X20(c)IF10E3-1

Data sheet
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Translation of the original documentation

Publishing information

B&R Industrial Automation GmbH

B&R Strasse 1

5142 Eggelsberg

Austria

Telephone: +43 7748 6586-0

Fax: +43 7748 6586-26

office@br-automation.com

Disclaimer

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1 General information

1.1 Other applicable documents

For additional and supplementary information, see the following documents.

Other applicable documents

Document name	Title
MAX20	X20 System user's manual

1.2 Coated modules

Coated modules are X20 modules with a protective coating for the electronics component. This coating protects X20c modules from condensation and corrosive gases.
The modules' electronics are fully compatible with the corresponding X20 modules.

For simplification purposes, only images and module IDs of uncoated modules are used in this data sheet.

The coating has been certified according to the following standards:

- Condensation: BMW GS 95011-4, 2x 1 cycle
- Corrosive gas: EN 60068-2-60, method 4, exposure 21 days

1.3 Order data

Order number	Short description	Figure
	X20 interface module communication	
X20IF10E3-1	X20 interface module, for DTM configuration, 1 PROFINET IO device (slave) interface module, electrically isolated	
X20cIF10E3-1	X20 interface module, coated, for DTM configuration, 1 PROFINET IO device (slave) interface module, electrically isolated	

Table 1: X20IF10E3-1, X20cIF10E3-1 - Order data

Optional accessories

Model number	Short description
X20CA0E61.xxxxx	POWERLINK/Ethernet connection cable, RJ45 to RJ45, 0.2 to 20 m
X20CA0E61.xxxx	POWERLINK/Ethernet connection cable, RJ45 to RJ45, 20 m and longer

1.4 Module description

The interface module is equipped with a PROFINET IO device interface. This allows the B&R system (I/O modules, POWERLINK, etc.) to be connected to systems from other manufacturers and makes it possible to quickly and easily transfer data in both directions.

The interface is equipped with 2 RJ45 connections. Both connections result in an integrated switch. This makes it easy to implement daisy chain cabling.

Functions:

- PROFINET IO device
- Error monitoring

PROFINET IO

PROFINET IO (Process Field Network) is a real-time TCP/IP industrial Ethernet protocol.

Error monitoring

The status of the module and fieldbus is monitored. An error code is returned if an error occurs.

2 Technical description

2.1 Technical data

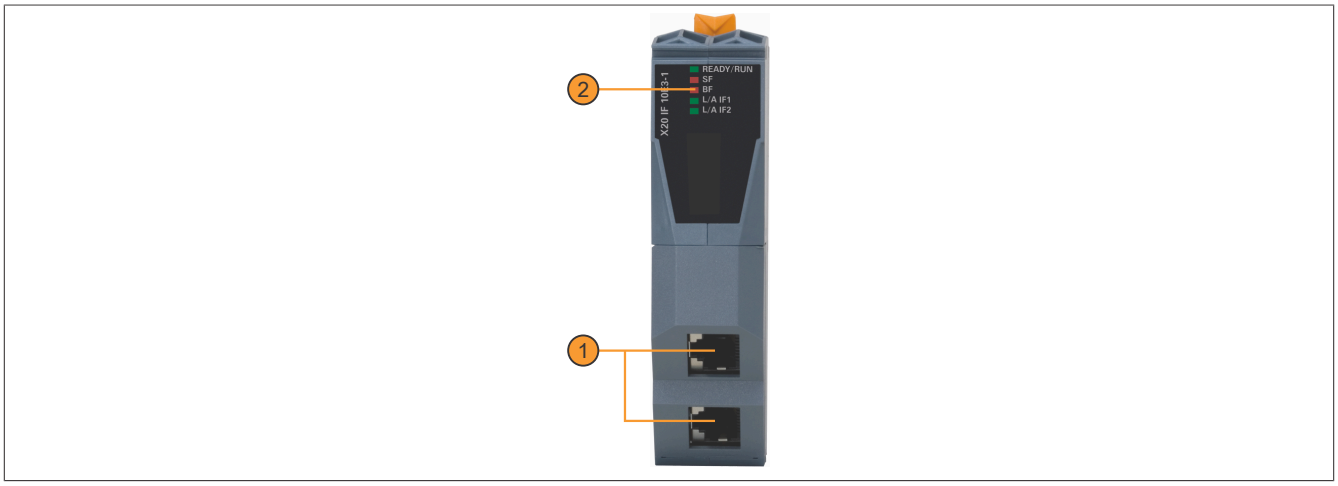
Order number	X20IF10E3-1	X20cIF10E3-1
Short description		
Communication module	PROFINET IO device (slave)	
General information		
B&R ID code	0xA71E	0xE238
Status indicators	Module status, network status, data transfer	
Diagnostics		
Module status	Yes, using LED status indicator and software	
Network status	Yes, using LED status indicator and software	
Data transfer	Yes, using LED status indicator	
Power consumption	2 W	
Additional power dissipation caused by actuators (resistive) [W]	-	
Certifications		
CE	Yes	
UKCA	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 09 ATEX 0083X	
UL	cULus E115267 Industrial control equipment	
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5	
DNV	Temperature: **B** (0 to 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)	
CCS	Yes	-
LR	ENV1	
KR	Yes	
ABS	Yes	
BV	**EC33B** Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck	
KC	Yes	-
Interfaces		
Fieldbus	PROFINET IO device (slave)	
PROFINET attributes		
Conformance class	C	
Performance class	RT (switch supports IRT)	
Netload class	III	
Variant	2x shielded RJ45 (switch)	
Line length	Max. 100 m between 2 stations (segment length)	
Transfer rate	100 Mbit/s	
Transfer		
Physical layer	100BASE-TX	
Half-duplex	Yes	
Full-duplex	Yes	
Autonegotiation	Yes	
Auto-MDI/MDIX	Yes	
Controller	netX100	
Electrical properties		
Electrical isolation	PLC isolated from PROFINET IO (IF1 and IF2)	
Operating conditions		
Mounting orientation		
Horizontal	Yes	
Vertical	Yes	
Installation elevation above sea level		
0 to 2000 m	No limitation	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	

Table 2: X20IF10E3-1, X20cIF10E3-1 - Technical data

Order number	X20IF10E3-1	X20cIF10E3-1
Ambient conditions		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
Derating	-	
Storage	-40 to 85°C	
Transport	-40 to 85°C	
Relative humidity		
Operation	5 to 95%, non-condensing	Up to 100%, condensing
Storage	5 to 95%, non-condensing	
Transport	5 to 95%, non-condensing	
Mechanical properties		
Slot	In the X20 PLC and expandable bus controller X20BC1083	In the X20c PLC and expandable bus controller X20cBC1083

Table 2: X20IF10E3-1, X20cIF10E3-1 - Technical data

2.2 Operating and connection elements



1	PROFINET IO connection with 2x RJ45 for simple wiring	2	LED status indicators

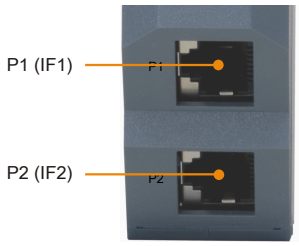
2.2.1 LED status indicators

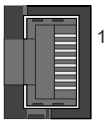
Figure	LED	Color	Status	Description
	READY/RUN	Green/red	Off	No power to module
		Red	Blinking	Boot error
			On	Communication on the PCI bus has not yet been started
		Green	On	PCI bus communication in progress
	SF	Red	Off	No error
			Cyc. Blinking[1)]	DCP signal service triggered via bus
			On	System errors
	BF	Red	Off	No error
			Blinking	No data exchange
			On	No configuration or physical connection error
	L/A IF1/IF2	Green	Off	No link to remote station
			Flickering	A link to the remote station has been established. The LED blinks when Ethernet activity is taking place on the bus.
			On	A link to the remote station has been established.

1) Blinks cyclically at 2 Hz, duration 3 s.

2.2.2 Ethernet interface

For information about wiring X20 modules with an Ethernet interface, see section "Mechanical and electrical configuration - Wiring guidelines for X20 modules with Ethernet cables" in the X20 user's manual.



Interface	Pinout		
	Pin	Ethernet	
 Shielded RJ45	1	RXD	Receive data
	2	RXD\	Receive data\
	3	TXD	Transmit data
	4	Termination	
	5	Termination	
	6	TXD\	Transmit data\
	7	Termination	
	8	Termination	

3 Function description

3.1 PROFINET IO

PROFINET (Process Field Network) is an Industrial Ethernet protocol. It uses TCP/IP and is real-time capable.

PROFINET IO is specially designed for communication between a controller and decentralized field devices and describes the entire data exchange between controllers (masters) and devices (slaves) as well as configuration and diagnostics. It follows the producer-consumer model.
2 transfer variants are available:

- Real-time (RT) communication
- Isochronous real-time (IRT) communication.

Within PROFINET IO, process data and alarms are always transferred in real time (RT). RT communication is the basis for data exchange with PROFINET IO. Clock-synchronous data exchange with PROFINET is defined in the isochronous real-time (IRT) concept. The difference to real-time communication lies essentially in the determinism so that the start of a bus cycle is maintained with the highest precision.

For additional information, see PROFINET IO interface.

3.2 Error codes

The module returns an error code if an error occurs. A complete list of all error codes in PDF format is available in under item "Communication_Error" in section "Communication / Fieldbus systems / Support with FDT/DTM / Diagnostic functions / Diagnostics on the runtime system / Master diagnostics" in Automation Help.

3.2.1 Recognizing an invalid connection

All cyclic data is set to zero in the event of an invalid connection between the master and slave.
An invalid connection may be caused by the following:

- No connection between the master and the slave
- Interface card initialization is not yet complete.
- The master is in error mode.
- Data is marked as invalid (IOPS = Bad).

It cannot be determined whether the data is valid or invalid based on the transmitted data. In order to be able to reliably recognize an invalid connection, it is necessary to evaluate the master's IOPS data additionally in the application.

Passing on IOPS data to the application can be enabled via the DTM of the interface card ("I/O status information" in Automation Studio).

4 Commissioning

4.1 Minimum DTM version for coated modules

Information:

This module requires at least version 1.0.2.14 of the DTM, which can be downloaded from category "Software/DTM" of the Downloads section of the B&R website (www.br-automation.com).

4.2 Firmware

The module comes with preinstalled firmware. The firmware is part of the Automation Studio project. The module is automatically brought up to this level.

A hardware upgrade must be performed to upgrade the firmware included in Automation Studio (see Help "Project management - Workspace - Upgrades" in Automation Help).

4.3 Operating the module

The interface module can be operated in the slot of a controller or in the slot of an expandable POWERLINK bus controller.

4.3.1 Use in the expandable X20BC1083 POWERLINK bus controller

4.3.1.1 Cyclic data

If this module is connected to the expandable POWERLINK bus controller, the amount of cyclic data is limited by the POWERLINK frame. This is 1488 bytes each in the input and output directions.
When using multiple X20IF10xx-1 interfaces or other X2X modules with a POWERLINK bus controller, the 1488 bytes are divided between all connected modules.

4.3.1.2 Operation

It is important to note the following in order to operate the module with the bus controller without problems:

- A minimum revision ≥ E0 is required for the bus controller.
- The module can only be operated with the POWERLINK V2 setting. V1 is not permitted.
- With SDO access to POWERLINK object 0x1011/1 on the bus controller, the firmware and configuration stored on the bus controller are not reset. They can only be overwritten by accessing them again. This affects objects 0x20C0 and 0x20C8, subindexes 92 to 95.

4.3.1.3 Timing characteristics

The internal data transfer results in an additional runtime shift of one cycle per direction.

Information:

For additional information about runtime behavior, see section "Runtime shift" in X20BC1083.

5 PROFINET IO interface

2 steps are generally necessary for connecting module X20IF10E3-1 to an external master environment.

1) Add and configure the X20 interface module in B&R's Automation Studio.

2) Add the PROFINET device (slave) GSDML device description file in the external master environment, e.g. Siemens STEP 7 or Siemens TIA-Portal. The interface module must then be configured.

Information:

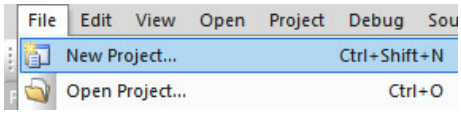
To ensure error-free PROFINET communication between controller (master) and device (slave), the settings for the interface module in Automation Studio must match the settings of the GSDML device description file in the master environment.

5.1 Settings in Automation Studio

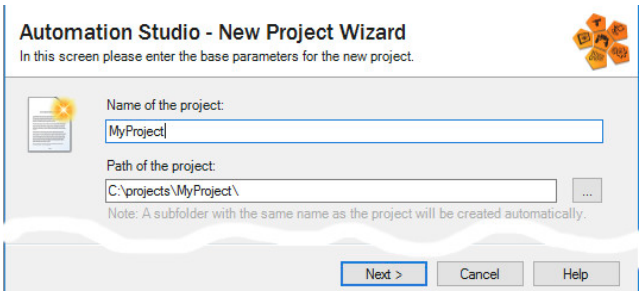
To configure the interface, a new Automation Studio project is created and the suitable settings are made on the module.

5.1.1 Creating an Automation Studio project

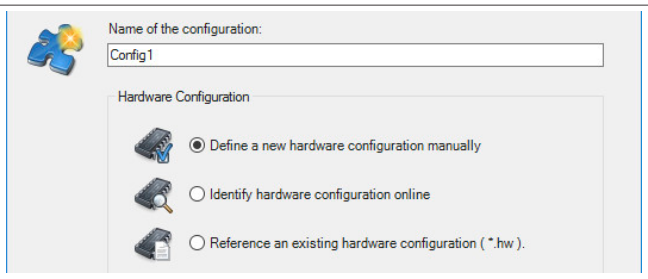
- Create a new Automation Studio project by selecting "New project".



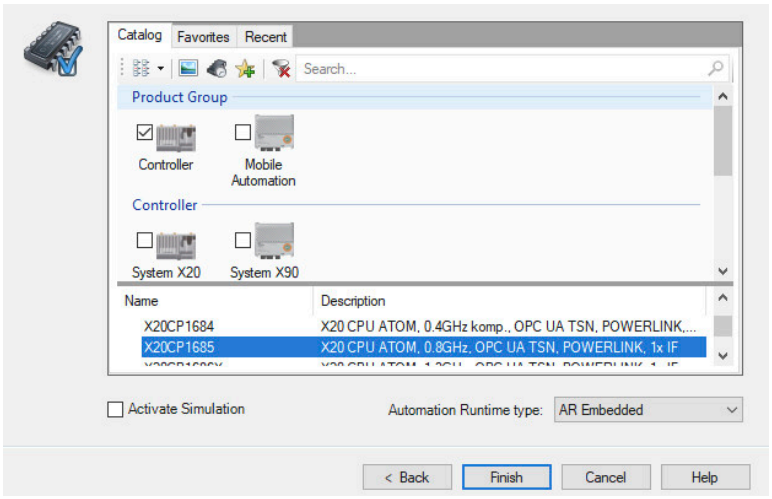
- Assign a project name and set up the project path.



- The type of hardware configuration is selected, and the name of the configuration is assigned.

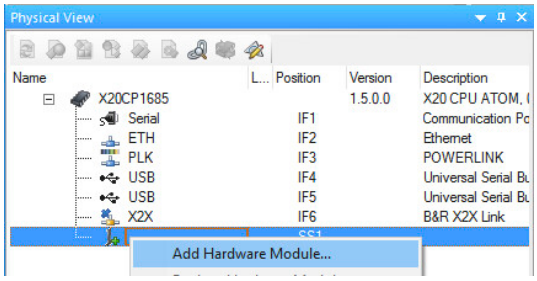


• If "Define a new hardware configuration manually" was selected, the hardware is selected in the next step. In order to simplify the search, different filters can be set for this in the Hardware Catalog. Finally, the Automation Studio project is created by selecting the required hardware is and clicking "Finish".

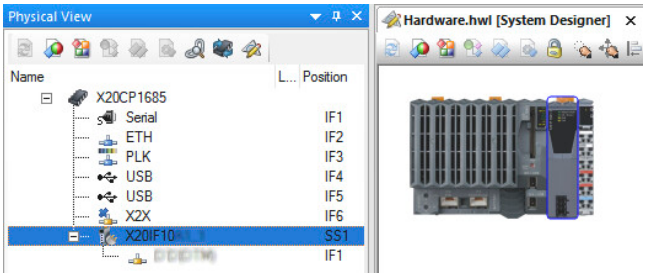


5.1.2 Adding and configuring the interface module

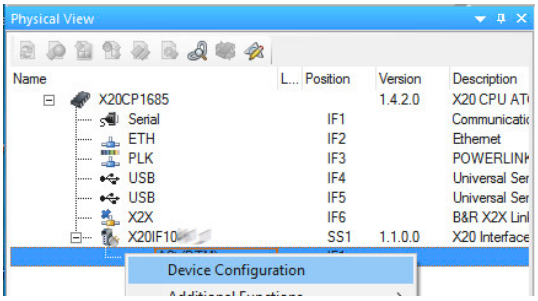
• In this example, the interface card is connected in the slot of a controller. Right-clicking on the slot and selecting "Add hardware module" opens the Hardware Catalog.



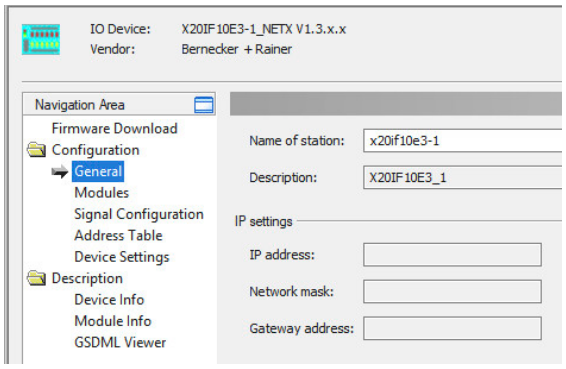
• The module is added to the project via drag-and-drop or by double-clicking on the interface card.



• Additional module settings can be made under "Device configuration". This configuration environment is opened by right-clicking on the IF interface and selecting "Device configuration".



- General settings are made in the device configuration.



5.1.2.1 General

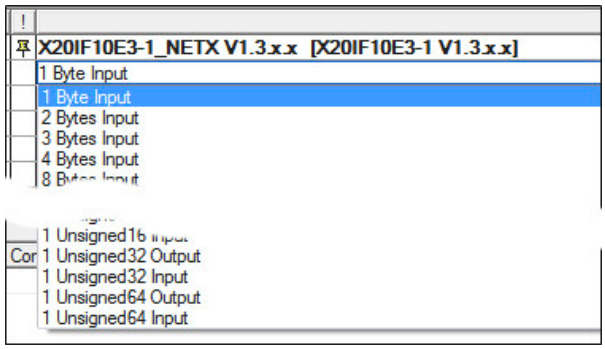
The name of the station (slave) can be set here.

All other parameters are defined at the master. The PROFINET IO device (slave) is identified by the station name. As soon as there is a connection from the controller to the PROFINET IO device (slave), the other parameters (IP address, network mask, etc.) are transferred to the PROFINET IO device (slave).

5.1.2.2 Modules

Modules can be added to the PROFINET IO device (slave) here.

Parameter	Explanation
⊞	Selecting a submodule If a submodule is selected, more detailed information about the submodule is displayed in the lower table.
Slot	Shows the current slot number assigned to a module. The sequence of the modules can be changed by changing the slot number.
Subslot	Shows the current subslot number assigned to a module. The sequence of the modules can be changed by changing the subslot number.
!	Slot symbol: Indicates the use of the (sub)modules. • **No symbol:** (Sub)slot number and name can be changed. • **Pin symbol:** No change possible
Modules	The module type can be changed by selecting the desired type in the dropdown box.



"Add module" adds the default module "1 byte input" to the slave. This module can be changed via the dropdown menu in column "Modules".

Use "Remove" to remove the modules again.

— Submodule details

"Dataset" can be used to toggle between I/O data and parameters.

"Display mode" allows toggling between decimal and hexadecimal display.

The modules are simple input and output modules. These have no adjustable parameters. I/O data cannot be changed in this table.

5.1.2.3 Signal configuration

The data structure of the individual modules can be defined here; the name and data type of the inputs and outputs can also be adjusted. Data types can also be combined.

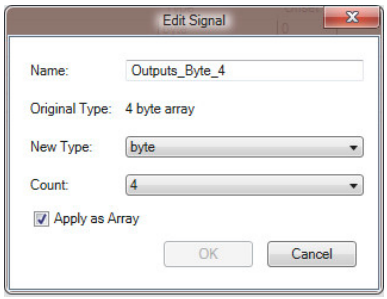
Parameter	Explanation
Slot	Position of the slot
Name	Name of the slot
Module type	Number of bytes and type of connection (input or output)

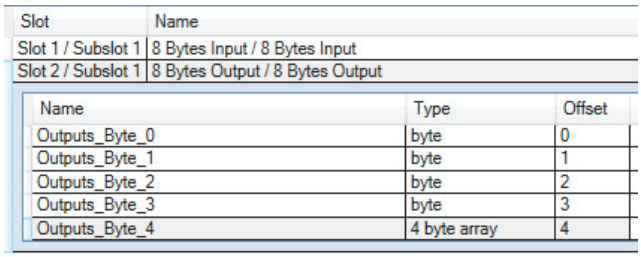
After selecting a slot, the type, data type and offset are displayed in another table below.

After right-clicking on the signal to be configured, the following options can be selected in the shortcut menu:

- **Edit signal**
  This allows the currently selected signal to be edited.

Parameter	Explanation
Name	The new name for the signal
New type	The new data type for the signal
Count	Number of individually listed data type elements for the signal. Only the data of the original type is restructured; the quantity is not adjusted. - The maximum number corresponds to the quantity that the new data type requires to display the original type. - If fewer elements are selected, the last data type element is listed as an array of all remaining elements.
Apply as array	If selected, the new data type is displayed as an array. Otherwise, the data type elements set under "Count" are displayed.

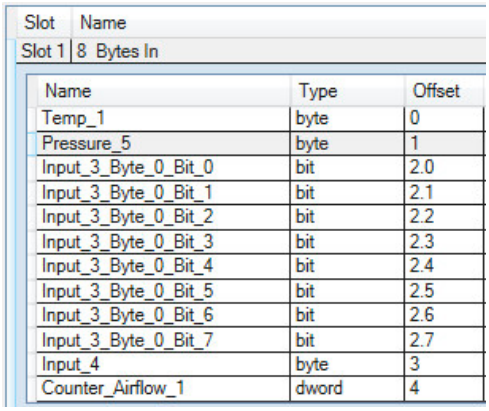




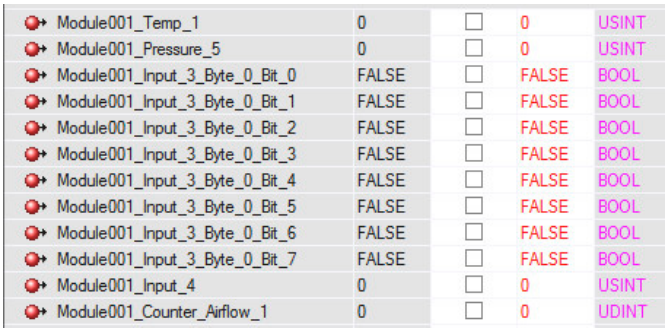
- **Reset**
  This can be used to undo the signal change or a merge previously completed with "Merge signal".
- **Merge signal**
  This allows all signals to be merged into a new group. The same settings can be made for the new group as under "Edit signal".

The settings made are reflected in the process image (I/O mapping).

Configuring the signal



Process image



5.1.2.4 Address table

This table provides information about the addresses of the input and output data (in decimal or hexadecimal notation).

"Display mode" allows toggling between decimal and hexadecimal display.

Parameter	Explanation
Modules	Name of the module
Submodule	Name of the submodule
Type	Data type
Length	Length of the module/submodule in bytes
Address	Offset address of the data

The address table can also be exported as a CSV file.

5.1.2.5 Device settings

- Start of bus communication

It is possible here to select how data exchange is started on the module.

Parameter	Explanation
Automatically by device [1)]	Data exchange is started automatically after the module is initialized.
Controlled by application	Data exchange is started by Automation Runtime.

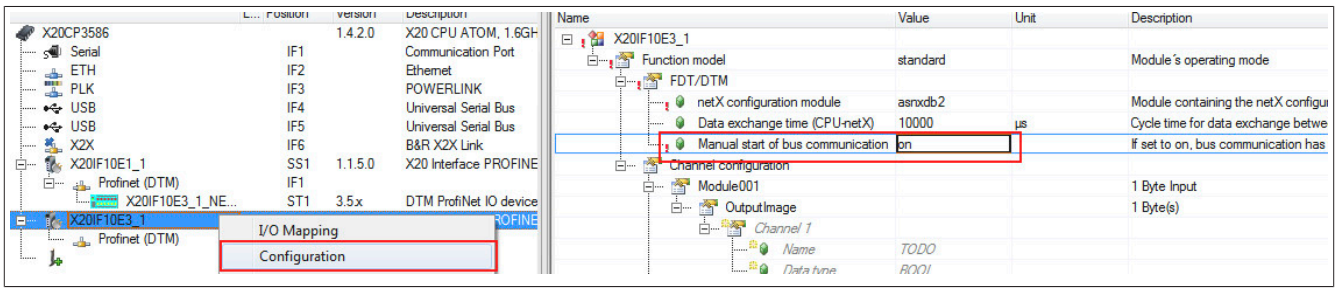
1) If "Automatically by device" is used, it is possible that the interface module already boots up and establishes a connection to the remote station before the entire system has booted up. If the system requires another restart during startup, however, the interface module will also be restarted.
Note: In some situations, this may mean that a connection can no longer be established with the remote station.

Information:

"Controlled by application" should preferably be used on the expandable POWERLINK bus controller.

Information:

Parameter "Manual start of bus communication" can be enabled under the I/O configuration of the PROFINET IO device (slave).



The following settings must be made in order to avoid automatic data exchange:

- In the IF module configuration, "Manual start of bus communication" must be set to "On".
- "Start of bus communication" must be set to "Controlled by application".

With this setting, the communication can only be started via function block **AsNxPnS - nxpnsStartBusComm()**.

- Application monitoring

The module-internal watchdog time can be set here. If the watchdog has been enabled (watchdog time not equal to 0), the hardware watchdog must be reset after the set time at the latest.

Parameter	Explanation	Values
Watchdog time	Software watchdog disabled	0 ms
	Permissible range of values. Default value: 1000 ms	20 to 65535 ms

Information:

The watchdog time is reset automatically by Automation Runtime.

Information:

This value refers exclusively to the software watchdog and not to the PROFINET watchdog time set in the PROFINET IO controller.

- Process image storage format

This is used to define how data is stored in the process image (I/O mapping). The storage format is only applied to data type "Word". This change has no effect on other data types.

Storage format	Explanation
Big-endian	MSB/LSB = Higher/Lower byte (Motorola format)
Little-endian	MSB/LSB = Higher/Lower byte (Intel format)

Storage format - Little-endian (default setting)

Module002_Output_1	16#00	16#00	USINT
Module003_Input_2	16#3344	16#0000	UINT
Module004_Output_2	16#0000	16#0000	UINT

Storage format - Big-endian

Module002_Output_1	16#00	16#00	USINT
Module003_Input_2	16#4433	16#0000	UINT
Module004_Output_2	16#0000	16#0000	UINT

— I/O state information

The IOPS interface can be configured here. If configured, the PROFINET input/output object provider state (IOPS) permits the PROFINET IO device application program to recognize whether the received data from the PROFINET device is valid or not and declares the output data as valid or invalid.

Setting	Explanation
Disabled	I/O state information disabled.
Bit	The IOPS is treated as a bit list in the DPM (Dual Port Memory) of the PROFINET IO device. For this purpose, 2 I/O data points (InIOPS and OutIOPS) are listed in the I/O assignment for the individual input and output data. • Respective bit set to 1: Data is valid. • Respective bit set to 0: Data is invalid.
Byte	The IOPS is treated as a byte array in the dual-ported memory (DPM) of the PROFINET IO device. For this purpose, 2 I/O data points (InIOPS and OutIOPS) are listed in the I/O assignment for the individual input and output data of the slave. • Respective byte set to 0x80: Data is valid. • Respective bit set to not equal to 0x80: Data is invalid.

5.1.2.6 Description

General device information and the entire GSDML file can be read here.

6 GSDML device description file

The module description is made available to the master in an GSDML file. This text file contains the description of the slave's complete range of functions. The GSDML file can be downloaded from the B&R website (www.br-automation.com) in the Downloads section for the interface module and then imported into the respective master environment.

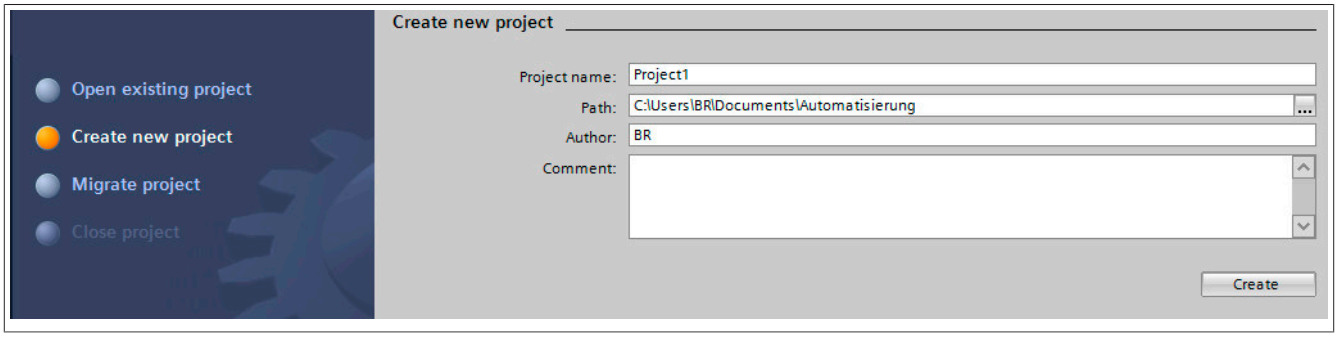
7 TIA portal

Software and hardware used for this example:

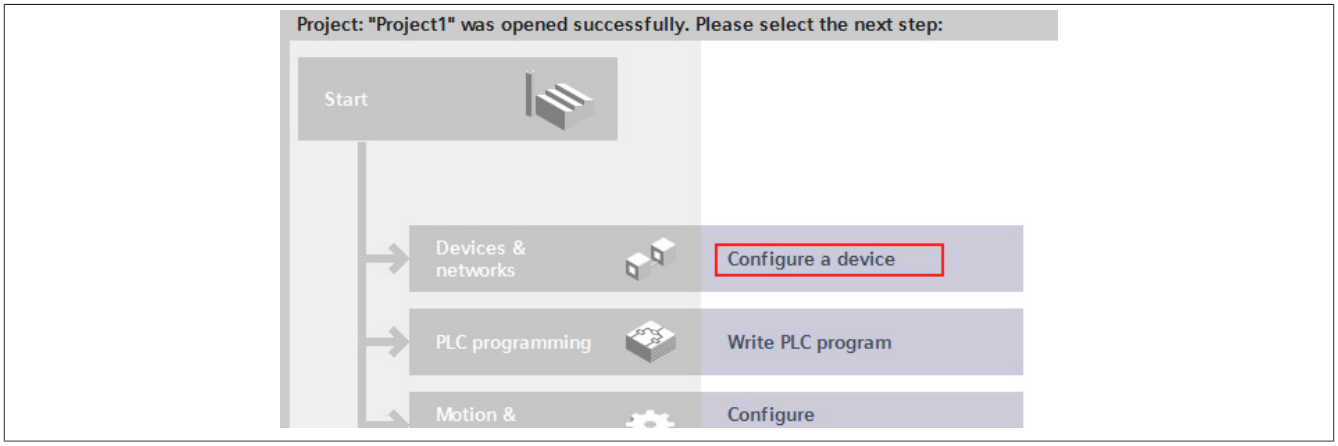
- X20IF10E3-1 B&R PROFINET IO device (slave) interface module
- GSDML file from the B&R website
- CPU315-2 PN / DP Siemens controller as PROFINET master
- TIA portal version 13 (trial version)

7.1 Creating a new project

• After opening the TIA Portal development environment, a new project must first be created. To do this, select **Create new project** and specify the name and path of the new project. The new project is created with button **Create**.

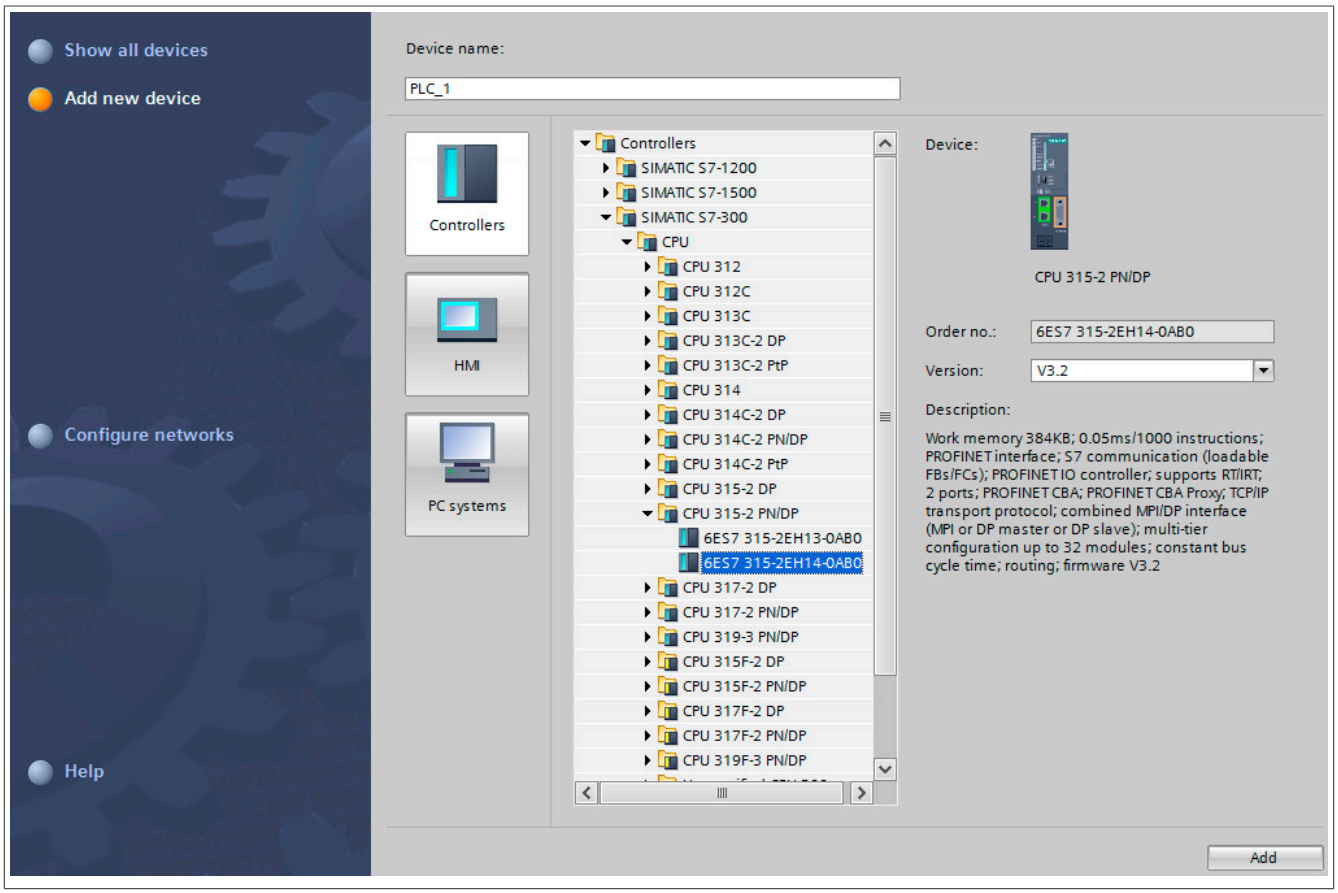


• After the project is created, the necessary devices can be added and configured.
The first step is to select **Configure a device**.



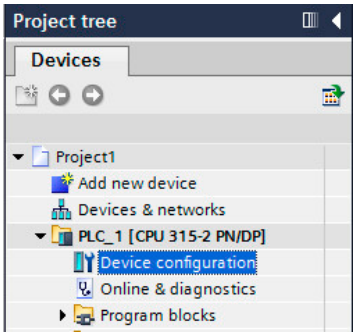
TIA portal

- The controller used is selected using **Add new device** and added to the configuration with button **Add**.

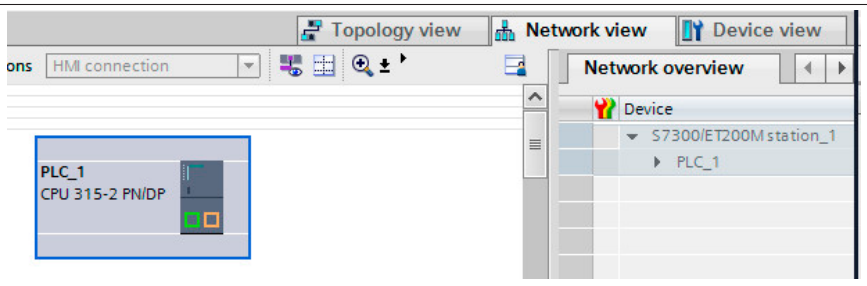


7.2 Adding a PROFINET IO device (slave)

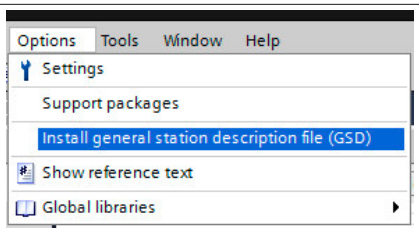
- To add a PROFINET IO device (slave), you must switch to the hardware view. To do this, select **Device configuration** by double-clicking in column **Project tree**.



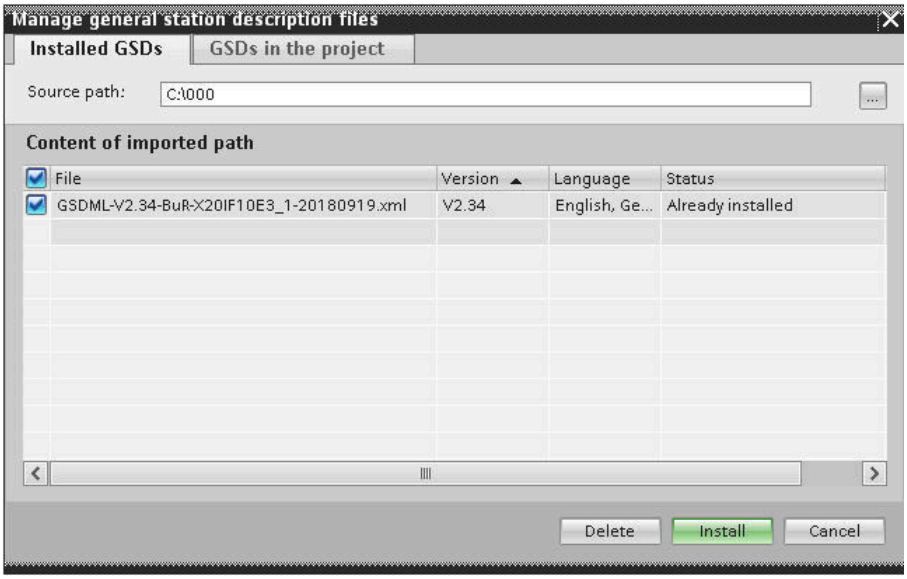
- The hardware structure can be checked or updated via tab **Network view**.



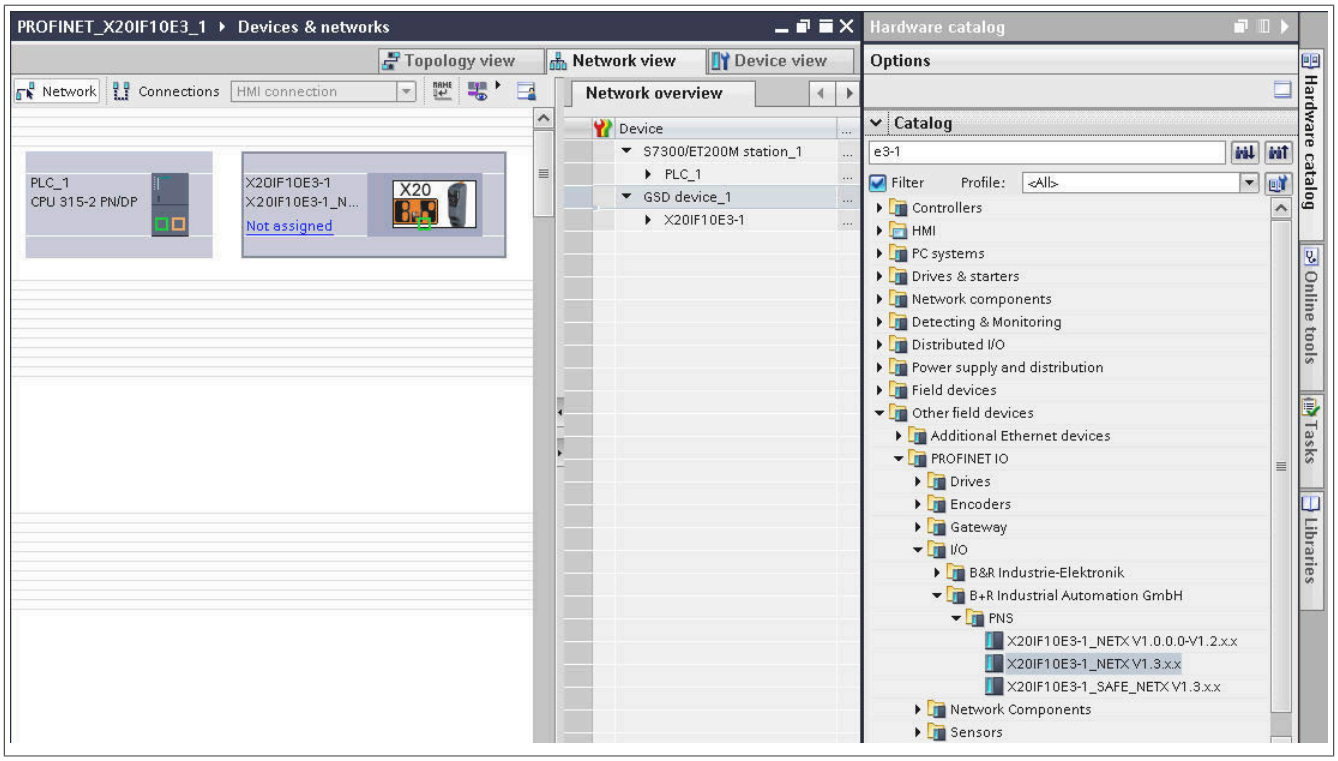
- In order to use the interface module, its description file must first be installed. The description file can be downloaded from the B&R website and installed via Options → Install general station description file (GSD).



- The downloaded description file is selected in the dialog box and added to the project with button **Install**. This adds the bus controller to the Hardware Catalog of the TIA portal.

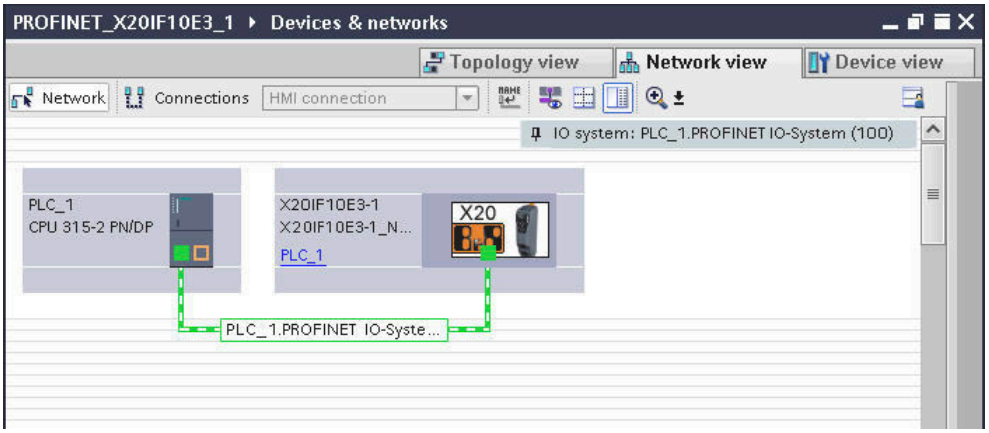


- Now the installed interface module can be used in the project. The interface module is selected in the Hardware Catalog and then dragged and dropped into the project.

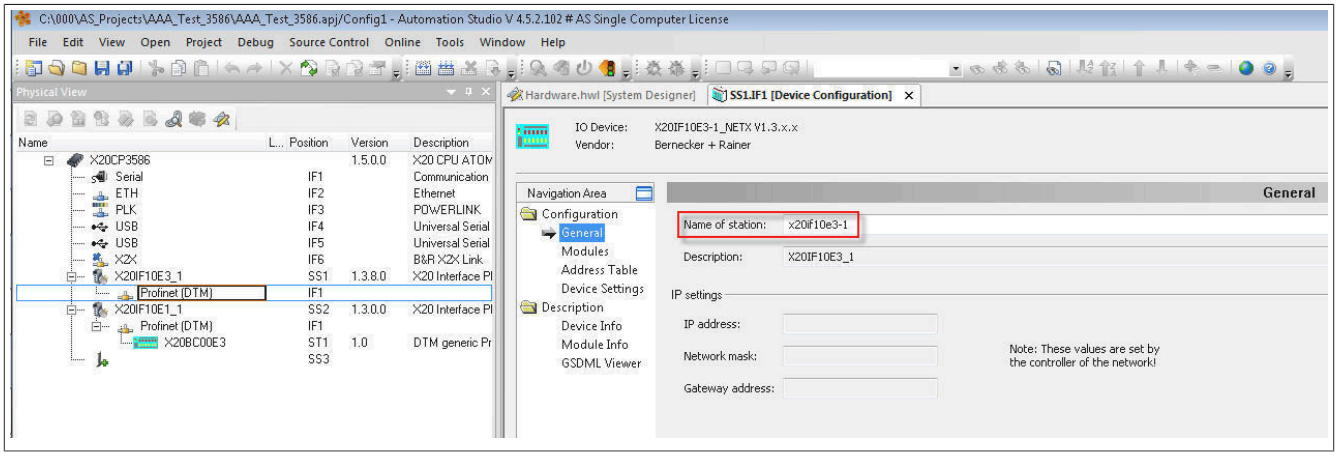


TIA portal

- The installed controller and the interface module are connected via PROFINET. For this purpose, the PROFINET interface of the controller is connected to the PROFINET interface of the interface module via drag-and-drop.



- To establish communication between the PROFINET IO controller (master) and PROFINET IO device (slave), the PROFINET device name of the slave must be set. This must match the set PROFINET device name of the interface module in Automation Studio.

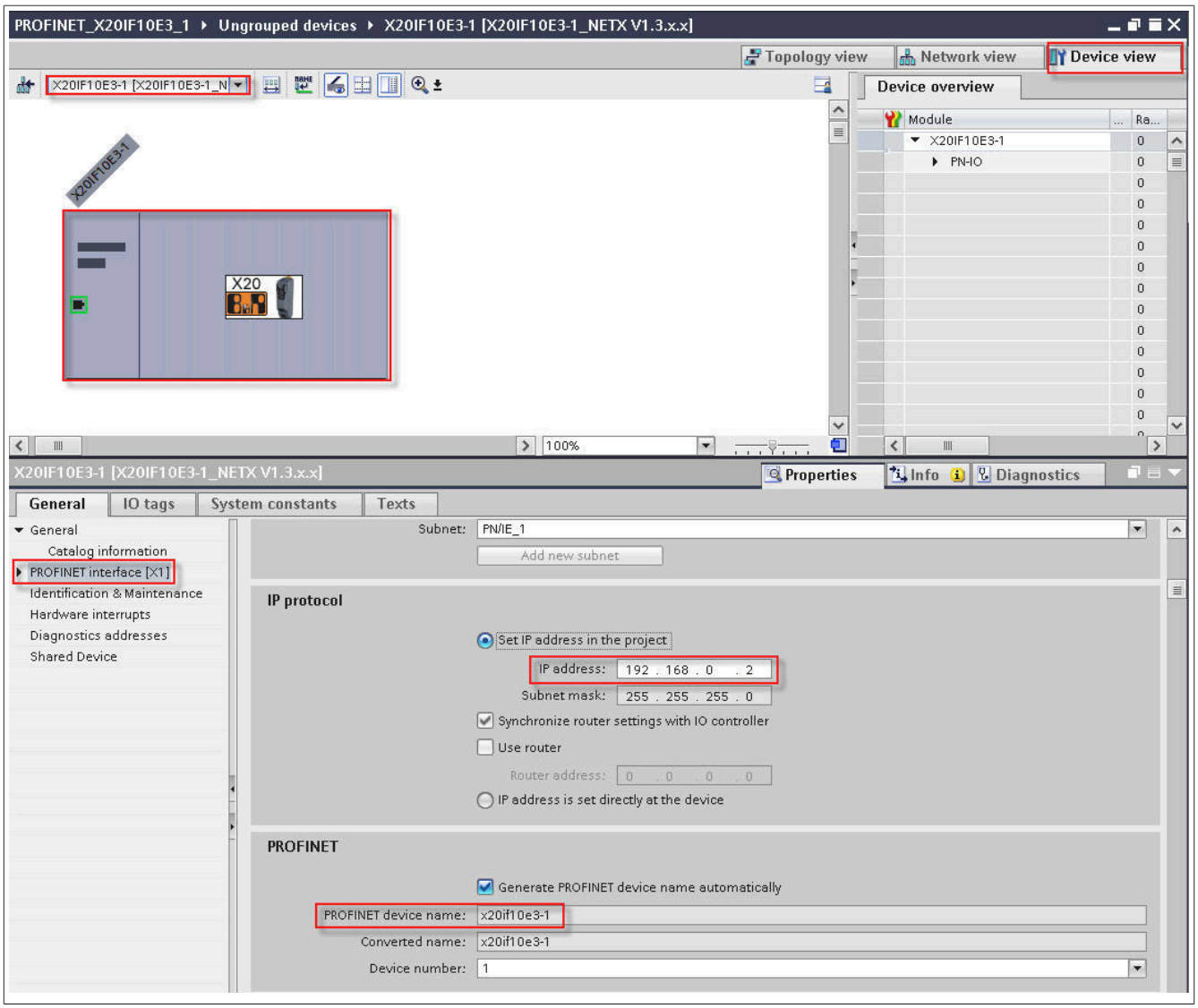


To set the PROFINET IO device name in the TIA portal, select the PROFINET interface module (X20IF10E3-1) from the **Device overview** in the drop-down list.

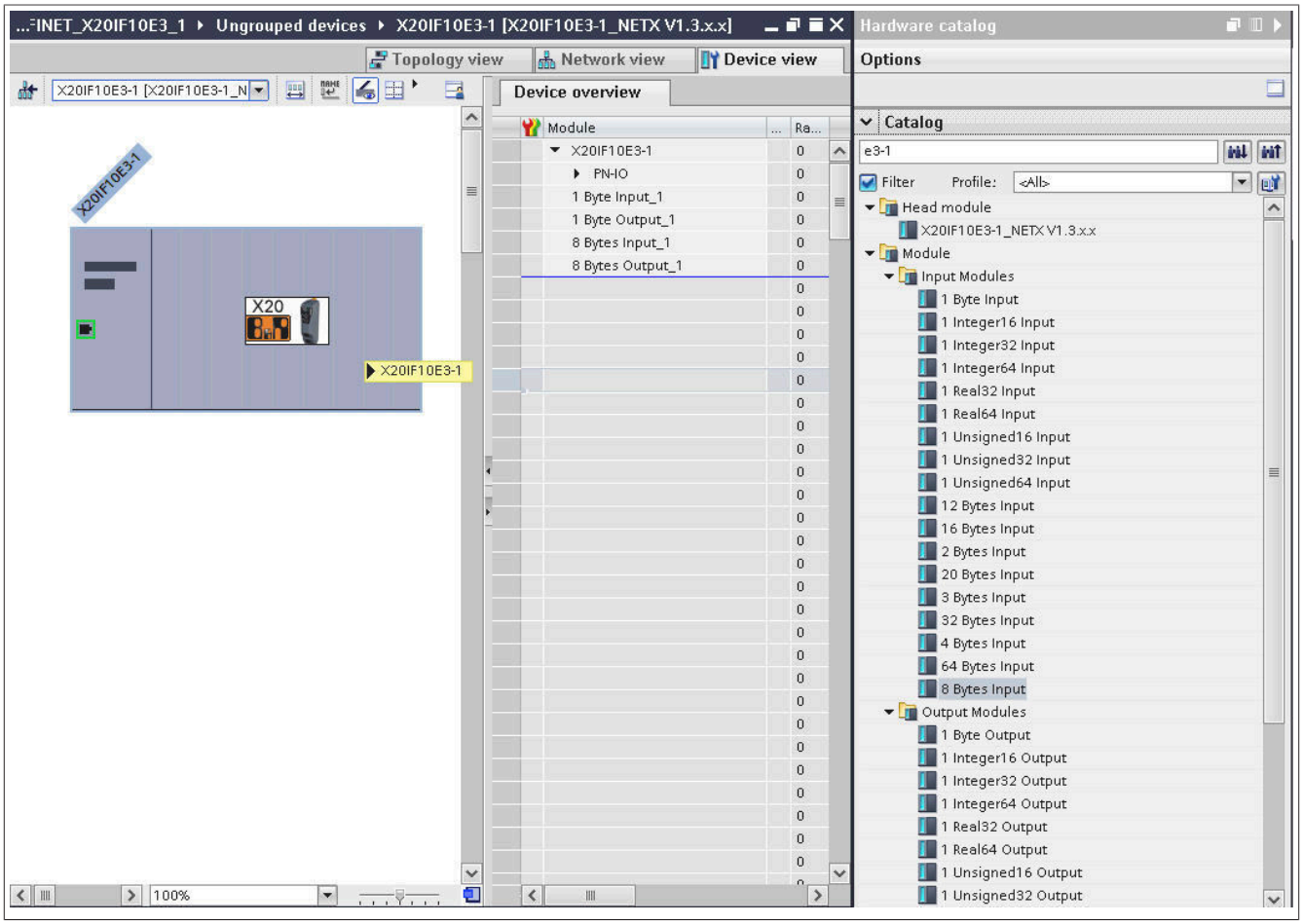
By double-clicking on the image of the module, the setting options become visible below. The desired PROFINET IO device name must be set here.

If flag "Generate PROFINET device name automatically" is active, the default name stored in the PROFINET IO device is assigned automatically.

In addition, the PROFINET IO device must also be assigned an IP address. An IP address is assigned from the IP address range of the PROFINET IO controller by default. The IP address of the PROFINET IO controller corresponds to the management IP address of the controller. For additional information, see "Establishing a connection to hardware" on page 25.



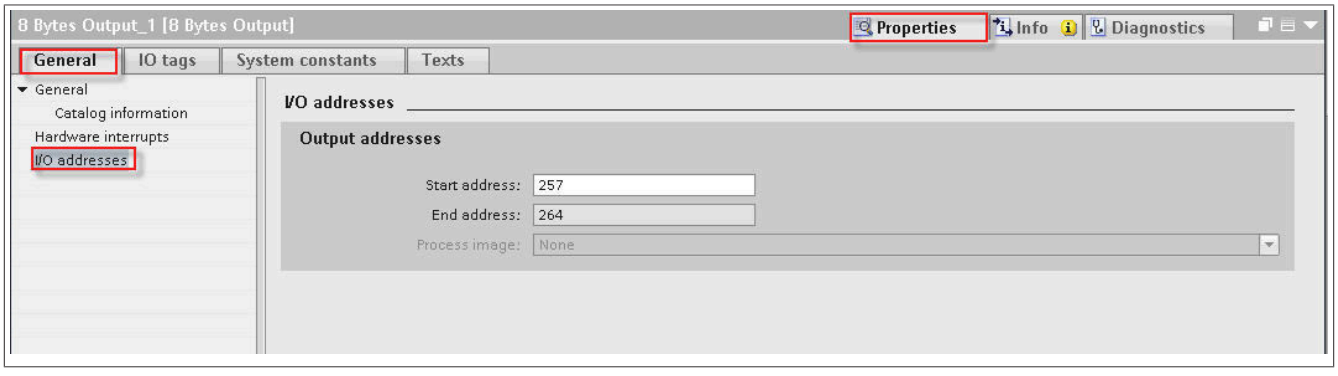
- Any additional modules can be added with the Hardware Catalog. To do this, drag and drop the modules into the **Device overview**.



- After modules are added, they can be easily configured by selecting them.

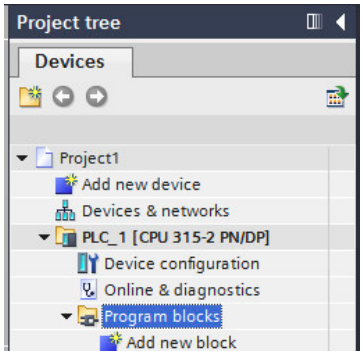
Example

"End address" of a module is read out via Properties → General → I/O addresses in order to be able to link it with a variable created in the application.

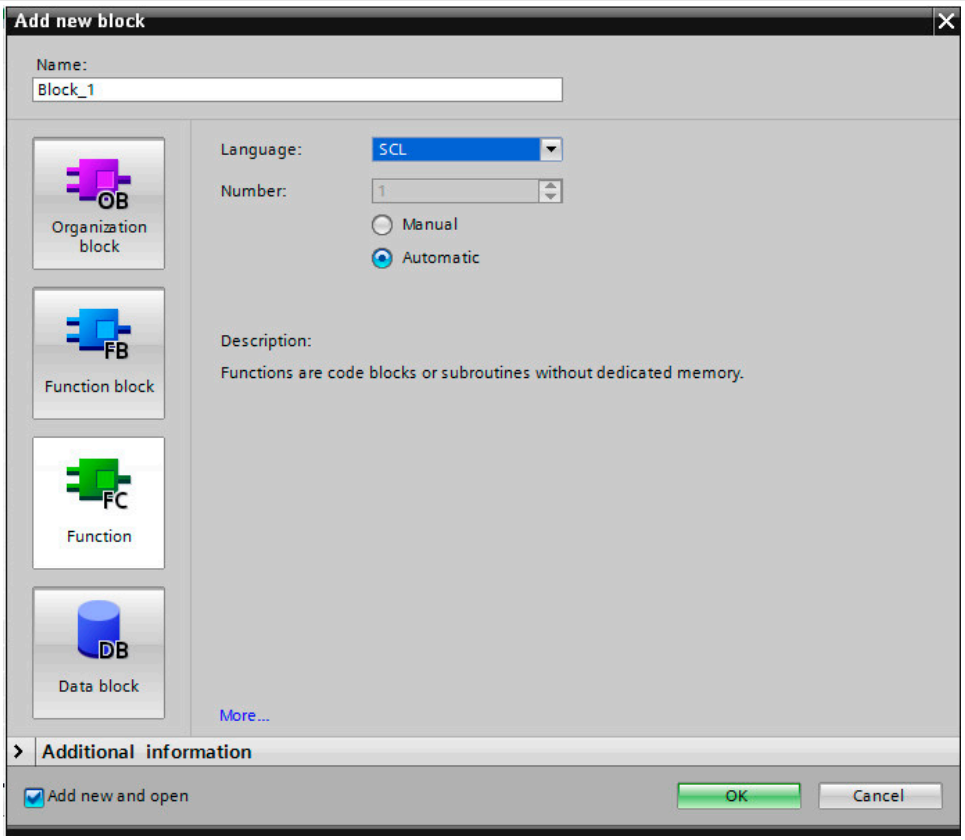


7.3 Creating an application

- An application can be added via Project tree → Program blocks.



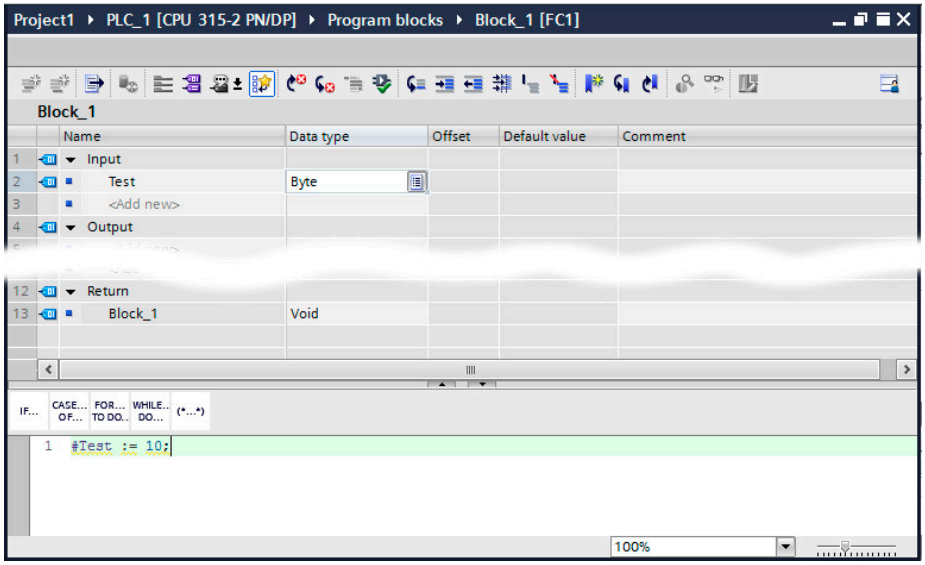
- If a new program is created using **Add new block**, the name of the block and the programming language are first set and confirmed with **OK**.
In this example, this is **SCL** (Structured Text), but any programming language can be used.



- The block is divided into two parts.
  - Variables can be created in the upper part of the block.
  - The application is programmed in the lower part.

Example

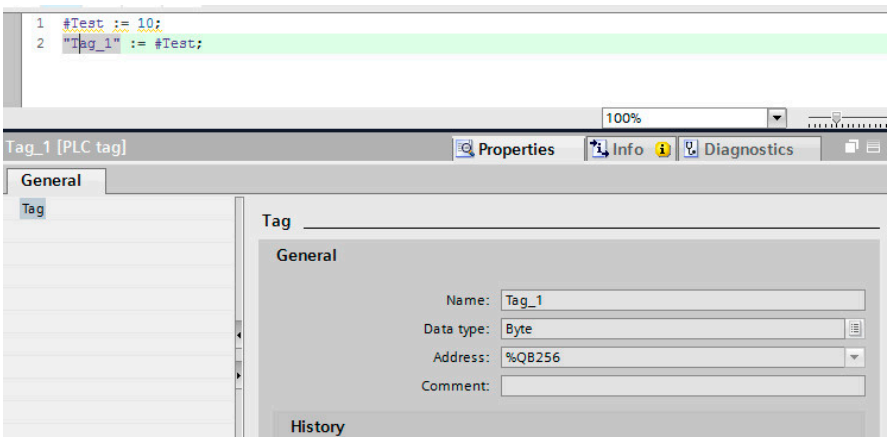
A variable named "Test" of data type "BYTE" should be created and assigned value 10 using the application.



- A **tag** can now be created in the application to link the variable to an output via an address. This is created with "%QB + Address" or "%IB + Address":

Example

Tag %QB256 is assigned to variable "#Test".

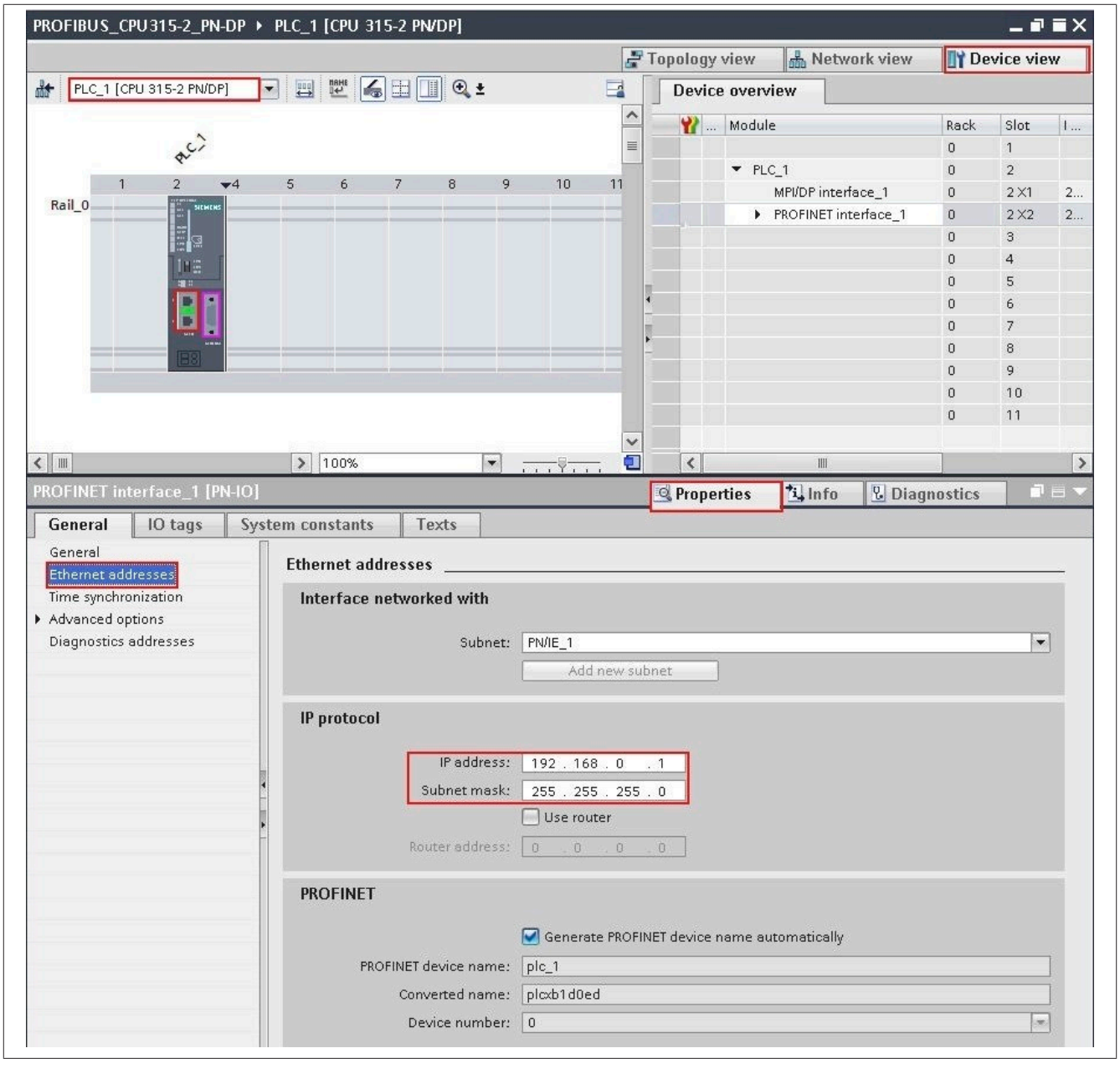


7.4 Establishing a connection to hardware

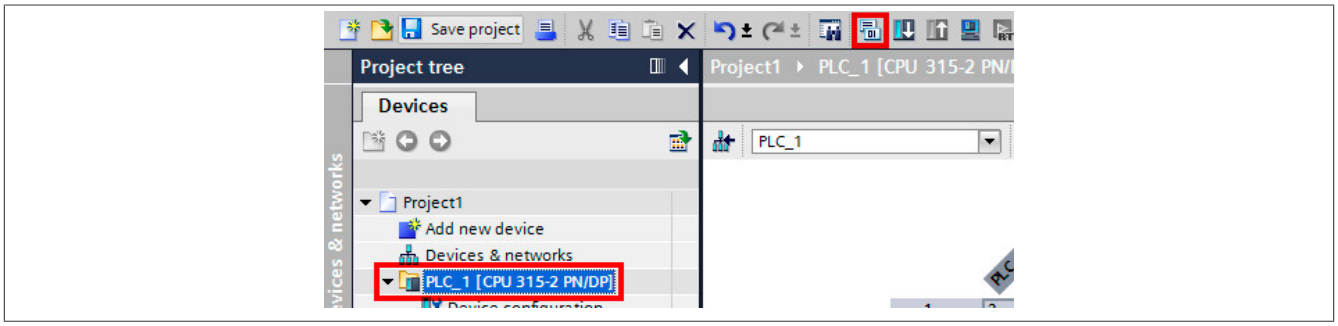
- To establish a connection from the TIA Portal to the controller, the IP address and controller subnet mask must be configured in the TIA Portal. This is done by selecting the controller in the **Device view**. Clicking on the Ethernet interfaces with the mouse opens the corresponding window in menu "Properties". The IP address and subnet mask can be entered here.

Information:

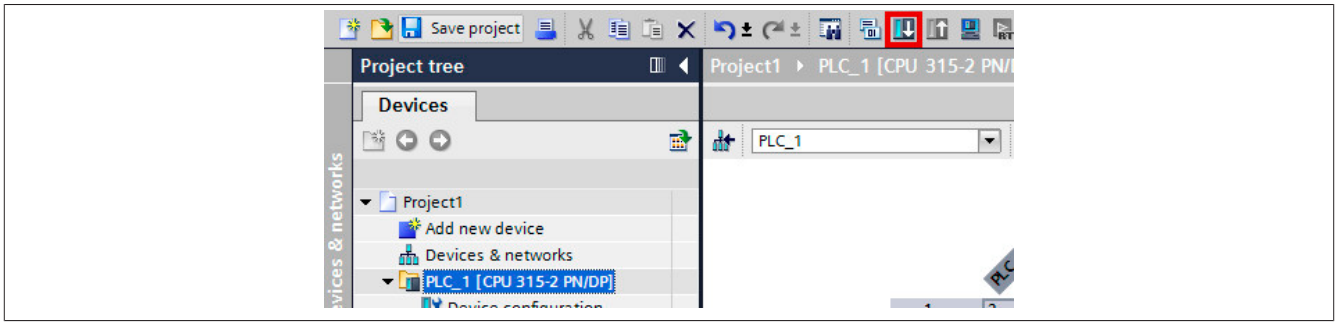
The management IP address of the controller corresponds to the PROFINET IO controller IP address. See "Adding a PROFINET IO device (slave)" on page 18.



- Now the project can be compiled. This is done by selecting controller "PLC_1[CPU 315-2 PN/DP" in the **Project tree** view and button **Compile** in the toolbar.

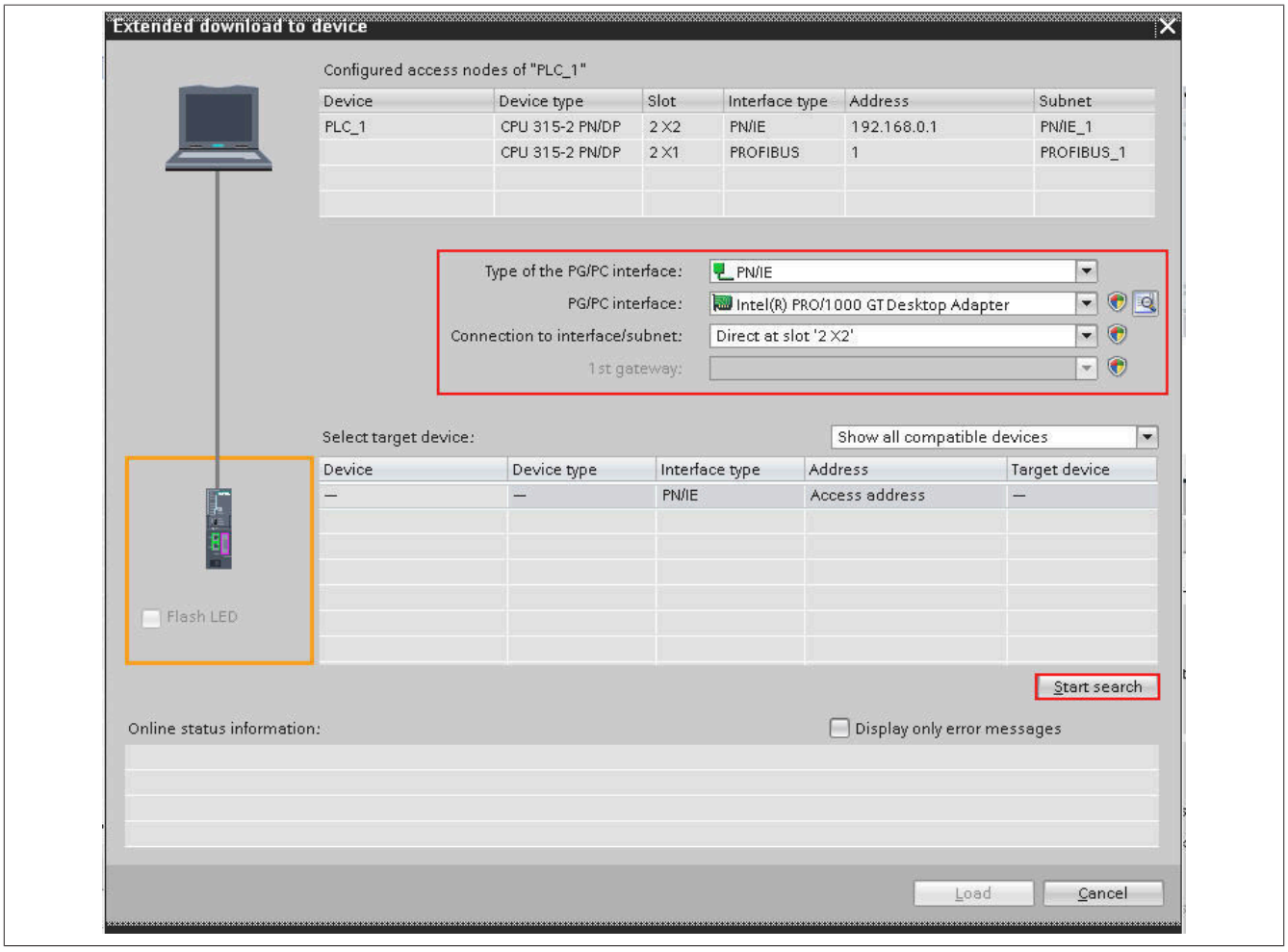


- After the project has been successfully compiled, it can be loaded onto the device. To do this, select button **Download to device** in the toolbar.

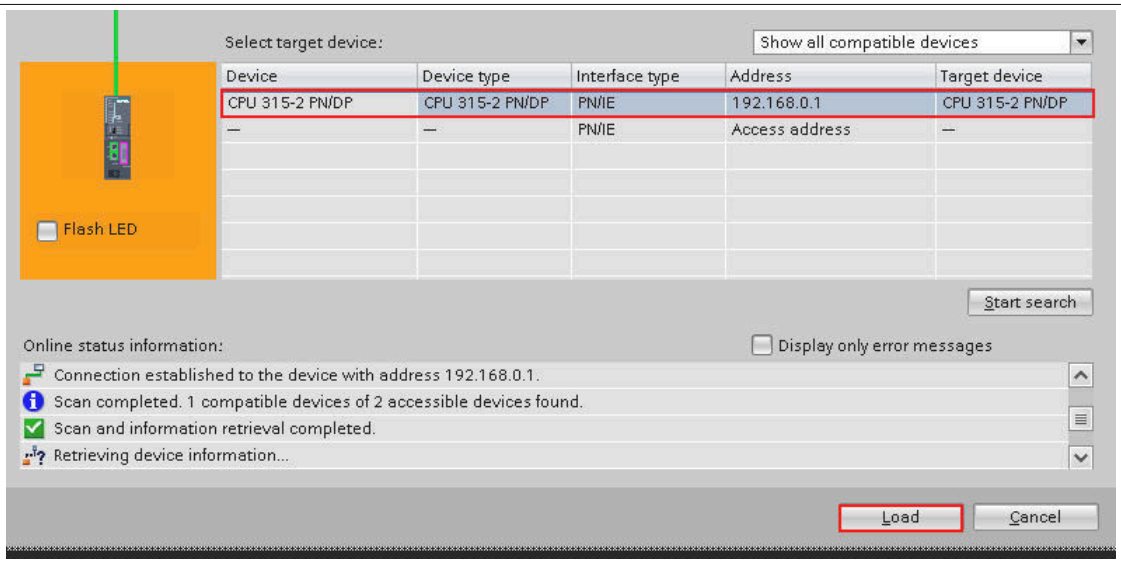


- A query dialog box opens in which the interface configuration is set.

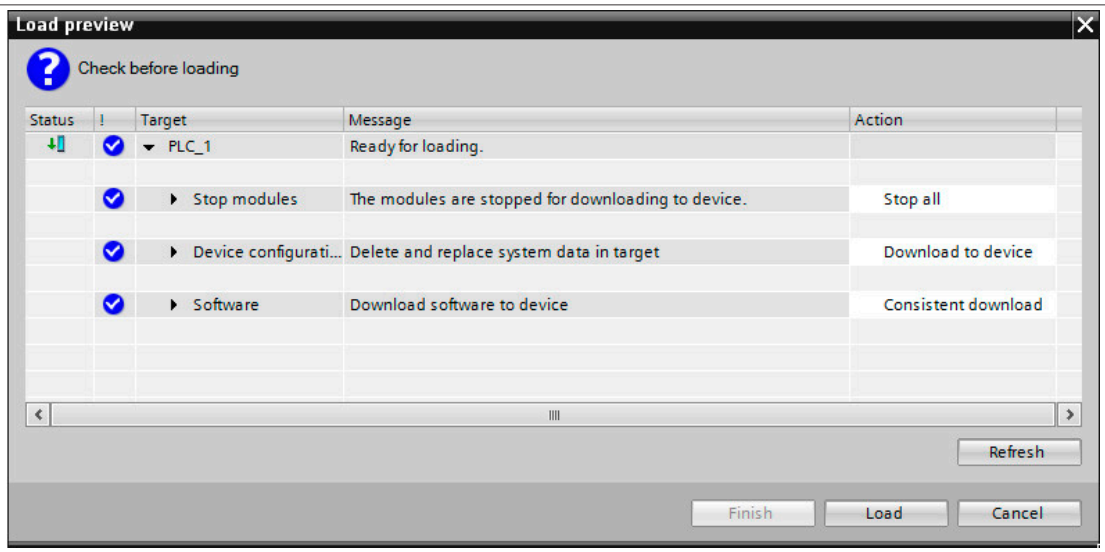
With button **Start search**, the network is scanned for devices. If no devices are found, this indicates that an incorrect IP address was set in the controller.



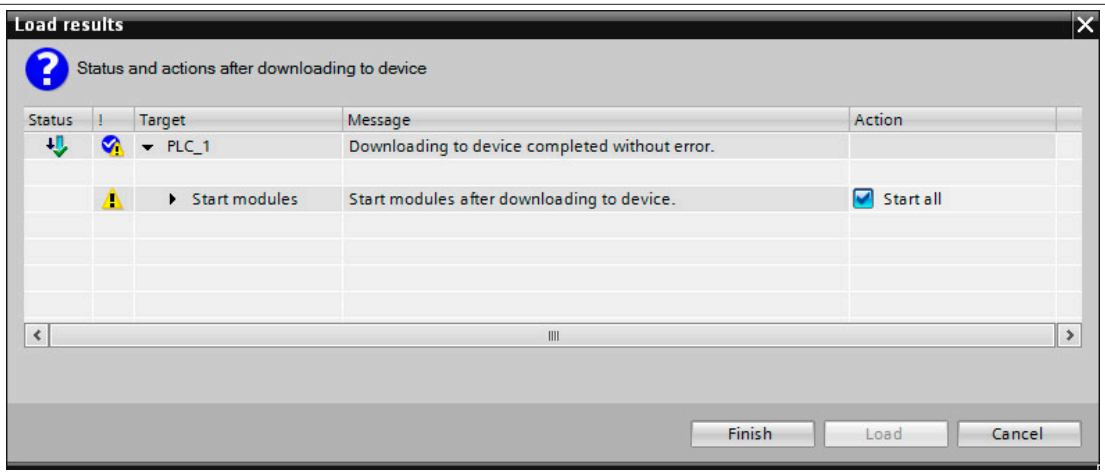
- If the search is successful, the devices found are listed under **Compatible devices in target subnet**. After selecting the controller, the data can be loaded to the controller with button **Load**.



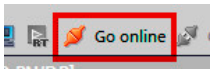
- Before loading, a notification window opens and lists a preview of all loading processes. This can be used to check whether the correct data is being transferred. The data is transferred after pressing **Load**.



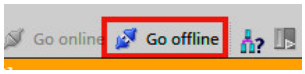
- The result of the loading process is listed and must be confirmed with **Finish**.



- Button **Go online** is selected to establish a connection to the controller. The connection is established and, if configured correctly, the slave is set to state "Run".
In state "Run", no changes can be made to the configuration or application.



- The connection to the controller can be disconnected again with button **Go offline**.



- The application can be started or stopped in the toolbar via buttons **Start CPU** and **Stop CPU**.