

SFAB-.-PNLK with Festo PLC through EtherCAT using CPX-AP IO-Link

This Application Note explains how to integrate the SFAB IO Link Flow Sensor and the function block library for the Festo SFAB Flow Sensor through EtherCAT using the Festo CPX-AP IO Link with a Festo PLC in the CODESYS programming environment.

SFAB-10
SFAB-50
SFAB-200
SFAB-600
SFAB-1000

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1 Introduction

This application note demonstrates the integration of the Festo SFAB IO-Link Flow Sensor with Festo PLC through EtherCAT using CPX-AP IO-Link Master module.

- **Festo_SFAB_Connect** maps the SFAB Flow Sensor reference structure and serves as the foundation for all other function blocks.
- **Festo_SFAB_Monitoring** reads and decodes the cyclic process data input of the SFAB Flow Sensor including flow rate temperature and SSC status.
- **Festo_SFAB_System_Command** Executes IO-Link acyclic system commands for the SFAB Flow Sensor including teach reset and recorder control commands.
- **Festo_SFAB_Diagnostics** reads diagnostic data from the SFAB Flow Sensor including device status IO-Link events and supply voltage.
- **Festo_SFAB_RecorderMode** controls and reads the volume recorder mode of the SFAB Flow Sensor including run pause reset and recorder data readout.
- **Festo_SFAB_Flow_Monitoring** reads acyclic flow monitoring data including minimum maximum and averaged flow rate values and resets MDC1 statistics.
- **Festo_SFAB_Flow_Parameters** reads and writes SSC1.1 SSC1.2 and SSC1.3 flow switching signal channel parameters including setpoints mode and logic.
- **Festo_SFAB_Device_Parameter** reads and writes device configuration parameters including measurement output display filter and access lock settings.

```

Festo_SFAB_IOLink.Festo_SFAB_Connect
abyDataIn          stSFABRef
byDeviceAvailable
uiSlaveAddress
usiPort
eSensorFlowRange
eFlowUnit
eTemperatureUnit

```

```

Festo_SFAB_IOLink.Festo_SFAB_System_Command
stSFABRef          xDone
xExecute           xBusy
eSystemCommand     xError
                  udiErrorCode
                  eErrorDescription

```

```

Festo_SFAB_IOLink.Festo_SFAB_Monitoring
stSFABRef          xEnabled
xEnable           xError
                  eErrorDescription
                  rFlowRate
                  xSSC11_FlowMonitoring
                  xSSC12_FlowMonitoring
                  xSSC13_VolumeMassPulse
                  rTemperature
                  xSSC21_TemperatureMonitoring
                  xSSC22_TemperatureMonitoring

```

```

Festo_SFAB_IOLink.Festo_SFAB_Flow_Monitoring
stSFABRef          xEnabled
xEnable           xError
xReadAcyclicData  udiErrorCode
xResetStatistics  eErrorDescription
                  eStatus
                  rFlowRate
                  xSSC11_FlowMonitoring
                  xSSC12_FlowMonitoring
                  xSSC13_VolumeMassPulse
                  stFlowMonitoring

```

```

Festo_SFAB_IOLink.Festo_SFAB_RecorderMode
stSFABRef          xDone
xExecute           xBusy
xStartRec         xError
xStopRec          udiErrorCode
xResetRec         eErrorDescription
                  eStatus
                  stRecorderParameters

```

```

Festo_SFAB_IOLink.Festo_SFAB_Flow_Parameters
stSFABRef          xDone
xExecute           xBusy
xWrite            xError
stSSC11_Parameters udiErrorCode
stSSC12_Parameters eErrorDescription
stSSC13_Parameters eStatus

```

```

Festo_SFAB_IOLink.Festo_SFAB_Device_Parameters
stSFABRef          xDone
xExecute           xBusy
xWrite            xError
stDeviceParameters udiErrorCode
                  eErrorDescription
                  eStatus

```

```

Festo_SFAB_IOLink.Festo_SFAB_Diagnostics
stSFABRef          xDone
xExecute           xBusy
                  xError
                  udiErrorCode
                  eErrorDescription
                  uiIOLinkErrorCount
                  eDeviceStatus
                  astIOLinkEvent
                  rSupplyVoltage

```

1.1 Software Used

Software Name	Software Version
CODESYS	V3.5 SP15 Patch 4
Festo Automation Suite	V2.12.0.436
CPX-AP Plug-in	V1.11.0.11
SFAB IODD File	V1.3.17
CPX-AP-EC ESI File	V20260519
Festo_SFAB_EC_IOLink Library	V3.5.15.410

Table 1.1: Software used

1.2 Hardware Used

Device Name	Device Type	Version / Firmware
CPX-E-CEC-M1-EP	CPX-E-CEC-M1-EP	Based on Version / Firmware
SFAB-.PNLK Flow Sensor	SFAB-200	V8.8.29
CPX-AP Head Module	CPX-AP-I-EC-M12	V1.7.4
CPX-AP IO-Link Master	CPX-AP-I-4IOL-M12	V1.6.6
AP Communication Cable	NEBC-D8G4-ES-0.5-N-S-D8G4-ET	Version Free
M12 – RJ45 Ethernet Cable	NEBC-D12G4-ES-0.5-S-D12G4-ET	Version Free
Ethernet Cable	-	Version Free

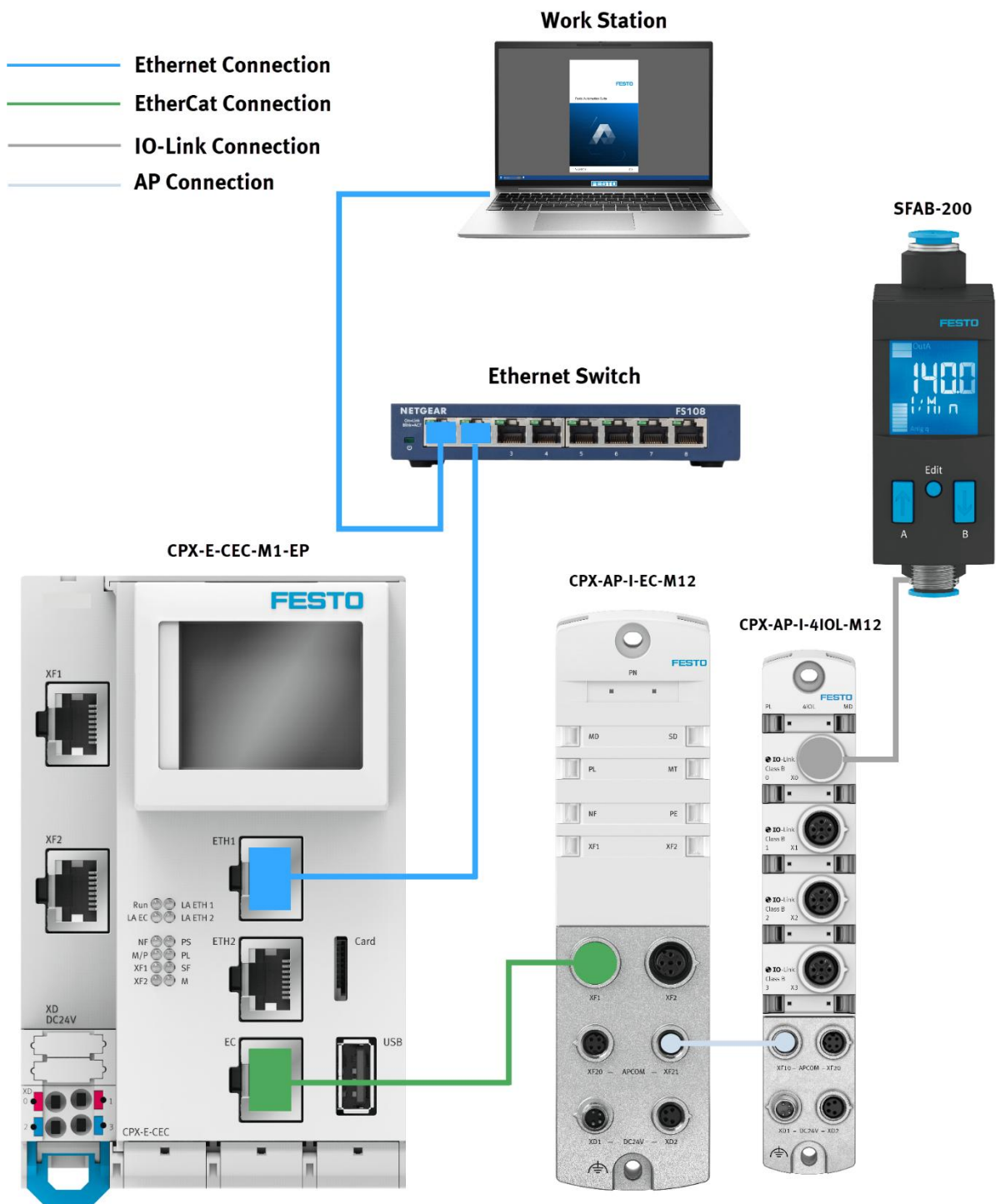
Table 1.2: Hardware used



Note

- The hardware mentioned above is specific to this application note and may vary depending on user requirements.
- This Application note is applicable to both CPX-AP-A-EC and CPX-AP-I-EC, and is therefore referred to collectively as CPX-AP-_-EC.
- For this Application note, CPX-AP-I-EC is used.

1.3 Topology Overview



2 Hardware Overview

2.1 SFAB -.- PNLK Product Overview

2.1.1 Product Desing

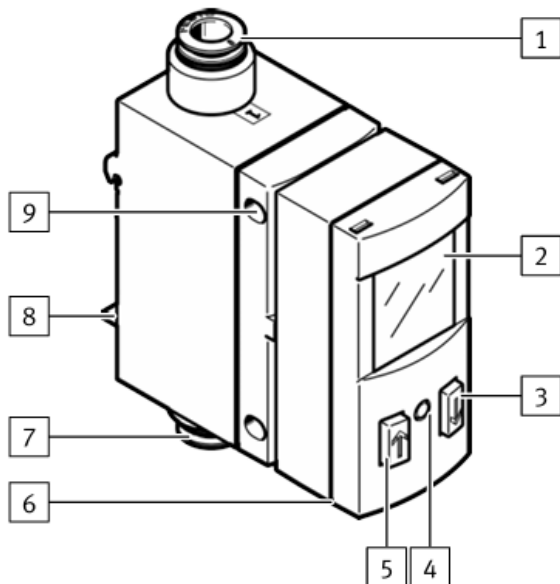


Fig. 1: Control elements and connection elements

- | | |
|--------------------|---|
| 1 Pneumatic port 1 | 6 Plug for M12 electrical connection |
| 2 Display | 7 Pneumatic port 2 |
| 3 [B] key | 8 Mounting slide for DIN rail
mounting and wall mounting, rear |
| 4 [Edit] key | 9 Hole for panel mounting |
| 5 [A] key | |

2.1.2 Display Components

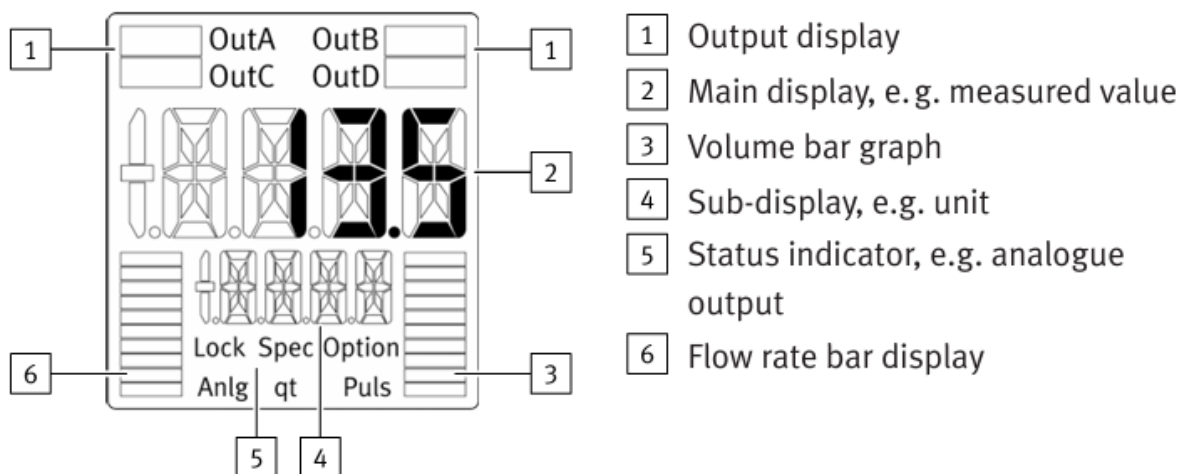


Fig. 2: LCD display

2.1.3 Symbols on the display

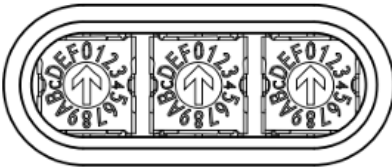
Example for LCD display	Meaning
Output display	
' OutA'	Switching output OutA selected, flashes when IO-Link is active.
 ' OutA'	Switching output OutA set.
'OutC'	Volume pulse OutC selected, flashes when IO-Link is active.
 'OutC'	Volume pulse OutC set.
'OutB'	Switching output OutB selected.
'OutB' 	Switching output OutB set.
'Pulse'	Volume pulse selected.
'Anlg'	Analogue output selected.
Information/input display	
	Graphic display of flow measurement
	Graphic display of volume measurement
'q'	Input signal flow rate selected.
't'	Input signal temperature selected.
'Lock'	Security code activated.
'Spec'	Special menu selected.
'Option'	Illuminates when parameters having a special influence on the measured value indicator have been changed compared to the factory setting: reference condition (standard), gas.

Tab. 2: Symbols on the display

2.2 CPX-AP EtherCAT Interface Node Address Configuration

2.2.1 Assigning Explicit Device ID for CPX-AP-.EC

CPX-AP-.EC is in Configured Station Alias/no Explicit Device ID mode by default. The user must therefore assign the EtherCAT address of the module using by changing rotary switches.

Rotary switch	Function
IDx100hx10hx1h 	The 3 rotary switches are used to set the EtherCAT "Explicit Device ID" of the interface in hexadecimal code. Possible settings: – 0 = stored EtherCAT address, no "Explicit Device ID" assigned – 1 ... 4095 (1_h ... fff_h) = permissible address range If set to 0, the address of the interface is automatically assigned by the EtherCAT master (autoincrement). Factory setting: 0

As shown in the figure above, the module is in Configured Station Alias / no Explicit Device ID mode when all three rotary switches are in zero position. In this condition, the user must set the EtherCAT address. For example if 1h rotary switch is set to 5th position & remaining two rotary switches are in zero position, then actual EtherCAT address of the module will be 5.



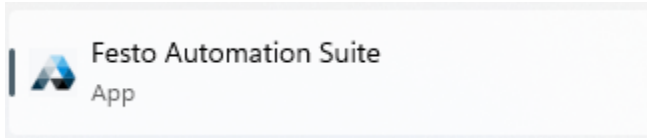
Information

Changes to the rotary switches only take effect following a power restart of the interface.

2.3 Festo PLC IP Address Configuration

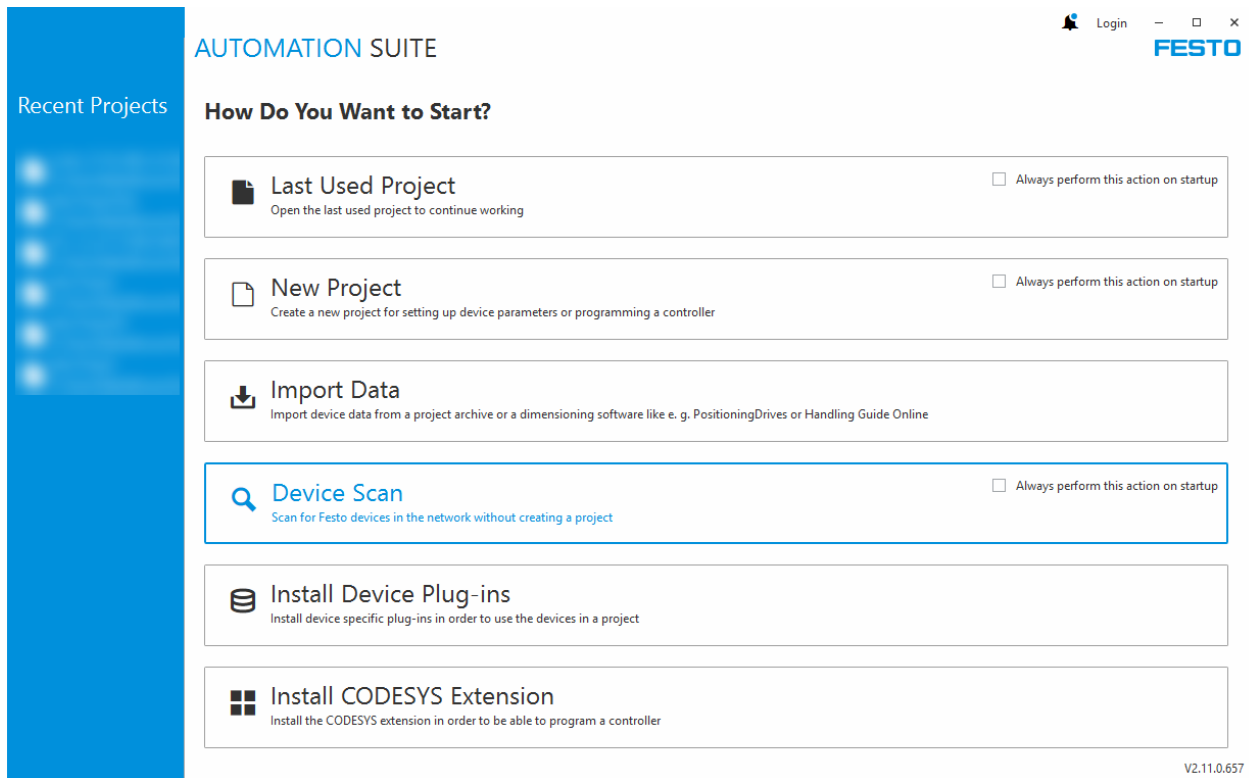
This chapter explains how to configure the IP Address of the Festo PLC using Festo Automation Suite.

Step 1



Open the **Festo Automation Suite** software (**Windows Start >> Festo Software >> Festo Automation Suite**).

Step 2



Click on **Device Scan** to detect and add devices to the current project.

Step 3

The screenshot shows the FESTO AUTOMATION SUITE interface. The top bar includes 'AUTOMATION SUITE' and 'New Project' buttons. The main area displays a table of scanned devices. The selected device, CPX-E-CEC-M1-EP, is highlighted. On the right, the 'Actions' menu is open, showing 'Network Settings' selected. The 'Network Settings' dialog box is displayed, allowing configuration of DHCP, IP address, subnet mask, gateway, and DNS. The 'Activate New Settings' button is at the bottom of the dialog.

Status	Device Name	Device Type	Address	Subnet Mask	Firmware
✖	CPX-E-CEC-M1-EP	CPX-E-CEC-M1-EP	192.168.0.15	255.255.255.0	3.4.8-3501e2a5c8.20260125

CPX-E-CEC-M1-EP
192.168.0.15

Actions

Device Details

Identification ☐

Reboot

Firmware

Licenses

Network Settings

Device Name

Diagnosis

Version Information

Open Device Web Page

Support

Add to Project

< Actions Network Settings

DHCP: ☐ Enable

Address: 192 . 168 . 0 . 15

Subnet Mask: 255 . 255 . 255 . 0

Gateway: 0 . 0 . 0 . 0

DNS: 0 . 0 . 0 . 0

Activate New Settings

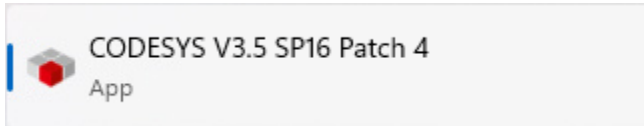
1. Select the **CPX-E-CEC-M1-EP** device from the **Device Scan**.
2. From the **Actions** menu on the right-hand side, select **Network Settings**.
3. Enter the **IP address** and **subnet mask** according to the application requirements.
4. Click **Activate New Settings** to apply the changes.

3 Software Configuration

This chapter describes Festo **CODESYS** software configurations such as installing **CPX-AP ESI** file, creating a new project, configuring CPX-AP devices, configuring IO-Link modules & adding **Festo_SFAB_IOLink** library to the project.

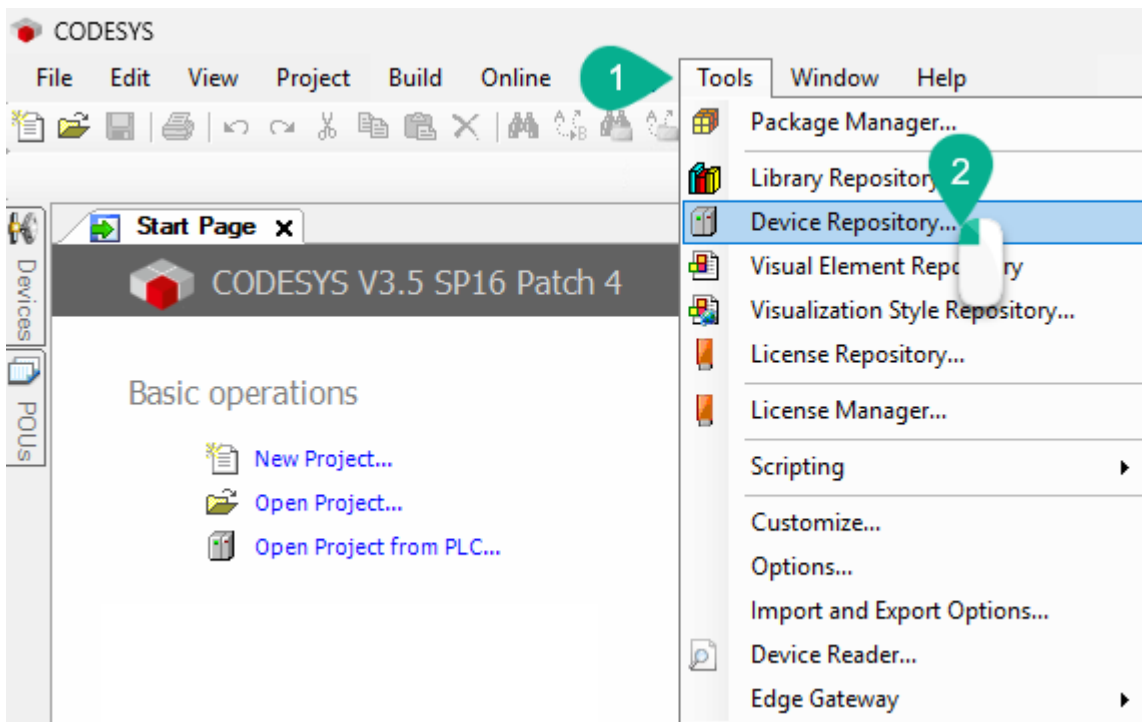
3.1 Adding the CPX-AP ESI File in CODESYS

Step 1



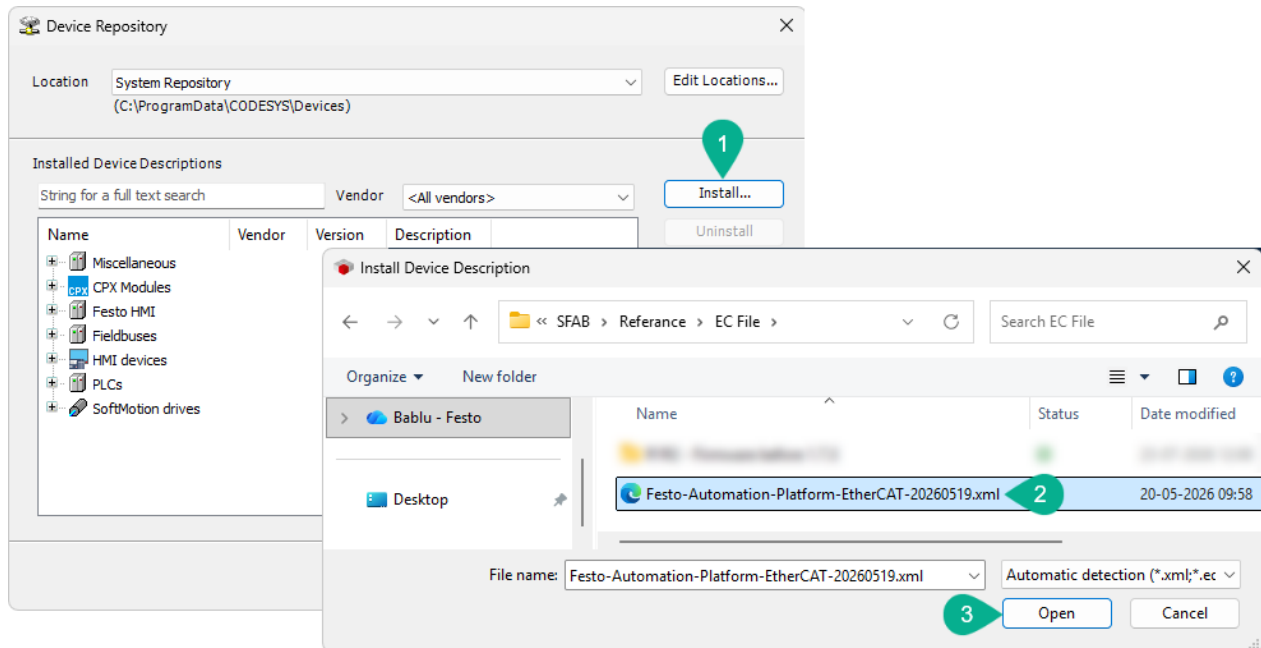
Open the **CODESYS V3.5 SP16 Patch 4** software (**Windows Start >> CODESYS >> CODESYS V3.5 SP16 Patch 4**).

Step 2



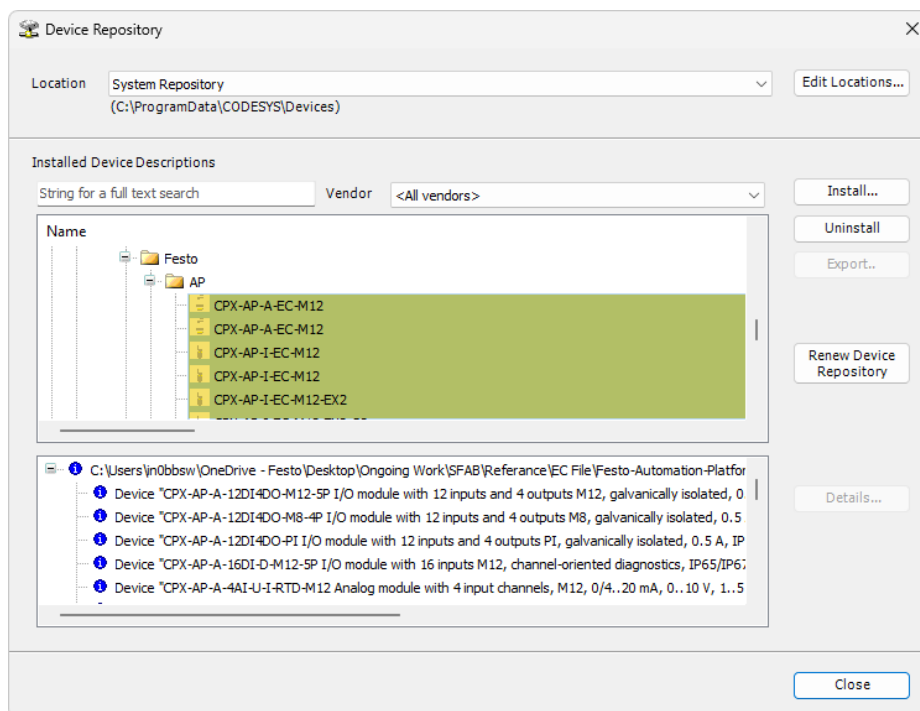
1. In the CODESYS menu bar, click on **Tools**.
2. Select **Device Repository...** from the dropdown list. This will open the Device Repository window.

Step 3



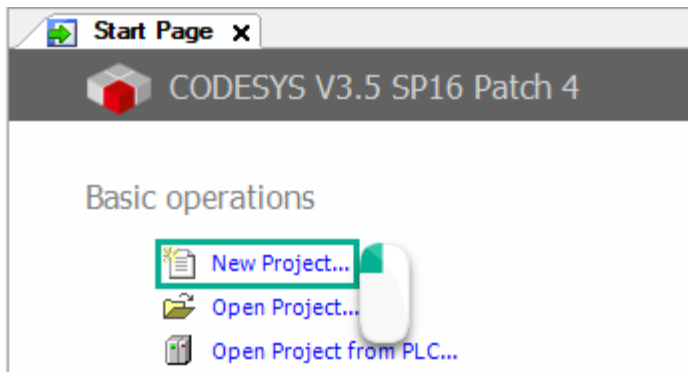
1. In the **Device Repository** window, click on the **Install...** button.
2. In the **Install Device Description** window that opens, browse to the folder containing the ESI file and select **Festo-Automation-Platform-EtherCAT-20260519.xml**.
3. Click **Open** to install the selected device description file.

Once the ESI file installation is successful, all the corresponding modules will be displayed in the Installed Device Descriptions list under the Device Repository window, as highlighted below:



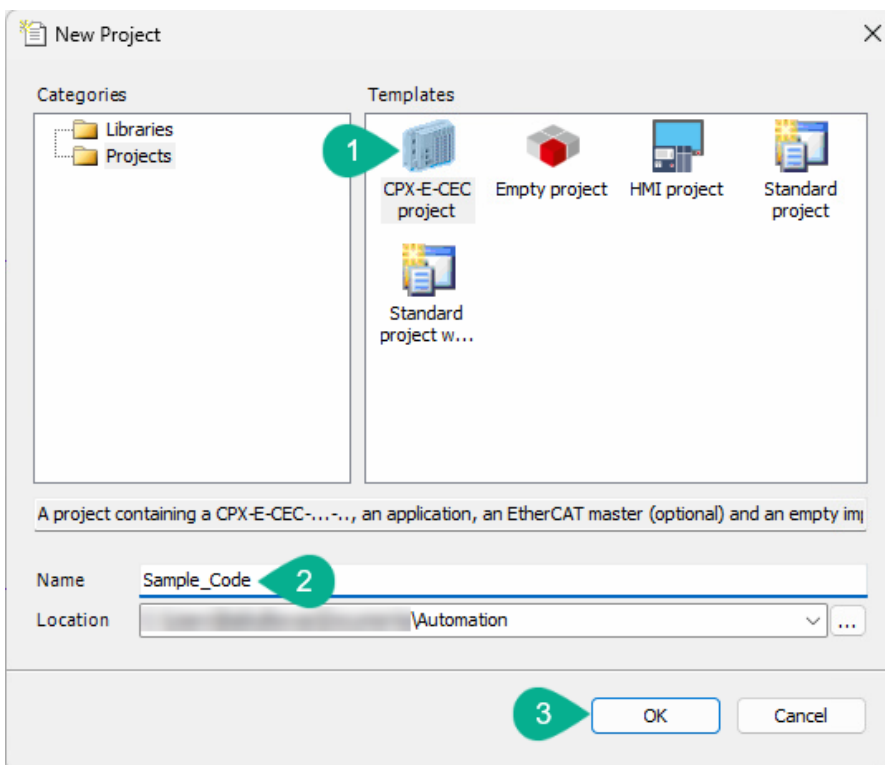
3.2 Creating a New Project in CODESYS

Step 1



Click on **New Project...** to create a new project.

Step 2



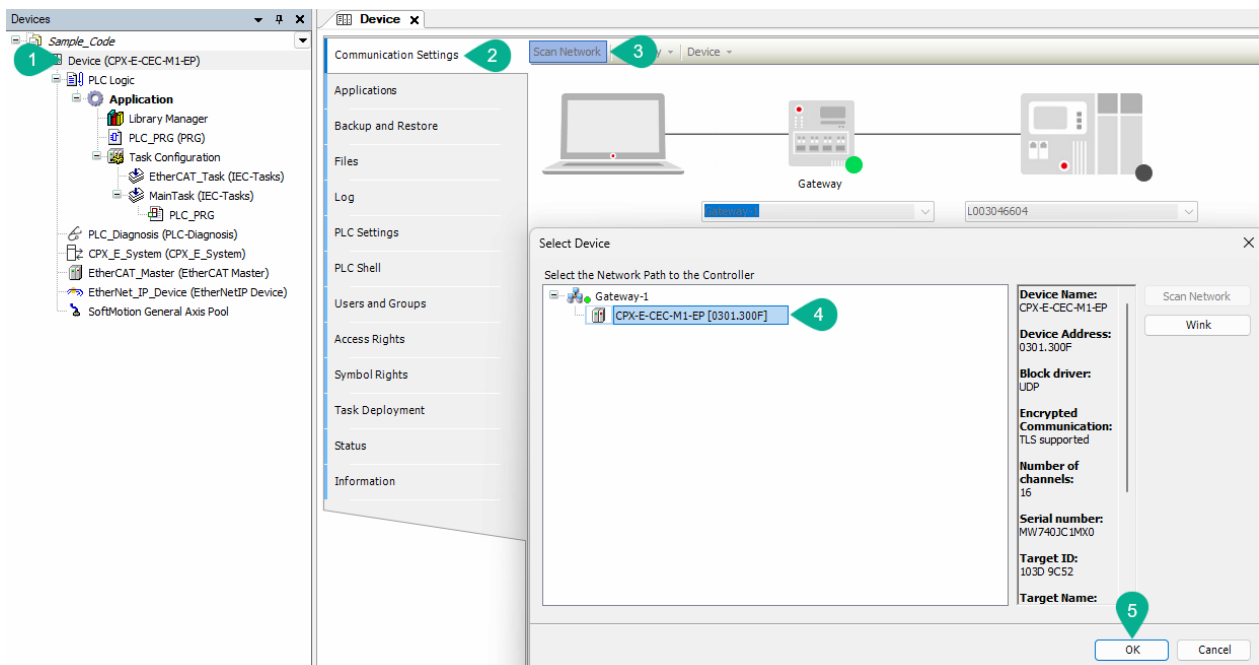
1. In the **New Project** window, under **Templates**, select **CPX-E-CEC project**.
2. In the **Name** field, enter a suitable project name, e.g., **Sample_Code**.
3. Choose the desired **Location** to save the project, then click **OK** to create the project.

Step 3

1. From the **Device** dropdown, select the required device, e.g., **CPX-E-CEC-M1-EP (Festo), 3.5.16.46**.
2. Check the **Show all device versions** checkbox to display all available versions of the selected device.
3. From the **PLC_PRG in** dropdown, select the desired programming language, e.g., **Function Block Diagram (FBD)**.
4. Check the **Add EtherCAT Master** checkbox to include the EtherCAT Master in the project.
5. Click **OK** to create the project.

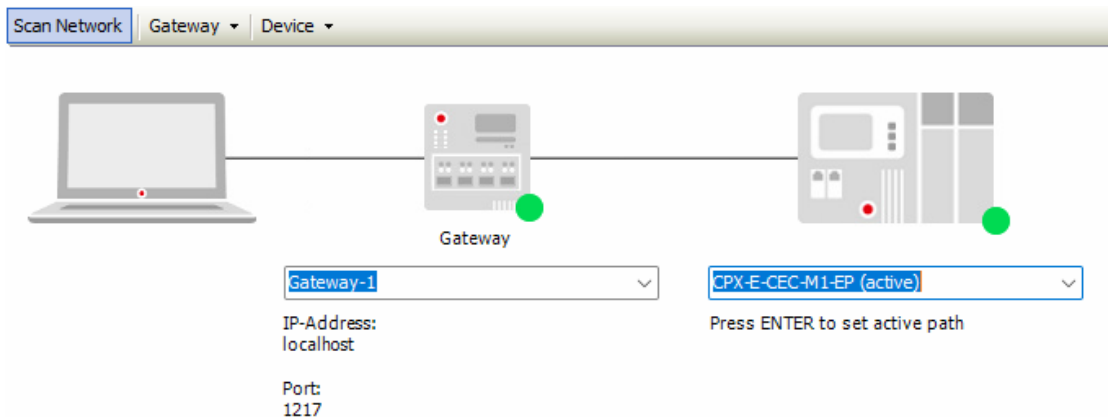
**Note**

- The user can select the **Controller** as per requirement. The above-mentioned method is used for this application note purpose.

3.3 Selecting the Communication Gateway Connection

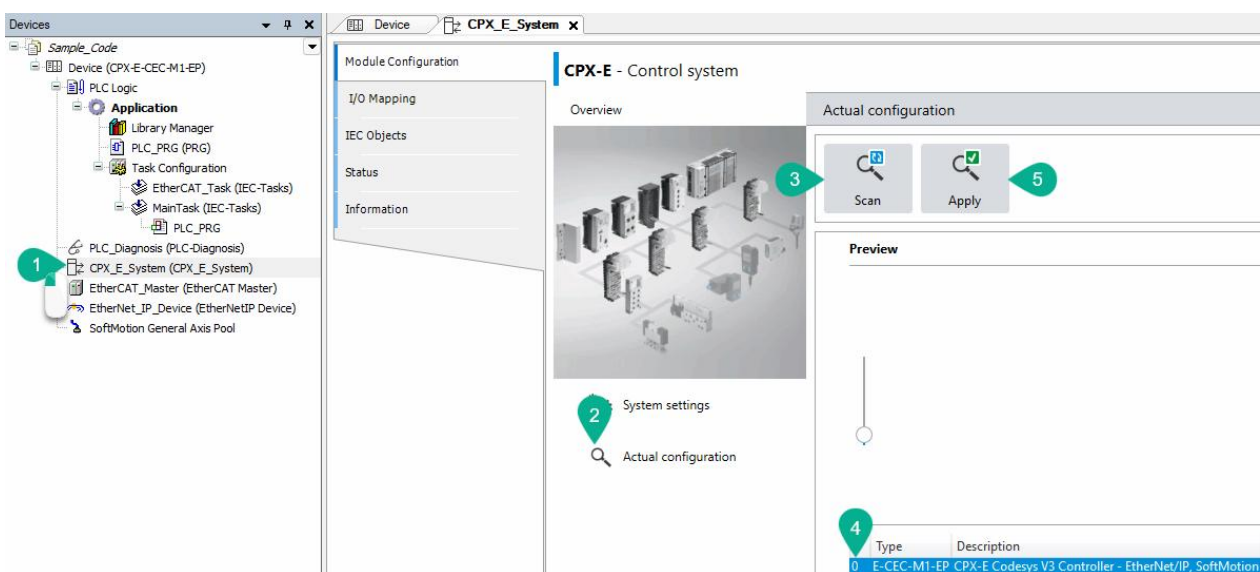
1. In the **Devices** tree on the left side, double-click on **Device (CPX-E-CEC-M1-EP)** to open the device configuration window.
2. Go to the **Communication Settings** tab.
3. Click on **Scan Network...** to search for available devices on the network.
4. Expand **Gateway-1** and select the detected controller, e.g., **CPX-E-CEC-M1-EP [0301.300F]**.
5. Click **OK** to confirm the selected device and establish the communication gateway connection.

Once the device is connected, the Communication Settings will look as shown in the image below, displaying the active gateway and device connection details.

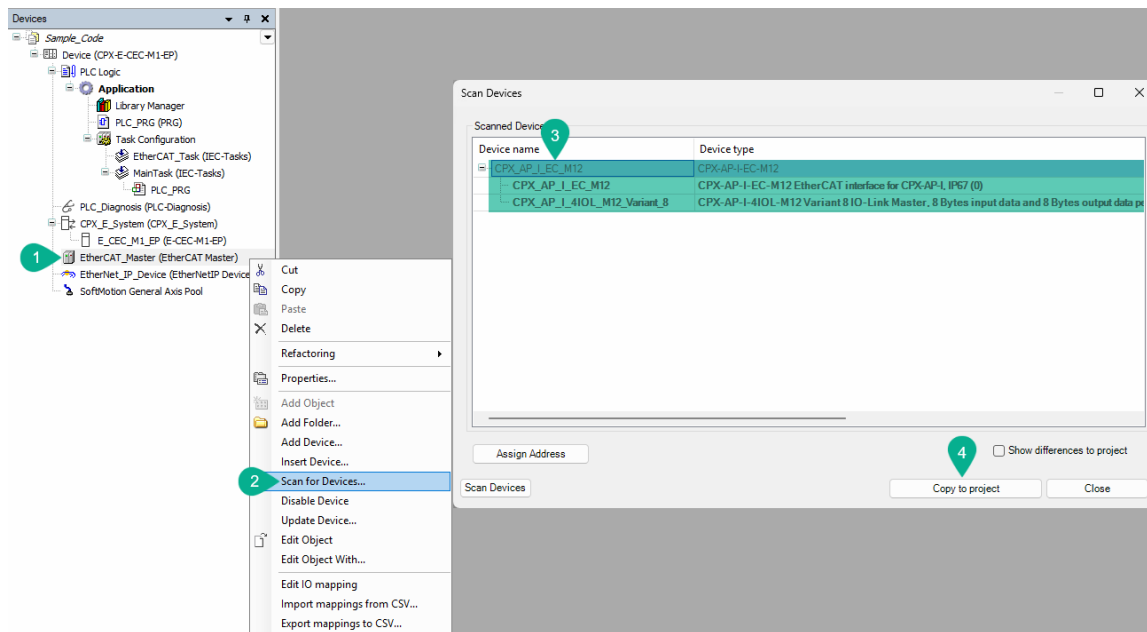


3.4 Scanning and Adding the Actual Controller Configuration

Step 1

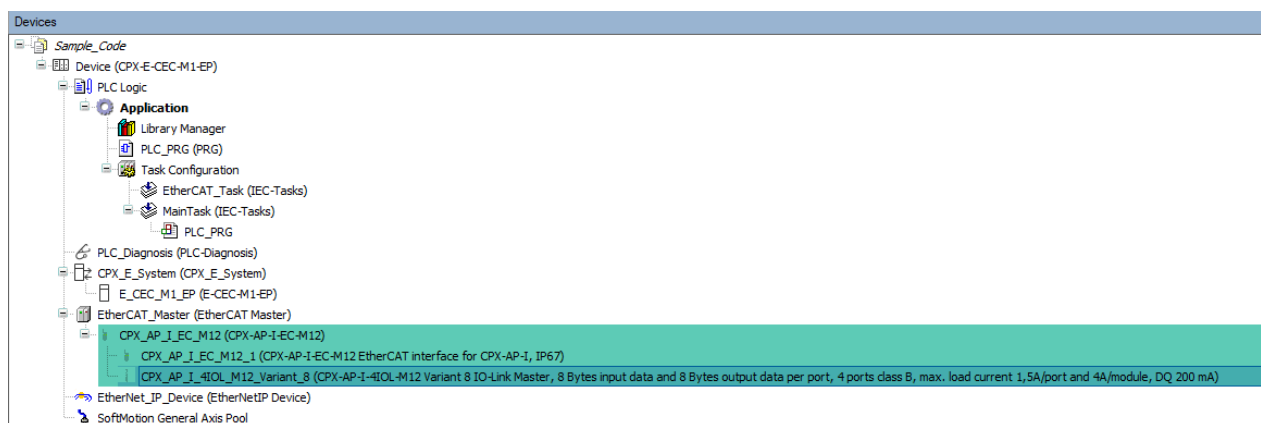


1. In the **Devices** tree, double-click on **CPX_E_System (CPX_E_System)** to open its configuration window.
2. In the **Module Configuration** tab, click on **Actual configuration**.
3. Click on the **Scan** button to detect the actual hardware configuration connected to the controller.
4. The scanned result will be displayed under **Type** and **Description**, showing the detected controller, e.g., **E-CEC-M1-EP CPX-E Codesys V3 Controller - EtherNet/IP, SoftMotion**.
5. Click on the **Apply** button to add the detected actual configuration to the project.

Step 2

1. In the **Devices** tree, right-click on **EtherCAT_Master**.
2. From the context menu, select **Scan for Devices...**
3. The scanned devices will be listed under **Device name**, showing the detected CPX-AP modules, e.g., **CPX_AP_I_EC_M12**, **CPX_AP_I_4IOL_M12_Variant_8**.
4. Click on **Copy to project** to add the scanned devices to the project.

Once the devices are copied, it looks as shown in the image below:

**Note**

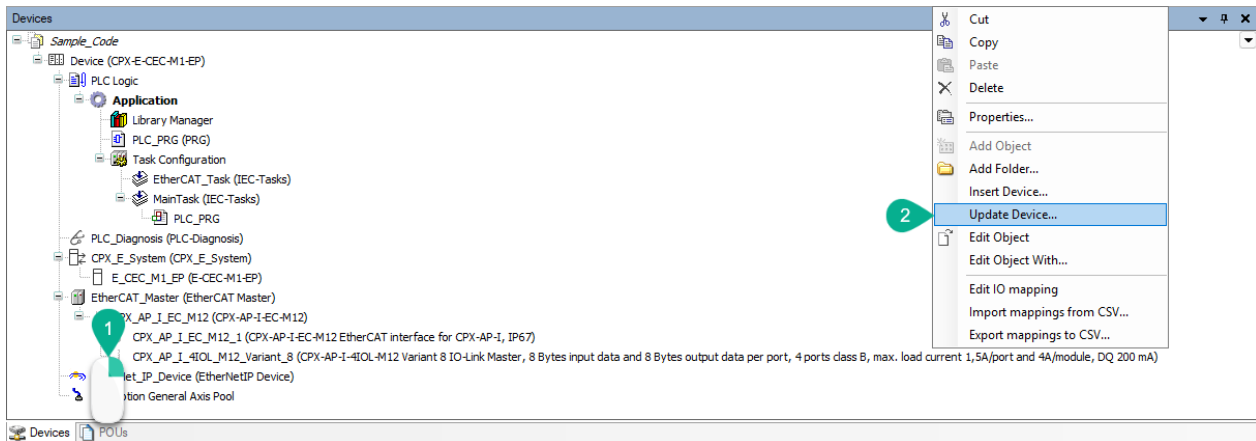
- If any issue occurs while copying the device to the project, the corresponding devices may be manually added by referring to the Scan Devices window.

3.5 Variant Selection of CPX-AP IO-Link Master Module

The **Technical Data** of the **SFAB-.-PNLK Flow Sensor** is shown below. The **Process Data In** and **Process Data Out** sizes are highlighted in yellow color boxes, indicating **0 Bit Process Data Out** and **64 Bits (8 Byte) Process Data In**.

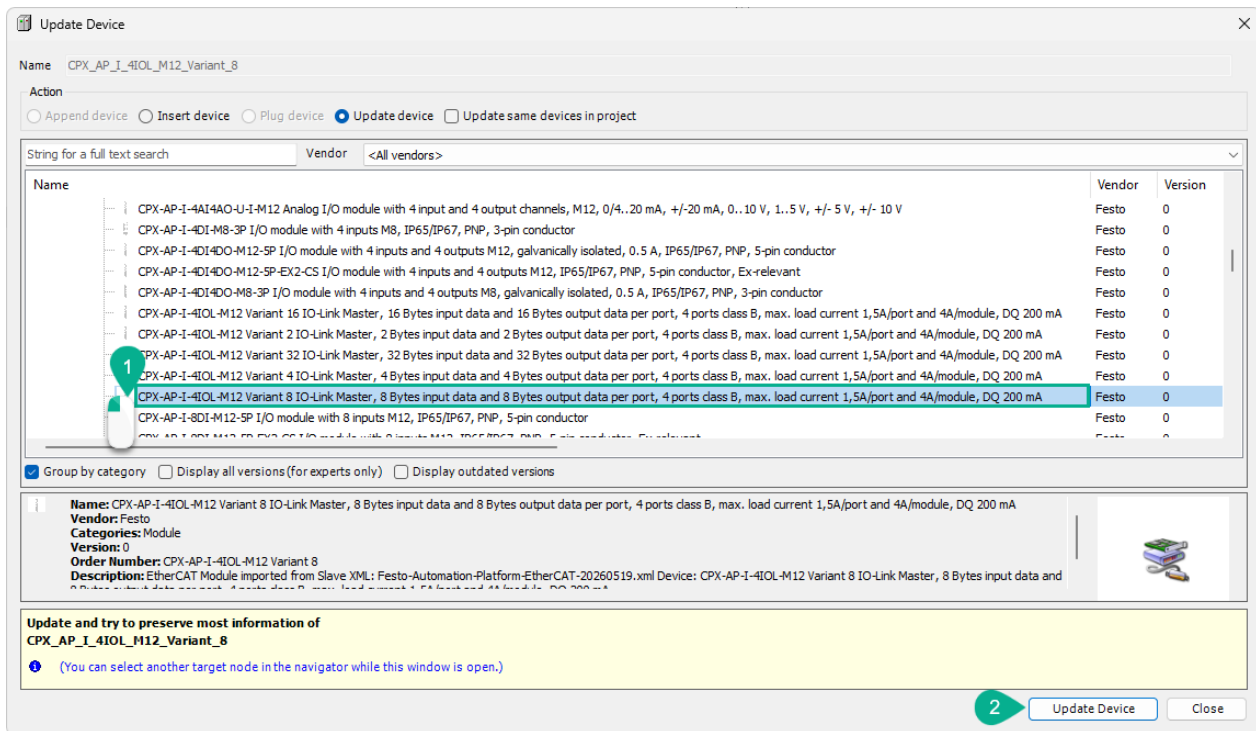
Characteristics	Specification
Protocol	IO-Link
Revision ID	V1.1
Device profiles	Smart Sensor - SSP 4.1.2 Firmware Update identification and diagnosis
	Function Measurement data, standard resolution Function Multiple switching signal Function Teach single value Function Extended identification Function Locator Function Product URI
Transmission rate	COM3
SIO-Mode support	Yes
Port type	class A
Process data output length	0 bit
Process data input length	64 bit
Process data content IN	Flow measurement value 16 bit MDC Flow monitoring 2 bit SSC Temperature measurement value 16 bit MDC Temperature monitoring 2 bit SSC Volume / mass pulse 1 bit SSC
Service data IN	Volume /mass measurement value 32 bit
Min. cycle time	1,2 ms
Data storage required	0,5 kByte

Step 1



1. In the **Devices** tree, right-click on **CPX_AP_I_4IOL_M12_Variant_8 (CPX-AP-I-4IOL-M12 Variant 8 IO-Link Master, 8 Bytes input data and 8 Bytes output data per port, 4 ports class B, max. load current 1.5A/port and 4A/module, DQ 200 mA)** (1).
2. From the context menu, select **Update Device...**

Step 2



1. From the device list, select **CPX-AP-I-4IOL-M12 Variant 8 IO-Link Master, 8 Bytes input data and 8 Bytes output data per port, 4 ports class B, max. load current 1.5A/port and 4A/module, DQ 200 mA**.
2. Click on **Update Device** to apply the selected variant.

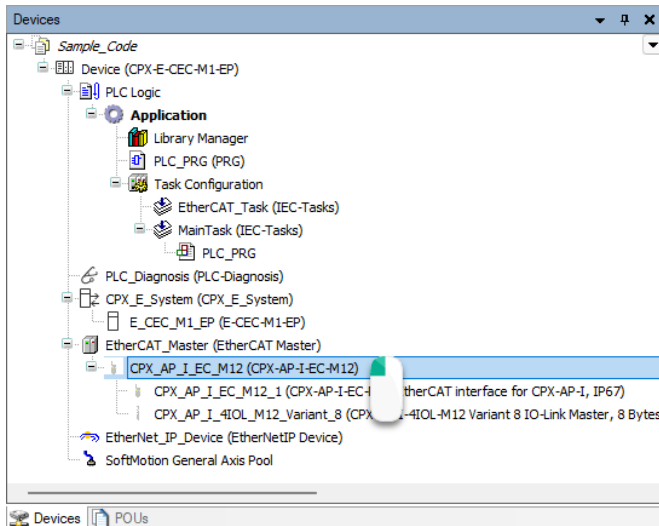
3.6 Finding EtherCAT Slave Address of CPX-AP-.-EC Module



Note

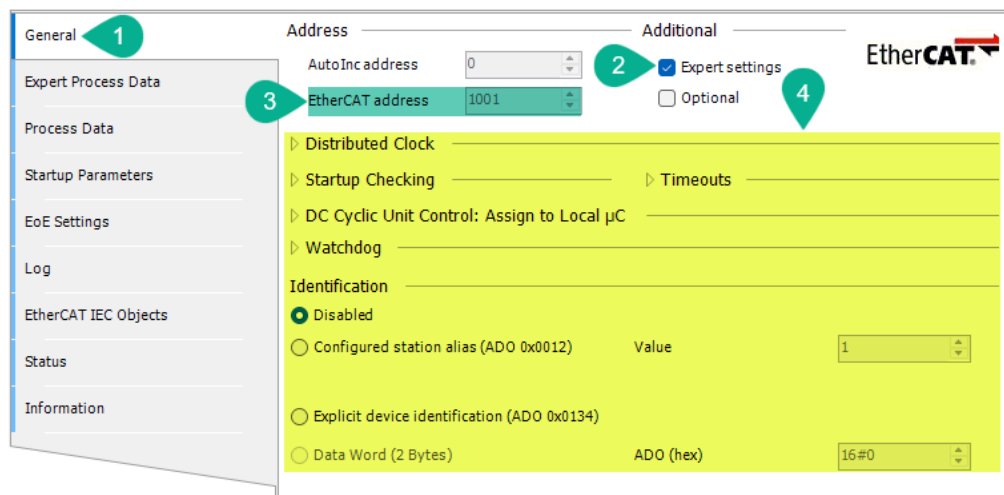
- For this sample code, the settings are shown based on the configuration referred to in [Refer Chapter 1.3](#).

Step 1



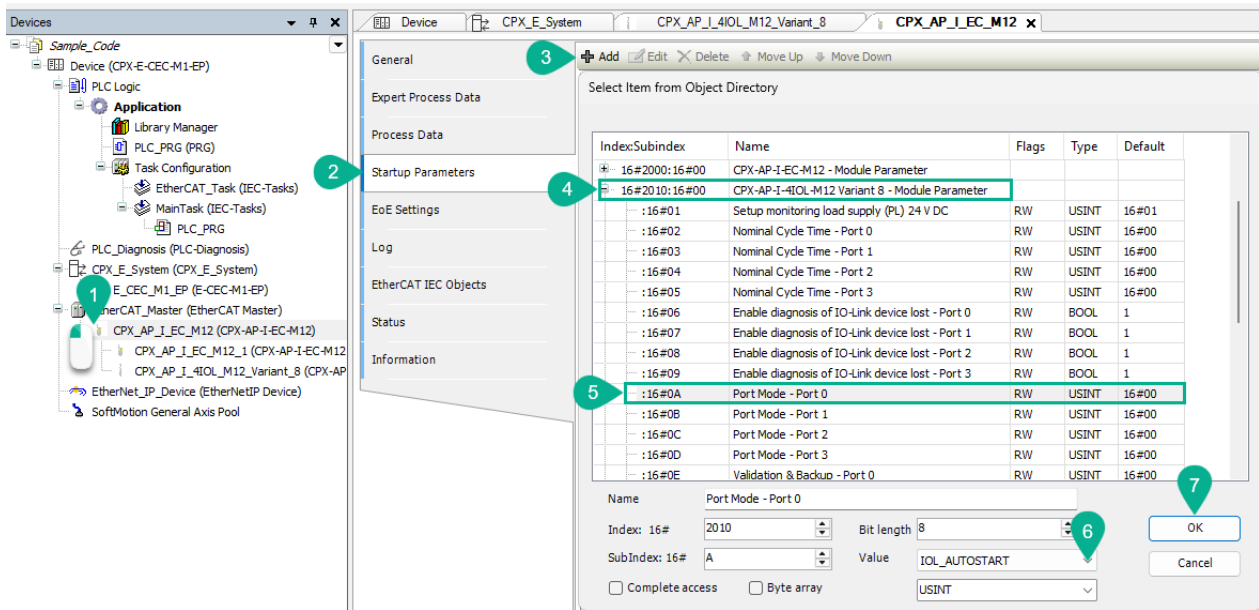
In **Devices** toolbox, double click on the **CPX-AP-.-EC** as shown above.

Step 2



- Go to the **General** tab.
- Check the **Expert settings** checkbox under the **Additional** section to enable advanced address settings.
- Note the **EtherCAT address** value displayed, e.g., **1001**, which represents the slave address of the CPX-AP-.-EC module.
- Once the **Expert Settings** option have been enabled, user will notice that the **Expert Process Data** tab and settings highlighted in a yellow colour box.

3.7 CPX-AP Start-up Configuration



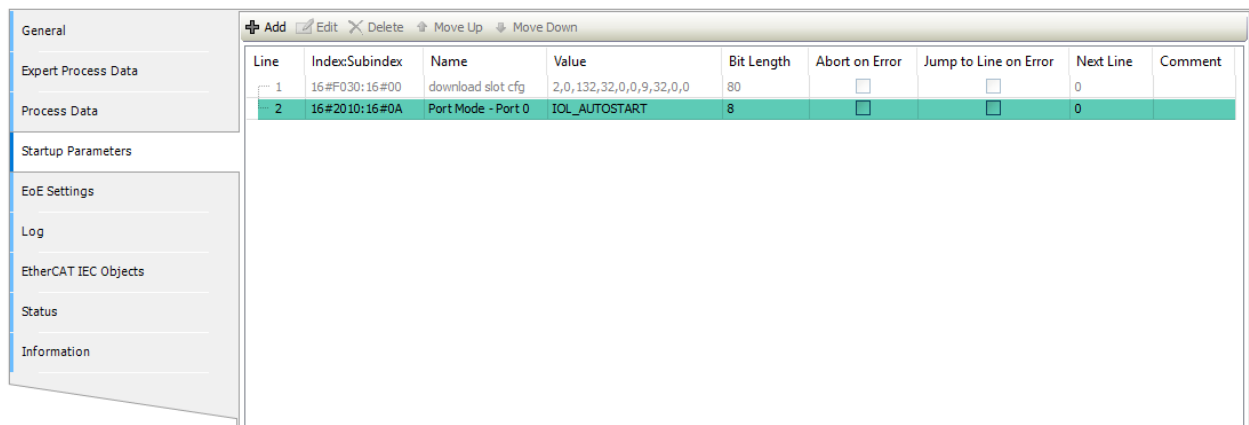
1. In the **Devices** tree, double-click on **CPX_AP_I_EC_M12** to open its configuration window.
2. Go to the **Startup Parameters** tab.
3. Click on **Add** to open the **Select Item from Object Directory** window.
4. Expand the **CPX-AP-I-4IOL-M12 Variant 8 - Module Parameter**,
5. Select **16#0A – Port Mode - Port 0**.
6. In the **Value** field, set the value to **IOL_AUTOSTART**.
7. Click **OK** to confirm and add the startup parameter configuration.



Note

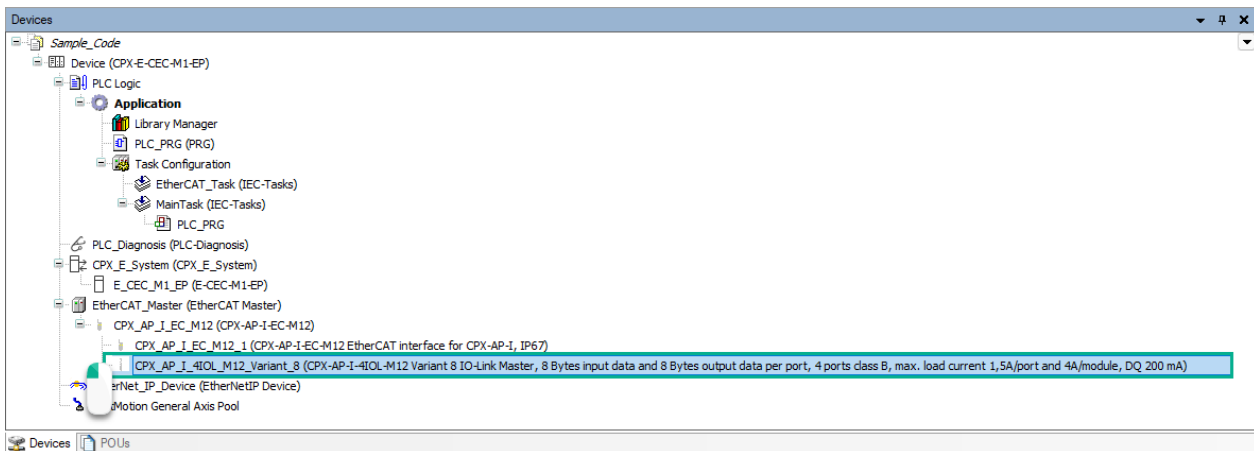
- For this application note demonstration, the **SFAB-.PNLK** sensor is connected to **Port 0** of the IO-Link Master module. [Refer Chapter 1.3.](#)
- Users can repeat this chapter to add start-up parameters as per their requirement.

Once the **IO-Link Port** is configured, it looks as shown in the image below:



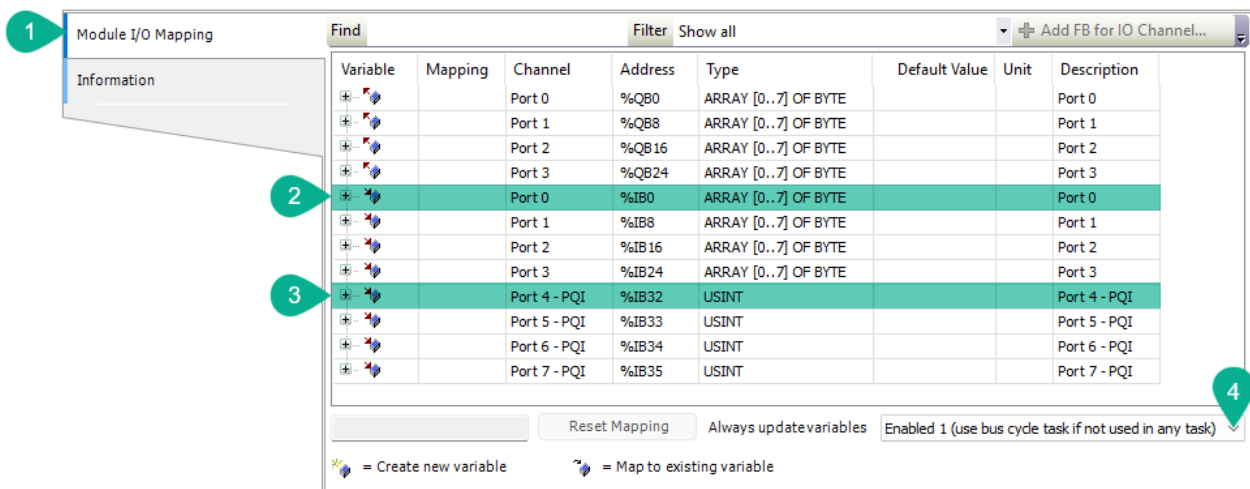
3.8 Finding the Module I/O Address

Step 1



In the Devices tree, double-click on **CPX_AP_I_4IOL_M12_Variant_8** to open its configuration window.

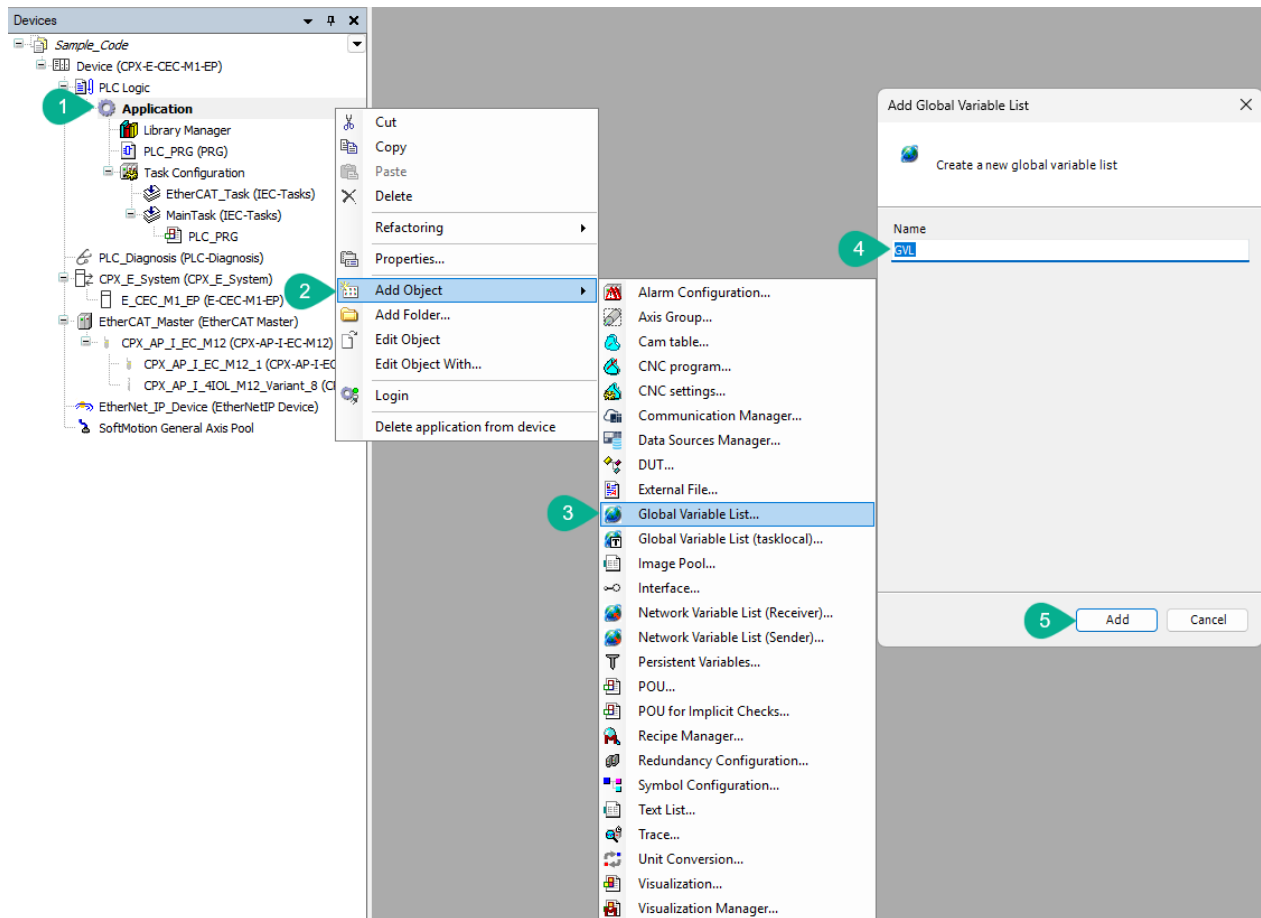
Step 2



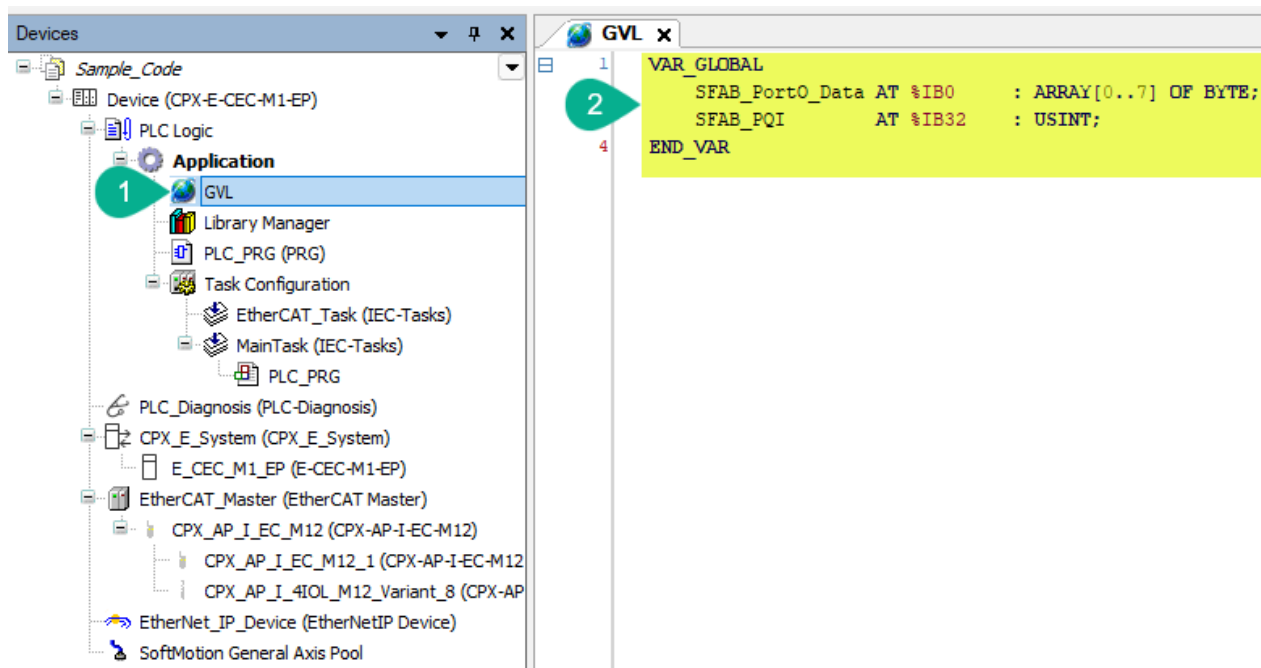
1. Go to the **Module I/O Mapping** tab.
2. Under the **Address** column, locate the **Port 0** input entry, mapped to **%IB0**, of type **ARRAY [0..7] OF BYTE**, representing the 8-byte process data input for the sensor connected to Port 0.
3. Additional port-specific PQI status information is available under **Port 4 - PQI**, mapped to **%IB32**, of type **USINT**.
4. Ensure the **Always update variables** setting is set to **Enabled 1 (use bus cycle task if not used in any task)** to ensure the I/O data is updated correctly.

3.9 Creating Global Variables

Step 1



1. In the **Devices** tree, right-click on **Application**.
2. From the context menu, select **Add Object**.
3. From the submenu, select **Global Variable List...**
4. In the **Add Global Variable List** window, enter the desired **Name**, e.g., **GVL**.
5. Click **Add** to create the new global variable list.

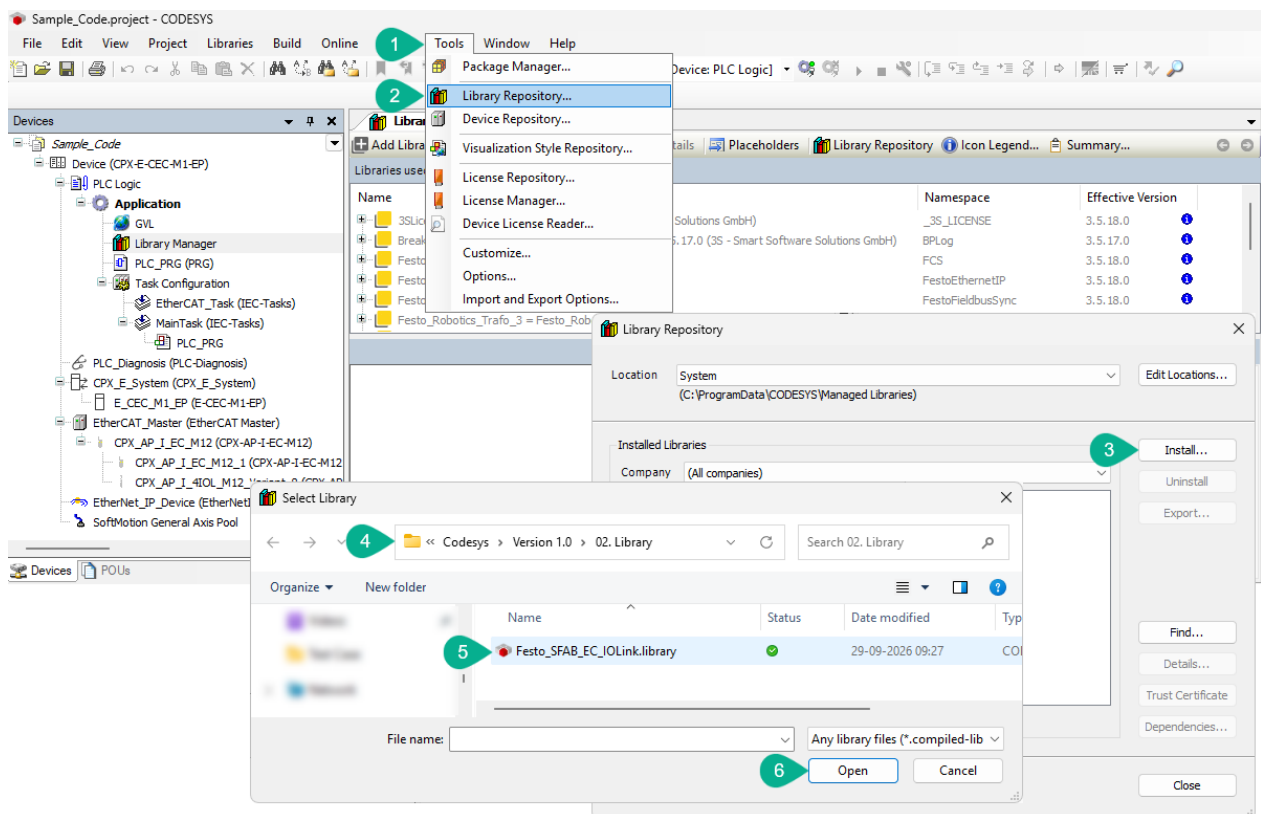
Step 2

1. In the **Devices** tree, double-click on **GVL** under **Application** to open the global variable editor.
2. In the **GVL** editor, declare the global variables mapped to the module I/O addresses.

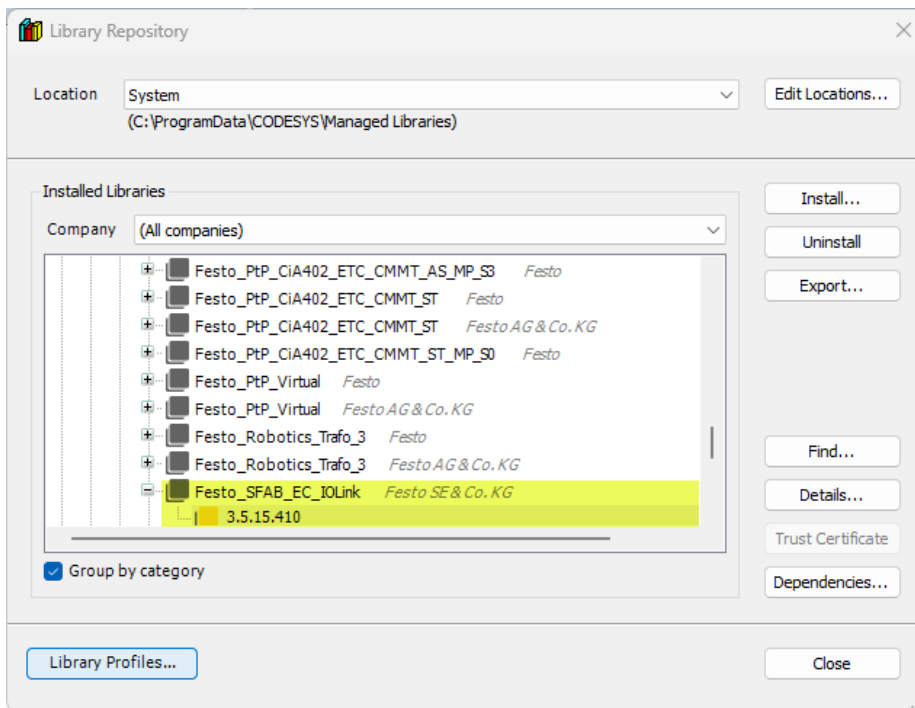
**Note**

- [Refer Chapter 3.8](#) for the corresponding **Module I/O Address** to correctly declare the process data variables shown above.

3.10 Installing the Festo_SFAB_EC_IOLink Library in CODESYS



1. In the menu bar, click on **Tools**.
2. From the dropdown menu, select **Library Repository...**
3. In the **Library Repository** window, click on **Install...**
4. In the **Select Library** window, navigate to the folder **02. Library**.
5. Select the file **Festo_SFAB_EC_IOLink.library**.
6. Click **Open** to install the library.

Step 2

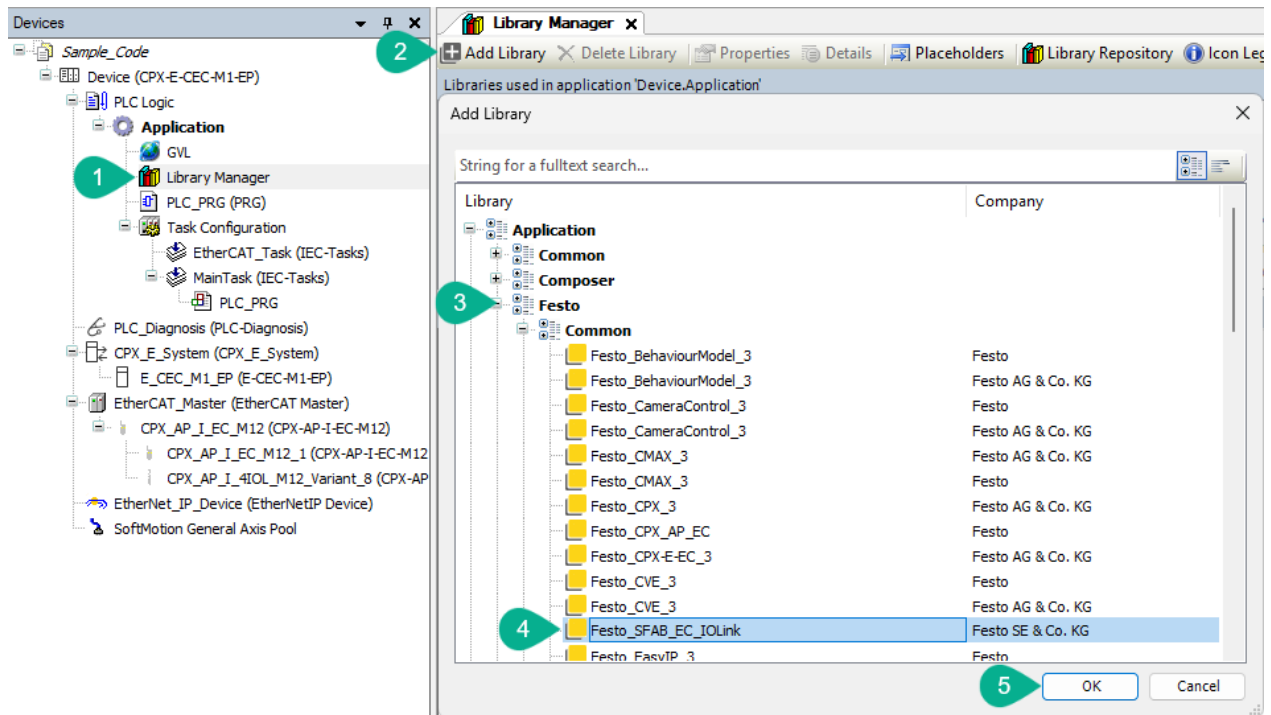
The installed library **Festo_SFAB_EC_IOLink**, version **3.5.15.410**, from **Festo SE & Co. KG**, can be found listed under **Installed Libraries** in the **Library Repository** window, as shown Above:

Application >> Festo >> Common >> Festo_SFAB_EC_IOLink

Click on **Close** to close the **Library Repository** window.

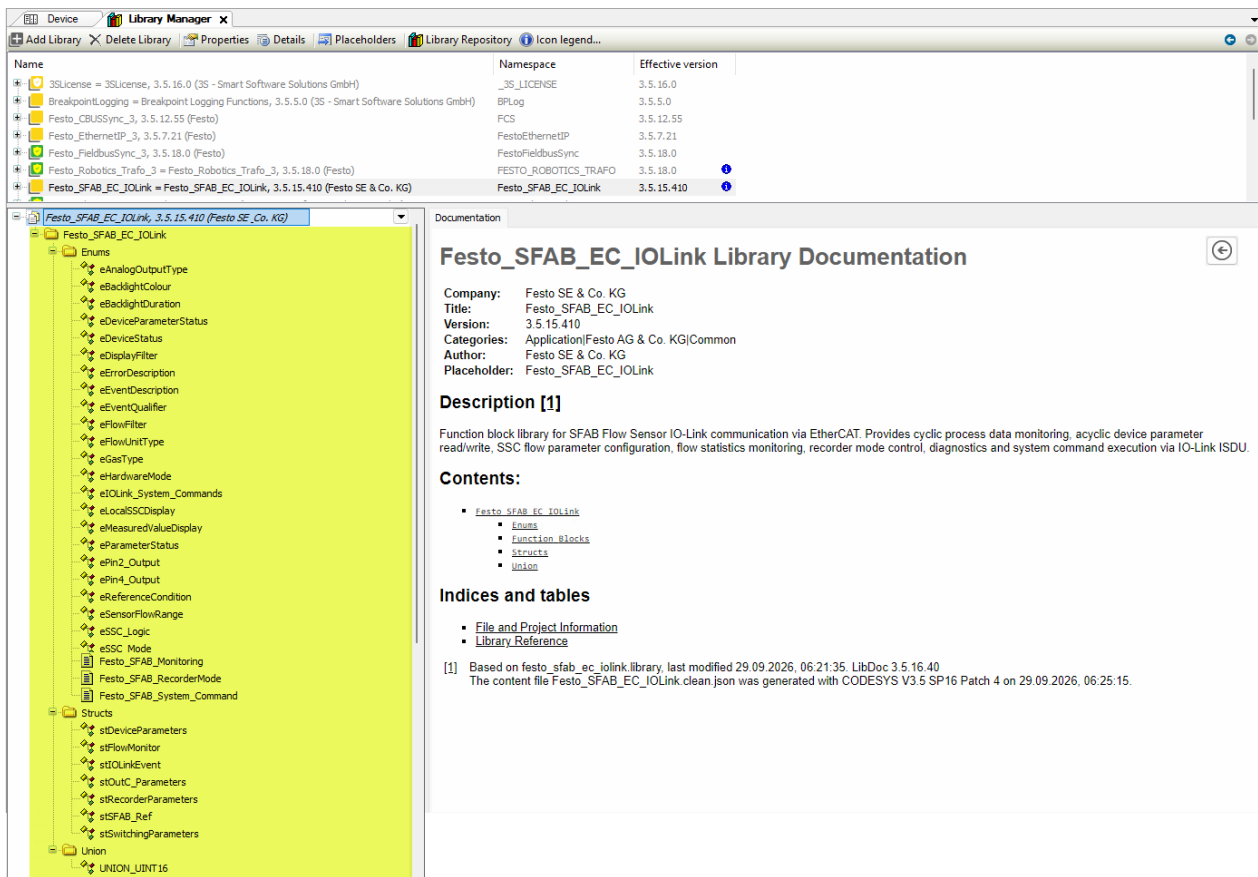
3.11 Adding the Library into Library Manager

Step 1



1. In the **Devices** tree, double-click on **Library Manager** under **Application**.
2. In the **Library Manager** window, click on **Add Library**.
3. In the **Add Library** window, expand **Application >> Festo >> Common**.
4. Select **Festo_SFAB_EC_IOLink** from the library list.
5. Click **OK** to add the selected library to the application.

Once the library is added successfully, the library elements will be available as shown below:



Function Blocks

- Festo_SFAB_Connect
- Festo_SFAB_Monitoring
- Festo_SFAB_System_Command
- Festo_SFAB_Diagnostics
- Festo_SFAB_RecorderMode
- Festo_SFAB_Flow_Monitoring
- Festo_SFAB_Flow_Parameters
- Festo_SFAB_Device_Parameters

Structures

- stDeviceParameters
- stFlowMonitor
- stSwitchingParameters
- stIOLinkEvent
- stOutC_Parameters
- stRecorderParameters
- stSFAB_Ref

Enumerations

- eAnalogOutputType
- eBacklightColour
- eBacklightDuration
- eDeviceParameterStatus
- eDeviceStatus
- eDisplayFilter
- eErrorDescription
- eEventDescription
- eEventQualifier
- eFlowFilter
- eFlowUnitType
- eGasType
- eHardwareMode
- eIOLink_System_Commands
- eLocalSSCDisplay
- eMeasuredValueDisplay
- eParameterStatus
- ePin2_Output
- ePin4_Output
- eReferenceCondition
- eSensorFlowRange
- eSSC_Logic
- eSSC_Mode
- eSubDisplayMode
- eTemperatureUnit
- eVolumeUnit

Union

- UNION_UINT16

4 Festo SFAB EC IOLink Library Function Blocks Description

4.1 Festo SFAB Connect

```

Festo_SFAB_EC_IOLink.Festo_SFAB_Connect
abyDataIn          stSFABRef
byDeviceAvailable
uiSlaveAddress
usiPort
eSensorFlowRange
eFlowUnit
eTemperatureUnit

```

4.1.1 Festo_SFAB_Connect Block Input Variables

Input Variables	Data Type	Description
abyDataIn	ARRAY [0..7] OF BYTE	Raw Process Data Input from SFAB Sensor
byDeviceAvailable	BYTE	Port Qualifier Information (PQI) from IO-Link Master
uiSlaveAddress	UINT	EtherCAT Address of CPX-AP-.EC-M12 Module
usiPort	USINT	IO-Link Port Number of CPX-AP-.4IOL-M12 Module
eSensorFlowRange	ENUM of the type (eSensorFlowRange)	Connected SFAB Sensor Flow Range Selection (Refer Chapter 4.10.20)
eFlowUnit	ENUM of the type (eFlowUnitType)	Flow Rate Unit Type Selection (Refer Chapter 4.10.10)
eTemperatureUnit	ENUM of the type (eTemperatureUnit)	Temperature Unit 1: °F Fahrenheit 0: °C Celsius (Refer Chapter 4.10.24)

Table 4.1: Festo_SFAB_Connect Block Input Variables descriptions

4.1.2 Festo_SFAB_Connect Block Output Variables

Output Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure (Refer Chapter 4.9.1)

Table 4.2: Festo_SFAB_Connect Block Output Variables descriptions

4.2 Festo SFAB Monitoring

```

Festo_SFAB_EC_IOLink.Festo_SFAB_Monitoring
stSFABRef          xEnabled
xEnable            xError
                  eErrorDescription
                  rFlowRate
                  xSSC11_FlowMonitoring
                  xSSC12_FlowMonitoring
                  xSSC13_VolumeMassPulse
                  rTemperature
                  xSSC21_TemperatureMonitoring
                  xSSC22_TemperatureMonitoring

```

4.2.1 Festo_SFAB_Monitoring Block Input Variables

Input Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure (Refer Chapter 4.9.1)
xEnable	BOOL	TRUE: Enable Function Block

Table 4.3: Festo_SFAB_Monitoring Block Input Variables descriptions

4.2.2 Festo_SFAB_Monitoring Block Output Variables

Output Variables	Data Type	Description
xEnabled	BOOL	TRUE: Function Block is Enabled and Running
xError	BOOL	TRUE: Error while Reading Process Data
eErrorDescription	ENUM of the type (eErrorDescription)	Enumeration of Function Block Error Code (Refer Chapter 4.10.26)
rFlowRate	REAL	MDC1 Flow Measurement Value Unit: As per user selection
xSSC11_FlowMonitoring	BOOL	SSC1.1 Flow Rate Monitoring OutA TRUE: On FALSE: Off
xSSC12_FlowMonitoring	BOOL	SSC1.2 Flow Rate Monitoring OutB TRUE: On FALSE: Off
xSSC13_VolumeMass-Pulse	BOOL	SSC1.3 Volume / Mass Pulse OutC TRUE: On FALSE: Off
rTemperature	REAL	MDC2 Temperature Measurement Value Unit: As per user selection
xSSC21_Temperature-Monitoring	BOOL	SSC2.1 Temperature Monitoring TRUE - On FALSE - Off
xSSC22_Temperature-Monitoring	BOOL	SSC2.2 Temperature Monitoring TRUE - On FALSE - Off

Table 4.4: Festo_SFAB_Monitoring Block Output Variables descriptions

4.3 Festo SFAB RecorderMode

Festo_SFAB_EC_IO-Link.Festo_SFAB_RecorderMode	
stSFABRef	xDone
xExecute	xBusy
xStartRec	xError
xStopRec	udiErrorCode
xResetRec	eErrorDescription
	eStatus
	stRecorderParameters

4.3.1 Festo_SFAB_RecorderMode Block Input Variables

Input Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure (Refer Chapter 4.9.1)
xExecute	BOOL	Rising Edge - Read Recorder Mode Data
xStartRec	BOOL	Rising Edge - Run / Resume Recorder
xStopRec	BOOL	Rising Edge - Pause Recorder
xResetRec	BOOL	Rising Edge - Reset Recorder Statistics

Table 4.5: Festo_SFAB_RecorderMode Block Input Variables descriptions

4.3.2 Festo_SFAB_RecorderMode Block Output Variables

Output Variables	Data Type	Description
xDone	BOOL	TRUE = Operation Executed Successfully
xBusy	BOOL	TRUE = Operation is Executing
xError	BOOL	TRUE = Error while Executing
udiErrorCode	UDINT	Function Block Error Code
eErrorDescription	ENUM of the type (eErrorDescription)	Enumeration of Function Block Error Code (Refer Chapter 4.10.26)
eStatus	ENUM of the type (eParameterStatus)	Enumeration of Recorder Mode Status (Refer Chapter 4.10.16)
stRecorderParameters	STRUCT of the type (stRecorderParameters)	Recorder Mode Data Structure (Refer Chapter 4.9.2)

Table 4.6: Festo_SFAB_RecorderMode Block Output Variables descriptions

4.4 Festo SFAB System Command

Festo_SFAB_EC_IO-Link.Festo_SFAB_System_Command	
stSFABRef	xDone
xExecute	xBusy
eSystemCommand	xError
	udiErrorCode
	eErrorDescription

4.4.1 Festo_SFAB_System_Command Block Input Variables

Input Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure (Refer Chapter 4.9.1)
xExecute	BOOL	Rising Edge: Execute IO-Link System Command
eSystemCommand	ENUM of the type (eIO-Link_System_Commands)	Enumeration of the SFAM IO-Link System Commands (Refer Chapter 4.10.13)

Table 4.7: Festo_SFAB_System_Command Block Input Variables descriptions

4.4.2 Festo_SFAB_System_Command Block Output Variables

Output Variables	Data Type	Description
xDone	BOOL	TRUE - Command Executed Successfully
xBusy	BOOL	TRUE - Command is Executing
xError	BOOL	TRUE - Error while executing System Command
udiErrorCode	UDINT	Function Block Error Code
eErrorDescription	ENUM of the type (eErrorDescription)	Enumeration of Function Block Error Code (Refer Chapter 4.10.26)

Table 4.8: Festo_SFAB_System_Command Block Output Variables descriptions

4.5 Festo SFAB Flow Monitoring

Festo_SFAB_EC_IO-Link.Festo_SFAB_Flow_Monitoring	
stSFABRef	xEnabled
xEnable	xError
xReadAcyclicData	udiErrorCode
xResetStatistics	eErrorDescription
	eStatus
	rFlowRate
	xSSC11_FlowMonitoring
	xSSC12_FlowMonitoring
	xSSC13_VolumeMassPulse
	stFlowMonitoring

4.5.1 Festo_SFAB_Flow_Monitoring Block Input Variables

Input Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure (Refer Chapter 4.9.1)
xEnable	BOOL	TRUE = Enable Function Block
xReadAcyclicData	BOOL	Rising Edge = Update Flow Rate Monitoring Parameters
xResetStatistics	BOOL	Rising Edge = Reset Min Max Flow Rate Statistics

Table 4.9: Festo_SFAB_Flow_Monitoring Block Input Variables descriptions

4.5.2 Festo_SFAB_Flow_Monitoring Block Output Variables

Output Variables	Data Type	Description
xEnabled	BOOL	TRUE = Function Block is Enabled and Running
xError	BOOL	TRUE = Error while Monitoring Flow Rate Parameters
udiErrorCode	UDINT	Function Block Error Code
eErrorDescription	ENUM of the type (eErrorDescription)	Enumeration of Function Block Error Code (Refer Chapter (Refer Chapter 4.10.26))
eStatus	ENUM of the type (eParameterStatus)	Enumeration of Flow Rate Monitoring Status (Refer Chapter 4.10.16)
rFlowRate	REAL	MDC1 Flow Measurement Value Unit as per user selection
xSSC11_FlowMonitoring	BOOL	SSC1.1 Flow Rate Monitoring OutA TRUE=On FALSE=Off
xSSC12_FlowMonitoring	BOOL	SSC1.2 Flow Rate Monitoring OutB TRUE=On FALSE=Off
xSSC13_VolumeMassPulse	BOOL	SSC1.3 Volume/Mass Pulse OutC TRUE=On FALSE=Off
stFlowMonitoring	STRUCT of the type (stFlowMonitor)	Flow Rate Monitoring Parameters Structure (Refer Chapter 4.9.6)

Table 4.10: Festo_SFAB_Flow_Monitoring Block Output Variables descriptions

4.6 Festo SFAB Device Parameters

Festo_SFAB_EC_IOLink.Festo_SFAB_Device_Parameters	
stSFABRef	xDone
xExecute	xBusy
xWrite	xError
stDeviceParameters	udiErrorCode
	eErrorDescription
	eStatus

4.6.1 Festo_SFAB_Device_Parameters Block In-Out Variables

In-Out Variables	Data Type	Description
stDeviceParameters	STRUCT of the type (stDeviceParameters)	SFAB Device Configuration Parameters Structure (Refer Chapter 4.9.7)

Table 4.11: Festo_SFAB_Device_Parameters Block In-Out Variables description

4.6.2 Festo_SFAB_Device_Parameters Block Input Variables

Input Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure (Refer Chapter 4.9.1)
xExecute	BOOL	Rising Edge: Read All Device Parameters
xWrite	BOOL	Rising Edge: Write All Device Parameters TRUE = Parameter Write, FALSE = Parameter Read

Table 4.12: Festo_SFAB_Device_Parameters Block Input Variables descriptions

4.6.3 Festo_SFAB_Device_Parameters Block Output Variables

Output Variables	Data Type	Description
xDone	BOOL	TRUE: Read or Write Operation Completed Successfully
xBusy	BOOL	TRUE: Read or Write Operation in Progress
xError	BOOL	TRUE: Error during Read / Write
udiErrorCode	UDINT	Function Block Error Code
eErrorDescription	ENUM of the type (eErrorDescription)	Enumeration of Function Block Error Code (Refer Chapter 4.10.26)
eStatus	ENUM of the type (eDeviceParameterStatus)	Enumeration of Device Parameters Read / Write Status (Refer Chapter 4.10.4)

Table 4.13: Festo_SFAB_Device_Parameters Block Output Variables descriptions

4.7 Festo SFAB Flow Parameters

Festo_SFAB_EC_IOLink.Festo_SFAB_Flow_Parameters	
stSFABRef	xDone
xExecute	xBusy
xWrite	xError
stSSC11_Parameters	udiErrorCode
stSSC12_Parameters	eErrorDescription
stSSC13_Parameters	eStatus

4.7.1 Festo_SFAB_Flow_Parameters Block In-Out Variables

In-Out Variables	Data Type	Description
stSSC11_Parameters	STRUCT of the type (stSwitchingParameters)	SSC1.1 OutA - Flow Rate Monitoring Parameters (Refer Chapter 4.9.5)
stSSC12_Parameters	STRUCT of the type (stSwitchingParameters)	SSC1.2 OutB - Flow Rate Monitoring Parameters (Refer Chapter 4.9.5)
stSSC13_Parameters	STRUCT of the type (stOutC_Parameters)	SSC1.3 OutC - Volume/Mass Pulse Parameters (Refer Chapter 4.9.3)

Table 4.14: Festo_SFAB_Flow_Parameters Block In-Out Variables descriptions

4.7.2 Festo_SFAB_Flow_Parameters Block Input Variables

Input Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure from Festo_SFAB_Connect (Refer Chapter 4.9.1)
xExecute	BOOL	Rising Edge - Read All Flow Rate Parameters
xWrite	BOOL	Rising Edge - Write All Flow Rate Parameters TRUE = Parameter Write FALSE = Parameter Read

Table 4.15: Festo_SFAB_Flow_Parameters Block Input Variables descriptions

4.7.3 Festo_SFAB_Flow_Parameters Block Output Variables

Output Variables	Data Type	Description
xDone	BOOL	TRUE: Read or Write Operation Completed Successfully
xBusy	BOOL	TRUE: Read or Write Operation in Progress
xError	BOOL	TRUE: Error during Read / Write
udiErrorCode	UDINT	Function Block Error Code
eErrorDescription	ENUM of the type (eErrorDescription)	Enumeration of Function Block Error Code (Refer Chapter 4.10.26)
eStatus	ENUM of the type (eParameterStatus)	Enumeration of Flow Parameters Read / Write Status (Refer Chapter 4.10.16)

Table 4.16: Festo_SFAB_Flow_Parameters Block Output Variables descriptions

4.8 Festo SFAB Diagnostics

Festo_SFAB_EC_IOLink.Festo_SFAB_Diagnostics	
stSFABRef	xDone
xExecute	xBusy
	xError
	udiErrorCode
	eErrorDescription
	uiIOLinkErrorCount
	eDeviceStatus
	astIOLinkEvent
	rSupplyVoltage

4.8.1 Festo_SFAB_Diagnostics Block Input Variables

Input Variables	Data Type	Description
stSFABRef	STRUCT of the type (stSFAB_REF)	SFAB Sensor Reference Structure (Refer Chapter 4.9.1)
xExecute	BOOL	Rising Edge: Trigger Diagnostic Read

Table 4.17: Festo_SFAB_Diagnostics Block Input Variables descriptions

4.8.2 Festo_SFAB_Diagnostics Block Output Variables

Output Variables	Data Type	Description
xDone	BOOL	TRUE: Diagnostic Data Read Completely
xBusy	BOOL	TRUE: Function Block Executing Diagnostic
xErro	BOOL	TRUE: Error while Reading Diagnostic Data
udiErrorCo	UDINT	Function Block Error Code
eErrorDescription	ENUM of the type (eErrorDescription)	Enumeration of Function Block Error Code (Refer Chapter 4.10.26)
uiIO-LinkErrorCount	UINT	Total Active Error Count
eDeviceStatus	ENUM of the type (eDeviceStatus)	Current Sensor Condition and Diagnosis State (Refer Chapter 4.10.5)
astIO-LinkEvent	ARRAY [1..8] OF stIO-LinkEvent	IO-Link Event Array - Max 8 Events (Refer Chapter 4.9.4)
rSupplyVoltage	REAL	Supply Voltage of the Sensor in Volt

Table 4.18: Festo_SFAB_Diagnostics Block Output Variables descriptions

4.9 Structure Data Type

4.9.1 stSFAB_Ref

Structure Variables	Data Type	Description
uiEtherCatAddress	UINT	EtherCAT Address of CPX-AP-.EC-M12 Module
usiPort	USINT	IO-Link Port Number (1..4)
abySFAB_DataIn	ARRAY [0..7] OF BYTE	Raw PDI Bytes from SFAB Sensor
byPQI	BYTE	Raw PQI Byte from IO-Link Master
xDeviceAvailable	BOOL	TRUE = IO-Link Communication Available PQI Bit 5
eSensorFlowRange	ENUM of the type (eSensorFlowRange)	Connected SFAB Sensor Flow Range Selection (Refer Chapter 4.10.20)
eFlowUnit	ENUM of the type (eFlowUnitType)	Flow Rate Unit 0=l/min 2=m ³ /h 3=scfm 4=g/min (Refer Chapter 4.10.10)
eTemperatureUnit	ENUM of the type (eTemperatureUnit)	Temperature Unit FALSE = Celsius TRUE = Fahrenheit (Refer Chapter 4.10.24)

Table 4.19: stSFAB_Ref descriptions

4.9.2 stRecorderParameters

Structure Variables	Data Type	Description
rRecorderVolume	REAL	Scaled volume/mass value
udRecorderTime_s	UDINT	Recorder time in seconds
udRecorderErrorTime_s	UDINT	Recorder error time in seconds
eVolumeUnit	ENUM of the type (eVolumeUnit)	Current volume/mass unit (Refer Chapter 4.10.25)
xRecorderRunning	BOOL	TRUE = Recorder is running
xRecorderPaused	BOOL	TRUE = Recorder is paused
xRecorderReset	BOOL	TRUE = Recorder was just reset

Table 4.20: stRecorderParameters descriptions

4.9.3 stOutC_Parameters

Structure Variables	Data Type	Description
udPulseThreshold	UDINT	Volume/mass pulse threshold (PULS, SP)
eLogic	ENUM of the type (eSSC_Logic)	Pulse output logic NO/NC (Refer Chapter 4.10.21)
uiPulseLength_ms	UINT	Volume/mass pulse length in ms

Table 4.21: stOutC_Parameters descriptions

4.9.4 stIOLinkEvent

Structure Variables	Data Type	Description
eEventType	ENUM of the type (eEventQualifier)	Enumeration of Event Type of the SFAB Sensor (Refer Chapter 4.10.8)
iEventCode	INT	Enumeration of Event Code of the SFAB Sensor
eEventDescription	ENUM of the type (eEventDescription)	Enumeration of Event Code Description (Refer Chapter 4.10.7)

Table 4.22: stIOLinkEvent descriptions

4.9.5 stSwitchingParameters

Structure Variables	Data Type	Description
iSetPoint_SP1	INT	Setpoint SP1 (SP, SP.Lo, SP.Hi) Range 0..24000
iSetPoint_SP2	INT	Setpoint SP2 (SP, SP.Lo, SP.Hi) Range 0..24000
Logic	ENUM of the type (eSSC_Logic)	Switching point logic, NO/NC (Refer Chapter 4.10.21)
Mode	ENUM of the type (eSSC_Mode)	Switching point mode (Refer Chapter 4.10.22)
iHysteresis	INT	Hysteresis at switch point Range 0..21600
eBacklightColour	ENUM of the type (eBacklightColour)	Display backlight colour (Refer Chapter 4.10.2)

Table 4.23: stSwitchingParameters descriptions

4.9.6 stFlowMonitor

Structure Variables	Data Type	Description
rMinFlowRate	REAL	Minimum flow rate value Unit as per user selection
rMaxFlowRate	REAL	Maximum flow rate value Unit as per user selection
rAvgFlowRate	REAL	Averaged flow rate value Unit as per user selection

Table 4.24: stFlowMonitor descriptions

4.9.7 stDeviceParameters

Structure Variables	Data Type	Description
eFlowUnit	ENUM of the type (eFlowUnitType)	Flow unit selection (Refer Chapter 4.10.10)
eTemperatureUnit	ENUM of the type (eTemperatureUnit)	Temperature unit °C / °F (Refer Chapter 4.10.24)
eReferenceCondition	ENUM of the type (eReferenceCondition)	Reference condition 0°C/15°C/20°C (Refer Chapter 4.10.19)
eGasType	ENUM of the type (eGasType)	Gas type Air/N2/Ar/CO2 (Refer Chapter 4.10.11)
eFlowMeasurementFilter	ENUM of the type (eFlowFilter)	Flow measurement filter 0..2048ms (Refer Chapter 4.10.9)
eFlowDisplayFilter	ENUM of the type (eDisplayFilter)	Flow display filter 256/512/1024ms (Refer Chapter 4.10.6)
ePin2_OutputSignal	ENUM of the type (ePin2_Output)	Output signal Pin2 (Refer Chapter 4.10.17)
ePin4_OutputSignal	ENUM of the type (ePin4_Output)	Output signal Pin4 (Refer Chapter 4.10.18)
eHardwareMode	ENUM of the type (eHardwareMode)	NPN / PNP selection (Refer Chapter 4.10.12)
eAnalogOutputType	ENUM of the type (eAnalogOutputType)	0-10V / 1-5V / 4-20mA (Refer Chapter 4.10.1)
iAnalogStartValue	INT	Analog start value % Range -100..90
iAnalogEndValue	INT	Analog end value % Range -90..100
eBacklightDuration	ENUM of the type (eBacklightDuration)	Backlight duration always on/5..640s (Refer Chapter 4.10.3)
eSubDisplayMode	ENUM of the type (eSubDisplayMode)	Sub-display mode selection (Refer Chapter 4.10.23)
eLocalSSCDisplay	ENUM of the type (eLocalSSCDisplay)	Show only active or all SSCs (Refer Chapter 4.10.14)
eMeasuredValueDisplay	ENUM of the type (eMeasuredValueDisplay)	Flow/Volume/Temperature display (Refer Chapter 4.10.15)
uiLockCode	UINT	Local parameter lock code 0=Off; 0...9999
xParameterizationLock	BOOL	FALSE: Unlocked TRUE: Locked
xUserInterfaceLock	BOOL	FALSE: Unlocked TRUE: Locked
xUserZeroAdjustment	BOOL	User zero adjustment On/Off

Table 4.25: stDeviceParameters descriptions

4.10 Enumerations

4.10.1 eAnalogOutputType

Enumeration Value	Enumeration Text
0	e0_10V
1	e1_5V
2	e4_20mA

Table 4.26: eAnalogOutputType enumeration

4.10.2 eBacklightColour

Enumeration Value	Enumeration Text
0	AlwaysBlue
1	RedIfOutOff
2	RedIfOutOn

Table 4.27: eBacklightColour enumeration

4.10.3 eBacklightDuration

Enumeration Value	Enumeration Text
0	AlwaysOn
1	Time5s
2	Time10s
3	Time20s
4	Time40s
5	Time80s
6	Time160s
7	Time320s
8	Time640s

Table 4.28: eBacklightDuration enumeration

4.10.4 eDeviceParameterStatus

Enumeration Value	Enumeration Text
0	No_Status
1	Read_All_Parameters_Started
2	Write_All_Parameters_Started
3	Flow_Unit
4	Temperature_Unit
5	Reference_Condition
6	Gas_Type
7	Flow_Measurement_Filter
8	Flow_Display_Filter
9	Pin2_Output_Signal
10	Pin4_Output_Signal
11	Hardware_Mode
12	Analog_Output_Type
13	Analog_Output_Start_Value
14	Analog_Output_End_Value
15	Backlight_Duration
16	Sub_Display_Mode
17	Local_SSC_Display
18	Measured_Value_Display
19	Lock_Code
20	Parameterization_Lock
21	UserInterface_Lock
22	User_Zero_Adjustment
23	Read_All_Parameters_Completed
24	Write_All_Parameters_Completed

Table 4.29: eDeviceParameterStatus enumeration

4.10.5 eDeviceStatus

Enumeration Value	Enumeration Text
0	Device_OK
1	Device_MaintenanceRequired
2	Device_OutOfSpecification
3	Device_FunctionalCheck
4	Device_Failure
255	Device_Unknown

Table 4.30: eDeviceStatus enumeration

4.10.6 eDisplayFilter

Enumeration Value	Enumeration Text
8	Display_256ms
9	Display_512ms
10	Display_1024ms

Table 4.31: eDisplayFilter enumeration

4.10.7 eEventDescription

Enumeration Value	Enumeration Text
0	Device_Ok
16#1000	Device_Error
16#1808	Moisture_Or_Dirt_in_the_Compressed_Air
16#1815	Overload_Or_Short_Circuit_at_Switching_Out- put_OutA_Puls
16#1816	Overload_Or_Short_Circuit_at_Switching_Output_OutB
16#181F	Recorder_Counter_Overflow
16#4000	Temperature_Error_in_IOLink_Driver
16#5000	Device_Hardware_Fault
16#5111	Supply_Voltage_Under_run

Table 4.32: eEventDescription enumeration

4.10.8 eEventQualifier

Enumeration Value	Enumeration Text
0	No_Event
1	Notification
2	Warning
3	Error

Table 4.33: eEventQualifier enumeration

4.10.9 eFlowFilter

Enumeration Value	Enumeration Text
0	Filter_Disabled
1	Filter_2ms
2	Filter_4ms
3	Filter_8ms
4	Filter_16ms
5	Filter_32ms
6	Filter_64ms
7	Filter_128ms
8	Filter_256ms
9	Filter_512ms
10	Filter_1024ms
11	Filter_2048ms

Table 4.34: eFlowFilter enumeration

4.10.10 eFlowUnitType

Enumeration Value	Enumeration Text
0	L_Min
1	M3_Hour
2	Scfm
3	G_Min

Table 4.35: eFlowUnitType enumeration

4.10.11 eGasType

Enumeration Value	Enumeration Text
0	Air
1	N2
2	Ar
3	CO2

Table 4.36: eGasType enumeration

4.10.12 eHardwareMode

Enumeration Value	Enumeration Text
0	NPN
1	PNP

Table 4.37: eHardwareMode enumeration

4.10.13 eIOLink_System_Commands

Enumeration Value	Enumeration Text
65	TeachSingleValue_SP1
66	TeachSingleValue_SP2
75	VendorSpecificTeachCommand
76	TeachCancelCommand
126	LocatorStart
127	LocatorStop
128	DeviceReset
129	ApplicationReset
130	RestoreFactorySettings
131	BackToBox
160	ResetMinFlow
161	ResetMaxFlow
166	ResetMinTemperature
167	ResetMaxTemperature
168	AdjustZeroPoint
176	VolRecorderReset
177	VolRecorderRun
178	VolRecorderPause

Table 4.38: eIOLink_System_Commands enumeration

4.10.14 eLocalSSCDisplay

Enumeration Value	Enumeration Text
0	OnlyActiveSSCs
1	AllLocalSSCs

Table 4.39: eLocalSSCDisplay enumeration

4.10.15 eMeasuredValueDisplay

Enumeration Value	Enumeration Text
0	DisplayFlow
1	DisplayVolumePulse
2	DisplayTemperature

Table 4.40: eMeasuredValueDisplay enumeration

4.10.16 eParameterStatus

Enumeration Value	Enumeration Text
0	No_Status
1	Read_All_Parameters_Started
2	Write_All_Parameters_Started
3	Flow_OutA_SSC11_Set_Point_1
4	Flow_OutA_SSC11_Set_Point_2
5	Flow_OutA_SSC11_SwitchPoint_Logic
6	Flow_OutA_SSC11_SwitchPoint_Mode
7	Flow_OutA_SSC11_Hysteresis
8	Flow_OutA_SSC11_Backlight_Colour
9	Flow_OutA_SSC12_Set_Point_1
10	Flow_OutA_SSC12_Set_Point_2
11	Flow_OutA_SSC12_SwitchPoint_Logic
12	Flow_OutA_SSC12_SwitchPoint_Mode
13	Flow_OutA_SSC12_Hysteresis
14	Flow_OutA_SSC12_Backlight_Colour
15	Flow_OutC_SSC13_Switch_Point
16	Flow_OutC_SSC13_SwitchPoint_Logic
17	Flow_OutC_SSC13_Length

Enumeration Value	Enumeration Text
18	Flow_Monitor_Enabled
19	MDC1_Minimum_Flow_Rate
20	MDC1_Maximum_Flow_Rate
21	MDC1_Average_Flow_Rate
22	MDC1_OutC_Pulse_Output_Value
23	Flow_Monitor_Data_Read_Done
24	Flow_Reset_Minimum_MDC1
25	Flow_Reset_Maximum_MDC1
26	Flow_MDC1_Min_Max_Reset_Done
27	Flow_Recorder_Monitor_Start
31	Flow_Recorder_Value
33	Flow_Time_of_Recorder
34	Flow_Error_Time_of_Recorder
35	Flow_Recorder_Monitor_Done
28	Flow_Run_or_Resume_Recorder
29	Flow_Pause_Recorder
30	Flow_Reset_Recorder
36	Flow_Run_or_Resume_Recorder_Write_Done
37	Flow_Pause_Recorder_Write_Done
38	Flow_Reset_Recorder_Write_Done
56	Warning_Read_Write_Executed_Together
57	Warning_Execute_Start_Stop_Reset_Recorder_Executed_Together
58	Read_All_Parameters_Completed
59	Write_All_Parameters_Completed

Table 4.41: eParameterStatus enumeration

4.10.17 ePin2_Output

Enumeration Value	Enumeration Text
0	Pin2_OutB_FlowMonitoring
2	Pin2_FlowAnalog
4	Pin2_TemperatureAnalog

Table 4.42: ePin2_Output enumeration

4.10.18 ePin4_Output

Enumeration Value	Enumeration Text
0	Pin4_OutA_FlowMonitoring
1	Pin4_OutC_VolumePulse

Table 4.43: ePin4_Output enumeration

4.10.19 eReferenceCondition

Enumeration Value	Enumeration Text
0	DIN1343_0C
1	ISO2533_15C
2	ISO6358_20C

Table 4.44: eReferenceCondition enumeration

4.10.20 eSensorFlowRange

Enumeration Value	Enumeration Text
0	SFAB_10
1	SFAB_50
2	SFAB_200
3	SFAB_600
4	SFAB_1000

Table 4.45: eSensorFlowRange enumeration

4.10.21 eSSC_Logic

Enumeration Value	Enumeration Text
0	NO_HighActive
1	NC_LowActive

Table 4.46: eSSC_Logic enumeration

4.10.22 eSSC_Mode

Enumeration Value	Enumeration Text
0	Deactivated_Mode
1	SinglePoint_Mode
2	Window_Mode
3	TwoPoint_Mode

Table 4.47: eSSC_Mode enumeration

4.10.23 eSubDisplayMode

Enumeration Value	Enumeration Text
0	Units
1	GasType
2	FlowValue
3	VolumeValue
5	TemperatureValue
6	SP1
7	SP2

Table 4.48: eSubDisplayMode enumeration

4.10.24 eTemperatureUnit

Enumeration Value	Enumeration Text
0	Celsius (°C)
1	Fahrenheit (°F)

Table 4.49: eTemperatureUnit enumeration

4.10.25 eVolumeUnit

Enumeration Value	Enumeration Text
0	Vol_Liter
1	Vol_M3
2	Vol_SCFt
3	Vol_Gram

Table 4.50: eVolumeUnit enumeration

4.10.26 eErrorDescription

Enumeration Value	Enumeration Text
16#0	No_Error
16#01	INTERNAL_ERROR
16#02	No_Master_Found
16#03	ETC_CO_Data_Overflow
16#04	ETC_CO_Timeout_or_Wrong_EtherCAT_Address
16#05	WRONG_HMSG
16#06	TARGET_PORT_NOT_FOUND
16#07	TARGET_MACHINE_NOT_FOUND
16#08	UNKNOWN_COMMAND_ID
16#09	BAD_TASK_ID
16#0A	NO_IO
16#0B	UNKNOWN_ADS_COMMAND
16#0C	WIN32_ERROR
16#0D	PORT_NOT_CONNECTED
16#0E	INVALID_ADS_LENGTH
16#0F	INVALID_AMS_NETID
16#10	LOW_INSTALLATION_LEVEL
16#11	NO_DEBUG_AVAILABLE
16#12	PORT_DISABLED
16#13	PORT_ALREADY_CONNECTED
16#14	AMS_SYNC_WIN32_ERROR
16#15	AMS_SYNC_TIMEOUT
16#16	AMS_SYNC_AMS_ERROR
16#17	AMS_SYNC_NO_INDEX_MAP
16#18	INVALID_AMS_PORT
16#19	NO_MEMORY
16#1A	TCP_SEND_ERROR
16#1B	HOST_UNREACHABLE
16#1C	INVALID_AMS_FRAGMENT
16#700	ADSERR_DEVICE_ERROR

Enumeration Value	Enumeration Text
16#21	ETC_CO_First_MF
16#100	ETC_CO_Last_Error
16#101	Invalid_Flow_Display_Filter_Value
16#102	Invalid_LockCode_Value
16#103	PQI_Error
16#104	OutA_SetPoint_1_Value_Invalid
16#105	OutA_SetPoint_2_Value_Invalid
16#106	OutA_Hysteresis_Value_Invalid
16#107	OutB_SetPoint_1_Value_Invalid
16#108	OutB_SetPoint_2_Value_Invalid
16#109	OutB_Hysteresis_Value_Invalid
16#10A	OutC_Switch_Point_Value_Invalid
16#111	SSC22_Hysteresis_Value_Invalid
16#112	Invalid_EtherCAT_Address
16#113	Invalid_Port_Number
16#114	Invalid_EtherCAT_Address_And_Port_Number
16#115	Invalid_Pin2_Output_Signal_Selection
16#116	Analog_Start_Value_Below_Limit
16#117	Analog_Start_Value_Above_Limit
16#118	Analog_End_Value_Below_Limit
16#119	Analog_End_Value_Above_Limit
16#1000	Master_Communication_Error
16#1100	Master_ISDU_Timeout
16#5600	Master_ISDU_Checksum_Error
16#8000	Device_Application_Error_No_Details
16#8011	Index_Not_Available
16#8012	Sub_Index_Not_Available
16#8020	Service_Not_Available
16#8023	Index_Not_Writeable
16#8030	Parameter_Value_Out_Of_Range
16#8031	Parameter_Value_Above_Limit

Enumeration Value	Enumeration Text
16#8032	Parameter_Value_Below_Limit
16#8033	Parameter_Length_Overrun
16#8034	Parameter_Length_Underrun
16#8035	Function_Not_Available
16#8036	Function_Temporary_Unavailable
16#8040	Invalid_Parameter_Set
16#8041	Inconsistent_Parameter_Set
16#8082	Application_Not_Ready
16#8100	Vendor_Unspecific
16#999	Vendor_Specific
16#6020000	Wrong_Port_Number
16#8000000	General_SDO_Error

Table 4.51: eErrorDescription enumeration

5 Configuration of Festo SFAB EC IOLink Function Blocks in CODESYS

This chapter describes adding **Festo_SFAB_EC_IOLink** library function blocks in program & assigning input, output tags.

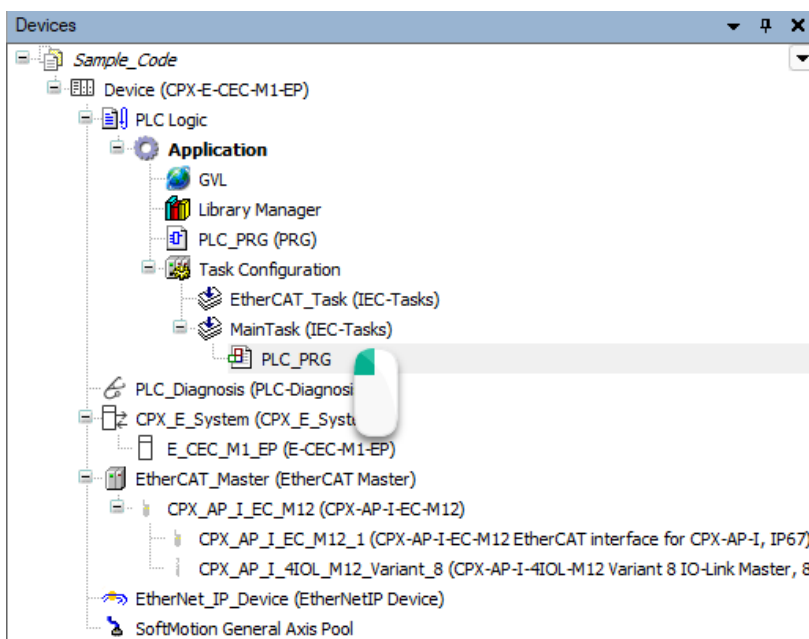


Programming Language (Optional)

This application note explains integration of library function blocks in **Function Block Diagram (FBD)** program.

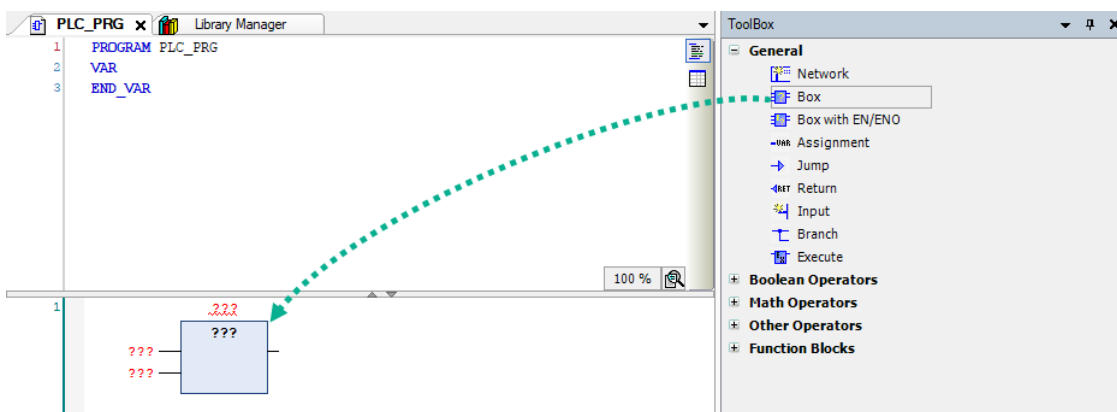
Users can implement the function blocks as per their requirement.

Step 1



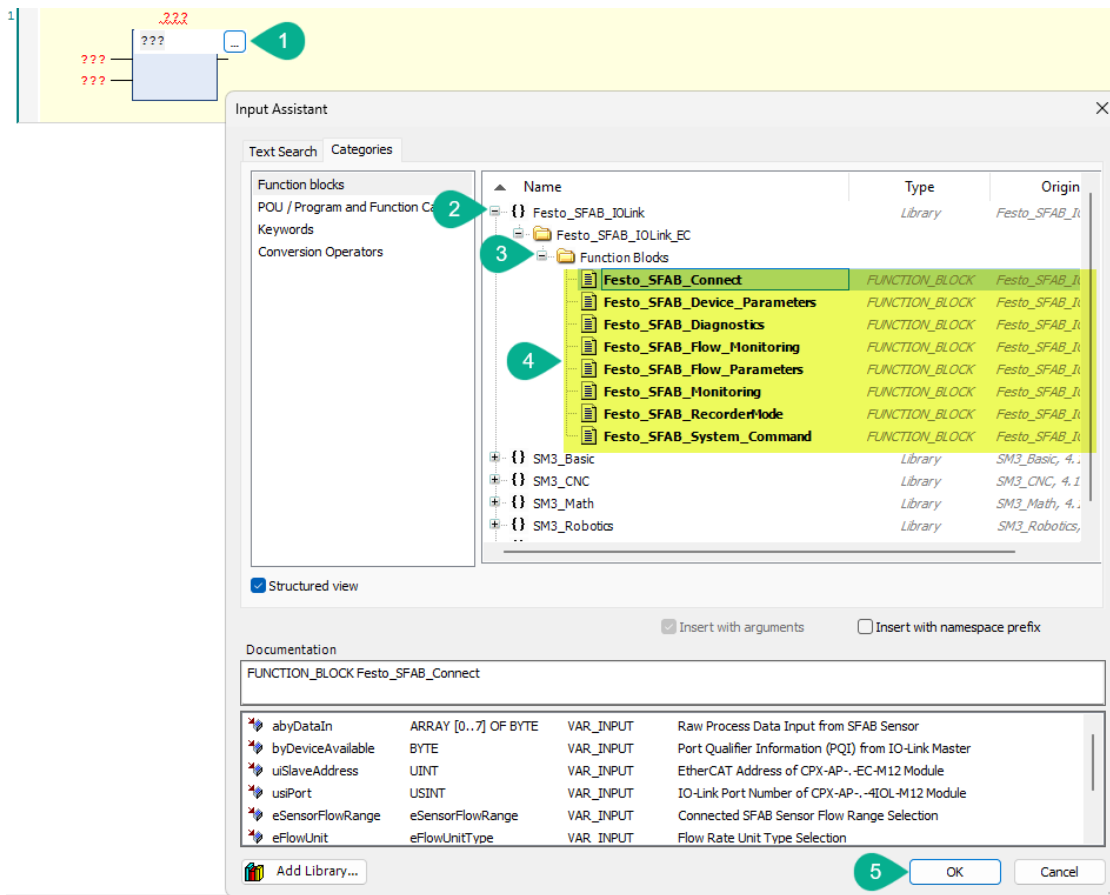
Double click on **PLC_PRG** in **Devices** toolbox to open the program editor.

Step 2

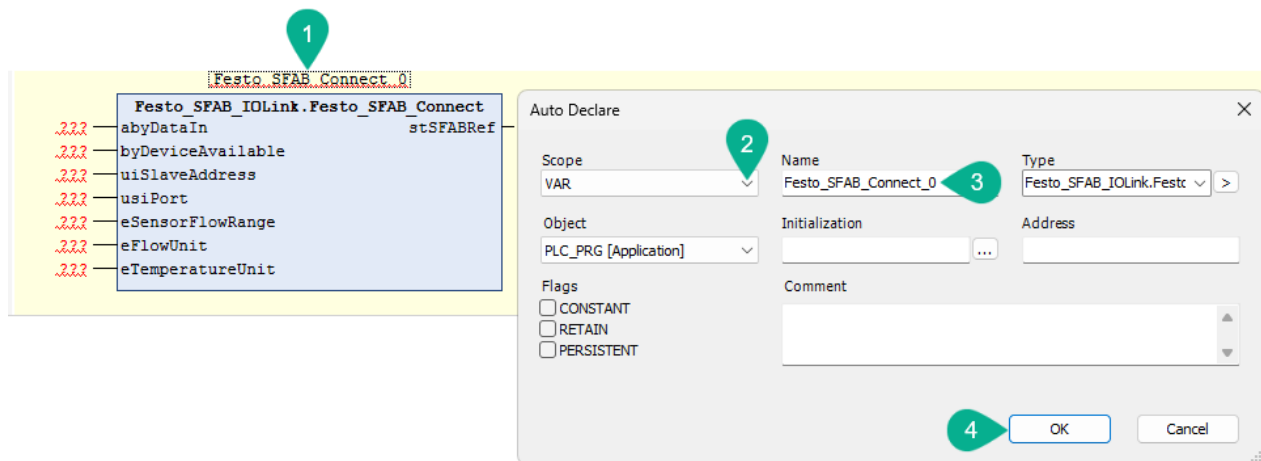


Drag and drop the **Box** option from **Toolbox** window to program editor as shown.

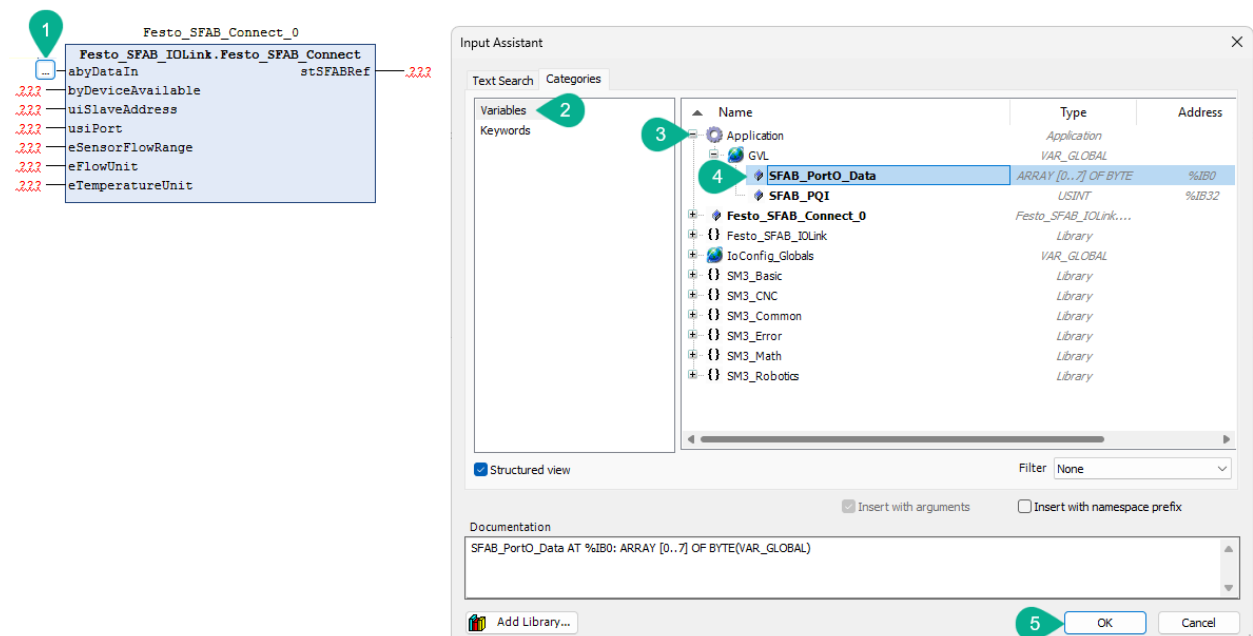
Step 3



1. In the code editor, click on the ... browse button next to the function block instance to open the **Input Assistant** window.
2. In the **Input Assistant** window, under the **Categories** tab, expand **Festo_SFAB_EC_IOLink**.
3. Expand **Festo_SFAB_EC_IOLink >> Function Blocks**.
4. From the list of available function blocks, select **Festo_SFAB_Connect**, which is highlighted along with the related function blocks:
 - **Festo_SFAB_Connect**
 - **Festo_SFAB_Device_Parameters**
 - **Festo_SFAB_Diagnostics**
 - **Festo_SFAB_Flow_Monitoring**
 - **Festo_SFAB_Flow_Parameters**
 - **Festo_SFAB_Monitoring**
 - **Festo_SFAB_RecorderMode**
 - **Festo_SFAB_System_Command**
5. Click **OK** to insert the selected function block, **Festo_SFAB_Connect**, into the code editor.

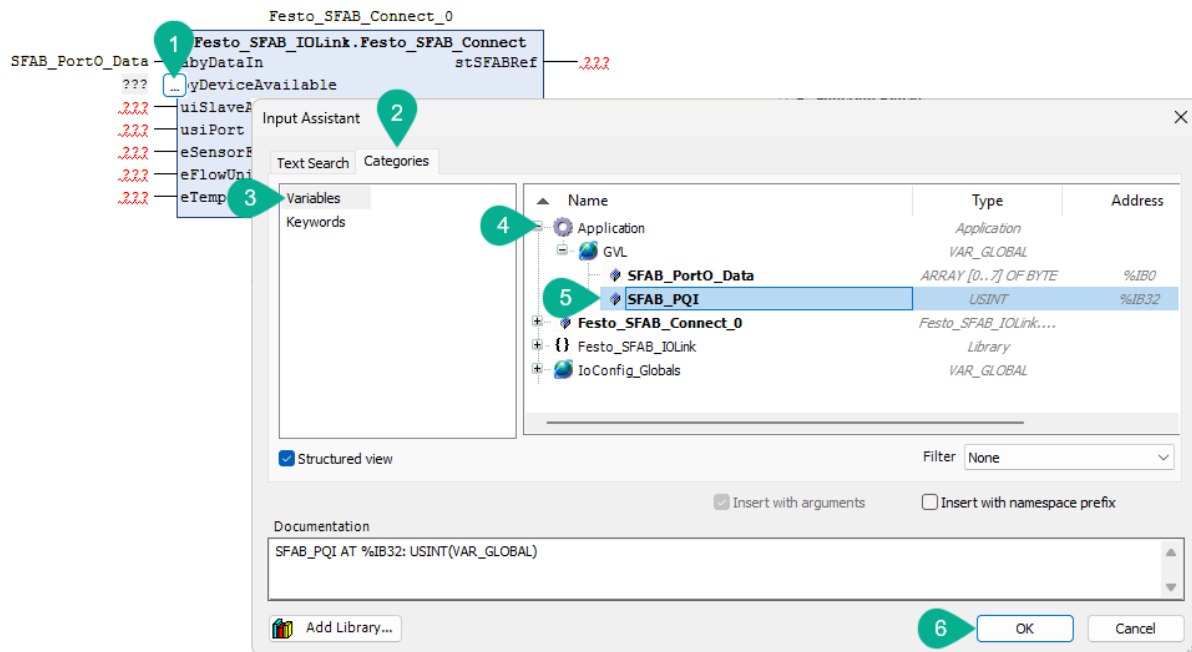
Step 4

1. In the code editor, type the instance name **Festo_SFAB_Connect_0**, followed by the function block call **Festo_SFAB_IOLink.Festo_SFAB_Connect**, which triggers the **Auto Declare** window to open automatically.
2. In the **Auto Declare** window, under **Scope**, select **VAR**.
3. Under **Name**, confirm or enter the instance name **Festo_SFAB_Connect_0**, with **Type** set to **Festo_SFAB_IOLink.Festo_SFAB_Connect**.
4. Click **OK** to confirm the declaration.

Step 5

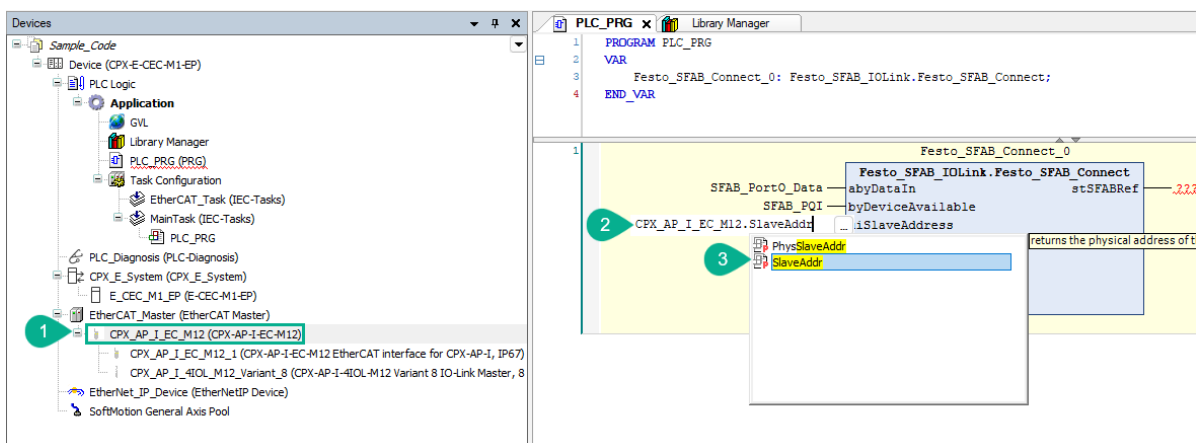
1. In the code editor, click on the input parameter `abyDataIn` of the **Festo_SFAB_Connect_0** instance to open the **Input Assistant** window.
2. In the **Input Assistant** window, select the **Variables** tab.
3. Under the **Categories** tree, expand **Application >> GVL**.
4. Select the global variable **SFAB_Port0_Data** as declared — [Refer Chapter 3.9](#).
5. Click **OK** to assign the selected variable to the `abyDataIn` input parameter.

Step 6

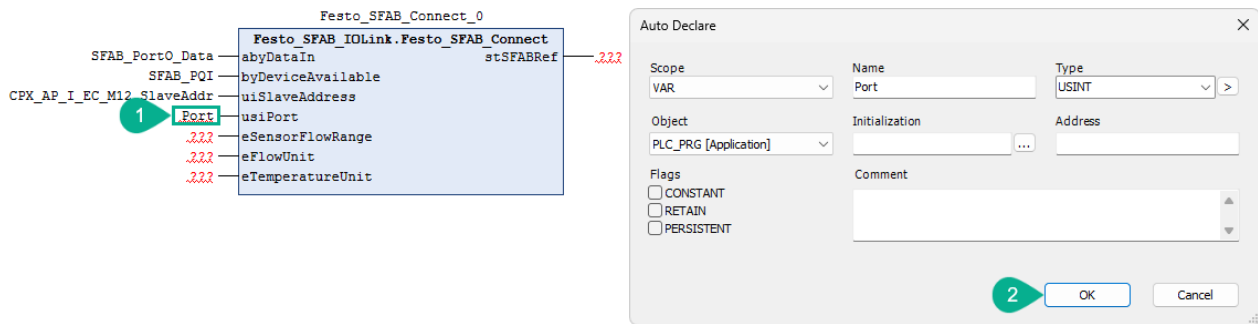


1. In the code editor, click on the ... browse button next to the **byDeviceAvailable** input parameter of the **Festo_SFAB_Connect_0** instance to open the **Input Assistant** window.
2. In the **Input Assistant** window, select the **Categories** tab.
3. Under **Categories**, select **Variables**.
4. In the **Name** list, expand **Application >> GVL**.
5. Select the global variable **SFAB_PQI**, declared as — [Refer Chapter 3.9](#).
6. Click **OK** to assign the selected variable to the **byDeviceAvailable** input parameter.

Step 7



1. In the **Devices** tree, copy **CPX_AP_I_EC_M12** module name to identify its EtherCAT slave address reference.
2. In the code editor, at the **uiSlaveAddress** input parameter of the **Festo_SFAB_Connect_0** instance, type **CPX_AP_I_EC_M12.SlaveAddr**.
3. From the dropdown list, select **SlaveAddr**, as shown along with the related member **PhysSlaveAddr**.

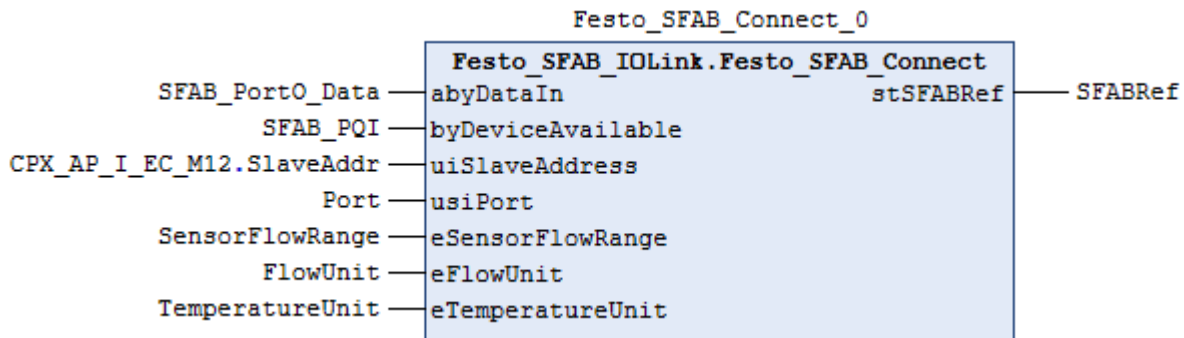
Step 8

1. In the code editor, at the **usiPort** input parameter of the **Festo_SFAB_Connect_0** instance, type **Port**, which triggers the **Auto Declare** window to open automatically.
2. Click **OK** to confirm the declaration.

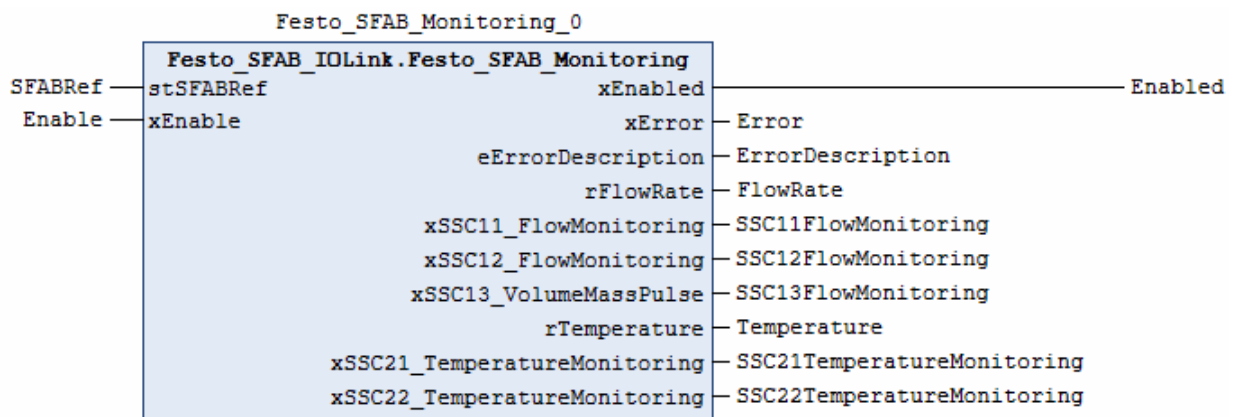
**Note**

- Repeat the same procedure to complete assigning the remaining inputs and outputs of the other Festo SFAB function blocks (**Festo_SFAB_Device_Parameters**, **Festo_SFAB_Diagnostics**, **Festo_SFAB_Flow_Monitoring**, **Festo_SFAB_Flow_Parameters**, **Festo_SFAB_Monitoring**, **Festo_SFAB_RecorderMode**, and **Festo_SFAB_System_Command**), as applicable to the connected SFAB sensor configuration.

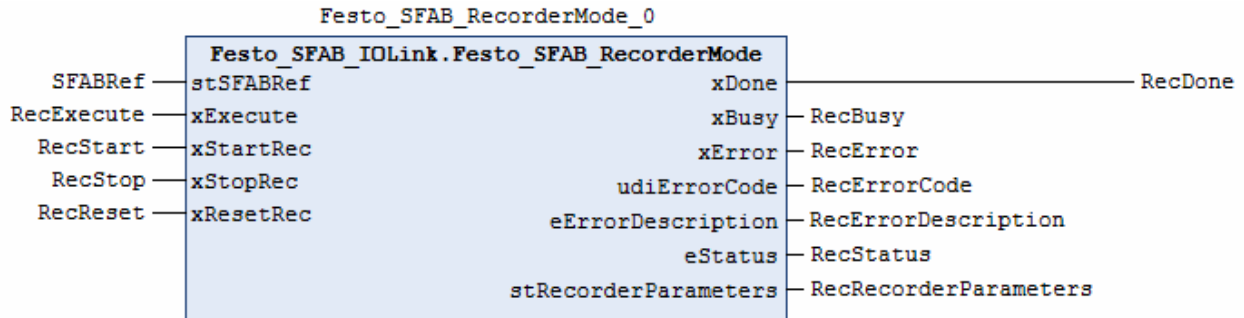
Once all the I/Os are assigned to **Festo_SFAB_Connect** successfully, the function block will look like below:



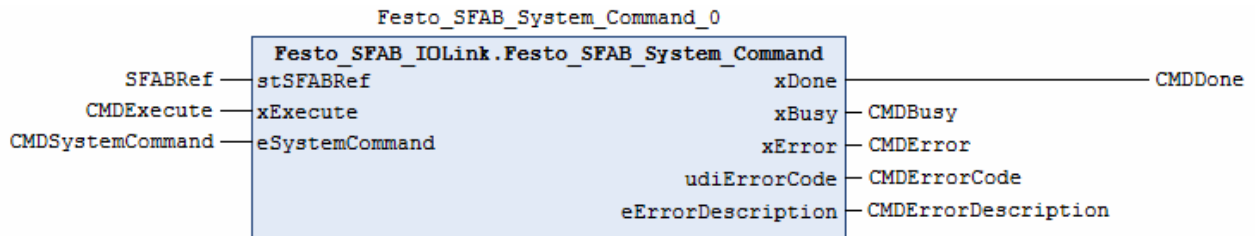
Once all the I/Os are assigned to **Festo_SFAB_Monitoring** successfully, the function block will look like below:



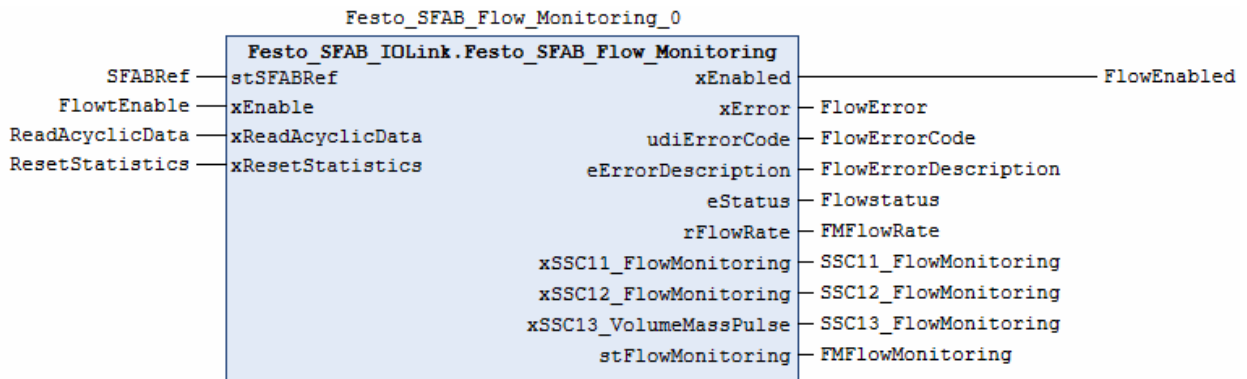
Once all the I/Os are assigned to **Festo_SFAB_RocorderMode** successfully, the function block will look like below:



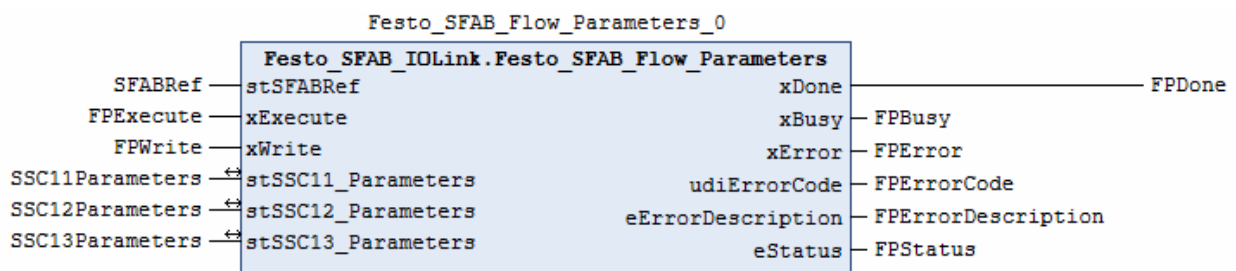
Once all the I/Os are assigned to **Festo_SFAB_System_Command** successfully, the function block will look like below:



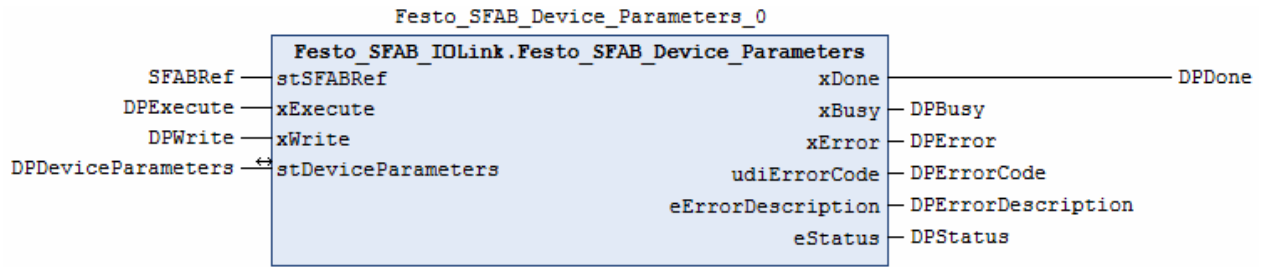
Once all the I/Os are assigned to **Festo_SFAB_Flow_Monitoring** successfully, the function block will look like below:



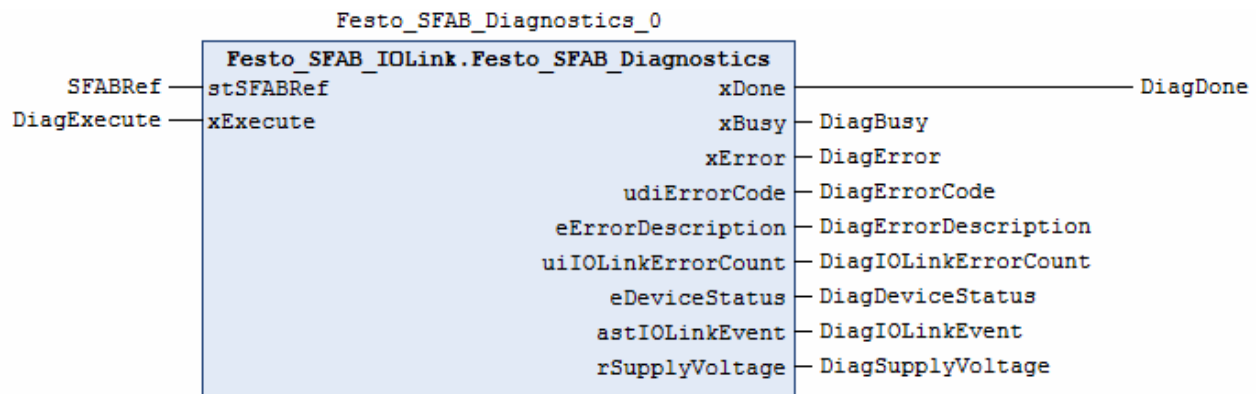
Once all the I/Os are assigned to **Festo_SFAB_Flow_Parameters** successfully, the function block will look like below:



Once all the I/Os are assigned to **Festo_SFAB_Device_Parameters** successfully, the function block will look like below:

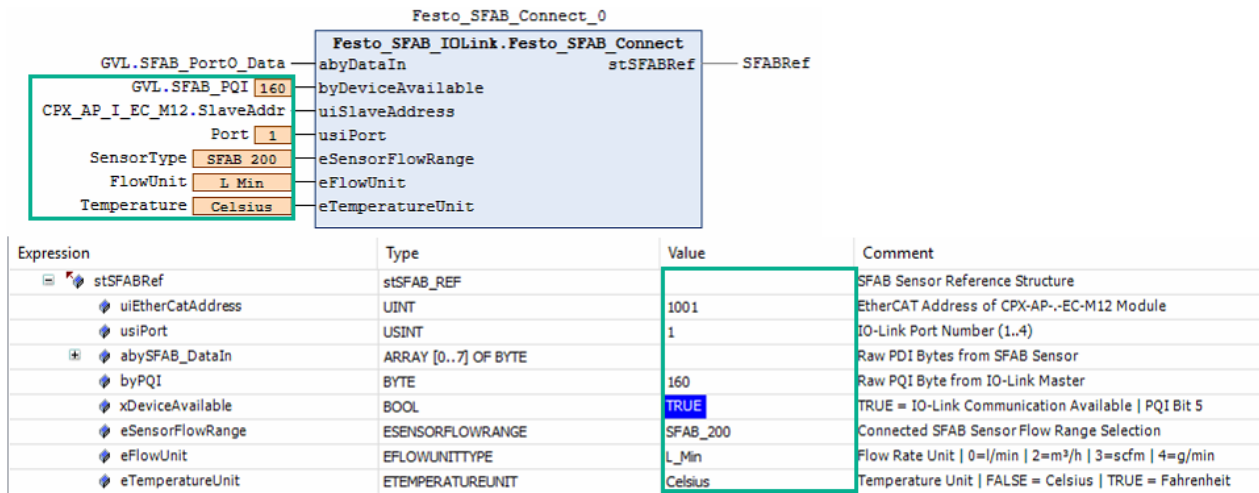


Once all the I/Os are assigned to **Festo_SFAB_Diagnostics** successfully, the function block will look like below:



6 Sample Code for Festo SFAB EC IOLink Library Function Blocks

6.1 Festo SFAB Connect Block



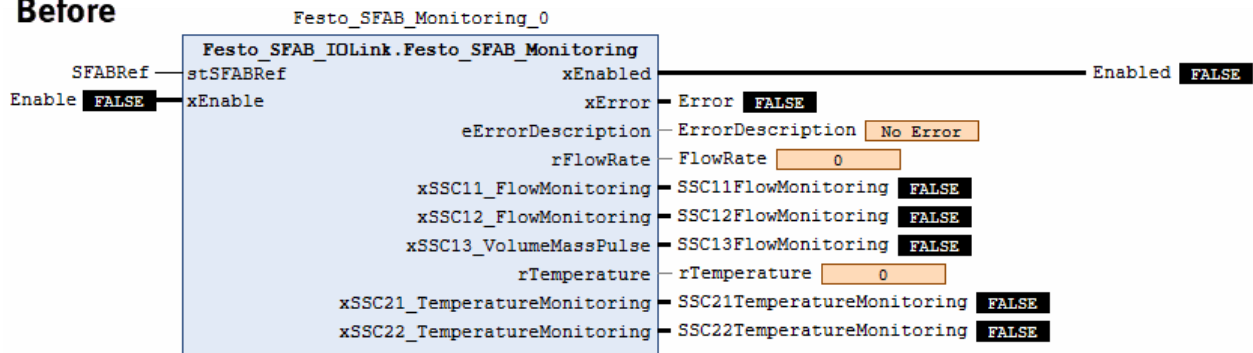
1. **usiPort** is assigned with the variable **Port**, set to value **1**, representing the IO-Link Port Number (1..4) on the **CPX-AP-...-4IOL-M12** module.
2. **eSensorFlowRange** is assigned with the variable **SensorType**, set to **SFAB_200**, representing the connected SFAB Sensor Flow Range selection.
3. **eFlowUnit** is assigned with the variable **FlowUnit**, set to **L_Min**, representing the selected Flow Rate Unit.
4. **eTemperatureUnit** is assigned with the variable **Temperature**, set to **Celsius**, representing the selected Temperature Unit.

The function block returns the output **stSFABRef**, assigned to the variable **SFABRef**, of type **stSFAB_REF**, which serves as the **SFAB Sensor Reference Structure** used as input for the other **Festo_SFAB** function blocks.

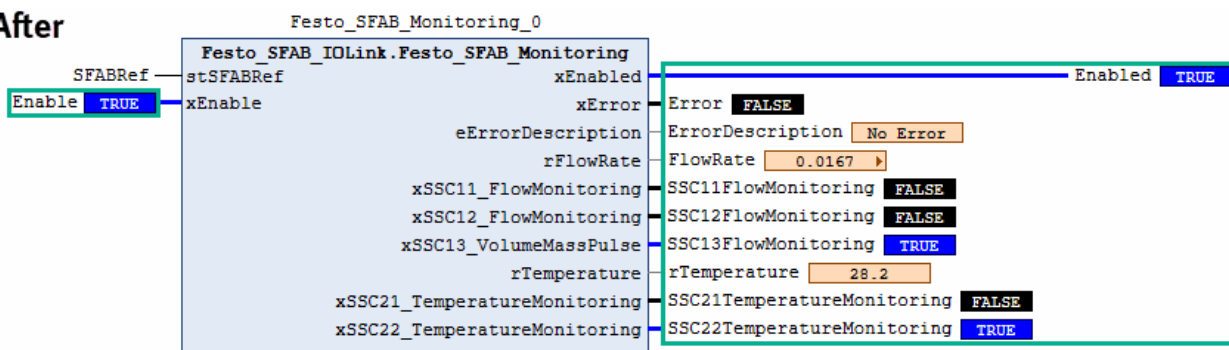
6.2 Festo SFAB Monitoring Block

The **Festo_SFAB_Monitoring** function block is used to monitor the cyclic process data of the connected **SFAB Flow Sensor**, including flow rate, temperature, and the status of the configured **SSC (Switching Signal Channel)** thresholds.

Before



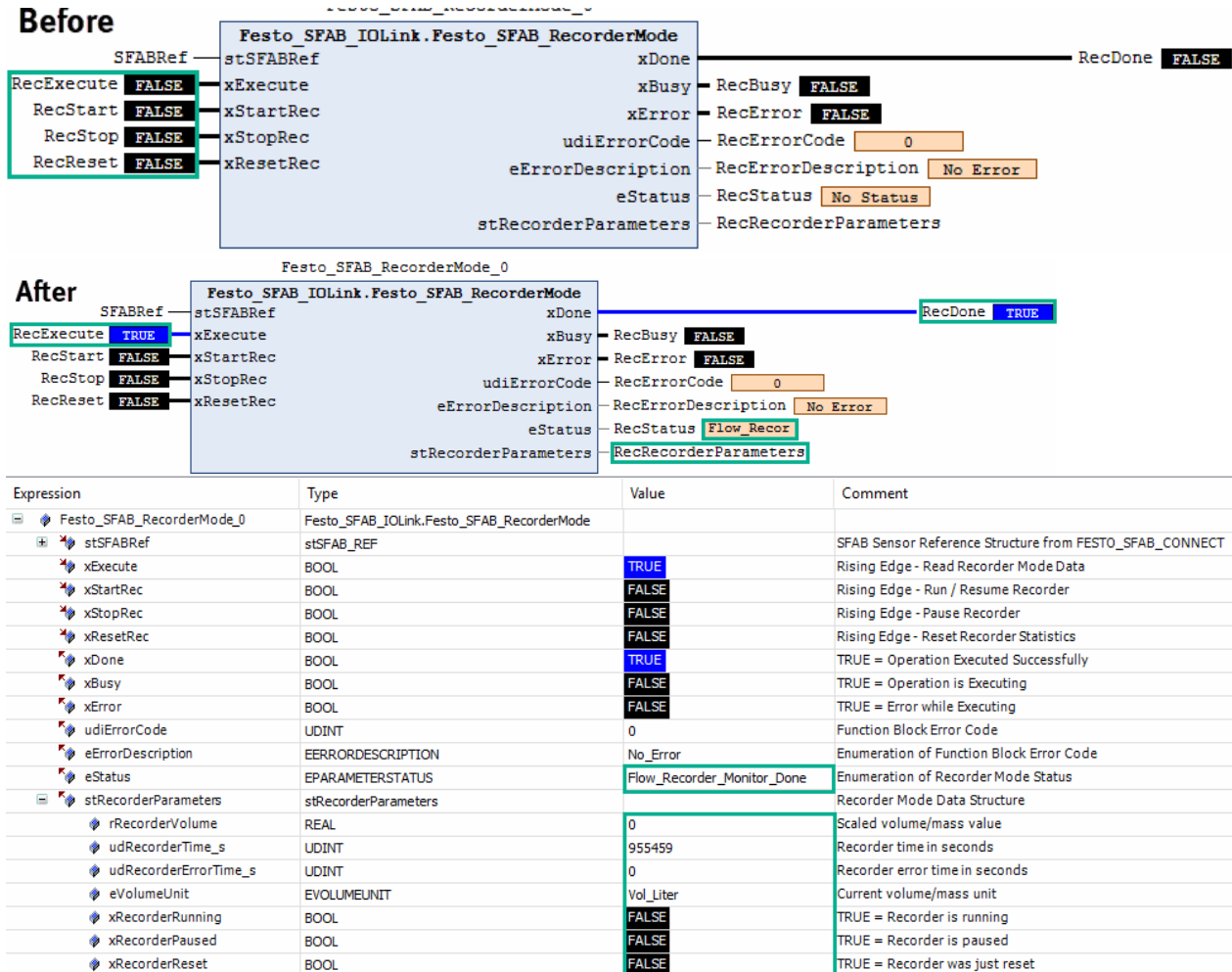
After



1. Set the input **xEnable** to **TRUE**, then the **xEnabled** output changes to **TRUE**, confirming the block is active.
2. **xError** remains **FALSE**, with **eErrorDescription** will show **No Error**.
3. **rFlowRate** updates to **0.0167**, reflecting the live flow rate measured by the SFAB sensor.
4. **rTemperature** updates to **28.2**, reflecting the live temperature measured by the sensor.
5. **SSC13FlowMonitoring** changes to **TRUE**, and **SSC22TemperatureMonitoring** changes to **TRUE**, indicating that the corresponding switching signal channel thresholds (**SSC13** for Volume/Mass Pulse and **SSC22** for Temperature Monitoring) have been triggered based on the current process values.
6. **SSC11FlowMonitoring**, **SSC12FlowMonitoring**, and **SSC21TemperatureMonitoring** remain **FALSE**, as their respective threshold conditions have not been met.

6.3 Festo SFAB RecorderMode

The **Festo_SFAB_RecorderMode** function block is used to control and monitor the recorder function of the connected **SFAB Flow Sensor**, allowing the user to start, stop, and reset the recording of volume/mass and time values.



1. Set the input **xExecute** from **FALSE** to **TRUE**, which will start reading all the relevant parameters.
2. Make sure **xStartRec**, **xStopRec**, and **xResetRec** are set to **FALSE**.
3. The output **xBusy** will turn to **TRUE** while reading; once the reading is done, it will turn to **FALSE**.
4. The output **xDone** changes to **TRUE**, indicating that the function block read has completed successfully.
5. While reading, if there is any error, then **xError** will turn **TRUE**, along with **udiErrorCode** and **eErrorDescription**.
6. **eStatus** shows the current status of the function block; once the reading is done, it will show **Flow_Recorder_Monitor_Done**, indicating the current recorder mode status of the sensor.

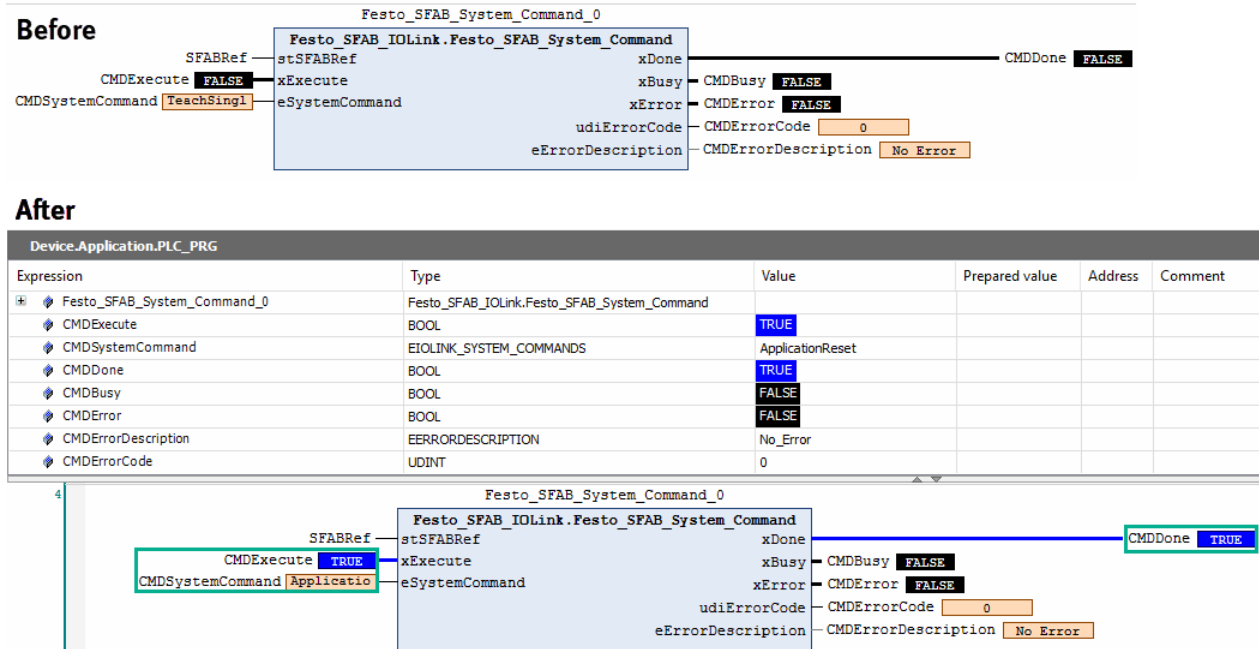


Note

- To start, stop, or reset the recording, the user must trigger only one input at a time. If multiple inputs (**xStartRec**, **xStopRec**, **xResetRec**) are set to **TRUE** simultaneously, this may result in an error.
- It is recommended to activate the required input as per the application need, setting it to **TRUE** individually while keeping the remaining inputs set to **FALSE**.

6.4 Festo SFAB System Command

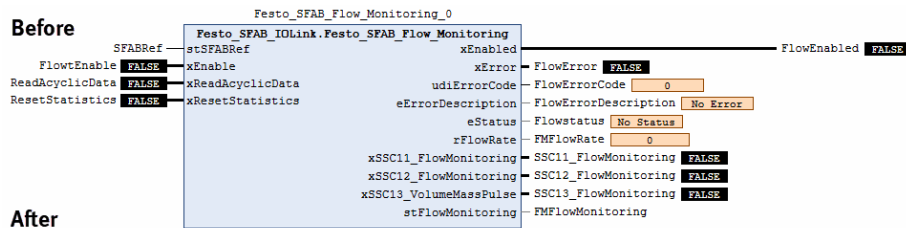
The **Festo_SFAB_System_Command** function block is used to execute specific system commands on the connected SFAB Flow Sensor, such as **TeachSingle**, **ApplicationReset**, and other supported IO-Link system commands.



1. Set the input **xExecute** from **FALSE** to **TRUE**, and set **sSystemCommand** to **ApplicationReset**, which will trigger the execution of the selected system command [Refer Chapter 4.10.13](#).
2. **xBusy** will turn to **TRUE** while the command is being executed; once the execution is complete, it will turn to **FALSE**.
3. **xDone** changes to **TRUE**, indicating that the system command has been executed successfully.
4. If there is any error during execution, then **xError** will turn **TRUE**, along with **udiErrorCode** and **eErrorDescription** showing the relevant error details.
5. In this case, **xError** remains **FALSE**, with **udiErrorCode** showing **0**, and **eErrorDescription** showing **No_Error**, confirming that the **ApplicationReset** system command was executed successfully on the connected **SFAB Flow Sensor**.

6.5 Festo SFAB Flow Monitoring

Before



After

Expression	Type	Value	Prepared value	Address	Comment
Festo_SFAB_Flow_Monitoring_0	Festo_SFAB_IOLink.Festo_SFAB_Flow_Monitoring				
stSFABRef	stSFAB_REF				SFAB Sensor Reference Structure from FESTO_SFAB_CONNECT
xEnable	BOOL	TRUE			TRUE = Enable Function Block
xReadAcyclicData	BOOL	FALSE			Rising Edge = Update Flow Rate Monitoring Parameters
xResetStatistics	BOOL	FALSE			Rising Edge = Reset Min Max Flow Rate Statistics
xEnabled	BOOL	TRUE			TRUE = Function Block is Enabled and Running
xError	BOOL	FALSE			TRUE = Error while Monitoring Flow Rate Parameters
udiErrorCode	UDINT	0			Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error			Enumeration of Function Block Error Code
eStatus	EPARAMETERSTATUS	Flow_Monitor_Enabled			Enumeration of Flow Rate Monitoring Status
rFlowRate	REAL	0.016667			MDC1 Flow Measurement Value Unit as per user selection
xSSC11_FlowMonitoring	BOOL	FALSE			SSC1.1 Flow Rate Monitoring OutA TRUE=On FALSE=Off
xSSC12_FlowMonitoring	BOOL	FALSE			SSC1.2 Flow Rate Monitoring OutB TRUE=On FALSE=Off
xSSC13_VolumeMassPulse	BOOL	FALSE			SSC1.3 Volume/Mass Pulse OutC TRUE=On FALSE=Off
stFlowMonitoring	stFlowMonitor				Flow Rate Monitoring Parameters Structure
rMinFlowRate	REAL	0			Minimum flow rate value Unit as per user selection
rMaxFlowRate	REAL	0.116666667			Maximum flow rate value Unit as per user selection
rAvgFlowRate	REAL	0.0166666675			Averaged flow rate value Unit as per user selection

1. Set the input **xEnable** from **FALSE** to **TRUE**, starts monitoring the process data and it will read the acyclic data.
2. Keep **xReadAcyclicData** and **xResetStatistics** set to **FALSE**.
3. **xEnabled** changes to **TRUE**, confirming that the function block is enabled and running.
4. **xError** remains **FALSE**, with **udiErrorCode** showing **0**, and **eErrorDescription** showing **No_Error**.
5. **eStatus** changes to **Flow_Monitor_Enabled**, and **rFlowRate** updates to **0.0167**, reflecting the live flow rate measured by the sensor.
6. **xSSC11_FlowMonitoring**, **xSSC12_FlowMonitoring**, and **xSSC13_VolumeMassPulse** remain **FALSE**, as their respective SSC threshold conditions have not been triggered.
7. The output **stFlowMonitoring** provides the following flow rate statistics.



Note

- To read the acyclic data, make sure the function block is enabled (**xEnable = TRUE**) first. Once enabled, the user can read the acyclic data by setting **xReadAcyclicData** from **FALSE** to **TRUE**, which triggers a single read of the acyclic data.
- To read the acyclic data again, repeat the same procedure by toggling **xReadAcyclicData** from **FALSE** to **TRUE** on each occasion.

6.6 Festo SFAB Flow Parameters

The **Festo_SFAB_Flow_Parameters** function block is used to read and write the Flow Rate Monitoring (**SSC11**, **SSC12**) and Volume/Mass Pulse (**SSC13**) parameters of the connected SFAB Flow Sensor.

6.6.1 Read Parameters

Before Read

After Read

Expression	Type	Value	Prepared value	Address	Comment
Festo_SFAB_Flow_Parameters_0	Festo_SFAB_IOLink.Festo_SFAB_Flow_Parameters				
stSFABRef	stSFAB_Ref				SFAB Sensor Reference Structure from FESTO_SFAB_CONNECT
xExecute	BOOL	TRUE			Rising Edge - Read All Flow Rate Parameters
xWrite	BOOL	FALSE			Rising Edge - Write All Flow Rate Parameters
stSSC11_Parameters	REFERENCE TO stSwitchingParameters	16#B25E894C			SSC1.1 OutA - Flow Rate Monitoring Parameters
iSetPoint_SP1	REAL	120.000023			Setpoint SP1 (SP, SP.Lo, SP.Hi)
iSetPoint_SP2	REAL	140.000031			Setpoint SP2 (SP, SP.Lo, SP.Hi)
Logic	ESSC_LOGIC	NO_HighActive			Switching point logic NO/NC
Mode	ESSC_MODE	SinglePoint_Mode			Switching point mode
iHysteresis	REAL	1.00000012			Hysteresis at switchpoint
eBacklightColour	EBACKLIGHTCOLOUR	AlwaysBlue			Display backlight colour
stSSC12_Parameters	REFERENCE TO stSwitchingParameters	16#B25E8960			SSC1.2 OutB - Flow Rate Monitoring Parameters
iSetPoint_SP1	REAL	120.000023			Setpoint SP1 (SP, SP.Lo, SP.Hi)
iSetPoint_SP2	REAL	140.000031			Setpoint SP2 (SP, SP.Lo, SP.Hi)
Logic	ESSC_LOGIC	NO_HighActive			Switching point logic NO/NC
Mode	ESSC_MODE	SinglePoint_Mode			Switching point mode
iHysteresis	REAL	1.00000012			Hysteresis at switchpoint
eBacklightColour	EBACKLIGHTCOLOUR	AlwaysBlue			Display backlight colour
stSSC13_Parameters	REFERENCE TO stOutC_Parameters	16#B25E8974			SSC1.3 OutC - Volume/Mass Pulse Parameters
udPulseThreshold	UDINT	200			Volume/mass pulse threshold (PULS, SP)
eLogic	ESSC_LOGIC	NO_HighActive			Pulse output logic NO/NC
uiPulseLength_ms	UINT	100			Volume/mass pulse length in ms
xDone	BOOL	TRUE			TRUE : Read or Write Operation Completed Successfully
xBusy	BOOL	FALSE			TRUE : Read or Write Operation in Progress
xError	BOOL	FALSE			TRUE : Error during Read / Write
udiErrorCode	UDINT	0			Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error			Enumeration of Function Block Error Code
eStatus	EPARAMETERSTATUS	Read_All_Parameters_Comple...			Enumeration of Flow Parameters Read / Write Status

Before Read

1. Set the input **xExecute** from **FALSE** to **TRUE**, which triggers a rising edge to read all the Flow Rate Parameters, while keeping **xWrite** set to **FALSE**.
2. **xBusy** will turn to **TRUE** while reading; once the reading is complete, it will turn back to **FALSE**.
3. **xDone** changes to **TRUE**, indicating that the read operation has completed successfully.
4. **xError** remains **FALSE**, with **udiErrorCode** showing **0**, and **eErrorDescription** showing **No_Error**.
5. **eStatus** changes to **Read_All_Parameters_Completed** confirming that all Flow Parameters have been successfully read.
6. The output structures **stSSC11_Parameters**, **stSSC12_Parameters**, and **stSSC13_Parameters** are updated with the following read values.

6.6.2 Write Parameters

Before Write

Device: Application_PLC_PRG						
Expression	Type	Value	Prepared value	Address	Comment	
xWrite	BOOL	TRUE			Rising Edge - Write All Flow Rate Parameters	
stSSC11_Parameters	REFERENCE TO stSwitchingParameters	16#B25E894C			SSC1.1 OutA - Flow Rate Monitoring Parameters	
iSetPoint_SP1	REAL	60			Setpoint SP1 (SP, SP.Lo, SP.Hi)	
iSetPoint_SP2	REAL	80			Setpoint SP2 (SP, SP.Lo, SP.Hi)	
Logic	ESSC_LOGIC	NO_HighActive			Switching point logic NO/NC	
Mode	ESSC_MODE	SinglePoint_Mode			Switching point mode	
iHysteresis	REAL	10			Hysteresis at switchpoint	
eBacklightColour	EBACKLIGHTCOLOUR	AlwaysBlue			Display backlight colour	
stSSC12_Parameters	REFERENCE TO stSwitchingParameters	16#B25E8960			SSC1.2 OutB - Flow Rate Monitoring Parameters	
iSetPoint_SP1	REAL	120.000023			Setpoint SP1 (SP, SP.Lo, SP.Hi)	
iSetPoint_SP2	REAL	140.000031			Setpoint SP2 (SP, SP.Lo, SP.Hi)	
Logic	ESSC_LOGIC	NO_HighActive			Switching point logic NO/NC	
Mode	ESSC_MODE	SinglePoint_Mode			Switching point mode	
iHysteresis	REAL	1.00000012			Hysteresis at switchpoint	
eBacklightColour	EBACKLIGHTCOLOUR	AlwaysBlue			Display backlight colour	
stSSC13_Parameters	REFERENCE TO stOutC_Parameters	16#B25E8974			SSC1.3 OutC - Volume/Mass Pulse Parameters	
udPulseThreshold	UDINT	200			Volume/mass pulse threshold (PULS, SP)	
eLogic	ESSC_LOGIC	NO_HighActive			Pulse output logic NO/NC	
uiPulseLength_ms	UINT	100			Volume/mass pulse length in ms	
xDone	BOOL	FALSE			TRUE : Read or Write Operation Completed Successfully	
xBusy	BOOL	FALSE			TRUE : Read or Write Operation in Progress	
xError	BOOL	FALSE			TRUE : Error during Read / Write	
udiErrorCode	UDINT	0			Function Block Error Code	
eErrorDescription	EERRORDESCRIPTION	No_Error			Enumeration of Function Block Error Code	
eStatus	EPARAMETERSTATUS	No_Status			Enumeration of Flow Parameters Read / Write Status	
RTRIG_Read	R_TRIG					
RTRIG_Write	R_TRIG					

1. The input **xWrite** is set to **TRUE**, in preparation for a write operation, while **xExecute** remains **FALSE**.
2. In **stSSC11_Parameters**, the values are updated to the desired new setting:
 - **iSetPoint_SP1** = 60
 - **iSetPoint_SP2** = 80
 - **Logic** = NO_HighActive
 - **Mode** = SinglePoint_Mode
 - **iHysteresis** = 10
 - **eBacklightColour** = AlwaysBlue



Note

- The user can enter values and select the required **ENUM** options in **stSSC12_Parameters** and **stSSC13_Parameters** to configure the desired write data for the device before executing the function block.

After Write

Expression	Type	Value	Prepared value	Address	Comment
xWrite	BOOL	TRUE			Rising Edge - Write All Flow Rate Parameters
stSSC11_Parameters	REFERENCE TO stSwitchingParameters	16#B2E894C			SSC1.1 OutA - Flow Rate Monitoring Parameters
iSetPoint_SP1	REAL	60			Setpoint SP1 (SP, SP.Lo, SP.Hi)
iSetPoint_SP2	REAL	80			Setpoint SP2 (SP, SP.Lo, SP.Hi)
Logic	ESSC_LOGIC	NO_HighActive			Switching point logic NO/NC
Mode	ESSC_MODE	Single_Point_Mode			Switching point mode
iHysteresis	REAL	10			Hysteresis at switchpoint
eBacklightColour	EBACKLIGHTCOLOUR	AlwaysBlue			Display backlight colour
stSSC12_Parameters	REFERENCE TO stSwitchingParameters	16#B2E8960			SSC1.2 OutB - Flow Rate Monitoring Parameters
iSetPoint_SP1	REAL	120.000023			Setpoint SP1 (SP, SP.Lo, SP.Hi)
iSetPoint_SP2	REAL	140.000031			Setpoint SP2 (SP, SP.Lo, SP.Hi)
Logic	ESSC_LOGIC	NO_HighActive			Switching point logic NO/NC
Mode	ESSC_MODE	Single_Point_Mode			Switching point mode
iHysteresis	REAL	1.00000012			Hysteresis at switchpoint
eBacklightColour	EBACKLIGHTCOLOUR	AlwaysBlue			Display backlight colour
stSSC13_Parameters	REFERENCE TO stOutC_Parameters	16#B2E8974			SSC1.3 OutC - Volume/Mass Pulse Parameters
udPulseThreshold	UDINT	200			Volume/mass pulse threshold (PULS, SP)
eLogic	ESSC_LOGIC	NO_HighActive			Pulse output logic NO/NC
uiPulseLength_ms	UINT	100			Volume/mass pulse length in ms
xDone	BOOL	TRUE			TRUE : Read or Write Operation Completed Successfully
xBusy	BOOL	FALSE			TRUE : Read or Write Operation In Progress
xError	BOOL	FALSE			TRUE : Error during Read / Write
udiErrorCode	UDINT	0			Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error			Enumeration of Function Block Error Code
eStatus	EPARAMETERSTATUS	Write_All_Parameters_Completed			Enumeration of Flow Parameters Read / Write Status
RTRIG_Read	R_TRIG				
RTRIG_Write	R_TRIG				

Festo_SFAB_Flow_Parameters_0

```

graph LR
    subgraph Festo_SFAB_Flow_Parameters_0 [Festo_SFAB_Flow_Parameters_0]
        direction TB
        S1[SFABRef] --> B1[xExecute]
        B1 --> B2[xBusy]
        B2 --> B3[xWrite]
        B3 --> B4[xError]
        B4 --> I1[udiErrorCode]
        I1 --> I2[eErrorDescription]
        I2 --> I3[eStatus]
    end

    B1 ==> O1[FPDone]
    B2 ==> O2[FFBusy]
    B3 ==> O3[FFEError]
    B4 ==> O4[FFEErrorCode]
    I1 ==> O5[FFEErrorDescription]
    I2 ==> O6[FFStatus]

    S1 --- O1
    S1 --- O2
    S1 --- O3
    S1 --- O4
    S1 --- O5
    S1 --- O6
  
```

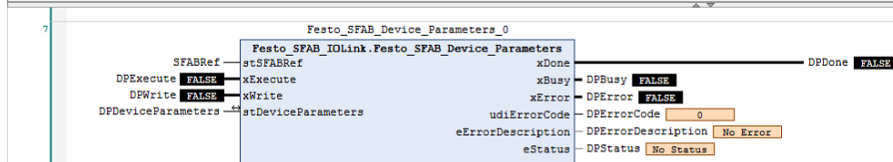
1. Set the input **xExecute** from **FALSE** to **TRUE**, with **xWrite** set to **TRUE**, which triggers a rising edge to write all the Flow Rate Parameters to the connected **SFAB Flow Sensor**.
2. **xBusy** will turn to **TRUE** while writing; once the write operation is complete, it will turn back to **FALSE**.
3. **xDone** changes to **TRUE**, indicating that the write operation has completed successfully.
4. **xError** remains **FALSE**, with **udiErrorCode** showing **0**, and **eErrorDescription** showing **No_Error**.
5. **eStatus** changes to **Write_All_Parameters_Completed**, confirming that all Flow Parameters have been successfully written to the sensor.
6. The updated values in **stSSC11_Parameters** are retained as written:
 - **iSetPoint_SP1** = 60
 - **iSetPoint_SP2** = 80
 - **Logic** = NO_HighActive
 - **Mode** = SinglePoint_Mode
 - **iHysteresis** = 10
 - **eBacklightColour** = AlwaysBlue

6.7 Festo SFAB Device Parameters

6.7.1 Read Device Parameters

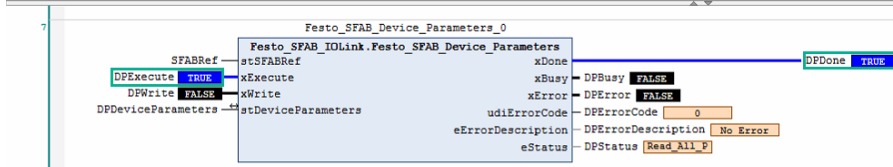
Before Execute

Expression	Type	Value	Prepared value	Comment
stDeviceParameters	REFERENCE TO stDeviceParameters	16#B25E9B74		SFAB Device Configuration Parameters Structure
eFlowUnit	EFLOWUNITTYPE	L_Min		V_P383 Index 383 Flow unit selection
eTemperatureUnit	ETEMPERATUREUNIT	Celsius		V_P443 Index 443 Temperature unit °C / °F
eReferenceCondition	EREERENCECONDITION	DIN1343_0C		V_P496 Index 496 Reference condition 0°C/15°C/20°C
eGasType	EGASTYPE	Air		V_P494 Index 494 Gas type Air/N2/Ar/CO2
eFlowMeasurementFilter	EFLOWFILTER	Filter_Disabled		V_P386 Index 386 Flow measurement filter 0..2048ms
eFlowDisplayFilter	EDISPLAYFILTER	Display_256ms		V_P385 Index 385 Flow display filter 256/512/1024ms
ePin2_OutputSignal	EPIN2_OUTPUT	Pin2_Out8_FlowMonitoring		V_P482 Index 482 Output signal Pin2
ePin4_OutputSignal	EPIN4_OUTPUT	Pin4_Out8_FlowMonitoring		V_P483 Index 483 Output signal Pin4
eHardwareMode	EHARDWAREMODE	NPN		V_P481 Index 481 NPN / PNP selection
eAnalogOutputType	EANALOGOUTPUTTYPE	e0_10V		V_P364 Index 364 0-10V / 1-5V / 4-20mA
iAnalogStartValue	INT	0		V_P362 Index 362 Analog start value % Range -100..90
iAnalogEndValue	INT	0		V_P363 Index 363 Analog end value % Range -90..100
eBacklightDuration	EBACKLIGHTDURATION	AlwaysOn		V_P488 Index 488 Backlight duration always/5..640s
eSubDisplayMode	ESUBDISPLAYMODE	Units		V_P489 Index 489 Sub-display mode selection
eLocalSSCDisplay	ELOCALSSCDISPLAY	OnlyActiveSSCs		V_P476 Index 476 Show only active or all SSCs
eMeasuredValueDisplay	E MEASUREDVALUEDISPLAY	DisplayFlow		V_P477 Index 477 Flow/Volume/Temperature display
uLockCode	UINT	0		V_P490 Index 490 Local parameter lock code 0=Off
xParameterizationLock	BOOL	FALSE		SubIndex 3 FALSE: Unlocked TRUE: Locked
xUserInterfaceLock	BOOL	FALSE		SubIndex 4 FALSE: Unlocked TRUE: Locked
xUserZeroAdjustment	BOOL	FALSE		V_P388 Index 388 User zero adjustment On/Off
xDone	BOOL	FALSE		TRUE: Read or Write Operation Completed Successfully
xBusy	BOOL	FALSE		TRUE: Read or Write Operation in Progress
xError	BOOL	FALSE		TRUE: Error during Read / Write
udiErrorCode	UDINT	0		Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error		Enumeration of Function Block Error Code
eStatus	EDEVICEPARAMETERSTATUS	No_Status		Enumeration of Device Parameters Read / Write Status



After Execute

Expression	Type	Value	Prepared value	Comment
stDeviceParameters	REFERENCE TO stDeviceParameters	16#B25E9B74		SFAB Device Configuration Parameters Structure
eFlowUnit	EFLOWUNITTYPE	L_Min		V_P383 Index 383 Flow unit selection
eTemperatureUnit	ETEMPERATUREUNIT	Celsius		V_P443 Index 443 Temperature unit °C / °F
eReferenceCondition	EREERENCECONDITION	DIN1343_0C		V_P496 Index 496 Reference condition 0°C/15°C/20°C
eGasType	EGASTYPE	Air		V_P494 Index 494 Gas type Air/N2/Ar/CO2
eFlowMeasurementFilter	EFLOWFILTER	Filter_64ms		V_P386 Index 386 Flow measurement filter 0..2048ms
eFlowDisplayFilter	EDISPLAYFILTER	Display_256ms		V_P385 Index 385 Flow display filter 256/512/1024ms
ePin2_OutputSignal	EPIN2_OUTPUT	Pin2_FlowAnalog		V_P482 Index 482 Output signal Pin2
ePin4_OutputSignal	EPIN4_OUTPUT	Pin4_Out8_FlowMonitoring		V_P483 Index 483 Output signal Pin4
eHardwareMode	EHARDWAREMODE	PNP		V_P481 Index 481 NPN / PNP selection
eAnalogOutputType	EANALOGOUTPUTTYPE	e0_10V		V_P364 Index 364 0-10V / 1-5V / 4-20mA
iAnalogStartValue	INT	0		V_P362 Index 362 Analog start value % Range -100..90
iAnalogEndValue	INT	100		V_P363 Index 363 Analog end value % Range -90..100
eBacklightDuration	EBACKLIGHTDURATION	AlwaysOn		V_P488 Index 488 Backlight duration always/5..640s
eSubDisplayMode	ESUBDISPLAYMODE	Units		V_P489 Index 489 Sub-display mode selection
eLocalSSCDisplay	ELOCALSSCDISPLAY	OnlyActiveSSCs		V_P476 Index 476 Show only active or all SSCs
eMeasuredValueDisplay	E MEASUREDVALUEDISPLAY	DisplayFlow		V_P477 Index 477 Flow/Volume/Temperature display
uLockCode	UINT	0		V_P490 Index 490 Local parameter lock code 0=Off
xParameterizationLock	BOOL	FALSE		SubIndex 3 FALSE: Unlocked TRUE: Locked
xUserInterfaceLock	BOOL	FALSE		SubIndex 4 FALSE: Unlocked TRUE: Locked
xUserZeroAdjustment	BOOL	FALSE		V_P388 Index 388 User zero adjustment On/Off
xDone	BOOL	TRUE		TRUE: Read or Write Operation Completed Successfully
xBusy	BOOL	FALSE		TRUE: Read or Write Operation in Progress
xError	BOOL	FALSE		TRUE: Error during Read / Write
udiErrorCode	UDINT	0		Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error		Enumeration of Function Block Error Code
eStatus	EDEVICEPARAMETERSTATUS	Read_All_Parameters_Completed		Enumeration of Device Parameters Read / Write Status



1. Turn OFF **xWrite** Input.
2. Turn ON **xExecute** Input (**TRUE** - Reads All Device Parameters).
3. Output **xBusy** turns **ON** while reading parameters.
4. Output **xDone** turns **ON** once the parameter read is completed.
5. Output **eStatus** will be updated with **Read_All_Parameters_Completed**.
6. In-Out **stDeviceParameters** will be updated with the read data from the sensor ([Refer Chapter 4.9.7](#)).

6.7.2 Write Device Parameters

Before Execute

Device: Application.PLC_PRG				
Expression	Type	Value	Prepared value	Comment
Festo_SFAB_Device_Parameters_0	Festo_SFAB_IOLink.Festo_SFAB_Device_Parameters			SFAB Sensor Reference Structure from Festo_SFAB_Connect
stSFABRef	stSFAB_REF			Rising Edge : Read All Device Parameters
xExecute	BOOL	FALSE		Rising Edge : Write All Device Parameters
xWrite	BOOL	TRUE		SFAB Device Configuration Parameters Structure
stDeviceParameters	REFERENCE TO stDeviceParameters	16#B25E9B74		
eFlowUnit	EFLOWUNITTYPE	M3_Hour		V_P383 Index 383 Flow unit selection
eTemperatureUnit	ETEMPERATUREUNIT	Celsius		V_P443 Index 443 Temperature unit °C / °F
eReferenceCondition	EREERENCECONDITION	DIN1343_OC		V_P496 Index 496 Reference condition 0°C/15°C/20°C
eGasType	EGASTYPE	N2		V_P494 Index 494 Gas type Air/N2/Ar/CO2
eFlowMeasurementFilter	EFLOWFILTER	Filter_64ms		V_P386 Index 386 Flow measurement filter 0..2048ms
eFlowDisplayFilter	EDISPLAYFILTER	Display_256ms		V_P385 Index 385 Flow display filter 256/512/1024ms
ePin2_OutputSignal	EPIN2_OUTPUT	Pin2_FlowAnalog		V_P482 Index 482 Output signal Pin2
ePin4_OutputSignal	EPIN4_OUTPUT	Pin4_OutA_FlowMonitoring		V_P483 Index 483 Output signal Pin4
eHardwareMode	EHARDWAREMODE	PNP		V_P481 Index 481 NPN / PNP selection
eAnalogOutputType	EANALOGOUTPUTTYPE	e0_10V		V_P364 Index 364 0-10V / 1-5V / 4-20mA
iAnalogStartValue	INT	0		V_P362 Index 362 Analog start value % Range -100..90
iAnalogEndValue	INT	100		V_P363 Index 363 Analog end value % Range -90..100
eBacklightDuration	EBACKLIGHTDURATION	Time5s		V_P488 Index 488 Backlight duration always/5..640s
eSubDisplayMode	ESUBDISPLAYMODE	GasType		V_P489 Index 489 Sub-display mode selection
eLocalSSCDisplay	ELOCALSSCDISPLAY	OnlyActiveSSCs		V_P476 Index 476 Show only active or all SSCs
eMeasuredValueDisplay	EMEASUREDVALUEDISPLAY	DisplayFlow		V_P477 Index 477 Flow/Volume/Temperature display
uiLockCode	UINT	0		V_P490 Index 490 Local parameter lock code 0=Off
xParameterizationLock	BOOL	FALSE		SubIndex 3 FALSE : Unlocked TRUE : Locked
xUserInterfaceLock	BOOL	FALSE		SubIndex 4 FALSE : Unlocked TRUE : Locked
xUserZeroAdjustment	BOOL	FALSE		V_P388 Index 388 User zero adjustment On/Off
xDone	BOOL	FALSE		TRUE : Read or Write Operation Completed Successfully
xBusy	BOOL	FALSE		TRUE : Read or Write Operation in Progress
xError	BOOL	FALSE		TRUE : Error during Read / Write
udiErrorCode	UDINT	0		Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error		Enumeration of Function Block Error Code
eStatus	EDEVICEPARAMETERSTATUS	No_Status		Enumeration of Device Parameters Read / Write Status

1. Turn ON **xWrite** Input (**TRUE** - Enables Write Mode).
2. Configure the required parameters within the **stDeviceParameters** structure as per user preference ([Refer Chapter 4.9.7](#)).

After Execute

Device.Application.PLC_PRG				
Expression	Type	Value	Prepared value	Comment
Festo_SFAB_Device_Parameters_0	Festo_SFAB_IOLink.Festo_SFAB_Device_Parameters			
stSFABRef	stSFAB_REF			SFAB Sensor Reference Structure from Festo_SFAB_Connect
xExecute	BOOL	TRUE		Rising Edge : Read All Device Parameters
xWrite	BOOL	TRUE		Rising Edge : Write All Device Parameters
stDeviceParameters	REFERENCE TO stDeviceParameters	16#B25E9B74		SFAB Device Configuration Parameters Structure
eFlowUnit	EFLOWUNITTYPE	M3_Hour		V_P383 Index 383 Flow unit selection
eTemperatureUnit	ETEMPERATUREUNIT	Celsius		V_P443 Index 443 Temperature unit °C / °F
eReferenceCondition	EREERENCECONDITION	DIN1343_0C		V_P496 Index 496 Reference condition 0°C/15°C/20°C
eGasType	EGASTYPE	N2		V_P494 Index 494 Gas type Air/N2/Ar/CO2
eFlowMeasurementFilter	EFLOWFILTER	Filter_64ms		V_P386 Index 386 Flow measurement filter 0..2048ms
eFlowDisplayFilter	EDISPLAYFILTER	Display_256ms		V_P385 Index 385 Flow display filter 256/512/1024ms
ePin2_OutputSignal	EPIN2_OUTPUT	Pin2_FlowAnalog		V_P482 Index 482 Output signal Pin2
ePin4_OutputSignal	EPIN4_OUTPUT	Pin4_OutA_FlowMonitoring		V_P483 Index 483 Output signal Pin4
eHardwareMode	EHARDWAREMODE	PNP		V_P481 Index 481 NPN / PNP selection
eAnalogOutputType	EANALOGOUTPUTTYPE	e0_10V		V_P364 Index 364 0-10V / 1-5V / 4-20mA
iAnalogStartValue	INT	0		V_P362 Index 362 Analog start value % Range -100..90
iAnalogEndValue	INT	100		V_P363 Index 363 Analog end value % Range -90..100
eBacklightDuration	EBAKLIGHTDURATION	Time5s		V_P488 Index 488 Backlight duration always/5..640s
eSubDisplayMode	ESUBDISPLAYMODE	GasType		V_P489 Index 489 Sub-display mode selection
eLocalSSCDisplay	ELOCALSSCDISPLAY	OnlyActiveSSCs		V_P476 Index 476 Show only active or all SSCs
eMeasuredValueDisplay	EMEASUREDVALUEDISPLAY	DisplayFlow		V_P477 Index 477 Flow/Volume/Temperature display
uiLockCode	UINT	0		V_P490 Index 490 Local parameter lock code 0=Off
xParameterizationLock	BOOL	FALSE		SubIndex 3 FALSE : Unlocked TRUE : Locked
xUserInterfaceLock	BOOL	FALSE		SubIndex 4 FALSE : Unlocked TRUE : Locked
xUserZeroAdjustment	BOOL	FALSE		V_P388 Index 388 User zero adjustment On/Off
xDone	BOOL	TRUE		TRUE : Read or Write Operation Completed Successfully
xBusy	BOOL	FALSE		TRUE : Read or Write Operation in Progress
xError	BOOL	FALSE		TRUE : Error during Read / Write
udiErrorCode	UDINT	0		Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error		Enumeration of Function Block Error Code
eStatus	EDEVICEPARAMETERSTATUS	Write_All_Parameters_Completed		Enumeration of Device Parameters Read / Write Status

1. Turn ON **xExecute** Input (**TRUE** - Triggers the Write Operation).
2. Output **xBusy** turns **ON** while writing parameters to the device.
3. Output **eStatus** will be updated with the current parameter writing state.
4. Output **xDone** turns **ON** once the parameter write is completed.
5. Output **eStatus** will be updated with **Write_All_Parameters_Completed**.

6.8 Festo SFAB Diagnostics

Before Execute

Device.Application.PLC_PRG				
Expression	Type	Value	Prepared value	Comment
Festo_SFAB_Diagnostics_0	Festo_SFAB_IOLink.Festo_SFAB_Diagnostics			
stSFABRef	stSFAB_REF			SFAB Sensor Reference Structure from Festo_SFAB_Connect
xExecute	BOOL	FALSE		Rising Edge : Trigger Diagnostic Read
xDone	BOOL	FALSE		TRUE : Diagnostic Data Read Completely
xBusy	BOOL	FALSE		TRUE : Function Block Executing Diagnostic
xError	BOOL	FALSE		TRUE : Error while Reading Diagnostic Data
udiErrorCode	UDINT	0		Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error		Enumeration of Function Block Error Code
uiIOLinkErrorCount	UINT	0		Total Active Error Count
eDeviceStatus	EDEVICESTATUS	Device_OK		Current Sensor Condition and Diagnosis State
astIOLinkEvent	ARRAY [1..8] OF stIOLinkEvent			IO-Link Event Array - Max 8 Events
rSupplyVoltage	REAL	0		Supply Voltage of the Sensor in Volt

After Execute

Device.Application.PLC_PRG				
Expression	Type	Value	Prepared value	Comment
Festo_SFAB_Diagnostics_0	Festo_SFAB_IOLink.Festo_SFAB_Diagnostics			
stSFABRef	stSFAB_REF			SFAB Sensor Reference Structure from Festo_SFAB_Connect
xExecute	BOOL	TRUE		Rising Edge : Trigger Diagnostic Read
xDone	BOOL	TRUE		TRUE : Diagnostic Data Read Completely
xBusy	BOOL	FALSE		TRUE : Function Block Executing Diagnostic
xError	BOOL	FALSE		TRUE : Error while Reading Diagnostic Data
udiErrorCode	UDINT	0		Function Block Error Code
eErrorDescription	EERRORDESCRIPTION	No_Error		Enumeration of Function Block Error Code
uiIOLinkErrorCount	UINT	0		Total Active Error Count
eDeviceStatus	EDEVICESTATUS	Device_OK		Current Sensor Condition and Diagnosis State
astIOLinkEvent	ARRAY [1..8] OF stIOLinkEvent			IO-Link Event Array - Max 8 Events
astIOLinkEvent[1]	stIOLinkEvent			
eEventType	EEVENTQUALIFIER	No_Event		Enumeration of Event Type of the SFAB Sensor
iEventCode	INT	0		Enumeration of Event Code of the SFAB Sensor
eEventDescription	EEVENTDESCRIPTION	Device_Ok		Enumeration of Event Code Description
astIOLinkEvent[2]	stIOLinkEvent			
astIOLinkEvent[3]	stIOLinkEvent			
astIOLinkEvent[4]	stIOLinkEvent			
astIOLinkEvent[5]	stIOLinkEvent			
astIOLinkEvent[6]	stIOLinkEvent			
astIOLinkEvent[7]	stIOLinkEvent			
astIOLinkEvent[8]	stIOLinkEvent			
rSupplyVoltage	REAL	24.300011		Supply Voltage of the Sensor in Volt

1. Turn ON **xExecute** Input (**TRUE** - Reads Device Diagnostics).
2. Output **xBusy** turns **True** while reading diagnostic data.
3. Output **xDone** turns **True** once the diagnostic read is completed.
4. Output **eDeviceStatus** will be updated with the current device health status (e.g., **Device_OK**).
5. Output **rSupplyVoltage** will be updated with the current voltage reading from the sensor.
6. Output **uiIOLinkErrorCount** will be updated with the current error count from the IO-Link connection.
7. Output **astIOLinkEvent** array will be updated with the latest event logs (if any events are present) [Refer Chapter 4.9.4.](#)