Starting up Axioline E PROFINET IO-Link devices using a SIMATIC S7 controller (TIA portal)

Quick start guide

UM QS EN AXL E PN IOL S7 TIA

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2015-12-14

Designation: UM QS EN AXL E PN IOL S7 TIA

Revision: 00

This document is valid for all Axioline E PROFINET IO-Link devices.

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to:

- Qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.
- Qualified application programmers and software engineers, who are familiar with the safety concepts of automation technology and applicable standards.

Explanation of symbols used and signal words

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.

There are three different categories of personal injury that are indicated with a signal word.

DANGER This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.

This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

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Table of contents

1 Basics and example project

1.1 Information about this document

This document describes specific features associated with the startup of Axioline E PROFINET IO-Link devices on a SIMATIC S7-1500 controller.

The document is aimed at experienced TIA Portal users. It does not cover a complete project, just specific features associated with the use of Axioline E PROFINET IO-Link devices.

It is assumed the user has knowledge and experience in the operation of PCs and Windows operating systems, and knowledge of TIA Portal and Ethernet basics.

1.2 System requirements

1.2.1 Software requirements

At the time this document was written, the Totally Integrated Automation Portal (version V13 SP1) software was used.

1.2.2 Hardware requirements for TIA Portal

Please refer to the SIMATIC S7-1500 controller documentation for the hardware requirements.

1.2.3 Axioline E PROFINET IO-Link devices

The document is valid for the following Axioline E PROFINET IO-Link devices:

Designation	Order No.	Device ID	ModuleIdentNumber	Firmware
AXL E PN IOL8 DI4 M12 6P	2701513	0x0104	0x00500000	v2.0.0.0 or later
AXL E PN IOL8 DI4 M12 6M	2701519	0x0104	0x00510000	v2.0.0.0 or later

1.3 Example network configuration

This example consists of a SIMATIC S7-1500 controller, the AXL E PROFINET IO-Link devices, and a PC with TIA Portal.

The example system is shown in Figure 1-1.

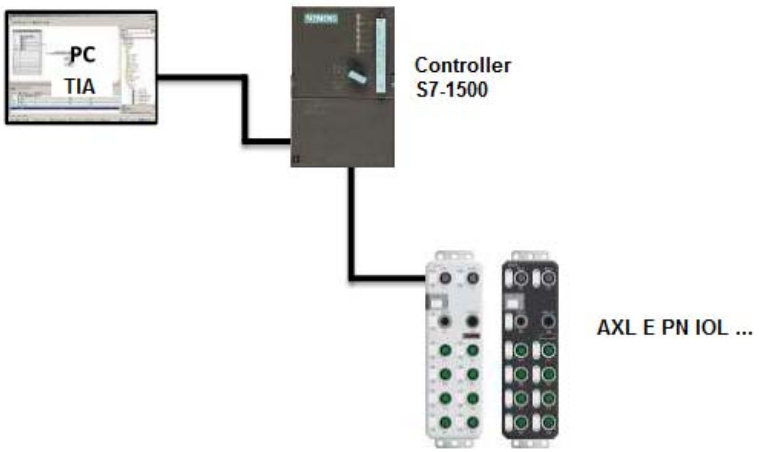

Figure 1-1 Example system

1.4 General startup steps

Proceed as follows to start up Axioline E PROFINET IO-Link devices:

- Install the devices and connect the power supply.
- Create a new project in the engineering tool.
- Add the controller and I/O devices to the project.
- Enter addresses/names.
- Compile the project and send it to the controller.
- Establish communication with the I/O device and test this.

2 Creating a project in TIA Portal

To integrate the AXL E PROFINET IO-Link devices into the network, proceed as described in the manufacturer's documentation for your controller. This section only explains fundamental steps that are relevant to the Axioline E system.

2.1 Creating/opening a project

- In TIA Portal, create a new project or open an existing project. In this example, a new project is created.
- Click “Create a new project” (1) in the project view.
- Assign a name (2) to the project and click “Create” (3).

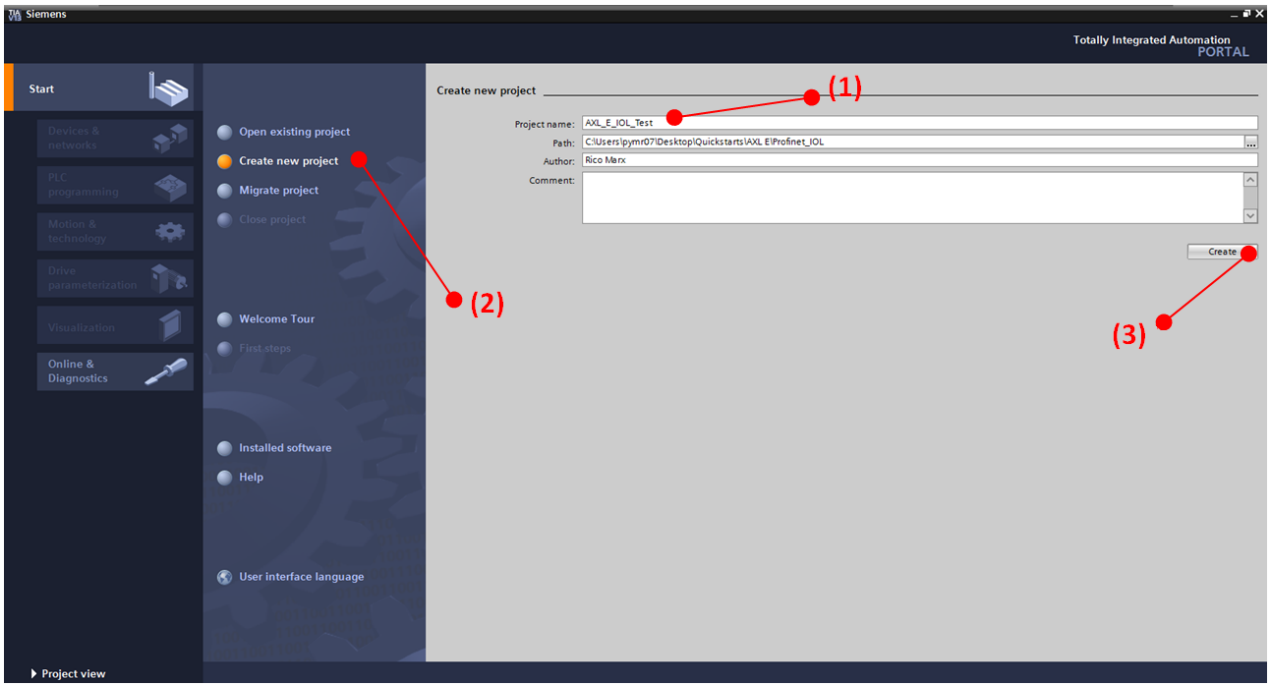

Figure 2-1 Creating a new project

2.2 Adding a controller

This example uses a Siemens SIMATIC S7-1500 CPU 1517-3 PN/DP controller. The following steps apply specifically to this controller. Please perform the steps required for your controller according to the associated documentation.

- Click “Configure a device” (1), then click “Add new device”.

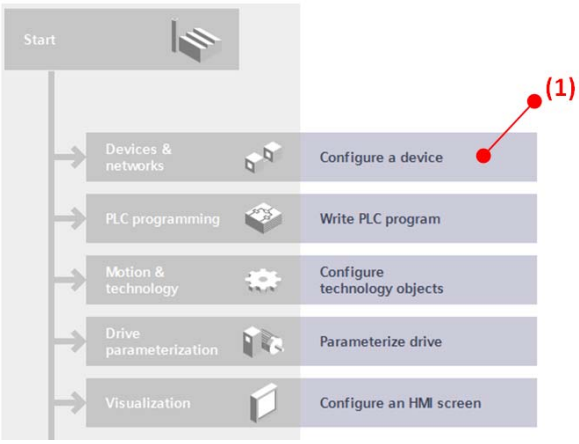

Figure 2-2 Configuring a device

- Select “Unspecified CPU 1500” (1) from the displayed file path and click “Add” (2).

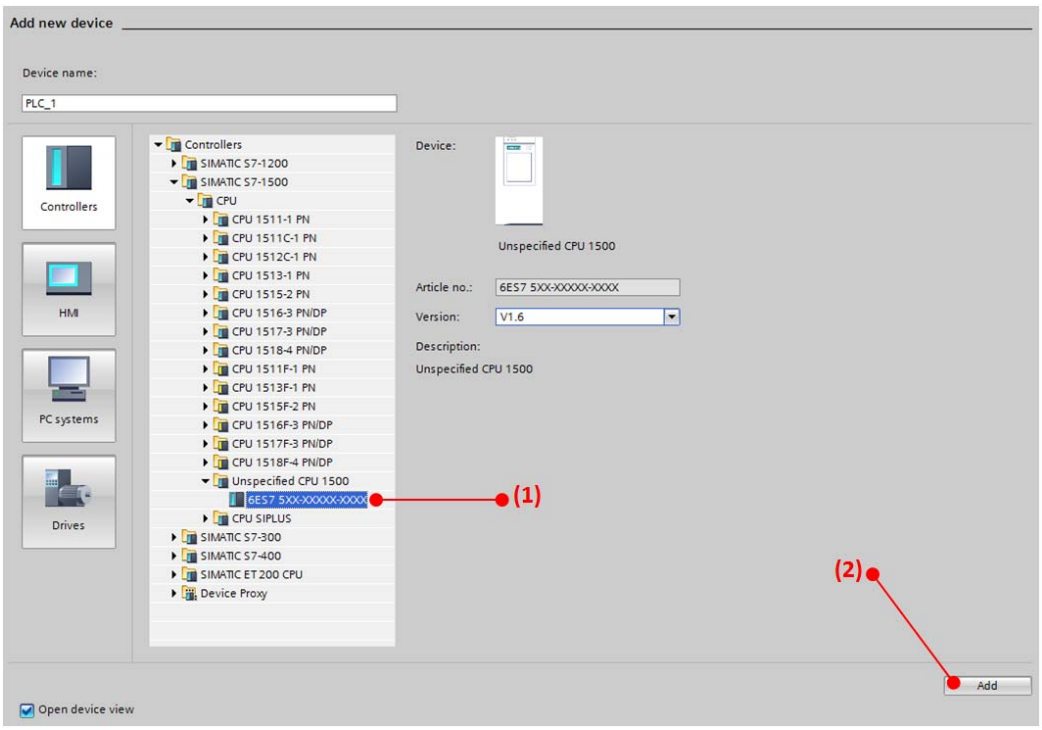

Figure 2-3 Adding a controller

On the “Device view” tab, the controller is displayed in white.

- Click “detect” in the yellow field in order to specify the controller.

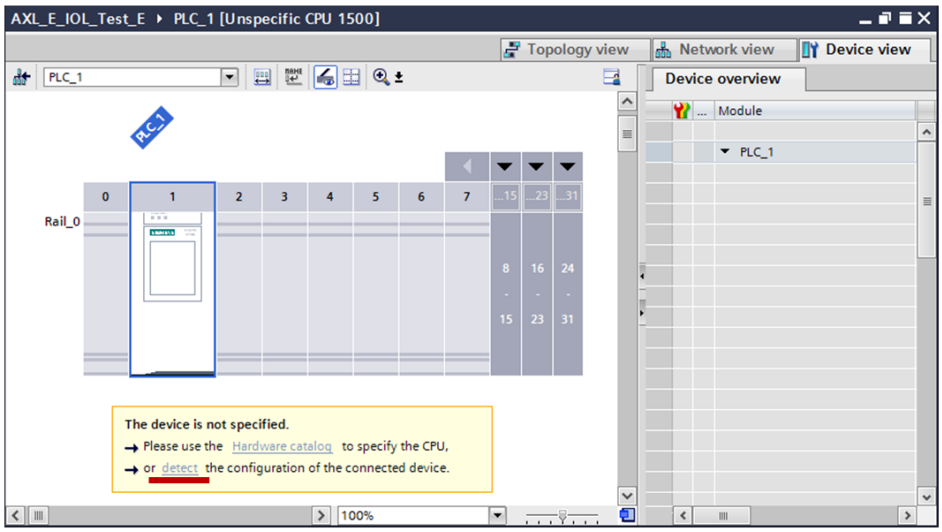

Figure 2-4 Controller display

- Then select the PC interface and its types (1).
- Then click “Start search” (2).

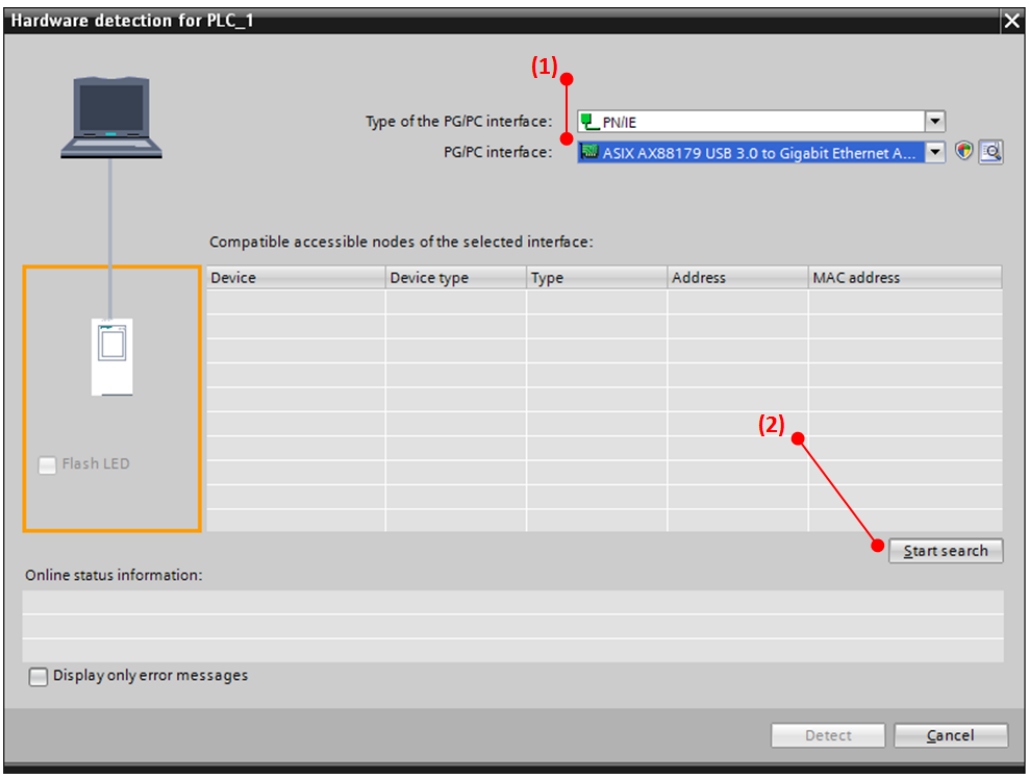

Figure 2-5 Selecting the PC interface

- Select the desired controller.
- To ensure the connection is correct, you can make the LEDs on the front of the controller flash (1).
- When you have selected the correct controller, click “Detect” (2).

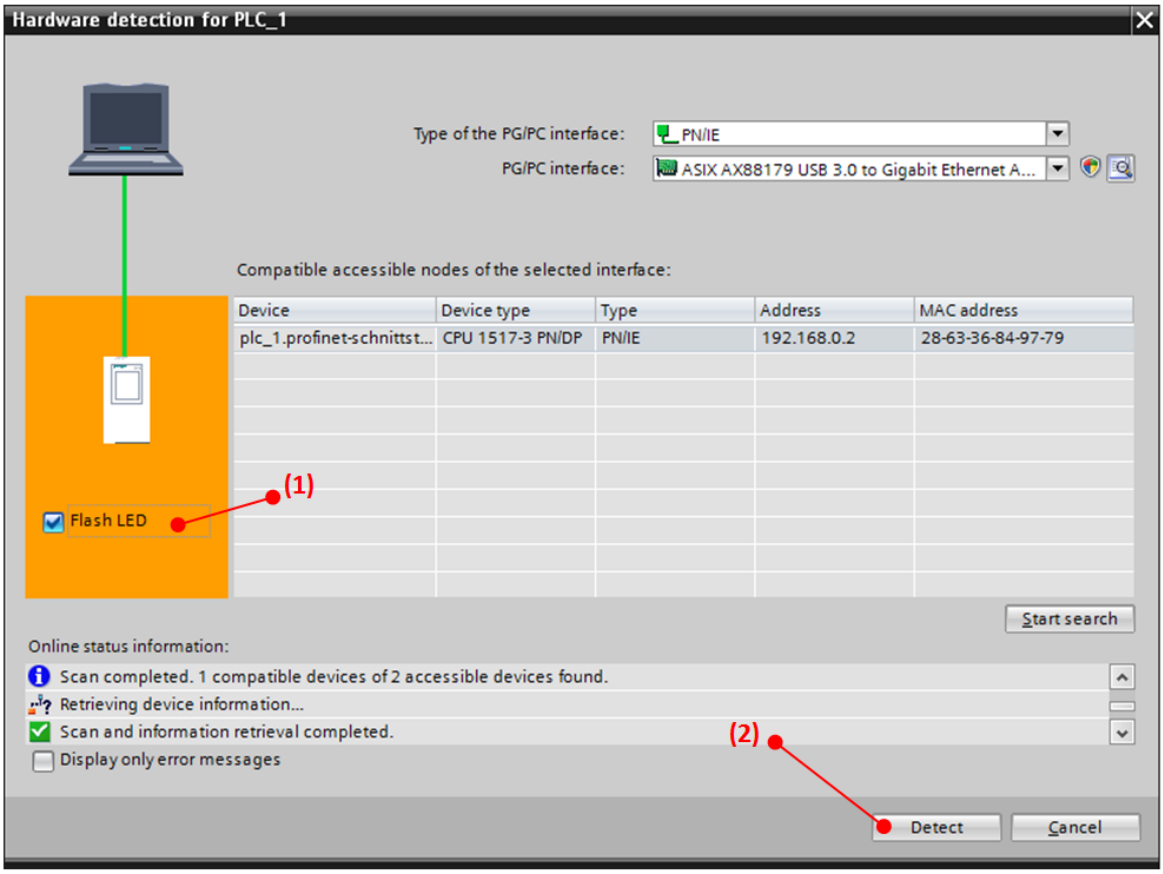

Figure 2-6 Selecting the controller

- Confirm the message for online access. To do this, you must make sure that you are connected to the controller.

Once the program has created the controller, it will be displayed in color in the device view.

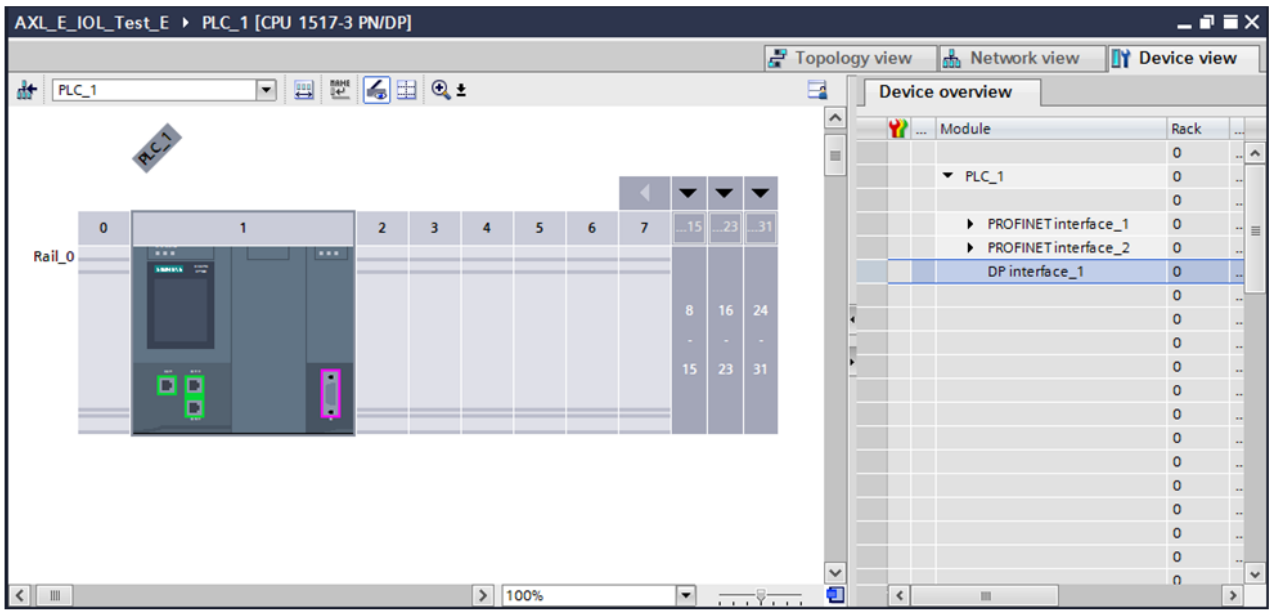

Figure 2-7 Controller in device view

- You can now configure the controller.
- To do this, click the controller once in the device view.
- This example uses the PROFINET interface [X1] (1). Under this menu item, set the IP address and the PROFINET device name for this interface (2).

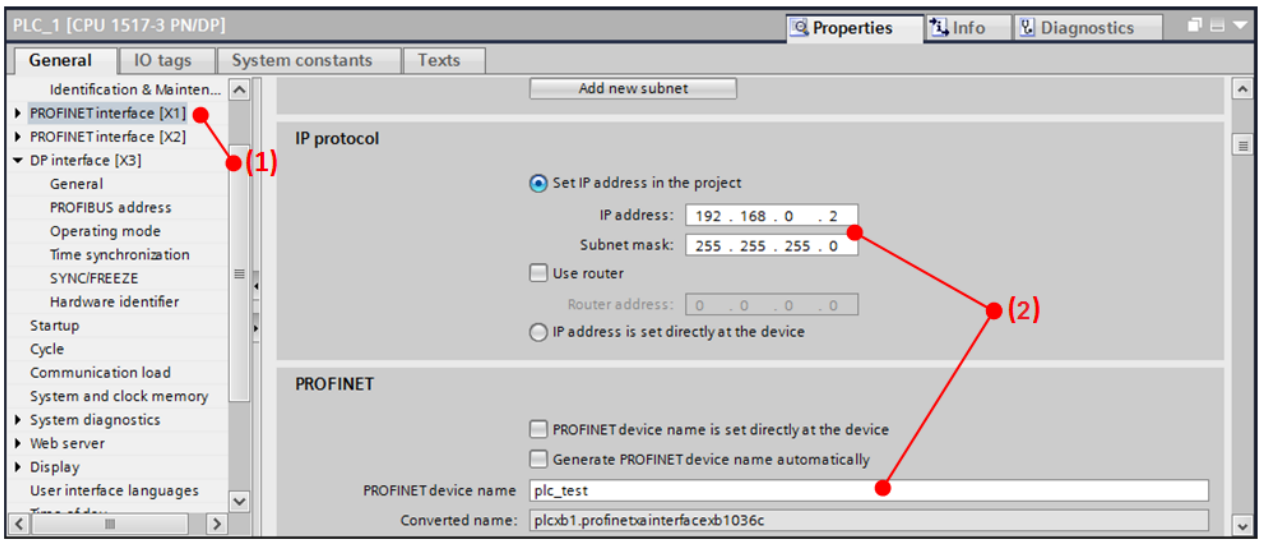

Figure 2-8 Setting the IP address and PROFINET device name

2.3 Installing the device description file (GSDML)

If this is the first time you have worked with AXL E PROFINET IO-Link devices in your engineering system, you need to install the necessary device description files.

Make sure you use the latest GSDML file. It is available on the Internet at www.phoenixcontact.net/products.

Make sure that the name of the downloaded GSDML file is the same as the name displayed in the Download area. If the file name differs following download (e.g., after downloading with Mozilla Firefox), rename the file. Otherwise, the file will not be recognized by STEP 7.

- In the project view, select the “Options” menu and click “Manage general station description files (GSD)” (1).

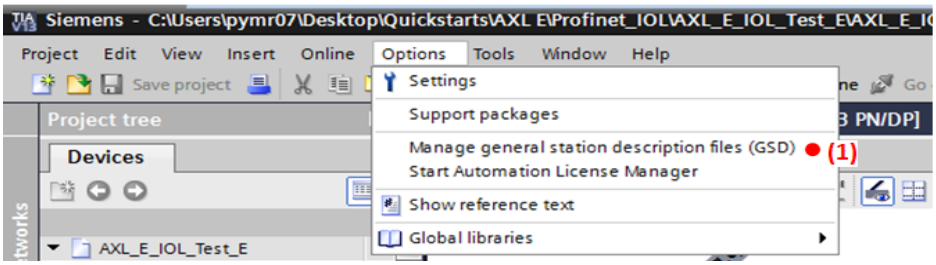

Figure 2-9 Opening “Manage GSD”

- Switch to the folder (1) containing the GSDML file.
- Select the required GSDML file (2).
- Click “Install” (3).

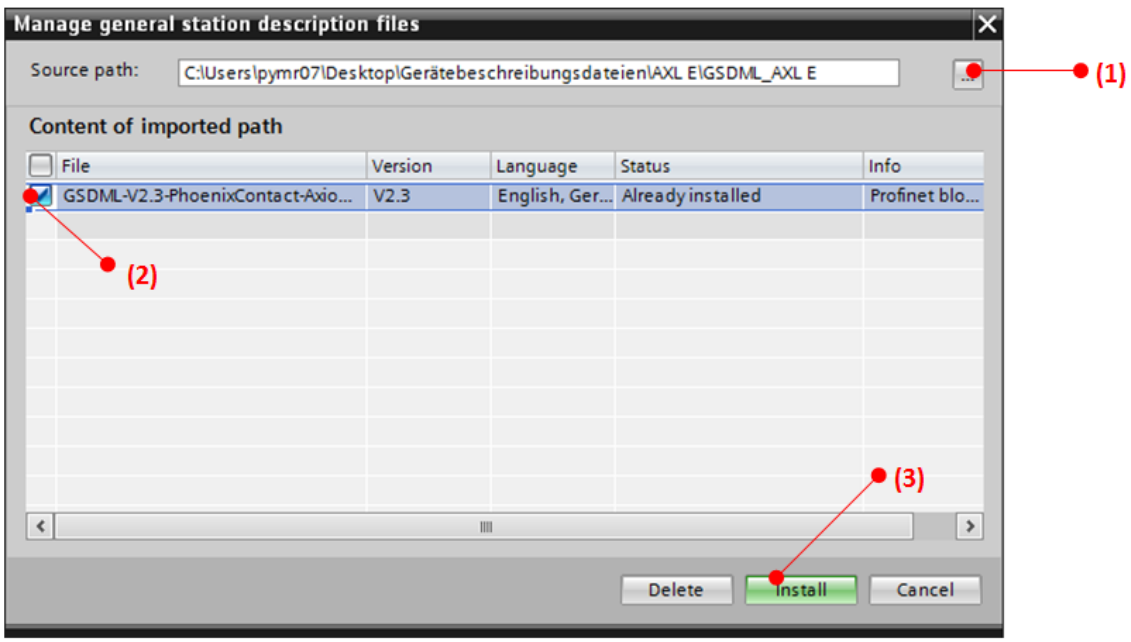

Figure 2-10 Installing GSD

- Quit the “Manage general station description files” dialog box by clicking “Close” (1).

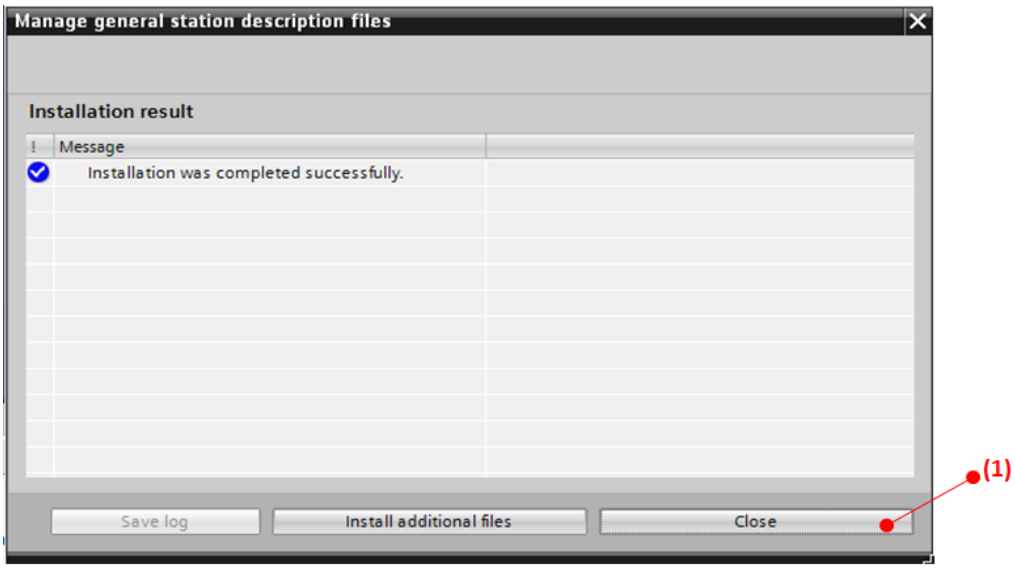

Figure 2-11 Closing the “Manage general station description files” dialog box

- Switch from the “Device view” tab to the “Network view” tab (1).
- Here you can view the devices in the hardware catalog under:
  Other field devices > PROFINET IO > I/O > Phoenix Contact > AXL E (2).

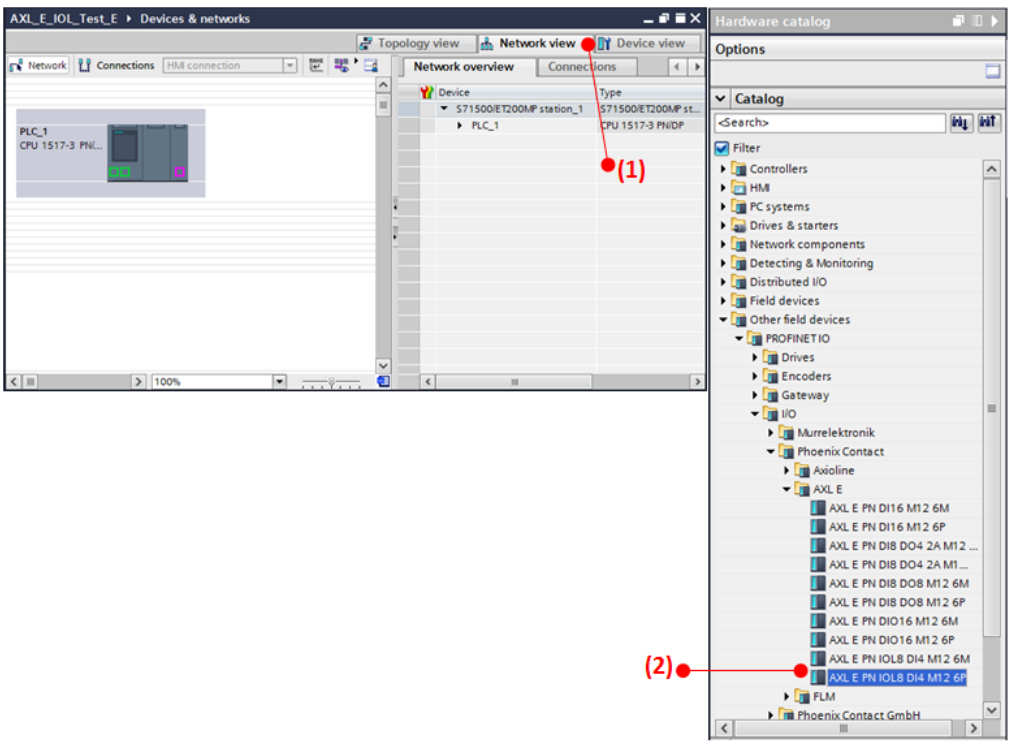

Figure 2-12 Hardware catalog

2.4 Adding an I/O device

I/O devices can be added to the network in the PROFINET string by dragging and dropping.

- Select the AXL E PROFINET IO-Link device in the hardware catalog and move it to the PROFINET network (1) using drag and drop.
- Connect the ports of the controller with those of the device (2) to establish a PROFINET network. To do this, keep the left mouse button pressed down.

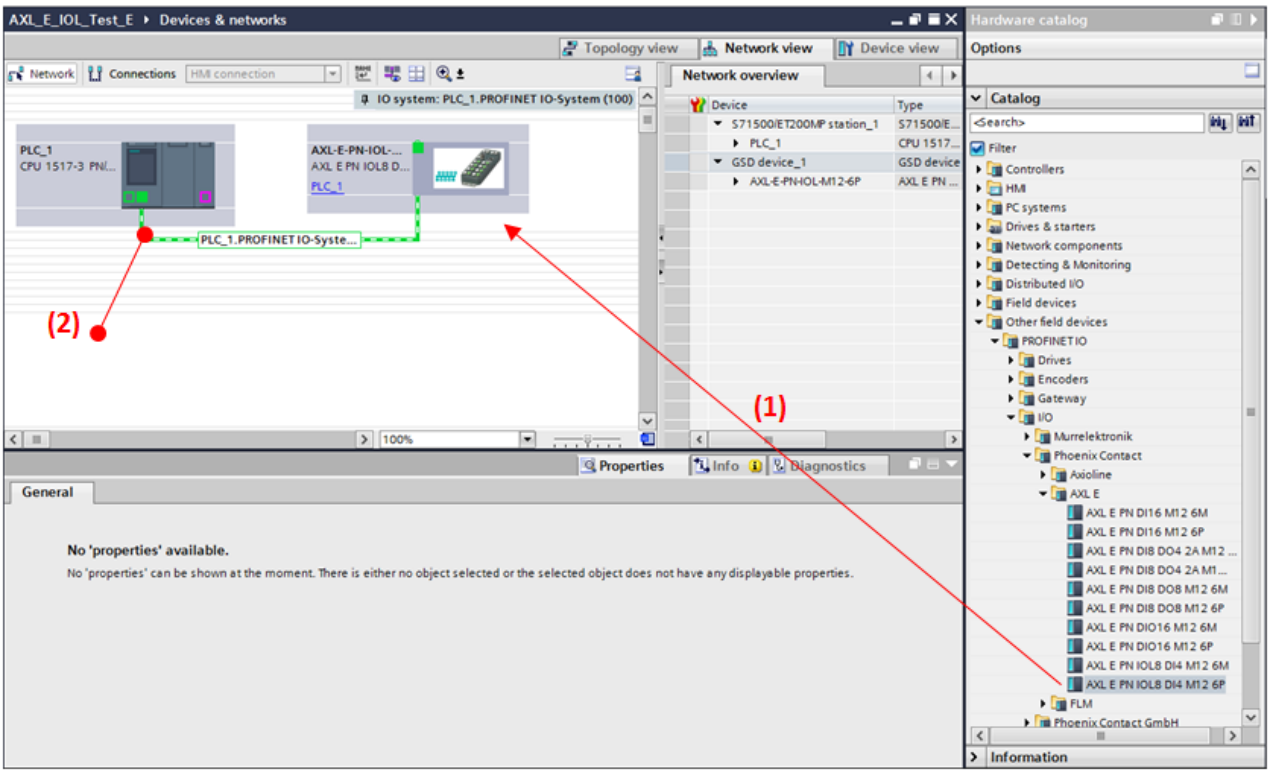

Figure 2-13 Establishing a PROFINET network

- Click once on the AXL E PROFINET IO-Link device (1) to open its settings.
- Change the IP address and PROFINET device name (2).

When changing the name, the “Generate PROFINET device name automatically” checkbox must not be activated.

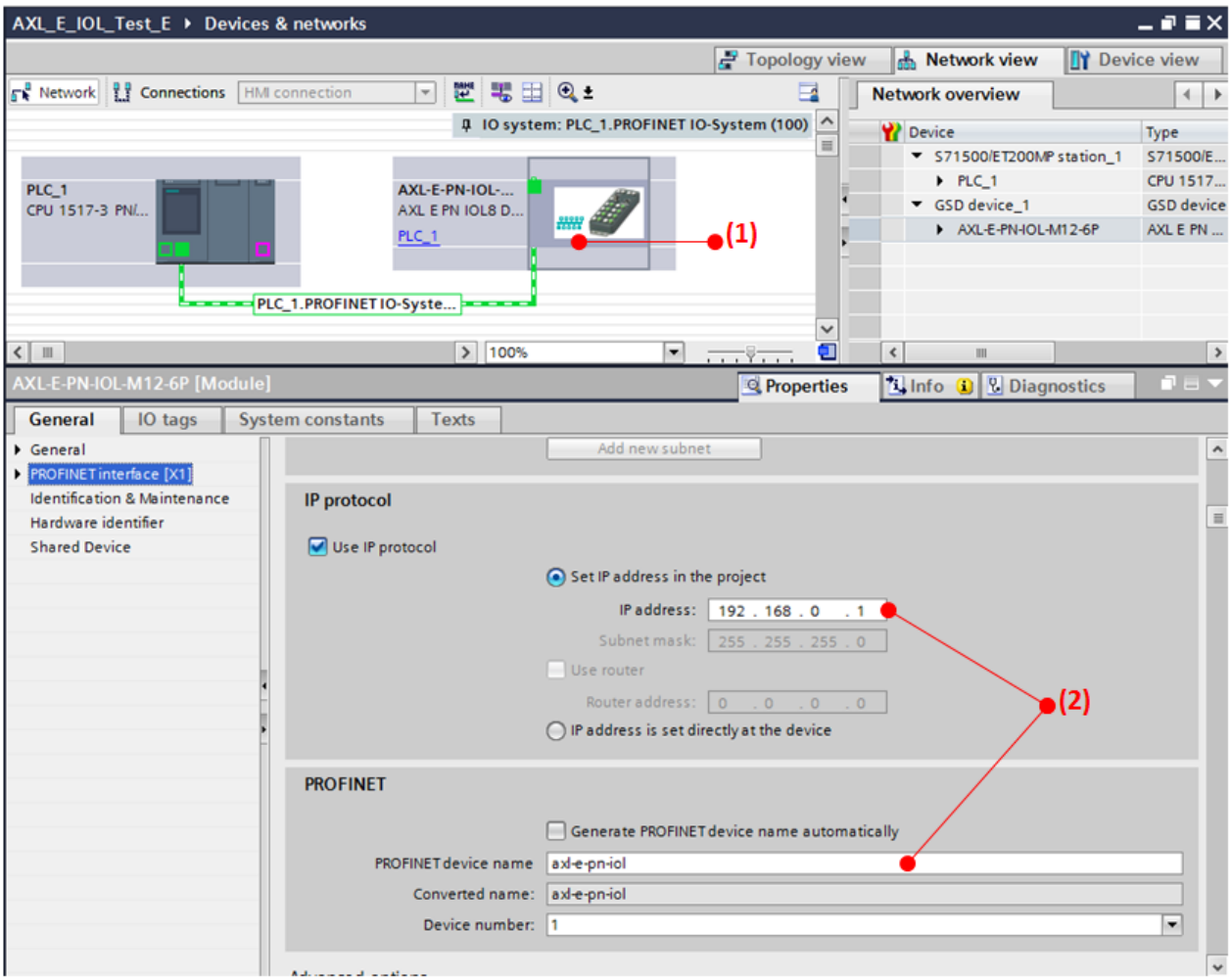

Figure 2-14 Changing the IP address and PROFINET device name

- To assign a name to the device, right-click the device on the “Network view” tab.
- Select “Assign device name” (1).

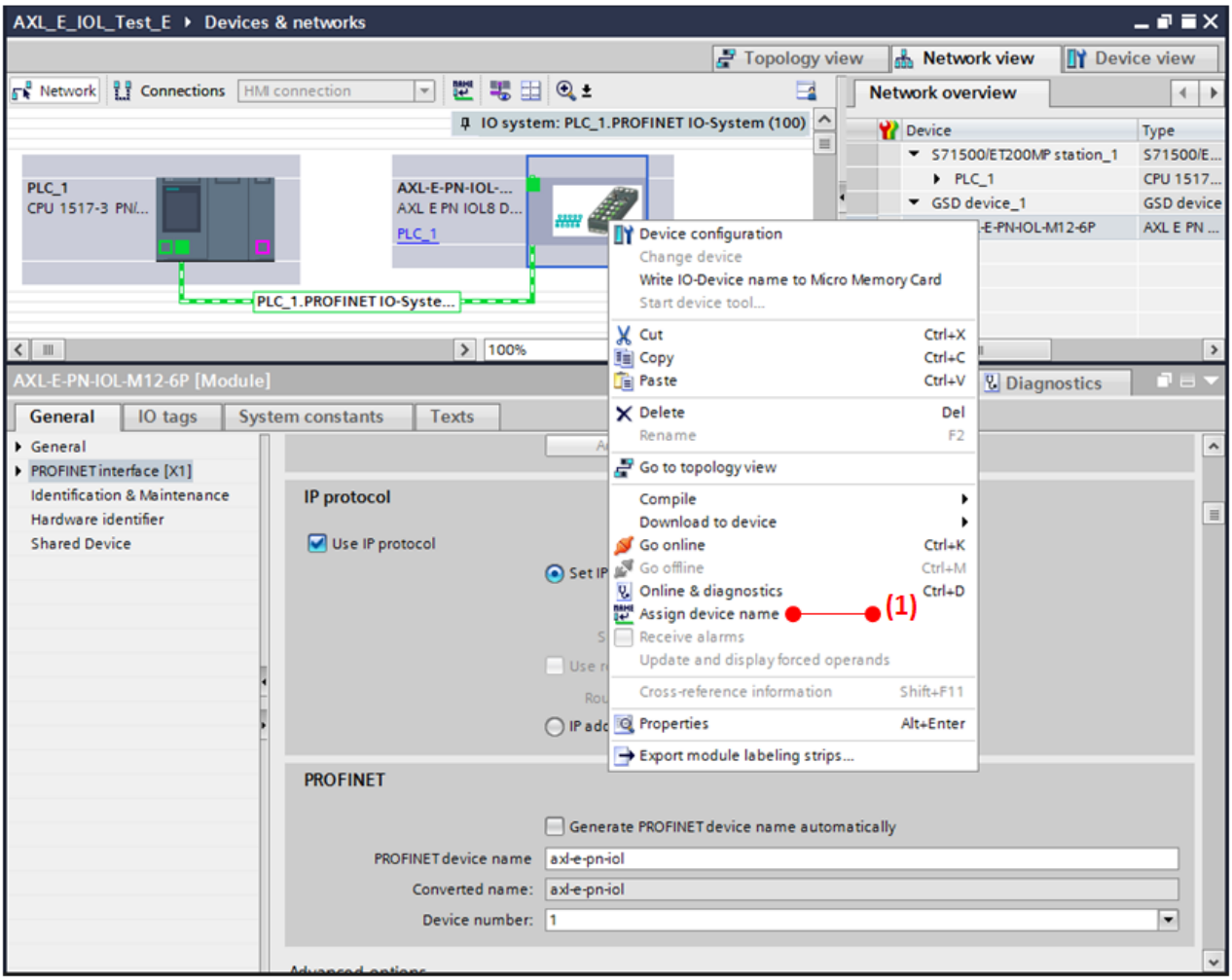

Figure 2-15 Assigning a device name

- The name you previously selected must be listed in the “PROFINET device name” drop-down list (1).
- Enter your PC interface and its types (2) again.
- Click the checkbox “Only devices of the same type” (3) in the “Device filter” section. This will now only display devices of the same type.
- Select the desired device (4).
- Click “Assign name” (5).

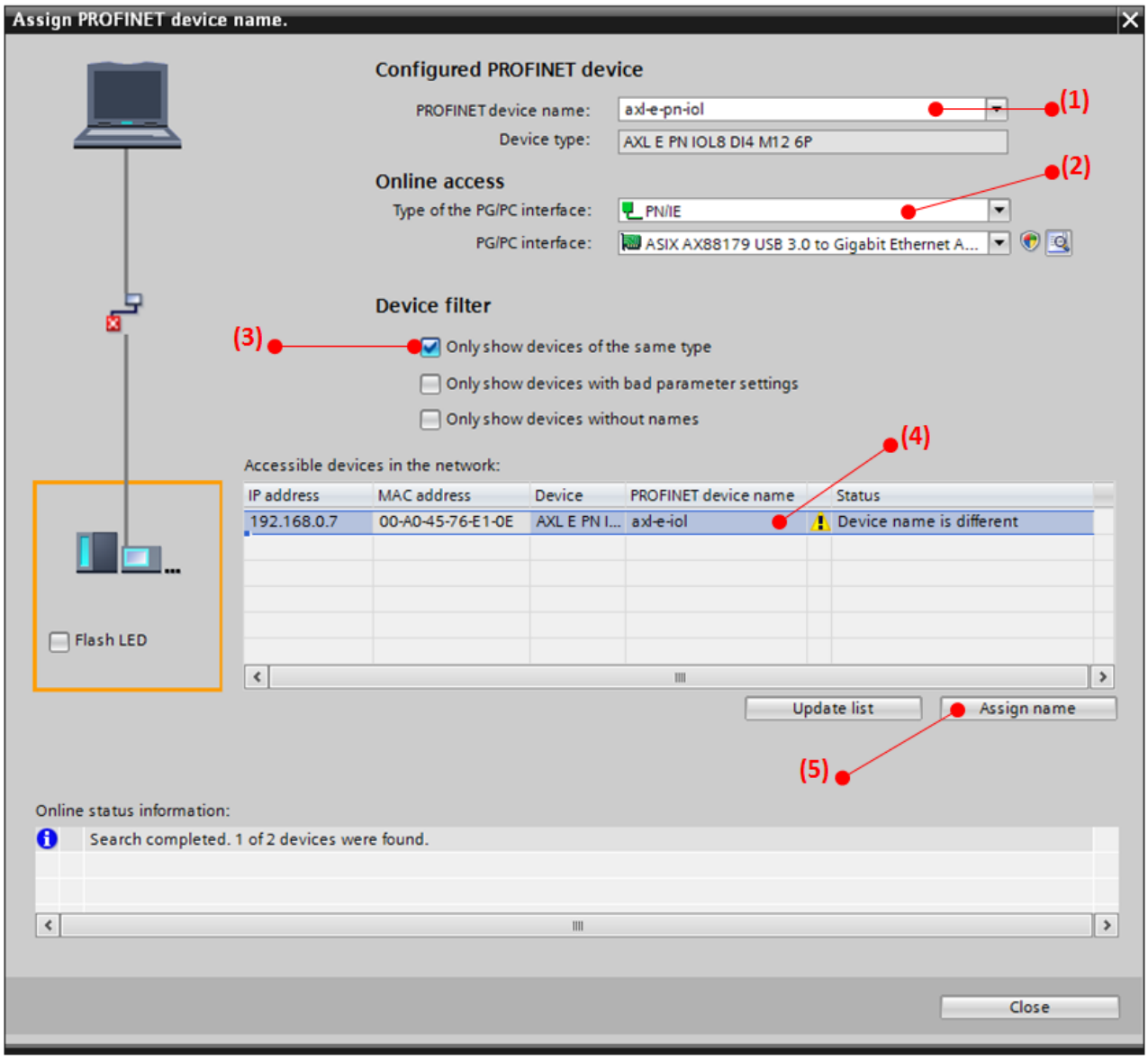

Figure 2-16 Assigning a device name

- Once you have successfully assigned the name, “OK” (1) must appear in the “Status” column for your device.

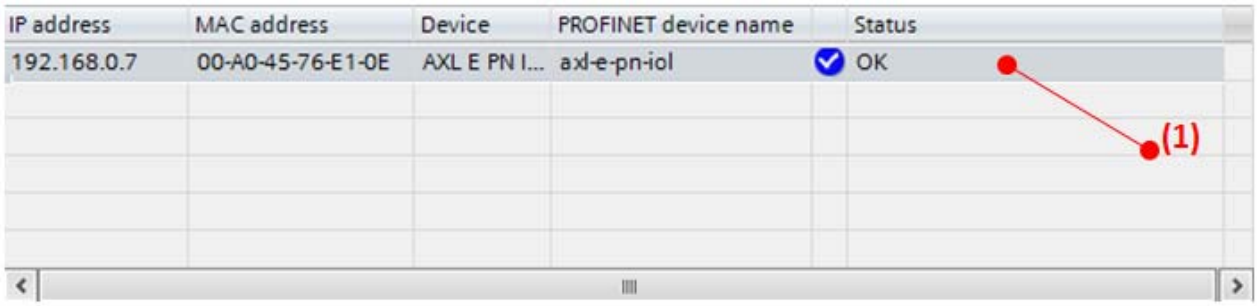

Figure 2-17 “OK” status

Make sure that you are connected to the controller and the device.

3 Setting Axioline E PROFINET IO-Link device

- If you navigate in the “Project tree” to PLC_1 (or a name you have assigned) > Distributed I/O > PROFINET IO system > AXL-E-PN-IOL-M12-6P and double-click “Device configuration” (1), you will be taken directly to the “Device view” of the Axioline E PROFINET IO-Link device.

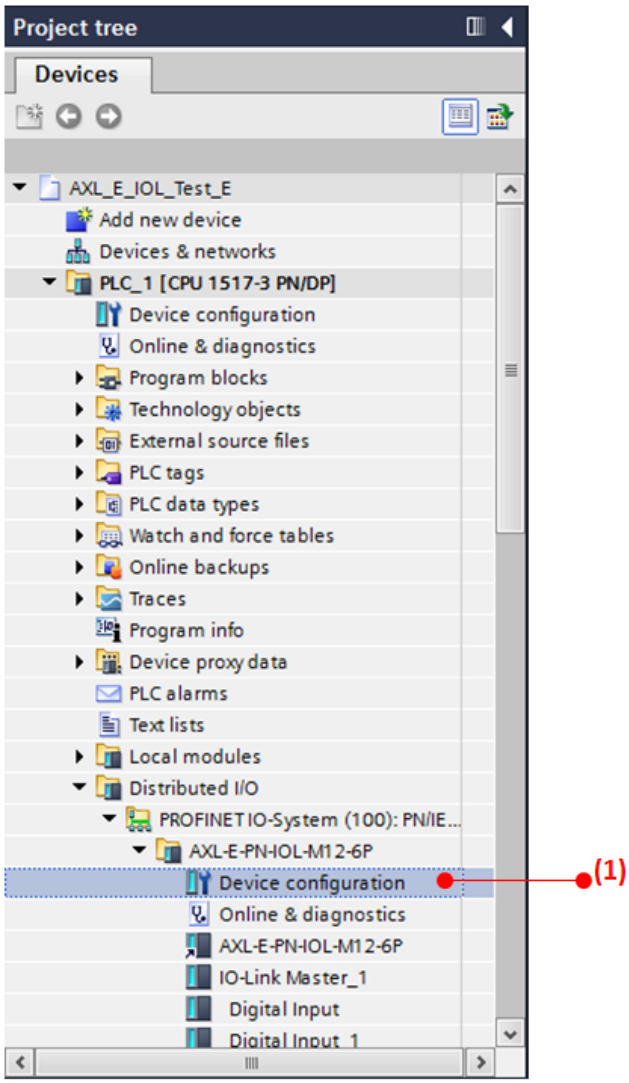

Figure 3-1 Project tree

The Axioline E PROFINET IO-Link device is modular. Slot 1.1 (slot 1, subslot 1) always contains the “Status/Control Module” with four bytes of input and four bytes of output process data.

In the additional slots 1.2 to 1.9, both the operating mode and the process data length for the respective IO-Link port are parameterized. In the default state, these slots are pre-allocated the “digital input” mode.

The PROFINET device model of the AXL E PN IOL8 DI4 M12 6P device is shown as an example.

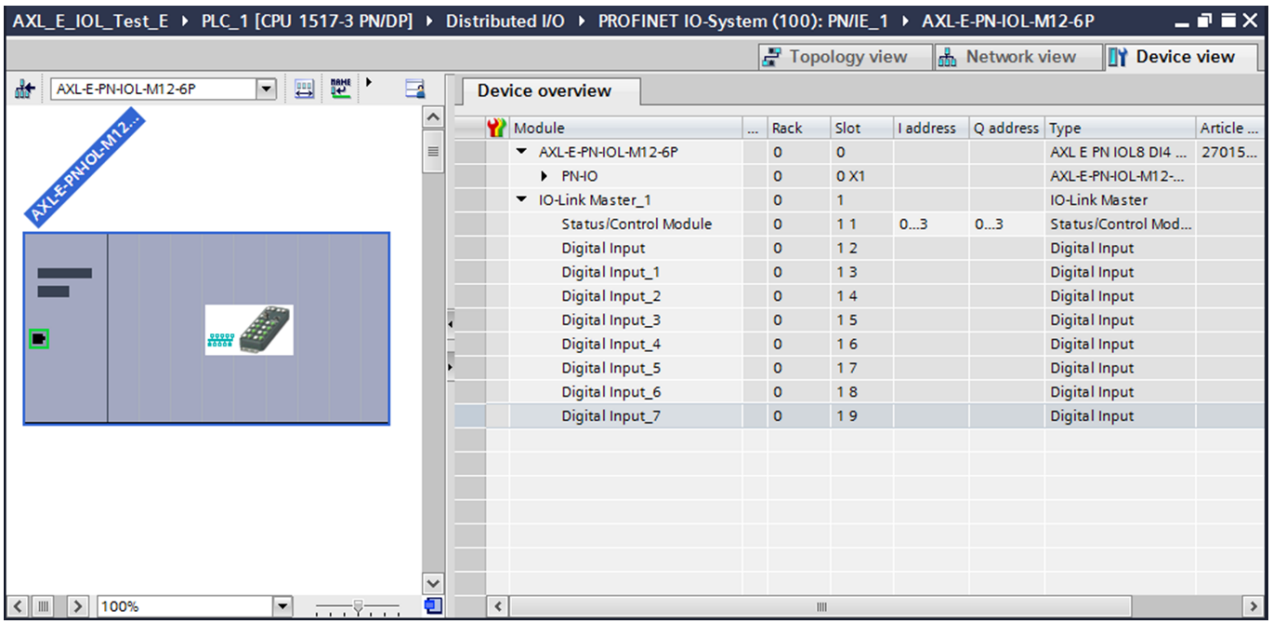

Figure 3-2 PROFINET device model

For further information about the individual operating modes and configuration options, please refer to the device-specific data sheet.

The following sections describe all the necessary configuration options for the device.

3.1 Performing a flash test

If you want to start up several Axioline E PROFINET IO-Link devices of the same type, but do not have unique identification, you can uniquely identify these by carrying out a flash test directly on the device.

The TIA Portal engineering tool can search all devices located/accessible on the PROFINET network and perform a flash test. This does not need to be available in the created project.

To do so, carry out the following steps:

- Click the “Accessible devices” icon on the menu bar.

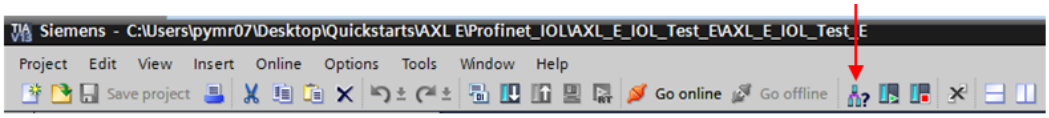

Figure 3-3 Clicking the “Accessible devices” icon

- Then select your PC interface again and select its types (1).
- Then click “Start search” (2).

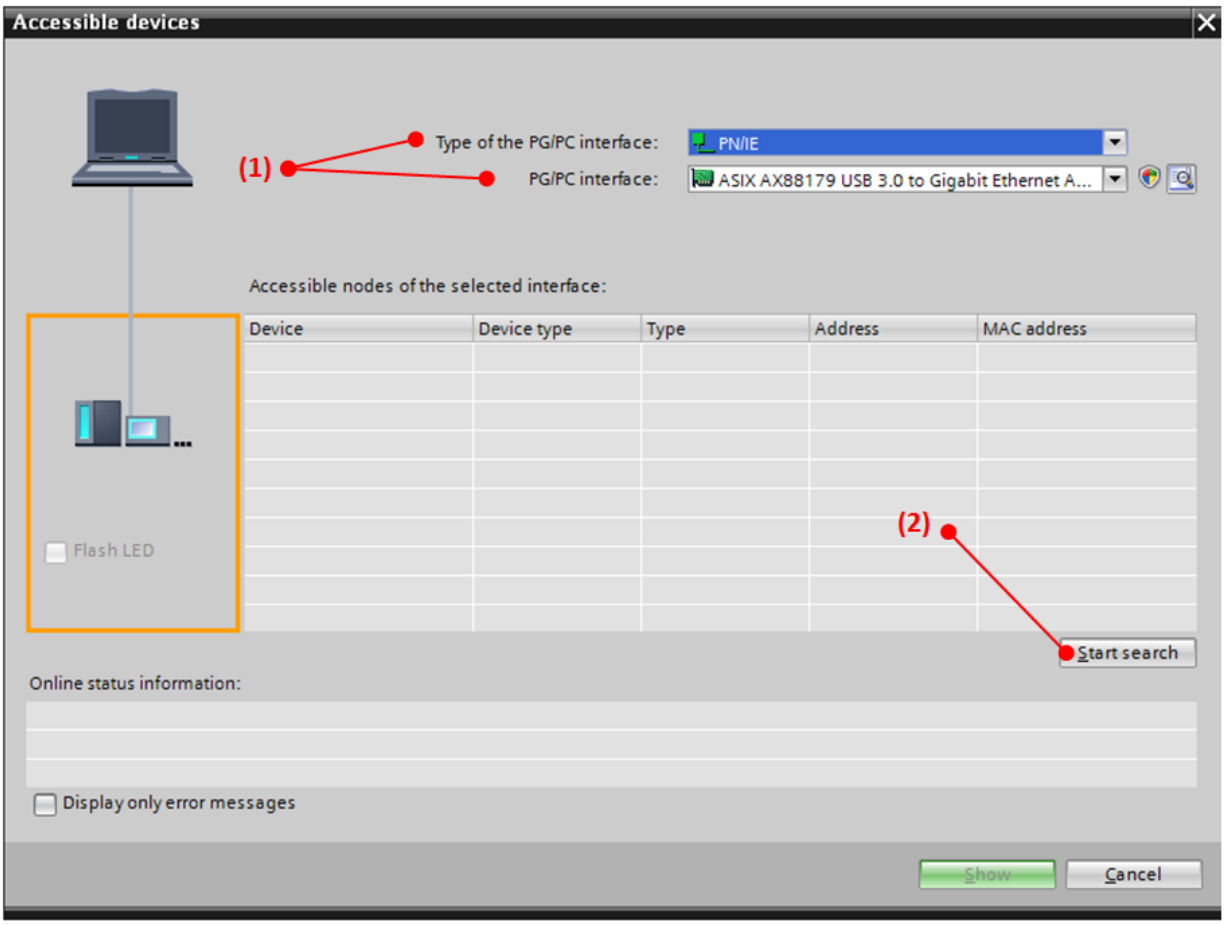

Figure 3-4 Searching “Accessible devices”

- Now highlight the desired device (1).
- Click the “Flash LED” checkbox (2) in order to perform the flash test on the corresponding device.

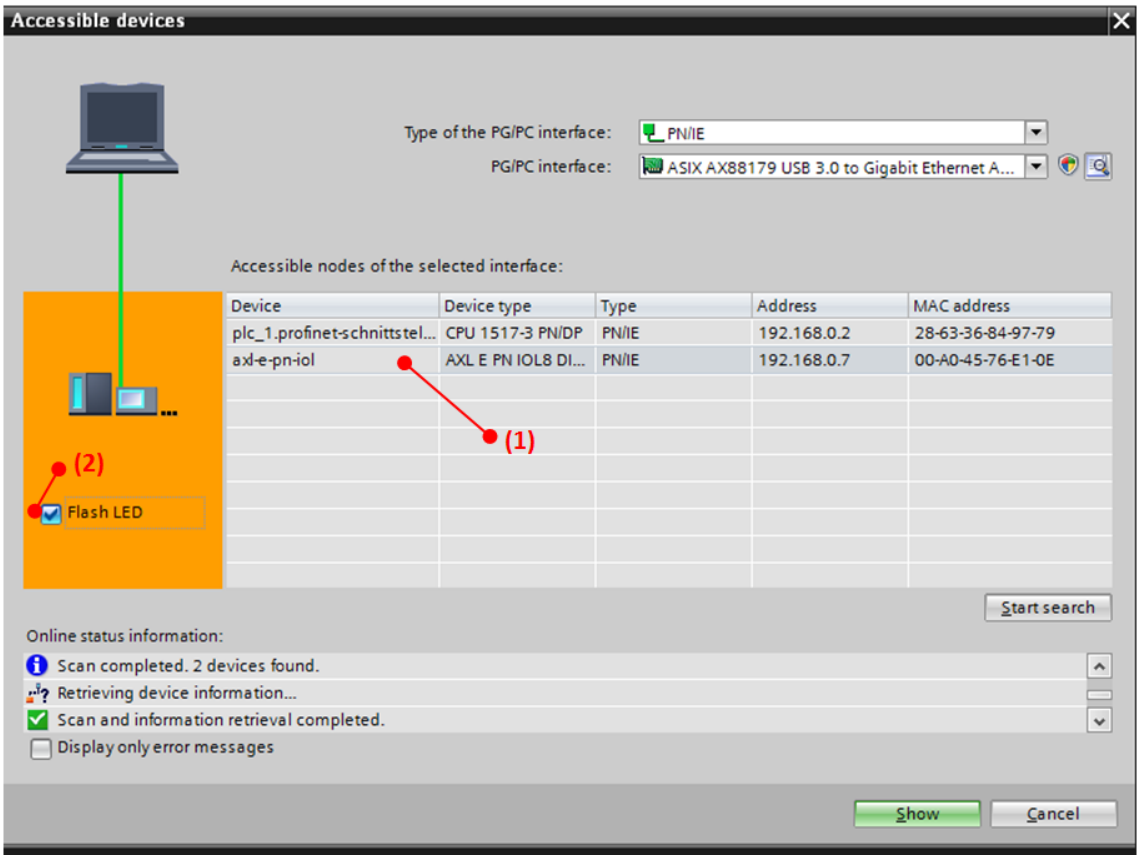

Figure 3-5 Performing a flash test

	On Axioline E PROFINET IO-Link devices, the BF and SF LEDs flash red simultaneously.

3.2 Performing IO-Link port configuration

In order for the ports to be freely configured, all the default port settings are deleted in this example.

- Select the ports and delete all default settings with the delete key.

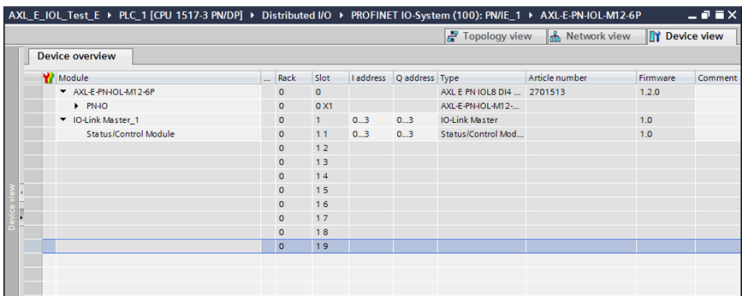

Figure 3-6 Deleting default settings

- Now add in the available submodules (operating modes) of the IO-Link master (1) from the hardware catalog to the respective port by dragging and dropping.
- By way of example, only one AXL E IOL RTD1 M12 R will be used on one port in order to measure the room temperature.

Add in the submodule “Deactivated” to unused ports in order to send a complete device parameterization to the IO-Link master.

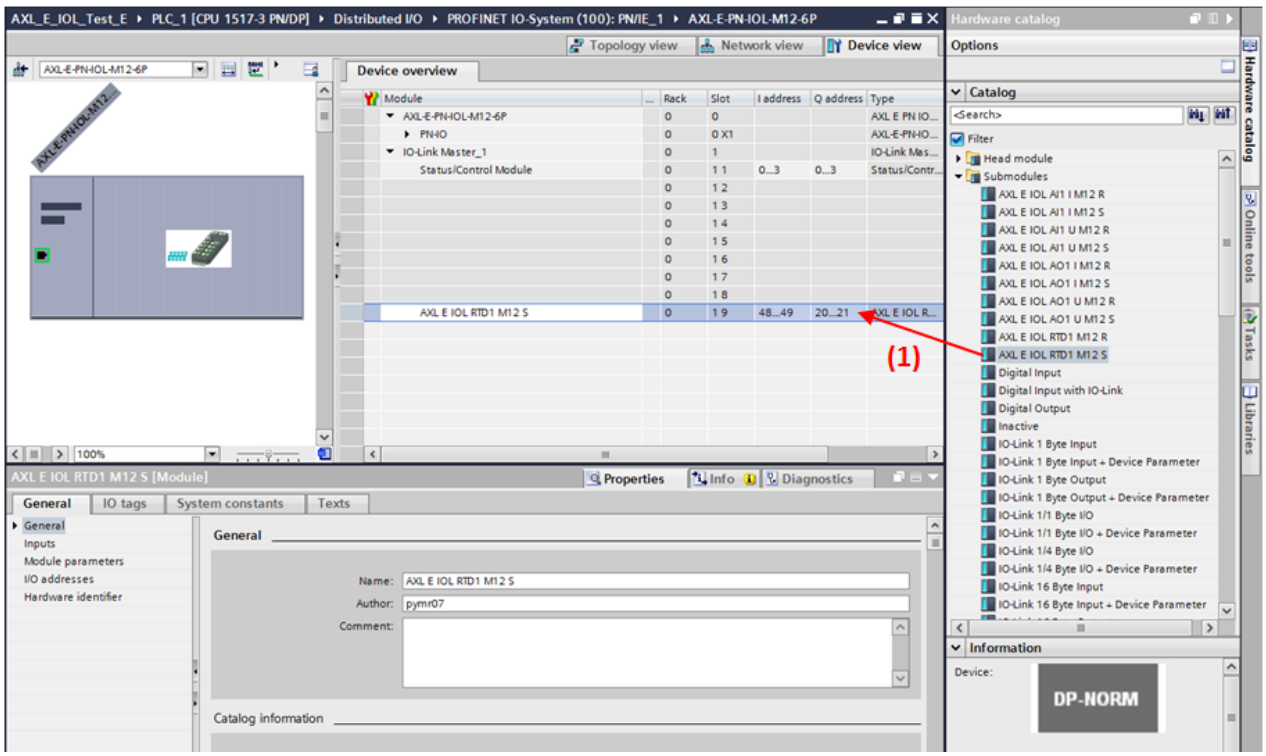

Figure 3-7 Inserting submodules

3.3 Setting IO-Link device identification

The Axioline E PROFINET IO-Link masters support recognition and calibration of connected IO-Link devices. The vendor ID and the device ID can be set for each port.

As soon as the contents of the vendor ID and/or device ID do not equal “0”, the “Type Compatible” IO-Link inspection level is activated. It is only when both the parameterized vendor ID and device ID match the IDs that are read (in the device) that communication is established with the device (COM state bit of the corresponding port is set), otherwise this is rejected (red IO-Link LED on).

Perform the following steps in order to configure the IO-Link device identification:

- Carry out the port configuration in accordance with section “Performing IO-Link port configuration” on page 25.
- Switch over the ports, for which device identification should be performed, to IO-Link operating mode.
- In the settings of the relevant port, switch to the “Module parameters” area (1).

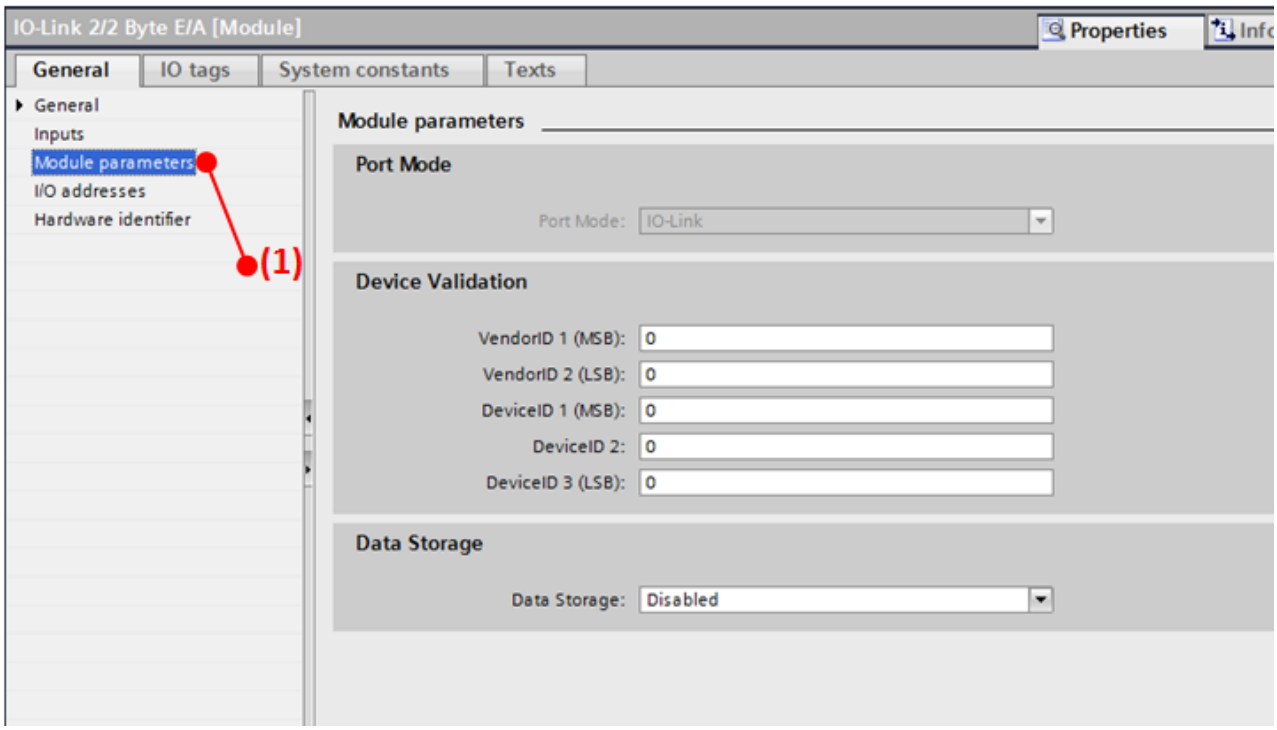

Figure 3-8 Switching to the “Module parameters” area

Using the example of a capacitive sensor KQ6005 from ifm, the following settings are required: vendor ID 310d (01 36 h) and device ID 371d (00 01 73 h).

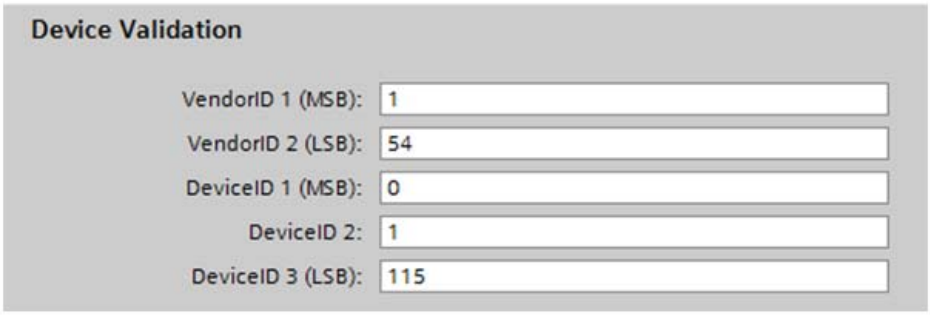

Figure 3-9 Example settings

In the “Value” field, enter the decimal values, i.e., you must convert every hexadecimal byte to decimal in advance and enter it in the corresponding field, in this example:

Vendor ID: $01_{hex} = 1_{dec}$; $36_{hex} = 54_{dec}$

Device ID: $00_{hex} = 0_{dec}$; $01_{hex} = 1_{dec}$; $73_{hex} = 115_{dec}$

3.4 Setting the IO-Link data storage mechanism (parameter server)

The Axioline E PROFINET IO-Link devices support the data storage mechanism, which enables parameters to be exchanged between the master and device.

Connected devices must support at least IO-Link specification v1.1 in order to use the function.

The options are as follows:

– Deactivated
– Download Only
– Upload Only
– Download/Upload Allowed
– Cleared

For further information about the individual functions, please refer to the device-specific data sheet.

To set the data storage mechanism perform the following steps:

- Carry out the port configuration in accordance with section “Performing IO-Link port configuration” on page 25.
- Switch over the ports, for which device identification should be performed, to IO-Link operating mode.
- Select port 5 again on slot 1.6; see Figure 3-8 on page 26.
- Double-click to open the “Properties” window of the port.
- Switch to the “Module parameters” (1) area.
- Perform the settings above using the drop-down menu in the “Data management” area (2).

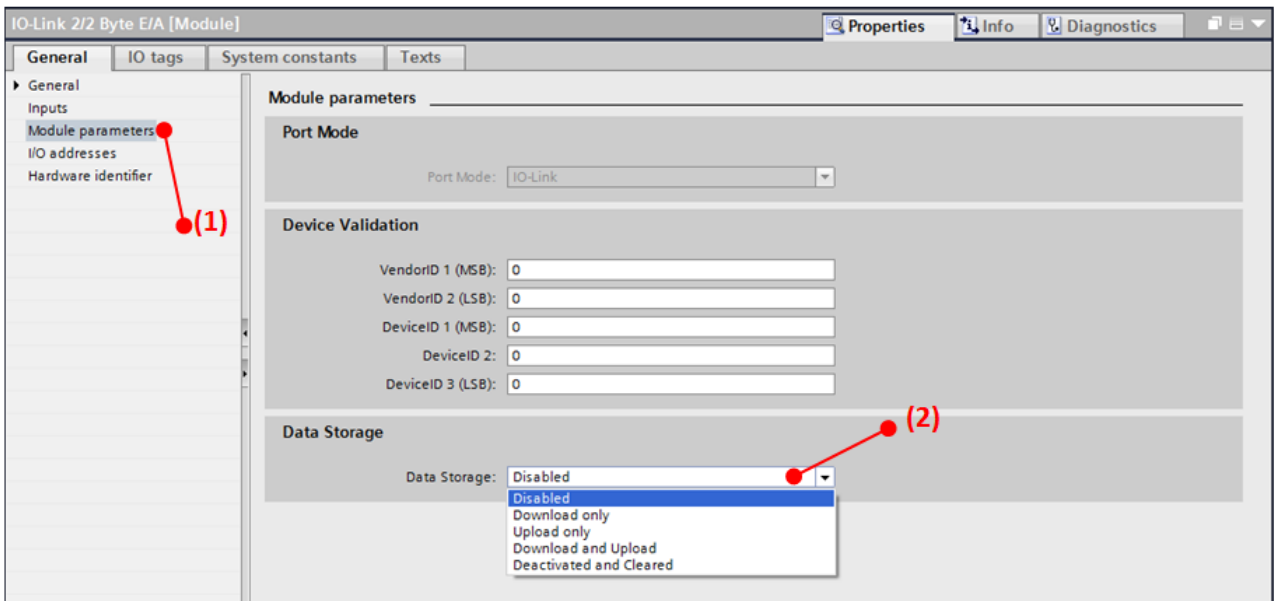

Figure 3-10 Expanding the “Device verification” menu item

In order for the data storage mechanism to work, you should carry out the following steps:

Use of “Upload only” > “Download only”

1 Connect a fully parameterized IO-Link device to the appropriate port.
2 Configure the port to “**Upload only**”.
3 Download the program and switch the controller to online mode.
   – The parameters are now read by the device and stored in the master on the port.
4 The device can now be swapped with a new device.
5 Re-parameterize the port to “**Download only**”.
6 Download the program and switch the controller to online mode.
7 The parameters are transferred as soon as the master is started and the device has been detected.

Use of “Download/Upload allowed”

1 Connect a fully parameterized IO-Link device to the appropriate port.
2 Configure the port to “**Download/Upload allowed**”.
3 Download the program and switch the controller to online mode.
   – The parameters are now read by the device and stored in the master on the port.
4 The device can now be swapped with a new device.
5 The parameters are transferred once the device has been detected.

3.5 Setting substitute value reaction (fail safe)

If PROFINET communication fails, all device outputs are set to the parameterized substitute values. The Axioline E PROFINET IO-Link device has a modular design, i.e., the operating mode can be flexibly set for each port.

- You can set the higher-level substitute value reaction of the ports by double-clicking slot 1.1 (slot 1, subslot 1; status/control module).

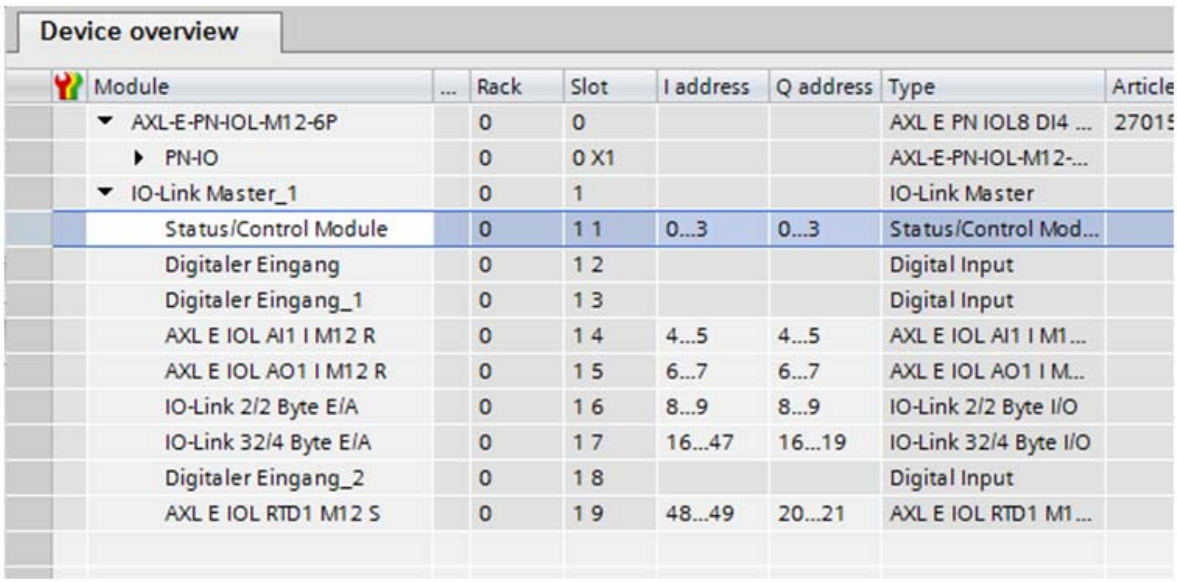

Figure 3-11 Double-clicking the status/control module

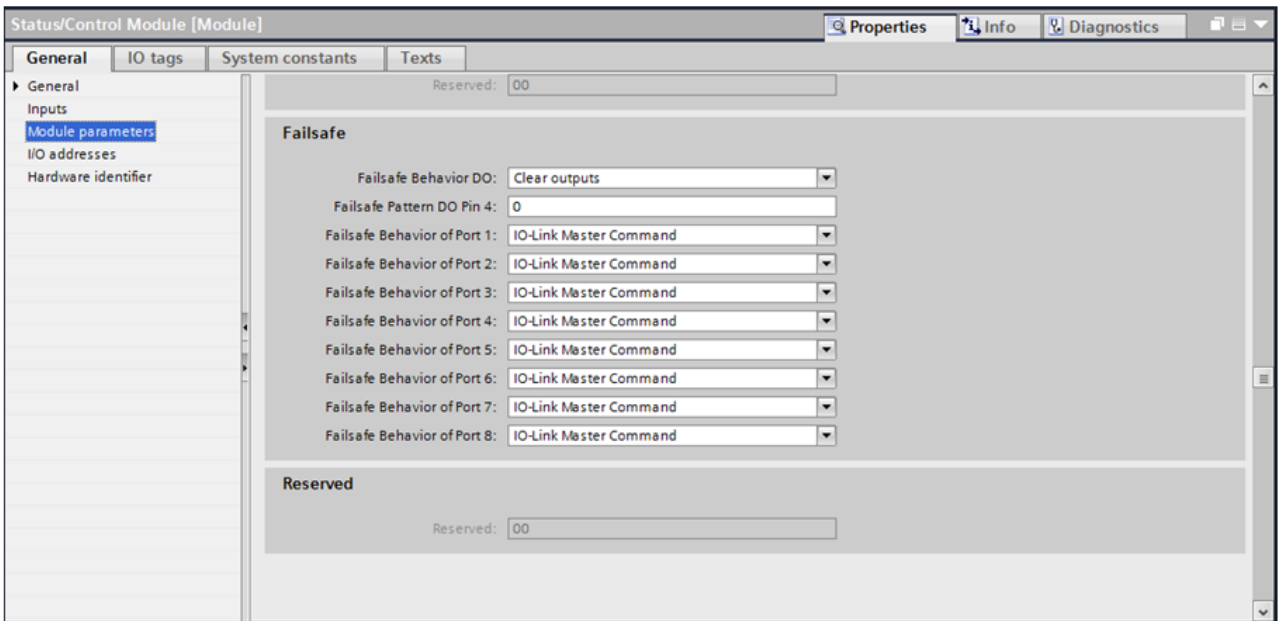

Figure 3-12 Setting substitute values

3.5.1 Ports in “digital output” mode

If ports are available in your configuration with the “digital output” mode, the substitute value reaction can be set via the following parameters.

Behavior in the event of an error for status/control module

– Sets the global behavior for all ports

Substitute values for DO

– The behavior for each port can be set using the substitute value pattern.
– This only applies if “Substitute values” is selected in the previous parameter.

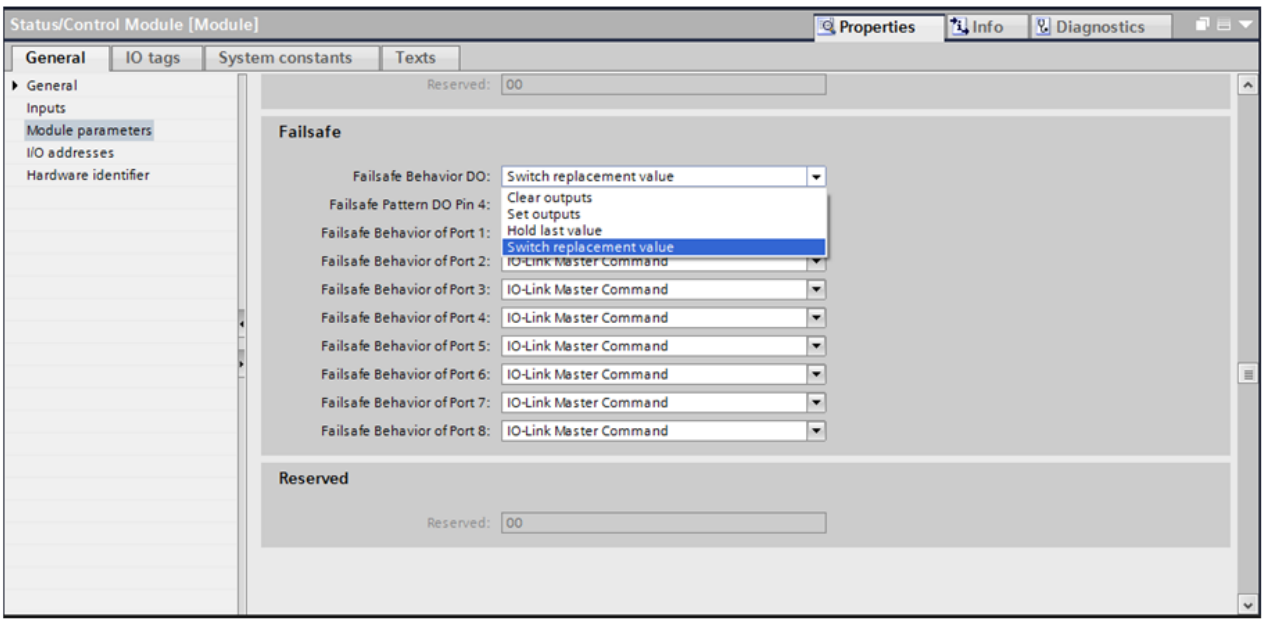

Figure 3-13 Setting substitute value reaction

Example: setting the substitute value pattern

Port 2, 5, and 8 work in “digital output” mode and should be set in the event of an error.

Port	1	2	3	4	5	6	7	8
Bit	0	1	2	3	4	5	6	7
Substitute value	0	1	0	0	1	0	0	1

If the bit pattern is converted to decimal, this results in a value of 146.

- Enter this value into the “Substitute values for DO” parameter in order to set the desired behavior.

For additional information, refer to the device-specific data sheet.

3.5.2 Ports in the “IO-Link” mode

If there are ports with “IO-Link” or “AXL E IOL …” mode in your configuration, the substitute value reaction can be set via the “Substitute Value Reaction of Port X” parameter.

By default, “IO-Link Master Command” is set for the ports. The “IO-Link Master Command” option enables the use of IO-Link-specific mechanisms for valid/invalid output process data. Therefore, the IO-Link device itself determines which substitute value reaction should be used.

Alternatively, the Axioline E PROFINET IO-Link can also specify the substitute value reaction. The following options are available:

– Reset all outputs
– Set all outputs
– Hold last value

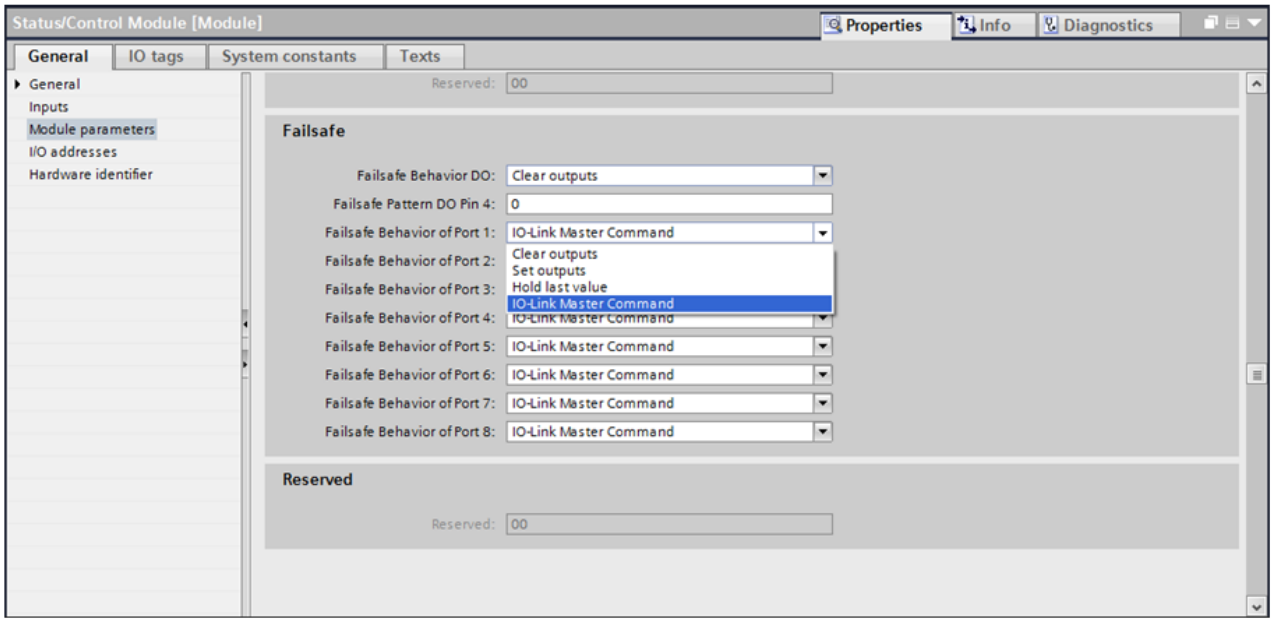

Figure 3-14 Substitute value reaction

For additional information, refer to the device-specific data sheet.

3.6 Activating fast startup (prioritized startup)

The Axioline E PROFINET IO-Link devices support the “fast startup” function. This function enables fast startup of the PROFINET device. The Axioline E PROFINET IO-Link device is ready for operation in approximately 3 s.

If the Media Redundancy Protocol is activated, the “fast startup” function cannot be used.

- In order to use the “fast startup” function, you must activate “prioritized startup” in the interface submodule (PN-IO) of the Axioline E PROFINET IO-Link device.

The following steps must be carried out:

- Select “PN-IO” to open the port settings.

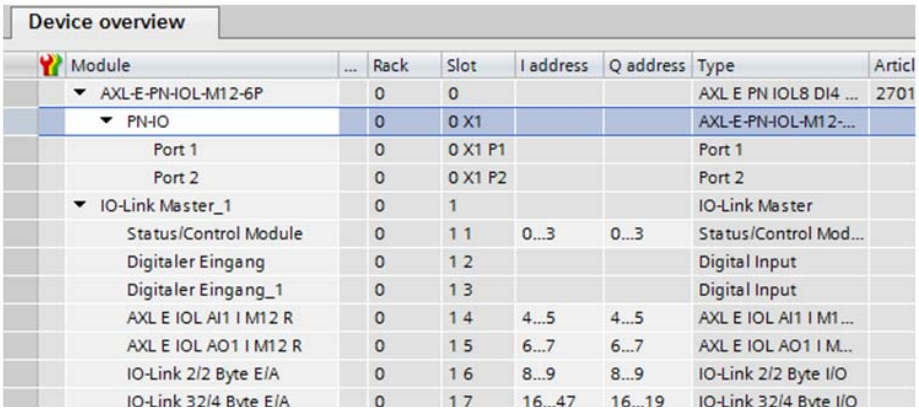

Figure 3-15 Selecting the port settings

- Click the “General” tab in the “Properties” window under the menu item “Extended options” and select the “Prioritized startup” checkbox.

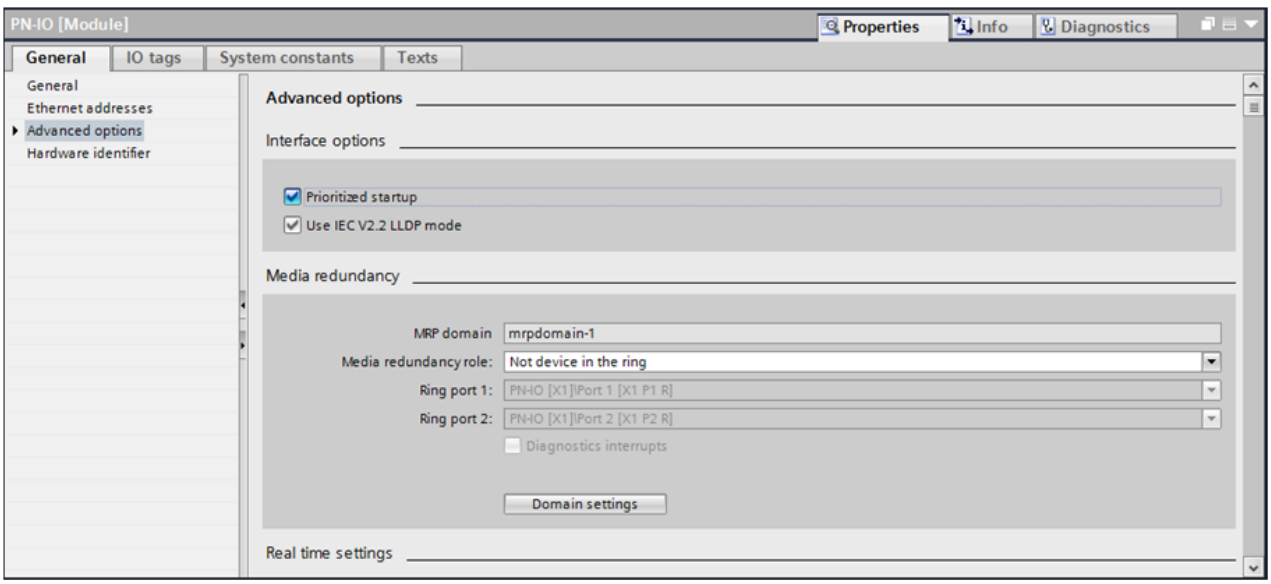

Figure 3-16 Selecting “prioritized startup”

In addition, you must manually configure the connection parameters of the network port so that they are not negotiated between the connected PROFINET devices, as is conventional during startup.

The following steps must be carried out:

- Double-click “Port 1” or “Port 2”.

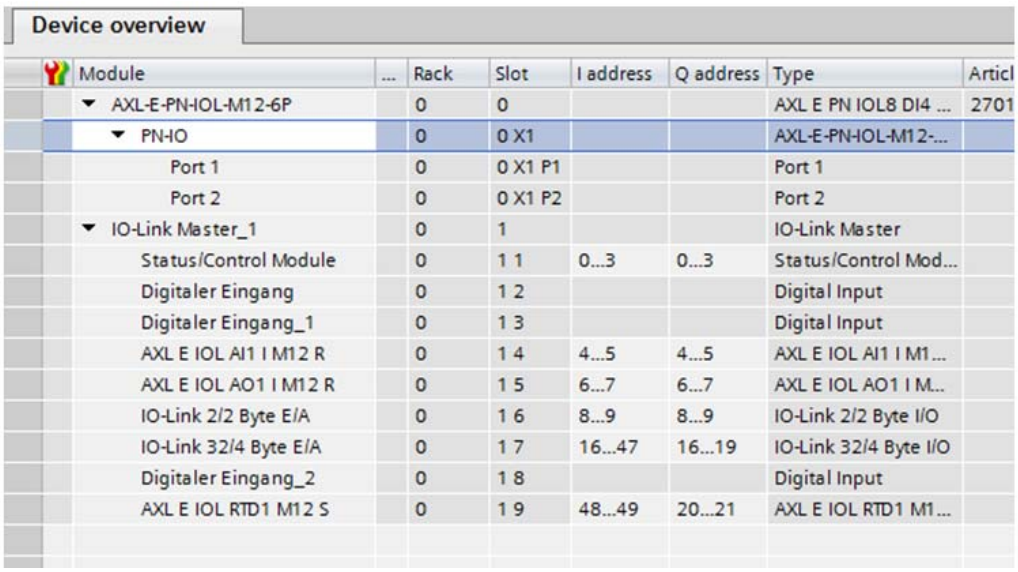

Figure 3-17 Opening “Port settings”

- On the “General” tab of the “Properties” window, under the menu item “Port options”, select the setting “TP 100 Mbps full duplex” (1) from the “Transmission medium/duplex” drop-down list.
- Then activate the “Enable autonegotiation” checkbox (2).

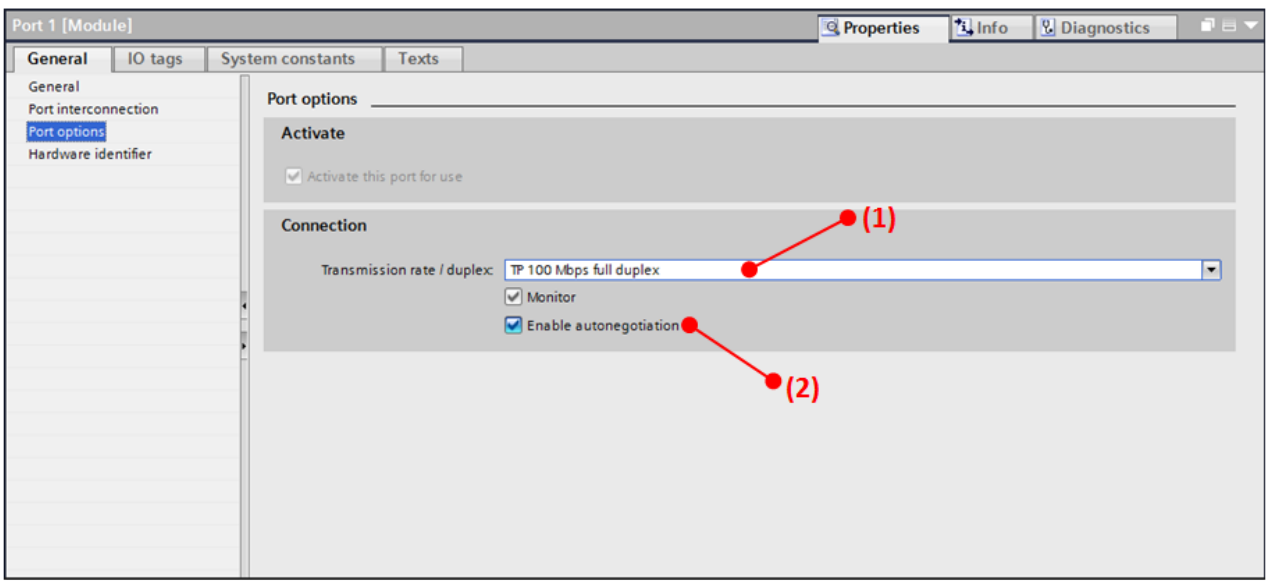

Figure 3-18 Activating “Enable autonegotiation”

3.7 Activating Media Redundancy Protocol (MRP)

The Axioline E PROFINET IO-Link devices support the role of a media redundancy client (MRC) within an MRP network.

If MRP is activated, fast startup cannot be used.

In order to configure the Media Redundancy Protocol, the ring must be set for the corresponding dialog boxes of the PROFINET interfaces.

Firstly, the PROFINET Managed Switch must be configured as an MRP manager. To do this, consult the documentation of your device.

You can then configure the Axioline E PROFINET IO-Link device as an MRP client.

The following steps must be carried out:

- Select “PN-IO” to open the port settings.
- Double-click “(PN-IO)” on the “Device overview” tab.

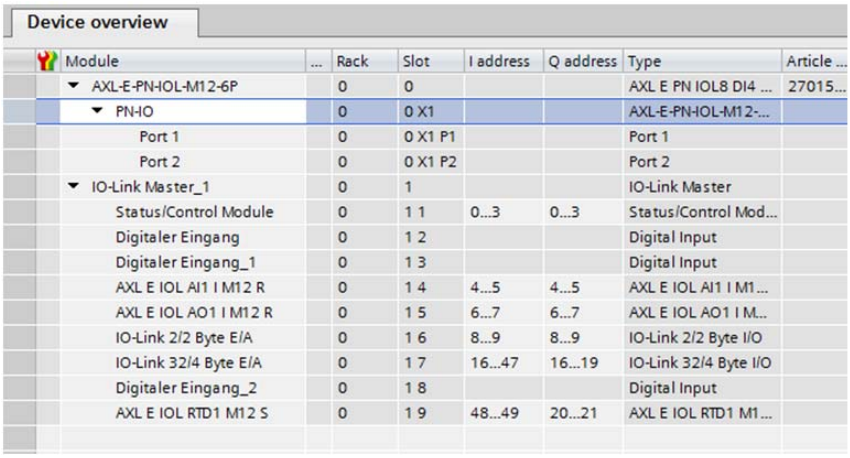

Figure 3-19 Opening “Port settings”

- On the “General” tab of the “Properties” window, select the setting “Not member of the ring” from the “Media redundancy role” drop-down menu under the “Media redundancy” menu item.

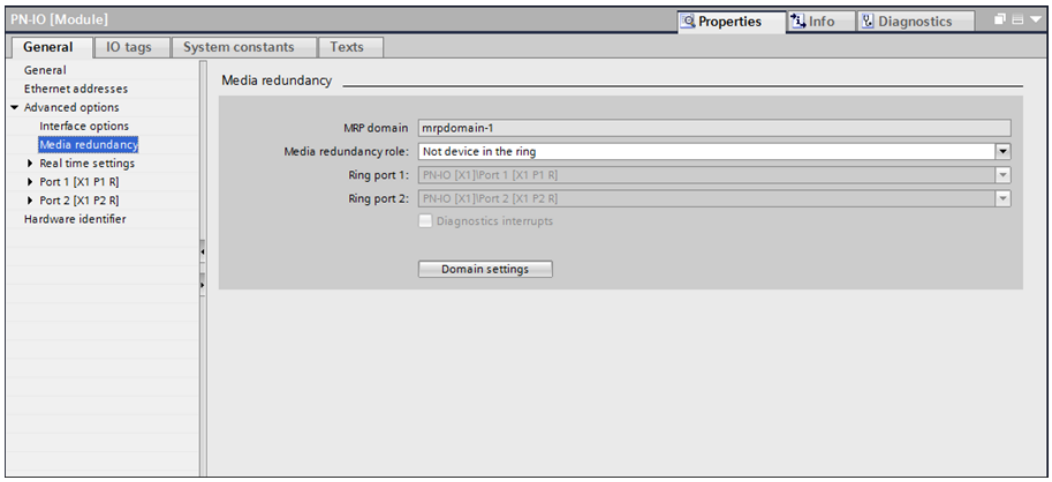

Figure 3-20 Selecting “Not member of the ring”

If an S7 controller with two Ethernet ports is used and autonegotiation is also deactivated, the second port must be set exactly the same as the first port. A crossed patch cable must therefore be used to establish a connection from the second port of the controller to the second port of an Axioline E PROFINET IO-Link device.

- On the “General” tab of the “Properties” window, select the “Client” entry from the “Media redundancy role” drop-down menu under the “Media redundancy” menu item.

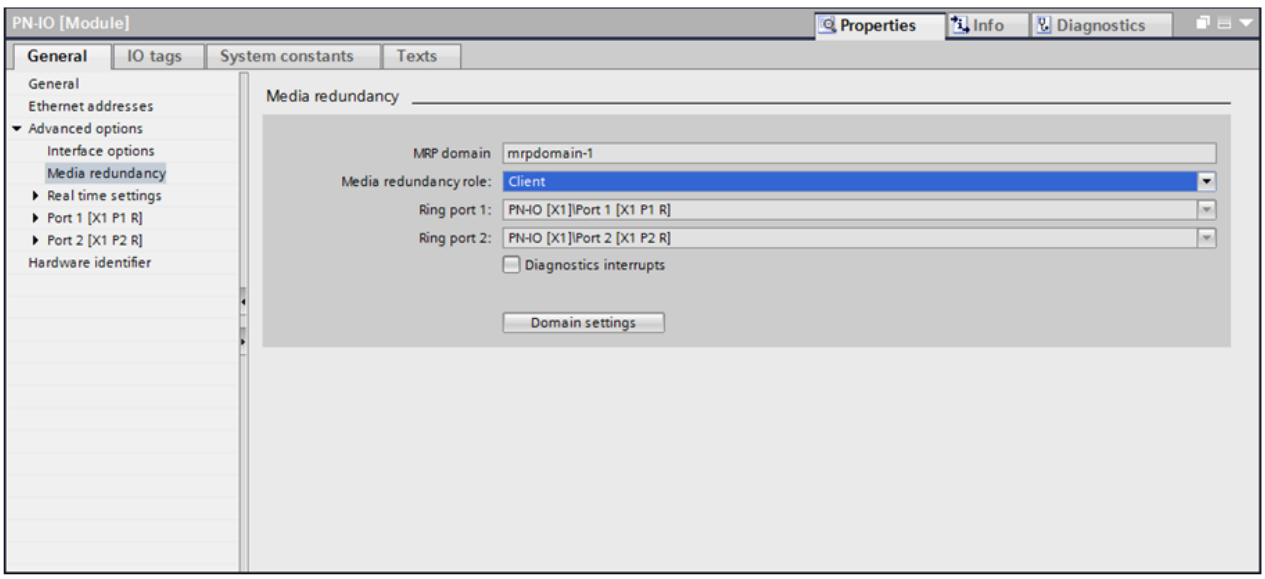

Figure 3-21 Selecting “Client”

In order to ensure that the watchdog is not triggered during the MRP failure detection time, you must set it to a value greater than the expected MRP failure detection time.

The following steps must be carried out:

- Select “PN-IO” to open the port settings.
- On the “General” tab under the menu item ?“Realtime settings” in the “Watchdog time” section, modify the value of “Accepted number of update cycles when IO data is missing” so that a value greater than 200,000 is under “Watchdog time (ms)” (1).

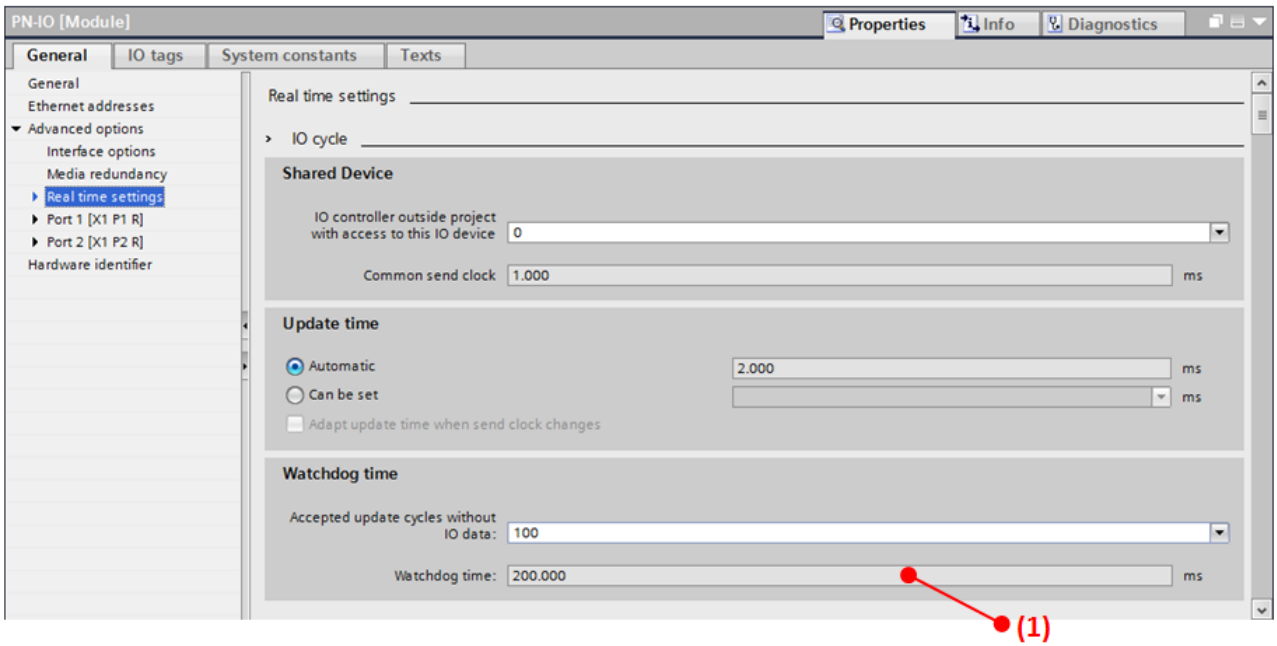

Figure 3-22 Entering the watchdog time

3.8 Configuring shared devices

The Axioline E PROFINET IO-Link device supports the “Shared device” function. This enables two controllers to simultaneously establish a cyclic connection to the device. Only one master can establish a cyclic connection to each submodule. The I/O data of another submodule, which is used by the other master in cyclic connection, cannot be accessed.

To enable this, follow the steps below.

- Open another instance of TIA Portal.
- Create a new project.
- Add a controller again to the second project and assign it the name “PLC_2”.
- Copy the Axioline E PROFINET IO-Link device from the first to the second project by right-clicking it.

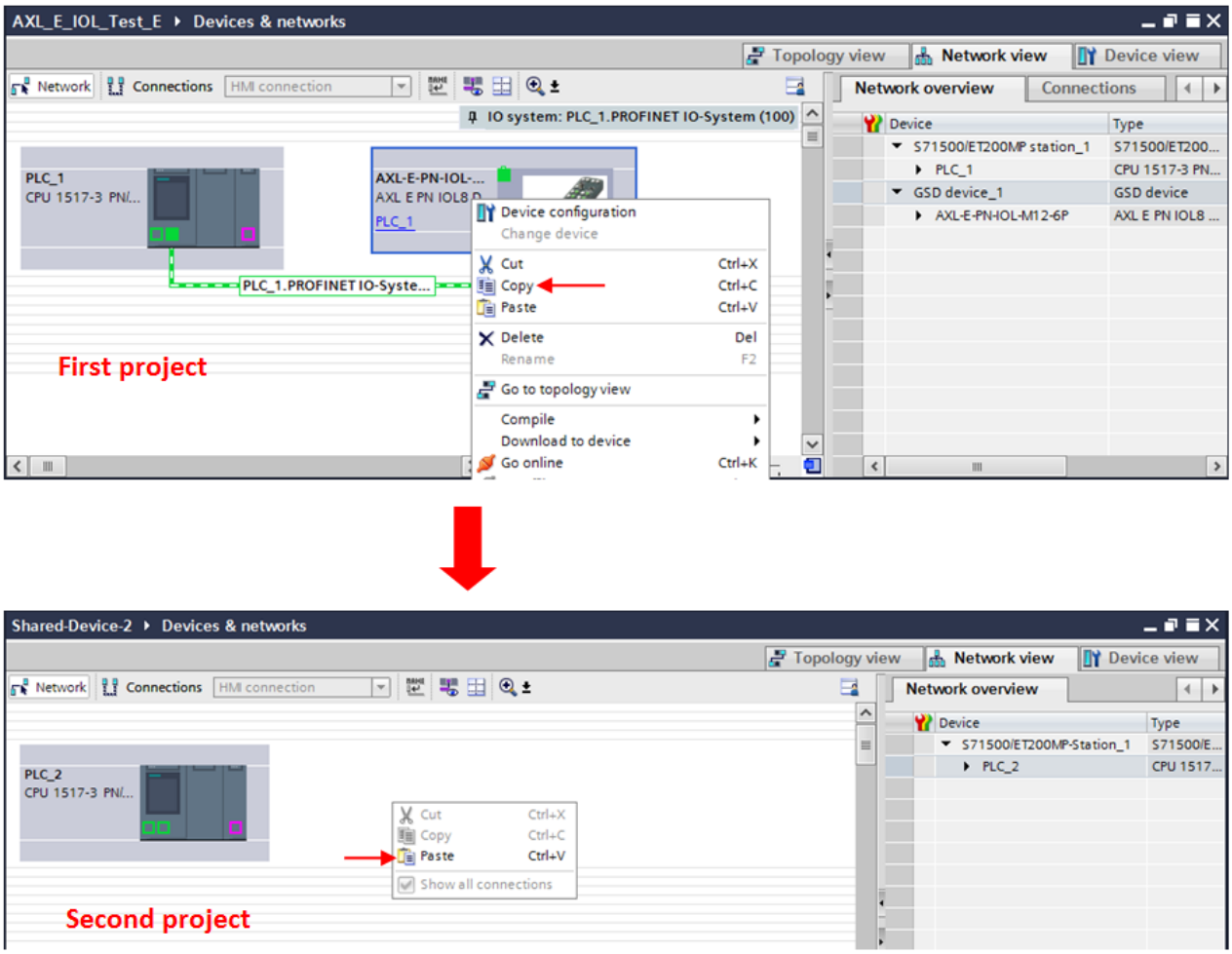

Figure 3-23 Access authorization of the PLC_2 to submodules of the Axioline E PROFINET IO-Link device

- In the second project, connect the controller to the Axioline E PROFINET IO-Link device.
- Assign the device the same IP address and the same PROFINET name as in the first project.
- Adjust the IP address of the controller accordingly.

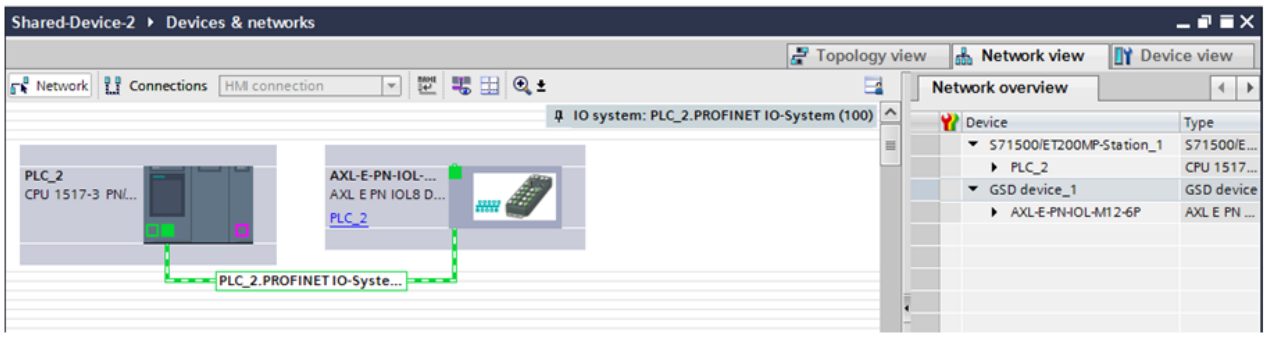

Figure 3-24 Connecting the controller and device

- Highlight the Axioline E PROFINET IO-Link device and select the “Shared Device” menu item.
- If “PLC_2” is shown in the “Access” field, only the controller can access this port from your second project.
- If “---” is shown in the “Access” field, a different controller outside this project can access this port.

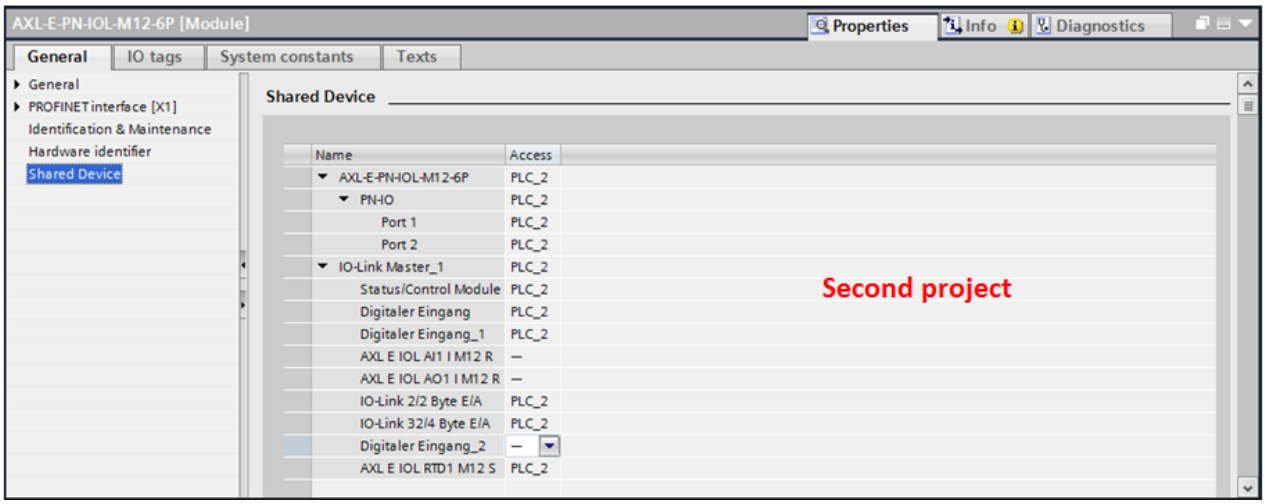

Figure 3-25 Access authorization of the PLC_2 to submodules of the Axioline E PROFINET IO-Link device

- Define the access authorization of PLC_1 in the first project as follows.

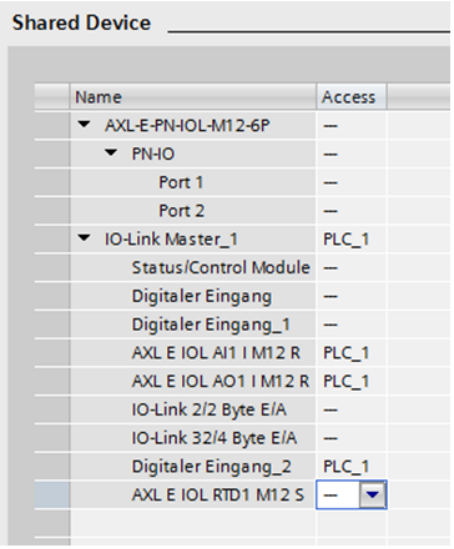

Figure 3-26 Access authorization of the PLC_1 to submodules of the Axioline E PROFINET IO-Link device

If “---” is shown in the “Access” column, this controller can only read the parameters of the device, and not modify them.

Changes to access rules only take effect once the project is stored on the relevant linked controller. You should therefore save the project each time you make a change in this regard.

3.9 Reading identification and maintenance (I&M) functions

The Axioline E PROFINET IO-Link device supports identification and maintenance functions (I&M).

For further information about the I&M functions, please refer to the device-specific data sheet.

3.9.1 Reading I&M data records

General identification and maintenance functions 0 - 4 can be read via slot 0. IO-Link-specific identification and maintenance functions 0, 16 - 23, and 99 can be read via slot 1 and subslot 1.

I&M data records are online data which is read by the device, i.e., your station must be operational.

The following steps must be carried out:

- Click “Go online” on the ribbon.

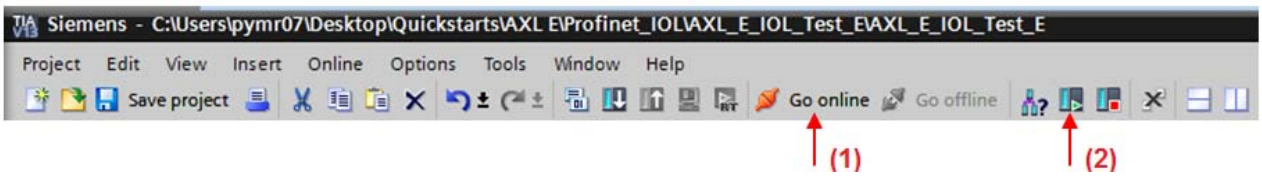

Figure 3-27 Clicking “Go online”

- Navigate to the following path in the “Project tree”:
  PLC_1 (or a name you have assigned) > Distributed I/O > PROFINET IO system > AXL-E-PN-IOL-M12-6P
- Double-click “Online & Diagnostics” (1).

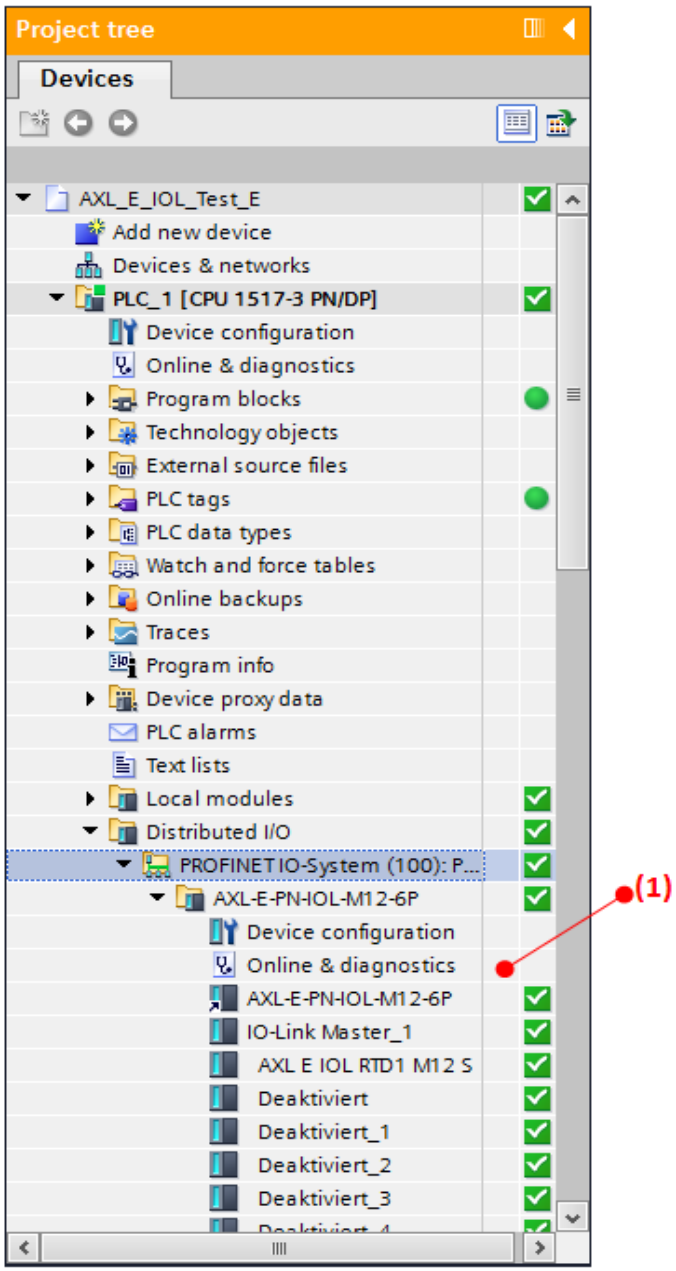

Figure 3-28 Clicking “Online & Diagnostics”

3.9.2 Writing I&M data records

I&M data records 1 - 3 can be read and written using the “Download/Upload Module Identification” dialog boxes.

The following steps must be carried out (offline view):

- Make sure you have disconnected the “Online connection”. The icon is then grayed out.

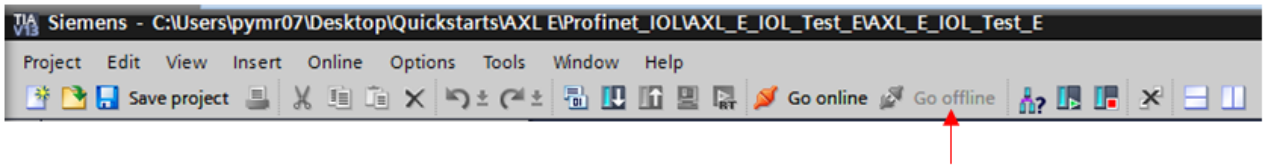

Figure 3-29 “Online connection” disconnected

- Switch to the device settings.
- Select the menu item “Identification & Maintenance” (1) from the “General” tab.

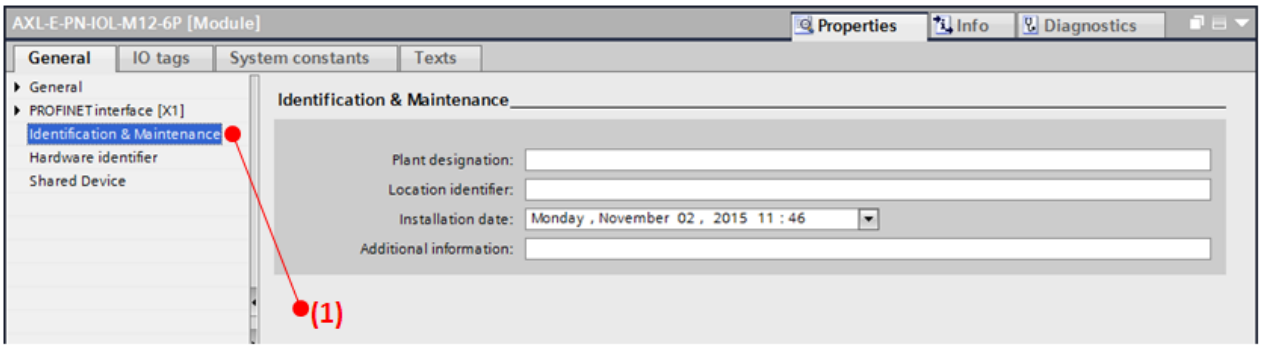

Figure 3-30 “Identification & Maintenance”

- In the new window, you can adjust the I&M data records 1 - 3.
- These settings will take effect when you reload the program into the controller.

3.10 Reading diagnostic alarms and IO-Link device events

The Axioline E PROFINET IO-Link device supports diagnostic alarms. IO-Link device events are also supported and are converted into PN-IO alarms (channel diagnostics and extended channel diagnostics). These are saved to the device and the PROFINET controller is informed via incoming and outgoing diagnostics.

For a list of supported alarms and additional information, refer to the device-specific data sheet.

You can view the diagnostic alarms in TIA Portal in the online view in the “Module Information” dialog box.

The following steps must be carried out:

- Click “Go online” on the ribbon.

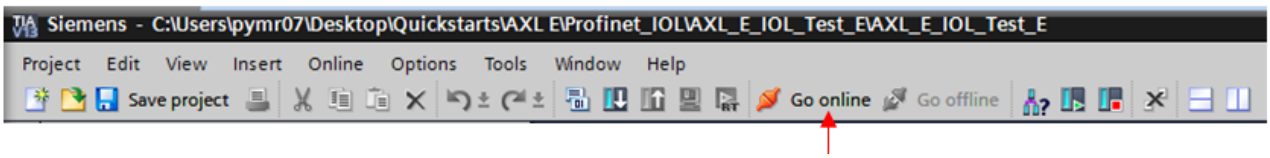

Figure 3-31 Switching to online view

- In the device overview of the Axioline E PROFINET IO-Link device, select the desired channel by right-clicking it.
- In the context menu, click “Online & Diagnostics” to open the desired view.

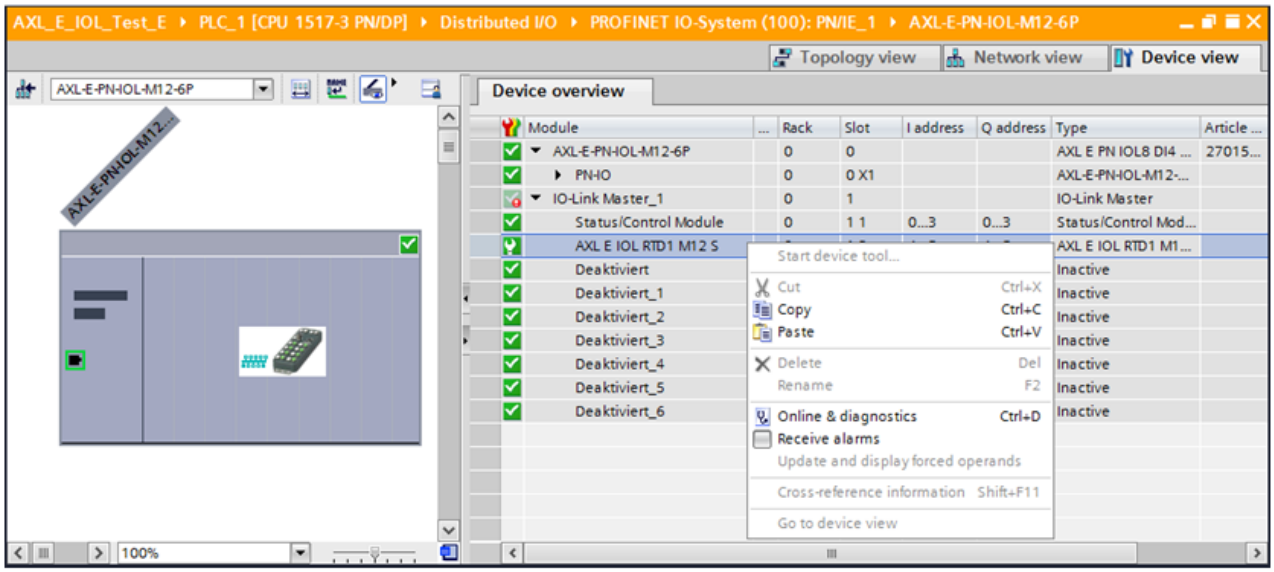

Figure 3-32 Selecting a channel

- Select the “Channel diagnostics” field (1) under the “Diagnostics” menu item.
- To view the detailed texts, click the error column (2).

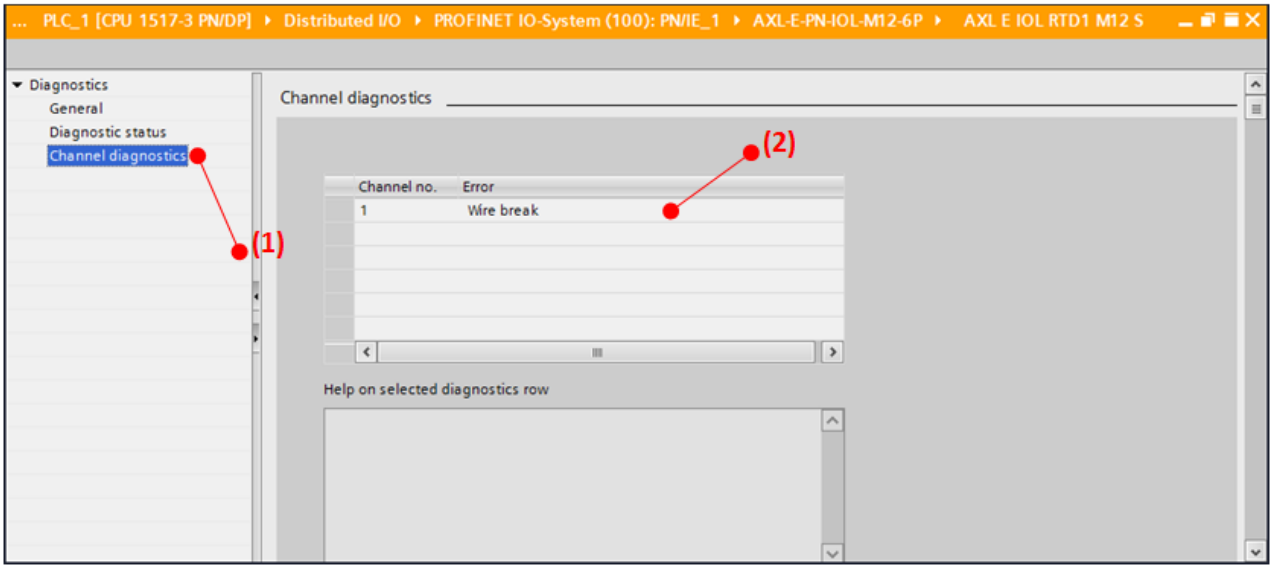

Figure 3-33 Viewing diagnostic texts

4 Operation and monitoring of variables in TIA Portal

4.1 Creating and linking variables

- Carry out a port configuration in accordance with the previous sections.
- Then create a new variable table for the IO-Link port (1).

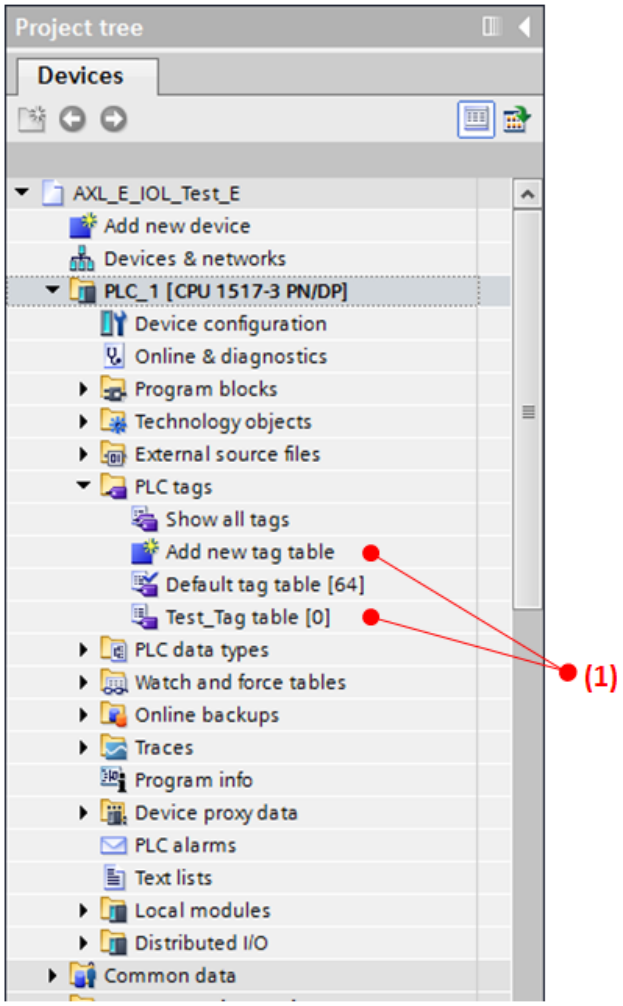

Figure 4-1 Creating a new variable table

- You can create a new variable (1) in the variable table using the “Add” field. You can modify this variable using the adjacent fields.
- In order to find the types and address for the variable, you must select the port to which you want to assign the variable, located in the “Project tree” section under Distributed I/O > PROFINET IO system > [desired device] > [desired port] (2).
- The required information for the variable can be found in the “Details view” (3).

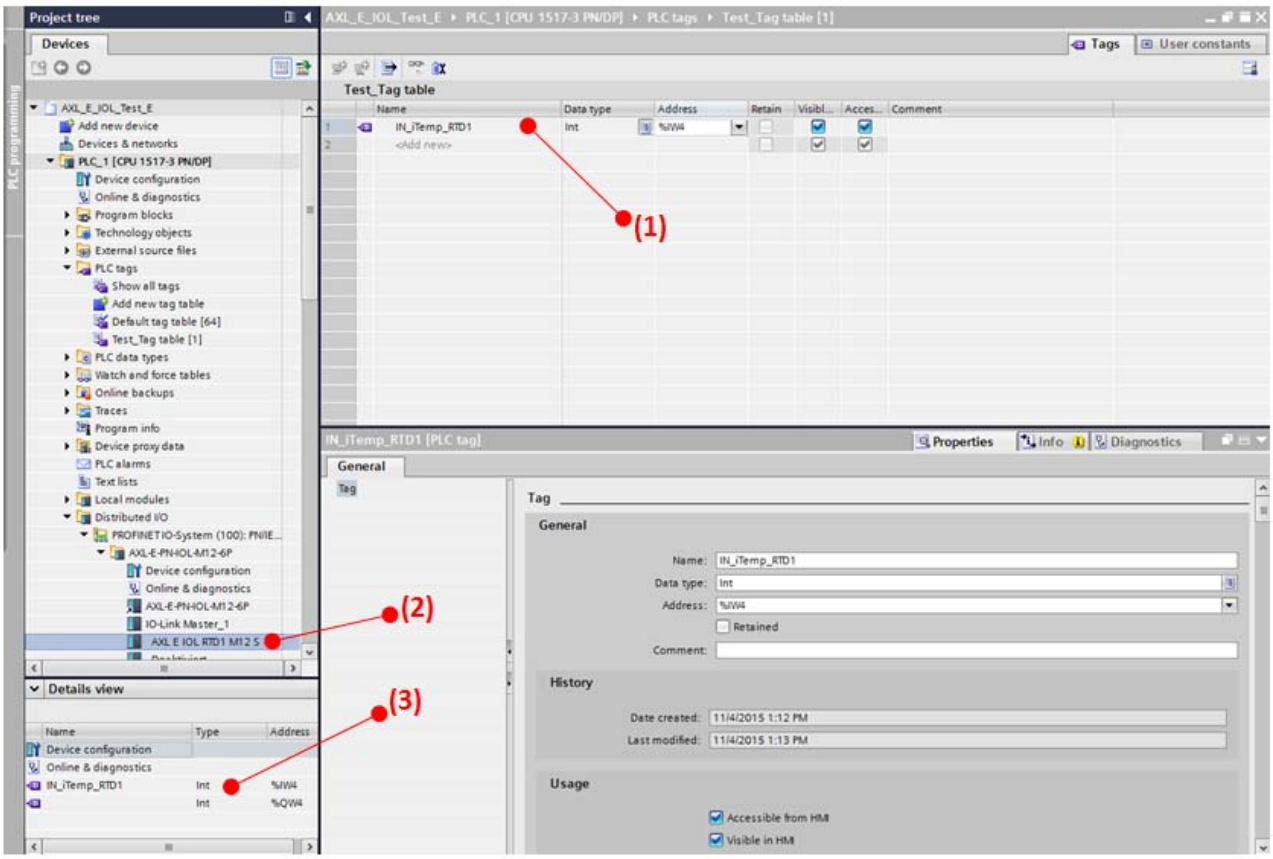

Figure 4-2 Creating a new variable

4.2 Going online and observing values

The program must first be compiled.

- To do this, click the corresponding icon on the ribbon (1).

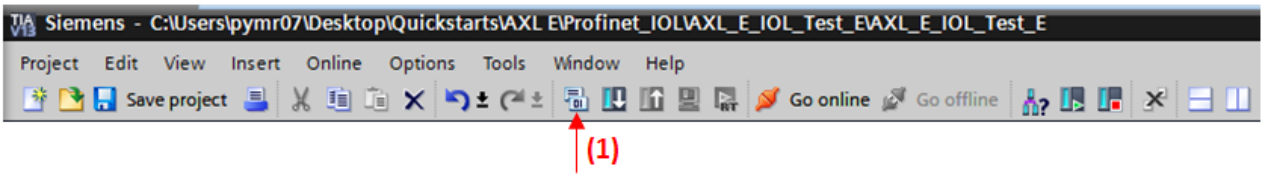

Figure 4-3 Loading the program to the controller

- If no errors are displayed in the “Info” field, you can load the program to the controller by clicking the “Download to device” icon. This icon is directly adjacent to the “Compile” icon.

- In the “Load preview” window, click “Load” (1).

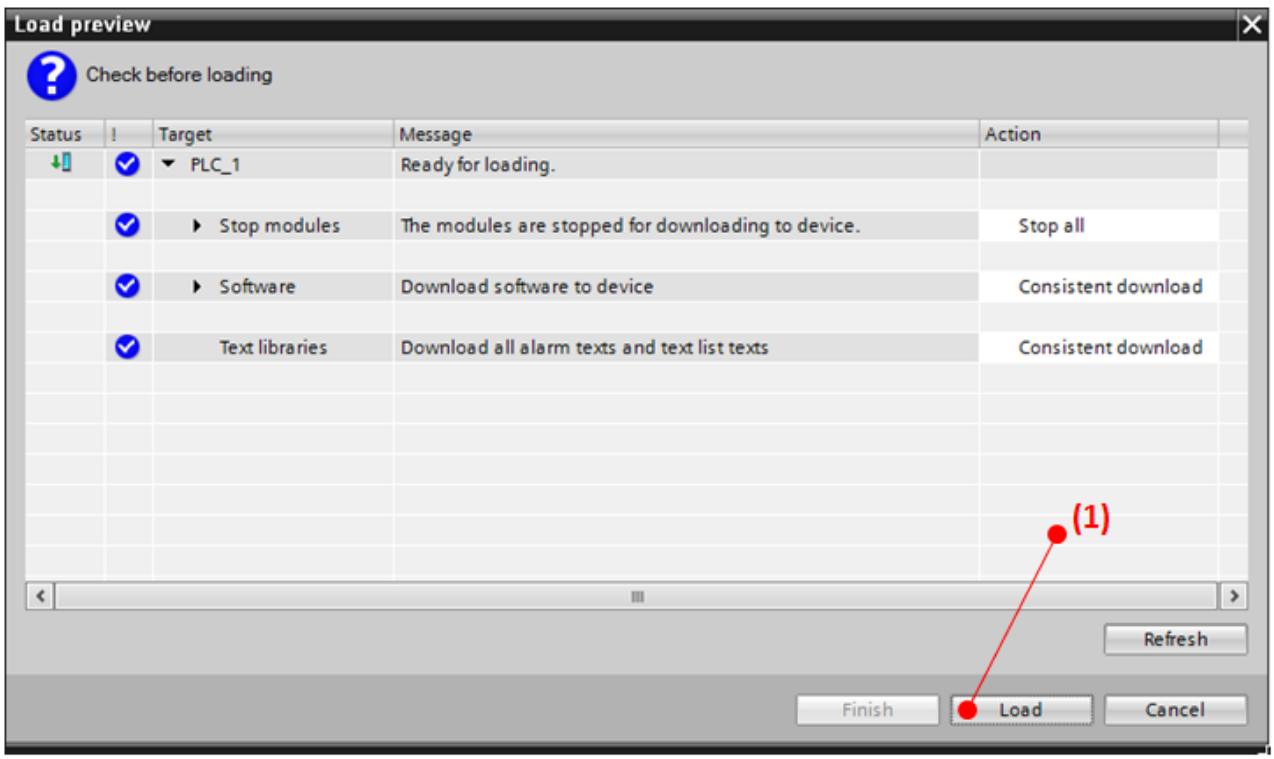

Figure 4-4 “Load preview” window

- In the “Load results” window, select the “Start all” checkbox (1) and click “Finish” (2).

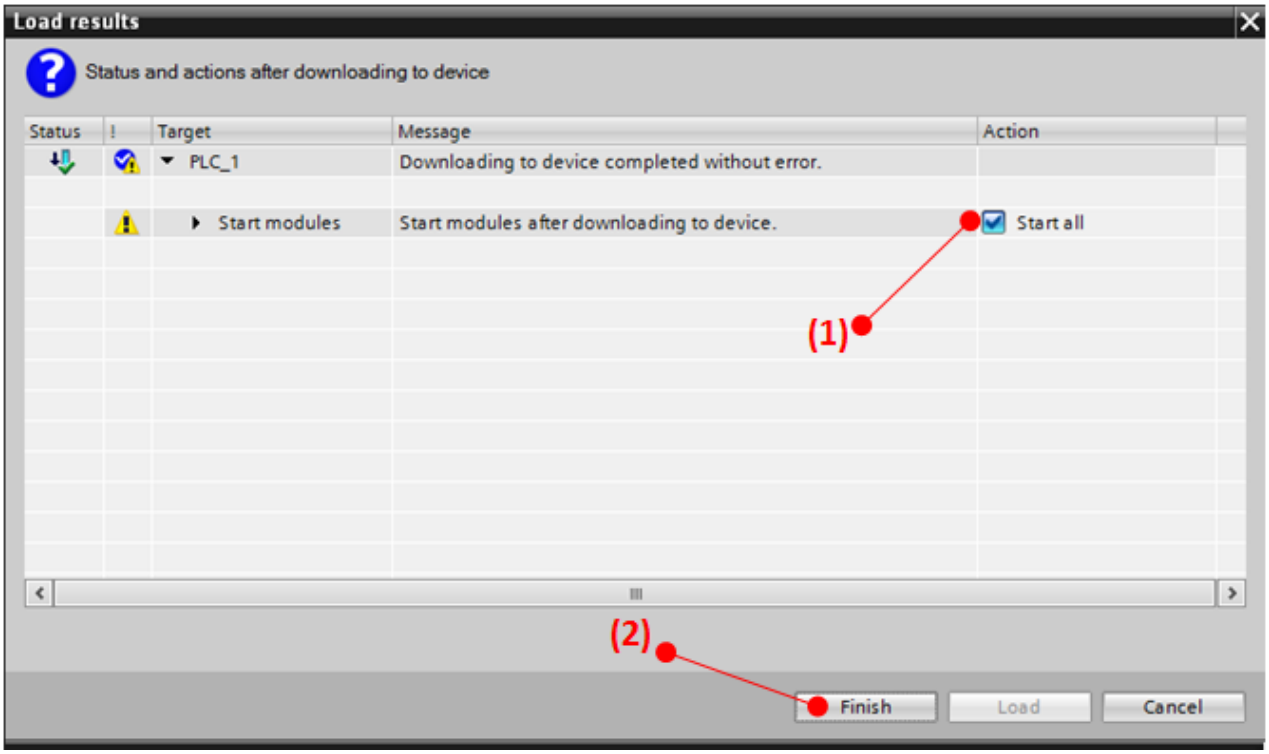

Figure 4-5 “Load results” window

- In order to go online with the controller, click the “Go online” icon (1) on the ribbon.

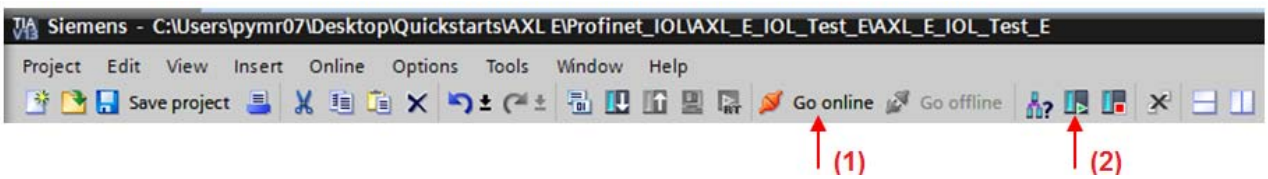

Figure 4-6 “Go online” with controller

- The controller should automatically be in “RUN”. If not, click “Start CPU” (2) in the ribbon.
- To monitor the “online value” of your variable, click the “Monitor all” icon.

5 Using the IOL_CALL function block

5.1 Basics

The Axioline E PROFINET IO-Link devices support the Siemens IOL_CALL function block for TIA Portal.

The function block helps to make it possible to write data to an IO-Link device or read data from an IO-Link device. To do so, the IO-Link protocol uses ISDU objects (Index Service Data Unit). These have an index and a sub index. For a description of the ISDU objects supported by a device, please refer to the device-specific data sheet of the IO-Link device.

The IO-Link protocol uses ISDU objects (Index Service Data Unit) for acyclic data. Not all IO-Link devices have ISDU objects. The IOL_CALL function block is only required if your IO-Link device has ISDU objects and you want to read or write these or read diagnostics information. Otherwise, the process data communication is sufficient.

The IOL_CALL function block must be downloaded separately from the Siemens homepage and imported into TIA Portal. There you can also find further information and documentation on the block.

5.2 Prerequisites

You should have an executable project and observe the following points:

- The GSDML file of the Axioline E PROFINET IO-Link devices is installed in TIA Portal.
- A connection can be established with the controller and the IO-Link device.
- The IOL_CALL function block is imported into TIA Portal.

5.3 Importing the function block into TIA Portal

You must first download the function block or zip archive onto your PC.

- In order to use the function block in TIA Portal, you must first import it.

Carry out the following steps:

- Click the “Libraries” on the right-hand sidebar.
- In the “Global libraries” panel, right-click in an empty field.
- Select “Retrieve library” (1).

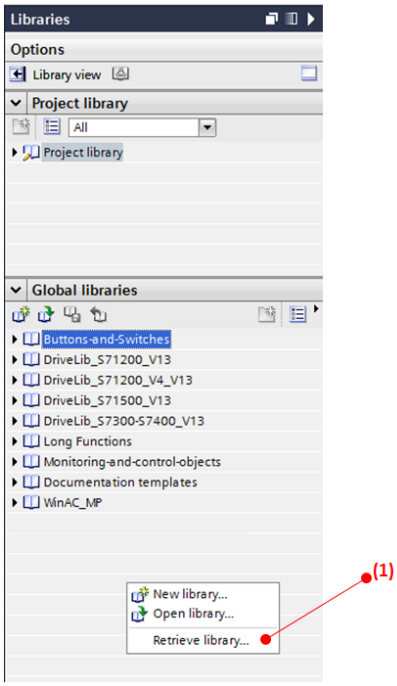

Figure 5-1 Selecting “Retrieve library”

- Navigate to the folder in which you have saved the zip archive and select it. Follow the subsequent instructions.
- Once the library is imported, it will be added to the directory.

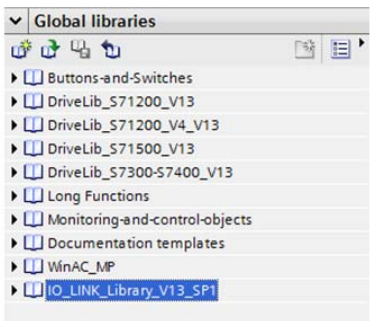

Figure 5-2 “Global libraries” window

5.4 Inserting a function block into your project

Once you have completed the steps specified in the previous chapter, the function block will be imported into TIA Portal and recognized.

To use the function block in your actual project, the following steps must be carried out.

- Add the block “IO_LINK_DEVICE” from the file path IO_LINK_Library_V13_SP1 > Types > S7-1200/1500 to your program by dragging and dropping.

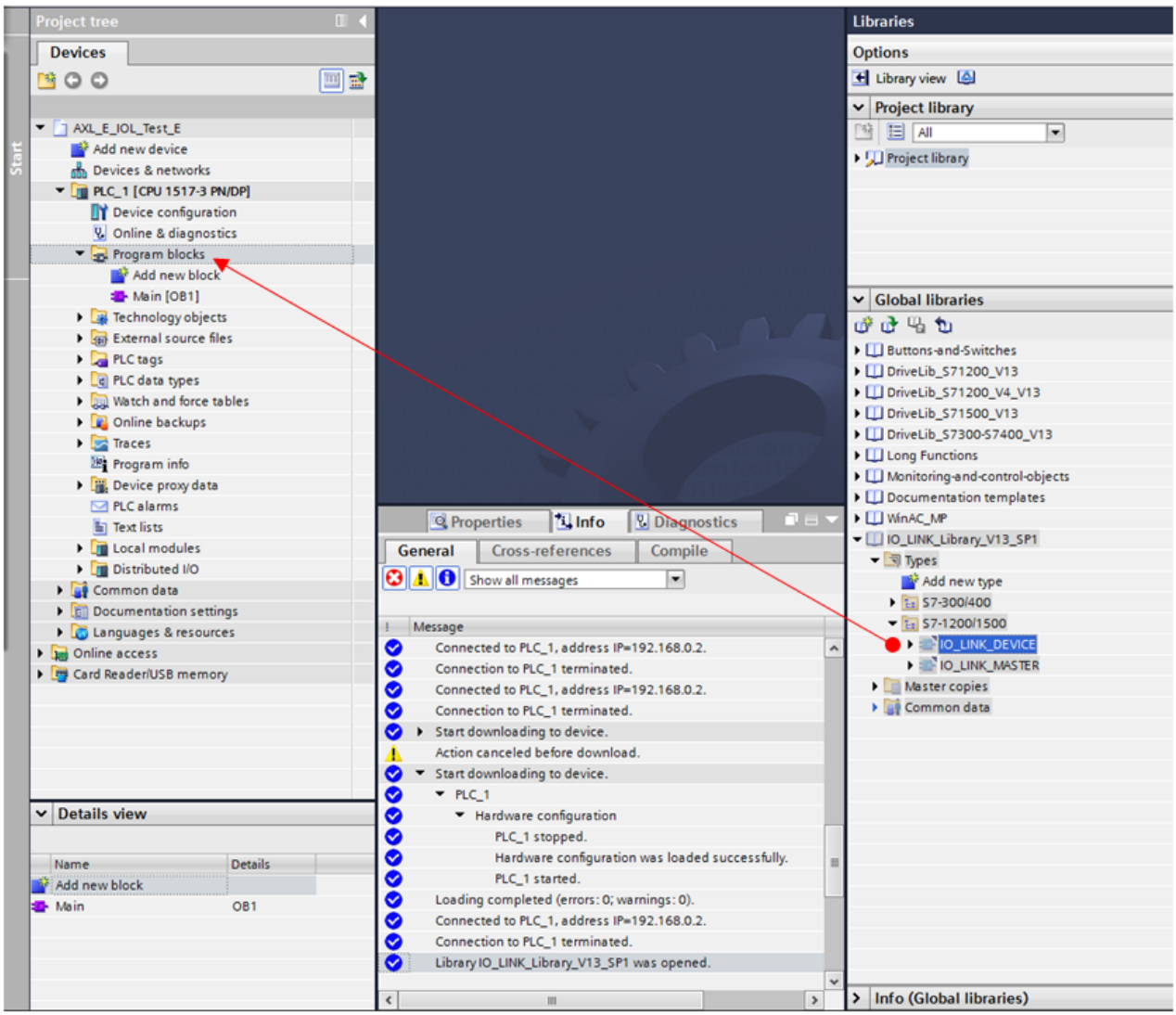

Figure 5-3 Adding a function block

- Open the main program “Main [OB1]” (1) by double-clicking it.
- Add the “IO_LINK_DEVICE” function block to this program by dragging and dropping (2).
- Confirm the “Call options” dialog box with “OK”.
- The “DB1” function block is generated automatically in the project tree (3).

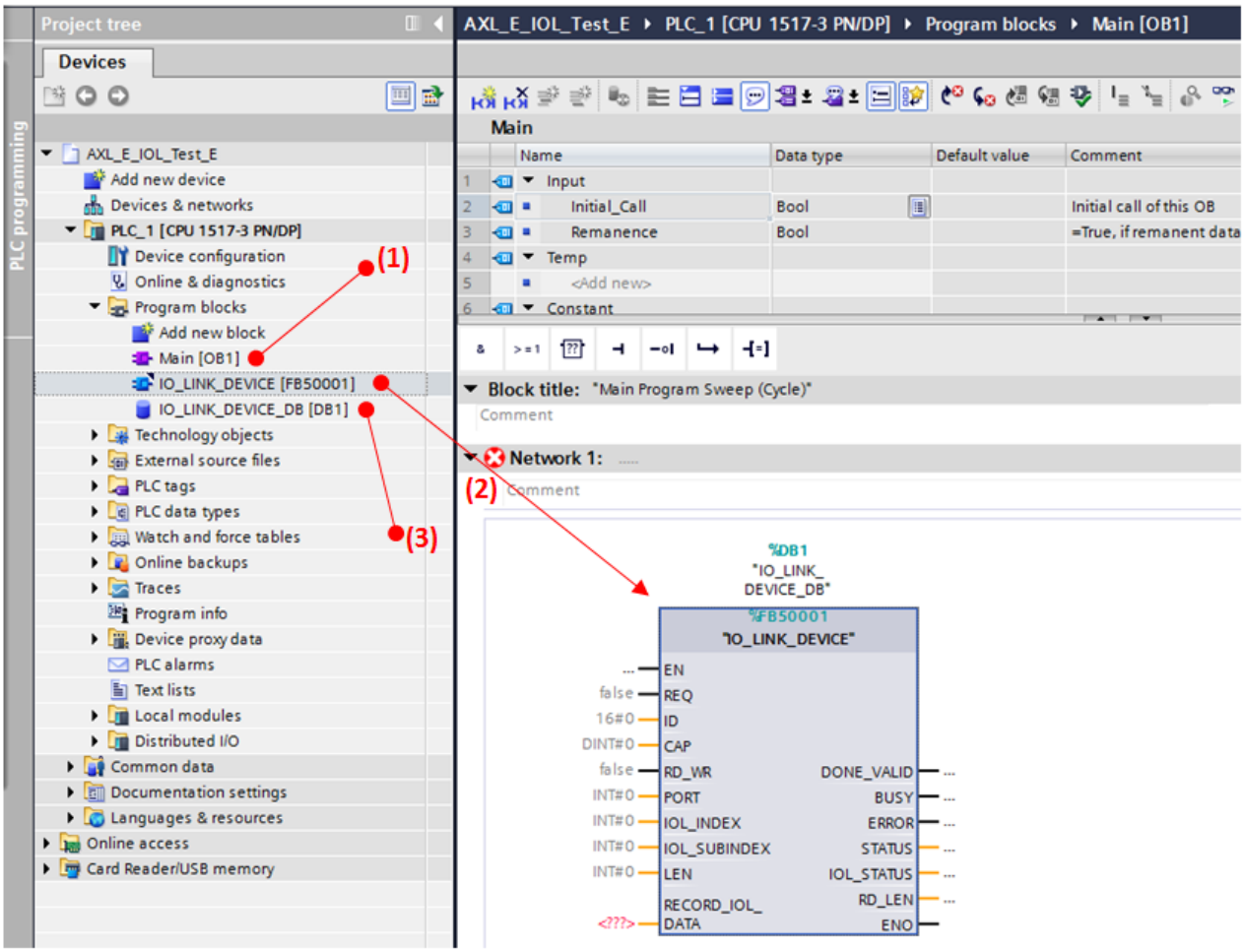

Figure 5-4 Inserting the function block

5.5 IOL_CALL parameter description

The function block is structured as follows.

Variable	Description
EN	Activate the function block 0 = deactivation; 1 = activation
REQ	Positive edge: data transmission is started
ID	Hardware identifier of the IO-Link communication module For AXL E IOL devices, use the HW_ID of the status/control module of the IO-Link master.
CAP	Access point of the IO_LINK_DEVICE function Phoenix Contact = 255_{dec}
RD_WD	Read/write access 0 = read; 1 = write
PORT	Port number with which the IO-Link device is connected Possible values: 1 - 63
IOL_INDEX	Parameter index Possible values: 0 - 32767
IOL_SUBINDEX	Parameter subindex 0: entire record 1 - 255: parameter from record
LEN	Length of the data to be written (net data) Read: 0 - 232 (not relevant) Write: 1 - 232
RECORD_IOL_DATA	Source/target range for the read/write data
DONE_VALID	Validity of the data transmission 0 = data not valid; 1 = data valid
BUSY	Status of the data transmission 0 = transmission complete; 1 = transmission in progress
ERROR	Error during data transmission 0 = no error; 1 = canceled with error
STATUS	Contains error information for SFB52/SFB53 For interpreting error information, see help on SFB52/SFB53 (Select function block and press F1)
IOL_STATUS	Error code when error is reported 0x00000000 = Transmission OK Byte 0, 1 = Device error codes Byte 2, 3 = Master and FB1 error codes
RD_LEN	Length of the data read/number of bytes

The hardware identifier is in the hardware configuration of the Axioline E PROFINET IO-Link device in the general properties of the status/control module.

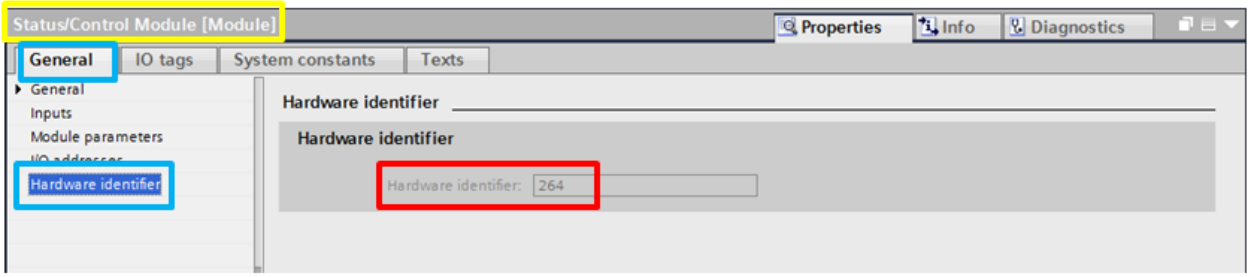

Figure 5-5 Hardware identifier

For more information, refer to the Siemens manufacturer documentation.

5.6 IOL_CALL error codes (IOL_Status)

The IOL_Status variable contains the value 0x00000000 if the data transfer was completed without errors. If errors occurred during the transmission, it will contain the following information:

– Byte 0 and byte 1: error codes of the connected IO-Link device.
  You can find these in the device-specific data sheet of the device.
– Byte 2 and byte 3: error codes of the IO-Link master and from FB1 “IOL_CALL”. The various meanings of the code are listed in the table below. This is derived from the Siemens documentation on the function block.

Error codes

IOL-M error code (hex)	Brief description	Description
0000	No error	No errors have occurred.
0001	No IOL_CALL	FB 1 “IOL_CALL” ready for new assignment
0002	IOL_CALL write	IOL_CALL is in the sending stage (SEND_REQUEST)
0003	BOOL	IOL_Call is in the polling stage (WAIT_ON_RES)
0004 - 06FF	Reserved	Reserved
7000	IOL_CALL conflict	Sending and response data inconsistent
7001	Wrong IOL_CALL	Decoding error
7002	Port blocked	Port occupied by another assignment or does not exist
7003 - 7FFF	Reserved	Reserved
8000	Timeout	The assignment could not be executed within the timeout period.
8001	Wrong port address	Port address smaller than 1 or greater than 63
8002	Wrong index	Index smaller than 1 or greater than 32767
8003	Wrong subindex	Subindex smaller than 0 or greater than 255
8004	No device	No device connected (however, port is in IO-Link operation)
8005	Wrong LEN	Invalid length for writing; smaller than 1 or greater than 232
8006	Wrong LEN	Invalid length for reading; smaller than 0 or greater than 232
8007	DI/DO mode	Port in DI/DO mode
8008	No SPDU	Device in IO-Link mode does not support any SPDU
8009	-	Uploading is not possible because the function has been deactivated (data storage).
8010 - 8051	-	Reserved
8052	SFB52Fault	Error when calling the SFB52; see STATUS
8053	SFB53Fault	Error when calling the SFB53; see STATUS
8054	Unexpected acknowledge	Internal error in the IO-Link technology (unexpected status during an IO-Link request)
8055	Port function failed	Only relevant for port functions
8056 - FFFF	Reserved	Reserved

5.7 Reading IO-Link device parameters

During read access (RD_WR = 0), all data from the IO link device is stored in the data block at the “RECORD_IOL_DATA” input. The number of bytes read are displayed in the “RD_LEN” output.

The target area for the data at the RECORD_IOL_DATA input must be at least as large as RD_LEN in order to read all the data.

5.7.1 Example: reading the manufacturer name of the AXL E IOL AO1 I M12 S device

The following structure is used in this example:

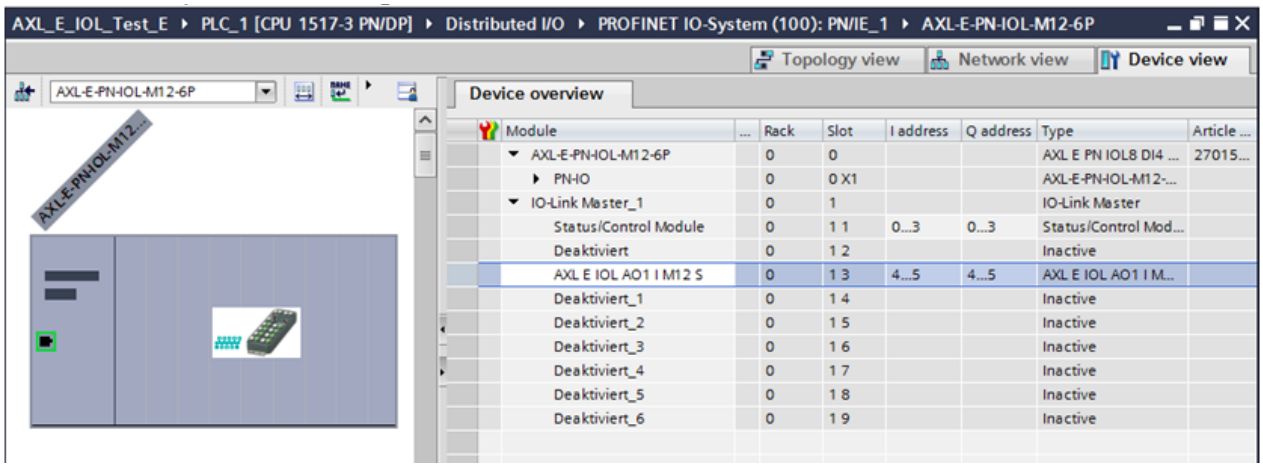

Figure 5-6 Example

By referring to the data sheet of the AXL E IOL AO1 I M12 S device, connected to port 2, you can determine that the ISDU object with the index 10_{hex}, decimal 16, contains the manufacturer name to be read.

- Make the following settings on the IOL_CALL function block:

Parameter	Description
REQ	= 1 (true)
ID	= 108 (264_{dec} => HW ID)
CAP	= 255
RD_WR	= 0 (read)
PORT	= 2
IOL_INDEX	= 10 (manufacturer name, 16_{dec})
IOL_SUBINDEX	= 0 (no subindex)
LEN	= 0 (read access)
RECORD_IOL_DATA	= Target area for the read data

A separate data block (DB) and array variable must be created for the target area of RECORD_IOL_DATA.

Carry out the following steps:

- Navigate to "... > Program blocks" in the project tree.
- Double-click "Add new block".

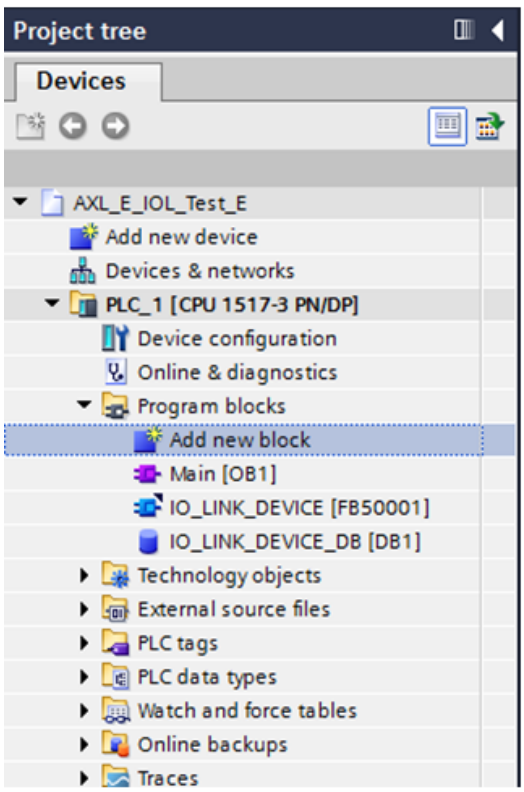

Figure 5-7 Adding a new block

- In the new window, assign a name (e.g., DB2) to the new data block.
- Close the window by clicking “OK”.

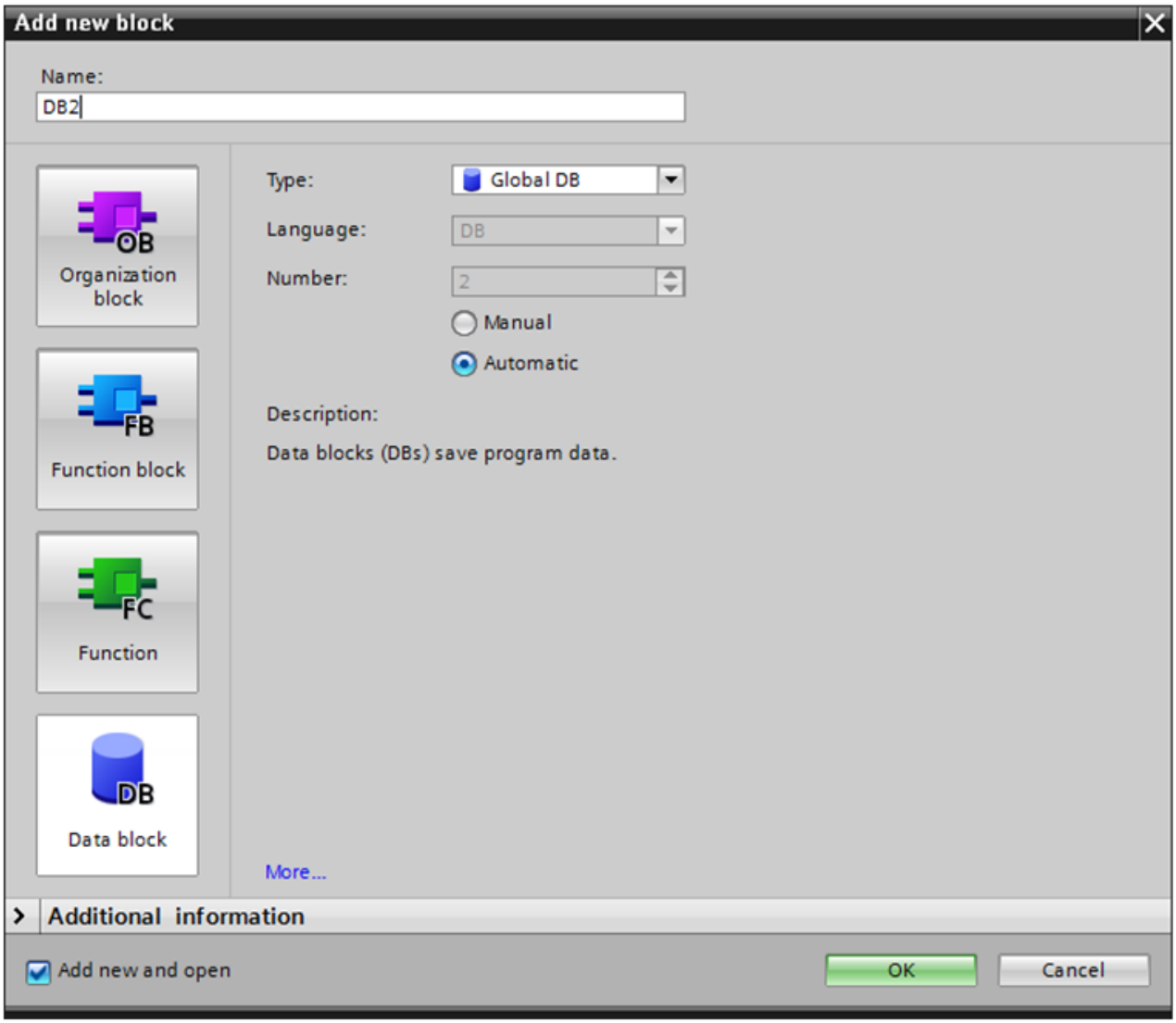

Figure 5-8 Assigning a name to the data block

- The block should open automatically. If not, double-click the new block.
- In the new window, define the structure of the block.
- Create a new variable of type “ARRAY [0..231] of BYTE”.

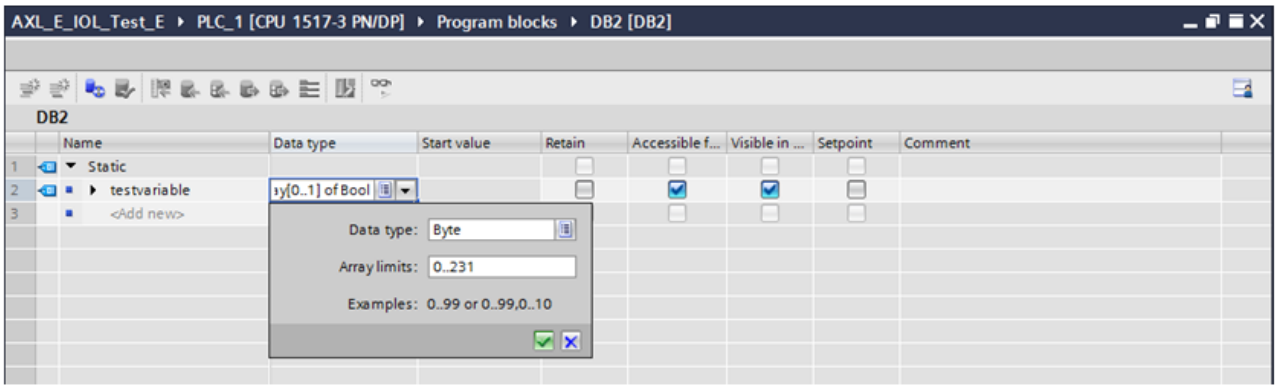

Figure 5-9 Creating a new variable

- Finally, link the block with the RECORD_IOL_DATA input.
- To do this, double-click the “Main” organization block.

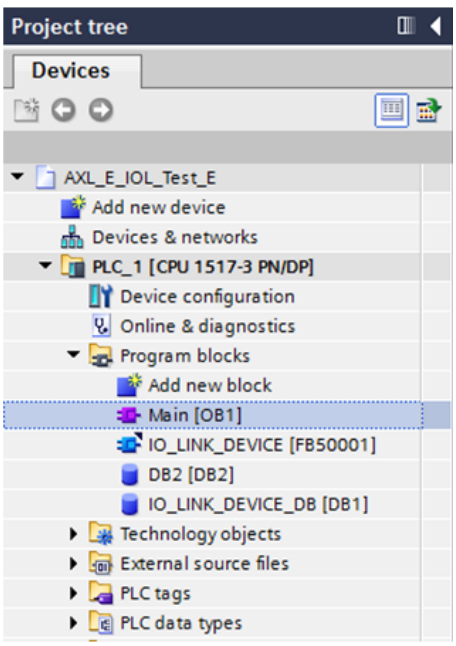

Figure 5-10 Linking the data block

- Now enter “*DB2*.example_variable” into the RECORD_IOL_DATA input in the block.

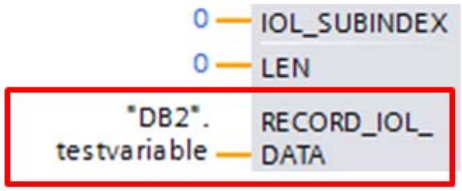

Figure 5-11 Entering an input

The main program in OB1 can appear as follows:

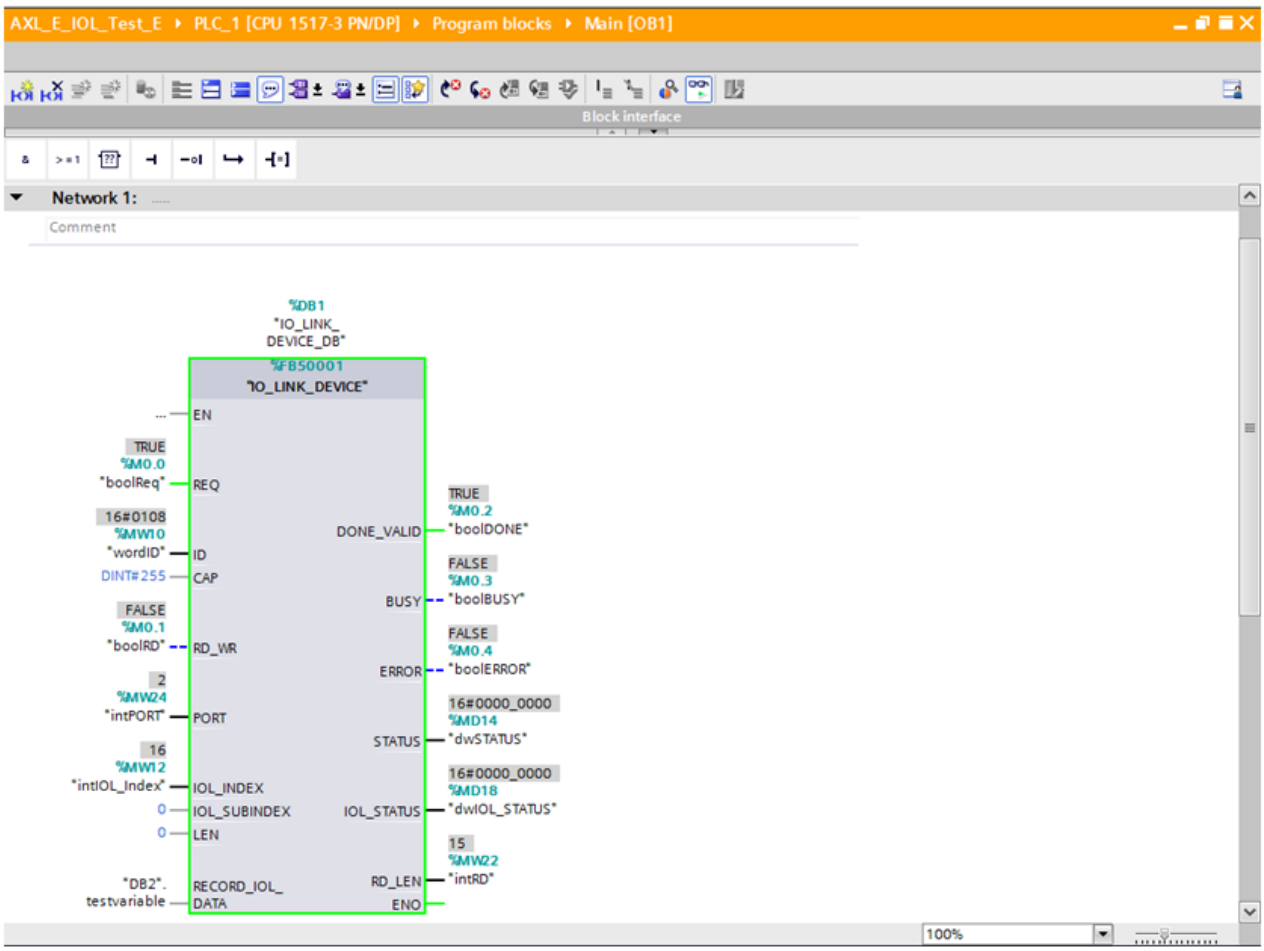

Figure 5-12 Main program

The target area (DB2) of RECORD_IOL_DATA contains the following data.

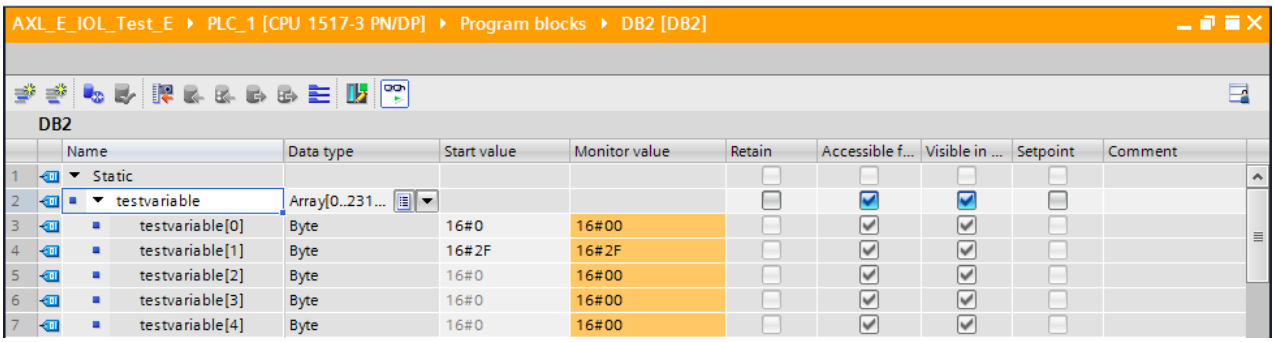

Figure 5-13 Data in the target area

If these are now converted from HEX to ASCII, the result will be: “Phoenix Contact”.

5.8 Writing IO-Link device parameters

During write access (RD_WR = 1), all data from the “RECORD_IOL_DATA” output is read and transferred to the IO-Link device. The amount of data to be written is specified in the LEN variable.

The “BUSY” output is TRUE during data transmission. When data transmission is completed, the “BUSY” output is FALSE again, irrespective of whether data transfer was successful or not.

The “DONE_VALID” output is set to TRUE after successful data transfer.

In the event of an error, the “ERROR” output = “TRUE” and the error information is output via the “STATUS” and “IOL_STATUS” outputs.

5.8.1 Example: writing the ParaWord of the AXL E IOL RTD1 M12 S device.

The following structure is used in this example:

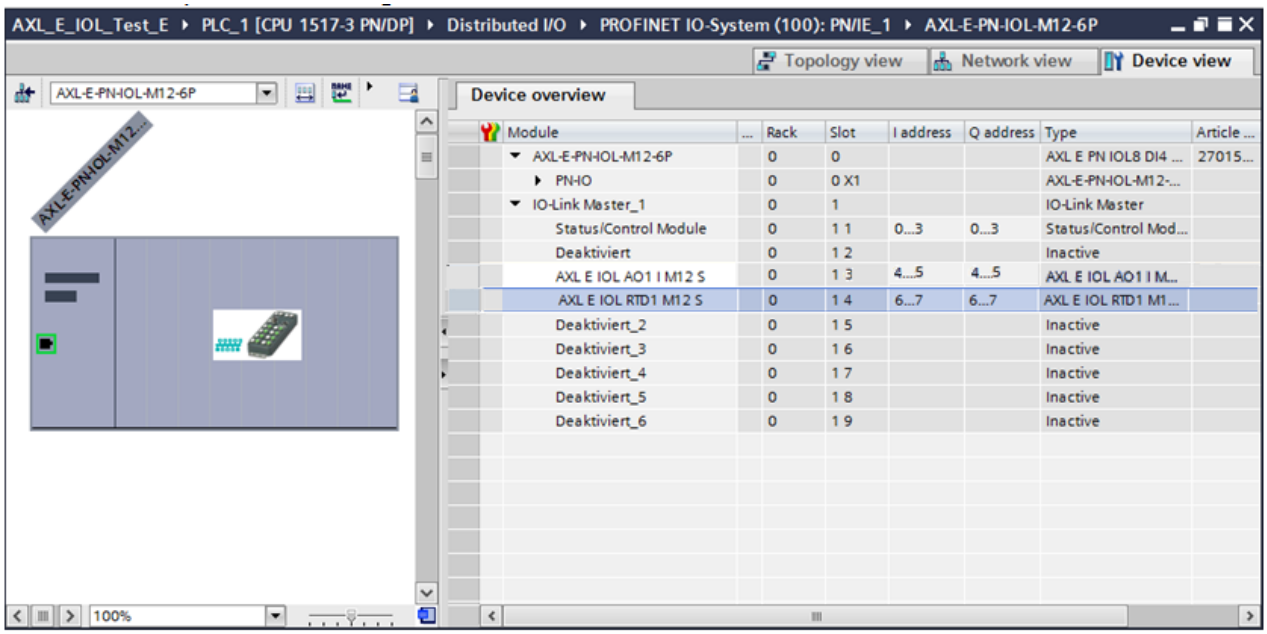

Figure 5-14 Example structure

By referring to the data sheet for the AXL E IOL RTD1 M12 S device, connected to port 3, you can determine that the ISDU object with index 80_{hex}, decimal 128, contains the parameter word (ParaWord) to be written.

In this example, the format is to be changed to IB IL and the sensor type to linear R0 ohm … 5k ohm. The data to be written are therefore $002F_{hex}$.

Parameter	Description
REQ	= 1 (true)
ID	= 108 (264_{dec} => HW-ID)
CAP	= 255
RD_WR	= 1 (write)
PORT	= 3
IOL_INDEX	= 80_{hex} (ParaWord, 128_{dec})
IOL_SUBINDEX	= 0 (no subindex)
LEN	= 2 (ParaWord is 2 bytes too large)
RECORD_IOL_DATA	= Source range of the data to be written ($002F_{hex}$)

A separate data block (DB) and array variable must be created for the source range of RECORD_IOL_DATA. This variable must point to the start address of the DB.

- Carry out the following steps:
- Navigate to "... > Program blocks" in the project tree.
- Double-click "Add new block".

If you have already created a DB and have linked it with the FB, you will not need a new DB to send the data. The data can be edited in the existing DB.

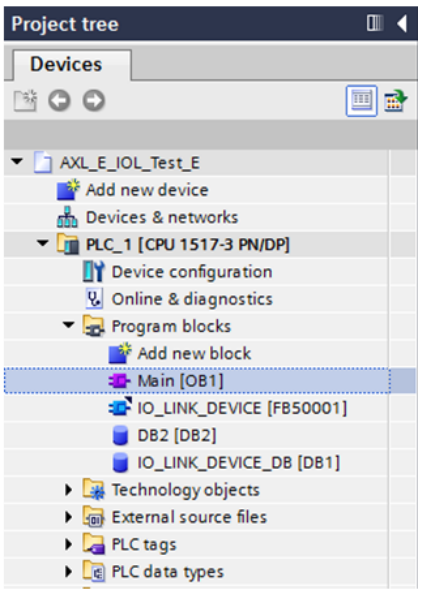

Figure 5-15 Selecting the data block

- In the new window, assign a name (e.g., DB2) to the new data block.
- Close the window with “OK”.

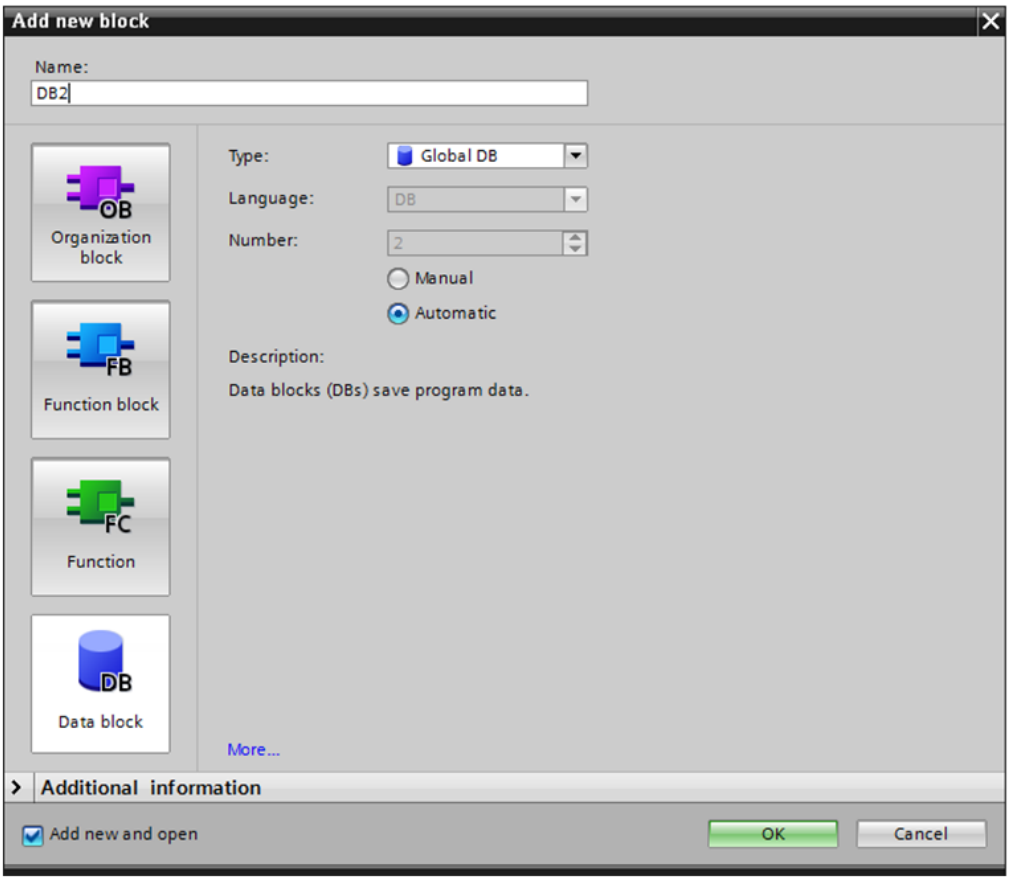

Figure 5-16 Entering the name of the data block

- The block should open automatically; if not, double-click it.
- In the new window, define the structure of the block.
- Create a new variable of type “ARRAY [0..231] of BYTE”.

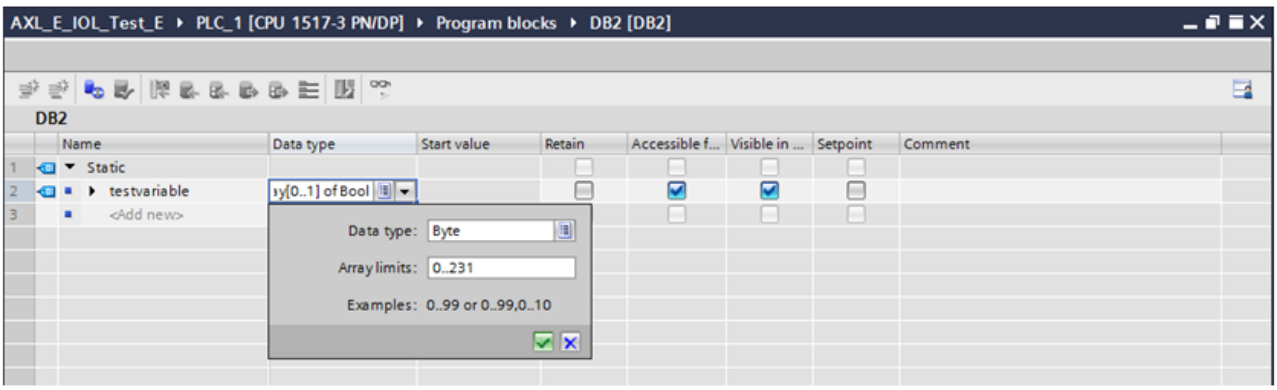

Figure 5-17 Creating a variable

- Finally, link the data block with the RECORD_IOL_DATA input.
- Double-click your “Main” organization block.

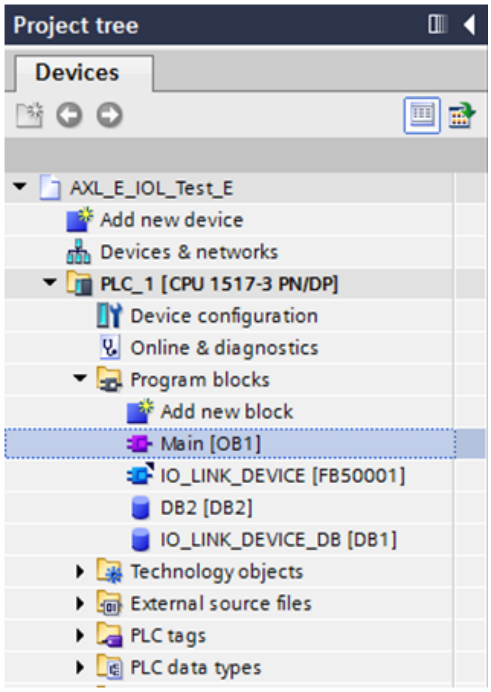

Figure 5-18 Linking the data block

Now enter “*DB2*.example_variable” into the RECORD_IOL_DATA input in the block.

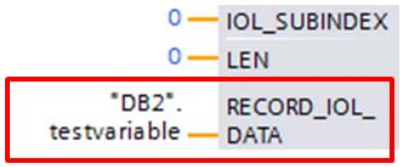

Figure 5-19 Entering an input

According to the example above, the data in DB2 is as follows:

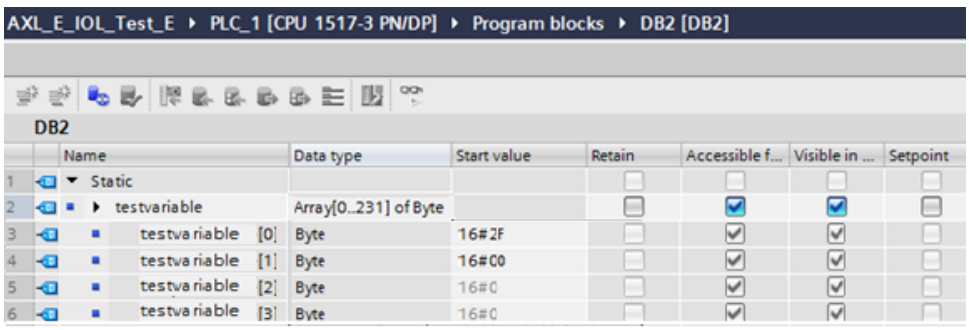

Figure 5-20 Example

The main program in OB1 may look like the following:

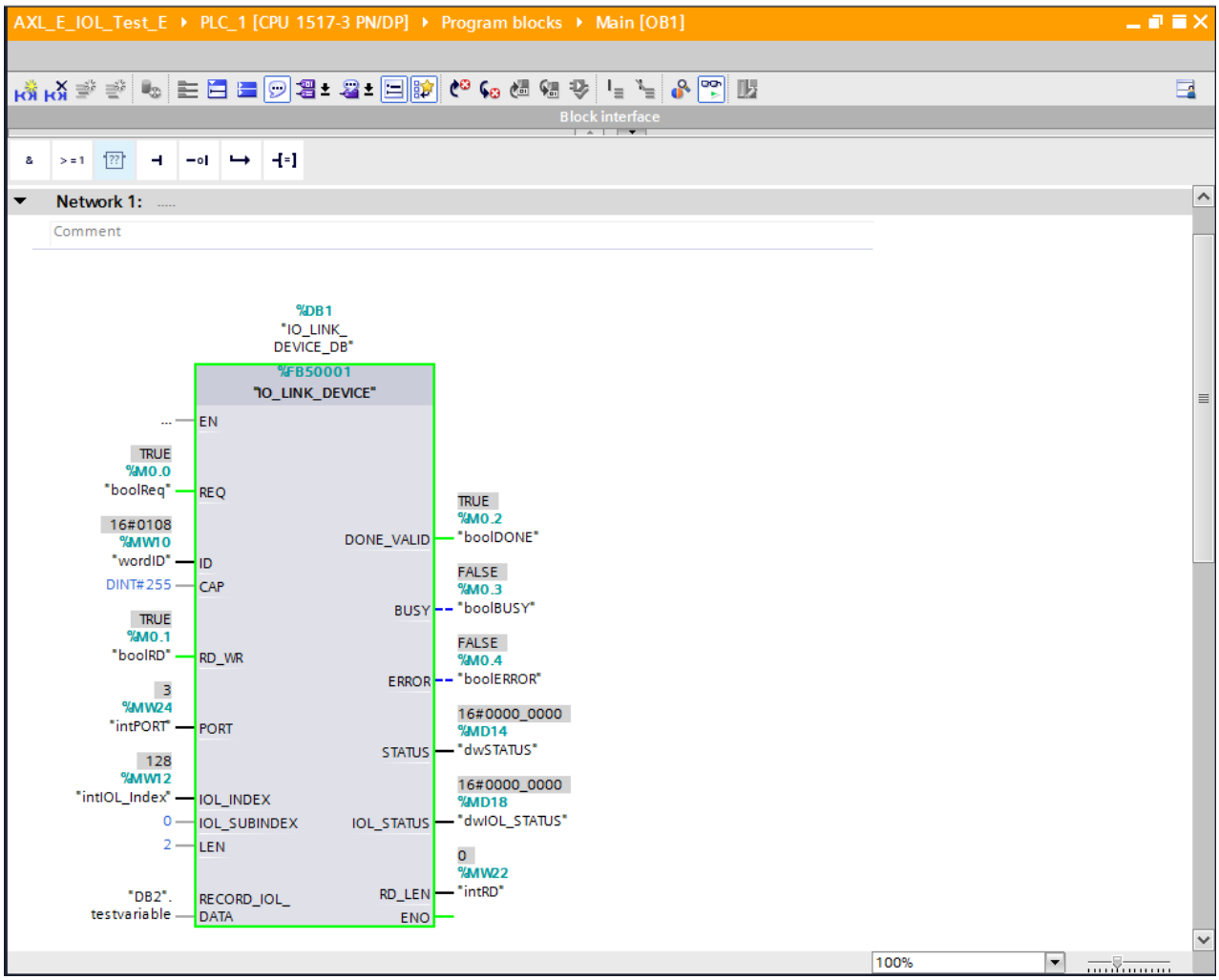

Figure 5-21 Main program

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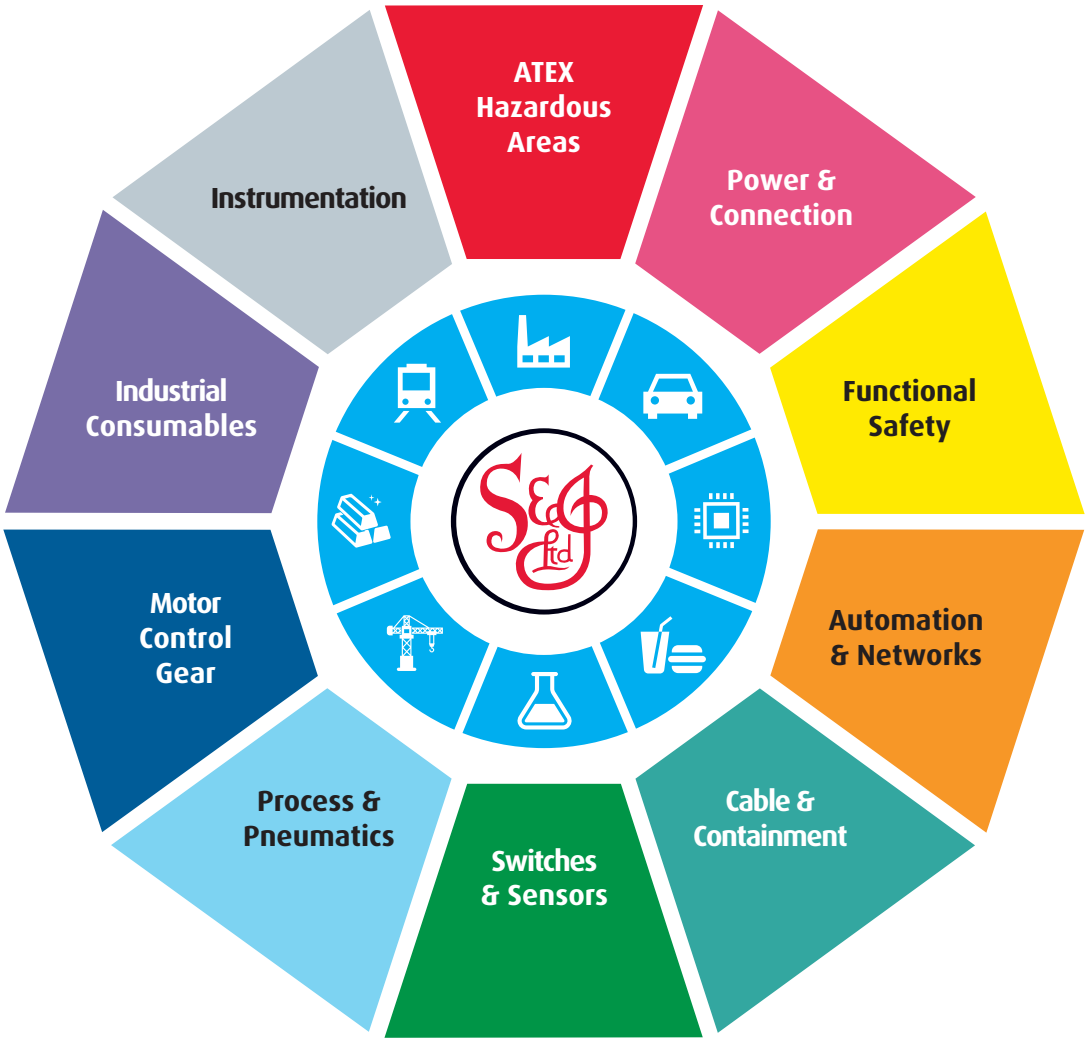

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