

Operating Instructions

RMx621 / FML621

PROFINET module ("PROFINET coupler") from V3.03.01
Connection of RMx621 / FML621 to PROFINET via the
serial RS485 interface with an external module (HMS
AnyBus Communicator for PROFINET Device)



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1 General information

1.1 Damage in transit

Please notify the freight forwarder and supplier immediately.

1.2 Scope of delivery

- These Operating Instructions
- The PROFINET module HMS AnyBus Communicator for PROFINET Device
- Serial connecting cable to RMx621 / FML621
- CD-ROM with GSDML file and bitmaps

Please notify the supplier immediately if any parts are missing!

1.3 Safety symbols

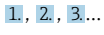
Symbol	Meaning
	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	NOTE! This symbol contains information on procedures and other facts which do not result in personal injury.

1.4 Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
	Notice or individual step to be observed.
	Series of steps.
	Result of a step.

Symbol	Meaning
	Help in the event of a problem.
	Visual inspection.

1.5 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers		Series of steps
A, B, C, ...	Views	A-A, B-B, C-C, ...	Sections
	Hazardous area		Safe area (non-hazardous area)

1.6 List of abbreviations/definition of terms

PROFINET coupler

In the following text, the term "PROFINET coupler" is used to refer to the external PROFINET module HMS AnyBus Communicator for PROFINET Device.

PROFINET controller

All units such as the PLC and PC plug-in boards that perform a PROFINET master function are referred to as PROFINET controllers.

2 Installation

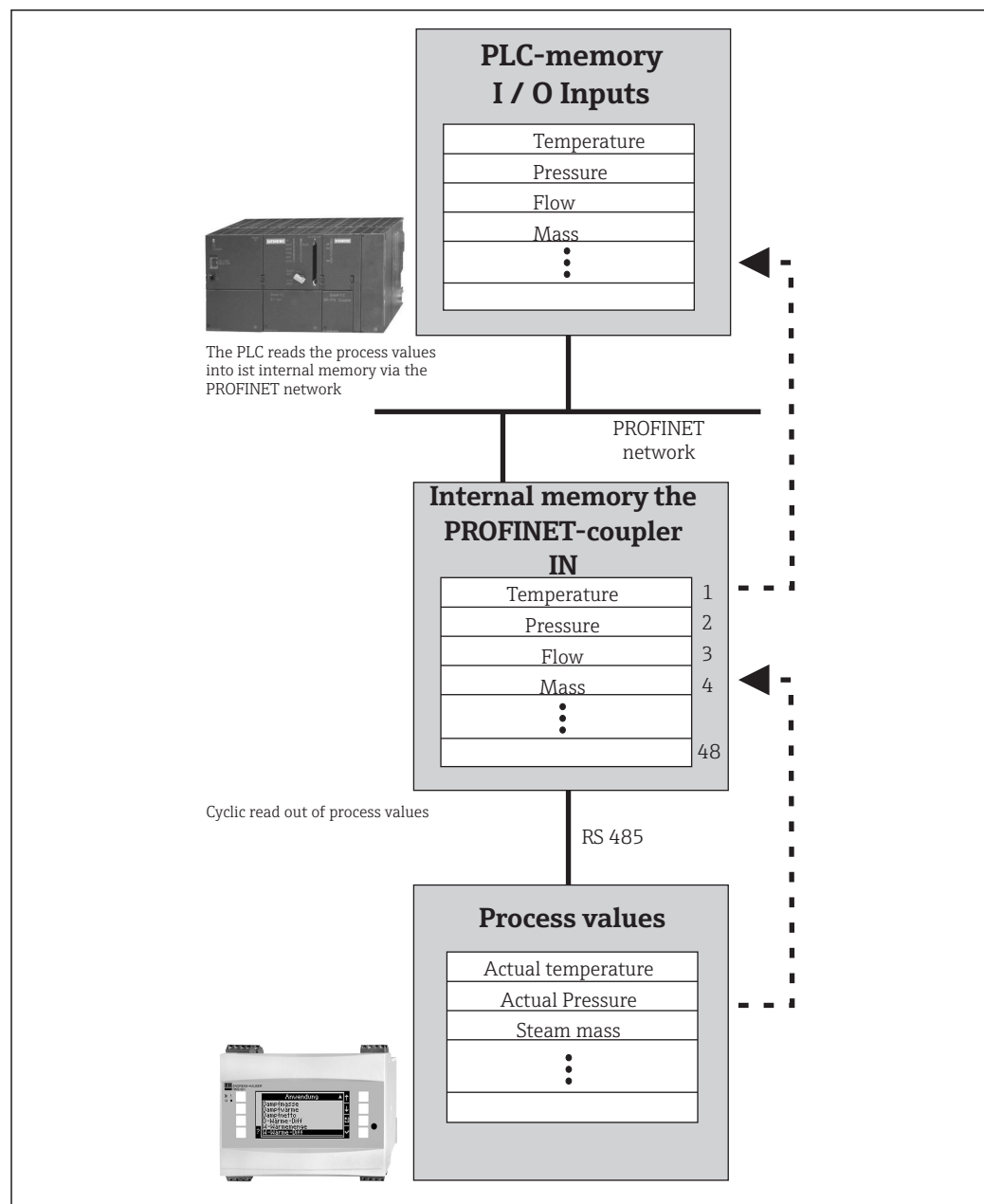
2.1 Function description

The PROFINET connection is made using an external PROFINET coupler. The module is connected to the RS485 interface (RxTx1) of the RMx621 / FML621.

The PROFINET coupler acts as a master in the direction of the RMx621 / FML621 and reads the process values to its buffer memory every second.

In the direction of the PROFINET, the PROFINET coupler operates with the function of a PROFINET device and makes the buffered process values available on the bus on request (cyclic data exchange).

For the architecture, see the following graphic.

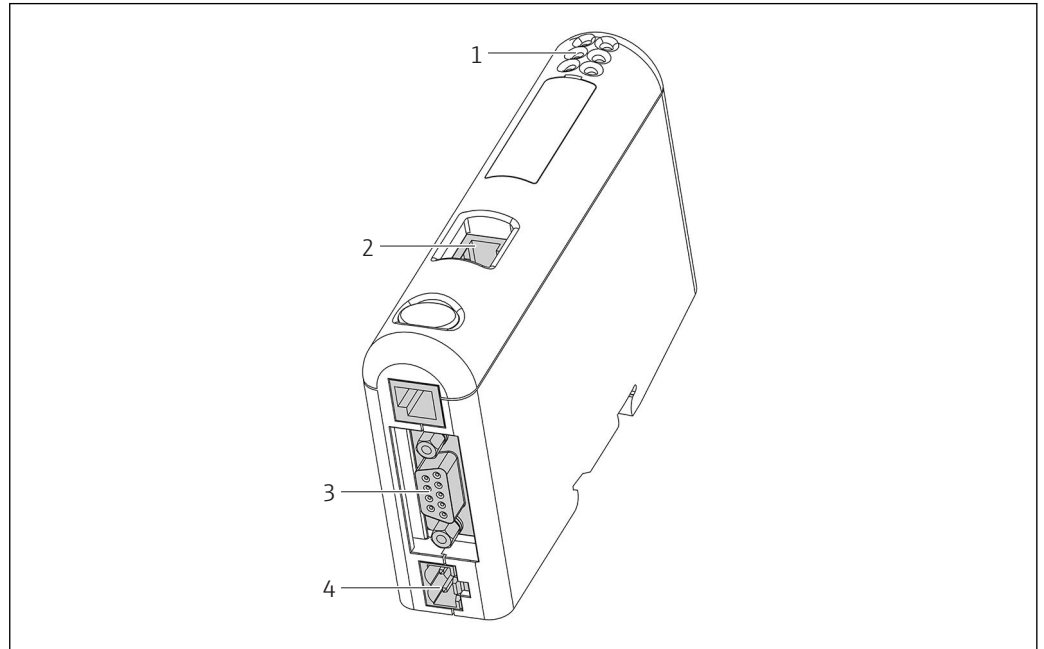


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2.2 Requirements

The PROFINET option is available for RMx621 with firmware version V 3.09.00 and higher, and for the FML621 with firmware version V1.03.00 and higher.

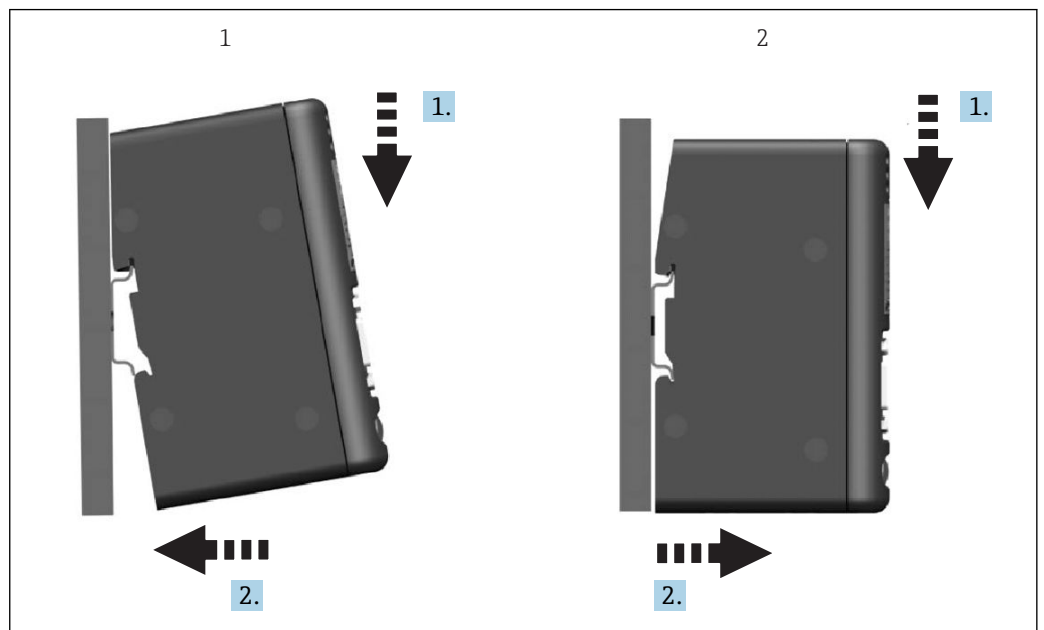
2.3 Connections and operating elements



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- 1 Status LEDs
- 2 Fieldbus connection
- 3 RMx621, FML621 connection
- 4 Connection for supply voltage

2.4 Installation on DIN rail

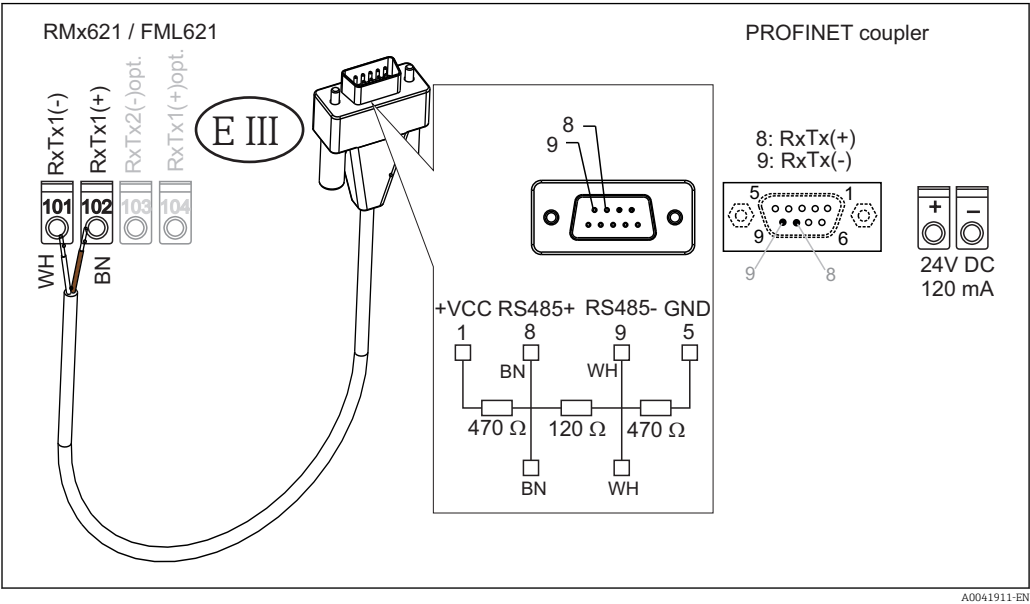


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- 1 Snap on
- 2 Snap off

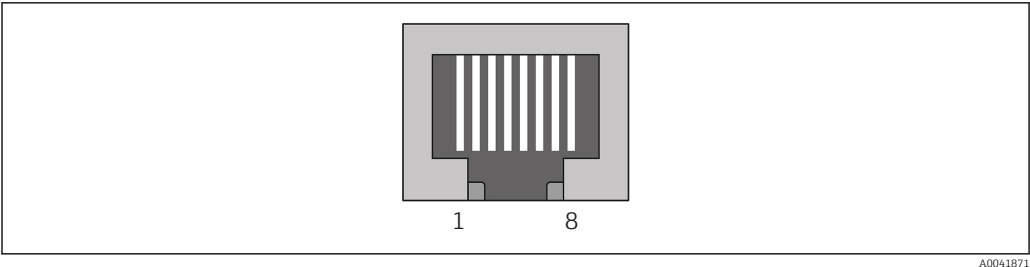
2.5 Connections and terminal diagram

Connecting the RMx621 / FML621 with the PROFINET coupler.



 The color coding applies for the cable supplied.

2.6 PROFINET pin assignment

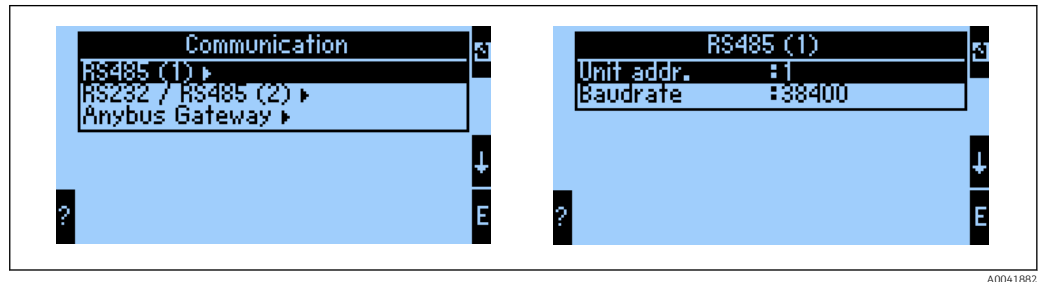


Pin No.	Signal	Meaning
Housing	Shielding	Functional ground
1	TD+	Tx (+)
2	TD-	Tx (-)
3	RD+	Rx (+)
4	Termination	Termination
5	Termination	Termination
6	RD-	Rx (-)
7	Termination	Termination
8	Termination	Termination

3 Commissioning

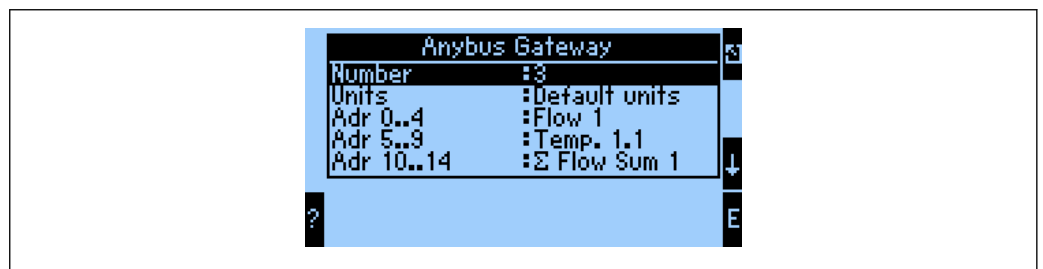
3.1 Configuration of the RMx621 / FML621

In the main menu **Communication** → **RS485(1)** of the RMx621/ FML621, the parameters of the RS485(1) interface must be configured as follows: set **Unit address** to 1 and set **Baud rate** to 38400.



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The number of process values that should be output must be defined in the main menu **Communication** → **Anybus Gateway** → **Number**. The maximum number is limited to 48. In the next steps, each offset address is assigned the desired process value using the selection lists.



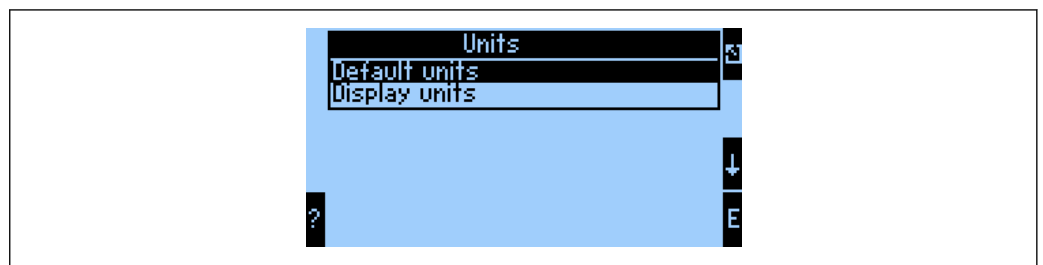
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To facilitate the further processing of the process values, the list of offset addresses can also be printed out via the ReadWin® 2000 operating software.



When defining the process values displayed with PROFINET, please note that the same process value can be set to more than one address.

The units of the process values to be transmitted must be defined in the main menu **Communication** → **Anybus Gateway** → **Units**.



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Set **Display units** to use the units that are configured for the display for data transmission. Set **Default units** to use the following default units for data transmission:

Volume flow	l/s
Temperature	°C

Pressure	bar
Heat quantity	kJ
Heat flow (output)	kW (kJ/s)
Mass flow	kg/s
Corrected volume	(N)l/s
Total volume	l
Total mass	kg
Total corrected volume	(N)l
Density	kg/m ³
Enthalpy	kJ/kg

3.2 Configuring the PROFINET coupler

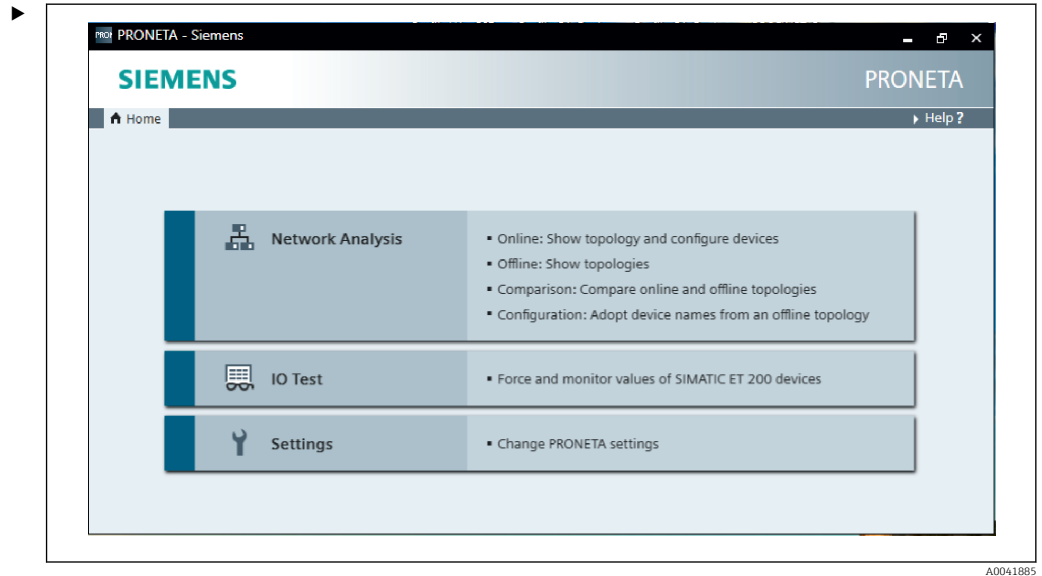
The PROFINET coupler is already pre-configured at the factory for communication with the RMx 621 / FML 621. Apart from the device name and the IP configuration, no further settings are required.



As the PROFINET coupler is preconfigured at the factory, only a preconfigured PROFINET coupler purchased through Endress+Hauser can be used as a replacement device. A PROFINET coupler purchased through HMS cannot be used as it does not contain the preconfigured settings.

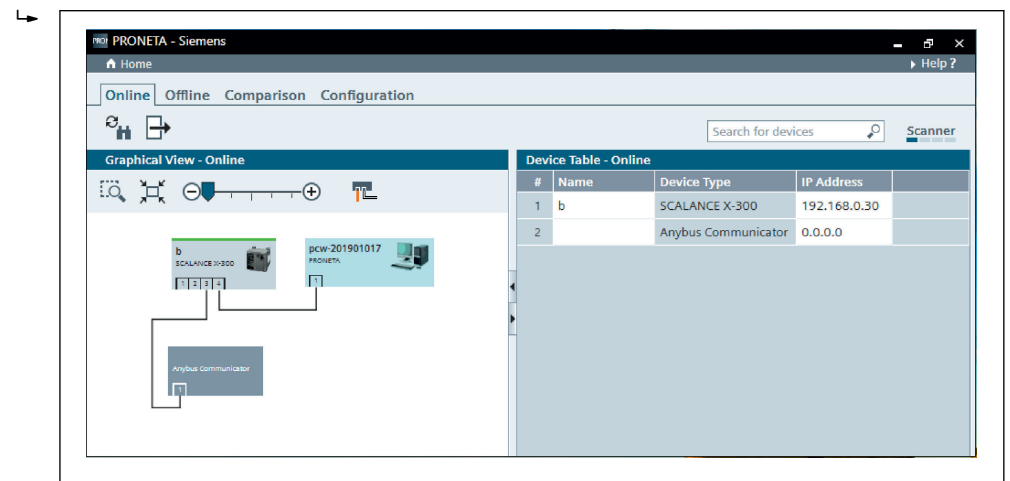
The Discovery and Basic Configuration (DCP) protocol is used to configure the device name and IP settings. Configuration tools that support the DCP protocol (e.g. PRONETA) can be used for the configuration.

The following example shows the configuration of the device name and a static IP configuration using the SIEMENS tool PRONETA. Here, it is assumed that the network adapter is already selected for access to the PROFINET network.



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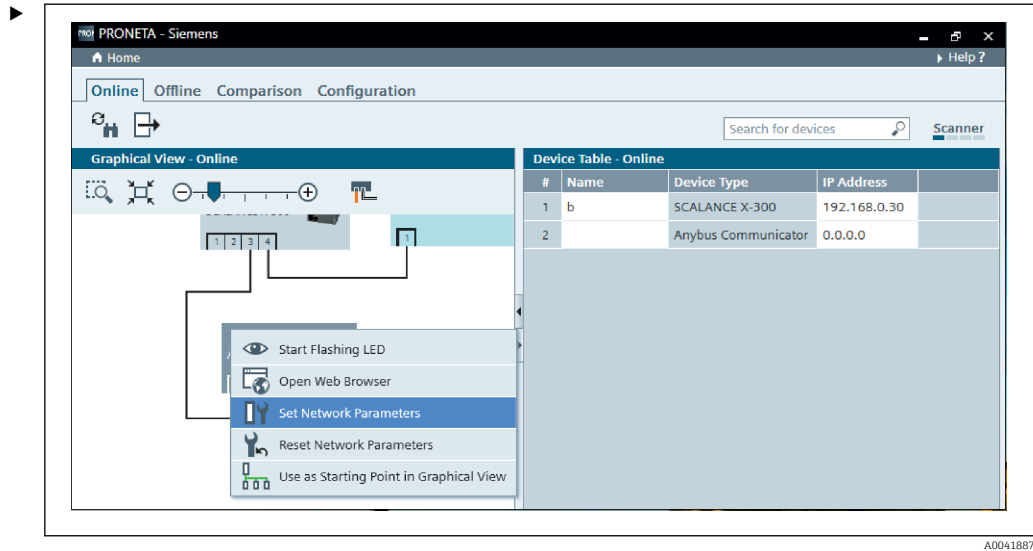
In the tool, click **Network analysis** to display all the devices available.



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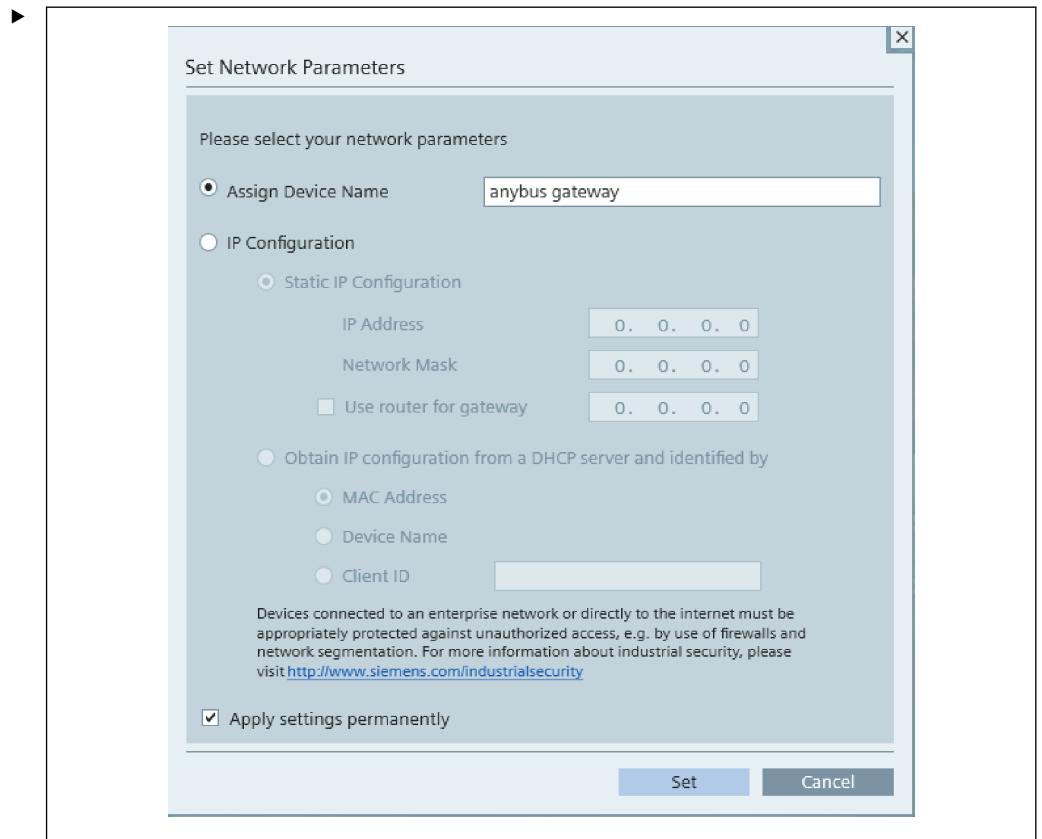


The PROFINET coupler is delivered from the factory without a device name and without a valid IP configuration (0.0.0.0).



In the network displayed, right-click the PROFINET coupler and select **Set network parameters**.

i If there are several PROFINET couplers in the network, the **Start flashing LED** function can be used to determine whether this is the correct device. Once activated, the module status LED (→ 15) starts flashing until flashing is stopped with the **Stop flashing LED** function.

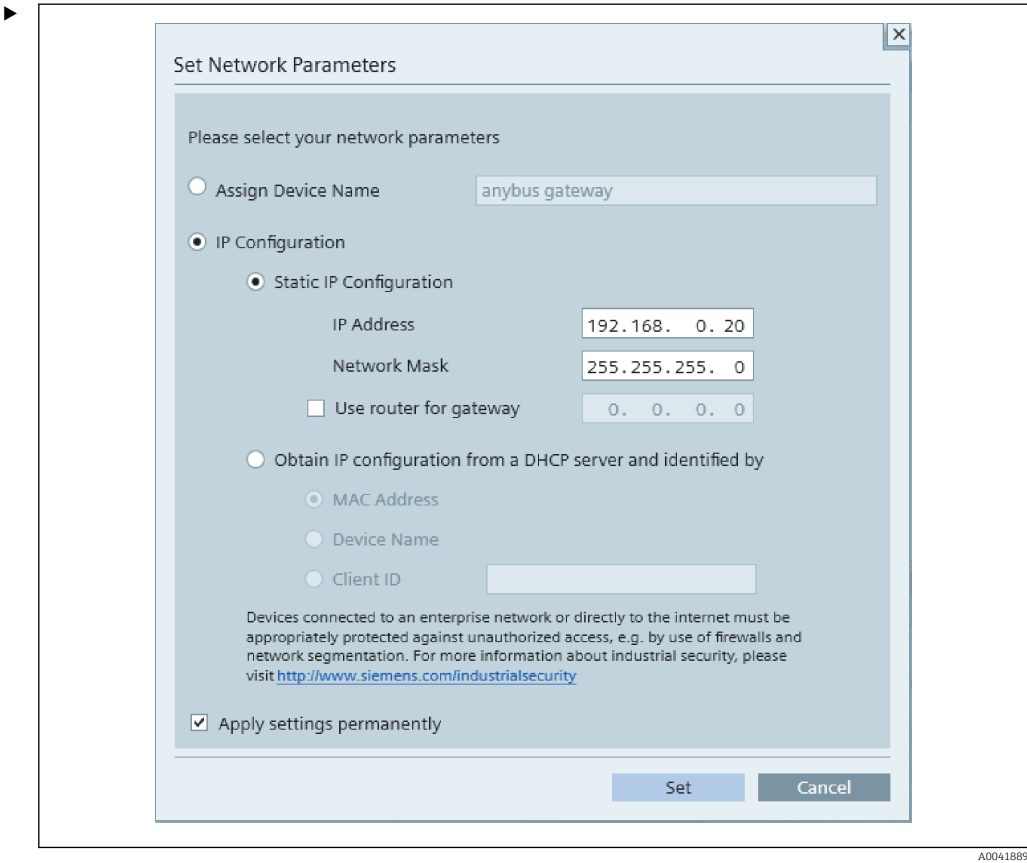


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In the dialog box that now opens, select the **Assign device name** option and enter a device name in the adjacent text field. In doing so, make sure to comply with the device naming conventions (→ 15). Clicking **Set** transmits the device name to the PROFINET coupler and closes the dialog box.



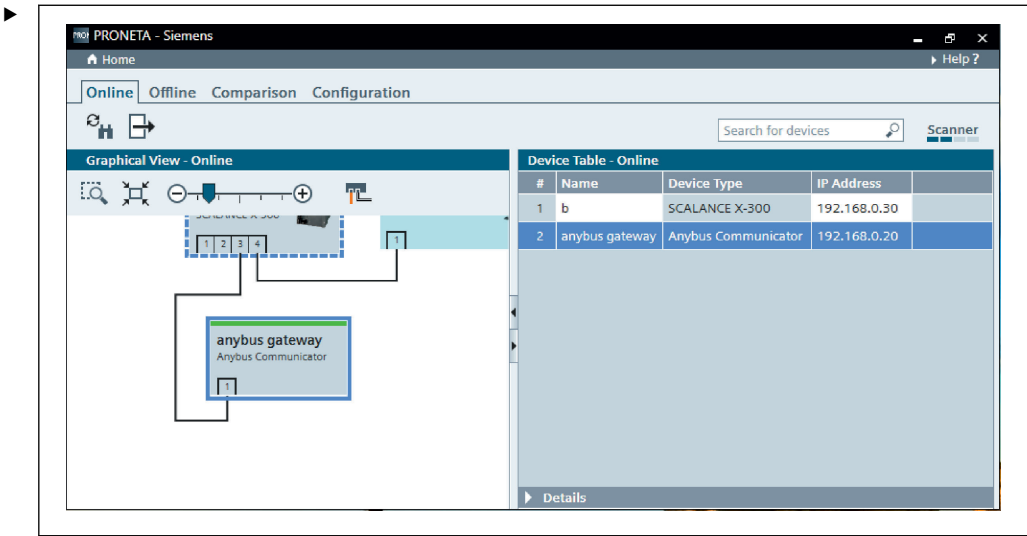
To save the device name permanently in the PROFINET coupler, tick the **Apply settings permanently** box. If this box is not ticked, the device name is only applied temporarily and is replaced by the last saved device name when the PROFINET coupler is restarted.



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As described above, right-click the PROFINET coupler again and select **Set network parameters**. In the dialog box that opens, select the **IP configuration** option and enter a valid IP configuration. Clicking **Set** transmits the device name to the PROFINET coupler and closes the dialog box.

i To save the IP configuration permanently in the PROFINET coupler, tick the **Apply settings permanently** box. If this box is not ticked, the IP configuration is only applied temporarily and is replaced by the last saved IP configuration when the PROFINET coupler is restarted.



3.3 Device naming conventions

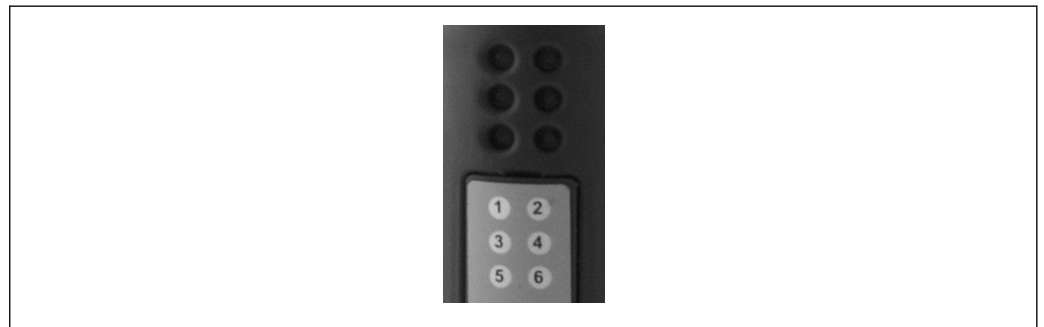
- The name consists of one or more name elements that are separated by a period [.]
- Name length limited to 240 characters in total (lower case letters, digits, hyphen or period).
- A name element within the device name, i.e. a character string between two periods, may not be more than 63 characters long.
- A name element consists of the characters [a-z, 0-9, -].
- The device name may not begin or end with the character "-".
- The device name may not begin with digits.
- The device name may not have the format n.n.n.n (n = 0 to 999)
- The device name may not begin with the character string "port-xyz" or "port-xyz-abcde" (a, b, c, d, e, x, y, z = 0 to 9).

Examples of device names:

- coupler-1.machine-1.component-1
- coupler005

3.4 Status indicators

The 6 light emitting diodes indicate the current status of the PROFINET coupler and of cyclic data exchange with the PROFINET controller.



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LED	Description	Display	Status	Actions
1	Comm. status	Green	Communication established with a PROFINET controller. Controller in "RUN" state	
		Flashing green	Communication established with a PROFINET controller. Controller in "STOP" state	
		Off	No communication established with a PROFINET controller.	Check network cabling Check configuration of the components involved (PROFINET controller, switches, etc.)
2	Module status	Green	PROFINET coupler ready for operation	
		Flashing green	Activation of device identification by a configuration tool (e.g. PRONETA 'Start flashing LED' function)	Switch off identification as soon as it is no longer needed
		Flashing red once	Configuration error	Check configuration of the PROFINET controller
		Flashing red 3 times	Device name and/or IP configuration missing	Set the device name and/or IP configuration again

LED	Description	Display	Status	Actions
		Flashing red 4 times	Device failure	Device defective
		Off	Supply voltage failure	Check supply voltage
3	Link/Activity	Green	Network connection available	
		Flashing green	Data transmission active	
		Off	No network connection	Check network cable
4	NOT USED			
5	SUBNET STATUS	Green	Data exchange in progress	Check wiring of PROFINET coupler - RMx621 / FML621; check communication parameters in RMx621 / FML621
		Flashing green	Data exchange paused	
		Red	No data exchange possible	
		Off	Supply voltage failure	Check supply voltage
6	DEVICE STATUS	Green	Initializing	
		Flashing green	PROFINET coupler operating	
		Flashing red/green	Configuration incorrect	Device defective
		Off	Supply voltage failure	Check supply voltage

4 Process data

4.1 General information

Depending on the applications configured, a wide variety of process variables are computed in the RMx621/ FML621 and are available for read-out.

In addition to the computed values, the input variables can also be read out of the RMx621/ FML621.

4.2 Payload structure

Each process value occupies 5 bytes in the process representation.

The first 4 bytes correspond to a 32-bit floating point number as per IEEE-754 (MSB first).

32-bit floating point number (IEEE-754)

Octet	8	7	6	5	4	3	2	1
1	Sign	(E) 2^7	(E) 2^6					(E) 2^1
2	(E) 2^0	(M) 2^{-1}	(M) 2^{-2}					(M) 2^{-7}
3	(M) 2^{-8}							(M) 2^{-15}
4	(M) 2^{-16}							(M) 2^{-23}

Sign = 0: positive number

Sign = 1: negative number

$$Number = -1^{\text{sign}} \cdot (1 + M) \cdot 2^{E-127}$$

E = exponent; M = mantissa

Example: 40 F0 00 00 h

$$= 0100\ 0000\ 1111\ 0000\ 0000\ 0000\ 0000\ 0000\ \text{b}$$

Value

$$= -1^0 \cdot 2^{129-127} \cdot (1 + 2^{-1} + 2^{-2} + 2^{-3})$$

$$= 1 \cdot 2^2 \cdot (1 + 0.5 + 0.25 + 0.125)$$

$$= 1 \cdot 4 \cdot 1.875 = 7.5$$

The last byte indicates the status:

80h = valid value

81h = valid value with limit value violation (linked with relay output)

10h = invalid value (e.g. cable open circuit)

00h = no value available (e.g. communication error in subnet)

In the case of calculated values (e.g. mass flow), the alarm condition of all the inputs used and of the application is checked. If a "fault" is indicated in one of these variables, the calculated value is given the status "10h", i.e. invalid value.

Example:

Temp1 cable open circuit; alarm type: fault => calculated mass flow (10h)

Temp1 cable open circuit; alarm type: notification => calculated mass flow (80h)



The number of process values transmitted is defined in the configuration of the energy manager, . The minimum number is 1 process value (5 bytes), the maximum is 48 process values (240 bytes).

5 Integration into a PROFINET network

A GSDML file is needed to integrate the PROFINET coupler into a PROFINET network. This file describes the functional scope of the PROFINET coupler and must be imported into an appropriate configuration tool. The way in which this GSDML file is imported into the configuration tool and used depends on the configuration tool. Users must refer to the particular configuration tool for more information.

The procedure for integration using the SIEMENS TIA Portal V15.1, for example, is described in Section 6 "Configuring the RMx621 / FML621..." → 22.

The following files are required:

- Device description: **GSDML-V2.3-HMS-ABC_PROFINET_IO-20141127.xml**
- Device image: **GSDML-010C-0002-ABC-PRT.bmp**

These can be found on the Readwin® 2000 CD-ROM provided in the directory **\GSD\IRMS621 RMC621 RMM621\PROFINET**

5.1 Device Access Point (DAP)

A Device Access Point (DAP) describes the basic functions of a device (including number of ports, number of available modules, etc.).

Users can choose from the following DAPs:

- RT Migration
- RT Migration (FW >=4.02)
- RT Standard

RT Standard should primarily be used for the integration. If older PROFINET hardware is used (e.g. older S7-300), **RT Migration (FW >=4.02)** can be used if **RT Standard** causes problems.

RT Migration should not be used.

5.2 Modules

The data to be transmitted are defined via the modules described in the GSDML file.

Users can choose from the following modules:

- Other modules: empty space
- Output modules: outputs xxx byte(s)
- Input/output modules: inputs/outputs xxx byte(s)
- Input modules: inputs xxx byte(s)

(xxx = number of transmitted bytes: 1,2,4,8,16,32,64,128,256,512)

The PROFINET coupler is configured at the factory in such a way that data that have been read from the RMx621 / FML621 are only sent to a PROFINET controller. Data that are sent from a PROFINET controller to the PROFINET coupler are not accepted / are rejected by the PROFINET coupler. This means that only the input modules may be used for integration. The use of other modules is not envisaged. Therefore other modules may not be used.

A minimum of 1 module must be configured for data transmission. A maximum of 63 modules may be configured.

 The total data to be transmitted may not exceed 256 bytes. Example:

- 1x "inputs 256 bytes" or
- 2x "inputs 128 bytes" or
- 3x "inputs 64 bytes" + 2x "inputs 32 bytes" etc.

5.3 Mapping the process data

As described in Section 4 "Process data" →  17, the process values configured in the RMx621 / FML621 are buffered in the PROFINET coupler in 5-byte blocks, starting with offset 0.

The configuration of the modules **inputs xxx** (see Section "5.2 Modules" →  18) defines how many bytes a PROFINET controller reads from the PROFINET coupler. A maximum of 256 bytes can be read from the PROFINET coupler irrespective of how many process values are configured in the RMx621 / FML621. Bytes that are not assigned to any process value are always transmitted with the value 0. Example:

All 48 process values are configured in the RMx621 / FML621. An **inputs 256 bytes** module is configured in the PROFINET controller. The process values are transmitted as follows:

Process values	PROFINET coupler	PROFINET controller	
	Byte offset	Module	Byte offset
Process value 1	0	Inputs 256 bytes	0
	1		1
	2		2
	3		3
Status process value 1	4		4
Process value 2	5		5
	6		6
	7		7
	8		8
Status process value 2	9		9
Process value 3	10		10
	11		11
	12		12
	13		13
Status process value 3	14		14
...	...		...
...	...		...
Process value 46	225		225
	226		226
	227		227
	228		228
Status process value 46	229		229
Process value 47	230		230
	231		231
	232		232
	233		233
Status process value 47	234		234
Process value 48	235		235
	236		236
	237		237
	238		238

Status process value 48	239		239
No process value = 0	240		240
	241		241
	...		...
	254		254
	255		255



The input modules can be combined in any way provided that the maximum data length and the maximum number of modules is not exceeded. Depending on the configured modules, parts of a process value can be divided among several modules.

Example: 3 process values are configured in the RMx621 / FML621. 1x "inputs 8 bytes" and 2x "inputs 4 bytes" are configured in the PROFINET controller. The process values are transmitted as follows:

Process values	PROFINET coupler	PROFINET controller	
	Byte offset	Module	Byte offset
Process value 1	0	Inputs 8 bytes	0
	1		1
	2		2
	3		3
Status process value 1	4	Inputs 4 bytes	4
Process value 2	5		5
	6		6
	7		7
	8	Inputs 4 bytes	0
Status process value 2	9		1
Process value 3	10		2
	11		3
	12	Inputs 4 bytes	0
	13		1
Status process value 3	14		2
No process value = 0	15		3

=> Process value 1 + status: Is located completely in the **inputs 8 bytes** module.

=> Process value 2 + status: The first 3 bytes of the process value are in the **inputs 8 bytes** module, the last byte and the related status are in the first module **inputs 4 bytes**.

=> Process value 3 + status: The first 2 bytes of the process value are in the first module **inputs 4 bytes**, the last 2 bytes and the related status are in the second module **inputs 4 bytes**.

To avoid splitting bytes among modules, it is recommended to select a module in which all the configured process values are transmitted (in this case 1x **inputs 16 bytes** or bigger).

Alternatively, it is possible to use a combination of an **inputs 4 bytes** module (= process value) followed by an **inputs 1 byte** module (= status of process value) to map the configured process values (incl. status).

Process values	PROFINET coupler	PROFINET controller	
	Byte offset	Module	Byte offset

Process value 1	0	Inputs 4 bytes	0
	1		1
	2		2
	3		3
Status process value 1	4	Inputs 1 byte	0
Process value 2	5	Inputs 4 bytes	0
	6		1
	7		2
	8		3
Status process value 2	9	Inputs 1 byte	0
Process value 3	10	Inputs 4 bytes	0
	11		1
	12		2
	13		3
Status process value 3	14	Inputs 1 byte	0

6 Configuring the PROFINET coupler in the TIA Portal 15.1

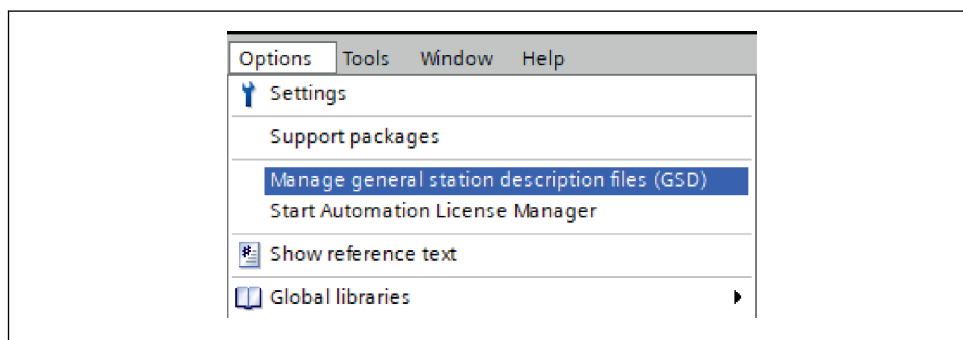
The following sections explain how the PROFINET coupler can be integrated into a PROFINET network.

The following pre-configurations are required for the integration:

- The RMx621 / FML621 is configured in such a way that 3 process values are transmitted.
- The RMx621 / FML621 is connected to the PROFINET coupler via the connecting cable supplied and data transmission is active.
- A PROFINET network is set up (PROFINET controller, the PROFINET coupler and the PC running the TIA Portal are all interconnected).
- A project containing the PROFINET controller is created in the TIA Portal and access to the PROFINET network has already been configured.

6.1 Importing the GSDML file

1.

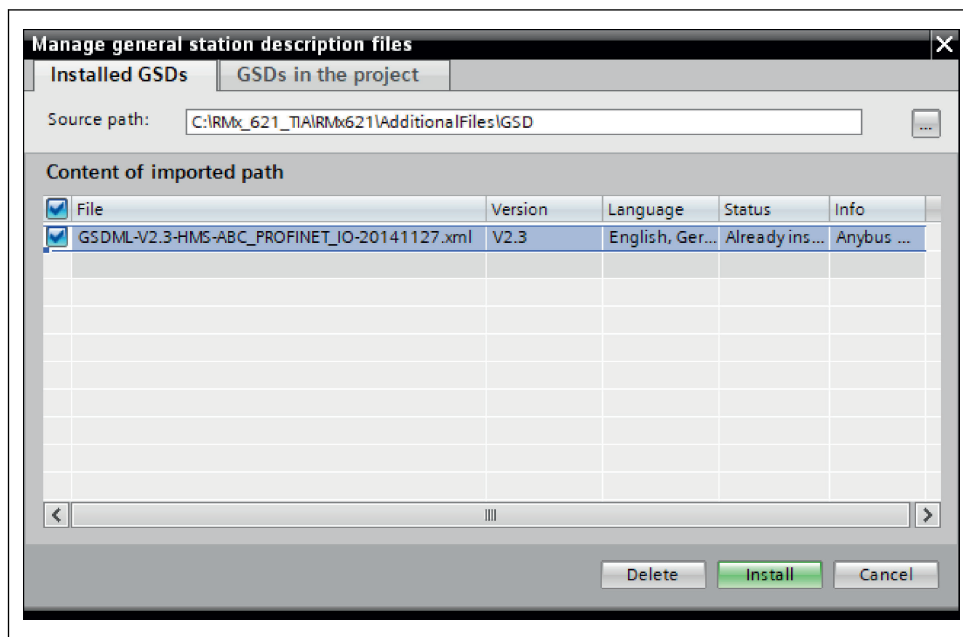


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In the **Options** menu, select the **Manage general station description files (GSD)** entry.

2. In the dialog box that now opens, select the folder containing the GSDML file (including image) under **Source path**.

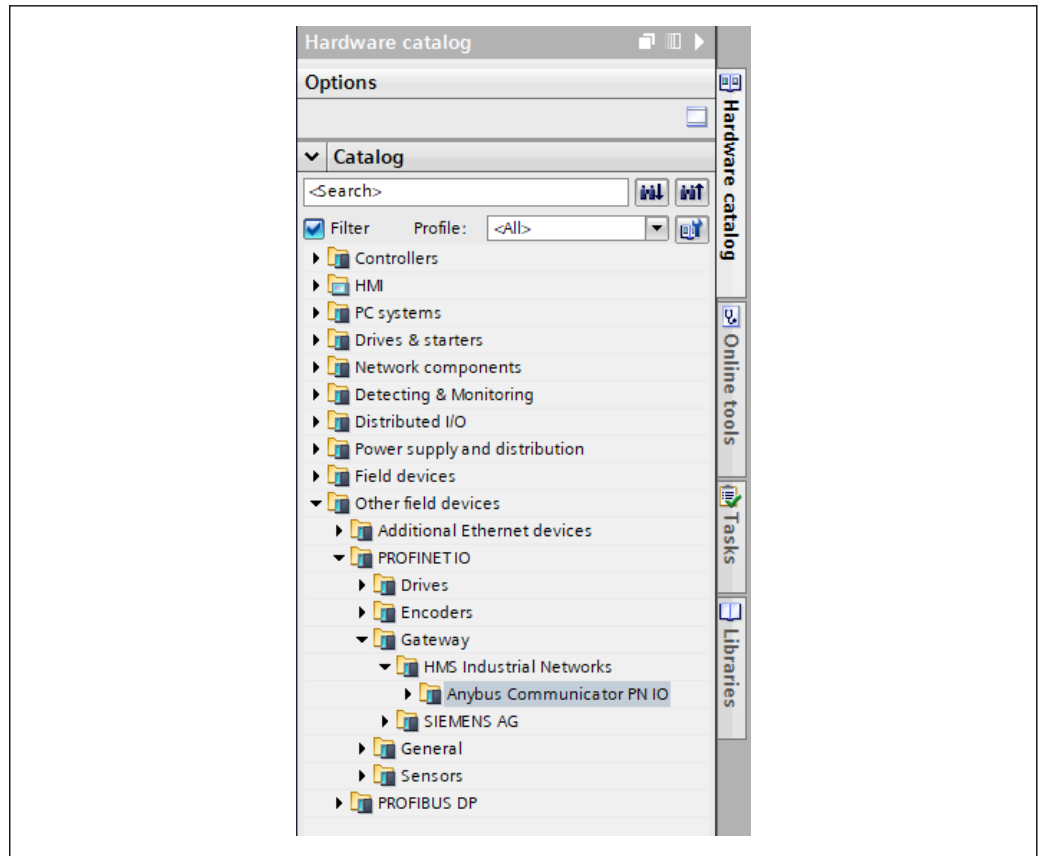
3.



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Select the GSDML file and click **Install** to confirm the GSDML file import.

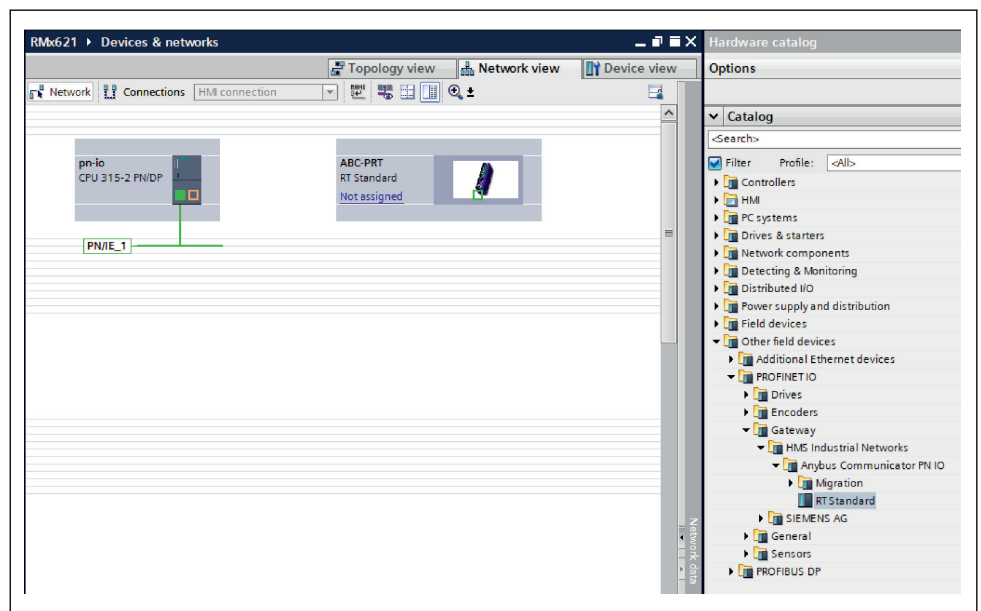
↳ Once the GSDML file has been imported, the file appears in the hardware catalog.



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6.2 Integrating the PROFINET coupler

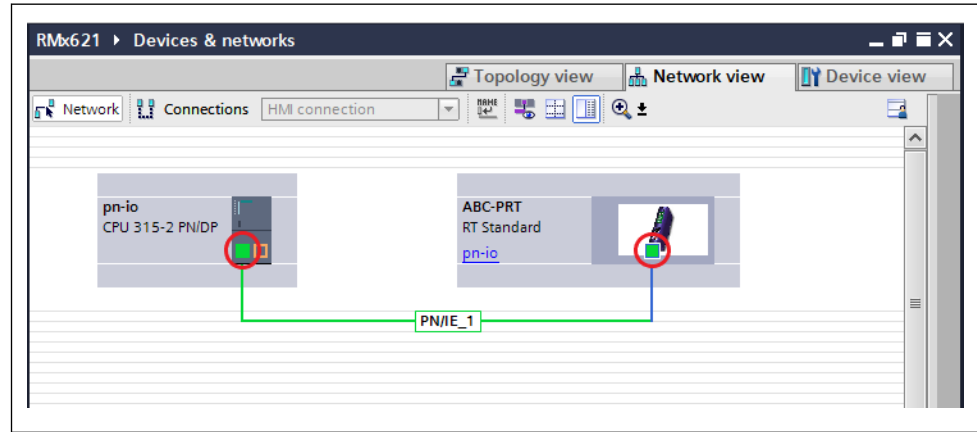
1.



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Once the GSDML file has been imported, switch to the **Network view**. Using the drag-and-drop function, drag the PROFINET coupler from the hardware catalog into the **Network view**.

2.



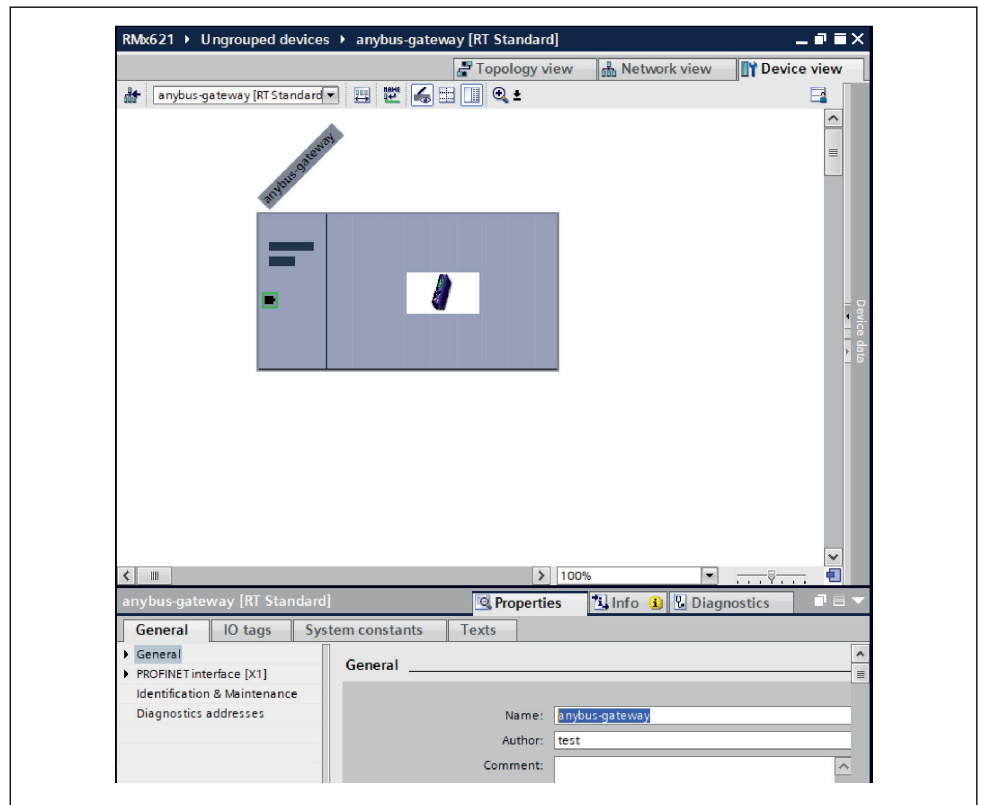
Then establish a PROFINET network connection to the PROFINET controller. To do so, press and hold the left mouse button on the network interface of the PROFINET coupler (see the red mark on the PROFINET coupler). With the mouse button pressed, move the mouse to the network interface of the PROFINET controller (see the red mark on the PROFINET controller) and then release the mouse button.

- ↳ A connection should now be established between the PROFINET controller and the PROFINET coupler with the result that the PROFINET coupler is now part of this PROFINET network.

6.3 Assigning device names and IP configuration

1. Switch to the **Device view** and select the PROFINET coupler.

2.



A0041896

Under the device displayed, select the **Properties** tab and then select the **General** tab.

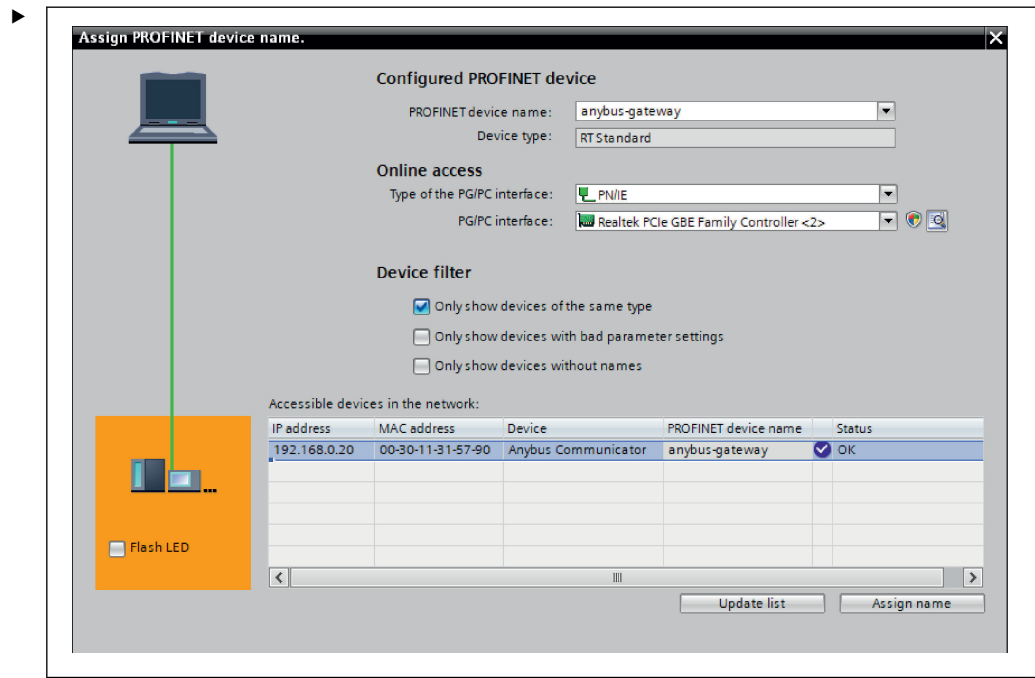


If the **Properties** tab is hidden, it can be displayed by double-clicking on the PROFINET coupler with the left mouse button.

- Assign the desired device name in the **Name** field of the **General** menu (see screenshot above).



The **Generate PROFINET device name automatically** setting is enabled by default. Because of this, the name configured here corresponds to the device name that is assigned to the PROFINET coupler. If this is not desired, this can be changed in the **PROFINET interface [x1]** menu.



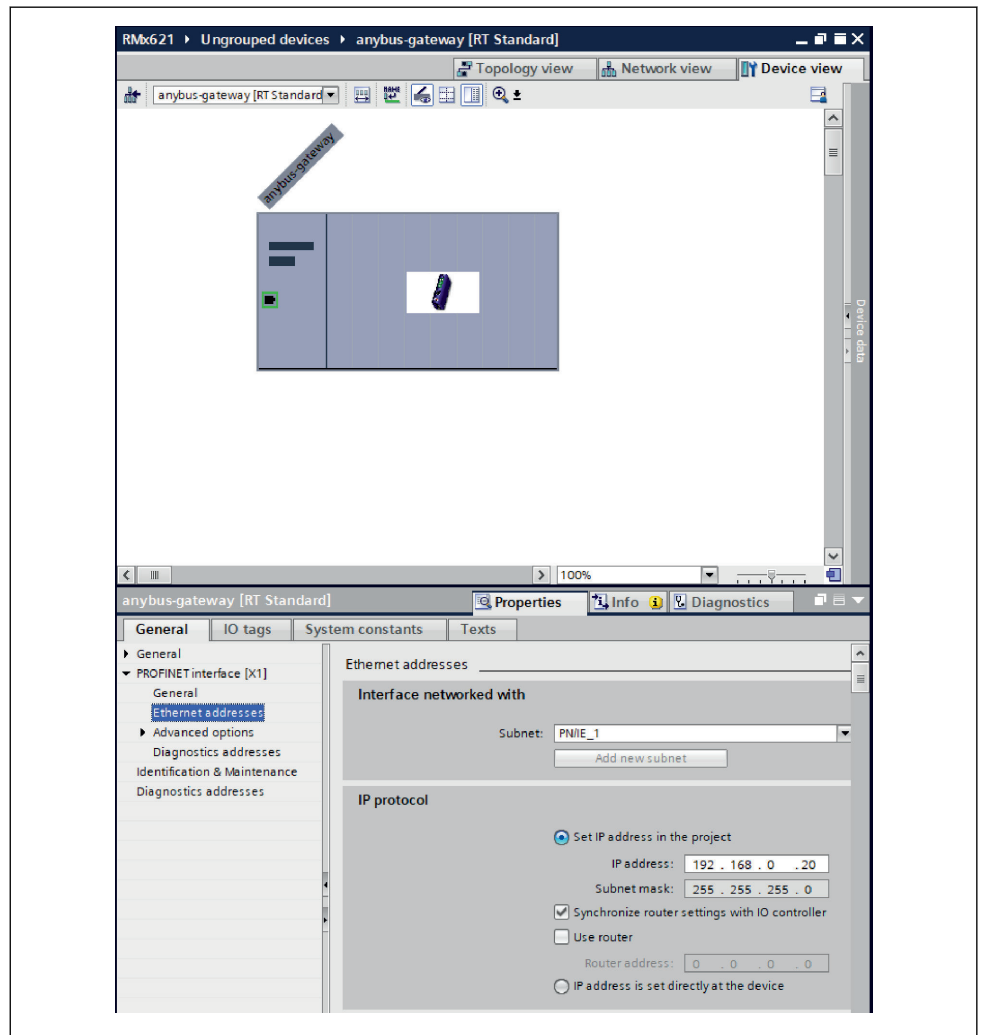
A0041897

Right-click the PROFINET coupler and select **Assign device name**.

- With the **Update list** function, a search is run for devices in the connected network and accessible devices are listed. If several PROFINET couplers are in the network and listed here, the desired PROFINET coupler can be either identified optically via the Status LED module (tick the **Flash LED** box) or via the unique MAC address of the PROFINET coupler.

i The MAC address is imprinted on the side of the PROFINET coupler.

1.



A0041898

To configure IP-related settings, switch to the **PROFINET interface [x1]** menu and then to the **Ethernet addresses** submenu.

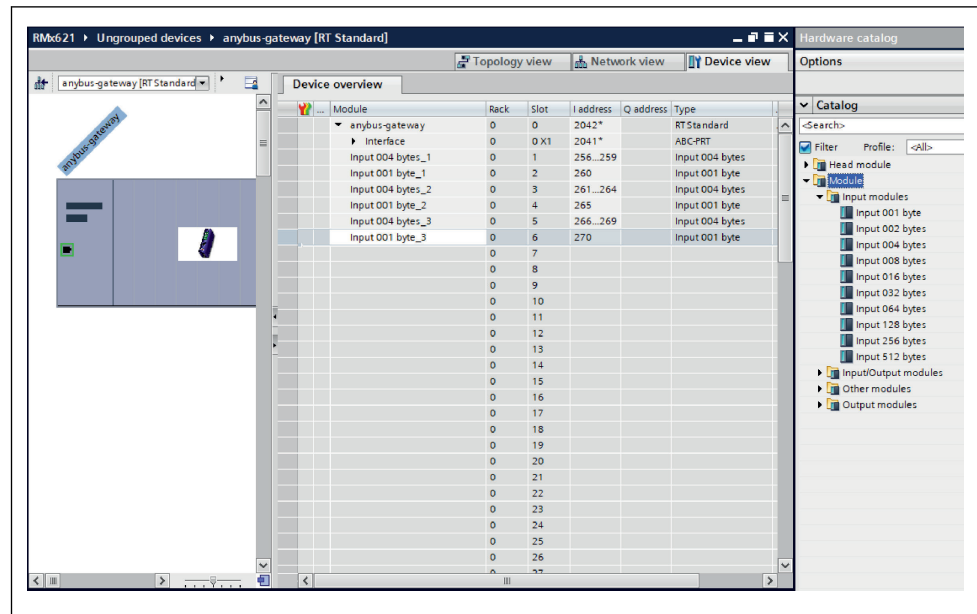
2. In the **IP protocol** section, make the desired settings for the IP configuration.



In the **Interface networked with** section, the **Subnet** field shows the connection that was created in Section 6.2 "Integrating the PROFINET coupler" → 23. As an alternative to "wiring" directly, the PROFINET network can also be configured here.

6.4 Configuring the input module

1.



A0041899

Under **Device view**, open the **Device overview** tab.

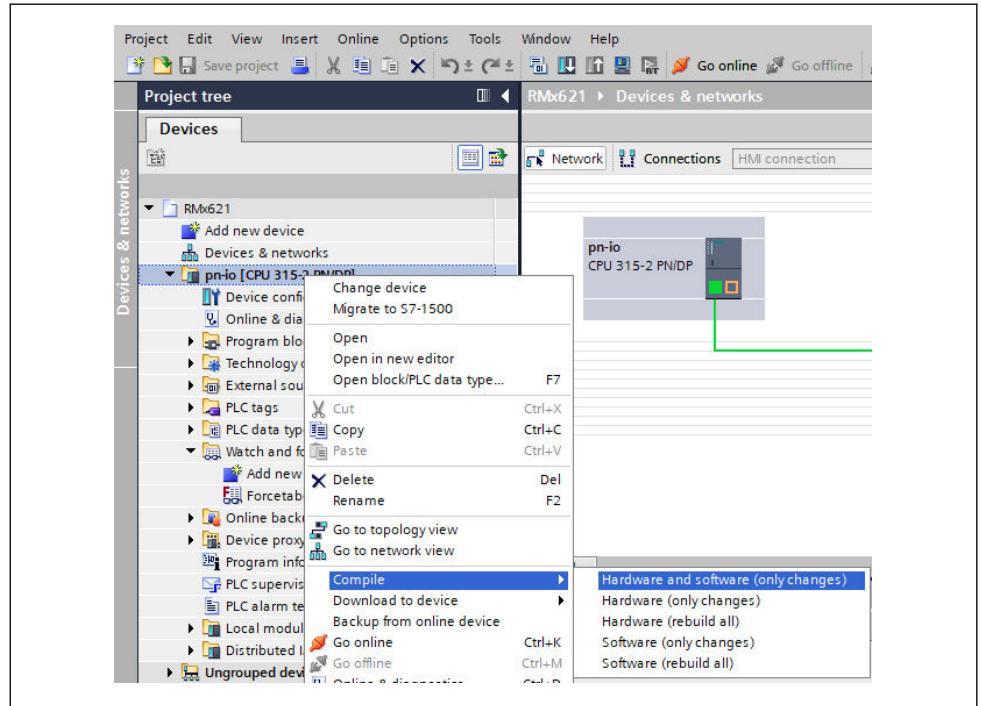
2. Using the drag-and-drop function, drag the input modules from the hardware catalog and assign them to the slots.

↳ The RMx621 / FML621 3 makes the process values available. In this case, the combination **inputs 4 bytes + inputs 1 byte** has been selected. As a result, the modules **inputs 4 bytes_x** (x=1,2,3) contain the process value in each case and the modules **inputs 1 byte_x** (x=1,2,3) contain the status of the process value. The module **inputs 16 bytes** could also be used just as easily. The process values and their status information would then be after one another (→ 19).

6.5 Downloading the configuration to the PROFINET controller

Before the configuration is transmitted to the PROFINET controller, it must first be compiled in the TIA Portal.

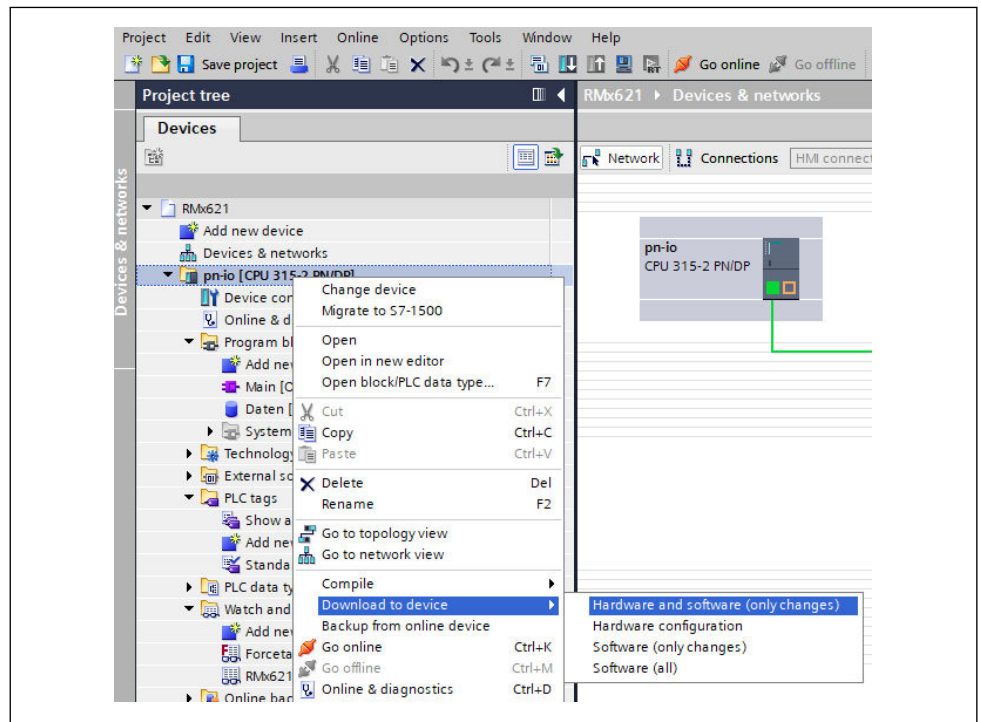
1.



A0041900

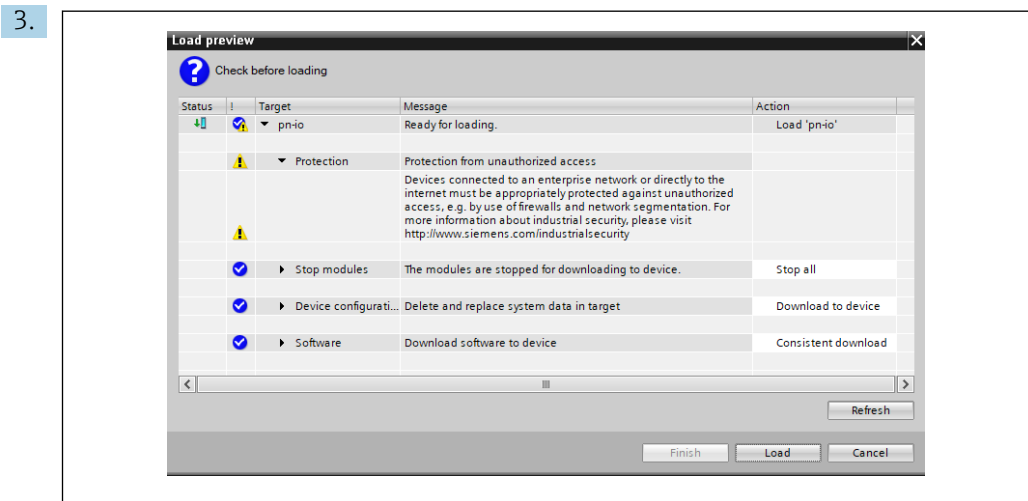
For this purpose, right-click the PROFINET controller in the **Project tree** area and in the **Compile** menu select the **Hardware and software (only changes)** entry.

2.



A0041901

After compiling, right-click the PROFINET controller again and in the **Download to device** menu, select the **Hardware and software (only changes)** entry.



A0041902

In the dialog box that now opens, click **Load** to start sending the configuration to the PROFINET controller. Afterwards, click **Finish** to finish the loading process and exit the dialog box.

7 Technical data

Dimensions:	120mm x 75mm x 27mm (height, depth, width)
Supply voltage:	24V DC +/- 10%
Current consumption:	Typ. 100mA, max. 300mA
RS485 interface parameters:	Baud rate 38400, 8 data bit, 1 stop bit, device address 01
Ambient temperature:	0 to 55 °C
Storage temperature:	-40 to +85 °C
Humidity:	0 to 95%, non-condensing
Degree of protection:	IP 20
Protective ground connection:	Grounded internally via DIN rail
Approvals:	UL - E203225, CE - 2004/108/EC, RoHS

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