Your Global Automation Partner

TURCK

IO-Link Devices
Commissioning

Table of contents

1 About these instructions

The instructions describe the setup, functions and use of the system, and help you to commission Turck IO-Link devices. Read this manual carefully before using the system. This is to avoid potential damage to people, property, or the device. Keep the manual in a safe place as long as the system is in use.

1.1 Target groups

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

1.2 Explanation of symbols used

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.
	**WARNING** WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided.
	**CAUTION** CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.
	**NOTICE** NOTICE indicates a situation which may lead to property damage if not avoided.
	**NOTE** NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work.
▶	**CALL TO ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULTS OF ACTION** This symbol denotes relevant results of actions.

1.3 Other documents

Besides this document the following material can be found on the Internet at www.turck.com:

- Data sheets
- Instructions for use
  - Instructions for use BL…-4IOL…
  - Instructions for use TBEN-S2-4IOL
  - Instructions for use TBEN-L…-8IOL
  - Instructions for use FEN20-4IOL
  - Instructions for use TBPN-L…
  - Instructions for use TBIP-L…
  - Instructions for use IO-Link devices
- IO-Link parameter manuals
- Safety manuals
- Approvals

1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to techdoc@turck.com.

2 Notes on the product

2.1 Product identification

This manual applies to all IO-Link-capable Turck devices.

2.2 Turck service

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database under www.turck.com contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats.

The contact details of Turck subsidiaries worldwide can be found on p. [▷ 161].

3 For your safety

The product is designed according to state-of-the-art technology. However, residual risks still exist. Observe the following warnings and safety notices to prevent damage to persons and property. Turck accepts no liability for damage caused by failure to observe these warning and safety notices.

3.1 Intended use

IO-Link is a digital point-to-point connection for use in industrial automation applications. IO-Link-capable sensors and actuators can be set in an advanced manner and operated via the IO-Link interface. Cyclic process data and acyclic data can be exchanged and energy transferred between an IO-Link master and an IO-Link device.

With IO-Link, different devices (e.g., a temperature sensor and a linear position sensor) on an input module. For further information, refer to the device-specific instructions for use.

4 System description IO-Link

IO-Link is a fieldbus-independent communication interface for sensors and actuators. A digital, serial point-to-point connection transmits signals and energy among any networks, fieldbus systems, or backplane bus systems.

Each IO-Link system consists of an IO-Link master and an IO-Link device (e.g., sensor, I/O hub, valve manifold). An IO-Link master has at least one IO-Link port (channel). An IO-Link device can be connected to each port. The system components are connected to each other via standard 3-wire (Class A) or 5-wire (Class B) unshielded cables, depending on the port specification.

IO-Link technology is described in the "IO-Link Interface and System Specification" and IEC 61131-9. IO-Link-capable devices comply with either the V1.0 specification or the V1.1 specification.

The properties, functions, and parameters of the IO-Link devices are shown in an electronic device description (IODD). The IODDs for Turck devices can be downloaded via the Turck Software Manager and are also available free of charge at www.turck.com. The IODDs of all devices are structured in the same way and contain the following information for system integration:

- Communication properties
- Device parameters with value range and default value
- Identification, process, and diagnostic data
- Device data
- Text description
- Image of the device
- Manufacturer's logo

The structure of the IODD is specified by the IO-Link specification and is the same for all IO-Link devices. The IODD structure is based on indexes. In the IODD, fixed indexes are assigned to the communication properties, device parameters, identification, process, diagnostic, and device data, via which the parameters can be controlled. Some indexes are further subdivided by subindexes.

4.1 Features

- Point-to-point connection (max. cable length: 20 m)
- Unshielded standard 3-wire or 5-wire cables
- Cyclical process data transmission
- Acyclic transfer of data, e.g., device data and events
- Communication between the IO-Link master and IO-Link devices is possible in three transmission rates
- Parallel exchange of the device data without affecting the process data
- Communication through 24 V pulse modulation, standard UART protocol

4.2 System architecture

At least one IO-Link master and one IO-Link device (e.g. sensor or actuator) are required for IO-Link communication. IO-Link master and IO-Link device are interconnected via an unshielded 3-wire or 5-wire standard cable. The setting can be carried out with a configuration tool or via the fieldbus level.
The IO-Link master establishes the connection between IO-Link device and the higher-level control system. An IO-Link master can have several IO-Link ports. Only one IO-Link device can be connected to each port.
Devices with a digital switching input or output can also be integrated into automation systems via IO-Link I/O hubs.
Standard tools and functions are provided for the integration, commissioning and configuration of the IO-Link communication.

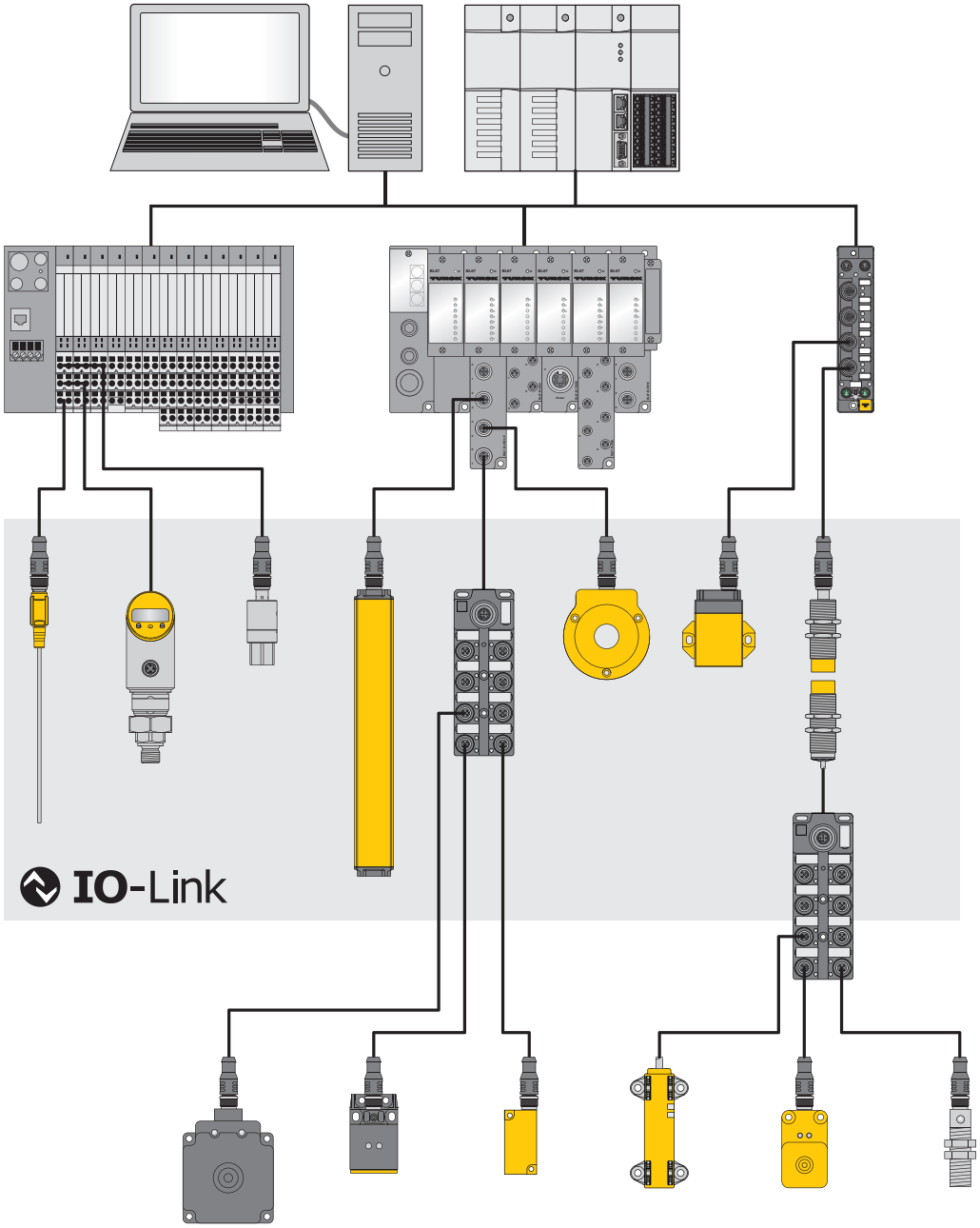


Fig. 1: IO-Link system overview

4.3 Operating principle

IO-Link is a digital point-to-point connection between an IO-Link master and an IO-Link device. Process data and other information such as parameters and diagnostic messages are transferred with a 24 V pulse modulation via a combined switching status and data channel (C/Q).

IO-Link communication is independent of the fieldbus used.

4.4 Operating modes

The operating mode can be set separately at any port of the IO-Link master.

Two operating modes are available for the IO-Link master:

- IO-Link mode: IO-Link communication possible
- Standard I/O mode (SIO): digital I/O communication

IO-Link communication is implemented via the switching and communication cable (C/Q).

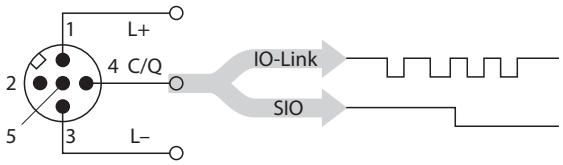


Fig. 2: IO-Link communication via C/Q

During initialization the ports of the IO-Link master behave like a normal digital input. The IO-Link devices are operated in SIO mode as digital switching input and switching output. A command of the higher-level IO-Link master establishes IO-Link communication in IO-Link mode. This command is called the “Wake-up request”.

4.4.1 IO-Link mode

In IO-Link mode communication takes place between an IO-Link master and an IO-Link device. Communication always starts from the IO-Link master.

Transmission speed between IO-Link master and IO-Link device

Three transmission rates are defined in the IO-Link specification:

- COM1: 4,8 kBaud
- COM2: 38,4 kBaud
- COM3: 230,4 kBaud

Each device supports only one transmission rate, an IO-Link master supports all transmission rates. The transfer time of the cyclical process data is determined by the telegram length as well as the delay times in the device and the master. With a transmission rate of 38.4 kBaud and a telegram length of 2 byte the transmission time is typically 2.3 ms.

Response times

The response time of the IO-Link system provides information on the frequency and speed of the data transmission between IO-Link master and IO-Link device. This response time depends on the following factors:

- Minimum cycle time: Intervals defined in the IODD in which the IO-Link master addresses the IO-Link device. Different minimum cycle times can be defined for different devices.
- Internal processing time of the IO-Link master and the IO-Link device

Cyclical and Acyclical Communication

The data exchanged between IO-Link master and the IO-Link device can be divided into cyclical process data and acyclical data. Process data and value states are transferred cyclically. Acyclical data is transferred separately to cyclic process data. Acyclical data includes device data, parameter functions and events such as diagnostic information, which is only transferred on request. The two communication types are independent of each other and do not interact.

Cyclical communication	
Process data	**Value status (port qualifier)**
■ 0…32 bytes of process data possible per device (each input and output) ■ Process data size determined by the device	■ The Port Qualifier indicates whether the process data is valid or not.

Acylical communication	
Device data	**Value status (port qualifier)**
■ Parameters, identification data or diagnostic information ■ Data exchange on request of the IO-Link master ■ Device data can be written to the device or read from the device.	■ Device indicates event to master: Error messages and warnings ■ Master indicates event to device: e.g. cable break or communication abort

Combining IO-Link devices with different specifications

Only devices of specification V1.0 can be operated on IO-Link masters of specification V1.0. Devices of specification V1.0 and V1.1 can be operated on IO-Link masters of specification V1.1.

	IO-Link device V1.0	IO-Link device V1.1
IO-Link master V1.0	x	-
IO-Link master V1.1	x	x

Data Storage Mode

NOTE
Data storage mode is only available for devices complying with the IO-Link specification V1.1. IO-Link devices in accordance with IO-Link specification V1.0 do not support data storage.

Data storage mode makes it possible to replace IO-Link devices without the need for a reconfiguration.

The IO-Link master or the IO-Link device save the device parameters set in the previous configuration. In data storage mode the parameter data memories of IO-Link master and IO-Link device are synchronized. If data storage mode is activated in the IO-Link master, the master writes the stored device parameters to the new device after a device is replaced. The application can be restarted without having to perform a new configuration.

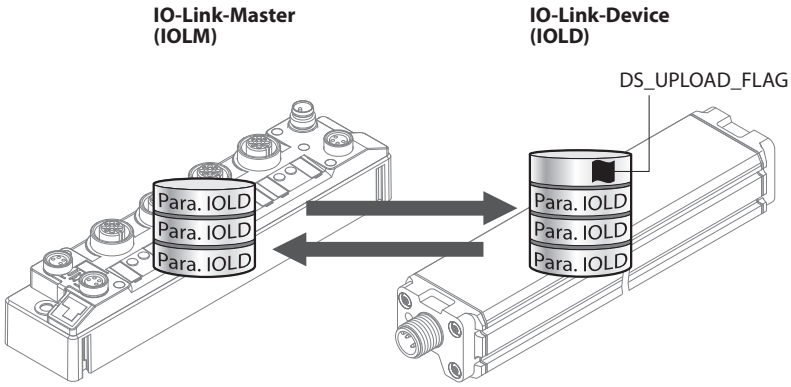


Fig. 3: Data storage mode – general principle, Para. IOLD = parameters of the IO-Link device

4.4.2 Standard I/O mode (SIO mode)

In standard I/O mode IO-Link devices behave like digital sensors or actuators. In this mode the devices only send input or output data to the higher-level instance. IO-Link access to the device is not possible.

4.5 IO-Link configuration in PROFINET

SIDI (Simple IO-Link Device Integration) enables IO-Link devices in PROFINET applications to be configured directly in the programming environment (e.g. TIA Portal). The Turck IO-Link devices are integrated in the GSDML file of the TBEN, TBPN and FEN20 series IO-Link masters and can be set in the programming environment as submodules of a modular I/O system. During this process, the user has access to the device properties and parameters. The scope of the device and functions differs depending on the version of the GSDML file. For some SIDI devices, not all parameters are available.

A customized SIDI can also be created on request.

5 Connection

A Turck IO-Link master has one or more ports for connecting IO-Link devices. The IO-Link devices are connected to the ports of the IO-Link master via unshielded 3-wire or 5-wire standard cables. The maximum cable length is 20 m.

The IO-Link specification distinguishes between two types of ports with a different power supply for IO-Link masters.

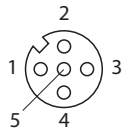
- Port Class A: The functions of pins 2 and 5 are manufacturer-specific. For example, pin 2 can be assigned an additional digital channel.
- Port Class B: An additional galvanically isolated supply voltage is provided via pins 2 and 5. Class B IO-Link ports are suitable for connecting IO-Link devices that have an increased power requirement. A standard 5-wire cable is required to use the additional supply voltage.

Adapters are available for connecting Port Class B devices to Port Class A masters (ID 6629515 and 6629516).

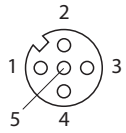
5.1 Wiring diagrams

5.1.1 IO-Link master

IO-Link master Port Class A wiring diagram

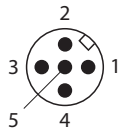
Pin	Pin assignment	Wiring diagram
Pin 1	V_1+	
Pin 2	Manufacturer-specific (e.g., additional digital channel)	
Pin 3	V_1-	
Pin 4	C/Q	
Pin 5	n. c.	

IO-Link master Port Class B wiring diagram

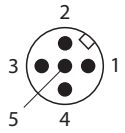
Pin	Pin assignment	Wiring diagram
Pin 1	V_1+	
Pin 2	V_2+	
Pin 3	V_1-	
Pin 4	C/Q	
Pin 5	V_2-	

5.1.2 IO-Link device

IO-Link device Class A wiring diagram

Pin	Pin assignment	Wiring diagram
Pin 1	V_1+	
Pin 2	not specified	
Pin 3	V_1-	
Pin 4	C/Q	
Pin 5	n. c.	

IO-Link device Class B wiring diagram

Pin	Pin assignment	Wiring diagram
Pin 1	V_1+	
Pin 2	V_2+	
Pin 3	V_1-	
Pin 4	C/Q	
Pin 5	V_2-	

6 Configuration and commissioning

▶ Set the IO-Link master to IO-Link mode (see device-specific instructions for use).

If the port is set to IO-Link mode, the IO-Link master attempts to establish communication with the IO-Link device. IO-Link communication is established in IO-Link mode by means of a wake-up request from the higher-level IO-Link master. The IO-Link master first attempts to establish transmission with the highest defined data transmission rate. If communication cannot be established, the master automatically attempts to establish communication at the next lowest data transmission rate.

The transmission starts when the master receives feedback from the device. First, the communication parameters are exchanged. If necessary, parameters stored in the system are transferred from the IO-Link master to the device. The cyclic exchange of process data and value status then begins.

IO-Link devices can be commissioned via a Turck IO-Link master on various types of controller. In PROFINET systems, the GSDML file of the IO-Link master is required for this purpose. The GSDML files for the Turck devices are available free of charge for download at **www.turck.com**.

In Ethernet/IP systems, the EDS file of the IO-Link master is required for this purpose. The EDS files for the Turck devices are available for download at **www.turck.com**.

The following examples describe the configuration of IO-Link devices. The following scenarios are possible:

- Configure devices via a PC using a configuration tool
  - Configure with IO-Link USB adapter
  - Configure with IO-Link master
  - Set with IO-Link master and IODD configurator
- Configure devices via the fieldbus level
  - Configure with programmable gateway and CODESYS 2
  - Configure with programmable gateway and CODESYS 3
  - Configure with Siemens controller in Simatic Manager
  - Configure with Siemens controller in the TIA Portal
  - Configure with Allen-Bradley controller in Studio 5000
- Configure devices via the fieldbus level with extended GSDML file

6.1 Setting devices via a PC using a configuration tool

IO-Link devices can be configured via a PC using a configuration tool (e.g., PACTware). All the required Turck software components can be downloaded via the Turck Software Manager.

The Turck Software Manager is available free of charge at **www.turck.com**.

6.1.1 Setting using a USB adapter and configuration tool

Software used

This example uses the following software:

- PACTware 4.1 configuration tool
- IODD interpreter configuration software
- DTM for USB IO-Link adapter USB-2-IOL-0002
- IODD for temperature sensor TS720-2UPN8-H1141

Hardware used

- TS720-2UPN8-H1141
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- USB-IO-Link adapter USB-2-IOL-0002

Setup

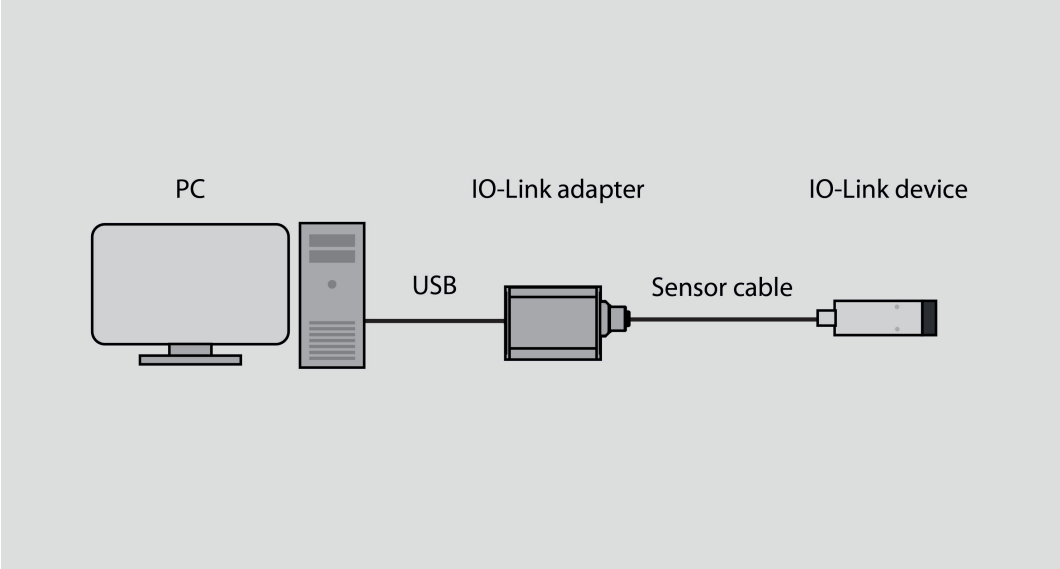


Fig. 4: Application example — setup

Example: configuring the device

- Start the IODD interpreter.
- Click on **Add IODD**.
- Select IODD for TS720-2UPN8-H1141 in the following window.
- Add IODD for temperature sensor TS720-2UPN8-H1141 by clicking on **Open**.

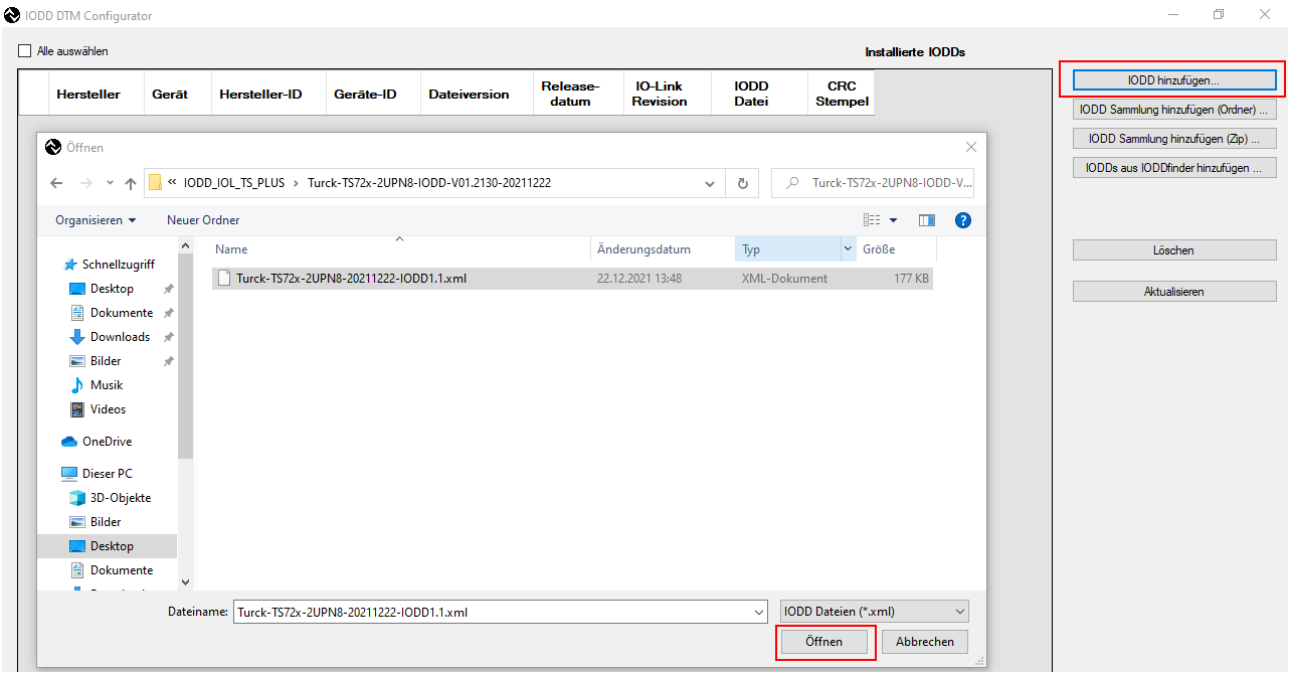


Fig. 5: Adding IODD for TS720-2UPN8-H1141 in the IODD interpreter

- Launch PACTware.
- Add a USB adapter: right-click on **Host PC** → **Add device**.

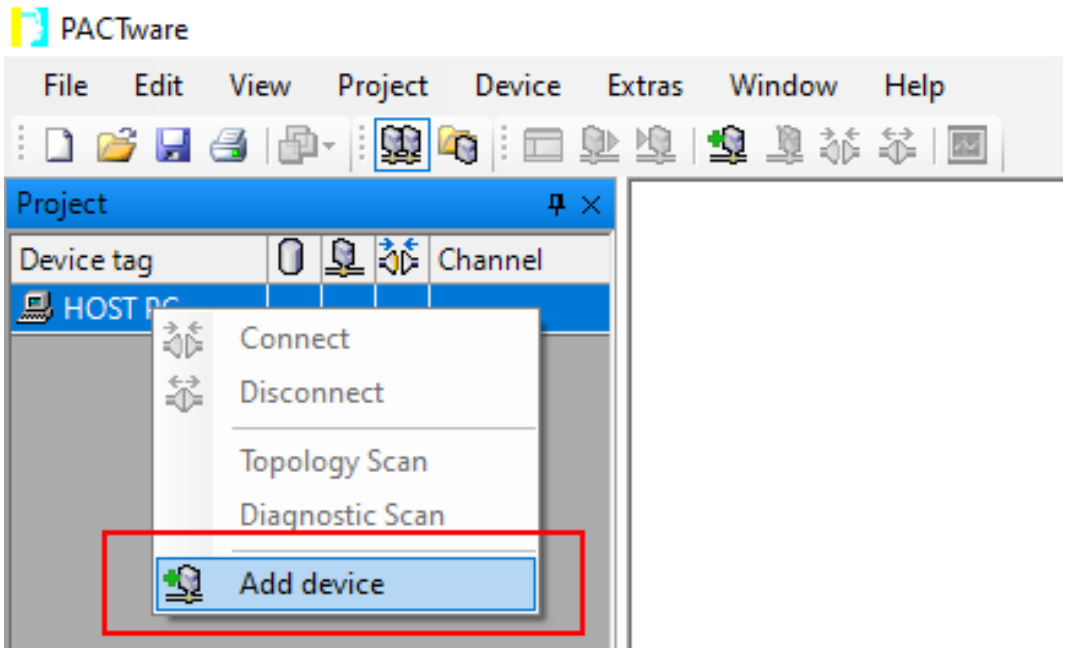


Fig. 6: Adding a device in PACTware

▶ Select the **IO-Link USB Master 2.0** IO-Link interface.

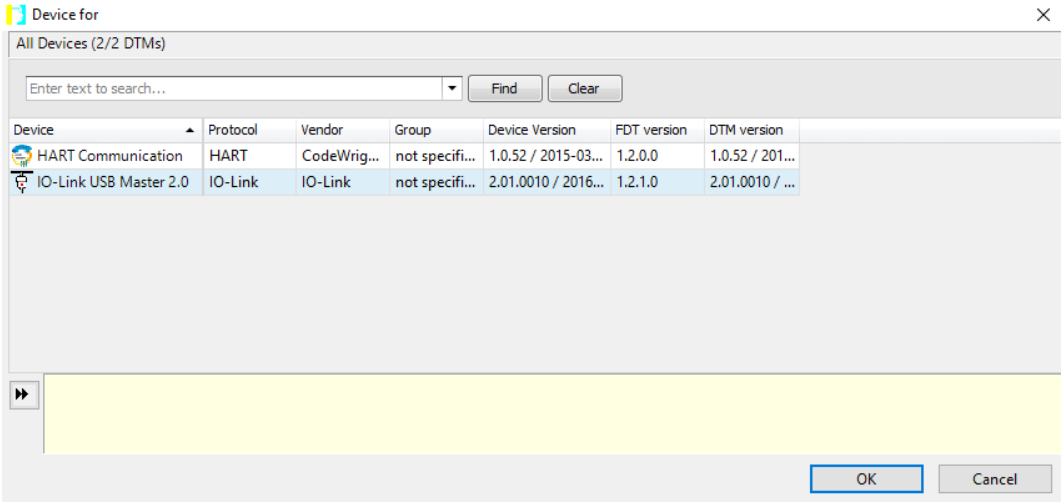


Fig. 7: Adding a USB IO-Link adapter

- Start the topology scan to find devices connected to the IO-Link adapter: Right-click on the IO-Link adapter → Click on **Topology Scan**.

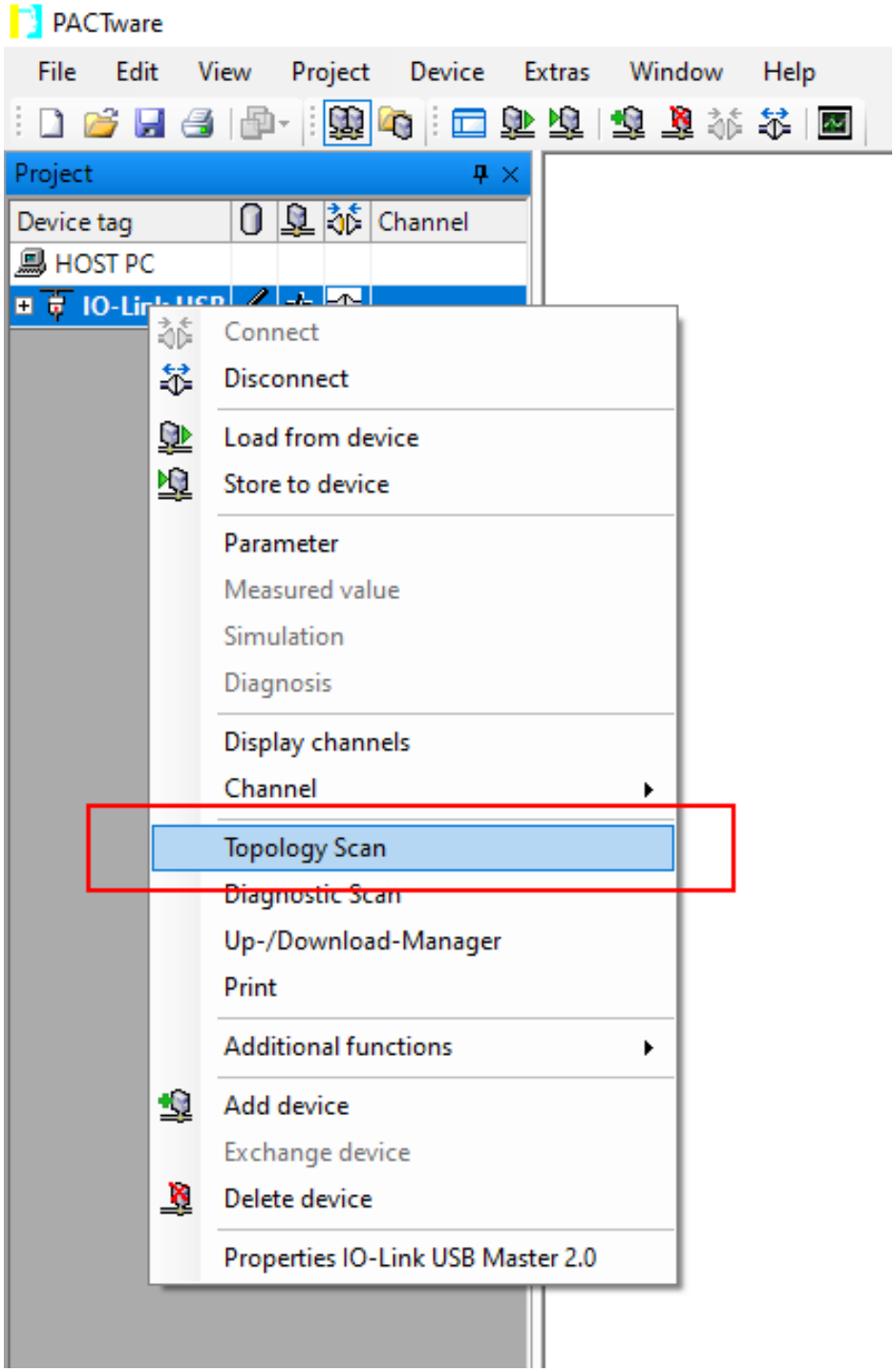


Fig. 8: Starting the topology scan

▶ Search for devices using the topology scan: Click on **Search**.

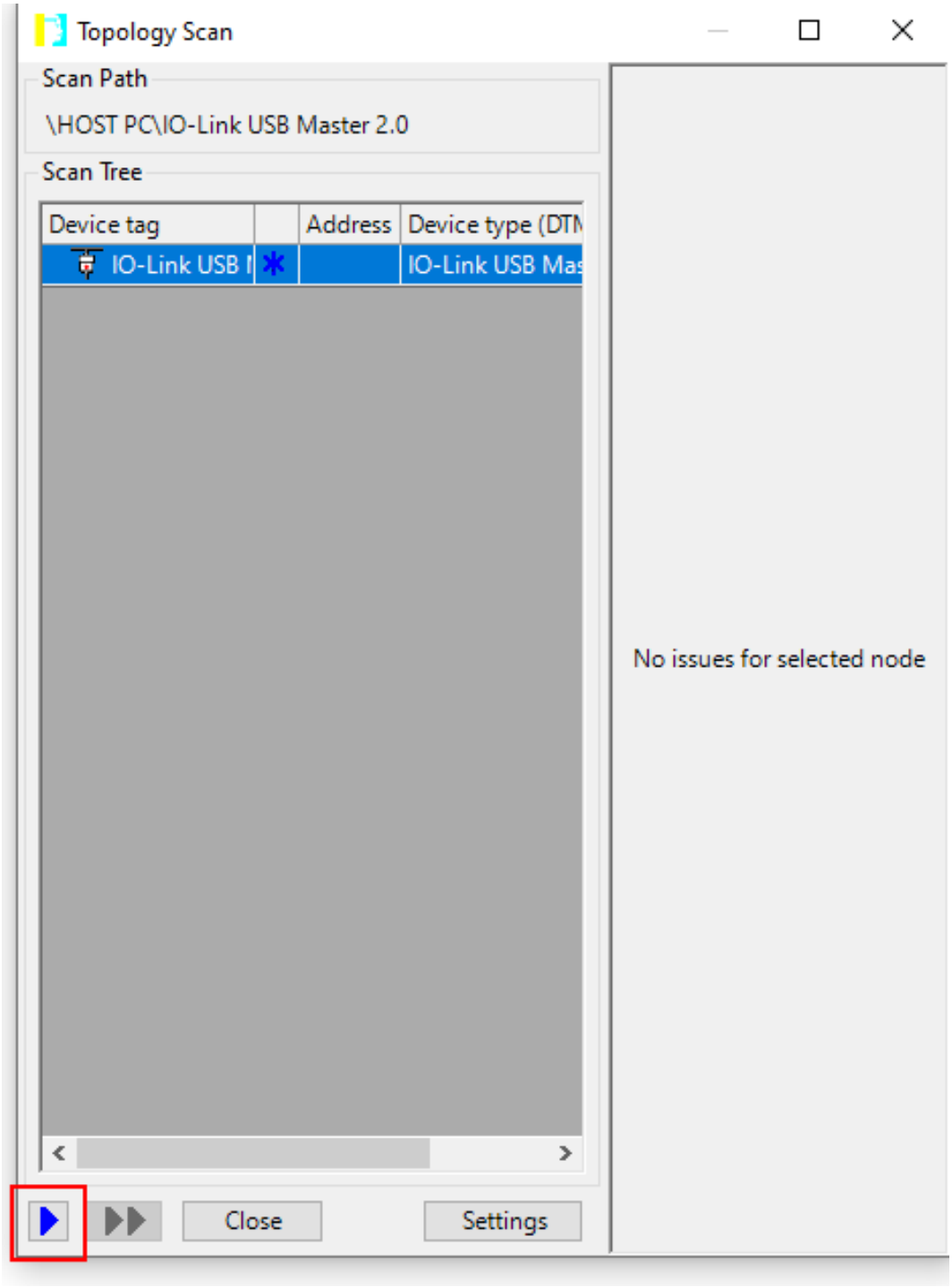


Fig. 9: Topology scan — find devices

- Select IODD for the connected device if the device is not automatically detected (see red mark).

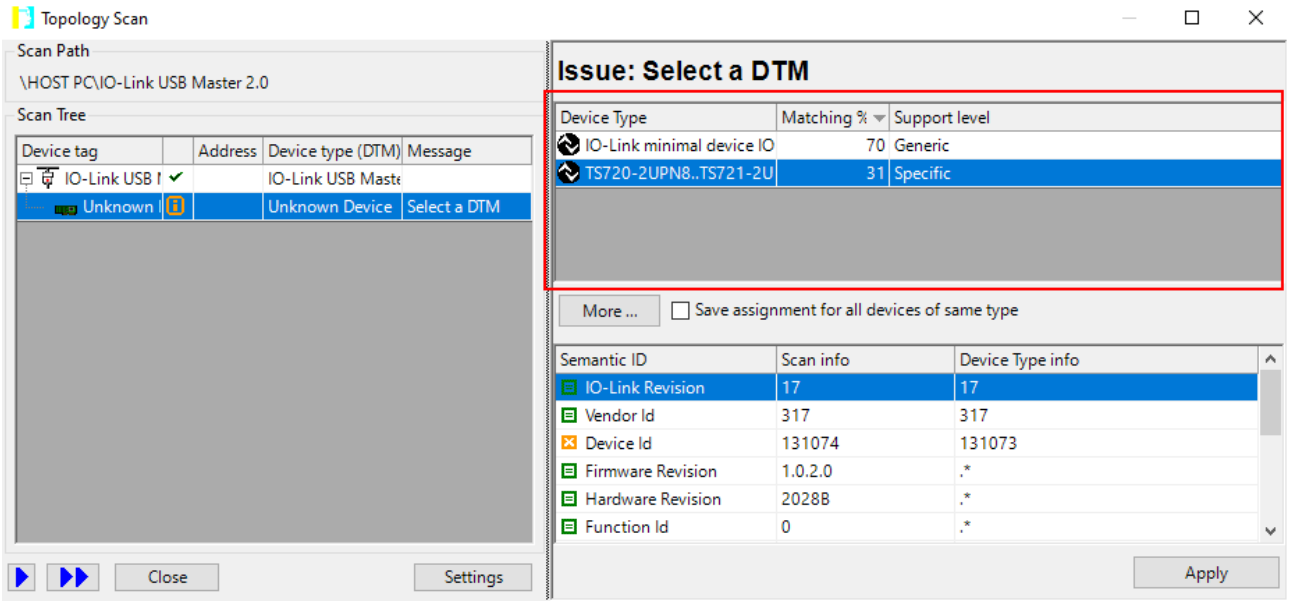


Fig. 10: Topology scan — select IODD

- Apply the settings to the configuration: Click on **Apply** → Close the topology scan.

- Establish a connection between the IO-Link device and the PC by right-clicking on the device.

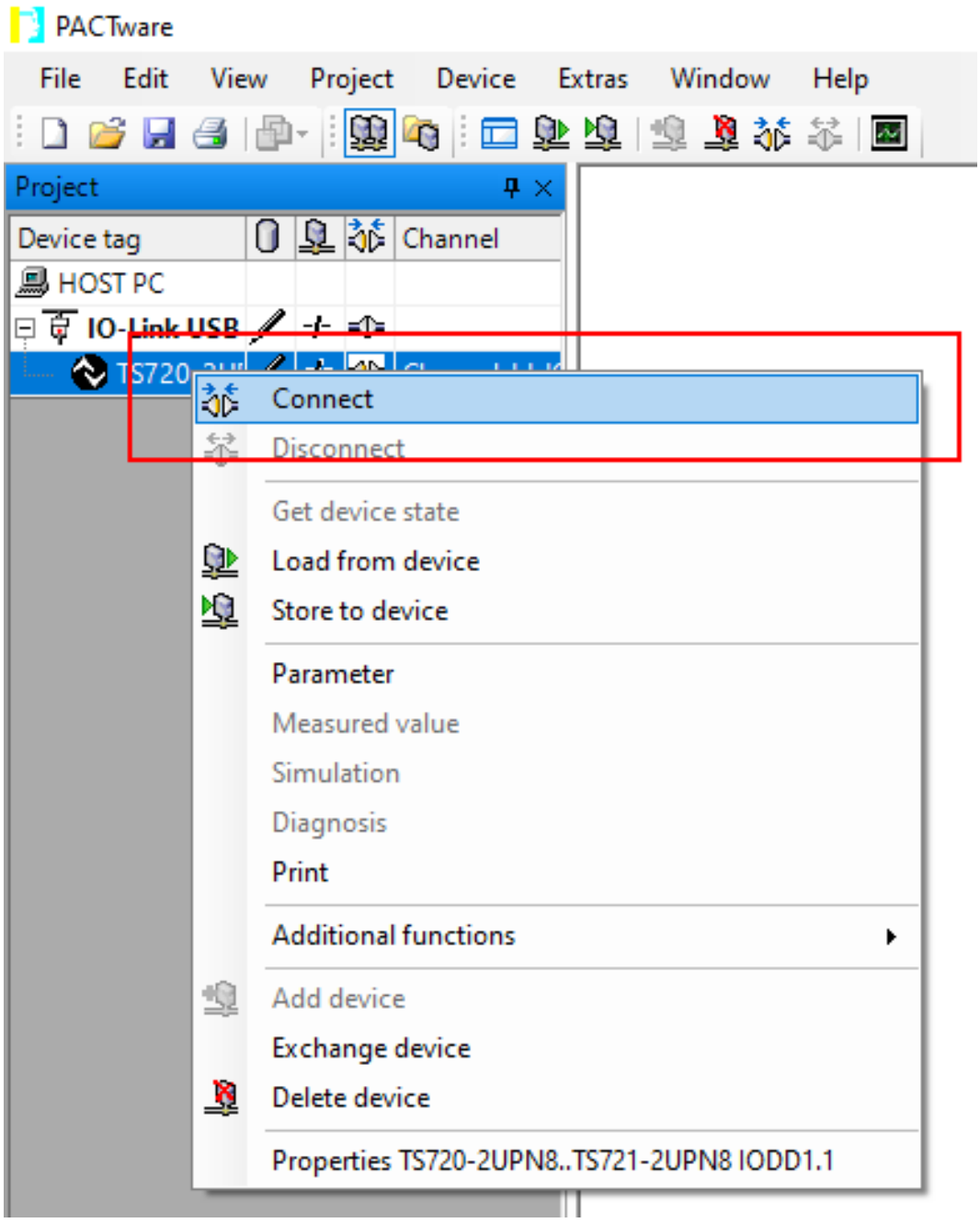


Fig. 11: Connect

- Start expert mode: right-click on the adapter → Click on **Additional functions** → **Experten Modus**.

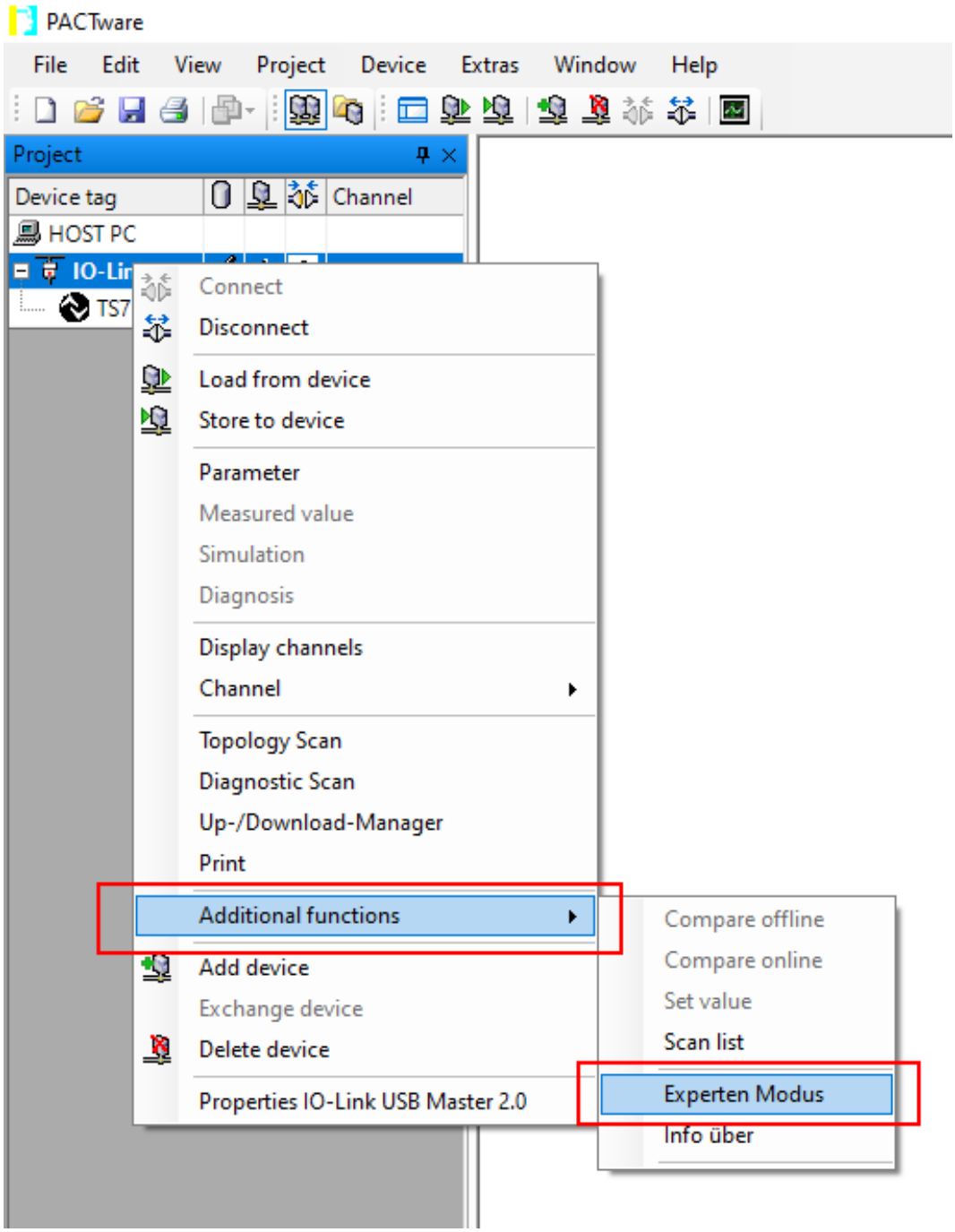


Fig. 12: Start expert mode

- Select the **IO-Link Parameters** menu item.

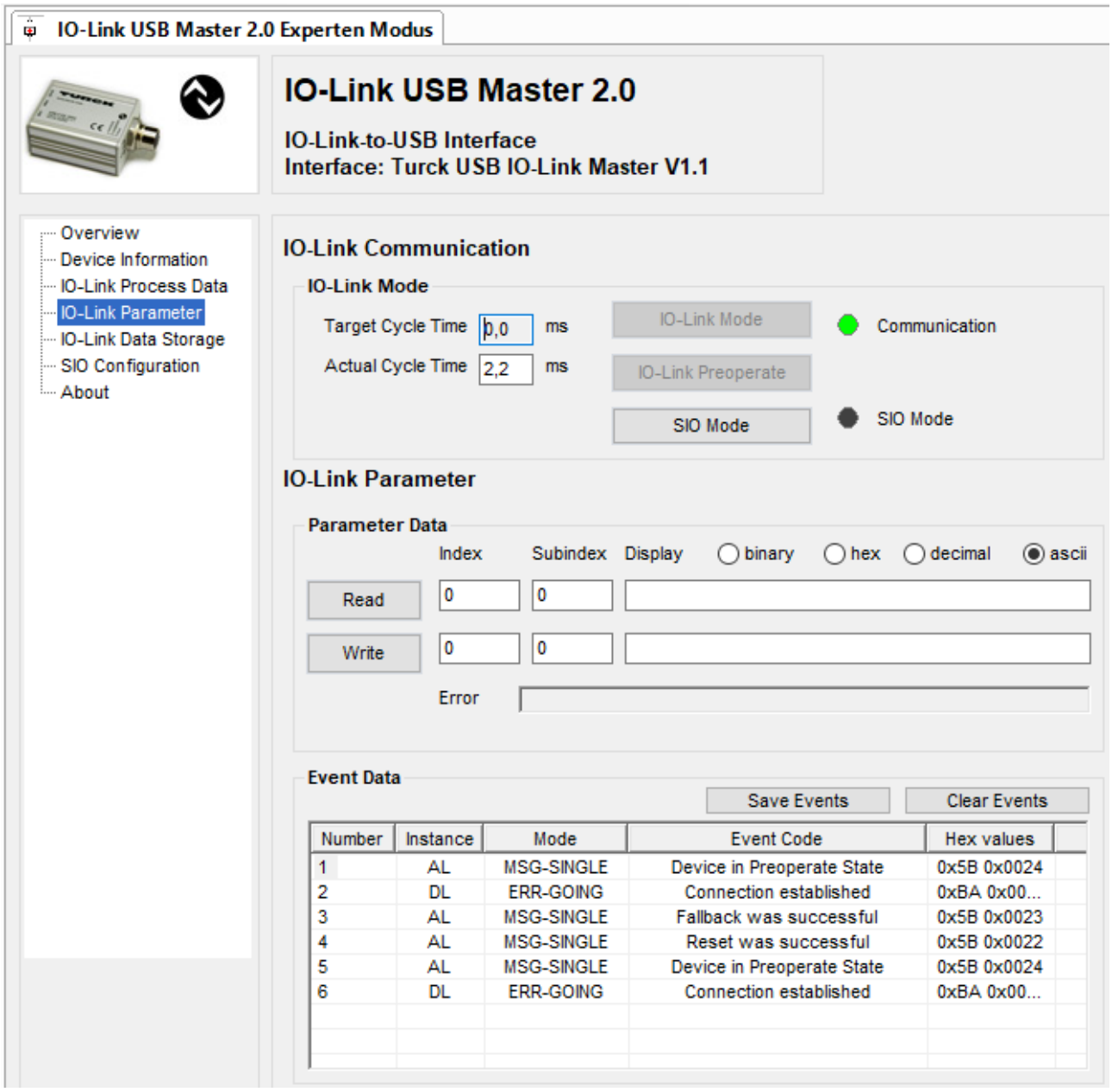


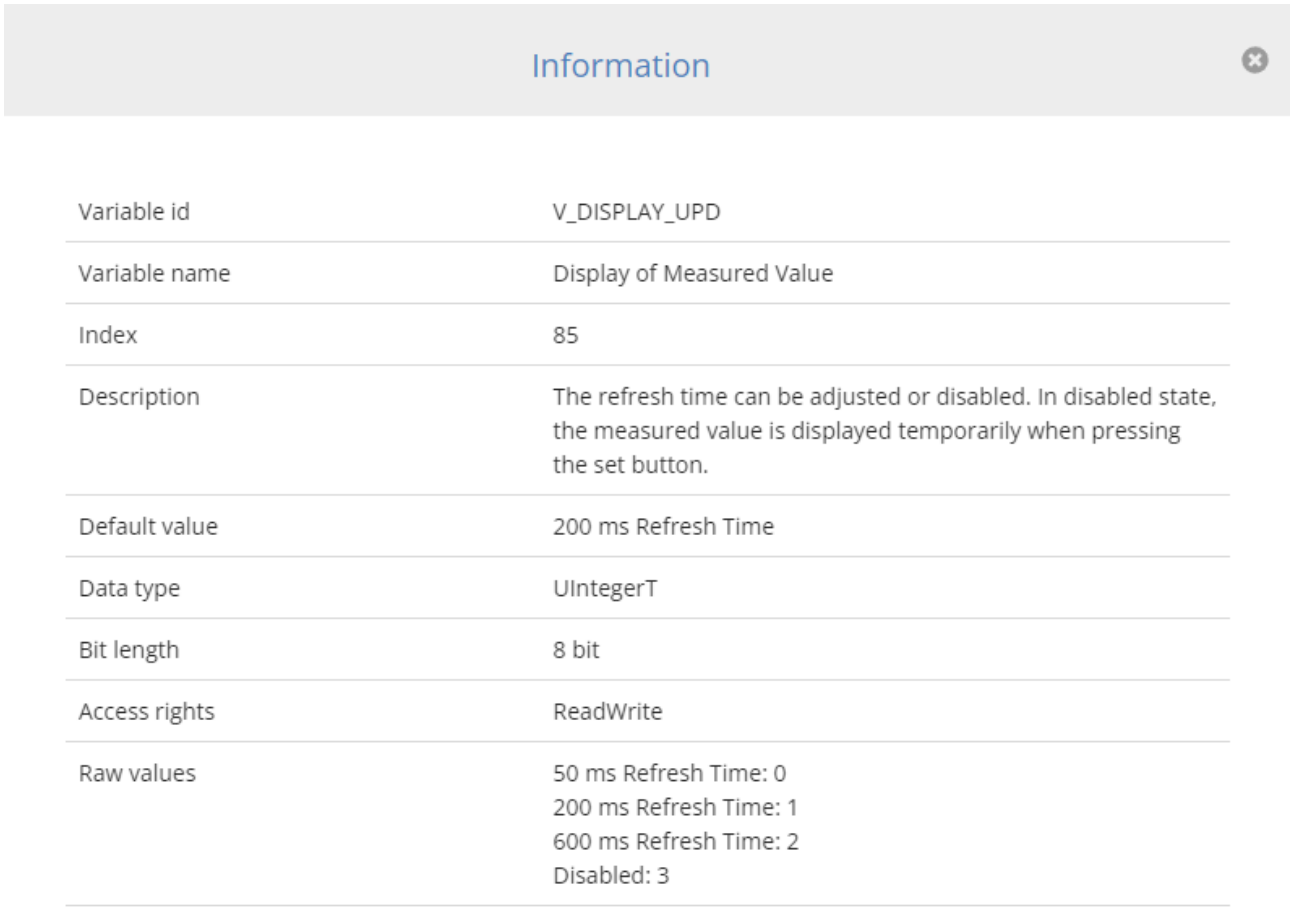
Fig. 13: PACTware expert mode — IO-Link parameters

The adjustable parameters can be found in the device-specific IO-Link parameter manuals or in the IODDfinder. The parameter manuals contain a description of the IODD and are available for download at www.turck.com. The IODDfinder can be viewed at ioddfinder.io-link.com.

Example: The command "Rotate the display and set the measured value update time" is controlled via index **85**.

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	Subindex access supported	Access	Byte. Bit Offset	Bit length	Data Type	Value	Default	Description
Display of measured value	85	0x55	0	0x0	True	read/ write	0.0	8	UInteger	0...6	0	The refresh time can be adjusted. The display can be rotated by 180° or disabled. In disabled state, the measured value is displayed temporarily when pressing the set button.
										0		50 ms refresh time
										1		200 ms refresh time
										2		600 ms refresh time
										3		50 ms refresh time/display rotated by 180°
										4		200 ms refresh time/display rotated by 180°
										5		600 ms refresh time/display rotated by 180°
										6		disabled

Fig. 14: Excerpt from the parameter manual for sensor TS720-…-H1141 (example: set the display)



Information

Variable id	V_DISPLAY_UPD
Variable name	Display of Measured Value
Index	85
Description	The refresh time can be adjusted or disabled. In disabled state, the measured value is displayed temporarily when pressing the set button.
Default value	200 ms Refresh Time
Data type	UIntegerT
Bit length	8 bit
Access rights	ReadWrite
Raw values	50 ms Refresh Time: 0 200 ms Refresh Time: 1 600 ms Refresh Time: 2 Disabled: 3

Fig. 15: Excerpt from the IODDfinder for sensor TS720-…-H1141 (example: measured value display)

- ▶ Set the number format for the index (here: **85**).
- ▶ Read out the value of the **Measured value display** parameter.
- ⇨ The default value **0** preset in the device is displayed in the display field (highlighted in red) (50 ms measured value update time).

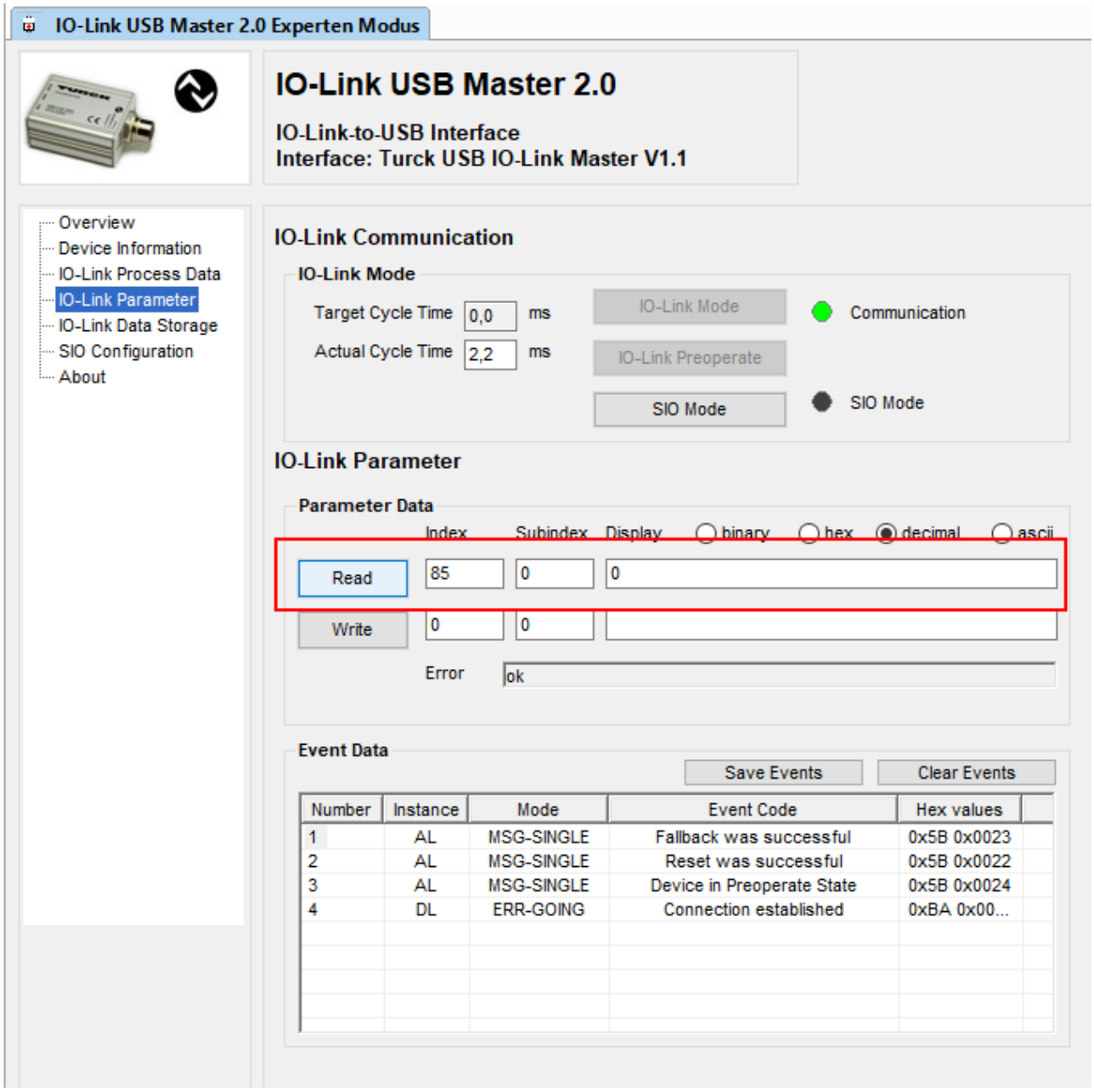


Fig. 16: Reading out parameters

- Rotate the display 180° and set a measured value update time of 50 ms: Set the index value to **03** → **Write**.

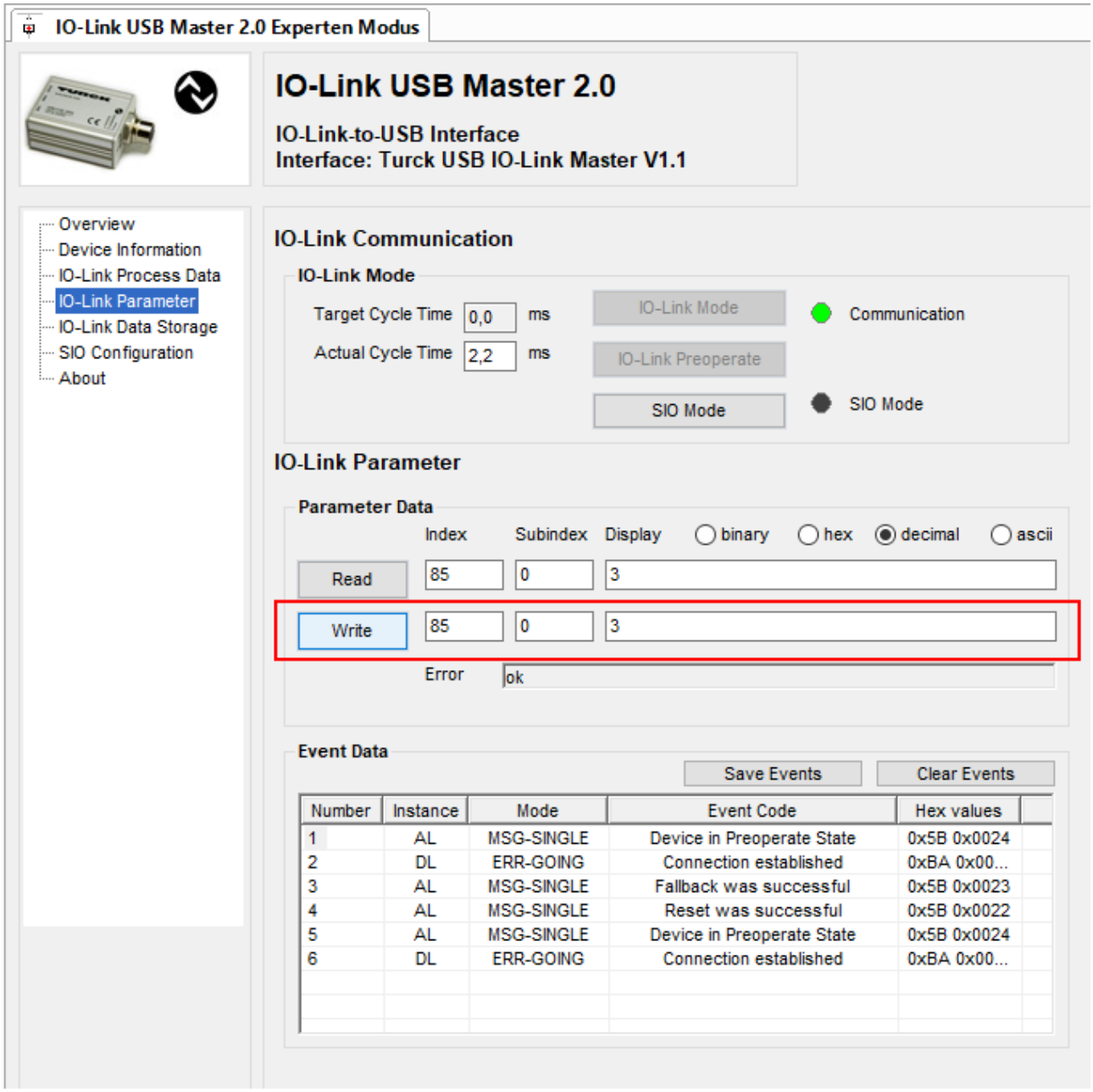


Fig. 17: Setting parameters for the display and measured value update time

6.1.2 Setting with IO-Link master and configuration tool

Software used

- PACTware 4.1 configuration tool
- IODD interpreter configuration software
- IODD for temperature sensor TS720-2UPN8-H1141

Hardware used

NOTE
As an alternative to the BL67-GW-EN gateway with BL67-4IOL IO-Link master module, all Turck IO-Link masters can be used.

- BL67-GW-EN multiprotocol gateway (IP address: 192.168.1.254)
- IO-Link master module BL67-4IOL with base module BL67-B-4M12
- Temperature sensor TS720-2UPN8-H1141 (connected to port 1 of the IO-Link master)
- Sensor cable RKC4.4T-2-RSC4.4T/TXL

Setup

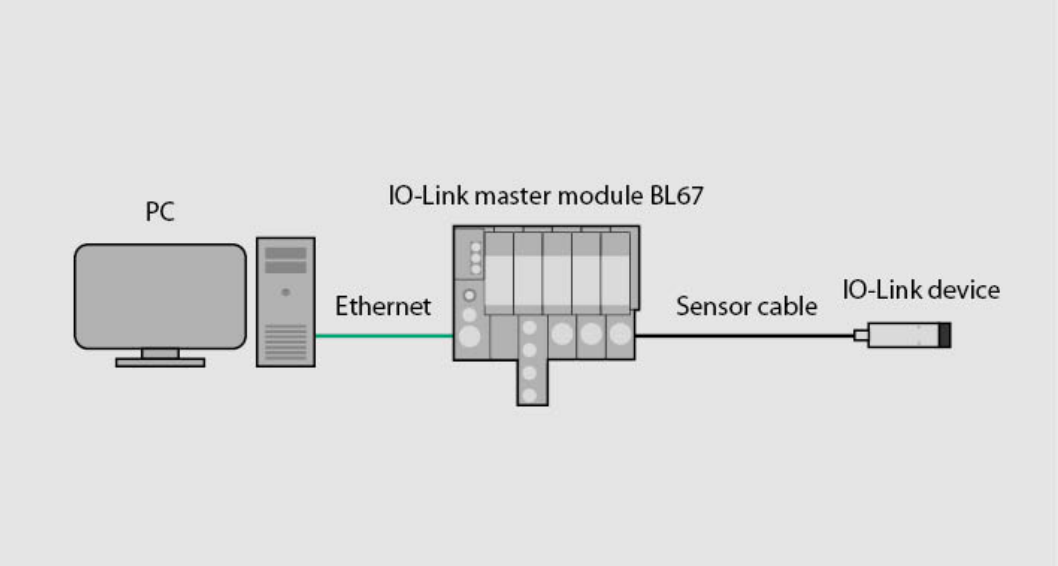


Fig. 18: Application example — setup

Example: configuring the device

- Start the IODD interpreter.
- Click on **Add IODD**.
- Select IODD for TS720-2UPN8-H1141 in the following window.
- Add IODD for temperature sensor TS720-2UPN8-H1141 by clicking on **Open**.

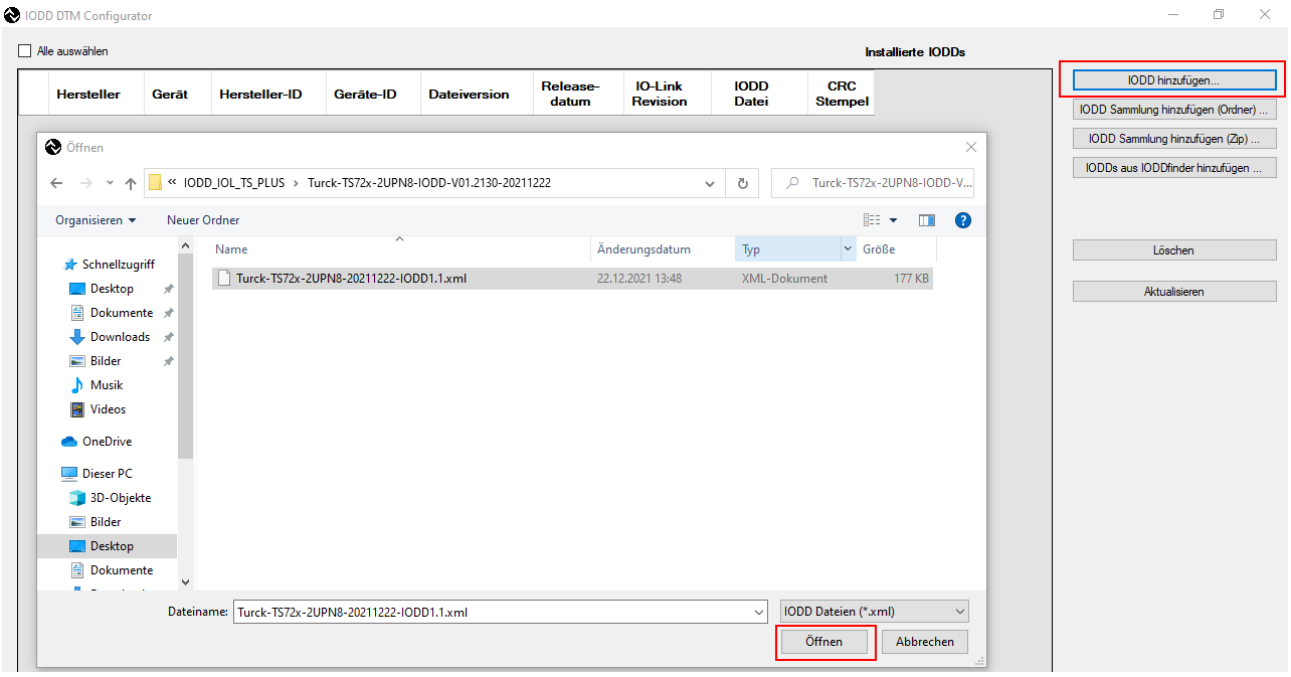


Fig. 19: Adding IODD for TS720-2UPN8-H1141 in the IODD interpreter

- Launch PACTware.
- Add IODD to PACTware (**View** → **Device Catalog** → **Update Device Catalog**).
- Add an Ethernet interface (right-click on **HOST PC** → **Add device**).

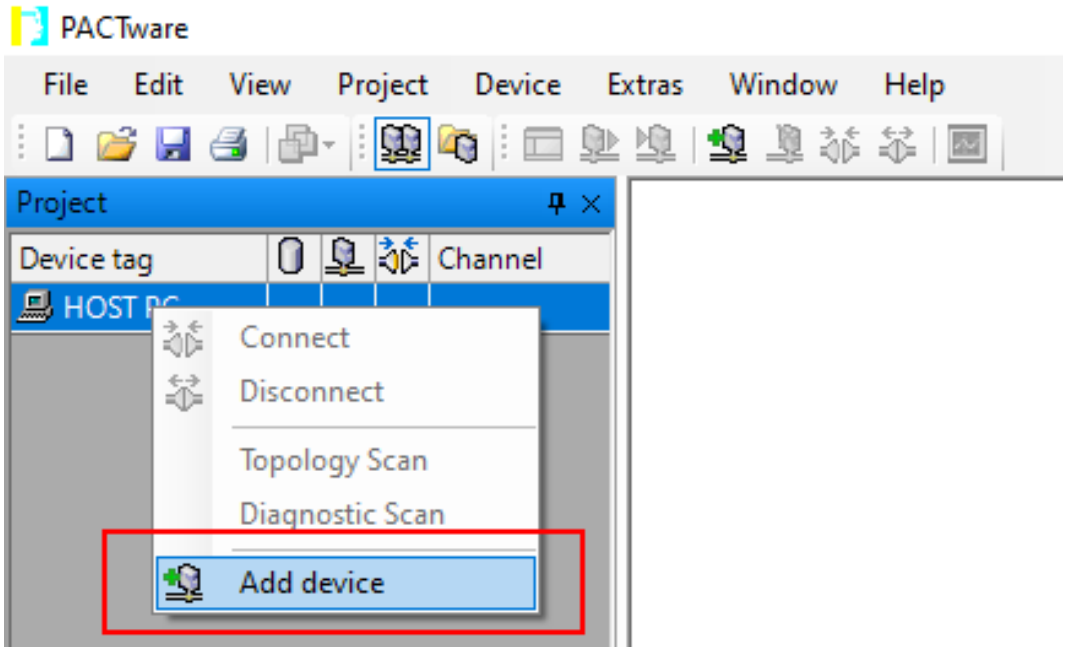


Fig. 20: Adding a device in PACTware

▶ Select the **BL Service Ethernet** Ethernet interface.

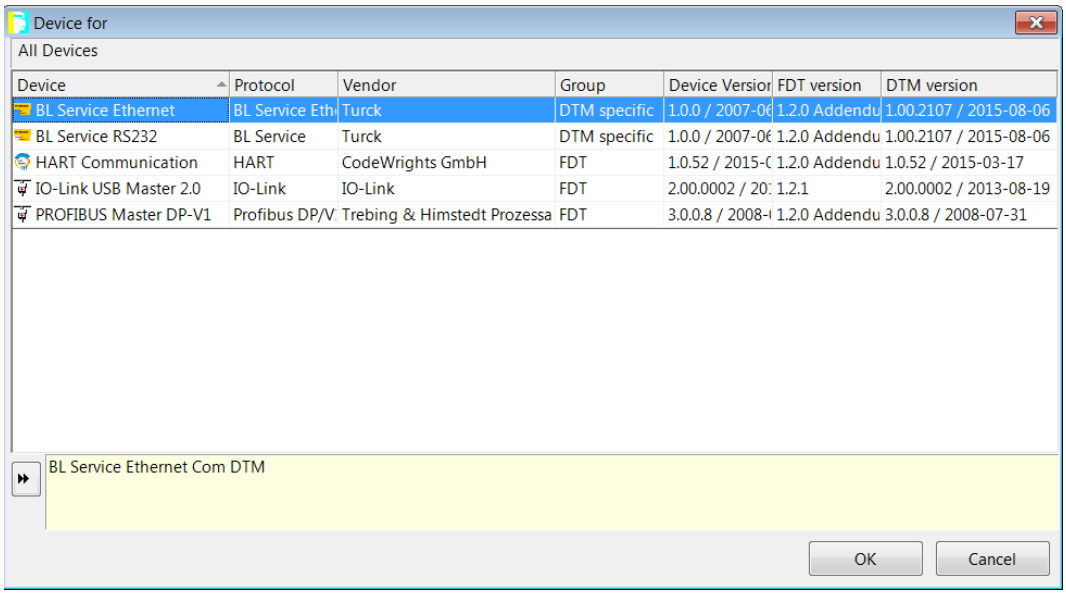


Fig. 21: Add the BL Service Ethernet

- Add BL67-GW-EN via the Ethernet interface bus address management: right-click on the Ethernet interface (here: **TCP: 192.168.1.50**) → **Additional functions** → **Busaddress management**.

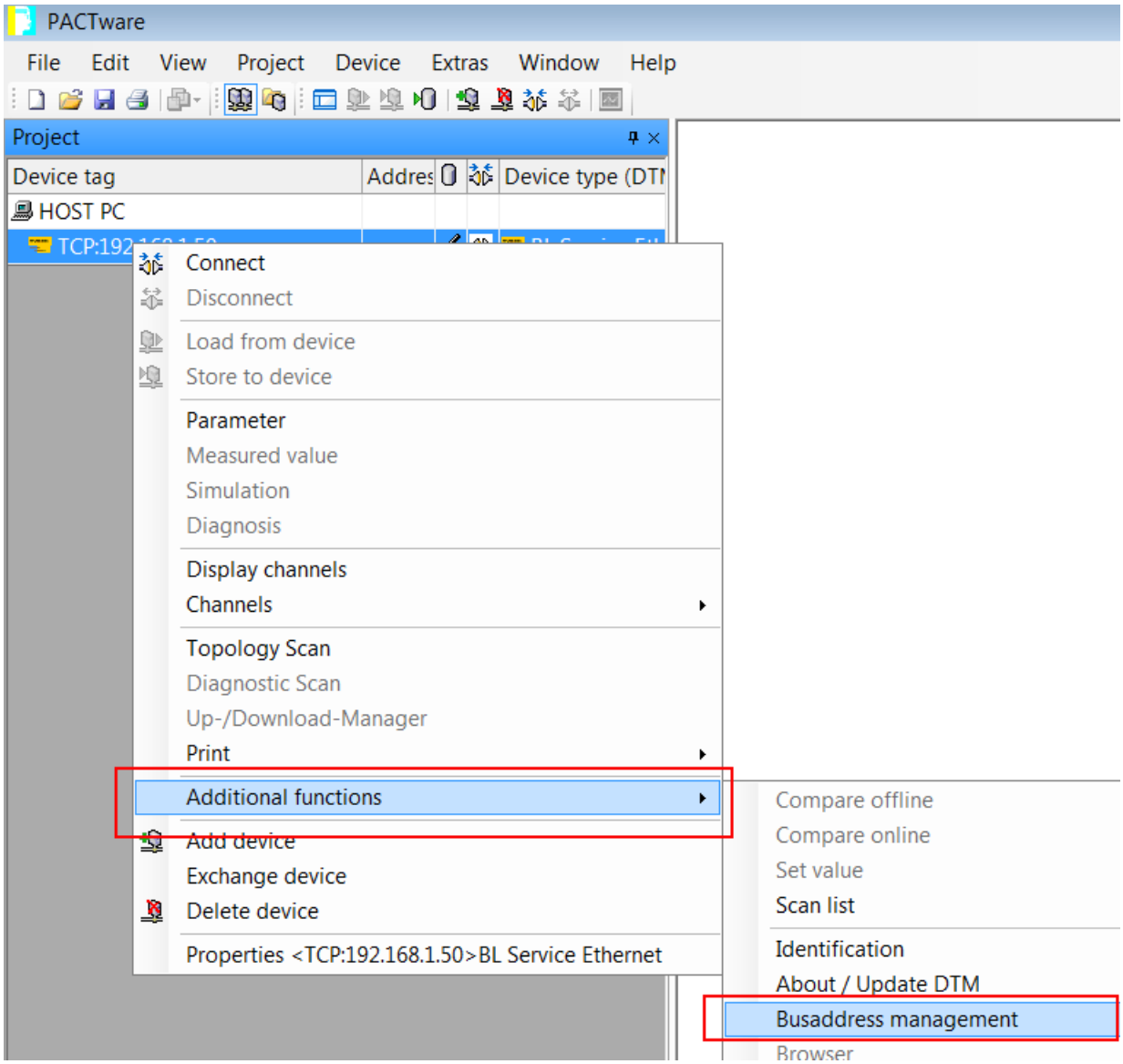


Fig. 22: Start bus address management

▶ Find the BL67 gateway (search icon) and add it to the project (cylinder icon).

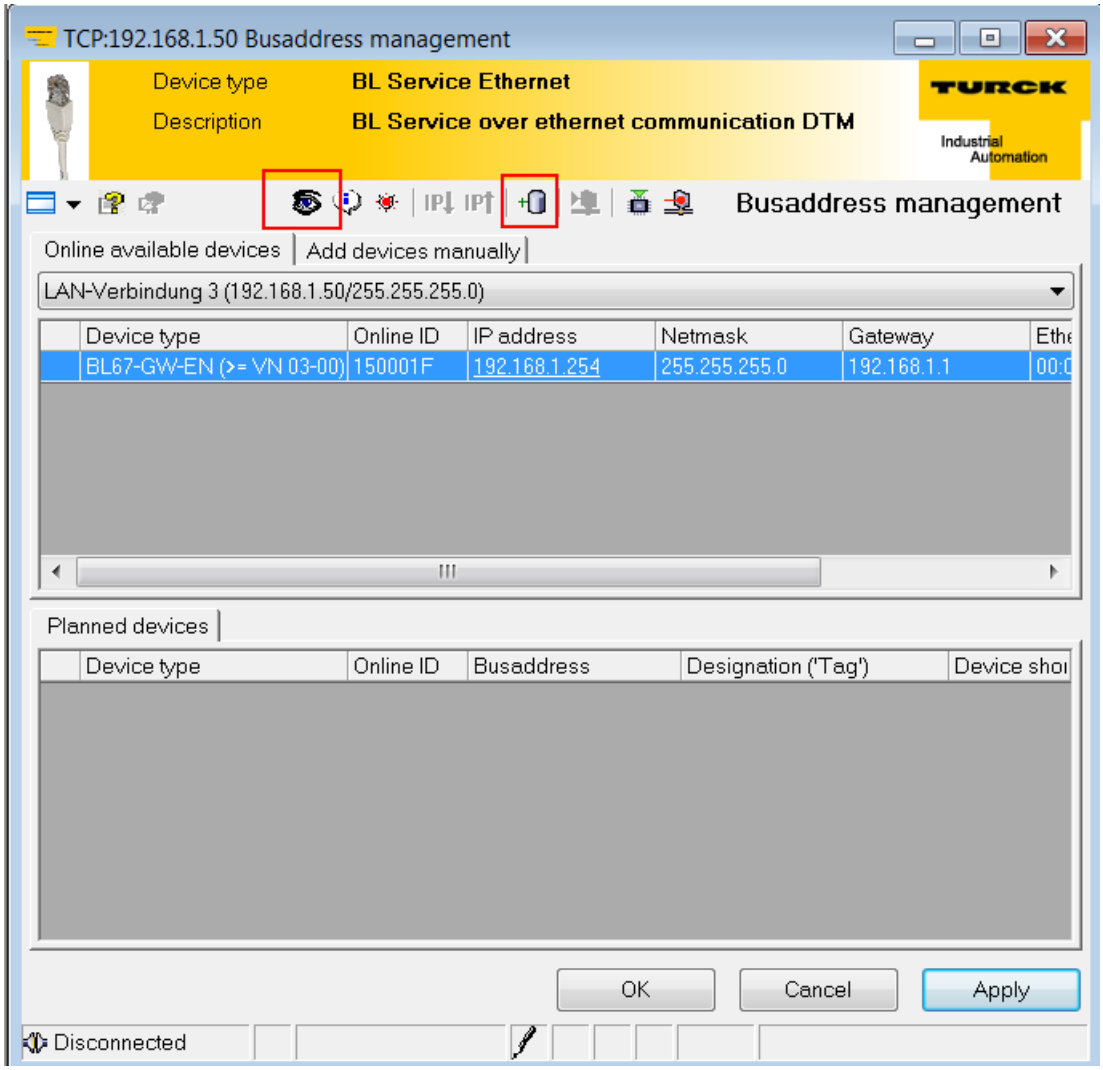


Fig. 23: Add a gateway to the project

▶ Confirm the message **Add DTMs for all connected devices** with **OK**.

NOTE
The info icon can be used to query the respective firmware version of the gateway and the IO-Link master.

- Start the topology scan to find devices connected to the IO-Link adapter: right-click on **IO-Link USB Master 2.0** → **Topology Scan**.

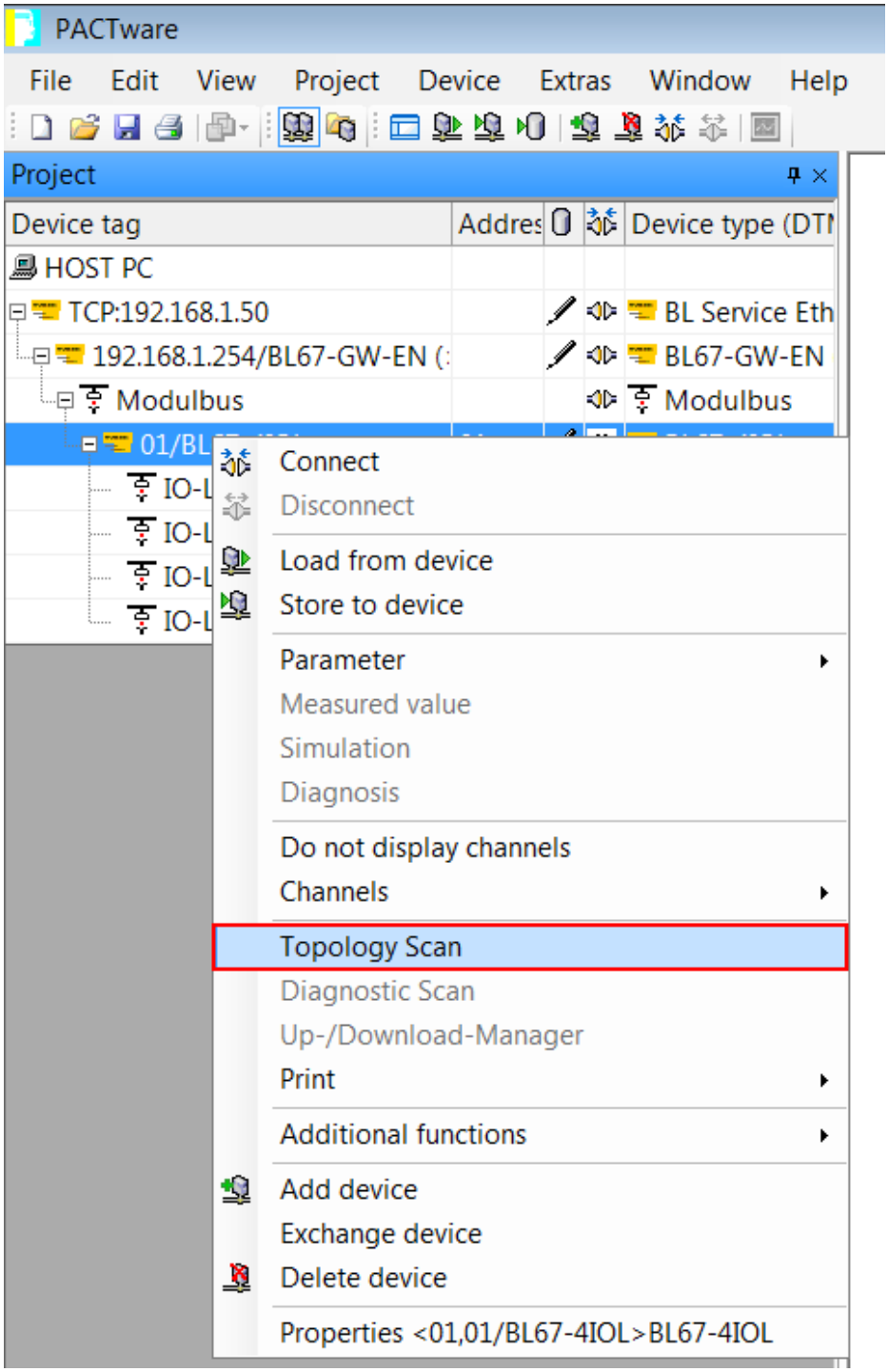


Fig. 24: Starting the topology scan

- If the topology scan finds a DTM instead of an IODD, load IODD manually: right-click on device → **Exchange device**.

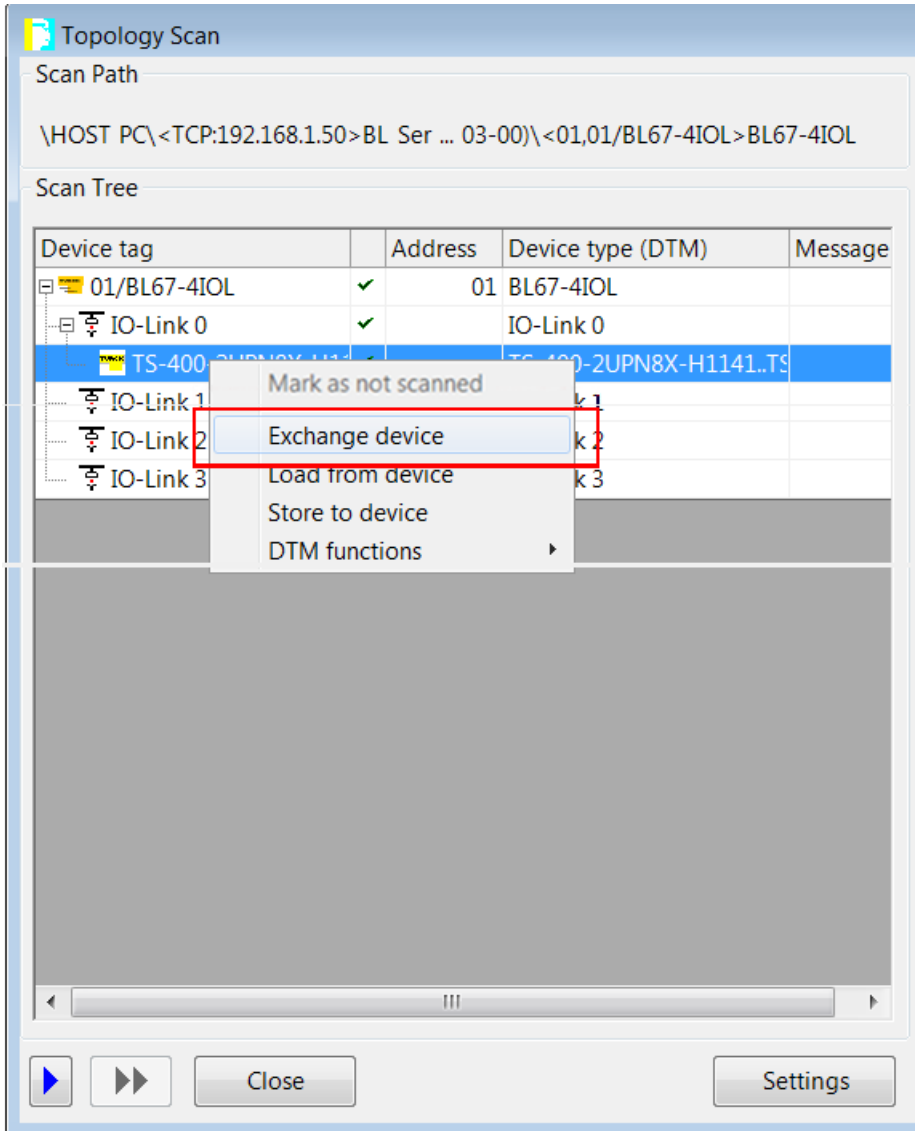


Fig. 25: Replacing the DTM with IODD

- ▶ Select IODD for temperature sensor TS720-2UPN8-H1141.
- ▶ Confirm with **OK**.

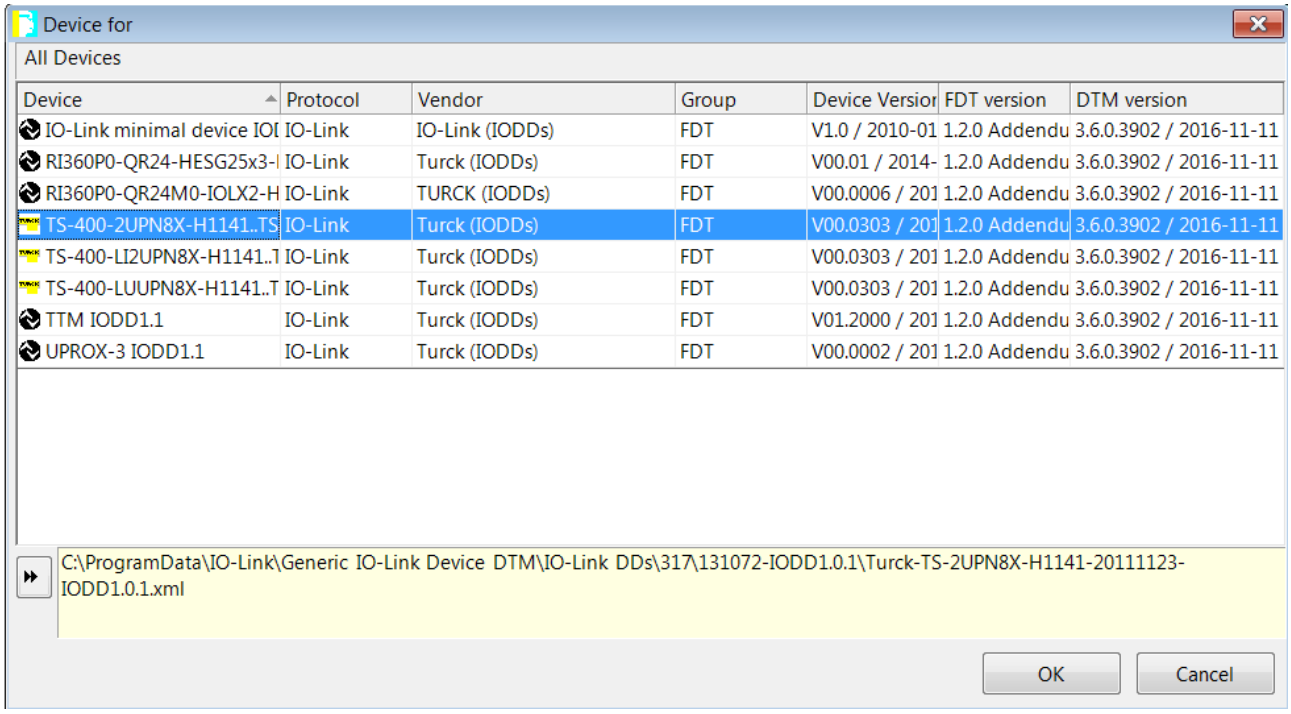


Fig. 26: Select IODD

- Close the topology scan.
- Connect the host PC and IO-Link device by right-clicking on the IO-Link device → **Connect**.

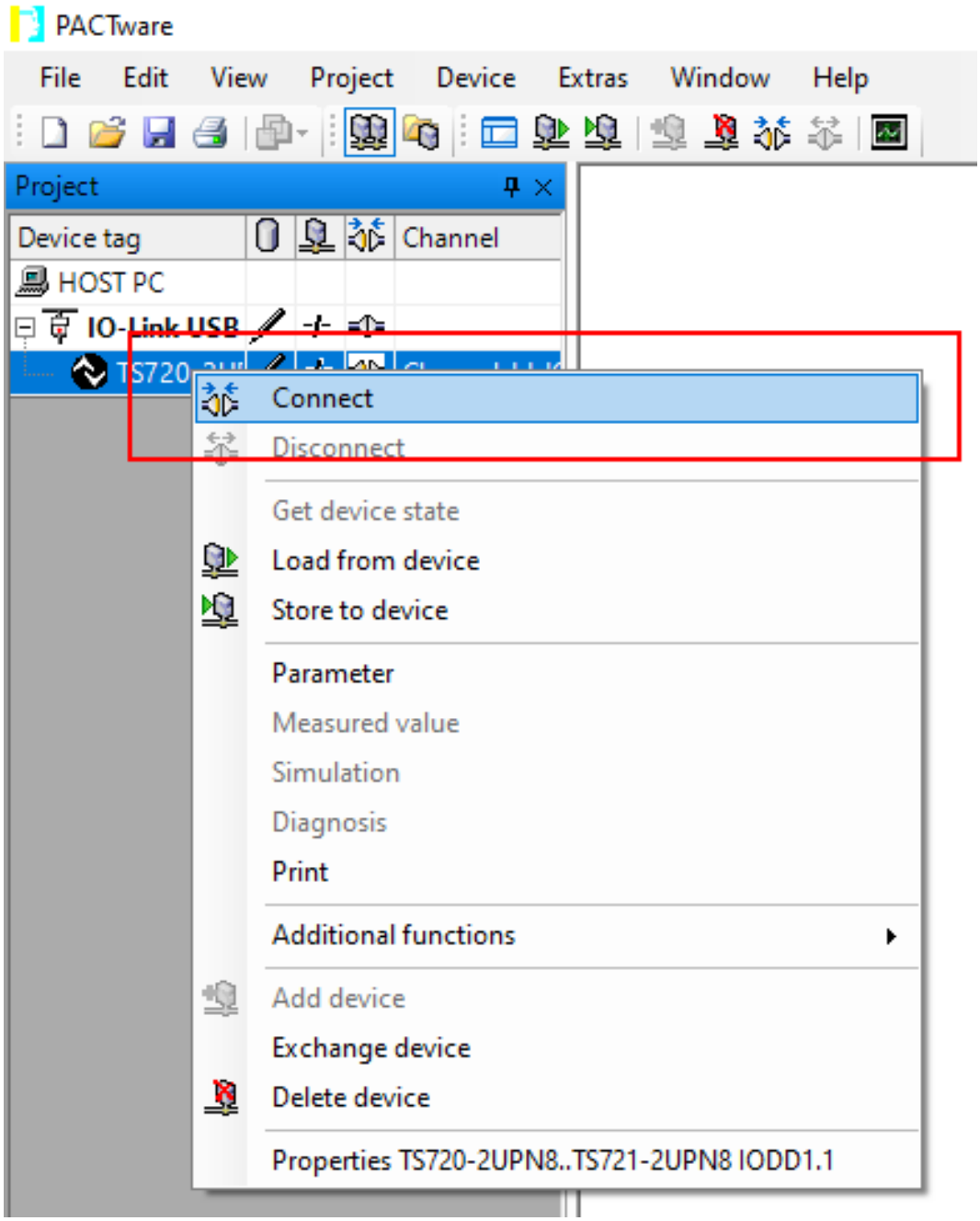


Fig. 27: Connect

▶ In the tree structure, double-click the IO-Link device to display the parameters.

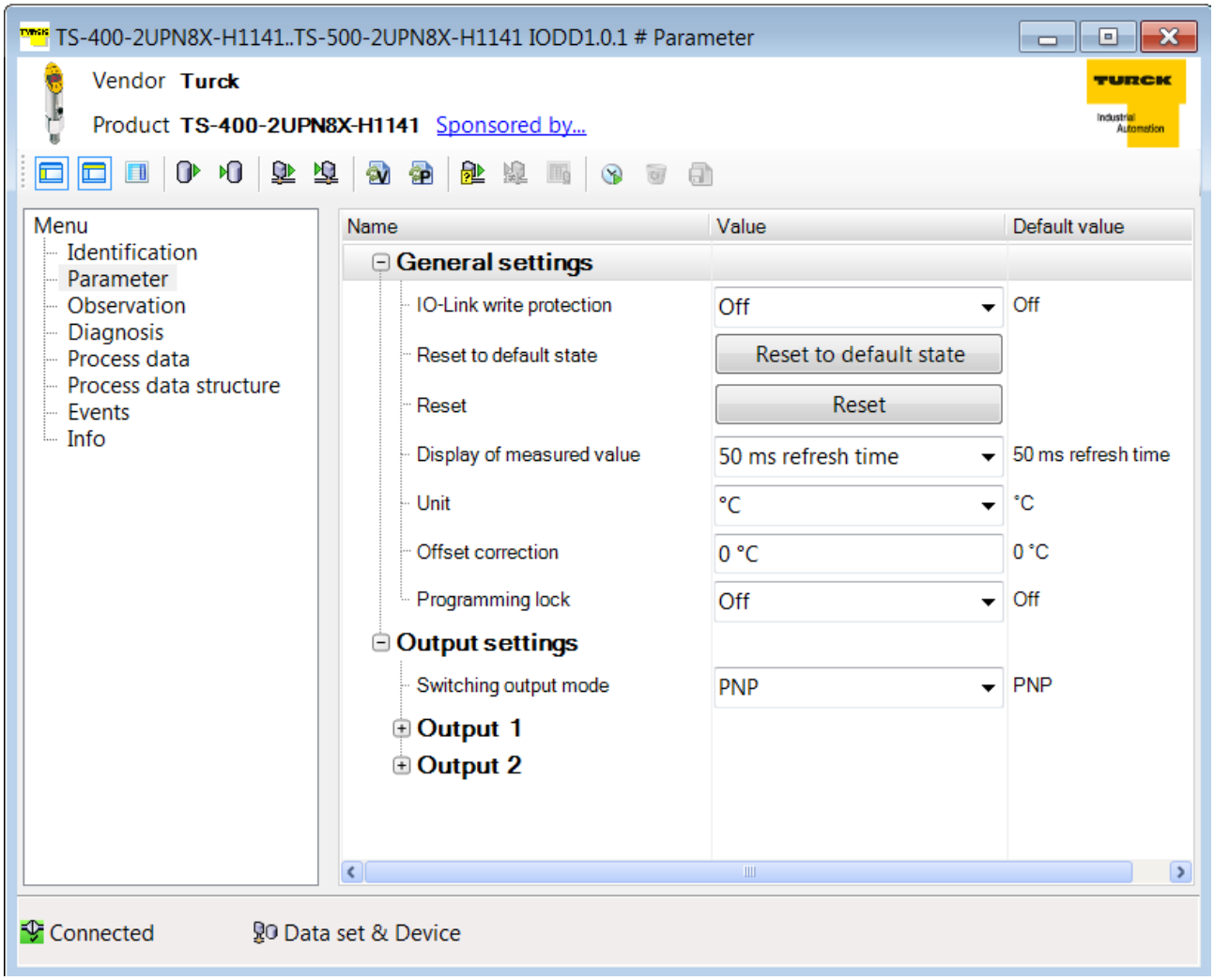


Fig. 28: IO-Link parameters

- Set the **Display of measured value** parameter in the drop-down menu to **50 ms refresh time/display rotate 180°.**

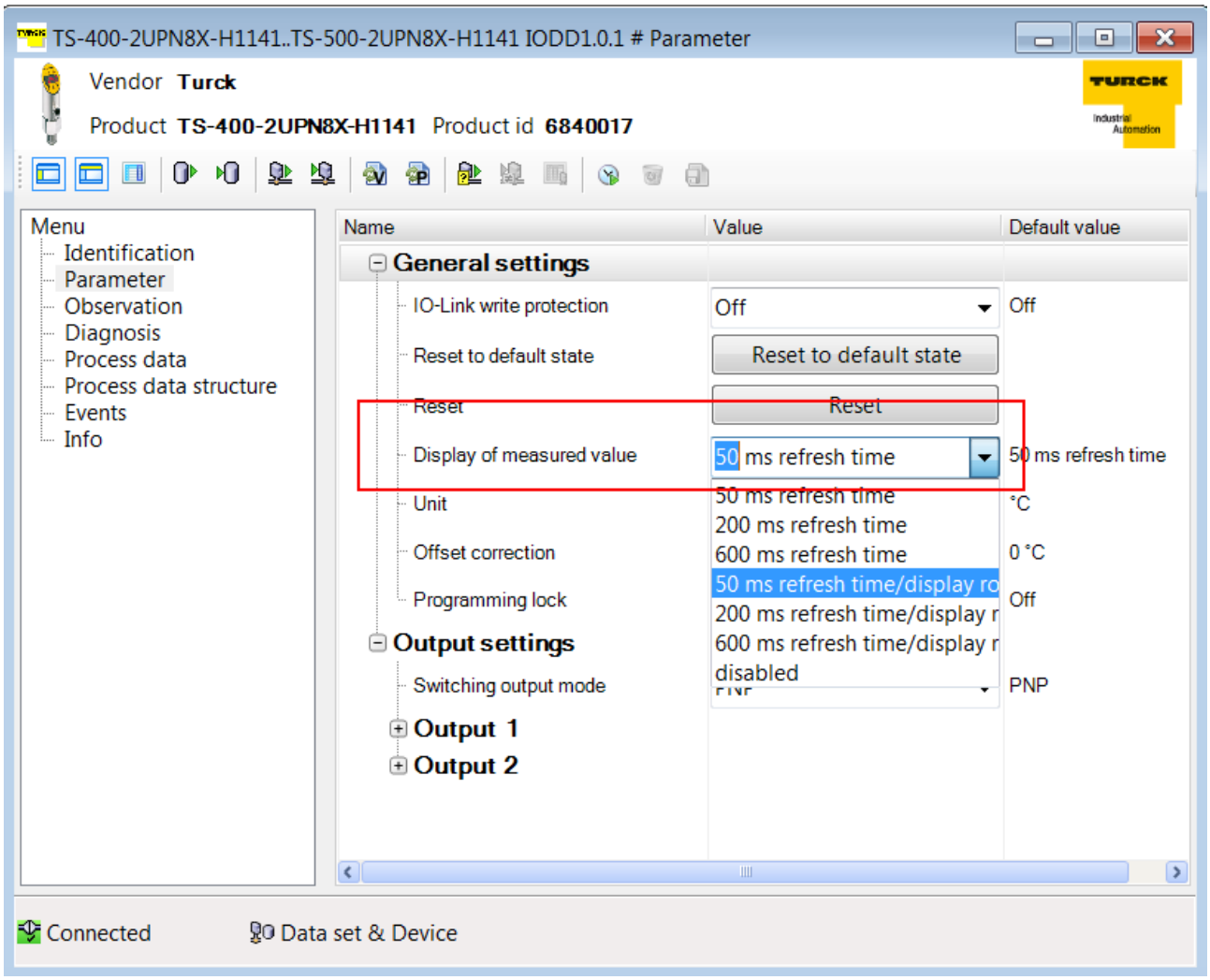


Fig. 29: Set the measured value display

▶ Write parameters to the device: click on the icon (highlighted in red).

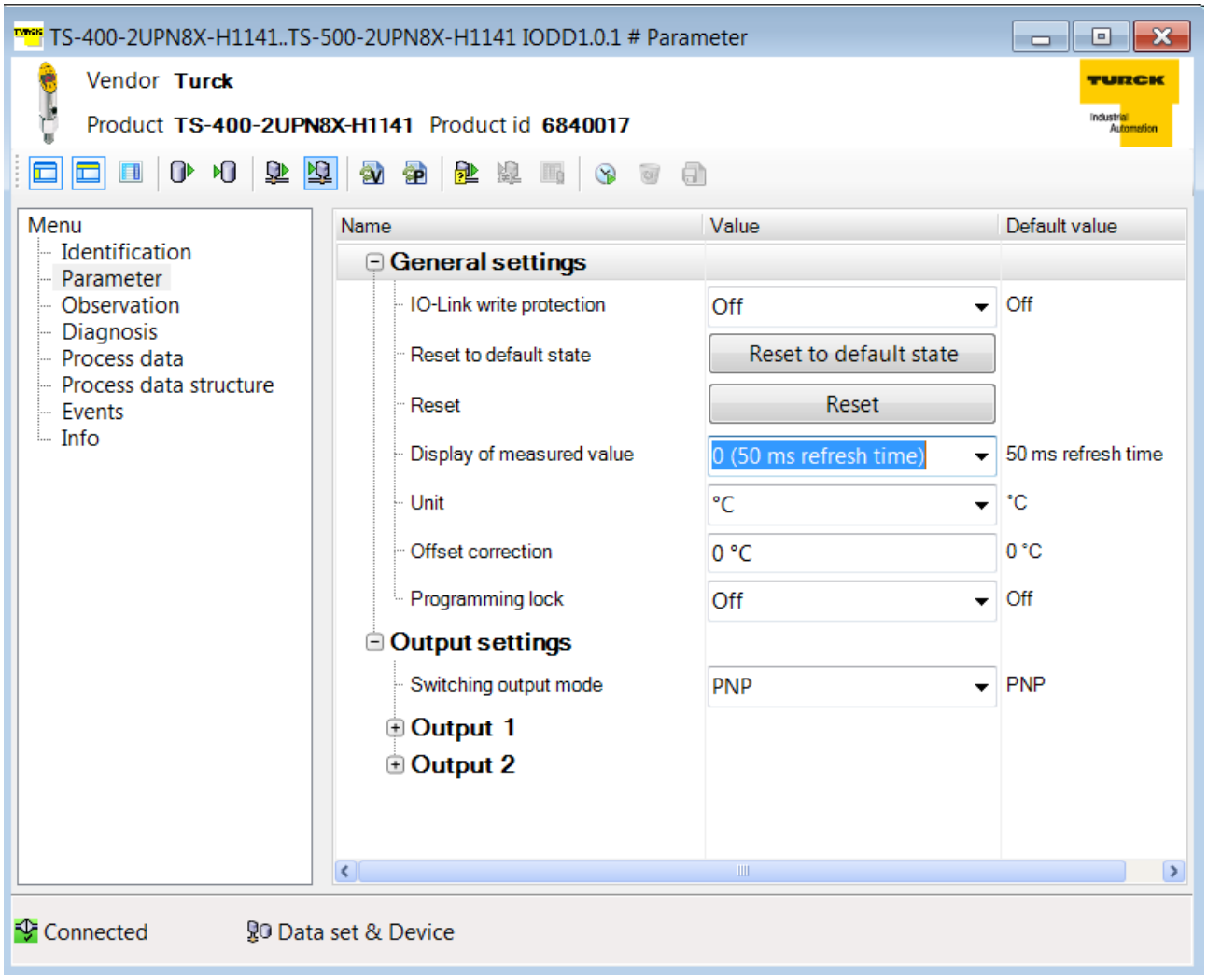


Fig. 30: Writing parameters to the device

6.1.3 Set with IO-Link master and IODD configurator

The IODD configurator can be used to configure devices either generically or specifically via a web browser. No other tool is required.

NOTE
The IODD configurator is available for the following IO-Link masters with the following firmware versions: TBEN-L…-8IOL (from V3.3.0.0), TBEN-S2-4IOL (from V3.4.0.0), and FEN20-4IOL (from V1.1.0.0).

Software used

- Turck Service Tool V3.2.2
- Web browser
- IODD for read/write head TN-Q40-IOL2-H1141

The Turck Service Tool can be downloaded free of charge at www.turck.com.

Hardware used

- IO-Link master TBEN-S2-4IOL (IP address: 192.168.1.27)
- RF read/write head TN-Q40-IOL2-H1141
- Sensor cable RKC4.4T-2-RSC4.4T/TXL

Setup

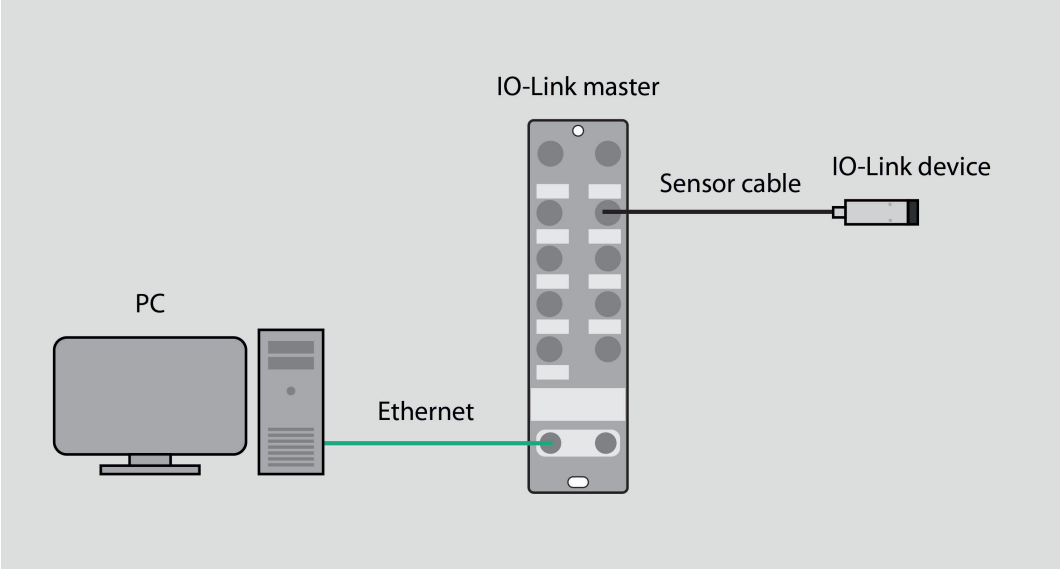


Fig. 31: Application example — setup

Setting the IP address

- ▶ Connect the IO-Link master to a PC using an Ethernet cable.
- ▶ Open the Turck Service Tool.
- ▶ Click on **Search** or press [F5].
- ⇨ The Turck Service Tool displays the connected devices.

Opening a web server

- ▶ To open the web server via a web browser, enter 192.168.1.27 in the address bar of the web browser.
- ▶ Alternatively, double-click on the IP address in the Turck Service Tool.

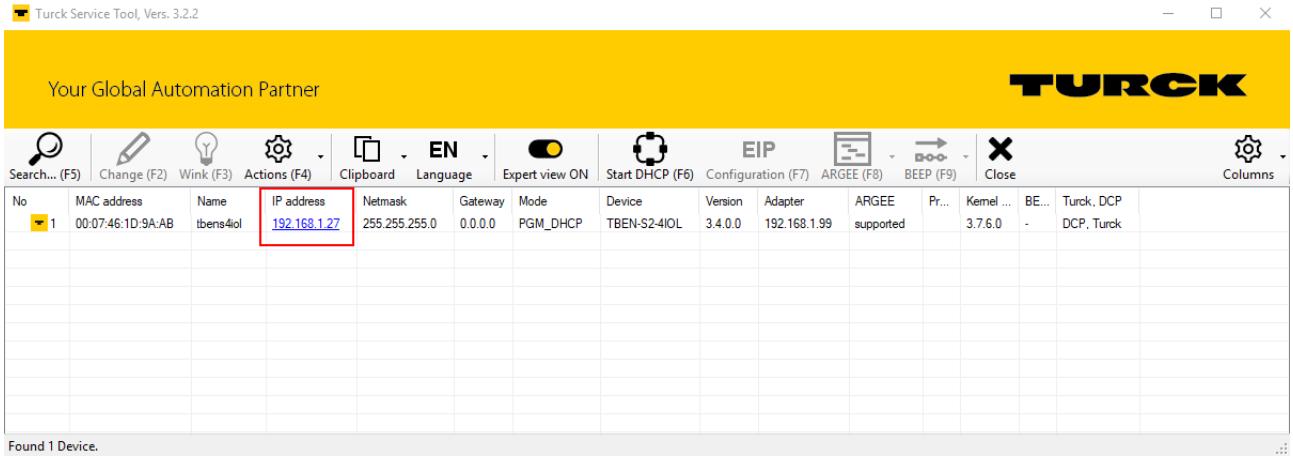


Fig. 32: Opening the IP address

➪ The web server opens.

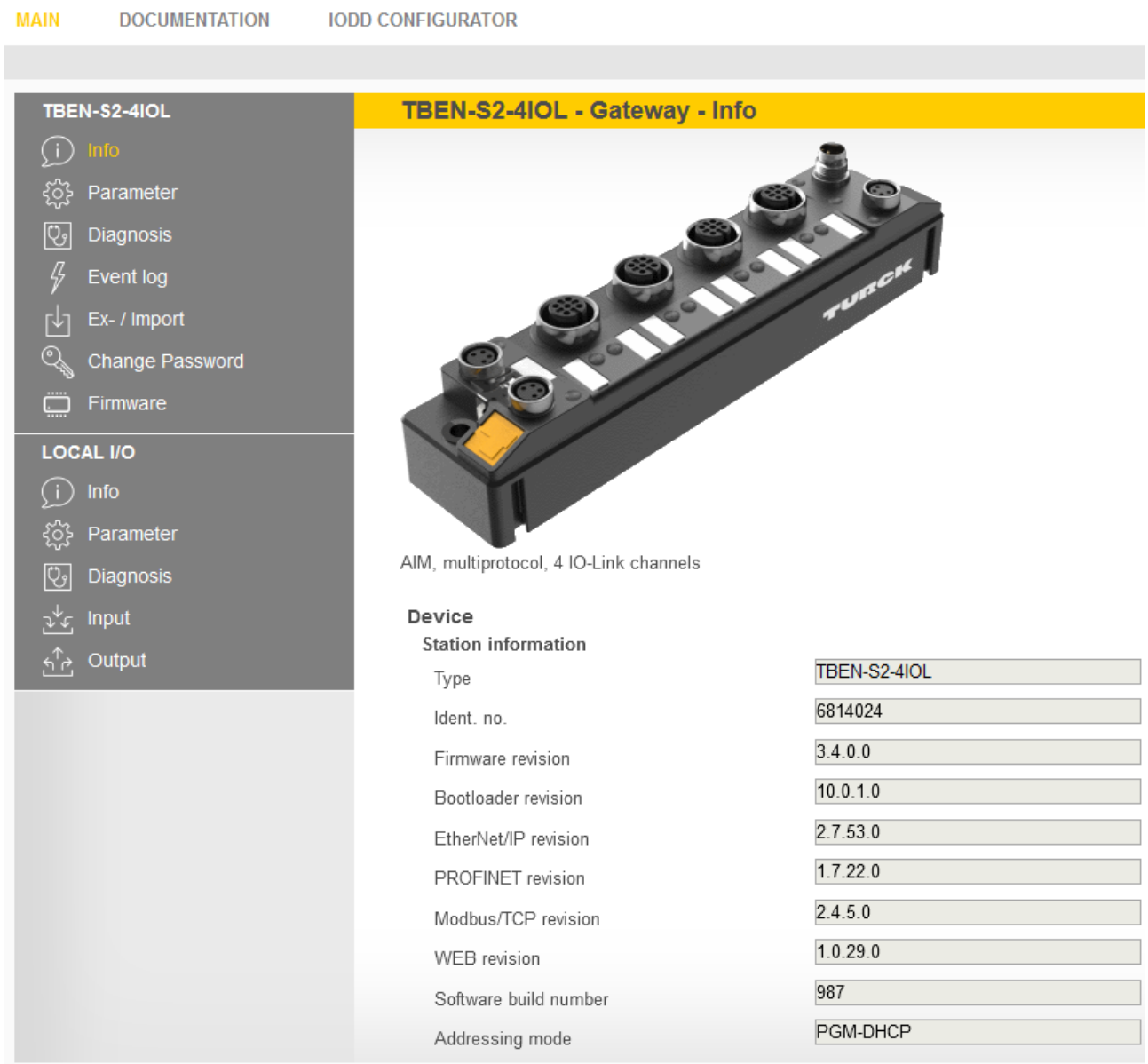


Fig. 33: Web server — IO-Link master

A login is required in order to edit settings via the web server. The default password is “password”.

NOTE
To ensure greater security, Turck recommends changing the password after the first login.

- ▶ Enter the password in the Login field on the start page of the web server.
- ▶ Click **Login**.

Example: configure the device generically

- ▶ Click on **IODD CONFIGURATOR** in the top menu bar.
- ⇨ Devices connected to the IO-Link master are displayed in the sidebar.
- ⇨ The device is automatically configured generically.

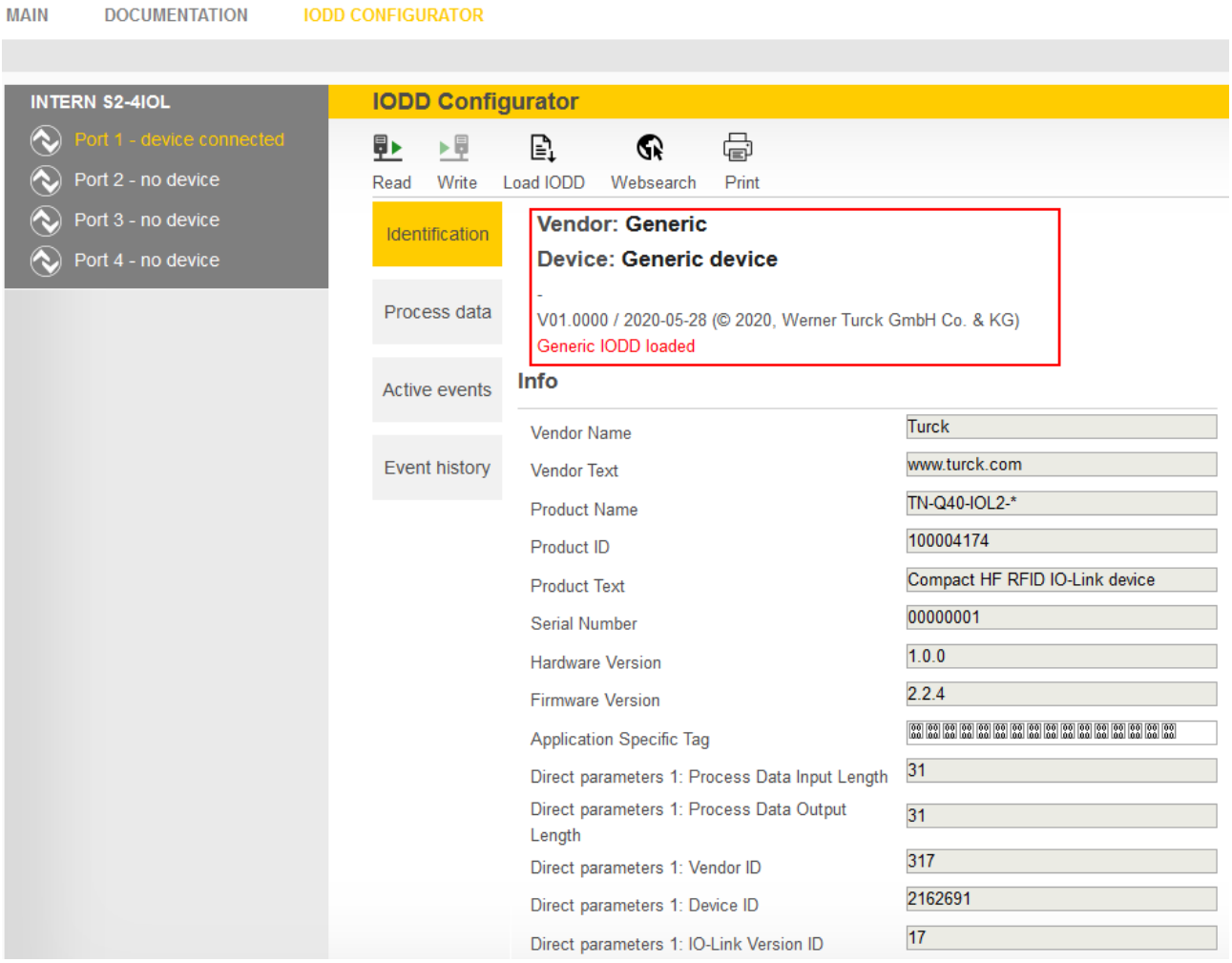


Fig. 34: Generically configured device

Example: configure the device specifically

The device can be configured specifically using either **Load IODD** or **Websearch**.

Configure via **Load IODD**:

- ▶ click on the device in the sidebar.
- ▶ Click on **Load IODD**.

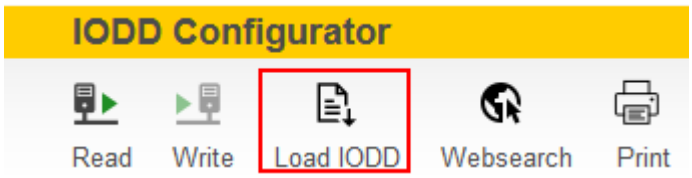


Fig. 35: Load IODD — IODD configurator

- ▶ In the following window, find and select the IODD on the local hard drive.
- ▶ Add the IODD by clicking on **Open**.

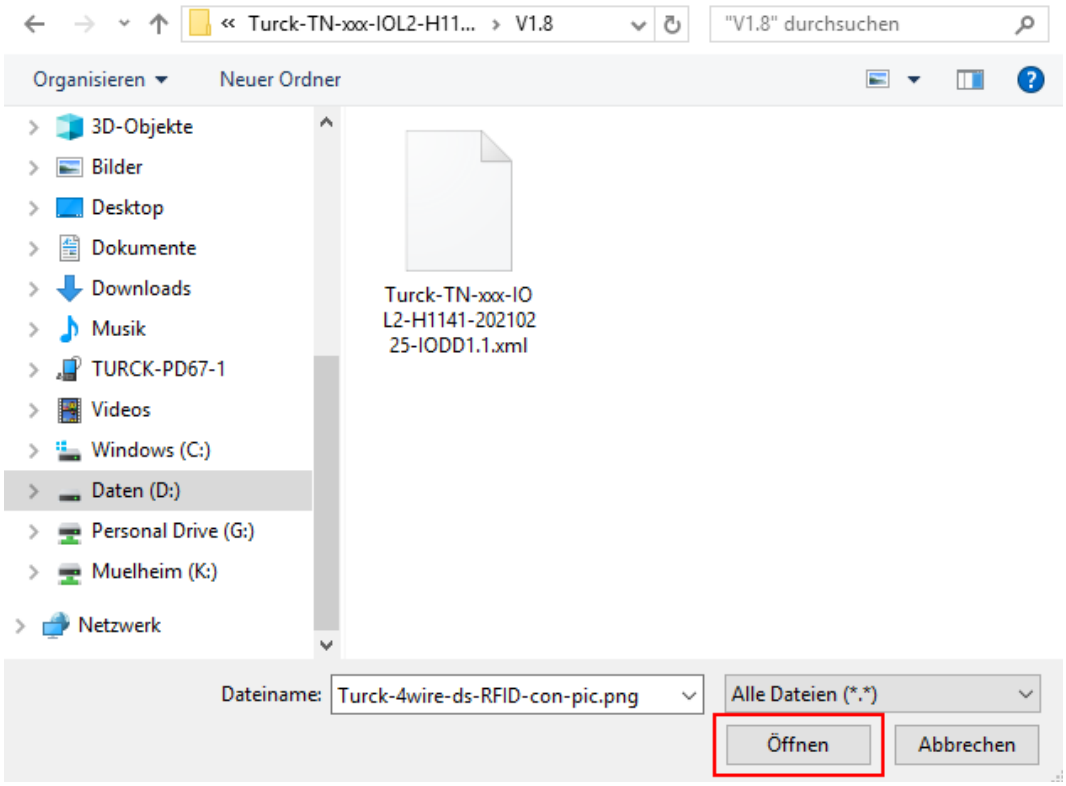


Fig. 36: Select IODD

⇨ The device is configured specifically.

The **Websearch** feature is only available if the PC is connected to the Internet and the firewall does not block access.

Configure via **Websearch**:

- ▶ Click on **Websearch**.

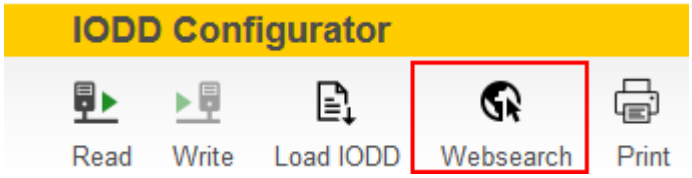


Fig. 37: Web search — IODD configurator

- ⇨ The IODD is automatically loaded from the IO-Link IODD database.
- ⇨ The device is configured specifically.

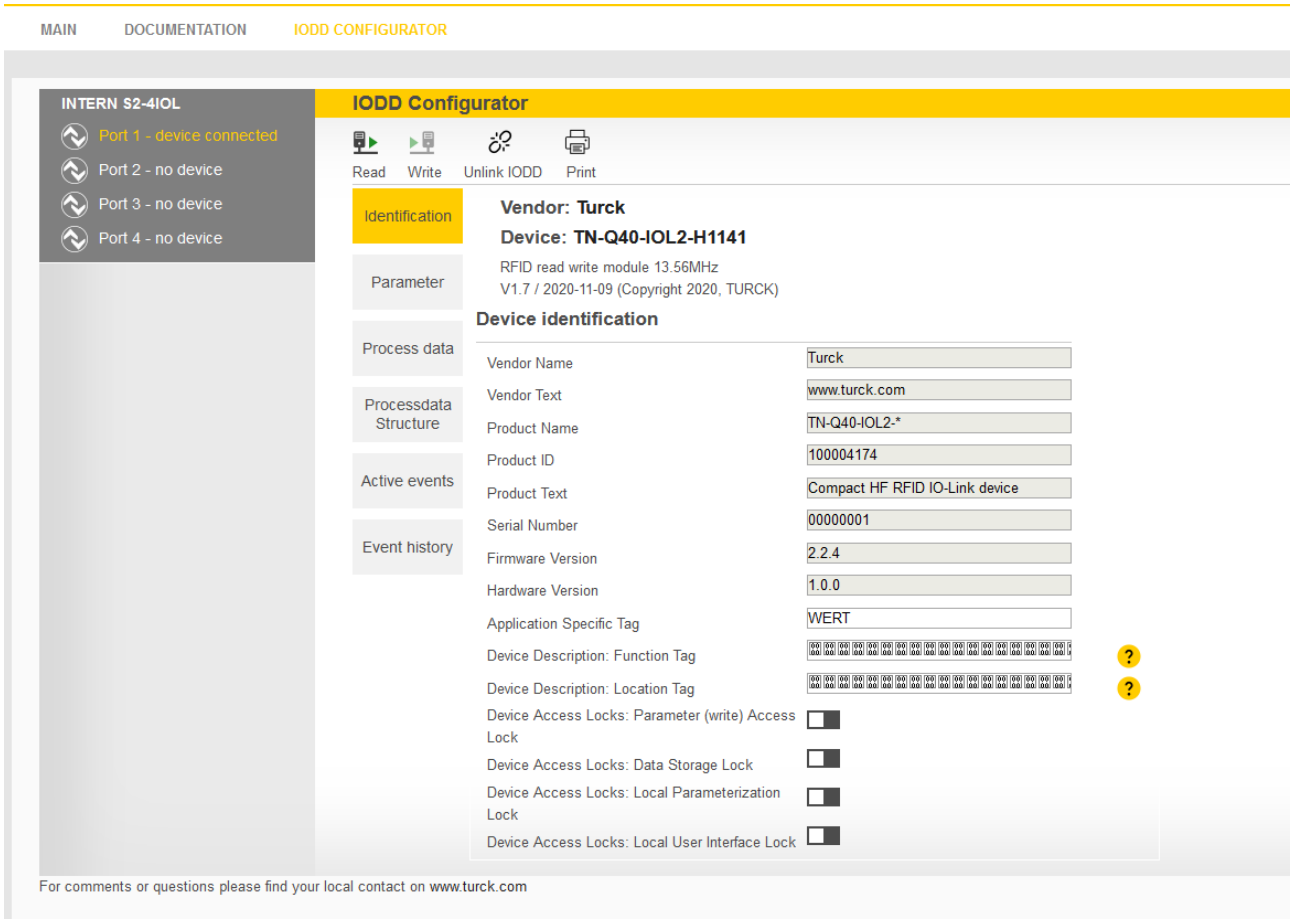


Fig. 38: Specifically configured device

Set parameters

- Click on **Parameter** in the left-hand, device-specific menu bar.
- Read data from the device: Click on **Read**.
- Write data to the device (grayed out without any changes): Click on **Write**.

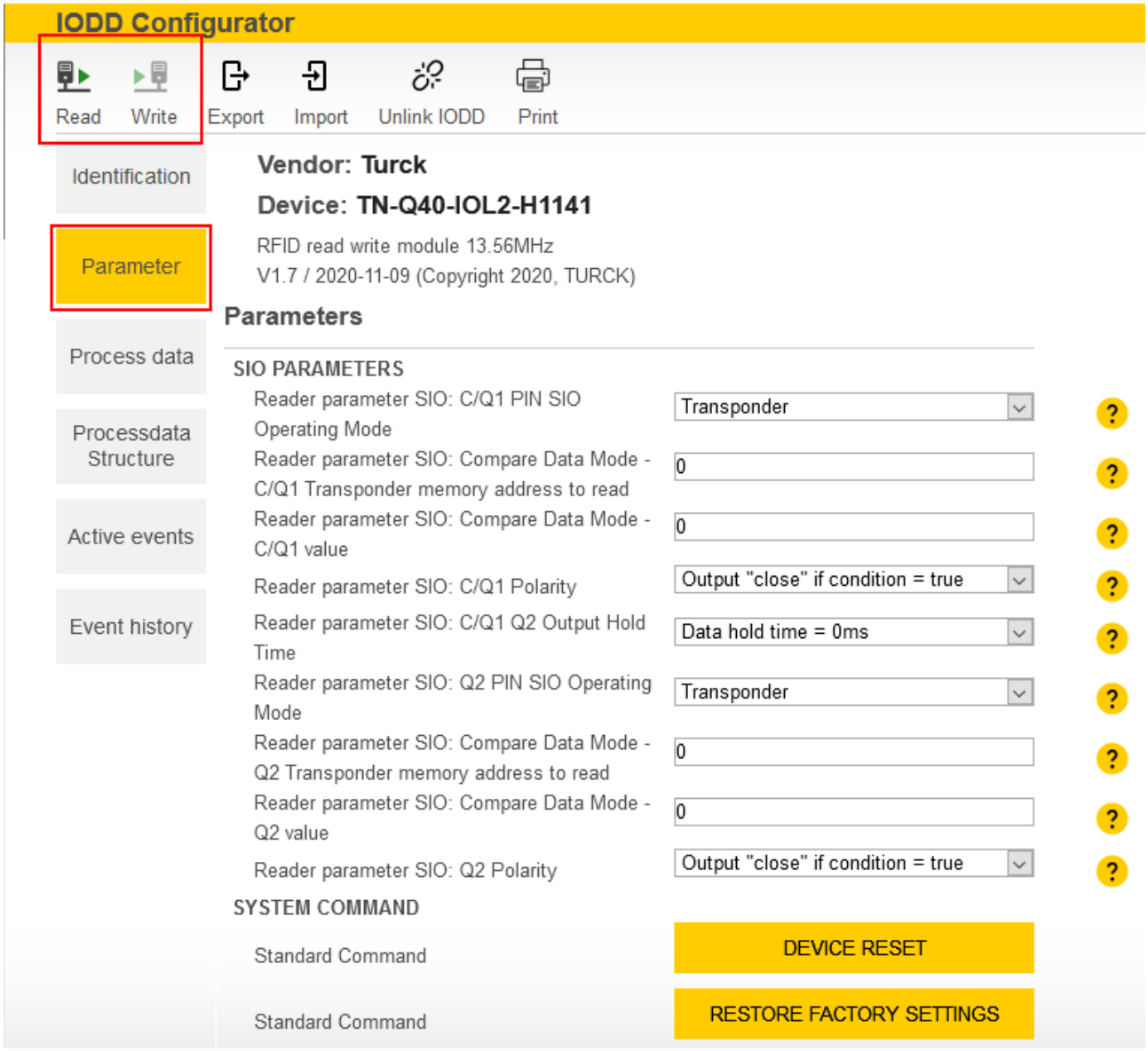


Fig. 39: Parameters — IODD configurator

6.2 Configuring devices using the control program

IO-Link devices can be commissioned via a Turck IO-Link master on various controllers. The GSDML file of the IO-Link master is required for configuration with a Siemens controller in PROFINET. The GSDML file is available for download at www.turck.com.

The EDS file of the IO-Link master is required for configuration with an Allen-Bradley controller via Ethernet/IP. The EDS file is available for download at www.turck.com.

6.2.1 Commissioning with BL… and programmable gateway in CODESYS 2

Software used

- CODESYS 2.3.9.35 with library BLxx_PG_PB.lib

Hardware used

- Programmable gateway BL67-PG-EN
- IO-Link master module BL67-4IOL with BL67-B-4M12
- Temperature sensor TS720-2UPN8-H1141, connected to IO-Link channel 1
- Sensor cable RKC4.4T-2-RSC4.4T/TXL

Setup

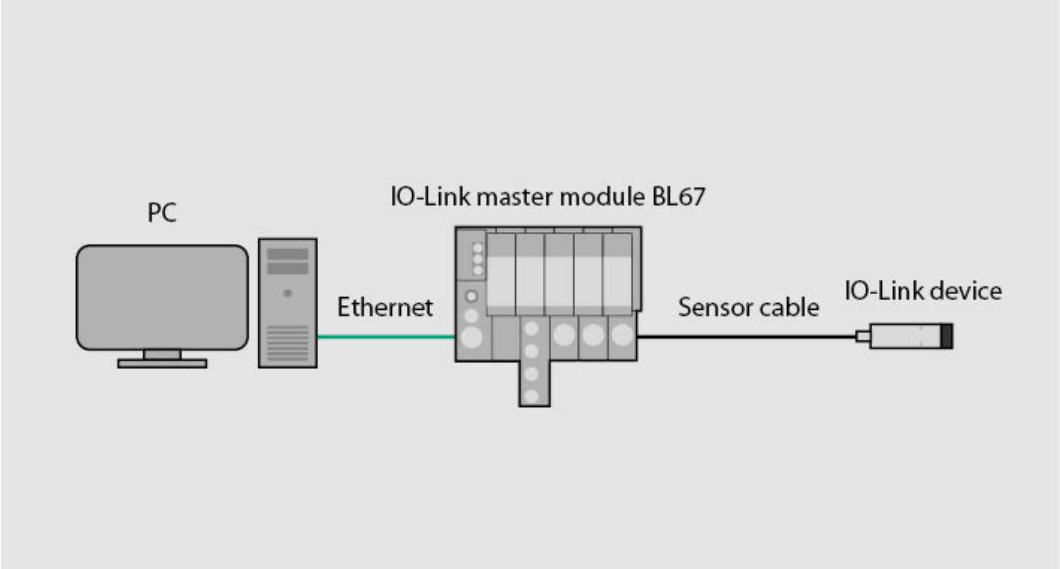


Fig. 40: Application example — setup

Example: configure the device generically

NOTE
The IO-Link master BL…-4IOL can only be configured generically. The connected devices must be configured separately.

NOTE
Information on the IO-Link master can be found in the instructions for use.

▶ Configure hardware in CODESYS.

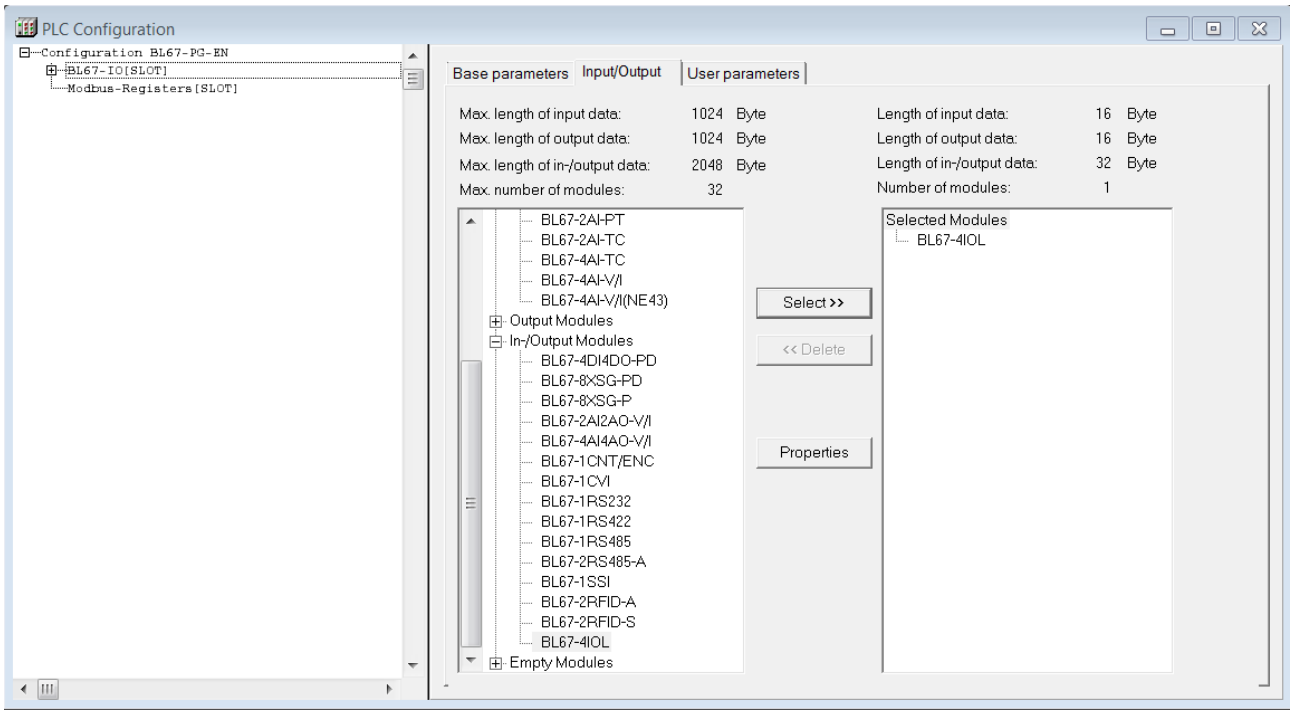


Fig. 41: Configure hardware in CODESYS

▶ Set the module properties of the IO-Link master BL67-4IOL.

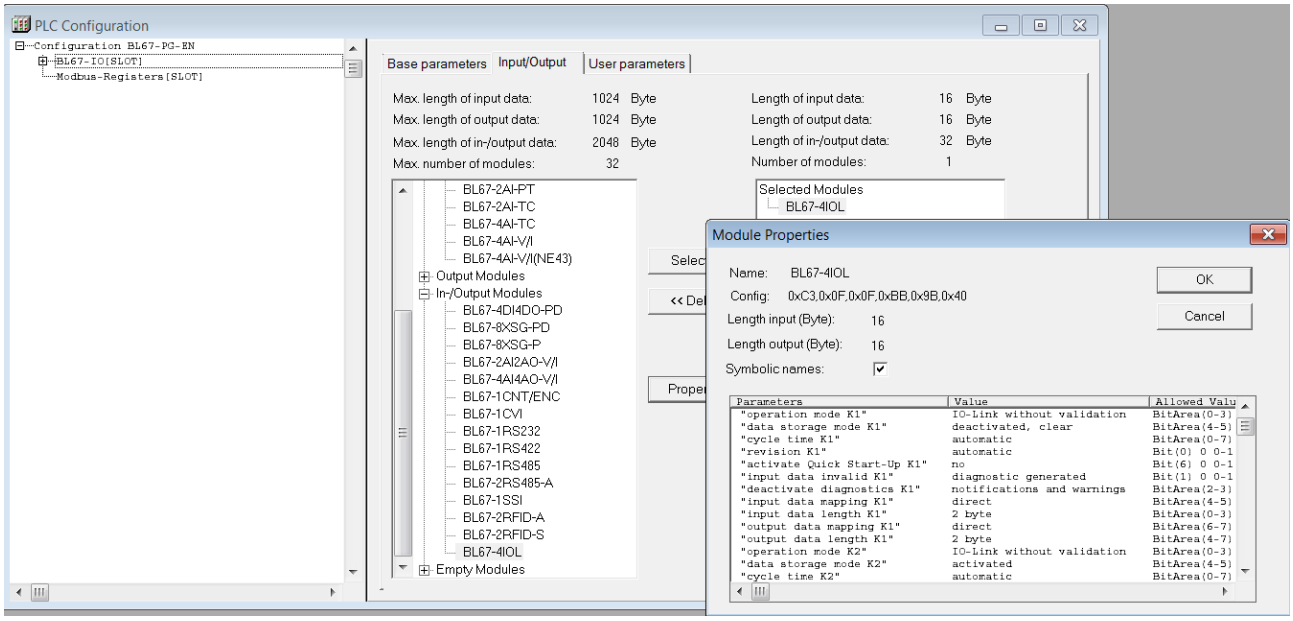


Fig. 42: Set parameters

In online mode, the process data can be read out if an IO-Link device is connected.

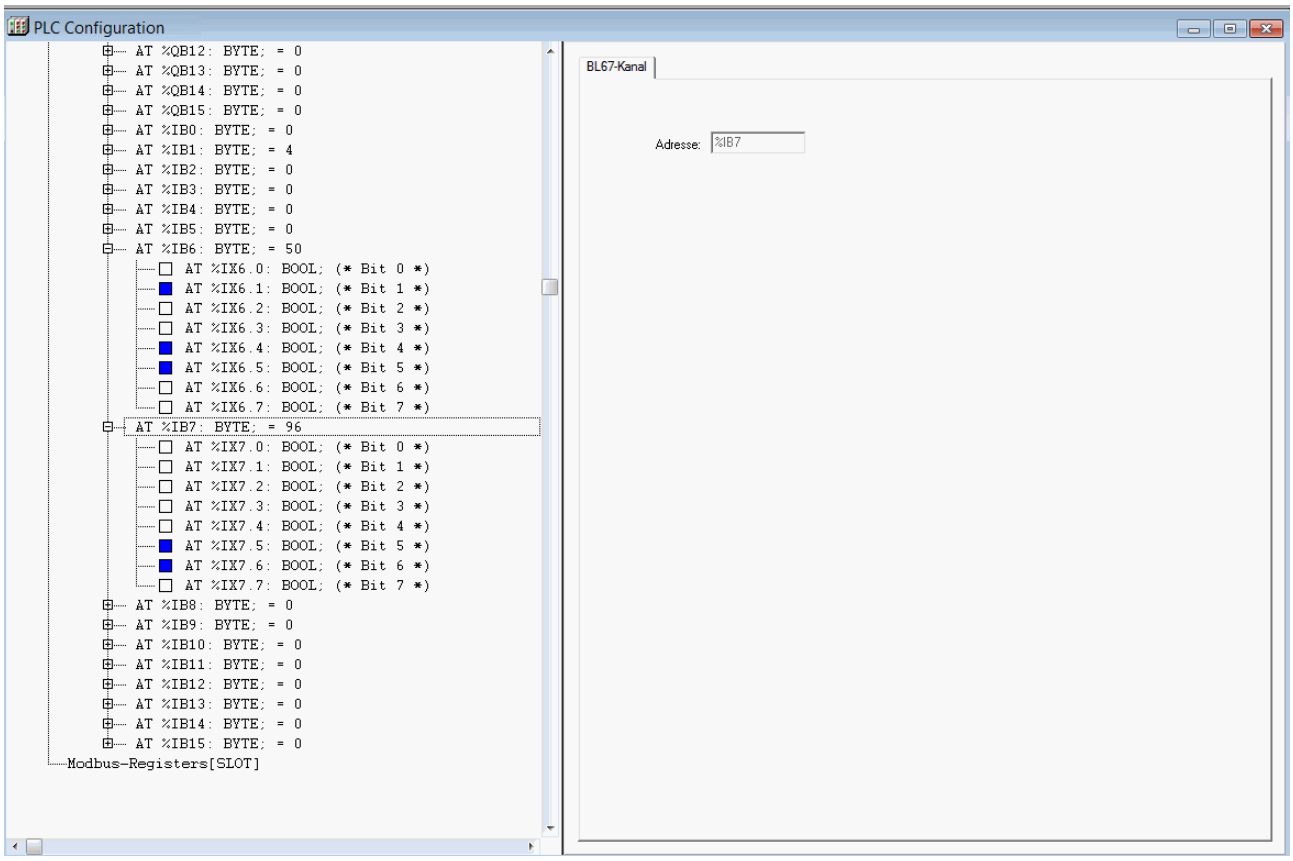


Fig. 43: Reading out process data in online mode

6.2.2 Commissioning with BL… and TX500 in CODESYS 3

Software used

- CODESYS 3.5 SP8 Patch 1
- GSDML file for BL67-GW-EN

Hardware used

- Multiprotocol gateway BL67-GW-EN
- IO-Link master module BL67-4IOL with base module BL67-B-4M12
- Temperature sensor TS720-2UPN8-H1141, connected to IO-Link channel 1
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Visual HMI/PLC combination device TX507

Setup

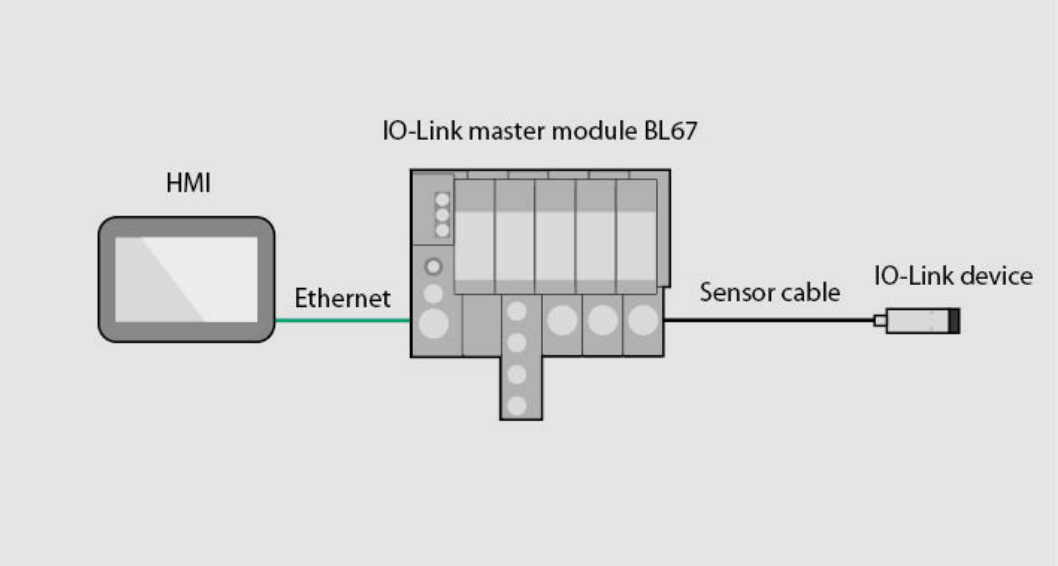


Fig. 44: Application example — setup

Example: configure a device

NOTE
The IO-Link master BL…-4IOL can only be configured generically. The connected devices must be configured separately.

NOTE
Information on the IO-Link master can be found in the instructions for use.

▶ Configure hardware in CODESYS.

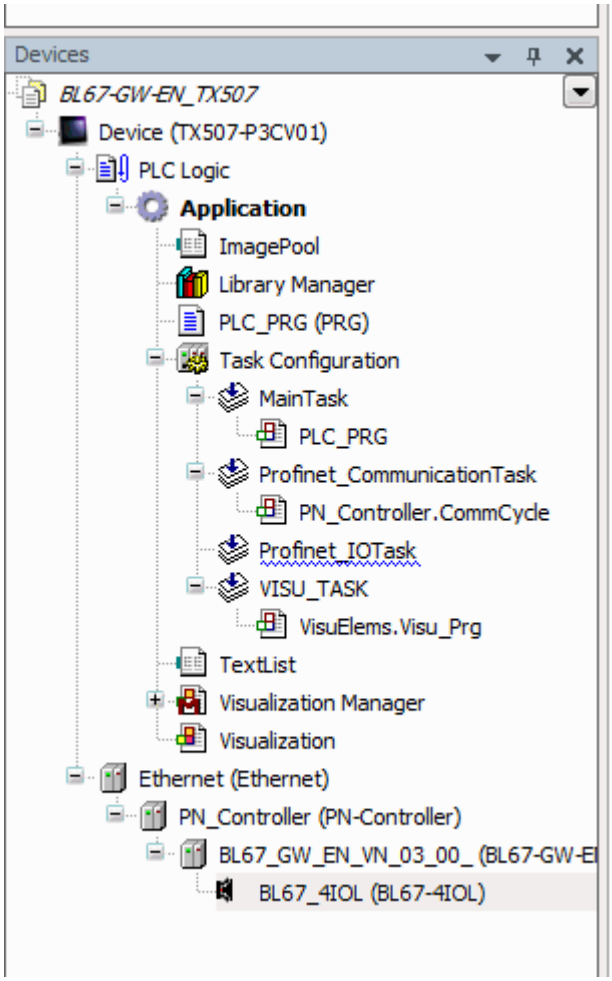


Fig. 45: Configure hardware in CODESYS

- ▶ Double-click on the IO-Link master.
- ▶ Select parameters.

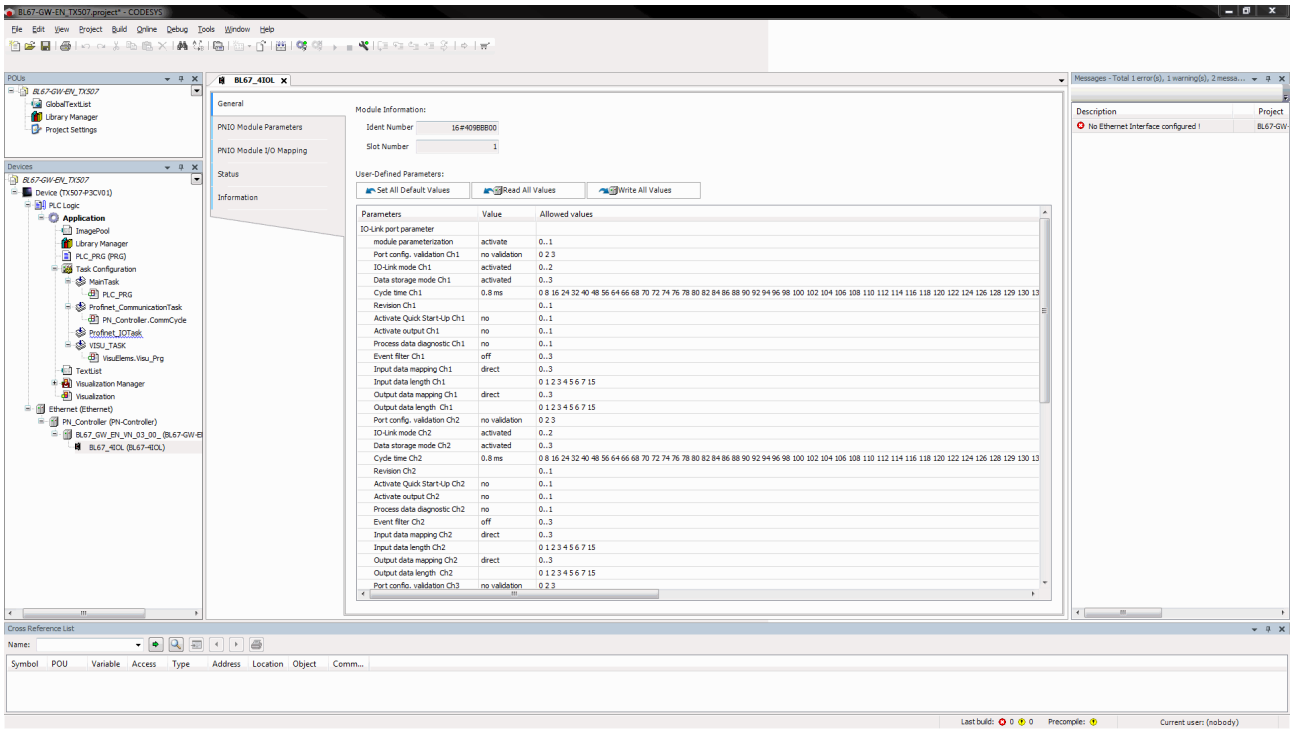


Fig. 46: Set parameters

In online mode, the process data can be read out if an IO-Link device is connected.

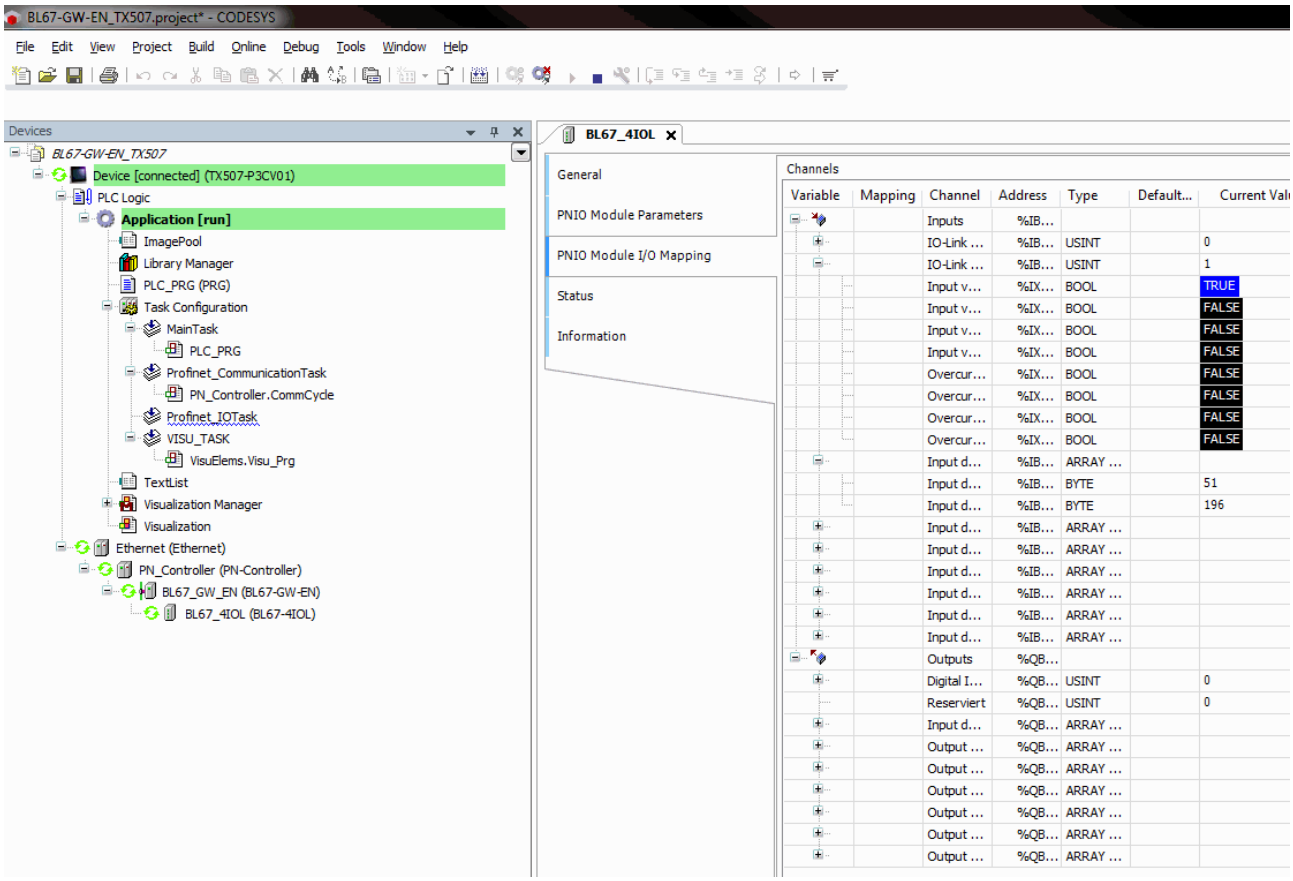


Fig. 47: Reading out process data in online mode

6.2.3 Commissioning with TBEN and TX507 in CODESYS 3

Software used

- CODESYS 3.5 SP8 Patch 1
- GSDML file for TBEN-S2-4IOL

Hardware used

NOTE
As an alternative to the IO-Link block module TBEN-S2-4IOL, the IO-Link block modules TBEN-L…-8IOL or FEN20-4IOL can be used.

NOTE
Information on the IO-Link master can be found in the instructions for use.

- IO-Link master TBEN-S2-4IOL
- Temperature sensor TS720-2UPN8-H1141, connected to IO-Link channel 1
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Visual HMI/PLC combination device TX507

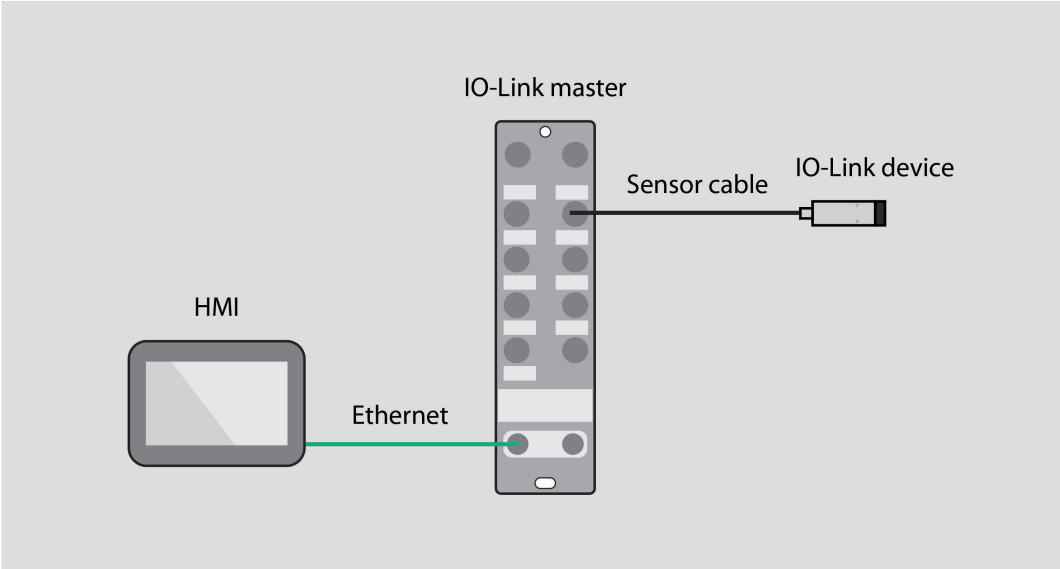


Fig. 48: Application example — setup

Example: configure the device generically

▶ Configure hardware in CODESYS.

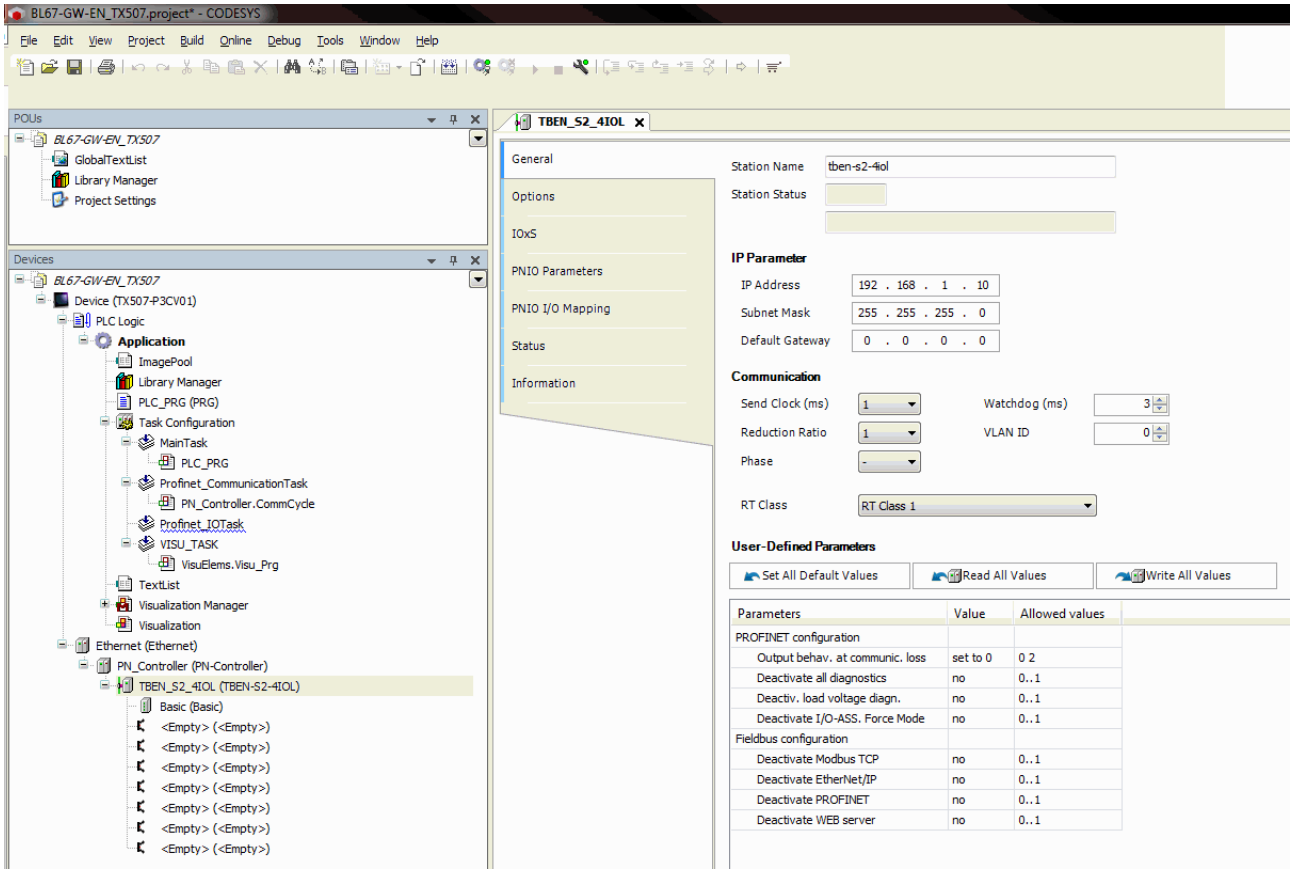


Fig. 49: Configure hardware

▶ Assign slots of the TBEN IO-Link master: right-click on the slot → Select **Plug Device…**.

The last three slots are for diagnostics, bytes, and module status.

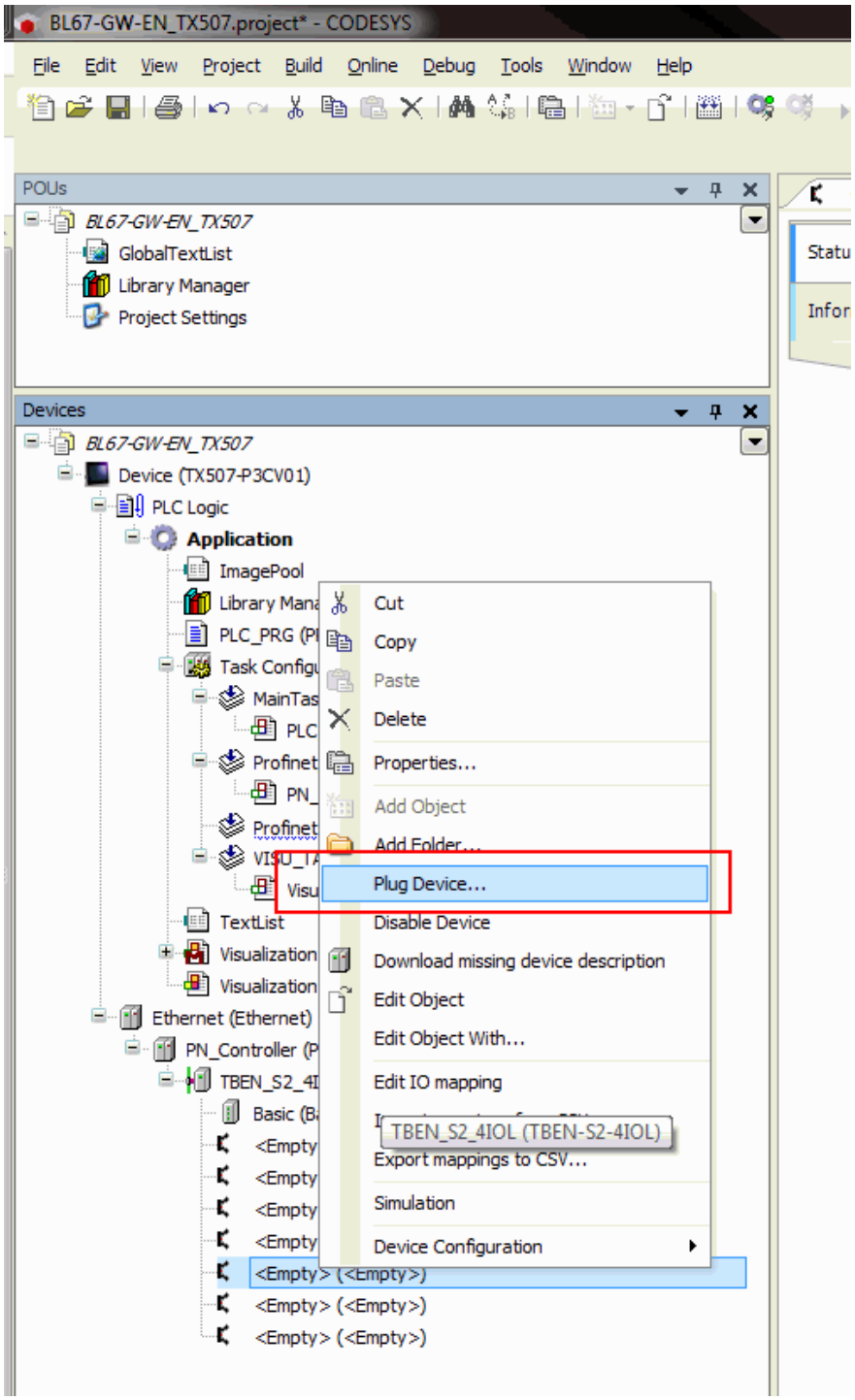


Fig. 50: IO-Link master — assigning slots

▶ Select **Diagnostics**.

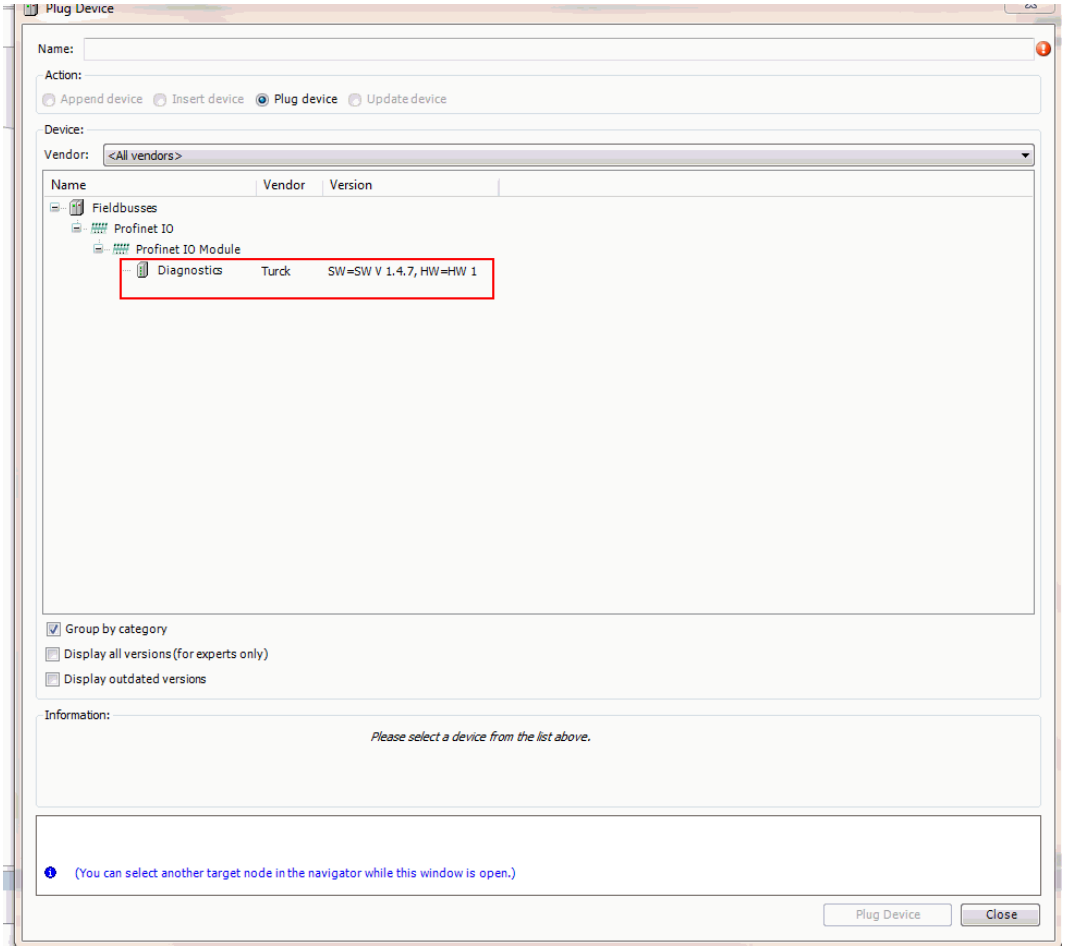


Fig. 51: Select diagnostics

- Assign IO-Link ports: right-click on the slot → **Plug Device**.
- Select **Port configuration generic**.

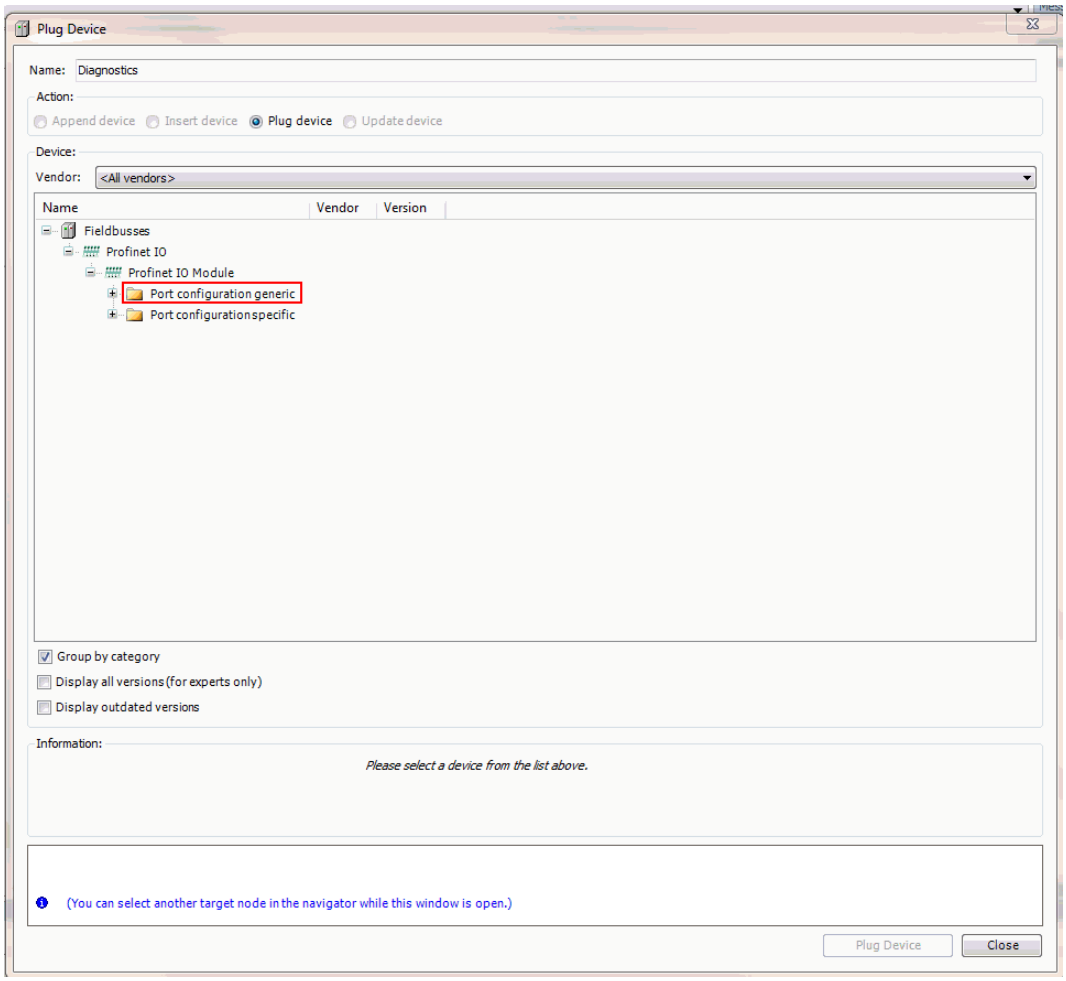


Fig. 52: Selecting generic configuration

▶ Configure the port.

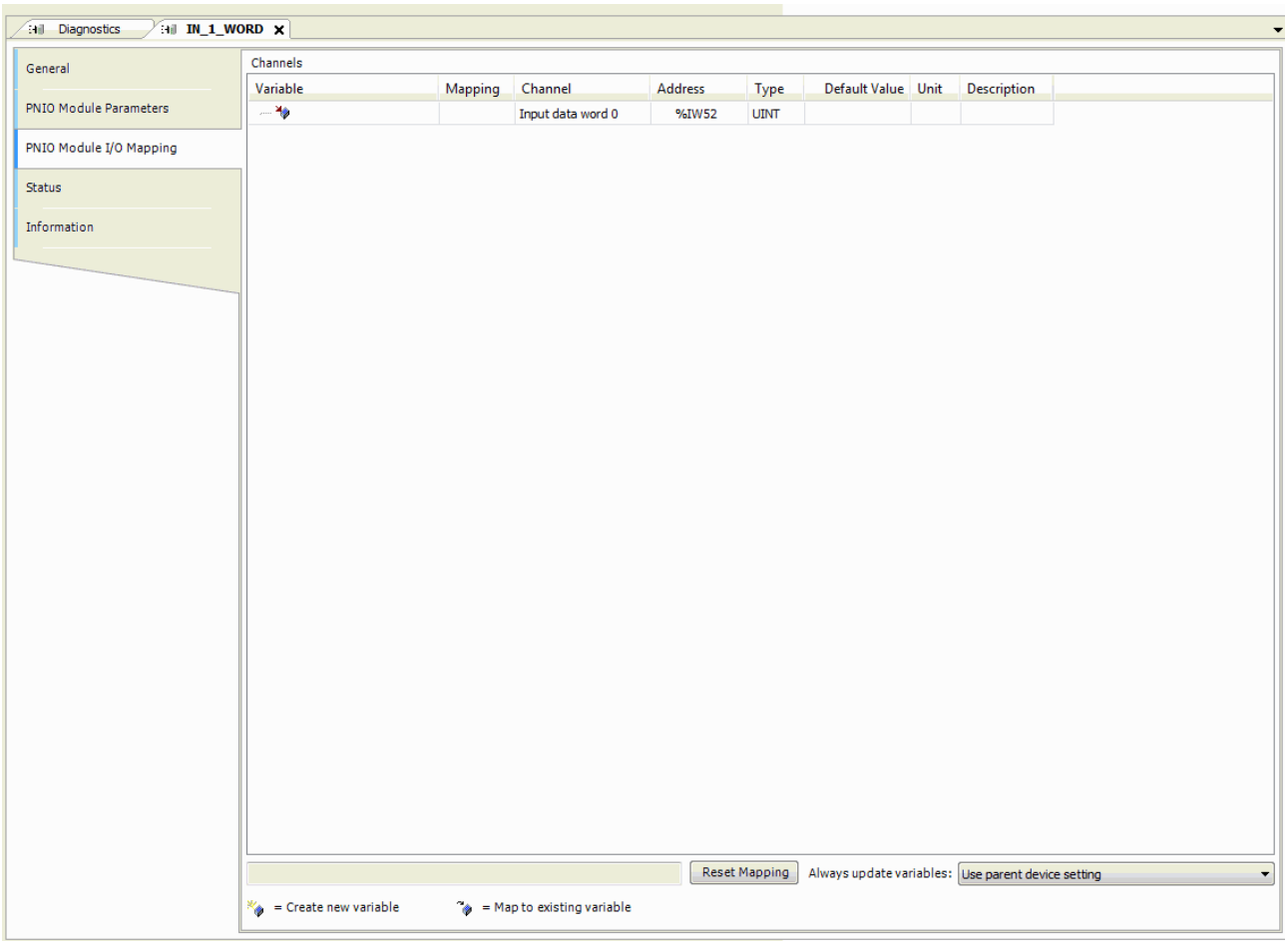


Fig. 53: Configure the port

The process values can be monitored in online mode.

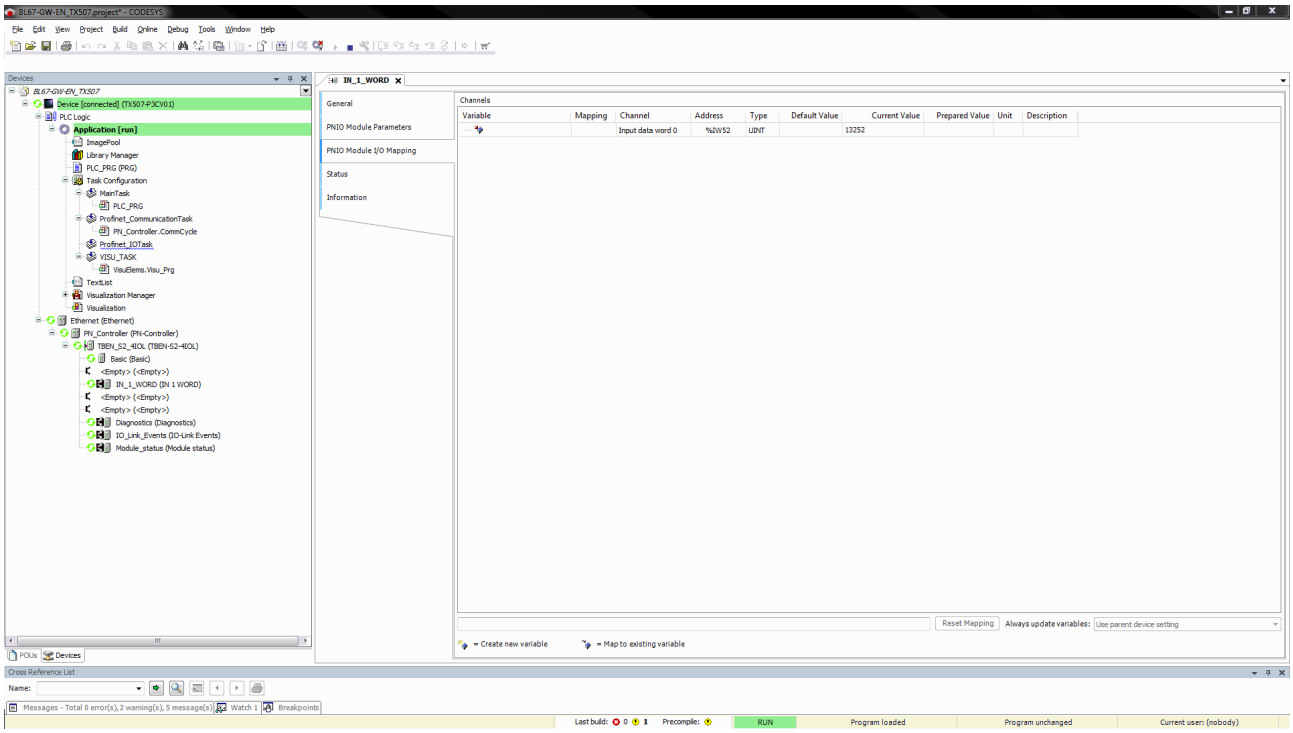


Fig. 54: Process values in online mode

Example: configure the device specifically

NOTE
The IO-Link master TBEN-S2-4IOL can be configured specifically. The connected devices can be configured via the configuration program of the controller.

▶ Configure hardware in CODESYS.

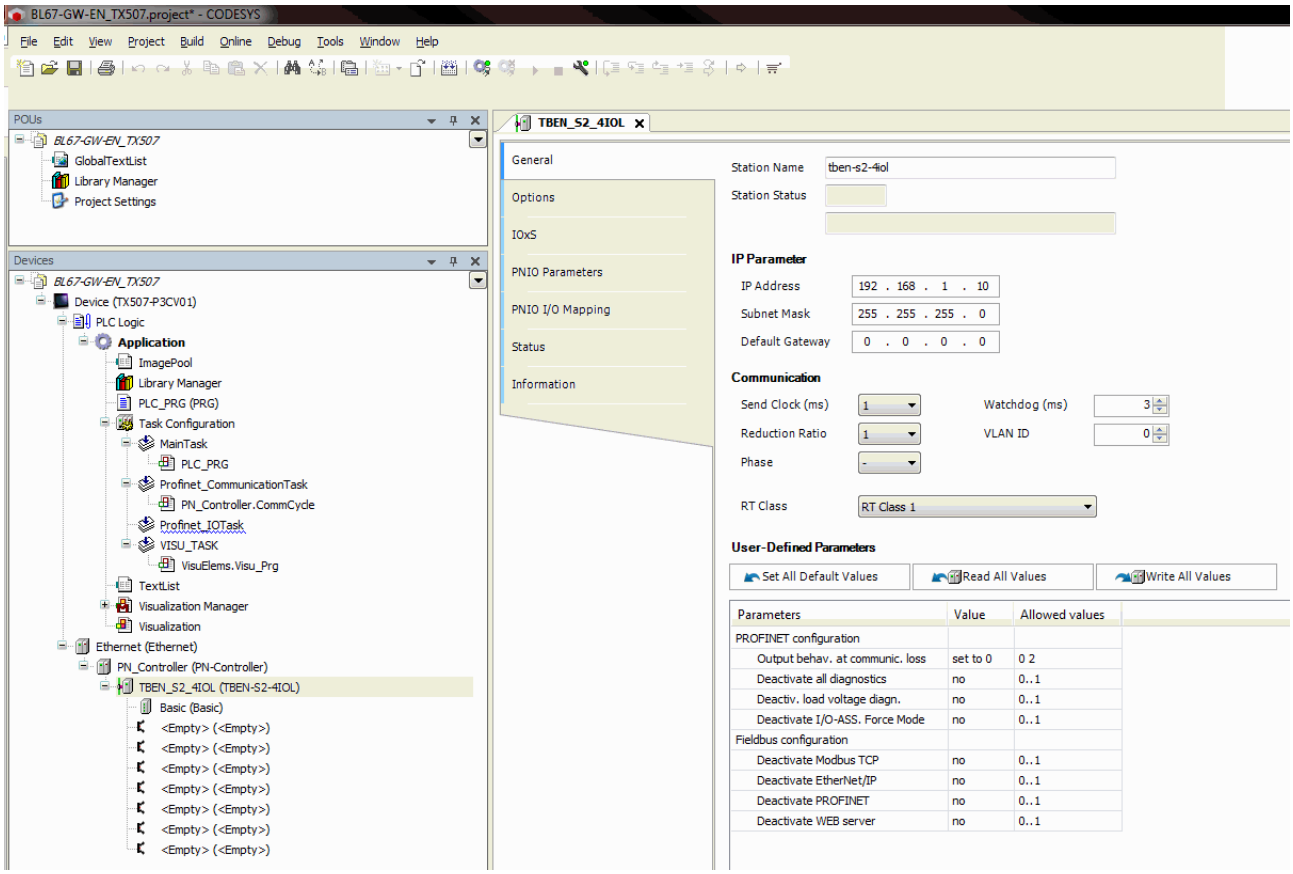


Fig. 55: Configure hardware

▶ Assign slots of the TBEN IO-Link master: right-click on the slot → Select **Plug Device…**.

The last three slots are for diagnostics, bytes, and module status.

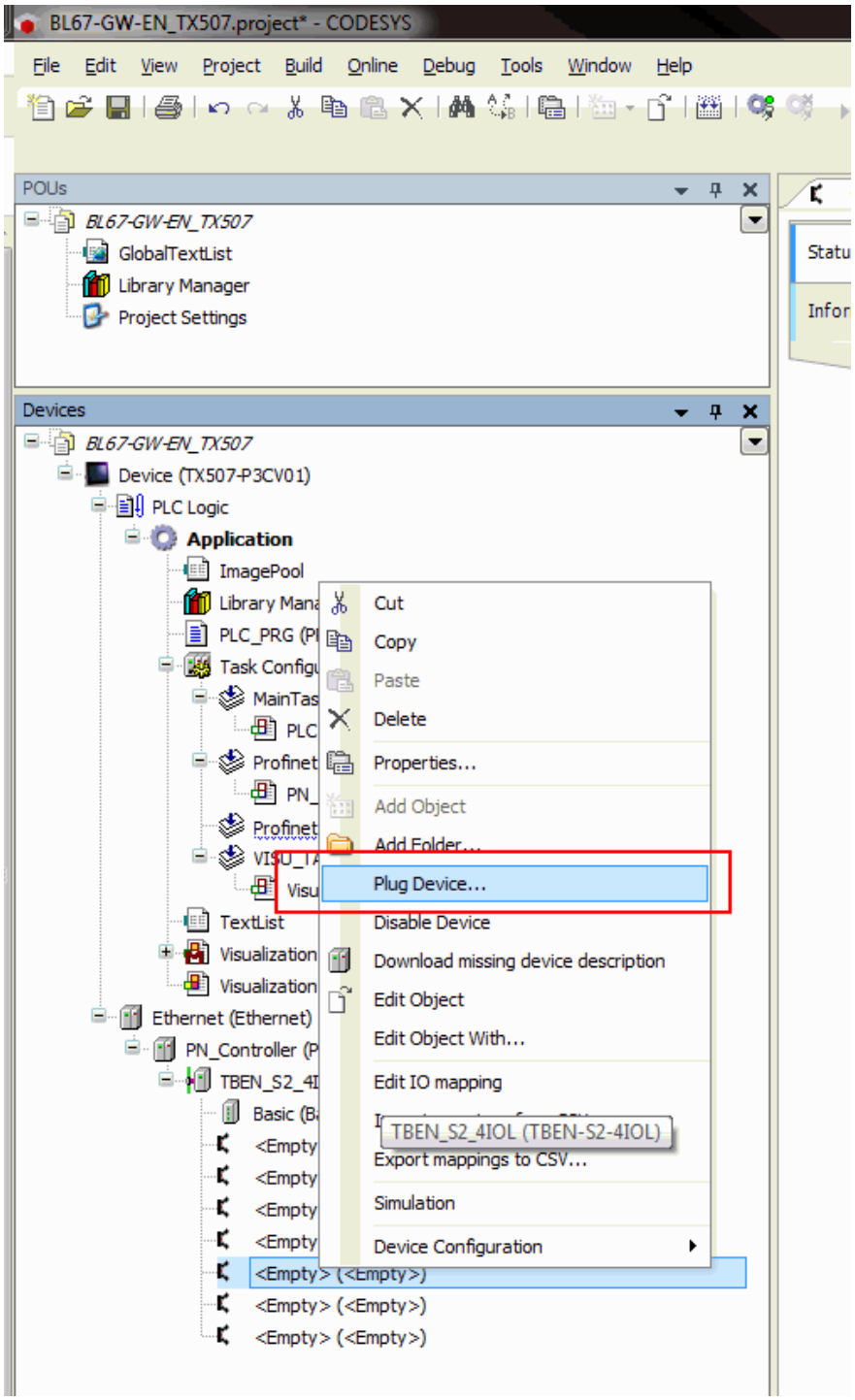


Fig. 56: IO-Link master — assigning slots

▶ Select **Diagnostics**.

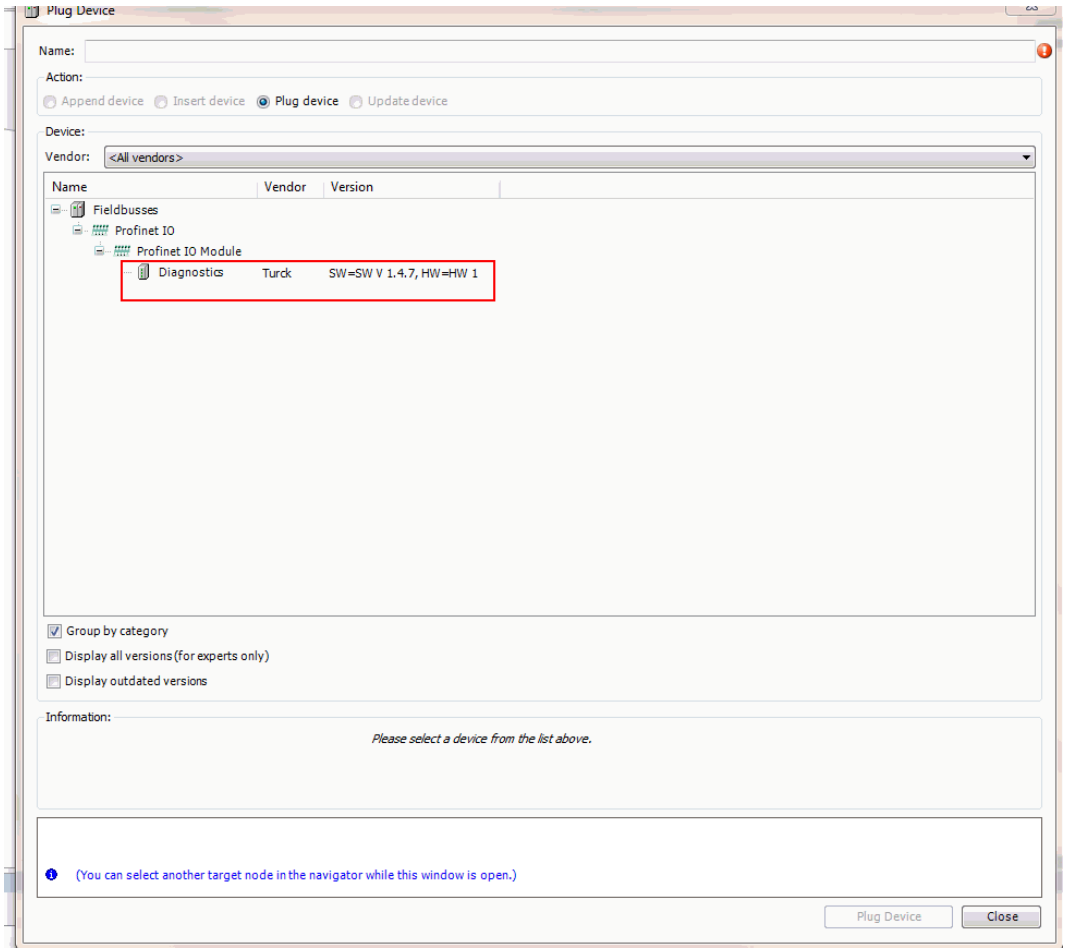


Fig. 57: Example: Select diagnostics

- Assign IO-Link ports: right-click on the slot → **Plug Device**.
- Select **Port configurationspecific**.

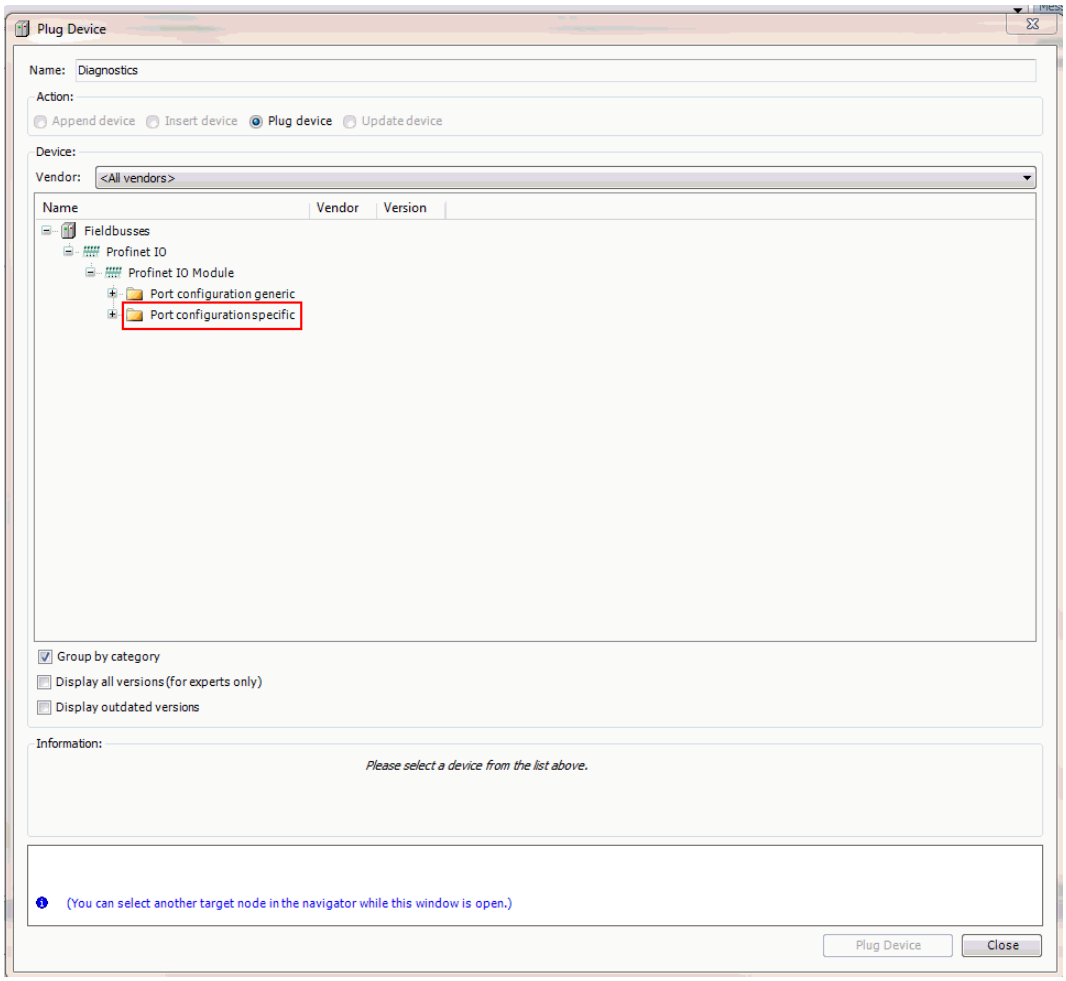


Fig. 58: Select specific configuration

▶ Configure the port.

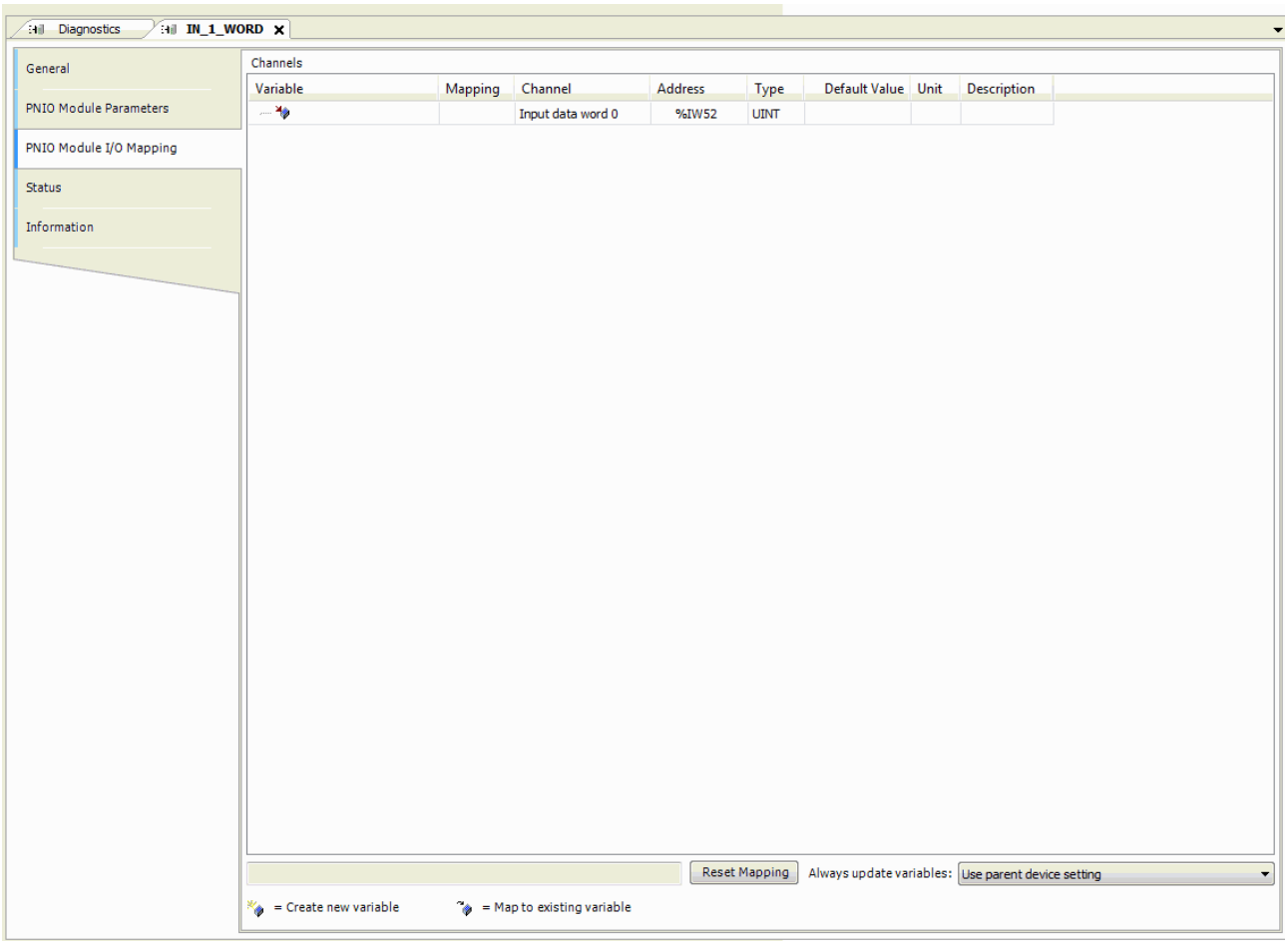


Fig. 59: Configure the port

▶ Select IO-Link device.

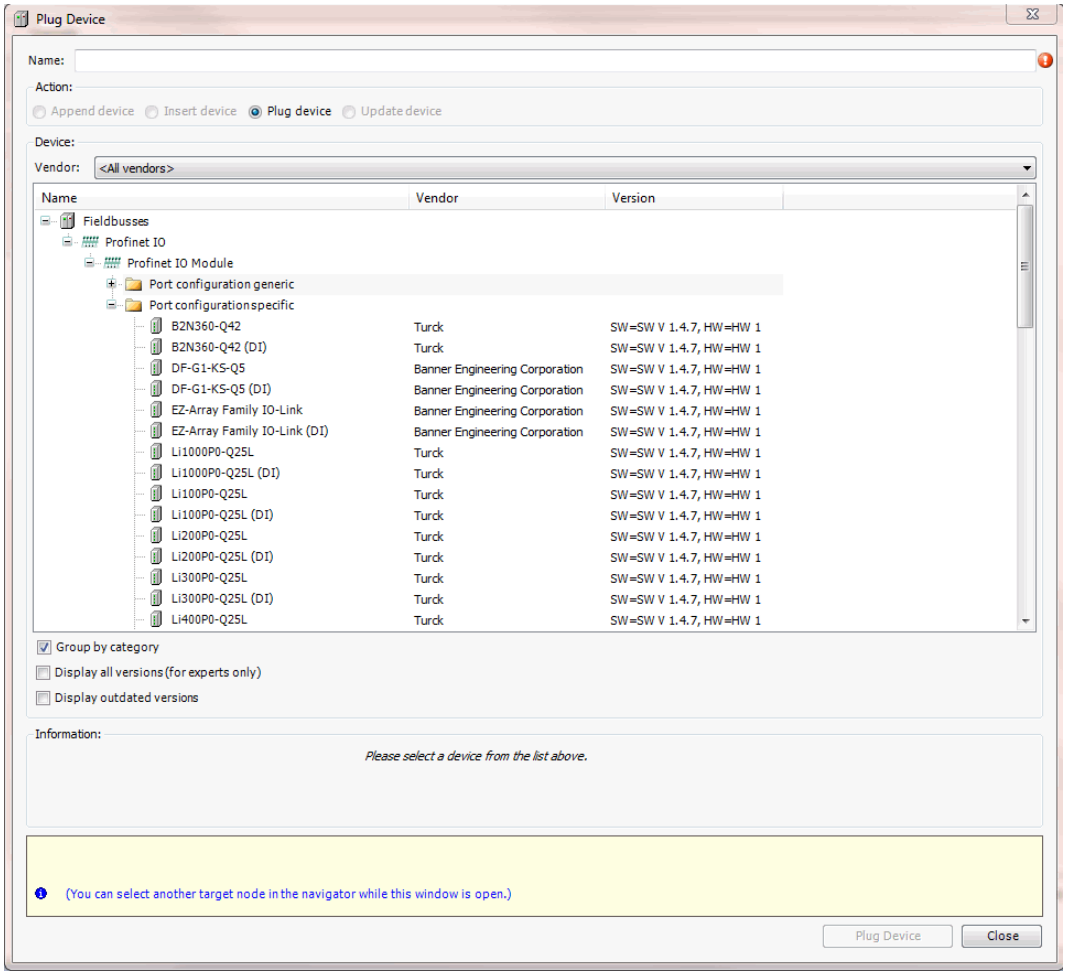


Fig. 60: Select IO-Link device

▶ Select device parameters.

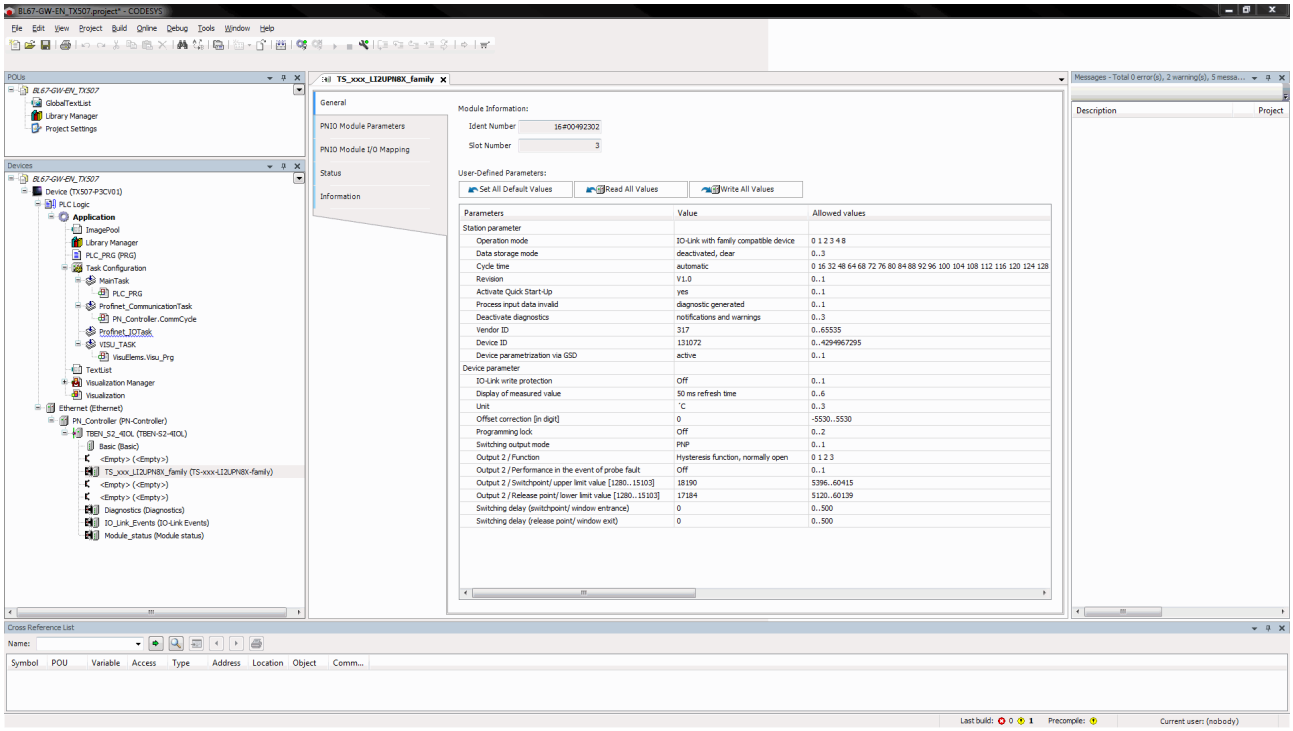


Fig. 61: Select device parameters

With the specific configuration, the IO-Link devices can be set specifically in addition to the parameters of the IO-Link master. When the application is started in the controller, the settings are transferred via PROFINET to the device.

The process values can be monitored in online mode.

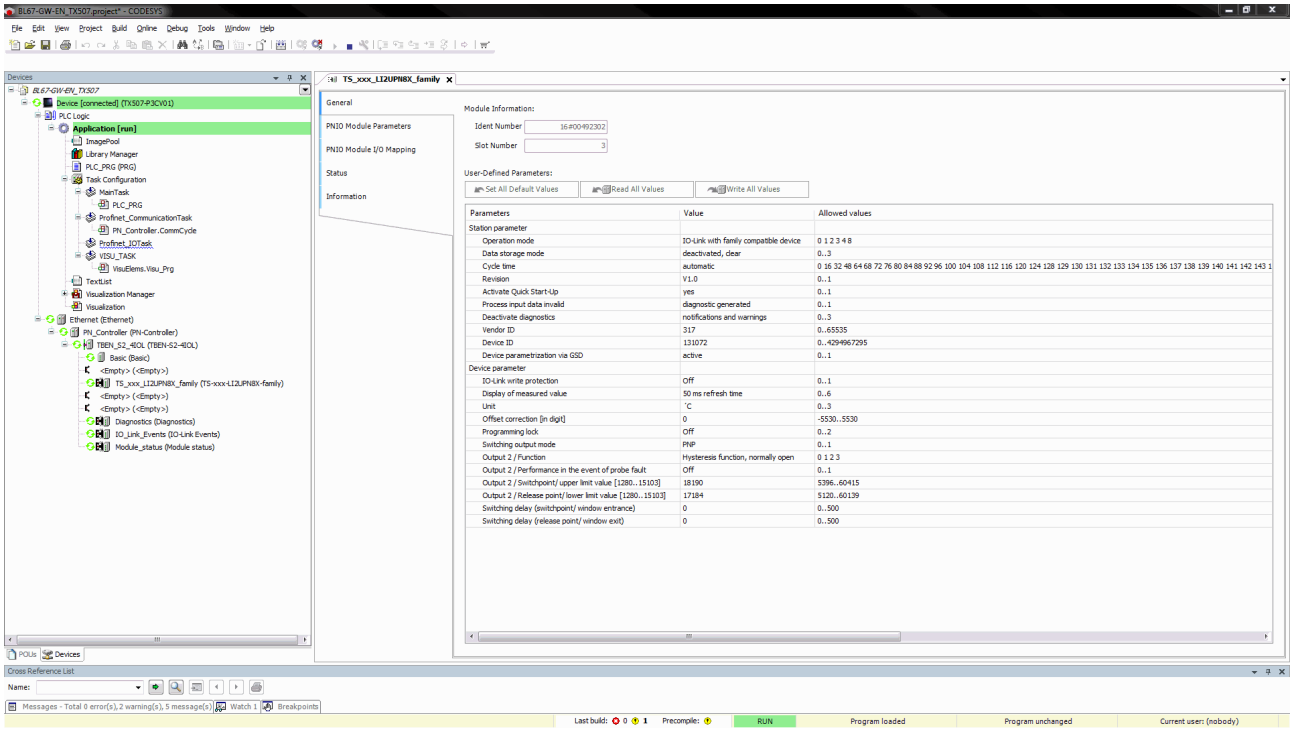


Fig. 62: Process values in online mode

6.2.4 Commissioning with TBEN-L…-8IOL and TBEN-L5-PLC-1… in CODESYS 3

Software used

- CODESYS 3.5 SP14 Patch 2
- GSDML file for TBEN-L…-8IOL
- Package for TBEN-L5-PLC-1…

Hardware used

NOTE
As an alternative to the IO-Link block module TBEN-S2-4IOL, the IO-Link block modules TBEN-L…-8IOL or FEN20-4IOL can be used.

NOTE
Information on the IO-Link master can be found in the instructions for use.

- TBEN-L5-PLC-10
- IO-Link master TBEN-L…-8IOL
- TS720-2UPN8-H1141
- Sensor cable RKC4.4T-2-RSC4.4T/TXL

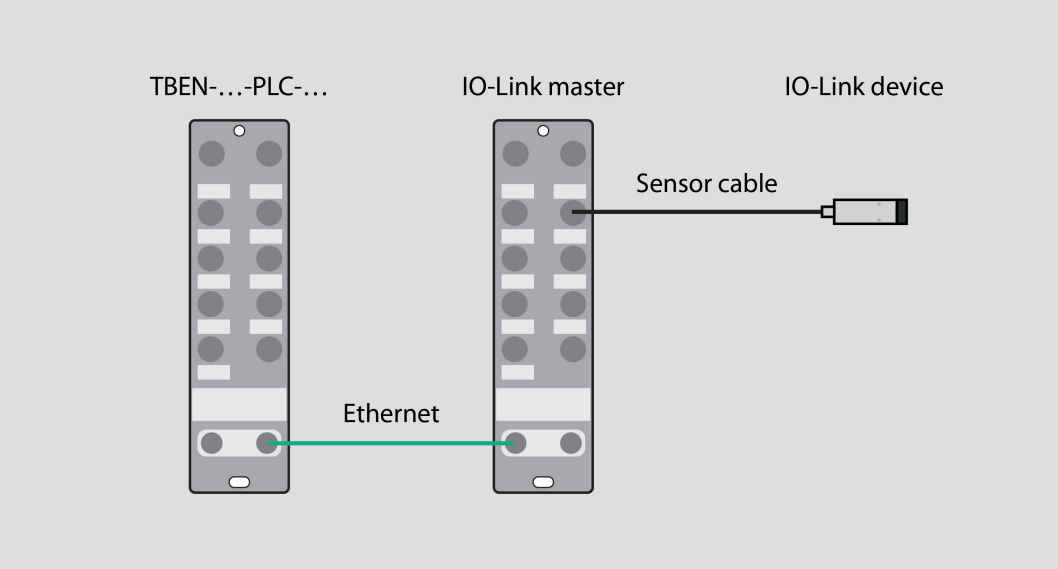


Fig. 63: Application example — setup

Example: configure the device generically

▶ Configure hardware in CODESYS.

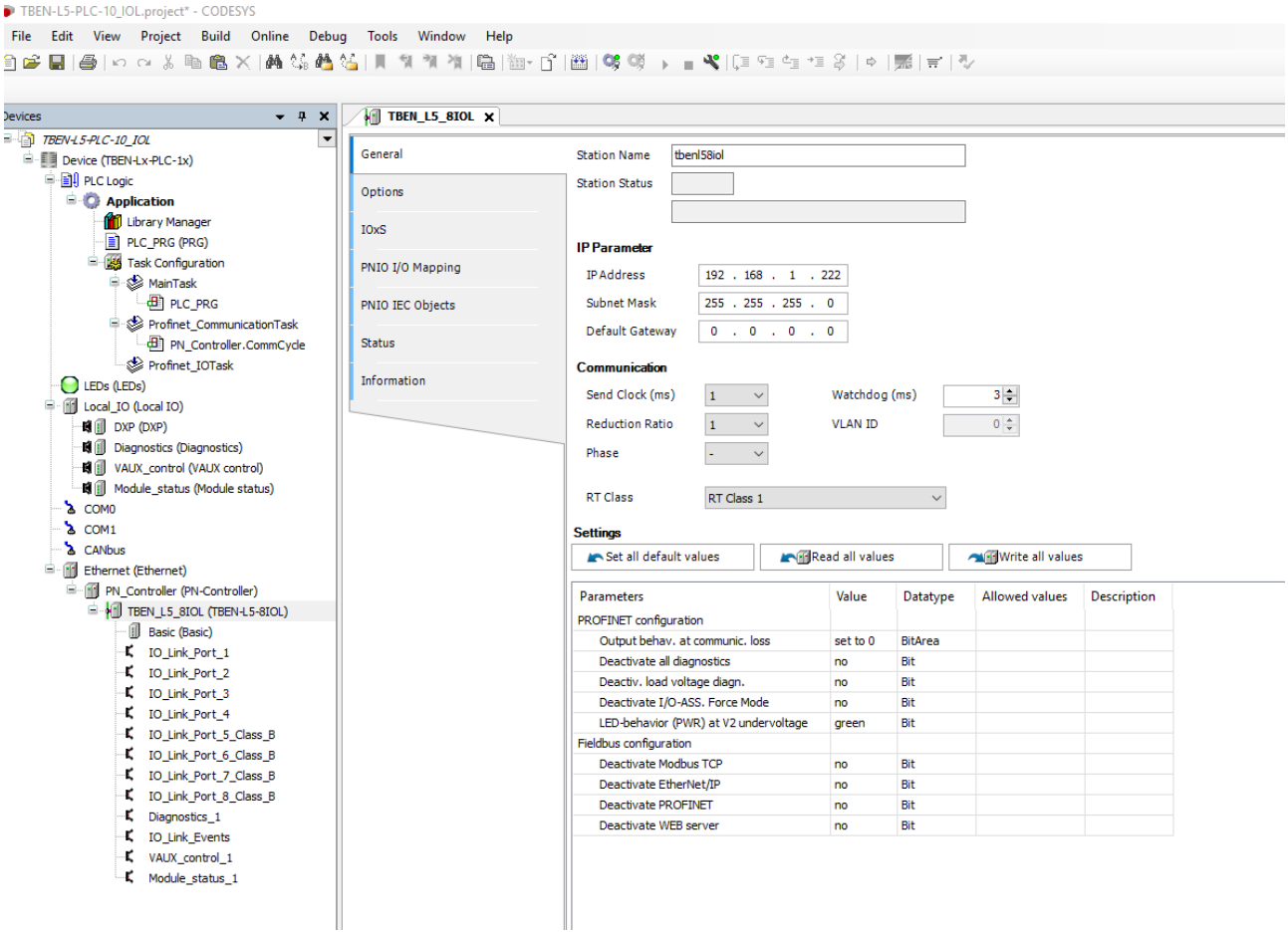


Fig. 64: Configure hardware

▶ Assign slots of the TBEN IO-Link master: right-click on the slot → Select **Plug Device…**.

The last four slots are intended for diagnostics, IO-Link events, VAUX Control, and module status.

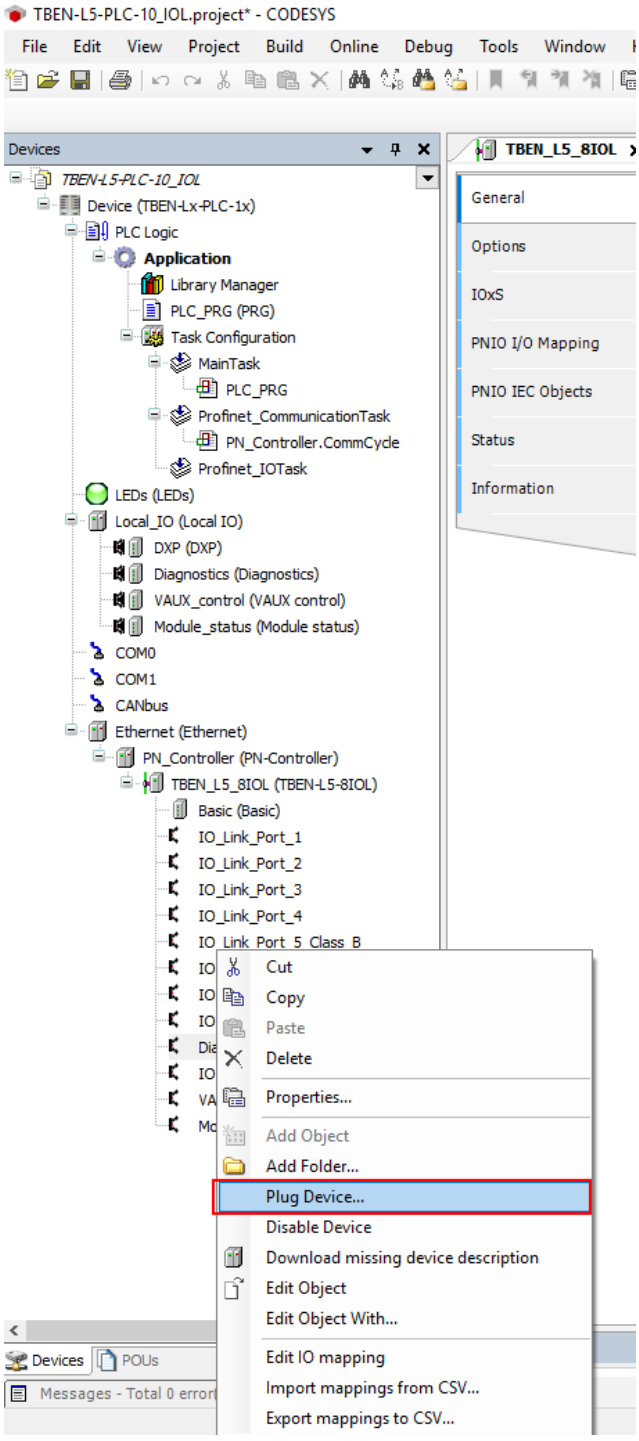


Fig. 65: IO-Link master — assigning slots

▶ Select **Diagnostics**.

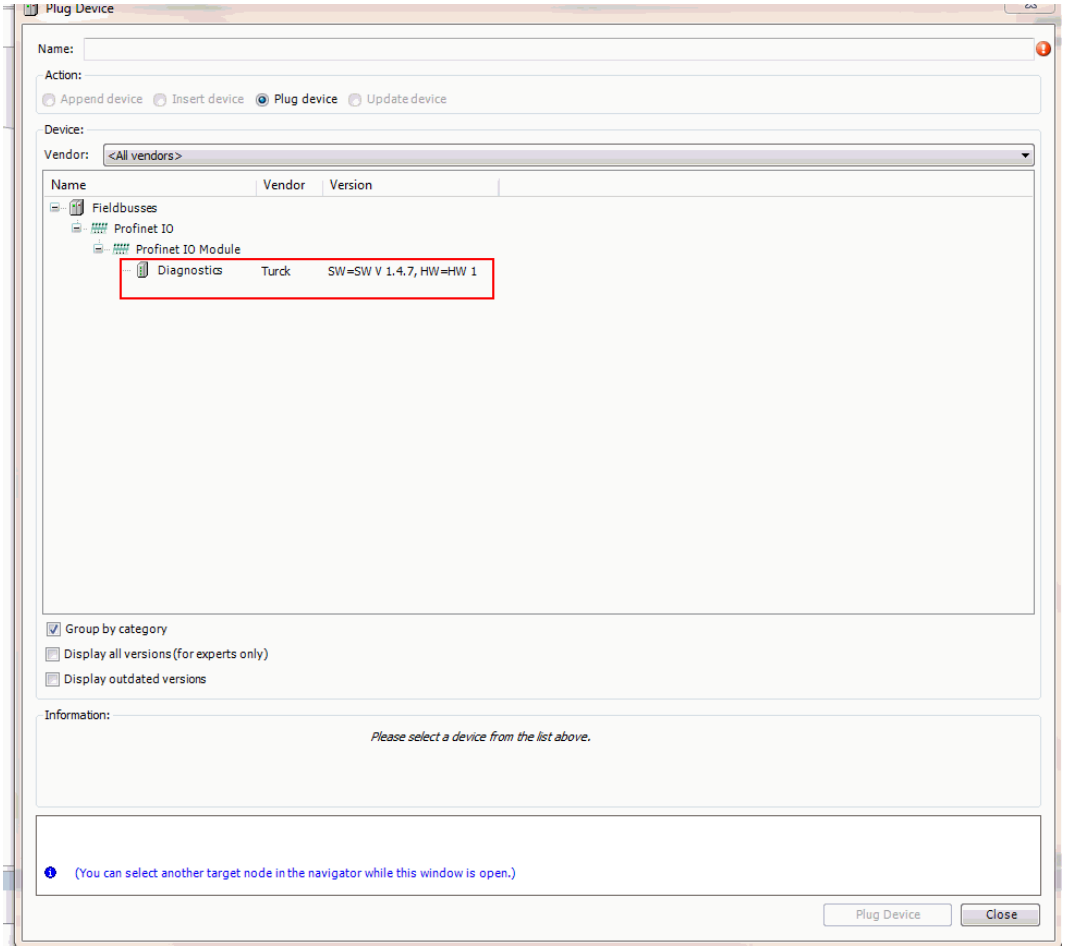


Fig. 66: Select diagnostics

- Assign IO-Link ports: right-click on the slot → **Plug Device**.
- Select **Port configuration generic**.

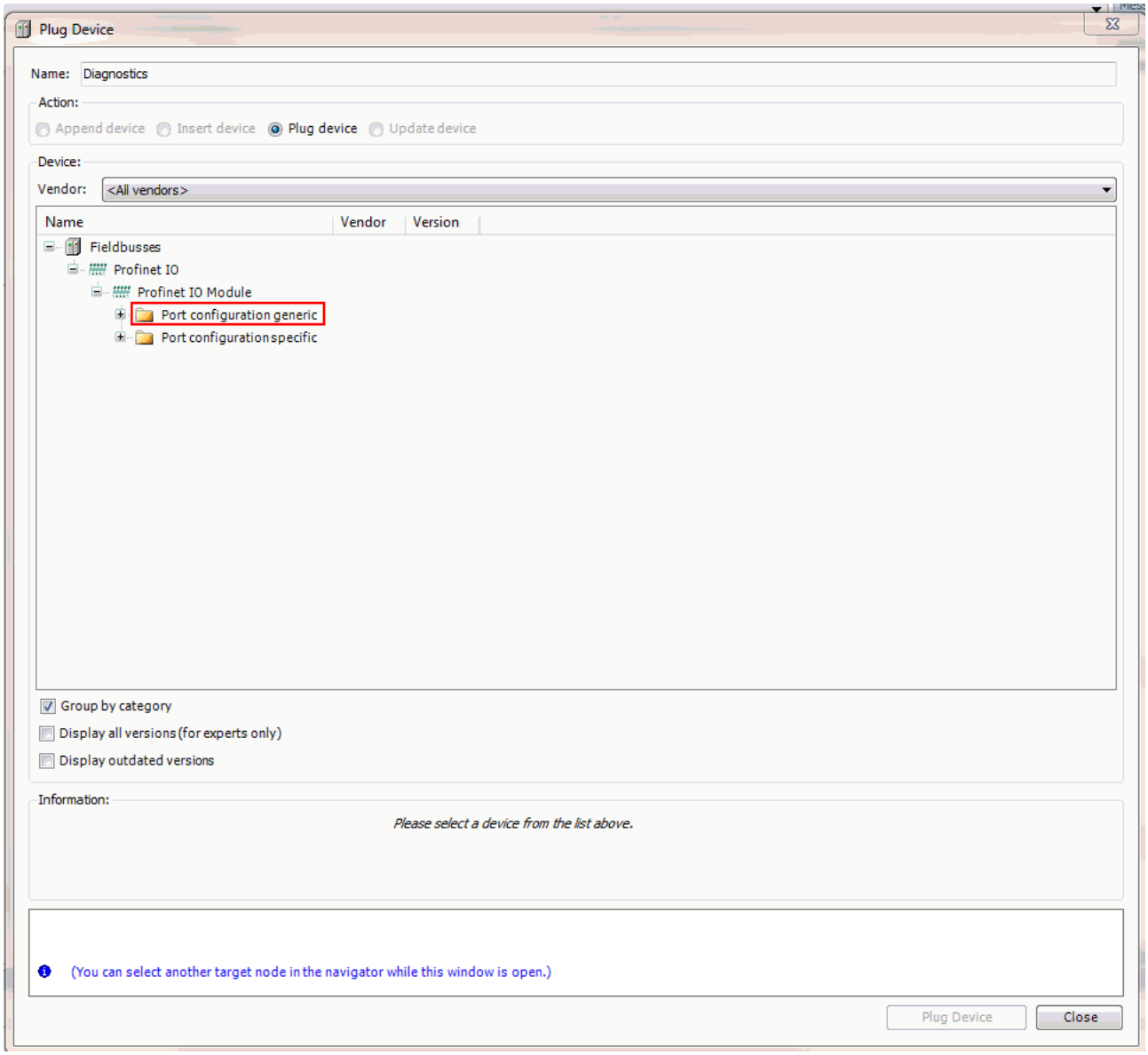


Fig. 67: Selecting generic configuration

▶ Configure the port.

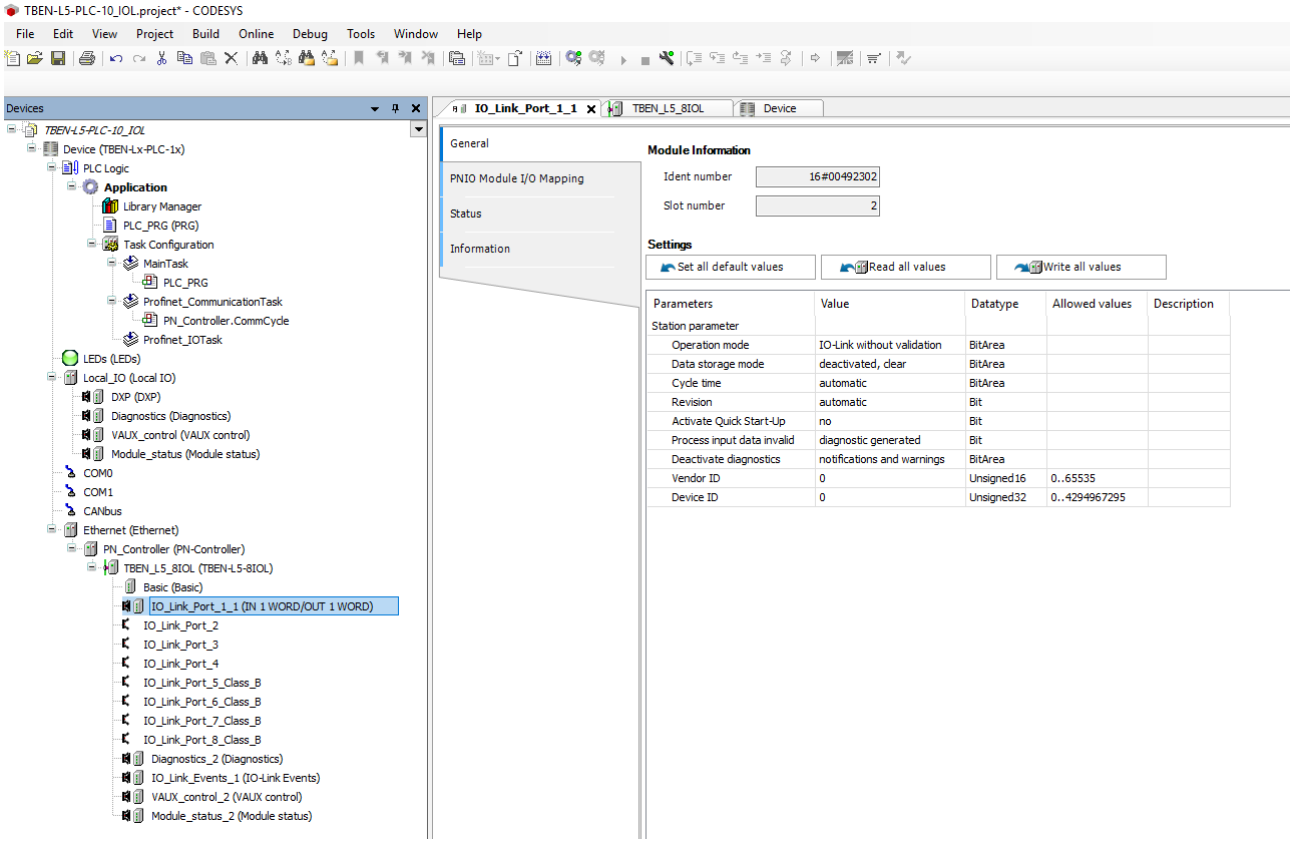


Fig. 68: Configure the port

The process values can be monitored in online mode.

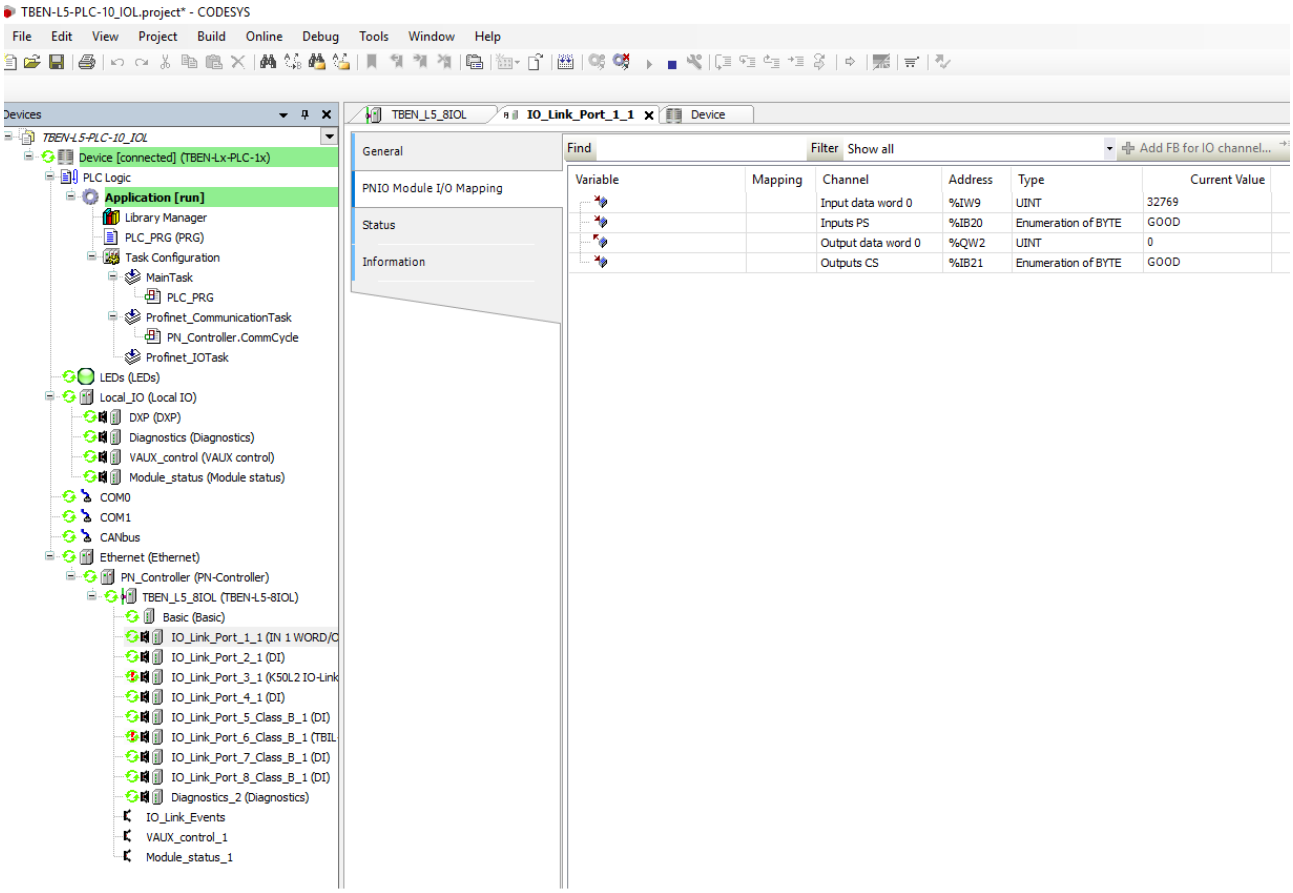


Fig. 69: Online mode — monitoring process values

Example: configure the device specifically

NOTE
The IO-Link master TBEN-L…-8IOL can be configured specifically. The connected devices can be configured via the configuration program of the controller.

To configure the device specifically, the GSDML file must have SIDI.

- ▶ Configure hardware in CODESYS.

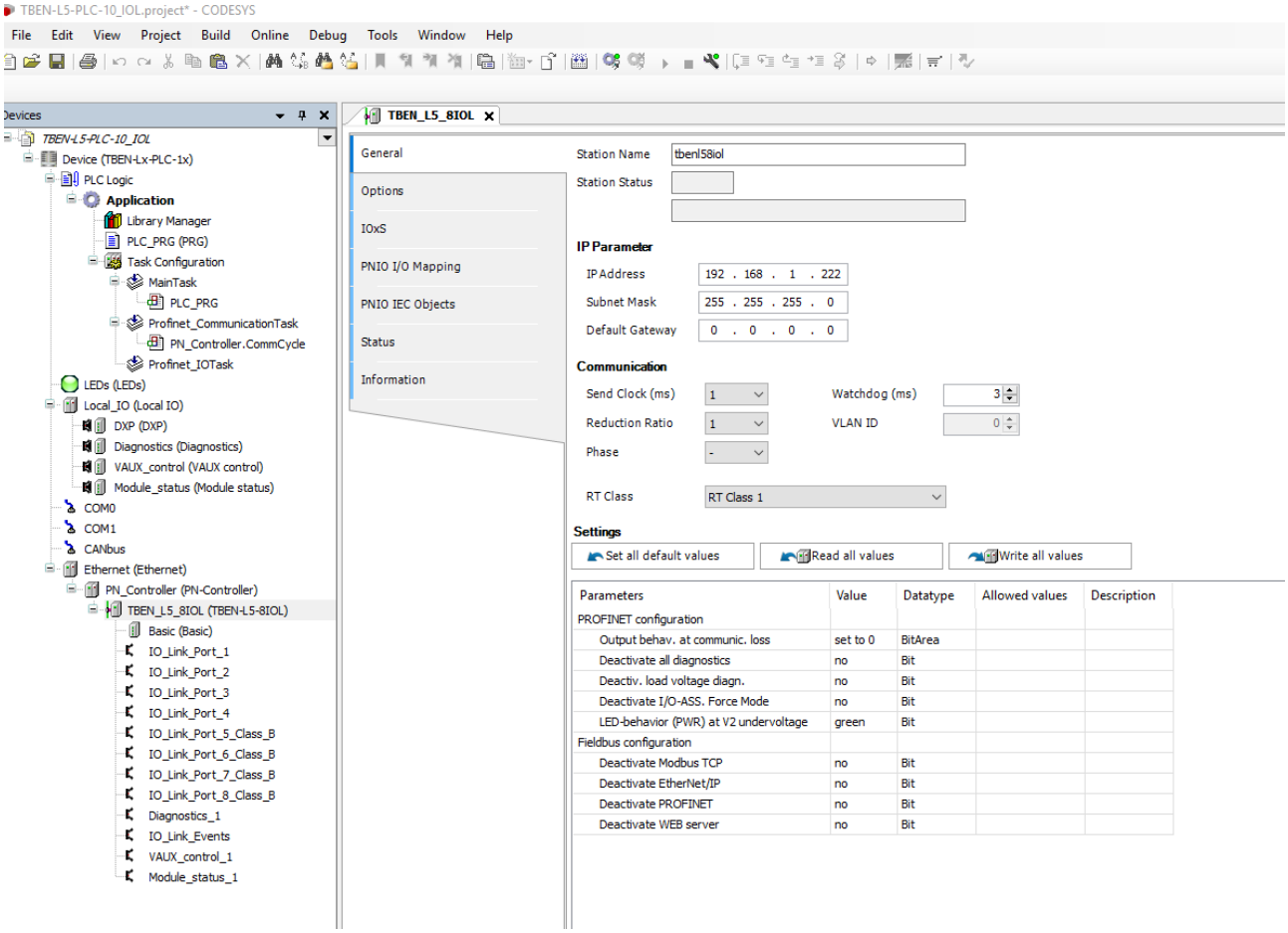


Fig. 70: Configure hardware

▶ Assign slots of the TBEN IO-Link master: right-click on the slot → Select **Plug device…**.

The last four slots are intended for diagnostics, IO-Link events, VAUX Control, and module status.

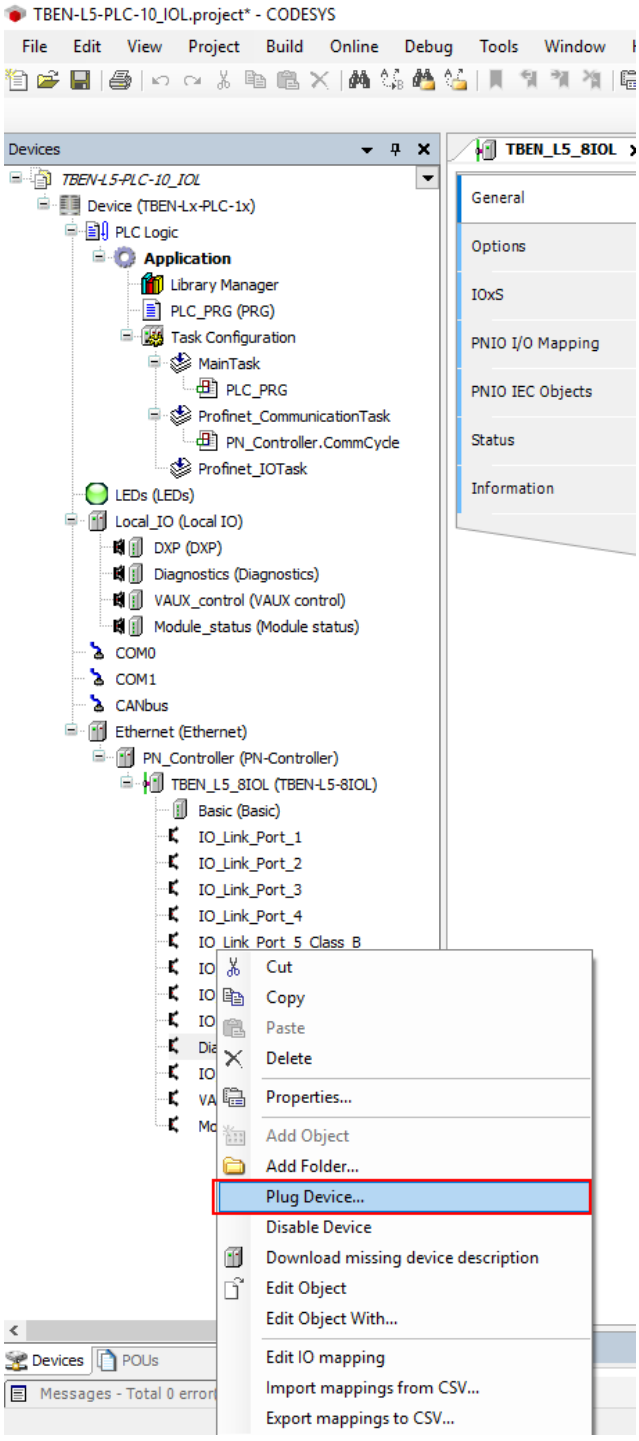


Fig. 71: IO-Link master — assigning slots

▶ Select **Diagnostics**.

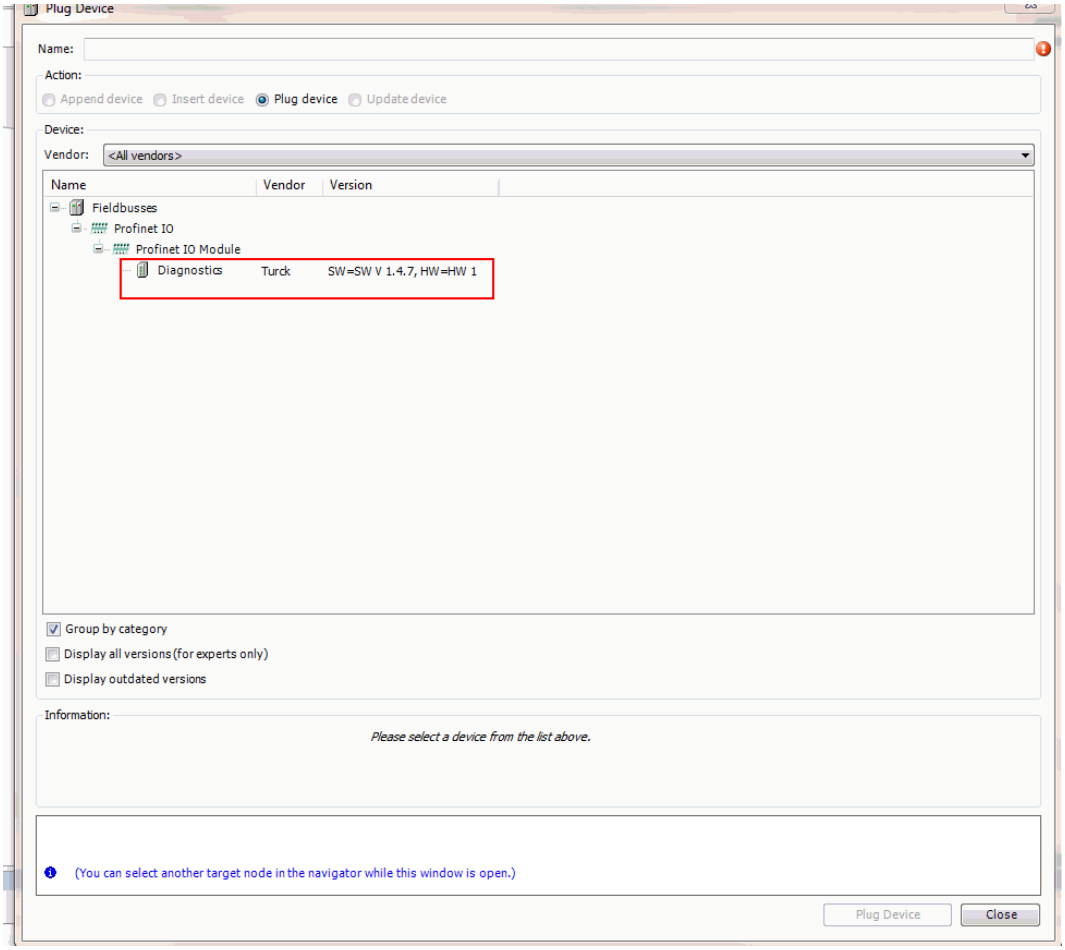


Fig. 72: Example: Select diagnostics

- Assign IO-Link ports: right-click on the slot → **Plug Device**.
- Select **Port configurationspecific**.

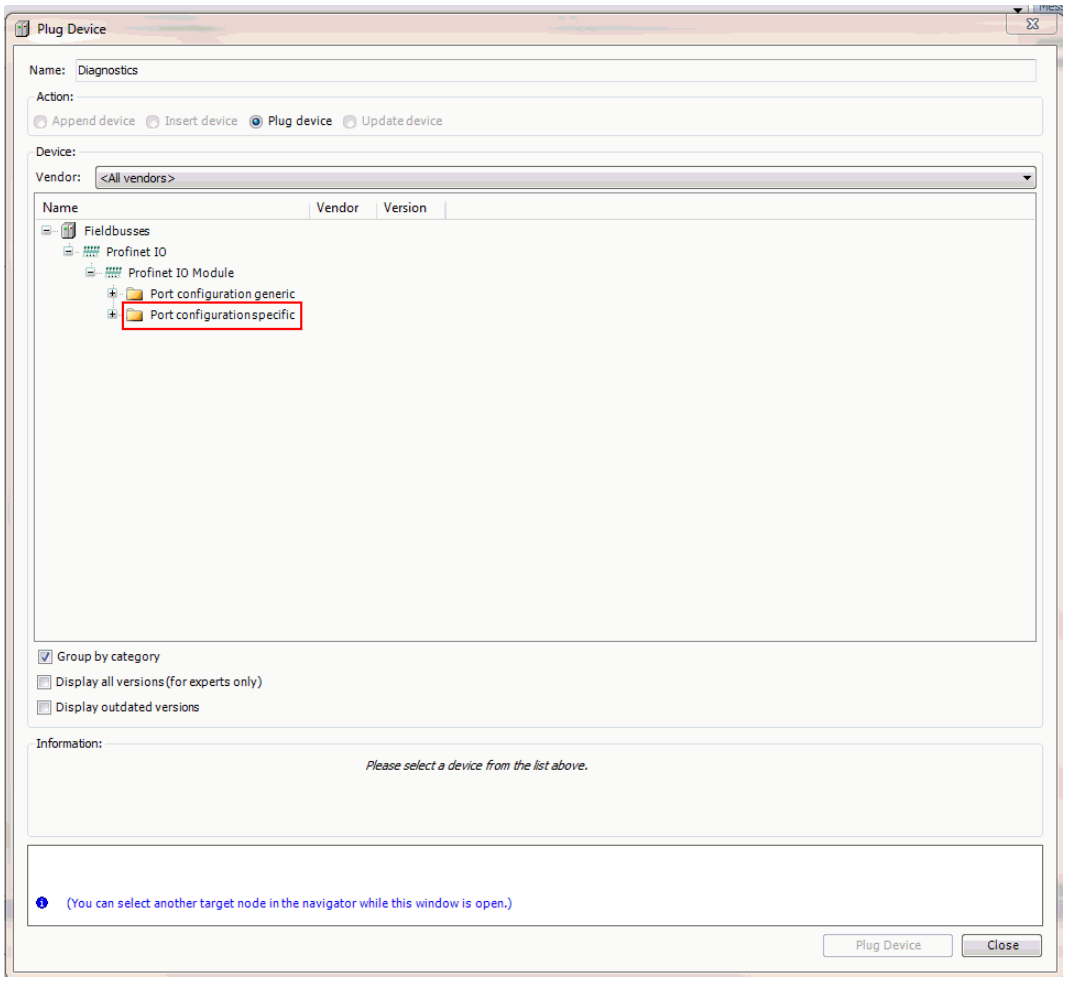


Fig. 73: Select specific configuration

▶ Configure the port.

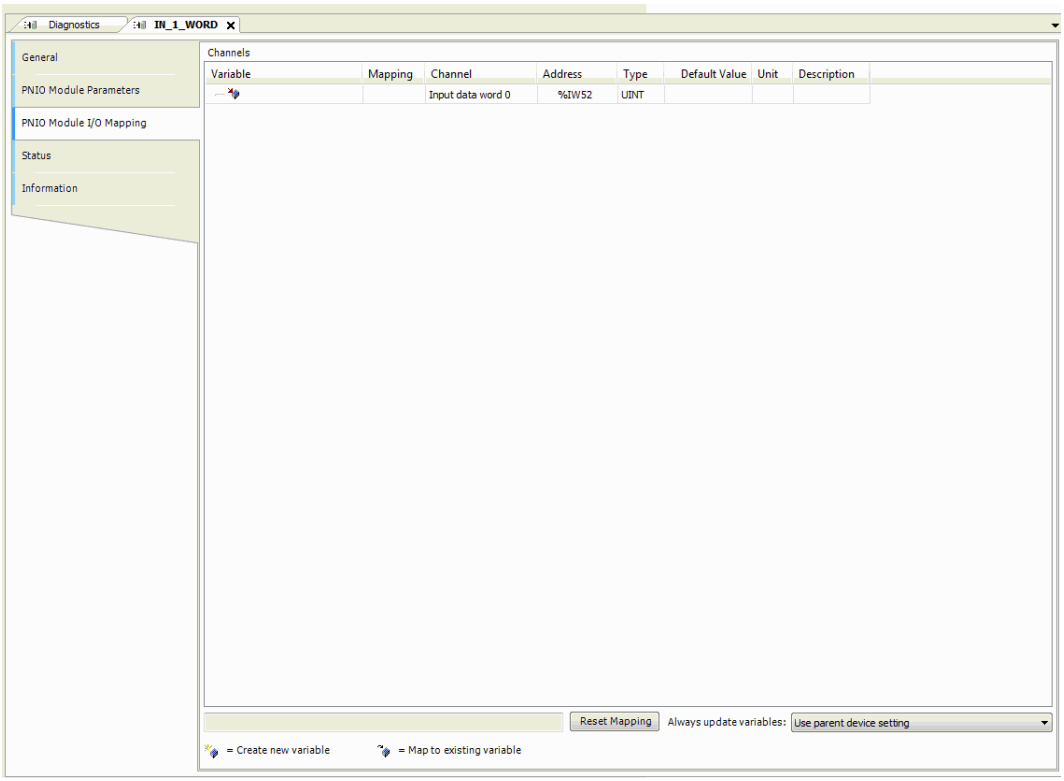


Fig. 74: Configure the port

▶ Select IO-Link device.

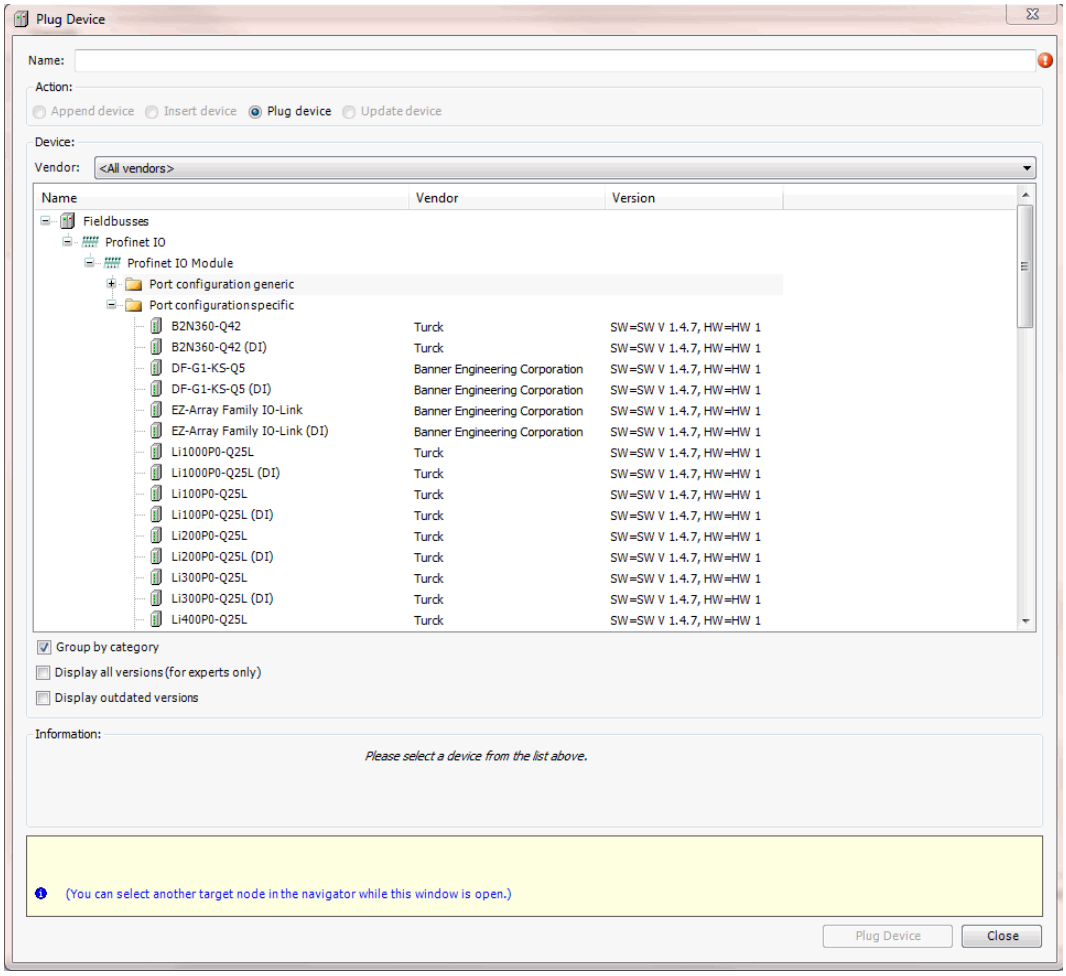


Fig. 75: Select IO-Link device

▶ Select device parameters.

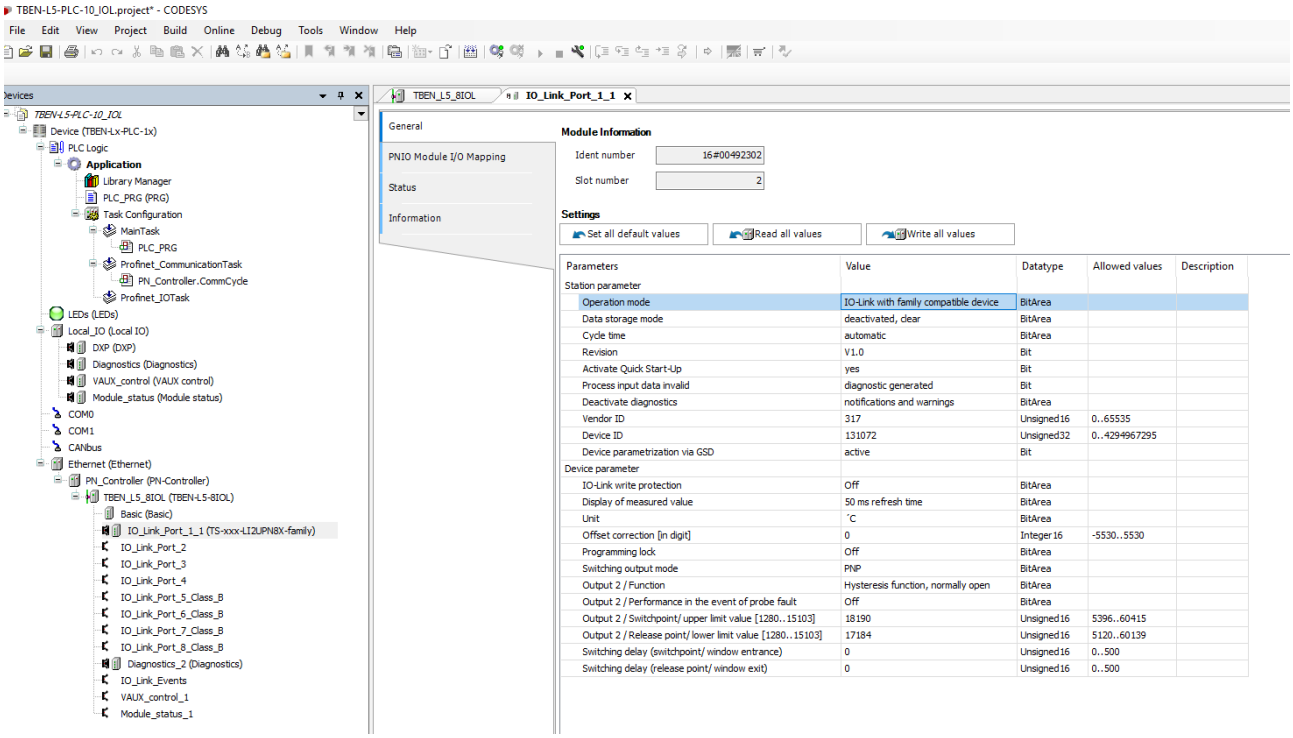


Fig. 76: Select device parameters

With the specific configuration, the IO-Link devices can be set specifically in addition to the parameters of the IO-Link master. When the application is started in the controller, the settings are transferred via PROFINET to the device.

The process values can be monitored in online mode.

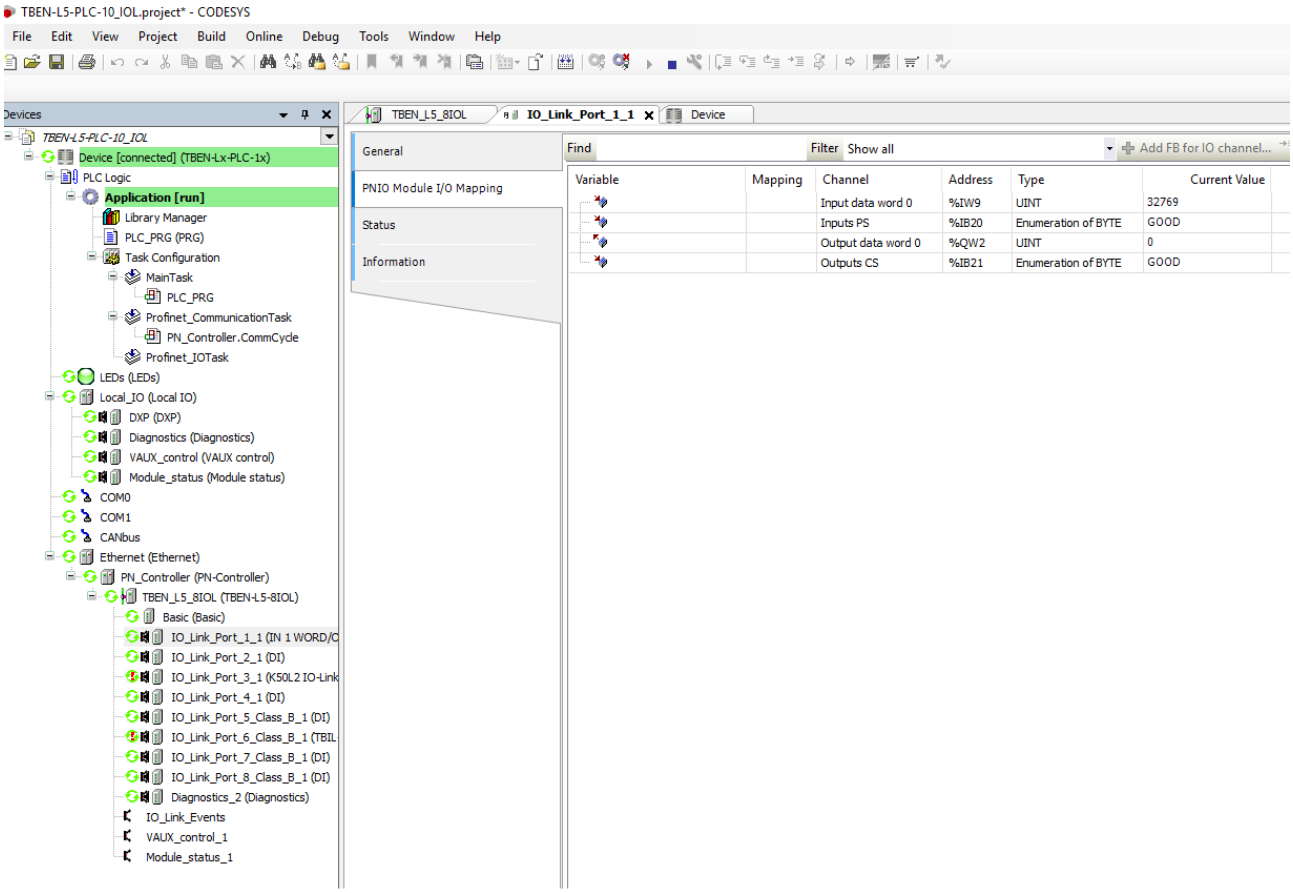


Fig. 77: Online mode — monitoring process values

6.2.5 Commissioning with BL… and Siemens controller in Simatic Manager (V5.5)

Software used

- Siemens STEP7 V5.5 (Simatic Manager)
- GSDML file for BL67-GW-EN

Hardware used

- Multiprotocol gateway BL67-GW-EN
- IO-Link master module BL67-4IOL with base module BL67-B-4M12
- Temperature sensor TS720-2UPN8-H1141, connected to IO-Link channel 1
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Siemens controller S7, e.g. CPU 315-2PN/DP

Setup

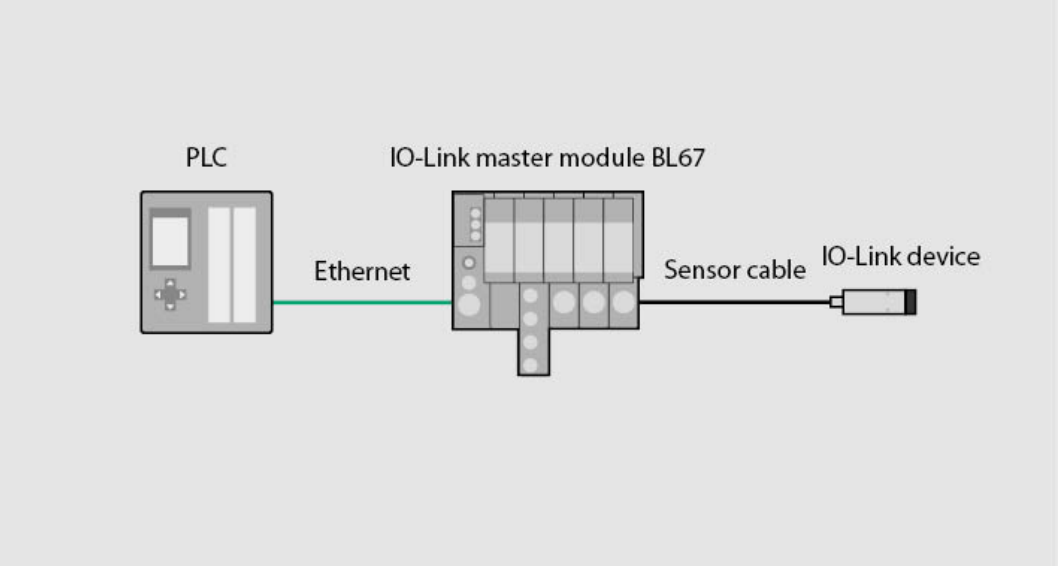


Fig. 78: Application example — setup

Example: configure the device generically

NOTE
The IO-Link master BL…-4IOL can only be configured generically. The connected devices must be configured separately.

NOTE
Information on the IO-Link master can be found in the instructions for use.

- Configure the hardware in the Simatic Manager.
- Describe I/O addresses.

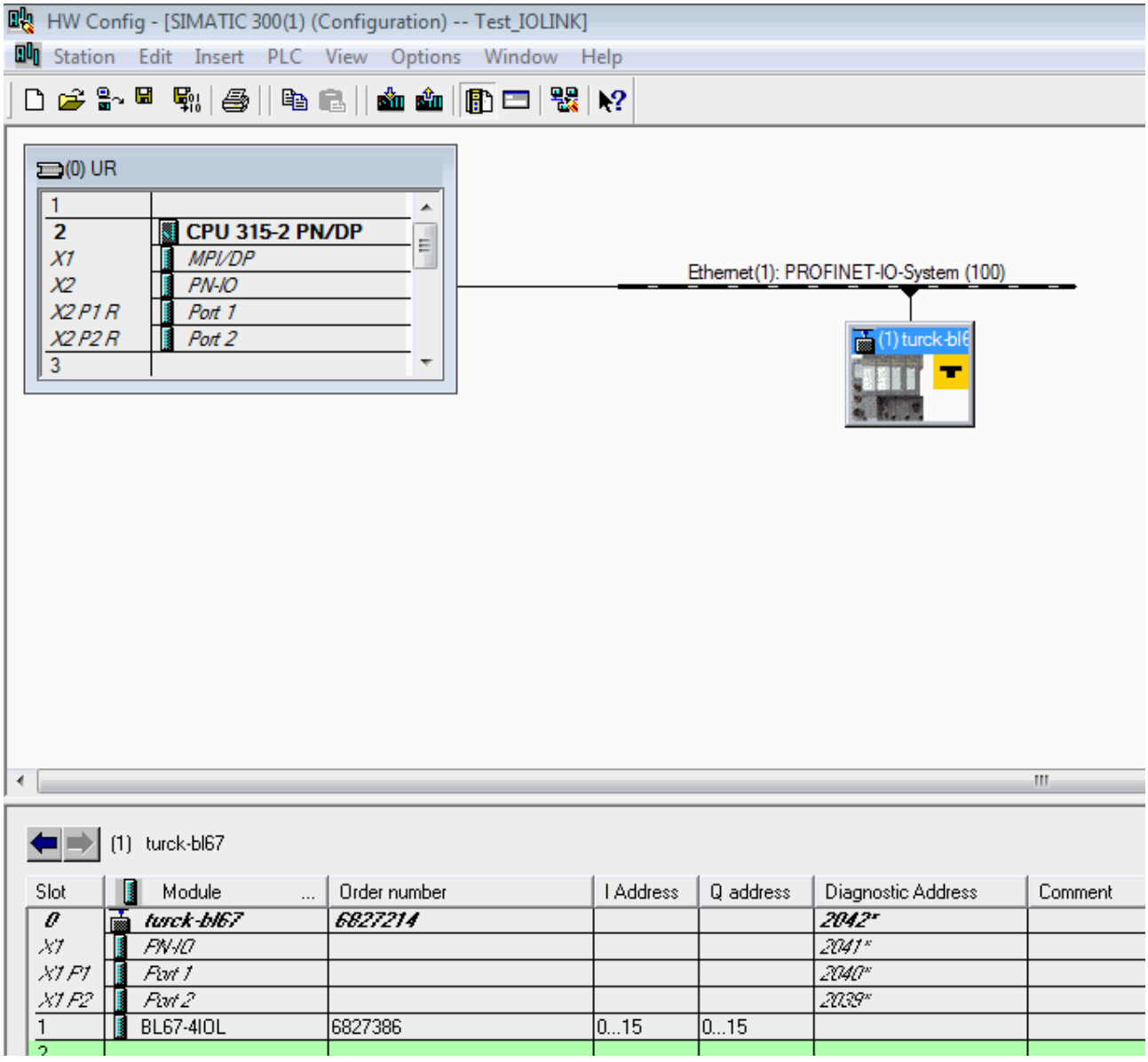


Fig. 79: Describe I/O addresses in the Simatic Manager

- Double-click on the IO-Link master.
- Select parameters.

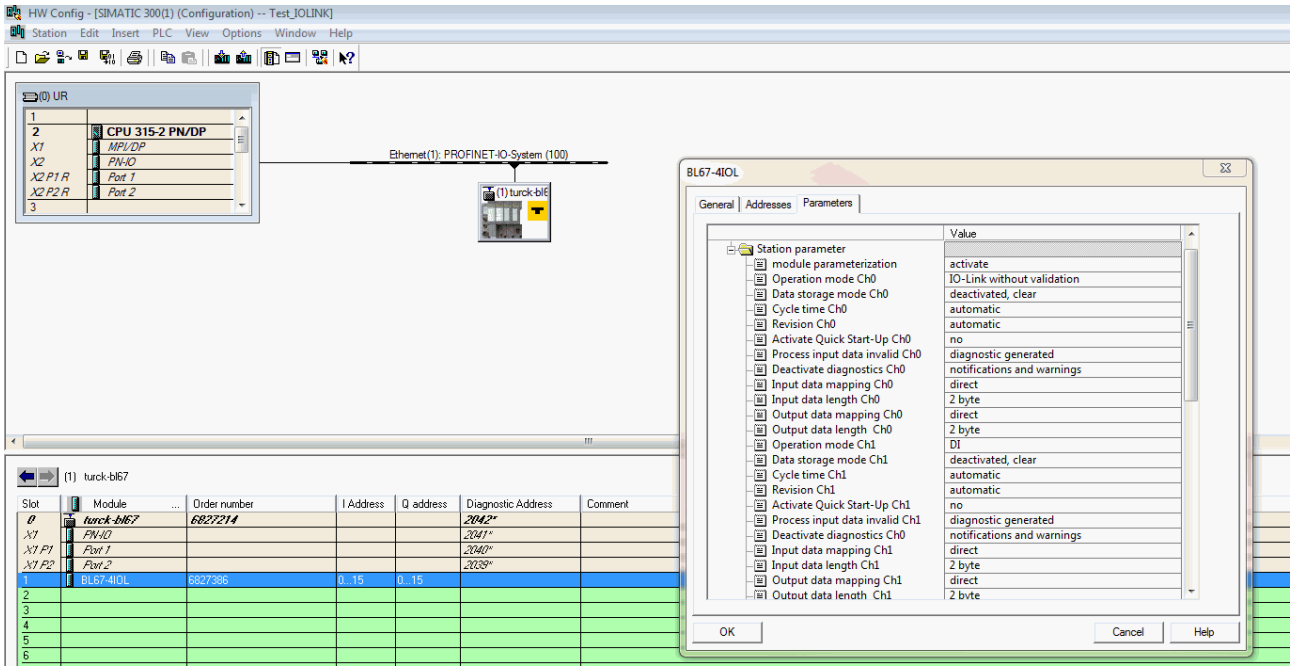


Fig. 80: Set parameters

In online mode, the process data can be read out if an IO-Link device is connected.

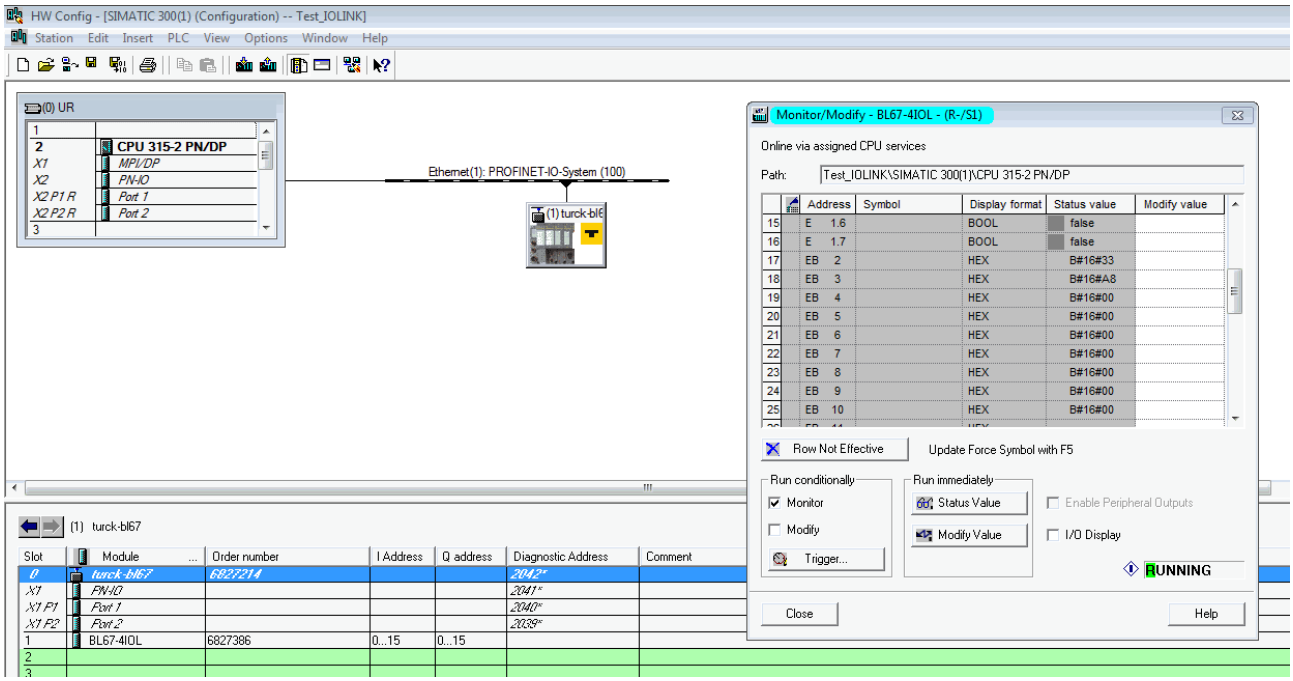


Fig. 81: Reading out process data in online mode

6.2.6 Commissioning with TBEN and Siemens controller in Simatic Manager (V5.5)

Software used

- Siemens STEP7 V5.5 (Simatic Manager)
- GSDML file for TBEN-S2-4IOL

Hardware used

NOTE
As an alternative to the IO-Link block module TBEN-S2-4IOL, the IO-Link block modules TBEN-L…-8IOL or FEN20-4IOL can be used.

NOTE
Information on the IO-Link master can be found in the instructions for use.

- IO-Link master TBEN-S2-4IOL
- Temperature sensor TS720-2UPN8-H1141, connected to IO-Link channel 1
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Siemens controller S7, e.g. CPU 315-2PN/DP

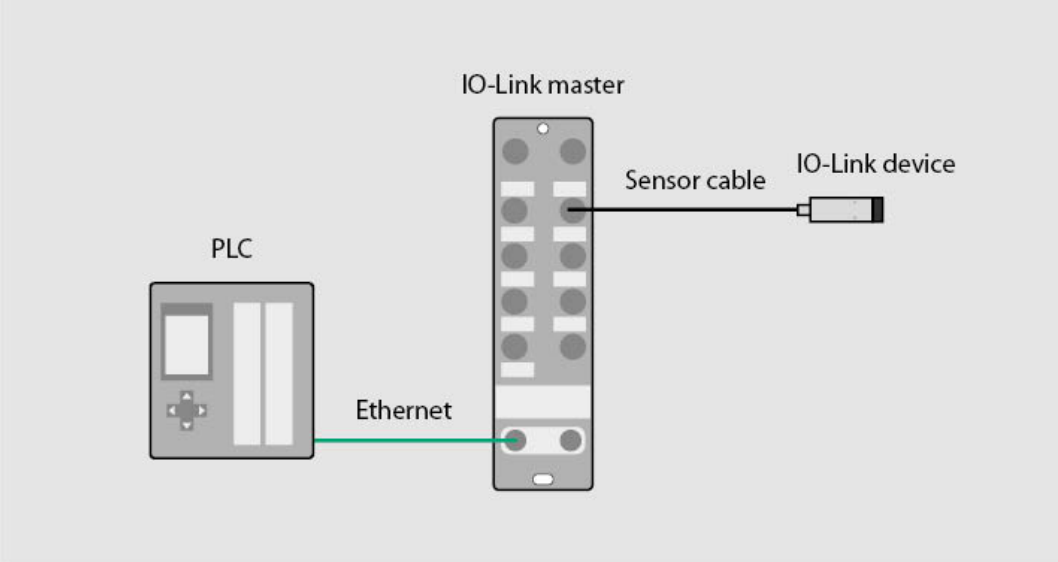


Fig. 82: Application example — setup

Example: configure the device specifically

NOTE
The IO-Link master TBEN-S2-4IOL can be configured specifically or generically. The connected Turck devices can be configured via the control program.

- Configure the hardware in the Simatic Manager.
- Assign the device ports of the TBEN IO Link master.

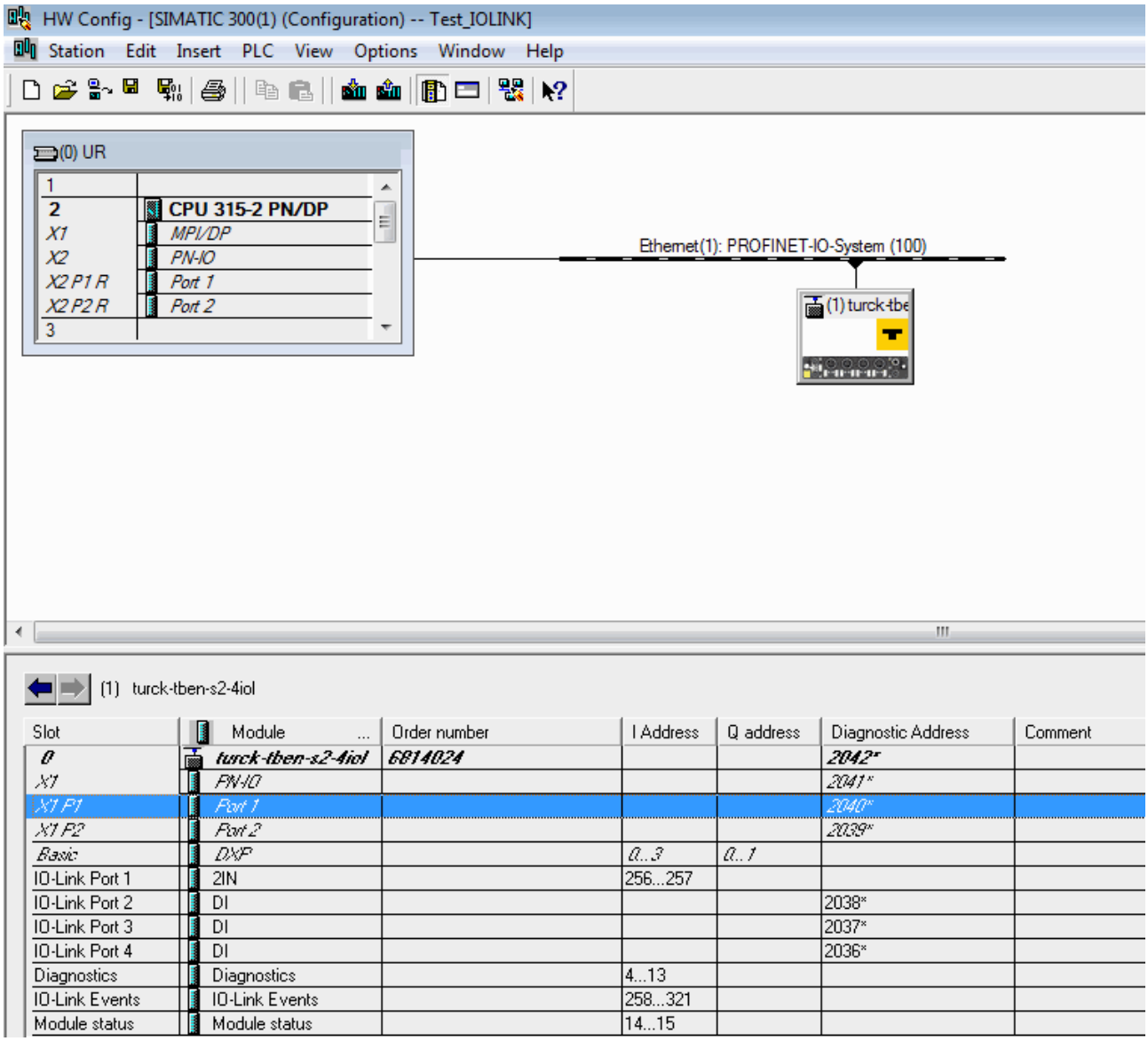


Fig. 83: Assign device ports

- Double-click on **2IN**.
- Select parameters.

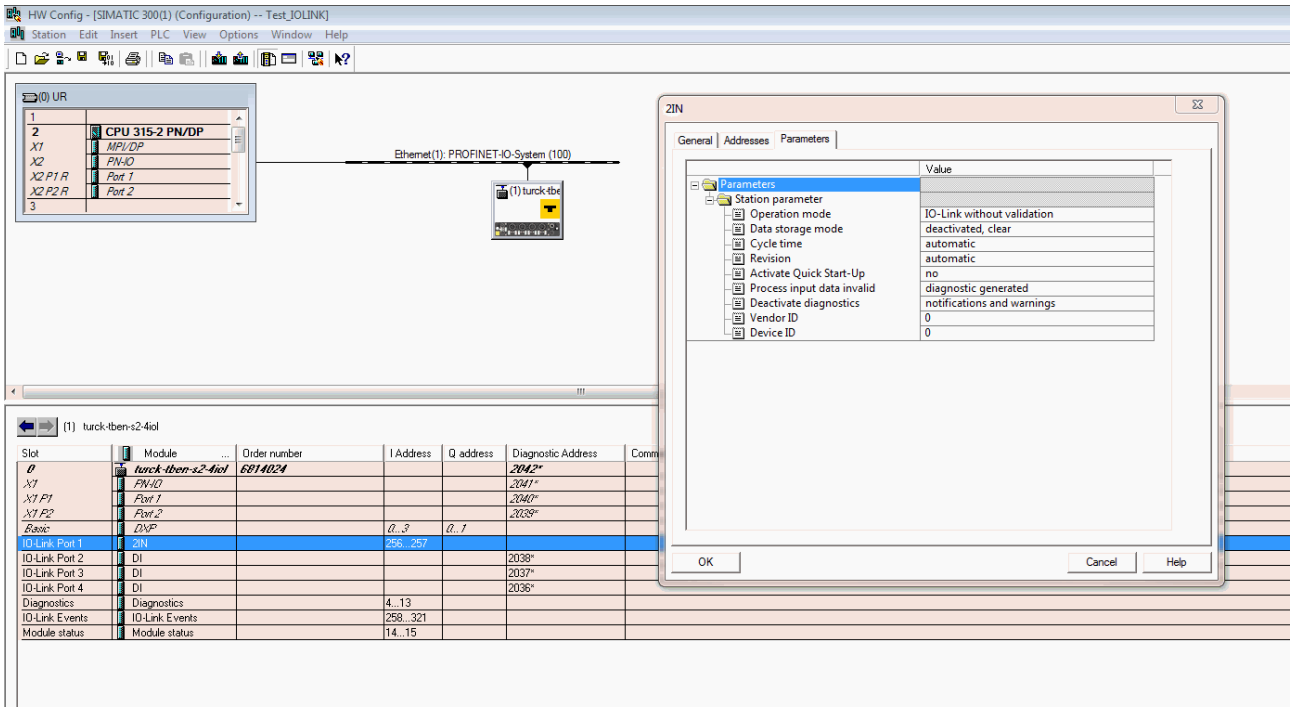


Fig. 84: Select parameters for 2IN

- Double-click on **DI**.
- Select parameters.

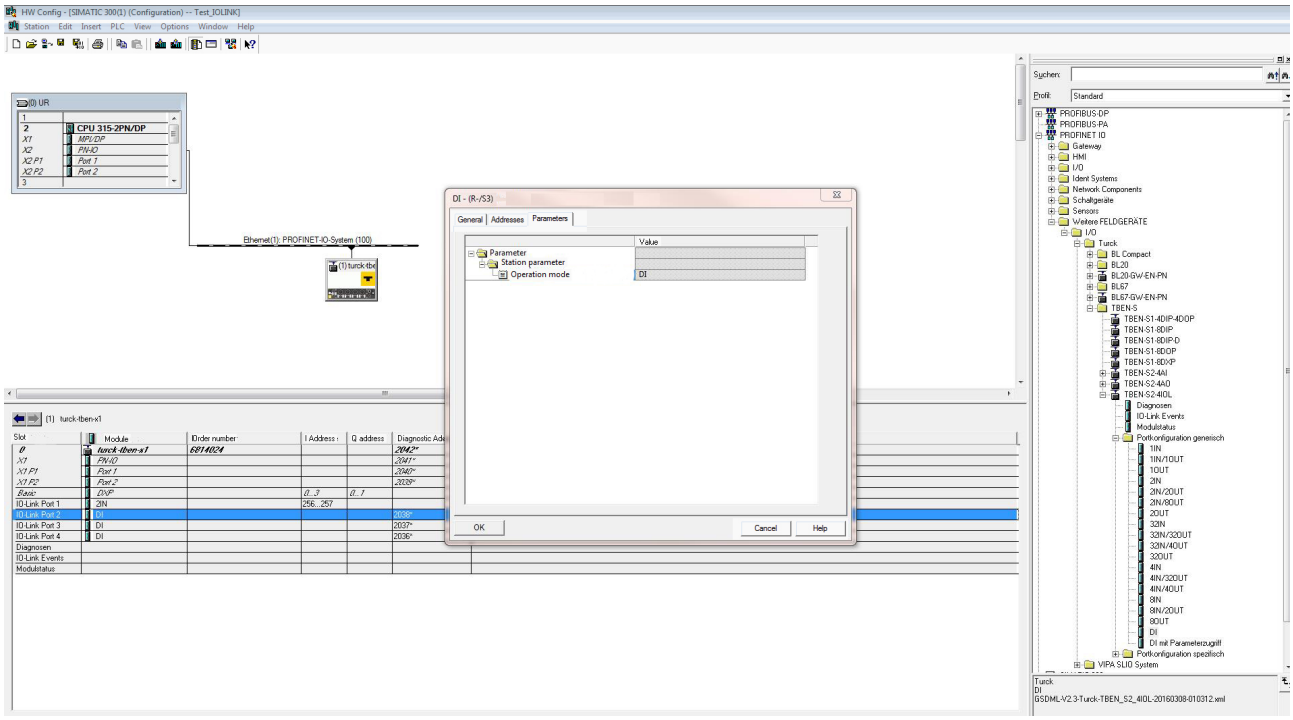


Fig. 85: Select parameters for DI

In online mode, the process data can be read out if an IO-Link device is connected.

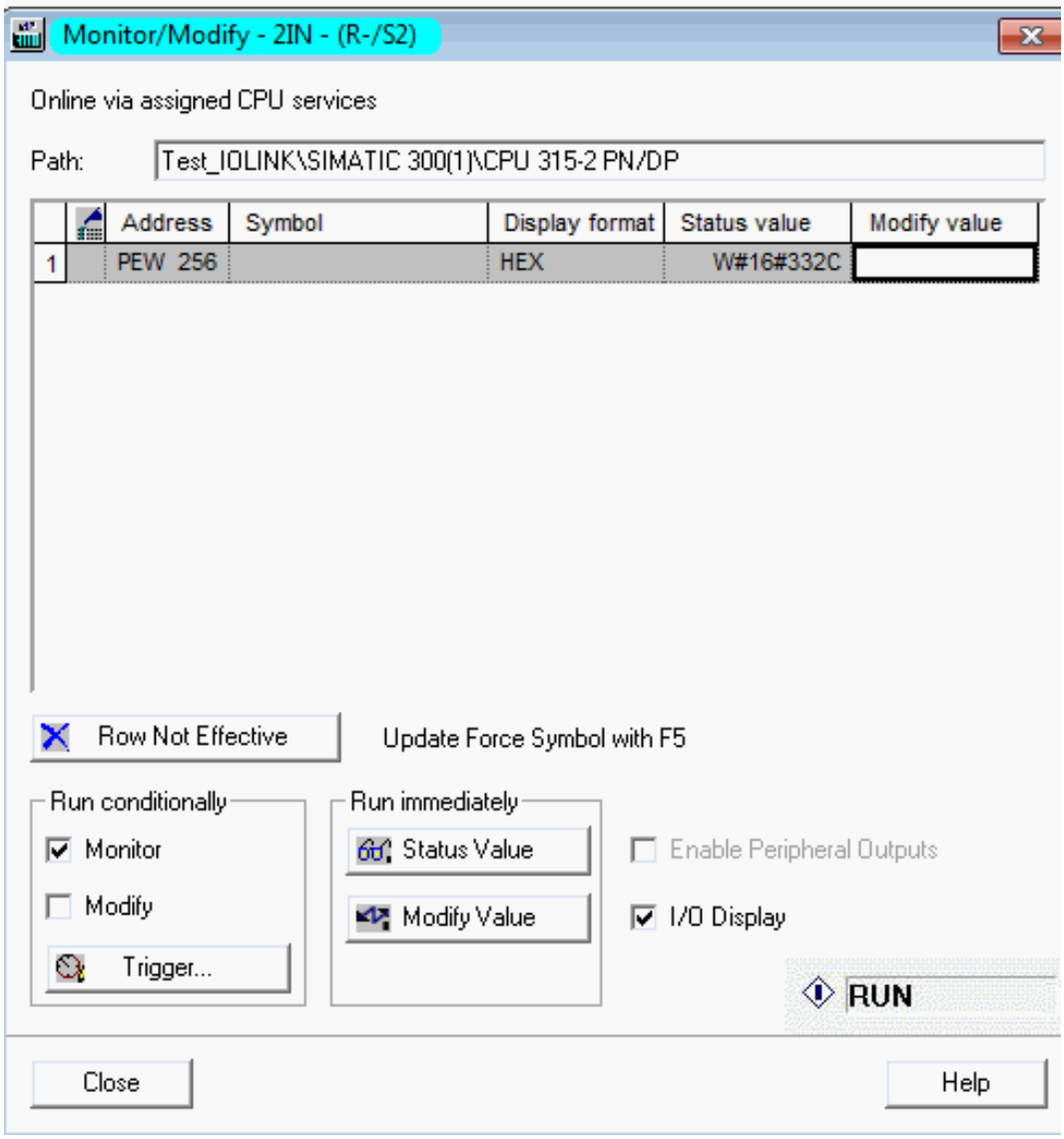


Fig. 86: Read out process data

Setting device parameters

The GSDML file for TBEN devices can be used to set the parameters for IO-Link devices.

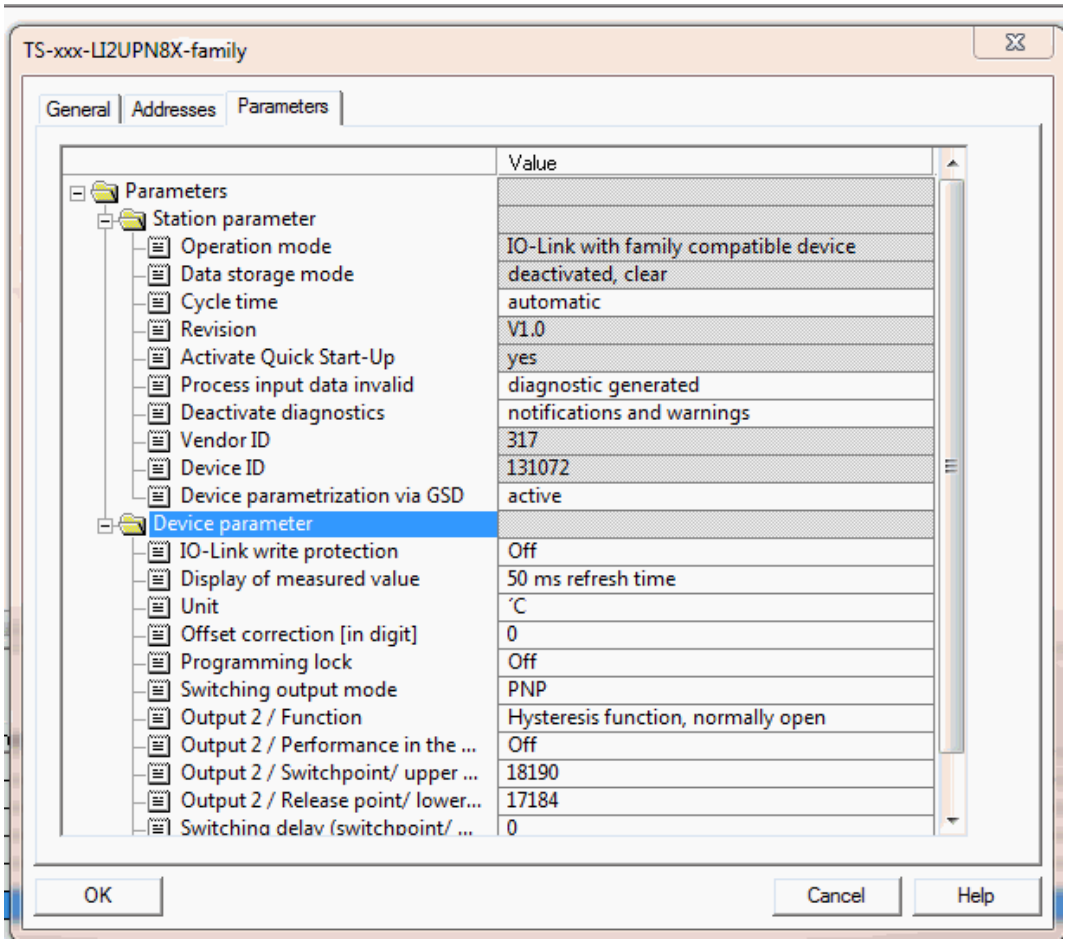


Fig. 87: Set device parameters

With the specific configuration, the IO-Link devices can be set specifically in addition to the parameters of the IO-Link master. When the application is started in the controller, the settings are transferred via PROFINET to the device.

In online mode, the process data of the connected device can be read out.

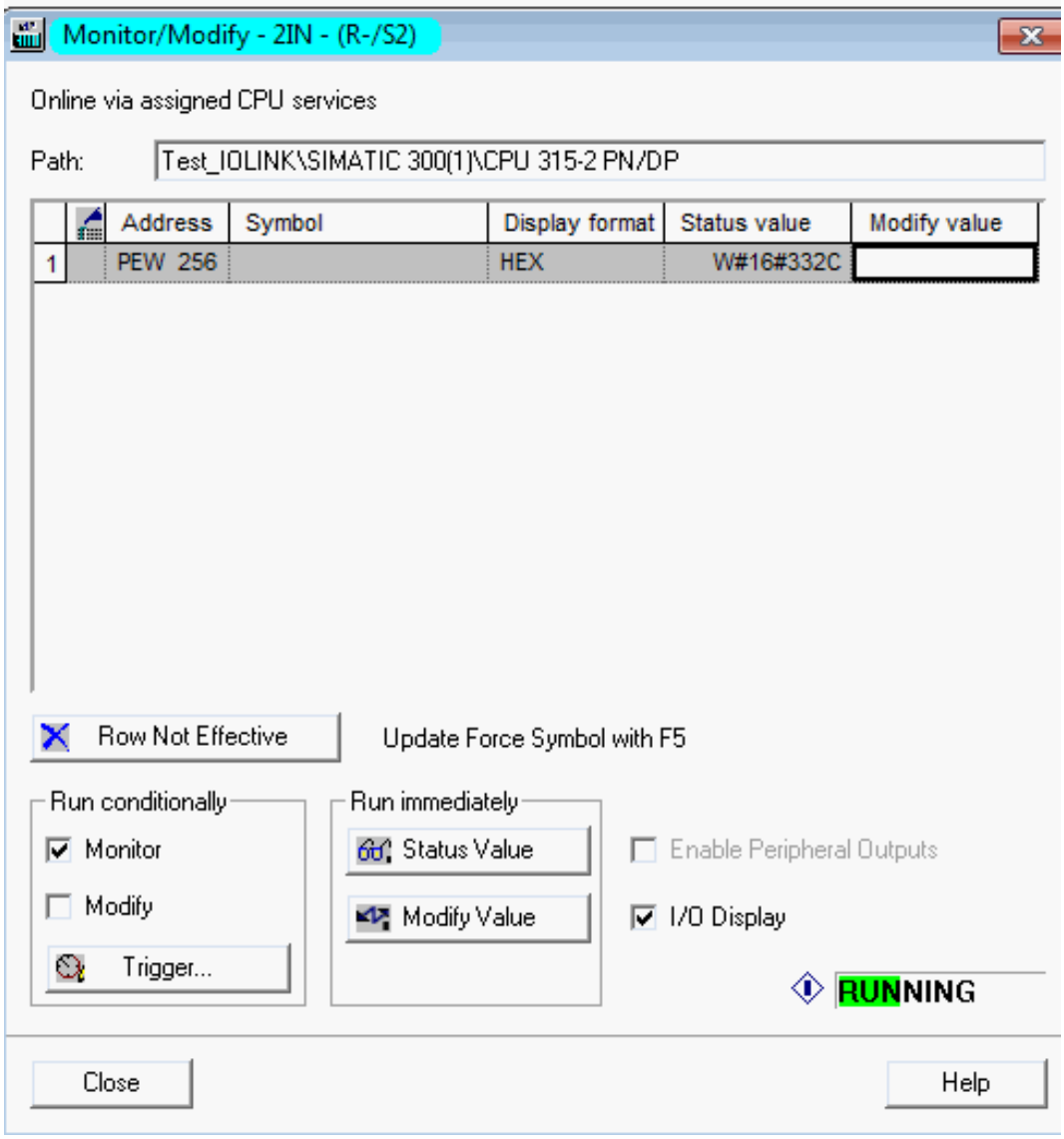


Fig. 88: Read out process data

6.2.7 Commissioning with BL… and Siemens controller in the TIA Portal V13 SP1

Software used

- Siemens STEP 7 V13 Professional (TIA Portal) SP1 Update 5
- GSDML file for BL67-GW-EN

Hardware used

NOTE
Information on the IO-Link master can be found in the instructions for use.

- Multiprotocol gateway BL67-GW-EN
- IO-Link master module BL67-4IOL with base module BL67-B-4M12
- Temperature sensor TS720-2UPN8-H1141, connected to IO-Link channel 1
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Siemens S7-300 controller, e.g., CPU 315-2PN/DP

Setup

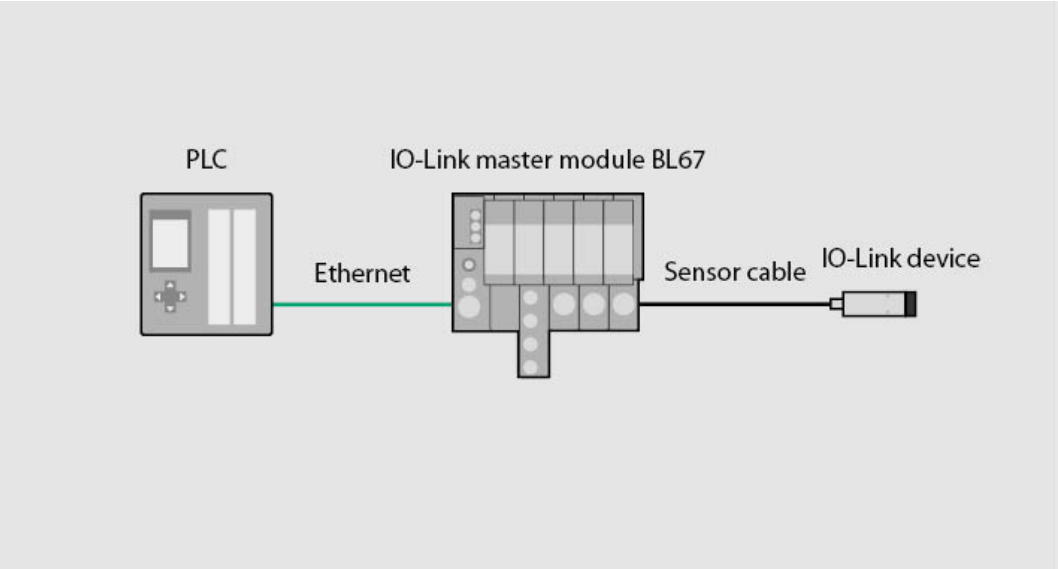


Fig. 89: Application example — setup

Example: configure the device generically

NOTE
The IO-Link master BL…-4IOL can only be configured generically. The connected devices must be configured separately.

▶ Configure the hardware in the TIA Portal.

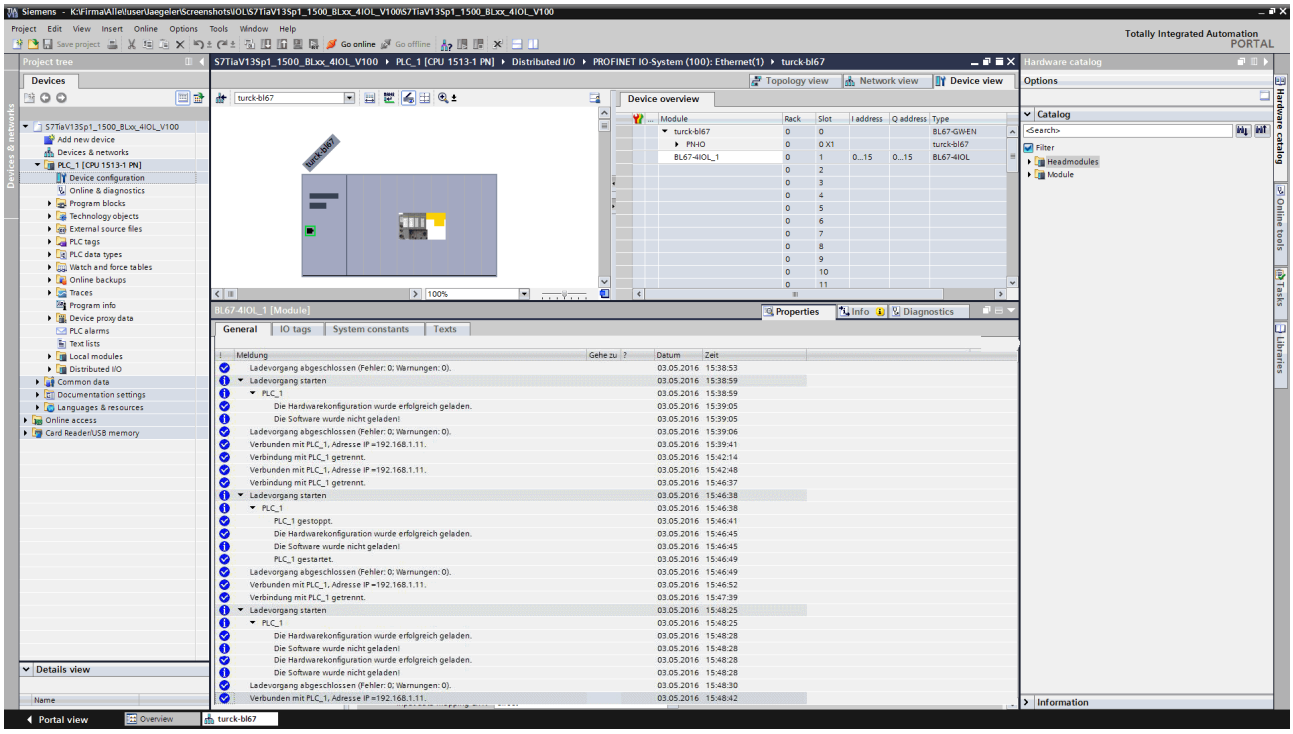


Fig. 90: Configure hardware

- Select the operating mode for the IO-Link ports.

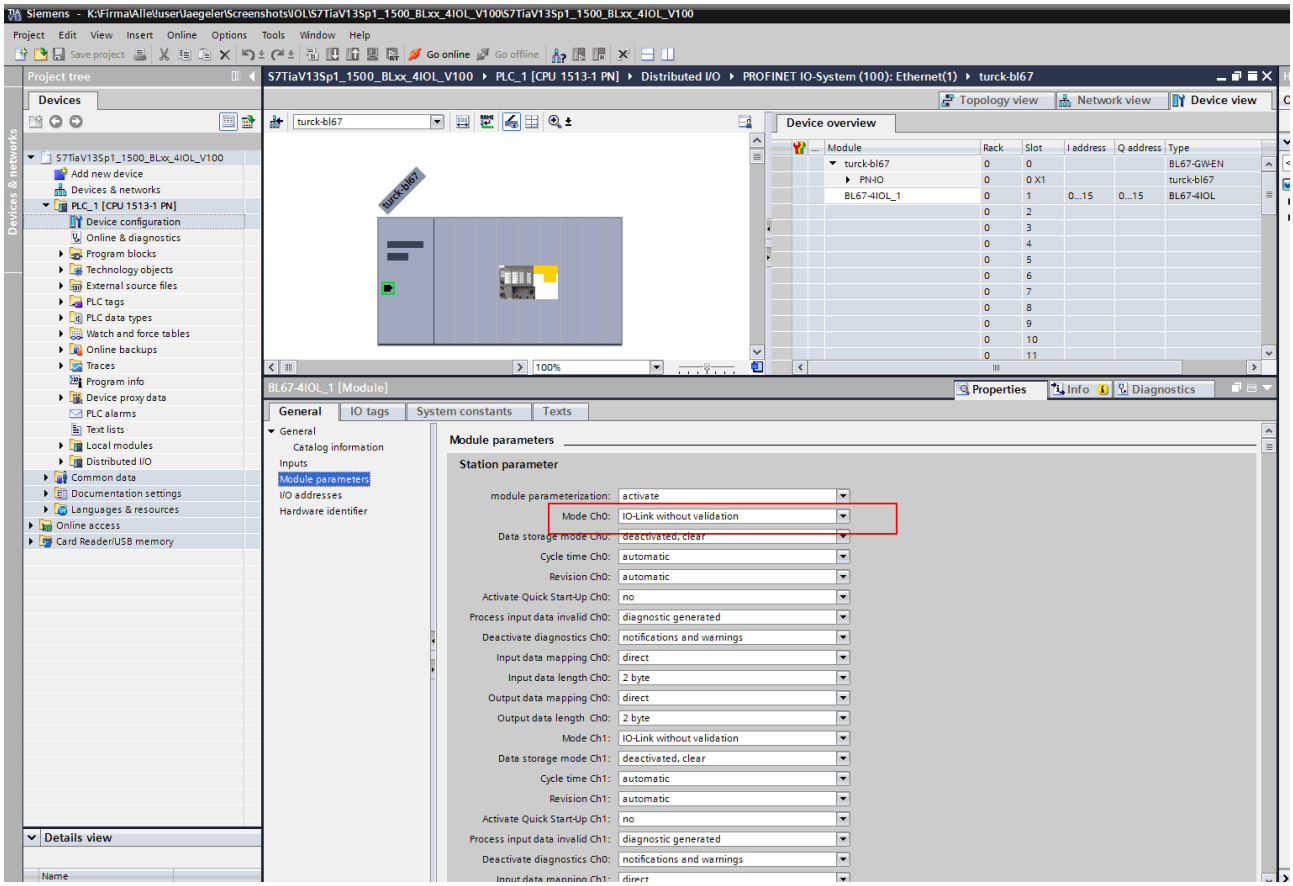


Fig. 91: IO-Link ports — setting the operating mode

In online mode, the process values can be monitored if an IO-Link device is connected.

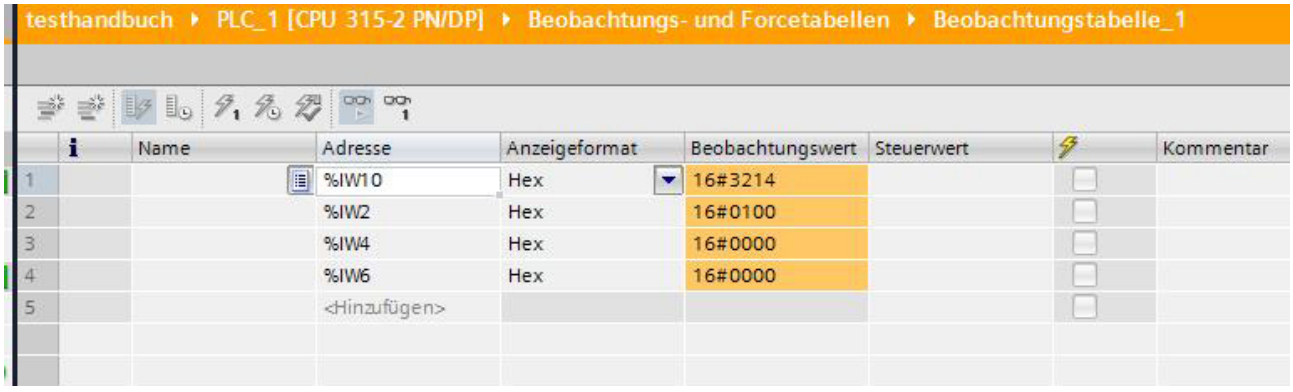


Fig. 92: Online mode — monitoring process values

6.2.8 Commissioning with TBEN and Siemens controller in the TIA Portal

Software used

- Siemens STEP 7 V13 Professional (TIA Portal) SP1 Update 5
- GSDML file for TBEN-S2-4IOL

Hardware used

NOTE
As an alternative to the IO-Link block module TBEN-S2-4IOL, the IO-Link block modules TBEN-L…-8IOL or FEN20-4IOL can be used.

NOTE
Information on the IO-Link master can be found in the instructions for use.

- IO-Link master TBEN-S2-4IOL
- IODD for temperature sensor TS720-2UPN8-H1141
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Siemens S7-300 controller, e.g., CPU 315-2PN/DP

Setup

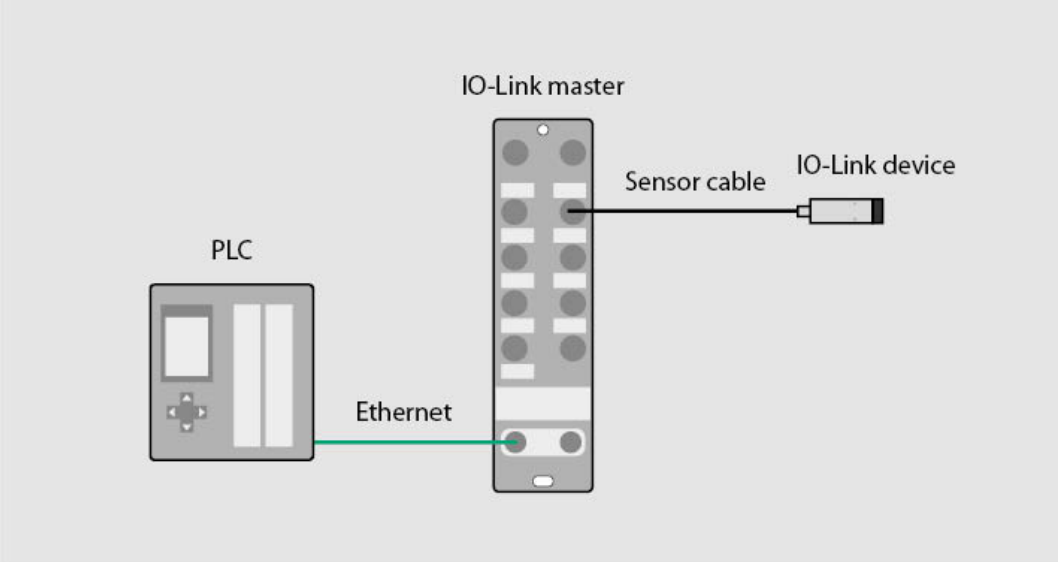


Fig. 93: Application example — setup

Example: configure the device specifically

NOTE
The IO-Link master TBEN-S2-4IOL can be configured specifically. The connected devices can be configured via the control program.

▶ Configure the hardware in the TIA Portal.

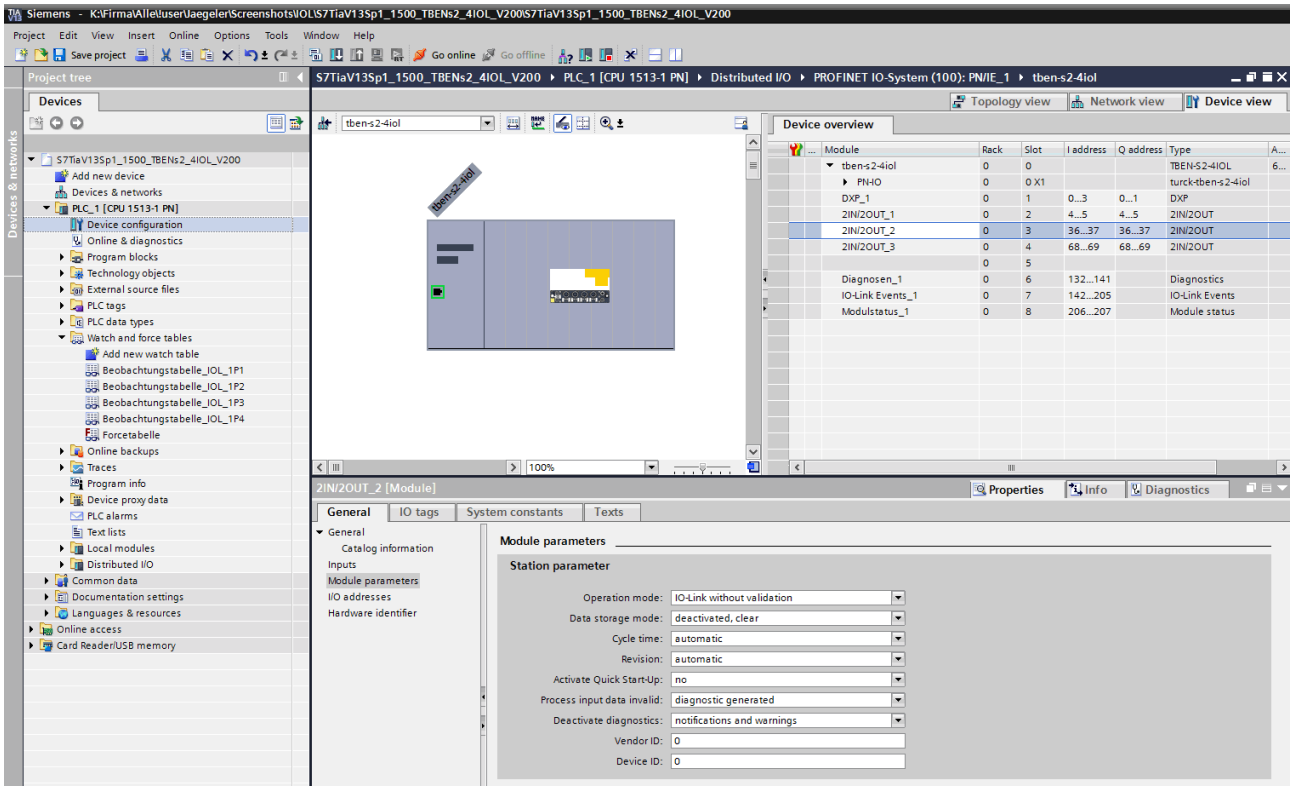


Fig. 94: Configure hardware

▶ Select the operating mode for the IO-Link ports.

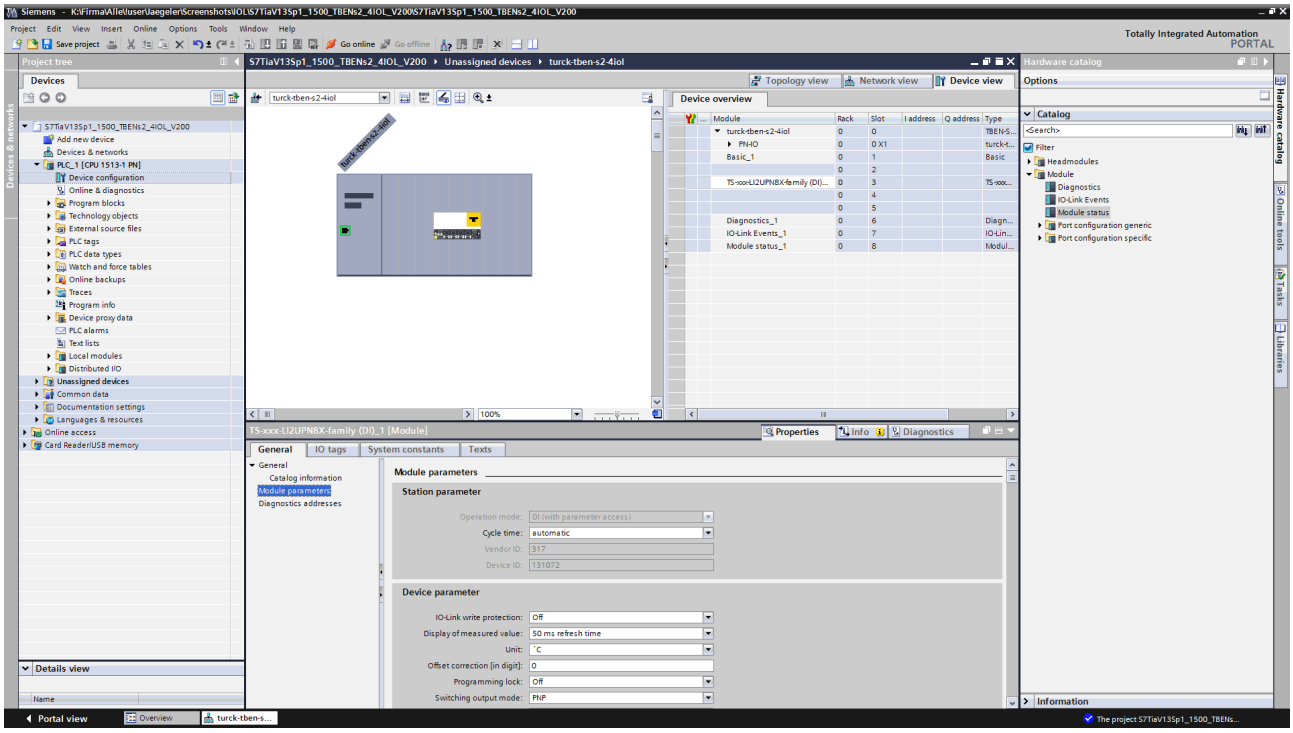


Fig. 95: IO-Link ports — setting the operating mode

NOTE
When a specific module is selected, the I/O addresses are automatically displayed.

▶ Select the IO-Link device for the desired port.

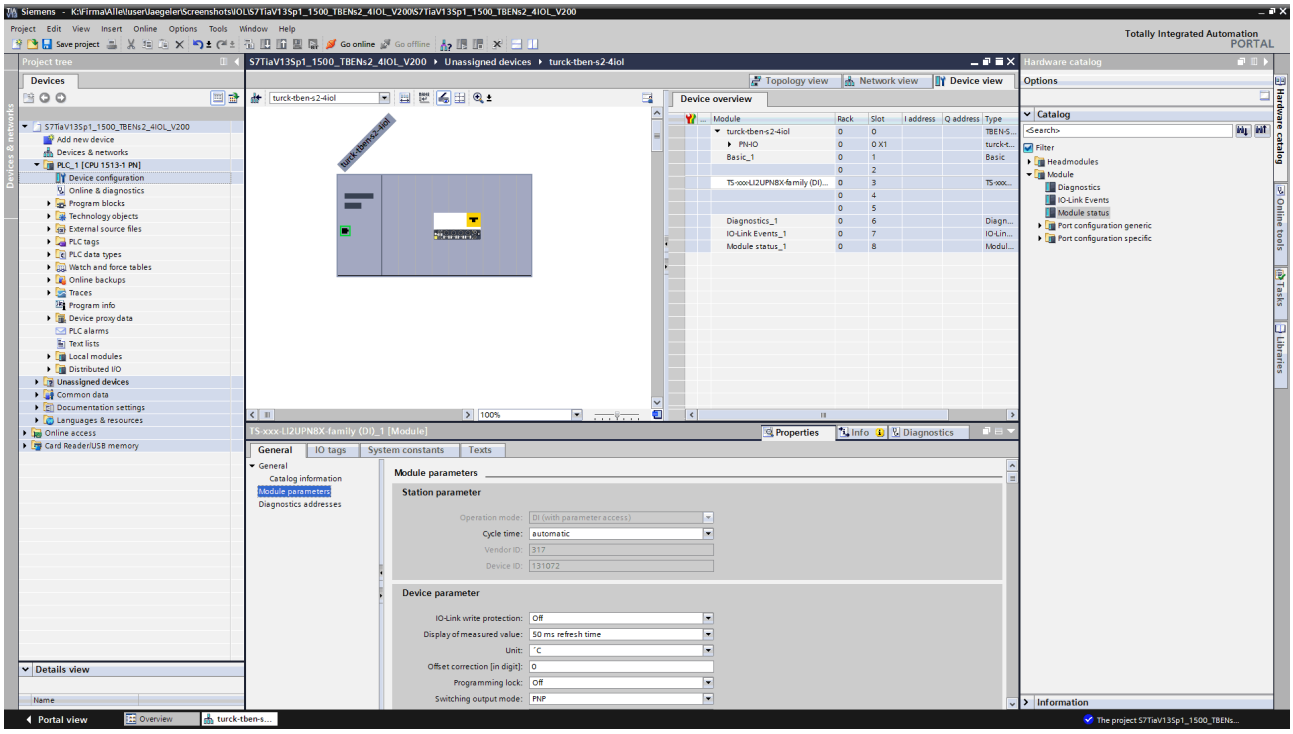


Fig. 96: Select IO-Link device

The process values can be monitored in online mode.

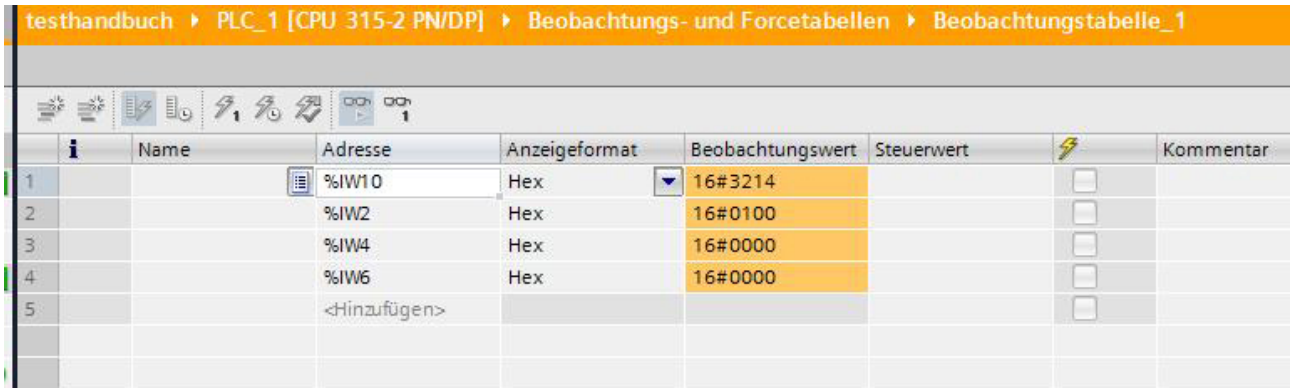


Fig. 97: Online mode — monitoring process values

6.2.9 Commissioning with TBEN-L…-8IOL and Siemens controller in TIA Portal V16

Software used

- Siemens STEP 7 V16 Professional (TIA Portal) Update 1
- GSDML file for TBEN-L…-8IOL

Hardware used

NOTE
As an alternative to the IO-Link block module TBEN-L…-8IOL, the IO-Link block modules TBEN-S2-4IOL can be used.

NOTE
Information on the IO-Link master can be found in the instructions for use.

- IO-Link master TBEN-L…-8IOL
- TS720-2UPN8-H1141
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Siemens controller S7-1500, e.g., CPU 1513-1 PN

Setup

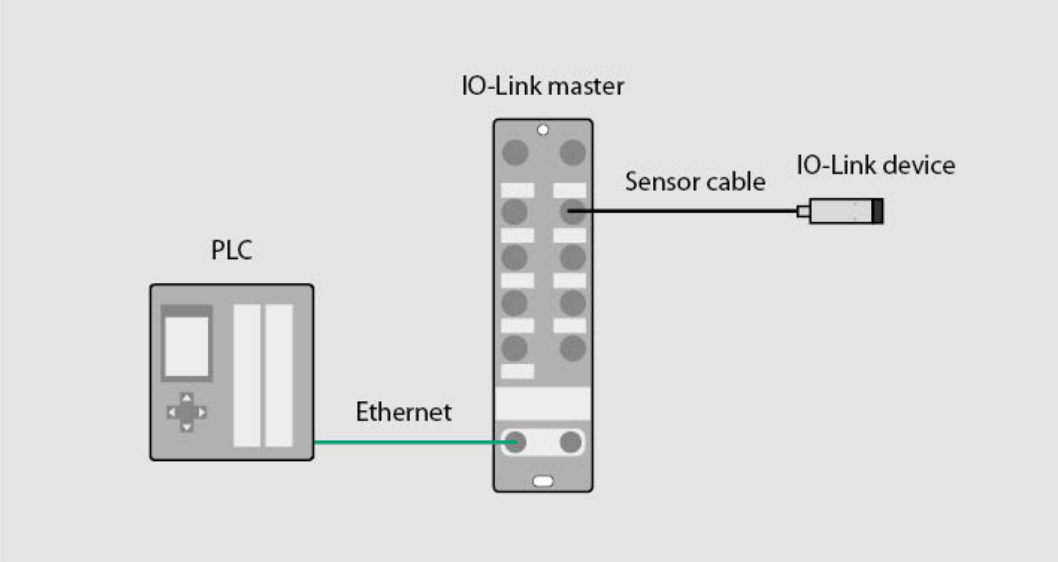


Fig. 98: Application example — setup

Example: configure the device generically

NOTE
The number of input words and output words of the IO-Link device can be found in the data sheet, the IO-Link parameter manual, or the IODDfinder.

- Configure the hardware in the TIA Portal.

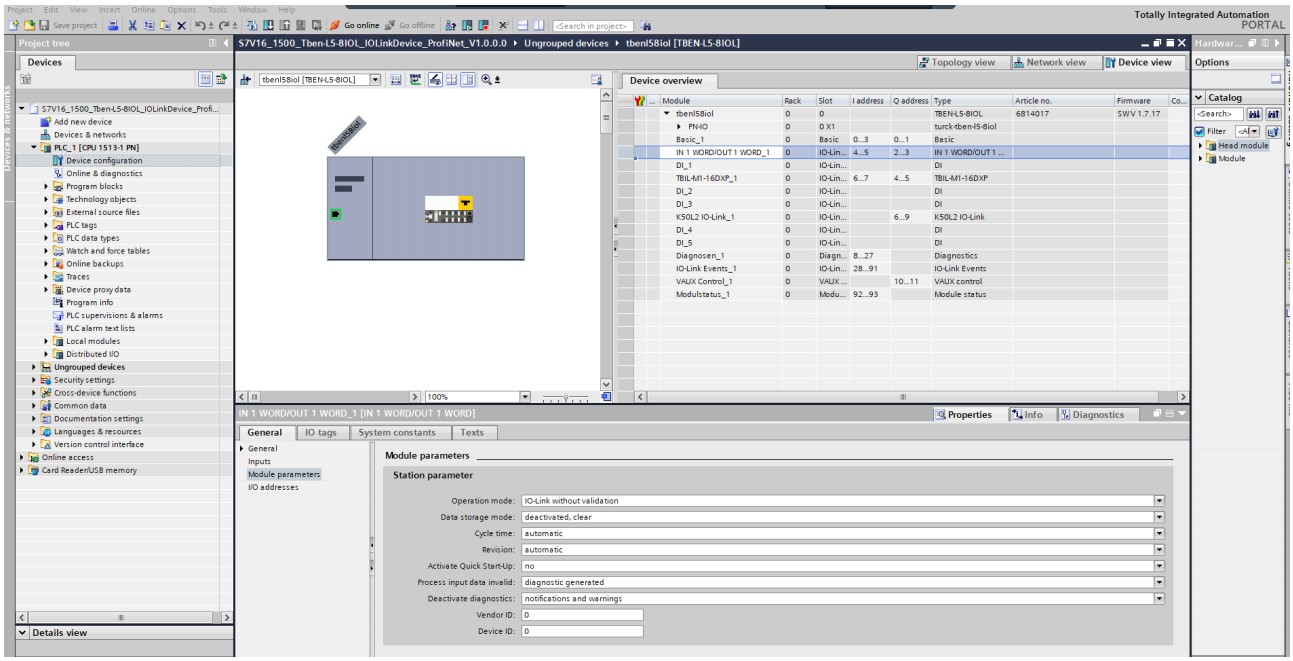


Fig. 99: Configure hardware

▶ Select the operating mode for the IO-Link ports.

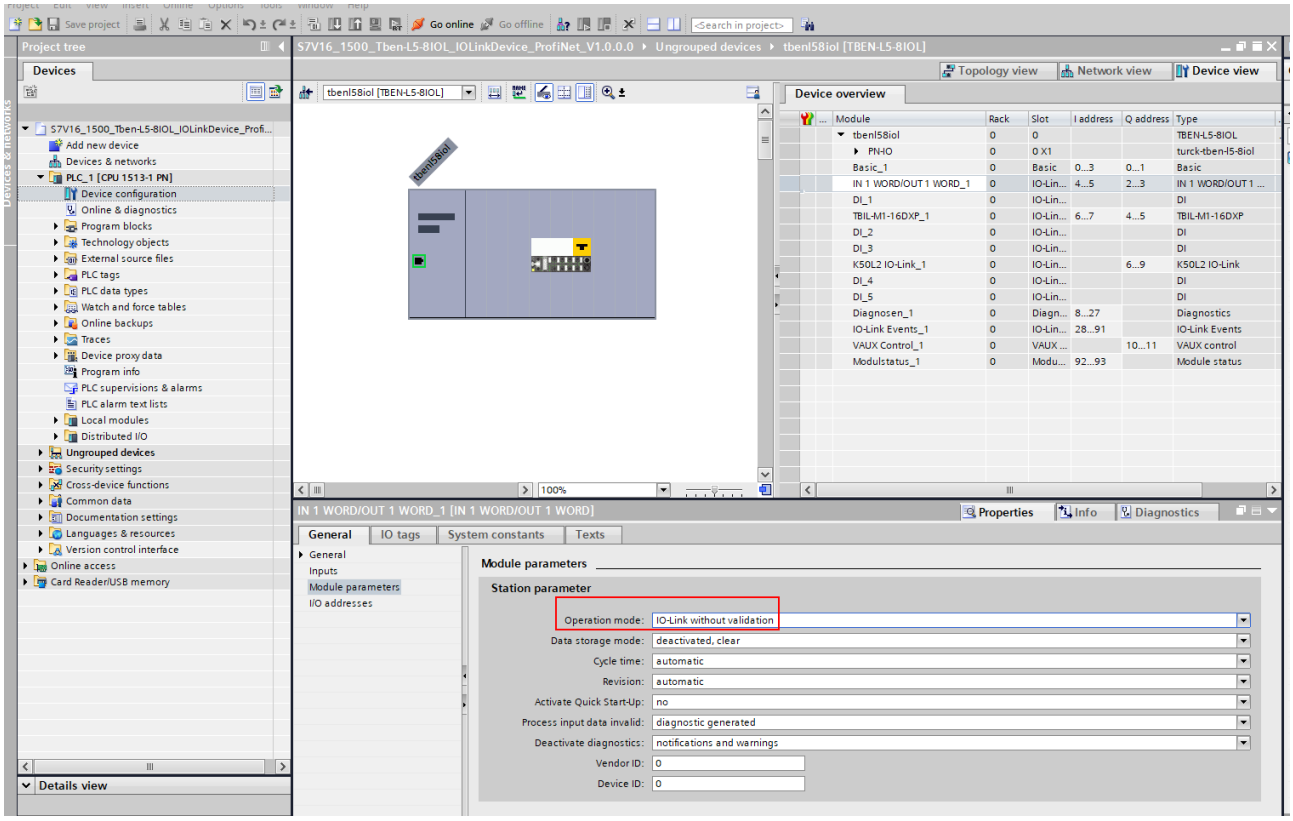


Fig. 100: IO-Link ports — setting the operating mode

Example: configure the device specifically

NOTE
The IO-Link master TBEN-L…-8IOL can be configured specifically. The connected devices can be configured via the control program.

▶ Configure the hardware in the TIA Portal.

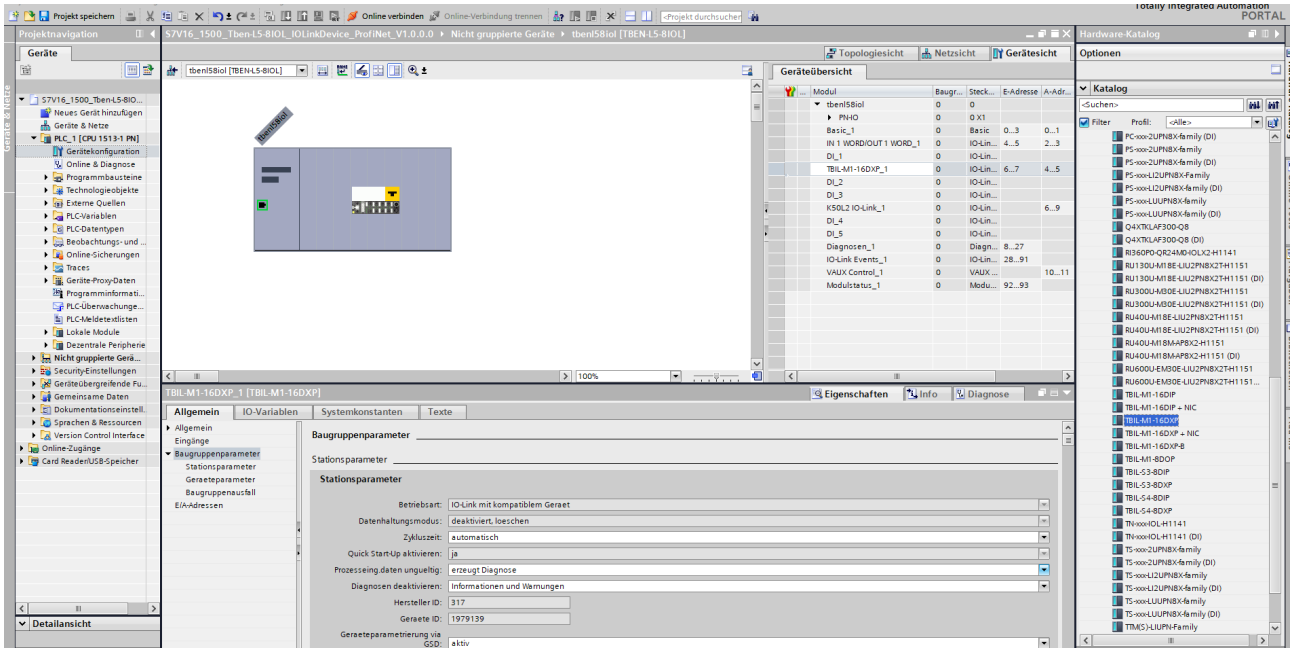


Fig. 101: Configure hardware

▶ Select a specific device for the IO-Link ports.

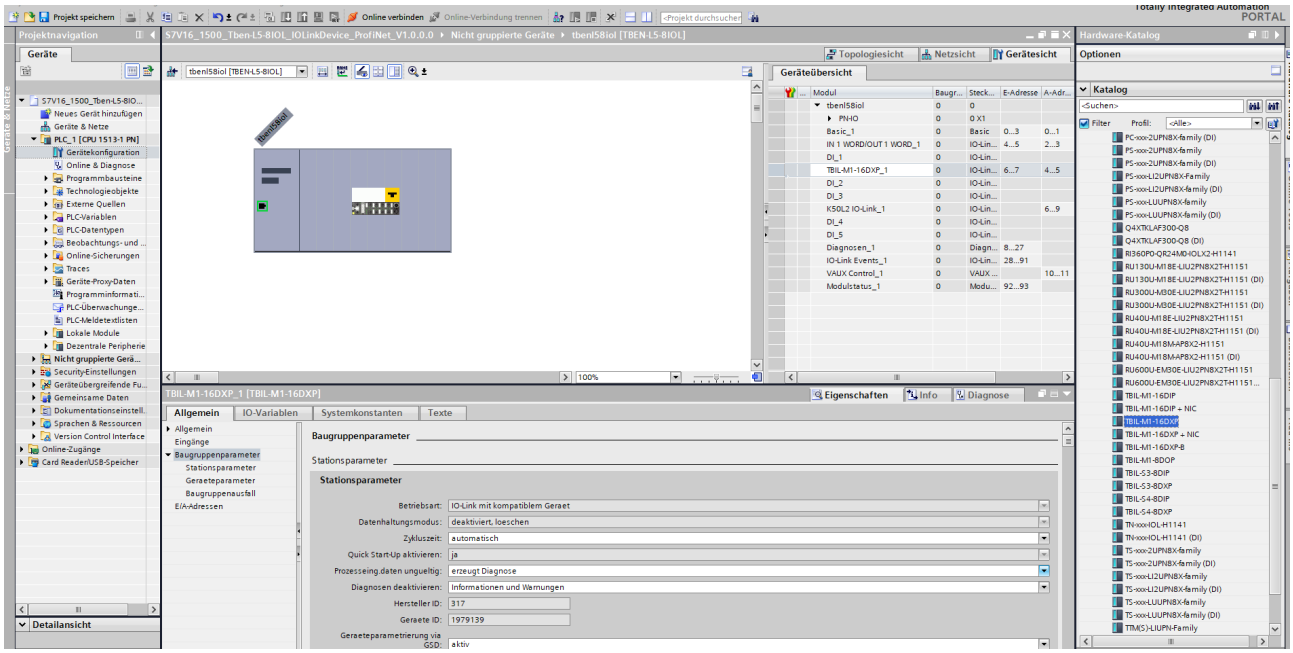


Fig. 102: IO-Link ports — setting the operating mode

NOTE
When a specific module is selected, the I/O addresses are automatically displayed. The grayed-out fields are preset for simplified configuration.

The process values can be monitored in online mode.

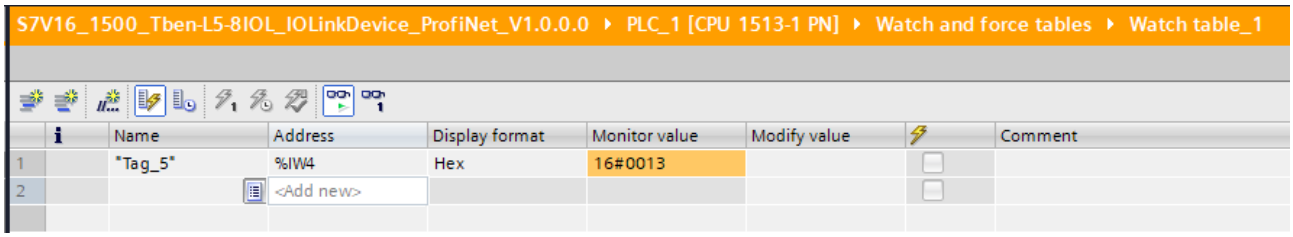


Fig. 103: Online mode — monitoring process values

6.2.10 Commissioning with TBEN and Allen-Bradley controller in Rockwell

When commissioning via EDS file, only the process data of the inputs and outputs can be viewed. Configuration via EDS file is not possible. The IO-Link master and IO-Link devices can be configured using the PACTware configuration tool and the web server.

Software used

- Studio 5000 Logix Designer Version 30.00.00 - Mini Edition
- EDS file for TBEN-L…-8IOL

Hardware used

NOTE
As an alternative to the IO-Link block module TBEN-L…-8IOL, the IO-Link block modules TBEN-S2-4IOL can be used.

NOTE
Information on the IO-Link master can be found in the instructions for use.

- IO-Link master TBEN-L…-8IOL
- Pressure sensor PS510-16V-LI2UPN8
- Temperature transmitter TTM
- Laser distance sensor Q4X
- Sensor cable RKC4.4T-2-RSC4.4T/TXL
- Allen-Bradley controller, e.g. Compact GuardLogix 5370 Safety Controller

Setup

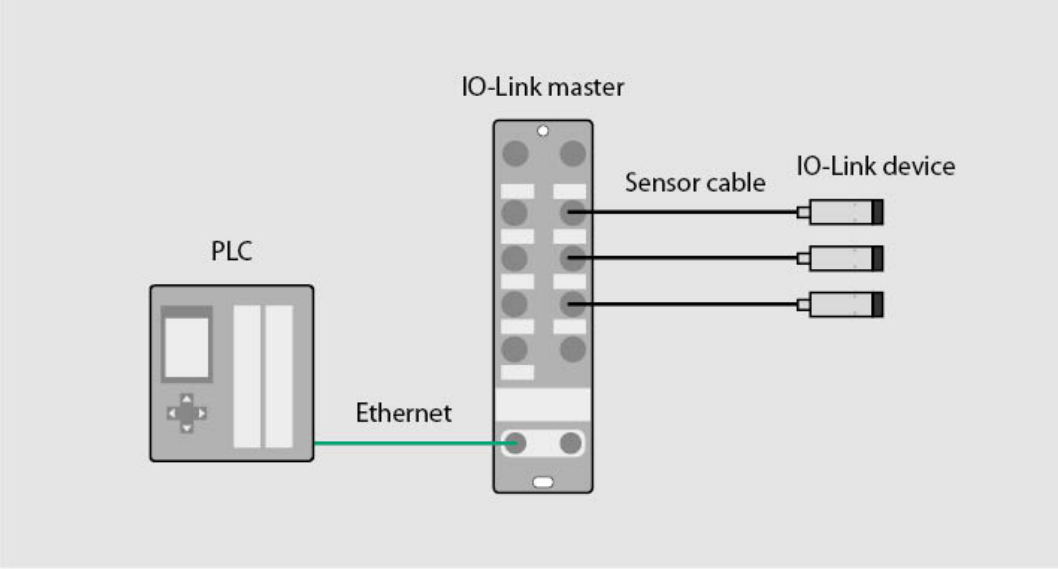


Fig. 104: Application example — setup

Incorporating the EDS file

- Studio Logix 5000 Designer → Open the created project.
- Under **Controller Organizer** →, click on **Ethernet** once.
- Under **Tools** →, click on **EDS Hardware Installation Tool**.

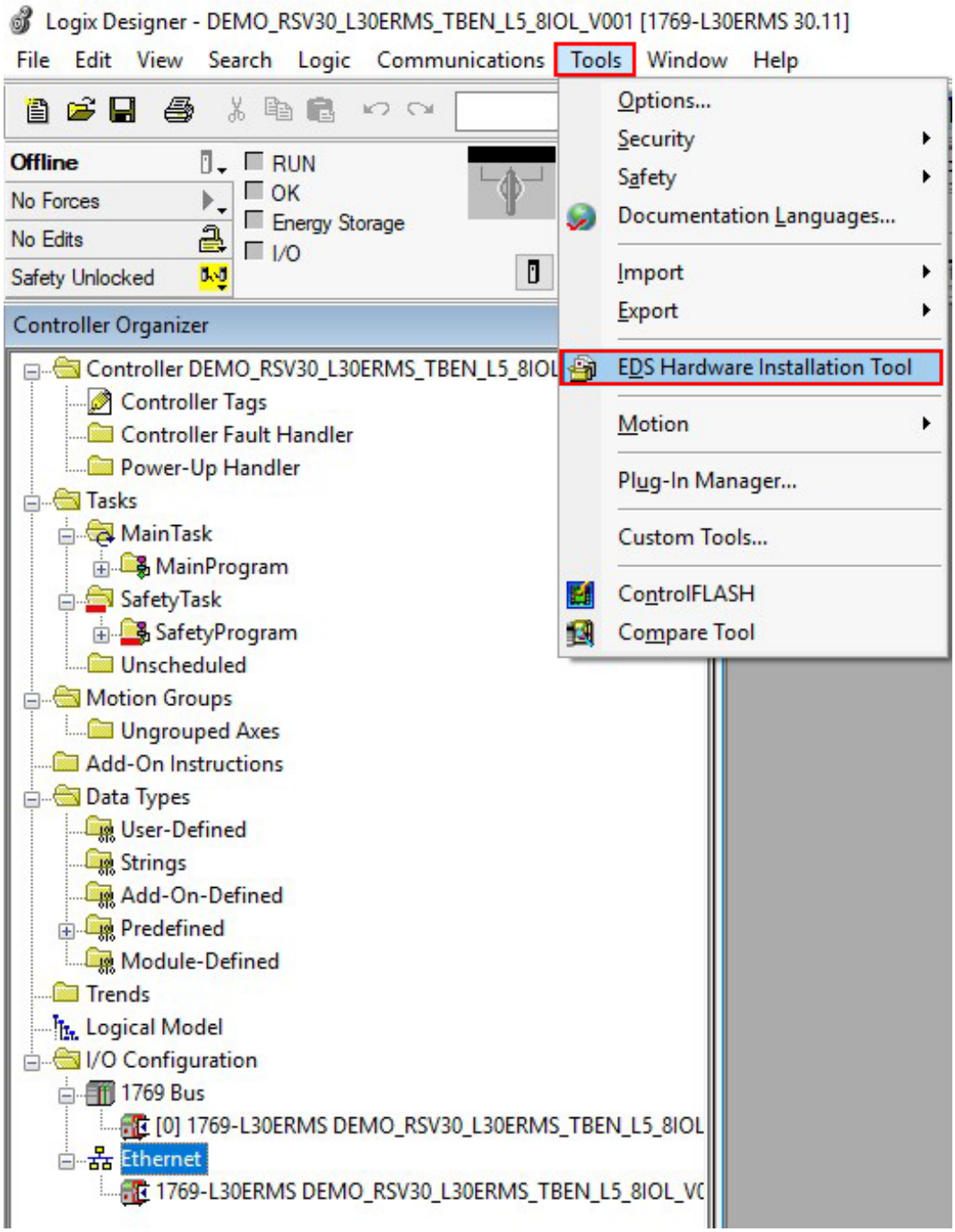


Fig. 105: Opening the EDS Hardware Installation Tool

⇨ The **Rockwell Automation's EDS Wizard** window opens.

- Click on **Next** → Select **Register EDS file(s)**.
- Click on **Next**.
- In the **Register a directory of EDS files** window, click on → **Browse…**.
- The **Find folder** window opens.
- Find and select an EDS file in the folder structure.
- Confirm the selection with **OK**.

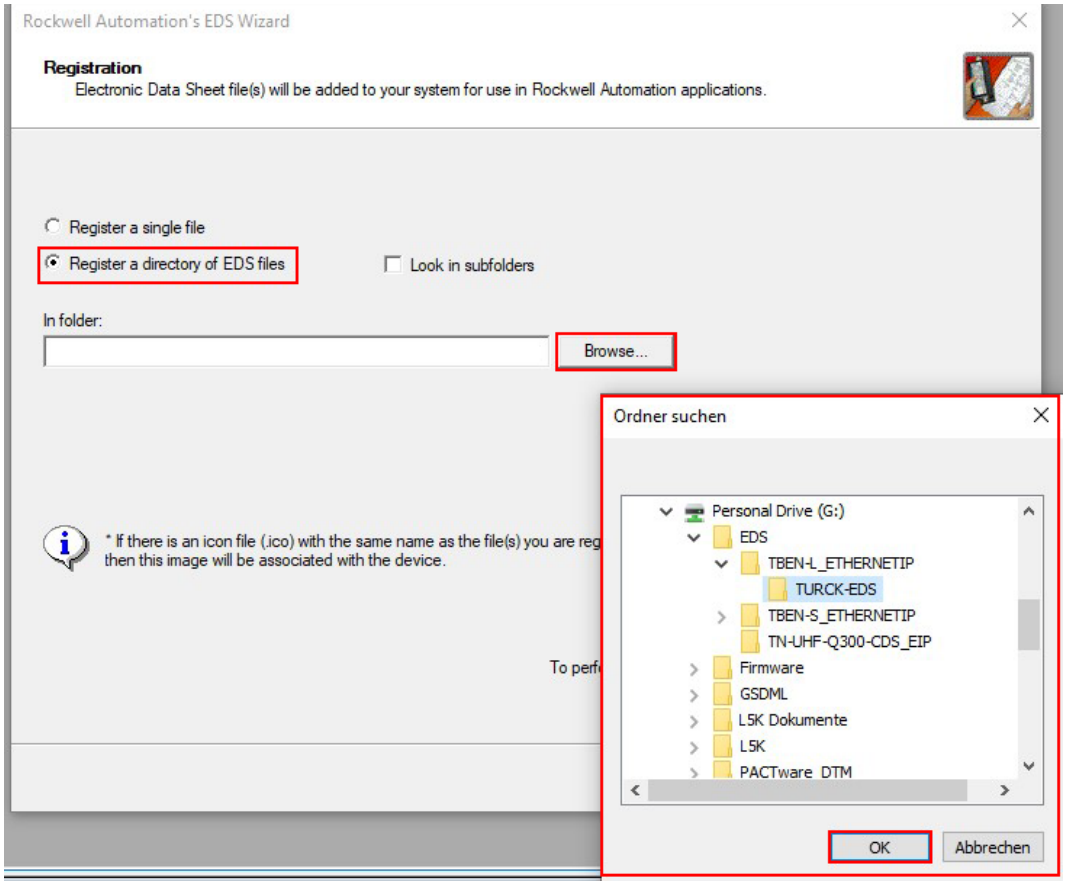


Fig. 106: Find and select the EDS file

- Confirm the following windows with **Next**.
- Click on **Finish**.

Example: integrate the module generically via the EDS file

▶ Right-click on **Ethernet** → **New Module…**.

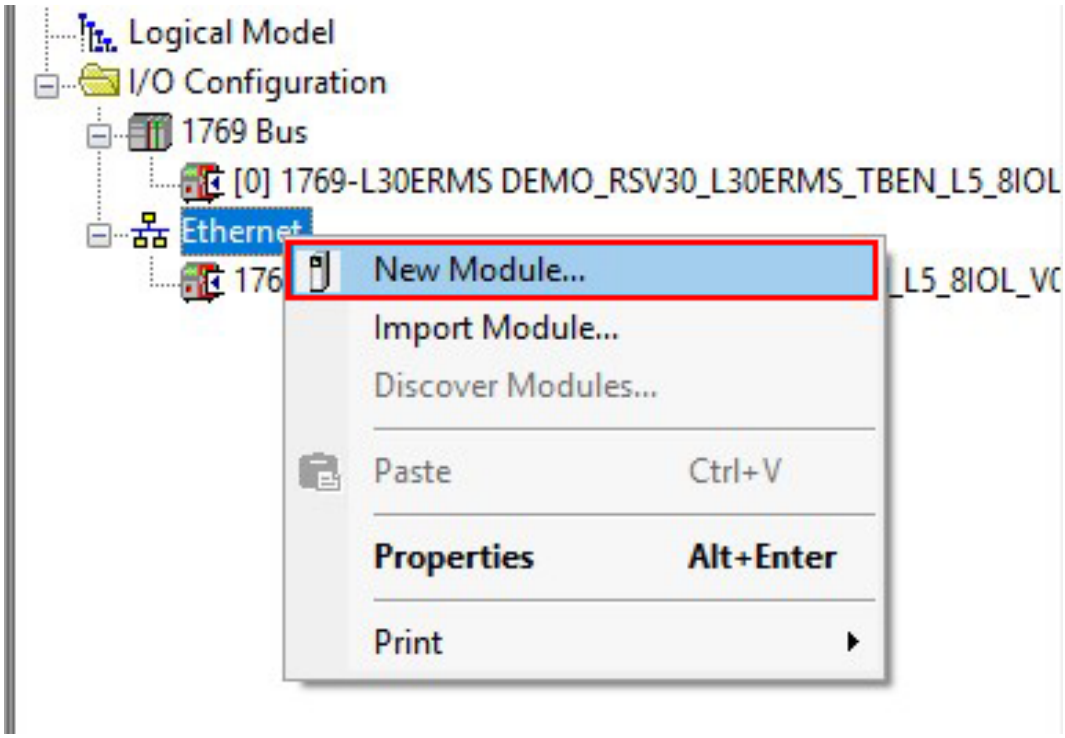


Fig. 107: Create a new module

⇨ The **Select Module Type** window opens.

- ▶ Under **Module Type Vendors Filters** →, select **TURCK**.
- ▶ Select the corresponding module (here: **TBEN-L5-8IOL**) by double-clicking.

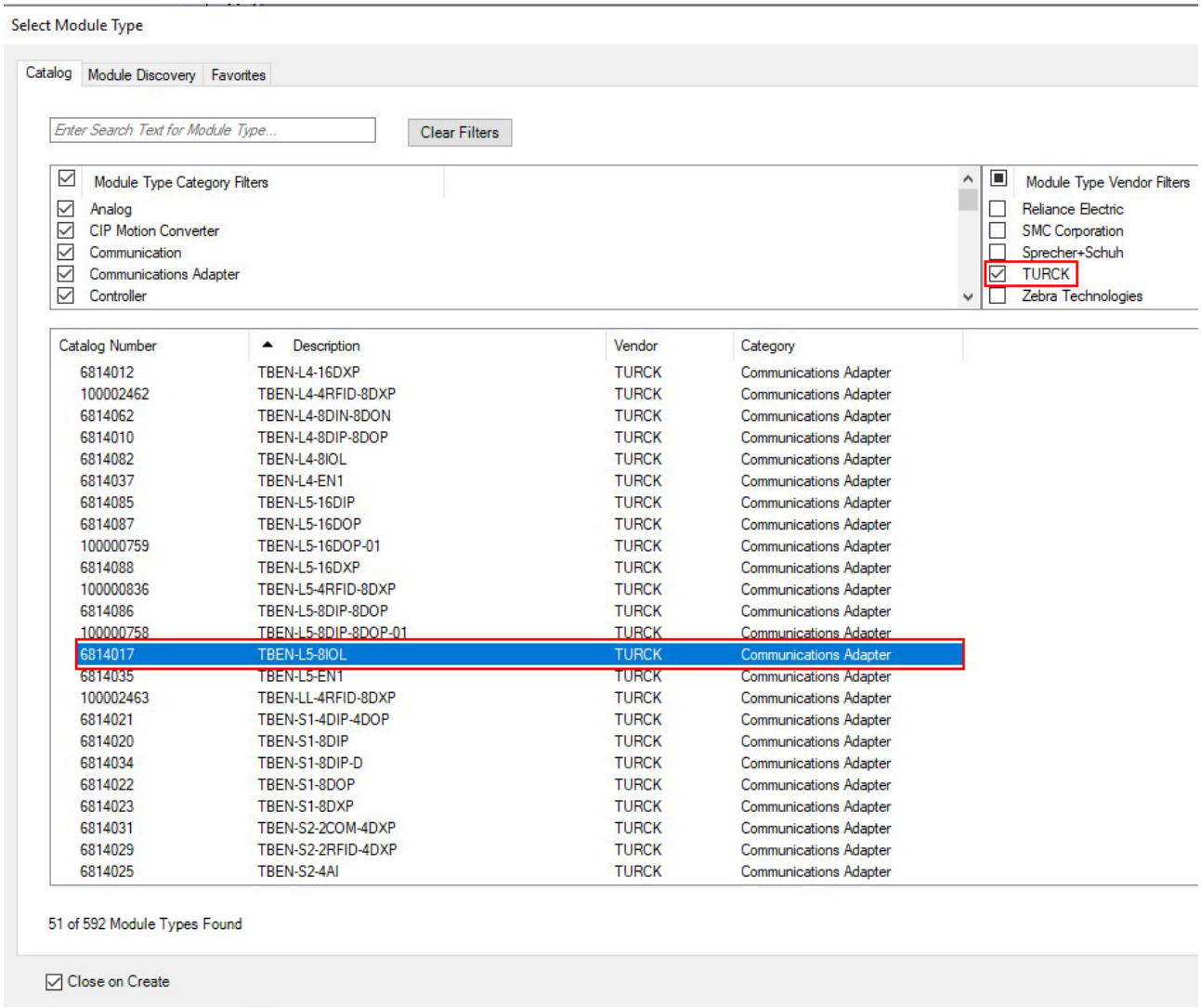


Fig. 108: Select a module

⇨ The **New Module** window opens.

▶ Set the and IP address (here: **192.168.1.30**).

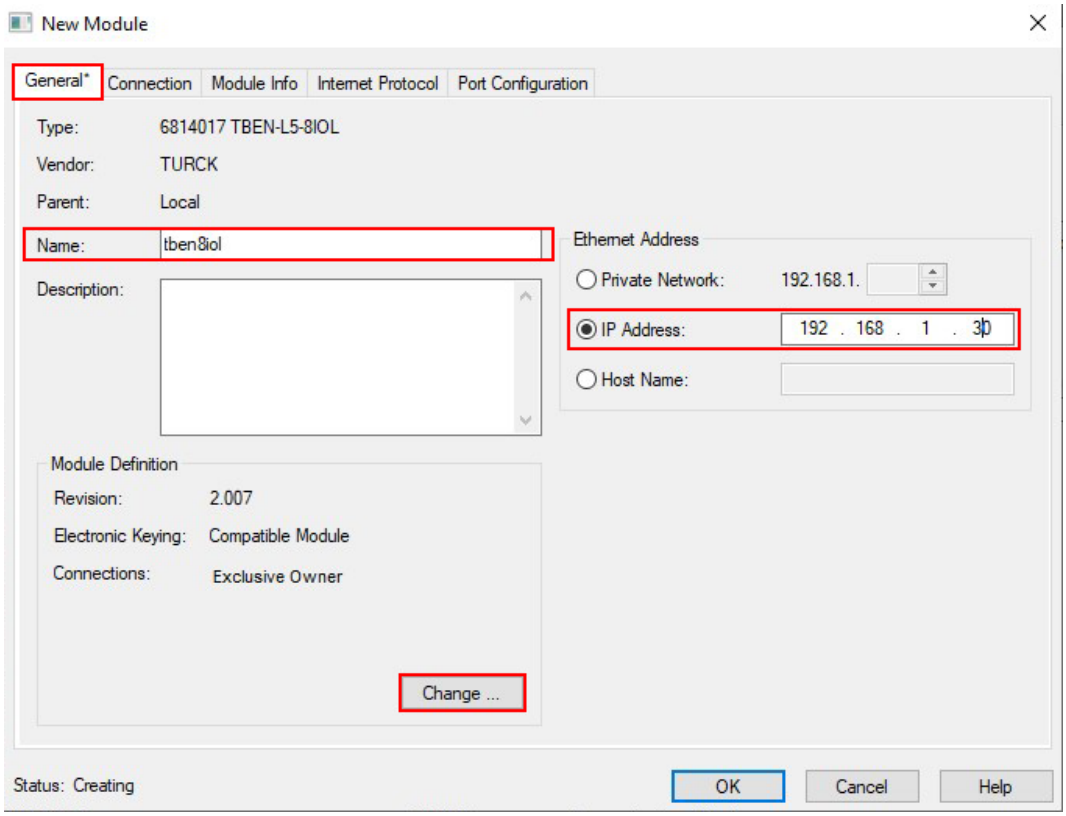


Fig. 109: Set the name and IP address

▶ Click on **Module Definition** → **Change ...**.
⇨ The **Module Definition*** window opens.

- ▶ Under **Size**, select **INT** (integer) from the drop-down menu.
- ▶ Confirm with **OK**.

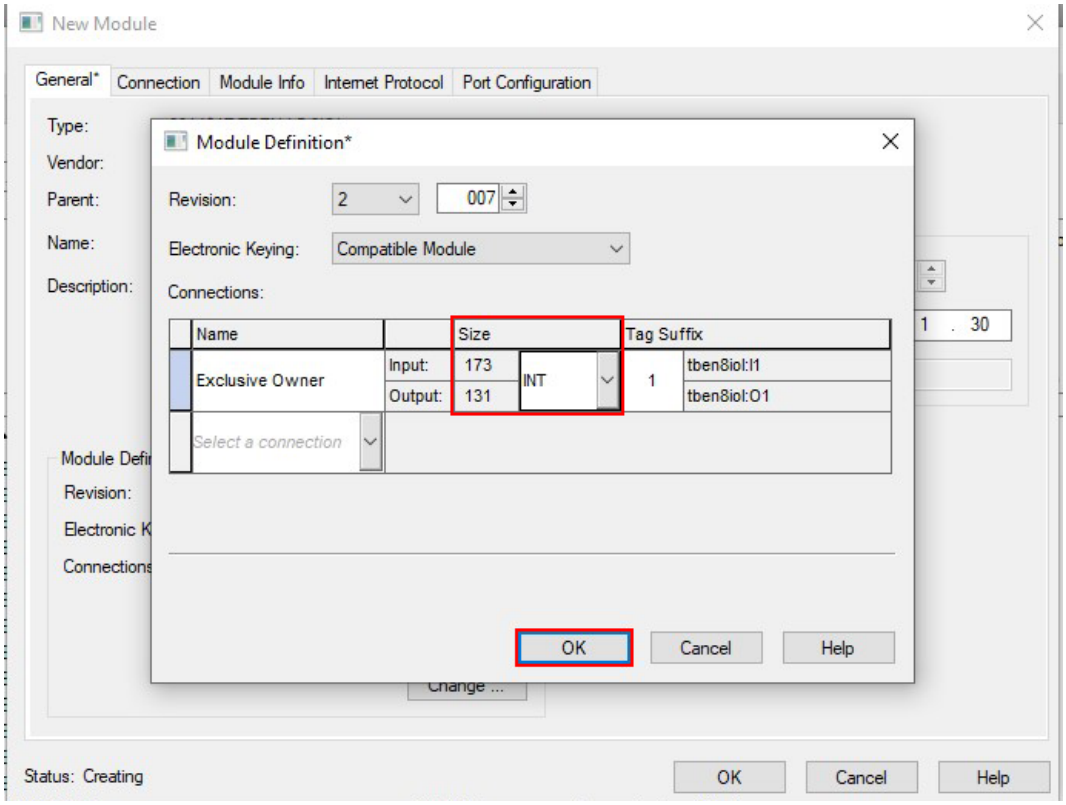


Fig. 110: Select the data type

- ▶ Confirm the **Change module definition** window with **Yes**.
- ▶ Close the **New Module** window with **OK**.
- ⇨ The IO-Link master TBEN… appears under **Controller Organizer**.

Going online

- Click on the icon next to **Offline**.
- Click on **Go Online** in the context menu.

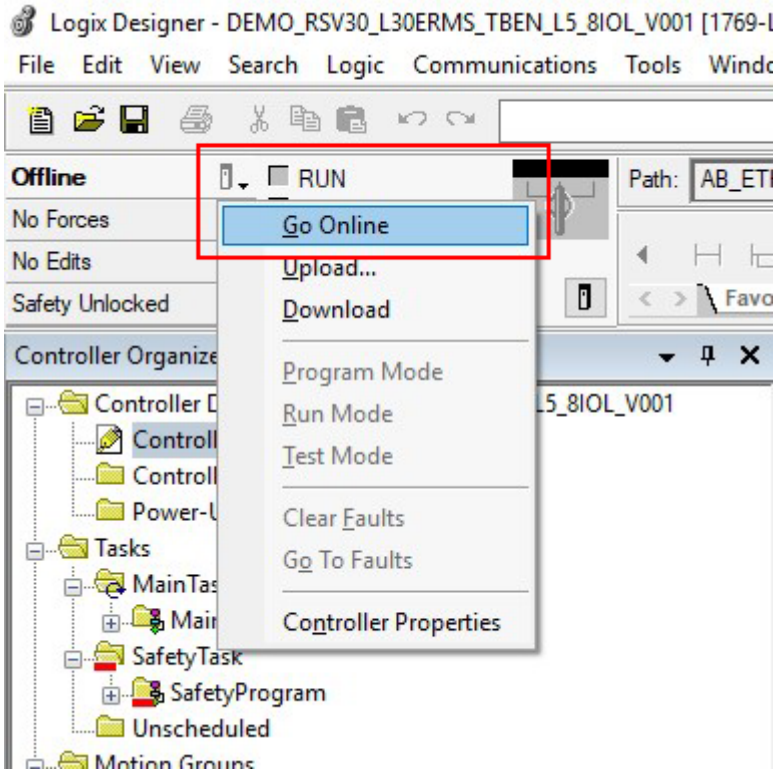


Fig. 111: Context menu — Go Online

▶ Click on **Download**.

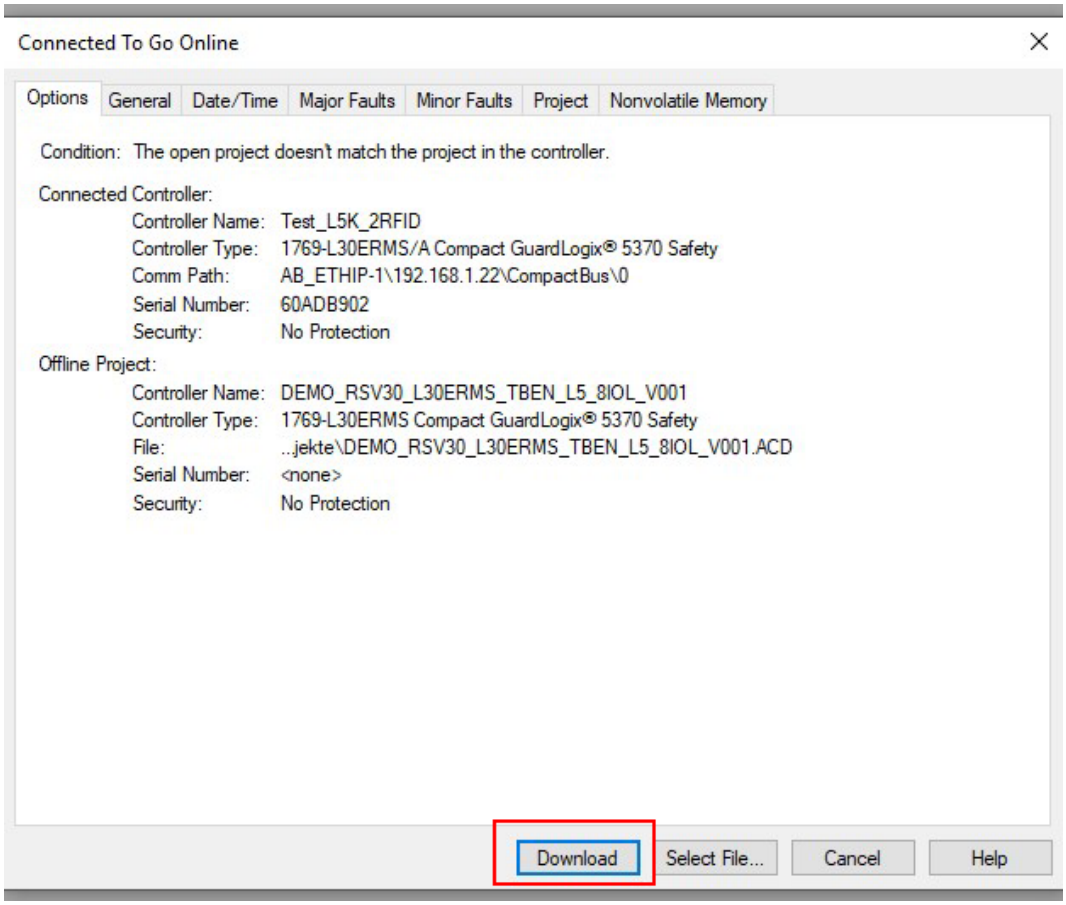


Fig. 112: Download window

⇨ The **Download** window opens.

▶ Click on **Download**.

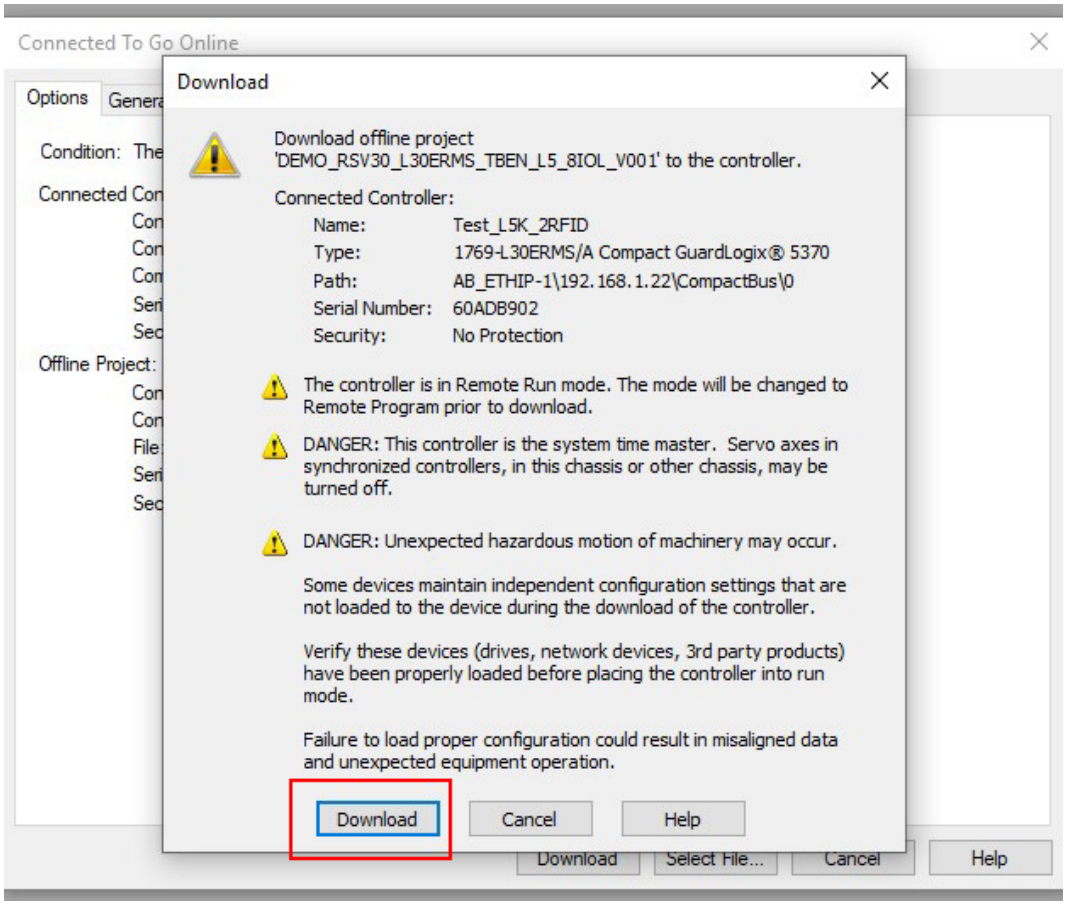


Fig. 113: Download configurations to the device

⇨ The configurations are being downloaded to the device. When the download is complete, a query window opens.

▶ Click on **Yes**.

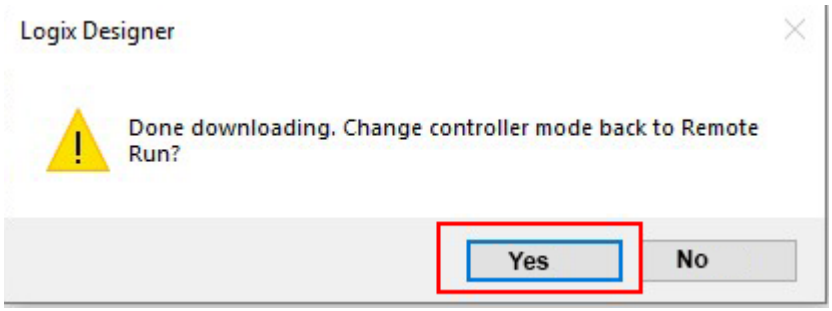


Fig. 114: Download complete

The process data can be viewed under **Controller Tags**.

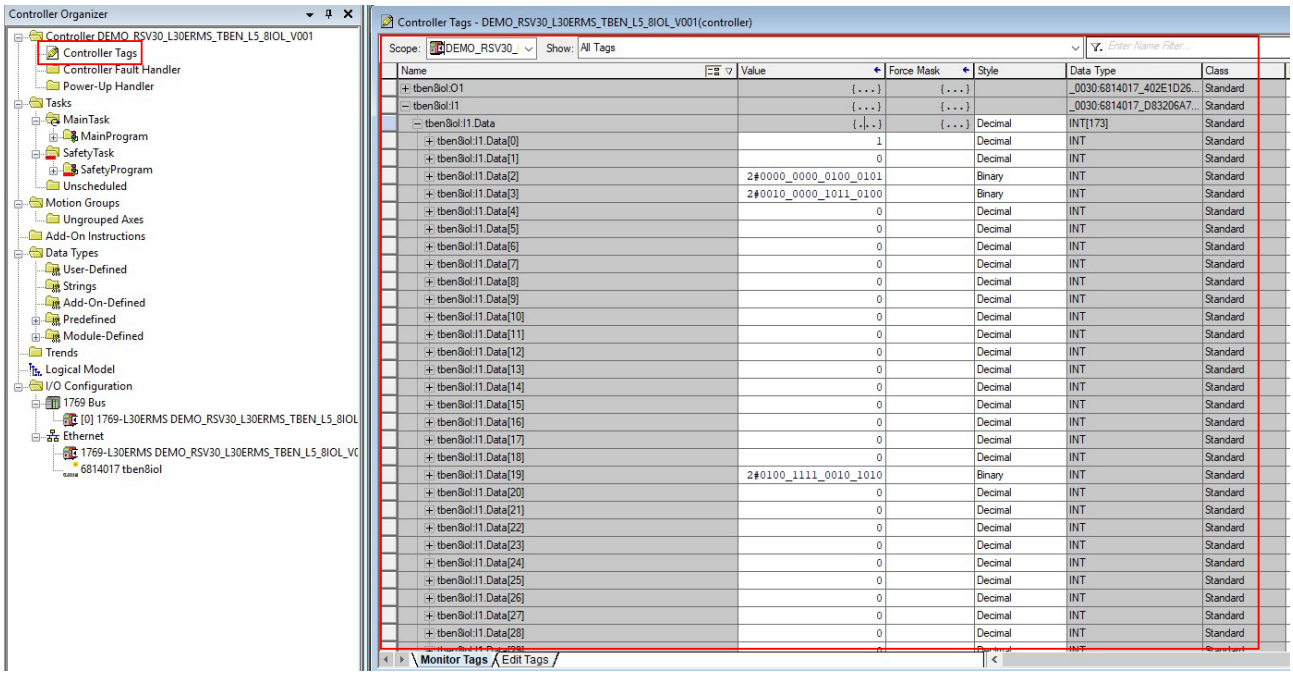


Fig. 115: View process data

7 Setting

The following examples describe the setting of IO-Link devices during operation. The following scenarios are possible:

- Setting with programmable gateway from VN03-00 and CODESYS 3
- Setting with programmable gateway and CODESYS 2
- Setting with Siemens controller in Simatic Manager
- Setting with Siemens controller in the TIA Portal

7.1 Setting devices using the control program with the function block

IO-Link devices can be set and configured via the higher-level controller. An IO-Link function block is required for this purpose. The function block is provided by the controller manufacturer. Depending on the software version of the programming environment, the function and execution of the IO-Link function block may differ. To do this, observe the manufacturer's information on the programming environment and the IOL_CALL function block.

The IO-Link function block IOL_CALL is specified in the IO-Link specification "IO-Link Integration Part 1- Technical Specification for PROFIBUS and PROFINET".

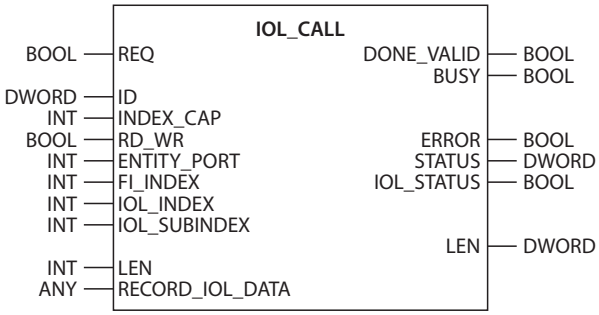


Fig. 116: IOL_CALL in accordance with IO-Link specification

NOTE
Depending on the controller manufacturer, the function blocks may deviate from the specification, e.g. in the representation and use of the variables used (example: Siemens function block IO_Link_Device for TIA Portal). For more information, refer to the documentation of the respective controller manufacturer.

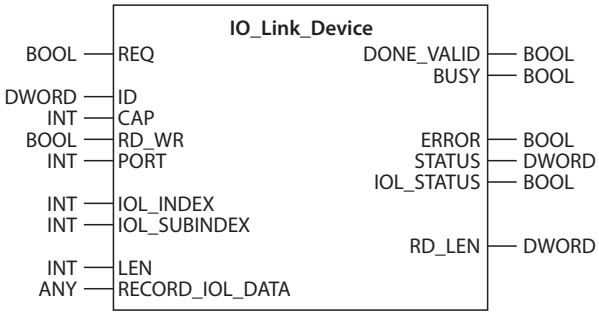


Fig. 117: IO_Link_Device function block for S7-TIA Portal

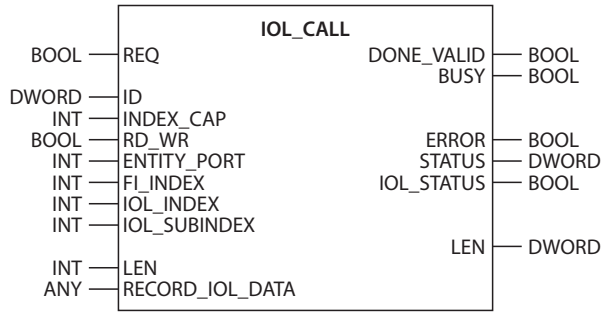


Fig. 118: Function block IOL_CALL for CODESYS3

Function block IOL_CALL: input variables

The following description of the function block variables is partially taken from the IO-Link specification.

Name in accordance with IO-Link specification	Data type	Meaning
REQ	BOOL	0 → 1 → 0: Send command
ID	DWORD	Address of the IO-Link master module Siemens CPU 300, 400 (PROFIBUS/PROFINET): Start address of the input data of the IO-Link master module ■ 3 S CODESYS: Addressing the IO-Link master ■ Siemens CPU 1200, 1500 (PROFIBUS/PROFINET): Hardware identifier of the IO-Link master module ■ Siemens CPU 300, 400 (PROFIBUS/PROFINET): Start address of the input data of the IO-Link master module
ITFMODULE	DWORD	Device name of the IO-Link master
INDEX_CAP	INT	Function block instance: 251…254
RD_WR	BOOL	0: Write access 1: Write access
ENTITY_PORT	INT	Address of the IO-Link port to be accessed.
FI_INDEX	INT	Constant value (65098): Defines the access as IO-Link function block IOL_CALL
IOL_INDEX	INT	Number of the IO-Link index which has to be read or written
IOL_SUBINDEX	INT	Number of the IO-Link sub index has to be read or written
LEN	INT	Length of the data to be read or written
RECORD_IOL_DATA		Source or destination for the data to be read/written

Function block IOL_CALL: output variables

The following description of the function block variables is partially taken from the IO-Link specification.

Name in accordance with IO-Link specification	Data type	Meaning
DONE_VALID	BOOL	0: Command was not executed. 1: Command was executed.
BUSY	BOOL	0: Command is currently not executed. 1: Command is currently executed.
ERROR	BOOL	0: No error present 1: Error while reading or writing.
STATUS	DWORD	Communication error status: status of the acyclic communication [▶ 120]
IOL_STATUS	DWORD	IO-Link error message: Error in the communication between IO-Link master ad IO-Link device [▶ 121]
LEN	INT	Length of the read data

IOL_CALL – communication error status

The status of the acyclic communication contains 4 byte and is structured as follows:

Byte 3	Byte 2	Byte 1	Byte 0
Manufacturer specific identifier (not always applicable)	0×80 Specifies the error as an error of acyclic communication.	Error code/ status code	Vendor specific identifier (not always applicable)

Status Code	Name	Meaning
0xFF000000	TIMEOUT	Internal error in the communication with the module
0x00FFF00	INVALID_HANDLE	
0x00FFFE00	HANDLE_OUT_OF_ BUFFERS	
0x00FFFD00	HANDLE_DESTINATION_ UNAVAILABLE	
0x00FFFC00	HANDLE_UNKNOWN	
0x00FFFB00	HANDLE_METHOD_ INVALID	
0xXX80A0XX	MASTER_READ_ERROR	Error while reading
0xXX80A1XX	MASTER_WRITE_ERROR	Error while writing
0xXX80A2XX	MASTER_MODULE_ FAILURE	Failure of the IO-Link master, bus failure possible
0xXX80A6XX	MASTER_NO_DATA	No data received
0xXX80A7XX	MASTER_BUSY	IO-Link master busy
0xXX80A9XX	MASTER_FEATURE_NOT_ SUPPORTED	Function not supported by IO-Link master.
0xXX80AAXX	MASTER_RESOURCE_ UNAVAILABLE	IO-Link master not available.

Status Code	Name	Meaning
0xXX80B0XX	ACCESS_INVALID_INDEX	Index invalid, wrong INDEX_CAP used
0xXX80B1XX	ACCESS_WRITE_ LENGTH_ERROR	Length of data to be written can not be handled from the module, wrong module accessed.
0xXX80B2XX	ACCESS_INVALID_ DESTINATION	Wrong slot accessed
0xXX80B03XX	ACCESS_TYPE_CONFLICT	IOL_CALL invalid
0xXX80B5XX	ACCESS_INVALID_INDEX	Error in IOL_CALL sequence
0xXX80B6XX	ACCESS_DENIED	IOL-Link master module refuses the access.
0xXX80C2XX	RESOURCE_BUSY	The IO-Link master module is busy or is waiting for an answer of the connected IO-Link device.
0xXX80C3XX	RESOURCE_UNAVAILABLE	
0xXX8901XX	INPUT_LEN_TOO_SHORT	The index to be read contains more data than defined in the input variable "LEN".

IOL_CALL – IOL_STATUS

The IOL_STATUS consists of 2 byte Error Code (IOL_M Error_Codes, according to "IO-Link Integration Part 1- Technical Specification for PROFIBUS and PROFINET") and 2 byte Error Type (according to "IO-Link Interface and System").

Byte 3	Byte 2	Byte 1	Byte 0
IOL_M-Error-Code		IOL-Error Type	

IOL_M Error Code	Designation acc. to specification	Meaning
0x0000	No error	No error
0x7000	IOL_CALL Conflict	Unexpected write-request, read request expected
0x7001	Wrong IOL_CALL	Decoding error
0x7002	Port blocked	The accessed port is occupied by another task
…	reserved	
0x8000	Timeout	Timeout, IOL master or IOL device port busy
0x8001	Wrong index	Error: IOL index < 32767 or > 65535 selected
0x8002	Wrong port address	Port address not available
0x8003	Wrong port function	Port function not available
…	reserved	

IOL Error Type	Designation acc. to specification	Meaning
0x1000	COM_ERR	Communication error Possible source: the addressed port is parameterized as digital input DI and is not in IO-Link mode
0x1100	I_SERVICE_TIMEOUT	Timeout in communication, device does not respond in time
0x5600	M_ISDU_CHECKSUM	Master reports checksum error, access to device not possible
0x5700	M_ISDU_ILLEGAL	Device can not respond to master request
0x8000	APP_DEV	Application error in the device
0x8011	IDX_NOTAVAIL	Index not available
0x8012	SUBIDX_NOTAVAIL	Sub-Index not available
0x8020	SERV_NOTAVAIL	The service is temporarily not available.
0x8021	SERV_NOTAVAIL_LOCCTRL	Service temporarily not available, device is busy (e. g. teaching or parameterization of the device via the master active)
0x8022	SERV_NOTAVAIL_DEVCTRL	Service temporarily not available, device is busy (e. g. teaching or parameterization of the device via DTM or PLC etc. active)
0x8023	IDX_NOT_WRITEABLE	Access denied, index cannot be written
0x8030	PAR_VALOUTOFRNG	Parameter value out of the valid range
0x8031	PAR_VALGTLIM	Parameter value above upper limit
0x8032	PAR_VALLTLIM	Parameter value value below the lower limit
0x8033	VAL_LENOVRRUN	Length of data to be written does not match the length defined for this parameter
0x8034	VAL_LENUNDRUN	
0x8035	FUNC_NOTAVAIL	Function not available in the device
0x8036	FUNC_UNAVAILTEMP	Function not available in the device
0x8040	PARA_SETINVALID	Invalid parameter: Parameters not consistent with other parameters in the device.
0x8041	PARA_SETINCONSIST	Inconsistent parameters
0x8082	APP_DEVNOTRDY	Application not ready, device busy
0x8100	UNSPECIFIC	Vendor specific, according to device documentation
0x8101…0x8FFF	VENDOR_SPECIFIC	

7.1.1 Setting with programmable gateway and CODESYS 3

IO-Link devices can be set with a programmable gateway from VN03-00 and CODESYS. The IO-Link function block IOL_CALL is required for this purpose. The function block is contained in the library for programmable gateways BLxx_PG_PB.lib. The library is part of the target support package for BLxx-PG-EN and is available free of charge at www.turck.com.

For information on configuring the IO-Link master with CODESYS, refer to the device-specific instructions for use.

Software used

- CODESYS 3.5 SP8 Patch 1
- Example program for an application in CODESYS (available on request from Turck)

Hardware used

- Programmable gateway BL67-PG-EN (VN03.00)
- IO-Link master module BL67-4IOL with base module BL67-B-4M12
- Temperature sensor TS720-2UPN8-H1141 (connected to port 1 of the IO-Link master)

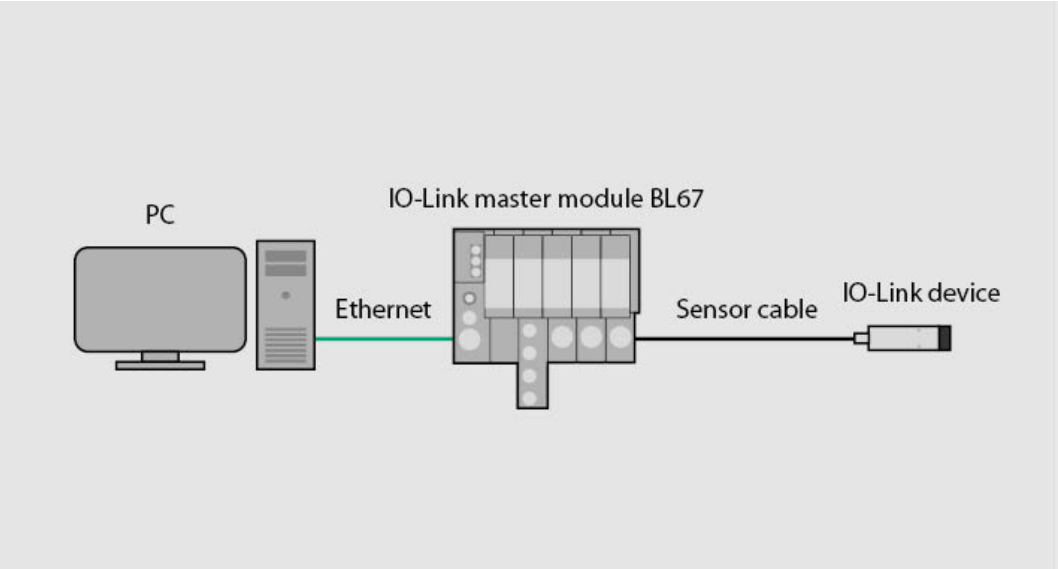


Fig. 119: Application example — setup

Example: read out product names

The required parameter values for configuring the IO-Link device can be found in the IODD-finder or in the device-specific IO-Link parameter manual.

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	SubIndex access supported	Access	Byte. Bit-offset	Bit Length	Data Type	Value	Default	Description
Min Cycle Time	0	0x0	3	0x3	True	read	2.0	8	UInteger			
IO-Link Version ID	0	0x0	5	0x5	True	read	4.0	8	UInteger		17	
Vendor ID 1	0	0x0	8	0x8	True	read	7.0	8	UInteger			
Vendor ID 2	0	0x0	9	0x9	True	read	8.0	8	UInteger			
Device ID 1	0	0x0	10	0xA	True	read	9.0	8	UInteger			
Device ID 2	0	0x0	11	0xB	True	read	10.0	8	UInteger			
Device ID 3	0	0x0	12	0xC	True	read	11.0	8	UInteger			
Standard Command	2	0x2	0	0x0	True	write	0.0	8	UInteger	0...159		System command
										128		Device Reset
										129		Application Reset
										130		Restore Factory Settings
Parameter (write) Access Lock	12	0xC	1	0x1	False	read/write	0.0	1	Boolean	false/true		Device access locks
Data Storage Lock	12	0xC	2	0x2	False	read/write	0.1	1	Boolean	false/true		Device access locks
Local Parameterization Lock	12	0xC	3	0x3	False	read/write	0.2	1	Boolean	false/true		Device access locks
Local User Interface Lock	12	0xC	4	0x4	False	read/write	0.3	1	Boolean	false/true		Device access locks
Vendor Name	16	0x10	0	0x0	True	read	0.0	512	String		Turck	Vendor name
Vendor Text	17	0x11	0	0x0	True	read	0.0	512	String		www.turck.com	Additional manufacturer information
Product Name	18	0x12	0	0x0	True	read	0.0	512	String			Manufacturer's device designation
Product ID	19	0x13	0	0x0	True	read	0.0	512	String			Ident-No.
Product Text	20	0x14	0	0x0	True	read	0.0	512	String			Device category
Serial Number	21	0x15	0	0x0	True	read	0.0	128	String			Device serial number

Fig. 120: Excerpt from the parameter manual for temperature sensor TS720-…-H1141 (example: read out product names)

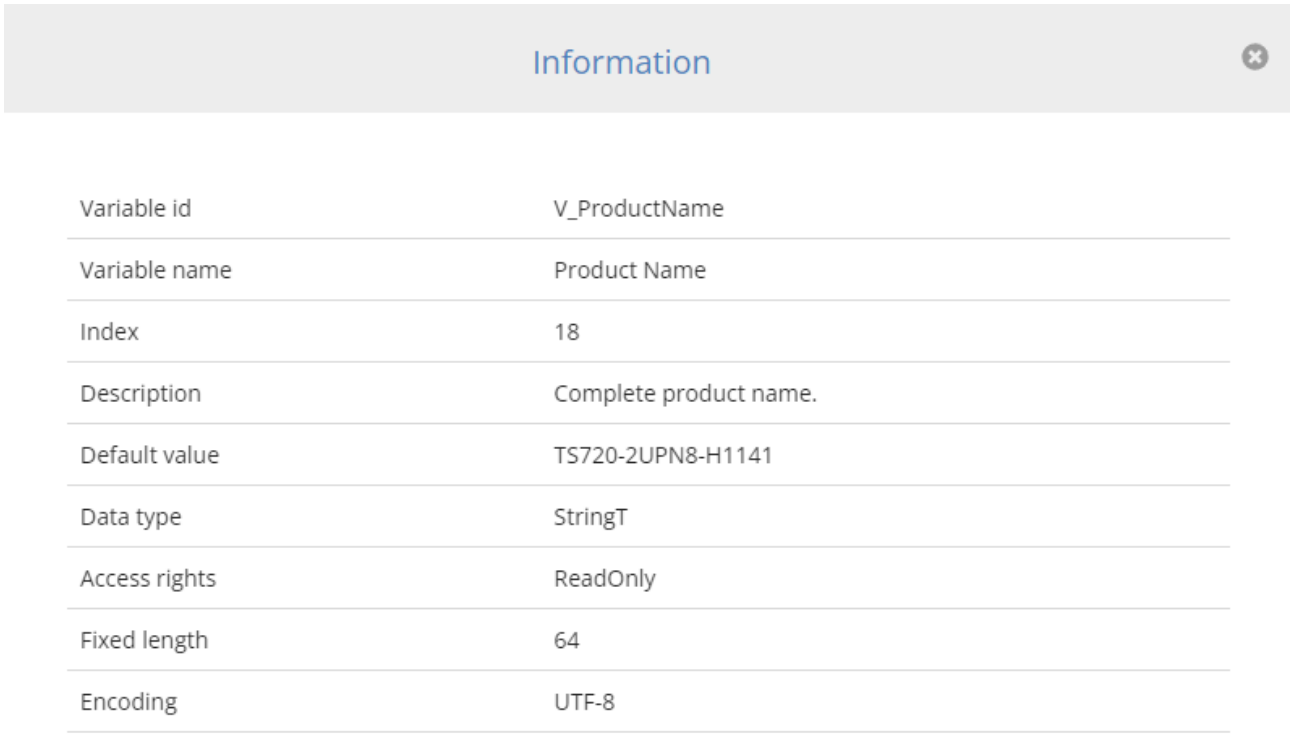


Fig. 121: Excerpt from the IODDfinder for temperature sensor TS720-…-H1141 (example: product name)

- Read out values (example: read out the product names of the temperature sensor): Control variables as follows:

Variable	Value	Meaning
RD_WR	0	Read access
SLOT	1	Position of the IO-Link master module in the BL67 station
INDEX_CAP	251	Function block instance
Entity_Port	1	The IO-Link device is connected to port 1.
IOL_INDEX	0x12	Index for display parameters
LEN	0x20	32 bytes are read out

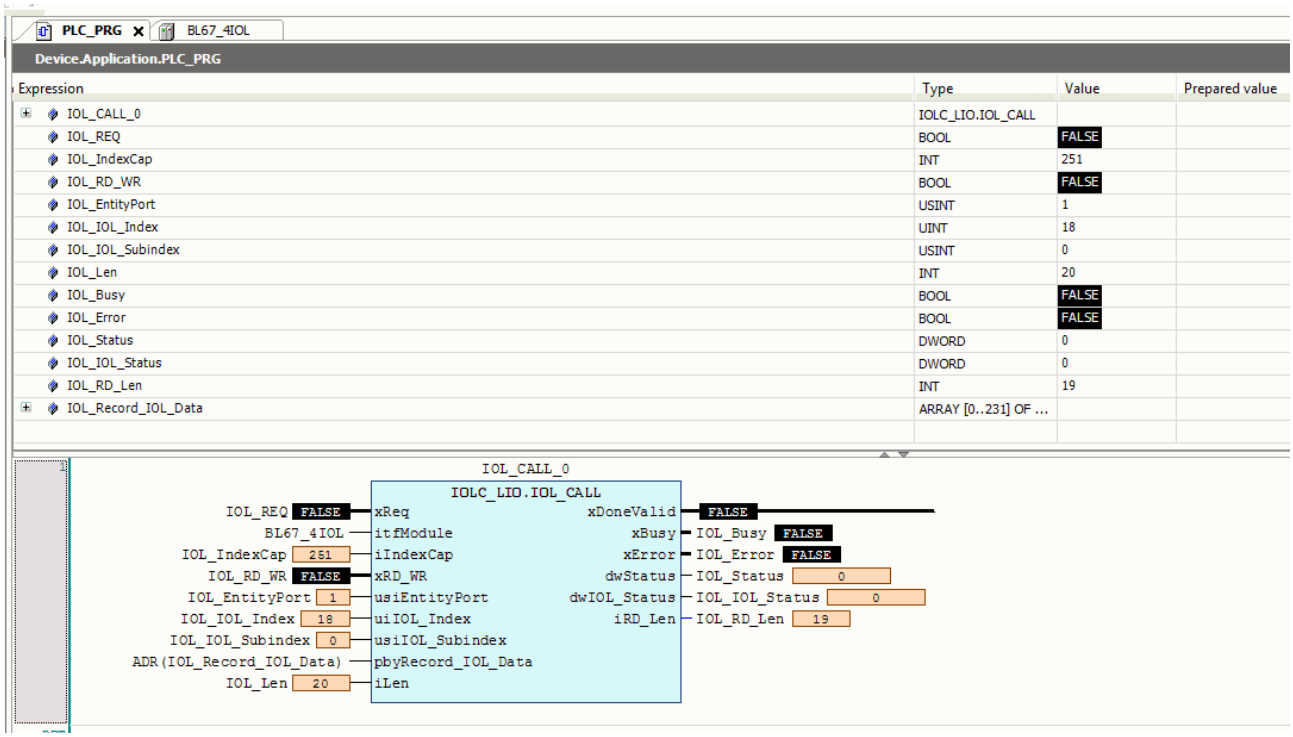


Fig. 122: Entering input variables for read access

- Enable read access via a rising edge on **IOL_REQ**.

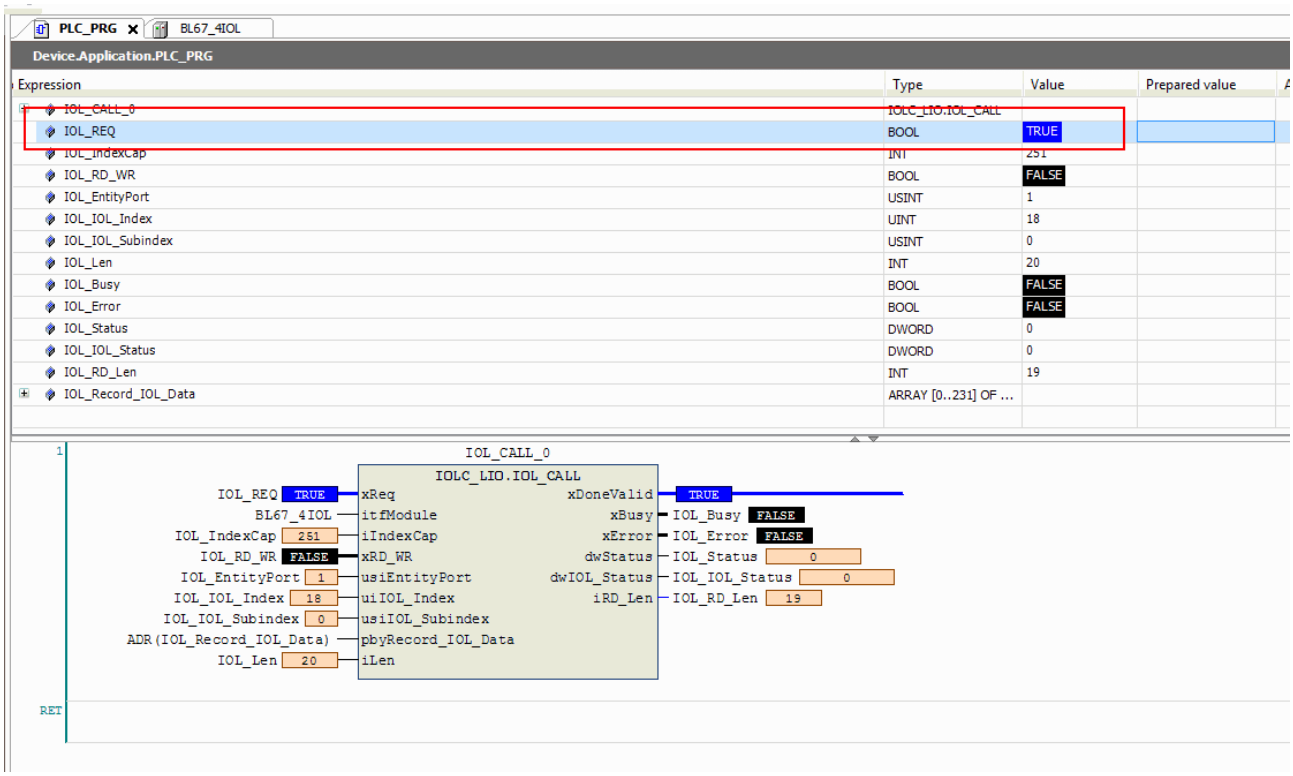


Fig. 123: Enable read access

The product name is displayed in the “READ” data array as a hexadecimal code.

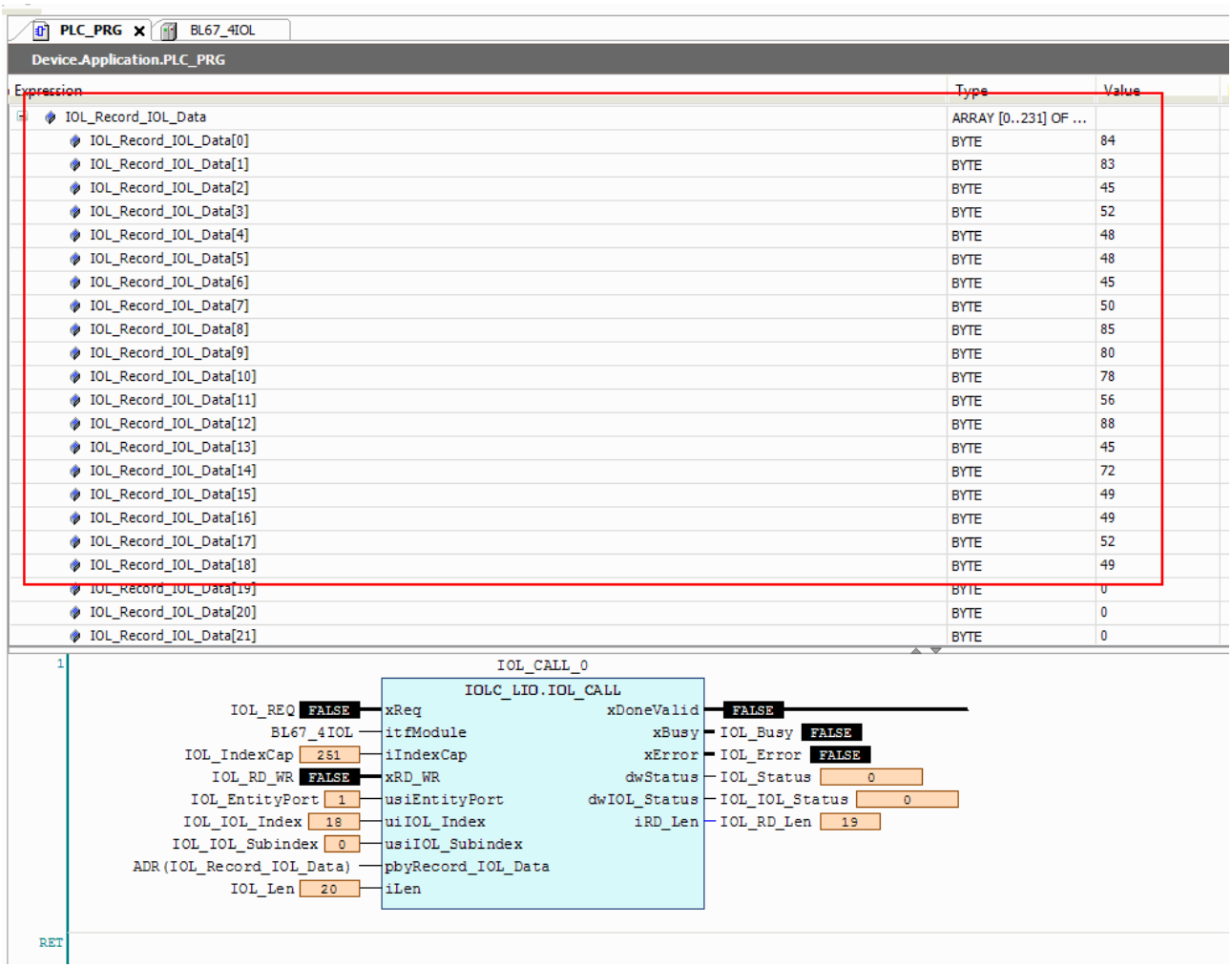


Fig. 124: Process data array "READ"

Example: write values

The required parameter values of the IO-Link device can be found in the IODDfinder or in the device-specific IO-Link parameter manual.

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	Subindex access supported	Access	Byte. Bit Offset	Bit length	Data Type	Value	Default	Description
Display of measured value	85	0x55	0	0x0	True	read/ write	0.0	8	UInteger	0...6	0	The refresh time can be adjusted. The display can be rotated by 180° or disabled. In disabled state, the measured value is displayed temporarily when pressing the set button.
										0		50 ms refresh time
										1		200 ms refresh time
										2		600 ms refresh time
										3		50 ms refresh time/display rotated by 180°
										4		200 ms refresh time/display rotated by 180°
										5		600 ms refresh time/display rotated by 180°
										6		disabled

Fig. 125: Excerpt from the parameter manual for sensor TS720-…-H1141 (example: set the display)

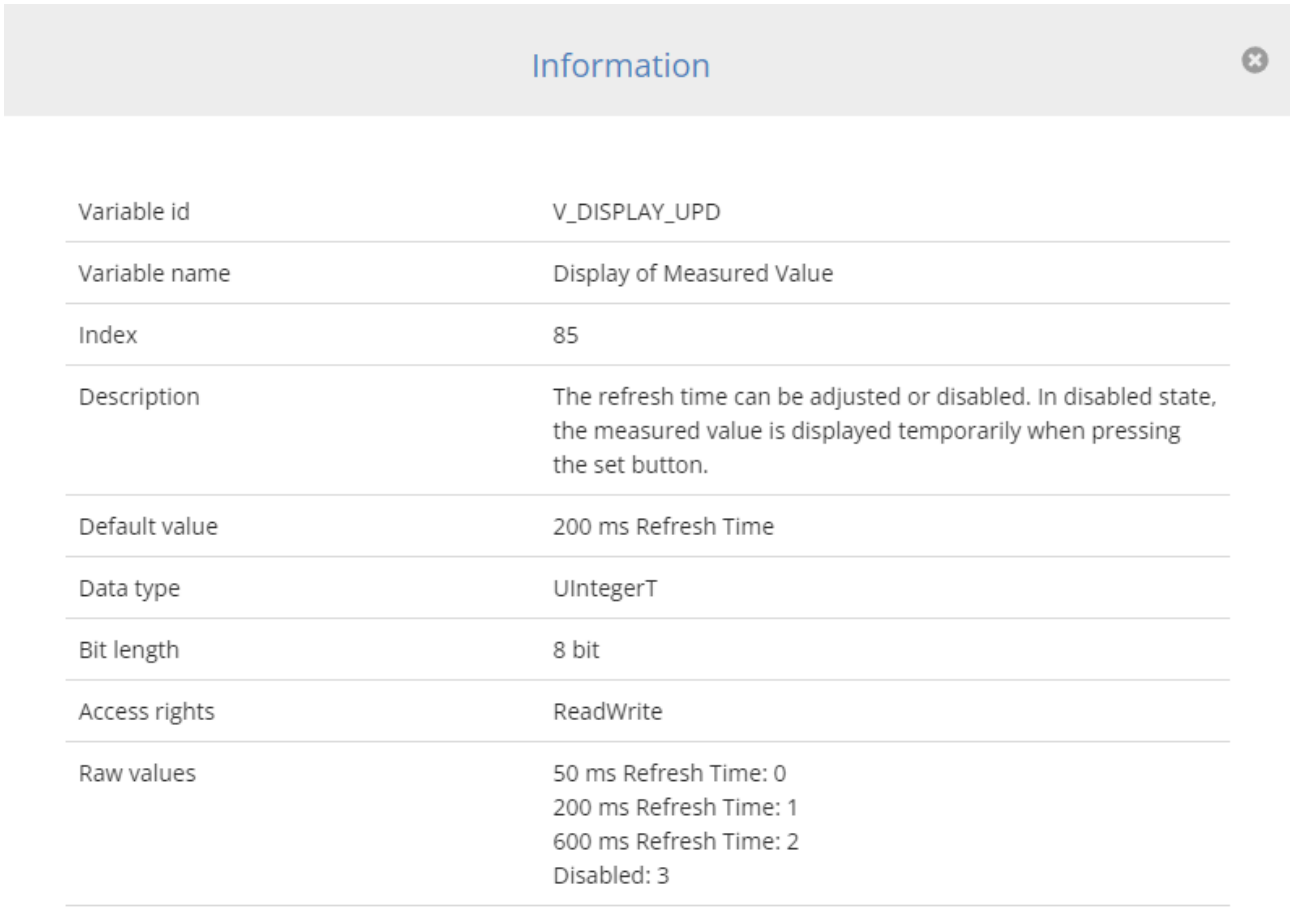


Fig. 126: Excerpt from the IODDfinder for sensor TS720-…-H1141 (example: measured value display)

- Write values (example: rotate the display of temperature sensor TS720-…-H1141 180°, set the measurement update time to 200 ms): Control variables as follows:

Variable	Value	Meaning
RD_WR	1	Write access
SLOT	1	Position of the IO-Link master module in the BL67 station
INDEX_CAP	251	Function block instance
ENTITY_PORT	1	The IO-Link device is connected to port 1.
IOL_INDEX	0x55	Index for display parameters
LEN	1	1 byte is written

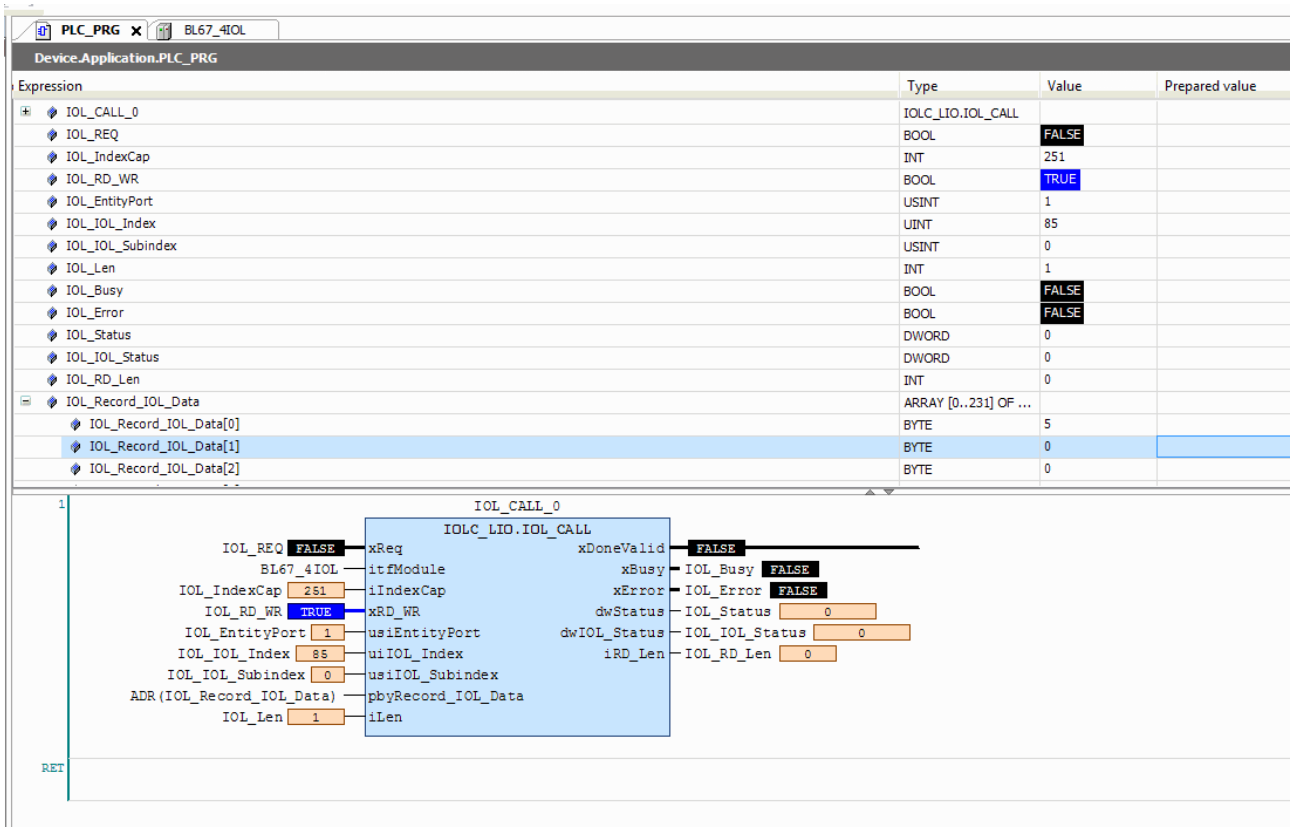


Fig. 127: Enter input variables for write access

- Enter a value of **5** in Array WRITE to rotate the display 180° and set the measured value update time to 200 ms.
- Enable write access via a rising edge on REQ.

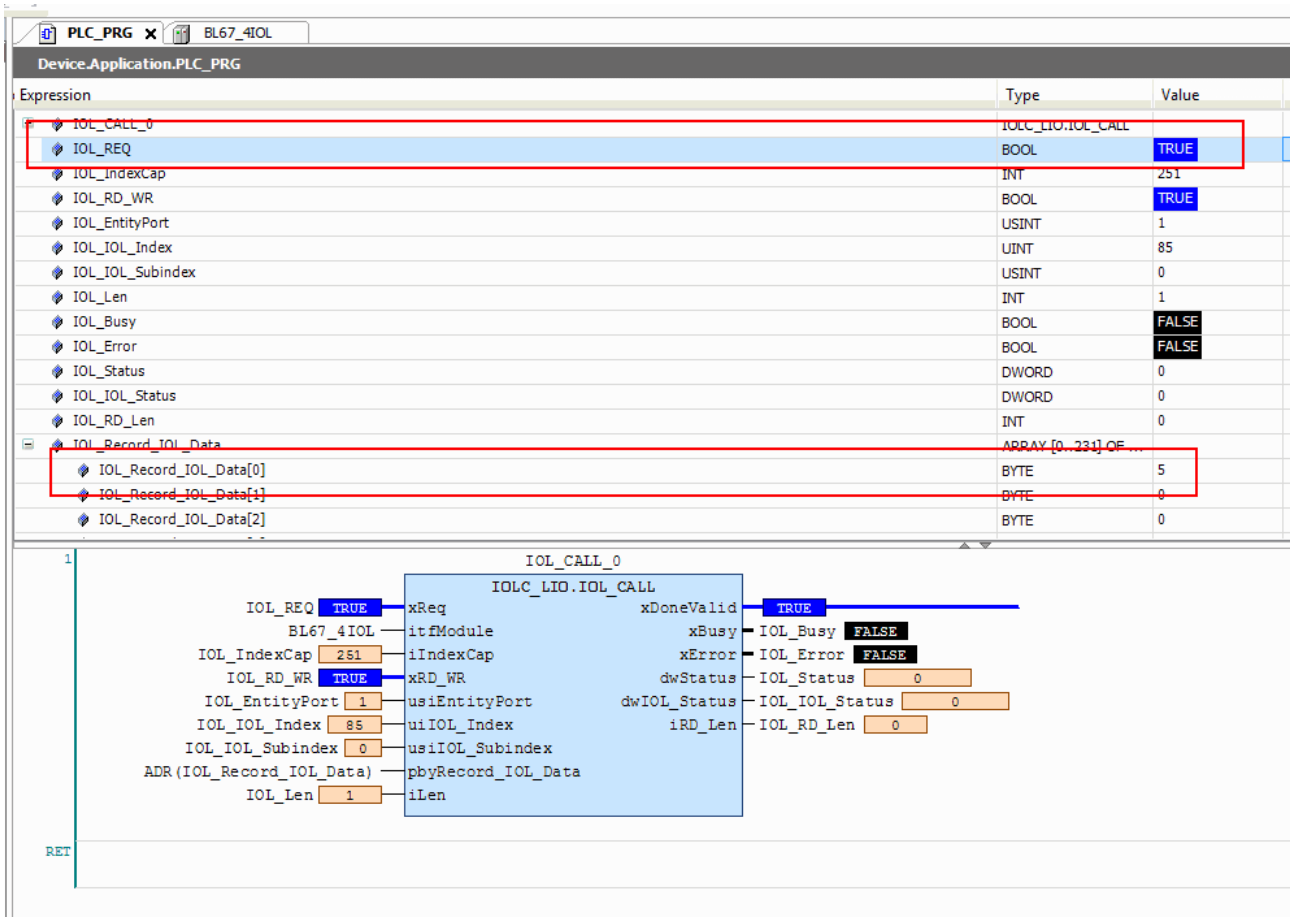


Fig. 128: Enable write access

7.1.2 Setting with programmable gateway and CODESYS 2

IO-Link devices can be set with a programmable gateway up to version 2 and CODESYS. The IO-Link function block IOL_CALL is required for this purpose. The function block is contained in the library for programmable gateways BLxx_PG_PB.lib. The library is part of the target support package for BLxx-PG-EN and is available free of charge at www.turck.com.

For information on configuring the IO-Link master with CODESYS, refer to the device-specific instructions for use.

Software used

- CODESYS 2.3 with library BLxx_PG_PB.lib
- Example program for an application in CODESYS (available on request from Turck)

Hardware used

- Programmable gateway BL20-PG-EN
- IO-Link master Module BL20-E-4IOL
- Temperature sensor TS720-2UPN8-H1141 (connected to port 1 of the IO-Link master)
- IO-Link I/O hub TBIL-M1-16DIP (connected to port 4 of the IO-Link master)

Setup

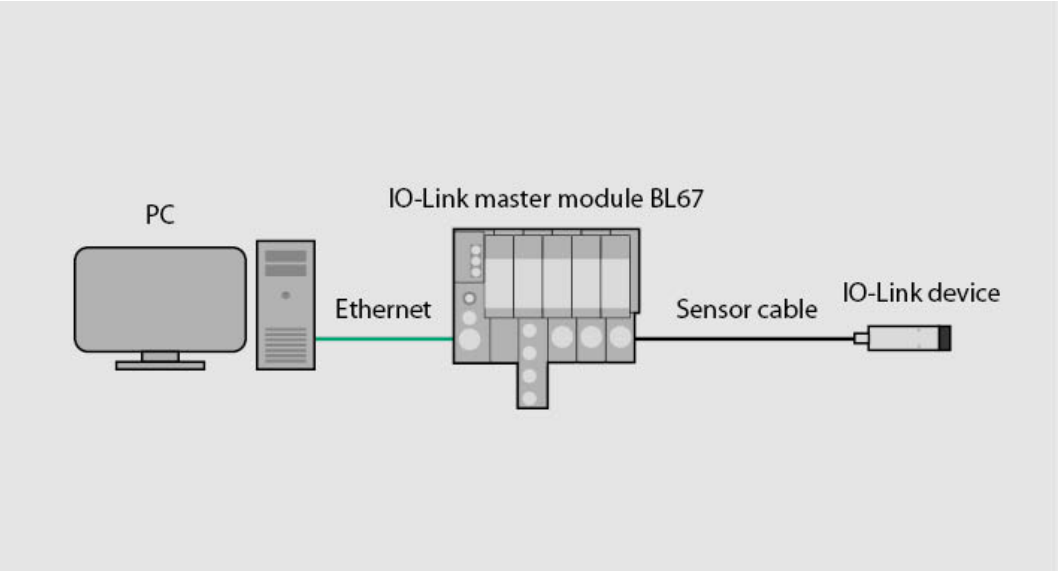


Fig. 129: Application example — setup

Example: read out product names

The required parameter values for configuring the IO-Link device can be found in the IODD-finder or in the device-specific IO-Link parameter manual.

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	SubIndex access supported	Access	Byte. Bit-offset	Bit Len-gth	Data Type	Value	Default	Description
Min Cycle Time	0	0x0	3	0x3	True	read	2.0	8	UInteger			
IO-Link Ver-sion ID	0	0x0	5	0x5	True	read	4.0	8	UInteger		17	
Vendor ID 1	0	0x0	8	0x8	True	read	7.0	8	UInteger			
Vendor ID 2	0	0x0	9	0x9	True	read	8.0	8	UInteger			
Device ID 1	0	0x0	10	0xA	True	read	9.0	8	UInteger			
Device ID 2	0	0x0	11	0xB	True	read	10.0	8	UInteger			
Device ID 3	0	0x0	12	0xC	True	read	11.0	8	UInteger			
Standard Command	2	0x2	0	0x0	True	write	0.0	8	UInteger	0...159		System command
										128		Device Reset
										129		Application Reset
										130		Restore Fact-ory Settings
Parameter (write) Access Lock	12	0xC	1	0x1	False	read/ write	0.0	1	Boolean	false/ true		Device access locks
Data Storage Lock	12	0xC	2	0x2	False	read/ write	0.1	1	Boolean	false/ true		Device access locks
Local Para-meterization Lock	12	0xC	3	0x3	False	read/ write	0.2	1	Boolean	false/ true		Device access locks
Local User Interface Lock	12	0xC	4	0x4	False	read/ write	0.3	1	Boolean	false/ true		Device access locks
Vendor Name	16	0x10	0	0x0	True	read	0.0	512	String		Turck	Vendor name
Vendor Text	17	0x11	0	0x0	True	read	0.0	512	String		www. turck. com	Additional manufacturer information
Product Name	18	0x12	0	0x0	True	read	0.0	512	String			Manufac-turer's device designation
Product ID	19	0x13	0	0x0	True	read	0.0	512	String			Ident-No.
Product Text	20	0x14	0	0x0	True	read	0.0	512	String			Device category
Serial Number	21	0x15	0	0x0	True	read	0.0	128	String			Device serial number

Fig. 130: Excerpt from the parameter manual for the IO-Link I/O hub TBIL-M1-16DIP (example: read out product names)

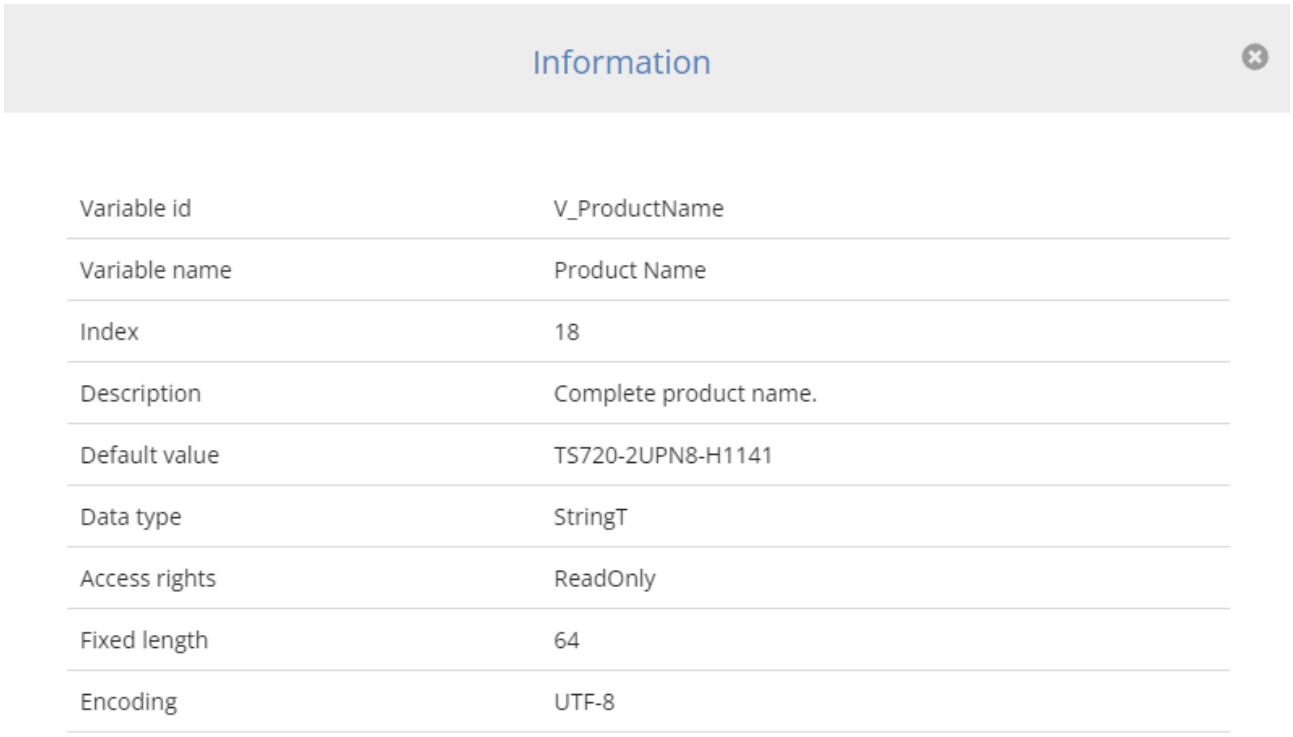


Fig. 131: Excerpt from the IODDfinder for temperature sensor TS720-…-H1141 (example: product name)

- Read out values (example: read out the product names of the IO-Link I/O hub): Control variables as follows:

Variable	Value	Meaning
RD_WR	0	Read access
SLOT	1	Position of the IO-Link master module in the BL67 station
INDEX_CAP	251	Function block instance
Entity_Port	4	The IO-Link device is connected to port 4.
IOL_INDEX	0x12	Index for display parameters
LEN	0x20	32 bytes are read out

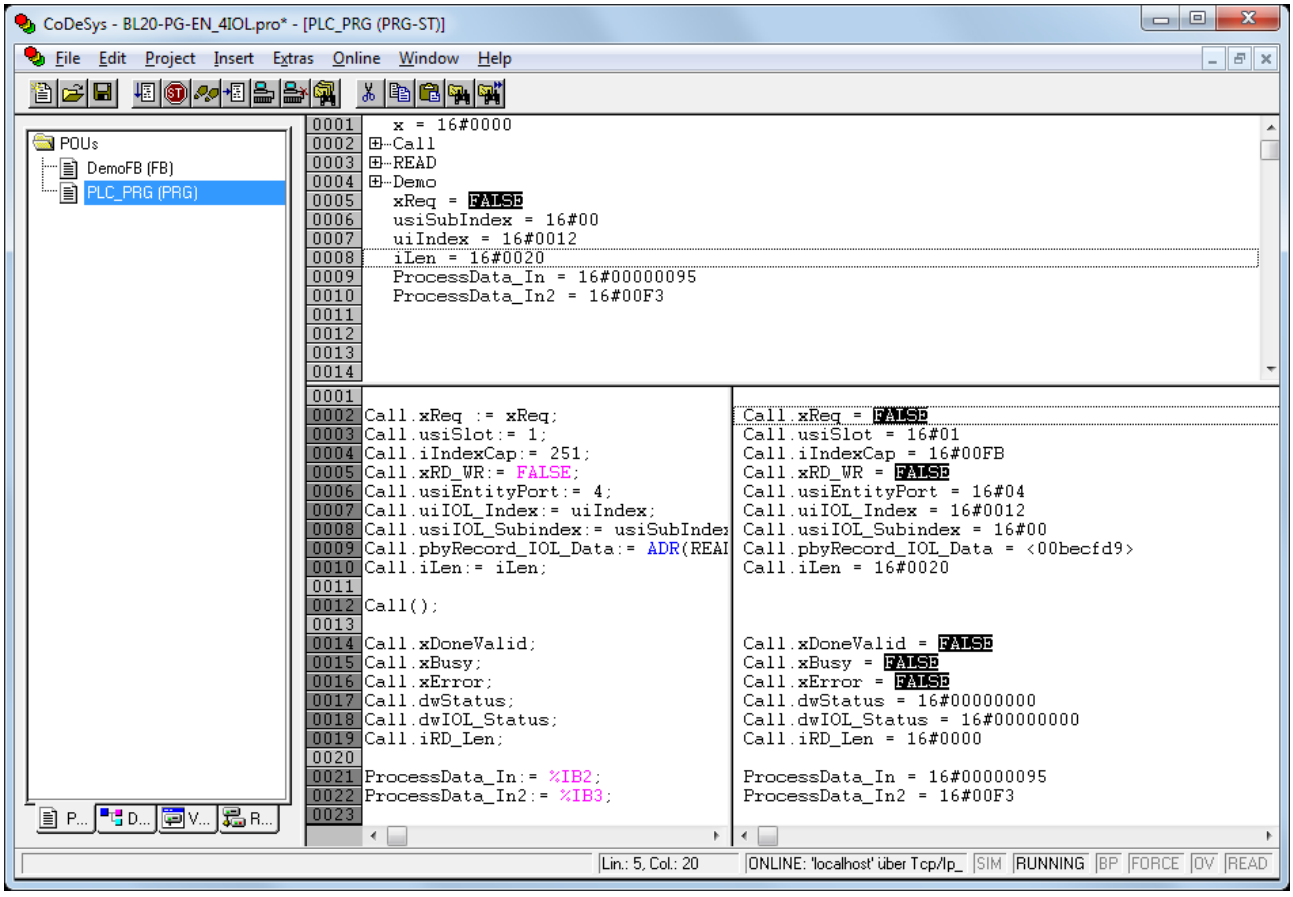


Fig. 132: Entering input variables for read access

- Enable read access via a rising edge on **xREQ**.

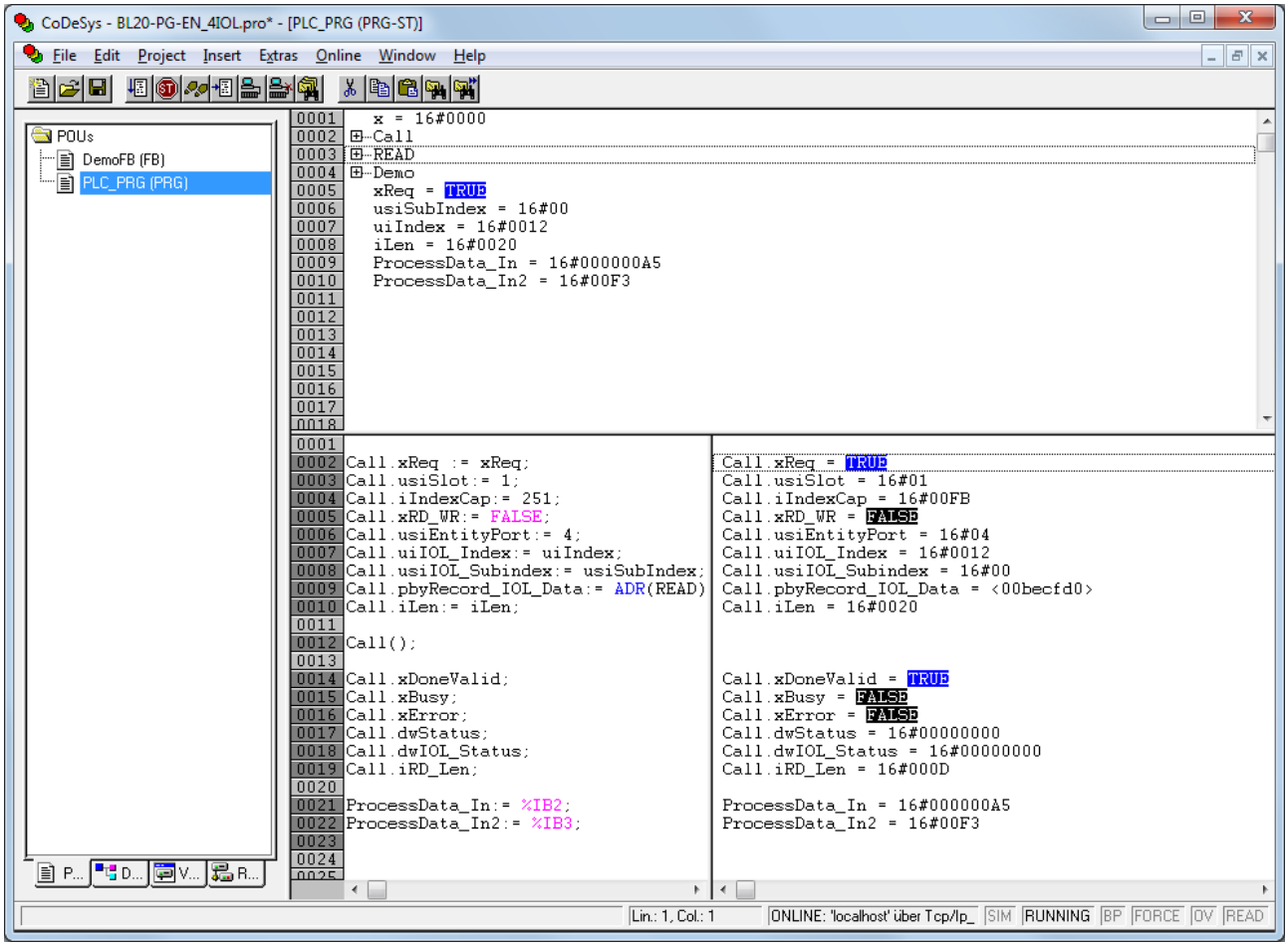


Fig. 133: Enable read access

The product name is displayed in the **READ** data array as a hexadecimal code.

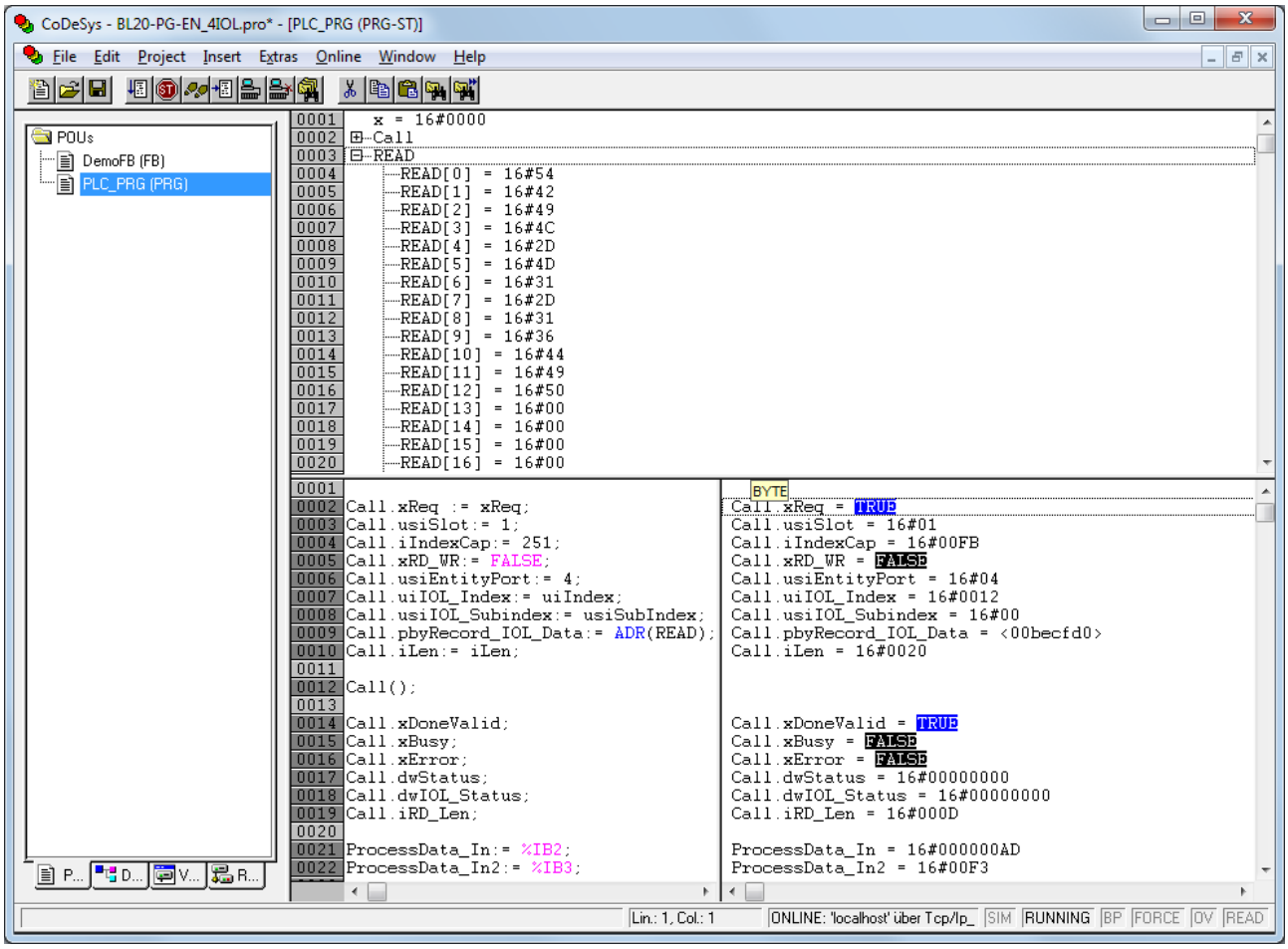


Fig. 134: Process data array "READ"

Example: write values

The required parameter values of the IO-Link device can be found in the IODDfinder or in the device-specific IO-Link parameter manual.

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	Subindex access supported	Access	Byte. Bit Offset	Bit length	Data Type	Value	Default	Description
Display of measured value	85	0x55	0	0x0	True	read/ write	0.0	8	UInteger	0...6	0	The refresh time can be adjusted. The display can be rotated by 180° or disabled. In disabled state, the measured value is displayed temporarily when pressing the set button.
										0		50 ms refresh time
										1		200 ms refresh time
										2		600 ms refresh time
										3		50 ms refresh time/display rotated by 180°
										4		200 ms refresh time/display rotated by 180°
										5		600 ms refresh time/display rotated by 180°
										6		disabled

Fig. 135: Excerpt from the parameter manual for sensor TS720-…-H1141 (example: set the display)

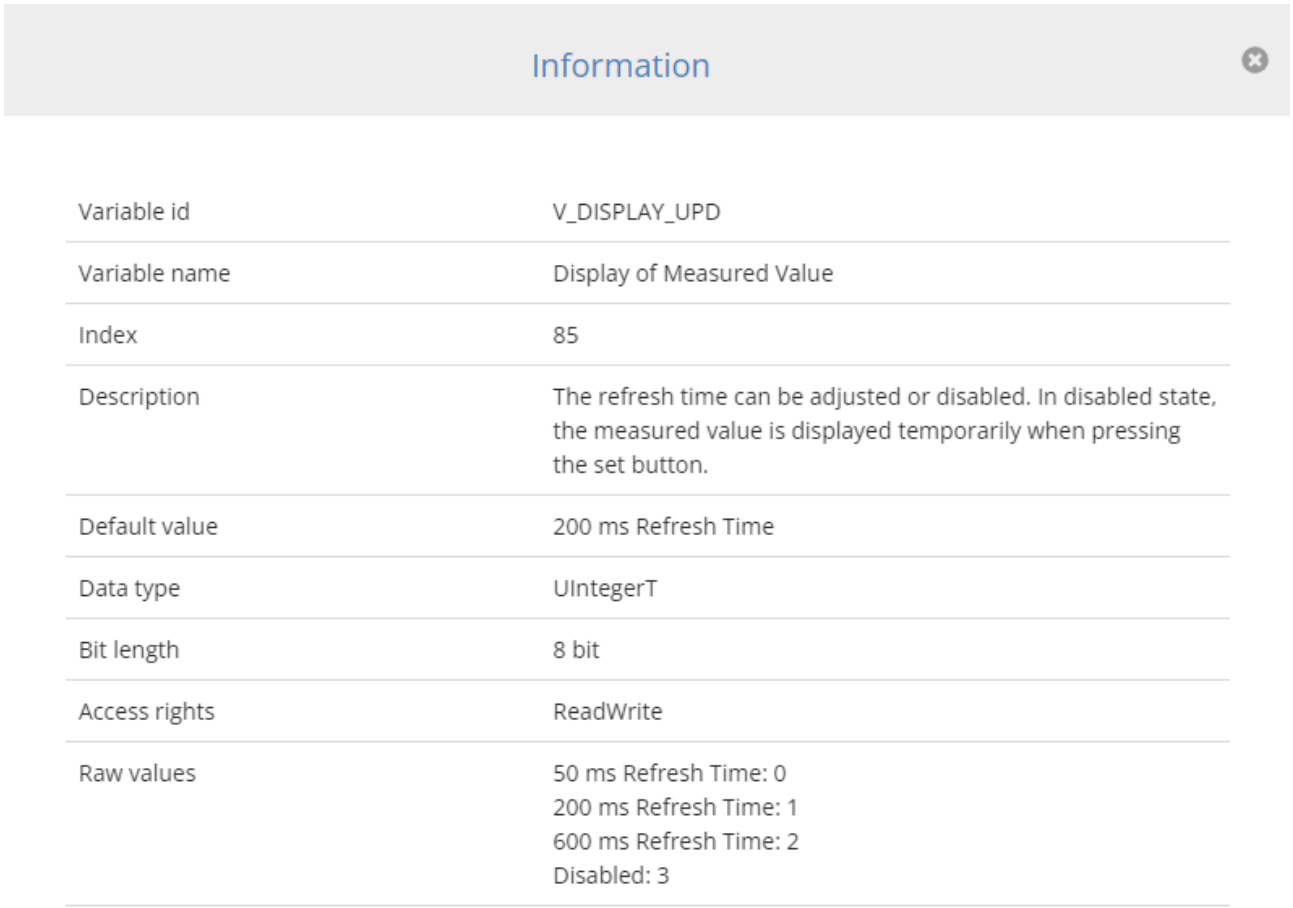


Fig. 136: Excerpt from the IODDfinder for sensor TS720-…-H1141 (example: measured value display)

- Write values (example: rotate the display of temperature sensor TS720-…-H1141 180°, set the measurement update time to 200 ms): Control variables as follows:

Variable	Value	Meaning
RD_WR	1	Write access
SLOT	1	Position of the IO-Link master module in the BL67 station
INDEX_CAP	251	Function block instance
ENTITY_PORT	1	The IO-Link device is connected to port 1.
IOL_INDEX	0x55	Index for display parameters
LEN	1	1 byte is written

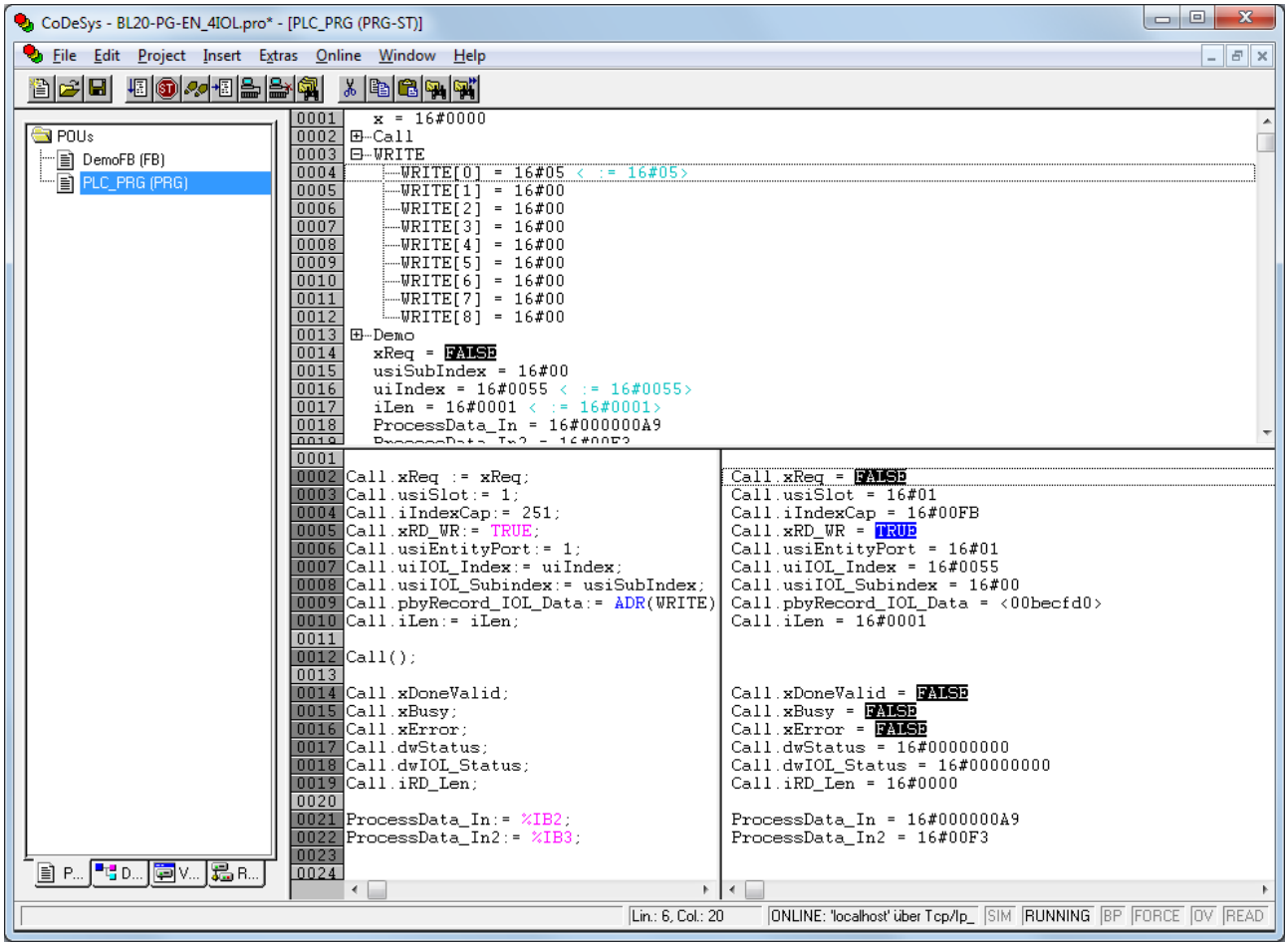


Fig. 137: Enter input variables for write access

- Enter a value of **5** in Array WRITE to rotate the display 180° and set the measured value update time to 200 ms.
- Enable write access via a rising edge on REQ.

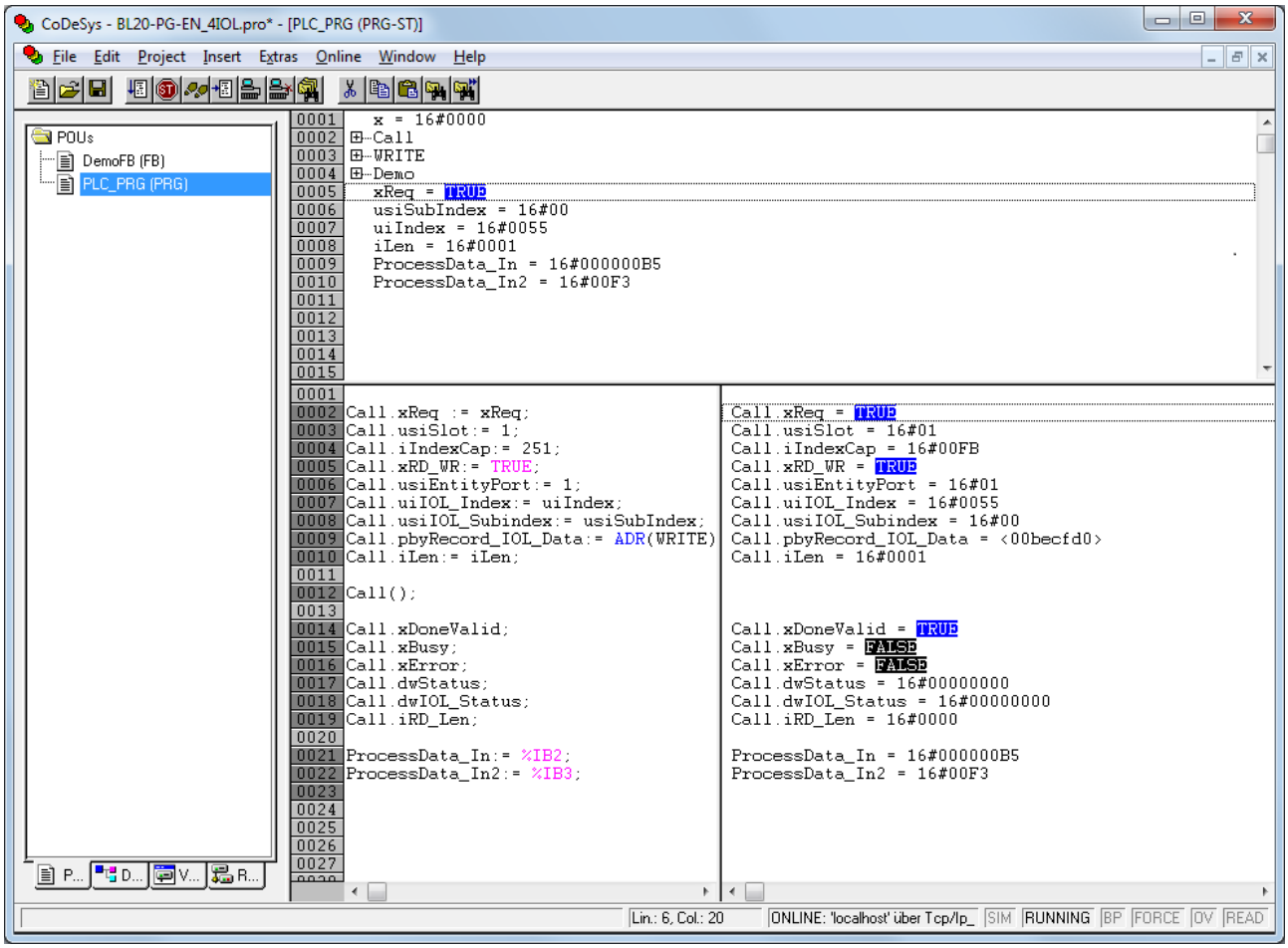


Fig. 138: Enable write access

7.1.3 Setting with Siemens S7-1200 or S7-1500 Controller and TIA Portal

IO-Link devices can be set and configured via a Turck IO-Link master on a Siemens S7-1200 or S7-1500 controller and STEP7 V12 or STEP7 V13 TIA Portal. This requires the IO-Link function block IOL_DEVICE and the GSDML file of the IO-Link master. The function block is contained in the IO_Link_Library_v13_SP1 library. The library is available on the website of the controller manufacturer. The GSDML file is available for download at www.turck.com.

For information on configuring the IO-Link master with STEP7 V13 TIA Portal, refer to the device-specific instructions for use.

Software used

- Siemens STEP 7 V13 Professional (TIA Portal) SP1 Update 5
- GSDML file of the IO-Link master
- Example program (available on request from Turck)

Hardware used

NOTE
As an alternative to the IO-Link block module TBEN-S2-4IOL, the IO-Link block modules TBEN-L…-8IOL or FEN20-4IOL can be used.

- Siemens S7 controller, e.g. with CPU 1513-1-PN
- IO-Link master TBEN-S2-4IOL
- Temperature sensor TS720-2UPN8-H1141 (connected to port 1 of the IO-Link master)

Setup

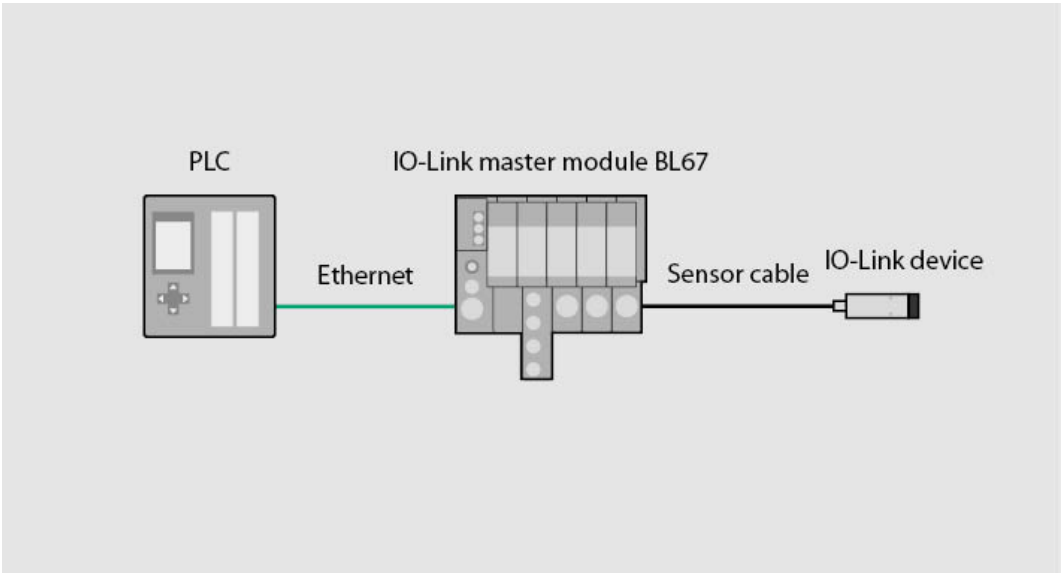


Fig. 139: Application example — setup

Example: configuring the device

The required parameter values of the IO-Link device can be found in the IODDfinder or in the device-specific IO-Link parameter manual.

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	Subindex access supported	Access	Byte. Bit Offset	Bit length	Data Type	Value	Default	Description
Display of measured value	85	0x55	0	0x0	True	read/ write	0.0	8	UInteger	0...6	0	The refresh time can be adjusted. The display can be rotated by 180° or disabled. In disabled state, the measured value is displayed temporarily when pressing the set button.
										0		50 ms refresh time
										1		200 ms refresh time
										2		600 ms refresh time
										3		50 ms refresh time/display rotated by 180°
										4		200 ms refresh time/display rotated by 180°
										5		600 ms refresh time/display rotated by 180°
										6		disabled

Fig. 140: Excerpt from the parameter manual for sensor TS720-…-H1141 (example: set the display)

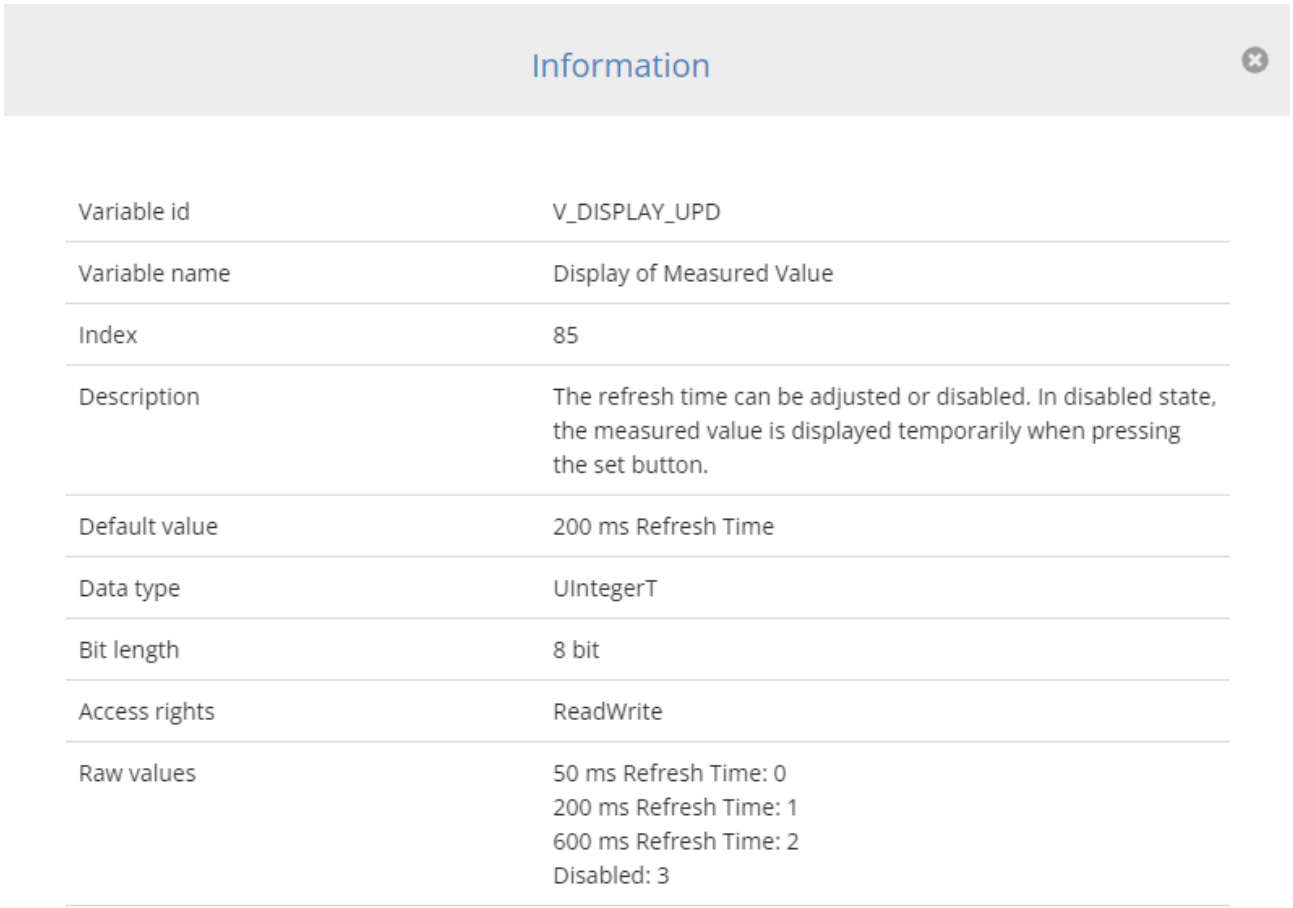


Fig. 141: Excerpt from the IODDfinder for sensor TS720-…-H1141 (example: measured value display)

The sequences are visualized in the example program in the monitoring table "IOL1P1".

- Read out values (example: read out the product names of the temperature sensor): Control variables as follows:

Variable	Value	Meaning
RD_WR	0	Read access
CAP	251	Function block instance
PORT	1	The temperature sensor is connected to port 1.
IOL_INDEX	18	Index for display parameters
LEN	32	32 bytes are read out

S7TiaV13Sp1_1500_TBENs2_4IOL_V200 ▸ PLC_1 [CPU 1513-1 PN] ▸ Watch and force tables ▸ Beobachtungstabelle_IOL_1P1

	Name	Address	Display format	Monitor value	Modify value	Comment
1	// IO-Link Master 1 - Port 1 - Process input data status bits of status byte m+0 and m+2:					
2	"IOL_1_PROCESS_DATA".IN_STATUS_DI1	%DB10.DBX0.0	Bool	FALSE		
3	"IOL_1_PROCESS_DATA".IN_STATUS_DXP2	%DB10.DBX0.1	Bool	FALSE		
4	"IOL_1_PROCESS_DATA".IN_STATUS_DVS1	%DB10.DBX2.0	Bool	FALSE		
5	"IOL_1_PROCESS_DATA".IN_DIAG_ERR_DXP2	%DB10.DBX132.1	Bool	FALSE		
6						
7	// IO-Link Master 1 - Port 1 - Process output control bit of control byte n+0:					
8	"IOL_1_PROCESS_DATA".OUT_CONTROL_DXP2	%DB10.DBX172.1	Bool	FALSE		
9						
10	// IO-Link Master 1 - Port 1 - Process input data of byte m+2 and m+3:					
11	"Tag_5"	%IW4	DEC	0		
12	"IOL_1_PROCESS_DATA".IN_PROCESSDATA_P1...	%DB10.DBW148	DEC	0		
13						
14	// IO-Link Master 1 - Port 1 - Process output data of byte n+2 and n+3:					
15	"Tag_7"	%QW4	Hex	16#0000		
16	"IOL_1_PROCESS_DATA".OUT_PROCESSDATA_...	%DB10.DBW304	Hex	16#0000		
17						
18	// IO-Link Master 1 - Port 1 - IO-Link Call configuration:					
19	"IOL_1P1_PARA_DATA".ID	%DB1.DBW2	DEC	266		
20	"IOL_1P1_PARA_DATA".INDEX_CAP	%DB1.DBW4	DEC	251		
21	"IOL_1P1_PARA_DATA".ENTITY_PORT	%DB1.DBW8	DEC	1		
22						
23	// IO-Link Master 1 - Port 1 - IO-Link Call parameter data set:					
24	"IOL_1P1_PARA_DATA".REQ	%DB1.DBX0.0	Bool	FALSE	FALSE	
25	"IOL_1P1_PARA_DATA".RD_WR	%DB1.DBX6.0	Bool	FALSE		
26	"IOL_1P1_PARA_DATA".IOL_INDEX	%DB1.DBW10	DEC	0	18	
27	"IOL_1P1_PARA_DATA".IOL_SUBINDEX	%DB1.DBW12	DEC	0		
28	"IOL_1P1_PARA_DATA".LEN	%DB1.DBW246	DEC	0	32	
29						
30	// IO-Link Master 1 - Port 1 - IO-Link Call parameter data feedback:					
31	"IOL_1P1_PARA_DATA".DONE_VALID	%DB1.DBX248.0	Bool	FALSE		
32	"IOL_1P1_PARA_DATA".BUSY	%DB1.DBX248.1	Bool	FALSE		
33	"IOL_1P1_PARA_DATA".ERROR	%DB1.DBX248.2	Bool	FALSE		
34	"IOL_1P1_PARA_DATA".STATUS	%DB1.DBD250	Hex	16#0000_0000		
35	"IOL_1P1_PARA_DATA".IOL_STATUS	%DB1.DBD254	Hex	16#0000_0000		
36	"IOL_1P1_PARA_DATA".RD_LEN	%DB1.DBW258	DEC	0		
37						

Fig. 142: Entering input variables for read access

- Enable read access via a rising edge on **REQ**.

The read data is displayed in the **Observational value** column.

S7TiaV13Sp1_1500_TBENs2_4IOL_V200 ▸ PLC_1 [CPU 1513-1 PN] ▸ Beobachtungs- und Forcetabellen ▸ Beobachtungstabelle_IOL_1P1

	Name	Address	Display format	Monitor value	Modify value	Comment
23	// IO-Link Master 1 - Port 1 - IO-Link Call parameter data set:					
24	"IOL_1P1_PARA_DATA".REQ	%DB1.DBX0.0	BOOL	FALSE	FALSE	
25	"IOL_1P1_PARA_DATA".RD_WR	%DB1.DBX6.0	BOOL	FALSE	FALSE	
26	"IOL_1P1_PARA_DATA".IOL_INDEX	%DB1.DBW10	DEZ	18	18	
27	"IOL_1P1_PARA_DATA".IOL_SUBINDEX	%DB1.DBW12	DEZ	0	0	
28	"IOL_1P1_PARA_DATA".LEN	%DB1.DBW246	DEZ	232	232	
29						
30	// IO-Link Master 1 - Port 1 - IO-Link Call parameter data feedback:					
31	"IOL_1P1_PARA_DATA".DONE_VALID	%DB1.DBX248.0	BOOL	FALSE		
32	"IOL_1P1_PARA_DATA".BUSY	%DB1.DBX248.1	BOOL	FALSE		
33	"IOL_1P1_PARA_DATA".ERROR	%DB1.DBX248.2	BOOL	FALSE		
34	"IOL_1P1_PARA_DATA".STATUS	%DB1.DBD250	Hex	16#0000_0000		
35	"IOL_1P1_PARA_DATA".IOL_STATUS	%DB1.DBD254	Hex	16#0001_0000		
36	"IOL_1P1_PARA_DATA".RD_LEN	%DB1.DBW258	DEZ	0		
37						
38	// IO-Link Master 1 - Port 1 - IO-Link Call Read/Write data:					
39	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[0]	%DB1.DBB14	Zeichen	'T'	'$00'	
40	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[1]	%DB1.DBB15	Zeichen	'S'	'$00'	
41	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[2]	%DB1.DBB16	Zeichen	'-'		
42	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[3]	%DB1.DBB17	Zeichen	'7'		
43	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[4]	%DB1.DBB18	Zeichen	'2'		
44	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[5]	%DB1.DBB19	Zeichen	'0'		
45	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[6]	%DB1.DBB20	Zeichen	'-'		
46	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[7]	%DB1.DBB21	Zeichen	'2'		
47	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[8]	%DB1.DBB22	Zeichen	'U'		
48	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[9]	%DB1.DBB23	Zeichen	'P'		
49	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[10]	%DB1.DBB24	Zeichen	'N'		
50	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[11]	%DB1.DBB25	Zeichen	'8'		
51	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[12]	%DB1.DBB26	Zeichen	'X'		
52	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[13]	%DB1.DBB27	Zeichen	'-'		
53	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[14]	%DB1.DBB28	Zeichen	'H'		
54	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA...	%DB1.DBB29	Zeichen	'1'		
55	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[16]	%DB1.DBB30	Zeichen	'1'		
56	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[17]	%DB1.DBB31	Zeichen	'4'		
57	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[18]	%DB1.DBB32	Zeichen	'1'		

Fig. 143: Data read in the **Observational value** column

- Write values (example: rotate the display of temperature sensor TS720-…-H1141 180°, set the measurement update time to 50 ms): Control variables as follows:

Variable	Value	Meaning
RD_WR	1	Write access
CAP	251	Function block instance
PORT	1	The IO-Link device is connected to port 1.
IOL_INDEX	85	Index for display parameters
LEN	1	1 byte is written

S7TiaV13Sp1_1500_TBENs2_4IOL_V200 ▸ PLC_1 [CPU 1513-1 PN] ▸ Beobachtungs- und Forcetabellen ▸ Beobachtungstabelle_IOL_1P1

	Name	Address	Display format	Monitor value	Modify value	Comment
23	// IO-Link Master 1 - Port 1 - IO-Link Call parameter data set:					
24	"IOL_1P1_PARA_DATA".REQ	%DB1.DBX0.0	BOOL	FALSE	FALSE	
25	"IOL_1P1_PARA_DATA".RD_WR	%DB1.DBX6.0	BOOL	TRUE	TRUE	
26	"IOL_1P1_PARA_DATA".IOL_INDEX	%DB1.DBW10	DEZ	85	85	
27	"IOL_1P1_PARA_DATA".IOL_SUBINDEX	%DB1.DBW12	DEZ	0	0	
28	"IOL_1P1_PARA_DATA".LEN	%DB1.DBW246	DEZ	1	1	
29						
30	// IO-Link Master 1 - Port 1 - IO-Link Call parameter data feedback:					
31	"IOL_1P1_PARA_DATA".DONE_VALID	%DB1.DBX248.0	BOOL	FALSE		
32	"IOL_1P1_PARA_DATA".BUSY	%DB1.DBX248.1	BOOL	FALSE		
33	"IOL_1P1_PARA_DATA".ERROR	%DB1.DBX248.2	BOOL	FALSE		
34	"IOL_1P1_PARA_DATA".STATUS	%DB1.DBD250	Hex	16#0000_0000		
35	"IOL_1P1_PARA_DATA".IOL_STATUS	%DB1.DBD254	Hex	16#0001_0000		
36	"IOL_1P1_PARA_DATA".RD_LEN	%DB1.DBW258	DEZ	0		
37						
38	// IO-Link Master 1 - Port 1 - IO-Link Call Read/Write data:					
39	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA...	%DB1.DBB14	DEZ	3	3	
40	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[1]	%DB1.DBB15	DEZ	0	0	
41	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[2]	%DB1.DBB16	DEZ	0	0	
42	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[3]	%DB1.DBB17	DEZ	0	0	
43	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[4]	%DB1.DBB18	DEZ	0	0	
44	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[5]	%DB1.DBB19	DEZ	0	0	
45	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[6]	%DB1.DBB20	DEZ	0	0	
46	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[7]	%DB1.DBB21	DEZ	0	0	
47	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[8]	%DB1.DBB22	DEZ	0	0	
48	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[9]	%DB1.DBB23	DEZ	0	0	
49	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[10]	%DB1.DBB24	DEZ	0	0	
50	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[11]	%DB1.DBB25	DEZ	0	0	
51	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[12]	%DB1.DBB26	DEZ	0	0	
52	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[13]	%DB1.DBB27	DEZ	0	0	
53	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[14]	%DB1.DBB28	DEZ	0	0	
54	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[15]	%DB1.DBB29	DEZ	0	0	
55	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[16]	%DB1.DBB30	DEZ	0	0	
56	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[17]	%DB1.DBB31	DEZ	0	0	
57	"IOL_1P1_PARA_DATA".RECORD_IOL_DATA[18]	%DB1.DBB32	DEZ	0	0	

Fig. 144: Enter input variables for write access

7.1.4 Setting with Siemens S7-300/400 and STEP7 V5.5 Controllers

IO-Link devices can be set and configured via a Turck IO-Link master on a Siemens S7-300/400 and STEP7 V5.5 controller. This requires the IO-Link function block IOL_CALL and the GSDML file of the IO-Link master. The function block is available from the controller manufacturer. The GSDML file is available for download at www.turck.com.

For information on configuring the IO-Link master with STEP7 V5.5, refer to the device-specific instructions for use.

Software used

- Siemens STEP7 V5.5 (Simatic Manager)
- GSDML file for BL67-GW-EN
- Example program (available on request from Turck)

Hardware used

- Multiprotocol gateway BL67-GW-EN (VN03-00)
- Base module BL67-B-4M12 with IO-Link master module BL67-4IOL
- TS720-2UPN8-H1141
- Siemens S7 controller, e.g. CPU 315-2 PN/DP

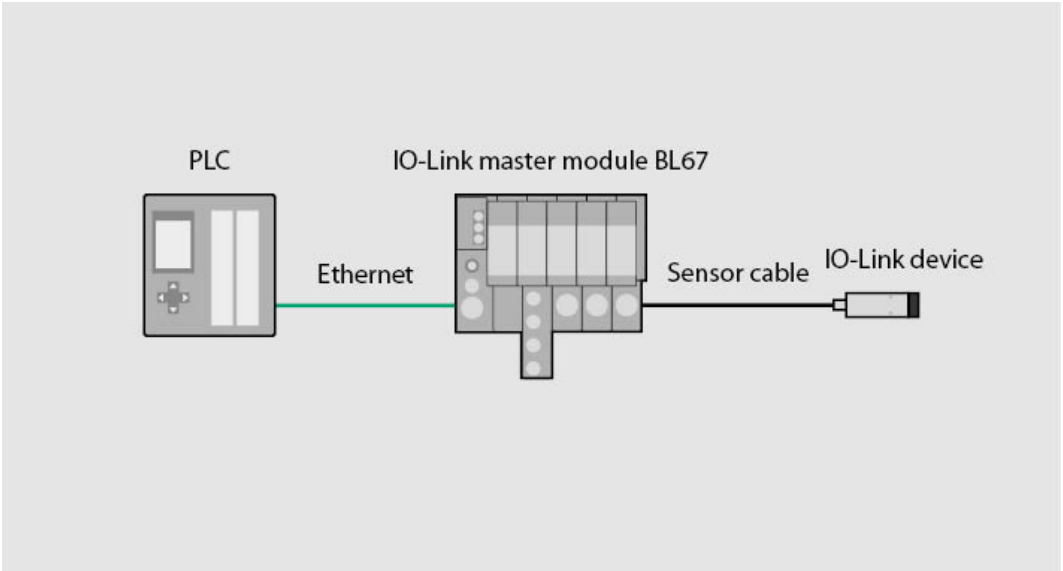


Fig. 145: Application example — setup

Example: configuring the device

The required parameter values of the IO-Link device can be found in the IODDfinder or in the device-specific IO-Link parameter manual.

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	Subindex access supported	Access	Byte. Bit Offset	Bit length	Data Type	Value	Default	Description
Display of measured value	85	0x55	0	0x0	True	read/ write	0.0	8	UInteger	0...6	0	The refresh time can be adjusted. The display can be rotated by 180° or disabled. In disabled state, the measured value is displayed temporarily when pressing the set button.
										0		50 ms refresh time
										1		200 ms refresh time
										2		600 ms refresh time
										3		50 ms refresh time/display rotated by 180°
										4		200 ms refresh time/display rotated by 180°
										5		600 ms refresh time/display rotated by 180°
										6		disabled

Fig. 146: Excerpt from the parameter manual for sensor TS720-…-H1141 (example: set the display)

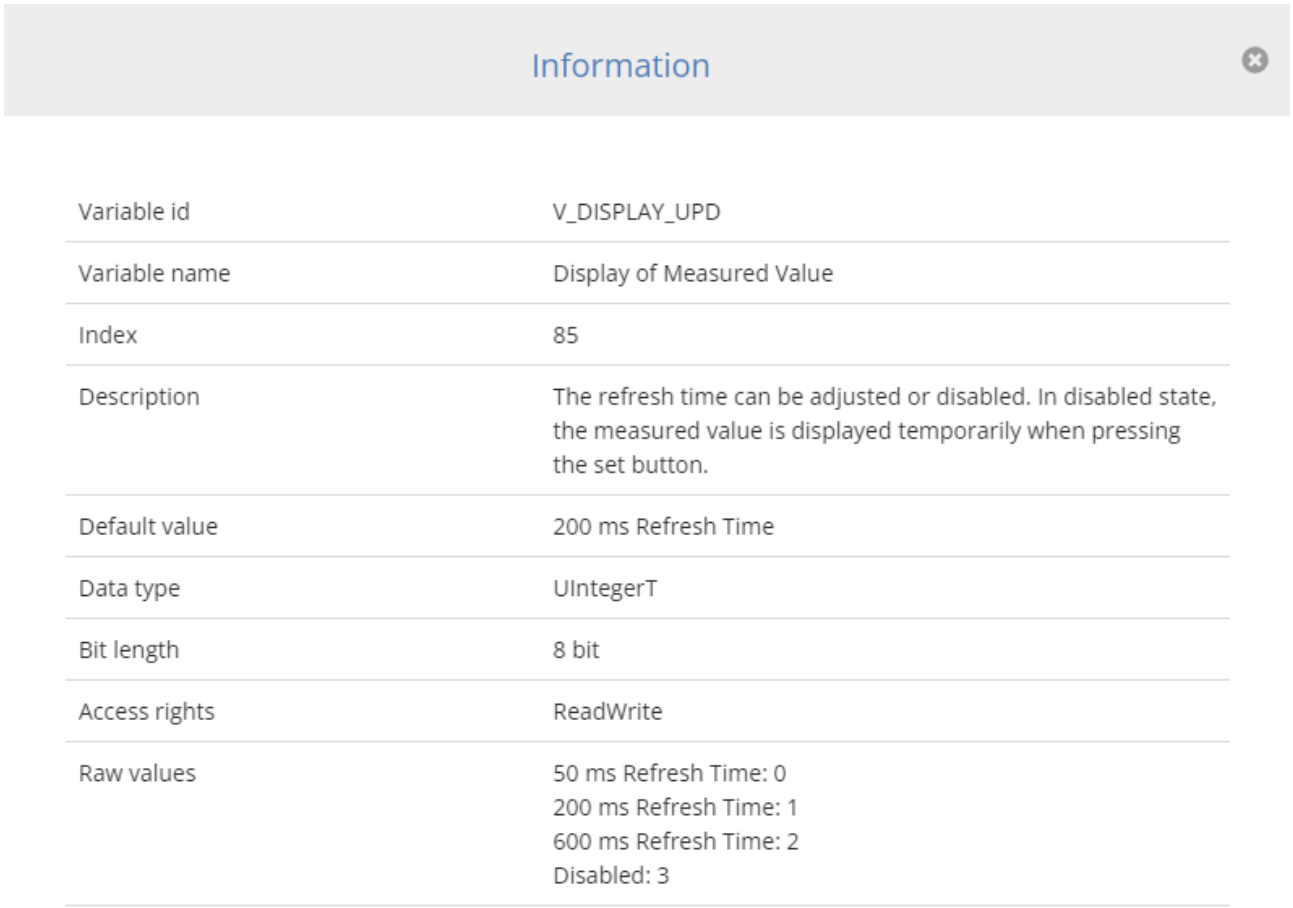


Fig. 147: Excerpt from the IODDfinder for sensor TS720-…-H1141 (example: measured value display)

Name	Index (dec.)	Index (hex.)	Sub-index (dec.)	Sub-index (hex.)	SubIndex access supported	Access	Byte. Bit-offset	Bit Length	Data Type	Value	Default	Description
Min Cycle Time	0	0x0	3	0x3	True	read	2.0	8	UInteger			
IO-Link Version ID	0	0x0	5	0x5	True	read	4.0	8	UInteger		17	
Vendor ID 1	0	0x0	8	0x8	True	read	7.0	8	UInteger			
Vendor ID 2	0	0x0	9	0x9	True	read	8.0	8	UInteger			
Device ID 1	0	0x0	10	0xA	True	read	9.0	8	UInteger			
Device ID 2	0	0x0	11	0xB	True	read	10.0	8	UInteger			
Device ID 3	0	0x0	12	0xC	True	read	11.0	8	UInteger			
Standard Command	2	0x2	0	0x0	True	write	0.0	8	UInteger	0...159		System command
										128		Device Reset
										129		Application Reset
										130		Restore Factory Settings
Parameter (write) Access Lock	12	0xC	1	0x1	False	read/write	0.0	1	Boolean	false/true		Device access locks
Data Storage Lock	12	0xC	2	0x2	False	read/write	0.1	1	Boolean	false/true		Device access locks
Local Parameterization Lock	12	0xC	3	0x3	False	read/write	0.2	1	Boolean	false/true		Device access locks
Local User Interface Lock	12	0xC	4	0x4	False	read/write	0.3	1	Boolean	false/true		Device access locks
Vendor Name	16	0x10	0	0x0	True	read	0.0	512	String		Turck	Vendor name
Vendor Text	17	0x11	0	0x0	True	read	0.0	512	String		www.turck.com	Additional manufacturer information
Product Name	18	0x12	0	0x0	True	read	0.0	512	String			Manufacturer's device designation
Product ID	19	0x13	0	0x0	True	read	0.0	512	String			Ident-No.
Product Text	20	0x14	0	0x0	True	read	0.0	512	String			Device category
Serial Number	21	0x15	0	0x0	True	read	0.0	128	String			Device serial number

Fig. 148: Excerpt from the parameter manual for the IO-Link I/O hub TBIL-M1-16DIP (example: set the display)

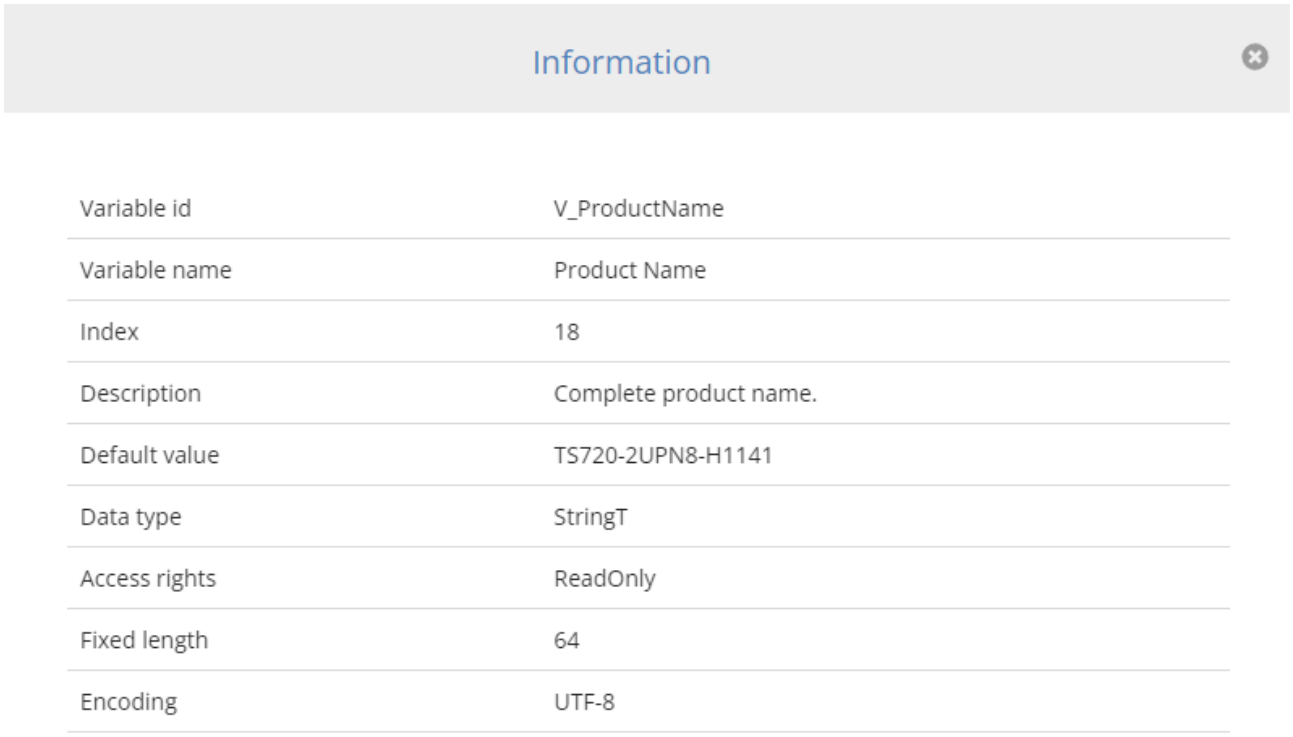


Fig. 149: Excerpt from the IODDfinder for temperature sensor TS720-…-H1141 (example: product name)

The processes are visualized in the **HMI** variable table in the example program. The process data is shown in the variable tables **Sensor1** and **Sensor2**.

Read out values (example: read out the product names of the IO-Link I/O hub):

▶ Control variables as follows:

Variable	Value	Meaning
RD_WR	0	Read access
ID	30	Start address of the output data of the module according to the hardware configuration
INDEX_CAP	251	Function block instance
ENTITY_PORT	4	The IO-Link I/O hub is connected to port 4.
IOL_INDEX	0x12	Index for display parameters
LEN	32	32 bytes are read out

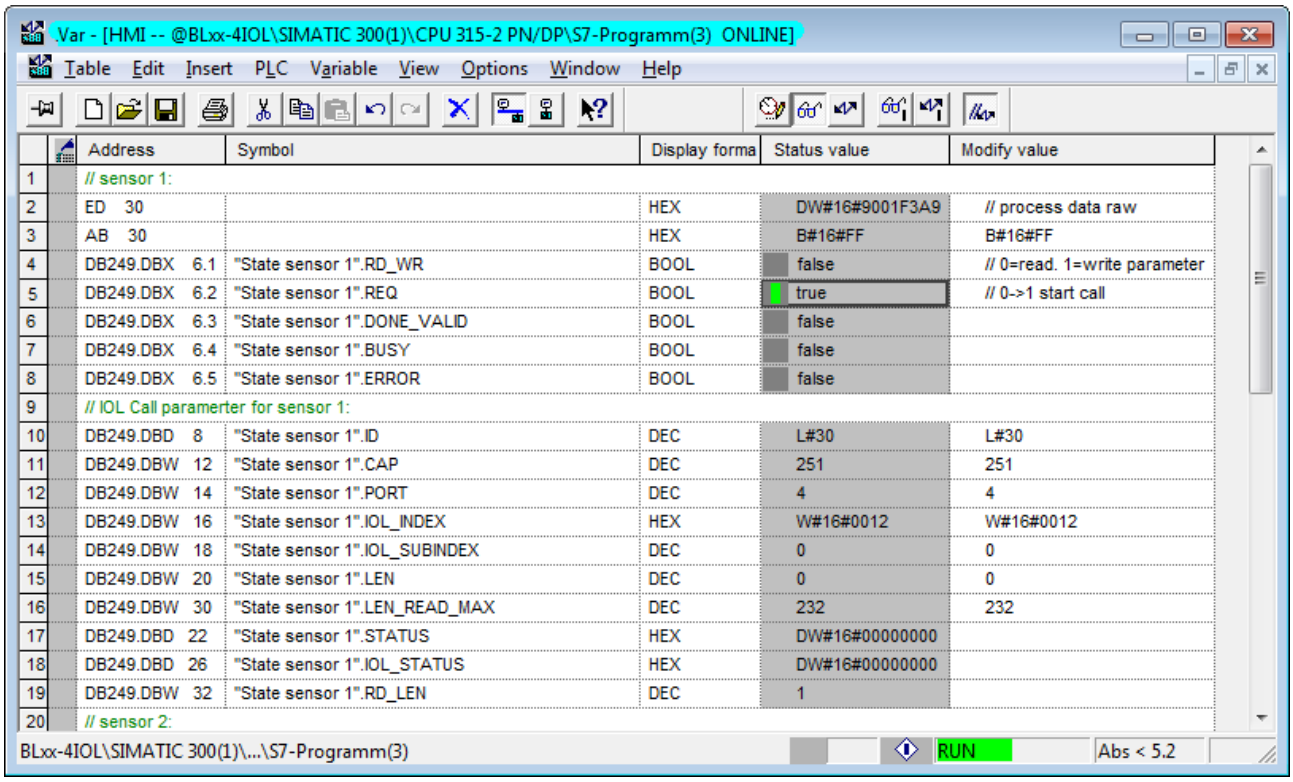
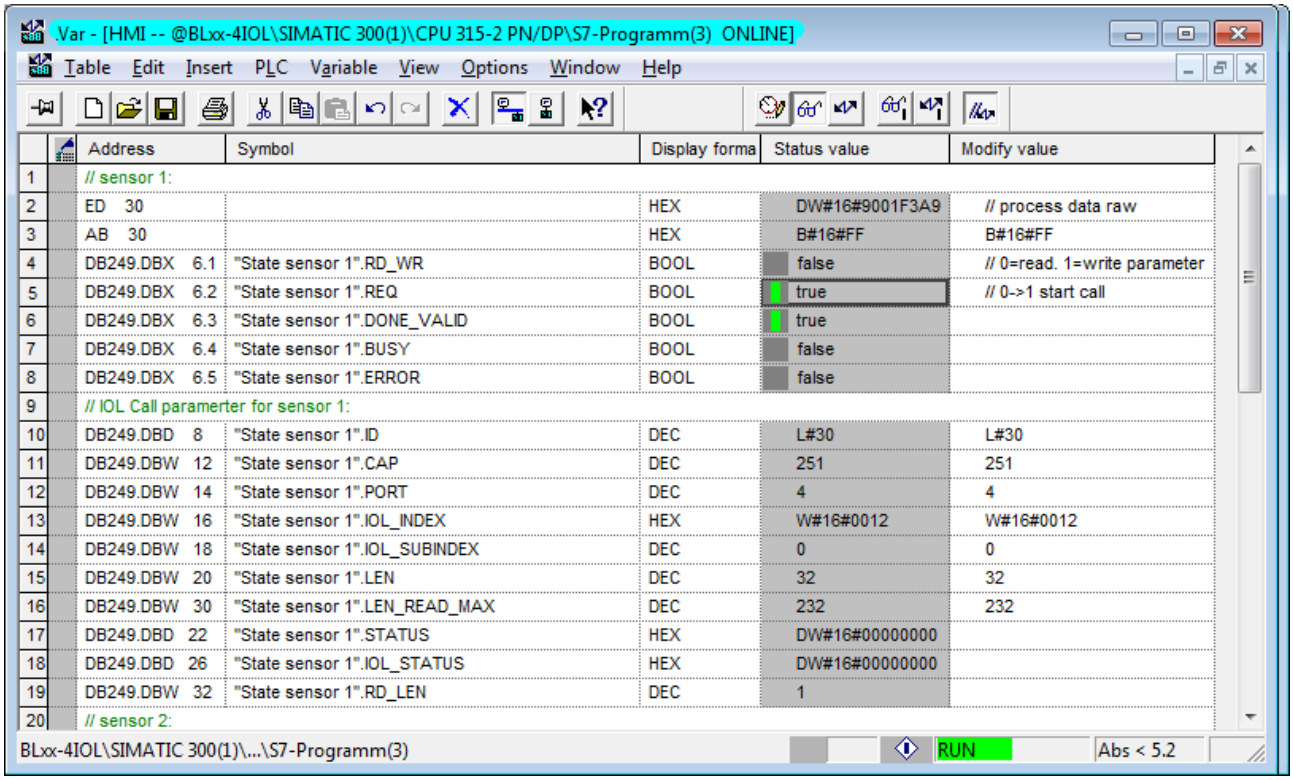


Fig. 150: Entering input variables for read access

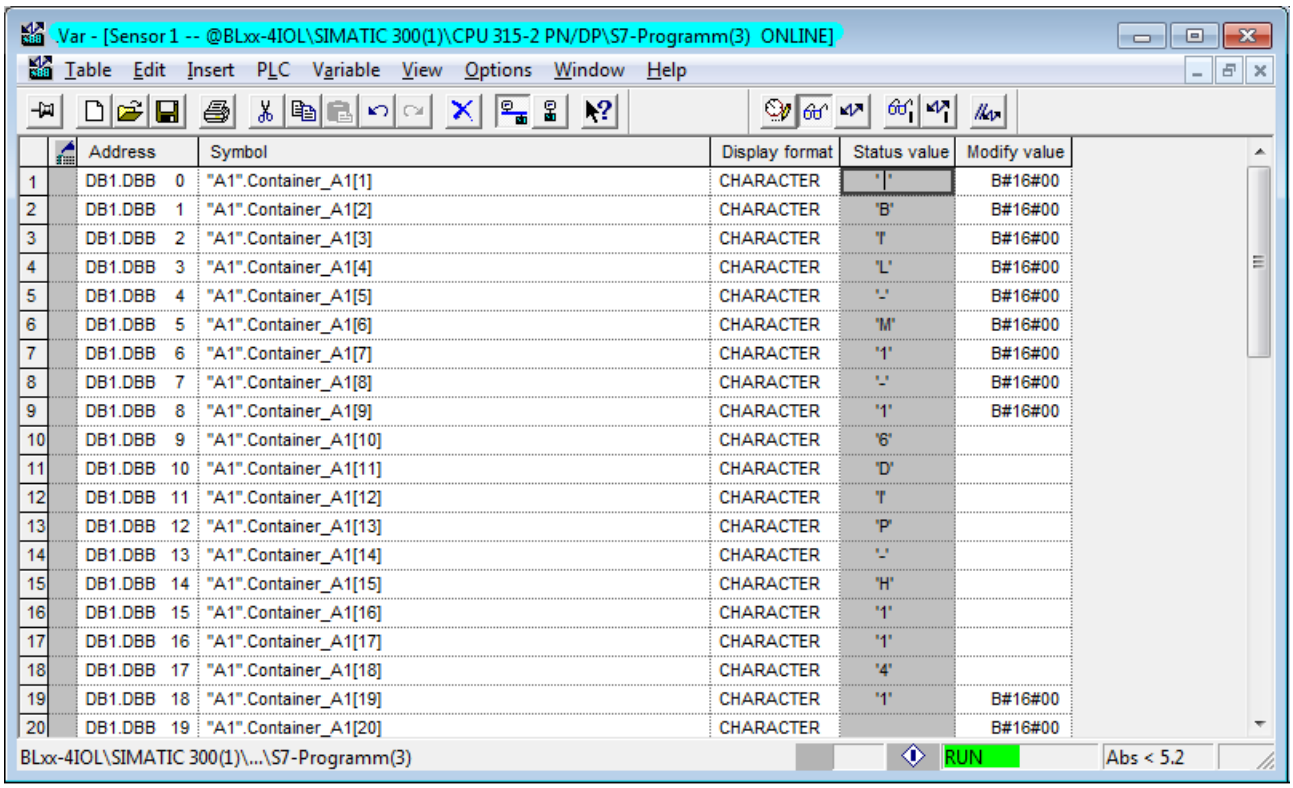
- Enable read access via a rising edge on **REQ**.



	Address	Symbol	Display forma	Status value	Modify value
1	// sensor 1:				
2	ED 30		HEX	DW#16#9001F3A9	// process data raw
3	AB 30		HEX	B#16#FF	B#16#FF
4	DB249.DBX 6.1	"State sensor 1".RD_WR	BOOL	false	// 0=read. 1=write parameter
5	DB249.DBX 6.2	"State sensor 1".REQ	BOOL	true	// 0->1 start call
6	DB249.DBX 6.3	"State sensor 1".DONE_VALID	BOOL	true	
7	DB249.DBX 6.4	"State sensor 1".BUSY	BOOL	false	
8	DB249.DBX 6.5	"State sensor 1".ERROR	BOOL	false	
9	// IOL Call paramerter for sensor 1:				
10	DB249.DBD 8	"State sensor 1".ID	DEC	L#30	L#30
11	DB249.DBW 12	"State sensor 1".CAP	DEC	251	251
12	DB249.DBW 14	"State sensor 1".PORT	DEC	4	4
13	DB249.DBW 16	"State sensor 1".IOL_INDEX	HEX	W#16#0012	W#16#0012
14	DB249.DBW 18	"State sensor 1".IOL_SUBINDEX	DEC	0	0
15	DB249.DBW 20	"State sensor 1".LEN	DEC	32	32
16	DB249.DBW 30	"State sensor 1".LEN_READ_MAX	DEC	232	232
17	DB249.DBD 22	"State sensor 1".STATUS	HEX	DW#16#00000000	
18	DB249.DBD 26	"State sensor 1".IOL_STATUS	HEX	DW#16#00000000	
19	DB249.DBW 32	"State sensor 1".RD_LEN	DEC	1	
20	// sensor 2:				

Fig. 151: Enable read access

The read data is displayed in the process data table **Sensor1**.



	Address	Symbol	Display format	Status value	Modify value
1	DB1.DBB 0	"A1".Container_A1[1]	CHARACTER	'1'	B#16#00
2	DB1.DBB 1	"A1".Container_A1[2]	CHARACTER	'B'	B#16#00
3	DB1.DBB 2	"A1".Container_A1[3]	CHARACTER	'I'	B#16#00
4	DB1.DBB 3	"A1".Container_A1[4]	CHARACTER	'L'	B#16#00
5	DB1.DBB 4	"A1".Container_A1[5]	CHARACTER	'-'	B#16#00
6	DB1.DBB 5	"A1".Container_A1[6]	CHARACTER	'M'	B#16#00
7	DB1.DBB 6	"A1".Container_A1[7]	CHARACTER	'1'	B#16#00
8	DB1.DBB 7	"A1".Container_A1[8]	CHARACTER	'-'	B#16#00
9	DB1.DBB 8	"A1".Container_A1[9]	CHARACTER	'1'	B#16#00
10	DB1.DBB 9	"A1".Container_A1[10]	CHARACTER	'6'	
11	DB1.DBB 10	"A1".Container_A1[11]	CHARACTER	'D'	
12	DB1.DBB 11	"A1".Container_A1[12]	CHARACTER	'I'	
13	DB1.DBB 12	"A1".Container_A1[13]	CHARACTER	'P'	
14	DB1.DBB 13	"A1".Container_A1[14]	CHARACTER	'-'	
15	DB1.DBB 14	"A1".Container_A1[15]	CHARACTER	'H'	
16	DB1.DBB 15	"A1".Container_A1[16]	CHARACTER	'1'	
17	DB1.DBB 16	"A1".Container_A1[17]	CHARACTER	'1'	
18	DB1.DBB 17	"A1".Container_A1[18]	CHARACTER	'4'	
19	DB1.DBB 18	"A1".Container_A1[19]	CHARACTER	'1'	B#16#00
20	DB1.DBB 19	"A1".Container_A1[20]	CHARACTER		B#16#00

Fig. 152: Data read in the **Sensor1** variable table

- Write values (example: rotate the display of temperature sensor TS720-…-H1141 180°, set the measurement update time to 200 ms): Control variables as follows:

Variable	Value	Meaning
RD_WR	1	Write access
ID	1	Position of the IO-Link master module in the BL67 station
INDEX_CAP	251	Function block instance
ENTITY_PORT	1	The IO-Link device is connected to port 1.
IOL_INDEX	0x55	Index for display parameters
LEN	1	1 byte is written

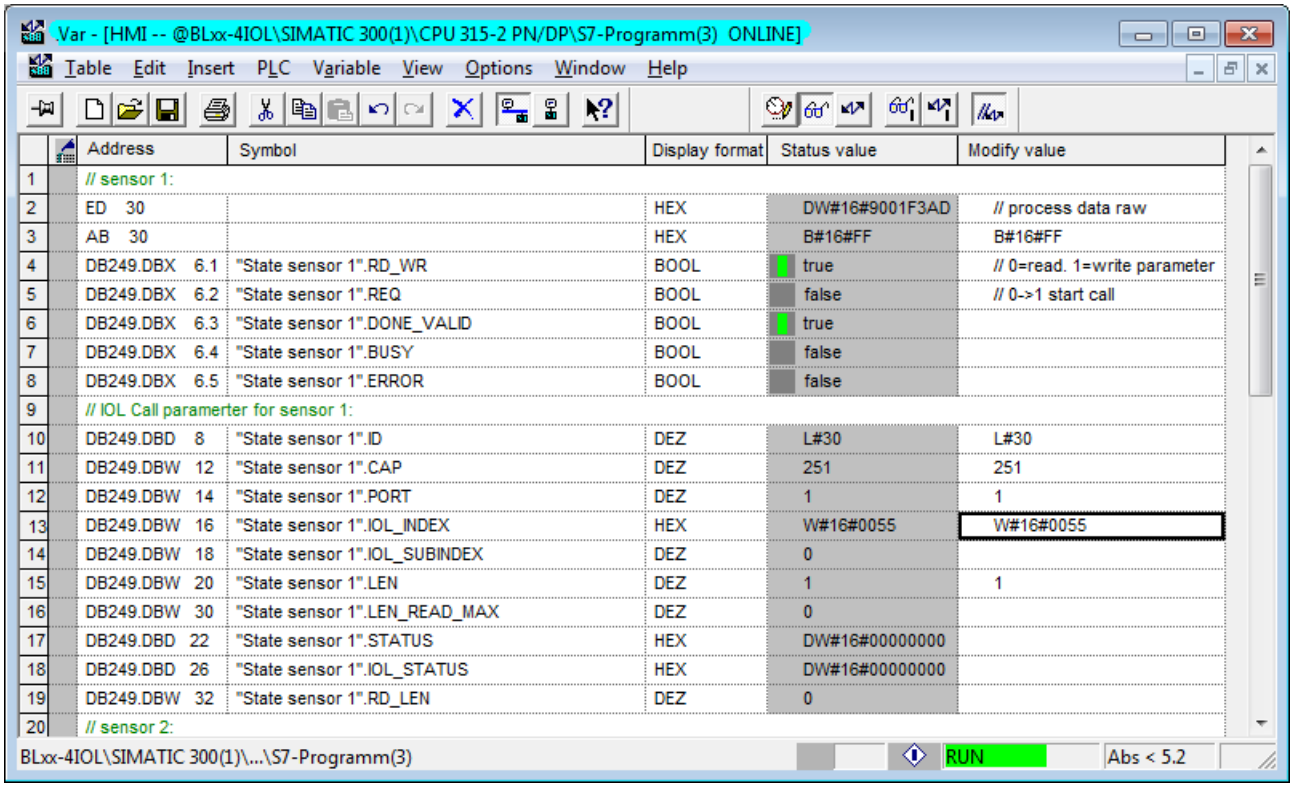
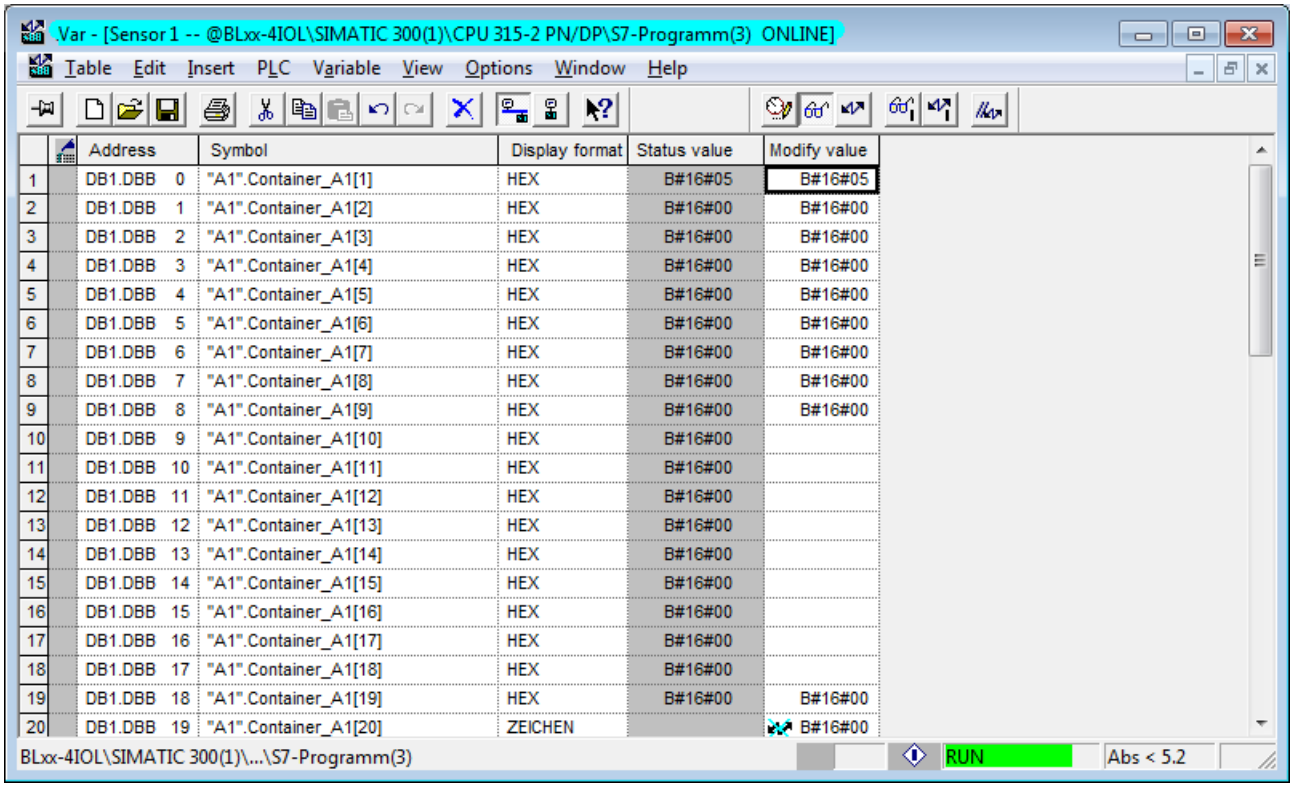


Fig. 153: Enter input variables for write access

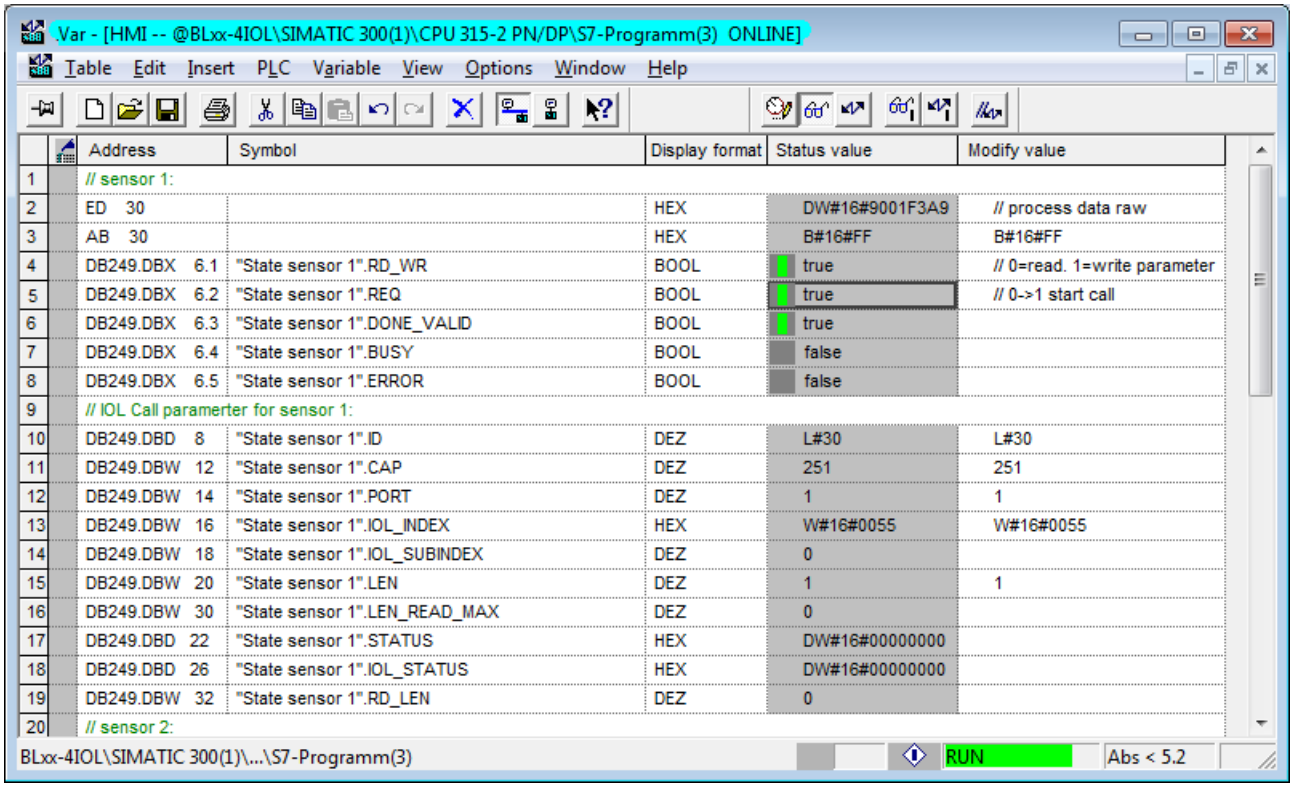
- Enter the value **5** to be written in the variable table under **Control value** to rotate the display by 180° and set the measured value update time to 200 ms.



	Address	Symbol	Display format	Status value	Modify value
1	DB1.DBB 0	"A1".Container_A1[1]	HEX	B#16#05	B#16#05
2	DB1.DBB 1	"A1".Container_A1[2]	HEX	B#16#00	B#16#00
3	DB1.DBB 2	"A1".Container_A1[3]	HEX	B#16#00	B#16#00
4	DB1.DBB 3	"A1".Container_A1[4]	HEX	B#16#00	B#16#00
5	DB1.DBB 4	"A1".Container_A1[5]	HEX	B#16#00	B#16#00
6	DB1.DBB 5	"A1".Container_A1[6]	HEX	B#16#00	B#16#00
7	DB1.DBB 6	"A1".Container_A1[7]	HEX	B#16#00	B#16#00
8	DB1.DBB 7	"A1".Container_A1[8]	HEX	B#16#00	B#16#00
9	DB1.DBB 8	"A1".Container_A1[9]	HEX	B#16#00	B#16#00
10	DB1.DBB 9	"A1".Container_A1[10]	HEX	B#16#00	
11	DB1.DBB 10	"A1".Container_A1[11]	HEX	B#16#00	
12	DB1.DBB 11	"A1".Container_A1[12]	HEX	B#16#00	
13	DB1.DBB 12	"A1".Container_A1[13]	HEX	B#16#00	
14	DB1.DBB 13	"A1".Container_A1[14]	HEX	B#16#00	
15	DB1.DBB 14	"A1".Container_A1[15]	HEX	B#16#00	
16	DB1.DBB 15	"A1".Container_A1[16]	HEX	B#16#00	
17	DB1.DBB 16	"A1".Container_A1[17]	HEX	B#16#00	
18	DB1.DBB 17	"A1".Container_A1[18]	HEX	B#16#00	
19	DB1.DBB 18	"A1".Container_A1[19]	HEX	B#16#00	B#16#00
20	DB1.DBB 19	"A1".Container_A1[20]	ZEICHEN		B#16#00

Fig. 154: Enter the control value for index 85 (0x55)

- Enable write access via a rising edge on **REQ**.



	Address	Symbol	Display format	Status value	Modify value
1	// sensor 1:				
2	ED 30		HEX	DW#16#9001F3A9	// process data raw
3	AB 30		HEX	B#16#FF	B#16#FF
4	DB249.DBX 6.1	"State sensor 1".RD_WR	BOOL	true	// 0=read. 1=write parameter
5	DB249.DBX 6.2	"State sensor 1".REQ	BOOL	true	// 0->1 start call
6	DB249.DBX 6.3	"State sensor 1".DONE_VALID	BOOL	true	
7	DB249.DBX 6.4	"State sensor 1".BUSY	BOOL	false	
8	DB249.DBX 6.5	"State sensor 1".ERROR	BOOL	false	
9	// IOL Call paramerter for sensor 1:				
10	DB249.DBD 8	"State sensor 1".ID	DEZ	L#30	L#30
11	DB249.DBW 12	"State sensor 1".CAP	DEZ	251	251
12	DB249.DBW 14	"State sensor 1".PORT	DEZ	1	1
13	DB249.DBW 16	"State sensor 1".IOL_INDEX	HEX	W#16#0055	W#16#0055
14	DB249.DBW 18	"State sensor 1".IOL_SUBINDEX	DEZ	0	
15	DB249.DBW 20	"State sensor 1".LEN	DEZ	1	1
16	DB249.DBW 30	"State sensor 1".LEN_READ_MAX	DEZ	0	
17	DB249.DBD 22	"State sensor 1".STATUS	HEX	DW#16#00000000	
18	DB249.DBD 26	"State sensor 1".IOL_STATUS	HEX	DW#16#00000000	
19	DB249.DBW 32	"State sensor 1".RD_LEN	DEZ	0	
20	// sensor 2:				

Fig. 155: Enable write access

8 Operation

The communication system operates with a 24 V signal. If transmission is unsuccessful, the telegram is automatically repeated twice. If the second retry is not successful, the IO-Link master detects a communication interruption. The error is automatically reported to the higher-level controller.

IO-Link devices can be set application-specific or operated without special settings. If no settings are required in the IO-Link device, the signals are forwarded directly to the higher-level control system.

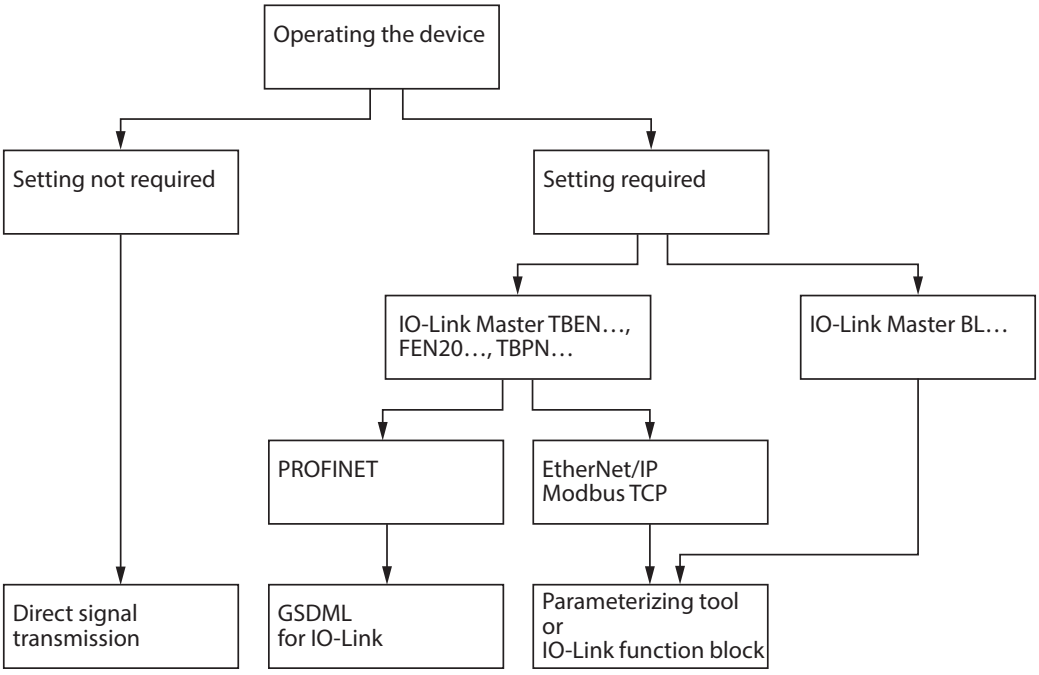


Fig. 156: Overview — operating IO-Link devices

For more information on operating the IO-Link masters and IO-Link devices, refer to the device-specific instructions for use.

8.1 Combining Turck IO-Link devices

NOTE
All IO-Link block modules (TBEN…, TBPN…, FEN20…) support SIDI.
The BL… IO-Link master modules do not support SIDI.

Device	Version	TBEN-L… -8IOL	TBEN-S… -4IOL	TBPN-… 2IOL	BL67-4IOL	BL20-E-4IOL	FEN20-4IOL
LI…-Q25	1.0	x	x	x	x	x	x
RI360P	1.0	x	x	x	x	x	x
B2N360-Q42	1.0	x	x	x	x	x	x
PC…	1.0	x	x	x	x	x	x
PS…	1.0	x	x	x	x	x	x
TS…	1.0	x	x	x	x	x	x
EZ-ARRAY	1.0	x	x	x	x	x	x
FM(X)-IM	1.0	x	x	x	x	x	x
RU…U	1.1	x	x	x	x	x	x
DF-G1	1.1	x	x	x	x	x	x
TBIL-M1	1.1	x	x	x	x	x	x
TTM	1.1	x	x	x	x	x	x
Uprox IO-Link	1.1	x	x	x	x	x	x
BCT…	1.1	x	x	x	x	x	x
Q4X	1.1	x	x	x	x	x	x
LE…	1.1	x	x	x	x	x	x
LTF…	1.1	x	x	x	x	x	x
TL50	1.1	x	x	x	x	x	x
NIC…	1.1	x	x	x	x	x	x
IM12-CCM…	1.1	x	x	x	x	x	x
PT…	1.1	x	x	x	x	x	x
NCLS…	1.1	x	x	x	x	x	x
LS5…	1.1	x	x	x	x	x	x
BI/NI…	1.1	x	x	x	x	x	x
TBIL-S…	1.1	x	x	x	x	x	x
LRS…	1.1	x	x	x	x	x	x
Q5X…	1.1	x	x	x	x	x	x
QS…	1.1	x	x	x	x	x	x
K50…	1.1	x	x	x	x	x	x
FS…	1.1	x	x	x	x	x	x
LUS…	1.1	x	x	x	x	x	x
REM…	1.1	x	x	x	x	x	x
RES…	1.1	x	x	x	x	x	x

9 Turck subsidiaries — contact information

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Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo www.turck.com.br
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Malaysia	Turck Banner Malaysia Sdn Bhd Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C, 46200 Petaling Jaya Selangor www.turckbanner.my
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Russian Federation	TURCK RUS OOO 2-nd Pryadilnaya Street, 1, 105037 Moscow www.turck.ru
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