MES->

* MES is a complex software application that can track, monitor and manage just about every manufacturing process, system, operation and function inside multiple facilities to provide manufacturers with critical and detailed information to run their business. MES integration with other software systems optimizes data management across manufacturing organizations.
* containing every piece of relevant operational information from incoming raw materials to processes, the mixing of ingredients, measurements, cost-saving efforts, product changes and real time monitoring on everything happening inside a factory's walls.
* MES software's greatest value is also one of its most difficult challenges: It's complexity is such that one MES system can't be all things to all manufacturers. A chemical company MES system, for example, will require different processes than will an automaker or a large-scale bakery. Each system must be configured and adapted for whatever a company makes.
* MES is often integrated with other key business IT systems, including enterprise resource planning (ERP) and supply chain management (SCM) to enable companies to watch over all facets of their operations. For example, ERP warehouse management system (WMS) software tracks orders that come into the warehouse through the order management system so they are filled accurately and on time.
* Many applications today are web-based and can be used through standard web browsers for ease of use and accessibility from any location. This makes them very flexible and powerful for users.

A well-rounded, robust manufacturing execution system (MES) includes functions that are crucial to facilities such as:

* Data Collection - Input of information whether it is manual or automatic, which provides a concise evaluation of the entire process.
* Management of Labor - Manage the best qualities and features of employees and equipment and utilize them in the most advantageous areas.
* Product Tracking - Easily oversee and manage the process within production in real time.
* Quality Control - Control the quality of the manufacturing process and allow for production variation and enhancement.
* Performance Analysis - The system performs analysis on the entire process and locates areas in which productivity is lacking. This enables the system to be able to move closer to the efficiency point as the process is cycled.
* Maintenance Management - Plan for inevitable maintenance without hindering production, enabling a smooth production flow.

Benefits of a Manufacturing Execution System (MES)

Various benefits of a manufacturing execution system includes the following:

* Reduce Manufacturing Cycle Time
* Reduce Work-In-Process
* Reduce Lead Time
* Improve Product Quality
* Improve Customer Service
* Reduce Setup Cost

Advanced Planning and Scheduling (APS) with Manufacturing Execution Systems (MES)

[Advanced planning and scheduling software](https://www.planettogether.com/free-aps-advanced-plannning-scheduling-software-trial) offers as an extension to manufacturing execution systems and can take your production facility to the next level. Through various benefits and capabilities, advanced planning and scheduling permits you to maintain your competitive advantage by reducing cost and enhancing production within your operation. Various benefits of APS include the following:

* Improved Delivery Time
* Profit Boost
* Reductions in Inventory
* Six Month ROI

SAP MES (Manufacturing Execution Systems): Managing And Monitoring Production Processes: How To And Best Practices

The [MES](https://www.apprisia.com/sap-scm/sap-mes-integration/index.html) software are adopted by many customers for managing the production and material flow on the shop floor. In this blog, we look at the integration between SAP and the MES software.

MES stands for Manufacturing Execution System which is used to manage the operations; for example, production order, process data, work instruction storage etc. It is related to the manufacturing and operations. The main purpose of any [MES system](https://www.apprisia.com/sap-scm/sap-mes-integration) is to gain visibility, flexibility in operations and manage the supply chain effectively along with consistent documentation. In the market, there are numerous MES systems specific to industry type, product nature and manufacturing complexity.

In general, MES is vendor specific and as per explicit need of the customer. MES systems are independent of [ERP systems](https://www.apprisia.com/sap-r3/sap-functional-services-erp-consultant) and are “add-on” software. Usually, it is difficult to find all our requirements in any ERP suite that can manage the complex manufacturing flow of products; in such situations, specialized software products such as MES are suited, where ERP functionalities are not sufficient to run the operations. Indeed, MES assists in achieving the multifaceted requirements of the organization.

At the highest level, MES needs integration between the ERP and shop floor automation. SAP maintains the record of materials, BOM, routings and orders; the MES maintains the records/transactions such as WIP (work in progress). For implementing the MES, the consultant has to perform detailed analysis of MES requirements such that they can be mapped with the manufacturing environment. The consultant has to perform the analysis of the integration with SAP PP since there is overlap of functionality offered by SAP and MES software.

MES plays a major role when there are many shared resources or work centers, complex routings (master recipes) and substantial effort to manage the production of material into finished product. MES increases operation excellence and manages asset and its utilization, which in turn reduces overall operational cost of the business.

MES provides capabilities such as plant data collection, production process quality management, order tracking; additionally, the MES system provides detailed scheduling of operations, production process management, performance monitoring, resource allocation, manpower allocation and management control of engineering documents. Resource allocation can be manual or automated in MES. There is real time exchange of messages between the [SAP ERP](https://www.apprisia.com/sap-r3/sap-functional-services-erp-consultant) and MES system regarding various facets of the manufacturing operations. Let’s say in case of production management, one can easily download production schedule from SAP to MES system, upload production confirmation/consumption to SAP.  In case of asset management in MES, we can download equipment list from SAP and upload equipment runtime data to MES.

ISA (Instrumentation, Systems, and Automation Society) S95 standard describes the connectivity between ERP and the MES system; this includes MES functionality and database schema, message formats between application systems etc.

**Integration**  
There are two major integration options for MES integration with SAP

1. **SAP xMII** (Manufacturing Integration and Intelligence) : SAP xMII facilitates real-time transactional integration between plant shop floor and enterprise (SAP ERP) systems out-of-the box. By using the schemas available in the xMII repository, we can perform faster integration between xMII and the MES systems conforming to the IS95 industry standard interfaces.
2. **SAP PI** : This is the integration middleware platform within the [SAP NetWeaver](https://www.apprisia.com/sap-netweaver-development-services) suite. We can use [SAP PI](https://www.apprisia.com/sap-netweaver/sap-pi-developer) to exchange information between the MES and SAP ERP products.

### **From Point Solutions to Enterprise Platform: a modular, expandable MES solution to help you achieve Manufacturing Excellence**

The Shopfloor-Online MES software platform comprises 26 independent modules across the 4 main areas of manufacturing operations, as defined by the ISA-95 model.

It is possible to select only the modules needed to meet an initial requirement, but over time more modules can be added as the scope increases, to build a comprehensive Enterprise MES system

### [**Production Operations**](https://www.lighthousesystems.com/mes-software#modules_accordion_2-block-0)

**[Scheduling](https://www.lighthousesystems.com/mes-software/production-scheduling)**[**Scheduling**](https://www.lighthousesystems.com/mes-software/production-scheduling)

Plan production orders, determine start and end dates and assess capacity and ability to meet deadlines. Communicate the plan to production with real-time feedback as production executes.

**[Job Tracking](https://www.lighthousesystems.com/mes-software/job-tracking)**[**Job Tracking**](https://www.lighthousesystems.com/mes-software/job-tracking)

Production tracking for batch and discrete manufacturing orders. Track production order progress through the factory for each manufacturing operation or for each batch process.

**[Downtime](https://www.lighthousesystems.com/mes-software/downtime-analysis)**[**Downtime**](https://www.lighthousesystems.com/mes-software/downtime-analysis)

Machine downtime is recorded by direct connection to the PLCs controlling production processes (or manually where such connections are not possible); downtime analysis and reporting then identifies opportunities for improvement.

**[Production Counting](https://www.lighthousesystems.com/mes-software/production-counting)**[**Production Counting**](https://www.lighthousesystems.com/mes-software/production-counting)

Record production quantities either manually at the end of the production run, or in real-time, by picking up counts from the production lines and equipment. Calculate KPIs such as production efficiency and actual cycle times.

**[Waste](https://www.lighthousesystems.com/mes-software/manufacturing-waste)**[**Waste**](https://www.lighthousesystems.com/mes-software/manufacturing-waste)

Record production waste & scrap manually or automatically. Analyse waste with real-time data capture to help reduce losses.

**[OEE](https://www.lighthousesystems.com/mes-software/oee-software)**[**OEE**](https://www.lighthousesystems.com/mes-software/oee-software)

Collect and analyse production performance data in the software module that calculates OEE for each production process. Improve production efficiency and accountability.

**[Line Log Book](https://www.lighthousesystems.com/mes-software/line-log-book)**[**Line Log Book**](https://www.lighthousesystems.com/mes-software/line-log-book)

Improve communications across all groups within manufacturing, e.g. hand-over between crews on shift change, team and management reporting, operators back to planning.  Improve traceability.

**[Labour](https://www.lighthousesystems.com/mes-software/labour-tracking)**[**Labour**](https://www.lighthousesystems.com/mes-software/labour-tracking)

Track where labour hours have been spent. Define target manpower on the product routing. Control costs. Improve exception management. Support traceability.

**[Workflow](https://www.lighthousesystems.com/mes-software/workflow)**[**Workflow**](https://www.lighthousesystems.com/mes-software/workflow)

Model the execution of the manufacturing process in the MES. Identify all the steps that should be followed, capture the progress of the job as it executes and keep a detailed record of the production process.

### [**Quality Operations**](https://www.lighthousesystems.com/mes-software#modules_accordion_2-block-1)

**[Quality](https://www.lighthousesystems.com/mes-software/quality-management)**[**Quality**](https://www.lighthousesystems.com/mes-software/quality-management)

Quality management software allowing data to be collected at the line or in the lab. Issue reminders to operatives, enforce the quality control system, respond to issues and measure conformance.

**[SPC](https://www.lighthousesystems.com/mes-software/spc-analysis)**[**SPC**](https://www.lighthousesystems.com/mes-software/spc-analysis)

The tools to measure process variation, understand process capability and reduce the impact of process variation. Visualise SPC charts and add SPC data to conformance certificates.

**[Process Monitoring](https://www.lighthousesystems.com/mes-software/process-monitoring)**[**Process Monitoring**](https://www.lighthousesystems.com/mes-software/process-monitoring)

Monitor process parameters with the built-in historian of Shopfloor-Online MES. Chart data. Gain deeper insight into the process. Enhance traceability.

**[Links to Documents](https://www.lighthousesystems.com/mes-software/links-documents)**[**Links to Documents**](https://www.lighthousesystems.com/mes-software/links-documents)

Quickly access all the documents you need e.g. SOPs, CAD drawings, product specification documents, quality procedures. Ensure everyone is working from the latest revision.

**[Concerns & CAPA](https://www.lighthousesystems.com/mes-software/concerns-capa)**[**Concerns & CAPA**](https://www.lighthousesystems.com/mes-software/concerns-capa)

Speed up the resolution of non-conformances. Record, track and document non-conformances through to resolution.

**[Customer Complaints](https://www.lighthousesystems.com/mes-software/customer-complaints-management)**[**Customer Complaints**](https://www.lighthousesystems.com/mes-software/customer-complaints-management)

Record, investigate and manage customer complaints. Improve the speed of resolution. Develop accountability and best practice. Improve customer satisfaction.

**[Supplier Complaints](https://www.lighthousesystems.com/mes-software/supplier-complaints-management)**[**Supplier Complaints**](https://www.lighthousesystems.com/mes-software/supplier-complaints-management)

Drive greater suppliers’ performance. Record, investigate and manage supplier non-conformances. Create a paperless record to support the complaint. Manage claims.

### [**Inventory Operations**](https://www.lighthousesystems.com/mes-software#modules_accordion_2-block-2)

**[Inventory Management](https://www.lighthousesystems.com/mes-software/inventory-management)**[**Inventory Management**](https://www.lighthousesystems.com/mes-software/inventory-management)

Create, track and manage lots of materials/handling units, from raw materials, to semi-finished and finished goods to enable traceability.

**[Label Printing](https://www.lighthousesystems.com/mes-software/label-printing)**[**Label Printing**](https://www.lighthousesystems.com/mes-software/label-printing)

Automatically print bar-code labels on your own templates. Use labels to implement traceability.

**[Traceability - Consumption](https://www.lighthousesystems.com/mes-software/traceability-consumption)**[**Traceability - Consumption**](https://www.lighthousesystems.com/mes-software/traceability-consumption)

Track lot traceability as materials are consumed in the manufacturing process. Improve stock accuracy and meet traceability requirements.

**[Build Traceability](https://www.lighthousesystems.com/mes-software/build-traceability)**[**Build Traceability**](https://www.lighthousesystems.com/mes-software/build-traceability)

Ensure traceability of manufacturing operations at serialised parts level through to finished goods. Achieve compliance with inventory updates in real-time.

**[Warehouse - Logistics](https://www.lighthousesystems.com/mes-software/warehouse-logistics)**[**Warehouse - Logistics**](https://www.lighthousesystems.com/mes-software/warehouse-logistics)

Manage in-bound & out-bound deliveries. Capture traceability data at shipping. Manage internal material movement orders (replenishment) and deliveries. Track orders and materials in the warehouse. Link with the ERP.

### [**Maintenance Operations**](https://www.lighthousesystems.com/mes-software#modules_accordion_2-block-3)

**[Asset Register](https://www.lighthousesystems.com/mes-software/asset-register)**[**Asset Register**](https://www.lighthousesystems.com/mes-software/asset-register)

Improve Enterprise Asset Management. Manage manufacturing assets through their life cycle.

**[Maintenance](https://www.lighthousesystems.com/mes-software/maintenance-management)**[**Maintenance**](https://www.lighthousesystems.com/mes-software/maintenance-management)

Optimise maintenance activities: create maintenance procedures. Plan and manage maintenance work. Record work done, spare parts used.

**[Repairs](https://www.lighthousesystems.com/mes-software/repairs-management)**[**Repairs**](https://www.lighthousesystems.com/mes-software/repairs-management)

Speed up response to breakdowns. Manage repair work. Enforce procedures.

**[Tool Management](https://www.lighthousesystems.com/mes-software/tool-management)**[**Tool Management**](https://www.lighthousesystems.com/mes-software/tool-management)

Monitor tool life. Track tools used in the process. Develop detailed tool histories. Make better decisions regarding tool use and maintenance.

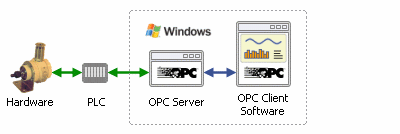
**[Energy Management](https://www.lighthousesystems.com/mes-software/energy-management)**[**Energy Management**](https://www.lighthousesystems.com/mes-software/energy-management)

Record energy and resource consumption. Know where your energy goes. Reduce energy losses.

**PLC and OPC server->**

**->OPC SERVER->**

OPC [[**1**](https://opcdatahub.com/WhatIsOPC.html#note1)] is a software interface standard [[**2**](https://opcdatahub.com/WhatIsOPC.html#note2)] that allows Windows programs to communicate with industrial hardware devices.



OPC is implemented in server/client pairs. The OPC server is a software program that converts the hardware communication protocol used by a PLC [[**3**](https://opcdatahub.com/WhatIsOPC.html#note3)] into the OPC protocol. The OPC client software is any program that needs to connect to the hardware, such as an HMI [[**4**](https://opcdatahub.com/WhatIsOPC.html#note4)] . The OPC client uses the OPC server to get data from or send commands to the hardware.

The value of OPC is that it is an open standard, which means lower costs for manufacturers and more options for users. Hardware manufacturers need only provide a single OPC server for their devices to communicate with any OPC client. Software vendors simply include OPC client capabilities in their products and they become instantly compatible with thousands of hardware devices. Users can choose any OPC client software they need, resting assured that it will communicate seamlessly with their OPC-enabled hardware, and vice-versa.

The typical OPC connection scenario is a single server-client connection on a single computer as illustrated above, but there are more possibilities. For example, you might need to:

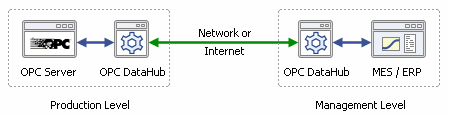
* Connect an OPC client to several OPC servers. This is called [**OPC aggregation**](https://opcdatahub.com/Features/OPC_Aggregation.html).
* Connect an OPC client to an OPC server over a network. This can be done with [**OPC tunnelling**](https://opcdatahub.com/Features/OPC_Tunnelling.html).
* Connect an OPC server to another OPC server to share data. This is known as [**OPC bridging**](https://opcdatahub.com/Features/OPC_Bridging.html).

The OPC DataHub is uniquely designed to do all of these tasks. It is a combination OPC server and OPC client that supports multiple connections. Thus it can connect to several OPC servers simultaneously, for OPC aggregation and OPC bridging. Two OPC DataHubs can mirror data across a TCP network to provide OPC tunnelling.

**OPC to MES and ERP systems**

**Bridging the gap between production and management systems**

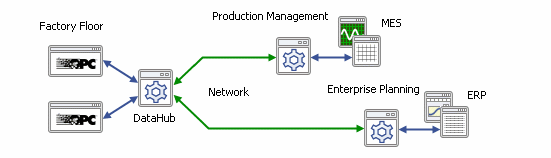
Managers have long known that valuable information resides in the systems that run their production facilities. The problem has often been that both worlds operate in isolation, with little or no connection between them. The OPC DataHub provides a gateway for managers to make plant data available on corporate networks, so it can be integrated into Management Execution Systems (MES) and Enterprise Resource Planning (ERP) systems.



* Integrate live plant data with management systems for accurate scheduling and performance monitoring.
* Provide a reliable gateways between management level networks and plant floor control networks.
* Supports direct access to ODBC compliant management systems.
* DataHub API for C++, Java and .NET enable easy integration with existing systems.

# OPC to MES/ERP

You can use the OPC DataHub to put your data into an MES (Manufacturing Execution System) or ERP (Enterprise Resource Planning) environment.



This might involve [**OPC aggregation**](https://opcdatahub.com/Docs/dho-opcaggregation.html) to consolidate factory floor data, [**OPC tunnelling**](https://opcdatahub.com/Docs/dho-opctunnelling.html) to get the data past firewalls, and [**OPC to a web browser**](https://opcdatahub.com/Docs/dho-webserverhowto.html), [**OPC to Excel or DDE**](https://opcdatahub.com/Docs/dho-opctoexcelanddde.html), [**OPC to ODBC**](https://opcdatahub.com/Docs/dho-logging.html) or custom programs using the [**DataHub APIs for C++, Java, and .NET**](https://opcdatahub.com/Docs/bookadc.html) to put the data where it can best be used by the MES or ERP system.

## What is OPC DA?

OPC DA stands for [OPC Data Access](https://www.matrikonopc.com/opc-server/opc-data-access.aspx). It is an OPC Foundation specification that defines how real-time data can be transferred between a data source and a data sink (for example: a PLC and an HMI) without either of them having to know each other’s native protocol.

## Why is OPC DA so popular? How is it different than previous protocols?

The [OPC DA Client/Server architecture](https://www.matrikonopc.com/opc-server/opc-client-server.aspx) was the first architecture defined by the OPC Foundation. Before OPC DA, vendors’ products (devices, PLCs, HMIs) required any device or applications connecting to them to have a “custom driver” that translated between the third party connection and the product in question. There were many problems associated with custom driver based communications; some of these most common ones were: high cost, proprietary technology that tied users to a particular vendor, hard to configure and maintain because each custom driver had its own way of doing things, hard to keep up-to-date because of the constant release of new devices and applications. In contrast, OPC DA made it possible to connect to any real-time data source without a custom connector written specifically for the data-source/data-sink pair. Hence, reads and writes could be performed without the data-sink having to know the data-source’s native protocol or internal data structure.

**->PLC->**

A PLC or Programmable Logic Controller is a type of industrial digital computer which can be used to control a manufacturing process or machine.

How does it do it?

A PLC, like a computer has a central processing unit or CPU, memory for the program & data and a communications interface. Additionally and more importantly, it has an interface to analog and digital inputs and outputs.

PLCs span a wide range of sizes, but all contain six basic components:

* processor or central processing unit (CPU);
* rack or mounting;
* input assembly;
* output assembly;
* power supply;
* programming unit, device, or PC/software

## Benefits of [ERP Software](http://www.oatesco.com/erp) Integration with Shop Floor PLC System

As a manufacturer, you understand the importance of finding new ways to save time on labor and money on material while increasing productivity. The main goals for any business when implementing ERP software (enterprise resource planning system) are to cut costs and increase performance.  ERP software helps businesses accomplish this with the following capabilities:

* reduced operational costs
* increased company profits
* improved ease of use with process automation
* more accurate data with real-time information
* better management of company assets, inventories, capacity, schedules, forecasts, orders, etc.

Economic realities are making ERP software implementations almost compulsory for every business in every industry. However, manufacturing is one of the sectors that benefit the most from the use of ERP software. This is because ERP software provides manufacturers with tools and functions that make daily work easier, faster, and more accurate.

### [**ERP software**](http://erpvar.com/erp-software/) **helps manufacturers with the following capabilities:**

* improved product costing
* sales and operations planning
* demand management
* material requirements planning
* long-term planning
* production order creation
* capacity requirements planning
* production execution, etc.

In a manufacturing environment, the ideal set up of an ERP software system is where business operations are integrated with the manufacturing processes that take place on the shop floor or production line. All too often, the shop floor programmable logic controller (PLC), which is an automated control for plant floor machinery lines is not connected to the ERP system.

The shop floor has numerous entities, devices, and equipment that generate different types of data; it is safe to assume that a big percentage of that data is essential for company management.

### **Shop Floor PLC systems often gather data such as:**

* time per job
* time per machine
* idle times and downtimes
* setup and cycle times
* number of units produced or rejected

Considering how important this data would be to a manufacturer, it’s understandable as to why combining the two systems would be beneficial.  Combining systems, however, is no easy task, and you might be thinking “Why can’t we just take the data from the PLC directly and avoid the hassle of integrating two systems?”

And the answer is: because the PLCs cannot store data. They collect data and give real-time access to plant-wide information, but they do not keep a record of the data.

Another answer is: because unlike ERP systems, PLC systems can’t convert the data into comprehensive reports relating to production or break the data down into useful information for the management, which improves the decision making process.

**WAREHOUSE🡪**

The warehouse needs to be tightly integrated with the factory. Raw materials need to flow in; finished goods need to flow out. When a factory is already managing inventory at a lot or handling unit level in the manufacturing execution system, it makes perfect sense to extend into the warehouse. Use the **Warehouse – Logistics software** module to:

* Manage in-bound deliveries
* Manage movement orders to replenish materials consumed
* Make internal deliveries to production processes more efficient
* Manage shipments made in the warehouse
* Link with the ERP system

**->FEATURES->**

#### **Manage in-bound deliveries**

* Download from ERP, expected in-bound deliveries from suppliers
* Deliveries can be at the level of individual handling units (e.g. pallets, containers, boxes, crates). This level of detail may come though EDI when your suppliers send you details of materials shipped, including traceability information
* Unload the goods and using scanners, validate the goods received against the planned in-bound orders
* Confirm in-bound deliveries back to ERP
* Assign new lot numbers to uniquely identify each handling unit (container, pallet…) of incoming goods so that materials can be tracked through the facilities and processes.
* With the Inventory module, move the incoming goods to locations/bins and manage the quality state (e.g. isolations)

#### **Manage out-bound deliveries**

* Download from the ERP system expected out-bound deliveries
* Fork lift drivers select from prioritised shipping lists and then work through picking lists, scanning the handling units as the goods are loaded onto transport
* Validate the out-bound order is correct and complete
* Capture traceability data automatically
* Confirm out-bound deliveries back to ERP

#### **Manage warehouse and local stores**

* Track all materials in the factory warehouse or local stores
* Provide dashboards showing summaries of stock levels, expected movements
* Create hierarchy inventory and apply logic to all items in the hierarchy
* Quarantine pallets and their entire content, with one bar-code reading

**BENEFITS->**

* **Reduce WIP** – pull materials through the factory with replenishment orders, automatically generated when materials are consumed. Only create semi-finished goods for what is needed.
* **Stock control** – provide greater control of inventory, down to handling unit level
* **Increase efficiency** – better organise shipping and internal deliveries
* **Traceability** – end-to-end traceability at handling unit and serialised part level (materials, WIP and Finished Goods)
* **Reduce the application landscape** – avoid third party warehouse management systems with the extra support, infrastructure and interfacing needs they bring
* **Business continuity** – protect operations from ERP outage with a responsive and locally available MES application

**RELATED MODULES->**

To enable the **Warehouse – Logistics** functionality of Shopfloor-Online, the [**Inventory module**](https://www.lighthousesystems.com/mes-software/inventory-management) is required in order for the system to know inventory before it is used. Get more value from the module by using it in conjunction with other applications of **Shopfloor-Online MES**:

* [**Traceability – Consumption**](https://www.lighthousesystems.com/mes-software/traceability-consumption) and [**Build Traceability**](https://www.lighthousesystems.com/mes-software/build-traceability) - to trigger replenishment orders as materials are consumed
* [**Label Printing**](https://www.lighthousesystems.com/mes-software/label-printing) - to produce new bar-code labels and identify goods when received