

CPX-AP-.-PN Profinet Integration with Siemens S7-300 PLC

This Application Note gives a step by step description of how to integrate CPX-AP-I-PN and CPX-AP-A-PN with Siemens PLC in Simatic Manager Step 7 programming environment. This library is intended for common use of CPX-AP-I-PN and CPX-AP-A-PN.

CPX-AP-I-PN-M12

CPX-AP-A-PN-M12

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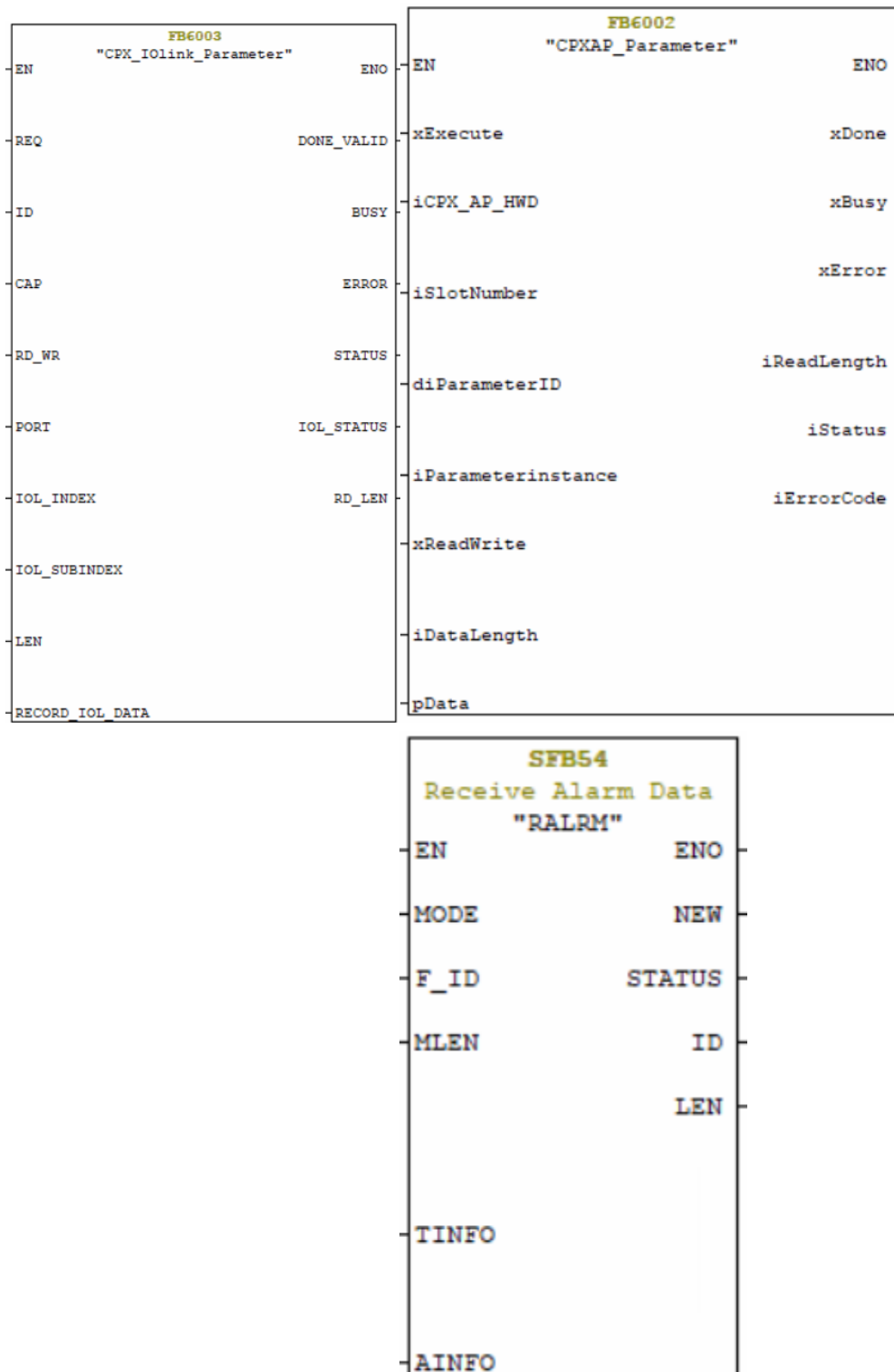
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1 Introduction of CPX-AP Library

This library contains 2 functional blocks which are used to read and write a parameters in CPX-AP expansion modules, IO-Link master sub-module & **“RALRM”** SFC is used to diagnose the error details in CPX-AP expansion modules. All the Functional blocks are shown below & they are named as **“CPXAP_Parameter”** and **“CPXAP_IOLink_Parameter”**.



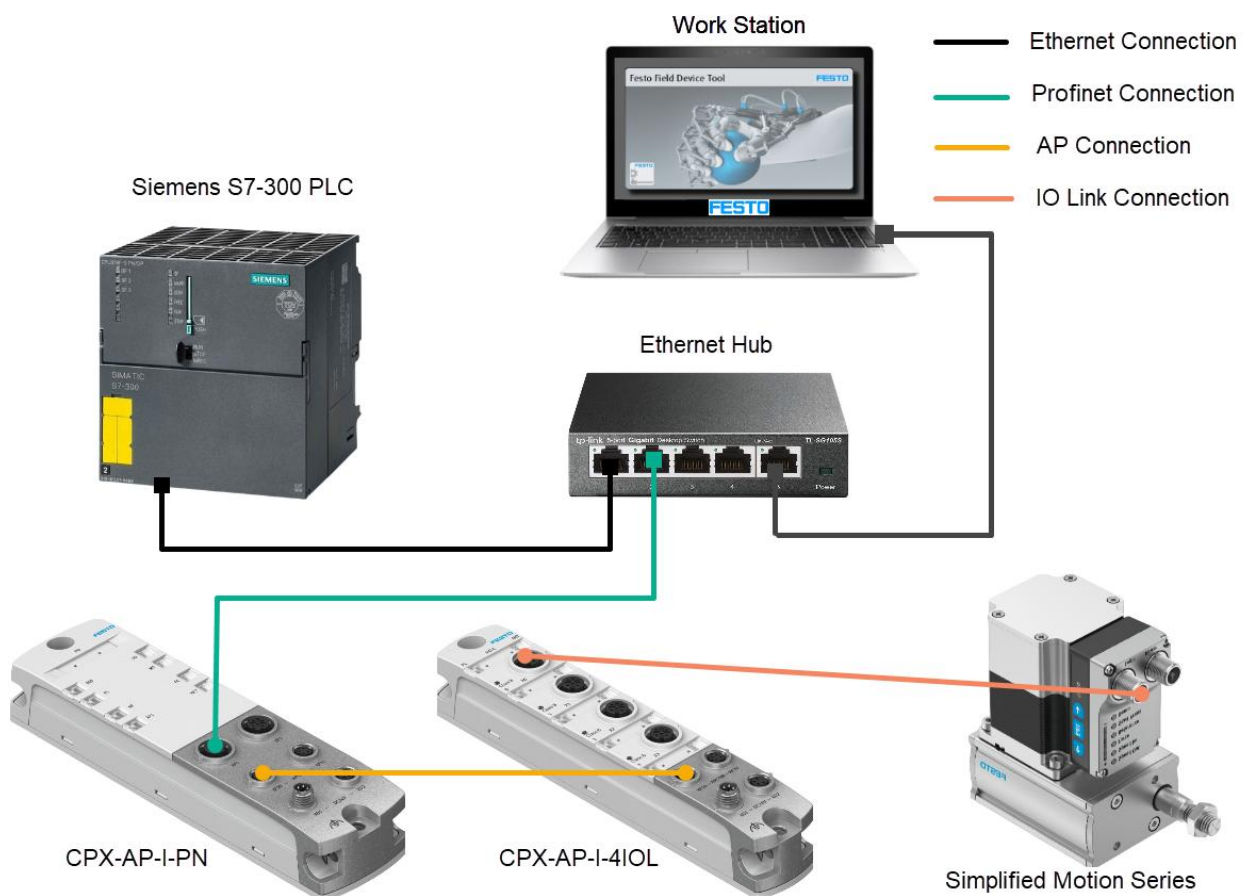
1.1 Hardware & Software Requirement

Device Name	Version Software/Firmware	Requirement Type
Simatic Step 7	V5.6 SP2	Software
CPX-AP-I-PN GSDM File	2.34	Software
CPX-AP-A-PN GSDM File	2.35	Software
Web Browser	Version Free	Software
Festo CPX-AP-.PN-M12	Latest	Hardware
Festo CPX-AP-.4IOL-M12	Latest	Hardware
IO-Link Sub-Modules	Any IO-Link Device	Hardware

Table 1.1: Hardware's /Software's Requirement

1.2 Topology Overview

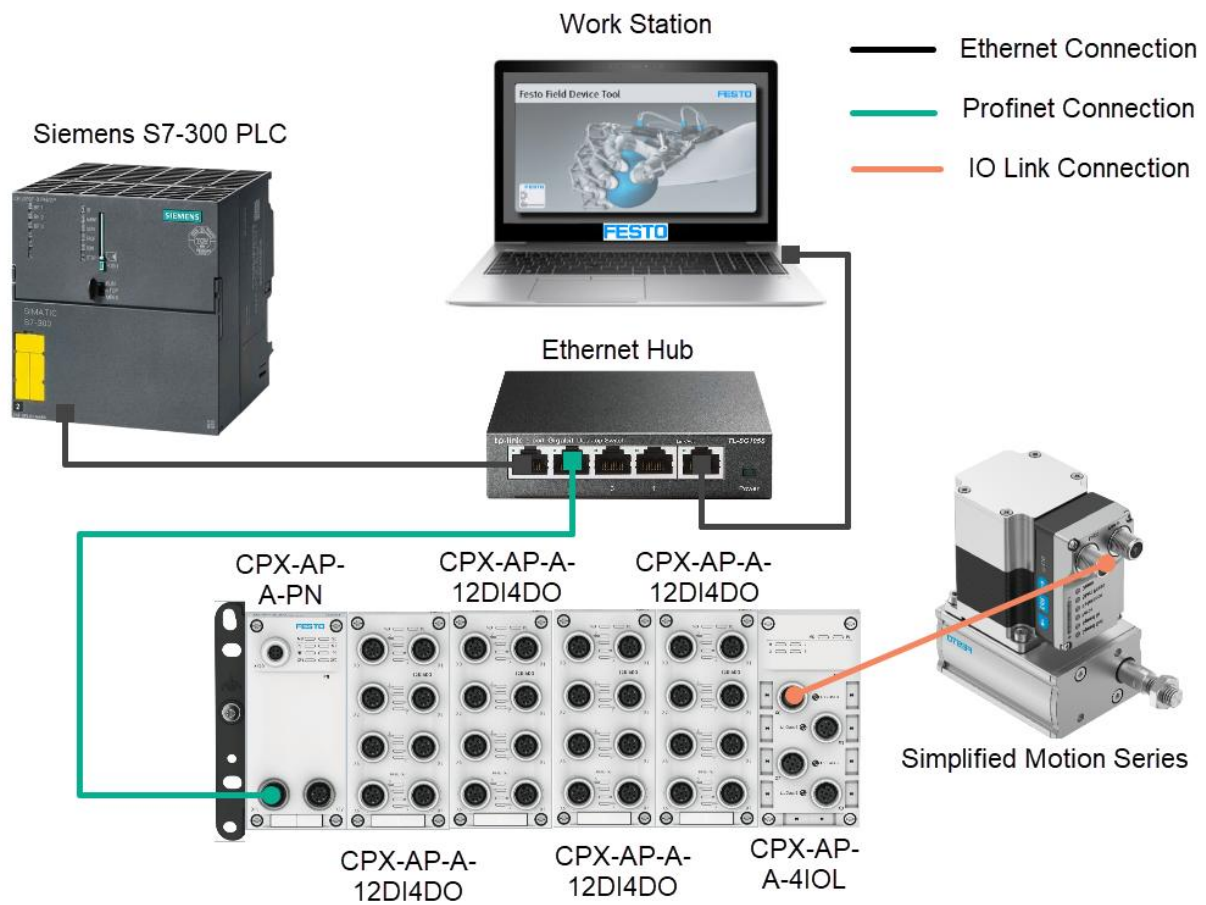
1.2.1 Topology Overview of CPX-AP-I-PN-M12



Note

- Above network configuration is an example network for this application note but depends on users network configuration above architecture may change.

1.2.2 Topology Overview of CPX-AP-A-PN



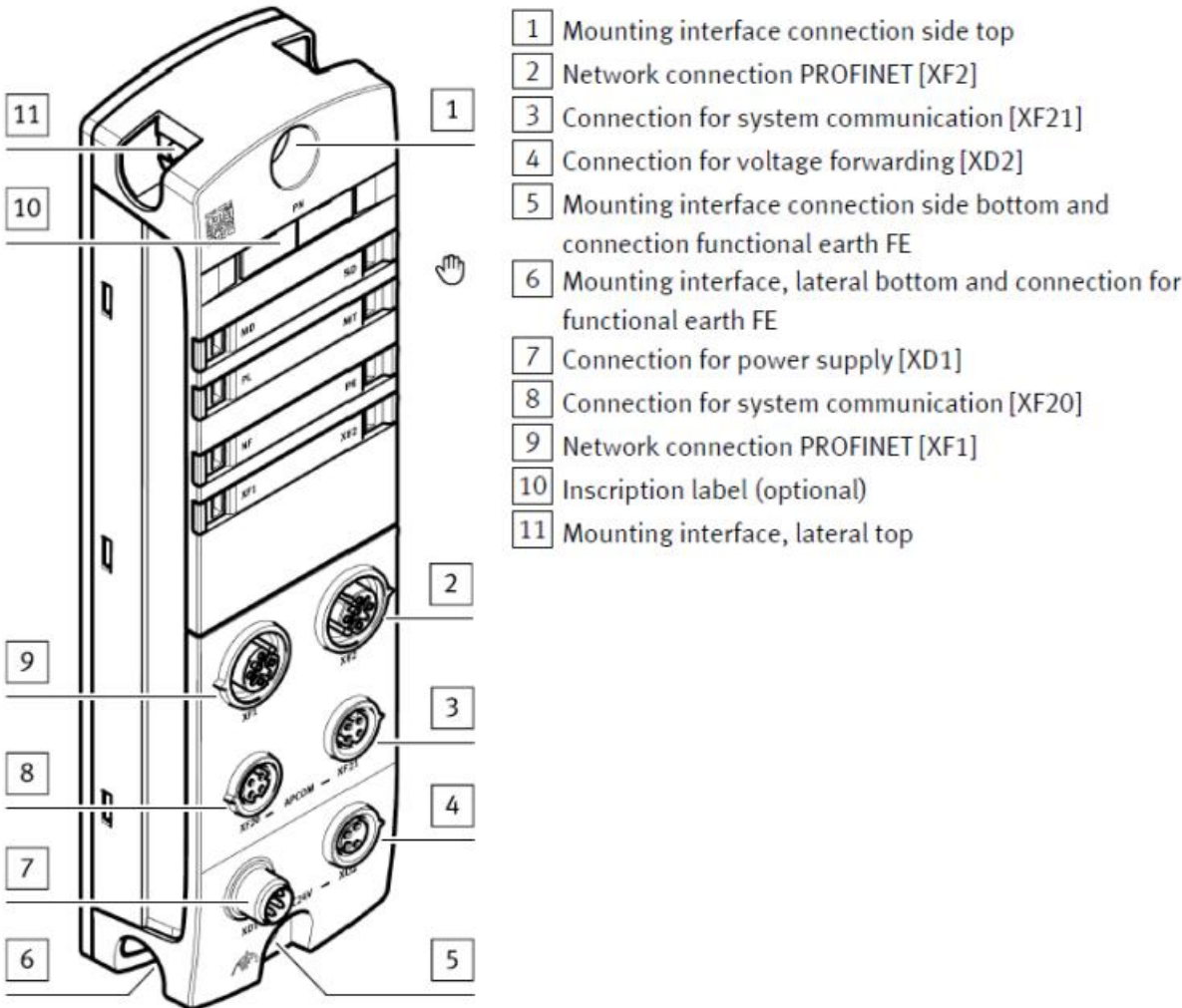
Note

- Above network configuration is an example network for this application note but depends on users network configuration above architecture may change.

1.3 CPX-AP Module Over View

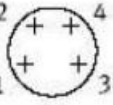
1.3.1 CPX-AP-I-PN Module Parts

- Connect the power supply of the Head module named **XD1**.



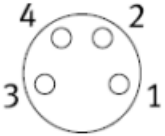
Connection for power supply [XD1]		
Plug M8, 4-pin, A-coded		Signal
	1	+24 V DC logic supply PS
	2	0 V DC load supply PL
	3	0 V DC logic supply PS
	4	+24 V DC load supply PL

- The Power Supply connection for XD1 is as shown below.
- If NEBU-M8G4... cable is used to give power supply to XD1 then the connection details will be as shown below.

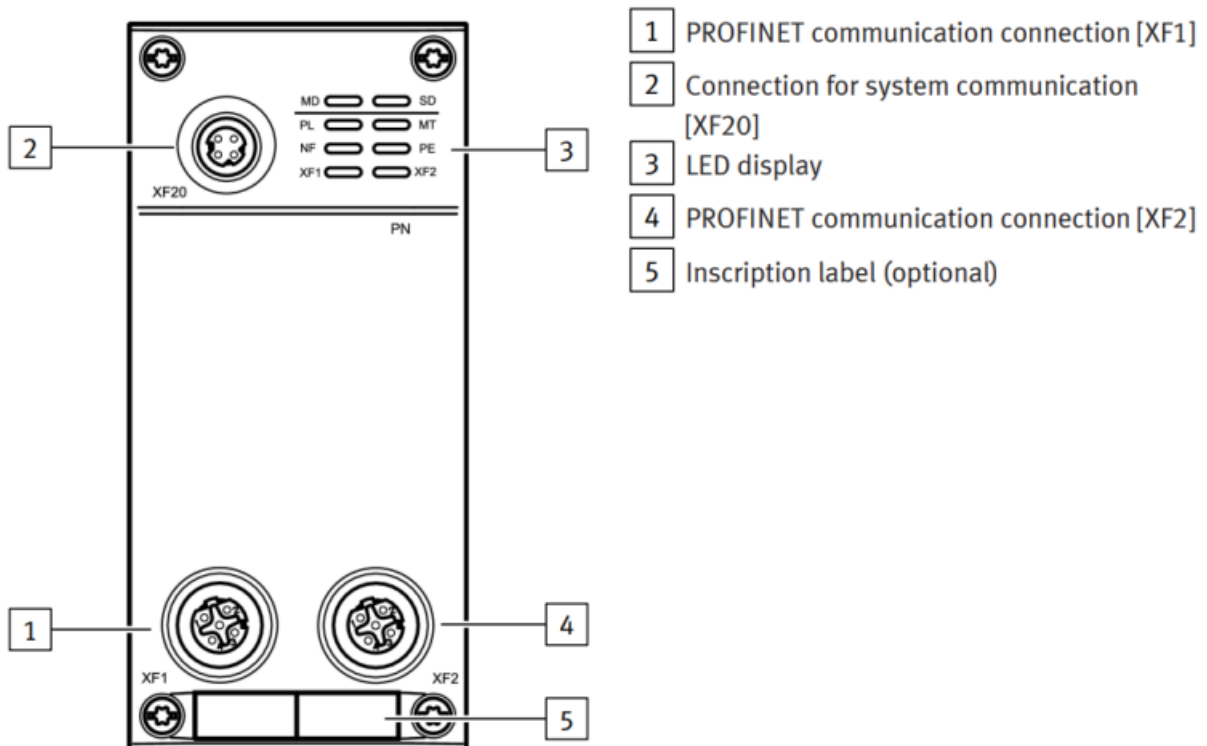
Electrical connection, open cable end, 4-wire – plug, 4-pin				
	1	BN	1	Plug M8 
	2	WH	2	
	3	BU	3	
	4	BK	4	

- Connection **XD2** is used for voltage forwarding to give supply between CPX-AP-I devices.

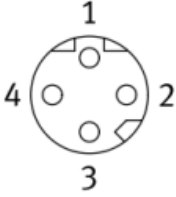
The connection details are as shown below.

Connection for voltage forwarding [XD2]		
Socket M8, 4-pin, A-coded	Signal	
	1	+24 V DC logic supply PS
	2	0 V DC load supply PL
	3	0 V DC logic supply PS
	4	+24 V DC load supply PL

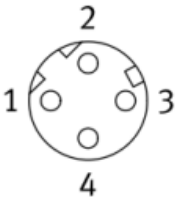
1.3.2 CPX-AP-A-PN Module Parts



Connection for system communication [XF20]

Socket M8, 4-pin, D-coded		Signal	
	1	RX–	Received data –
	2	TX+	Transmitted data +
	3	RX+	Received data +
	4	TX–	Transmitted data –
	Thread	Shield	Functional earth FE

Connection PROFINET network [XF1], [XF2]

Socket M12, 4-pin, D-coded		Signal	
	1	TD+	Transmitted data +
	2	RD+	Received data +
	3	TD–	Transmitted data –
	4	RD–	Received data –
	Thread	Shield	Functional earth FE

2 Software Configuration

2.1 Creating a New Project and Adding Controller in Simatic Manager

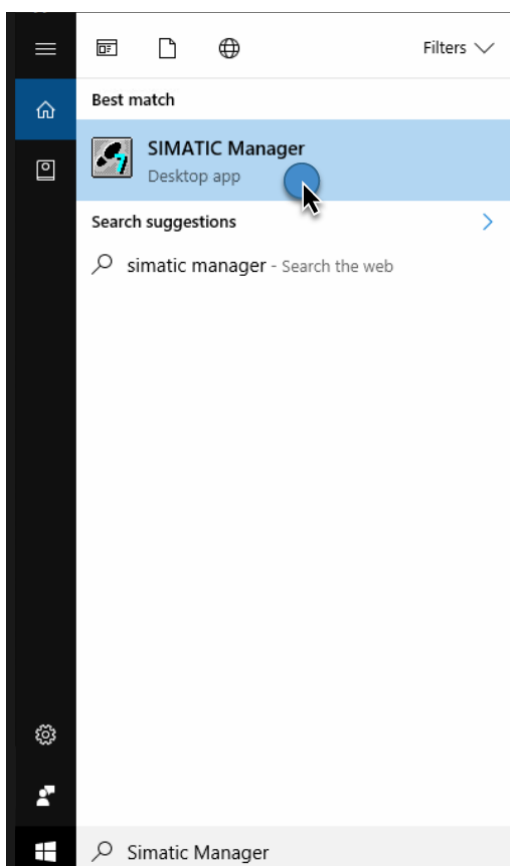
This Chapter will describe about Creating a Project in Simatic Manager V5.6.



Note

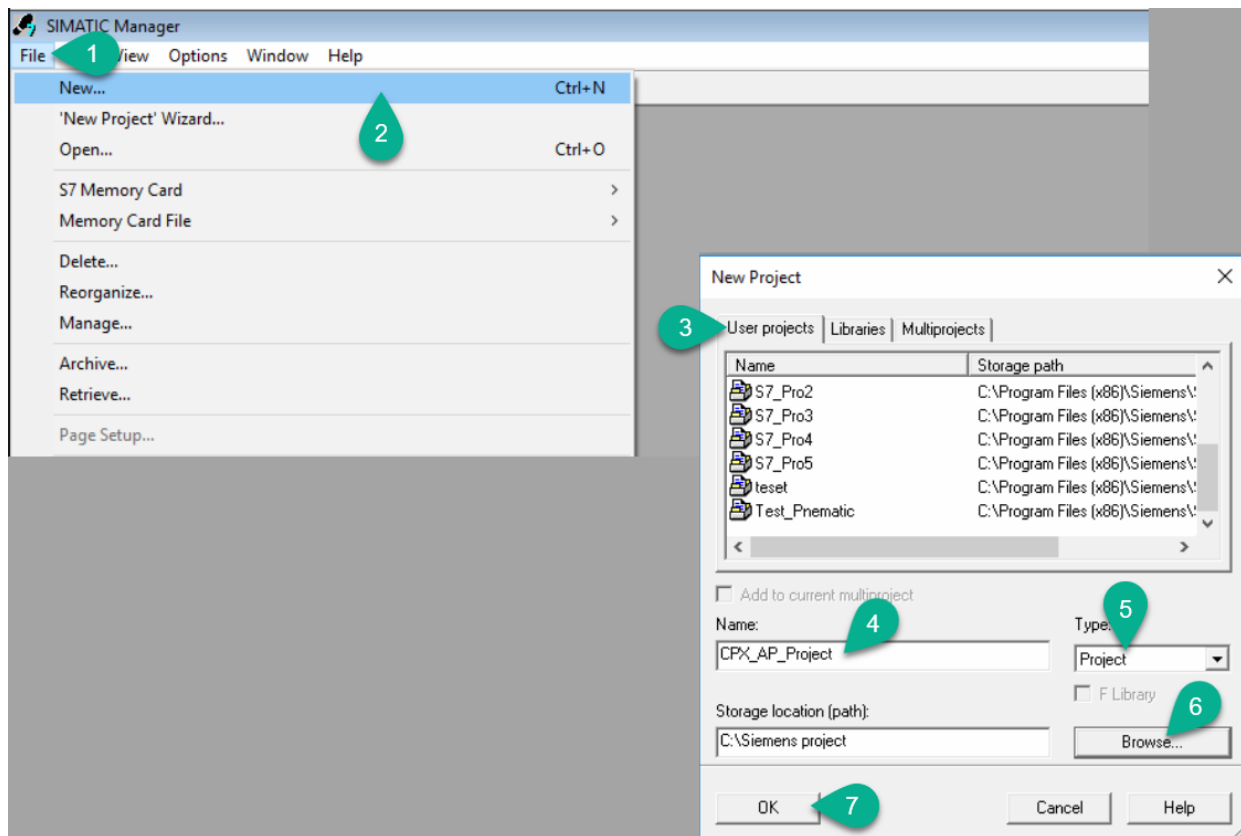
- Skip this Chapter if User Integrating the device in existing Project.

Step – 1

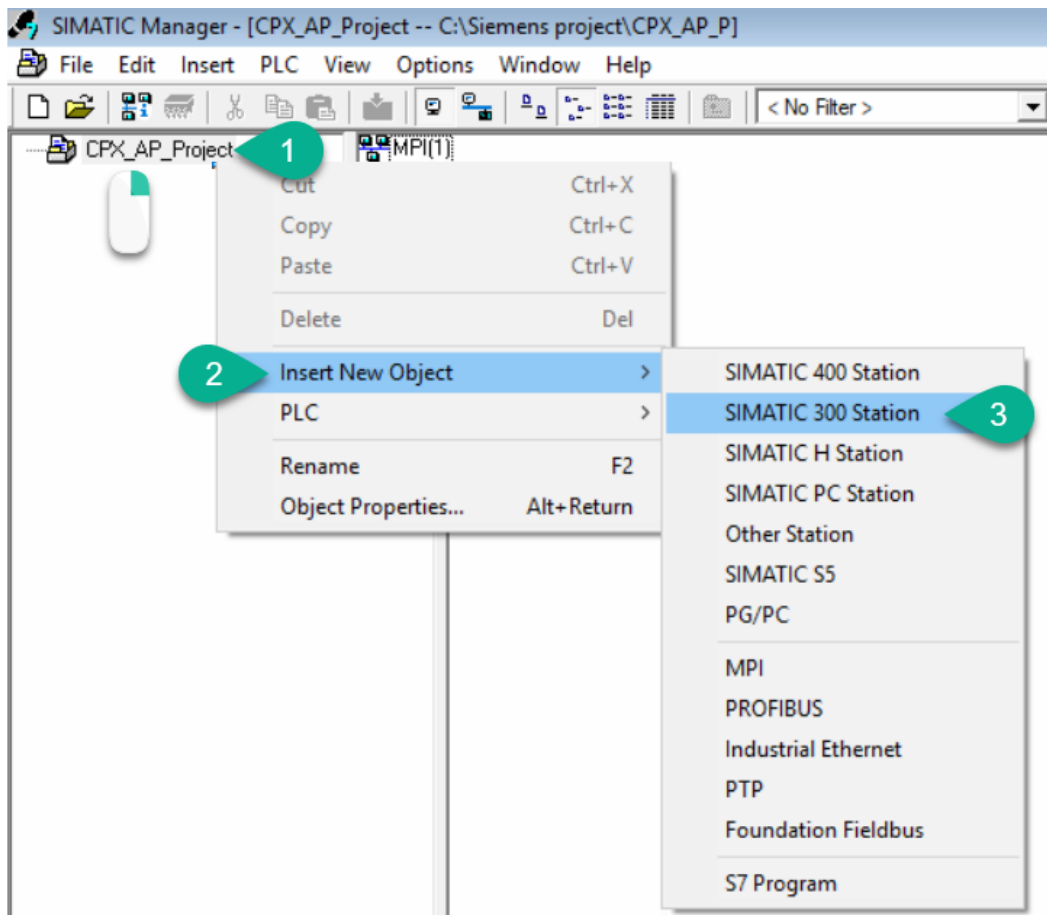


- In Windows Search box Enter the name as **Simatic Manager** or Use the following path to open the Software **Windows Start > Siemens Automation > SIMATIC Manager**.

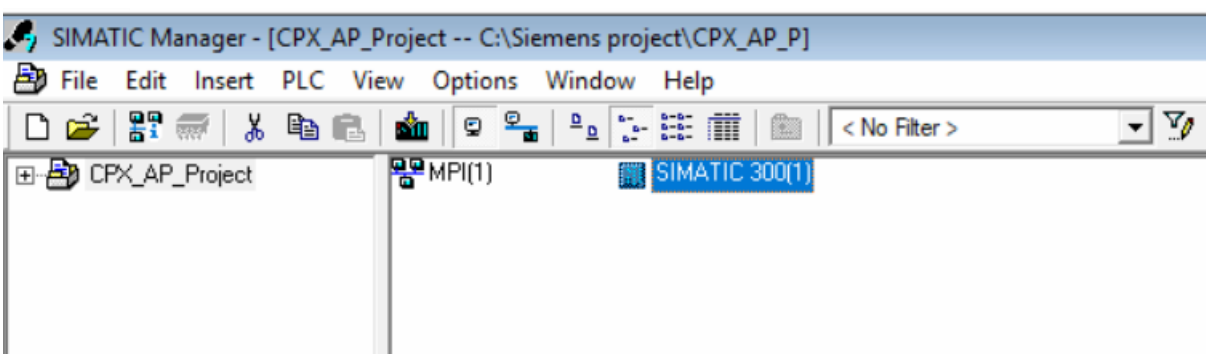
Step – 2



1. Select **"File"**.
2. Click **"New..."** or use shortcut **"CTRL+N"** to create a New Project.
3. Select **"User projects"** tab on **New Project** window.
4. Enter **"Project name"** in **Name** box.
5. Select **"Project"** as type from drop-down menu **Type**.
6. Select path to save the project.
7. Select **"OK"**.

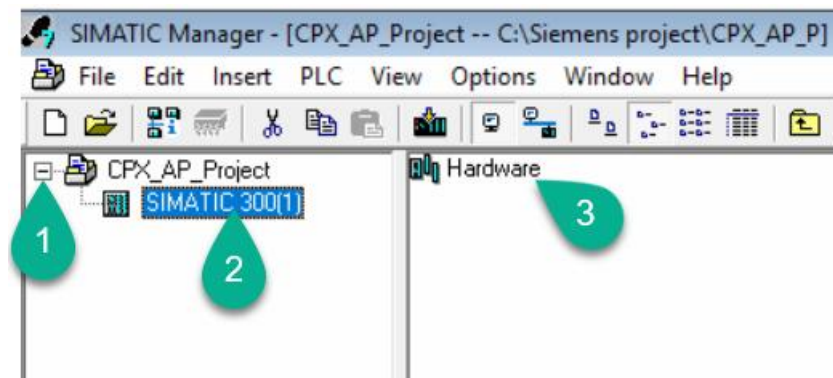
Step – 3

1. Right click **“Project Name”**.
2. Select **“Insert New Object”**.
3. Select **“SIMATIC 300 Station”**.

Step – 4

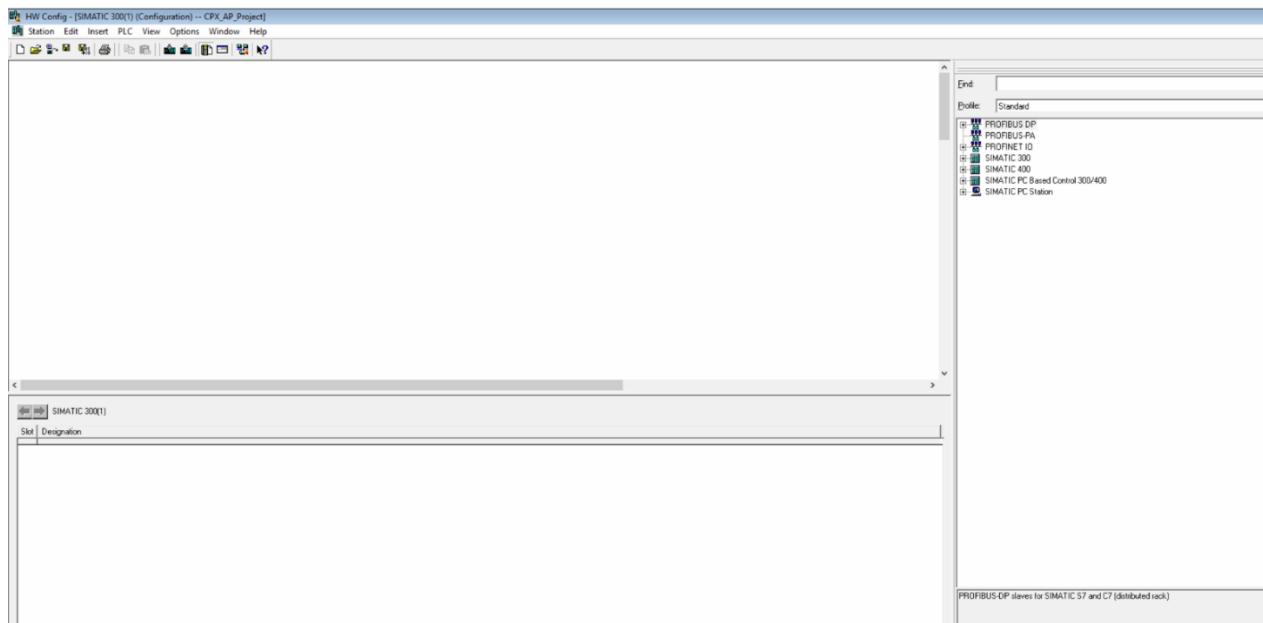
- Created Station will be displayed like above.

Step – 5

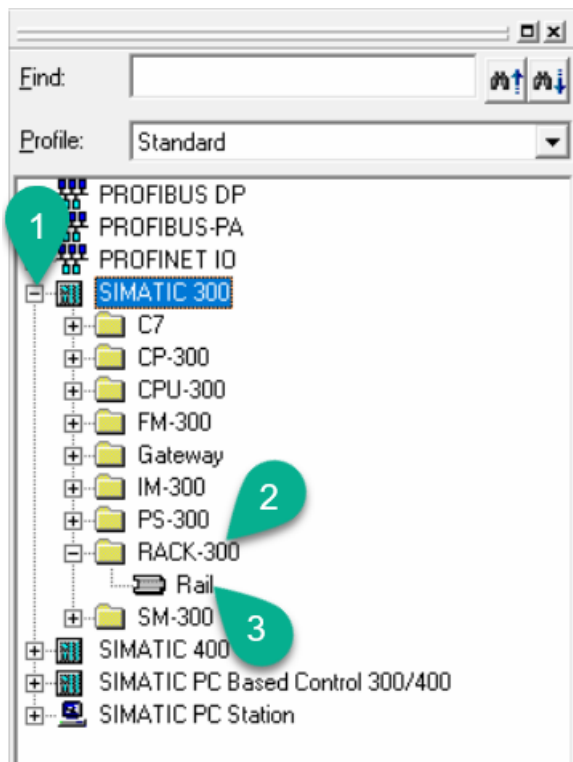


1. Expand the **"Project Structure"**.
2. Select **"SIMATIC300(1)"** station.
3. Double click on **"Hardware"**.

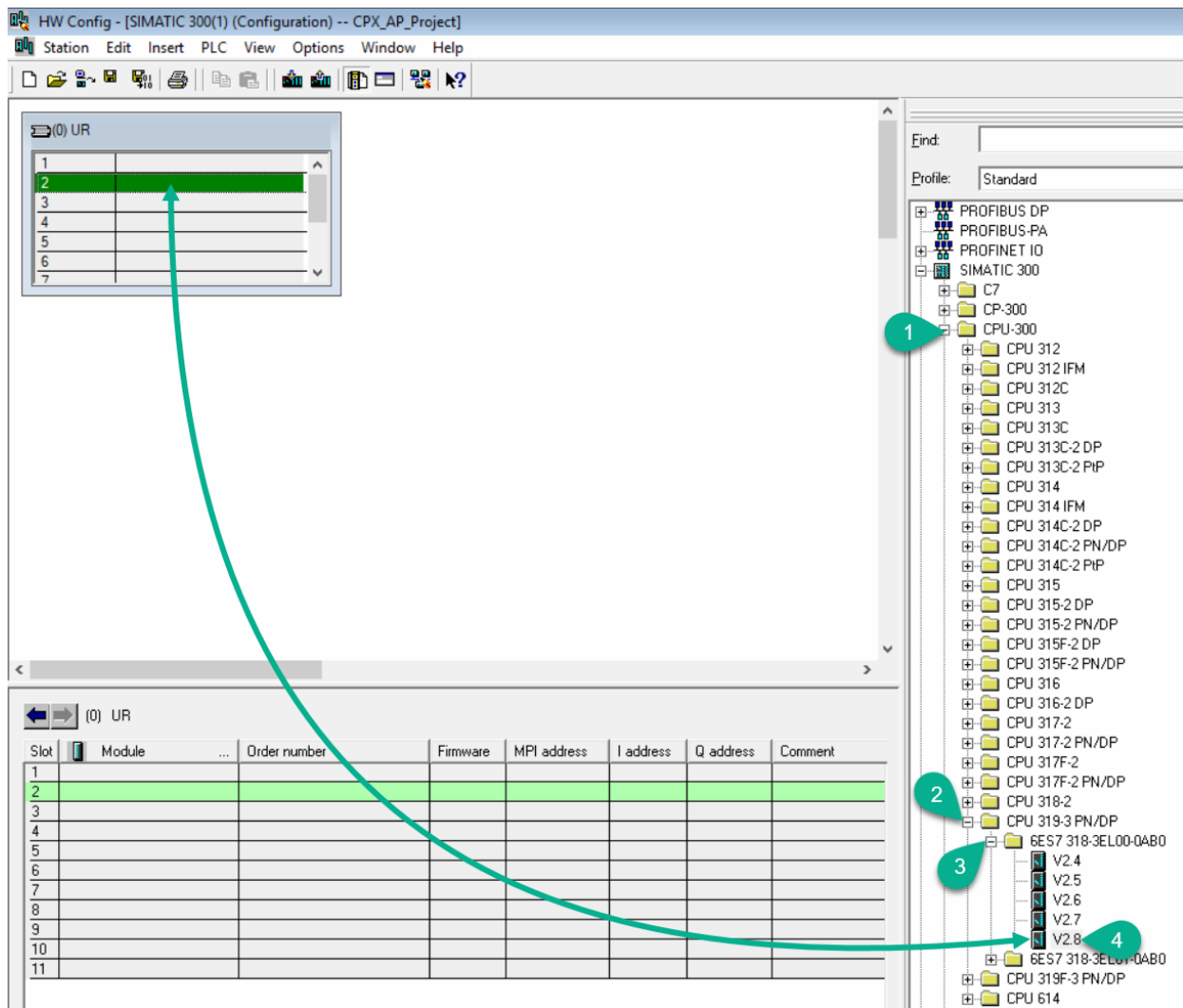
Step – 6



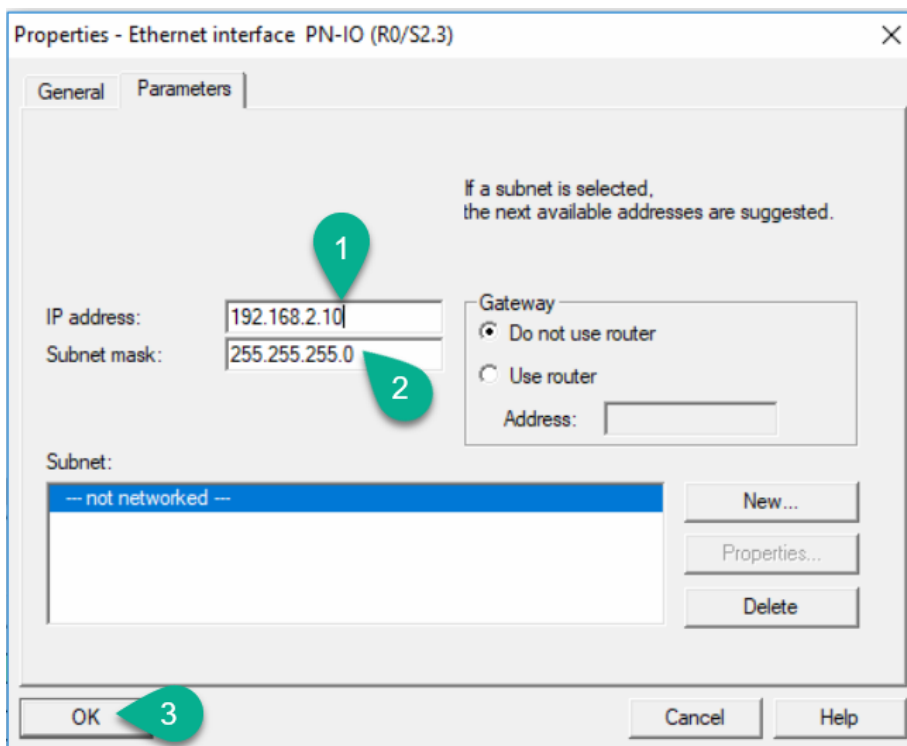
- Hardware Configuration window will appear as shown.

Step – 7

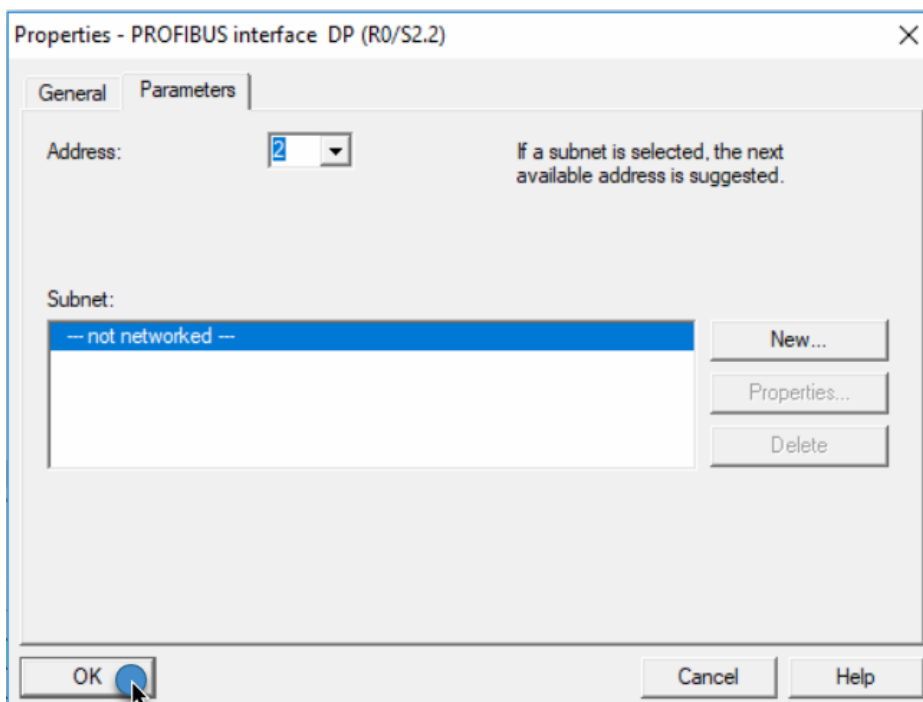
1. Click **"SIMATIC 300"** to start the configuration from the equipment list.
2. Click **"RACK - 300"**.
3. Double click on **"Rail"**.

Step – 8

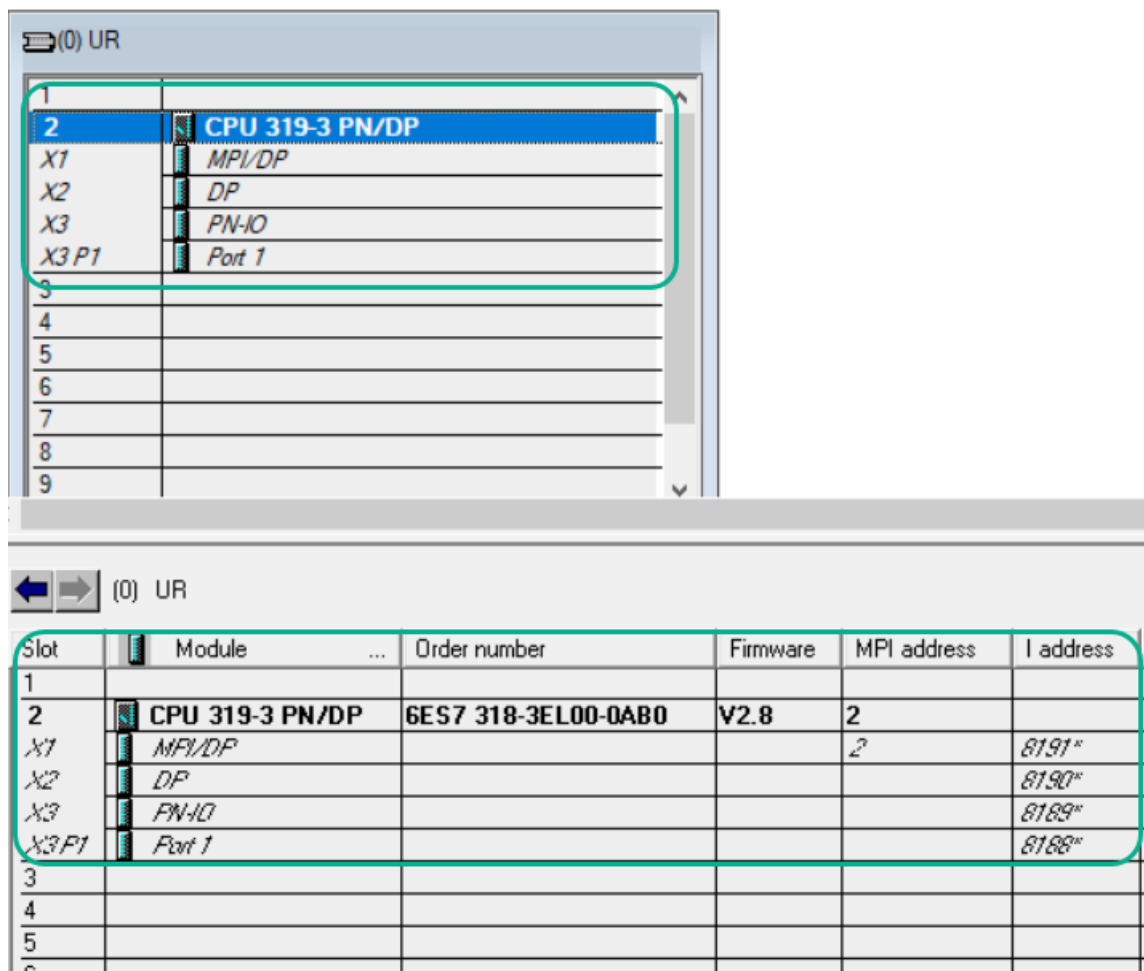
1. Expand **CPU-300**.
2. Select user required PLC for the project. In this example **CPU 319-3 PN/DP** PLC is used.
3. Select the PLC variant and Expand.
4. Drag and Drop the PLC version to the slot **2**. In this example **V2.8** PLC is used.

Step – 9

1. Enter **“IP Address”** for Ethernet Interface PN-IO port.
2. Enter **“Subnet mask”** for Ethernet Interface PN-IO port.
3. Click **“OK”**.

Step – 10

- Click **“OK”**.

Step – 11

- Selected CPU will be shown as above image.

**Note**

- The Profinet Interface address of PLC, CPX-AP-I-PN module must be in the same range.

2.2 Install CPX-AP-I-PN GSD File to the SIMATIC Manager

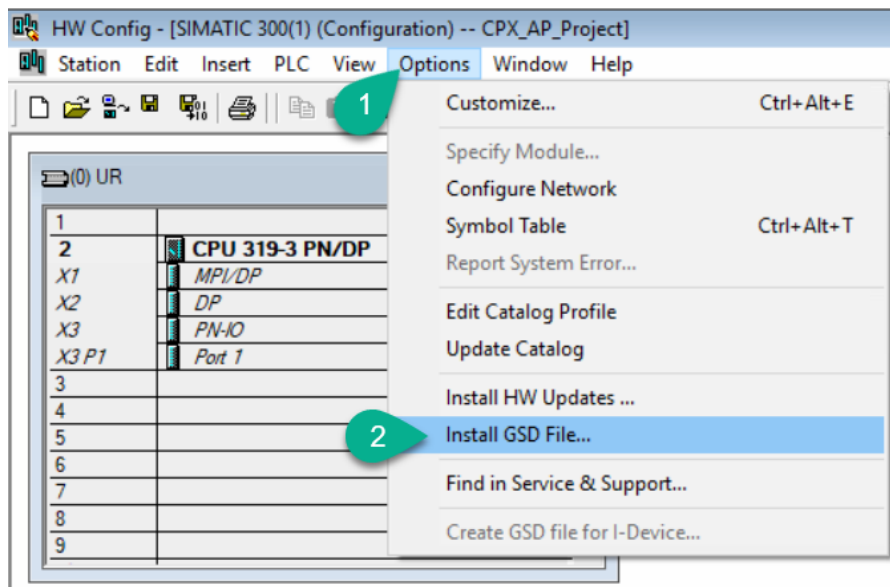
This Chapter will describe about import the CPX-AP-I-PN GSD file to the Siemens Simatic Manager V.5.6.

**Note**

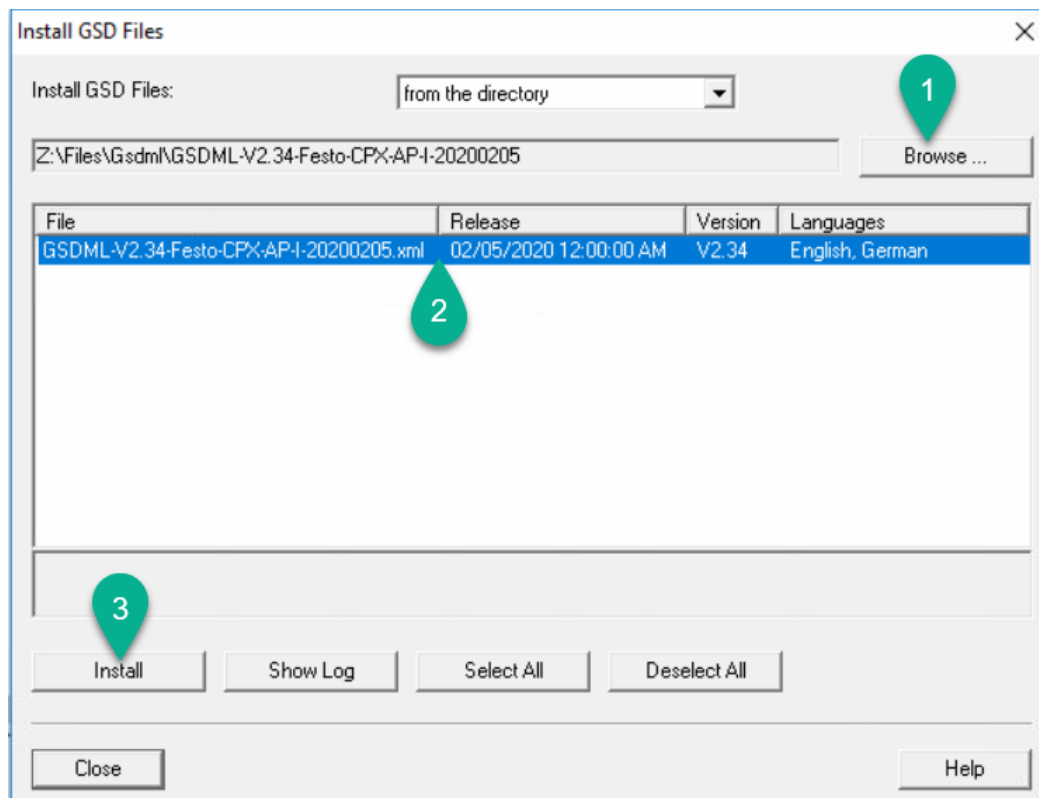
- Skip this Chapter if user is not using the CPX-AP-I-PN Module.

Step 1

- Download the **GSDML** file for **CPX-AP-I-PN** module from the Festo Support Portal and save it in an appropriate folder in your PC.

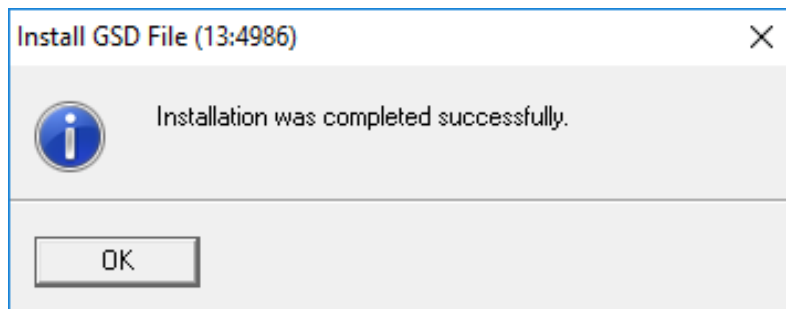
Step 2

1. Select “Options”.
2. Click “Install GSD File..” to import **CPX-AP-I-PN** module to SIMATIC Manager.

Step 3

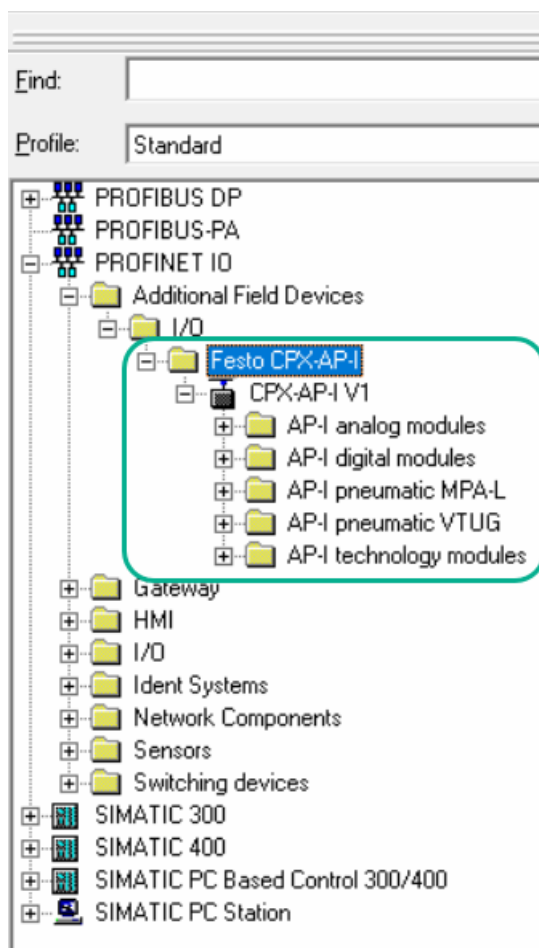
1. Select the Path, where the GSDML file is located.
2. Select the GSDML file from the list.
3. Click “Install” to add GSD to the SIMATIC Manager.

Step 4



- Click “OK” to complete the Installation.

Step 5



- Installed GSD file will be appear as shown above.

2.3 Install CPX-AP-A-PN GSD File to the SIMATIC MANAGER

This Chapter will describe about import the CPX-AP-A-PN GSD file to the Siemens Simatic Manager V.5.6.



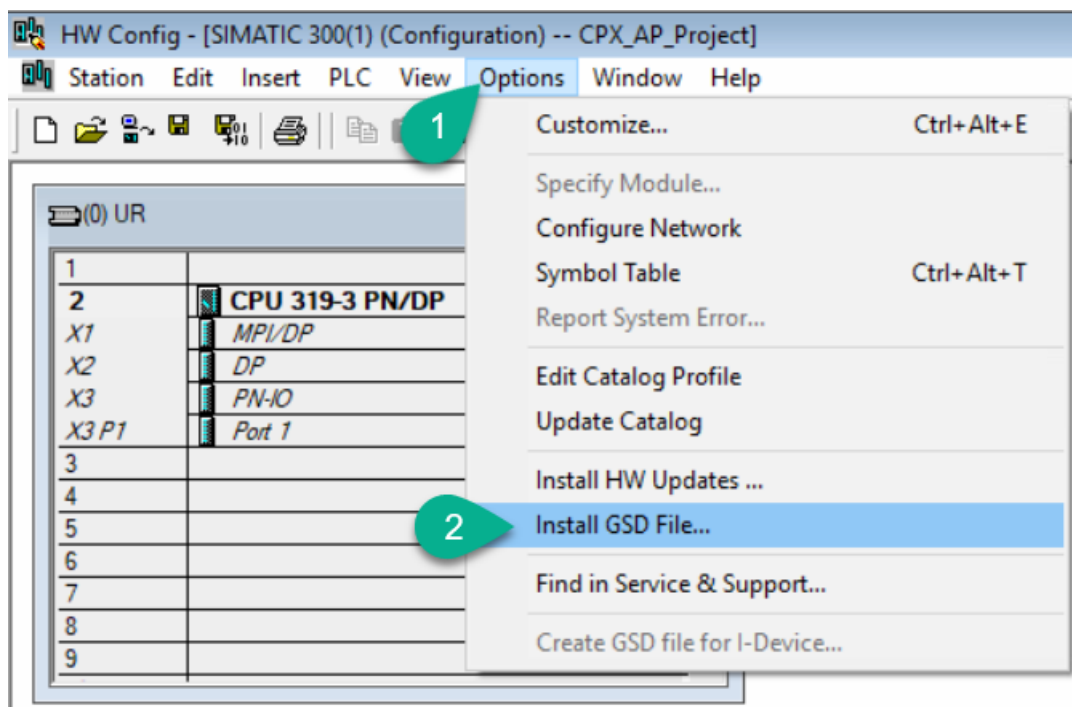
Note

- Skip this Chapter if user is not using the CPX-AP-A-PN Module.

Step 1

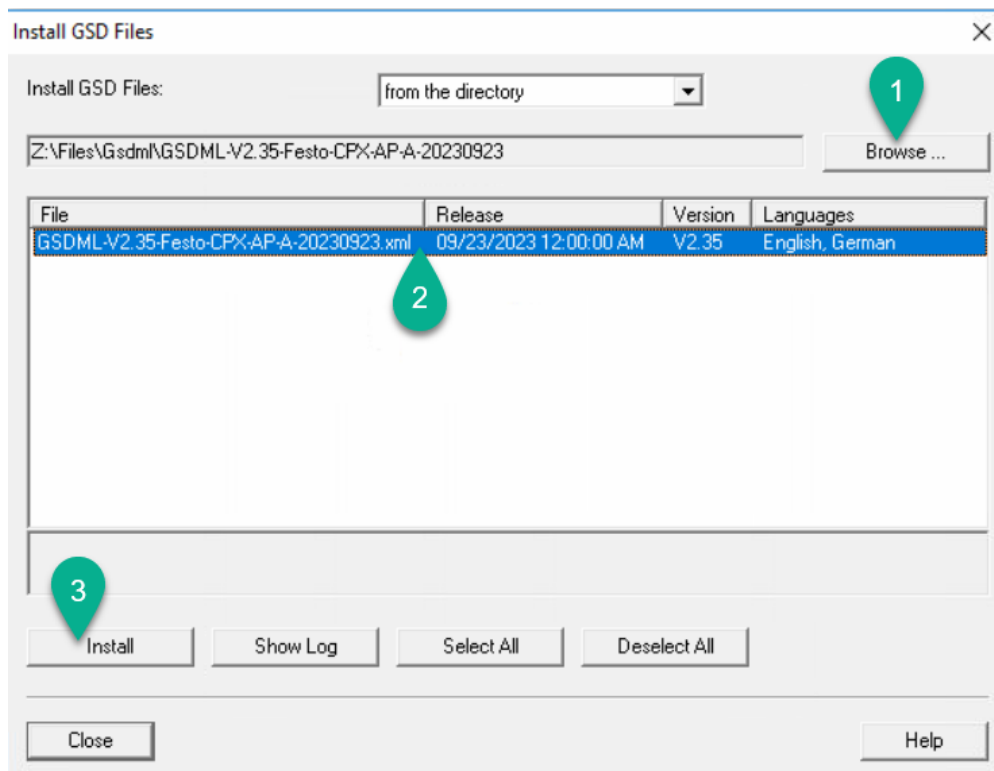
- Download the **GSDML** file for **CPX-AP-A-PN** module from the Festo Support Portal and save it in an appropriate folder in your PC.

Step 2



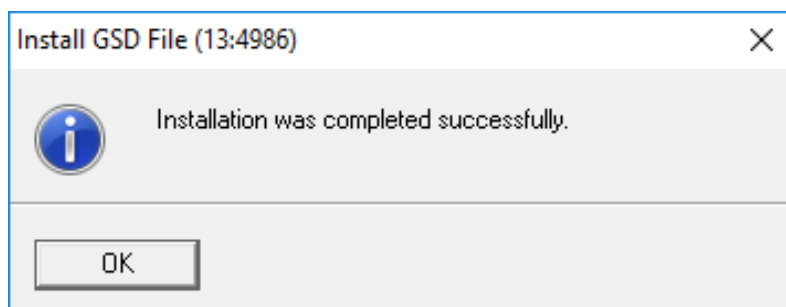
1. Select “**Options**”.
2. Click “**Install GSD File..**” to import **CPX-AP-A-PN** module to SIMATIC Manager.

Step 3

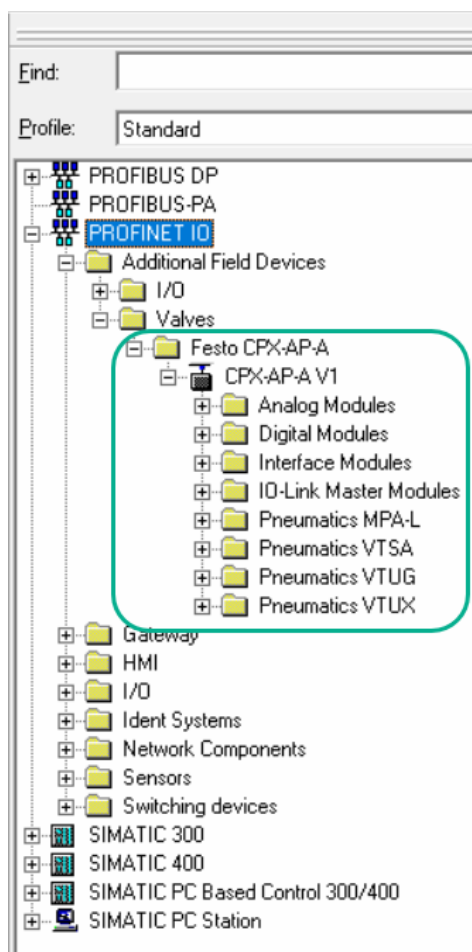


1. Select the Path, where the GSDML file is located.
2. Select the GSDML file from the list.
3. Click **“Install”** to add GSD to the SIMATIC Manager.

Step 4



- Click **“OK”** to complete the Installation.

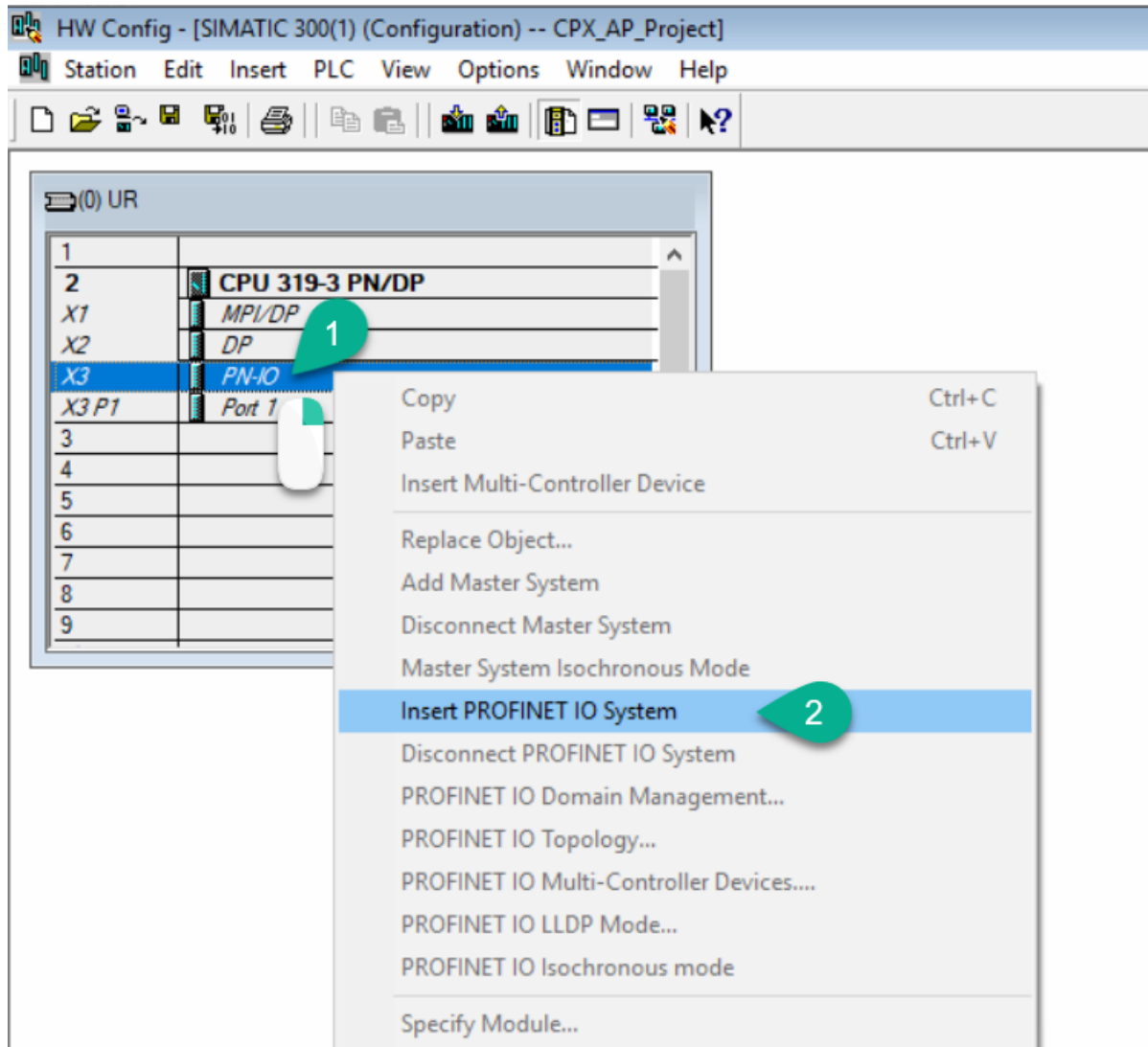
Step 5

- Installed GSD file will be appear as shown above.

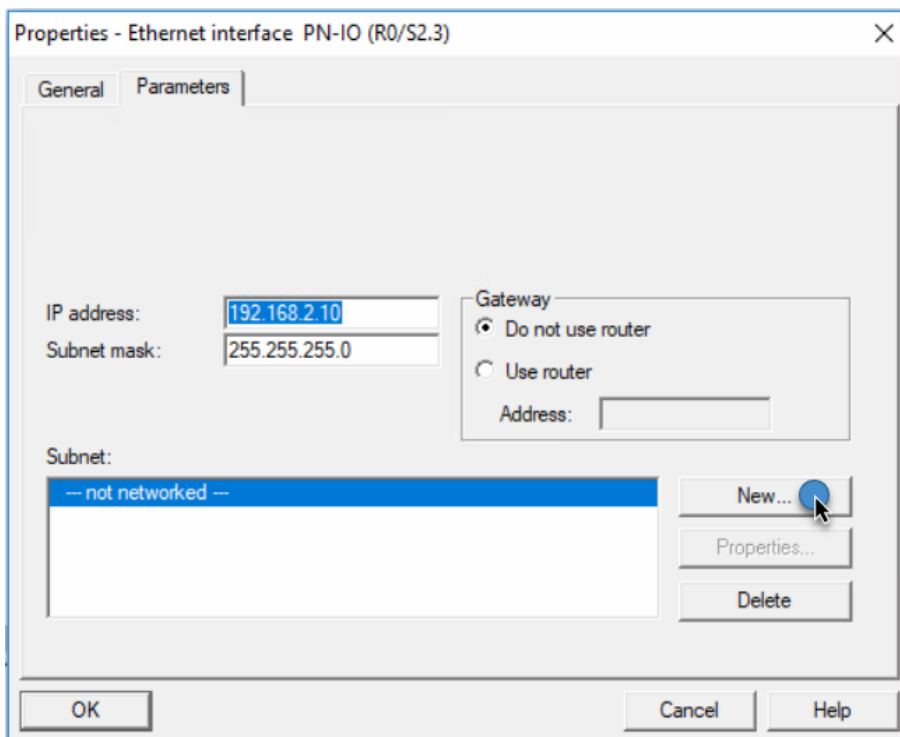
2.4 Adding Profinet IO System in to the Hardware Network

This chapter will describe about adding the CPX-AP-I-PN module to the Profinet network.

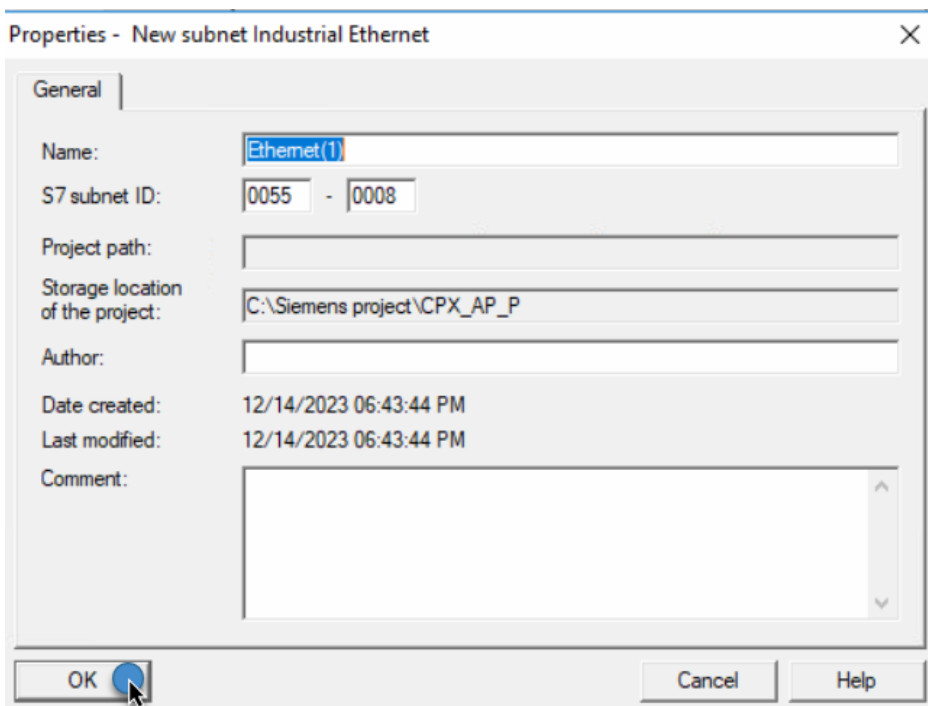
Step 1



1. Select & right click on **"PN – IO"** from UR.
2. Select **"Insert PROFINET IO System"**.

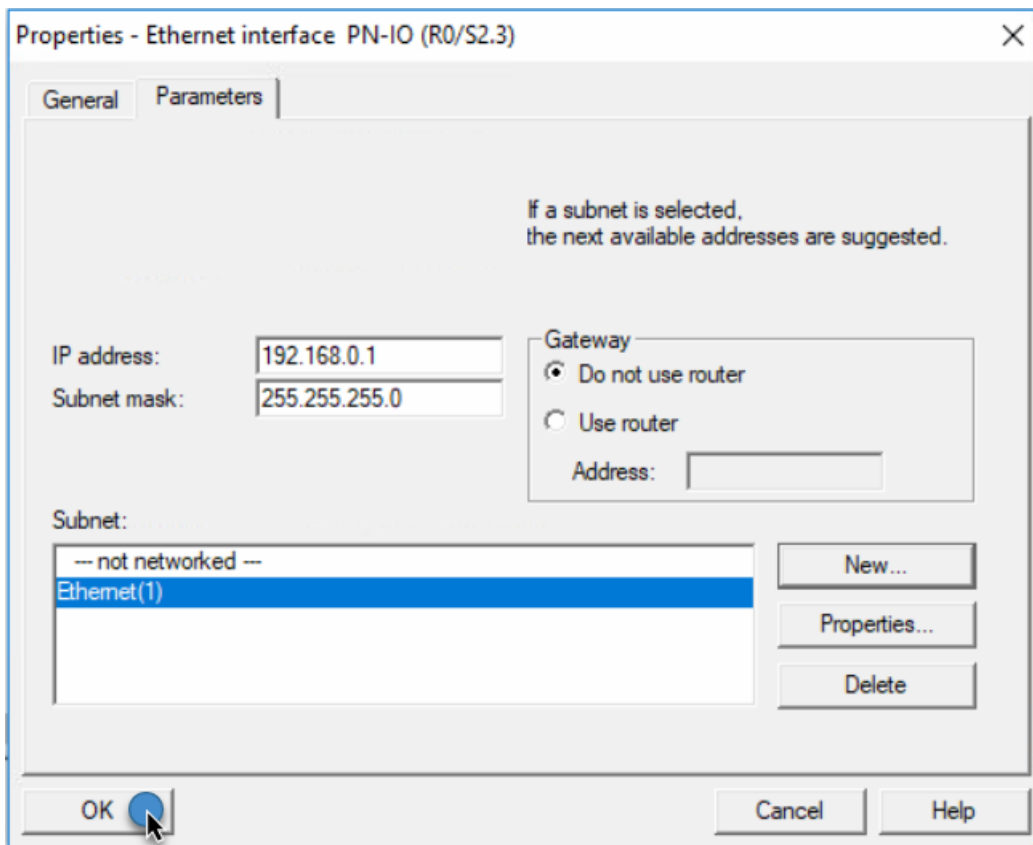
Step 2

- Click **“New”** to add new network in **Subnet**.

Step 3

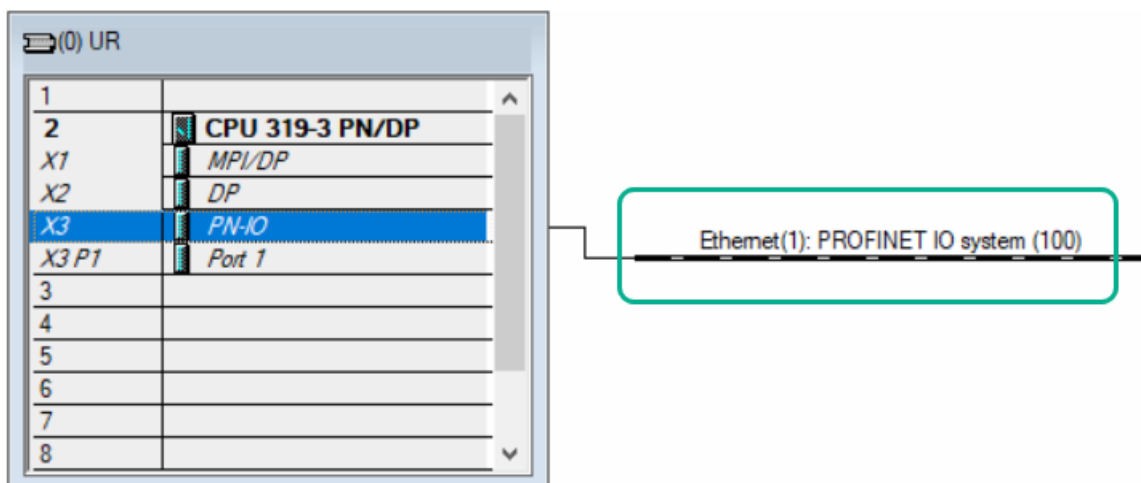
- Click **“OK”** to confirm the **Name & S7 Subnet ID** of network.

Step 4



- After confirming the network click OK.

Step 5



- Added Profinet IO System will appear like above.

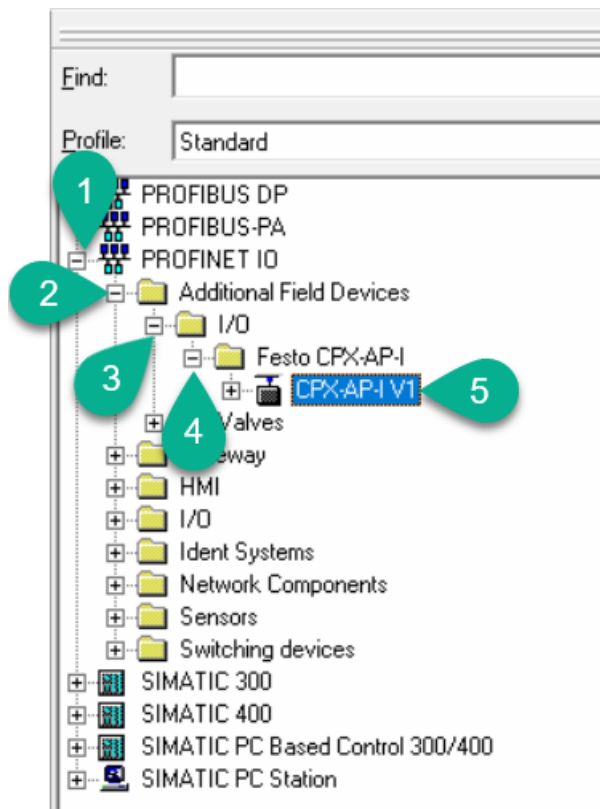
2.5 Adding CPX-AP-I-PN Module to Network



Note

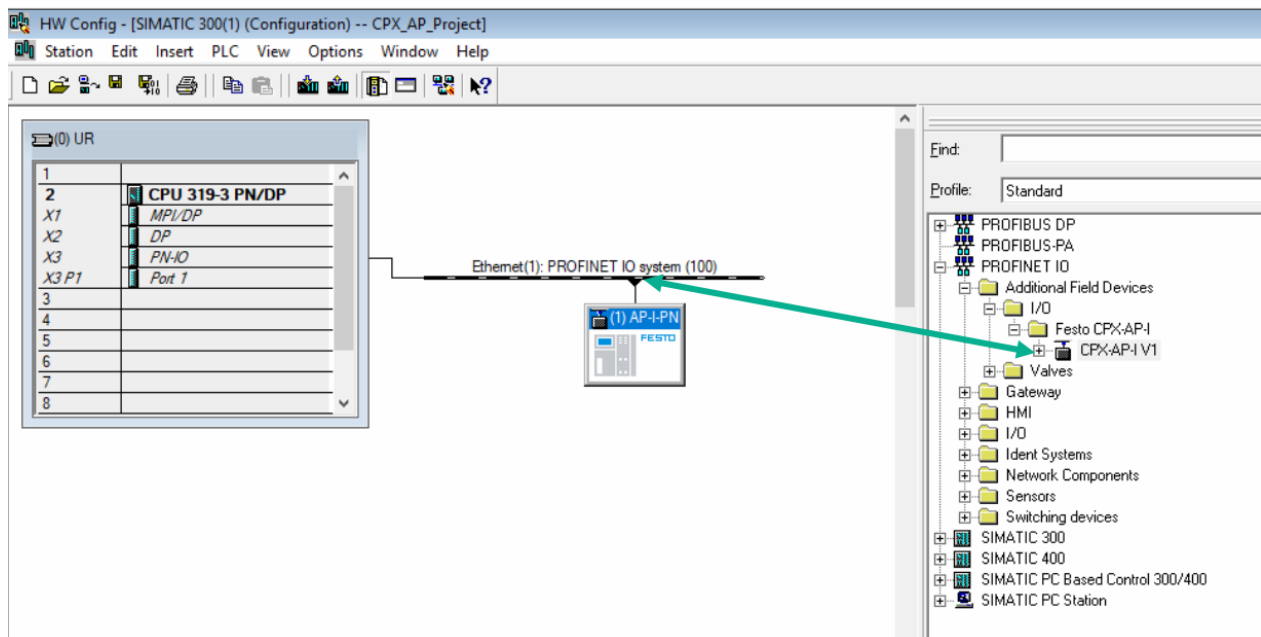
- Skip to CPX-AP-A-PN Configuration [Chapter 2.6](#) if user is not using the CPX-AP-I-PN Module.

Step 1



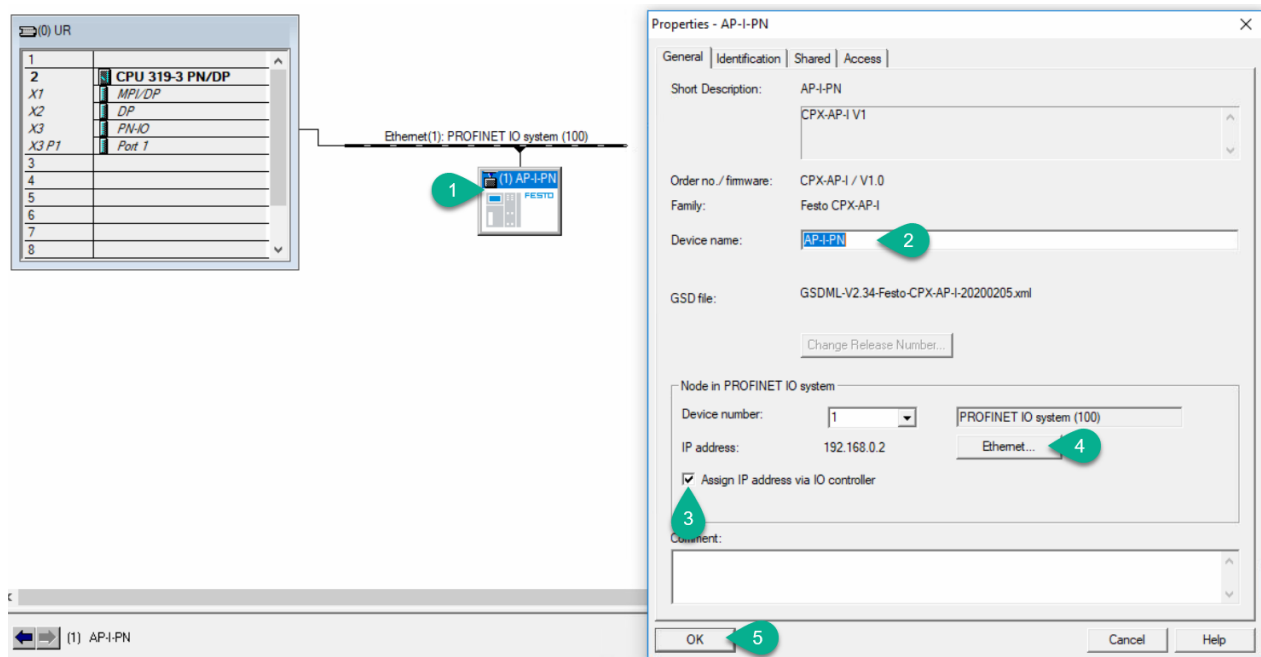
1. Debranch the **PROFINET IO**.
2. Debranch **Additional Field devices**.
3. Debranch **I/O**.
4. Debranch **Festo CPX-AP-I**.
5. Select **CPX-AP-I V1**.

Step 2



- Drag and Drop the **CPX-AP-I V1** to the **Ethernet(1): PROFINET IO System**.

Step 3



1. Double Click on **AP-I-PN**.
2. Enter the Device Name as required.
3. Make sure **“Assign IP address via IO controller”** box is checked.
4. User want to change the IP address of the CPX-AP-I-PN, then user can click **Ethernet** button to change the IP address.
5. Click **OK**.

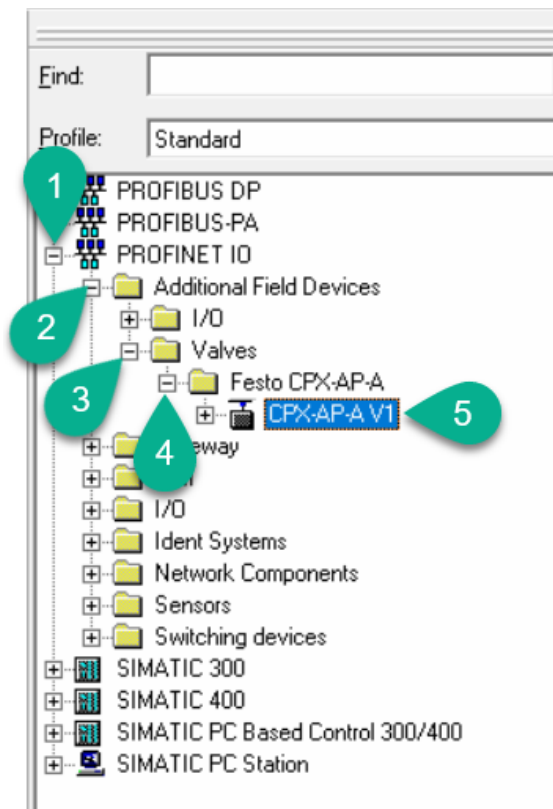
2.6 Adding CPX-AP-A-PN Module to Network



Note

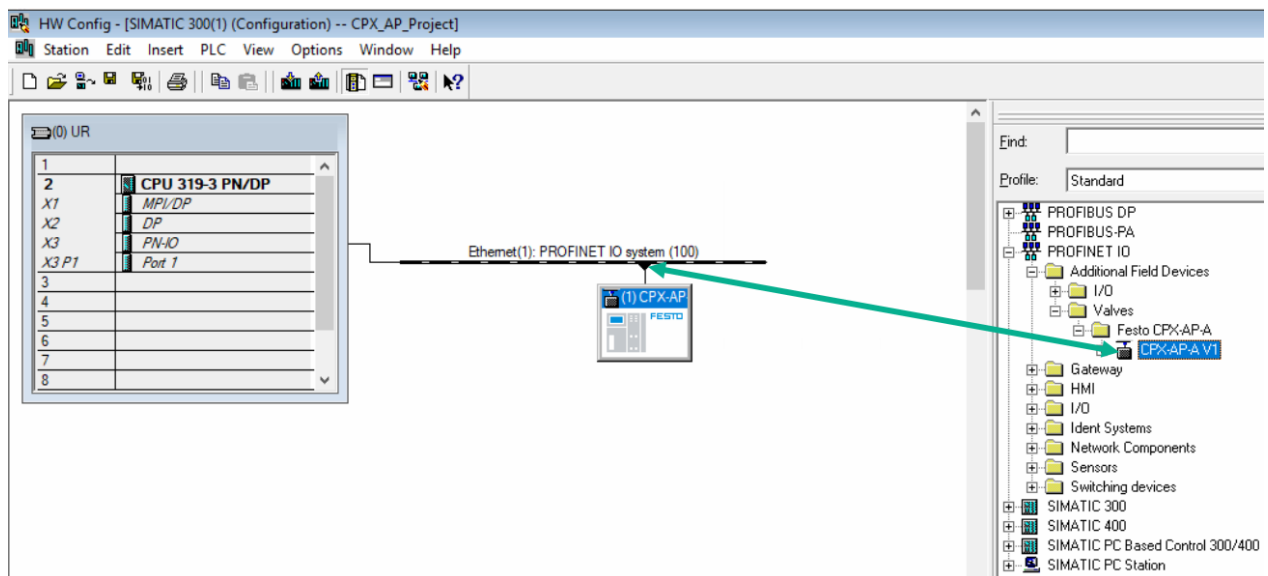
- Skip this Chapter if user is not using the CPX-AP-A-PN Module.

Step 1



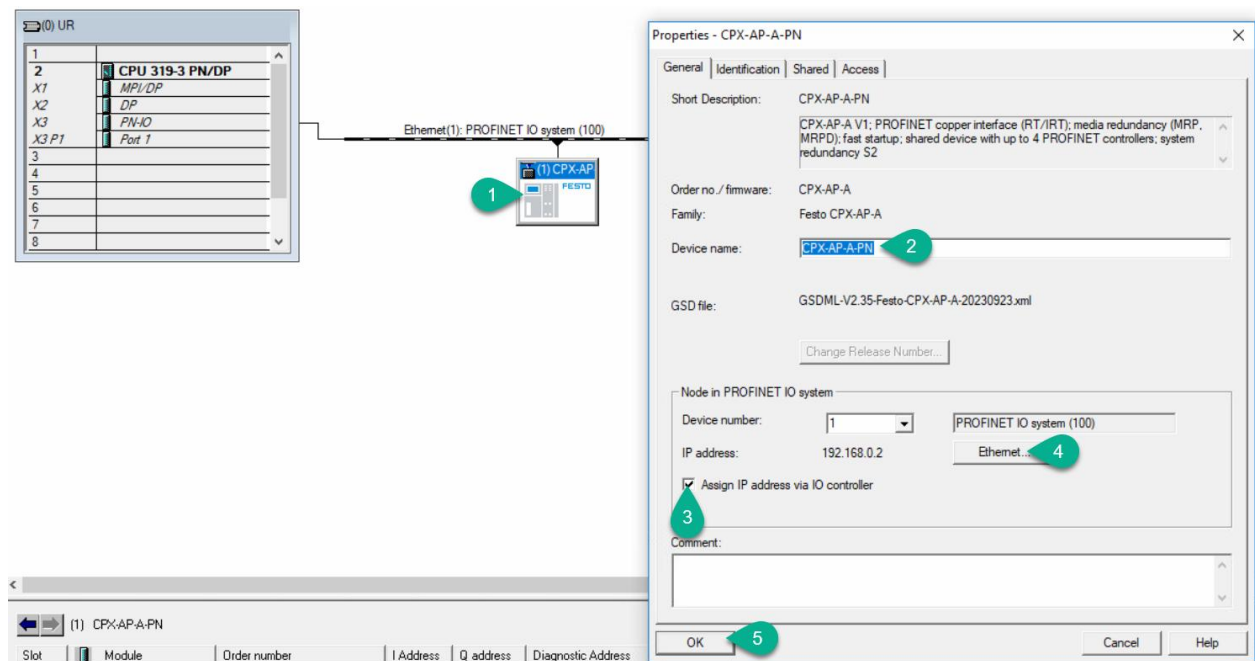
1. Debranch the **PROFINET IO**.
2. Debranch **Additional Field devices**.
3. Debranch **I/O**.
4. Debranch **Festo CPX-AP-A**.
5. Select **CPX-AP-A V1**.

Step 2



- Drag and Drop the **CPX-AP-A V1** to the **Ethernet(1): PROFINET IO System**.

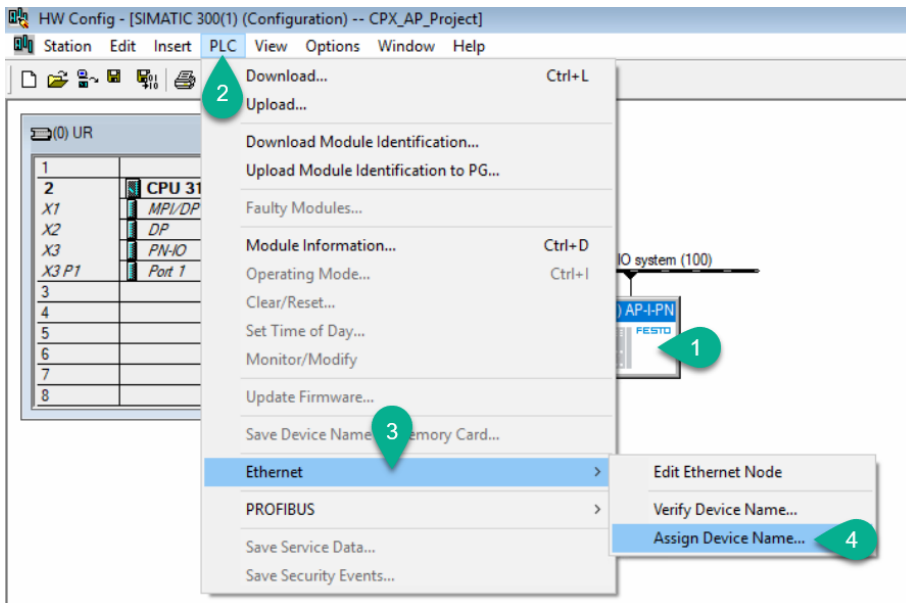
Step 3



1. Double Click on **CPX-AP**.
2. Enter the Device Name as required.
3. Make sure **“Assign IP address via IO controller”** box is checked.
4. User want to change the IP address of the CPX-AP-A-PN, then user can click **Ethernet** button to change the IP address.
5. Click **OK**.

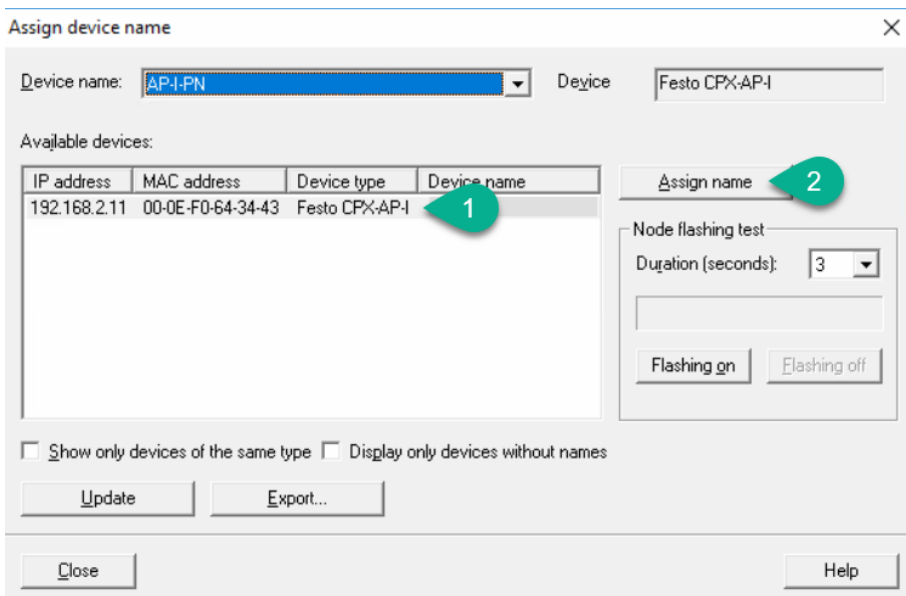
2.7 Assigning Profinet Name to CPX-AP-I-PN Module

Step 1



1. Click on **AP-I-PN**.
2. Select **"PLC"** from toolbar.
3. Select **"Ethernet"** option.
4. From **Ethernet** select **"Assign Device Name"** option.

Step 2



1. Select the required module from **"Available Devices"** list on **Assign Device Name** window.
2. Select **"Assign Name"** option.

Step 3

Assign device name

Device name: Device:

Available devices:

IP address	MAC address	Device type	Device name
192.168.2.11	00-0E-F0-64-34-43	Festo CPX-AP-I	ap-i-pn

Node flashing test
Duration (seconds):

☐ Show only devices of the same type ☐ Display only devices without names

- Once device name assigned successful it will be appear at **Device Name** column. Then click **“Close”** button to finish the **Assign Device Name**.

**Note**

- Repeat the same procedure to assign the name for **CPX-AP-A-PN** device.

2.8 Configuring CPX-AP-I Device in Simatic Manager

This chapter will describe about configuring CPX-AP-I devices to SIMATIC Manager.

Step 1

The screenshot shows the SIMATIC Manager HW Config interface. The main window displays a rack configuration with a CPU 319-3 PN/DP and a CPX-AP-I V1 module. A network diagram shows the connection to a PROFINET IO system. The right-hand pane shows the hardware catalog with the CPX-AP-I V1 module selected, and the bottom pane shows the module list with the CPX-AP-I V1 module highlighted.

Slot	Module	Order number	I Address	Q address	Diagnostic Address	Comment	Access
0	AP-I PN	CPX-AP-I			8186*		Full
X1	PN-I/O Interface				8185*		Full
X1 P1	Port 1				8184*		Full
X1 P2	Port 2				8183*		Full
1	CPX-AP-I PN-M12	6ES7 660-0*			8182*		Full
2							
3							
4							
5							

1. Debranch the **CPX-AP-I V1**.
2. Debranch **AP-I technology modules**.
3. Drag and drop **CPX-AP-I-4IOL-M12** module. For this application note demonstration **CPX-AP-I-PN** topology overview example is used. IO-Link Module has been drag and dropped to the slot position as per the topology over view. This may change according to User network.

Step 2

The screenshot shows the HW Config software interface for a SIMATIC 300(1) system. The main window displays a rack configuration with a CPU 319-3 PN/DP and various modules. A diagram shows the system connected to an Ethernet(1) PROFINET IO system (100). The right-hand pane shows a tree view of available modules, with 'IO-Link In/Out 2/2 Byte + PQI' selected. The bottom pane shows a table of installed modules, including 'CPX-AP-I-4IOL-M12' and 'IO-Link generic Devices'.

Slot	Module	Order number	I Address	Q address	Diagnostic Address	Comment	Access
1	Port 2	8086807			8183*		Full
2	CPX-AP-I-4IOL-M12	8086804			8181*		Full
2.1	CPX-AP-I-4IOL-M12	8086804			8181*		Full
Port 1							
Port 2							
Port 3							
Port 4							
3							

1. Debranch **CPX-AP-I-4IOL-M12**.
2. Debranch **IO-Link generic Devices**.
3. Drag and Drop the **IO-Link In/Out 2/2 Bytes + PQI**. In this demonstration Simplified Motion Series IO-Link Device has been used, So 2Byte In/Out Option is selected.

Step 3

HW Config - [SIMATIC 300(1) (Configuration) -- CPX_AP_Project]

Station Edit Insert PLC View Options Window Help

Find:
 Profile: Standard

PROFIBUS DP
PROFIBUS-PA
PROFINET IO
Additional Field Devices
I/O
Festo CPX-AP-I V1
AP-I analog modules
AP-I digital modules
AP-I pneumatic MPA-L
AP-I pneumatic VTUG
AP-I technology modules
CPX-AP-I-4IOL-M12
IO-Link digital I/O
Digital Input
IO-Link generic Devices
IO-Link In/Out: 2/ 2 Byte + PQI
IO-Link In/Out: 4/ 4 Byte + PQI
IO-Link In/Out: 8/ 8 Byte + PQI
IO-Link In/Out: 16/16 Byte + PQI
IO-Link In/Out: 32/32 Byte + PQI
Port deactivated
Valves
Gateways
I/M
I/O
Ident Systems
Network Components
Sensors
Switching devices
SIMATIC 300
SIMATIC 400
SIMATIC PC Based Control 300/400
SIMATIC PC Station

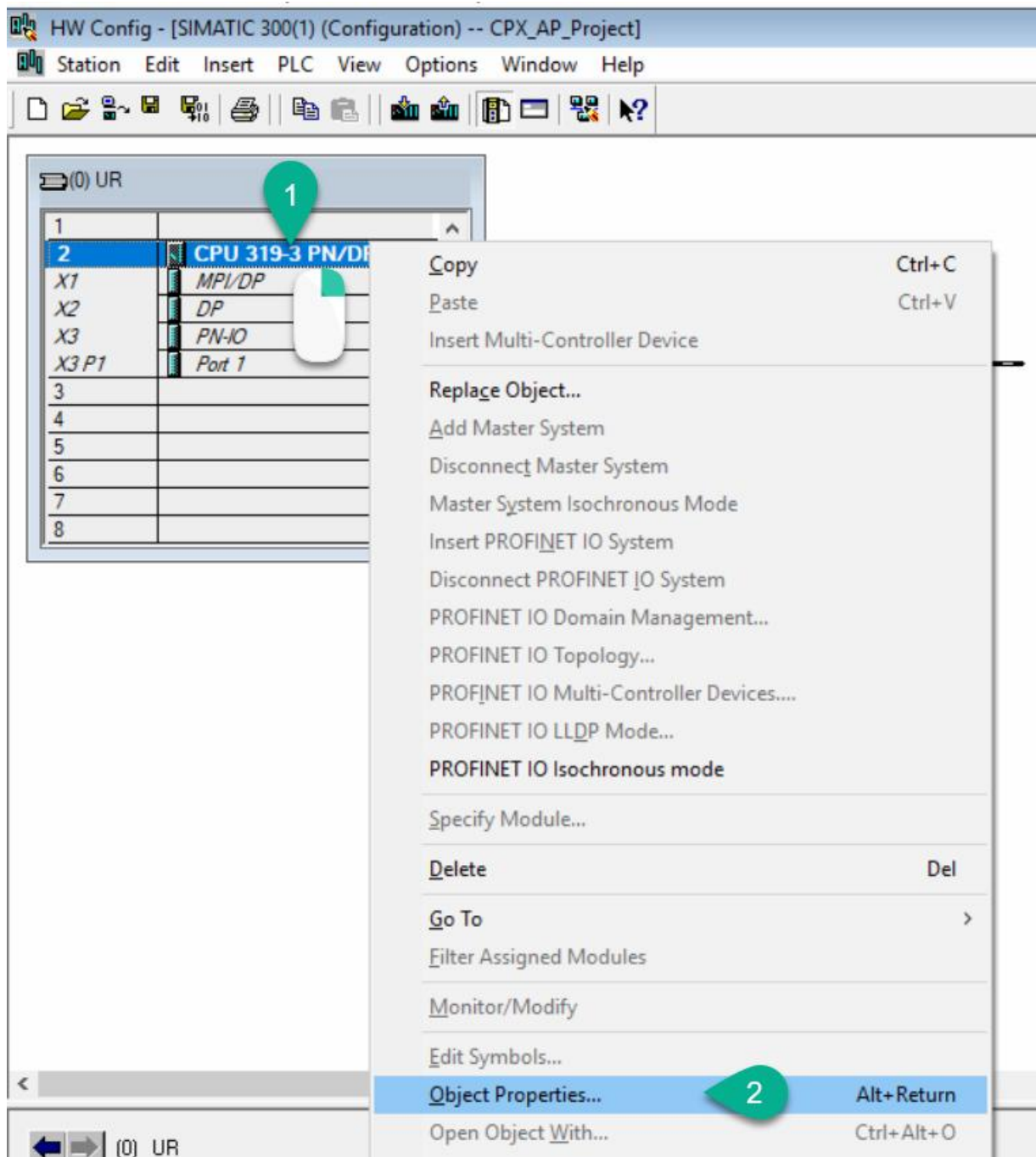
Port deactivated
Port deactivated
GSDML-V2.34-Festo-CPX-AP-I-20200205.xml

Slot	Module	Order number	I Address	Q address	Diagnostic Address	Comment	Access
X1	PN-I/O Interface				8183*		Full
X1 R	Port 1				8184*		Full
X2 R	Port 2				8185*		Full
1	CPX-AP-I-PN-M12	8086601*			8182**		Full
2	CPX-AP-I-4IOL-M12	8086604			8181*		Full
2.1	CPX-AP-I-4IOL-M12	8086604			8181*		Full
Port 1	IO-Link In/Out: 2/ 2 Byte + PQI		256...258	256...257			Full
Port 2	Port deactivated	Port deactivated			8180*		Full
Port 3	Port deactivated	Port deactivated			8179*		Full
Port 4	Port deactivated	Port deactivated			8178*		Full

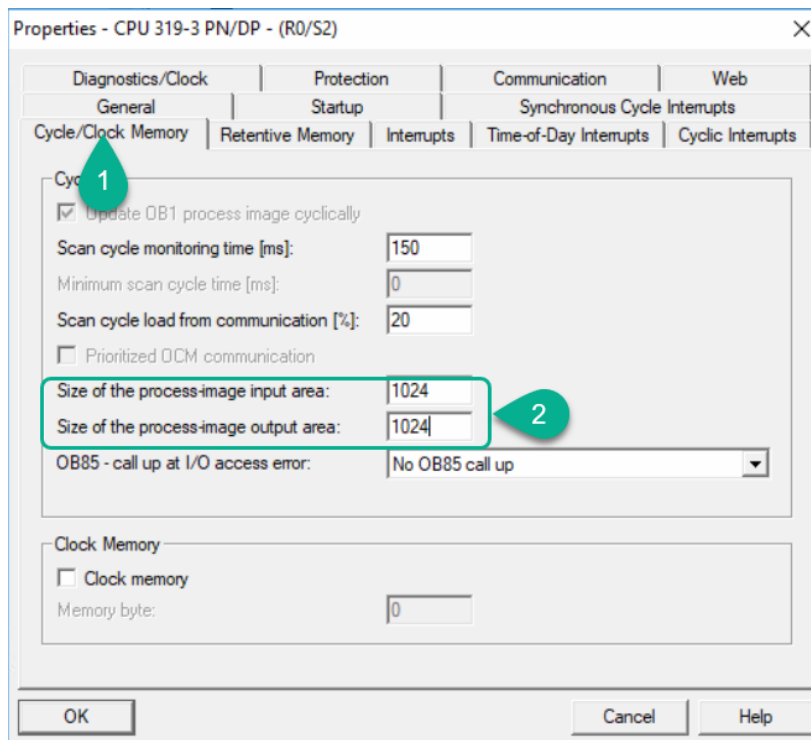
- Drag & drop **“Port Deactivated”** telegram to deactivate the **Port 2 to Port 4**.

**Note**

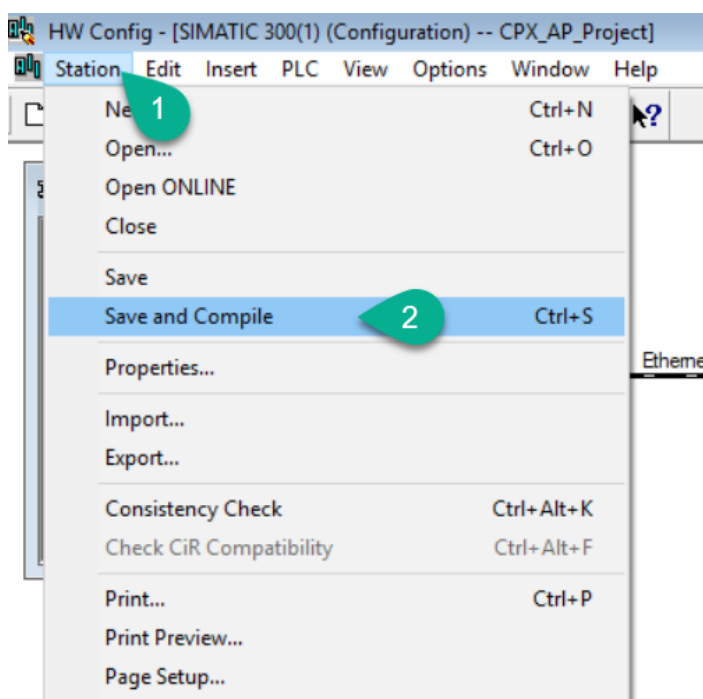
- If there is no devices connected to the CPX-AP-I-4IOL-M12 master module's port, it is recommended to deactivate the unused ports.

Step 4

1. Right click on the CPU.
2. Select **Object Properties**.

Step 5

1. Go to **“Cycle/Clock Memory”** tab on **Properties** window.
2. Make sure Input & Output area size is greater than Profinet device sizes.

Step 6

1. Select **“Station”**.
2. Click **“Save and Compile”** or use shortcut **“CTRL+S”** or simply use **Save and Compile** icon from toolbar to save & compile the project.

2.9 Configuring CPX-AP-A Device in Simatic Manager

This chapter will describe about configuring CPX-AP-A devices to SIMATIC Manager.

Step 1

HW Config - [SIMATIC 300(1) (Configuration) -- CPX_AP_Project]

Station Edit Insert PLC View Options Window Help

(0) UR

1	
2	CPU 319-3 PN/DP
X1	MPI/DP
X2	DP
X3	PN-IO
X3 P1	Port 1
3	
4	
5	
6	
7	
8	

Ethernet(1): PROFINET IO system (100)

(1) CPX-AP

Find:

Profile: Standard

PROFIBUS DP
PROFIBUS-PA
PROFINET IO

Additional Field Devices

I/O

Valves

Festo CPX-AP-A

CPX-AP-A V1

Analog Modules

Digital Modules

CPX-AP-A-12DI4DO-M12-5P
CPX-AP-A-12DI4DO-M12-4P
CPX-AP-A-12DI4DO-PI
CPX-AP-A-16DI-M12-5P
CPX-AP-A-8DI-M12-5P
CPX-AP-A-8DI-M8-3P
CPX-AP-A-8DI-PI
CPX-AP-A-8DO-M12-5P
CPX-AP-A-8DO-M8-3P
CPX-AP-A-8DO-PI
CPX-AP-I-4DI-M8-3P
CPX-AP-I-4DI4DO-M12-5P
CPX-AP-I-4DI4DO-M8-3P
CPX-AP-I-8DI-M12-5P
CPX-AP-I-8DI-M8-3P

Interface Modules

IO-Link Master Modules

CPX-AP-A-4IOL-M12

IO-Link digital IO

IO-Link generic Devices

CPX-AP-I-4IOL-M12

Pneumatics MPA-L

Pneumatics VTSA

Pneumatics VTUG

Pneumatics VTUX

Gateway

HMI

I/O

Ident Systems

Network Components

Sensors

Switching devices

8129114
Festo
IO-Link Master with 4 ports class B. Maximum load current 1,5A
GSDML V1.2.35 Festo CPX-AP-A-10230933.ind1

(1) CPX-AP-A-PN

Slot	Module	Order number	I Address	Q address	D...	C...	A...
1	CPX-AP-A-12DI4DO-PI	8129108	0...1	0	8183		Full
2	CPX-AP-A-12DI4DO-PI	8129108	2...3	1			Full
3	CPX-AP-A-12DI4DO-PI	8129108	4...5	2			Full
4	CPX-AP-A-12DI4DO-PI	8129108	6...7	3			Full
5							
6							
7							
8							
9							
10							

1. Debranch the **CPX-AP-A V1**.
2. Debranch **Digital Modules**.
3. As per the Topology Overview mentioned in the [chapter-1.3.2](#), 4 number of CPX-AP-A-12DI4DO has added to the network.
4. Debranch **IO-Link Master Modules**
5. Drag and drop **CPX-AP-A-4IOL-M12** module. For this application note demonstration **CPX-AP-A-PN** topology overview example is used. IO-Link Module has been drag and dropped to the slot position as per the topology over view. This may change according to User network.

Step 2

HW Config - [SIMATIC 300(1) (Configuration) -- CPX_AP_Project]

Station Edit Insert PLC View Options Window Help

Find:
 Profile: Standard

Additional Field Devices

- I/O
- Valves
- Festo CPX-AP-A
 - CPX-AP-A V1
 - Analog Modules
 - Digital Modules
 - CPX-AP-A-12DI4DO-M12-5P
 - CPX-AP-A-12DI4DO-M8-4P
 - CPX-AP-A-12DI4DO-PI
 - CPX-AP-A-16DI-M12-5P
 - CPX-AP-A-8DI-M12-5P
 - CPX-AP-A-8DI-M8-3P
 - CPX-AP-A-8DI-PI
 - CPX-AP-A-8DO-M12-5P
 - CPX-AP-A-8DO-M8-3P
 - CPX-AP-A-8DO-PI
 - CPX-AP-I-4DI-M8-3P
 - CPX-AP-I-4DI4DO-M12-5P
 - CPX-AP-I-4DI4DO-M8-3P
 - CPX-AP-I-8DI-M12-5P
 - CPX-AP-I-8DI-M8-3P
 - Interface Modules
 - IO-Link Master Modules
 - CPX-AP-A-4IOL-M12
 - IO-Link digital IO
 - IO-Link generic Devices
 - IO-Link In/Out 0/ 16 Byte + PQI
 - IO-Link In/Out 0/ 2 Byte + PQI
 - IO-Link In/Out 0/ 4 Byte + PQI
 - IO-Link In/Out 0/ 8 Byte + PQI
 - IO-Link In/Out 16/ 0 Byte + PQI
 - IO-Link In/Out 2/ 0 Byte + PQI
 - IO-Link In/Out 2/ 2 Byte + PQI**
 - IO-Link In/Out 4/ 0 Byte + PQI
 - IO-Link In/Out 4/ 4 Byte + PQI
 - IO-Link In/Out 8/ 0 Byte + PQI
 - IO-Link In/Out 8/ 8 Byte + PQI
 - IO-Link In/Out 16/16 Byte + PQI
 - IO-Link In/Out 32/32 Byte + PQI
 - Port deactivated

UR

1	
2	CPU 319-3 PN/DP
X1	MPI/DP
X2	DP
X3	PN-IO
X3 P1	Port 1
3	
4	
5	
6	
7	
8	

Ethernet(1): PROFINET IO system (100)

(1) CPX-AP

(1) CPX-AP-A-PN

Slot	Module	Order number	I Address	Q address	D...	C...	A...
4	CPX-AP-A-12DI4DO-PI	8129108	6...7	3			Full
5	CPX-AP-A-4IOL-M12	8129114			8182		Full
5.1	CPX-AP-A-4IOL-M12	8129114			8182		Full
Port 1							
Port 2							
Port 3							
Port 4							

1. Debranch **CPX-AP-A-4IOL-M12**.
2. Debranch **IO-Link generic Devices**.
3. Drag and Drop the **IO-Link In/Out 2/2 Bytes + PQI**. In this demonstration Simplified Motion Series IO-Link Device has been used, So 2Byte In/Out Option is selected.

Step 3

HW Config - [SIMATIC 300(1) (Configuration) -- CPX_AP_Project]

Station Edit Insert PLC View Options Window Help

Find:
 Profile: Standard

Additional Field Devices
I/O
Valves
Festo CPX-AP-A
CPX-AP-A V1
Analog Modules
Digital Modules
CPX-AP-A-12DI4DO-M12-5P
CPX-AP-A-12DI4DO-M8-4P
CPX-AP-A-12DI4DO-PI
CPX-AP-A-16DI-D-M12-5P
CPX-AP-A-8DI-M12-5P
CPX-AP-A-8DI-M8-3P
CPX-AP-A-8DI-PI
CPX-AP-A-8DO-M12-5P
CPX-AP-A-8DO-M8-3P
CPX-AP-A-8DO-PI
CPX-AP-I-4DI-M8-3P
CPX-AP-I-4DI4DO-M12-5P
CPX-AP-I-4DI4DO-M8-3P
CPX-AP-I-8DI-M12-5P
CPX-AP-I-8DI-M8-3P

Interface Modules
IO-Link Master Modules
CPX-AP-A-4IOL-M12
IO-Link digital IO
IO-Link generic Devices
IO-Link In/Out 0/ 16 Byte + PQI
IO-Link In/Out 0/ 2 Byte + PQI
IO-Link In/Out 0/ 4 Byte + PQI
IO-Link In/Out 0/ 8 Byte + PQI
IO-Link In/Out 16/ 0 Byte + PQI
IO-Link In/Out 2/ 0 Byte + PQI
IO-Link In/Out 2/ 2 Byte + PQI
IO-Link In/Out 4/ 0 Byte + PQI
IO-Link In/Out 4/ 4 Byte + PQI
IO-Link In/Out 8/ 0 Byte + PQI
IO-Link In/Out 8/ 8 Byte + PQI
IO-Link In/Out 16/16 Byte + PQI
IO-Link In/Out 32/32 Byte + PQI
Port deactivated

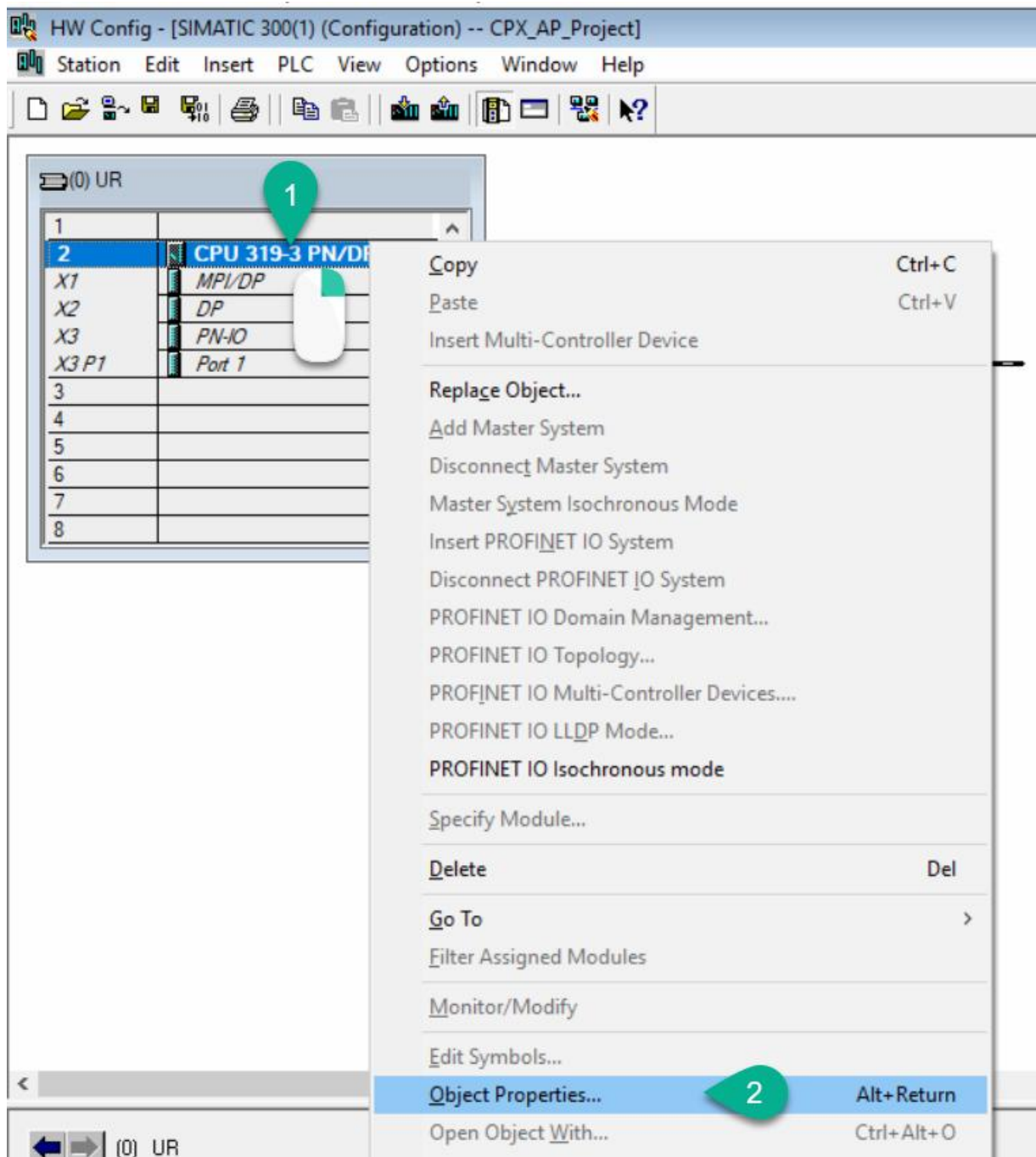
(1) CPX-AP-A-PN

Slot	Module	Order number	I Address	Q address	D...	C...	A...
4	CPX-AP-A-12DI4DO-PI	8129108	6...7	3			Full
5	CPX-AP-A-4IOL-M12	8129114			8182		
5.1	CPX-AP-A-4IOL-M12	8129114			8182		Full
Port 1	IO-Link In/Out 2/ 2 Byte		256...258	256...257			Full
Port 2	Port deactivated	Port deactivated			8181		Full
Port 3	Port deactivated	Port deactivated			8180		Full
Port 4	Port deactivated	Port deactivated			8179		Full

- Drag & drop **“Port Deactivated”** telegram to deactivate the **Port 2 to Port 4**.

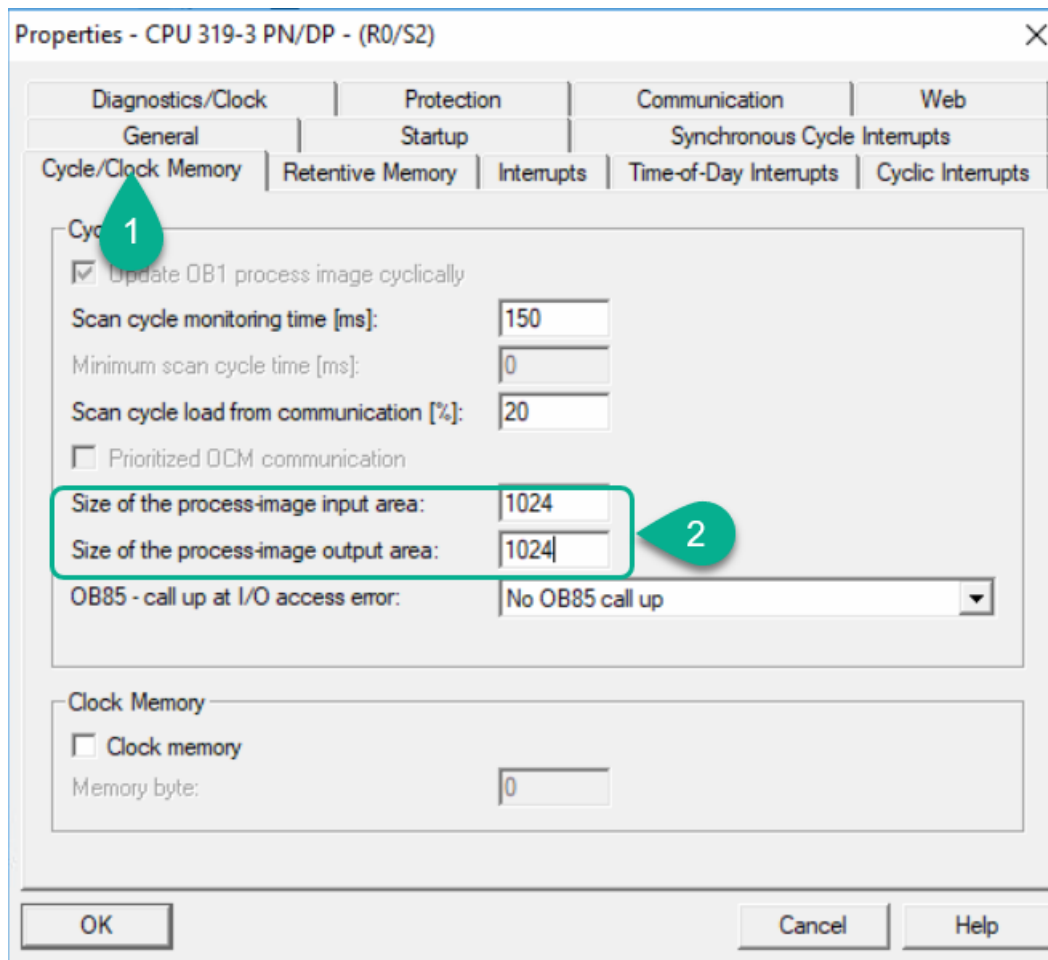
**Note**

- If there is no devices connected to the CPX-AP-A-4IOL-M12 master module's port, it is recommended to deactivate the unused ports.

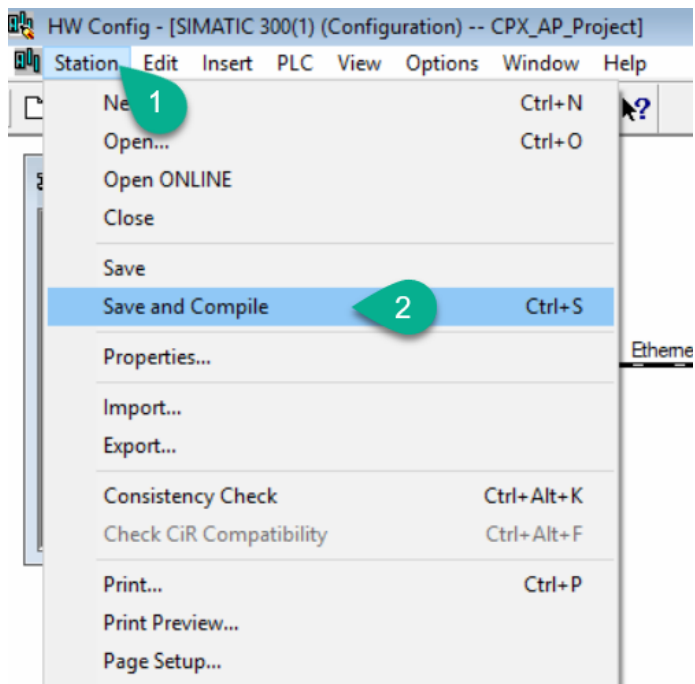
Step 4

1. Right click on the CPU.
2. Select **Object Properties**.

Step 5



1. Go to **“Cycle/Clock Memory”** tab on **Properties** window.
2. Make sure Input & Output area size is greater than Profinet device sizes.

Step 6

1. Select **“Station”**.
2. Click **“Save and Compile”** or use shortcut **“CTRL+S”** or simply use **Save and Compile** icon from toolbar to save & compile the project.

2.10 Determining Hardware ID of CPX-AP-I-PN and CPX-AP-I-4IOL-M12 IO Link Module

HW Config - [SIMATIC 300(1) (Configuration) -- CPX_AP_Project]

Station Edit Insert PLC View Options Window Help

(0) UR

1	
2	CPU 319-3 PN/DP
X1	MPI/DP
X2	DP
X3	PN-IO
X3 P1	Port 1
3	
4	
5	
6	
7	
8	

Ethernet(1): PROFINET IO system (100)

(1) AP-I-PN

(1) AP-I-PN

Slot	Module	Order number	I Address	Q address	Diagnostic Address	Comment	Access
0	AP-I-PN	CPX-AP-I			8186*		Full
X1	PN-IO Interface				8185*		Full
X1 P1	Port 1				8184*		Full
X1 P2	Port 2				8183*		Full
1	CPX-AP-I-PN-M12	8086607			8182*		Full
2	CPX-AP-I-4IOL-M12	8086604			8181*		Full
2.1	CPX-AP-I-4IOL-M12	8086604			8181*		Full
Port 1	IO-Link In/Out 2/ 2 By~		256...258	256...257			Full
Port 2	Port deactivated	Port deactivated			8180*		Full
Port 3	Port deactivated	Port deactivated			8179*		Full
Port 4	Port deactivated	Port deactivated			8178*		Full
3							

1. Select **AP-I-PN** Module.
2. Hardware ID for CPX-AP-I-PN is found in **Diagnostic Address** of **AP-I-PN** in Slot "0".
3. Hardware ID for CPX-AP-I-4IOL-M12 is found in **Diagnostic Address** of **CPX-AP-I-4IOL-M12** in Slot "2".

2.11 Determining Hardware ID of CPX-AP-A-PN and CPX-AP-A-4IOL-M12 IO Link Module

HW Config - [SIMATIC 300(1) (Configuration) -- CPX_AP_Project]

Station Edit Insert PLC View Options Window Help

(0) UR

1	
2	CPU 319-3 PN/DP
X1	MPI/DP
X2	DP
X3	PN-IO
X3 P1	Port 1
3	
4	
5	
6	
7	
8	

Ethernet(1): PROFINET IO system (100)

(1) CPX-AP-A-PN

Slot	Module	Order number	I Address	Q address	Diagnostic	C...	Access
0	CPX-AP-A-PN	CPX-APA			8186*		Full
X1	PN-IO Interface				8185*		Full
X1 R	Port 1				8184*		Full
X2 R	Port 2				8183*		Full
1	CPX-AP-A-12DI4DO-PI	8129108	0...1	0			Full
2	CPX-AP-A-12DI4DO-PI	8129108	2...3	1			Full
3	CPX-AP-A-12DI4DO-PI	8129108	4...5	2			Full
4	CPX-AP-A-12DI4DO-PI	8129108	6...7	3			Full
5	CPX-AP-A-4IOL-M12	8129114			8182*		Full
5.1	CPX-AP-A-4IOL-M12	8129114			8182*		Full
Port 1	IO-Link In/Out 2/ 2 By~		256...258	256...257			Full
Port 2	Port deactivated	Port deactivated			8181*		Full

1. Select **AP-A-PN** Module.
2. Hardware ID for CPX-AP-A-PN is found in **Diagnostic Address** of **AP-A-PN** in Slot "0".
3. Hardware ID for CPX-AP-A-4IOL-M12 is found in **Diagnostic Address** of **CPX-AP-A-4IOL-M12** in Slot "5".

2.12 Adding “CPX-AP_Festo_Lib” Library to Simatic Manager

This chapter will describe about importing the **CPX-AP_Festo_Lib** library file inside the PLC program.

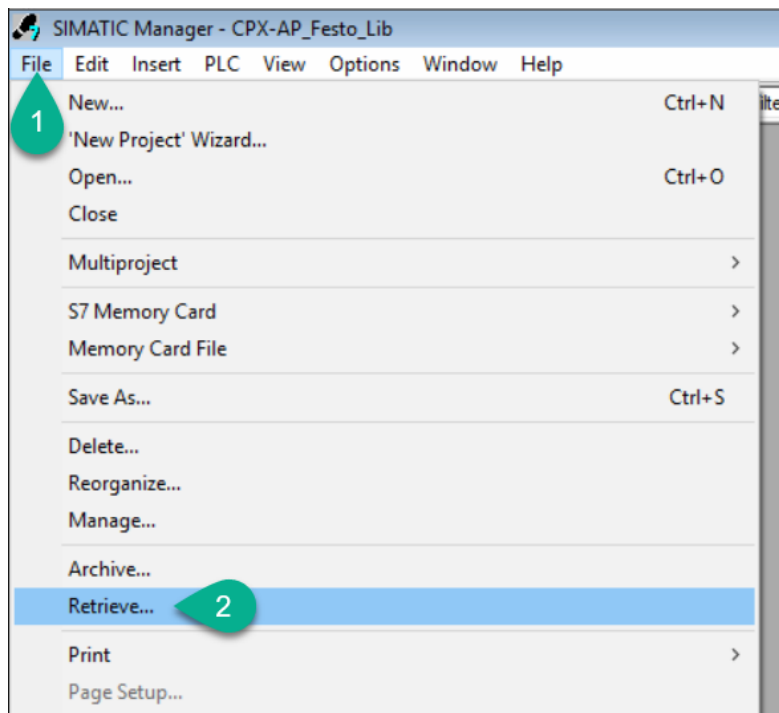
Step 1

1. Download the **CPX-AP_Festo_Lib** library file from the Festo Support Portal and save it in an appropriate folder in your PC.

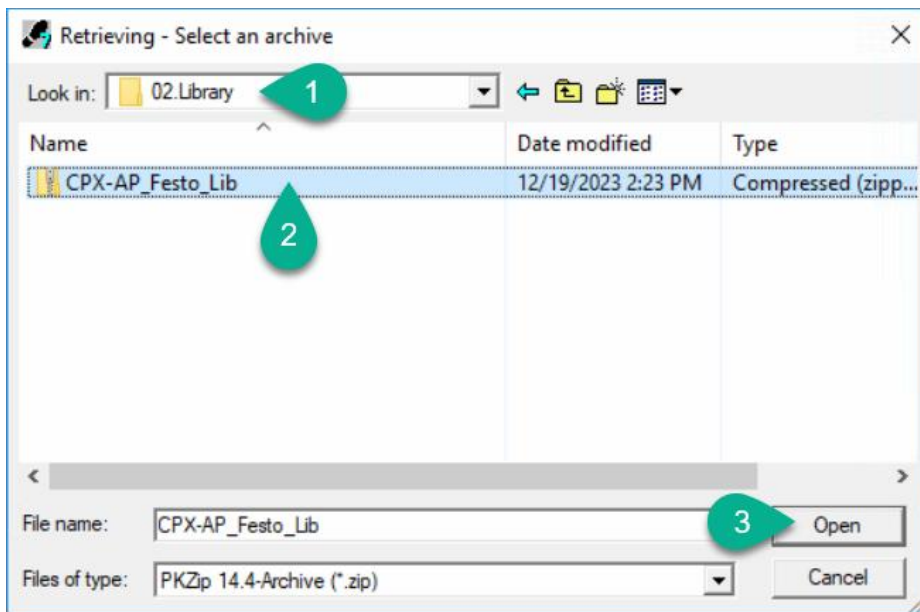
Step 2

- Open **SIMATIC Manager** software as shown in [Chapter 2.1 Step 1](#).

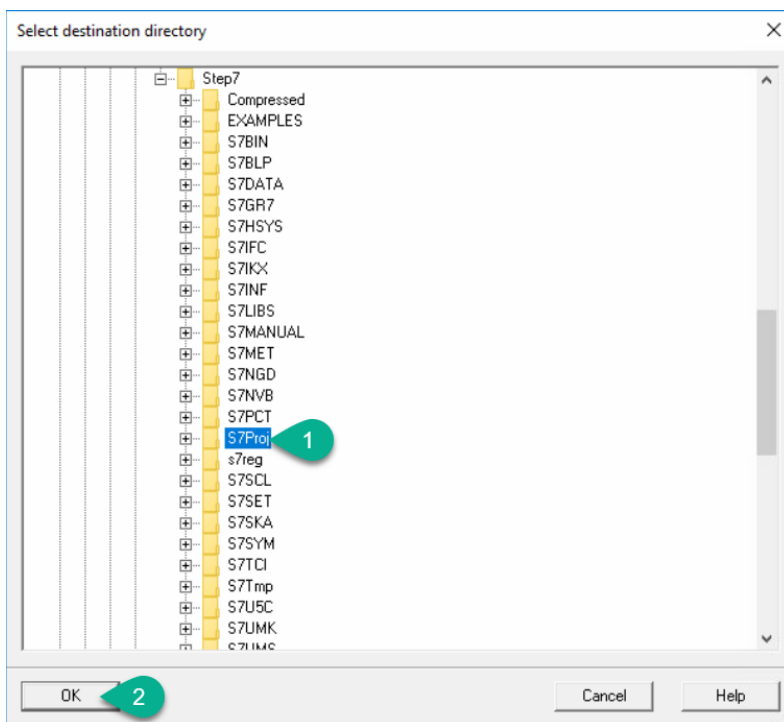
Step 3



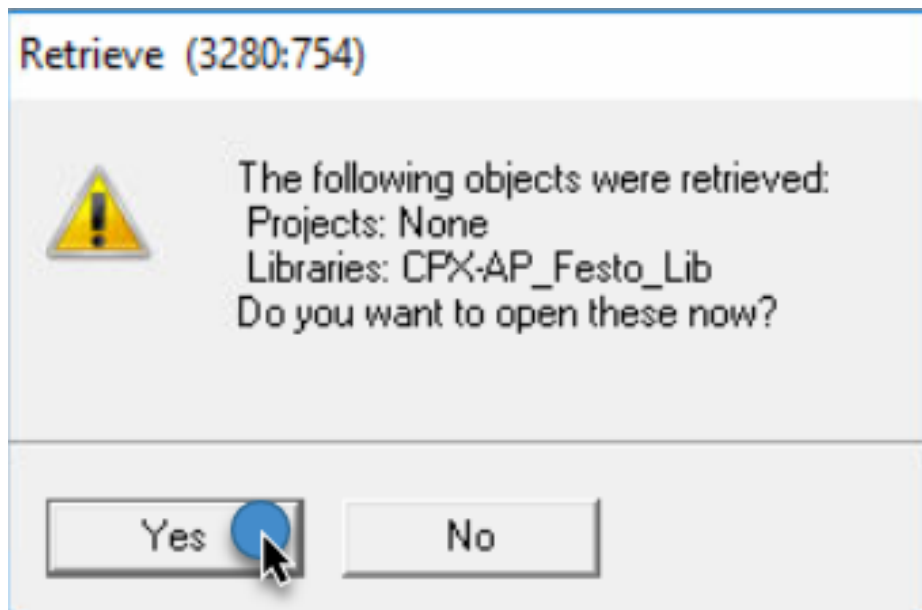
1. Select “**File**”.
2. Click “**Retrieve**”.

Step 4

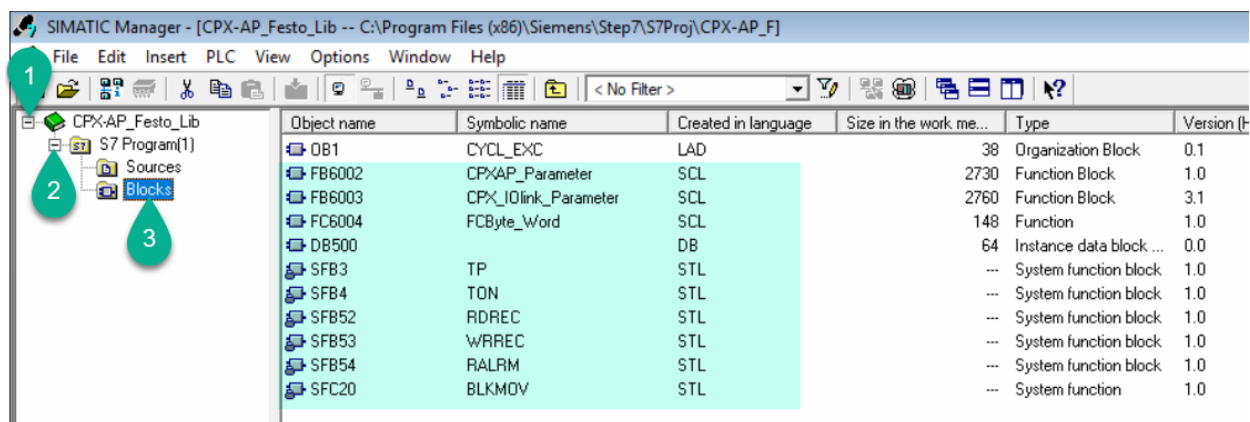
1. Browse the Path of the Library.
2. Select the Library Archive file.
3. Click **Open**.

Step 5

1. Select the Path where the User wants to Save the Retrieve Library file.
2. Click **“OK”**.

Step 6

- Click **Yes** to Open the Library.

Step 7

1. Debranch the **CPX-AP_Festo_Lib**.
2. Debranch the **S7 Program(1)**.
3. Click on **Blocks** to view the functional blocks in the Library

- Highlighted Functional blocks are required to do the Parameter Read/Write, IO-Link Parameter Read/Write and Diagnosis the Error of the CPX Device.
- User need to Copy paste the Highlighted FB's and SFB's to their Project.

The library has following blocks & supporting functions, system blocks.

Function Blocks

1. **CPXAP_Parameter** block is used to read / write the Parameter data of CPX-AP Devices.
2. **CPX_IOLink_Parameter** block is used to read / write the data of IO-Link device.
3. **RALRM** block used to Read the Diagnostic data of the Module.

Supporting System Blocks

1. TP
2. TON
3. RDREC
4. WRREC
5. BLKMOV

Step 8

Object name	Symbolic name	Created in language	Size in the s
System data	---	---	
OB1		STL	
OB80	CYCL_FLT	LAD	
OB82	I/O_FLT1	LAD	
OB83	I/O_FLT2	LAD	
OB85	OBNL_FLT	LAD	
OB86	RACK_FLT	LAD	
OB87	COMM_FLT	LAD	
OB121	PROG_ERR	LAD	
OB122	MOD_ERR	LAD	
FB6002	CPXAP_Parameter	SCL	
FB6003	CPX_IOlink_Parameter	SCL	
FC6004	FCByte_Word	SCL	
DB500		DB	
SFB3	TP	STL	
SFB4	TON	STL	
SFB52	RDREC	STL	
SFB53	WRREC	STL	
SFB54	RALRM	STL	
SFC20	BLKMOV	STL	

- **Copy & Paste** all the blocks available from “**CPX-AP_Festo_Lib**” library to the project which is highlighted in Green.
- Create all the Required **OB’s** which highlighted in Orange in the above image in User project.



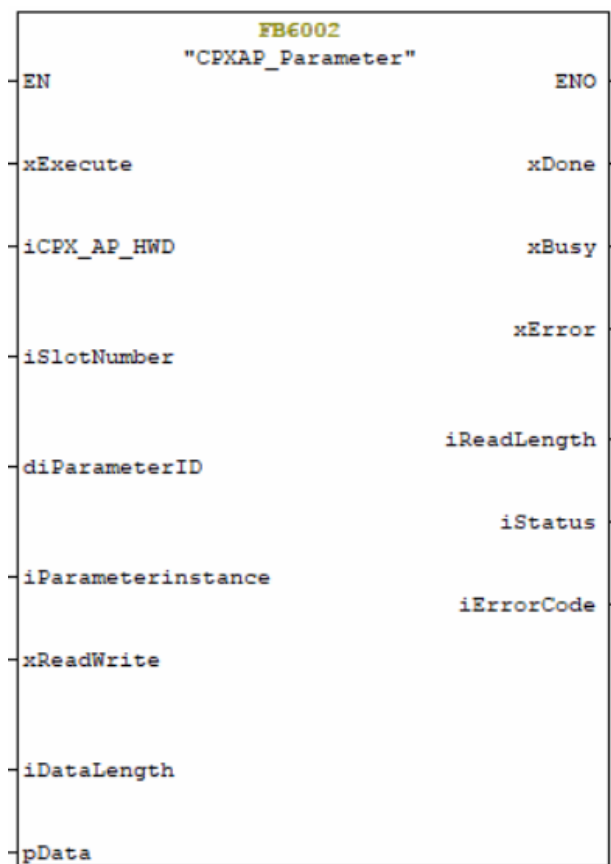
Note

- In this Step 7 Platform, CPX-AP-I-PN required following OBs – **OB80,OB82,OB83,OB85, OB86,OB87, OB121 & OB122** to run the library. So the user needs to confirm the mentioned OBs are available before downloading the project .

3 Function of “CPXAP_Parameter” Functional Block

3.1 Introduction to “CPXAP_Parameter” Functional Block

- This Function Block allows the user to do Read and Write parameters of the CPX-AP devices which are connected in network with the Siemens PLC via **CPX-AP-.PN-M12** module
- The user can Read or Write only one parameter at a time using this Function Block.
- When the user has to Read or Write a parameter **xExecute** is set to TRUE.
- When **xExecute** is set to TRUE only one parameter Read or Write can be done.
- To Read or Write another parameter the user has to set **xExecute** = TRUE again.



3.1.1 Input Data

Name	Data Type	Description
EN	BOOL	TRUE – Function Block Enable
xExecute	BOOL	TRUE – Parameter Read/Write
iCPX_AP_HWD	DWORD	Hardware ID of CPX-AP-...-PN-M12 module. Refer Chapter-2.9 to determine the Hardware ID of CPX-AP-I-PN
iSlotNumber	INT	Slot Number of the device whose Parameter is Read or Write. Refer Chapter-2.9 to determine the Slot number of CPX-AP-I-PN
diParameterID	DINT	ID of the Parameter which has to be Read or Write. Refer the CPX-AP-... device Manuals to get to know the Parameter ID.
iParameterinstance	INT	Instance of the Parameter. Refer the CPX-AP-... device Manuals to get to know the Parameter Instance.
xReadWrite	BOOL	FALSE – Read Parameter. TRUE – Write Parameter.
iDataLength	INT	Number of Bytes of data to be Read or Written using the Function Block.

Table 3.1: Input Data

3.1.2 InOut Data

Name	Data Type	Description
pData	Array [0..233] Byte	Variable to be Read/Written with the corresponding parameter

Table 3.2: InOut Data

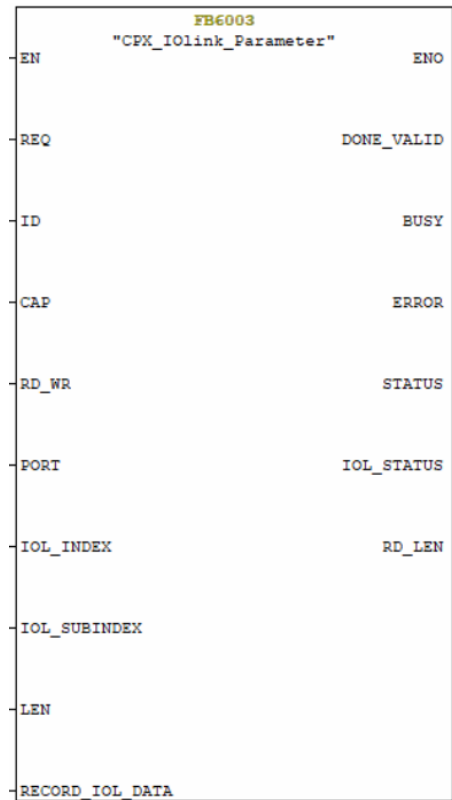
3.1.3 Output Data

Name	Data Type	Description
ENO	BOOL	TRUE – Function Block Enabled
xDone	BOOL	TRUE – Parameter Read or Write Finished.. FALSE- Parameter Read or Write not yet finished
xBusy	BOOL	TRUE – Parameter Read or Write started. FALSE – Parameter Read or Write not yet started or it's completed.
XError	BOOL	TRUE – Parameter Read or Write has an error. FALSE – No error during Parameter Read or Write.
iReadLength	INT	Number of bytes of Parameter Data read.
iStatus	INT	Status of Read or Write operation. The below status values are in Decimal. 1 – Parameter Read or Write successful. 67 – Status Error. Parameter Read or Write Failed
iErrorCode	INT	Gives the error code of the error occurred during Parameter Read or write . The below error code values are in Decimal. 1 – Invalid Parameter ID given. 8 – Invalid Data Length given .

Table 3.3: Output Data

3.2 CPXAP_IOLink_Parameter

- This Function Block allows the user to Read and Write parameters of the IO Link devices which are connected to the IO Link master **CPX-AP-I-4IOL-M12**.
- The user has to give the Index and Sub Index of the parameter in order to perform Read or Write operation.



3.2.1 Input Data

Name	Data Type	Description
EN	BOOL	TRUE – Function Block Enable
Req	BOOL	TRUE – Parameter Read/Write
ID	DWORD	e ID of CPX-AP-I-4IOL IO Link Master module. Refer Chapter-2.9 to determine the Hardware ID of CPX-AP-I-4IOL IO Link Master Module.
CAP	INT	Access Point (Client Access Point) Festo IO-Link : 227
RD_WR	BOOL	FALSE – Read Parameter. TRUE – Write Parameter.
PORT	INT	The port of the CPX-AP-I-4IOL IO Link Master module to which the IO Link device is connected
IOL_INDEX	INT	Index of the parameter of IO Link device. Refer IO Link device manual.
IOL_SUBINDEX	INT	Sub Index of the parameter of IO Link device. Refer IO Link device manual.
LEN	INT	Number of Bytes of data to be Read or Written using the Function Block.

Table 3.4: Input Data

3.2.2 InOut Data

Name	Data Type	Description
RECORD_IOL_DATA	Array [0..233] Byte	Variable to be Read/Written with the corresponding parameter

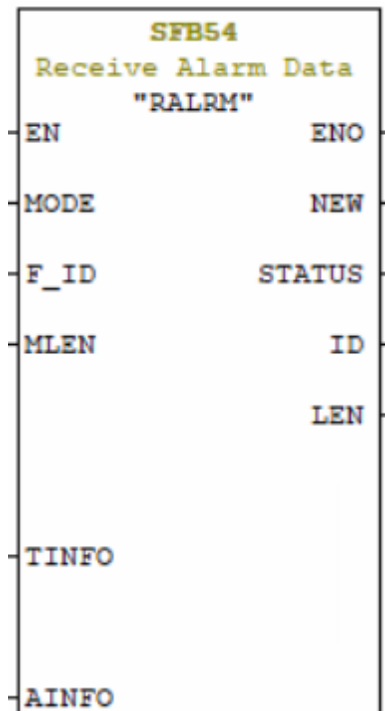
Table 3.5: InOut Data

3.2.3 Output Data

Name	Data Type	Description
ENO	BOOL	TRUE – Function Block Enabled
DONE_VALID	BOOL	TRUE – Parameter Read or Write Finished.. FALSE- Parameter Read or Write not yet finished
BUSY	BOOL	TRUE – Parameter Read or Write started. FALSE – Parameter Read or Write not yet started or it's completed.
ERROR	BOOL	TRUE – Parameter Read or Write has an error. FALSE – No error during Parameter Read or Write.
STATUS	DWORD	Profinet IO Error Status
IOL_STATUS	DWORD	IO-Link Error Status
RD_LEN	INT	Length of read data record

Table 3.6: Output Data

3.3 RALRM Functional Block for Diagnostics



3.3.1 Input Data

Name	Data Type	Description
EN	BOOL	TRUE – Function Block Enable
MODE	INT	Operating Mode
F_ID	DWORD	Logical start address of the component (module) from which interrupts are to be received Note: If the address is an output address, bit 15 must be set.
MLEN	INT	maximum length in bytes of the data interrupt information to be received

Table 3.7: Input Data

3.3.2 InOut Data

Name	Data Type	Description
TINFO	ANY	Target range for OB start and management information Note: For S7-300 CPUs, please note that the parameter TINFO always requires the complete specifications for the DB parameters (e.g. P#DB13.DBX0.0 byte 100). For S7-300 CPUs, leaving out an explicit DB no. is not permitted and causes an error message in the user program. Refer Chapter 3.3.4 for the TINFO Struct type.
AINFO	ANY	Target area for header information and additional interrupt information For AINFO you should provide a length of at least MLEN bytes. Note: For S7-300 CPUs, please note that the parameter AINFO always requires the complete specifications for the DB parameters (e.g. P#DB13.DBX0.0 byte 100). For S7-300 CPUs, leaving out an explicit DB no. is not permitted and causes an error message in the user program. Refer Chapter 3.3.5 for the TINFO Struct type

Table 3.8: InOut Data

3.3.3 Output Data

Name	Data Type	Description
ENO	BOOL	TRUE – Function Block Enable
NEW	INT	A new interrupt was received.
STATUS	DWORD	Error code of the SFB or DP Master
ID	DWORD	Logical start address of the component (module) from which an interrupt was received. Bit 15 contains the I/O ID: 0 for an input address; 1 for and output address
LEN	INT	Length of the received interrupt information

Table 3.9: Output Data

3.3.4 TINFO Structure Data Type

- User Need to Create the same below mention TINFO Struct data type in User Program DB.

Name	Data Type	Initial Value
TINFO	STRUCT	
SI_Format	INT	0
OB_Class	INT	82
OB_Nr	INT	0
LADDR	INT	0
IO_State	WORD	W#16#0
Channel	INT	0
MultiError	BOOL	FALSE
address	WORD	W#16#0
slv_prfl	BYTE	B#16#0
intr_type	BYTE	B#16#0
flags1	BYTE	B#16#0
flags2	BYTE	B#16#0
id	INT	0
manufacturer	INT	0
instance	INT	0

Table 3.10: TINFO Structure

3.3.5 AINFO Structure Data Type

- User Need to Create the same below mention AINFO Struct data type in User Program DB.

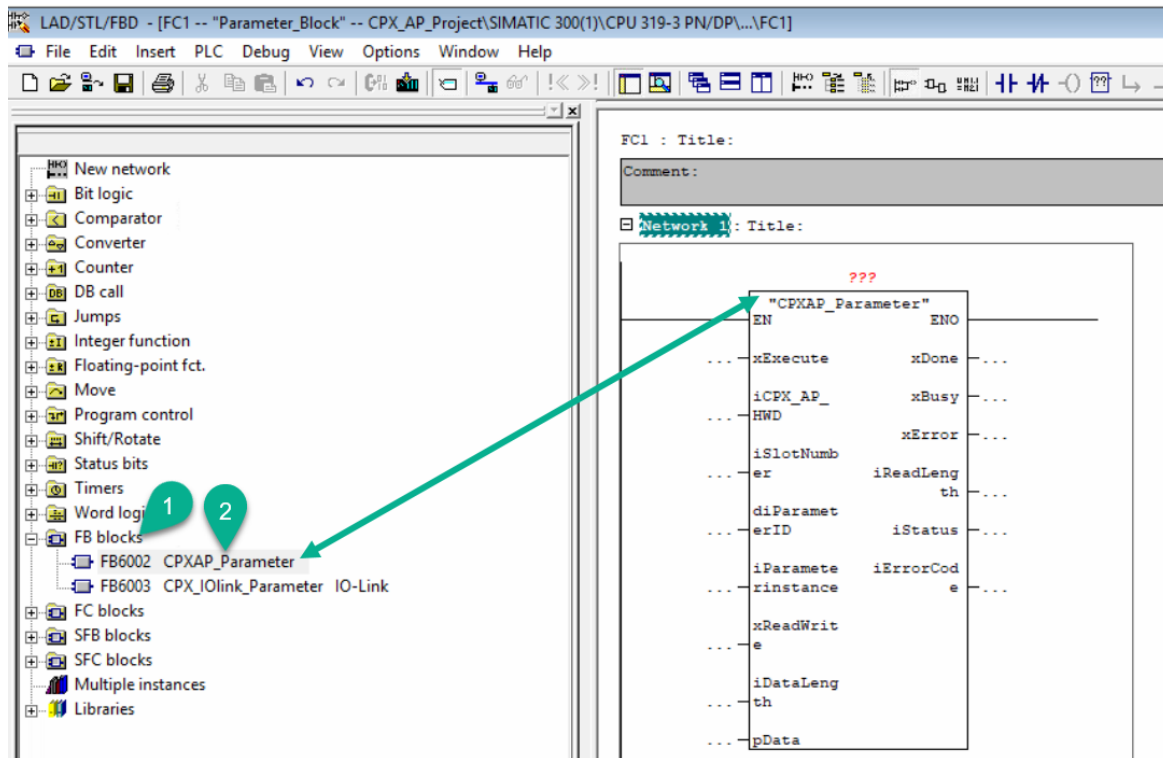
Name	Data Type	Initial Value
AINFO	STRUCT	
Header	STRUCT	
BlockType	WORD	W#16#0
BlockLength	INT	0
VersionWord	WORD	W#16#0
InteruptType	INT	0
API	DWORD	DW#16#0
SlotNumber	INT	0
SubSlotNumber	INT	0
ModuleSpecinfo	DWORD	DW#16#0
SubModuleSpecinfo_1	DWORD	DW#16#0
InterruptSpecification	WORD	W#16#0
addinfo	STRUCT	
Formatidentifier	WORD	W#16#0
ChannelNumber	WORD	W#16#0
ChannelErrorType	BYTE	B#16#0
DataFormat	BYTE	B#16#0
ChannelErrType	WORD	W#16#0
ErrorCode	WORD	W#16#0
StaticAddinfo	ARRAY[0..1000] WORD	

Table 3.11: AINFO Structure

4 Configuring of CPX-AP Functional Blocks in Step-7 Simatic Manager

4.1 Configuring the CPXAP_Parameter Functional Block Input & Output Interface Tags

Step 1



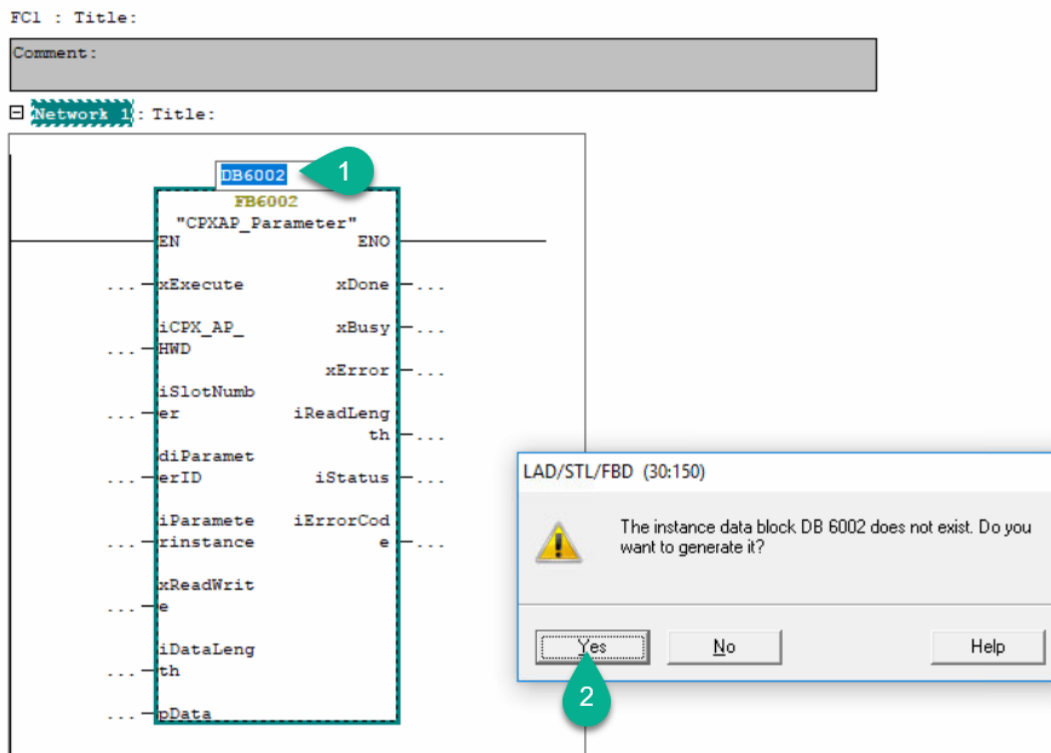
1. Debranch **FB Blocks**.
2. Drag and Drop the **CPXAP_Parameter** functional block to the Network.

Step 2

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	Execute	BOOL	FALSE	
+2.0	HWD	DWORD	DW#16#0	
+6.0	SlotNumber	INT	0	
+8.0	ParameterID	DINT	L#0	
+12.0	ParameterInstance	INT	0	
+14.0	Write	BOOL	FALSE	
+16.0	DataLength	INT	0	
+18.0	pData	ARRAY[0..233]		
*1.0		BYTE		
+252.0	done	BOOL	FALSE	
+252.1	Busy	BOOL	FALSE	
+252.2	Error	BOOL	FALSE	
+254.0	ReadLength	INT	0	
+256.0	Status	INT	0	
+258.0	ErrorCode	INT	0	
=260.0		END_STRUCT		

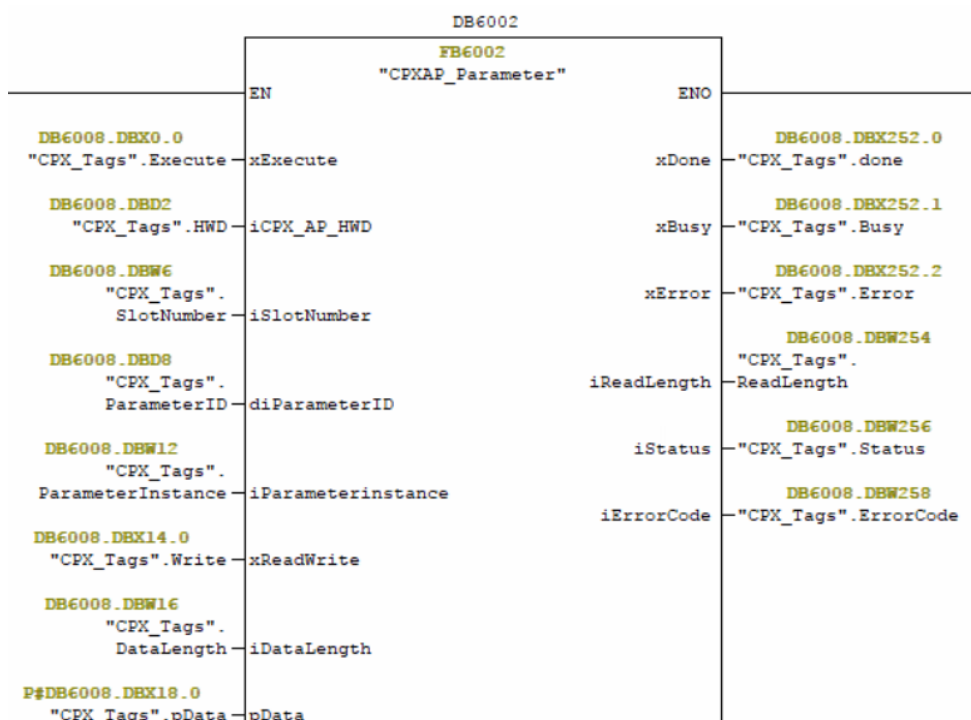
- User can create the Required Tags for CPXAP-Parameter functional block in **DB's**.

Step 3

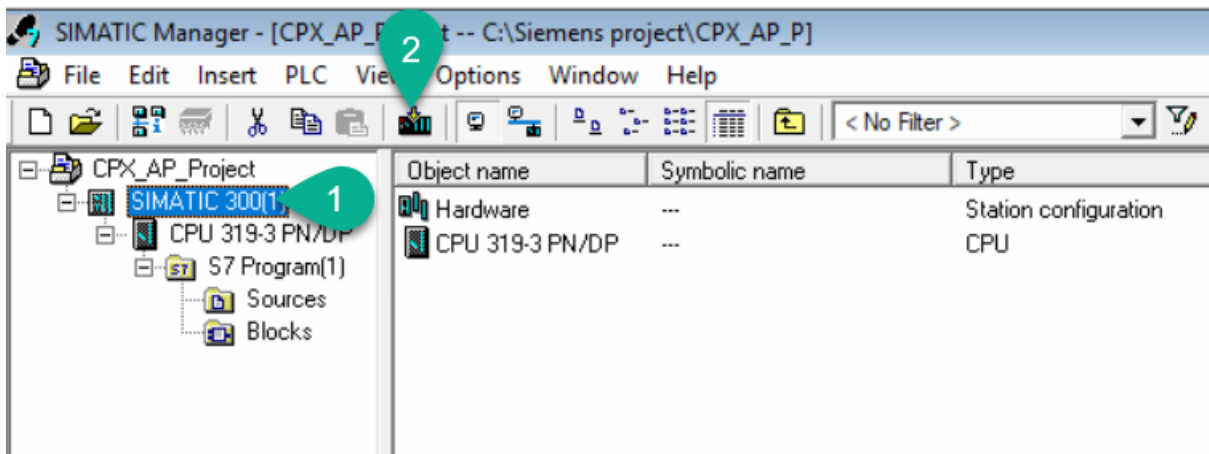


1. Enter the Instance DB name to Create for the Functional block.
2. Click **Yes** to Create.

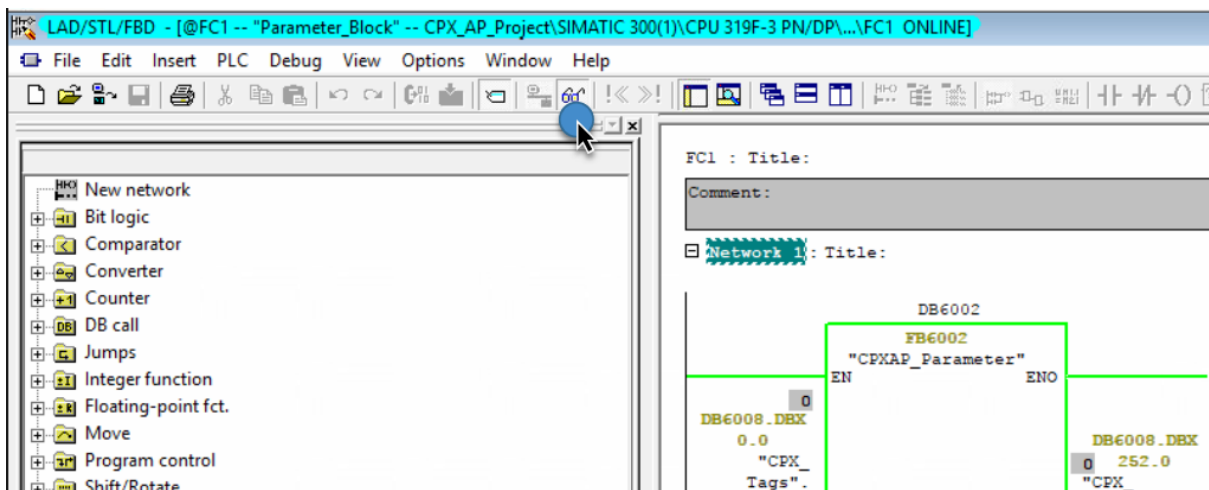
Step 4



- Configure the tags which is Created in **DB**.

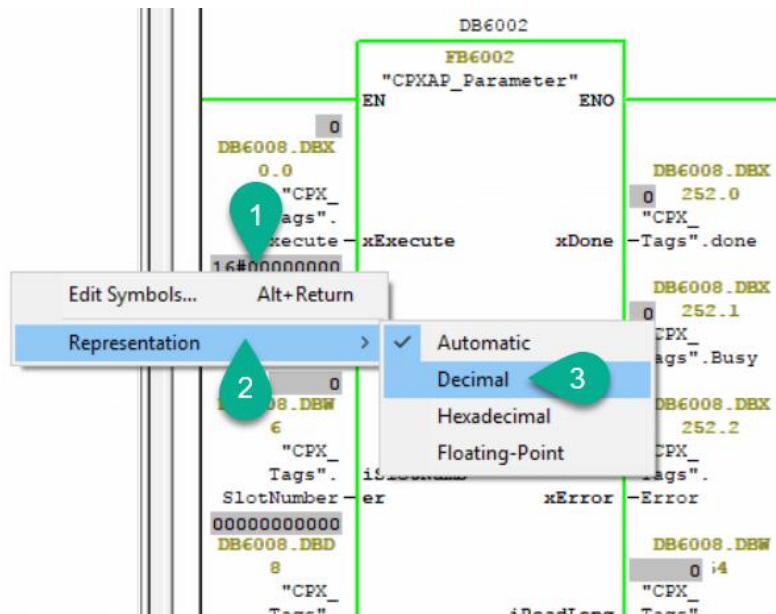
Step 5

1. Click on **SIMATIC 300(1)** to select the Total configuration.
2. Click **Download** to Load the created Project to the PLC.

Step 6

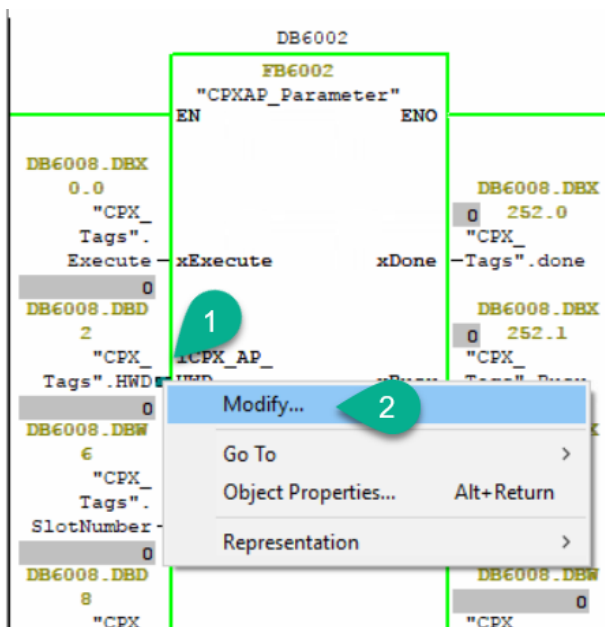
- Open the Called Function of CPX-AP_Parameter block.
- Click Monitor button to Go Online.

Step 7



1. Right Click on any of the tag representation.
2. From the Right click menu Select **Representation**.
3. Select **Decimal** Option.

Step 8

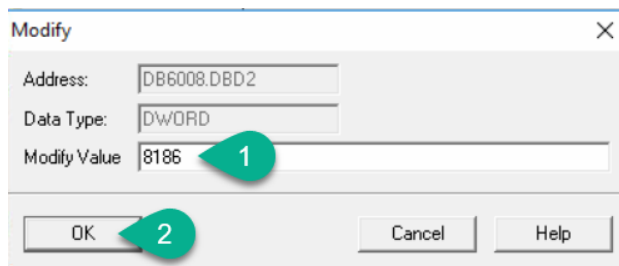


1. Right Click on “**iCPX_AP_HWD**” tag.
2. Select modify to Enter the Hardware ID of CPX-AP-I-PN.

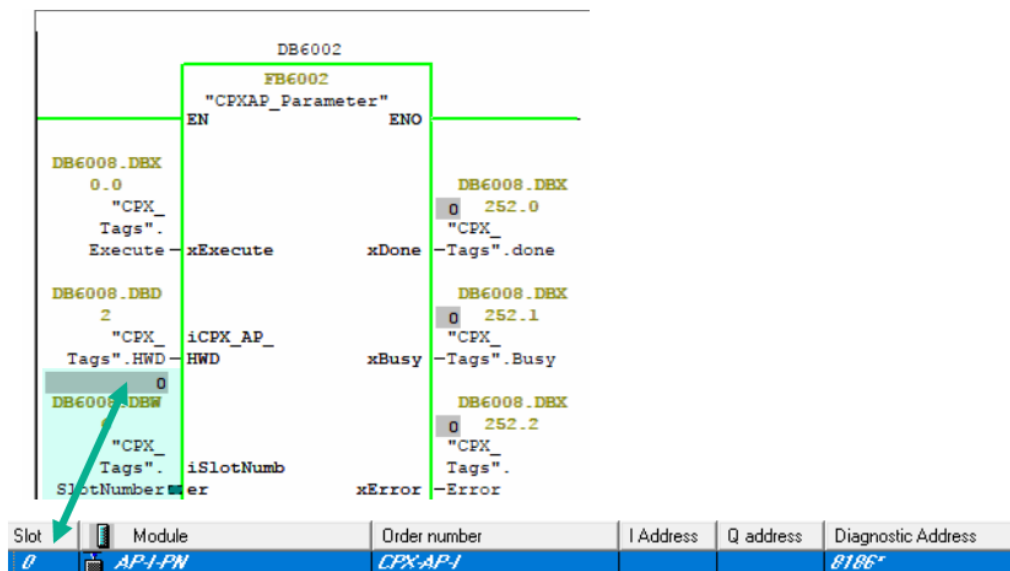


Note

- User can view the [chapter-2.9](#) to check how to find the Hardware ID of CPX-AP-I-PN module

Step 9

1. Enter the CPX-AP-I-PN Hardware ID in Modify Value Filed.
2. Click **OK**.

Step 10

- Enter the Slot value of the CPX-AP-I device in the “iSlotNumber” tag.

4.1.1 Reading the Parameter Value using CPXAP_Paramter functional block**Step 1**

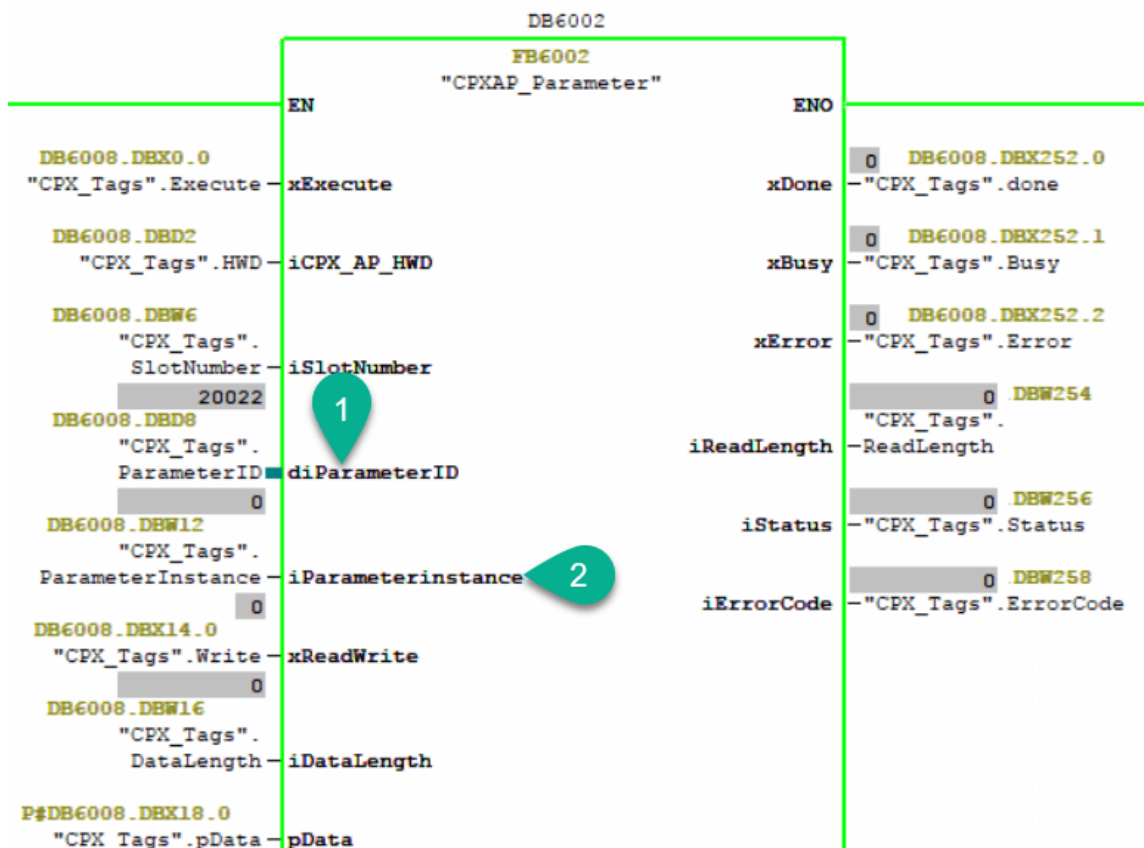
20022	Configuration of voltage monitoring load supply PL – 0: load voltage monitoring inactive – 1: load voltage monitoring active, with suppression of diagnostics at switch-off (factory setting) – 2: load voltage monitoring active	1	UINT8	rw	–
-------	--	---	-------	----	---

Parameter ID

Number of Instances

- In this example we are going to Read the above mentioned Voltage Monitoring load supply PL value.

Step 2

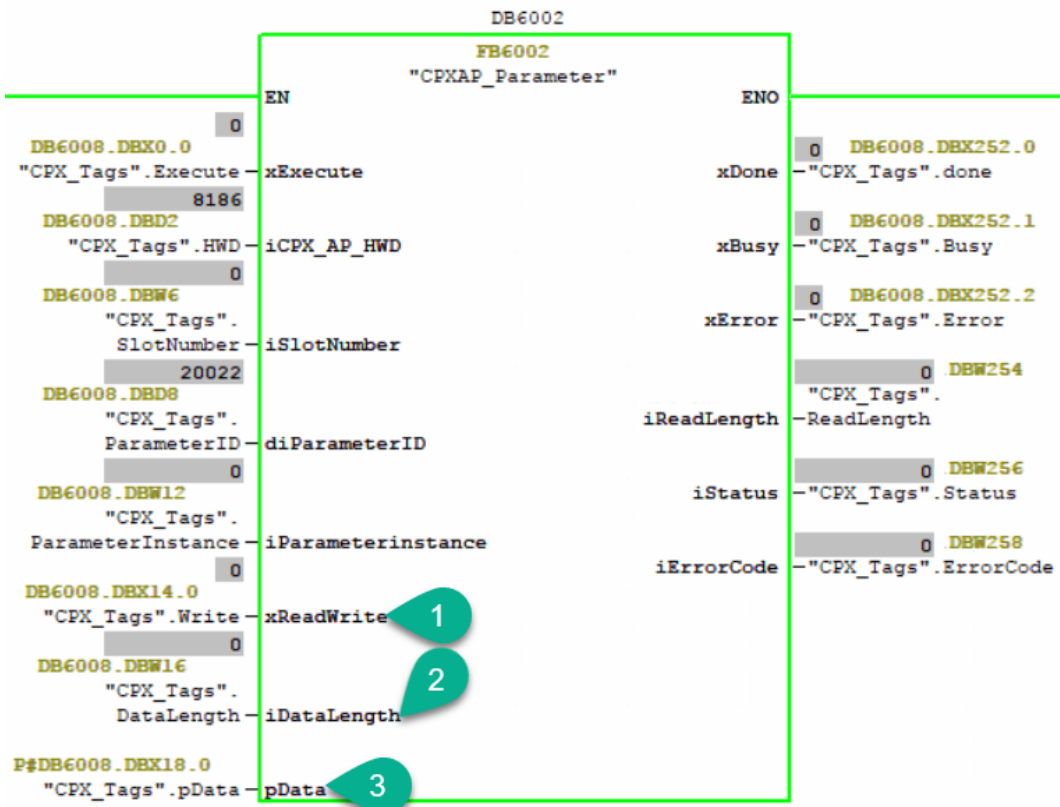


1. Enter the Parameter ID value that going to read in the tag **"diParameterID"**.
2. Enter the Parameter Instance Value that going to read in the tag **"iParameterinstance"**.

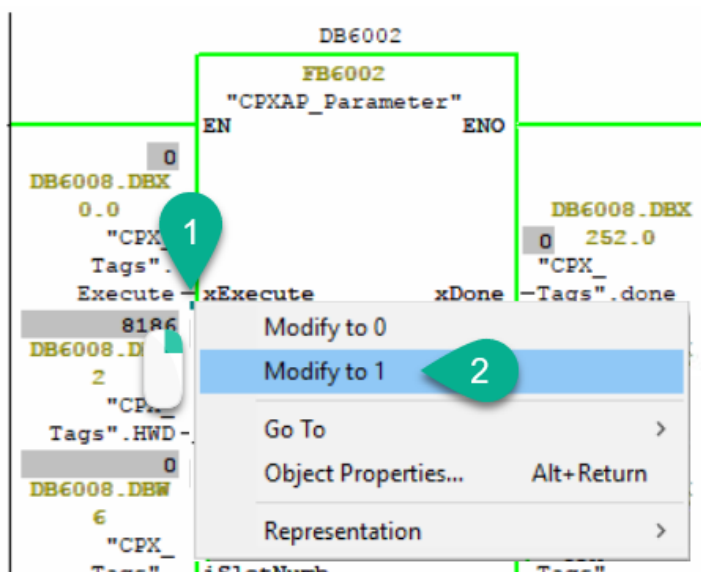


Note

- If Parameter Instance is **"1"** It holds only one Instance data and its starts from **"0"**. For Example if Parameter Instance value is **"4"** its holds 4 Instance data and starting from the Instance value **"0 to 3"**.

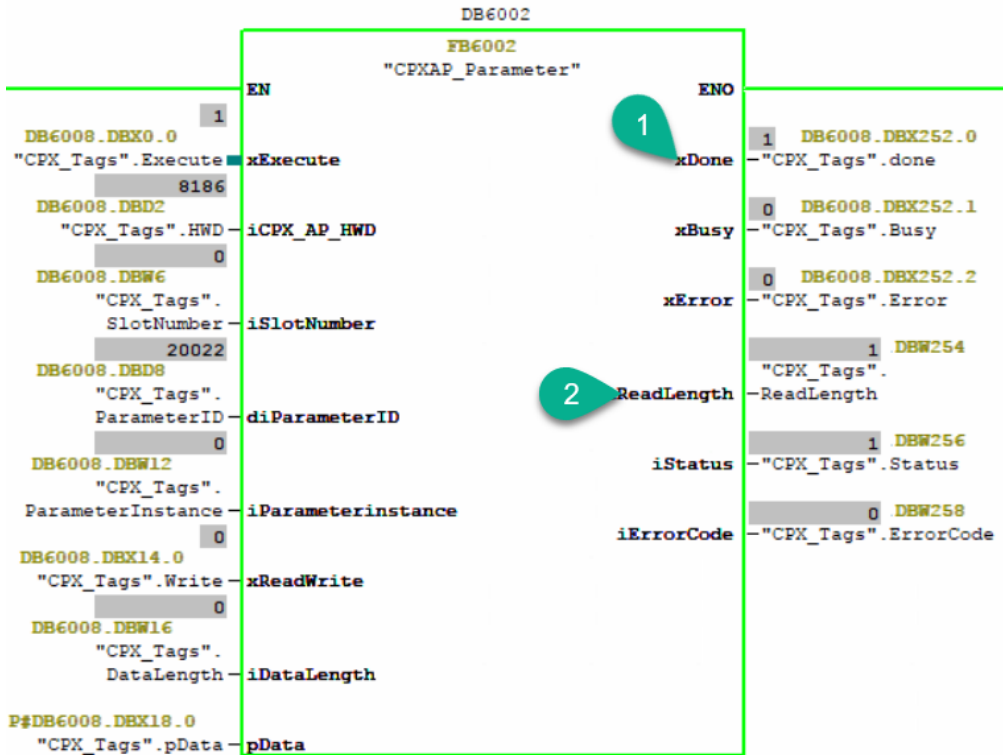
Step 3

1. Set the **xReadWrite** tag value to "0" for Read the Parameter.
2. Data Length Value is not required to Provide for Reading Operation.
3. Read Value will be appeared in the **pData** tag.

Step 4

1. Right Click on the **xExecute** tag.
2. Click **Modify to 1** option to Execute the Read function.

Step 5



1. Once Read function is Done. **xDone** tag will be as "1".
2. Length of the data read will be appear in "**iReadLength**" tag.

Step 6

- Create a VAT table to Monitor the pData Values.

Var - [VAT_1 -- @CPX_AP_Project\SIMATIC 300(1)\CPU 319F-3 PN\DP\S7 Program(1) ONLINE]					
Table Edit Insert PLC Variable View Options Window Help					
	Address	Symbol	Display format	Status value	Modify value
1	DB6008.DBX 0.0	"CPX_Tags".Execute	BOOL	true	true
2	DB6008.DBD 2	"CPX_Tags".HWD	DEC	L#8186	L#8186
3	DB6008.DBW 6	"CPX_Tags".SlotNumber	DEC	0	0
4	DB6008.DBD 8	"CPX_Tags".ParameterID	DEC	L#20022	L#20022
5	DB6008.DBW 12	"CPX_Tags".ParameterInstance	DEC	1	1
6	DB6008.DBX 260.0	"CPX_Tags".pData	BOOL	false	false
7	DB6008.DBB 18	"CPX_Tags".pData[0]	DEC	1	0
8	DB6008.DBB 19	"CPX_Tags".pData[1]	DEC	0	
9	DB6008.DBB 20	"CPX_Tags".pData[2]	DEC	0	
10	DB6008.DBB 21	"CPX_Tags".pData[3]	DEC	0	
11	DB6008.DBB 22	"CPX_Tags".pData[4]	DEC	0	
12	DB6008.DBB 23	"CPX_Tags".pData[5]	DEC	0	
13	DB6008.DBB 24	"CPX_Tags".pData[6]	DEC	0	
14	DB6008.DBB 25	"CPX_Tags".pData[7]	DEC	0	
15	DB6008.DBB 26	"CPX_Tags".pData[8]	DEC	0	
16	DB6008.DBB 27	"CPX_Tags".pData[9]	DEC	0	
17	DB6008.DBB 28	"CPX_Tags".pData[10]	DEC	0	

1. Declare the pData tags in the Vat table to Monitor the Tags.
2. Click on Monitor.
3. Read Data will be visible in Status Value Tab of pData data array.

4.1.2 Writing the Parameter Value using CPXAP_Parameter Functional Block

Step 1

20022	Configuration of voltage monitoring load supply PL – 0: load voltage monitoring inactive – 1: load voltage monitoring active, with suppression of diagnostics at switch-off (factory setting) – 2: load voltage monitoring active	1	UINT8	rw	–
-------	--	---	-------	----	---

Parameter ID

Number of Instances

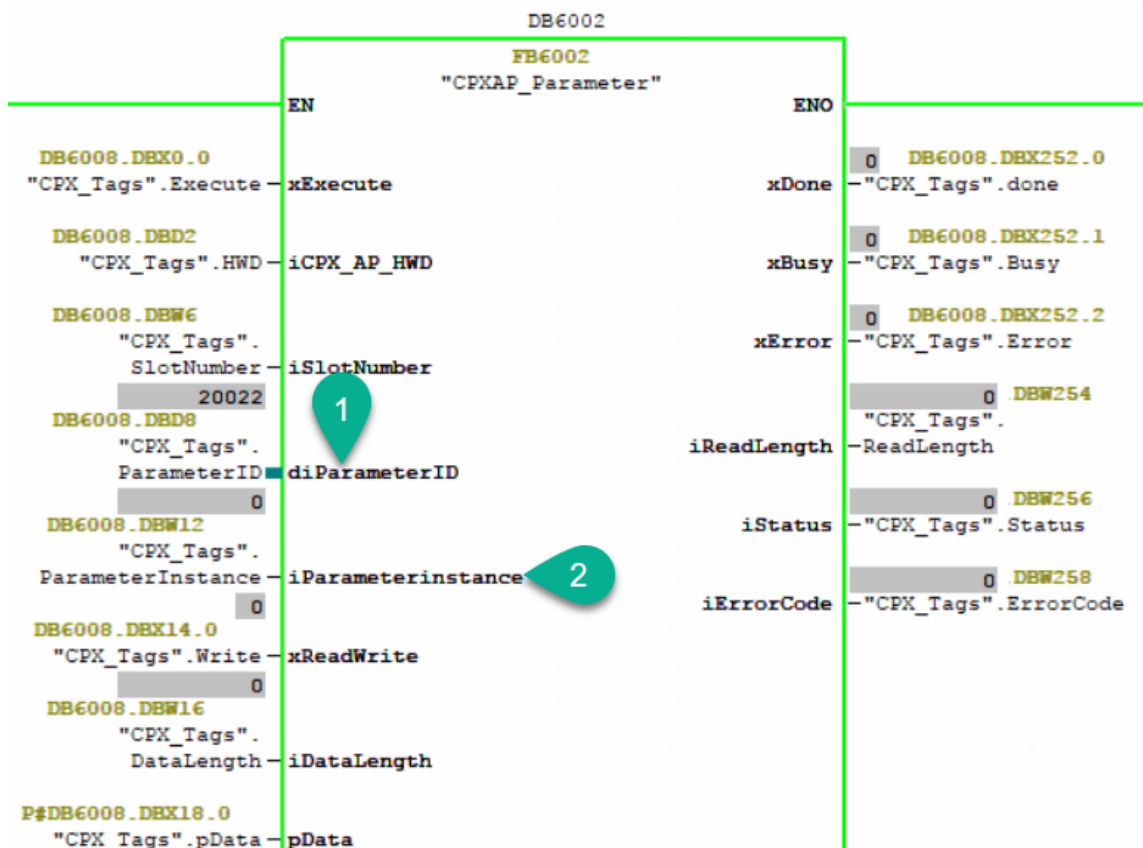
- In this example Load Voltage Monitoring active is to be activated by Writing the value as 2.

Step 2

Table Edit Insert PLC Variable View Options Window Help						
	Address	Symbol	Dis	Format	Status value	Modify value
1	DB6008.DBX 0.0	"CPX_Tags".Execute	1	3	false	false
2	DB6008.DBD 2	"CPX_Tags".HWD			L#8186	L#8186
3	DB6008.DBW 6	"CPX_Tags".SlotNumber			0	0
4	DB6008.DBD 8	"CPX_Tags".ParameterID			L#20022	L#20022
5	DB6008.DBW 12	"CPX_Tags".ParameterInstance			1	1
6	DB6008.DBX 260.0					false
7	DB6008.DBB 18	"CPX_Tags".pData[0]			2	2
8	DB6008.DBB 19	"CPX_Tags".pData[1]			0	
9	DB6008.DBB 20	"CPX_Tags".pData[2]			0	
10	DB6008.DBB 21	"CPX_Tags".pData[3]			0	
11	DB6008.DBB 22	"CPX_Tags".pData[4]			0	
12	DB6008.DBB 23	"CPX_Tags".pData[5]			0	
13	DB6008.DBB 24	"CPX_Tags".pData[6]			0	

- Click on monitoring in the VAT table.
- Enter the Value "2" in the Modify value of **pData** tag.
- Click on **Modify Variable** button to transfer the value to the **pData** tag.
- Transferred value will be Visible in the **Status Value** tag.

Step 3

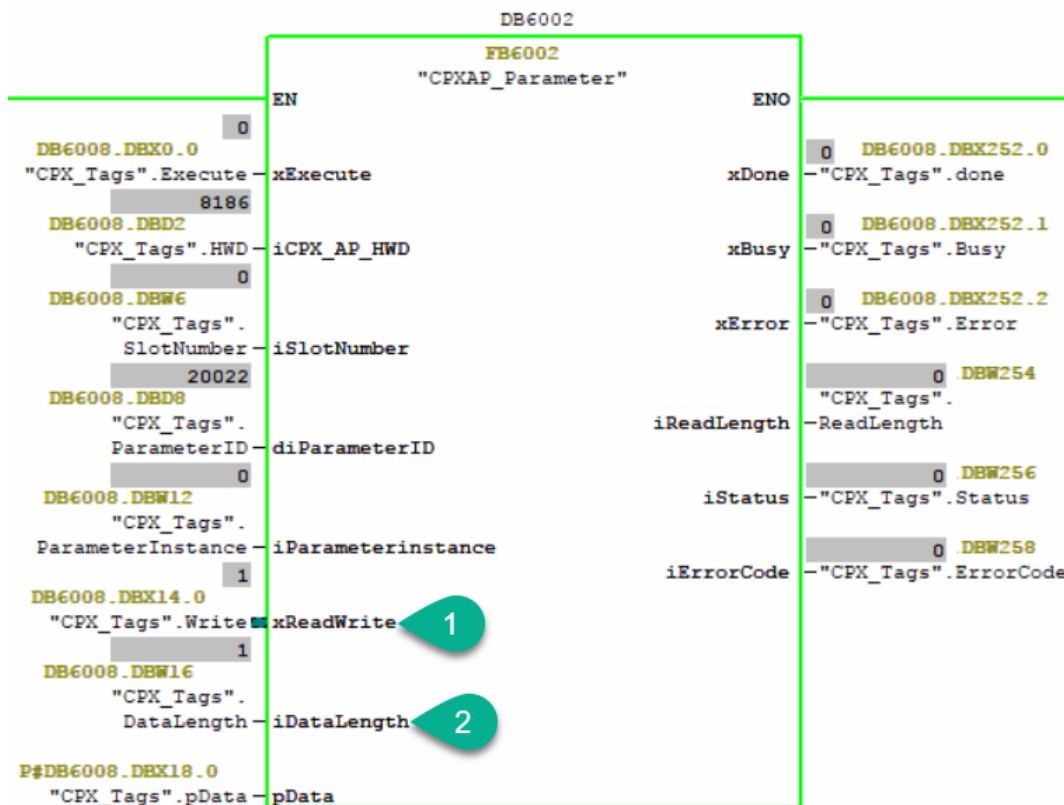


1. Enter the Parameter ID value that going to Write in the tag **"diParameterID"**.
2. Enter the Parameter Instance Value that going to Write in the tag **"iParameterinstance"**.

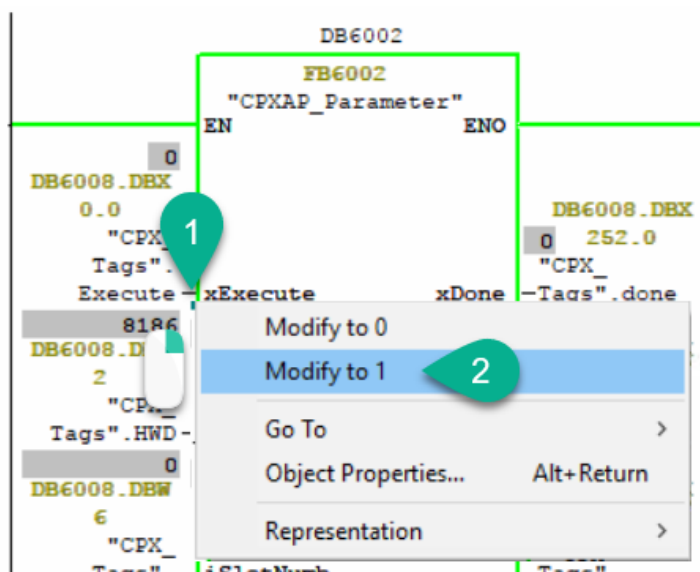


Note

- If Parameter Instance is **"1"** It holds only one Instance data and its starts from **"0"**. For Example if Parameter Instance value is **"4"** its holds 4 Instance data and starting from the Instance value **"0 to 3"**.

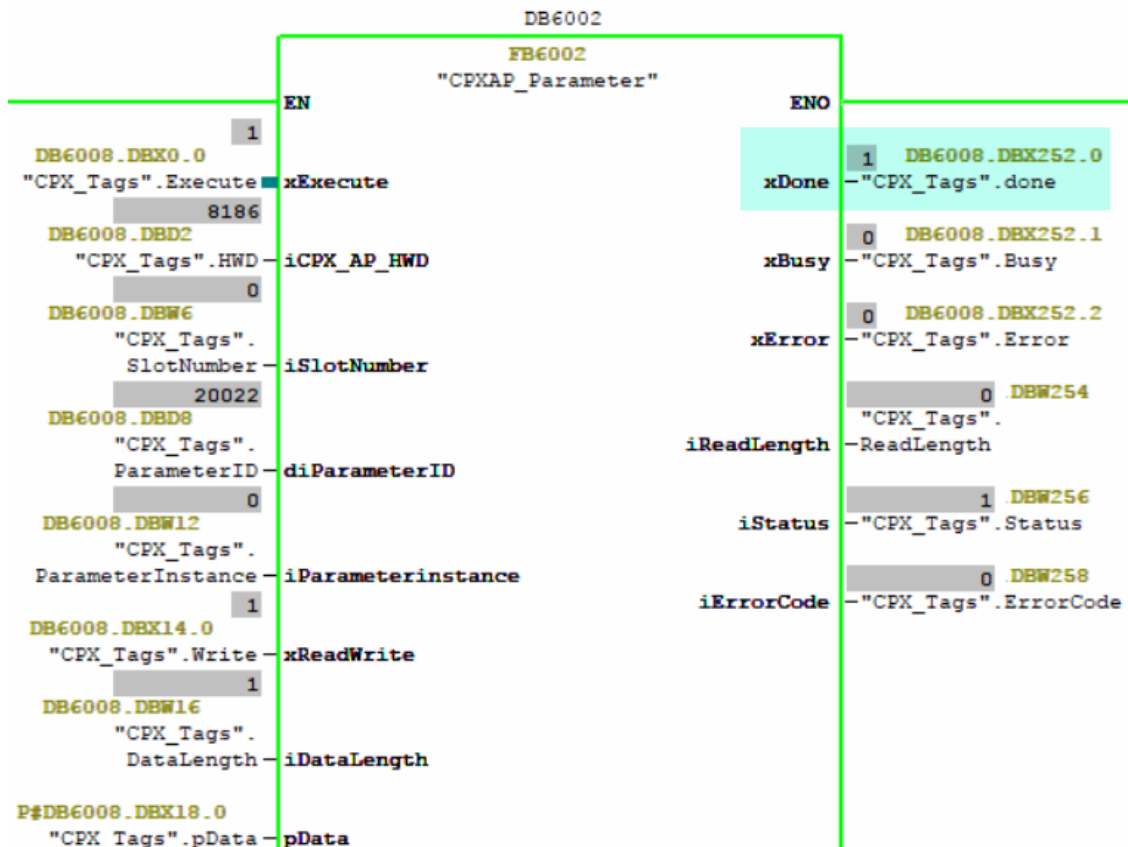
Step 4

1. Set the **xReadWrite** tag value to "1" to Write the Parameter.
2. Enter the Length of the value that going to Write. Here entered the value as "1" due the Length of the value to be write is "1".

Step 5

1. Right Click on the **xExecute** tag.
2. Click **Modify to 1** option to Execute the Write function.

Step 6



- Once Write function is Done. **xDone** tag will be as "1".

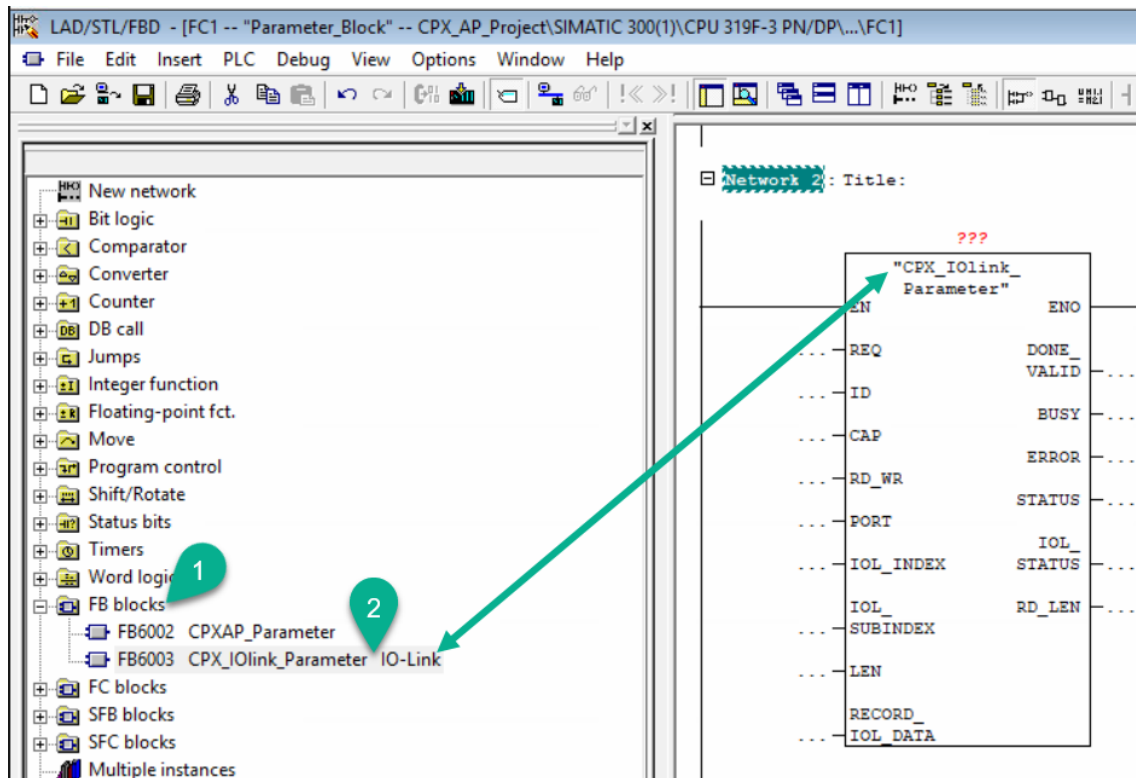


Note

- User can verify the Write value by reading the Same parameter by using the CPXAP_Parameter functional block.

4.2 Configuring the CPX_IOLink_Parameter Functional block Input & Output Interface Tags

Step 1



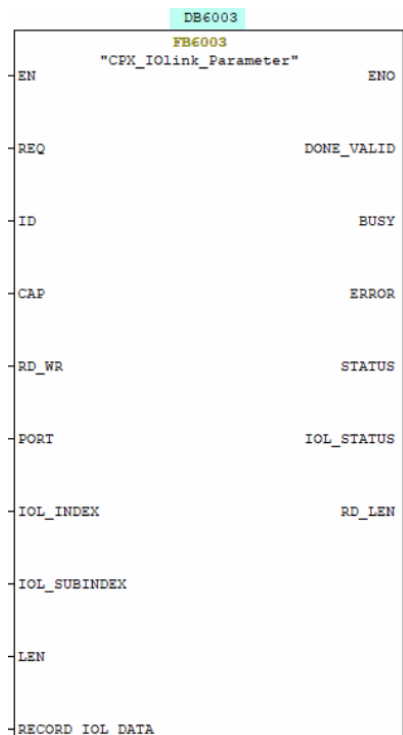
1. Debranch **FB Blocks**.
2. Drag and Drop the **CPX_IOLink_Parameter** functional block to the Network.

Step 2

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	IO_Link_Request	BOOL	FALSE	
+2.0	IO_Link_ID	DWORD	DW#16#0	
+6.0	IO_Link_CAP	INT	0	
+8.0	IO_Link_ReadWrite	BOOL	FALSE	
+10.0	IO_Link_Port	INT	0	
+12.0	IO_Link_Index	INT	0	
+14.0	IO_Link_SubIndex	INT	0	
+16.0	IO_Link_Length	INT	0	
+18.0	IOL_Record_Data	ARRAY[0..231]		
*1.0		BYTE		
+250.0	IOL_Done	BOOL	FALSE	
+250.1	IOL_Busy	BOOL	FALSE	
+250.2	IOL_Error	BOOL	FALSE	
+252.0	IOL_Status	DWORD	DW#16#0	
+256.0	IOL_ReadLength	INT	0	
+258.0	IOL_IOLStatus	DWORD	DW#16#0	
=262.0		END_STRUCT		

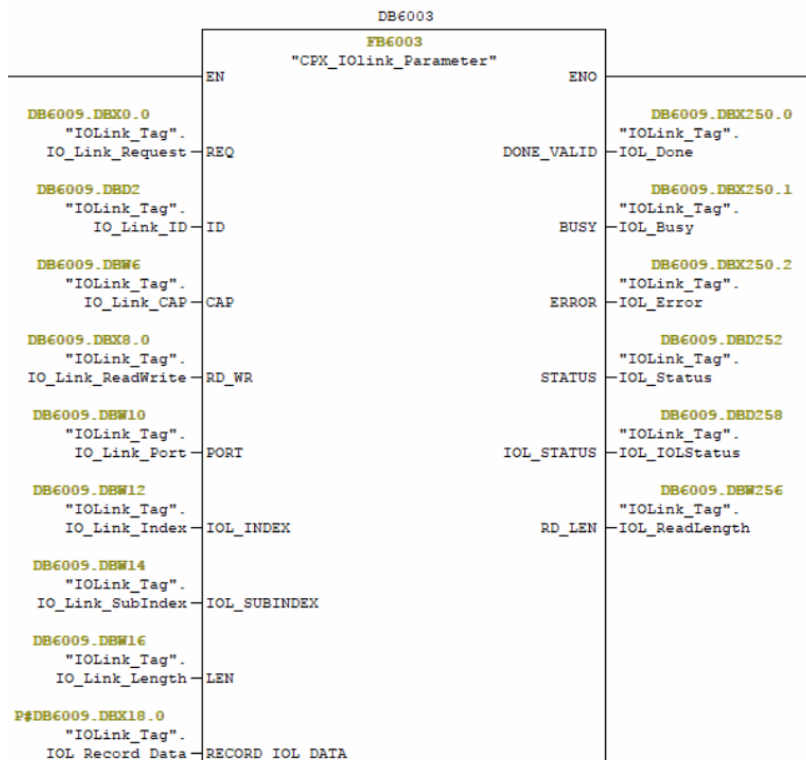
- User can create the Required Tags for CPX_IOLink_Parameter functional block in **DB's**.

Step 3

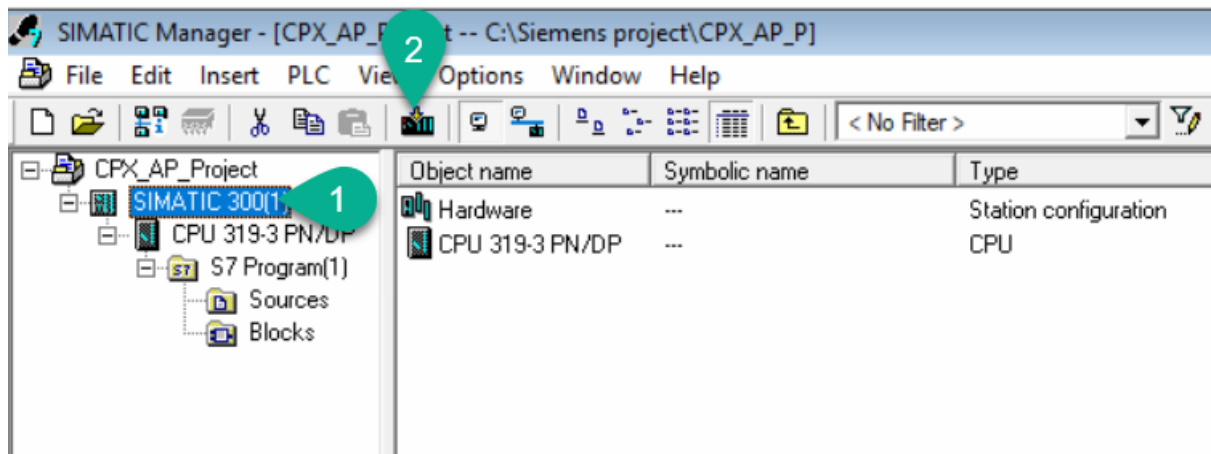


- Enter the Instance DB name to Create for the Functional block.

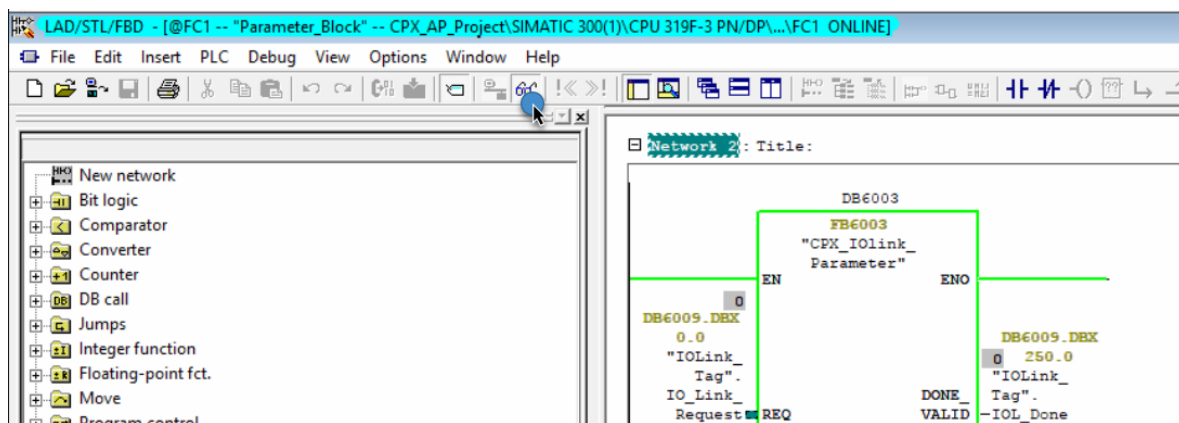
Step 4



- Configure the tags which is Created in **DB**.

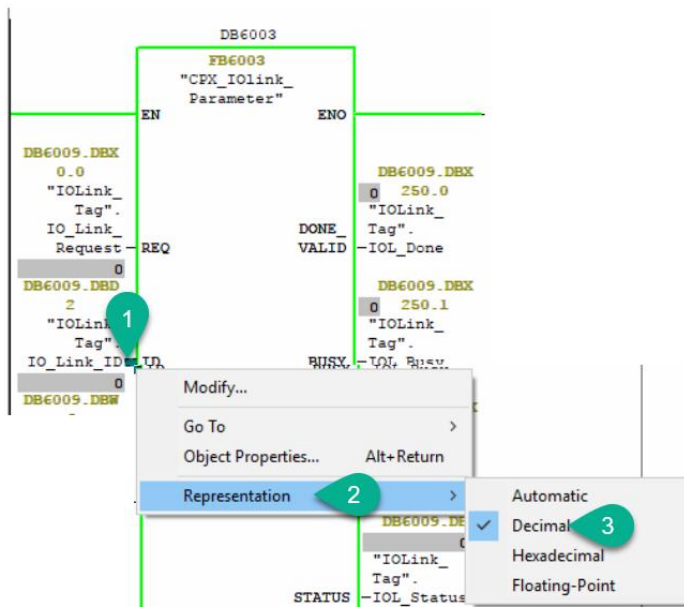
Step 5

1. Click on **SIMATIC 300(1)** to select the Total configuration.
2. Click **Download** to Load the created Project to the PLC.

Step 6

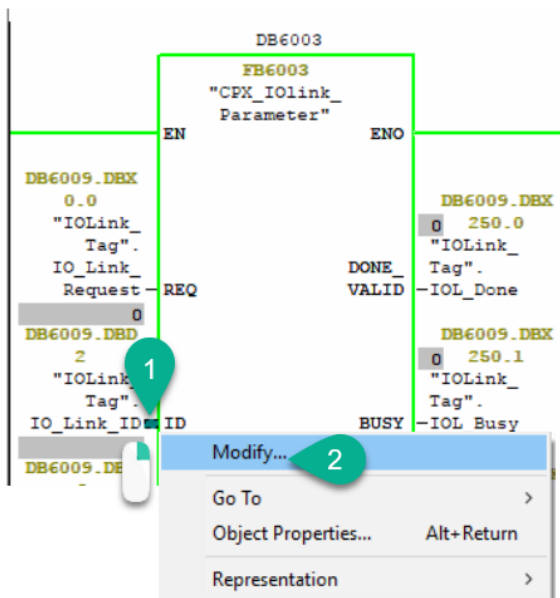
- Open the Called Function of CPX-IOLink_Parameter block.
- Click Monitor button to Go Online.

Step 7



1. Right Click on any of the tag representation.
2. From the Right click menu Select **Representation**.
3. Select **Decimal** Option.

Step 8



1. Right Click on "ID" tag.
2. Select modify to Enter the Hardware ID of CPX-AP-I-4IOL.



Note

- User can view the [chapter-2.9](#) to check how to find the Hardware ID of CPX-AP-4IOL module

Step 9

Modify

Address: DB6009.DBD2

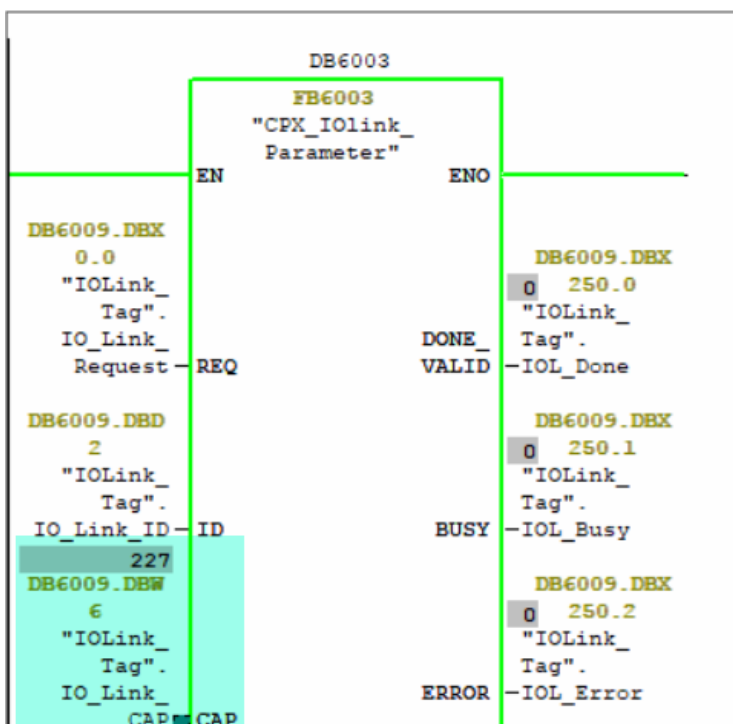
Data Type: DWORD

Modify Value: 8181

OK Cancel Help

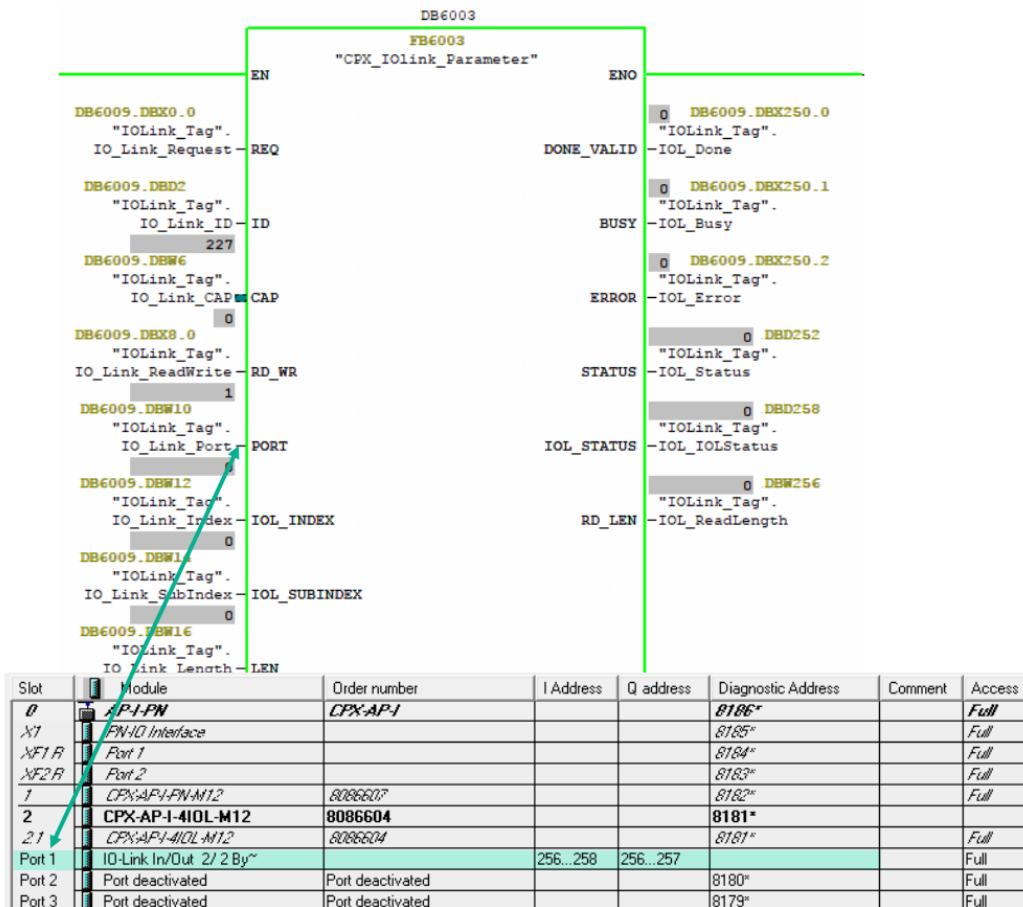
Slot	Module	Order number	I Address	Q address	Diagnostic Address
0	AP-I-PN	CPX-AP-I			8186*
X1	PN-IO Interface				8185"
X1 R	Port 1				8184"
X2 R	Port 2				8183"
1	CPX-AP-I-PN-M12	8086607			8182"
2	CPX-AP-I-4IOL-M12	8086604			8181*

1. Enter the CPX-AP-I-4IOL-M12 Hardware ID in Modify Value Filed.
2. Click **OK**.

Step 10

- Enter the **CAP** id value as "227" for the Festo IO-Link Device.

Step 11



- Enter the Port value as “1” in the Port tag. Here Simplified Motion Series IO-Link device is connected to the Port-1 of IO-Link Master.

4.2.1 Reading the IO-Link Device Parameter value by using the CPX_IOLink_Parameter functional block

Step 1

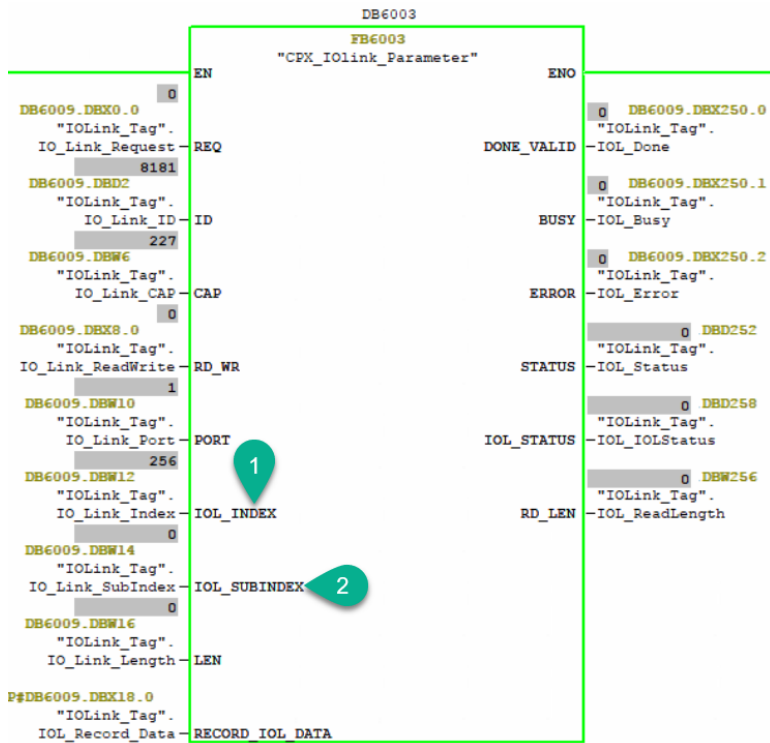
- Let us consider an example where we have to Read the parameter **Speed “In”** of Festo SMS Device.
- We get the following details from the IO-Link interface description Simplified motion series manual.

Index (dec)	Sub-index	Name	Value / unit / gradient	Access ¹⁾			Length (byte)	Format
				U	M	S		
Control parameters („Master » Device“)								
0x0100 (256)	0	Speed "In"	1 = 10% (default) ... 10 = 100%,	-	R/ W	R/ W	1	UInteger8

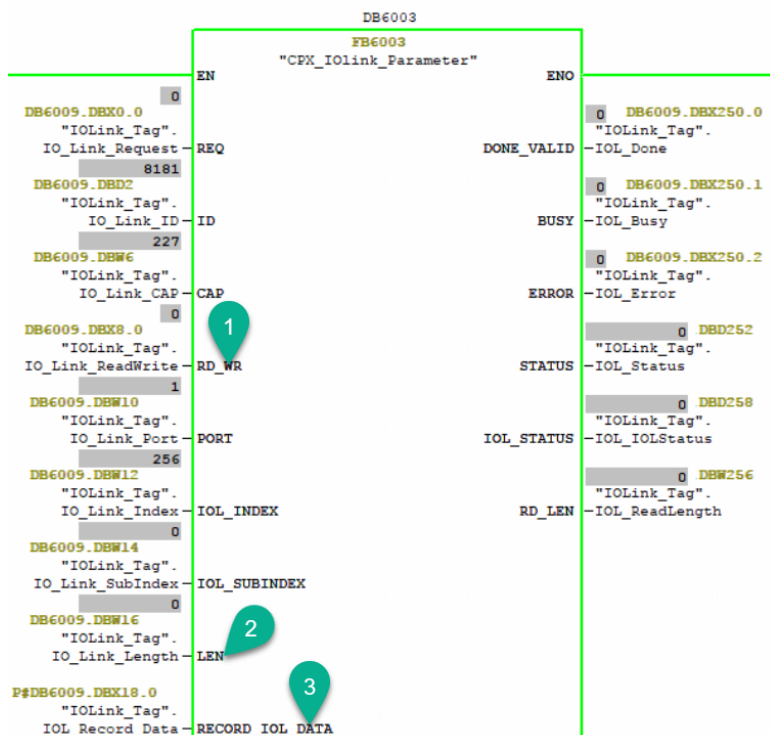

Index


Sub Index

- From the parameter details we come to know that the Length of the Parameter Speed “In” is Uint8. Since length of the parameter is Uint8 , we have to use a variable of the data type Usint to Read/Write the parameter Data.

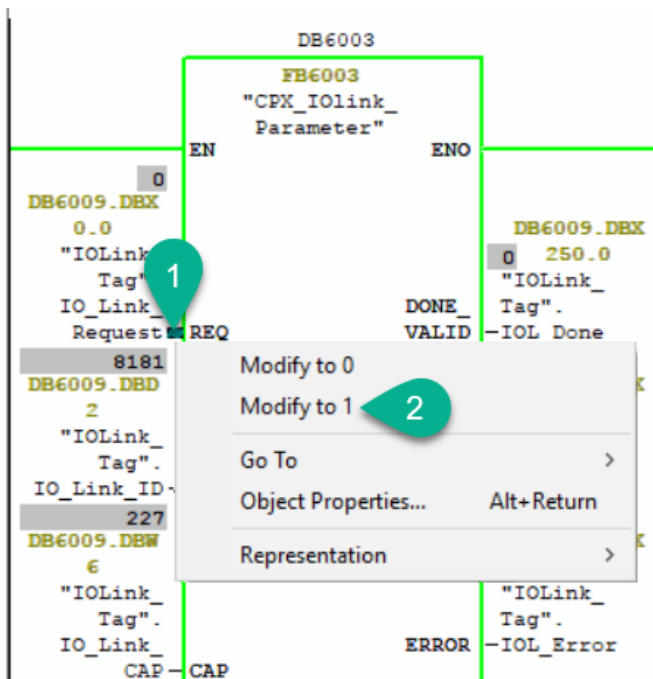
Step 2

1. Enter the Index value as “256” in **IOL_INDEX** tag.
2. Enter the SubIndex as “0” in **IOL_SUBINDEX** tag.

Step 3

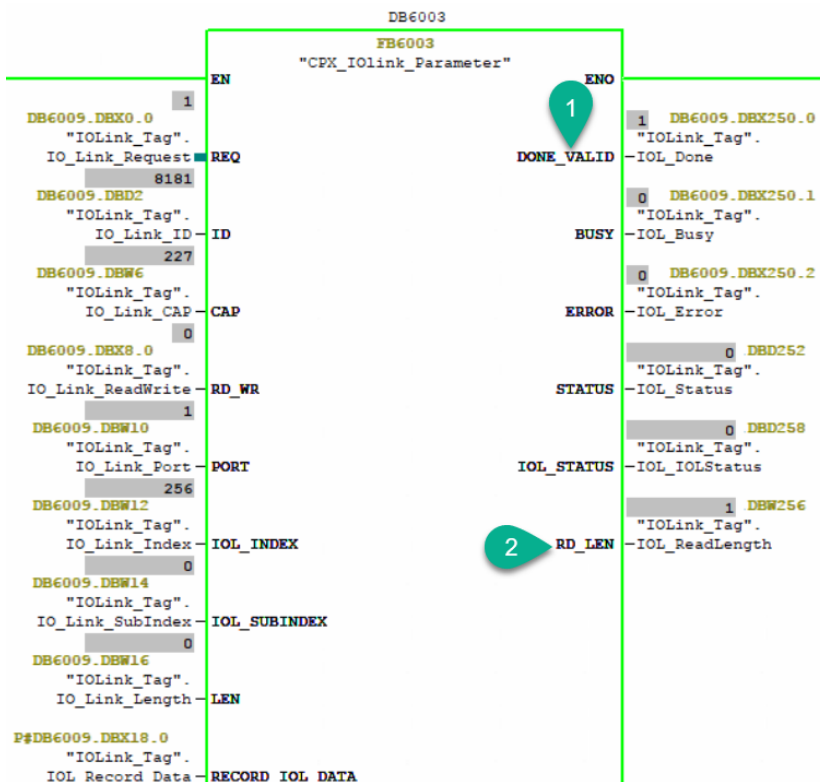
1. Enter the Value as “0” in **RD_WR** tag to read the value.
2. Data Length Value is not required to Provide for Reading Operation.
3. Read Value will be appeared in the **RECORD_IOL_DATA** tag.

Step 4



1. Right Click on the **REQ** tag.
2. Click **Modify to 1** option to Execute the Read function.

Step 5



1. Once Read function is Done. **DONE_VALID** tag will be as **"1"**.
2. Length of the data read will be appear in **"RD_LEN"** tag.

Step 6

- Create a VAT table to Monitor the **RECORD_IOL_DATA** Values.

	Address	Symbol	Display format	Status value	Modify value
1	DB6009.DBB 18	"IOLink_Tag".IOL_Record_Data[0]	DEC	9	
2	DB6009.DBB 19	"IOLink_Tag".IOL_Record_Data[1]	DEC	0	
3	DB6009.DBB 20	"IOLink_Tag".IOL_Record_Data[2]	DEC	0	
4	DB6009.DBB 21	"IOLink_Tag".IOL_Record_Data[3]	DEC	0	
5	DB6009.DBB 22	"IOLink_Tag".IOL_Record_Data[4]	DEC	0	
6	DB6009.DBB 23	"IOLink_Tag".IOL_Record_Data[5]	DEC	0	
7	DB6009.DBB 24	"IOLink_Tag".IOL_Record_Data[6]	DEC	0	
8	DB6009.DBB 25	"IOLink_Tag".IOL_Record_Data[7]	DEC	0	
9	DB6009.DBB 26	"IOLink_Tag".IOL_Record_Data[8]	DEC	0	
10	DB6009.DBB 27	"IOLink_Tag".IOL_Record_Data[9]	DEC	0	
11	DB6009.DBB 28	"IOLink_Tag".IOL_Record_Data[10]	DEC	0	
12	DB6009.DBB 29	"IOLink_Tag".IOL_Record_Data[11]	DEC	0	
13	DB6009.DBB 30	"IOLink_Tag".IOL_Record_Data[12]	DEC	0	
14	DB6009.DBB 31	"IOLink_Tag".IOL_Record_Data[13]	DEC	0	
15	DB6009.DBB 32	"IOLink_Tag".IOL_Record_Data[14]	DEC	0	
16	DB6009.DBB 33	"IOLink_Tag".IOL_Record_Data[15]	DEC	0	
17	DB6009.DBB 34	"IOLink_Tag".IOL_Record_Data[16]	DEC	0	
18	DB6009.DBB 35	"IOLink_Tag".IOL_Record_Data[17]	DEC	0	
19	DB6009.DBB 36	"IOLink_Tag".IOL_Record_Data[18]	DEC	0	

1. Declare the Created IOL_Record_Data tags in the Vat table to Monitor the Tags.
2. Click on Monitor.
3. Read Data will be visible in Status Value Tab of IOL_Record_Data data array.

4.2.2 Writing the IO-Link Device Parameter value by using the CPX_IOLink_Parameter functional block**Step 1**

- Let us consider an example where we have to Write the parameter **Speed "In"** of Festo SMS Device.
- We get the following details from the IO-Link interface description Simplified motion series manual.

Index (dec)	Sub-index	Name	Value / unit / gradient	Access ¹⁾			Length (byte)	Format
				U	M	S		
Control parameters („Master » Device“)								
0x0100 (256)	0	Speed "In"	1 = 10% (default) ... 10 = 100%,	-	R/ W	R/ W	1	UInteger8

Index

Sub Index

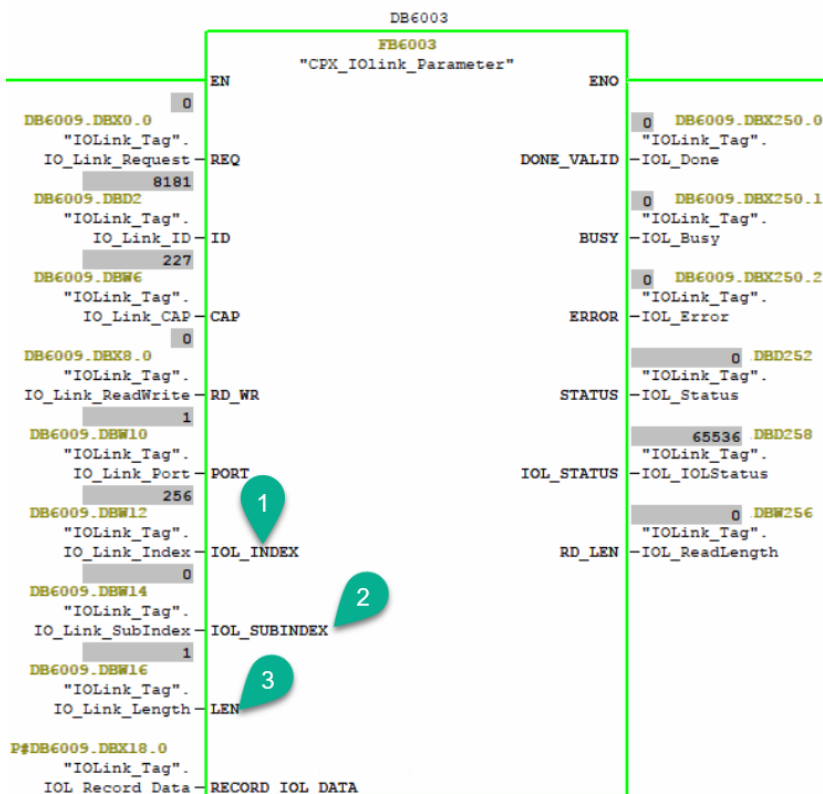
- From the parameter details the Length of the Parameter Speed "In" is Uint8. Since length of the parameter is Uint8, we have to use a variable of the data type Usint to Read/Write the parameter Data.

Step 2

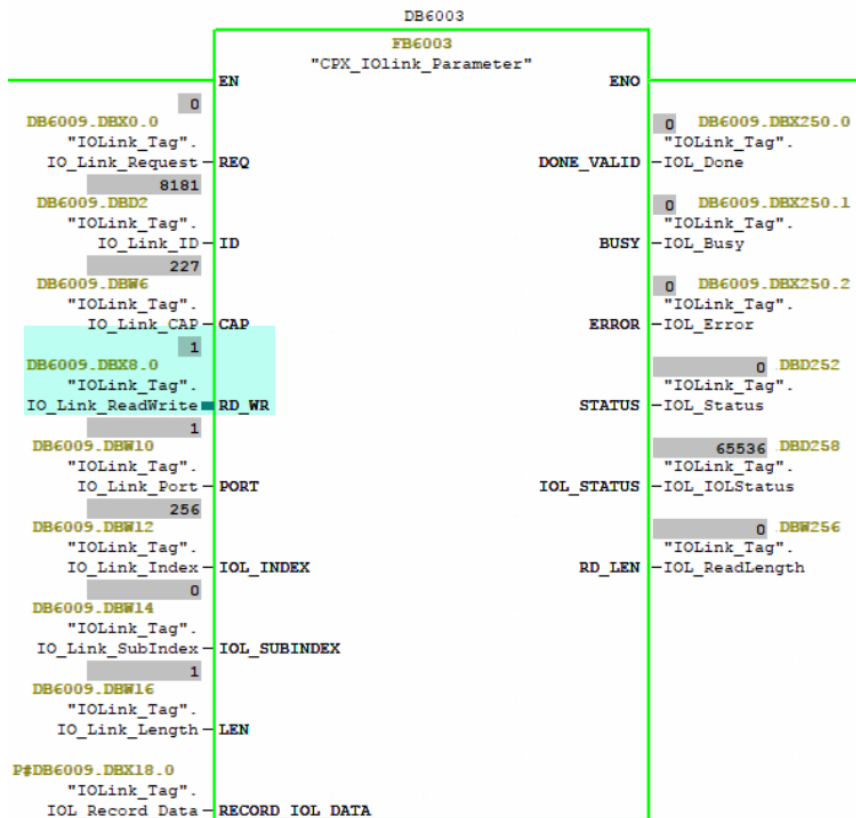
	Address	Symbol	Display format	Status value	Modify value
1	DB6009.DBB 18	"IOLink_Tag".IOL_Record_Data[0]	DEC	6	6
2	DB6009.DBB 19	"IOLink_Tag".IOL_Record_Data[1]	DEC	0	
3	DB6009.DBB 20	"IOLink_Tag".IOL_Record_Data[2]	DEC	0	
4	DB6009.DBB 21	"IOLink_Tag".IOL_Record_Data[3]	DEC	0	
5	DB6009.DBB 22	"IOLink_Tag".IOL_Record_Data[4]	DEC	0	
6	DB6009.DBB 23	"IOLink_Tag".IOL_Record_Data[5]	DEC	0	
7	DB6009.DBB 24	"IOLink_Tag".IOL_Record_Data[6]	DEC	0	
8	DB6009.DBB 25	"IOLink_Tag".IOL_Record_Data[7]	DEC	0	
9	DB6009.DBB 26	"IOLink_Tag".IOL_Record_Data[8]	DEC	0	
10	DB6009.DBB 27	"IOLink_Tag".IOL_Record_Data[9]	DEC	0	
11	DB6009.DBB 28	"IOLink_Tag".IOL_Record_Data[10]	DEC	0	
12	DB6009.DBB 29	"IOLink_Tag".IOL_Record_Data[11]	DEC	0	
13	DB6009.DBB 30	"IOLink_Tag".IOL_Record_Data[12]	DEC	0	
14	DB6009.DBB 31	"IOLink_Tag".IOL_Record_Data[13]	DEC	0	

1. Click on monitoring in the VAT table.
2. Enter the Value "6" in the Modify value of **IOL_Record_Data** tag.
3. Click on **Modify Variable** button to transfer the value to the **IOL_Record_Data** tag.
4. Transferred value will be Visible in the **Status Value** tab.

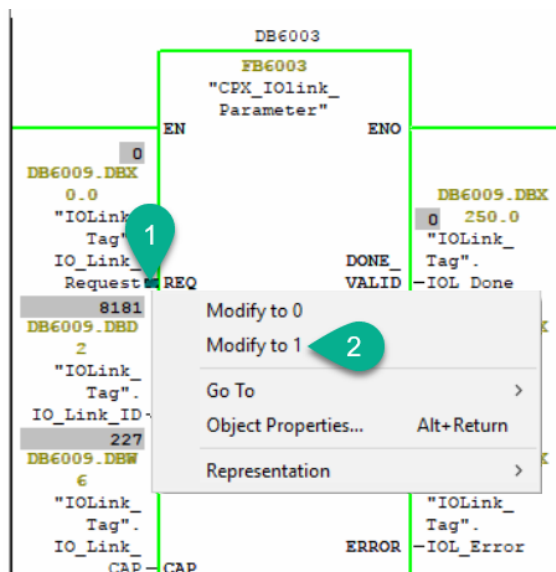
Step 3



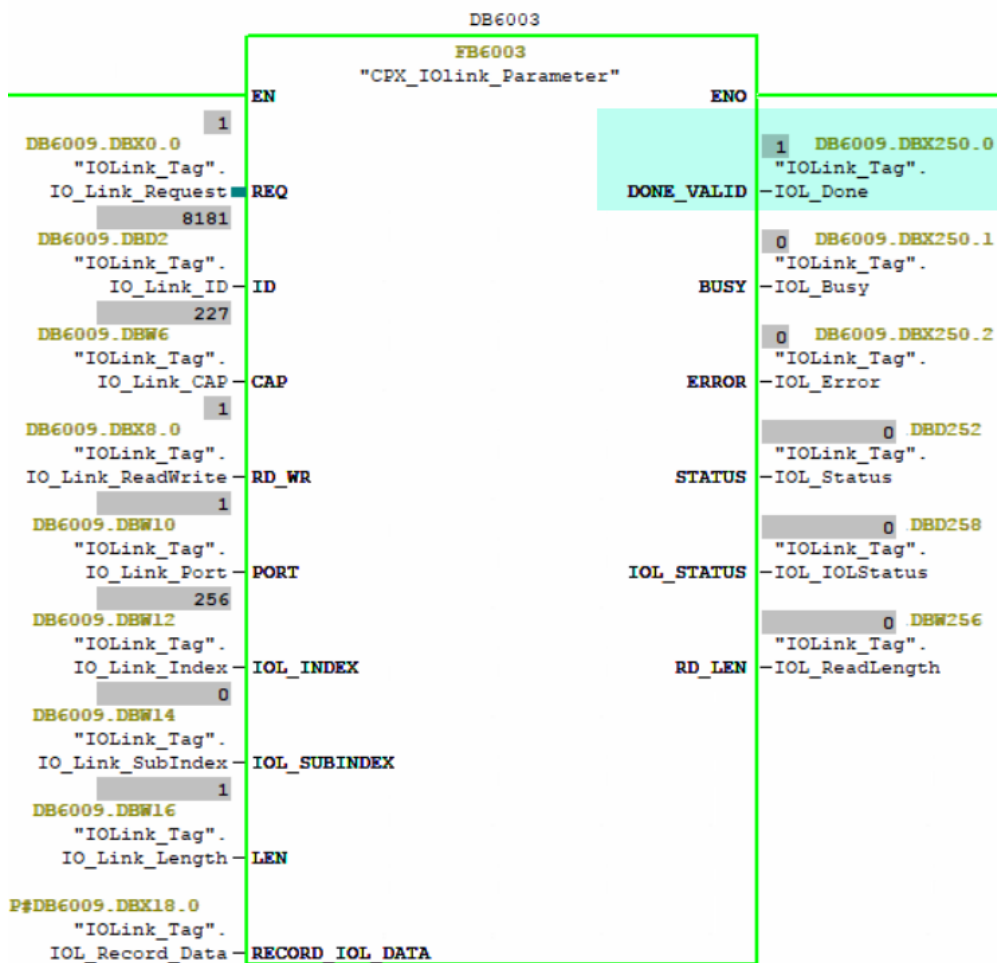
1. Enter the Parameter Index value that going to Write in the tag "**IOL_INDEX**".
2. Enter the Parameter Instance Value that going to Write in the tag "**IOL_SUBINDEX**".
3. Enter the Length of the value that are going to Write. Here the Length of Speed In value is "**1**".

Step 4

- Set the **xRD_WR** tag value to "1" to Write the Parameter.

Step 5

1. Right Click on the **REQ** tag.
2. Click **Modify to 1** option to Execute the Write function.

Step 6

- Once Write function is Done. **DONE_VALID** tag will be as "1".

**Note**

- User can verify the Write value by reading the Same parameter by using the CPX_IOLink_Parameter functional block.

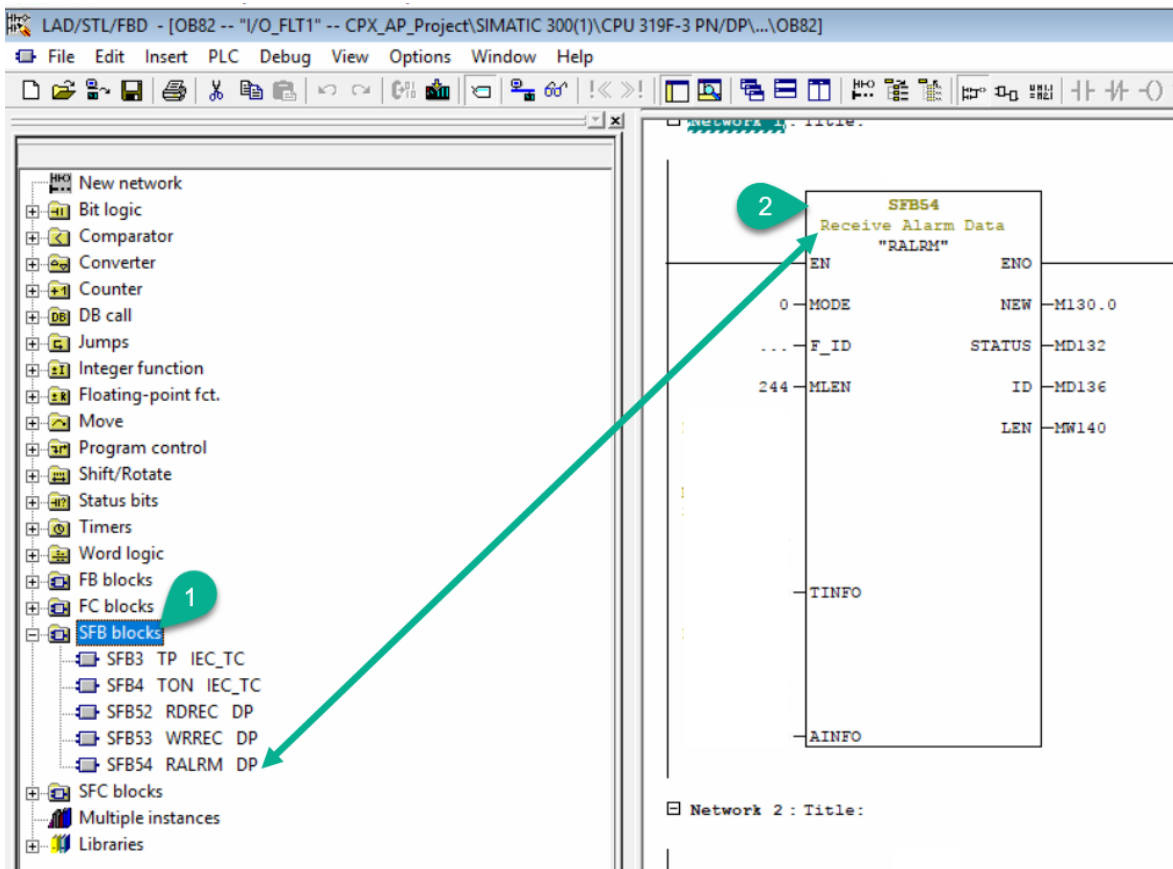
4.3 Diagnosis using RALRM Instruction in OB82

- This Chapter explains how to Read Diagnostic information using RALRM instruction in OB82.

Step 1

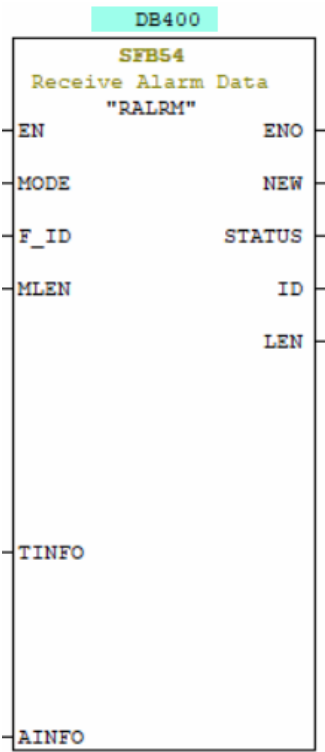
- Open the **OB82** Organisation Block

Step 2



- Debranch the **SFB blocks**.
- Drag and Drop the **SFB54 RALRM** Block to the Network.

Step 3



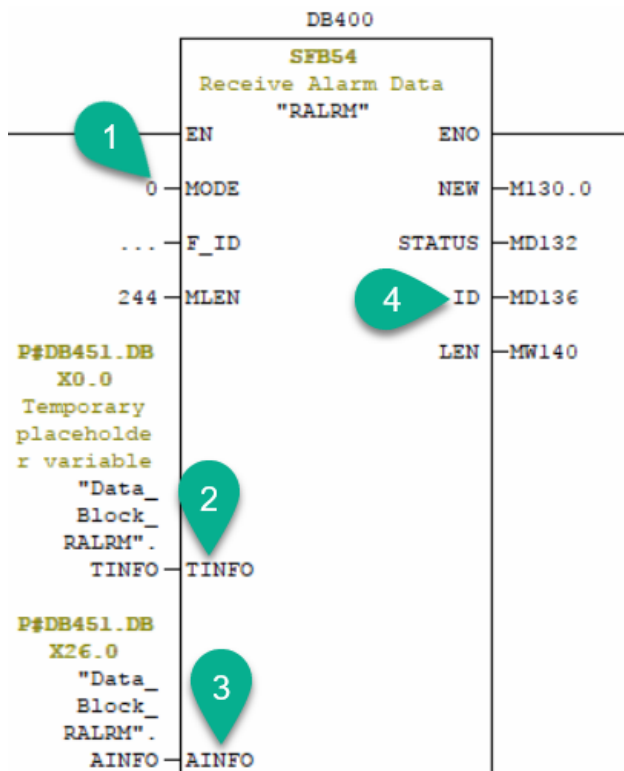
- Enter the Instance DB name to Create for the System Functional block DB.

Step 4

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	TINFO	STRUCT		Temporary placeholder variable
+0.0	SI_Format	INT	0	
+2.0	OB_Class	INT	82	
+4.0	OB_Nr	INT	0	
+6.0	LADDR	INT	0	
+8.0	IO_State	WORD	W#16#0	
+10.0	Channel	INT	0	
+12.0	MultiError	BOOL	FALSE	
+14.0	address	WORD	W#16#0	
+16.0	slv_prfl	BYTE	B#16#0	
+17.0	intr_type	BYTE	B#16#0	
+18.0	flags1	BYTE	B#16#0	
+19.0	flags2	BYTE	B#16#0	
+20.0	id	INT	0	
+22.0	manufacturer	INT	0	
+24.0	instance	INT	0	
=26.0		END_STRUCT		
+26.0	AINFO	STRUCT		
+0.0	Header	STRUCT		
+0.0	BlockType	WORD	W#16#0	
+2.0	BlockLength	INT	0	
+4.0	VersionWord	WORD	W#16#0	
+6.0	InterruptType	INT	0	
+8.0	API	DWORD	DW#16#0	
+12.0	SlotNumber	INT	0	
+14.0	SubSlotNumber	INT	0	
+16.0	ModuleSpecinfo	DWORD	DW#16#0	
+20.0	SubModuleSpecinfo_1	DWORD	DW#16#0	
+24.0	InterruptSpecification	WORD	W#16#0	
=26.0		END_STRUCT		
+26.0	addinfo	STRUCT		
+0.0	Formatidentifier	WORD	W#16#0	
+2.0	ChannelNumber	WORD	W#16#0	
+4.0	ChannelErrorType	BYTE	B#16#0	
+5.0	DataFormat	BYTE	B#16#0	
+6.0	ChannelErrType	WORD	W#16#0	
+8.0	ErrorCode	WORD	W#16#0	
+10.0	StaticAddinfo	ARRAY[0..1000]		
+2.0		WORD		
=2012.0		END_STRUCT		
=2038.0		END_STRUCT		

- Create the **TINFO** and **AINFO** Struct data type as mentioned in the [Chapter-3.3.4](#) and [Chapter-3.3.5](#).

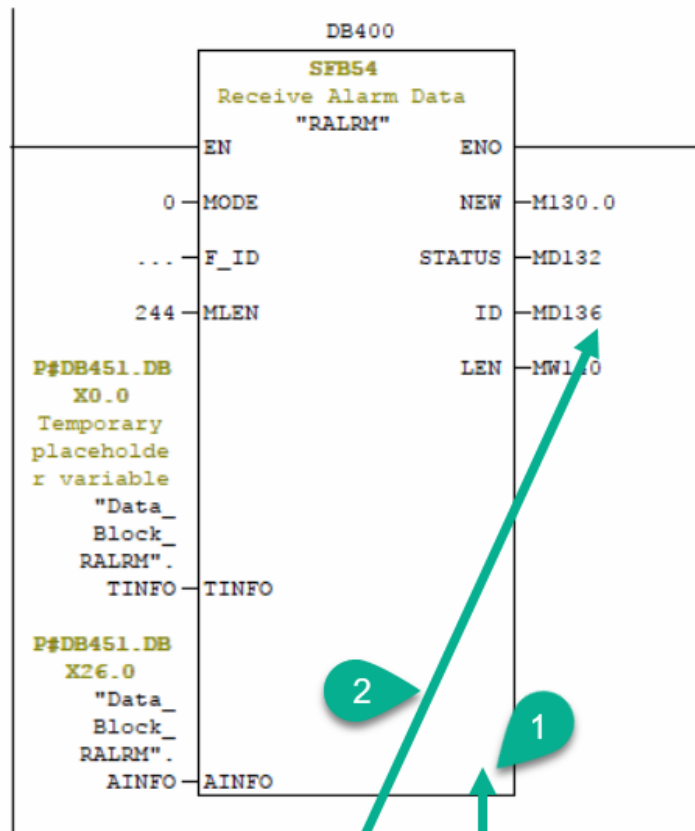
Step 5



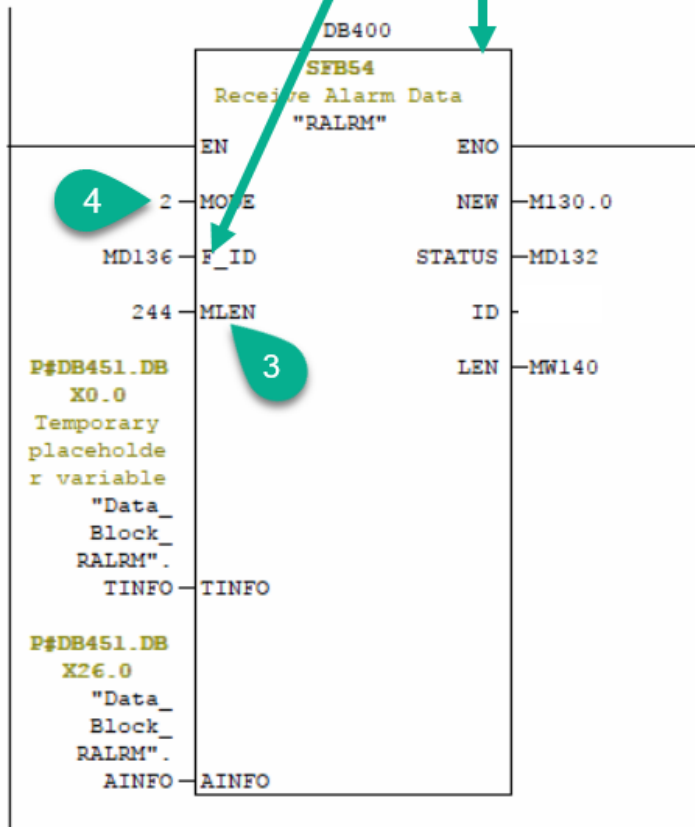
1. Enter the Mode Value as "0". To get the Hardware ID of the module with Latest error.
2. Assign the Created **TINFO** data type to the **TINFO** tag.
3. Assign the Created **AINFO** data type to the **AINFO** tag.
4. Assign the tag for **ID** tag to get the Hardware ID value.

Step 6

Network 1: Title:



Network 2: Title:



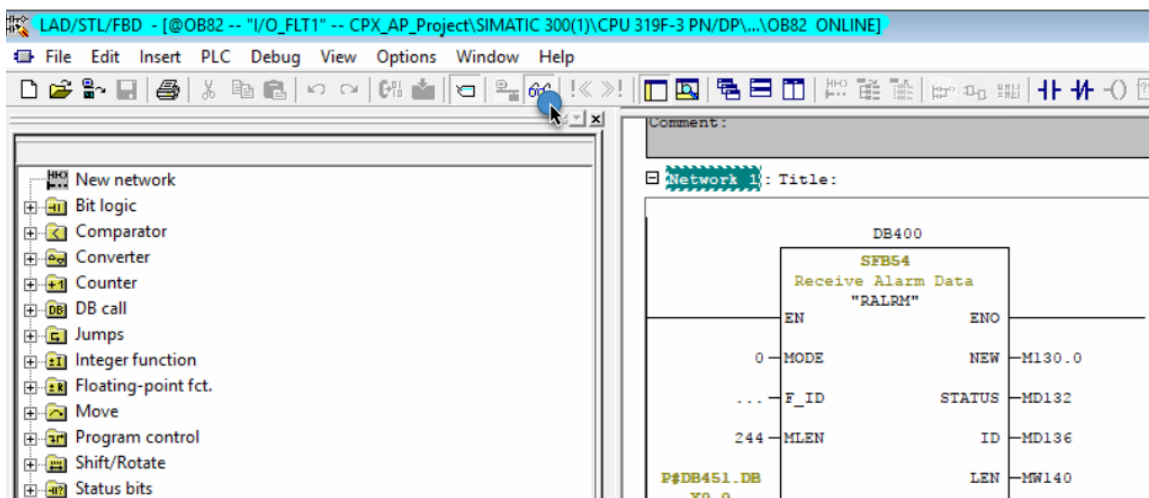
1. Copy and Paste the same **RALRM** function to the Network 2 rung.
2. Enter the **ID** tag to the **F_ID** tag.
3. Enter the length value as **244** to read the data.
4. Enter the Mode value as **"2"**. Mode value 2 gives the diagnostic information of the module with latest error.



Note

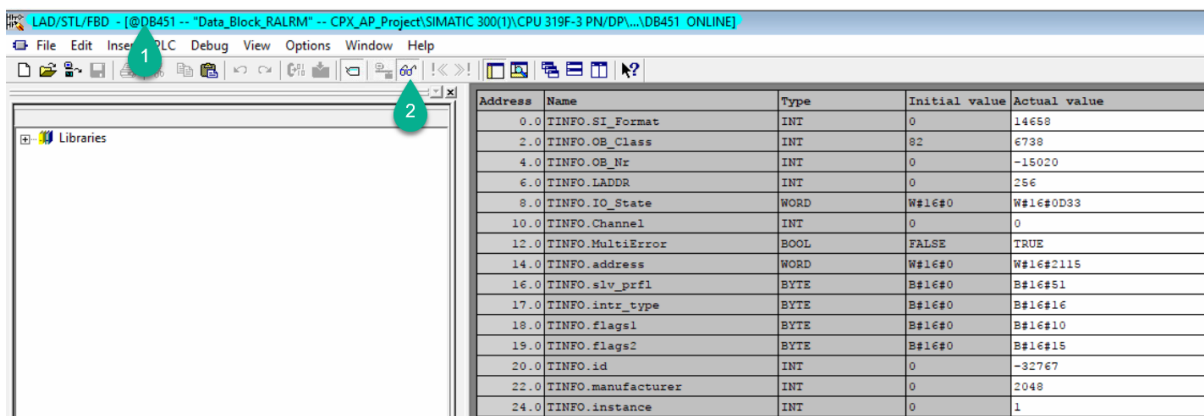
- Download the **OB82** block alone after configuring the **"RALRM"** block.

Step 7



- Click on Monitor button to Monitor the RALRM blocks.

Step 8



1. Open the **TINFO** and **AINFO** Data struct created DB.
2. Click Monitor to View the Error Details.

Step 9

26.0	AINFO.Header.BlockType	WORD	W#16#0	W#16#0002
28.0	AINFO.Header.BlockLength	INT	0	36
30.0	AINFO.Header.VersionWord	WORD	W#16#0	W#16#0100
32.0	AINFO.Header.InterruptType	INT	0	1
34.0	AINFO.Header.API	DWORD	DW#16#0	DW#16#00004E01
38.0	AINFO.Header.SlotNumber	INT	0	2
40.0	AINFO.Header.SubSlotNumber	INT	0	2
42.0	AINFO.Header.ModuleSpecinfo	DWORD	DW#16#0	DW#16#00002015
46.0	AINFO.Header.SubModuleSpecinfo	DWORD	DW#16#0	DW#16#FFFF0001
50.0	AINFO.Header.InterruptSpecinfo	WORD	W#16#0	W#16#A800
52.0	AINFO.addinfo.FormatIdentifier	WORD	W#16#0	W#16#8002
54.0	AINFO.addinfo.ChannelNumber	WORD	W#16#0	W#16#8000
56.0	AINFO.addinfo.ChannelErrorType	BYTE	B#16#0	B#16#08
57.0	AINFO.addinfo.DataFormat	BYTE	B#16#0	B#16#00
58.0	AINFO.addinfo.ChannelErrType	WORD	W#16#0	W#16#9502
60.0	AINFO.addinfo.ErrorCode	WORD	W#16#0	W#16#1800
62.0	AINFO.addinfo.StaticAddinfo[0]	WORD	W#16#0	W#16#0000

Diagnosis trace

Time elapsed since last system start: 0 Days, 00:02:39 Trace count: 6

Entry	Time	Device	Origin	Event	Severity	Diagnosis
1	0 days 00:00:06	2	IOLD 1	inform	info	IO-Link device EventCode: 3600cd / 8CA0h
2	0 days 00:00:06	2	IOLM 1	resolve	error	IO-Link master/port EventCode: 6144d / 1800h - No device (communication)
3	0 days 00:00:00	1	module	raise	info	D02 01 00262 Load supply (PL) 24 V DC switched off
4	444485 us	2	IOLM 1	raise	error	IO-Link master/port EventCode: 6144d / 1800h - No device (communication)
5	3130 us	2	module	raise	info	D02 01 00262 Load supply (PL) 24 V DC switched off
6	0 days 00:00:00	1	system	inform	info	D11 00 00320 Systemstart (4 514)

- In **AINFO.addinfo.ErrorCode** user can get the generated Module error details.