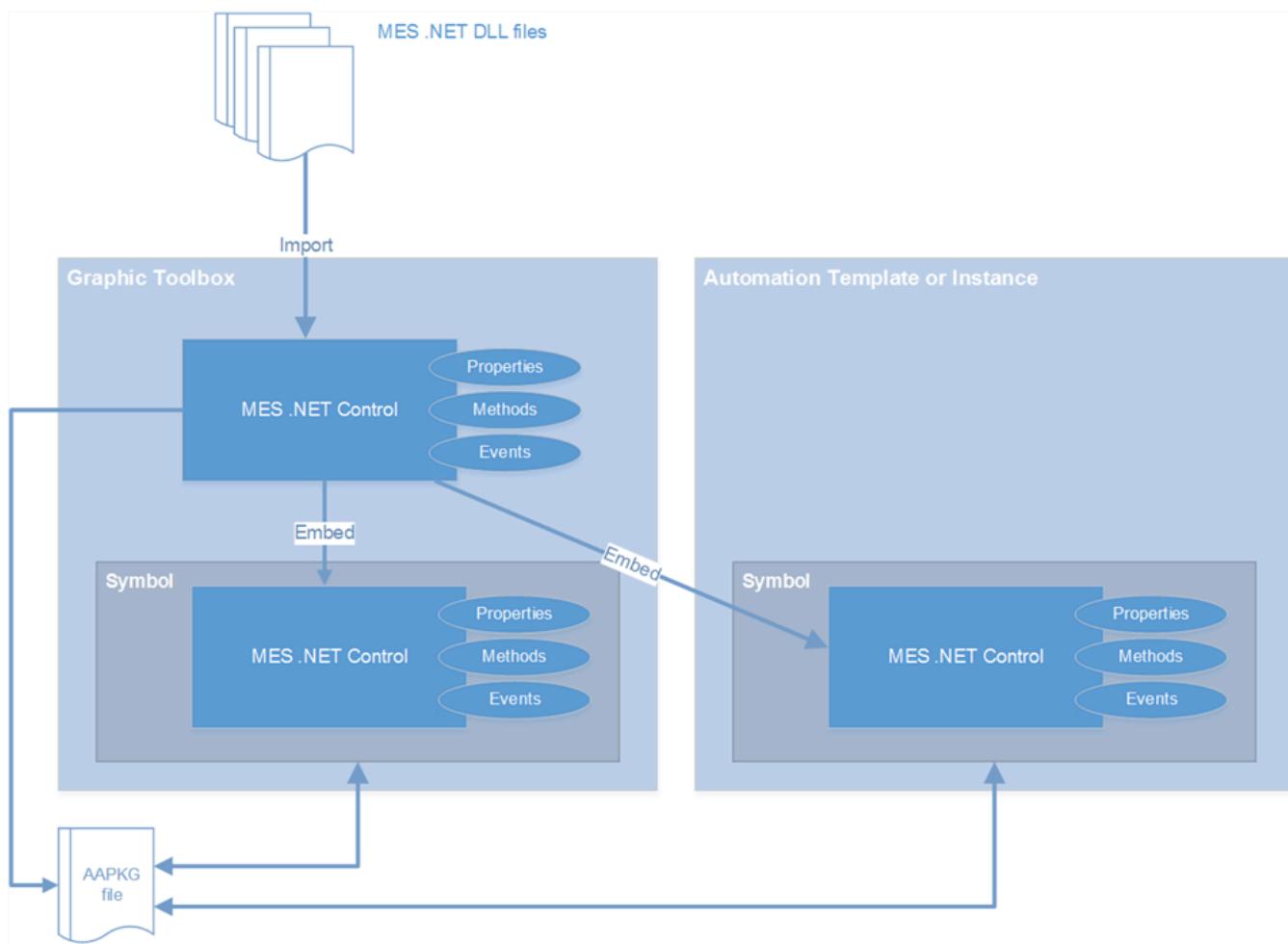
The MES .NET controls can be localized using the Language strings. You can use the MES Client Languages module to search for a specific string and make the modification. For more information, see the Language section in the *MES Client User Guide* or online help.

## About .NET Controls

.NET controls give you functionality to use in InTouch HMI symbols or InTouch OMI panes. To use this functionality, you must:

- For InTouch HMI symbols, import the .dll file containing one or more .NET controls. The .NET control is imported into the Graphic Toolbox. For OMI panes, you import the entire .NET **Controls** folder and the controls become available as OMI Apps.
- Browse and embed one or more of the .NET controls or Apps into a new or existing InTouch HMI symbol or OMI layout. The .NET controls appear as elements.
- View and edit the exposed .NET control properties.
- Bind the .NET control properties to InTouch HMI attributes, symbol custom properties, or InTouch tags. Do this using the data binding animation.
- Configure scripts for .NET control events. Do this using the events animation.

You can then use the InTouch HMI symbol or OMI layout containing the embedded .NET control in an InTouch HMI application. The diagram below represents the use of a .NET control in an InTouch HMI symbol.



## Organizing .NET Controls

You can organize the .NET controls within the Graphic Toolbox the same way as you would with System Platform graphics. You can do the following:

- Rename .NET controls.
- Move .NET controls in and out of Graphic toolsets.
- Delete .NET controls.

For more information, see the System Platform help.

---

**Note:** Currently you cannot organize the OMI Apps.

---

## Importing .NET Controls for Use in AVEVA InTouch HMI Symbols

The .NET Controls are installed in the **MES\Controls** folder during the installation. All the control .dll files present in the **MES\Controls** directory are enclosed in the **MESControls.aaPKG** file. You can also import individual control .dll files or all the .NET Controls into the System Platform Integrated Development Environment (IDE) by importing the **MESControls.aaPKG** file.

If you import a newer version of a .NET control that is already used in the System Platform IDE or in InTouch HMI

as an embedded InTouch HMI symbol, you need to restart the System Platform IDE or InTouch HMI.

To import a .NET control, you must have security permissions to import graphic objects.

After importing .NET controls, you can organize them in the Graphic Toolbox similar to the other InTouch HMI Symbols. For more information, see [Organizing .NET Controls](#).

---

**Note:** If you select .NET .dll files that do not contain .NET controls, the import process ignores these and continues at the next .dll file.

### To import all of the .NET controls

1. Open the System Platform IDE.
2. From the ribbon, select **Galaxy**, then **Import**.
3. Select **Objects**, then **From package**.  
The Import Objects from package dialog appears.
4. Browse to the MES application \Controls folder.
5. Select the the **MESControls.aaPKG** file.
6. Click **Open**.  
The Import Preferences dialog appears.
7. Leave the default settings and click **OK**.  
The Import Objects from package dialog appears.
8. When the import is finished, click **Close** to close the dialog.
9. In the Graphic Toolbox, expand the Galaxy name node.  
The imported controls appear in the list.

### To import individual .NET controls

1. Open the System Platform IDE.
2. From the ribbon, select **Galaxy**, then **Import**.
3. Select **Visualization**, then **Client Controls**.  
The Import Client Controls dialog appears.
4. Browse to the MES application \Controls folder.
5. Select the .dll files for the .NET controls you want to use.  
For a list of the available .dll files, see [MES .NET Control .dll Files](#).
6. Click **Open**.  
The Import Preferences dialog appears.
7. Leave the default settings and click **OK**.  
The Import Client Controls dialog appears.
8. When the import is finished, click **Close** to close the dialog.
9. In the Graphic Toolbox, expand the Galaxy name node.  
The imported controls appear in the list.

---

**Note:** If the import fails, a message indicates the error in the Import Client Controls dialog box.

## MES .NET Control .dll Files

The following table lists the available MES .NET Control .dll files and links to the topics that describe how they can be used.

DLL Name	Control Name and Links to More Information
Fact.Controls.ButtonBar	<a href="#">Configuring the Button Bar Control</a>
FactMES.Controls.Audit	<a href="#">Configuring the Audit Control</a>
FactMES.Controls.Consumption	<a href="#">Configuring the Consumption Control</a>
FactMES.Controls.CountsOrDurationControl	<a href="#">Counts/Duration KPI Control</a>
FactMES.Controls.DataLog	<a href="#">Configuring the Data Log Control</a>
FactMES.Controls.EntityUsageEditor	<a href="#">Configuring the Entity Usage Editor Control</a>
FactMES.Controls.Folders	<a href="#">Configuring the Folders Control</a>
FactMES.Controls.Genealogy	<a href="#">Configuring the Genealogy Control</a>
FactMES.Controls.Inventory	<a href="#">Configuring the Inventory Control</a>
FactMES.Controls.ItemConsEditor	<a href="#">Configuring the Item Consumption Editor Control</a>
FactMES.Controls.ItemLotEditor	<a href="#">Configuring the Item Lot Editor Control</a>
FactMES.Controls.ItemProdEditor	<a href="#">Configuring the Item Production Editor Control</a>
FactMES.Controls.JobStepDataEditor	<a href="#">Configuring the Job Step Data Editor Control</a>
FactMES.Controls.JobSummary	<a href="#">Configuring the Job Summary Control</a>
FactMES.Controls.LaborUsageEditor	<a href="#">Configuring the Labor Usage Editor Control</a>
FactMES.Controls.OEEKPIControl	<a href="#">OEE KPI Control</a>
FactMES.Controls.Production	<a href="#">Configuring the Production Control</a>
FactMES.Controls.ProductionProgressControl	<a href="#">Production Progress Control</a>
FactMES.Controls.Queue	<a href="#">Configuring the Queue Control</a>
FactMES.Controls.Route	<a href="#">Configuring the Route Control</a>
FactMES.Controls.SampleViewer	<a href="#">Configuring the Sample Viewer Control</a>
FactMES.Controls.Spec	<a href="#">Configuring the Spec Control</a>
FactMES.Controls.Steps	<a href="#">Configuring the Job Step Data Editor Control</a>

DLL Name	Control Name and Links to More Information
FactMES.Controls.Utilization	<a href="#">Configuring the Utilization Control</a>

### Example of Installing the Utilization and Button Bar Controls

You can install the Utilization and Button Bar controls from the .dll files. You can then use these controls to create an InTouch HMI symbol containing the Utilization and Button Bar controls.

#### To install the Utilization and Button Bar control

1. Open the System Platform IDE.
2. From the ribbon, select **Galaxy**, then **Import**.
3. Select **Visualization**, then **Client Controls**.  
The Import Client Controls dialog appears.
4. Browse to the MES application \Controls folder and select the following files:
  - **Fact.Controls.ButtonBar.dll**
  - **FactMES.Controls.Utilization.dll**
5. Click **Open**.  
The Import Preferences dialog appears.
6. Leave the default settings and click **OK**.  
The Import Client Controls dialog appears.
7. When the import is finished, click **Close** to close the dialog.
8. In the Graphic Toolbox, expand the Galaxy name node.

The ButtonBar and UtilizationControl controls are listed as .NET controls.



### Importing Previously Exported .NET Controls

You can import one or more previously exported .NET controls from a package file (.aaPKG). Previously the .NET controls may have been:

- Exported without a symbol or an AutomationObject instance or template.
- Embedded in a symbol and the symbol was exported.
- Embedded in a symbol and contained in an AutomationObject instance or template and the AutomationObject was exported.

## To import a previously exported package containing one or more .NET controls

- Import the exported .NET controls the same way as you would import an AutomationObject from a package file (.aaPKG). For more information, see the System Platform IDE help.

## Exporting .NET Controls

You can export .NET controls as package files (.aaPKG). You can export them:

- Directly from the Graphic Toolbox.
- Indirectly when you export AutomationObjects or symbols referencing them.

You can import the .NET controls again from the exported .aaPKG files.

## To export .NET controls directly as package files

- In the Graphic Toolbox, select one or more .NET controls that you want to export.
- From the ribbon, select **Galaxy**, then **Export**.
- Select **Objects**, then **Selected objects**.  
The Export Selected Objects dialog appears.
- Navigate to the destination folder for the package file, name the file, and select **Save**.  
The Exporting object(s) dialog appears.
- When the export is finished, click **Close** to close the dialog.  
The package file is added to the destination folder.

## Importing .NET Controls for Use in AVEVA OMI Panes

The .NET Controls are installed in the MES\Controls folder during the installation. To make any of the controls available for insertion into an AVEVA Operations Management Interface (OMI) pane, you import the entire Controls folder.

If you import a newer version of the .NET controls that are already used in an OMI pane, you need to restart OMI.

To import the .NET controls, you must have security permissions to import graphic objects.

- Open the System Platform Integrated Development Environment (IDE).
- From the ribbon, select **Galaxy**, then **Import**.
- Select **Visualization**, then **OMI Apps**.  
The Import OMI App dialog appears.
- Browse to and select the MES application \Controls folder, then click **OK**.  
The Import OMI App dialog shows the import progress.

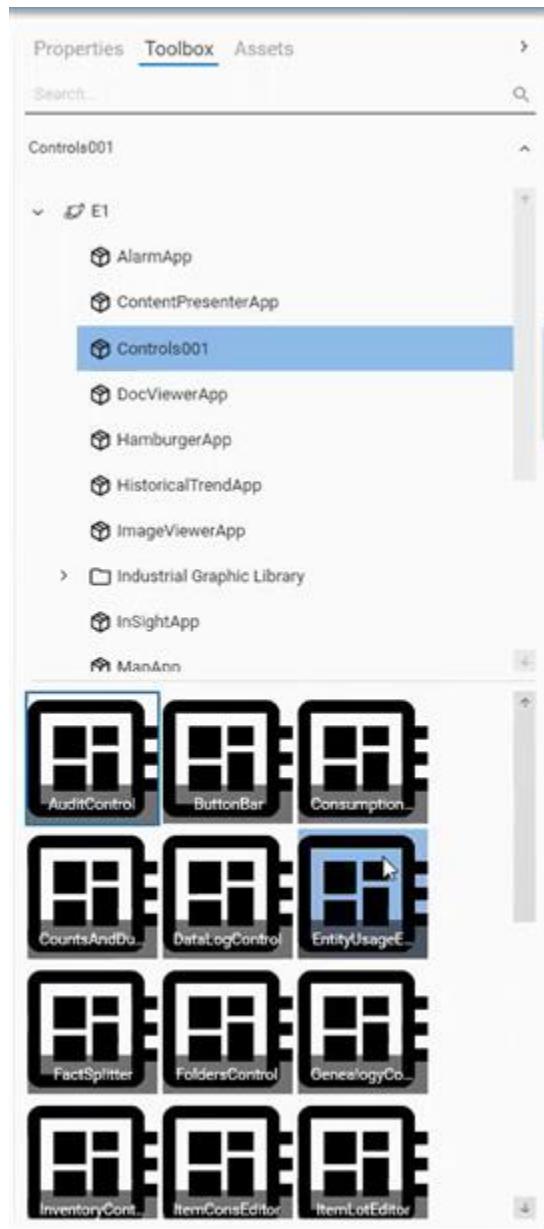
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**Note:** If the import fails, a message indicates the error in the dialog box.

---

- When the import is complete, click **Close**.
- To see the imported controls, open an OMI ViewApp layout.
- In the Toolbox pane, select the .NET Controls app.

The imported controls appear in the pane.



## Securing .NET Controls

The .NET controls use the same security setting as the symbols. You can set the security for .NET controls and symbols in the Security dialog box of the System Platform IDE. For more information, see the System Platform help.

**Note:** Any fixed user settings for a .NET control should be a user with minimal privileges, especially when using MES OS User credentials.

## Configuring .NET Control Event Scripts

You can configure a System Platform script that runs when a .NET control event occurs. You do this using the

**Event animation.**

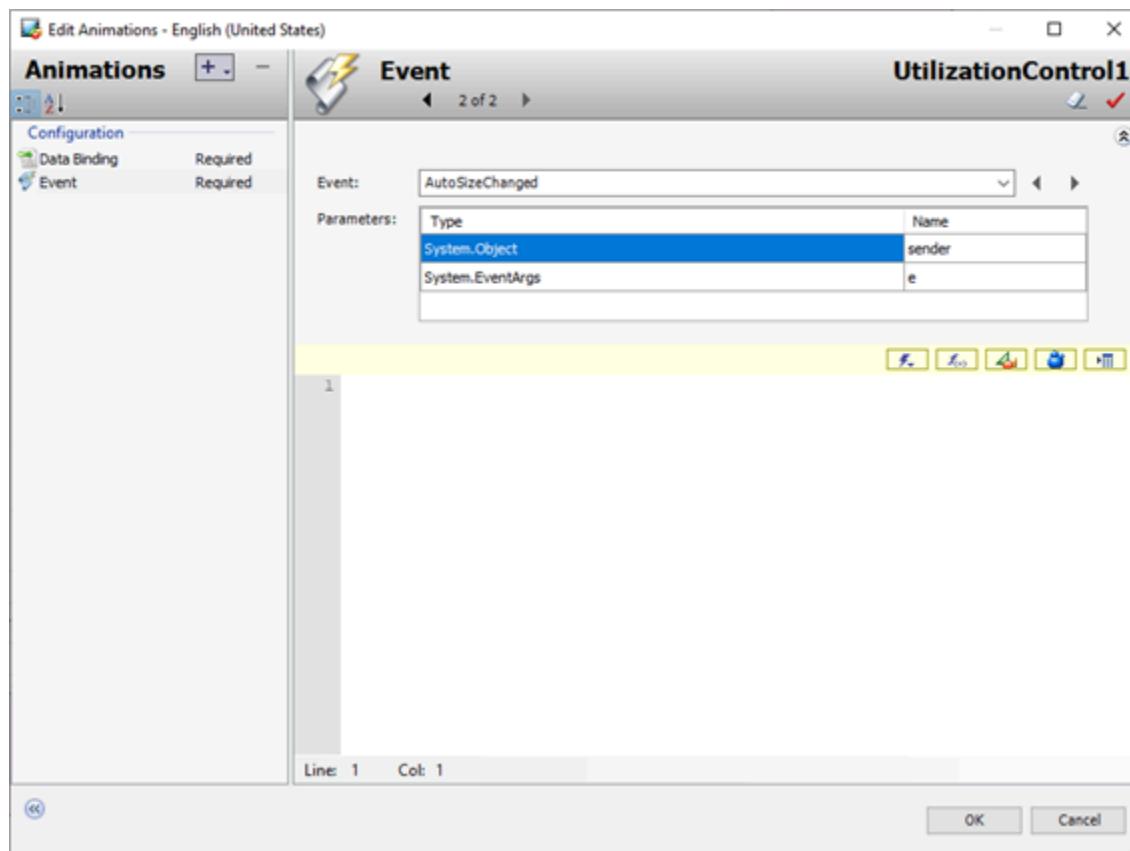
### To configure a System Platform script for a .NET control event

1. Double-click the embedded .NET control on the canvas.

The Edit Animations dialog appears.

2. In the animation list, click **Event**.

The right pane shows the events configuration.



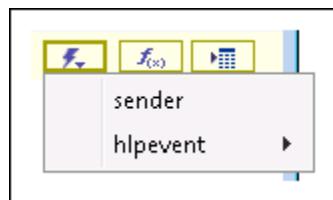
3. In the **Event** list, select the event for which you want to execute a script.

The **Parameters** list shows for the selected event:

- **Type**: the data type of each parameter.
- **Name**: the name of each parameter.

4. In the script area, write the event script.

5. If you want to insert an event parameter in your script, click the **Browse Event Parameters** icon. Select the parameter. The parameter name is inserted into the script at the cursor position.



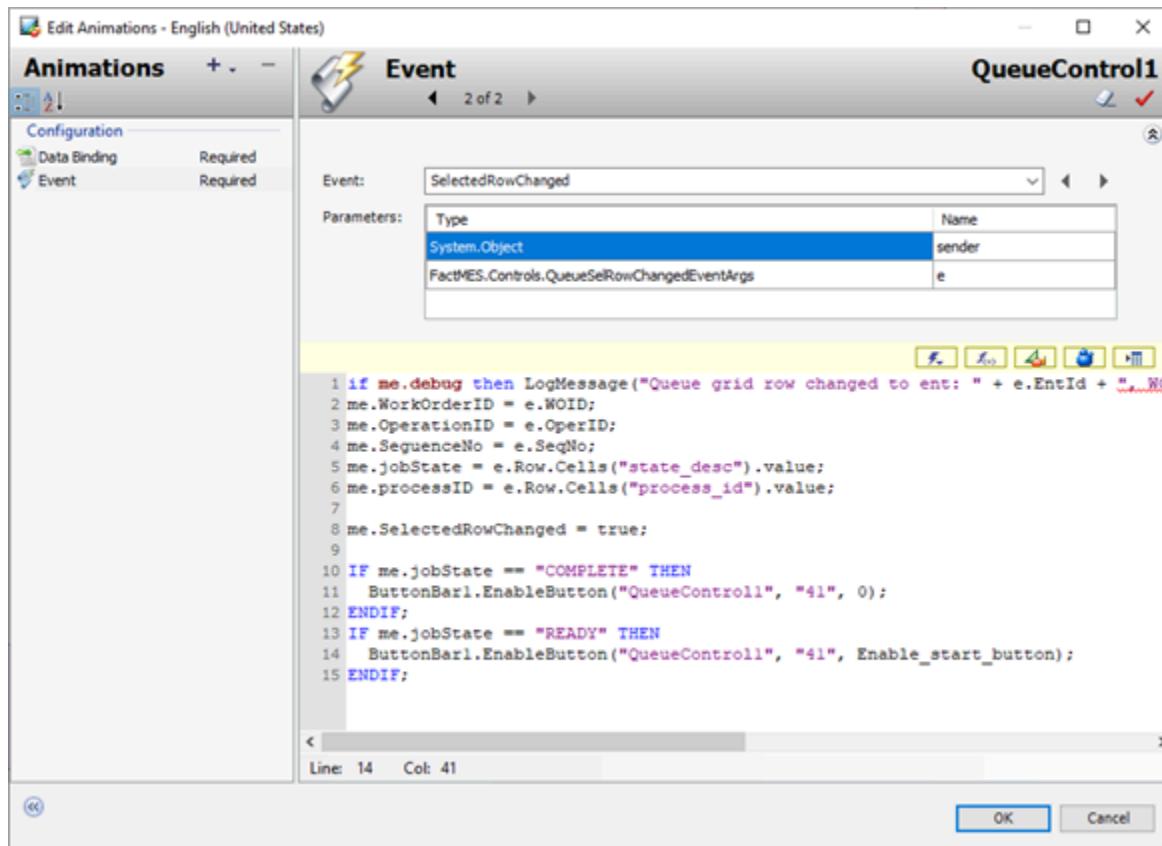
6. If you want to configure scripts for other events, select the event from the **Event** list.

You can select the following three main events from the **Event** list:

- **SelectedRowChanged**
  - **PreButtonClick**
  - **PostButtonClick**
7. The script area is cleared and you can write the script for the newly selected event.
  8. When you are finished, save and close.

### Selected Row Changed Event

When the script runs and needs an information from a row, you can use the **SelectedRowChanged** event. This event is triggered when an operator selects a new row. The row is returned as a part of the event. This event does not trigger when the grid is initially loaded or shows only one record.

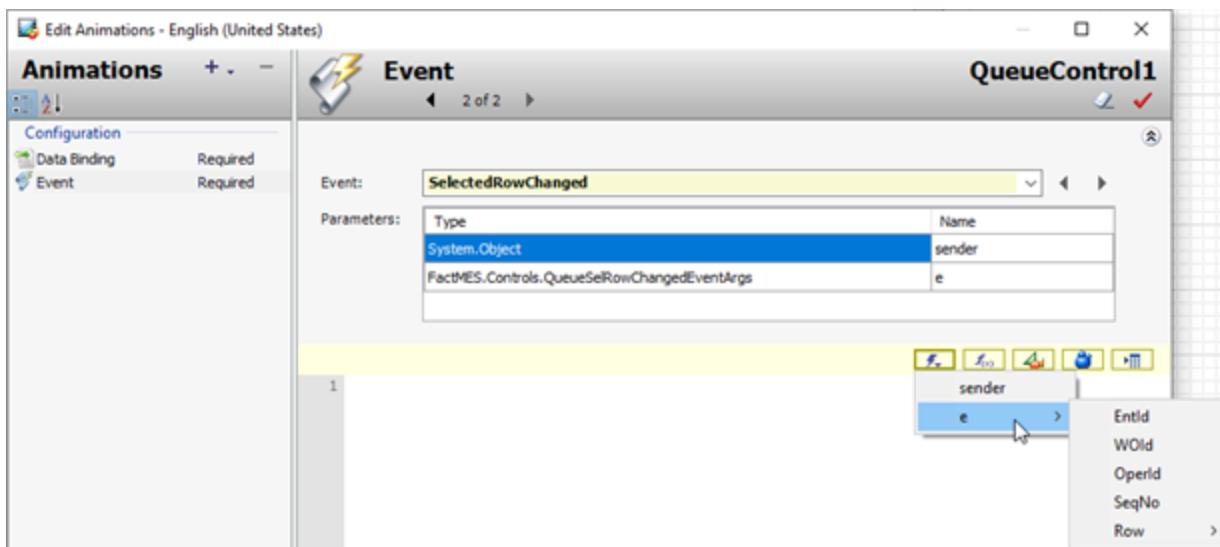


However, for scripts outside the .NET control, a reference to the name of the control is required. For example, to get access to the Queue Control displayed in the image, a reference to the name is required:

```
dim row as xceed.grid.datarow;
row = QueueControl1.FactGrid.SelectedItem;
if (row <> null) then
    ProcessID = row.Cells("process_id").value;
endif;
```

## Properties of the SelectedRowChanged Event

The properties shown in the **SelectedRowChanged** event depend on the control that you select in the **Event** list.



For example, the Queue control displays the following properties:

- **EntId**
- **WOId**
- **OperId**
- **SeqNo**
- **Row**

The **EntId**, **WOId**, **OperId**, and **SeqNo** properties return the key information for a job as the Job Queue control is selected for configuration. However, all controls display a **Row** or **Rows** property, which contains the information about the selected row. The Cells option in this **Row** property retrieves data from a specific column in the row object.

However, some of the .NET control grids allow you to select multiple rows. You can use the **SelectedRows** property for these grids. To access a specific row when multiple rows are selected, use the *FactGrid.SelectedRows.Item(0)* data type. The (0) in this parameter indicates the first row in the collection.

### Pre- and Post-Button Click Events

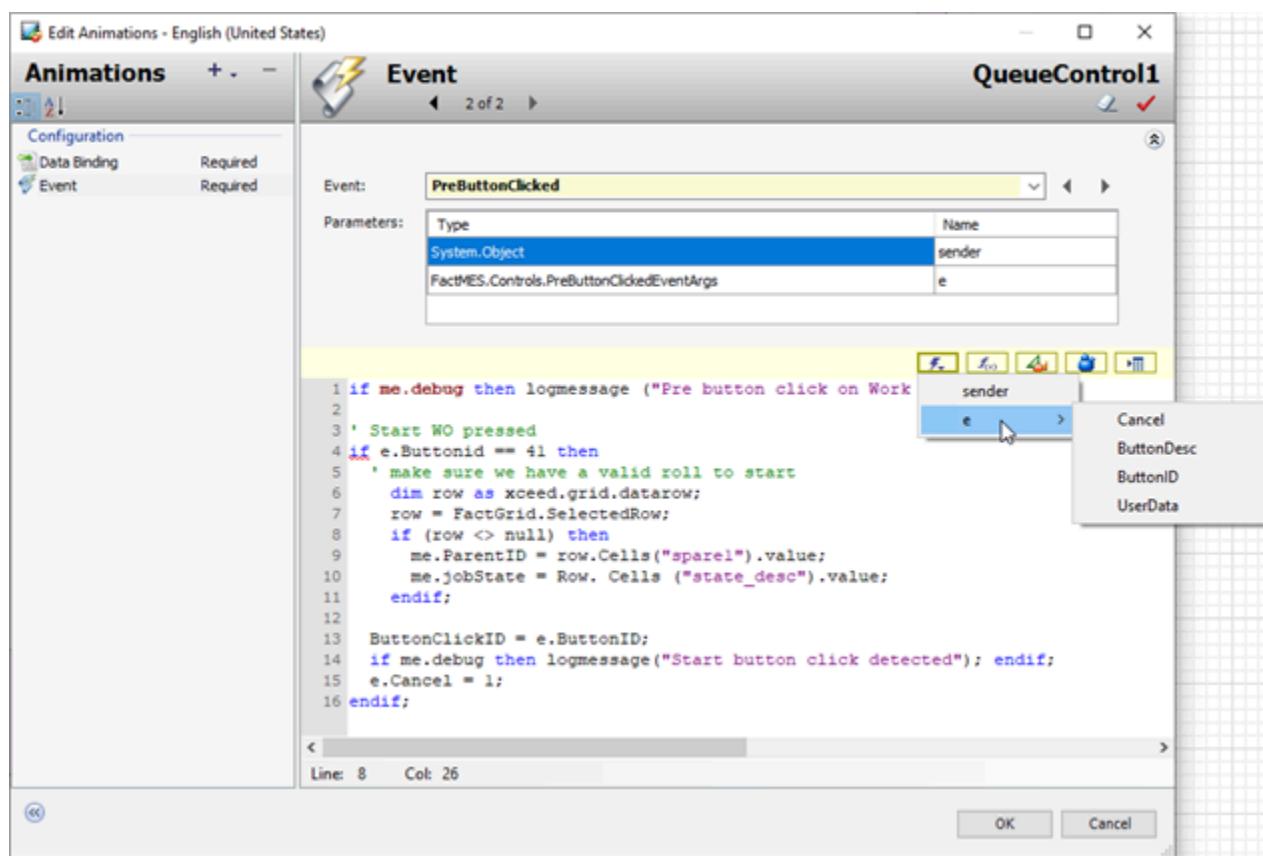
The button bar that is associated with a .NET control sends the pre- and post-button click events on the associated control.

For example, when an operator opens a window in the application that provides the Job/Work Queue control and an associated button bar.

1. If the control does not locate an existing client session, then the user is prompted to connect, and then log on to one or more entities.  
The Job Queue control displays various jobs assigned to an entity.
2. If the user selects one of the jobs, and then clicks the **Start Job** button on the button bar, the Start Job button event is triggered.  
The **PreButtonClicked** event is triggered.

In the following example, the **PreButtonClicked** event is captured using the **e.ButtonID** property of the

event.



Each button contains an associated ID. However, you can also create custom buttons and assign a custom ID number to the buttons.

3. The start event is detected and the row that a user selects in the grid is retrieved.
4. The values from the selected row are read into attributes and the Start command is canceled.

If a command is canceled, the .NET control does not execute the start transaction and calls a custom script to perform the Start command to include additional transactions.

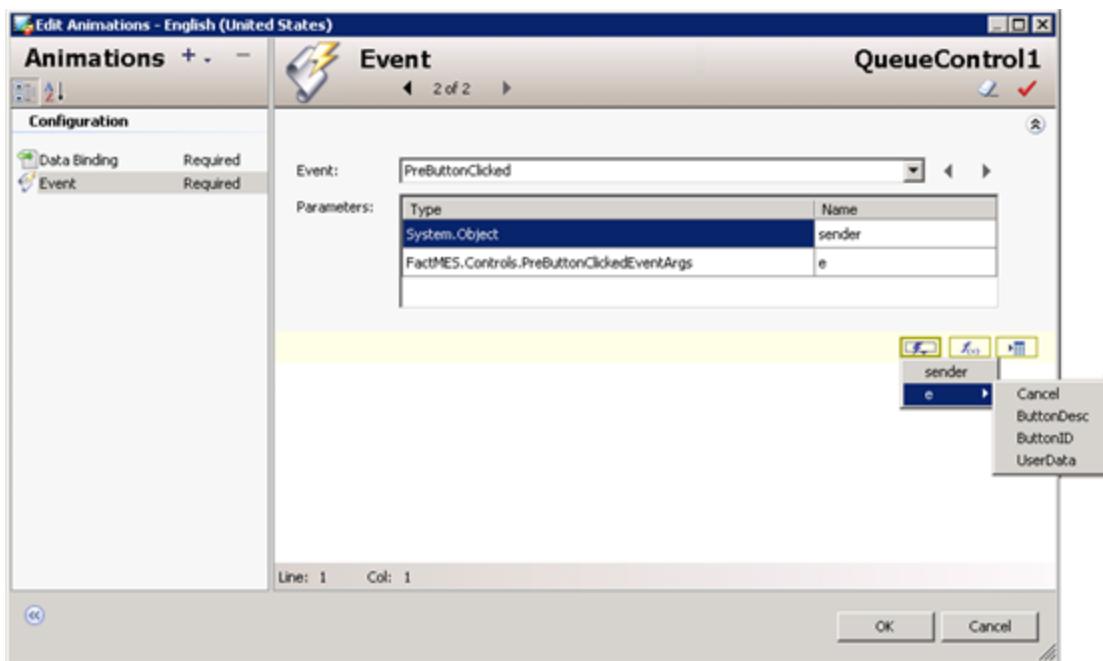
## Properties of the PreButtonClicked and PostButtonClicked Events

The **PreButtonClicked** and **PostButtonClicked** events contain the following common properties:

- **Cancel**

The **Cancel** property is only available on the **PreButtonClicked** event that cancels the execution of the button code.

- **ButtonDesc**
- **ButtonID**
- **UserData**



For information on the **ButtonID** property, see [Buttons](#). The **ButtonDesc** and **UserData** properties are configured by an operator.

The **PostButtonClicked** event is similar to the **PreButtonClicked** event. However, it is triggered after the button command is completed and is used to perform the post condition transactions, such as updating attributes or logging information to an external system.

### Example of Configuring an Event Script for the Utilization Control

Install and embed the Utilization control into a symbol as described in:

- [Example of Installing the Utilization and Button Bar Controls](#).
- [Embedding .NET Controls into a Symbol](#).

In this example, when one of the rows in the Utilization grid is selected, a message is logged in the Operations Control Management Console Log Viewer.

#### To configure the Utilization control to log a message when a row is selected

1. In the System Platform Industrial Graphic Editor, double-click the embedded Utilization control.
2. In the animation list, click **Event**.
3. In the **Event** list, click the **SelectedRowChanged** event.
4. In the script area, type the following:  

```
LogMessage("User selected a row.");
```
5. Save and close the Edit Animations dialog box.
6. Save and close the System Platform Industrial Graphic Editor.
7. Embed the symbol in a managed InTouch application.
8. Switch to run time and log on to the software.

9. Select a row in the grid of the Utilization control.
10. Check the Log Viewer. The message *User selected a row* appears.

## Using Controls in System Platform Symbols

After you import controls, you can configure them by embedding them into System Platform symbols.

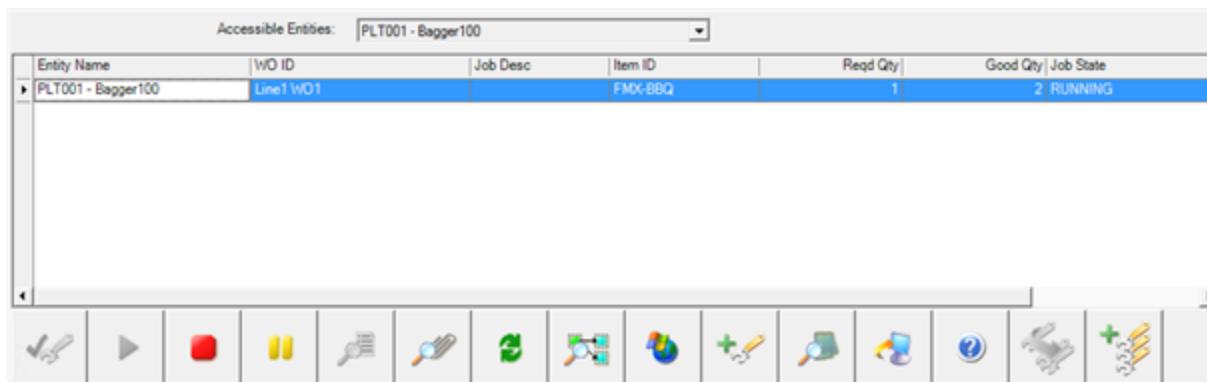
You can embed one or more controls into a System Platform symbol and add graphical features from the System Platform Industrial Graphic Editor to access the methods and properties of the control.

For example, you can create a System Platform symbol to contain the:

- Button Bar control
- Utilization control

The Button Bar control is a special .NET control. You can associate the Button Bar control with another .NET control in the symbol. At run time, the Button Bar control provides a collection of buttons you can use to pass commands to the .NET control.

You can further add buttons, input boxes, and many other elements to your symbol to interact with these embedded controls.



### Embedding .NET Controls into a Symbol

You must embed the installed .NET controls into System Platform symbols so that you can configure and use them.

We recommend that you do not overlap .NET controls with other elements on the canvas. Otherwise, the .NET controls may not work correctly.

**Note:** Embedding the Button Bar control is a special case. For more information, see [Embedding the Button Bar Control](#).

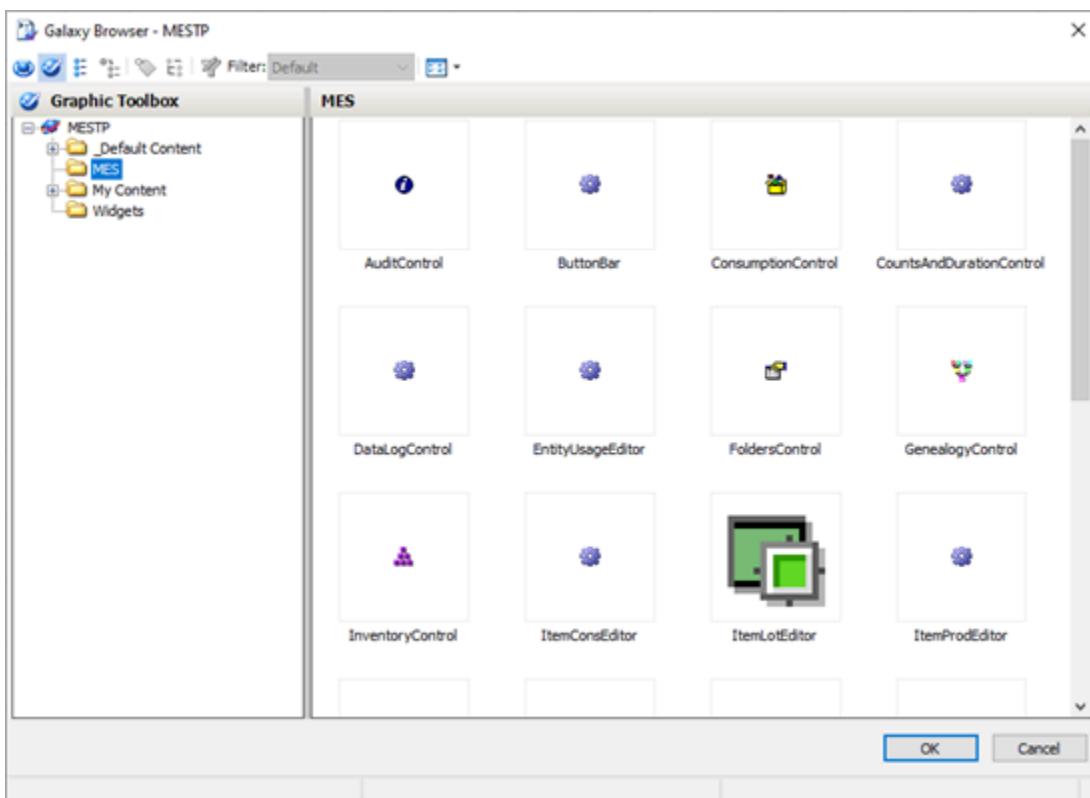
### To embed a .NET control into a System Platform symbol

1. Open the System Platform IDE.
2. In the Graphic Toolbox, right-click the galaxy.
3. On the context menu, select **New**, then **Symbol**.  
A new symbol is added to the list with a default name.
4. Rename the symbol, for example, as OperatorPanel.

5. Double-click the symbol.
- The System Platform Industrial Graphics Editor appears.

6. On the **Edit** menu, click **Embed Industrial Graphic**.

The Galaxy Browser appears.

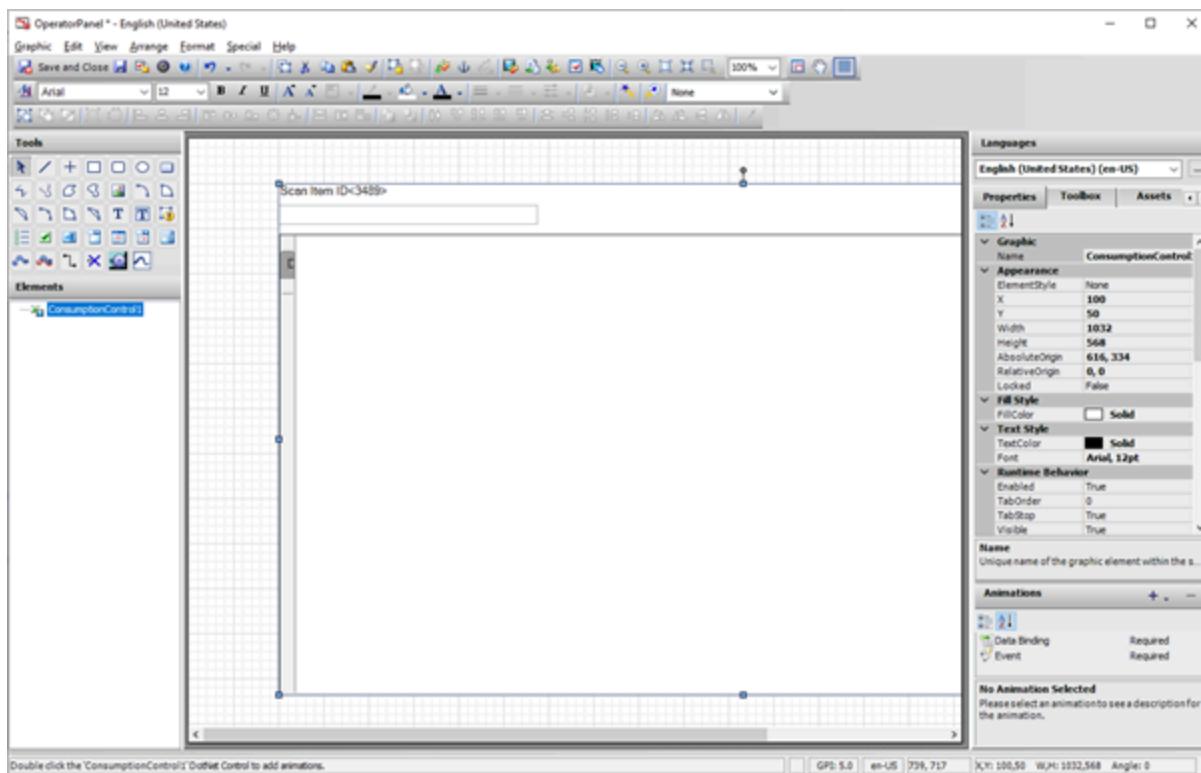


7. Select the control you want to embed from the right pane and click **OK**.

The pointer changes to paste mode .

8. Click on the canvas where you want to place the control.

The .NET control is placed onto the canvas.



You are now ready to configure the control or you can embed more controls.

## Configuring Controls

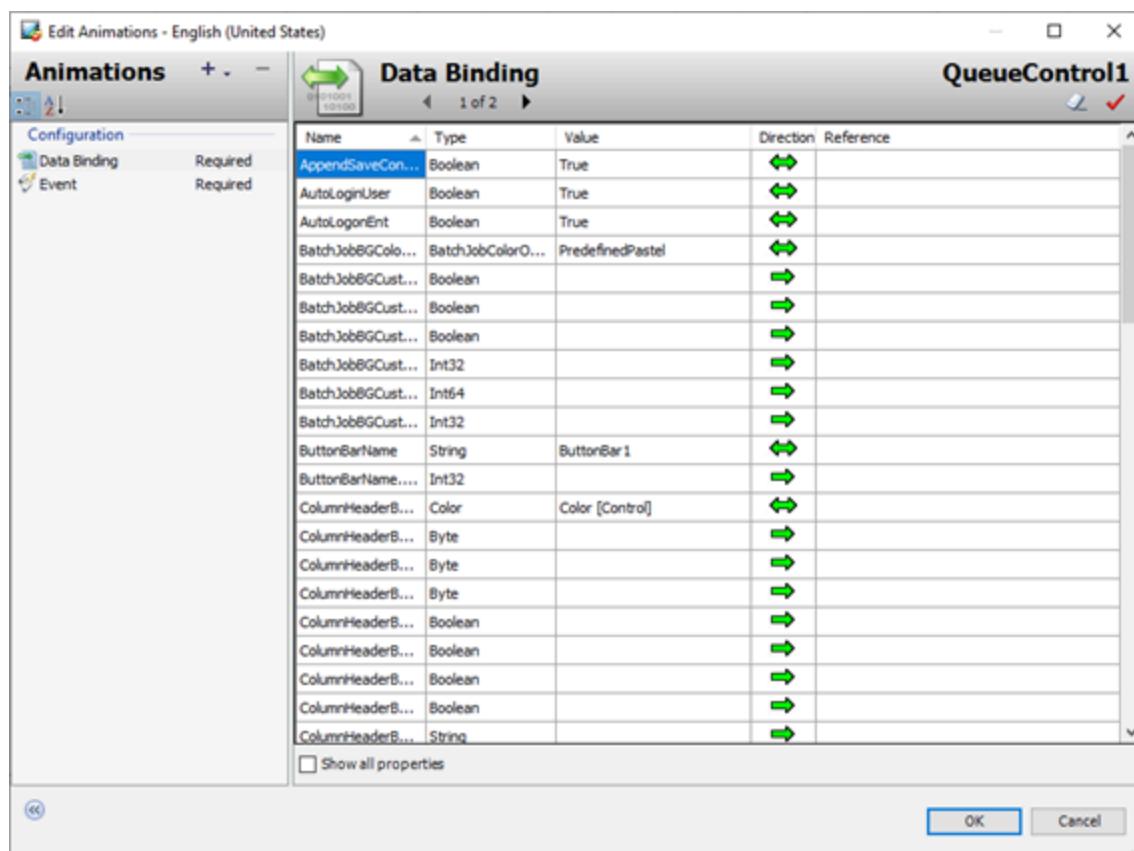
You can configure controls in the same way as you would configure .NET client controls embedded into System Platform symbols:

- Bind control properties to System Platform attributes, InTouch tags, properties of elements, or symbol custom properties.
- Write scripts and associate them with .NET events.
- Access .NET properties and methods from other elements in the System Platform symbol.

### To bind System Platform attributes, InTouch tags, element properties or custom properties to a control

- Open the symbol in the System Platform Industrial Graphics Editor that contains the control.
- Double-click the embedded control.

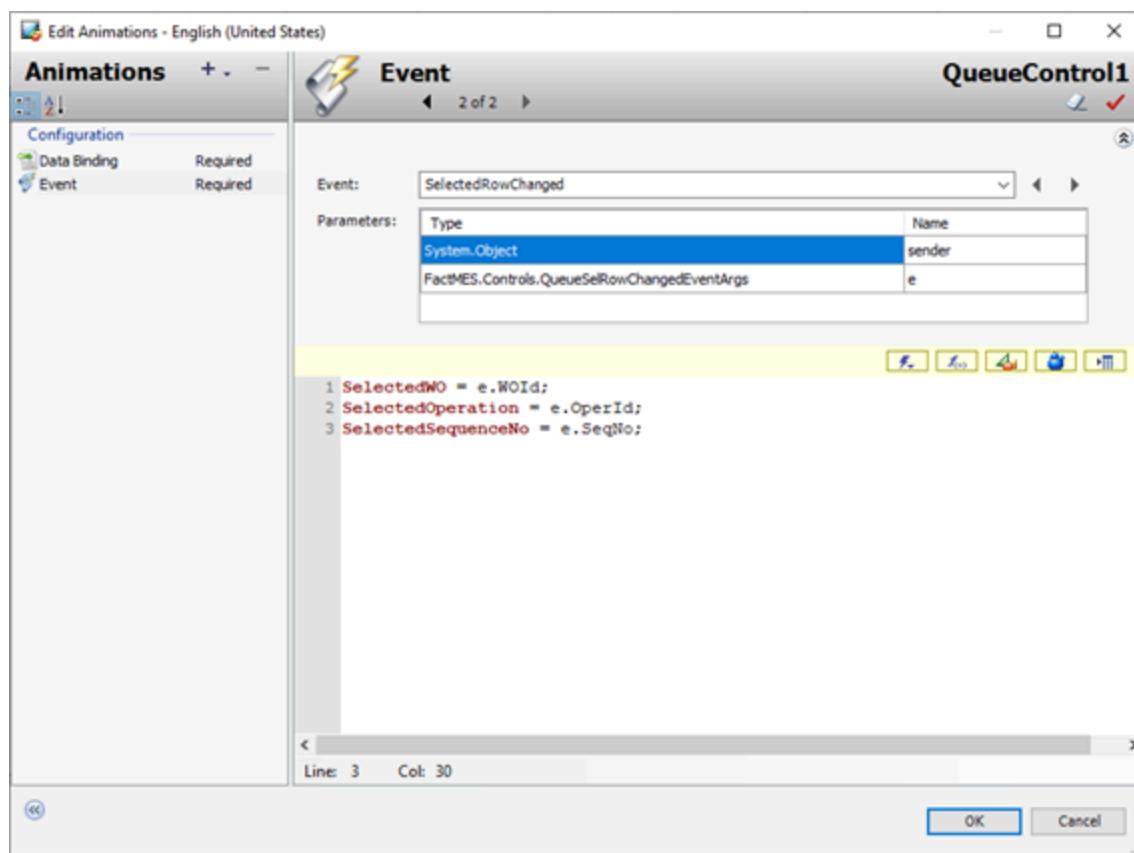
The Edit Animations dialog box appears.



3. In the left pane, select **Data Binding**.
4. In the right pane, locate the control property you want to bind.
5. In the **Reference** box, type the name of the System Platform attribute, InTouch tag, element property, or custom property. For more information, see the System Platform help.
6. When you are finished, click **OK**.

#### To associate scripts with control events

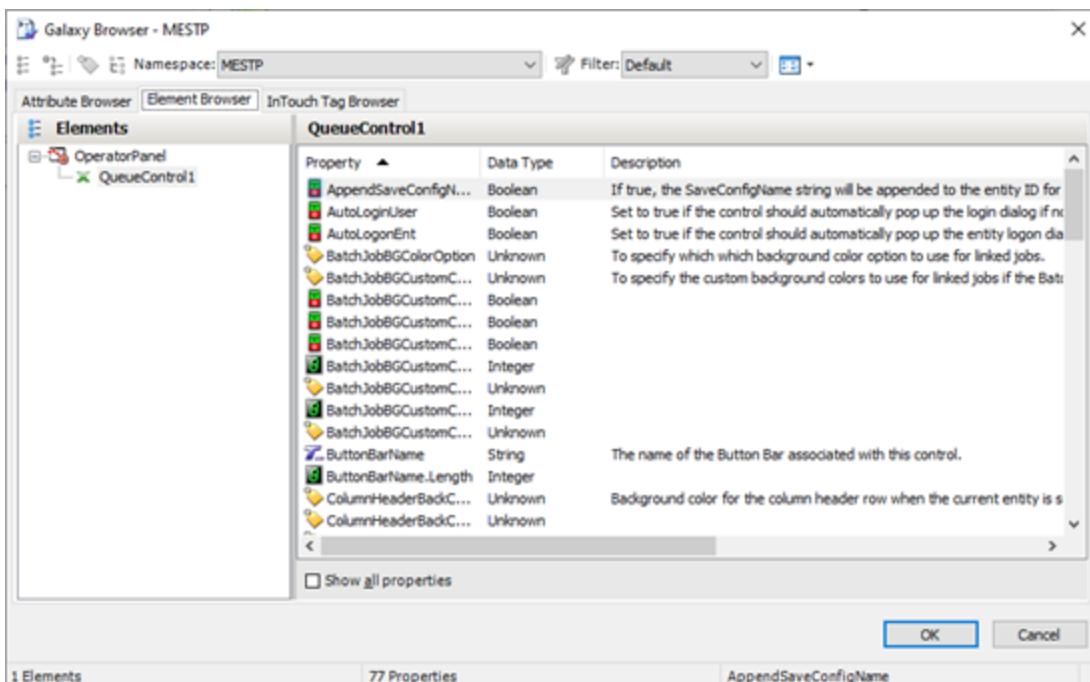
1. Open the symbol in the System Platform Industrial Graphics Editor that contains the control.
2. Double-click the embedded control.  
The Edit Animations dialog box appears.
3. In the left pane, select **Event**.



4. In the **Event** list, select the control event that triggers the script.
5. Write your script in the script window. For more information on scripting, see the System Platform help.
6. When you are finished, click **OK**.

#### To access .NET properties and methods from other symbol elements

1. Open the symbol in the System Platform Industrial Graphics Editor that contains the control.
2. Double-click on the elements you want to interact with the embedded control.  
The Edit Animations dialog box appears.
3. Add an appropriate animation to the left pane.  
In the right pane, depending on the animation type, you can configure and browse for references.
4. Browse for a reference.  
The Galaxy Browser appears.
5. Go to the **Element Browser** tab.



- In the left pane, select the embedded control.

The right pane shows the methods and properties of the control.

- Select a property or method and click **OK**.

## Using Controls in AVEVA OMI and InTouch

You can configure AVEVA OMI and InTouch to use the software controls similar to any other .NET control that you indirectly embed by using symbols. For more information about embedding symbols that contain .NET controls, see the OMI or InTouch user documentation.

### Logging On and Off Controls

The controls can use AVEVA OMI or InTouch security to authenticate a run time operator when both OMI/ InTouch and MES are using OS security.

The controls are designed to handle the different security settings for the MES system and the OMI and InTouch systems. If OMI or InTouch security is used and the users have been synchronized with MES, the controls will use OMI or InTouch security to authenticate the OMI or InTouch user as an MES user. Otherwise, the control will prompt for user credentials or use the configured user settings on the control.

**Note:** Any fixed user settings for a .NET control should be a user with minimal privileges, especially when using MES OS User credentials.

## AVEVA OMI or InTouch Not Using OMI or InTouch Security

If an OMI ViewApp or an InTouch application does not use OMI or InTouch security, or if the current OMI or

InTouch user is not an MES software user, the login dialog appears.

Do one of the following:

- Enter a user name and password to log on to the control. Depending on the control type, a list appears to pick an entity, or the control is ready for use.
- Click **Cancel**. The control shows only the **No User** button. If you click this button, either the Switch User dialog box appears (if other users are already logged on), or the Login dialog box appears.

When you log off from a control that requires authentication, one of the following events may occur:

- The Switch User dialog box appears if another user is logged on to the control.
- The Login dialog box appears if you are the only user using this control.

If you click **Cancel** on either the Switch User or Login dialog box, the control shows only the **No User** button. If you click this button, either the Switch User dialog box appears (if other users are already logged on), or the Login dialog box appears.

## AVEVA OMI or InTouch Using OMI or InTouch Security

When using OMI or InTouch Security, controls are disabled until you log on to OMI or InTouch.

When you attempt to use a control that requires authentication and identical users are set up, you are automatically logged on. Depending on the control type, a list is shown for you to pick an entity, or the control is ready for use.

However, if you are using an OMI or InTouch user name that is not configured, the login dialog box appears, as it would if you were not using OMI or InTouch security. For more information, see [AVEVA OMI or InTouch Not Using OMI or InTouch Security](#).

If you log off from the control, you remain logged in to OMI or InTouch security.

If you log off from OMI or InTouch security, you can no longer use the control until you log in to OMI or InTouch security again.

### Using Properties in System Platform Scripts

Some properties are not visible in the System Platform Attribute browser, but you can use them in scripts if you manually type the property name.

### Using Common Control Properties

This section shows you how to:

- Dock a control within a System Platform symbol.
- Log on to a control automatically.
- Log on to an entity automatically.

- Refresh a control automatically.
- Save the control configuration.

## Docking the Controls Within a Symbol

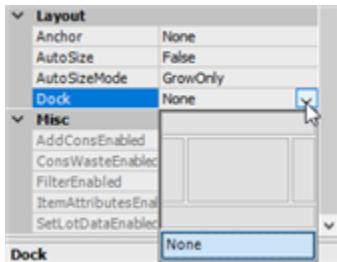
You can dock a control to the top, bottom, left, or right of a symbol. If you want to dock a control, you must draw a rectangle first; then you can dock the control to the rectangle.

After docking, the control is moved accordingly.

### To dock a control

1. Select the control on the canvas.
2. In the **Factelligence** category of the **Properties** Editor, locate the **Dock** property.
3. Click the arrow down icon.

A positioning layout appears.



4. Click on the appropriate layout option to position the control in relation to the symbol.

Setting	Control and Buttons Alignment
Top	Top side of the symbol boundary; horizontally
Right	Right side of the symbol boundary; vertically
Bottom	Bottom side of the symbol boundary; horizontally
Left	Left side of the symbol boundary; vertically
Fill	All sides of the symbol boundary.
None	Not docked

## Logging on the Controls Automatically

You can configure the controls having an **AutoLoginUser** property to log a run time operator on the control automatically. If you set this property to True, at run time either the logon dialog box appears for the control, or the current InTouch user is logged on automatically. You can also set a fixed value in the *LoginUserID* and *LoginUserPassword* attributes for the control to logon the operator automatically.

**Note:** The **LoginUserID** and **LoginUserPassword** fields accept only hard-coded values and not references to the

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object attributes. Any fixed user settings for a .NET control should be a user with minimal privileges, especially when using MES OS User credentials.

When multiple MES controls are included in an InTouch window or OMI layout and at least one of the controls is configured with the **AutoLoginUser** property set to True, then all controls will be logged on with first the configured **LoginUserID** and **LoginUserPassword** settings or the currently logged-in InTouch/OMI user.

If the **AutoLoginUser** property is set to False, you need to include a script to log on users to the controls. For more information, see the *MES Stateful API Reference* online help.

### To log on the software controls automatically

1. Select the control for which you want to enable automatic logon.
2. In the **Factelligence** category of the **Properties** Editor, locate the **AutoLoginUser** property.
3. Set the value of the property to True.

### Logging on to Entities Automatically

If one or more controls in your symbol require the run time operator to log on to an entity, you can set the **AutoLogOnEnt** property of those controls that require a logon to True. At run time, the control then opens the logon dialog box for the control. You can also set a fixed value in the *LogOnSite* and *LogOnEntName* attributes for the control to logon to the entity automatically.

The **LogOnSite** and **LogOnEntName** fields only accept hard-coded values and not references to the object attributes.

If the **AutoLogOnEnt** property is set to False, you need to configure a script to log on users to the controls.

### To log on the entity used in software controls automatically

1. Select the control for which you want to enable automatic logon to the entity.
2. In the **Factelligence** category of the **Properties** Editor, locate the **AutoLogOnEnt** property.
3. Set the value of the property to True.

### Refreshing the Controls Automatically

You can configure controls to ignore any:

- Internal attempt to refresh the control.
- External attempt to refresh the control with the RefreshData command.

To ignore refresh events, you set the **IgnoreRefreshEvents** property to True.

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**Tip:** This setting is useful if the symbol contains more than one control and only one of the controls is visible at a time. Ignoring refresh events also improves performance because hidden controls are not refreshed. For the visible control, set the **IgnoreRefreshEvents** property to False so that it can show the latest data.

### To ignore refresh events in software controls

1. Select the control for which you want to ignore refresh events.
2. In the **Factelligence** category of the **Properties** Editor, locate the **IgnoreRefreshEvents** property.
3. Set the value of the property to True.

## Viewing and Changing the Properties of .NET Controls

When you embed a .NET control into a symbol, the native properties of the .NET control are imported into the Properties Editor in property categories.

Also, the element container of the .NET control has properties such as:

- **Name**
- **X, Y, Width, Height, AbsoluteOrigin, RelativeOrigin, and Locked**
- **FillColor**
- **TextColor and Font**
- **Enabled, TabOrder, TabStop, and Visible**

The element container properties override the native properties of the .NET control.

You can view and change the properties of the control in the **Properties** Editor.

### To view or change the properties of a .NET control

1. Select the embedded .NET control on the canvas.
2. In the **Properties** Editor, locate a:
  - Container property in the property categories **Graphic, Appearance, Fill Style, Text Style or Runtime Behavior.**
  - Native property in other property categories.
3. View or change the located property. For more information, see the System Platform IDE help.

## Example of Changing the Dock Property

Install and embed the Utilization and Button Bar controls into a symbol as described in:

- [Example of Installing the Utilization and Button Bar Controls](#)
- [Embedding .NET Controls into a Symbol](#)

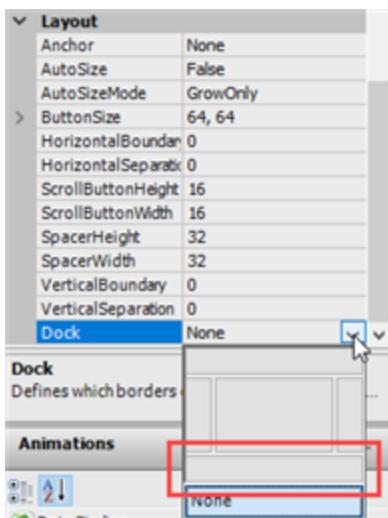
In this example the Dock properties of the Button Bar and Utilization controls are set.

The Dock properties are set to enable the controls to fill the symbol, resize correctly when the symbol size is changed, and maintain the correct relative position with other objects when the symbol is resized.

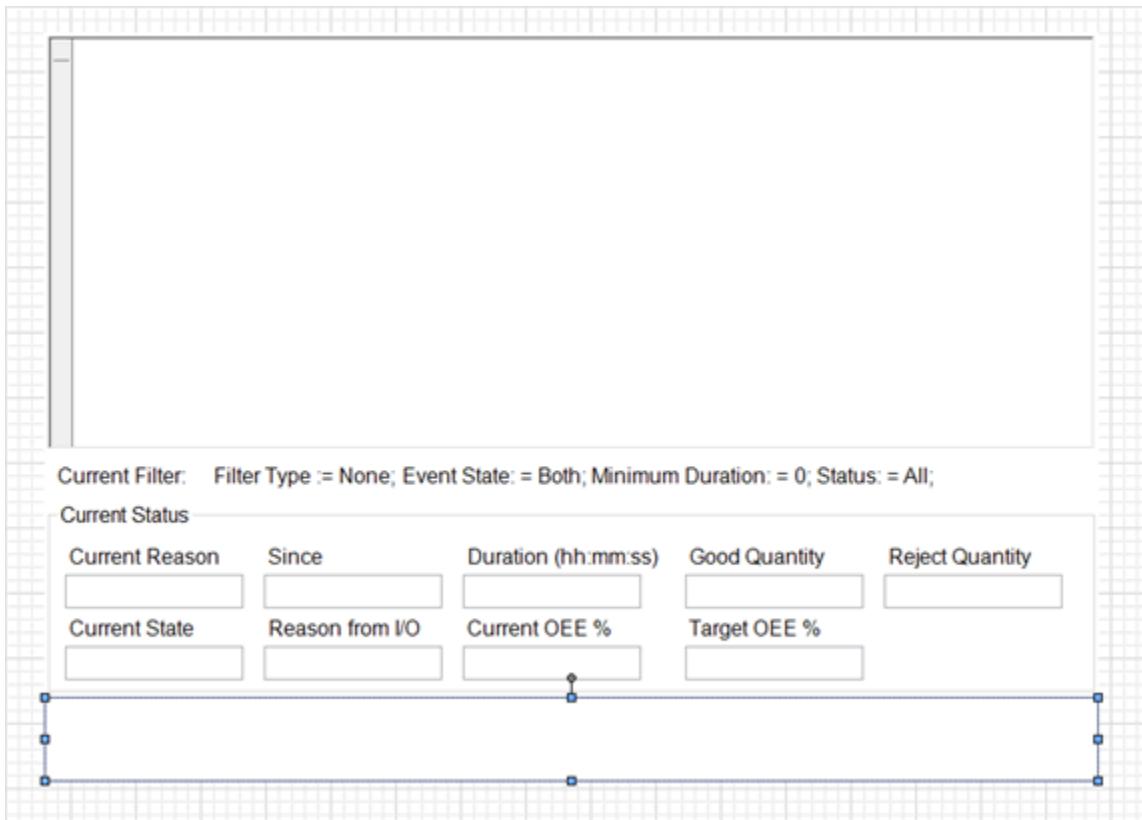
For more information, see [Dock Property](#).

### To set the Dock property of the Button Bar and Utilization controls

1. Select the embedded Button Bar control.  
The **Properties** Editor shows all properties of the Button Bar control.
2. In the **Layout** property category, locate the property **Dock**.
3. Open the **Dock** property list and click the Bottom panel (highlighted below) on the layout template.



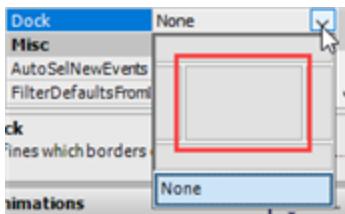
The Button Bar control is docked to the bottom of the symbol defined by the previously drawn rectangle.



4. Select the embedded Utilization control.

The **Properties** Editor shows all properties of the Utilization control.

5. In the **Layout** property category, open the **Dock** property list and click the Fill panel (highlighted below) on the layout template.



The Utilization control is resized to fill the size of the previously drawn rectangle.

### Example of Changing the ControlInCharge and ButtonBarName Properties

Install and embed the Utilization and Button Bar controls into a symbol as described in:

- [Example of Installing the Utilization and Button Bar Controls](#)
- [Embedding .NET Controls into a Symbol](#)

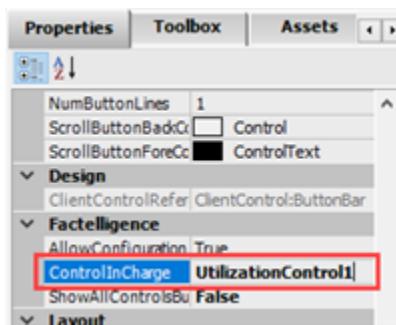
In this example, the **ControlInCharge** property of the Button Bar control and the **ButtonBarName** property of the Utilization controls are set.

The **ButtonBarName** property is set to associate the Button Bar control with the Utilization control. For more information, see [ButtonBarName Property](#).

The **ControlInCharge** property is used to set or get the ID of the control that currently has control of the Button Bar control. For more information, see [ControlInCharge Property](#).

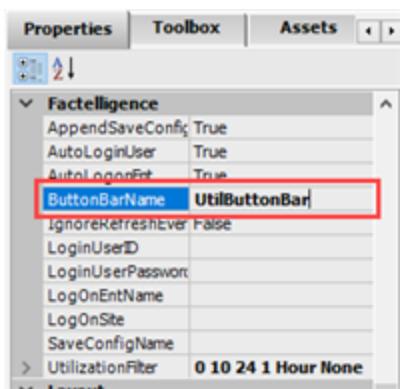
#### To set the ControlInCharge property of the ButtonBar control

1. Select the embedded Button Bar control.  
The **Properties** Editor shows all properties of the Button Bar control.
2. In the **Factelligence** property category, locate the **ControlInCharge** property.
3. Set the **ControlInCharge** property to the name of the Utilization control.



#### To set the ButtonBarName property of the Utilization control

1. Select the embedded Utilization control.  
The Properties Editor shows all properties of the Utilization control.
2. In the **Factelligence** property category, locate the property **ButtonBarName**.
3. Set the **ButtonBarName** property to the name of the button bar.



## Viewing Additional .NET Control Information

You can view:

- Which .dll files, or assemblies, are used for the .NET control.
- The class name, vendor, and version.
- Which AutomationObjects and System Platform Symbols use the .NET control.

This information is contained in the .NET control Properties panels.

The .NET control properties are different than the properties of the embedded .NET control. The .NET control properties can be viewed in the IDE directly. The properties of the embedded .NET control can be viewed in the Properties Editor of the System Platform Industrial Graphics Editor.

## Viewing the .NET Control Assemblies

You can view which .NET control .dll files, or assemblies, are used for the .NET control.

### To view the .NET control assemblies

1. In the Graphic Toolbox, right-click the .NET control and on the context menu click **Properties**.

The Properties dialog box appears.

ButtonBar properties

General    Referenced By    Operational limits    Errors/Warnings

ButtonBar

Codebase Archestra.ClientControl.1

Derived from \$ClientControl

Errors 0

Warnings 0

Class name Fact.Controls.ButtonBar

Vendor AVEVA\_Group\_Plc\_Fact.Controls.ButtonBar.dll

Version 4.6.0.0

Primary assembly Fact.Controls.ButtonBar.dll

Supported languages

Selected Option

Additional assemblies

- Fact.Controls.ButtonBar.dll
- Fact.Common.Interfaces.dll
- WindowsFormsIntegration.dll
- PresentationFramework.dll
- WindowsBase.dll
- PresentationCore.dll
- UIAutomationTypes.dll
- UIAutomationProvider.dll
- Roslyn.Compilers.dll

Close

2. On the **General** tab, you can view:
  - The **Primary Assembly**, which is the main .dll file.
  - **Additional Assemblies**, which are linked to the main .dll file and automatically loaded.

### Viewing Class Name, Vendor, and Version of a .NET Control

You can view the class name, vendor, and version of a .NET control in its **Properties** panel.

#### To view the class name, vendor, and version of a .NET control

1. In the Graphic Toolbox, right-click the .NET control and on the context menu click **Properties**.  
The Properties dialog box appears.
2. Go to the **General** tab.

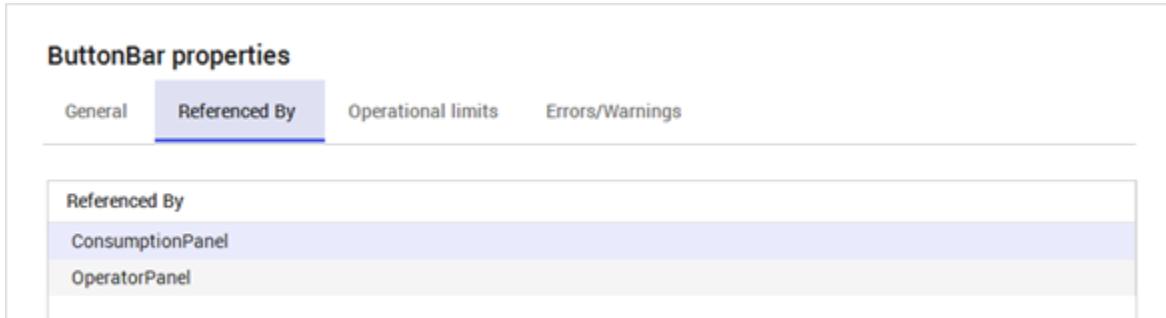
Class name	Fact.Controls.ButtonBar
Vendor	AVEVA_Group_Plc_Fact.Controls.ButtonBar.dll
Version	4.6.0.0
Primary assembly	Fact.Controls.ButtonBar.dll

## Viewing Objects and Symbols Referencing .NET Controls

You can view which AutomationObjects and System Platform Symbols use a given .NET control. This can be viewed in the Properties dialog box of the .NET control.

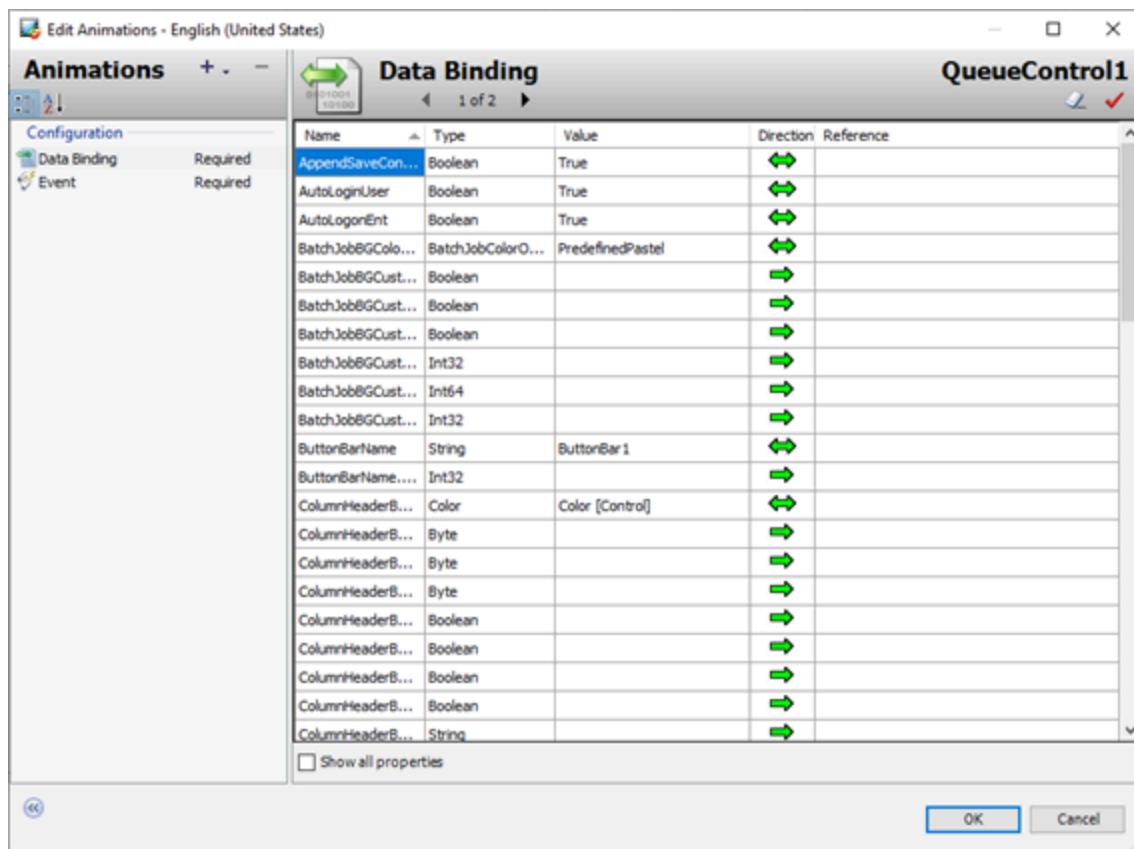
### To view objects and symbols referencing a .NET control

1. In the Graphic Toolbox, right-click the .NET control and on the context menu click **Properties**.  
The Properties dialog box appears.
2. Go to the **Referenced By** tab.  
The list of objects and symbols using the .NET control is shown.



## Binding .NET Control Properties to Attributes or Element References

You can bind the properties of an embedded .NET control to attributes or element references. By binding properties of an embedded .NET control, you can use attributes and element references as source and consumer of data for the .NET control properties. You do this with the Data Binding animation.



The Data Binding table contains the following information:

#### Name

The name of the .NET control property.

#### Type

The .NET data type of the property.

#### Value

The default value of the .NET control property.

#### Direction

Indicates if the property is read/write or just read-only.



Read/write property



Read-only property



Write-only property

#### Reference

The attribute or element reference the property is bound to the property.

**Note:** You cannot remove the Data Binding animation.

## To bind a .NET control property with an attribute or element reference

1. Double-click the embedded .NET control on the canvas.  
The Edit Animations dialog box appears and the **Data Binding** animation is selected by default.
2. Locate the .NET control property that you want to bind with an attribute or element reference.
3. Click the **Reference** field and click it again to enable it.
4. Do one of the following:
  - Type an attribute or element reference.
  - Browse for an attribute or element reference by clicking the **Browse** button.
5. Repeat above for any other properties you want to bind.
6. Click **OK**.

### Example of Data Binding in the Utilization Control

Install and embed the Utilization control into a symbol as described in:

- [Example of Installing the Utilization and Button Bar Controls](#)
- [Embedding .NET Controls into a Symbol](#)

In this example, the boolean symbol custom property **URE** controls whether the Utilization control can be refreshed.

### To use data binding in the Utilization control

1. Create a Boolean custom property and rename it **URE**.
2. In the System Platform Industrial Graphics Editor, double-click the embedded Utilization control.  
The Edit Animations dialog appears.
3. From the list of properties in the **Data Binding** configuration area, locate the **UtilRefreshEnabled** property.
4. Click the **Reference** field of the **UtilRefreshEnabled** property and click it again to enable it.
5. Click the field browse button, then browse to and select the **URE** custom property and click **OK**.

The **UtilRefreshEnabled** property is now assigned to the element reference **URE**.



6. To save the change and close the dialog, click **OK**.
7. Place a button on the canvas and configure it with a Boolean pushbutton animation that toggles the custom property **URE**.
8. Save and close the symbol.
9. Embed the symbol in a managed InTouch application and test the data binding by clicking on the button in WindowViewer. When you do so, the ability for the Utilization control to refresh is toggled.

### Animating .NET Controls

Every .NET control has these animation types:

- Data binding animations determine which attributes and element references can read and write to the .NET control.
- Event animations assign scripts to individual .NET control events.

You can add the following animations that correspond to the supported .NET control container properties:

- Visibility
- Fill Style
- Text Style
- Location Horizontal
- Location Vertical
- Width
- Height
- Tooltip
- Disable

If you configure these animations, the resulting behavior and appearance overrides the behavior and appearance given by the native properties of the .NET control.

### To add animation to embedded .NET controls

1. Double-click the embedded .NET control on the canvas. The Edit Animations dialog box appears.
2. Add animations as you would with any other element. For more information, see the System Platform help.

## About Operator Controls

You use Operator .NET controls to include parts of the Operator functionality in System Platform symbols. You can use the System Platform symbols that contain Operator controls during run time in WindowViewer and interact with the software.

You can configure the following Operator controls. These .NET controls correspond to functional areas of the MES Operator application.

### Audit

Shows all audit-type certifications required for a job to be completed and provides a way for users to sign-off on these certifications.

### Consumption

Lists the BOM (Bill of Materials) items for the active job. It can be used to report consumption for those BOM items, and to change their lot numbers or storage locations.

### Data Log

Shows the “log” of data values recorded for the active job and allows you to enter new data values.

### Folders

Allows an operator to view, edit, and print collection of files associated with a specific job. It also allows an operator to download and upload part programs.

### Genealogy

Shows the consumption history against the running work order. These records include goods and waste

consumption. It also allows an operator to change previously reported consumption information.

#### **Inventory**

Maintains item consumption editor and storage status of the currently logged on entity and all the movable storage entities located at the current entity. Allows the operator to view the item consumption editor and storage status of other entities.

#### **Job Summary**

Shows all current job information of a given entity. When multiple jobs are running at once, it determines which job is active so that you can view and work with that job's data.

#### **Labor**

Shows a history of the current operator's labor activity.

Allows operators to log on, log off, change their labor codes and their entities.

#### **Production**

Reports produced items and allows the operator to change the lot data and quantity amounts for each job, and to include good and rejected production of the produced item and its by-products. Allows the operator to change previously reported production information, to set up default information for additional production, and to mark a production lot as processed.

#### **Queue**

Shows all jobs queued to an entity. Allows the operator to change the state of jobs queued to an entity.

#### **Route**

Shows the routing and status of all jobs of a given work order.

#### **Spec**

Shows the specifications assigned to the active job, but not assigned to any particular step. Using this control, you can consult the minimum, maximum, and set point values, as well as any attached files or comments/instructions. The actual value for the active job is reported here. With the appropriate user privileges, you can change the specification guidelines, for this job only or for all subsequent jobs.

#### **Steps**

Shows the steps of the currently running job as a procedure guide if steps have been defined for this job.

#### **Utilization**

Shows the history of entity utilization and allows the operator to enter changes to the entity state. If entity has the ability to track overall equipment efficiency (OEE), calculates the current OEE percentage for the active entity, and compares that to the entity's target OEE percentage.

### **About Data Editor Controls**

You use the Data Editor .NET controls to view and edit historical data records from the MES database. You can also use the Data Editor controls to insert and delete records.

You can use the following Data Editor controls.

#### **Entity Usage Editor**

Views, edits, inserts, and deletes the utilization data of all entities that are configured to capture utilization data. Allows data in the util\_log and job\_util\_log\_link tables to be maintained.

#### **Item Consumption Editor**

Views, edits, inserts, and deletes usage of all consumed items. Provides the ability to allow normal consumption

data in the item\_cons table to be maintained.

#### **Item Lot Editor**

Views, edits, inserts, and deletes usage of all item lots. Provides the ability to maintain the lot and subplot number for an item.

#### **Item Production Editor**

Views, edits, inserts, and deletes usage of all produced items.

#### **Job Step Data Editor**

Views, edits, inserts, and deletes usage of all job steps. Allows data in the job\_step\_data table to be maintained.

#### **Labor Usage Editor**

Views, edits, inserts, and deletes usage of all labor. Allows data in the labor\_usage table to be maintained.

### **About Miscellaneous Controls**

You can use the following miscellaneous .NET controls.

#### **Sample Viewer**

Shows the current, past, and the future samples. Also shows the characteristics assigned to the samples and the results collected for the characteristics. This control allows the user to modify existing results and to add new results to characteristics which are associated with current and past samples. The Sample Viewer control also launches the SPC Chart control to display the results of measurements taken for a particular characteristic, associated with a set of samples.

#### **SPC Chart**

Monitors characteristics associated with the product and the process. Displays the graphical representation of the data associated with product and process characteristics.

#### **Counts/Duration KPI**

Displays a Pareto graph of counts and/or duration of entity's utilization states, reason groups, or reasons.

#### **OEE KPI**

Shows Overall Equipment Effectiveness (OEE) or one aspect of OEE on a dial or bar graph which displays OEE, Quality, Availability, or Performance and also indicates its target value.

#### **Production Progress**

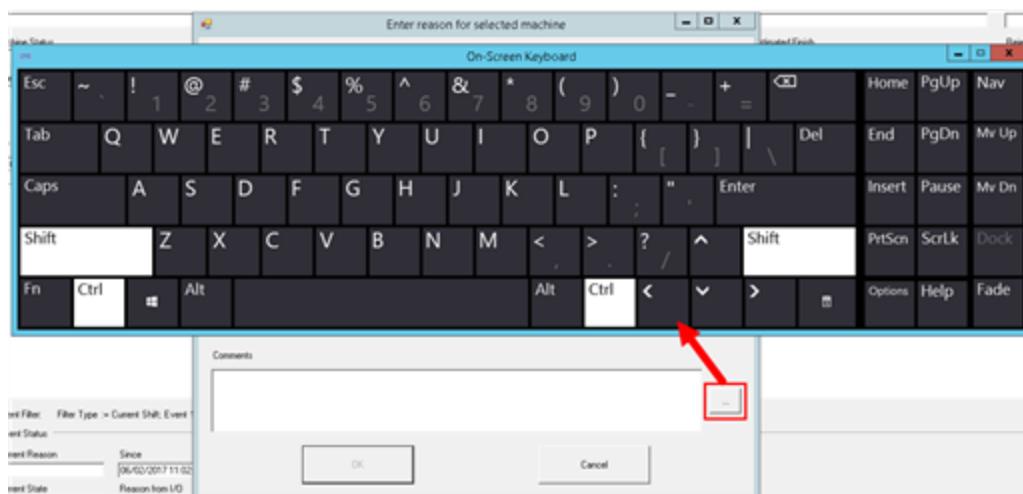
Displays an operator's progress towards a provided target for the current shift. If there is no current job or no current shift, the control indicates this and does not display any data.

#### **Button Bar**

Hosts buttons for multiple controls on a form. You can set up the Button Bar control to show all the buttons for all controls or to show only the buttons for the currently active control. This control does not apply to Job Summary control and SPC Chart control.

### **On-Screen Keyboard**

To assist users who do not have a physical keyboard attached to the local machine, text boxes in MES .NET applications, such as Operator and Data Editor, include a keyboard button. Clicking this button opens an on-screen keyboard, as shown below.



- After opening the keyboard, the focus for the text entry will be to the text box associated with the keyboard button.
- You can leave the keyboard open (either displayed or minimized). However, if the keyboard is open and you click another text box keyboard button, the focus will go to the keyboard and not to the new text box. You must first click in the new text box before typing on the keyboard to enter text into it.
- The **Enter** and **Tab** keys work just like they do on a physical keyboard.
- The keyboard can be resized by clicking and dragging an edge or corner.

Depending on the Windows version, there are additional keyboard features, such as the Fade key (making it transparent) and selectable options on the option keys. For more information about the on-screen keyboard features, see the help topic "Use the On-Screen Keyboard (OSK) to type" on the Microsoft Support web site.

### To change the keyboard language

- Open the Input Method menu on the system tray and select the language.



## Common Properties and Methods

There are properties and methods that are common to many of the MES .NET controls. These properties and methods are described here instead of in the sections for the individual controls.

## Common Properties

This section describes properties that are common to the following MES .NET controls: Audit, Consumption, Counts/Duration KPI, Data Log, Entity Usage Editor, Folders, Genealogy, Inventory, Item Consumption Editor, Item Lot Editor, Item Production Editor, Job Step Data Editor, Job Summary, Labor Usage Editor, OEE KPI, Production, Production Progress, Queue, Route, Sample Viewer, Specs, Steps, and Utilization.

### AppendSaveConfigName Property

Use the **AppendSaveConfigName** property to determine if the **SaveConfigName** property value is appended to an entity ID.

When the configuration data (column widths or sort orders) for a control is saved to the database, the instance name for the saved configuration (specifically, this is the config\_id field in the UI\_Config table) is the entity ID by default. The **AppendSaveConfigName** and **SaveConfigName** properties allow this default to be changed.

- If **AppendSaveConfigName** is set to True and the **SaveConfigName** is not an empty string, the **SaveConfigName** is prepended to the entity ID to form the instance name for the saved configuration.

For example, if **SaveConfigName** is ABC and the entity ID is 53, setting the **AppendSaveConfigName** to True causes the control's configuration data to be stored with an instance name of ABC53.

If **AppendSaveConfigName** is True, but **SaveConfigName** is an empty string, the **AppendSaveConfigName** property has no effect; the entity ID is used.

- If **AppendSaveConfigName** is False and the **SaveConfigName** is not an empty string, the **SaveConfigName** is used instead of the entity ID. In other words, the entity ID is not used at all in the instance name for the saved configuration data.

For example, if **SaveConfigName** is set to XYZ and **AppendSaveConfigName** is False, the control's configuration data is saved with an instance name of XYZ.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### AutoLoginUser Property

Use the **AutoLoginUser** property to log an operator on the control automatically. If you set the **AutoLoginUser** property to True, at run time either the logon dialog box appears for the control or the current InTouch/OMI user is logged on automatically.

When multiple MES controls are included in an InTouch window or OMI layout and at least one of the controls is configured with the **AutoLoginUser** property set to True, then all controls will be logged on with first the configured **LoginUserID** and **LoginUserPassword** settings or the currently logged-in InTouch/OMI user.

If the **AutoLoginUser** property is set to False, you need to configure a script to log on operators to the controls.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### AutoLogonEnt Property

Use the **AutoLogonEnt** property to automatically open the entity logon dialog box.

If one or more controls in your symbol require the run time operator to log on to an entity, you can set the **AutoLogonEnt** property of those controls that require a logon to True.

If the **AutoLogonEnt** property is set to:

- True, the control should automatically open the entity logon dialog box after the operator logs on to the software.
- False, you need to configure a script to log on operators to the controls.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ButtonBarName Property

Use the **ButtonBarName** property to associate the Button Bar control with the control.

If the optional Button Bar control is to be used in association with a given control, the **ButtonBarName** property must be set to the **Name** property of the ButtonBar instance to be used. This is required because a form can contain multiple controls and multiple ButtonBars.

The **ButtonBarName** property is used to associate the correct ButtonBar with the correct control.

### Example

For example, suppose a form contains both the Utilization and Production controls, and two ButtonBars named "ButtonBar1" and "ButtonBar2".

If the Utilization control is to be associated with the first of these ButtonBars, its **ButtonBarName** property must be set to "ButtonBar1".

Similarly, the Production control's **ButtonBarName** property must be set to "ButtonBar2".

Data Type	Read/Write	Default Value
String	R/W	""

### ControlLicensed Property

Use the **ControlLicensed** property to specify that the control is licensed.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### ExecuteEnabled Property

Use the **ExecuteEnabled** property to specify whether the Execute function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### Font Property

Use the **Font** property to override the fonts.

Data Type	Read/Write	Default Value
Font	R/W	Arial 12 pt

### HeadingFont Property

Use the **HeadingFont** property to set or get the heading font of the grid associated with the control. This property is only applicable to controls that contain a grid.

The **HeadingFont** property allows a different font to be used for the grid's headings. This could be useful, for example, to show the grid column headings with a larger or bold font.

Data Type	Read/Write	Default Value
Font	R/W	Microsoft Sans Serif, 9.75F, Regular

### IgnoreRefreshEvents Property

Use the **IgnoreRefreshEvents** property to set whether refresh events are ignored by the control. This setting is useful if the symbol contains more than one control and only one of the controls is visible at a time.

Ignoring refresh events also improves performance because hidden controls are not refreshed.

For the visible control, set the **IgnoreRefreshEvents** property to False so that it can show the latest data.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### LoginUserID Property

Use the **LoginUserID** property to specify the UserID of an operator to log on to the control automatically.

The **LoginUserPassword** property must be set up and the **AutoLoginUser** property must be True.

Data Type	Read/Write	Default Value
String	R/W	

**Note:** Any fixed user settings for a .NET control should be a user with minimal privileges, especially when using MES OS User credentials.

### LoginUserPassword Property

Use the **LoginUserPassword** property to specify the password of an operator to log on to the control automatically.

The **LoginUserPassword** property must be set up and the **AutoLoginUser** property must be True.

Data Type	Read/Write	Default Value
String	R/W	""

Reading this property does not return the user's password unless the password has been previously written through the same property. That is, it does not provide a way to access a user's password if they are logging in normally.

**Note:** Any fixed user settings for a .NET control should be a user with minimal privileges, especially when using MES OS User credentials.

### LogOnEntName Property

Use the **LogOnEntName** property to specify the name of the entity to which an operator can automatically log on.

The **AutoLogonEnt** property must be True.

Data Type	Read/Write	Default Value
String	R/W	""

### LogOnSite Property

Use the **LogOnSite** property to specify the site name that determines the entity. An operator can log on to this entity automatically.

The **LogOnSite** property is required only if sites are used.

Data Type	Read/Write	Default Value
String	R/W	""

### SaveConfigName Property

Use the **SaveConfigName** property to set or get the instance name for the saved configuration. The instance name can be appended to or replace the entity ID. If blank, the entity ID is used.

For more information, see [AppendSaveConfigName Property](#).

Data Type	Read/Write	Default Value
String	R/W	""

## Common Methods

This section describes methods that are common to the following MES .NET controls: Audit, Consumption, Counts/Duration KPI, Data Log, Entity Usage Editor, Genealogy, Inventory, Item Consumption Editor, Item Lot Editor, Item Production Editor, Job Step Data Editor, Job Summary, Labor Usage Editor, OEE KPI, Production, Production Progress, Queue, Route, Sample Viewer, Specs, Steps, and Utilization controls.

The Job Summary control can access all methods except the **IsButtonMenuItemEnabled()** method.

### BeginInit() Method

Use the **BeginInit()** method to prevent the screen from being updated while a control is starting.

## Syntax

```
BeginInit();
```

### EndInit() Method

Use the **EndInit()** method to allow screen updates after the control has been started.

## Syntax

```
EndInit();
```

### Execute() Method

Use the **Execute()** method to start an external application specified in the commandInfo parameter. If the underlying control contains a grid and a row is selected in the grid, the method can pass information from the selected row to the external application. The method can also be used to pass global information to the external application.

This method is available by means of the Button Bar control and allows the Execute function to be accessed in a context where a Button Bar control does not exist.

For example, to place the Utilization control in a form that contains a menu, but does not contain the Button Bar control, the method can be called by a script with corresponding menu options.

For information about how to pass global information or information from the selected row in a grid, see [Passing Information with the ButtonBar Execute\(\) and LaunchBrowser\(\) Methods](#).

## Syntax

```
Execute(commandInfo);
```

### Parameter

*commandInfo*

A string that specifies the application being launched and any command-line information needed by the application.

## ExecuteButtonMenuCommand() Method

Use the **ExecuteButtonMenuCommand()** method to execute the specified button menu command.

## Syntax

```
result = ExecuteButtonMenuCommand(menuID, userData);
```

### Parameters

*menuID*

An integer that is the ID of the menu command to execute.

*userData*

The user data attached to the button menu command.

## GetButtonMenuItems() Method

Use the **GetButtonMenuItems()** method to return the button menu for the associated control. If no button bar is attached to the control, an empty button menu is returned.

## Syntax

```
result=GetButtonMenuItems();
```

### Return Value

*result*

A ButtonMenuArrayList of the buttons supported by the control.

### Help() Method

Use the **Help()** method to open the online help file.

This method is available by means of the Button Bar control and allows the Help function to be accessed in a context where a Button Bar control does not exist.

For example, to place the Utilization control in a form that contains a menu but does not contain the Button Bar control, the method can be called by script with corresponding menu options.

## Syntax

```
Help();
```

### InitializeSuperclass() Method

Use the **InitializeSuperclass()** method to load the required information from the subclass (the inheriting control). The **InitializeSuperclass()** method must be called in the inheriting control's constructor.

---

**Note:** This method should be used only to develop a new control based on the common control (FactMES.Controls). It should not be used to work with an existing control, such as Utilization, Production or Queue.

---

There are two overloads for this method based on whether the inheriting control contains a grid or not.

## Syntax for controls containing a grid

```
InitializeSuperClass(FactGrid, controlType, formStateButton);
```

### Parameters

*FactGrid*

A reference to the wrapper class to the control's grid.

*controltype*

A string that defines the type of the descendant control. For example, "Util" or "Steps". This is the screen portion of the UI\_Config key for the control's configuration settings.

*formStateButton*

A string that appears on the large button in the center of the control that indicates the control's state when the control is not active. For example, "No User" or "No Entity".

## Syntax for controls not containing a grid

```
InitializeSuperClass(controlType, formStateButton);
```

## Parameters

### *controltype*

A string that indicates the type of the descendant control. For example, "Util" or "Steps".

This is the screen portion of the UI\_Config key for the control's configuration settings.

### *formStateButton*

A string that appears on the large button in the center of the control that indicates the control's state when the control is not active. For example, "No User" or "No Entity".

## **IsButtonMenuItemEnabled() Method**

Use the **IsButtonMenuItemEnabled()** method to determine whether the specified button menu item is enabled.

A button menu item is a Button Bar control function, for example Execute, End Job, Refresh, which is referenced from a menu.

## Syntax

```
result = IsButtonMenuItemEnabled(menuID);
```

## Parameters

### *menuID*

A integer that indicates the ID of the button menu item.

### *result*

A Boolean value. If True, the button menu item is enabled. If False, the button menu item is disabled.

## **LaunchBrowser() Method**

Use the **LaunchBrowser()** method to launch the browser application specified in the commandInfo parameter. If the underlying control contains a grid and a row is selected in the grid, the method can pass information from the row to the application. The method can also be used to pass global information to the external application.

This method is available by means of the Button Bar control and allows the **LaunchBrowser()** function to be accessed in a context where a Button Bar control does not exist.

For example, to place the Utilization control in a form that contains a menu but does not contain the Button Bar control, the method can be called by a script with corresponding menu options.

For information about how to pass global information or information from the selected row in a grid, see [Passing Information with the ButtonBar Execute\(\) and LaunchBrowser\(\) Methods](#).

## Syntax

```
LaunchBrowser(commandInfo);
```

## Parameter

*commandInfo*

A string that provides information needed by the specific application being launched

## OpenForm() Method

Use the **OpenForm()** method to open an external form. This method is only available if the system parameter, *Form Program*, is set up.

This method is available by means of the Button Bar control and allows the Execute function to be accessed in a context where a Button Bar control does not exist.

For example, to place the Utilization control in a form that contains a menu but does not contain the Button Bar control, the method can be called by a script with corresponding menu options.

## Syntax

```
OpenForm(userData);
```

## Parameter

*userData*

A string that provides the name of the form and arguments.

## RefreshData() Method

Use the **RefreshData()** method to refresh the control by retrieving dynamic data from the database, re-applying UI configuration settings, and enabling or disabling relevant buttons.

## Syntax

```
RefreshData();
```

## ResetAppendSaveConfigName() Method

Use the **ResetAppendSaveConfigName()** method to set the **AppendSaveConfigName** property to its default value (True).

## Syntax

```
ResetAppendSaveConfigName();
```

## ResetAutoLoginUser() Method

Use the **ResetAutoLoginUser()** method to set the **AutoLoginUser** property to its default value (True).

## Syntax

```
ResetAutoLoginUser();
```

### ResetAutoLogonEnt() Method

Use the **ResetAutoLogonEnt()** method to set the **AutoLogonEnt** property to its default value (True).

## Syntax

```
ResetAutoLogonEnt();
```

### ResetButtonBarName() Method

Use the **ResetButtonBarName()** method to clear the **ButtonBarName** property.

## Syntax

```
ResetButtonBarName();
```

### ResetHeadingFont() Method

Use the **ResetHeadingFont()** method to set the **HeadingFont** property to its default value (MS Sans Serif, 9.75 pt).

## Syntax

```
ResetHeadingFont();
```

### ResetIgnoreRefreshEvents() Method

Use the **ResetIgnoreRefreshEvents()** method to set the **ResetIgnoreRefreshEvents** property to its default value (False).

## Syntax

```
ResetIgnoreRefreshEvents();
```

### ResetSaveConfigName() Method

Use the **ResetSaveConfigName()** method to set the **SaveConfigName** property to its default value (empty string).

## Syntax

```
ResetSaveConfigName();
```

## SetGraphicSite() Method

Use the **SetGraphicSite()** method to set the Graphic Site object used to get the InTouch User ID and Domain.

**Note:** This method is called by InTouch to set up the ability to log on the current InTouch user. We do not recommend using this method in scripting.

## Syntax

```
SetGraphicSite(site);
```

### Parameter

*site*

IGraphicSite the indicates the object representing the Graphic Site.

## SwitchUser() Method

Use the **SwitchUser()** method to open the Switch User dialog box. The Switch User dialog box is used to set the currently active operator. If another operator logs on, the user interface is changed appropriately. For example, the new operator's language is used.

This method is available by means of the Button Bar control and allows the SwitchUser function to be accessed in a context where a Button Bar control does not exist.

For example, to place the Utilization control in a form which contains a menu, but does not contain the Button Bar control, the method could be called by script with corresponding menu options.

## Syntax

```
SwitchUser();
```

## TranslateColumnHeadings() Method

Use this method to translate the grid column heading strings, which can contain an embedded string ID. If the column heading is blank, use a default.

This method translates the grid column heading strings and the grid title. These strings can contain an embedded string ID. An angle bracket delimited integer is appended to the string, which references a string\_id in the Language table. If a column heading is blank, a default string is used.

## Syntax

```
TranslateColumnHeadings(FactGrid);
```

### Parameter

*FactGrid*

A string to specify the ID of the grid whose column headings and title are to be translated.

## Passing Information with the ButtonBar Execute() and LaunchBrowser() Methods

The ButtonBar **Execute()** and **LaunchBrowser()** methods will pass along the selected row to the external application if the underlying control contains a grid and a row is selected in the grid.

The value from a column in the selected row from the grid will be passed if the column name from the grid is specified in the method's commandInfo parameter. The columns names for the grid can be found by right-clicking on the grid in the control and then clicking **Configure**.

These methods can also get global information and pass it on to the external application in the commandInfo parameter by specifying any of the values listed below with an "@" preceding the name.

### **session\_id**

The current session ID.

### **ent\_id**

The ID of the current entity.

### **ent\_name**

The name of the current entity.

### **user\_id**

The ID of the current user.

### **wo\_id**

The ID of the current job's work order.

### **oper\_id**

The ID of the current job's operation.

### **seq\_no**

The sequence number of the current job.

### **item\_id**

The ID of the item being made by the current job.

### **item\_desc**

The description of the item being made by the current job.

### **wo\_desc**

The description of the current job's work order.

### **job\_desc**

The description of the current job.

### **util\_state\_desc**

The description of the utilization state for the current entity.

### **qty\_at\_start**

The starting quantity of the current job.

### **batch\_size**

The batch size of the current job.

### **qty\_prod**

The quantity produced for the current job.

### **qty\_reqd**

The quantity required for the current job.

**qty\_rejected**

The quantity rejected for the current job.

**notes**

Notes for the current job

## Audit Control

The Audit control shows all audit-type certifications required for a job to be completed. This control also lists the operators who have already signed off on a certification. You can use the Audit control to permit an operator to sign-off these certifications and enter a comment for each certification.

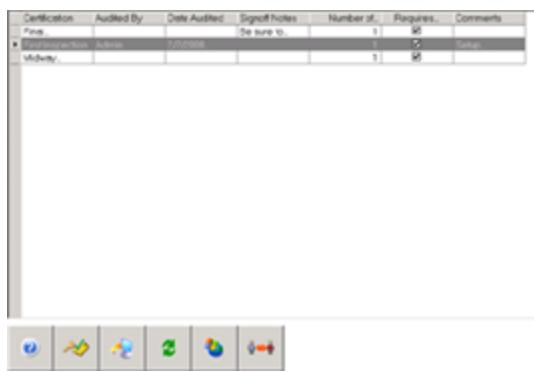
### Configuring the Audit Control

When you use an Audit control in a System Platform symbol and the current job has been configured to require audit sign-off, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).

Operators can use the Button Bar control at run time to:

- Refresh the Audit grid.
- Sign-off and add comments to the selected certification.
- Change the active user.
- Start an external application.
- Start Internet Explorer.
- Open the Help window.

**Note:** The Audit control corresponds to the **Audit** tab of MES Operator. For more information, see the Audit Tab section in the *MES Operator Guide* or online help.



### Properties of the Audit Control

This section describes the properties of the Audit control. For information about the common properties shared by this control, see [Common Properties](#).

## AuthorizeEnabled Property

Use the **AuthorizeEnabled** property to get a Boolean value indicating whether an operator can sign off on a certification.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

## RefreshEnabled Property

Use the **RefreshEnabled** property to get a Boolean value indicating whether this control can be refreshed or not. This control cannot be refreshed if the operator is not logged on to an MES application or any MES entity.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

## Methods of the Audit Control

This section describes the methods of the Audit control. For information about the common methods shared by this control, see [Common Methods](#).

### Sign Off() Method

Use the **Signoff()** method to sign off the certification. An inspector dialog box is displayed to authenticate a user. After the user is authenticated, the selected certification row in the grid is signed off.

## Syntax

```
SignOff();
```

## Button Bar Control

The buttons for multiple controls on a form can be hosted in a single Button Bar control. You can set up the Button Bar control to show all the buttons for all controls or to show only the buttons for the currently active control.

### Configuring the Button Bar Control

The Button Bar control is a special control that provides a set of buttons that can be used to send commands to any other control in the same System Platform symbol.

A symbol can contain a control but does not require the Button Bar control. But, a symbol containing only a Button Bar control does not provide any functionality.

The following list summarizes the major steps in configuring the symbol with the Button Bar Control:

1. Embed the Button Bar control on the canvas.
2. Dock the Button Bar control to the symbol.
3. Embed other controls in your symbol.
4. Associate the Button Bar control with a control.

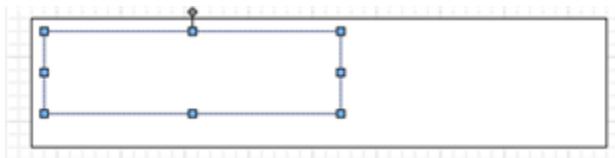
### Embedding the Button Bar Control

Before you embed the Button Bar control on the canvas, you should set definite boundaries to the System Platform symbol. To set symbol boundaries, paste a rectangle on the canvas first.

**Note:** Due to limitations in Microsoft .NET Framework, you must place the Button Bar control on the canvas before you embed the control it is referencing.

#### To embed the Button Bar control

1. Create a new System Platform symbol and open it.
2. Select the Rectangle primitive from the **Tools** panel.
3. Paste the Rectangle element on the canvas.
4. On the **Edit** menu, click **Embed Graphic**. The Galaxy Browser appears.
5. From the Graphic Toolbox, select **ButtonBar**, and then click **OK**. The cursor appears in insert mode.
6. Click near the rectangle where you want to paste the Button Bar control. The Button Bar control is pasted on the canvas.



### Docking the Button Bar Control

After you embed the Button Bar control on the canvas, you must dock it to the symbol to prevent it from overlapping any other controls.

Docking lets you automatically position the control in relation to the other elements. You can do this for the Button Bar control and other controls. For more information, see [Docking the Controls Within a Symbol](#).

### Associating the Button Bar Control with Other Controls

After embed any other control on the canvas, you can associate it with the Button Bar control. You associate it with the Button Bar control by setting the **ButtonBarName** property of the other control.

You can also associate multiple controls with the same Button Bar control. For more information, see [Showing the Buttons for a Specific Control](#).

#### To associate a control with the Button Bar control

1. Select the control you want to associate with the Button Bar control.
2. In the Properties Editor, locate the **ButtonBarName** property.
3. In the **Value** box, type the name of the Button Bar control you want to associate with the control.

## Showing the Buttons for a Specific Control

If multiple controls are associated with the same Button Bar control, you assign the buttons of the Button Bar control to specific controls.

You assign controls to Button Bar buttons by setting the **ShowAllControlsButton** property to False and the **ControlInCharge** property to the control name.

### To show the buttons of a specific control in the Button Bar control

1. Select the Button Bar control on the canvas.
2. In the Properties Editor, set the **ShowAllControlsButton** property to False.
3. In the Properties Editor, locate the **ControlInCharge** property.
4. In the value box, type the name of the control for which you want to show the buttons.

**Note:** You must change the **ControlInCharge** property at runtime to enable buttons for any specific control.

## Properties of the Button Bar Control

This section describes the properties of the Button Bar control. The Button Bar control does not share any common properties with the other controls.

### AllowConfiguration Property

Use the **AllowConfiguration** property to set or get whether the Configure Button Bar dialog box is available at run time.

This property is set by the controls using the Button Bar control and is based on the operator's permissions.

Set this property to True to permit the operator to right-click on the Button Bar control, click **Configure**, and open the Configure Button Bar dialog box.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### BackColor Property

Use the **BackColor** property to set the color of the background of the area on which the buttons are placed.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	Control

### ButtonSize Property

Use the **ButtonSize** property to set or get the size (in pixels) of buttons. Button dimensions are in the form width, height.

Data Type	Read/Write	Default Value
String	R/W	64x64

### ControlInCharge Property

Use the **ControlInCharge** property to set or get the ID of the control that currently has control of the Button Bar control. This property is also set by the controls when they become the active control.

Data Type	Read/Write	Default Value
String	R/W	""

### DefaultButtonBackColor Property

Use the **DefaultButtonBackColor** property to set or get the default background color of buttons.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	Control

### DefaultButtonForeColor Property

Use the **DefaultButtonForeColor** property to set or get the default text color of button captions.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	ControlText

### Dock Property

Use the **Dock** property to set or get the docking location of the control. Possible values are Top, Bottom, Left, Right, None.

If the **Dock** property is set to anything but None, you must draw a rectangle on the symbol before the Button Bar control is placed in the symbol.

The rectangle defines the symbol size that enables the Button Bar control to dock properly.

Data Type	Read/Write	Default Value
String	R/W	Top

### ForeColor Property

Use the **ForeColor** property to set or get the foreground color used to show text and graphics in the control.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	ControlText

### HorizontalBoundary Property

Use the **HorizontalBoundary** property to set or get the horizontal separation (in pixels) between the top and bottom of the buttons and the edge of the control.

Data Type	Read/Write	Default Value
Integer	R/W	0

### HorizontalSeparation Property

Use the **HorizontalSeparation** property to set or get the horizontal separation (in pixels) between buttons. Only applicable when the Dock property is set to Top, Bottom, or None.

Data Type	Read/Write	Default Value
Integer	R/W	0

### NumButtonLines Property

Use the **NumButtonLines** property to set or get the number of:

- Rows of buttons if the Dock property is set to Top or Bottom.
- Columns of buttons if the Dock property is set to Left or Right.

Data Type	Read/Write	Default Value
Integer	R/W	1

### ScrollBarBackColor Property

Use the **ScrollBarBackColor** property to set or get the background color of the scroll buttons.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	Control

### ScrollBarForeColor Property

Use the **ScrollBarForeColor** property to set or get the text and graphics color used on the scroll buttons.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	ControlText

### ScrollButtonHeight Property

Use the **ScrollButtonHeight** property to set or get the height (in pixels) of scroll buttons. This property is only applicable when the Dock property is set to Left, Right, or None.

Data Type	Read/Write	Default Value
Integer	R/W	16

### ScrollButtonWidth Property

Use the **ScrollButtonWidth** property to set or get the width (in pixels) of scroll buttons. This property is only applicable when the Dock property is set to Top, Bottom, or None.

Data Type	Read/Write	Default Value
Integer	R/W	16

### ShowAllControlButtons Property

Use the **ShowAllControlButtons** property to set or get whether the Button Bar control:

- Shows the buttons for all the controls registered with it (set True).
- Only shows the buttons for the control currently in charge of the Button Bar control (set False).

Data Type	Read/Write	Default Value
Boolean	R/W	True

### Size Property

Use the **Size** property to set or get the size of the control in pixels. Dimensions are expressed as width, height.

Data Type	Read/Write	Default Value
String	R/W	

### SpacerHeight Property

Use the **SpacerHeight** property to set or get the height (in pixels) of the button separation line. This property is only applicable when the Dock property is set to Left or Right.

Data Type	Read/Write	Default Value
Integer	R/W	32

### SpacerWidth Property

Use the **SpacerWidth** property to set or get the width (in pixels) of the button separation line. This property is only applicable when the Dock property is set to Top or Bottom.

Data Type	Read/Write	Default Value
Integer	R/W	32

### UserButtonExecutionLevel Property

Use the **UserButtonExecutionLevel** property to set or get the operator's button execution level.

The **UserButtonExecutionLevel** property is set by the controls using the Button Bar control and is based on the operator's permissions.

The **UserButtonExecutionLevel** property must be greater than or equal to a button's execution level in order for the button to be enabled. The button's execution level is set on the configuration dialog or when the button is added to the Button Bar control.

Data Type	Read/Write	Default Value
Integer	R/W	1

### VerticalBoundary Property

Use the **VerticalBoundary** property to set or get the vertical separation (in pixels) between the left and right of the buttons and the edge of the control.

Data Type	Read/Write	Default Value
Integer	R/W	0

### VerticalSeparation Property

Use the **VerticalSeparation** property to set or get the vertical separation (in pixels) between buttons. Only applicable when the Dock property is set to Left or Right.

Data Type	Read/Write	Default Value
Integer	R/W	0

## Methods of the Button Bar Control

This section describes the methods of the Button Bar control. For information about the common methods shared by this control, see [Common Methods](#).

### EnableButton() Method

Use the **EnableButton()** method to enable or disable the named button associated with the specified control.

## Syntax

```
result = ButtonEnabled(controlID, buttonID, enabled);
```

### Parameters

*controlID*

A string that indicates the ID of the control associated with the Button Bar control.

*buttonID*

An integer that indicates the ID of the button. For more information, see [Buttons](#).

**Note:** If you omit this parameter, all buttons associated with the specified control are enabled or disabled.

*enabled*

A Boolean value that indicates whether to enable (1) or disable (0) the button.

### IsButtonEnabled() Method

Use the **IsButtonEnabled()** method to loop through all buttons in the Button Bar control looking for the button specified by the supplied information. If the button is found, the enabled status is returned. If it is not found, False is returned.

## Syntax

```
result = IsButtonEnabled(controlID, buttonID, userData);
```

### Parameters

*controlID*

A string that indicates the ID of the control associated with the Button Bar control.

*buttonID*

An integer that indicates the ID of the button. For more information, see [Buttons](#).

*userData*

An object that provides the user data of the button.

*result*

A Boolean value. The value is True if button is found and the button is enabled; otherwise the value is False.

### ResetAllowConfiguration() Method

Use the **ResetAllowConfiguration()** method to reset the **AllowConfiguration** property to its default value of True.

## Syntax

```
ResetAllowConfiguration();
```

### ResetBackColor() Method

Use the **ResetBackColor()** method to reset the **BackColor** property to the default background color for a control.

## Syntax

```
ResetBackColor();
```

### ResetButtonSize() Method

Use the **ResetButtonSize()** method to reset the button size (in pixels) to the default value of 64x64.

## Syntax

```
ResetButtonSize();
```

### ResetControlInCharge() Method

Use the **ResetControlInCharge()** method to reset the **ControlInCharge** property to an empty string.

## Syntax

```
ResetControlInCharge();
```

### ResetDefaultButtonBackColor() Method

Use the **ResetDefaultButtonBackColor()** method to reset the **DefaultButtonBackColor** property to default background color for a control.

## Syntax

```
ResetDefaultButtonBackColor();
```

### ResetDefaultButtonForeColor() Method

Use the **ResetDefaultButtonForeColor()** method to reset the **DefaultButtonForeColor** property to default foreground color for a control.

### Syntax

```
ResetDefaultButtonForeColor();
```

### ResetDock() Method

Use the **ResetDock()** method to reset the **Dock** property value to Top.

### Syntax

```
ResetDock();
```

### ResetForeColor() Method

Use the **ResetForeColor()** method to reset the **ForeColor** property to the default foreground color of the control.

### Syntax

```
ResetForeColor();
```

### ResetHorizontalBoundary() Method

Use the **ResetHorizontalBoundary()** method to reset the **HorizontalBoundary** property to a value of 0.

### Syntax

```
ResetHorizontalBoundary();
```

### ResetHorizontalSeparation() Method

Use the **ResetHorizontalSeparation()** method to reset the **HorizontalSeparation** property to a value of 0.

### Syntax

```
ResetHorizontalSeparation();
```

### ResetNumButtonLines() Method

Use the **ResetNumButtonLines()** method to reset the **NumButtonLines** property to the value of 1.

## Syntax

```
ResetNumButtonLines();
```

### ResetScrollButtonBackColor() Method

Use the **ResetScrollButtonBackColor()** method to reset the **ScrollButtonBackColor** property to default background color for a control.

## Syntax

```
ResetScrollButtonBackColor();
```

### ResetScrollButtonForeColor() Method

Use the **ResetScrollButtonForeColor()** method to reset the **ScrollButtonForeColor** property to default foreground color for a control.

## Syntax

```
ResetScrollButtonForeColor();
```

### ResetScrollButtonHeight() Method

Use the **ResetScrollButtonHeight()** method to reset the **ScrollButtonHeight** property to 16.

## Syntax

```
ResetScrollButtonHeight();
```

### ResetScrollButtonWidth() Method

Use the **ResetScrollButtonWidth()** method to reset the **ScrollButtonWidth** property to 16.

## Syntax

```
ResetScrollButtonWidth();
```

### ResetShowAllControlsButtons() Method

Use the **ResetShowAllControlsButtons()** method to reset the **ShowAllControlsButtons** property to True.

## Syntax

```
ResetShowAllControlsButtons();
```

## ResetSize() Method

Use the **ResetSize()** method to reset the **Size** property.

If the Button Bar control is laid out horizontally, the height is set to the number of button lines times the button height plus two times the horizontal boundary.

If the Button Bar control is laid out vertically, the width is set to the number of button lines times the width of the buttons plus two time the vertical boundary.

## Syntax

```
ResetSize();
```

## ResetSpacerHeight() Method

Use the **ResetSpacerHeight()** method to reset the **SpacerHeight** property to 32.

## Syntax

```
ResetSpacerHeight();
```

## ResetSpacerWidth() Method

Use the **ResetSpacerWidth()** method to reset the **SpacerWidth** property to 32.

## Syntax

```
ResetSpacerWidth();
```

## ResetUserButtonExecutionLevel() Method

Use the **ResetUserButtonExecutionLevel()** method to reset the **UserButtonExecution** property to 1.

## Syntax

```
ResetUserButtonExecutionLevel();
```

## ResetVerticalBoundary() Method

Use the **ResetVerticalBoundary()** method to reset the **VerticalBoundary** property to a value of 0.

## Syntax

```
ResetVerticalBoundary();
```

## ResetVerticalSeparation() Method

Use the **ResetVerticalSeparation()** method to reset the **VerticalSeparation** property to a value of 0.

### Syntax

```
ResetVerticalSeparation();
```

## SetButtonColor() Method

Use the **SetButtonColor()** method to set the background and foreground colors of all buttons associated with the specified control.

### Syntax

```
SetButtonColor(controlID[, buttonID], backColor, foreColor);
```

#### Parameters

*controlID*

A string that indicates the ID of the control associated with the Button Bar control.

*buttonID*

An integer that indicates the ID of the button. If this parameter is omitted, all the buttons for this control are affected. For more information, see [Buttons](#).

*backColor*

The color to use for the button's background.

*foreColor*

The color to use for the button's foreground.

## UnregisterControl() Method

Use the **UnregisterControl()** method to remove controls associated with the button bar. All the control buttons are removed, and the control will no longer appear on the run time configuration dialog.

### Syntax

```
UnregisterControl(controlID)
```

#### Parameters

*controlID*

A string that indicates the ID of the control associated with the Button Bar control.

## Consumption Control

The Consumption control consists of a grid that displays the Bill of Material (BOM) for the currently running job on the selected entity.

### Configuring the Consumption Control

You use the Consumption control to report consumption against a job. You can report the consumption for a consumable Bill of Material item that is listed in the table.

You can use the Consumption control to record this consumption as scrap from this control and change the lot data.

When you use the Consumption control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Consumption control to:

- Add consumption.
- Record scrap of consumable items.
- Set the lot data.
- Refresh the Consumption control.
- Filter the entries on the Consumption control.
- Switch the active user.
- View item attributes.
- Open or launch a form, if the *Path to Form Program* system parameter is set.

This control corresponds to the **BOM** tab of MES Operator. For more information, see the BOM Tab section in the *MES Operator Guide* or MES online help.

### Properties of the Consumption Control

This section describes the properties of the Consumption control. For information about the common properties shared by this control, see [Common Properties](#).

#### AddConsEnabled Property

Use the **AddConsEnabled** property to determine if the **Add Consumption** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### ConsWasteEnabled Property

Use the **ConsWasteEnabled** property to determine if the **Consumption Waste** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### FilterEnabled Property

Use the **FilterEnabled** property to determine if the **Filter** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### ItemAttributesEnabled Property

Use the **ItemAttributesEnabled** property to determine if the **Item Attributes** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### OpenFormEnabled Property

Use the **OpenFormEnabled** property to determine if the **Open Form** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### SetLotDataEnabled Property

Use the **SetLotDataEnabled** property to determine if the **Set Lot Data** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

## Methods of the Consumption Control

This section describes the methods of the Consumption control. For information about the common methods shared by this control, see [Common Methods](#).

### AddConsumption() Method

Use the **AddConsumption()** method to open the form for adding consumption.

#### Syntax

```
AddConsumption();
```

### ConsWaste() Method

Use the **ConsWaste()** method to open the form for consumption waste.

#### Syntax

```
ConsWaste();
```

### Show\_BOMStep\_Filter\_Dialog() Method

Use the **Show\_BOMStep\_Filter\_Dialog()** method to open a dialog box for specifying Inventory Filter.

#### Syntax

```
Show_BOMStep_Filter_Dialog();
```

### SetCurrentConsLotData() Method

Use the **SetCurrentConsLotData()** method to open the form to set the current Lot information.

#### Syntax

```
SetCurrentConsLotData();
```

### SelectRowByKey() Method

Use the **SelectRowByKey()** method to search and select the first row in the grid that matches the specified work order, operation, sequence, and BOM position. If no such row is found and the *selectFirstRowAsDefault* parameter is set to True, the first row in the grid is selected. Otherwise the previous row selection is not changed.

## Syntax

```
result = SelectRowByKey(string woId, string operId, int seqNo,  
int bomPos, bool selectFirstRowAsDefault);
```

## Parameters

*woId*

A string value that is the work order ID to match.

*operId*

A string value that is the operation ID to match.

*seqNo*

An integer value that is the sequence number to match.

*bomPos*

An integer value that is the BOM position to match.

*selectFirstRowAsDefault*

A Boolean value that is set to True if the first row must be selected when there is no match. It is set to False if the row selection must not change when there is no match.

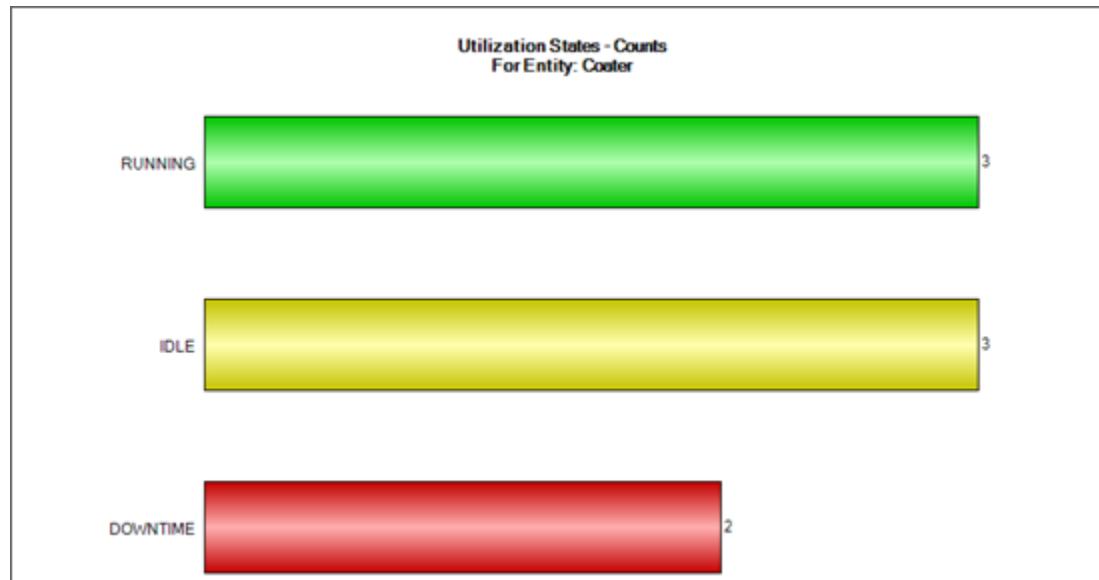
## Return Value

*result*

A Boolean value that is True if a match is found; otherwise it returns False.

## Counts/Duration KPI Control

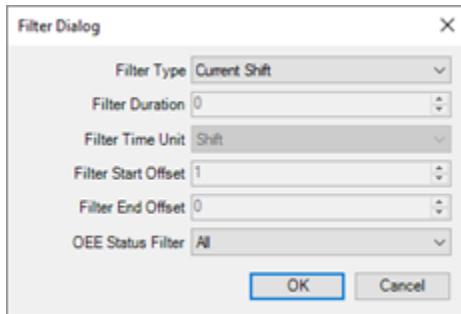
The Counts/Duration KPI Control is used to display a Pareto graph of either the counts or duration of an entity's utilization states, reason groups, or reasons.



## Using the Counts/Duration KPI Control

When configuring Counts/Duration KPI control, the designer will typically set a default **CountsAndDurationControlStyle** (counts or duration or both), the **CountsAndDurationGraphType** (UtilStates, ReasonGroups, or Reasons), and filter defaults (**TypeFilter**, **FilterDuration**, **CDKPIFilter.FilterTime**, **CDKPIFilter.FilterStartOffset**, **CDKPIFilter.FilterEndOffset**). The user can also set the maximum number of bars to be seen in the graph (**NumberOfBars**), the duration refresh rate (**DurationRefreshRate**), filtering based on utilization state (**OEEStatusFilter**), and reason group colors (**ReasonGroupColors**). It is also possible to specify that various property values will be configured by the operator at run time and saved to or retrieved from the MES database on a per-user basis. If this is the case, configuring these properties will be disabled at design time. See the [FilterDefaultsFromDB Property](#) for more on this.

At design time or run time, when configuring filters, a Filter dialog exists to help coordinate the setting of several properties at once. This Filter dialog can be invoked at design time by selecting the browse button next to the **TypeFilter** property. At run time, it is invoked by calling the **Filter()** method or using the button bar.



At run time, the control is refreshed whenever a **UtilizationStateChanged** event is detected from the MES database if utilization states are being displayed, or when an **UtilizationReasonChanged** event is detected from the MES database if reason groups or reasons are being displayed. This event is handled internally by the control. The control is also refreshed when the **CountsAndDurationControlStyle** or **CountsAndDurationGraphType** property is set. Setting the other properties will not cause an automatic refresh, so you will need to call the **RefreshData()** method (for more information on this method, see [RefreshData\(\) Method](#)). If durations are being displayed, the control can also be refreshed based on a timer that is set to the value of the **DurationRefreshRate** property. The **IgnoreRefreshEvents** property can be set to True to avoid unwanted refreshes from occurring while you are setting properties.

The Counts/Duration KPI control has a context menu that allows a user with the proper permissions to save the configuration of the control to the database for either a specific entity, all the logged on entities, or as a default. Only the button bar setup and the current filter settings will be saved as configuration data.

## Logging On to the Counts/Duration KPI Control

To use the Counts/Duration KPI control, the operator must log on to a session and select one or more entities, or set the **DisplayEntity** property which will use the display entity as the source of the data. If the operator is not already logged on to a session and logged on to at least one entity, and the **DisplayEntity** property is set to null or an empty string, the control automatically initiates the log on process by one of the following methods:

- Logging on the current InTouch user to the session.
- Presenting the operator with a log on dialog box.

After the operator is logged on to the session, the control by default presents the operator with an entity log on

dialog box. These behaviors can be overridden by setting the **AutoLoginUser** or the **AutoLogOnEnt** properties to False. If this is done, logging on to a session and logging on to an entity must be done with a script. If the user is logged onto an entity, but the **DisplayEntity** property is set, the entity in the **DisplayEntity** property will be used instead of the current logged on entity.

## Switching Entities

The Counts/Duration KPI control shows information only for the current entity or the display entity. If the Job Summary control is included in the form, you can use it to change the current entity. You can also change the current entity by using a script.

## Associating the Button Bar Control

When you use the Counts/Duration KPI control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).

## Properties of the Counts/Duration KPI Control

This section describes the properties of the Counts/Duration KPI Control. For information about the common properties shared by this control, see [Common Properties](#).

### CDKPIFilter.FilterEndOffset Property

The **CDKPIFilter.FilterEndOffset** property specifies the end of the filter period relative to now. This filter value is only legitimate when the **TypeFilter** property is set to Custom. If the **TypeFilter** property is not set to Custom, this property is set to 0 if the type is ThisHour, LastNHours, CurrentShift, CurrentDay, CurrentWeek, or CurrentMonth; it is set to 1 if the type is LastShift, Yesterday, LastWeek, or LastMonth. The value of this property should always be less than the value of the **CDKPIFilter.FilterStartOffset** property and greater than or equal to 0.

Data Type	Read/Write	Default Value
Integer	R/W	0

### CDKPIFilter.FilterStartOffset Property

The **CDKPIFilter.FilterStartOffset** property specifies the start of the filter period relative to now. This filter value is only legitimate when the **TypeFilter** property is set to Custom. If the **TypeFilter** property is not set to Custom, this property is set to 1 if the type is ThisHour, CurrentShift, CurrentDay, CurrentWeek, or CurrentMonth; it is set to 2 if the type is LastShift, Yesterday, LastWeek, or LastMonth. It is set to N if the type is set to LastNHours. The value of this property should always be greater than the value of the **CDKPIFilter.FilterEndOffset** property and should always be greater than or equal to 1.

Data Type	Read/Write	Default Value
Integer	R/W	1

### CDKPIFilter.FilterTime Property

The **CDKPIFilter.FilterTime** property specifies the time unit for a custom filter type. This filter value is only legitimate when the **TypeFilter** property is set to Custom. If the **TypeFilter** property is not set to Custom, this property is set to a value that matches the type (hour if type is ThisHour or LastNHours; Shift is type is CurrentShift or LastShift; Day if type is CurrentDay or Yesterday; Week if type is CurrentWeek or LastWeek; or Month if type is CurrentMonth or LastMonth).

When this property is set to hour, the results will include data for 0 or more entire hour periods, relative to the current time. For all other settings (Shift, Day, Week, Month or Year), the results will start at the beginning of the time unit specified by the **CDKPIFilter.FilterStartOffset** property.

Data Type	Read/Write	Default Value
Enum {Hour=0, Shift=1, Day=2, Week=3, Month=4, Year=5}	R/W	Hour

### CDKPIFilter.TypeFilter Property

The **CDKPIFilter.TypeFilter** property specifies which filter to use including a custom filter. If LastNHours is selected, you will also need to set the **FilterDuration** property. If Custom is selected, you will also need to set the **CDKPIFilter.FilterTime**, **CDKPIFilter.FilterStartOffset**, and **CDKPIFilter.FilterEndOffset** properties.

Data Type	Read/Write	Default Value
Enum {ThisHour=0, LastNHours=1, CurrentShift=2, LastShift=3, CurrentDay=4, Yesterday=5, CurrentWeek=6, LastWeek=7, CurrentMonth=8, LastMonth=9, Custom=10}	R/W	ThisHour

### ChartBackColor Property

Use the **ChartBackColor** property to get and set the background color of the chart.

Data Type	Read/Write	Default Value
Color	R/W	

### ControlStyle Property

The **ControlStyle** property is an enumeration type that specifies whether the control is showing counts, duration, or both. If Counts is chosen, the number of times a State, Reason Group, or Reason was chosen within the time period set by the filter is displayed on the graph. If Duration is chosen, the amount of time spent in a State, Reason Group, or Reason is displayed on the graph. If CountsWithDuration is chosen, a group of two bars for each State, Reason Group, or Reason is displayed on the graph with the top bar being the counts and the bottom bar being the duration. If DurationWithCounts is chosen, a group of two bars for each State, Reason Group, or Reason is displayed on the graph with the top bar being the duration and the bottom bar being the counts. When either CountsWithDuration or DurationWithCounts is chosen, the graph is sorted by the top bar in the grouping.

Data Type	Read/Write	Default Value
Enum {Counts=0, Duration=1, CountsWithDuration=2, DurationWithCounts = 3}	R/W	Counts

### GraphType Property

The **GraphType** property specifies the type of data that will be shown in the Pareto graph (see the table below for the list of choices). If UtilStates is selected, each bar in the graph represents the counts or duration of a utilization state. If ReasonGroups is selected, each bar in the graph represents the counts or duration of a reason group. If Reasons is selected, each bar in the graph represents the counts or duration of a reason.

Data Type	Read/Write	Default Value
Enum {UtilStates=0, ReasonGroups=1, Reasons = 2}	R/W	UtilStates

### DisplayEntity Property

When the **DisplayEntity** property is set to a specific entity name, the control will use that entity as the source of the data instead of the currently logged in entity. This will enable multiple KPI controls to exist on the same screen, each one showing values for a different entity (dashboard setup).

Dynamic entity names can be configured through the Industrial Graphics Editor by data-binding the tag reference or custom property in the reference column.

If this property is set to null or an empty string, the currently logged in entity will be used as the source of data.

Data Type	Read/Write	Default Value
String	R/W	Null

**DurationRefreshRate Property**

The **DurationRefreshRate** property specifies the amount of time in minutes between refreshes. This property is only legitimate when the **CountsAndDurationControlType** property is set to Duration. This property must have a value greater than or equal to zero. If the value is set to 0, the graph will only refresh when there is a change in utilization.

Data Type	Read/Write	Default Value
Integer	R/W	5

**FilterDefaultsFromDB Property**

The **FilterDefaultsFromDB** property controls whether the default filter settings (**TypeFilter**, **FilterDuration**, **CDKPIFilter.FilterTime**, **CDKPIFilter.FilterStartOffset**, and **CDKPIFilter.FilterEndOffset** properties) are established during design time or if they will be pulled in from the MES database during run time. If this property is set to False, the default filter settings will not be loaded from the database. If the property is set to True, the default filter settings will be pulled from the MES database. In this case, the design-time setting of the filter properties is disabled.

Data Type	Read/Write	Default Value
Boolean	R/W	False

**FilterDuration Property**

The **FilterDuration** property specifies the N in the Last N Hours filter type. The value of this property is only legitimate when the **TypeFilter** property is set to Last N Hours.

Data Type	Read/Write	Default Value
Integer	R/W	0

**FilterEnabled Property**

The **FilterEnabled** property indicates whether the **Filter()** method may be called. If it is set to False, the **Filter()** method may not be called. This property is set by the control whenever the state of the control changes. It will be set to False if there is no MES session, no user, or no entity. At all other times it should be set to True.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

## LabelFont Property

Use the **LabelFont** property to set or get the font for the labels in a bar chart.

The font size can be up to 30 pt. It should be adjusted to a size that is appropriate for the size of the chart.

The font size can be set to more than 9 pt for controls whose *ControlStyle* property is set to Counts or Duration by not CountsWithDuration or DurationWithCounts.

Data Type	Read/Write	Default Value
Font	R/W	

## LabelFontColor Property

Use the **LabelFontColor** property to set the font color for the labels in a bar chart.

Data Type	Read/Write	Default Value
Color (System.Drawing.Color)	R/W	

## NumberOfBars Property

The **NumberOfBars** property specifies the maximum number of bars for individual utilization states, reason groups, or reasons that will appear on the graph. The number of bars is an upper limit for the number of bars shown. If there is not enough data to show that many bars, fewer will be displayed. If there are more values than the number of bars, another bar will be added showing the sum of the remaining values.

Data Type	Read/Write	Default Value
Integer	R/W	5

## OEEStatusFilter Property

The **OEEStatusFilter** property determines what filtering, if any, will be performed based on utilization status (Runtime and Downtime).

Data Type	Read/Write	Default Value
Enum {Runtime=0, Downtime=1, Neither=2, All=3}	R/W	All

## ReasonGroupColors Property

The **ReasonGroupColors** property is an array with a size equal to the value of the **NumberOfBars** property plus one for the summary bar. When displaying utilization states and reasons, the colors for the bars come from the

database. Since reason groups do not have colors defined in the database, this property allows the user to specify the bar colors when displaying reason groups. The colors will not map to a particular reason group, but instead will specify what color by bar position.

Data Type	Read/Write	Default Value
Array of Color	R/W	Red for all positions

### ValueFont Property

Use the **ValueFont** property to set the font for the values in a bar chart.

Data Type	Read/Write	Default Value
Font	R/W	

### ValueFontColor Property

Use the **ValueFontColor** property to set the font color for the values in a bar chart.

Data Type	Read/Write	Default Value
Color (System.Drawing.Color)	R/W	

## Methods of the Counts/Duration KPI Control

This section describes the methods of the Counts/Duration KPI Control. For information about the common methods shared by this control, see [Common Methods](#).

### Filter () Method

The **Filter()** method can only be called when the **FilterEnabled** property is set to True. Call this method to display the same Filter dialog box that is used to set properties at design-time with one additional list for setting the OEE Status Filter.

### Syntax

```
Filter();
```

### FillSampleDataCountsDuration() Method

Use the **FillSampleDataDuration()** method to fill the sample data for the Bar Chart at design time.

### Syntax

```
FillSampleDataCountsDuration();
```

## GetButtonMenuItems() Method

Use the **GetButtonMenuItems()** method to retrieve the button menu for the Utilization control. If no Button Bar control is associated with the Utilization control, an empty button menu is returned.

## Syntax

```
result = GetButtonMenuItems();
```

## InitializeBarGraph() Method

Use the **InitializeBarGraph()** method to initialize the Bar Graph at constructor.

## Syntax

```
InitializeBarGraph();
```

## RefreshDisplay() Method

Use the **RefreshDisplay()** method to refresh and update the display in the control where the data source to the bar chart is assigned.

This method updates the display only if the database of **CaDViewData** class is updated.

## Syntax

```
RefreshDisplay();
```

## Update Display() Method

Use the **UpdateDisplay()** method to update the Counts/Duration KPI control at run time and design time.

## Syntax

```
UpdateDisplay();
```

## Events of the Counts/Duration KPI Control

This section describes events of the Counts/Duration KPI Control.

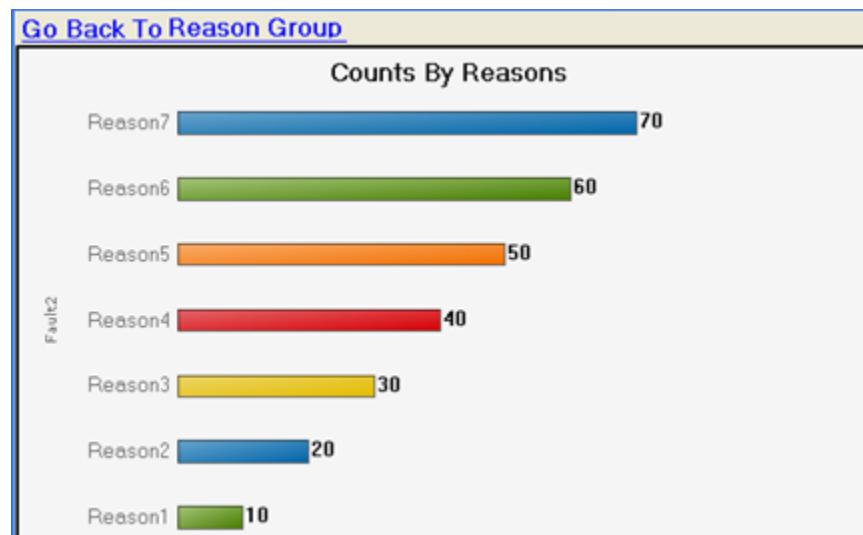
### OnClick() event

The **OnClick()** event is fired when the user clicks on any bar on the OEE KPI control. When fired, the graph type displayed will change based on the bar that was clicked on. If reason groups are being displayed, clicking on a reason group will update the graph with the reason data for the selected reason group using the same filters. The **CountsAndDurationGraphType** property will not be changed; the users will have to catch the click event if

they want to update the UI to indicate that reasons are being displayed. If the graph is displaying the reasons for a particular reason group, the UI must provide a means for getting back to displaying the reason groups. If reasons are being displayed and a reason is clicked on, the graph will change to display the utilization states associated with the reason. If utilization states are being displayed and a state is clicked on, the graph will change to display the reason groups that the utilization state is part of. Again, the same filters will be applied and the **CountsAndDurationGraphType** property will not be changed.

## Syntax

```
OnClick();
```



## Data Log Control

The Data Log control allows you to view and edit the data logs associated with the job running on the current entity. It also allows toggling between a grid and chart to view the retrieved data.

### Configuring the Data Log Control

You can use the Data Log control to record any information about the current job that is being run on a selected entity.

The collected data is typically not a value that is specified prior to running the job. The fields that appear in this control are created in Supervisor.

When you use the Data Log control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Data Log control to:

- Add a new row to the grid.
- Save all entered data.
- Refresh the Data Log grid.
- Delete the selected row from the grid.
- Open the Help window.
- Start an external application.
- Start Internet Explorer.
- Switch between grid display and chart display.
- Switch the active user.
- Open or launch a form, if *Path to form program* system parameter is set.

The Data Log control corresponds to the **Data Log** tab of the MES Operator application. For more information, see the Data Log Tab section in the *MES Operator Guide* or MES online help.

## Properties of the Data Log Control

This section describes the properties of the Data Log control. For information about the common properties shared by this control, see [Common Properties](#).

### curEnt Property

Use the **curEnt** property to return a reference to the current Ent object for the current logged on user.

Data Type	Read/Write	Default Value
Ent	Read Only	

### curUser Property

Use the **curUser** property to return a reference to the current User object for the currently logged on user.

Data Type	Read/Write	Default Value
User	Read Only	

### Font Property

Use the **Font** property to change the font of each constituent control to that is specified for the "whole" control in design mode. This property overrides the master control **Font** property.

Data Type	Read/Write	Default Value
Font	R/W	0

### IsSaveNeeded Property

Use the **IsSaveNeeded** property to indicate whether the data needs to be saved.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### LotNo Property

Use the **LotNo** property to get the current lot number for which to retrieve data.

Data Type	Read/Write	Default Value
String	Read Only	""

### MaxValues Property

Use the **MaxValues** property to return the maximum number of value fields (16 or 48) for the current data log group. If a current group does not exist, this property returns 0.

Data Type	Read/Write	Default Value
Boolean	Read Only	0

### NewRowEnabled Property

Use the **NewRowEnabled** property to specify whether the Insert Row button action is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### RemoveEnabled Property

Use the **RemoveEnabled** property to specify whether the **Remove** button action is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### SaveEnabled Property

Use the **SaveEnabled** property to specify whether the **Save** button action is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### StepNo Property

Use the **StepNo** property to get the current step number for which to take data.

Data Type	Read/Write	Default Value
Integer	Read Only	

### SublotNo Property

Use the **SublotNo** property to get the current subplot number for which to take data.

Data Type	Read/Write	Default Value
String	Read Only	

### ToggleChartEnabled Property

Use the **ToggleChartEnabled** property to specify whether the **Toggle Chart** button action is enabled or not.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

## Methods of the Data Log Control

This section describes the methods of the Data Log control. For information about the common methods shared by this control, see [Common Methods](#).

### AddNewRow() Method

Use the **AddNewRow()** method to add a new row to the data log grid for a new set of data log samples.

## Syntax

```
AddNewRow(int stepNo, string lotNo, string subLotNo,  
string stepDesc);
```

## Parameters

**stepNo**

An integer value, if not Null, that is the current step number to which this datalog row applies.

*lotNo*

An integer value, if not Null, that is current lot number to which this datalog row applies.

*subLotNo*

An integer value, if not Null, that is current subplot number to which this datalog row applies.

*stepDesc*

A string value, if not Null, that is current step description to which this datalog row applies.

### CheckAndSave() Method

Use the **CheckAndSave()** method to verify if any data needs to be saved. It prompts the user if a save is required, and saves the data upon user action if the user chooses.

## Syntax

```
CheckAndSave();
```

### DeleteDataLogRow() Method

Use the **DeleteDataLogRow()** method to delete the selected row from the relevant Data Log table—Data\_Log\_16 table or Data\_Log\_48 table.

## Syntax

```
DeleteDataLogRow();
```

### SaveRows() Method

Use the **SaveRows()** method to save all the data log rows that are edited or inserted. This method checks if the data log row must be saved in Data\_Log\_16 table or Data\_Log\_48 table.

## Syntax

```
SaveRows();
```

### SelectRowByKey() Method

Use the **SelectRowByKey()** method to select the specified row in the grid. If the row is not found optionally, the last row is selected based on a parameter. If the specified row cannot be found and the *selectLastRowAsDefault* parameter is False, then the existing selected row is left and a False value is returned. If a new row is selected, it enables/disables any buttons based on this new selection.

## Syntax

```
result = SelectRowByKey(rowID, selectLastRowAsDefault);
```

## Parameters

*rowID*

An integer that is the row ID of the selected row.

*selectLastRowAsDefault*

A Boolean value that is the last row if the row is not found.

Return Value

*result*

A Boolean value that is True, if the row ID is found; otherwise it returns False.

## Entity Usage Editor Control

The Entity Usage Editor control allows users to edit data in the Util\_Log table and Job\_Util\_Log\_Link table.

### Configuring the Entity Usage Editor Control

You use the Entity Usage Editor control to view, filter, edit, insert, and delete entity usage data directly in the database tables.

When you use the Entity Usage Editor control in a System Platform symbol and view this symbol in WindowViewer, it automatically shows the entity usage data from the MES database.

Entity	Event Start Time	Event End Time	Duration...	Shift Description	Shift Start Time	Reason	State	Runtime
Coaster	6/6/2021 10:53:09 AM	6/6/2021 2:11:47 PM	00:18:38	Day	6/6/2021 5:00:00 AM	Running	RUNNING	<input checked="" type="checkbox"/>
Coaster	6/6/2021 11:11:47 AM	6/6/2021 3:00:00 PM	00:48:13	Day	6/6/2021 5:00:00 AM	Not Scheduled	IDLE	<input type="checkbox"/>
Coaster	6/6/2021 12:00:00 PM	6/6/2021 3:07:41 PM	00:07:41	Day	6/6/2021 5:00:00 AM	Running	RUNNING	<input checked="" type="checkbox"/>
Coaster	6/6/2021 12:07:41 PM	8/3/2022 4:43:26 PM	10153:35:45	Day	6/6/2021 5:00:00 AM	Not Scheduled	IDLE	<input type="checkbox"/>
Coaster	8/3/2022 1:43:26 PM	8/3/2022 5:14:13 PM	00:30:47	Afternoon	8/3/2022 1:00:00 PM	Running	RUNNING	<input checked="" type="checkbox"/>

The Entity Usage Editor is based on the **Entity Use** tab in the MES Data Editor. From the editor, you can filter, edit, insert, delete, and refresh records during run time. For more information, see the Entity Use Tab section of the *MES Data Editor Guide* or MES online help.

### Properties of the Entity Usage Editor Control

This section describes the properties of the Entity Usage Editor control. For information about the common properties shared by this control, see [Common Properties](#).

## AppendSaveConfigName Property

The **AppendSaveConfigName** property is an override of the **AppendSaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

Data Type	Read/Write	Default Value
Boolean	R/W	True

## SaveConfigName Property

The **SaveConfigName** property is an override of the **SaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

Data Type	Read/Write	Default Value
String	R/W	The instance name for the saved configuration. This may be appended to or replace the entity ID. If left blank, the entity ID is used.

## Methods of the Entity Usage Editor Control

The Entity Usage Editor control does contain any unique methods. For information about the common methods shared by this control, see [Common Methods](#).

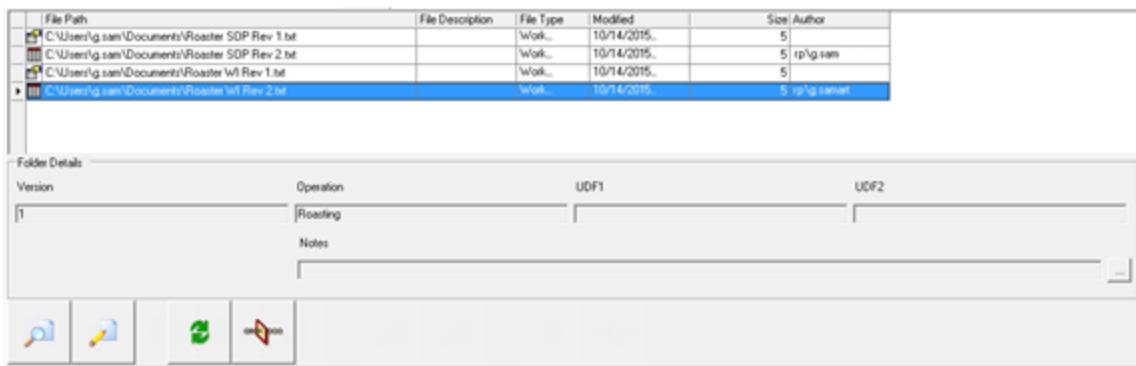
## Folders Control

The Folders control allows you to show the folder for the currently running job. If no job is running, a folders tree shows all the folders for the current entity or all entities if the user has the override entity privilege.

### Configuring the Folders Control

You use the Folders control to view, edit, and print files.

When you use the Folders control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Folders control to:

- View the selected file.
- Edit the selected file.
- Refresh the Folders control.
- Enter a file filter.
- Start an external application.
- Start Internet Explorer.
- Open the Help window.
- Switch the active user.
- Print the selected file.
- Open/Launch Form, if the **Path to Form Program** system parameter is set.

The Folders control corresponds to the **Folders** tab of the MES Operator application. For more information, see the **Folders Tab** section in the *MES Operator Guide* or MES online help.

### Setting the Icon Size

You can select the desired folder from the tree in the left pane, when the Folders control is displayed outside the context of a running job. If the control is displayed in the context of a running job, the desired folder is already selected.

You can use the properties of the Folders control to set the icon size. You can set the icon size in the Folders control to either small (16x16 pixels) or large (32x32 pixels). If you set the property **UseLargeTreeIcons** to True, large icons are used in the tree.

#### To set the icon size in the Folders control

1. Select the Folders control for which you want to set the icon size.
2. In the Properties Editor, locate the property **UseLargeTreeIcons**.
3. Set the value of the property to:
  - True for large icons (32x32 pixels)
  - False for small icons (16x16 pixels)

## Properties of the Folders Control

This section describes the properties of the Folders control. For information about the common properties shared by this control, see [Common Properties](#).

### CompareEnabled Property

Use the **CompareEnabled** property to set or get whether the **Compare** command is available at run time.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### EditEnabled Property

Use the **EditEnabled** property to set or get whether the **Edit** command is available at run time.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### FilterEnabled Property

Use the **FilterEnabled** property to set or get whether the **Filter** command is available at run time.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### PrintEnabled Property

Use the **PrintEnabled** property to set or get whether the **View** command is available at run time.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

### UseLargeTreeIcons Property

Use the **UseLargeTreeIcons** property to set or get a value to indicate whether large icons are used on the folders tree. The value is set to True if the control uses large icons, and set to False if the control uses small icons.

Data Type	Read/Write	Default Value
Boolean	R/W	False

## ViewEnabled Property

Use the **ViewEnabled** property to set or get whether the **View** command is available at run time.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

## Methods of the Folders Control

This section describes the methods of the Folders control. For information about the common methods shared by this control, see [Common Methods](#).

### ApplyFilter() Method

Use the **ApplyFilter()** method to set filter values and display the folders tree based on the filter values. If a null value is passed, the current filter value does not change. If an empty string is passed as a filter value, the filter is cleared. This method affects the control if no job is running on the current entity.

## Syntax

```
ApplyFilter(itemClassIDFilter, itemClassDescFilter, itemIDFilter, itemDescFilter,  
operIDFilter, operDescFilter, entIDFilter, verIDFilter, udf1Filter, udf2Filter,  
fileFilter);
```

## Parameters

*itemClassIDFilter*

A string value of the Item Class ID filter. You need to pass null to use the current value.

*itemClassDescFilter*

A string value of the Item Class description filter. You need to pass null to use the current value.

*itemIDFilter*

A string value of the Item ID filter. You need to pass null to use the current value.

*itemDescFilter*

A string value of the Item description filter. You need to pass null to use the current value.

*operIDFilter*

A string value of the operation ID filter. You need to pass null to use the current value.

*operDescFilter*

A string value of the operation description filter. You need to pass null to use the current value.

*entIDFilter*

A string value of the entity ID filter. The string must contain a number or an empty string. You need to pass null to use the current value.

*verIDFilter*

A string value of the folder version ID filter. You need to pass null to use the current value.

*udf1Filter*

A string value of the first user-defined filter. You need to pass null to use the current value.

*udf2Filter*

A string value of the second user-defined filter. You need to pass null to use the current value.

*fileFilter*

A string value of the file filter. Only folders containing a matching file are displayed. You need to pass null to use the current value.

## Edit() Method

Use the **Edit()** method to check if a row is selected in the grid, and then to check if you have the edit level permission for the selected file. If the check is successful, the **EditFile()** method in the **Documents** class invokes the editor for the selected file type.

## Syntax

```
Edit();
```

## Filter() Method

Use the **Filter()** method to specify folder filter. If you apply the filter, the **RefreshData()** method reloads the folders tree.

## Syntax

```
Filter();
```

## Print() Method

Use the **Print()** method to check if a row is selected in the grid, and then to check if you have the view level permission for editing the selected file. If the check is successful, the **PrintFile()** method in the **Documents** class prints the file.

## Syntax

```
Print();
```

## ResetUseLargeTreeIcons() Method

Use the **ResetUseLargeTreeIcons()** method to reset the **UseLargeTreeIcons** property to its default value of False.

## Syntax

```
ResetUseLargeTreeIcons();
```

## SelectRowByKey() Method

Use the **SelectRowByKey()** method to select the row in the grid containing the file path. If the file is not found and the *selectFirstRowAsDefault* parameter is set, the first row in the grid is selected. Otherwise, the current row selection remains unchanged.

## Syntax

```
result = SelectRowByKey(fileSource, filePath, selectFirstRowAsDefault);
```

## Parameters

*fileSource*

An enumeration type { ItemFile=0, WorkOrderFile=1, FolderFile=2, FolderEntity=3, RunEntity=4} that is a file source to determine whether the file is an Item file, a Work Order file, a Folder file (specifies a file for the Entity for which the folder was built) or a Run Entity (specifies a file for the current Entity on which the job is running).

*filePath*

A file path that is the path of the selected file.

*selectFirstRowAsDefault*

A Boolean value that is set to True to select the first row if the specified path is not found.

## Return Value

*result*

A Boolean value that is True if the row containing the file path is found; otherwise, it returns False.

## View() Method

Use the **View()** method to check if a row is selected in the grid, and then to check if you have the view level permission for the selected file. If the check is successful, the **ViewFile()** method in the **Documents** class invokes the viewer for the selected file type.

## Syntax

```
View();
```

## Genealogy Control

The Genealogy control consists of a grid that displays the item consumption history for the currently running job of the selected entity. This table maintains the finished goods to raw material lot traceability/genealogy data.

### Configuring the Genealogy Control

You use the Genealogy control to show the consumption history against the running work order.

When you use the Genealogy control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).

The screenshot shows a genealogy control interface. At the top, there are two filter sections: 'Filter Genealogy By' with 'Current User' (radio button) selected and 'All Users' (radio button), and another 'Filter Genealogy By' section with 'Current Shift' (radio button) selected and 'All' (radio button). Below these is a table header with columns: Work Order, Operation, Seq No, Item ID, Item, Shift Start, Reason, Status, Lot No, and FG. Two rows of data are shown: one for work order 20220803.03 with operation 100-RST, item CSW-BLK, reason Good Consumption, status Raw Materials, lot number CSW-BLK-20220815, and FG RM; and another for work order 20220803.03 with operation 100-RST, item PNT-BLK, reason Good Consumption, status Raw Materials, lot number PNT-BLK-20220815, and FG RM. At the bottom of the table are five icons: a box with a minus sign, a box with a plus sign, a green checkmark, a group of people, and a question mark.

Work Order	Operation	Seq No	Item ID	Item	Shift Start	Reason	Status	Lot No	FG
20220803.03	100-RST	0	CSW-BLK	Cashews in Bulk	8/15/2022 4:00:00 PM	Good Consumption	Raw Materials	CSW-BLK-20220815	RM
20220803.03	100-RST	0	PNT-BLK	Peanuts in Bulk	8/15/2022 4:00:00 PM	Good Consumption	Raw Materials	PNT-BLK-20220815	RM

The **Filter Genealogy By** options allow the operator to limit the consumption data displayed based on users or shifts.

The operator can use the Genealogy control to:

- Reduce consumption in the current job.
- Change the reason the item was consumed by the job. This is known as "Reclassify".
- Refresh the Genealogy control.
- Switch the active user.
- Open the Help window.
- Open or launch a form, if the *Path to Form Program* system parameter is set.

The Genealogy control corresponds to the **Genealogy** tab of the MES Operator application. For more information, see the Genealogy Tab section in the *MES Operator Guide* or MES online help.

### Properties of the Genealogy Control

This section describes the properties of the Genealogy control. For information about the common properties shared by this control, see [Common Properties](#).

#### OpenFormEnabled Property

Use the **OpenFormEnabled** property to determine if the **Open Form** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ReclassifyConsEnabled Property

Use the **ReclassifyConsEnabled** property to determine if the **Reclassify Consumption** button is enabled to change the reason of the item that is consumed by a job.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ReduceConsEnabled Property

Use the **ReduceConsEnabled** property to determine if the **Reduce Consumption** button is enabled to reduce consumption of items in the current job.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

## Methods of the Genealogy Control

This section describes the methods of the Genealogy control. For information about the common methods shared by this control, see [Common Methods](#).

### ReduceConsumption() Method

Use the **ReduceConsumption()** method to open the form for reducing consumption.

#### Syntax

```
ReduceConsumption();
```

### ReclassifyConsumption() Method

Use the **ReclassifyConsumption()** method to open the form for reclassifying consumption.

#### Syntax

```
ReclassifyConsumption();
```

## SelectRowByKey() Method

Use the **SelectRowByKey()** method to search for the specified row ID in the grid. If the row ID is found, the row is selected. If the row ID is not found and the *SelectFirstRowAsDefault* parameter is set to True, the first row is selected; otherwise the row selection is not changed.

## Syntax

```
result = SelectRowByKey(int rowID, bool selectFirstRowAsDefault);
```

## Parameters

*rowID*

An integer value that indicates the row ID of a row in the item\_prod table.

*selectFirstRowAsDefault*

A Boolean value that is set to True if the first row must be selected when the row ID is not found. It is set to False, if the row selection must not change when the row ID is not found.

## Return Value

*result*

A Boolean value that is True if the row ID is found; otherwise it returns False.

## Inventory Control

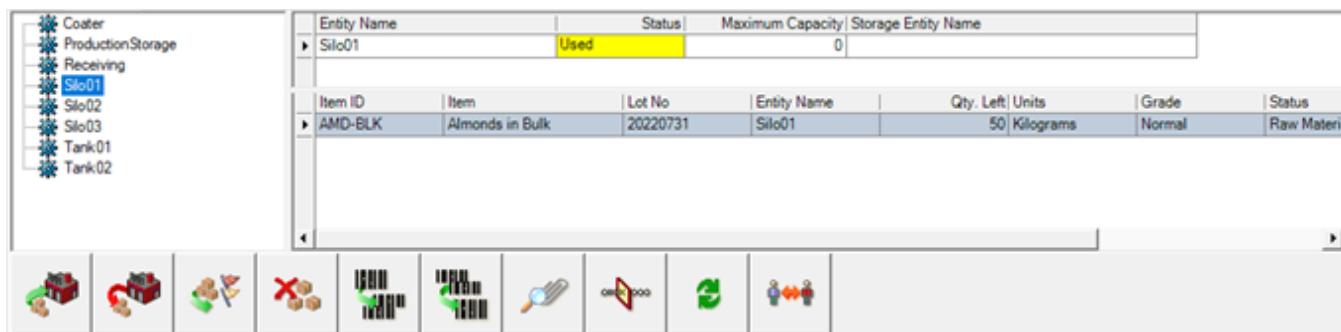
The Inventory control is used to view and maintain item consumption editor and storage status of the currently logged on entity and all the movable storage entities located at the current entity.

This control is also used to view the Item Consumption editor and storage status of other entities.

## Configuring the Inventory Control

You use the Inventory control to show the current inventory status of a given entity. You can also transfer in, transfer out, and reclassify inventory at a given location.

When you use the Inventory control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Inventory control to:

- Transfer inventory from another entity to the selected storage location. This is referred to as "transfer in."
- Transfer inventory from the selected entity to another storage location. This is referred to as "transfer out."
- Change the grade and status of the selected lot. This is referred to as "reclassify."
- Remove all or some of the items from the inventory of the selected storage location. This is referred to as "scrap."
- Add, remove, and change the attributes of the selected lot.
- Filter parameters to limit the view of the Inventory control.
- Refresh the Inventory control.
- Switch the active user.
- Show the attributes of the selected lot.
- Receive inventory from an external location.
- Transfer serial numbers.
- Open or launch a form, if the *Path to Form Program* system parameter is set.

The Inventory control corresponds to the **Inventory** tab of the MES Operator application. For more information, see the **Inventory Tab** section in the *MES Operator Guide* or MES online help.

You can also use the properties of the Inventory control to allow selection of multiple rows, show an entity tree, show the storage entity status grid, and set the icon size.

### Selecting Multiple Rows in the Inventory Control

You can allow the run time operator to select multiple rows in the Inventory control by setting the property **AllowMultipleSelection** to True. Selecting multiple rows is useful when the operator needs to run the **Reclassify** and **TransferOut** commands.

#### To allow multiple row selection in the Inventory control

1. Select the Inventory control for which you want to allow multiple row selection.
2. In the Properties Editor, locate the property **AllowMultipleSelection**.
3. Set the value of the property to True.

### Showing the Tree of Entities in the Inventory Control

You can set the Inventory control to show a tree of entities at run time. Set the **ShowEntityTree** property to True to show the entities. At the terminal node of a branch, you can only view entities that can store items.

#### To show the tree of entities in the Inventory control

1. Select the Inventory control for which you want to show the tree of entities.
2. In the Properties Editor, locate the property **ShowEntityTree**.
3. Set the value of the property to True.

## Showing the Storage Entity Status Grid in the Inventory Control

You can set the Inventory control to show a storage entity status grid. To do this, set the **ShowStorageEntityStatusGrid** property of the control to True.

### To show the storage entity status grid in the Inventory control

1. Select the Inventory control for which you want to show the storage entity status grid.
2. In the Properties Editor, locate the property **ShowStorageEntityStatusGrid**.
3. Set the value of the property to True.

## Setting the Icon Size

You can set the icon size in the Inventory control to either small (16x16 pixels) or large (32x32 pixels). If you set the property **UseLargeTreeIcons** to True, large icons are used in the tree.

### To set the icon size in the Inventory control

1. Select the Inventory control for which you want to set the icon size.
2. In the Properties Editor, locate the property **UseLargeTreeIcons**.
3. Set the value of the property to:
  - True for large icons (32x32 pixels)
  - False for small icons (16x16 pixels)

## Properties of the Inventory Control

The properties of the Inventory control are as follows:

- **UseLargeTreeIcons** property
- **ShowEntityTree** property
- **ShowStorageStatusGrid** property
- **FilterEnabled** property
- **TransferInEnabled** property
- **ReclassifyEnabled** property
- **TransferOutEnabled** property
- **ScrapInventoryEnabled** property
- **SplitLotEnabled** property
- **CombineLotEnabled** property
- **LotAttributesEnabled** property
- **SelectedRows** property
- **FactGrid** property
- **AllowMultipleSection** property
- **ReceiveInventoryEnabled** property
- **HeadingFont** property

For information about the common properties shared by this control, see [Common Properties](#).

## Methods of the Inventory Control

This section describes the methods of the Inventory control. For information about the common methods shared by this control, see [Common Methods](#).

### ClearEntityTreeFilter() Method

Use the **ClearEntityTreeFilter()** method to clear the entity tree filter and to refresh the control so that the entity tree displays all the entities.

#### Syntax

```
ClearEntityTreeFilter();
```

### ClearInventoryFilter() Method

Use the **ClearInventoryFilter()** method to clear the inventory filter and to refresh the inventory grid.

#### Syntax

```
ClearInventoryFilter();
```

### ResetAllowMultipleSection() Method

Use the **ResetAllowMultipleSection()** method to reset the **AllowMultipleSection** property to its default value (True).

#### Syntax

```
ResetAllowMultipleSection();
```

### ResetShowEntityTree() Method

Use the **ResetShowEntityTree()** method to reset the default value (True) to the **ShowEntityTree** property.

#### Syntax

```
ResetShowEntityTree();
```

### ResetShowStorageStatusGrid() Method

Use the **ResetShowStorageStatusGrid()** method to reset the default value (True) to the **ShowStorageStatusGrid** property.

## Syntax

```
ResetShowStorageStatusGrid();
```

### ResetUseLargeTreeIcons() Method

Use the **ResetUseLargeTreeIcons()** method to reset the **UseLargeTreeIcons** property to its default value of False.

## Syntax

```
ResetUseLargeTreeIcons();
```

### SetEntityTreeFilter() Method

Use the **SetEntityTreeFilter()** method to set the entity tree, based on the specified array of entity IDs. The specified entity IDs must appear at the top level of the entity tree and you must have view permission for the inventory of entities. This method refreshes the control so that the entity tree displays only the specified entities.

## Syntax

```
SetEntityTreeFilter(int [] entIDs);
```

### Parameter

*entIDs*

An integer array holding the IDs of the entities, which must appear in the entity tree.

### SetInventoryFilter() Method

Use the **SetInventoryFilter()** method to set the inventory filter and then to refresh the data in the inventory grid to reflect the change in the filter. You can set any of the parameters, except the *reurseEntities* parameter, to Null.

## Syntax

```
SetInventoryFilter(string itemClassID, string itemClassDesc, string itemID, string itemDesc, string lotNo, string expiryDate, int [] gradeCodes, int [] statusCodes, bool recurseEntities);
```

### Parameters

*itemClassID*

A string that holds the filter setting for the item class ID.

*itemClassDesc*

A string that holds the filter setting for the item class description.

*itemID*

A string that holds the filter setting for the item ID.

*itemDesc*

A string that holds the filter setting for the item description.

*lotNo*

A string that holds the filter setting for the lot number.

*expiryDate*

A string that holds the filter setting for the expiry date.

*gradeCodes*

An integer array that holds grade codes, which may be empty.

*statusCodes*

An integer array that holds status codes, which may be empty.

*recurseEntities*

A Boolean that is True if the inventory for the entities located at the selected entity must be displayed.

### SelectRowByKey() Method

Use the **SelectRowByKey()** method to search for the specified row ID in the grid. If the row ID is found, the row is selected. If the row ID is not found and the *SelectFirstRowAsDefault* parameter is set to True, the first row is selected; otherwise the row selection is not changed.

### Syntax

```
result = bool SelectRowByKey(int rowID, bool selectFirstRowAsDefault);
```

### Syntax (with overload)

```
result = public bool SelectRowByKey(int [] rowIDs,  
bool selectFirstRowAsDefault);
```

### Parameters

*rowID*

An integer value that is the row ID of a row in the Item\_Inv table.

*selectFirstRowAsDefault*

A Boolean value that is set to True if the first row must be selected when there is no match. It is set to False, if the row selection must not change when there is no match.

### Return Value

*result*

A Boolean value that is True if the row ID is found; otherwise it returns False.

## Item Consumption Editor Control

The Item Consumption Editor control is used to view, filter, edit, insert, and delete item consumption data stored in the Item\_Cons table.

### Configuring the Item Consumption Editor Control

When you use the Item Consumption Editor control in a System Platform symbol and view this symbol in WindowViewer, it automatically shows the item consumption data from the MES database.

The Item Consumption Editor is based on the **Item Consumption** tab in the MES Data Editor. From the editor, you can filter and edit records during run time. For more information, see the Item Consumption Tab section of the *MES Data Editor Guide* or MES online help.

### Properties of the Item Consumption Editor Control

This section describes the properties of the Item Consumption Editor control. For information about the common properties shared by this control, see [Common Properties](#).

#### AppendSaveConfigName Property

The **AppendSaveConfigName** property is an overridden property that cannot be browsed. This property is made nonbrowsable for you to always save the configuration data.

Data Type	Read/Write	Default Value
Boolean	R/W	True

#### SaveConfigName Property

The **SaveConfigName** property is an overridden property that cannot be browsed. This property cannot be browsed to allow you to always save the configuration data.

Data Type	Read/Write	Default Value
String	R/W	The instance name for the saved configuration. This may either be appended to or replace the entity ID. If left blank, the entity ID is used.

### Methods of the Item Consumption Editor Control

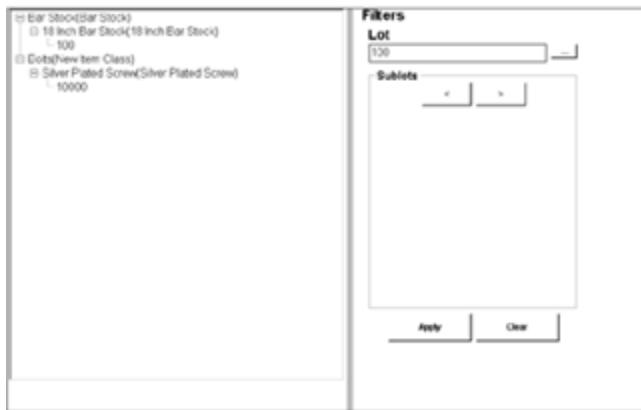
The Item Consumption Editor Control does not contain any unique methods. For information about the common methods shared by this control, see [Common Methods](#).

## Item Lot Editor Control

The Item Lot Editor control is used to edit associations among item classes, items, lots, and sub lots.

### Configuring the Item Lot Editor Control

You can use the Item Lot Editor control to maintain the lot and subplot number for an item. To use the Item Lot Editor, the Data Editor and Tracking modules must be licensed and you must have both the **May run Data Editor** and **May edit lot data** privileges.



#### To insert a new lot or subplot in the Item Lot Editor control during run time

1. In the left pane, highlight the item, lot, or subplot where you want to insert the new lot or subplot.
2. In the Button Bar for the Item Lot Editor control, click **Insert**. The Insert dialog box appears.
3. In the **Name** box, type the name of the lot or subplot you want to insert.
4. Click **OK**.

#### To change the parent of a lot or subplot in the Item Lot Editor control during run time

1. In the left pane, highlight the lot or subplot for which you want to change the parent.
2. In the Button Bar for the Item Lot Editor control, click **Change Parent**. The **Change Parent** dialog box appears.
3. In the left pane of the Change Parent dialog box, highlight the new parent.
4. Click **OK**.

#### To rename a lot or subplot in the Item Lot Editor control during run time

1. In the left pane, select the lot or subplot you want to rename.
2. In the Button Bar for the Item Lot Editor control, click **Rename**. The Rename dialog box appears.
3. In **New Name**, enter the name you want to assign to the lot or subplot.
4. Click **OK**. The select lot or subplot is renamed in all occurrences of the MES database.

#### To delete an existing lot or subplot in the Item Lot Editor control during run time

1. In the left pane, highlight the item, lot, or subplot you want to delete

2. In the Button Bar for the Item Lot Editor control, click **Delete**. A confirmation dialog box appears.
3. Click **OK**. The currently selected lot or subplot deleted from the Item Class tree and MES database. In addition, all child lots and sublots are deleted from the Item Class tree and MES database.

### To refresh records in the Item Lot Editor control during run time

- In the Button Bar for the Item Lot Editor control, click **Refresh**. The data in the control is updated.

### Properties of the Item Lot Editor Control

The Item Lot Editor control does not contain any unique properties. For information about the common properties shared by this control, see [Common Properties](#).

### Methods of the Item Lot Editor Control

The Item Lot Editor control does not contain any unique methods. For information about the common methods shared by this control, see [Common Methods](#).

## Item Production Editor Control

The Item Production Editor control is used to view, filter, edit, insert, and delete item production data in the database tables.

### Configuring the Item Production Editor Control

When you use the Item Production Editor control in a System Platform symbol and view this symbol in WindowViewer, it automatically shows the item production data from the MES database.

The Item Production Editor is based on the **Item Production** tab in the MES Data Editor. From the editor, you can filter, edit, insert, delete, and refresh records during run time. For more information, see the Item Production Tab section of the *MES Data Editor Guide* or MES online help.

### Properties of the Item Production Editor Control

This section describes the properties of the Item Production Editor control. For information about the common properties shared by this control, see [Common Properties](#).

### AppendSaveConfigName Property

The **AppendSaveConfigName** property is an override of the **AppendSaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### SaveConfigName Property

The **SaveConfigName** property is an override of the **SaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

Data Type	Read/Write	Default Value
String	R/W	The instance name for the saved configuration. This may be appended to or replace the entity ID. If left blank, the entity ID is used.

## Methods of the Item Production Editor Control

This section describes the methods of the Item Production Editor control. For information about the common methods shared by this control, see [Common Methods](#).

### GetQuantityForDownstreamOperation() Method

Use the **GetQuantityForDownstreamOperation()** method to compute the total quantity produced for an operation that is immediately downstream from the specified job and lot.

## Syntax

```
result = GetQuantityForDownstreamOperation(woID,operID, seqNo, lotNo, subplotNo);
```

## Parameters

*woID*

A string that is the work order ID of a job.

*operID*

A string that is the operation ID of a job.

*seqNo*

An integer that is the sequence number of a job.

*lotNo*

A string that is the lot number.

*subplotNo*

A string that is the subplot number.

## Return Value

*result*

A floating point number that is the total quantity for the downstream operation.

### GetTotalQuantityForOperation() Method

Use the **GetTotalQuantityForOperation()** method to compute the total quantity produced for the specified operation. The operation can be split amongst multiple jobs that have the same work order ID, operation ID, lot number, and subplot number.

## Syntax

```
result = GetTotalQuantityForOperation(woID,operID, seqNo, lotNo, subplotNo);
```

## Parameters

*woID*

A string that is the work order ID of a job.

*operID*

A string that is the operation ID of a job.

*seqNo*

An integer that is the sequence number of a job.

*lotNo*

A string that is the lot number.

*subplotNo*

A string that is the subplot number.

## Return Value

*result*

A floating point number that is the total quantity for the specified operation.

## Job Step Data Editor Control

You use the Job Step Data Editor control to view, filter, edit, insert, and delete job step data in the `Job_Step_Data` table.

### Configuring the Job Step Data Editor Control

When you use the Job Step Data Editor control in a System Platform symbol and view this symbol in WindowViewer, it automatically shows the job step data from the MES database.

The Job Step Data Editor is based on the **Steps Data** tab in the MES Data Editor. From the editor, you can filter,

edit, insert, delete, and refresh records during run time. For more information, see the Steps Data Tab section of the *MES Data Editor Guide* or MES online help.

## Properties of the Job Step Data Editor Control

This section describes the properties of the Job Step Data Editor control. For information about the common properties shared by this control, see [Common Properties](#).

### AppendSaveConfigName Property

The **AppendSaveConfigName** property is an override of the **AppendSaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### SaveConfigName Property

The **SaveConfigName** property is an override of the **SaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

Data Type	Read/Write	Default Value
String	R/W	The instance name for the saved configuration. This may be appended to or replace the entity ID. If left blank, the entity ID is used.

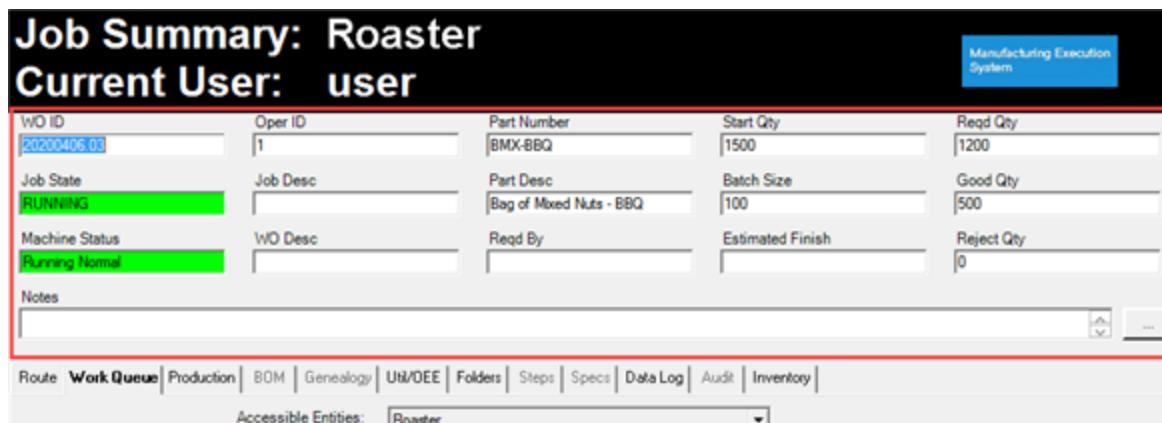
## Methods of the Job Step Data Editor Control

The Job Step Data Editor Control does not contain any unique methods. For information about the common methods shared by this control, see [Common Properties](#).

## Job Summary Control

The Job Summary control shows all current job information of a given entity.

The Job Summary control corresponds to the header of the Job window in Operator application. For more information, see the Job section in the *MES Operator Guide* or online help.



## Configuring the Job Summary Control

You can configure the Job Summary control to show the title bar at run time. The title bar can be used at run time to set the entity the Job Summary control is referencing.

You can also use the **DisplayTitleBar** property of the Job control to show or hide the title of the Job Summary control. Setting the **DisplayTitleBar** property to True shows the Job Summary control title bar. If you do not configure the Job Summary control to show the title bar, the only way you can switch entities at run time is by scripting.

When the entity can capture utilization, the title bar blinks to alert the user that a non-final reason has been entered via the Utilization Capability Object and that a final reason is required for this entity.

### To show the title bar in the Job Summary control

1. Select the Job Summary control for which you want to show the title bar.
2. In the Properties Editor, locate the property **DisplayTitleBar**.
3. Set the value of the property to True.

## Using the Job Summary Control

The **JobSummary** class provides a control to view job information for all jobs running on an entity. The **JobSummary** class also provides a means for users to log on and log off from entities. Also, the control includes a title bar control that can be made visible through a control property to set the current entity.

To use the Job Summary control, you must log on to the control and select one or more entities.

## Switching Entities

If the operator is going to be logged on to more than one entity, you can use the Job Summary control to allow the operator to select the current entity in one of the following ways:

- Clicking an entity name in the title bar and selecting a different entity from the list of entities that the operator is currently logged on to.
- Clicking the **Logon Entity** button and using the entity selector to log on to one or more entities.

The Job Summary control only shows information for the current entity.

If the current entity can only run one job at a time, the Job Summary control shows the job information for the job that is currently running on the entity.

If the current entity can run more than one job at a time, the Job Summary control shows a grid. Each row on the grid corresponds to a job currently running on the entity.

The Job Summary control contains a single push button the operator can use to open the notes editor.

The Job Summary control does not have a Button Bar control associated with it.

## Properties of the Job Summary Control

This section describes the properties of the Job Summary control. For information about the common properties shared by this control, see [Common Properties](#).

### DisplayTitlebar Property

Set the **DisplayTitlebar** property to True if the control should show the title bar with the entity name to use as the entity selector.

Data Type	Read/Write	Default Value
Boolean	R/W	True

## Methods of the Job Summary Control

This section describes the methods of the Job Summary control. For information about the common methods shared by this control, see [Common Methods](#).

### InitEntitySelect() Method

Use the **InitEntitySelect()** method to display the entity list dialog, which allows you to do the following:

- Select a different entity to use as the current entity
- Log on or log off entities
- Log off job, if job-based login is used

If an entity can capture utilization, the defined color of the utilization state of the entity is used for the text of the entity name.

## Syntax

```
InitEntitySelect();
```

### ResetDisplayTitleBar() Method

Use the **ResetDisplayTitleBar()** method to reset the **DisplayTitleBar** property to the default of True. When the **DisplayTitleBar** property is True, the title bar showing the current entity name with link to the entity select list is

shown on the Job Summary Control.

## Syntax

```
ResetDisplayTitleBar();
```

### SelectRowByKey() Method

Use the **SelectRowByKey()** method to search for the specified job in the grid and select the row containing the job. If the job is not found, the first row of the grid is selected by default.

## Syntax

```
result = SelectRowByKey(Job, SelectFirstRowAsDefault);
```

### Parameters

*job*

A string containing the work order ID + "\_" + the operation ID + "\_" + the sequence number of the job.

*SelectFirstRowAsDefault*

A Boolean value that specifies whether to select the first row as default. The first row is always selected by default if the job is not found.

### Return Value

*result*

A Boolean value that is True, if the row containing the job is found; otherwise it returns False.

## Labor Usage Editor Control

You use the Labor Usage Editor control to view, filter, edit, insert, and delete labor usage data in the Labor\_Usage table.

### Configuring the Labor Usage Editor Control

When you use the Labor Usage Editor control in a System Platform symbol and view this symbol in WindowViewer, it automatically shows the labor usage data from the MES database.

The Labor Usage Editor is based on the **Labor Use** tab in the MES Data Editor. From the editor, you can filter, edit, insert, delete, and refresh records during run time. For more information, see the Labor Use Tab section of the *MES Data Editor Guide* or MES online help.

### Properties of the Labor Usage Editor Control

This section describes the properties of the Labor Usage Editor control. For information about the common

properties shared by this control, see [Common Properties](#).

### AppendSaveConfigName Property

The **AppendSaveConfigName** property is an override of the **AppendSaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### SaveConfigName Property

The **SaveConfigName** property is an override of the **SaveConfigName** property and cannot be browsed. This property cannot be browsed because the configuration data is always saved by a user.

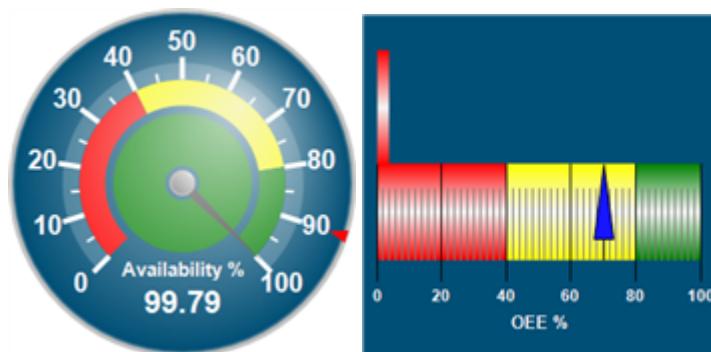
Data Type	Read/Write	Default Value
String	R/W	The instance name for the saved configuration. This may be appended to or replace the entity ID. If left blank, the entity ID is used.

### Methods of the Labor Usage Editor Control

The Labor Usage Editor Control does not contain any unique methods. For information about the common methods shared by this control, see [Common Methods](#).

## OEE KPI Control

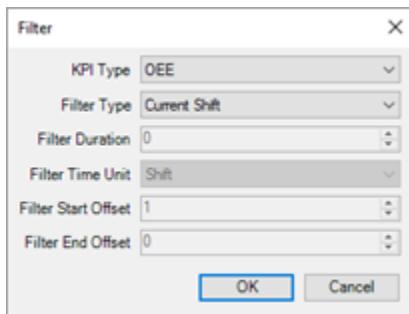
The OEE KPI control shows OEE or one aspect of OEE on a dial or bar graph. The control shows OEE, Quality, Availability, and/or Performance actual values for an entity. It also shows the associated target values.



## Using the OEE KPI Control

When configuring the OEE KPI control, the designer will typically set a default Control Style (dial or bar graph) and Filter Defaults ([TypeFilter](#), [FilterDuration](#), [OEEKPIFilter.FilterTime](#), [OEEKPIFilter.FilterStartOffset](#), [OEEKPIFilter.FilterEndOffset](#)). It is also possible to specify that various property values will be configured by the operator at run time and 'saved to' or 'retrieved from' the MES database on a per user basis. If this is the case, configuring these properties will be disabled at design time. See the [FilterDefaultsFromDB Property](#) for more on this.

At design time or run time, when configuring filters, a Filter dialog box exists to help coordinate the setting of several properties at once. This Filter dialog box can be invoked at design time by selecting the ellipsis button next to the **TypeFilter** property. At run time, it is invoked by calling the **Filter()** method or using the button bar.



At run time, the control is refreshed whenever an **OEEChanged** event is detected from the MES database. This event is handled internally by the control. The control is also refreshed when various properties are set (such as **ControlStyle**, **TypeFilter**, and so on). To prevent a refresh from occurring in the middle of setting the filters, the control supports the common **IgnoreRefreshEvents** property and **RefreshData()** method scheme. For more information on this method, see [RefreshData\(\) Method](#).

The OEE KPI control has a context menu that allows a user with the proper permissions to save the configuration of the control to the database for either a specific entity, all the logged on entities, or as a default. Only the button bar setup and the current filter settings will be saved as configuration data.

To use the OEE KPI control, the operator must log on to a session and select one or more entities, or set the **DisplayEntity** property which will use the display entity as the source of the data.

## Switching Entities

The OEE KPI control shows information only for the current entity. If the Job Summary control is included in the form, you can use it to change the current entity. You can also change the current entity by using a script.

## Associating the Button Bar Control

When you use the OEE KPI control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).

## Properties of the OEE KPI Control

This section describes the properties of the OEE KPI Control. For information about the common properties shared by this control, see [Common Properties](#).

## CurrentValue Property

The **CurrentValue** property indicates the current value for the configured KPI.

Datatype	Read/Write	Default Value
Double	Read Only	N/A

## DisplayEntity Property

When the **DisplayEntity** property is set to a specific entity name, the control will use that entity as the source of the data instead of the currently logged in entity. This will enable multiple KPI controls to exist on the same screen, each one showing values for a different entity (dashboard setup).

Dynamic entity names can be configured through the Industrial Graphics Editor by data-binding the tag reference or custom property in the reference column.

If this property is set to null or an empty string, the currently logged in entity will be used as the source of data.

Data Type	Read/Write	Default Value
String	R/W	Null

## FilterDefaultsFromDB Property

The **FilterDefaultsFromDB** property controls whether the default filter settings (**TypeFilter**, **FilterDuration**, **OEEKPIFilter.FilterTime**, **OEEKPIFilter.FilterStartOffset**, and **OEEKPIFilter.FilterEndOffset** properties) are established during design time or if they will be pulled in from the MES database during run time. If this property is set to False, the default filter settings will not be loaded from the database. This could be suitable when the control is running within System Platform – the default filter would be set during design-time. If the property is set to True, the default filter settings will be pulled from either the **UI\_Config** table or the **UI\_Config\_Default** table during run time. In this case, the design-time setting of the properties is disabled.

Datatype	Read/Write	Default Value
Boolean	R/W	False

## FilterEnabled Property

The **FilterEnabled** property indicates whether the **Filter()** method may be called. If it is set to False, the **Filter()** method may not be called. This property is set by the control whenever the state of the control changes. It will be set to False if there is no MES session, no user, or no entity. At all other times it should be set to True.

Datatype	Read/Write	Default Value
Boolean	Read Only	False

### FirstZoneColor Property

The **FirstZoneColor** property indicates the color to use when a value is in the first zone. When using a dial, the background of the dial should be displayed in this color if the value is within the first zone. When using a bar graph, the bar should be this color if the value is within the first zone.

Datatype	Read/Write	Default Value
Color	R/W	Red

### FirstZoneCutoff Property

The **FirstZoneCutoff** property indicates the cutoff for the worst values. The first zone runs from 0 to FirstZoneCutoff. This value must be greater than or equal to 0 and less than or equal to 100 and it must be less than or equal to the value of SecondZoneCutoff.

Datatype	Read/Write	Default Value
Double	R/W	40

### GaugeBackColor Property

Use the **GaugeBackColor** property to set the color of the dial area for the dial control and the background of the bar control.

Data Type	Read/Write	Default Value
Color	R/W	

### GaugeBorderColor Property

Use the **GaugeBorderColor** property to set the color of the border for both the dial control and the bar control.

Data Type	Read/Write	Default Value
Color	R/W	

### GaugeBorderVisible Property

Use the **GaugeBorderVisible** property to set the visibility of the border of the dial control and the bar control.

Data Type	Read/Write	Default Value
Color	R/W	

#### GaugeFillColor Property

Use the **GaugeFillColor** property to set the color of the area that surrounds the dial control view.

Data Type	Read/Write	Default Value
Color	R/W	

#### GaugeForeColor Property

Use the **GaugeForeColor** property to set the color of the text on the dial control and the bar control. For the dial control, this property also sets the color for the minor and major tick marks.

Data Type	Read/Write	Default Value
Color	R/W	

#### GaugeGradientEnabled Property

Use the **GaugeGradientEnabled** property to set the visibility of the gradient for the dial control and the bar control. For the dial control, this property enables or disables the gradient over the dial area. For the bar control, it enables or disables the gradient of the bar elements on the graph.

Data Type	Read/Write	Default Value
Boolean	R/W	True

#### GaugeMarkerFont Property

Use the **GaugeMarkerFont** property to set the font properties for the marker values. You can use this property to separately configure the dial control and the bar control. For the dial control, this property also sets the font for the value label.

Data Type	Read/Write	Default Value
Font	R/W	

#### GaugeTitleFont Property

Use the **GaugeTitleFont** property to set the font properties for the title label. You can use this property to separately configure the dial control and the bar control.

Data Type	Read/Write	Default Value
Font	R/W	

**GaugeTitleTextVisible Property**

Use the **GaugeTitleTextVisible** property to set the visibility of the title label for the dial control and the bar control.

Data Type	Read/Write	Default Value
Boolean	R/W	True

**GaugeValueTextVisible Property**

Use the **GaugeValueTextVisible** property to set the visibility of the value label for the dial control.

Data Type	Read/Write	Default Value
Boolean	R/W	True

**KPIControlStyle Property**

The **KPIControlStyle** property is an enumeration type that specifies how the data is displayed. The control will either display the data on a dial or in a bar graph. If a dial is being used, the position of the needle will be set according to the value being displayed (as determined by the **KPIType** property) and a tick mark made at the target value. If a bar graph is being used, there will be a bar for the value being displayed and another bar for the associated target value.

Datatype	Read/Write	Default Value
Enum {Dial=0, BarGraph=1}	R/W	Dial

**KPIType Property**

The **KPIType** property indicates whether the OEE, Quality, Availability, or Performance will be displayed for the specified filter period.

Datatype	Read/Write	Default Value
Enum {OEE=0, Quality=1, Availability=2, Performance=3}	R/W	0

### OEEKPIFilter.FilterDuration Property

The **OEEKPIFilter.FilterDuration** property specifies the N in the Last N Hours filter type. The value of this property is only legitimate when the **TypeFilter** property is set to Last N Hours.

Datatype	Read/Write	Default Value
Integer	R/W	0

### OEEKPIFilter.FilterEndOffset Property

The **OEEKPIFilter.FilterEndOffset** property specifies the end of the filter period relative to now. This filter value is only legitimate when the **TypeFilter** property is set to Custom. If the **TypeFilter** property is not set to Custom, this property is set to:

- 0 if the type is ThisHour, LastNHours, CurrentShift, CurrentDay, CurrentWeek, or CurrentMonth
- 1 if the type is LastShift, Yesterday, LastWeek, or LastMonth

The value of this property should always be less than the value of the **FilterStartOffset** property and greater than or equal to 0.

Datatype	Read/Write	Default Value
Integer	R/W	0

### OEEKPIFilter.FilterStartOffset Property

The **OEEKPIFilter.FilterStartOffset** property specifies the start of the filter period relative to now. This filter value is only legitimate when the **TypeFilter** property is set to Custom. If the **TypeFilter** property is not set to custom, this property is set to:

- 1 if the type is ThisHour, CurrentShift, CurrentDay, CurrentWeek, or CurrentMonth;
- 2 if the type is LastShift, Yesterday, LastWeek, or LastMonth
- N if the type is set to LastNHours

The value of this property should always be greater than the value of the **FilterEndOffset** property and should always be greater than or equal to one.

Datatype	Read/Write	Default Value
Integer	R/W	1

### OEEKPIFilter.FilterTimeUnit Property

The **OEEKPIFilter.FilterTimeUnit** property specifies the time unit for a custom filter type. This filter value is only legitimate when the **TypeFilter** property is set to Custom. If the **TypeFilter** property is not set to custom, this property is set to value that matches the type (hour if type is ThisHour or LastNHours; Shift type is CurrentShift or LastShift; Day if type is CurrentDay or Yesterday; Week if type is CurrentWeek or LastWeek; or Month if type is CurrentMonth or LastMonth).

When this property is set to Hour, the results will include data for 0 or more entire hour periods, relative to the current time. For all other settings (Shift, Day, Week, Month, or Year), the results will start at the beginning of the time unit specified by the **FilterStartOffset** property.

Datatype	Read/Write	Default Value
Enum {Hour=0, Shift=1, Day=2, Week=3, Month=4, Year=5}	R/W	Hour

### OEEKPIFilter.FilterType Property

The **OEEKPIFilter.FilterType** property specifies which filter to use including a custom filter. If **LastNHours** is selected, you will also need to set the **FilterDuration** property. If Custom is selected, you will also need to set the **OEEKPIFilter.FilterTime**, **OEEKPIFilter.FilterStartOffset**, and **OEEKPIFilter.FilterEndOffset** properties.

Datatype	Read/Write	Default Value
Enum {ThisHour=0, LastNHours=1, CurrentShift=2, LastShift=3, CurrentDay=4, Yesterday=5, CurrentWeek=6, LastWeek=7, CurrentMonth=8, LastMonth=9, Custom=10}	R/W	ThisShift

### SecondZoneColor Property

The **SecondZoneColor** property indicates the color to use when a value is the second zone. When using a dial,

the background of the dial should be displayed in this color if the value is within the second zone. When using a bar graph, the bar should be this color if the value is within the second zone.

Datatype	Read/Write	Default Value
Color	R/W	Yellow

### SecondZoneCutoff Property

The **SecondZoneCutOff** property indicates the cutoff for the middle values. Values that are greater than the **FirstZonePercent** and less than or equal to the **SecondZoneCutOff** in the second zone. The value of **SecondZoneCutoff** must be greater than or equal to 0 and less than or equal to 100 and it must be greater than or equal to the value of **FirstZoneCutOff**.

Datatype	Read/Write	Default Value
Double	R/W	80

### TargetValue Property

The **TargetValue** property indicates the target value for the configured KPI.

Datatype	Read/Write	Default Value
Double	Read Only	N/A

### ThirdZoneColor Property

The **ThirdZoneColor** property indicates the color to use when a value is in the third zone. A value is in the third zone if it is greater than the value of the **SecondZoneCutOff** property and less than or equal to 100. When using a dial, the background of the dial should be displayed in this color if the value is within the third zone. When using a bar graph, the bar should be this color if the value is within the third zone.

Datatype	Read/Write	Default Value
Color	R/W	Green

## Methods of the OEE KPI Control

This section describes the methods of the OEE KPI Control. For information about the common methods shared by this control, see [Common Methods](#).

### Filter() Method

The **Filter()** method can only be called when the **FilterEnabled** property is set to True. Call this method to bring up the Filter dialog box.

## Syntax

```
Filter();
```

## Production Control

The Production control allows users to view and maintain an entity's production.

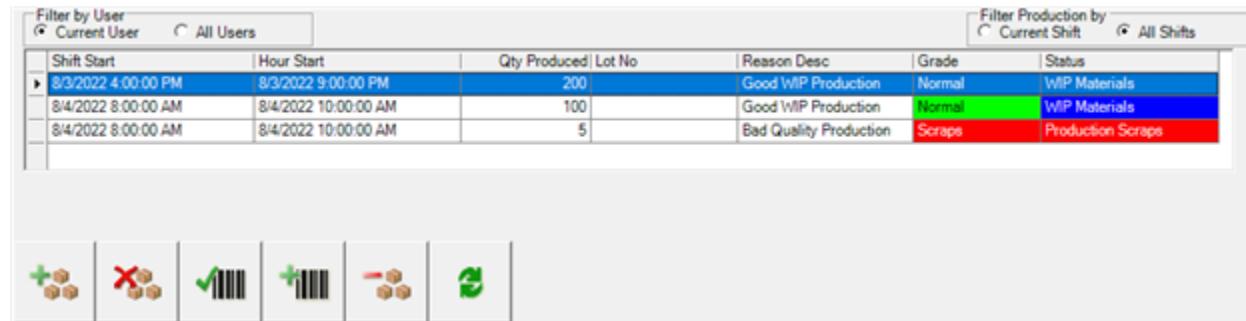
You can also use the Production control to:

- Add new serial numbers and assign serial numbers to a job when a job is producing a serialized item.
- Transfer serialized parts between storage locations when a job is producing serialized items.

## Configuring the Production Control

You use the Production control to report produced items and change the lot data.

When you use the Production control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Production control to:

- Add good units to the production.
- Add rejected units to the production.
- Mark the production lot as processed.
- Set a new lot number, production code and storage location.
- Reduce units from the production.
- Refresh the Production control.
- Start an external application.
- Start a web browser.
- Open the Help window.
- Switch the active user.
- Add/assign serial numbers.
- Transfer serial numbers.
- View attributes of the produced item.
- Open or launch a form, if the *Path to Form Program* system parameter is set.

This control corresponds to the **Production** tab of the MES Operator application. For more information, see the Production Tab section in the *MES Operator Guide* or online help.

## Using the Production Control

To use the Production control, the operator must log on to a session and select one or more entities.

When you use the Production control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).

## Properties of the Production Control

This section describes the properties of the Production control. For information about the common properties shared by this control, see [Common Properties](#).

### AddAssignSerialNumbersEnabled Property

Use the **AddAssignSerialNumbersEnabled** property to determine if **Add/Assign Serial Numbers** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### AddProdEnabled Property

Use the **AddProdEnabled** property to determine if the **Add Production** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ProcessEnabled Property

Use the **ProcessEnabled** property to determine if the **Process** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ReduceProdEnabled Property

Use the **ReduceProdEnabled** property to determine if the **Reduce Production** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### RejectsEnabled Property

Use the **RejectsEnabled** property to determine if the **Reclassify Production** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### SetLotDataEnabled Property

Use the **SetLotDataEnabled** property to determine if the **Set Lot Data** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### TransferSerialNumbersEnabled Property

Use the **TransferSerialNumbersEnabled** property to determine if the **Transfer Serial Numbers** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ViewItemAttributesEnabled Property

Use the **ViewItemAttributesEnabled** property to determine if the **View Item Attributes** button and functionality is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

## Methods of the Production Control

This section describes the methods of the Production control. For information about the common methods shared by this control, see [Common Methods](#).

### AddAssignSerialNumbers() Method

The **AddAssignSerialNumbers()** method can only be called when the **AddAssignSerialNumbersEnabled** property

is True. Use the **AddAssignSerialNumbers()** method to open the Add/Assign Serial Numbers dialog box to add, assign, or unassign serial numbers to the currently selected work order for the serialized item it produces.

## Syntax

```
AddAssignSerialNumbers();
```

### AddProduction() Method

The **AddProduction()** method can only be called when the **AddProductionEnabled** property is True. Use the **AddProduction()** method to open a dialog box that allows entering either of good or rejected production. The dialog box will contain fields to set the amount of production to be added, to select the reason code to associate with the production being added and the item that is being produced, the lot, and the storage location for the produced item.

If there are defaults for any of these fields, they will be filled in when the dialog box is opened. Entering a quantity and clicking the **Save** button will add the good or rejected production for the reason.

## Syntax

```
AddProduction();
```

### ItemAttributes() Method

The **ItemAttributes()** method can only be called when the **ItemAttributesEnabled** property is True. Use the **ItemAttributes()** method to open a dialog box that allows for the entering of item attribute values and/or notes.

## Syntax

```
ItemAttributes();
```

### Process() Method

Use the **Process()** method to open a dialog box that allows marking a production lot as processed.

## Syntax

```
Process();
```

### ReduceProduction() Method

The **ReduceProduction()** method can only be called when the **ReduceProductionEnabled** property is True. Use the **ReduceProduction()** method to open a dialog box that allows the reduction of previously entered production. The dialog box will contain a field to set the amount of production to be reduced. It will also display the reason code, the item produced, the lot, and the storage location for the produced item. Entering a quantity and clicking the **OK** button will reduce the previous production quantity.

## Syntax

```
ReduceProduction();
```

### RejectProduction() Method

The **RejectProduction()** method can only be called when the **RejectProductionEnabled** property is True. Use the **RejectProduction()** method to open the Reclassify Production dialog box that allows the reclassification of previously entered production. The dialog box will contain fields to set the amount of production to be changed, to select the reason code to associate with the production being changed, the item that is being produced, the lot, and the storage location for the produced item. The previously recorded values for these fields will be filled in when the dialog box is opened. Entering a quantity and clicking the **OK** button will update the production.

## Syntax

```
RejectProduction();
```

### SelectRowByKey() Method

Use the **SelectRowByKey()** method to search for the specified row ID in the grid. If the row ID is found, the row is selected.

If the row ID is not found and the *SelectFirstRowAsDefault* parameter is set to True, the first row is selected; otherwise the row selection is not changed.

## Syntax

```
result = SelectRowByKey(rowID, selectFirstRowAsDefault);
```

### Parameters

*rowID*

An integer that indicates the row ID of a row in the item\_prod table.

*selectFirstRowAsDefault*

A Boolean value that is set to True if the first row should be selected if the row ID is not found or set to False if the row selection should not be changed if the row ID is not found.

## Return Value

*result*

A Boolean value that is True, if the row ID is found, otherwise it returns False.

### SetLotData() Method

Use the **SetLotData()** method to open the Set Lot Data dialog box that allows setting of lot data for the current job. This is used to set the production information prior to adding production so that calls to consumption will

also record the produced lot number. There must be a current user logged on to at least one entity, and the current entity must be running a job. If the lot data is changed, the grid is refreshed.

## Syntax

```
SetLotData();
```

### TransferSerialNumbers() Method

Use the **TransferSerialNumbers()** method to open the Transfer Serial Numbers dialog box to allow transferring of serialized parts from one inventory location to another.

## Syntax

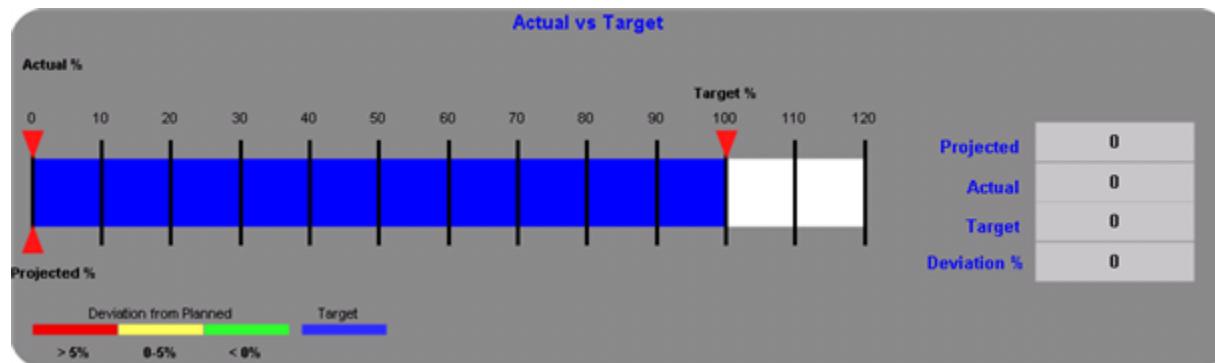
```
TransferSerialNumbers();
```

## Production Progress Control

The Production Progress control is used to display an operator's progress towards a provided target for the current shift. If there is no current job or there is no current shift, the control would indicate this and not display any data.

### Using the Production Progress Control

The Production Progress control is a horizontal overlaid bar chart that displays a bar for the current production, with its left edge at zero. The projected production is based on the current rate of production for the current job running on the current machine. The current production and projected production bars display in the colors as defined by the properties of the control.



There is also a tick mark showing the target production. If the projected production is less than the target, the control displays a warning to the user to indicate that the target production will not be reached. This warning should not be shown until the user has reported some quantities for the shift. The control has 120 scale markings on it with every 10th marking, starting with the 0th mark, being a larger mark. The scale has no fixed meaning. The Target tick mark is always placed at the 100 mark, and the scale is calculated from there.

The **TargetQuantity** or a **TargetRate** and **TargetRateUnits** can be set at run time, resulting in the other target values being recalculated using the new value and the control being refreshed based on the new target. See section on [Setting Target Values](#). The control also refreshes when the current job changes or the job quantity of

the current job changes.

### Logging On to the Production Progress Control

To use the Production Progress Control, the operator must log on to a session and select one or more entities that can run jobs. The operator must then log into a job. If the operator is not already logged on to a session and logged on to at least one entity the control automatically initiates the log on process by one of the following methods:

- Logging on the current InTouch user to the session.
- Presenting the operator with a log on dialog box.

After the operator is logged on to the session, the control by default presents the operator with an entity log on dialog box. These behaviors can be overridden by setting the **AutoLoginUser** or the **AutoLogOnEnt** properties to False. If this is done, logging on to a session and logging on to an entity must be done with a script. Once the user is logged onto an entity, they must start a job on the entity if one is not already running. The projected production is based on the current rate of production for the current job running on the current machine. If there is no current job or there is no current shift, the control would indicate this and not display any data. The Queue control can be used to start a job if it is included on the form, or a data entry job can be started through the Utilization Control if it is included on the form. Otherwise, the job will have to be started by using script.

### Switching Entities

The Production Progress Control shows information only for the current job on the current entity. If the Job Summary control is included in the form, you can use it to change the current entity. You can also change the current entity by using a script.

### Switching Jobs

The Production Progress control shows information only for the current job and the current shift. If the Job Summary control is included in the form, and the current entity can run multiple jobs, and it currently has multiple jobs running, you can use the Job Summary control to change the current job by selecting a different job on the grid. The Queue control and Utilization control can also be used to change the current job if they are on the form. To do this, the current job would be ended using the **Stop Job** button that appears on the button bar of both of these controls. Then, on the Queue control, another job would be selected from the grid and the **Start Job** button would be pushed. The selected job will be started and set as the current job. On the Utilization control, the user would start a data entry job by clicking the **Start Job** button, which will open a dialog for entering data entry job information. Setting the information to the appropriate data entry job and clicking **OK** will start the job. You can also change the current job by using a script.

### Setting Target Values

If the **TargetRateFromDB** property is set to True, the **TargetRate**, **ProductionUnitOfMeasure**, and **BatchSize** properties are set by getting the values from the MES database and the **TargetQuantity** property is calculated from the **TargetRate**. These values can not be set at design-time or run time in this case. If the **TargetRateFromDB** property is False, either the **TargetQuantity** property or the **TargetRate** property must be set at design time or run time to get the production target. To set the values at design time, the user opens the form

for editing in System Platform and clicks on the Production Progress Control and goes to the Properties section on the right side of the window. A value can be entered for the **TargetQuantity** or **TargetRate** property as well as other properties of the Progress Production Control if the defaults are not to be used. To set the values at run time, the user must hook a System Platform tag to the properties. When the value of the System Platform tag is changed during run time, the property hooked to it will be updated with the new value. To do this, the user opens the form in System Platform and double clicks on the Production Progress Control. This will open an Edit Animations dialog. Click **Data Binding** in the **Configuration** list on the left side of the dialog box. On the right side, a list will appear containing the properties of the Production Progress Control. A tag can be filled into the Reference column on the row of the property want to hook to the tag. The tag can be typed in directly, or browsed for by clicking the browse button at the end of the reference field. Clicking **OK** will then hook this tag to the property. Script can also be used to set the target property values at run time.

## Properties of the Production Progress Control

This section describes the properties of the Production Progress Control. For information about the common properties shared by this control, see [Common Properties](#).

### BatchSize Property

The **BatchSize** property indicates the quantity of items in each batch. Since the **TargetRate** property is expressed in terms of batches per time unit or time unit per batch, the batch size is required to determine the target quantity.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Double	R/W	1

### Data.CurrentProduction Property

The **Data.CurrentProduction** property exposes the value being used to draw the bar on the graph for the current production.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Double	Read Only	0

### Data.Deviation Property

The **Data.Deviation** property exposes the deviation between target and projected productions.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Double	Read Only	

### DeviationfromPlannedFont Property

The **DeviationfromPlannedFont** property sets or gets the font for the Deviation from Planned legend.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Font	R/W	

### DisplayProjectedDetails Property

The **DisplayProjectedDetails** property specifies the visibility of the projected quantity indicator.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Boolean	R/W	

### FirstZoneColor Property

The **FirstZoneColor** property indicates the color to use when a value is in the first zone. The actual bar will be displayed using this color.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Color	R/W	Red

### FirstZonePercent Property

The **FirstZonePercent** property indicates the cutoff for the worst values. If the projected production is below the target quantity by a percentage that is greater than or equal to this percentage, the actual bar will be displayed using the color specified by the **FirstZoneColor** property. This value must be between 0 and 100 and it must be greater than the value of the **SecondZonePercent** property.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Double	R/W	5

### GaugeTextFont Property

The **GaugeTextFont** property sets or gets the font for the Gauge text.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Font	R/W	

### ProductionUnitOfMeasure Property

The **ProductionUnitOfMeasure** property specifies how many batches are being produced in a given time period. The possible values are BatchesPerSecond (0), BatchesPerMinute (1), BatchesPerHour (2), SecondsPerBatch (3), MinutesPerBatch (4), and HoursPerBatch (5). The first three values specify that N batches are made every (second, minute, or hour), while the last three specify that it takes N (seconds, minutes, or hours) to make a

batch. Without units, the **TargetRate** is a meaningless number.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Enum {BatchesPerSecond=0, BatchesPerMinute=1, BatchesPerHour=2, SecondsPerBatch=3, MinutesPerBatch=4, HoursPerBatch=5}	R/W	BatchesPerHour

### ProjectedProduction Property

The **ProjectedProduction** property exposes the value being used to draw the bar on the graph for the projected production.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Double	Read Only	0

### SecondZoneColor Property

The **SecondZoneColor** property indicates the color to use when a value is the second zone. The actual bar will be displayed using this color.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Color	R/W	Yellow

### SecondZonePercent Property

The **SecondZonePercent** property indicates the cutoff for the middle values. If the projected production is below the target quantity by a percentage that is less than the value of the **FirstZonePercent** but greater than this percent, the actual bar will be displayed using the color specified by the **SecondZoneColor** property. This value must be between 0 and 100 and it must be less than the value of **FirstZonePercent** property.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Double	R/W	0

### TargetBarColor Property

The **TargetBarColor** property specifies the color to use when drawing the target bar on the graph.

Data Type	Read/Write	Default Value
Color	R/W	Blue

### TargetQuantity Property

The **TargetQuantity** property provides one of two ways to specify the target for the operator. If the **TargetQuantity** is set, the **TargetRate** is calculated at run time by dividing the **TargetQuantity** by the length of the shift or the duration from the beginning of the current job to the end of the shift if the job begins after the shift has started. If this property is set at design-time, the **TargetRate** is set to 0.

Data Type	Read/Write	Default Value
Double	R/W	0

### TargetRate Property

The **TargetRate** property provides one of two ways to specify the target for the operator. If the **TargetRate** is set, the **TargetQuantity** is calculated at run time by multiplying the **TargetRate** with either the length of the shift or the duration from the beginning of the current job to the end of the shift if the job begins after the shift has started. If this property is set at design-time, the **TargetQuantity** is set to 0.

Data Type	Read/Write	Default Value
Double	R/W	0

### TargetRateFromDB Property

The **TargetRateFromDB** property is a flag indicating whether or not the target rate will be set by the rate in the MES database for the current job. If this is set to *True*, the **TargetRate**, **ProductionUnitOfMeasure**, and **BatchSize** properties will be set by getting the values from the MES database and the **TargetQuantity** property will be calculated from the **TargetRate**. If it is set to *False*, either the **TargetQuantity** property or the **TargetRate** property must be set at design time or run time to get the production target.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### TargetUnreachable Property

The **TargetUnreachable** property exposes a flag indicating whether or not the projected production is less than the target. It is set to *True* if the projected production is less than the target. It is set to *False* if the projected production is greater than or equal to the target or if no production has been reported for the shift.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Boolean	Read Only	False

**ThirdZoneColor Property**

The **ThirdZoneColor** property indicates the color to use for the actual bar when a value is in the third zone. A value is in the third zone if the projected production is below the target quantity by a percentage that is less than or equal to the value of the **SecondZonePercent** or if the projected production is greater than the target quantity.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Color	R/W	Green

**ValueLegendLabelFont Property**

The **ValueLegendLabelFont** property sets or gets the font for the Value Legend labels.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Font	R/W	

**ValueLegendValueBackColor Property**

The **ValueLegendValueBackColor** property sets or gets the font for the Value Legend values.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Color	R/W	

**ValueLegendValueColor Property**

The **ValueLegendValueColor** property sets or gets the font for the Value Legend values.

<b>DataType</b>	<b>Read/Write</b>	<b>Default Value</b>
Color	R/W	

**ValueLegendValueFont Property**

The **ValueLegendValueFont** property sets or gets the font for the Value Legend values.

Data Type	Read/Write	Default Value
Font	R/W	

## Events of the Production Progress Control

This section describes the events of the Production Progress Control.

### TargetQuantityChanged Event

The **TargetQuantityChanged** event is raised by the Production Progress Control when the value of the **TargetQuantity** property changes. When this event occurs, the **TargetRate** is recalculated using the new target value, and the control will force a refresh of its data using the new value.

### TargetRateChanged Event

The **TargetRateChanged** event is raised by the Production Progress Control when the value of the **TargetRate** property changes. When this event occurs, the **TargetQuantity** will be recalculated using this new target value and the control will force a refresh of it's data using the new value.

Event	Handled/Raised	Action
TargetQuantityChanged	Raised by: - Control	Refresh Control with values from the database.
Target Rate Changed	Raised by: - Control	Refresh Control with values from the database.

## Queue Control

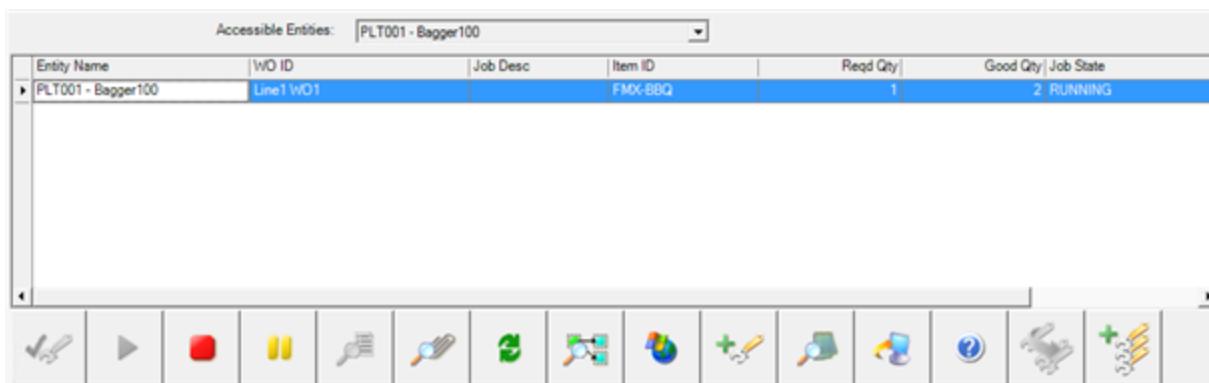
The Queue control allows users to view all jobs queued to an entity and to change the state of jobs queued to an entity.

### Configuring the Queue Control

You use the Queue control to:

- Log on to and log off from jobs of a given entity.
- Control which jobs are run on this entity at any given time.

When you use the Queue control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Queue control to:

- Start the selected job.
- Stop the currently running job.
- Pause the currently running job.
- Changes the selected job's state from New to Ready.
- Show the routing diagram for either the currently running job, or the selected job.
- Show all required components for either the currently running job, or the selected job.
- Create a new work order to replenish the inventory level for a selected item.
- Show attributes of the currently running job, or the selected job.
- Refresh the Queue control.
- Switch the active user.
- Start an external application.
- Start Internet Explorer.
- Open the Help window.
- View job notes.
- Show attributes of the item being produced.
- Split a job.
- Link jobs together in a batch.
- Start a portion of a job.
- Add/assign serial numbers.
- Transfer serial numbers.
- Log off the job.
- Open or launch a form, if the *Path to Form Program* system parameter is set.

The Queue control corresponds to the **Work Queue** tab of the MES Operator application. For more information, see the Queue Tab section in the *MES Operator Guide* or online help.

An operator must log on to MES and use the Queue control to select one or more entities. This is the default behavior.

## Switching Entities

By default, the Queue control shows the job queue information for the current entity.

The operator can use the Job Summary control to select the current entity. This is the default behavior.

The job queue for other entities that the operator has access to can be shown by selecting the other entity in the Accessible Entities list.

Functionality is limited when viewing the job queue of an entity other than the current entity.

## Associating the Button Bar Control

When you use the Queue control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).

## Properties of the Queue Control

This section describes the properties of the Queue control. For information about the common properties shared by this control, see [Common Properties](#).

### AttributesEnabled Property

Use the **AttributesEnabled** property to determine if the **Job Attributes** button is enabled.

The **AttributesEnabled** property is also used in the methods **PopupJobAttrsDlg()** and **PopupItemAttrsDlg()** to determine if the attributes can be viewed.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### BatchJobBColorOption Property

Use the **BatchJobBColorOption** property to specify the background color to use for linked jobs. This is an enumeration of the batch job color options available to the Queue Control to concurrently run batches of jobs.

Data Type	Read/Write	Default Value
enum { MatchSupervisor, PredefinedPastel, Custom }	R/W	PredefinedPastel

The MatchSupervisor option sets the batch job color options according to what was configured in Supervisor for the Queue window in this executable.

The PredefinedPastel option uses the predefined pastel color scheme defined within the Queue control.

Enum	Setting
0	System.Drawing.Color.Thistle
1	System.Drawing.Color.Violet
2	System.Drawing.Color.LightSteelBlue
3	System.Drawing.Color.Lavender
4	System.Drawing.Color.LightCyan
5	System.Drawing.Color.Khaki
6	System.Drawing.Color.MistyRose
7	System.Drawing.Color.Moccasin
8	System.Drawing.Color.LightPink
9	System.Drawing.Color.LightSalmon
10	System.Drawing.Color.PowderBlue
11	System.Drawing.Color.LightSkyBlue
12	System.Drawing.Color.PaleGreen
13	System.Drawing.Color.PeachPuff
14	System.Drawing.Color.PaleGoldenrod
15	System.Drawing.Color.LightGoldenrodYellow

The Custom option allows the operator to specify custom colors as a design-time property of the control.

There is a predefined limit of 16 different colors. After that, colors are reused for batches.

### BatchJobBGCustomColors Property

Use the **BatchJobBGCustomColors** property to specify the custom background colors of linked jobs if the **BatchJobBGColorOption** property is set to Custom.

Data Type	Read/Write	Default Value
array of GDI+ System.Drawing.Color structures	R/W	Thistle, Violet, LightSteelBlue, Lavender, LightCyan, Khaki, MistyRose, Moccasin, LightPink, LightSalmon, PowderBlue, LightSkyBlue, PaleGreen, PeachPuff, PaleGoldenrod, LightGoldenrodYellow

### ColumnHeaderBackColor Property

Use the **ColumnHeaderBackColor** property to specify the background color of the column header row when the current entity is selected.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	Control

### ColumnHeaderBackColorDifferentEnt Property

Use the **ColumnHeaderBackColorDifferentEnt** property to specify the background color of the column header row when the current entity is NOT selected in the combobox.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	Yellow

### ColumnHeaderForeColor Property

Use the **ColumnHeaderForeColor** property to specify the foreground color of the column header row.

Data Type	Read/Write	Default Value
System.Drawing.Color	R/W	Black

### EndJobEnabled Property

Use the **EndJobEnabled** property to determine if the functionality of the **End Job** button is enabled.

The default value is False, but is set to True in the **EnableDisableButtons()** method if the selected job is running and the operator has the privilege to end jobs.

The **EndJobEnabled** property also indicates whether or not the selected job on the Queue grid can be completed because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### FlowDiagramEnabled Property

Use the **FlowDiagramEnabled** property to determine if the functionality of the **View Flow Diagram** button is enabled.

The default value is False, but it is set to True in the **EnableDisableButtons()** method if a job is selected on the queue grid.

The **FlowDiagramEnabled** property also indicates if a job flow diagram can be shown because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### Font Property

Use the **Font** property to allow the font property of the controls on the Queue control to be changed.

Data Type	Read/Write	Default Value
Font	R/W	Same as base control

### ItemAttributesEnabled Property

Use the **ItemAttributesEnabled** property to determine if the functionality of the **Job Attributes** button is enabled. The Job Attributes dialog box allows the operator to view the attributes of the item of the selected job.

The default value is False, but the value is changed to True in the **EnableDisableButtons()** method if a job is selected on the queue grid.

The **ItemAttributesEnabled** property also indicates if the Item Attributes dialog box can be shown because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### NotesEnabled Property

Use the **NotesEnabled** property to determine if the functionality of the **Notes** button is enabled. The **Notes** button opens the Notes dialog box to view the notes for the selected job.

The default value is False, but the value is changed to True in the **EnableDisableButtons()** method if a job is selected on the queue grid.

The **NotesEnabled** property also indicates if a notes editor can be shown because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### PauseJobEnabled Property

Use the **PauseJobEnabled** property to determine if the functionality of the **Pause Job** button is enabled. This button allows the operator to put the selected job into a Suspended, New, or Onhold state.

The default value is False, but the value is changed to True in the **EnableDisableButtons()** method if a job is selected on the queue grid and the job is in a running or suspended state, or it is on hold and the operator has the privilege to take a job off of hold.

The **PauseJobEnabled** property also indicates if the selected job can be paused because the method can be called directly without using the button on the button bar.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### PreviewBomEnabled Property

Use the **PreviewBomEnabled** property to determine if the button to open the Job BOM dialog box for the selected job is enabled.

The default value is False, but the value is changed to True in the **EnableDisableButtons()** method if a job is selected on the queue grid and the job contains job BOM data for a BOM position that is greater than zero.

The **PreviewBomEnabled** property also indicates if a Job BOM dialog box can be shown because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ReadyJobEnabled Property

Use the **ReadyJobEnabled** property to determine if the button to ready the selected job is enabled.

The default value is False, but the value is changed to True in the **EnableDisableButtons()** method if a job is selected on the queue grid and the operator has the privilege to ready a job, and the selected job is running or suspended, or it is complete and the operator has the privilege to uncomplete a job, or the job is on hold and the operator has the privilege to take a job off of hold.

The **ReadyJobEnabled** property also indicates if the selected job can be put in a ready state because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### StartJobEnabled Property

Use the **StartJobEnabled** property to determine if the functionality of the **Start Job** button is enabled. The **Start Job** button allows the operator to start the selected job.

The default value is False, but the value is changed to True in the **EnableDisableButtons()** method if a job is selected on the queue grid and the job is not running or canceled, and the entity has the capacity to run this job, and the operator has the privilege to override the queue or the selected job is the next job in the queue.

The **StartJobEnabled** property indicates if the selected job can be started because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### StartSomeEnabled Property

Use the **StartSomeEnabled** property to determine if the functionality of the **Start Some** button is enabled. The Start Some dialog box allows the selected job to be split with the specified amount being set as the start quantity of the split job and then starts the split job.

The default value is False, but the value is changed to True in the **EnableDisableButtons()** method if a job is selected on the queue grid and the job is not running or canceled, and the entity has the capacity to run this job, and the operator has the privilege to override the queue or the selected job is the next job in the queue.

The **StartSomeEnabled** property indicates if the selected job can be split and started because the method can be called directly without using the button on the Button Bar control.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

## Methods of the Queue Control

This section describes the methods of the Queue control. For information about the common methods shared by this control, see [Common Methods](#).

### ApplyDefaultSortParameters() Method

Use the **ApplyDefaultSortParameters()** method to apply the sort criteria configured in Supervisor for the current entity's Queue.

## Syntax

```
ApplyDefaultSortparameters();
```

### CreateWO() Method

Use the **CreateWO()** method to open the Create a job from shortage dialog box. The Create a job from shortage dialog box allows an operator to select an item shortage on the entity to create a work order for, and then opens the form for creating the work order from the process used to create the item. This method returns True if the dialog box opens.

## Syntax

```
CreateWO();
```

### EnableDisableButtons() Method

Use the **EnableDisableButtons()** method to enable or disable the buttons on the Button Bar control associated with the Queue control. The buttons are enabled or disabled depending on the current context.

## Syntax

```
EnableDisableButtons();
```

### EndJob() Method

Use the **EndJob()** method to end the specified job if the following conditions exist:

- The job is in a running or in a suspended state.
- The operator is authorized to end jobs.
- The required quantity for the job has been met.

## Syntax

```
EndJob(woID,operID,seqNo,woDesc,jobDesc,statusNotes,canAppendNotes,  
canReplaceNotes,qtyGood,qtyRejected,qtyStart,qtyReqd,selJobState,  
userCancelled[,concurrentLink]);
```

## Parameters

*woID*

A string that indicates the work order ID of the job to be ended.

*operID*

A string that indicates the operation ID of the job to be ended.

*seqNo*

An integer that represents the sequence number of the job to be ended.

*woDesc*

A string that indicates the work order description used in the confirmation dialog box.

*jobDesc*

A string that indicates the Job description used in the confirmation dialog box.

*statusNotes*

A string that holds the status notes of the job that are shown in the confirmation dialog. These notes can be appended to or edited on this dialog if the operator has the privileges to do so.

*canAppendNotes*

A Boolean value that is True if this operator can append to the Status Notes in the confirmation dialog box.

*canReplaceNotes*

A Boolean value that is True if this operator can replace the Status Notes in the confirmation dialog box.

*qtyGood*

A double data type value that indicates the total produced quantity for this job that are good.

*qtyRejected*

A double data type value that indicates the total produced quantity for this job that are rejected.

*qtyStart*

A double data type value that indicates the start quantity for this job. The quantity produced can not be less than this amount when ending the job.

*qtyReqd*

A double data type value that indicates the total required quantity for this job. This quantity must be met in order to end the job.

*selJobState*

An enumeration data type that indicates the state of the job selected to be ended. The enumerated data type can have the following values:

- NoJob (A value to set a current job state property to JobStates, if no job is running) = -1
- New (A job that is scheduled but not yet ready to run) = 1
- Ready ( A job that is ready to run) = 2
- Running (A job that is currently running on an entity) = 3
- Complete (A job that has finished) = 4
- Suspended (A job that has not run to completion, but is no longer running on an entity) = 5
- Onhold (A job that is no longer ready to run) = 6
- Cancelled (A job that no longer needs to be run) = 7

*userCancelled*

A Boolean value that is returned as True if the operator cancels this action when prompted for confirmation.

*concurrentLink*

An integer value for the specified job that is used to determine if this is a batch of jobs or not. If this value is greater than zero and other jobs in the queue contain the same value, then this job is a part of a batch. This is an optional parameter and the default value is 0.

## IsPartOfBatch() Method

Use the **IsPartOfBatch()** method to check the queue of the current entity to determine if there are any jobs in that queue with a concurrent link value that matches a specified value.

## Syntax

```
boolResult=IsPartOfBatch(ConcurrentLink);
```

## Parameter

*concurrentLink*

An integer that is used to determine if a job is part of a batch of jobs.

If there is more than one job in the current entities queue with this concurrent link value, True is returned signifying that the job is part of a batch. Otherwise, False is returned signifying that the job is not in a batch.

## JobLogOff() Method

Use the **JobLogOff()** method to open the Job Log Off dialog box if the current operator has a *Job Based Login Required* restriction and is logged on to the selected job.

## Syntax

```
JobLogOff(woID, operID, seqNo);
```

## Parameters

*woid*

A string that indicates the work order ID used to identify the job that the operator is to be logged off from.

*operId*

A string that is used to identify the job that the operator is to be logged off from.

*seqNo*

An integer that is used to identify the job that the operator is to be logged off from.

## LoadConfigSettings() Method

Use the **LoadConfigSettings()** method to load and apply the previously saved UI configuration settings from the database for the specified entity or the default UI settings for this control type. This includes both the grid and Button Bar control settings.

## Syntax

```
LoadConfigSettings(UseDefaults);
```

## Parameter

### *useDefaults*

A Boolean value specifying whether the default configuration should be loaded. If it is False, the configuration for the current entity is loaded and applied.

## ParseConfigSettings() Method

Use the **ParseConfigSettings()** method to parse an XML string containing the configuration settings and to save the grid configuration settings and Button Bar control configuration settings into separate strings.

## Syntax

```
ParseConfigSettings (configSettings);
```

## Parameter

### *configSettings*

An XML string that contains the configuration settings for the control.

The separate strings for the grid configuration and Button Bar control configuration are set to empty strings if there is an error in parsing the *configSettings* string.

## PauseJob() Method

Use the **PauseJob()** method to pause the specified job if the following conditions exist:

- The job is in a running or in a suspended state.
- The operator is authorized to end jobs.
- The job is On Hold and the operator has the privilege to take a job off hold.

## Syntax

```
PauseJob(woId,operId,seqNo,woDesc,jobDesc,statusNotes,canAppendNotes,  
canReplaceNotes,selJobState,editTime,userCancelled  
[,concurrentLink]);
```

## Parameters

### *woID*

A string that indicates the work order ID of the job to be ended.

### *operID*

A string that indicates the operation ID of the job to be ended.

### *seqNo*

An integer that represents the sequence number of the job to be ended.

*woDesc*

A string that indicates the WO description used in the confirmation dialog box.

*jobDesc*

A string that indicates the Job description used in the confirmation dialog box.

*statusNotes*

A string that holds the status notes of the job that are shown in the confirmation dialog box. These notes can be appended to or edited on this dialog box if the operator has the privileges to do so.

*canAppendNotes*

A Boolean value that is True if the operator can append to the Status Notes in the confirmation dialog box.

*canReplaceNotes*

A Boolean value that is True if the operator can replace the Status Notes in the confirmation dialog box.

*selJobState*

An enumeration data type that indicates the state of the selected job, which is to be ended. The enumerated data type can have the following values:

- NoJob (A value to set a current job state property to JobStates, if no job is running) = -1
- New (A job that is scheduled but not yet ready to run) = 1
- Ready ( A job that is ready to run) = 2
- Running (A job that is currently running on an entity) = 3
- Complete (A job that has finished) = 4
- Suspended (A job that has not run to completion, but is no longer running on an entity) = 5
- Onhold (A job that is no longer ready to run) = 6
- Cancelled (A job that no longer needs to be run) = 7

*editTime*

A string that indicates the last edit time for the specified job to ensure the operator is working on the latest data for the job.

*userCancelled*

A Boolean value that is returned as True if the operator cancels this action when prompted for confirmation.

*concurrentLink*

An integer value for the specified job that is used to determine if this is a batch of jobs or not. If this value is greater than 0 and other jobs in the queue contain the same value, then this job is part of a batch. This is an optional parameter and the default value is 0.

### **PopupAddAssignSerialNumbersDlg() Method**

Use the **PopupAddAssignSerialNumbersDlg()** method to open the Add/Assign Serial Numbers dialog box to add, assign, or unassign serial numbers to the currently selected work order for the serialized item it produces.

### Syntax

```
PopupAddAssignSerialNumbersDlg(woID, itemID, operID);
```

## Parameters

*wold*

A string that indicates the work order ID that the serial numbers are to be assigned to.

*itemId*

A string that indicates the item ID that is being produced and is used to determine the number of serial numbers that can be assigned.

*operId*

A string that identifies the job that the serial numbers are assigned to.

## PopupItemAttrsDlg() Method

Use the **PopupItemAttrsDlg()** method to open the Item Attributes dialog box for the item specified to view and edit the attributes of the item if the **AttributesEnabled** property is True.

## Syntax

```
PopupItemAttrsDlg(itemID);
```

## Parameter

*itemID*

A string that indicates the item whose attributes are to be viewed and edited.

## PopupJobAttrsDlg() Method

Use the **PopupJobAttrsDlg()** method to open the Job Attributes dialog box for the job specified to show the attributes of the job if the **AttributesEnabled** property is True.

## Syntax

```
PopupJobAttrsDlg(woID, operID, seqNo, jobDesc);
```

## Parameters

*wold*

A string that indicates the work order ID used to identify the job whose attributes are shown.

*operId*

A string that indicates the operation ID used to identify the job whose attributes are shown.

*seqNo*

An integer that represents the sequence number used to identify the job whose attributes are shown.

*jobDesc*

A string that indicates the job description of the job whose attributes are shown. The description appears in the

title bar of the Job Attributes dialog box.

### PopupJobBOMDlg() Method

Use the **PopupJobBOMDlg()** method to open the Job BOM dialog box for the job specified to show the BOM of the job if the **PreviewBomEnabled** property is True.

## Syntax

```
PopupJobBOMDlg(woID, operID, seqNo, jobDesc);
```

### Parameters

*woid*

A string that indicates the work order ID used to identify the job whose BOM is shown.

*operId*

A string that indicates the operation ID used to identify the job whose BOM is shown.

*seqNo*

An integer that represents the sequence number used to identify the job whose BOM is shown.

*jobDesc*

A string that indicates the job description of the job whose BOM is shown. The description appears in the title bar of the BOM grid.

### PopupJobLinksDlg() Method

Use the **PopupJobLinksDlg()** method to open the Job Link dialog box if the current operator has the privilege to modify batches. All the jobs in the queue for the current entity that are not running, completed, or canceled are displayed. The jobs can then be selected to link them together into a batch of jobs.

## Syntax

```
PopupJobLinksDlg();
```

### PopupJobSplitDlg() Method

Use the **PopupJobSplitDlg()** method to open the Job Split dialog box to split the specified job if the amount of good production reported for it so far is less than the good quantity that is required. The entity to split the job to and the quantity that is to be assigned to the new job from the quantity left to be produced on the specified job can be specified before splitting.

## Syntax

```
PopupJobSplitDlg(woID, operID, seqNo, jobDesc, reqdQty, prodQty, processID);
```

## Parameters

*wold*

A string that indicates the work order ID used to identify the job to be split.

*operId*

A string that indicates the operation ID used to identify the job to be split.

*seqNo*

An integer that represents the sequence number to identify the job to be split.

*jobDesc*

A string that indicates the job description of the job to be split. The description appears in the title on the split job dialog box.

*reqdQty*

A double data type that represents the required quantity of the job to be split. Used to determine how much quantity is left to split.

*prodQty*

A double data type that represents the quantity already produced for the job to be split. Used to determine how much quantity still needs to be produced that can be split.

*processId*

A string that indicates the process ID of the job to be split. The process ID is used to retrieve the entities that can run this operation to allow the entity the split is to be assigned to be selected on the Job Split dialog box.

## PopupNotesDlg() Method

Use the **PopupNotesDlg()** method to open the Notes dialog box to show the notes of the specified job if the **NotesEnabled** property is True.

## Syntax

```
PopupNotesDlg(notes, woID, operID, seqNo, itemID);
```

## Parameters

*notes*

A string that indicates the current job notes of the specified job.

*wold*

A string that indicates the work order ID used to identify the job whose notes are shown.

*operId*

A string that indicates the operation ID used to identify the job whose notes are shown.

*seqNo*

An integer that represents the sequence No to identify the job whose notes are shown.

*itemID*

A string that indicates the item ID of the job. If specified, the item notes of the job are viewable by selecting the

**Item Notes** option on the Notes dialog box.

### PopupStartSomeDlg() Method

Use the **PopupStartSomeDlg()** method to open the Start Some dialog box to split the specified job and start the split job if the **StartSomeEnabled** property is True.

## Syntax

```
PopupStartSomeDlg(woID, operID, seqID, jobDesc, batchSize, startQty, reqdQty, prodQty);
```

### Parameters

*woid*

A string that indicates the work order ID used to identify the job that is to be split.

*operId*

A string that indicates the operation ID used to identify the job that is to be split.

*seqNo*

An integer that represents the sequence number to identify the job that is to be split.

*jobDesc*

A string that indicates the job description of the job that is to be split. The description appears in the title of the Start Some dialog box.

*batchSize*

A double data type that indicates the batch size of the job that is to be split. A batch is used to determine the standard production time for a given amount of product. Standard production times are expressed either in time per batch, or batches per time. For example, assume that you want to track all of the cookies that are baked during a shift as a group, and that you want to determine the cookie production's OEE. That calculation is based on the batch size and the batch production rate. If a batch size is 100 cookies and it takes 20 minutes to bake a batch of cookies, then up to 24 batches of cookies could be baked during an 8-hour shift, or a maximum of 2,400 cookies in a lot.

*startQty*

A double data type that indicates the start quantity of the job that is to be split. The start quantity of the split job defaults to half of this value. The start quantity of the split job can be edited on the Start Some dialog box, but can not exceed this amount.

*reqdQty*

A double data type that indicates the required quantity of the job that is to be split. This quantity is used to determine how much quantity is left to produce and the default quantity of the split job is set to half of this amount. This quantity can be edited on the Start Some dialog box, but can not exceed this amount.

*prodQty*

A double data type that indicates the produced quantity of the job that is to be split. This quantity is used to determine how much quantity is left to produce.

## PopupTransferSerialNumbersDlg() Method

Use the **PopupTransferSerialNumbersDlg()** method to open the Transfer Serial Numbers dialog box to allow for the transferring of serialized parts from one inventory location to another.

## Syntax

```
PopupTransferSerialNumbersDlg();
```

## PromptForProdQtys() Method

Use the **PromptForProdQtys()** method to open the Add Production dialog box to prompt for production quantities for the currently selected job on the Queue control.

## Syntax

```
PromptForProdQtys();
```

## ReadyJob() Method

Use the **ReadyJob()** method to set the state of the specified job to Ready if the following conditions are True:

- The **Ready Job** button is enabled.
- An operator is currently logged on.

## Syntax

```
ReadyJob(woID, operID, seqNo, editTime);
```

## Parameters

*woid*

A string that indicates the work order ID used to identify the job that is to be readied.

*operId*

A string that indicates the operation ID used to identify the job that is to be readied.

*seqNo*

An integer that represents the sequence number that is used to identify the job that is to be readied.

*editTime*

A string that indicates the last edit time for the specified job to ensure this operator is acting on the latest data for the job.

## ResetBatchJobBGCustomColors() Method

Use the **ResetBatchJobBGCustomColors()** method to reset the **BatchJobBGColorOption** property to its default

value depending on the **BatchJobColorOption** that is set.

## Syntax

```
ResetBatchJobBGCustomColors();
```

### ResetBatchJobColorOptions() Method

Use the **ResetBatchJobColorOptions()** method to reset the **BatchJobColorOption** property to the default of PredefinedPastel.

## Syntax

```
ResetBatchJobColorOptions();
```

### RestoreGridUISettings() Method

Use the **RestoreGridUISettings()** method to reapply the current loaded and cached grid settings for this entity if the grid configuration is not empty. This method also translates the column headings.

## Syntax

```
RestoreGridUISettings();
```

### SelectFirstRunningJob() Method

Use the **SelectFirstRunningJob()** method to select the row in the grid corresponding to the first running job. If none of the above are valid, then the first row in the grid is selected.

## Syntax

```
SelectFirstRunningJob(selectFirstJobAsDefault);
```

### Parameter

*selectFirstJobAsDefault*

A Boolean value that, if True, tells the method to select the first job if no jobs are running.

### SelectRowByKey() Method

Use the **SelectRowByKey()** method to select the row in the grid corresponding to the specified job. If the row is not found, the method optionally selects the first row based on a parameter.

If the specified job cannot be found and the *selectFirstRowAsDefault* parameter is False, then leave the existing selected rows as is and return False.

If a new job is selected, a call is made to enable/disable any buttons based on this new selection.

## Syntax

```
result = SelectRowByKey(woID, operID, seqNo, selectFirstRowAsDefault);
```

## Parameters

*woid*

A string that indicates the work order ID used to identify the job that is to be selected.

*operId*

A string that indicates the operation ID used to identify the job that is to be selected.

*seqNo*

An integer that represents the sequence number used to identify the job that is to be selected.

*selectFirstRowAsDefault*

A Boolean value that, if True, signifies to select the first row if the specified job is not found.

## Return Value

*result*

A Boolean value that is True, if a match is found; otherwise it returns False.

## SerializeConfigSettings() Method

Use the **SerializeConfigSettings()** method to retrieve the configuration settings from the grid and associated Button Bar control associated with the Queue control and to create and return an XML string containing all current configuration settings.

## Syntax

```
SerializeConfigSettings();
```

## SetFilterColumns() Method

Use the **SetFilterColumns()** method to apply a comma-separated list or string array of filter columns and their filter values to the grid.

## Syntax

```
SetFilterColumns(FilterColumnList, FilterColumnValues);
```

## Parameters

*FilterColumnList*

A comma-separated list of filter columns (no spaces after comma)/string array of filter columns.

*FilterColumnValues*

A comma-separated list of filter values (no spaces after comma)/string array of filter column values.

### SetGroupByColumns() Method

Use the **SetGroupByColumns()** method to apply a comma-separated list of Group By columns to the grid and to group rows together which share common values in the Group By column(s).

## Syntax

```
SetGroupByColumns(groupByList);
```

### Parameter

*groupByList*

A comma-separated list of columns, with no spaces after commas, by which to group the grid.

### SetSortColumns() Method

Use the **SetSortColumns()** method to apply a comma-separated list or string array of sort columns to the grid and to sort the grid according to the specified columns.

## Syntax

```
SetSortColumns(sortColumn[, sortColumnDirection]);
```

### Parameters

*sortColumn*

A comma-separated list (with no spaces after commas) or a string array of columns by which to sort the grid.

*sortColumnDirection*

An array of Xceed.Grid.SortDirection values that defines the sort column direction as either ascending or descending. The default sort direction is ascending. You can use this parameter only if *sortColumn* is a string array.

### ShowWOFflowDiagram() Method

Use the **ShowWOFflowDiagram()** method to open the Job Flow Diagram dialog box to show the flow diagram for the specified work order if the corresponding button is enabled.

## Syntax

```
ShowWOFflowDiagram(woId);
```

### Parameter

*woid*

A string that indicates the work order that the job flow diagram that is shown is for.

### StartJob() Method

Use the **StartJob()** method to start the specified job on the current entity if the following conditions exist:

- The `_startJob` flag is True.
- An operator is currently logged on.
- The operator is logged on to at least one entity.
- The maximum number of jobs is not already running or entity can run jobs concurrently.
- The job is not currently running.

The operator is prompted to confirm the action of starting the job.

### Syntax

```
StartJob(woId, operId, seqNo, woDesc, jobDesc, statusNotes, canAppendNotes,  
canReplaceNotes, userCancelled[,concurrentLink]);
```

### Parameters

*woid*

A string that indicates the work order ID used to identify the job to be started.

*operId*

A string that indicates the operation ID used to identify the job to be started.

*seqNo*

An integer that represents the sequence number used to identify the job to be started.

*woDesc*

A string that indicates the work order description used in the confirmation dialog box.

*jobDesc*

A string that indicates the job description used in the confirmation dialog box.

*statusNotes*

A string that indicates the status notes used in the confirmation dialog box.

*canAppendNotes*

A Boolean value that is True if this operator can append to the Status Notes in the confirmation dialog box.

*canReplaceNotes*

A Boolean value that is True if this operator can replace the Status Notes in the confirmation dialog box.

*userCancelled*

A Boolean value that is returned as True if the operator cancels this action when prompted for confirmation.

*concurrentLink*

An integer for the specified job used to determine if this is a batch of jobs or not. A value is greater than 0 and where other jobs have the same value means it is part of a batch. This is an optional parameter and the default

value is 0.

## Route Control

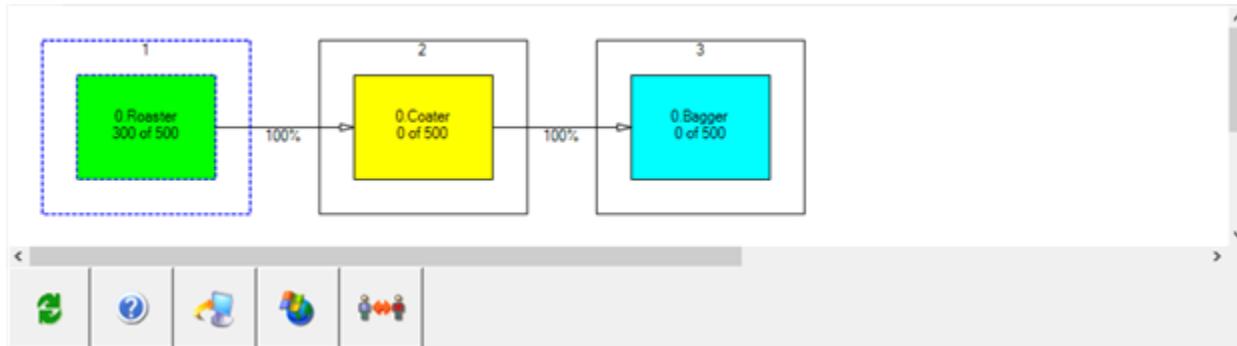
The Route Control is used to show operation-wise material flow for a work order and associated entities.

### Configuring the Route Control

You use the Route control to show routing and status of a job within its work order.

When you use the Route control in a System Platform symbol, you can associate the Button Bar control with it.

For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Route control to:

- Refresh the Route control.
- Open the Help window.
- Start an external application.
- Start a web browser.
- Switch the active user.
- Open or launch a form, if *Path to form program* system parameter is set.

The Route control corresponds to the **Route** tab of the MES Operator application. For more information, see the Route Tab section in the *MES Operator Guide* or online help.

### Properties of the Route Control

This section describes the properties of the Route control. For information about the common properties shared by this control, see [Common Properties](#).

#### RefreshEnabled Property

Use the **RefreshEnabled** property to determine whether this control can be refreshed. This control is not refreshed if a user is not logged on to any entity or MES database. This is an overridden property.

Data Type	Read/Write	Default Value
Boolean	Read Only	True

## Methods of the Route Control

The Route Control does not contain any unique methods. For information about the common methods shared by this control, see [Common Methods](#).

## Sample Viewer Control

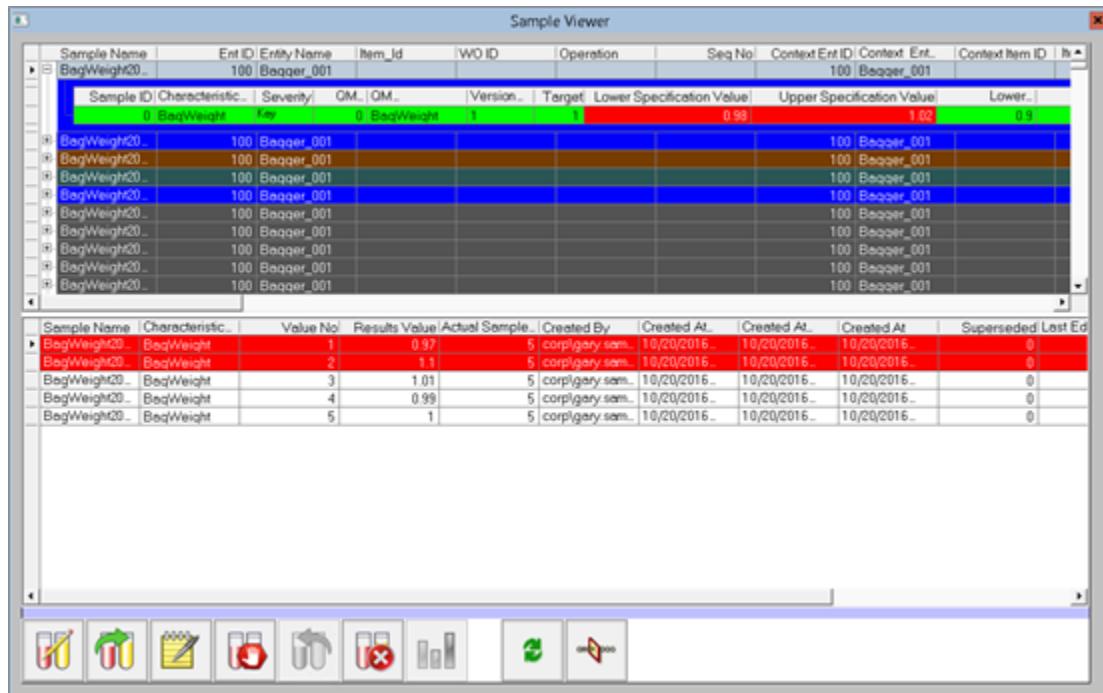
You can use the Sample Viewer control to display the current, past, and the future samples and the characteristics assigned to the samples. The Sample Viewer control also displays the results collected for the characteristics in the lower grid.

The Sample Viewer control allows you to modify the existing results, add new results to the characteristics which are associated with current and past samples, and cancel samples.

The Sample Viewer also launches the SPC Chart control to display the results of measurements taken for a particular characteristic associated with a set of samples.

## Configuring the Sample Viewer Control

When you use the Sample Viewer control in a System Platform symbol, you can link it with a Button Bar control. For more information, see [Associating the Button Bar Control with Other Controls](#).



In addition to viewing the current, past, and future samples, an operator can perform the following tasks using the buttons in the button bar, listed by buttons from left to right:

- Edit a sample's lot number, subplot number, segment requirement ID, segment response ID, or priority.
- Specify that a sample has been pulled.
- Specify that a sample that had been previously pulled but for which no results were entered is no longer considered to be pulled.
- Indicate whether a sample is considered to be finalized.
- Enter new results or edit previously entered results for the characteristics that are associated with a current or past sample.
- Launch the SPC Chart control to display the results of measurements taken for a particular characteristic.
- Cancel a sample (this button is not shown above, as it is not included on the button bar by default)
- Filter the set of samples displayed.
- Open the MES online help, which includes MES Operator help topics.
- Refresh the Sample Viewer control contents.

## Using the Sample Viewer Control

This section describes how to use the Sample Viewer control to work with the samples.

### Logging on to the Sample Viewer

To use the Sample Viewer control, you must log on to a session.

If the **RequireEntityLogon** property is set to True and you are not logged in to one or more entities with the *Can Collect QM data* capability, you must log in to at least one entity that has the *Can Collect QM data* capability selected.

If you have a filter setting saved in the UI\_Config table, it is fetched and used. The **RequireEntityLogon** property is used to control the **EntityFilterRestriction** property settings and to display the past, current, and future samples that match the filter criteria. The characteristics associated with the sample and the results of the characteristics are also displayed.

If the **RequireEntityLogon** property is set to False, you do not need to login to an entity. The information is displayed automatically from all the entities which have the *Can Collect QM Data* capability enabled.

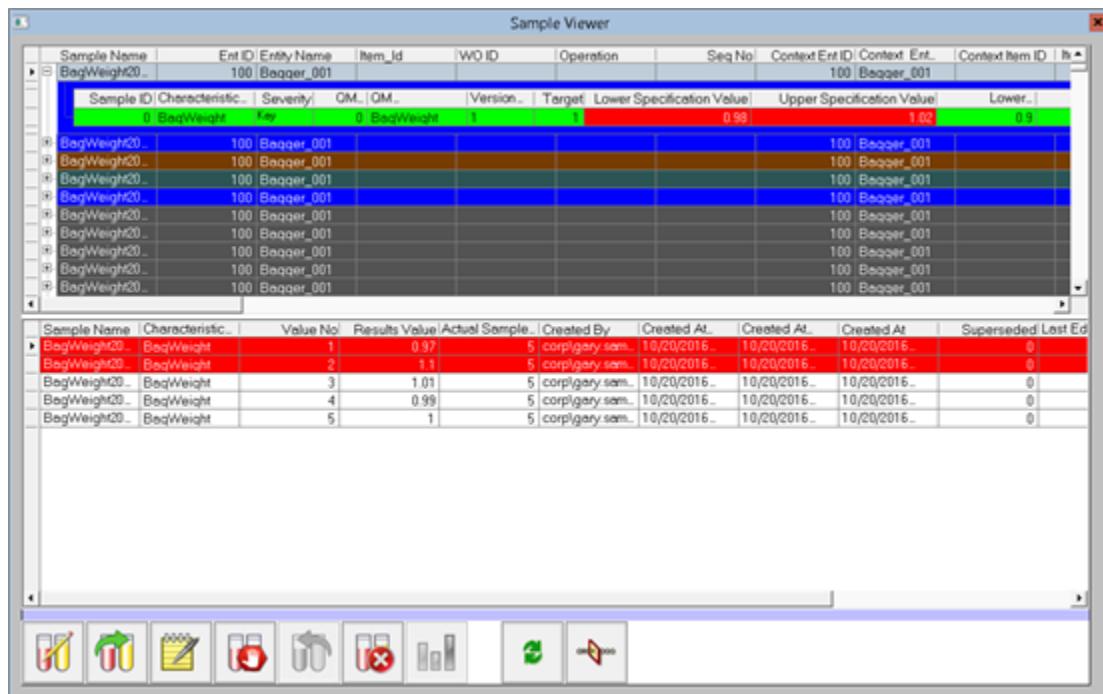
The only filter properties that are saved in the UI\_Config table are **RequireEntityLogon** and **EntityFilterRestriction**. The other properties are run-time filters and are not saved between sessions. You must set the filter properties for filtering the samples.

### Viewing the Samples

The Sample Viewer displays the past, current, and future samples that match the filter criteria. The characteristics associated with the sample and the results for the characteristics are also displayed.

Users can filter the samples that are displayed in the control. See [Filtering the Samples Displayed in the Sample Viewer Control](#).

# Sample Data Display



The top grid displays a list of samples that meet the specified filter conditions. You can select a sample record to view the results in the lower grid, and expand it to view list of characteristics in it. You can also view and hide the columns in the sample table in the Sample Viewer. You can view the following columns in the Sample Viewer:

- Sample name
- Entity
- Item
- Job information
  - Work order
  - Operation
  - Sequence number
- Sample status
- Sample ID, generated by the system to uniquely identify the sample
- Context information from the specification, which generated the sample
- Sample plan frequency
- S95 segment requirement and segment response
- Lot/Sublot
- Requested time
- Warning time
- Expiry time
- Pulled by operator and time

- Finalized by operator, time, and flag
- Verified by operator
- Result state
- Priority
- Spare fields
- Last edit information

The overall sample status and each sample characteristic result are indicated by colors. These colors are controlled by system parameters that are set in MES Client. For more information on sample status and result color coding, see [Setting Status Color Coding for Samples, Characteristics, and Results](#).

## Characteristic Data Display

Each sample record in the top grid can be expanded to display the list of characteristics and some additional information. A characteristic within a sample can be selected to display only the result for the selected characteristic in the bottom grid. You can view the following columns in the characteristic list subgrid of the Sample Viewer:

- The equipment column
- The characteristic name column
- The QM specification name column
- The QM specification version column
- The sample ID column
- The reasonable limits columns
- The specification limits columns
- The last edit comment, user, and time columns

## Result Data Display

You can view and hide the following columns in the result table of the Sample Viewer:

- Sample name
- Characteristic name
- Value number
- Result value
- Sample size
- Created by operator, and created by time
- Superseded indicator

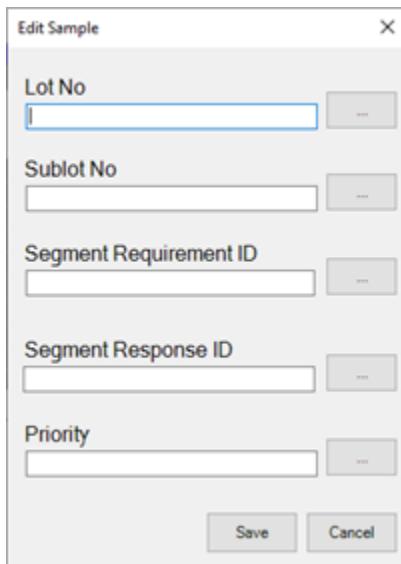
## Selecting Context

In the Sample Viewer, you can select a sample, the characteristics associated with a sample, and the results for the characteristics. When a new sample or characteristic is selected, an event is raised by the Sample Viewer to notify that the selected context has changed.

## Editing Sample Information

The Sample Viewer allows users to modify a selected sample's information, if they have the required permission to do so.

Users click the  Edit Sample button to open the Edit Sample dialog box.



The dialog box is titled "Edit Sample". It contains five input fields with "..." browse buttons: "Lot No", "Sublot No", "Segment Requirement ID", "Segment Response ID", and "Priority". At the bottom are "Save" and "Cancel" buttons.

The following sample information can be modified:

- Lot
- Sublot
- Segment requirement ID
- Segment response ID
- Priority

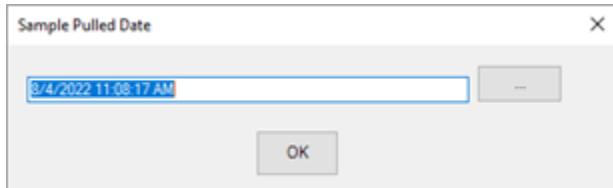
Future samples, samples that are marked as Final, or samples that are marked as Missed cannot be modified.

## Pulling Samples

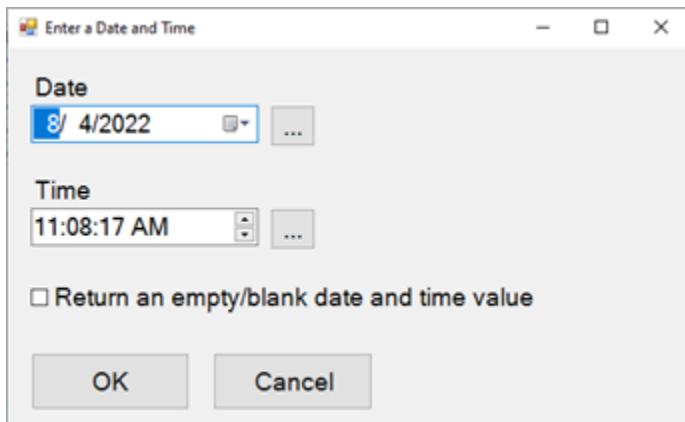
The Sample Viewer allows users to specify that a sample has been pulled, if they have the required permission to modify the sample information.

A sample is said to be pulled when it is selected from the other samples for recording the time required for measurement. It is not necessary to tell the system that a sample was pulled to record measurements for it. A sample can be pulled only if it is yet to be pulled and the sample status is Ready or Ready Warning.

Users click the  Pull Sample button to mark the selected sample as Pulled. The Sample Pulled Date dialog box appears.



The pulled date defaults to the current date and time. Users can manually change the date and time, or click the Browse button to display the Enter a Date and Time dialog box.



## Unpulling Samples

The Sample Viewer allows users to specify that a pulled sample is no longer pulled, if they have the required permission to modify the sample information. A sample can be unpulled only if it is pulled and no results have been collected for the characteristics associated with the sample.

Users click the  Unpull Sample button to mark the selected sample as no longer pulled.

## Toggling the Sample Final Flag

The Sample Viewer allows users to mark a sample as Final or to remove the Final flag from a sample.

The characteristic result records cannot be modified if a sample has been marked as Final.

Users click the  Toggle Sample Final Flag button to toggle the selected sample's Final flag on and off.

## Launching an SPC Chart

The Sample Viewer allows users to display an SPC chart for the selected characteristic of a sample. A characteristic within a sample must be selected before SPC Chart button is enabled.

Users click the  SPC Chart button to open the chart for the selected characteristic. For information about implementing and using the SPC Chart control, see [SPC Chart Control](#).

## Entering and Editing Sample Results

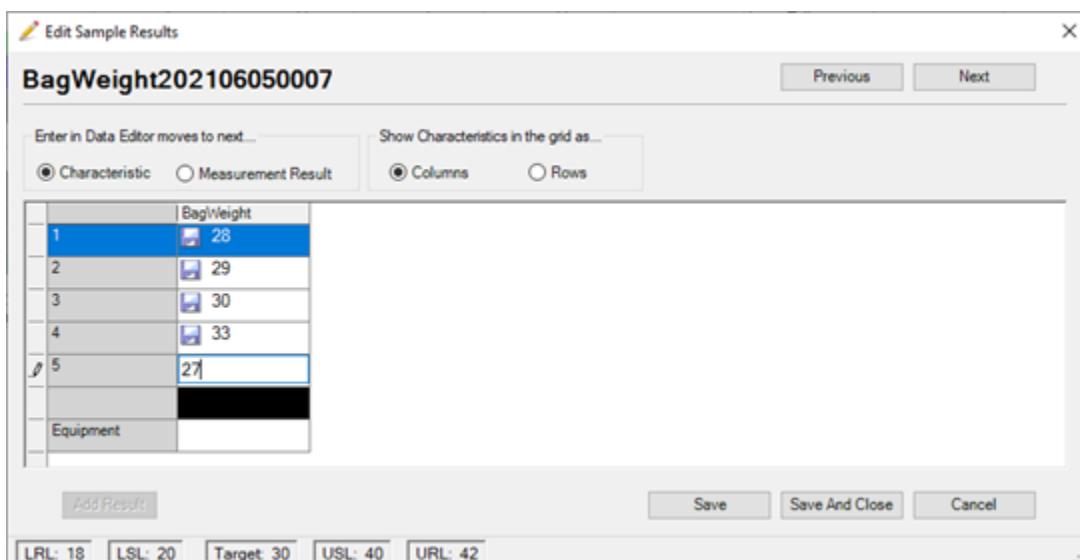
The Sample Viewer allows users to enter the results of the selected sample or the characteristic within the sample. Users can also edit existing results for the characteristic.

Users must have the privileges to edit sample information to add new results or edit existing results.

Results cannot be entered or edited for samples with the following conditions:

- If the sample status is Future or Missed
- If the sample to which the characteristic is associated is marked as Final

Users click the  Edit Results button to open the Edit Sample Results dialog box.



The Edit Sample Results dialog box allows users to navigate through the grid such that it works best when you enter the characteristic results.

The following tasks can be performed:

- From the list, select a characteristic for the sample.
- **Find:** Click **Find** to move focus within the grid to the column (or row if characteristics are displayed as rows) that contains the selected characteristic. The cursor moves to the first available result record for the selected characteristic.
- **Enter in Data Editor moves to next...:** Control the behavior of where the focus moves to next after a result value is entered. Choose whether the **Enter** key moves the focus in the grid to the next characteristic for the same result value or the next result value for the same characteristic.
- **Show Characteristics in the grid as...:** Select whether characteristics are listed as columns or rows. By default, the result number is shown as the first column in the grid and then the characteristics are listed in the remaining columns. If **Rows** is selected, the characteristic names are listed in rows in the first column of the table and the result numbers are listed in the remaining columns.
- Navigate to the previous or next sample by clicking the **Previous** or **Next** buttons.

If the resulting characteristic is a variable type, the following tasks can be performed:

- Set the value for an existing result
- Add new results and set the value for the new results

If the characteristic has a maximum sample size set, users can add the results until the total number of results equals the maximum number of samples for the characteristic.

If the resulting characteristic is an attribute type, the following tasks can be performed:

- Set the count value for the attribute.

For counted attributes, the count value is the total number of defects in the entire sample. For binary attributes, the count value is the number of defective units in the sample. This value cannot be larger than the sample size.

- Set the sample size, if the sample size of the attribute characteristic is not fixed.

When a sample that contains both variable and attribute characteristics is edited, additional rows available for the variable characteristics are disabled for all attribute characteristics.

If the characteristic has upper or lower reasonable values defined by a QM specification, these values are enforced when the data is entered. Users can also record the equipment that is used to measure the characteristic result data.

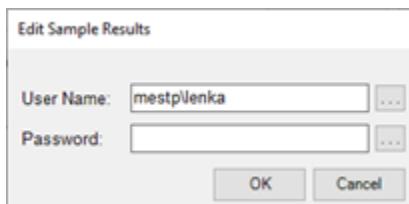
The following tasks must be performed after entering or editing the results:

- Save the characteristic result data.
- Check the data for rule violations before saving it. The user is prompted to verify the data if any rule violations are found.

When entering data, any individual results outside the specification limits must be saved or cancelled. At this point, the system only checks specification limits and not rule violations.

## Verifying the Result Entries

If the **Verify Write** option of the sample plan associated to the sample was enabled, then the user must enter their password prior to saving the result entries.



It is also possible for a user other than the user who entered the results (e.g., a supervisor) to enter their username and password to verify the result entries.

The user information entered during this verification process is logged in the Verified By field of the sample table.

# How the Results Are Processed

The MES system does the following while updating and adding the results:

- Supersedes the specified result and creates a new entry for the result, by using the new value while updating an existing result.
- Ensures that the maximum number of samples for the characteristic has not exceeded, and then assigns the next available value number to the result, while adding new result records to a characteristic within a sample.

If the value number exceeds the minimum number of samples for all the characteristics, you must click **Save**. The status of the sample changes to Complete. The status will be Complete if the current time is before the sample expiration. The status will be Complete Late, if the current time is after the sample expiration.

The run rules are tested (if the result that is added or updated meets the minimum sample size for characteristic) and sample\_result is updated if any violations occur.

The sample\_result must be set as follows:

- **Good:** Indicates that the sample is in control and all the results are within specification limits.
- **OOC:** Indicates the following:
  - An entire sample is in or out of control.
  - No measurements entered for the sample are out of specification.
  - No monitored characteristics are out of control.
- **OOS:** Indicates the following:
  - At least one measurement entered is out of specification.
  - No measurements entered for key or critical characteristics are out of specification and no key or critical characteristics are out of control.
- **OOC KEY:** Indicates the following:
  - The sample is out of control and is for a key characteristic.
  - No measurements entered for key characteristics are out of specification.
  - No measurements entered for key or critical characteristics are out of specification and no critical characteristics are out of control.
- **OOS KEY:** Indicates the following:
  - At least one measurement entered is out of specification and is for a key characteristic.
  - No measurements entered for critical characteristics are out of specification and no critical characteristics are out of control.
- **OOC CRITICAL:** Indicates the following:
  - The sample is out of control for a critical characteristic.
  - No measurements entered for critical characteristics are out of specification.
- **OOS CRITICAL:** Indicates at least one measurement entered is out of specification and is for a critical characteristic.

## Canceling a Sample

The Sample Viewer allows users to cancel a sample if all of the following conditions are true:

- They have permission to edit samples
- The sample does not have a status of Future or Canceled
- The sample has not been finalized



Users click the Cancel button to cancel the selected sample.



The Filter button is not included in the Sample Viewer button bar by default. The user can right-click the button bar area and click **Configure** to open the Configure Bar Button dialog box and add the Filter button to the bar.

## Filtering the Samples Displayed in the Sample Viewer Control

The Sample Viewer allows users to filter which samples are displayed in the control.



Users click the Filter button to open the Set Filters dialog box.

The dialog box contains the following fields:

- Sample Name:** Text input field.
- Start Time:** Text input field.
- End Time:** Text input field.
- Sample Status:** A group of check boxes:
  - Future
  - Ready
  - Ready Warning
  - Missed
  - In Progress
  - Late
  - Complete
  - Complete Late
  - Canceled
- Pulled By:** Text input field.
- Entity/Entity Class:** Text input field.
- Work Order ID:** Text input field.
- Operation ID:** Text input field.
- Sequence Number:** Text input field.
- Item:** Text input field.

At the bottom are three buttons: **Clear Filters**, **Apply** (highlighted in blue), and **Cancel**.

The following filters are available:

#### **Sample Name**

Specifies the string that represents the name or part of the sample(s) to be displayed.

#### **Start Time**

Specifies date and time that represent the minimum request time of the sample to be displayed.

#### **End Time**

Specifies date and time that represent the maximum request time of the sample to be displayed.

#### **Status**

Specifies the set of check boxes that represents the status of the samples to be displayed. Each of the following sample statuses has a Boolean value assigned to it:

- Future
- Ready
- Ready Warning
- Missed
- In Progress
- Late

- Complete
- Complete Late
- Cancelled

**Pulled By**

Specifies the details of the user who has marked a sample as pulled.

**Entity Class or Entity**

Specifies the entity class or the entity to which the samples to be displayed are assigned. This depends on the setting of the **EntityFilterRestriction** property.

**Item or Item Category**

Specifies the item or the item category to which the samples to be displayed are assigned.

**Work Order**

Specifies the work order of the job that generated the sample.

**Operation**

Specifies the operation of the job that generated the sample.

**Sequence Number**

Specifies the sequence number of the job that generated the sample.

When the filter is applied, the Sample Viewer is refreshed using the new filters to display the samples.

## Setting Status Color Coding for Samples, Characteristics, and Results

The Sample Viewer uses colors to indicate:

- The overall sample status, by the sample row color.
- Whether each characteristic of a sample is out of control, by the characteristic row color.
- Whether results are out of specification, by the color of the result row. If any of a characteristic's results are out of specification, the cells for those specifications in the characteristic row are also highlighted in this color.

These colors are defined by Sample system parameters in MES Client, in the **Display** group of the **General Parameters** module.

### To set the sample, characteristic, and result status color codes

- From the **Master Data Config** group in MES Client, open the **General Parameters** module.  
The Sample Result and Sample Status color code parameters are listed in the **Display** group.

The following figure shows the relation between some of the Sample parameter colors and their appearance in an example list of samples in Sample Viewer.

The screenshot illustrates the relationship between the Sample Viewer and the General Parameters windows.

**Sample Viewer (Top Window):**

Sample Name	Ent ID	Entity Name	Item_Id	WO ID	Operation	Seq No	Context Ent ID	Context Ent.	Context Item ID	It...
BagWeight20	100	Bagger_001					100	Bagger_001		
	Sample ID	Characteristic	Severity	QM..	OM..	Version..	Target	Lower Specification Value	Upper Specification Value	Lower..
	0	BagWeight	X	0	BagWeight	1		0.98	1.02	0.9
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		
BagWeight20	100	Bagger_001					100	Bagger_001		

**General Parameters (Bottom Window):**

Status	System Parameter	Value	
Y	sample	Y	
(+)	Data Entry (1 item)		
(+)	Display (17 items)		
	Status	System Parameter	Value
	Sample Result Good Color		Green
	Sample Result OOC Color		Yellow
	Sample Result OOC Critical Color		Yellow
	Sample Result OOC Key Color		Yellow
	Sample Result OOS Color		Pink
	Sample Result OOS Critical Color		Red
	Sample Result OOS Key Color		Red
	Sample Result Pending Color		Grey
	Sample Status Canceled Color		Brown
	Sample Status Complete Color		Blue
	Sample Status Complete Late Color		Dark Blue
	Sample Status Future Color		Dark Teal
	Sample Status In Progress Color		Magenta
	Sample Status Late Color		Orange
	Sample Status Missed Color		Grey
	Sample Status Ready Color		Black
	Sample Status Ready Warning Color		Dark Grey

Note that if you click a cell in a sample's characteristic row:

- The characteristic row is highlighted in light blue
- The background color of the selected cell is the color used to indicate the characteristic's out-of-control status or, for specification columns, the characteristic's out-of-specification status

Sample Name	Ent ID	Entity Name	Item
BagWeight20...	100	Bagger_001	
Sample ID	Characteristic	Severity	
0	BadWeight	Key	
BagWeight20...	100	Bagger_001	

The following table includes a description of each sample status and its default color.

Sample Status	Description	Default Color
Future	Requested for a future time	White
Ready	The current time is greater than or equal to the requested time, less than or equal to the expiration time, and the warning interval is not Null. If the current time value is less than the sample requested time and the warning interval, the sample pulled time is NULL, and there are no results.	Light grey
Ready Warning	The current time is less than or equal to the expiration time, the sample pulled time is Null, the current time is greater than the sample requested time and the warning interval, and there are no results.	Dark grey
Missed	The current time is greater than the sample expiration time, the sample pulled time is Null, and there are no results.	Orange
In Progress	The current time is greater than or equal to the requested time and less than or equal to the expiration time, there are not enough results for at least one characteristic, and either the sample pulled time is not Null or there is at least one result.	Blue grey
Late	The current time is greater than the expiration time, there are not enough results for every characteristic, and either the sample pulled time is not Null or there is at least one result.	Purple

Sample Status	Description	Default Color
Complete	The time at which the minimum number of original results in the sample is recorded (using the earliest created_at time for each value_no), is less than or equal to the sample expiration time and there are enough results for every characteristic.	Blue
Complete Late	The time at which at least one original result in the sample at or below the minimum number is recorded, is greater than the expiration time and there are enough results for every characteristic.	Dark blue
Canceled	The user decided not to make measurements for this sample.	Brown

The following table includes a description of each characteristic status and its default color.

Characteristic Status	Description	Default Color
Good	No SPC run rule violations	Green
OOC	Out of control for non key characteristic	Light yellow
OOC Key	Out of control for key characteristic	Yellow
OOC Critical	Out of control for critical characteristic	Dark yellow
None	No data yet	White
Pending	Some variables and data are waiting to be collected and all that have been collected are within the normal range.	Light grey

The following table includes a description of each result out-of-specification status and its default color.

Result Status	Description	Default Color
OOS	Out of specification for non-key characteristic	Light pink
OOS Key	Out of specification for key	Red

Result Status	Description	Default Color
	characteristic	
OOS Critical	Out of specification for critical characteristic	Crimson

## Properties of the Sample Viewer Control

This section describes the properties of the Sample Viewer control. For information about the common properties shared by this control, see [Common Properties](#).

### CancelSampleEnabled Property

Use the **CancelSampleEnabled** property to determine if a sample can be canceled.

The **Cancel** button will be enabled if a sample is selected, the selected sample does not have a status of Future or Canceled, the Final flag for the selected sample is not set, and the logged-in user has permission to edit samples.

Data Type	Read/Write	Values
Boolean	Read Only	True if the <b>Cancel</b> button is enabled. False if the <b>Cancel</b> button is not enabled.

### EditResultsEnabled Property

Use the **EditResultsEnabled** property to determine if sample results can be modified.

The selected result can be modified when the sample is not marked as Final, Missed, or Future. You must also have the required permission to add and modify the sample information.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### EditSampleEnabled Property

Use the **EditSampleEnabled** property to determine whether samples can be modified.

You can modify a selected sample when it has not been marked as Final, Missed, or Future. You must also have the required permission to modify the sample information.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### EndTimeFilter Property

Use the **EndTimeFilter** property to filter the samples based on the sample request time being less than or equal to this value. The filter method displays the samples that match the end time value of the sample request time, which is lesser than or equal to the time entered as the filtering criteria. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
DateTime	R/W	Null

### EntityFilter Property

Use the **EntityFilter** property to filter the samples based on the entity or entity class with which they are associated. The filter method displays the samples that have an entity and any of its descendants that match the filtering criteria. The valid values for this property are determined by the **EntityFilterRestriction** property. This is a run-time property.

You can set this property to Null if the **EntityFilterRestriction** property is set to None.

Data Type	Read/Write	Default Value
String	R/W	Null

### EntityFilterRestriction Property

Use the **EntityFilterRestriction** property to determine the setting of the entity filter. This is a design-time property.

If the **RequireEntityLogon** property is set to True, you can set this property to one of the following:

- Current entity (1)
- Current entity or storage entities (2)
- Logged on entities (3)
- Logged on entities or storage entities (4)

If the **RequireEntityLogon** property is set to False, the **EntityFilterRestriction** property must be set to None (0). If the **RequireEntityLogon** property is set to True, this property cannot be set to None.

Data Type	Read/Write	Default Value
Enumeration	R/W	None

### FilterEnabled Property

Use the **FilterEnabled** property to specify whether the filtering option is enabled for the samples.

This option will be disabled if the control is not in Available state.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ItemCategoryNameFilter Property

Use the **ItemCategoryNameFilter** property to filter the samples based on the item category with which it is associated. The filter displays the samples with item ID whose item category exactly matches the filtering criteria. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### ItemFilter Property

Use the **ItemFilter** property to filter the samples based on the item ID with which it is associated. The filter method displays the sample that exactly matches the filtering criteria. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### LaunchSpcChartEnabled Property

Use the **LaunchSpcChartEnabled** property to determine whether or not the **LaunchSpcChart** command is enabled. This command is enabled when a characteristic is selected.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### OperationFilter Property

Use the **OperationFilter** property to filter the samples based on the job which generates the samples in the viewer. The filter contains the string filter to match any operation that matches the string entered for the filter. It is possible to search for operation IDs that contain specified characters. For example, to return all samples for operations that contain the letters Op1, you must provide the string Op1% for the value.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### PullSampleEnabled Property

Use the **PullSampleEnabled** property to determine whether the **PullSample** command is enabled.

A sample can be pulled when the sample status is Ready or Ready Warning and the sample is yet to be pulled. You must have the required permission to edit the sample information to pull a sample.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### RequireEntityLogon Property

Use the **RequireEntityLogon** property to specify whether an entity logon is required for the Sample Viewer control. This is a design-time property.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### RefreshRate Property

Use the **RefreshRate** property to specify the polling rate, in minutes, to check the MES database for new data. You can disable this property by setting the value of the polling rate to 0. This is a design-time and a run-time property. When a new filter is applied, the current refresh rate value will be used to set up the rate at which the grid is refreshed; changing the value of the **RefreshRate** property will only take effect after applying a new filter.

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Int32	R/W	5 minutes

### SampleNameFilter Property

Use the **SampleNameFilter** property to filter the samples shown in the Sample Viewer control. The filter method displays the samples that match the sample name entered as the filtering criteria. This is a run-time property. It is possible to search for sample names that contain specified characters. For example, for SQL Server to return all samples that start with the letters Blender, you must provide the string Blender% for the value.

Data Type	Read/Write	Default Value
String	R/W	Null

### SpcChartEnabled Property

Use the **SpcChartEnabled** property to check if the SPC chart button is enabled or not. This property returns a value True if **LaunchSpcChart()** method is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### StartTimeFilter Property

Use the **StartTimeFilter** property to filter the samples based on the sample request time being greater than or equal to this value. The filter method displays the samples that match the start time value of the sample request time, which is greater than or equal to the time entered as the filtering criteria. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
DateTime	R/W	Null

### StatusFilter Property

Use the **StatusFilter** property to filter the samples based on the following values:

- 0 = Future
- 1 = Ready
- 2 = Ready Warning
- 3 = Missed
- 4 = In Progress
- 5 = Late
- 6 = Complete
- 7 = Complete Late
- 8 = Cancelled

The filter supports selection of multiple comma-separated enumeration values. For example, to show only Ready and Ready Warning samples, set the value to **1,2**.

This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### ToggleSampleFinalFlagEnabled Property

Use the **ToggleSampleFinalFlagEnabled** property to determine whether the **ToggleSampleFinalFlag** command is enabled.

This command is enabled if a past sample is selected and you have the required permission to modify the final state of the sample.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### UnpullSampleEnabled Property

Use the **UnpullSampleEnabled** property to determine whether the **UnpullSample** command is enabled.

This command is enabled when the sample has been pulled and no results have been generated for any of the characteristics associated with the sample. You must have the required permission to edit the sample information to unpull a sample.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### UserFilter Property

Use the **UserFilter** property to filter the samples based on the details of the user who marked the sample as pulled. The filter method displays the user details value that is an exact match of the filtering criteria. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### WorkOrderFilter Property

Use the **WorkOrderFilter** to filter the samples based on the job that generates the samples in the viewer. The filter contains the string filter to match any work order that matches the string entered for the filter. It is possible

to search for work order IDs that contain specified characters. For example, to return all samples with work order IDs having ABC as the ending letters, you must provide the string %ABC for the value.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

## Methods of the Sample Viewer Control

This section describes the methods of the Sample Viewer control. For information about the common methods shared by this control, see [Common Methods](#).

### CancelSample() Method

Use the **CancelSample()** method to cancel the currently selected sample. The **CancelSampleEnabled** property must be set to True for this method to be successful.

The Sample Viewer calls the **Cancel()** method in the **Sample** class in the Stateless API to cancel the sample. If the API method returns an error, the error is displayed to the user after it has been translated into the user's language. If the API method successfully cancels the sample, the Sample Viewer updates the display.

## Syntax

```
CancelSample();
```

### EditSampleInfo() Method

Use the **EditSampleInfo()** method to open the Edit Sample dialog box for editing the currently selected sample. The **EditSampleEnabled** property must be set to True for this method to be successful.

## Syntax

```
EditSampleInfo();
```

### EditSampleResults() Method

Use the **EditSampleResults()** method to open the Edit Sample Results dialog box for modifying the results of the currently selected sample or characteristic. The **EditResultsEnabled** property must be set to True for this method to be successful.

## Syntax

```
EditSampleResults();
```

## Filter() Method

Use the **Filter()** method to enable the filter editing mode in the Sample Viewer. The **FilterEnabled** property must be set to True for this method to be successful.

## Syntax

```
Filter();
```

## LaunchSpcChart() Method

Use the **LaunchSpcChart()** method to display an SPC chart of the characteristic selected within a sample. The SPC chart uses the language of the user currently logged in to the Sample Viewer control. The total number of samples and the number of points per page displayed in the chart are based on the QM specification setting linked to the selected characteristic. If there is no setting for the total number of points, all points meeting the filter criterion are displayed. If there is no setting for the number of points per page, then 18 points are displayed by default.

The type of chart displayed on the SPC chart control, when called by the Sample Viewer control, is the default chart of the selected characteristic. Based on the filter flags of the selected characteristic, the information set on the Sample Viewer's Filter dialog is sent to the SPC Chart control. These filters, sent from the Sample Viewer to the SPC Chart control, contain the following information:

- Entity
- Item
- Work order
- Operation

These filters are a subset of the filters that are used by the SPC Chart control.

For this method to be successful, you must set the **LaunchSpcChartEnabled** property to True.

## Syntax

```
LaunchSpcChart();
```

## PullSample() Method

Use the *isPullSample* parameter of the **PullSample()** method to set the user who pulled the sample and the sample pull time in a date and time editor. By default, the current date and time is set as the sample pull time and the currently logged on user as the user who pulled the sample. The **PullSampleEnabled** property must be set to True for this method to be successful.

When the *isPullSample* parameter is set to True, a dialog box is displayed for the user to modify the date. This method is useful when you monitor the screen. The sample pulled with the current date and time is not marked automatically.

If the sample is already pulled, the sample will be set as not pulled as long as no results have been collected for the sample. The *isPullSample* parameter must be set to False to unpull the sample. If it is set to True and the sample is already pulled, then this method will return doing nothing.

## Syntax

```
PullSample(isPullSample);
```

### SelectRowByKey() Method

Use the **SelectRowByKey()** method to search for the specified sample ID in the grid. If the sample ID is found, the row is selected. If the sample ID is not found and the *SelectFirstRowAsDefault* parameter is set to True, the first row is selected; otherwise the row selection is not changed. This method returns a Boolean value that is True if the sample ID is found; otherwise it returns False.

## Syntax

```
result = bool SelectRowByKey(int sampleId);
```

### Parameter

*sampleId*

An integer that indicates the sample ID of a row in the sample table.

### Return Value

*result*

A Boolean value that is True, if a match is found; otherwise it returns False.

### ToggleFinalFlag() Method

Use the **ToggleFinalFlag()** method to mark a sample as final or to clear the final flag.

If the selected sample is not marked as Final, this method sets the final flag against the sample. On setting the final flag, the results and characteristics associated with the sample cannot be edited.

If the selected sample is marked as Final, the method clears the final flag and enables editing of the results and characteristics associated with the sample.

This method updates the database information immediately. You do not have to save the information. The **ToggleSampleFinalFlagEnabled** property must be set to True for this method to be successful.

## Syntax

```
ToggleFinalFlag();
```

### ValidEntityFilter() Method

Use the **ValidEntityFilter()** method to validate the entity specified against the *EntityFilterRestriction* parameter to determine if it is within the restriction type. If the entity is not within the Entity Filter restriction or cannot collect quality data, an error message appears and the method returns False. If the entity is within the Entity Filter restriction, it returns True.

## Syntax

```
bool ValidEntityFilter(int entId, EntityFilterRestrictionType entityFilterRestriction);
```

## Parameters

*entId*

An integer value that indicates the ID of the entity to be validated.

*entityFilterRestriction*

An enumeration value that indicates the filter restriction to be validated against.

## Events of the Sample Viewer Control

This section describes the events of the Sample Viewer control.

### SelectedRowChanged Event

The **SelectedRowChanged** event is raised by the Sample Viewer control on startup of the control and when a different sample row or characteristic row in the top grid is selected by a user. The event is not raised when selecting a result in the bottom grid. This event indicates which sample and, if applicable, which characteristic has been selected.

The **SelectedRowChanged** event has two read-only properties, **SampleID** and **CharacteristicID**.

- When a different sample row is selected, the **SampleID** property is set to the sample ID of the newly selected row, and the **CharacteristicID** property is set to -1.
- When a different characteristic row is selected, the **SampleID** and **CharacteristicID** properties are set to the sample ID and characteristic ID of the newly selected row.

### StatusChanged Event

The **StatusChanged** event is raised by the Sample Viewer control when a sample status changes to Ready or to Ready Warning. The event indicates the change in the status of a sample.

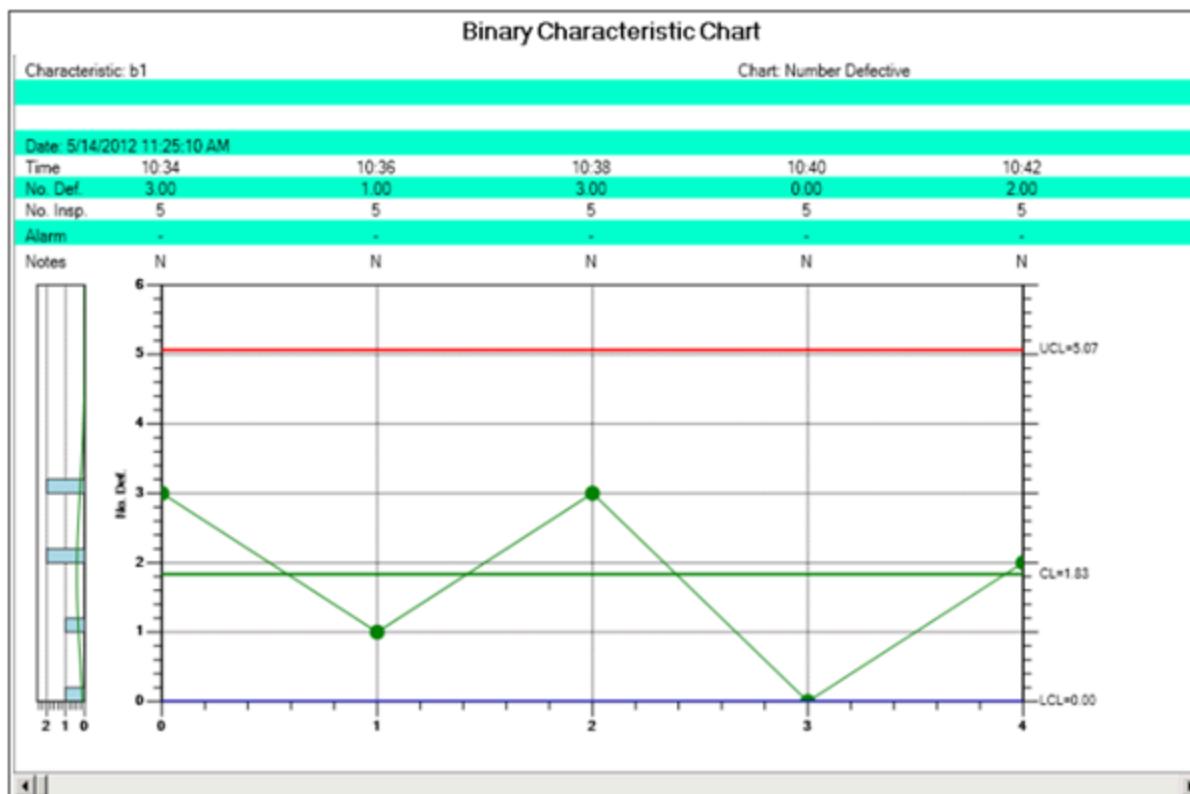
---

**Note:** The **StatusChanged** event is not currently implemented.

---

## SPC Chart Control

You can use the Statistical Process Control (SPC) Chart control to monitor characteristics associated with the product and the process. The SPC charts are important decision aids for MES Quality Management because they provide statistical information that is indicative of the actual process.



The SPC charts display the following data:

- Graphical representation of the data associated with product and process characteristics
- Control limits and a center line, which is either a fixed line or a line drawn based on the plotted data
- Control rule violations indicated on the chart
- Contextual data and chart title
- Summary data, including notes and alarms

To monitor process performance, you can check the relationship of the plotted data with the control limits and the center line. You can either integrate the SPC charts with the Sample Viewer control or generate them independently.

To use the SPC Chart control, the operator need not log on to the control. The SPC Chart control does not support the Button Bar control.

## Using the SPC Chart Control

This section describes how to use the SPC Chart control to do the following:

- Retrieve data to be plotted
- Display data
- Display control rule violations

## Retrieving Data

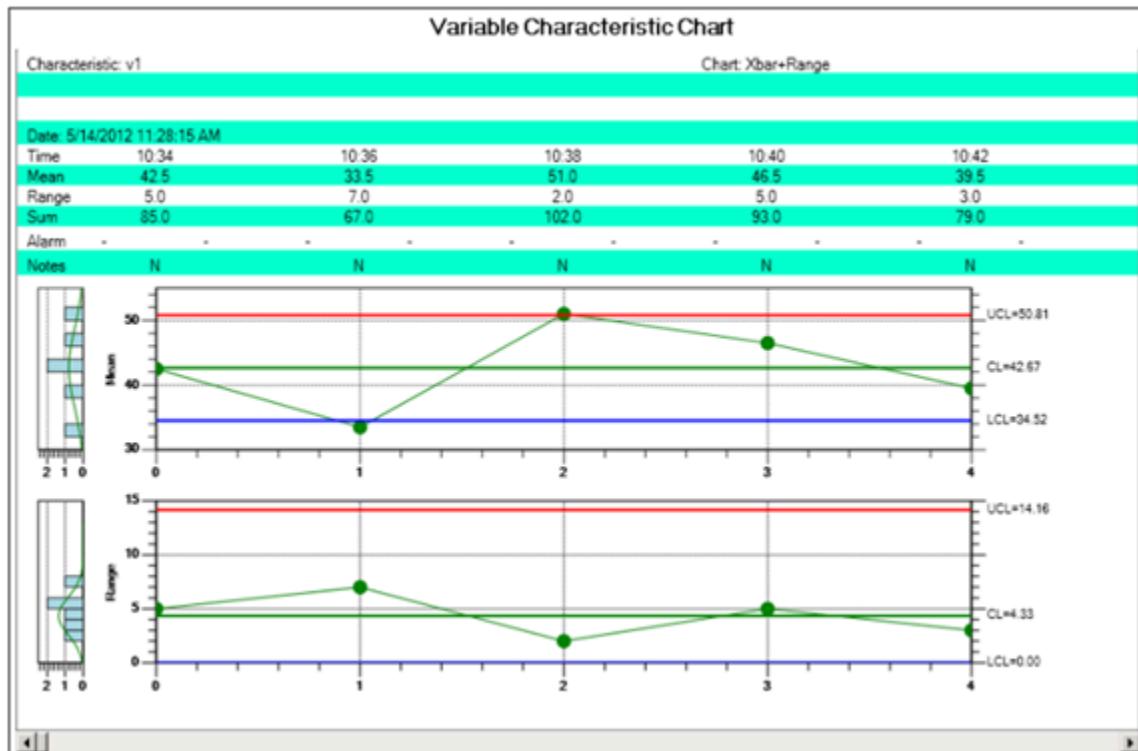
When the **DisplayChart()** method is called, the SPC Chart control retrieves the specified characteristic's sample results that match the specified filter criteria. The retrieved data is sorted by the requested\_time\_utc column of the sample table.

The SPC Chart control checks the MES database for new samples at an interval defined in the **RefreshRate** property.

If one or more results are added to any samples that match the filter criteria since the last check, the SPC Chart is updated. If the number of points on the chart is equal to the configured value of the **NumberOfPointsFilter** property, the control does the following:

- Deletes the first point
- Adds the new point
- Replots the chart

If new results are added to an existing sample, the control recalculates the point and replots the chart.

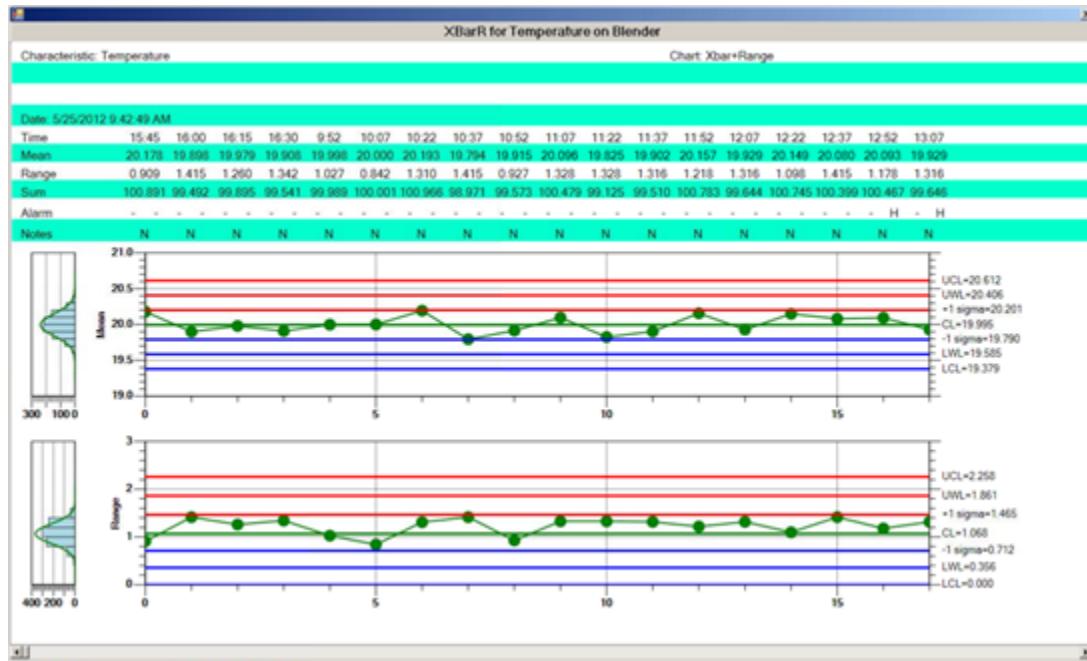


The chart is also updated when other events related to chart data occur, such as sample data being updated, marking a data point to be ignored or as a control move, or adding a note to a data point.

## Displaying Data

The SPC Chart control generally plots one point for each sample. You can also use the control to plot a chart (IX + MR chart, MA & MR chart, or MA & MS chart) for samples where each result produces a new point. For samples with more than one result, the average is calculated and plotted. Each point in the chart is connected to the next with a line. If the **PlotPrimaryMeasurementValues** property is set, the measurement values for each point are represented with a different shape on the y-axis.

The sample request time is plotted on the x-axis and the sample value is plotted on the y-axis. If the plotted points do not fit on a single page, a scroll bar appears at the bottom of the control. You can plot two types of charts for the samples — primary charts and secondary charts. The histograms, if displayed, appear to the left of the chart.



## Chart Types

The SPC Chart control supports displaying characteristics of all types. The following is the list of chart types supported for specific characteristic type:

- A Binary Attribute characteristic can be displayed as a PercentDefective (p) chart or NumberDefective (np) chart.
- A Counted Attribute characteristic can be displayed as a NumberOfDefects (c) chart, DefectsPerUnit (u) chart, or DefectsPerMillionOpportunities (DPMO) chart.
- A Variable characteristic can be displayed as a XBarRange (XBarR) chart, XBarSigma (XBarS) chart, MovingAverageMovingRange (MARange) chart, MovingAverageSigma (MASigma) chart, or XI ndividualRange (IxIr) chart.

Depending on the chart type and configuration of the variable characteristic, the following are the additional limitations:

### PercentDefective (p) and DefectsPerUnit (u)

The p and u charts are ratio charts that can have a variable sample size in the denominator. As such, it is recommended to set control limits with either standard values or auto-calculated.

If preset limits are used, the chart requires the "single point outside control limits" rule to be enabled so that the fixed control limits are applied to the chart. If the QM specification does not have this rule enabled, the SPC Chart control will enable the rule on the chart only. The rule checking within the MES database will not use the single point outside control limits rule, unless the QM Specification has this rule enabled. However, the chart will, which can lead to inconsistencies in what is recorded in the MES database and what is shown in the SPC Chart.

### X Bar

This chart plots samples that have multiple results per sample. If all the samples for the characteristic have only one reading per sample, a blank chart is displayed.

### X Bar Range

This chart is designed for fixed sample sizes. However, the chart does support plotting samples where the number of results in the sample is less than or greater than the standard sample size. Because the sample size is artificially the same, all samples will have the same control limits applied to them. When using fixed control limits, the chart supports asymmetric upper and lower limits. When using standard values or auto-calculated control limits, the chart will have symmetric upper and lower limits.

### X Bar Sigma

This chart does support variable sample sizes so the control limits can change from point to point. To accomplish this, the chart sets limits based on a center line and standard mean (*Use standard values* option). If the characteristic being plotted has fixed limits, these limits are transferred into a center line and a standard mean value for the upper control limit and for the lower control limit. The chart supports asymmetric upper and lower control limits.

### Moving Average

This chart starts plotting with the first result received and adjusts the control limits accordingly until the number of points plotted is equal to the number of results used in the moving average calculation. If two or more samples to be plotted have the same sample request time, then one second is added to the times for each plotted point after the first.

## Determining and Displaying Control Limits

- For all variable characteristic chart types, the control limits are calculated by the chart based on the center line and standard deviation.
- An upper and lower sigma are supported, so fixed limits can be unbalanced. The upper sigma is calculated by subtracting the mean from the upper control limit and dividing by 3. The lower sigma is calculated by subtracting the lower control limit from the mean and dividing by 3. The normal sample size does not factor into this equation. If either the upper control limit, lower control limit, or mean are missing, the control limits are automatically calculated from the data.
- When the characteristic definition has single-side control limits, the control rule violations displayed in the chart might not reflect the control rules calculated by the MES system [recorded in the MES database and reported to the Sample Recording Object (SRO) if one exists].
- When calculating the lower control limit for an attribute or range chart, a negative calculated value is not displayed and does not factor into calculated control rule violations.

## Displaying Control Rule Violations

The SPC Chart control does the following to display control rule violations:

- Identify the control rules to be applied based on the QM specification of the latest filtered sample
- Ignore any control rule that is not applicable to the characteristic or to the chart type
- Enable rule checking for the identified control rules

The following table describes the control rules that the SPC Chart control supports:

Rule ID	Description	Alarm Text
0	1 outside control limits	H/L
1	2 of 3 outside of 2 standard deviations	H/L
2	3 of 7 outside of 2 standard deviations	H/L
3	4 of 10 outside of 2 standard deviations	H/L
4	4 of 5 outside of 1 standard deviation	H/L
5	7 of 7 on one side of center line	H/L
6	8 of 8 on one side of center line	H/L
7	8 of 8 beyond 1 standard deviation*	B
8	9 of 9 on one side of center line	H/L
9	10 of 11 on one side of center line	H/L
10	12 of 14 on one side of center line	H/L
11	6 of 6 increasing or decreasing	T
12	7 of 7 increasing or decreasing	T

\*This control rule is the only one not based on a trend (T) that can be violated by a combination of points on either side of the center line. All the other control rules require the specified number of points on the same side of the center line.

The control rules are evaluated based on the priority order specified in the Spc\_Rule table. The chart displays control lines for the enabled control rules as defined below:

- If rule IDs 1,2, or 3 are enabled, control lines are drawn at two standard deviations from the center line.
- If rule IDs 4 or 7 are enabled, control lines are drawn at one standard deviation from the center line.
- Rule IDs 5, 6, 8, 9, 10, 11, and 12 have no effect on the control lines.

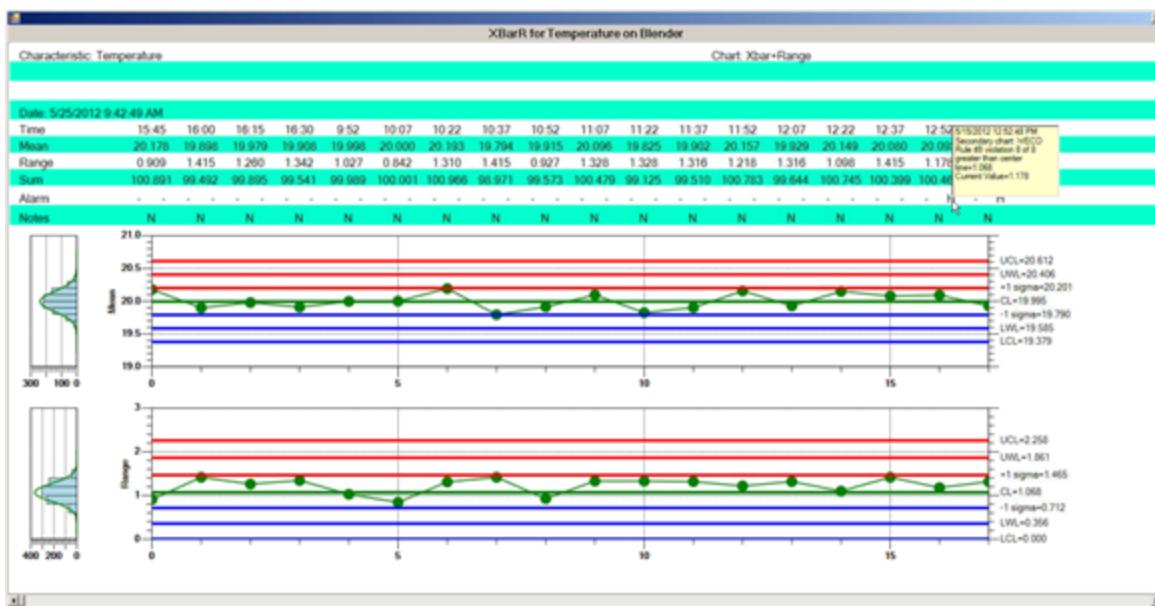
---

**Note:** The control limits (at +/- 3 standard deviations) are always displayed on the chart.

---

The alarm text is used to indicate control rule violations as defined below:

- H, if the violation occurs above the center line
- L, if the violation occurs below the center line
- B, if the violation occurs on both sides of the center line
- T, if the violation is a trend and is not dependent on the position of the points relative to the center line



## Runtime Interaction with the Chart

You can interact with the chart at run time. When a chart is displaying data, you can do the following:

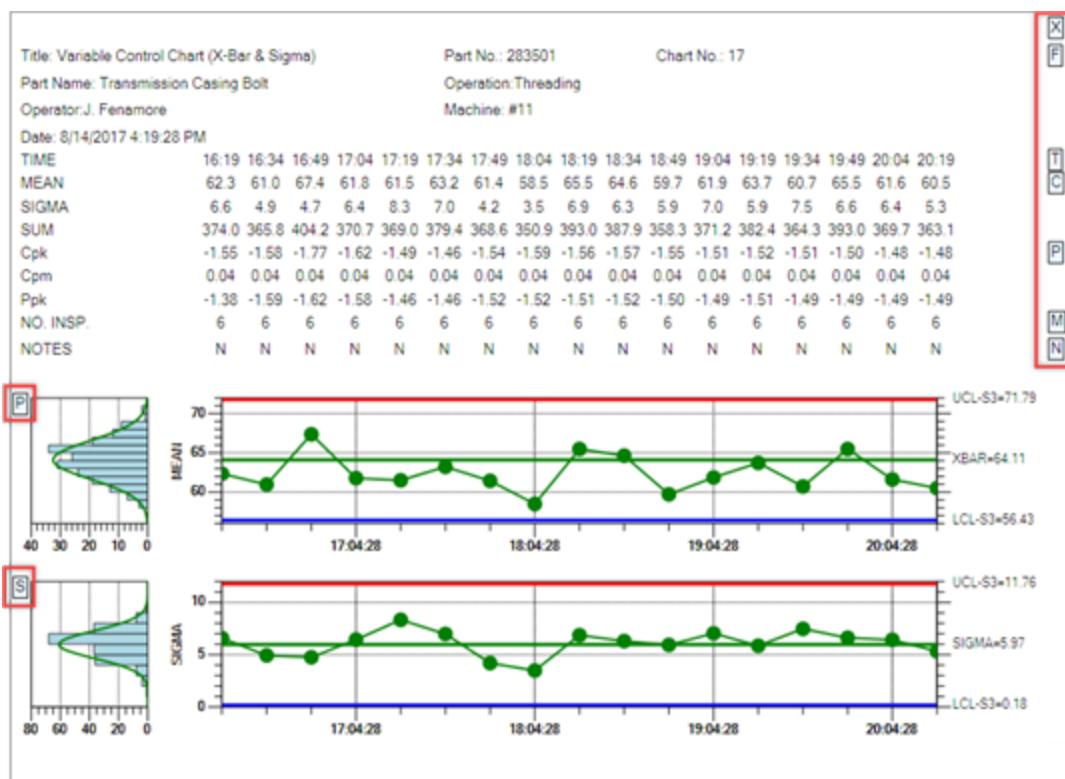
- Toggle areas of the chart window on and off.
- Zoom on a chart.
- Move the mouse pointer over a sample to see the value of the point.
- Use the scroll bar to move to newer/older data, when the plotted points do not fit on the display. After you stop scrolling, the control waits for a second or two to refresh and redraws the chart.
- Click either of the two alarm indicators in the **Alarm** row to see the control rule violation description. There is a separate indicator for the top chart (first) and bottom chart (second).

You can also assign a cause to a sample point, add notes to a sample point, mark a sample point as a control move, and mark a sample point to be ignored in sample calculations. These operations are described in the following topics.

## Toggling Areas of the Chart Window On and Off

Toggle buttons allow users to hide areas of the chart and toggle them back on again.

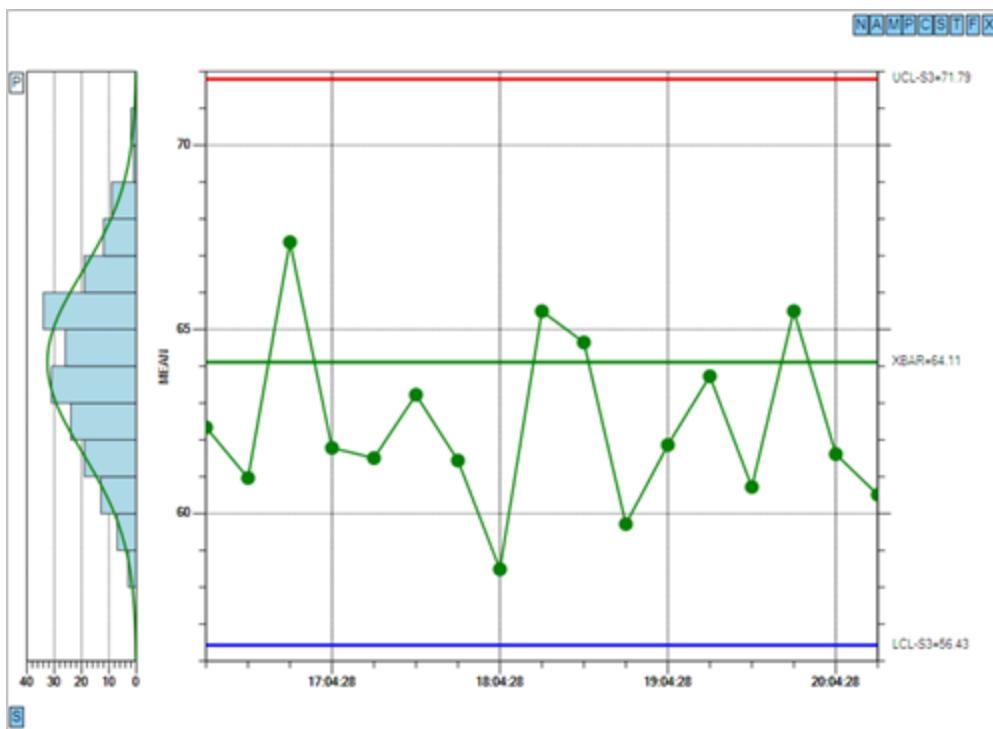
If the **EnableCollapsibleToggles** property has been set to True, toggle buttons will appear on the chart.



The toggle buttons can hide the following areas:

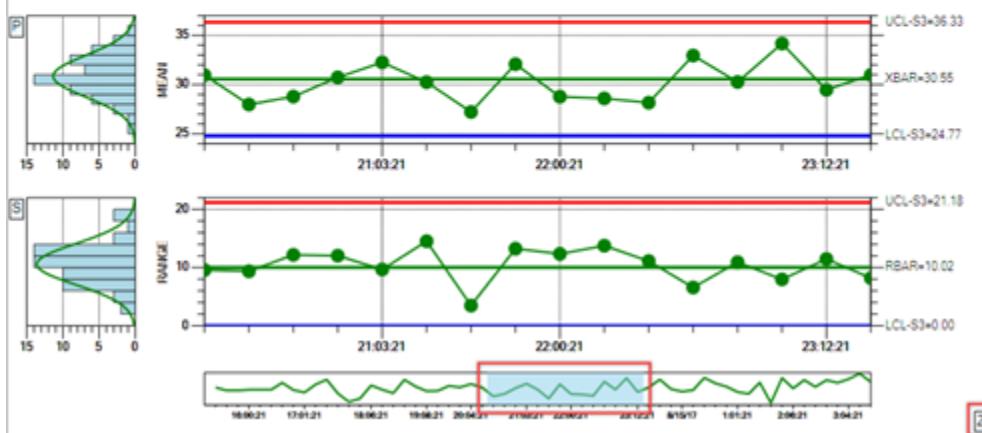
- X = Hide the header information and all areas of the data table
- F = Header information
- T = Time table row
- C = Chart data table row
- M = Measurements table row
- A = Alarm table row
- N = Notes table row
- P = Primary Chart
- S = Secondary Chart

In the following example, all of the chart areas except for the Primary chart have been toggled off using the buttons.



## Zooming on a Chart

If the **EnableZoomToggle** property has been set to True, a Zoom (Z) toggle button will appear at the lower right corner of the chart window. Clicking the Z toggle button causes a zoom window to replace the horizontal scrollbar. A user can then scroll a zoomed area of the charts by dragging the transparent blue zoom window.



The zoomed area can be increased or decreased by dragging the left or right edge of the zoom window.

If the number of points in the display exceeds the initial setup value for the number of data points, the table is

temporarily removed to prevent overlap of the table columns. If the number of data points is reduced to the initial number of points or less than the initial number, the table will reappear.

### Assigning a Cause to a Sample Point

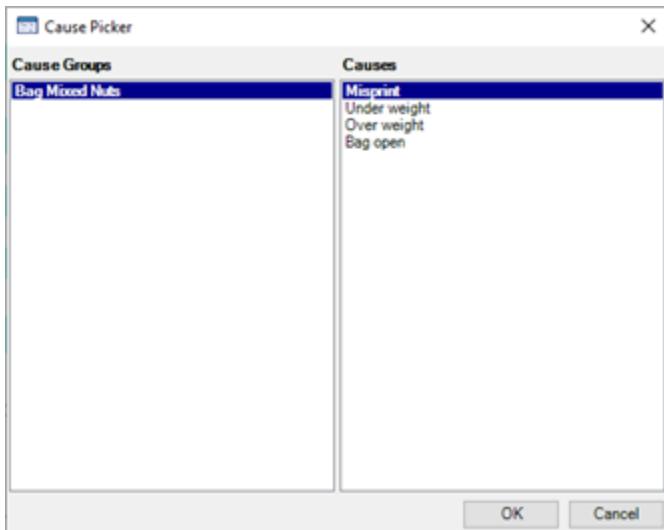
Causes can be assigned to characteristic sample points.

Causes are organized into related cause groups, and cause groups are then linked to characteristics through categories. The cause groups that are linked to a characteristic will be the cause groups that are presented when you choose to assign a cause to a sample point. Causes, cause groups, and links between cause groups and characteristics are configured using MES Client.

#### To assign a cause to a sample point in the chart

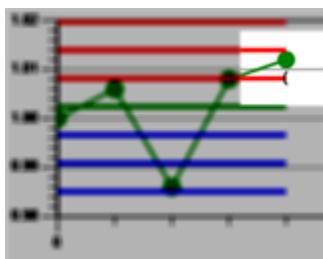
1. Right-click the sample point and click **Assign Cause**.

The Cause Picker dialog box appears.



2. Select the appropriate cause group and cause, and then click **OK**.

The selected cause is assigned to the sample result, which is indicated by an open parenthesis character that appears below the sample point.



#### To unassign a cause from a sample point in the chart

- Right-click the sample point and click **Unassign Cause**.

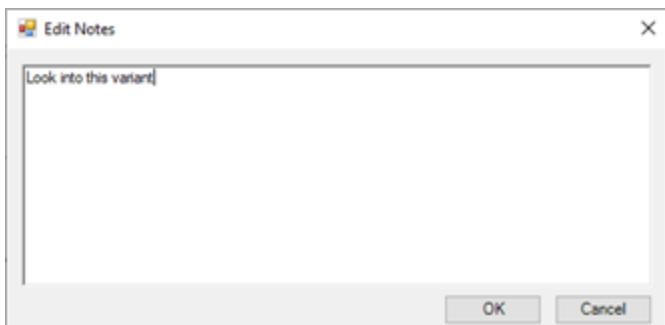
The cause is removed from the sample point and the open parentheses character no longer appears below the sample point

## Adding a Note to a Sample Point

### To add a note to a sample point in the chart or edit an existing note

1. Right-click the sample point and click **Edit Notes**.

The Edit Notes dialog box appears.



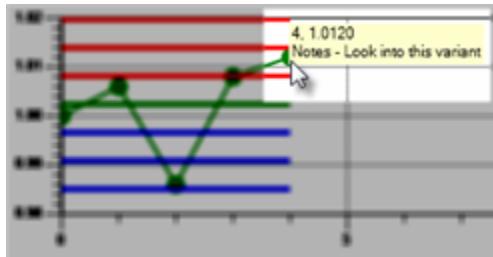
2. Enter the note and click **OK**.

The note is saved to the database and associated with the sample result.

### To view a sample point's note

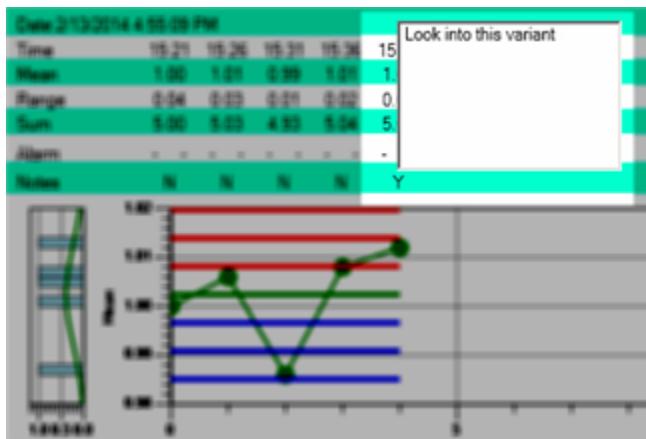
- Do one of the following:
  - Click the sample point.

The note displays above the sample point along with the sample value.



- Click **N** or **Y** in the column of the **Notes** row directly above the sample point in the chart.

The note displays above the N or Y value.



### To remove a sample point's note

1. Right-click the sample point and click **Edit Notes**.

The Edit Notes dialog box appears.

2. Delete the note entry and click **OK**.

The note is removed from the sample result.

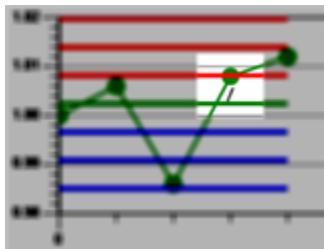
### Marking a Sample Point as a Control Move

You can mark a sample point as a control move so that it resets the counter for consecutive control rule checks.

#### To mark a sample point in the chart as a control move

- Right-click the sample point and click **Toggle Control Move**.

The sample point is marked as a control move, which is indicated by a slash character (/) that appears below the sample point.



#### To unmark a sample point as a control move

- Right-click the sample point and click **Toggle Control Move**.

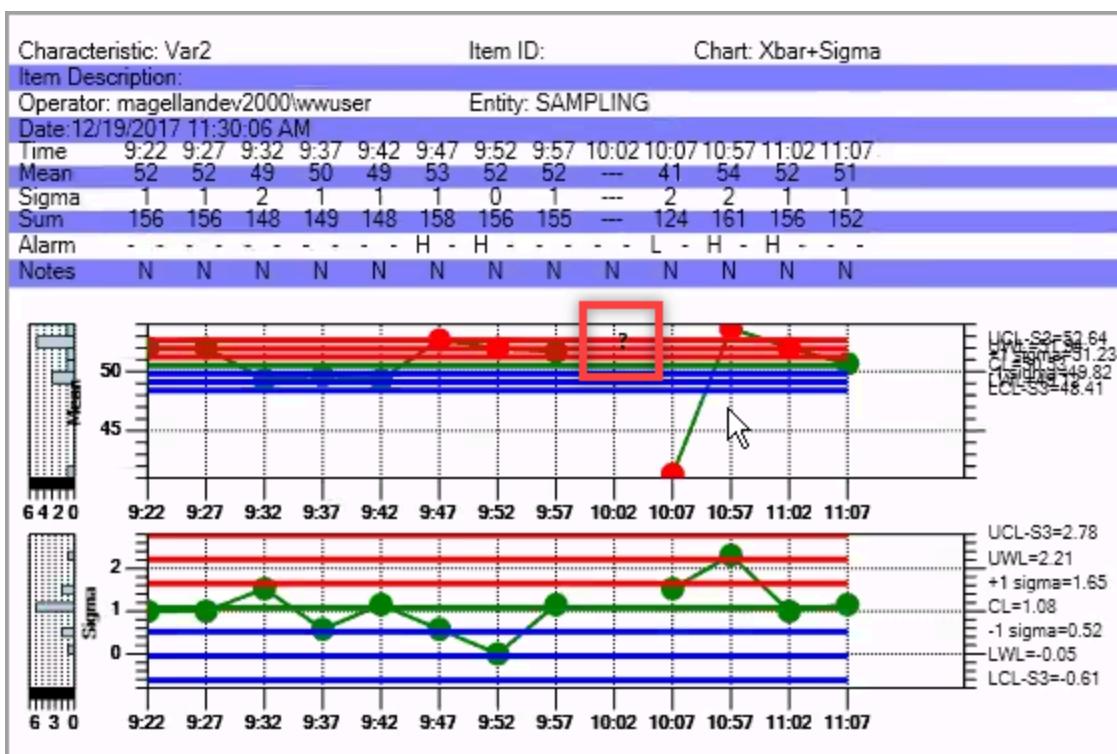
The control move designation is removed and the slash character no longer appears below the sample point.

### Marking a Sample Point to Be Ignored in Sample Calculations

#### To mark a sample point in the chart to be ignored in sample calculations

- Right-click the sample point and click **Toggle Ignore Sample**.

The sample point is removed from the chart and a question mark (?) annotation appears at the sample position at the top of the chart. The chart will rescale if the chart MinY and MaxY properties have not been set to a specific value. The ignored sample point will not be evaluated in control limit testing or in auto-calculations for control limits and y-axis range.



### To remove the ignore sample designation

- Right-click the question mark annotation for the sample point and click **Toggle Ignore Sample**.  
The sample will now be included in sample calculations and the sample point will be shown again in the chart.

### Properties of the SPC Chart Control

The SPC Chart control properties allow you to control what is displayed in the SPC Chart and how its components are displayed. You can filter the samples based on entity or item category by using name or ID filter properties.

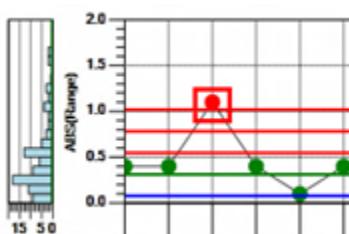
If the samples are filtered based on entity and item category, you must use the same type of filter properties, name or ID, for both criteria.

The SPC Chart control does not share any common properties with the other controls.

### AlarmPointColor Property

Use the **AlarmPointColor** property to specify the color used for sample points that violate a control rule.

The following figure highlights an example alarm point in red.



This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The symbol used to plot an alarm data point in the chart is controlled by the **OutOfLimitsPointSymbol** property. If the alarm highlighting for chart symbols is turned on (the default; see [ColorPointsInAlarm Property](#)), the color of a sample point that violates a control rule will change to the color defined by this property.

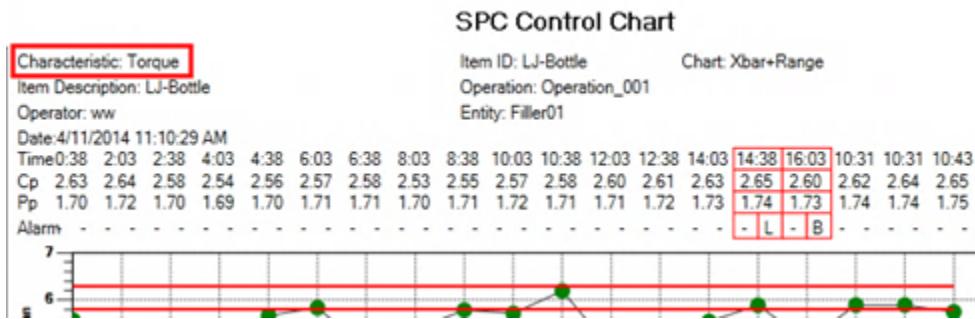
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Color	R/W	Red (255, 0, 0)

### CharacteristicNameFilter Property

Use the **CharacteristicNameFilter** property to specify the characteristic for which the chart is to be plotted. This property filters samples with characteristic that match the specified criteria. This is a design-time and a run-time property.

The following figure highlights the selected characteristic as shown in the chart header area.



The **CharacteristicNameFilter** property is the only required property of the control. If all the other filters are Null, and the chart is refreshed or the **DisplayChart()** method is called, the system reads the filter settings from the MES database.

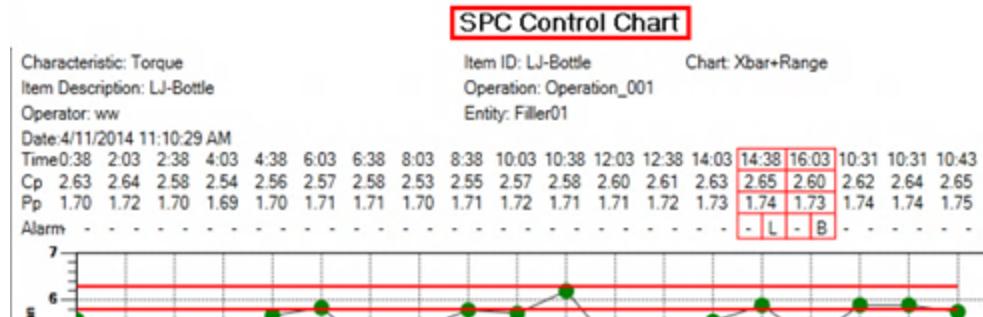
If you set this property to Null, you cannot display the chart.

Data Type	Read/Write	Default Value
String	R/W	Null

### ChartTitle Property

Use the **ChartTitle** property to specify a title for the chart. This is a design-time and a run-time property.

The following figure highlights the title as shown in the chart header area.



If you set this property to Null, the SPC chart is untitled. If there is no title, the title space is collapsed, allowing more vertical space for the other displayed chart elements.

Data Type	Read/Write	Default Value
String	R/W	Null

## ChartType Property

Use the **ChartType** property to specify the type of chart for plotting the data points or set the chart type to Default to use the chart configured in MES database for the characteristic or the characteristic/QM Specification link if the characteristic setting has been overridden. You can set the chart type to a valid value that is listed along with the **ChartType** enumeration.

For variable sample sizes, you can use the following chart types:

- XBarR (Mean and Range, 2)
  - XBarSigma (Mean and Sigma, 3)
  - Ixlr (Individual X and Moving Range, 5)
  - MARange (Moving Average and Range, 7)
  - MASigma (Moving Average and Sigma, 8)

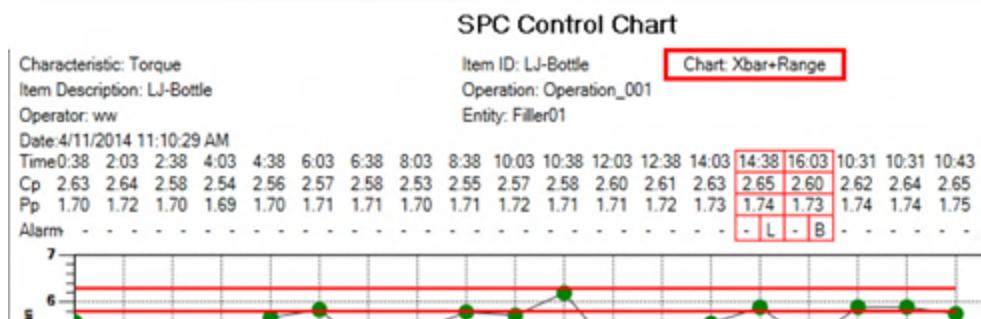
For binary attribute characteristics, you can use the following chart types:

- PercentDefective ( $p$ , 16)
  - NumberDefective ( $np$ , 17)

For counted attribute characteristics, you can use the following chart types:

- NumberofDefectives (c, 19)
  - DefectsperUnit (u, 18)
  - DefectsperMillionOpportunities (DPMO, 20)

The following figure highlights the selected chart type as shown in the chart header area.



You must ensure that the values assigned to chart types match the values in the default\_chart column of the characteristic table. The Default chart type is assigned a value of 0. This is a design-time and a run-time property.

Example code for setting this property is:

```
SpcChartControl1.ChartType = FactMES.Controls.ChartType.PercentDefective;
```

You cannot set this property to Null.

Data Type	Read/Write	Default Value
ChartType	R/W	Default

### **ColorPointsInAlarm Property**

Use the **ColorPointsInAlarm** property to specify whether or not the chart should display a sample point that has violated a control rule using the alarm color. The alarm color is determined by the **AlarmPointColor** properties (see [AlarmPointColor Property](#)).

This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

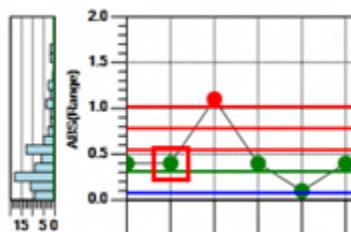
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

## DataPointColor Property

Use the **DataPointColor** property to specify the color used for sample points in the chart graph. This is a design-time and run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure highlights an example data point in green.



You cannot set this property to Null.

Data Type	Read/Write	Default Value
Color	R/W	Green (0, 128, 0)

### **DisplayChartEnabled Property**

Use the **DisplayChartEnabled** property to determine whether or not the **DisplayChart()** method is enabled. This property is set to True if a characteristic is passed to the control. Otherwise, it is set to False. This is a run-time property.

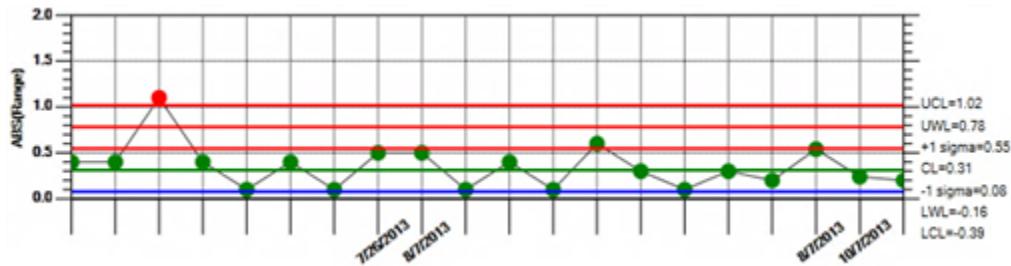
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

#### **DisplayXaxisLabelChanges** Property

Use the **DisplayXaxisLabelChanges** property to specify whether or not to display labels along the x-axis of the chart whenever the sample value changes. For example, if the **XaxisLabel** property is set to WorkOrderID, each time there is a change in the work order ID, an x-axis label will be displayed.

The following figure shows an example of x-axis labels being applied on selected dates when the sample value changed.



This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

This property works with the **DisplayXAxisLabelFrequency** property to determine how frequently labels are displayed along the x-axis.

- If the **DisplayXaxisLabelChanges** property is False, x-axis labels are displayed at the sample value frequency specified by the **DisplayXaxisLabelFrequency** property.
  - If the **DisplayXaxisLabelChanges** property is True, x-axis labels are displayed whenever the x-axis sample value changes and at the sample value frequency specified by the **DisplayXaxisLabelFrequency** property.

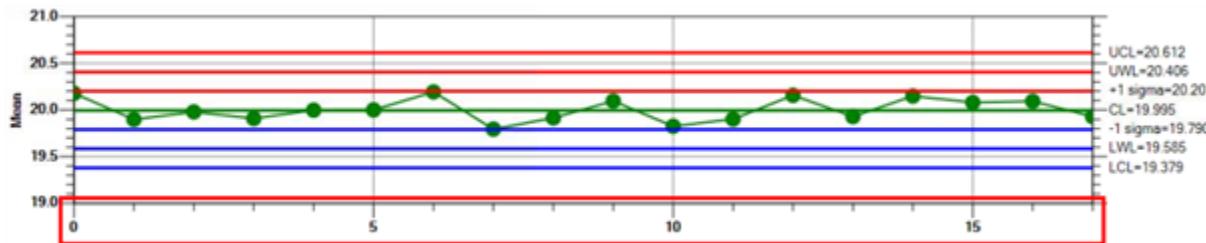
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### DisplayXaxisLabelFrequency Property

Use the **DisplayXaxisLabelFrequency** property to specify the sample value frequency at which labels are displayed along the x-axis of the chart. For example, the default value 5 means that every fifth sample plotted in the SPC Chart will have a label along the x-axis.

The following figure shows an example of x-axis labels being applied at a frequency of every 5 samples.



This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

This property works with the **DisplayXaxisLabelChanges** property to determine how frequently labels are displayed along the x-axis.

- If the **DisplayXaxisLabelChanges** property is False, x-axis labels are displayed at the sample value frequency specified by the **DisplayXaxisLabelFrequency** property.
- If the **DisplayXaxisLabelChanges** property is True, x-axis labels are displayed whenever the x-axis sample value changes and at the sample value frequency specified by the **DisplayXaxisLabelFrequency** property.

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Int32	R/W	5

### EnableCollapsibleToggles Property

Use the **EnableCollapsibleToggles** property to add toggle buttons that allow users to hide areas of the chart and toggle them back on again. See [Toggling Areas of the Chart Window On and Off](#).

This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### EnableZoomToggle Property

Use the **EnableZoomToggle** property to have a zoom toggle button appear on the chart. The zoom toggle button allows users to show a zoom window that can be used to control what areas of the charts appear when they are too wide to be displayed in their entirety. See [Zooming on a Chart](#).

This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### EndTimeFilter Property

Use the **EndTimeFilter** property to filter samples with request time less than or equal to the specified criteria. This property converts the local date/time to UTC standard time. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
Nullable of DateTime	R/W	Null

### EntityIdFilter Property

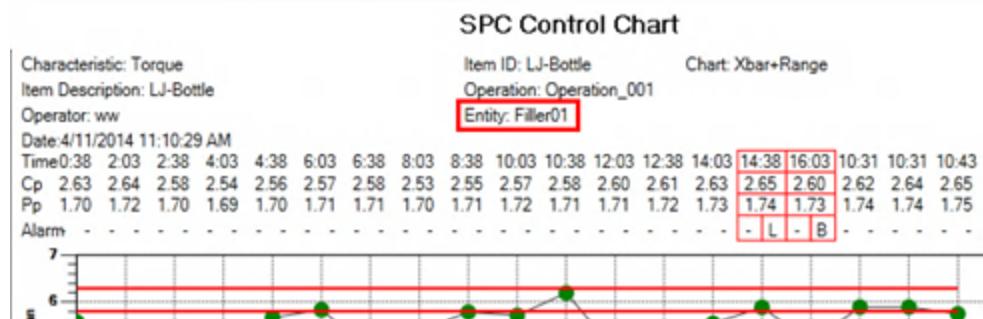
Use the **EntityIdFilter** property to filter samples with entity ID that match the specified criteria. This property will be ignored if the **SiteNameFilter** property or **EntityNameFilter** property are specified. This is a run-time property. You can set this property to Null.

Data Type	Read/Write	Default Value
Nullable of Integer	R/W	Null

### EntityNameFilter Property

Use the **EntityNameFilter** property along with the **SiteNameFilter** property to determine an entity. This property filters samples with entity ID that match the specified criteria. This is a run-time property.

The following figure highlights the specified entity as shown in the chart header area.



You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

## Graph Position Properties

Use the graph position properties to specify settings, as a factor of the total control width or height, that define the left, right, and bottom margins of the SPC Control chart graphic within the control. If the table is shown, it will also adjust based on these position properties. These are design-time and run-time properties.

You can use these properties to reduce white space in the chart display. For example, if the chart does not include frequency histograms on the left (by default, they take up about 20% of the available chart width), you may want to adjust the location of the start (left side) of the graph to be closer to the edge of the control. (For information about not including the histograms, see [ShowPrimaryHistogram Property](#) and [ShowSecondaryHistogram Property](#).)

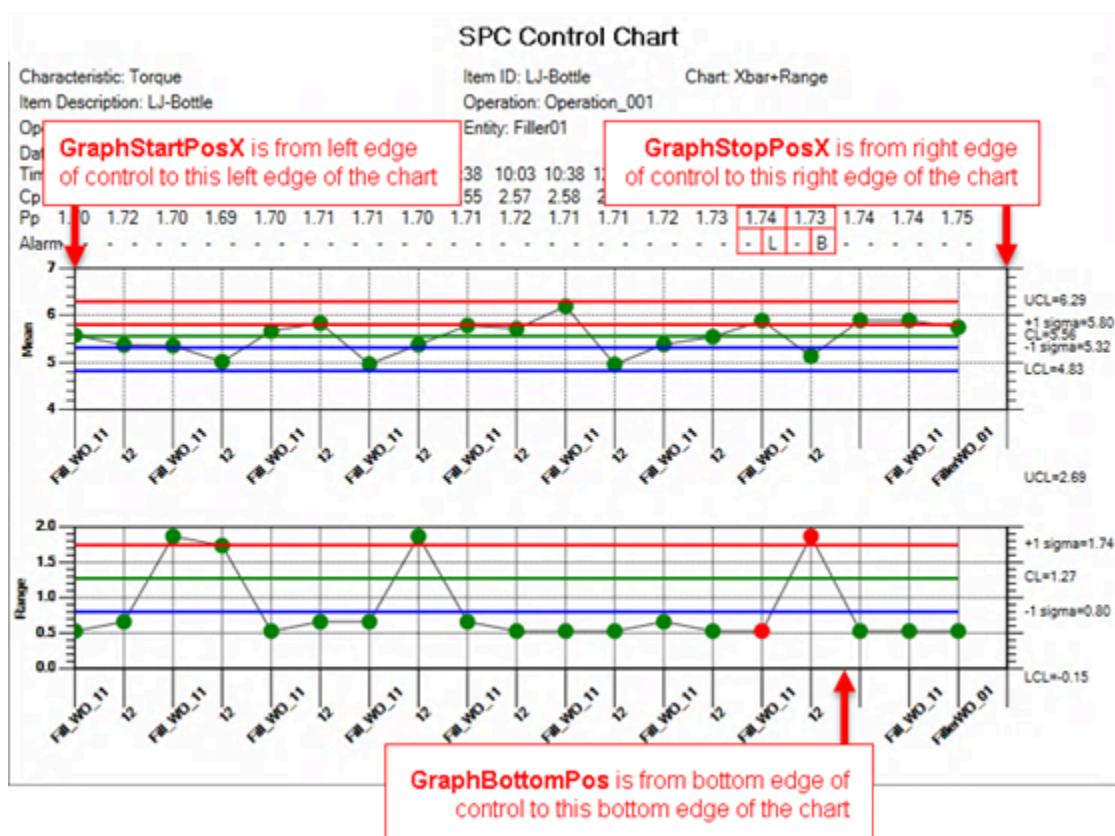
You cannot set these properties to Null.

The available graph position properties are described in the following table. All graph position properties have a range of 0 to 1

Graph Position Property	Description	Data Type	Read/ Write	Default Value
GraphBottomPos	The position of the bottom of the graph, relative to the height of the control.	Double	R/W	0.9
GraphStartPosX	The start position (left side) of the graph, relative to the width of the control.	Double	R/W	0.125
GraphStopPosX	The stop position (right side) of the graph, relative to the width of the	Double	R/W	0.85

Graph Position Property	Description	Data Type	Read/Write	Default Value
	control.			

The following figure indicates to what edges of the graph the position properties apply.



Note that the sides of the graph are considered to begin and end with the grid, and do not take into account labels that might display outside of the graph grid. Therefore, use care when adjusting these settings:

- Too small a value for **GraphStartX** will cause the chart to overlap with the histogram or will cause the values in the table to overlap with the labels.
- Too large a value for **GraphStopPosX** will cause the control line labels to be lost off the right-side of the control.
- Too large a value for **GraphBottomPos** will cause the x-axis labels to be lost off the bottom of the control.

### HeaderLevel Property

Use the **HeaderLevel** property to specify how much information is included in the chart header. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The available levels are:

**None**

Do not include header information in the chart.

## Minimal

Includes the date, characteristic, chart type, and item.

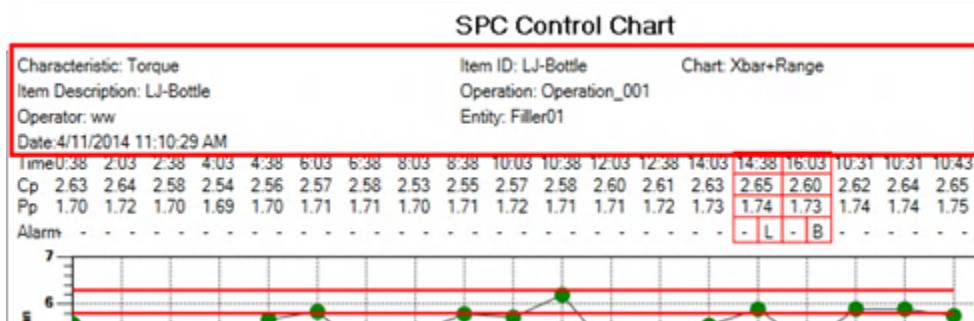
Most

Includes the Minimal information, plus item description, operation, entity, operator, and test equipment.

All

Includes the Most information, plus specification limits, units of measure, and gage.

The following figure shows an example of the header level set to Most.



You cannot set this property to Null.

Data Type	Read/Write	Default Value
ChartHeaderLevel	R/W	Most

## ItemCategoryIdFilter Property

Use the **ItemCategoryIdFilter** property to filter samples with item ID whose item category ID matches the specified criteria. This property will be ignored if the **ItemCategoryNameFilter** property is specified. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
Integer	R/W	Null

## ItemCategoryNameFilter Property

Use the **ItemCategoryNameFilter** property to filter samples with item ID whose item category matches the specified criteria. This is a run-time property.

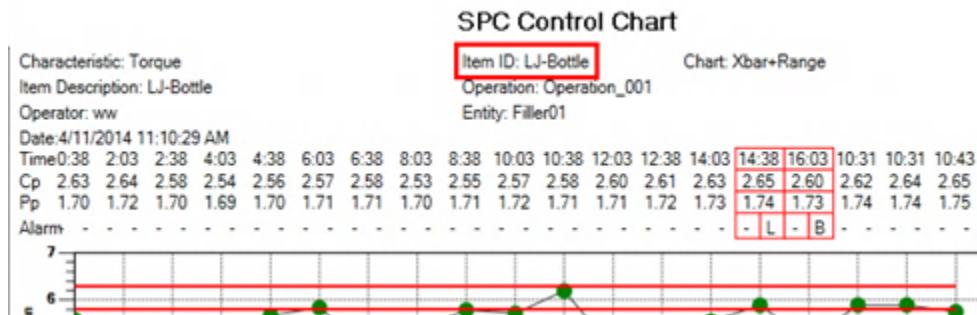
You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### ItemIdFilter Property

Use the **ItemIdFilter** property to filter samples with item ID that match the specified criteria. This is a run-time property.

The following figure highlights the specified item as shown in the chart header area.



You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### LanguageStrings Property

Use the **LanguageStrings** property to provide the SPC Chart control with an object for translating strings. You must use this property to provide the translation object because there is no user logged on to the control. This is a run-time property.

You can pass the translation object to the SPC Chart control in the following ways.

If your InTouch application is using other MES controls that require a user login, use the following script to use the logged in user's translation object:

```
dim clienSession as aaFactMES.aaClientSession;
dim result as aaFactMES.Result;
result = aaFactMES.ClientSession.GetInstance();
if (result.Exception <> null) then
    ' Log or display an error
else
    clientSession = result.Value;
    if (clientSession.curUser <> null) then
        spcChartControl.LanguageStrings =
            clientSession.curUser.LangStrings;
    else
        spcChartControl.LanguageStrings = null;
    endif;
endif;
```

If your InTouch application is not using other MES controls, use the following script to get a language translation

object:

```

dim clientsession as aaFactMES.aaClientSession;
dim result as aaFactMES.result;
dim languageId as integer;
dim langStrings as aaFactMES.aaLangStrings;
' Set the language ID to your user's language. This must be a valid language ID in the MES
database.
languageId=1000;
result=aaFactMES.aclientsession.GetInstance();
if (result.Exception<>null) then
    LogMessage(result.Exception.Message);
else
    clientsession=result.value;
    result = clientsession.GetLangStringsObject(languageId);
    if (result.Exception<>null) then
        LogMessage(result.Exception.Message);
    else
        langStrings = result.Value;
        SpcChartControl1.LanguageStrings=langStrings.ClientAPIClass;
    endif;
endif;

```

This script must be called before calling the **DisplayChart()** method. If you want to change the language after calling the **DisplayChart()** method, then you will have to call **DisplayChart()** again before you will see the language change.

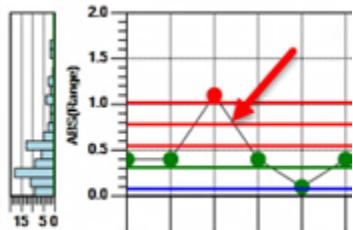
You can set this property to Null. If the **LanguageStrings** property is set to Null, the strings are not translated. Instead, the strings are displayed in the language used by the developer.

Data Type	Read/Write	Default Value
ILanguageStrings	R/W	Null

### LineAttributeColor Property

Use the **LineAttributeColor** property to specify the color used for plot lines in the graph. This is a design-time and run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure highlights a plot line.



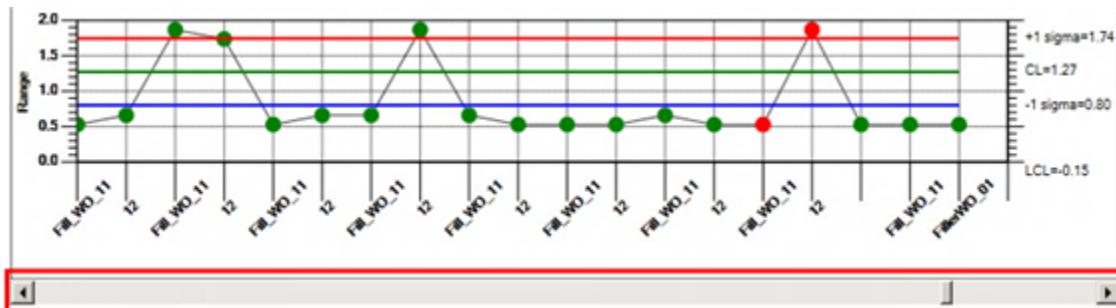
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Color	R/W	Green (0, 128, 0)

### NumberOfPointsFilter Property

Use the **NumberOfPointsFilter** property to specify the maximum number of data points that can be plotted on the chart. If the **PointsPerPage** property value is less than the **NumberOfPointsFilter** value, a scroll bar appears below the chart to indicate that there are additional points to plot. This is a run-time property.

The following figure shows a scroll bar appearing in the control, indicating that the number of points per page is less than the number of total points in the chart.



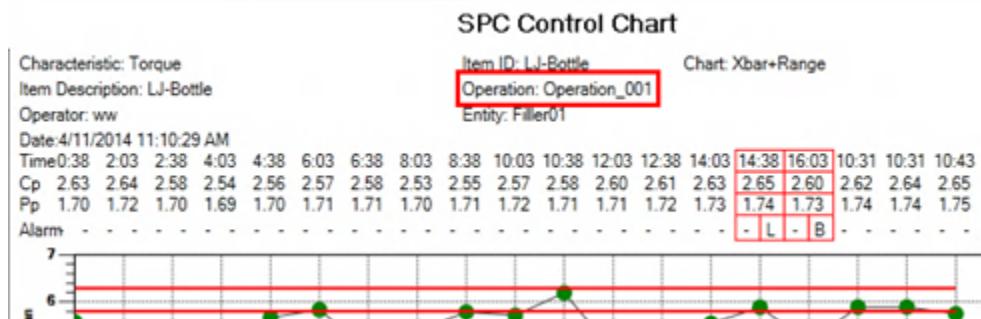
You can set this property to Null.

Data Type	Read/Write	Default Value
Nullable of Integer	R/W	Null

### OperationIdFilter Property

Use the **OperationIdFilter** property to filter samples with operation ID that match the specified criteria. This property must be used in conjunction with the **ProcessIDFilter** property. This is a run-time property.

The following figure highlights the specified operation as shown in the chart header area.



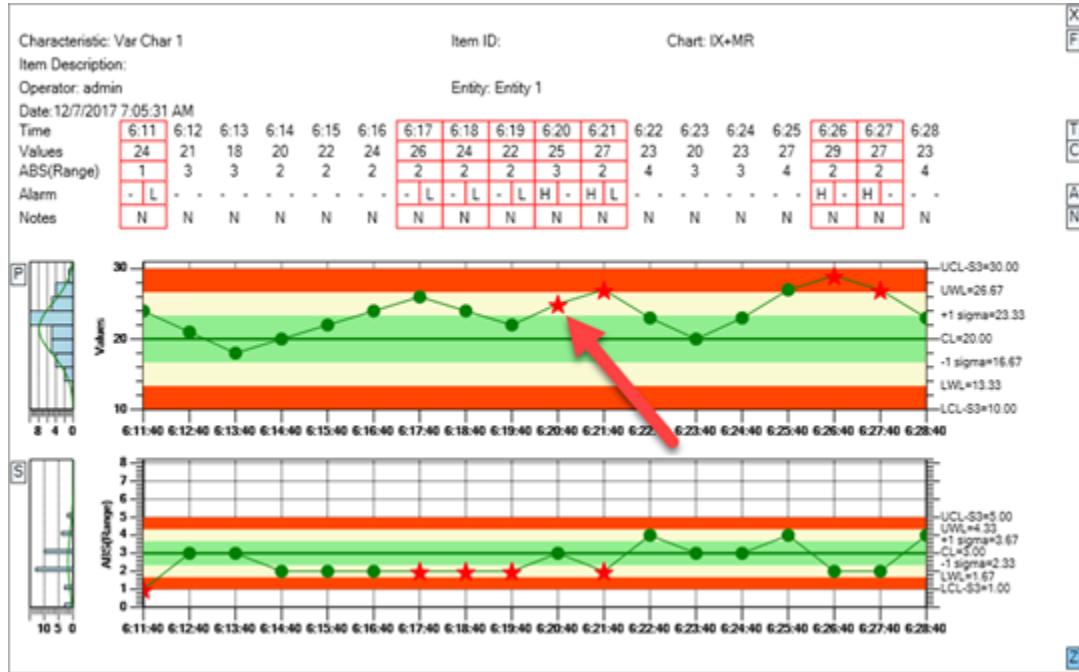
You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

## OutOfLimitsPointSymbol Property

Use the **OutOfLimitsPointSymbol** property to specify the shape to be used for sample points that violate a control rule. To specify the size of the shape, see [OutOfLimitsPointSize Property](#).

The following figure points to an example alarm point using a star shape.



Valid shape values are:

- Circle
- Cross
- Diamond
- DownTriangle
- HorizontalBar
- Line
- Plus
- Square
- Star
- UpTriangle
- VerticalBar

This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The symbol used to plot a data point in the chart is a fixed color circle. If the alarm highlighting for chart symbols is turned on (the default; see [ColorPointsInAlarm Property](#)), the shape of a sample point that violates a control rule will change to the shape defined by this property.

Example code for setting this property is:

```
SpcChartControl1.OutOfLimitsPointSymbol = FactMES.Controls.SymbolType.Star;
```

You cannot set this property to Null.

Data Type	Read/Write	Default Value
SymbolType	R/W	Circle

### OutOfLimitsPointSymbolSize Property

Use the **OutOfLimitsPointSymbolSize** property to specify the size of the shape (in points) to be used for sample points that violate a control rule. To specify the shape to use, see [OutOfLimitsPointSymbol Property](#).

Reasonable shape sizes range from 1 to 50.

This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The size used to plot a data point in the chart is fixed at 10 pixels. If the alarm highlighting for chart symbols is turned on (the default; see [ColorPointsInAlarm Property](#)), the size of a sample point that violates a control rule will change to the size defined by this property.

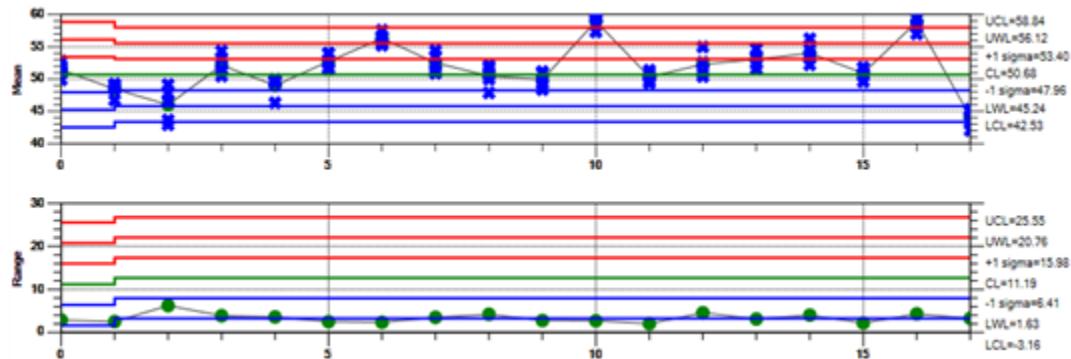
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Int	R/W	10

### PlotPrimaryMeasurementValues Property

Use the **PlotPrimaryMeasurementValues** property to specify whether or not to display the measurement values for each point, along with the average value point, on the primary chart. This property affects only the charts that display an average of multiple measurements within a sample such as an XBar Range chart. This property can be used with the **ShowSpecLimits** property to see if any individual values exceed the specification limits. This is a design-time and a run-time property.

The following figure shows measurement values displayed as blue Xs.



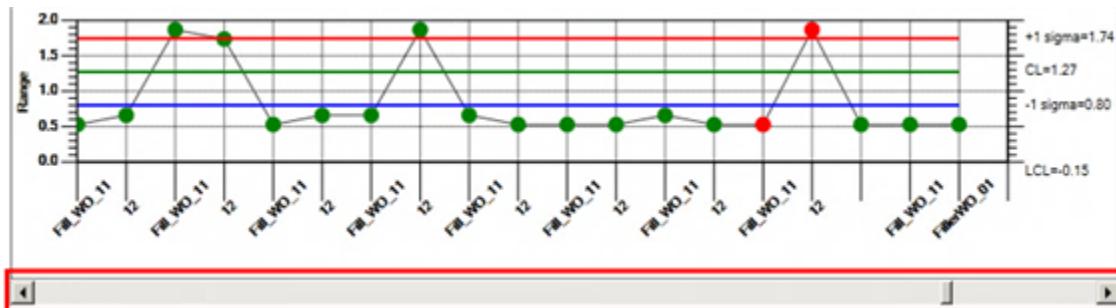
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### PointsPerPage Property

Use the **PointsPerPage** property to specify the number of points that can be displayed on the graph at a given time. If the **PointsPerPage** value is less than the **NumberOfPointsFilter** value, a scroll bar appears below the chart to indicate that there are additional points to plot. This is a design-time and a run-time property.

The following figure shows a scroll bar appearing in the control, indicating that the number of points per page (20) is less than the number of total points in the chart.



You cannot set this property to Null.

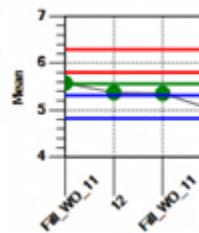
Data Type	Read/Write	Default Value
Int32	R/W	18

Note that the number of decimals that have been set in MES Client for a characteristic's results can cause the data displayed in the table to overlap, depending on the number of points per page that has been set. If this is occurring, either reduce the number of decimals or reduce the number of points per page.

### PrimaryChartMinY and PrimaryChartMaxY Properties

Use the **PrimaryChartMinY** and **PrimaryChartMaxY** properties to set the scale of the y-axis on the primary chart. These are design-time and run-time properties. However, changing the values will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows the minimum and maximum values set at 4 and 7.



If no value is supplied for one or both of these properties, the values will be calculated from the sample result data.

You can set this property to Null.

Data Type	Read/Write	Default Value
Nullable of Integer	R/W	Null

### ProcessIdFilter Property

Use the **ProcessIdFilter** property to filter samples with process ID that match the specified criteria. This property should be used in conjunction with the **OperationIDFilter** property. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### RefreshRate Property

Use the **RefreshRate** property to specify the polling rate, in minutes, to check the MES database for new data. You can disable this property by setting the value of the polling rate to zero. This is a design-time and a run-time property. However, changing the value will not update the chart refresh rate until the next time the **DisplayChart()** method is called.

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Int32	R/W	5 minutes

### ResetFiltersEnabled Property

Use the **ResetFiltersEnabled** property to determine whether or not the filter properties can be reset. This property is set to True if a characteristic is passed to the control. Otherwise, it is set to False. This is a run-time property.

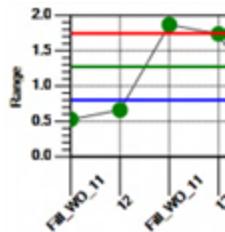
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### SecondaryChartMinY and SecondaryChartMaxY Properties

Use the **SecondaryChartMinY** and **SecondaryChartMaxY** properties to set the scale of the y-axis on the secondary chart. These are design-time and run-time properties. However, changing the values will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows the minimum and maximum values set at 0.0 and 2.0.



If no value is supplied for one or both of these properties, the values will be calculated from the sample result data.

You can set this property to Null.

Data Type	Read/Write	Default Value
Nullable of Integer	R/W	Null

### SegmentRequirementIdFilter Property

Use the **SegmentRequirementIdFilter** property to filter samples that contain the specified string in the segment requirement ID. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### SegmentResponseIdFilter Property

Use the **SegmentResponseIdFilter** property to filter samples that contain the specified string in the segment response ID. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### ShowAlarmIndicators Property

Use the **ShowAlarmIndicators** property to specify whether or not the chart should show the alarm indicators row in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

If set, an alarm indicator row will be added to the table that includes one or two of the following indicators above each sample point in the chart. When two indicators are used, the first is for the primary chart and the second is for the secondary chart.

- -, if no control rule violation occurred.
- H, if the violation occurred above the center line

- L, if the violation occurred below the center line
- B, if the violation occurred on both sides of the center line
- T, if the violation is a trend and is not dependent on the position of the points relative to the center line

The following figure highlights indicators in the Alarm row of the table:

SPC Control Chart																		
Characteristic: Volume					Item ID:					Chart: Xbar+Range								
Item Description:										Specifications: 10, 10					UOM: fluid ounce			
Operator: SERVERMES\Administrator					Entity: Capper_004					Zero Equals: zero								
Date: 10/7/2016 4:53:47 PM	Time	20:32	17:34	16:49	11:33	11:33	13:33	13:33	15:33	15:33	12:46	12:46	12:46	14:46	14:46	14:46	14:46	
Sample #0	50.95	49.25	47.79	50.46	49.55	51.73	57.58	52.27	47.88	49.92	57.30	50.34	50.38	52.32	53.74	51.77	58.55	45.31
Sample #1	49.90	48.74	49.17	53.16	49.94	51.51	56.67	50.91	49.98	49.24	58.36	51.37	50.98	53.29	53.32	51.78	58.07	44.96
Sample #2	52.80	46.72	46.54	54.35	46.33	52.41	56.41	51.40	51.71	48.38	59.32	50.90	52.50	51.57	52.20	49.60	56.98	45.18
Sample #3	52.10	49.18	43.68	51.21	49.74	53.97	55.23	53.59	52.11	50.97	59.74	49.73	52.57	53.44	54.56	50.97	59.45	43.38
Sample #4	51.44	48.42	42.92	51.52	49.50	54.03	55.69	54.43	50.72	51.17	60.02	49.34	54.97	54.70	56.26	50.46	61.32	42.03
Mean	51.44	48.46	46.02	52.14	49.01	52.73	56.32	52.52	50.48	49.93	58.95	50.34	52.28	53.06	54.01	50.92	58.88	44.17
Range	2.90	2.53	6.25	3.89	3.61	2.52	2.35	3.52	4.23	2.79	2.71	2.03	4.59	3.14	4.06	2.19	4.33	3.27
Sum	257.18	242.30	230.09	260.70	245.06	263.65	281.59	262.60	252.40	249.67	294.74	251.69	261.42	265.32	270.07	254.59	294.38	220.86
Alarm	-	-	-	-	-	L	-	L	-	L	-	L	H	L	-	L	-	L
Notes	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowCalculatedValues Property

Use the **ShowCalculatedValues** property to specify whether or not to show the upper and lower chart plotted value rows in the table. The names of the rows will change depending on the type of chart being plotted. For example, the top chart row label will be MA when plotting a Moving Average chart. X Bar charts will also include a SUM row.

This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows an example of calculated values rows in a table.

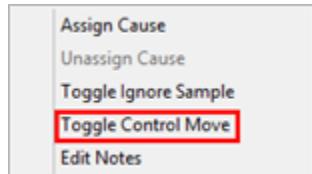
SPC Control Chart																		
Characteristic: Volume					Item ID:					Chart: Xbar+Range								
Item Description:										Specifications: 10, 10					UOM: fluid ounce			
Operator: SERVERMES\Administrator					Entity: Capper_004					Zero Equals: zero								
Date: 10/7/2016 4:58:03 PM	Time	20:32	17:34	16:49	11:33	11:33	13:33	13:33	15:33	15:33	12:46	12:46	12:46	14:46	14:46	14:46	14:46	
Mean	51.44	48.46	46.02	52.14	49.01	52.73	56.32	52.52	50.48	49.93	58.95	50.34	52.28	53.06	54.01	50.92	58.88	44.17
Range	2.90	2.53	6.25	3.89	3.61	2.52	2.35	3.52	4.23	2.79	2.71	2.03	4.59	3.14	4.06	2.19	4.33	3.27
Sum	257.18	242.30	230.09	260.70	245.06	263.65	281.59	262.60	252.40	249.67	294.74	251.69	261.42	265.32	270.07	254.59	294.38	220.86
No. Insp.	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Alarm	-	-	-	-	-	L	-	L	-	L	-	L	H	L	-	L	-	L

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowControlMove Property

Use the **ShowControlMove** property to specify whether or not to display the **Toggle Control Move** menu option in the sample point context menu (see the figure below and [Marking a Sample Point as a Control Move](#)). This is a design-time and a run-time property.



This property will be ignored if the **UserId** property is set to any value except Null. If the **UserId** property is set, then the availability of the **Toggle Control Move** menu item will depend on the user's privilege settings. See [UserId Property](#).

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowCpkValues Property

Use the **ShowCpkValues** property to specify whether or not to display the Cpk row in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

For Cpk values to be calculated, the characteristic must have upper and lower specification limits.

Depending on the filters applied to the chart and the **NumberOfPointsFilter** property, the final Cpk value in the chart might not match the value in the MES database Stats table (also reflected in the Sample Recording Object).

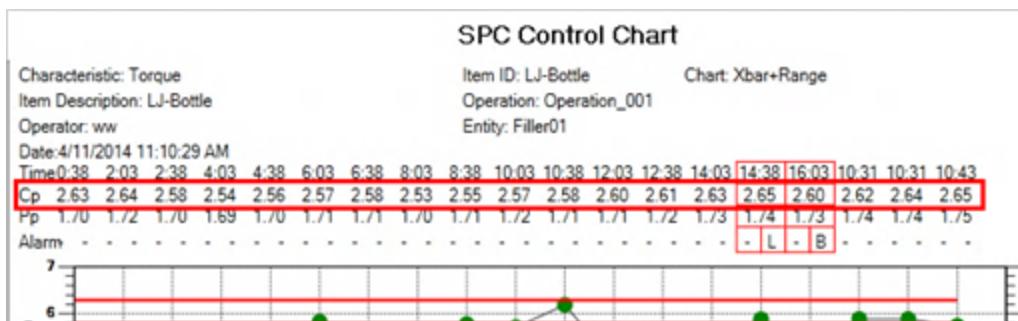
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### ShowCpValues Property

Use the **ShowCpValues** property to specify whether or not to display the Cp row in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows the Cp row included in the table.



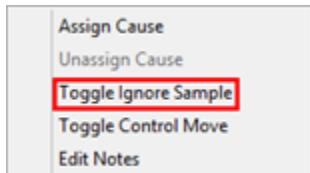
For Cp values to be calculated, the characteristic must have upper and lower specification limits.

Depending on the filters applied to the chart and the **NumberOfPointsFilter** property, the final Cp value in the chart might not match the value in the MES database Stats table (also reflected in the Sample Recording Object). You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

## ShowIgnoreSample Property

Use the **ShowIgnoreSample** property to specify whether or not to display the **Toggle Ignore Sample** menu option in the sample point context menu (see the figure below and [Marking a Sample Point to Be Ignored in Sample Calculations](#)). This is a design-time and a run-time property.



This property will be ignored if the **UserId** property is set to any value except null. If the **UserId** property is set, then the availability of the **Toggle Ignore Sample** menu item will depend on the user's privilege settings. See [UserId Property](#).

You cannot set this property to Null.

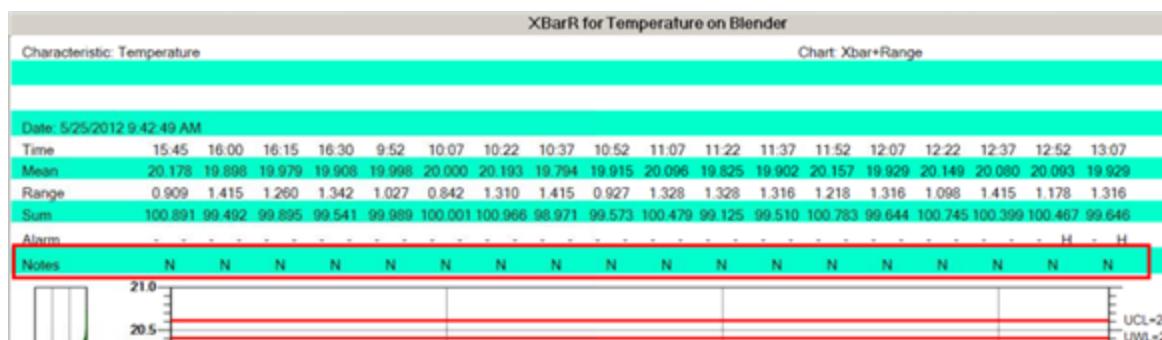
Data Type	Read/Write	Default Value
Boolean	R/W	True

## ShowNotesIndicators Property

Use the **ShowNotesIndicators** property to specify whether or not to display the notes indicator row in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The Notes row will display Y if the sample point has a note and N if it does not have a note. Notes can be either entered by a user (see [Adding a Note to a Sample Point](#)) or because a cause has been assigned to the sample point (the cause description is displayed as a note).

The following figure shows the Notes row included in the table.



You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowPpkValues Property

Use the **ShowPpkValues** property to specify whether or not to display the Ppk row in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

For Ppk values to be calculated, the characteristic must have upper and lower specification limits.

Depending on the filters applied to the chart and the **NumberOfPointsFilter** property, the final Ppk value in the chart might not match the value in the MES database Stats table (also reflected in the Sample Recording Object).

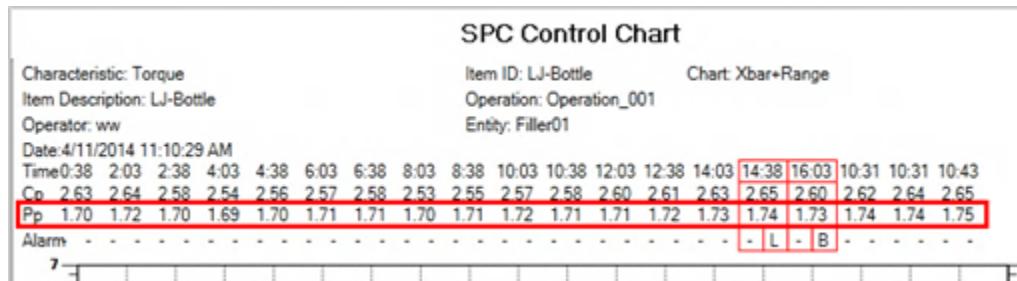
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### ShowPpValues Property

Use the **ShowPpValues** property to specify whether or not to display the Pp row in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows the Pp row included in the table.



For Pp values to be calculated, the characteristic must have upper and lower specification limits.

Depending on the filters applied to the chart and the **NumberOfPointsFilter** property, the final Pp value in the

chart might not match the value in the MES database Stats table (also reflected in the Sample Recording Object). You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### ShowPrimaryChart Property

Use the **ShowPrimaryChart** property to specify whether or not to display the primary chart. This is a design-time and a run-time property. The following table summarizes the chart types and the corresponding primary charts:

Chart Type	Chart
X-Bar R	Mean
X-Bar Sigma	Mean
IX & MR	Individual
MA & MR	Moving Average
MA & MS	Moving Average
p-chart	Fraction Defective
np-chart	Number Defective
c-chart	Number of Defects
u-chart	Number of Defects Per Unit
DPMO	Number of Defects Per Million Opportunities

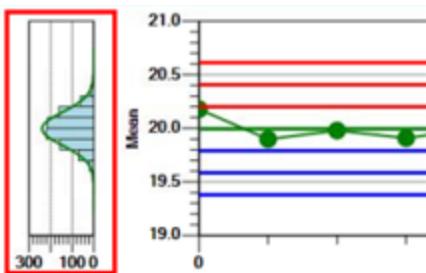
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowPrimaryHistogram Property

Use the **ShowPrimaryHistogram** property to specify whether or not to display the primary histogram beside the primary chart. The primary histogram is displayed only if the **ShowPrimaryChart** property is set to True. This is a design-time and a run-time property.

The following figure highlights the primary histogram included with the primary chart.



You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowResultValues Property

Use the **ShowResultValues** property to specify whether or not to display one or more result values rows in the table. For example, an X Bar R chart with five individual results per plot point would show five additional rows labeled **Sample #x** above the calculated values rows. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows example result value rows in the table.

SPC Control Chart																			
Characteristic: Volume					Item ID:					Chart: Xbar+Range					Specifications: 10, 10				
Item Description:					Entity: Capper_004														
Operator: SERVERMES\Administrator Date: 10/7/2016 4:53:47 PM																			
Time	20.32	17.34	16.49	11.33	11.33	13.33	13.33	15.33	15.33	15.33	12.46	12.46	12.46	12.46	14.46	14.46	14.46	14.46	14.46
Sample #0	50.95	49.25	47.79	50.46	49.55	51.73	57.58	52.27	47.88	49.92	57.30	50.34	50.38	52.32	53.74	51.77	58.55	45.31	
Sample #1	49.90	48.74	49.17	53.16	49.94	51.51	56.67	50.91	49.98	49.24	58.36	51.37	50.98	53.29	53.32	51.78	58.07	44.96	
Sample #2	52.80	46.72	46.54	54.35	46.33	52.41	56.41	51.40	51.71	48.38	59.32	50.90	52.50	51.57	52.20	49.60	56.98	45.18	
Sample #3	52.10	49.18	43.68	51.21	49.74	53.97	55.23	53.59	52.11	50.97	59.74	49.73	52.57	53.44	54.56	50.97	59.45	43.38	
Sample #4	51.44	48.42	42.92	51.52	49.50	54.03	55.69	54.43	50.72	51.17	60.02	49.34	54.97	54.70	56.26	50.46	61.32	42.03	
Mean	51.44	48.46	46.02	52.14	49.01	52.73	56.32	52.52	50.48	49.93	58.95	50.34	52.28	53.06	54.01	50.92	58.88	44.17	
Range	2.90	2.53	6.25	3.89	3.61	2.52	2.35	3.52	4.23	2.79	2.71	2.03	4.59	3.14	4.06	2.19	4.33	3.27	
Sum	257.18	242.30	230.09	260.70	245.06	263.65	281.59	262.60	252.40	249.67	294.74	251.69	261.42	265.32	270.07	254.59	294.38	220.86	
Alarm	-	-	-	-	L	-	L	-	L	-	L	H	L	-	L	-	L	-	L
Notes	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### ShowSampleSizes Property

Use the **ShowSampleSizes** property to specify whether or not to display the sample sizes rows in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows an example sample size row in the table.

**SPC Control Chart**

Characteristic: Volume	Item ID:	Chart: Xbar+Range
Item Description:		Specifications: 10, 10
Operator: SERVERMES\Administrator	Entity: Capper_004	UOM: fluid ounce
Date: 10/7/2016 4:58:03 PM		Zero Equals: zero
Time	20.32 17.34 16.49 11.33 11.33 13.33 13.33 15.33 15.33 15.33 12.46 12.46 12.46 14.46 14.46 14.46	
Mean	51.44 48.46 46.02 52.14 49.01 52.73 56.32 52.52 50.48 49.93 58.95 50.34 52.28 53.06 54.01 50.92 58.88 44.17	
Range	2.90 2.53 6.25 3.89 3.61 2.52 2.35 3.52 4.23 2.79 2.71 2.03 4.59 3.14 4.06 2.19 4.33 3.27	
Sum	257.18 242.30 230.09 260.70 245.06 263.65 281.59 262.60 252.40 249.67 294.74 251.69 261.42 265.32 270.07 254.59 294.38 220.86	
No. Insp.	5 5	
Alarm	- - - - - L - L - L - L - L H L - L - L - L - L H L - L	

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

**ShowSecondaryChart Property**

Use the **ShowSecondaryChart** property to specify whether or not to display the secondary chart. This is a design-time and a run-time property. The following table summarizes the chart types and the corresponding secondary charts:

Chart Type	Chart
X-Bar R	Range
X-Bar Sigma	Sigma
IX & MR	Moving Range
MA & MR	Moving Range
MA & MS	Moving Sigma
p-chart	N/A
np-chart	N/A
c-chart	N/A
u-chart	N/A
DPMO	N/A

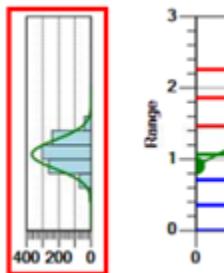
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowSecondaryHistogram Property

Use the **ShowSecondaryHistogram** property to specify whether or not to display the secondary histogram beside the secondary chart. The secondary histogram is displayed only if the **ShowSecondaryChart** property is set to True. This is a design-time and a run-time property.

The following figure highlights the secondary histogram included with the secondary chart.



You cannot set this property to Null.

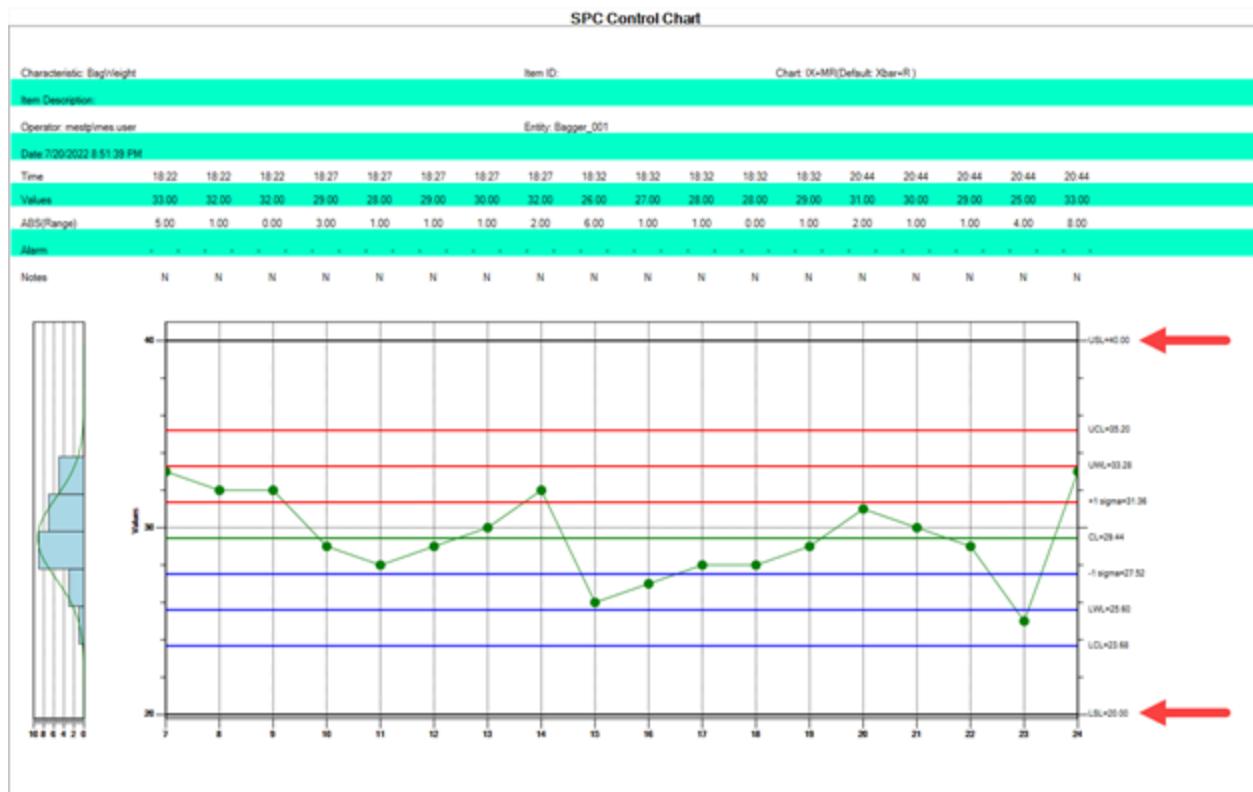
Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowSpecLimits Property

Use the **ShowSpecLimits** property to specify whether or not to display the specification limits in the primary chart. The specification limit indications are displayed only if the **ShowSpecLimits** property is set to True. This is a design-time and a run-time property.

Specification limits apply to individual values and not the mean that is plotted for XBar charts. Showing the specification limits can cause the chart to auto-scale so much that it is difficult to view the plotted points, especially with large sample sizes. This property can be used with the **PlotPrimaryMeasurementValues** property to see if any individual value is outside specification limits (which is not an SPC control rule violation/alarm indicator).

The following figure highlights the specification limit indications with the primary chart.



You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### ShowTable Property

Use the **ShowTable** property to specify whether or not to display the table in the chart. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

When this property is set to false, the following rows will not be shown in the data table above the chart graph:

- All Header rows
- Time row
- Individual result row
- Calculated Values row
- Sample Size row

However, if the following properties are enabled, their rows will still be shown in the table even if the **ShowTable** property is set to False:

- Notes
- Alarm

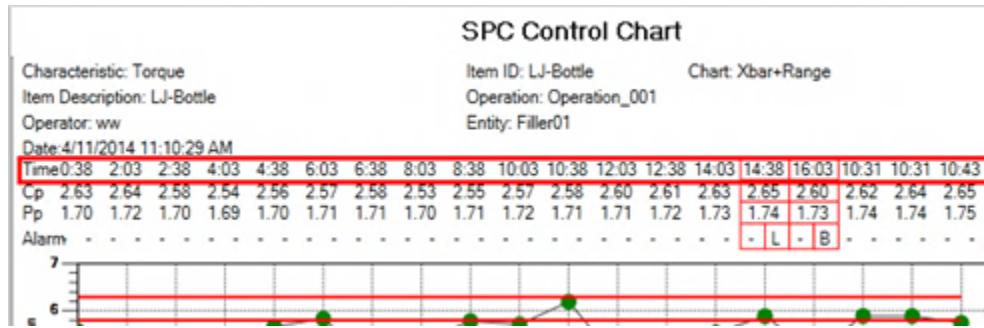
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowTimes Property

Use the **ShowTimes** property to specify whether or not to display the sample request time row in the table. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The following figure shows the Time row included in the table.



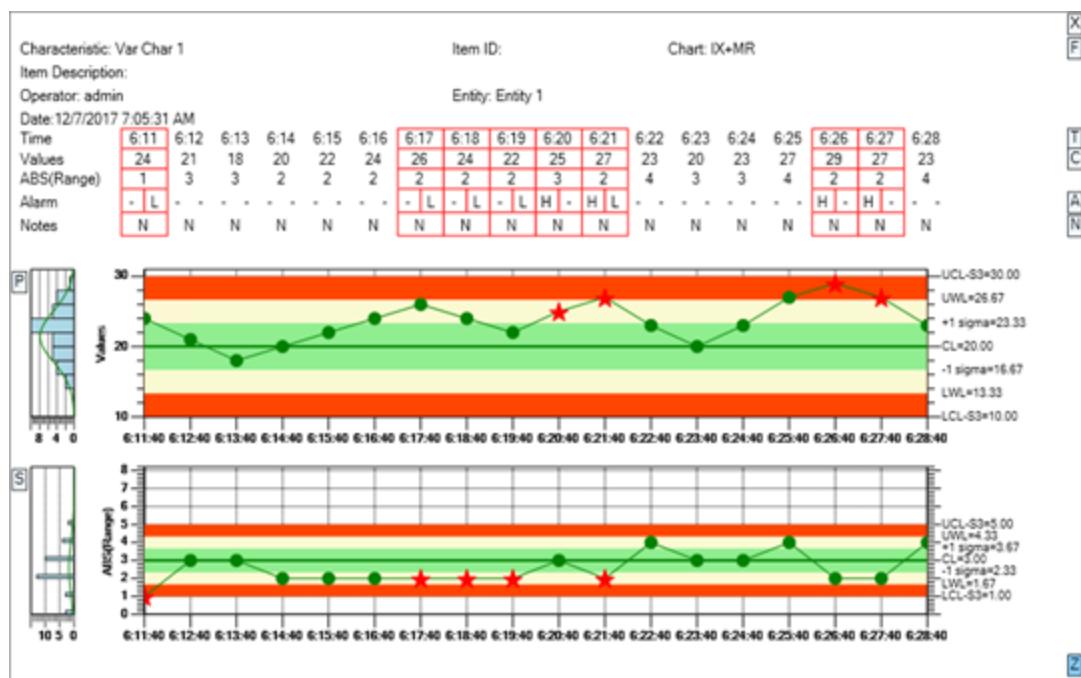
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### ShowZones Property

Use the **ShowZones** property to have the chart color coded into three zones corresponding to the number of standard deviations from the center line.

- The inner zone between +1 and -1 standard deviation shows in green and is enabled whenever a rule is enabled that uses the 1 standard deviation limit.
- The second zone is between +1 and +2 standard deviations and between -1 and -2 standard deviations and shows in yellow. It is enabled when there is a rule enabled that uses the 2 standard deviation limit (often referred to as the warning limit).
- The final outer zone is between +2 and +3 standard deviations and between -2 and -3 standard deviations and shows in red. This zone is enabled when the out-of-control rule is enabled.



If one or more of the zones are not enabled, the next level zone will fill in the missing zone's area. For example, if the out-of-control limit rule is the only rule applied to a chart and ShowZones is enabled, the entire area between the control limits will be colored red.

This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

You cannot set this property to Null.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### SiteNameFilter Property

Use the **SiteNameFilter** property along with the **EntityNameFilter** property to determine an entity. This property filters samples with entity ID that match the specified criteria. This is a run-time property.

You can set this property to Null, only if sites are not used.

Data Type	Read/Write	Default Value
String	R/W	Null

### SpareNFilter Properties

Use the **Spare1Filter** through **Spare4Filter** properties to filter samples that contain the specified string in the spare1 through spare4 columns of the sample table. These are run-time properties.

You can set these properties to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

## StartTimeFilter Property

Use the **StartTimeFilter** property to filter samples with request time greater than or equal to the specified criteria. This property converts the local date/time to UTC standard time. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
Nullable of DateTime	R/W	Null

## TableAlarmEmphasis Property

Use the **TableAlarmEmphasis** property to specify how to display alarm indicators in the table for sample points that violate a control rule. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The possible alarm highlight values are:

None

Alarm conditions are not indicated in the table.

Text

The text appears in the alarm color.

## Outline

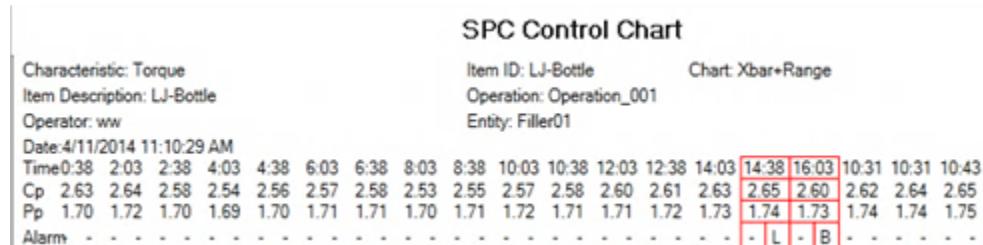
The cells in the table are outlined in the alarm color.

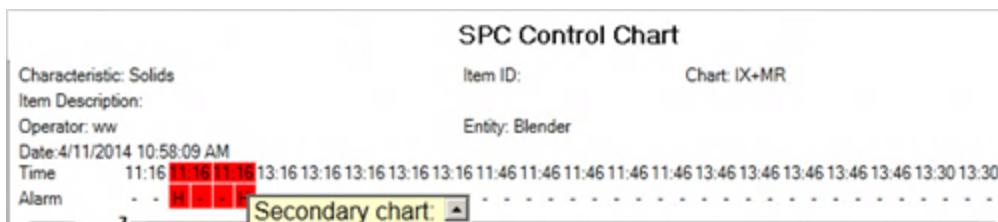
Bar

The cells in the table are filled in with the alarm color.

The alarm color is determined by the **AlarmPointColor** property; see [AlarmPointColor Property](#).

The following figures shows the table alarm emphasis for the outline and bar highlight types.





You cannot set this property to Null.

Data Type	Read/Write	Default Value
AlarmHighlight	R/W	None

### TableBackgroundColor Property

Use the **TableBackgroundColor** property to specify the color used for the table background. This is a design-time and a run-time property.

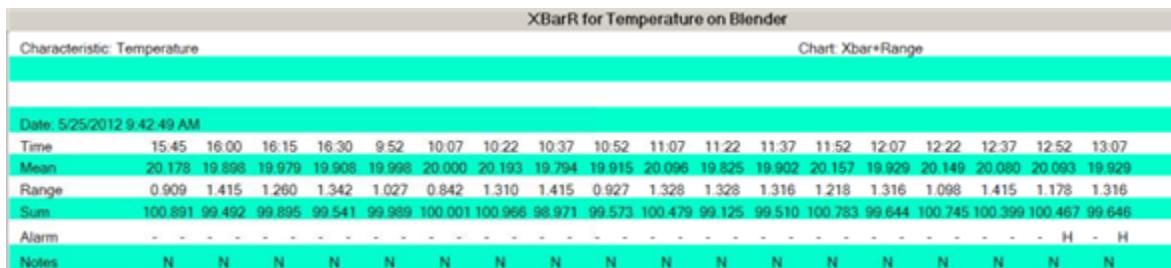
You cannot set this property to Null.

Data Type	Read/Write	Default Value
Color	R/W	White (255, 255, 255)

### TableStripeColor Properties

Use the **TableStripeColor** properties to specify the color used for alternating rows in the table. The color for the other rows will be the table background color. This is a design-time and a run-time property.

The following figure shows the table stripes set to cyan. The table background color is set to white.



You cannot set this property to Null.

Data Type	Read/Write	Default Value
Color	R/W	Cyan (0, 255, 204)

### UserId Property

Use the **UserId** property to specify the MES user. The user's privileges will determine if the sample point context menu will enable the user to mark samples as a control move or to be ignored in calculations. This is a design-time and a run-time property.

If this property is set to Null, access to privileged actions will either be controlled by other properties (see [ShowControlMove Property](#) and [ShowIgnoreSample Property](#)) or access will be denied. If a non-existent user is supplied, access to privileged actions will be denied.

Data Type	Read/Write	Default Value
String	R/W	Null

### WorkOrderIdFilter Property

Use the **WorkOrderIdFilter** property to filter samples that contain the specified string in the work order ID. This is a run-time property.

You can set this property to Null.

Data Type	Read/Write	Default Value
String	R/W	Null

### XAxisLabel Property

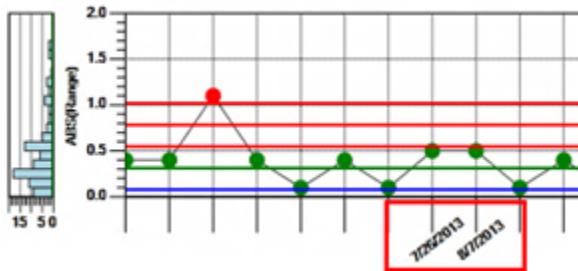
Use the **XAxisLabel** property to specify the text label to use for the sample points on the x-axis of the chart graph. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

The possible values for this property are:

- Date
- DateTime
- EntityName
- Equipment
- FrequencyName
- Item
- LotNumber
- OperationId
- PlanName
- PulledBy
- PulledByDate
- QMSpecificationName
- SampleName
- SampleNumber (Default value)
- SampleSpare1
- SampleSpare2
- SampleSpare3
- SampleSpare4

- SegmentRequirementId
- SegmentResponseId
- SubLotNumber
- Time
- VerifiedBy
- WorkOrderId

The following figure shows the label set to Date.



You cannot set this property to Null.

Data Type	Read/Write	Default Value
ChartXAxisLabel	R/W	SampleNumber

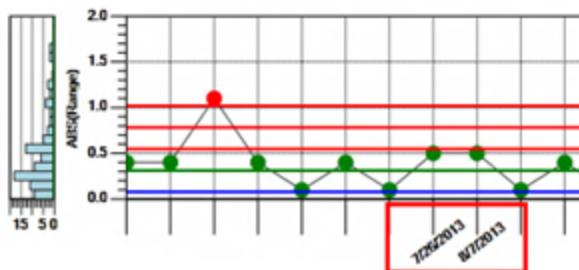
### XAxisLabelRotation Property

Use the **XAxisLabelRotation** property to specify the angle of rotation value (in degrees) that should be applied to x-axis labels. This is a design-time and a run-time property. However, changing the value will not update the chart until the next time the chart is refreshed or the **DisplayChart()** method is called.

Valid values behave as follows:

- **Null** results in the label being at 0° (horizontal text with a direction from left to right) unless the labels will overlap, in which case the appropriate angle will be calculated automatically.
- **0** results in fixed horizontal text. Labels will not be rotated if they overlap.
- **Positive values** rotate the labels counterclockwise. For example, **90** results in vertical text turned 90° counterclockwise (text direction is bottom to top).
- **Negative values** rotate the labels clockwise. For example, **-90** results in vertical text turned 90° clockwise (text direction is top to bottom).

The following figure shows the label rotated using a value of **45** (that is, 45° counterclockwise).



Data Type	Read/Write	Default Value
Int32	R/W	Null

## Methods of the SPC Chart Control

This section describes the methods of the SPC Chart control. The SPC Chart control does not share any common methods with the other controls.

### ClearFilters() Method

Use the **ClearFilters()** method to clear the data on the chart and to set the value of the following filter properties to Null:

- **SiteNameFilter**
- **EntityNameFilter**
- **EntityIdFilter**
- **ItemIdFilter**
- **ItemCategoryIdFilter**
- **ItemCategoryNameFilter**
- **WorkOrderIdFilter**
- **OperationIdFilter**
- **ProcessIdFilter**
- **SegmentRequirementIdFilter**
- **SegmentResponseIdFilter**
- **StartTimeFilter**
- **EndTimeFilter**
- **NumberOfPointsFilter**
- **Spare1Filter**
- **Spare2Filter**
- **Spare3Filter**
- **Spare4Filter**

## Syntax

```
SPCChartControl1.ClearFilters();
```

### DisplayChart() Method

Use the **DisplayChart()** method to fetch the filtered data and display the chart. If this method is called without passing a characteristic, the control displays an appropriate error message.

## Syntax

```
SPCChartControl1.DisplayChart();
```

### ResetFilters() Method

Use the **ResetFilters()** method to set the value of the following filter properties to the most recent sample result of the characteristic:

- **EntityIdFilter**
- **ItemIdFilter**
- **WorkOrderIdFilter**
- **OperationIdFilter**
- **ProcessIdFilter**
- **SegmentRequirementIdFilter**
- **SegmentResponseIdFilter**
- **Spare1Filter**
- **Spare2Filter**
- **Spare3Filter**
- **Spare4Filter**

This method also sets the value of the following filter properties to Null:

- **SiteNameFilter**
- **EntityNameFilter**
- **StartTimeFilter**
- **EndTimeFilter**
- **NumberOfPointsFilter**
- **ItemCategoryNameFilter**
- **ItemCategoryIDFilter**

## Syntax

```
SPCChartControl1.ResetFilters();
```

## Spec Control

The Spec control shows the current job and a grid of the individual specifications for this job within the selected specification group. When you use the Spec control in a System Platform symbol, you can associate the Button Bar control with the Spec control.

### Configuring the Spec Control

The Spec control shows the specifications assigned to the active job, but not assigned to any particular step. You can do the following:

- View and modify the minimum, maximum, and set point values.
- View and modify attached files or comments or instructions.
- View the actual value for the active job.
- Change the specification guidelines, for a specified job or for subsequent jobs.

When you use the Spec control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).

The screenshot shows a user interface for managing specifications. On the left, a sidebar titled 'Spec Group' lists 'Roasting Nuts'. The main area contains a table with the following data:

Description	Value	Current Value	Minimum value	Maximum value	Access Level	Variance
Roasting Temperature	200	202	195	205	0	2

Below the table are two small icons: a green plus sign and a green document.

This control corresponds to the **Specs** tab of the MES Operator application. For more information, see the Specs Tab section in the *MES Operator Guide* or online help.

### Properties of the Spec Control

This section describes the properties of the Spec control. For information about the common properties shared by this control, see [Common Properties](#).

#### EditSpecificationsEnabled Property

Use the **EditSpecificationsEnabled** property to get whether specifications can be edited.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### RefreshEnabled Property

Use the **RefreshEnabled** property to get whether this control can be refreshed or not. This control cannot be refreshed if the user has not logged into MES, or the user has not logged on to any entity.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### UpdateJobSpecsEnabled Property

Use the **UpdateJobSpecsEnabled** property to get whether job specs can be updated.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### UpdateTemplateSpecsEnabled Property

Use the **UpdateTemplateSpecsEnabled** property to get whether template specs can be updated.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ViewSpecDocumentEnabled Property

Use the **ViewSpecDocumentEnabled** property to set or get whether specification documents can be viewed.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### Xceed.Grid.RowSelectedJobSpecGroupRow Property

Use the **Xceed.Grid.RowSelectedJobSpecGroupRow** property to get the currently selected job spec group row from the grid. This property is set to Null if there are no rows in the grid or if none of the rows in the grid are selected. It returns the first selected row from the grid if more than 1 row is selected.

Data Type	Read/Write	Default Value
Xceed.Grid.Row	Read Only	Null

## Methods of the Spec Control

This section describes the methods of the Spec control. For information about the common methods shared by this control, see [Common Methods](#).

### PopUpEditSpecDlg() Method

Use the **PopUpEditSpecDlg()** method to open the Edit Specification dialog box and edit specification details. If the current user does not have privileges, then a list of alternate users is shown to edit specification details.

## Syntax

```
PopUpEditSpecDlg();
```

### SelectRowByKey(Int32,String) Method

Use the **SelectRowByKey(Int32,String)** method to select a row in the grid using the specified parameters. If a row for the specified parameter is not found in the grid, then the row selection is unchanged.

## Syntax

```
result = SelectRowByKey(StepNo, SpecId);
```

## Parameters

### StepNo

An integer value that represents a step\_no value from the job\_spec table.

### SpecId

A string value that represents a spec\_id value from the job\_spec table.

## Return Value

### result

A Boolean value that is True, if a match is found; otherwise it returns False.

### SelectRowByKey(Int32,String,Boolean) Method

Use the **SelectRowByKey(Int32,String,Boolean)** method to select a row in the grid using the specified parameters. If a row for the specified parameter is found and the *selectFirstRowAsDefault* parameter is set to True, the first row in the grid is selected. Otherwise the previous row selection is not changed.

## Syntax

```
result = SelectRowByKey(StepNo, SpecId, SelectFirstRowAsDefault);
```

## Parameters

### *StepNo*

An integer value that represents a step\_no value from the job\_spec table.

### *SpecId*

A string value that represents a spec\_id value from the job\_spec table.

### *SelectFirstRowAsDefault*

A Boolean value that indicates whether the first row in the grid should be selected, if the specified parameters does not exist in the grid. This parameter should be set to False if the row selection is not changed in a case when the specified parameters are not found in the grid.

## Return Value

### *result*

A Boolean value that is True, if a match is found; otherwise it returns False.

## UpdateSpecValues() Method

Use the **UpdateSpecValues()** method to update job spec values or template spec values.

## Syntax

```
result = UpdateSpecValues(buttonClicked);
```

## Parameters

### *buttonClicked*

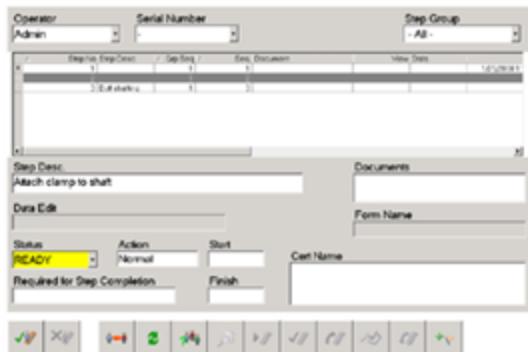
A button set that updates the job spec values.

## Steps Control

The Steps control shows the steps of the currently running job as a procedure guide.

## Configuring the Steps Control

When you use the Steps control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Steps control to:

- Log on to the selected step.
- Log off from the selected step.
- List all users currently logged on to the selected step.
- View a document that is associated with the selected step.
- Initiate the action defined for the selected step.
- Sign-off the selected step.
- Refresh the Steps control.
- Mark the state of the active step to "completed".
- Mark the state of the active step as "bypassed".
- Show the Job Event Log dialog box.
- Mark the state of any completed step as requiring rework.
- Open or launch a form, if the *Path to Form Program* system parameter is set.

The Steps control corresponds to the **Steps** tab of the MES Operator application. For more information, see the Steps Tab section in the *MES Operator Guide* or online help.

## Properties of the Steps Control

This section describes the properties of the Steps control. For information about the common properties shared by this control, see [Common Properties](#).

### ActionEnabled Property

Use the **ActionEnabled** property to specify whether the Action function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### AuthorizeEnabled Property

Use the **AuthorizeEnabled** property to specify whether the Authorize function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### BypassEnabled Property

Use the **BypassEnabled** property to specify whether the Bypass function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### CompleteEnabled Property

Use the **CompleteEnabled** property to specify whether the Complete function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### EventEnabled Property

Use the **EventEnabled** property to specify whether the Job Events function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### LoginEnabled Property

Use the **LoginEnabled** property to specify whether the Login function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### LogoutEnabled Property

Use the **LogoutEnabled** property to specify whether the Logout function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ReworkEnabled Property

Use the **ReworkEnabled** property to specify whether the Rework function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### SetLotDataEnabled Property

Use the **SetLotDataEnabled** property to specify whether the Set Lot Data function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ShowListEnabled Property

Use the **ShowListEnabled** property to specify whether the Show Operator List function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### ViewEnabled Property

Use the **ViewEnabled** property to specify whether the View Document function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

## Methods of the Steps Control

This section describes the methods of the Steps control. For information about the common methods shared by this control, see [Common Methods](#).

### Authorize() Method

Use the **Authorize()** method to allow a certification for sign-off.

## Syntax

```
Authorize();
```

### DisplayJobEventDialog() Method

Use the **DisplayJobEventDialog()** method to open the dialog box that allows entry of user-defined job events.

Predefined job events cannot be entered via this dialog box.

## Syntax

```
DisplayJobEventDialog();
```

### ExecuteStepAction() Method

Use the **ExecuteStepAction ()** method to perform the action associated with the currently selected step.

## Syntax

```
ExecuteStepAction();
```

### LaunchCurrentStepDocument () Method

Use the **LaunchCurrentStepDocument()** method to launch the step document displayed in the selected grid row.

## Syntax

```
LaunchCurrentStepDocument();
```

### LogoutCurrentStep() Method

Use the **LogoutCurrentStep()** method to log out of the selected step.

## Syntax

```
LogoutCurrentStep();
```

### OnLotNoChanged() Method

Use the **OnLotNoChanged()** method to trigger the **LotNoChanged** event by invoking the relevant delegates.

## Syntax

```
result = OnLotNoChanged(e);
```

## Parameter

*e*

An event argument that is used to determine if a Save or a Save As Default is done.

### OnStepDataEntered() Method

Use the **OnStepDataEntered()** method to trigger the **StepDataEntered** event by invoking the relevant delegates.

## Syntax

```
result = OnStepDataEntered(e);
```

## Parameter

*e*

An event argument that is used to determine if a Save or a Save As Default is done.

### OnStepGroupChanged() Method

Use the **OnStepGroupChanged()** method to trigger the **StepGroupChanged** event by invoking the relevant delegates.

## Syntax

```
result = OnStepGroupChanged(e);
```

## Parameter

*e*

An event argument that is used to determine if a Save or a Save As Default is done.

### OnStepStateChanged() Method

Use the **OnStepStateChanged()** method to trigger the **StepStateChanged** event by invoking the relevant delegates.

## Syntax

```
result = OnStepStateChanged(e);
```

## Parameter

*e*

An event argument that is used to determine if a Save or a Save As Default is done.

### PopupAnalogEntry() Method

Use the **PopupAnalogEntry()** method to open an analog entry dialog box.

## Syntax

```
PopupAnalogEntry(Control, minValue, maxValue, minValueUsed, maxValueUsed, limitWarning);
```

### Parameters

*Control*

A control that contains a reference to the control into which the analog value (possibly blank) is placed.

*minValue*

A Decimal minimum allowed value.

*maxValue*

A Decimal maximum allowed value.

*minValueUsed*

A Boolean value that if set to False, the minimum allowed value is ignored.

*maxValueUsed*

A Boolean value that if set to False, the maximum allowed value is ignored.

*limitWarning*

A Boolean value that if set to True, the user is warned if they enter a value outside the allowed range. They have the option to accept the value, even though the value is outside the range.

### PopupRadioButtonEntry() Method

Use the **PopupRadioButtonEntry()** method to open a radio button selection dialog box.

## Syntax

```
PopupRadioButtonEntry(Control, ds);
```

### Parameters

*Control*

A control that contains a reference to the control into which the label associated with the selected radio button is placed.

*ds*

A dataset, from the Job\_Step\_Choices table, that defines the set of radio buttons to display.

## ProcessDataTypeForSelectedLot() Method

**Note:** This method is not intended for customer use; it is intended for MES internal use only.

This method updates the step data that is displayed in the specified grid row with the data value in the specified row from the JobStep table.

## Syntax

```
ProcessDataTypeForSelectedLot(gridRow, jobStepRow);
```

## Rework() Method

Use the **Rework()** method to open the Steps to Rework dialog box, which allows rework for steps.

## Syntax

```
Rework();
```

## SetLotData() Method

Use the **SetLotData()** method to set the lot data for the current job. There must be a current user logged into at least one entity, and the current entity must be running a job. The **PopupSetProdLotDataDlg()** method is called, passing along the information about the current job. If the lot data is changed, the grid is refreshed.

## Syntax

```
SetLotData();
```

## ShowOperatorsOnThisStep() Method

Use the **ShowOperatorsOnThisStep()** method to show a list of all operators logged into the currently selected step.

## Syntax

```
ShowOperatorsOnThisStep();
```

## StepBypass() Method

Use the **StepBypass()** method to bypass the currently selected step.

## Syntax

```
StepBypass();
```

## StepComplete() Method

Use the **StepComplete()** method to complete the currently selected step .

## Syntax

```
StepComplete();
```

## StepLogin() Method

Use the **StepLogin()** method to log on to the currently selected step.

## Syntax

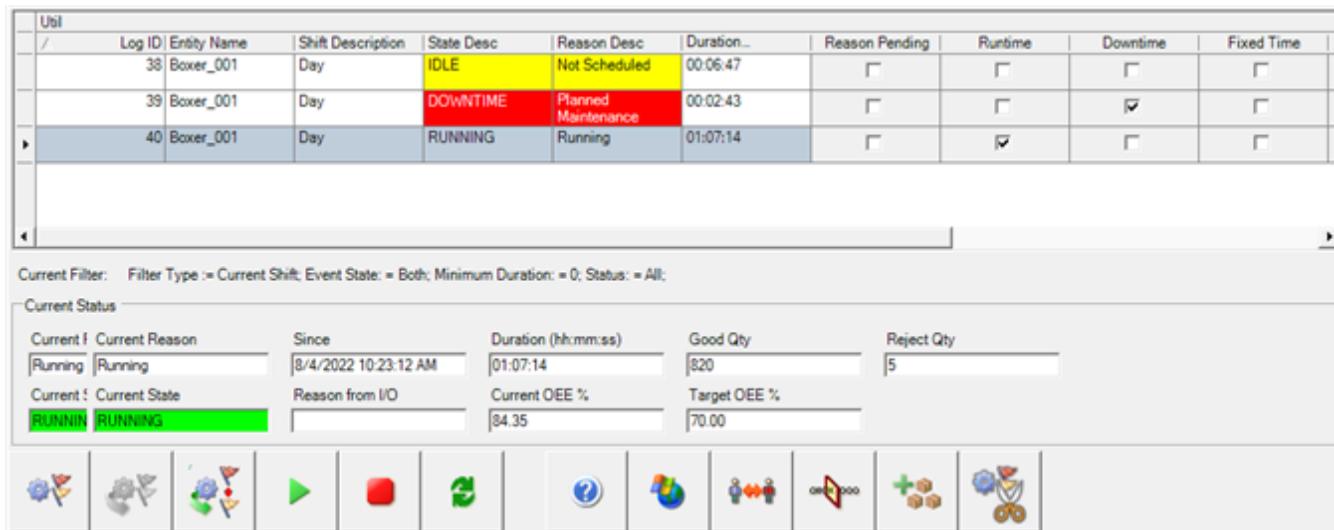
```
StepLogin();
```

## Utilization Control

You can use the Utilization control to show the history of entity utilization and to change the utilization state for an entity. You can edit the utilization events by using the split utilization functionality.

## Configuring the Utilization Control

When you use the Utilization control in a System Platform symbol, you can associate the Button Bar control with it. For more information, see [Associating the Button Bar Control with Other Controls](#).



The operator can use the Utilization control to:

- Enter a new machine reason for the selected machine.
- Refresh the utilization control.
- Enter a final reason for the utilization record.

- Switch the active user.
- Start a data entry job.
- Split a utilization record.
- Open or launch a form, if the *Path to Form Program* system parameter is set.

This control corresponds to the **Util/OEE** tab of the MES Operator application. For more information, see the Util/OEE Tab section in the *MES Operator Guide* or online help.

## Using the Utilization Control

The Utilization control displays entity utilization data (for example, downtime, idle time and running time), allows the current utilization reason to be changed, and allows pending reasons to be set.

Fields are added to the text box section under the grid where OEE data is displayed for showing the good and scrap quantities. If OEE is being displayed by shift, the quantities should be displayed by shift. If OEE is being displayed by job, the quantities would be displayed by job. As with other fields on the control, the visibility of these fields will be configurable at run time.

The screenshot shows the Utilization Control interface. At the top, there is a grid titled "Util" with columns for Log ID, Entity Name, Shift Description, State Desc, Reason Desc, Duration, Reason Pending, Runtime, Downtime, and Fixed Time. The data in the grid includes rows for Log IDs 38, 39, and 40, each associated with Entity Name Boxer\_001, Day Shift, and different states (IDLE, DOWNTIME, RUNNING). Below the grid, a message box displays the "Current Filter" settings: Filter Type := Current Shift; Event State := Both; Minimum Duration := 0; Status := All. It also shows "Current Status" with fields for Current I/O, Current Reason, Since (8/4/2022 10:23:12 AM), Duration (01:07:14), Good Qty (820), Reject Qty (5), Current I/O, Current State, Reason from I/O, Current OEE % (84.35), and Target OEE %. At the bottom, there is a toolbar with various icons for operations like start, stop, pause, and maintenance.

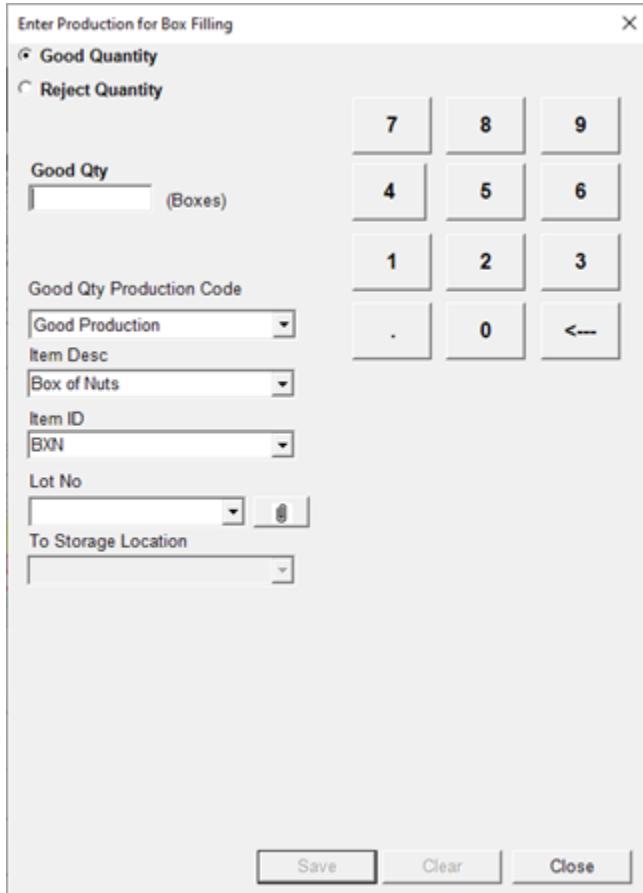
The Utilization control provides for four types of filtering: time-based, event state, minimum duration, and status. Time-based filtering limits data based on a specified period of time or number of events. Event State filtering limits data based on whether the event was acknowledged, unacknowledged or it can be set to both to not filter by event state. Minimum duration filtering limits data based on a duration by only showing those events that lasted as least as long as the minimum duration. Status filtering limits data based on the utilization status (that is, run time or downtime). Any combination of these four types of filters may be employed. A description of the current filter will be displayed in the control, so the user will always know what filter criteria are being used. For further detail on filtering, see [Configuring the Filters](#).

The Multiple Selection for Reason Entry function is provided to allow the user to select multiple grid rows in the Utilization control which have a reason pending and set the final reason for a series of pending rows, or allow the user to select multiple grid rows in the Utilization which are non-pending and edit the final reason. For more information, see [Multiple Selection for Reason Entry/Editing](#).

The comments of a selected reason or multiple selected reasons can be changed without changing anything else about the reason by use the **EditComments()** method or the **Edit Comment** button on the button bar. Both calling the method and pushing the button will bring up a dialog allowing the editing of the comments associated

with one or more reasons. For more information, see [Methods of the Utilization Control and Buttons](#).

Good or rejected production can be added for a selected reason using the **AddProduction()** method or the **AddProduction** button of the button bar if the **AddProduction** button is enabled. Both will open a dialog box that allows the user to enter the amount of production to be added. For more information, see [Methods of the Utilization Control and Buttons](#).



## Switching Entities

The utilization control displays entity utilization data for the current entity. The current entity can be switched in one of three ways.

- Adding a Job Summary control to the symbol
- Through script
- By using the EntitySelect control that is part of the Utilization control. The EntitySelect control is a combo box that lists all entities that the current user is logged onto. It also contains an entity logon button that will allow the user to log onto or off of entities. The entity that is selected in the combo box will become the new current entity.

## Associating the Button Bar Control

At run time, the following features are available on the Button Bar when it is associated with the Utilization Control.

### Filter button

When clicked, the Utilization control's **Filter()** method is called to open the filter dialog. If the operator sets a new filter, the Utilization control is refreshed. If the Utilization controls **FilterEnabled** property is False, this button is disabled.

### Add Production button

When clicked, the Utilization control's **AddProduction()** method is called to open the add production dialog box. This dialog box is used to add good or rejected quantities. The user can enter a production amount as well as set the item information, the reason code to associate with the production, the lot, and the storage information. Any fields that have default values will be set to these default values when the dialog is opened. Clicking **Save** will save the good or rejected production.

### Edit Comment button

When clicked, the Utilization control's **EditComment()** method is called to open the Edit Comment dialog box. The comments text box on the dialog box will contain the comments of the selected reason or reasons if multiple reasons are selected and all have the same comments. If multiple reasons are selected and the comments are not the same for each, the **Comments** text box will contain <various> to let the user know that the comments are not the same for all selected reasons. The operator can edit the comments of the selected reasons without editing anything else about the reason by typing new comments into the **Comments** text box and clicking **OK**. The new comments will be saved to each of the selected reasons as this point.

## Configuring the Filters

Filter in the Utilization control is done through a filter dialog box, allowing the user to set time-based, event state, minimum duration, and status filters. Any combination of these types of filters can be used.

### Time-Based

The Time-Based filters are Last N Events, This Shift, Last Shift, and Last N Hours. The time-based filters determine what events are shown by limiting the events to those that occur within the time frame set.

### Event State

The Event State filter can be either Unacknowledged, Acknowledged, or both.

### Minimum Duration

The Minimum Duration filter specifies that only events that have duration at least as long as this filter are shown. For example, a minimum duration of 15 will show only those events that lasted at least 15 seconds.

### Status

The Status filter can be either Run Time, Downtime, Neither, or All. This filter is used to filter data by utilization state. A description of the current filter will be displayed in the control, so the user will always know what filter criteria are being used.

The filter dialog box can be opened either by calling the **Filter()** method or by clicking the **Filter** button on the button bar associated with the Utilization control. The values for each type of filter that is to be used to filter the data displayed are then set using combo boxes to select valid values or entering integer values for those filters based on a numeric value. Clicking **OK** applies the filter values to the data displayed. The filter values can be saved to the configuration or to the default configuration for the Utilization control through the context menu of the Utilization control. The **FilterDefaultsFromDB** property must be True to save the filter values to the default configuration.

Clicking **OK** on the filter dialog box will only apply the filters for the current display. They will not be saved to the configuration unless saved through the context menu command.

## Multiple Selection for Reason Entry/Editing

Selecting multiple grid rows on the Utilization control is allowed for entering a final reason for multiple reason-pending rows or for editing the final reason for multiple non-pending reason rows. If the user selects multiple rows that have a final reason pending, the **Set Past Reason** button will become available. By clicking this button, the user will be presented with the reason editing dialog box. If multiple rows were selected on the Utilization grid, then the **Since** and **Duration** fields of the reason editing dialog box will be blank. If the comments for all of the selected rows are the same, the comments will be displayed in the **Comments** field. If at least one of the rows selected has comments that are different from any other row, then **<various>** will be displayed in the **Comments** field of the reason editing dialog box, to indicate to the user that they are editing a group of non-matching comments.

The user selects a reason group from the **Reason Group** tree and a final reason, edits the comments, and then clicks **OK**. The comments for each selected row will be set to whatever the user has entered in the **Comments** field, regardless of their former contents. The final reason for all rows will be set to the final reason selected.

A user can also edit the final reason of non-pending rows using multiple selections in much the same way as setting the final reason of pending rows. When multiple non-pending rows are selected, the **Edit Final Reason** button will become available on the button bar. If the user presses this button, they will be presented with the same dialog as above. The editing dialog will not change the current reason code if the current reason code is not in the list of reasons. If the current reason is in the list, the reason will be selected. If it is not in the list, no reasons will be selected from the list. If the user saves without selecting a reason, the original reason will be used. If a reason is selected, all selected rows' final reasons will be updated to the selected reason. The comments for all the rows will also be updated with any comment changes if there were some made. If no comment changes were made, the rows will maintain the comments as they were.

## Configuring Split Utilization Functionality

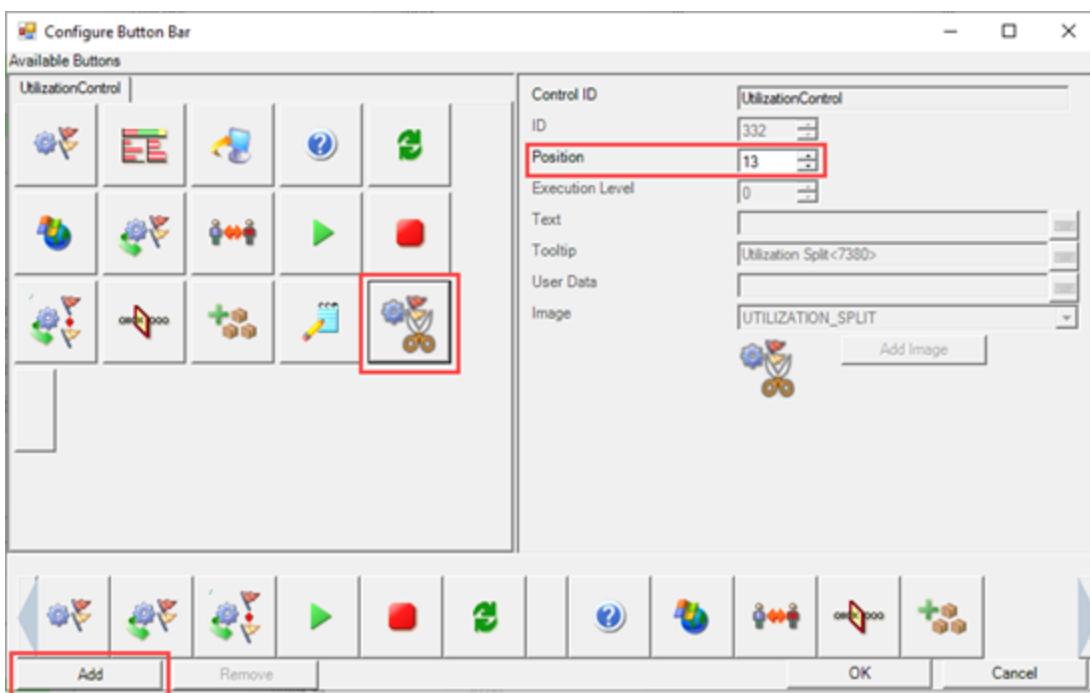
You can split a selected utilization event by using the split utilization functionality. You can also combine and change the reason for the split events.

### To configure the Utilization Split button

1. Log in to the MES Operator and select an entity.
2. On the **Util/OEE** tab, right-click the **Button Bar** and click **Configure**.



The **Configure Button Bar** window appears.



3. Select the **Utilization Split** button in the **Available Buttons** pane.
4. In the **Position** field, enter a number to indicate the position on the button bar at which to insert the **Utilization Split** button.
5. Click **Add**.

The **Utilization Split** button is added to the button bar at the bottom of the window.



6. In the **Execution Level** field, enter the permission level required to split an event.
7. Click **OK**.

The **Utilization Split** button appears on the button bar in the Operator window.

## Using Split Utilization Functionality

You must select an event in the Utilization grid to enable the **Utilization Split** button. You can edit the duration and shift information of the split events, based on the time boundaries and shift boundaries of the selected event.

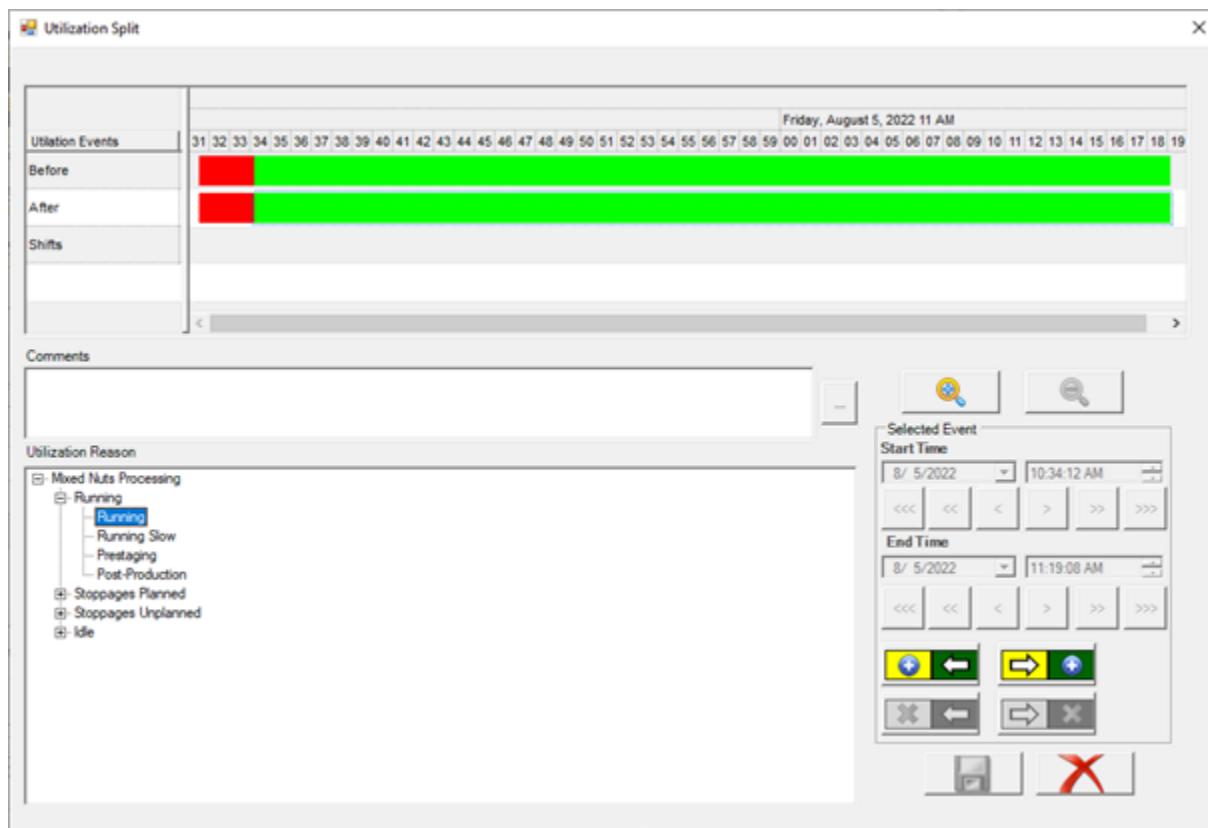
### To split an utilization event

1. Log on to the MES Operator, select an entity and then go to the **Util/OEE** tab.
2. Select a row from the Utilization grid and click **Utilization Split**.

The **Utilization Split** window appears. It contains four panes:

- **Utilization Events:** The new events that are a result of splitting the selected event.
- **Comments:** Comments about splitting the event.
- **Utilization Reason:** The reason for the split event.

- **Selected Event:** The controls for splitting the event. For more information, refer to [Splitting an Event](#).



3. Use the **Selected Event** controls to specify how to split the event.
4. Click **Save**.

The new utilization events are added to the Utilization grid.

## Splitting an Event

You can split the selected utilization event by using the following commands:

- **Split Before:** You can use this command to split the selected event into two events, each having half the duration of the selected event. After executing this command, the first half of the event becomes the selected event. The **Start Time** and **End Time** for the new events are calculated as follows:

First New Event	<b>Start Time:</b> same as that of the selected event
	<b>End Time:</b> Start Time + (duration of the selected event/2)
	<b>Note:</b> If the result of dividing the duration of the selected event is a fractional value, round up the number.

Second New Event	<p><b>Start Time:</b> Start time of the first new event + (duration of the selected event/2)</p> <p><b>Note:</b> If the result of dividing the duration of the selected event is a fractional value, round down the number.</p> <p><b>End Time:</b> same as that of the selected event</p>
------------------	--

All the other settings of the new events, except the start and end times, are the same as that of the selected event.

**Note:** The **Split Before** command is disabled if the selected event cannot be edited.

- **Split After:** You can use this command to split the selected event into two events, each having half the duration of the selected event. After executing this command, the second half of the event becomes the selected event. The **Start Time** and **End Time** for the new events are calculated as follows:

First New Event	<p><b>Start Time:</b> same as that of the selected event</p> <p><b>End Time:</b> <b>Start Time</b> + (duration of the selected event/2)</p> <p><b>Note:</b> If the result of dividing the duration of the selected event is a fractional value, round up the number.</p>
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| Second New Event | **Start Time:** Start time of the first new event + (duration of the selected event/2)  **Note:** If the result of dividing the duration of the selected event is a fractional value, round down the number. |

All the other settings of the new events, except the start and end times, are the same as that of the selected event.

**Note:** The **Split After** command is disabled if the selected event cannot be edited.

You can delete the selected utilization event by using the following commands:

- **Delete Before:** You can use this command to combine the selected event with the previous event. After executing this command, the selected event is deleted and the previous event becomes the selected event. The duration of the deleted event is added to the duration of the selected event. The **Utilization Reason** and **Comments** of the deleted event are retained by the selected event.

**Note:** The **Delete Before** command is disabled if the selected event cannot be edited or if it is the first event that can be edited.

- **Delete After:** You can use this command to combine the selected event with the next event. After executing this command, the selected event is deleted and the next event becomes the selected event. The start time of the deleted event becomes the start time of the selected event. The **Utilization Reason** and **Comments** of the deleted event are retained by the selected event.

**Note:** The **Delete Before** command is disabled if the selected event cannot be edited or if it is the last event that can be edited.

## Properties of the Utilization Control

This section shows the properties of the Utilization control. For information about the common properties shared by this control, see [Common Properties](#).

### AddProductionEnabled Property

The **AddProductionEnabled** property indicates whether the **AddProduction()** method may be called. If it is set to False, the **AddProduction()** method may not be called. This property is set by the control whenever the state of the control changes.

Data Type	Read/Write	Default Value
Boolean	R/W	False

### AutoSelNewEvents Property

The **AutoSelNewEvents** property determines the behavior of the control when new events occur. If this property is True, a newly added event is automatically selected in the control's grid. If it is False, the event which currently selected will continue to be selected when new events occur.

Data Type	Read/Write	Default Value
Boolean	R/W	True

### EditFinalReasonEnabled Property

Use the **EditFinalReasonEnabled** property to determine if the Edit Final Reason function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

### EndJobEnabled Property

Use the **EndJobEnabled** property to determine if the End Job function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

**FilterDefaultsFromDB Property**

The **FilterDefaultsFromDB** property controls whether the default filter settings(**UtilTimeFilterType**, **UtilStatusFilter**, **FilterLastNEvents**, **UtilizationFilter.FilterLastNHours**, **UtilFilterUnAck**, and **UtilizationFilter.FilterMinDuration** properties) are established during design time or if they will be pulled in from the MES database during run time. If this property is set to False, the default filter settings will not be loaded from the database. If the property is set to True, the default filter settings will be pulled from the MES database during run time. In this case, the design-time settings of the properties are disabled.

Data Type	Read/Write	Default Value
Boolean	R/W	True

**FilterEnabled Property**

The **FilterEnabled** property specifies if the **Filter()** method is available. This read-only property will work in the same manner as the other function-enabled properties. That is, when the property is False, the corresponding function (the filter dialog box in this case) will not be available.

This property is set by the control whenever the state of the control changes. It will be set to False if there is no MES session, no user, or no entity. At all other times, it should be set to True.

Data Type	Read/Write	Default Value
Boolean	R/W	False

**SetPastReasonEnabled Property**

Use the **SetPastReasonEnabled** property to determine if the Set Past Reason function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

**SetReasonEnabled Property**

Use the **SetReasonEnabled** property to determine if the Set Reason function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

**StartDEJobEnabled Property**

Use the **StartDEJobEnabled** property to determine if the Start Data Entry Job function is enabled.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

**StartDEJobProdRateFieldVisible Property**

Use the **StartDEJobProdRateFieldVisible** property to get or set the visibility of the **Production Rate** box in the Start Job Data Entry dialog box. If set to False, the **Production Rate** box is not shown in the dialog box.

Data Type	Read/Write	Default Value
Boolean	R/W	True

**StartDEJobUOMFieldVisible Property**

Use the **StartDEJobUOMFieldVisible** property to get or set the visibility of the **Unit of Measure** box in the **Start Job Data Entry** dialog box. If set to False, the **Unit of Measure** box is not shown in the dialog box.

Data Type	Read/Write	Default Value
Boolean	R/W	True

**UtilRefreshEnabled Property**

Use the **UtilRefreshEnabled** property to temporarily allow or prevent the operator from refreshing the control. If set to False, the operator cannot refresh the control and any refresh requests submitted to the control are ignored.

Data Type	Read/Write	Default Value
Boolean	R/W	True

**UtilizationFilter.FilterEndOffset Property**

The **UtilizationFilter.FilterEndOffset** property specifies the end of the filter period relative to now. This filter value is only legitimate when the **UtilTimeFilterType** property is set to Custom. If the **UtilTimeFilterType** property is not set to Custom, this property is:

- Set to 0 if the type is ThisHour, LastNHours, LastNEvents, CurrentShift, CurrentDay, CurrentWeek, or CurrentMonth.
- Set to 1 if the type is LastShift, Yesterday, LastWeek, or LastMonth.

The value of this property should always be less than the value of the **UtilizationFilter.FilterStartOffset** property and greater than or equal to 0.

Data Type	Read/Write	Default Value
Integer	R/W	0

#### UtilizationFilter.FilterLastNEvents Property

The **UtilizationFilter.FilterLastNEvents** property is only applicable if the **UtilTimeFilterType** property is set to LastNEvents. It determines how many events will be included in the control when the data is displayed.

Data Type	Read/Write	Default Value
Positive Integer	R/W	10

#### UtilizationFilter.FilterLastNHours Property

The **UtilizationFilter.FilterLastNHours** property is only applicable if the **UtilTimeFilterType** property is set to LastNHours. Only those events whose event time falls within the last N hours, where N is the value of this property, will be included in the control when the data is displayed.

Data Type	Read/Write	Default Value
Positive Integer	R/W	24

#### UtilizationFilter.FilterMinDuration Property

The **UtilizationFilter.FilterMinDuration** property specifies the amount of time that had to be spent in the event in order to consider the event. Only events with a duration that is greater than or equal to the value of this property will be included. This value must be greater than or equal to 0.

Data Type	Read/Write	Default Value
Integer	R/W	0

#### UtilizationFilter.FilterStartOffset Property

The **UtilizationFilter.FilterStartOffset** property specifies the start of the filter period relative to now. This filter value is only legitimate when the **UtilTimeFilterType** property is set to Custom. If the **UtilTimeFilterType** property is not set to Custom, this property is:

- Set to 1 if the type is ThisHour, CurrentShift, CurrentDay, CurrentWeek, or CurrentMonth

- Set to 2 if the type is LastShift, Yesterday, LastWeek, or LastMonth.
- Set to N if the type is set to LastNEvents or LastNHours.

The value of this property should always be greater than the value of the **UtilizationFilter.FilterEndOffset** property and should always be greater than or equal 1.

Data Type	Read/Write	Default Value
Integer	R/W	0

### UtilizationFilter.FilterTime Property

The **UtilizationFilter.FilterTime** property specifies the time unit for a custom filter type. This filter value is only legitimate when the **UtilTimeFilterType** is set to Custom. If the **UtilTimeFilterType** property is not set to *Custom*, this property is set to the value that matches the type:

- Hour if type is ThisHour or LastNHours
- Shift if type is ThisShift or LastShift
- Day if type is CurrentDay or Yesterday
- Week if type is CurrentWeek or LastWeek
- Month if type is CurrentMonth or LastMonth

When this property is set to Hour, the results will include data for 0 or more entire hour periods, relative to the current time. For all other settings (Shift, Day, Week, Month, or Year), the results will start at the beginning of the time unit specified by the **UtilizationFilter.FilterStartOffset** property.

Data Type	Read/Write	Default Value
Enum {Hour=0, Shift=1, Day=2, Week=3, Month=4, Year=5}	R/W	Hour

### UtilizationFilter.UtilFilterUnAck Property

The **UtilizationFilter.UtilFilterUnAck** property specifies whether unacknowledged events, acknowledged events, or both types of events should be shown.

Data Type	Read/Write	Default Value
Enum {Unacknowledged=0, Acknowledged=1, Both=2}	R/W	Both

**UtilizationFilter.UtilStatusFilter Property**

The **UtilizationFilter.UtilStatusFilter** property determines what filtering, if any, will be performed based on utilization status (that is, Run Time and Down Time).

Data Type	Read/Write	Default Value
Enum {Runtime=0, Downtime=1, Neither=2, All=3}	R/W	All

**UtilizationFilter.UtilTimeFilterType Property**

The **UtilizationFilter.UtilTimeFilterType** property determines what time-based filtering, if any, will be performed on the data.

Data Type	Read/Write	Default Value
Enum {LastNEvents = 0 ThisShift = 1 LastShift = 2 ThisHour = 3 LastNHours = 4 CurrentDay = 5 Yesterday = 6 CurrentWeek = 7 LastWeek = 8 CurrentMonth = 9 LastMonth = 10 Custom = 11 None = 12}	R/W	None

**UtilizationSplitEnabled Property**

The **UtilizationSplitEnabled** property determines whether or not **UtilizationSplit** command is enabled. This

property is set to True if the command is enabled. Otherwise it is set to False.

Data Type	Read/Write	Default Value
Boolean	Read Only	False

## Methods of the Utilization Control

This section describes Utilization control methods. For information about the common methods shared by this control, see [Common Methods](#).

### AddProduction() Method

The **AddProduction()** method can only be called when the **AddProductionEnabled** property is True. Call this method to open a dialog box that allows for the entering either of good or rejected production. The dialog box contains fields to set the amount of production to be added and to select the reason code to associate with the production being added, the item that is being produced, the lot, and the storage location for the produced item. If there are defaults for any of these fields, they will be filled in when the dialog box is opened. Entering a quantity and clicking the **Save** button will add the good or rejected production for the selected reason.

## Syntax

```
AddProduction();
```

### EditComment() Method

The **EditComment()** method can only be called when at least one row is selected on the Utilization control's grid. Calling this method will open a dialog box that allows the editing of the comments for one or more reasons without changing anything else about the reason. The dialog box will show the current comments for the selected reason or the selected reasons if multiple reasons are selected and the comments are the same. If multiple reasons are selected and the comments are not the same for all, then the **Comments** field will contain <various> to let the user know that the selected reasons do not all have the same comments. The user can then edit the displayed comment and save it. If multiple reasons are selected, the new comments will be saved to each even if the reasons did not have the same comments initially.

## Syntax

```
EditComment();
```

### EditFinalReason() Method

Use the **EditFinalReason()** method to open the Edit Final Reason dialog box. The operator can edit the final reason of the currently selected grid row.

## Syntax

```
EditFinalReason();
```

### EndJob() Method

Use the **EndJob()** method to end the currently running job.

## Syntax

```
EndJob();
```

### Filter() Method

The **Filter()** method can only be called when the **FilterEnabled** property is set to True. Call this method to open the same Filter dialog box that is used to set properties at design time.

## Syntax

```
Filter();
```

### GetButtonMenuItems() Method

Use the **GetButtonMenuItems()** method to retrieve the button menu for the Utilization control. If no Button Bar control is associated with the Utilization control, an empty button menu is returned.

## Syntax

```
result = GetButtonMenuItems();
```

### Parameter

*result*

The ButtonMenuArrayList for the Utilization control.

### GetOEEExecData() Method

Use the **GetOEEExecData()** method to read the OEE Exec data for the specified entity. OEE Exec data is the extra configuration data required for an entity which is capable of tracking OEE data.

## Syntax

```
result = GetOEEExecData(entID);
```

## Parameters

*entID*

The entity whose OEE Exec data is to be retrieved.

*result*

A dataset containing data for the specified entity from the OEE\_Exec table.

### SetPastReason() Method

Use the **SetPastReason()** method to open the Set Past Reason dialog box. The operator can set the reason and an optional comment for the currently selected reason-pending row in the grid.

## Syntax

```
SetPastReason();
```

### SetReason() Method

Use the **SetReason()** method to open the Set Reason dialog box. The operator can change the current reason on the current entity.

## Syntax

```
SetReason();
```

### StartDEJob() Method

Use the **StartDEJob()** method to open the dialog box for starting a data entry job.

## Syntax

```
StartDEJob();
```

### UtilizationSplit() Method

Use the **UtilizationSplit()** method to open the Utilization Split dialog box. You can split the selected utilization reason and/or change the comments and reason code.

## Syntax

```
UtilizationSplit();
```

## Buttons

The buttons that are available to be used with .NET control methods are listed and described here.

The description includes:

- The button ID
- The language ID
- The button's tooltip
- The language ID of the button's tooltip
- Which controls can use the button

The tooltip shown for each button is the tooltip for the default language, English. The tooltip text can be replaced by setting up a new language and configuring the button bar.

Look in the `Ui_Button` database table for ID, language string, and tooltip information.

### Action

The **Action** button executes the step action.

Button ID	251
Language ID	702
Tooltip	Execute step action
Tooltip Language ID	4932
Control Usage	Steps

### Accept Job

The **Accept Job** button marks a job as ready to run.

Button ID	40
Language ID	4473
Tooltip	Accept the selected job as ready to run
Tooltip Language ID	4872
Control Usage	Queue

### Add Consumption

The **Add Consumption** button opens the dialog box for adding consumption.

Button ID	82
Language ID	3675
Tooltip	Add consumption quantity
Tooltip Language ID	4893
Control Usage	Consumption

## Add Production

The **Add Production** button opens a dialog box that allows for the entering either of good or rejected production. The dialog box contains fields to set the amount of production to be added and to select the reason code to associate with the production being added, the item that is being produced, the lot, and the storage location for the produced item. If there are defaults for any of these fields, they will be filled in when the dialog box is opened. Entering a quantity and clicking the **Save** button will add the good or rejected production for the reason.

Button ID	60
Language ID	3674
Tooltip	Add Production to the current job
Tooltip Language ID	4887
Control Usage	Production, Utilization

## Authorize

The **Authorize** button opens the Inspector dialog box which allows to authenticate a user.

Button ID	224
Language ID	4483
Tooltip	Authorize
Tooltip Language ID	4483
Control Usage	Audit, Steps

## Add/Assign SNo's

The **Add/Assign SNo's** button opens the Add/Assign Serial Numbers dialog box for users to add serial numbers and assign existing serial numbers to a job.

Button ID	316
Language ID	5357
Tooltip	Add/Assign SNo's
Tooltip Language ID	5357
Control Usage	Production, Queue

## BOM Preview

The **BOM Preview** button opens the BOM Preview dialog box to view the components needed for the selected job and relevant information for each.

Button ID	238
Language ID	2967
Tooltip	View BOM details
Tooltip Language ID	4883
Control Usage	Queue

## Bypass

The **Bypass** button skips the step.

Button ID	254
Language ID	2047
Tooltip	Step bypass
Tooltip Language ID	4923
Control Usage	Steps

## Copy Row

The **Copy Row** button opens the Edit dialog box to create a new row. The new row is populated with the data from the selected row.

Button ID	314
Language ID	5033
Tooltip	Copy Row

Tooltip Language ID	5033
Control Usage	Entity Usage Editor, Item Production Editor, Item Consumption Editor, Labor Usage Editor, Job Step Data Editor

## Complete

The **Complete** button accepts and completes the step.

Button ID	253
Language ID	705
Tooltip	Step accept/complete
Tooltip Language ID	4922
Control Usage	Steps

## Create Work Order

The **Create Work Order** button creates a new work order.

Button ID	49
Language ID	1755
Tooltip	Create new work order against shortage
Tooltip Language ID	4880
Control Usage	Queue

## Delete Lot and Sublots

The **Delete Lot and Sublots** button deletes the selected lot and sublots.

Button ID	323
Language ID	5375
Tooltip	Delete Lot and Sublots
Tooltip Language ID	5375
Control Usage	Item Lot Editor

## Delete Rows

The **Delete Rows** button deletes one or more selected rows.

Button ID	313
Language ID	5028
Tooltip	Delete Rows
Tooltip Language ID	5028
Control Usage	Entity Usage Editor, Item Production Editor, Item Consumption Editor, Job Step Data Editor, Labor Usage Editor

## Edit

The **Edit** button opens the editor to edit the selected file.

Button ID	265
Language ID	58
Tooltip	Edit File
Tooltip Language ID	4871
Control Usage	Folders

## EditComment

The **EditComment** button opens a dialog box that shows the current comments for the selected reason or the selected reasons if multiple reasons are selected and the comments are the same. If multiple reasons are selected and the comments are not the same for all, then the comments field will contain <various> to let the user know that the selected reasons do not all have the same comments. The user can then edit the displayed comment and save it. If multiple reasons are selected, the new comments will be saved to each even if the reasons did not have the same comments initially.

Button ID	317
Language ID	1
Tooltip	Edit Comment
Tooltip Language ID	5315
Control Usage	Utilization

## Edit Reason

The **Edit Reason** button opens the Edit Final Reason dialog box to change the final reason for the currently selected grid row.

Button ID	294
Language ID	4805
Tooltip	Edit final reason for selected utilization record
Tooltip Language ID	4909
Control Usage	Utilization

## Edit Results

The **Edit Results** button enables the editing mode for sample results.

Button ID	330
Language ID	7212
Tooltip	Edit Results
Tooltip Language ID	7212
Control Usage	Sample Viewer

## Edit Row

The **Edit Row** button opens the Edit dialog box for the selected row. For the Entity Usage Editor, this can be a master (entity usage) row or a detail (job) row.

Button ID	311
Language ID	5026
Tooltip	Edit Row
Tooltip Language ID	5026
Control Usage	Entity Usage Editor, Item Production Editor, Item Consumption Editor, Job Step Data Editor, Labor Usage Editor

## Edit Sample

The **Edit Sample** button enables the editing mode for sample information.

Button ID	326
Language ID	7208
Tooltip	Edit Sample
Tooltip Language ID	7208
Control Usage	Sample Viewer

## Edit Specs

The **Edit Specs** button enables the editing mode for specification details.

Button ID	291
Language ID	3953
Tooltip	Edit specifications
Tooltip Language ID	4870
Control Usage	Spec

## End Job

The **End Job** button ends a job.

For the Queue control, the **End Job** button ends the selected job.

For the Utilization control, the **End Job** button ends the current job.

Button ID	42
Language ID	370
Tooltip	Stop the selected job
Tooltip Language ID	4874
Control Usage	Utilization, Queue

## Entity Logon

The **Entity Logon** allows the operator to log in to another machine.

Button ID	161
Language ID	4480

Tooltip	Log in to another machine
Tooltip Language ID	4927
Control Usage	Labor Usage Editor

## Event

The **Event** button opens a dialog box for entering a job event.

Button ID	255
Language ID	4176
Tooltip	Enter event
Tooltip Language ID	4924
Control Usage	Steps

## Execute

The **Execute** button starts a program which is specified in the user data for the button.

Button ID	12
Language ID	2095
Tooltip	Launch an external application
Tooltip Language ID	4855
Control Usage	General

## File Filter

The **File Filter** button opens a dialog box to enter file filter for the folders tree.

Button ID	262
Language ID	3600
Tooltip	Enter file filter
Tooltip Language ID	4939
Control Usage	Folders

## Filter

The **Filter** button opens a filter dialog box to filter the data shown on the control.

Button ID	24
Language ID	3122
Tooltip	Enter filter criteria
Tooltip Language ID	4864
Control Usage	Utilization, Sample Viewer

## Help

The **Help** button opens the help file.

Button ID	4
Language ID	62
Tooltip	Open a help file
Tooltip Language ID	4847
Control Usage	General

## Insert Entity Usage Row

The **Insert Entity Usage Row** button opens the Edit dialog box for entering a new master (entity usage) row.

Button ID	319
Language ID	5389
Tooltip	Insert Entity Usage Row
Tooltip Language ID	5389
Control Usage	Entity Usage Editor

## Insert Job Detail Row

The **Insert Job Detail Row** button opens the Edit dialog box for entering a new detail (job) row.

Button ID	320
Language ID	5390

Tooltip	Insert Job Detail Row
Tooltip Language ID	5390
Control Usage	Entity Usage Editor

### Insert Lot or Sublot

The **Insert Lot or Sublot** button allows to insert lot or subplot.

Button ID	321
Language ID	5373
Tooltip	Insert Lot or Sublot
Tooltip Language ID	5373
Control Usage	Item Lot Editor

### Insert New Row

The **Insert New Row** button opens the Edit dialog box for entering a new row.

Button ID	312
Language ID	5027
Tooltip	Insert New Row
Tooltip Language ID	5027
Control Usage	Item Production Editor, Item Consumption Editor, Job Step Data Editor, Labor Usage Editor

### Job Attributes

The **Job Attributes** button opens the Job Attributes dialog box for viewing, editing, and deleting job attributes for the selected job.

Button ID	239
Language ID	2515
Tooltip	View job attributes
Tooltip Language ID	4884

Control Usage	Queue
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## Job Logoff

The **Job Logoff** button logs the operator off the current dialog box.

Button ID	325
Language ID	5436
Tooltip	Log User Off of the Job
Tooltip Language ID	5437
Control Usage	Queue, Labor Usage Editor

## Launch Browser

The **Launch Browser** button opens the web page specified in the user data of the button.

Button ID	245
Language ID	4489
Tooltip	Launch the browser
Tooltip Language ID	4856
Control Usage	General

## Link Jobs

The **Link Jobs** button opens the Select Jobs to Batch dialog box to select jobs to link together into a batch.

Button ID	268
Language ID	4207
Tooltip	Link jobs together in a batch
Tooltip Language ID	4886
Control Usage	Queue

## Log In

The **Login** button allows another operator to log on.

Button ID	6
Language ID	4468
Tooltip	Log in another operator
Tooltip Language ID	4849
Control Usage	Labor Usage Editor

## Log Out

The **Log Out** button allows the operator to log off.

Button ID	7
Language ID	4469
Tooltip	Log Off operator
Tooltip Language ID	4850
Control Usage	Labor Usage Editor

## Login

The **Login** button allows operator to log on to the step.

Button ID	225
Language ID	1253
Tooltip	Login to step
Tooltip Language ID	4920
Control Usage	Steps

## Logout

The **Logout** button logs the operator off the step.

Button ID	226
Language ID	4484
Tooltip	Logout from step
Tooltip Language ID	4921

Control Usage	Steps
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### Lot Attributes

The **Lot Attributes** button displays lot attributes.

Button ID	250
Language ID	2056
Tooltip	View lot attributes
Tooltip Language ID	4903
Control Usage	Inventory

### New Row

The **New Row** button opens a dialog box to add a row for the new set of data log samples.

Button ID	220
Language ID	4481
Tooltip	Add new DataLog row
Tooltip Language ID	4915
Control Usage	Data Log

### Notes

The **Notes** button opens a read-only dialog box for viewing the job, work order, or item notes for the selected job and item it produces.

Button ID	227
Language ID	600
Tooltip	View notes
Tooltip Language ID	4882
Control Usage	Queue

### Open/Launch Form

The **Open/Launch Form** button opens the form specified in the user data. This button is only available when the

system parameter *Path to form program* is set.

Button ID	27
Language ID	4472
Tooltip	Open/Launch form
Tooltip Language ID	4869
Control Usage	General

## Pause Job

The **Pause Job** button pauses the selected job.

Button ID	43
Language ID	3993
Tooltip	Pause the selected job
Tooltip Language ID	4875
Control Usage	Queue

## Print

The **Print** button prints the selected file.

Button ID	201
Language ID	4
Tooltip	Print document
Tooltip Language ID	4911
Control Usage	Folders

## Process

The **Process** button marks the selected production record as processed.

Button ID	62
Language ID	604
Tooltip	Mark a production lot as processed

Tooltip Language ID	4889
Control Usage	Production

## Pull Sample

The **Pull Sample** button opens a dialog box to modify the sample pull time.

Button ID	327
Language ID	7209
Tooltip	Pull Sample
Tooltip Language ID	7209
Control Usage	Sample Viewer

## Receive Inventory

The **Receive Inventory** button enables receiving inventory from an external location.

Button ID	309
Language ID	5021
Tooltip	Receive Inventory
Tooltip Language ID	5021
Control Usage	Inventory

## Reclassify

The **Reclassify** button opens a dialog box to change the grade and status of the selected lot.

Button ID	102
Language ID	1832
Tooltip	Reclassify the grade or status
Tooltip Language ID	4900
Control Usage	Inventory

## Reduce Consumption

The **Reduce Consumption** button reduces the consumption for the selected row.

Button ID	241
Language ID	4488
Tooltip	Reduce the consumption for selected row
Tooltip Language ID	4897
Control Usage	Consumption

## Reduce Production

The **Reduce Production** button opens the Reduce Production dialog box to reduce the amount of production reported in the selected production record.

Button ID	240
Language ID	4487
Tooltip	Reduce the production for current job
Tooltip Language ID	4890
Control Usage	Production

## Refresh

The **Refresh** button refreshes the control's data.

Button ID	21
Language ID	945
Tooltip	Refresh the screen
Tooltip Language ID	4861
Control Usage	General

## Rejects

The **Rejects** button opens the Reclassify Production dialog box for rejecting some or all of the selected production records.

Button ID	61
Language ID	1070
Tooltip	Add rejected production to the current job
Tooltip Language ID	4888
Control Usage	Production

## Remove

The **Remove** button deletes the selected Data Log row.

Button ID	101
Language ID	717
Tooltip	Delete Datalog row
Tooltip Language ID	4899
Control Usage	Data Log

## Rename Lot or Sublot

The **Rename Lot or Sublot** button renames the lot or subplot.

Button ID	324
Language ID	5376
Tooltip	Rename Lot or Sublot
Tooltip Language ID	5376
Control Usage	Item Lot Editor

## Rework

The **Rework** button opens the Rework dialog box, which allows rework for steps.

Button ID	264
Language ID	1818
Tooltip	Step rework
Tooltip Language ID	4925

Control Usage	Steps
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## Save Row

The **Save Row** button saves the Data Log row.

Button ID	221
Language ID	4482
Tooltip	Save DataLog row
Tooltip Language ID	4916
Control Usage	Data Log

## Scrap

The **Scrap** button removes all or some of the items from the inventory of the selected storage location.

Button ID	104
Language ID	4427
Tooltip	Scrap inventory
Tooltip Language ID	4902
Control Usage	Inventory

## Set Lot Data

The **Set Lot Data** button opens the Set Lot Data dialog box for setting the current lot number, production code, and storage location.

Button ID	84
Language ID	4288
Tooltip	Set new lot information
Tooltip Language ID	4895
Control Usage	Production, Consumptions, Steps

## Set Past Reason

The **Set Past Reason** button opens the Set Past Reason dialog box, which allows the reason for the currently

selected reason-pending row in the grid to be set.

Button ID	124
Language ID	4479
Tooltip	Enter reason-required for selected utilization record
Tooltip Language ID	4908
Control Usage	Utilization

### Set Reason

The **Set Reason** button opens the Set Reason dialog box, which allows the current reason on the current entity to be changed.

Button ID	122
Language ID	4477
Tooltip	Enter a reason for selected machine
Tooltip Language ID	4906
Control Usage	Utilization

### Show List

The **Show List** button displays the list of operators logged into step.

Button ID	222
Language ID	3515
Tooltip	List Operators logged into step
Tooltip Language ID	4919
Control Usage	Steps

### SPC Chart

The **SPC Chart** button displays an SPC chart.

Button ID	331
Language ID	7213

Tooltip	SPC Chart
Tooltip Language ID	7213
Control Usage	Sample Viewer

## Split Job

The **Split Job** button opens the Split Job dialog box for splitting the selected job into two jobs.

Button ID	267
Language ID	1770
Tooltip	Split the current job
Tooltip Language ID	4885
Control Usage	Queue

## Split Lot

The **Split Lot** button splits items from the selected row into another lot.

Button ID	105
Language ID	4560
Tooltip	Split items from the selected row into another lot
Tooltip Language ID	4904
Control Usage	Inventory

## Start Job

The **Start Job** button starts a job.

For the Queue control, the **Start Job** button starts the selected job.

For the Utilization control, the **Start Job** button opens the Start Data Entry Job dialog box.

Button ID	41
Language ID	3992
Tooltip	Start the selected job
Tooltip Language ID	4873

Control Usage

Utilization, Queue

## Start Some

The **Start Some** button allows for the splitting off of required production quantity into a new job that is then started on the active entity.

Button ID	310
Language ID	5022
Tooltip	Start Some
Tooltip Language ID	5022
Control Usage	Queue

## Switch User

The **Switch User** button opens the Switch User dialog box to allow:

- Switching between operators
- Logging on new operators
- Logging off existing operators
- Changing the password of selected operators

Button ID	9
Language ID	1377
Tooltip	Switch to another operator's session
Tooltip Language ID	4852
Control Usage	General

## Toggle Chart

The **Toggle Chart** button switches between grid display and chart display.

Button ID	228
Language ID	4485
Tooltip	Toggle chart
Tooltip Language ID	4917

Control Usage	Data Log
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### Toggle Sample Final Flag

The **Toggle Sample Final Flag** button marks a sample as final or clears the final flag.

Button ID	329
Language ID	7211
Tooltip	Toggle Sample Final Flag
Tooltip Language ID	7211
Control Usage	Sample Viewer

### Transfer In

The **Transfer In** button transfers inventory from another entity to the selected storage location.

Button ID	100
Language ID	1863
Tooltip	Receive inventory to a storage location
Tooltip Language ID	4898
Control Usage	Inventory

### Transfer Out

The **Transfer Out** button transfers inventory from the selected entity to another storage location.

Button ID	103
Language ID	1826
Tooltip	Transfer out inventory to another location
Tooltip Language ID	4901
Control Usage	Inventory

### Transfer Serial Numbers

The **Transfer Serial Number** button opens the Select and Transfer WIP Inventory dialog box for transferring

serialized parts between inventory locations.

Button ID	318
Language ID	5372
Tooltip	Transfer Serial Numbers
Tooltip Language ID	5372
Control Usage	Production, Queue, Inventory

### UnPull Sample

The **UnPull Sample** button sets the sample pull time and pulled by fields for the selected sample to Null.

Button ID	328
Language ID	7210
Tooltip	UnPull Sample
Tooltip Language ID	7210
Control Usage	Sample Viewer

### Update Job Spec. Values

The **Update Job Spec. Values** button opens a dialog box to edit job specification values.

Button ID	292
Language ID	3991
Tooltip	Update Job Spec. Values
Tooltip Language ID	3991
Control Usage	Spec

### Update Template Spec. Values

The **Update Template Spec. Values** button opens a dialog box to edit template specification values.

Button ID	293
Language ID	3997
Tooltip	Update Template Spec. Values

Tooltip Language ID	3997
Control Usage	Spec

## Utilization Split

The **Utilization Split** button opens the Utilization Split dialog box for editing the duration and shift information of the split events.

Button ID	332
Language ID	7380
Tooltip	Utilization Split
Tooltip Language ID	7380
Control Usage	Utilization

## View

The **View** button displays the document.

Button ID	200
Language ID	3126
Tooltip	View document
Tooltip Language ID	4910
Control Usage	Folders, Steps

## View Flow Diagram

The **View Flow Diagram** button opens the Job Diagram dialog box to show the job route diagram.

Button ID	223
Language ID	1006
Tooltip	View job flow diagram
Tooltip Language ID	4881
Control Usage	Queue

## View Item Attributes

The **View Item Attributes** button opens the Item Attributes dialog box to view, add, modify, and delete item attributes.

For the Queue control, the item produced by the selected job is used.

For the Production control, the item produced by the current job is used.

Button ID	229
Language ID	4497
Tooltip	View Item Attributes
Tooltip Language ID	4497
Control Usage	Production, Queue

## Waste

The **Waste** button opens the dialog box for entering waste consumption for the selected item.

Button ID	83
Language ID	1071
Tooltip	Enter waste for the selected item
Tooltip Language ID	4894
Control Usage	Consumption

# Integrate MES with Other Applications

As an integrator, you can configure other AVEVA products to work with MES.

## Use MES with System Platform

### Entity Model Builder

#### Entity Model Builder

Entity Model Builder (EMB) is a System Platform IDE extension for creating entities from your System Platform equipment model that uses:

- The Utilization Capability Object (UCO) to configure utilization and OEE support
- The Operation Capability Object (OCO) to configure job execution and storage execution capabilities
- The Sample Recording Object (SRO) to configure sample and sample result data.

The installation of Entity Model Builder also provides you the capability to export existing System Platform users and roles to create corresponding Manufacturing Execution System (MES) users and groups.

Entity Model Builder creates and maintains the entity model within the MES database. In the System Platform IDE equipment Model View, when you add and configure the UCO, OCO, or SRO as a child object to an existing application object, you can run Entity Model Builder to export the configured information and create corresponding entities.

This eliminates the need to manually create and configure entities to match the IDE equipment model.

Although Entity Model Builder is not a comprehensive user/role synchronization tool, it provides the convenience to avoid re-entering each System Platform user/role into the MES database.

### Setting Up Entity Model Builder

Entity Model Builder is installed on a System Platform IDE node as part of the MES installation.

Before you install Entity Model Builder, you must ensure the following:

- System Platform IDE is installed on a node
- MES middleware or a middleware proxy is installed on the System Platform IDE node

If you install Entity Model Builder, you must also install the MES Application Objects component and import at least one of these objects into a System Platform galaxy. Running Entity Model Builder without having an MES application object installed and imported is not a supported scenario.

See the *MES Installation Guide* or online help for details on installing Entity Model Builder as part of the MES installation.

## Building the Entity Model

You can build an entity model in the System Platform IDE Model view by:

- Adding a Utilization Capability Object (UCO) under any application object (area, system, and device integration objects are not supported) to create an entity with utilization and OEE capabilities.
- Adding an Operations Capability Object (OCO) below any area or application object (all other system and device integration objects are not supported) to create an entity with job executions and storage capabilities.
- Adding a Sample Recording Object (SRO) under any application object (system and device integration objects are not supported) to record data for one or more characteristics and capture contextual information and result data.

When you add a UCO, OCO, or SRO object as a child to an application object in the IDE equipment model, Entity Model Builder creates an entity for all the parent application objects and area objects as depicted in the Equipment Model View tab. Therefore, the basic equipment structure in the Galaxy is created with the intention of duplicating the same structure in the MES database.

Entity Model Builder validates licensing while exporting the entity model. Make sure that the appropriate license count for Utilization, Operations, and Quality exists prior to running Entity Model Builder.

## Exporting the Entity Model

You can manually export the System Platform Equipment Model to MES using the following methods:

- Cascade Export
- Repeat Export

For more information, see [Creating Entities with Entity Model Builder](#).

You can attempt a repeat export or cascade export, even if no changes are made to the System Platform equipment model.

## Cascade Export

You can select a root application object (for example, an Area) or a leaf application object (for example, a UCO, OCO, or SRO) to start the export. This enables a cascade export in a similar way as a cascade deploy. The export focuses primarily on the selected application object and its children. The parents of the selected application objects are also exported, but only to build the hierarchy until the selected application object.

If multiple application objects are selected, they will all be part of the export.

If the selected application object is not a UCO, OCO, or SRO and does not have a child UCO, OCO, or SRO below, then no object is exported. The user is informed that no object was exported via the normal progress dialog.

## Repeat Exports

Repeat exports essentially check that the OEE/Utilization configuration is the same in the System Platform equipment model and in the MES entity model. If there are any differences, the MES configuration is updated to

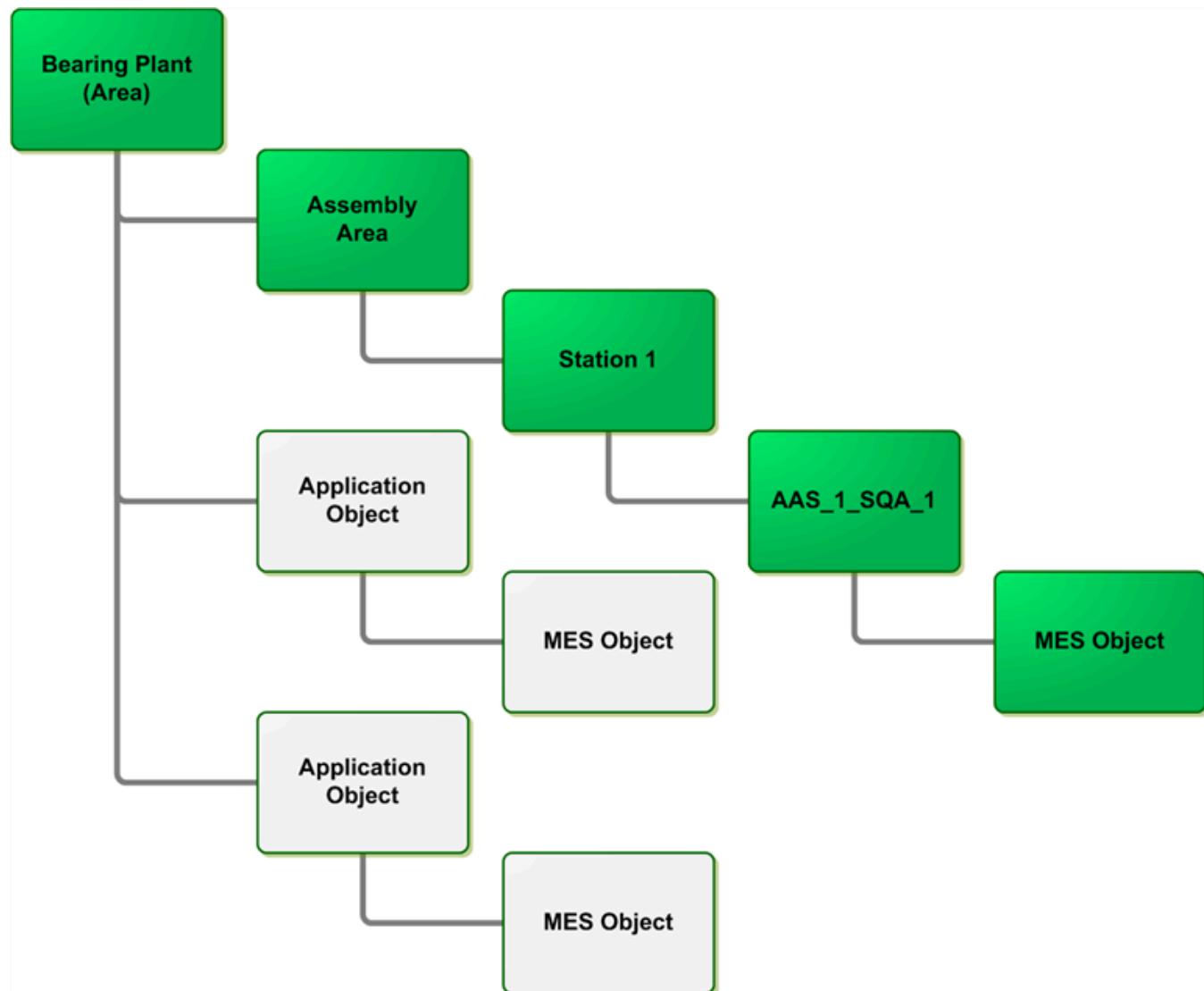
match the System Platform configuration. This ensures that any OEE/Utilization changes made via MES Client are overwritten on the next export when there is a contained UCO. Similarly, repeat exports check that the job exec configuration that exists in the System Platform equipment model also exists in the MES entity model. If there are any differences, the MES configuration is also updated to match the System Platform configuration.

This ensures that any job execution changes made via MES Client are overwritten on the next export when there is a contained OCO. Other changes such as labor, data log, and shipping capabilities made within MES Client are retained.

The SRO has no design-time impact and does not need to be re-exported.

### Entity Creation Example

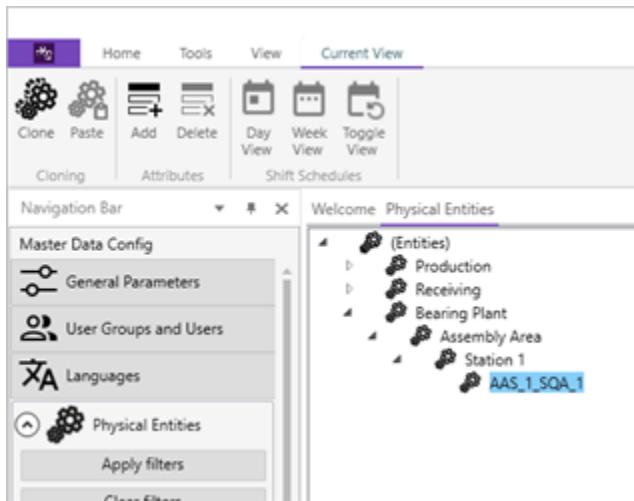
In the following example, if you select the UCO that is a child of the AAS\_1\_SQA\_1 object, Entity Model Builder creates the objects above it as entities up to and including the Bearing Plant (area). Only the objects that contain one of the MES objects have the capabilities defined by the MES object. Other entities that are created to support the hierarchy and do not have MES capabilities enabled are not included in the license count of the enforced capabilities.



Since the other UCOs in the same equipment model are not directly part of the selected equipment tree hierarchy, they are not included in the entity creation because it isn't part of the direct parent/child equipment structure.

You can similarly create entities by using the OCO or SRO.

You can also select any parent application object that has a UCO, OCO, or SRO descendant attached to it to create the same structure.



In the example above, you could have selected the parent application object AAS\_1\_SQA\_1 directly and the result would have been the same.

If MES already has an entity created in the database, Entity Model Builder overwrites the entity information with the new configured information in a UCO, OCO, or SRO when you run Entity Model Builder.

Entity Model Builder does not delete an existing entity or remove any capabilities (including utilization/OEE capabilities.) It can re-parent entities at any level to reflect new structural changes to the System Platform equipment model hierarchy.

The new entity model is defined in the database with the same structure as the IDE model view. The utilization/OEE configuration information is extracted from the UCOs and stored in the corresponding entities. Similarly, the job execution and storage information is extracted from the OCOs and stored in the corresponding entities. An application object can contain only one UCO, OCO, and SRO.

## Entity Names in MES

When Entity Model Builder creates entities, it creates the new entity names using the TagName attribute in the source application object.

As discussed in the entity creation example, if the following System Platform equipment model was exported, it would produce two Entities: Bearing\_Plant which is a parent to Assembly\_Area.

```
+ Bearing_Plant (Area)
+ Assembly_Area
  + Station1
  AAS_1_SQA_1
```

The export is non-destructive and it creates new entities and entity hierarchies that don't already exist. If an OEE/Utilization entity or the job execution entity already exists, it may be overwritten with new OEE/Utilization data and/or job execution data. However, an existing entity will never have any capabilities removed. This includes OEE/utilization and job execution capabilities.

---

**Note:** Entity Model Builder will first use the UCO and then use the OCO to create/update the entity in the MES database. Entity Model Builder can possibly overwrite the entity if an OCO and UCO exist under the same application object.

---

## Entity Capabilities and Properties

The Entity Model Builder creates new entities with the following configured UCO capabilities or features:

- Scheduling jobs
- Running jobs
- Capturing utilization
- Tracking OEE

The following performance parameter information is extracted from the UCO objects and written to the corresponding entities:

- Target OEE percent
- Target utilization percent
- Target performance percent
- Target quality percent
- Default production rate
- Default production unit of measure
- Default batch size
- Raw reason codes

For each raw reason code in the UCO, the following information is written to the entity.

- Raw reason code
- Default reason code
- Prompt flag
- Set of allowable reasons codes

If a raw reason code is deleted in the UCO, it will be deleted from the entity.

All application objects that contain an OCO are created as entities with the following functionality optionally enabled.

- Can Sched Jobs
- Can Run Jobs
- Can Store

If the OCO is configured to Enable PEM Attributes, Entity Model Builder configures the entity in the MES database with the following settings:

- Can Run Jobs
- Can Log Data

The following job execution information is extracted from the OCO objects and written to the corresponding entities:

- Number of simultaneous job positions
- Default "To" entity
- Default "From" entity
- Default "Reject" entity
- Default production reason
- Default consumption reason
- Default lot number
- Default subplot number
- Automatically load job specification
- Start next job
- End job
- Must required quantity be produced to end job
- Post execution FC counts
- Allow zero quantity split
- Auto-allocate quantity to running job

The following storage information is extracted from the OCO objects and written to the corresponding entities:

- Entity ID and location
- Status of an entity
- Items to store
- Delete inventory when 0
- Allow negative inventory
- Lot and subplot numbers of items
- Capability to store multiple lots
- Capability to store multiple items
- Storage location
- Inventory transfer

The SRO sets the *Can capture QM data* parameter for the entity.

## Creating Entities with Entity Model Builder

When you select an object or any parent application object in the IDE equipment model tree and run Entity Model Builder, their parent objects including the object area and the associated properties are replicated in MES.

### To create a new entity

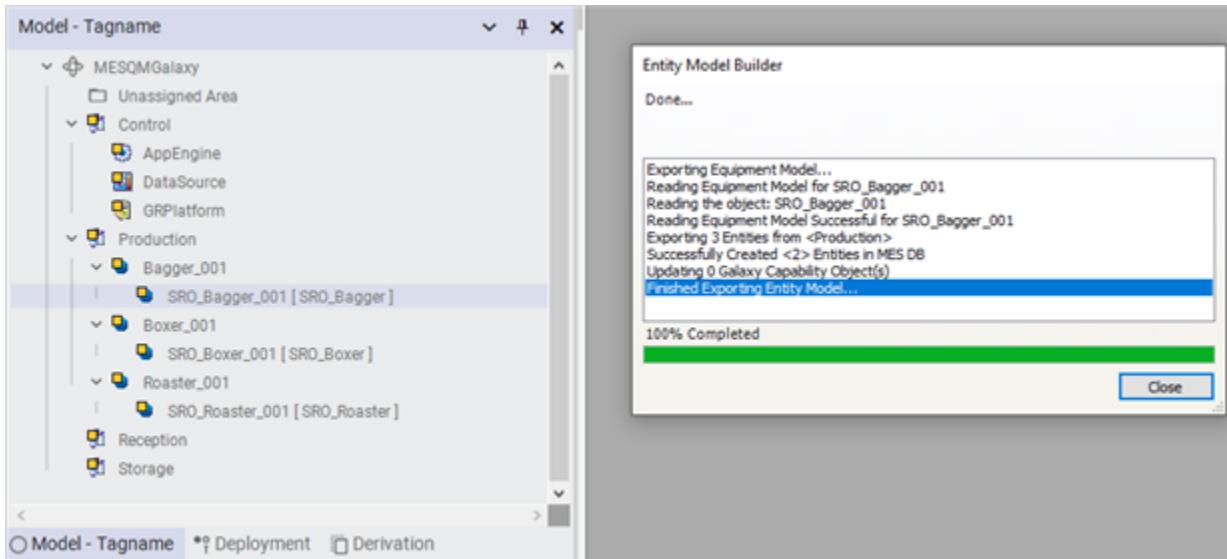
1. To avoid conflicts with other MES applications that are capable of adding or modifying entities, exit any MES applications that are currently running.

2. In the System Platform IDE equipment model, select the object or a parent of the object. You can select an OCO, UCO, or SRO object.

You cannot cancel the entity creation process. So make sure that you have selected the correct object or parent object before proceeding.

3. Right-click the OCO, UCO, or SRO object or its parent object, and then click **Build MES Entity Model**.

The Entity Model Builder dialog box appears. It shows the status, errors, and percentage of the completed information.



4. When the operation has completed, click **Close**.

The entities are created for the application object and all its parents.

If there is more than one object instance of the same type under a single parent application object, then the entity is not created and an error message appears.

When Entity Model Builder stores the utilization/OEE information in the corresponding entity of the parent application object, Entity Model Builder validates the UCO information and marks the information as synchronized with the MES database. You can then deploy the parent application object in the System Platform IDE.

Similarly, when Entity Model Builder stores the configured information of an OCO instance in the corresponding entity of the parent application object, Entity Model Builder validates the OCO instance and marks the instance as synchronized with the MES database. You can then deploy the parent application object in the System Platform IDE.

## Modifying Entities

You can use Entity Model Builder to modify or update the entities when you do any of the following to a System Platform application object:

- Add an OCO, UCO, or SRO instance at a higher level in the tree.
- Move an application object to a higher level in the tree.
- Rename an application object at a higher level in the tree. This creates a new entity and then the children of the old entity are assigned to the new parent application object.

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**Note:** When renaming an application object, the entity with the previous application object name is not deleted. You must delete the entity with the old name from the entity list through MES Client.

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**Note:** Renaming a parent user-defined object that contains an MES object (OCO, UCO, or SRO) will not trigger an out-of-synchronization error on the MES object. If Entity Model Builder is not run to synchronize the two hierarchies, the objects will generate errors at run time since the entity will not exist in the MES database.

- Add an application object in the operation capability tree that has the same name of an existing entity. The children of the existing entity are assigned to the new parent application object.
- Move an instance of an object under another parent application object. The previous parent is no longer considered as an entity (although it still exists). This creates a new entity corresponding to the new parent application object.
- Configure an instance of an object.

When you run Entity Model Builder, it validates whether the entity model contains the same information that is configured in the System Platform equipment model.

If there are any changes in the entity, the MES configuration is updated to match the information configured in the object.

Note the following:

- If you make any changes to an entity outside the IDE equipment model (MES Client), Entity Model Builder overwrites the content managed by the OCO or UCO with the existing configured parameter values when you run Entity Model Builder next time. Other content such as labor, data log, and shipping remains the same.
- If you remove an entity from the IDE equipment model, the entity is not deleted in MES.

## Exporting Users and Roles into MES

Although Entity Model Builder is not a comprehensive user/role synchronization tool, you can use it to export System Platform users and roles into corresponding MES users and groups in the MES database.

In System Platform, you must use Galaxy, OS User, or OS Group security to export users and roles into MES. Also, MES must be in the same security mode as the Galaxy. For example, if System Platform is in the Galaxy security mode, MES must be in Native security mode.

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**Note:** If the System Platform security type is None, you will not be able to export users and roles into MES.

You can export System Platform IDE users and roles into corresponding MES users and groups with the following conditions:

- If using System Platform OS Group security, the OS Users are added to the Galaxy as those users are authenticated. Therefore, you might have to periodically run Entity Model Builder to export new OS users into the MES database.
- You cannot export the System Platform DefaultUser user or Default role.

When a user and role export to the MES database is performed:

- All users and roles in the Galaxy database will be candidates for export even if they do not match the current System Platform security mode.

- If duplicate names are present in the set of names to export, a warning message will appear in the Progress dialog box and the Operations Control Management Console Log Viewer during the export.
- Entity Model Builder will create users and groups if they do not already exist in the MES database. It will not delete or modify the configuration of any existing MES users or groups.
- MES users and groups will have the same parent/child relationships as the associated System Platform users and roles.
- If a user is new but the groups of which the user is a member already exist in the MES database, the user will be added to the existing groups.
- New users are initially set as Inactive in MES.
- If using System Platform Galaxy and MES Native security modes, new users are assigned a password that is the same as their username. An administrator must assign the user to a group in MES Client that has MES Client login privileges. Each user can then log on to MES Client and change their password to a more secure password.
- The permissions for new MES groups are left blank. Permissions will have to be assigned in MES Client.
- New MES groups are not granted any entity access. Entity access will have to be assigned in MES Client.
- If a user or role is deleted in System Platform, Entity Model Builder will not delete the corresponding MES user or group.

You can modify or update users and roles at any time in the System Platform IDE. When exporting, Entity Model Builder will check the System Platform users and roles and make any necessary additions or modifications to the MES users and groups.

## Creating New Users and Groups

You cannot select individual users or roles in the System Platform IDE for export. All users and roles in System Platform Galaxy will be exported into corresponding MES users and groups unless they already exist in the MES database.

### To create new groups and users

1. Open a Galaxy and log on with your System Platform IDE user ID and password.
2. In the System Platform IDE, define new security roles and users and assign the users to one or more roles.  
If you are using OS Groups security, you can only create roles.
3. From the ribbon, select **Galaxy**, then **Export**.
4. Select **Export Users and Roles to MES DB**.  
A progress dialog displays the status, errors, and percent complete of the export.  
Status and error information is also logged to the Operations Control Management Console Logger.
5. Click **Close** when the export is completed.
6. Open MES Client.
7. In the **Navigation** pane, select the **Master Data Config** group, and then select **User Groups and Users** to view the exported users and groups.  
The exported users are listed under the groups of which they are members. If a System Platform user was not assigned to a role, the exported user in MES is listed in **Unassigned Users**.
8. To activate any new users, select their **Active** check box.

9. Assign new users to groups as needed.
10. For new groups, assign privileges and entity access as needed.

For more information about managing MES users and groups, see the *MES Client User Guide* or online help.

## Allowing New MES Native Mode Users to Change Their Password

If using System Platform Galaxy and MES Native security modes, new users are assigned a password that is the same as their username. You must assign the user to a group in MES Client that has MES Client login privileges. Each user can then log in to MES Client and change their password to a more secure password.

1. Add each of the exported users to a MES user group that has login privileges for MES Client:
  - a. Select the user and go to the **Properties** pane.
  - b. In the **Groups** section, select a MES user group that has MES Client login privileges.
2. On the ribbon, click **Save** in the **Main** group to save the user group assignments.
3. Notify each user that they need to log on to MES Client using a password that is the same as their login name, and to change password immediately to a more secure one. Include the following instructions for changing their password:
  - a. In the **Navigation** pane, click the **Master Data Config** group, and then click **User Groups and Users**.
  - b. Find and select your user name.
  - c. Go to the **Properties** pane.
  - d. In the **NewPassword** box, type a new password.
  - e. In the **RepeatPassword** box, type the new password to confirm. Re-entering the password ensures it was entered correctly. If the new password and repeat password values are not the same, you will be prompted to re-enter them.
  - f. On the ribbon, click **Save** in the **Main** group to save the password changes.

## Modifying Existing Groups and Users

You can also export modifications to existing System Platform users and roles to their corresponding MES users and roles at any time. To do this, perform the Export Users and Roles to MES DB operation as described in [Creating New Users and Groups](#).

No other information is changed during the update process. For example, group permissions are unchanged. In addition, the update process can add users to groups but will not remove users from groups.

## Sample Recording Object

Use the Sample Recording Object (SRO) to extend the System Platform IDE equipment model to record data for one or more characteristics and capture any of the following:

- Contextual information related to a sample
- Contextual information related to a characteristic within a sample
- Characteristic result data

## Getting Started with the SRO

The Sample Recording Object (SRO) is a System Platform automation object that extends the System Platform IDE equipment model and allows you to record data for one or more characteristics and capture the following:

- Contextual information related to a sample
- Contextual information related to a characteristic within a sample
- Characteristic result data

The MES middleware maintenance service is responsible for generating and managing frequency-based samples. These are generated per entity based on frequencies, such as calendar time and shift patterns. Single samples can also be generated when a job starts or ends, or when the main produced item's lot number changes, programmatically using the API.

When a sample is requested, the system sets the sample request time and the expiration time. When the status of the sample is Ready, the SRO can read from and write to the sample. When the sample is pulled (that is, when the operator physically collects material from the production line), the SRO updates the name of the operator and the time when the sample is pulled.

The operator name and the time when a result is recorded for each variable characteristic or attribute characteristic associated with an SRO are collected separately. These details are required as multiple tests are conducted against the same sample.

The SRO supports both the Manufacturing Execution System (MES) naming convention and the S95 naming convention. However, you must specify the naming convention during installation. The naming convention applies to attribute labels only, and not to the actual object attributes. For more information on mapping attributes, see [Mapping Attributes](#).

### SRO Operational Flow

The SRO is an application server object for two-way communication between the user and the MES database through the MES middleware.

The SRO can be used to:

- Configure delay timers
- Configure QM characteristic attributes
- Configure QM sample attributes



## The SRO, the System Platform Equipment Model, and MES Entities

The SRO adds MES capabilities to the equipment-oriented application objects in your System Platform IDE equipment model. By adding an SRO instance below another application object instance in your equipment model, you are able to map and configure the System Platform IDE equipment model to the MES entity model.

Exporting the configured SRO instance into MES using the Entity Model Builder will create MES entities that are represented in your equipment model. These entities can be used to perform sample recording operations according to the SRO configuration. Exporting SROs to the MES database also provides an automated alternative to manually creating and configuring the entities in MES Web Portal or MES Client.

### SRO Templates and Instances

You can create derived templates and instances in your System Platform IDE equipment model.

For more information about derived templates and instances, see the System Platform help.

When you configure any information in a derived SRO template in the System Platform IDE, the configured information is automatically propagated to all the child instances of the SRO template. This saves time in configuring the same information for different entities to execute similar jobs or store similar items.

For more information about managing System Platform objects, see the System Platform help.

If you modify an SRO instance directly or indirectly through a template, an Invalid indicator appears adjacent to the SRO icon in the System Platform IDE, which indicates that the SRO object is invalid and is not synchronized with the MES database. You must run the Entity Model Builder (EMB) to update the entity in the MES database per the changes in the SRO instance.

You must deploy the System Platform IDE equipment model to use the updated entity at run time. You must also deploy the SRO OnScan to use the defined SRO configurations at run time.

For more information about building and deploying entities on the galaxy, see the [Building the MES Entity Model from SROs](#).

## Importing the SRO Package into the System Platform IDE

You can import the SRO package into the System Platform IDE or upgrade it to the latest version.

### System Requirements

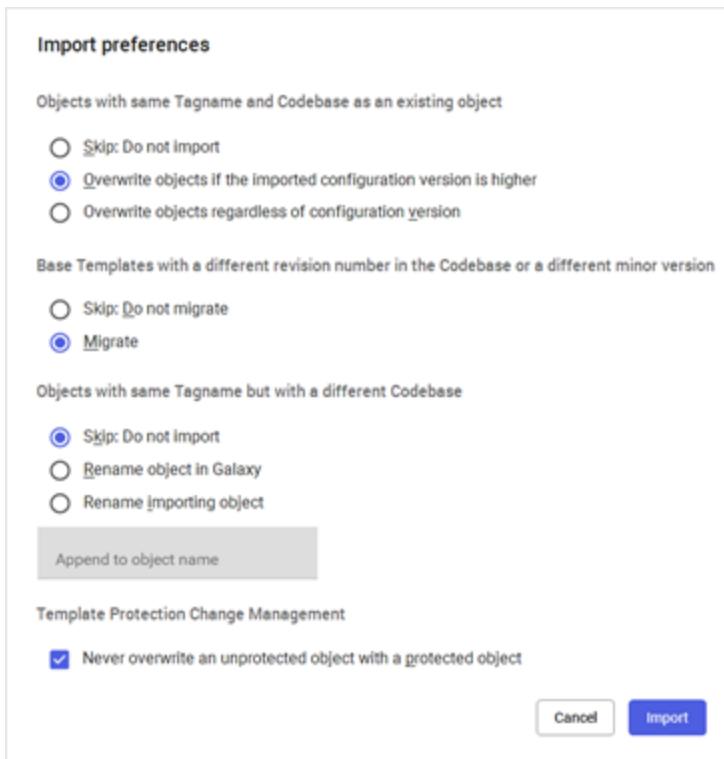
- All MES application objects—OCO, SRO, and UCO—must be at the same version; otherwise, incompatibility errors will occur.
- The Entity Model Builder must be installed. This can be installed during an MES installation with the Client applications.
- The Entity Model Builder requires that the MES middleware proxy be installed if the MES middleware is not installed on the local node.
- To utilize certain features of the SRO, you need to be able to access the MES database through the MES middleware. If the MES middleware is not installed on the same node where you are using the SRO, you must have the middleware proxy installed to establish a connection with the database.

For information on setting up or installing the middleware proxy, see the *MES Installation Guide* or online help.

### Importing the SRO Package

Installation of the SRO requires a separate import operation in System Platform IDE after you have completed the MES installation.

1. From the System Platform IDE ribbon, select **Galaxy**, then **Import**.
2. Select **Objects**, then **From package**.  
The Import Objects from package dialog appears.
3. Browse for the SRO package file (**SampleRecordingObject.aaPKG**) located either on your hard drive or on your MES installation disc.
  - If you used the default folder destination during the MES installation, the package file is stored in the **C:\ProgramFiles (x86)\Wonderware\MES\AppObjects** directory.
  - The SRO object file can also be found on the installation disc in the **\MES\AppObjects** directory.
4. Select the file and click **Open**.  
The Import Preferences dialog appears.



5. Select the appropriate import settings.

The SRO is considered a base template. Select whether to migrate (the default) or skip the installation if an existing SRO base template is in the galaxy.

6. Click **OK**.

The import process starts.

If the import process completes successfully, the \$SampleRecording base template object is available under the Production template toolset.

## Upgrading the SRO from Previous Versions

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**Note:** If you are upgrading MES application objects to the current version of MES, the version you are upgrading from must be MES 2012 (version 4.5) or later. If your version of MES is at a version prior to version 4.5, you must first upgrade it to version 4.5.

When MES is updated from a previous version, you must import the new SRO into the System Platform IDE. Each version of the SRO is compatible with the MES version with which the SRO was shipped.

1. Undeploy any System Platform galaxies that have SRO instances before installing the new version of MES. This ensures that the System Platform IDE is disconnected from the MES database and any MES components.
2. After installing the new version of MES, import the new version of the SRO with the **Migrate** option selected so that all existing templates and instances will be updated.
3. Before deploying the objects, make sure that all MES application objects—OCO, SRO, and UCO—are at the same version and that their existing templates and instances have been migrated. Otherwise, incompatibility errors will occur.

## Configuring SRO Templates and Instances

The SRO is managed like other System Platform application objects. The SRO supports creating derived templates and instances as needed for placement into your System Platform IDE equipment model.

For more information on managing System Platform objects, see the System Platform IDE help.

### SROs, the System Platform Equipment Model, and MES Entity Hierarchy

In the System Platform IDE Model View, you can add an SRO below any application object or system area object that you want to create in MES as an entity with MES quality capabilities.

When you place the SRO object as a child to an application or area object in the System Platform equipment model and then run the Entity Model Builder, an entity is created in the MES database for the SRO's parent object. Additional parent entities are created in the MES database as needed to replicate that object's branch of the equipment model in MES.

**Note:** You can add the SRO as a child under application and area objects only. If you add the SRO as a child under any other object such as an engine, the SRO does not work properly. An application or area object can contain only one SRO object as a child.

### SRO Attribute Inheritance and Planning the Templates and Instances

You can create derived templates and instances in your System Platform IDE equipment model.

When you configure any information in a derived SRO template on the **Characteristic** tab in the System Platform Object Editor, the configured information is automatically propagated to all the child instances of the SRO template. This saves you time in configuring the same information for different entities to capture the same characteristic results.

Note that inherited attribute values that are locked in the parent template cannot be modified in a child template or instance.

If you modify an SRO instance directly or indirectly through a template, an invalid indicator  appears adjacent to the SRO icon in the System Platform IDE, which indicates that the SRO object is not synchronized with the MES database. You must run the Entity Model Builder to update the entity in the MES database as per the changes in the SRO instance.

You must deploy the System Platform IDE equipment model to use the updated entity at run time. You must also deploy the SRO OnScan to use the defined SRO configurations at run time.

- For more information about derived templates and instances, and managing System Platform objects, see the System Platform IDE help.
- For more information about building and deploying MES entities from SROs, see [Building the MES Entity Model from SROs](#).
- For information about the run-time behavior of the SRO, see [SRO Run-Time Behavior](#).

### Configuring SRO Templates

You can configure SRO templates in the System Platform IDE. You can configure a SRO template in a similar way that you configure other object templates in the System Platform IDE.

## To configure an SRO template

1. Open the appropriate galaxy in the System Platform IDE.
2. In the **Template Toolbox** pane, right-click the required base SRO template, and then click **Derived Template**.  
The derived SRO template is created and appears under the base SRO template.  
You can rename the derived SRO template.
3. In the **Template Toolbox** pane, place the derived SRO template under a user-defined template that represents an entity.
4. Right-click the SRO template and click **Open**.  
The **General** tab appears in the Object Editor.
5. Configure the attributes in the **General**, **Sample**, and **Characteristic** tabs.
6. Save the template after configuring the required information.
7. When you have created the required templates, you are ready to create instances to add to application objects in the System Platform model. See [Adding SRO Instances to System Platform Objects](#).

## Specifying an Attribute and Command Value or Input Source

You can either enter a value for an attribute or command, or specify an input source.

### To enter a value

1. Clear the attribute or command's **Use Input Source** check box.
2. Enter or select the value to be used in the **Value or Input Source** field.



### To specify an input source

1. Select the attribute or command's **Use Input Source** check box.  
The control in the **Value or Input Source** column becomes a box with the default input source, `MyContainer.<AttributeOrCommand>`, automatically entered.
2. To change the default entry, do one of the following:
  - Manually edit the input source entry.
  - Click the attribute's Browse button. In the **Galaxy Browser** dialog box that appears, select the object and its attribute that is the input source.



Tagname	Attribute	Data type	Category	Security da...
	RecentSampl...	Integer	CalculatedRete...	Free access
	RecentSampl...	String	CalculatedRete...	Free access
	RecentSampl...	BigString	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	Integer	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	Time	Calculated	Operate
	RecentSampl...	Integer	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
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	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate
	RecentSampl...	String	Calculated	Operate

OK Cancel

13 Objects 27 Attributes SRO\_Bagger\_001.RecentSample.ErrorCode

## Locking SRO Attributes

As you configure the SRO templates, you can lock and unlock specific attribute settings by clicking the attribute's Lock icon. These locked attributes can only be updated by modifying the original template and redeploying it.



You can choose not to lock some of your template attributes so you can configure specific attribute settings for child instances of the template that are assigned to objects in your equipment model.

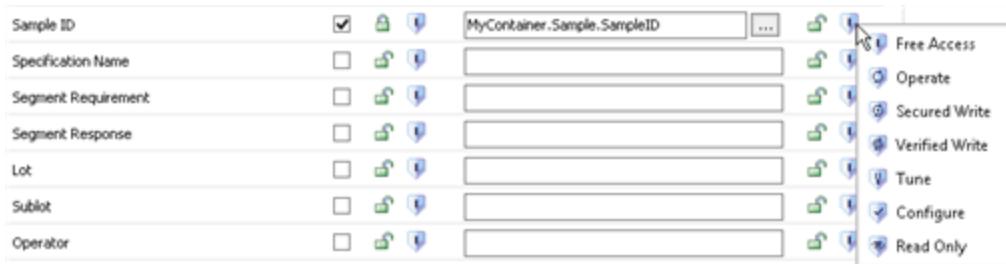
For more detailed information on attribute locks, see the System Platform IDE help.

## Attribute Security Settings

Many of the SRO attributes include a security classification setting, as indicated by the icon. You can set the security classification setting of these SRO attributes during configuration.

### To set attribute security

- Right-click on the security icon and select the appropriate security option.



For detailed information on managing attribute security, see the System Platform IDE help.

## Bad Quality Attributes in the SRO

When an SRO command is triggered and before the message is sent to the MES middleware, the SRO checks each attribute to be sent in the message for quality. If the quality for all of the attributes is Good, the data is sent to the middleware. If any of the attributes' quality is Bad, a warning message is logged in the Logger and the command is aborted. The trigger for the particular function in the SRO is not reset; you must manually reset the object before the object is ready to be triggered again (see [Resetting the Object to Clear an Error Condition](#)).

An example warning message is:

*The quality of this attribute: 'Lot', Object:SRO\_001, Entity:Machine\_01 is not good to process the requested command.*

In this scenario, no data is written and the ErrorCode and ErrorMessage attributes are not updated.

## Resetting the Object to Clear an Error Condition

The Reset command is used to clear the current error code and error messages, and to change the object's status to Ready in the object context. This command applies to all the functions within the SRO object where the reset capability is available (for example, sample commands and characteristic commands).

When this command is triggered, it resets the status and error attributes that belong to the same context as the reset attribute.

For example, a sample group has the following attributes (not all attributes are included for this example):

Sample.ErrorCode

Sample.ErrorMessage

Sample.Status

Sample.ResetCmd

When the Reset command is triggered in the sample context, the error code in the Sample.ErrorCode attribute and the error message in the Sample.ErrorMessage attribute are cleared, and the status in the Sample.Status attribute is set to Ready.

If the Reset command is triggered when the object context is in the Busy state, then the reset is ignored and the error code, error message, and the status is left unchanged.

## Configuring General SRO Attributes

In Object Editor, the **General** tab includes attributes that are common to the SRO.

### Response Type

Specifies whether the calls to the middleware are to be executed synchronously or asynchronously. The values are as follows:

#### With Response (Synchronous)

When you select this value, the object waits for a response from the middleware after submitting a request to the middleware to write the data in the MES database.

#### Without Response (Asynchronous)

When you select this value, a call from the middleware is sent to the message queue, and the object does not wait for a response.

The calls are submitted to the message queue when it communicates with the object. An exception is logged each time the object is unable to submit the message to the message queue.

---

**Note:** In the current version of MES, the **Response Type** list on the **General** tab is disabled, and it defaults to With Response mode.

---

### Default Delay Timer

Specifies the duration between two consecutive measurement data for a characteristic within a sample when collecting data automatically from the I/O. The Default Delay Timer value is used only when there is no value available from the MES database.

### Auto Reset

Specifies the behavior of the Status attribute.

- If you select this flag, the status attribute is reset to Ready after it completes its call to the middleware. This occurs if the result of the last call is successful. Otherwise, the status is reset to Error.
- If you do not select this flag, the Status attribute is reset to Done after it completes its call to the middleware. This occurs if the result of the last call is successful. Otherwise, the status displays Error. If the object has to execute another command, you must set the status to Ready in the code manually by using the Reset command.

The status attribute can have one of the following values:

#### Ready

Indicates that the command group is ready to process the next command when its attribute is set to True. A trigger attribute can initiate an MES transaction only when the status of the command group is Ready.

#### Busy

Indicates that the command group is currently processing a command in the middleware. Any command attribute that is set to True from the group, except the one that initiates the call to the middleware, is rejected and is reset to False.

#### Error

Indicates that the last call to the middleware resulted in an error. The caller must acknowledge the error by resetting the status to Ready before the next command from this group is processed.

#### Done

Indicates that the result of the last call to the middleware is successful. The status is reset to Ready. This status is available when the instance of an object is set to manual mode.

## Configuring the Sample Attributes and Commands

In Object Editor, the **Sample** tab includes object attributes for interacting with samples associated with the entity, which is a part of the SRO instance.

At any given time, an entity can be associated with more than one active sample. Each monitored sample provides sample-related MES attributes, such as Lot and Sublot, for writing the contextual data that can be changed for a sample.

You can also configure the following on the **Sample** tab:

- Data to be recorded for samples
- Commands to execute the recording of the data
- Number of samples to monitor at run time

### Sample Data Attributes

The sample data object attributes are on the **Sample Data Attributes** section of the **Sample** tab.

#### Number of Recent Samples to View

Specifies the number of recent samples that can be viewed at a given time. The minimum number you can view at a given time is 1, and the maximum is 20. When you increment this setting, the SRO generates 23 object attributes (RecentSample[n].xxx) to store information about the sample at run time.

You should increment this setting with caution because incrementing this value creates many object attributes, which take longer to deploy and load. For more information, see [Sample Attributes Available at Run Time](#).

#### Specification Name

Specifies the QM specification to be used when generating on-demand samples. This attribute is used with the Generate Sample command in the **Sample Data Commands** pane. The QM specification specifies which characteristics should be considered in the on-demand sample, which sample plan should be used, and the sample name (as defined in the sample plan).

#### Sample ID

Specifies the ID (an integer) of the sample for which the data is to be recorded in the MES database.

#### Segment Requirement

Specifies the S95 segment requirement value for the sample.

#### Segment Response

Specifies the S95 segment response value for the sample.

#### Lot

Specifies the lot number for the sample.

#### Sublot

Specifies the subplot number for the sample.

#### Operator

Specifies the user/operator who pulls the sample from the production line or finalizes the sample.

#### Final

Specifies a Boolean value that indicates whether the sample data is final or not. After a sample is marked as final, the data and results for all the characteristics cannot be modified.

**Priority**

Specifies an integer value that identifies the priority for the sample.

**Spare1 to Spare4**

Custom information about the sample data, if any.

**Event Data Attribute**

The event data object attribute is on the **Event Data** section of the **Sample** tab.

**Event DateTime**

Specifies the date and time when the sample is pulled or finalized.

You can do either of the following:

- Map the attribute to an I/O tag to read the value from it.
- Select the AutoGenerate check box to automatically generate a date and time value in the object.

If the attribute is not mapped to an I/O tag and the **AutoGenerate** check box is not selected, the attribute is not updated. The value is then updated by the MES database.

**MES Sample Attributes Data Attributes**

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**Note:** In the current version of MES, MES Sample Attributes Data is disabled in the object.

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**Sample Data Commands**

The Sample Data commands are on the **Sample Data Command** section of the **Sample** tab.

**Record Sample Data Command**

Allows you to update the sample record for the sample ID in the Sample table, if the SegmentResponse, SegmentRequirement, Priority, Spare1-4, Lot or Sublot attributes contain a value that is not null. You can also set the pulled\_by and pulled\_at fields in the Sample table for the sample ID, if the EventDateTime and Operator contain values that are not null.

An error message appears when the command is triggered with Operator being non-null and a sample already having non-null values in pulled\_by and pulled\_at fields. To change the pulled\_by and pulled\_at fields in the Sample table, you need to unpull the sample. You must use Sample Viewer or scripting to unpull a sample. You cannot unpull the sample from the SRO.

**Record MES Sample Attribute Data Command**

Records the Value and Notes for all MES attribute data for a sample using the SampleID attribute in the Sample\_Attr table.

---

**Note:** In the current version of MES, the Record MES Sample Attribute Data command is not available.

---

**Finalize Sample Data Command**

Finalizes the sample and its data to prevent further editing. This command uses the Final, Operator, and EventDateTime attributes to update the finalized\_at and finalized\_by columns in the Sample table. If the status of the Final attribute is True, the sample is marked as Final. If the status of the Final attribute is False, the flag is cleared and data can be recorded against the sample again.

**Generate Sample Command**

Generates samples on demand. Uses the Sample.QMSpecName attribute to determine which characteristics should be considered in the on-demand sample.

#### Reset Command

Resets the object state for a characteristic to Ready and sets the command attributes to False. This prepares the sample characteristic to process the next request.

## Configuring Characteristics Attributes and Commands

In Object Editor, the **Characteristics** tab includes attributes and commands for interacting with the characteristic results within a sample associated with the entity that is a part of the SRO instance.

Any given sample can have more than one characteristic to capture. The SRO can be configured to monitor multiple characteristics at a time and to interact with the samples. Each characteristic is monitored to do the following:

- Provide attributes for writing the contextual data that can be changed, such as notes and causes.
- Provide ReadOnly attributes for fixed data, such as statistical results.
- Provide attributes for writing characteristic results.

Characteristics may be captured automatically from an I/O source and may contain multiple measurements.

---

**Note:** You must configure SRO at design time to expose the **Characteristic** tab, so that you can record data for a characteristic within a sample.

You can configure one or more characteristics in the **Characteristics** tab. You can map the individual attributes of a characteristic to the I/O tags.

## Configuring Characteristics

Characteristics are added to the SRO on the **Characteristics** tab.

Once a characteristic is added, you can configure the following for the characteristic:

- Sample data attributes
- Result data
- MES result attributes data
- Data commands

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**Note:** In the current version of MES, the MES Result Attributes Data pane is disabled.

Characteristics that are inherited from parent templates appear in the **Inherited Characteristics** list.

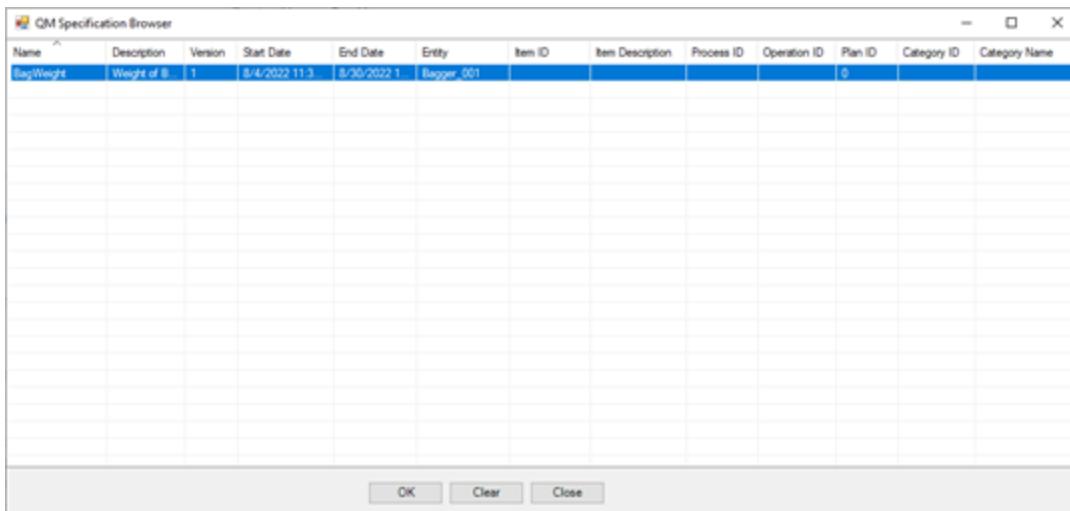
## Adding Characteristics

You can configure attributes only after you add a characteristic or if you select an existing characteristic.

#### To add characteristics

1. Click the  Add button at the top of the **Characteristics** tab.

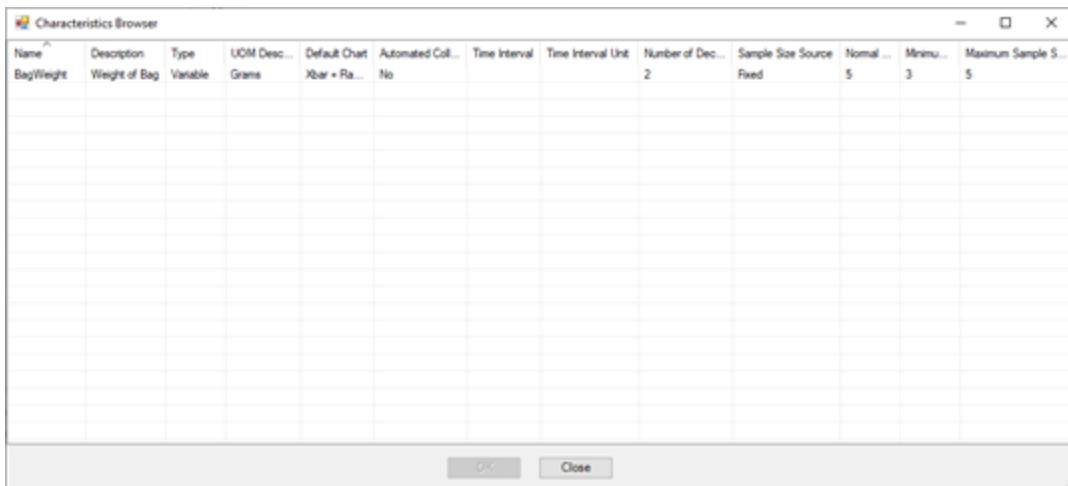
The QM Specification Browser window appears.



If the number of QM specifications in the MES database is more than the warning level, a filter dialog box appears. This filters the unwanted QM specifications, and displays a list of QM specifications that you can use. The warning level amount is determined by the *Warning level number of records for the Sample Characteristic Filter Dialog in SRO* system parameter in MES Client; for more information, see the *MES Client User Guide* or online help.

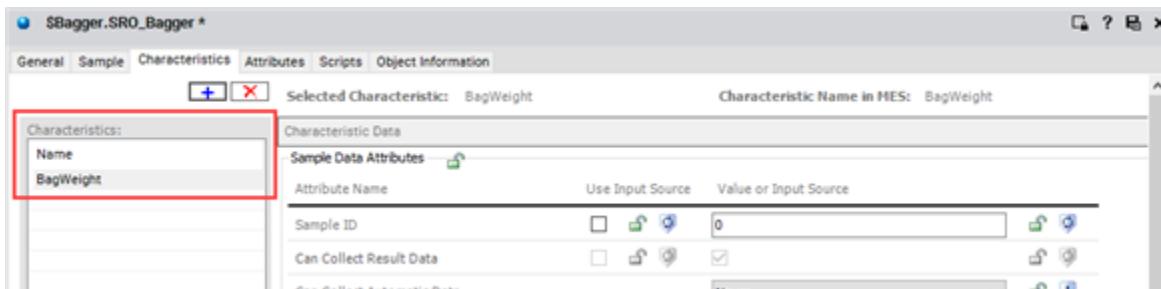
2. Select one or more QM specifications to be monitored for the characteristic and click **OK**.

The Characteristic Browser window appears, with a list of characteristics for the selected QM specifications.



3. Select one or more characteristics to be added to the object and click **OK**.

The characteristics are added to the **Characteristics** list.



When adding a characteristic to an SRO instance, the SRO does the following:

- Uses characters that conform with System Platform attribute naming scheme. Any other characters are deleted. If the characteristic name contains a space, it is replaced with an underscore. For more information on System Platform attribute naming scheme, see the System Platform IDE help.
- Restricts the length of the MES attribute to 32 characters in the SRO.

## Renaming a Characteristic

You can change the name of a characteristic that has been added to the SRO.

### To rename a characteristic

1. In the **Characteristics** list, select and click the characteristic that you want to rename.
2. Type the new name and press **Enter**.

The name of the selected characteristic is changed.

## Deleting a Characteristic

You can delete a characteristic from the SRO template or instance.

1. In the **Characteristics** list, select the characteristic that you want to delete.
2. Click the  Delete button.  
A confirmation message appears.
3. Click **Yes**.

The selected characteristic is deleted from the list.

## Configuring a Characteristic's Sample Data Attributes

The **Characteristic Data** section includes a list of the sample data attributes that can be configured for the currently selected characteristic.

### Sample ID

Specifies the ID of the sample record generated for the characteristic which is to be recorded in the MES database.

### Can Collect Result Data

Specifies whether the SRO can collect measurements for a characteristic at run time. If the status of this attribute is set to False, the measurement data for the characteristic is not collected at run time.

---

**Note:** In the current version of MES, the Can Collect Result Data attribute is set to True and disabled.

---

### Can Collect Automatic Data

Specifies whether the characteristic should always collect automatic data, never collect automatic data, or use the specification configuration for a sample to determine whether it should collect automatic data at run time. If the status of this attribute is set to Never, no automatic measurements are collected for the characteristic. If the status of this attribute is set to Always, the characteristic collects automatic measurements. If the status of this attribute is set to Use Configuration, the automatic data is collected during run time, depending on the characteristic and the QM specification that is used to generate a sample.

When a characteristic collects data automatically, the SampleID attribute is updated to the most recent sample containing the characteristic. It is not possible to write to older sample characteristic records.

### Delay Timer

Specifies a value that identifies the time interval between each measurement data for a variable characteristic. If there is a non-null value for the characteristic's delay timer setting in the database, the attribute contains a default value from the MES database. You can change the default value in the Configuration Editor. This attribute is used when the status of the Can Collect Automatic Data is set to Always or Use Configuration, and there are more than one measurement per sample for the variable characteristic. This setting does not apply to attribute characteristics.

### Note

Specifies any additional information that you want to record in the MES database for the characteristic within the specified sample.

### Cause Group

Specifies a cause group for the characteristic within the specified sample.

### Cause

Specifies a cause for the sample characteristic within the specified sample.

### Equipment

Specifies a string that indicates the equipment used to measure the sample characteristic data.

### Expose Statistics

Specifies a Boolean value that indicates whether the statistic object attributes for the characteristic are exposed at run time. If you enable this setting, many additional object attributes are exposed at run time. The object attributes are updated when results are recorded.

You should enable the Expose Statistics setting only if statistics are required. For more information, see [Characteristic Attributes Available at Run Time](#).

### Operator

Specifies a value that identifies who measured the sample characteristic. The user name provided does not have to be an MES user.

### Value Number For Result Attributes

Specifies a value number that identifies the measurement data for the characteristic sample. This identifies the particular measurement value (result) within a subgroup for which the result MES attributes are to be updated. For ungrouped variables (individuals) and attributes, the value number is always 1.

---

**Note:** In the current version of MES, the Value Number For Result Attributes field is disabled.

---

## Configuring a Characteristic's Result Data

The **Result Data** section provides attributes for configuring multiple measurements for a sample for a variable characteristic. It is initially populated with **ValueNumber.Value** and **ValueNumber.ActualSampleSize** for attribute characteristics and is empty for variable characteristics. The maximum number of result attributes for a variable characteristic is 99.

Result data attributes that are inherited from parent templates appear in the **Inherited Result Attributes** list.

For information on how value numbers are recorded as results, see [SRO Run-Time Behavior](#).

### Adding Result Data Attributes

- In the **Result Data** section, click the  Add button.

A new result attribute is added to the list.

The screenshot shows a software interface titled "Result Data". At the top, there is a toolbar with a "Result Attribute" button (with a plus sign) and a "Delete" button (with a minus sign). To the right of the toolbar, it says "Sample Size:1". Below the toolbar, there are three columns: "Attribute Name", "Use Input Source", and "Value or Input Source". Under "Attribute Name", the value "ValueNumber01" is listed. Under "Value or Input Source", there is a text input field containing "0.0" and several small icons to its right. The entire dialog box has scroll bars on the right side.

The result attributes start with ValueNumber01, and the name numbering is incremented for each attribute that is added. For example, if there are five result attributes in the SRO, the sixth result attribute is added as ValueNumber06.

The maximum number of result values in the object is 99. At least one result value must be exposed for a variable characteristic to record data at run time.

### Deleting a Result Data Attribute

- Click the Delete button.

The result attribute at the bottom of the list is removed for the selected characteristic. For example, if there are five result attributes in the SRO, the SRO removes the fifth result attribute for the selected characteristic.

### Result Data Attributes

#### **ValueNumber.Value**

Specifies a value that is measured for the sample characteristic. This exists only if the characteristic type is binary or counted.

#### **ValueNumber.ActualSampleSize**

Specifies the actual sample size for the sample characteristic. This exists only if the characteristic type is binary or counted.

#### **Sample Size**

This is a display-only property that has a count of the number of result data entries for the sample. The sample size increments each time a new result data entry is added to the list (up to a maximum of 99) and decrements each time a result data entry is removed. The sample size does not represent the normal or maximum sample size of the characteristic or the QM specification-linked overrides. It represents the maximum number of results that can be recorded at a time for a particular characteristic. For example, if the desired sample size is 20, but there are only 5 devices to measure the characteristic, each sample will be read in 4 sets of 5, and only 5 result data entries will be used (one to each tag that connects to a measuring device).

### Configuring a Characteristic's MES Result Attributes Data

---

**Note:** In the current version of MES, the MES Result Attributes Data section is disabled.

---

## Characteristic Data Commands

The **MES Result Attributes Data** pane provides commands for recording data about the characteristic.

### Record Sample Characteristic Data Command

Allows you to update additional data for the characteristic (in the Sample\_Char\_Link table) for the provided SampleID using the Note, CauseGroup, Cause, ControlMove, IgnoreSample, and Equipment attributes.

### Record Result Data Command

Records the measurement data for a characteristic for the provided Sample ID using Operator and ValueNumber<N>.Value attributes for Sample ID linked to a variable characteristic; ValueNumber.Value and ValueNumber.ActualSampleSize attributes are used for the Sample ID linked to an attribute characteristic. Operator is also used for attribute-type characteristics. For attribute characteristics that are configured to use a fixed sample size, the ValueNumber.ActualSampleSize attribute is ignored. This captures all measurements for a characteristic and records them in a single transaction.

### Record MES Result Attribute Data Command

Records all the MES result attribute data for the provided Sample ID and Result Value Number using the <ResultAttributeName>.Value and <ResultAttribute>.Notes attributes in a single transaction.

**Note:** In the current version of MES, the Record MES Result Attribute Data command is not available.

### Reset Command

Resets the object state for a characteristic to Ready and sets all command properties to False. This prepares the sample characteristic to process the next request.

## Adding SRO Instances to System Platform Objects

Once you have created your SRO templates, you can add instances of the templates to your equipment model in the System Platform IDE below any object that you want to create in MES as an entity with SRO-related capabilities.

1. In the System Platform IDE Model View, configure your equipment model, including any objects that represent MES entities that require SRO-related capabilities.  
For detailed information about creating your equipment model in the System Platform IDE, see the System Platform IDE help.
2. Create and add an SRO instance as a child of any modeled object that represents an MES entity that requires SRO-related capabilities.

An object can contain only one SRO object as a child.



3. Configure the individual SRO instances in your equipment model as needed.

For general SRO configuration information, see [Configuring SRO Templates and Instances](#).

For information about the specific configuration attributes, see the appropriate chapters in this document.

When you are ready to export the SRO instance to the MES database as an MES entity, see [Building the MES Entity Model from SROs](#).

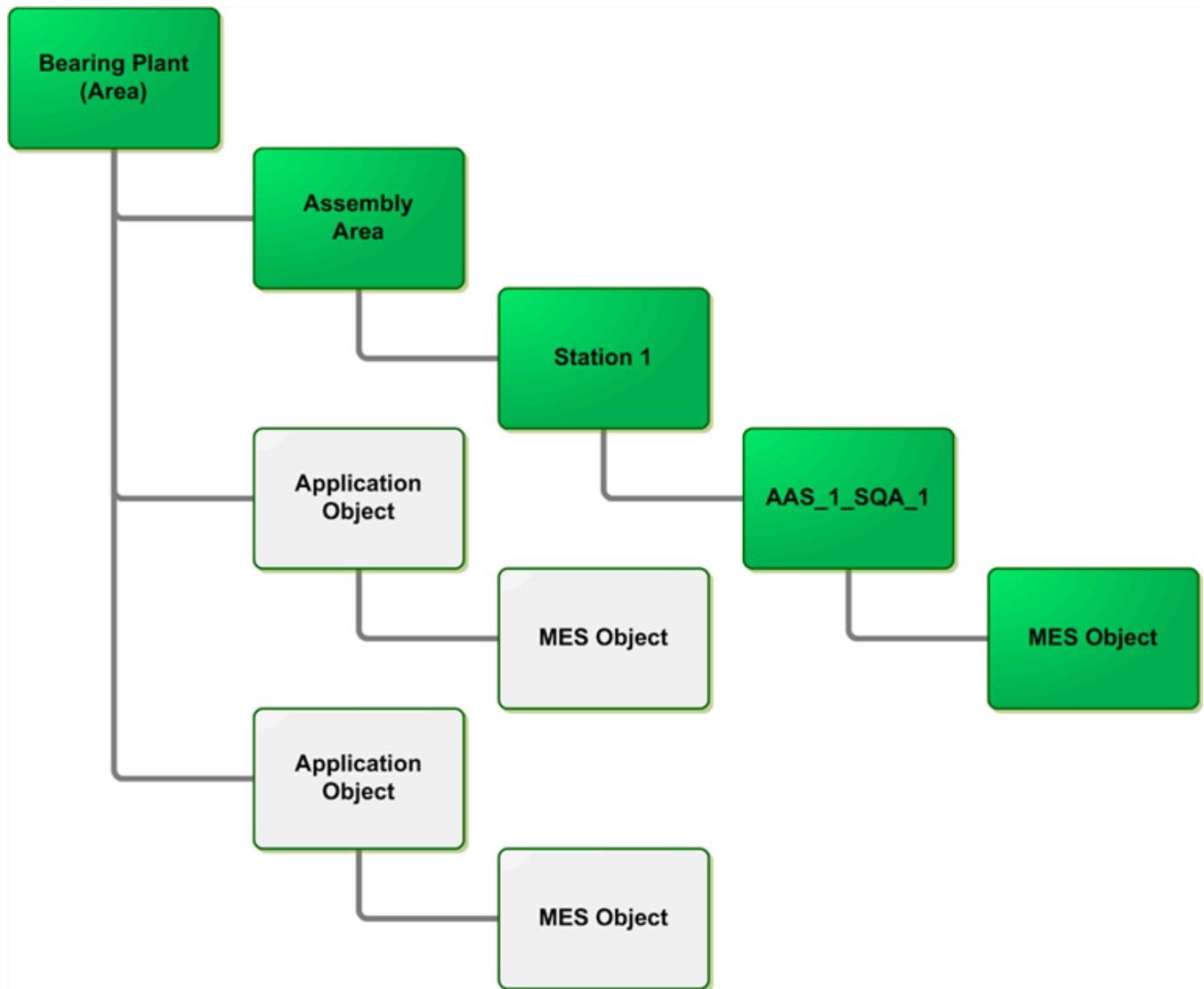
## Building the MES Entity Model from SROs

The Entity Model Builder is a System Platform IDE extension for creating entities from your System Platform equipment model that use the SRO for recording sample data in the MES database.

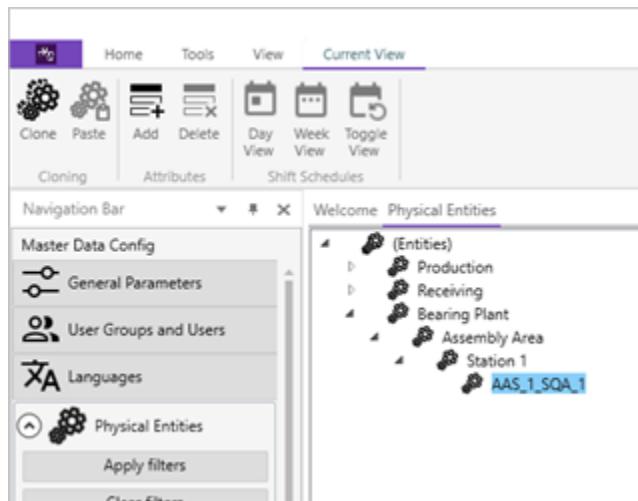
You can also use the Entity Model Builder to export existing System Platform users and roles to create corresponding users and groups. For more information about this capability, see the *MES Entity Model Builder User Guide*.

### How SRO-Enabled Objects Are Added to the MES Database as Entities

In the following example, if you select the SRO that is a child of the AAS\_1\_SQA\_1 object, the Entity Model Builder creates MES entities only for the objects above it in the branch, up to and including the Bearing Plant (area). The attribute configuration information is extracted from the SROs and stored as the corresponding property settings for the target entity (in this case, the AAS\_1\_SQA\_1 entity).



The following figure shows the resulting entity tree in MES Client. You could also have selected the parent application object that has a SRO child attached to it and then run Entity Model Builder to create the same structure.



Since the other SROs in the same equipment model are not directly part of the selected equipment tree branch, they are not included in the entity creation because they are not part of the direct parent/child equipment structure to the AAS\_1\_SQA\_1 object.

Note the following additional behaviors about SROs and using Entity Model Builder to create or modify their entities in the MES database:

- If you select multiple application objects with SROs, the Entity Model Builder creates entities for all of them.
- If the selected application object is not a SRO, does not have a SRO below it, and is not part of an MES sample recording configuration hierarchy, then the Entity Model Builder does not create any entities.
- The Entity Model Builder only creates new entities and new entity hierarchies that do not already exist.
- To delete an entity, you must delete it using MES Client. For more information on managing entities, see the *MES Client User Guide*.
- If there is already an entity in the MES database with the same name as the application object with a SRO, Entity Model Builder will overwrite its corresponding properties with the SRO attribute settings.
- Though the Entity Model Builder never deletes an existing entity or removes any capabilities (including SRO capabilities), it can re-parent entities at any level to reflect new structural changes to the System Platform equipment model hierarchy.
- When the Entity Model Builder encounters an error, the error will be indicated in the progress window and the SRO will remain in the unsynchronized state. It will not be possible to deploy or redeploy the SRO until it is synchronized with the MES database. When the Entity Model Builder encounters an error, the error will be indicated in the progress window and the OCO will remain in the unsynchronized state. It will not be possible to deploy or redeploy the OCO until it is synchronized with the MES database. Additional diagnostic information is also available in the Logger.

## Entity Names

When the Entity Model Builder creates entities, it bases the new entity names on the TagName attribute in the source application object.

From the example above, the Entity Model Builder produces four entities using the TagNames accordingly, with the final entity with the SRO child having the SRO capabilities set.

```
+ Bearing_Plant
  + Assembly_Area
    + Station1
      + AAS_1_SQA_1
```

## Entity Capability Copied to the MES Database

When the Entity Model Builder adds an entity to the MES database for an SRO, it enables the Can Capture QM Data capability for the entity.

## Building and Deploying an Entity

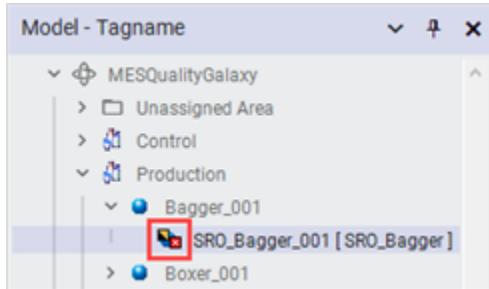
Once you are finished configuring the SRO, save the SRO and fix any errors that are reported. Depending on the changes you made, you will have to build the entity model.

- If you made a change to a SRO template, you might have to update your entities to cascade your changes to

any derived SRO instances. This depends on what you changed and what attributes you may have locked in your template.

- If you made a change to a SRO instance, you will only have to build the entity for the instance.

SRO instances that need to have their corresponding entities built or updated using Entity Model Builder will display an error indicator on the SRO icon in the System Platform IDE.



After you have saved your configured SRO, you can then create or update the corresponding MES entities by building your entity models. See [Creating an Entity in the MES Database from an Application Object with a SRO](#) and [Updating MES Entities with SRO Changes](#).

After you have built or updated the entities, you can deploy your equipment model for run-time operation. For detailed information deploying your galaxy, see the System Platform IDE help.

When you deploy the SRO OnScan, it will begin using the defined SRO configuration for run-time operations.

If changes are made in MES Client to the characteristics captured by the SRO, the SRO will need to be modified to make the same characteristic changes. For information about configuring SRO characteristics, see [Configuring Characteristics Attributes and Commands](#).

## Creating an Entity in the MES Database from an Application Object with a SRO

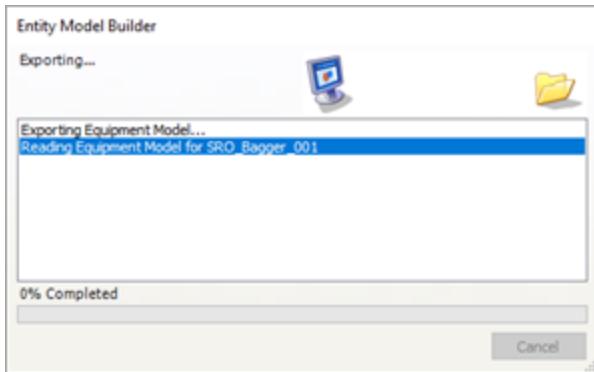
When you select a SRO or any parent application object in the IDE equipment model tree and run the Entity Model Builder, their parent objects up to and including the object area and their associated properties are replicated in MES.

### To create a new entity

1. To avoid conflicts with other MES applications that are capable of adding or modifying entities, exit any MES applications that are currently running.
2. In the System Platform IDE equipment model, right-click an SRO instance or any of its parent objects and click **Build MES Entity Model**.

**Note:** You cannot cancel the entity creation process, so make sure you have selected the right SRO or parent object before continuing.

The Entity Model Builder dialog box appears. It displays the status, errors, and percent complete.



**Note:** If you have more than one SRO under a single parent application object, the SRO will not be created and an error will be displayed in the progress dialog box.

- When the *100% Completed* message appears, click **Close**.

After the build process has successfully completed, the Entity Model Builder validates the SRO and marks it as being synchronized with MES. You can now deploy the parent application object in the System Platform IDE.

## Updating MES Entities with SRO Changes

You can use the Entity Model Builder to update your MES entities with any of the following changes made to the SROs in the System Platform IDE:

- Changing the configuration of an SRO.
- Adding an SRO at a higher level in the equipment model.
- Moving an SRO to a higher level in the equipment model (re-parenting).
- Renaming a parent to an SRO at a higher level in the equipment model. This creates a new entity in the MES database and re-parents the old entity's children, if there are any.
- Adding an SRO to the equipment model that has the same name as an entity manually configured using MES Web Portal or MES Client. The existing entity's children (if any) are re-parented.
- Moving an SRO to another parent application object. The old parent is no longer considered an entity from the perspective of Entity Model Builder. However, if the entity has already been created in the MES database, it will remain in the database. This creates a new entity and parent entities, if needed.

If you remove an entity in your IDE equipment model, the entity is not deleted in MES.

If you have not made any changes to the System Platform equipment model, the Entity Model Builder just checks that the SRO configuration in the System Platform equipment model also exists in the entity model. If there are any differences (for example, if someone changed an entity's configuration using MES Client), the MES configuration is updated to match the System Platform configuration.

## Where to Maintain an Entity's Object Attributes

For MES entities that are created from System Platform objects, changes to the object's attributes are one-directional—that is, from the System Platform IDE to the MES database. There is no mechanism to update the object's attributes if the corresponding entity's properties are changed in the MES database using MES Web Portal or MES Client.

Also, when Entity Model Builder is run, it overwrites the entity's property settings in the MES database with the current object attribute settings. So if you make changes to such an entity's object attributes outside the System Platform IDE equipment model (for example, using MES Web Portal or MES Client), those changes will be overwritten by the Entity Model Builder the next time it is run.

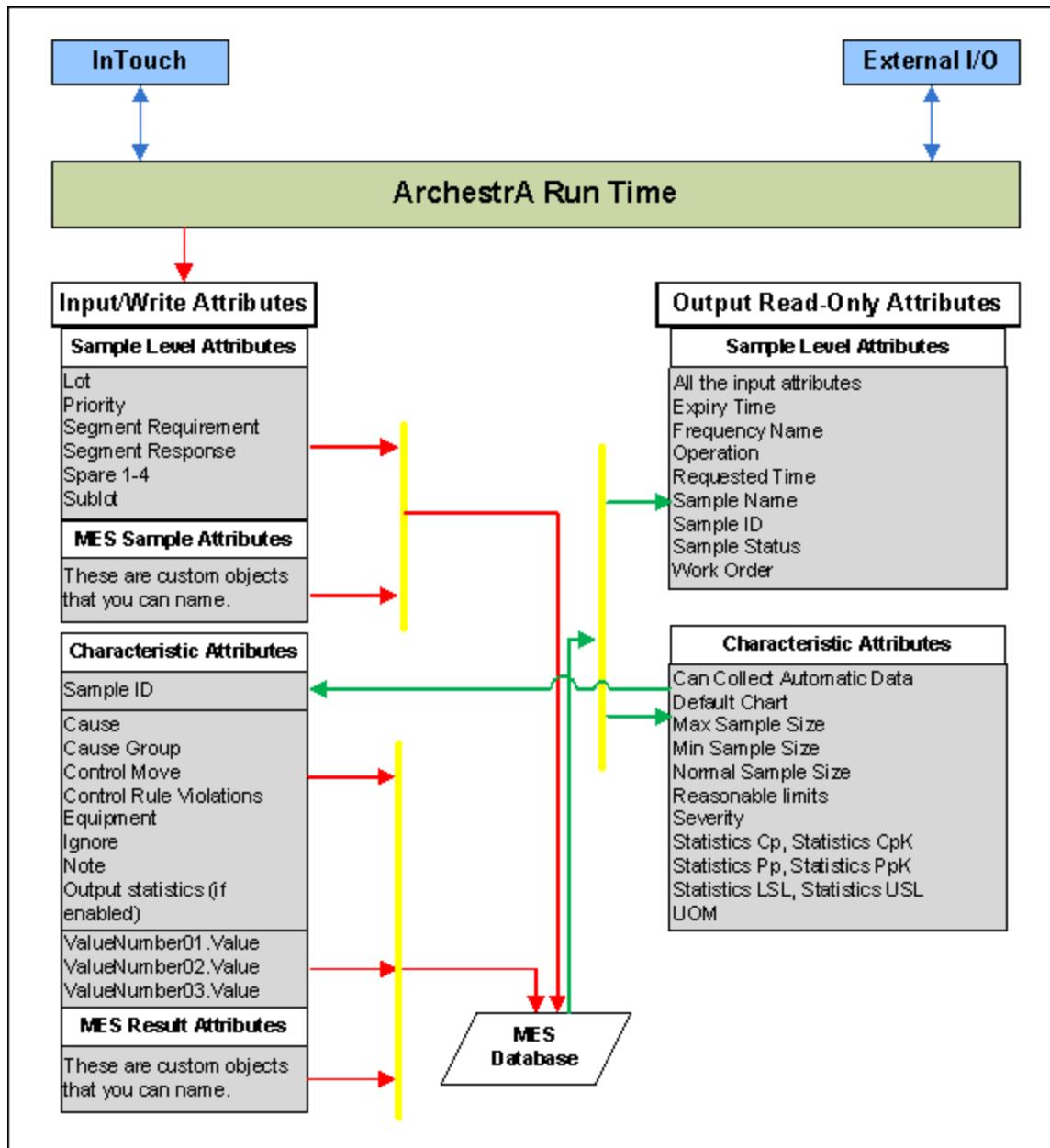
For this reason, once you create an MES entity using an object and Entity Model Builder, you should only maintain the object's attributes in the System Platform IDE.

## SRO Run-Time Behavior

The Sample Recording Object (SRO) allows you to capture the following data at run time:

- Sample data
- Sample MES attribute data
- Sample characteristic data
- Result data
- MES result attribute data

The SRO also allows you to generate sample data on demand so that you can easily add new samples.



## Run-Time Behavior of Attributes and Commands

The common behavior of the SRO attributes and commands at run time is described in the following topics.

### Use Input Source

When this option is selected for an attribute, the object reads the attribute data from the I/O reference.

The I/O qualities of the attribute are as follows:

#### Good

Specifies no errors while the object reads the data for an attribute from the I/O reference.

#### Bad

Specifies error such as *invalid reference*, *invalid data type conversion*, or a failure in reading I/O data for unknown reason, which occur while the object reads the data for an attribute from the I/O reference.

When this option is not selected for an attribute, no action occurs if the previous state of the attribute is already set to False.

### Input Source

Specifies the I/O reference from which the data is read for an attribute, when the **Use Input Source** option is selected. The new reference value configured for the attribute is used.

The quality of the attribute is set to Bad when an error such as *invalid reference*, *invalid data type conversion*, or a failure in reading I/O data for unknown reason, occur while the object reads data for an attribute from the I/O reference. Otherwise, the quality of the attribute is set to Good.

The object does not read the data from the I/O reference when:

- The **Use Input Source** option is not selected.
- The Input Source is entered or changed.

### Read Status

Specifies that the value is updated when an attribute fails to read the data from its respective I/O reference. The corresponding MxStatus value is also updated accordingly. The value in the ReadStatus is cleared when the last data read from the I/O succeeds or when the object is re-deployed.

### Grouping Commands

The SRO is organized into groups so that commands within one group do not interfere with commands within other groups. Each characteristic added to the SRO has its own command group. A command is triggered from a group, without interfering with a command triggered from another group at the same time. The commands exposed under the same namespace form a single group of commands, such as the following:

- Sample.RecordSampleDataCmd
- Sample.RecordMESSampleAttributeDataCmd
- Sample.GenerateSampleCmd
- Sample.FinalizeSampleDataCmd
- Sample.ResetCmd

---

**Note:** In the current version of MES, the Sample.RecordMESSampleAttributeDataCmd command is not available.

---

Sometimes the set of commands exposed in one instance are also exposed on the other instances simultaneously. This enables a command from one instance to be triggered simultaneously with a command from another instance. The two sets of command attributes are created in the SRO. For example, Height.RecordSampleCharacteristicDataCmd, and Width.RecordSampleCharacteristicDataCmd.

## Status Attribute

Specifies the status values of an attribute. An attribute has one of the following status values:

### Ready

Indicates that the command group is ready to process the next command, when the command attribute is set to True. A trigger attribute can initiate an MES transaction only when the status of the command group is Ready.

### Busy

Indicates that the command group is currently processing a command in the middleware. Any command attribute that is set to True from the group, except the command attribute that initiates the call to the middleware, is rejected and is reset to False.

### Error

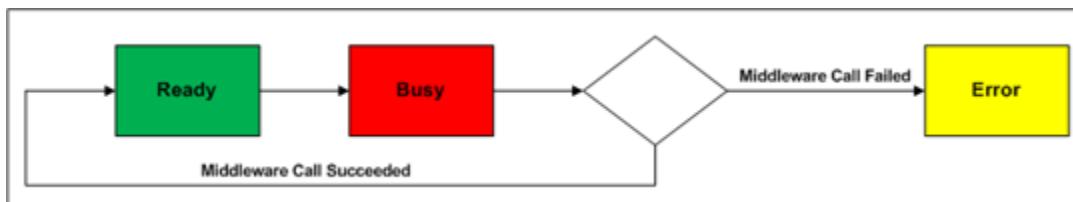
Indicates that the last call to the middleware resulted in an error. The caller has to acknowledge the error by resetting the status to Ready, before processing/initiating the next command from this command group.

### Done

Indicates that the last call to the middleware is successful. The status is reset to Ready when the Auto Reset command is set to True. This status is available when the instance of an object is set to Manual Reset mode.

## Auto Reset

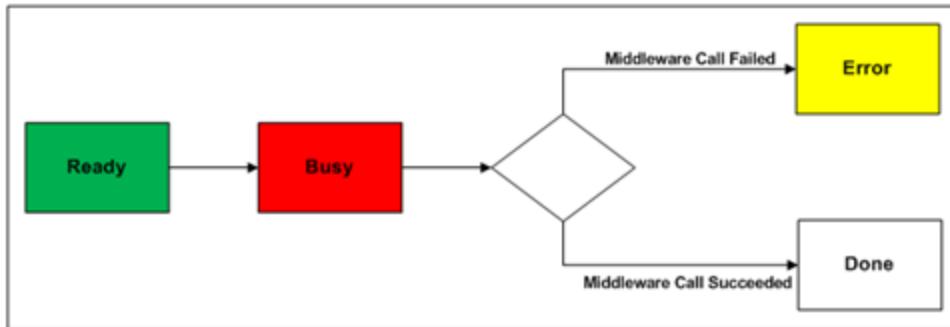
The Auto Reset mode indicates that the command group is ready to process the next call to the MES middleware, without acknowledging the success from the previous MES transaction. If you set the trigger attribute to True, the status of the object is set to Busy in the next scan cycle. The status of the command group is reset to Ready, after it completes its call to the middleware. Otherwise, the status of the command is set to Error.



The Auto Reset mode resets the trigger attribute to False and sets the status of the command group to Ready for the next command, after each call to the middleware is a success.

## Manual Reset

The Manual Reset mode requires the caller to acknowledge the result of each MES transaction (by using the ResetCmd command) before the next call is initiated from the command group. If you set the trigger attribute to True, the status is set to Busy in the next cycle. The status of the command group is set to Done, if the last call to the middleware is completed successfully; otherwise, the status of the command group is set to Error.



The Manual Reset mode does not reset the trigger attribute to False. The status remains True after it completes its call to the middleware. You need to reset the command trigger to False and set the status to Ready by using the Reset command.

### Reading Values from I/O

The SRO reads data from an I/O reference, if an attribute is configured to read data from an I/O. The object performs the following actions for the SRO attributes that are configured to read data from an I/O reference:

- Sets the quality of an SRO attribute to Good, when it reads the data from an I/O. It can convert the data from an I/O to the datatype of the SRO attribute.
- Sets the quality of an SRO attribute to Bad, when the I/O reference cannot read the data. The Read Status attribute associated to the SRO attribute updates the MxStatus value to indicate the failure.
- Sets the quality of an SRO attribute to Bad when the data read from an I/O reference cannot convert the datatype from an I/O reference to the datatype of the SRO attribute.

### Handling Command Attributes

The SRO performs the following actions when a command attribute is set to True:

- Enters an error in the error attribute if the entity does not exist in the database or a client session is not started.
- Rejects the command attribute to be set to True when its state is already True.
- Rejects the command attribute to be set to True when there is another command from the group to execute its call to middleware. The command attribute and the associated I/O attribute are reset to False.
- Rejects the command attribute to be set to True when the status of the command group is not Ready. The command attribute and the associated I/O attribute are reset to False.
- Updates the data from the I/O reference for all the data attributes such as work order, operation, lot, subplot are read, whose configuration is set to read data from I/O.
- Updates the data and quality for all the data attributes associated with the command.
- Sets the status of the command group to Busy, and initiates an MES call when all the data attributes are of good quality. Otherwise, an error is logged in the Logger.
- Updates the command attribute, I/O reference attribute associated to the command attribute, and the status of the command group after a response is received from the middleware for the last call.

The following actions are performed when a command attribute is changed from True to False:

- Clears the error message and resets the error number to 0.
- Sets the status of the command group to Ready.
- The I/O reference attribute is set to False, if the command attribute is associated to an I/O reference.

## Error Attributes

The following error attributes indicate the error code and the error message when there is an error.

### Error Code

Specifies the error number that identifies an error.

The error number is received from the middleware when a call from the SRO to the MES middleware fails. This can be a database generated error, business logic error, or a communication protocol error. Any error that occurs in the SRO object is also logged on this attribute.

### Error Message

Specifies the error message that identifies an error.

The error message can be an error received from the middleware or an error generated within the SRO.

## Reset Command

Resets any error in the command group, and sets the status of the command group to Ready to initiate the next call in the command group.

The Reset command can only be set to True. This command clears any error in the command group, sets the status of the command attribute to False, sets the status of the command group to Ready, and finally resets itself to False, including the I/O attribute in the SRO.

## Failover Support

When the SRO starts after a failure or a shut down, a value and quality for each SRO attribute stored in a System Platform galaxy is reloaded at run time.

The SRO attributes such as ErrorCode, ErrorMessage, Status, and ControlRuleViolations are never stored in a System Platform galaxy.

## Logging Errors, Warnings and Trace Messages to the Logger

The SRO records errors and warning messages such as the following:

- Serious errors such as exceptions, errors generated by the application object toolkit, incorrect data mapping, memory overflow, divide by zero are logged as errors (in red) in the Logger.
- Any error specific to the SRO are logged as warnings in the Logger, such as an error returned from the middleware.
- Errors that occur while recording the sample data in the MES database, such as the supplied sample ID does not exist in the database, are logged as a warning in the Logger.
- The warning messages from the database are logged as warning messages in the Logger. The messages are prefixed with *Warning* so that the actual error messages and warning messages are distinguished in the Logger.

## Calculating Process Statistics

The specification and control limits are obtained from a specification that is linked to the most recent sample of an entity. The process statistics are calculated from a range of samples, which are filtered as follows:

- The set of filter\_by\_\* columns in the Characteristic table (filter\_by\_item\_id, filter\_by\_wo\_id, filter\_by\_oper\_id, etc.) that are true for the characteristic are used to restrict the samples. Samples having same value as the most recent sample in the column are restricted.
- The sample time is filtered using the cut-off time configured in the system attribute. This limits the number of samples.
- The number of samples is filtered using a value configured in the system attribute. This limits the number of samples.

The most recent sample record for a characteristic is represented as the starting sample. A range is obtained from the most recent sample record to the oldest sample record based on the values configured in the system attributes. The values for some of the process statistic attributes depend on the default chart type configured characteristic or the override of the characteristic's default chart for a particular QM specification.

The statistical values are as follows:

### **Actual Percent Out of Specification Limits (ActPercentOutofSL)**

The ratio of the number of individual results that are outside of specification limits to the total number of individual results.

### **Process Capability (Cp)**

The ratio of the difference between the upper and lower specification limits and six times the estimated standard deviation based on sample variability. The difference between it and the target value is compared to three times the estimated standard deviation if there is only one specification limit. This is only calculated for variable-type data.

### **Process Capability Index (CpK)**

The ratio of the difference between the upper and lower specification limits and six times the estimated standard deviation based on sample variability. It considers a mean that is not centered between the specification limits. This is only calculated for variable-type data.

### **Average (Mean)**

Specifies the average of the individual results for variables. For attributes, the average of the values are plotted on the default chart.

### **Process Performance (Pp)**

The ratio of the difference between the upper and lower specification limits and six times the estimated standard deviation based on the entire measured population. This is only calculated for variable-type data.

### **Process Performance Index (PpK)**

The ratio of the difference between the upper and lower specification limits and six times the estimated standard deviation based on the entire measured population. It considers a mean that is not centered between the specification limits. This is only calculated for variable-type data.

### **Range**

Specifies the difference between the highest data point and the lowest data point. This is calculated as the difference between the maximum individual reading and the minimum individual reading.

### **Average Range of Subgroups (RBar)**

Specifies the average range of values from a set of samples. This is only calculated for variable-type data.

#### **Number of Result Rows (Rows)**

Specifies the total number of individual results (for variables), or the number of subgroups (for attributes) involved in calculating the process statistics.

#### **Estimated Standard Deviation (EstSigma)**

Specifies the statistical measure of the spread or the variability within samples. The configuration of the characteristic determines if it is based on Rbar or calculated from the data. This value is used for calculating Cp and Cpk. This is only calculated for variable-type data.

#### **Standard Deviation (StdDev)**

Specifies the statistical measure of the spread or the variability of the individual results. This value is used for calculating Pp and Ppk.

#### **Total Number of Samples (Total)**

Specifies the total number of samples for a characteristic involved in calculating the process statistics. If default chart type of the characteristic is set to Individual and Moving Range, Moving Average and Range, or Moving Average and Sigma, the total is calculated as follows:

#### **Individual and Moving Range Chart**

The total number of samples is equal to the total number of individual readings (result data) from all the samples used to calculate process statistics. Each individual reading from a sample is treated separately.

#### **Moving Average and Range Chart and Moving Average and Sigma Chart**

The total number of samples is calculated as the difference of the total number of individual readings from all the samples and the moving average span configured for a characteristic. An individual sample is added.

#### **Minimum Individual Reading (Min)**

Specifies the minimum individual reading among the set of sample measurements.

#### **Maximum Individual Reading (Max)**

Specifies the maximum individual reading among the set of sample measurements.

#### **Lower Specification Limit (LSL)**

Specifies the lower specification limit for a specification that is obtained from the most recent sample.

#### **Upper Specification Limit (USL)**

Specifies the upper specification limit for a specification that is obtained from the most recent sample.

### **Capturing Sample Context Data**

You can update the existing sample data with the current contextual information for a sample when the attributes of a sample are exposed. You can also record any additional contextual information for a sample.

### **Record Sample Data Command**

When you set this command to True, the SRO makes a call to the MES middleware to update the Sample table with information about a sample. The Lot, Sublot, SegmentRequirement, SegmentResponse, Priority, and Spare1-4 attributes are used to update the sample data and any contextual data for a sample. If the Operator and EventDateTime attributes are not null, the pulled\_by and pulled\_at fields are also updated in the Sample table.

For more information about the attributes that can be updated when the RecordSampleDataCmd is triggered, see [Sample Attributes Available at Run Time](#).

### Record MES Sample Attribute Data Command

When you set this command to True, the sample recording object makes a call to the MES middleware to insert or update MES sample attributes information in the sample\_attr table. The list of attributes adds or updates additional contextual data for a sample.

For more information about the attributes that can be updated when the RecordMESSampleAttributeDataCmd is triggered, see [Sample Attributes Available at Run Time](#).

**Note:** In the current version of MES, the Record MES Sample Attribute Data Command is disabled.

### Finalize Sample Data Command

When you set the FinalizeSampleDataCmd to True, the Final field in the Sample table is updated with a value from the Boolean attribute Final for the selected SampleID attribute in the SRO.

The value in Operator and EventDateTime attributes updates the finalized\_by and finalized\_at\_\* columns in the Sample table.

If the final flag for a sample is set to True, the finalized\_by and finalized\_at columns are updated with a non null value. Otherwise, the finalized\_by and finalized\_at columns are updated with a null value.

### Reading Recent Samples

When the status of the sample changes from Ready to some other state, or when a sample is created in the database, the SRO subscribes for sample data change notification to the middleware, and a list of output attributes are exposed in the SRO. The set of RecentSample attributes are updated by the SRO based on first in first out method. The sample information is maintained in the RecentSample group until it becomes the oldest sample in the set and is replaced by a new sample information.

For example, if the object is configured to keep track of the four most recent samples, and the four sets of recent sample attributes are populated, it overwrites the data of the oldest recent sample set when a new sample arrives. If RecentSample01 was the oldest, it becomes the latest record after a new sample arrives.

For more information about the output attributes, see [Sample Attributes Available at Run Time](#).

### Capturing Sample Characteristic Data

You can update the existing sample characteristic data with the current contextual information, such as equipment, cause, control move. These are associated to the sample characteristic, record result (measurement) data for each characteristic and record any additional contextual information for each result.

Note that the following statistics are only available for variable characteristics, and not attribute characteristics: EstSigma, Cp, Cpk, Pp, Ppk, and RBar.

### Record Sample Characteristic Data Command

When you set this command to True, the SRO makes a call to the MES middleware to update the information about a characteristic within a sample in the Sample\_Char\_Link table. The Note, Cause Group, Cause, Ignore

Sample, Control Move, and Equipment attributes update the sample characteristic contextual data for a sample. For more information about the attributes that can be updated when the Record Sample Characteristic Data command is triggered, see [Characteristic Attributes Available at Run Time](#).

### Record Result Data Command

When you set this command to True, the SRO makes a call to the MES middleware to insert new result records for the supplied SampleID and characteristic in the Result table. For variable characteristics, the ValueNumber## attributes add a new result data for a sample characteristic. The SRO records a result for each ValueNumber## exposed up to the maximum sample size. For attribute characteristics, the ValueNumber.Value and ValueNumber.ActualSampleSize attributes add a new result for the characteristic. If the result being recorded satisfies the minimum sample size for the characteristic, then any control rules will be applied to the data. If rule violations are found, they will be returned to the ControlRuleViolations attribute.

The SRO records data up to the maximum sample size for the characteristic. The SRO cannot mark an existing result record as superseded.

For more information about the attributes that can be updated when the Record Result Data Command is triggered, see [Characteristic Attributes Available at Run Time](#).

### Record MES Result Attribute Data Command

When you set this command to True, the SRO makes a call to the MES middleware to insert or update MES Result attribute information for the supplied sample ID, characteristic, and ValueNumberForResultAttributes in the result\_attr table. The Value and Note attributes for each exposed MES Result attribute adds or updates the additional contextual data for a sample characteristic result.

For more information about the attributes that can be updated when the Record MES Result Attribute Data command is triggered, see [Characteristic Attributes Available at Run Time](#).

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**Note:** In the current version of MES, the Record MES Result Attribute Data command is disabled.

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### Logging Result Data for Automatically Collected Characteristics

The delay timer represents the wait time between logging each set of measurement data. The delay timer is enabled in the following conditions:

- When the Can Collect Automatic Data is set to Always.
- The variable characteristic or the QM specification that is linked to the characteristic is configured to automatically collect data, and the object is configured to Use Configuration.

The timer is disabled in all other conditions and the result data is not automatically logged into the MES database.

When the delay timer is enabled, the maximum number of individual readings for a sample will be equal to the maximum sample size configured for a characteristic or for a QM specification that overrides the characteristic. After the SRO reaches the maximum number of readings, the timer stops. Individual readings beyond the maximum sample size are not recorded in the MES database for that characteristic. This continues till a new sample is ready, regardless of the expiry of the delay timer in the SRO.

When the SRO detects that a sample for its entity is ready, finds all exposed characteristics within the object that match the characteristic list of the sample, and any of its characteristics are collected automatically, the SRO sets

the <characteristic>.SampleID to the new sample's SampleID. The timer is reset, and the SRO logs the current readings against the new sample. If there are multiple characteristics in the sample that are collected automatically, the SRO records one characteristic of the object, per scan. The automatic data collected for a sample depends on the following criteria:

- If the maximum sample size configured for a characteristic is null, the SRO uses the normal sample size that is configured for a characteristic or a QM specification that overrides the characteristic.
- If both the maximum and normal sample sizes are null, then the number of measurements collected for a sample is equal to the number of result attributes exposed in the SRO. Then, the delay timer is disabled for the sample.

When the status of the object is set to OnScan, the SRO reads the number of result data (measurements) for a sample characteristic that is logged in the MES database. In this stage, the SRO determines if further measurements are to be logged for the current sample. This process of collecting result data is based on the number of results logged in the MES database and the characteristic configuration in the SRO.

### Always Collect Automatic Data

When a characteristic is configured to Always Collect Automatic Data, the delay time configured in the SRO for that characteristic is considered the wait time between logging each set of measurement data for that characteristic, regardless of whether or not a specification is configured to collect automatic data.

When a sample is set to Ready, the SRO collects result data and MES result attributes data that are available, and logs them in the MES database.

The examples below explain how the result data from the SRO are captured and logged in the MES database. The delay time in the SRO for the characteristic 'Length' is configured to wait for 45 seconds between each set of measurements. The SRO is configured to take 3 readings at a time with a maximum sample size of 8 configured in the MES database, and the characteristic is linked to different specs in the MES database having different time intervals.

In the table below, some specifications have automatic data collection set to True. These specifications have delay timer configured for the characteristic, but they are ignored by the SRO.

Specification Name	Characteristic	Automated Collection	Time Interval	Time Interval Unit
SpecP	Length	No		
SpecQ	Length	Yes	30	0 (Seconds)
SpecR	Length	Yes	1	1 (Minutes)

A value for ValueNo. indicates the value number recorded in the MES database and ValueNumber<N> indicates the SRO attribute from where the value is read.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
03:00:00	Length	100	SpecP	Yes	0	Yes	<p>Timer does not elapse, but the individual reading is logged. Log Result and Result Attributes Data for sample ID: 100 for the following result attributes below:</p> <p>ValueNo: 1 (ValueNumber01)</p> <p>ValueNo: 2 (ValueNumber02)</p> <p>ValueNo: 3 (ValueNumber03)</p>
03:00:30	Length	100	SpecP	Yes	30	No	Timer does not elapse.
03:00:45	Length	100	SpecP	Yes	45	Yes	<p>Log Result and Result Attributes Data for sample ID: 100.</p> <p>ValueNo: 4 (ValueNumber01)</p> <p>ValueNo: 5 (ValueNumber02)</p> <p>ValueNo: 6 (ValueNumber03)</p>

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
							ber03)
03:01:25	Length	100	SpecP	Yes	40	No	Timer does not elapse.
03:01:30	Length	100	SpecP	Yes	45	Yes	Log Result and Result Attributes Data for sample ID: 100. ValueNo: 7 (ValueNumber01) ValueNo: 8 (ValueNumber02)
03:01:50	Length	100	SpecP	Yes	20	No	Time stops.
03:02:15	Length	100	SpecP	Yes	45	No	Timer stops, because the maximum number of individual readings for the sample is already taken. No reading is logged.
03:02:20	Length	100	SpecP	Yes	5	No	Timer stops.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
03:02:45	Length	110	SpecP	Yes	0	Yes	<p>Timer does not elapse, but a new ready sample ID, which has a spec that is same as the current spec, is received.</p> <p>Log Result and Result Attributes Data for sample ID: 110.</p> <p>ValueNo: 1 (ValueNumber01)</p> <p>ValueNo: 2 (ValueNumber02)</p> <p>ValueNo: 3 (ValueNumber03)</p>
03:02:55	Length	110	SpecP	Yes	10	No	Timer does not elapse.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
03:03:10	Length	120	SpecQ	Yes	0	Yes	<p>Timer does not elapse, but a new sample ID, having a spec different from the current spec, is received.</p> <p>Log Result and Result Attributes Data for sample ID: 120.</p> <p>Since a new sample (120) is received, no more measurements are recorded for previous sample ID: 110.</p> <p>ValueNo: 1 (ValueNumber01)</p> <p>ValueNo: 2 (ValueNumber02)</p> <p>ValueNo: 3 (ValueNumber03)</p>
03:03:50	Length	120	SpecQ	Yes	40	No	Timer does not elapse.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
03:03:55	Length	120	SpecQ	Yes	45	Yes	Log Result and Result Attributes Data for sample ID: 120. ValueNo: 4 (ValueNumber01) ValueNo: 5 (ValueNumber02) ValueNo: 6 (ValueNumber03)
03:04:40	Length	120	SpecQ	Yes	45	Yes	Log Result and Result Attributes Data for sample ID: 120. ValueNo: 7 (ValueNumber01) ValueNo: 8 (ValueNumber02)
03:05:25	Length	120	SpecQ	Yes	45	No	Timer stops, because the maximum number of individual readings for the sample is already taken. No reading is logged.
03:06:10	Length	120	SpecQ	Yes	45	No	Timer stops, because the maximum

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
							number of individual readings for the sample is already taken. No reading is logged.
03:06:10	Length	130	SpecR	Yes	0	Yes	<p>Timer does not elapse, but a new sample ID, having a spec different from the current spec, is received.</p> <p>Log Result and Result Attributes Data for sample ID: 130.</p> <p>ValueNo: 1 (ValueNumber01)</p> <p>ValueNo: 2 (ValueNumber02)</p> <p>ValueNo: 3 (ValueNumber03)</p>
03:06:20	Length	130	SpecR	Yes	10	No	Timer does not elapse.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
03:06:30	Length	140	SpecP	Yes	0	Yes	<p>Timer does not elapse, but a new sample ID, having a spec different from the current spec, is received.</p> <p>Log Result and Result Attributes Data for sample ID: 140 .</p> <p>ValueNo: 1 (ValueNumber01)</p> <p>ValueNo: 2 (ValueNumber02)</p> <p>ValueNo: 3 (ValueNumber03)</p>

### Use Spec Configuration to Collect Automatic Data

When a characteristic is configured to Use Configuration To Collect Automatic Data, the timer resets and starts each time a new ready sample is received from the MES database. The start time for the delay timer is the time it receives a new sample in the SRO.

When the time evaluates to True, the SRO collects the result data and the MES result attributes data that are currently available in the SRO, and logs them in the MES database.

The table below indicates how result data from the SRO is captured and logged in the MES database when the SRO is configured to collect a maximum of 4 readings at a time. The characteristic 'Width' is linked to different specifications with different time intervals in the MES database.

Specification Name	Characteristic	Automated Collection	Time Interval	Time Interval unit	Max Sample Size
SpecP	Width	No			
SpecQ	Width	Yes	30	0 (Seconds)	10
SpecR	Width	Yes	1	1 (Minutes)	16

A value for ValueNo. indicates the value number recorded in the MES database and ValueNumber<N> indicates the SRO attribute from where the value is read.

Scan Time	Characteris-tic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
04:00:00	Width	200	SpecP	No		No	Timer is not enabled, because SpecP is not configured to collect automatic data.
04:15:40	Width	210	SpecQ	Yes	0	Yes	Timer is enabled, but a new sample ID, having a spec different from the current spec, is received, and SpecQ is configured to collect automatic data. Log Result and Result Attributes Data for sample ID: 210. ValueNo: 1

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
						(ValueNumber01) ValueNo: 2 (ValueNumber02) ValueNo: 3 (ValueNumber03) ValueNo: 4 (ValueNumber04)	
04:16:05	Width	210	SpecQ	Yes	25	No	Timer does not elapse.
04:16:10	Width	210	SpecQ	Yes	30	Yes	Log Result and Result Attributes Data for sample ID: 210.  ValueNo: 5 (ValueNumber01) ValueNo: 6 (ValueNumber02) ValueNo: 7 (ValueNumber03) ValueNo: 8 (ValueNumber04)
04:16:20	Width	210	SpecQ	Yes	10	No	Timer does not elapse.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
04:16:40	Width	210	SpecQ	Yes	30	Yes	Log Result and Result Attributes Data for sample ID: 210. ValueNo: 9 (ValueNumber01) ValueNo: 10 (ValueNumber02)
04:16:41	Width	210	SpecQ	Yes	1	No	Timer stops.
04:17:10	Width	210	SpecQ	Yes	30	No	Timer does not running because the maximum number of individual readings for the sample is already taken. No reading is logged.
04:17:40	Width	210	SpecQ	Yes	30	No	Timer does not running because the maximum number of individual readings for the sample is already taken. No reading is logged.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
04:17:50	Width	220	SpecR	Yes	0	Yes	<p>Timer is enabled, but a new sample ID, having a spec different from the current spec, is received, and SpecR is configured to collect automatic data. Log Result and Result Attributes Data for sample ID: 220.</p> <p>ValueNo: 1 (ValueNumber01)</p> <p>ValueNo: 2 (ValueNumber02)</p> <p>ValueNo: 3 (ValueNumber03)</p> <p>ValueNo: 4 (ValueNumber04)</p>
04:18:45	Width	220	SpecR	Yes	55	No	Timer does not elapse.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
04:18:50	Width	220	SpecR	Yes	60	Yes	Log Result and Result Attributes Data for sample ID: 220. ValueNo: 5 (ValueNumber01) ValueNo: 6 (ValueNumber02) ValueNo: 7 (ValueNumber03) ValueNo: 8 (ValueNumber04)
04:19:50	Width	220	SpecR	Yes	60	Yes	Log Result and Result Attributes Data for sample ID: 220. ValueNo: 9 (ValueNumber01) ValueNo: 10 (ValueNumber02) ValueNo: 11 (ValueNumber03) ValueNo: 12 (ValueNumber04)
04:20:50	Width	220	SpecR	Yes	60	Yes	Log Result and Result Attributes Data for sample ID:

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
					220.		
					ValueNo: 13 (ValueNumber01)		
					ValueNo: 14 (ValueNumber02)		
					ValueNo: 15 (ValueNumber03)		
					ValueNo: 16 (ValueNumber04)		
04:21:50	Width	220	SpecR	Yes	60	No	Timer stops, because the maximum number of individual readings for the sample is already taken. No reading is logged.
04:22:50	Width	220	SpecR	Yes	60	No	Timer stops, because the maximum number of individual readings for the sample is already taken. No reading is logged.

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
04:23:00	Width	230	SpecR	Yes	0	Yes	<p>Timer is enabled, and a new sample ID is received. SpecR is configured to collect automatic data. Log Result and Result Attributes Data for sample ID: 230.</p> <p>ValueNo: 1 (ValueNumber01)</p> <p>ValueNo: 2 (ValueNumber02)</p> <p>ValueNo: 3 (ValueNumber03)</p> <p>ValueNo: 4 (ValueNumber04)</p>
04:24:00	Width	230	SpecR	Yes	60	Yes	<p>Log Result and Result Attributes Data for sample ID: 230.</p> <p>ValueNo: 5 (ValueNumber01)</p> <p>ValueNo: 6 (ValueNumber02)</p> <p>ValueNo: 7 (ValueNumber03)</p>

Scan Time	Characteristic	Sample ID	Spec	Timer Enabled	Time Elapsed (in sec)	Log Data	Comments
							ber03) ValueNo: 8 (ValueNumber04)
04:24:30	Width	240	SpecP	No		No	A new sample ID is received, which is linked to a spec that is not configured to collect automatic data. Hence, the timer is disabled.
04:25:00	Width	240	SpecP	No		No	Timer is not enabled, because SpecP is not configured to collect automatic data.

### Handling Automatic Data Collections During Network Interruptions

When the sample is linked to a characteristic for which it was created, the subscription thread returns the count of result records. The number of result data logged in the MES database for a sample characteristic is reassessed each time the result records are returned. During a network failure, the SRO continues to log the result data by using the last known good data that was received from the subscription thread till it reaches the maximum sample size. If the network connection is established again, the subscription thread returns the most recent data, which resets the data in the SRO.

## Reading Characteristics Data

When the SRO subscribes to the sample characteristic data change notification from the middleware, it receives notice of the new sample when it is generated. The SRO receives an update from the middleware, and a list of output attributes are exposed at the sample characteristic level. The following table shows a list of the output attributes.

Attribute	Description
Output.RecentSampleID	Specifies the ID of the most recent sample linked to the characteristic
Output.SpecName	Specifies the name of the specification that is used to generate the sample
Output.StartEffDate	Specifies the start effective date and time (in local time) of the QM specification
Output.UnitofMeasurement	Specifies the unit of measurement for a characteristic
Output.MinSampleSize	Specifies the minimum sample size for the sample characteristic.  If you override the minimum sample size of a characteristic for a particular QM specification, and if the specification is applied to the current situation, the override value is used for minimum sample size.  Otherwise, it uses the minimum sample size for the characteristic.
Output.NormalSampleSize	Specifies the normal sample size for the sample characteristic.  If you choose to override the normal sample size of a characteristic for a certain QM specification, and the specification is applied to the current situation, the minimum sample size is used.  Otherwise, it uses the normal sample size for the characteristic.
Output.MaxSampleSize	Specifies the maximum sample size for the sample characteristic  If you choose to override the maximum sample size of a characteristic for a certain QM specification, and the specification is applied to the current situation, the minimum sample size is used.  Otherwise, it uses the maximum sample size for the characteristic.
Output.Severity	Specifies the severity description for the characteristic

Attribute	Description
Output.SeverityCd	Specifies the severity code for the characteristic
Output.DefaultChart	Specifies the default chart for the characteristic
Output.DefaultChartCd	Specifies the default chart code for the characteristic
Output.LRL	Specifies the lower reasonable limit for the characteristic  The LRL is calculated from the qm_spec that is used to generate the sample.
Output.URL	Specifies the upper reasonable limit for the characteristic  The URL is calculated from the qm_spec that is used to generate the sample.

A few attributes are updated when there is an error while reading the characteristic data, or when the object updates itself with the current data. The following table shows the list of these attributes.

Attribute	Description
Output.ErrorCode	Specifies the error number that identifies the error
Output.ErrorMessage	Specifies the error message that contains a description of the error
Output.Status	Ready indicates the last data read from the MES middleware is of good quality.  Busy indicates the object is currently updating itself with the characteristic data linked to the most recent sample data received from the middleware.  The status of the recent sample is set to Busy when the object receives a data update from the middleware.  Error indicates the object is not able to read the subscribed data from the middleware. The error code and error message are updated with the message received from the middleware.

For more information about the output attributes, see [Characteristic Attributes Available at Run Time](#).

## Generating On-Demand Samples

You can use the Generate Sample command to generate samples on demand. When using this command, you identify a QM Specification to use for the on-demand sample. The QM specification specifies which characteristics should be considered in the on-demand sample, which sample plan should be used, and the sample name (as defined in the sample plan).

When generating an on-demand sample from the SRO, the provided QM Specification attribute is used to create a new ready sample for the object's parent entity with a requested time set to the current time. A check is performed to verify that the provided QM Specification is an active QM Specification.

- If there is more than one version of the QM Specification, then the version with the most recent start effectiveness date whose end effectiveness is not in the past will be selected.
- If there are no versions of the QM Specification that are active, an error will be returned.

The sample generated from the QM Specification will have all the characteristics that belong to the QM Specification whose severity is not Unused.

- The sample context fields for work order, operation, sequence number, and item will be set to the current job running on the entity at the lowest job position.
- If the QM Specification's sample plan contains a "Manual" sample frequency definition, then it will be used; otherwise, the first "Manual" sample frequency definition in the database will be used.
- The sample name will be set based on the sample plan associated to the QM Specification.
- The warning time and expiration time for the sample will be set based on the sample frequency definition.

If warning and expiration times are to be set, then a Manual sample frequency must exist in the database. If the command completes successfully, the SampleID of the created sample will be populated in the Sample.SampleID object attribute.

## Background User

Any communication between the MES object and the MES database is routed through the MES middleware. The MES middleware uses a connection string to connect to the MES database.

Whenever an MES user logs on to an application to start a session, the ID of the user is stored in the Session table in the MES database. The Session table contains the user\_id column that identifies the user who started the session.

All the MES objects share a common session with the MES middleware.

The user ID available in the Session table is Null for the MES object. So, the system associates the default user that is configured as a system attribute with a transaction.

The default user configured in the system can be non-MES user.

## SRO Attributes

The previous chapters describe the attributes available at configuration time. This appendix describes both configuration and run-time object attributes.

### About SRO Attributes Available at Run Time

The SRO attributes are grouped by tabbed functions in the IDE Object Editor. The following are the different SRO attribute tables:

- General Attributes

- Sample Attributes
- Characteristics Attributes

This section does not include information about the common tabs that are available in the Object Editor. For information about the other common tabs, see the System Platform Help.

The Configuration column in the tables specifies whether you can configure an attribute in the Object Editor.

The Note column in the tables describes whether the attribute exists at configuration time, run time, or both. The values of the columns for each tabbed function are given in the tables below.

## General Attributes Available at Run Time

The attributes that are available at run time for any SRO instance are described in the following table.

Attribute Name	Description	Note
ResponseType	Specifies whether the calls to the MES middleware are to be executed synchronously or asynchronously.	Exists at config time and run time. Has a value of With Response.  <b>Note:</b> In the current version of MES, the SRO supports only synchronous communication.
SelectedChars	List of characteristic object attribute names contained within the sample recording object.	Exists at config time and run time. Updated automatically at config time as the user changes the set of selected characteristics.
SelectedAttrs	List of MES sample attribute names contained within the sample recording object.	Exists at config time and run time. Updated automatically at config time as the user changes the set of selected MES sample attributes.
SelectedResult Attrs	List of MES result attribute names contained within this sample recording object.	Exists at config time and run time. Updated automatically at config time as the user changes the set of selected MES result attributes.
DefaultDelay Timer	Specifies the duration between two consecutive measurement data of an automatically collected characteristic within a sample.	Exists only at config time, and writeable at config time.
AutoReset	Specifies whether the status attribute is reset to Ready or left at Done after completing a successful call to the MES middleware.	Exists at config time and run time. Writeable only at config time.
ErrorCode	Specifies an integer value to indicate that an error has occurred	Not configurable at config time, but writeable only by the object at run

Attribute Name	Description	Note
	while processing the MES middleware call.	time.
ErrorMessage	Specifies the description of an error that occurs while processing the MES middleware call.	Not configurable at config time, but writeable only by the object at run time.
Status	Specifies the status of an attribute as Ready, Busy, or Error.	Not configurable at config time, but writeable only by the object at run time.

### Sample Attributes Available at Run Time

The attributes that are available at run time for any SRO instance are described in the following table.

Attribute Name	Description	Note
RecentSample. Number ofRecent Samples ToView	The number of recent samples that can be viewed at a time.	Exists at config time and run time. Writeable only at config time.
Sample. SampleID	An integer value that is the ID of the sample for which the data is to be recorded in the MES database.	Exists at config time and run time. Writeable at config time and run time.
Sample. QMSpecName	The QM specification to be used when generating on-demand samples with the Generate Sample command. The QM specification specifies which characteristics and sample plan should be considered in the on-demand sample.	Exists at config time and run time. Writeable at config time and run time.
Sample.Segment RequirementID	The segment requirement value for the sample.	Exists at config time and run time. Writeable at config time and run time.
Sample.Segment ResponseID	The segment response value for the sample.	Exists at config time and run time. Writeable at config time and run time.
Sample.Lot	The lot number for the sample.	Exists at config time and run time. Writeable at config time and run

Attribute Name	Description	Note
		time.
Sample.Sublot	The subplot number for the sample.	Exists at config time and run time. Writable at config time and run time.
Sample.Operator	The user/operator who pulls the sample from the production line.	Exists at config time and run time. Writable at config time and run time.
Sample.Final	A Boolean value that indicates whether the sample data is final or not.	Exists at config time and run time. Writable at config time and run time.
Sample.Priority	An integer value that identifies the priority for the sample.	Exists at config time and run time. Writable at config time and run time.
Sample.Spare1	Additional information about the sample.	Exists at config time and run time. Writable at config time and run time.
Sample.Spare2	Additional information about the sample.	Exists at config time and run time. Writable at config time and run time.
Sample.Spare3	Additional information about the sample.	Exists at config time and run time. Writable at config time and run time.
Sample.Spare4	Additional information about the sample.	Exists at config time and run time. Writable at config time and run time.
Sample.Event DateTime	The date and time when a sample is pulled or finalized.	Exists at config time and run time. Writable at config time and run time.
Sample.Event DateTime. AutoGenerate	A Boolean value that specifies whether the EventDateTime value in the object is generated automatically.	Exists at config time and run time. Writable at config time and run time.
Sample. <SampleAttribute Name>. AttributeDesc	The MES sample attribute name from the MES database that was defined during configuration.	Exists at config time and run time, but writeable only at config time.

Attribute Name	Description	Note
Sample.<SampleAttributeName>.Value	The sample attribute value to send to the MES database.	Exists at config time and run time. Writeable at config time and run time.
Sample.<SampleAttributeName>.Notes	Sample attribute notes to send to the MES database.	Exists at config time and run time. Writeable at config time and run time.
Sample.RecordSampleDataCmd	Updates the sample record, the pulled_by and pulled_at fields, and the sample attribute data for the sample ID.	Exists only at run time and writeable at run time.
Sample.RecordMES.SampleAttributeDataCmd	Records the MES sample attribute data for a sample using the sample ID attribute.	Exists only at run time and writeable at run time.  <b>Note:</b> In the current version of MES, this attribute is disabled.
Sample.GenerateSampleCmd	Generates samples on demand. Uses the Sample.QMSpecName attribute to determine which characteristics and sample plan should be considered in the on-demand sample.	Exists only at run time and writeable at run time.
Sample.FinalizeSampleDataCmd	Finalizes the sample and its data to prevent further editing.	Exists only at run time and writeable at run time.
Sample.ResetCmd	Clears the error code, error message, and sets status to Ready.	Exists only at run time and writeable at run time.
<Attribute Name>.UseInputSource	A Boolean value that, if set to True, specifies that the object reads the data for an attribute from the I/O reference, using the InputSource reference value configured for that attribute.	Exists at config time and run time. Writeable at config time and run time.
<Attribute Name>.InputSource	If UseInputSource is set to True, specifies the location of the input source from which the data will be read.	Exists at config time and run time. Writeable at config time and run time.
<Attribute Name>.ReadStatus	The MxStatus value when an attribute fails to read a value from the I/O reference from its last data.	Exists only at run time and writeable at run time only by the object.

Attribute Name	Description	Note
Sample.ErrorCode	An integer value that is the error code for an error that occurs while processing the last MES middleware call to the database.	Exists only at run time. Writeable at run time only by the object.
Sample.ErrorMessage	The description of an error that occurs while processing the last MES middleware call to the database.	Exists only at run time. Writeable at run time only by the object.
Sample.Status	The status of an attribute: Ready, Busy, or Error. This attribute can also have a value of Done if it is not in AutoReset mode.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. SampleID	The sample ID of the sample retrieved from the MES database. This is used for updating the sample record from the sample commands (Sample.RecordSampleDataCmd) or for writing in one of the characteristics within the sample (<Characteristic>.Record SampleCharacteristic DataCmd).	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. SampleName	The name of the sample retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. CharacteristicNames	A list of characteristic names from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. WorkOrder	The work order retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. Operation	The operation retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. Sequence	The job sequence number retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.

Attribute Name	Description	Note
Number		
Recent Sample<N>.Item	The item retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.RequestedTime	The requested time of the sample retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.ExpiryTime	The expiry time of the sample retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.WarningTime	The warning time of the sample retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.SampleStatus	The status of the sample request, such as InProcess, Late, which are retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.SampleStatusID	The ID value of the sample status retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.SampleResult	The result of the sample, such as OOC, OOS Critical, which are retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.SampleResultID	The ID value of the sample result retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.FrequencyName	The frequency name used to generate the sample record retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>.FrequencyTypeID	The enumeration value of the frequency type retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.

Attribute Name	Description	Note
Recent Sample<N>. FrequencyType	The type of frequency used to generate the sample record retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. Priority	The priority of the sample used for the sample record retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. VerifiedBy	The user who verified the sample retrieved from the MES database for the sample ID.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. Spare1	Any additional value of the sample retrieved from the MES database.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. Spare2	Any additional value of the sample retrieved from the MES database.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. Spare3	Any additional value of the sample retrieved from the MES database.	Exists only at run time. Writeable at run time only by the object.
Recent Sample<N>. Spare4	Any additional value of the sample retrieved from the MES database.	Exists only at run time. Writeable at run time only by the object.
RecentSample. ErrorCode	The error code from the MES middleware if the last data read is unsuccessful.	Exists only at run time. Writeable at run time only by the object.
RecentSample. ErrorMessage	The error string received from the MES middleware if the last data read is unsuccessful.	Exists only at run time. Writeable at run time only by the object.
RecentSample. Status	The status of the last data read for the sample: Ready, Busy, or Error.	Exists only at run time. Writeable at run time only by the object.

## Characteristic Attributes Available at Run Time

The attributes that are available at run time for each characteristic are described in the following table:

Attribute Name	Description	Note
<CharacteristicName>.CharacteristicName	The name of the characteristic as it exists in the MES database. The name may differ from the object attribute name as expressed by <Characteristic Name>.	Exists at config time and run time, but writeable only at config time.
<CharacteristicName>.SampleID	The ID of the sample for manually collected characteristics. You can set this attribute at run time to enter results for the characteristic. For automatically collected characteristics, the object writes the current SampleID to this attribute and automatically saves the result data.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.CanCollectResultData	A Boolean value that enables or disables measurements collection for the characteristic at run time.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.CanCollectAutomaticData	A Boolean value that specifies whether the characteristic should always, or never, collect automatic data. Also specifies if the characteristic should use the specification configuration of a sample to determine whether it should collect automatic data at run time.	Exists at config time and run time. Writeable only at config time. A value for this attribute at run time is either Always, Never, or Use Configuration.
<CharacteristicName>.DelayTimer	The time interval between each measurement data for a characteristic.	Exists at config time and run time. Writeable only at config time.
<CharacteristicName>.SampleSize	The count of result values that are exposed for the characteristic (that is, how many ValueNumber## attributes exists for the SRO).	Exists at config time and run time. Writeable only at config time.
<CharacteristicName>.Note	Additional information that you can record in the MES database while recording data for the characteristic.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.CauseGroup	The cause group for the characteristic.	Exists at config time and run time. Writeable at config time and run time.

Attribute Name	Description	Note
<CharacteristicName>.Cause	The cause for why the characteristic is unexpected. The named cause must exist with the named cause group.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.ControlMove	A Boolean value that specifies whether there is a change to an environmental factor for the sample. When the value is set to True, the count for consecutive control rule evaluation restarts.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.IgnoreSample	A Boolean value that specifies whether calculating statistics should ignore the sample record.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.Equipment	A string that is the equipment used to measure the sample characteristic data.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.Expose Statistics	A Boolean value that specifies whether the statistic attributes for the characteristic are exposed at run time.	Exists at config time and run time. Writeable only at config time.
<CharacteristicName>.ValueNumber<N>	A value of the characteristic that is measured for the sample. Exists only if the characteristic type is a variable.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.ValueNumber.Value	The value for the characteristic that is measured for the sample. Exists only if the characteristic type is binary or counted.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.ValueNumber. ActualSampleSize	An integer that is the actual sample size for the sample characteristic. Exists only if the characteristic type is binary or counted.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.ValueNumberForResult Attributes	The number of the measurement result of a characteristic of a sample for which MES result attribute data is added. The result_attr table requires the SampleID, the characteristicID, and the ValueNumber to which the MES	Exists at config time and run time. Writeable at config time and run time.

Attribute Name	Description	Note
	attribute is linked.	
<CharacteristicName>.Operator	The operator who measured the sample characteristic.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>. <ResultAttributeName>.AttributeDesc	The actual MES Result attribute name from the MES database during the configuration time.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>. <ResultAttributeName>.Value	The value for the MES Result attribute that is recorded against this characteristic sample and value number.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>. <ResultAttributeName>.Notes	A note for the MES Result attribute that is recorded against this characteristic sample and value number.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>.RecordSampleCharateristicDataCmd	Updates any contextual data for this characteristic.	Exists only at run time and writeable at run time.
<CharacteristicName>.RecordResultDataCmd	Records the measurement data for this characteristic using the provided sample ID.	Exists only at run time and writeable at run time.
<CharacteristicName>.RecordMESResultAttributeDataCmd	Records the MES Result attribute data for this characteristic using the provided sample ID and value number for result attributes.	Exists only at run time and writeable at run time.  <b>Note:</b> In the current version of MES, this attribute is disabled.
<CharacteristicName>.ResetCmd	Resets the object state for a characteristic to Ready so that the next request is processed.	Exists only at run time and writeable at run time.

Attribute Name	Description	Note
<CharacteristicName>. <AttributeName>. Use InputSource	A Boolean value that, if set toTrue, specifies that the object reads the data for an attribute from the I/O reference, using the InputSource reference value configured for that attribute.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>. <AttributeName>. Input Source	If UseInputSource is set to True, specifies the location of the input source from which the data will be read.	Exists at config time and run time. Writeable at config time and run time.
<CharacteristicName>. <AttributeName>. ReadStatus	The MxStatus value when an attribute fails to read a value from the I/O reference from its last data.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>. ErrorCode	The error number returned from the stateless API after submitting a call to the MES middleware, or an error code from the object.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>. ErrorMessage	The error message received from the stateless API after submitting a call to the MES middleware, or an error message from the object.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>. Status	The status of this characteristic instance. The status is either Ready, Busy, Done, or Error.	Exists only at run time. Writeable at run time only by the object.

Attribute Name	Description	Note
<CharacteristicName>.ControlRuleViolations	<p>The control rule violations that occurred, if any, while recording the measurement data.</p> <p>The format of this attribute is:</p> <pre>[ChartType]:ID(RuleID): RuleName;ID(RuleID):RuleName;[CharacterType]:ID(RuleID): RuleName;</pre> <p>where:</p> <ul style="list-style-type: none"> <li>• ChartType is the name of the chart type that was used in triggering the rule violation</li> <li>• RuleID is the RuleID number from SPC_Rule table</li> <li>• RuleName is the text rule description from SPC_Rule table.</li> </ul> <p>It is possible to have multiple chart types and rules within the string.</p> <p>For example:</p> <pre>[Moving Range Chart]: ID(5): 7 of 7 on one side of center line; ID(9): 10 of 11 on one side of center line.</pre>	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.RecentSampleID	The ID of the most recent sample (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.SpecName	The name of the specification that is used to generate this sample characteristic (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.StartEffDate	The start effective date of the specification that is used to generate this sample characteristic (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.Type	The type of this characteristic (retrieved from the MES database). The possible values are variable, binary, or counted attributes.	Exists only at run time. Writeable at run time only by the object.

Attribute Name	Description	Note
<CharacteristicName>.Output.TypeID	<p>The type code for this characteristic (retrieved from the MES database).</p> <p>The possible values are:</p> <ul style="list-style-type: none"> <li>• 0 is variable</li> <li>• 1 is binary</li> <li>• 2 is counted</li> </ul>	<p>Exists only at run time. Writeable at run time only by the object.</p>
<CharacteristicName>.Output.UnitofMeasurement	<p>The unit of measurement for this characteristic (retrieved from the MES database).</p>	<p>Exists only at run time. Writeable at run time only by the object.</p>
<CharacteristicName>.Output.MinSampleSize	<p>The minimum number of measurements in a sample for this characteristic (retrieved from the MES database).</p>	<p>Exists only at run time. Writeable at run time only by the object.</p>
<CharacteristicName>.Output.NormalSampleSize	<p>The normal sample size for this characteristic (retrieved from the MES database).</p>	<p>Exists only at run time. Writeable at run time only by the object.</p>
<CharacteristicName>.Output.MaxSampleSize	<p>The maximum number of measurements in a sample for this characteristic (retrieved from the MES database).</p>	<p>Exists only at run time. Writeable at run time only by the object.</p>
<CharacteristicName>.Output.Severity	<p>The severity for this characteristic (retrieved from the MES database). The possible values depend on the default language of the system. The possible values for English are Non-Key, Key, Critical, and Not Monitored.</p>	<p>Exists only at run time. Writeable at run time only by the object.</p>
<CharacteristicName>.Output.SeverityCd	<p>The severity code for this characteristic (retrieved from the MES database). The possible values are:</p> <ul style="list-style-type: none"> <li>• 1 is Not Monitored (run rule violations are not checked)</li> <li>• 2 is Non-Key (default)</li> <li>• 3 is Key</li> <li>• 4 is Critical</li> </ul>	<p>Exists only at run time. Writeable at run time only by the object.</p>

Attribute Name	Description	Note
<CharacteristicName>.Output.DefaultChart	The default chart name for this characteristic (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.DefaultChartCd	<p>The default chart code for this characteristic (retrieved from the MES database). The possible values are:</p> <ul style="list-style-type: none"> <li>• 2 is Xbar + Range</li> <li>• 3 is Xbar + Sigma</li> <li>• 5 (default) is IX + MR</li> <li>• 7 is MA + Range</li> <li>• 8 is MA + Sigma</li> <li>• 16 is p</li> <li>• 17 is np</li> <li>• 18 is u</li> <li>• 19 is c</li> <li>• 20 is DPMO (coding per QI Analyst)</li> </ul>	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.LRL	The lower reasonable limits for this sample (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.URL	The upper reasonable limits for this sample (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Act.PercentOutofSL	The percentage of measurement data outside the specification limits.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Cp	The process capability, which is based on the upper and lower specification limits.  This attribute is only available for variable characteristics.	Exists only at run time. Writeable at run time only by the object.

Attribute Name	Description	Note
<CharacteristicName>.Statistics.Cpk	<p>The process capability index of the sample mean, which is based on the upper or lower specification limit.</p> <p>This attribute is only available for variable characteristics.</p>	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Mean	The average of a set of data.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Pp	<p>The process performance, which is based on the upper and lower specification limits.</p> <p>This attribute is only available for variable characteristics.</p>	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Ppk	<p>The process performance index of the sample mean, which is based on the upper or lower specification limit.</p> <p>This attribute is only available for variable characteristics.</p>	Exists only at run time. Writeable at run time only by the object
<CharacteristicName>.Statistics.Range	<p>The range between the highest data point and the lowest data point. This is calculated as the difference between the maximum individual reading and the minimum individual reading.</p>	Exists only at run time. Writeable at run time only by the object
<CharacteristicName>.Statistics.Rbar	<p>The average range of values from various samples of equal sample size.</p> <p>This attribute is only available for variable characteristics.</p>	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Rows	The total number of rows (result data) involved in calculating the process statistics.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.StdDev	The statistical measure of spread or variability of the individual results.	Exists only at run time. Writeable at run time only by the object

Attribute Name	Description	Note
<CharacteristicName>.Statistics.EstSigma	The statistical measure of spread or variability estimated based on sample variability.	Exists only at run time. Writeable at run time only by the object.
	This attribute is only available for variable characteristics.	
<CharacteristicName>.Statistics.Total	The total number of samples involved in calculating the process statistics.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Min	The minimum individual reading among the set of sample measurements.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.Max	The maximum individual reading among the set of sample measurements.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.LSL	The lower specification limit for a specification that is obtained from the most recent sample.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Statistics.USL	The upper specification limit for a specification that is obtained from the most recent sample.	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.ErrorCode	The error code returned by the Stateless API after submitting a call to the MES middleware (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.ErrorMessage	An error message returned by the Stateless API after submitting a call to the MES middleware (retrieved from the MES database).	Exists only at run time. Writeable at run time only by the object.
<CharacteristicName>.Output.Status	The status of the characteristic instance (retrieved from the MES database). The status is either Ready, Busy, Done, or Error.	Exists only at run time. Writeable at run time only by the object.

## Mapping Attributes

The SRO supports both the MES attribute naming convention and the S95 naming convention. If you want to convert the MES attribute naming convention to S95, you have to do this using the MES Client. You can only translate the attribute names exposed at configuration time. The attributes at run time are exposed as they are

saved in the MES database. The naming convention applies only to attribute labels, and not to the actual attributes.

You can map the S95 attributes and MES attributes as described in the following table.

S95 Attributes	MES Attributes
Production Request	Work Order (wo_id)
Process Segment	Operation (oper_id)
Material	Item (item_id)
Equipment	Entity (ent_id)
Personnel	Operator (user_id)

## Naming Attributes

In this context, attribute refers to a System Platform attribute such as Sample.SampleID, Sample.Lot, and Sample.Sublot. These attribute names are pre-fixed such that they cannot be changed either at configuration time or at run time. In some cases, part of an attribute name is added from the MES database:

- Characteristic names (characteristic.char\_name)
- Sample attribute descriptions (attr.attr\_desc for attr\_grp = 10)
- Result attribute descriptions (attr.attr\_desc for attr\_grp = 11)

These attribute names can be renamed at configuration time.

The descriptions of the System Platform attributes are as follows:

### Characteristic Attributes

Refers to the characteristic names added to the System Platform object. These names are obtained from the Characteristic table in the MES database.

### MES Sample Attributes

Refers to the attribute descriptions added to the System Platform object. These descriptions are obtained from the Attribute table in the MES database whose attribute group = 10.

### Result Attributes

Refers to the attribute descriptions added to the System Platform object. These descriptions are obtained from the Attribute table in the MES database whose attribute group = 11.

## When Attributes Are Updated During Run Time

At run time, the SRO allows you to capture sample data, sample characteristic data, and result data.

During OnScan, the number of result data (measurements) for a sample characteristic logged in the MES database is read into the SRO. The SRO determines whether to log further measurements for the current sample, based on the number of results logged in the MES database and the characteristic configuration in the SRO.

During normal execution, the object receives notification of new samples for the entity that contains the object. When a new sample is detected, the recent sample attributes are updated along with the recent sample ID, for

all characteristics contained within the recent sample.

If a characteristic is marked as automatic, the object begins to collect data for the characteristic as soon as a new sample arrives. During each scan, the object records data for an automatically collected characteristic. Once the maximum sample size is met for an automatically collected characteristic, the recording stops. During the collection process, if the object detects a new sample, the recording of data for a sample ID stops.

## Process Statistics

Calculating process statistics helps to determine whether a current process is under control. It also helps in determining the future performance of the process using the existing data. The statistics for a characteristic are calculated based on parameters such as specification limits, sigma estimation method. The calculation of process statistics happens when new results are recorded in the SRO.

The specification limits and control limits for a characteristic are obtained from a QM specification that is linked to the most recent sample for an entity. The result data from the range of samples are evaluated against the spec limits obtained from the most recent sample.

The range of samples for a characteristic is limited as follows:

- The samples are restricted to those that have the same value as the most recent sample for the columns corresponding to the ones where the filter\_by\_\* settings for the characteristic is True. For example, if filter\_by\_item\_id is True, only samples for the same item as the most recent sample are used to calculate these values.
- The difference between samples that were requested more recently than the time of the most recent sample and the cut-off time configured in the system attribute are used. This helps to limit the number of samples.
- The maximum number of samples is limited to the value configured in the system attribute. This helps to limit the number of samples.

The most recent sample record for a characteristic is represented as the starting sample. A range is obtained from the most recent to the oldest sample record, based on the values configured in the system attributes. The value for the process statistic attribute is calculated on the basis of the default chart type, which is configured for a characteristic or a QM specification that overrides the characteristic.

The statistical values are calculated in a stored procedure that is called whenever results are added. The calculated statistical values are used in Sample Viewer control, custom implementations, etc.

The statistical values are rounded off to their nearest decimal places configured for a characteristic before they are returned to the client. However, the intermediate statistical values such as range, sample average, and sample deviation are stored in the sample\_char\_link table. They are not rounded off to the nearest decimal places. The current values of the process statistics are also stored in the stats table by entity and characteristic and any filter fields.

The values configured for a characteristic for standard deviation and standard mean are not used to calculate the process statistics. These values are used only to calculate control limits. None of the statistic attributes listed in [Statistical Values](#) are exposed in the SRO.

## Controlling the Amount of Data Used in Calculating Process Statistics

In addition to a characteristic's **Filter by options** settings, which can be set for the characteristic in MES Client, the following system parameters can be used to control the amount of sample data that is included in the

calculation of process statistics. These parameters are included in the **Display** group of the MES Client **General Parameters** module.

**Cut-off time in days to limit the number of samples while calculating process statistics from the samples (0 = Include all samples)**

Upper bound on the age of sample data used to calculate process statistics. This time range is applied to the sample's requested time. Use this parameter to exclude sample data that is considered too old to be relevant. For example, setting this parameter to a value of 2 would mean that only the last 2 days of sample data would be used to calculate process statistics.

**Number of samples to consider calculating process statistics**

Maximum number of samples to include when calculating process statistics. Use this parameter to tune the performance of the system so that there is not too much data being analyzed.

These two parameters do not affect the calculation of control limits from the data, which is based on the **Samples for Control Limit** setting in the characteristic configuration.

These two parameters are used when calculating the statistics that are recorded in the stats table. They can help you to control system performance and ensure that statistic calculations use only recent data. The **Cut-off time in days** parameter allows you to exclude data that is no longer relevant. The **Number of samples to consider** parameter allows you to tune the performance of the system by placing a cap on how much data will be included in the process statistics calculation. Logically, they would be used together as follows:

Perform the process statistics calculations on the top <**Number of samples to consider**> samples from those that were recorded in the last <**Cut-off time in days**> days.

For example, if 10 samples per day are being recorded, the cut-off time is set to 2 days, and the number of samples to consider is set to 12, then only the most recent 12 samples will be included in the process statistics calculation. However, if the number of samples to consider is set to 30, and there are 2 days worth of samples recorded, then the most recent 20 samples will be included in the process statistics calculation.

## Statistical Values

The statistical values are calculated in a stored procedure. They are described in the following table:

Value	Description	Calculation	Note
Actual Percent Out of Specification Limits (ActPercentOut ofSL)	The actual percentage of data that falls outside of specification limits.	Total number of result records outside of specification limits/Total number of individual result records	
C Chart	Specifies how standard deviation for the C Chart is calculated.	StatValuesCChart	<i>NormalSample-Size</i> is the size configured for a characteristic. $\bar{u}$ is the value calculated for UBar.

Value	Description	Calculation	Note
DPMO Chart	Specifies how standard deviation for the DPMO Chart is calculated.	StatValuesDPMOChart	<p><i>NormalSampleSize</i> is the size configured for a characteristic.</p> <p><i>NumDefectOps</i> is the <i>num_defect_opp</i> configured for a characteristic.</p> <p><math>\bar{u}</math> is the value calculated for UBar.</p>
Defects per Million Opportunities (DPMO)	Specifies the average count of defects for every 1 million opportunities, where a single unit may have more than 1 opportunity for a specific defect. This value is only applicable for counted attribute characteristics.	StatValuesDPMO	<p><i>N</i> is the number of results data for a characteristic.</p> <p><i>NumDefectOps</i> is the value the user enters for number of defect opportunities.</p>
Fraction Defective	Specifies the ratio of defects to sample size, for a single sample point.	Stat	
Lower Reasonable Limit (LRL)	Specifies the lower reasonable limit for a specification that is obtained from the most recent sample.	$\text{Target} - ((\text{Target} - \text{LSL}) \times \text{LRV})$ <p>if <i>lrv_is_mult</i> is True, and <i>LSL</i> is not null; otherwise, <i>LRL</i> = <i>LRV</i>.</p>	<p><i>LSL</i> is the lower specification limit.</p> <p><i>LRV</i> is the value configured by the user.</p>

Value	Description	Calculation	Note
Moving Average	Specifies the average of individual readings from a number of consecutive individual readings.	$x_{\text{BarSubi}} = \frac{\sum_{i=s}^{N} x_{\text{Subk}}}{i}$ $i$ is the number of the sample to which the moving average value is assigned. $i$ is always less than or equal to $N - s + 1$ , where $N$ represents the number of individual values.	$s$ is the moving average span configured for a characteristic. $x_{\text{Subk}}$ is the individual result data. $x_{\text{BarSubi}}$ is the moving average for sample $i$ .
Moving Average Bar ()	Specifies the average of moving averages.	$x_{\text{BarSubi}} = \frac{\sum_{i=1}^{N} x_{\text{BarSubi}}}{N}$ $i$ is the number of the sample to which the moving range value is assigned. $s$ is the moving average span configured for a characteristic.	$N$ is the number of results data. $x_{\text{BarSubi}}$ is the moving average value for sample $i$ .

Value	Description	Calculation	Note
Moving Range	Specifies the difference between the highest and lowest individual readings among a number of consecutive individual readings.	StatValuesMovingRange	<p><math>s</math> is the moving average span configured for a characteristic.</p> <p><math>x_{Subk}</math> is the individual result data, where <math>k</math> ranges from <math>i</math> to <math>i + s - 1</math>.</p> <p><math>i</math> is the number of the sample to which the moving range value is assigned. <math>i</math> is always less than or equal to <math>N - s + 1</math>, where <math>N</math> represents the number of individual values.</p>
Moving Sigma	Specifies the standard deviation ( $\sigma$ ) from a number of consecutive individual readings.		<p><math>s</math> is the moving average span configured for a characteristic.</p> <p><math>x_{Subk}</math> is the individual result data.</p> <p><math>i</math> is the number of the sample to which the moving sigma value is assigned. <math>i</math> is always less than or equal to <math>N - s + 1</math>.</p> <p><math>\bar{x}</math> represents the mean calculated from the set of individual readings used to calculate the moving sigma.</p>
NP Chart	Specifies how standard deviation for the NP chart is calculated.		<p><math>NormalSampleSize</math> is the size configured for a characteristic.</p> <p><math>p_{Bar}</math> is the value calculated for <math>P_{Bar}</math>.</p>

Value	Description	Calculation	Note
NPBar and CBar (npBar and cBar)	Specifies the average for binary and counted attribute characteristics as a count.	StatValuesNPBarAndCBar	$N$ is the number of results data for a characteristic. $i$ is the number of sample from which the Number of ((Defectives)/ (Defects)) and actual sample size are obtained.
PBar and UBar (pBar and uBar)	Specifies the average for binary and counted attribute characteristics as a ratio to sample size.	StatValuesPBarAndUBar	$N$ is the number of results data for a characteristic. $i$ is the number of sample from which the Number of ((Defectives)/ (Defects)) and actual sample size are obtained.
P Chart	Specifies how standard deviation for the P Chart is calculated.	StatValuesPChart	$NormalSampleSize$ is the size configured for a characteristic. $pBar$ is the value calculated for PBar.
Process Capability Index (Cp)	Specifies the process capability index, which is based on the upper and lower specification limits.	When USL and LSL contain non-null values: StatValuesCp1 When USL or LSL is null for a characteristic: StatValuesCp2	$\sigma$ is the estimated standard deviation.
Process Capability Index (CpK)	Specifies the process capability index accounting for the sample mean, which is based on the upper and lower specification limits.	When USL and LSL contain non-null values: StatValuesCpK1 When USL contains a non-null value, but LSL contains a null value: StatValuesCpK2 When LSL contains a non-null value, but USL contains a null value: StatValuesCpK3	$USL$ is the upper specification limit. $LSL$ is the lower specification limit. $x_{\text{CapBar}}$ is the arithmetic mean. $\sigma$ is the estimated standard deviation. $Cp$ is the process capability index.

Value	Description	Calculation	Note
Process Performance Index (Pp)	Specifies the process performance index, which is based on the upper and lower specification limits.	<p>When USL and LSL contain a non-null value:  <math>\text{StatValuesPp1}</math></p> <p>When either the USL or the LSL contain a null value:  <math>\text{StatValuesPp2}</math></p>	<p><math>USL</math> is the upper specification limit.  <math>LSL</math> is the lower specification limit.  <math>\sigma</math> is the standard deviation.</p>
Process Performance Index (PpK)	Specifies the process performance index accounting for the sample mean, which is based on the upper and lower specification limits.	<p>When USL and LSL contain non-null values:  <math>x\text{CapBar}</math> is the arithmetic mean.</p> <p>When USL contains a non-null value, but LSL contains a null value:  <math>\sigma</math> is the standard deviation.</p> <p>When LSL contains a non-null value, but USL contains a null value:  <math>Pp</math> is the process performance index.</p>	
Range	Specifies the range between the highest and the lowest data points.	Maximum Individual Reading – Minimum Individual Reading	
Range Average of Subgroups (RBar)	Specifies the average range of values from various samples of equal size.		<p><math>\text{StatValuesRBar2}</math> is the individual range among each sample or the moving range between two consecutive samples.</p> <p><math>S</math> is the total number of samples used for calculating the process statistics.</p>

Value	Description	Calculation	Note
Sample Average (Mean)	Specifies the average of a set of data.		$x_{\text{CapBar}} = \frac{\sum x_{\text{Subi}}}{N}$ $N$ is the number of values (individual readings). $x_{\text{Subi}}$ is each data element. The arithmetic mean is calculated from the set of individual readings.
Standard Deviation (StdDev)	Specifies the statistical measure of spread or variability. Applies only to variable-type characteristics. The C chart, U chart, DPMO chart, P chart, and NP chart mentioned below are part of the Standard Deviation.		$N$ is the number of results data. $x_{\text{Subi}}$ is the individual result data. $x_{\text{CapBar}}$ is the arithmetic mean obtained from the results data.
U Chart	Specifies how standard deviation for the U Chart is calculated.		$\text{NormalSample-Size}$ is the size configured for a characteristic. $u_{\text{Bar}}$ is the value calculated for $U_{\text{Bar}}$ .
Upper Reasonable Limit (URL)	Specifies the upper reasonable limit for a specification that is obtained from the most recent sample.	$if urv\_is\_mult is True, and USL is not null; otherwise, URL = URV.$	$USL$ is the upper specification limit. $URV$ is the value configured by the user.

## Calculating Control Limits

The control limits are determined by some settings on the characteristic table, which may be overridden for a particular QM specification. The QM specification is the one used by the most recent sample that meets the filter criteria. So once the most recent sample is identified, its record in the Sample\_Char\_Link table for that sample and characteristic is found (each graph is for a particular characteristic). The `qm_spec_id` field in that table

identifies the particular QM specification to use. Then the Qm\_Spec\_Char\_Link record that goes with this QM specification and characteristic is identified. In it are several fields, which generally have exact counterparts in the characteristic table also, that are needed to calculate the control limits. If a field is null in the Qm\_Spec\_Char\_Link table, the value from the field of the same name in the characteristic table is used instead (which generally will not be null).

The first field to consider is cl\_source. If cl\_source is 0, the control limits are to be calculated from the data. If cl\_source is 1, it means the population average/proportion/defects per unit and population standard deviation (for variables) are given in the database tables. And if cl\_source is 2, it means that the exact control limits (and the center line) have been specified in the database for specific chart(s). This last case is the simplest - the control limits are whatever is specified in the appropriate fields (see below) of the Qm\_Spec\_Char\_Link table, or if such a field is null, by the corresponding field in the characteristic table. If that too is null there is then no control limit. In the case of attribute charts, it is normal not to have a lower control limit, though having one is not illegitimate.

Chart	Lower Control Limit	Center Line	Upper Control Limit
Average (top of Xbar + Range or Xbar + Sigma)	lcl_xbar	cl_xbar	ucl_xbar
Range (bottom of Xbar + Range)	lcl_range	cl_range	ucl_range
Sigma (bottom of Xbar + Sigma)	lcl_sigma	cl_sigma	ucl_sigma
Individual X (top of IX + MR)	lcl_ix	cl_ix	ucl_ix
Individual moving range (bottom of IX + MR)	lcl_imr	cl_imr	ucl_imr
Moving average (top of MA + Range or MA + Sigma)	lcl_ma	cl_ma	ucl_ma
Moving range (bottom of MA + Range)	lcl_mr	cl_mr	ucl_mr
Moving sigma (bottom of MA + Sigma)	lcl_ms	cl_ms	ucl_ms
Percent defective (p)	lcl_p	cl_p	ucl_p
Number defective (np)	lcl_np	cl_np	ucl_np
Defects per unit (u) – also used for DPMO after adjustment	lcl_u	cl_u	ucl_u

Chart	Lower Control Limit	Center Line	Upper Control Limit
Number of defects (c)	lcl_c	cl_c	ucl_c

The control limit values are in this case represented by a horizontal line at the control limit value; there is no adjustment for changing sample size. The adjustment for DPMO charts mentioned in the second-last line of the chart above means taking the given control limit value (in defects per unit), multiplying by 1 million and dividing by the number of defect opportunities per unit, which is found in the num\_defect\_opp field of the characteristic table. If the num\_defect\_opp field is null 1 is used instead.

When cl\_source is 1, the field to use for the given average/proportion/defects per unit is determined by the field std\_avg\_is\_target. If true, the target field in the Qm\_Spec\_Char\_Link table supplies this value. (This field is not nullable, and there is no corresponding field in the characteristic table.) If it is false the std\_avg field is used instead. The value for the given standard deviation comes from the std\_deviation field.

- For charts of the average (the top chart of chart types 2 or 3) the lower control limit is 3 divided by the square root of the sample size times the given standard deviation below the given average, and the upper control limit is this same amount above the given average. 3 divided by the square root of the sample size is known as A and for convenience it is stored it in the a field of the factor table, so it can be read instead of calculated.
- For a range chart (the bottom chart of type 2) the lower control limit is the given standard deviation times  $D_1$  for  $n$  = the actual sample size. This is found in the d1 field of the factor record for the appropriate sample\_size. The upper control limit is the given standard deviation times  $D_2$  for  $n$  = the actual sample size. This is found in the d2 field of the same factor record.
- For a sigma chart (the bottom of chart type 3) the lower control limit is the given standard deviation times  $B_1$  for  $n$  = the actual sample size times the square root of the ratio of the sample size to one less than the sample size ( $B_1$  times this square root is also known as  $B_5$ ).  $B_1$  is found in the b1 field of the factor record for the appropriate sample\_size. The upper control limit is the given standard deviation times  $B_2$  for  $n$  = the actual sample size times the square root of the ratio of the sample size to one less than the sample size ( $B_2$  times this square root is also known as  $B_6$ ).  $B_2$  is found in the b2 field of the same factor record. That is, if  $\sigma'$  is the given standard deviation, and  $n$  is the actual sample size, the lower control limit is  $\sigma' \cdot B_1 \cdot \sqrt{\frac{n}{n-1}}$  and the upper control limit is  $\sigma' \cdot B_2 \cdot \sqrt{\frac{n}{n-1}}$ .
- For an individual X chart (the top of chart type 5) the lower control limit is 3 times the given standard deviation below the given average, and the upper control limit is this same amount above the given average.
- For an individual moving range chart (the bottom of chart type 5) effectively there is no control lower limit, since its value is reported as 0. The upper control limit is the given standard deviation times  $D_2$  for  $n$  = 2. This is found in the d2 field of the factor record where sample\_size = 2, and is equal to approximately 3.686.
- For a moving average chart (the top chart of chart types 7 or 8) the lower control limit is 3 divided by the square root of the moving average span times the given standard deviation below the given average, and the upper control limit is this same amount above the given average. This is the same A factor as is used for charts of the average, but the factor record used is the one where sample\_size = the moving average span. Every result for a moving average chart produces a new point, regardless of how the results were originally grouped into samples.
- For a moving range chart (the bottom chart of chart type 7) the lower control limit is the given standard deviation times  $D_1$  for  $n$  = the moving average span, and upper control limit is the given standard deviation times  $D_2$  for  $n$  = the moving average span. It is analogous to the range chart except that  $n$  is not necessarily 2.

but rather the moving average span.

- For a moving sigma chart (the bottom chart of chart type 8) the lower control limit is the given standard deviation times  $B_1$  for  $n$  = the moving average span, and the upper control limit is the given standard deviation times  $B_2$  for  $n$  = the moving average span. It is analogous to the sigma chart except that  $n$  is not necessarily 2, but rather the moving average span.
- For a percent defective (p) chart (type 16) the lower control limit is 3 times the square root of the ratio of the product of the given average proportion and 1 minus the given average proportion to the sample size above the given average proportion, and the upper control limit is this same amount above the given average proportion. That is, if  $p'$  is the given average proportion, and  $n$  is the actual sample size, the lower control limit is , and the upper control limit is .
- For a number defective (np) chart (type 17), which as the name suggests is simply a chart of the percent defective times the sample size ( $n$ ), the lower control limit is 3 times the square root of the product of the sample size, the given average proportion, and 1 minus the given average proportion below the sample size times given average proportion, and the upper control limit is this same amount above the actual sample size times given average proportion.

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**Note:** Though the chart is not normalized and is showing the number of defects, the given standard is still expressed as a proportion.

Thus, if  $p'$  is the given average proportion, and  $n$  is the actual sample size, the lower control limit is and the upper control limit is .

- For a defects per unit (u) chart (type 18) the lower control limit is 3 times the square root of the ratio of the given average number per unit to the sample size below the given mean, and the upper control limit is this same amount above the given average number per unit. That is, if  $u'$  is the given average number per unit, and  $n$  is the actual sample size, the lower control limit is CalcControlLimitsEq and the upper control limit is .
- For a number of defects (c) chart (type 19) the given standard is still expressed as the average number per unit. Therefore the lower control limit is 3 times the square root of the product of the actual sample size and the given average number per unit below the product of the actual sample size and the given average number per unit, and the upper control limit is this same amount above the product of the actual sample size and the given average number per unit. That is, if  $u'$  is the given average number per unit, and  $n$  is the actual sample size, the lower control limit is and the upper control limit is .
- For a defects per million opportunities (DPMO) chart (type 20), use the control limit values for the defects per unit (u) chart multiplied by 1 million and divided by the number of defect opportunities per unit.

When `cl_source` = 0, control limits are calculated from the data already entered, using the most recent `samples_for_cl` number of samples that meet the filter criteria. If there are not at least `samples_before_cl` number of qualifying samples, control limits are not calculated but remain null. When calculating the number of samples for both of these requirements, the number of samples is counted given the default chart type, which may be different than the number of samples originally taken, if grouped data is being plotted on a chart of individuals.

For variables, the sample standard deviation when charting grouped data is calculated as the square root of the sum of the ratio of the sum of the squares of the difference between each result in and the sample average to one less than the number of samples. That is, if  $s$  is the sample standard deviation,

where  $x_{Subi}$  is the  $i$ th result\_value in the sample,  $\bar{x}$  is the average result\_value for the sample, and  $n$  is the actual sample size. If  $n$  = 1, treat  $s$  as 0. In the case of a Moving Average and Moving Sigma chart, the "sample" is the set of results within the span, so  $n$  can be taken as the value of `mov_avg_span`, with the current result plus the preceding  $(n - 1)$  being considered.  $s$  is the value plotted on a sigma/moving sigma chart. Once  $s$  is known it can

be used to make an estimate of the population standard deviation, also just called the estimated standard deviation or estimated sigma, written as , if  $\sigma_{est} = 0$ . It is the average of the sample standard deviation divided by the value of  $c_4$  for the actual sample size, for qualifying samples having  $n > 1$ . If charting range (which is the difference between the largest and smallest result values in a sample) for a variable, the estimated standard deviation when  $\sigma_{est} = 0$  is the average of the range divided by the value of  $d_2$  for the actual sample size  $n$ , for qualifying samples having  $n > 1$ . As with the Moving Average and Moving Sigma chart, for the Moving Average and Moving Range chart the "sample" is the set of results within the span, so  $n$  can be taken as the value of  $mov\_avg\_span$ , with the current result and the preceding ( $n - 1$ ) being considered. For the IX + MR chart  $n$  is always 2, since the moving range is defined as the absolute value of the difference between the current and preceding result values (thus the "sample" in this case comprises the current result and immediately preceding result).  $c_4$  and  $d_2$  are found in the  $c_4$  and  $d_2$  fields of the factor record respectively for the appropriate sample\_size. If  $\sigma_{est} = 1$ , then the estimated standard deviation is set equal to the population standard deviation, which is equal to

where  $j$  is the total number of results in the qualifying samples,  $xSub_i$  is the value of the  $i$ th result, and  $\bar{x}$  is the average of all these values.

- For charts of the average (the top chart of chart type 2 or 3), the lower control limit is the estimated standard deviation times 3 divided by the square root of the actual sample size below the overall average, and the upper control limit is this same amount above the overall average.
- For a range chart (the bottom chart of type 2) the center line is at the estimated standard deviation times  $d_2$  for the actual sample size. The lower control limit is the estimated standard deviation times 3 times  $d_3$  for  $n =$  the actual sample size below the center line, and the upper control limit is this same amount above the center line. This is found in the  $d_3$  field of the factor record for the appropriate sample\_size.
- For a sigma chart (the bottom of chart type 3) the center line is at the estimated standard deviation times  $c_4$  for the actual sample size. The lower control limit is the estimated standard deviation times 3 times the square root of the sum of the ratio of the one less than the actual sample size to the actual sample size, and  $c_4$  (for the actual sample size) squared below the center line, and the upper control limit is this same amount above the center line. That is, the lower control limit is  $CalcSigmaChartLCL$  and the upper control limit is  $CalcSigmaChartUCL$ .
- For an individual X chart (the top of chart type 5) the lower control limit is 3 times the estimated standard deviation below the overall average, and the upper control limit is this same amount above the overall average.
- For an individual moving range chart (the bottom of chart type 5) effectively there is no control lower limit, since its value is reported as 0. The center line is at  $d_2$  times the estimated standard deviation, and the upper control limit is 3 times  $d_3$  times the estimated standard deviation above this. Both  $d_2$  and  $d_3$  are for  $n = 2$ . Thus the upper control limit is the estimated standard deviation times  $D_2$  for  $n = 2$  (approximately 3.686).
- For a moving average chart (the top chart of chart types 7 or 8) the lower control limit is 3 divided by the square root of the moving average span times the given standard deviation below the overall average, and the upper control limit is this same amount above the overall average. This is the same A factor as is used for charts of the average, but the factor record used is the one where sample\_size = the moving average span.
- For a moving range chart (the bottom chart of chart type 7) the center line and control limits are calculated the same as for the range chart except that  $n$  is not necessarily 2, but rather the moving average span.
- For a moving sigma chart (the bottom chart of chart type 8) the center line and control limits are calculated the same as for the sigma chart except that  $n$  is not necessarily 2, but rather the moving average span.

For attributes, the sigma\_est field has no effect, because each sample consists of just one reading.

- For a percent defective (p) chart (type 16) the lower control limit is 3 times the square root of the ratio of the product of the actual average proportion and 1 minus the actual average proportion to the sample size above the actual average proportion, and the upper control limit is this same amount above the actual average proportion. The actual average proportion, pBar, is the total number of defectives (= mean = result\_value) divided by the total number sampled (= act\_sample\_size). So CalcPChartAvgProportion, where  $k$  is the total number of qualifying samples, is the number of defectives in sample  $i$ , and  $n$  is the actual size of sample  $i$ . The lower control limit is , and the upper control limit is , where  $n$  is the actual size of the sample.
- For a number defective (np) chart (type 17), the lower control limit is 3 times the square root of the product of the sample size, the actual average proportion, and 1 minus the actual average proportion below the sample size times actual average proportion, and the upper control limit is this same amount above the actual sample size times given actual average proportion. Thus, if pBar is the given average proportion, and  $n$  is the actual sample size, the lower control limit is CalcNPChartAvgProportionLCL, and the upper control limit is CalcNPChartAvgProportionUCL.
- For a defects per unit (u) chart (type 18) the actual average number per unit, uBar is the total number of defects (= mean = result\_value) divided by the total number sampled (= act\_sample\_size). So , where  $k$  is the total number of qualifying samples, is the number of defects in sample  $i$ , and  $n$  is the actual size of sample  $i$ . The lower control limit is 3 times the square root of the ratio of the given mean to the sample size below the given mean, and the upper control limit is this same amount above the given mean. That is, if  $u'$  is the given average number per unit, and  $n$  is the actual sample size, the lower control limit is and the upper control limit is .
- For a number of defects (c) chart (type 19) the actual average number of defects cBar is the total number of defects (= mean = result\_value) divided by the number of samples. That is, CalcCChartSampleDefects where  $k$  is the total number of qualifying samples and  $n$  is the number of defects in sample  $i$ . Therefore the lower control limit is 3 times the square root of the actual average number of defects below the actual average number of defects, and the upper control limit is this same amount above the actual average number of defects. That is, if cBar is the actual average number of defects, and  $n$  is the actual sample size, the lower control limit is and the upper control limit is .
- For a defects per million opportunities (DPMO) chart (type 20), use the control limit values for the defects per unit (u) chart multiplied by 1 million and divided by the number of defect opportunities per unit.

When cl\_source = 0 or 1 with a default\_chart\_type of 2 or 3 (an Xbar chart), samples containing just one result should have the plotted point and control limits for the second chart go to 0.

### Estimated Standard Deviation

The estimated sigma is calculated based on the chart type linked to a characteristic. If sigma\_est for a variable is set to 1= use std.dev, the estimated sigma is calculated using the standard population deviation method.

The methods for calculating estimated standard deviation from sample information (when sigma\_est = 0) for individual chart types are described in the following table.

Default Chart Type	Calculation	Description of Terms
XBar and Range Chart		<p><math>\sigma_{\text{Caret}}</math> is the estimated standard deviation.</p> <p><math>S</math> is the number of samples used in calculating the estimated sigma.</p> <p><math>R</math> is the range from a sample.</p> <p><math>d_2</math> is the constant (adjustment) factor for the estimated sigma.</p> <p><math>n</math> is the number of individual readings for a sample.</p>
XBar and Sigma Chart		<p><math>\sigma_{\text{Caret}}</math> is the estimated standard deviation.</p> <p><math>S</math> is the number of samples used in calculating the estimated sigma.</p> <p><math>\sigma_{\text{Subscript}i}</math> is the sample standard deviation.</p> <p><math>c_4</math> is the constant (adjustment) factor for the estimated sigma.</p> <p><math>n</math> is the number of individual readings for a sample.</p>
Individual and Moving Range Chart		<p><math>\sigma_{\text{Caret}}</math> is the estimated standard deviation.</p> <p><math>N</math> is the total number of individual readings from all the samples.</p> <p><math>x_{\text{Subi}}</math> is the individual result data.</p> <p><math>d_2</math> is the constant (adjustment) factor for the estimated sigma.</p>
Moving Average and Range Chart		<p><math>\sigma_{\text{Caret}}</math> is the estimated standard deviation.</p> <p><math>N</math> is the total number of individual readings from all the samples.</p> <p><math>s</math> is the moving average span configured for a characteristic.</p> <p><math>x_{\text{Subi}}</math> is the individual result data.</p> <p><math>d_2</math> is the constant (adjustment) factor for the estimated sigma.</p>

Default Chart Type	Calculation	Description of Terms
Moving Average and Sigma Chart	<p>The moving sigma is calculated as:</p> $\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_{Subk} - \bar{x})^2}$ <p>The estimated standard deviation is calculated as:</p> $s = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_{Subk} - \bar{x})^2}$	<p><b>Moving sigma:</b>  <math>\sigma</math> is the standard deviation.</p> <p><b>Estimated standard deviation:</b>  <math>s</math> is the moving average span configured for a characteristic.</p> <p><math>x_{Subk}</math> is the individual result data.</p> <p><math>\bar{x}</math> is the arithmetic mean from the results data.</p> <p><math>N</math> is the total number of individual readings from all the samples.</p> <p><math>s</math> is the moving average span configured for a characteristic.</p> <p><math>c_4</math> is the constant (adjustment) factor for the estimated sigma.</p>

## Control Rule Violations

Control rules are used to identify and reduce the non-random variability within a process. You can configure one or more control rules for a specification that is linked to one or more characteristics, which are applied if the severity for the characteristic is Non-Key, Key, or Critical.

Control rules are validated when

- An individual reading for a characteristic is recorded in the MES database.
- Rule violations, if any, are reported as a warning message to the client.

The control rules are evaluated against a characteristic that is linked to a most recent sample.

Control rules are not evaluated or validated against a characteristic that is linked to a sample whose sample time is in the past and is not the most recent sample for the characteristic.

### About Validating Control Rule Violations

When an individual reading is recorded in the MES database, the QM specification used to generate the sample is used to validate the control rules against the individual readings for the sample.

The following conditions are required to validate control rules against sample data:

- The total number of individual readings must be at least equal to the minimum number of readings configured for a characteristic or for a specification that is linked to the characteristic before the control rule validations are performed against the current sample.
- If the severity for a characteristic is greater than or equal to Non-Key, and a specification linked to a rule

must have at least one of the use\_\* values set to True.

A warning message is returned to the client when there are control rule violations while recording the result data in the MES database.

If more than one result for a sample is sent to the middleware to record all the results in a single transaction, the control rules are not evaluated as each result is inserted into the MES database, but the control rules are evaluated once after inserting all the results into the database.

## About Logging Control Rule Violations

Control rule violations are logged in the ControlRuleViolations attribute in the SRO. A log message related to the rule violation is logged to the Logger. If a specification is attached to more than one rule, then the following occurs:

- Each rule attached to a specification is evaluated and validated in the order of rule ID.
- A single string concatenating each control rule violation description, separated by semicolons, is returned to the client.

The format of this attribute is:

[ChartType]:ID(RuleID):RuleName;ID(RuleID):RuleName;[ChartType]:ID(RuleID):RuleName;

where ChartType is the name of the chart type that was used in triggering the rule violation, RuleID is RuleID number from SPC\_Rule table, and RuleName is the text rule description from SPC\_Rule table.

It is possible to have multiple chart types and rules within the string.

- Each control rule violation is separately logged in the MES database (sample\_char\_rule\_link) against the most recent sample that caused the rule violation(s).

A control rule for a sample characteristic recorded in the Sample\_Char\_Rule\_Link table against the most recent sample is removed from this table when a new result data is recorded for the most recent sample characteristic and the result data, when converted to a chart point, no longer violates that rule.

## Standard Rules and Calculation Types

The standard rules from the MES database are described in the following table.

Rule ID	Description
0	1 point beyond/outside control limits
1	2 of 3 outside 2 standard deviations
2	3 of 7 outside 2 standard deviations
3	4 of 10 outside 2 standard deviations
4	4 of 5 outside 1 standard deviation
5	7 of 7 on one side of centerline (that is, outside 0 standard deviations)

Rule ID	Description
6	8 of 8 on one side of centerline
7	8 of 8 beyond 1 standard deviation
8	9 of 9 on one side of centerline
9	10 of 11 on one side of centerline
10	12 of 14 on one side of centerline
11	6 of 6 trending up or down
12	7 of 7 trending up or down

Points beyond standard deviations are either above the positive number or below the negative number of standard deviations together. Points outside standard deviations are the violating points. They are either above the positive number of standard deviations, or below the negative number of standard deviations. It is easier to violate a Beyond rule than an Outside rule, if all the other values are the same.

The calculation for obtaining standard deviation depends on the following:

- Chart type
- Control limit source
- Sigma estimation method configured for a characteristic

For more information see [About Calculating Process Statistics](#).

## About Chart Point

A chart point is a data point or a plot point that can be plotted in a chart. The data for a chart point could be an individual reading or a data calculated from the set of individual readings from one or more samples. When the chart point is derived from a set of individual readings, the calculation for that chart point depends upon the chart type that is linked to a characteristic.

The lower control limit (LCL) and upper control limit (UCL) for a chart point are calculated using the standard deviation (given or calculated). Since the control limits may vary for each chart point in a chart, the control limits are calculated for each chart point in a chart. The calculation for control limits may also vary for each chart type.

The lower sigma (LS) and upper sigma (US) are calculated for a chart point. Finally, the CL, LCL, UCL, LS and US are used to validate a rule violation against a chart point.

The control rules are validated for each chart point calculated based on the chart type against the control limits and sigma calculated for each chart point.

The method to obtain a chart point from each chart type is described in the following table:

Chart Type	Chart Point
Individual Values (ix)	Individual Reading.
Moving Range (ix + mr)	Absolute Range between 2 consecutive points.

Chart Type	Chart Point
Moving Range (ma + range)	Absolute Moving Range among consecutive points, where the number of points is equal to moving average span configured for a characteristic.
XBar (xbar + range)	Xbar value from each sample.
XBar (xbar + sigma)	Xbar value from each sample.
Range	Range value from each sample.
Sigma	Population Sigma from each sample.
Moving Average (ma + range)	Moving Average among consecutive points, where the number of points is equal to the moving average span configured for a characteristic.
Moving Average (ma + sigma)	Moving Average among consecutive points, where the number of points is equal to the moving average span configured for a characteristic.
p	Fraction Defective, that is, Value/Actual Sample Size.
np	Defective Count (Value).
c	Defect Count (Value).
u	Defects per unit, that is, Value/Actual Sample Size.
DPMO	Defects per Million Opportunities.

### Applicable Control Rules for a Chart

The rules that apply to samples for a characteristic depend on the following:

- Whether the control rule is obsolete.
- The default chart for the applicable QM specification linked to the characteristic.
- Whether the `use_for_*` property of the rule is True for the default chart.

For default charts for variables having separate parts for the variable and its variability, the `use_for_*` properties applicable to each part are applied independently.

The following table shows the control rule `use_for_*` properties that applies to each of the default chart types.

Rule	Property	XBar + Range	XBar + Sigma	MA IX + MR	MA + Range	MA + Sigma	p	np	u	c	DPMO
use_for		1									

Rule	Property	XBar + Range	XBar + Sigma	IX + MR	MA + Range	MA + Sigma	p	np	u	c	DPMO
_ix											
use_for _mr			2		2						
use_for _xbar	1		1								
use_for _range	2										
use_for _sigma		2			2						
use_for _ma			1		1						
use_for _attr						A	A	A	A	A	A

In the table:

- A – Applicable and supported.
- 1 – Applicable to top chart and supported.
- 2 – Applicable to bottom chart and supported.
- Blank Cell – Not applicable and not supported.

## Storing Control Rules Internally

A rule, whether standard or custom, is controlled by their definition in the Spc\_Rule table, as described in the table below.

Values configured for Test1 and Test2 can be interchanged without affecting whether the rule is violated or not. Test1 uses the value in Level1, and Test2 uses the value in Level2.

- If the Boolean flag AndNotOr is set to True, Test1 and Test2 must contain a non-null value and they both must satisfy the tests to log a rule violation; otherwise, the rule is not considered to be violated.
- If the Boolean flag AndNotOr is set to False, it is only required if either Test1 or Test2 satisfies its test to log a rule violation.

Test1/ Test2	Level1/ Level2	Num Points	Of Points	Type of Rule Violations	Comments/ Example
Trend Up (1)	Not Applicable	Applicable, if > 2	Applicable, if > 2	Num Points of Of Points increasing	Num Points and Of Points must be greater than 2 (e.g., 7 of 7 increasing)
Trend Down (2)	Not Applicable	Applicable, if > 2	Applicable, if > 2	Num Points of Of Points decreasing	Num Points and Of Points must be greater than 2 (e.g., 7 of 7 decreasing)
Run Above (3)	Applicable	Applicable, if > 0	Applicable, if > 0	Chart point above upper control limit Num Points of Of Points above >=Level* std. dev. Num Points of Of Points on one side (upper) of center line	If Num Points = 1, Level1 is NULL, then this test validates whether the chart point is above upper control limit (e.g., 1 above upper control limits). If Num Points > 0 Of Points > 0, Level1 <> 0, then this test validates whether the Num Points of Of Points above >= Level1 std. dev. (e.g., 2 of 3 above 2 std. dev.). If Num Points > 1, Of Points > 1, Level1 = 0, then this test validates whether the Num Points of

Test1/ Test2	Level1/ Level2	Num Points	Of Points	Type of Rule Violations	Comments/ Example
					Of Points on upper side of centerline (e.g., 8 of 8 points on one side (above) of CL).

Test1/ Test2	Level1/ Level2	Num Points	Of Points	Type of Rule Violations	Comments/ Example
Run Below (4)	Applicable	Applicable, if > 0	Applicable, if > 0	Chart point below lower control limit Num Points of Of Points below <= Level * std. dev. Num Points of Of Points on one side (lower) of center line	If Num Points = 1, Level1 is NULL, then this test validates whether the chart point is below lower control limit (e.g., 1 below lower control limit). If Num Points > 0, Of Points > 0, Level1 <> 0, then this test validates whether the Num Points of Of Points below <=Level1 std. dev. (e.g., 2 of 3 below 2 std. dev). If Num Points > 1, Of Points > 1, Level1 = 0, then this test validates whether the Num Points of Of Points on lower side of centerline (e.g., 8 of 8 points on one side (below) of CL).

Test1/ Test2	Level1/ Level2	Num Points	Of Points	Type of Rule Violations	Comments/ Example
Run Beyond (6)	Applicable	Applicable, if > 0	Applicable, if > 0	Num Points of Of Points beyond <=Level * std.dev. or >=+Level * std. dev.	If Num Points > 1, Of Points > 1, then this test validates whether the Num Points of Of Points beyond <= Level* std. dev. or beyond >=+Level* std.dev. (e.g., 8 of 8 points beyond 1 std. dev.).

### Automatically Calculating Standard Mean and Standard Deviation from Data

When the cl\_source for a characteristic is configured to calculate standard mean and standard deviation dynamically (cl\_source = 0), or for a QM specification that overrides the characteristic, the standard mean and standard deviation are calculated when the result data is logged in the MES database, and it satisfies the following conditions:

- The minimum number of individual readings is at least equal to the minimum sample size.
- The number of samples for a characteristic prior to the current sample must be at least equal to the configured value (samples\_before\_cl) for a characteristic, or for a QM specification that overrides the characteristic. By default, the number of sample is 1.
- The number of samples that are not ignored for a characteristic must be fewer than or equal to the configured value (samples\_for\_cl) or for a QM specification that overrides the characteristic, if samples\_for\_cl is greater than 0. By default, if the configured value is 0, all samples that are not ignored are used for calculation.

### Calculating CL, LCL and UCL for Variable Type Characteristics

You can calculate the center line, LCL and UCL for each chart type based on different sigma calculation methods. The following table shows the result data captured for each sample and its deviation from specification limits.

Sample ID	Sample Time	Specifi-cation Name	Charac-teristic Name	Value No.	Value	Is the Value Out of Spec Limits	Deviation from Lower Spec Limit	Deviation from Upper Spec Limit
3	10:30a	SpecC	Width	2	0.9550	False		
3	10:30a	SpecC	Width	4	0.9400	False		
3	10:30a	SpecC	Width	5	0.9600	False		
4	10:45a	SpecC	Width	1	0.9525	False		
5	11:00a	SpecC	Width	1	0.9575	False		
51	11:15a	SpecC	Width	1	0.9400	False		
51	11:15a	SpecC	Width	3	0.9500	False		

The following examples use the last chart point that can be plotted for a chart to illustrate the control limit calculations.

## Individual Values (ix)

The LCL and UCL are calculated based on the sigma setting for a characteristic. The tables below contain formulas to calculate the CL, LCL and UCL for a chart point. Since the center line (CL) is the xbar (xCapBar), the center line, LCL and UCL is the same for all the chart points for this chart type. A chart point is an individual reading (measurement data) collected for a characteristic.

The examples given below illustrate the control limits calculated for chart point 0.9350 (Sample ID: 51, ValueNumber:4).

Use Tables (sigma est = 0)	
Formula	Example
CL = Mean (xCapBar)	CL = 0.95267
LCL = CL – (3 * Estimated Standard Deviation)	LCL = 0.95267 – (3 * 0.02247) = 0.88526
UCL = CL + (3 * Estimated Standard Deviation)	UCL = 0.95267 + (3*0.02247) = 1.02008
	For this example data, the estimated standard deviation is 0.02247.

**Use Std. Dev. (sigma est = 1)**

Formula	Example
CL = Mean (xCapBar)	CL = 0.95267
LCL = CL - (3 * Standard Deviation)	LCL = 0.95267 - (3 * 0.02025) = 0.89192
UCL = CL + (3 * Standard Deviation)	UCL = 0.95267 + (3 * 0.02025) = 1.01342
	For this example data, the standard deviation is 0.02025.

The following tables show examples of control limits and sigma limits for the first three chart points and the last chart point using all the data.

Label	Chart Point	Use Tables (sigma est = 0)				
LCL	CL	UCL	Lower σ	Upper σ		
1	0.9100	0.885250	0.952667	1.020083	0.022472	0.022472
2	0.9550	0.885250	0.952667	1.020083	0.022472	0.022472
3	0.9800	0.885250	0.952667	1.020083	0.022472	0.022472
...						
15	0.9350	0.885250	0.952667	1.020083	0.022472	0.022472

Label	Chart Point	Use Std. Dev. (sigma est = 1)				
LCL	CL	UCL	Lower σ	Upper σ		
1	0.9100	0.891904	0.952667	1.013430	0.020254	0.020254
2	0.9550	0.891904	0.952667	1.013430	0.020254	0.020254
3	0.9800	0.891904	0.952667	1.013430	0.020254	0.020254
...						
15	0.9350	0.891904	0.952667	1.013430	0.020254	0.020254

## Moving Range (ix + mr)

The CL, LCL, and UCL are calculated based on the sigma setting for a characteristic. In a moving range chart, the range is always between 2 measurements, hence the  $d_2$  factor is always 2. The tables below contain formulas to calculate the CL, LCL, and UCL for a chart point. A chart point is the absolute difference between an individual reading (measurement data) and the individual reading collected prior to this reading for a characteristic.

The example given below illustrates the control limits calculated for chart point 0.015.

<b>Use Tables (sigma est = 0)</b>	
<b>Formula</b>	<b>Example</b>
$CL = \text{Estimated Standard Deviation} * d_2[2]$	$CL = 0.02247 * 1.12838 = 0.02535$
$LCL = CL - (3 * (\text{Estimated Standard Deviation} * d_3[2]))$	The estimated standard deviation calculated from the data is 0.02247 and is the $d_2$ factor value for a sample size of 2 is 1.12838.
$UCL = CL + (3 * (\text{Estimated Standard Deviation} * d_3[2]))$ if LCL < 0 then 0; otherwise LCL	$LCL = 0.02538 - (3 * (0.02248 * 0.85250)) = -0.03212$ Since LCL is less than 0, LCL = 0 $UCL = 0.02538 + (3 * (0.02247 * 0.85250)) = 0.08283$ The $d_3$ factor value for a sample size of 2 is 0.85250.

<b>Use Std. Dev. (sigma est = 1)</b>	
<b>Formula</b>	<b>Example</b>
$CL = \text{Standard Deviation} * d_2[2]$	$CL = 0.02025 * 1.12838 = 0.02285$
$LCL = CL - (3 * (\text{Standard Deviation} * d_3[2]))$	The standard deviation calculated from the data is 0.02025 and the $d_2$ factor value for a sample size of 2 is 1.12838.
$UCL = CL + (3 * (\text{Standard Deviation} * d_3[2]))$ if LCL < 0 then 0; otherwise LCL	$LCL = 0.02285 - (3 * (0.02025 * 0.85250)) = -0.02895$ Since LCL is less than 0, LCL = 0 $UCL = 0.02285 + (3 * (0.02025 * 0.85250)) = 0.07466$ The $d_3$ factor value for a sample size of 2 is 0.85250.

The following tables show examples of control limits and sigma limits for the first three chart points and the last chart point using all the data.

<b>Label</b>	<b>Chart Point</b>	<b>Use Tables (sigma est = 0)</b>				
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower <math>\sigma</math></b>	<b>Upper <math>\sigma</math></b>		
1	-	-	-	-	-	-
2	0.045	0	0.025357	0.082830	0.008452	0.019158
3	0.025	0	0.025357	0.082830	0.008452	0.019158
...						
15	0.015	0	0.025357	0.082830	0.008452	0.019158

Label      Chart Point      Use Std. Dev. (sigma est = 1)						
LCL	CL	UCL	Lower σ	Upper σ		
1	-	-	-	-	-	-
2	0.045	0	0.022855	0.074655	0.007618	0.017267
3	0.025	0	0.022855	0.074655	0.007618	0.017267
...						
15	0.015	0	0.022855	0.074655	0.007618	0.017267

## Moving Range (ma + range)

The CL, LCL, and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the formulas used to calculate the CL, LCL, and UCL for a chart point.

The examples given below illustrate the control limits calculated for chart point 0.0375.

Use Tables (sigma est = 0)	
Formula	Example
CL = Estimated Standard Deviation * $d_2$ [Moving Average Span]	CL = 0.02216 * 1.69257 = 0.03751
LCL = CL - (3 * (Estimated Standard Deviation * $d_3$ [Moving Average Span]))	The estimated standard deviation calculated from the data is 0.02216 and the $d_2$ factor value for a sample size of 3 is 1.69257.
UCL = CL + (3 * (Estimated Standard Deviation * $d_3$ [Moving Average Span]))	LCL = 0.03751 - (3 * (0.02216 * 0.88837)) = -0.02155 Since LCL is less than 0, LCL = 0
if LCL < 0 then 0; otherwise LCL	UCL = 0.03751 + (3 * (0.02216 * 0.88837)) = 0.09655 The $d_3$ factor value for a sample size of 3 is 0.88837.

**Use Std. Dev. (sigma est = 1)**

Formula	Example
CL = Given Standard Deviation * $d_2$ [Moving Average Span]	CL = 0.02025 * 1.69257 = 0.03428
LCL = CL – (3 * (Standard Deviation * $d_3$ [Moving Average Span]))	The standard deviation calculated from the data is 0.020254 and the $d_2$ factor value for a sample size of 3 is 1.69257.
UCL = CL + (3 * (Standard Deviation * $d_3$ [Moving Average Span]))	LCL = 0.03428 – (3 * (0.02025 * 0.88837)) = -0.01970 Since LCL is less than 0, LCL = 0
if LCL < 0 then 0; otherwise LCL	UCL = 0.03428 + (3 * (0.02025 * 0.88837)) = 0.08826 The $d_3$ factor value for a sample size of 3 is 0.88837.

The following tables show examples of control limits and sigma limits for the first 3 chart points and the last chart point using all the data.

Label	Chart Point	Use Tables (sigma est = 0)				
LCL	CL	UCL	Lower σ	Upper σ		
1	0.07	0	0.037500	0.096547	0.0125	0.019682
2	0.04	0	0.037500	0.096547	0.0125	0.019682
3	0.04	0	0.037500	0.096547	0.0125	0.019682
...						
13	0.0375	0	0.037500	0.096547	0.0125	0.019682

Label	Chart Point	Use Std. Dev. (sigma est = 1)				
LCL	CL	UCL	Lower σ	Upper σ		
1	0.07	0	0.034282	0.088262	0.011427	0.017993
2	0.04	0	0.034282	0.088262	0.011427	0.017993
3	0.04	0	0.034282	0.088262	0.011427	0.017993
...						
13	0.0375	0	0.034282	0.088262	0.011427	0.017993

## XBar (xbar + range)

The LCL and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the

formulas to used calculate the CL, LCL, and UCL for a chart point. A chart point is the xCapBar (xbar) value from each sample.

The examples given below illustrate the control limits calculated for chart point 0.94938.

<b>Use Tables (sigma est = 0)</b>	
<b>Formula</b>	<b>Example</b>
CL = Mean (xCapBar) LCL = CL – (3 * ASTD) UCL = CL + (3 * ASTD)  The adjusted standard deviation from the estimated standard deviation is ASTD.	ControlRuleVioXbarRangeEq2  The estimated standard deviation is 0.02205 and the sample size obtained from the last sample is 4.  CL = 0.95267 LCL = 0.95267 – (3 * 0.01102) = 0.91960 UCL = 0.95267 + (3 * 0.01102) = 0.98574
<b>Use Std. Dev. (sigma est = 1)</b>	
<b>Formula</b>	<b>Example</b>
ControlRuleVioXbarRangeEq3  CL = Mean (xCapBar) LCL = CL – (3 * ASTD) UCL = CL + (3 * ASTD)  The adjusted standard deviation from the calculated standard deviation is ASTD.	ControlRuleVioXbarRangeEq4  The standard deviation calculated from the data is 0.02025 and the sample size obtained from the last sample is 4.  CL = 0.95267 LCL = 0.95267 – (3 * 0.01013) = 0.92229 UCL = 0.95267 + (3 * 0.01013) = 0.98305

The following tables show examples of control limits and sigma limits for all the chart points using all the data.

<b>Label</b>	<b>Chart Point</b>	<b>Use Tables (sigma est = 0)</b>				
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower σ</b>	<b>Upper σ</b>		
1	0.949	0.923087	0.952667	0.982247	0.009860	0.009860
2	0.954167	0.914479	0.952667	0.990854	0.012729	0.012729
3	0.961667	0.914479	0.952667	0.990854	0.012729	0.012729
4	0.949375	0.919595	0.952667	0.985738	0.011024	0.011024

<b>Label</b>	<b>Chart Point</b>	<b>Use Std. Dev. (sigma est = 1)</b>				
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower σ</b>	<b>Upper σ</b>		
1	0.949	0.925493	0.952667	0.979841	0.009058	0.009058

Label	Chart Point	Use Std. Dev. (sigma est = 1)					
2	0.954167	0.917585	0.952667	0.987748	0.011694	0.011694	
3	0.961667	0.917585	0.952667	0.987748	0.011694	0.011694	
4	0.949375	0.922285	0.952667	0.983048	0.010127	0.010127	

## XBar (xbar + sigma)

The LCL and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the formulas used to calculate CL, LCL, and UCL for a chart point. A chart point is the xCapBar (xbar) value from each sample.

The examples given below illustrate the control limits calculated for chart point 0.94938.

Use Tables (sigma est = 0)	
Formula	Example
CL = Mean (xCapBar) LCL = CL – (3 * ASTD) UCL = CL + (3 * ASTD)  The adjusted standard deviation from the estimated standard deviation is ASTD.	The estimated standard deviation is 0.02100 and the sample size obtained from the last sample is 4.  CL = 0.95267 LCL = 0.95267 – (3 * 0.01050) = 0.92117 UCL = 0.95267 + (3 * 0.01050) = 0.98416
Use Std. Dev. (sigma est = 1)	
Formula	Example
ControlRuleVioXbarRangeEq3  CL = Mean (xCapBar) LCL = CL – (3 * ASTD) UCL = CL + (3 * ASTD)  The adjusted standard deviation from the calculated standard deviation is ASTD.	ControlRuleVioXbarRangeEq4  The standard deviation calculated from the data is 0.02025 and the sample size obtained from the last sample is 4.  CL = 0.95267 LCL = 0.95267 – (3 * 0.01013) = 0.92229 UCL = 0.95267 + (3 * 0.01013) = 0.98305

The following tables show examples of control limits and sigma limits for all the chart points using all the data.

<b>Use Tables (sigma est = 0)</b>						
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower <math>\sigma</math></b>	<b>Upper <math>\sigma</math></b>		
1	0.949	0.924495	0.952667	0.980838	0.009391	0.009390
2	0.954167	0.916297	0.952667	0.989036	0.012123	0.012123
3	0.961667	0.916297	0.952667	0.989036	0.012123	0.012123
4	0.949375	0.921170	0.952667	0.984163	0.010499	0.010499

<b>Use Std. Dev. (sigma est = 1)</b>				
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower <math>\sigma</math></b>	<b>Upper <math>\sigma</math></b>
1	0.949	0.925493	0.952667	0.979841
2	0.954167	0.917585	0.952667	0.987748
3	0.961667	0.917585	0.952667	0.987748
4	0.949375	0.922285	0.952667	0.983048

## Range

The CL, LCL, and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the formulas used to calculate CL, LCL, and UCL for a chart point.

The examples given below illustrate the control limits calculated for chart point 0.0375.

<b>Use Tables (sigma est = 0)</b>	
<b>Formula</b>	<b>Example</b>
$CL = \text{Estimated Standard Deviation} * d_2 [\text{Sample Size}]$	$CL = 0.02205 * 2.05875 = 0.045391$
$LCL = CL - (3 * (\text{Estimated Standard Deviation} * d_3 [\text{Sample Size}]))$	The estimated standard deviation calculated from the data is 0.02205 and the $d_3$ factor value for a sample size of 4 is 2.05875.
$UCL = CL + (3 * (\text{Estimated Standard Deviation} * d_3 [\text{Sample Size}]))$	$LCL = 0.04539 - (3 * 0.02205 * 0.87981)) = -0.01280$
if $LCL < 0$ then 0; otherwise $LCL$	Since LCL is less than 0, $LCL = 0$
	$UCL = 0.04539 + (3 * (0.02205 * 0.87981)) = 0.10358$
	The $d_3$ factor value for a sample size of 4 is 0.87981.

<b>Use Std. Dev. (sigma est = 1)</b>	
<b>Formula</b>	<b>Example</b>
$CL = \text{Standard Deviation} * d_2 [\text{Sample Size}]$	$CL = 0.02025 * 2.05875 = 0.04170$
$LCL = CL - (3 * (\text{Standard Deviation} * d_3 [\text{Sample Size}]))$	The standard deviation calculated from the data is 0.02025 and the $d_2$ factor value for a sample size of 4 is 2.05875.
$UCL = CL + (3 * (\text{Standard Deviation} * d_3 [\text{Sample Size}]))$	
if $LCL < 0$ then 0; otherwise $LCL$	$LCL = 0.04170 - (3 * (0.02025 * 0.87981)) = -0.01176$ Since $LCL$ is less than 0, $LCL = 0$ $UCL = 0.04170 + (3 * (0.02025 * 0.87981)) = 0.09516$ The $d_3$ factor value for a sample size of 4 is 0.87981.

The following tables show examples of control limits and sigma limits for all the chart points using all the data.

<b>Label</b>	<b>Chart Point</b>	<b>Use Tables (sigma est = 0)</b>				
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower <math>\sigma</math></b>	<b>Upper <math>\sigma</math></b>		
1	0.07	0	0.051281	0.108434	0.017094	0.019051
2	0.06	0	0.037317	0.096076	0.012439	0.019586
3	0.0075	0	0.037317	0.096076	0.012439	0.019586
4	0.0375	0	0.045391	0.103584	0.015130	0.016895

<b>Label</b>	<b>Chart Point</b>	<b>Use Std. Dev. (sigma est = 1)</b>				
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower <math>\sigma</math></b>	<b>Upper <math>\sigma</math></b>		
1	0.07	0	0.047110	0.099614	0.015703	0.017501
2	0.06	0	0.034282	0.088262	0.011427	0.017993
3	0.0075	0	0.034282	0.088262	0.011427	0.017993
4	0.0375	0	0.041699	0.095158	0.013900	0.017820

## Sigma

The CL, LCL, and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the formulas used to calculate CL, LCL, and UCL for a chart point.

The examples given below illustrate the control limits calculated for the chart point 0.01663.

**Use Tables (sigma est = 0)**

<b>Formula</b>	<b>Example</b>
Sample Size = Size of a sample	$CL = 0.02100 * 0.92132 = 0.01935$
$CL = \text{Estimated Standard Deviation} * C_4 [\text{Sample Size}]$	The estimated standard deviation calculated from the data is 0.02100 and the $C_4$ factor value for a sample size of 4, obtained from the last sample is 0.92132.
$LCL = CL - (3 * \text{Estimated Standard Deviation} * ControlRuleVioSigmaEq1)$	$LCL = 0.01935 - (3 * 0.02100 * ControlRuleVioSigmaEq1) = -0.00515$
$UCL = CL + (3 * \text{Estimated Standard Deviation} * ControlRuleVioSigmaEq1)$	Since LCL is less than 0, LCL = 0
if $LCL < 0$ then 0; otherwise LCL	$UCL = 0.01935 + (3 * 0.02100 * ControlRuleVioSigmaEq1) = 0.04384$

**Use Std. Dev. (sigma est = 1)**

<b>Formula</b>	<b>Example</b>
Sample Size = Size of a sample	$CL = 0.02025 * 0.92132 = 0.01866$
$CL = \text{Standard Deviation} * C_4 [\text{Sample Size}]$	The standard deviation calculated from the data is 0.02025 and the $C_4$ factor value for a sample size of 4, which is obtained from the last sample is 0.92132.
$LCL = CL - (3 * \text{Standard Deviation} * ControlRuleVioSigmaEq1)$	$LCL = (0.01866) - (3 * 0.02025 * ControlRuleVioSigmaEq1) = -0.00496$
$UCL = CL + (3 * \text{Standard Deviation} * ControlRuleVioSigmaEq1)$	Since LCL is less than 0, LCL = 0
if $LCL < 0$ then 0; otherwise LCL	$UCL = (0.01866) + (3 * 0.02025 * ControlRuleVioSigmaEq1) = 0.04229$

The following tables show examples of control limits and sigma limits for all the chart points using all the data.

<b>Label</b>	<b>Chart Point</b>	<b>Use Tables (sigma est = 0)</b>				
		<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower <math>\sigma</math></b>	<b>Upper <math>\sigma</math></b>
1	0.026077	0	0.019738	0.041232	0.006579	0.007165
2	0.030035	0	0.018609	0.047790	0.006203	0.009727
3	0.003819	0	0.018609	0.047790	0.006203	0.009727
4	0.016630	0	0.019346	0.043838	0.006449	0.008164

Label	Chart Point	Use Std. Dev. (sigma est = 1)				
LCL	CL	UCL	Lower σ	Upper σ		
1	0.026077	0	0.019039	0.039772	0.026077	0.052154
2	0.030035	0	0.017950	0.046098	0.030035	0.06007
3	0.003819	0	0.017950	0.046098	0.003819	0.007638
4	0.016630	0	0.018661	0.042286	0.016630	0.03326

## Moving Average (ma + range)

The LCL and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the formulas used to calculate CL, LCL, and UCL for a chart point.

The example columns in the tables below illustrate the control limits calculated for the chart point 0.9525.

Use Tables (sigma est = 0)	
Formula	Example
$CL = maCapBar$ $LCL = CL - (3 * ASTD)$ $UCL = CL + (3 * ASTD)$ The adjusted standard deviation from the estimated standard deviation is ASTD.	$ControlRuleVioMASigmaEq2$ The estimated standard deviation calculated from the data is 0.02216 and the moving average span configured for a characteristic is 3. $CL = 0.95577$ , where 0.95577 is the moving average bar calculated from the data. $LCL = 0.95577 - (3 * 0.01279) = 0.91739$ $UCL = 0.95577 + (3 * 0.01279) = 0.99414$

Use Std. Dev. (sigma est = 1)	
Formula	Example
$ControlRuleVioMASigmaEq3$ $CL = Mean \times CapBar$ $LCL = CL - (3 * ASTD)$ $UCL = CL + (3 * ASTD)$ The adjusted standard deviation from the calculated standard deviation is ASTD.	$ControlRuleVioMASigmaEq4$ The standard deviation calculated from the data is 0.02025 and the moving average span configured for a characteristic is 3. $CL = 0.95267$ $LCL = 0.95267 - (3 * 0.01169) = 0.91759$ $UCL = 0.95267 + (3 * 0.01169) = 0.98775$

The following tables show examples of control limits and sigma limits for the first three chart points and the last chart point using all the data.

Label	Chart Point	Use Tables (sigma est = 0)			
LCL	CL	UCL	Lower σ	Upper σ	
1	0.948333	0.917394	0.955769	0.994144	0.012792
2	0.958333	0.917394	0.955769	0.994144	0.012792
3	0.96	0.917394	0.955769	0.994144	0.012792
...					
13	0.9525	0.917394	0.955769	0.994144	0.012792

Label	Chart Point	Use Std. Dev. (sigma est = 1)			
LCL	CL	UCL	Lower σ	Upper σ	
1	0.948333	0.917585	0.952667	0.987748	0.011694
2	0.958333	0.917585	0.952667	0.987748	0.011694
3	0.96	0.917585	0.952667	0.987748	0.011694
...					
13	0.9525	0.917585	0.952667	0.987748	0.011694

## Moving Average (ma + sigma)

The LCL and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the formulas used to calculate CL, LCL, and UCL for a chart point.

The example given below illustrates the control limits calculated for the chart point 0.9525.

Use Tables (sigma est = 0)	
Formula	Example
$CL = maCapBar$ $LCL = CL - (3 * ASTD)$ $UCL = CL + (3 * ASTD)$ The adjusted standard deviation from the estimated standard deviation is ASTD.	<code>ControlRuleVioMASigmaEq2</code> The estimated standard deviation calculated from the data is 0.02162 and the moving average span configured for a characteristic is 3. $CL = 0.95577$ , where 0.95577 is the moving average bar calculated from the data. $LCL = 0.95577 - (3 * 0.01248) = 0.91833$ $UCL = 0.95577 + (3 * 0.01248) = 0.993212$

**Use Std. Dev. (sigma est = 1)**

Formula	Example
ControlRuleVioMASigmaEq3 CL = Mean xCapBar LCL = CL - (3 * ASTD) UCL = CL + (3 * ASTD) The adjusted standard deviation from the calculated standard deviation is ASTD.	ControlRuleVioMASigmaEq4 The standard deviation calculated from the data is 0.02025 and the moving average span configured for a characteristic is 3. CL = 0.95267 LCL = 0.95267 - (3 * 0.01169) = 0.91759 UCL = 0.95267 + (3 * 0.01169) = 0.98775

The following tables show examples of control limits and sigma limits for the first three chart points and the last chart point using all the data.

Label	Chart Point	Use Tables (sigma est = 0)				
LCL	CL	UCL	Lower σ	Upper σ		
1	0.948333	0.918326	0.955769	0.993211	0.012481	0.012481
2	0.958333	0.918326	0.955769	0.993211	0.012481	0.012481
3	0.96	0.918326	0.955769	0.993211	0.012481	0.012481
...						
13	0.9525	0.918326	0.955769	0.993211	0.012481	0.012481

Label	Chart Point	Use Std. Dev. (sigma est = 1)				
LCL	CL	UCL	Lower σ	Upper σ		
1	0.948333	0.917585	0.952667	0.987748	0.011694	0.011694
2	0.958333	0.917585	0.952667	0.987748	0.011694	0.011694
3	0.96	0.917585	0.952667	0.987748	0.011694	0.011694
...						
13	0.9525	0.917585	0.952667	0.987748	0.011694	0.011694

## Moving Sigma (ma + ms)

The CL, LCL, and UCL are calculated based on the sigma setting for a characteristic. The tables below contain the formulas used to calculate CL, LCL, and UCL for a chart point.

The examples given below illustrate the control limits calculated for the chart point 0.01887.

<b>Use Tables (sigma est = 0)</b>	
<b>Formula</b>	<b>Example</b>
CL = Estimated Standard Deviation * C4 [Moving Average Span]	CL = 0.02162 * 0.88623 = 0.01916
LCL = CL – (3 * Estimated Standard Deviation * ControlRuleVioMAMSEq1)	The estimated standard deviation calculated from the data is 0.02162 and the C4 factor value for the moving average span of 3, which is configured for this characteristic is 0.88623.
UCL = CL + (3 * Estimated Standard Deviation * ControlRuleVioMAMSEq1)	LCL = (0.01916) – 3 * (0.02162 * ControlRuleVioMAMSEq2 = -0.01089
if LCL < 0 then 0; otherwise LCL	Since LCL is less than 0, LCL = 0
	UCL = (0.01916) + 3 * (0.02162 * ControlRuleVioMAMSEq2 = 0.04920

<b>Use Std. Dev. (sigma est = 1)</b>	
<b>Formula</b>	<b>Example</b>
L = Standard Deviation * [Moving Average Span]	CL = 0.02025 * 0.88623 = 0.01795
LCL = CL – (3 * Standard Deviation * ControlRuleVioMAMSEq1)	The standard deviation calculated from the data is 0.02025 and the C4 factor value for the moving average span of 3, which is configured for the characteristic is 0.88623.
UCL = CL + (3 * Standard Deviation * ControlRuleVioMAMSEq1)	LCL = (0.01795) – 3 * (0.02025 * ControlRuleVioMAMSEq2 = -0.01020
if LCL < 0 then 0; otherwise LCL	Since LCL is less than 0, LCL = 0
	UCL = (0.01795) + 3 * (0.02025 * ControlRuleVioMAMSEq2 = 0.04070

The following tables show examples of control limits and sigma limits for all the chart points using all the data.

<b>Label</b>	<b>Chart Point</b>	<b>Use Tables (sigma est = 0)</b>				
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower σ</b>	<b>Upper σ</b>		
13	018875	0	0.019158	0.049201	0.006386	0.010014
<b>Label</b>						
<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower σ</b>	<b>Upper σ</b>		
13	018875	0	0.017949	0.040698	0.005983	0.009383

## Calculating CL, LCL and UCL for Counted Type Characteristics

Result data (measurement) is captured for each sample and its deviation from specification limits (if any).

The following table shows the result data (measurement) captured for each sample and its deviation from specification limits (if any).

Sample ID	Sample Time	Spec Name	Characteristic Name	Value No.	Value	Actual Sample Size	Is the Value Out of Spec Limits	Fraction Defective
6	11:15a	SpecD	No. of Dents	1	3	15	False	0.2
8	11:30a	SpecD	No. of Dents	1	10	15	True	0.66667
9	11:45a	SpecD	No. of Dents	1	6	15	False	0.4
10	12:00p	SpecD	No. of Dents	1	2	15	True	0.13333
12	12:15p	SpecD	No. of Dents	1	9	15	True	0.6
13	12:30p	SpecD	No. of Dents	1	5	15	False	0.33333

The following examples illustrate control limits calculated for a sample size.

## c Chart

The following table contains the formulas used to calculate LCL and UCL for a chart point.

The example in this table illustrates the control limits calculated for a sample size of 15.

Formula	Example
Mean = $\bar{u}$	Mean = $\bar{u} = 0.55224$
$CL = \bar{u} * n$	$CL = 0.55224 * 15 = 8.28358$
$LCL = \bar{u} - (3 * ControlRuleVioCChartEq1)$	$LCL = 8.28358 - (3 * ) = -0.35078$
$UCL = \bar{u} + (3 * ControlRuleVioCChartEq1)$	$LCL = 0$
where $n$ is the actual sample size from the sample.	$UCL = 8.28358 + (3 * ) = 16.91795$
If $LCL < 0$ , then $LCL = 0$ ; otherwise $LCL$	

The following table shows example control limits calculated for each chart point.

Label	Chart Point (Count)	Size	LCL	CL	UCL	Lower σ	Upper σ
1	3	15	0	8.283582	16.91795	2.761194	2.878123
2	8	9	0	4.970149	11.65830	1.656716	2.229384
3	10	15	0	8.283582	16.91795	2.761194	2.878123
4	6	15	0	8.283582	16.91795	2.761194	2.878123
5	2	15	0	8.283582	16.91795	2.761194	2.878123
6	11	20	1.074672	11.04478	21.01488	3.323369	3.323367
7	9	15	0	8.283582	16.91795	2.761194	2.878123
8	5	15	0	8.283582	16.91795	2.761194	2.878123
9	20	15	0	8.283582	16.91795	2.761194	2.878123

## u Chart

The following table contains the formulas used to calculate LCL and UCL for a chart point.

The example in the table illustrates the control limits calculated for a sample size of 15.

Formula	Example
$CL = u\bar{X}$	$u\bar{X} = 0.55224$
$LCL = u\bar{X} - (3 * ControlRuleVioUChartEq1)$	$CL = 0.55224$
$UCL = u\bar{X} + (3 * ControlRuleVioUChartEq1)$ where $n$ is the actual sample size from the sample.	$LCL = 0.45378 - (3 * ControlRuleVioUChartEq2) = -0.02339$
If $LCL < 0$ , then $LCL = 0$ ; otherwise $LCL$	$LCL = 0$
	$UCL = 0.55224 + (3 * ControlRuleVioUChartEq2) = 1.12786$

The following table shows example control limits calculated for each chart point.

Label	Chart Point (Defects Per Unit)	Count	Size	LCL	CL	UCL	Lower σ	Upper σ
1	0.2	3	15	0	0.552239	1.127863	0.184080	0.191875
2	0.888889	8	9	0	0.552239	1.295367	0.184080	0.247709

<b>Label</b>	<b>Chart Point (Defects Per Unit)</b>		<b>Size</b>	<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower σ</b>	<b>Upper σ</b>
	<b>Count</b>	<b>Per Unit</b>						
3	0.666667	10	15	0	0.552239	1.127863	0.184080	0.191875
4	0.4	6	15	0	0.552239	1.127863	0.184080	0.191875
5	0.133333	2	15	0	0.552239	1.127863	0.184080	0.191875
6	0.55	11	20	0.053734	0.552239	1.050744	0.184080	0.166168
7	0.6	9	15	0	0.552239	1.127863	0.184080	0.191875
8	0.333333	5	15	0	0.552239	1.127863	0.184080	0.191875
9	1.333333	20	15	0	0.552239	1.127863	0.184080	0.191875

## DPMO Chart

The following table contains the formulas used to calculate CL, LCL, and UCL for a chart point.

The example in the table illustrates the control limits calculated for a sample size of 15.

<b>Formula</b>	<b>Example</b>
$CL = uBar * (1000000 / num\_defect\_opp)$	$CL = 0.55224 * (1000000 / 1) = 552238.80597$
$LCL = uBar - (3 * ControlRuleVioUChartEq1) * (1000000 / num\_defect\_opp)$	$LCL = (0.45378 - (3 * ControlRuleVioUChartEq2)) * (1000000 / 1) = -0.02339 * 1000000 = -23385.44958$
$UCL = uBar + (3 * ControlRuleVioUChartEq1) * (1000000 / num\_defect\_opp)$	$LCL = 0$
where $n$ is the actual sample size from the sample, and $num\_defect\_opp$ is the number of defect opportunities configured for the characteristic.	$UCL = (0.55224 + (3 * ControlRuleVioUChartEq2)) * (1000000 / 1) = 1.12786 * 1000000 = 1127863.06152$
If $LCL < 0$ , then $LCL = 0$ ; otherwise $LCL$	

The following table shows example control limits calculated for each chart point.

<b>Label</b>	<b>Chart Point (Defects Per Million Opportunities)</b>		<b>Size</b>	<b>LCL</b>	<b>CL</b>	<b>UCL</b>	<b>Lower σ</b>	<b>Upper σ</b>
	<b>Count</b>	<b>Per Million Opportunities</b>						
1	200000	3	15	0	552238.8	1127863.0	184079.6	191874.75

Chart Point (Defects Per Million Opportunities)								
Label	Count	Size	LCL	CL	UCL	Lower σ	Upper σ	
						6		
2	888888.9	8	9	0	552238.8	1295366.5	184079.6	247709.24
3	666666.7	10	15	0	552238.8	1127863.0	184079.6	191874.75
4	400000	6	15	0	552238.8	1127863.0	184079.6	191874.75
5	133333.3	2	15	0	552238.8	1127863.0	184079.6	191874.75
6	550000	11	20	53733.58	552238.8	1050744.0	184079.6	166168.41
7	600000	9	15	0	552238.8	1127863.0	184079.6	191874.75
8	333333.3	5	15	0	552238.8	1127863.0	184079.6	191874.75
9	1333333.3	20	15	0	552238.8	1127863.0	184079.6	191874.75

#### Calculating CL, LCL and UCL for Binary Type Characteristics

Result data (measurement) is captured for each sample and its deviation from specification limits (if any). The following table contains the captured result data.

Sample ID	Sample Time	Spec Name	Characteristic Name	Value No.	Value	Actual Sample Size	Is the Value Out of Spec Limits	Fraction Defective
6	11:15a	Speck	Scratched	1	2	15	False	0.13333
8	11.30a	Speck	Scratched	1	3	15	False	0.2
9	11.45a	Speck	Scratched	1	1	15	False	0.06667

Sample ID	Sample Time	Spec Name	Characteristic Name	Value No.	Value	Actual Sample Size	Is the Value Out of Spec Limits	Fraction Defective
12	12:15p	SpecK	Scratched	1	1	15	False	0.06667
13	12:30p	SpecK	Scratched	1	3	15	False	0.2

## p Chart

The following table contains the formulas used to calculate LCL and UCL for a chart point.

The example in the table illustrates the control limits calculated for a sample size of 15.

Formula	Example
$CL = p\bar{Bar}$	$p\bar{Bar} = 0.17647$
$LCL = p\bar{Bar} - (3 * ControlRuleVioPChartEq1)$	$CL = 0.17647$
$UCL = p\bar{Bar} + (3 * ControlRuleVioPChartEq1)$	$LCL = 0.17647 - (3 * )$
where $n$ is the actual sample size from the sample.	$= -0.11882$
If $LCL < 0$ , then $LCL = 0$ ; otherwise $LCL$ .	$LCL = 0$
If $UCL > 1$ , then $UCL = 1$ ; otherwise $UCL$ .	$UCL = 0.17647 (+ 3 * )$ $= 0.47176$

The following table shows example control limits calculated for each chart point.

Label	Chart Point (Fraction Defective)	Count	Size	LCL	CL	UCL	Lower σ	Upper σ
1	0.13333	2	15	0	0.176471	0.471762	0.058824	0.098430
2	0.11111	1	9	0	0.176471	0.557691	0.058824	0.127073
3	0.2	3	15	0	0.176471	0.471762	0.058824	0.098430
4	0.06667	1	15	0	0.176471	0.471762	0.058824	0.098430
5	0.26667	4	15	0	0.176471	0.471762	0.058824	0.098430
6	0.3	6	20	0	0.176471	0.432201	0.058824	0.085243
7	0.06667	1	15	0	0.176471	0.471762	0.058824	0.098430
8	0.2	3	15	0	0.176471	0.471762	0.058824	0.098430

# np Chart

The following table contains the formulas used to calculate LCL and UCL for a chart point.

The example in the table illustrates the control limits calculated for a sample size of 15.

Formula	Example
$CL = p\bar{Bar} * n$	$p\bar{Bar} = 0.17647$
$LCL = CL - (3 * ControlRuleVioNPChartEq1)$	$CL = 0.17647 * 15 = 2.64706$
$UCL = CL + (3 * ControlRuleVioNPChartEq1)$ where $n$ is the actual sample size from the sample.	$LCL = 2.64706 - (3 * ControlRuleVioNPChartEq2)$ $= -1.78232$
If $LCL < 0$ , then $LCL = 0$ ; otherwise $LCL$	$LCL = 0$ $UCL = 2.64706 + (3 * ControlRuleVioNPChartEq2)$ $= 7.07644$

The following table shows example control limits calculated for each chart point.

Label	Chart Point (Count)	Size	LCL	CL	UCL	Lower $\sigma$	Upper $\sigma$
1	2	15	0	2.647059	7.076435	0.882353	1.47645867
2	1	9	0	1.588235	5.019215	0.5294117	1.14366
3	3	15	0	2.647059	7.076435	0.882353	1.47645867
4	1	15	0	2.647059	7.076435	0.882353	1.47645867
5	4	15	0	2.647059	7.076435	0.882353	1.47645867
6	6	20	0	3.529412	8.6440153	1.176470	1.70486785
7	1	15	0	2.647059	7.076435	0.882353	1.47645867
8	3	15	0	2.647059	7.076435	0.882353	1.47645867

## Computing from Standard Values

When the `cl_source` for a characteristic or for a QM specification that overrides the characteristic is configured to use the given standard mean and standard deviation (`cl_source = 1`), the given standard mean (`std_avg`) and the standard deviation (`std_deviation`) are used to calculate the control limits to validate the measurements recorded for a characteristic.

If the standard mean (`std_avg`) or the standard deviation (`std_deviation`) for a characteristic is not given, the mean or the standard deviation (estimate or population) is calculated from the data. The standard deviation is calculated based on the following:

- The sigma estimate (sigma\_est) configured for a characteristic.
- The default chart type linked to the characteristic.

If the standard deviation is given, it is adjusted based on the chart type.

The mean and standard deviation are only used to calculate control limits for a characteristic. These values are not used for calculating statistical values such as Cp and CpK. The target value configured for a specification, that is associated with the characteristic is used as the standard average in the following conditions:

- The given standard average (std\_avg) contains a non null value.
- The std\_avg\_is\_target is set to True for the characteristic.

The following table describes how the given standard deviation, CL, LCL and UCL are adjusted based on the chart type. The examples given below have the following:

- Standard mean set to 0.6 for variable-type characteristics
- Standard deviation set to 0.8 for variable-type characteristics
- Standard proportion set to 0.6 for binary-type characteristics
- Standard defects per unit set to 10 for counted-type characteristics

The examples in the table below are only applicable to the final chart point that can be plotted in a chart for a characteristic. The control limits for the other chart points can be calculated using the formula for a chart type.

Chart Type	Formula	Comments	Example
ix	$CL = \text{Given Standard Mean}$ $LCL = CL - (3 * \text{Given Std. Dev.})$ $UCL = CL + (3 * \text{Given Std. Dev.})$	Since individual data is considered for this chart type, the sample size is always 1.	$CL = 0.6$ The given standard mean is 0.6, and the given standard deviation is 0.8. $LCL = 0.6 - (3 * 0.8) = -1.80$ $UCL = 0.6 + (3 * 0.8) = 3.00$
mr (ix + mr)	$CL = \text{Given Std. Dev.} * d_2 [2]$ $LCL = CL - (3 * (\text{Given Std. Dev.} * d_3 [2]))$ $UCL = CL + (3 * (\text{Given Std. Dev.} * d_3 [2]))$ if $LCL < 0$ , then 0; otherwise $LCL$ .	Since this is a moving range chart, the range is always between 2 measurements, hence the $d_2$ factor is always for sample_size=2.	$CL = 0.8 * 1.12838 = 0.90270$ The given standard deviation is 0.8 and the $d_2$ factor value for a sample size of 2 is 1.12838. $LCL = 0.90270 - (3 * (0.8 * 0.85250)) = -1.14330$ Since LCL is less than 0, $LCL = 0$ $UCL = 0.90270 + (3 * (0.8 * 0.85250)) = 2.94871$ The $d_3$ factor value for a

Chart Type	Formula	Comments	Example
			sample size of 2 is 0.85250.
mr (ma + range)	$CL = \text{Given Std. Dev.} * d_2 [\text{Moving Average Span}]$ $LCL = CL - (3 * (\text{Given Std. Dev.} * d_3 [\text{Moving Average Span}]))$ $UCL = CL + (3 * (\text{Given Std. Dev.} * d_3 [\text{Moving Average Span}]))$ if $LCL < 0$ , then 0; otherwise LCL.	The moving average span configured for a characteristic is used to adjust the given standard deviation for calculating the control limits.	$CL = 0.8 * 1.69257 = 1.35406$ The given standard deviation is 0.8 and the $d_2$ factor value for a sample size of 3 is 1.69257. $LCL = 1.35406 - (3 * (0.8 * 0.88837)) = -0.77803$ Since LCL is less than 0, $LCL = 0$ $UCL = 1.35406 + (3 * (0.8 * 0.88837)) = 3.48614$ The $d_3$ factor value for a sample size of 3 is 0.88837.
xbar	$CL = \text{Given Standard Mean}$ $ASTD = \text{ComputeStdValuesXbar}$ $LCL = \text{Mean} - (3 * ASTD)$ $UCL = \text{Mean} + (3 * ASTD)$ where ASTD is the adjusted standard deviation from the given standard deviation.	The sample size from a sample is used to adjust the given standard deviation for calculating the control limits (center line).	$ASTD = \text{ComputeStdValuesXbarEq} 2 = 0.4$ The given standard deviation is 0.8 and the sample size obtained from this sample is 4. $CL = 0.6 (\text{Mean})$ $LCL = 0.6 - (3 * 0.4) = -0.600$ $UCL = 0.6 + (3 * 0.4) = 1.800$

Chart Type	Formula	Comments	Example
range	$CL = \text{Given Std. Dev.} * d_2 [\text{Sample Size}]$ $LCL = CL - (3 * (\text{Given Std. Dev.} * d_3 [\text{Sample Size}]))$ $UCL = CL + (3 * (\text{Given Std. Dev.} * d_3 [\text{Sample Size}]))$ <p>if <math>LCL &lt; 0</math>, then 0; otherwise <math>LCL</math>.</p>	<p>The sample size from a sample is used to adjust the given standard deviation for calculating the control limits (center line).</p>	$CL = 0.8 * 2.05875$ $CL = 1.64700$ <p>The given standard deviation is 0.8 and the <math>d_2</math> factor value for a sample size of 4 is 2.05875.</p> $LCL = 1.64700 - (3 * (0.8 * 0.87981)) = -0.46454$ <p>Since <math>LCL</math> is less than 0, <math>LCL = 0</math></p> $UCL = 1.64700 + (3 * (0.8 * 0.87981)) = 3.75854$ <p>The <math>d_3</math> factor value for a sample size of 4 is 0.87981.</p>
sigma (xbar + sigma)	$\text{Sample Size} = \text{Sample Size of a sample}$ $CL = \text{Given Std. Dev.} * C_4 [\text{Sample Size}]$ $LCL = CL - (3 * (\text{Given Std. Dev.} * \text{ComputeStdValuesSigmaX barSignma}))$ $UCL = CL + (3 * (\text{Given Std. Dev.} * \text{ComputeStdValuesSigmaX barSignma}))$ <p>if <math>LCL &lt; 0</math>, then 0; otherwise <math>LCL</math>.</p>	<p>The sample size from a sample is used when adjusting the center line, LCL and UCL.</p>	$CL = 0.8 * 0.92132 = 0.73705$ <p>The given standard deviation is 0.8 and the <math>C_4</math> factor value for a sample size of 4, obtained from this sample is 0.92132.</p> $LCL = 0.73705 - (3 * (0.8 * \text{ControlRuleVioSigmaEq2})) = -0.19609$ <p>Since <math>LCL</math> is less than 0, <math>LCL = 0</math></p> $UCL = 0.73705 + (3 * (0.8 * \text{ControlRuleVioSigmaEq2})) = 1.67020$

Chart Type	Formula	Comments	Example
ma	$CL = \text{Given Standard Mean}$ $ASTD = \text{ComputeStdValuesMA}$ $LCL = \text{Mean} - (3 * ASTD)$ $UCL = \text{Mean} + (3 * ASTD)$ The adjusted standard deviation from the given standard deviation is ASTD.	The moving average span configured for a characteristic is used to adjust the given standard deviation for calculating the control limits (center line).	$ASTD = \text{ComputeStdValuesMAEq2} = 0.46188$ The given standard deviation is 0.8 and the moving average span configured for a characteristic is 3. $CL = 0.6 \text{ (Mean)}$ $LCL = 0.6 - (3 * 0.46188) = -0.78564$ $UCL = 0.6 + (3 * 0.46188) = 1.98564$
sigma (ma + ms)	$CL = \text{Given Std. Dev.} * C_4 [\text{Moving Average Span}]$ $LCL = CL - (3 * (\text{Given Std. Dev.} * ))$ $UCL = CL + (3 * (\text{Given Std. Dev.} * ))$ if $LCL < 0$ , then 0; otherwise LCL.	The $C_4$ value is based on the moving average span configured for a characteristic.	$CL = 0.8 * 0.88623 = 0.70898$ The given standard deviation is 0.8 and the $C_4$ factor value for a moving average span of 3 configured for this characteristic is 0.88623. $LCL = 0.70898 - (3 * (0.8 * \text{ComputeStdValuesMAMS Eq2})) = -0.40282$ Since LCL is less than 0, $LCL = 0$ $UCL = 0.70898 + (3 * (0.8 * \text{ComputeStdValuesMAMS Eq2})) = 1.82077$
p	$CL = \text{Std. Mean (Given)}$ $LCL = CL - (3 * )$ $UCL = CL + (3 * )$ where $n$ is the actual sample size from a sample, and Std. Mean (Given) is the given mean value. If $LCL < 0$ then $LCL = 0$ ;	The given mean value is used as a center line for all the chart points. However, the LCL and UCL are calculated for each chart point.	Sample Size: 15 $CL = 0.6 \text{ (Mean/proportion)}$ where 0.6 is the given mean value. $LCL = 0.6 - (3 * \text{ComputeStdValuesPEq1}) = 0.22053$ $UCL = 0.6 + (3 * \text{ComputeStdValuesPEq1}) = 0.97947$

Chart Type	Formula	Comments	Example
	<p>otherwise LCL.</p> <p>If UCL &gt; 1 then UCL = 1; otherwise UCL.</p>		
np	$CL = \text{Std. Mean (Given)} * n$ $LCL = CL - (3 * \sigma)$ $UCL = CL + (3 * \sigma)$ <p>where <math>n</math> is the actual sample size from the sample, and Std. Mean (Given) is the given mean value.</p> <p>If <math>LCL &lt; 0</math> then <math>LCL = 0</math>; otherwise LCL.</p>	<p>The CL, LCL and UCL are calculated for each chart point.</p>	<p>Sample Size: 15  <math>CL = 0.6 * 15 = 9.0</math>  <math>CL = 9.0</math>  <math>LCL = 9.0 - (3 * \sigma) = 3.30790</math>  <math>UCL = 9.0 + (3 * \sigma) = 14.692099788303082</math>  <math>UCL = 14.69210</math></p>
c	$CL = \text{Given Avg. No. of Defects per Unit} * n$ $LCL = CL - (3 * \sigma)$ $UCL = CL + (3 * \sigma)$ <p>where <math>n</math> is the actual sample size from the sample, and <i>GivenAvgNoOfDefects</i> is the given average number of defects per unit (<i>std_avg</i>) for this characteristic.</p> <p>If <math>LCL &lt; 0</math>, then <math>LCL = 0</math>; otherwise LCL.</p>	<p>The CL, LCL and UCL are calculated for each chart point.</p>	<p>Sample Size: 15  <math>CL = 10 * 15 = 150</math>  <math>CL = 150</math>  <math>LCL = 150 - (3 * \sigma) = 113.25765</math>  <math>UCL = 150 + (3 * \sigma) = 186.74235</math></p>

Chart Type	Formula	Comments	Example
u	$CL = \text{Given Avg. No. of Defects per Unit}$ $LCL = CL - (3 * \text{ComputeStdValuesUEq1})$ $UCL = CL + (3 * \text{ComputeStdValuesUEq1})$ <p>where <math>n</math> is the actual sample size from the sample and <math>GivenAvgNoOfDefects</math> is the given average number of defects per unit (<math>std\_avg</math>) for this characteristic.</p> <p>If <math>LCL &lt; 0</math>, then <math>LCL = 0</math>; otherwise <math>LCL</math>.</p>	The LCL and UCL are calculated for each chart point.	Sample Size: 15 $CL = 10.0$ $LCL = 10 - (3 * \text{ComputeStdValuesUEq2})$ $= 7.55051$ $UCL = 10 + (3 * \text{ComputeStdValuesUEq2})$ $= 12.44949$
DPMO	$\text{ComputeStdValuesDPMO Eq1}$ $\text{ComputeStdValuesDPMO Eq2a}$ $\text{ComputeStdValuesDPMO Eq2b}$ $\text{ComputeStdValuesDPMO Eq3a}$ $\text{ComputeStdValuesDPMO Eq2b}$ <p>where <math>n</math> is the actual sample size from the sample, <math>AvgNoDPU</math> is the given average number of defects per unit for this characteristic (<math>std\_avg</math>), and <math>NoDefectsOpps</math> is the number of defects opportunities (<math>num\_defects\_opp</math>) configured for this characteristic.</p> <p>If <math>LCL &lt; 0</math>, then <math>LCL = 0</math>; otherwise <math>LCL</math>.</p>	The LCL and UCL are calculated for each chart point.	Sample Size: 15 $\text{ComputeStdValuesDPMO Eq4}$ $\text{ComputeStdValuesDPMO Eq5}$ $\text{ComputeStdValuesDPMO Eq5b}$ $\text{ComputeStdValuesDPMO Eq6}$ $\text{ComputeStdValuesDPMO Eq6b}$

## Using Preset Values

When the cl\_source for a characteristic or for a QM specification that overrides the characteristic is configured (cl\_source = 2) to use preset values, the standard mean and the standard deviation are calculated using the cl\_\*, lcl\_\* and ucl\_\* configured for a characteristic or for a QM specification, and are used to validate the measurements against the control rules configured for a characteristic.

If no preset control limits are given (that is, CL, LCL, UCL is null), the average of data points from the last n samples is considered as the center line, the standard deviation is calculated using the data from the last n samples. If the control limit is only given for one side, that is, either LCL or UCL, the control rule violations are evaluated against that one-sided limit.

The preset limits cannot be configured for the characteristics whose default chart type is set to DPMO. Hence, the control limits and sigma (lower and upper) are calculated from all the data points using the configuration from u-chart.

Chart Element	Std. Dev (Lower) (cl* and lcl* contains a non-null value)	Std. Dev (Upper) (cl* and ucl* contains a non-null value)
ix	cl_ix - lcl_ix / 3	ucl_ix - cl_ix / 3
imr	cl_imr - lcl_imr / 3	ucl_imr - cl_imr / 3
mr	cl_mr - lcl_mr / 3	ucl_mr - cl_mr / 3
xbar	cl_xbar - lcl_xbar / 3	ucl_xbar - cl_xbar / 3
range	cl_range - lcl_range / 3	ucl_range - cl_range / 3
sigma	cl_sigma - lcl_sigma / 3	ucl_sigma - cl_sigma / 3
ma	cl_ma - lcl_ma / 3	ucl_ma - cl_ma / 3
ms	cl_ms - lcl_ms / 3	ucl_ms - cl_ms / 3
p	cl_p - lcl_p / 3	ucl_p - cl_p / 3
np	cl_np - lcl_np / 3	ucl_np - cl_np / 3
c	cl_c - lcl_c / 3	ucl_c - cl_c / 3
u	cl_u - lcl_u / 3	ucl_u - cl_u / 3
DPMO	cl_u - lcl_u / 3 * ComputeStdValuesDPMOEq2b	ucl_u - cl_u / 3 * ComputeStdValuesDPMOEq2b

## SRO Error Codes

The error codes that might occur while working with the SRO objects are described in the following table. The error codes are stored in the ErrorCode attribute.

If a command generates a warning message, the ErrorCode attribute value remains 0 and the ErrorMessage attribute shows the warning text.

Error Code	Description
500	The command input source quality is not good.
0	No error.
-1	An unknown error. The error message contains the detailed information.
-100	The connection to the MES middleware was lost.
-101	An error occurred while starting the MES client session.
-102	An error occurred while closing the MES client session.
-103	The MES database is not available.
-121	The entity name specified by an object container does not exist.
-122	An error occurred while recording characteristic result data.
-123	An error occurred while recording sample data.
-124	An error occurred while reading recent samples.
-125	An error occurred while reading data related to characteristic output attributes.
-126	An error occurred while recording sample characteristic data of a characteristic.
-127	An error occurred while executing the Finalize command.
-128	An error occurred while executing the Generate Sample command.

## Utilization Capability Object

Use the Utilization Capability Object (UCO) to enable the System Platform MES entity object to monitor machine performance.

Utilization events are logged by the UCO for the entity based on external I/O values and calculated values. The UCO can query the MES database for updates on the current shift OEE, performance, quality, and utilization percentages.

## Getting Started with the UCO

The UCO (Utilization Capability Object) is a System Platform automation object that provides machine performance monitoring. The UCO is contained by another System Platform object that is considered an MES entity. Utilization events are logged by the UCO for the entity through potentially complex conditions based on external I/O values and calculated values. The UCO also queries the MES database for updates on the current shift OEE, performance, quality, and utilization percentages.

Information configured in the UCO is used to create and configure entities in the MES database using the Entity Model Builder, a System Platform IDE extension.

The UCO has the following areas that can be configured:

- Raw reason codes and other utilization attributes
- Target percentages for OEE (Overall Equipment Effectiveness) and its components: performance, quality, and utilization
- Job production attributes

Once the UCO is deployed, users will be able to perform the following tasks for MES entities associated with the UCO:

- Log utilization events
- Track the entity's OEE and OEE components
- Run jobs based on the production attributes that were configured for the entity

### The UCO, the System Platform Equipment Model, and MES Entities

The UCO adds MES capabilities to the equipment-oriented application objects in your System Platform IDE equipment model. By adding a UCO instance below another application object instance in your equipment model, you are able to map and configure the System Platform IDE equipment model to the MES entity model.

Exporting the configured UCO instance into MES using the Entity Model Builder will create entities that are represented in your equipment model. These entities will be capable of capturing utilization and tracking OEE. These entities can also have their job production attributes configured in the UCO.

Exporting UCOs to the MES database also provides an automated alternative to manually creating and configuring the entities in MES Web Portal or MES Client.

## Importing the UCO Package into the System Platform IDE

You can import the UCO package into the System Platform IDE or upgrade it to the latest version.

### System Requirements

- All MES application objects—OCO, SRO, and UCO—must be at the same version; otherwise, incompatibility errors will occur.
- The Entity Model Builder must be installed. This can be installed during an MES installation with the Client applications.

- To utilize certain features of the UCO, such as Entity Model Builder, you need to be able to access the MES database through the MES middleware. If the MES middleware is not installed on the same node where you are using the UCO, you must have the middleware proxy installed on the client machine to establish a connection with the middleware.

UCO features that require the middleware or middleware proxy are:

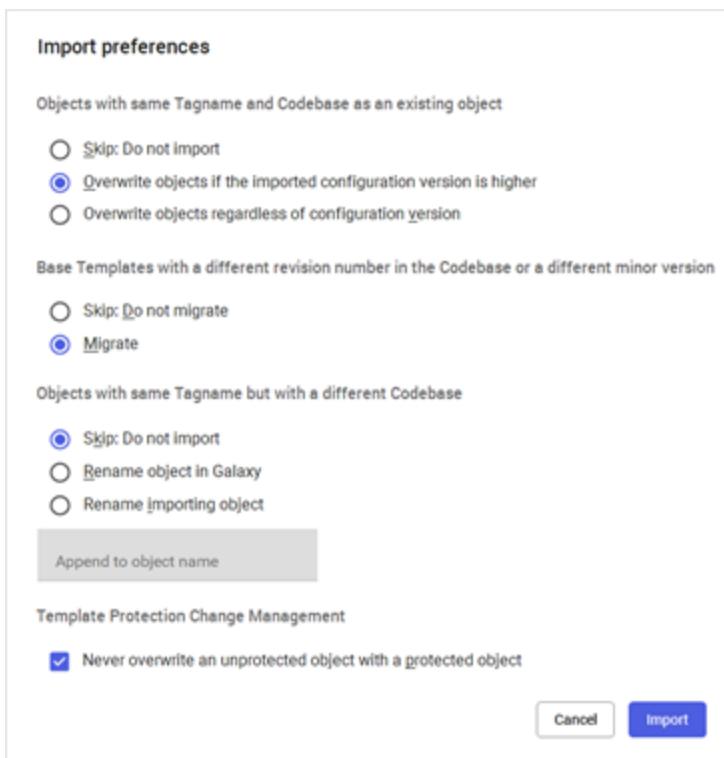
- Setting default utilization reasons
- Selecting allowable utilization reasons
- Validating utilization reasons

For information on setting up or installing the middleware proxy, see the *MES Installation Guide* or online help.

## Importing the UCO Package

Installation of the UCO requires a separate import operation in System Platform IDE after you have completed the MES installation.

1. On the System Platform IDE **Galaxy** menu, click **Import** and then click **Object(s)**.  
The Import Automation Object(s) dialog box appears.
2. Browse for the UCO file (**UtilizationCapability.aaPKG**) located either on your hard drive or on your MES installation disc.
  - If you used the default folder destination during the MES installation, the object file is stored in the **C:\ProgramFiles (x86)\Wonderware\MES\AppObjects** directory.
  - The UCO Object file can also be found on the installation disc in the **\MES\AppObjects** directory.
3. Select the file and click **Open**.  
The Import Preferences dialog box appears.



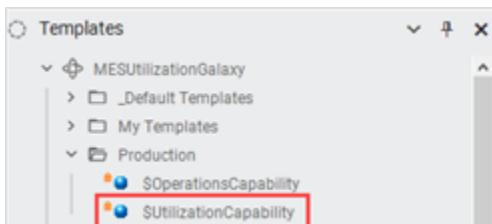
#### 4. Select the appropriate import settings.

The UCO is considered a base template. Select whether to migrate (the default) or skip the installation if an existing UCO base template is in the galaxy.

#### 5. Click **OK**.

The import process starts.

If the import process completes successfully, the \$UtilizationCapability base template object is available under the Production template toolset.



## Upgrading the UCO from Previous Versions

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**Note:** If you are upgrading MES application objects to the current version of MES, the version you are upgrading from must be MES 2012 (version 4.5) or later. If your version of MES is at a version prior to version 4.5, you must first upgrade it to version 4.5.

When MES is updated from a previous version, you must import the new UCO into the System Platform IDE. Each version of the UCO is compatible only with the MES version with which the UCO was shipped.

#### 1. Undeploy any System Platform galaxies that have UCO instances before installing the new version of MES.

This ensures that the System Platform IDE is disconnected from the MES database and any MES components.

2. After installing the new version of MES, import the new version of the UCO into all the galaxies containing an old version of the UCO with the **Migrate** option selected so that all existing templates and instances will be updated.
3. Before deploying the objects, make sure that all MES application objects—OCO, SRO, and UCO—are at the same version and that their existing templates and instances have been migrated. Otherwise, incompatibility errors will occur.

### UCO No Longer Includes Production Counters

With MES version 5.2, the UCO production counters are no longer a part of the UCO configuration. MES Performance customers are licensed to use the counters available in the Operations Capability Object (OCO) and should use those. Refer to the *Operations Capability Object User Guide* for details on how to configure the OCO production counters. Note that OCO production counters contain additional configuration options that were not available with the UCO production counters.

### Assistance with Migrating the UCO Production Counters to OCOs

During the migration of an older UCO that contains production counters to a newer UCO that does not contain production counters, two files are created for each galaxy for which the UCO migration is performed:

- A CSV file—**CountersBackup.csv**—that includes entries for each production counter and its settings. If a UCO does not have any production counters, then there will not be an entry in the CSV file for the UCO. If no UCOs have production counters, then no file will be created.
- An XML file—**UCODerivationHierarchy.xml**—that includes the template-instance hierarchy for the UCOs in the equipment model, regardless of whether they have production counters.

These files are stored in the following folder on the local machine:

%ProgramData%\WonderwareMES\<galaxy\_name>\UCOMigrationCountersBackup

The information in these files can be used to assist in the recreation of the production counters in the OCO.

During the counter information backup, an informational message is logged by the first object/template that creates the backup folder and files. If file I/O errors occur during the backup, warning messages are logged and the backup information is instead provided in the Operations Control Management Console Log Viewer.

---

**Note:** If you restore the UCOs to a version prior to 5.2 and then want to upgrade again, you must first remove the CSV and XML files in the **UCOMigrationCountersBackup** folder. Otherwise, the backup information will not be properly created during the subsequent migration.

---

## CSV File Structure

The CSV file includes an entry for the four properties of each counter that was found. The entry structure is:

Type, ObjectName, Counter, Property, Value, Lock

These parameters are described below.

### Type

Indicates whether the object is an Instance or a Template.

### ObjectName

The System Platform Object name.

#### Counter

The name of the UCO production counter.

#### Property

Each production counter has the following properties: SetItemID, AddProdQtyCntr.Deadband, AddProdQtyCntr.MaxValue, and AddProdQtyCntr.UpdateInterval.

#### Value

The configured value of the counter property.

#### Lock

Indicates whether the property is locked. Possible values are LockedInMe, LockedInParent, or UnLocked.

An example CSV file is shown below.

```
Type, ObjectName, Counter, Property, Value, Lock
Instance, Bundler_UCO, Counter1, SetItemId, 2, UnLocked
Instance, Bundler_UCO, Counter1, AddProdQtyCntr.Deadband, 2.0, UnLocked
Instance, Bundler_UCO, Counter1, AddProdQtyCntr.MaxValue, 5.0, UnLocked
Instance, Bundler_UCO, Counter1, AddProdQtyCntr.UpdateInterval, 00:00:06.0000000, UnLocked
Template, $cpUtilizationCapability, Counter1, SetItemId, 0, UnLocked
Template, $cpUtilizationCapability, Counter1, AddProdQtyCntr.Deadband, 1.0, LockedInMe
Template, $cpUtilizationCapability, Counter1, AddProdQtyCntr.MaxValue, 2.0, LockedInMe
Template, $cpUtilizationCapability, Counter1, AddProdQtyCntr.UpdateInterval, 00:00:03.0000000,
UnLocked
```

## XML Template/Instance Hierarchy File Structure

The general structure of the XML file is:

```
<?xml version="1.0" encoding="UTF-8"?>
<DerivationTree>
    <Template Name="uco_base_template_name_1">
        <Template Name="uco_derived_template_name_1">
            <Instance Name="uco_instance_name_1" />
            <Instance Name="uco_instance_name_2" />
        </Template>
    </Template>
    <Template Name="uco_base_template_name_2">
        <Template Name="uco_derived_template_name_2" />
        <Template Name="uco_derived_template_name_3">
            <Instance Name="uco_instance_name_3" />
            <Instance Name="uco_instance_name_4" />
        </Template>
    </Template>
</DerivationTree>
```

## If Errors Occur During the XML File Creation

If any errors occur during the XML file creation (for example, the backup folder cannot be accessed or a file creation failure occurred), the template/instance derivation hierarchy is split into smaller portions and

information messages are entered in the Logger. Sample messages are shown below.

1945	12/7/2015	6:11:05 PM	2852	7992	Info	UtilizationCapabili... Exporting UCO derivation hierarchy structure to the file C:\ProgramData\WonderwareMES\UCOMigrat...
1946	12/7/2015	6:11:05 PM	2852	7992	Error	UtilizationCapabili... (UtilizationCapabilityConfigure ExportDerivationHierarchy) Error occurred while writing the UCO deriv...
1947	12/7/2015	6:11:05 PM	2852	7992	Info	UtilizationCapabili... <DerivationTree> <Template Name="\"UCO_D7002\"> <Template Name="\"UCO_D7003\"> <Te...
1948	12/7/2015	6:11:05 PM	2852	7992	Info	UtilizationCapabili... 005 005 005 @ 002.UCO_D7009> <Template Name="\"UCO_D7009\">
1949	12/7/2015	6:11:07 PM	2852	7992	Info	UtilizationCapabili... Exporting UCO derivation hierarchy structure to the file C:\ProgramData\WonderwareMES\UCOMigrat...

The XML content from the information messages must be concatenated to recreate the entire derivation hierarchy structure. This concatenation should be performed using the XML content from the messages logged by the first template-instance. If the XML content is taken from messages related to other templates or instances, the derivation structure might include temporary templates or instances created by the migration process.

### Fixing References to UCO Production Counter Attributes

When upgrading UCOs from versions prior to MES version 5.2, any references to the UCO production counter attributes such as script references will need to be modified after the UCO has been upgraded and the counters have been recreated in a corresponding OCO.

## Configuring UCO Templates and Instances

The UCO is managed like other System Platform application objects. The UCO supports creating derived templates and instances as needed for placement into your System Platform IDE equipment model.

For more information on managing System Platform objects, see the System Platform IDE help.

### UCOs, the System Platform Equipment Model, and MES Entity Hierarchy

In the System Platform IDE Model View, you can add a UCO below any application object or system area object that you want to create in MES as an entity with utilization, OEE, or job production capabilities.

When you place the UCO object as a child to an application or area object in the System Platform equipment model and then run the Entity Model Builder, an entity is created in the MES database for the UCO's parent object. Additional parent entities are created in the MES database as needed to replicate that object's branch of the equipment model in MES.

**Note:** You can add the UCO as a child under application and area objects only. If you add the UCO as a child under any other object such as an engine, the UCO does not work properly. An application or area object can contain only one UCO object as a child.

### UCO Configuration

When configuring UCO templates and instances, you define raw reason codes and general utilization attributes, OEE performance target attributes, and job production attributes for objects that will be entities in the MES database.

When you open a UCO template or instance for editing in the System Platform IDE Object Editor, the following tabs include the UCO-specific object attributes:

#### General tab

Utilization raw reason codes and general utilization attributes. For a description of these attributes, see [Configuring Utilization Attributes](#).

#### Entity Configuration tab

OEE attributes, such as target OEE percentages and the default production rate and unit of measure. For a description of these attributes, see [Configuring OEE Attributes](#).

### Production Attributes tab

Production attributes for configuring work orders, items, production quantities, and target production rates for jobs running on the entity. For a description of these attributes, see [Configuring Job Production Attributes and Commands](#).

## UCO Attribute Inheritance and Planning the Templates and Instances

A recommended strategy for creating the UCO templates and instances is to first identify the generic raw reason codes that are common to all of the MES entities in the model and define these in a top-level template. Then you can create child templates for categories or classes of MES entities that share subsets of raw reason codes. This approach makes it easier to add or make changes to raw reason codes, as these changes will ripple down to all child UCOs and their corresponding MES entities.

For example, you might have raw reason codes that apply to an area of a plant or to a class of machines. So you could create a sub-template that includes those area or class-specific raw reason codes and from which specific UCO instances of that area or class would be created.

Note that, in the UCO templates, you can also define and lock any utilization, OEE, or production attributes that are generic to areas or classes of equipment.

Once the UCO templates configured with raw reason codes are created, you can create instances of them and assign the UCO instances to the appropriate MES entity application objects. For each UCO instance, you can then define the attributes that are specific to individual entities (these attributes will be those that are unlocked in the instance's parent templates).

## Specifying an Attribute and Command Value or Input Source

You can either enter a value for a production attribute or command, or specify an input source.

### To enter a value

1. Clear the attribute or command's **Use Input Source** check box.
2. Enter or select the value to be used in the **Value or Input Source** column.



### To specify an input source

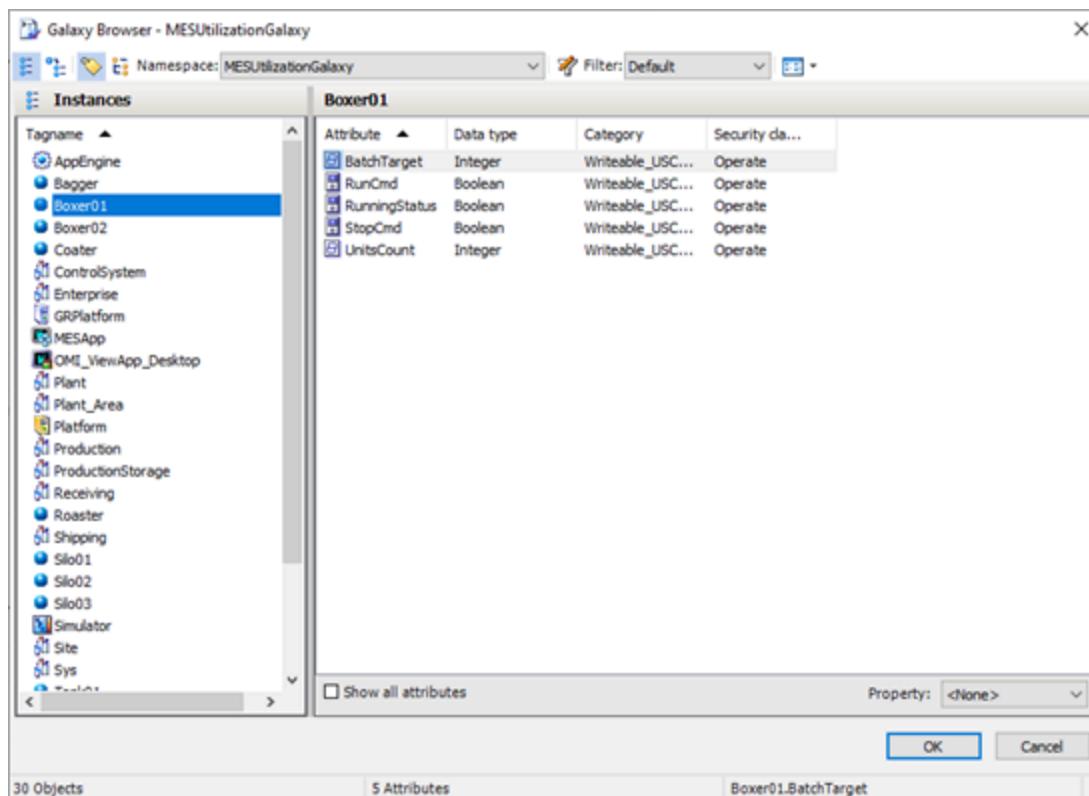
1. Select the attribute or command's **Use Input Source** check box.

The control in the **Value or Input Source** column becomes a box with the default input source, `MyContainer.<AttributeOrCommand>`, automatically entered.



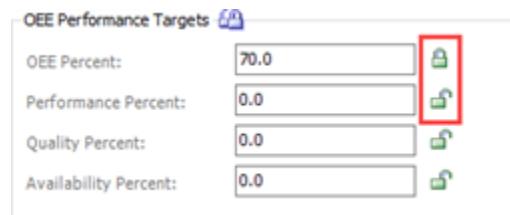
2. To change the default entry, do one of the following:

- Manually edit the input source entry.
- Click the attribute's Browse button. In the **Galaxy Browser** dialog box that appears, select the object and its attribute that is the input source.



## Locking UCO Attributes

As you configure the UCO templates, you can lock and unlock specific attribute settings by clicking the attribute's Lock icon. These locked attributes can only be updated by modifying the original template and redeploying it.



You can choose not to lock some of your template attributes so you can configure specific attribute settings for child instances of the template that are assigned to objects in your equipment model.

For more detailed information on attribute locks, see the System Platform IDE help.

## Setting Attribute Security

Many of the UCO attributes include a security classification setting, as indicated by the icon. You can set the security classification setting of these UCO attributes during configuration.

### To set attribute security

- Right-click on the security icon and select the appropriate security option.



For detailed information on managing attribute security, see the System Platform IDE help.

### Considerations Regarding Inherited Raw Reason Codes

When planning your UCO templates and instances, it is important to understand raw reason code inheritance.

Raw reason code definitions are inherently locked at the level at which they are created. Therefore, when an UCO instance (child) inherits another object's raw reason code list and allowable reasons, you cannot alter the existing parents' raw reason code list or allowable reasons by editing the child UCO instance. However, you can add new raw reason codes to the child instance that are interleaved between the parent raw reason codes. You can also add new allowable reasons.

Changing a parent UCO's raw reason codes or allowable reasons will invalidate all derived object instances. You will have to run the Entity Model Builder and redeploy the object to cascade the changed raw reason codes list to its derived object instances.

### MES Utilization Reasons and UCOs

It is important to understand the relationship of MES utilization reasons and your UCO configurations that use them.

When configuring a raw reason code in a UCO template or instance, the default utilization reason and allowable utilization reasons that you assign to it come directly from the global set of utilization reasons defined in the MES database. Therefore, the best practice is to first define utilization reason groups and reasons within the MES database before configuring raw reason codes in the UCOs.

If this global set of utilization reasons are added, deleted, or changed in any way, your UCO configurations that use them might be affected.

The Entity Model Builder will only write the utilization reasons configured for a UCO's raw reason codes that exist in the global set to the MES entity that is being created or modified.

Also, each UCO must have a default raw reason code that the Entity Model Builder will pass into the MES database, whose assigned default utilization reason will become the default unknown utilization reason for the entity. If the default utilization reason mapped to the default raw reason code of the UCO does not exist in the global set of possible utilization reasons, an error is logged and the UCO is marked as invalid.

### Without Response Mode and UCO Calls

The UCO uses Without Response mode and Microsoft Message Queuing (MSMQ) to record all utilization events so that calls can be processed without requiring that the UCO wait for the status of the message deliveries. Only the logging of utilization events uses Without Response mode and MSMQ. All other commands, such as starting and ending jobs, use With Response mode.

To allow a UCO to log messages in the Message Queue, an Anonymous Logon user with the Send Message privilege must be added to the MESASyncQueue on the middleware server. Otherwise, the messages will not be logged. See [Adding an Anonymous Logon User to MESASyncQueue](#).

### Adding an Anonymous Logon User to MESASyncQueue

To allow MES application objects to log messages in the Microsoft Message Queue (MSMQ) while in Without Response mode, an Anonymous Logon user with the Send Message privilege must be added to the MESASyncQueue on the MES middleware node. Otherwise, the messages will not be logged.

Beginning with MES version 5.3, the Anonymous User login is automatically added to the MESASyncQueue with the Send Message privilege when the DB/MW Communication component is configured using the post-install Configurator. However, if the Anonymous User login is removed from the MESASyncQueue, you can use the following procedure to add it again.

#### To add an Anonymous Logon user to MESASyncQueue

1. In Windows Explorer on the database server node, right-click **This PC** and click **Manage**.  
The Server Manager window appears.
2. In the navigator pane, expand **Features, Message Queuing**, and then **Private Queues**.  
The mesasyncqueue entry appears.
3. Right-click the mesasyncqueue entry and click **Properties**.  
The mesasyncqueue Properties dialog box appears.
4. Go to the **Security** tab.
5. Click the **Add** button.  
The Select Users, Computers, Service Accounts, or Groups dialog box appears.
6. In the **Enter the object names to select** box, enter ANONYMOUS LOGON and click **OK**.  
The Anonymous Logon user is added to the **Group or user names** list.
7. Select the Anonymous Logon user and then in the **Permissions** list select only the **Send Message** check box.
8. Click **OK** to save your changes.

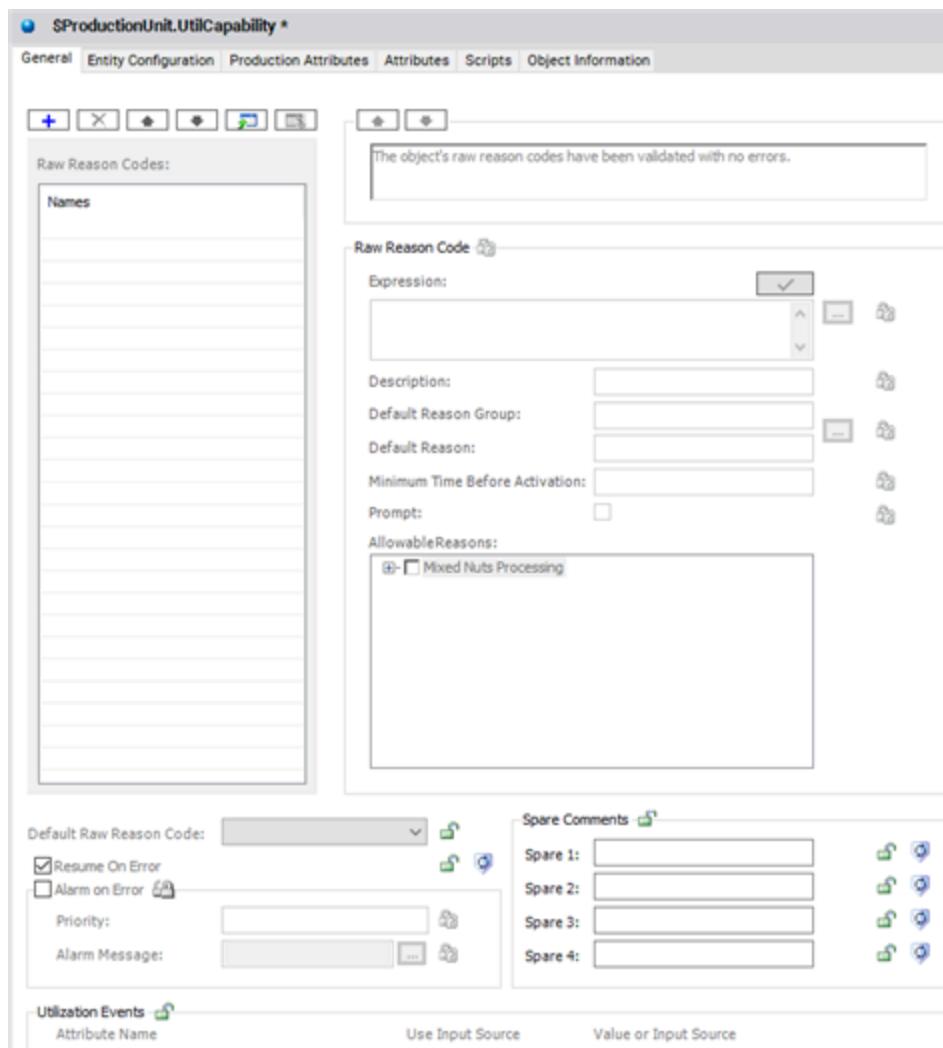
## Configuring Utilization Attributes

The utilization attributes are on the **General** tab in the UCO Object Editor.

The **General** tab includes two areas:

- The raw reason code list; see [Configuring Raw Reason Codes](#)
- General utilization attributes; see [Configuring General Utilization Attributes](#)

Before configuring utilization attributes, you might find it helpful to review the topic [OEE](#) for background information on how utilization is determined in MES.



## Utilization Concepts

An entity's utilization is tracked when an associated Utilization Capability Object (UCO) or production operator enters events, such as when the entity is running a job or when the entity is down for repairs or maintenance.

At all times, an entity will have a reason assigned to it. The reason can be assigned by an operator manually or determined directly from a UCO by input/output (I/O) automatically. The reason will assign a utilization state. Based on the configuration of the utilization state, the event as classified by the reason will contribute to either the Performance or Availability component of OEE, or the time will be excluded from the OEE calculation entirely.

It is important to understand that "event" does not refer to an isolated occurrence of something at the entity. All utilization events for an entity form a contiguous series from the time the entity was configured as being capable of capturing utilization to the present. In other words, one sort of event or another is always occurring at the entity.

An operator adds an event by selecting a utilization reason for the entity. The utilization reason specifies:

- The state of the entity
- A reason for that state

Operators might have to make adjustments to events that have already been entered so that they represent actual entity activity. These adjustments include:

- Reclassifying an event by selecting a different utilization reason
- Splitting an event into two events
- Merging two adjacent events
- Modifying an event's start or end time
- Modifying the comment entered about an event

The UCO's role is to determine the correct current state of the entity and to log state changes through events in real time. The UCO has no mechanism for making adjustments to events that have already been entered. Any necessary adjustments can be made through the MES Utilization .NET control, the MES Web Portal, or the MES API.

## Utilization States

To support utilization tracking, entities are considered to be in utilization states, such as Running, Idle, Down, or Maintenance. It is the utilization state that determines if the event duration is classified as Performance, Utilization, or Neither.

During system configuration, utilization states are assigned to utilization reasons. Therefore, an entity's state is defined when a utilization reason is assigned to an entity's event.

## Utilization Reasons

Utilization reasons describe the current condition of an entity and associate each reason with a utilization state. A reason group is a category of reasons. For example, the reason Bottle Jam can belong to the reason group Bottle Descrambler Down, and results in a Downtime utilization state. On the production floor, a reason can be selected by a PLC, an input/output (I/O) connection to a device, or an operator.

The utilization reasons that operators can assign to events during production are created during system configuration.

## Utilization Reason Groups

To help production operators navigate a large list of utilization reasons, reasons can be assigned to utilization reason groups during system configuration.

In the MES applications or application objects, the reason groups are displayed as expandable nodes in the reason list.

It is helpful to understand the difference between utilization states and utilization reason groups. While both terms represent an aggregation of utilization reasons, states are sets of reasons that imply something about the physical situation of the entity, with respect to the way it is operating or not operating. Utilization reason groups are strictly a navigational aid for lists of utilization reasons in the user interface.

## Raw Reason Codes

Machine utilization raw reason codes can be sent directly from an entity to MES via a UCO. Depending on how

the raw reason code is configured in the UCO or in MES Client, it will create a new utilization event in the MES database, using the utilization reason to which the raw reason code was mapped.

One and only one raw reason code can be active at a time. If more than one raw reason code expression evaluates to True simultaneously, the active raw reason code is the one with the highest priority. The priority is determined by their order in the raw reason code list and the Minimum Time Before Activation setting in the UCO instance.

If a raw reason code that is not configured for the entity is received, the Unknown Reason utilization reason, which is configurable for each entity or UCO instance, is used.

## Utilization Events

A utilization event indicates the current operational state of the entity. An entity is always considered to be in a utilization event. The events that are typically of interest are those that indicate that the entity is down or when it is idle when it should be running.

If so configured, the system can set an entity's event automatically based on changes in the operational state of the entity.

Production operators can also manually change the event that an entity is in when the condition or state of the entity changes. When changing to a new event, the operator assigns a utilization reason to the new event. The reason specifies the entity's utilization state and the reason for that state. For example, the utilization reasons Running - Normal Speed, Running - High Speed, and Running - Low Speed all indicate a utilization state of Running. However, each reason indicates a running speed.

## Configuring Raw Reason Codes

The following topics explain how to configure and manage raw reason codes.

### Adding a Raw Reason Code

To configure utilization events, you must add one or more raw reason codes in the **Raw Reason Code** list on the **General** tab. You must also select a default raw reason code; see [Configuring General Utilization Attributes](#). These two conditions must be met to successfully include the object instance in an Entity Model Builder build.

When defining raw reason codes, it is important to understand that codes higher in the list take precedence over codes lower in the list. The UCO processes the codes in order and records the first code whose expression evaluates to True. In general, this means you should add more specific codes higher in the list and more generic codes lower in the list. Another good practice is to have the last code in the list always evaluate to true and set an Unknown reason that requires further operator selection of an actual reason.

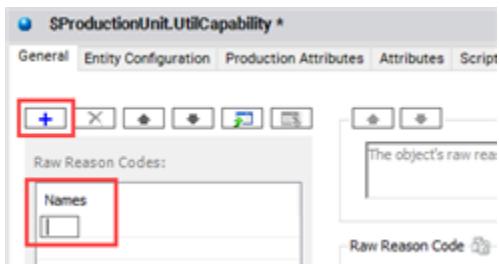
Note the following when adding or modifying a UCO's raw reason codes:

- When a UCO instance (child) inherits another object's raw reason code list and allowable reasons, you cannot alter the raw reason code list or allowable reasons that are inherited from a parent UCO's raw reason code list. You can add new raw reason codes interleaved between the parent raw reason codes and allowable reasons.
- Changing a parent object's raw reason codes or allowable reasons will invalidate all derived object instances. You will have to run the Entity Model Builder and redeploy the object to cascade the changed raw reason codes list to its derived object instances. For more detailed information, see [Locking UCO Attributes](#).

## To add a raw reason code

1. In the System Platform IDE, open the UCO template or instance that you want to configure and go to the **General** tab.
2. Select the **+ Add** button.

A text box appears in the raw reason code list.



3. Enter the raw reason code name in the text box.

The raw reason code name must adhere to the following rules:

- Consist of alphanumeric or special characters (\$, #, \_)
- Contain no more than 40 characters
- Contain at least one letter

4. Press the **Enter** key.

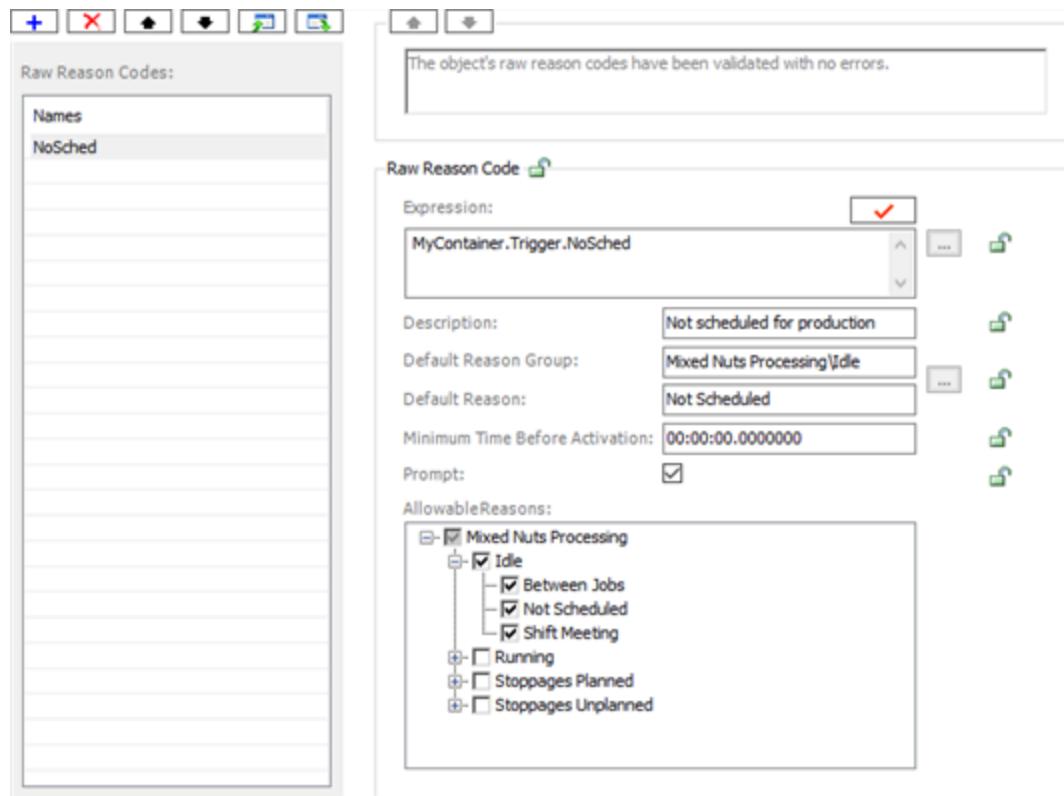
The new raw reason code is added to the list.



5. Configure the raw reason code attributes. For a description of the attributes, see [Raw Reason Code Attributes](#).

## Raw Reason Code Attributes

The following topics describe the raw reason code attributes.



## Expression

Raw reason codes are defined by creating an expression that is evaluated at run time to determine if the raw reason code is True or False. These expressions are similar to the expressions used in other application objects and are evaluated every scan cycle.

For information about entering and validating raw reason code expressions, see [Entering a Raw Reason Code System Platform Script Expression](#)

## Description

A description of the raw reason code. The description is stored in the MES database, but otherwise not used.

## Default Reason Group and Reason

The default utilization reason group and reason for the selected raw reason code.

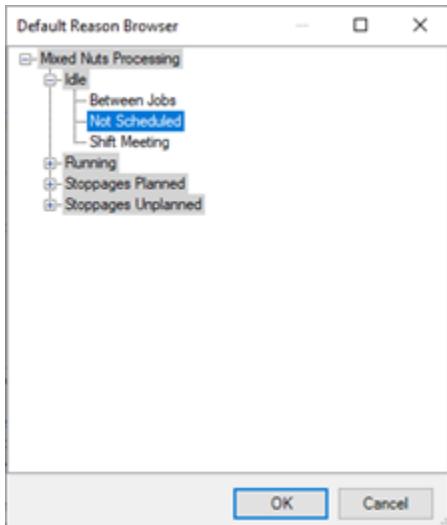
Selecting a default utilization reason group and reason requires the following:

- The ability to communicate to the MES database through the MES middleware. If you do not have the MES middleware loaded on the same node on which you are configuring the UCO, you must have the MES middleware proxy installed. For more information on the middleware or middleware proxy, see [System Requirements](#).

- The default utilization reason groups and reasons configured in the MES, using either the MES Web Portal or the MES Client application.

**To select the default utilization reason:**

1. Select the raw reason code you want to configure.
2. Select the **Default Reason** browser button to display the default reason tree.



3. Select a default utilization reason and click **OK**.

## Minimum Time Before Activation

The period of time that determines how long a raw reason code's expression has to be True before it is considered a candidate to be the active raw reason code. This value has the format hour:minute:second.millisecond (for example, 00:00:10.5 for 10 and a half seconds).

For a raw reason code to become the active raw reason code, the raw reason code expression must evaluate to True and meet the minimum time to activation requirement.

One use of this parameter is to filter out noise conditions. Another use would be to define two raw reason codes with identical expressions where one has a minimum activation time and the other has none. Once the event has been in a specific reason greater than the minimum activation time, the entity can change into a different reason that might have a different utilization state so as to classify the event time as performance instead of utilization.

If a raw reason code expression evaluates to True and stays True beyond the minimum time before activation, and has the highest priority of all the True raw reason codes, it becomes the active raw reason code.

The time logged for a new active raw reason code will be the time when the minimum activation time elapses.

All timers for raw reason code expressions that are still true after a higher priority raw reason code became true will not be reset and will continue to be evaluated as True.

Once an active raw reason code transitions from True, to False, and back to True, its timer is reset from the point it evaluates True once again.

## Prompt

Determines whether an operator will be prompted to manually select a utilization reason from the list of allowable reasons (specified in the **Allowable Reasons** tree) when a new raw reason code becomes active.

When this option is selected and the raw reason code evaluates to True, the event logged in the database has the Prompt flag set to True, which is indicated in the utilization grid .NET control and in MES Web Portal.

## Allowable Reasons

Select the utilization reasons from which a user will be allowed to choose, when prompted (that is, if the **Prompt** attribute is selected), when the raw reason code becomes the active raw reason code.

If no reasons are selected, all reasons will be allowed. By default, no reason is selected.

When a raw reason code becomes active and a utilization event is logged, a utilization reason is assigned to the event based on the default allowable reason assigned to that raw reason code.

If a new reason is added in MES Client to an existing reason group that has been selected as an allowable reason group in the UCO configuration, the new reason will not be selected automatically. You must edit the raw reason code definition in Object Editor and select the newly defined reason in the list of allowable reasons.

Selecting an allowable utilization reason group and reason requires the ability to communicate with the MES database through the MES middleware. If you do not have the MES middleware loaded on the same node on which you are configuring the UCO, you must have the MES middleware proxy installed. For more information on the middleware or middleware proxy, see [System Requirements](#).

Derived UCOs can have additional allowable reasons selected. However, reasons that are already selected in parent templates cannot be cleared.

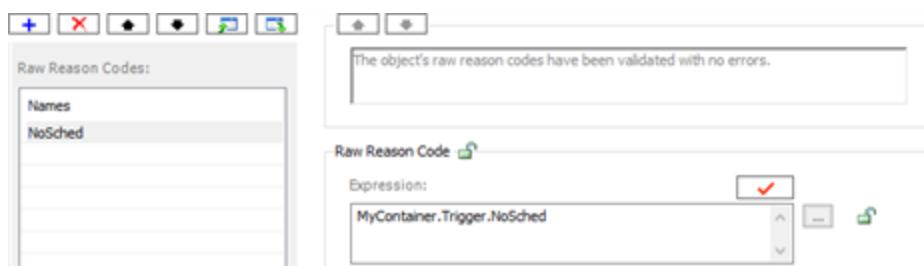
### Entering a Raw Reason Code System Platform Script Expression

The raw reason code expression is a System Platform script expression that will determine whether the selected raw reason code is active.

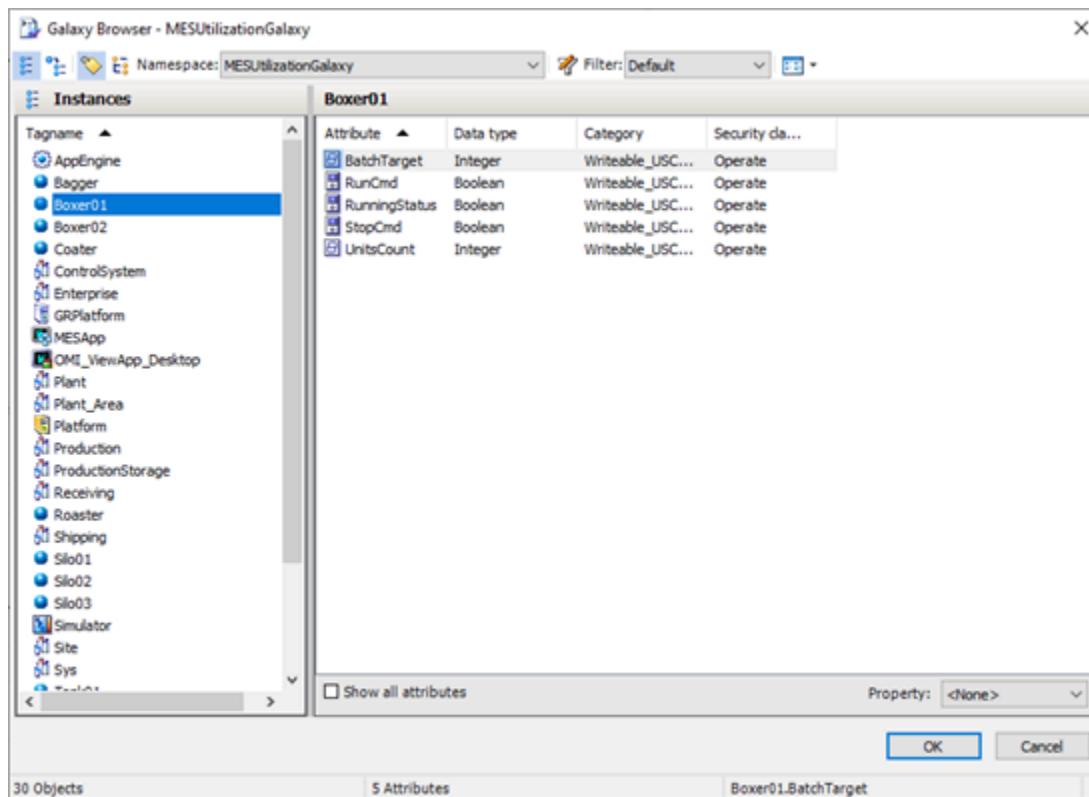
More than one raw reason code expression can evaluate to True simultaneously, but only one of the True raw reason codes can be the active raw reason code. The active raw reason code is based on the priority of the raw reason codes, which is determined by their order in the raw reason code list, and the Minimum Time Before Activation setting. At run time, when a raw reason code becomes the active raw reason code, a utilization event is logged against the associated entity.

#### To enter a raw reason code expression:

1. Select the raw reason code you want to configure.
2. Specify the expression by doing one of the following:
  - In the **Expression** text box, enter a valid System Platform script expression that will determine whether the selected raw reason code is active.



- To specify an existing attribute as a contained attribute reference, click the **Expression** Browser button. In the Galaxy Browser dialog box, select the instance and attribute and click **OK**.



Array attributes are supported in raw reason code expressions.

For more information on using System Platform expressions, see the System Platform IDE help.

- Check to make sure that the expression is valid by clicking the Validate Expression button.



A message appears, indicating whether the expression is valid or invalid. If invalid, the message will indicate the areas of the script that are causing the issue.

For information about expression validation, see [Validation of Expression Syntax and References](#).

# Ensuring That the Expression Evaluates to a Boolean Value

At run time, when an expression evaluates to True, the raw reason code can be considered as a candidate to be the active raw reason code. The expression should evaluate to a Boolean value or to some other value that can easily be converted to a Boolean value. For example, an integer with a non-zero value will evaluate to True at run time.

If the type of the expression is other than Boolean, then the result of the expression at run time will be cast to a Boolean type according to the standard coercion rules applied throughout System Platform expression evaluation.

## Proper Structure for Expressions with Array Attributes

MyContainer or Me should be only used to refer to attributes on the object. They should not be used to navigate the hierarchy of an expression. For example, if the expression references an array, a reference with the syntax AnotherObject.IndexAttribute should be used to access the value of the array, and not MyContainer.AnotherObject.IndexAttribute. So the proper syntax for an expression that references an array would be:

```
MyContainer.ArrayUDA[AnotherObject.IndexAttribute] == n
```

Attempting to access this attribute using the syntax MyContainer.AnotherObject.IndexAttribute would result in the logging of warnings that the quality of the attribute is not accessible. This is because System Platform will not be able to resolve the reference properly.

## Validation of Expression Syntax and References

Validation of a raw reason code expression's syntax and references are handled separately.

- Syntax validation is performed for templates and instances when the Validate Expression button is clicked, when the object is saved, and when Object Editor is closed. Syntax errors will be reported in the raw reason code status box immediately after the expression validation is completed or, if initiated by closing Object Editor, when the object is reopened in Object Editor.
- Reference validation is performed for instances (not for templates) only when the Object Editor is closed. Therefore, to see if there are any reference validation errors in the status box for an object instance's raw reason code expressions, you must close the object and then reopen it in Object Editor.

Errors are generated for syntactically incorrect expressions. Warnings are generated for unresolved references. For information about how these errors are displayed, see [Raw Reason Code Validation Error Messages](#).

Note that syntax errors take precedence over reference errors. So, if Object Editor is closed and both a syntax and reference error are detected in a raw reason code's expression, only the syntax error will be displayed when the object is reopened in Object Editor. You would not see the reference error until you corrected the syntax

error, closed Object Editor, and reopened the object.

## Examples of Expression Syntax and Reference Validation Behavior for an UCO Instance

- If the expression is MyContainer.NonExistentReference == 1 and the Validate Expression button is clicked, no error would be reported even though the reference does not exist because only syntax validation is performed.
- If the expression is MyContainer.NonExistentReference === 1 and the Validate Expression button is clicked, an error regarding the unexpected equal sign (=) would appear.
- If the expression is MyContainer.NonExistentReference == 1 and the Object Editor is closed, a warning would be reported for the nonexistent reference.
- If the expression is MyContainer.NonExistentReference === 1 and the Object Editor is closed, a syntax error would be reported for the unexpected equal sign (=), but the reference error would not be reported.
- If after reopening the object, the expression MyContainer.NonExistentReference == 1 is fixed to MyContainer.ExistingReference == 1 and the Validate Expression button is clicked or the object is saved, the reference error will still appear, since a reference validation was not performed.
- If after reopening the object, the expression MyContainer.NonExistentReference === 1 is fixed to MyContainer.NonExistentReference == 1 and the Validate Expression button is clicked or the object is saved, the syntax error will be cleared but the reference error will not be reported. This is because, for validation error message display purposes, the syntax error took precedence over the reference error. The Object Editor would have to be closed and the object reopened to see the reference error in the status box.

## Expression Evaluation Quality

Expression evaluation for raw reason codes follows the System Platform scripting evaluation logic in terms of quality of expression references. Expression references are considered to be the individual reference values.

When attempting to determine raw reason code evaluated values and its quality for an expression, the following rules apply:

- If the quality of all expression references is Good, then the expression evaluates True or False depending on the outcome of the Boolean logic, and the expression Quality evaluates Good.
- If the quality of all expression references is Bad, then the expression quality evaluates Bad.
- If all expression references with Good quality evaluate properly and at least one expression reference has Bad quality, the expression quality evaluates Bad. This is because those references with Good quality evaluate properly, and there is no way to verify whether the final references evaluate properly as well because their quality is Bad.
- If at least one expression reference with Good quality evaluates False, it does not matter what the quality or value of the rest of the expression reference is; the expression will evaluate False with Good quality. This is because if at least one expression with Good quality evaluates False, the expression as a whole will evaluate False, so the quality on the remaining expression references are ignored.

If an expression's quality evaluates Bad, the UCO will:

- Go into an error state if ResumeOnError = False.
- Skip the expression and treat it as if it evaluates False if ResumeOnError = True.

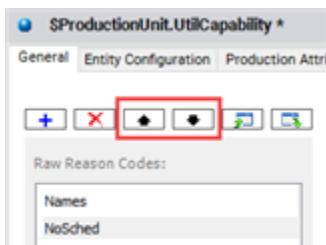
## Setting the Raw Reason Code Evaluation Order

At run time, the order of the raw reason codes in the list on the **General** tab is used to determine which raw reason code should become the active raw reason code when several raw reason code expressions become True. If this condition occurs, the raw reason codes are evaluated starting at the top of the list through to the bottom of the list.

The raw reason codes at the top of the list should be more specific in nature. General raw reason codes should be listed near the bottom of the list and used as fallback raw reason codes when the raw reason codes higher on the list are not True. The last raw reason code in the list should always evaluate to True and should be set to some unknown reason requiring operator selection of a true reason.

### To change a raw reason code's position in the evaluation order:

1. Select the raw reason code in the list.
2. Click the up arrow or down arrow to move the selected raw reason code up or down in the list.

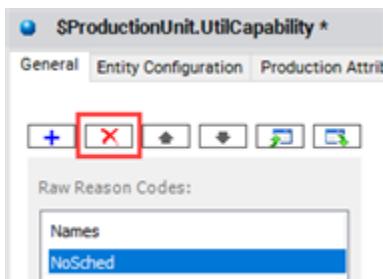


## Renaming a Raw Reason Code

1. Select the raw reason code you want to rename, wait one second, and select it again. The name becomes editable.
2. Rename the raw reason code and press the **Enter** key to save the new name.

## Deleting a Raw Reason Code

1. Select the raw reason code you want to delete.
2. Click the X Delete button.



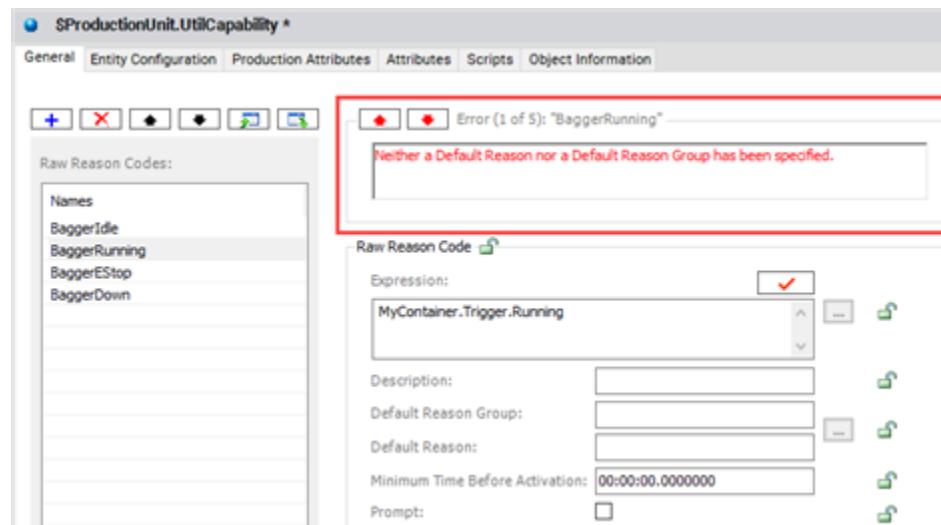
The raw reason code is deleted.

## Raw Reason Code Validation Error Messages

Whenever the UCO is saved in Object Editor, a validation of the raw reason codes is performed. This validation is

performed on the syntax of all expressions and the existence of the default utilization reason group and reason. The validation takes approximately 5 seconds for 1000 raw reason codes. In addition, expression reference validation is performed for instances (not for templates) when the Object Editor is closed.

If any errors are found, they appear in the error message area above the attribute settings on the **General** tab. These errors must be resolved for the object to be deployed and used at run time. For object instances, raw reason code errors can be reported for the object regardless of whether the raw reason code is unique to the object or derived from a template.



The error message list behavior is as follows:

- If there is more than one error, you can scroll through the messages using the up and down arrows. The raw reason code corresponding to the current error message is automatically selected. However, note that selecting a raw reason code does not cause its error messages to be selected. You have to use the error message up and down arrows to navigate to its error messages.
- Scroll controls will appear for long error messages.
- If the raw reason code name is too long to fit in the error message header area, you can hover over the name to see the full name in a tool tip.
- If you correct an error, the error messages are not automatically cleared or updated. You must perform a Save, or Save/Close/Reopen for expression reference errors in an instance, to refresh the error message list.

## Exporting and Importing Raw Reason Codes

Raw reason codes can be exported to and imported from an XML file. This capability allows you to:

- Transfer sets of raw reason codes to other UCOs (for example, in other System Platform galaxies).
- Create raw reason code XML files manually or programmatically outside of System Platform to facilitate entry and management of your site's raw reason codes. These files can then be imported into selected UCOs as needed.

### Sample Raw Reason Codes XML File

The following is sample content for a raw reason codes XML file.

```
<?xml version="1.0" encoding="utf-8"?>
<raw_reason_list>
<default_raw_reason raw_reas_cd="PumpProducingChocolate" overwrite="False" />
<raw_reason raw_reas_cd="PumpDown" prompt="False" priority="100"
min_time_before_activation="00:00:00" last_edit_comment="" description="">
<expression><![CDATA[UserDefined_001.PumpRunning == false]]></expression>
<available_reason reas_grp_desc_1="Example Util. Reason Group" reas_desc="Unknown"
last_edit_comment="" />
<default_reason reas_grp_desc_1="Example Util. Reason Group" reas_desc="Unknown"
last_edit_comment="" />
</raw_reason>
<raw_reason raw_reas_cd="PumpRunning_NotProducingChocolate" prompt="False" priority="200"
min_time_before_activation="00:00:00" last_edit_comment="" description="">
<expression><![CDATA[UserDefined_001.PumpRunning == true AND
UserDefined_001.PumpingChocolate == false]]></expression>
<available_reason reas_grp_desc_1="Example Util. Reason Group" reas_desc="Idle"
last_edit_comment="" />
<default_reason reas_grp_desc_1="Example Util. Reason Group" reas_desc="Idle"
last_edit_comment="" />
</raw_reason>
<raw_reason raw_reas_cd="PumpProducingChocolate" prompt="False" priority="300"
min_time_before_activation="00:00:00" last_edit_comment="" description="">
<expression><![CDATA[UserDefined_001.PumpRunning == true AND
UserDefined_001.PumpingChocolate == true]]></expression>
<available_reason reas_grp_desc_1="Example Util. Reason Group" reas_desc="Running"
last_edit_comment="" />
<default_reason reas_grp_desc_1="Example Util. Reason Group" reas_desc="Running"
last_edit_comment="" />
</raw_reason>
</raw_reason_list>
```

## Raw Reason Codes XML File Format

The raw reason codes XML file format includes the following tagged elements to define a raw reason code list.

### Raw Reason List Element

**<raw\_reason\_list>**

Specifies the content as a raw reason code list.

There can be only one <raw\_reason\_list> element per XML file.

### Default Raw Reason Element

**<default\_raw\_reason parameters>**

The default raw reason code for the UCO. For more information, see [Default Raw Reason Code](#).

There must be one and only one <default\_raw\_reason> element per list.

**raw\_reas\_cd**

The name of the default raw reason code. This name must be unique among the raw reason codes included in the XML file.

The value should specify a raw reason code that is either included in this list or already defined in the UCO.

Otherwise, an error will occur during the import operation.

This parameter can also be null (raw\_reas\_cd=""").

#### *overwrite*

Specifies whether to overwrite the object's current default raw reason code value, if one has been specified. If set to True, the default raw reason code value will be overwritten by the raw reason code specified in this element unless the current default raw reason code setting is locked. If set to False, the current default raw reason code setting will not be overwritten. However, if a default raw reason code has not been defined for the object, then the raw reason code specified in this element will be used regardless of the *overwrite* setting.

## Raw Reason Code Element

### **<raw\_reason parameters>**

Specifies a raw reason code. Each **<raw\_reason>** element includes one **<expression>** element, one or more **<available\_reason>** elements, and one **<default\_reason>** element.

There can be one or more **<raw\_reason>** elements per list.

#### *raw\_reas\_cd*

The name of the raw reason code.

Raw reason code names are case insensitive. For example, raw reason codes named RunningSlow and runningslow would be considered duplicate raw reason code records and would cause an error during import.

#### *prompt*

True or False (the default). Determines whether an operator will be prompted to manually select a utilization reason from the list of allowable reasons (specified by the **<available\_reason>** elements) when a new raw reason code becomes active.

This parameter cannot be null.

#### *priority*

Required. A positive integer value that indicates the evaluation order of the raw reason code in the list. The value must be unique among raw reason codes included in the import file. If this parameter has no value or an invalid value, the file import will fail.

Each raw reason code element must have the priority value specified, and the value must be a positive integer. Otherwise, that raw reason code will not be imported. There should also not be duplicate priority values among the raw reason code elements in the file. If a duplicate priority value is found, that raw reason code and those that follow it will not be imported.

Priority is used to determine the order of the raw reason codes when they are imported into a UCO at the selected location among existing raw reason codes. For more information, see [Setting the Raw Reason Code Evaluation Order](#).

When exporting raw reason codes, the priority of the first raw reason code in the list is set at 100 and each raw reason code after that is incremented by 100. This allows you to modify the XML file to add additional raw reason codes between the existing ones.

When importing a raw reason code XML file, the raw reason codes being imported are sorted by ascending priority before adding them at the selected location in the raw reason code list on the **General** tab.

#### *min\_time\_before\_activation*

The period of time that determines how long the raw reason code's expression has to be True before it is considered a candidate to be the active raw reason code. This value has the format hour:minute:second.millisecond (for example, 00:00:10.5 for 10 and a half seconds). For more information, see

**Minimum Time Before Activation.**

The value must be in the proper format (hh:mm:ss). Otherwise, the raw reason code will not be imported.

***last\_edit\_comment***

A comment regarding when the raw reason code was created or last modified.

This parameter can be null.

***description***

A description of the raw reason code.

This parameter can be null. However, the string cannot exceed 1024 characters. Otherwise, the raw reason code will not be imported.

**<expression><![CDATA[*expression*]>**

A System Platform script expression that will determine whether the selected raw reason code is active. For more information, see [Entering a Raw Reason Code System Platform Script Expression](#) and its sub-topics. The expression will be validated automatically when the object is saved after the import operation.

There must be one and only one <expression> element per <raw\_reason> element.

***<available\_reason parameters>***

A utilization reason that a user will be allowed to choose, when prompted (that is, if the *prompt* parameter is True), from a list of allowable reasons when the raw reason code becomes the active raw reason code.

There can be one or more <available\_reason> elements per <raw\_reason> element, or none. Each allowable reason must include values for both the *reas\_grp\_desc* and the *reas\_desc* parameters.

If no <available\_reason> element is included, then the user will be able to select from all utilization reasons in the MES database.

***reas\_grp\_desc***

The name of the raw reason group for the allowable raw reason.

The value should be a reason group that is actually in the MES database. The reason group and reason will be validated against the MES database on the first object Save operation after import. If it does not exist, the raw reason code will be indicated to be in an error state.

This parameter can be null.

***reas\_desc***

The name of the allowable raw reason.

The value should be a reason that is actually in the MES database and in the reason group specified by the *reas\_grp\_desc* parameter. The reason group and reason will be validated against the MES database on the first object Save operation after import. If it does not exist, the raw reason code will be indicated to be in an error state.

This parameter can be null.

***last\_edit\_comment***

A comment regarding when the allowable reason group and reason were added or last modified.

This parameter can be null.

***<default\_reason parameters>***

The default utilization reason for the raw reason code. For more information, see [Default Reason Group and Reason](#).

There must be one and only one <default\_reason> element per <raw\_reason> element. Values for both the *reas\_grp\_desc* and the *reas\_desc* parameters must be defined.

*reas\_grp\_desc*

The name of the default utilization reason group for the raw reason code.

The value should be a utilization reason group that is actually in the MES database. This value will be validated automatically when the object is saved after the import operation.

*reas\_desc*

The name of the default utilization reason.

The value should be a utilization reason that is actually in the MES database and in the utilization reason group specified by the *reas\_grp\_desc* parameter. This value will be validated automatically when the object is saved after the import operation.

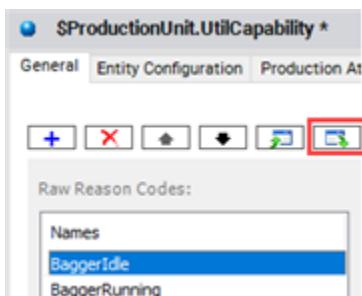
*last\_edit\_comment*

A comment regarding when the default reason was added or last modified.

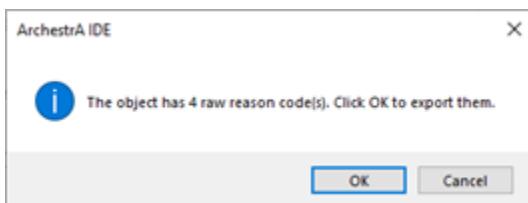
This parameter can be null.

## Exporting Raw Reason Codes

- With the UCO opened in Object Editor, on the **General** tab click the **Export** button.



A confirmation dialog box appears, indicating the number of raw reason codes that will be exported.

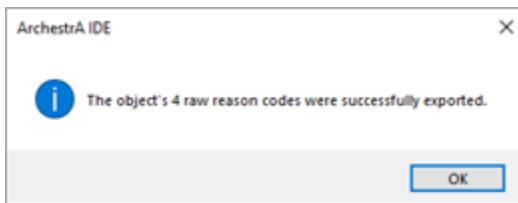


- To confirm the export, click **OK**.

The Export dialog box appears.

- Navigate to the destination directory for the XML file, enter a name for the file, and click **Save**.

When the export file has been created, a success message appears.



- Click **OK** to dismiss the message.

The priority order of the raw reason code list is preserved by assigning priority values of 100, 200, and so on to

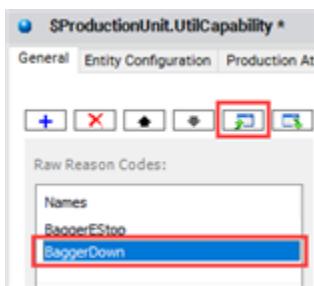
the raw reason codes listed in the XML file.

## Importing Raw Reason Codes

The ability to import raw reason codes from an XML file allows you to more easily create a large number of raw reason codes than adding them using Object Editor. It also allows you to import raw reason codes that were exported from another UCO.

For an explanation of the raw reason code XML file structure and a sample file, see [Raw Reason Codes XML File Format](#) and [Sample Raw Reason Codes XML File](#).

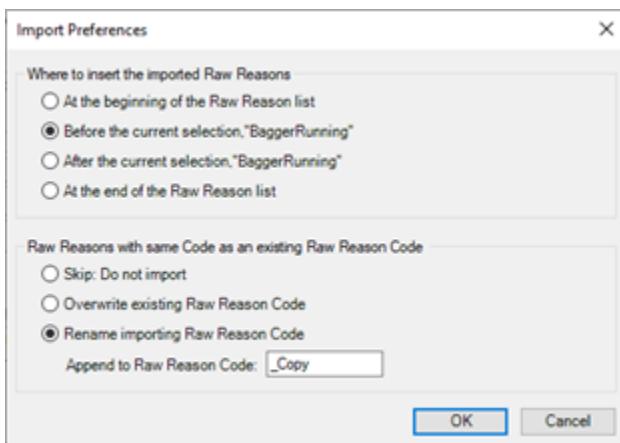
1. With the UCO opened in Object Editor, on the **General** tab select the raw reason code in the list before or after which you want to insert the imported raw reason codes.  
If you want to insert the imported raw reason codes at the beginning or end of the current list, it does not matter what raw reason code is selected.
2. Click the  Import button.



The Import dialog box appears.

3. Navigate to and select the raw reason code XML file that you want to import.
4. Click **Open**.

The Import Preferences dialog box appears.



5. Select where you want to insert the imported raw reason codes in the current list (that is, at the beginning or end of the list, or before or after the selected raw reason code).
6. Select how to handle imported raw reason codes that have the same name as existing codes:

### Skip: Do not import

Do not import the duplicate raw reason code.

### Overwrite existing Raw Reason Code

Overwrite the existing duplicate raw reason code with the imported code.

### Rename importing Raw Reason Code

Append the text string in the box to the imported raw reason code, so that the name is not duplicated.

- After selecting the insert and duplicate actions, click **OK**.

The contents of the XML file are validated. This validation includes the syntax of the expression, but not the validity of a contained attribute reference in the expression. An expression's contained attribute reference will be validated when a Save operation is performed, or by clicking the Validate Expression button above the Expression box. See [Entering a Raw Reason Code System Platform Script Expression](#) and [Validation of Expression Syntax and References](#).

If there are validation errors, see [Import Validation Errors](#).

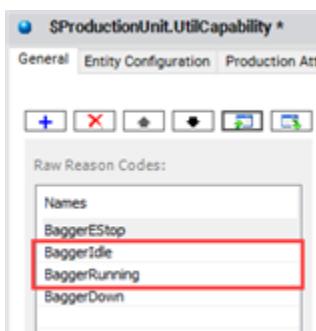
If there are no file validation errors, the raw reason codes are imported into the object. The import process will take approximately 5 seconds per 1000 raw reason code records in the XML file.

When the import has successfully completed, a message appears that includes the number of raw reason codes imported.



- Click **OK** to dismiss the message.

The imported raw reason codes appear in the list at the specified location.



## Import Overwrite Behavior

If a raw reason code in the import file matches a raw reason code already in the list for the UCO, the existing raw reason code will be overwritten unless it is locked.

Whether the default raw reason in the import file overwrites the UCO's current default raw reason depends on the default raw reason *overwrite* setting in the import file:

- If set to True, the current default raw reason code value will be overwritten by the default raw reason code specified in the import file unless the current default raw reason setting is locked. If the default raw reason code in the import file matches the name of a locked default raw reason code setting, an error will not be raised.

- If set to False, the current default raw reason setting will not be overwritten. However, if a default raw reason code has not been defined for the object, then the default raw reason code specified in the import file will be used regardless of the *overwrite* setting.

## Import Validation Errors

### Errors That Cause the Import to Fail

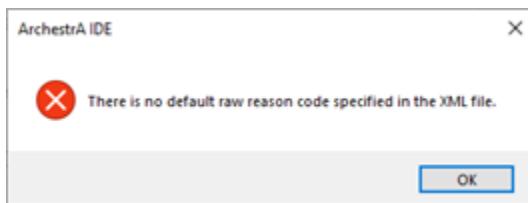
The following conditions will cause the import operation to fail.

#### More than one raw reason code has the same priority value



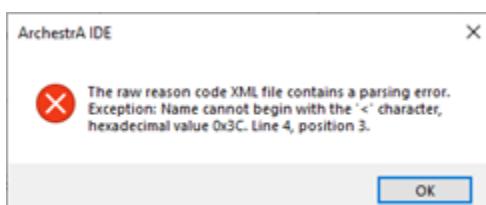
If a duplicate priority value is found, that raw reason code and those that follow it in the priority order will not be imported.

#### The Default Raw Reason attribute has not been included



If a default raw reason attribute has not been included, the entire import operation will fail.

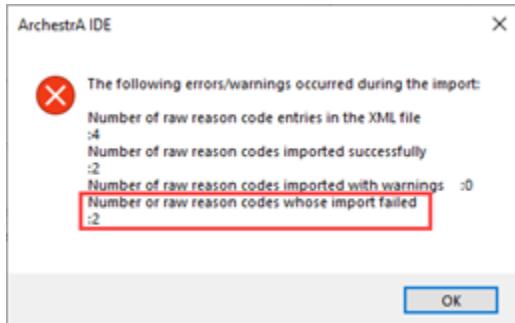
#### There are XML syntax errors



If there are any XML syntax errors, the entire import operation will fail.

If any of these validation errors occur, edit the XML file to fix the cause of the error and then try importing the file again.

## Errors That Prevent a Raw Reason Code from Being Imported

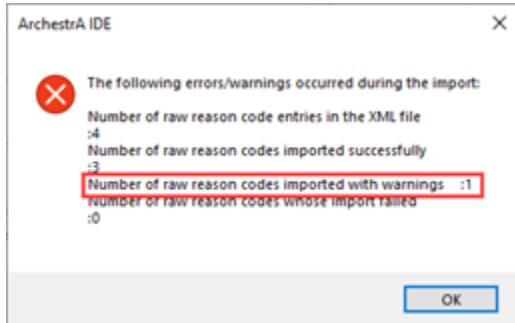


The following errors will cause a raw reason code to not be imported:

- The Priority attribute is missing or invalid (it must be a positive integer).
- The length of the Description is more than 1024 characters.
- The time entered for Minimum Time Before Activation is negative.
- The raw reason code is missing.

If any of these validation errors occur, you can either edit XML file to fix the cause of the error and then try importing the file again or add the raw reason code directly on the **General** tab in Object Editor.

## Errors That Cause a Raw Reason Code to Be Imported with Warnings

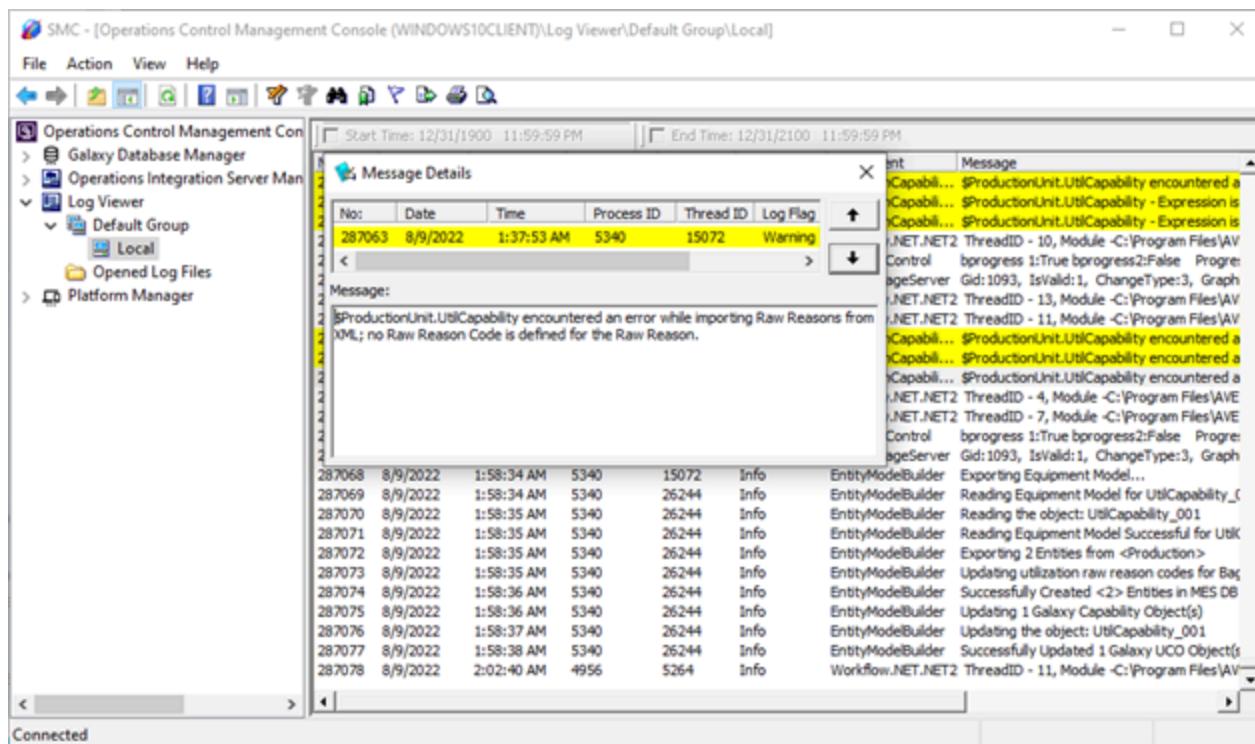


The raw reason code will be imported with warnings for the following errors:

- An attribute other than Priority is missing.
- The validity compilation of the Expression resulted in errors. However, because this compilation is done after parsing the raw reason code, the imported with warnings count will not include expression compilation errors.
- The validation of the Allowable Reasons failed when checked against actual allowable reasons in the MES database.

These errors result in the effected attribute of the imported raw reason code being empty.

You can check the Operations Control Management Console Log Viewer to see which attributes were missing.



Also, when a Save operation is performed, which runs a validation on the entire list of raw reason codes, errors are indicated in red above the raw reason code attribute settings. For more information, see [Raw Reason Code Validation Error Messages](#).

## Configuring General Utilization Attributes

The following topics describe the general utilization attributes.

The screenshot shows the configuration interface for general utilization attributes. It includes sections for 'Default Raw Reason Code' (set to 'BaggerIdle'), 'Spare Comments' (with four input fields for Spare 1 through Spare 4), 'Utilization Events' (with columns for 'Attribute Name', 'Use Input Source', and 'Value or Input Source'), and a 'Log Utilization Events' section.

### Default Raw Reason Code

Select the default raw reason code to be used upon initial deployment of the UCO.

Note the following about the use of the default raw reason code:

- Each UCO must have a default reason code that the Entity Model Builder will pass into the MES database, which will become the default unknown utilization reason for the entity. If the default raw reason of the UCO does not exist in the global set of possible reason codes, an error is logged and the UCO is marked as invalid.

- The default raw reason code will be used only immediately after the deployment of the UCO object instance when the status of the equipment (entity) cannot be determined and all of the other raw reason codes evaluate to False. During run time, if all expressed values become False, the last raw reason code to have a state of True will be used, and not the default raw reason code.

### Resume on Error

The **Resume on Error** attribute allows expression evaluation errors to be ignored while the system is trying to determine the active raw reason code at run time. When the **Resume on Error** attribute is not selected, expression errors (for example, due to quality issues) will stop the raw reason code evaluation, leave the UCO in its last known utilization reason, and will re-evaluate all expressions in the next scan cycle of the object. In addition, you can specify an alarm if a raw reason code expression error occurs.

### Alarm on Error

This attribute determines whether an entity will produce an alarm when a UCO-related error occurs. They include:

- Expression errors

Note that, if the quality on an expression is bad and the Resume on Error check box is selected, an alarm will not be produced.

- Client session errors
- Utilization event errors
- Entity naming errors
- OEE and utilization value errors

If the Alarm on Error attribute is selected, then the following attributes become available.

#### Alarm Priority

A number that is logged and that represents the priority of the System Platform alarm.

#### Alarm Message

The System Platform alarm message that is logged.

You can manually enter the alarm message, or click the Browse button to select and insert a System Platform attribute reference into the alarm message.

Two types of alarm conditions are available for equipment monitoring:

- An alarm indicating that an error occurred while attempting to determine the current raw reason code. For example, an attribute reference contained in an expression for a raw reason code goes to bad quality.
- You can monitor the current raw reason code and use scripting in conjunction with alarm extensions to trigger an alarm. For instance, a field attribute of type Boolean can be added to the UCO and an alarm extension set on it. Then, a script can be written to set this attribute if a specific raw reason code or set of raw reason codes is detected on the object.

### Spare Comments

When utilization events are logged, the user can use the **Spare 1 to 4** fields to provide additional context that will

be logged along with the utilization event data. These attributes are writable during run time.

The spare comments can be up to 80 characters.

## Log Utilization Events

The Log Utilization Events attribute allows for stopping the UCO from logging utilization events. The events can then be entered manually by an operator using a .NET controls-based UI (such as MES Operator or a custom UI) or using MES Web Portal.

- If selected, the UCO will automatically log utilization events.
- If cleared, the UCO will stop logging utilization events. Utilization events can be logged manually.

This capability can be useful when, for example, the PLC providing the equipment raw reason code fails or malfunctions for some reason. The UCO can then be switched to manual mode by an operator or through script detection switches. Although the UCO will stop logging utilization events, it will continue to update other UCO attributes, such as OEE attributes, so that current utilization data can continue to be viewed in the UI.

### To change the logging mode during configuration by value

1. Clear the **Use Input Source** check box.
2. Select or clear the **Value or Input Source** check box.

Utilization Events			
Attribute Name	Use Input Source	Value or Input Source	
Log UtilizationEvents	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

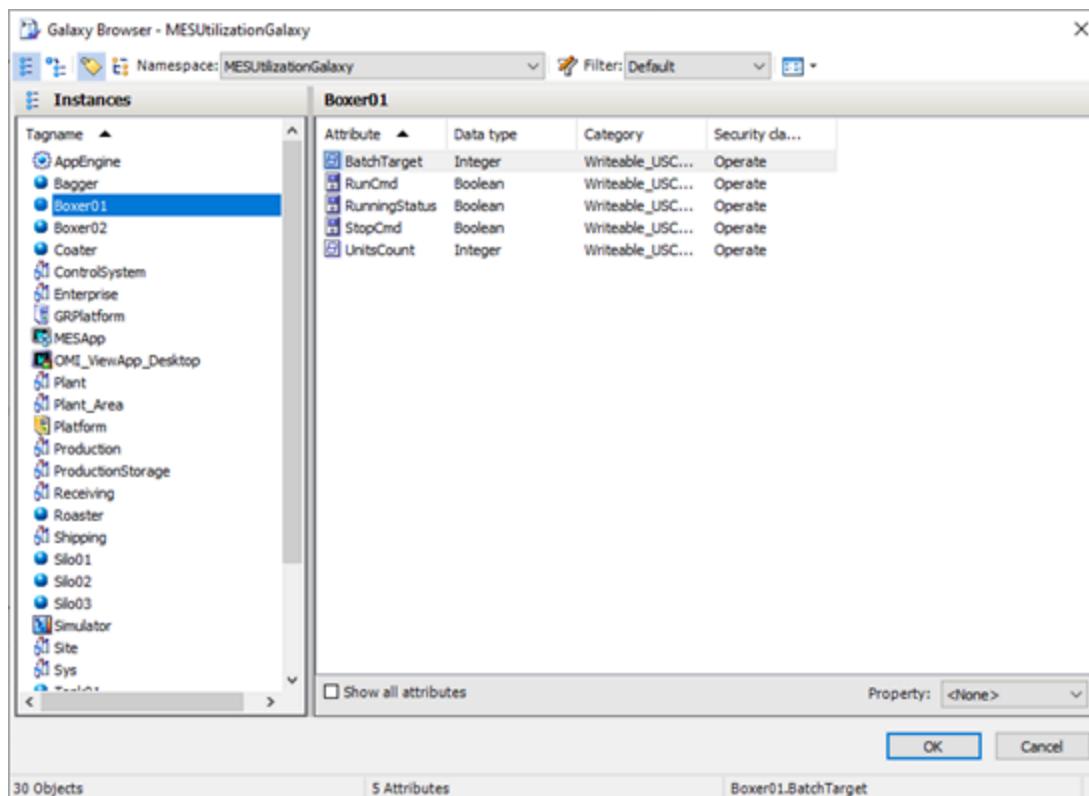
3. Save your changes and deploy the UCO.

### To change the logging mode during configuration using script detection switches

1. Select the attribute or command's **Use Input Source** check box.  
The control in the **Value or Input Source** column becomes a box.

Utilization Events			
Attribute Name	Use Input Source	Value or Input Source	
Log UtilizationEvents	<input checked="" type="checkbox"/>	<input type="text"/> MyContainer.LogUtilEvents <input type="button"/>	<input type="checkbox"/>

2. To specify the input source, do one of the following:
  - Manually enter the input source.
  - Click the attribute's Browse button. In the **Galaxy Browser** dialog box that appears, select the object and its attribute that is the input source.



### To change the logging mode during run time

- Open the application object in Object Viewer and set the **Log Utilization Events** to True or False.

### Automatic Mode Behavior

When the utilization event logging is in automatic mode, raw reason code expressions are evaluated, run-time attributes are read from the MES database, and utilization events are logged into the MES database.

### Manual Mode Behavior

When the utilization event logging is in manual mode, the object continues to evaluate the raw reason codes and sets the following attributes. However, no events are logged to the MES database. The object does not read current reasons from the database. Instead, it continues evaluating its logic to determine the correct raw reason code to log when it transitions back to automatic mode.

- PreviousRawReasonCode
- RawReasonCode
- RawReasonCodeDefaultReason
- RawReasonCodeDescription
- TimeEntered
- TimeInRawReasonCode

The following run-time attributes continue to be read from the MES database:

- CurrentOEEPercent
- CurrentPerformancePercent
- CurrentQualityPercent
- CurrentAvailabilityPercent

## Failover Behavior

During failover, the current mode will continue to be active. For example, if the utilization event logging is in manual mode and a failover occurs, the logging will continue to be in manual mode.

## Configuring OEE Attributes

The OEE attributes are on the **Entity Configuration** tab in the UCO Object Editor.

These attributes are used to configure OEE performance targets and default production rates for entities.

### OEE

The efficiency calculation implemented in the MES is based on the industry standard OEE (Overall Equipment Effectiveness) efficiency methodology.

OEE is determined as follows:

$$\text{OEE} = \text{Availability} \times \text{Quality} \times \text{Performance}$$

OEE as implemented by MES is described in the following topics.

### Availability

The availability component of OEE measures a system's availability during the scheduled operation time for a given time period, based on the following equation:

$$\text{Availability} = \text{Runtime} / \text{Net Operating Time}$$

To support the determination of entity availability, utilization events are applied to each entity. A utilization event indicates the current operational state of the entity. Utilization events can be applied automatically based on an entity's default utilization settings (see [Configuring Default Utilization Reasons for Standard Events](#)) or manually by an operator.

The component of a utilization event that is used to determine entity availability is OEE Use. Each utilization event, via its utilization reason and that reason's assigned utilization state, is assigned an OEE Use value of Runtime, Downtime, or Neither. MES bases the calculation of an entity's availability by summarizing the duration of its Runtime and Downtime events in the given time period for each OEE Use. Events with an OEE Use value of Neither are not included in the calculation.

So for MES, an entity's availability is:

$$\text{Entity Availability} = \text{Runtime} / (\text{Runtime} + \text{Downtime})$$

### Quality

The quality efficiency component of OEE measures a system's output quality while producing units during a

given interval.

Quality = Good Output / Total Output

In MES, entity quality is:

Quality = Good Production / (Good Production + Rejected Production)

where only production at the entity is considered.

## Performance

The performance efficiency component of OEE measures a system's ability to produce at the target production rate:

Performance = Total Output / Target Output

In MES, an entity's performance during a time period is based solely on the production reported on the entity only while the entity is in a Runtime utilization state. If multiple work orders are run during the period, producing different items with different unit of measures, the performance calculation is based purely on item production counts with no effort to convert units of measure.

## Understanding Batches and Lots for OEE

It is important to understand the difference between batches and lots so that your OEE results are within expected ranges.

- A lot is generally used to uniquely identify a group of consumed or produced items for tracking purposes.
- A batch is an amount of product that is processed simultaneously. A batch is used to determine the standard production time for a given amount of product. Standard production times are expressed either in time per batch, or batches per time.

For example, assume that you want to track all of the cookies that are baked during a shift as a group, and that you want to determine the cookie production's OEE. A unique lot number can be assigned to the group of cookies produced during the shift. But the lot size has nothing to do with the OEE calculation. That calculation would be based on the batch size and the batch production rate. If a batch size is 100 cookies and it takes 20 minutes to bake a batch of cookies, then up to 24 batches of cookies could be baked during an 8-hour shift, or a maximum of 2,400 cookies in a lot.

Also, note that the amount of production might not be an integral number of batches. This is because the standard production time for a batch will be constant, regardless of whether the batch actually includes the maximum number of items for the batch. For example, if the oven capacity, and thus a batch, is 100 cookies, it takes as long to bake 90 cookies as it does to bake 100. The performance component of OEE factors into this nonlinear behavior. So, for OEE to be reported accurately, it is important that the batch size be set according to the way production actually occurs.

## OEE Performance Target Attributes

By establishing your own target percentage setpoints for each OEE component, you can accurately evaluate your OEE and pinpoint out-of-target parameters.

Used in conjunction with graphical OEE KPI control displays, users can visually see run-time performance percentages against the target percentages.

Use the **OEE Performance Targets** attributes to set the target percentage setpoints for OEE, Performance, Quality, and Availability.

Percentage values must be from 0 to 100 and in decimal form.

These values are written to the MES database by running Entity Model Builder. There is no run-time functionality with these attributes.

## Default Production and Util/OEE Refresh Rate Attributes

The **Default Production Rate** attributes are used to calculate the utilization and performance of corresponding entities.

The **Default Production Rate** values are written to the MES database by running Entity Model Builder. There is no run-time functionality with these attributes. When written to the database, these values will overwrite the existing values in the database for the entity. Therefore, you should run Entity Model Builder only when the entity is not running a job that might have set these rates to a different value.

### Rate

The default production rate for the entity. The default value is 1.0.

The default production rate must be greater than 0. An entry of 0 will cause an error.

### Rate Unit of Measure

The default unit of measure for the production rate. The default is hours/batch.

- hours/batch (the default)
- minutes/batch
- seconds/batch
- batches/hour
- batches/minute
- batches/second

### Batch Size

If using batches during production, enter the default batch size. The default is 1.

The batch size cannot be 0.

The decimal place resolution of the batch size is controlled by the system parameter *Maximum number of decimals for batch entry*. For information about setting this parameter, see the *MES Client User Guide* or online help.

### Util/OEE Refresh Rate

At run time, OEE information is retrieved from MES and displayed via current OEE, Performance, Quality, and Utilization attributes.

The OEE information is updated within the attributes at a time interval defined by this attribute. The minimum refresh rate is 15 seconds. The default value is 00:01:00.0000000 (1 min).

Although a refresh rate can be specified, if no new data is available from MES within the specified interval, the values will not be updated until a subsequent scan when new data is available.

## Configuring Job Production Attributes and Commands

Job production attributes are defined on the **Production Attributes** tab. They allow you to specify parameters

associated with running a job on an entity with UCO capabilities.

These attributes are provided when the system is licensed only for Performance. If MES Operations functionality is also licensed, then use the corresponding production attributes available in the Operations Capability Object (OCO).

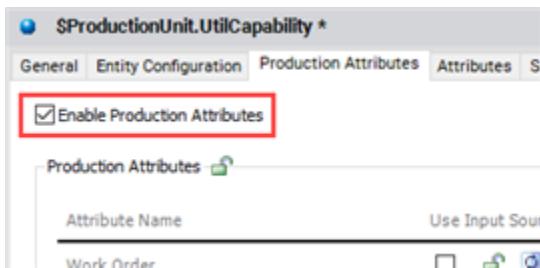
You can also specify how jobs will start and end using the production attribute commands on the **Production Attributes** tab.

The jobs that are available within the UCO are referred to as data entry jobs. Like jobs associated to a process, data entry jobs have work order, operation, sequence number, and item information. However, the data entry jobs are not linked to a process and are tied to a single entity. Data entry jobs do not have the concept of a bill of material for consumption transactions and produce just the one item.

## Enabling Production Attributes and Commands

### To enable the use of production attributes and commands through the UCO

- Select the **Enable Production Attributes** check box.



You can now configure the production attributes and commands.

## Production Attributes

The production attributes specify the parameters associated with running a job on an entity with UCO capabilities.

Each production attribute can be configured to get its value from a System Platform input source by setting the production attribute value directly or by browsing to an object attribute.

If an input source is used, the value is retrieved at run time with each scan and is written to the production attribute value (for example, the Batch Size value is written to the BatchSize attribute).

### Work Order

A data entry job consists of a work order performing some operation and a sequence number. This attribute is the work order description. If left blank, then the default work order system parameter value will be used.

### Item Class

A job produces an item and every item belongs to an item class. If the Item class specified here does not exist, it will be created when a job is started. If left blank, then the default item class system parameter value will be used.

### Item

A job produces an item. If the item specified here does not exist, it will be created when a job is started. If left blank, then the default item system parameter value will be used.

### Item Unit of Measure

A job produces an item and every item has a unit of measure. If the item UOM specified here does not exist, it will be created when a job is started. If left blank, then the default item UOM system parameter value will be used.

### **Operation**

A data entry job consists of a work order performing some operation and a sequence number. This attribute is the operation ID. If left blank, then the default operation system parameter value will be used.

### **Required Quantity**

The required quantity for the job. This value must be equal to or less than the start quantity. This attribute represents the required good units produced at the operation.

### **Start Quantity**

The start quantity for the job. This value must be equal to or greater than the required quantity. This attribute represents the quantity to start at the operation to ensure the required good quantity is produced. The start quantity would be greater than the required to take into consideration expected scrap counts.

### **Batch Size**

The size of a single batch. The value must be greater than 0. This is the batch size for the job and usually is the same as the entity batch size.

The batch size represents the group of quantities that are processed together. Batch size is used to calculate the production statistics, such as OEE.

### **Target Job Production Rate**

The target production rate for the running job, which may change depending on the item being produced.

The production rate represents the number of batches with specified size that you want to produce within a period. For example, 10 batches per hour.

### **Target Job Production Rate Unit of Measure**

The job production rate unit of measure based on the batch size. Select one of the available options:

- Hours per batch
- Minutes per batch
- Seconds per batch
- Batches per hour
- Batches per minute
- Batches per second

### **Operator**

The MES username of the user to which production activity will be assigned.

If you do not specify a user name, the default user that is configured in the system is associated with this job, which might not be a legitimate user.

## **Production Commands**

You can use the production commands to control when a job on the entity is started or ended.

### **Starting and Ending a Job**

When the UCO is managing the jobs running on an entity, the object can start a job (which will create the data

entry job and start it) and end the job. Optionally, the UCO can start a job on deploy of the object to ensure that a job is running on the entity without having to write code to trigger the start command on deploy.

### Start Job on Deploy Attribute

When selected, the entity will create a new data entry job and start the job on the deployment of the object.

### Start and End Job Commands

The **Start Job** and **End Job** commands are used to trigger a change in the job running on the entity.

- To start a job, first set all the desired production attributes as needed to define the job and then trigger the **Start Job** command.
- To end a job, trigger the **End Job** command (no production attributes are needed). All jobs running on the entity will be stopped.

The trigger attribute will stay True until the transaction is complete, at which time it will go False and you can set it again. If there are errors with one of the production attributes, or if there are errors while processing the transaction, or if none of the values have changed since the last transaction, an error will appear in the ProdAttrs.ErrorCode attribute and the transaction will not be completed.

In the event of an error, the trigger attribute will stay True and no other commands will be allowed. The object status will change to Error and the error code and error message attributes will be updated with the error information.

### Reset Command

Use the **Reset** command to clear an error code and error message, reset the job command attributes, and place the object status back to Ready.

### Production Counters

Beginning with MES version 5.2, the UCO does not have any production counters.

To record good and bad production counts, use the Operations Capability Object (OCO). The Performance license allows for the use of the OCO to record good and bad production counts. For more information about migrating UCO production counters to the OCO, see [Assistance with Migrating the UCO Production Counters to OCOs](#).

If the UCO is being used to only capture utilization events, then production counters are not required.

## Adding UCO Instances to System Platform Application Objects and Areas

Once you have created your UCO templates, you can add instances of the templates to your equipment model in the System Platform IDE below any application object or area that you want to create in MES as an entity with utilization, OEE, or job production capabilities.

1. In the System Platform IDE Model View, configure your equipment model, including any application objects that represent MES entities that require UCO-related capabilities.

For detailed information about creating your equipment model in the System Platform IDE, see the System

Platform IDE help.

2. Create and add a UCO instance as a child of any modeled application object or area that represents an MES entity that requires UCO-related capabilities.

You can add the UCO as a child under application and area objects only. If you add the UCO as a child under any other object such as an engine, the UCO does not work properly. An application or area object can contain only one UCO object as a child.



3. Configure the individual UCO instances in your equipment model as needed.

For general UCO configuration information, refer to [Configuring UCO Templates and Instances](#).

For information about the specific configuration attributes, refer to:

- [Configuring Utilization Attributes](#)
- [Configuring OEE Attributes](#)
- [Configuring Job Production Attributes and Commands](#)

When you are ready to export the UCO instance to the MES database as an MES entity, see [Building the MES Entity Model from UCOs](#).

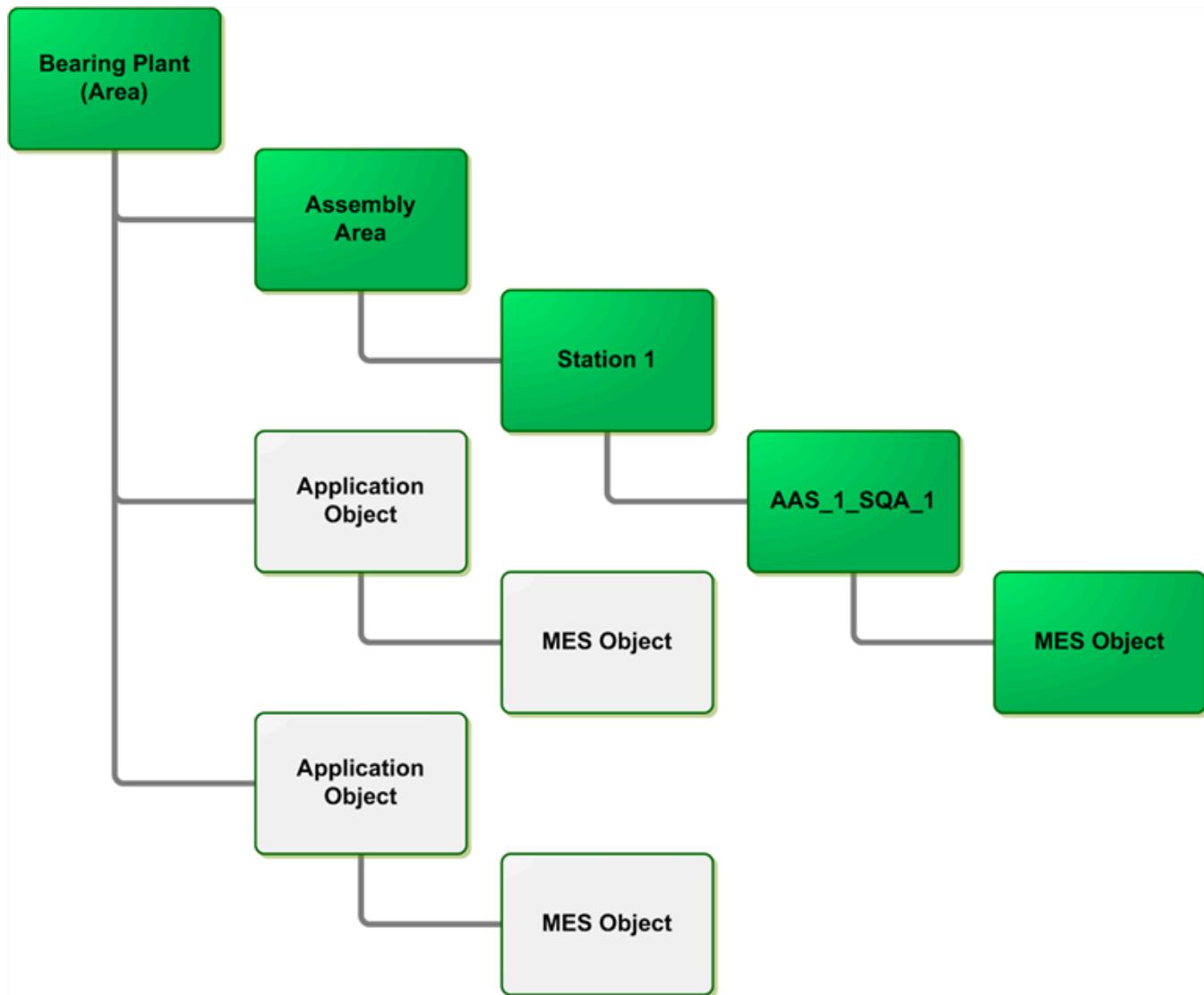
## Building the MES Entity Model from UCOs

The Entity Model Builder is a System Platform IDE extension for creating entities from your System Platform equipment model that use the UCO for configuring utilization, OEE tracking, and job production support.

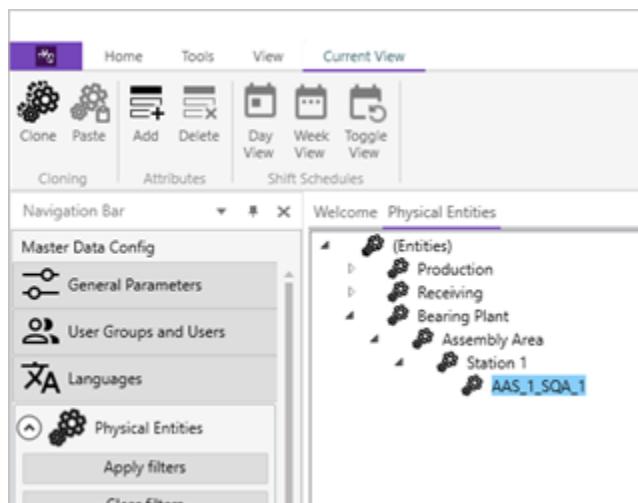
You can also use the Entity Model Builder to export existing System Platform users and roles to create corresponding users and groups. For more information about this capability, refer to the *MES Entity Model Builder User Guide*.

### How UCO-Enabled Objects Are Added to the MES Database as Entities

In the following example, if you select the UCO that is a child of the AAS\_1\_SQA\_1 object, the Entity Model Builder creates MES entities only for the objects above it in the branch, up to and including the Bearing Plant (area). The utilization, OEE, and job production attribute configuration information is extracted from the UCOs and stored as the corresponding property settings for the target entity (in this case, the AAS\_1\_SQA\_1 entity).



The following figure shows the resulting entity tree in MES Client. You could also have selected the parent application object that has a UCO child attached to it and then run Entity Model Builder to create the same structure.



Since the other UCOs in the same equipment model are not directly part of the selected equipment tree branch, they are not included in the entity creation because they are not part of the direct parent/child equipment structure to the AAS\_1\_SQA\_1 object.

Note the following additional behaviors about UCOs and using Entity Model Builder to create or modify their entities in the MES database:

- If you select multiple application objects with UCOs, the Entity Model Builder creates entities for all of them.
- If the selected application object is not a UCO, does not have a UCO below it, and is not part of a utilization/OEE configuration hierarchy, then the Entity Model Builder does not create any entities.
- The Entity Model Builder only creates new entities and new entity hierarchies that do not already exist.
- To delete an entity, you must delete it using MES Client. For more information on managing entities, see the *MES Client User Guide*.
- If there is already an entity in the MES database with the same name as the application object with a UCO, Entity Model Builder will overwrite its corresponding properties with the UCO attribute settings.
- Though the Entity Model Builder never deletes an existing entity or removes any capabilities (including UCO capabilities), it can re-parent entities at any level to reflect new structural changes to the System Platform equipment model hierarchy.
- When the Entity Model Builder encounters an error, the error will be indicated in the progress window and the UCO will remain in the unsynchronized state. It will not be possible to deploy or redeploy the UCO until it is synchronized with the MES database. Additional diagnostic information is also available in the Logger.

## Entity Names

When the Entity Model Builder creates entities, it bases the new entity names on the TagName attribute in the source application object.

From the example above, the Entity Model Builder produces four entities using the TagNames accordingly, with the final entity with the UCO child having the UCO capabilities set.

```
+ Bearing_Plant
  + Assembly_Area
    + Station1
      + AAS_1_SQA_1
```

## Entity Capabilities and Properties Copied to the MES Database

The Entity Model Builder creates new entities with the following configured UCO capabilities or features:

- Scheduling jobs
- Running jobs
- Capturing utilization
- Tracking OEE

The following performance parameter information is extracted from the UCO objects and written to the corresponding entities:

- Target OEE percent
- Target utilization percent

- Target performance percent
- Target quality percent
- Default production rate
- Default production unit of measure
- Default batch size
- Raw reason codes

For each raw reason code in the UCO, the following information is written to the entity.

- Raw reason code
- Default reason code
- Prompt flag
- Set of allowable reasons codes

If a raw reason code is deleted in the UCO, it will be deleted from the entity.

## Building and Deploying an Entity

Once you are finished configuring the UCO, save the UCO and fix any errors that are reported. Depending on the changes you made, you will have to build the entity model.

- If you made a change to a UCO template, you might have to update your entities to cascade your changes to any derived UCO instances. This depends on what you changed and what attributes you may have locked in your template.
- If you made a change to a UCO instance, you will only have to build the entity for the instance.

UCO instances that need to have their corresponding entities built or updated using Entity Model Builder will display an error indicator on the UCO icon in the System Platform IDE.



After you have saved your configured UCO, you can then create or update the corresponding MES entities by building your entity models. See [Creating an Entity in the MES Database from an Application Object with a UCO](#) and [Updating MES Entities with UCO Changes](#).

After you have built or updated the entities, you can deploy your equipment model for run-time operation. For detailed information deploying your galaxy, see the System Platform IDE help.

When you deploy the UCO OnScan, it will begin using the defined UCO configuration for run-time operations. You can configure system parameters, such as default reasons or good and rejected production records in MES

Client application. For more information about configuring system parameters, see *MES Client User Guide* or online help.

## Creating an Entity in the MES Database from an Application Object with a UCO

When you select a UCO or any parent application object in the IDE equipment model tree and run the Entity Model Builder, their parent objects up to and including the area object and their associated properties are replicated in MES.

### To create a new entity

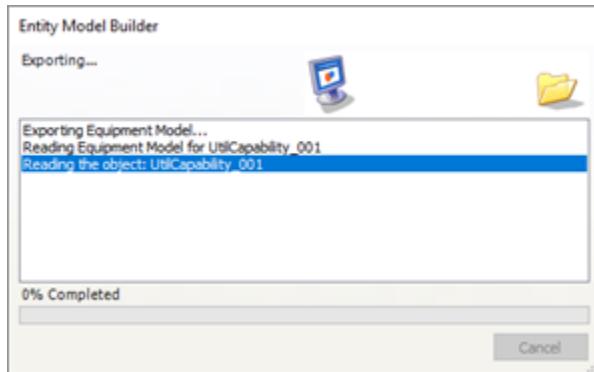
1. To avoid conflicts with other MES applications that are capable of adding or modifying entities, exit any MES applications that are currently running.
2. In the System Platform IDE equipment model, right-click a UCO instance or any of its parent objects and click **Build MES Entity Model**.

---

**Note:** You cannot cancel the entity creation process, so make sure you have selected the right UCO or parent object before continuing.

---

The Entity Model Builder dialog box appears. It displays the status, errors, and percent complete.



---

**Note:** If you have more than one UCO under a single parent application object, the UCO will not be created and an error will be displayed in the progress dialog box.

---

3. When the *100% Completed* message appears, click **Close**.

After the build process has successfully completed, the Entity Model Builder validates the UCO and marks it as being synchronized with MES. You can now deploy the parent application object in the System Platform IDE.

## Updating MES Entities with UCO Changes

You can use the Entity Model Builder to update your MES entities with any of the following changes made to the UCOs in the System Platform IDE:

- Changing the configuration of a UCO.
- Adding a UCO at a higher level in the equipment model.
- Moving a UCO to a higher level in the equipment model (re-parenting).
- Renaming a parent to a UCO at a higher level in the equipment model. This creates a new entity in the MES database and re-parents the old entity's children, if there are any.

- Adding a UCO to the equipment model that has the same name as an entity manually configured using MES Web Portal or MES Client. The existing entity's children (if any) are re-parented.
- Moving a UCO to another parent application object. The old parent is no longer considered an entity (although it still exists in MES). This creates a new entity and parent entities, if needed.

If you remove an entity in your IDE equipment model, the entity is not deleted in MES.

If you have not made any changes to the System Platform equipment model, the Entity Model Builder just checks that the utilization/OEE configuration in the System Platform equipment model also exists in the entity model. If there are any differences, the MES configuration is updated to match the System Platform configuration.

### Swapping the Parent-Child Positions of MES Entity Objects in the Equipment Model

If you are swapping the parent-child positions of MES entity objects in the equipment model that have a UCO object assigned to them (that is, entity\_object\_A was the parent of entity\_object\_B, but now entity\_object\_B is the parent of entity\_object\_A), you must do either of the following in MES Client before running Entity Model Builder:

- Delete the two entities, or
- Move the child entity to another level in the entity hierarchy

### Where to Maintain an Entity's Object Attributes

For MES entities that are created from System Platform objects, changes to the object's attributes are one-directional—that is, from the System Platform IDE to the MES database. There is no mechanism to update the object's attributes if the corresponding entity's properties are changed in the MES database using MES Web Portal or MES Client.

Also, when Entity Model Builder is run, it overwrites the entity's property settings in the MES database with the current object attribute settings. So if you make changes to such an entity's object attributes outside the System Platform IDE equipment model (for example, using MES Web Portal or MES Client), those changes will be overwritten by the Entity Model Builder the next time it is run.

For this reason, once you create an MES entity using an object and Entity Model Builder, you should only maintain the object's attributes in the System Platform IDE.

### UCO Run-Time Behavior

Once you deploy the configured UCO OnScan, you can start evaluating raw reason codes and logging utilization events when the active raw reason code changes.

At run time you can:

- Monitor the raw reason code attributes:
  - RawReasonCode
  - PreviousRawReasonCode
  - RawReasonCodeDefaultReason
  - RawReasonCodeDelay
  - RawReasonCodeDescription

- TimeEntered
- TimeInRawReasonCode
- Monitor for errors using the ErrorCode, ErrorMessage, and Status attributes.
- Reset any error condition using the Reset attribute.
- Enable/disable logging of utilization events to the MES database.
- Monitor current performance parameter values are based on the current shift.

## Production Run-Time Operations

When you deploy the UCO OnScan, it will begin using the defined production attributes. At run time you can:

- Monitor for errors using the ProdAttrs.ErrorCode and ProdAttrs.ErrorMessage attributes.
- Change a production attribute input source or UseInputSource attribute to change how or where it will get its value.
- Set a production attribute value directly if its UseInputSource attribute is False.

When the product start job attribute is triggered (ProdAttrs.StartJobCmd=True), the production attribute values will be used to create a new work order.

Configured production attribute values that do not exist in the MES database, when triggered, will be created based on the properties in the table below.

The meanings of the table columns are:

### Provide default value if blank

Indicates whether a default value will be provided if the production attribute value is left blank.

### Default value

Indicates the default value provided for production attributes when no value is configured.

### Create if doesn't exist

Indicates whether a new MES type will be created with the value specified if it doesn't already exist. For example, if the Item production attribute is set to "SuperWidget" and "SuperWidget" does not currently exist, it will be created when ProdAttrs.StartJobCmd is set True.

### Create new data entry job if changed

Indicates whether a new job will be created if the specified production attribute's value is changed and ProdAttrs.StartJobCmd is set True.

Production Attribute	Provide default value if blank	Default Value	Create if doesn't exist	Create new data entry job if changed
BatchSize	No	N/A	No	Yes
Item	Yes	"Example Item"	Yes	Yes
ItemClass	Yes	"Example Item Class"	Yes	Yes

Production Attribute	Provide default value if blank	Default Value	Create if doesn't exist	Create new data entry job if changed
Operation	Yes	"DefaultOper"	Yes	Yes
Operator	Yes	"__"	No	No
TargetJobProduction Rate	No	N/A	No	Yes
TargetJobProduction RateUoM	No	N/A	No	Yes
WorkOrder	Yes	DefaultWO	Yes	Yes
StartQuantity	No	N/A	No	Yes
RequiredQuantity	No	N/A	No	Yes
ItemUoM	Yes	"Pounds"	Yes	Yes

For the **Operator** attribute value, labor usage data will only be attributed to a valid user. If the user is not a valid user, the default background user will be used to execute the job and no labor will be captured. If the entity is configured to capture labor and a user is not provided for the Operator attribute, no labor records will be added.

None of the production attributes of type STRING have default values during configuration. The values listed are the defaults that will be supplied through system parameters when ProdAttrs.StartJob Cmd is set True if the production attributes are blank. For information about configuring default values, see *MES Client User Guide* or online help.

The triggered work order creation will occur once the product start job command attribute is set (ProdAttrs.StartJobCmd=True).

- If triggered and no production attribute values have changed since the last trigger, no new work order will be created.
- If triggered and a job containing a work order that requires a minimum quantity is running:
  - If the required quantity has been met, a new work order will be created.
  - If the required quantity has not been met, a new work order will not be created, and an error will be returned in the ProdAttrs.ErrorCode and ProdAttrs.ErrorMessage attributes.
- If a UCO creates a new job on an entity that is already running another UCO job, the running job will be completed and its operator will be logged off the entity. The operator associated with the new job will then be logged on to the entity and the new job is started if they are a valid user.
- If another user logs into the entity on which a UCO job is running through operator, that user will not receive labor for the job.

When the production end job attribute is triggered (ProdAttrs.EndJobCmd=True), an unconditional request will be sent to the middleware to end all jobs on the related entity.

Passing a new value to the Item attribute and supplying a WorkOrder value that already exists does not alter the item associated with the existing work order. A new job will be created using the new item and the existing work

order ID, but the work order record itself will still be associated with the original item.

If an error is returned to a call to start or end a job, then the Reset command will need to be called to clear the error message and reset the production attributes primitive to the Ready state.

## Utilization Run-Time Attributes

The UCO includes run-time attributes that are used to display the current active raw reason code as determined by the UCO, the previous raw reason code, the time the entity entered the raw reason code, and the current performance parameters.

In addition, when an equipment raw reason code error condition exists, an error attribute will be set. In most cases errors will go away automatically, such as when the quality of I/O goes bad and later goes good again or the MES middleware communication is lost and then resumed. Other errors might be more serious, requiring the use of the Reset command attribute to get raw reason code evaluation running again.

For a complete list of the run-time attributes, see [UCO Attributes Reference](#).

## UCO Run-Time Deployment and Execution

Once deployed, all objects within System Platform IDE go through states of Startup, On Scan, Execute, and Off Scan. With the UCO, the following functionality happens during these states.

### Startup

- The first MES application object (UCO, OCO, or SRO) to startup will create a stateful client session to the MES middleware. All subsequent objects will retrieve a reference to the session.
- All raw reason code expressions will be compiled.
- If the ProdAttrs.StartJobOnDeploy attribute is set to True, the values of all production attributes will be used and a call to **PrepareProductionAttributes** method will be made to start a new data entry job.

### OnScan

- When the object goes OnScan, the equipment status primitive will go into the default raw reason code. The default raw reason code will appear in the exposed raw reason code attribute. The default raw reason code will be written to the MES database if the Log Utilization Events property is set to True. All attribute references contained in raw reason code expressions will be resolved and set on advise. The quality of the current raw reason code attribute will be set to initializing.
- If the object is starting from a check-pointed raw reason code, it will resume with last known raw reason code until a new raw reason code is determined.
- The input references for production attributes will be resolved and set on advised.

The quality of the raw reason code attribute represents an aggregation of the object's ability to calculate the raw reason code expressions. There is no recording of the quality into the MES database.

### Execute

- During each execution cycle, the equipment status primitive will evaluate each expression associated with a raw reason code to determine if a raw reason code transition has occurred. During evaluation, if any expression encounters an error, the evaluation will stop if ResumeOnError is False and the object will go into an error state. If ResumeOnError is True, the expression with an error will evaluate False and the object will continue with the next expression. Independent of the ResumeOnError setting, the object will reset expression errors and re-evaluate on the next scan cycle.

- When a raw reason code transition occurs, the published attributes for the entity are:
  - The new raw reason code.
  - The raw reason code description.
  - The raw reason code default reason.
  - The time that the raw reason code was entered. Time entered represents the time that the expression was evaluated as True (not the time any configured delay has expired).
  - The length of time the raw reason code has been active. The time in raw reason code attribute will be updated to reflect the elapsed time since the last raw reason code transition.
  - The configured minimum activation time.
  - The previous raw reason code.
  - If the Log Util Events attribute is True, the new raw reason code is logged to the MES database as a new utilization event. Depending on the setting of the system parameter *How to handle raw reason codes when merging utilization events*, the Util\_Log table might have a new event or might modify the existing event.
- When a raw reason code becomes active (its expression is True, its delay has expired, and it is the highest priority of all RRCs), its delay timer will be reset. All other potential raw reason code delay timers will continue.
- Production attributes will be logged (set) if the ProdAttrs.StartJobCmd Trigger attribute is set (True).
- All jobs will be completed if the ProdAttrs.EndJobCmd trigger attribute is set (True).

Though the time entered is stored in as a UTC value in the attribute, some clients such as Object Viewer convert the time value to local time for display purposes.

---

**Note:** Utilization events are logged in the MES database to the nearest second. If two or more events are logged within the same second, only the final event will remain in the database. Note that the application engine scan rate defaults to 500 ms and can be set even lower.

#### OffScan

- The final MES object to go off scan will end the stateful session to the MES middleware
- All attribute references that were put on Advise during OnScan will be Unadvised. The raw reason code attribute will retain its last known raw reason code, and the quality of the raw reason code attribute will be set to Bad.

The quality of the raw reason code attribute represents an aggregation of the object's ability to calculate the raw reason code expressions. There is no feedback of the quality into the MES database.

### How Raw Reason Code Changes and Utilization Event Logging Is Handled

Whenever a raw reason code change occurs, a new utilization event is logged in the database. All utilization event logging uses Without Response mode and Microsoft Message Queuing (MSMQ) so that the utilization events are properly resolved and recorded.

In Without Response mode, the UCO does not receive the notifications about the delivery status of messages for its calls. The MES middleware pulls the event logs from the queue and records them in the MES database. If the middleware detects that more than one event occurred within the same 1-second time slice, the most recent utilization event is logged and the other events that occurred in that 1-second time slice are overwritten. No errors are logged as this is standard behavior of MES. If other errors are encountered while logging an event, such as the entity can no longer capture utilization data or the raw reason code is no longer associated to the entity, then the middleware will log a rejected message to the MES database. These errors will be read by the

UCO later and shown in the Rejected Messages attributes.

To allow a UCO to log messages in the Message Queue while in Without Response mode, an Anonymous Logon user with the Send Message privilege must be added to the MESAsyncQueue on the middleware server. Otherwise, the messages will not be logged. See [Adding an Anonymous Logon User to MESAsyncQueue](#).

## UCO Run-Time Status

The UCO has Status attributes to indicate the current state of the object's primitives (grouping of functionality).

The status initially starts as Ready. The ready state indicates that the object is performing normally and is waiting for a command.

When the UCO is processing a command, the Status goes to Busy while it waits for a response from the MES middleware. While in the Busy state, no other commands will be processed.

If the command processes successfully, the status will go back to Ready. If the command fails, the status will go to Error.

If the UCO is in Without Response mode, then the object does not wait for a response from the MES middleware and immediately transitions back to a ready state. The production attribute commands are executed in With Response mode and will reject commands while in the Busy or Error state. The logging of utilization events is done in Without Response mode and will remain in the Ready state.

## Switching the UCO Between Automatic and Manual Mode to Record Downtime Events

The Log Utilization Events attribute determines if the UCO should log raw reason code transitions to the MES database or not. When True, the UCO will log raw reason code transitions as utilization events to the MES database against the entity (that is, the parent object to the UCO). If the Log Utilization Events attribute is False, the object will continue to evaluate raw reason code transitions and update the object attributes, but it will not log utilization events to the MES database.

When the Log Utilization Events attribute transitions from True to False, the next scan of the object will not log any further raw reason code transitions to the MES database. When the Log Utilization Events attribute transitions from False to True, the next scan of the object will immediately log the current raw reason code as a utilization event to the MES database. The UCO does not require a raw reason code transition to occur; the transition of the Log Utilization Events attribute from False to True will trigger a write to the MES database.

## Resetting Error Attribute Values

During execution of the UCO, the object might encounter an error. Some examples are:

- The quality of the input sources for a Raw Reason Code is not good
- The quality of production attributes are not good
- The MES middleware is not responding
- The MES API call returns an error back to the UCO

Depending on the error, the UCO might transition into an error condition. If it does, the Status attribute will be Error and the appropriate error code and error message will be updated. Once in an error state, the UCO will not accept a new command until the error is cleared.

To clear the Error status, the **Reset** command must be set. This will reset the status to Ready, clear out all error

code and error message properties, and reset all command attributes to False. Certain errors such as bad quality of I/O inputs will log an error to the Logger, but the UCO will remain in a Ready state as these might be temporary issues with the I/O and do not indicate a failure of the UCO.

## How Rejected Messages Are Handled

The object includes a set of RejectedMessages attributes for retrieving, viewing, and acknowledging rejected messages that occur during run time. The rejected messages are stored in the MES database. There is no configuration of the RejectedMessages attributes as these are set by the object.

With the exception of the RejectedMessages.Filter.MaxHours attribute, the RejectedMessage attributes configuration, such as I/O extensions, is not supported on UCO-specific tabs in Object Editor. However, RejectedMessages attributes can be interacted with through scripts, LMX-based read/write operations, Object Viewer, and also through System Platform's I/O extensions on the **Attributes** tab.

## OnScan Behavior

At OnScan, a subscription to rejected message events is established. A filter is applied to specify a representative rejected message dataset. The filter comprises the following attributes.

### RejectedMessages.Filter.Entity

The MES entity by which to filter the rejected messages that will be visible. This will be the object's parent entity. This attribute is auto-set at run time by the UCO. Its value should not be changed to ensure correct retrieval of rejected messages.

### RejectedMessages.Filter.MaxHours

The rejected messages that occurred up to the number of previous hours entered for this attribute will be retrieved.

The range of allowable values is from 1 to 100. However, any values greater than 24 will cause the filter to behave as if the value is 24. This is because, every hour, the UCO resets the Time filter to the previous 24 hours.

### RejectedMessages.Filter.MsgType

The message type by which to filter the rejected messages that will be visible. For example, for a UCO, this filter will be set to raw reason code change events.

### RejectedMessages.Filter.Time

Only rejected messages that are more recent than this time stamp value will be retrieved. At OnScan, the time stamp value is set to the current time. During execution, this time stamp is checked every hour to see whether it is older than 24 hours. If it is, it is reset to ensure that rejected messages older than 24 hours are not retrieved.

A count of the rejected messages that match the filter criteria and a string array of the messages themselves will be available through the RejectedMessages.Count and RejectedMessages.Messages attributes. The RejectedMessages.Messages attribute can hold up to 200 messages. For example, in a 12-hour period, 450 rejected messages might be logged. The RejectedMessages.Count attribute would have a value of 450 but the RejectedMessages.Messages attribute would have only the 200 most recent messages.

The message array is ordered with the most recent message at the top (that is, with the first index value). Time stamps are in the object's local time.

## Rejected Message Retrieval Failures

If the rejected message retrieval fails, the RejectedMessages.Status attribute value changes from Ready to Error.

Also, an error code (`RejectedMessages.ErrorCode`) and error message (`RejectedMessages.ErrorMessage`) are returned.

The error codes are:

- -100, which indicates a communication error or MES middleware exception.
- -1, which indicates an unknown error.

The `RejectedMessages.ResetCmd` is used to clear the error condition. The reset command:

- Clears the `ErrorCode` and `ErrorMessage` attributes.
- Sets the `Status` attribute to Ready.
- Re-subscribes if the subscription has become invalid due to the error.

## Acknowledging Rejected Messages and Resetting the Subscription

The `RejectedMessages.AckRejectedMessagesCmd` command attribute is used to acknowledge the rejected messages and clear them.

Setting this command to True acknowledges that the currently visible rejected messages have been viewed. The active rejected message subscription is removed and a new one is established. Also, the time stamp filter is set to the current time, effectively clearing any previous rejected messages.

## Failover Behavior

On failover to a redundant engine, the most recent `RejectedMessages.Filters.Time` value is retained and used when the new subscription is established from the redundant engine. The `RejectedMessages.Filters.Entity` and `RejectedMessages.Filters.MsgType` attributes will be set to their default values. This will cause the rejected message dataset that was current at the time of the failure to be retrieved.

## OffScan and Shutdown Behavior

At OffScan or Shutdown, the rejected message subscription is removed.

## Alarms and History

Rejected message alarm or history configuration is not supported for the object on the object-specific tabs in Object Editor. However, alarms and history can be configured for any of the attributes on the **Attributes** tab.

## Column Structure of a Rejected Message

The column structure and order of a message in the `RejectedMessages.Messages` array is provided here to allow you to set up processing of rejected messages. The message in the array is formatted in JSON.

- The timestamp of the rejected message in the local time where the object is running
- The XML error message returned by the MES middleware
- The XML message that was originally submitted

- The timestamp of the rejected message, in UTC
- The status of the rejected message after originally being submitted to the MES database:
  - 0 = Never submitted before
  - 1 = Resubmitted with error
  - 2 = Resubmitted with success
  - 3 = Edited and resubmitted with error
  - 4 = Edited and resubmitted with success
- The name of the object that submitted the original message
- The name of the object section from where the message was initiated
- The region from where the original message was initiated
- The message locale
- The message version
- A comment about the last edit made to the rejected message record, if one was provided
- Who last edited the rejected message record
- When the rejected message was initially logged or last edited
- The row ID of the rejected message record

An example message is shown below.

```
[{"rejected_message_local": "2015-10-09 4:14:21 pm",  
 "xml_error_message": "A row does not exist in util_exec for this entity{3243}",  
 "xml_message": "<?xml version='1.0'?><request><object>util_exec</object>  
<msgtype>exec</msgtype><cmd>setrawreasonbyname</cmd><session_id>29</session_id>  
<ent_name>Roaster</ent_name><raw_reas_cd>Idle</raw_reas_cd>  
<new_reas_start_utc>10/9/2015 11:14:21 PM</new_reas_start_utc>  
<comments></comments></request>",  
 "rejected_message_utc": "2015-10-09T23:14:21", "message_status": 0,  
 "object_name": "Roaster", "object_section": null,  
 "message_region": "Pacific Standard Time", "message_locale": "en-US", "message_version": 1,  
 "last_edit_comment": null, "last_edit_by": "oneuser",  
 "last_edit_at": "2015-10-09 11:14:21 pm", "row_id": 18}]
```

## Viewing and Managing Rejected Messages in MES Client

In addition to being exposed in the RejectedMessages attributes and viewable in Object Viewer, rejected messages can be viewed on the Rejected Message Viewer in MES Client. MES Client users with appropriate privileges can also edit, resubmit, and delete rejected messages. For more information, see the *MES Client User User Guide* or online help.

## Effect of Stopping and Restarting the Middleware Connection When the UCO Is Deployed

If the UCO is deployed and the MES middleware is stopped, an error will eventually be logged indicating that communication with the middleware has been lost. When the middleware is running again, the UCO will automatically clear any of the communication errors that were logged and reestablish communication with the middleware.

## Background User

Any communication between the MES object and the MES database is routed through the MES middleware. The MES middleware uses a connection string to connect to the MES database.

Whenever an MES user logs on to an application to start a session, the ID of the user is stored in the Session table in the MES database. The Session table contains the user\_id column that identifies the user who started the session.

All the MES objects share a common session with the MES middleware.

The user ID available in the Session table is Null for the MES object. So, the system associates the default user that is configured as a system attribute with a transaction.

The default user configured in the system can be non-MES user.

## Troubleshooting

The following topics provide information on how to troubleshoot UCO issues.

### UCO Error Codes

The error codes that might occur while working with the UCO objects are described in the following table. The error codes are stored in the ErrorCode attribute.

If a command generates a warning message, the ErrorCode attribute value remains 0 and the ErrorMessage attribute shows the warning text.

Error Code	Description
500	The command input source quality is not good.
0	No error.
-1	An unknown error. The error message contains the detailed information. Errors reported as unknown errors can include errors during initialization of the expression compiler, compilation of expressions, loading of raw reason code expressions, and updating of OEE values.
-100	The connection to the MES middleware was lost.
-101	An error occurred while starting the MES client session.
-102	An error occurred while closing the MES client session.
-103	The MES database is not available.
-111	An expression evaluation error occurred.
-112	An error occurred when setting a raw reason

Error Code	Description
	exception.
-121	The entity name specified by an object container does not exist.
-152	An error occurred during a Start Job command. This indicates that the MES system cannot process the request to start a job.
-154	An error occurred during a End Job command. This indicates that the MES system cannot process a request to stop a job.

## UCO Configuration Not Available When the MES Middleware Is Down

The MES middleware must be running so that the System Platform IDE can connect to the MES database during UCO configuration time. If the MES middleware is down, the UCO configuration tabs will not be shown in Object Editor to prevent attempts at making UCO configuration changes.

## UCO Attributes Reference

The following table describes both the configuration and run time UCO attributes.

The following attributes are not included in the table:

- Attributes that are common to all objects are not included in the table. For information about common attributes, see the Attributes Help. To access this help, click the Object Editor Help button. Then, in the Object Help window, click the **Attributes Help** link.
- Hidden attributes. Hidden attribute names are prefixed with an underscore (\_) and might be visible within certain applications, such as the Object Viewer. Hidden attributes are generally used for internal System Platform functionality and should be ignored.

### Table Legend

The **Config** column specifies whether the attribute can be configured using an option in the object editor.

The **RT Access** column describes how the attribute value can be accessed at run time. The possible values are:

#### **Supervisory**

The attribute value can be changed using a script.

#### **User**

The attribute value can be modified by a user.

#### **Read-Only**

The attribute value cannot be changed.

#### **None**

The primitive is being deployed; however, the attribute is not deployed at run time.

### UCO Attribute Reference Table

Attribute	Description	Config	RT Access
BatchSize	<p>The BatchSize that is currently associated with the Entity. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.</p> <p>Value must be greater than 0.</p>	Yes	Supervisory User
CurrentOEEPercent	Displays the current OEE percent value.	No	Read-Only
CurrentPerformancePercent	Displays the current performance percent value.	No	Read-Only
CurrentQualityPercent	Displays the current quality percent value.	No	Read-Only
CurrentUtilizationPercent	Displays the current utilization percent value.	No	Read-Only
DefaultProductionBatchSize	<p>This value is used by the Entity Model Builder to configure the entity's default batch size.</p> <p>Default = 1</p>	Yes	Read-Only
DefaultProductionRate	<p>This value will be used by the Entity Model Builder to configure entity default production rate.</p> <p>The value must be greater than 0.</p>	Yes	Read-Only

Attribute	Description	Config	RT Access
DefaultProductionRateUoM	<p>This attribute will be used by the Entity Model Builder to configure entities. The possible values for this selectable drop-down list are:</p> <ul style="list-style-type: none"> <li>• hours/batch (default)</li> <li>• minutes/batch</li> <li>• seconds/batch</li> <li>• batches/hour</li> <li>• batches/minute</li> <li>• batches/second</li> </ul>	Yes	Read-Only
EnableProductionAttributes	<p>Determines if the production attribute primitive should be created.</p> <p>If set to True (checked) the Production Attribute primitive will be added.</p> <p>If set to False (unchecked) the Production Attributes primitive will be deleted.</p> <p>Default = False (unchecked).</p>	Yes	Read-Only
ErrorCode	Displays an integer value that represents an error that has occurred. A value of 0 indicates no error.	No	Read-Only
ProdAttrs.ErrorCode			
RejectedMessages.ErrorCode	This value is set in conjunction with the error message (ErrorMessage).		
ErrorMessage	Displays readable text indicating an error has occurred. This value is set in conjunction with the error code (ErrorCode).	No	Read-Only
ProdAttrs.Error Message			
RejectedMessages.ErrorMessage			
InError.Condition	<p>When an error occurs this attribute is set to True.</p> <p>Will change to False when</p>	No	Read-Only

Attribute	Description	Config	RT Access
it is no longer in error.			
InputSource <PAName>.InputSource	<p>Displays the reference of the attribute you want to input for the value of the production attribute.</p> <p>Whenever the production attribute input source changes the SetHandler is used in resolving the full tagname of the input reference.</p>	Yes	Supervisory User
Item	<p>The Item that is currently associated with the Entity. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.</p>	Yes	Supervisory User
ItemClass	<p>The ItemClass that is currently associated with the Entity. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.</p> <p>When a ItemClass is specified in the UCO, but does not match the configured ItemClass in the database, the configured ItemClass in the database will be used (the UCO configured ItemClass ignored) and a warning message is logged stating, <i>ItemClass specified is different from the existing ItemClass for this item - ignoring ItemClass specified.</i></p>	Yes	Supervisory User

Attribute	Description	Config	RT Access
ItemUOM	<p>Item. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.</p> <p>When a ItemUoM is specified in the UCO, but does not match the configured ItemUoM in the database, the configured ItemUoM in the database will be used (the UCO configured ItemUoM ignored) and a warning message is logged stating, "Item UOM specified is different from the existing ItemUOM for this item - ignoring item UOM specified."</p>	Yes	Supervisory User
LogUtilEvents	<p>Allows for stopping the UCO from logging utilization events so that the events can be entered manually by an operator using a .NET controls-based UI (such as MES Operator or a custom UI) or using MES Web Portal.</p> <p>If True, the UCO will automatically log utilization events.</p> <p>If False, the UCO will stop logging utilization events. Utilization events can be logged manually. However, the UCO continues to evaluate raw reason codes and updates the object properties accordingly.</p>	Yes	Supervisory User

Attribute	Description	Config	RT Access
Operation	Along with the WorkOrder attribute, defines the job to be created when the <b>Start Job</b> command is triggered. If left blank, the the default operation from the system parameter will be used.	Yes	Supervisory User
Operator	The Operator that is currently associated with the Entity. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.	Yes	Supervisory User
PreviousRawReason Code	Displays the name of the previous active raw reason code.	No	Read-Only

Attribute	Description	Config	RT Access
ProdAttrs.EndJobCmd	<p>This command is available when you select the <b>Enable Production Attributes</b> check box in the Object Editor. Is used to end all running jobs on the related entity. When set to True it will trigger the MES middleware to do EndAllJobs on the related entity. This database request will be executed at the start of the next execution cycle.</p> <p>Default value = False</p> <p>The following rules apply:</p> <ul style="list-style-type: none"> <li>• If set to True while another request is in progress, the set will be rejected. Request is a call to the middleware in order to start (data entry job) or end a job.</li> <li>• Set to False will be ignored since the actual runtime routine will take care to reset it to False once the request completes.</li> <li>• The ErrorMessage and ErrorCode attributes will reflect exceptions (only) raised by the middleware and will indicate the actual request (PrepareProductionAttributes or EndAllJobs)</li> <li>• The ErrorMessage and ErrorCode are reset</li> </ul>	No	Supervisory User

Attribute	Description	Config	RT Access
	<p>any time either one of these attributes is set to True.</p> <ul style="list-style-type: none"><li>• Informational (warning messages) will be logged to the Logger in case that some unusual behavior was encountered while completing the request.</li></ul>		
ProdAttrs.ResetCmd	If an error has occurred during a job command execution, resets the job commands and clears the error.	No	Supervisory User
ProdAttrs.StartJob Cmd	This command is available when you select the <b>Enable Production Attributes</b> check box in the Object Editor. Is used to start a new data entry	No	Supervisory User

Attribute	Description	Config	RT Access
	<p>job. When set to True, the names and values of the configured production attributes will be marked to be logged to the MESDB at the start of the next execution cycle.</p> <p>Default value = False</p> <p>The following rules apply:</p> <ul style="list-style-type: none"><li>• If set to True while another request is in progress, the set will be rejected. Request is a call to the middleware in order to start (data entry job) or end a job.</li><li>• Set to False will be ignored since the actual runtime routine will take care to reset it to False once the request completes.</li><li>• The ErrorMessage and ErrorCode attributes will reflect exceptions (only) raised by the middleware and will indicate the actual request (PrepareProductionAttributes or EndAllJobs)</li><li>• The ErrorMessage and ErrorCode are reset any time either one of these attributes is set to True.</li><li>• Informational (warning messages) will be logged to the Logger in case that</li></ul>		

Attribute	Description	Config	RT Access
	some unusual behavior was encountered while completing the request.		
ProdAttrs.StartJobOn Deploy	This command is available when you select the <b>Enable Production Attributes</b> check box in the Object Editor. When set to True, on deploy, the object will automatically handle starting a new data entry job. This attribute can only be set at config time.  Default = False	Yes	Read-Only
RawReasonCode	Used to display the name of the selected active raw reason code.	No	Read-Only
RawReasonCode DefaultReason	Displays the default reason for the current active raw reason code.	No	Read-Only
RawReasonCode Delay	Displays the minimum time before activation for the current active raw reason code.	No	Read-Only
RawReasonCode Description	Displays the description of the current active raw reason code.	No	Read-Only
ReadStatus <PAName>.ReadStatus	The status of the Input using the reference stored in <PAName>.InputSource.	No	Read-Only

Attribute	Description	Config	RT Access
RejectedMessages.AckRejectedMessagesCmd	If True, acknowledges that the rejected messages have been viewed. The active rejected message subscription is removed and a new one is established. Also, the time stamp filter is set to the current time, effectively clearing any previous rejected messages. The command value is automatically toggled back to False.	No	Supervisor User
RejectedMessages.Count	The number of rejected messages that match the current filter attribute values.	No	Read-Only
RejectedMessages.Filter.Entity	The MES entity by which to filter the rejected messages that will be retrieved. This will be the object's parent entity.  This attribute is auto-set at run time by the UCO. Its value should not be changed to ensure correct retrieval of rejected messages.	No	Read-Only
RejectedMessages.Filter.MaxHours	The rejected messages that occurred up to the number of previous hours entered for this attribute will be retrieved.  The range of values is 1 to 100. The default is 100. However, any values greater than 24 will cause the filter to behave as if the value is 24. This is because, every hour, the UCO resets the Time filter to the previous 24 hours.	No	Read-Only

Attribute	Description	Config	RT Access
RejectedMessages.Filter.MsgType	The message type by which to filter the rejected messages that will be retrieved. For example, for a UCO, this filter will be set to raw reason code change events.	No	Read-Only
RejectedMessages.Filter.Time	Only rejected messages that are more recent than this time stamp value will be retrieved. At OnScan, the time stamp value is set to the current time. During execution, this time stamp is checked to see whether it is older than 24 hours. If it is, it is reset to ensure that rejected messages older than 24 hours are not retrieved.	No	Supervisor User
RejectedMessages.Messages	The string array of the rejected messages that match the current filter attribute values. The array is ordered with the most recent message at the top (that is, with the first index value). Time stamps are in the object's local time.	No	Read-Only
RejectedMessages.ResetCmd	Used to clear a rejected messages retrieval error condition. The command does the following: <ul style="list-style-type: none"> <li>• Clears the ErrorCode and ErrorMessage attributes.</li> <li>• Sets the Status attribute to Ready.</li> <li>• Re-subscribes to</li> </ul>	No	Supervisor User

Attribute	Description	Config	RT Access
	rejected message events if the subscription has become invalid due to the error.		
RequiredQuantity	The RequiredQuantity that is currently associated with the Entity. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.  Value must be greater than or equal to 0.	Yes	Supervisory User
Reset	<u><b>Note:</b></u> In this version of the UCO, the <b>Reset</b> command is not available.	No	Supervisory User
ResumeOnError	Determines whether raw reason code expression errors are ignored at runtime. Default = False (unchecked).  If False, and an error/warning occurs when evaluating a raw reason code's expression, no more raw reason code expressions will be evaluated until the next scan.  If True (checked), the error/warning will be ignored and the raw reason code's expression will evaluate to False.	Yes	Supervisory User
Spare1 Spare2 Spare3	These four spare attributes can be used for additional context when	Yes	Supervisory User

Attribute	Description	Config	RT Access
Spare4	logging utilization events at run time. The user can configure the security classification for each spare in the object editor.		
StartQuantity	The StartQuantity that is currently associated with the Entity. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.  Value must be greater than or equal to 0.	Yes	Supervisory User
Status  RejectedMessages. Status	Displays the current status of the UCO. If the status is in error the user must fix the error and set the reset attribute to True.  More information about what caused the status error can be retrieved from the ErrorMessage attribute.	No	Read-Only
TargetJobProdRate	The TargetJobProdRate that is currently associated with the entity. Quality is calculated when input source is used. Quality will be Bad if unable to read from the input source.  Value must be greater than 0.	Yes	Supervisory User
TargetJobProdRateUoM	The Target Job Production Rate Unit of Measure value must be one of the following predefined values:  • hours/batch	Yes	Supervisory User

Attribute	Description	Config	RT Access
	<ul style="list-style-type: none"> <li>• minutes/batch</li> <li>• seconds/batch</li> <li>• batches/hour</li> <li>• batches/minute</li> <li>• batches/second</li> </ul> <p>If the TargetJobProdRateUoM attribute uses an InputSource to retrieve the value the string value must match exactly, or the ordinal value must be between 1 and 6.</p> <p>If the string value cannot be coerced into one of the six predefined values, or if the ordinal value is less than 1 or greater than 6, the TargetJobProdRateUoM quality will be set to Bad, and the Job will not be able to be started from that UCO instance.</p>		
TargetOEEPercent	<p>This value will be used by the Entity Model Builder to configure entity target OEE percentage. Value must be 0 to 100 percent in decimal form.</p> <p>Default = 0.0.</p>	Yes	Read-Only
TargetPerformancePercent	<p>This value will be used by the Entity Model Builder to configure entity target performance percentage. Value must be 0 to 100 percent in decimal form.</p> <p>Default = 0.0.</p>	Yes	Read-Only

Attribute	Description	Config	RT Access
TargetQualityPercent	This value will be used by the Entity Model Builder to configure entity target quality percentage. Value must be 0 to 100 percent in decimal form.  Default = 0.0.	Yes	Read-Only
TargetUtilizationPercent	This value will be used by the Entity Model Builder to configure entity target utilization percentage. Value must be 0 to 100 percent in decimal form.  Default = 0.0.	Yes	Read-Only
TimeEntered	Displays the UTC time that current active raw reason code changed.  For raw reason codes for which a minimum time before activation has been set, the TimeEntered is the same as the time at which the raw reason code became active.  Some clients such as Object Viewer might convert the time to local for display purposes.	No	Read-Only
TimeInRawReasonCode	Displays the total time the current raw reason code has been active. This is the amount of time from the TimeEntered value and the current time.	No	Read-Only
UseInputSource <PAName> .UseInputSource	If set to True, the production attribute will be set to the input value every scan cycle and the input source reference is used to retrieve the production attribute value.	Yes	Supervisory User

Attribute	Description	Config	RT Access
	If set to False (the default), the user will be expected to set the attribute value since the input source reference is not being used.		
UtilOEEDataRefreshRate	<p>Sets the rate in which utilization and OEE data will be refreshed in the UCO.</p> <p>While this sets the rate at which the UCO will poll for new data, no new data may be available.</p> <p>The minimum value is 15 seconds.</p> <p>The default value is 00:01:00.0000000 (1 min).</p>	Yes	Supervisory User
WorkOrder	Along with the Operation attribute, defines the job to be created when the <b>Start Job</b> command is triggered. If left blank, the the default work order from the system parameter will be used.	Yes	Supervisory User

## Operations Capability Object

Use the Operations Capability Object (OCO) to configure MES entities to perform the following tasks:

- Start, stop, and run jobs
- Record the amount of material that is produced or consumed while executing a job
- Store and transfer inventory items
- Load, upload, and download job specifications

## Getting Started with the OCO

The Operations Capability Object (OCO) is a System Platform automation object that allows you to configure Manufacturing Execution System (MES) entities to perform the following tasks:

- Start, stop, and run jobs
- Record the amount of material that is produced or consumed while executing a job
- Store and transfer inventory items
- Load, upload, and download job specifications

A single instance of OCO can also support all Production Events Module (PEM) events for its associated equipment within the equipment model. This includes material events related to material consumption, material production, and material movement, as well as status events related to equipment, production data, and personnel.

## The OCO, the System Platform Equipment Model, and MES Entities

The OCO adds MES capabilities to the equipment-oriented application objects in your System Platform IDE equipment model. By adding an OCO instance below another application object instance in your equipment model, you are able to map and configure the System Platform IDE equipment model to the MES entity model.

Exporting the configured OCO instance into MES using the Entity Model Builder will create entities that are represented in your equipment model. These entities can be used to perform different operations as per the information configured in the OCO. Exporting OCOs to the MES database also provides an automated alternative to manually creating and configuring the entities in MES Web Portal or MES Client.

## OCO Templates and Instances

You can create derived templates and instances in your System Platform IDE equipment model.

When you configure any information in a derived OCO template in the System Platform IDE, the configured information is automatically propagated to all the child instances of the OCO template. This saves you time in configuring the same information for different entities to execute similar jobs or store similar items.

If you modify an OCO instance directly or indirectly through a template, an invalid indicator  appears adjacent to the OCO icon in the System Platform IDE, which indicates that the OCO object is not synchronized with the MES database. You must run the Entity Model Builder to update the entity in the MES database as per the changes in the OCO instance.

You must deploy the System Platform IDE equipment model to use the updated entity at run time. You must also deploy the OCO OnScan to use the defined OCO configurations at run time.

For more information about derived templates and instances, and managing System Platform objects, see the System Platform IDE help.

For more information about building and deploying MES entities from OCOs, see [Building the MES Entity Model from OCOs](#).

For information about the run-time behavior of the OCO, see [OCO Run-Time Behavior](#).

## Importing the OCO Package into the System Platform IDE

Installation of the OCO requires a separate import operation in System Platform IDE after you have completed the MES installation.

## System Requirements

- All MES application objects—OCO, SRO, and UCO—must be at the same version; otherwise, incompatibility errors will occur.
- The Entity Model Builder must be installed. This can be installed during an MES installation with the Client applications.
- The Entity Model Builder requires that the MES middleware proxy be installed if the MES middleware is not installed on the local node.
- To utilize certain features of the OCO, you need to be able to access the MES database through the MES middleware. If the MES middleware is not installed on the same node where you are using the OCO, you must have the middleware proxy installed to establish a connection with the database.

For information on setting up or installing the middleware proxy, see the *MES Installation Guide* or online help.

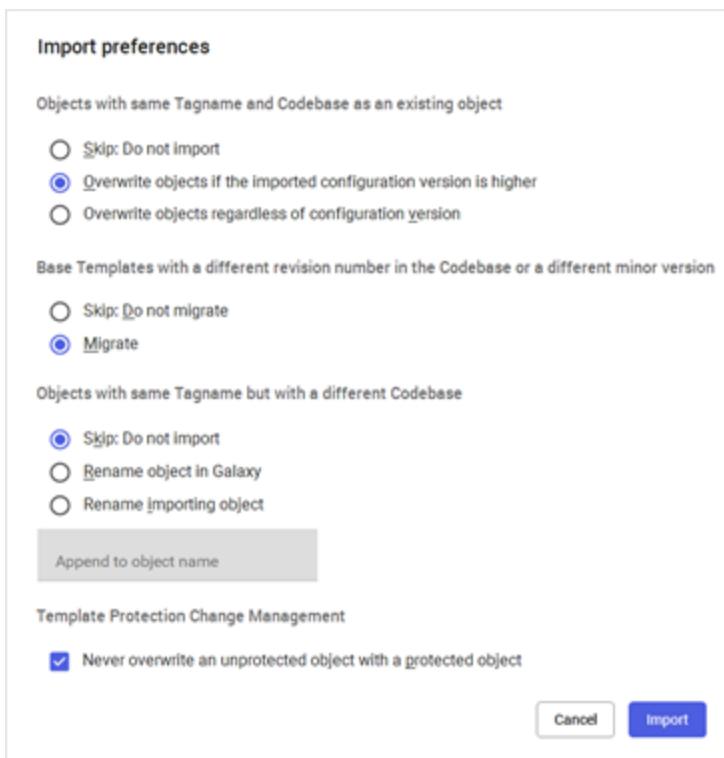
## Importing the OCO Package

1. From the System Platform IDE ribbon, select **Galaxy**, then **Import**.
2. Select **Objects**, then **From package**.

The Import Objects from package dialog appears.

3. Browse for the OCO package file (**OperationsCapability.aaPKG**) located either on your hard drive or on your MES installation disc.
  - If you used the default folder destination during the MES installation, the package file is stored in the **C:\ProgramFiles (x86)\Wonderware\MES\AppObjects** directory.
  - The OCO package file can also be found on the installation disc in the **\MES\AppObjects** directory.
4. Select the file and click **Open**.

The Import Preferences dialog appears.



5. Select the appropriate import settings.

The OCO is considered a base template. Select whether to migrate (the default) or skip the installation if an existing OCO base template is in the galaxy.

6. Click **OK**.

The import process starts.

If the import process completes successfully, the \$OperationsCapability base template object is available under the Production template toolset.

## Upgrading the OCO from Previous Versions

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**Note:** If you are upgrading MES application objects to the current version of MES, the version you are upgrading from must be MES 2012 (version 4.5) or later. If your version of MES is at a version prior to version 4.5, you must first upgrade it to version 4.5.

When MES is updated from a previous version, you must import the new OCO into the System Platform IDE. Each version of the OCO is compatible with the MES version with which the OCO was shipped.

1. Undeploy any System Platform galaxies that have OCO instances before installing the new version of MES. This ensures that the System Platform IDE is disconnected from the MES database and any MES components.
2. After installing the new version of MES, import the new version of the OCO with the **Migrate** option selected so that all existing templates and instances will be updated.
3. Before deploying the objects, make sure that all MES application objects—OCO, SRO, and UCO—are at the same version and that their existing templates and instances have been migrated. Otherwise, incompatibility errors will occur.

## Configuring OCO Templates and Instances

The OCO is managed like other System Platform application objects. The OCO supports creating derived templates and instances as needed for placement into your System Platform IDE equipment model.

For more information on managing System Platform objects, see the System Platform IDE help.

### OCOs, the System Platform Equipment Model, and MES Entity Hierarchy

In the System Platform IDE Model View, you can add an OCO below any application object or system area object that you want to create in MES as an entity with MES operations capabilities.

When you place the OCO object as a child to an application or area object in the System Platform equipment model and then run the Entity Model Builder, an entity is created in the MES database for the OCO's parent object. Additional parent entities are created in the MES database as needed to replicate that object's branch of the equipment model in MES.

**Note:** You can add the OCO as a child under application or area objects only. If you add the OCO as a child under any other object such as an engine, the OCO does not work properly. An application or area object can contain only one OCO object as a child.

## OCO Configuration

When configuring OCO templates and instances, you define operation and production attributes and commands for objects that will be entities in the MES database.

When you open an OCO template or instance for editing in the System Platform IDE Object Editor, the following tabs include the OCO-specific object attributes and commands:

### General

Job execution and other entity capability settings, and the event response type setting. Selecting the entity capability options makes the other OCO-specific tabs visible in Object Editor.

### Job Defaults

Default property attributes for an entity with restrictions to control the behavior of jobs that are running on the entity.

### Job Execution

Attributes for specifying the details of a job to be run on an entity, such as the work order and operation IDs, and commands to specify the action to be performed on the entity when the job is run.

### Create Job Attributes

Job attributes and triggering commands for creating a job or work order from an existing process.

### Production Counters

Attributes for specifying counters to track the production of items at entities.

### Consumption Counters

Attributes for specifying counters to track the consumption of items at entities.

### Storage Execution

Attributes for specifying how to store items that are produced or consumed while executing a job.

### Inventory Transfer

Attributes and commands for specifying how to receive items at an entity or to transfer items between entities.

### Specifications

Attributes and commands for configuring and executing job specifications that have been created in the MES database using MES Client.

### PEM Attributes

Attributes and commands for using the Production Events Module (PEM) functionality in the OCO to monitor, report, and analyze production history and genealogy for lots, batches, and serial numbers without having to define the full MES model.

## OCO Attribute Inheritance and Planning the Templates and Instances

You can inherit the attribute values of an OCO template or instance to another OCO instance for the following tabs in the System Platform Object Editor:

- Production Counter
- Consumption Counter
- PEM Attributes
- Specifications

You cannot modify the inherited attribute values.

The name of the OCO instance from which the attribute values are inherited appears in the corresponding **Inherited Instance/Operation Name** section.

When you inherit the attribute values of an OCO instance in the Object Editor, the following check boxes corresponding to the inherited functionalities are disabled in the **General** tab:

- Enable Production Counters
- Enable Consumption Counters
- Enable PEM Attributes
- Enable Specifications

For more information about inheriting attribute values, see the System Platform IDE help.

## Configuring OCO Templates

You can configure OCO templates in the System Platform IDE. You can configure a OCO template in a similar way that you configure other object templates in the System Platform IDE.

### To configure an OCO template

1. Open the appropriate galaxy in the System Platform IDE.
2. In the **Template Toolbox** pane, right-click the required base OCO template, and then click **Derived Template**.  
The derived OCO template is created and appears under the base OCO template.  
You can rename the derived OCO template.
3. In the **Template Toolbox** pane, place the derived OCO template under a user-defined template that represents an entity.

4. Right-click the OCO template and click **Open**.

The **General** tab appears in the Object Editor.

5. Configure the attributes in the **General** tab.

When you select check boxes in the **General** tab, the appropriate OCO tabs appear in the Object Editor.

You can configure the OCO attributes available on these tabs. For information about configuring **General** tab attributes and viewing other tabs, see [Configuring General OCO Attributes](#).

6. Save the template after configuring the required information.

7. When you have created the required templates, you are ready to create instances to add to application objects in the System Platform model. See [Adding OCO Instances to System Platform Objects](#).

## Specifying an Attribute and Command Value or Input Source

You can either enter a value for an attribute or command, or specify an input source.

### To enter a value

1. Clear the attribute or command's **Use Input Source** check box.
2. Enter or select the value to be used in the **Value or Input Source** field.



### To specify an input source

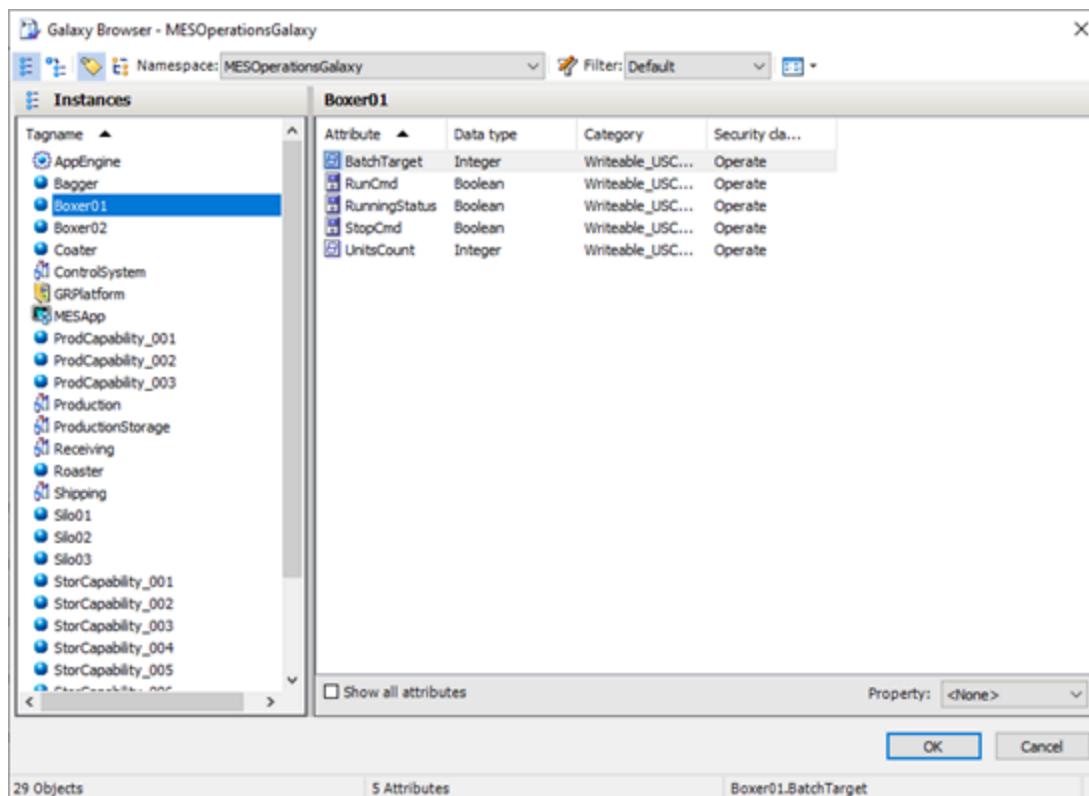
1. Select the attribute or command's **Use Input Source** check box.

The control in the **Value or Input Source** column becomes a box with the default input source, `MyContainer.<AttributeOrCommand>`, automatically entered.



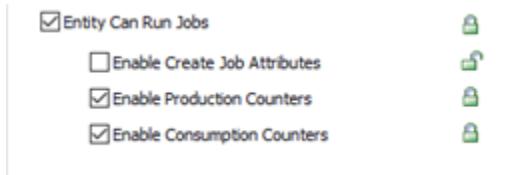
2. To change the default entry, do one of the following:

- Manually edit the input source entry.
- Click the attribute's Browse button. In the **Galaxy Browser** dialog box that appears, select the object and its attribute that is the input source.



## Locking OCO Attributes

As you configure the OCO templates, you can lock and unlock specific attribute settings by clicking the attribute's Lock icon. These locked attributes can only be updated by modifying the original template and redeploying it.



You can choose not to lock some of your template attributes so you can configure specific attribute settings for child instances of the template that are assigned to objects in your equipment model.

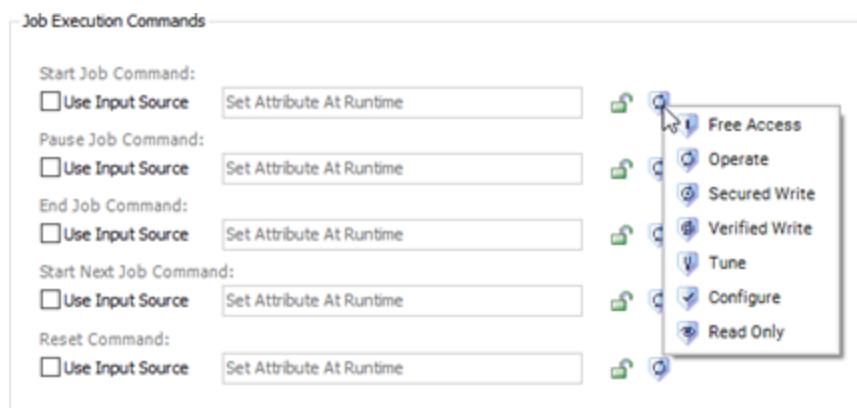
For more detailed information on attribute locks, see the System Platform IDE help.

## Attribute Security Settings

Many of the OCO attributes include a security classification setting, as indicated by the Security icon. You can set the security classification setting of these OCO attributes during configuration.

### To set attribute security

- Right-click on the security icon and select the appropriate security option.



For detailed information on managing attribute security, see the System Platform IDE help.

## Bad Quality Attributes in the OCO

When an OCO command is triggered and before the message is sent to the MES middleware, the OCO checks each attribute to be sent in the message for quality. If the quality for all of the attributes is Good, the data is sent to the middleware. If any of the attributes' quality is Bad, a warning message is logged in the Logger and the command is aborted. The trigger for the particular function in the OCO is not reset; you must manually reset the object before the object is ready to be triggered again (see [Resetting the Object to Clear an Error Condition](#)).

An example warning message is:

*The quality of this attribute: 'WorkOrder', Object:OCO\_001, Entity:Machine\_01 is not good to process the requested command.*

In this scenario, no data is written and the ErrorCode and ErrorMessage attributes are not updated.

## Resetting the Object to Clear an Error Condition

The Reset command is used to clear the current error code and error messages, and to change the object's status to Ready in the object context. This command applies to all the functions within the OCO object where the reset capability is available (for example, production, consumption, creating jobs, PEM, and so on).

When this command is triggered, it resets the status and error attributes that belong to the same primitive namespace as the reset attribute.

For example, a production counter is called GoodProd that has the following attributes (not all attributes are included for this example):

```
JobExec.JobPos0.Prod.GoodProd.ErrorCode  
JobExec.JobPos0.Prod.GoodProd.ErrorMessage  
JobExec.JobPos0.Prod.GoodProd.Status  
JobExec.JobPos0.Prod.GoodProd.ResetCmd
```

When the Reset command is triggered in the GoodProd context, the error code in the JobExec.JobPos0.Prod.GoodProd.ErrorCode attribute and the error message in the JobExec.JobPos0.Prod.GoodProd.ErrorMessage attribute are cleared, and the status in the JobExec.JobPos0.Prod.GoodProd.Status attribute is set to Ready.

If the Reset command is triggered when the object context is in the Busy state, then the reset is ignored and the error code, error message, and the status is left unchanged.

## Configuring General OCO Attributes

In Object Editor, the OCO **General** tab includes attributes that allow an entity to perform certain actions, such as creating jobs for this entity, capturing production and consumption counts, storing items, and so on.

For information about the attributes available at run time, see [General Attributes Available at Run Time](#).

### Job Execution Capabilities

The **Job Execution** attributes allow you to assign job execution capabilities to the entity.

#### Entity Can Run Jobs

Selecting this option enables an entity to run jobs that are created using the OCO. It also makes the **Job Defaults** and **Job Execution** tabs visible in Object Editor, allowing you to configure job default and execution attributes. If this check box is not selected, the job execution capability will not be enabled for this instance of the OCO when you run the Entity Model Builder.

If an OCO object co-exists with the UCO object, the entity is automatically made capable of running jobs, regardless of whether this entity is explicitly configured to run jobs or not.

#### Enable Create Job Attributes

Selecting this option makes the **Create Job Attributes** tab visible in Object Editor, allowing you to configure attributes for creating jobs.

#### Enable Production Counters

Selecting this option makes the **Production Counters** tab visible in Object Editor, allowing you to configure production counters to track the production of items at entities.

#### Enable Consumption Counters

Selecting this option makes the **Consumption Counters** tab visible in Object Editor, allowing you to configure consumption counters to track the consumption of items at entities.

### Miscellaneous Attributes

The **Miscellaneous** attributes allow you to add additional capabilities to an entity.

#### Entity Can Store Items

Specifies whether the entity can store items for tracking inventory.

- If selected, **Storage Execution** and **Inventory Transfer** tabs appear in the Object Editor, allowing you to configure the storage execution and inventory transfer attributes. For more information, see [Configuring Storage Execution and Managing Inventory Transfer](#).
- If not selected, the entity cannot store items. When an entity is designated not to store items and track inventory, it cannot store items and track inventory outside the OCO as well.

#### Entity Can Schedule Jobs

Specifies whether the entity can schedule jobs.

If selected, jobs can be scheduled and assigned to the entity, and a work queue will be maintained.

#### Enable Specifications

Specifies whether the entity can support the use of specifications.

- If selected, the **Specifications** tab appears in the Object Editor, allowing you to manage the specification

attributes. For more information, see [Managing Specifications](#).

- If not selected, you cannot use specification values on the entity for external input or output devices.

#### Enable PEM Attributes

Specifies whether the entity can support the PEM functionality: adding production and consumption, logging consumables, capturing production data, capturing equipment data, and capturing personnel data.

If selected, the **PEM Attributes** tab appears in the Object Editor, allowing you to configure the PEM attributes. For more information, see [Managing PEM Attributes](#).

---

**Note:** PEM attributes should not be used in conjunction with an MES process model.

---

## Response Mode

The **Event Settings** section includes one attribute, **Response Type**, for setting the object's Response mode. If **Without Response** is selected for this attribute, the attribute **Maximum Retrieval Hours** is available for setting the rejected message retrieval filter.

The following response modes can be selected:

### With Response

Select this mode to receive notifications about the delivery status of messages for the OCO calls. If you select this mode, you will receive notifications, such as messages are successfully delivered or messages are not delivered due to system or communication errors.

### Without Response

Select this mode if you do not want to receive the notifications about the delivery status of messages for the OCO calls. The messages that are rejected by the MES middleware are stored in the Rejected Messages table in the MES database.

If Without Response is selected as the response type, the **Maximum Retrieval Hours** box becomes available. Rejected messages that occurred up to the number of previous hours entered here will be retrieved. The range of values is 1 to 100. The default is 72. Every hour, the object will set the Time filter to a value in the past that is the number of hours entered in this box from the current time.

The middleware can reject messages due to system or communication errors or other errors such as invalid inputs.

To allow an OCO to log messages in the Message Queue while in Without Response mode, an Anonymous Logon user with the Send Message privilege must be added to the MESAsyncQueue on the middleware server.

Otherwise, the messages will not be logged. See [Adding an Anonymous Logon User to MESAsyncQueue](#).

You can view, edit, and resubmit rejected messages using the Rejected Message Viewer feature in the MES Client application. For information about using the Rejected Message Viewer feature, see the *MES Client User Guide* or online help.

## PEM Objects and Response Modes

The PEM objects use Message Queuing for the Without Response mode and the MES Stateless API for the With Response mode.

Each message from a PEM object has a unique characteristic and must be evaluated accordingly. For example, messages that are sent using With Response mode must be evaluated at run time by the available object attributes.

Error messages generated by PEM objects when the Without Response mode is selected are different, and can be viewed using the Rejected Message Viewer in the MES Client application.

PEM objects generate the following two error types:

- Production Event messages
- Validation messages

Validation messages are shown when the following pattern or other validation errors occur:

- Returned to the triggered object when the With Response mode is selected.
- Written to the RejectedProductionMessages table when the Without Response mode is selected.

### Adding an Anonymous Logon User to MESAsyncQueue

To allow MES application objects to log messages in the Microsoft Message Queue (MSMQ) while in Without Response mode, an Anonymous Logon user with the Send Message privilege must be added to the MESAsyncQueue on the MES middleware node. Otherwise, the messages will not be logged.

Beginning with MES version 5.3, the Anonymous User login is automatically added to the MESAsyncQueue with the Send Message privilege when the DB/MW Communication component is configured using the post-install Configurator. However, if the Anonymous User login is removed from the MESAsyncQueue, you can use the following procedure to add it again.

#### To add an Anonymous Logon user to MESAsyncQueue

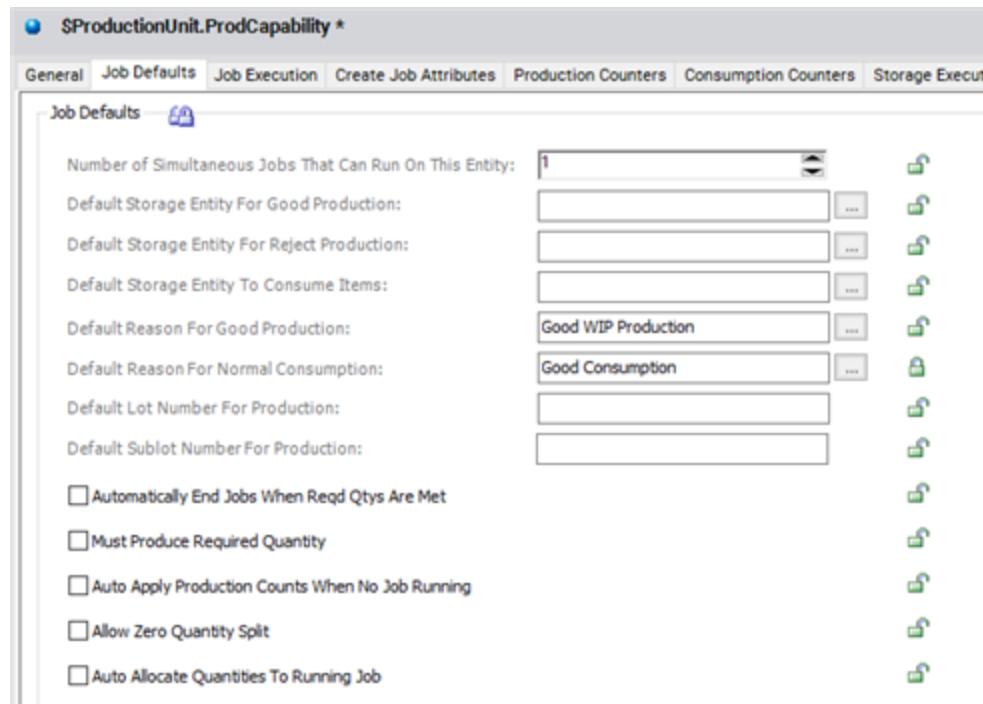
1. In Windows Explorer on the database server node, right-click **This PC** and click **Manage**.  
The Server Manager window appears.
2. In the navigator pane, expand **Features, Message Queuing**, and then **Private Queues**.  
The mesasyncqueue entry appears.
3. Right-click the mesasyncqueue entry and click **Properties**.  
The mesasyncqueue Properties dialog box appears.
4. Go to the **Security** tab.
5. Click the **Add** button.  
The Select Users, Computers, Service Accounts, or Groups dialog box appears.
6. In the **Enter the object names to select** box, enter ANONYMOUS LOGON and click **OK**.  
The Anonymous Logon user is added to the **Group or user names** list.
7. Select the Anonymous Logon user and then in the **Permissions** list select only the **Send Message** check box.
8. Click **OK** to save your changes.

### Configuring Default Job Execution and Job Properties

You can configure the default property attributes for an entity with restrictions to control the behavior of jobs that are running on the entity.

Some of the default settings that are configured for an entity apply to all the jobs that run on the entity and job positions for the entity.

The job default property attributes are on the **Job Defaults** tab in the Object Editor. For this tab to appear in Object Editor, the **Entity Can Run Jobs** option on the **General** tab must be selected.



When an entity is created, the default job values that are configured in the OCO are stored for an entity. If the default data already exists for an entity, then those values are overwritten with the configured values in the OCO when you run the Entity Model Builder.

If the default values are changed in the System Platform IDE after running the Entity Model Builder, you must run the Entity Model Builder again to update the new values in the MES database.

For information about the attributes available at run time, see [Default Job Attributes Available at Run Time](#).

### Number of Simultaneous Jobs That Can Run on This Entity Attribute

You can configure the number of simultaneous jobs that can run on the entity at a given time in the **Number of Simultaneous Jobs That Can Run On This Entity** box. A value of 0 is not allowed.

An entity can have a maximum of 50 jobs. However, there is a limitation within System Platform that an object can have a maximum of 5000 attributes. The number of job positions greatly affects the number of dynamic attributes added to the object. If production and consumption counters are to be configured for the object and it will have multiple job positions, then the effective number of job positions will be limited. For example, an object that can create jobs and has one consumption counter, two production counters, and a specification will have a limit of about 10 job positions.

### Default Storage Entity Attributes

A storage entity is used to store items that are produced or consumed while executing a job. You can specify the default storage entities for good production, rejected production, and consumed items when jobs are executed.

Entities must exist with the option for storage before these fields can be set. Generally this means that the Entity Model Builder must have been run once to populate the MES database with the entities that have the storage option set. These are default settings stored with the entity and can be overridden at run time during execution of the job.

When you run the Entity Model Builder, entities for which the **Entity Can Store Items** option is enabled in the

**General** tab, the Entity Model Builder creates a new default storage entity or updates the existing storage entity settings.

You can configure the following default storage entities on this tab.

#### **Default Storage Entity For Good Production**

When a production request is made with a production quality of Good, and if the production request does not contain a storage location identifying where the production item to be stored, then the default storage location configured for the entity is used to store the production item.

This default storage location is used in the following scenarios:

- A storage location is not specified while adding good production recorded by production counters in the OCO or an operator.
- A storage location is not configured to log good production for a job on an entity.

#### **Default Storage Entity For Reject Production**

When a production request is made with a production quality of Bad, and if the production request does not contain a storage location identifying where the production item to be stored, then the default storage location configured for the entity is used to store the production item.

This default storage location is used in the following scenarios:

- A storage location is not specified while adding rejected production recorded by production counters in the OCO or an operator.
- A storage location is not configured to log rejected production for a job on an entity.

#### **Default Storage Entity To Consume Items**

When a consumption request is made without identifying a storage location from where the items can be consumed, then the default storage location configured for the entity is used to consume the items from this location.

This default storage location is used in the following scenarios:

- A storage location to consume items is not specified while adding consumption recorded by consumption counters in the OCO or an operator.
- A storage location is not configured to log consumption for a job on an entity.

### **To select a default storage entity**

1. Click the  Browse button of the appropriate **Default Storage Entity** attribute box.

The Entity Browser dialog box appears.

2. In the **Database** list, click the **Galaxy** or the **MESDB** option.

When you click the **MESDB** option, a list of storage entities that are configured in the MES database appears.

When you click the **Galaxy** option, a list of entities from the **Galaxy** whose **Entity Can Store** property is set to True appears.

If the list of corresponding entities that can store items does not appear, you must configure the required storage entities in the MES Client application. For more information, see the *MES Client User Guide* or online help.

3. Click the required storage entity to be used as a default entity while producing or consuming items, and then click **OK**.

The selected entity appears in the box as a default storage entity corresponding to the attribute.

## Default Production and Consumption Reason Attributes

Reasons provide information for classifying produced, consumed, and rejected items. Default reasons must be specified to produce or consume items. The specified default reason is logged for an entity during the production or consumption transaction.

The default reasons can be overwritten with new values at run time. For example, if the OCO contains configured production or consumption counters, associated reasons of production or consumption counters override the existing default reasons for the entity.

You can configure the following default reasons on this tab.

### Default Reason For Good Production

This default reason is used for production in the following scenarios:

- A production reason is not specified while adding production recorded by production counters in the OCO or an operator.
- A production reason is not configured for a job.

### Default Reason For Normal Consumption

This default reason is used for consumption in the following scenarios:

- A consumption reason is not specified while adding consumption recorded by consumption counters in OCO or an operator.
- A consumption reason is not configured for a job.

## To select default production and consumption reasons

1. Click the  Browse button of the appropriate **Default Reason** attribute box.

The Produced Item Reason Browser or Consumed Item Reason Browser dialog box containing a list of reasons whose type is marked as production or consumption appears.

2. In the **Produced** or **Consumed** list, click the required reason, and then click **OK**.

The selected reason appears in the box as a default reason corresponding to the attribute.

## Default Lot and Sublot Number Attributes

Lot and subplot numbers are identifiers of materials that are produced or consumed.

The default lot and subplot numbers for the entity are specified in the **Default Lot Number For Production** and **Default Sublot Number For Production** boxes.

The default lot and subplot numbers are used for production, when the production lot or subplot is not specified at the time of adding production from production counters in OCO, Operator, and so on. It is also used at the time of production if the lot or subplot number is not configured for a job.

## Job Processing Option Attributes

You can configure job processing options to control jobs running on entities, such as starting or stopping a job. You can also specify other options associated with a job, such as splitting a job or moving quantities between jobs.

### Automatically End Jobs When Reqd Qtys Are Met

If you select this option and if the total quantity produced by a job is equal to or greater than the required quantity of the job, then the job is automatically ended.

If you do not select this option, the job must be manually stopped even if the production quantity is greater than the required quantity.

#### Must Produce Required Quantity

If you select this option, a job cannot be ended unless the total number of good quantity produced is equal to or greater than the required quantity for the job.

If you do not select this option, the job can be ended even if the job does not produce the required quantity.

If the OCO and a UCO are under the same application object, when the Entity Model Builder is run, this parameter will be set to False for the entity. This is because the UCO must always be able to end a job regardless of the produced quantity and regardless of the OCO setting.

#### Auto Apply Production Counts When No Job Running

If you select this option, and if production is made when no jobs are running on an entity, the production request is applied to the last job that ran on this entity. If no such jobs are found, the production request is rejected.

If you do not select this option and production counts are sent when no jobs are running on the job position, the production is rejected.

---

**Note:** This property is not applicable to OCO, because if a job is not running on the entity while adding production, the production will be rejected.

---

#### Allow Zero Quantity Split

You can split a job and assign some quantity of work that must be produced by the job that is split. Splitting a job allows you to run jobs on different entities and reduce the time to complete the task.

If this option is not selected, a job with 0 quantity cannot be split.

For example, to process 5000 parts on a single milling machine (Machine 1), we can split 1000 parts to Machine 2 and 1500 parts to Machine 3, leaving 2500 to be done on Machine 1.

A job must be split to execute it on multiple entities. If the **Auto Allocate Quantities To Running Job** option is selected, more production for the job that is split can be reported as compared to the job start quantity.

A job cannot be split if the job is scheduled for an entity group that contains only one entity.

#### Auto Allocate Quantities To Running Job

Select option to automatically allocate quantities to a running job that is split from the scheduled job.

If this option is selected and the Total quantity produced + Total quantity reported for a job exceeds the starting quantity of the job, then the overage quantity is calculated and transferred from another job. The overage quantity is transferred from a job whose start quantity is more than the overage quantity and the job is not scheduled for any entity.

If this option is not selected, the overage quantity will not be calculated to update the start quantity for each production.

## Managing Job Creation

You can use the job creation attributes on the **Create Job Attributes** tab in the Object Editor to create a new data entry job or work order from an existing process by configuring job attributes and triggering commands.

**SProductionUnit.ProdCapability \***

Attribute Name	Use Input Source	Value or Input Source
Work Order	<input type="checkbox"/>	<input type="text"/>
Item Class	<input type="checkbox"/>	<input type="text"/>
Item	<input type="checkbox"/>	<input type="text"/>
Item Unit Of Measure	<input type="checkbox"/>	<input type="text"/>
Operation	<input type="checkbox"/>	<input type="text"/>
Required Quantity	<input type="checkbox"/>	<input type="text"/> 0.0
Start Quantity	<input type="checkbox"/>	<input type="text"/> 0.0
Batch Size	<input type="checkbox"/>	<input type="text"/> 1.0
Target Job Production Rate	<input type="checkbox"/>	<input type="text"/> 0.0
Target Job Production Rate Unit Of Measure	<input type="checkbox"/>	<input type="text"/> hours/batch
Operator	<input type="checkbox"/>	<input type="text"/>
Manufacturing Order	<input type="checkbox"/>	<input type="text"/>
Production Schedule	<input type="checkbox"/>	<input type="text"/>
Update Inventory	<input type="checkbox"/>	<input type="checkbox"/>
Process	<input type="checkbox"/>	<input type="text"/>
BOM Version	<input type="checkbox"/>	<input type="text"/>

**Create Job Command**

Create New Job Command:  
 Use Input Source  Set Attribute At Runtime

Reset Command:  
 Use Input Source  Set Attribute At Runtime

Create New Jobs From Process Command:  
 Use Input Source  Set Attribute At Runtime

For this tab to appear in Object Editor, the **Entity Can Run Jobs** and **Enable Create Job Attribute** options on the **General** tab must be selected.

The following information can be configured to create a job:

- Item information, such as item name, item class, item unit of measure for the item
- Job information, such as work order, manufacturing order, operation, process, and operator
- Start and required quantities
- Job production rate information
- Inventory information

For information about the attributes available at run time, see [Job Creation Attributes Available at Run Time](#).

## Job Creation Attributes

You can specify the value for a job attribute directly or retrieve the value from another attribute at run time. You can specify the Bill of Material (BOM) item, BOM item class, and Units of Measure (UOM) that are associated with a job.

For information about whether these attributes that are required or optional, see the table in [How Job Creation Attributes Are Used with the Job Creation Commands](#).

### Work Order

A data entry job consists of a work order performing some operation and a sequence number. This attribute is the work order description. If left blank, then the default work order system parameter value will be used.

### Item Class

A job produces an item and every item belongs to an item class. If the Item class specified here does not exist, it will be created when a job is started. If left blank, then the default item class system parameter value will be used.

### Item

A job produces an item. If the item specified here does not exist, it will be created when a job is started. If left blank, then the default item system parameter value will be used.

### Item Unit of Measure

A job produces an item and every item has a unit of measure. If the item UOM specified here does not exist, it will be created when a job is started. If left blank, then the default item UOM system parameter value will be used.

### Operation

A data entry job consists of a work order performing some operation and a sequence number. This attribute is the operation ID. If left blank, then the default operation system parameter value will be used.

### Required Quantity

The required quantity for the job. This value must be equal to or less than the start quantity. This attribute represents the required good units produced at the operation.

### Start Quantity

The start quantity for the job. The start quantity represents the initial quantity to start a process. This value must be equal to or greater than the required quantity.

This attribute represents the quantity to start at the operation to ensure the required good quantity is produced. The start quantity would be greater than the required to take into consideration expected scrap counts.

### Batch Size

The size of a single batch. The value must be greater than 0. This is the batch size for the job and usually is the same as the entity batch size.

The batch size represents the group of quantities that are processed together. Batch size is used to calculate the production statistics, such as OEE.

### Target Job Production Rate

The target production rate for the running job, which may change depending on the item being produced.

The production rate represents the number of batches with specified size that you want to produce within a period. For example, 10 batches per hour.

### Target Job Production Rate Unit of Measure

The job production rate unit of measure based on the batch size. Select one of the available options:

- Hours per batch
- Minutes per batch
- Seconds per batch
- Batches per hour
- Batches per minute
- Batches per second

**Operator**

The MES username of the user to which production activity will be assigned.

If you do not specify a user name, the default user that is configured in the system is associated with this job, which might not be a legitimate user. For more information, see the [Configuring General OCO Attributes](#).

**Manufacturing Order**

The manufacturing order for the job.

**Production Schedule**

The production schedule.

**Update Inventory**

When this option is selected, the inventory is updated whenever an item is produced or consumed by a job.

**Process**

The name of the process associated with a job or a reference to the name.

**BOM Version**

The BOM version for the work order or a reference to the BOM version.

## Configuring Job Commands

You can specify commands to create a new data entry job or a new work order from an existing process.

You can also specify the command to reset any errors that occur while executing the job commands.

The screenshot shows a configuration interface for 'Create Job Command'. It includes three main sections: 'Create New Job Command', 'Reset Command', and 'Create New Jobs From Process Command'. Each section contains a checkbox labeled 'Use Input Source' and a text input field labeled 'Set Attribute At Runtime'. To the right of each input field are two small icons: a lock icon and a gear icon.

**Note:** PEM transactions should not be performed on jobs that are part of an MES process model, as PEM manages its own jobs. Doing so could result in MES process model jobs being overwritten by the PEM transactions.

## Creating a New Data Entry Job

You can use the **Create New Job Command** attribute to trigger the Create New Job command to create a new data entry job.

If you do not specify values for the job attributes, the default values configured in the database are used while

creating a new data entry job.

The default values are configured for the following attributes in the MES Client general system parameters:

- Work Order
- Operation
- Item Class
- Item
- Unit of Measure

For information about configuring default values, see the *MES User Client Guide* or online help.

When the Create New Job command is triggered, the middleware creates the item, item class, and UOM as per the specified values and if these attributes are not already configured in the database. This command also creates a new data entry job if the values of job attributes apart from the Operator attribute are updated.

A new work order is created if the specified work order is different than the existing work order. The newly configured job attributes are associated with the new work order.

If the specified value of a job attribute does not match with the existing value of the attribute in the database, a warning message describing the mismatch is logged. But if the specified information is sufficient, a job is created.

To retrieve the value of an attribute from other object instance, you must select the corresponding **Use Input Source** check box. When you select the **Use Input Source** check box, the default value and the Browse button appear in the corresponding attribute box. You can specify the Bill of Material (BOM) item, BOM item class, and Units of Measure (UOM) that are associated with a job.

### To create a new data entry job

- In the **Create New Job Command** box, provide a reference to a job command to create a new data entry job.

The data entry jobs do not require a predefined Process and Operation.

If job attribute values are not changed after the last trigger or if the work order already exists in the MES database for the specified job, then a job with the next sequence number is created.

### Creating a New Work Order from a Process

You can create a new work order from an existing process. You must ensure that a valid process exists in the MES database. If the process exists, a work order is created based on the process.

The Create New Jobs From Process command uses the existing process data to create a new work order and it does not create any new items or UOM.

### To create a new work order from a specified process

- In the **Create New Jobs From Process Command** box, provide a reference to a job command to create a new work order based on the specified process.

### Resetting Job Commands

You can trigger the Reset command to clear any error codes and error messages that are generated while executing the job commands. The Reset command resets the status of the job attributes to Ready, and resets the last triggered command to False.

**To reset the job commands**

- In the **Reset Command** box, provide a reference to a job command to reset error codes and messages.

**How Job Creation Attributes Are Used with the Job Creation Commands**

The following table describes how the Create New Job and Create New Jobs from Process commands use the job creation attributes to create a job.

Attribute Name	Used by Create New Job (CNJ) Command	Used by Create New Jobs from Process (CNJFP) Command	Comments
Work Order	Yes	Yes	<p><b>CNJ (Optional)</b> - If the work order is supplied, then it is used to create a new work order.</p> <p>If the value for this attribute is not supplied, the default value that is configured in the system for the Default Work Order ID attribute is used to create a new work order.</p> <p>If such a work order already exists, a new job is created using this work order.</p> <p><b>CNJFP (Required)</b> - While creating a work order from the process, an error is logged if the supplied work order already exists in the database or a work order ID is not supplied.</p> <p>A work order is created if all the conditions, such as user privileges and process status, are passed; otherwise, an error is logged.</p>

Attribute Name	Used by Create New Job (CNJ) Command	Used by Create New Jobs from Process (CNJFP) Command	Comments
Item Class	Yes	No	<p><b>CNJ (Optional)</b> - If the item class is supplied and the supplied item class does not exist in the database, then a new item class is created.</p> <p>If a value for the item class is not supplied, then the default value that is configured in the system for the Default Item Class ID attribute is used to create a new item class.</p> <p>The item class is created only if the item does not exist in the database; otherwise, the item class is ignored.</p> <p>A warning message will be returned, and logged in the Logger, if there is a discrepancy between the supplied item and the item class.</p>
Item	Yes	Yes	<p><b>CNJ (Optional)</b> - When the item is supplied, and the item does not exist in the database, a new item is created.</p> <p>If a value for the item is not supplied, the default value configured in the system for the Default Item ID attribute is used to create a new item.</p> <p><b>CNJFP (Required)</b> - If an item is not supplied while creating a work order from a process, an error is</p>

Attribute Name	Used by Create New Job (CNJ) Command	Used by Create New Jobs from Process (CNJFP) Command	Comments
			logged in the Logger.
Item Unit Of Measure	Yes	No	<p><b>CNJ</b> (Optional) - When the supplied value for the unit of measure contains an empty string, a default value from the system Default Unit of Measure for Items attribute is used.</p> <p>Either the supplied value or a value from the system attribute is used to create a new unit of measurement, but only if the identified item and the UOM does not exist in the database. Otherwise, the obtained unit of measurement is ignored, and a warning message indicating the discrepancy between the item's UOM and the supplied UOM is returned.</p>

Attribute Name	Used by Create New Job (CNJ) Command	Used by Create New Jobs from Process (CNJFP) Command	Comments
Operation	Yes	No	<p><b>CNJ</b> (Optional) - When the value for the operation is blank, a default value from the system Default Operation ID attribute is used.</p> <p>The supplied value or a value from the system attribute is used to create a new job only if the identified work order and operation do not exist in the database and the supplied item, item UOM, target production rate, start quantity, required quantity, and batch size do not match with the existing job that has the supplied work order and operation. If no such job is found, a new job with the next highest sequence number is used; otherwise, no action will be taken.</p>
Required Quantity	Yes	Yes	<p>The required quantity represents the quantity of good items that must be produced before finishing a job.</p> <p><b>CNJ</b> (Optional) - Total number of required items to be produced. The default value is 0.</p> <p><b>CNJFP</b> (Optional) - Total number of required items to be produced. The default value is 0.</p>

Attribute Name	Used by Create New Job (CNJ) Command	Used by Create New Jobs from Process (CNJFP) Command	Comments
Start Quantity	Yes	Yes	<p>The start quantity represents the initial quantity to start a process. The start quantity must be equal to or greater than the required quantity.</p> <p><b>CNJ</b> (Optional) - Total number of quantity to produce if there are no scrap, waste, or rejects. The default value is 0.</p> <p><b>CNJFP</b> (Optional) - Total number of quantity to produce if there are no scrap, waste, or rejects. The value must be greater than or equal to the required quantity. The default value is 0.</p>
Batch Size	Yes	No	<p><b>CNJ</b> (Optional) - Amount of product per batch. Used to force multiples of production in some cases. The default value is 1.</p> <p>The batch size represents the group of quantities that are processed together. Batch size is used to calculate the production statistics, such as OEE.</p>
Target Job Production Rate	Yes	No	<p><b>CNJ</b> (Optional) - Estimated entity batch rate, or time, depending upon the production rate of measure. The default value is 0.</p> <p>The production rate</p>

Attribute Name	Used by Create New Job (CNJ) Command	Used by Create New Jobs from Process (CNJFP) Command	Comments
			represents the number of batches with specified size that you want to produce within a period (for example, 10 batches per hour).
Target Job Production Rate Unit Of Measure	Yes	No	CNJ (Optional) - Units of measurement, such as hours/batch and minutes/batch. The default value is hours/batch.
Operator	No	Yes	CNJFP (Required) - Used to identify the user and verify whether the user has the required permission to create a work order from a process. A valid MES user must be supplied.
Manufacturing Order	Yes	Yes	CNJ (Optional) - Used only when a new work order is created. If the supplied work order already exists in the database, the manufacturing order is not updated against the existing work order.  CNJFP (Optional) - Used when a new work order is created.
Production Schedule	Yes	Yes	CNJ (Optional) - Used only when a new work order is created. If the supplied work order already exists in the database, the production schedule is not updated against the existing work order.

Attribute Name	Used by Create New Job (CNJ) Command	Used by Create New Jobs from Process (CNJFP) Command	Comments
			<b>CNJFP</b> (Optional) - Used when a new work order is created.
Update Inventory	Yes	No	<b>CNJ</b> (Optional) - Determines whether to track inventory for this job. The default value is False.  The inventory is updated whenever an item is produced or consumed by a job.
Process	No	Yes	<b>CNJFP</b> (Required) - Used to identify the process from which this work order must be instantiated. The Process attribute must already be defined in the MES system.
BOM Version	No	Yes	<b>CNJFP</b> (Required) - Used to identify the BOM version of the original item this work order makes. The BOM Version attribute must already be defined in the MES system.

## Managing Job Execution

You can specify details of a job that you want to run on an entity such as work order, operation IDs, and commands to specify the action to be performed on the entity when the job is run.

The job execution attributes are on the **Job Execution** tab in the Object Editor. For this tab to appear in Object Editor, the **Entity Can Run Jobs** option on the **General** tab must be selected.

The screenshot shows the configuration of job execution attributes for a production unit. The interface includes tabs for General, Job Defaults, Job Execution, Create Job Attributes, Production Counters, Consumption Counters, Storage Execution, and Inventory. The Job Execution tab is active, displaying a table of attributes:

Attribute Name	Use Input Source	Value or Input Source
Work Order	<input type="checkbox"/>	<input type="text"/> <input type="button"/>
Operation	<input type="checkbox"/>	<input type="text"/> <input type="button"/>
Sequence Number	<input type="checkbox"/>	<input type="text"/> 0 <input type="button"/>
Job Position	<input type="checkbox"/>	<input type="text"/> 0 <input type="button"/>
Operator	<input checked="" type="checkbox"/>	<input type="text"/> MyContainer.JobExec.Operator <input type="button"/>

Below the table, there is an "Event Data" section with an "Event Date/Time" field containing a date and time, and a checkbox for "Auto Generate".

Under "Job Execution Commands", there are five sections: Start Job Command, Pause Job Command, End Job Command, Start Next Job Command, and Reset Command, each with a "Use Input Source" checkbox and a "Set Attribute At Runtime" button.

Note that these transactions update the current WO, operation, and sequence number properties in the object. The preferred method is to record these transactions through the application object. However, if a job is modified through an external mechanism (for example, the MES Stateless API or MES Operator), the properties will still be updated and the updated data will be reflected in the application object.

For information about the attributes available at run time, see [Job Execution Attributes Available at Run Time](#).

## Configuring Job Execution Attributes

You must specify the work order, operation, and sequence number to identify the job you want start, pause, or end on an entity.

Attribute Name	Use Input Source	Value or Input Source
Work Order	<input type="checkbox"/>	<input type="text"/>
Operation	<input type="checkbox"/>	<input type="text"/>
Sequence Number	<input type="checkbox"/>	0 <input type="text"/>
Job Position	<input type="checkbox"/>	0 <input type="text"/>
Operator	<input type="checkbox"/>	<input type="text"/>

All the configured values in the parent template are automatically distributed to child templates and instances.

### Work Order, Sequence Number, and Operation

The values or references for the work order ID, sequence number, and operation ID that specify the job to be run.

#### Job Position

The position at which to run the job on an entity. The default value is 0.

If an entity has one job position, then the value for the job position attribute must be 0. If the entity is capable of running multiple jobs at a time, then you must specify the job position to identify where the job should start, pause, or end on an entity.

#### Operator

The name of the operator who performs an action on a job, such as starting a job, ending a job, and adding production to a job.

The Operator attribute is used to track the user who performs an action on a job. If the operator name is not specified, the default operator name that is configured in the system User ID for Background Tasks attribute is used. If the default operator name cannot be retrieved from the system, the user name that is used to connect the MES database from the middleware server is used as the operator for a request that is initiated from OCO.

## Configuring the Date/Time for Events

The Event DateTime attribute is used to identify when an action has occurred in the OCO when the Response mode for the OCO is set to Without Response. If the event datetime is in the future or has not been specified, then the current date and time is used.

The event datetime in the object is always ignored if the Response mode is set to With Response.

<b>Event Data</b>	
Event DateTime:	<input type="checkbox"/> Use Input Source <input type="text"/>
<input checked="" type="checkbox"/> Auto Generate	

### To configure the date and time of events

- Perform one of the following tasks:
  - In the **Event Date Time** box, type the new date and time.
  - Select the **Use Input Source** option and specify the input source to read the value from an input source. A value from the I/O reference is read on each scan cycle, and the value read from the I/O is used when the object logs the event data in the MES database.
  - Select the **Auto Generate** check box to automatically generate the date and time of an event.

A new date and time is generated by the object as soon as a command in that context is triggered. The newly generated date and time is used for the event when it is logged in the MES database.

## Configuring Job Execution Commands

You can control the execution of a job using Job Execution commands.

The screenshot shows a configuration panel titled "Job Execution Commands". It contains six sections, each with a checkbox labeled "Use Input Source" and a "Set Attribute At Runtime" dropdown menu. Each section also includes a lock icon and a refresh icon. The sections are: "Start Job Command", "Pause Job Command", "End Job Command", "Start Next Job Command", "Reset Command", and "Stop Job Command".

You can configure the Job Execution commands to perform the following changes to jobs on the entity for this OCO instance:

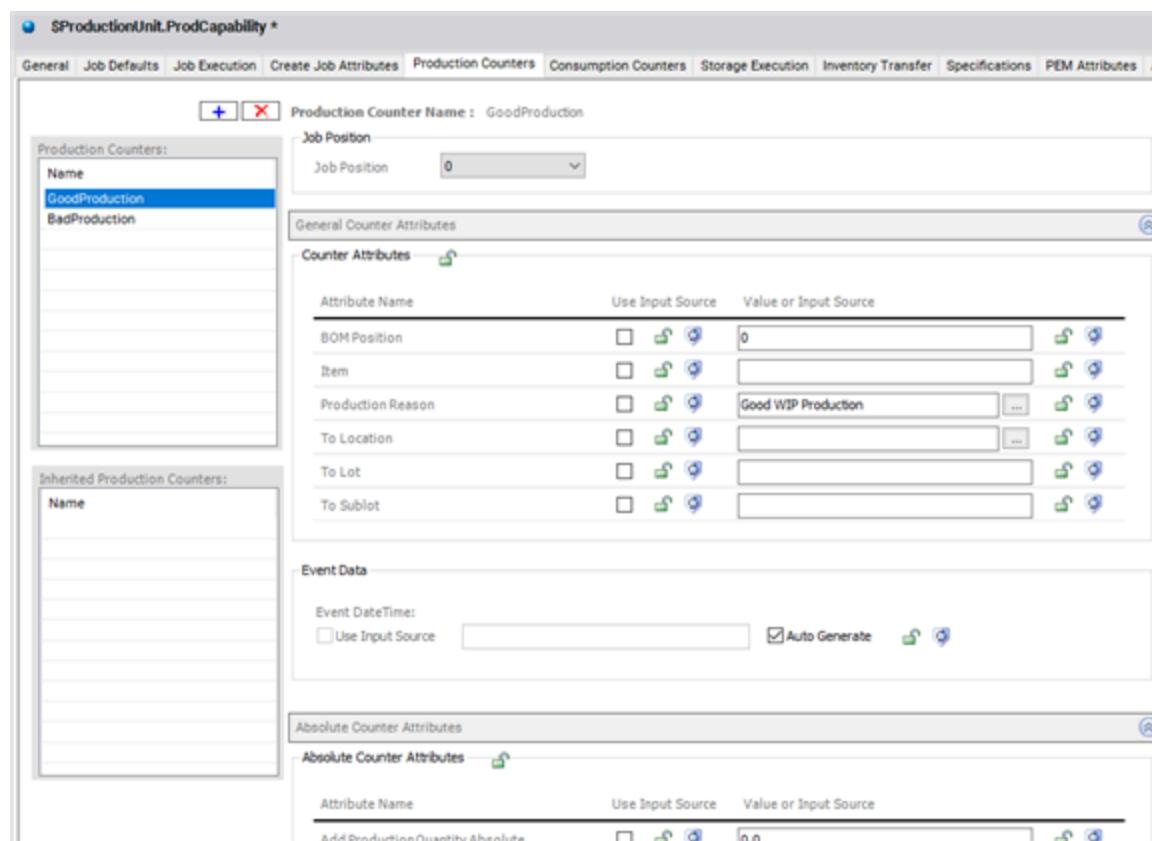
- Start an existing job on the entity.
- Pause or end a running job on the entity.
- Start a job that is next in the queue for the entity.
- Reset a job command execution. After an error has occurred while executing another job command, clear the error code and error message, reset the job command attributes, and set the job status back to Ready.

To trigger a Job Execution command, provide a reference to a trigger in the command attribute's box.

## Managing Production Counters

You can use production counters to track the production of a material for an entity. You can configure up to 20 production counters for an entity.

The production counter attributes are on the **Production Counters** tab in the Object Editor. For this tab to appear in Object Editor, the **Entity Can Run Jobs** and **Enable Production Counters** options on the **General** tab must be selected.



When you configure multiple production counters for an OCO instance, all the job positions contain the same number of production counters at run time. For example, if you configure 3 production counters for the particular OCO instance and there are 4 job positions, each job position will have 3 production counters, and a total of 12 production counters are created at run time.

For information about the attributes available at run time, see [Production Counter Attributes Available at Run Time](#).

## Configuring Production Counters

You can create new production counters. You can also modify or delete existing production counters. On the **Production Counters** tab, you can configure the following:

- General counter attributes
- Absolute counter attributes
- Rolling counter attributes
- Counter extension attributes

Production counters that are inherited from parent templates appear in the **Inherited Production Counters** list.

### Creating a New Production Counter Instance

You can configure attributes only after you create a new instance or if you select an existing instance. The production counter attributes are disabled in the Object Editor for any of the following conditions:

- No production counter instance is created
- No production counter instance is selected from the existing list of instances

### To create a new production counter instance

1. Click the  Add button.

A new row is added to the **Production Counters** list.

2. Type the name for the production counter instance and press **Enter**.

The production counter instance name appears in the **Production Counter Name** box at the top of the Object Editor.

### Renaming a Production Counter Instance

You can change the name of an existing production counter instance. When you rename a production counter instance, attributes corresponding to the instance are linked to the new production counter instance.

### To rename a production counter

1. In the **Production Counters** list, select and click the production counter instance that you want to rename.

2. Type the new name and press **Enter**.

The name of the selected production counter instance is changed.

### Deleting a Production Counter Instance

You can delete a production counter instance. When you delete a production counter instance, attributes corresponding to the production counter instance are removed.

### To delete a production counter

1. In the **Production Counters** list, select the production counter instance that you want to delete.

2. Click the  Delete button.

A confirmation message appears.

3. Click **Yes**.

The selected production counter instance is deleted from the list.

### Selecting a Job Position

A job position is a number that indicates a position on an entity to run a job. You must specify job positions if you want to simultaneously run multiple jobs on an entity. When you run a job at the specified job position, the configured production counters are used to log the produced item count.

You can configure production counter attributes for each job position.

- In the **Job Position** list, click the job position.



## Configuring General Counter Attributes [Production]

You can configure the following information in the **General Counter Attributes** section:

- Item
- Production reason
- Storage location to store produced quantities
- Lot and subplot numbers of produced items
- Date and time to log a production transaction

The item that is configured in this section is used as the production item for the job. You can override the production item by configuring a different item and BOM position other than the current BOM position that is configured for the job.

A value of 0 for the BOM position indicates a produced item and a negative value indicates a by-product.

General Counter Attributes		
Counter Attributes		
Attribute Name	Use Input Source	Value or Input Source
BOM Position	<input type="checkbox"/>	<input type="text" value="0"/>
Item	<input type="checkbox"/>	<input type="text"/>
Production Reason	<input type="checkbox"/>	<input type="text" value="Good WIP Production"/>
To Location	<input type="checkbox"/>	<input type="text"/>
To Lot	<input type="checkbox"/>	<input type="text"/>
To Sublot	<input type="checkbox"/>	<input type="text"/>

### BOM Position

The BOM position of the item. This attribute is required.

### Item

The item name. This attribute is required.

### To Lot Number

The lot number associated with the items being produced.

### To SubLot Number

The subplot number associated with the items being produced.

### Production Reason

The reason for the production. Provide a reference to a production reason attribute or select an item reason from the list of item reasons defined in the MES system whose reason group is classified as Produced. For example, Produced Good, Produced Bad, Waste, etc. This attribute is required.

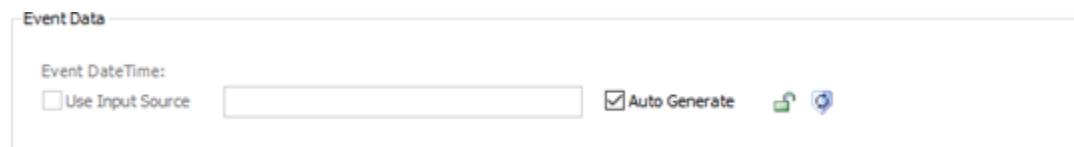
### To Location

The location at which to store items that are produced while executing a job.

## Configuring the Date/Time for Events

The Event DateTime attribute is used to identify when an action has occurred in the OCO when the Response mode for the OCO is set to Without Response. If the event datetime is in the future or has not been specified, then the current date and time is used.

The event datetime in the object is always ignored if the Response mode is set to With Response.



### To configure the date and time of events

- Perform one of the following tasks:
  - In the **Event Date Time** box, type the new date and time.
  - Select the **Use Input Source** option and specify the input source to read the value from an input source.  
A value from the I/O reference is read on each scan cycle, and the value read from the I/O is used when the object logs the event data in the MES database.
  - Select the **Auto Generate** check box to automatically generate the date and time of an event.  
A new date and time is generated by the object as soon as a command in that context is triggered. The newly generated date and time is used for the event when it is logged in the MES database.

## Configuring Absolute Counter Attributes

You can configure absolute counter attributes to specify the quantity of produced items.

Attribute Name	Use Input Source	Value or Input Source
Add Production Quantity Absolute	<input type="checkbox"/>	0.0

Absolute Counter Commands

Set Job BOM Defaults Command:	<input type="checkbox"/> Use Input Source	Set Attribute At Runtime
Add Prod Qty Abs Command:	<input type="checkbox"/> Use Input Source	Set Attribute At Runtime
Reset Command:	<input type="checkbox"/> Use Input Source	Set Attribute At Runtime

## Specifying Absolute Production Quantity

You can specify an absolute quantity of items produced by an entity. When the Add Prod Quantity Abs command is triggered, the specified absolute production quantity is logged for the entity.

You can use absolute production counters to specify an absolute quantity of produced items in case of the following conditions:

- You find any errors in the production count that was automatically recorded.
- You want to log a quantity that is additionally produced apart from the produced quantity that is automatically recorded.

To retrieve the value of an attribute of other object instance, you must select the corresponding **Use Input Source** check box. When you select the **Use Input Source** check box, the default value and the browse button appear in the corresponding attribute box.

### To specify the absolute production quantity

- In the **Add Production Quantity Absolute** box in the **Absolute Counter Attributes** section, type the produced quantity or provide a reference.

## Specifying Absolute Counter Commands

You can specify absolute counter commands to log the specified production counts and the default BOM value of a job.

### Set Job BOM Defaults Command

Logs the default BOM value of a job. The purpose of this command is to set a default reason code, default lot number, default subplot number, and a default storage location for a produced item.

The configured default values are used if the production request does not contain one of the following: a reason code identifying the production reason, storage location, production lot number, or production subplot number.

### Add Prod Quantity Abs Command

Logs the count of produced items specified by the Add Production Quantity Absolute attribute.

### Reset Command

Resets another counter command's execution. After an error has occurred while executing a counter command, clear the error code and error message, reset the command attributes, and set the counter status back to Ready

## Configuring Rolling Counter Attributes

You can configure a rolling counter to count the number of items that are produced and to update the production count when items are being produced at run time.

A rollover counter is typically used in manufacturing operations for which a value for production or consumption is needed using a device like a PLC or other counting device that either through manual or automatic action resets its value to 0. For example, a counter might need to be reset if it can contain only 4 digits or if there is a maximum count such as 32,767. So at a certain point the counter would reset to a lower number between update intervals in the OCO. The OCO understands this resetting and it knows how to calculate the counts required based on the last known value and the current value. The OCO can also reset a counter at the start of a shift in order for the production crew to understand their production for the shift.

The rolling counter option is disabled if you do not have any production counter instances that are created or if you do not select a production counter instance.

### To enable the rolling counter option

- In the **Rolling Counter Attributes** area, select the **Enable Rolling Counter** check box.

The screenshot shows the 'Rolling Counter Attributes' configuration window. At the top, there is a header bar with a back arrow icon. Below it, the 'Enable Rolling Counter' checkbox is checked. The main area is divided into sections: 'Rolling Counter Attributes', 'Rolling Counter Data', and 'Rolling Counter Commands'. In the 'Rolling Counter Attributes' section, there is a table with three columns: 'Attribute Name', 'Use Input Source', and 'Value or Input Source'. A single row is present with the attribute name 'Add Production Quantity Counter', the 'Use Input Source' checkbox unchecked, and the value '0.0' in the input field. The 'Rolling Counter Data' section contains four input fields: 'Deadband' (1.0), 'Update Interval' (00:01:00.0000000), 'Max Value' (10000.0), and a checkbox 'Push Production Counts Upon Reset' which is unchecked. The 'Rolling Counter Commands' section has a 'Reset Rolling Counter Command' field containing 'Set Attribute At Runtime' with the 'Use Input Source' checkbox unchecked.

To retrieve the value of an attribute from other object instance, you must select the corresponding **Use Input Source** check box. When you select the **Use Input Source** check box, the default value and the browse button appear in the corresponding attribute box.

Use the following attributes to configure the rolling counter.

#### Add Production Quantity Counter

The initial quantity to start the production count or a reference to the input source that will be read when the object first goes on scan. This quantity is updated when the items are produced at run time.

**Note:** You must specify the justified required values for all the rolling counter attributes to avoid the excessive production being reported. This affects performance of the database and may cause reporting issues.

#### Rolling Counter Data: Deadband

The minimum quantity value increase from the last update from this counter that must occur before logging the new quantities recorded by the counter. The default value is 1.

It is recommended to specify a non-zero value for the Deadband attribute to avoid logging every single production.

#### Rolling Counter Data: Update Interval

The time interval that must be passed after logging the previous production and before logging the new quantities recorded by the counter. The default value is 00:01:00.0000000 (1 minute of elapsed time for each production).

It is recommended not to specify the 00:00:00 value for the Update Interval attribute.

#### Rolling Counter Data: Max Value

The maximum quantity value that the counter can record. For example, if the maximum value is set to 100 and the counter value is 98, when the counter is next updated and the counter value is 5, then the production value is set to 7.

Do not configure the maximum value as 0 because the counter will never reset.

The rolling counter logs production data only when the values configured for the Deadband and Update Interval attributes are reached.

The following table describes the functioning of the rolling counter for which the Deadband is 10 (10 quantities), Update Interval is 00:00:30 (30 seconds), and Max Value is 100:

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
12:00:00 AM	1	No	No	0	The production quantities are not logged because the current quantity is less than the deadband value of 10, and the time interval is less than 30 seconds since last production.
12:00:10 AM	6	No	No	0	Same as above.
12:00:12 AM	12	Yes	No	0	The production quantities are not logged because the time interval is not reached even though the deadband value of 10 is exceeded.
12:00:22 AM	24	Yes	No	0	Same as above.
12:00:30 AM	24	Yes	Yes	24	A production quantity of 24 is logged because the quantity of 24 exceeds the deadband value 10, and the time 12:00:30 AM

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
					satisfies the time interval limit of 30 seconds (started at 12:00:00 AM).
12:00:42 AM	27	No	No	0	The production quantities are not logged because the quantity difference is less than deadband value, and the time interval limit did not exceed after the last logged production. For this instance, current counter value of (27)- Last logged production quantity (24) = 3. A quantity difference of at least 10 is required before logging the production counts.
12:00:56 AM	32	No	No	0	Same as above.
12:01:02 AM	32	No	Yes	0	The production quantities are not logged because the quantity difference is less than the deadband value, though the time

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
					interval limit is exceeded since last production.
12:01:34 AM	33	No	Yes	0	Same as above.
12:01:38 AM	34	Yes	Yes	10	A production quantity of 10 is logged as the deadband value is reached and time interval value is already reached.
12:03:10 AM	5	Yes	Yes	71	A production quantity of 71 is logged because the quantity recorded by the counter exceeds the deadband and time interval values after last production.

#### **Rolling Counter Data: Push Production Counts Upon Reset**

Specifies whether to log the pending production count that is recorded after resetting the counter. The count recorded is the value since the last update before the reset occurs.

If you do not select this check box and the Reset command is triggered, the counter value is set to 0 and the recorded counts are not logged.

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
12:01:38 AM	34	Yes	Yes	10	A production quantity of 10 is logged as the deadband value is reached and time interval value is already

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
reached.					
12:03:10 AM	5	Yes	Yes	71	A production quantity of 71 is logged because the quantity recorded by the counter exceeds the deadband and time interval values after last production.
12:04:05 AM	12	No	Yes	0	Production quantities are not logged because the time interval is not reached, though the deadband value of 10 is exceeded.

When the ResetRollingCounterCmd is triggered at 12:05:02 AM, the counter value is reset to 0. If the PushProductionCountsUponReset attribute is set to True, the pending quantity of 7 (Current Counter Value 12 - Last Counter Value 5) is logged. Otherwise, the quantities (e.g., 7 in the example above) are ignored.

When a job is paused or ended from the OCO, the pending counts from the counters are always recorded.

Additionally, pending counts are also logged when a value for one of the following attributes changes: item, BOM position, production reason, storage location, lot number, or subplot number.

## Resetting the Rolling Counter with External I/O Configured for Reset Commands

When a rolling counter is linked to an external I/O that is configured to support count Reset commands, the following script must be added to reset the value of the I/O counter to a 0 quantity without dropping production counts:

Expression: Me.ResetRollingCounter

Trigger Type: OnFalse

Script:

```
MyContainer.RollingProdCounter = 0;
```

where MyContainer.RollingProdCounter is the input source that is being read.

Without this script, it is possible that the counter tag will reset to 0 before the OCO receives the reset rolling counter command and will record a larger quantity thinking the counter has rolled over. By adding a script to detect the reset rolling counter command and have the script set the input source to 0, the transaction order is properly maintained.

For example, consider the following sequence with Push Production Counts Upon Reset set to true and the indicated script added:

1. The current rolling counter value is 10.
2. This production count of 10 is recorded.
3. The rolling counter increases to 13 but the interval time has not expired as of yet to record the additional production of 3.
4. A Reset counter command is issued.
5. The additional production of 3 is expected to be recorded.

If the I/O counter is also set to 0 at the same time the reset command is issued, it is possible that a rollover quantity will be recorded instead of the 3 units. With the script, the I/O counter is set to 0 after the reset command has completed and only reported the 3 units.

6. The OCO rolling counter is reset to 0.
7. The I/O counter is reset to 0.
8. The next scan cycle will initialize the OCO counter to 0 (i.e., the value from I/O) with no production added.
9. The next increment of the rolling counter will add production starting from 0.

## Configuring Production Counter Extensions

Production counter extensions are used to capture any additional data for each production transaction.

To enable the production counter extensions, in the **Counter Extension Attributes** section, select the **Extension Attributes** check box.

The screenshot shows a software interface for configuring production counter extensions. At the top, there is a header bar with the title "Counter Extension Attributes" and a close button. Below the header, there is a checkbox labeled "Extension Attributes" which is checked. To the right of the checkbox is a green "Save" button. The main area is a table titled "Counter Extension Attributes" with a "New" button icon. The table has columns: "Attribute Name", "Use Input Source", and "Value or Input Source". There are eight rows in the table, each corresponding to a different extension attribute: Segment Requirement, Segment Response, Operator, Comments, Spare 1, Spare 2, Spare 3, and Spare 4. Each row contains three checkboxes: "Use Input Source" (unchecked), "Default Value" (unchecked), and "Browse" (unchecked). To the right of each row is a small "Edit" icon.

Attribute Name	Use Input Source	Value or Input Source
Segment Requirement	<input type="checkbox"/>	<input type="text"/>
Segment Response	<input type="checkbox"/>	<input type="text"/>
Operator	<input type="checkbox"/>	<input type="text"/>
Comments	<input type="checkbox"/>	<input type="text"/>
Spare 1	<input type="checkbox"/>	<input type="text"/>
Spare 2	<input type="checkbox"/>	<input type="text"/>
Spare 3	<input type="checkbox"/>	<input type="text"/>
Spare 4	<input type="checkbox"/>	<input type="text"/>

To retrieve the value of an attribute from other object instance, you must select the corresponding **Use Input Source** check box. When you select the **Use Input Source** check box, the default value and the browse button

appear in the corresponding attribute box.

Use the following attributes to configure the counter extensions.

#### Segment Requirement

The segment requirement ID.

#### Segment Response

The segment response ID.

#### Operator

The operator who is entering item counts.

#### Comments

Comments about the item counts being entered.

#### Spare 1 to 4

User-defined data, for entering additional information about the item counts being entered.

## Managing Consumption Counters

You can use consumption counters to track the consumption of a material for an entity. You can configure up to 20 consumption counters for an entity.

The consumption counter attributes are on the **Consumption Counters** tab in the Object Editor. For this tab to appear in Object Editor, the **Entity Can Run Jobs** and **Enable Consumption Counters** options on the **General** tab must be selected.

The screenshot shows the AVEVA Object Editor interface with the title bar "SProductionUnit.ProdCapability \*". The tabs at the top include General, Job Defaults, Job Execution, Create Job Attributes, Production Counters, Consumption Counters (which is the active tab), Storage Execution, Inventory Transfer, Specifications, PEM Attributes, and Advanced. The main area is titled "Consumption Counter Name:" with a plus sign (+) and minus sign (-) button. Below it is a "Job Position" dropdown menu. To the left is a list of "Consumption Counters" with names BOMPos1, BOMPos2, and BOMPos3. The central area contains a "General Counter Attributes" section with a table:

Attribute Name	Use Input Source	Value or Input Source
BOM Position	<input type="checkbox"/>	[Input Field]
Item	<input type="checkbox"/>	[Input Field]
ConsumptionReason	<input type="checkbox"/>	[Input Field]
From Storage Location	<input type="checkbox"/>	[Input Field]
From Lot	<input type="checkbox"/>	[Input Field]
From Sublot	<input type="checkbox"/>	[Input Field]
Finished Goods Lot	<input type="checkbox"/>	[Input Field]
Finished Goods Sublot	<input type="checkbox"/>	[Input Field]

Below this is an "Event Data" section with "Event Date/Time" and checkboxes for "Use Input Source" and "Auto Generate". At the bottom are sections for "Inherited Consumption Counters" and "Absolute Counter Attributes".

When you configure multiple consumption counters for an OCO instance, all the job positions contain the same number of consumption counters at run time.

For example, if you configure 3 consumption counters for the particular OCO instance and there are 4 job positions, each job position will have 3 consumption counters, and a total of 12 consumption counters are created at run time.

For information about the attributes available at run time, see [Consumption Counter Attributes Available at Run Time](#).

## Configuring Consumption Counters

You can create new consumption counters. You can also modify or delete existing consumption counters. In the **Consumption Counter** tab, you can configure the following:

- General counter attributes
- Absolute counter attributes
- Rolling counter attributes
- Counter extension attributes

Consumption counters that are inherited from parent templates appear in the **Inherited Consumption Counters** list.

## Creating a New Consumption Counter Instance

You can configure attributes only after you create a new instance or if you select an existing instance.

The consumption counter attributes are disabled in the Object Editor for any of the following conditions:

- No consumption counter instance is created
- No consumption counter instance is selected from the existing list of instances

### To create a new consumption counter instance

1. Click the  Add button.

A new row is added to the **Consumption Counters** list.

2. Type the name for the consumption counter instance and press **Enter**.

The consumption counter instance name appears in the **Consumption Counter Name** field at the top of the Object Editor.

## Renaming a Consumption Counter Instance

You can change the name of an existing consumption counter instance. When you rename a consumption counter instance, attributes corresponding to the instance are linked to the new consumption counter instance.

### To rename a consumption counter

1. In the **Consumption Counters** list, select and click the consumption counter instance that you want to rename.
2. Type the new name and press **Enter**.

The name of the selected consumption counter instance is changed.

## Deleting a Consumption Counter Instance

You can delete a consumption counter instance. When you delete a consumption counter instance, attributes corresponding to the consumption counter instance are removed.

### To delete a consumption counter

1. In the **Consumption Counters** list, select the consumption counter instance that you want to delete.
2. Click the  Delete button.

A confirmation message appears.

3. Click **Yes**.

The selected consumption counter instance is deleted from the list.

## Selecting a Job Position

A job position is a number that indicates a position on an entity to run a job. You must specify job positions if you want to simultaneously run multiple jobs on an entity. When you run a job at the specified job position, the configured consumption counters are used to log the consumed item count.

You can configure consumption counter attributes for each job position.

### To select a job position

- In the **Job Position** list, click the required job position.



## Configuring General Counter Attributes [Consumption]

You can configure the following information in the **General Counter Attributes** section:

- Item
- Consumption reason
- Storage location from which quantities are consumed
- Lot and subplot numbers of consumed items and finished goods
- Date and time to log a consumption transaction

The Item that is configured in this section is used as the consumption item for the job. You can override the consumption item by configuring a different item and BOM position other than the current BOM position that is configured for the job.

General Counter Attributes

Attribute Name	Use Input Source	Value or Input Source
BOM Position	<input type="checkbox"/>	<input type="text" value="1"/>
Item	<input type="checkbox"/>	<input type="text"/>
ConsumptionReason	<input type="checkbox"/>	<input type="text" value="Good Consumption"/>
From Storage Location	<input type="checkbox"/>	<input type="text"/>
From Lot	<input type="checkbox"/>	<input type="text"/>
From Sublot	<input type="checkbox"/>	<input type="text"/>
Finished Goods Lot	<input type="checkbox"/>	<input type="text"/>
Finished Goods Sublot	<input type="checkbox"/>	<input type="text"/>

**BOM Position**

The BOM position of the item. This attribute is required and must have a positive value.

**Item**

The item name. This attribute is optional.

**Consumption Reason**

The reason for the consumption. This attribute is required.

If you want to retrieve the value for the attribute from an attribute of an object instance, provide a reference to a consumption reason, or select an item reason from the list of item reasons defined in the MES system whose reason group is classified as Consumed. For example, Consumed Good, Pack Out, Cut Up, etc.

**From Storage Location**

The storage location from where items are consumed. You can browse through a list of entities from the entity list. You can specify a valid storage location regardless of whether the entity identified in this attribute can store items.

**From Lot**

The number of the lot from which the items are consumed. You can specify a valid lot number, regardless of whether the entity identified in the attribute From\_Storage\_Location can store items.

**From Sublot**

The number of the subplot from which the items are consumed. You can specify a valid subplot number, regardless of whether the entity identified in the attribute From\_Storage\_Location can store items.

**Finished Goods Lot**

The lot number for finished goods. The finished goods lot number represents the production lot number for this consumption item to track genealogy for the defective products.

**Finished Goods SubLot**

The subplot number for finished goods. The finished goods subplot number represents the production subplot number for this consumption item to track genealogy for the defective products.

**Configuring the Date/Time for Events**

The Event DateTime attribute is used to identify when an action has occurred in the OCO when the Response mode for the OCO is set to Without Response. If the event datetime is in the future or has not been specified,

then the current date and time is used.

The event datetime in the object is always ignored if the Response mode is set to With Response.

The screenshot shows a configuration panel titled "Event Data". It includes fields for "Event Date/Time" with options to "Use Input Source" or "Auto Generate". There are also standard save and cancel buttons.

### To configure the date and time of events

- Perform one of the following tasks:
  - In the **Event Date Time** box, type the new date and time.
  - Select the **Use Input Source** option and specify the input source to read the value from an input source. A value from the I/O reference is read on each scan cycle, and the value read from the I/O is used when the object logs the event data in the MES database.
  - Select the **Auto Generate** check box to automatically generate the date and time of an event. A new date and time is generated by the object as soon as a command in that context is triggered. The newly generated date and time is used for the event when it is logged in the MES database.

## Configuring Absolute Counter Attributes

You can configure absolute counter attributes to specify the quantity of consumed items.

The screenshot shows a configuration panel titled "Absolute Counter Attributes". It includes a table for "Add Consumption Quantity Absolute" with columns for "Attribute Name", "Use Input Source", and "Value or Input Source". Below this is a section for "Absolute Counter Commands" with three entries: "Set Job BOM Defaults Command", "Add Cons Qty Abs Command", and "Reset Command", each with its own "Use Input Source" checkbox and "Value or Input Source" field.

### Specifying Absolute Consumption Quantity

You can specify the quantity of items consumed by an entity. When the **Add Cons Quantity Abs** command is triggered, the specified consumption quantity is logged for the entity.

You can use absolute consumption counters to specify the quantity of consumed items in case of following:

- You find any errors in the consumption count that was automatically recorded.
- You want to log a quantity that is additionally consumed apart from the consumed quantity that is automatically recorded.

To retrieve the value of an attribute from other object instance, you must select the corresponding **Use Input Source** check box. When you select the **Use Input Source** check box, the default value and the browse button appear in the corresponding attribute box.

### To specify the absolute consumption quantity

- In the **Add Consumption Quantity Absolute** box, type the consumed quantity or provide a reference.

## Specifying Absolute Counter Commands

You can specify absolute counter commands to log the specified consumption counts and the default BOM value of a job.

### Set Job BOM Defaults Command

Provide a reference to log the default BOM value of a job. The purpose of this command is to set a default reason code, default lot number, default subplot number, and a default storage location for a BOM item.

The configured default values are used if the consumption request does not contain one of the following: a reason code identifying the consumption reason, storage location, consumption lot number, or consumption subplot number.

### Add Cons Quantity Abs Command

Provide a reference to log the specified count of consumed items.

### Reset Command

Provide a reference to reset the OCO's consumption functionality.

## Configuring Rolling Counter Attributes

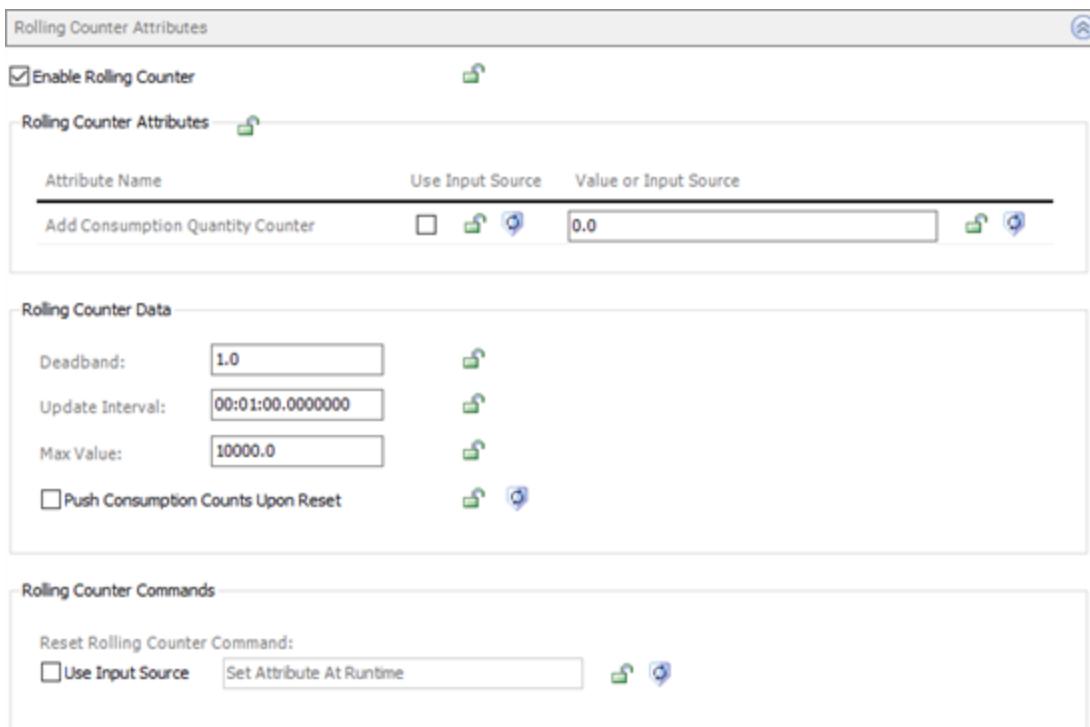
You can configure a rolling counter to count the items that are consumed and to update the consumption count when items are being consumed at run time.

A rollover counter is typically used in manufacturing operations for which a value for production or consumption is needed using a device like a PLC or other counting device that either through manual or automatic action resets its value to 0. For example, a counter might need to be reset if it can contain only 4 digits or if there is a maximum count such as 32,767. So at a certain point the counter would reset to a lower number between update intervals in the OCO. The OCO understands this resetting and it knows how to calculate the counts required based on the last known value and the current value. The OCO can also reset a counter at the start of a shift in order for the production crew to understand their production for the shift.

The rolling counter option is disabled if you do not have any consumption counter instances that are created or if you do not select a consumption counter instance.

### To enable the rolling counter option

- In the **Rolling Counter Attributes** select, select the **Enable Rolling Counter** check box.



To retrieve the value of an attribute from other object instance, you must select the corresponding **Use Input Source** check box. When you select the **Use Input Source** check box, the default value and the browse button appear in the corresponding attribute box.

Use the following attributes to configure the rolling counter.

#### Add Consumption Quantity Counter

The initial quantity to start the consumption count or a reference to the input source that will be read when the object first goes on scan. This quantity is updated when the items are consumed at run time.

**Note:** You must specify the justified required values for all the rolling counter attributes to avoid the excessive consumption being reported. This affects performance of the database and may cause reporting issues.

#### Rolling Counter Data: Deadband

The minimum quantity value increase from the last update from this counter that must occur before logging the new quantities recorded by the counter. The default value is 1.

It is recommended to specify a non-zero value for the Deadband attribute to avoid logging every single production.

#### Rolling Counter Data: Update Interval

The time interval that must be passed after logging the previous consumption and before logging the new quantities recorded by the counter. The default value is 00:01:00.0000000 (1 minute of elapsed time for each consumption).

It is recommended to not specify the 00:00:00 value for the Update Interval attribute, as this could trigger transactions every scan of the object.

#### Rolling Counter Data: Max Value

The maximum quantity value that the counter can record. For example, if the maximum value is set to 100 and the counter value is 98, when the counter is next updated and the counter value is 5, then the consumption value is set to 7.

Do not configure the maximum value as 0 because the counter will never reset.

The rolling counter logs consumption data only when the values configured for the Deadband and Update Interval attributes are reached.

The following table describes the functioning of the rolling counter for which the Deadband is 10 (10 quantities), Update Interval is 00:00:30 (30 seconds), and Max Value is 100:

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
12:00:00 AM	1	No	No	0	The consumption quantities are not logged because the current quantity is less than the deadband value of 10, and the time interval is less than 30 seconds since last consumption.
12:00:10 AM	6	No	No	0	Same as above.
12:00:12 AM	12	Yes	No	0	The consumption quantities are not logged because the time interval is not reached even though the deadband value of 10 is exceeded.
12:00:22 AM	24	Yes	No	0	Same as above.
12:00:30 AM	24	Yes	Yes	24	A consumption quantity of 24 is logged because the quantity of 24 exceeds the deadband value 10, and the time 12:00:30 AM satisfies the time

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
					interval limit of 30 seconds (started at 12:00:00 AM).
12:00:42 AM	27	No	No	0	The consumption quantities are not logged because the quantity difference is less than deadband value, and the time interval limit did not exceed after the last logged production. For this instance, current counter value of (27)- Last logged consumption quantity (24) = 3. A quantity difference of at least 10 is required before logging the consumption counts.
12:00:56 AM	32	No	No	0	Same as above.
12:01:02 AM	32	No	Yes	0	The consumption quantities are not logged because the quantity difference is less than the

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
					deadband value, though the time interval limit is exceeded since last consumption.
12:01:34 AM	33	No	Yes	0	Same as above.
12:01:38 AM	34	Yes	Yes	10	A consumption quantity of 10 is logged as the deadband value is reached and time interval value is already reached.
12:03:10 AM	5	Yes	Yes	71	A consumption quantity of 71 is logged because the quantity recorded by the counter exceeds the deadband and time interval values after last consumption.

#### **Rolling Counter Data: Push Consumption Counts Upon Reset**

Specifies whether to log the pending consumption count that is recorded after resetting the counter. The count recorded is the value since the last update before the reset occurs.

If you do not select this check box and the Reset command is triggered, the counter value is set to 0 and the recorded counts are not logged.

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
12:01:38 AM	34	Yes	Yes	10	A consumption quantity of 10 is logged as the deadband value is reached and time interval value is already reached.

Current Time	Counter Value	Deadband Value Reached	Time Interval Reached	Qty to Be Logged	Comments
					time interval value is already reached.
12:03:10 AM	5	Yes	Yes	71	A consumption quantity of 71 is logged because the quantity recorded by the counter exceeds the deadband and time interval values after last consumption.
12:04:05 AM	12	No	Yes	0	Consumption quantities are not logged because the time interval is not reached, though the deadband value of 10 is exceeded.

When the ResetRollingCounterCmd is triggered at 12:05:02 AM, the counter value is reset to 0. If the PushConsumptionCountsUponReset attribute is set to True, the pending quantity of 7 (Current Counter Value 12 - Last Counter Value 5) is logged. Otherwise, the quantities (e.g., 7 in the example above) are ignored.

When a job is paused or ended from the OCO, the pending counts from the counters are always recorded.

Additionally, pending counts are also logged when a value for one of the following attributes changes: item, BOM position, consumption reason, storage location, lot number, or subplot number.

## Resetting the Rolling Counter with External I/O Configured for Reset Commands

When a rolling counter is linked to an external I/O that is configured to support count Reset commands, the following script must be added to reset the value of the I/O counter to a 0 quantity without dropping consumption counts:

Expression: Me.ResetRollingCounter

Trigger Type: OnFalse

Script:

```
MyContainer.RollingConsCounter = 0;
```

where MyContainer.RollingConsCounter is the input source that is being read.

Without this script, it is possible that the counter tag will reset to 0 before the OCO receives the reset rolling counter command and will record a larger quantity thinking the counter has rolled over. By adding a script to detect the reset rolling counter command and have the script set the input source to 0, the transaction order is properly maintained.

For example, consider the following sequence with Push Production Counts Upon Reset set to true and the indicated script added:

1. The current rolling counter value is 10.
2. This consumption count of 10 is recorded.
3. The rolling counter increases to 13 but the interval time has not expired as of yet to record the additional consumption of 3.
4. A Reset counter command is issued.
5. The additional consumption of 3 is expected to be recorded.

If the I/O counter is also set to 0 at the same time the reset command is issued, it is possible that a rollover quantity will be recorded instead of the 3 units. With the script, the I/O counter is set to 0 after the reset command has completed and only reported the 3 units.

6. The OCO rolling counter is reset to 0.
7. The I/O counter is reset to 0.
8. The next scan cycle will initialize the OCO counter to 0 (i.e., the value from I/O) with no consumption added.
9. The next increment of the rolling counter will add consumption starting from 0.

## Configuring Consumption Counter Extensions

Consumption counter extensions are used to capture any additional data for each consumption transaction.

### To enable the consumption counter extensions

- In the **Counter Extension Attributes** section, select the **Extension Attributes** check box.

Attribute Name	Use Input Source	Value or Input Source
Segment Requirement	<input type="checkbox"/>	<input type="text"/>
Segment Response	<input type="checkbox"/>	<input type="text"/>
Operator	<input type="checkbox"/>	<input type="text"/>
Comments	<input type="checkbox"/>	<input type="text"/>
Spare 1	<input type="checkbox"/>	<input type="text"/>
Spare 2	<input type="checkbox"/>	<input type="text"/>
Spare 3	<input type="checkbox"/>	<input type="text"/>
Spare 4	<input type="checkbox"/>	<input type="text"/>

To retrieve the value of an attribute from other object instance, you must select the corresponding **Use Input Source** check box. When you select the **Use Input Source** check box, the default value and the browse button appear in the corresponding attribute box.

Use the following attributes to configure the counter extensions.

#### Segment Requirement

The segment requirement ID.

#### Segment Response

The segment response ID.

#### Operator

The operator who is entering item counts.

#### Comments

Comments about the item counts being entered.

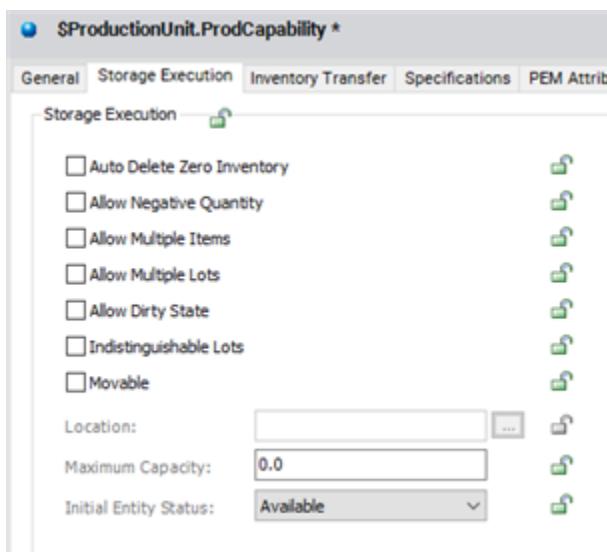
#### Spare 1 to 4

User-defined data, for entering additional information about the item counts being entered.

## Configuring Storage Execution

You can configure an entity to store items. Whenever you execute a job, items are produced and consumed in the process. You can specify the location to store items that are produced or consumed while executing a job.

The storage execution attributes are on the **Storage Execution** tab in the Object Editor. For this tab to appear in the Object Editor, the **Entity Can Store Items** option on the **General** tab must be selected.



For information about the attributes that are available at run time, see [Storage Execution Attributes Available at Run Time](#).

## Configuring Storage Execution Attributes

You can configure the storage execution options for an entity that is used to store multiple items and lots.

You can also configure the initial status of an entity, which indicates whether the entity is available to store items.

**Auto Delete Zero Inventory**

If selected, the inventory record for this storage entity is automatically deleted when the item quantity in the inventory becomes 0.

**Allow Negative Quantity**

Specifies whether to allow negative quantities to be stored in the inventory.

If not selected, the entity does not allow the quantities in the inventory to become less than 0 and the requested transaction fails.

**Allow Multiple Items**

Specifies whether different items can be stored at this storage entity.

**Allow Multiple Lots**

Specifies whether different lots can be stored at this storage entity.

**Allow Dirty State**

Specifies whether to allow the state for the storage entity to become Dirty when it becomes empty after storing an item.

This attribute affects the Initial Entity Status attribute. If this attribute's option is not selected, the storage entity cannot have the status Dirty.

**Indistinguishable Lots**

If selected, the lots stored at this entity lose their identity in the MES system. For example, you might select this option if the entity is a bulk storage tank.

If you do not select this option, items that are stored in this entity are not distinguished by separate lots.

**Movable**

Select this option to indicate that the entity can be moved (e.g., pallets). The movable entity can be moved or transported throughout a plant floor.

If this option is selected, you must specify the location of the movable entity that holds the inventory items to transfer.

**Location**

The location where you want to move the movable storage entity. This attribute represents a different storage entity than the storage entity that is movable. The location of the entity specified here is used at run time.

For example, if an entity, such as pallet, is configured as movable, this entity (pallet) may be located at another entity/location (Warehouse).

This attribute is applicable only if the storage entity is configured as movable.

**Maximum Capacity**

The maximum overall quantity that can be stored in the entity. A value of 0 indicates that unlimited quantities can be stored in this entity.

**Initial Entity Status**

You can select the status that represents whether the entity is available to store items.

**Available**

Indicates the storage location is currently empty. When the overall quantity becomes 0 or less than 0 and if the entity cannot be represented as Dirty, then the status of this entity is automatically changed to Available and items can be stored at this storage location. Otherwise, the entity state would remain in the Dirty state.

**Used**

Indicates the storage location is currently used and this entity has a quantity greater than 0 in it. However, items can be added to this storage location.

### Dirty

Indicates the storage location is currently dirty. After the storage location becomes dirty, items cannot be added to this storage entity until the entity is cleaned and made available for storing items.

The status of the storage entity change to Dirty, only if the entity supports the Dirty state.

To allow the entity to have the status Dirty, the Allow Dirty State attribute's option must be selected.

You can use the MES Supervisor or MES Operator application to change the Dirty state of the entity to Available.

For more information, see the *MES Supervisor User Guide*, *MES Operator User Guide*, or the MES online help that is available in those applications.

## Managing Inventory Transfer

Using the inventory transfer attributes and commands, you can have the entity receive a new inventory item quantity or transfer an inventory item quantity from a source storage entity to a destination storage entity. The source storage entity is the entity from which you want to move inventory items and the destination storage entity is the entity to which you want to move inventory items.

The inventory transfer attributes and commands are on the **Inventory Transfer** tab in the Object Editor. For this tab to appear in the Object Editor, the **Entity Can Store Items** option on the **General** tab must be selected.

To receive a new inventory item, attributes that begin with the words To and Transfer are used, whereas, to transfer inventory items, all the attributes are used.

You can reclassify an inventory item to a new grade, state, or expiry date by triggering the **Move Inventory** command.

To reclassify the grade, state, or expiry for an existing inventory item, values of the following attributes must be same:

- To Location and From Location
- To Item and From Item
- To Lot and From Lot
- To Sublot and From Sublot

If an inventory is maintained according to a job, the following additional attributes must also be the same:

- To Work Order and From Work Order
- To Operation and From Operation
- To Sequence Number and From Sequence Number

You must specify source and destination details to transfer an inventory item, such as location, transfer quantity, and lot and subplot numbers.

For information about the attributes available at run time, see [Inventory Transfer Attributes Available at Run Time](#).

## Specifying Inventory Transfer Attributes

Use the Inventory Transfer attributes to specify source and destination information. For a description of the attributes, see the following two topics.

Inventory Transfer

Attribute Name	Use Input Source	Value or Input Source
To Location	<input type="checkbox"/>	<input type="text"/>
To Item	<input type="checkbox"/>	<input type="text"/>
To Lot	<input type="checkbox"/>	<input type="text"/>
To Sublot	<input type="checkbox"/>	<input type="text"/>
To Grade	<input type="checkbox"/>	<input type="text"/>
To State	<input type="checkbox"/>	<input type="text"/>
To Unit of Measure	<input type="checkbox"/>	<input type="text"/>
To Expiry Date	<input type="checkbox"/>	<input type="text" value="6/5/2022 4:22:19.677 PM"/>
To Work Order	<input type="checkbox"/>	<input type="text"/>
To Operation	<input type="checkbox"/>	<input type="text"/>
To Sequence Number	<input type="checkbox"/>	<input type="text" value="0"/>
Transfer Quantity	<input type="checkbox"/>	<input type="text" value="0.0"/>
Transfer Option	<input type="checkbox"/>	<input type="text" value="Enforce Destination Settings"/>
From Location	<input type="checkbox"/>	<input type="text"/>
From Item	<input type="checkbox"/>	<input type="text"/>
From Lot	<input type="checkbox"/>	<input type="text"/>
From Sublot	<input type="checkbox"/>	<input type="text"/>
From Work Order	<input type="checkbox"/>	<input type="text"/>
From Operation	<input type="checkbox"/>	<input type="text"/>
From Sequence Number	<input type="checkbox"/>	<input type="text" value="0"/>
Comments	<input type="checkbox"/>	<input type="text"/>

## Specifying Source Information

You must specify the source information such as, location, item name and quantity, lot and subplot numbers, and sequence number to move an inventory item. The source information that you need to specify depends on other system settings. For example, if multiple lots are allowed for the same item, then you must specify the item and lot number attributes.

### From Location

A reference to the location from which the item is to be transferred.

### From Item

The item name of the items to be transferred or a reference to retrieve the item name.

### From Lot

The lot number of the items to be transferred or a reference to retrieve the lot number.

### From Sublot

The subplot number of the items to be transferred or a reference to retrieve the subplot number.

### From Work Order

The ID of the work order for the items to be transferred or a reference to retrieve the work order ID.

**From Operation**

The ID of the operation associated with the items to be transferred or a reference to retrieve the operation ID.

**From Sequence Number**

The sequence number associated with the items to be transferred or a reference to retrieve the sequence number.

**Transfer Quantity**

The quantity to be transferred or a reference to retrieve the quantity.

**Transfer Option**

The required transfer option or a reference to retrieve the option. Transfer option allows you to specify whether you want to use the configured information of the source entity or the destination entity.

**Specifying Destination Information**

You must specify the destination information where you want to store the inventory item that is being moved from the source location.

**To Location**

The destination location where you want to store the transferred items or a reference to retrieve the location.

**To Item**

The item name of the items that are to be added to the destination location or a reference to retrieve the item name.

**To Lot**

The lot number of the items that are to be added to the destination inventory or a reference to retrieve the lot number.

**To Sublot**

The subplot number of the items that are to be added to the destination inventory or a reference to retrieve the subplot number.

**To Grade**

The grade of the items that are to be added to the destination inventory or a reference to retrieve the grade.

**To State**

The state of the items that are to be added to the destination inventory or a reference to retrieve the state.

**To Unit of Measure**

The units of measure of the items that are to be added to the destination inventory or a reference to retrieve the unit of measure.

**To Expiry Date**

The expiry date of the items that are to be added to the destination inventory or a reference to retrieve the expiry date.

**To Work Order**

The ID of the work order of the items that are to be added to the destination inventory or a reference to retrieve the work order ID.

**To Operation**

The ID of the operation associated with the items that are to be added to the destination inventory or a

reference to retrieve the operation ID.

#### To Sequence Number

The sequence number associated with the items that are to be added to the destination inventory or a reference to retrieve the sequence number.

### Triggering Commands to Transfer Inventory

You must use the Inventory Transfer commands to specify the trigger that will initiate inventory transfers involving the entity for this OCO instance.

#### Move Inventory Command

Transfers the specified inventory item from this entity to the destination location, as defined in the destination attributes.

If the lot or subplot numbers does not exist or are not specified for the destination location, the new lot or subplot numbers are created for the destination location.

#### Receive Command

Transfers the specified inventory item to this entity from the source location, as defined in the source attributes. If the lot or subplot numbers does not exist or are not specified for the destination location, the new lot or subplot numbers are created for the destination location.

#### Reset Command

After an error has occurred while executing an inventory transfer, clears the error code and error message and resets the inventory transfer functionality.

### How Inventory Transfer Attributes Are Used with the Inventory Transfer Commands

The following table describes how the inventory transfer commands use the transfer inventory attributes to move inventory from one storage entity to another.

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
ToLocation	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Identifies the destination storage entity to receive an item, transfer an inventory, or reclassify an inventory. For example: Warehouse A, WarehouseB, PalletA.</p> <p>If this attribute is not specified, the object's parent entity is used.</p>
ToItem	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Identifies the destination item for inventory receive, inventory transfer, or inventory reclassification. For example: cycles.</p> <p>When the item is not supplied, the default item from the source location is used, if available.</p>
ToLot	Yes	Yes	Yes	<p>Identifies the destination lot number where the item is to be received or when the inventory is transferred or reclassified. For example: LotA, LotB, and so on. When the lot is not supplied, the default lot from the source location is used if available.</p>

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
ToSublot	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Identifies the destination subplot number where the item is to be received, or when the inventory is transferred or reclassified. For example: SublotA, SublotB, and so on.</p> <p>When the subplot is not supplied, the default subplot from the source location is used if available.</p>
ToGrade	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Identifies the destination grade of an item that is received, transferred, or reclassified. This attribute uses a string description, not the integer ID. For example: Acceptable, Overage, Shortage, Reject, and so on.</p> <p>When the inventory grade is not supplied, the default inventory grade from the source inventory location is used if available.</p> <p>If no inventory grade is found while creating a new inventory and a default state is configured for this subplot and lot, the default state is used</p>

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
				<p>to identify the item grade of the new inventory.</p> <p>If no inventory grade is found and a default grade is configured for this lot, the default grade is used to identify the item grade of the new inventory.</p>

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
ToState	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Identifies the destination state of an item that is received, transferred, or reclassified. This attribute uses a string description, not the integer ID. For example: Normal, Condemned, Hold, and so on.</p> <p>When the inventory state is not supplied, the default inventory state from the source inventory location is used if available.</p> <p>If no inventory state is found while creating a new inventory and a default state is configured for this subplot and lot, the default state is used to identify the item state of the new inventory.</p> <p>If no inventory state is found and a default grade is configured for this lot, the default state is used to identify the item state of the new inventory.</p>
ToUnitofMeasure	Yes (Optional)	Yes (Optional)	Yes (Optional)	Identifies the quantity in specific units that is used when the quantity is

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
				<p>transferred. For example: Gallons, Liters, and so on.</p> <p>If a legitimate unit is supplied, the destination inventory is available, and it is measured in units other than the supplied units, the supplied quantity is converted to the destination units in the inventory based on a defined UOM conversion between the units. If a legitimate unit is supplied that is not the default unit for the item, the supplied quantity is converted from the supplied units to the native units of that item.</p> <p>If the unit is not specified or is not a valid unit of measure, it is assumed that the quantity is represented in native units of that item.</p>
ToExpiryDate	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Identifies the expiry date for the destination item that is received, transferred, or reclassified.</p> <p>When the expiry</p>

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
				<p>date of this item is not supplied, the default expiry date from the source inventory location is used if available.</p> <p>If no expiry date is found while creating a new inventory and a default expiry date is configured for this subplot and lot, the default expiry date is used to identify the expiry date of the new inventory.</p>
ToWorkOrder	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Used to identify and log the job that produces this item. When a value is supplied, it is used to log the work order in the inventory. Otherwise, the default work order from the source inventory location is used if available.</p> <p>During inventory transfers, the destination work order is overwritten with the work order ID from the source if a value for this attribute is not specified during inventory transfers.</p>

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
ToOperation	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Used to identify and log the job that produced this item. When a value is supplied, it is used to log the operation ID in the inventory. Otherwise, the default operation ID from the source inventory location is used if available.</p> <p>During inventory transfers, the destination operation is overridden with the operation ID from the source if a value for this attribute is not specified during inventory transfers.</p>
ToSequenceNumber	Yes (Optional)	Yes (Optional)	Yes (Optional)	<p>Used to identify and log the job that produced this item. When a value is supplied, it is used to log the job sequence number in the inventory; otherwise, the default job sequence number from the source inventory location is used if available.</p> <p>During inventory transfers, the destination job sequence number is overridden with the sequence number from the source, if a</p>

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
				value for this attribute is not specified during inventory transfers.
TransferQuantity	Yes (Required)	Yes (Required)	Yes (Required)	Identifies the quantity to be transferred.
TransferOption  (Option 1: Enforce Destination Settings)	No	Yes (Required)	No	The transfer option is applicable only when the inventory is transferred to a different storage location, lot, or a subplot, whose storage location, lot, or subplot is not same.  For Option 1 Enforce Destination Settings:  The grade, status, and expiry date from the source inventory location must match with the grade, status, and expiry in the destination inventory location. If the grade, status, and expiry from the source location do not match the grade, status, and expiry in the destination location, the inventory is not

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
				transferred.

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
TransferOption  (Option 2: Ignore Destination Settings)	No	Yes (Required)	No	<p>The transfer option is applicable only when the inventory is transferred to a different storage location, lot, or a subplot, whose storage location, lot, or subplot is not same.</p> <p>For Option 2 Ignore Destination Settings:</p> <p>The grade, status, and expiry date in the destination inventory location is ignored, if an item is transferred from a location whose date is different than the existing date. While transferring the quantities from one location to another, if a legitimate value for the grade, status, or expiry is supplied, the supplied value overwrites the existing value in the inventory.</p> <p>Otherwise, the existing grade, status, or expiry date in the destination inventory is retained.</p>
TransferOption  (Option 3: Overwrite Destination Settings)	No	Yes (Required)	No	The transfer option is applicable only when the inventory is transferred to a different storage

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
				<p>location, lot, or a subplot, whose storage location, lot, or subplot is not same.</p> <p>For Option 3 Overwrite Destination Settings: The grade, status, and expiry date in the destination inventory location are always overridden with the grade, status, and expiry date from the source location, regardless of whether the grade, status, and expiry date in the destination row match those in the source location.</p>
FromLocation	Yes (Optional)	Yes (Required)	Yes (Required)	<p>Identifies the source storage entity from where the item needs to be transferred or shipped. For example: WarehouseA, WarehouseB, PalletA, and so on.</p>
FromItem	No	Yes (Required)	Yes (Required)	<p>Identifies the source item that is part of the inventory transfer or inventory reclassification. For example: Cycles.</p>

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
FromLot	No	Yes (Required)	Yes (Required)	Identifies the source lot number from where the item needs to be transferred or shipped. For example: LotA, LotB, and so on.
FromSublot	No	Yes (Required)	Yes (Required)	Identifies the source subplot number from where the item needs to be transferred or shipped. For example: LotA, LotB, and so on.
FromWorkOrder	No	Yes (Optional)	Yes (Optional)	Identifies the work order of the job from where the item came when the option to uniquely identify item by job is configured.
FromOperation	No	Yes (Optional)	Yes (Optional)	Identifies the operation of the job from where the item came when the option to uniquely identify item by job is configured.
FromSequenceNumber	No	Yes (Optional)	Yes (Optional)	Identifies the sequence number of the job from where the item came when the option to uniquely identify item by job is configured.
Comments	Yes (Optional)	Yes (Optional)	Yes (Optional)	Any additional comments that need to be logged during

Attribute Name	Used By Receive	Used by Move Inventory	Used by Reclassify	Comments
				the inventory transfer or receive process.

## Managing Specifications

Using the OCO specifications attributes and commands, you can configure specifications that have been created in the MES database using MES Client and then execute the specifications. However, you cannot create specifications using the OCO.

The specification attributes and commands are on the **Specifications** tab in the Object Editor. For this tab to appear in the Object Editor, the **Enable Specifications** option on the **General** tab must be selected.

You can map the specification properties such as specification value, minimum value, or maximum value with object attributes. When you execute the specifications commands available for an object at run time, the mapped specification values are retrieved from the database for the corresponding object attributes at run time.

You can map run-time attributes of a specification with external input or output sources to execute upload and download commands. The following two sets of attributes are created for every specification:

- **Working** attributes, which allow you to change properties of a specification, such as SpecValue, MinValue, or MaxValue. You can change specification properties after loading them from the database and before uploading them to external input or output sources.
- **Target** attributes, which allow you to map specification properties with external input or output sources while extending them with an InputOutput.Reference or InputSource attribute (only for SpecValueActual, the only uploadable attribute).

For information about the attributes available at run time, see [Specification Attributes Available at Run Time](#).

## About Specification Alias

When you select a specification through the specification browser in the Object Editor, an alias is automatically assigned to the selected specification and it appears in the Object Editor. For most of the cases, an alias is equal to the SpecID in the MES database. The alias name must conform to the System Platform naming conventions that are used for User Defined Attributes (UDAs).

The MES database allows certain characters such as single quote and space for the SpecId property of a specification, which are not supported in System Platform attribute names. To overcome this problem, an alias is created for the selected specification.

The Alias is then used in the name of attributes to organize all specification related properties, such as Specs.<SpecAlias>.SpecId, Specs.<SpecAlias>.SpecGroupId, Specs.<SpecAlias>.Units.

## Configuring Specifications

You can configure mapping of properties of the specifications that you add to the template or instance in the

Object Editor to System Platform attributes. You can also modify or delete specifications that have been added. When you modify or delete specifications in the Object Editor, the actual specification values are not altered or deleted from the MES database.

On the **Specifications** tab, you can configure the following:

- Map specification properties with object attributes.
- Specify two scaling factors to be used for upload and download commands.
- Configure security classifications and input sources for specification properties, job filters, and commands.
- Specify job filter attributes.

## Adding Specifications

You can add any of the globally-defined specifications in the MES database.

When adding specifications, you can:

- Select a specification group
- Select individual specifications from a specification group

When you add a specification group, all the specifications belonging to that group are added to the **Specifications** list.

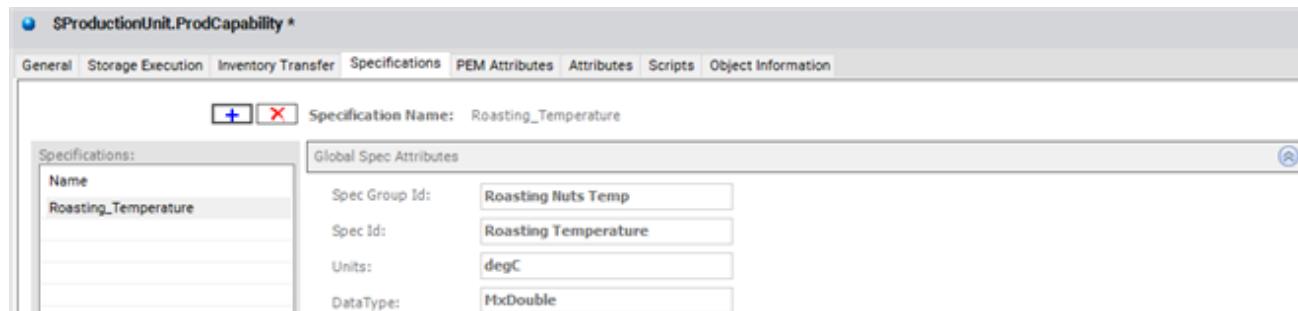
### To add a specification

1. Click the  Add button.

The **Specification Browser** dialog box appears.

2. Select the required specifications or specification groups, and then click **OK**.

The selected specification or specifications belonging to the selected specification groups appear in the **Specification Name** list.



When you select a specification from the **Specifications** list, the following information about the specification is retrieved from the MES database and appears in the **Global Spec Attributes** area.

#### Specification Group Id

ID of the group to which the specification belongs.

#### Specification Id

ID of the specification.

#### Units

Units of measure of the specification.

#### Data Type

Data type of the specification, such as floating point or string.

### Renaming a Specification

When you rename a specification, the specification alias is renamed and attributes corresponding to the specification are automatically linked to the new specification. You cannot rename the actual specification in the MES database.

#### To rename a specification

1. In the **Specification** list, select and click the specification that you want to rename.
2. Type the new name and press **Enter**.

The alias name of the selected specification is changed.

### Deleting a Specification

You can delete a specification from the Object Editor. When you delete a specification, you delete the specification alias that is removed from the Object Editor. You cannot delete the actual specification from the MES database.

#### To delete a specification

1. In the **Specification** list, select the specification that you want to delete.
2. Click the  Delete button.  
A confirmation message appears.
3. Click **Yes**.

The selected specification is deleted from the list.

### Mapping Specification Properties with System Platform Attributes

You can map properties of a specification with System Platform attributes in the **Extendable Spec Attributes** section of the **Specifications** tab.

Attribute Name	Use Input Output Source	Input Output Source	Working Attribute
Spec Id	<input type="checkbox"/>		
Spec Group Id	<input type="checkbox"/>		

Attribute Name	Use Input Output Source	Input Output Source	Working Attribute
Units	<input type="checkbox"/>		
Spec Value	<input type="checkbox"/>	0.0	
Min Value	<input type="checkbox"/>	0.0	
Max Value	<input type="checkbox"/>	0.0	
Spare1	<input type="checkbox"/>		
Spare2	<input type="checkbox"/>		
Spare3	<input type="checkbox"/>		
Spare4	<input type="checkbox"/>		

Attribute Name	Use Input Source	Input Source	Working Attribute
Spec Value Actual	<input type="checkbox"/>	0.0	

Mapping is required to execute the following commands:

- Download command, which is used to write specification values to the specified System Platform attributes.
- Upload command, which is used to retrieve the value of the configured input source for the **Spec Value Actual** property and update the target attribute.

To specify a System Platform attribute, select the **Use Input Output Source** check box corresponding to a specification property.

The default attribute appears in the corresponding specification property box. Also, the galaxy browse button appears to the right of the box.

#### Spec ID

The specification ID.

#### Spec Group ID

The specification group ID.

#### Units

The units for the specification value.

#### Spec Value

The value for the specification

**Min Value**

The minimum value for the specification.

**Max Value**

The maximum value for the specification.

**Spare 1–4**

User-defined information for the specification.

**Spec Value Actual**

The actual value of the specification as collected while the job is running.

## Specifying Scaling Factors

A scaling factor is a number that indicates the extent of scaling that can be used. For example, the scaling factor value 0.8 specifies that you can use 80% scaling. The value 1 for a scaling factor indicates that scaling is not used. You cannot use the scaling factors for the string data type.

Scaling factors are required when different equipments use different inputs to produce the same result. For example, pumps A and B are used for transferring water. If pump A takes input values in liters per minute and pump B takes input values in gallons per minute, you must use the appropriate scaling factors for each pump.

You can configure the following scaling factors for a selected specification in the **Scaling** section.

Attribute Name	Use Input Source	Value or Input Source
Scaling Factor DB to IO	<input type="checkbox"/>	1.0
Scaling Factor IO to DB	<input type="checkbox"/>	1.0

**Scaling Factor DB to IO**

Used during download of specification properties. The working attributes are multiplied with this scaling factor before target attributes are updated.

**Scaling Factor IO to DB**

Used during upload of object values. The target attributes are multiplied with this scaling factor and are written to working attributes of a specification.

**To specify the value for a scaling factor**

- In the **Value or Input Source** box corresponding to a scaling factor, type the value or provide a reference.

## Specifying Job Filter Attributes

You must configure job filter attributes in the **Runtime Job Filter** section to specify job information.

**Work Order**

The work order ID of a job or a reference to a work order ID attribute.

**Operation**

The operation ID of a job or a reference to an operation ID attribute.

**Sequence Number**

The sequence number of a job or a reference to a sequence number attribute.

**Step Number**

The job step number or a reference to a step number attribute.

**Job Position**

The job position or a reference to a job position attribute.

When a specification command is triggered, the specifications for the specified job are loaded to the working attributes area.

If you want to load specifications of a job by using the LoadJobSpecs and LoadDownloadJobSpecs commands, you must specify the following job filter attributes:

- Work Order
- Operation
- Sequence Number
- Step Number

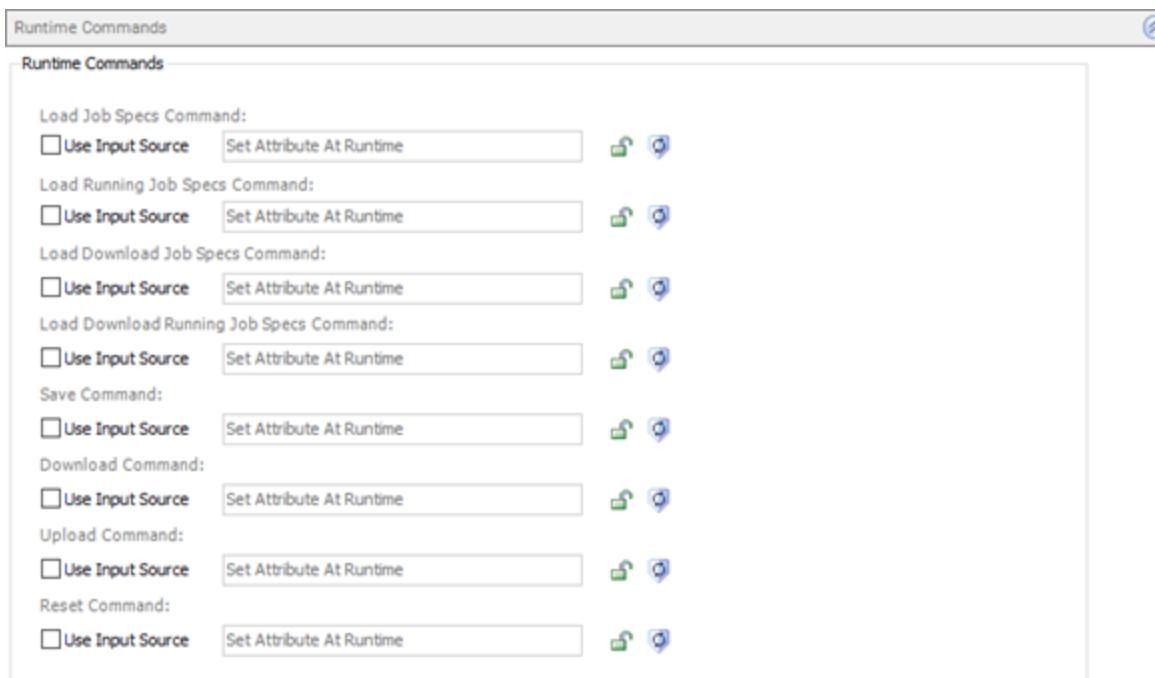
If you want to load specifications of a running job by using the LoadRunningJobSpecs and LoadDownloadRunningJobSpecs commands, you must specify the following job filter attributes:

- Job Position
- Step Number

## Triggering Specification Commands

You can trigger specification run-time commands to perform the following:

- Load job specifications.
- Download specification values from working attributes to target attributes, and subsequently update "Target.InputOutput.Reference" System Platform attributes if configured.
- Upload values of "Target.SpecValueActual.InputSource" attribute to update working attributes.
- Save actual values of specifications.
- Reset any errors.



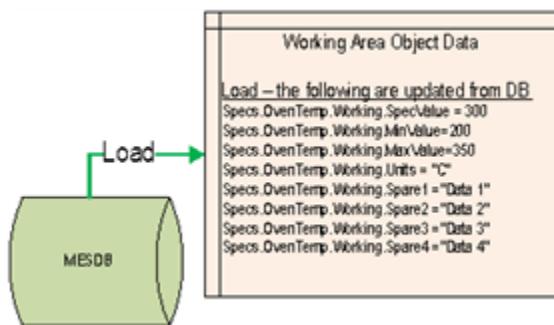
At run time, the specifications primitive supports the following commands:

#### **Load Job Specs Command (corresponding attribute: Specs.LoadJobSpecsCmd)**

The following attributes are used to specify job information and load the required specifications from the database:

- Specs.WorkOrder
- Specs.SequenceNumber
- Specs.Operation
- Specs.StepNumber

At run time, specifications data corresponding to the specified job (from the Job\_Spec table) to be run on a parent entity of an OCO instance is retrieved.



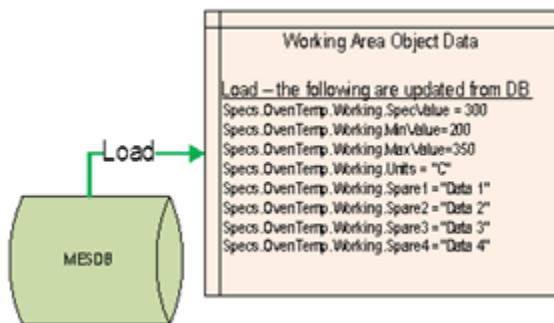
#### **Load Running Job Specs Command (corresponding attribute: Specs.LoadRunningJobSpecsCmd)**

You must specify the job position to retrieve the specification data for a job running on a parent entity of an OCO instance at the specified job position.

At run time, the Spec.JobPosition attribute is used to specify the job position.

Additionally, you can specify a job step number to retrieve specification data for the specific job step. At run time, the Spec.StepNumber is used to retrieve the specification data.

The value 1 for this attribute indicates no specification data is retrieved for the job step.



#### **Load Download Job Specs Command (corresponding attribute: Specs.LoadDownloadJobSpecsCmd)**

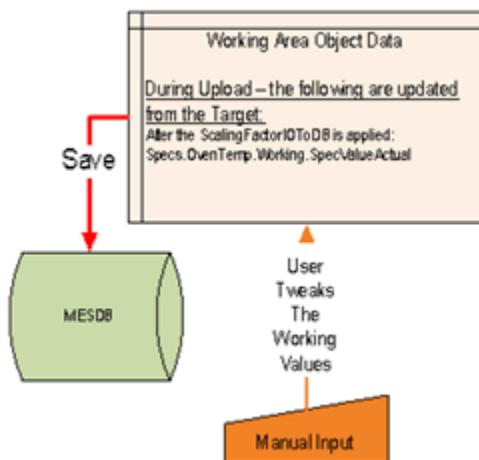
This command is the combined action of executing the Load Job Specs command and Download command.

#### **Load Download Running Job Specs Command (corresponding attribute: Specs.LoadDownloadRunningJobSpecsCmd)**

This command is the combined action of executing the Load Running Job Specs command and Download command.

#### **Save Command (corresponding attribute: Specs.SaveCmd)**

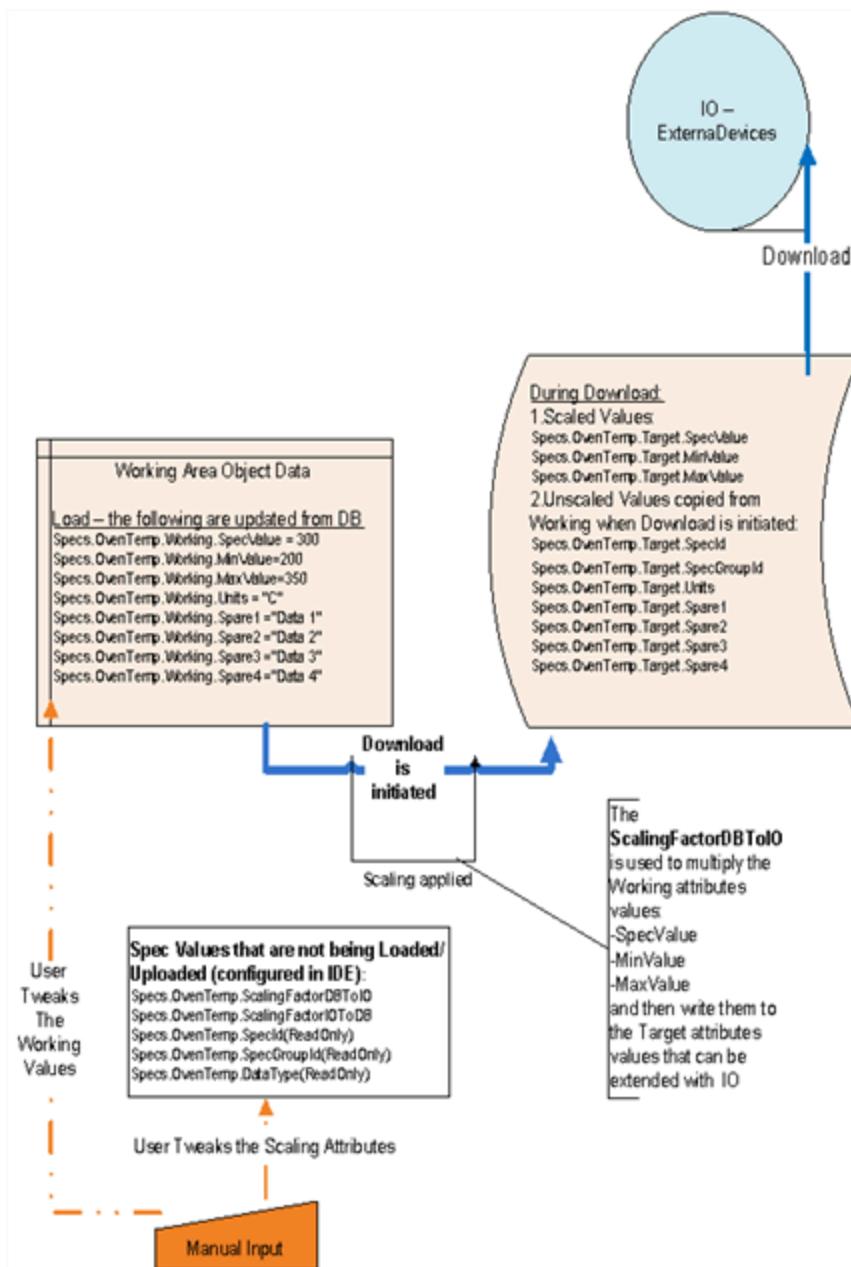
This command is used to write the actual value of Specs.<SpecAlias>.Working.SpecValueActual for each specification to the MES database. You can change the value of the Specs.<SpecAlias>.Working.SpecValueActual attribute before triggering the Save command.



#### **Download Command (corresponding attribute: Specs.DownloadCmd)**

This command is used to copy the values of working attributes to target attributes while applying the **Scaling Factor DB To IO** attribute value for each specification.

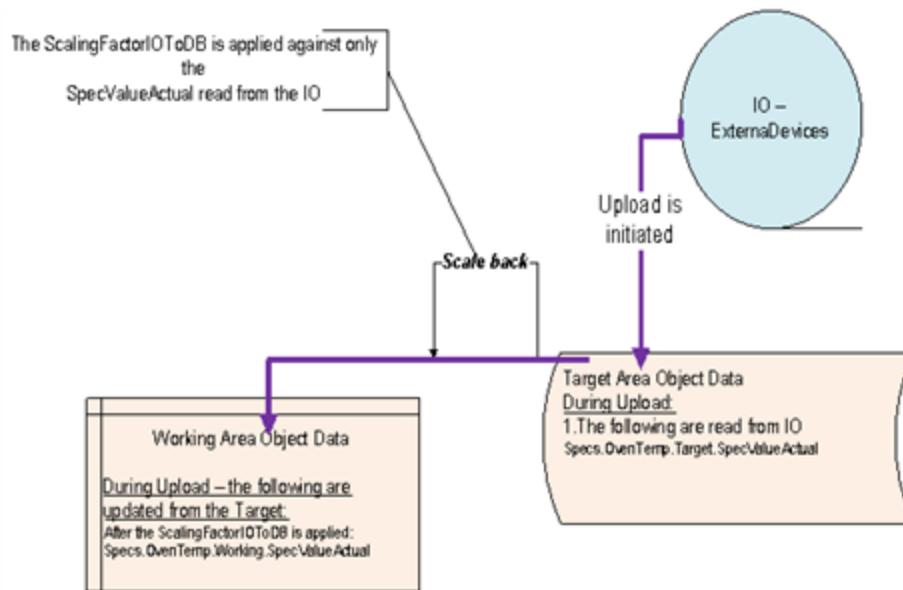
When inputoutput.reference is configured for target attributes, the values of downloadable specification properties are written to the System Platform attributes that are specified by the inputoutput.reference. You can change the specification values that are loaded from the database before triggering the Download command.



### Upload Command (corresponding attribute: Specs.UploadCmd)

This command is used to read the InputSource value that is configured for the SpecValueActual attribute and update the target attribute (Specs.<SpecAlias>.Target.SpecValueActual) at run time.

The target attribute value is written to the working attribute (Specs.<SpecAlias>.Working.SpecValueActual) while applying the scaling factor (Specs.<SpecAlias>.ScalingFactorIOToDB).



### Reset Command

This command is used to clear the status attributes if any errors that occur while executing specification commands.

### Restricting Run-Time Access to Working Attributes

You can restrict access to the working attributes of a specification at run time to prevent unauthorized users from changing the configured information.

To restrict access to the working attributes at run time, do the following:

1. In the **Working Attribute Security** column, click the icon corresponding to the specification property whose working attribute access you want to restrict.
2. Click the required option to restrict access.
3. Click **Save** to save the changes.

### Managing PEM Attributes

The Production Events Module (PEM) functionality within the OCO lets you monitor, report, and analyze production history and genealogy for lots, batches, and serial numbers without having to define the full MES model.

**Note:** PEM attributes should not be used in conjunction with an MES process model.

The PEM attributes and commands are on the **PEM Attributes** tab in the Object Editor. For this tab to appear in the Object Editor, the **Enable PEM Attributes** option on the **General** tab must be selected. When the **Enable PEM Attributes** option is selected, the **Entity Can Run Jobs** option on the **General** tab is automatically selected. When Entity Model Builder is run, the entity will have the **Can Log Data** capability option enabled.

The PEM functionality in the OCO delivers the information defined in the ISA-95 Production Performance category. This category includes the following production classes of information:

- Material Produced Actual

- Material Consumed Actual
- Material Consumable Actual
- Personnel Actual
- Equipment Actual
- Production Data

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**Note:** The PEM instances are not intended to be ISA-95 compliant, but to record the data to support the ISA-95 structures that will facilitate enterprise integration. For more detailed information about ISA-95 definitions and standards, refer to the ISA documentation.

---

You can use PEM attributes for the following:

- Create new work orders, jobs, or items.
- Generate genealogy ID to trace all the source materials of a product.

You can configure the following information in the **PEM Attributes** tab:

- Common Data Attributes
- Genealogy
- Production Attributes
- Extended Production Attributes

A single instance of OCO supports the definition of multiple PEM instances and each instance has specific PEM attributes. A maximum of 20 PEM instances is allowed for a single OCO instance.

For example, if we have two PEM instances Produce1 and Equip1 within the OCO instance named OCO\_001, the PEM attributes are represented as follows:

```
OCO_001.PEMAttrs.Produce1.ProductionRequestID  
OCO_001.PEMAttrs.Produce1.ProcessSegmentID  
OCO_001.PEMAttrs.Produce1.Quantity  
OCO_001.PEMAttrs.Equip1.EquipmentID  
OCO_001.PEMAttrs.Equip1.MaterialID  
OCO_001.PEMAttrs.Equip1.Quantity
```

For information about the attributes available at run time, see [PEM Attributes Available at Run Time](#).

## ISA-95 and MES Attribute Mapping

The OCO follows the naming conventions and object modeling structures as described in the International Society of Automation (ISA)-95 Enterprise-Control System Integration standards. The ISA-95 standard allows you to standardize and integrate the processes and workflow of the business systems at the enterprise level with the manufacturing and control systems at the plant level.

The OCO supports the MES attribute and ISA-95 naming conventions.

For more information about ISA-95 standard, visit the ISA 95 standard web site at:

<https://www.isa.org/standards-and-publications/isa-standards/isa-standards-committees/isa95>

You can map the S95 and the MES attributes as described in the following table.

ISA-95 Attributes	MES Attributes
Production Request ID	Work Order (wo_id)
Process Segment ID	Operation (oper_id)
Material ID	Item (item_id)
Material Type	Item Reason (reas_cd)
Equipment	Entity (ent_id)
Location	Entity (to_ent_id, from_ent_id, etc.)
Personnel	Operator (user_id)

### Naming of Attributes for Compatibility with ISA-95

MES in general is capable of supporting both MES attribute naming and the PEM/EOM naming, which was based on ISA-95 names. You can choose to rename the major ISA names.

Note that the naming convention used in the OCO only applies to attribute labels of the OCO, and not to the actual attributes in the PEM Instance labels in the object.

#### To change the name of attributes to ISA-95 names to match the PEM/EOM naming

1. In MES Client, make a copy of the language **Default (English)**.
2. Edit the following strings in the new language and change the names using the Replace functionality to give new names.

MES Name	Attribute ID	ISA-95 Name
Work Order	<1113>	Production Request ID
Operation	<714>	Process Segment ID
Item Id	<63>	Material Id
Item	<5652>	Material
Operator	<1202>	User
Entity	<710>	Equipment

3. Save your changes.
4. In MES Client, set the system attribute **Default Language** in the **General Parameters** section to the new language you created.
5. Save your changes.
6. Close and reopen the System Platform IDE so that the OCO can load the new language strings.

## PEM Data Storage

For information about where PEM attributes are stored in the MES database, see [PEM Data Storage](#).

## Configuring PEM Instances

A PEM instance is capable of recording production events and associated production data. You can create, delete, and rename PEM instances in the OCO.

You can create up to 20 PEM instances for a single OCO instance and configure each PEM instance to capture data, such as equipment, personnel, or material. This can be done by configuring attributes for each PEM instance.

A PEM instance does not have any mechanism to start or stop jobs. The jobs are created at run time and are started or stopped automatically.

When the identified job is not currently running on an entity, then the job is started on the entity. The entity represents the parent application object hosting the OCO. When no such job positions are available, then the oldest job that is running on the entity is stopped, and the identified job is started on the entity. If the identified job is running, the job is not stopped.

### Creating a New PEM Instance

You can create a PEM instance to configure PEM attribute values and to generate the genealogy IDs.

For information about Genealogy, see the [Tracking Genealogy](#).

You can configure PEM attribute values for each PEM instance.

#### To create a new PEM instance

1. Click the  Add button.

A new instance is added to the **PEM Instances** list.

2. Type the new name and press **Enter**.

The name that is created appears in the **PEM Instance Name** box at the top of the Object Editor.

### Renaming a PEM Instance

You can change the name of an existing PEM instance. When you rename a PEM instance, the configured PEM attributes are linked to the new PEM instance.

#### To rename a PEM instance

1. In the **PEM Instances** list, select and click the PEM instance you want to rename.
2. Type the new name and press **Enter**.
3. Save the changes.

The selected PEM instance name is changed.

## Deleting a PEM Instance

You can delete an existing PEM instance. When you delete a PEM instance, all the PEM attributes associated with the instance are deleted.

### To delete a PEM instance

1. In the **PEM Instances** list, click the PEM instance you want to delete.
2. Click the  Delete button.

The selected PEM instance is removed from the list.

## Configuring a PEM Instance's Command Type

A PEM command type defines the type of production data to be configured for the PEM instance.

The instance's command type is selected on the **PEM Command Type** list.

The PEM command types are organized by the following categories:

- Material event
- Status event

Each of the command types provides a set of production attributes that you can configure for a defined production segment.

### Material Event PEM Command Types

The Material Event PEM command types are used to trigger events related to consumption of raw materials or production of goods.

#### Material Consumable Actual

Used to trigger events and record data related to consumption of materials that cannot be directly associated with actual materials used in a production process.

The Material Consumable Actual command type identifies the consumables used during a defined production segment. The information collected includes the material, quantity, and unit of measure of the consumed material.

The consumables are not included in a bill of materials, as they might be items which are not individually accounted for in a defined production segment. However, these items might result in direct charges that are considered in the costing of a production segment.

Consumables can include utilities, such as electricity and water, common chemicals, or catalysts.

#### Material Consumed Actual

Used to trigger events and record data related to consumption of material that can be directly associated with actual materials used in a production process.

The Material Consumed Actual command type allows you to record materials consumed during a defined production segment. The material consumed is included in a bill of material as raw material, purchased material, or the output of a process segment.

It is recommended to use the Quantity attribute to define consumption of a resource.

#### Material Produced Actual

Used to trigger events and record data related to production of materials that are part of a production process.

The Material Produced Actual command type allows you to record the process of manufacturing a final product as the output of a production segment.

It is recommended to use the Quantity attribute to define how much material is produced.

## Status Event PEM Command Types

The Status Event PEM command types are used to trigger events related to the production environment.

### Production Data

Used to trigger events and log additional production data related to an instance in a production process.

Production Data events can be used to record values at the end of a step in a production process, such as values for temperature, pressure, or color.

### Equipment Actual

Used to trigger events and log equipment-related data for a production segment.

The Equipment Actual command type allows you to record information about the usage of an equipment within a production process segment.

Equipment Actual events can contain a list of equipment properties associated with a production segment, such as values for dies, setup tools, or serial numbers of an equipment.

### Personnel Actual

Used to trigger events and log personnel data for a production segment.

Personnel Actual events can include details, such as identification number of an employee and workstation, within a production segment.

You cannot change the specified command type for a PEM instance. If you want to change the command type, you must delete the PEM instance and create a new PEM instance.

## Material Moved Actual Object in PEM

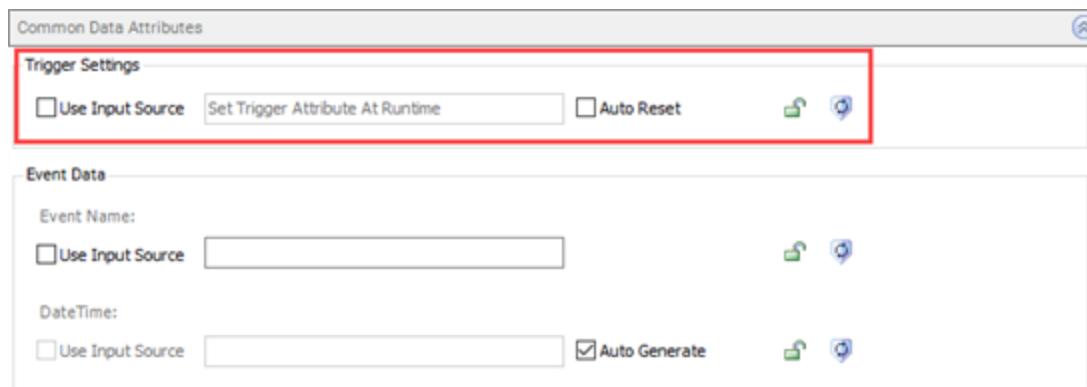
The Material Moved Actual object in PEM was used to record the movement of materials with a single PEM event object. This Material Moved Actual object was a combination of a Material Consumed Actual event and a Material Produced Actual event.

An example is the movement of material from a receiving location to a storage silo on a production line. In this case, the Material Moved Actual event traced the consumption of a material from the receiving location to the production of a material in the storage silo.

Using the OCO built-in Inventory functionality, you can track the event and manage the current inventory in the location at the same time, which was not possible with PEM. This inventory functionality requires the MES Operations licensing.

## Configuring the PEM Instance Trigger Settings

The PEM instance's Trigger Settings in the **Common Data Attributes** section associates the PEM instance with a Boolean attribute that acts as the PEM object trigger, for example, when a batch of material has finished entering a piece of equipment. Production attributes are not updated when using an input source until the object is triggered.



You can control:

- What triggers the PEM instance
- Whether to automatically reset the trigger after triggering an event

You can configure a PEM instance trigger to:

- Link the PEM instance trigger with a Boolean attribute by selecting the **Use Input Source** check box. When the Boolean attribute is set to True, the `PEMInstance.Trigger` extended attribute becomes True at run time.



- Trigger manually by clearing the **Use Input Source** check box. You can specify to reset the value of a trigger extended attribute of a PEM object to True at run time.



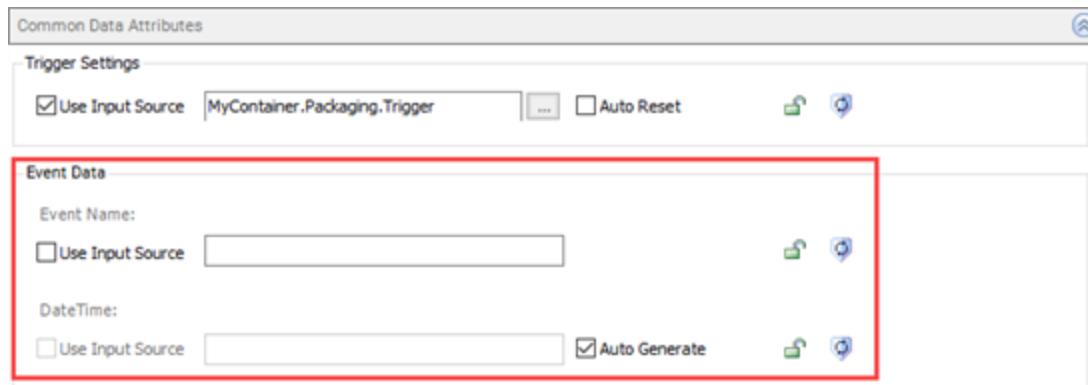
- Automatically reset by selecting the **Auto Reset** check box. If the **Use Input Source** check box is selected, then the I/O point entered as the input source must accept a write so that the OCO can write to the I/O point when the trigger is reset to 0.

For information about what attributes are created when a PEM instance is triggered, see [Attributes Created When a PEM Instance Is Triggered](#).

For information about how the trigger attribute is affected by the Auto Reset setting during run time, see [Effect of the Instance Trigger Auto Reset Setting](#).

## Configuring the Name and DateTime of a PEM Triggering Event

Use the Event Data attributes in the **Common Data Attributes** section to specify a new name for the triggering event, and the date and time for the PEM event.



### Event Name

The name of the PEM event to be triggered.

### DateTime

The date and time to log the PEM event to the database.

### Auto Generate

If selected, at run time automatically generates the date and time to log the PEM event.

## Configuring Production Attributes

You can configure the PEM instance's production attributes in the **Production Attributes** section.

Production attributes are not updated when using an input source until the object is triggered.

For a description of the attribute behavior during run time, see the table in [Attribute Behavior During Run Time](#).

Attribute Name	Trigger Genealogy	Use Input Source	Value or Input Source
Location	<input type="checkbox"/>	<input type="checkbox"/>	
Material ID	<input type="checkbox"/>	<input type="checkbox"/>	
Unit of Measure	<input type="checkbox"/>	<input type="checkbox"/>	
Production Request ID	<input type="checkbox"/>	<input type="checkbox"/>	
Process Segment ID	<input type="checkbox"/>	<input type="checkbox"/>	
Production Schedule ID	<input type="checkbox"/>	<input type="checkbox"/>	
Segment Requirement ID	<input type="checkbox"/>	<input type="checkbox"/>	
Segment Response ID	<input type="checkbox"/>	<input type="checkbox"/>	
Subsegment ID	<input type="checkbox"/>	<input type="checkbox"/>	
Personnel List	<input type="checkbox"/>	<input type="checkbox"/>	
Comments	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment ID	<input type="checkbox"/>	<input type="checkbox"/>	
Quantity	<input type="checkbox"/>	<input type="checkbox"/>	0.0
Lot	<input type="checkbox"/>	<input type="checkbox"/>	
Sublot	<input type="checkbox"/>	<input type="checkbox"/>	
Serial Number List	<input type="checkbox"/>	<input type="checkbox"/>	

Production attributes are not updated when using an input source until the object is triggered.

### Location

The location at which to store items.

### Material ID

The ID of the material.

### Unit of Measure

The unit of measure for the item.

### Production Request ID

The ID of the production request for a job.

### Process Segment ID

The process segment ID for a job.

### Production Schedule ID

The production schedule ID for a job.

### Segment Requirement ID

The segment requirement ID for a job.

### Segment Response ID

The segment response ID for a job.

### Subsegment ID

The subsegment ID for a job.

**Personnel List**

The operator that runs the job.

**Comments**

Additional comments to be logged about the item production or consumption.

**Equipment ID**

The ID of the equipment used for the job.

**Quantity**

The number of items produced or consumed.

**Lot**

The lot number for the items.

**Sublot**

The subplot number for the items.

**Serial Number List**

The serial number list for the items.

## Configuring Extended Production Attributes

You can extend the amount of data you want to record when the PEM instance is triggered by configuring extended production attributes (EPAs) in the **Extended Production Attributes** section.

Log Attribute	Attribute Name	DataType	Use Input Source	Input Source or Initial Value

Log Attribute	Attribute Name	DataType	Use Input Source	Input Source or Initial Value

If any PEM extended production attributes are inherited from a parent OCO template, they appear in the **Inherited Extended Production Attributes** list.

Up to 48 EPAs can be created for each PEM instance. You can create an extended PEM attribute only if you select to log its value to the database. You can specify the type of data such as Boolean, String, Float, Double, or Integer that is logged for the extended PEM attribute to the database. Extended production attributes can be directly configured using a derived template or instance of an OCO with a PEM instance, or can be inherited from a parent template.

You can specify the name and data type of an extended production attribute if you want the extended production attribute to be recorded when the PEM instance is triggered.

If you want to associate an extended production attribute with a System Platform attribute, then provide an input source reference.

You can configure extended PEM attributes for a PEM instance only after configuring PEM attributes. A single PEM instance supports extended PEM attributes only for a specific command (for example, add production or add consumption).

The set of extended production attributes configured for a PEM instance are grouped under one data log group in the MES database. The data log group name obtained for this PEM instance will be unique across all OCO instances. And, each extended production attribute (name) is added as a value\_name in the Data\_Log\_Value table, corresponding to its data log group. Each value name in the Data\_Log\_Value table for a data log group is uniquely identified by the value\_index. Thus, a value specified at run time for an extended production attribute is

logged in the Data\_Log table corresponding to its value index column that is related to the value name for a data log group.

After the extended production attributes are configured for a PEM instance, and when the OCO instance is deployed, the Entity Model Builder automatically creates the necessary data log group and data log values in the MES database, so that the value from these extended attributes can be properly logged into the corresponding value\* columns in the Data\_Log table.

For example, the data log group name for the PEM extended attributes are typically represented as:

- OCO\_001|Mixing|ProductionData
- OCO\_100|Blending|MaterialConsumption

When the extended attribute data is triggered:

- The middleware queries the Data\_Log\_Value table using the supplied data log group name and value name (extended attribute name) to retrieve the value index.
- After the value index is retrieved, the supplied extended attribute value is copied to the corresponding value\* column in the Data\_Log table.
- This process is repeated for all the supplied extended attributes.
- The extended attributes that match those of the value\_name column for a data log group in the Data\_Log\_Value table are the only attributes that gets logged into the Data\_Log table, and the remaining value\* columns are updated with (blank) values. An exception will be thrown to the caller if the supplied extended attribute name does not exist in the Data\_Log\_Value table for the supplied data log group.

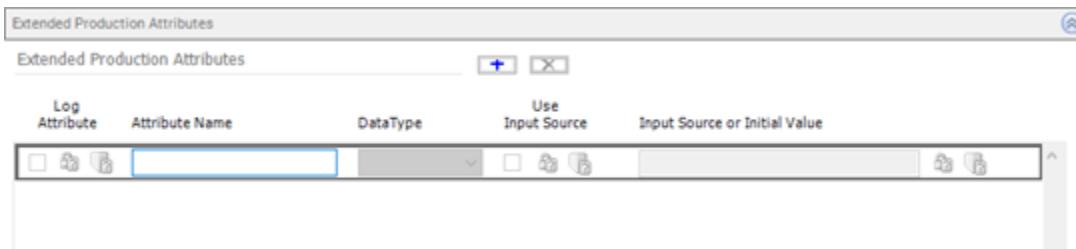
The values collected at runtime from these extended attributes will always be recorded in the Data\_Log table.

## Creating an Extended PEM Attribute

You can create extended PEM attributes for a PEM instance. The maximum is 48 extended PEM attributes for a single PEM instance.

### To create an extended PEM attribute

- Click the  Add button in the **Extended Production Attributes** section.  
A new attribute row is added in the **Extended Production Attributes** section.



Each extended production attribute has the following settings.

#### Log Attribute

Determines whether the attribute will be logged.

When there are more than one configured extended PEM attribute, you can clear the required **Log Attribute** check boxes for attributes whose values are not to be logged. The **DataType**, **Use Input Source**, and **Input Source**

or **Initial Value** boxes are enabled only when the **Log Attribute** check box is selected.

#### Attribute Name

The name of the extended attribute.

#### DataType

The data type for the extended attribute:

- Boolean (the default)
- Double
- Float
- Integer
- String
- Time
- ElapsedTime

You cannot change the data type of an extended PEM attribute after the OCO object is deployed.

#### Input Source or Initial Value

A value for the attribute or, if the **Use Input Source** check box is selected, a reference that will be the source for the attribute value.

The value of the specified attribute is retrieved at run time. By default, the input value is False.

### Deleting an Extended PEM Attribute

You can delete an extended PEM attribute that is configured for a PEM instance.

When you delete the extended PEM attribute, the corresponding data (if any) that is collected for this attribute is deleted from the database when you run the Entity Model Builder.

#### To delete an extended PEM attribute

1. In the **Extended Production Attributes** section, select the extended PEM attribute you want to delete.
2. Click the  Delete button.

A confirmation message appears.

3. Click **Yes**.

The selected extended PEM attribute is deleted.

### Tracking Genealogy

A manufacturing company must record the production process details to track the production status at any instant.

Genealogy allows you to trace the complete history of any material lot (produced or consumed) that is managed by the MES software. You can use genealogy to trace the origins of a contaminated or defective end product.

You can use genealogy to:

- Track materials that are produced back to all the raw and intermediate materials used for production (genealogy).

For example, this can be used to track the origins of contaminated or defective end product.

- Track the raw material or intermediate material to all materials that are produced using them (reverse genealogy).

For example, this can be used to track the extent of contaminated or defective end products if the raw material is known to be contaminated.

Genealogy uses the following:

#### Genealogy ID

Links production, consumption, production data, equipment data, and so on with a unique ID.

A new genealogy ID is generated each time when a value of an attribute is changed at run time.

A sample genealogy ID is as follows:

OCO\_001|Mixing|2022-08-19 14:19:51.523

#### Production Event ID

Links PEM instances of OCO objects across process segments.

A process segment is a logical grouping of resources, such as personnel, equipment, and material required to execute a production step. The process segment defines the type and quantity of resources required.

When a production transaction is triggered, it generates a unique production event ID on each call to the middleware.

A sample event ID is as follows:

Bar Chocolate|2022-08-19 14:23:38.841

### Prerequisites for PEM Instances Genealogy

When PEM instances are used to produce items, consume items, and collect genealogy information, the following system attributes must be turned on in the MES Client General Parameters to record unique production and consumption events:

- Maintain distinct reject production records
- Maintain distinct consumption records
- Maintain distinct good production records
- Log production transactions as job events
- Log consumption transactions as job events

### Enabling Genealogy Tracking

You can configure PEM attributes to generate genealogy IDs respectively when the attribute value changes at run time. The genealogy ID is a unique ID that links all the OCO objects within a same process segment.

All PEM attributes are not capable of creating new genealogy IDs even if the PEM instance is configured to generate a new genealogy ID.

The genealogy ID cannot be generated for the following attribute changes:

- Comments
- Quantity
- Material Type
- Personnel List

Use the following attributes to configure genealogy.

#### **Generate and log internal genealogy identifiers (Genealogy ID and EventLinkID)**

If selected, enables the Genealogy attributes.

#### **Generate GenealogyID on demand (runtime)**

Enter a value in the box, or select the check box and specify a reference that will provide the genealogy ID.

#### **Generate on Production Attribute changes**

Select the check box to generate a new genealogy ID at run time when the attribute value changes.

### **Generating a Genealogy ID**

Genealogy IDs are generated for an instance only if the corresponding instance is configured to generate a new genealogy ID.

You must select the **Generate and log genealogy identifiers (GenealogyID and EventLinkID)** option to generate the genealogy ID and EventLink ID.

You can generate genealogy ID using the following methods:

- Select the **Trigger Genealogy** check box of a production attribute to generate a genealogy ID when the value of the attribute is changed at run time.

For example, in the following diagram, the **Trigger Genealogy** check box is selected for the Material ID attribute. Any changes in the Material ID triggers a change in the genealogy ID.

Attribute Name	Trigger Genealogy	Use Input Source	Value or Input Source
Location	<input type="checkbox"/>	<input checked="" type="checkbox"/>	MyContainer.Packaging.Location
Material ID	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	MyContainer.Packaging.MaterialID
Unit of Measure	<input type="checkbox"/>	<input type="checkbox"/>	EACH

- In the **Generate GenealogyID on demand (runtime)** section, select the **Use Input Source** check box and provide a reference to an input source that can be used as the value for the genealogy ID at run time.

<b>Genealogy</b>
<input checked="" type="checkbox"/> Generate and log internal genealogy identifiers (GenealogyID and EventLinkID)
<b>GenealogyID</b>
GenealogyID is typically used to link together objects belonging to the same process segment.
Generate GenealogyID on demand (runtime)
<input checked="" type="checkbox"/> Use Input Source      MyContainer.Packaging.GenealogyID
<input type="checkbox"/> Generate on Production Attribute changes

- Trigger the GenerateGenealogyID command on the OCO PEM Instance at run time.

When a PEM instance is set to trigger a new genealogy ID on an attribute value change, a new genealogy ID is generated each time a value for an attribute is changed at run time and the trigger genealogy (<Attribute>.TriggerGenealogy) is set to True.

Following is the sample genealogy ID format:

<OCO Instance Name>|<PEM Instance Name>|YYYY-MM-DD HH24:MI:SS.nnn

For example:

OCO\_001|Mixing|2022-08-19 14:19:51.523

The PEM instance name in the genealogy ID is restricted to 190 characters.

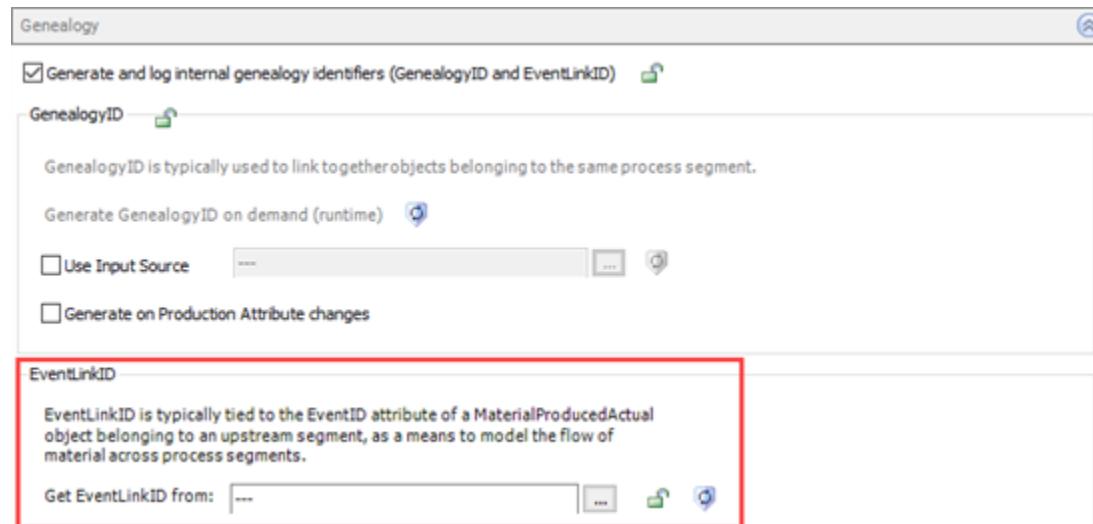
You must configure the correct attributes to create a new genealogy ID when the value for an attribute is changed at run time.

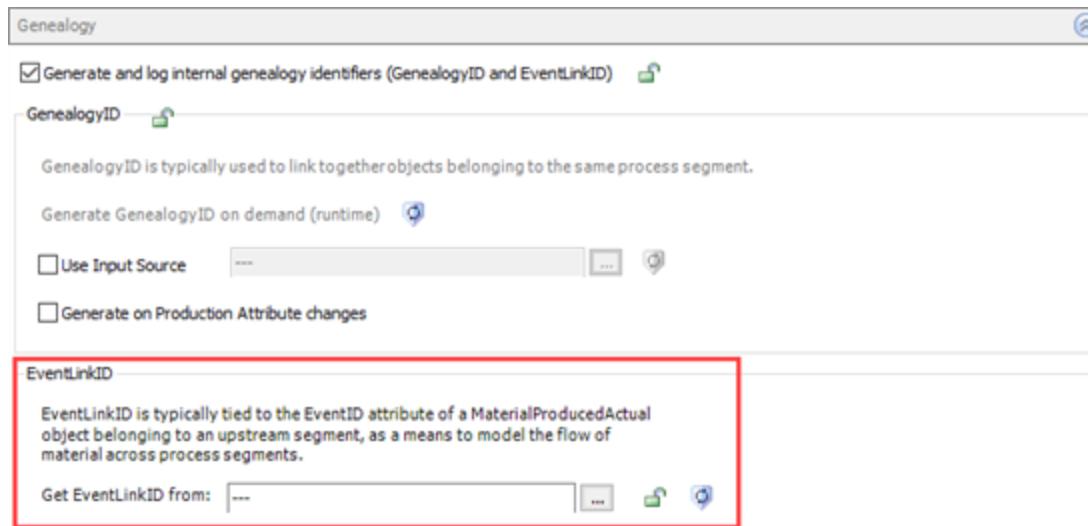
When the GenerateGenealogyID command is set to True at run time, a new genealogy ID is generated at run time and the value is added to the genealogy ID attribute. The subsequent MES middleware call uses the genealogy ID that is generated while making calls to the middleware.

When the use input source for the genealogy ID attribute is set to True, the genealogy ID is queried from the input source or from an external I/O for each MES middleware call. The retrieved value overrides the current genealogy ID.

## Configuring EventLink ID

If the Material Consumed Actual command type is selected for the PEM instance, then the EventLinkId attribute is available. For all other command types, the EventLinkId attribute is not available.





The EventLink IDs are used to link the consumption record to the upstream production event. It also links the OCO objects of the current process segment with the OCO objects of the previous process segment.

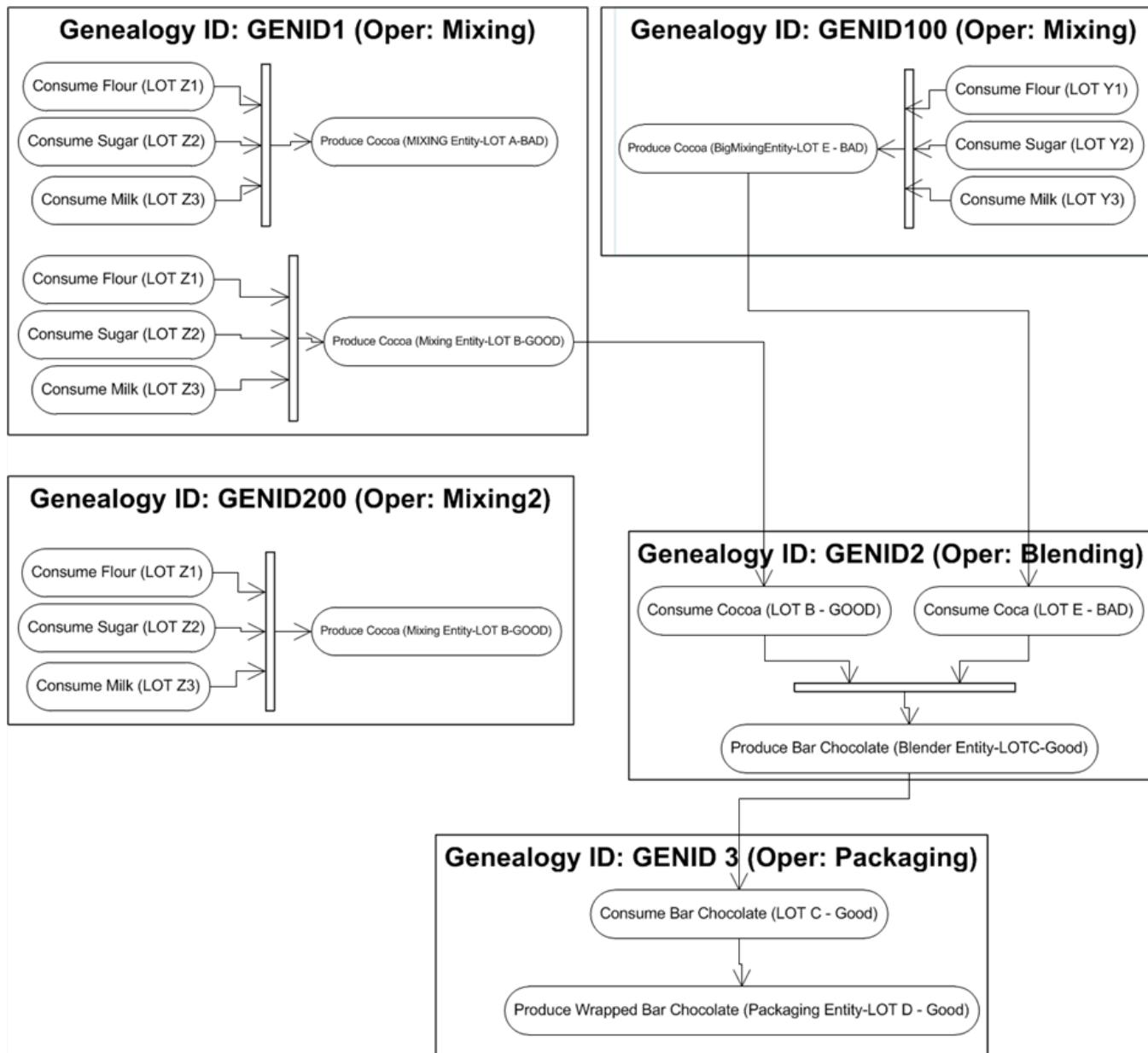
### To configure the EventLink ID

- Do one of the following:
  - Type the EventLink ID in the **Get EventLinkID from** box.
  - Click the Browse button and select the EventLink ID attribute.

The EventLink ID is retrieved from the selected attribute at run time.

### Example of Applying Genealogy

The following genealogy example shows the production and consumption when linked with genealogy IDs and EventLink IDs.



The following table describes the production information:

Work Order	Operation	Entity	Item	Lot No	Reason	Genealogy ID	Event ID	Qty
WO1	Mixing	Mixer1	Cocoa	LOT A	BAD	GENID1	EVENT1	4
WO1	Mixing	Mixer1	Cocoa	LOT B	GOOD	GENID1	EVENT2	4
WO2	Mixing	Big Mixer1	Cocoa	LOT E	BAD	GENID100	EVENT3	4
WO3	Mixing	Mixer1	Cocoa	LOT B	GOOD	GENID200	EVENT4	4
WO1	Blending	Blender1	Bar Chocolate	LOT C	GOOD	GENID2	EVENT5	4

Work Order	Operation	Entity	Item	Lot No	Reason	Genealogy ID	Event ID	Qty
WO1	Packaging	Packer1	Wrapped Bar Chocolate	LOT D	GOOD	GENID3	EVENT6	4

The following table describes the consumption information:

Work Order/ Production Request ID	Operation / Process Segment ID	Con- sumed from Entity	Item	Lot No	Fg Lot No	Genealog y ID	Event LinkID	Qty
WO1	Mixing		Flour	LOT Z1	(blank)	GENID1		2
WO1	Mixing		Sugar	LOT Z2	(blank)	GENID1		1
WO1	Mixing		Milk	LOT Z3	(blank)	GENID1		1
WO1	Mixing		Flour	LOT Z1	(blank)	GENID1		2
WO1	Mixing		Sugar	LOT Z2	(blank)	GENID1		1
WO1	Mixing		Milk	LOT Z3	(blank)	GENID1		1
WO2	Mixing		Flour	LOT Y1	(blank)	GENID100		2
WO2	Mixing		Sugar	LOT Y2	(blank)	GENID100		1
WO2	Mixing		Milk	LOT Y3	(blank)	GENID100		1
WO3	Mixing		Flour	LOT Z1	(blank)	GENID200		2
WO3	Mixing		Sugar	LOT Z2	(blank)	GENID200		1
WO3	Mixing		Milk	LOT Z3	(blank)	GENID200		1
WO1	Blending	Mixer	Cocoa	LOT B	(blank)	GENID2	EVENT2	1
WO1	Blending	Big Mixer	Cocoa	LOT E	(blank)	GENID2	EVENT3	1
WO1	Packaging	Blender	Bar Chocolate	LOT C	(blank)	GENID3	EVENT5	4

## PEM Instance Behavior at Run Time

The following topics explain the PEM instance behavior at run time.

## Attributes Created When a PEM Instance Is Triggered

When a PEM instance is triggered, the following attributes are automatically created at run time.

### Item Class

- If the **Item Class** attribute value is not specified or left blank, the value that is configured in the **Default Item Class ID** attribute is used.
- If the specified **Item Class** value is already exists in the system, then the existing **Item Class** value is linked to the PEM event.
- If the specified **Item Class** value does not exist in the system, then a new Item Class is created using the specified value.

### Item

- If the **Item** attribute value is not specified or left blank, the value that is configured in the **Default Item ID** attribute is used.
- If the specified **Item** value is already exists in the system, then the existing **Item** value is linked to the PEM event.
- If the specified **Item** value does not exists in the system, then a new Item is created using the specified value.

### Unit of Measure (UOM)

- If the **UOM** attribute value is not specified or left blank, the value that is configured in the **Default Item ID** attribute is used.
- If the specified **Item** value is already exist in the system, then the existing **Item** value is linked to the PEM event.
- If the specified **Item** value does not exist in the system, then a new Item is created using the specified value.
- A new UOM is created in the database only if the specified **Item** value does not exist in the database. If the value exists in the database, the specified quantities are converted to the native units of the existing Item if it is already defined for an Item.

### Work Order

A new work order is created only if the following conditions are True:

- The **Production Request ID** attribute value is specified and the specified value that does not exist in the database.
- If the **Work Order** attribute value is not specified or left blank, the **Default Work Order ID** is used to create a new work order only if the work order ID does not exist in the database.

### Job

A job is created only if the following conditions are True:

- The specified **Process Segment ID** attribute is left blank and it does not exist for the **Production Request ID**.
- If the **Process Segment** attribute value is not specified or left blank, the **Default Operation ID** that is configured in the System Attribute table is used to create a new job only if the job does not exist in the database.

## Attribute Behavior During Run Time

The following table lists the PEM instance attributes and indicates whether they can be created at run time if they do not exist and whether a new data entry job can be created if the value changes.

Production attributes are not updated when using an input source until the object is triggered.

PEM Instance Attributes	Create if does not exist	Create new data entry job if changed	Comments
Comments	No	No	The value is logged when the production or consumption transaction is reported.
Equipment ID	No	No	The value is logged when the production or consumption transaction is reported.
Event Date Time	No	No	If this attribute supports input source, the value is always read from the input source. If the <b>Auto Generate</b> option is set to True, a date time value is generated at run time when the trigger command is triggered.  If the <b>Auto Generate</b> and <b>Use Input Source</b> options are set to True, the value is read from the input source.  If none of the options are selected, a blank datetime value is sent to the middleware at run time.
Event ID	No	No	This value is logged when the production transaction is reported (item_prod.event_id).
Event Link ID	No	No	This value is logged when the consumption transaction is reported (item_cons.upstream_event_id).
Event Name	No	No	The event_name value is stored in the

PEM Instance Attributes	Create if does not exist	Create new data entry job if changed	Comments
			job_event.value3 column.
Location	No	No	This value is logged when the production or consumption or subsegment transaction is reported.
Lot	No	No	This value is logged when the production or consumption or subsegment transaction is reported.
Material ID	Yes	No	Create new item if the specified value is not null and it does not exist in the database.
Material Type	No	No	This value is logged when a production transaction is reported. The material_type is also logged in the job_event.value9 column. This attribute is applicable only to Material Produced Event.
Personnel List	No	No	The value is logged against the current production or consumption in the job_event.value4. There is no validation on the data received for personnel list, so the format of the list is completely open. For example, Jack, David Miller, etc.
Process Segment ID	Yes	Yes	Create new job for this work order if the value is not blank and it does not

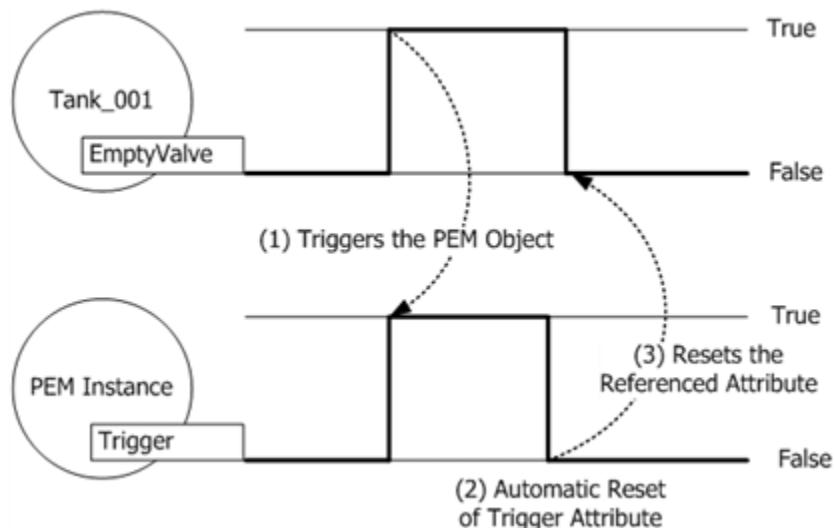
PEM Instance Attributes	Create if does not exist	Create new data entry job if changed	Comments
			exist in the database.
Production Request ID	Yes	Yes	Create new work order if the value is not blank and it does not exist in the database.
Production Schedule ID	No	No	Update the existing production schedule ID for this work order if the production schedule ID is not same in the work order.
Quantity	No	No	The value is logged when the production or consumption transaction is reported.
Segment Requirement ID	No	No	<p>This value is used to log data to:</p> <ul style="list-style-type: none"> <li>• item_prod.segment_requirement_id if the current transaction is a Production transaction</li> <li>• item_cons.segment_requirement_id if the current transaction is a Consumption transaction</li> <li>• job_event.segment_requirement_id if the current transaction is to Start a subsegment.</li> </ul>

PEM Instance Attributes	Create if does not exist	Create new data entry job if changed	Comments
Segment Response ID	No	No	<p>This value is used to log data to:</p> <ul style="list-style-type: none"> <li>• item_prod.segment_response_id if the current transaction is a Production transaction</li> <li>• item_cons.segment_response_id if the current transaction is a Consumption transaction</li> <li>• job_event.segment_response_id if the current transaction is to start a subsegment</li> </ul>
Serial Number List	No	No	<p>This value is logged against the current production or consumption in the job_event.value5. There is no validation on the data received for the serial number list, so the format of the list is completely open. For example: 00123, SNO1, etc.</p>
Sublot	No	No	<p>This value is logged when the production or consumption or subsegment transaction is reported.</p>
Subsegment ID	No	No	<p>This value is logged when the production or consumption or subsegment transaction is reported.</p>

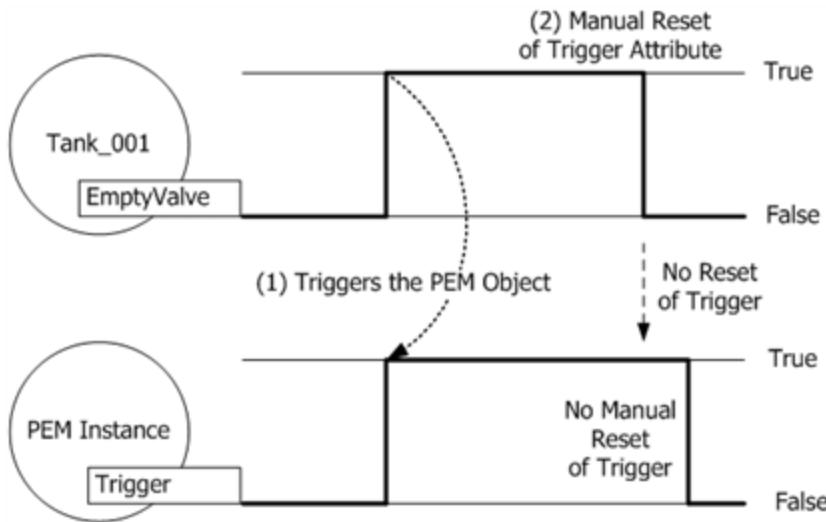
PEM Instance Attributes	Create if does not exist	Create new data entry job if changed	Comments
Unit Of Measure	Yes	No	Create new UOM if the specified value is not blank and it does not exist in the database. The UOM is logged in the job_event.value7 column.

### Effect of the Instance Trigger Auto Reset Setting

If you select the Trigger Settings **Auto Reset** check box in the **Common Data Attributes** section of the **PEM Attributes** tab, the Trigger attribute and the associated Boolean attribute values are set to False after it becomes True at run time.



If you do not select the **Auto Reset** check box, the trigger attribute and the associated Boolean attribute values remain True. You must reset them manually.



### Starting or Pausing Jobs

**Note:** PEM transactions should not be performed on jobs that are part of an MES process model, as PEM manages its own jobs. Doing so could result in MES process model jobs being overwritten by the PEM transactions.

Because the PEM instance does not have an explicit mechanism for starting/stopping jobs, the jobs created on the fly are started and stopped automatically.

When the identified job is not currently running on an entity, then the job is started on the entity. The entity is nothing, but the parent object hosting this OCO. When no such job positions are available, then the oldest job that is running on this entity will be stopped, and the identified job will be started on this entity. When the identified job is running, the job will be kept running.

Additionally, when a new Job is created, an associated BOM 0 record (`job_bom.bom_pos = 0`) also gets created along with this job identifying the item being produced by this OCO. The job BOM 0 record will be created using the supplied values and the default values supplied.

If the identified job exists, but the supplied production item is not the same item in the job, then a new `job_bom_subst` record for this item is created. The purpose of creating `job_bom_subst` record is to individually maintain various BOM flags such as `update_inventory` etc. for each Item produced/consumed in a job.

If the supplied item is a consumption item for this job, then a new BOM record is created for the supplied item for this job. The `bom_pos` number is the next minimum number currently available in the `Job_Bom` table for the supplied job.

If a consumption transaction is sent to the middleware before the production item is identified, the BOM 0 item is created with the default item configured in the `System_Attribute` table for attribute Default ItemID. When the actual production transaction is triggered, then the event updates the BOM 0 item and the item produced by the job (`job.item_id`) with the supplied item.

### Status Sequence of the PEM Instance at Run Time

1. The status of the instance must be Ready for the instance to be triggered to record the data.  
If triggered when not ready, this error can occur:
2. When triggered, the status of the instance goes to Busy while processing the message.

3. Once the message is processed, the status of the instance goes to Done if there is no error while processing the message.
4. The status of the instance goes to Error when there is a problem while processing the message.
5. The status of the PEM instance goes to Ready where there is no error while processing the message and the Auto Reset indicator checked.
6. If the Auto Reset is not checked, the instance must be manually reset to Ready in order to trigger another message.

### How the Production or Consumption Reason Is Determined

The production or consumption reason is determined as follows:

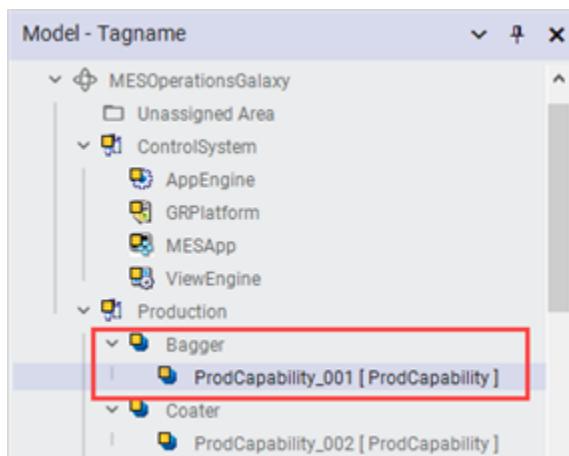
- If the **Material Type (Item Reason)** attribute value is not specified or left blank, the **Default production reason** value is used.
- If the **Material Type (Item Reason)** attribute value is not specified or left blank and the current transaction is a Consumption transaction, then the value from the **Default consumption reason** attribute value that is configured in the System Attribute table is used.

### Adding OCO Instances to System Platform Objects

Once you have created your OCO templates, you can add instances of the templates to your equipment model in the System Platform IDE below any object that you want to create in MES as an entity with OCO-related capabilities.

1. In the System Platform IDE Model View, configure your equipment model, including any objects that represent MES entities that require OCO-related capabilities.  
For detailed information about creating your equipment model in the System Platform IDE, see the System Platform IDE help.
2. Create and add an OCO instance as a child of any modeled object that represents an MES entity that requires OCO-related capabilities.

An object can contain only one OCO object as a child.



3. Configure the individual OCO instances in your equipment model as needed.

For general OCO configuration information, see [Configuring OCO Templates and Instances](#).

For information about the specific configuration attributes, see the appropriate chapters in this document.

When you are ready to export the OCO instance to the MES database as an MES entity, see [Building the MES Entity Model from OCOs](#).

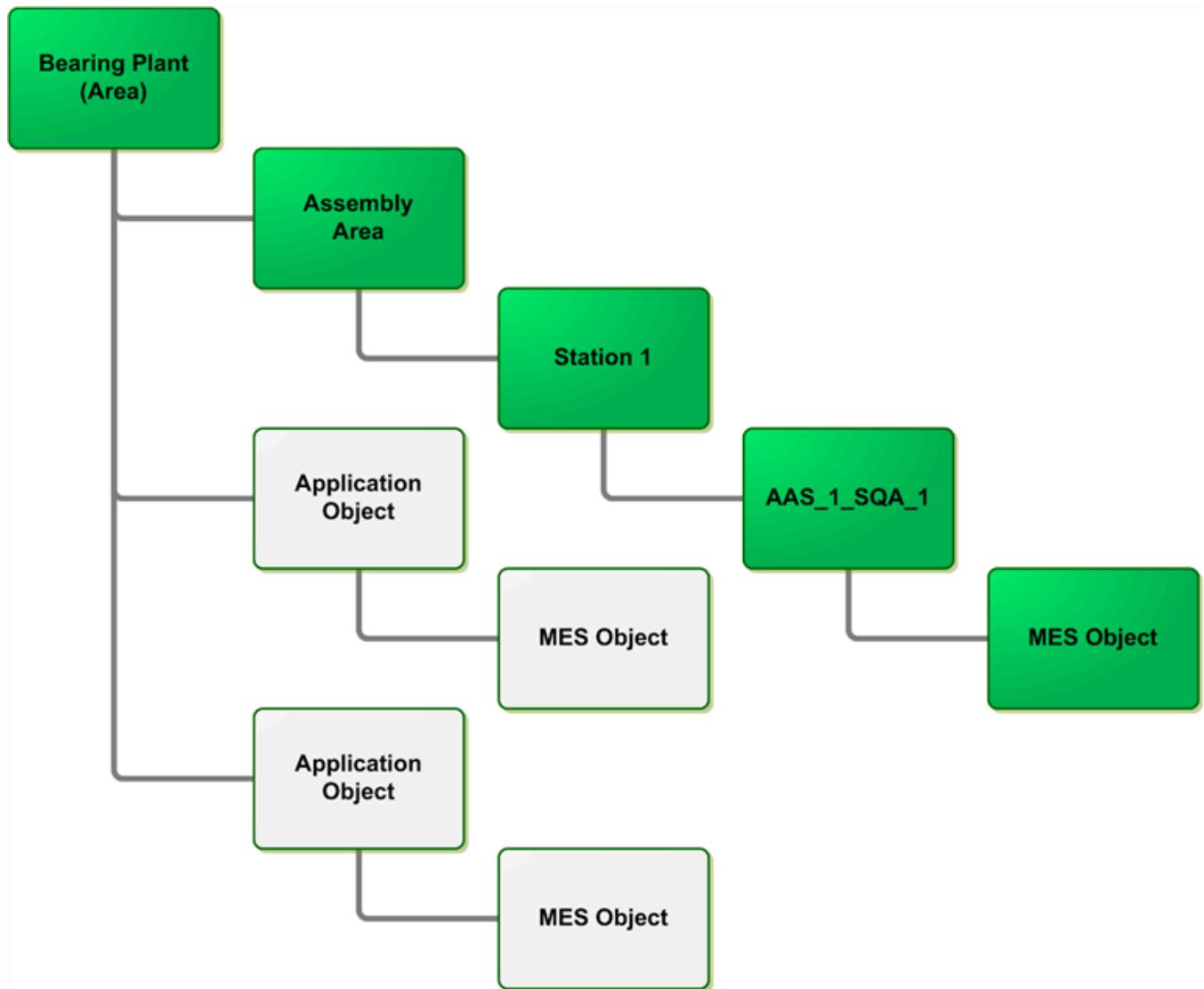
## Building the MES Entity Model from OCOs

The Entity Model Builder is a System Platform IDE extension for creating entities from your System Platform equipment model that use the OCO for configuring MES operations support.

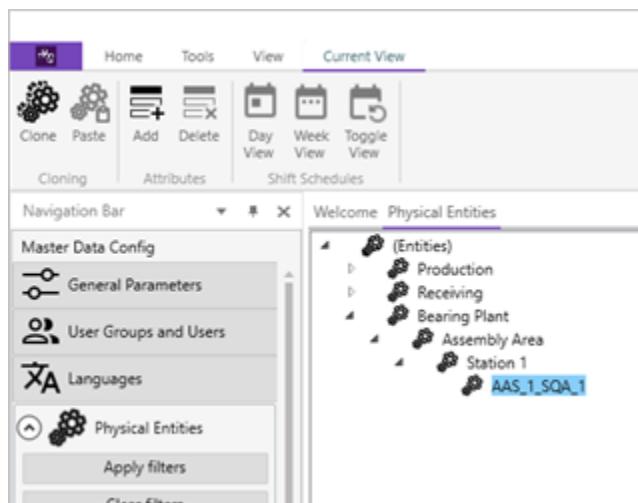
You can also use the Entity Model Builder to export existing System Platform users and roles to create corresponding users and groups. For more information about this capability, see the *MES Entity Model Builder User Guide*.

### How OCO-Enabled Objects Are Added to the MES Database as Entities

In the following example, if you select the OCO that is a child of the AAS\_1\_SQA\_1 object, the Entity Model Builder creates MES entities only for the objects above it in the branch, up to and including the Bearing Plant (area). The attribute configuration information is extracted from the OCOs and stored as the corresponding property settings for the target entity (in this case, the AAS\_1\_SQA\_1 entity).



The following figure shows the resulting entity tree in MES Client. You could also have selected the parent application object that has a OCO child attached to it and then run Entity Model Builder to create the same structure.



Since the other OCOs in the same equipment model are not directly part of the selected equipment tree branch, they are not included in the entity creation because they are not part of the direct parent/child equipment structure to the AAS\_1\_SQA\_1 object.

Note the following additional behaviors about OCOs and using Entity Model Builder to create or modify their entities in the MES database:

- If you select multiple application objects with OCOs, the Entity Model Builder creates entities for all of them.
- If the selected application object is not a OCO, does not have a OCO below it, and is not part of an MES operations configuration hierarchy, then the Entity Model Builder does not create any entities.
- The Entity Model Builder only creates new entities and new entity hierarchies that do not already exist.
- To delete an entity, you must delete it using MES Client. For more information on managing entities, see the *MES Client User Guide*.
- If there is already an entity in the MES database with the same name as the application object with a OCO, Entity Model Builder will overwrite its corresponding properties with the OCO attribute settings.
- Though the Entity Model Builder never deletes an existing entity or removes any capabilities (including OCO capabilities), it can re-parent entities at any level to reflect new structural changes to the System Platform equipment model hierarchy.
- The Entity Model Builder might not allow some modifications to an OCO. For example, if an entity was created that could run jobs and jobs have been created on the entity, then clearing the Entity Can Run Jobs attribute will fail when running Entity Model Builder. Since there are existing jobs on the entity, it is not possible to remove this option from the entity until all existing jobs are completed or canceled.
- When the Entity Model Builder encounters an error, the error will be indicated in the progress window and the OCO will remain in the unsynchronized state. It will not be possible to deploy or redeploy the OCO until it is synchronized with the MES database. Additional diagnostic information is also available in the Operations Control Management Console Log Viewer.

## Entity Names

When the Entity Model Builder creates entities, it bases the new entity names on the TagName attribute in the source application object.

From the example above, the Entity Model Builder produces four entities using the TagNames accordingly, with the final entity with the OCO child having the OCO capabilities set.

```
+ Bearing_Plant
  + Assembly_Area
    + Station1
      + AAS_1_SQA_1
```

## Entity Capabilities and Properties Copied to the MES Database

As the entities are created and updated in the MES database, Entity Model Builder enables the entity capabilities and configures the entity based on the configuration specified in the OCO. On the **General** tab, selecting the **Can Run Jobs**, **Can Store Items**, and **Can Schedule Jobs** options enable the corresponding entity capabilities.

- If the entity can run jobs, then the configuration specified on the **Job Defaults** tab will be recorded in the MES database.
- If the entity can store items, then the configuration specified on the **Storage Execution** tab will be recorded

in the MES database.

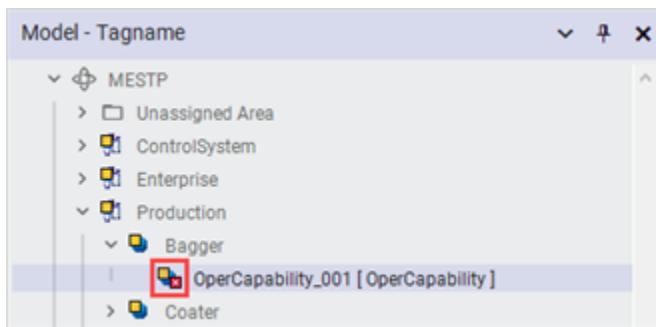
- If the entity can schedule jobs, only the capability is set; there is no additional configuration.

## Building and Deploying an Entity

Once you are finished configuring the OCO, save the OCO and fix any errors that are reported. Depending on the changes you made, you will have to build the entity model.

- If you made a change to a OCO template, you might have to update your entities to cascade your changes to any derived OCO instances. This depends on what you changed and what attributes you may have locked in your template.
- If you made a change to a OCO instance, you will only have to build the entity for the instance.

OCO instances that need to have their corresponding entities built or updated using Entity Model Builder will display an error indicator on the OCO icon in the System Platform IDE.



After you have saved your configured OCO, you can then create or update the corresponding MES entities by building your entity models. See [Creating an Entity in the MES Database from an Application Object with an OCO](#) and [Updating MES Entities with OCO Changes](#).

After you have built or updated the entities, you can deploy your equipment model for run-time operation. For detailed information deploying your galaxy, see the System Platform IDE help.

When you deploy the OCO OnScan, it will begin using the defined OCO configuration for run-time operations.

You can configure additional entity settings and system parameters, such as default reasons for good and rejected production records, in MES Client. For more information about configuring entities and system parameters, see the *MES Client User Guide* or online help.

## Creating an Entity in the MES Database from an Application Object with an OCO

When you select an OCO or any parent application object in the IDE equipment model tree and run the Entity Model Builder, their parent objects up to and including the object area and their associated properties are replicated in MES.

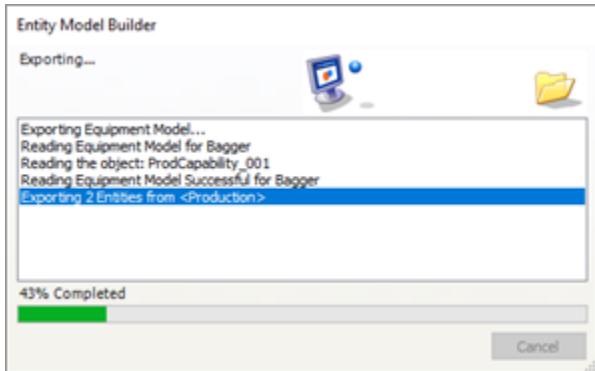
### To create a new entity

1. To avoid conflicts with other MES applications that are capable of adding or modifying entities, exit any MES applications that are currently running.
2. In the System Platform IDE equipment model, select the OCO object or a parent of the object.  
You cannot cancel the entity creation process. So make sure that you have selected the correct OCO or

parent object before proceeding.

3. Right-click the object or its parent object, and then click **Build MES Entity Model**.

The Entity Model Builder dialog box appears. It shows the status, errors, and percent complete.



**Note:** If you have more than one OCO under a single parent application object, the OCO will not be created and an error will be displayed in the progress dialog box.

4. When the operation has completed, click **Close**.

After the build process has successfully completed, the Entity Model Builder validates the OCO and marks it as being synchronized with MES. You can now deploy the parent application object in the System Platform IDE.

## Updating MES Entities with OCO Changes

You can use the Entity Model Builder to update your MES entities with any of the following changes made to the OCOs in the System Platform IDE:

- Changing the configuration of an OCO.
- Adding an OCO at a higher level in the equipment model.
- Moving an OCO to a higher level in the equipment model (re-parenting).
- Renaming a parent to an OCO at a higher level in the equipment model. This creates a new entity in the MES database and re-parents the old entity's children, if there are any.
- Adding an OCO to the equipment model that has the same name as an entity manually configured using MES Web Portal or MES Client. The existing entity's children (if any) are re-parented.
- Moving an OCO to another parent application object. The old parent is no longer considered an entity from the perspective of Entity Model Builder. However, if the entity has already been created in the MES database, it will remain in the database. This creates a new entity and parent entities, if needed.

If you remove an entity in your IDE equipment model, the entity is not deleted in MES.

If you have not made any changes to the OCOs in the System Platform equipment model, the Entity Model Builder just checks that the OCO configuration in the System Platform equipment model also exists in the entity model in the MES database. If there are any differences (for example, if someone changed an entity's configuration using MES Client), the MES configuration is updated to match the System Platform configuration.

The Entity Model Builder might not allow some modifications to an OCO. For example, if an entity was created that could run jobs and jobs have been created on the entity, then clearing the Entity Can Run Jobs attribute will fail when running Entity Model Builder. Since there are existing jobs on the entity, it is not possible to remove

this option from the entity until all existing jobs are completed or canceled.

## Where to Maintain an Entity's Object Attributes

For MES entities that are created from System Platform objects, changes to the object's attributes are one-directional—that is, from the System Platform IDE to the MES database. There is no mechanism to update the object's attributes if the corresponding entity's properties are changed in the MES database using MES Web Portal or MES Client.

Also, when Entity Model Builder is run, it overwrites the entity's property settings in the MES database with the current object attribute settings. So if you make changes to such an entity's object attributes outside the System Platform IDE equipment model (for example, using MES Web Portal or MES Client), those changes will be overwritten by the Entity Model Builder the next time it is run.

For this reason, once you create an MES entity using an object and Entity Model Builder, you should only maintain the object's attributes in the System Platform IDE.

## OCO Run-Time Behavior

The run-time behavior indicates the state of the OCO at run time. When you deploy the OCO OnScan, it starts using the configured OCO information for run-time operations.

During OnScan, the OCO checks for a client session on the engine. If the OCO is the first object on the engine, the OCO creates a special stateful client session for its use. All the new OCO objects use the same client session that is created by the first OCO object.

Since the OCO creates a special client session, the Stateful API cannot be used on a engine that contains the OCO. The Stateless API can be used on a engine that contains the OCO.

Once the object has a client session, the object initializes all the configured production and consumption counters by reading the latest value from the I/O (if configured). The object will not write any production or consumption counts to the MES database until the values change from the initialized readings.

## How Rejected Messages Are Handled

The object includes a set of RejectedMessages attributes for retrieving, viewing, and acknowledging rejected messages that occur during run time. The rejected messages are stored in the MES database. There is no configuration of the RejectedMessages attributes as these are set by the object.

RejectedMessage attributes configuration, such as I/O extensions, is not supported on OCO-specific tabs in Object Editor. However, RejectedMessages attributes can be interacted with through scripts, LMX-based read/write operations, Object Viewer, and also through System Platform's I/O extensions on the **Attributes** tab.

## OnScan Behavior

At OnScan, a subscription to rejected message events is established. A filter is applied to specify a representative rejected message dataset. The filter comprises the following attributes.

### RejectedMessages.Filter.Entity

The MES entity by which to filter the rejected messages that will be visible. This will be the object's parent entity. This attribute is auto-set at run time by the OCO. Its value should not be changed to ensure correct retrieval of rejected messages.

### **RejectedMessages.Filter.MaxHours**

The rejected messages that occurred up to the number of previous hours entered for this attribute will be retrieved.

The range of allowable values is from 1 to 100. The default value is 72. Every hour, the object will set the Time filter to a value in the past that is the MaxHours from the current time.

This value is expected to be set by the user at configuration time.

### **RejectedMessages.Filter.MsgType**

The message type by which to filter the rejected messages that will be visible. This attribute is auto-set by the OCO to retrieve all Without Response events that the OCO can generate. Its value should not be changed to ensure correct retrieval of rejected messages.

### **RejectedMessages.Filter.Time**

Only rejected messages that are more recent than this time stamp value will be retrieved. At OnScan, the time stamp value is set to the current time.

During execution, the difference between Filter.Time and the current time is compared against the Filter.MaxHours value. If exceeded, Filter.Time is reset an hour forward, ensuring that rejected messages older than Filter.MaxHours are never retrieved.

When this value is set by the user at run time, it will remove the current subscription and establish a new one. It is recommended that this value not be set frequently to avoid the performance overhead of recreating subscriptions.

A count of the rejected messages that match the filter criteria and a string array of the messages themselves will be available through the RejectedMessages.Count and RejectedMessages.Messages attributes. The RejectedMessages.Messages attribute can hold up to 200 messages. For example, in a 12-hour period, 450 rejected messages might be logged. The RejectedMessages.Count attribute would have a value of 450 but the RejectedMessages.Messages attribute would have only the 200 most recent messages.

The message array is ordered with the most recent message at the top (that is, with the first index value).

## **Rejected Message Retrieval Failures**

If the rejected message retrieval fails, the RejectedMessages.Status attribute value changes from Ready to Error. Also, an error code (RejectedMessages.ErrorCode) and error message (RejectedMessages.ErrorMessage) are returned.

The error codes are:

- -100, which indicates a communication error or MES middleware exception.
- -1, which indicates an unknown error.

The RejectedMessages.ResetCmd is used to clear the error condition. The reset command:

- Clears the ErrorCode and ErrorMessage attributes.
- Sets the Status attribute to Ready.
- Re-subscribes if the subscription has become invalid due to the error.

## **Acknowledging Rejected Messages and Resetting the Subscription**

The RejectedMessages.AckRejectedMessagesCmd command attribute is used to acknowledge the rejected

messages and clear them.

Setting this command to True acknowledges that the currently visible rejected messages have been viewed. The active rejected message subscription is removed and a new one is established. Also, the time stamp filter is set to the current time, effectively clearing any previous rejected messages.

## Failover Behavior

On failover to a redundant engine, the most recent RejectedMessages.Filters.Time value is retained and used when the new subscription is established from the redundant engine. The RejectedMessages.Filters.Entity and RejectedMessages.Filters.MsgType attributes will be set to their default values. This will cause the rejected message dataset that was current at the time of the failure to be retrieved.

## OffScan and Shutdown Behavior

At OffScan or Shutdown, the rejected message subscription is removed.

## Alarms and History

Rejected message alarm or history configuration is not supported for the object on the object-specific tabs in Object Editor. However, alarms and history can be configured for any of the attributes on the **Attributes** tab.

## Column Structure of a Rejected Message

The column structure and order of a message in the RejectedMessages.Messages array is provided here to allow you to set up processing of rejected messages. The message in the array is formatted in JSON.

- The timestamp of the rejected message in the local time where the object is running
- The XML error message returned by the MES middleware
- The XML message that was originally submitted
- The timestamp of the rejected message, in UTC
- The status of the rejected message after originally being submitted to the MES database:
  - 0 = Never submitted before
  - 1 = Resubmitted with error
  - 2 = Resubmitted with success
  - 3 = Edited and resubmitted with error
  - 4 = Edited and resubmitted with success
- The name of the object that submitted the original message
- The name of the object section from where the message was initiated
- The region from where the original message was initiated
- The message locale
- The message version
- A comment about the last edit made to the rejected message record, if one was provided
- Who last edited the rejected message record

- When the rejected message was initially logged or last edited
- The row ID of the rejected message record

An example message is shown below.

```
[{"rejected_message_local": "2015-10-09 4:14:21 pm",  
 "xml_error_message": "A row does not exist in util_exec for this entity{3243}",  
 "xml_message": "<?xml version='1.0'?><request><object>util_exec</object>  
 <msgtype>exec</msgtype><cmd>setrawreasonbyname</cmd><session_id>29</session_id>  
 <ent_name>Roaster</ent_name><raw_reas_cd>Idle</raw_reas_cd>  
 <new_reas_start_utc>10/9/2015 11:14:21 PM</new_reas_start_utc>  
 <comments></comments></request>",  
 "rejected_message_utc": "2015-10-09T23:14:21", "message_status": 0,  
 "object_name": "Roaster", "object_section": null,  
 "message_region": "Pacific Standard Time", "message_locale": "en-US", "message_version": 1,  
 "last_edit_comment": null, "last_edit_by": "oneuser",  
 "last_edit_at": "2015-10-09 11:14:21 pm", "row_id": 18}]
```

## Viewing and Managing Rejected Messages in MES Client

In addition to being exposed in the RejectedMessages attributes and viewable in Object Viewer, rejected messages can be viewed on the Rejected Message Viewer in MES Client. MES Client users with appropriate privileges can also edit, resubmit, and delete rejected messages. For more information, see the *MES Client User User Guide* or online help.

## Background User

Any communication between the MES object and the MES database is routed through the MES middleware. The MES middleware uses a connection string to connect to the MES database.

Whenever an MES user logs on to an application to start a session, the ID of the user is stored in the Session table in the MES database. The Session table contains the user\_id column that identifies the user who started the session.

All the MES objects share a common session with the MES middleware.

The user ID available in the Session table is Null for the MES object. So, the system associates the default user that is configured as a system attribute with a transaction.

The default user configured in the system can be non-MES user.

## OCO Attributes Available at Run Time

The following topics list and describe the OCO attributes that are available at run time according to the OCO-specific tabs in Object Editor.

For information about the common tabs that are available in the Object Editor, see the System Platform IDE Help.

The Configuration column in the tables specifies whether you can configure an attribute in the Object Editor.

The Run Time (RT) access column in the tables describes how the attribute values are accessed at run time. Values of the column include the following:

### Supervisory

The attribute value can be changed using a script.

**User**

The attribute value can be modified by the user.

**Read-Only**

The attribute value cannot be changed.

**None**

The primitive is deployed, but the attribute is not deployed at run time.

## General Attributes Available at Run Time

The attributes that are available at run time for any OCO instance are described in the following table.

Attribute Name	Description	Configura-tion	Run Time Access
CanRunJobs	Specifies whether the entity can run jobs. When you select this option, job execution attributes are enabled in the Object Editor.	No	Read-Only
JobExec. EnableJobAttributes	Specifies attributes and commands to create a new job. Available only if CanRunJobs is True.	No	Read-Only
JobExec. EnableProductionCount ers	Specifies whether production counters are enabled at run time to track production. Available only if CanRunJobs is True.	No	Read-Only
JobExec. EnableConsumptionCount ers	Specifies whether consumption counters are enabled at run time to track consumption. Available only if CanRunJobs is True.	No	Read-Only
CanSchedule Jobs	Specifies whether the jobs can be scheduled to the entity.	No	Read-Only
Enable Specifications	Specifies whether specifications can be configured.	No	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
EnablePEMAAttributes	Specifies whether PEM attributes are enabled at run time.	No	Read-Only
CanStore	Specifies whether the materials can be stored or transferred to this entity.	No	Read-Only
ResponseType	Specifies whether the configured object instance must have a With Response or Without Response communication with the middleware.	No	Read-Only
ErrorMessage	Specifies the description of an error that occurs while processing the middleware call.	No	Read-Only
ErrorCode	Specifies an integer value to indicate that an error has occurred while processing the middleware call.	No	Read-Only

When the OCO ResponseType mode is Without Response, then the following attributes are available.

Attribute Name	Description	Configura-tion	Run Time Access
RejectedMessages. AckRejectedMessagesCm d	If True, acknowledges that the rejected messages have been viewed. The active rejected message subscription is removed and a new one is established. Also, the time stamp filter is set to the current time, effectively clearing any previous rejected messages. The command value is automatically toggled back to False.	No	Supervisor User
RejectedMessages.Count	The number of rejected messages that match the current filter attribute values.	No	Read-Only
RejectedMessages. Filter.Entity	The MES entity by which to filter the rejected messages that will be retrieved. This will be the object's parent entity.  This attribute is auto-set at run time by the OCO. Its value should not be changed to ensure correct retrieval of rejected messages.	No	Read-Only
RejectedMessages. Filter.MaxHours	The rejected messages that occurred up to the number of previous hours entered for this attribute will be retrieved.  The range of allowable values is from 1 to 100. The default value is 72. Every hour, the object will set the Time filter to a value in the past that is the MaxHours from the current time.	Yes	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
	This value is expected to be set by the user at configuration time.		
RejectedMessages.Filter.MsgType	The message type by which to filter the rejected messages that will be retrieved.	No	Read-Only
RejectedMessages.Filter.Time	<p>This attribute is auto-set by the OCO to retrieve all Without Response events that the OCO can generate. Its value should not be changed to ensure correct retrieval of rejected messages.</p> <p>Only rejected messages that are more recent than this time stamp value will be retrieved. At OnScan, the time stamp value is set to the current time.</p> <p>During execution, the difference between Filter.Time and the current time is compared against the Filter.MaxHours value. If exceeded, Filter.Time is reset an hour forward, ensuring that rejected messages older than Filter.MaxHours are never retrieved.</p> <p>When this value is set by the user at run time, it will remove the current subscription and establish a new one. It is recommended that this value not be set frequently to avoid the performance overhead of recreating subscriptions.</p>	No	Supervisor User

Attribute Name	Description	Configura-tion	Run Time Access
RejectedMessages.Messages	The string array of the rejected messages that match the current filter attribute values. The array is ordered with the most recent message at the top (that is, with the first index value).	No	Read-Only
RejectedMessages.ResetCmd	<p>Used to clear a rejected messages retrieval error condition. The command does the following:</p> <ul style="list-style-type: none"> <li>• Clears the ErrorCode and ErrorMessage attributes.</li> <li>• Sets the Status attribute to Ready.</li> <li>• Re-subscribes to rejected message events if the subscription has become invalid due to the error.</li> </ul>	No	Supervisor User

## Default Job Attributes Available at Run Time

The default job attributes that are available at run time are described in the following table.

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.NumberofJobPositions	Specifies the number of jobs that an entity can simultaneously run. It is used by the Entity Model Builder to configure job execution defaults in the MES database.	Yes	User
JobExec.DefToEntGoodProd	Specifies the default storage entity for good production.  During the production time, the middleware attempts to use the specified storage entity. If no value is specified, the middleware attempts to use the default storage entity.	Yes	Read-Only
JobExec.DefToEntRejectProd	Specifies the default storage entity for reject production.  During the production time, the middleware attempts to use the specified storage entity. If no value is specified, the middleware attempts to use the default storage entity.	Yes	Read-Only
JobExec.DefFromEntToCons	Specifies the default storage entity to consume items.	Yes	Read-Only
JobExec.DefReasForGoodProd	Specifies the default production reason code.  During the production time, the middleware attempts to use the specified storage entity. If no value is specified, the middleware attempts to use the default storage	Yes	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
	entity.		
JobExec. DefReasForNormalCons	<p>Specifies the default consumption reason code.</p> <p>During the production time, the middleware attempts to use the specified storage entity. If no value is specified, the middleware attempts to use the default storage entity.</p>	Yes	Read-Only
JobExec. DefLotNoForProd	<p>Specifies the default lot number.</p> <p>During the production time, the middleware attempts to use the specified storage entity. If no value is specified, the middleware attempts to use the default storage entity.</p>	Yes	Supervisory, User
JobExec. DefSublotNoForProd	<p>Specifies the default subplot number.</p> <p>During the production time, the middleware attempts to use the specified storage entity. If no value is specified, the middleware attempts to use the default storage entity.</p>	Yes	Supervisory, User
JobExec. AutoEndJobWhenQtysAre Met	Specifies whether to end the job automatically when the quantities produced are greater than	No	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
	or equal to the required quantity for a job.		
JobExec. MustProdReqdQty	Specifies whether a job that ends on the entity must produce the required quantities.	No	Read-Only
JobExec. ApplyCountsToLastJobWhen NoJobRun	Specifies whether the production counts that are received from an external system must be updated in the last run job on the entity when no job is running on the entity.	No	Read-Only
JobExec. AllowZeroQtySplit	Specifies whether a job can be split with 0 quantities.	No	Read-Only
JobExec. AutoAllocQtysToRunJob	Specifies whether the overages in production must be covered by moving some of the quantities from a scheduled, non-running job. If the value of this attribute is No, an error message is reported when an overage occurs.	No	Read-Only
UseInputSource	Determines whether or not to use an input source from an external system. If the attribute value is set to True, an input value is set for the attribute on every scan cycle automatically. If the value is False, the user has to set a value for this attribute manually.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.ErrorCode	Represents the error value that occurs while processing the middleware call.  If the last call succeeds, the value of this attribute is set to 0.	No	Read-Only
JobExec.ErrorMessage	Provides a messages about the error that has occurred while processing the middleware call to start, pause, or end a job.	No	Read-Only
Status	Indicates the status of the request sent to the middleware. The following are the different statuses: <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there is an error during the last call.</li> </ul>	No	Read-Only

## Job Execution Attributes Available at Run Time

The job execution attributes that are available at run time are described in the following table.

Note that job-related transactions can update the job attributes in the object. The preferred method is to record these transactions through the application object. However, if job attributes are modified through an external mechanism (for example, the MES Stateless API or MES Operator), the attributes will still be updated and the updated data will be reflected in the application object.

Attribute Name	Description	Configura-tion	Run Time Access
JobExec. Wold	Sets a work order to start, pause, or end on an entity.	Yes	Supervisory, User
JobExec. Oper Id	Specifies an operation ID that must be started, paused, or ended on an entity.	Yes	Supervisory, User
JobExec. SeqNo	Specifies a job sequence number that must be started, paused, or ended on an entity.	Yes	Supervisory, User
JobExec. JobPos	Identifies a running job at the job position that must be paused or ended on this entity.	Yes	Supervisory, User
JobExec. Operator	Specifies the operator associated with a job.  An operator is a user defined in the MES system that has the required privileges to run jobs on entities.	Yes	Supervisory, User
JobExec. EventDateTime	Specifies the data and time of a job at run time.	Yes	Supervisory, User
JobExec. EventDateTime.AutoGene rate	Generates the data and time of a job at run time.	No	Supervisory, User
JobExec. StartJobCmd	Starts an existing job on the entity from the MES database.	No	Supervisory, User
JobExec. PauseJobCmd	Pauses a running job on the entity in the MES database.  It also captures the pending production/consumption counts before pausing the identified job.	No	Supervisory, User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec. EndJobCmd	<p>Ends a running job on the entity in the MES database.</p> <p>It also captures the pending production/consumption counts before ending the identified job.</p>	No	Supervisory, User
JobExec. StartNextJobCmd	<p>Starts the next job in the queue for the entity.</p> <p>It also captures the pending production/consumption counts of the existing job before starting the next available job from the queue.</p>	No	Supervisory, User
JobExec. ResetCmd	<p>Clears the error code, error message, and sets status to Ready.</p>	No	Supervisory, User
JobExec. UseCurrentDate AndTimeAtRun	<p>Uses the current date and time to log a job execution event.</p>	No	Run Time
UseInputSource	<p>Determines whether or not to use an input source from an external system.</p> <p>If the attribute value is set to True, an input value is set for the attribute on every scan cycle automatically. If the value is False, the user has to set a value for this attribute manually.</p>	Yes	User

### Current Job Attributes Available at Run Time

The following attributes are available for a job position of an entity at run time. These attributes represent the current state of a running job. The variable N in the table represents a job position. At run time, the value of N is replaced by the corresponding job position value.

Note that job-related transactions can update the job attributes in the object. The preferred method is to record these transactions through the application object. However, if job attributes are modified through an external

mechanism (for example, the MES Stateless API or MES Operator), the attributes will still be updated and the updated data will be reflected in the application object.

Attribute Name	Description	Configura-tion	Run Time Access
JobPosN.CurWold	Identifies the work order that is currently running on this entity at this job position.	No	Read-Only
JobPosN.CurOperId	Identifies the operation id of the job that is currently running on this entity at this job position.	No	Read-Only
JobPosN.CurSeqNo	Identifies the job sequence number (normally 0, >1 in case of split jobs).	No	Read-Only
JobPosN.ItemId	Identifies the item that is currently being produced by this job.	No	Read-Only
JobPosN.QtyAtStart	Identifies the starting quantity.	No	Read-Only
JobPosN.QtyReqd	Identifies the quantity of item required.	No	Read-Only
JobPosN.QtyProd	Identifies the number of quantities produced so far.	No	Read-Only
JobPosN.QtyRejected	Identifies the number of quantities rejected so far.	No	Read-Only
JobPosN.ReqdFinishTime	Identifies the required completion time of this job.	No	Read-Only
JobPosN.ErrorCode	An integer value that represents an error has occurred while processing the call. This attribute value will be set to 0 if the last call was successful.	No	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
JobPosN. ErrorMessage	Provides a readable description of the error that occurs while processing the middleware call to set the job BOM defaults.	No	Read-Only
JobPosN. Status	Indicates the status of the request sent to the middleware. The following are the different statuses: <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there is an error during the last call.</li> </ul>	No	Read-Only

### Job Creation Attributes Available at Run Time

The job creation attributes that are available at run time are described in the following table.

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.CreateJobAttrs. WorkOrder *	Specifies the work order that is currently associated with this job.	Yes	User
JobExec.CreateJobAttrs. ItemClass*	Specifies the class of the item that is being produced by a job.	Yes	User
JobExec.CreateJobAttrs. Item*	Specifies the item that is being produced by a job.	Yes	User
JobExec.CreateJobAttrs. ItemUOM*	Specifies the textual unit of measure for an item.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.CreateJobAttrs.Operation*	Specifies the operation that is currently associated with this job.	Yes	User
JobExec.CreateJobAttrs.ManufacturingOrder*	Specifies the manufacturing order that is currently associated with this job.	Yes	User
JobExec.CreateJobAttrs.BatchSize*	Specifies the batch size that is currently associated with a job.	Yes	User
JobExec.CreateJobAttrs.StartQuantity*	Specifies the start quantity that is currently associated with a job.	Yes	User
JobExec.CreateJobAttrs.RequiredQuantity*	Specifies the required quantity that is currently associated with a job.	Yes	User
JobExec.CreateJobAttrs.TargetJobProdRate*	Specifies the target job production rate that is currently associated with a job.	Yes	User
JobExec.CreateJobAttrs.TargetJobProdRateUOM*	Specifies the target job production rate UOM that is currently associated with a job.  0 = hours/batch (default) 1 = minutes/batch 2 = seconds/batch, 3 = batches/hour 4 = batches/minute 5 = batches/second	Yes	User
JobExec.CreateJobAttrs.Operator	Specifies the operator who performs this operation.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.CreateJobAttrs.UpdateInventory*	Specifies the update inventory flag that identifies whether to update the inventory when the required quantity of items are produced or consumed for the job.	Yes	User
JobExec.CreateJobAttrs.ProductionSchedule*	Specifies the schedule for production.	Yes	User
JobExec.CreateJobAttrs.Process*	Specifies the process that is associated with this work order.	Yes	User
JobExec.CreateJobAttrs.BomVersion*	Specifies the BOM version of the process that is associated to create this work order.	Yes	User
JobExec.CreateJobAttrs.CreateNewJobCmd*	Creates a new job in the database.	No	Read-Only
JobExec.CreateJobAttrs.ResetCmd*	Resets an entity status and errors that occur while executing the create new job command.	No	Read-Only
JobExec.CreateJobAttrs.CreateNewJobsFromProcessCmd*	Creates a new job in the database based on the specified process.	No	Read-Only
JobExec.CreateJobAttrs.ErrorCode	Represents the error value that occurs while processing the call. If the last call succeeds, the value of this attribute is set to 0.	No	Read-Only
JobExec.CreateJobAttrs.ErrorMessage	Provides a message about the error that has occurred while processing the middleware call to start, pause, or end a job.	No	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.CreateJobAttrs.Status	<p>Indicates the status of the request sent to the middleware. The following are the different statuses:</p> <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there is an error during the last call.</li> </ul>	No	Read-Only

\*Quality is calculated when an input source is used, and the result of the quality will be Bad if an attribute it is unable to read the input source.

## Production Counter Attributes Available at Run Time

The production counter attributes that are available at run time are described in the following table.

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Prod.<Counter Name>.BOMPos	Contains the BOM position of the production item.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.Item	Contains the item that is being produced by this job.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.ProductionReason	Contains the production reason. The subsequent production transaction uses this production reason when production quantities are added.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Prod.<Counter Name>.ToStorageLocation	Contains the storage location for production items. The subsequent production transaction uses this storage location when production quantities are added.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.ToLot	Contains the lot number to produce items. The subsequent production transaction uses this lot number when production quantities are added.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.ToSublot	Contains the subplot number to produce items. The subsequent production transaction uses this subplot number when production quantities are added.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.EventDateTime	Specifies the date and time of a production event at run time.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.EventDateTime.AutoGenerate	Automatically generates the local date and time of a production event at run time.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.AddProdQtyAbs	Used to specify the absolute quantity of production to add.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.SetJobBOMDefaultsCmd	Sets the BOM defaults for a job so that the subsequent production transaction can use these default values if a value is not specified.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.AddProdQtyAbsCmd	Triggers production data to be added via the AddProdQtyAbs tag value.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Prod.<Counter Name>.ResetCmd	Resets the AddProdQtyAbs command.	Yes	User
JobExec.Prod.<Counter Name>.EnableRollingCounter	Specifies whether to expose the rolling counter attributes for this instance.	No	Supervisory, User
JobExec.JobPosN.Prod.<Counter Name>.AddProdQtyCounter	A counter value that automatically triggers production data to be added. This counter tag contains a running count value of the quantity produced. If this value has changed or exceeds the configured dead band, and if the update interval has been exceeded since the last flush, the production quantity that is being measured will be added automatically.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.AddProdQtyCounter.Deadband	The maximum value of AddProdQtyCounter before rolling over.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.AddProdQtyCounter.UpdateInterval	The amount of time that has to pass before logging the value of AddProdQtyCounter.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.AddProdQtyCounter.MaxValue	The maximum value of AddProdQtyCounter before rolling over.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.PushProductionCountsUponReset	Specifies whether or not to flush the current production counts when the ResetCmd is set to True.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Prod.<Counter Name>.ResetRollingCounterCmd	Resets the selected production counter.	Yes	User
JobExec.Prod.<Counter Name>.EnableProdCounterExtension	Specifies whether to expose the production counter extension attributes for an instance.	No	Supervisory, User
JobExec.JobPosN.Prod.<Counter Name>.SegmentRequirementID	Contains the Segment Requirement ID.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.SegmentResponseID	Contains the Segment Response ID.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.Operator	Contains the ID of the user who is making this production transaction.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.Comments	Contains additional comments.	Yes	User
JobExec.JobPosN.Prod.<Counter Name>.Spare1	Contains additional data for Spare1 field of the item_prod record.	No	Supervisory, User
JobExec.JobPosN.Prod.<Counter Name>.Spare2	Contains additional data for Spare2 field of the item_prod record.	No	Supervisory, User
JobExec.JobPosN.Prod.<Counter Name>.Spare3	Contains additional data for Spare3 field of the item_prod record.	No	Supervisory, User
JobExec.JobPosN.Prod.<Counter Name>.Spare4	Contains additional data for Spare4 field of the item_prod record.	No	Supervisory, User
JobExec.JobPosN.Prod.<Counter Name>.ErrorCode	Represents the error value that occurs while processing the call. If the last call succeeds, the value of this attribute is set to 0.	No	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Prod.<Counter Name>.ErrorMessage	Provides a message about the error that has occurred while processing the middleware call to start, pause, or end a job.	No	Read-Only
JobExec.JobPosN.Prod.<Counter Name>.Status	Indicates the status of the request sent to the middleware. The status can be any one of the following: <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there is an error during the last call.</li> </ul>	No	Read-Only

### Consumption Counter Attributes Available at Run Time

The consumption counter attributes that are available at run time are described in the following table.

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Cons.<Counter Name>.BOMPos	Contains the BOM position of a consumed item.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.ItemID	Contains the item that is being consumed by this job.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.ConsumptionReason	Contains the consumption reason. The subsequent consumption transaction uses this consumption reason when consumed quantities are added.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Cons.<Counter Name>.FromStorageLocation	Contains the storage location for consumed items. The subsequent consumption transaction uses this storage location when consumption quantities are added.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.FromLotNo	Contains the lot number from where to consume items. The subsequent consumption transaction uses this lot number when consumption quantities are added.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.FromSublotNo	Contains the subplot number from where to consume items. The subsequent consumption transaction uses this subplot number when consumption quantities are added.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.FgLotNo	Contains the lot number to store finished goods. The subsequent consumption transaction uses this lot number when consumption quantities are added.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.FgSublotNo	Contains the subplot number to store finished goods. The subsequent consumption transaction uses this subplot number when consumption quantities are added.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.EventDateTime	Specifies the date and time of a consumption event at run time.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>	Generates the date and time of a consumption	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
AutoGenerate	event at run time.		
JobExec.JobPosN.Cons.<Counter Name>.AddConsQtyAbs	Specifies the absolute quantity of consumption to add.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.SetJobBOM DefaultsCmd	Specifies the BOM defaults for a job so that the subsequent consumption transaction can use these default values if a value is not specified.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.AddConsQtyAbsCmd	Triggers the consumption data to be added via the AddConsQtyAbs tag value.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.ResetCmd	Resets the AddConsQtyAbs command.	Yes	User
JobExec.Cons.<Counter Name>.EnableRollingCounter	Specifies whether to expose the rolling counter attributes for this instance.	No	Supervisory, User
JobExec.JobPosN.Cons.<Counter Name>.AddConsQtyCounter	A counter value that automatically triggers consumption data to be added. This counter tag contains a running count value of the consumed quantity. If this value has changed, exceeds the configured dead band, and if the update interval has been exceeded since the last flush, the consumption quantity that is being measured will be added automatically.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.AddConsQtyCounter	The maximum value of AddConsQtyCounter	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
AddConsQtyCounter.Dead band	before rolling over.		
JobPosN.Cons.<Counter Name>.AddConsQtyCounter.UpdateInterval	The amount of time that has to pass before logging the value of AddConsQtyCounter.	Yes	User
JobPosN.Cons.<Counter Name>.AddConsQtyCounter.MaxValue	The maximum value of AddConsQtyCounter before rolling over.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.PushConsumptionCounts.UponReset	Specifies whether or not to flush the current consumption counts when the ResetCmd is set to True.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.ResetRollingCounterCmd	Resets the selected consumption counter.	Yes	User
JobExec.Cons.<Counter Name>.EnableProdCounterExtension	Specifies whether to expose the consumption counter extension attributes for an instance.	No	Supervisory, User
JobExec.JobPosN.Cons.<Counter Name>.SegmentRequirement	Contains the Segment Requirement ID.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.SegmentResponse	Contains the Segment Response ID.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.Operator	Contains the ID of the user who is making this consumption transaction.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.Comments	Contains additional comments.	Yes	User
JobExec.JobPosN.Cons.<Counter Name>.Spare1	Contains additional data for Spare1 field of the item_cons record.	No	Supervisory, User

Attribute Name	Description	Configura-tion	Run Time Access
JobExec.JobPosN.Cons.<Counter Name>.Spare2	Contains additional data for Spare2 field of the item_cons record.	No	Supervisory, User
JobExec.JobPosN.Cons.<Counter Name>.Spare3	Contains additional data for Spare3 field of the item_cons record.	No	Supervisory, User
JobExec.JobPosN.Cons.<Counter Name>.Spare4	Contains additional data for Spare4 field of the item_cons record.	No	Supervisory, User
JobExec.JobPosN.Cons.<Counter Name>.ErrorCode	Represents the error value that occurs while processing the call. If the last call succeeds, the value of this attribute is set to 0.	No	Read-Only
JobExec.JobPosN.Cons.<Counter Name>.ErrorMessage	Provides a message about the error that has occurred while processing the middleware call to start, pause, or end a job.	No	Read-Only
JobExec.JobPosN.Cons.<Counter Name>.Status	Indicates the status of the request sent to the middleware. The following are the possible statuses: <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there is an error during the last call.</li> </ul>	No	Read-Only

## Storage Execution Attributes Available at Run Time

The Storage Execution attributes that are available at run time are described in the following table.

Attribute Name	Description	Configuration	Run Time Access
AutoDeleteZero Inventory	Deletes a row in the Item_Inv table when the quantity becomes less than or equal to 0. By default, it is False.	No	Read-Only
AllowNegative Quantity	Specifies whether the negative quantities can be stored in the inventory. By default, it is False	No	Read-Only
AllowMultiple Items	Specifies whether multiple items can be stored in the storage entity. By default, it is True.	No	Read-Only
AllowMultiple Lots	Specifies whether multiple lot numbers can be stored in the entity. By default, it is True.	No	Read-Only
AllowDirty State	Specifies whether the entity allows dirty state. By default, it is False.	No	Read-Only
IndistinguishableLots	Specifies whether the inventory stored here cannot be separated by lot_no (bulk storage) when consumed, shipped, or transferred out. By default, it is False.	No	Read-Only
Movable	Specifies whether the entity is movable. By default, it is False.	No	Read-Only
Location	Represents the other storage entity that is used only when the storage entity is movable.	Yes	Read-Only
Maximum Capacity	Represents the maximum capacity of this entity.	Yes	Read-Only
InitialEntity Status	Enumerates the status of	Yes	Read-Only

Attribute Name	Description	Configuration	Run Time Access
	the storage.		

## Inventory Transfer Attributes Available at Run Time

The Inventory Transfer attributes that are available at run time are described in the following table.

Attribute Name	Description	Configuration	Run Time Access
StorageExec. To Location	Specifies the entity where the inventory will be transferred.	Yes	User
StorageExec. To Item	Specifies the item that is stored at the destination location.	Yes	User
StorageExec.ToLot	Specifies the lot where the item is being stored.	Yes	User
StorageExec. To Sublot	Specifies the subplot where the item is being stored.	Yes	User
StorageExec. To Grade	Specifies the grade of the item being stored.	Yes	User
StorageExec. To State	Specifies the state of the item being stored.	Yes	User
StorageExec. To UOM	Specifies the unit of measure for the item being stored.	Yes	User
StorageExec. To ExpiryDate	Specifies the expiry date for the item being stored.	Yes	User
StorageExec. To WorkOrder	Specifies the work order of a destination.	Yes	User
StorageExec. To Operation	Specifies the operation of a destination.	Yes	User
StorageExec. To Sequence Number	Specifies the job sequence of a destination.	Yes	User
StorageExec. Transfer	Specifies the quantity to be transferred.	Yes	User

Attribute Name	Description	Configuration	Run Time Access
Quantity			
StorageExec.TransferOption	Specifies the options to transfer an inventory item.	Yes	User
StorageExec.FromLocation	Specifies the entity where the item is being transferred from.	Yes	User
StorageExec.FromItem	Specifies the item that is being removed from the source location.	Yes	User
StorageExec.FromLot	Specifies the lot from where the item is being removed.	Yes	User
StorageExec.FromSublot	Specifies the subplot from where the item is being removed.	Yes	User
StorageExec.FromWork Order	Specifies the work order of a source.	Yes	User
StorageExec.From Operation	Specifies the operation of a source.	Yes	User
StorageExec.FromSequence Number	Specifies the job sequence of a source.	Yes	User
StorageExec.Move InventoryCmd	Specifies the command to move an inventory item from a source location to a destination location.	No	Supervisory, User
StorageExec.ReceiveCmd	Specifies the command to receive an inventory item to a destination location.	No	Supervisory, User
StorageExec.ResetCmd	Resets the commands and errors that occur while executing the commands.	No	Supervisory, User

Attribute Name	Description	Configuration	Run Time Access
ErrorCode	Represents the error value that occurs while processing the call.  If the last call succeeds, the value of this attribute is set to 0.	No	Read-Only
ErrorMessage	Provides a message about the error that has occurred while processing the middleware call to start, pause, or end a job.	No	Read-Only
Status	Indicates the status of the request sent to the middleware. The following are the possible statuses: <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there was an error during the last call.</li> </ul>	No	Read-Only

### Specification Attributes Available at Run Time

The specification attributes that are available at run time are described in the following table.

Attribute Name	Description	Configura-tion	Run Time Access
Specs.<SpecAlias>.SpecId	Specifies the ID of the selected specification.	No	Read Only
Specs.<SpecAlias>.SpecGroupId	Specifies the ID of the selected specification group.	No	Read Only

Attribute Name	Description	Configura-tion	Run Time Access
Specs.<SpecAlias>.Units	Specifies the units of measure of the selected specification.	No	Read Only
Specs.<SpecAlias>.Working.Units	Specifies the working units of measure of the selected specification.	No	Read Only
Specs.<SpecAlias>.Data-Type	Specifies the data type of the selected specification.	No	Read Only
Specs.<SpecAlias>.Target.SpecValue	Specifies the target attribute of the specification value actual property of a specification.	No	Read Only
Specs.<SpecAlias>.Target.SpecValueActual	Specifies the target attribute of the specification value actual property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.Spare1	Specifies the target attribute of the spare 1 property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.Spare2	Specifies the target attribute of the spare 2 property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.Spare3	Specifies the target attribute of the spare 3 property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.Spare4	Specifies the target attribute of the spare 4 property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.SpecId	Specifies the target attribute of the specification ID property of a specification.	Yes	Read Only

Attribute Name	Description	Configura-tion	Run Time Access
Specs.<SpecAlias>.Target.SpecGroupId	Specifies the target attribute of the specification group ID property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.Units	Specifies the target attribute of the units property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.MinValue	Specifies the target attribute of the minimum value property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Target.MaxValue	Specifies the maximum value property of a specification.	Yes	Read Only
Specs.<SpecAlias>.Working.SpecValue	Specifies the working attribute of the specification value property of a specification.	Yes	User
Specs.<SpecAlias>.Working.SpecValueActual	Specifies the working attribute of the specification value actual property of a specification.	Yes	User
Specs.<SpecAlias>.Working.Spare1	Specifies the working attribute of the spare1 property of a specification.	Yes	User
Specs.<SpecAlias>.Working.Spare2	Specifies the working attribute of the spare2 property of a specification.	Yes	User
Specs.<SpecAlias>.Working.Spare3	Specifies the working attribute of the spare3 property of a specification.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
Specs.<SpecAlias>.Working.Spare4	Specifies the working attribute of the spare4 property of a specification.	Yes	User
Specs.<SpecAlias>.Working.MinValue	Specifies the working attribute of the minimum value property of a specification.	Yes	User
Specs.<SpecAlias>.Working.MaxValue	Specifies the working attribute of the maximum value property of a specification.	Yes	User
Specs.<SpecAlias>.ScalingFactorDBToIO	Specifies the scaling factor to use while downloading specification values to System Platform attributes.	Yes	User
Specs.<SpecAlias>.ScalingFactorIOToDB	Specifies the scaling factor to use while uploading values from System Platform attributes to target attributes of a specification.	Yes	User
Specs.LoadJobSpecsCmd	Loads the specifications of a job specified by job filter attributes.	Yes	User
Specs.LoadRunningJobSpecsCmd	Loads the specifications of a job that is running on the entity.	Yes	User
Specs.LoadDownloadJobSpecsCmd	Loads and downloads the specifications of a job specified by job filter attributes and updates the working attributes.	Yes	User
Specs.LoadDownloadRunningJobSpecsCmd	Loads and downloads the specifications of a job that is running on the entity and updates the working attributes.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
Specs. SaveCmd	Writes the specification values to the MES database.	Yes	User
Specs. DownloadCmd	Downloads the specification values to System Platform attributes.	Yes	User
Specs. UploadCmd	Uploads the values of System Platform attributes to the target attributes of a specification.	Yes	User
Specs. ResetCmd	Clears an error that occurred while executing the specification commands	Yes	User
Specs. WorkOrder	Specifies the work order ID associated with a job.	Yes	User
Specs. Operation	Specifies the operation ID associated with a job.	Yes	User
Specs. SequenceNumber	Specifies the sequence number associated of a job.	Yes	User
Specs. JobPosition	Specifies the job position to retrieve the job that is running on the entity.	Yes	User
Specs. StepNumber	Specifies the step number as part of the each Load commands, which is an additional filter for the specifications from the Job_Spec table.	No	Read-Only
Specs. SelectedSpecs	Shows the selected specifications in Object Editor.	No	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
Specs. SelectedSpecAliasNames	Specifies the specification alias names. The alias names are updated by the package code during validation to deploy to a comma separated string of Spec Aliases at run time.	No	Read-Only
Specs. SpecsLoadedCnt	Specifies the integer count of loaded specifications.	No	Read-Only
Specs. SpecsLoadedIDs	Specifies a string array of loaded specification names.	No	Read-Only
ErrorCode	Represents the error value that occurs while processing the call.  If the last call succeeds, the value of this attribute is set to 0.	No	Read-Only
ErrorMessage	Provides a message about the error that has occurred while processing the middleware call to start, pause, or end a job.	No	Read-Only
Status	<p>Indicates the status of the request sent to the middleware. The following are the possible statuses:</p> <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there was an error during the last call.</li> </ul>	No	Read-Only

**PEM Attributes Available at Run Time**


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**Note:** PEM attributes should not be used in conjunction with an MES process model.

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The PEM attributes that are available at run time are described in the following table.

The PEM attributes vary according to the PEM command type.

Attribute Name	Description	Configura-tion	Run Time Access
PEM.<PEM Instance Name>.Trigger	Logs the values of PEM attributes.	No	Supervisory, User
PEM.<PEM Instance Name>.EnableGenerateGenealogyID	Enables the genealogy ID creation for a PEM instance.	No	Supervisory, User
PEM.<PEM Instance Name>.GenerateGenealogyID	Generates the genealogy ID if an attribute value is changed at run time. If the input source is set True for the attribute, the generated genealogy ID is overwritten with the genealogy ID from an external source when the production or consumption transaction is triggered.	No	Supervisory, User
PEM.<PEM Instance Name>.EventID	Specifies the production event ID that is generated for each production transaction.	No	Supervisory, User
PEM.<PEM Instance Name>.Genealogy ID	Specifies the genealogy ID to be used for a PEM instance.	No	Supervisory, User
PEM.<PEM Instance Name>.EventLinkId	Links a Material Consumed Event with a Material Produced Event. It can be set only by specifying an input source.	No	Supervisory, User
PEM.<PEM Instance Name>.	Points to the Material Produced Event ID.	No	Supervisory, User

Attribute Name	Description	Configura-tion	Run Time Access
EventLinkId.InputSource			
PEM. <PEM Instance Name>.PEMCommandType	Specifies different PEM command types.	Read-Only	
PEM. <PEM Instance Name>.Location*	Specifies the storage location that is associated with the production or consumption transaction.	Yes	User
PEM. <PEM Instance Name>.MaterialID*	Specifies the BOM item associated with a job	Yes	User
PEM. <PEM Instance Name>.UnitofMeasure*	Specifies the units of measure for the BOM item associated with a job.	Yes	User
PEM. <PEM Instance Name>.ProductionRequestID*	Specifies the production request ID that is currently associated with a job.	Yes	User
PEM. <PEM Instance Name>.ProcessSegmentID*	Specifies the process segment ID that is currently associated with a job.	Yes	User
PEM. <PEM Instance Name>.ProductionScheduleID*	Specifies the production schedule ID that is currently associated with a job.	Yes	User
PEM. <PEM Instance Name>.SegmentRequirementID*	Specifies the segment requirement ID that is currently associated with a job.	Yes	User
PEM. <PEM Instance Name>.SegmentResponseID*	Specifies the segment response ID that is currently associated with a job.	Yes	User

Attribute Name	Description	Configura-tion	Run Time Access
PEM.<PEM Instance Name>.SubsegmentID*	Specifies the subsegment ID associated with production or consumption transaction.	Yes	User
PEM.<PEM Instance Name>.PersonnelList*	Specifies the users associated with a production event.	Yes	User
PEM.<PEM Instance Name>.Comments*	Specifies the comments that are associated with the current production or consumption transaction.	Yes	User
PEM.<PEM Instance Name>.MaterialType*	Specifies the type of material that is logged with a production transaction.	Yes	User
PEM.<PEM Instance Name>.LotNo*	Specifies the lot number that is associated with the current production or consumption transaction.	Yes	User
PEM.<PEM Instance Name>.SublotNo*	Specifies the subplot number that is associated with the current production or consumption transaction.	Yes	User
PEM.<PEM Instance Name>.SeralNumberList*	Specifies the serial numbers of consumed items.	Yes	User
PEM.<PEM Instance Name>.Quantity*	Specifies the absolute quantity that must be added to the production or consumption transaction.	Yes	User
PEM.<PEM Instance Name>.ResetCmd	Resets any errors that occur while triggering PEM events.	No	Supervisory, User
PEM.<PEM Instance Name>.AutoReset	Resets the trigger command automatically.	No	Supervisory, User

Attribute Name	Description	Configura-tion	Run Time Access
PEM. <PEM Instance Name>.DateTime	Specifies the date and time to log a PEM event	No	Supervisory, User
PEM. <PEM Instance Name>.DateTime	Specifies automatic generation of the date and time values for a PEM event	No	Supervisory, User
<PEM Instance Name>.Log	Enables data to be logged for an extended PEM attribute when the PEM command is triggered	No	Supervisory, User
PEMAttrs. <PEM Instance Name>.<Attribute Name>	Specifies the name for an extended PEM attribute	Yes	User
PEMAttrs. <PEM Instance Name>.<Attribute Name>.InitialValue	Specifies the initial value that is retrieved from an extended PEM attribute.	No	Read-Only
PEM. <PEM Instance Name>.Data Type	Specifies the data type for an extended PEM attribute	No	Read Only
ErrorCode	Represents the error value that occurs while processing the call.  If the last call succeeds, the value of this attribute is set to 0.	No	Read-Only
ErrorMessage	Provides a message about the error that has occurred while processing the middleware call to start, pause, or end a job.	No	Read-Only

Attribute Name	Description	Configura-tion	Run Time Access
Status	<p>Indicates the status of the request sent to the middleware. The following are the possible statuses:</p> <ul style="list-style-type: none"> <li>• Ready: If the object is ready to process the request.</li> <li>• Busy: If the call is currently being processed.</li> <li>• Error: If there was an error during the last call.</li> </ul>	No	Read-Only

\*Quality is calculated when an input source is used, and the result of the quality will be Bad if an attribute is unable to read the input source. The TriggerGenealogy attribute is associated with this attribute.

### PEM Attributes for Different Command Types

Each command type has a different set of PEM attributes. When you select a particular command type, a set of PEM attributes corresponding to the command type appears in the Object Editor.

The following table lists the PEM attributes and the corresponding command types for which the attributes are available.

For information about configuring attributes in the **PEM Attributes** tab, see [Managing PEM Attributes](#).

PEM Attribute	Command Types
Location	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Material ID	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual

PEM Attribute	Command Types
Unit of Measure	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Production Request ID	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Process Segment ID	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Production Schedule ID	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Segment Requirement ID	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual

PEM Attribute	Command Types
Segment Response ID	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Subsegment ID	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Personnel List	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Comments	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Equipment ID	Equipment Actual
Material Type	Material Produced Actual
Quantity	Equipment Actual Material Consumable Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual

PEM Attribute	Command Types
Lot	Equipment Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Sublot	Equipment Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual
Serial Number List	Equipment Actual Material Consumed Actual Material Produced Actual Production Data Personnel Actual

### Extended PEM Attributes at Run Time

The values of extended PEM attributes for which the PEMAttrs.<Instance Name>.<AttributeName>.Log log attribute is set to True are recorded at run time when a PEM command is triggered.

A valid data log group ID must exist for the specified data log group name.

For example, the data log group name for extended PEM attributes is represented as follows:

- OCO\_001|Mixing|ProductionData
- OCO\_100|Blending|MaterialConsumption

When extended PEM attributes are triggered, the following actions are performed at run time:

- The middleware queries the Data\_Log\_Value table by using the specified data log group name and the extended PEM attribute name to retrieve the value index.
- The specified extended attribute value is copied in the corresponding value column in the Data\_Log table after retrieving the value index.
- This process is repeated for all the specified extended attributes.

### PEM Data Storage

The topics in this section describe the data that is stored for the PEM data storage operations.

## Logging Production and Consumption

The production or consumption data is logged into the Item\_Prod or Item\_Cons table respectively only if the specified quantity is not 0. A new job\_event record is created with the following values while logging the production and consumption data.

PEM Attribute	Column in Job_Event Table	Comments
	event_type	<p>The event type is:</p> <ul style="list-style-type: none"> <li>• PEMMaterialProduced if the material is produced</li> <li>• PEMMaterialConsumed if the material is consumed</li> <li>• PEMMaterialConsumable if the material is consumable.</li> </ul>
Equipment Id	ent_id	The ID of the entity that triggers the middleware call.
	bom_pos	The BOM position of the production or consumption.
Comment	Comments	
Event Name	value3	
Location	value2	
Lot	lot_no	
Material Id	item_id	
Personnel List	value4	
Process Segment Id	oper_id	
Production RequestId	wo_id	
Production Schedule Id	value1	
Segment Requirement Id	segment_requirement_id	
Segment Response Id	segment_response_id	
Sublot	sublot_no	
Serial Number List	value5	

PEM Attribute	Column in Job_Event Table	Comments
Genealogy ID	genealogy_id	
Subsegment	subsegment_id	
Quantity	quantity	
	value6	The row_id from the Data_Log table that is linked to the EPA data of this transaction.
Unit Of Measure	value7	This UOM only represents the actual unit of measurement reported during production. The corresponding quantity may be stored in different units, as the quantities for the production and consumption are recorded in the native units of the item.

If the production or consumption transaction receives a UOM ID that does not exist in the database for an item, then the specified quantities are converted to the native units of an item only if a conversion factor exists for this item in the database.

The quantities are always recorded in the native units in the production and consumption tables. If no such conversion exists for the item, an error is logged. If a blank value is specified or a value is not specified for the UOM parameter, then the quantities are reported in native units, by default.

### Material Consumable Actual

When the consumable command is triggered, the specified item is not added to the BOM, as the specified data is considered as a direct consumption. The specified data is added directly to the Item\_Cons table.

When the update inventory Boolean flag is set to True, the quantity from the inventory is reduced.

The following table illustrates the functional data mapping between the attributes exposed in the UI and how the data is recorded in the MES database.

PEM Attribute	Column in Item_Cons Table	Comments
	ent_id	The ID of the entity that triggers the middleware call.
MaterialId	item_id	

PEM Attribute	Column in Item_Cons Table	Comments
UnitOfMeasure		The specified quantities are converted to the native units of the item, if the specified UOM is different from the native UOM of this item and a conversion factor exists for this item. Otherwise, an exception is logged.
ProductionRequestId	wo_id	
ProcessSegmentId	oper_id	
ProductionScheduleId	N/A	Stored in the job_event.value1 column.
SegmentRequirementId	segment_requirement_id	
SegmentResponseId	segment_response_id	
Comments	comments	
Quantity	qty_cons	
Location	from_ent_id	The from_ent_id is resolved by querying the Ent table using the specified entity name.
SubsegmentId	N/A	Stored in the job_event.subsegment_id and identifies the consumable transaction in the Item_Cons table.
PersonnelList	user_id	

The other values that are recorded along with consumable are the extended attributes that are configured for this instance.

## Production Data (Data Logging)

When the production command is triggered, the specified data is logged in the Job\_Event table. The job\_event record for the production data is identified through the PEMProductionData event\_type.

The following table illustrates the functional data mapping between the attributes exposed in the UI and how the data is recorded.

PEM Attribute	Columns in Job_Event Table	Comments
	event_type	The event type is PEMProductionData.
	ent_id	The ID of the entity that triggers the middleware call.
Comments	comments	
Event Name	value3	
Location	value2	
Lot	lot_no	
Material Id	item_id	
Personnel List	value4	
Process Segment Id	oper_id	
Production Request Id	wo_id	
Production Schedule Id	value1	
Segment Requirement Id	segment_requirement_id	
Segment Response Id	segment_response_id	
Serial Number List	value5	
Sublot	subplot_no	
Subsegment	subsegment_id	
Genealogy ID	genealogy_id	
	value6	The row_id from the Data_Log table that is linked to the EPA data of this transaction.

## Personnel Actual (Labor)

When the Personnel Actual command is triggered, the specified data is logged in the Job\_Event table. The Job\_Event record for the personnel actual data is identified through the PEMPersonnelActual event\_type.

The following table illustrates the functional data mapping between the attributes exposed in the UI and how the data is recorded.

PEM Attribute	Columns in Job_Event Table	Comments
	event_type	PEMPersonnelActual.
	ent_id	The ID of the entity that triggers the middleware call.
Comments	comments	
Event Name	value3	
Location	value2	
Lot	lot_no	
Material Id	item_id	
Personnel List	value4	Accepts a comma-separated list.
Process Segment Id	oper_id	
Production Request Id	wo_id	
Production Schedule Id	value1	
Segment Requirement Id	segment_requirement_id	
Segment Response Id	segment_response_id	
Sublot	sublot_no	
Serial Number List	value5	
Genealogy ID	genealogy_id	
Subsegment	subsegment_id	
Quantity	quantity	
	value6	The row_id from the Data_Log table that is linked to the EPA data of this transaction.
Unit Of Measure	value7	This UOM only represents the actual unit of measurement that is reported during production. The corresponding quantity may be stored in different units in the MES database, as the quantities for the production and consumption are recorded in native units of this

PEM Attribute	Columns in Job_Event Table	Comments
		item.

## Equipment Actual (Entity)

When the equipment actual command is triggered, the specified data is logged in the Job\_Event table. The job\_event record for the equipment actual data is identified through the PEMEquipmentActual event\_type.

The following table illustrates the functional data mapping between the attributes exposed in the UI and how the data is recorded.

PEM Attribute	Columns in Job_Event Table	Comments
	event_type	PEMEquipmentActual.
	ent_id	The ID of the entity that triggers the middleware call.
Comments	comments	
Event Name	value3	
Location	value2	
Lot	lot_no	
Material Id	item_id	
Personnel List	value4	Accepts a comma-separated list.
Process Segment Id	oper_id	
Production Request Id	wo_id	
Production Schedule Id	value1	
Segment Requirement Id	segment_requirement_id	
Segment Response Id	segment_response_id	
Sublot	sublot_no	

PEM Attribute	Columns in Job_Event Table	Comments
Serial Number List	value5	
Genealogy ID	genealogy_id	
Subsegment	subsegment_id	
Quantity	quantity	
	value6	The row_id from the Data_Log table that is linked to the EPA data of this transaction.
Unit Of Measure	value7	This UOM only represents the actual unit of measurement that is reported during production. The corresponding quantity may be stored in different units in the MES database, as the quantities for the production and consumption are recorded in native units of this item.
Equipment Id	value8	

## Extended Production Attributes

The extended attribute values for which the PEMAttrs.<Instance Name>.<AttributeName>.Log log attribute is set to True are collected at run btime and sent to the middleware when a PEM command is triggered. When a PEM command is triggered, only the extended attributes linked to a PEM instance are collected.

A valid data log group ID must exist for the specified data log group name. An exception is logged if the specified data log group does not exist in the database.

For example, the data log group name for the PEM extension attributes is represented as:

OCO\_001|Mixing|ProductionData, OCO\_100|Blending|MaterialConsumption, and so on.

When the extended attribute data is sent to the middleware, the middleware queries the Data\_Log\_Value table using the specified data log group and value names (extended attribute name) to retrieve the value index.

After retrieving the value index is retrieved, the specified extended attribute value is copied to the corresponding value column in the Data\_Log table. This process is repeated for all the specified extended attributes.

The extended attributes that match the value of the value\_name column for a data log group in the Data\_Log\_Value table are logged into the Data\_Log table and the remaining value columns are updated with Null values.

An exception is logged if the specified extended attribute name does not exist in the Data\_Log\_Value table for the specified data log group. The values that are retrieved at runtime from the extended attributes are always recorded in the Data\_Log table.

The following table illustrates the functional data mapping between the attributes exposed in the UI and how the

data is recorded.

PEM Attribute	Column in Data_Log Table	Comments
	grp_id	The group ID linked to the extended attribute.
Event Time	sample_time_local and sample_time_utc	The specified local time that is recorded in the sample_time_local field and the corresponding UTC time is calculated from the local time with the specified offset.
Production Request	wo_id	
Process Segment	oper_id	
	seq_no	The sequence number that is identified for the job.
	step_no	Null
Material Id	item_id	
Lot	lot_no	
Sublot	sublot_no	
	shift_start_utc	The shift start time (in UTC) that is running at EventTime.
	shift_start_local	The shift start time (in local) that is running at EventTime.
	shift_id	The shift that is running at EventTime.
	ent_id	The entity ID that triggers the middleware call.
Genealogy	genealogy_id	
Segment Requirement	segment_requirement_id	
Segment Response	segment_response_id	
	value1 ... value48	Values related to an extended attribute.

## OCO Error Codes

The error codes that might occur while working with the OCO objects are described in the following table. The error codes are stored in the ErrorCode attribute.

If a command generates a warning message, the ErrorCode attribute value remains 0 and the ErrorMessage attribute shows the warning text.

Error Code	Description
500	The command input source quality is not good.
0	No error.
-1	An unknown error. The error message contains the detailed information.
-100	The connection to the MES middleware was lost.
-101	An error occurred while starting the MES client session.
-102	An error occurred while closing the MES client session.
-103	The MES database is not available.
-121	The entity name specified by an object container does not exist.
-152	An error occurred during a Start Job command. This indicates that the MES system cannot process the request to start a job.
-153	An error occurred during a Pause Job command. This indicates that the MES system cannot process a request to pause a job.
-154	An error occurred during a End Job command. This indicates that the MES system cannot process a request to stop a job.
-155	An error occurred during a Start Next Job command. This indicates the the MES system cannot process a request to start the next job.
-161	A PEM event error. An error has occurred while processing the PEM commands in the MES database. See the error message for more information.
-171	An exception has occurred while creating jobs in the MES database. See the error message for more information.

Error Code	Description
-172	An error occurred during a Create Job Attributes command. This indicates that the MES system cannot process a request to create new jobs.
-181	A production counter error occurred. This indicates that an exception occurred while processing the production counters in the MES database. See the error message for more information.
-182	An add consumption error occurred. This indicates that the MES system cannot process a request to add consumption to a job.
-183	A set job BOM defaults for production error occurred. This indicates that the MES system cannot process a request to configure the BOM for production.
-201	An error occurred when loading job specifications.
-202	An error occurred when loading job specifications for a running job.
-203	An error occurred when saving job specifications.
-204	An error occurred when loading loading job specifications for a running job and then downloading the values of work attributes to target attributes.
-205	An error occurred when loading loading job specifications and then downloading the values of work attributes to target attributes.
-206	An error occurred when downloading the values of work attributes to target attributes.
-207	An error occurred when uploading target attributes with values read from the InputSource.
-220	An error occurred during a storage execution Receive command.
-221	An error occurred during a storage execution Transfer Update command.

# Quality System Platform Graphics

## Overview

The supplied System Platform graphics are made available as an example of how to interact with the Manufacturing Execution System (MES) SPC Chart .NET control properties and methods and how to display most of the Sample Recording Object (SRO) attributes and commands.

**Note:** These graphics are provided as is with no guarantee of future updates to the objects.

All the code within the graphics is exposed and can be modified by the end user.

This documentation provides a description of the graphics, the intended use, how to merge them into your application, and some overview of the scripting.

## Installation

The provided **MES2014\_QualityGraphics.aapkg** file contains all the graphics in a single file. This package file was created with System Platform 2014 R2 (IDE version 4.1).

### To install the Quality graphics package

- From within the IDE, on the **Galaxy** menu click **Import**, then click **Object(s)** and in the dialog box select the package file.

Once the import process is complete, there will be a folder in the Graphic Toolbox called **MES Graphics** and a sub-folder called **QualityManagementDemo** containing the eight graphics. There is one graphic for the SPC Chart control (**SPC\_Chart\_Graphic**) and seven for interacting with the Sample Recording Object (SRO).

## SPC Chart Graphic

### Introduction to the SPC Chart Graphic

The graphic called **SPC\_Chart\_Graphic** is provided as part of this package for interacting with the MES Quality SPC Chart control. For a full description of all the properties and methods available in the control, see the *MES .NET Controls Developer Guide*.

The SPC Chart graphic consists of two main components:

- The left side and below the chart has numerous chart properties available for interacting with the chart.
- The top right side has the embedded SPC Chart .NET control.

### SPC Chart Control Design-Time Configuration

The SPC Chart .NET control has been configured with some of the properties already set. These can be found by selecting the chart and going to the end of the properties list in the group titled **Quality management**.

- The **CharacteristicNameFilter** property is a required property at run time and has been pre-configured to pick the last characteristic in the list of defined characteristics. This can be changed at run time or in design

time.

- The **ChartTitle** property has also been entered in design time.
- The **PlotPrimaryMeasurements** property is turned off initially.
- The **ChartType**, **PointsPerPage**, and **RefreshRate** properties are left at the default values.

All the chart properties for showing the charts and histograms are turned on.

The y-axis range for both the top and bottom charts are set at 0 to 100. These can be changed at run time with the settings beneath the SPC Chart.

If you double-click the chart, a list of data bindings done on the SPC Chart appears. Many of the chart properties are best accessed through the data bindings of the chart so that changes are directly sent to the chart without having to write extra code to handle data types not well understood by System Platform.

## SPC Chart Graphics - Design Time

Many user input fields are available on the graphic for interacting with the chart. As mentioned previously, some like the **Chart Title** input field are tied to the chart through the data bindings. Others like all the chart filter options are tied to the SPC Chart property directly in the user input animation link. All the chart filter options are available except the **Spare3** and **Spare4** field filters.

The **Chart Control Options** section has toggle check boxes to turn on and off charts, histograms, and individual measurements that are all directly linked to the SPC Chart through the animation links. The **Refresh Rate**, **Number of Points**, **Points per Page**, and **Chart Type** options are linked to the chart through the data bindings option to more readily handle data types.

The **Additional Chart Control Options** section has check boxes to show and hide most elements of the chart, such as the data table above the chart, the time row, the alarm row, the notes row, additional statistics, and whether to color alarm points or not. All of these are linked to the chart through the data bindings of the chart. Also, the graph position options are linked to the chart through the data bindings. Finally, this section is where you set the y-axis values for the top and bottom chart. These settings are then used in the **Display Chart** button script to set the ranges.

Beneath the **Chart Control Options** are other fields for interacting with certain display elements of the chart. First is a list from which to select how alarms are emphasized in the chart. Next are options for what to display on the x-axis label, frequency of displaying the value, and an option to choose to also include when the value changes. Next (under the chart type user input) is a list of the preconfigured charts that are supported by the control and the corresponding **ChartType** enumeration value expected by the control. Under the **Display Chart** button is a list from which to select what is shown in the header section of the SPC Chart as well as an entry field for the user interacting with the chart. The chart's language is controlled by the user connected to the chart, as are the right-click menu commands for marking a sample as Ignored, performing a control move, or selecting a cause.

The graphic also has buttons that contain scripting to work with the settings.

- The **Clear Filters** button calls the **ClearFilters()** method on the SPC Chart and then reads all the filter settings from the chart. This will clear out all the filters except the characteristic.
- The **Reset Filters** button calls the **ResetFilters()** method on the SPC Chart and then reads all the filter settings from the chart. This will read the most recent sample for the provided characteristic and set the filters to the values in the database for the sample. Generally, this will set the entity ID and, if available, the item ID, work order, process, and operation. There is also a disable link if the chart is not in a state in which this command can be called.

- The **Display Chart** button calls the **DisplayChart()** method to refresh the SPC Chart with the updated filters, chart type, and display settings applied. This script applies the y-axis ranges for both charts. There is also a disable link if the chart is not in a state in which this command can be called.

## SPC Chart - Run Time

The graphic element can be directly embedded within an InTouch window. There is no need to associate the graphic to an object.

When the window containing the graphic is first opened, the chart will be blank.

### To generate an SPC Chart

1. Select a valid characteristic from the list.
2. Set the y-axis ranges.
3. Click the **Display Chart** button.

A chart is generated, using all the available data for the provided characteristic that may be across multiple machines and/or products.

### To generate a chart based on the filters defined within the MES database

- Click the **Reset Filters** button and then click the **Display Chart** button.

The chart has the following additional controls and behaviors:

- Clicking any of the chart control options to show or hide chart components will immediately be reflected within the chart. The chart title will also be immediately reflected within the chart.
- Clicking any of the additional chart control options to show or hide data table elements requires that the **Display Chart** button be clicked. The same is true for any of the other display elements beneath the **Chart Control Options** section.
- Changing the characteristic will immediately clear out the chart and require the **Display Chart** button to be clicked again.
- Changing any of the filters or the **Chart Type** will not clear out the chart and will not be applied until the **Display Chart** button is clicked again.
- Clicking the **Clear Filters** button removes all the filters except the characteristic and clears out the SPC Chart. Enter any new filters if desired and click the **Display Chart** button to read the data for the supplied characteristic and generate the SPC Chart.

## Sample Recording Object Graphics

### Introduction to Sample Recording Objects Graphics

The Quality graphics package contains seven graphics for the Sample Recording Object (SRO). Of these, four are available as top level graphics to be added to an SRO and the remaining three are embedded in two of the top level graphics.

The graphics relate to the properties available within the SRO.

- There is a graphic for the properties and commands available on the **Sample** tab of the object.
- There is a graphic for the Recent Sample properties that get exposed when the number of recent samples property on the **Sample** tab equals 1 or more.
- There are two graphics for the properties shown in the **Characteristic** tab. The first is for the properties at the Sample Characteristic level and the second is for recording results for the characteristics within a sample.

These graphics are provided as independent graphics (symbols) when imported. However, they must be associated with an SRO to work correctly at run time. The recommendation is to derive a master SRO template from the base SRO:

1. Open your master SRO template.
2. Go to the **Graphics** tab.
3. Add graphics that embed the provided symbols (QualitySamplePanel, QualityRecentSamplePanel, QualitySampleCharPanel, and QualityRecordDataPanel).

You can choose to either create separate graphics (one for each of the four mentioned), or create one large graphic containing all four.

## QualitySamplePanel

This graphic presents most of the properties and all the commands that are available on the **Sample** tab within the SRO. The graphic is designed with the expectation that none of the properties within the SRO **Sample** tab have been mapped to an input source. It also assumes that the **Event DateTime** property is marked for auto-generation, as this property is not exposed in the graphic.

### Design

The fields in the graphic have a **User Input** link to the corresponding SRO attribute through a link to me.Sample.xxx, where xxx is the property name. If the SRO has an input source for any of these properties, the user will not be able to change the value at run time as it will come from the mapped input source and not the input from the screen.

The commands write to the corresponding command attribute. To the right of the command is an indicator that shows the status of the command. If there is an error in issuing a command, the error appears in the error message box. If there is an error (or if the SRO is not configured to auto-reset the object), the reset command can be called by clicking the **R** button next to the error message.

### Run Time

At run time, the **SampleID** property must be set first to indicate what sample record is to be updated by the **Record Sample Data** and **Finalize Sample Data** commands. The **SampleID** is a returned value for the **Generate Sample** command. The sample ID can be any valid sample in the database and does not have to be a sample that exists for the entity containing the SRO.

Fill in any of the other fields. There is no data checking on any of the fields, including the **Operator** field. The **Operator** field entry does not have to be a valid MES user, as this is a string value that gets recorded in the database. If user validation is desired, additional scripting will be required to logon the user with the MES Stateless API.

- Clicking the **Record Sample Data** button updates the sample with the provided **Lot**, **Sublot**, **Segment Requirement ID**, **Segment Response ID**, **Priority**, and **Spare 1** values. If the Operator string is provided, then clicking the **Record Sample Data** button also marks the sample as Pulled by the operator at the current time.
- Clicking the **Finalize Sample Data** button toggles the final flag on the sample based on the setting of the **Finalize Sample** check box. It fills in the **Finalized by** field with the name of the operator provided and uses the current time.
- Clicking the **Generate Sample** button generates a new sample for the parent entity of the object using the provided **QM Specification Name**. None of the other user input fields are used. This command returns the generated sample ID into the *SampleID* property.
- Clicking the **Clear** button clears out all the values except **SampleID** and **Operator**.
- Clicking the **R** button next to the error message resets the command group. If there is an error in the error message box, the sample group must be reset before calling another command. If the SRO is not configured to auto-reset the object, the sample group must be reset before calling another command.

## QualityRecentSamplePanel

This graphic represents the attributes that are enabled when the **Number of Recent Samples to View** property on the **Sample** tab in the SRO is set to 1 or greater. The graphic displays most of the attributes with the exception of the characteristic names list (which is used in later graphics), the spare fields, and the enumeration numbers.

### Design

The fields in the graphic have a **Value Display** link to custom properties that link to the corresponding SRO attribute through scripting. Initially, the custom properties map to me.RecentSample01.xxx, where xxx is the corresponding object attribute.

If the SRO has more than one recent sample exposed, then the **Next** and **Previous** buttons will move through the exposed RecentSampleYY attributes. The script does check the RecentSample.NumberofRecentSamplesToView property to know when it has reached the end of the list and restart at one. There is also an entry field to provide a specific Recent Sample group and a **Refresh** button to get the values. All the buttons' scripts make use of the **SetCustomPropertyValue** script function to redirect the custom properties in the graphic to the correct SRO attributes.

The **Find Current Sample** script cycles through all the RecentSampleYY.RequestedTime attributes to find the most current one. This script might need to be called twice when the graphic is first opened to allow time for all the attributes to be bound by the graphic.

### Run Time

At run time, this is a display-only graphic. It initializes with the RecentSample01 attributes displayed.

- Clicking the **Previous** and **Next** buttons navigate through the exposed recent sample attributes.
- Clicking the **Find Current Sample** button locates the Recent Sample with the most current Requested Time. When the graphic is first opened, this button will likely need to be clicked twice to bind to all the Requested Time attributes.
- Clicking the **Refresh** button reads data from the provided recent sample object number, which can be entered in the field to the left of the button. If the value provided is not a valid recent sample attribute, the script will read the largest available group.

- Clicking the **R** button next to the error message resets the command group. If there is an error in the error message box, the recent sample group must be reset before it will receive updates.

## QualitySampleCharPanel

This graphic represents the characteristic data group of attributes that are enabled when characteristics are added on the **Characteristic** tab in the SRO. The graphic is designed with the expectation that none of the properties within the SRO **Characteristic** tab characteristic data group have been mapped to an input source. The graphics have some additional limitations for those characteristics marked for automatic data collection. The graphic is designed to be used for all the characteristics within the SRO but only one characteristic at a time.

### Design

The fields in the graphic have a **User Input** link to custom properties that correspond to the SRO attributes for the characteristics. If the SRO has an input source for any of these properties, the user will not be able to change the value at run time as it will come from the mapped input source and not the input from the screen.

The graphic has an on show script to populate the list box with the names of the characteristics added to the SRO and contained in the **SelectedCharNames** object attribute. These will be the names exposed in the object and not necessarily the characteristic name defined in the MES database, as there are some restrictions in object attribute naming within System Platform. For example, if the MES characteristic name has a space in the name, the object attribute will replace the space with an underscore. The list in the graphic will show the System Platform object name with the underscore.

The graphic has a second script on data change of the selected characteristic from the list box that calls **SetCustomPropertyValue** to direct all the custom properties to the corresponding characteristic's object attributes. This includes an object attribute that contains the MES characteristic name.

The graphic has a button script to clear all the values in the custom properties except the **Sample ID** and **Operator**.

The graphic has a **More Info** button that calls **showGraphic** on the QualityCharacteristicOutput graphic and sends the name of the selected characteristic from the list to the QualityCharacteristicOutput graphic.

The graphic has a **Statistics** button that is only available when the selected characteristic has the option to expose statistics enabled. The button calls **showGraphic** on the QualityCharacteristicStatistics graphic and sends the name of the selected characteristic from the list to the QualityCharacteristicStatistics graphic.

The **Record Sample Char Data** command writes to the corresponding command attribute. To the right of this command is an indicator that shows the status of the command. If there is an error in issuing the command, the error will be displayed in the error message box. If there is an error (or if the SRO is not configured to auto-reset the object), the reset command can be called by clicking the **R** button next to the error message.

### Run Time

At run time this graphic initially opens up with no characteristic selected. It will populate the list with the available characteristics defined on the SRO.

To begin using the graphic, select one of the characteristics in the list, which will map all the inputs to the appropriate custom properties and will display the MES characteristic name.

The **SampleID** property must be set to indicate what sample record for the selected characteristic is to be updated by the command. The sample ID can be any valid sample in the database that contains the selected characteristic. It does not have to be a sample that exists for the entity containing the SRO. If the characteristic

selected is marked for automatic data collection in the SRO, then the sample ID cannot be changed and will always be set to the most recent sample ID for the entity and characteristic. This is because the SRO constantly updates this property for automatically collected characteristics.

- Clicking the **Record Sample Char Data** button updates the sample characteristic record with the provided information. The **Operator** field is not used with this command as it is for recording results.
- Clicking the **Clear** button clears out all the values except **Characteristic**, **SampleID**, and **Operator**.
- Clicking the **R** button next to the error message resets the command group. If there is an error in the error message box, the sample characteristic group must be reset before calling another command. If the SRO is not configured to auto-reset the object, the sample characteristic group must be reset before calling another command.
- Clicking the **More Info** button shows additional information about the selected characteristic. See [QualityCharacteristicOutput](#).
- Clicking the **Statistics** button shows additional information about the exposed statistics for the selected characteristic. If no statistics are exposed for the selected characteristic, this button is not displayed. See [QualityCharacteristicStatistics](#).

### QualityCharacteristicOutput

This graphic displays additional characteristic attributes that are read from the configuration within the MES database. The graphic displays most of the attributes with the exception of the enumerations. It also displays the current control rule violations string, which lists all SPC control rules evaluated for the most recent sample.

There is an on show script that calls **SetCustomPropertyValue** to direct all the custom properties to the corresponding characteristic's output object attributes. All the display fields have value displays to the custom property.

### QualityCharacteristicStatistics

This graphic displays all the characteristic statistic attributes for the entity that are read from the MES database. The graphic displays the characteristic name and type along with all the statistics. If the selected characteristic is an attribute type, some of the statistics are not applicable and will not have valid references.

There is an on show script that calls **SetCustomPropertyValue** to direct all the custom properties to the corresponding characteristic's statistics object attributes. All the display fields have value displays to the custom property.

### QualityRecordDataPanel

This is the most complex graphic in the group and is built as an example of constructing a custom interface for manually entering results similar to what is available in the Sample Viewer control. This graphic displays up to five characteristics with up to five measurement results per characteristic. It uses the number of results exposed for each characteristic as defined in the SRO **Characteristic** tab under the **Result** data group. The graphic is designed with the expectation that none of the characteristics are marked for automatic data collection. The exposed results in the SRO can be mapped to an input source, but this is not necessary. The graphic is designed to handle both variable and attribute characteristics.

The graphic is designed to be as flexible as possible so that it will work no matter how the SRO is implemented. It is possible that an SRO has many characteristics exposed, but any specific sample will only contain a subset of

those. For each characteristic, the SRO might expose only one result attribute even though the sample requires multiple measurements per sample (typically an automatically collected variable). The graphic is limited to five characteristics and five measurements per characteristic, but the design and scripting can be modified to accommodate more.

## Design

The graphic embeds five copies of the QualityVariable graphic, which is described in [Run Time](#). These have a visibility link to only show them if there are enough characteristics within the RecentSample01 characteristic list.

There are five custom properties each for sample size, expose statistics, and type, as these are needed to determine how many bindings to do on the embedded QualityVariable graphics. More custom properties will need to be added to manage more input fields.

The graphic has an on show script to prepare the graphic for initialization. This script sets the sampleID displayed on the screen to the RecentSample01.SampleID. The script also goes through the list of SRO characteristic names (me.SelectedCharNames) and binds to the characteristic's MES name with the **SetCustomPropertyValue()** script. The script also retrieves the list of MES characteristics from the RecentSample01.CharacteristicNames object attribute, goes through the list (up to five), and binds the sample size, expose statistics, and type custom properties with the **SetCustomPropertyValue()** script. This is necessary as it takes time for System Platform to bind to these values. The binding is done in the on show script and another button script then uses all these values. For this to work correctly, the characteristic's description needs to match the characteristic name (both set in MES Client) since the RecentSamplexx.CharacteristicNames attribute is returning the characteristic's description field. If the characteristic name and description do not match, the script assumes the recent sample has all the configured characteristics in the SRO and maps them one to one in order.

The **Initialize** button script completes all the bindings for the embedded QualityVariable graphics. The script starts the same as the on show script to get the list of characteristics exposed on the SRO and to get the list of characteristics in RecentSample01. Depending on whether the characteristic is a variable or attribute characteristic, the script binds the appropriate custom properties in each of the embedded QualityVariable graphics. The script only binds the number of result values exposed for the variable characteristics and binds the two result values for attribute characteristics. For attribute characteristics, the script does not bind reasonable limits or specification limits as it does for variable characteristics. The script also counts how many characteristics there are to enable the visibility of the QualityVariable graphics.

The **Sample ID** user input field initially is set to the RecentSample01.SampleID, but this can be changed. When it is changed, then a data change script will run to propagate the sample ID to all the QualityVariable graphics and to try to find the sample name from the recent samples exposed in the SRO. If not found, the value display for the Sample Name will point to the highest recent sample on the object.

The **Operator** user input field will trigger a data change script to propagate the Operator to all of the QualityVariable graphics. The Operator is also displayed in the QualitySampleCharPanel.

The **Save All** button script triggers a save on all the embedded QualityVariable graphics through the RecordResultDataCmd custom property on each of the embedded graphics.

All of the errors from the embedded graphics are concatenated together in the error text box. There are data change scripts to detect and propagate errors from the embedded graphics. If there is an error (or if the SRO is not configured to auto-reset the object), the reset command can be called by clicking the **R** button next to the error message. This is sent to all the characteristics.

## Run Time

At run time, this graphic initially opens up with no characteristic data entry fields available. The initialization script will have completed and will show the sample ID of the RecentSample01.SampleID (which might not be the most recent sample if more than one recent sample group is exposed).

To begin using the graphic, click on the **Initialize** button, which will map all the inputs to the appropriate custom properties of up to five characteristics. The characteristic name, unit of measure, up to five input fields, and a **Save** button will appear for each characteristic.

The **SampleID** must be set to indicate what sample record for the characteristics is to be updated by the record results command. The sample ID can be any valid sample in the database that contains the same list of characteristics and does not have to be a sample that exists for the entity containing the SRO. If any of the characteristics have all the results collected (the number of results is equal to the maximum sample size), then no new data can be recorded for the characteristic.

Enter values for the result fields and click the **Save** button for each characteristic. For attribute characteristics, the first value is the count of defects and the second value is the number of samples tested. For variable characteristics, the input field will limit the value to between the upper and lower reasonable limits. The value will appear in red if it is outside the upper and lower specification limits (only if statistics are exposed for the characteristic).

Instead of clicking the individual **Save** buttons for each characteristic, you can record the data for all characteristics at once by clicking the **Save All** button.

## QualityVariable

This graphic is used by the QualityRecordDataPanel to provide up to five input fields for recording results against a characteristic. It consists of many custom properties that are set from the QualityRecordDataPanel graphic.

At the top are two value displays for the characteristic name and the unit of measures.

There are five user input fields to manage recording up to five results at one time. These have visibility links to hide those input fields that are not required based on the number of result attributes exposed in the SRO.

- For variable characteristics, the number of exposed results is in the **SampleSize** property.
- Attribute characteristics always expose two results with a different name, as described in [QualityRecordDataPanel](#).

The text of the input field will also change to red if the value entered is outside the specification limits for the characteristic (this only applies to variable characteristics).

The **Save** button triggers the **Record Result Data** command for the characteristic.

## Use MES with BI Gateway

Manufacturing Execution System (MES) BI Gateway Reports are SQL Server Reporting Service (SSRS) reports based on the BI Gateway software solution.

## MES BI Gateway Reports

Manufacturing Execution System (MES) BI Gateway Reports are SQL Server Reporting Service (SSRS) reports based on the BI Gateway software solution. The BI Gateway services extract data from the MES database, transform it, and populate the MES data in the BI Gateway database. This data is then available to the following MES BI Gateway Reports for viewing and analysis.

The reports are listed below.

### **Production by Entity Report**

Summarizes good and reject production counts by line, entity, and shift.

### **Line Production Report**

Summarizes production counts by line, entity, shift, work order, and item and displays production over time or item.

### **Genealogy by Work Order Report**

Shows, by work order, which input or raw material items were consumed directly and indirectly to create production items.

### **Genealogy by Lot Report**

Shows, by lot, which work orders and produced lots consumed specific raw materials.

### **Utilization Timeline Report**

Displays a color time line of utilization states by entity.

### **Utilization by Entity Report**

Summarizes event counts and durations by line, entity, and shift.

### **Utilization Analysis Report**

Displays event counts and durations by reason, reason group or category, and by entity.

### **Utilization Waterfall Chart**

Shows successive chart entries of time spent in utilization reasons and states to indicate how the effective production time for an entity is derived.

### **OEE Analysis Report**

Shows Overall Equipment Effectiveness (OEE) and its components (Availability, Performance, and Quality) by entity over time.

### **Mean Time Between Failures (MTBF) Report**

Calculates the failure counts and mean time between failures by entity.

### **Mean Time to Repair (MTTR) Report**

Calculates the event counts and mean time to repair an entity.

### **Performance Dashboard**

Shows several panels of at-a-glance performance summary data for an entity over a specified time period.

### **Quality Summary Report**

Shows out-of-specification and out-of-control Pareto charts and summary statistics based on equipment, product (item), work order, operation, process, and item category.

### **Quality Characteristic Detail Report**

Provides information on sample data and Statistical Process Control (SPC) charts based on characteristics and

multiple filters.

For information on how to install and configure BI Gateway and the MES BI Gateway Reports, refer to the *MES Installation Guide* or online help.

## MES BI Gateway Reports Configuration and Deployment

The MES reporting content defaults to using the BI Gateway database as the source for the report data. The BI Gateway model includes content from MES Performance, Operations, and Quality data tables.

The section in the *MES Installation Guide* called "Configuring and Deploying MES BI Gateway Reports" describes how to configure and deploy the MES BI Gateway reports.

The MES installation software includes a non-licensed limited version of BI Gateway that can be used solely with MES BI Gateway reports. The MES BI Gateway reports will also work with a full version of BI Gateway.

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**Note:** To install the Quality Characteristic Detail report's SPC Chart control, the MES BI Gateway Reports component must be installed and configured on the same node as the BI Gateway Datastore and SQL Server Reporting Services (SSRS).

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The configuration and deployment of the MES BI Gateway reports includes the following procedures:

1. If not already performed, configuring the BI Gateway components and MES Database Setup component.
2. Importing and deploying the MES BI Gateway model.
3. Deploying the SSRS MES reports against the BI Gateway database.
4. Configuring the security policies for the Quality Characteristic Detail report.

Once deployed, links to the MES BI Gateway Reports are included in a folder within the standard SSRS Report Manager web page. The default folder is **MES Reports**, but that can be modified during the MES BI Gateway Reports configuration.

The default SSRS Report Manager web page for the MES reports is shown below, but access to the reports can be implemented in many ways.

The screenshot shows the SQL Server Reporting Services interface. At the top, there's a navigation bar with 'Favorites', 'Browse', 'New', 'Upload', 'Manage folder', 'Tiles', 'Search...', and a user dropdown for 'mes.user'. Below the navigation bar, the title 'MES Reports' is displayed, with a breadcrumb trail 'Home > MES Reports'. The main area is divided into two sections: 'FOLDERS (1)' containing a single folder named 'Images', and 'PAGINATED REPORTS (15)' which lists the following reports in a grid:

Report Name	Preview	Actions
GenealogyByLot		...
GenealogyByWorkOrder		...
LineProduction		...
MTBFRReport		...
MTTRReport		...
OEEAnalysis		...
PerformanceDashboard		...
ProductionbyEntity		...
QualityCharacteristicData		...
QualitySummary		...
UtilizationAnalysis		...
UtilizationAnalysisWaterfa		...
UtilizationByEntity		...
UtilizationTimeline		...

Note the following about the configuration and deployment:

- The MES Quality Characteristic Detail report includes a subreport containing a .NET control for displaying the SPC Chart. This report requires that certain security policy settings for Reporting Services are configured to display the .NET control.

To configure these security policy settings, follow the instructions provided in the **Reporting Services Security Configuration.txt** file that is located in the **BI Gateway Reports\Reports** folder of the **MES** application folder.

- By default, dimensions and dependencies will be updated at 25 minutes past the hour.
- If there is a large amount of data in the MES database loaded into the BI Gateway database, then it is recommended to periodically remove duplicate records to improve data retrieval performance. The BI Gateway tables with the largest amount of data are generally the following three. Execute these statements against the BI Gateway database to delete their duplicate records.

Delete from MESRDBUtilization where aaObsolete = 1

Delete from MESRDBItemProduction where aaObsolete = 1

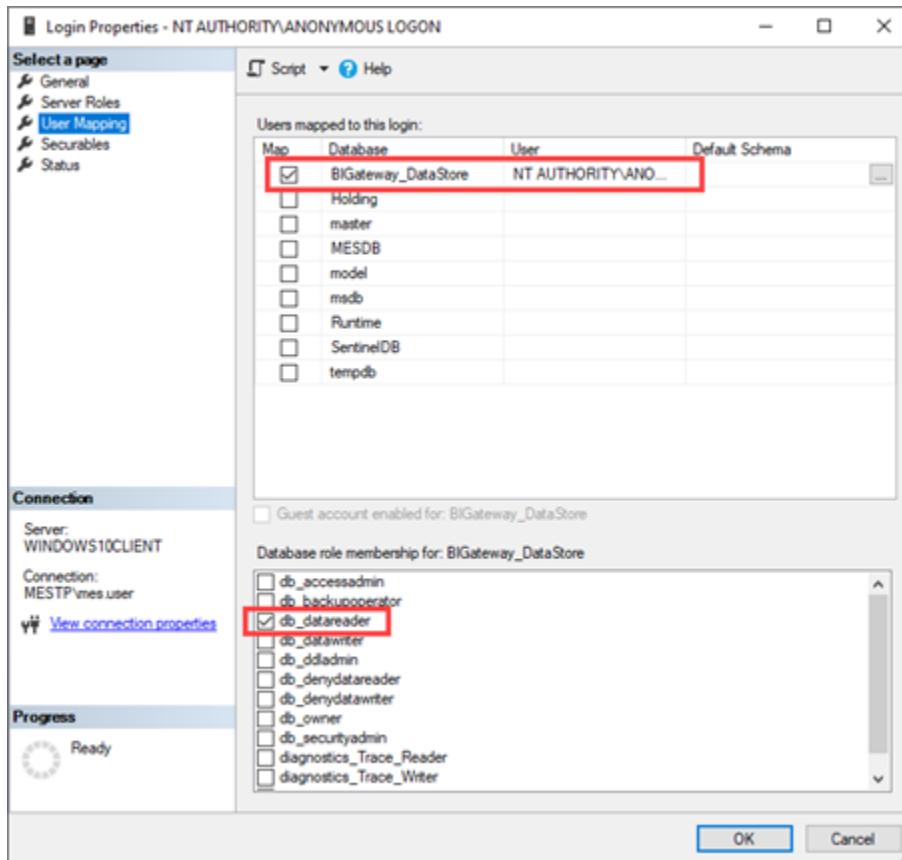
Delete from MESRDBItemConsumption where aaObsolete = 1

- The BI Gateway database and the MES database are expected to be in the same time zone. This is so that local times for measures that are calculated by the BI Gateway server will match local times from dimensions that are copied from the source (that is, the MES database).

## Adding BI Gateway Database Access for SQL Server 2019 or Later

When using SQL Server 2019 or later for the BI Gateway database and the MES BI Gateway reports are being deployed on a different node than SQL Server, user access to the BI Gateway datastore database must be configured. This can be performed by doing one of the following:

- Creating a SQL Server login for the **NT AUTHORITY\ANONYMOUS LOGON** Windows account and granting that login read access to the BI Gateway datastore database, as shown below.



- Creating SQL Server logins for individual users and granting those logins read access to the BI Gateway datastore database.

## Specifying the Production Day

All the reports except Utilization Analysis, Utilization by Entity, and Utilization Waterfall use the Reports system parameters. These parameters define when the 24 hours of the production day starts. The Reports system parameters are set in MES Client.

Status	System Parameter	Value
Production Day Start		ShiftStart
Production Day Start (Hour)		ShiftStart
Production Day Start (Minute)		ShiftEnd
Security (18 items)		TimeOfDay
Supervisor (5 items)		

The shift history dimension uses the Reports system parameter to set the production day for each shift record, which is then used by the reports to filter or group data by production day. Therefore, shifts must be defined within MES for the production day filtering to function.

The Utilization Analysis and Utilization by Entity reports use the utilization event time and calendar day to determine what records to include and calculate time during the day when an event crosses a day boundary. The Utilization Waterfall report uses the provided start and end times and does not have options for time periods of current day, previous day, etc.

**Note:** Any time you change the production day, the model must be redeployed. See [Guidelines for Modifying and Redeploying the Model](#).

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## Production Day Start

The possible values are:

### ShiftStart

The production day starts with the first shift that starts in the day. For example, if the first shift that starts in the day starts at 08:00:00, then the production day starts at 08:00:00 of the current calendar day and ends at 07:59:59 of the next calendar day. If the current calendar day is December 1, then the production day would be from December 1 at 08:00:00 to December 2 at 07:59:59.

### ShiftEnd

The production day ends with the last shift that ends in the day. For example, if the last shift that ends in the day ends at 23:00:00, then the production day starts at 23:00:00 of the previous calendar day and ends at 22:59:59 of the current calendar day. If the current calendar day is December 1, then the production day would be from November 30 at 23:00:00 to December 1 at 22:59:59.

### TimeOfDay

The production day starts with the first shift that occurs after the cut-off time specified by the *Production Day Start (Hours)* the *Production Day Start (Minutes)* parameters. For example, if the cut-off time is defined to be 06:00:00 and the first shift that starts after that time starts at 07:00:00, then the production day starts at 07:00:00 of the current calendar day and ends at 06:59:59 of the next calendar day. If the current calendar day is December 1, then the production day would be from December 1 at 07:00:00 to December 2 at 06:59:59. When TimeOfDay is selected as the *Production Day Start* parameter, the values from the *Production Day Start (Hour)* and *Production Day Start (Minute)* parameters will be used as the cut-off time.

## Production Day Start (Hours)

If the *Production Day Start* parameter is set to Time of Day, specifies the hour portion of the cut-off time for the production day. The valid range of values is 0 (the default) to 23.

## Production Day Start (Minutes)

If the *Production Day Start* parameter is set to Time of Day, specifies the minute portion of the cut-off time for the production day. The valid range of values is 0 (the default) to 59.

## Running a Report

How you open an MES BI Gateway Report to run it depends on how they are deployed. For example, if reports

are generated according to a schedule and emailed to recipients, the email can contain a link that opens the report.

### To open and run a report from the MES reports web page in SSRS Report Manager

1. Click the report name link.

The report opens in a new browser window.

Each report has parameters for specifying time ranges, report-specific filters, and in some cases options to show or hide elements of the report. Within SSRS, copies of the reports can be created to remove, pre-populate, and otherwise modify the provided reports.

2. Set the desired parameters.

Note that the Start Date and End Date are calendar controls for picking a specific day. If a time is also required, it can be typed in manually.

3. Click **View Report** to run the report.

The report appears, with the data content set according to the selected parameters.

The screenshot shows the 'Production By Entity' report interface. At the top, there are several filter dropdowns: 'Time Period' (set to 'Current Week'), 'Show Details By' (set to 'Entity'), 'Start Date' (set to '1/17/2017'), 'End Date' (set to '1/17/2017'), 'Line Name' (set to 'None'), 'Entities' (listing 'Bagger001, Bagger002, Bagger003, Bagger004'), 'Work Order' (listing 'WO-010, WO-020, WO-030, WO-040'), 'Items' (listing 'BMX-BBQ, BMX-SRI, BMX-TST'), and 'Item Reason' (listing 'Bad Production, Delete Inventory'). Below the filters is a toolbar with navigation icons (back, forward, search) and a 'View Report' button. The main content area displays the title 'Production By Entity' and the date range 'From: 1/16/2017 To 1/22/2017'. It then lists production details for each entity:

Entity	Good Count	Reject Count
Bagger001	348 200g	2 200g
Bagger002	58 200g	8 200g
Bagger003	58 200g	8 200g
Bagger004	48 200g	2 200g
	Good Count: 58 200g	Reject Count: 8 200g

### Report Layout

The report parameters are summarized at the top of the report, followed by the body of the report.

## Production By Entity

From: 3/1/2019 To 3/31/2019

Line: Mixed Nuts Bags (Bagger)		Good Quantity: 29196 Pieces				Reject Quantity: 1295 Pieces		
Entity: Roaster		Good Quantity: 5197.5 Kilograms				Reject Quantity: 182.5 Kilograms		
3/1/2019 Shift: Day		Good Quantity: 287.5 Kilograms				Reject Quantity: 2.5 Kilograms		
Quality	Production Time	Work Order	Item	Reason	Grade	State	Quantity	Unit
Good	3/1/2019 5:00:00 AM	20190301.001	BMX-BBQ/Bag of Mixed Nuts - BBQ	Good WP Production	Normal	VIP Materials	205.00	Pieces
Reject	3/1/2019 5:00:00 AM	30190301.002	BMX-BBQ/Bag of Mixed Nuts - BBQ	Contaminated Production	Scraps	Production Scraps	5.00	Pieces
3/1/2019 Shift: Afternoon		Good Quantity: 932.5 Kilograms				Reject Quantity: 42.5 Kilograms		
3/1/2019 Shift: Night		Good Quantity: 895 Kilograms				Reject Quantity: 50 Kilograms		
3/2/2019 Shift: No Shift		Good Quantity: 2325 Kilograms				Reject Quantity: 75 Kilograms		
3/4/2019 Shift: Afternoon		Good Quantity: 837.5 Kilograms				Reject Quantity: 12.5 Kilograms		
Entity: Coater		Good Quantity: 4831.5 Kilograms				Reject Quantity: 282.5 Kilograms		
Entity: Bagger		Good Quantity: 9138 Pieces				Reject Quantity: 525 Pieces		
3/1/2019 Shift: Day		Good Quantity: 268 Pieces				Reject Quantity: 8 Pieces		
Quality	Production Time	Work Order	Item	Reason	Grade	State	Quantity	Unit
Good	3/1/2019 5:00:00 AM	20190301.001	BMX-BBQ/Bag of Mixed Nuts - BBQ	Good WP Production	Normal	VIP Materials	195.00	Pieces
	3/1/2019 5:00:00 AM	30190301.002					73.00	
3/1/2019 Shift: Afternoon		Good Quantity: 1745 Pieces				Reject Quantity: 50 Pieces		
3/1/2019 Shift: Night		Good Quantity: 1300 Pieces				Reject Quantity: 200 Pieces		
3/2/2019 Shift: No Shift		Good Quantity: 4275 Pieces				Reject Quantity: 200 Pieces		
3/4/2019 Shift: Afternoon		Good Quantity: 1550 Pieces				Reject Quantity: 75 Pieces		

Depending on the report, there might be multiple pages and options to collapse and expand sections of the report. See the following sections for details about each report.

SSRS reports that contain tabular data will also enable an option to export the data in various formats. This option is available in the SSRS report's tool bar, where you can select a file format and then export the data.

## MES BI Gateway Reports Dimensional Model

The MES BI Gateway reports use the BI Gateway database for their data instead of the MES database. This is done to limit the performance impact that a large report query would cause on the MES database server.

To optimize performance, the MES database should be on a separate server from the BI Gateway database.

BI Gateway is used as the mechanism to periodically extract data out of the MES database, transform it to a star schema, and store it in the BI Gateway database for easier reporting. Since the data is not residing in the MES database and the extraction occurs periodically, the report developer should understand the following about the BI Gateway model that is used by the MES product:

- The underlying dimension and measure model
- The settings used in the model
- The additional views and stored procedures that query the dimension and measure tables
- The links between all the components.

## Model Definition

The BI Gateway model consists of the dimensions and measures used to define the data that is extracted from

the MES database. Some data is configuration data that rarely changes once initially defined. Other data is run-time data this is constantly being added to the system.

The measures are calculated by the BI Gateway service. To ensure that the local times in the measures and the local times from the dimensions are comparable, the BI Gateway database should be in the same time zone as the MES database.

## Guidelines for Modifying and Redeploying the Model

The model is provided as a JSON file for importing and deploying through the BI Gateway Model Builder web application.

The model uses custom queries for the dimensions. These can be viewed in the JSON file and in the BI Gateway Model Builder. Additional columns can be added to the model by modifying the custom queries.

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**Note:** Any modifications to a query will require a redeployment of the dimension/model, which will delete the existing data and repopulate it from the source system. Therefore, these types of changes should be performed in a smaller test environment due to the impact that the redeployment can have on the MES database.

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Whenever the full model or a component of it is redeployed, the existing BI Gateway tables are deleted and the data is repopulated from the source system (that is, the MES database). Therefore, the source data should not be deleted until all model changes have been completed. Also, it is recommended to make a backup of the BI Gateway database before making a model change.

### To redeploy the model

1. On the node on which BI Gateway is installed and configured, open the BI Gateway Model Builder.
2. Import the updated MES model file with the default Overwrite option.
3. Validate the data source by connecting to the MES data source.
4. Deploy the model.

When the new model is deployed, the existing BI Gateway tables are deleted and the BI Gateway database is repopulated with current data from the MES database.

## Configuration Dimensions

### Refreshing of the Configuration Dimensions

The configuration dimensions are refreshed every 8 hours or daily at 15 minutes past midnight. These dimensions look for data changes from the start of the deployment.

The default refresh rate settings are set with the expectation that configuration data is relatively static over time. With these settings, new records added to these configuration dimensions will not appear in reports for at least 8 or 24 hours depending on the setting. The dimensions set with an 8-hour refresh are the ones to which the measure definitions refer. This is done because the measures are configured to recalculate only the last 8 hours of data, which means any dependent dimensions must be updated within that time window to reflect changes.

Additionally, BI Gateway will create a new record and mark the old record obsolete when a change is detected in non-time-defining dimensions. The impact of this is that a change in the name or other fields of a record will only be reflected on new dependent data coming into the system with the older records still referencing the original values. Redeploying the model will correct this, but will delete existing data and restart the extraction process.

## Configuration Dimensions List: 8-Hour Refresh

### **MESRDBEquipmentDetail**

Contains the MES entity (equipment) definitions. It includes all entities and their associated capability configuration data from the OEE, Utilization, and Storage Executor tables (OEE\_Exec, Util\_Exec, and Storage\_Exec).

### **MESRDBItem**

Contains the item (product) definitions. It also includes item display setting, item class, unit of measure, and unit of measure conversion data.

### **MESRDBItemReason**

Contains the production (item) reason, grade, and state definitions.

### **MESRDBLineEquipment**

Contains the MES Performance line and line entity (equipment) definitions.

## Configuration Dimensions List: Daily Refresh

### **MESRDBCause**

Contains the MES Quality cause definitions.

### **MESRDBCharacteristic**

Contains the MES Quality characteristic definitions.

### **MESRDBItemCategory**

Contains the item category definitions for MES Quality.

### **MESRDBOperation**

Contains the MES Operations process and operations definitions.

### **MESRDBQMSSpec**

Contains the MES Quality QM Specification and associated characteristic definitions.

### **MESRDBReasonGroup**

Contains the MES Performance reason group definitions and hierarchy.

### **MESRDBReasons**

Contains the MES Performance reason definitions. It includes the reason group and utilization state to which the reason is linked.

### **MESRDBSampleFreq**

Contains the MES Quality sample frequency definitions.

### **MESRDBShift**

Contains the shift definitions.

### **MESRDBSystemAttr**

Contains the general system attribute (parameter) definitions.

### **MESRDBUOM**

Contains the unit of measure and conversion definitions.

### **MESRDBUser**

Contains the MES user definitions.

#### **MESRDBUtilCategory**

Contains the MES Performance utilization reason category definitions from the possible set of categories defined for all reasons.

#### **MESRDBUtilState**

Contains the MES Performance utilization state definitions.

#### **MESRDBVersion**

Contains the MES database version, MES model version, and MES SSRS report version information.

### **Run-Time Dimensions**

The run-time dimensions are refreshed hourly (except where noted) and retrieve new and modified data from the MES database. These dimensions look for data in the last 2 days (update interval) based on the last\_edit\_at column in the corresponding MES database table. The utilization, job, and job context dimensions look for data in the last 1 day instead of 2 days.

#### **MESRDBItemConsumption**

Contains the MES Operations consumption transaction records. It is dependent on the Item dimension and has a 20-minute offset.

#### **MESRDBItemProduction**

Contains the job production transaction records. It also contains the item grade, item state, and entity information from those tables. It is dependent on the job, shift, item reason, and item dimensions and has a 20-minute offset.

#### **MESRDBJob**

Contains the job records from the Job table. It has no dependencies and a 17-minute offset. This dimension is configured as a Time-Defining Dimension. This means that existing records will be overwritten if the value changes between updates (as opposed to creating a new record and marking the original record as obsolete).

#### **MESRDBJobContext**

Contains the metadata that describes a job record (work order, operation, and sequence number) and its start time. This dimension is referenced by the measures instead of the Job dimension as the job context records should not change after their initial retrieval. It has no dependencies and has a 17-minute offset.

#### **MESRDBLot**

Contains the metadata that fully describes a lot and subplot. It has no dependencies and has a 15-minute offset.

#### **MESRDBResourceActual**

Contains the job events records. It has no dependencies and has a 15-minute offset.

#### **MESRDBSampleCharRuleLink**

Contains the MES Quality control rule violations recorded for a characteristic in a sample. It has no dependencies and has a 15-minute offset.

#### **MESRDBSampleResults**

Contains the MES Quality sample results recorded for each characteristic in a sample. It also includes the process name from the Wo table and the entity name from the Entity table. It is dependent on the QM Specification, characteristic, sample frequency, and cause dimensions and has a 20-minute offset.

#### **MESRDBShiftHistory**

Contains the shift history records for each entity. It also calculates the Production Day value based on the system attribute setting (see Specifying the Production Day). It has no dependencies and a 15-minute offset. This dimension is configured as a Time-Defining Dimension. This means that existing records will be overwritten if the value changes between updates (as opposed to creating a new record and marking the original record as obsolete). It is also configured for a 30-minute refresh rate to more quickly capture shift changes in time zones with a 30-minute offset.

#### **MESRDBUtilization**

Contains the utilization records for each entity. It includes the job, item, entity, line, and KPI target values from the corresponding tables. It is dependent on the job, shift history, line equipment, item, and reason dimensions and has a 20-minute offset.

#### **MESRDBWorkOrder**

Contains the metadata that fully describes a work order record. It has no dependencies and has a 15-minute offset.

### **Run-Time Measures**

The run-time measures are refreshed hourly at 25 minutes past the hour. The measures look for data in the last 8 hours (update interval) based on the `last_edit_at` column of the core table being retrieved.

#### **MESRDBHourlyProduction**

Calculates the total good quantity, total reject quantity, entity production rate, and entity batch size for each hour by shift, entity, and job. It is dependent on the shift history, job context, and equipment detail dimensions. This measure assumes that a job's production rate and batch size are not changing over time. If they are, this measure calculates the average for the hour.

This measure uses a different query from the MESRDBItemProduction dimension to return the production rate and batch size information.

#### **MESRDBHourlyUtilization**

Calculates the total entity run time, downtime, and idletime for each hour. It is dependent on the shift history and equipment detail dimensions.

This measure uses a different query from the MESRDBUtilization dimension to account for shift times not occurring on the hour.

Events with a duration longer than 15 days will not be processed.

#### **MESRDBProduction**

Calculates the entity production quantity for each hour by shift, line, entity, job, item, and item reason. It is dependent on the item, item reason, line equipment, shift history, job context, and equipment detail dimensions.

This measure uses the same query as the MESRDBHourlyProduction measure.

### **Refresh and Update Intervals**

All the configuration dimensions are independent definitions that are expected to remain static over long periods of time. As such, these dimensions are configured for a refresh interval of every 8 hours or every 24 hours with an offset of 15 minutes, depending on the dimension. This means that these dimensions are updated at least every day at 12:15 AM.

The run-time dimensions are the key dimensions that extract the data from the MES database for the reporting content. Except for the shift history dimension, which runs every 30 minutes, these are configured for a refresh

interval of every hour by default. Based on their dependencies, these dimensions have an offset from the dependent dimensions to ensure the dependent dimensions are updated first. The offsets are set at 17 or 20 minutes based on the dependencies.

The run-time dimensions have an update interval of either 1 or 2 days depending on the dimension. This means that only new or changed records from the most recent 1 or 2 days are being retrieved.

The run-time measures further calculate aggregate data with additional data grouping. Since these measures require all the other dimensions to be updated first, they are configured for a refresh interval of every hour by default and an offset of 25 minutes.

The measures are configured for an update interval of 8 hours, which is used to update existing hourly buckets within the last 8 hours when a record is modified. For example, if an historical utilization event is split or modified to change its utilization state, this change will be reflected in the BI Gateway database as long as the modification was made to a record within the last 8 hours. Also, depending on your offset from UTC, the modifications will not appear in BI Gateway for the number of hours your timezone is offset from UTC for those locations that have a negative offset from UTC.

## BI Gateway Model Dimension and Measure Objects

The JSON-based MES BI Gateway report model is imported into the BI Gateway database using the BI Gateway Model Builder. Deploying the report model is described in the *MES Installation Guide*.

The model's dimension and measure objects are defined in the MES BI Gateway model file, **MESIntelligenceModel.json**. The naming of the dimension and measure objects in the JSON file and the Refresh Rate and Update Interval properties for updating them are described in the following topics.

### Dimension Name

The DimensionDataItems property holds an array of dimension objects. The name of the dimension is defined by the Name property in the dimension object. For example (JSON content is shown in a tree view for readability):

```
"DimensionDataItems": [
  {
    "DimensionDataItemUID": 1,
    ...
    "Name": "MESRDBEquipmentDetail",
    "Description": "Intelligence Dimension Object",
    ...
  }
```

### Measure Name

The MeasureDataItems property holds an array of measure objects. The name of the measure is defined by the Name property in the measure object. For example (JSON content is shown in a tree view for readability):

```
"MeasureDataItems": [
  {
    "MeasureDataItemUID": 1,
    ...
    "Name": "MESRDBProduction",
    "Description": "Intelligence Measure Object",
    ...
  }
```

## Refresh Rate

The following properties define the refresh rate of a dimension or measure.

### RefreshRateInterval

The refresh rate interval of the dimension or measure. The interval time value must be a positive integer.

### RefreshRateUnit

The unit of time for the refresh rate. The minimum refresh rate is 1 minute and maximum is 366 days. The unit can be Minute, Hour, or Day.

### RefreshRateOffset

The offset time, in minutes, used to delay the scheduled data collection start time. The maximum offset time is 59 minutes.

The following example demonstrates the refresh rate configured at 1 hour with an offset of 15 minutes:

```
"RefreshRateInterval": 1,  
"RefreshRateOffset": 15,  
"RefreshRateUnit": "Hour",
```

## Update Interval

The following properties define the update interval of a dimension or measure.

### UpdatePeriodInterval (for a dimension)

The update period interval is a time interval for which dimension data has to be refreshed during the dimension refresh. The minimum update period is 1 minute and the maximum update period is 366 days. The update period must be equal to or more than the dimension refresh rate.

### UpdatePeriod (for a measure)

The update period is a time interval for which measure data has to be refreshed during the measure refresh. The minimum update period is 1 minute and the maximum update period is 366 days. The update period must be equal to or more than the measure refresh rate.

### UpdatePeriodUnit (both dimensions and measures)

The unit of time for the update period. It can be one of the following values: Minute, Hour, Day, Week, or Month.

The following **dimension** example demonstrates the update period interval configured at 1 day:

```
"UpdatePeriodInterval": 1,  
"UpdatePeriodUnit": "Day",
```

The following **measure** example demonstrates the update period configured at 1 day:

```
"UpdatePeriod": 1,  
"UpdatePeriodUnit": "Day",
```

## Production by Entity Report

The Production by Entity report shows production data for all shifts that started within the given period for selected entities and items.

The report displays, for each item on each entity, the units produced, units rejected, and the calculated percentage quality in a table.

With millions of production records in the database, this report should return data within 20 seconds for one

month of data across multiple lines and/or entities.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Time Period	-	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Show Details By	Entity	No	Single	<p>The level at which the report is expanded on initial display:</p> <ul style="list-style-type: none"> <li>• Line</li> <li>• Entity</li> <li>• Shift</li> <li>• Event</li> </ul>
Start Date	Today	Time Period	Single	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Today	Time Period	Single	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any</p>

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				value other than Date/Time Range.
Line Name	All	No	Multiple	<p>The lines to include in the report.</p> <p>In addition to every line, the list includes the option None, which causes all entities that are not on a line to be included in the Entities parameter list. A combination of None and lines is allowed.</p>
Entities	All	Line Name	Multiple	<p>The entities to include in the report.</p> <p>The list of entities is filtered by the Line Name parameter:</p> <ul style="list-style-type: none"> <li>• The entities for any lines selected in the Line Name list will be included in this list.</li> <li>• If None is selected in the Line Name list, all the entities that are not on a line will be included in the list, in addition to the entities for any selected lines.</li> </ul>
Work Order	All	No	Multiple	The work orders to include in the report.

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Items	All	No	Multiple	The items to include in the report.
Item Reasons	All	No	Multiple	The item reasons to include in the report.

## Report Data

Good Quantity shows the good count value during the production converted to standard item UOM at the respective levels.

Reject Quantity shows the reject count value during the production converted to standard item UOM at the respective levels.

The Event Details section includes the following columns.

### Quality

Indication of good production or reject production.

### Production Time

### Work Order

### Item

Produced item.

### Reason

Item production reason.

### Grade

Produced item's grade.

### State

Produced item's state.

### Quantity

### Unit

Quantity unit of measure

In Event Details, the data is not shown if it is the same as the previous row.

When there are no events found based on the selected filter criteria, the tabular data will show available lines and entities with production counts of 0.

## Unit of Measure Conversion Example

In the example report shown below, all the unit of measures at the event level (e.g., 50 Kilograms, 2.5 Kilograms) are converted to the line's Standard Item UOM (e.g., Pieces), then the sum is shown at the line level in the line's Standard Item UOM. Similarly, all the UOMs at the event level are converted to the entity's Standard Item UOM (e.g., Kilograms) and the sum is shown at the entity level and shift level in entity's Standard Item UOM. The

formula for conversion is:

(Event level Quantity) x (conversion factor)

In the example report, if the first event row is considered, 100.00 Pieces is converted to 50 Kilograms.

$100 \times 0.5 = 50$

This conversion is performed for each entity level quantity and then summed at respective levels.

## Production By Entity

From: 3/1/2019 To 3/31/2019

Line: Mixed Nuts Bags (Bagger)		Good Quantity: 29195 Pieces				Reject Quantity: 1295 Pieces		
Entity: Roaster		Good Quantity: 5197.5 Kilograms				Reject Quantity: 182.5 Kilograms		
3/1/2019 Shift: Day		Good Quantity: 267.5 Kilograms				Reject Quantity: 2.5 Kilograms		
Quality	Production Time	Work Order	Item	Reason	Grade	State	Quantity	Unit
Good	3/1/2019 5:00:00 AM	20190301.001	BMX-BBQ/Bag of Mixed Nuts - BBQ	Good WIP Production	Normal	WIP Materials	205.00	Pieces
Reject	3/1/2019 5:00:00 AM	30190301.002	BMX-BBQ/Bag of Mixed Nuts - BBQ	Contaminated Scraps	Scrap	Production Scraps	210.00	Pieces
							5.00	Pieces
3/1/2019 Shift: Afternoon		Good Quantity: 932.5 Kilograms				Reject Quantity: 42.5 Kilograms		
3/1/2019 Shift: Night		Good Quantity: 895 Kilograms				Reject Quantity: 50 Kilograms		
3/2/2019 Shift: No Shift		Good Quantity: 2325 Kilograms				Reject Quantity: 75 Kilograms		
3/4/2019 Shift: Afternoon		Good Quantity: 837.5 Kilograms				Reject Quantity: 12.5 Kilograms		
Entity: Coater		Good Quantity: 4831.5 Kilograms				Reject Quantity: 202.5 Kilograms		
Entity: Bagger		Good Quantity: 9138 Pieces				Reject Quantity: 525 Pieces		
3/1/2019 Shift: Day		Good Quantity: 268 Pieces				Reject Quantity: 8 Pieces		
Quality	Production Time	Work Order	Item	Reason	Grade	State	Quantity	Unit
Good	3/1/2019 5:00:00 AM	20190301.001	BMX-BBQ/Bag of Mixed Nuts - BBQ	Good WIP Production	Normal	WIP Materials	195.00	Pieces
	3/1/2019 5:00:00 AM	30190301.002					73.00	
3/1/2019 Shift: Afternoon		Good Quantity: 1745 Pieces				Reject Quantity: 58 Pieces		
3/1/2019 Shift: Night		Good Quantity: 1300 Pieces				Reject Quantity: 200 Pieces		
3/2/2019 Shift: No Shift		Good Quantity: 4275 Pieces				Reject Quantity: 200 Pieces		
3/4/2019 Shift: Afternoon		Good Quantity: 1550 Pieces				Reject Quantity: 75 Pieces		

## Line Production Report

The Line Production report shows production data for lines that started within the given period for selected items and work orders. Production data includes good and reject counts; UOM; and item production reasons, grades, and states.

The report has three layout options, allowing data to be organized by entity, work order, or time period. When organized by entity or time period, data can be displayed in tabular or chart format. When organized by work order, data is always displayed in tabular format.

With millions of production records in the database, this report should return data within 20 seconds for one month of data across multiple lines.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
Time Period	No	No	Single	The time period for

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
				the report data. See <a href="#">Time Range</a> .
Shift	Day	No	Multiple	The shift for the report data.
Start Date	Current Day	Time Period	Single (from Date picker)	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Current Day	Time Period	Single (from Date picker)	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p>
Line Name	All	No	Multiple	The lines to include in the report.
Items	All	No	Multiple	The items to include in the report.
Work Order	All	No	Multiple	The work orders to include in the report.
Layout	Period	No	Single	The type of layout to use for the report:

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
			<ul style="list-style-type: none"> <li>Entity</li> <li>Period</li> <li>Work Order</li> </ul>	
Report Type	Tabular	Layout	Single	<p>The report content type. The options are based on the Layout parameter that is selected :</p> <ul style="list-style-type: none"> <li>Entity - Tabular, Chart, Both</li> <li>Period - Tabular, Chart, Both</li> <li>Work Order - Tabular</li> </ul>
Show Details By	Entity	No	Single	<p>The level at which the report is expanded on initial display.</p> <p>Entity or Work Order layout:</p> <ul style="list-style-type: none"> <li>Line</li> <li>Entity</li> <li>Shift</li> <li>Event</li> </ul> <p>Period layout:</p> <ul style="list-style-type: none"> <li>Line</li> <li>Entity</li> <li>Event</li> </ul> <p>This parameter applies to tabular data but not to chart data.</p>

## Report Data

The Line header row includes the following line data:

**Good Quantity**

Good production count.

**Reject Quantity**

Reject production count.

The report includes only the entities that are designated as the source of production counts for the lines.

When there is no data, the report will be blank with a *No Data Available* message displayed.

## Line Production Report

From: 3/1/2019 To 3/31/2019



## Report Variations

### Entity Layout

An example of the Entity layout, with tabular and chart data, is shown below.

- The tabular Event Details section includes the following columns:

**Item**

The produced item.

**Good**

Good production counts. Production count values are converted to the UOM of the line's standard item if one is defined.

**Reject**

Good production counts. Production count values are converted to the UOM of the line's standard item if one is defined.

**UOM**

Unit of measure.

**Reason**

Item production reason.

**Grade**

Produced item's grade.

**State**

Produced item's state.

- The Production By Type By Item chart is grouped by Lines, categorized on Good and Reject counts by percentage, and shown by Item and Production Day.
- The Production By Type/Date chart is a trend chart that is grouped by Lines and categorized on Good and Reject counts.
- The Total Production By Date chart is grouped by Lines and categorized on categorized on Good and Reject counts, with data for each Production Day in the selected time period.
- To see a stacked bar's value, hover the pointer over the bar.

## Line Production Report

From: 3/1/2019 To 3/31/2019

Line: Mixed Nuts Bags		Good Quantity: 9138 Pieces		Reject Quantity: 525 Pieces					
Entity: Bagger		Good Quantity: 9138 Pieces		Reject Quantity: 525 Pieces					
<input type="checkbox"/> 3/1/2019 Shift: Day									
<input type="checkbox"/> 3/1/2019 Shift: Afternoon									
<input type="checkbox"/> 3/1/2019 Shift: Night									
Item	Good	Reject	UOM	Reason	Grade				
BMX-BBQ/Bag of Mixed Nuts - BBQ	1300.00		Pieces	Good VMP Production	Normal				
		200.00	Pieces	Contaminated Production	Scrap				
<input type="checkbox"/> 3/2/2019 Shift: No Shift									
<input type="checkbox"/> 3/4/2019 Shift: Afternoon									
<b>Mixed Nuts Bags - Production By Type By Item</b>									
<p>BMX-BBQ/Bag of Mixed Nuts - BBQ 3/1/2019      BMX-BBQ/Bag of Mixed Nuts - BBQ 3/4/2019</p> <p>■ Good ■ Reject</p>									
<b>Mixed Nuts Bags - Production By Type / Date</b>									
<p>■ Good ■ Reject</p>									
<b>Mixed Nuts Bags - Total Production By Date</b>									
<p>■ Good ■ Reject</p>									

## Period Layout

An example of the Period layout, with tabular and chart data, is shown below.

- The tabular Event Details section includes the following columns:

**Production Day****Shift Name****Item**

The produced item.

**Good**

Good production counts. Production count values are converted to the UOM of the line's standard item if one is defined.

**UOM**

Unit of measure.

**Reject**

Reject production counts. Production count values are converted to the UOM of the line's standard item if one is defined.

**UOM**

Unit of measure.

- The Production By Item chart shows the total Good and Reject counts for the selected shifts of each day in the specified time period.
- To see a stacked bar's value, hover the pointer over the bar.

## Line Production Report by Period

From: 3/1/2019 To 3/31/2019



## Work Order Layout

An example of the Work Order layout, with tabular data, is shown below.

The Event Details section includes the following columns for the Work Order layout:

#### Item

The produced item.

#### Good

Good production counts. Production count values are converted to the UOM of the line's standard item if one is defined.

#### Reject

Good production counts. Production count values are converted to the UOM of the line's standard item if one is defined.

#### UOM

Unit of measure.

#### Reason

Item production reason.

#### Grade

Produced item's grade.

#### State

Produced item's state.

## Line Production Report by Work Order

From: 3/1/2019 To 3/31/2019

Work Order: 20190301.001		Item: BMX-BBQ/Bag of Mixed Nuts - BBQ					
Line: Mixed Nuts Bags				Good Quantity: 195 Pieces		Reject Quantity: 0 Pieces	
Entity: Bagger				Good Quantity: 195 Pieces		Reject Quantity: 0 Pieces	
3/1/2019 Shift: Day				Item	Good	Reject	UOM
BMX-BBQ/Bag of Mixed Nuts - BBQ				BMX-BBQ/Bag of Mixed Nuts - BBQ	195.00	Pieces	Reason
Reason: Good WP Production				Reason: Good WP Production	Normal	Grade	State
State: VIP Materials				State: VIP Materials			
Work Order: 20190301.003		Item: BMX-BBQ/Bag of Mixed Nuts - BBQ					
Line: Mixed Nuts Bags				Good Quantity: 190 Pieces		Reject Quantity: 5 Pieces	
Entity: Bagger				Good Quantity: 190 Pieces		Reject Quantity: 5 Pieces	
3/1/2019 Shift: Afternoon				Item	Good	Reject	UOM
BMX-BBQ/Bag of Mixed Nuts - BBQ				BMX-BBQ/Bag of Mixed Nuts - BBQ	190.00	Pieces	Reason
Reason: Good WP Production				Reason: Good WP Production	Normal	Grade	State
State: VIP Materials				State: VIP Materials			
BMX-BBQ/Bag of Mixed Nuts - BBQ				BMX-BBQ/Bag of Mixed Nuts - BBQ	5.00	Pieces	Reason
Reason: Standard Scraps				Reason: Standard Scraps	Scraps	Grade	State
State: Production Scraps				State: Production Scraps			
Work Order: 20190301.004		Item: BMX-BBQ/Bag of Mixed Nuts - BBQ					
Line: Mixed Nuts Bags				Good Quantity: 380 Pieces		Reject Quantity: 20 Pieces	
Work Order: 20190301.006		Item: BMX-BBQ/Bag of Mixed Nuts - BBQ					
Line: Mixed Nuts Bags				Good Quantity: 1175 Pieces		Reject Quantity: 25 Pieces	

## Genealogy by Work Order Report

The Genealogy by Work Order report shows, by work order, which input or raw material items were consumed directly and indirectly to create production items.

To enable genealogy, you must ensure that produced items of the same production level share a common

operation ID, work order ID, sequence number, and lot number.

The following criterion is being used to establish the correct linkage:

```
item_prod.wo_id = item_cons.wo_id AND
item_prod.oper_id = item_cons.oper_id AND
item_prod.seq_no = item_cons.seq_no AND
item_prod.lot_no = item_cons.fg_lot_no
```

The Genealogy by Work Order report displays for any specified produced item of a specified grade and status all consumed items that went into its production.

Genealogy does not take into account sublots.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Start Date	Today	No	Single	<p>The start date for the report data.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Today	No	Single	The end date for the report data.
Work Order	All work orders	No		Work orders whose ID includes the entered string will be included in the report. If blank, all work orders will be included.
Items	All Items	No	Multiple	The items to include in the report.
Entity	All Entities	No	Multiple	The entities to include in the report.
Show Expanded	Collapsed	No	Single	Specifies whether the work order

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				entries in the report will initially be shown collapsed or expanded.

## Report Data

The report data consists of multiple expandable levels:

- The first level is the work order and includes information about the operation and entity that ran the work order.
- The second level is the item that was produced and includes information on when the job ran.
- The final level is the produced lot level and includes information on the production reason for the produced transaction, the item grade and state, the entity to which the produced lot went, and the production quantity. Under this final level is a table of all the consumable items with information on the consumed lot number, the entity from which it was consumed, and the quantity.

### Genealogy by Work Order

From: 5/1/2018 To 5/10/2018

<input type="checkbox"/> Work Order ID: WO-BMX-BBQ-0509.02			
Operation ID: 100-RST			Entity Name: Roaster
<input type="checkbox"/> Produced Item: RMX-BLK/Roasted Mixed Nuts			Job Start Time: 5/9/2018 3:28:19 PM
			Job End Time: 5/9/2018 3:29:43 PM
<input type="checkbox"/> Reason: Good WIP Production			
Produced Lot: RMX-BMX-BBQ-0509.02			Grade: Normal
Target Entity Name: Roaster			State: WIP Materials
Produced Quantity: 95 Kilograms			
Consumed Item	Consumed Lot	Consumed Entity Name	Consumed Quantity
PNT-BLK/Peanuts Bulk	PNT-BMX-BBQ-0509.02	Silo01	45 Kilograms
CSW-BLK/Cashews Bulk	CSW-BMX-BBQ-0509.02	Silo02	25 Kilograms
AMD-BLK/Almonds Bulk	AMD-BMX-BBQ-0509.02	Silo03	25 Kilograms
Operation ID: 200-COA			
<input type="checkbox"/> Produced Item: FMX-BBQ/Flavored Mixed Nuts - BBQ			Entity Name: Coater
			Job Start Time: 5/9/2018 3:29:56 PM
			Job End Time: 5/9/2018 3:33:58 PM
Operation ID: 300-BAG			
<input type="checkbox"/> Produced Item: BMX-BBQ/Bag of Mixed Nuts - BBQ			Entity Name: Bagger
			Job Start Time: 5/9/2018 3:34:10 PM
			Job End Time: 5/9/2018 3:35:38 PM
<input type="checkbox"/> Work Order ID: WO-BMX-BBQ-0509.03			
Operation ID: 100-RST			Entity Name: Roaster
<input type="checkbox"/> Produced Item: RMX-BLK/Roasted Mixed Nuts			Job Start Time: 5/9/2018 3:45:55 PM
			Job End Time: 5/9/2018 3:49:36 PM
Operation ID: 200-COA			Entity Name: Coater

## Genealogy by Lot Report

The Genealogy by Lot report shows, by lot, which work orders and produced lots consumed specific raw materials.

To enable genealogy, you must ensure that produced items of the same production level share a common operation ID, work order ID, sequence number, and lot number.

The following criterion is being used to establish the correct linkage:

```
item_prod.wo_id = item_cons.wo_id AND
item_prod.oper_id = item_cons.oper_id AND
item_prod.seq_no = item_cons.seq_no AND
item_prod.lot_no = item_cons.fg_lot_no
```

The Genealogy by Lot report displays for any specified raw material lot number all work orders that used it. This report is essentially the reverse of the Genealogy by Work Order report.

Genealogy does not take into account sublots.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Start Date	Today	No	Single	The start date for the report data. You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b> , the time is converted to 12-hour format.
End Date	Today	No	Single	The end date for the report data.
Raw Material Lot No	All lots	No		Lots whose number includes the entered string will be included in the report. If blank, all lots will be included.
Items	All Items	No	Multiple	The items to include in the report.

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Entity	All Entities	No	Multiple	The entities to include in the report.
Work Order	All Work Orders	No		Work orders whose ID includes the entered string will be included in the report. If blank, all work orders will be included.
Show Expanded	Collapsed	No	Single	Specifies whether the lot entries in the report will initially be shown collapsed or expanded.

## Report Data

The report data consists of multiple levels:

- The first level is the consumed lot and includes information about the item that was consumed. It is possible that there is no lot number associated with the transaction.
- The second level is the entity from which the lot was consumed.
- The final level is the produced lot level and includes a table with the job data (work order, operation, sequence number, start time, and end time), the entity to which the lot was produced, and the quantity.

## Genealogy by Lot

From: 5/1/2018 To 5/10/2018

<input type="checkbox"/> Consumed Lot: AMD-BMX-BBQ-0509.02														
Consumed Item: AMD-BLK/Almonds Bulk														
<input type="checkbox"/> Consumed Entity: Silo03														
<input type="checkbox"/> Produced Lot: RMX-BMX-BBQ-0509.02														
<table border="1"> <thead> <tr><th>Work Order ID</th><th>Operation ID</th><th>Seq No</th><th>Job Start Time</th><th>Job End Time</th><th>Target Entity Name</th><th>Total Quantity</th></tr> </thead> <tbody> <tr><td>WO-BMX-BBQ-0509.02</td><td>100-RST</td><td>0</td><td>5/9/2018 3:28:19 PM</td><td>5/9/2018 3:29:43 PM</td><td>Roaster</td><td>95 Kilograms</td></tr> </tbody> </table>	Work Order ID	Operation ID	Seq No	Job Start Time	Job End Time	Target Entity Name	Total Quantity	WO-BMX-BBQ-0509.02	100-RST	0	5/9/2018 3:28:19 PM	5/9/2018 3:29:43 PM	Roaster	95 Kilograms
Work Order ID	Operation ID	Seq No	Job Start Time	Job End Time	Target Entity Name	Total Quantity								
WO-BMX-BBQ-0509.02	100-RST	0	5/9/2018 3:28:19 PM	5/9/2018 3:29:43 PM	Roaster	95 Kilograms								
<input type="checkbox"/> Consumed Lot: AMD-BMX-BBQ-0509.03														
Consumed Item: AMD-BLK/Almonds Bulk														
<input type="checkbox"/> Consumed Entity: Silo03														
<input type="checkbox"/> Produced Lot: RMX-BMX-BBQ-0509.03														
<table border="1"> <thead> <tr><th>Work Order ID</th><th>Operation ID</th><th>Seq No</th><th>Job Start Time</th><th>Job End Time</th><th>Target Entity Name</th><th>Total Quantity</th></tr> </thead> <tbody> <tr><td>WO-BMX-BBQ-0509.03</td><td>100-RST</td><td>0</td><td>5/9/2018 3:45:55 PM</td><td>5/9/2018 3:49:36 PM</td><td>Roaster</td><td>190 Kilograms</td></tr> </tbody> </table>	Work Order ID	Operation ID	Seq No	Job Start Time	Job End Time	Target Entity Name	Total Quantity	WO-BMX-BBQ-0509.03	100-RST	0	5/9/2018 3:45:55 PM	5/9/2018 3:49:36 PM	Roaster	190 Kilograms
Work Order ID	Operation ID	Seq No	Job Start Time	Job End Time	Target Entity Name	Total Quantity								
WO-BMX-BBQ-0509.03	100-RST	0	5/9/2018 3:45:55 PM	5/9/2018 3:49:36 PM	Roaster	190 Kilograms								
<input type="checkbox"/> Consumed Lot: BAG-BMX-BBQ-0509.02														
Consumed Item: BAG-BBQ/BBQ Mixed Nuts Bag - Empty														
<input type="checkbox"/> Consumed Entity: Receiving														
<input type="checkbox"/> Produced Lot: BMX-BMX-BBQ-0509.02														
<table border="1"> <thead> <tr><th>Work Order ID</th><th>Operation ID</th><th>Seq No</th><th>Job Start Time</th><th>Job End Time</th><th>Target Entity Name</th><th>Total Quantity</th></tr> </thead> <tbody> <tr><td>WO-BMX-BBQ-0509.02</td><td>300-BAG</td><td>0</td><td>5/9/2018 3:34:10 PM</td><td>5/9/2018 3:35:38 PM</td><td>ProductionStorage</td><td>400 Pieces</td></tr> </tbody> </table>	Work Order ID	Operation ID	Seq No	Job Start Time	Job End Time	Target Entity Name	Total Quantity	WO-BMX-BBQ-0509.02	300-BAG	0	5/9/2018 3:34:10 PM	5/9/2018 3:35:38 PM	ProductionStorage	400 Pieces
Work Order ID	Operation ID	Seq No	Job Start Time	Job End Time	Target Entity Name	Total Quantity								
WO-BMX-BBQ-0509.02	300-BAG	0	5/9/2018 3:34:10 PM	5/9/2018 3:35:38 PM	ProductionStorage	400 Pieces								
<input type="checkbox"/> Consumed Lot: BAG-BMX-BBQ-0509.03														

## Utilization Timeline Report

The Utilization Timeline report shows the timeline of utilization events by entity. Data can be filtered by shifts and entities.

The events are displayed in a horizontal stacked bar format. A color key indicates the utilization states for each event.

With millions of utilization records in the database, the time for this report to render is heavily dependent on the timeframe of the report and the number of entities requested. Typical response time is a couple of seconds for each entity for each day.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Date	Today	No	Single	The date for the report data.
Shift	All	No	Single	The shift for the report data.
Entities	-	No	Multiple	The entities to include in the

report.

## Report Data

This report includes a stacked bar for selected entities of utilization events.

The color key indicates the utilization states for each event.

The time shown on the x-axis is the time since the start of the shift, which is shown below the entity name.

### Utilization Timeline

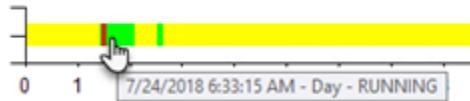
On 7/24/2018 - All



### To show event details

- Hover the pointer over the event.

Bagger  
7/24/2018 5:00:00 AM



## Utilization by Entity Report

The Utilization by Entity report shows utilization data for entities. Data can be filtered by:

- Time period
- Shifts
- Lines

- Entities
- Items
- Event types
- Utilization states, reason groups, and reasons
- Category

Utilization data is displayed in tabular format and includes total counts and durations for events, and details about each event by line, entity, and shift.

The Utilization by Entity report uses the calendar day instead of the production day, since this report totals the event durations that occur in the time period. The current BI Gateway model does not include the hours and minutes for when a production day starts for each entity, so it uses the event time and midnight for the start and end of a day, respectively.

With millions of utilization records in the database, this report takes approximately 20 seconds for one entity for one day. Additional entities and longer time periods increase the response time with the number of entities having a greater impact than the number of days. Ten entities for one week displayed in approximately 30 seconds in a testing environment while one month displayed in 40 seconds.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Time Period	No	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Shift	All	No	Multiple	The shift for the report data.
Start Date	Current Day	Time Period	Single	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to</p>

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description	
		12-hour format.			
End Date	Current Day	Time Period	Single	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p>	
Line Name	All, including None	No	Multiple	The lines to include in the report.	
Entities	All	Line Name	Multiple	<p>The entities to include in the report.</p> <p>The list of entities is filtered by the Line Name parameter.</p> <p>When None is selected as the Line Name parameter, all the entities are available in the Entities parameter; otherwise, the entities are filtered based on the line selection.</p>	
Items	All	No	Multiple	The items to include in the report.	
Event Type	Down Time	No	Multiple	The event types to include in the report.	
Utilization State	All related to Event Type selection	Event Type	Multiple	The utilization states to include in the report.	
Utilization Group	All related to Utilization State selection	Utilization State	Multiple	<p>The utilization groups to include in the report.</p> <p>The list of utilization</p>	

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				groups is filtered by the selection of the Utilization State parameter.
Utilization Reason	All related to Utilization State and Group selection	Utilization State and Utilization Group	Multiple	<p>The utilization reasons to include in the report.</p> <p>The list of utilization reasons is filtered by the selection of the Utilization State and Utilization Group parameters.</p>
Category	All	No	Multiple	<p>This parameter contains the list of Categories available in the database and the None option.</p> <p>The report data will be filtered on the selected categories.</p> <p>If None is selected, the report data will include records for which all four categories are null.</p>
Show Details By	Entity	No	Single	<p>The level at which the report is expanded on initial display:</p> <ul style="list-style-type: none"> <li>• Line</li> <li>• Entity</li> <li>• Shift</li> <li>• Event</li> </ul>

## Report Data

### Events Included in the Report

- Events that started prior to the filter start time and ended after the filter start time.
- Events that start before the filter end time and end after the filter end time.

However, the duration is calculated only for the time within the filter period. For example, an event that started at 10:00 pm the previous day and lasted until 3:00 am of the report day will be included in the report for that day, but the duration will be shown as 3 hours instead of the entire 5 hours of the event.

When showing multiple time periods in the grid (for example running a report for the last day and showing three shifts), events that cross one or more time boundaries are included in all groupings. This is important to note when looking at time period totals for duration and count at higher level groupings:

- At the parent level, the total count and duration reflect the events that existed during that time period.
- The total event duration for the time period will not exceed the total time span of the period.
- The total counts when added across multiple time periods (i.e., time periods above the lowest expanded level) will include extra event counts as the boundary events will be counted twice since they existed in both time periods.

For example, requesting the events for a day with three shifts and grouping by shifts will have a total count of 3 when a single event covers the entire day. This is an artifact of the simple addition of the lower groupings, which will show the single event occurring in each shift. The total duration for all levels accurately reflects the event duration within the time period

When looking at a current time period such as current shift or current day, the most recent event's duration will only be accurate up to the last time the BI Gateway service updated the dimension, which by default is hourly.

### Data Included in the Report

- The Total Count shows the number of events at their respective levels. Summary rows total the counts from all lower groupings, which will double count events occurring in multiple time periods.
- The Total Duration shows the Sum of Event Duration in (hh:mm:ss) at their respective levels.
- The Event Details section includes the following columns. If Duration is deviated from Standard Time, then it will be highlighted in bold and red. Data is not shown if it is the same as the previous row.
  - Event Time.
  - Duration(hh:mm:ss).
  - Utilization Reason.
  - Utilization Group.
  - Utilization State.
  - Failure: An indicator that the utilization reason for this event is flagged as an equipment failure reason.
  - Min/Std/Max(Minutes): Utilization reason settings.
  - Category: The four optional category fields defined for the utilization reason.
  - Item: The item associated with the work order running at the time of the event.

- Work Order: The work order running at the time of the event.
- Each line with entities is shown on its own page.
- If there are entities not assigned to lines, they are shown on their own page with the line name entry **Line: None**.

## Utilization By Entity

From: 3/1/2019 To 3/31/2019

Lines: Mixed Nuts/Bags									
Line: Mixed Nuts/Bags		Total Count: 308			Total Duration(h:mm:ss): 670:00:00				
<input type="checkbox"/> Entity: Roaster		Total Count: 104			Total Duration(h:mm:ss): 226:00:00				
<input type="checkbox"/> 9/5/2018 3:48:43 PM Shift: No Shift		Total Count: 46			Total Duration(h:mm:ss): 101:20:00				
<input type="checkbox"/> 2/28/2019 9:00:00 PM Shift: Night		Total Count: 1			Total Duration(h:mm:ss): 05:00:00				
<input type="checkbox"/> 3/1/2019 5:00:00 AM Shift: Day		Total Count: 5			Total Duration(h:mm:ss): 09:00:00				
Event Time	Duration(h:mm:ss)	Utilization Reason	Utilization Group	Utilization State	Failure	Min/Std/Max(Minutes)	Category	Item	WorkOrder
7/4/2018 7:28:22 AM	01:18:55	Idle	Standard Reasons	IDLE		---		--	
3/1/2019 5:16:55 AM	00:11:19	Running		Running Normal		---		BMX-BBQ/Bag of Mixed Nuts - BBQ	20190301_001
3/1/2019 5:28:14 AM	00:01:15	Idle		IDLE		---		--	
3/1/2019 5:29:29 AM	00:11:16	Running		Running Normal		---		BMX-BBQ/Bag of Mixed Nuts - BBQ	20190301_002
3/1/2019 5:40:45 AM	07:19:15	Idle		IDLE		---		--	
<input type="checkbox"/> 3/1/2019 1:00:00 PM Shift: Afternoon		Total Count: 14			Total Duration(h:mm:ss): 08:00:00				
Event Time	Duration(h:mm:ss)	Utilization Reason	Utilization Group	Utilization State	Failure	Min/Std/Max(Minutes)	Category	Item	WorkOrder
3/1/2019 5:40:45 AM	01:58:51	Idle	Standard Reasons	IDLE		---		--	
3/1/2019 2:58:51 PM	00:31:03	Maintenance		Downtime Unplanned		---		--	
3/1/2019 3:29:54 PM	00:10:31	Running		Running Normal		---		BMX-BBQ/Bag of Mixed Nuts - BBQ	20190301_003
3/1/2019 3:40:25 PM	00:06:55	Idle		IDLE		---		--	
3/1/2019 3:47:20 PM	00:11:07	Planned Stoppage		Idle		---		BMX-BBQ/Bag of Mixed Nuts - BBQ	20190301_004
3/1/2019 3:58:27 PM	00:00:55	Running		Running Normal		---		BMX-BBQ/Bag of Mixed Nuts - BBQ	20190301_005
3/1/2019 3:59:22 PM	00:16:02	Running Impaired	Low Prod Mode Reasons	Running Slow		---		--	
3/1/2019 4:15:24 PM	00:17:37	Idle	Standard Reasons	IDLE		---		--	
3/1/2019 4:33:01 PM	00:18:31	Machine Setup	Low Prod Mode Reasons	Downtime Planned		---		--	
3/1/2019 4:51:32 PM	01:36:06	Running		Running Normal		---		BMX-BBQ/Bag of Mixed Nuts - BBQ	20190301_06
3/1/2019 6:27:38 PM	00:21:20	Emergency Stop		Downtime Unplanned	✓	---		--	
3/1/2019 6:48:58 PM	01:36:16	Running Impaired		Running Slow		---		--	
3/1/2019 8:25:14 PM	00:00:25	Idle		Idle		---		--	
3/1/2019 8:25:39 PM	00:34:21	Maintenance		Downtime Unplanned		---		--	
<input type="checkbox"/> 3/1/2019 9:00:00 PM Shift: Night		Total Count: 9			Total Duration(h:mm:ss): 08:00:00				

## Utilization Analysis Report

The Utilization Analysis report shows utilization data for each entity by utilization event types (Runtime, Downtime, and Idletime). The report also shows Pareto charts of duration for all the filtered data by utilization state, utilization reason groups, and utilization reasons. These also include the charts for event counts. Data can be filtered by various parameters.

The Utilization Analysis report uses the calendar day instead of the production day, since this report totals the event durations that occur in the time period. The current BI Gateway model does not include the hours and minutes for when a production day starts for each entity, so it uses the event time and midnight for the start and end of a day, respectively.

With millions of utilization records in the database, this report takes approximately 25 seconds for one entity for one day. Additional entities and longer time periods slightly increase the response time with the number of entities having a greater impact than the number of days. Ten entities for one month displayed in approximately 30 seconds in the testing environment.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
Time Period	No	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Shift	All	No	Multiple	The shift for the report data.
Start Date	Current Day	Time Period	Single (from Date picker)	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Current Day	Time Period	Single (from Date picker)	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p>
Entities	None	No	Multiple	The entities to include in the report.
Items	All	No	Multiple	The items to include in the report.
Event Type	Down Time	No	Multiple	The event types to

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
				include in the report.
Utilization States	All related to Event Type selections	Event Type	Multiple	<p>The utilization states to include in the Utilization States by Duration &amp; Counts chart.</p> <p>The list of utilization states is filtered by the selection of the Event Type parameter.</p>
Utilization Groups	All related to Utilization States selections	Utilization States	Multiple	<p>The utilization reason groups to include in the Utilization Reason Groups by Duration chart.</p> <p>The list of utilization reason groups is filtered by the selection of the Utilization States parameter.</p>
Utilization Reasons	All related to Utilization Group selections	Utilization Group	Multiple	<p>The utilization reasons to include in the Utilization Reasons by Duration &amp; Counts chart.</p> <p>The list of utilization reasons is filtered by the selection of the Utilization Group parameter.</p>
Analysis By	All	No	Single	The number of utilization states, utilization reason groups, and utilization reasons to include in each of their charts:

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
			<ul style="list-style-type: none"><li>• All</li><li>• Top 5</li><li>• Top 10</li></ul>	If Top 5 or Top 10 is chosen, the Utilization States and Utilization Reasons charts include the top 5 or top 10 states and reasons, respectively. The Utilization Reason Groups chart includes the reason groups of which the top 5 or top 10 reasons are members. Therefore, it might not include 5 or 10 bars.

## Report Data

This report shows:

- A Duration by Entity chart of Runtime, Downtime, and Idle Time for each entity.
- A Pareto of durations by utilization states, with a line indicating counts.
- A Pareto of durations by utilization reason groups, using a stacked bar for each reason in the group. Hover over a bar to see its duration value. Bar colors are determined by the reason's utilization state color.
- A Pareto of durations by utilization reasons, with a line indicating counts. Bar colors are determined by the reason's utilization state color.

### Utilization Analysis

From: 3/2/2019 To 3/5/2019



## Utilization Waterfall Chart

The Utilization Waterfall Chart report shows successive chart entries of time spent in utilization states to indicate how the effective production time for an entity is derived.

The report starts with the total time in the selected time period and then subtracts out idle time to get the production time. From the production time, the report then subtracts out downtime losses, performance loss

(running state but not producing at target rate), and quality loss (converting bad counts to equivalent time lost) to derive effective production time.

Data can be filtered by:

- Time period, by start and end dates
- An entity

## Report Parameters

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
Start Date	None	No	Single (from Date picker)	The start date for the report data.  You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b> , the time is converted to 12-hour format.
End Date	None	No	Single (from Date picker)	The end date for the report data.
Entities	None	No	Single	The entity to include in the report.
Show By	Hours	No	Single	The data can be reported by: <ul style="list-style-type: none"> <li>• Hours</li> <li>• Percentages</li> </ul>

## Report Data

This report shows the effective production time for an entity over a specified time period and how it was derived by showing cumulative totals for utilization states over that time.

The cumulative times can be shown in hours or as a percentage of the time period. When shown as a percentage, the chart removes the bars for idle time and includes bars for the target OEE performance value and the gap (difference) between the target and actual.

## Utilization Waterfall Chart by Hours

From: 5/1/2021 To 5/31/2021



The bars in the chart by hours, from left to right, indicate the following:

- The number of hours in the time period (maximum time).
- Times for each of the Idle states, from most to least.
- Production time.
- Times for each of the production loss states, from most to least. This includes all components of OEE including downtime events, performance losses (running events as a single entry), and quality losses (bad counts as a single entry).
- The effective production time

## Utilization Waterfall Chart by Percentage

From: 5/1/2021 To 5/31/2021



The bars in the chart by percentage, from left to right, indicate the following:

- The total possible production time as 100% of the time period.
- The percentages for each of the production loss states, from most to least. This includes all components of OEE including downtime events, performance losses (running events as a single entry), and quality losses (bad counts as a single entry).
- The effective production percentage

- The gap between the target OEE KPI percentage and the effective production percentage. The gap percentage is only shown if the target performance percentage is greater than the effective production percentage.

## OEE Analysis Report

The OEE Analysis report displays the Overall Equipment Effectiveness grouped by entity over a specified period of time.

The report displays:

- The Efficiency Analysis Bar Chart displaying the four KPIs for every entity that matches the filter criteria.
  - % OEE
  - % Utilization
  - % Performance
  - % Quality
- The OEE Trend Line Chart displays the OEE% per time period for each entity that matches the filter criteria.
- The Utilization Loss Summary chart displays summaries of the utilization loss per time period for the entities that match the filter criteria.

With millions of utilization records in the database, this report takes approximately 5 seconds for one entity for one day. Additional entities and longer time periods increase the response time with both having a similar impact on response time. Ten entities for one week displayed in approximately 10 seconds in the testing environment while one month displayed in 20 seconds.

## Report Filters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Time period	-	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Shift	All shifts	No	Multiple	The shifts for which to include data.
Start Date	Today	Time Period	Single	The start date for the report data. This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range. You can enter the

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b> , the time is converted to 12-hour format.
End Date	Today	Time Period	Single	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p>
Entities	-	No	Multiple	The entities to include in the report.
Show Details By	Period	No	Single	<p>The level at which the report data is shown:</p> <ul style="list-style-type: none"> <li>• Period. If this option is selected, only the Utilization Loss Summary chart will be included in the report, regardless of what chart types are selected for the Show Chart(s) parameter (even if the Loss Summary chart is not selected).</li> <li>• Day.</li> </ul>

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
			<ul style="list-style-type: none"> <li>Shift.</li> <li>Hour.</li> </ul>	
Show Chart(s)	OEE	No	Multiple	<p>Which charts to include in the report:</p> <ul style="list-style-type: none"> <li>OEE</li> <li>Performance</li> <li>Availability</li> <li>Quality</li> <li>Loss Summary</li> </ul>

## Report Data

This report shows Overall Equipment Effectiveness (OEE) and its components (Availability, Performance, and Quality) by entity, and compares those metrics across similar equipment and over time. The report can also include a Utilization Loss Summary chart.

- Availability is based on the utilization events for the entity and is calculated by summing the runtime events and dividing by the sum of the runtime and downtime events. Events classified as Neither in the MES database are ignored.
- Performance is based on the actual production units on the entity compared to the estimated number of units. It is calculated by summing the good and reject production counts and dividing by the sum of the runtime events multiplied by the production rate and batch size.
- Quality is based on the good and reject production counts for the entity. It is calculated by summing the good counts and dividing by the sum of the good and bad counts.
- OEE is the product of Availability, Performance, and Quality. Note that this value is based on runtime and downtime duration and does not include times classified as Neither.
- The Utilization Loss Summary chart converts the OEE components into minutes of lost production at full capacity for each component. Note the following about the components in this chart:
  - The Availability component is the total downtime duration.
  - The Performance component is the number of minutes of lost capacity from running below the target rate. The Performance component can be negative if the entity is producing above the target rate.
  - The Quality component is the scrap counts converted to minutes of good production at the target rate.

Note the following about the report.

- The report will include rows based on the Show Details By parameter even if there is no data for the selected period. The default value for all the KPIs when no data exists is 0.

- When a shift transitions between an hour, the transition hour will have a record in both shifts. The calculation includes only data for the shift in this scenario and therefore represents less than an hour's data. On the chart, the x-axis time label for this scenario will show the hour twice, once for each shift.
- For all report variations except the Utilization Loss Summary Chart, each entity's data is shown on a separate page.
- When there is no data, the report will be blank with a *No Data Available* message displayed.

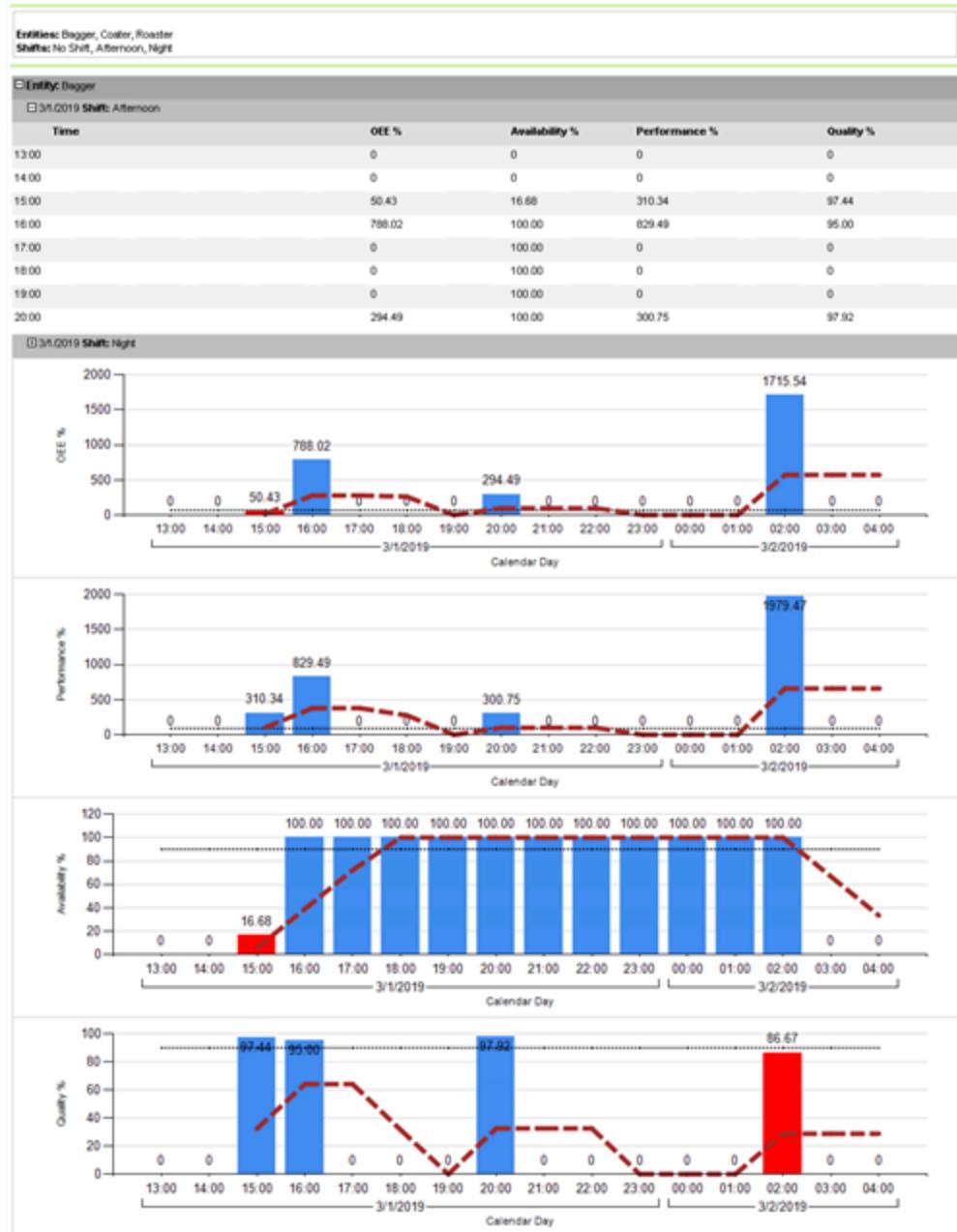
## Report Variations

### Show Details By Parameter Set to Hour

When the Show Details By parameter is set to Hour, the data is shown by the hour in 24-hour format.

**OEE Analysis**

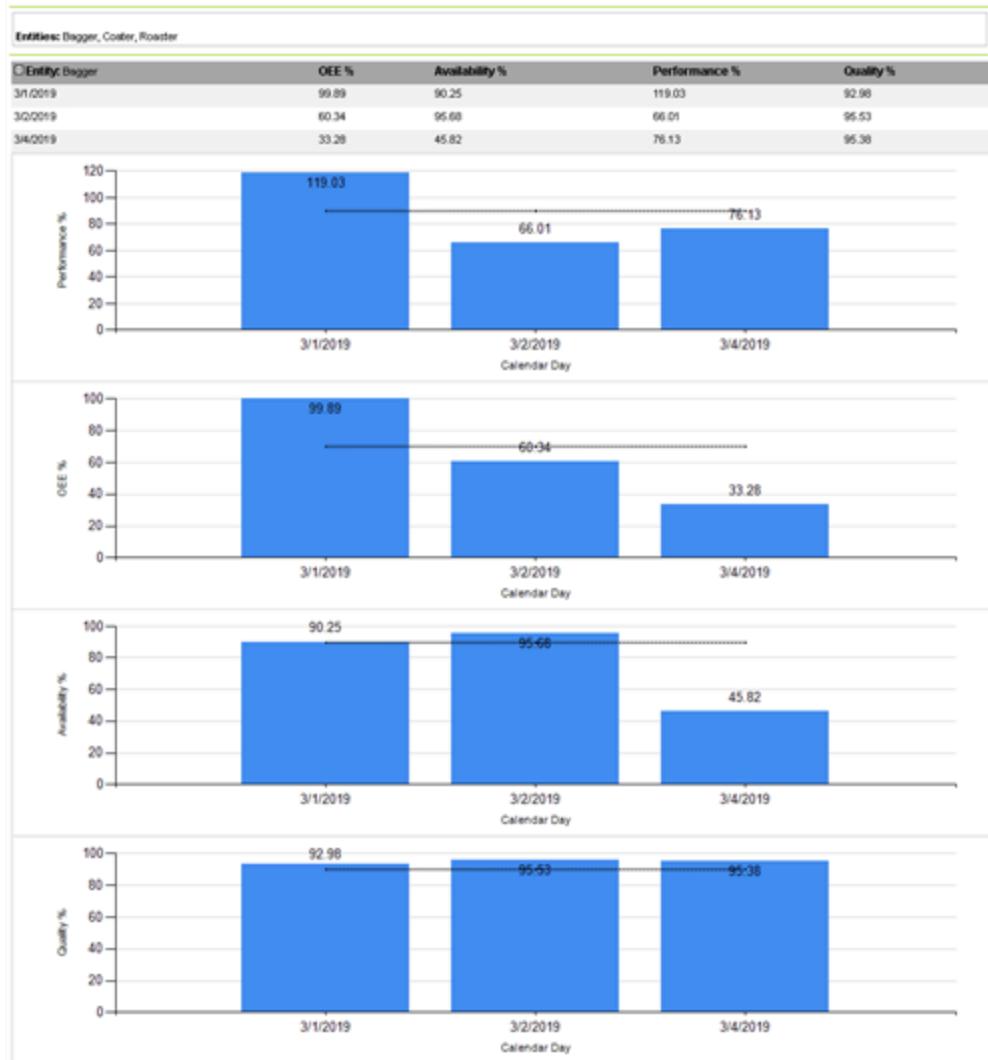
From: 3/1/2019 To 3/1/2019

**Show Details By Parameter Set to Day**

When the Show Details By parameter is set to Day, the data is shown by calendar day.

**OEE Analysis**

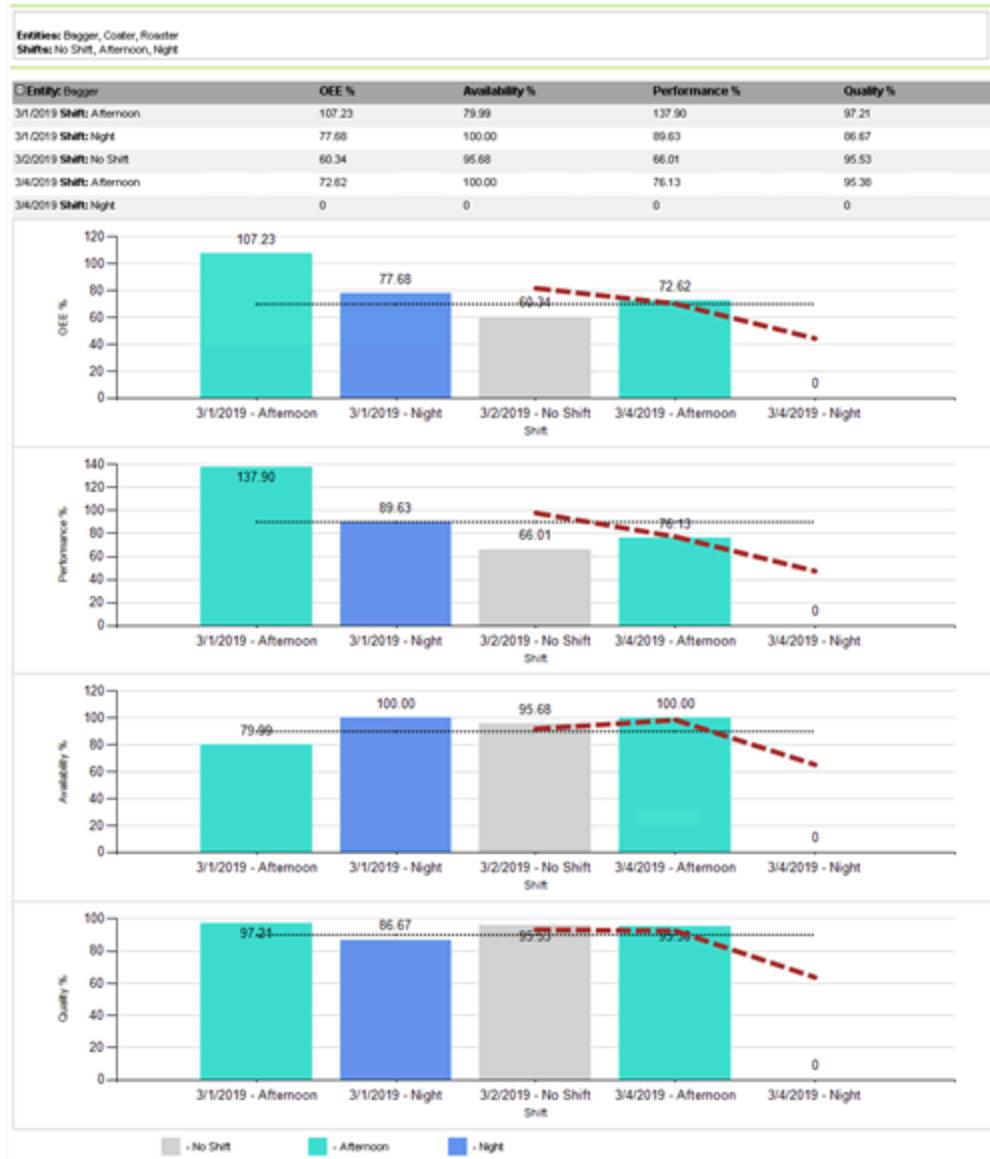
From: 3/1/2019 To 3/31/2019

**Show Details By Parameter Set to Shift**

When the Show Details By parameter is set to Shift, the data is shown as in the following report. This variation requires at least three data points to show report data.

**OEE Analysis**

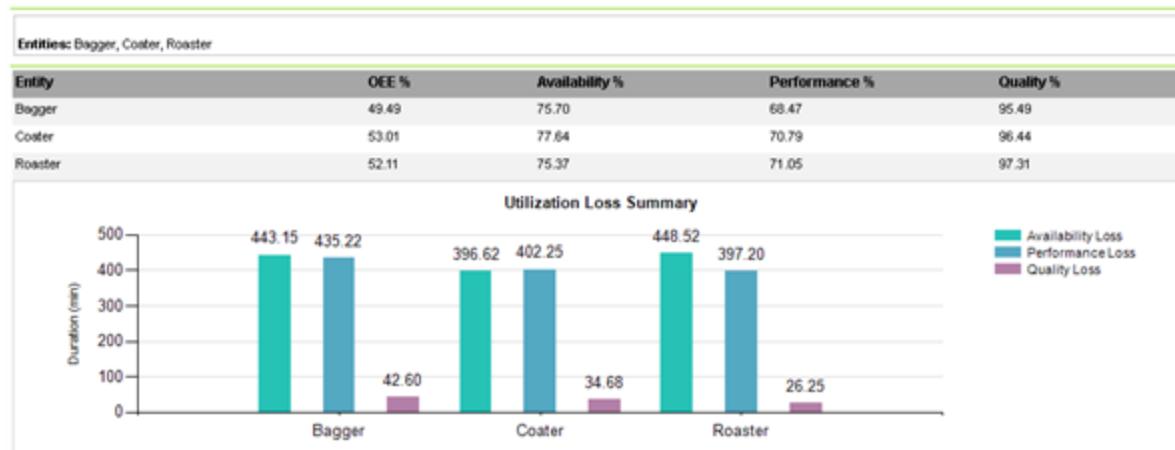
From: 3/1/2019 To 3/5/2019

**Utilization Loss Summary Chart**

If the Loss Summary chart is selected in the Show Chart(s) parameter list or the Show Details By parameter is set to Period, the Utilization Loss Summary chart is shown.

**OEE Analysis**

From: 3/2/2019 To 3/5/2019

**Mean Time Between Failures (MTBF) Report**

The MTBF report shows the mean time between events that are considered failure events. It includes only utilization events whose utilization reason has the Failure flag set.

The report finds all failure events in the requested time period and calculates the mean time between failure (MTBF) in hours. The calculation includes times during which the equipment was idle (in a utilization state classified as Neither).

**Report Parameters**

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
Time Period	No	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Entities	-	No	Multiple	The entities to include in the report.
Start Date	Current Day	Time Period	Single (from Date picker)	The start date for the report data. This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range. You can enter the

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
				time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b> , the time is converted to 12-hour format.
End Date	Current Day	Time Period	Single (from Date picker)	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p>
Utilization Group	All	No	Multiple	The utilization groups to include in the report.
Utilization Reason	All related to Utilization Group Selection	Utilization Group	Multiple	<p>The utilization reasons to include in the report.</p> <p>The list of utilization reasons is filtered by the selection of the Utilization Group parameter.</p>
Show Details By	Entity	No	Multiple	<p>The level at which the report is expanded on initial display:</p> <ul style="list-style-type: none"> <li>• Entity</li> <li>• Shift</li> <li>• Event</li> </ul>

## Report Data

This report includes only utilization events whose utilization reason is configured with the Failure flag set.

- The Total Count shows the number of failure events at their respective levels.
- The Average of Duration between all failures in hours is shown only at the entity level.
- Duration between each failure event in hours is shown.
- In Event Details, data is not shown if it is the same as the previous row.

The Event Details section includes the following columns:

**Event Time**

**Utilization Reason**

**Time of Next Failure**

The following failure event's start time.

**TBF(Hrs)**

The difference between the next failure event's start time and the reported event's start time.

**Utilization Group**

**Utilization State**

When there are no Failures for an entity, only the entity row is included in the report, with Total Count and MTBF values of 0.

## Mean Time Between Failures (MTBF)

For 1/15/2019

Entities: Bagger, Coater, Roaster Utilization Reasons: Emergency Stop					
<input type="checkbox"/> Entity: Roaster		Total Count: 3		MTBF (Hrs): 0.64	
<input type="checkbox"/> 1/15/2019 Shift: Afternoon		Total Count: 3			
Event Time	Utilization Reason	Time of Next Failure	TBF(Hrs)	Utilization Group	Utilization State
1/15/2019 4:47:11 PM	Emergency Stop	1/15/2019 5:10:44 PM	0.38	Standard Reasons	DOWNTIME
1/15/2019 5:10:44 PM		1/15/2019 6:43:16 PM	1.55		
1/15/2019 6:43:16 PM			>0		
<input type="checkbox"/> Entity: Coater		Total Count: 2		MTBF (Hrs): 0.18	
<input type="checkbox"/> 1/15/2019 Shift: Afternoon		Total Count: 2			
Event Time	Utilization Reason	Time of Next Failure	TBF(Hrs)	Utilization Group	Utilization State
1/15/2019 4:56:11 PM	Emergency Stop	1/15/2019 5:17:40 PM	0.35	Standard Reasons	DOWNTIME
1/15/2019 5:17:40 PM			>0		
<input type="checkbox"/> Entity: Bagger		Total Count: 2		MTBF (Hrs): 0.88	
<input type="checkbox"/> 1/15/2019 Shift: Afternoon		Total Count: 2			
Event Time	Utilization Reason	Time of Next Failure	TBF(Hrs)	Utilization Group	Utilization State
1/15/2019 5:06:18 PM	Emergency Stop	1/15/2019 6:52:30 PM	1.77	Standard Reasons	DOWNTIME
1/15/2019 6:52:30 PM			>0		

## Mean Time To Repair (MTTR) Report

The MTTR report shows the mean time between events that are considered failure events and the subsequent runtime event.

The report finds all failure events in the requested time period and the following runtime event. It calculates the mean time to repair (MTTR) in hours. The calculation includes times during which the equipment was idle (in a utilization state classified as Neither).

## Report Parameters

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
Time Period	No	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Entities	-	No	Multiple	The entities to include in the report.
Start Date	Current Day	Time Period	Single (from Date picker)	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Current Day	Time Period	Single (from Date picker)	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p>
Utilization Group	All utilization groups with the failure utilization reason	No	Multiple	The utilization groups to include in the report.
Utilization Reason	All failure utilization reasons related to the utilization group	Utilization Group	Multiple	The utilization reasons to include in the report.

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
	selection			The list of utilization reasons is filtered by the selection of the Utilization Group parameter.
Show Details By	Entity	No	Single	<p>The level at which the report is expanded on initial display:</p> <ul style="list-style-type: none"> <li>• Entity</li> <li>• Shift</li> <li>• Event</li> </ul>

## Report Data

This report includes only utilization events whose utilization reason is configured with the Failure flag set.

- The Total Count shows the number of failure events at their respective levels.
- The Average of Time to repair failures in hours is shown at the Entity level.
- The Time to Repair for each failure event in hours is shown.
- In Event Details, data is not shown if it is the same as the previous row.

The Event Details section includes the following columns:

### Event Time

### Utilization Reason

### Time of Next Running

The event start time of the first utilization event of type Running following the failure event.

### TTR (Hrs)

The difference between the next running event's start time and the reported event's start time.

### Utilization Group

### Utilization State

When there are no Failures for an entity, only the entity row is included in the report, with Total Count and MTTR values of 0.

## Mean Time To Repair (MTTR)

For 1/15/2019

Entities: Bagger, Coater, Roaster					
Entity: Roaster		Total Count: 3		MTTR (Hrs): 0.08	
1/15/2019 Shift: Afternoon		Total Count: 3		MTTR (Hrs): 0.08	
Event Time	Utilization Reason	Time of Next Running	TTR(Hrs)	Utilization Group	Utilization State
1/15/2019 4:47:11 PM	Emergency Stop	1/15/2019 4:51:46 PM	0.07	Standard Reasons	DOWNTIME
1/15/2019 5:10:44 PM		1/15/2019 5:13:23 PM	0.05		
1/15/2019 6:43:16 PM		1/15/2019 6:50:19 PM	0.12		
Entity: Coater		Total Count: 2		MTTR (Hrs): 0.72	
1/15/2019 Shift: Afternoon		Total Count: 2		MTTR (Hrs): 0.72	
Event Time	Utilization Reason	Time of Next Running	TTR(Hrs)	Utilization Group	Utilization State
1/15/2019 4:56:11 PM	Emergency Stop	1/15/2019 4:59:29 PM	0.05	Standard Reasons	DOWNTIME
1/15/2019 5:17:40 PM		1/15/2019 6:41:49 PM	1.4		
Entity: Bagger		Total Count: 2		MTTR (Hrs): 0.2	
1/15/2019 Shift: Afternoon		Total Count: 2		MTTR (Hrs): 0.2	
Event Time	Utilization Reason	Time of Next Running	TTR(Hrs)	Utilization Group	Utilization State
1/15/2019 5:06:18 PM	Emergency Stop	1/15/2019 5:09:35 PM	0.05	Standard Reasons	DOWNTIME
1/15/2019 6:52:30 PM		1/15/2019 7:13:04 PM	0.35		

## Performance Dashboard

The Performance Dashboard report shows performance summary data for an entity over a specified time period.

Data can be filtered by:

- Time period
- Entity

The report includes the following summary panels:

- OEE gauge and component KPI values
- Mean time between failures (MTBF)
- Mean time to repair (MTTR)
- Top five downtime reasons by duration and counts
- Utilization event summary
- Production summary
- Top five production reject reasons
- Utilization timeline

With millions of utilization records in the database, this report will take longer than other reports as it is executing multiple queries to populate all the summary content in a single report.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
Time Period	No	No	Single	The time period for the report data. See

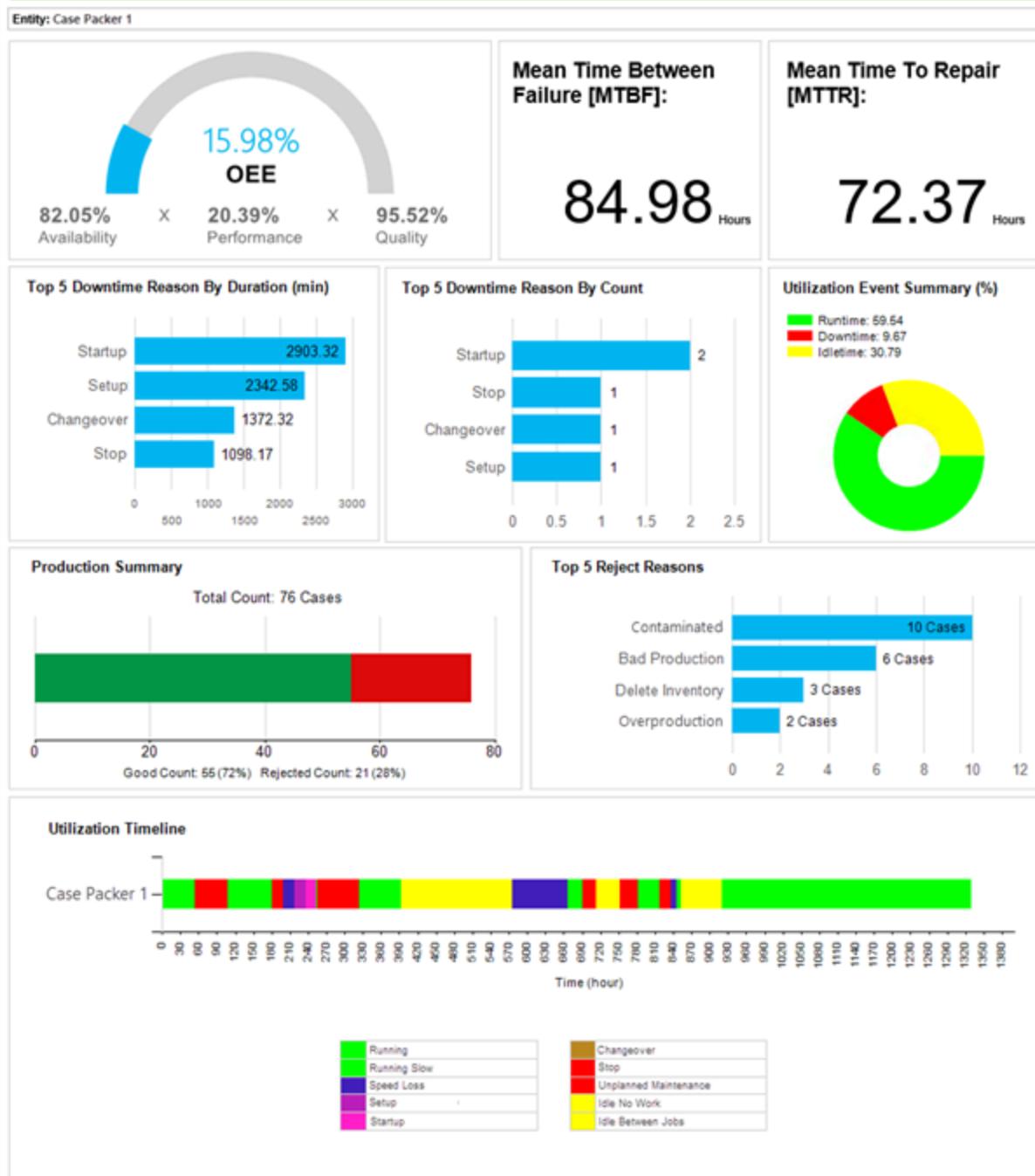
Parameter	Default Value	Dependency on Other Parameters	Allowed Selection	Description
				Time Range.
Start Date	Current Day	Time Period	Single (from Date picker)	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Current Day	Time Period	Single (from Date picker)	<p>The end date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p>
Entities	None	No	Single	The entity to include in the report.
Show By	Entity	No	Single	Currently this report applies only to entities.

## Report Data

This report includes several panels that provide at-a-glance summary information about an entity's OEE, MTBF/MTTR, production, and utilization over a selected period of time.

## Performance Dashboard by Entity

From: 5/1/2021 To 5/31/2021



## Quality Summary Report

The Quality Summary report provides information and statistics based on equipment, product (item), work order, operation, process, and item category. This report allows you to:

- Select from the multiple report bases.
- Specify various filters to apply to the data being reported.

- Select which sections of the report are displayed.

If you make a selection in one filter, it does not affect the choices in another filter because of the set of existing data.

With millions of sample result records in the database, this report takes approximately 90 seconds for one entity and 50 characteristics. Additional entities, additional characteristics, and longer time periods increase the response time with the number of entities having the greatest impact.

Each additional entity added to the report adds 20 to 30 seconds to the display time in the testing environment. The majority of the time is spent in rendering the charts and tables by SQL Server Reporting Services which AVEVA will continue to investigate.

## Report Filter Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Time Period	No	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Shift	All shifts	No	Multiple	The shifts whose data will be included in the report data.
Start Date	Current Day	Time Period	Manual entry or from Date picker	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Current Day	Time Period	Manual entry or from Date picker	<p>The end date for the report data.</p> <p>This parameter is not available when</p>

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				the Time Period parameter is any value other than Date/Time Range.
Entity	All entities	Line Name	Multiple	The entities to include in the report.
Item Category	All item categories	No	Multiple	The item categories to include in the report.
Items	All items	No	Multiple	The items to include in the report.
Severity	All severity levels	No	Multiple	The severity levels to include in the report: Unused, Not Monitored, Non-Key, Key, and Critical.
Work Order	All work orders	No		Work orders whose ID includes the entered string will be included in the report. If blank, all work orders will be included.
Operation	All operations	No		Operations whose ID includes the entered string will be included in the report. If blank, all operations will be included.
Sample Name	All samples	No		Samples whose name includes the entered string will be included in the report. If blank, all samples will be included.

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Sample Priority	All sample priorities	No	Single	<p>The sample priorities to include in the report.</p> <p>If the <b>Null</b> check box is selected, all priorities are included.</p> <p>Clear the <b>Null</b> check box to enter the integer of the priority level to include.</p>
Sample Frequency Type	All sample frequency types	No	Multiple	<p>The sample frequency type to include in the report.</p> <p>Options are Shift, Calendar Time, Production, Produced Lot Change, Job Start, Manual, Job End.</p>
Process	All processes	No		Processes whose ID includes the entered string will be included in the report. If blank, all processes will be included.
Lot Number	All lots	No		Lots whose number includes the entered string will be included in the report. If blank, all lots will be included.
Sublot Number	All sublots	No		Sublots whose number includes the entered string will be included in the report. If blank, all sublots will be

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				included.

## Report Display Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Report Basis 1 to 6	Entity	Other Report Basis selections	Single	<p>By selecting data types in the <b>Report Basis</b> lists, you can generate a report that groups the summary data by those data types. For example, setting <b>Report Basis 1 to Entity</b> and <b>Report Basis 2 to Item</b> will group the summary data first by entity and then by item.</p> <p>If you click any of the entity graphs, the resulting report drills down into that entity and is then grouped by the next lower basis option.</p>
Number of Characteristics to Display in Graphics	0	No	Single	<p>Enter an integer from 0 to 9. The results are as follows:</p> <ul style="list-style-type: none"> <li>• If you select 0, the results for all characteristics are grouped into a single bar in each of the charts, one for each basis</li> </ul>

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				<p>value.</p> <ul style="list-style-type: none"> <li>If you select 1 through 9, there is a grouped set of bars for each current basis value, and a bar within each set for each characteristic. There are as many characteristics as the basis value, till the limit set by the entered value.</li> </ul> <p>If there are more characteristics than this limit, an additional bar is added as the last one in each set, labeled Other.</p>
Statistics Columns to Display	All	No	Multiple	The statistics columns to include in the report.
% Out of Spec, Cp, Cpk, Pp, and Ppk Thresholds	Null	No		<p>Define the threshold values for % out of specification, Cp, Cpk, Pp, and Ppk Threshold boxes. If you select the Null option, there is no threshold set for the corresponding statistic.</p> <p>If threshold values have been entered and a value is above</p>

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				<p>the % Out of Spec value or below the performance indicators, the data point is highlighted for quick visual indication.</p> <p>Typically, if you enter a threshold value for any of these four measures, you would include that column in the Statistics Columns to Display list.</p>
Report Sections	All	No	Multiple	The report sections to include in the report.

## Report Data

The report can include the following sections.

### Filter Criteria

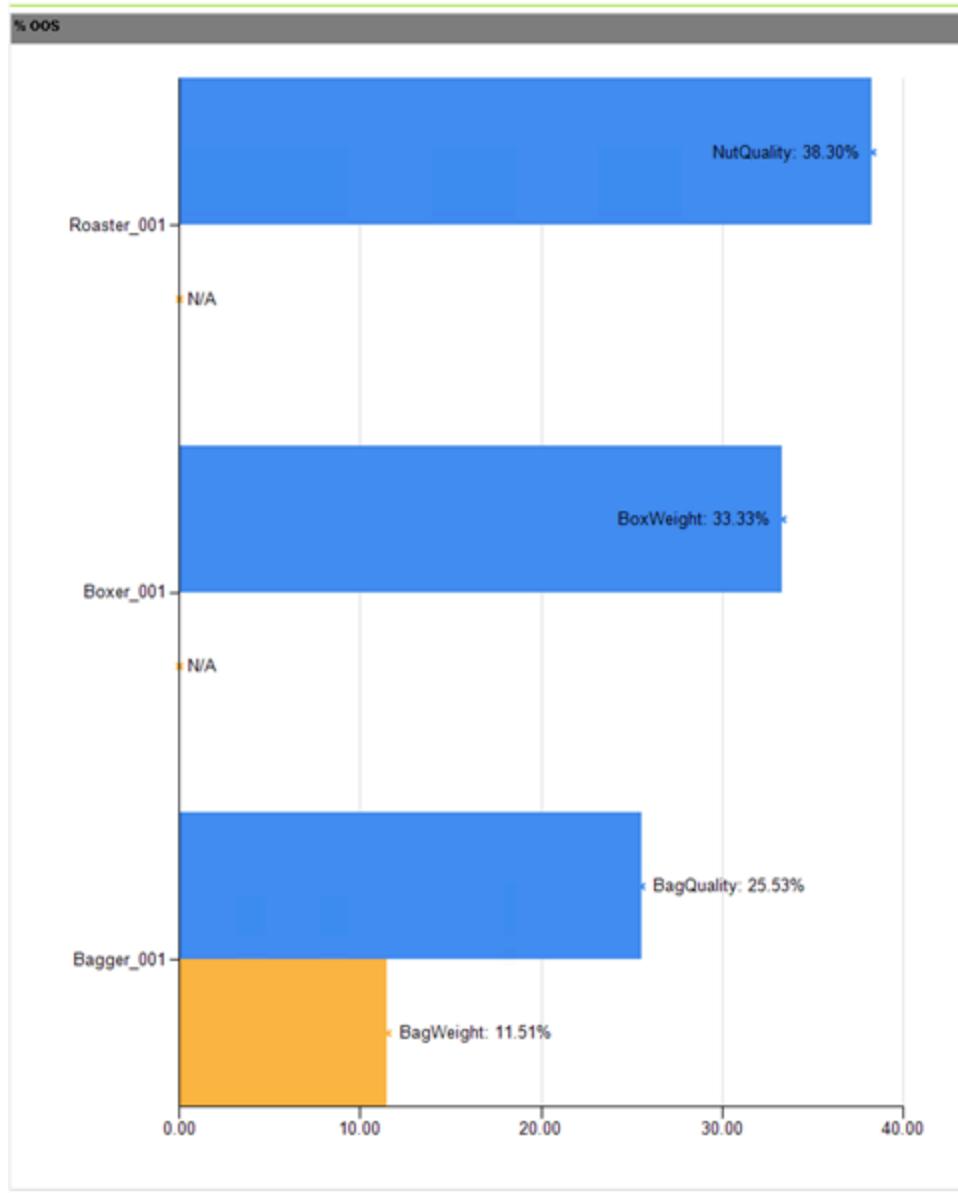
The time period that you had specified for the report and the other specified filters.

### %OOS

This bar chart of % out of specification displays the OOS percent, based on the selected report basis for each characteristic. The order from top to bottom is by the worst offending grouping context (e.g., entity) and characteristic.

## Quality Summary Report

From: 5/1/2018 To 5/31/2018



Generated on : 5/22/2018 2:52:50 PM

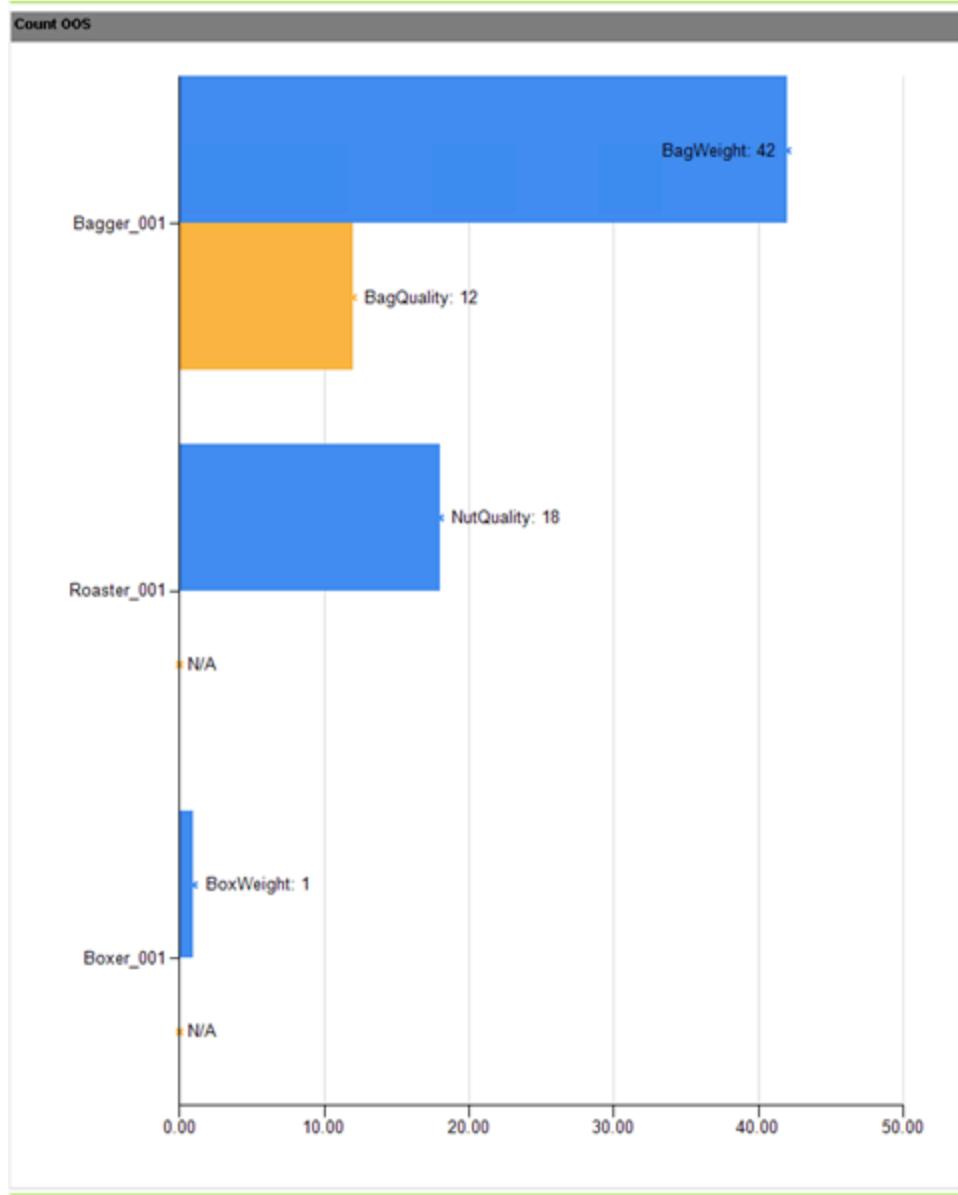
Page 1 of 6

### Count OOS

This bar chart of count out of specification displays the OOS count, based on the selected report basis for each characteristic. The order from top to bottom is by the worst offending grouping context (e.g., entity) and characteristic.

## Quality Summary Report

From: 5/1/2018 To 5/31/2018



Generated on : 5/22/2018 2:52:50 PM

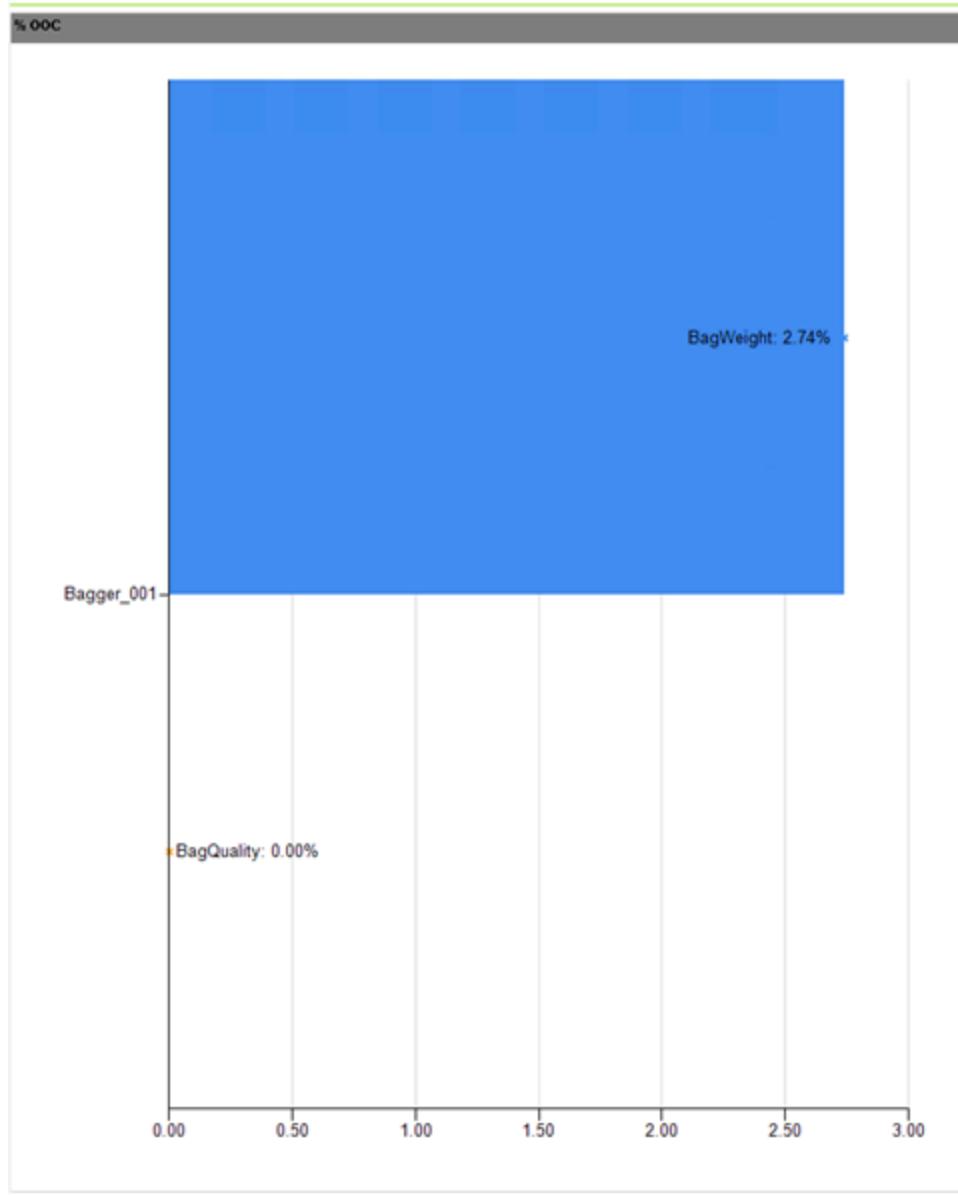
Page 2 of 6

### %OOC

This bar chart of % out of control displays the OOC percent, based on the selected report basis for each characteristic. The order from top to bottom is by the worst offending grouping context (e.g., entity) and characteristic. A sample for a characteristic is counted only once, even if it violates multiple control rules.

**Quality Summary Report**

From: 5/1/2018 To 5/31/2018



Generated on : 5/22/2018 2:55:05 PM

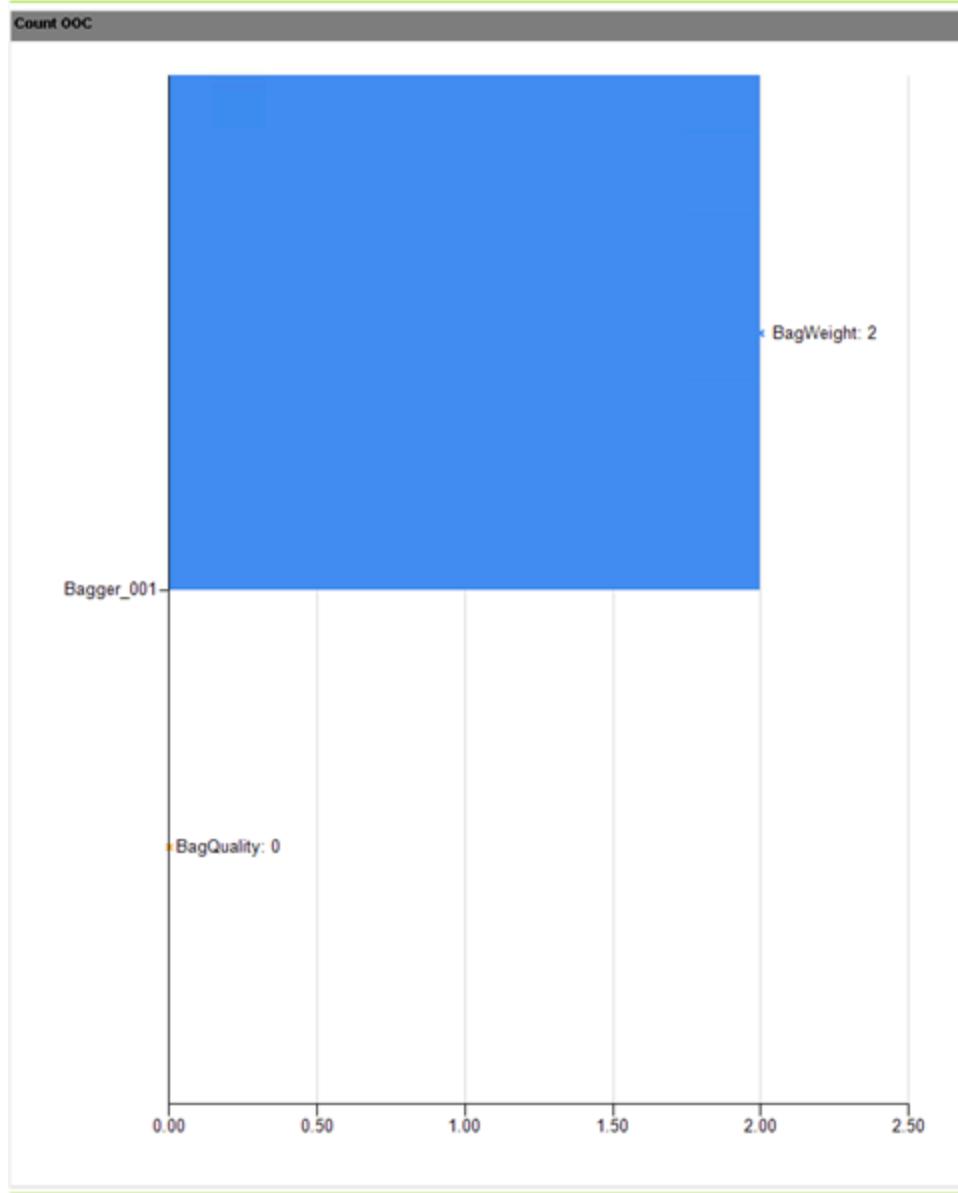
Page 3 of 6

**Count OOC**

This bar chart of count out of control displays the OOC count, based on the selected report basis for each characteristic. The order from top to bottom is by the worst offending grouping context (e.g., entity) and characteristic.

## Quality Summary Report

From: 5/1/2018 To 5/31/2018



Generated on : 5/22/2018 2:55:05 PM

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### Summary Data

Displays summary data columns, grouping the data based on the following:

- Most recent basis selected for the report.
- The characteristic.
  - The other columns display the following:
    - Total number of results (individual readings).
    - Number of results outside specification limits.
    - Percent out of specification.
    - Total number of samples for the characteristics.

- Number of sample characteristics out of control.
- Percent out of control.

If a threshold value is configured for % out of specification, the values in the table exceeding the threshold setting are displayed in a different background color that is visible in black and white printouts, and can be discerned by color blind individuals. When you select a new report basis, this section is updated.

## Quality Summary Report

From: 5/1/2018 To 5/31/2018

Summary Data							
Entity	Char	Num Results	Count OOS	% OOS	Sample Count	Count OOC	% OOC
Bagger_001	BagQuality	47	12	25.53%	47	0	0.00%
Bagger_001	BagWeight	365	42	11.51%	73	2	2.74%
Boxer_001	BoxWeight	3	1	33.33%	3	0	0.00%
Roaster_001	NutQuality	47	18	38.30%	47	0	0.00%

Generated on : 5/22/2018 2:47:50 PM

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### Statistical Data

Displays statistical data columns for the following:

- Characteristic name.
- QM specification name.
- Most recent basis selected for the report.

These columns are used to group data. The columns at the right of the table display the statistics that you have chosen. These columns include average, min, max, standard deviation, estimated sigma, range, Cp, Cpk, Pp, Ppk, Target, LSL, and USL.

If threshold values are configured for Cp, Cpk, Pp, and Ppk, the values in the table that are less than the threshold setting are displayed in a different background color that is visible in black and white printouts, and can be discerned by color blind individuals.

## Quality Summary Report

From: 5/1/2018 To 5/31/2018

Statistical Data															
Entity	Char	Spec	Avg	Min	Max	Std Dev	Est Sigma	Range	Cp	Cpk	Pp	Ppk	Target	LSL	USL
Bagger_001	BagQuality	BagQuality	0.05	0.00	0.52	0.00	0.00	0.52					0.00	0.00	0.05
Bagger_001	BagWeight	BagWeight	1.00	0.92	1.10	0.02	0.00	0.18	0.00	0.00	0.00	0.00	1.00	0.98	1.02
Boxer_001	BoxWeight	BoxWeight	99.17	97.50	100.10	1.45	1.24	2.60	0.13	(0.09)	0.12	(0.08)	100.00	99.50	100.50
Roaster_001	NutQuality	NutQuality	0.08	0.00	0.44	0.01	0.00	0.44					0.00	0.00	0.05

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## Quality Characteristic Detail Report

The Quality Characteristic Detail report provides information on sample data based on characteristics and multiple filters. Characteristic data can be shown in Statistical Process Control (SPC) charts or in tabular format. Data can be filtered by several elements including entities, items, severity, characteristics, QM specs, and sample name and frequency type.

A subreport named \_QualityCharacteristicDetail is available by clicking **Details View** on the toolbar of the MES Reports web page in SSRS. This subreport provides an image control for the SPC charts that can be included in

the Quality Characteristic Detail report.

The Quality Characteristic Detail Report requires that certain security policy settings for Reporting Services are configured. Follow the instructions provided in the **Reporting Services Security Configuration.txt** file that is located in the <MES installation folder>\BI Gateway Reports folder.

With millions of sample result records in the database, the time for this report to render is heavily dependent on the number of charts being generated and the number of results included in the report. Even with a small number of charts and a few thousand results, this report takes 90 seconds to display with large datasets. Hundreds of charts with many thousands of result records displayed on the order of 5 minutes in the testing environment. Note that rendering large results sets requires a lot of memory for reporting services.

In some cases, it is necessary to close the Quality Detail report and reopen it to run another report with different filtering options. The majority of the time is spent in rendering the charts and tables by SQL Server Reporting Services which AVEVA will continue to investigate.

## Report Parameters

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
Time Period	No	No	Single	The time period for the report data. See <a href="#">Time Range</a> .
Shift	All shifts	No	Multiple	The shifts whose data will be included in the report data.
Start Date	Current Day	Time Period	Single (from Date picker)	<p>The start date for the report data.</p> <p>This parameter is not applicable when the Time Period parameter is any value other than Date/Time Range.</p> <p>You can enter the time for the Start and End Date fields in 12-hour (am/pm) format or 24-hour format. When you click <b>View Report</b>, the time is converted to 12-hour format.</p>
End Date	Current Day	Time Period	Single (from Date picker)	The end date for the report data.

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				This parameter is not available when the Time Period parameter is any value other than Date/Time Range.
Entity	All entities	No	Multiple	The entities to include in the report.
Item Category	All item categories	No	Multiple	The item categories to include in the report.
Items	All items	No	Multiple	The items to include in the report.
Severity	All severity levels	No	Multiple	The severity levels to include in the report: Unused, Not Monitored, Non-Key, Key, and Critical.
Work Order	All work orders	No		Work orders whose ID includes the entered string will be included in the report. If blank, all work orders will be included.
Operation	All operations	No		Operations whose ID includes the entered string will be included in the report. If blank, all operations will be included.
Sample Name	All samples	No		Samples whose name includes the entered string will be included in the report. If blank, all samples will be

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
			included.	
Sample Priority	All sample priorities	No	Single	<p>The sample priorities to include in the report.</p> <p>If the <b>Null</b> check box is selected, all priorities are included.</p> <p>Clear the <b>Null</b> check box to enter the integer of the priority level to include.</p>
Sample Frequency Type	All sample frequency types	No	Multiple	<p>The sample frequency type to include in the report.</p> <p>Options are Shift, Calendar Time, Production, Produced Lot Change, Job Start, Manual, Job End.</p>
Process	All processes	No		Processes whose ID includes the entered string will be included in the report. If blank, all processes will be included.
Lot Number	All lots	No		Lots whose number includes the entered string will be included in the report. If blank, all lots will be included.
Sublot Number	All Sublots	No		Sublots whose number includes the entered string will be included in the

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				report. If blank, all sublots will be included.
Characteristic	All characteristics	No	Multiple	The characteristics to include in the report.
Spec	All QM specs	No	Multiple	The QM specs to include in the report.
Detail Columns to Display	All columns	No	Multiple	<p>Choose the optional columns you want to display in the <b>Characteristic Detail Data</b> section. The optional columns are:</p> <ul style="list-style-type: none"> <li>• Actual Sample Size</li> <li>• Entity Name</li> <li>• Sample Name</li> <li>• Item ID</li> <li>• Work Order ID</li> <li>• Operation ID</li> <li>• Segment Requirement ID</li> <li>• Segment Response ID</li> <li>• Lot Number</li> <li>• Sublot Number</li> <li>• Sample Note</li> <li>• Specification Name</li> <li>• Cause Description</li> <li>• Equipment</li> <li>• Whether the sample to which the result value</li> </ul>

Parameter	Default Value	Dependency on Other Parameter	Allowed Selection	Description
				originally belongs is in control or not
Report Sections	All	No	Multiple	The report sections to include in the report: SPC Chart and Characteristic Details.

## Report Data

The report can include the following sections.

### Filter Criteria

The time period that you had specified for the report and the other specified filters.

### SPC Chart for Characteristics

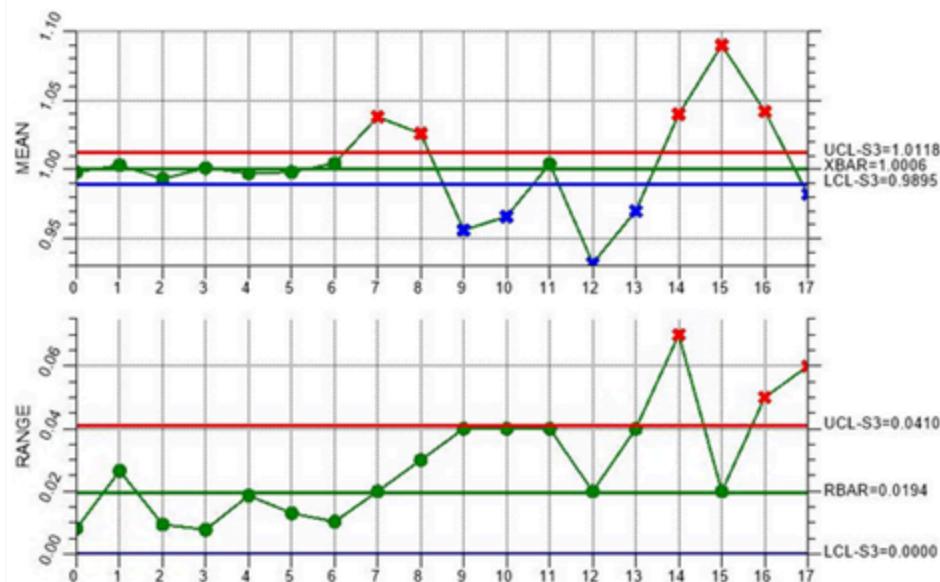
Displays each characteristic using the specified filter criteria and the settings defined for the QM specification used by the most recent sample. This section has the following features:

- If multiple characteristics are selected, their charts are displayed in alphabetical order by characteristic name, from top to bottom, using the default chart type as defined in the MES database.
- The chart uses the control limits for the last point plotted on the chart.
- The chart is an image and shows the most recent data, when there is more data returned by the query than what fits on the chart.

## Quality Characteristic Detail Report

From: 5/1/2018 To 5/31/2018

Chart - XBar + Range for Characteristic: BagWeight



Generated on : 5/22/2018 3:04:14 PM

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### Characteristic Detail Data

Each characteristic is listed alphabetically. The rows display the following data for each selected characteristic:

- The result value.
- The local sample requested time.
- Any other columns selected by you for display.

## Quality Characteristic Detail Report

From: 5/1/2018 To 5/31/2018

Characteristic Detail Data																
Char	Time	Result	Name	Item	WO	Oper	Seg Req	Seg Resp	Lot	Sublot	Note	Spec	Cause	Entity	Size	OOC
BoxWeight	5/21/2018 4:45:07 PM	99.9	BoxWeight201805210001	BXN	BXN-2018052102	100-BXF						BoxWeight	Boxer_001	1.00	False	
BoxWeight	5/21/2018 4:51:19 PM	100.1	BoxWeight201805210002	BXN	BXN-2018052103	100-BXF						BoxWeight	Boxer_001	1.00	False	
BoxWeight	5/21/2018 4:57:44 PM	97.5	BoxWeight201805210003	BXN	BXN-2018052104	100-BXF						BoxWeight	Boxer_001	1.00	False	

Generated on : 5/22/2018 3:04:14 PM

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## Common Issues and Resolutions

You should be aware of common report issues and how to resolve them.

## Reporting Services Not Running

### Error Description

SQL Server reporting service is stopped.

### Reason

This error is usually caused when the SQL Server reporting service is stopped, which will generate an *HTTP Error 503: The service is unavailable* message on the web page.

### Resolution

Go to Windows Services and start the SQL Server reporting service.

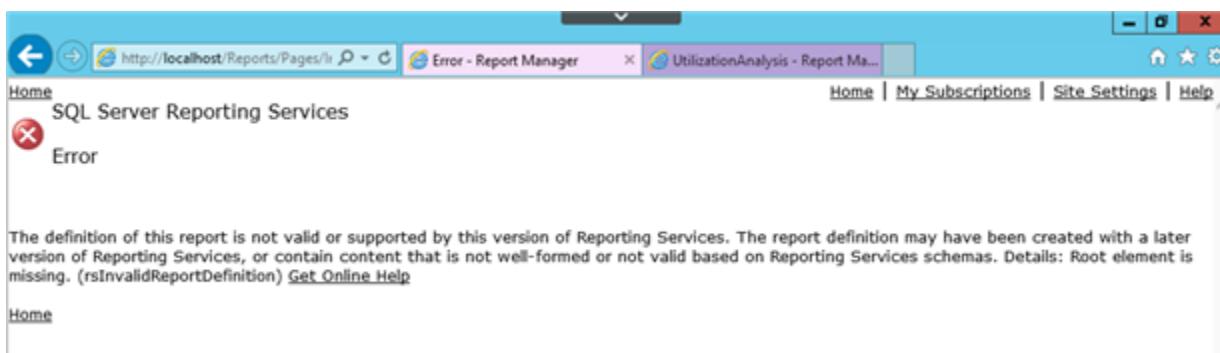
## Report Created in Older or New Version

### Error Description

Compatibility issues with the report definition file versions.

### Reason

An older version of a report definition file (.rdl) is being used. The following figure shows the message that appears when this error occurs.



### Resolution

Reconfigure the MES BI Gateway Reports component in the post-install Configurator to redeploy the latest report files. See the *MES Installation Guide* or online help.

## Report with Many Filter Parameters Will Not Run or Cannot Set All the Filters

### Error Description

Some of the reports such as the Quality Detail report have many filter parameters and many items within each filter can be selected. While selecting the multiple filters, the report will appear to freeze or take very long to load the filter list for a parameter.

### Reason

In some cases, the total length of the parameter list exceeds the default length set by SQL Server Reporting Services.

### Resolution

The length of the parameter request must be modified in the SQL Server Reporting Services web.config files. The files are located in the ReportManager and ReportServer folders under the Reporting Services folder. Open the files and make the following modification:

```
<httpRuntime maxRequestLength="2097151" executionTimeout="9000" />
```

Once the setting has been changed, restart the SQL Server Reporting Services service.

## No Data Source Configured in SSRS

### Error Description

No data source is configured in SSRS.

### Reason

There is no data source configured in SQL Server Reporting services. The message that appears when this error occurs is:

*The report server cannot process the report or shared dataset. The shared data source 'MES' for the report server or SharePoint site is not valid. Browse to the server or site and select a shared data source.  
(rsInvalidDataSourceReference)*

### Resolution

Reconfigure the MES BI Gateway Reports component in the post-install Configurator to redeploy the latest report files. Specifically, ensure that the settings in the **SQL Server Reporting Services Node** section of the component are correct. Check for errors in the Configurator **Configuration Messages** box. For more information about deploying MES BI Gateway Reports, see the *MES Installation Guide* or online help.

## Invalid View Definition

### Error Description

There is an invalid view or a view is missing in the database.

### Reason

Some of the related data source tables or views are not available. Therefore, the view is invalid. The message that appears when this error occurs is:

*An error has occurred during report processing. (rsProcessingAborted) Query execution failed for dataset '<datasetname>'. (rsErrorExecutingCommand) Invalid object name 'vw<viewname>'.*

### Resolution

Reconfigure the MES BI Gateway Reports component in the post-install Configurator to redeploy the latest report files. Specifically, ensure that the settings in the **BI Gateway Database Node** section of the component are correct. Check for errors in the Configurator **Configuration Messages** box. For more information about deploying MES BI Gateway Reports, see the *MES Installation Guide* or online help.

## SPC Chart Subreport Cannot Be Shown

### Error Description

The SPC Chart subreport cannot be shown in the Quality Characteristic Detail report.

### Reasons

- The BI Gateway and MES BI Gateway Report components are not installed on the same node.
- Certain security policy settings for Reporting Services are not configured to display the SPC Chart subreport's .NET control.

### Resolution

- Make sure that the BI Gateway and MES BI Gateway Report components are installed on the same node.
- To configure the security policy settings, follow the instructions provided in the **Reporting Services Security Configuration.txt** file that is located in the **BI Gateway Reports\Reports** folder of the **MES** application folder.

## Timeout Errors During Initial Model Deployment or Data Updates

### Error Description

The initial deployment of the MES BI Gateway model might have to retrieve large amounts of data from the MES database, especially if the MES database was recently upgraded. While retrieving the data, timeouts can occur

within the WCF communication layer or in the SQL Query.

## Reason

The amount of data requested by the BI Gateway service is not returned before the timeout expires.

## Resolution

Follow the guidelines provided in Tech Note 453 for setting the various timeouts for WCF and SQL Server.

You can search for this tech note from the Knowledge and Support Center web site. To access the Knowledge and Support Center, start at the Contact Page and click through the Customer Support links.

# Data Fails to Load During Initial Model Deployment with Socket Connection Warnings/Errors

## Error Description

The MES BI Gateway model deployment does not populate all the dimension tables and there are socket connection warnings or errors. Data is retrieved for smaller datasets but not for the large ones. This is similar to the issue described in [Timeout Errors During Initial Model Deployment or Data Updates](#) but is seen even after increasing the timeout settings.

## Reason

Even with the extended timeouts, the quantity of data being returned might exceed the maximum size expected by the BI Gateway Data Adapter Service.

## Resolution

Contact Technical Support and provide the following information:

- The error messages being seen
- The dimension not being populated
- The number of records in the corresponding MES table
- A description of the problem

This information will allow Technical Support to determine if Hotfix L00149698 will resolve your issue.

# Data Issues and Resolutions

Data issues might cause the reports to be inconsistent. Data issues could result based on the following scenarios:

- When an existing older version of MES is migrated to the new version
- When the parameters required for reporting purposes are not configured in MES software

## Data Is Not Available in Most Reports

No data is shown in most of the reports even though there is data in the dimensions.

All the reports except the Utilization by Entity, Utilization Analysis, and Utilization Waterfall reports use the Production Day to filter the returned data. The Production Day is associated with the entity shift history data and requires there to be at least one shift defined in the MES database.

At a minimum, define at least one shift in the MES database (it can be for 24 hours) and assign it to the top-level entity so that all child entities have the same shift schedule.

## Historical Entries for a Line Not Available After a Line Name Change

If a line name is changed, you must redeploy the model (see [Guidelines for Modifying and Redeploying the Model](#)). Otherwise, historical entries for the line will not be included in the Line Production or Production by Entity reports.

## Line Information Not Available in Line Production Report

When line information is not configured or is not available in MES, the Line Production report will not have summary information.

## Production Rate Information Not Available

When production rate information is not configured or is not available in MES, the following reports might have incorrect summary information or the summary information might be missing:

- Production By Entity
- Line Production
- OEE Analysis

## UOM Conversion Information Not Available

When UOM conversion factor information is not configured or is not available in MES, the following reports might have incorrect summary information or the summary information might be missing:

- Production By Entity
- Line Production

## Standard Item at Entity, Line Information Not Available

When a standard item for an entity or a line is not configured or is not available in MES, the following reports will have incorrect summary information:

- Production By Entity

- Line Production

## Production Entity Information Not Available

When a production entity is not configured or is not available in MES, the Line Production report will not have summary information.

## Failure Event Information Not Available

When failure events are not captured or are not available in MES, the following reports will not have summary information:

- MTBF
- MTTR

## Equipment Parameter List Is Empty or Partial List Is Shown

For the following reports, only a partial list of equipment will be shown or the equipment list will be empty if the equipment is not marked to capture OEE, utilization, or QM data, or it is not capable of running jobs. Only the equipment that can capture OEE, utilization, and QM data and can run jobs are shown in the list.

- Line Production
- Production By Entity
- Utilization Timeline
- Utilization By Entity
- Utilization Analysis
- OEE Analysis
- MTBF
- MTTR
- Quality Summary
- Quality Characteristic Detail

## Item Parameter List Is Empty or Partial List Is Shown

For the following reports, only a partial list of items will be shown or the item list will be empty if the items are not marked as produced items in the item class. Only the items that are marked as produced item are shown in the list.

- Utilization By Entity
- Production By Entity
- Utilization Analysis
- Line Production

## Incorrect Event Summary After Event Reclassification or Split

After an event is re-classified or split with an earlier event that causes it to be merged with a previous event that has the same reason (both of which cause the record to be removed from the source), the event summary will not be correct in the following reports:

- Utilization by Entity
- Utilization Analysis
- Utilization Timeline

This occurs because BI Gateway cannot capture the changes properly when the records get deleted from the source.

## Shift Data Not Shown in OEE Analysis Report

The OEE Analysis report can associate only up to two shifts to an hourly summary. Therefore, there can only be one shift transition in an hour. This means that shift durations must be at least one hour.

## Resolution

For all the issues except "Incorrect Event Summary After Event Reclassification or Split," configure the relevant data in MES for each of the above data issues to see the reports correctly.

For the issue "Incorrect Event Summary After Event Reclassification or Split," redeploy the BI Gateway model to capture the changes.

## MESRDBHourlyUtilization Measure Table Has Historical Data But Not All of It

When initially deploying the BI Gateway model for MES against a database with large amounts of existing data, the backfill process for the Hourly Utilization measure takes longer than all the other dimensions and measures.

Once all the dimensions and other measures are backfilled, the process for the Hourly Utilization measure will likely still be happening. As long as there are messages indicating that the processing is continuing, then BI Gateway is still working on it.

In very large systems with millions of records, the service has been observed to take 3 to 4 minutes to process each hourly bucket. For such a system, it may take days or weeks to complete the backfill process per year of data.

## Time Range

Based on the time range selection, the subtitle of the report content will be updated. This parameter allows you to pick one of the following options.

### **Current Shift**

Based on report execution date/time, select the current shift period (not ended yet).

### **Previous Shift**

Shift prior to the current shift as defined above.

**Current Day**

Based on report execution date/time, select the current production day (not ended yet).

**Current Week**

Based on report execution date/time, select the current production week (not ended yet). Note that the week is assumed to start on Sunday (day 0).

**Current Month**

When selected, the current month from the start of the month to the current date.

**Previous Day**

Day just preceding the current day as defined above.

**Previous Week**

Week just preceding the current week as defined above.

**Previous Month**

When selected, the data from the previous month, from the start of the month until the month end date, will be included based on other parameter selections.

**Date/Time Range**

When selected, you must enter a start date and an end date (calendar control, date only, no time) and, optionally, manually enter a time. The default time is midnight.

# Release Notes

The release notes describe the new and enhanced functionality available in Manufacturing Execution System (MES) 2023, providing an overview of the most significant changes and helping you to avoid any potential issues.

## AVEVA Manufacturing Execution System 2023 (Version 7.0)

Last revision: Wednesday, July 3, 2024

### About This Readme

This document contains important information about AVEVA™ Manufacturing Execution System (MES) 2023 (version 7.0). This Readme documents the system requirements, known issues, resolved issues, and changes, if any, to the MES user documentation.

Readme files from previous releases of MES are posted to the Product Hub page of the [Knowledge and Support Center](#). Once on the Product Hub page, you can use the filter to list the MES documents, which include the Readme files.

### About This Release

The MES 2023 release includes multiple significant changes as listed below. Highlighting a couple of the significant changes:

- MES 2023 has been enhanced to include a new shift pattern configuration that contains the shift schedules and links to entities. Prior releases had shift schedules assigned to entities. The database migration process will create new shift patterns with appropriate links. However, these should be reviewed and modified by the end user after migration as necessary.
- MES 2023 includes modifications to the database tables related to shift definition and item inventory. It also includes corresponding stored procedure and API changes that might require changes to existing applications that are upgraded to MES 2023.

Upon release, MES 2023 is compatible only with System Platform 2023, Work Tasks 2023, Recipe Manager 2023, and other current releases. See the compatibility information on the [Technology Matrix](#) page for further updates.

### MES Stateless API

- Added classes in the Commerce namespace: Shipment, ShipmentLot, Receipt, ReceiptLot, and CustContact.
- Added EnProd.DataLog class and redirected existing DataLog16 and DataLog48 calls to DataLog
- Added EnProd.JobStepData class.
- Added overloads to EnProd.ItemInv and EnProd.StorageExec methods to include UTC and local dates for expiry date.

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**Note:** Get calls that pass a filter parameter with expiry\_date (e.g., \$\$expiry\_date=\$\$) will need to change this to expiry\_date\_utc or expiry\_date\_local.

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- Added validation to item inventory and item production calls to ensure that input parameters and resulting data updates meet defined business rules.

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**Note:** Item inventory and production calls that previously worked might now fail due to validation errors.

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- Added new shift pattern and shift schedule classes in the Core namespace: ShiftPattern, ShiftPatternEntLink, and ShiftSchedule.
- Added Core.ShiftHistory.UpdateSpecific to record the user comments and spare fields that were added to the shift\_history table.
- The new Core.ShiftSchedule class replaces the ShiftSched class. Most but not all ShiftSched methods have been mapped to corresponding ShiftSchedule methods. However, there is a change in functionality that makes some of the calls non-functional now. For details, see the *MES Stateless API Reference* help.
- In the Core namespace, Ent.DoAutoShiftChanges, Ent.DoPastShiftChanges, Ent.GetRefreshedShiftSched, Ent.StartShift, and ShiftSched.DeleteAll are no longer functional calls and do not need to be used.
- Added new folder and file-related classes in the Prod namespace: Folder, FolderFile, and FolderItemOperEntLink.
- Added overloads for Prod.WO.CreateWOforALine and Prod.WO.ReassignWOToALine to include additional parameters.
- Item Inventory and Storage Exec APIs for moving, transferring, splitting, and updating inventory have been updated to include additional data validation checks.
- Added overloads for Commerce.Cust.GetByFilter and SOLine.GetByFilter to not include user context.
- Added EnProd.StorageExec.Scrap method.
- Updated Sample.GetChars to return additional columns.
- Removed various overloads that have been marked as obsolete in the MES 2014 (v5.0) release, including the following methods:
  - Ent.Add
  - Ent.GetAll
  - Ent.Update
  - Ent.UpdateSpecific
  - JobExec.GetQueue
  - OEEExec.Update
  - OEEExec.UpdateSpecific
  - Sample.UpdateSpecific
  - UserName.Add
  - UserName.AddOrUpdate
  - UserName.Update
  - UserName.UpdateSpecific
  - UtilReas.Add
  - UtilReas.GetAll
  - UtilReas.Update
  - UtilReas.UpdateSpecific

- UtilState.Add
- UtilState.GetAll
- UtilState.Update
- UtilState.UpdateSpecific

## MES Web API V3

- The MES installation software includes a PowerShell script to register a client ID and client secret with AVEVA Identity Manager (AIM) to allow for service-to-service Web API calls. For more information, see the *MES Installation Guide* or help and the *MES Web API V3 Reference* help.
- Added WO methods: Put, Post, Delete, GetAll, GetByKey, GetByFilter, Release, Cancel, ChangeWOQuantities, CreateForLine, ReassignWOToLine, and CreateFromProcess.
- Added Production/SetLotData and Consumption/SetLotData Put methods.
- Added POLine methods: Put, Post, Delete, Get, GetByKey.
- Add Item methods: Put, Post, Delete, Get, GetByKey, GetByFilter.
- Added ItemInventory/Scrap as a Put method to replace the Delete.
- Added a Jobs/ChangeJobStates Put method.
- Added UtilHistory methods: Put, Post, AddEvent
- Added QM chart-related Sample methods: GetChartDataByFilter, GetChartDataNameFilter, GetChartFilters, GetChartTypeByFilter, GetChartTypeNameFilter, GetControlRules, and GetChars.
- Updated the MiddlewareAccess endpoint to support generic commands for calling Put, Post, Delete, and Get calls.
- The input parameters max\_rows and trans\_id are now included in the Web API call header.
- Updated the Web API OpenAPI (Swagger) JSON file.

## MES Stateful API

- The ClientSession class has new properties for IsHostedByOMI and IsOMIUserLoggedIn
- Added an overload for Jobs.AddProdPostExec to include subplot

## MES Client

- Moved Customer configuration from MES Supervisor to MES Client except for the generation of sales orders.
- Moved Data Log configuration from MES Supervisor to MES Client, including a new property pane setting in entity configuration for linking data log groups.
- Added an option to create a database view from a data log group.
- Modified Shift Schedules to include shift patterns and moved shift exceptions from MES Supervisor to MES Client. Please see the *MES Client User Guide* or help for details about the new functionality provided.
- New installations include an updated color palette for job, utilization, sample, sample result states, and other system colors. An upgraded database will retain the existing color settings.
- Added an option to hide or show entities marked as unlisted.
- Added a calendar sample frequency option to delay the generation of the initial sample.

- Added Category on the QM Specification property pane for custom use.
- MES Client icons and theme have been updated. All menu items remain in the same locations and order.

## MES Middleware and Middleware Proxy

- MES Service has been merged into the MES middleware.
- One MES middleware will perform the background maintenance tasks that had been performed by the MES Service. In a multi-node environment with more than one Middleware Server, the maintenance tasks can be moved to another middleware if the current middleware that is handling them stops running. Related to this hand-off, the preferred middleware for handling the maintenance tasks can be set during post-install configuration.
- An option was added to set the default region/time zone for transactions that are not associated to a site.
- Shift generation will now use a site's region to generate shift transitions at local time for the entity.
- Log flags were added for the FactMES.Server.MaintenanceService to log shift and sample generation maintenance activity.
- All time conversion between UTC and Local use SQL Server functions and no longer rely on the tz\_offset table, which has been removed.
- In the Middleware Configuration editor, the default DB Connection retry count was changed from 100 to 10. For an upgrade, this setting will need to be manually modified after installation.
- In a multi-node environment with more than one Middleware Server, optional additional MES middlewares can now be defined for the Middleware Proxy to use if it cannot connect to the initial MES middleware.
- The communication between the MES Proxy and the MES Middleware is encrypted by default. New settings have been added to the Middleware Configuration Editor to change this behavior.

## MES Web Portal

- A new version of the Kendo library is being used in this release, including Kendo's version of globalization. MES Web Portal no longer is using the Globalize library. Any existing customer using this library will need to modify their custom pages to call the Kendo library instead.
- MES Web Portal icons and theme have been updated.

## MES Supervisor

- Only Inventory, Storage Entity Status, and Supply Chain Connector configuration remains in MES Supervisor.
- Customer, Data Log, and Shift Exception editors have been moved to MES Client.
- Removed Item Folders configuration from MES Supervisor. Stateless APIs have been added to cover this functionality, but no configuration screens.
- MES Supervisor is no longer included in any standard installation roles. Supervisor can be installed through a custom install.

## MES Security

- Improved MES native security password encryption technology is now being used.

- MES native security no longer supports unique password as an option.
- MES native security now uses new defaults of a 12-character password length and 5 login failures.
- The MES .NET Control option for auto-login now works in InTouch OMI as well as InTouch.
- MES OS Group based security addresses first-time user login issues. Now when a new user logs into MES for the first time from some method other than MES Client, the necessary user records will be generated in the MES database.

Note the following:

- AVEVA Identity Manager (AIM) supports validation with Azure AD as a provider. If the Azure AD provider is synchronized with the same domain used for MES users, the MES Web Portal and applications calling the MES Web API will function. However, there is no option within MES Client to add Azure AD users or groups to MES security.
- Platform Common Services (PCS) now has an option for a redundant single sign-on server. However, MES 2023 does not support PCS redundancy.

## Upgrade Information

- **Data Log:** Migration of a prior MES database version will move all data\_log\_16 and data\_log\_48 table data to the data\_log table. If you previously ran the optional scripts from MES 2020 to copy the data to this new table, then you should delete the duplicate data from the data\_log\_16 and data\_log\_48 tables prior to upgrading so that there isn't duplicate data in the data\_log table after migration. To continue support of reports that use the data\_log\_16 and data\_log\_48 tables, these are now views.
- **Shift Schedules Converted to Shift Patterns:** During migration, existing shift schedules will be validated for conversion to shift patterns. If any inconsistencies are found, a list will be stored in the error\_log table. If the existing shift schedules can be converted, then the migration creates shift patterns with names in the format **MES DB 7.0 upgrade pattern - n**. It is recommended to change these names to something meaningful. For more information, see the topic "Migrated Shift Schedules" in the MES Installation Guide or help.

Migration will not include any shift exception definitions from prior releases as the approach for defining these has changed.

Migration of shift schedules should be reviewed in close detail. You should determine whether or not a better approach exists with the new functionality added for shift patterns with effectiveness dates and entity-specific shift exceptions.

- **Item Inventory Expiry Dates:** Item Inventory records are updated to reflect expiry date local and UTC time, with the original value in the table retained in the expiry date local column.
- **New Licensing Version Required:** This release requires a new version of licensing. Prior licenses for MES 2017, MES 2017 R2, and MES 2020 will not work with this release. The license feature lines remain the same.
- **Middleware:**
  - An upgrade will require reconfiguration to enforce MES middleware security and synchronization with System Management Server, which is now a required component.
  - The MES Middleware service will be configured with **Delayed Startup** by default. If the database is on a separate node from the middleware, this can be changed to normal startup.

## MES Data Editor and Supervisor to Be Deprecated

Future releases of AVEVA MES will no longer include the Data Editor or Supervisor components.

- Transactions currently being performed in Data Editor should be transitioned into using the corresponding Stateless API methods or the Stateless API DirectAccess methods. If there is no Stateless API method to perform the desired action, use the Stateful API ClientSession.SendXMLCommand method.
- With the future removal of Supervisor, the configuration of Supply Chain Connector integration will be removed. MES databases that are migrated as part of an MES upgrade will continue to function. All new customers should use Enterprise Integration instead of Supply Chain Connector.

## BI Gateway

A limited version of BI Gateway Server is included with the MES installation software for use with MES BI Gateway reports and third-party reporting or BI Gateway tools. This version can be used solely with AVEVA Manufacturing Execution Software.

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**Note:** An Azure SQL-based BI Gateway datastore database is not supported with MES.

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**Note:** Install BI Gateway either from the MES installation software or from BI Gateway installation software but not both. Installing from both might cause issues.

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## Updated Documentation

Significant content updates to the MES user documentation are summarized below.

### **MES Deployment Guide**

Updated content to incorporate Work Tasks deployment with MES model-driven application content, database and recovery backup guidelines, and updated performance data.

### **MES Client User Guide and Help**

Updated content to cover the new and updated modules for the changes in this release.

### **MES Installation Guide and Help**

Updated content to cover changes to the installation, upgrading, and configuration.

### **MES Middleware User Guide**

A new document that replaces the *MES Middleware Extensibility Hooks Reference* and the *MES Service User Guide*, which have been removed from the library.

### **MES Stateless API Reference Help**

Updated content to cover API changes described above in "MES Stateless API."

### **MES Stateful API Reference Help**

Updated content to cover API changes described above in "MES Stateful API."

### **MES Supervisor User Guide**

Now contains only Inventory, Storage Entity Status, and Supply Chain Connector content.

### **MES Web API V3 Reference**

Updated content to cover API changes described above in "MES Web API V3."

### **MES Operator User Guide and Help**

Added content to cover serialization of produced items.

#### MES Web Portal User Guide and Help

Updated content to cover changes described above in "MES Web Portal Updates."

## System Requirements

This section describes the hardware, software, and operating system requirements to install the MES 2023 software.

For the most current compatibility information, see the [Technology Matrix](#) page.

## Hardware Requirements

The following are the recommended hardware requirements for nodes on which MES 2023 components will be installed.

The hardware requirements that are described in the following topics are based on the minimal requirements for running MES components. Additional minimum hardware might be required based on the version of Windows being used on a node (see [Minimum Hardware Requirements for Supported Windows Versions](#)).

### Middleware or Database Server

- Computer with dual core processor with 2 GHz or faster clock speed, or single core processor with 3 GHz or faster clock speed. Multi-core processor recommended for optimal performance.
- 8 GB or more of RAM recommended, 4 GB of RAM minimum.
- 300-GB Disk with RAID support for data. The amount of disk space necessary depends on the frequency of data collected (number of work orders, operations, production quantities, etc.) and the amount of data kept online in the production database.
- Depending on complexity and size of the database server, 30 GB or more of available disk space is recommended. The database hard disk space should be enough to support the storage and performance requirements for your particular deployment.

### MES Web Application Server

- Computer with 2 GHz or faster processor clock speed.
- 8 GB or more of RAM recommended, 4 GB of RAM minimum.

### All Systems (Client Applications)

- 30 GB (minimum) hard drive
- Super VGA (1024 x 768) or higher resolution video adapter and monitor
- CD-ROM or DVD drive, or access to a network share or portable media device that contains the installation files
- Keyboard
- Mouse or compatible pointing device

## Minimum Hardware Requirements for Supported Windows Versions

All supported Windows operating system versions require 64-bit CPUs.

See your specific Microsoft operating system hardware requirements for additional details.

## Software Requirements

This section lists the AVEVA and other third-party software requirements to install MES 2023:

- Microsoft .NET Framework 4.8 is required for all components. If the required version of .NET Framework is not installed, it will be installed during the MES installation. Note that Windows 10 versions prior to version 1607 will fail to install .NET Framework 4.8.
- If installing MES Web Portal, the following are required:
  - Microsoft Internet Information Services 7.5.
  - Microsoft Web Deploy tool.
  - MES Web Portal is compatible with version 13.0.1 of **newtonsoft.json.dll**.
- If installing MES application objects, the following are required:
  - The Entity Model Builder feature requires System Platform Integrated Development Environment (System Platform IDE).
  - The Utilization Capability Object (UCO) and Operations Capability Object (OCO) require Microsoft Message Queue for their asynchronous calls.

## Web Browsers Supported for MES Web Portal Client

The MES Web Portal client has been validated with the following web browsers, using the web browser versions that were available at the time of the MES 2023 release:

- Chrome
- Edge Chromium
- Firefox

It is expected that the MES Web Portal client will operate properly with subsequent releases of Chrome, Edge, and Firefox browsers. However, if any MES Web Portal features do not function due to changes in a new release of Chrome, Edge, or Firefox, customers will be notified by a Technical Alert when we are made aware of the issue.

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**Note:** Internet Explorer and Microsoft Edge releases prior to Edge Chromium version have a memory leak and are not recommended. Update your browser to Edge Chromium.

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**Note:** Demo videos in the MES Web Portal help will not run in standard Firefox. To run demo videos in Firefox, you must have an MP4-capable video player such as Windows Media Player installed on both the server and client machines or have a third-party MP4 plug-in installed in Firefox.

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## Database Requirements

### Supported Microsoft SQL Server Versions

Microsoft SQL Server Version		Type	Service Pack Level
2016	64-bit	Express, Standard, or Enterprise Edition	SP3
2017	64-bit	Express, Standard, or Enterprise Edition	N/A
2019	64-bit	Express, Standard, or Enterprise Edition	N/A

### Requirements

- The MES 2023 release requires SQL Server 2016 SP3 or later as it makes use of SQL functionality added in that release.
- SQL Server should be configured for TCP/IP for local connections. SQL Server should also be configured for TCP/IP for remote connections if servers that require access to the MES database, such as the MES middleware server or the Reports server, are on remote machines. SQL Server must be installed using a case-insensitive collation.
- Microsoft Distributed Transaction Coordinator and IIS 6.0 or later.
- MES Database using multiple languages requires AL32UTF8 Unicode character set installed on your server.

### Recommendations

- For proper database maintenance, use a SQL Enterprise version due to the availability of online indexing capability.

## Operating System Requirements

The following table lists the operating systems that are supported and can be installed on computers that run MES 2023.

Operating Systems	Type	Version	MES Features					
			Client Components	Database	Middleware	MES Web Portal Service	Reports Components	
Windows Server 2016	64-bit	Standard or Datacenter	none	Yes	Yes	Yes	Yes	Yes

		r						
<b>Windows Server 2019</b>	64-bit	Standard or Datacenter	none	Yes	Yes	Yes	Yes	Yes
<b>Windows Server 2022</b>	64-bit	Standard or Datacenter	none	Yes	Yes	Yes	Yes	Yes
<b>Windows Server</b>	64-bit	Core	1803/1903	No	No	No	No	No
<b>Windows 10</b>	64-bit	Professional or Enterprise	1607 (Anniversary Update) or later for .NET 4.8	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	No	Yes
<b>Windows 11</b>	64-bit	Professional or Enterprise	none	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	No	Yes

<sup>1</sup> Indicates that it is supported for sales and demo purposes only, not for production systems.

## Support for Virtual Environments and High Availability

The MES 2023 software can be run in virtual environments to support High Availability for Live Migration and Failover. Implementing High Availability can be performed using VMware technology or Microsoft Hyper-V technology.

For information about implementing MES in a virtual environment, see the *System Platform in a Virtualized Environment Implementation Guide* and the *MES Virtual Implementation Guide*.

For specific information on VMware product compatibility, see the VMWare Compatibility Guide at <http://www.vmware.com/resources/compatibility/search.php>.

## Support for Non-English Versions of Operating Systems

The MES 2023 software runs on the following non-English operating systems:

- French
- German
- Japanese
- Simplified Chinese
- Russian
- Spanish

The corresponding language versions of Microsoft SQL server are used, where applicable.

## MES Firewall Exceptions List and Firewall Ports

The firewall ports and exception white list entries specific to MES applications are created during the MES DB/MW Communication component configuration. The default HTTPS, HTTP, and SQL Server firewall ports that are required by MES applications are opened by default on Windows or by installing SQL Server.

The default port numbers that MES uses are listed in the following table.

Component	Port		Changeable?	
	HTTP	HTTPS	HTTP	HTTPS
MES Middleware Proxy			Y	N
MES Middleware Web API	80	443	Y	N
MES Web Portal			N	Y
System Management Server	N/A		N	Y

For a list of the firewall ports used by other AVEVA products with which MES works, refer to their documentation:

- License Server and Manager: *Enterprise Licensing Guide*
- System Platform: System Platform Readme and *Application Server User Guide*
- Work Tasks: *Work Tasks Administrator Guide*
- BI Gateway: *BI Gateway Installation Guide* and *BI Gateway Web Configuration Guide*

For SQL Server and similar third-party products, refer to the appropriate product documentation.

## Product Compatibility

MES 2023 is compatible and can co-exist with the following products. Compatibility means that the products can communicate with each other over the network. Co-existence means that the products can be installed on the same computer.

For the most current compatibility information, see the [Technology Matrix](#) page.

Component	Version	Compatibility	Co-existence
Application Server	2017 U3, 2020, 2020 R2	N	N
System Platform	2023	Y	Y
Platform Common	7.0	Y	Y

Component	Version	Compatibility	Co-existence
Services (PCS)			
Operations Management Interface (OMI)	2023	Y	Y
InTouch®	2023	Y	Y
Historian Server	2023	N/A	Y
Historian Client	2023	N/A	Y
Batch Management	2020	N/A	N
Batch Management	2023	N/A	Y
BI Gateway	2021 SP 1 <sup>1</sup>	Y	Y
Enterprise Integration	2023	Y	Y
Recipe Management	2020, 2020 R2	N/A	N
Recipe Management	2023	N/A	Y
Work Tasks	2020, 2020 U1, 2020 U2	N	N
Work Tasks	2023	Y	Y
Work Tasks Connector/ Extension for MES	7.0 <sup>2</sup>	Y	Y

<sup>1</sup>The version of BI Gateway included with MES has different OS and SQL Server version support. Check the [Technology Matrix](#) page for the latest updates to BI Gateway OS and SQL Server support.

<sup>2</sup>This version of Work Tasks Connector/Extension for MES works with MES 2023 and Work Tasks 2023.

## Licensing

The 2007 Microsoft Office Fluent User Interface is subject to protection under U.S. and international intellectual property laws and is used by MES under license from Microsoft.

### Quinn-Curtis SPC Chart Control:

The use of the QCSPCCChart and QCChart2D WPF, .NET, and JavaScript controls require the purchase of an Advanced Dev Studio or MES Quality license.

## Upgrading from a Previous Version to MES 2023

Upgrading from the following MES versions is supported:

- 4.0 (all service packs and patches)

- 4.5 (including P1)
- 5.0 (including SP1 and R2)
- 5.3
- 6.0 (including R2)
- 6.2

To upgrade from an earlier version, you must first uninstall the previous version and then install the new version.

## Database Migration

- The MES Database Setup component in the post-install Configurator application supports migration of databases from version 3.1 and later. To migrate from versions earlier than 3.1, you must first update the database to version 3.1. Custom modifications to any version of the MES database might not be supported by the utility and might prevent migration.
- The MES database upgrade from versions prior to 6.0 will take significantly longer than previous upgrades as the utilization data must be migrated to the new schema. Databases with multiple millions of records in the Util\_Log, Job\_Util\_Log\_Link, and Item\_Prod tables will take on the order of hours to migrate. Prior to migration, the post-install Configurator application will provide a rough estimate of the time required.
- The current database structure has views that include the same columns as the tables prior to MES version 6.0 so that legacy queries will not break. However, the data will be slightly different as there are no longer extra records during shift changes.
- Starting with MES 2020 (version 6.2), an additional link table is included and the views are updated to use this new table. The migration populates this new link table, so migrations from 6.0 and 6.1 to version 7.0 also take significant time.
- Migration of a prior MES database version will move all Data\_Log\_16 and Data\_log\_48 table data to the Data\_Log table. If you previously ran the optional scripts from MES 2020 to copy the data to this new table, then you should delete the duplicate data from the Data\_log\_16 and Data\_log\_48 tables prior to upgrading so that there isn't duplicate data in the Data\_Log table after migration.
- Migration will not include any shift exception definitions from prior releases as the approach for defining these has changed. Migration of shift schedules should be reviewed in close detail. You should determine whether or not a better approach exists with the new functionality added for shift patterns with effectiveness dates and entity-specific shift exceptions.

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**Note:** If an existing database has custom indexes or keys that reference MES core tables, the database migration will fail. Prior to upgrading, drop any custom indexes and keys. They can be added back after the database migration is complete.

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**Note:** You can only perform a database Restore from an archive that was created with the version of MES that you are currently running. Restores using an archive from a previous version of MES are not supported and might fail.

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For more information on upgrading, see the *MES Installation Guide* and online help.

## Resolved Issues

This section describes important resolved issues in MES 2023, listed by their Change Request number.

IMS 539797	Create WO from Process fails if the first operation includes a specification and the next operation has multiple entities. Cannot insert duplicate key in object 'dbo.job_spec'.
IMS 560891	Shifts not changing on some entities tracking labor.
IMS 561009	Editing a final reason for a utilization event does not change the Category; it is leaving the original one.
IMS 564097	Ending multiple jobs at one time takes a long time.
IMS 564325	Stateless API StorageExec.ReduceInv() method's Dateout parameter is not saved in the MES database.
IMS 565784	MES service is timing out when executing stored procedure sp_U_Sample_UpdateStatus.
IMS 577706	Undeploy/deploy of OCO causes rolling counters to improperly increment when using input source.
IMS 620413	The latest start time and required finish time for jobs on a multi-operation process are incorrect when percent to start is configured.
IMS 626235	Can't end a job with multiple long running jobs in the database.
IMS 644716	Entity Allowable Reason Group settings are getting cleared when viewing them and then adding a new allowable reason group to a different entity.
IMS 690874	Linking an item to a process times out when thousands of entities are associated to operations in the process
IMS 739856	The Stateless API Prod.ItemReasGrpEntLink.GetReasons method is ignoring item_id.
IMS 740518	Item and item class specification are not saved when removing another one.
IMS 805244	Create Work Order from Process times out.
IMS 826084	Control rule check is skipped when multiple entities have same characteristic, there are different request times, and the later request time sample results are recorded before the earlier sample.
IMS 826093	Middleware configuration does not accept the user in

	the username@domain format.
IMS 828969	Support single sign-on when MES .NET control is used in AVEVA OMI and the auto login user property is enabled.
IMS 831519	HF L00159969 for MES 6.0: On a Terminal Server node, MES middleware periodically denies connections and fails to record or read data.
IMS 834929	HF L00159969 for MES 6.2: On a Terminal Server node, MES middleware periodically denies connections and fails to record or read data.
IMS 840286	Using Australian regional settings (dd/mm/yyyy), MES Client can create a work order but cannot update a work order.
IMS 860392	Related to HF L00153970: With 64-bit applications, the error "Client Proxy configuration settings are missing" is logged.
IMS 861467	Stored procedure sp_i_Item_Cons_AddConsPostExec allows for NULL shift start time, which makes queries of the item_cons table to be slow.
IMS 888530	IMS 860392 for 6.2: Related to HF L00153970: With 64-bit applications, the error "Client Proxy configuration settings are missing" is logged.
IMS 1052245	MES service deadlock occurs when executing stored procedure sp_U_Sample_UpdateStatus while inserting a new result at the same time.
IMS 1055331	MES Web API SampleCharLink method does not provide the UOM and number of decimals properties.
IMS 1092380	Importing an attribute item with a space character using SCC is creating a record when it shouldn't.
IMS 1148093	Continuation of IMS 826084 for Xbar-Sigma chart: Control rule check is skipped when multiple entities have the same characteristic, there are different request times, and the later request time sample results are recorded before the earlier sample.
IMS 1209336	HF 826084 and 1148093 for MES 6.2: Control rule check is skipped when multiple entities have same characteristic, there are different request times, and the later request time sample results are recorded

	before the earlier sample.
IMS 1330272	Data Editor is showing the wrong wo_id on the Utilization tab.
IMS 1398371	The migration script for migrating from MES 5.3 to 6.0 generates the error "Cannot insert duplicate key in object 'dbo.job_history'." (multiple job positions starting at the same time).
IMS 1427402	The user has an apostrophe in their name and cannot log into MES.
IMS 1434375	An OS User was moved to a group other than local Administrator and can no longer log in to MES.
IMS 1437263	The stored procedure sp_U_Job_Hour_History_RefreshQtyAndTimes takes more than a minute to complete.
IMS 1440740	ItemProd.UpdateSpecific method cannot update created_at date.
IMS 1441052	An arithmetic overflow error occurs when converting IDENTITY to data type int in the job_hour_history table (row_id now is Big_Int).
IMS 1503396	The migration script for migrating from MES 5.3 to 6.0 generates the error "Cannot insert duplicate key in object 'dbo.job_history'." (duplicate job_event records in the original database).
IMS 1516792	Related to L00153800: Ending a paused job sets the job end utilization state when another job is still running.
IMS 1555706	Inserting messages into the rejected message table fails in Russian time zones.
IMS 1560981	Creating a new shift schedule interferes with existing calendar frequencies on other entities.
IMS 1562267	Utilization Control does not update Category fields when changing downtime reason.
IMS 1569379	Quality Web API Result (Post) to update an existing record does not flag the result as superseded.
IMS 1577968	Web API for splitting the current utilization event (Split Next) generates 3 events instead of 2 events.

IMS 1585235	IMS 1555706 for 5.3: Inserting messages into the rejected message table fails in Russian time zones.
IMS 1589005	After creating a new bom_ver for a parent item that contains a sub-item, the BOM item operation links for the sub-item are removed.
IMS 1592357	Setting OEE basis calculation to 1 (KPI per job) in the oee_exec table still calculates OEE KPIs by shift.
IMS 1595508	Job_event.quantity is an integer when it should be a real.
IMS 1605342	Reducing production of production counts recorded by the OCO fails in Operator or MDM Job Management Form because a different user is registered with the production vs reduction transaction.
IMS 1613590	HF 577706 for MES 6.1: Undeploy/deploy of OCO causes rolling counters to improperly increment when using input source.
IMS 1615207	Create Work Order from Process creates only one job for a process with a single operation and multiple entities.
IMS 1626643	In a complex process with a multilevel BOM, setting a subitem as the produced item at an operation times out.
IMS 1645833	OCO with push production on reset is recording the rollover value instead of just the incremental amount on reset command when the counter has an input source from I/O that also is changing to 0.
IMS 1655505	Related to HF IMS 805244: Create Work Order from Process fails to create job BOM records.
IMS 1677808	MES Web API Swagger JSON file for MDM updated to pass body parameters in the DirectAccess API (POST) within Work Tasks web API activity.
IMS 1679737	Shift change process timing out - slow sp_U TPM_Stat_RefreshTimes.
IMS 1691063	Canceling a work order with jobs running on multiple job positions only cancels the job on job position 0.
IMS 1698736	Cannot set the produced item for an operation in a process with complex BOMs.

IMS 1729228	OEE KPI Control generates an error when the OEE value equals 0.
IMS 1735473	Occasionally sample status stays "Ready" even when results have been recorded. Similar to HF L00145710.
IMS 1747702	MES Web API to retrieve utilization records missing spare and category fields.
IMS 1758256	HF 560891 for MES 6.2: Shifts are not changing on some entities tracking labor.
IMS 1758257	HF 564097 for MES 6.2: Ending multiple jobs at one time takes a long time.
IMS 1758342	HF 539797 for MES 6.2: Create WO from Process fails if the first operation includes a specification and the next operation has multiple entities. Cannot insert duplicate key in object 'dbo.job_spec'.
IMS 1776370	Migration from MES 5.0 to 6.2 generates unique key constraint errors on job_history table.
IMS 1781018	Continuation of HF 1747702: MES Web API to retrieve utilization records missing spare and category fields.
IMS 1786715	In MES Client, the Add Frequency Link dialog stops populating when editing Sample Plans after opening and closing it multiple times.
IMS 1791526	HF 1679737 for MES 6.2: Shift change process timing out - slow sp_U TPM_Stat_RefreshTimes.
IMS 1808716	Related to HF 1691063: MES Web API does not pause jobs running on multiple job positions; it can only pause the job at job position 0. Fix also includes changes from HF 1691063.
IMS 1839546	After migration to MES 6.2, the job_hour_history table might not include production counts from AddProdPostExec if the timestamp doesn't match the job record.
IMS 1847823	With large amounts of data within an hour, Purge process times with query size set to 1 hour.
IMS 1853100	Related to HF 1691063: MES Web API does not end jobs running on multiple job positions; it can only end the job at job position 0.
IMS 1860171	Cannot set the produced item for an operation in a

	process when the operation name is greater than 10 characters.
IMS 1869589	HF 1735473 for MES 6.2: Occasionally sample status stays "Ready" even when results have been recorded. Similar to HF L00145710.
IMS 1875623	Item Inventory Add incorrectly defaults status_cd to grade_cd in the stored procedure.
IMS 1877180	MES Client crashes when opening item specifications if the user's access level is NULL.
IMS 1882057	vw_prod_events is much slower to execute compared with MES 2014.
IMS 1885754	Item consumption from a storage entity with 'Multiple lots/items stored here become indistinguishable' does not set the segment_requirement_id and segment_response_id fields in the item_cons table.
IMS 1886463	Cannot register an application with AIM to call the MES Web API through a service-to-service token.
IMS 1891768	Cannot edit entity attributes in the MES Web Portal.
IMS 1903067	A new OS user cannot use MES Web API functions in Enterprise Console if they don't log in to the MES provider or MES Client application first.
IMS 1905658	An arithmetic overflow error occurs in the stored procedure that calculates statistics when characteristics have very large sample sizes.
IMS 1905962	Cloning a job does not transfer the serial_no_source field to the cloned job.
IMS 1953213	When there are multiple OCOs with storage enabled on an engine, restarting the engine might leave some OCOs in Connecting status.
IMS 1985700	On a French OS with comma as the decimal separator, MES QualityCharacteristicDetail Report generates the error "Subreport could not be shown" even with the correct security setting.
IMS 2007701	Control rule violations are triggered with first result instead of waiting for the minimum sample size before evaluating control rules.
IMS 2011639	Utilization group spare fields are not loaded in the

	MES Client editor.
IMS 2030255	Modifying the start time of the shift schedule for the active shift to an earlier time is updating the current shift's start time, causing an overlap with a previous shift.
IMS 2060346	The JobExec.AddConsDirect method logs created_at_local in the server time zone instead of the entity's site time zone.
IMS 2070351	job_bom Spare fields are truncated when creating WO from process, splitting, or cloning a job
IMS 2072146	The JobExec.AddProd method does not populate rmLotNo and rmSublotNo.
IMS 2076937	A pulled sample transitions from In Progress to Ready when the expiration time elapses instead of transitioning to Late.
IMS 2086178	Duplicate key error when setting the produced item for a process with complex routing.
IMS 2089008	The SRO attributes RecentSampleX.SampleStatus and .ControlRuleViolation have a 10-second delay.
IMS 2141338	HF 1330272 for MES 6.2: Data Editor is showing the wrong wo_id under the Utilization tab.
IMS 2160659	Calling Pause Job with no job information (only job position) fails to pause the job.
IMS 2160919	Required finish time for jobs created from a process with two initial operations do not match.
IMS 2198972	Shift breaks are missing in the shift_to_go table for shifts that span across midnight.
L00143038	Upgrades will fail if a table with a same name but different schema exists in MES database.
L00149773	expiry_date column is recorded in local time only.
L00149839	Milliseconds are not stripped off from the created_at_local and created_at_utc fields in the item_prod table.
L00151587	Sample generation offset automatically shifts after midnight - Added new Start Delay option for Calendar Frequency.

L00152300	When MES Service is changing shifts for a site not in the same timezone as where it is running, the records in shift_history are being created either before or after they should be.
L00152573	Creating an instance of Sample Recording Object (SRO) logs unhandled errors when there is a default Area defined. The work around is to not have a default area or to ignore the messages.
L00152703	Slowness in calling the API Prod.ItemProcessLink.Add method after many items and BOMs are linked.
L00153893	The ItemInv.Add method does not accept NULL for grade and state - Method marked as obsolete and documentation improved.
L00155839	Memory leak in Internet Explorer11/MS Edge when staying on a collection page such as line collection or work order collection. This is a Microsoft known issue and is addressed in the Chromium version of Edge.
L00157474	Incorrect timestamp values are recorded to the job_event table when recording backflush consumption.
L00157709	Setting 'Log storage entity changes' is not logging changes to spare_intx in the storage_ent_transfer table.
L00158123	<p>The following properties of the imported OMI apps cannot be saved in the OMI configuration (fixed in OMI 2020 R2):</p> <ul style="list-style-type: none"><li>• CDKPIFilter and ReasonGroupColors in the Counts and Duration control</li><li>• OEEKPIFilter in the OEE KPI control</li><li>• UtilizationFilter in the Utilization control</li></ul>
L00158991	The Prod.Sublot.Rename method does not work when there is inventory.
L00159022	Using PEM attributes in the OCO objects to report production/consumption for the same jobs on different entities at the same time results in not being able to stop the second job.
L00159062	Jobs running for over a month take a long time to end and can time out.

L00159144	Users are unable to log in to MES Client when one of the OS Groups to which the user belongs is deleted.
L00159262	HF L00159062 for MES 6.1: Jobs running for over a month take a long time to end and can time out.
L00159359	Pausing/suspending a job in the MES Client Job Queue does not update certain fields in the job and job_history tables.
L00159432	Deploying OCO with a PEM instance that references 'MyContainer' causes warnings in the logger.
L00159500	OCO Job attributes are stuck in the initializing state after a reboot.
L00159604	MES Client APR will crash if an archive job is created and then the system parameter for the Archive Root Directory is changed.
L00159669	When selecting an entity class in MES Client, the attributes are not updated.
L00159775	Related to CR L00159262: Changing the utilization event for an entity that has been in the same state for over a month takes 1 minute.
L00159891	When production is recorded during the first seconds of a new shift (shift change in progress), the shift information logged is for the previous shift, not the new one.
L00159969	On a Terminal Server node, the MES middleware periodically denies connections and fails to record or read data.

## Known Issues

This section describes important known issues in MES 2023, and in System Platform that affect MES.

### System Platform 2020 R2 SP1 and MES 2020 Patch 2 Upgrade Issues

If there are issues when upgrading from System Platform 2020 R2 SP1 and MES 2020 Patch 2 , first ensure that you follow the correct sequence to upgrade your system:

1. Upgrade System Platform to 2023; do not connect to the System Platform IDE.
2. Upgrade MES to 2023.
3. Start the System Platform IDE to migrate the galaxy.

4. Follow MES steps in the *MES Installation Guide* or help to import updated MES .NET Controls, application objects, and scripts.
5. Following completion of the upgrade, perform a reboot.

If there is still have an issue with deploying the objects or View app with errors related to the ArchestrA.Visualization components, try restarting the AVEVA Service Manager service.

Regarding IMS 2075532 (Unable to deploy the remote Windows platform once System Platform 2020 R2 SP1 is upgraded to System Platform 2023): If, during deployment, an error stating that the remote node's user ID or password doesn't match the GR node, try re-registering the transport component on the remote node as described below:

1. In a command prompt, go to **C:\Program Files (x86)\ArchestrA\Framework\Bin**.
2. Run **aaDCOMTransport.exe /REGSERVER**.

## Work Tasks 2023 Connector for System Platform

If the Work Tasks Connector for System Platform is installed in a Galaxy with any objects created from the Application Object Toolkit (AOT), then these objects will not show the **Workflows** tab in the System Platform IDE and will log an error in the OCMC Logger. All three of the MES application objects are created with the AOT and will not show the **Workflows** tab in the IDE.

The workaround is to use a standard user-defined object for configuring the **Workflows** tab.

The error message is:

*UIThreadExceptionHandler: Object reference not set to an instance of an object*

Additional errors might be logged related to *ArchestrA.Workflow.IDEExtension.Extensibility.xxx*.

This issue will be addressed in either an updated release of the Work Tasks Connector for System Platform or the next release of MES.

## MES BI Gateway Reports: Detection of Utilization Event Deletion or Modification

The MES BI Gateway Reports model cannot detect utilization event deletion or duration modification. The BI Gateway service is dependent upon a detection method for notification of changes to records. The MES model uses the `last_edit_at` field in the MES database for its detection method. When a utilization event is deleted by modifying an existing event's duration or inserting a new event to cover an existing event, there is no option to notify the BI Gateway Service. Similarly, if an event's duration is changed but not its start time, the `last_edit_at` column is not modified since the duration is not stored in the new `Util_History` table, resulting in no notification to the BI Gateway Service. There is no workaround for this issue.

## Known Issues for MES

The following table lists the known open change requests for MES, listed by their change request number.

<b>IMS 1809089</b>	Related to HF 152505: <code>sp_BOM_Item_Oper_Link_Chk</code> improvements when there are many BOM versions and items linked to a process.
<b>IMS 2147744</b>	MES Web API for Utilization Grid does not populate

	some fields such as raw_reas_cd, failure, spares, and categories.
<b>IMS 2150752</b>	Connection errors continue to be logged every few seconds when the MES Middleware is down and MES objects are undeployed. These will end when MES Middleware is restarted or the engine is undeployed.
<b>IMS 2156935</b>	Reducing item consumption to zero should not remove the record until the ERP quantity is also reduced to zero.
<b>IMS 2173510</b>	When MES is installed in a system with System Platform, running the MES Repair operation will cause you to be prompted to specify the location of the installation media. Use the <b>Browse</b> button to navigate to and select the MES <b>setup.exe</b> file in the MES installation software.
<b>IMS 2175840</b>	Continuation of IMS 2147744: Changing raw_reas_cd does not get recorded in the database.
<b>L00131983</b>	Trying to start a job on more than one machine causes an error inserting into the Prod_Rate_History table on very specific scenarios.
<b>L00132902</b>	If multiple items to be produced in a process have a common sub-item to be produced in BOM #1 and BOM #2, then every time that common sub-item is marked as "Set as Produced Item" on BOM #1 for an operation, the same sub-item will be marked as produced on that operation for BOM #2.
<b>L00135404</b>	With the OS language set to Russian, the Entity OEE targets set in MES Client will generate a validation error but still save correctly.
<b>L00137118</b>	During migration of the MES database from MES version 4.5 SP1 to 5.0 SP1, there is an error associated to conflict with check constraint CK_Sample_Size. MES 2014 (version 5.0) and above prohibit this invalid configuration. The user must correct the bad data in the database and then run the migration again.
<b>L00143414</b>	Launching of the Operator following a fresh install fails with an error dialog that states <i>Unable to load DLL 'PEGRP32C.DLL'</i> . This is an intermittent issue that can be resolved by rebooting the machine after installation.

## Known Issues for System Platform and Common Components That Affect MES

The following table lists the known open change requests for System Platform that affect MES, listed by their change request number.

<b>IMS 2178106</b>	System Platform IDE 2023 becomes sluggish and unresponsive when creating many instances of the MES Operations Capability Object (OCO) with PEM enabled and when running Entity Model Builder. Will be fixed in SP 2023 R2.
<b>L00117794</b>	Tooltip text on the MES Button Bar .NET control buttons is not shown when running the control in InTouch. This is an InTouch issue; fixed in OMI 2020.
<b>L00138837</b>	AppEngine can crash due to the calls made to the FactMES API dlls even when using try/catch. Specific to Nullable data types. Will not be fixed in System Platform, so recommendation is to continue using the wrapped MES API DLLs in System Platform scripting.
<b>L00140001</b>	On an OS using a comma separator instead of a period separator for numbers, when the System Platform IDE is first opened, the MES objects will display the period separator instead of the comma separator. If you open another editor, the MES objects will display correctly. This is a System Platform IDE issue.
<b>L00144202</b>	After failover, selecting an OCO object with PEM enabled in the Object Viewer logs many error messages from the BaseRuntimeComponentServer component when reading a PEM extended attribute's data type property.  This can be corrected by restarting the hosting engine of the object.
<b>L00153087</b>	SampleViewer .NET control does not honor RequireEntityLogOn property when used in an InTouch Frame window. Request InTouch Hotfix L00153571 for InTouch 2017 Update 2 to be released for your version of InTouch.
<b>L00154309</b>	Modifying a deployed OCO or SRO that adds or removes an object-generated attribute causes errors to be logged every scan (object reference not set) even though the object still functions correctly.  Request AOT HF L00154664 for System Platform 2023.
<b>L00158082</b>	Importing of the MES folder for OMI can generate a warning during the import and log a message that it

was unable to find referenced file system.windows.forms. Instead of importing the folder, MES 2023 includes an **MESOMIControls.aapkg** file that does not generate any warnings.

## MES Documentation

The MES 2023 documentation set includes the following:

### **MES Deployment Guide**

Provides guidance on deploying a MES solution.

### **MES Virtual Environment Implementation Guide**

Provides information to assist with implementing MES in a virtualized environment.

### **ReadMe**

Provides information about software and hardware requirements, known issues, licensing, and documentation.

### **MES Installation Guide and online help**

Provides information about installing MES applications.

### **MES Client User Guide and online help**

Provides information about customizing and maintaining the plant floor information.

### **MES Dynamic Routing User Guide**

Provides information required to set up dynamic routing of operations through a process defined in MES.

### **MES .NET Controls Developer Guide**

Provides information about the properties and methods of the MES .NET controls for use in custom applications and System Platform graphics.

### **MES Application Object (OCO, UCO, SRO) Help**

Provides information about run-time behavior, configuration, and run-time attributes of UCO, OCO, and SRO application objects. This help is accessed from the Object Editor **Help** menu in the System Platform IDE.

### **Operation Capability Object (OCO) User Guide**

Provides information about installing, configuring, and using the Operations Capability Object to track production transactions against equipment.

### **Sample Recording Object (SRO) User Guide**

Provides information about installing, configuring, and using the Sample Recording Object to collect and store values for samples.

### **Utilization Capability Object (UCO) User Guide**

Provides information about installing, configuring, and using the Utilization Capability Object to collect equipment performance data.

### **MES Entity Model Builder User Guide**

Provides information about creating entities from the System Platform equipment model.

### **MES Stateless API Reference online help**

Provides information about using the Stateless API within the System Platform IDE to develop and customize System Platform scripts.

**MES Stateful API Reference online help**

Provides information about using the Stateful API within the System Platform IDE to develop and customize System Platform scripts.

**MES Web API V1 Reference online help**

Provides information about using the MES Web API V1 to develop custom applications.

**MES Web API V3 Reference online help**

Provides information about using the MES Web API V3 to develop custom applications.

**MES Operator User Guide**

Provides information about executing production processes at the plant floor using the Operator application.

**MES Web Portal User Guide and online help**

Provides information about using the web browser-based MES Web Portal to customize and maintain the MES system and execute jobs at the plant floor.

**MES Middleware User Guide**

Provides information about how to configure the MES middleware and what regularly scheduled tasks it performs in the MES system. Also provides information about how to use middleware extensibility hooks to perform custom actions before or after a specific middleware event is executed.

**MES BI Gateway Reports User Guide**

Provides information about running and viewing MES BI Gateway Reports.

**MES Help**

Provides online information about MES Operator.

The MES 2023 product library includes a set of Portable Document Files (PDFs) located in the **Docs** folder in the MES installation folder. You need Adobe Reader installed on your computer to view the MES documentation. You can download the latest version of Adobe Reader from the Adobe Corporation web site.

After installing Adobe Reader, double-click a PDF file to view the book with Adobe Reader. You can also open a book with the Adobe Reader **Open** command from the **File** menu.

The MES installation instructions are located in the root folder of the MES installation folder as a PDF file and an online help file. You can view these instructions by clicking **Help** as you start the MES installation procedure.



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