Your Global Automation Partner

TURCK

PROFINET Controller/Device Commissioning in CODESYS 3

Getting Started

Table of Contents

1 About these instructions

These instructions describe the commissioning of the CODESYS 3 programmable Turck devices as PROFINET Controller and PROFINET Device on the example of the compact controller TBEN-L…-PLC-10.

The instructions are valid for the following devices:

	Compact controller	**HMI/PLC**	**Programmable gateways**
	TBEN-L…-PLC-…	TX500 series	BL20-PG-EN-V3/ BL67-PG-EN-V3
PROFINET Controller	✔	✔	–
PROFINET Device	✔	–	✔

1.1 Target Groups

These instructions are aimed at qualified personnel and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of Symbols

The following symbols are used in these instructions:

DANGER!

DANGER indicates an immediately dangerous situation, with high risk, the death or severe injury, if not avoided.

WARNING!

WARNING indicates a potentially dangerous situation with medium risk, the death or severe injury, if not avoided.

ATTENTION!

ATTENTION indicates a situation that may lead to property damage, if it is not avoided.

NOTE

In NOTES you find tips, recommendations and important information. The notes facilitate work, provide more information on specific actions and help to avoid overtime by not following the correct procedure.

➤ **CALL TO ACTION**

This symbol identifies steps that the user has to perform.

➥ **RESULTS OF ACTION**

This symbol identifies relevant results of steps

2 Creating a CODESYS Project and Configuring the Network

Turck provides the CODESYS version actually released for the devices under **www.turck.com.** This version contains the necessary Turck device packages.

➤ Download CODESYS from **www.turck.com** and install it.

↪ The installed CODESYS version contains all necessary CODESYS packages and device description files.

2.1 Installing a CODESYS package

If another CODESYS version is used, first of all the package for the used Turck device has to be installed.

➤ Download the CODESYS package for the used device under **www.turck.com.** In the following example, the TBEN-L…-PLC-10 is used.

➤ Install the package using the CODESYS Package Manager "Tools → Package Manager".

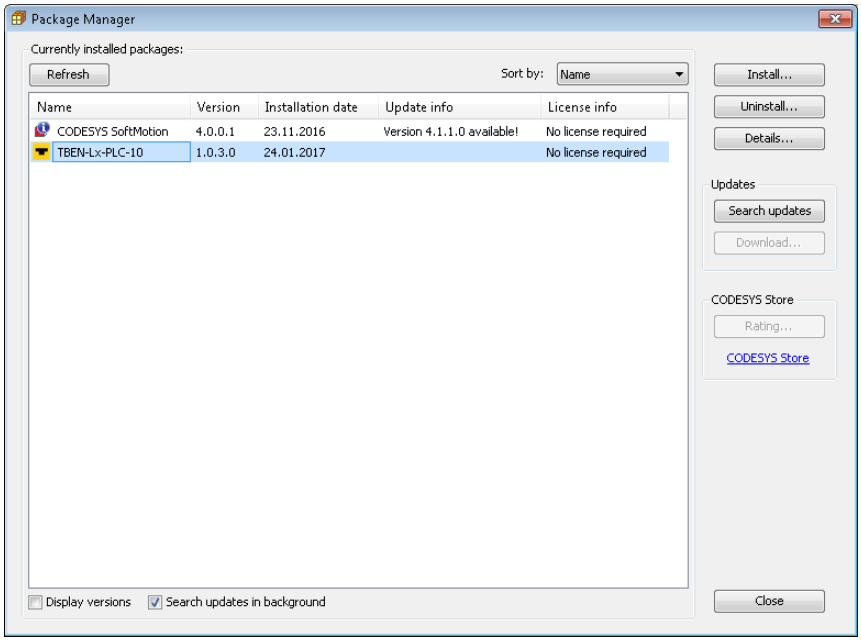

Fig. 1: Package Manager in CODESYS

The CODESYS package contains all necessary files:

- CODESYS Device Description,
- CODESYS libraries,
- GSDML file,
- EDS-file,
- …

2.2 Create CODESYS Standard Project with TBEN-L…-PLC-…

➤ Create a new standard project with TBEN-L…-PLC-… as CODESYS device.

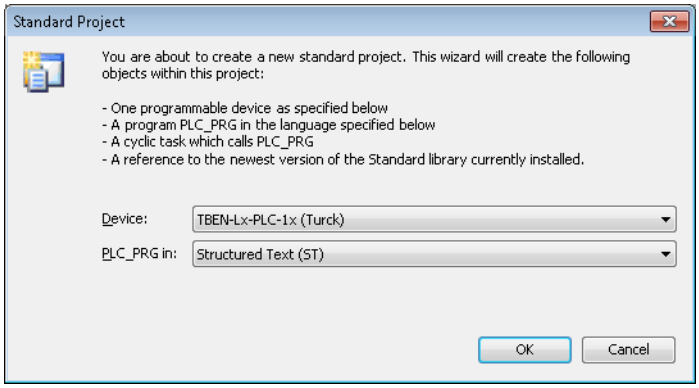

Fig. 2: Selecting the TBEN-L…-PLC-… as CODESYS device

➥ The CODESYS project is created.

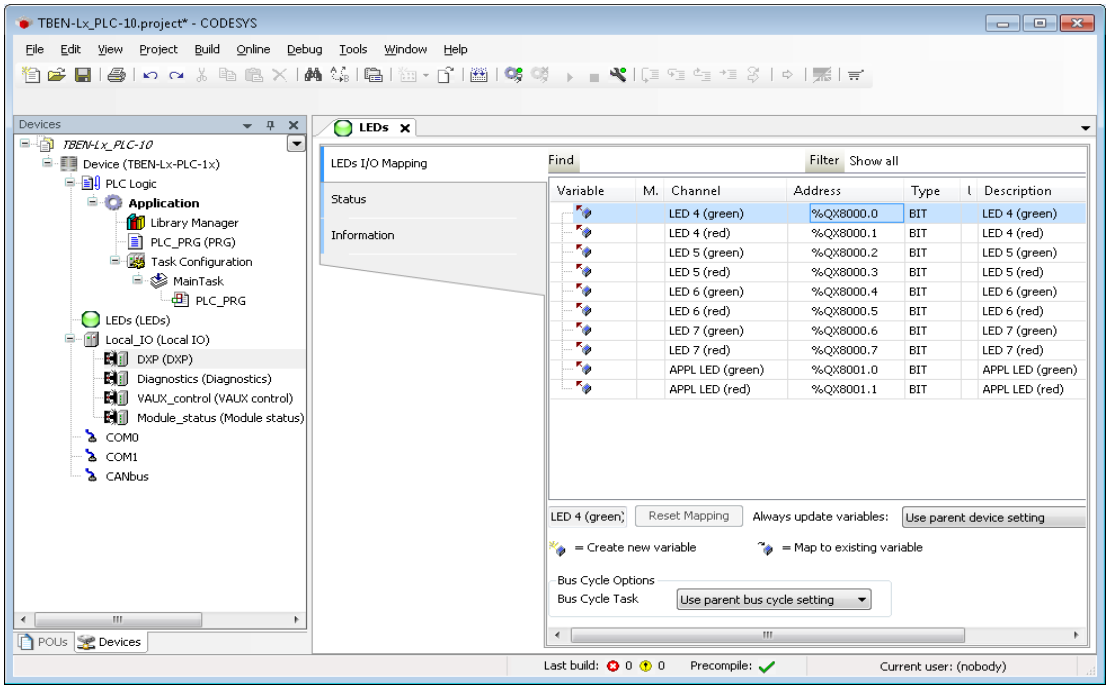

Fig. 3: CODESYS project

Additionally to the PLC logic, the project contains:

- **5 LEDs for free use in the program (LEDs)**
  - Each LED uses 2 bit in the process output data of the device. They are automatically mapped to the output bits %QX8000.0 to QX8001.1 (see Fig. 3: CODESYS project (page 6)).
- **Local IO (Local_IO)**
  - Process data and configuration of the device's local I/Os and the VAUX diagnostics
  - Diagnostics of the local I/Os and module status.
- **2 serial interfaces (COM0 and COM1)**
  - Connection of RS232 and RS485 devices
- **1 CAN interface (CANbus)**
  - Use of the device as CANopen Device, CANopen Manager or as SAE J1939 Manager

2.3 Configuring the Network

Double clicking the entry "Device (TBEN-Lx-PLC-1x)" opens the "device" tab.

➤ Scan the network for TBEN-L…-PLC-10 via the "scan network…" button and select the device.

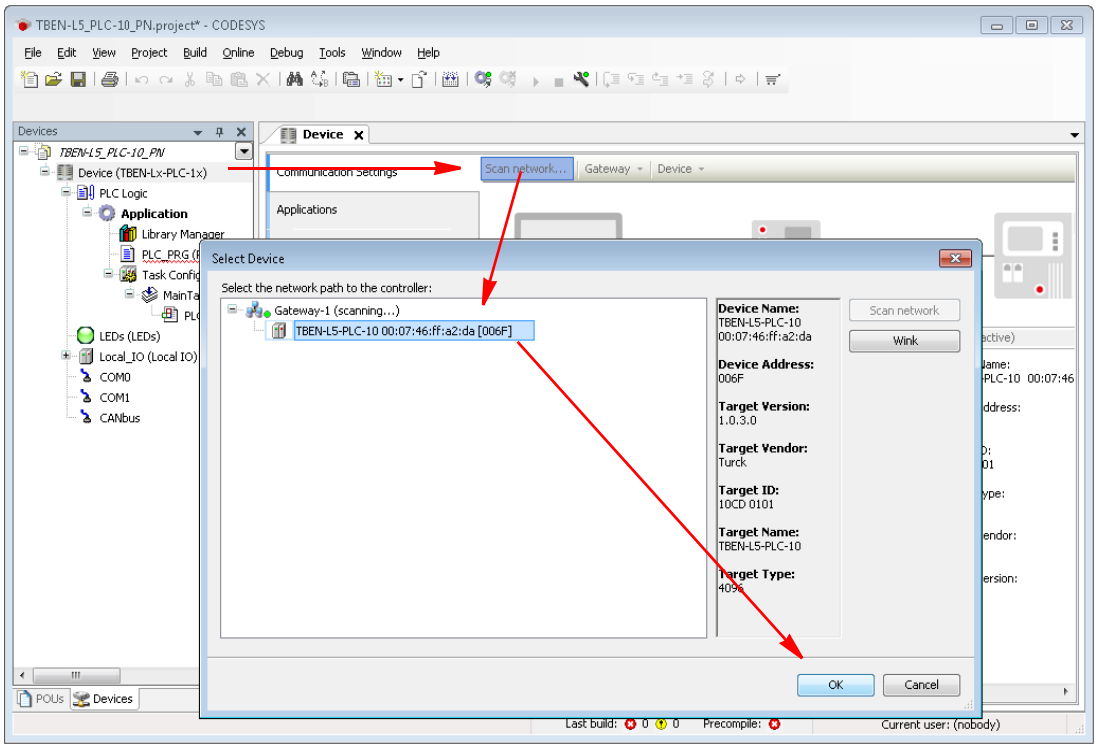

Fig. 4: Scan the network and select TBEN-L…-PLC-10 as device

2.3.1 Configuring the Ethernet Interface

Right clicking the entry "Device (TBEN-Lx-PLC-1x)" opens context menu.

➤ Add the Ethernet interface via the "Add device…" function.

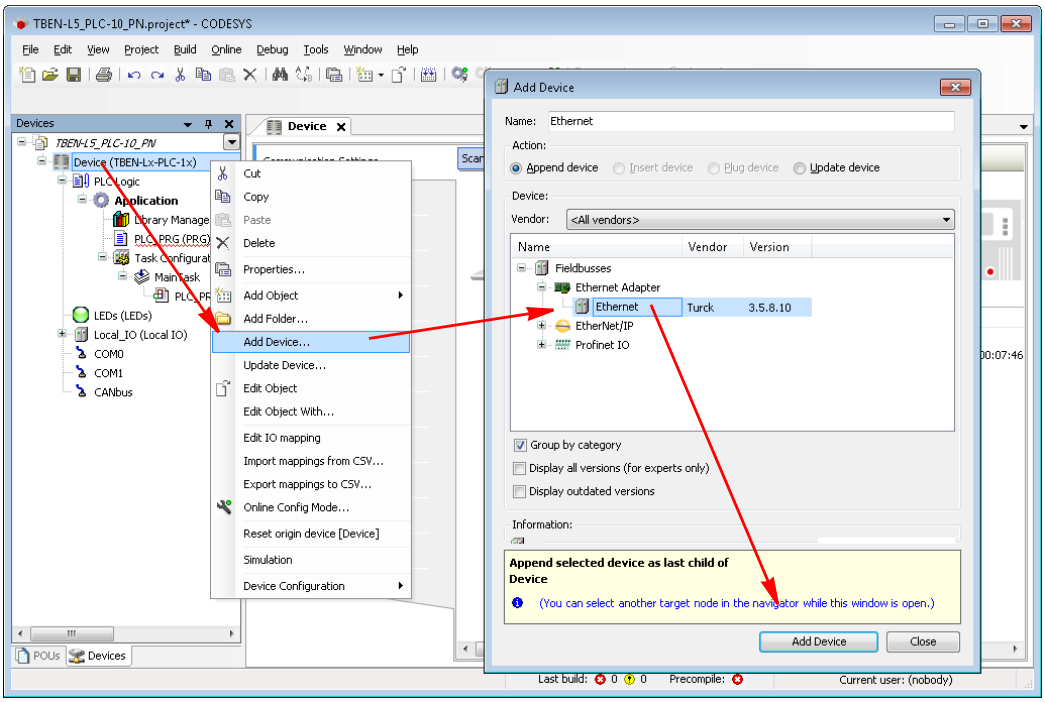

Fig. 5: Adding the Ethernet interface

➥ The Ethernet interface is added to the project tree.

➤ Open the "Ethernet" tab by double clicking the Ethernet interface in the project tree.

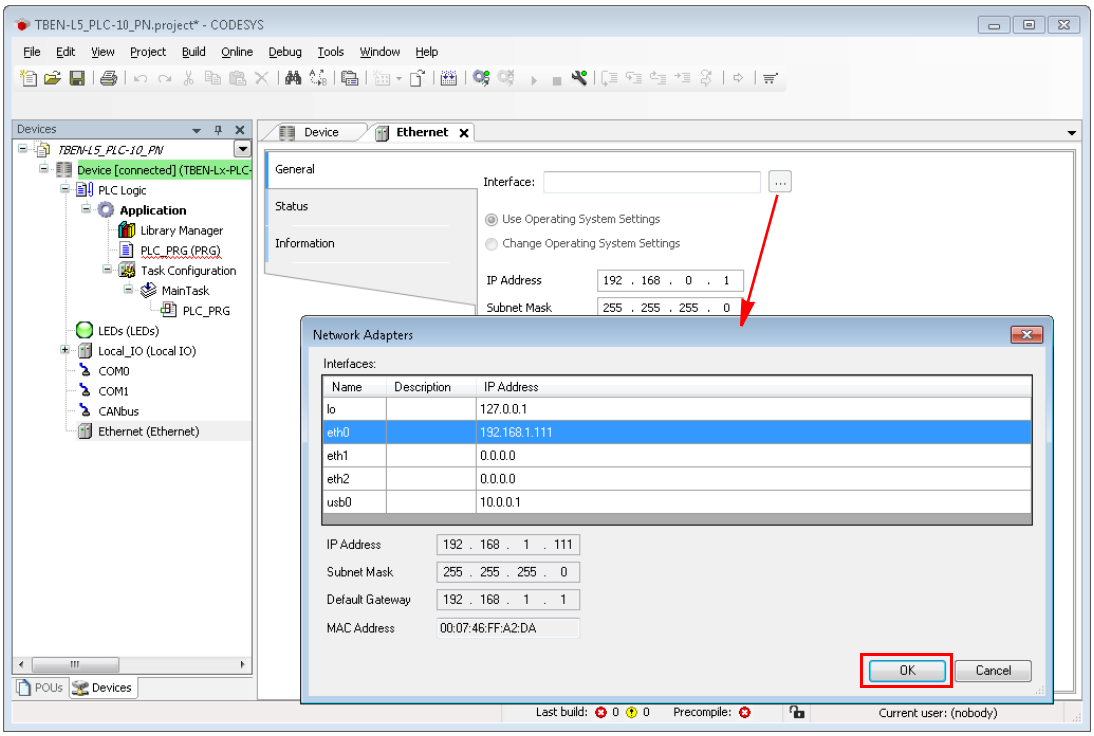

Fig. 6: Configuring the Ethernet interface

The IP address of the network interface corresponds to the IP address of the TBEN-L…-PLC-….

➤ Select "eth0" under "network interface".

↪ The IP address is set automatically.

Hans Turck GmbH & Co. KG | T +49 208 4952-0 | F +49 208 4952-264 | more@turck.com | www.turck.com

3 Using the Device as PROFINET Controller

Used Hardware

- PLC:
  - TBEN-L5-PLC-10
- I/Os:
  - TBEN-S1-8DXP
  - TBEN-S2-4IOL with:
    IO-Link port 1: Turck temperature sensor, TS-530-LI2UPN8X-H1141-L016, IO-Link V1.0
    IO-Link port 2: generic port configuration, one bit each in- and output data
    IO-Link port 3: Turck ultrasonic sensor, RU40U-M18E-LiU2PN8X2T-H1151, IO-Link V1.1
    IO-Link port 4: generic port configuration, used as digital input
  - BL20-E-GW-EN with:
    I/O module 1: BL20-E-2CNT-2PWM
    I/O module 2: BL20-2DO-24VDC-0.5A-P
    I/O module 3: BL20-2AI-I(0/4…20MA)

Used Software

- CODESYS V3, 3.5.8.10
- TBEN-L…-PLC-1…_V1.0.3.0.package

3.1 Creating a CODESYS Project and Configuring the Network

➤ Create CODESYS project and configure the network according to **Kapitel 2, Creating a CODESYS Project and Configuring the Network**.

3.2 Configuring the Device as PROFINET Controller

Properties	Compact controller TBEN-L…PLC-10	HMI/PLC TX500
Max. number of devices	64	64
Min. cycle time	1 ms	1 ms
Max. number of devices at 1 ms **A**	8	1

A *This information refers to standard PROFINET devices with up to 4 byte of process data as for example digital I/O modules. For PROFINET devices with much more process data (50 …400 byte) as for example IO-Link, RFID or serial COM interfaces, the cycle time has to be increased to 2, 4 or 8 ms.*

3.2.1 Adding the PROFINET Controller to the Project

The PN-Controller from 3S – Smart Software Solutions GmbH is used.

➤ Add the PN-Controller to the Ethernet interface using the "Add device…" function.

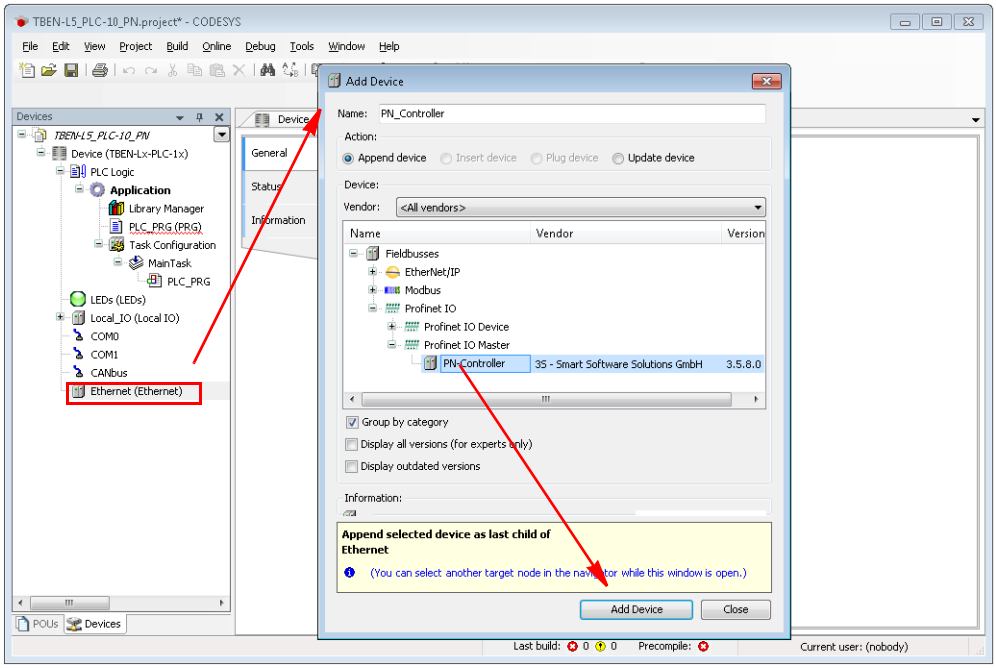

Fig. 7: Adding the PN-Controller

➥ The PROFINET controller is added to the project tree.

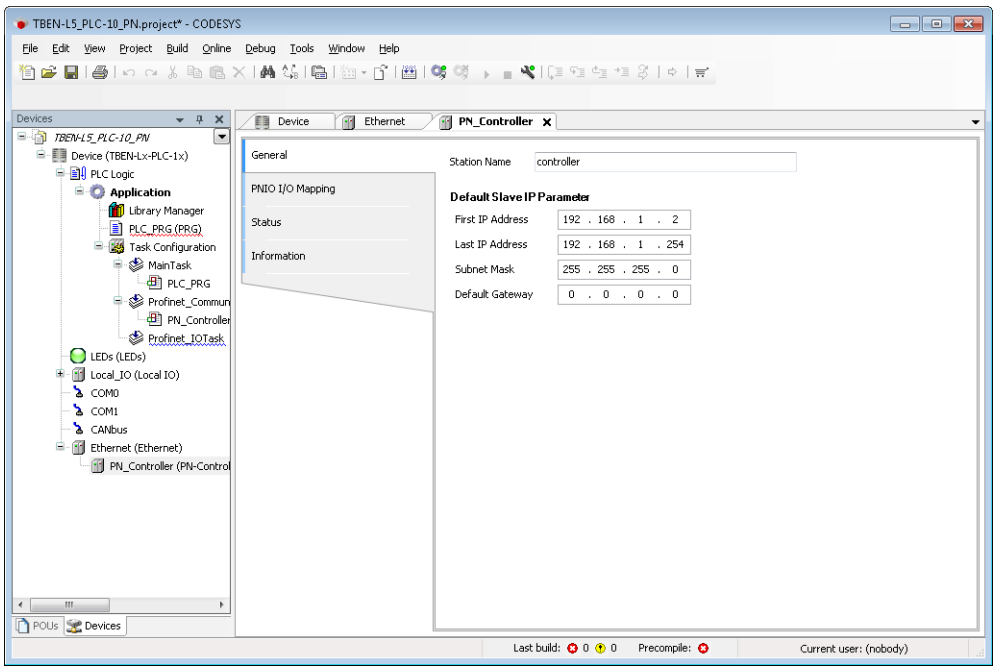

Fig. 8: PN-Controller in project tree

NOTE

The Device addresses under "Default Slave IP Parameter" and the Ethernet interface of the TBEN-L…-PLC-… have to be in the same subnet.

3.2.2 PROFINET tasks in CODESYS

The following PROFINET tasks are automatically added to the project as soon as a PROFINET controller is added to the Ethernet interface.

- Profinet_CommunicationTask
  This task includes the acyclic communication services, such as establishing connections, configuration of slaves and diagnostics. These services are not time-critical due to very weak real-time requirements. Therefore the task is low priority (default: priority 30, interval 10 ms). In applications with a large amount of slaves it can be necessary to extend the cycle time.
- Profinet_IOTask
  This task is responsible for the PROFINET IO real-time data exchange. It controls the PROFINET-Master-Stack. The task should be set to high priority (default: priority 1, interval 1 ms).

3.3 Configuring PROFINET Devices

In this example, the following Turck multiprotocol devices are used as PROFINET devices:

- TBEN-S1-8DXP
- TBEN-S2-4IOL
- BL20-E-GW-EN

3.3.1 Installing the GSDML-files

➤ Download the GSDML files from www.turck.com and install them in the CODESYS Device Repository.

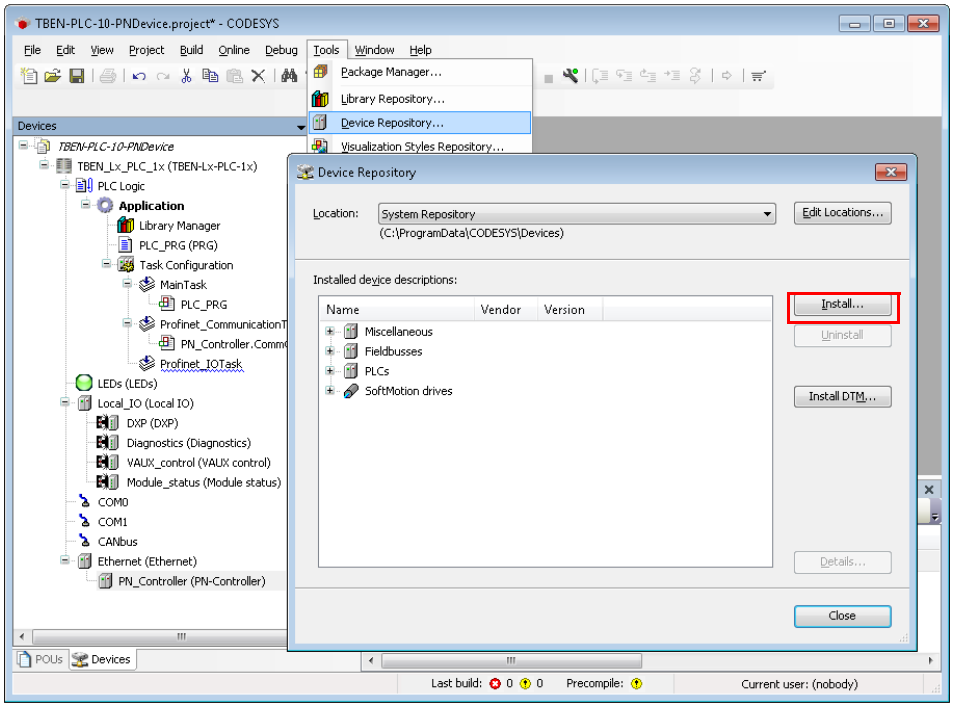

Fig. 9: CODESYS Device Repository

3.3.2 Scan Network for PROFINET Devices

➤ Start the device search via the "Scan for devices…" function at the PROFINET controller.

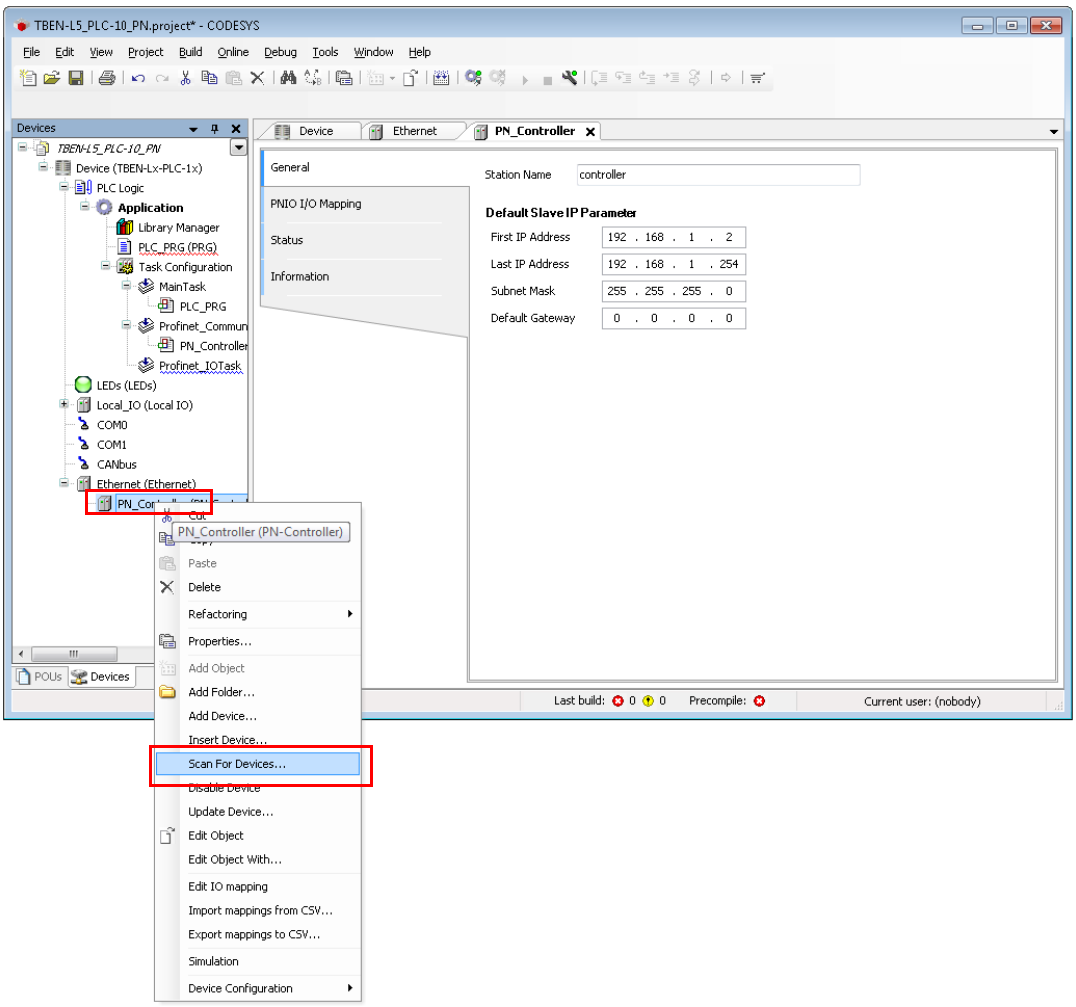

Fig. 10: Search devices

➤ The found devices can either be selected separately or all found devices can be added to the project via the "Copy All Devices to Project" button.

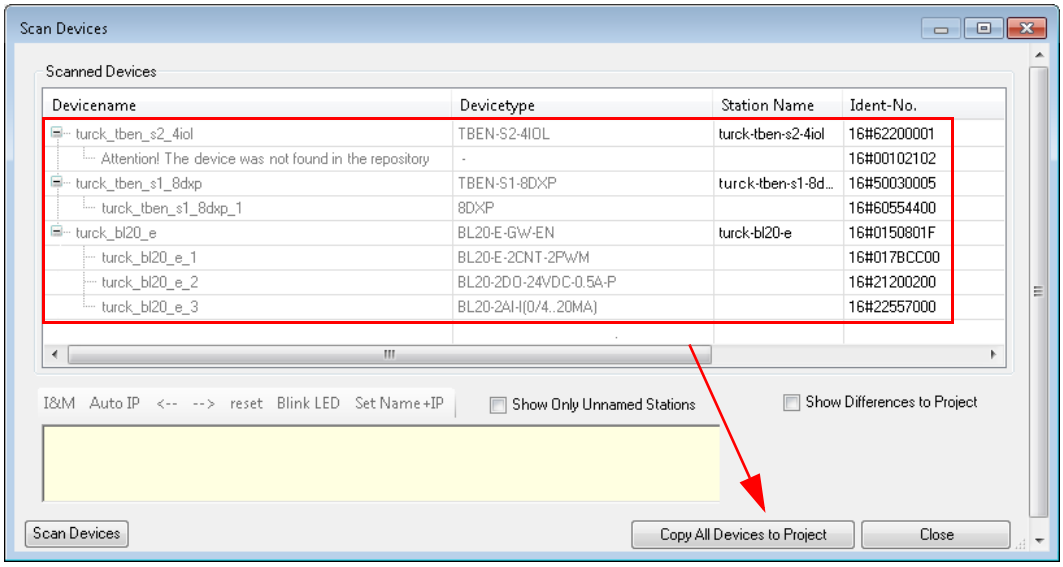

Fig. 11: Searching devices

➥ The devices are added to the project tree.

➥ Modular Turck devices, as the BL20 station in the example, are added with all connected I/O modules.

➥ The configuration of the IO-Link ports of the TBEN-S2-4IOL in the example is done manually afterwards (see **Configuring the TBEN-S2-4IOL (IO-Link Master) (page 20)**).

3.3.3 Adding PROFINET Devices Manually

As an alternative for the scanning of the network, PROFINET devices can also be add manually to PROFINET.

➤ Add external PROFINET devices using the "Add device…" function.

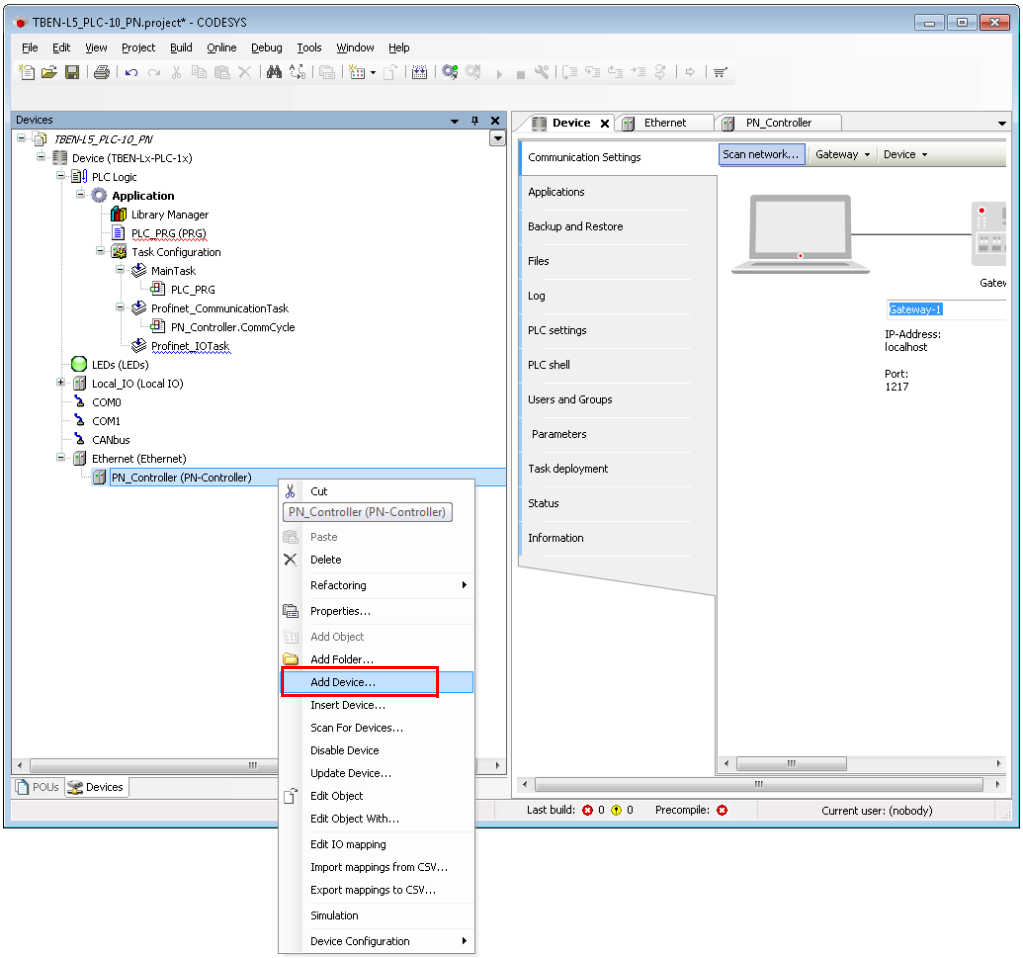

Fig. 12: Adding external PROFINET devices

➤ Select the PROFINET devices from the device catalog and add them to the project.

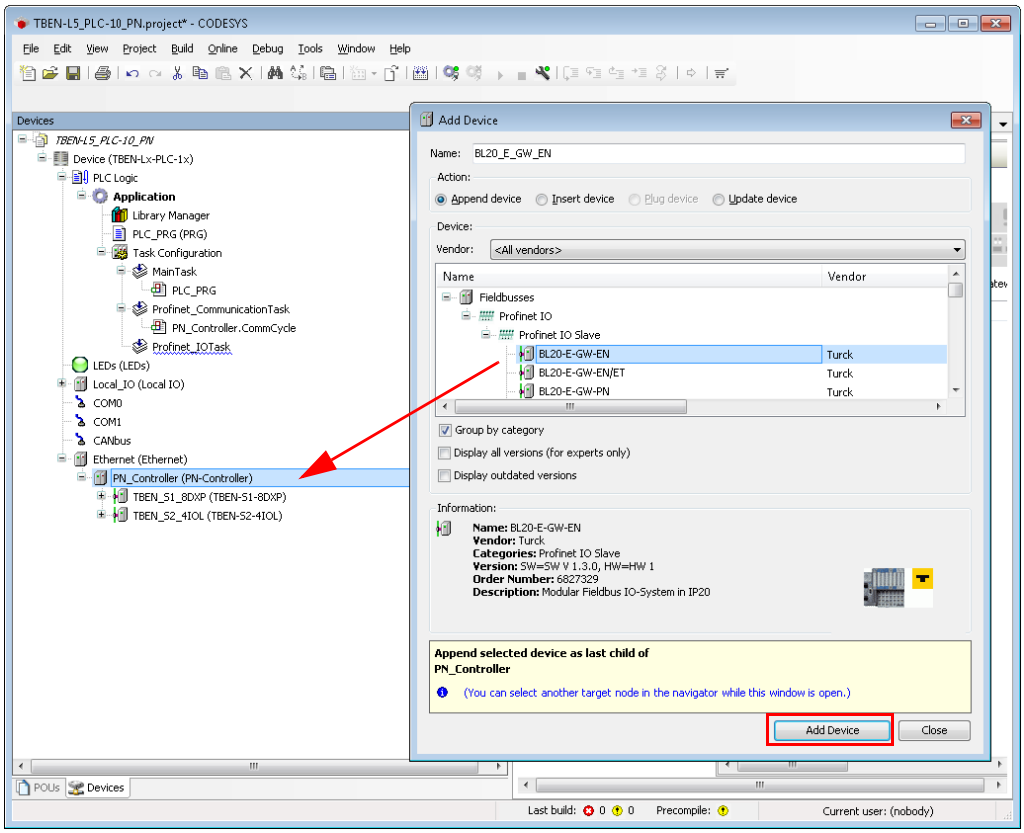

Fig. 13: Adding external PROFINET devices

3.3.4 Configuring the BL20 station

- For modular PROFINET devices, first of all select the gateway (in this example the BL20-E- GW-EN).
- Right-click the gateway and use the "Add device" function to add the I/O modules in the order in which they follow the gateway.

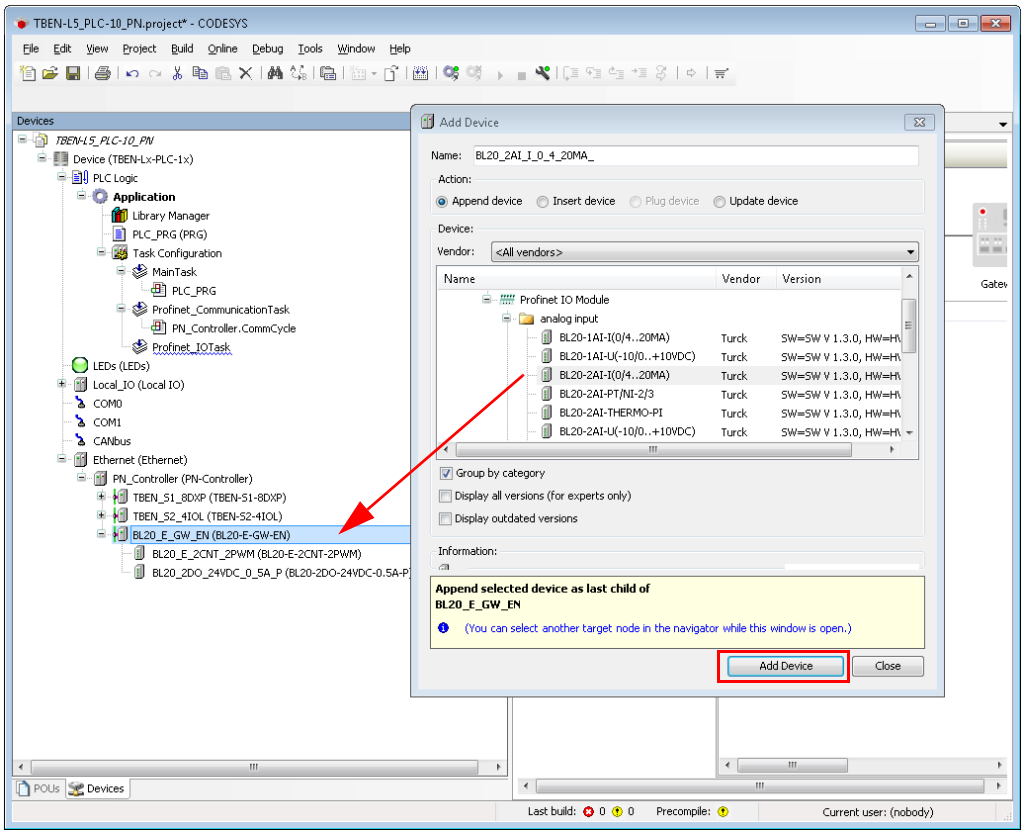

Fig. 14: Adding I/O modules to the BL20 gateway

3.3.5 Configuring the TBEN-S2-4IOL (IO-Link Master)

The TBEN-S2-4IOL is shown in the project tree as a modular slave with one basic slot and seven empty slots.

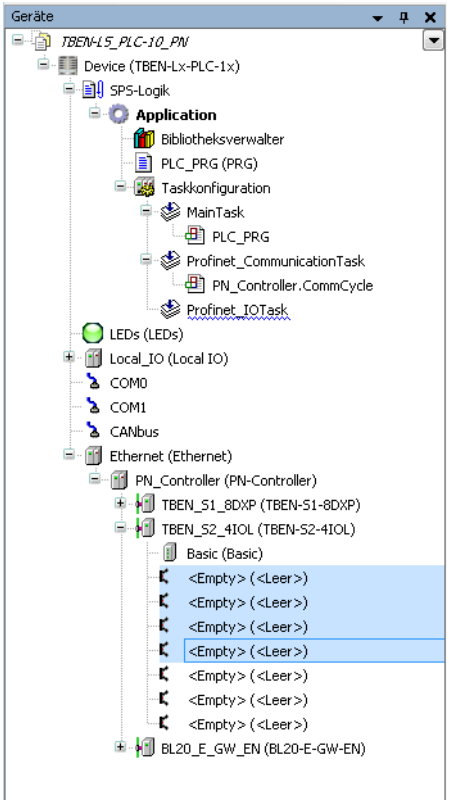

Fig. 15: TBEN-S2-4IOL in the project tree

Slot/empty slot		Meaning
1	Basic	DXP-channels of the device (DXP 2, 4, 6, and 8)
2 - 5	IO-Link ports	For the configuration of the four IO-Link ports. Specific or generic configuration of the IO-Link ports (see **Configuring the Empty Slots 2 – 5 (IO-Link-Ports) (page 21)**).
6	Diagnostics	Optional mapping of the diagnostics (IO-Link and DXP-diagnostics) into the master's process image.
7	IO-Link Events	Optional mapping of the diagnostics (IO-Link and DXP-diagnostics) into the master's process image.
8	Module status	Optional mapping of the diagnostics (IO-Link and DXP-diagnostics) into the master's process image.

Configuring the Empty Slots 2 – 5 (IO-Link-Ports)

Device configuration in the example:

- TBEN-S2-4IOL with:
  IO-Link port 1: Turck temperature sensor, TS-530-LI2UPN8X-H1141-L016, IO-Link V1.0
  IO-Link port 2: generic port configuration, one bit each in- and output data
  IO-Link port 3: Turck ultrasonic sensor, RU40U-M18E-LiU2PN8X2T-H1151, IO-Link V1.1
  IO-Link port 4: generic port configuration, used as digital input

➤ Use the "Plug device…" function to select an IO-Link device for the respective empty slot.

The configuration is either done via SIDI (Simple IO-Link Device Integration) or as generic configuration. In this example port 1 and 3 are used with a specific sensor, port 2 with a generic sensor with one byte IO-Link input data and one byte IO-link output data. Port 4 is configured generically as digital input.

NOTE

By means of the "Simple IO-Link Device Integration (SIDI)", Turck IO-Link devices can directly be selected from the device GSDML in PROFINET.

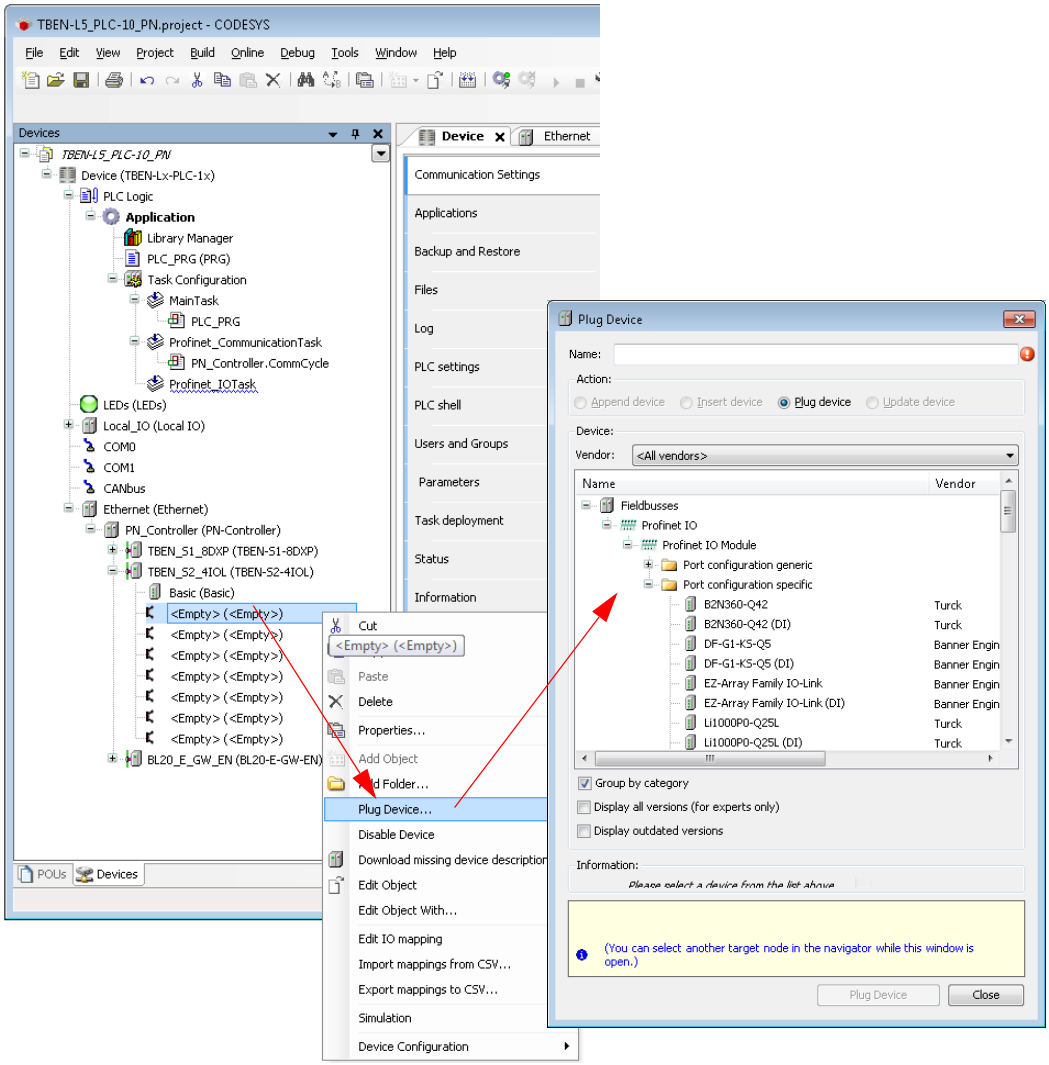

Fig. 16: TBEN-S2-4IOL, "Plug device…" and select port configuration

➤ Select the entry of the temperature sensor "TS-530-LI2UPN8X-family" under "Port configuration generic" and plug the device.
Select "TS-530-LI2UPN8X-family" and "Plug device…".

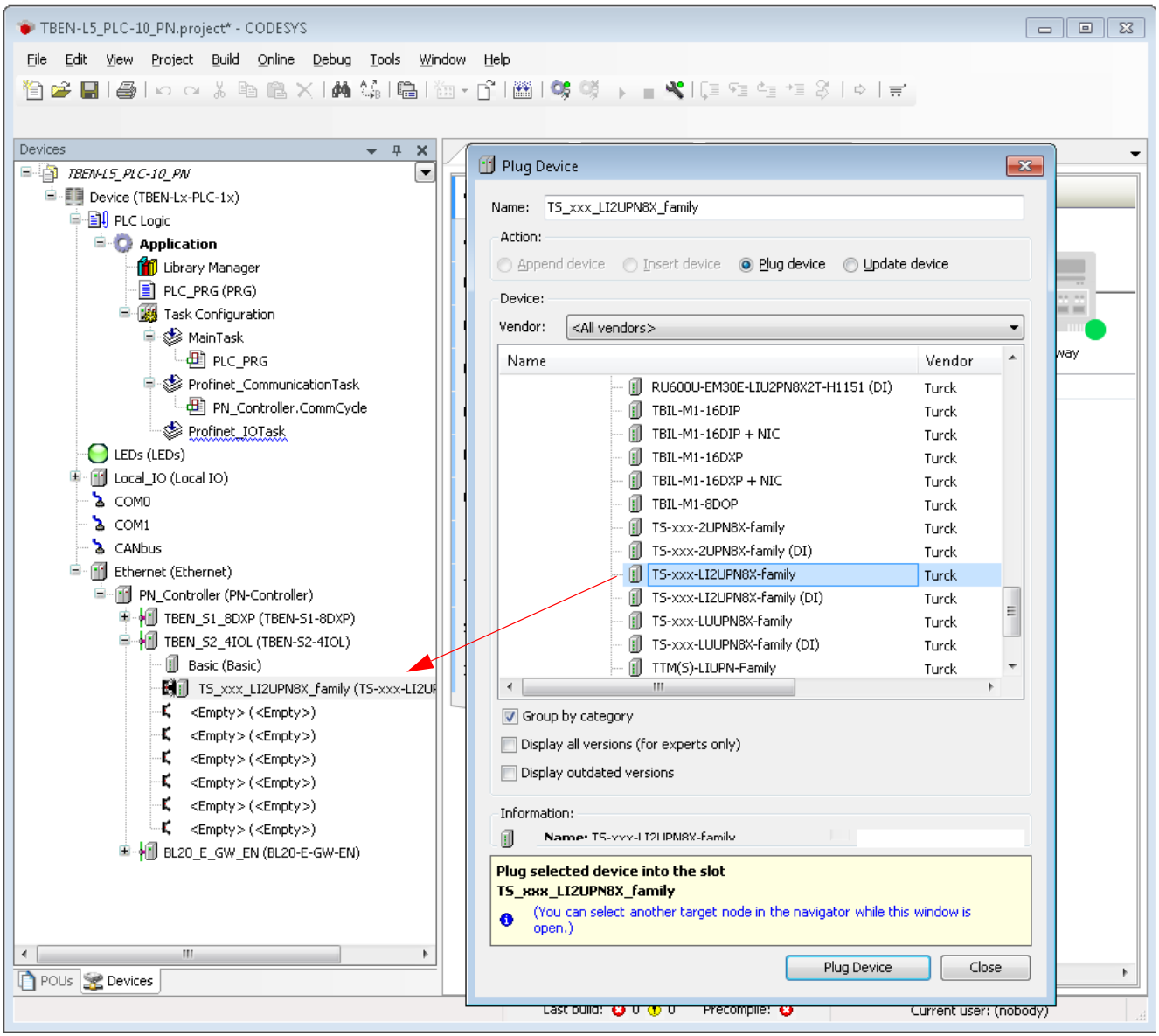

Fig. 17: Select TS-530-LI2UPN8X-family

➤ Configure port 2 generically and select the entry "IN 1 BYTE/OUT 1 BYTE".

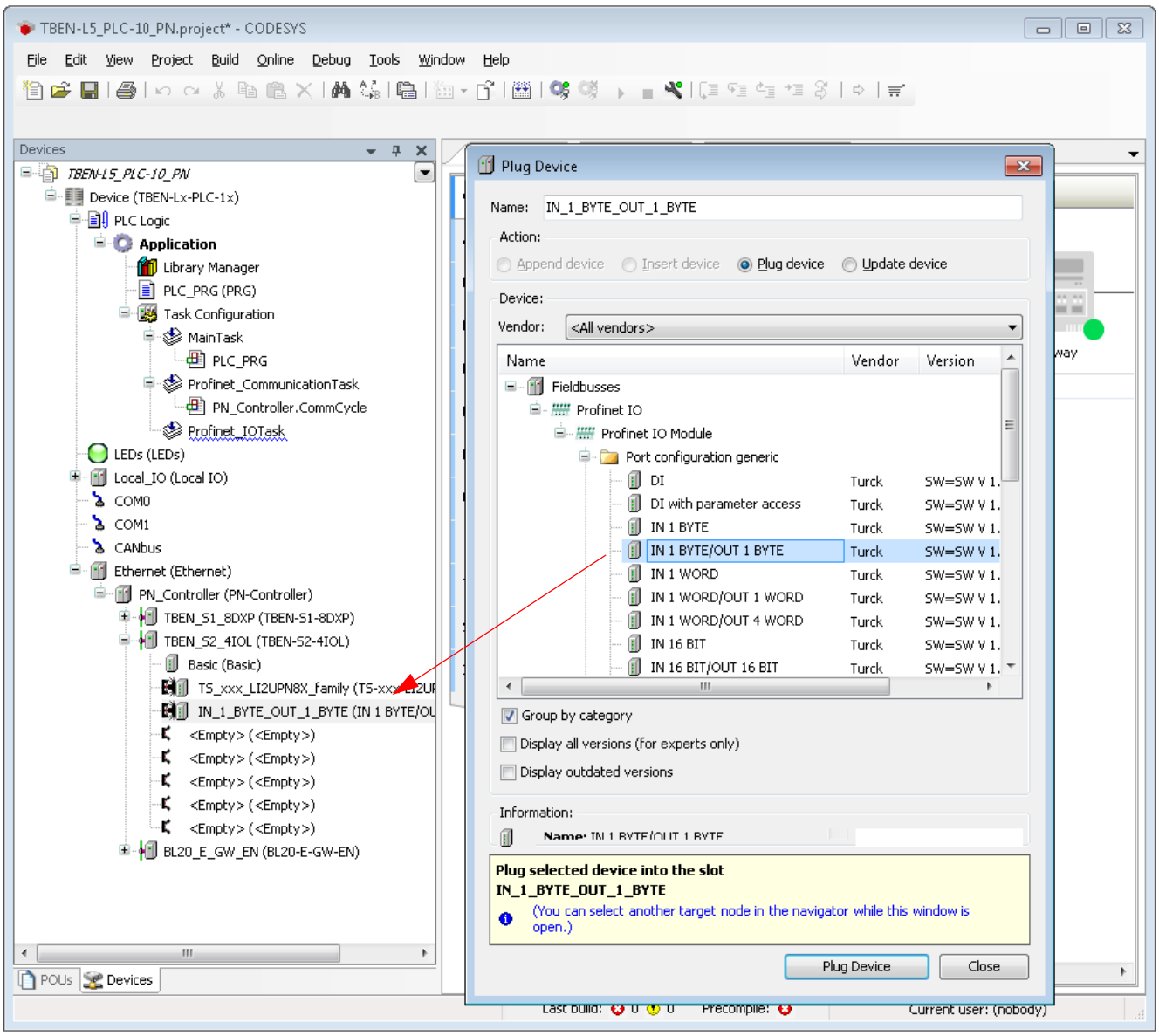

Fig. 18: Generic port configuration

➤ Select the entry of the ultrasonic sensor "RU40U-M18E-LiU2PN8X2T-H1151" under "Port configuration specific" and plug the device.

➤ Configure port 4 generically and select the entry "DI".

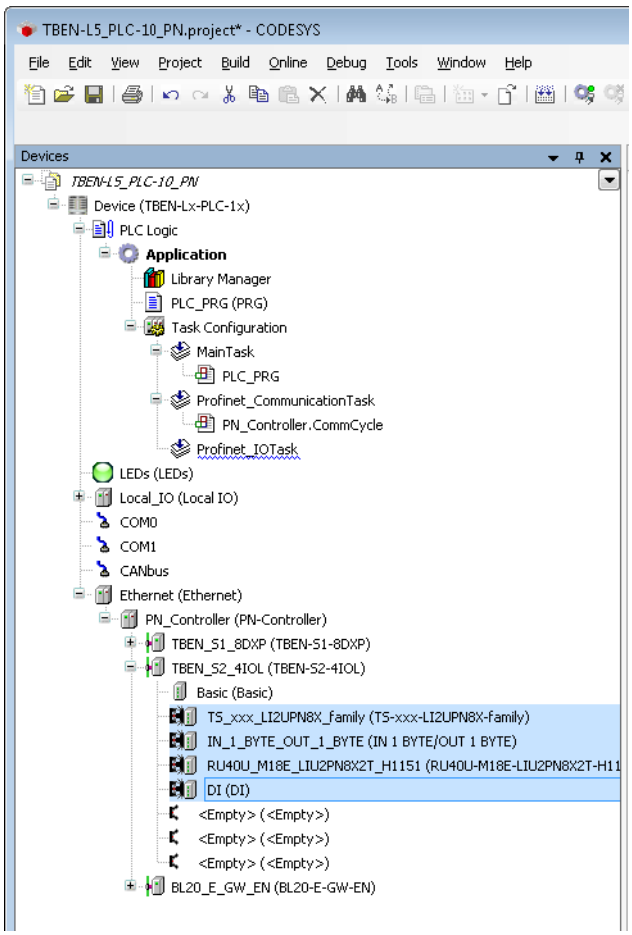

Fig. 19: IO-Link Port Configuration

Configuring the Empty Slots 6 – 8 (Diagnostics, IO-Link-Events, Module Status)

The empty slots 6 to 8 allow the mapping of channel diagnostics, IO-Link Events and the modules status to the process image of the IO-Link master.

➤ Select the entry for the respective empty slot using the "Plug device…" function.

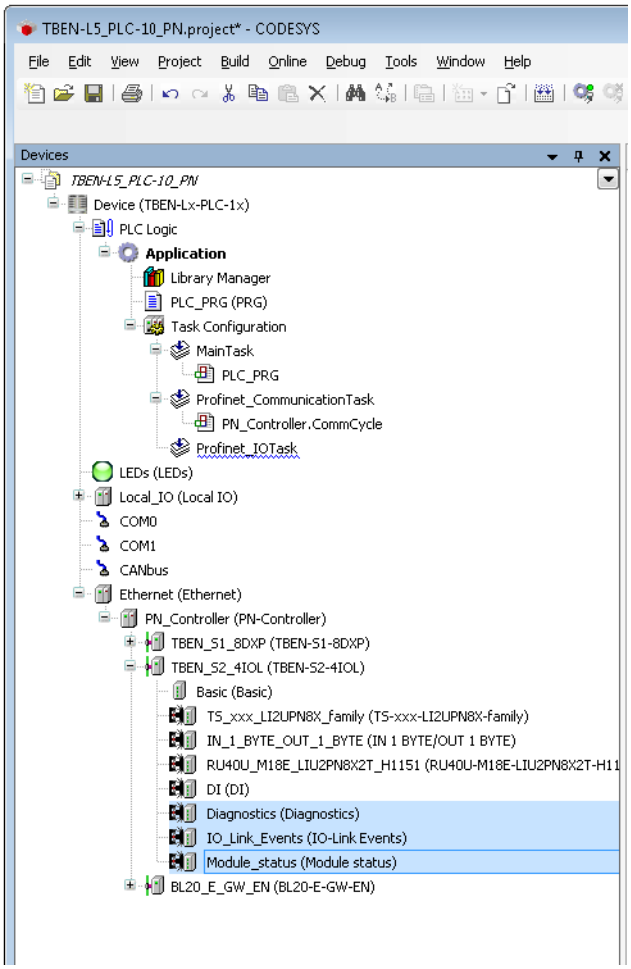

Fig. 20: TBEN-S2-4IOL: Add diagnostics, IO-Link Events and module status

- Diagnostics

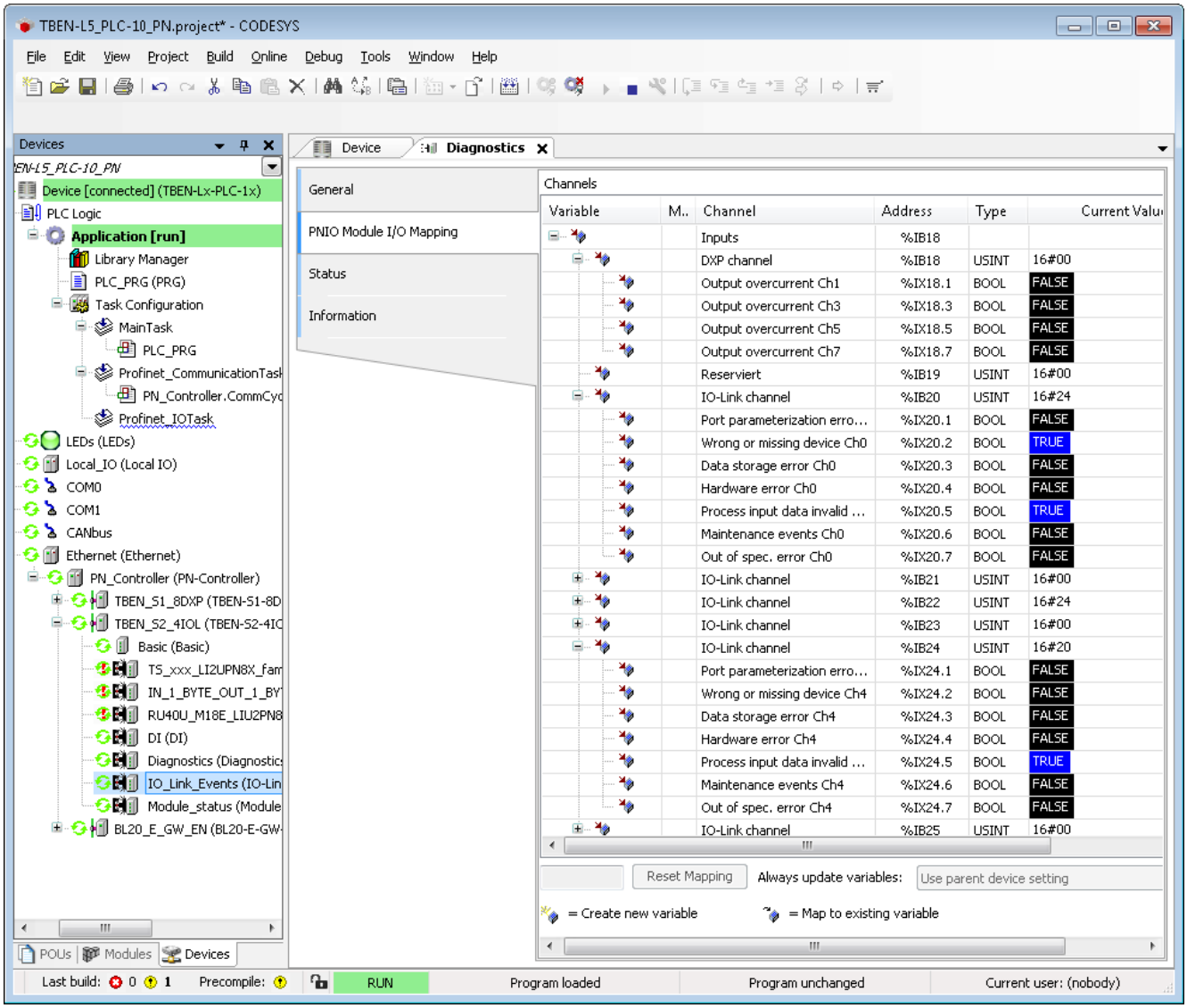

Fig. 21: TBEN-S2-4IOL: Diagnostics in the process image

- IO-Link Events

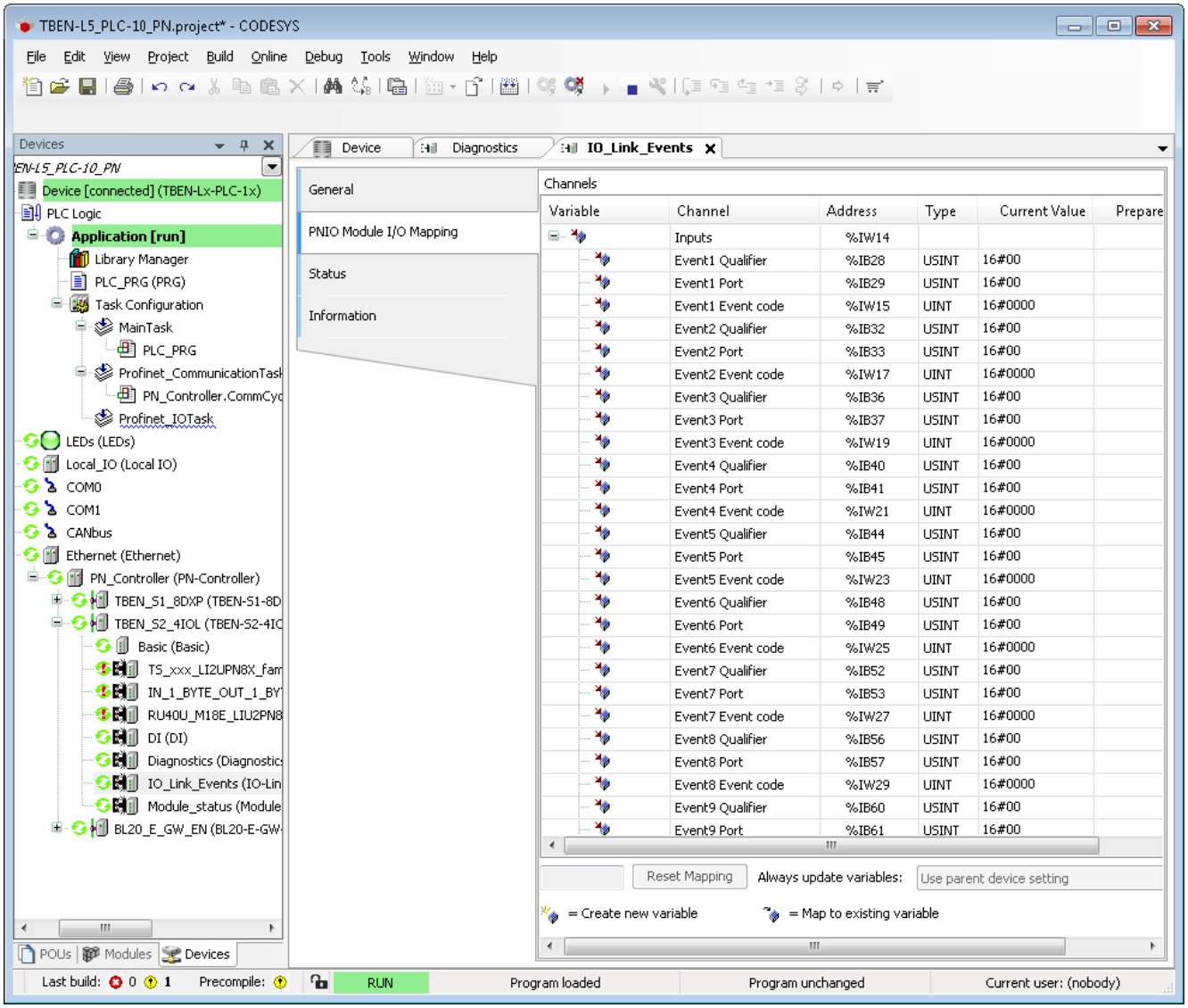

Fig. 22: TBEN-S2-4IOL: IO-Link Events in the process image

- Module status

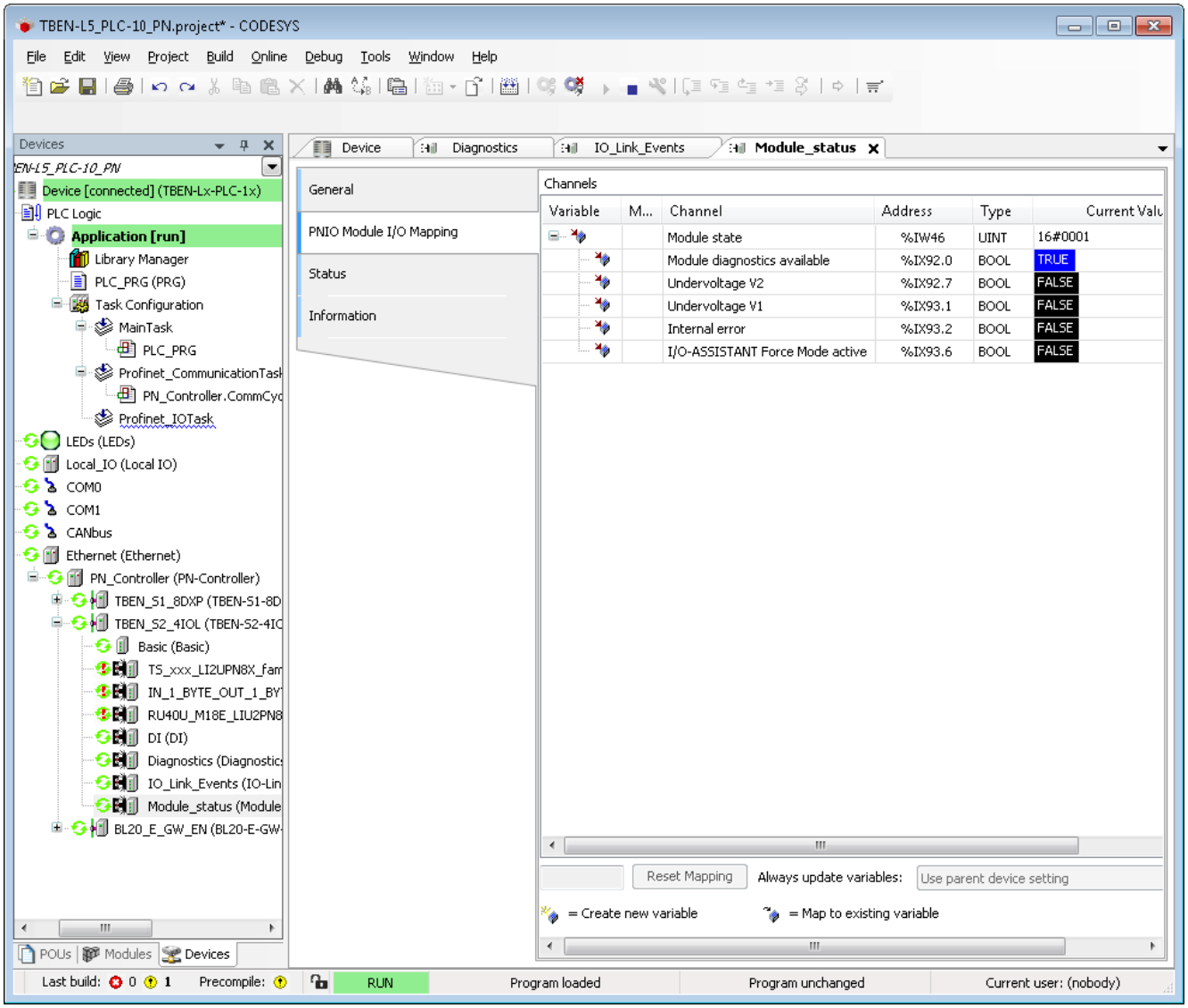

Fig. 23: TBEN-S2-4IOL: Module status in the process image

3.4 Communication Settings for PROFINET Devices

➤ Open the device's configuration tab by double clicking the entry of the respective PROFINET device in the project tree.

3.4.1 Assigning the IP Address and the Station Name

➤ Assign a PROFINET device name and an IP address and, if necessary, adapt the parameters "Send Clock", "Reduction Ratio2 and "Phase" to the application.

NOTE

Assigning an IP address or a station name to the devices is not necessary if the devices have been automatically read in using the "Scan for Devices" function (see **Scan Network for PROFINET Devices (page 15)**).

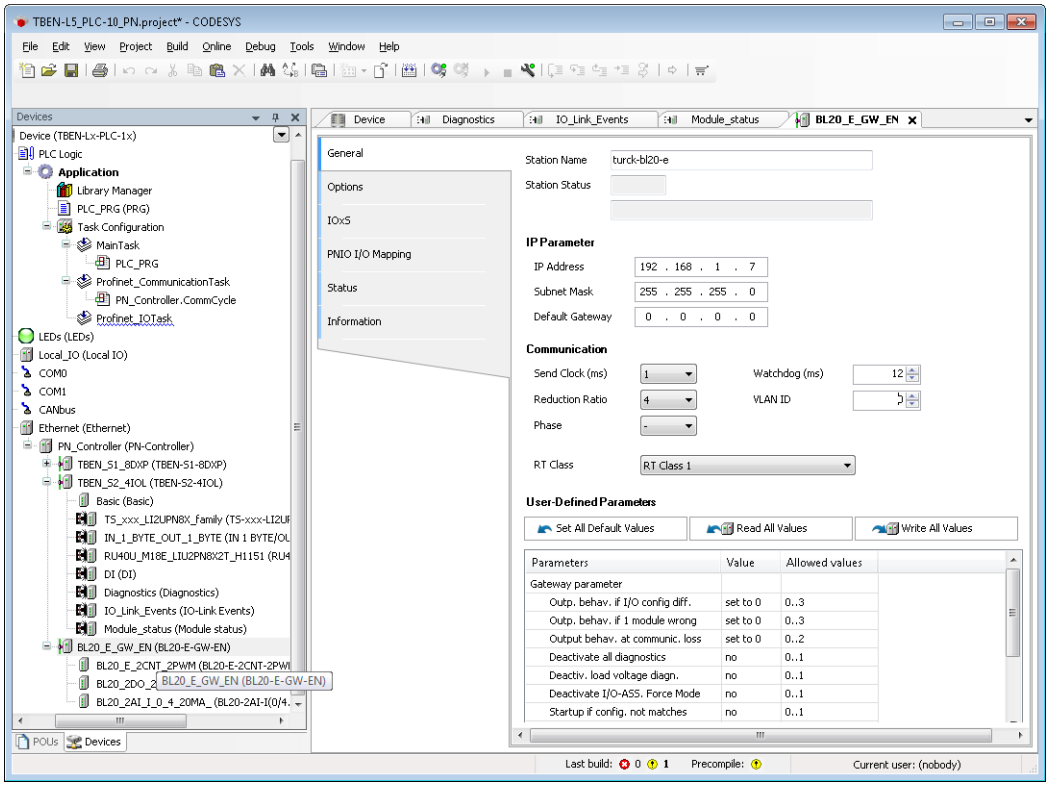

Fig. 24: Configuring external PROFINET devices

NOTE

The IP addresses of the PROFINET Devices and the PN Controller have to be in the same subnet.

3.4.2 Setting the communication parameters (Send Clock, Reduction Ratio, Phase)

- Send Clock (ms):
  Send clock time in milliseconds
- Reduction Ratio:
  Scaling factor
  The transmission interval results from the Send Clock × Reduction Ratio. Therefore, a Send Clock of 1ms and a Reduction Ratio of 4 means that I/O data is sent every 4 ms.
- Phase:
  With a Reduction Ratio of n, the transmission interval is subdivided into phases 1 to n (where transmission is in one phase only). The phase for transmission can be determined for the purpose of load distribution.

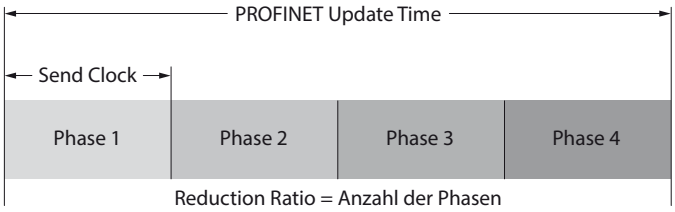

Fig. 25: PROFINET Update Time

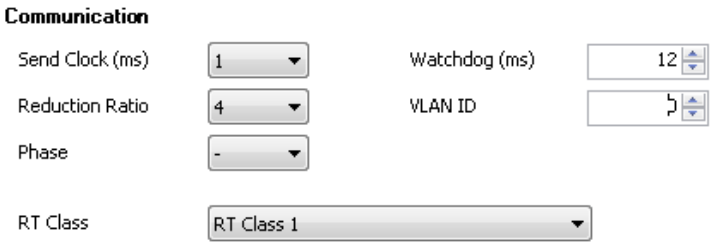

Fig. 26: Settings for the PROFINET device

With the settings "Send Clock" = 1 ms and "Reduction Ratio" = 4 the PROFINET Cycle Time (or Update Time) is divided into four phases of 1 ms each. A PROFINET device with these settings is updated every 4 ms. The PROFINET Update Time is thus the result of the multiplication of "Send Clock" and "Reduction Ratio".

PROFINET Update Time = Send Clock × Reduction Ratio

The parameter "Phase" defines in which phase this PROFINET device is updated. In PROFINET networks with several devices the devices can be split to the different phases. This helps the master to optimize the PN data transfer.

3.5 Requesting the Device Status in the Program

The device status can be requested in the program by entering the PROFINET device instance and the requested function.

```
Instance.Status;
```

Example:

Request, if the device is in cyclic data exchange:

```
tben_s2_4IOL.xRunning;
```

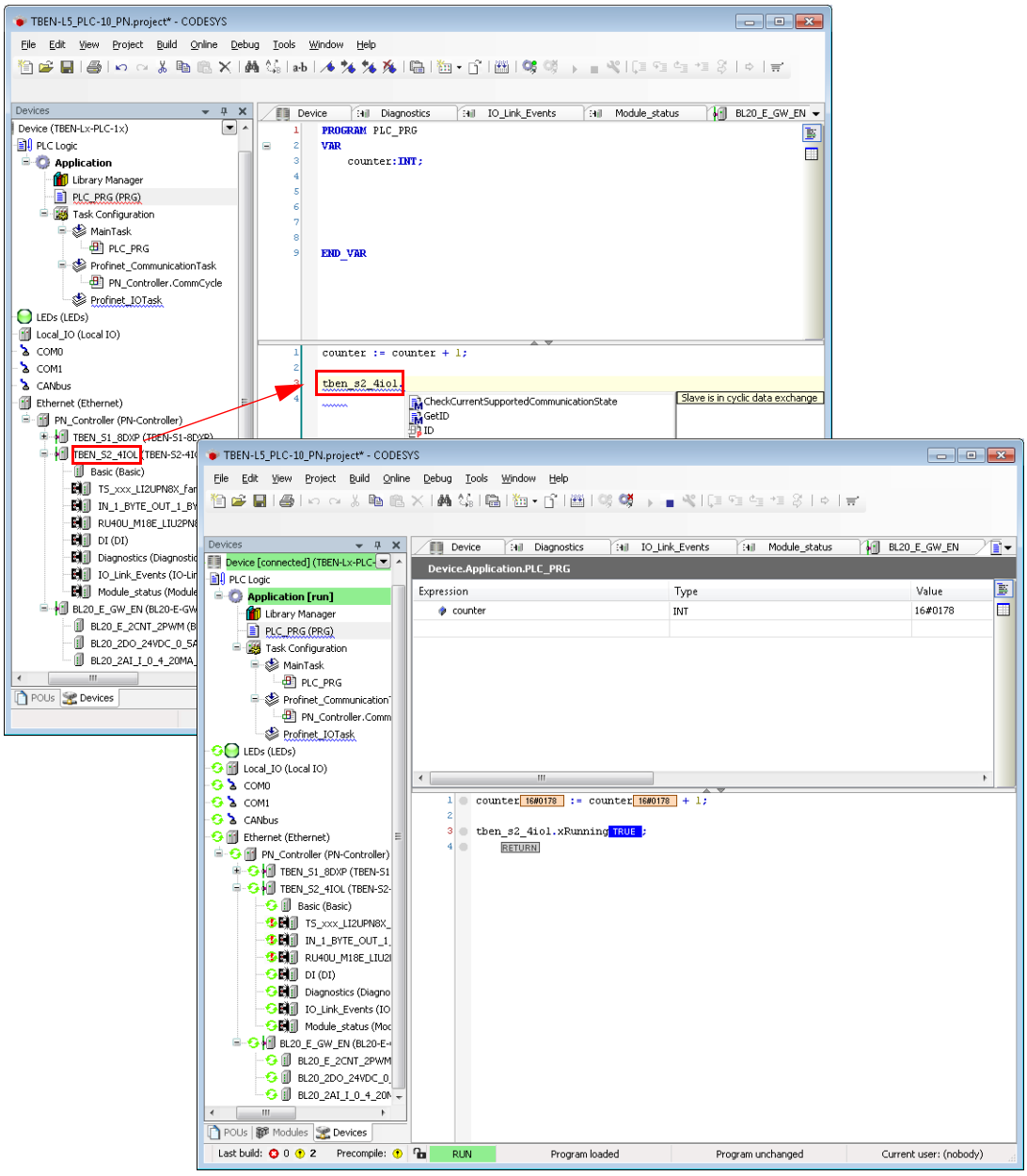

Fig. 27: Requesting the device status in the program

3.6 Using IO-Link Function Blocks for CODESYS

For acyclic access to the Turck IO-Link master devices (in the example TBEN-S2-4IOL) as well as to the connected IO-Link devices, Turck offers the following function blocks:

- IOL_CALL (in accordance with IO-Link specification)
  single acyclic accesses
- IOL_WriteParamterList:
  sending a parameter list for e. g. initial parameterization of IO-Link devices

The function blocks are part of the turck CODEYS library "IO-Link CALL PROFINET", V1.0.2.0 or higher.

Further information about the function blocks and their usage can be found in the operating instructions of the Turck IO-Link master or in the function block description in CODESYS.

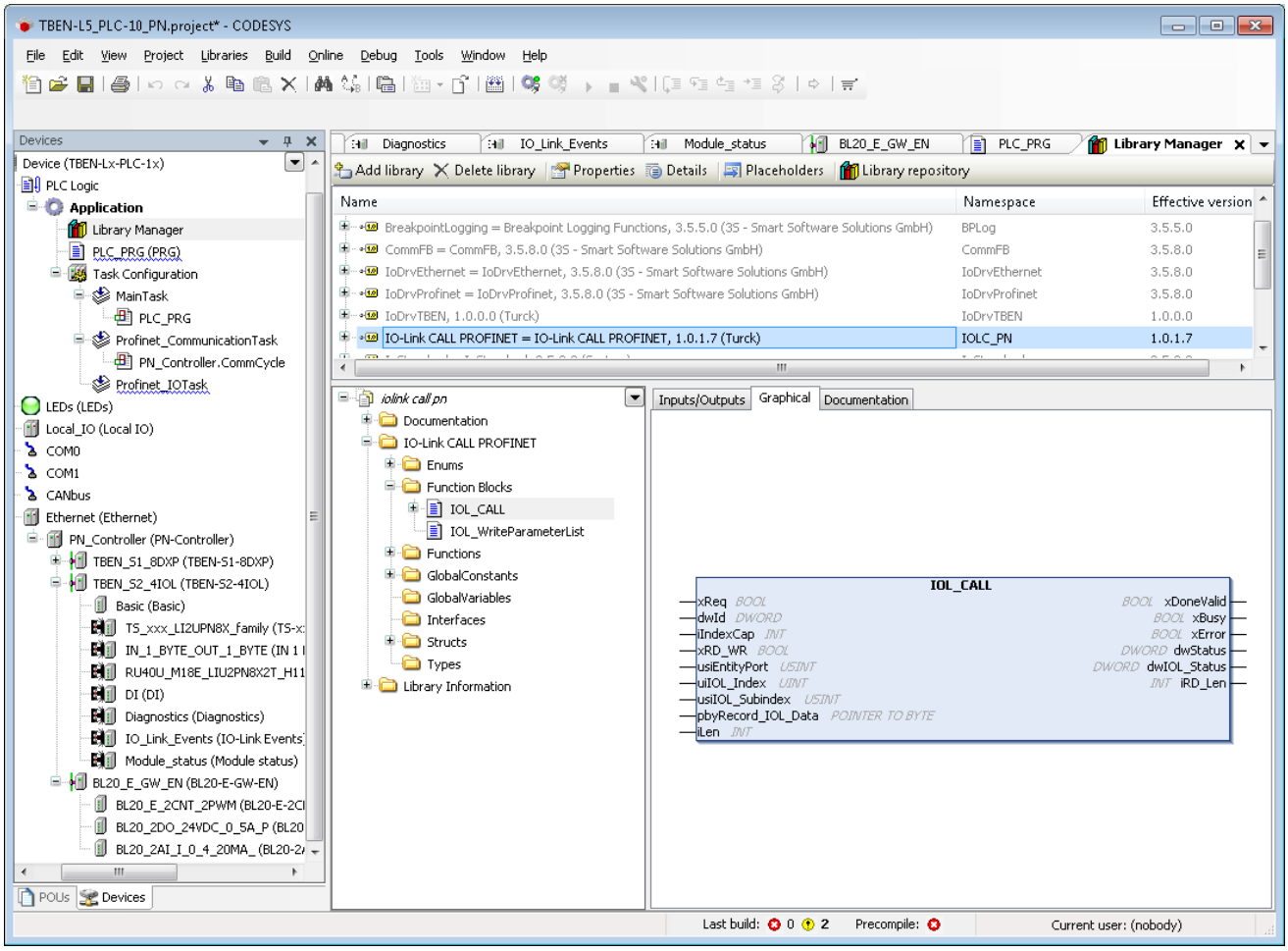

Fig. 28: Function block IOL_CALL

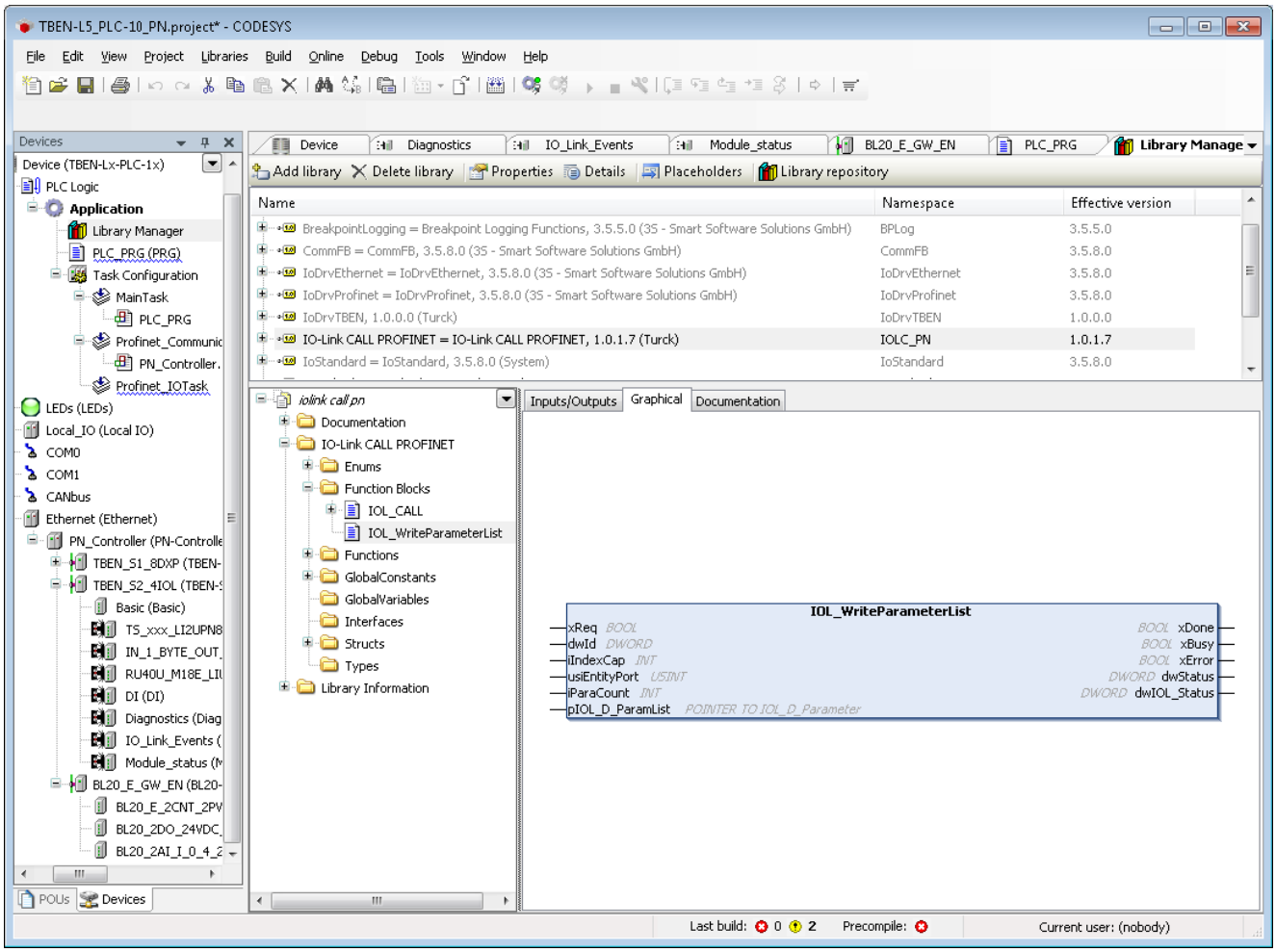

Fig. 29: Function block IOL_WriteParameterList

4 Using the Device as PROFINET Device

Properties	
max. number of I/O data	1024 byte in total (512 IN + 512 OUT)

Used Hardware

- Controller.
  - Siemens CPU 1515-2 PN
- Device:
  - TBEN-L5-PLC-10

Used Software

- CODESYS V3, 3.5.8.10
- TBEN-L…-PLC-1…_V1.0.3.0.package
- TIA Portal V13
- GSDML-V2.3-TURCK-CDS3_PN_Device-20151208-010322.xml

4.1 Creating a CODESYS Project and Configuring the Network

- Create CODESYS project and configure the network according to **Kapitel 2, Creating a CODESYS Project and Configuring the Network**.

4.2 Configuring the PROFINET Device

4.2.1 Adding the PROFINET Device to the Project

The Turck PROFINET Device is used.

➤ **Add the Profinet_Device to Ethernet using the "Add Device" function.**

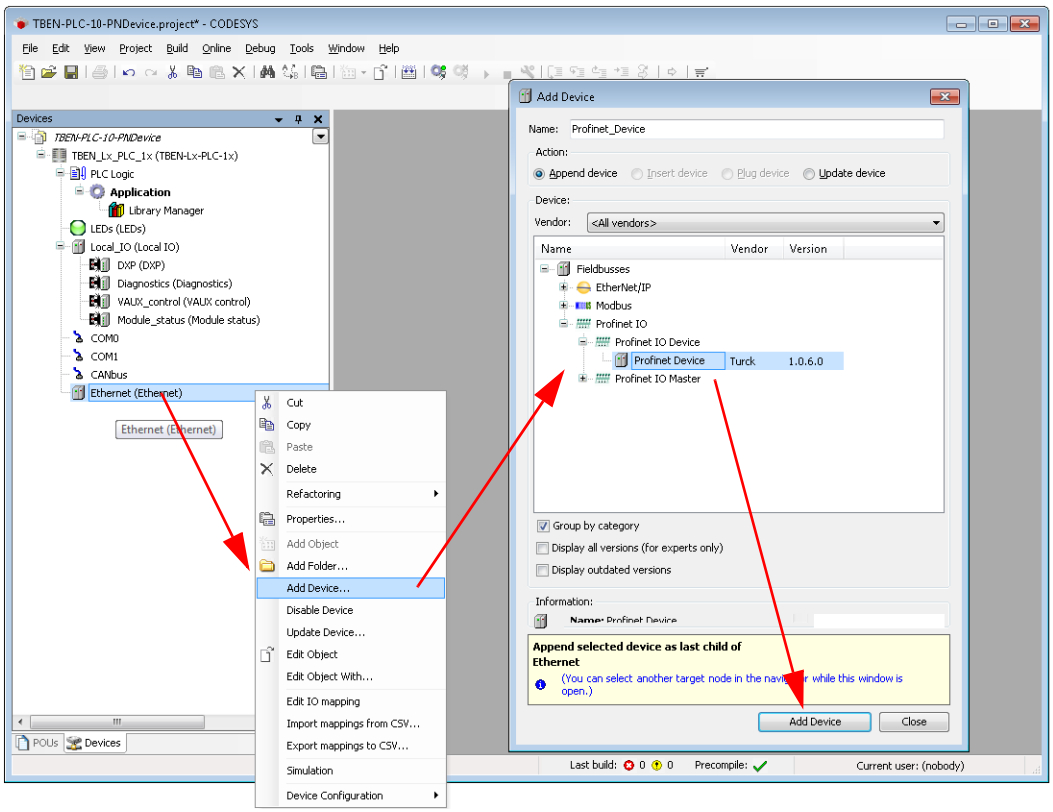

Fig. 30: Add PROFINET Device

➤ Configure the in- and output data lengths which have to be exchanged with the higher-level PROFINET Master. Therefore add the respective process data entries.

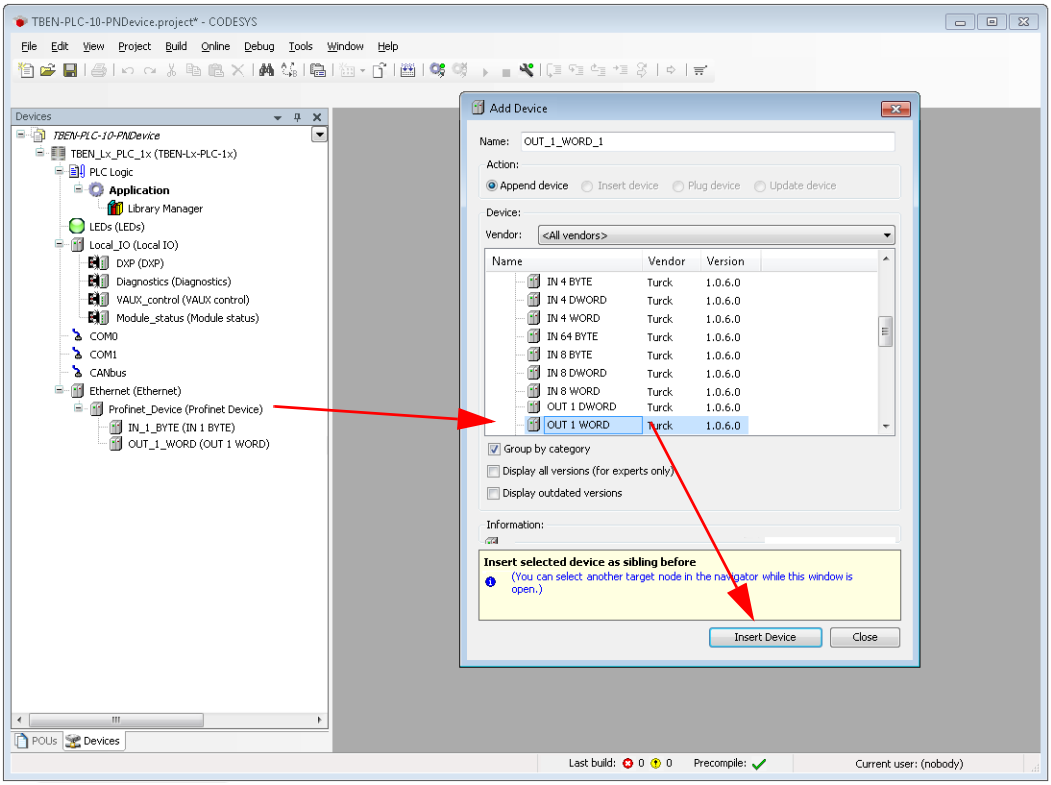

Fig. 31: Configuring the PROFINET Device

NOTE

Please observe the following for the configuration of the I/O data:
The CODESYS input data have to be have to be configured as output data in the PROFINET Controller configuration, the CODESYS output data have to be configured as input data. The data thus have to be configured in reverse order in the PROFINET Controller configuration (see also **Configuring the in- and output data (page 41)**).

Which data will be mapped into the configured input and output data, depends on assignments in the PLC program or in the I/O mapping of the TBEN-L…-PLC-….

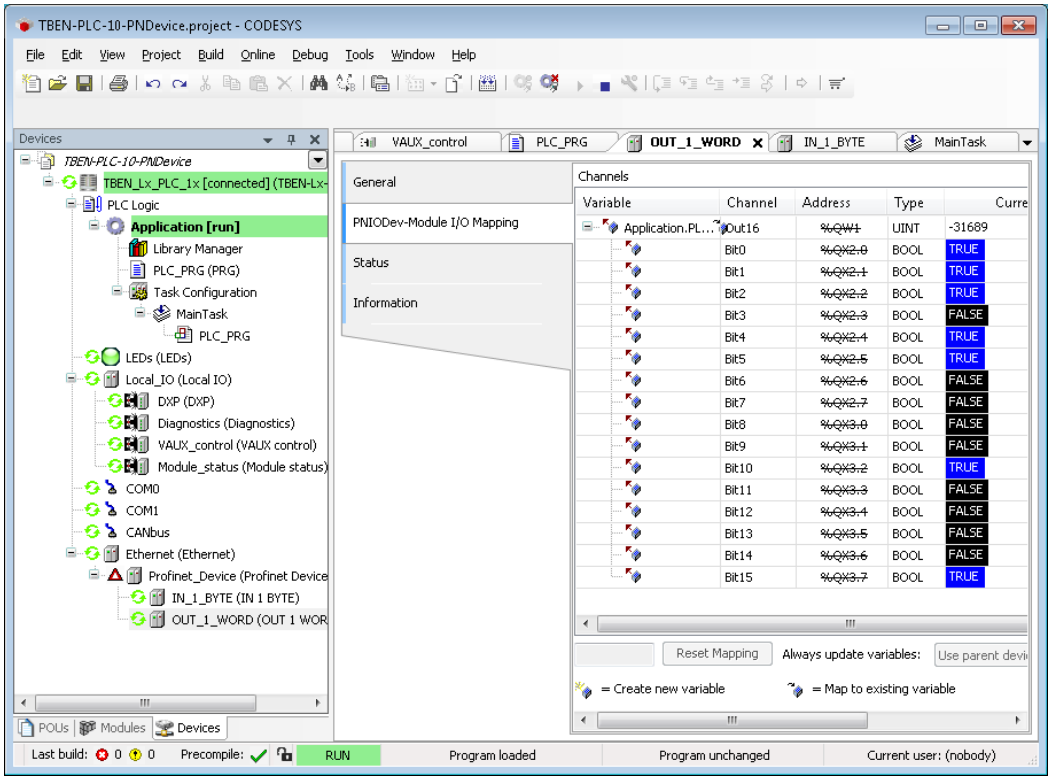

Fig. 32: PROFINET Device data mapping

NOTE

The PROFINET Device shows an error as long as a connection to the PROFINET Controller is established.

4.2.2 Configuring the PROFINET Device (CDS3 PN-Device) in TIA Portal

The following example shows the CDS3 PN-Device configuration in TIA Portal V13 from Siemens.

The PROFINET-CODESYS-device is configured as standard PROFINET Device in TIA Portal.

Installing the GSDML-file

➤ Install the device's GSDML-file (GSDML-V2.3-TURCK-CDS3_PN_Device-…-….xml) in TIA Portal. It can be downloaded at the respective product from www.turck.com.

➥ The device is added to the hardware catalog "CDS 3 PN Device".

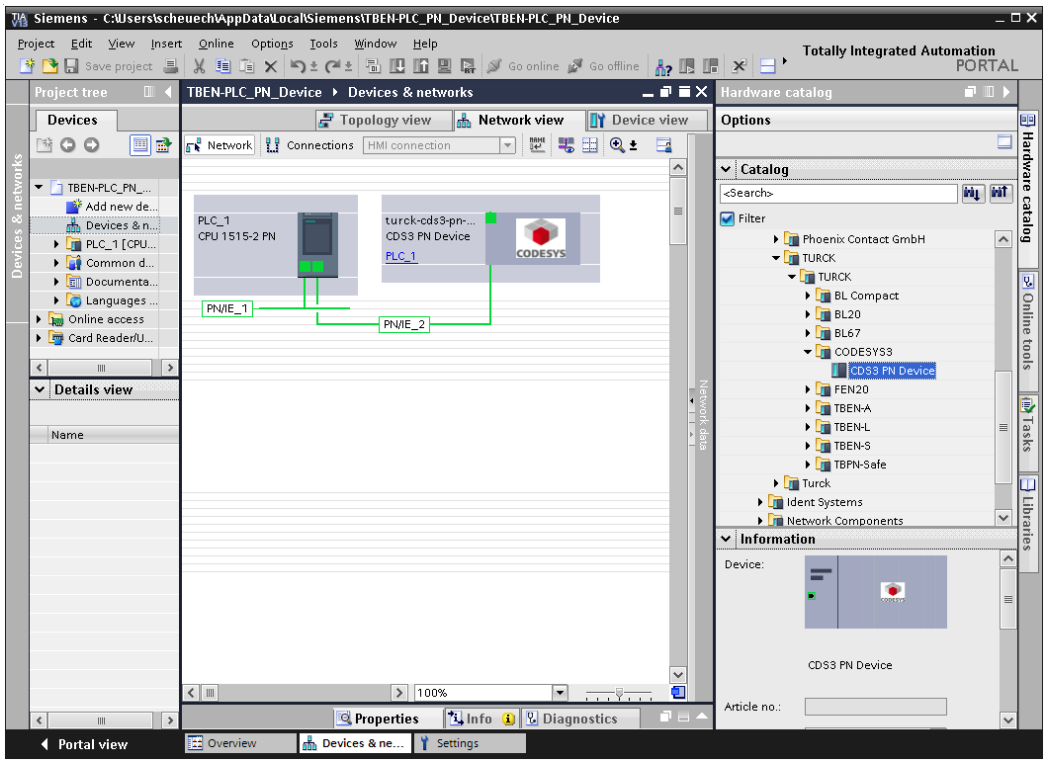

Fig. 33: Configuring the PROFINET Device in TIA Portal

Configuring the PROFINET parameters

Like for all other PROFINET Device, the PROFINET-interface has to be configured for the CDS3 PN-Device" in the project.

➤ Set all necessary IP-settings and assign a PROFINET Device name or use the device name which has already been assigned to the device.

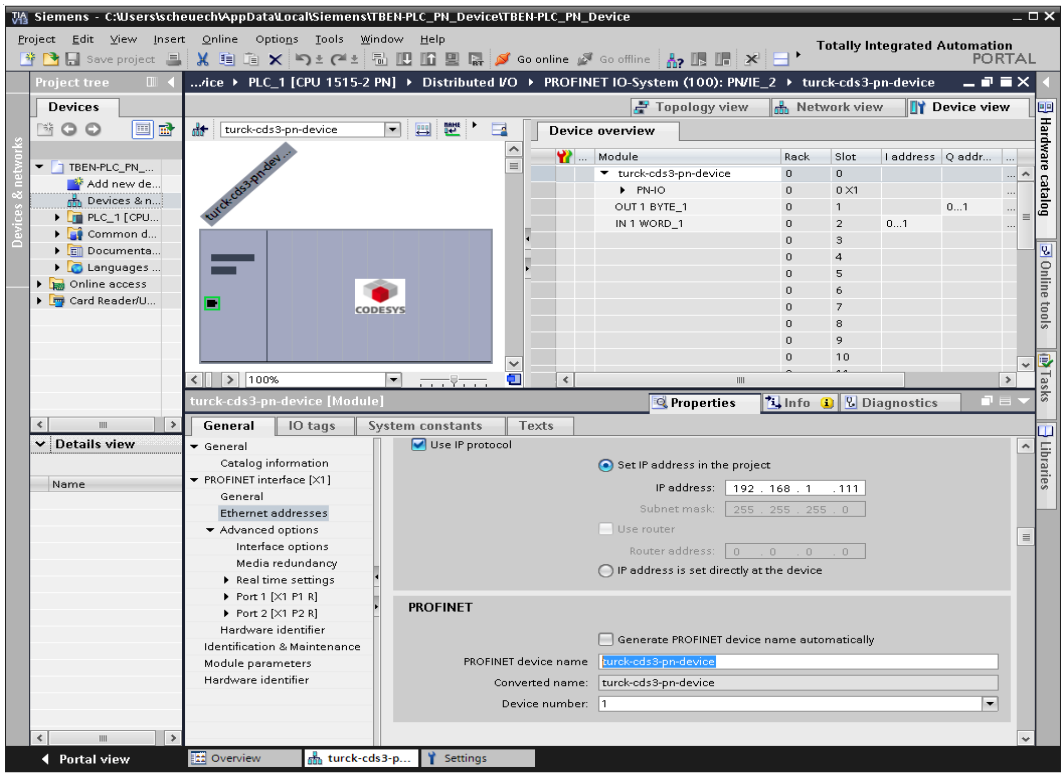

Fig. 34: Settings PROFINET-interface (CDS3 PN Device)

➤ Configure the in- and output data, which have to be exchanged with the CODESYS-device.

NOTE

The configuration of the data in TIA Portal has to be done in reverse order compared to the configuration in CODESYS. Input data in TIA Portal are output-data in CODESYS, and vice versa.
The configured data lengths have to match.

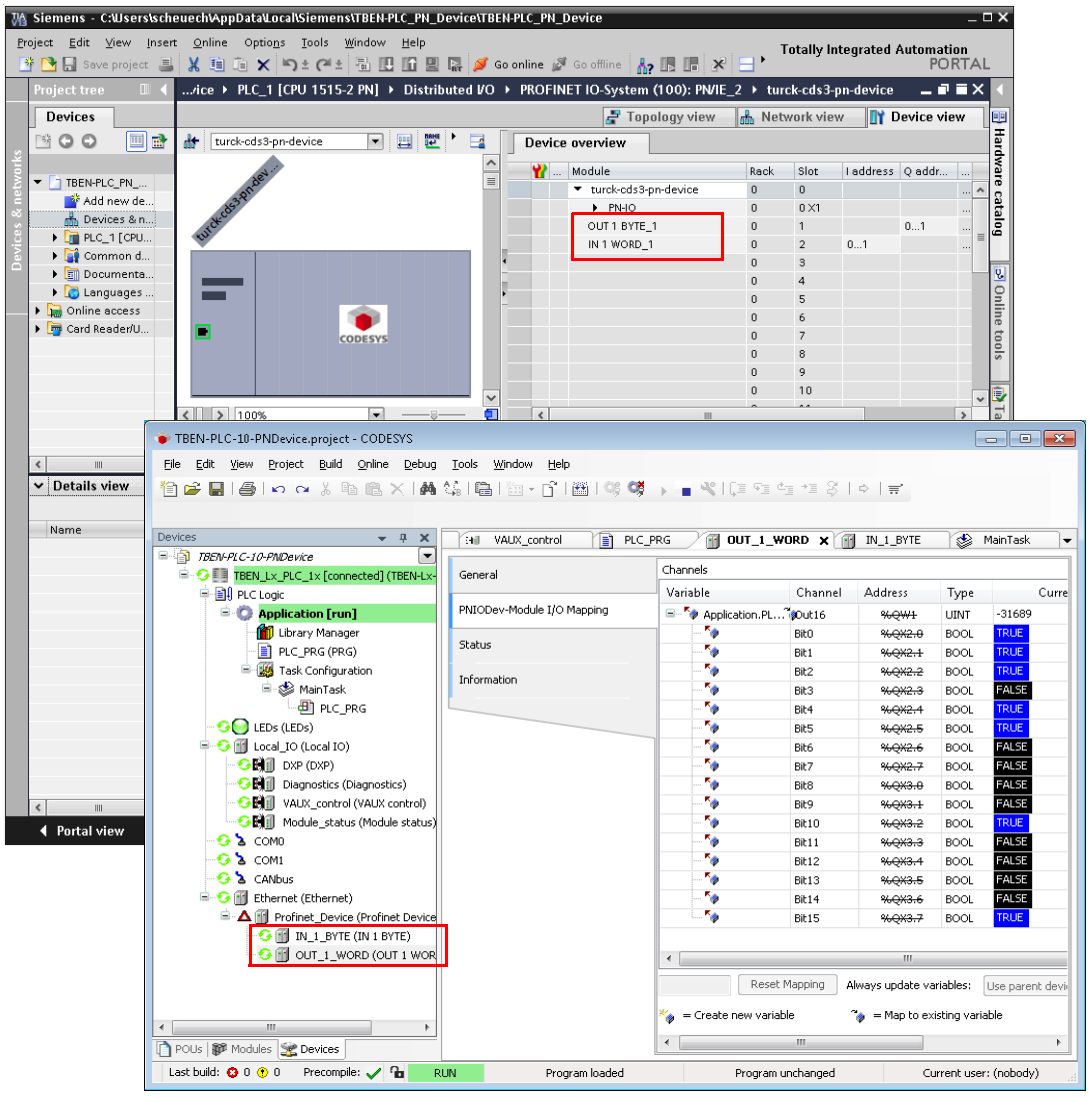

Fig. 35: Configuration of in- and output data in TIA Portal/CODESYS

After configuring the PROFINET Device in TIA Portal and starting the PN controller, the CODESYS application with the PROFINET Device is running error free.

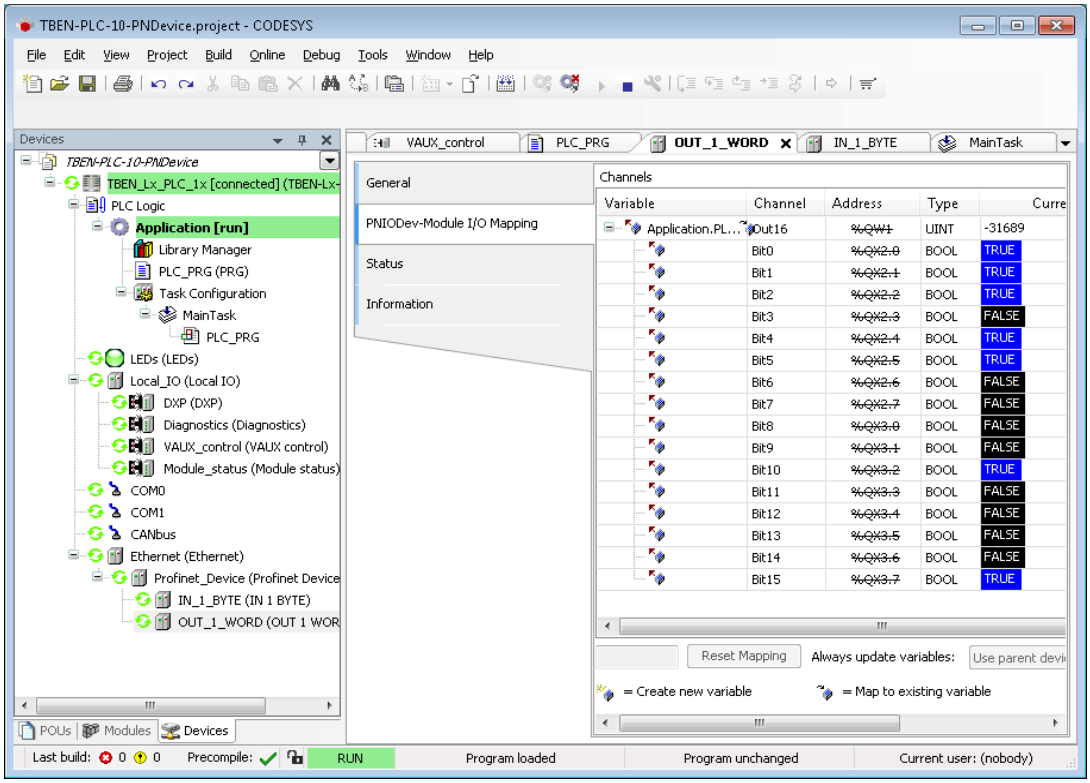

Fig. 36: CODESYS application with PROFINET Device

TURCK

28 subsidiaries and over
60 representations worldwide!

100000538 2017/06

www.turck.com