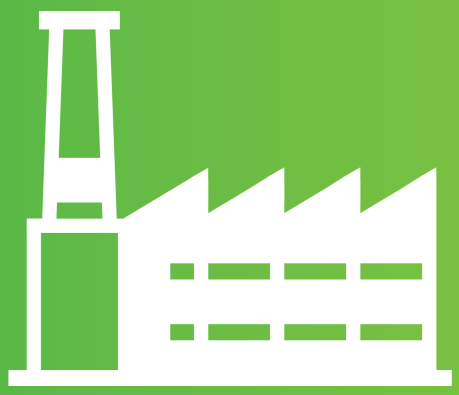
Factory Automation

Training Guide | Manufacturing Operations Management

Last Published: August 2020



SYSPRO™ LearnIt

Contents

Overview

Factory automation is an exciting new feature available in SYSPRO Manufacturing Operations Management. Factory Automation extends the existing manual data collection features in SYSPRO, with automated data collection to determine equipment effectiveness (OEE).

Including:

- Up/Downtime (including downtime reason)
- Operational completion (Quantity)
- Operational scrap (including scrap reason)

With over 140 industrial drivers to the most common PLC/IO devices including Allen Bradley, GE, Honeywell, Mitsubishi, Siemens and more. SYSPRO provides the platform to digitalize your factory by connecting machines, measuring equipment and other devices to read data without manual inputs.

SYSPRO's factory automation provides controlled management of machine data including error handling; live or controlled data posting to ERP/PLM systems; data collection from multiple geographical facilities; data historian.

Note: It is important to note that this feature guide does not cover the setup and maintenance requirements for the PLC or IO device and/or the OPC server. Configuration of these hardware and software devices will be completed by a recommended industrial engineer.

Within this feature guide, you will learn:

- System requirements to support factory automation
- How to enable factory automation
- How to create automated devices
- How to configure signals and processors
- How to monitor a live automated environment
- How to resolve data flow errors
- How to setup alerts for monitoring automation errors
- How to troubleshoot failures

Note: **OEE**: Automation increases the accuracy of overall equipment effectiveness with minimal human interaction.

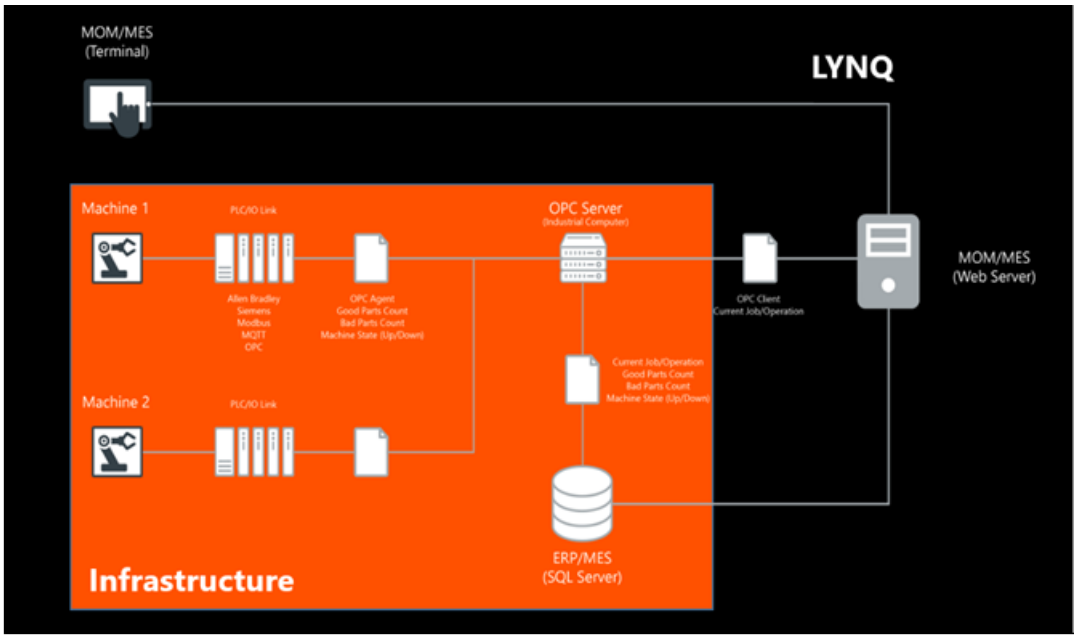
Realtime Posting: Post machine data instantly to your ERP/PLM system.

System Requirements

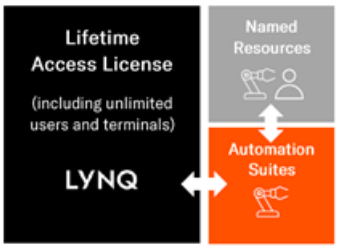
Factory automation is entirely dependent on the infrastructure illustrated in the Factory Automation Topology Diagram. You must have SYSPRO MOM implemented to utilize factory automation.

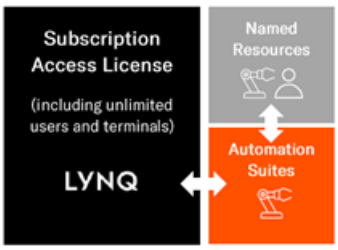
Machines that will be configured as automated devices in SYSPRO MOM must already be connected to a PLC or IO device and communicating with the OPC Server.

Figure 1: Factory Automation Topology Diagram



To automate equipment, an automation suite is required which differs to the names resource license. Suites provide access to collections of industrial drivers, which make it possible for MOM to connect to the most common PLC/IO devices used in the manufacturing industry.





System Requirements

Minimum Hardware and Software Requirements - OPC Server	
Hardware	**Requirements**
Device	Industrial Fanless PC Mounting: VESA or wall brackets
CPU	Intel i3 or equivalent

Minimum Hardware and Software Requirements - OPC Server	
Hardware	**Requirements**
RAM	4GB and above
Operating System	Windows Server 2008 R2 Windows Server 2012 Windows Server 2012 R2 Windows Server 2016
Ports and Connectivity	2Gb LAN ports 2 COM ports (RS-232/422/485) 4 USB ports
Audio jacks: line-out, mic-in	2 HDMI ports 1 VGA port

Note: **The Solution**: Factory Automation combines hardware and software to create a unique solution.

Device Licenses: Automated device licenses can be purchased separately.

The Concept of Automation

Factory automation in SYSPRO MOM has a simple concept. The Data Flow Diagram illustrates the overall factory automation solution. The orange columns (Infrastructure) illustrate the flow of data between the various hardware and software components before reaching SYSPRO MOM. The green columns (SYSPRO MOM) illustrate the flow of data once the data has reached SYSPRO MOM.

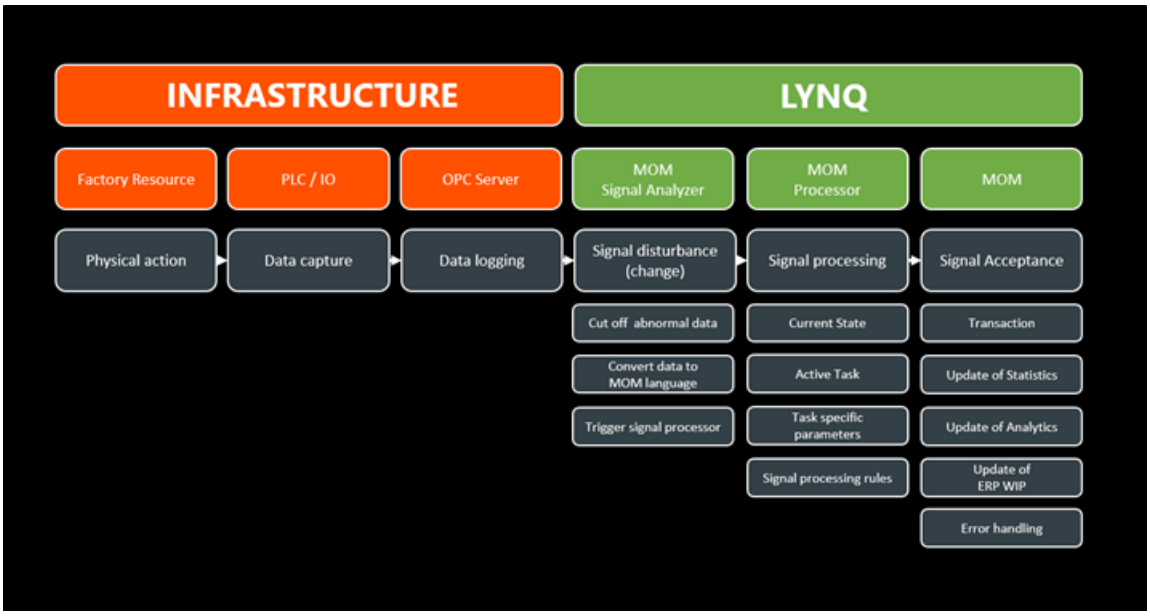


Figure 2: Data Flow Diagram

It is important that all these aspects of the factory automation solution are understood and configured correctly. To successfully adopt automation in your factory, you will require a resource, such as an **Industrial Engineer** that is sufficiently skilled to maintain your factory network including PLC/IO devices and the **OPC Server** hardware and software.

Note: SYSPRO Manufacturing Operations Management can only take responsibility for the support and maintenance of its own software.

Typically automation relies on a user selecting a task in the workbench to indicate which job/product is running when the automated devices are sending good and bad quantity data. This is because the automated device generally does not have any concept of which job/product it is running. Human interaction with the Workbench is not required for status (uptime/downtime) data collection.

Note: Data Logging: MOM combines the data logged by the OPC server to active jobs running in MOM.

Enabling Factory Automation

By default factory automation is disabled. The followings steps explain how to turn on automation within SYSPRO MOM.

SYSPRO MOM must understand which database is configured to store data logged by the OPC Server.

Note: Polling Interval: The polling interval determines how frequently data will be read in the factory automation database to SYSPRO MOM.

Data Buffer Interval: The data buffer interval determines how frequently the processor will translate machine data into SYSPRO MOM transactional data.

Intervals: Interval settings can be adjusted as required to suit the requirements of your factory. However, setting these values to very low numbers may place additional load on your infrastructure in high data volume environments. Fine tune these settings for optimal performance.

Configuring the Factory Automation Database

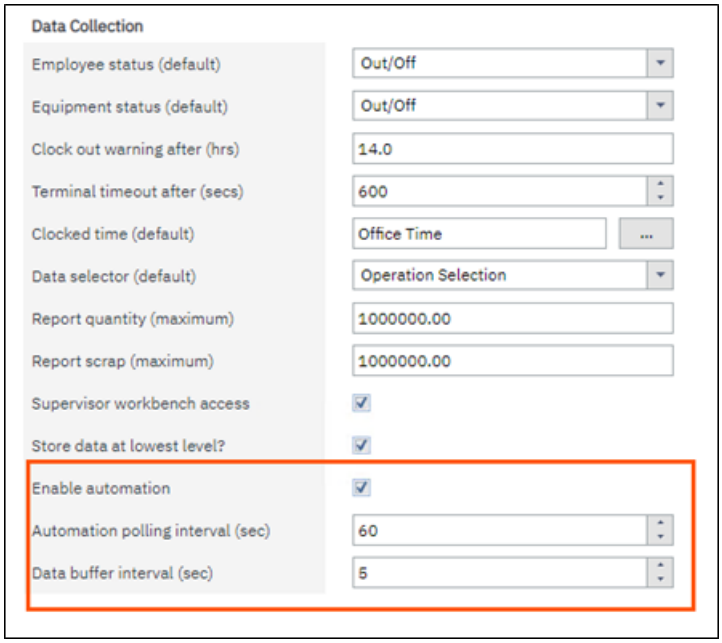
The following steps describe how to configure the Factory Automation Database

1. Logon to SYSPRO MOM as an administrator.
2. Select **Settings** from the home page.
3. Select **Settings**.
4. Navigate to the **Database Settings** section.
5. Enter the factory automation database name in the **Automation** row.

Enabling Factory Automation

The following steps describe how to enable factory automation.

1. Logon to SYSPRO MOM as an administrator.
2. Select **Settings** from the home page.
3. Select **Advanced Settings**.
4. Select **General**.
5. Check the **Enable automation** option.
6. Set the **Automation polling interval (secs)** as required.
7. Set the **Data buffer interval (secs)** as required.



Configuring Automated Devices

Automated devices are configured under **Resource Management**, **Seat Maintenance**, **Equipment Maintenance**. Devices that you choose to automate, must be imported into **MOM** using the standard **Import Equipment** function first. Once the equipment is imported, you will be able to configure the automated device settings in Equipment Maintenance.

To enable equipment for automation:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Check the **Automation** tick box.
4. For informational purposes only, enter the manufacturer's details, IP Address of the automated device, the OPC Agent and the IP Address of the OPC Server.
5. Click **Save**.

Equipment Maintenance

Against each **Automated Device within MOM**, you must configure both:

1. Signals
2. Processors

This is explained in the following sections

Note: Automation Settings : Except for the automation check box setting, all other fields in this section are for informational purposes only.

Seat Type: Once the automation checkbox is ticked, the seat type will change to auto.

Manual Data Collection: It is possible to turn off manual data collection for an automated device by deselecting the Workbench Checkbox in Equipment Maintenance.

Signals

Signals are configured to listen for any change in values for a unique OPC tag as defined in the OPC server. You must create a signal in SYSPRO MOM for each unique OPC Tag. OPC tags can be configured to read good parts count, scrap parts count and the actual state of the device.

Quantity and **Scrap Signals** support the configuration of default values for:

- Location
- Warehouse
- Bin Number
- Serial Number
- Lot Number
- Scrap Reason (Scrap Signal Only)
- User Defined Values

In order to capture scrap for 5 different reasons codes, the OPC Server must be configured to store 5 separate tags and distinct counters. SYSPRO MOM must be setup with 5 separate **Scrap Signals** each with a unique **Scrap Reason code**.

Other Non-OEE related data such as pressure, temperature, spindle speed, etc may be recorded and stored within the SYSPRO MOM Factory Automation SQL Database. SYSPRO MOM signal processing will ignore this data but the data can be used for custom reporting (i.e Power BI, Microsoft SQL Server Reporting Services). You can then provide visibility of this data in SYSPRO MOM via the **Webhook** functionality.

Note: **Activate/Deactive**: Signals can be activated or deactivated as required by double clicking on the signal.

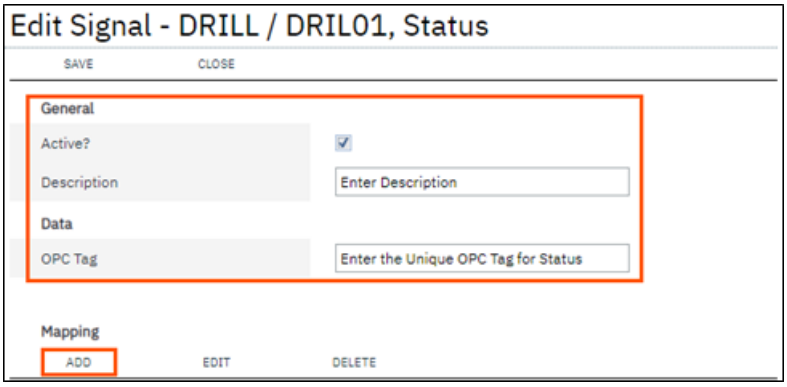
Copying Signals: Signals can be copied to simplify the setup process.

Webhooks: Webhooks is a standard feature in MOM. Refer to the Webhooks guide for more information.

Status Signals

To configure a signal for **Status**:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation Tab**.
4. Select **Signals**.
5. Select **New**.
6. Select **Status**.
7. Enter a description and the OPC Tag unique identifier.
8. Select **Add**.



To map the signal data to the relevant status in MOM:

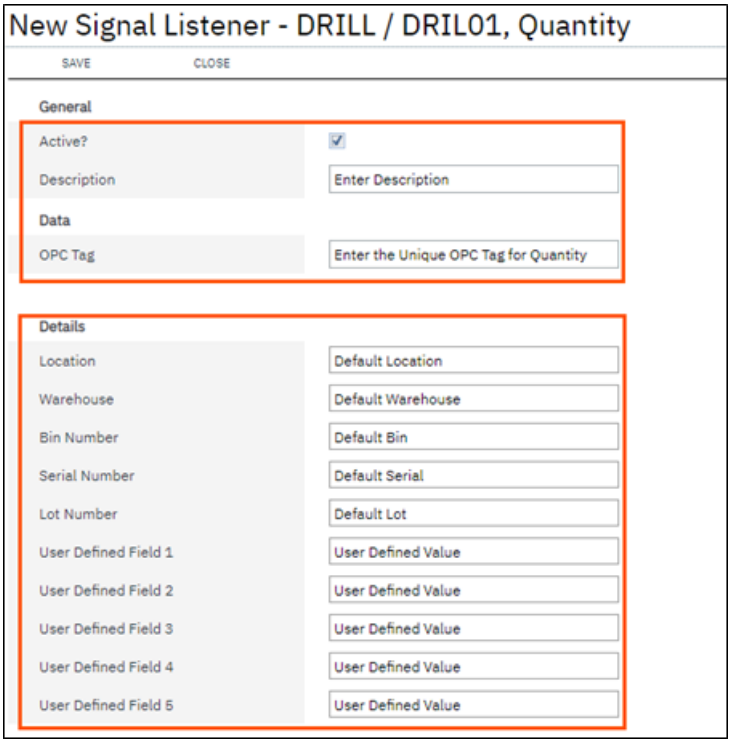
1. Enter the **OPC Tag** value.
2. Select the correct **Status**.
3. Enter a description.
4. Click **OK**.
5. Click **Save**.

Note: OPC Tag: The **OPC Tag** is written to the factory automation logging database along with all other values captured by the PLC/IO device. The data is stored in the **Lynq_ME_FA_InputData** table.

Quantity Signals

To configure a signal for **Quantity**:

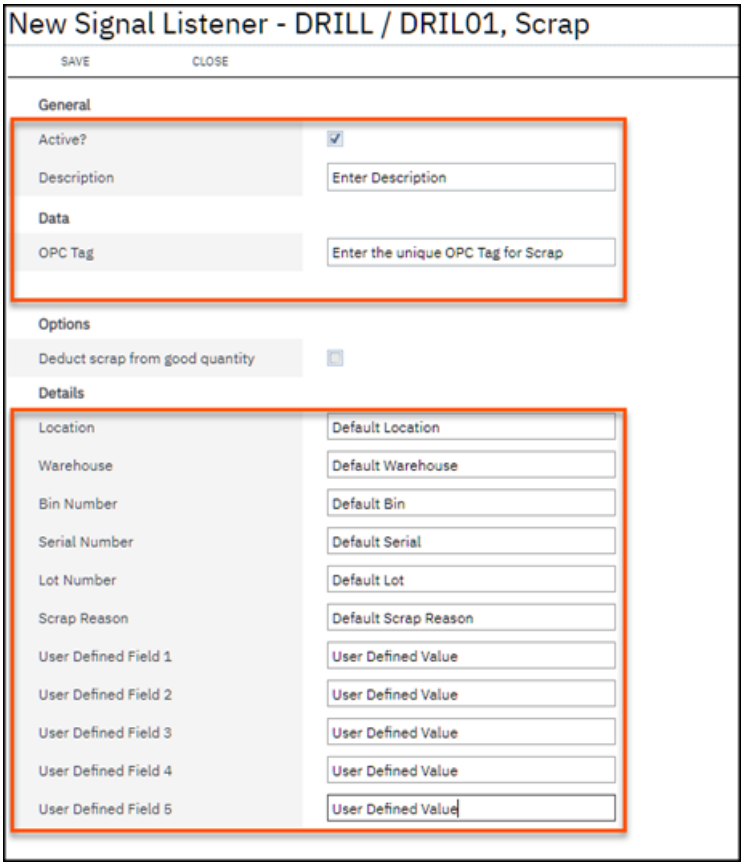
1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation Tab**.
4. Select **Signals**.
5. Select **New**.
6. Select **Quantity**.
7. Enter a description and the OPC Tag unique identifier.
8. Specify any default values for the **Quantity Signal**.
9. Click **Save**.



Scrap Signals

To configure a signal for **Scrap**:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation Tab**.
4. Select **Signals**.
5. Select **New**.
6. Select **Scrap**.
7. Enter a description and the **OPC Tag** unique identifier.
8. Specify any default values for the **Scrap Signal**.
9. Click **Save**.



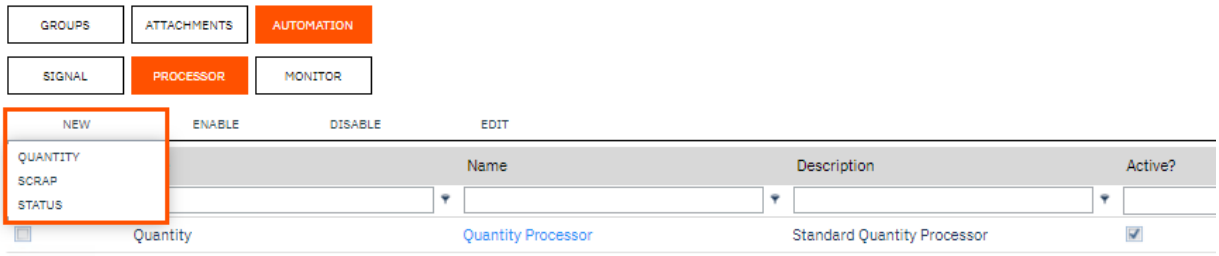
Processors

Processors are used to convert signal data into meaningful transactional data in **MOM**. Within the processor settings, you may also apply specific business rules to enable certain actions to be performed after the transaction has been created. It is important to note that **Processors** can also be used independently of **Factory Automation** with **LYNQ RestAPI**.

MOM is shipped with pre-defined Processors for:

- Quantity
- Scrap
- Status

You may however add your own processors if required from the Equipment Maintenance Processor screen.



Note: Activated: By default, all statuses are activated. You only need to deactivate a status if you want to stop the processor from processing data for that particular status code.

LYNQ RestAPI: Refer to the **Rest API** feature guide to understand how to communicate with the processor outside of MOM.

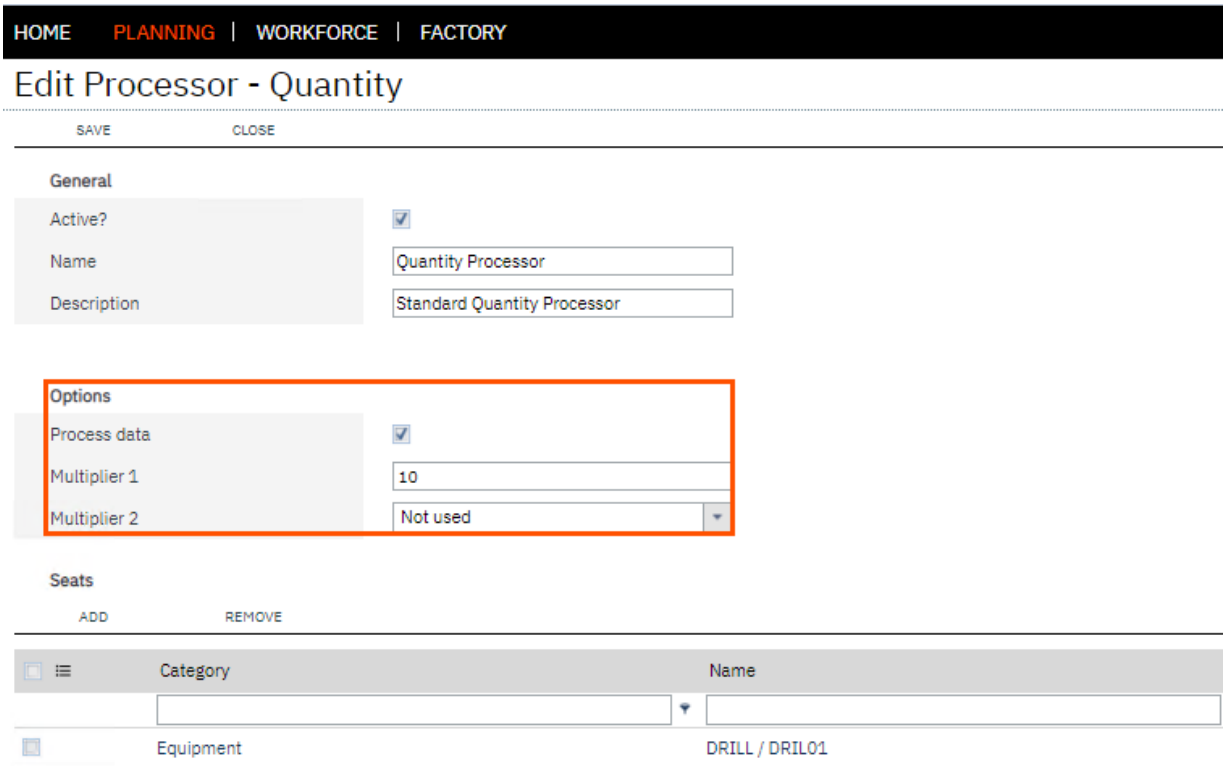
New Processors: Use the **New** option to create your own custom processor.

Processor Options

Against a Processor for Quantity and Scrap you can define a multiplication factor. Multiplication factors can be static (i.e. defined against the Processor) or dynamically assigned (i.e. defined in the Routing Operation, Stock Code or Custom Form Fields etc).

Multiplicators are typically used to indicate the number of units produced per operation cycle recorded with the PLC (i.e. multi-die forms when one punch of press creates multiple units)

Quantity Process Settings for Multiplier



Status Processor settings can be configured to perform certain actions once a transaction has been generated.

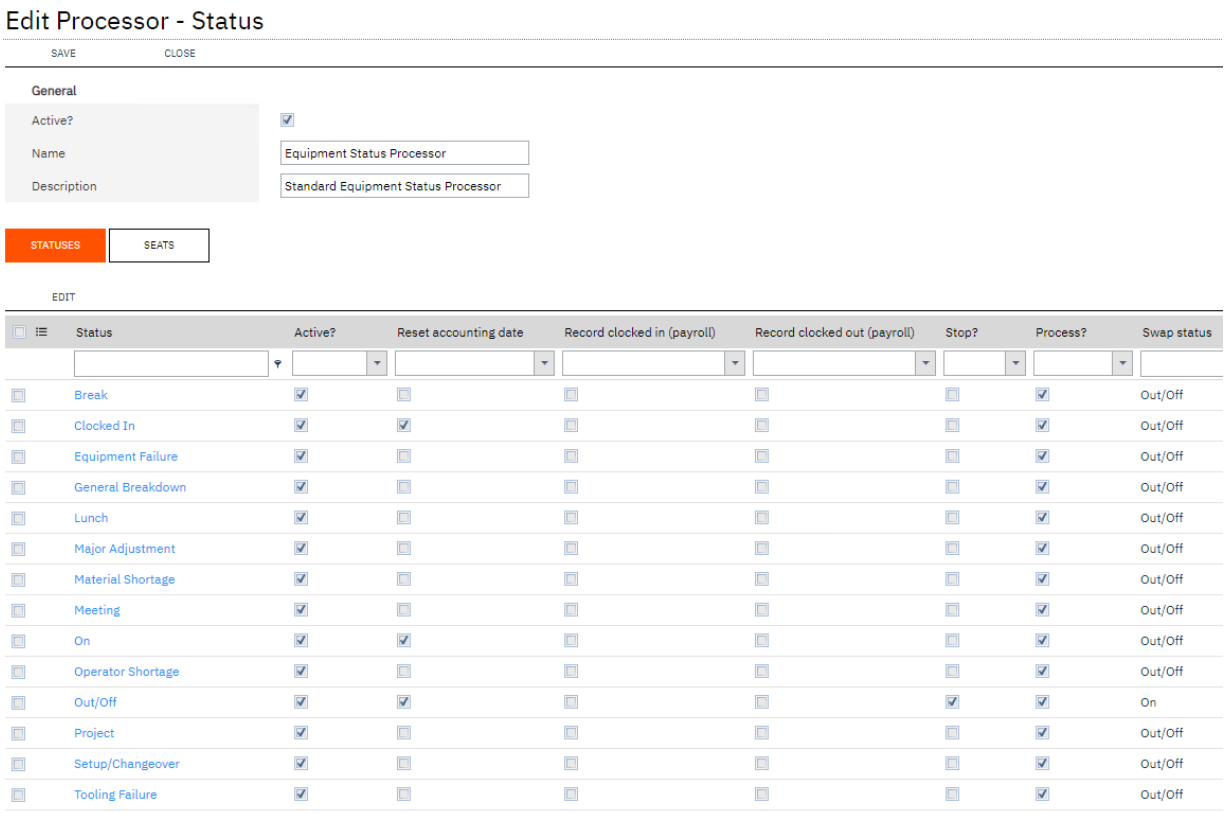
Tab Name	Sub Name	Purpose
Statuses	Active	The process is active for the type of status
	Reset Accounting Date	Whether the Accounting Date should be reset after the transaction is created
	Reset Clocked In	Whether the Clocked In Date should be reset after the transaction is created
	Reset Clocked Out	Whether the Clocked Out Date should be reset after the transaction is created
	Stop	Whether all active tasks should be stopped after the transaction is created
	Process	Whether additional data should be created after the transaction is created. This behavior works the same as the Process Data function within On Screen Elements.
	Swap Status	Whether the status of the resource should be swapped after the transaction is created

Note: Actions: You can view which actions were triggered from the Factory Automation screen.

Status Processor

To configure a processor for **Status**:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation** Tab.
4. Select **Processor**.
5. Select **Enable**.
6. Select the **Equipment Status Processor**.



To configure which seats are associated to the processor:

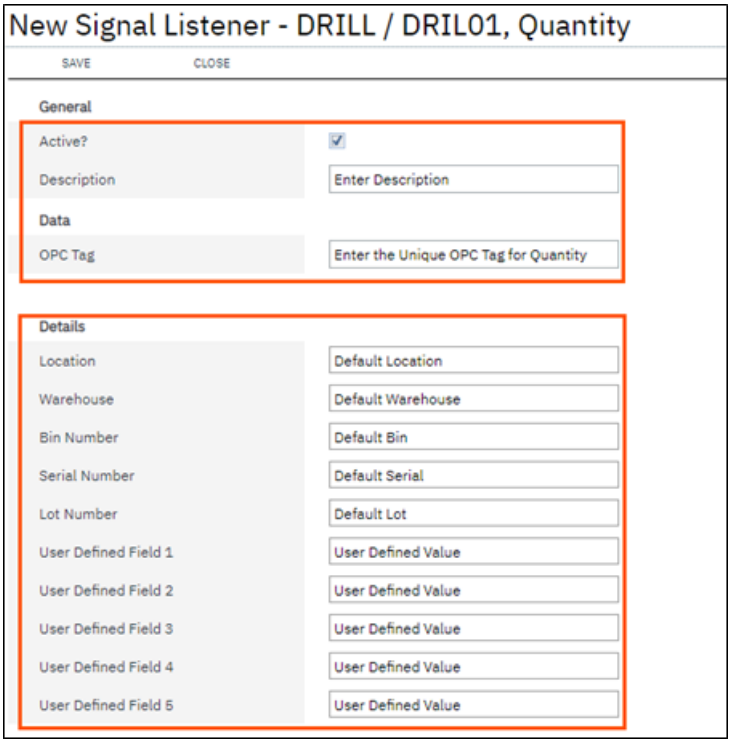
1. Select **Seats**.
2. Select **Add**.
3. Select the **Automated Resource**.
4. Click **OK**.
5. Click **Save**.

Note: Process Data: When this option is selected MOM will process other data at the time the quantity transaction is created. For example, if the equipment is running, equipment time will be generated at the same point.

Quantity Signals

To configure a signal for **Quantity**:

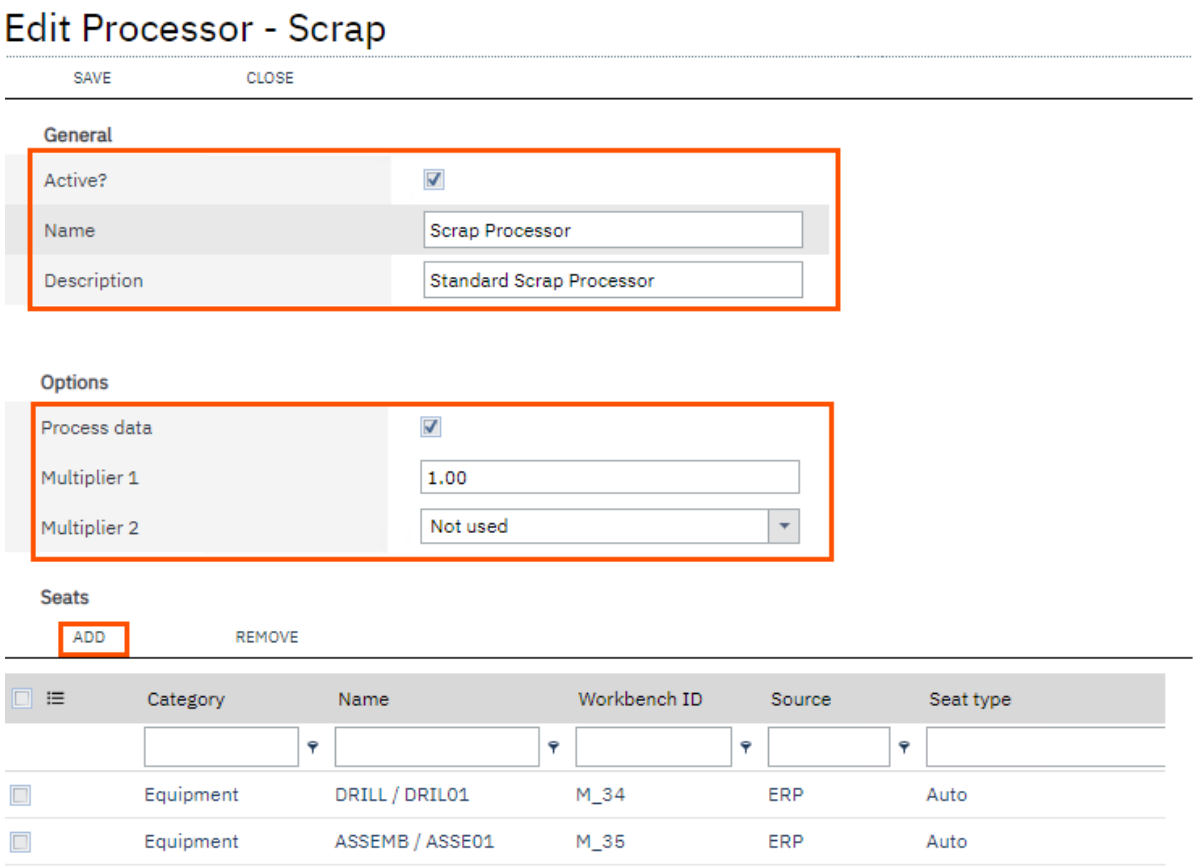
1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation Tab**.
4. Select **Signals**.
5. Select **New**.
6. Select **Quantity**.
7. Enter a description and the OPC Tag unique identifier.
8. Specify any default values for the **Quantity Signal**.
9. Click **Save**.



Scrap Processor

To configure a processor for **Scrap**:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation Tab**.
4. Select **Processor**.
5. Select **Enable**.
6. Select the **Scrap Processor**.
7. Select **OK**.
8. Select the **Scrap Processor** and select **Edit**.
9. Select **Active** to enable the processor.
10. Select whether the processor will process other data.
11. Enter any multiplication factors.



To configure which seats are associated to the processor:

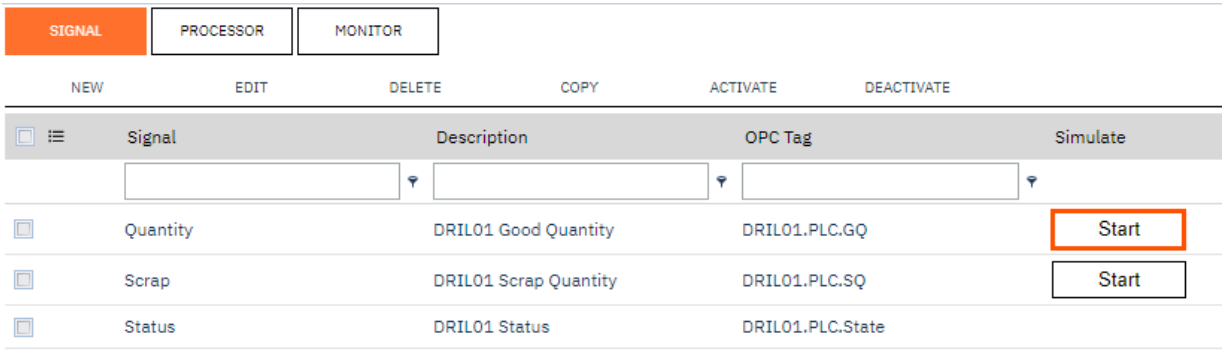
1. Select **Seats**.
2. Select **Add**.
3. Select the **Automated Resource**.
4. Click **OK**.
5. Click **Save**.

Testing Signals

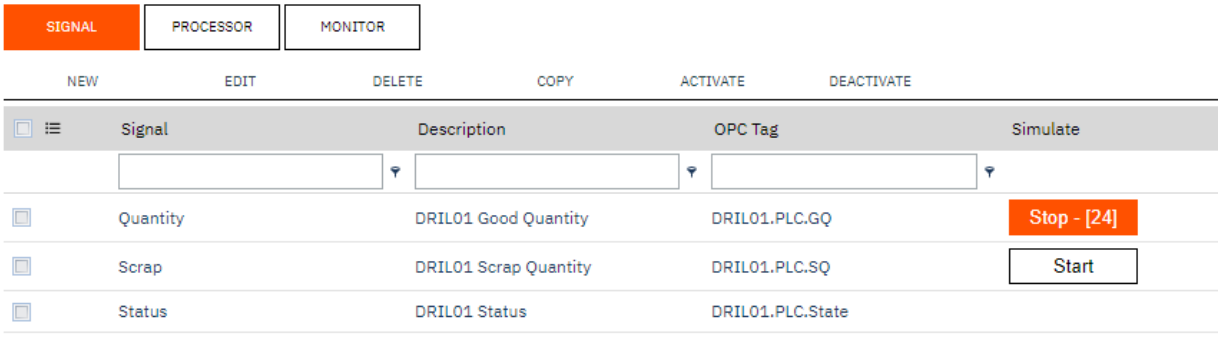
You may at any time use the simulate option to test that quantity/scrap signals and processors are configured correctly. Note: running this option will generate transactions but these can be deleted afterwards.

Before testing a **Signal**, start a task in the workbench for the automated device you wish to test.

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation** Tab.
4. Select **Signals**.
5. Select **Start** in the **Simulate** column.
6. Select **Monitor**.
7. Select **Start**.



Once started you will see the counter increase.



As the counter is increasing click on the Monitor Tab and press Start. You will now see the simulated transactions appear one after the other. Expand the row to show the transaction detail.

If everything has been configured correctly you will see the quantity or scrap reported against the Job.

As the counter is increasing click on the Monitor Tab and press Start. You will now see the simulated transactions appear one after the other. Expand the row to show the transaction detail.

If everything has been configured correctly you will see the quantity or scrap reported against the Job.

Note: The simulator will stop automatically if you move away from the Monitor Tab. The Monitor will operate for a maximum of 20 minutes (page life cycle time).

Simulation will stop as soon as you move off the **Monitor** Tab. To prevent this from happening select the option to **Open** the Monitor which will open the Monitor in a new Tab

Monitoring Live Data

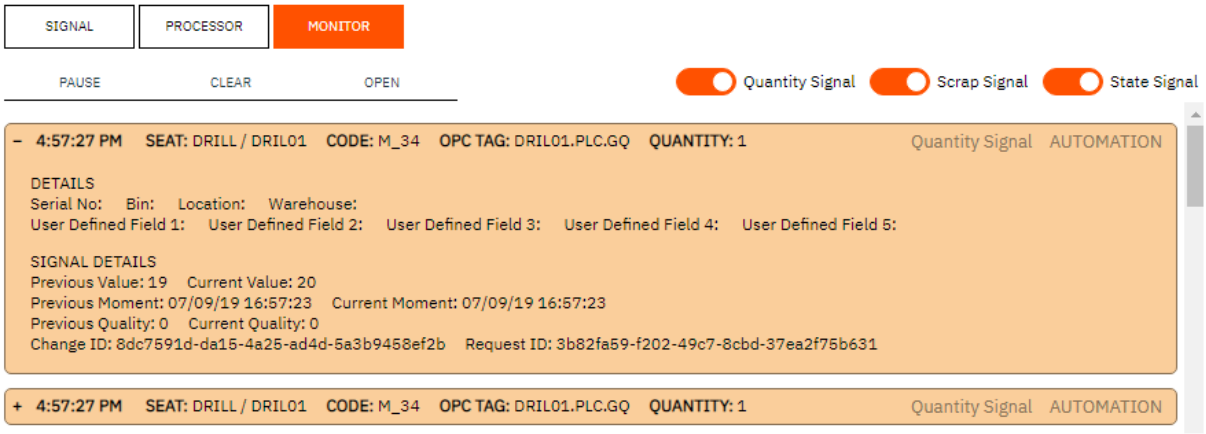
The actual live data coming from the factory floor can be visualized in the **Monitor**. The **Monitor** is optimized for mobile devices and is a useful tool for troubleshooting physical dataflow issues between multiple layers of the automated solution. (Machine, PLC, Network, OPC Server, MOM).

The monitor displays information relating to the quantity, scrap and status signals that are active in MOM.

To start the monitor:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation** Tab.
4. Select **Monitor**.
5. Select **Start**.

Expand the row to view the detail captured for the **OPC Tag**.



To pause the monitor:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation** Tab.
4. Select **Monitor**.
5. Select **Pause**.

To clear the monitor:

1. Select **Resource Management/Seat Maintenance**.
2. Select the **Equipment** record and click **Edit**.
3. Select the **Automation** Tab.
4. Select **Monitor**.
5. Select **Clear**.

Note: System Insights: Monitoring can also be run from the Automation Tab in the System Insights page.

No Data in Monitor?: Refer to the Troubleshooting section if you are not seeing any data in the Monitor.

Real-Time Analysis: When the Factory Automation feature is correctly configured and all components of the infrastructure are working seamlessly you will be able to see the data from your

automated devices appear in MOM. Quantity, Scrap and Status related Data coming into MOM will be updated on the Workbench and on all other live status screens in real-time

Transaction Review: All posted **Factory Automation Transactions** will appear in the **Transaction Review** screen and will be set to the approval status based on the default approval status specified in T**ransaction Rules (Advanced Settings)**. These transactions will still need to go through your standard approval process to be posted to your ERP application.

Red Indicator Icon: You will continue to see a Red Indicator Icon for an automated device until you resolve all invalid data entries for the accounting day.

The **Automation Status Indicator** on the **Equipment Status** screen and on the Workbench screen provides another useful tool for monitoring the health of an automated device.

The **Automation Status Indicator** has 5 different status meanings:

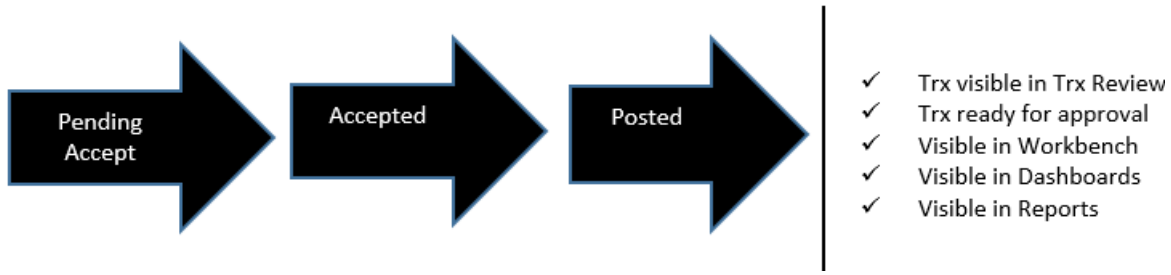
Indicator	Color/Image Code	Meaning	
	Finger	Factory Automation is disabled but Manual Data Collection is enabled	
	WIFI Grey with Diagonal Line	Device is not activated for Automation and Manual Data Collection is disabled	
	WIFI Grey	Device is activated for Automation but no data has been received	
	WIFI Green	Device is activated for Automation and valid data has been received on the accounting day	
	WIFI Red	Device is activated for Automation and unresolved invalid data has been received on the accounting day	

Error Handling

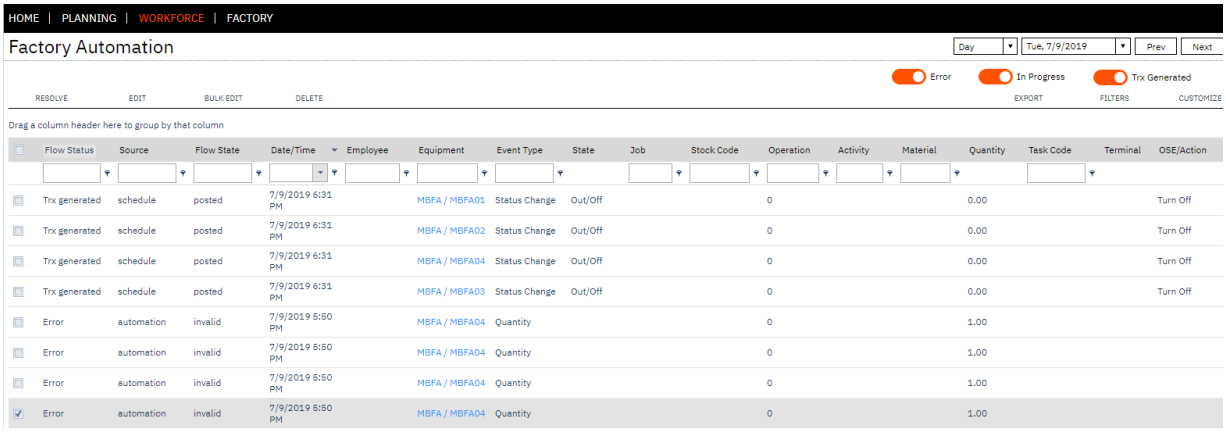
There may be occasions where data received from an automated device is not visible in the workbench or in reports and/or dashboard screens in MOM. If you are seeing the data on the Monitor but cannot report on the data in MOM you should use the **Factory Automation** screen to investigate the reasons for this problem.

Similar to the process flow in the **Transaction Review** Screen, **Factory Automation** data must pass through stages before the data becomes a valid transaction that can been seen in the **Transaction Review Screen** and in turn in other MOM dashboard and reporting screens.

Data from **Automated Devices** must pass through these flow states



Factory Automation Screen



There are in total 6 flow states in **MOM**.

Flow State	Type	Meaning
	Invalid	Invalid data received or no Job running (Qty)
	Pending Accept	Waiting for the Processor to run based on Data Buffer Interval
	Accepted	Data accepted but not processed by the MOM Platform Service (Service must be started, service polls every 1 minute)
	Accept Error	Internal Acceptance error due to data integrity issues
	Posted	Transaction successfully generated
	Instant Accept	Transaction was generated via the Workbench

The Factory Automation screen groups these different flow states into a simplified view of the flow status for quick troubleshooting purposes.

Note: No Data visible in Factory Automation: Check that you have enabled signals and processors for the data you are expecting MOM to capture.

Source Column: The source column indicates where the data originated from. Filter the Source column by the value **automation** to only show the transactions that have been created by the **Factory Automation Process**. By default, you will see records for manual actions and workbench.

Customize Screen: You can add/remove columns to the **Factory Automation** screen by clicking on Customize.

Deleting Transactions: You cannot delete transactions with a flow status of Trx generated and a **Flow State of Posted**.

System Insights: An ungrouped view of the factory automation data can be found on the Events Tab of the System Insights screen.

The **Factory Automation Screen** has 3 filters:

- In progress
- Errors
- Trx Generated

Relationship of filter to flow state value:

Relationship	Flow State	Flow Status
	Invalid	Errors
	Pending Accept	In Progress
	Accepted	In Progress
	Accept Error	Errors
	Posted	Trx Generated
	Instant Accept	Trx Generated

Transactions displayed on the **Factory Automation Screen** with a status of **Error** should be investigated promptly.

Transactions displayed on the **Factory Automation Screen** with a status of **Error** should be investigated promptly.

Errors will happen if:

1. Data received includes invalid data (i.e. string value received instead of a numerical value for good quantity/scrap quantity).
2. No Job/Operation running at the time when the **Quantity/Scrap** processor created the transaction. When this happens, the data cannot be processed correctly, as MOM does not know which Job/Product to process the data against.
3. Internal data acceptance issues due to violation of key constraints.

You should also investigate transactions in the status of **In Progress**, if these transactions have been in this status longer than the data buffer interval.

In Progress will happen if

The processor is still waiting to process the data based on the **Data Buffer Interval Setting** (Advanced Settings/General).

Some of these issues will resolve themselves, however there may be times when you need to resolve error data to allow the MOM transaction to be generated.

Note: Invalid Data: If the signal receives data from a tag that is not recognized in MOM, MOM will treat the data as invalid. The tag value specified against the **Signal** must match the **Tag** value specified on the **OPC Server**. In addition to the **Tag Value**, the value passed as a good quantity or bad quantity value must be numeric.

Pending Accept: Check the **Data Buffer Interval**: if you notice a number of transactions that have remained at the status of **Pending Accept** for some time. You may need to reduce the **Data Buffer** Interval if this is set to a high value and you wish to update MOM more frequently.

MOM Platform Service: The polling interval of the **MOM Platform Service** cannot be adjusted.

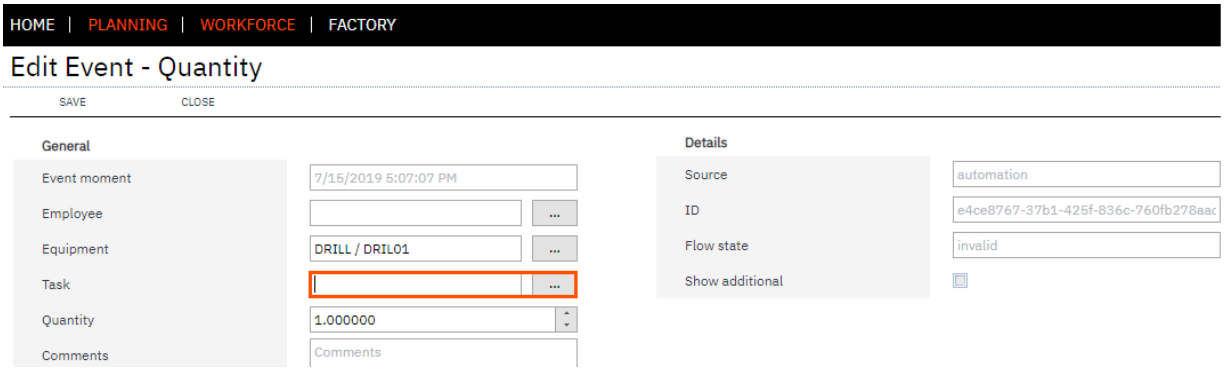
Accept Errors: These errors should be fixed to ensure the status changes to Trx Generated.

Correcting Invalid Errors

Transactions with a flow state of Invalid should be corrected to ensure data flow in MOM completes successfully. Corrections can only be applied to quantity or scrap transactions. Status transactions cannot be corrected as correction requires changes of time-based calculations in the past. Invalid status transactions are shown for visualization purposes only.

Invalid errors happen when the Factory Automation Processor cannot generate the final transaction for the data received from the automated device. This typically happens when the equipment was not running a **Job** at the time of the record creation.

Double clicking on the record will show a blank **Task** value.



To edit/correct these Transactions, complete these steps:

1. Select **Workforce**.
2. Select **Factory Automation**.
3. Filter the screen to show the correct date range.
4. Filter the screen to show only records where event type = **Quantity**.
5. Filter the screen to show only records where Flow State = **Error**.
6. Double Click on the Transaction that does not have a Job No.
7. Using the **Task Lookup** […] select a **Job/Task**.
8. Select **Save**.
9. Select the **Checkbox** in the **Row Data** (first column) and select **Resolve**.

The **Flow Status** will change to **Pending Accept** and the next time the processor runs the transaction should update to a **Flow Status of Trx Generated**.

When a record in the **Factory Automation** screen is updated to **Trx Generated** the data will be visible in the standard MOM screens.

If you are experiencing high volumes of Invalid Errors see the following Alerts Section.

Note: Bulk Edit : Use the Bulk Edit option in the Factory Automation screen to update multiple records at a time.

Correcting Accept Errors

Contact the Support Team if you receive any transactions with a flow state of **Accept Error** . Accept Errors will occur if the transaction cannot be generated due to internal data integrity issues. Your Support Team will investigate these issues with you to determine the root cause.

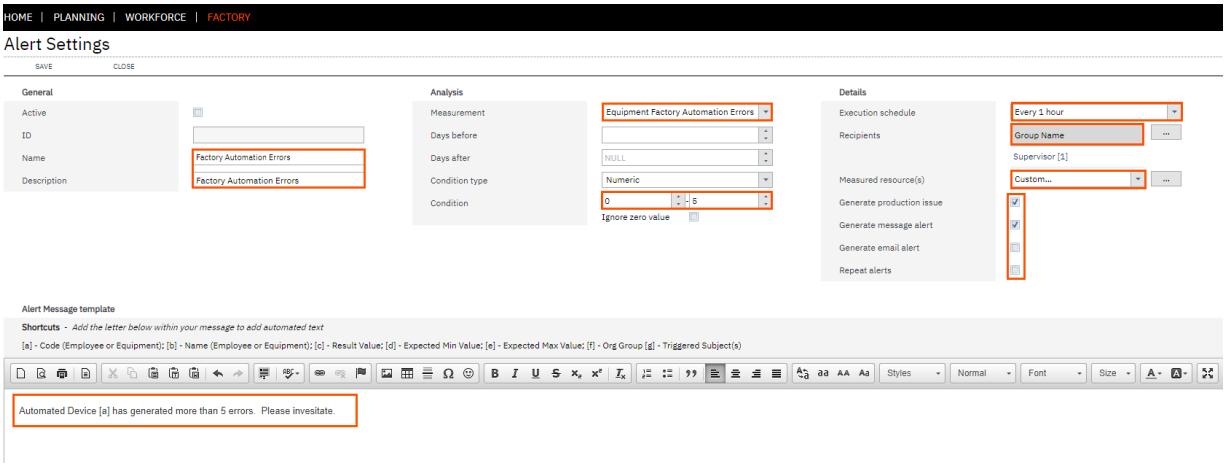
Alerts

MOM can be configured to alert you when errors are logged during the data flow process to help you promptly react to problems.

As an example, to configure an alert to notify recipients every hour when 5 or more errors have been logged:

1. Select **Factory**.
2. Select **Alert Maintenance**.
3. Select **New**.
4. In the **Name** field enter **Factory Automation Errors**.
5. In the **Description** field enter **Factory Automation Errors**.
6. In the **Measurement** field select E**quipment Factory Automation Errors**.
7. In the **Condition** field enter 0 and then 5.
8. In the **Execution Schedule** field select **Every 1 Hour**.
9. Select the **Recipient Group** for this alert
10. Select the **Measured** resources.
11. Select whether the alert should create:
    - Product Issue
    - Message Alert
    - Email Alert
12. Select whether the **Alert** can be repeated.
13. Check the **Active** field.

Alert Maintenance Settings



After 5 errors have been generated, the Alert will create a Production Issue and will send a message.

Troubleshooting

The overall Factory Automation solution will have various points for failure. Investing in redundant network infrastructure will ensure higher availability of the Factory Automation solution.

It is important to understand when Factory Automation is not working, where to start troubleshooting. Troubleshooting can take place at the infrastructure layer and at the MOM application layer.

Use the table below as a guide for troubleshooting purposes:

Troubleshoot	Issue	Troubleshooting Steps	Layer
	No Data in Monitor	Check that you have correctly configured the automated device seat in MOM. (i.e. Equipment has been imported, Equipment has been activated for Automation)	MOM Application
		Check there are no communication issues between the automated device/PLC/OPC Server or other underlying network issues	Infrastructure
		Check there are no communication issues between OPC server and the MOM Web Server	Infrastructure
		Check the Signals are activated in MOM with the correct **Tag Values** and **Status Codes**.	MOM Application
	Data in Monitor but no Transactions in MOM	Check the Processors are Enabled in MOM and that the correct seats have been associated to the Processor	MOM Application
		Check the **Factory Automation** screen to see if there are any flow status errors. Resolve these where appropriate.	MOM Application