Point85
Overall Equipment Effectiveness (OEE) Getting Started Guide

Version 3.10.3

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INTRODUCTION

This document is a tutorial on how to get started with a minimal system to collect and display OEE data. For a description of all the capabilities offered by Point85 OEE, please refer to the *Point 85 Overall Equipment Effectiveness (OEE) User Guide*.

INSTALLATION

PREREQUISITES

Prior to installing the OEE applications, a 64-bit Java 11+ JRE and JavaFX must be installed. The JAVA_HOME environment variable must be set. The Oracle Java distribution and Zulu Community build of OpenJDK/JFX has been used for development on Windows. JavaFX can be downloaded from Gluon at https://gluonhq.com/products/javafx/. The JAVAFX_HOME environment variable must be set.

After installation of the JRE, a database from one of the following vendors and versions (or later) must be installed:

- Microsoft SQL Server 2012 or SQL Server Express
- Oracle 12c or Express Edition XE
- MySql 8
- PostgresQL 11
- HyperSQL (HSQLDB) 2.4.1

For the purposes of a quick start, a default initialized HSQLDB database is installed in the /database/hsql/data/oeedb folder and is named "OEE". Run the Windows shell script "run-hsqldb-server.bat" or Unix bash script "run-hsqldb-server.sh"[1] to launch a local HSQLDB server connected to the OEE database in the PUBLIC schema. The default JDBC connection string for the JavaFX desktop applications. Using HSQLDB is the quickest way to get the Point85 applications up and running.

[1] Unix bash commands first require making the file executable (chmod +x <filename>.sh) then executing it from the terminal (./<filename>.sh &). In addition, the bash script contains newline characters from Windows editors. These can be removed by installing and executing the dos2unix utility.

Once the Point85 applications are running, you can use the Designer application to restore the example database in the OeeDemoDB.p85x backup file. The restore functionality is found in the Tools menu.

APPLICATIONS

The desktop applications are packaged in the oee-<version>.zip file in the latest Git release link at https://github.com/point85/OEE-Designer/releases. Download the oee-<version>.zip file and expand the archive into the following folder structure:

- root: oee-apps-<*version*>.jar (Designer, Monitor, Collector, Operator and Tester apps), oee-collector-<*version*>.jar (data collector in-process app), run-collector-app.bat (example Windows shell script for executing the data collector test UI), run-designer-app.bat (example Windows shell script for executing the designer application), run-monitor-app.bat (example Windows shell script for executing the monitor app), run-tester-app.bat (example Windows shell script for executing the tester application) and run-operator-app.bat (example Windows shell script for executing the operator application) . The corresponding Unix bash scripts have the same file name with the ".sh" extension. The program arguments are:
    - [0]: application id (e.g. "DESIGNER")
    - [1]: JDBC connection string
    - [2]: user name
    - [3]: user password
    - [4]: optional name of a collector if more than JVM is running on the same host machine. Only applies to a collector application.
- config > logging: log4j2.xml configuration file
- config > security: SSL truststore and keystore files
- database
    - import: example CSV import files (reasons.csv and materials.csv)
    - demo: example database backup OeeDemoDB.p85x. This demo database can be used as a starting point for exploring Point85 OEE.
    - mssql: create_tables.sql and create_event_table.sql - SQL scripts to create the Microsoft SQL Server database tables
    - oracle: create_tables.sql and create_event_table.sql - SQL scripts to create the Oracle database tables
    - mysql: create_tables.sql and create_event_table.sql - SQL scripts to create the MySQL database tables
    - postgresql: create_tables.sql and create_event_table.sql - SQL scripts to create the PostgreqsQL database tables

    - hsql: create_tables.sql, create_event_table.sql, create_indexes.sql and create_event_table_indexes.sql - SQL scripts to create the HSQLDB database tables and indexes. Note that if the default local OEE database is being used, these scripts have already been executed. run_hsql_server.bat - Windows shell script to launch the HSQLDB server (and ".sh" for Unix). The database files are in the "data" folder.

- lib: contains oee-domain-<*version*>.jar domain classes plus dependent jars
- lib/ext: folder for user-defined external jars for calling by JavaScript code
- logs: empty folder to contain the Log4j2 and Java Service Wrapper logging files
- wrapper
    - Win
        - bin: 64-bit Tanuki Java Service Wrapper community edition (wrapper.exe), install-oee-collector.bat (Windows shell script to install the data collector as a Windows service), uninstall-oee-collector.bat (Windows shell script to uninstall the data collector Windows service), oee-collector.bat (Windows shell script to execute the wrapper as a console app)
        - conf: wrapper.conf (Java Service Wrapper configuration file)
        - lib: wrapper.dll and wrapper.jar for Java Service Wrapper
    - MacOSX
        - bin: 64-bit Tanuki Java Service Wrapper community edition (wrapper), oee-collector (OS X shell script to execute the wrapper as a console app or daemon)
        - conf: wrapper.conf (Java Service Wrapper configuration file)
        - lib: libwrapper.jnilib and wrapper.jar for Java Service Wrapper
    - Linux
        - bin: 64-bit Tanuki Java Service Wrapper community edition as built by Simon Krenger (wrapper), oee-collector.sh[2] (Linux bash shell script to execute the wrapper as a console app or deamon)
        - conf: wrapper.conf (Java Service Wrapper configuration file)
        - lib: libwrapper.so and wrapper.jar for Java Service Wrapper

The Java Service Wrapper wrapper.conf file requires that the following parameters be defined:

- wrapper.java.command: path to a 64-bit Java JRE e.g. for Windows:
    - set.JAVA_HOME=C:/jdk/jdk-11.0.13/jre

[2] This bash shell script was created on Windows and has <CR><LF> characters at the ends of lines. On Linux, these characters need to be replaced with <FF>, and can be done with a sed command: **sed -i -e 's/\r$//' oee-collector.sh**.

    - wrapper.java.command=%JAVA_HOME%/bin/java

- program arguments for the JDBC connection string and autenticated user. For example for Microsoft SQL Server running on localhost at port 1433 and connecting to the OEE database with SQL Server authenticated user "Point85" and password "Point85":
    - wrapper.app.parameter.2=jdbc:sqlserver://localhost:1433;databaseName=OEE
    - wrapper.app.parameter.3=Point85
    - wrapper.app.parameter.4=Point85
    - wrapper.app.parameter.5=<*optional name of collector*>

The 5th parameter is optional and specifies the name of a collector if more than one JVM is running on the same host machine. If not specified, then all collectors for the host machine will be run.

For Oracle, the JDBC connection string would be similar to jdbc:oracle:thin:@localhost:1521:orcl SYSTEM admin (and "xe" for 18c Express Edition), for MySQL to jdbc:mysql://localhost:3306/oee Point85 Point85, for PostgresQL to jdbc:postgresql://localhost/oee Point85 Point85 and for HSQLDB to jdbc:hsqldb:hsql://localhost/OEE Point85 Point85.

Before running any JavaFX desktop applications:

- Edit the config/logging/log4j2.xml file to set the location of the Point85.log file and logging levels.
- If not using the pre-installed HSQLDB server, create a database and then initialize it by executing the table creation scripts. If using an interface table as a data source, execute the create_event_table.sql script.
- Optionally, download and install the RabbitMQ broker from https://www.rabbitmq.com. The monitor application now can be used for real-time collector status updates. Otherwise it can be set to periodically poll the database for new events.

The screenshots in this guide use the default localized text. If another language is desired, please see the user's guide on how to edit the .properties files.

Data Collector

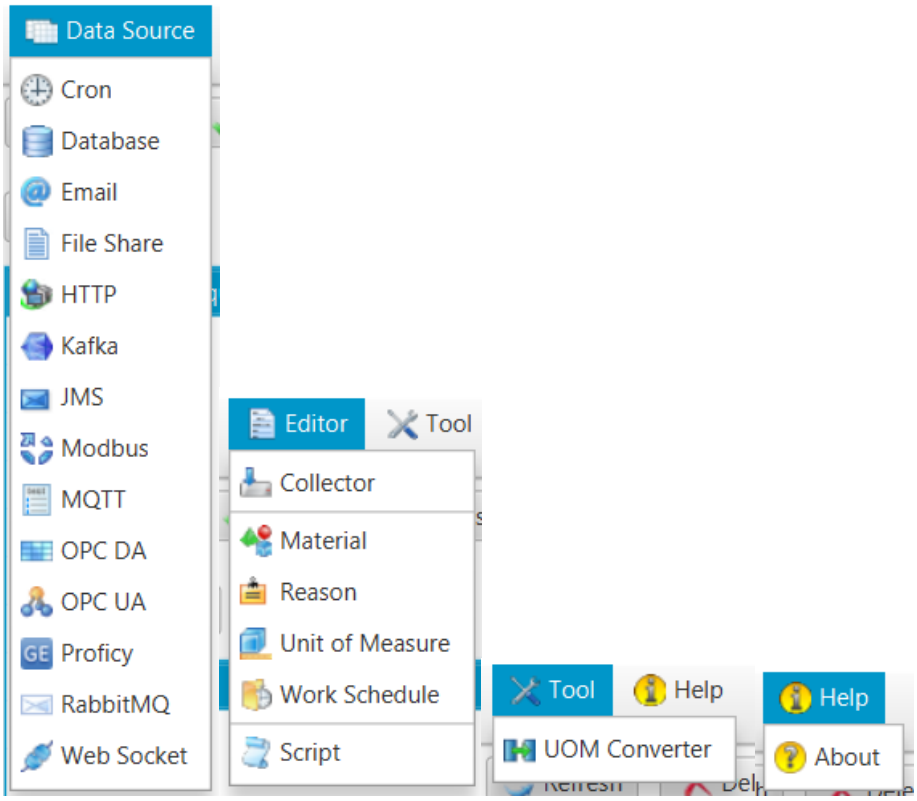
For your operating system (wrapper/MacOSX, Linux or Win) under the OEE-<version> root folder, the in-process data collector can be deployed as follows:

- Edit the conf/wrapper.conf file to set JAVA_HOME and the database JDBC connection, user name and password properties (wrapper.app.parameter.2, 3 and 4)
- Execute the shell script to install the collector as a Windows service (Win/bin/install-oee-collector.bat and uninstall-oee-collector.bat), Unix daemon (MacOSX/bin/oee-collector.sh <console>, Linux-x86/bin/oee-collector.sh <console>) or Windows console program (Win/bin/oee-collector.bat).

PLANT MODEL

In the <root> intall folder, execute the run-designer-app.bat (or Unix .sh) script to launch the Designer desktop application. A menu bar is at the top of the screen with four menus, Data Source, Editor, Tool and Help.

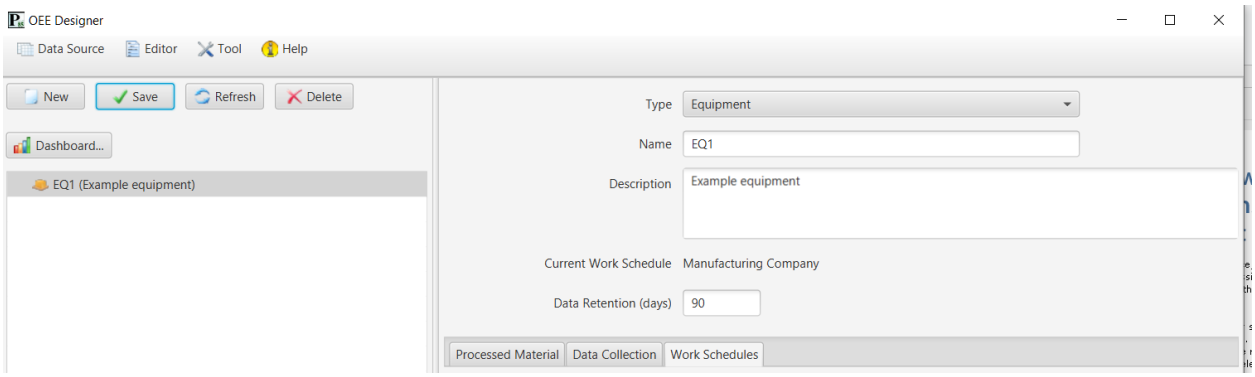
Data source editors are launched from the *Data Source* menu, other editors from the *Editor* menu, the UOM conversion tool from the Tool menu and the about dialog from the *Help* menu:



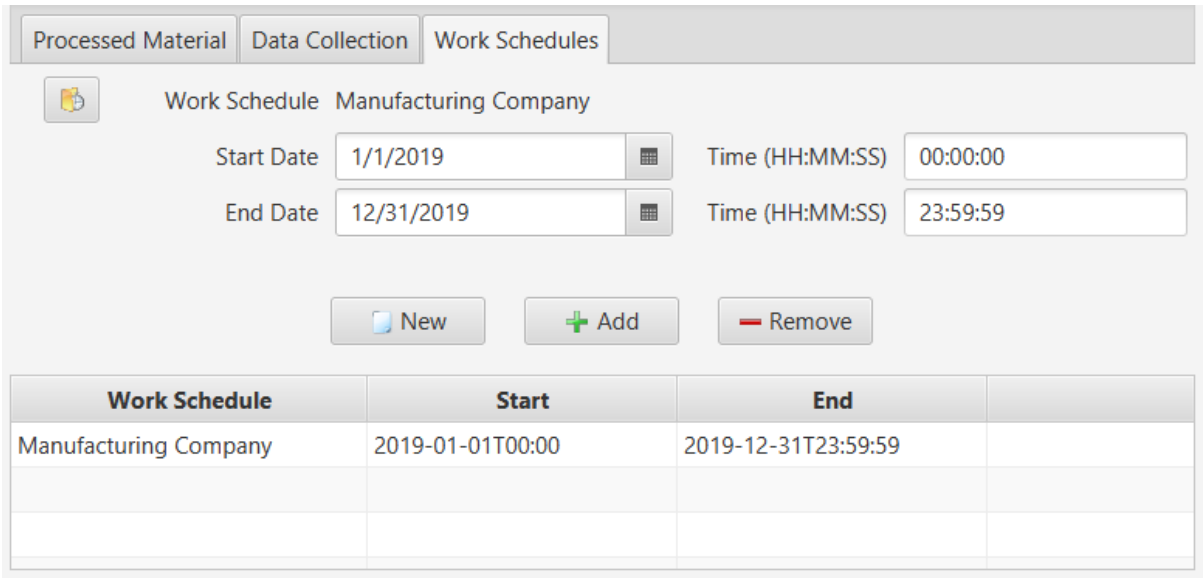
PHYSICAL MODEL

In this guide, we will create a single piece of equipment. In the physical model screen, click on the New button. Select EQUIPMENT as the type, enter the name and description as well as a 90 day data retention period. Click Save and answer yes to the question about creating the equipment as a top-level entity.

The screen will look similar to:

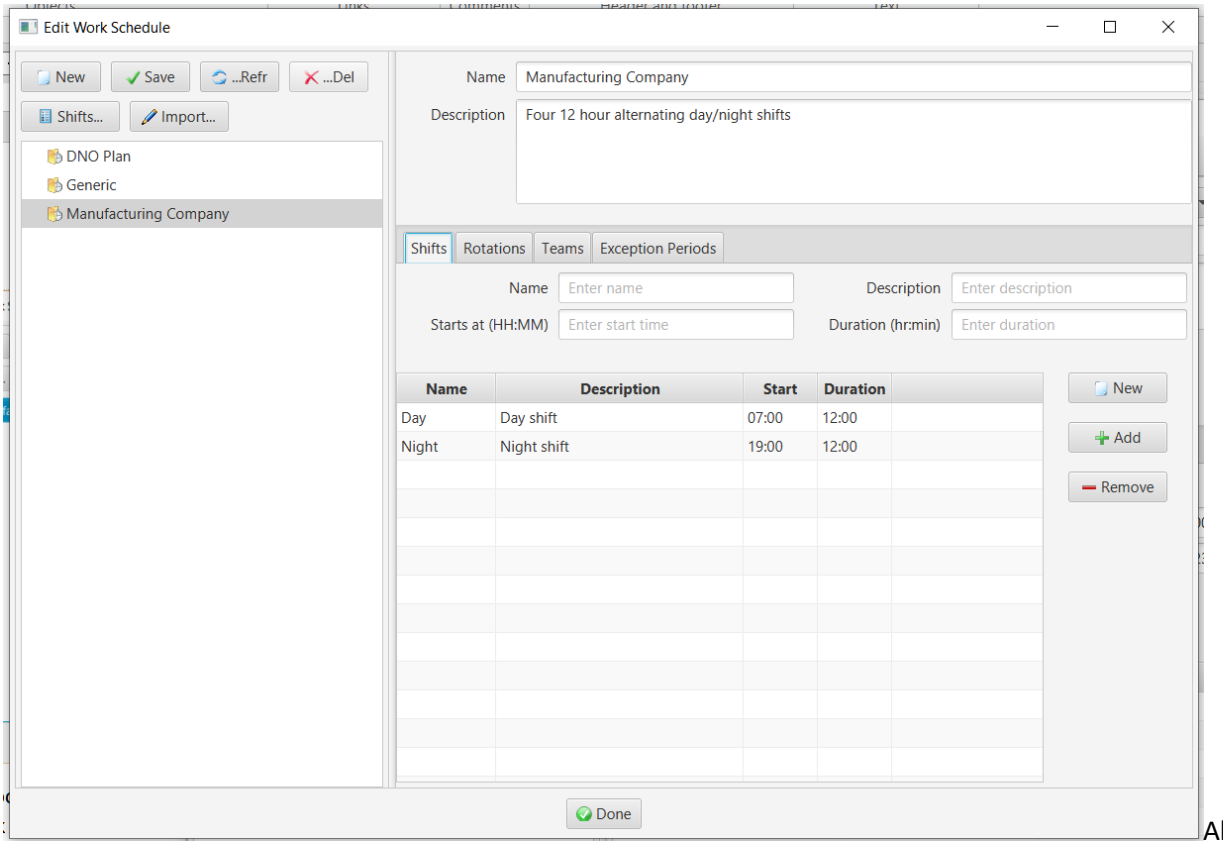


Click on the "Work Schedules" tab to assign work schedules to this equipment. Rather than creating a work schedule from scratch, we will use the pre-defined schedules:



Click the New button, then click on the work schedule editor button to launch the editor.

In the work schedule editor, click on the Import button and select the "Manufacturing Company" schedule, then click OK. Select this schedule in the left-hand pane. The work schedule editor should look similar to:



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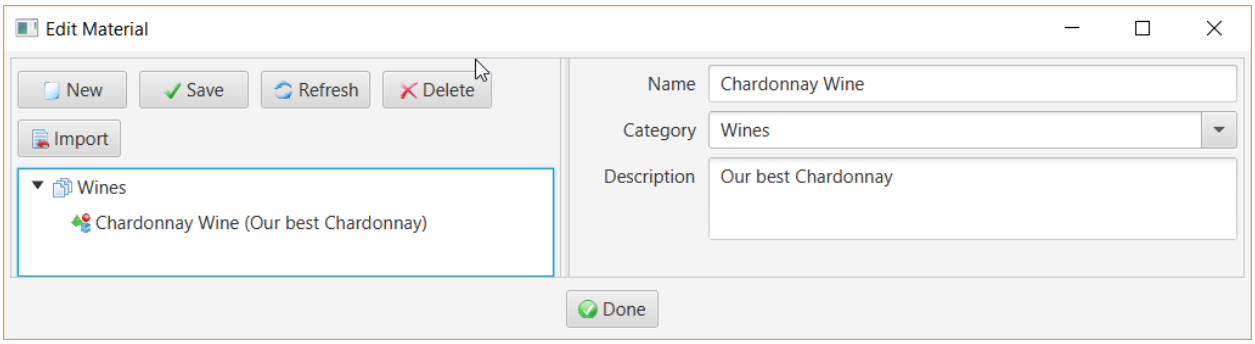
Select the Manufacturing Company work schedule, then click Done. Define the effectivity date and time range for this schedule and save the equipment entity.

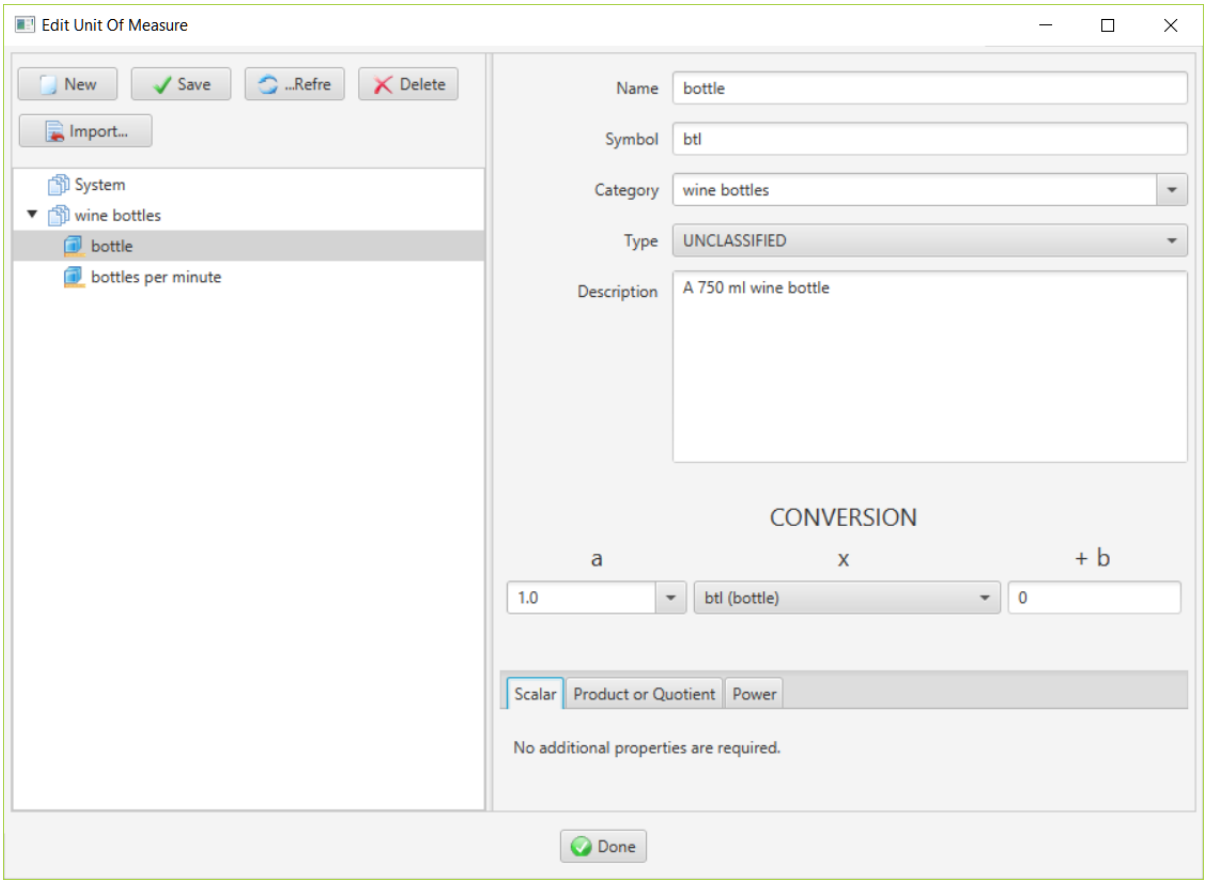
Now we are ready to define the material(s) that can be produced by this equipment. For the purposes of this guide, we will create just one material. First, click the Clear button above the list of produced materials (note, for the first material the list is empty).

With the “Processed Material” tab selected, click the button to the left of the “Material” label to launch the material editor. Click the New button, then enter the name of a material produced by this equipment, a category and description for it. Then click the Save button. The editor should similar to:



Click Done to return to the equipment editor. Check the “Is Default Material” box to indicated that this material will be assumed to be produced if an explicit setup has not been done. Enter a value for the target OEE, e.g. 85 then click the Save button.

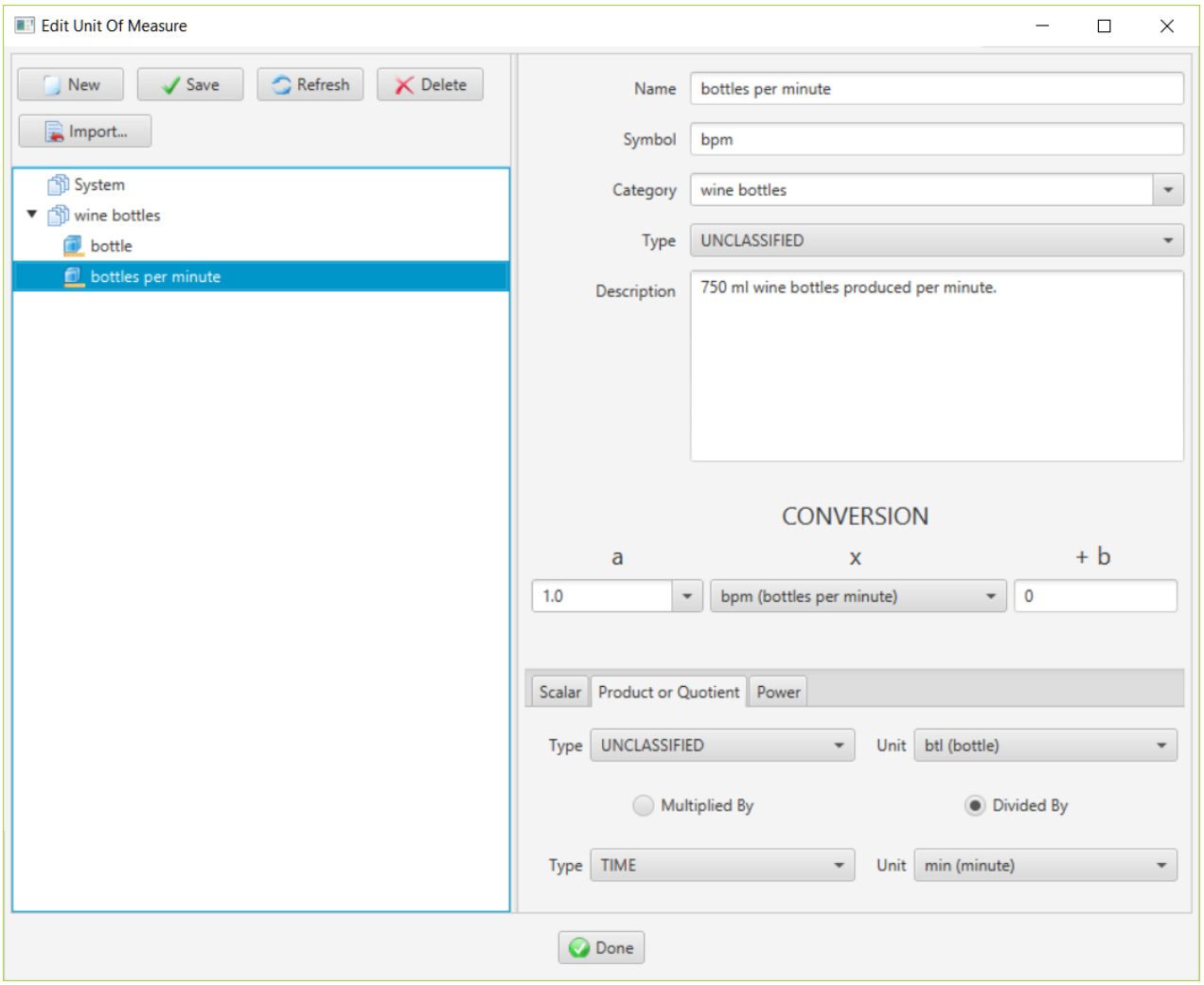
Click the button to the left of the “Design Speed” label to launch the unit of measure editor. Click the New button, then enter the name, symbol, category, type (UNCLASSIFIED) and description for the unit of measure of produced material. Click the Save button. The example below creates a bottle for the produced Chardonnay wine.



Since the design speed is a rate, we need to create a quotient unit of measure where the numerator is the previously created unit, and the denominator is a time unit. Click the New button, then enter the name, symbol, category (same as before), type and description for the rate unit of measure of produced material.

Select the “Product or Quotient” tab. Select the dividend type (e.g. UNCLASSIFIED), then the previously created unit (e.g. bottle). Click the “Divided By” radio button, then select TIME as the denominator type. Select “min (minute)” for the unit. Click the Save button.

The example below creates a rate of bottles per minute for the produced Chardonnay wine:

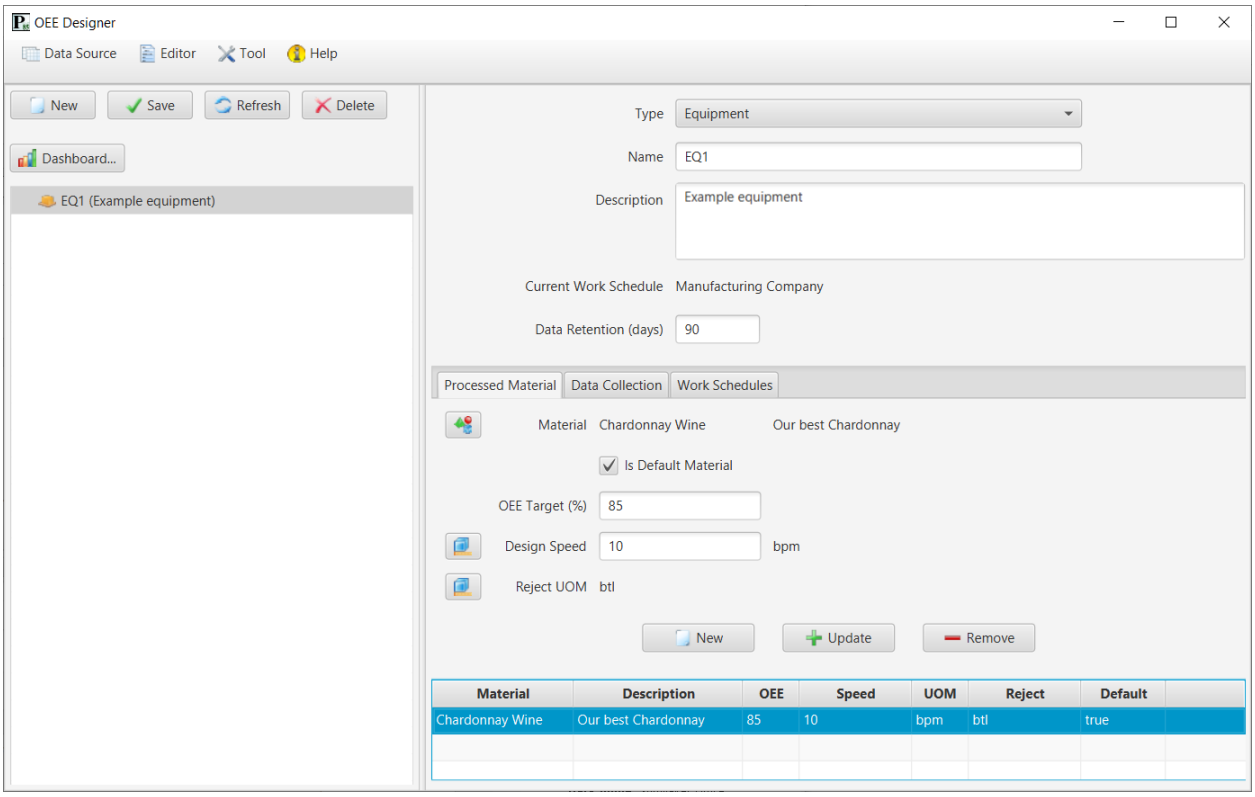


Select the rate unit of measure, then click the Done button to return to the equipment editor.

The rate symbol will be displayed to the right of the design speed value. Enter the design speed, e.g. 10.

Click on the button to the left of the “Reject UOM” label to re-launch the unit of measure editor. Choose the previously created scalar unit, e.g. “bottle”, then click the Done button to return to the equipment editor.

Click the Add button the add this material to the list of materials produced by this equipment (in our case, it is the first and only one). Click the Save button. The equipment editor should look similar to:

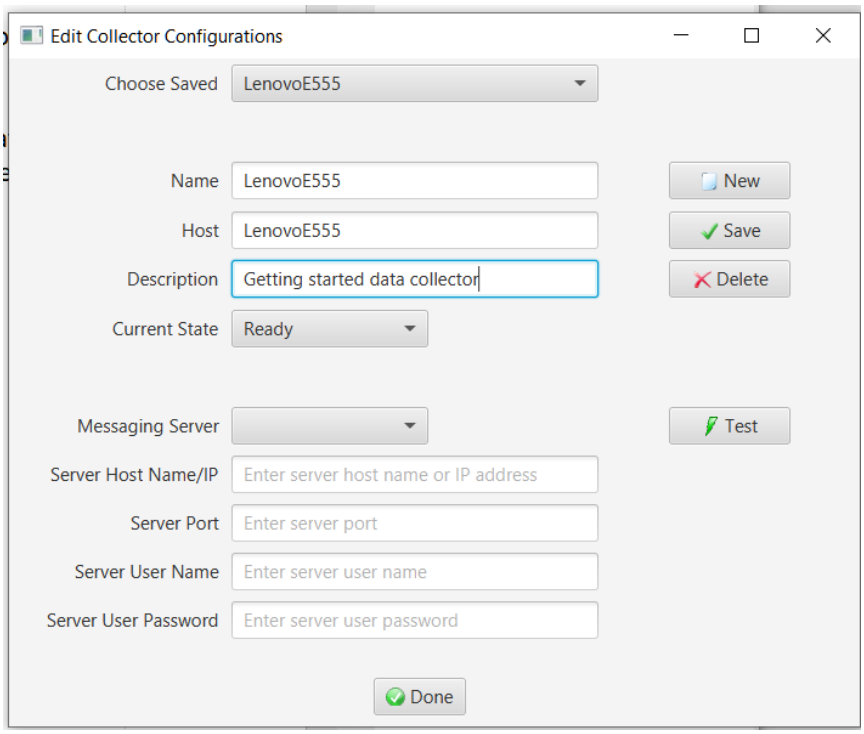


Defining Data Collection

Now we will define how the availabilty and production OEE data is collected. For the purpose of this guide, assume that the provider will make a web service call to the embedded HTTP server.

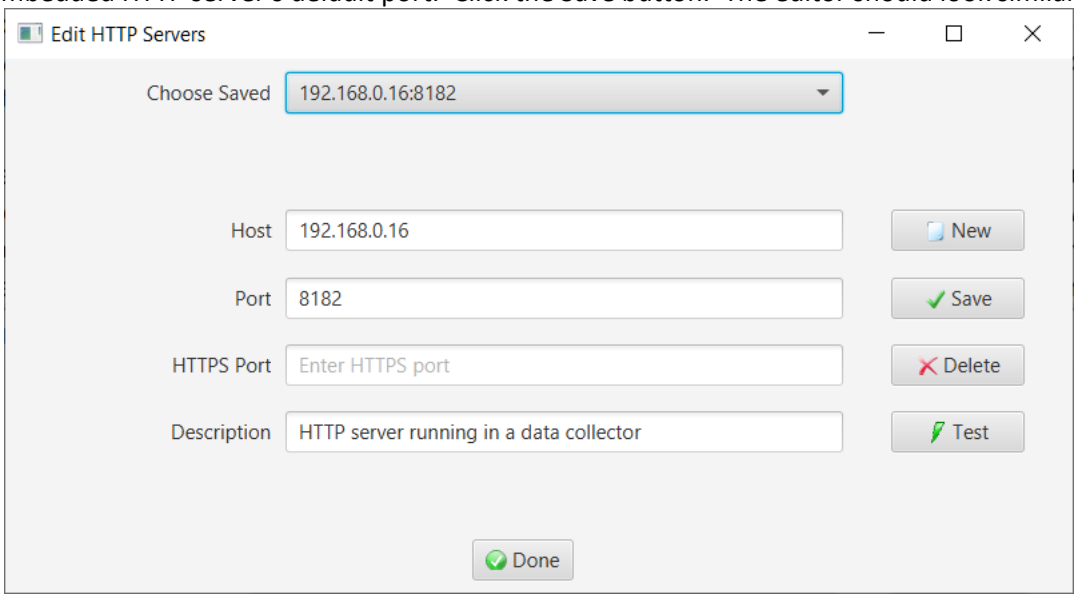
In the equipment editor, select the previously created equipment, then click on “Data Collection” tab. Click on the button to the left of the “Collector Host” label to launch the data collector editor.

Click New. Enter a name, host IP address (not “localhost”) and description. Set the current state to READY. For the purposes of this tutorial, leave the messaging server properties blank. Click Save. The editor should look similar to:



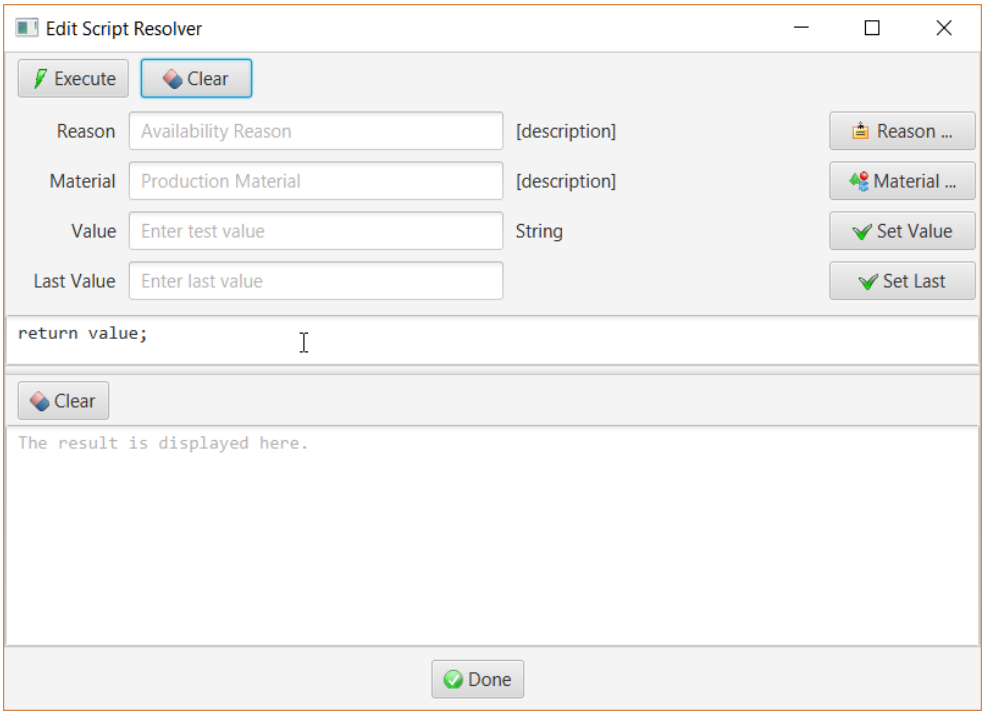
Click the Done button to return to the equipment editor. Select this data collector in the combobox. In the "Resolver For" combobox, select Availability. This will be the first resolver created. For the source type, select "HTTP".

Click on the button to the left of the "Source Id" label to launch the HTTP server editor. For the purposes of this tutorial, we will define just one HTTP server on the same machine that the data collector will run. Click the New button, then fill in the host IP address (not "localhost"), port and a description. Port 8182 is the embedded HTTP server's default port. Click the Save button. The editor should look similar to:

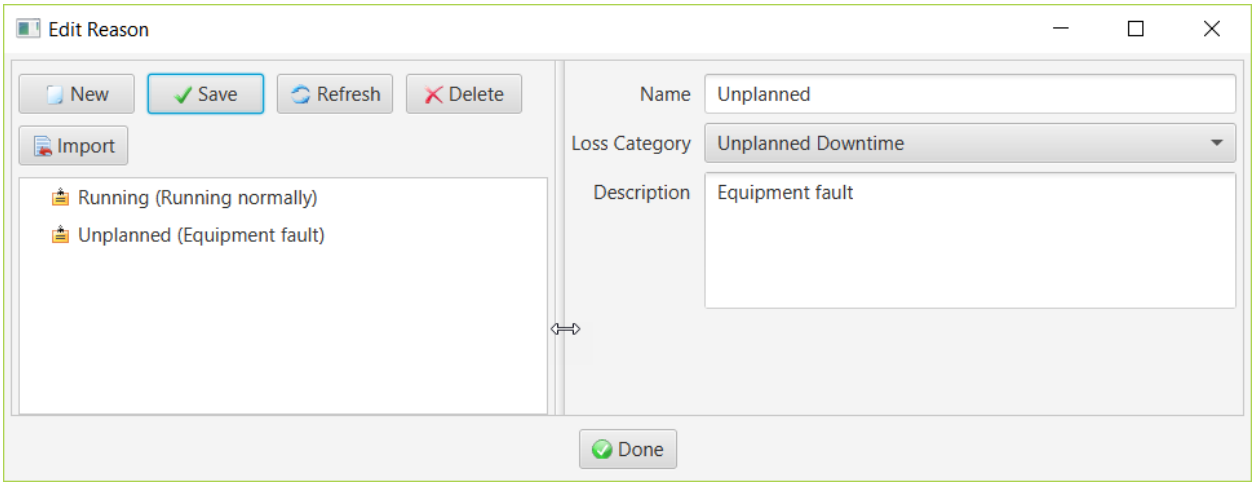


Click the Done button to return to the equipment editor. The source id and server fields will be updated with the data type indicated a a string.

Click on the button to the left of the “Script” label to launch the JavaScript editor. The editor will look similar to:

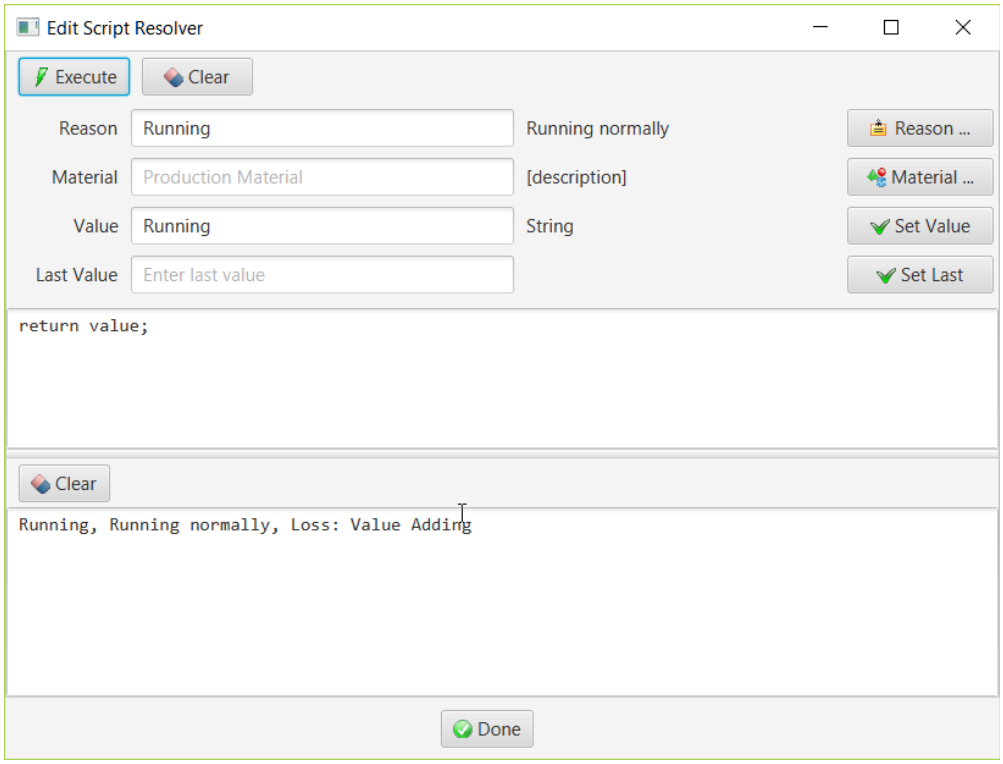


We will define two availability reasons now. Click on the Reason... button to launch the availability reason editor. Click the New button and enter “Running” as the reason name. Choose a loss category of “Value Adding” (i.e. no loss) and enter a description. Click the Save button and answer “yes” to create a top-level reason. Repeat these steps for a reason of “Unplanned” with a loss category of “Unplanned Downtime.” The reason editor should like this:



Select the “Running” reason, then click the Done button to return to the script editor. The “Running” reason will appear in the text box next to the reason label. Cut and paste this reason into the Value field, then click the Set Value button. Finally click the Execute button to run the script with “Running” as the input value. The output Running reason will be displayed at the bottom of the editor.

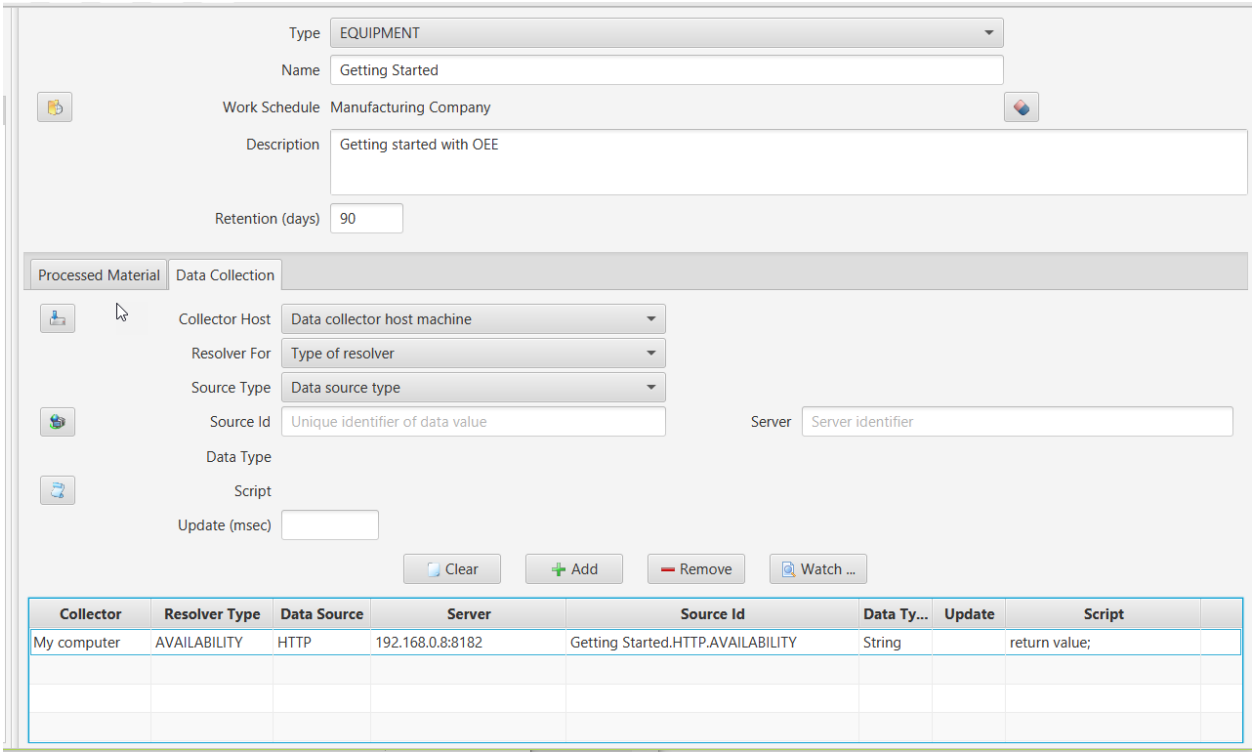
The script editor should look similar to now:



Click Done to accept the default script that just passes the input availability reason name as the output reason name and return to the equipment editor.

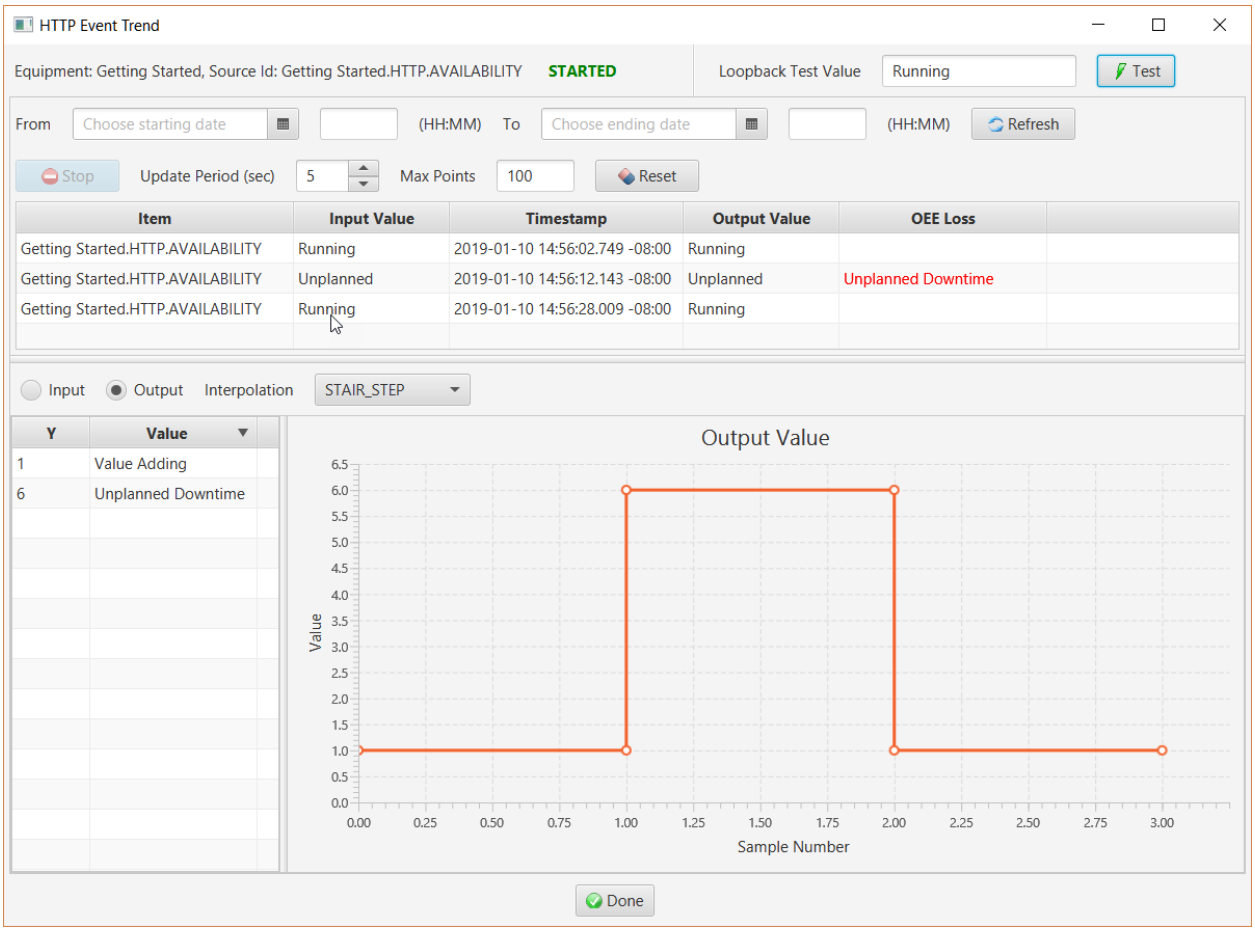
At this point, we have fully defined an HTTP script resolver (it is not necessary to set the update period for such a resolver). Click the Add button to add this availability resolver as the first one for this equipment. Then click the Save button.

The data collection tab should now display the single availability resolver:



In order to test this resolver in a historical trend chart, select it in the table and click the Watch button to launch the trend dialog. Select “Output” and interpolation type STAIR_STEP.

Enter “Running” as the loopback test value and click the Test button. The first data point will appear. Enter “Unplanned” as the test value and click the Test button. The second data point will appear. Repeat for “Running” again. The trend dialog should look similar to:



Next, define an HTTP resolver for good production (Good Production) and one for reject production (Reject/Rework Production) counts by following steps similar to the availability resolver above. Finally define a material setup HTTP resolver (Material Setup):

These new resolvers will look similar to:

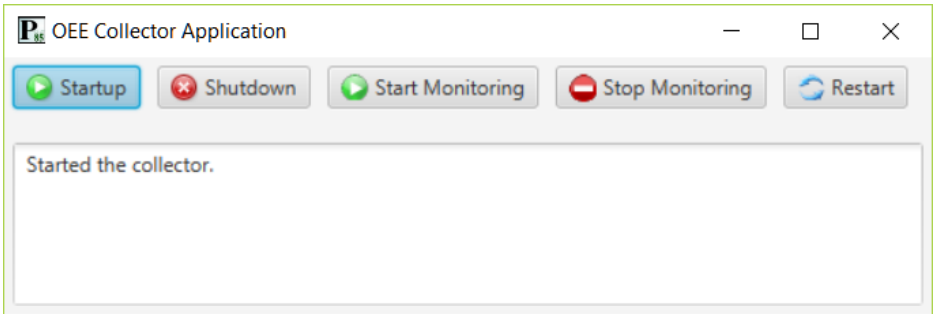
Collector	Resolver Type	Data Source	Server	Source Id	Data Type	Update	Script
My computer	Availability	HTTP	192.168.0.8:8182	Getting Started.HTTP.AVAILABILITY	String	5000	return value;
My computer	Good Production	HTTP	192.168.0.8:8182	Getting Started.HTTP.PROD_GOOD	String		return value;
My computer	Material Setup	HTTP	192.168.0.8:8182	Getting Started.HTTP.MATL_CHANGE	String		return value;
My computer	Reject/Rework Prod...	HTTP	192.168.0.8:8182	Getting Started.HTTP.PROD_REJECT	String		return value;

The production count and material setup resolvers can be tested in the trend chart similar to the availability chart.

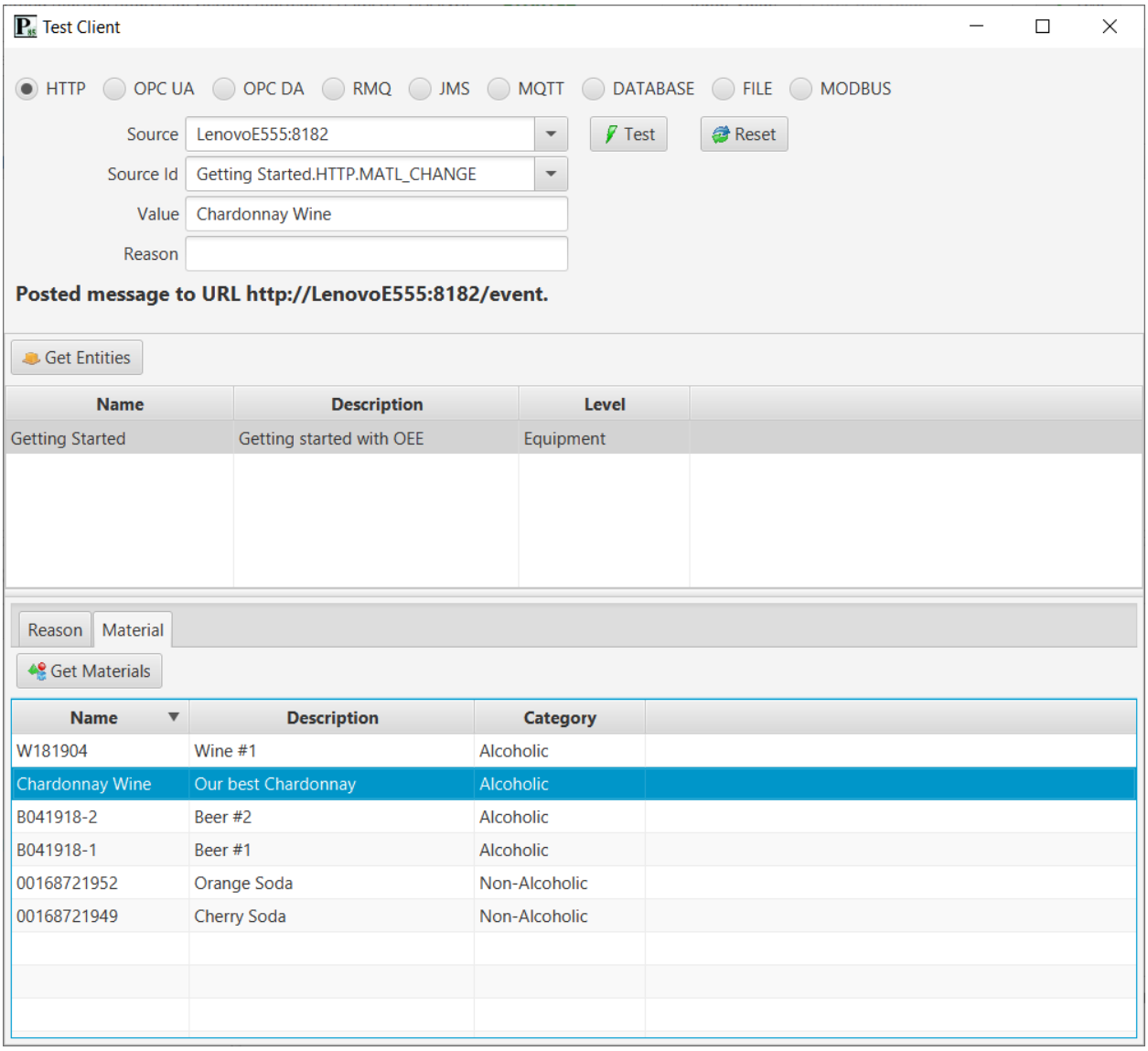
Testing Data Collection

Besides displaying input and output values in a trend chart in the Designer application, a collector test application and HTTP/Messaging test application can be used. On the computer with the data collector that is defined for the four resolvers above (e.g. 192.168.0.8), execute the run-collector-app.bat (or .sh)

shell script in the root folder. The collector UI will appear. Click the Startup button. When the collector is ready, the other four buttons will be enabled:



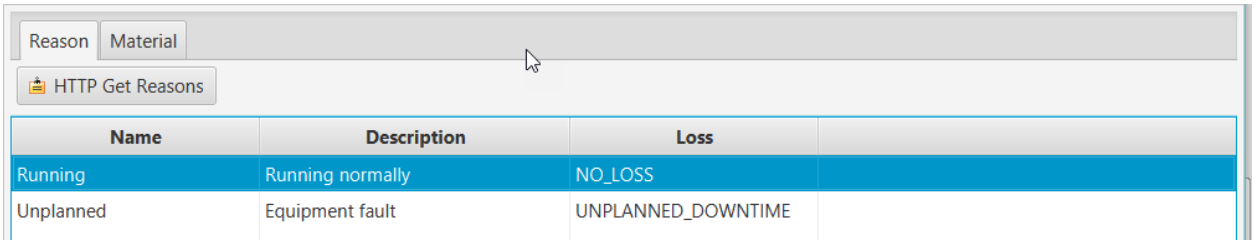
Now, execute the run-tester-app.bat (or .sh) shell script. The HTTP and messaging test application will appear. For this tutorial, we will only use the HTTP capabilities. The test client should look similar to this:



Check the HTTP radio button and select the previously defined HTTP source. Next, click the "Get Entities" button to display the physical model with the single piece of equipment and then select it. In the "Source Id" combobox, select the material change id. Select the Material tab and click the "Get Materials". Select the previously created wine material.

Click the Test button to make a material change request to the collector's HTTP server. A material setup will be recorded in the database.

Now, select the Reason tab and click the "Get Reasons" button to display the availability reasons:



Select the Running reason. Select the availability source id. Click the Test button to make an equipment availability request to the collector's HTTP server for a Running reason. Repeat this for the Unplanned reason.

Now, select the good production source id and enter a numerical value in the "Value" field. Repeat for the reject source id.

DATA COLLECTOR

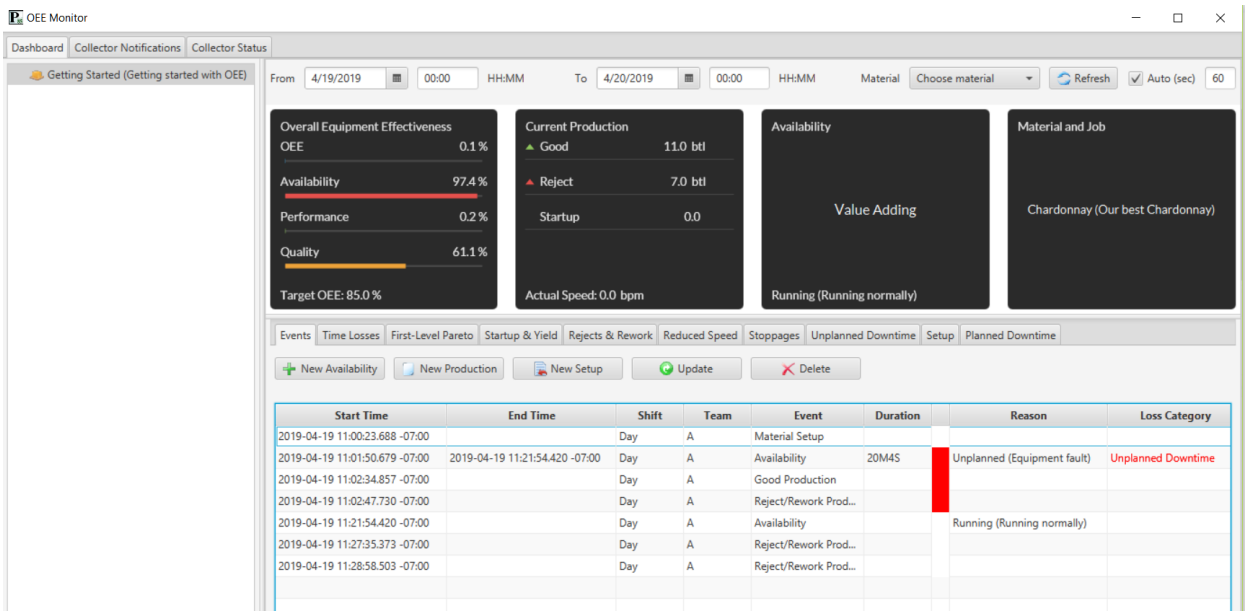
The data collector is a Windows service or Unix daemon and runs on the computer configured with a collector (in our case 192.168.0.8).

If the test collector application is still running, close it. For the purposes of this tutorial, we will run the collector as a Windows console application. Execute <root>/wrapper/Win/bin/oee-collector.bat (.sh) shell script. The logging output will appear in the console window.

Now, execute the run-tester-app.bat (.sh) shell script. The HTTP and messaging test application will appear. Follow the steps above to send requests to the collector.

MONITOR

The Monitor is a desktop application with an OEE dashboard. The dashboard is also accessible from the Designer's equipment editor. To launch the Monitor, execute <root>/run-monitor-app.bat (or Unix .sh) shell script. Select the equipment of interest in the left-hand panel. Enter a date and time-of-day range when the data from this tutorial was collected, then click the Refresh button. Select the "Events" tab. The Monitor's dashboard will display OEE information from this data. Note that a material setup event must be defined within the date range of interest. For example:

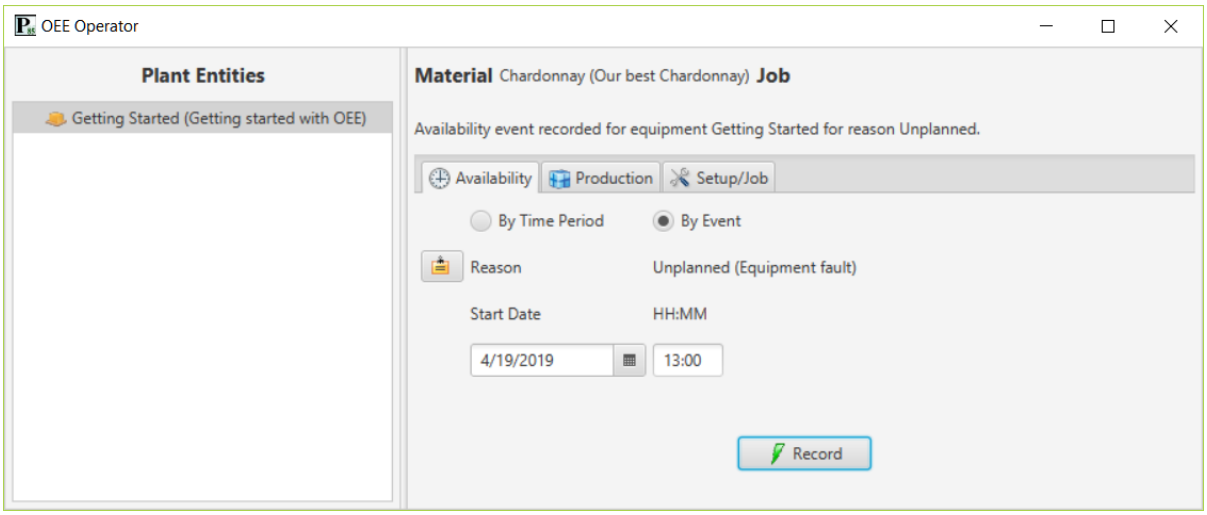


If the RabbitMQ message broker is installed, the monitor will update based on equipment events and status messages sent by the data collectors. Without a message broker, polling of the database is enabled by checking the "Auto" checkbox to update the OEE dashboard and configuring the update period in seconds.

Operator Application

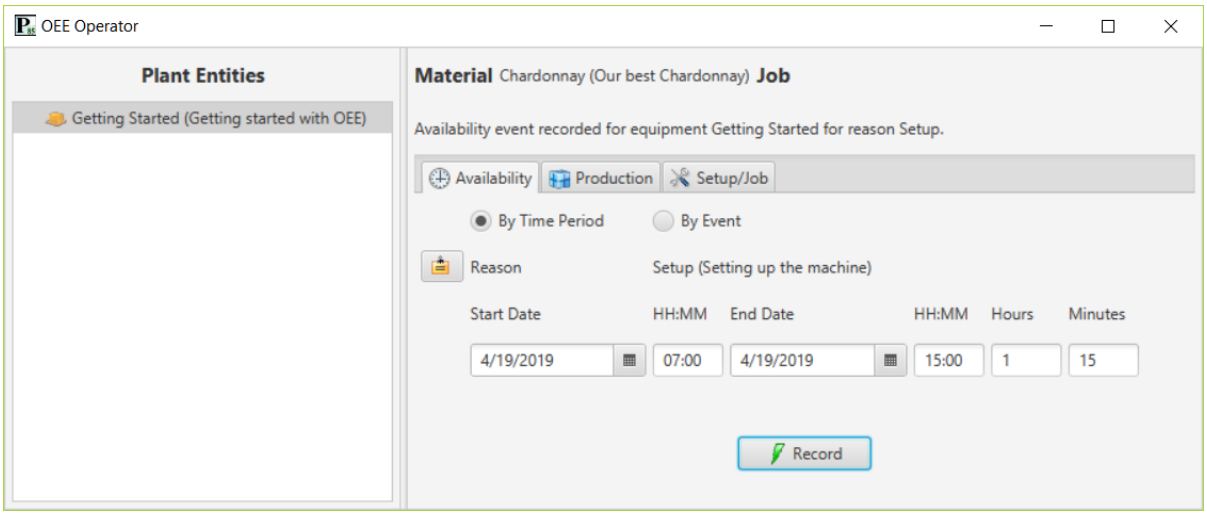
The Operator desktop application is an alternative to deploying the war file to a web server and using a browser. In this case, to launch the operator application, execute <root>/run-operator-app.bat (or Unix .sh) shell script.

Select the equipment configured above, then click the Availability tab. Select the "By Event" radio button, and enter a downtime event by choosing the "Unplanned" reason:



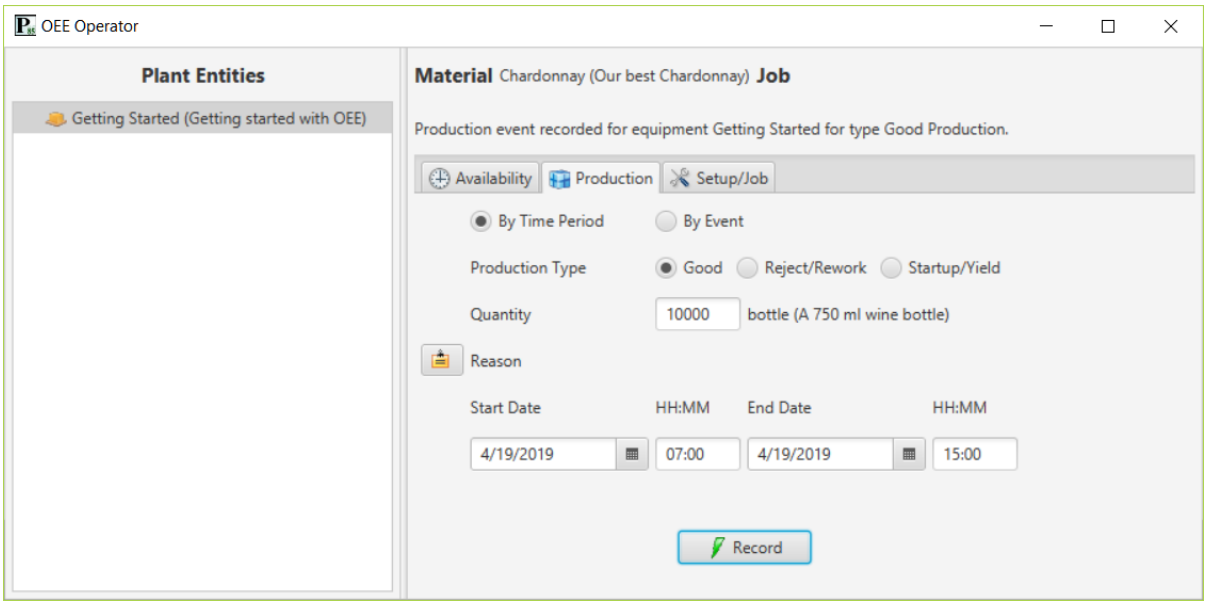
Click the Record button to save this availability event to the database.

Events can be entered in summarized form over a time period (e.g. shift). In this case, select the "By Time Period" button. Enter the reason, time period and total time. For example:



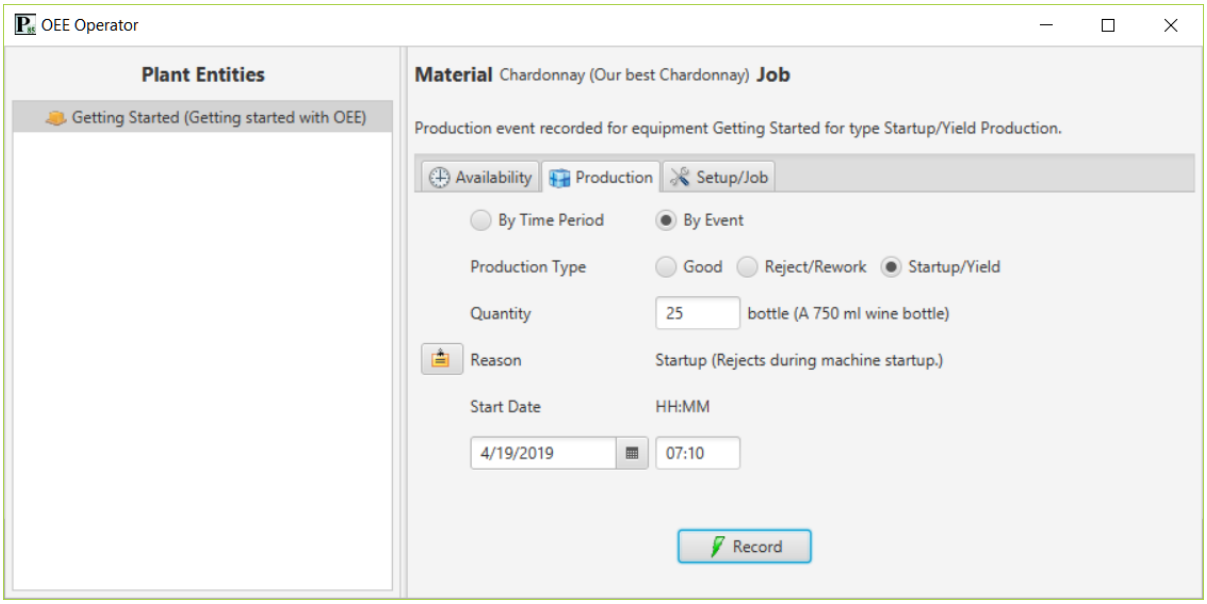
Click the Record button to save this availability to the database.

Select the Production tab, and click the "By Time Period" radio button. Select "Good" as the production type and enter the quantity. Enter the beginning and ending date and time of day (e.g. an entire shift) for the summarized good production counts:



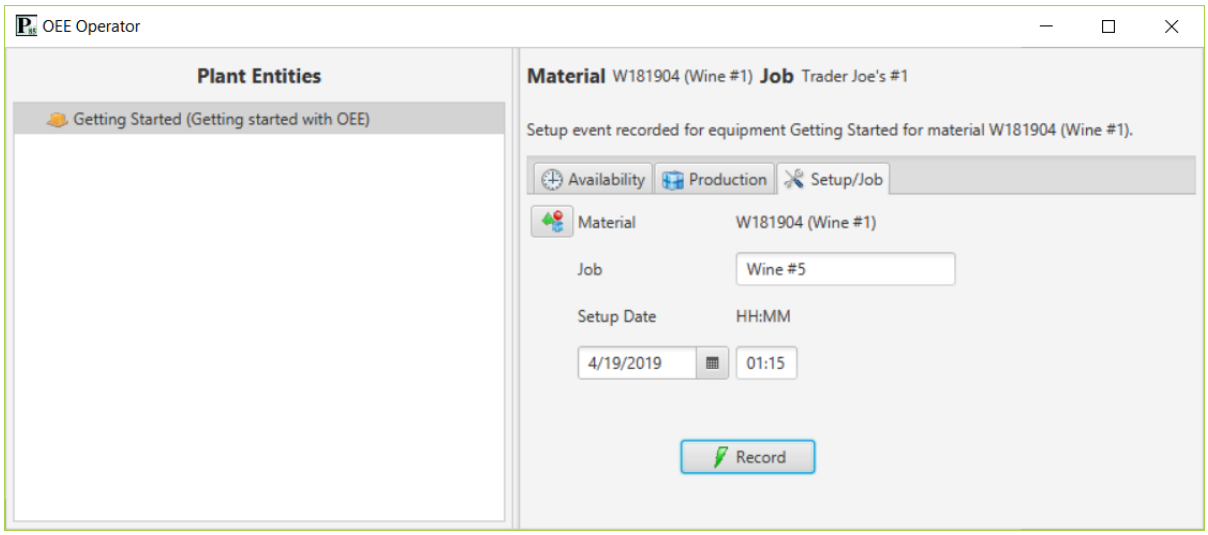
Click the Record button to save this production to the database.

Production counts can also be recorded each time such an event occurs. In this case, click the "By Event" radio button and the "Startup & Yield" button. Enter the quantity, an optional reason and the time of the production:



Click the Record button to save this production to the database.

Select the "Setup/Job" tab and enter both a new material (previously configured for this equipment) and job identifier as well as the setup time:



Click the Record button to save this setup to the database.

Operator Web Application

As an alternative to the desktop operator application, the operator web application can be installed into a web server (see the user's guide). Browse to the URL where the Point85 web app is installed, then select the equipment configured above. The user interface is very similar to that described for the desktop version.

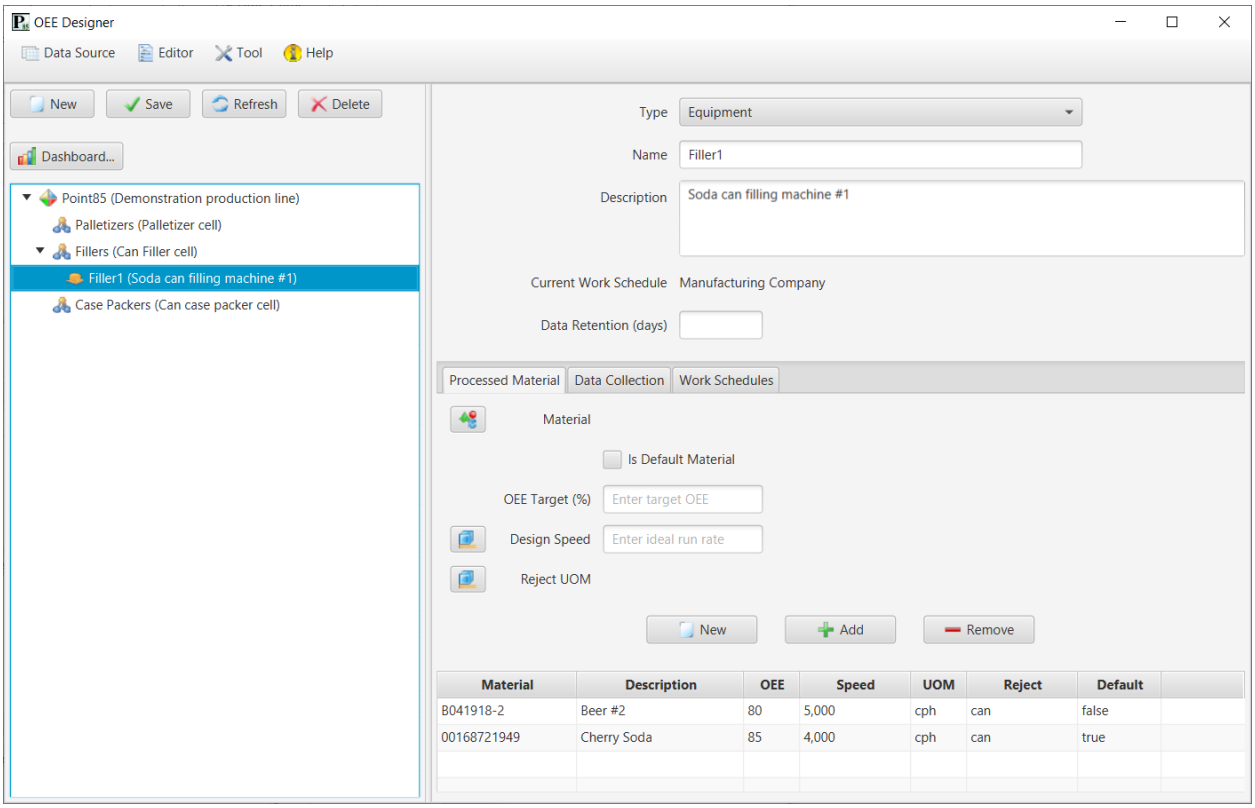
Operator Mobile Applications

As an alternative to the desktop and web operator applications, the operator Android mobile application can be installed from the Google Play Store and the iOS mobile application from the Apple App Store (see the user's guide). The user interface is similar to that described for the desktop version and is explained in more detail in the user's guide.

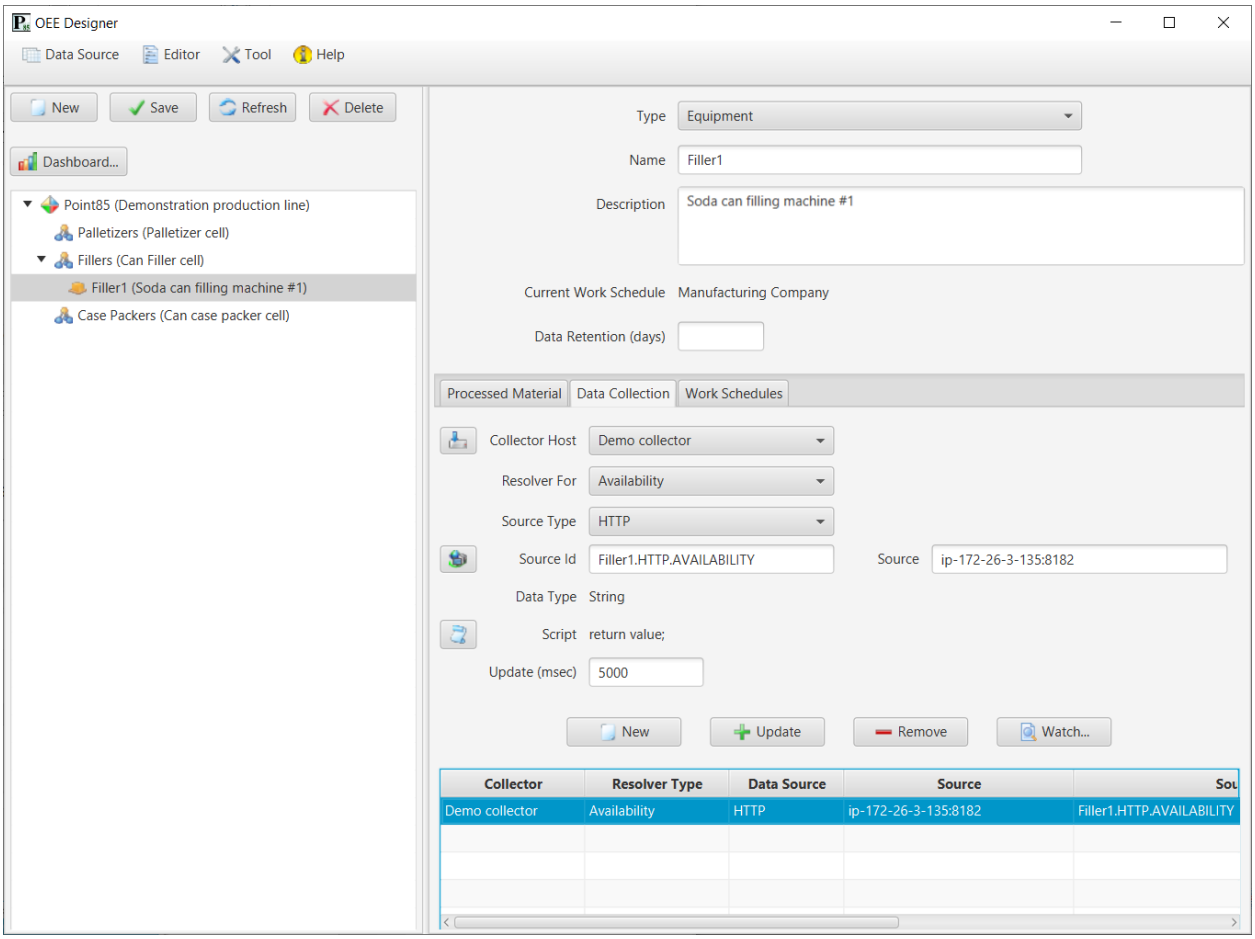
Demonstration System

An AWS LightSail instance at static IP address 52.37.56.187 running an Ubuntu 18.04 O/S has been created to demonstrate basic OEE data collection capabilities. This instance has a local HyperSQL database server on port 9001 with a database named "OEE". The user is "SA" with no password. There is a Point85 Collector running an embedded Jetty HTTP server on port 8182.

After connecting to this database with the Designer application, you will see the Filler1 equipment which fills cans of cherry soda or beer:



The local Collector at 172.26.15.180 has an HTTP data source on port 8182 for Availability:



The Jetty HTTP server on the 8182 port is addressed externally using the static IP address 52.37.56.187. For example from Postman: