Application Note

FESTO

Festo CPX and E2M via EtherNet/IP with Rockwell Automation FactoryTalk® Edge Gateway™ and Smart Objects

How to extract data from CPX-FB36 systems using the built-in auto-discovery feature of Factory Talk Edge Gateway by Rockwell Automation. What are the use cases of this data, and how to supplement it by using Factory Talk Smart Objects.

CPX-FB36
E2M
MPA-S
MPA-L
VTSA
Festo AX

100450

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Table of contents

1 Components/Software used

Type/Name	P/N, Version Software/Firmware	Date of manufacture
CPX-FB36	1912451 Rev15	
E2M	3990296	
CPX-MPA	530411	
CPX-VTEM	8047502	
Rockwell Studio 5000	V32	
Rockwell Factory Edge Gateway	Ver 1.03.00 User Manual 95055-UM006D-EN-P – April 2022	
Studio5000 Smart Object Config	Ver. 2.01.00	
Rockwell 1769-L18ER-BB1B PLC Rockwell 1769-L30ERMS PLC	V32 V32	

Table 1.1: 1 Components/Software used

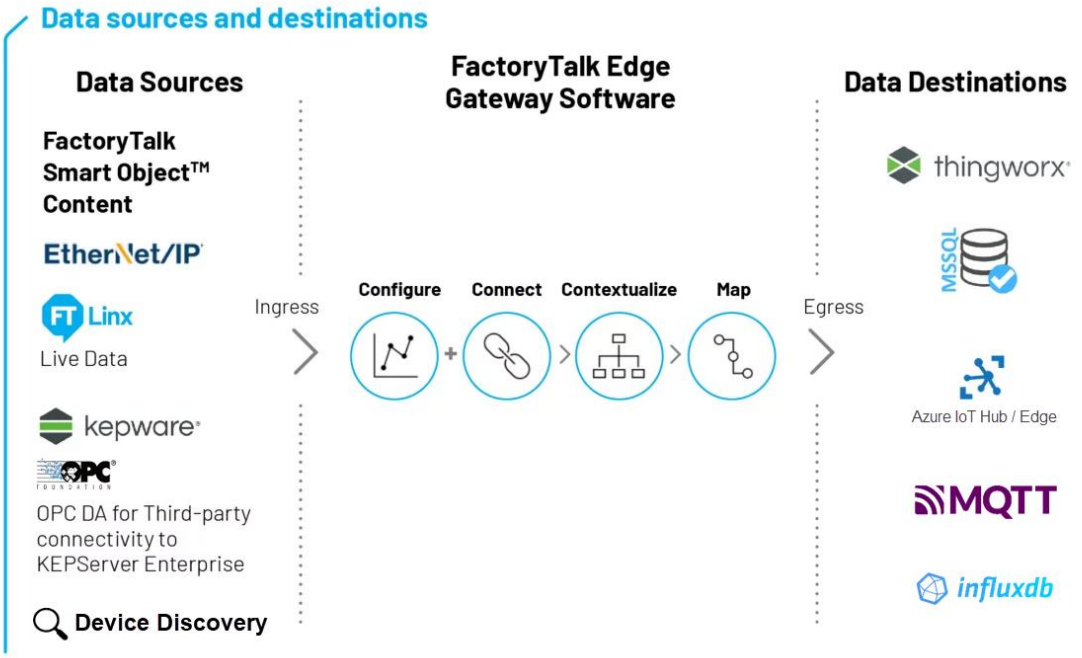
Revision History	Modified by	Date
Rev 0 – initial document	FPL / MP	October 2022

2 Introduction

Rockwell Automation has tools that allow for easy access to data used for IIoT applications. Data from Festo smart devices over EtherNet/IP can be extracted using these tools. This includes Festo valve terminals and pneumatic devices such as the E2M. For a description of pneumatic devices, refer to the Rockwell Automation Partner Locator: Rockwell Automation Partner Locator

Festo was the first 3rd-party company to be supported by Rockwell Automation Factory Talk Analytics for Devices. This was also known as the Shelby Appliance. Shelby configuration took only minutes. The appliance scanned the EtherNet/IP network, discovered devices, and created dashboards for them. Shelby recognized the Festo CPX-FB36, and returned basic diagnostic information. If there was an FB36 with an E2M, then Shelby created a dashboard for the E2M.

Rockwell Automation began to phase out Shelby in 2021. However, a new SW tool called FactoryTalk® Edge Gateway™ (FTEG) replaced the discovery function of Shelby. The CPX-FB36 was ported to FTEG. The same data for the CPX-FB36, and with the E2M, can be extracted by FTEG. It has much more flexibility than Shelby:



The FTEG user manual Ver 1.03.00 references the ported CPX-FB36 content in Chapter 2 for Data Sources:

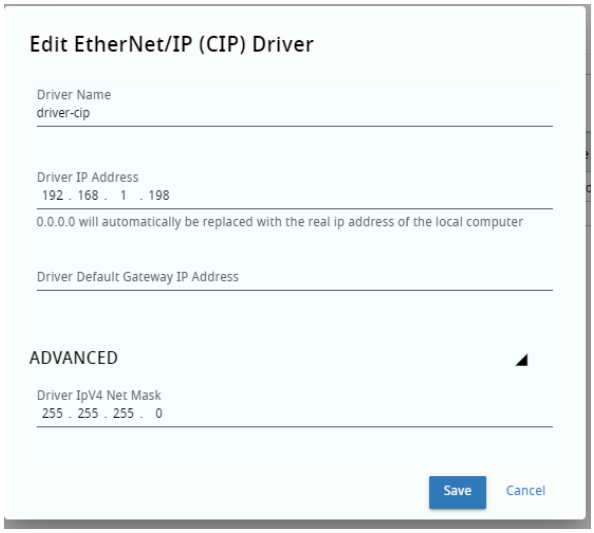
34	Festo CPX-FB36 Ethernet/IP Adapter	Fault Bits, Minor Recoverable Fault, Minor Unrecoverable Fault, Major Recoverable Fault, Major Unrecoverable Fault, Module 0 Input Size, Module 0 Output Size, Module 0 Identity, Module 1 Input Size, Module 1 Output Size, Module 1 Identity, Valve, Output, Input, Analog, Undervolt, Short Circuit, Open Circuit, Other Device Name, Flow, Consumption, Pressure, Valve Shut Off Status, Air Saving Status

Rockwell Automation also launched an add-on tool to Studio 5000 called Smart Object Configurator. A user would use this to create extended data models out of new or existing Logix tags. These models will define a time base for data collection and have multiple data instances, and can be easily collected by FTEG.

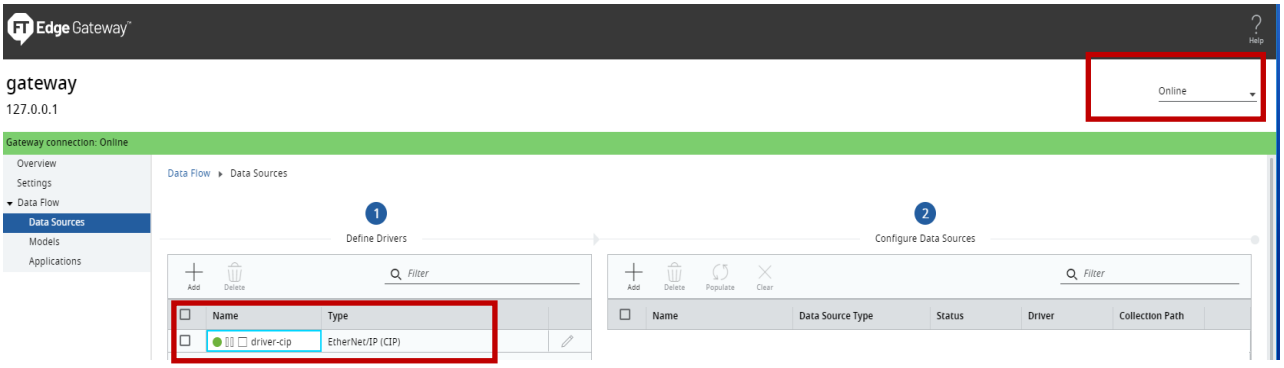
This App Note will cover use cases, examples on how to use FTEG with CPX-FB36 devices, and how to supplement this data by using Smart Objects. There is also a reference to use cases applying this to Festo AX analytics SW.

3 Install / Set-up FactoryTalk® Edge Gateway™

- Purchase license for FTEG. The license is based on the number of tags. This goes in increments from 100, 500, 2500, 10000.
    - Note: A tag is a single data point from a device or PLC. Each CPX-FB36 produces 24 tags.
- Set-up the EtherNet/IP (CIP) Driver

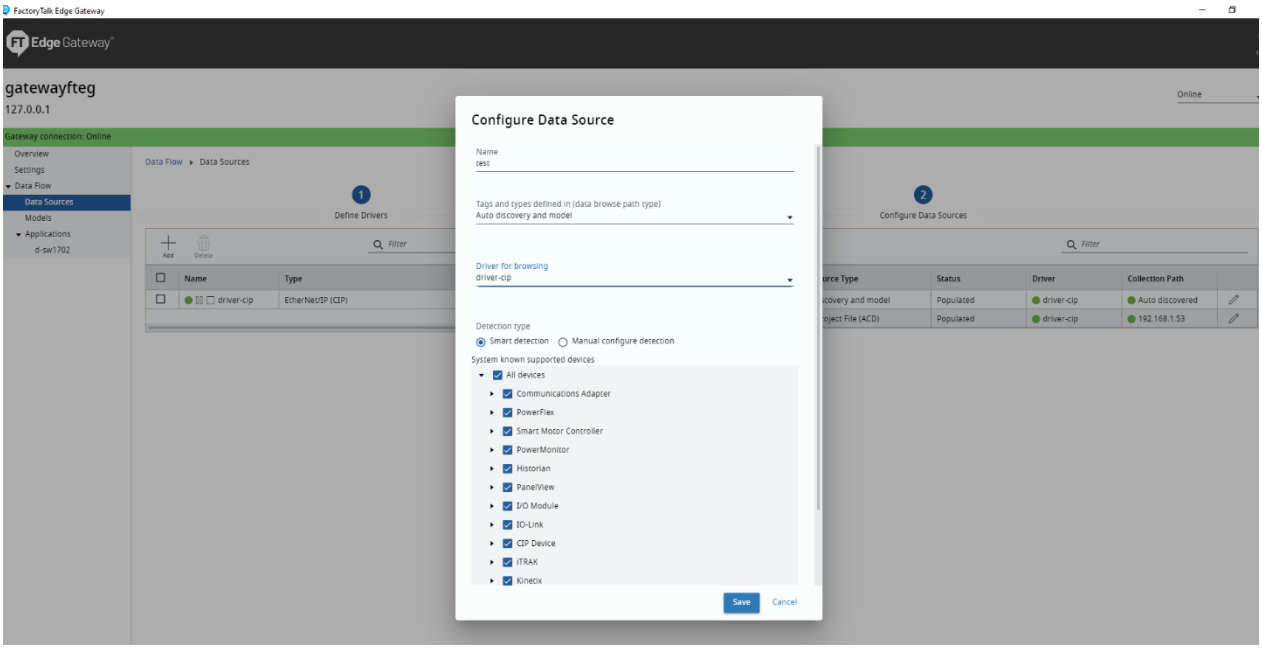


- Let FTEG use the real IP address of the local computer, or set it as shown here. Gateway and Mask can be default in most cases.
    - The IP address must be within the same subnet as the field devices.
- You should be able to go on-line with the device network and get a green dot next to the CIP driver

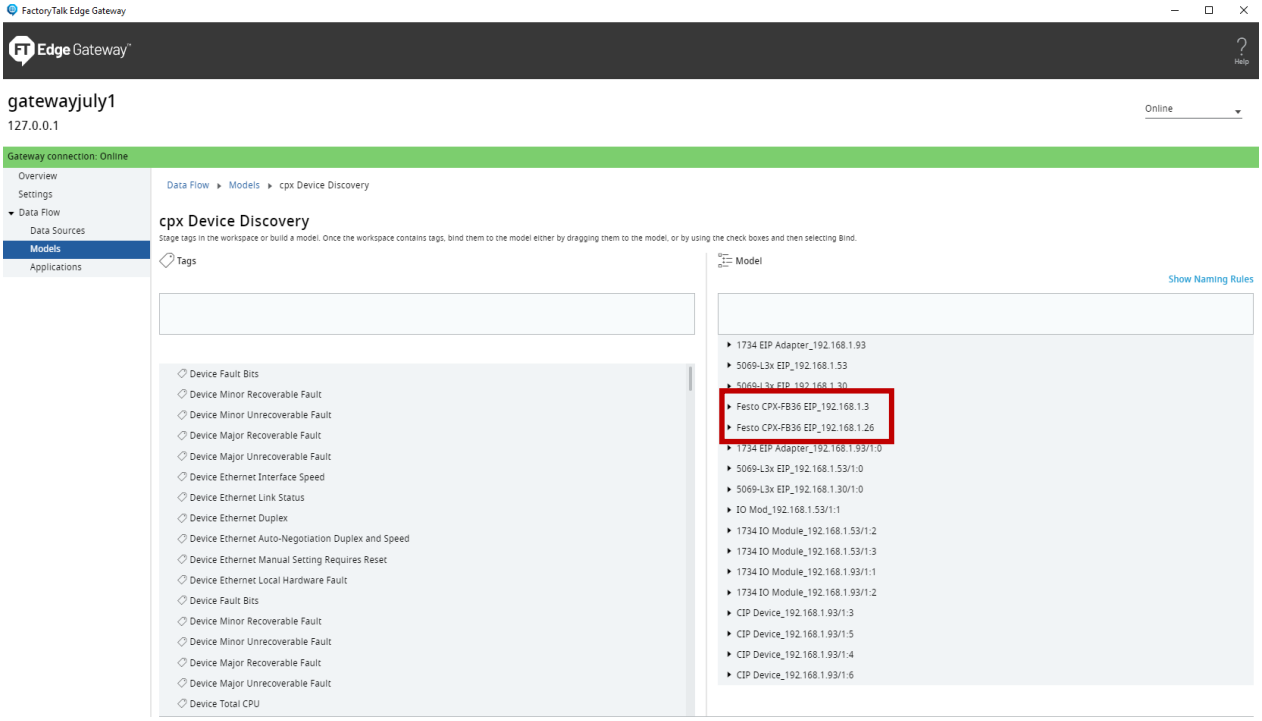


4 CPX-FB36 and FactoryTalk® Edge Gateway™

- While on-line, add a data-source type
- Select
  - Name
  - Auto Discovery and Model
  - Driver-CIP
  - Smart Detection
  - All devices



- Automatic models will appear for all devices, including CPX-FB36 systems. The data is pre-determined.



- Models will appear based on their IP address.
- All devices selected for discovery will have their pre-determined data included in the model.
- It will always start as Festo CPX-FB36 EIP_xxx.xxx.xxx.xxx (IP address)
- Click on triangle to see model data

Festo CPX-FB36 Data Model from FTEG

- The model data has 24 tags for each CPX. The table below describes the meaning for each tag name.

FTEG Tag Names for CPX-FB36. There are 24 Tag names under every Festo CPX-FB36 model:

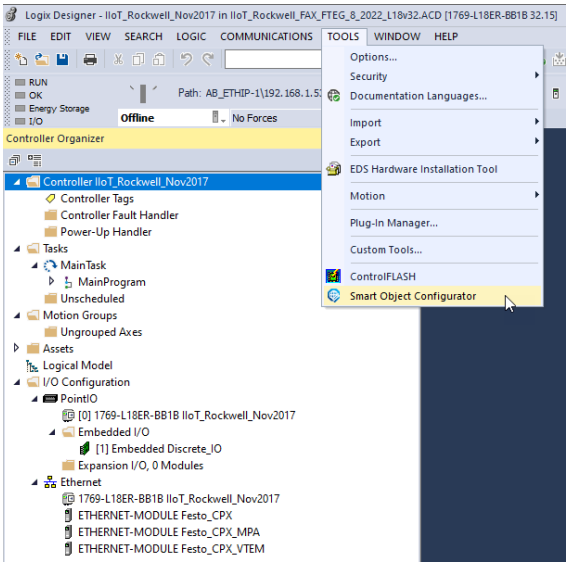
	Name	data type		Behavior	Comments
1	Device Fault Bits	INT		1 when there is an error, 0 when no diagnostic.	Global Error Bit
2	Device Minor recoverable	BOOL		True / False these are from the Identity object.	Classic identity object data
3	Device minor unrecoverable	BOOL		True / False these are from the Identity object.	
4	Device Major recoverable	BOOL		True / False these are from the Identity object.	
5	Device Major unrecoverable	BOOL		True / False these are from the Identity object.	
6	Device Module 0 Input size	INT		Example has 2, which is correct for the DIP settings of STI table	These fields can be used to identify an E2M module.
7	Device Module 0 Output size	INT		Example has 2, which is correct for the DIP settings of STI table	
8	Device Module 0 Identity	INT		Example has E000 hex, which is correct for the FB36	
9	Device Module 1 Input size	INT		Example has 12, which is correct for the E2M	
10	Device Module 1 Output size	INT		Example has 4, which is correct for the E2M	
11	Device Module 1 Identity	INT		Example has 8F2C hex, which is correct for the E2M module	
12	Device Valve	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	These are relevant for every CPX system.
13	Device Output	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	
14	Device Input	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	
15	Device Analog/Technology	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	
16	Device Undervoltage	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	
17	Device Short Circuit	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	
18	Device Open Circuit	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	
19	Device Other	BOOL		True / False these 8 bits are the CPX Diagnostic Byte.	
20	Device Flow	DINT		Works correct with an E2M	These valus are the E2M process values as described. This is very useful for trending pneumatic data. Ignore these values if there is no E2M.
21	Device Consumption	DINT		Works correct with an E2M	
22	Device Pressure	REAL		Works correct with an E2M	
23	Device Valve Shut Off Status	BOOL		True / False. Works correct with an E2M	
24	Device Air Saving Status	BOOL		True / False. Works correct with an E2M	

Note

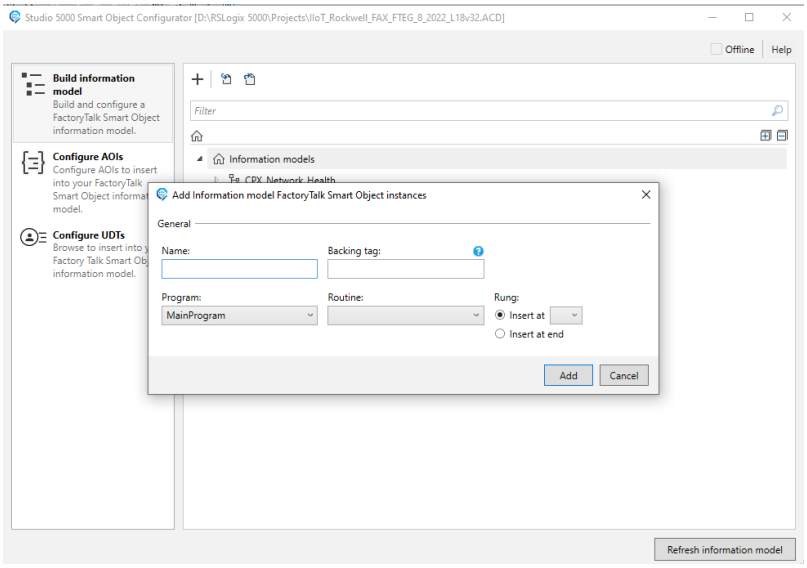
The data retrieved by auto discovery models have a fastest polled cycle time of 10 seconds. This is useful for long term trending analysis and some diagnostic information for visualization. Not suitable for rapid analysis.

5 Smart Object Configurator

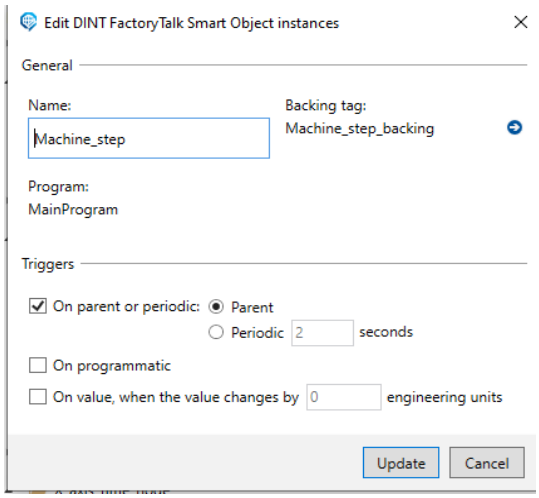
- Download SOC software and install. Studio 5000 Smart Object Configurator is included with the FTEG subscription and ships with FTEG. You can also download it from the Rockwell Download Center. A minimum of Rev. 28 must be used.
- Follow the instructions to install the Smart Object Configurator. When complete, it should be listed under “TOOLS” in Studio 5000.



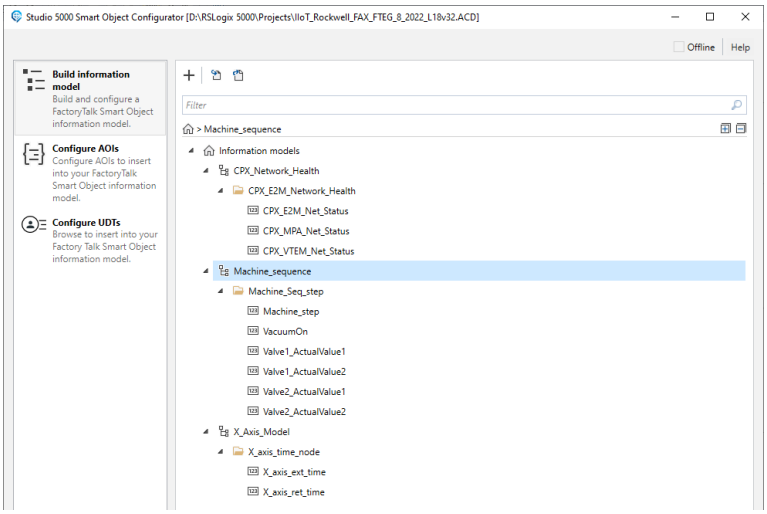
- Create objects. If you are working in a project for the first time with Smart Objects, there is no base code in the project. The Smart Object Config Tool will make base code in the project for tags the user selects to be included in data models. These models are extracted by FTEG, and used for IIoT purposes.



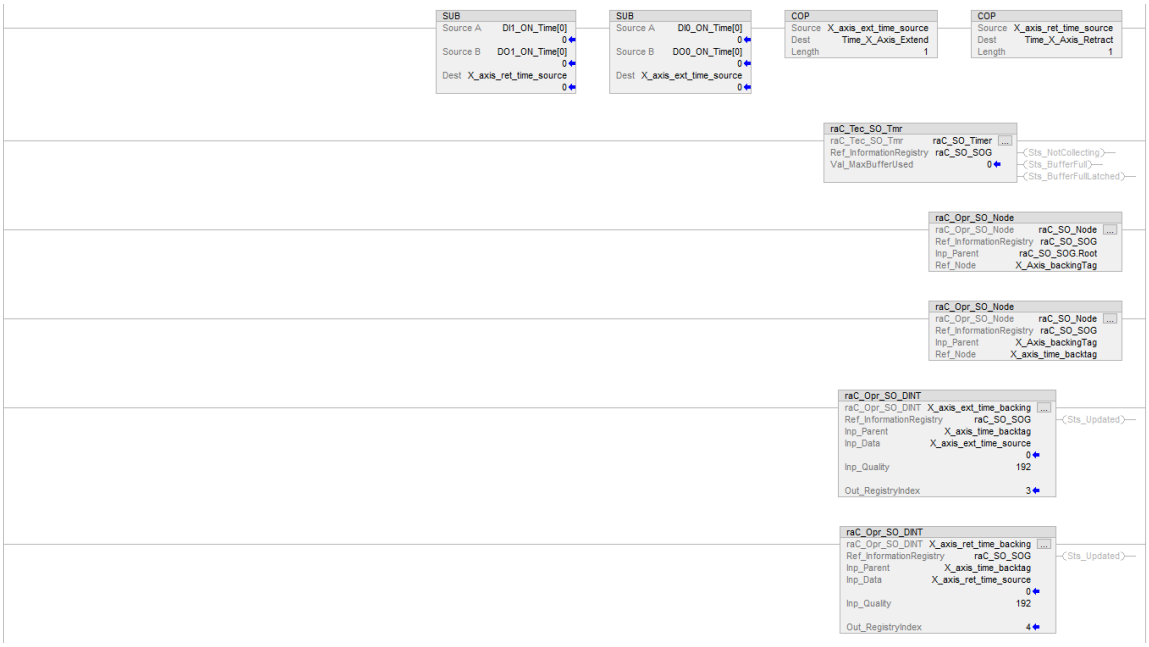
- Click on + to start creating a model. Follow instructions by adding:
  - Names
  - Backing tags
  - Selecting triggers and timing



- Build info models. Follow the above steps for each model desired. Models can be associated to tag names of various topics. This example, has network health, Machine Sequence, and axis timing.



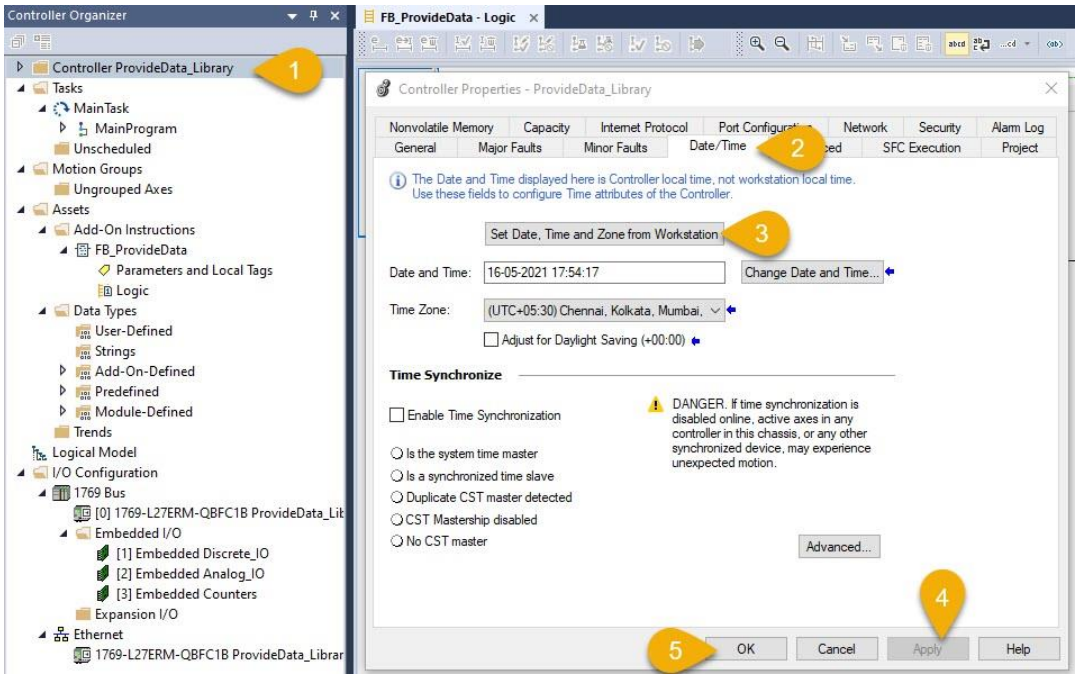
- The logic below was automatically added to the end of a routine for Cylinder switch timing.



6 Cylinder Timing AOI Example with Smart Objects

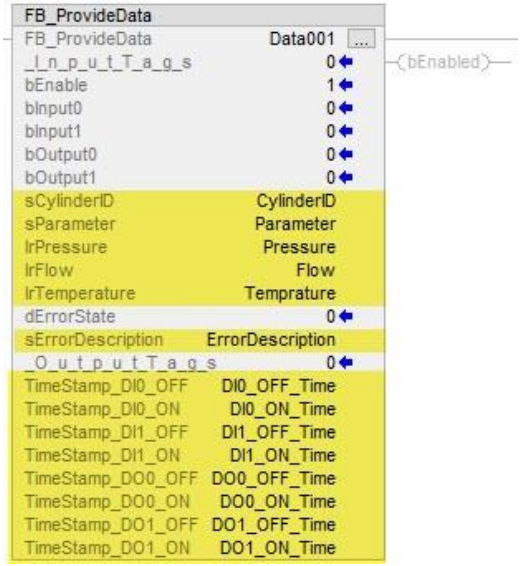
- Festo has an AOI that can be used for capturing timestamp values of cylinders extending and retracting. This is useful for trending data or applying analytics to detect anomalies of cylinder motion, example with Festo AX.

- The PLC time must be set by the Workstation Time Zone



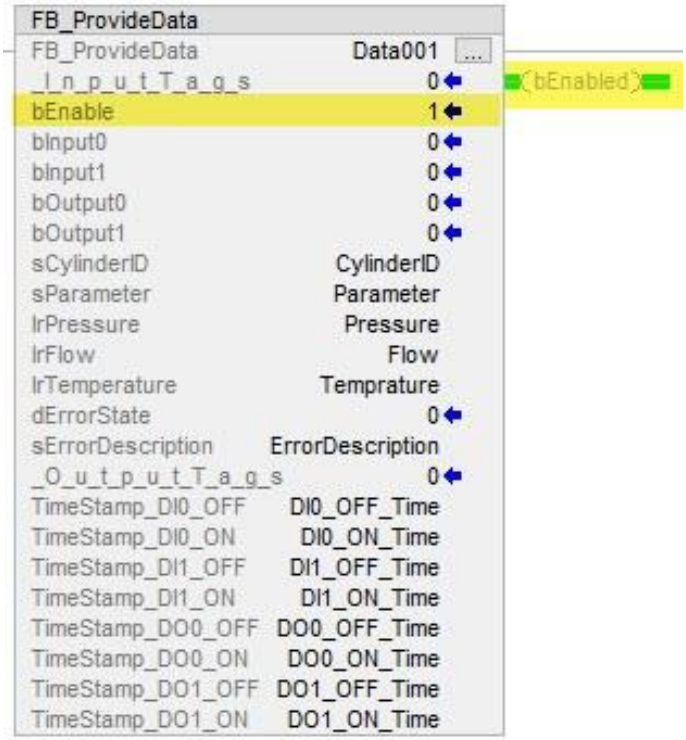
1. Double click the **“Controller”** folder form controller organizer menu.
2. Click the **“Date/Time”** tab from controller properties window.
3. Click **“Set Date, Time and Zone from Workstation”** button to copy the workstation time data to PLC.
4. Click **“Apply”** button to set the copied time data to PLC.
5. Click **“OK”** button to complete the configuration.

- Assign AOI required I/O interface tags

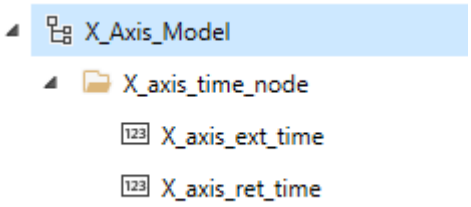


Assign all yellow highlighted IO's to AOI.

- Enable the AOI function by turning ON the input tag **"bEnable"** & AOI functions enabled status will update in output tag **"bEnabled"**.



- Once implemented, Smart Objects can be applied as shown in the X axis model example in section 5.



➔ **Note**
For full documentation of the AOI and sample code, contact Festo.
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➔ **Note**
See section 9 on how this AOI can be used with Festo AX to provide analytics with FTEG..
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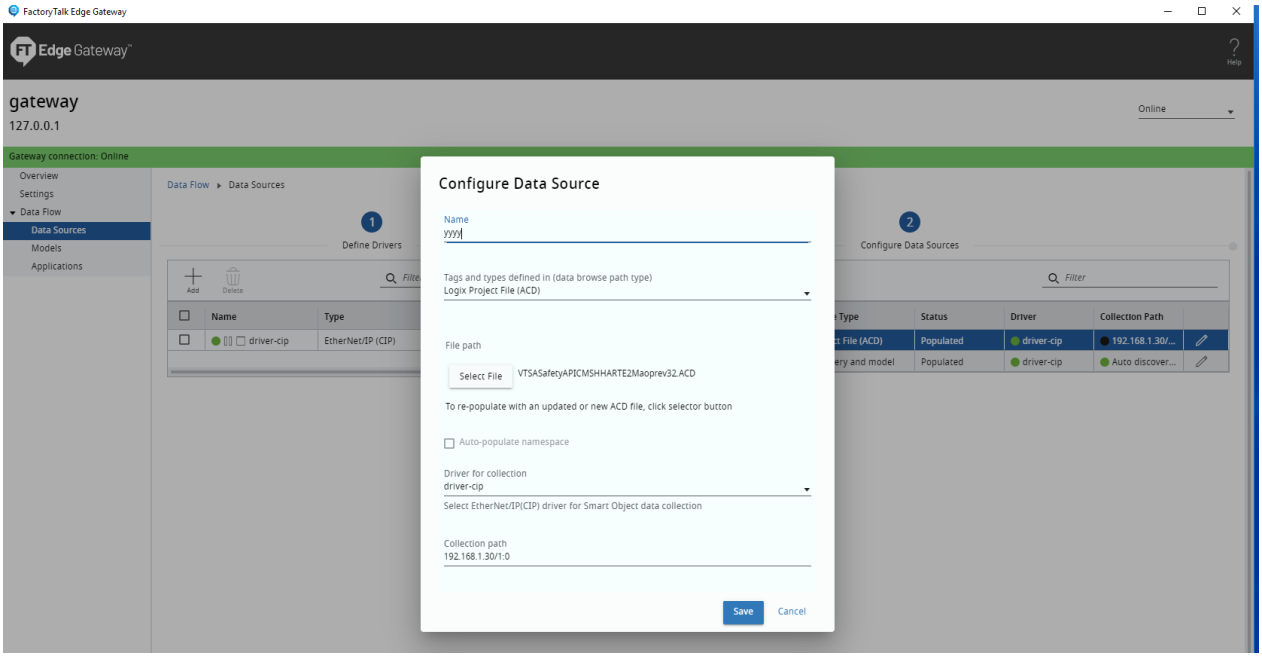
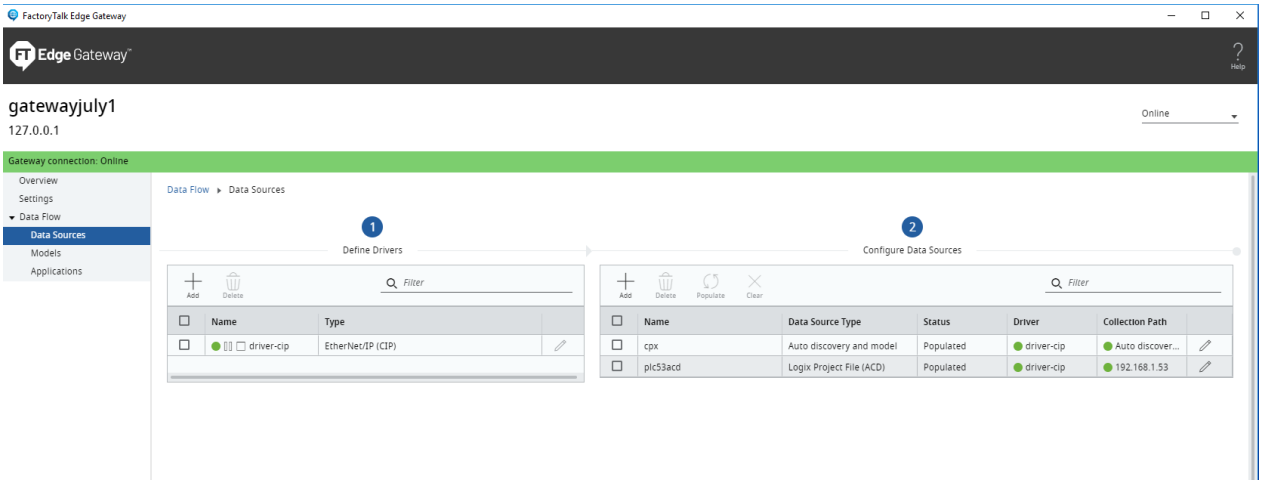
7 Smart Objects and FactoryTalk® Edge Gateway™

- Once information models are built using the Smart Objects Configurator, they can be ported to FTEG. Additional models will be added to FTEG.

- While on-line, create an additional data source using an ACD file
- Select
  - Name
  - Logix Project File (ACD)
  - Select the file. Its path should show after selection
  - CIP Driver for driver collection
  - Connection path is the IP address of the PLC. For some PLCs, a path for the bus might need to be included. In this example there is 192.168.1.30/1:0. The Compact logix L18 does not re-quire a path.
  - save

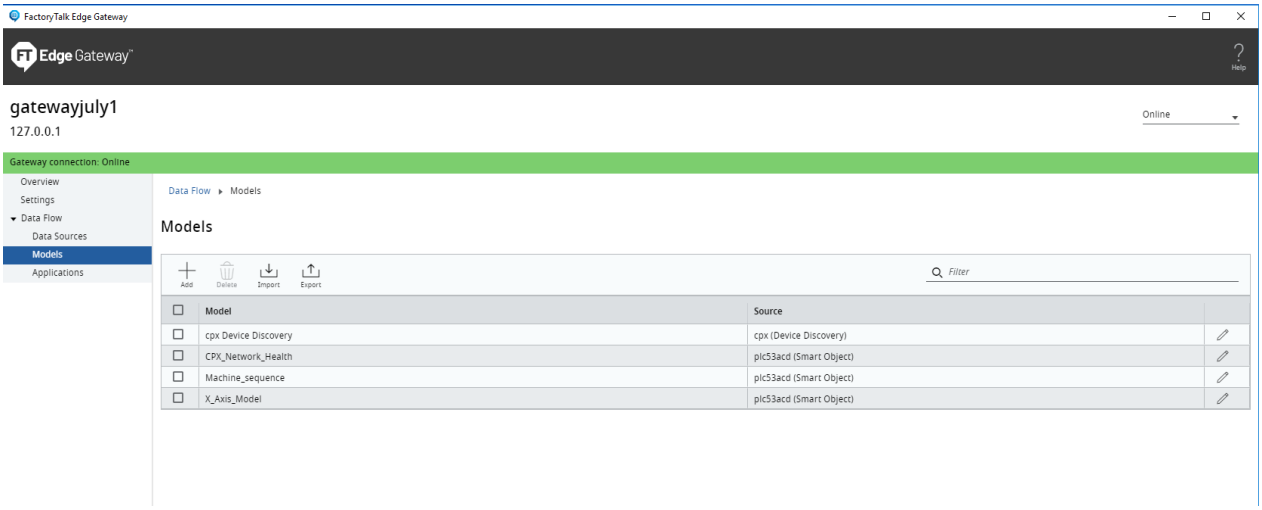


- There will be a new data source in FTEG

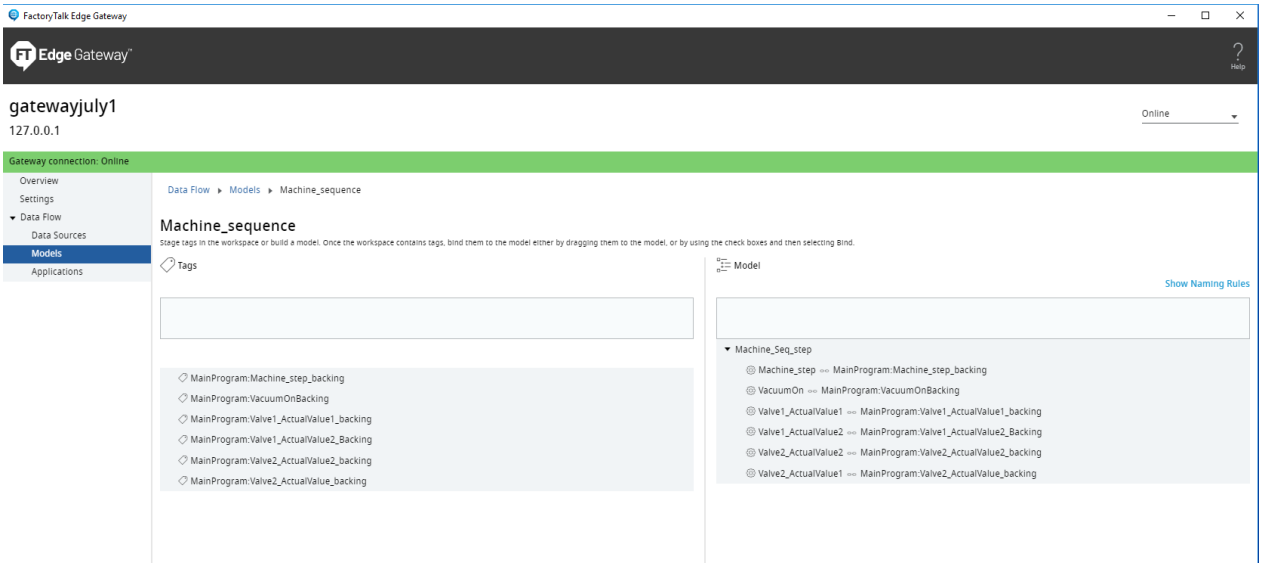


- While on-line, there should be a green dot next to the driver and collection paths for each of the sources if the devices are configured and connected correctly.

- This will expose a new model from the Smart Objects in the ACD file:



- In this example, there is one model from the Source “Device Discovery” called CPX.
- There are 3 additional models, as configured by the Smart Objects Configurator, as shown in section 5.
- For example, the model “Machine_sequence” has 6 tags configured within. Each tag is now available for consumption by a client.



- In this example, there are a total of 142 tags. They come from different sources:
  - 72 from 3 different CPX devices found during Device Discovery
  - 59 from the Rockwell PLC, I/O modules, etc. found during Device Discovery
  - 11 from 3 different Smart Object models configured from the PLC

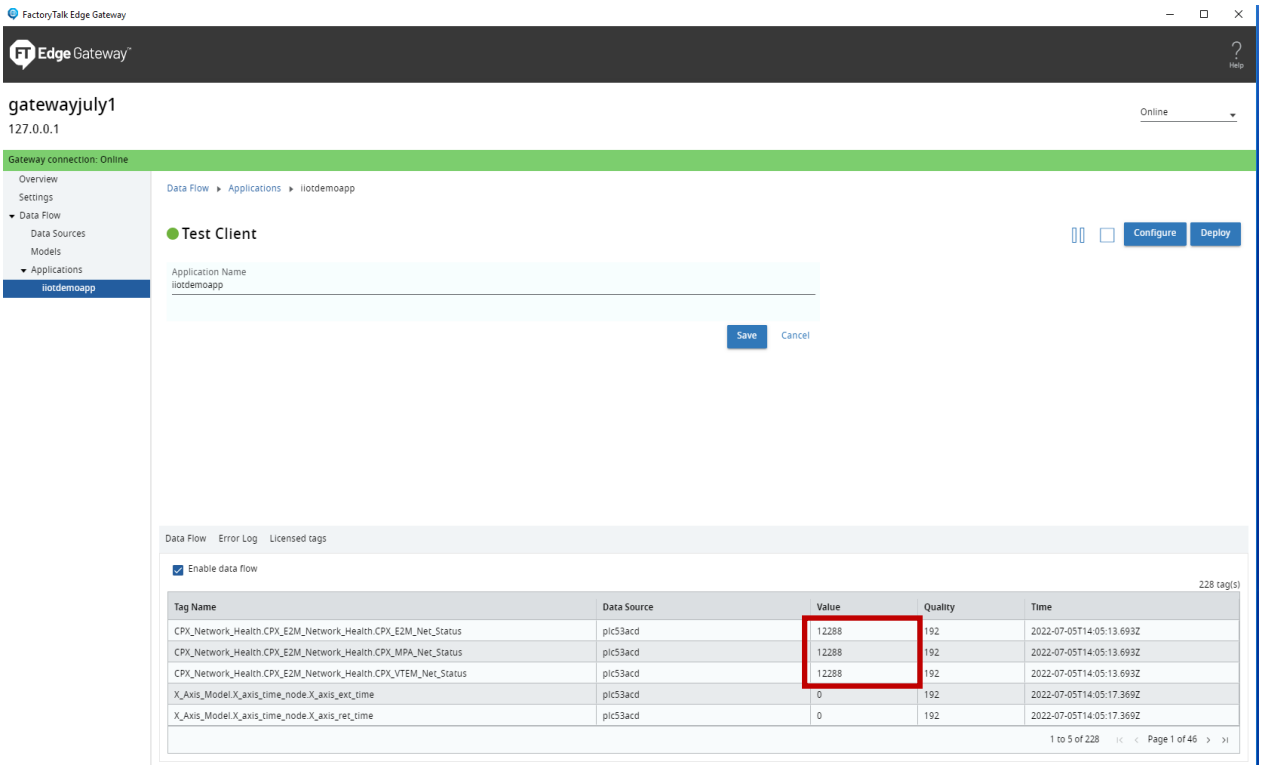
- This tag data can be egressed to various destination systems for analysis and storage:
  - Azure IoT Hub
  - MSSQL
  - ThingWorx®
  - MQTT
  - InfluxDB
  - Test Client within FTEG

8 Test Client Application in FactoryTalk® Edge Gateway™

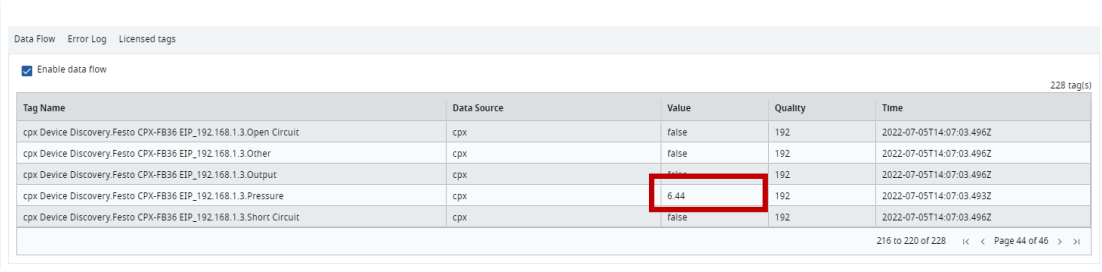
- Use the test client application included with FTEG to view the data from the devices.

- Steps to add an application:
  - Go on-line
  - Select Data Flow -› Applications
  - Add or click + application
  - Select Test Client Application
- Configure the Test Client to include the data desired from the models
- Deploy the Test Client
- Run the Test Client
- Select Enable Data Flow

- The screen should begin to populate with a spreadsheet of the following columns:
  - Tag Name
  - Data Source
  - Value
  - Quality (see code in FTEG manual. 192 = Good [non-specific])
  - Time (timestamp)



- This example shows the comms health of each CPX is good (12288d = 3000h (Rockwell Logix error)

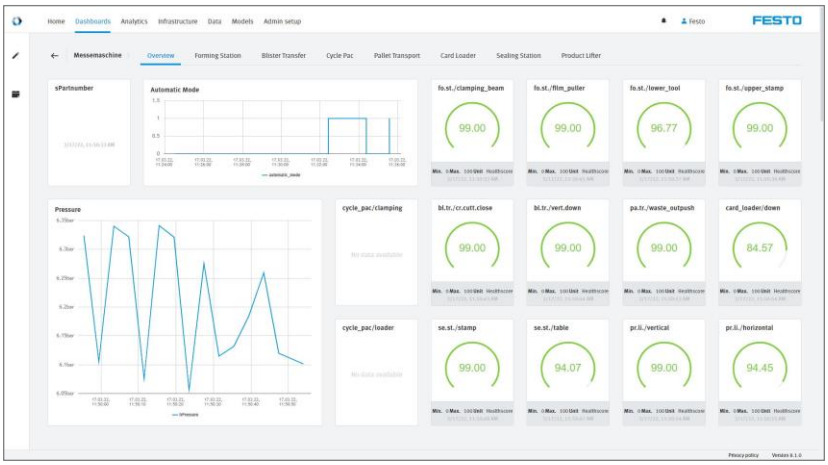


- This example shows the pressure of the E2M at 6.44 (bar). The number is a real value.

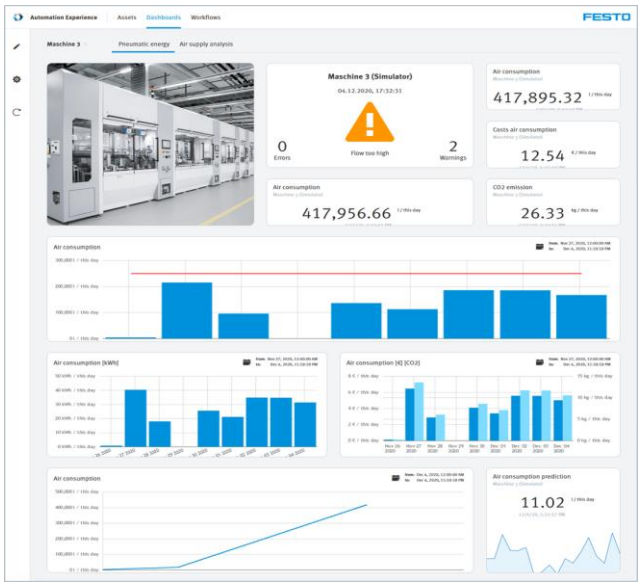
9 Festo AX Analytics

- Festo Automation Experience (Festo AX) is an industrial software solution that can be used for:
  - Improve maintenance processes by predictive maintenance
  - Increase product quality by predicting quality
  - Lower energy consumption by monitoring energy sources such as pneumatics
- Festo AX leverages technologies such as Artificial Intelligence / Machine Learning, Industrial Internet of Things, and Edge Computing, and applies this to an industrial context to achieve goals of predictive maintenance, quality, or energy consumption.
- Festo AX will work with any system due to its open architecture. It can leverage protocols such as OPC-UA and MQTT.
- Since MQTT is an egress for FTEG, Festo AX can consume data from FTEG via the Device Discovery model for CPX-FB36 and a Smart Object information model. This data can be used for analytics. Festo AX can be trained on various data points sourced by FTEG and determine an overall health score of the feature analysed.
- These features can be visualized within Festo AX or via another SW such as DataView.

- For example, a customer could use the AOI in section 6, along with digital I/O from the valve coils and cylinder switches. Data from a FTEG model can be used in a cylinder monitoring standard package with Festo AX. This can provide a health score for up to 20 pneumatic cylinders, predicting maintenance.



- A similar standard package exists with Festo AX for Energy Monitoring of pneumatic systems using an E2M/C2M. This can predict energy loss in a pneumatic system.



- Festo AX systems are typically customized to suite any need.