LYNQ

Factory Automation

USING LYNQ WITH FACTORY AUTOMATION

JULY 2019

LYNQ

Contents

LYNQ

Factory Automation Overview

140+ Industrial Drivers
LYNQ supports 140+ industrial drivers out of the box.

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

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

Factory automation is an exciting new feature available in LYNQ 2019. Factory Automation extends the existing manual data collection features in LYNQ, 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. LYNQ provides the platform to digitalise your factory by connecting machines, measuring equipment and other devices to read data without manual inputs.

LYNQ'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.

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 dataflow errors
- How to setup alerts for monitoring automation errors
- How to troubleshoot failures

LYNQ

System Requirements

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

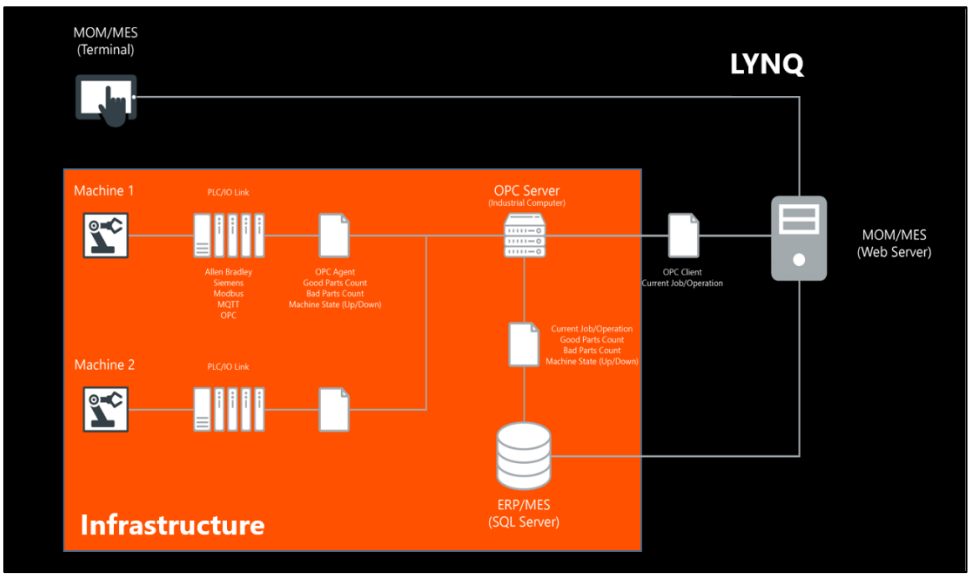
System Requirements
Read the System Requirements for OPC Server specifications.

Device Licenses
Automated device licenses can be purchased separately.

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

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

Factory Automation Topology Diagram



To automate your equipment you must have a device license which differs to the manual resource seat license. To check whether you have sufficient automated device licenses, click on Help, Change Product License from the LYNQ home page.

LYNQ System Requirements

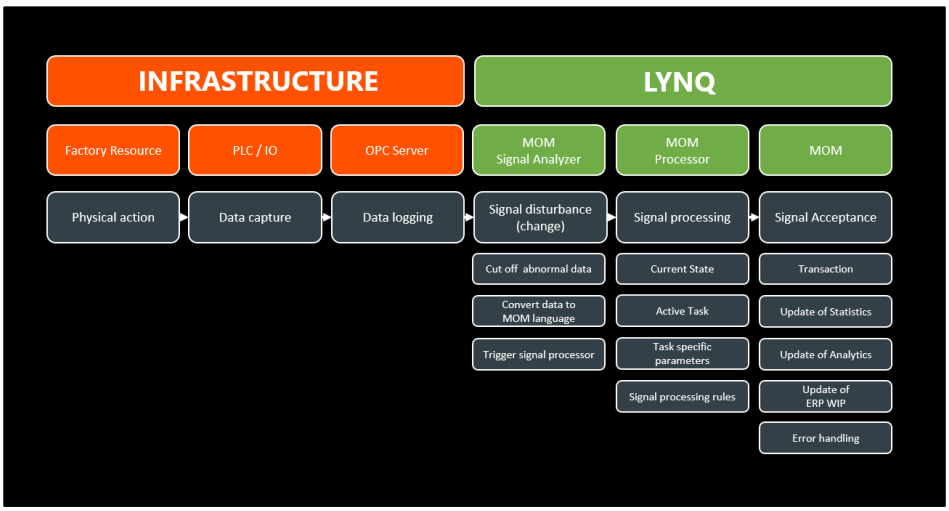
LYNQ

The Concept of Automation

Data Logging
LYNQ combines the data logged by the OPC server to active jobs running in LYNQ.

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

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: LYNQ can only take responsiblilty 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.

Enabling Factory Automation

Polling Interval
The polling interval determines how frequently data will be read in the factory automation database to LYNQ.

Data Buffer Interval
The data buffer interval determines how frequently the processor will translate machine data into LYNQ 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.

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

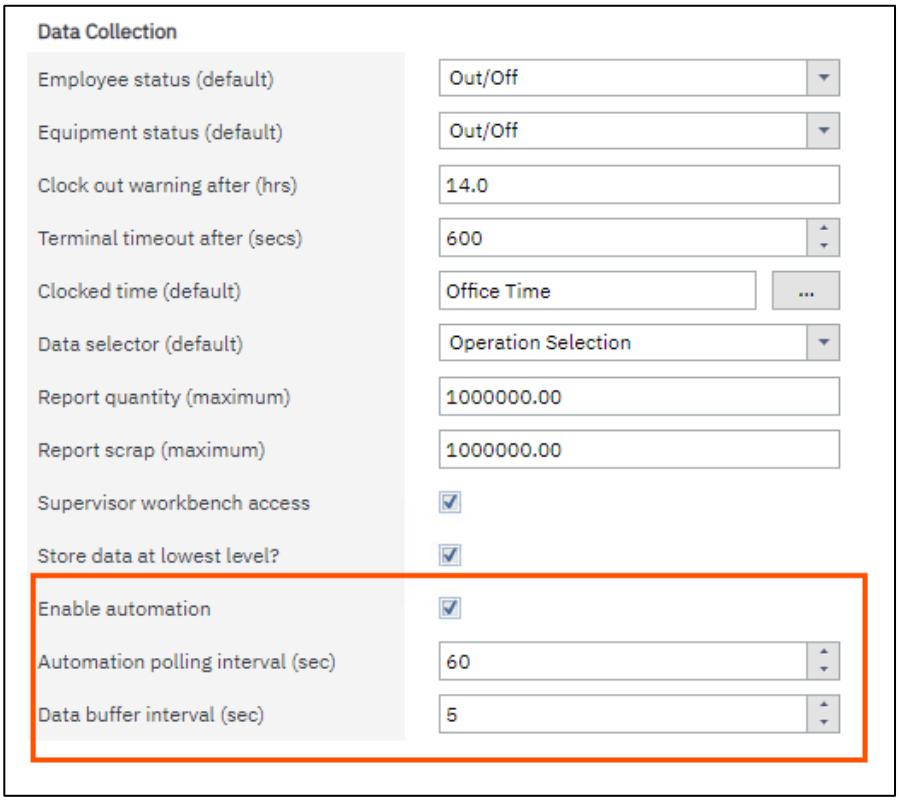
LYNQ must understand which database is configured to store data logged by the OPC Server.

Configure the Factory Automation Database:

1. Logon to LYNQ 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
6. Select Save

Enable Factory Automation:

1. Logon to LYNQ 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

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.

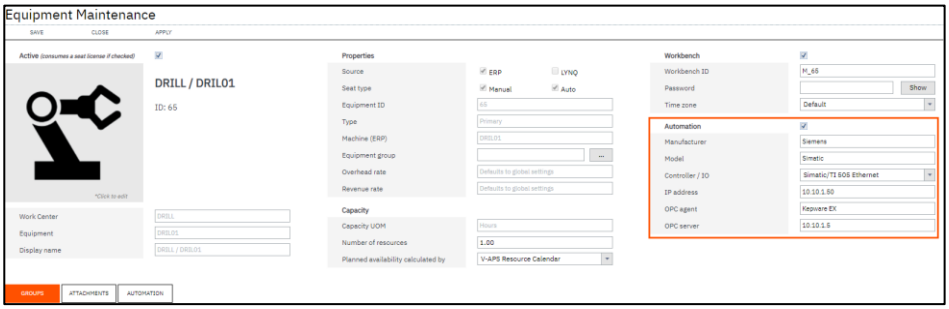
Manual Data Collection
It's possible to turn off manual data collection for an automated device by deselecting the Workbench Checkbox in Equipment Maintenance.

Automated devices are configured under Resource Management, Seat Maintenance, Equipment Maintenance. Devices that you choose to automate, must be imported into LYNQ 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 LYNQ, you must configure both:

1. Signals
2. Processors

This is explained in the following sections

Signals

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 LYNQ. Search the LYNQ Knowledgebase for further information. support.lynqmes.com.

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 LYNQ 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)
- 5 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. LYNQ must be setup with 5 separate Scrap Signals each with a unique Scrap Reason code.

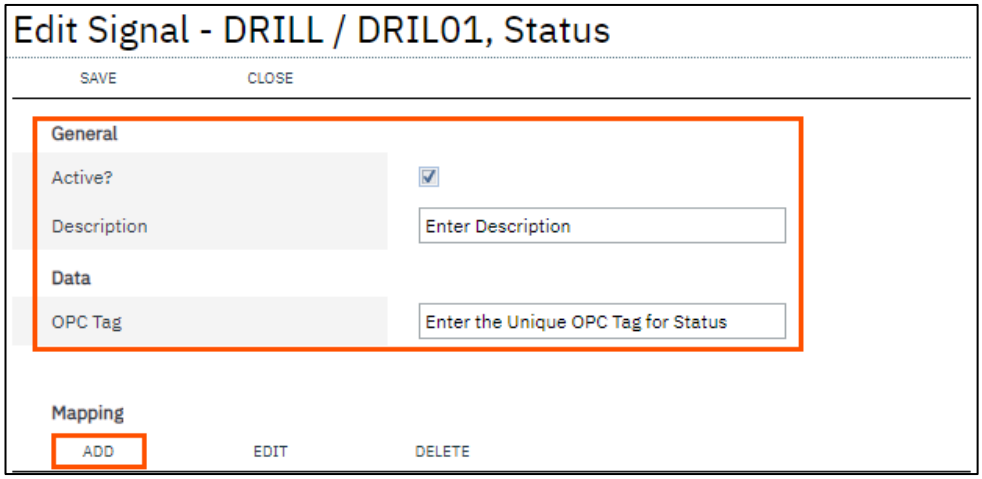
Other Non-OEE related data such as pressure, temperature, spindle speed, etc may be recorded and stored within the LYNQ Factory Automation SQL Database. LYNQ signal processing will ignore this data but the data can be used for custom reporting (i.e Power BI, Microsoft SQL Server Reporting Services).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

Status Signals

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.

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 LYNQ:

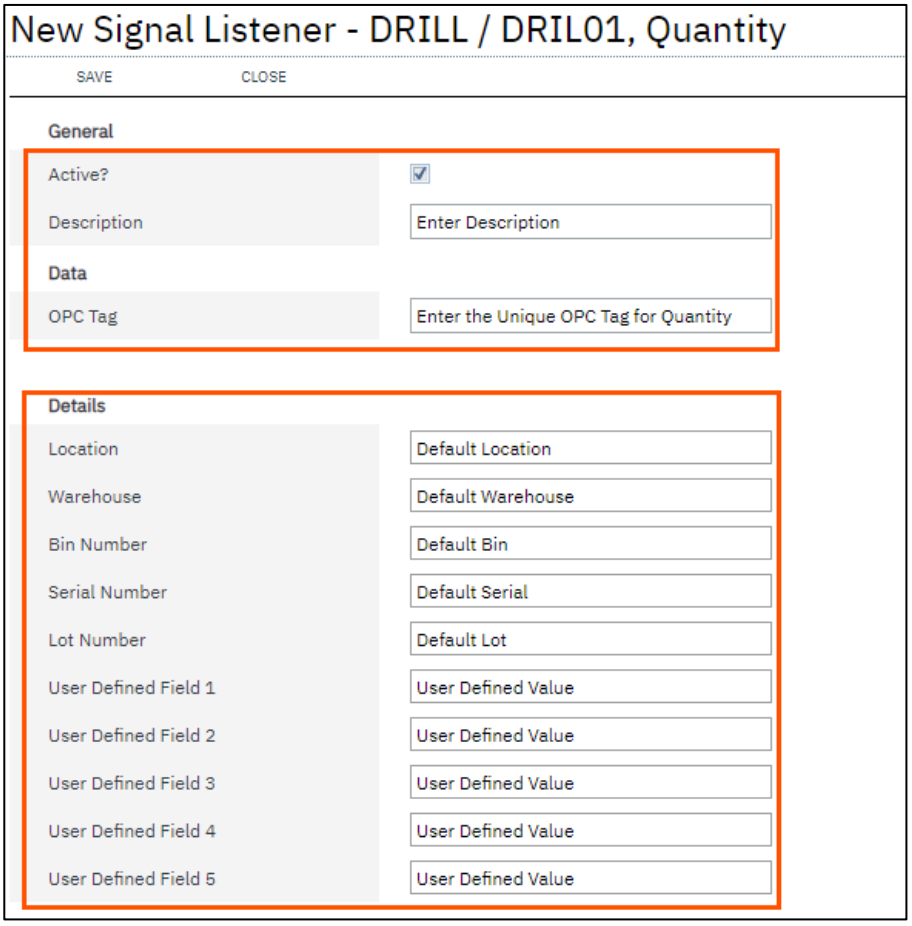
1) Enter the OPC Tag value
2) Select the correct Status
3) Enter a description
4) Click OK.
5) Click Save

Quantity Signals

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.

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

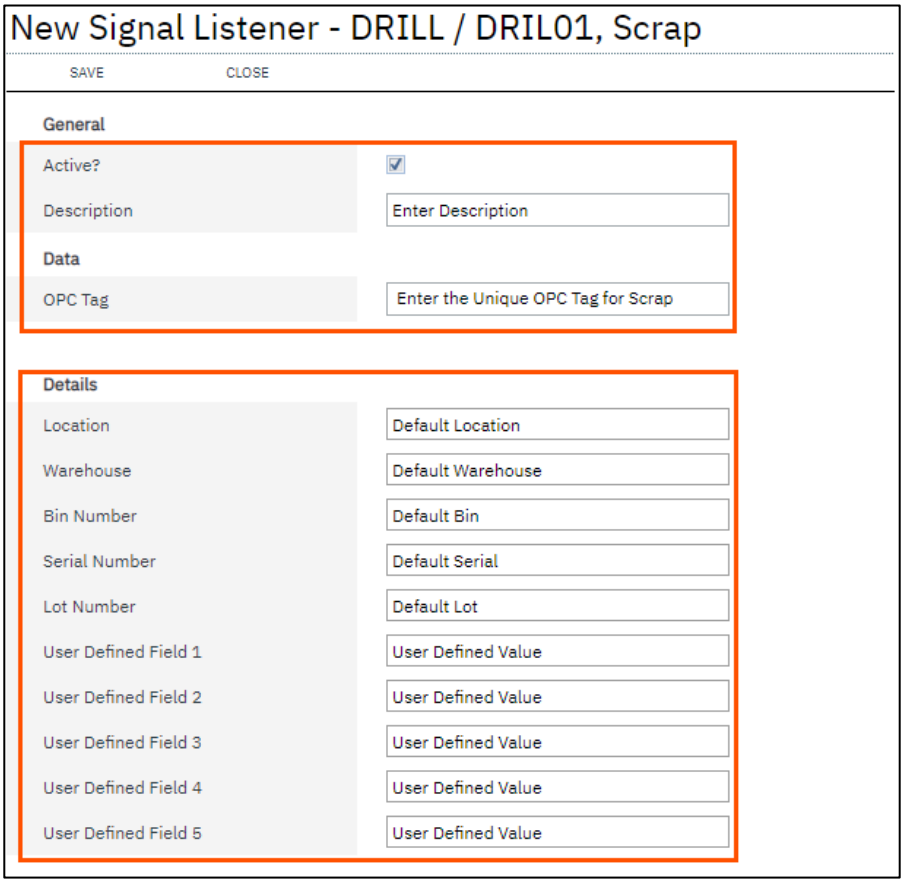


Scrap Signals

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.

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 Quantity
7. Enter a description and the OPC Tag unique identifier
8. Specify any default values for the Scrap Signal
9. Click Save



Processors

Activated
By default all statues 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 LYNQ.

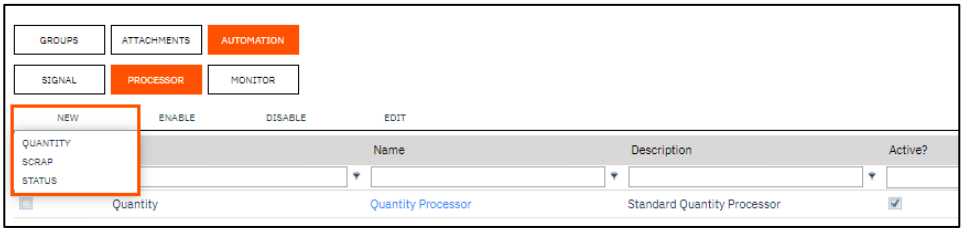
New Processors
Use the New option to create your own custom processor.

Processors are used to convert signal data into meaningful transactional data in LYNQ. 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.

LYNQ 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.



Processor Options

Activated
By default all statues are activated. You only need to deactivate a status if you want to stop the processor from processing data for that particular status type.

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

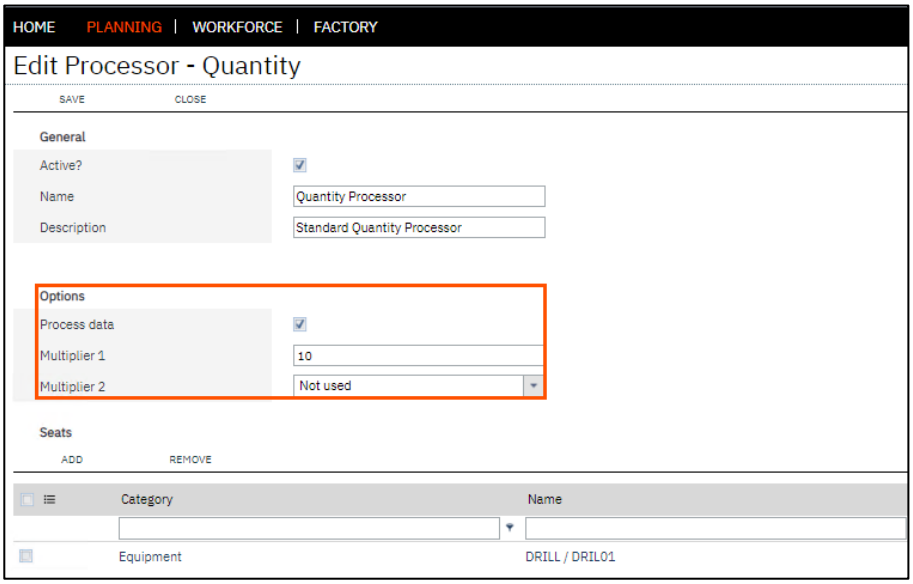
New Processors
Use the New option to create your own custom processor.

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

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.

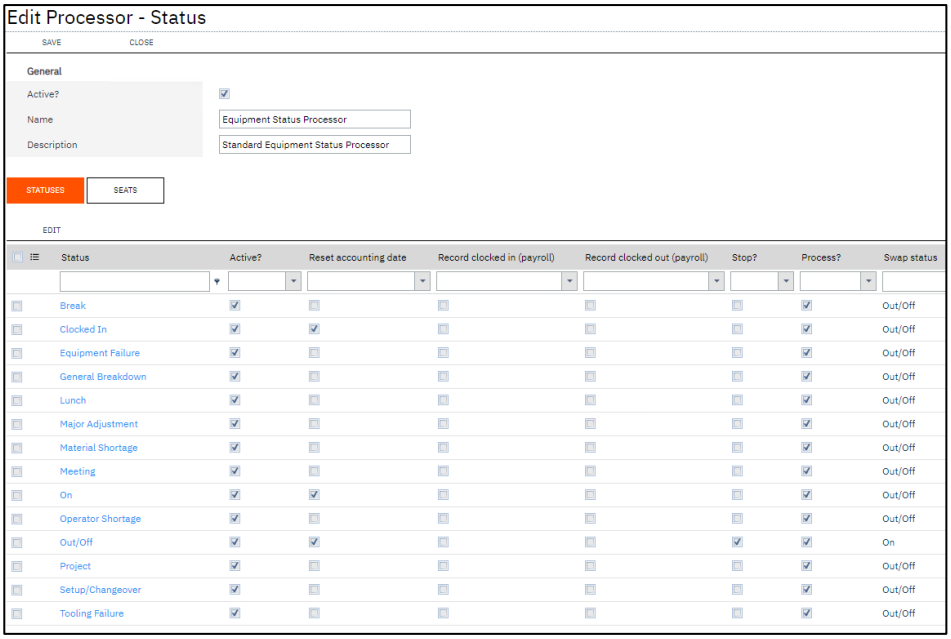
Tab Name	Sub Name	Purpose
Statues	Active	The process is active for the type of status
	Reset Accounting Date	Whether the Accounting Date should be reset after the transaction is created
	Reset Clocked In	Whether the Clocked In Date should be reset after the transaction is created
	Reset Clocked Out	Whether 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 behaviour 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

Status Processor

Process Data
When this option is selected LYNQ 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.

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:

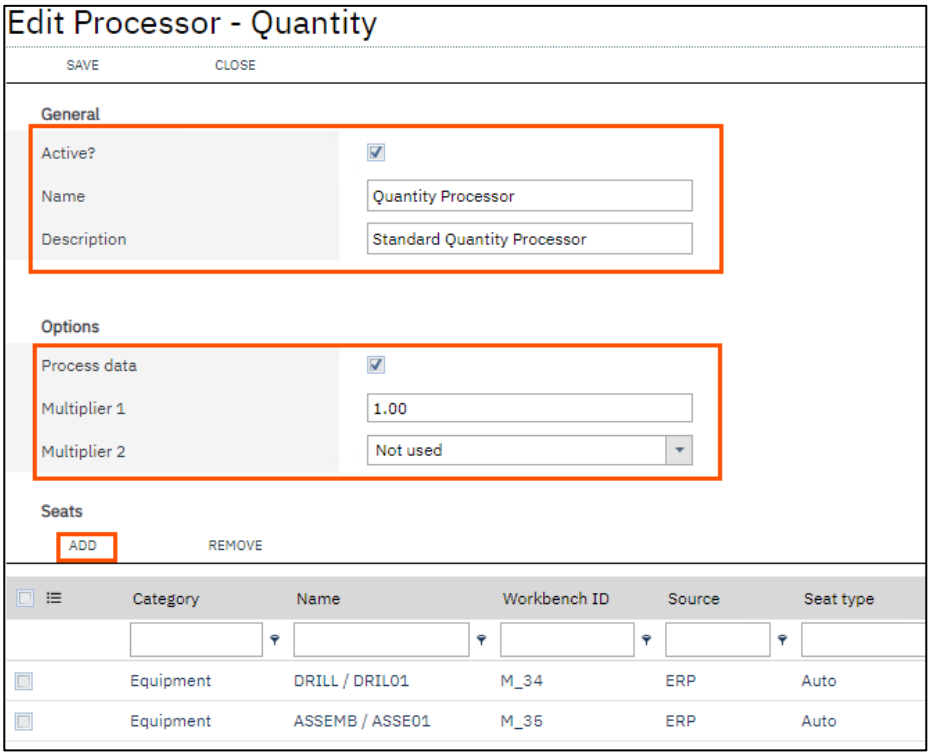
1. Select Seats
2. Select Add
3. Select the Automated Resource
4. Click OK
5. Click Save

Quantity Processor

Process Data
When this option is selected LYNQ 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.

To configure a processor for **Quantity:**

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 Quantity Status Processor
7. Select OK
8. Select the Quantity Processor and select Edit
9. Select Active to enable to processor
10. Select whether the processor will process other data
11. Enter any multiplication factors



To configure which seats are associated to the processor:

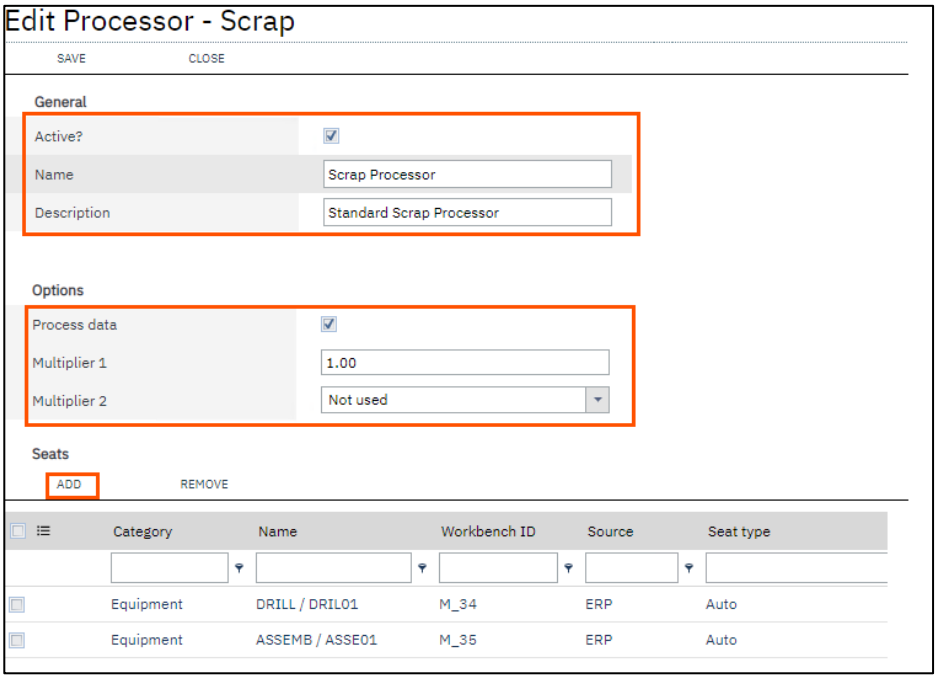
1. Select Seats
2. Select Add
3. Select the Automated Resource
4. Click OK
5. Click Save

Scrap Processor

Process Data
When this option is selected LYNQ 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.

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 Quantity Status Processor
7. Select OK
8. Select the Quantity Processor and select Edit
9. Select Active to enable to 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

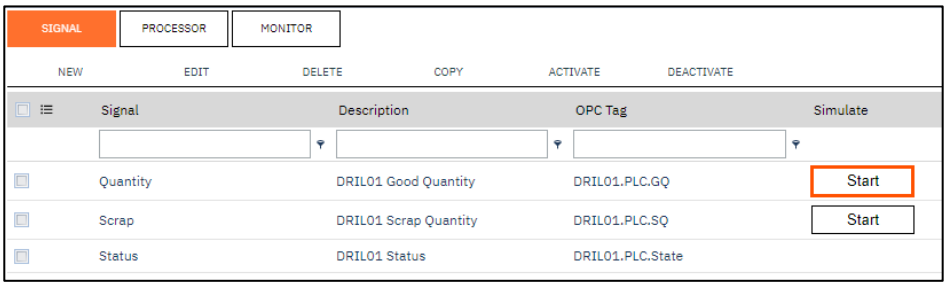
Testing Signals

Simulate
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.

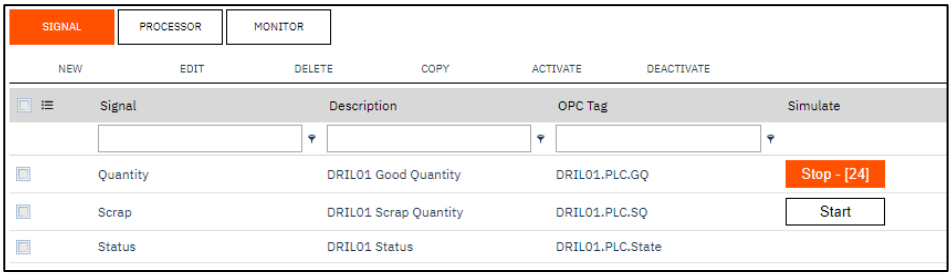
You may at any time use the simulate option to test that quantity/scrap signals and processors are configured correctly. Note: running this option will generate transactions but these can be deleted afterwards.

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.

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).

Monitoring Live Data

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 LYNQ. Quantity, Scrap and Status related Data coming into LYNQ 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 Transaction Rules (Advanced Settings). These transactions will still need to go through your standard approval process to be posted to your ERP application.

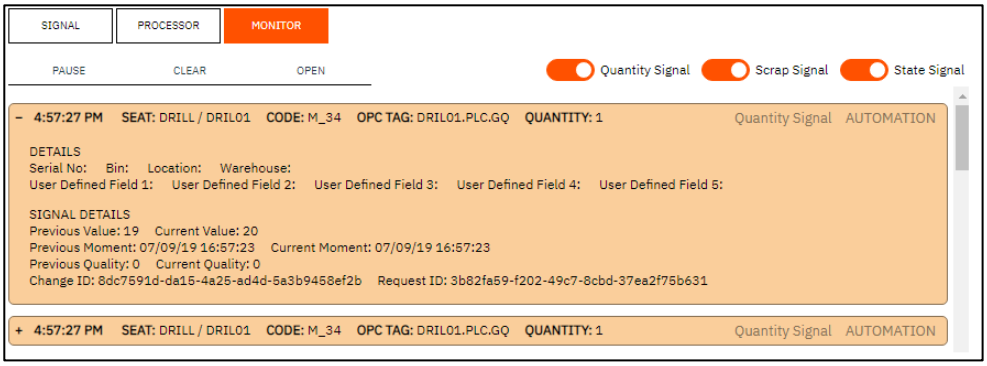
The actual live data coming from the factory floor can be visualised in the Monitor. The Monitor is optimised for mobile devices and is a useful tool for troubleshooting physical dataflow issues between mutliple layers of the automated solution. (Machine, PLC, Network, OPC Server, LYNQ).

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

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 Cle

LYNQ

Monitoring Live Data

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

No Data visible in Factory Automation
Check that you have enabled signals and processors for the data you are expecting LYNQ 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.

Customise Screen
You can add/remove columns to the Factory Automation screen by clicking on Customise

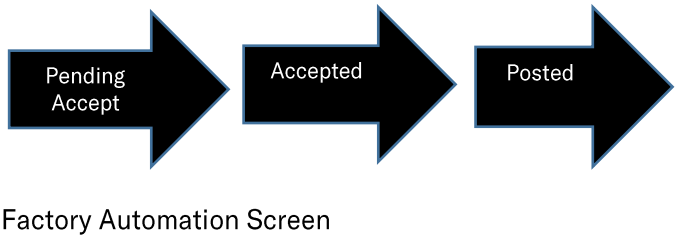
Deleting Transactions
You cannot delete transactions will a flow status of Trx generated and a Flow State of Posted.

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

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

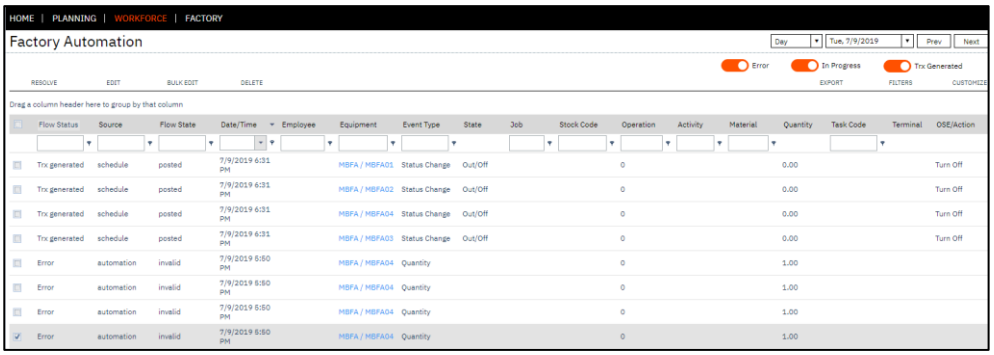
Similar to the process flow in the Transaction Review Screen, Factory Automation data must pass through stages before the data becomes a valid transaction that can been seen in the Transaction Review Screen and in turn in other LYNQ dashboard and reporting screens.

Data from Automated Devices must pass through these flow states



- ✓ Trx visible in Trx Review
- ✓ Trx ready for approval
- ✓ Visible in Workbench
- ✓ Visible in Dashboards
- ✓ Visible in Reports

Factory Automation Screen



There are in total 6 flows states in LYNQ.

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 LYNQ 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 the flow status for quick troubleshooting purposes.

LYNQ

Error Handling

Invalid Data
If the signal receives data from a tag that is not recognised in LYNQ, LYNQ 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 LYNQ more frequently.

LYNQ Platform Service
The polling interval of the LYNQ Platform Service cannot be adjusted.

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

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.

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 LYNQ doesn't 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:

1. 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 LYNQ transaction to be generated.

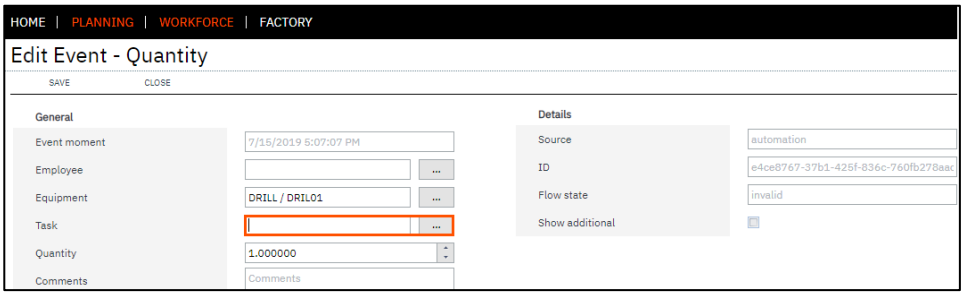
Correcting Invalid Errors

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

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

Invalid errors happen when the Factory Automation Processor cannot generate the final transaction for the data received from the auotmated 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 LYNQ screens.

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

LYNQ

Correcting Accept Errors

Support Team
Support can be reached at support@lynqmes.com

Contact the LYNQ 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. LYNQ will investigate these issues with you to determine the root cause.

Alerts

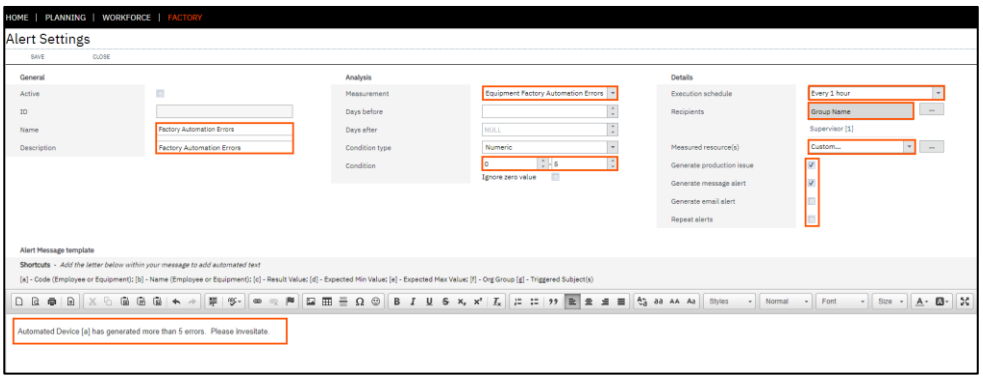
Alerts Setup
Search the Knowledgebase for articles relating to the setup of Alerts. You will need to ensure you have configured Alerts before using this function successfully.

LYNQ 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 Equipment 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
    a. Product Issue
    b. Message Alert
    c. 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.

LYNQ

Troubleshooting

Troubleshooting
LYNQ can only process automated device data once the infrastructure is performing correctly.

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 LYNQ application layer.

Use the table below as a guide for troubleshooing purposes

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