TURCK

Your Global Automation Partner

FEN20-8IOL
IO-Link Master Module

Instructions for Use

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1 About these instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are written for specifically trained personnel and must be read carefully by anyone entrusted with the installation, commissioning, operation, maintenance, disassembly or disposal of the device.

When using the device in Ex areas, the user must also have knowledge of explosion protection (IEC/EN 60079-14 etc.).

1.2 Explanation of symbols

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
	**NOTE** NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Additional documents

The following additional documents are available online at **www.turck.com**

- Data sheet
- EU Declaration of Conformity (current version)
- Commissioning manual IO-Link devices
- 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

These instructions apply to the following IO-Link master:

- FEN20-8IOL

2.2 Scope of delivery

The scope of delivery includes:

- FEN20-8IOL

2.3 TURCK service

TURCK supports you in your projects — from the initial analysis right through to the commissioning of your application. The TURCK product database at www.turck.com offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

For the contact details of our branches worldwide, please see page [▷ 182].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. TURCK accepts no liability for damage caused by failure to observe these safety instructions.

3.1 Intended use

The multiprotocol I/O module FEN20-8IOL is an IO-Link master according to IO-Link specification V 1.1.3 and can be can be operated in the four Ethernet protocols PROFINET, Ethernet/IP, Modbus TCP and CC-Link IE Field Basic. The device detects the bus protocol automatically during the start-up.

The IO-Link master FEN20-8IOL has eight IO-Link channels. Up to eight IO-Link sensors or IO hubs with IO-Link can be connected to the 24 screw terminals. When using I/O hubs, it is possible to connect up to 128 digital sensors per device. In addition, the eight IO-Link channels can also be used as universal digital DXP channels.

The device must only be used as described in these instructions. Any other use is not in accordance with the intended use. TURCK accepts no liability for any resulting damage.

3.2 General safety instructions

- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- Change the default password of the integrated web server after the first login. TURCK recommends the use of a secure password.

4 Product description

The devices are designed in protection class IP20.

The IO-Link Master Module FEN20-8IOL has eight IO-Link ports for connecting IO-Link devices. The four IO-Link channels can be parameterized independently of each other and operated either in IO-Link mode, in SIO mode (DI) or as universal DXP channels.

With Turck's "Simple IO-Link Device Integration (SIDI)", IO-Link devices can be directly integrated into PROFINET via the GSDML file of the Devices.

If the IO-Link channels are used as DXP channels, they are freely usable as input or output.

The device has two 12-pin terminal blocks with screw terminals for connecting IO-Link devices and digital sensors and actuators.

The power supply connectors are designed as 3-pole terminal connector.

4.1 Device overview

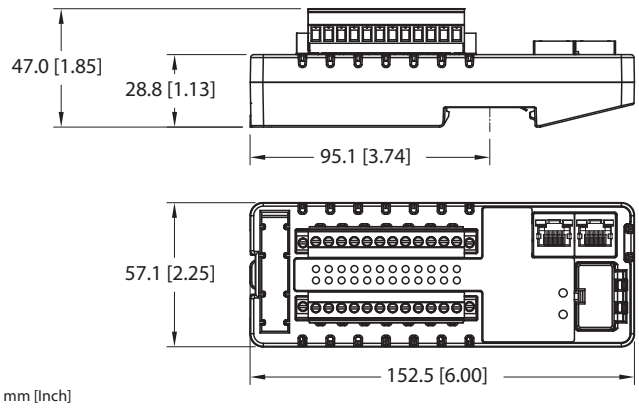


Fig. 1: Dimensions FEN20-8IOL

4.2 Properties and features

- Fibre-glass reinforced housing
- Shock and vibration tested
- Degree of protection IP20
- Terminal screw connector
- 8 IO-Link ports Class A
- Multiprotocol:
  PROFINET device, EtherNet/IP device, Modbus TCP server, CC-Link IE Field Basic server
- 2 × RJ45 sockets for Ethernet connection
- Integrated Ethernet-switch for building up a line-topology
- $V1+_0$ (Ch0)…$V1+_7$ (Ch7) configurable
- ARGEE functionality
- PROFINET:
  - Conformance Class B PA
  - Simple IO-Link Device Integration (SIDI)
  - Conformance according to PROFINET specification V2.35
  - System redundancy S2, network load class 3
- EtherNet/IP:
  - Support ot the IO-Link Parameter Object for asynchronous services (IO-Link CALL)
  - Predefined input and output assemblies
- Integrated web server

4.3 Operating principle

The IO-Link master module connects IO-Link sensors and actuators with the higher-level control system. The device has an Ethernet interface and fieldbus-independent I/O electronics with IO-Link master functionality (Class A ports). Via the Ethernet interface, the IO-Link master is connected to an (existing) Ethernet network as an EtherNet/IP device, Modbus TCP server, PROFINET device or CC-Link IE Field Basic server. During operation, the process data is exchanged between Ethernet and IO-Link.

In addition, the IO-Link ports can be used as digital inputs and outputs.

4.4 Functions and operating modes

4.4.1 Multiprotocol technology

The device can be used in the following Ethernet protocols:

- PROFINET
- EtherNet/IP
- Modbus TCP
- CC-Link IE Field Basic

The required Ethernet protocol can be detected automatically or determined manually.

Automatic protocol detection

A multiprotocol device can be operated without intervention of the user (which means, without changes in the parameterization) in all of the three Ethernet protocols mentioned.

During the system start-up phase (snooping phase), the module detects which Ethernet protocol requests a connection to be established and adjusts itself to the corresponding protocol. After this an access to the device from other protocols is read-only.

Manual protocol selection

The user can also define the protocol manually. In this case, the snooping phase is skipped and the device is fixed to the selected protocol. With the other protocols, the device can only be accessed read-only.

Protocol-dependent functions

The device supports the following Ethernet protocol-specific features:

PROFINET

- S2 redundancy

EtherNet/IP

- Device Level Ring (DLR)

Ethernet ports used

Port	Protocol
00022	SFTP
00053	DNS TCP
00067	DHCP
00080	HTTP
00093	PROFINET DCP
00502	Modbus TCP
58554	TURCK Services

4.4.2 IO-Link channels

The IO-Link master module has eight Class A IO-Link channels.

The IO-Link channels can be parameterized independently of each other and operated either in IO-Link mode or as universal DXP channel (DI or DO) in SIO mode.

Simple IO-Link - Device - Integration (SIDI)

TURCK's Simple IO-Link Device Integration (SIDI) simplifies the handling of IO-Link devices in PROFINET engineering systems. The IO-Link devices are integrated in the GSDML file of the master, which allows the user to select the devices from the device library (for example in TIA Portal) like sub modules on a modular I/O system and integrate them into the project. Plain-text access to all device properties and parameters is possible. IO-Link device-specific data such as measuring ranges, switching points, pulse rates, etc. can be set directly in the engineering system without programming or additional software [▶ 137].

NOTE
Data storage is not possible when configuring IO-Link devices with SIDI.

IO-Link-Device-Application

The IO-Link Device Application is a browser-based configuration tool and called from the web server of the IO-Link master module.

NOTE
To be able to call up the IO-Link Device Application, a login to the web server of the IO-Link master is required [▶ 19].

The IO-Link Device Application allows access to the plain text of all relevant IO-Link device parameters and supports and simplifies the parameterization, commissioning and maintenance of IO-Link devices.

IO-Link device-specific information is made available directly in the IO-Link master. The IODD suitable for the connected IO-Link devices is loaded into the IO-Link master and interpreted by the master. IO-Link events, diagnostics and process data of the IO-Link devices can thus be interpreted directly in the web server of the IOL master according to the specific device. In addition, the IO-Link Device Application provides information on the process data structure and pin assignment of the connected IO-Link devices.

The IO-Link Device Application supports the "Operator", "Maintenance" and "Specialist" user roles specified by the IO-Link specification. The specific access rights for these user roles are defined by the IODD of the IO-Link devices.

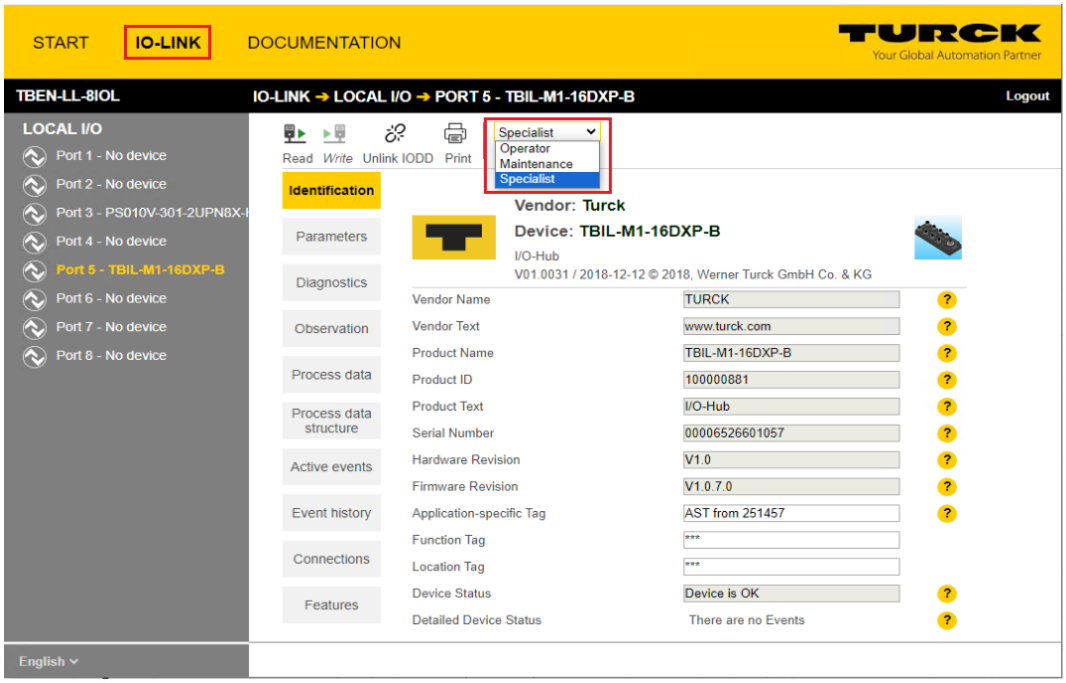


Fig. 2: IO-Link Device Application (using the TBEN-LL-8IOL as an example)

4.4.3 Turck Field Logic Controller function (FLC ARGEE)

The device supports logic processing via the "TURCK Field Logic Controller (FLC ARGEE)" function. This enables the device to implement small to medium-sized control tasks in order to reduce the load of the central controller. The FLCs can be programmed in the ARGEE engineering environment.

The ARGEE programming software can be downloaded free of charge from www.turck.com.

The "SW_ARGEE_Environment_Vx.x.zip" file also contains the documentation for the programming environment as well as the software.

5 Mounting

The device can be mounted on a DIN rail according to EN 60715 (TS35) or screwed onto a flat mounting plate.

5.1 Mounting the device onto a DIN rail (TS35)

✓ The DIN rail must already be mounted.

▶ Mount the device on the DIN rail as shown in the following illustration.

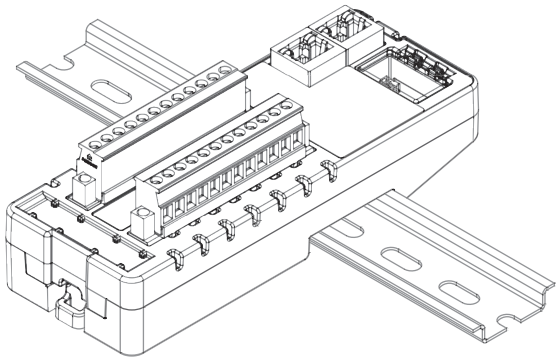


Fig. 3: Mounting the device on the DIN rail

▶ Hang the groove of the device into the DIN rail from below.
▶ Turn the upper end of the device to the rear.
▶ Press the device against the DIN rail until the latching hook audibly engages.
▶ Avoid mechanical stresses.
▶ Optional: Ground the device.

NOTE
To increase stability on the DIN rail, end brackets can be mounted on the left and right side of the module.

5.2 Grounding the device

When mounted on the DIN rail, the device is connected to the reference potential of the system via a metal contact.

6 Connecting

6.1 Connecting the device to Ethernet

For connection to Ethernet, the device has an autocrossing switch with two RJ45 Ethernet sockets.

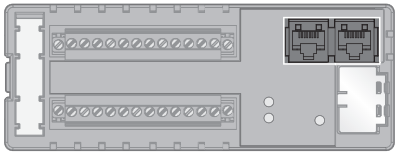


Fig. 4: RJ45 sockets for Ethernet connection

- ▶ Connect the device to Ethernet according to the pin assignment.

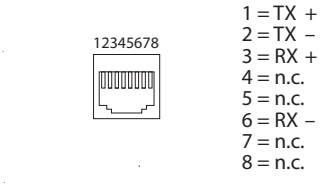


Fig. 5: Ethernet connectors – pin assigment P1 and P2

6.2 Connecting the supply voltage and the I/Os

The device has two 12-pin terminal blocks with screw terminals for connecting the supply voltage and the IO-Link devices or digital sensors and actuators. The max. tightening torque for the screw terminals is 0.7 Nm.

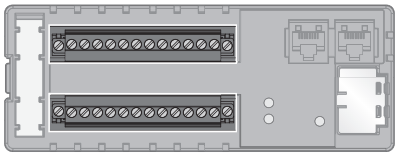


Fig. 6: Terminal block for connecting I/O-Link devices and digital sensors and actuators

The internal module electronics and IO channels 0…3 are supplied with power via the voltage across $V1_A$. Teh I/O channels 4…7 are supplied via $V1_B$. $V1_A$ and $V1_B$ have a common ground.

$V1+_0$…$V1+_7$ can be configured as permanently on, switchable, or as DXP channels.

NOTICE
Wrong supply of IO-Link devices
Damage to the electronics

- ▶ Only supply IO-Link devices with the voltage provided at the 10-pin terminal screw connector.

- Connect the supply voltage, the IO-Link devices and the digital sensors and actuators according to the pin assignment.

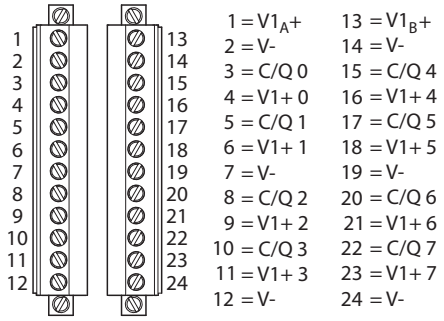


Fig. 7: Pin assignment

7 Commissioning

7.1 Adjusting network settings

NOTE
Changes to network settings are only applied after restarting the device.

The network settings can be adapted via TAS (Turck Automation Suite), the web server, the DTM, a DHCP server or PROFINET DCP.

7.1.1 Adjusting network settings via TAS (TURCK Automation Suite)

- Connect the device to the PC via the Ethernet interface.
- Open TAS.
- Click **Scan network**.

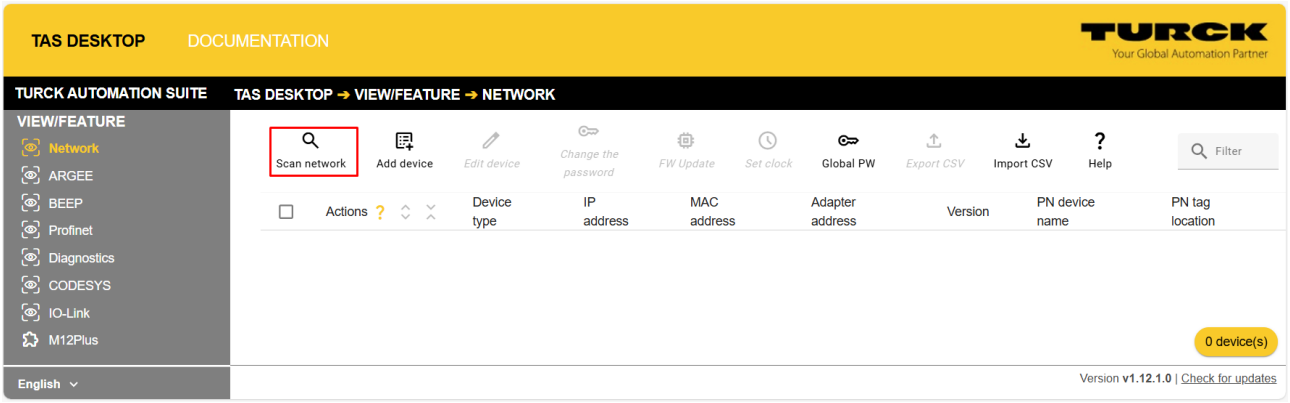


Fig. 8: Home screen in TAS

⇨ TAS shows the connected devices.

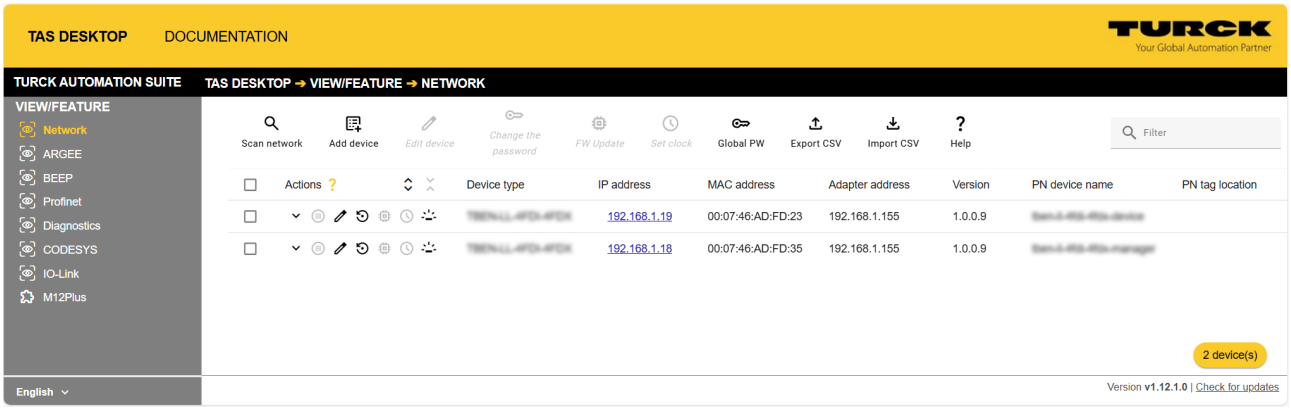


Fig. 9: Found devices in TAS

- ▶ Select the relevant device (check box).
- ▶ Click **Edit device**.

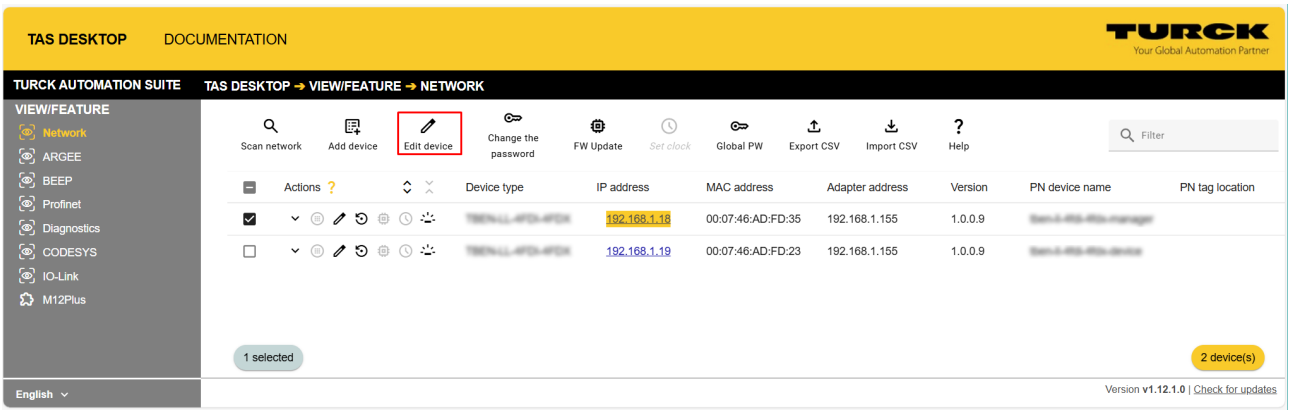


Fig. 10: Selecting the device in TAS

NOTE
By clicking on the IP address of the device, the configuration view of the device can be opened either in TAS or on the device website.

- ▶ Enter the device password and click **Login** The default password is "password".
  Note: TURCK recommends changing the password after the first login for security reasons.

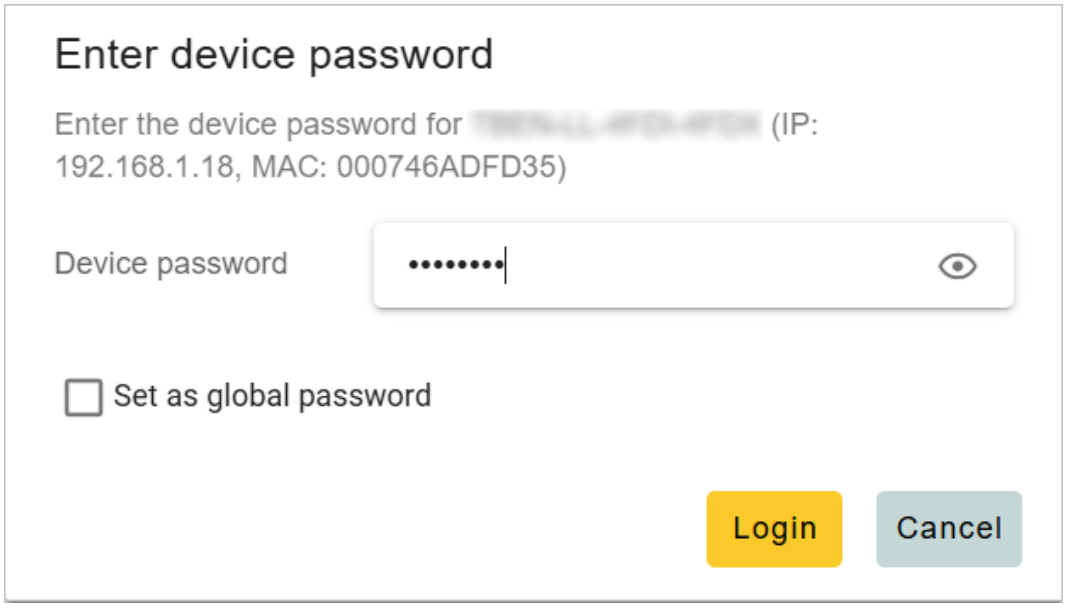


Fig. 11: Entering the device password

- ▶ Change the PN device name, IP address and, if necessary, the default gateway, subnet mask and PN tag location.
- ▶ Save changes by clicking on **Apply** .

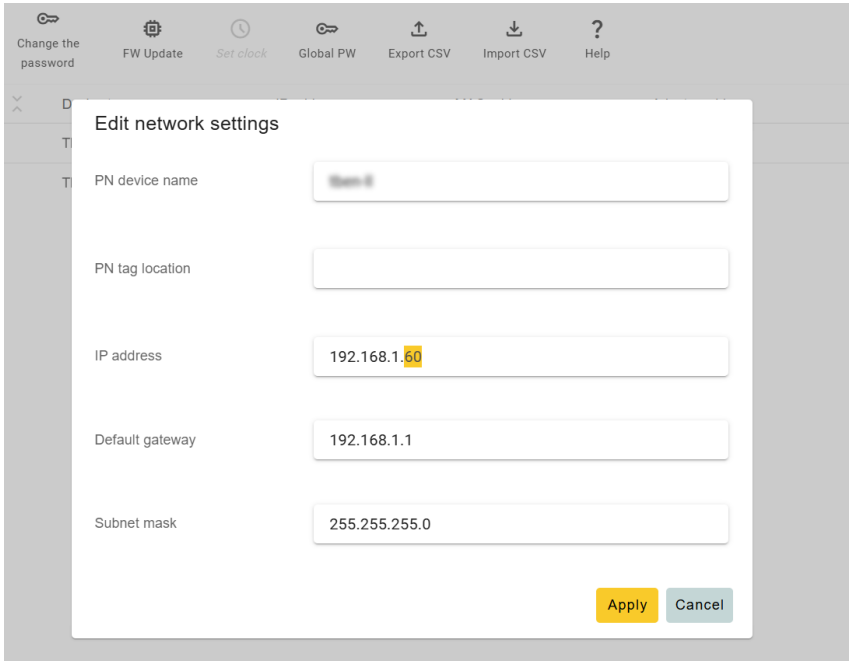


Fig. 12: Changing network settings in TAS

7.1.2 Adjusting network settings via the web server

- Click **Device → Parameters → Network**.
- Change the network settings.
- Write the changes into the device via **SET NETWORK CONFIGURATION**.

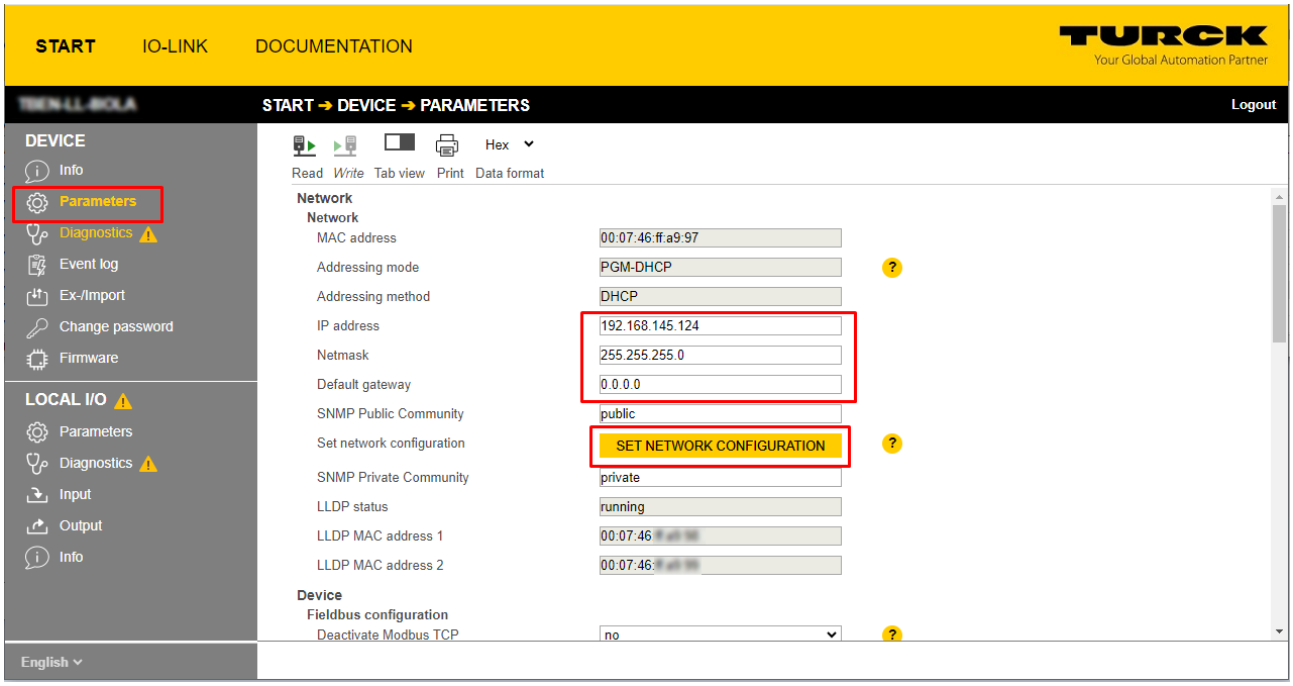


Fig. 13: Web server – adjusting network settings

7.2 Commissioning the Device in PROFINET

7.2.1 Device model – FEN20-8IOL

The FEN20-8IOL has eight parameterizable IO-Link channels, which can also be configured as four digital inputs or outputs (SIO). In addition to that, three virtual slots are provided via GSDML in PROFINET. The virtual channels are used to map the different diagnostic and status information (IO-Link diagnostics, IO-Link-Events, module status) data into the process image of the IO-Link master.

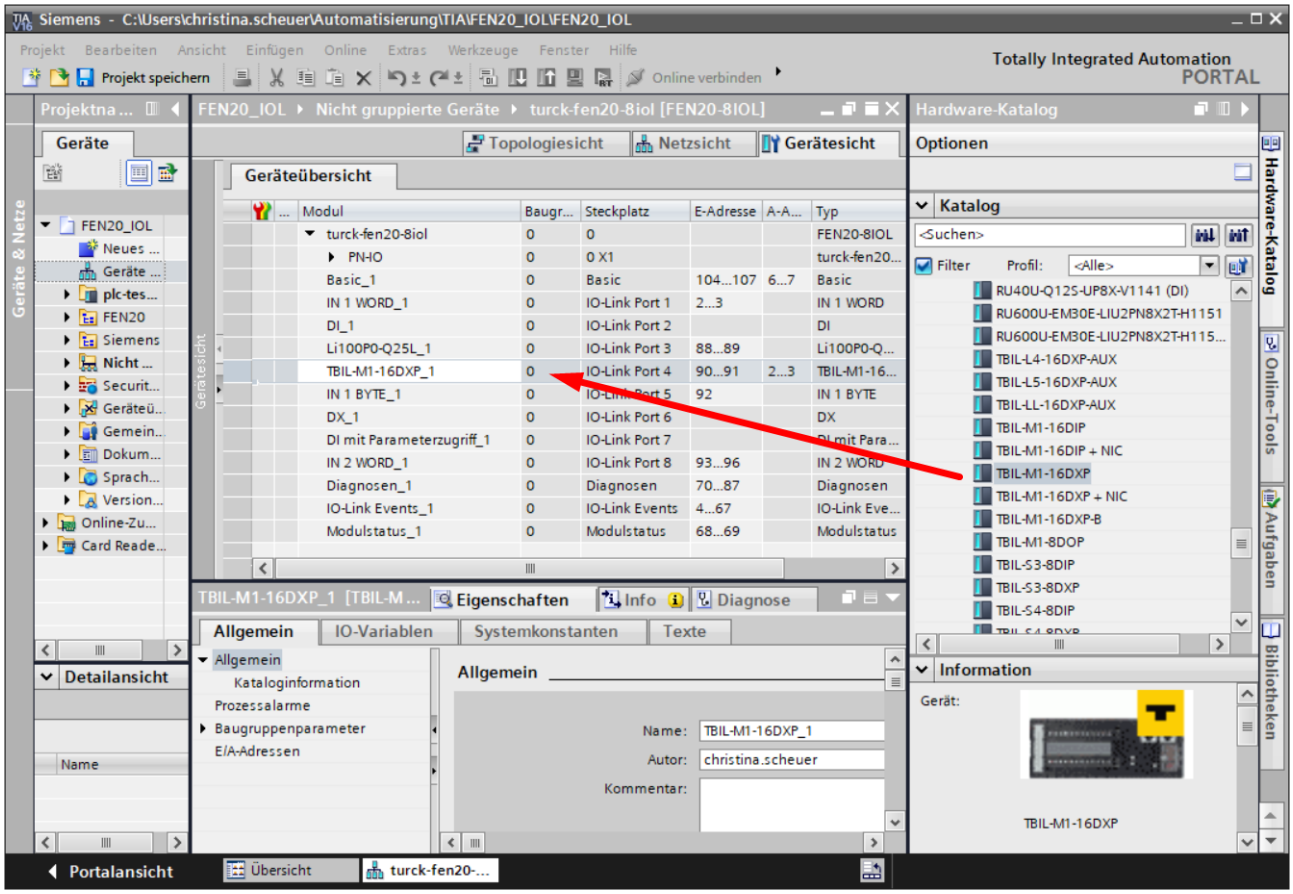


Fig. 14: FEN20-8IOL – slot overview in in TIA-Portal

7.2.2 Address setting in PROFINET

In IP-based communication, the field devices are addressed by means of an IP address. PROFINET uses the Discovery and Configuration Protocol (DCP) for IP assignment.

NOTE
DCP is a standard protocol and is not part of the installation of TAS, for example. The protocol can also be used outside of PROFINET in IPC operating systems (Windows, Linux), for example, and is available in tool packages such as WinPcap, Npcap, Wireshark, etc.

When delivered, each field device has, among other things, a MAC address. The MAC address is sufficient to give the respective field device a unique name.

The address is assigned in two steps:

- Assignment of a unique plant specific name to the respective field device
- Assignment of the IP address from the IO-Controller before the system start-up based on the plant-specific (unique) name

PROFINET naming convention

The device name is checked for correct spelling during input. The following rules apply to the use of the device name in accordance with PROFINET specification V2.3.

- All device names must be unique.
- Maximum name size: 240 characters
  Allowed:
  - Lower case letters a…z
  - Numbers 0…9
  - Hyphen and dot
- The name may consist of several components separated by a period. A name component, i.e. a string between two dots, may be a maximum of 63 characters long.
- The device name must not start or end with a hyphen.
- The name must not begin with "port-xyz" (y…z = 0…9).
- The name must not have the form of an IP address (n.n.n.n, n = 0…999).
- Do not use special characters.
- Do not use capital letters.

7.2.3 FSU – Fast Start-Up (prioritized startup)

FSU enables a PLC to build up connections to PROFINET nodes in less than 500 ms after switching-on the network power supply (V1). The fast start-up is necessary for fast tool changing applications at robot arms for example in the automobile industry.

NOTE
For the correct cabling in FSU applications please observe the note in the chapter "Connecting the Device to Ethernet" QuickConnect- and Fast Start-Up applications.

Fast Start-Up (FSU) in FEN20

The device supports the prioritized start-up (FSU). This function is only guaranteed for digital channels.

Activating FSU

In order to enable FSU, the field bus nodes have to be configured respectively, for example in TIA-Portal (Siemens).

Autonegotiation:	deactivated
Transmission medium/duplex:	set to a fixed value

- During configuration, please observe that the neighboring devices do also support FSU and that the settings for the ports of neighboring devices are identical.
- Set "Transmission rate/duplex" to a fix value.
- Deactivate auto-negotiation

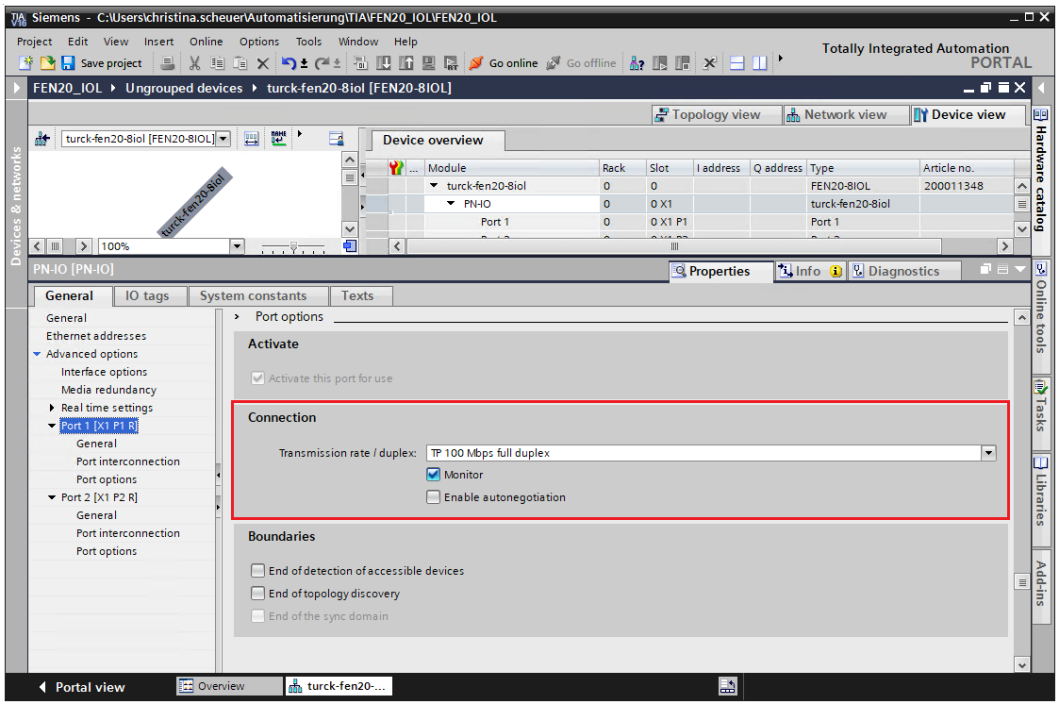


Fig. 15: TIA-Portal – port-settings for FSU

▶ Activate the prioritized start-up at the I/O device.

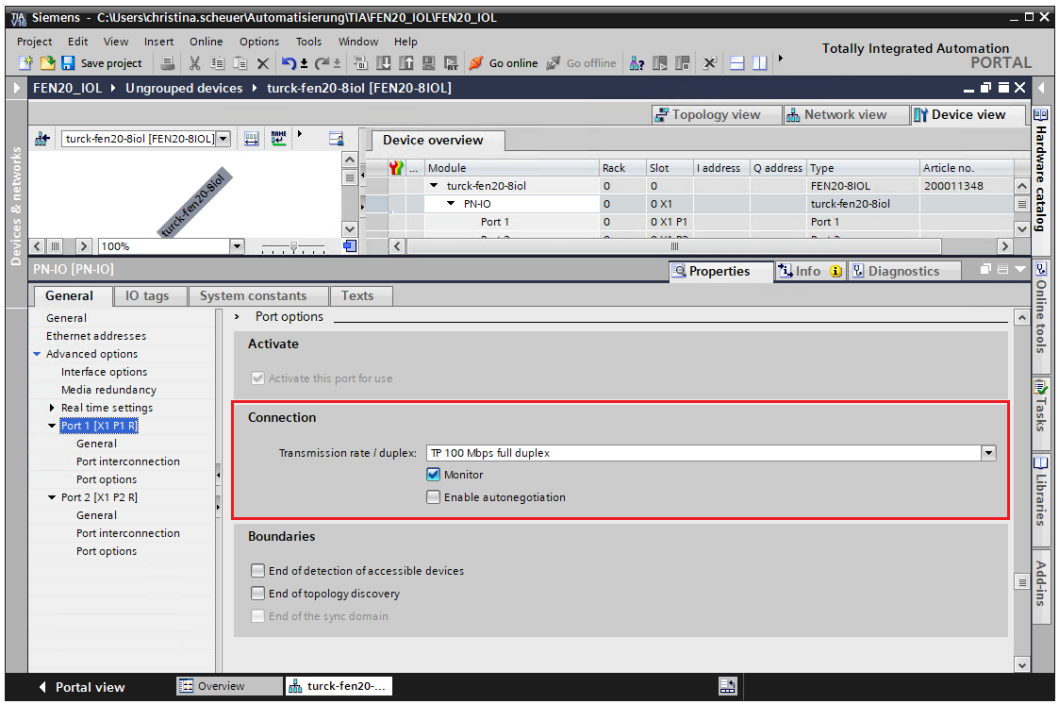


Fig. 16: TIA-Portal – prioritized start-up, activation at the I/O device

7.2.4 MRP (Media Redundancy Protocol)

The device supports MRP. MRP is a standardized protocol according to IEC 62439. It describes a mechanism for media redundancy in ring topologies. With MRP, a defective ring topology with up to 50 nodes is detected and reconfigured in the event of an error. With MRP a trouble-free switch-over is not possible.

A Media Redundancy Manager (MRM) checks the ring topology of a PROFINET network defined by the network configuration for functionality. All other network nodes are Media Redundancy Clients (MRC). In the error-free state, the MRM blocks normal network traffic on one of its ring ports, with the exception of the test telegrams. The physical ring structure thus becomes a line structure again at the logical level for normal network traffic. If a test telegram fails to appear, a network error has occurred. In this case, the MRM opens its blocked port and establishes a new functioning connection between all remaining devices in the form of a linear network topology.

The time between ring interruption and recovery of a redundant path is called reconfiguration time. For MRP, this is a maximum of 200 ms. Therefore, an application must be able to compensate for the 200 ms interruption. The reconfiguration time always depends on the Media Redundancy Manager (e.g. the PROFINET PLC) and the I/O cycle and watchdog times set here. For PROFINET, the response monitoring time must be selected accordingly > 200 ms.

It is not possible to use Fast Start-Up in an MRP network.

7.2.5 User data for acyclic services (IO-Link)

The acyclic data exchange is by using via Record Data CRs (Communication Relation). Via these Record Data CRs the reading and writing of the following services is realized:

- Writing of AR data (AR = Application Relation)
- Writing of configuration data
- Reading and writing of device data
- Reading of diagnostic data
- Reading of I/O data
- Reading of Identification Data Objects (I&M functions)

Acyclic I/O channel user data

Index		Name	Data type	Access	Comment
Dec.	Hex.				
1	0x01	Module parameters	specific	read/ write	Parameters of the module
2	0x02	Module type	ENUM UINT8	read	Contains the module type
3	0x03	Module version	UINT8	read	Firmware version of I/O channels
4	0x04	Module ID	DWORD	read	Module ID of the I/O
5…9	0x05 … 0x09	reserved	-	-	-
10	0x0A	Controller version	UINT8 array [8]	read	
11…18	0x0B… 0x12	reserved	-	-	-
19	0x13	Input data	specific	read	Input data of the respective I/O-channel
20…22	0x14 … 0x16	reserved	-	-	-
23	0x17	Output data	specific	read/ write	Output data of the respective I/O-channel
…	…	reserved	-	-	-

Index		Name	Data type	Access	Comment
Dec.	Hex.				
247	0xF7	CAP 1	Record	read/ write	Client Access Point for PROFINET IO controller
248	0xF8	CAP 2	Record	read/ write	
249	0xF9	CAP 3	Record	read/ write	
250	0xFA	CAP 4	Record	read/ write	
251	0xFB	CAP 5	Record	read/ write	
252	0xFC	CAP 6	Record	read/ write	
253	0xFD	CAP 7	Record	read/ write	
254	0xFE	CAP 8	Record	read/ write	
255	0xFF	CAP 9	Record	read/ write	Client Access Point for e.g. PROFINET IO supervisor

7.2.6 The IO-Link function block IOL_CALL

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".

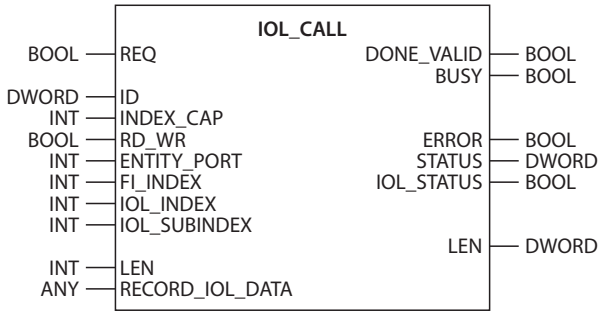


Fig. 17: IOL_CALL in accordance with IO-Link specification

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.

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 ■ 3S CODESYS: Slot number of 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: 247…254, 255
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 which 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, s. "IOL_CALL – communication error status" [▶ 27]
IOL_STATUS	DWORD	IO-Link error message: Error in the communication between IO-Link master ad IO-Link device [▶ 28]
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.
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
0xXX80B3XX	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

IOL Error Type	Designation acc. to specification	Meaning
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	

7.3 Connecting the device to a Siemens PLC in PROFINET

The following example describes the connection of the devices to a Siemens PLC in PROFINET by means of the programming software SIMATIC STEP7 Professional V15 (TIA-Portal).

Used hardware

The following hardware components are used in this example:

- Siemens PLC S7-1500
- IO-Link master FEN20-8IOL with the following configuration:
  - Port 1: Turck temperature sensor, TS700…, IO-Link V1.1
  - Port 2: Channel used as DI
  - Port 3: Turck linear position sensor, Li100P0-Q25LM0-…, IO-Link V1.0
  - Port 4: Turck IO-Link hub: TBIL-M1-16DXP, IO-Link V1.1

Used Software

The following software tools are used in this example:

- SIMATIC STEP7 Professional V15 (TIA-Portal)
- GSDML file for FEN20-…IOL (can be downloaded for free as ZIP archive “FEN20_PROFINET” under www.turck.com)

Prerequisites

- The software is started.
- A new project has been created.
- The controller has been added to the project.

7.3.1 Installing the GSDML-file

The GSDML file is available for free at www.turck.com.

▶ Adding the GSDML file: Click **Options** → **Manage general station description files (GSD)**.

▶ Installing the GSDML file: Define the source path for the GSDML-file and click **Install**.

⇨ The device is added to the hardware catalog.

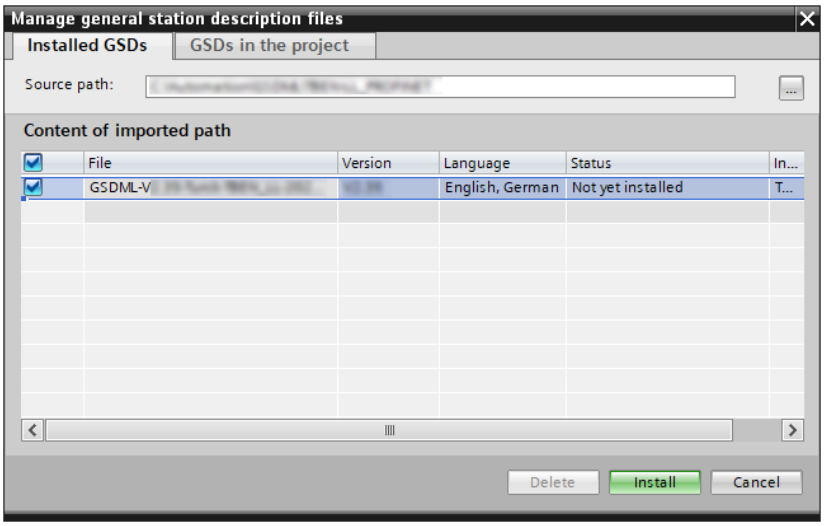


Fig. 18: TIA Portal – installing the GSDML file

7.3.2 Connecting the devices to the PLC

- Select the FEN20-8IOL from the Hardware catalog and drag it into the Device & networks editor.
- Connect the devices to the PLC in the "Devices & networks" editor.

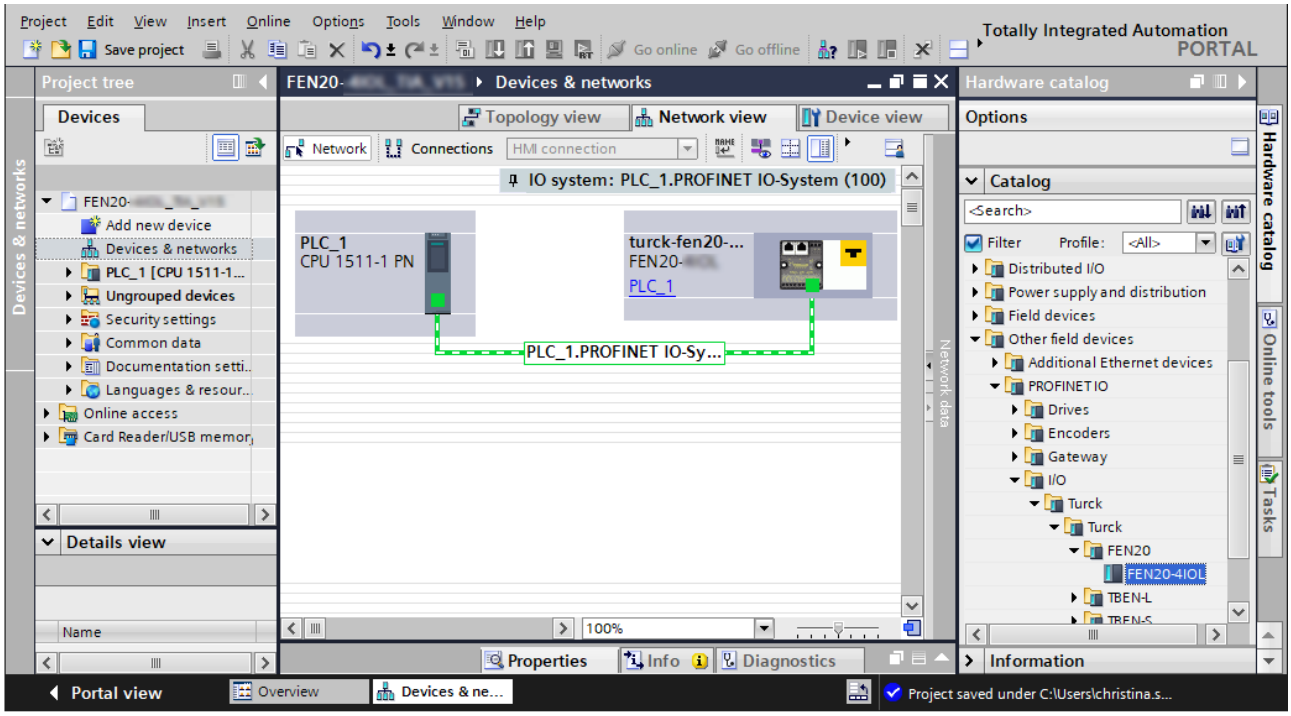


Fig. 19: Connecting the device to the PLC

7.3.3 Assigning the PROFINET device name

- **Select Online access → Online & diagnostics.** select
- **Select Function → Assigning a PROFINET name.**
- Assign the desired PROFINET device name with **Assign name.**

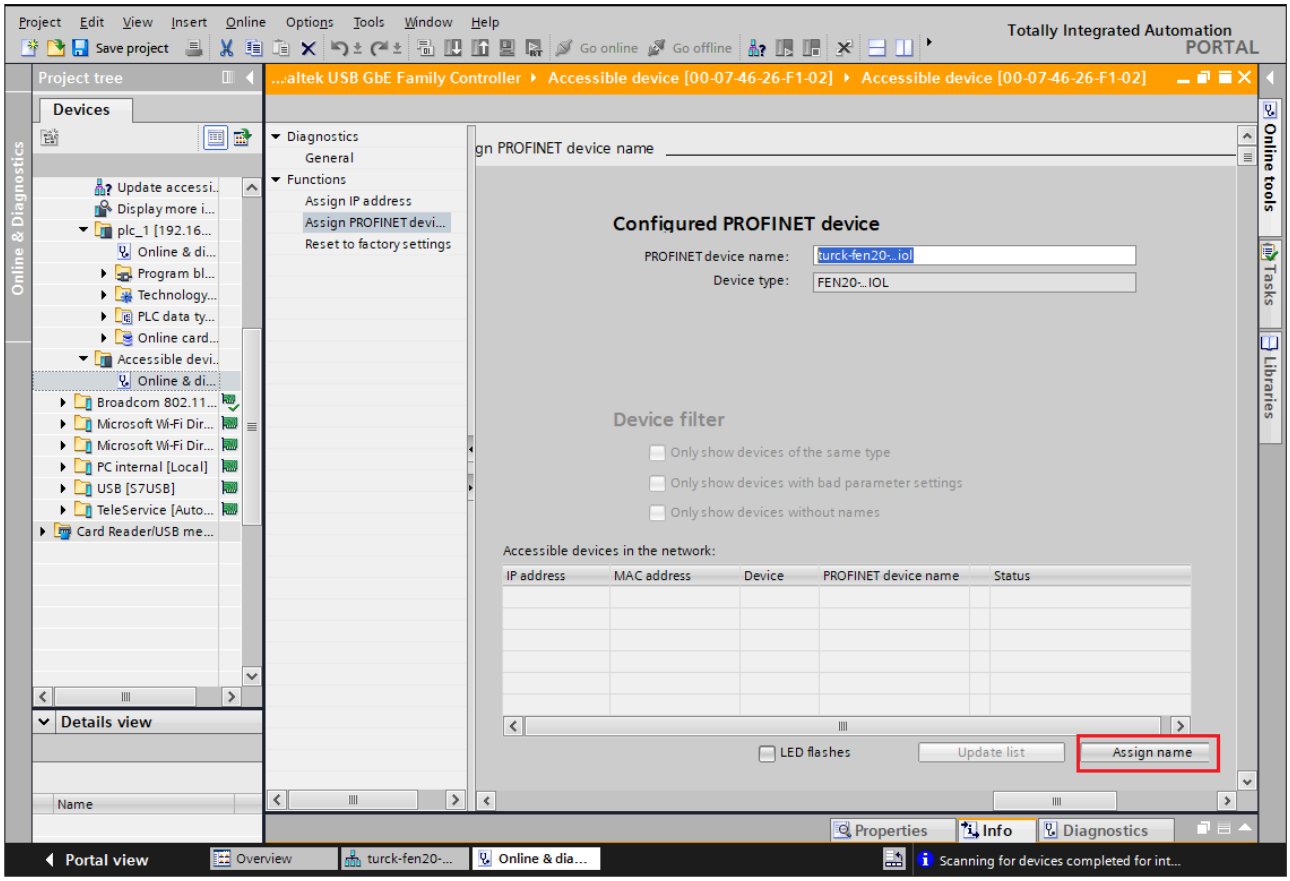


Fig. 20: TIA Portal: Assigning the PROFINET device name

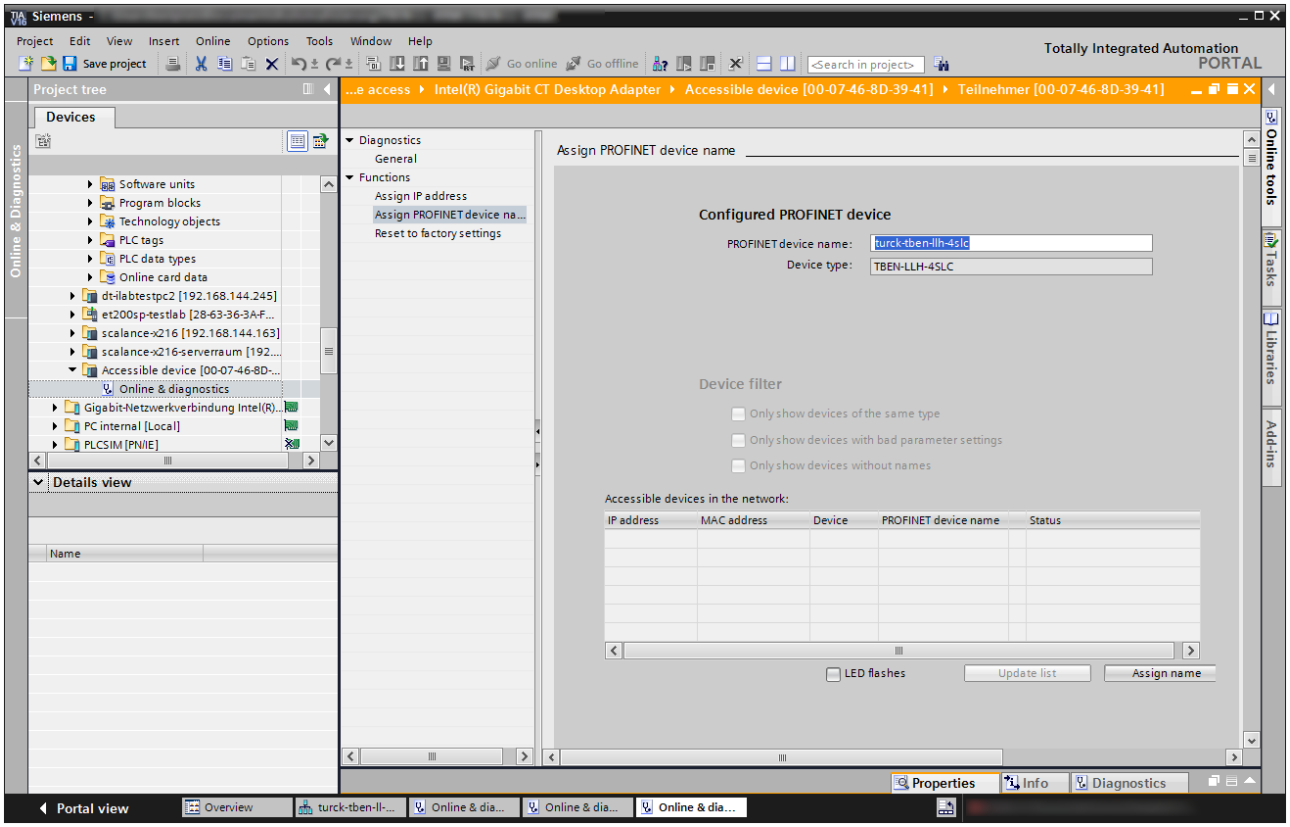


Fig. 21: TIA Portal Assigning the PROFINET device name

7.3.4 Setting the IP address in TIA Portal

- Select **Device view** → **Properties** tab → **Ethernet addresses**.
- Assign the desired IP address.

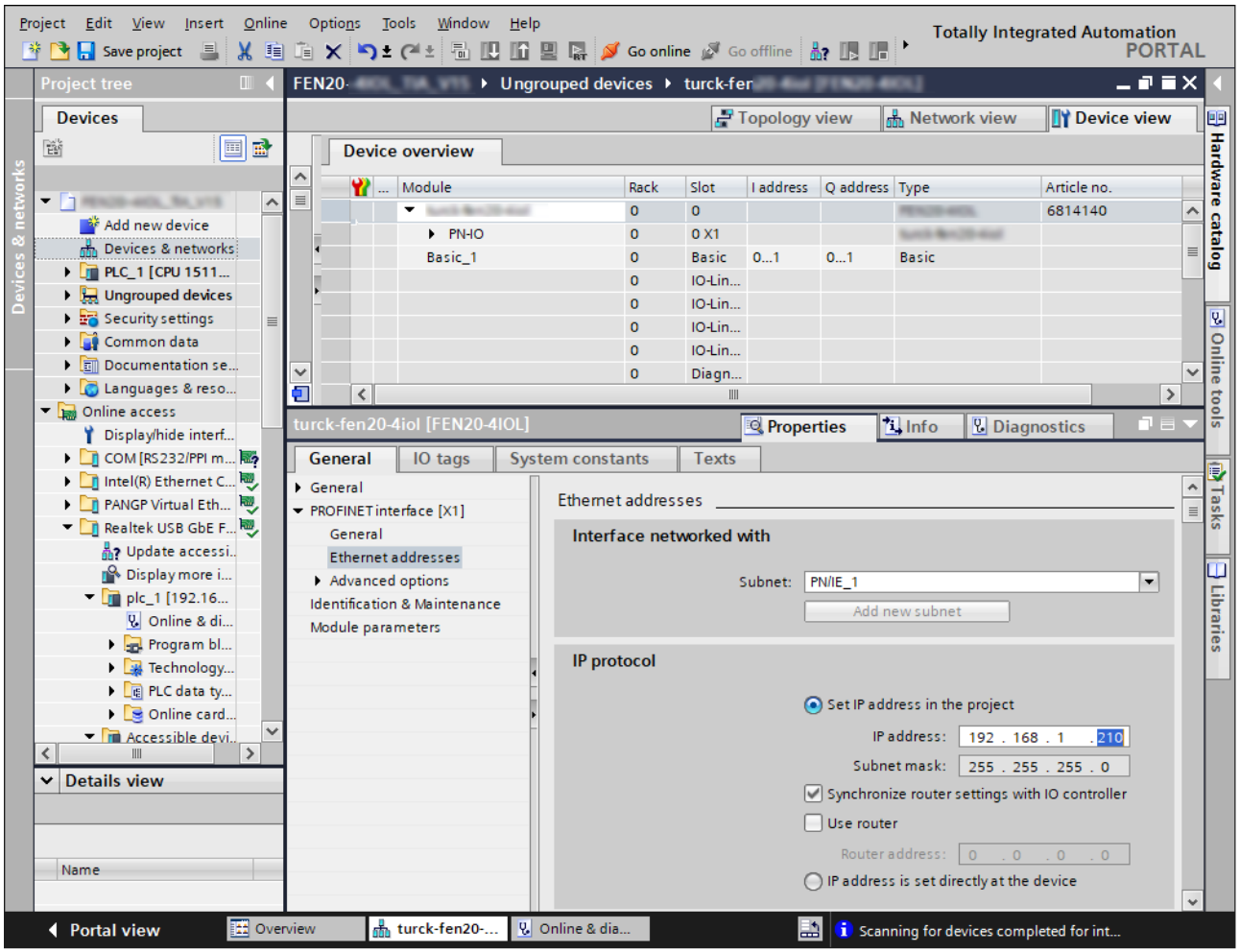


Fig. 22: TIA Portal: Assigning the IP address

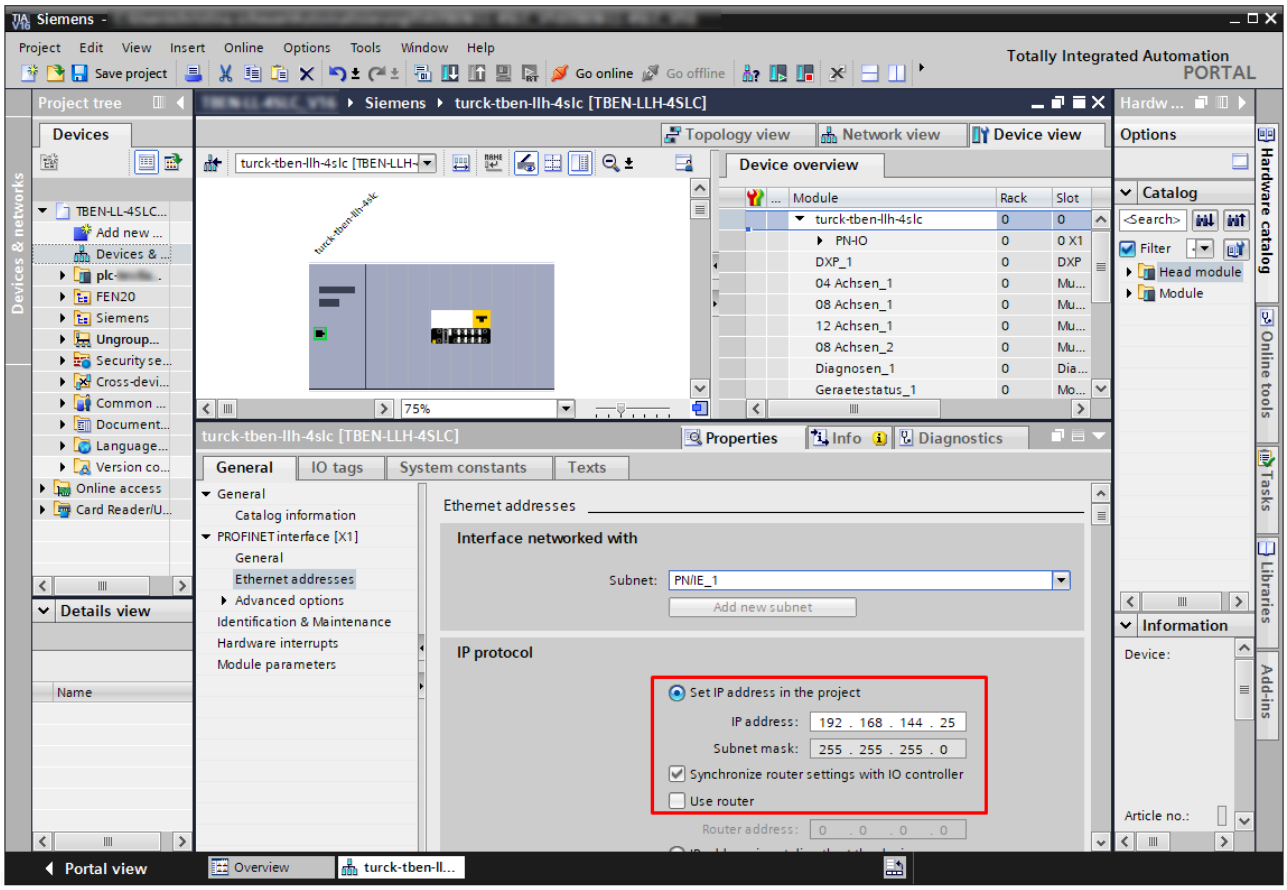


Fig. 23: Setting the IP address in TIA Portal

7.3.5 Configuring device functions

The FEN20-8IOL appears as a modular device with eleven empty virtual slots. Slots 0 and **Basic** are pre-configured.

The function of these slots is either defined via GSDML or can only be used for a specific purpose.

Slot	Meaning
0	Main module turck-fen20-…iol (default name) Parameterization of functions (protocol deactivation, etc.), which concern the complete module.
0 X1	Parameterization of PROFINET functions (MRP, etc.)
0 X1 P1	Parameterization of the Ethernet port properties (topology, connection options etc.).
0 X1 P2	
Basic	Parameters/diagnostics of the IO-Link channels of the device, if the ports are used as pure digital channels (DI/DXP)
IO-Link port 1… n	Configuration of the IO-Link ports
Diagnostics	Optional mapping of the diagnostics (IO-Link and DXP diagnostics) into the master's process image.
IO-Link Events	Optional mapping of the IO-Link events into the master's process image.
Module status	Optional mapping of the module status into the masters process image.

Configuring the IO-Link ports (example)

IO-Link port (hardware)	Process data length	Sensor	GSDML entry
Port 1	2 Byte IN	Turck temperature sensor, TS-700-…	Port configuration generic: IN 1 WORD
Port 2	1 Bit IN	-	DI
Port 3	2 Byte IN	Turck linearity sensor, Li100P0-Q25LM0-…	Port configuration specific: Li100P0-QU25L
Port 4	2 Byte IN 2 byte OUT	Turck I/O hub, TBIL-M1-16DXP	Port configuration specific: TBIL-M1-16DXP

- Select **Device view** → **Device overview**.
- Select functions as operation mode, diagnostics Diagnostics etc. from the hardware catalog and add them to the device slots via drag&drop.

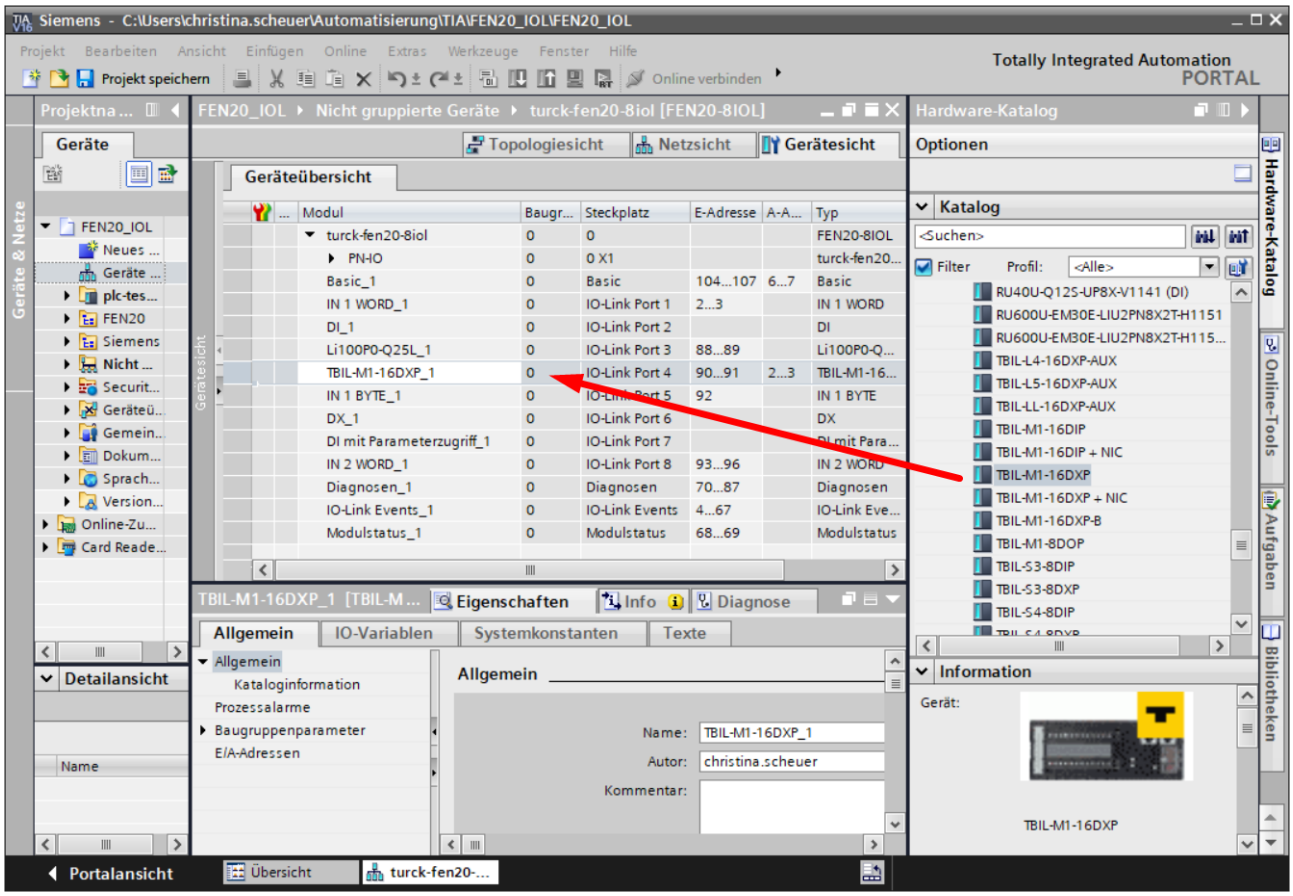


Fig. 24: TIA-Portal – configuring the device slots

Setting IO-Link port parameters

In generic port configuration, the ports of the IO-Link master can be operated in IO-Link mode with different configuration as well as in SIO mode (DI).

In specific port configuration, the IO-Link ports receive the parameters from the GSDML-file. Parameters like for example Operation mode, Data storage mode, Vendor- and Device ID cannot be changed.

- Select **Device view** → **Device overview**.
- Select the device to be parameterized.
- Click **Properties** →**General** →**Module parameters**.
- Set the device parameters.

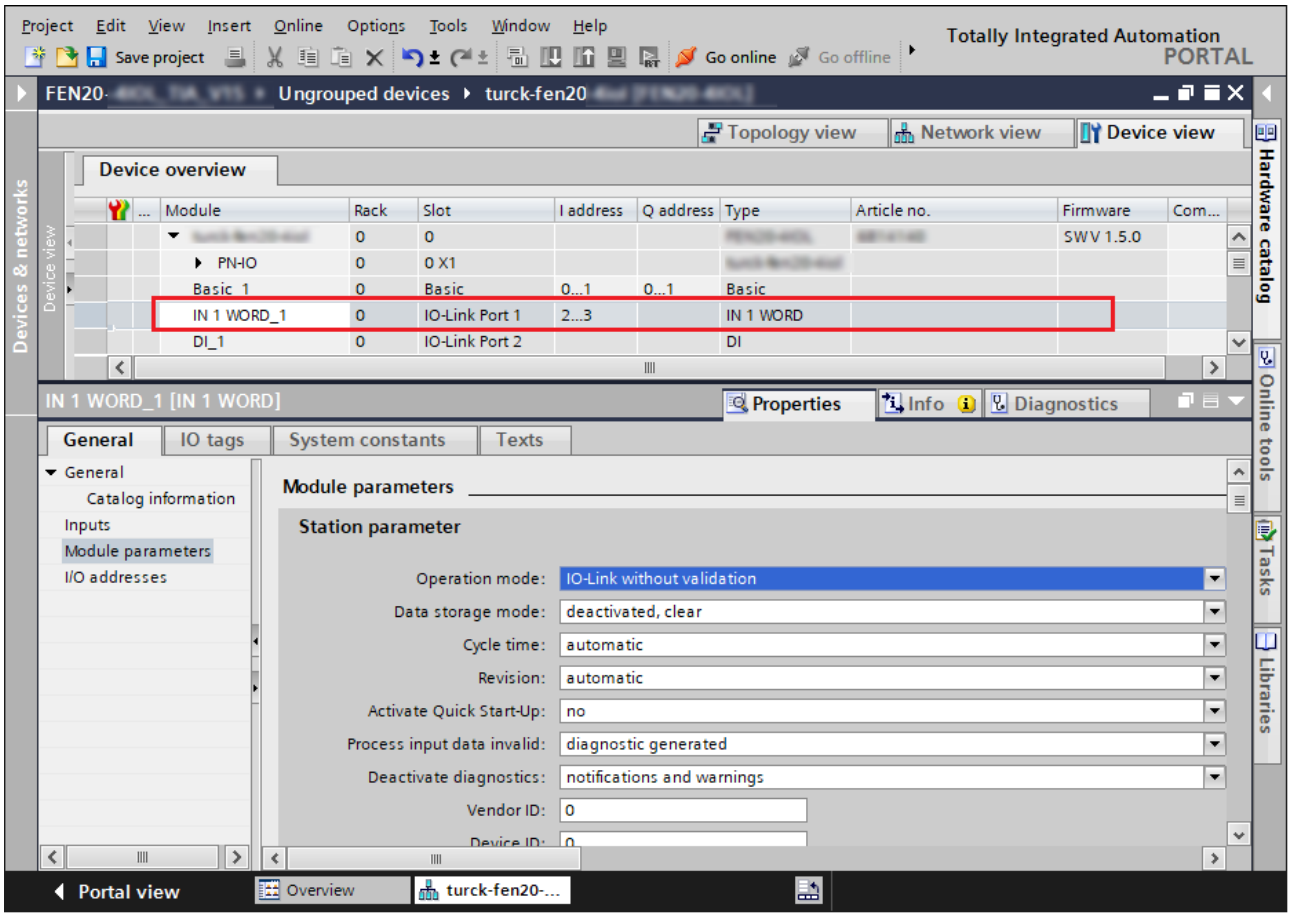


Fig. 25: TIA-Portal – parameterizing generic IO-Link devices

7.3.6 Connecting the device online with the controller

- ▶ Start the online mode (Go online).
- ⇨ The device has been successfully connected to the PLC.

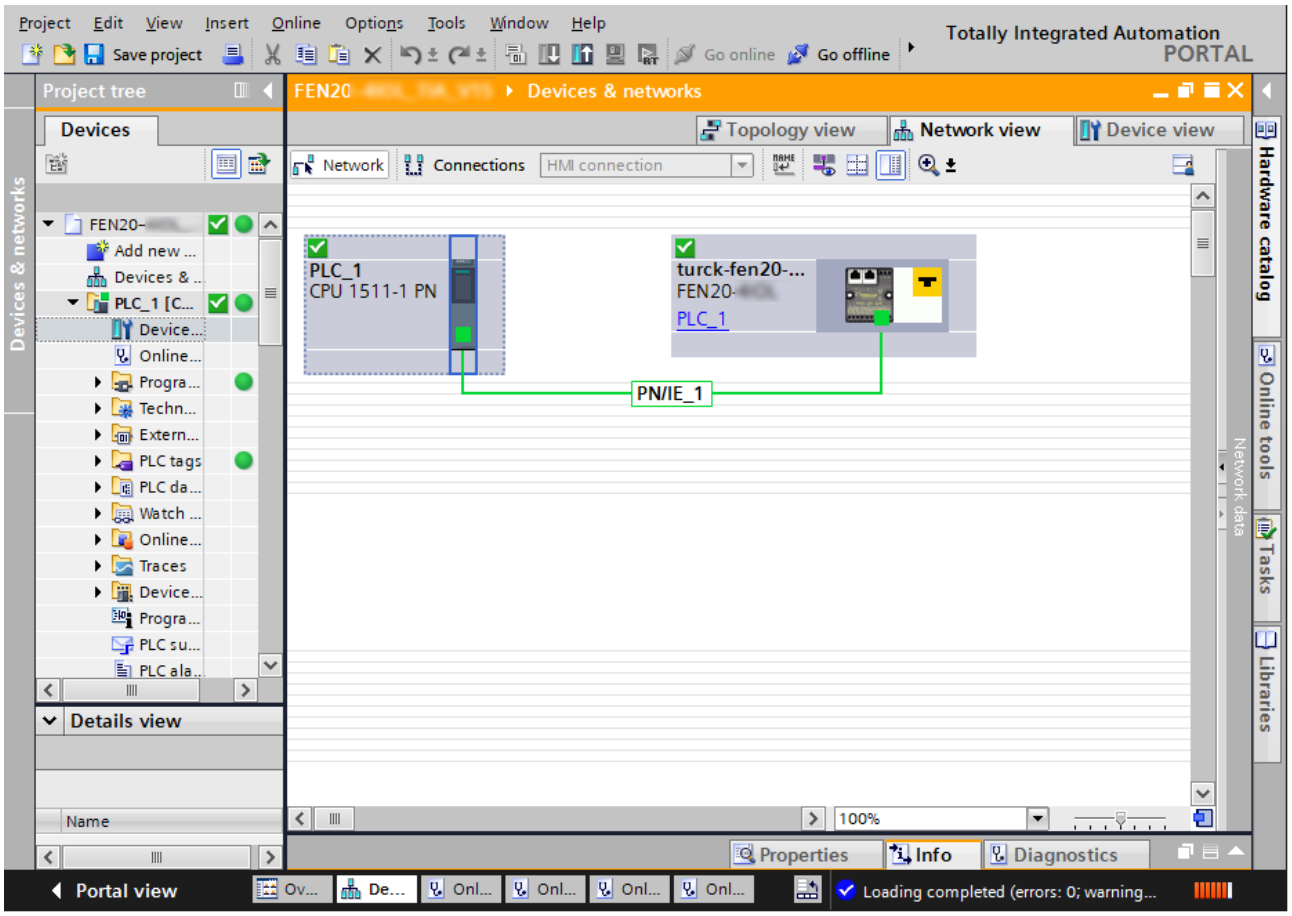


Fig. 26: TIA Portal: Starting the online mode (here: FEN20-4IOL)

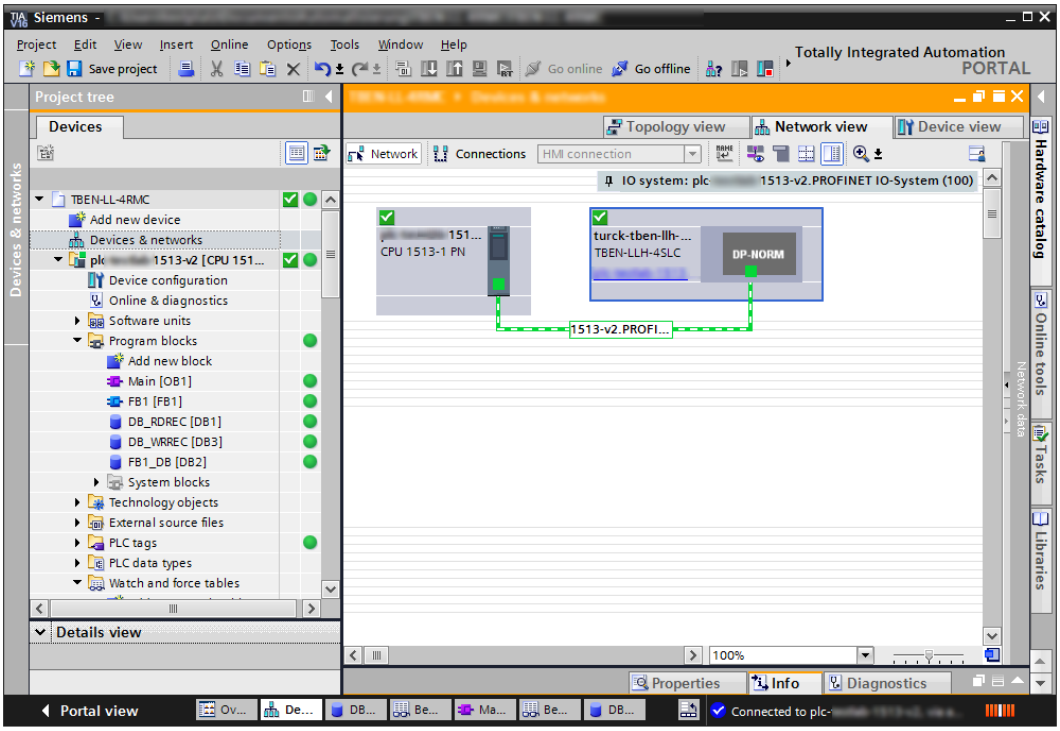


Fig. 27: TIA Portal: Online mode

7.3.7 PROFINET – mapping

The PROFINET mapping corresponds to the data mapping described in the sections “Process input data” and ”Process output data”.

7.3.8 Using the IO_LINK_DEVICE function block in TIA Portal

The IO_LINK_DEVICE function block is based on the IOL_CALL function block according to the IO-Link specification.

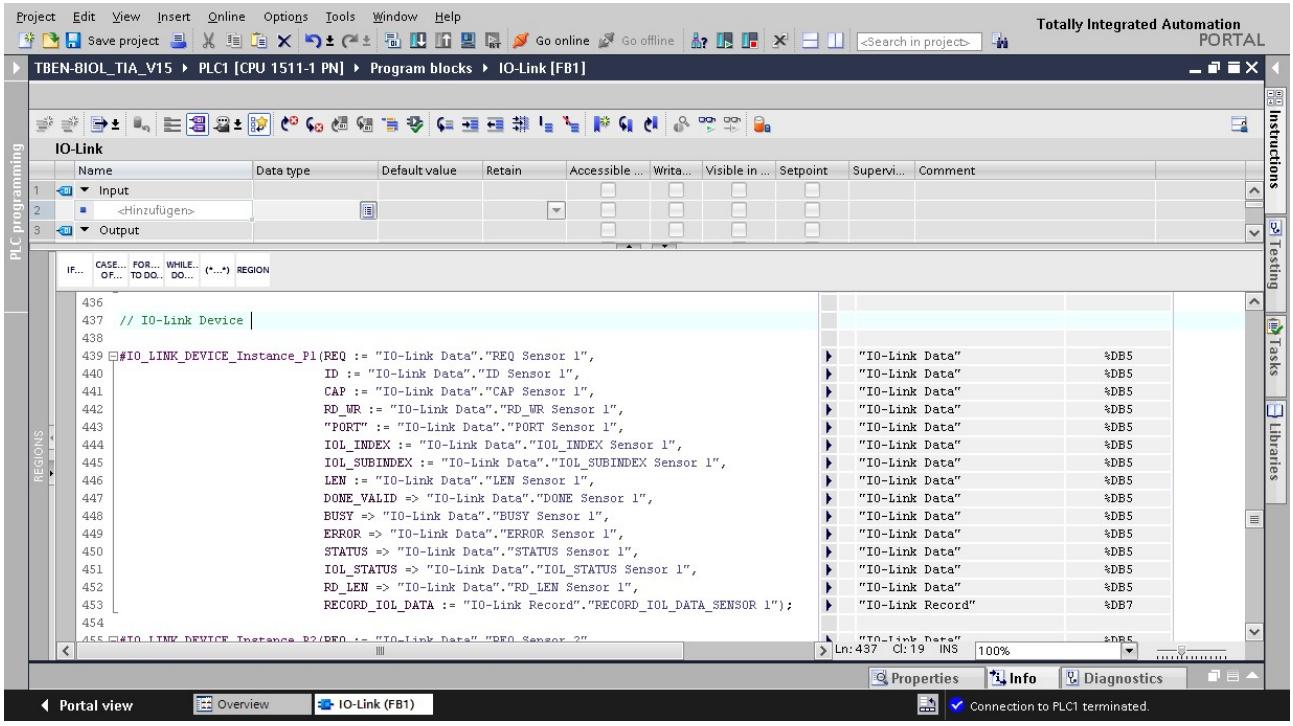


Fig. 28: Example call of Siemens FB "IO_LINK_DEVICE"

NOTE

The access to the port 0 functions of the IO-Link master with an IOL_INDEX of 65535 is not possible with version V3.0.2 of the Siemens IO_LINK_DEVICE block. In TIA Portal ≥ V15, the original IOL_CALL function block can also be used to access the Port 0 functions.

Example accesses with IO_LINK_DEVICE

In this example, the watch table **Sensor1** serves to visualize the procedure of the read and write access via IO_LINK_DEVICE. The assignment of the SPDU-indices of IO-Link devices can be found in the respective device documentation.

The function block access to the device an the connected sensors is done via the input variable **ID**. The value which has to be set as ID depends on the used CPU:

Example:

- HW identifier of the **Basic** slot (slot 1), for example with CPU 1511-PN (used in this example)
- Start address of the input data of the IO-Link master e.g. with CPU 315

Example read access – read product name

Reading out the product name (product name, index 0x12) of the TURCK IO-Link I/O-hub TBIL-M1-16DXP at IO-Link port 4.

▶ Write the input variables of the function block via **control variable** as follows:

Variable	Value	Meaning
REQ	TRUE	Send a read request
ID	264	Hardware identifier of the **Basic** slot according to the configuration in the Device view
CAP	251	Function block instance
Port	4	The I/O hub TBIL-M1-16DXP is connected to port 4.
IOL_INDEX	0x12	Index for product name

▶ Activate the read access via a rising edge at **REQ**.

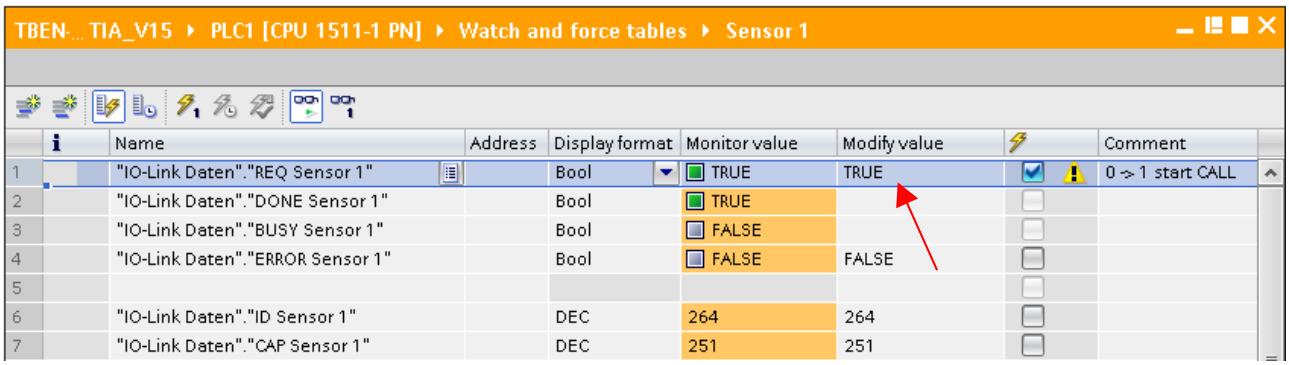


Fig. 29: IO_LINK_DEVICE – activate read access

⇨ In this example, the result of this request can be seen in the watch table (row 19 and following) in the **IO-Link Record**.

Example access write – rotate display

The display of the TURCK temperature sensor TS700 at IO-Link Port 1 is rotated. The parameter **Rotation of display** in index 91 is set to 0x01 = Rotated by **180°**.

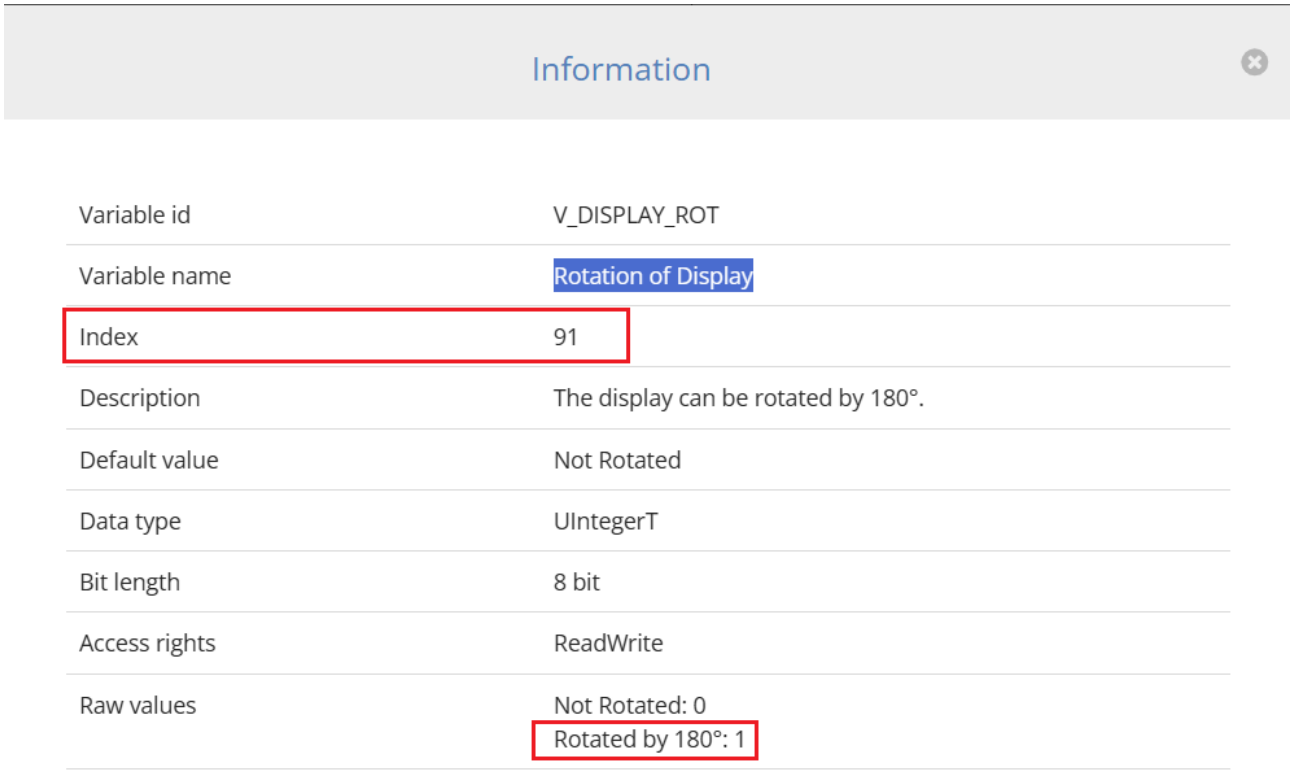
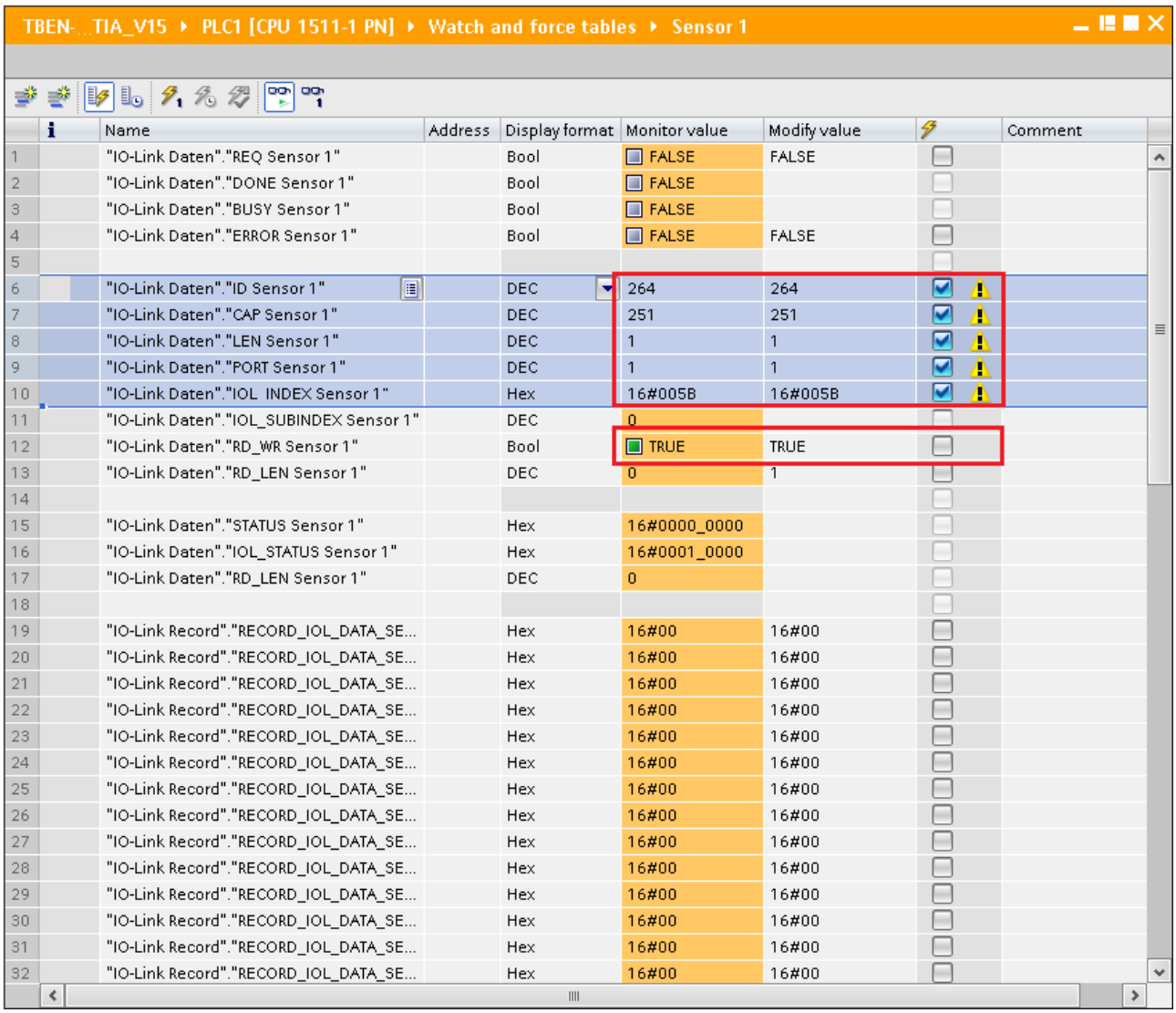


Fig. 30: Extract from the IODD of TS700-… in IODD viewer

- Write the input variables of the function block via **control variable** as follows.
- Activate the write access in the function block via **RD_WR Sensor 1**= TRUE.

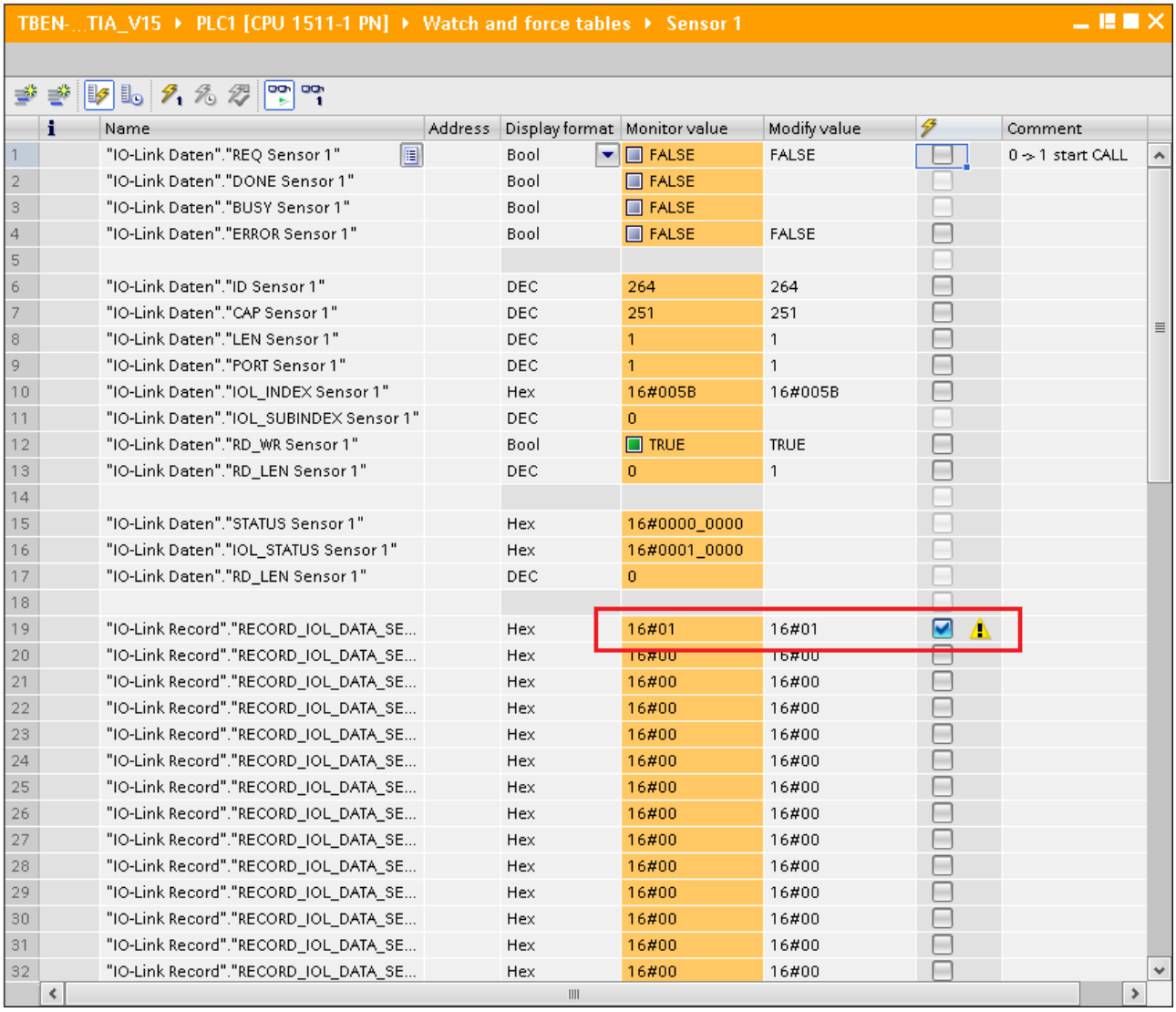
Variable	Value	Meaning
REQ	TRUE	Send a write request
ID	264	Hardware identifier of the **Basic** slot according to the configuration in the Device view
CAP	251	Function block instance
LEN	1	Length of the data to be written in byte
Port	1	The temperature sensor TS700 … is connected to port 1.
IOL_INDEX	0x5B	Index (91) for **Rotation of display**



	Name	Address	Display format	Monitor value	Modify value	Comment
1	"IO-Link Daten"."REQ Sensor 1"		Bool	FALSE	FALSE	
2	"IO-Link Daten"."DONE Sensor 1"		Bool	FALSE		
3	"IO-Link Daten"."BUSY Sensor 1"		Bool	FALSE		
4	"IO-Link Daten"."ERROR Sensor 1"		Bool	FALSE	FALSE	
5						
6	"IO-Link Daten"."ID Sensor 1"		DEC	264	264	
7	"IO-Link Daten"."CAP Sensor 1"		DEC	251	251	
8	"IO-Link Daten"."LEN Sensor 1"		DEC	1	1	
9	"IO-Link Daten"."PORT Sensor 1"		DEC	1	1	
10	"IO-Link Daten"."IOL_INDEX Sensor 1"		Hex	16#005B	16#005B	
11	"IO-Link Daten"."IOL_SUBINDEX Sensor 1"		DEC	0		
12	"IO-Link Daten"."RD_WR Sensor 1"		Bool	TRUE	TRUE	
13	"IO-Link Daten"."RD_LEN Sensor 1"		DEC	0	1	
14						
15	"IO-Link Daten"."STATUS Sensor 1"		Hex	16#0000_0000		
16	"IO-Link Daten"."IOL_STATUS Sensor 1"		Hex	16#0001_0000		
17	"IO-Link Daten"."RD_LEN Sensor 1"		DEC	0		
18						
19	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
20	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
21	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
22	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
23	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
24	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
25	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
26	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
27	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
28	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
29	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
30	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
31	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
32	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	

Fig. 31: IO_LINK_DEVICE – input variables for read access

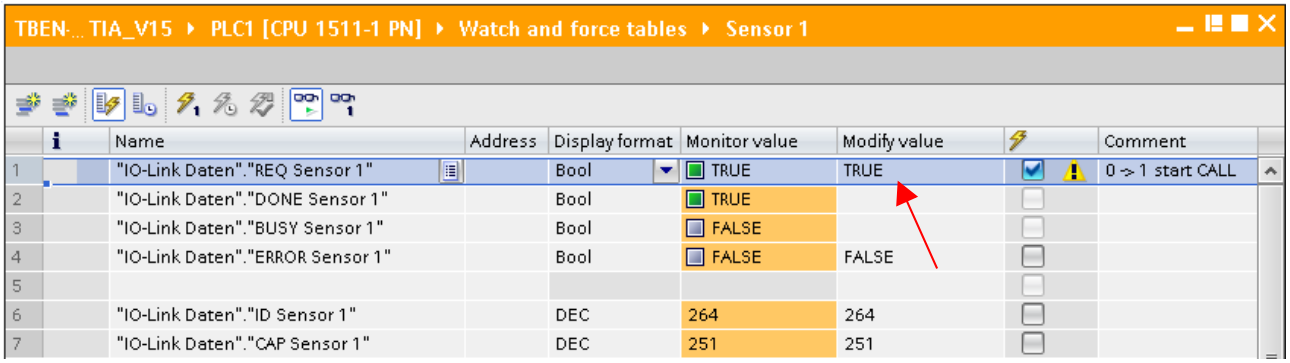
▶ Set the value to be written **0x01** via the first word of IO-Link Record in the watch table.



	Name	Address	Display format	Monitor value	Modify value	Comment
1	"IO-Link Daten"."REQ Sensor 1"		Bool	FALSE	FALSE	0 -> 1 start CALL
2	"IO-Link Daten"."DONE Sensor 1"		Bool	FALSE		
3	"IO-Link Daten"."BUSY Sensor 1"		Bool	FALSE		
4	"IO-Link Daten"."ERROR Sensor 1"		Bool	FALSE	FALSE	
5						
6	"IO-Link Daten"."ID Sensor 1"		DEC	264	264	
7	"IO-Link Daten"."CAP Sensor 1"		DEC	251	251	
8	"IO-Link Daten"."LEN Sensor 1"		DEC	1	1	
9	"IO-Link Daten"."PORT Sensor 1"		DEC	1	1	
10	"IO-Link Daten"."IOL_INDEX Sensor 1"		Hex	16#005B	16#005B	
11	"IO-Link Daten"."IOL_SUBINDEX Sensor 1"		DEC	0		
12	"IO-Link Daten"."RD_WR Sensor 1"		Bool	TRUE	TRUE	
13	"IO-Link Daten"."RD_LEN Sensor 1"		DEC	0	1	
14						
15	"IO-Link Daten"."STATUS Sensor 1"		Hex	16#0000_0000		
16	"IO-Link Daten"."IOL_STATUS Sensor 1"		Hex	16#0001_0000		
17	"IO-Link Daten"."RD_LEN Sensor 1"		DEC	0		
18						
19	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#01	16#01	
20	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
21	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
22	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
23	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
24	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
25	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
26	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
27	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
28	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
29	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
30	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
31	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	
32	"IO-Link Record"."RECORD_IOL_DATA_SE...		Hex	16#00	16#00	

Fig. 32: IO_LINK_DEVICE – control value 0x01 for index 0x5B

▶ Activate the Write access via a rising edge at **REQ**.



	Name	Address	Display format	Monitor value	Modify value	Comment
1	"IO-Link Daten"."REQ Sensor 1"		Bool	TRUE	TRUE	0 -> 1 start CALL
2	"IO-Link Daten"."DONE Sensor 1"		Bool	TRUE		
3	"IO-Link Daten"."BUSY Sensor 1"		Bool	FALSE		
4	"IO-Link Daten"."ERROR Sensor 1"		Bool	FALSE	FALSE	
5						
6	"IO-Link Daten"."ID Sensor 1"		DEC	264	264	
7	"IO-Link Daten"."CAP Sensor 1"		DEC	251	251	

Fig. 33: IO_LINK_DEVICE – activate read access

⇨ The sensor display is now 180° rotated.

7.4 Commissioning the Device in Modbus TCP

7.4.1 Implemented Modbus functions

The devices support the following functions for accessing process data, parameters, diagnostics and other services.

Function Code	
3	Read Holding Registers – reading multiple output registers
4	Read Input Registers – reading multiple input registers
6	Write Single Register – writing single output register
16	Write Multiple Registers – writing multiple output
23	Read/Write Multiple Registers – reading and writing multiple registers

7.4.2 Modbus registers

Address	Access Type	Meaning
0x0000…0x01FF	read only	Process data of the inputs (identical to registers 0x8000… 0x8FFF)
0x0800…0x09FF	read/write	Process data of the outputs (identical to registers 0x9000…0x9FFF)
0x1000…0x100B	read only	Module identifier
0x100C	read only	Module status
0x1017	read only	Register mapping revision (always 2, if not, mapping is incompatible with this description)
0x1020	read only	Watchdog, actual time in ms
0x1120	read/write	Watchdog, predefined time in ms (default: 500 ms)
0x1130	read/write	Modbus Connection Mode Register
0x1131	read/write	Modbus Connection Timeout in s. (def.: 0 = never)
0x113C…0x113D	read/write	Modbus Parameter Restore (reset of parameters to default values)
0x113E…0x113F	read/write	Modbus Parameter Save (permanent storing of parameters)
0x1140	read/write	Deactivate protocol Deactivates explicitly the selected Ethernet protocol: ■ Bit 0 = deactivate EtherNet/IP ■ Bit 1 = deactivate Modbus TCP ■ Bit 2 = deactivate PROFINET ■ Bit 15 = deactivate web server
0x1141	read/write	Active protocol ■ Bit 0 = EtherNet/IP active ■ Bit 1 = Modbus TCP active ■ Bit 2 = PROFINET active ■ Bit 15 = web server active
0x2400	read only	V1 in mV: 0 at < 18 V
0x8000…0x8400	read only	Process data of the inputs (identical to registers 0x0000… 0x01FF)
0x9000…0x9400	read/write	Process data of the outputs (identical to registers 0x0800…0x09FF)
0xA000…0xA400	read only	Diagnostics
0xB000…0xB400	read/write	Parameter

The following table shows the register mapping for the different Modbus addressing methods:

Description	Hex	Decimal	5 digit	Modicon
Process data inputs	0x0000…0x01FF	0…511	40001…40512	400001…400512
Process data outputs	0x0800…0x09FF	2048…2559	42049…42560	402049…402560
Module identifier	0x1000…0x100B	4096…4107	44097…44108	404097…404108
Module status	0x100C	4108	44109	404109
Watchdog, actual time	0x1020	4128	44129	404129
Watchdog, predefined time	0x1120	4384	44385	404385
Modbus connection mode register	0x1130	4400	44401	404401
Modbus Connection Timeout in s.	0x1131	4401	44402	404402
Modbus parameter restore	0x113C…0x113D	4412…4413	44413…44414	404413…404414
Modbus parameter save	0x113E…0x113F	4414…4415	44415…44416	404415…404416
Deactivate protocol	0x1140	4416	44417	404417
Active protocol	0x1141	4417	44418	404418
V1 in mV	0x2400	9216	49217	409217
Process data inputs	0x8000, 0x8001	32768, 32769	-	432769, 432770
Process data outputs	0x9000, 0x9001	36864, 36865	-	436865, 436866
Diagnostics	0xA000, 0xA001	40960, 40961	-	440961, 440962
Parameters	0xB000, 0xB001	45056, 45057	-	445057, 445058

Register 0x1130: Modbus connection mode

This register defines the behavior of the Modbus connections.

Bit	Designation	Value	Meaning
0	MB_OnlyOneWrite Permission	**0**	All Modbus connections receive the write authorization.
		1	Only one Modbus connection can receive the write permission. A write permission is opened until a disconnect. After the disconnect the next connection which requests a write access receives the write authorization.
1	MB_ImmediateWritePer-mission	**0**	With the first write access, a write authoriza-tion for the respective Modbus connection is requested. If this request fails, an exception response with exception-code 0x01 is gener-ated. If the request is accepted, the write access is executed and the write authorization remains active until the connection is closed.
		1	The write authorization for the respective Modbus connection is already opened during the connection establishment. The first Mod-bus connection thus receives the write author-ization, all following connections do not (only if bit 0 = 1).
2…15	Reserved	-	-

Register 0x1131: Modbus connection timeout

This register defines after which time of inactivity a Modbus connection is closed through a disconnect.

Value range: 0…65535 s

default: 0 s = never (Modbus connection will never be closed)

Behavior of the BUS LED

If Modbus is the active protocol in case of a connection timeout and no further Modbus connections exist, the BUS LED behaves as follows:

Connection timeout	BUS LED
Timeout	Green flashing

Register 0x113C and 0x113D: Restore Modbus connection parameters

Registers 0x113C and 0x113D serve for resetting the parameter-register 0x1120 and 0x1130 to 0x113B to the default settings. The service resets the parameters without saving them.

Procedure:

- ▶ Write 0x6C6F to register 0×113C.
- ▶ To activate the reset of the registers, write 0x6164 (”load”) within 30 seconds in register 0x113D. Both registers can also be written with one single request using the function codes FC16 and FC23.
- ⇨ The parameters are reset to default values.
- ▶ Save changes via a subsequent Save service.

Register 0x113E and 0x113F: Save Modbus connection parameters

Registers 0x113E and 0x113F are used for the non-volatile saving of parameters in registers 0x1120 and 0x1130 to 0x113B.

Procedure:

- ▶ Write 0x7361 to register 0×113E.
- ▶ Write 0x7665 (”save”) within 30 seconds in register 0x113F to activate the reset of the registers. Both registers can also be written with one single request using the function codes FC16 and FC23.
- ⇨ The parameters are saved.

7.4.3 Data width

Module	Process input	Process output	Alignment
FEN20-8IOL	338 byte	256 byte	Word by word

7.4.4 Register mapping

Input registers

Register no.	Bit no.															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	MSB								LSB							
0x0000… 0x00xx	**Input data**															
	Process input data [▶ 162]															
0x00xx + 1 register	**Module status**															
	see status and control word [▶ 167]															

Output registers

Register no.	Bit no.															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0x0800… 0x08xx	**Output data**															
	Process output data [▶ 165]															

Diagnostic registers

Register no.	Bit no.															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Diagnostics [▶ 167]															
0xA000	DXP channel diagnostics															
0xA001	IO-Link channel diagnostics															
…																
0xA004																

Parameter registers

Register no.	Bit no.															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Parameters [▶ 148]															
	Basic															
0xB000	SRO V1+ (Ch7)	SRO V1+ (Ch6)	SRO V1+ (Ch5)	SRO V1+ (Ch4)	SRO V1+ (Ch3)	SRO V1+ (Ch2)	SRO V1+ (Ch1)	SRO V1+ (Ch0)	SRO C/Q (Ch7)	SRO C/Q (Ch6)	SRO C/Q (Ch5)	SRO C/Q (Ch4)	SRO C/Q (Ch3)	SRO C/Q (Ch2)	SRO C/Q (Ch1)	SRO C/Q (Ch0)
0xB0001	Mode V1+ (Ch7)	Mode V1+ (Ch6)	Mode V1+ (Ch5)	Mode V1+ (Ch4)	Mode V1+ (Ch3)	Mode V1+ (Ch2)	Mode V1+ (Ch1)	Mode V1+ (Ch0)	Reserved							
	IO-Link port 1															
0xB001	Cycle time								GSD	Activate Quick Start-Up	Reserved		Operation mode			
0xB002	Reserved								Mapping PDIN		Mapping PDOUT		Deactivate diagnostics	PDIN In-valid	-	
0xB003 … 0xB005	Reserved															
0xB0056	Vendor ID															
0xB007	Device ID LSB															
	Device ID															
0xB008	Device ID															
	Device ID MSB															
0xB009	Reserved															
0xB00A	**IO-Link port 2**															
… 0xB011	8 registers of parameter data, assignment similar to port 1															
0xB012	**IO-Link port 3**															
… 0xB019	8 registers of parameter data, assignment similar to port 1															
0xB01A	**IO-Link port 4**															
… 0xB021	8 registers of parameter data, assignment similar to port 1															
0xB022	**IO-Link port 5**															
… 0xB029	8 registers of parameter data, assignment similar to port 1															
0xB02A	**IO-Link port 6**															
… 0xB031	8 registers of parameter data, assignment similar to port 1															
0xB032	**IO-Link port 7**															
… 0xB039	8 registers of parameter data, assignment similar to port 1															
0xB03A	**IO-Link port 8**															
… 0xB041	8 registers of parameter data, assignment similar to port 1															

7.4.5 Error behavior (watchdog)

Behavior of outputs

In case of a failure of the Modbus communication, the outputs' behavior is as follows, depending on the defined time for the Watchdog (register 0x1120):

Watchdog	Behavior of outputs
0 ms	All outputs maintain the actual value in case of an error
> 0 ms (default = 500 ms)	Outputs switch to 0 after the watchdog time has expired (setting in register 0x1120).

NOTE
Setting the outputs to predefined substitute values is not possible in Modbus TCP. Eventually parameterized substitute values will not be used.

Behavior of the BUS LED

When the watchdog triggers, the BUS LED lights up red.

Behavior of the device in case of loss of Modbus communication

If Modbus is used as the active protocol and all Modbus connections are closed, the watchdog sets all outputs to "0" after the set time has elapsed. This does not apply if another protocol such as PROFINET or EtherNet/IP has been activated in the meantime.

7.5 Connecting devices to a Modbus Client with CODESYS

Naming convention

TURCK uses the terms "Modbus client" and "Modbus server" according to Modbus Organization. The following description uses the terms "Modbus TCP Master" (client) and "Modbus TCP Slave" (server) only because of the naming in CODESYS.

Used hardware

The following hardware components are used in this example:

- TX715-P3CV01 (IP address: 192.168.145.72)
- Block module FEN20-… (IP address: 192.168.145.200)

Used software

The following software tools are used in this example:

- CODESYS 3.5.18.2 (can be downloaded for free under www.turck.com).

7.5.1 Connecting the device to the PLC

The following components have to be added to CODESYS first, in order to connect the device to the PLC.

- Ethernet adapter
- Modbus TCP client (in CODESYS: Modbus TCP Master)
- Modbus TCP server (in CODESYS: Modbus TCP Slave)

Adding the Ethernet Adapter

- ▶ Right-click **Device** in the project tree **TX715-P3CV01**.
- ▶ Select **Add Device**.
- ▶ Select **Ethernet Adapter**.
- ▶ Click **Insert device.**
- ⇨ The Ethernet Adapter is added to the project tree as **Ethernet (Ethernet)**.

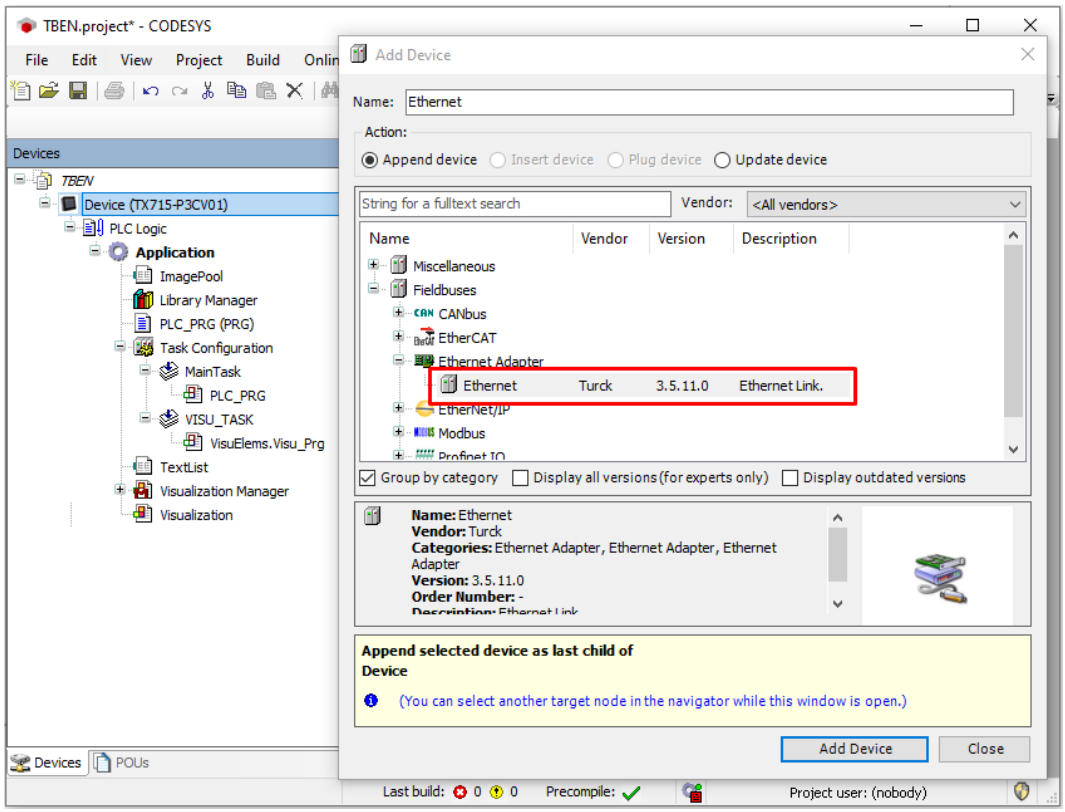


Fig. 34: Adding the Ethernet Adapter

Adding the Modbus TCP Master

- ▶ Right-click the **Ethernet (Ethernet)** in the project tree.
- ▶ Select **Add Device**.
- ▶ Double-click **Modbus TCP Master**.
- ⇨ The **Modbus_TCP_Master** is added to the project tree.

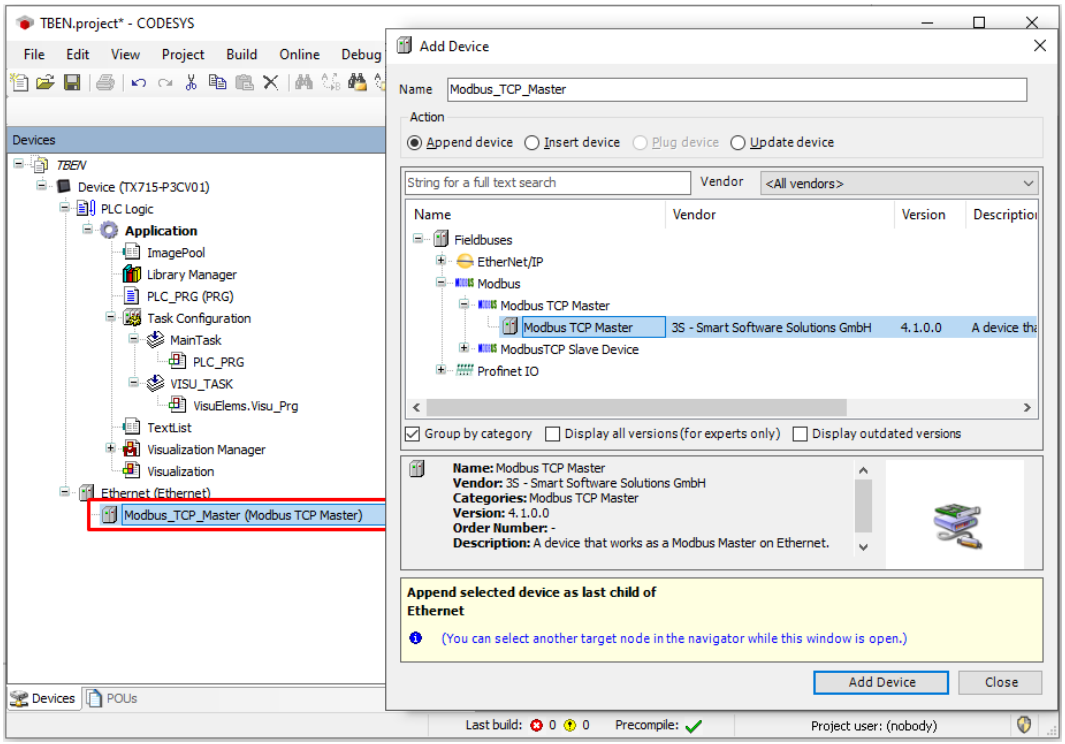


Fig. 35: Adding the Modbus TCP Master

Adding the Modbus TCP Server (Slave)

- ▶ Right-click the **Modbus TCP Master** in the project tree.
- ▶ Select **Add Device**.
- ▶ Double-click **Modbus TCP Slave**.
- ⇨ The **Modbus_TCP_Slave** is added to the project tree.

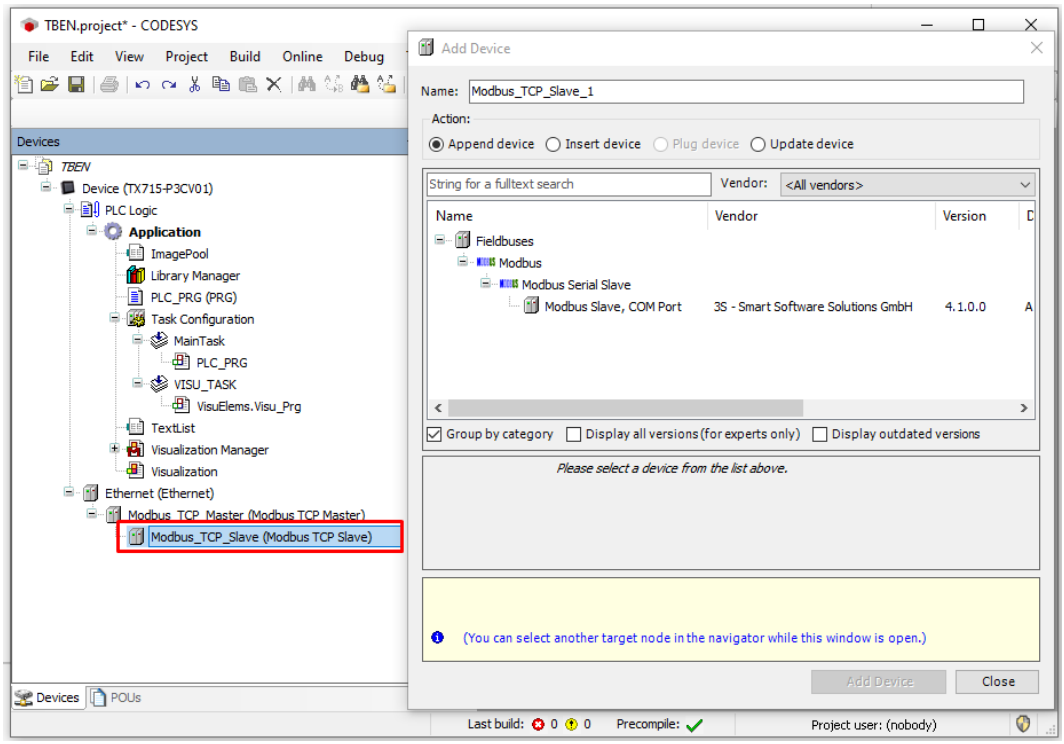


Fig. 36: Adding the Modbus TCP Slave

7.5.2 Configuring the Network Interface

- Click **Device → Scan network**.
- Modbus TCP Master (here: TX715-P3CV01) and confirm with OK.

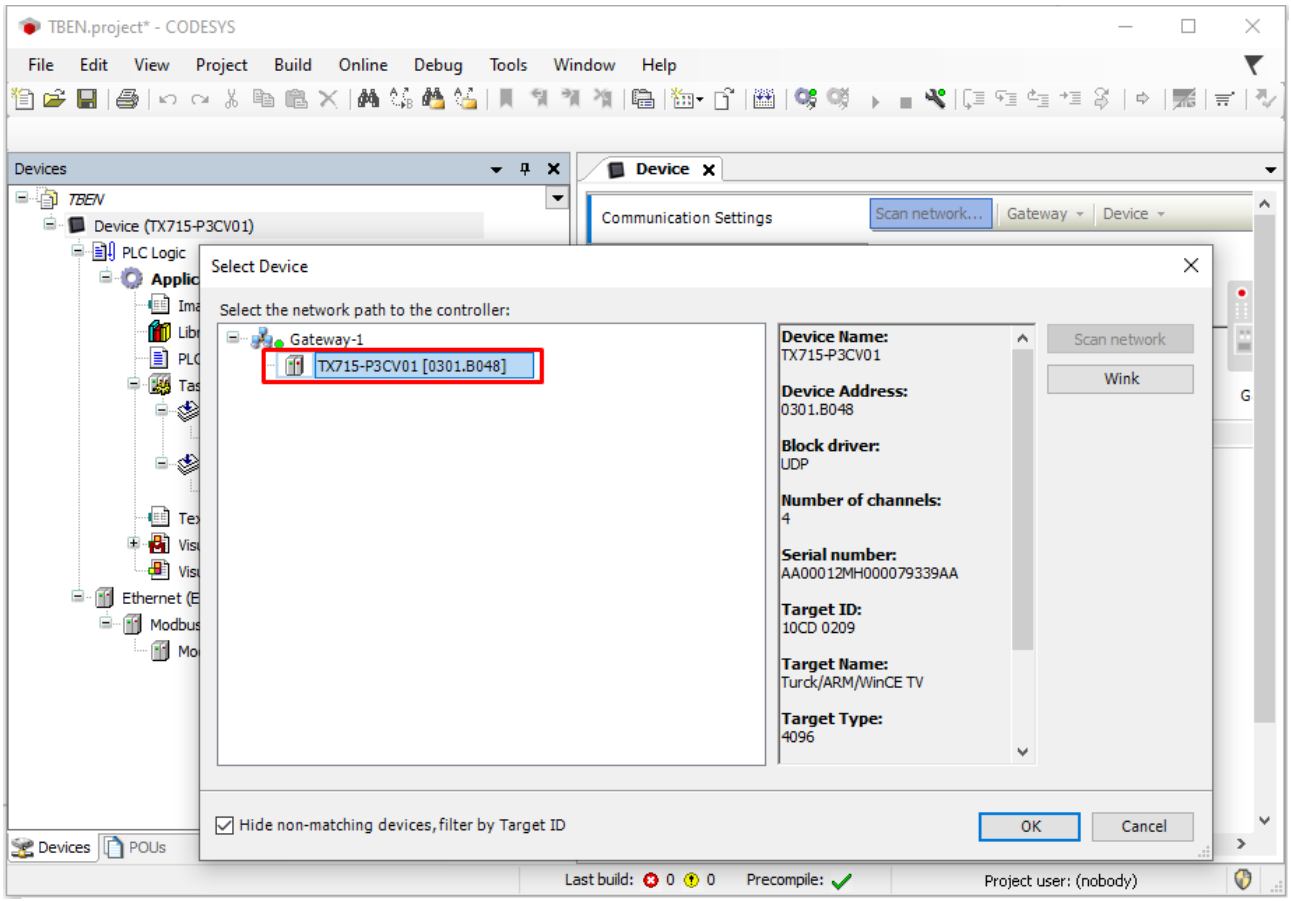


Fig. 37: Configuring the network interface

- Double-click **Ethernet**.
- Open the dialog box **Network Adapter** by clicking the **Browse...** button in the register tab **General**.
- Select the interface TX715-P3CV01 (here: 192.168.145.72)

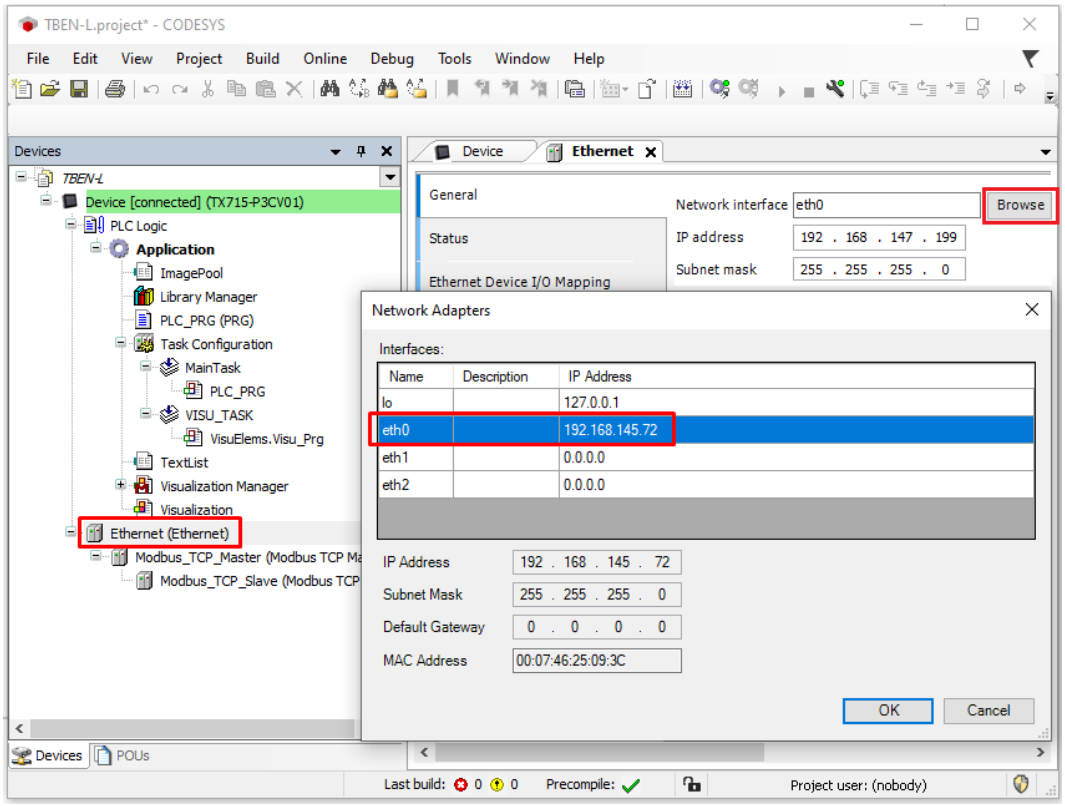


Fig. 38: Selecting the interface

7.5.3 Modbus TCP Server (Slave): setting the IP address

- Double click **Modbus TCP Slave**.
- Enter the **slave IP address** in the **General** register tab (here: 192.168.145.200).

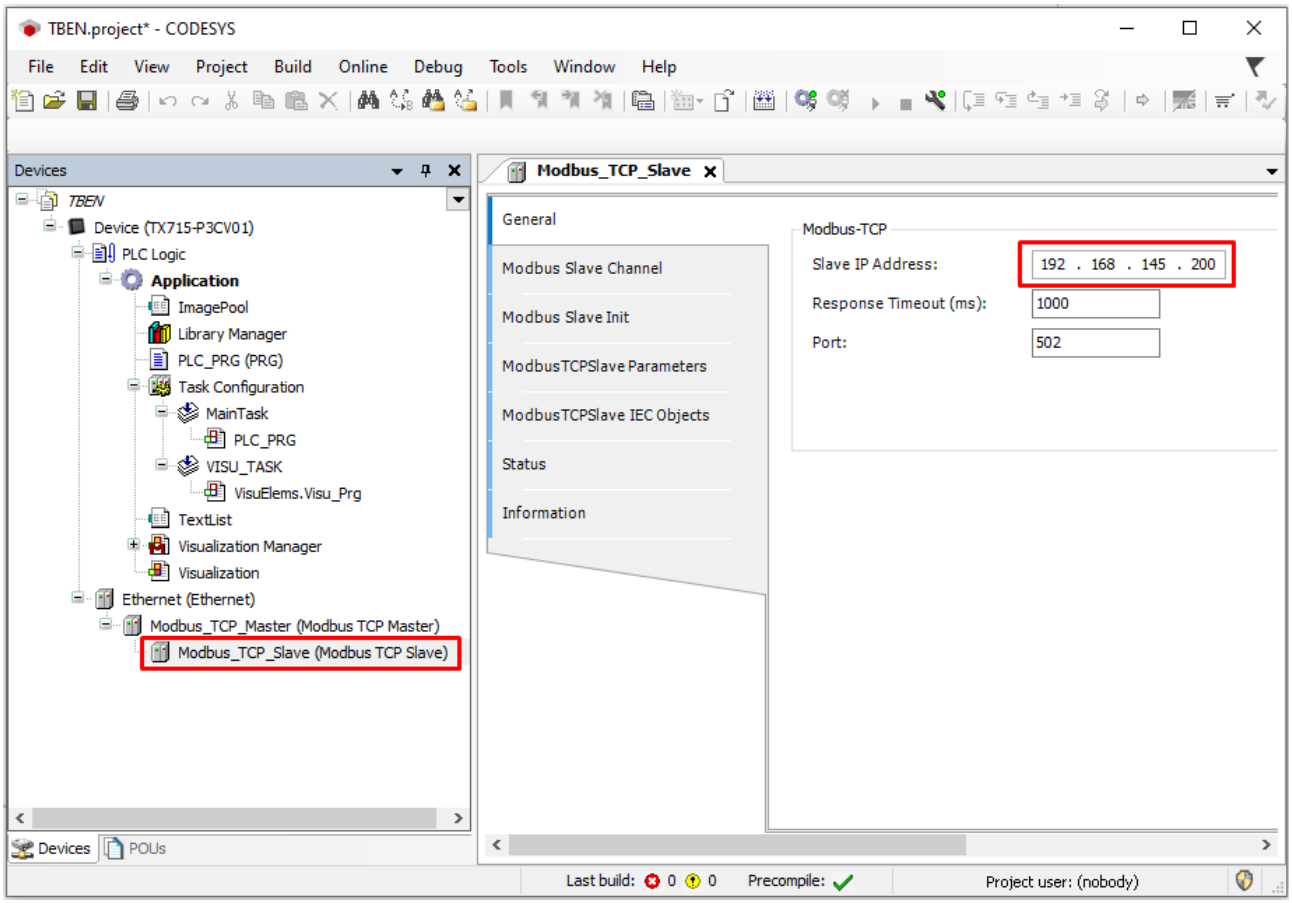


Fig. 39: Modbus TCP Slave: Setting the IP address

7.5.4 Defining modbus channels

Defining channel 0 (input data)

- Double click **Modbus TCP Slave**.
- In the register tab select **Modbus Slave Channel** → **Add Channel**.
- Enter the following values:
  Channel name
  Access type: Read Input Registers
  Offset: 0X0000 Length: 1 register
- Confirm with **OK**.

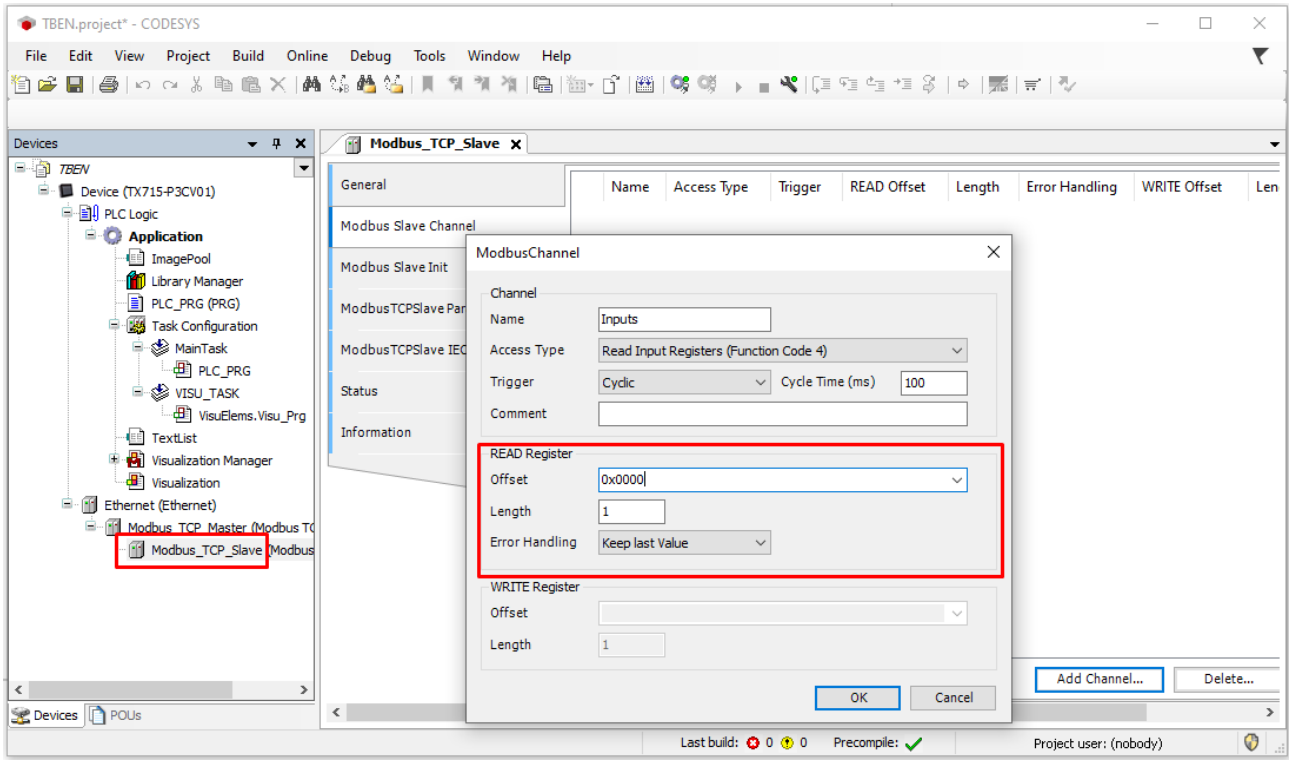


Fig. 40: Defining the input register

Defining channel 1 (output data)

- Double click **Modbus TCP Slave**.
- In the register tab select **Modbus Slave Channel** → **Add Channel**.
- Enter the following values:
  Channel name
  Access type Write Single Register
  Offset: 0x0800
  Length: 1 register
- Confirm with **OK**.

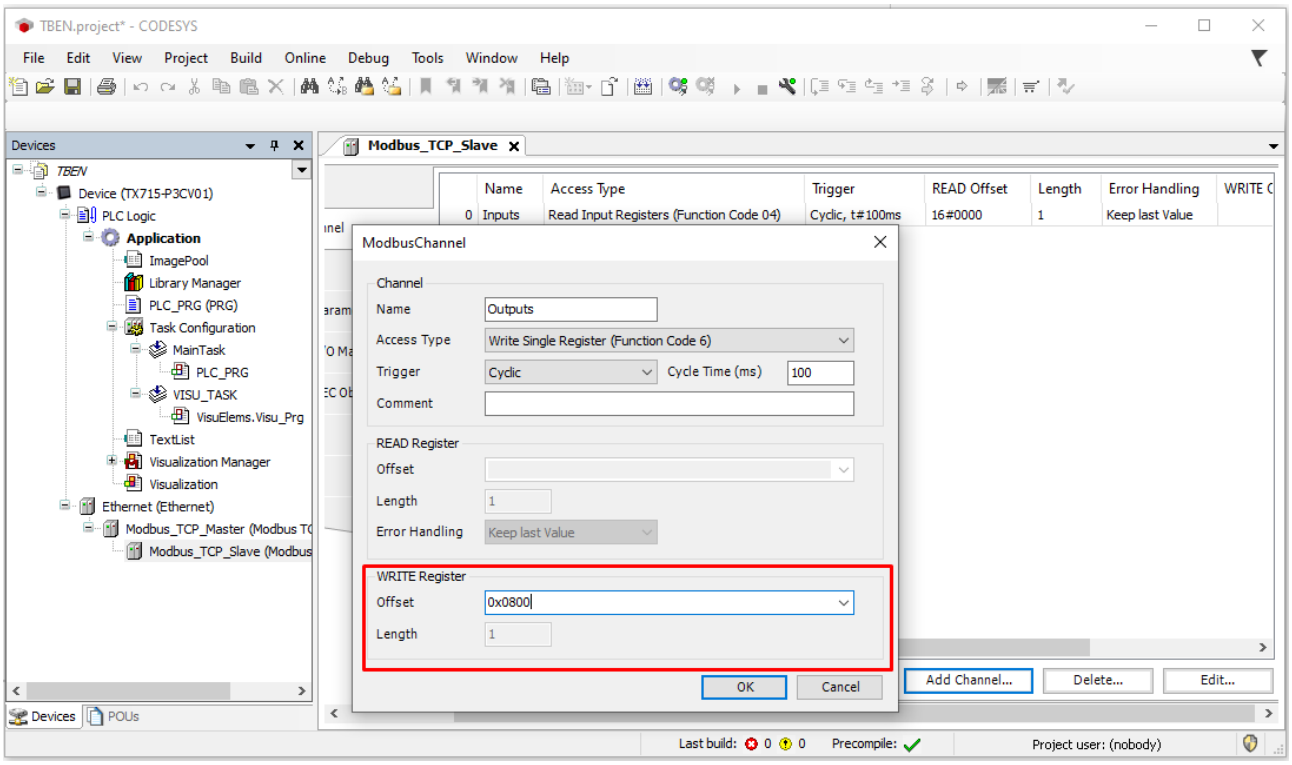


Fig. 41: Defining the output data register

7.5.5 Going online with the PLC

- ▶ Select the device.
- ▶ Click **Online → Login**.

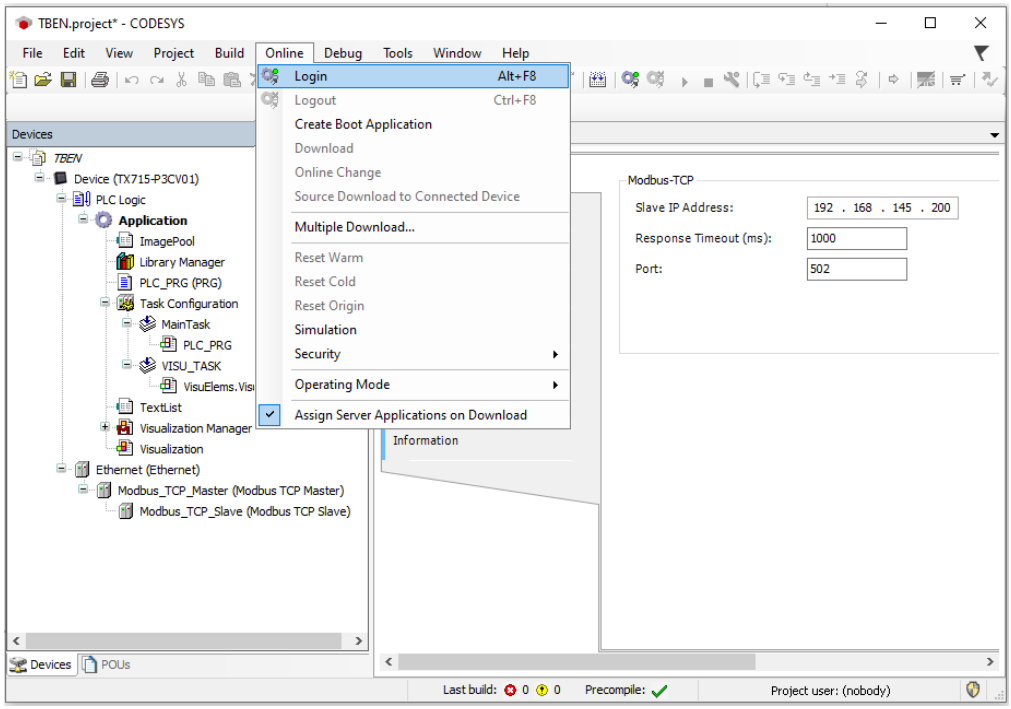


Fig. 42: Login

- ▶ Download the application to the PLC and start it via **Debug → Start**.
- ⇨ The Modbus TCP communication is setup.

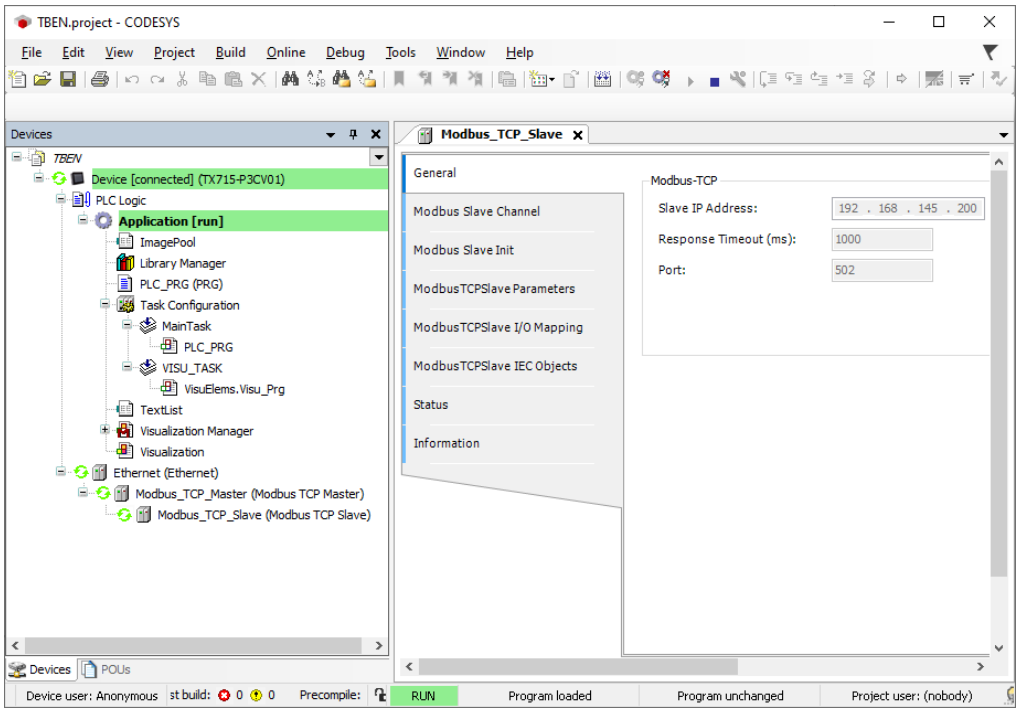


Fig. 43: Modbus TCP communication

7.5.6 Reading process data

The process data can be interpreted by means of the mapping [▶ 50] If the device is online with the PLC.

- ▶ Double click **Modbus TCP Slave**.
- ▶ Click onto register tab **Modbus TCP Slave I/O Mapping**.
- ▶ Set the function **Always update variables** to **Enabled 1 (…)**.
- ⇨ The process data are displayed.

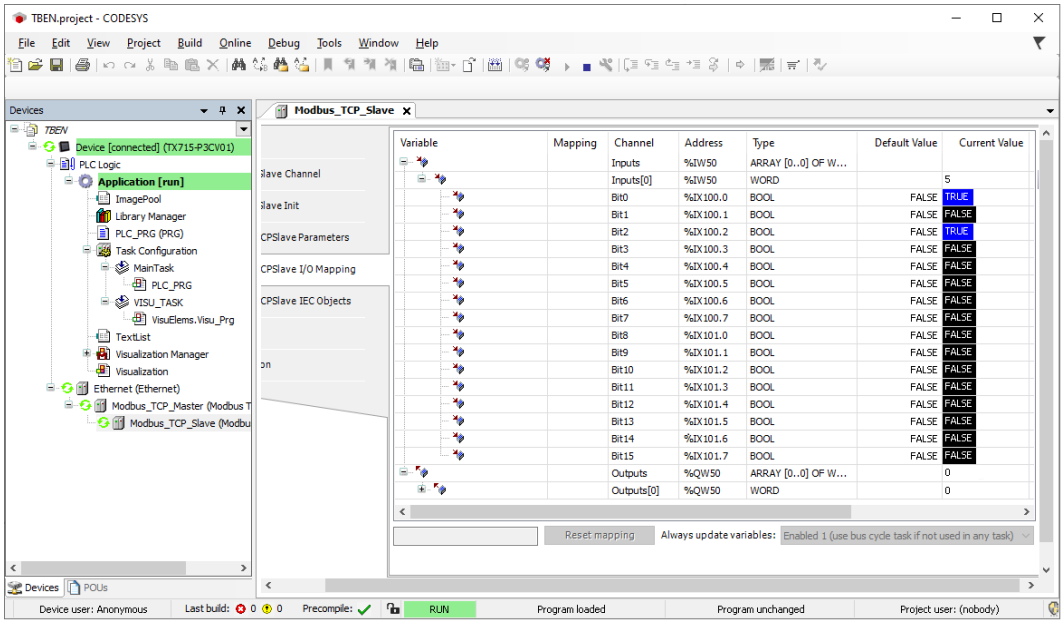


Fig. 44: Process data

7.6 Commissioning the device in EtherNet/IP

7.6.1 EDS and catalog files

The EDS and catalog files can be downloaded free of charge from **www.turck.com** .

- FEN20_ETHERNETIP.zip

7.6.2 Device Level Ring (DLR)

The devices support DLR (Device Level Ring). The DLR redundancy protocol is used to increase the stability of EtherNet/IP networks.

DLR-enabled devices have an integrated switch and can thus be integrated into a ring topology. The DLR protocol is used to detect an interruption in the ring. If the data line is interrupted, data are sent through an alternative network section, so that the network can be reconfigured as soon as possible.

DLR-capable network nodes (DLR supervisor) are provided with extended diagnostic functions which enable the devices to localize errors and thus decrease the time for error search and maintenance. Normally, the controller (i.e. the controller/PLC) assumes the supervisor function, all other network nodes are DLR participants. The supervisor blocks one of its two ports for normal Ethernet traffic, so that a line topology is created for normal Ethernet telegrams. DLR messages can continue to use the ring in both directions and thus continuously check the function of the ring.

7.6.3 Diagnostics via process data

The diagnostic messages of the IO-Link-channels are directly mapped into the process data [▶ 162].

Additionally, the device's status word contains the module diagnostics:

Byte 1 (MSB)								**Byte 0 (LSB)**							
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	FCE	-	-	-	-	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG

7.6.4 EtherNet/IP standard classes

The modules support the following EtherNet/IP Standard Classes in accordance with the CIP specification.

Class Code		Object name
Dec.	**Hex.**	
01	0x01	Identity Object [▶ 65]
04	0x04	Assembly Object [▶ 67]
06	0x06	Connection Manager Object [▶ 82]
245	0xF5	TCP/IP Interface Object [▶ 83]
246	0xF6	Ethernet Link Object [▶ 86]

Identity Object (0x01)

The following description is taken from the CIP specification, Vol. 2, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to the TURCK products.

Instance attributes

Attr. no.		Attribute name	Get/Set	Type	Value
Dec.	**Hex.**				
1	0x01	Vendor	G	UINT	Contains the manufacturer ID. TURCK = 0x30
2	0x02	Product type	G	UINT	Shows the general product type. Communications Adapter 12_{dec} = 0x0C
3	0x03	Product code	G	UINT	Identifies a special product in a device type. default: 27247_{dec} = 0x6A6F
4	0x04	Revision ■ Major ■ Minor	G	STRUCT OF: ■ USINT ■ USINT	Revision of the device which is represented by the Indentity Object. ■ 0x01 ■ 0x06
5	0x05	Device status	G	WORD	WORD
6	0x06	Serial number	G	UDINT	Contains the last 3 bytes of the MAC ID
7	0x07	Product name	G	STRUCT OF: USINT STRING [13]	i.e.: FEN20-8IOL

Device status

Bit	Name	Definition
0…1	Reserved	default = 0
2	Configured	TRUE = 1: The application in the device has been configured (default setting).
3	Reserved	default = 0
4…7	Extended Device Status	0011 = no I/O connection established 0110 = at least one I/O connection in RUN mode 0111 = at least one I/O connection established, all in IDLE mode All other settings = reserved
8	Minor recoverable fault	Recoverable fault, e.g.: ■ Undervoltage ■ Force mode of DTM active ■ Diagnostics at I/O channel active
9…10	Reserved	
11	DIAG	Common error bit
12…15	Reserved	default = 0

Common services

Service code		Class	Instance	Service name
Dec.	Hex.			
1	0x01	Yes	Yes	Get_Attribute_All Returns a predefined list of object attributes
5	0x05	No	Yes	Reset Starts the reset service for the device
14	0x0E	Yes	Yes	Get_Attribute_Single Returns the content of a specified attribute
16	0x10	No	No	Set_Attribute_Single Changes a single attribute

Assembly Object (0x04)

The Assembly Object combines attributes of several objects and allows data to be sent from one object to another or to receive data in a targeted manner

The following description of the Ethernet Link Object is taken from the CIP specification, Vol. 2, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to the Turck products.

Class attributes

Attr. no.		Attribute name	Get/Set	Type	Value
Dec.	Hex.				
1	0x01	Revision	G	UINT	2
2	0x02	Max. object instance	G	UINT	104

Instance Attributes

Attr. no.		Attribute name	Get/Set	Type	Value
Dec.	Hex.				
3	0x03	Data	S	ARRAY OF BYTE	identifies a special product in a device type Default: 27247dec. = 6A6F
4	0x04	Size	G	UINT	Number of bytes in attribute 3: 256 or variable

Common services

Service code		Class	Instance	Service name
Dec.	Hex.			
1	0x01	Yes	Yes	Get_Attribute_All returns a predefined list of object attributes
14	0x0E	Yes	Yes	Get_Attribute_Single returns the content of a specified attribute

Assembly instances

EtherNet/IP connection	Input assembly		Output assembly		Configuration assembly		Connection supported by	
	Instance	Size in 8 bit	Instance	Size in 8 bit	Instance	Size in 8 bit	Rockwell	Omron
Exclusive Owner	103	344 (342)	104	260 (258)	106	146	x	-
Exclusive Owner (Omron)	103	344 (342)	104	260 (258)	1	0	-	x
IOL 4 IN/4 OUT, diagnostics	120	56 (54)	150	36 (34)	106	146	x	x
IOL 6 IN/6 OUT, diagnostics	122	72 (70)	151	52 (50)	106	146	x	x
IOL 8 IN/8 OUT, diagnostics	124	88 (86)	152	68 (66)	106	146	x	x
IOL 4 IN/4 OUT	121	38 (36)	150	36 (34)	106	146	x	x
IOL 6 IN/6 OUT	123	54 (52)	151	52 (50)	106	146	x	x
IOL 8 IN/8 OUT	125	70 (68)	152	68 (66)	106	146	x	x

Configuration assembly (instance 106)

The modules support Configuration Assembly.

The Configuration Assembly contains:

10 byte device configuration data (EtherNet/IP specific)

+ 72 bytes (parameter data, depending on device

The meaning of the input data can be found in chapter “Parameterizing and configuring”.

Byte no.		**Bit no.**							
Dec.	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Device configuration data									
0…8	0x00… 0x08	-	-	-	-	-	-	-	-
9	0x09	-	-	-	-	-	Eth2 port setup	Eth1 port setup	QuickConnect
DXP channels									
10	0x0A	-	-	-	-	-	-	-	SRO C/Q (Ch0)
11	0x0B	-	-	-	-	-	-	-	SRO C/Q (Ch1)
12	0x0C	-	-	-	-	-	-	-	SRO C/Q (Ch2)
13	0x0D	-	-	-	-	-	-	-	SRO C/Q (Ch3)
14	0x0E	-	-	-	-	-	-	-	SRO C/Q (Ch4)
15	0x0F	-	-	-	-	-	-	-	SRO C/Q (Ch5)
16	0x10	-	-	-	-	-	-	-	SRO C/Q (Ch6)
17	0x11	-	-	-	-	-	-	-	SRO C/Q (Ch7)
18	0x12	-	-	-	-	-	-	-	SRO V1+ (Ch0)
19	0x13	-	-	-	-	-	-	-	SRO V1+ (Ch1)
20	0x14	-	-	-	-	-	-	-	SRO V1+ (Ch2)
21	0x15	-	-	-	-	-	-	-	SRO V1+ (Ch3)
22	0x16	-	-	-	-	-	-	-	SRO V1+ (Ch4)
23	0x17	-	-	-	-	-	-	-	SRO V1+ (Ch5)
24	0x18	-	-	-	-	-	-	-	SRO V1+ (Ch6)
25	0x19	-	-	-	-	-	-	-	SRO V1+ (Ch7)
26	0x1A	-	-	-	-	-	-	-	Mode V1+ (Ch0)
27	0x1B	-	-	-	-	-	-	-	Mode V1+ (Ch1)
28	0x1C	-	-	-	-	-	-	-	Mode V1+ (Ch2)
29	0x1D	-	-	-	-	-	-	-	Mode V1+ (Ch3)
30	0x1E	-	-	-	-	-	-	-	Mode V1+ (Ch4)
31	0x1F	-	-	-	-	-	-	-	Mode V1+ (Ch5)
32	0x20	-	-	-	-	-	-	-	Mode V1+ (Ch6)
33	0x21	-	-	-	-	-	-	-	Mode V1+ (Ch7)

Byte no.		Bit no.							
Dec.	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
IO-Link port parameters									
		IO-Link port 1							
34	0x22	-	-	-	-	Operation mode			
35	0x23	Cycle time							
36	0x24	-	-	-	-	-	-	-	Activate Quick Start-Up
37	0x25	-	-	-	-	-	-	-	GSD
38	0x26	-	-	-	-	-	-	-	PDIN Invalid
39	0x27	-	-	-	-	-	-	-	Deactivate diagnostics
40	0x28	-	-	-	-	-	-	Mapping PDOUT	
41	0x29	-	-	-	-	-	-	Mapping PDIN	
42…43	0x2A… 0x2B	Vendor ID							
44…47	0x2C… 0x2F	Device ID							
48…61	0x30… 0x3D	**IO-Link port 2** Assignment similar to IO-Link port 1							
62…75	0x3E… 0x4B	**IO-Link port 3** Assignment similar to IO-Link port 1							
76…89	0x4C… 0x59	**IO-Link port 4** Assignment similar to IO-Link port 1							
90…103	0x5A… 0x67	**IO-Link port 5** Assignment similar to IO-Link port 1							
104…117	0x68… 0x75	**IO-Link port 6** Assignment similar to IO-Link port 1							
118…131	0x76… 0x83	**IO-Link port 7** Assignment similar to IO-Link port 1							
132…145	0x84… 0x91	**IO-Link port 8** Assignment similar to IO-Link port 1							

Device configuration data

Device configuration data

Default values are shown in **bold**.

Designation	Value		Meaning
QuickConnect	0	**Disabled**	QuickConnect is deactivated.
	1	activated	QuickConnect is activated.
Eth x Port-Setup	0	**Auto negotiation**	The port is set to autonegotiation.
	1	100BT/FD	Fix setting of the communication parameters for the Ethernet port to: ■ 100BaseT ■ Full duplex

Input assembly instances

EtherNet/IP connection	Input assembly		Device status in byte	DXP (C/Q, V1+, DVS) in byte	IO-Link inputs in byte	Diagnostics in byte	Event data in byte
	Instance	Size in 8 bit					
Exclusive Owner	103	344 (342)	2	4	256	18	64
Exclusive Owner (Omron)	103	344 (342)	2	4	256	18	64
IOL 4 IN/4 OUT, diagnostics	120	56 (54)	2	4	32	18	0
IOL 6 IN/6 OUT, diagnostics	122	72 (70)	2	4	48	18	0
IOL 8 IN/8 OUT, diagnostics	124	88 (86)	2	4	64	18	0
IOL 4 IN/4 OUT	121	38 (36)	2	4	32	0	0
IOL 6 IN/6 OUT	123	54 (52)	2	4	48	0	0
IOL 8 IN/8 OUT	125	70 (68)	2	4	64	0	0

Instance 103 – Exclusive Owner

The description of the input data can be found in chapter "Operating" [▶ 162].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Status word [▶ 167]																	
0	0x00	-	FCE	-	-	-	COM	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG
Process input data valid									**Inputs**								
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
2	0x02	-	-	-	-	-	-	-	-	DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																	
3…18	0x03…0x12	16 words per IO-Link port															
19…34	0x13…0x22																
35…50	0x23…0x32																
51…66	0x33…0x42																
67…82	0x43…0x52																
83…97	0x53…0x62																
98…114	0x63…0x72																
115…130	0x73…0x82																
Overcurrent diagnostics																	
131	0x83	ERR V1+ (Ch7)	ERR V1+ (Ch6)	ERR V1+ (Ch5)	ERR V1+ (Ch4)	ERR V1+ (Ch3)	ERR V1+ (Ch2)	ERR V1+ (Ch1)	ERR V1+ (Ch0)	ERR DXP C/Q (Ch7)	ERR DXP C/Q (Ch6)	ERR DXP C/Q (Ch5)	ERR DXP C/Q (Ch4)	ERR DXP C/Q (Ch3)	ERR DXP C/Q (Ch2)	ERR DXP C/Q (Ch1)	ERR DXP C/Q (Ch0)

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
IO-Link port diagnostics																	
		Port 1															
132	0x84	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-
		…															
		Port 8															
139	0x8B	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-
IO-Link events																	
140	0x8C	Port (1st event)								Qualifier (1st event)							
141	0x8D	Event Code low byte (1st event)								Event Code high byte (1st event)							
…	…																
170	0xAA	Port 16th event)								Qualifier (16th event)							
171	0xAB	Event Code low byte (16th event)								Event Code high byte (16th event)							

Instance 120 – 4 byte IN/4 byte OUT, diagnostics

The description of the input data can be found in chapter "Operating" [▶ 162].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Status word [▶ 167]																	
0	0x00	-	FCE	-	-	-	COM	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG
Process input data valid									**Inputs**								
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
2	0x02	-	-	-	-	-	-	-	-	DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																	
3…4	0x03… 0x04	2 words per IO-Link port															
5…6	0x05… 0x06																
7…8	0x07… 0x08																
9… 10	0x09… 0x0A																
11… 12	0x0B… 0x0C																
13… 14	0x0D …0x0E																
15… 16	0x0F… 0x10																
17… 18	0x11… 0x12																
Overcurrent diagnostics																	
19	0x13	ERR V1+ (Ch7)	ERR V1+ (Ch6)	ERR V1+ (Ch5)	ERR V1+ (Ch4)	ERR V1+ (Ch3)	ERR V1+ (Ch2)	ERR V1+ (Ch1)	ERR V1+ (Ch0)	ERR DXP C/Q (Ch7)	ERR DXP C/Q (Ch6)	ERR DXP C/Q (Ch5)	ERR DXP C/Q (Ch4)	ERR DXP C/Q (Ch3)	ERR DXP C/Q (Ch2)	ERR DXP C/Q (Ch1)	ERR DXP C/Q (Ch0)
IO-Link port diagnostics																	
		Port 1															
20	0x14	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-
…	…	…															
		Port 8															
27	0x1B	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-

Instance 121 – 4 byte IN/ 4 byte OUT

The description of the input data can be found in chapter "Operating" [▶ 162].

Word no.		**Bit no.**															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Status word [▶ 167]																	
0	0x00	-	FCE	-	-	-	COM	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG
Process input data valid									**Inputs**								
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
2	0x02	-	-	-	-	-	-	-	-	DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																	
3…4	0x03… 0x04	2 words per IO-Link port															
5…6	0x05… 0x06																
7…8	0x07… 0x08																
9… 10	0x09… 0x0A																
11… 12	0x0B… 0x0C																
13… 14	0x0D …0x0E																
15… 16	0x0F… 0x10																
17… 18	0x11… 0x12																

Instance 122 – 6 byte IN/6 byte OUT, diagnostics

The description of the input data can be found in chapter "Operating" [▶ 162].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Status word [▶ 167]																	
0	0x00	-	FCE	-	-	-	COM	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG
Process input data valid									**Inputs**								
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
2	0x02	-	-	-	-	-	-	-	-	DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																	
3…5	0x03… 0x05	3 words per IO-Link port															
6…8	0x06… 0x08																
9… 11	0x09… 0x0B																
12… 14	0x0C… 0x0E																
15… 17	0x0F… 0x11																
18… 20	0x12… 0x14																
21… 23	0x15… 0x17																
24… 26	0x18… 0x1A																
Overcurrent diagnostics																	
27	0x1B	ERR V1+ (Ch7)	ERR V1+ (Ch6)	ERR V1+ (Ch5)	ERR V1+ (Ch4)	ERR V1+ (Ch3)	ERR V1+ (Ch2)	ERR V1+ (Ch1)	ERR V1+ (Ch0)	ERR DXP C/Q (Ch7)	ERR DXP C/Q (Ch6)	ERR DXP C/Q (Ch5)	ERR DXP C/Q (Ch4)	ERR DXP C/Q (Ch3)	ERR DXP C/Q (Ch2)	ERR DXP C/Q (Ch1)	ERR DXP C/Q (Ch0)
IO-Link port diagnostics																	
		Port 1															
28	0x1C	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-
…	…	…															
		Port 8															
35	0x23	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-

Instance 123 – 6 byte IN/ 6 byte OUT

The description of the input data can be found in chapter "Operating" [▶ 162].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Status word [▶ 167]																	
0	0x00	-	FCE	-	-	-	COM	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG
Process input data valid									**Inputs**								
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
2	0x02	-	-	-	-	-	-	-	-	DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																	
3…5	0x03… 0x05	3 words per IO-Link port															
6…8	0x06… 0x08																
9… 11	0x09… 0x0B																
12… 14	0x0C… 0x0E																
15… 17	0x0F… 0x11																
18… 20	0x12… 0x14																
21… 23	0x15… 0x17																
24… 26	0x18… 0x1A																

Instance 124 – 8 byte IN/8 byte OUT, diagnostics

The description of the input data can be found in chapter "Operating" [▶ 162].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Status word [▶ 167]																	
0	0x00	-	FCE	-	-	-	COM	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG
Process input data valid									**Inputs**								
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
2	0x02	-	-	-	-	-	-	-	-	DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																	
3…6	0x03… 0x06	4 words per IO-Link port															
7… 10	0x07… 0x0A																
11… 14	0x0B… 0x0E																
15… 18	0x0F… 0x12																
19… 22	0x13… 0x16																
23… 26	0x17… 0x1A																
27… 30	0x1B… 0x1E																
31… 34	0x1F… 0x22																
Overcurrent diagnostics																	
35	0x23	ERR V1+ (Ch7)	ERR V1+ (Ch6)	ERR V1+ (Ch5)	ERR V1+ (Ch4)	ERR V1+ (Ch3)	ERR V1+ (Ch2)	ERR V1+ (Ch1)	ERR V1+ (Ch0)	ERR DXP C/Q (Ch7)	ERR DXP C/Q (Ch6)	ERR DXP C/Q (Ch5)	ERR DXP C/Q (Ch4)	ERR DXP C/Q (Ch3)	ERR DXP C/Q (Ch2)	ERR DXP C/Q (Ch1)	ERR DXP C/Q (Ch0)
IO-Link port diagnostics																	
		Port 1															
36	0x24	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-
…	…	…															
		Port 8															
43	0x2B	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPR	-

Instance 125 – 8 byte IN/ 8 byte OUT

The description of the input data can be found in chapter "Operating" [▶ 162].

Word no.		**Bit no.**															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Status word [▶ 167]																	
0	0x00	-	FCE	-	-	-	COM	$V1+_A$	-	$V1+_B$	-	-	-	-	-	AR-GEE	DIAG
Process input data valid									**Inputs**								
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
2	0x02	-	-	-	-	-	-	-	-	DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																	
3…6	0x03… 0x06	4 words per IO-Link port															
7… 10	0x07… 0x0A																
11… 14	0x0B… 0x0E																
15… 18	0x0F… 0x12																
19… 22	0x13… 0x16																
23… 26	0x17… 0x1A																
27… 30	0x1B… 0x1E																
31… 34	0x1F… 0x22																

Output assembly instances

EtherNet/IP connection	Output assembly		Control word in byte	DXP (C/Q, V1+) in byte	IO-Link outputs in byte
	Instance	Size in 8 bit			
Exclusive Owner	104	260 (258)	2	2	256
IOL 4 IN/4 OUT	150	36 (34)	2	2	32
IOL 6 IN/6 OUT	151	52 (50)	2	2	48
IOL 8 IN/8 OUT	152	68 (66)	2	2	64

Instance 104 – Exclusive Owner

The description of the input data can be found in chapter "Operating" [▶ 165].

Word no.		Bit no.															
Dec.	Hex.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Control word																	
0	0x00	-	Reserved														
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
IO-Link process output data																	
2…17	0x02…0x11	16 words per port															
18…33	0x12…0x21																
34…49	0x22…0x31																
50…65	0x32…0x41																
66…81	0x42…0x51																
82…97	0x52…0x61																
98…113	0x62…0x71																
114…129	0x72…0x81																

Instance 150 – 4 byte IN/ 4 byte OUT

The description of the input data can be found in chapter "Operating" [▶ 165].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Control word																	
0	0x00	-	Reserved														
Outputs																	
1	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)	DXP C/Q (Ch0)
IO-Link process output data																	
2…3	0x02… 0x03	2 words per port															
4…5	0x04… 0x05																
6…7	0x06… 0x07																
8…9	0x08… 0x09																

Instance 151 – 6 byte IN/ 6 byte OUT

The description of the input data can be found in chapter "Operating" [▶ 165].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Control word																	
0	0x00	-	Reserved														
Outputs																	
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
	IO-Link process output data																
2…4	0x02… 0x04	3 words per port															
5…7	0x05… 0x07																
8… 10	0x08… 0x0A																
11… 13	0x0B… 0x0D																

Instance 152 – 8 byte IN/ 8 byte OUT

The description of the input data can be found in chapter "Operating" [▶ 165].

Word no.		Bit no.															
Dec.	**Hex.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Control word																	
0	0x00	-	Reserved														
Outputs																	
1	0x01	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
IO-Link process output data																	
2…5	0x02… 0x05	4 words per port															
6…9	0x06… 0x09																
10… 13	0x0A… 0x0D																
14… 17	0x0E… 0x11																

Connection Manager Object (0x06)

This object is used for connection and connectionless communications, including establishing connections across multiple subnets.

The following description of the Ethernet Link Object is taken from the CIP specification, Vol. 2, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to the TURCK products.

Common services

Service code		Class	Instance	Meaning
Dec.	**Hex.**			
84	0x54	No	Yes	FWD_OPEN_CMD (opens a connection)
78	0x4E	No	Yes	FWD_CLOSE_CMD (closes a connection)
82	0x52	No	Yes	UNCONNECTED_SEND_CMD

TCP/IP Interface Object (0xF5)

The following description of the Ethernet Link Object is taken from the CIP specification, Vol. 2, Rev. 1.1 by ODVA & ControlNet International Ltd. and adapted to the TURCK products.

Class attributes

Attr. no.		Designation	Get/Set	Type	Value
Dec.	Hex.				
1	0x01	Revision	G	UINT	1
2	0x02	Max. object instance	G	UINT	1
3	0x03	Number of instances	G	UINT	1
6	0x06	Max. class identifier	G	UINT	7
7	0x07	Max. instance attribute	G	UINT	6

Instance Attributes

Attr. no.		Designation	Get/Set	Type	Value
Dec.	Hex.				
1	0x01	Status	G	DWORD	Interface status
2	0x02	Configuration capability	G	DWORD	Interface capability flag
3	0x03	Configuration control	G/S	DWORD	Interface control flag
4	0x04	Physical link object	G	STRUCT	
		Path size		UINT	Number of 16 bit words: 0x02
		Path		Padded EPATH	0x20, 0xF6, 0x24, 0x01
5	0x05	Interface configuration	G	Structure of:	TCP/IP network interface configuration
		IP address	G	UDINT	Actual IP address
		Network mask	G	UDINT	Actual network mask
		Gateway addr.	G	UDINT	Actual default gateway
		Name server	G	UDINT	0 = no server address configured
		Name server 2	G	UDINT	0 = no secondary server address configured
		Domain name	G	UDINT	0 = no Domain Name configured
6	0x06	Host name	G	STRING	0 = no host name configured
12	0x0C	QuickConnect	G/S	BOOL	0 = deactivate 1 = activate

Common services

Service code		Class	Instance	Meaning
Dec.	Hex.			
1	0x01	Yes	Yes	Get_Attribute_All
2	0x02	No	No	Set_Attribute_All
14	0x0E	Yes	Yes	Get_Attribute_Single
16	0x10	No	Yes	Set_Attribute_Single

Interface Status

The Status attribute indicates the status of the TCP/IP network interface.

Bit	Designation	Meaning
0…3	Interface configuration status	Indicates the status of the Interface Configuration attribute: 0 = The Interface Configuration attribute has not been configured 1 = The Interface Configuration attribute contains valid configuration. 2…15 = reserved
4…31	Reserved	

Configuration Capability

The Configuration Capability indicates the device's support for optional network configuration capability.

Bit	Designation	Meaning	Value
0	BOOTP client	The device is capable of obtaining its network configuration via BOOTP.	1
1	DNS client	The device is capable of resolving host names by querying a DNS server.	0
2	DHCP client	The device is capable of obtaining its network configuration via DHCP.	1

Configuration control

The Configuration Control attribute is used to control network configuration options.

Bit	Designation	Meaning
0…3	Startup configuration	Determines how the device shall obtain its initial configuration. 0 = The device shall use the interface configuration values previously stored (for example, in non-volatile memory or via hardware switches, etc). 1…3 = reserved
4	DNS Enable	Always 0
5…31	Reserved	Set to 0

Interface Configuration

This attribute contains the configuration parameters required to operate a TCP/IP device.

To change this attribute, proceed as follows:

- ▶ Read out the attribute.
- ▶ Change the parameters.
- ▶ Set the attribute.
- ⇨ The TCP/IP Interface Object applies the new configuration upon completion of the Set service. If the value of the Startup Configuration bits (Configuration Control attribute) is 0, the new configuration is stored in non-volatile memory.

The device does not reply to the set service until the values are safely stored to non-volatile memory.

An attempt to set any of the components of the Interface Configuration attribute to invalid values results in an error (status code 0x09) returned from the Set service. If initial configuration is obtained via BOOTP or DHCP, the Interface Configuration attribute components are all 0 until the BOOTP or DHCP reply is received. Upon receipt of the BOOTP or DHCP reply, the Interface Configuration attribute shows the configuration obtained via BOOTP/DHCP.

Host name

This attribute contains the device's host name. The host name attribute is used when the device supports the DHCP-DNS Update capability and has been configured to use DHCP upon start up. The mechanism allows the DHCP client to transmit its host name to the DHCP server. The DHCP server then updates the DNS records on behalf of the client.

Ethernet Link Object (0xF6)

The following description of the Ethernet Link Object is taken from the CIP specification, Vol. 2, Rev. 1.1 by ODVA & ControlNet International Ltd. and adapted to the Turck products.

Class attributes

Attr.-no.		Designation	Get/Set	Type	Value
Dec.	Hex.				
1	0x01	Revision	G	UINT	1
2	0x02	Max. object instance	G	UINT	1
3	0x03	Number of instances	G	UINT	1
6	0x06	Max. class identifier	G	UINT	7
7	0x07	Max. instance attribute	G	UINT	6

Instance attributes

Attr.-no.		Designation	Get/Set	Type	Value
Dec.	Hex.				
1	0x01	Interface speed	G	UDINT	Speed in megabit per second (e.g. 10, 100, 1000 etc.)
2	0x02	Interface flags	G	DWORD	Interface capability flag
3	0x03	Physical address	G	ARRAY OF USINT	Contains the interface's MAC address (Turck: 00:07:46:xx:xx:xx)
6	0x06	Interface control	G	2 WORD	Allows port-wise changes of the Ethernet-settings
7	0x07	Interface type	G		
10	0x0A	Interface label	G		

Interface flags

Bit	Designation	Meaning	Default value
0	Link status	Indicates whether or not the Ethernet communications interface is connected to an active network. 0 = inactive link 1 = active link	Depends on application
1	Half/full duplex	0 = Half duplex 1 = Full duplex If the Link Status flag is 0, the value of the Half/Full Duplex flag is indeterminate.	Depends on application
2…4	Negotiation status	Indicates the status of the automatic autonegotiation 0 = autonegotiation in progress 1 = autonegotiation and speed detection failed, using default values for speed and duplex (10 Mbps/half duplex). 2 = auto-negotiation failed but detected speed (default: half duplex). 3 = successfully negotiated speed and duplex 4 = autonegotiation not started, yet. Forced speed and duplex.	Depends on application

Bit	Designation	Meaning	Default value
5	Manual setting requires reset	0 = interface can activate changes to link parameters (auto-negotiate, duplex mode, interface speed) automatically 1 = device requires a Reset service to be issued to its Identity Object in order to adapt the changes.	0
6	Local Hardware Fault	0 = interface detects no local hardware fault 1 = local hardware error detected	0

Common services

Service code		Class	Instance	Meaning
Dec.	Hex.			
1	0x01	Yes	Yes	Get_Attribute_All
14	0x0E	Yes	Yes	Get_Attribute_Single
76	0x4C	No	Yes	Enetlink_Get_and_Clear

7.6.5 Vendor Specific Classes (VSC)

In addition to supporting the above named CIP Standard Classes, the device support the vendor specific classes (VSCs) described in the following.

Class Code		Name	Description
Dec.	Hex.		
100	0x64	Gateway Class [▶ 87]	Data and parameters for the field bus specific part of the device.
103	0x67	IO-Link Parameter Object [▶ 89]	ISDU object for acyclic transmission of parameter data between IO-Link master and IO-Link device
138	0x8A	IO-Link Events Class [▶ 94]	IO-Link events
179	0xB3	IO-Link Port Class [▶ 95]	Parameters and diagnostics of the IO-Link-channels
198	0xB4	Basic Class [▶ 97]	Parameters and diagnostics of the digital channels channels

Gateway Class (VSC 100)

Object instance

Attr. no.		Designation	Get/Set	Type	Meaning
Dec.	Hex.				
100	0x64	Max. object attribute	G	USINT	Number of the last object attribute to be implemented
101	0x65	Hardware revision	G	STRUCT	Hardware revision number of the device (USINT Maj./USINT Min.)
102	0x66	Firmware revision	G	STRUCT	Firmware revision of the boot firmware (maj./min.).
103	0x67	Service tool ident number	G	UDINT	BOOT-ID (identification number)
104	0x68	Hardware Info	G	STRUCT	Module hardware information (UINT)

Object instance 2, gateway instance

Attr. no.		Designation	Get/Set	Type	Meaning
Dec.	Hex.				
109	0x6D	Device status	G	STRUCT	Contains the device status.
115	0x73	On IO connection timeout	G/S	ENUM USINT	Reaction when the time limit for an I/O connection is exceeded:
					0: SWITCH IO FAULTED (0): The channels are switched to substitute value.
					1: SWITCH IO OFF (1): The outputs are switched to 0.
					2: SWITCH IO HOLD (2): No further changes to I/O data. The outputs are held.
138	0x8A	GW status register	G/S	DWORD	Activates or deactivates the mapping of the status word into the device's input data. Activating or deactivating of the status word is only possible in Assembly Instance 103.
139	0x8B	GW control register	G/S	DWORD	Activates or deactivates the mapping of the control word into the device's output data. Activating or deactivating of the control word is only possible in Assembly Instance 104.
140	0x8C	Disable protocols	G/S	UINT	Deactivation of the used Ethernet protocol.
					Bit 0: Deactivates EtherNet/IP (cannot be deactivated via the EtherNet/IP interface).
					Bit 1: Deactivates Modbus TCP
					Bit 2: Deactivates PROFINET
					Bit 15: Deactivates the web server

IO-Link Parameter Object (VSC 103)

The IO-Link Parameter Object enables the acyclic transfer of parameter data between the IO-Link master and the IO-Link device.

Instance 1 of the object addresses the IO-Link master

The instance attribute numbers address the IO-Link port at the IO-Link master or the Port-0 functions of the IO-Link master.

- **1…n**: IO-Link port at the IO-Link master, n = number of IO-Link ports at the IO-Link master
- **128**: Port-0 functions of the IO-Link master

Instance attributes

Common services

Service code		Class	Instance	Service name
Dec.	Hex.			
14	0x0E	Yes	No	Get_Attribute_Single Returns the content of a specified attribute.
75	0x4B	No	Yes	Read_ISDU The service reads parameters from the connected IO-Link device.
76	0x4C	No	Yes	Write_ISDU The service writes parameters from the connected IO-Link device.

Read_ISDU - Request

Data	Value/content		
Class	0x67	IO-Link Parameter Object	
Instance	0x01	Addressing the IO-Link master	
Instance attribute	0x01…n, 128	IO-Link port number, or 128 for Port-0 functions	
Service code	0x4B	Read_ISDU	
Data	Request parameters for the ISDU Read Service		
	Name	**Data type**	**Description**
Data byte 0	Index (LSB)	UINT	LSB from index of the IO-Link ISDU object acc. to IODD
Data byte 1	Index (MSB)	UINT	MSB from index of the IO-Link ISDU object acc. to IODD
Data byte 2	Sub index	USINT	Sub index from the IO-Link ISDU object acc. to IODD

Read_ISDU – Response

- CIP Service Response, General-Status ≠ 0 → error-free access
  structure of the response:

Name	Data type	Description
ISDU data	Array of Byte	Read data, max. 232 byte

- CIP Service Response, General-Status ≠ 0 → access error
  structure of the response:

Name	Data type	Description
IOL_Master Error	UINT	IO-Link master specific, see IO-Link master Error Codes
IOL_Device Error	UINT	IO-Link device specific, see IO-Link device Error Codes and device documentation

Example:
Read access – reading the device name of device at port 4

Data	Value/content	Description	
Class	0x67	IO-Link Parameter Object	
Instance	0x01	Addressing the IO-Link master	
Instance attribute	0x04	IO-Link port number	
Service code	0x4B	Read_ISDU: Read access	
Data	Request parameters for the ISDU Read Service		
	Name	**Data type**	**Description**
Data byte 0	0x12	UINT	Index for the product name in the device (e.g. Turck I/O hub TBIL-M1-16DXP) according to IODD
Data byte 1	0x00	UINT	-
Data byte 2	0x00	USINT	The index has no sub index.

- CIP Service Response:

Name	Data type	Description
ISDU data	Array of Byte	**Error-free access:** Content: 54 42 49 4C 2D 4D 31 2D 31 36 44 58 50 (TBIL-M1-16DXP) **Access error:** content of data: error code

Write_ISDU – Request

Data	Value/content	Description	
Class	0x67	IO-Link Parameter Object	
Instance	0x01	Addressing the IO-Link master	
Instance attribute	0x01…n, 128	IO-Link port number, or 128 for Port-0 functions	
Service code	0x4C	Write_ISDU	
Data	Request parameters for the ISDU write service		
	Name	**Data type**	**Description**
Data byte 0	Index (LSB)	UINT	LSB from index of the IO-Link ISDU object acc. to IODD
Data byte 1	Index (MSB)	UINT	MSB from index of the IO-Link ISDU object acc. to IODD
Data byte 2	Sub index	USINT	Sub index from the IO-Link ISDU object acc. to IODD
Data byte 3…data byte n	Data	Array of Byte	Parameter data (n= length of ISDU object + 3)

Write_ISDU – Response

- CIP Service Response, general status = 0 → error-free access
  Service response without further data
- CIP Service Response, General-Status ≠ 0 → access error structure of the response:

Name	Data type	Description
IOL_Master Error	UINT	IO-Link master specific, see IO-Link master Error Codes
IOL_Device Error	UINT	IO-Link device specific, see IO-Link device Error Codes and device documentation

Example:
Write access – Application Specific Tag is written into the device at port 4

Data	Value/content	Description
Class	0x67	IO-Link Parameter Object
Instance	0x01	Addressing the IO-Link master
Instance attribute	0x04	IO-Link port number
Service code	0x4C	Write_ISDU: Write access

Data	Value/content	Description	
Data	Request parameters for the ISDU write service		
	Name	**Data type**	**Description**
	0x18	UINT	Index for the application specific tag in the device (e.g. In Turck I/O-Hub TBIL-M1-16DXP)
	0x00	USINT	The index has no sub index.
	Byte 0: 0x54 Byte 1: 0x65 Byte 2: 0x6D Byte 3: 0x70 Byte 4: 0x65 … Byte 17: 0x31 Byte 18…31: 00		The Application Specific Tag of the device can consist of 32 byte, example: ASCII: Temperature_sensor1 Hex: 54 65 6d 70 65 72 61 74 75 72 65 5f 73 65 6e 73 6f 72 31 00 00… The remainder of the 32 bytes not required is filled with 00.

IO-Link master error codes

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
0x8002	Wrong port function	Port function not available
…	reserved	

IO-Link device error codes

Error code	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.

Error code	Designation acc. to specification	Meaning
0x8021	SERV_NOTAVAIL_ LOCCTRL	Service temporarily not available, device is busy (e. g. teaching or parameterization of the device at the device active)
0x8022	SERV_NOTAVAIL_ DEVCTRL	Service temporarily not available, device is busy (e. g. teaching or parameterization of the device via DTM/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… 0x8FF	VENDOR_SPECIFIC	

IO-Link Event Class (VSC 138)

Attr. no.		Designation	Get/ Set	Type	Meaning
Dec.	Hex.				
1	0x01	IO-Link Events – port 1	G	USINT	Port number of the port which sends the 1st IO-Link Event.
…	…				
16	0x10	IO-Link Events – port 16	G	USINT	Port number of the port which sends the 16th IO-Link Event.
17	0x11	IO-Link Events – Qualifier 1	G	USINT	Qualifier of the 1st IO-Link Event
…	…				
32	0x20	IO-Link Events – Qualifier 16	G	USINT	Qualifier of the 16th IO-Link Event
33	0x21	IO-Link Events – Event Code 1	G	USINT	Event Code of the 1st IO-Link Event
…	…				
48	0x30	IO-Link Events – Event Code 16	G	USINT	Event Code of the 16th IO-Link Event

IO-Link Port Class (VSC 179)

This class has one instance per IO-Link port at the IO-Link master module.

Attr. no.		Designation	Get/Set	Type	Meaning
Dec.	Hex.				
Parameters					
1	0x01	Operation mode	G/S	USINT	0 = reserved 1…3 = reserved 4 = DI (with parameter access) 5…7 = reserved 8 = DI 9 = DX 10 = deactivated 11 = No device check (autostart) 12 = Type comp. device V1.0 13 = Type comp. device V1.1 14 = Type comp. device V1.1, backup + restore 15 = Type comp. device V1.1, restore
2	0x02	Cycle time	G/S	USINT	See IO-Link_ Paramter_Cycle_Time
3	0x03	Activate Quick Start-Up	G/S	USINT	0 = no 1 = yes
4	0x04	Device parameterization via GSD	G/S	USINT	0 = no 1 = yes
5	0x05	Process input data invalid	G/S	USINT	0 = diagnostics generated 1 = no diagnostics generated
6	0x06	Deactivate diagnostics	G/S	USINT	0 = no 1 = notifications 2 = notifications and warnings 3 = yes
7	0x07	Process input data mapping	G/S	USINT	0 = direct 1 = swap 16 bit 2 = swap 32 bit 3 = swap all
8	0x08	Process output data mapping	G/S	USINT	0 = direct 1 = swap 16 bit 2 = swap 32 bit 3 = swap all
9	0x09	Vendor ID	G/S	INT	
10	0x0A	Device ID	G/S	DINT	
Diagnostics					
11	0x0B	Wrong or missing device	G	USINT	0 = inactive 1 = active
12	0x0C	Data storage error	G	USINT	0 = inactive 1 = active
13	0x0D	Process input data invalid	G	USINT	0 = inactive 1 = active
14	0x0E	Hardware error	G	USINT	0 = inactive 1 = active
15	0x0F	Maintenance events	G	USINT	0 = inactive 1 = active

Attr. no.		Designation	Get/Set	Type	Meaning
Dec.	Hex.				
16	0x10	Out-of-specification events	G	USINT	0 = inactive 1 = active
17	0x11	Parameterization error	G	USINT	0 = inactive 1 = active
18	0x12	Over temperature	G	USINT	0 = inactive 1 = active
19	0x13	Lower limit underrun	G	USINT	0 = inactive 1 = active
20	0x14	Upper limit value exceeded	G	USINT	0 = inactive 1 = active
21	0x15	Undervoltage	G	USINT	0 = inactive 1 = active
22	0x16	Overvoltage	G	USINT	0 = inactive 1 = active
23	0x17	Overload	G	USINT	0 = inactive 1 = active
24	0x18	Common error	G	USINT	0 = inactive 1 = active
25	0x19	Port parameterization error	G	USINT	0 = inactive 1 = active
Process data					
26	0x1A	Input data word 0	G	USINT	
…	…	…	G	USINT	
41	0x29	Input data word 15	G	USINT	
42	0x2A	Output data word 0	G	USINT	
…	…	…	G	USINT	
57	0x39	Output data word 15	G	USINT	

Basic Class (VSC 198)

Attr. no.		Designation	Get/Set	Type	Meaning
Dec.	Hex.				
1	0x01	Basic 0 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
2	0x02	Basic 1 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
3	0x03	Basic 2 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
4	0x04	Basic 3 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
5	0x05	Basic 4 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
6	0x06	Basic 5 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
7	0x07	Basic 6 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
8	0x08	Basic 7 – Manual output reset after overcurr. C/Q	G/S	USINT	0 = no 1 = yes
9	0x09	Basic 0 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
10	0x0A	Basic 1 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
11	0x0B	Basic 2 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
12	0x0C	Basic 3 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
13	0x0D	Basic 4 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
14	0x0E	Basic 5 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
15	0x0F	Basic 6 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
16	0x10	Basic 7 – Manual output reset after overcurr. V1+	G/S	USINT	0 = no 1 = yes
17	0x11	Basic 0 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable
18	0x12	Basic 1 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable
19	0x13	Basic 2 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable
20	0x14	Basic 3 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable
21	0x15	Basic 4 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable
22	0x16	Basic 5 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable

Attr. no.		Designation	Get/Set	Type	Meaning
Dec.	Hex.				
23	0x17	Basic 6 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable
24	0x18	Basic 7 – Mode V1+	G	USINT	0 = 24 VDC 1 = switchable
25	0x19	Basic 0 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
26	0x1A	Basic 1 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
27	0x1B	Basic 2 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
28	0x1C	Basic 3 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
29	0x1D	Basic 4 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
30	0x1E	Basic 5 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
31	0x1F	Basic 6 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
32	0x20	Basic 7 – Overcurrent output C/Q	G	USINT	0 =- 1 = active
33	0x21	Basic 0 – Overcurrent output V1+	G	USINT	0 =- 1 = active
34	0x22	Basic 1 – Overcurrent output V1+	G	USINT	0 =- 1 = active
35	0x23	Basic 2 – Overcurrent output V1+	G	USINT	0 =- 1 = active
36	0x24	Basic 3 – Overcurrent output V1+	G	USINT	0 =- 1 = active
37	0x25	Basic 4 – Overcurrent output V1+	G	USINT	0 =- 1 = active
38	0x26	Basic 5 – Overcurrent output V1+	G	USINT	0 =- 1 = active
39	0x27	Basic 6 – Overcurrent output V1+	G	USINT	0 =- 1 = active
40	0x28	Basic 7 – Overcurrent output V1+	G	USINT	0 =- 1 = active
41	0x29	Basic – input value C/Q	G	Byte	0 = digital in-/output 0 1 = digital in-/output 1 2 = digital in-/output 2 3 = digital in-/output 3 4 = digital in-/output 4 5 = digital in-/output 5 6 = digital in-/output 6 7 = digital in-/output 7

Attr. no.		Designation	Get/Set	Type	Meaning
Dec.	Hex.				
42	0x2A	Basic – input value V1+	G	Byte	0 = digital in-/output 0 1 = digital in-/output 1 2 = digital in-/output 2 3 = digital in-/output 3 4 = digital in-/output 4 5 = digital in-/output 5 6 = digital in-/output 6 7 = digital in-/output 7
43	0x2B	Basic – input value valid (Data Valid Signal)	G	Byte	0 = digital in-/output 0 1 = digital in-/output 1 2 = digital in-/output 2 3 = digital in-/output 3 4 = digital in-/output 4 5 = digital in-/output 5 6 = digital in-/output 6 7 = digital in-/output 7
44	0x2C	Basic – output value C/Q	G	Byte	0 = digital in-/output 0 1 = digital in-/output 1 2 = digital in-/output 2 3 = digital in-/output 3 4 = digital in-/output 4 5 = digital in-/output 5 6 = digital in-/output 6 7 = digital in-/output 7
45	0x2D	Basic – output value V1+	G	Byte	0 = digital in-/output 0 1 = digital in-/output 1 2 = digital in-/output 2 3 = digital in-/output 3 4 = digital in-/output 4 5 = digital in-/output 5 6 = digital in-/output 6 7 = digital in-/output 7

7.7 Connecting the Devices to a Rockwell PLC with EtherNet/IP

Used hardware

The following hardware components are used in this example:

- Rockwell-controller ControlLogix 1756-L72, Logix 5572
- Rockwell scanner 1756-EN2TR
- Block module FEN20-8IOL

Used software

The following software tools are used in this example:

- Logix Designer
- Catalog file for Turck compact stations "TURCK_BLOCK_STATIONS_Vxx.L5K" as part of the file "FEN20_ETHERNETIP.zip" (downloadable free of charge under www.turck.com)

Catalog files

Turck provides catalog files (L5K files) for use in Studio5000 from Rockwell Automation. The catalog files contain predefined, application-dependent device configurations with different input and output data widths and descriptions of the configuration, input and output tag data. The predefined device configurations correspond to the input and output assembly instances described in the section "Assembly Object" in the chapter "Commissioning Devices with EtherNet/IP" → under "EtherNet/IP Standard Classes".

NOTE
The catalog file is available in the L5K file format and must be converted to the "ACD" file format before it can be used. The file is opened in Studio5000 and saved as a project (*.ACD).

Prerequisites

- An instance of the programming software Logix Designer with the catalog file is opened.
- A new project has been created in a second instance of Logix Designer.
- The PLC and the scanner mentioned above have been added to the project in the second instance.

7.7.1 Adding the devices from the catalog files to the new project

- ▶ Right-click the device entry and use **Copy**.

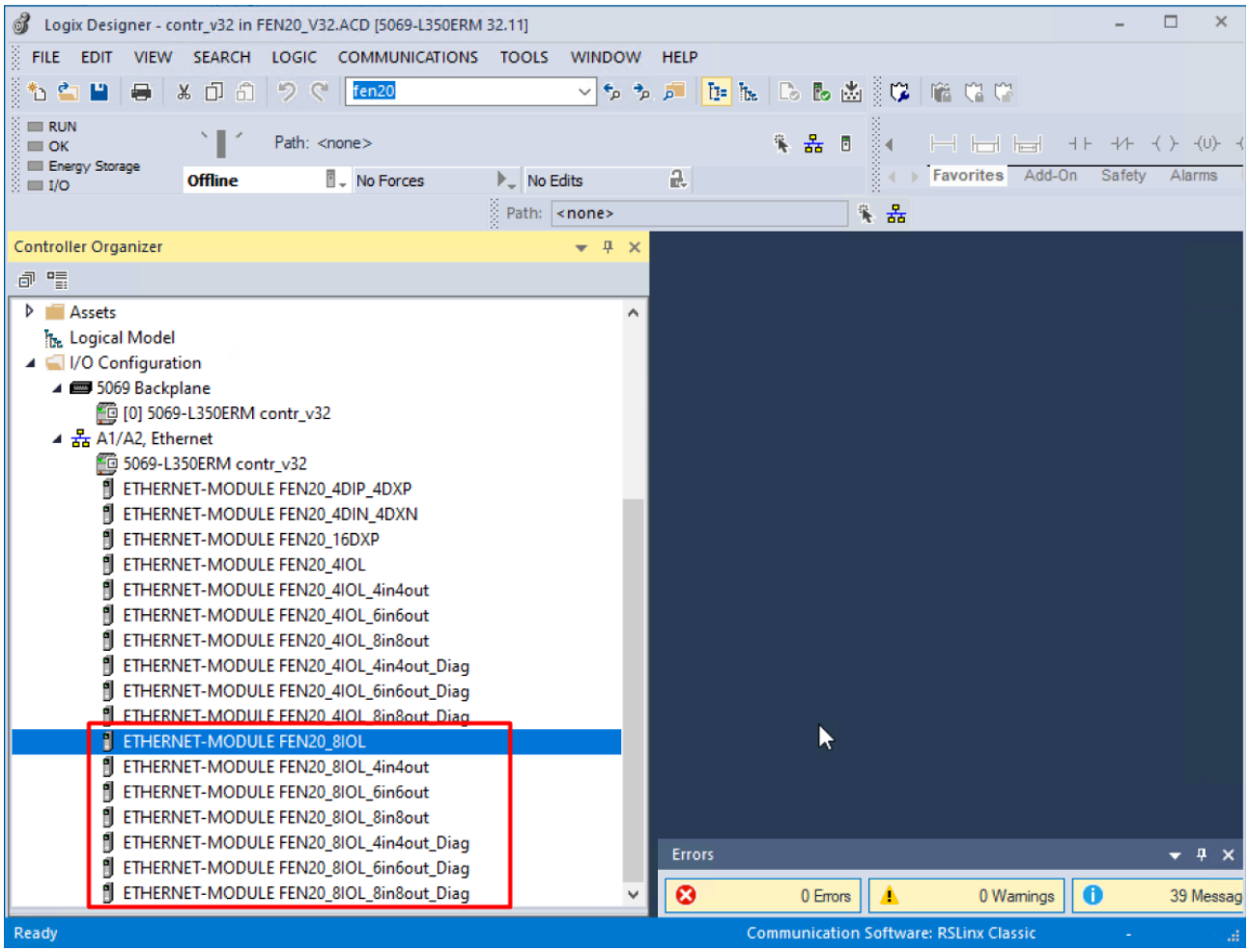


Fig. 45: Logix Designer – copying the device entry from the catalog file

- Right-click the EtherNet/IP scanner in the second instance of the Logix Designer and add the device to the project via **Paste**. In this example, the configuration with 4 byte in- and 4 byte output data plus diagnostics **FEN20_8IOL_4in4out_diag** is used.

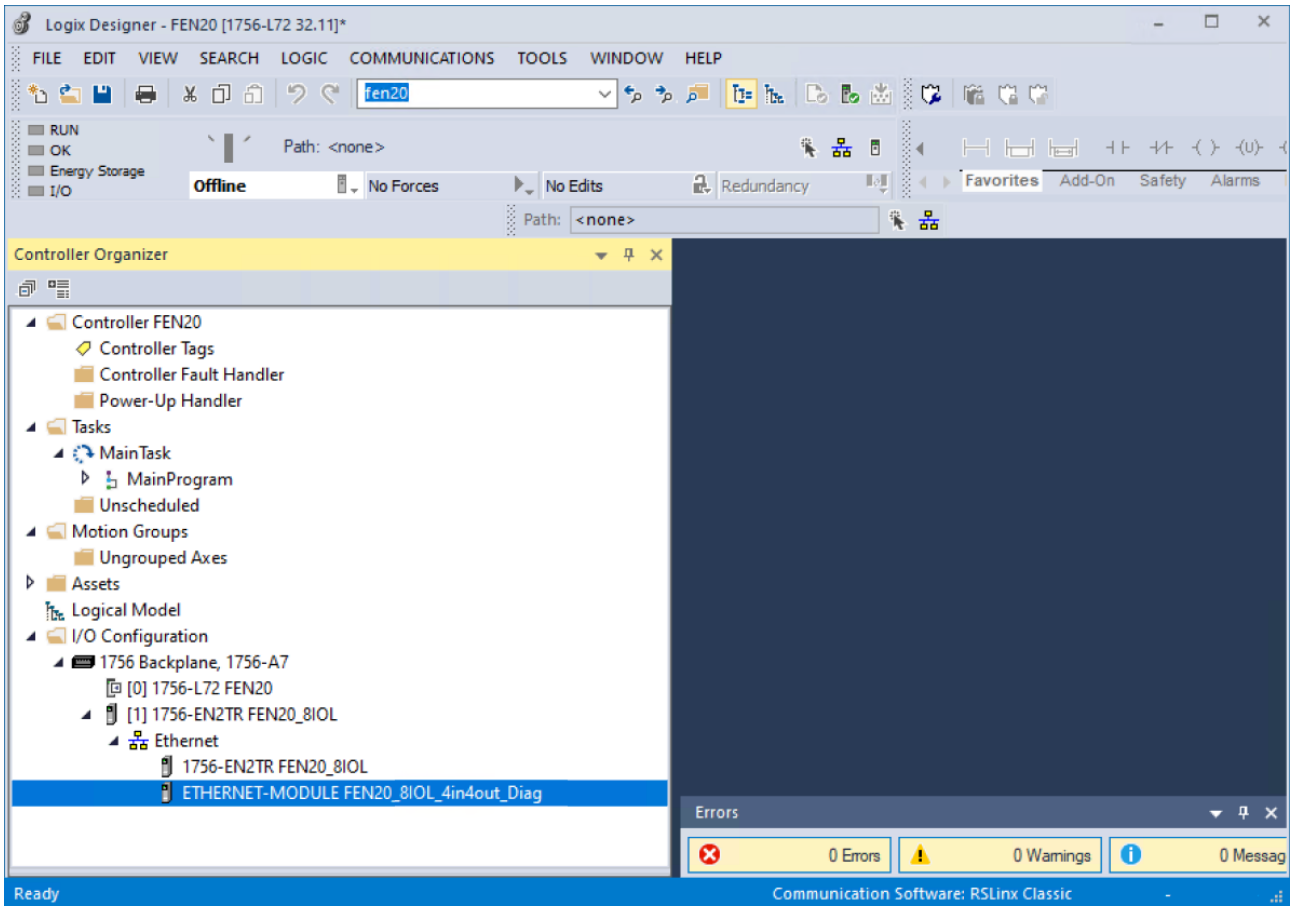


Fig. 46: Logix Designer – predefined configuration of FEN20-8IOL in new project

7.7.2 Configuring the device in Logix Designer

- Open the device entry by double-clicking.
- Assign a module name.
- Set the IP address of the device.

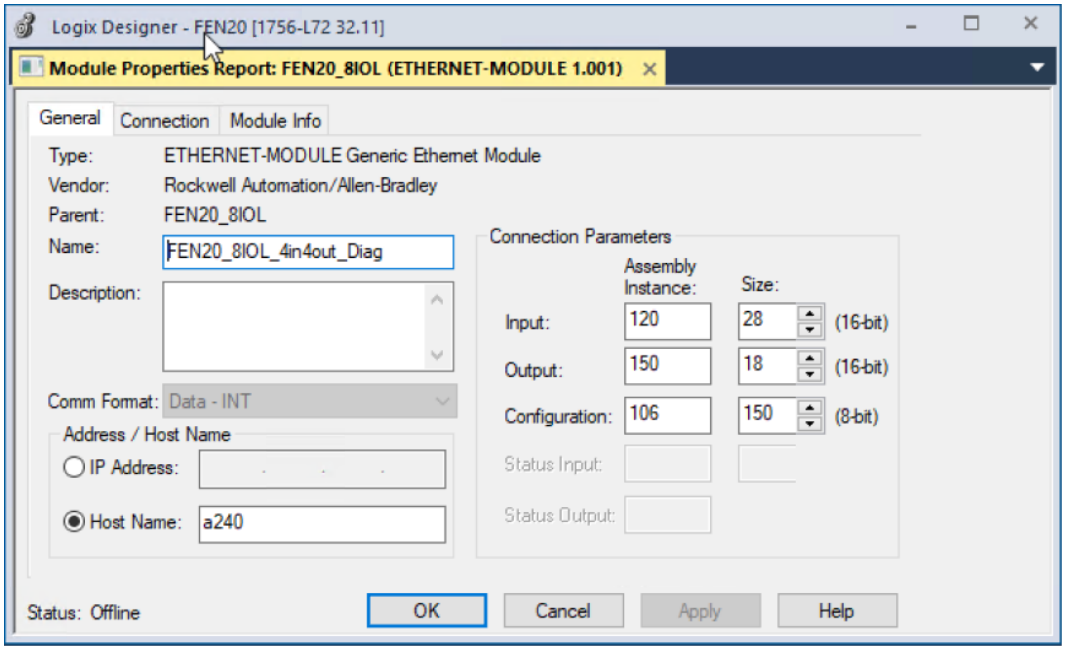


Fig. 47: Logix Designer – setting IP address and module name

- Optional: Set the connection parameters

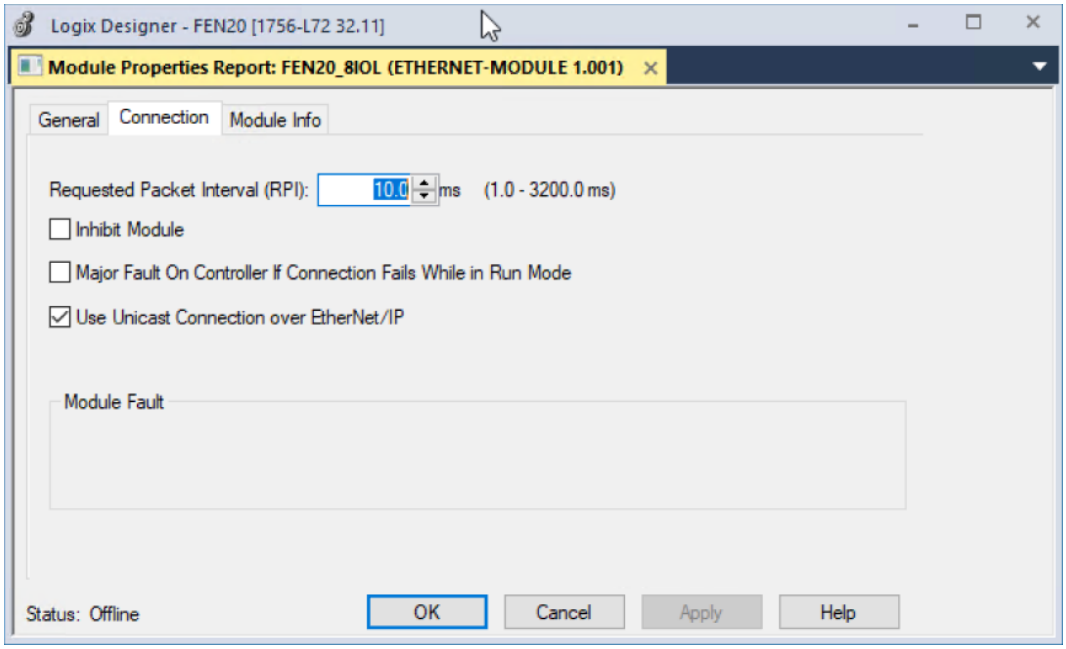


Fig. 48: Logix Designer – setting the connection parameters

7.7.3 Parameterizing the device

- Open the Controller Tags of the device.
- Parameterize the device via the Controller Tags **FEN20_8IOL_4in_4out_diag:C** .

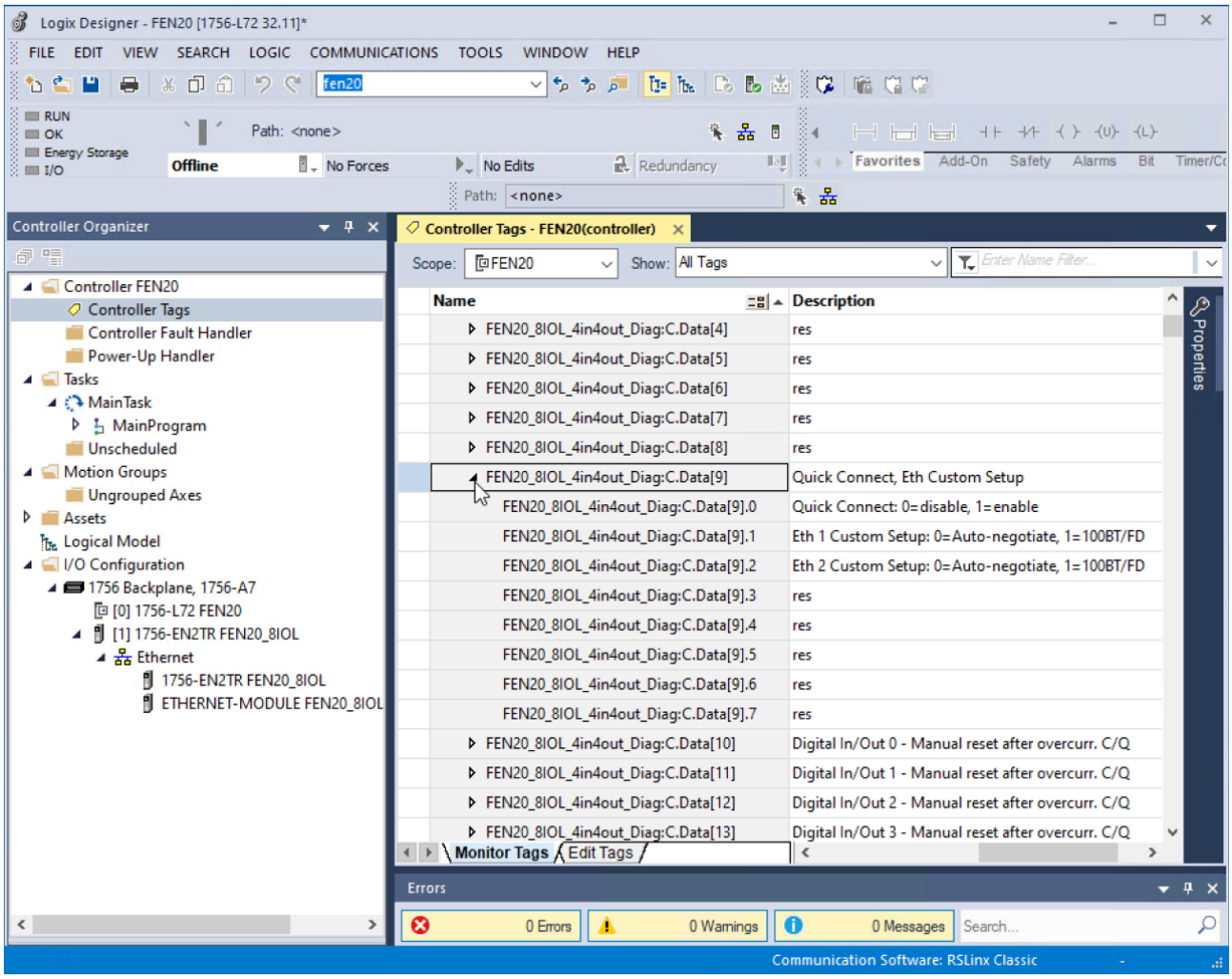


Fig. 49: Parameterizing the device

7.7.4 Going online with the PLC

- ▶ Search the network via **Who Active** function.
- ▶ Select the PLC.
- ▶ Set the communication path via **Set Project Path**.
- ⇨ The communication path is set

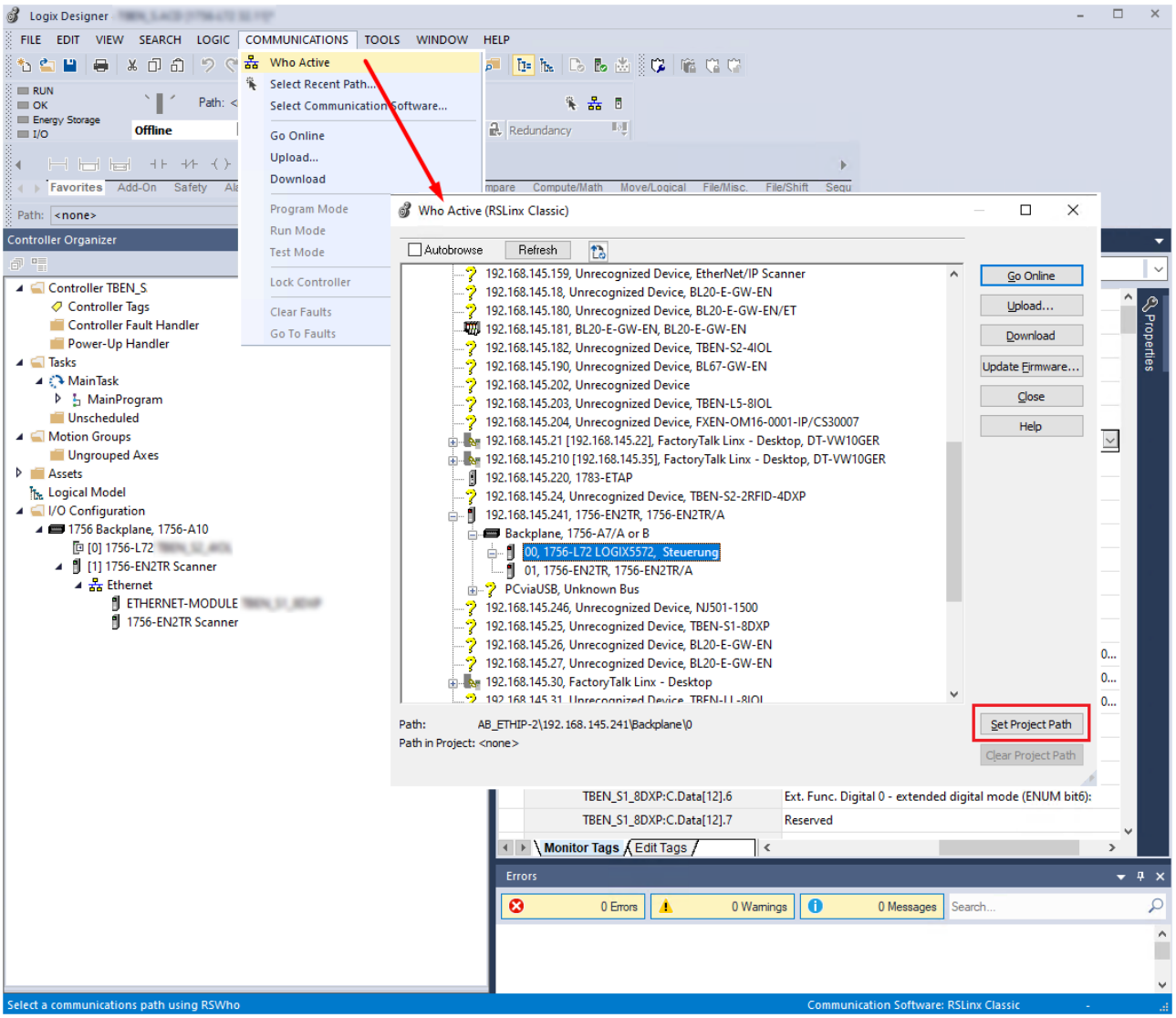


Fig. 50: Logix Designer – setting the communication path

- ▶ Select the PLC.
- ▶ Click **Go online**.

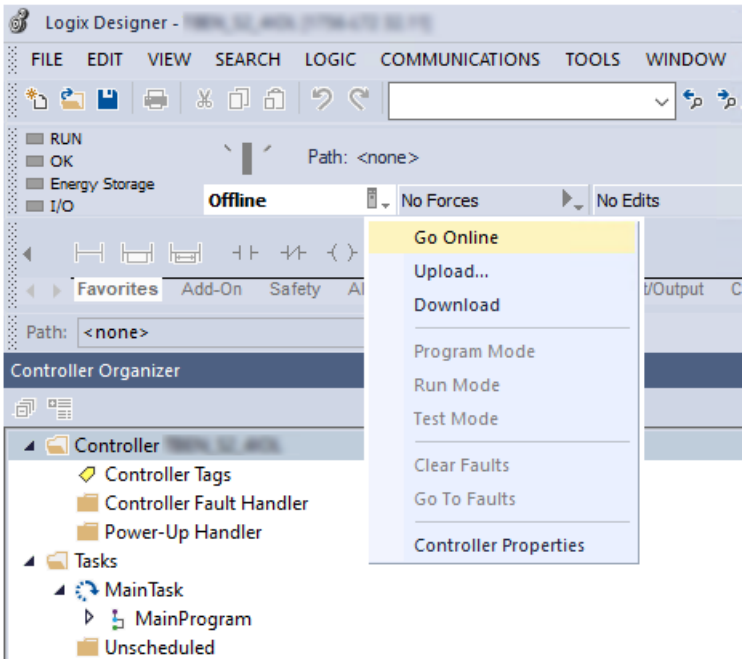


Fig. 51: Logix Designer – Going online with the device

- ▶ Click **Download** in the following dialog (Connect To Go Online)
- ▶ Confirm all following messages.
- ⇨ The program is downloaded to the PLC. The online connection is established.

7.7.5 Reading process data

- ▶ Open the Controller Tags in the project tree by double-clicking the entry.
- ⇨ The access to parameter data (FEN20_8IOL_4in_4out_diag:C), input data (FEN20_8IOL_4in_4out_diag:I) and output data (FEN20_8IOL_4in_4out_diag:O) is possible.

7.8 Commissioning the Device in CC-Link IE Field Basic

7.8.1 General features CC-Link IE Field Basic

CC-Link IE Field Basic works with a client/server communication model. A maximum data width of 64 × 64 bits is available for communication between a client station and several server stations, whereby a unit of 64 bits is referred to as an occupied station. A CC-Link Field Basic network can consist of a maximum of 64 occupied stations. I/O modules can occupy one or more of the 64 occupied stations, depending on their complexity and data width.

Turck IO-Link master modules FEN20-8IOL occupy 1...4 occupied stations.

CC-Link IE Field Basic		
Maximum number of stations in a network	Max. 64 occupied stations	An I/O module can occupy several occupied stations.
Groups:	Max. 16 occupied stations	To optimize process data traffic, devices can be combined into groups according to their function. A group can consist of a maximum of 16 occupied stations.
Acyclic data		Cyclical data is mapped bit by bit or word by word into registers.
	RX	Register for bit-by-bit access to digital inputs (DI)
	RY	Register for bit-by-bit access to digital Outputs (DO)
	RWr	Register for word-by-word, read access to process data (e.g. IO-Link)
	RWw	Register for word-by-word, write access to process data (e.g. IO-Link)
Port numbers	61450 (cyclic data)	
	61451 (port number of server station for NodeSearch and IPAddressSet)	

7.8.2 CSP+ files

The CSP+ files can be downloaded free of charge at www.turck.com.

7.8.3 Cyclic data transmission

The cyclic process image of the devices is divided into a bit area and a word area. The bit area is the same for all device configurations. The word area can vary in size depending on the profile used and, in addition to the IO-Link process data in the input area, can also contain the module status, IO-Link port diagnostics or IO-Link events. Due to the different process data sizes, the FEN20-8IOL can occupy a different number of stations (occupied stations Occupied Stations).

Input data		
Bit area RX	**Word area RWr**	**Access type**
Basic input: ■ Input data of the digital channels (DI and DXP channels) ■ Data valid bit of the IO-Link channels ■ Module status	■ IO-Link data ■ Module diagnostics ■ IO-Link port diagnostics ■ IO-Link events	RO

Output data		
Bit area RY	**Word area RWw**	**Access type**
Basic output: ■ Output data of the digital DXP channels	■ IO-Link data	RW

7.8.4 Occupied Stations

Profile	Occupied Stations	Size of the process input data		Size of the process output data	
		Bit area (RX)	**Register area (RWr)**	**Bit area (RY)**	**Register area (RWw)**
1	1	**6 byte** ■ Basic input (C/Q, V1+ and data valid bit): 32 bit ■ Module status: 16 bit	**50 byte** ■ IO-Link data: 4 byte per port ■ Module diagnostics: 2 byte ■ IO-Link port diagnostics: 2 byte per port	4 byte: ■ Basic output (C/Q and V1+): 16 bit ■ VAUX control: 16 bit	**64 byte** ■ IO-Link data: 8 byte per port
2	2		**114 byte** ■ IO-Link data: 12 byte per port ■ Module diagnostics: 2 byte ■ IO-Link port diagnostics: 2 byte per port		**128 byte** ■ IO-Link data: 16 byte per port
3	3		**178 byte** ■ IO-Link data: 12 byte per port ■ Module diagnostics: 2 byte ■ IO-Link port diagnostics: 2 byte per port ■ IO-Link events: max. 16 events, 4 byte per event		**192 byte** ■ IO-Link data: 24 byte per port
4	4		**256 byte** ■ IO-Link data: 32 byte per port		**256 byte** ■ IO-Link data: 32 byte per port

7.8.5 Bit area

See also process input data "Basic" and "Module status" [▶ 162] as well as process output data "Basic" [▶ 165].

RX	Signal	RY	Signal
Digital channels		Digital channels (DXP)	
RX0	Input value C/Q (Ch0)	RY0	Output value C/Q (Ch0)
RX1	Input value C/Q (Ch1)	RY1	Output value C/Q (Ch1)
RX2	Input value C/Q (Ch2)	RY2	Output value C/Q (Ch2)
RX3	Input value C/Q (Ch3)	RY3	Output value C/Q (Ch3)
RX4	Input value C/Q (Ch4)	RY4	Output value C/Q (Ch4)
RX5	Input value C/Q (Ch5)	RY5	Output value C/Q (Ch5)
RX6	Input value C/Q (Ch6)	RY6	Output value C/Q (Ch6)
RX7	Input value C/Q (Ch7)	RY7	Output value C/Q (Ch7)
RX8	Input value V1+ (Ch0)	RY8	Output value V1+ (Ch0)
RX9	Input value V1+ (Ch1)	RY9	Output value V1+ (Ch1)
RXA	Input value V1+ (Ch2)	RYA	Output value V1+ (Ch2)
RXB	Input value V1+ (Ch3)	RYB	Output value V1+ (Ch3)
RXC	Input value V1+ (Ch4)	RYC	Output value V1+ (Ch4)
RXD	Input value V1+ (Ch5)	RYD	Output value V1+ (Ch5)
RXE	Input value V1+ (Ch6)	RYE	Output value V1+ (Ch6)
RXF	Input value V1+ (Ch7)	RYF	Output value V1+ (Ch7)
RX10	DVS (Ch0)	-	
RX11	DVS (Ch1)		
RX12	DVS (Ch2)		
RX13	DVS (Ch3)		
RX14	DVS (Ch4)		
RX15	DVS (Ch5)		
RX16	DVS (Ch6)		
RX17	DVS (Ch7)		
RX18…RX1F	Reserved		
Module status (status word)			
RX20	DIAG		
RX21	ARGEE program running		
…	-		
RX27	V2		
RX28	-		
RX29	V1		
RX2A	COM		
…	-		
RX2E	FCE		
RX2F	-		

7.8.6 Word area

The data in the word area has different data sizes and content depending on the profile. The chapter "Operating" contains a detailed description of the process data and diagnostics.

1 Occupied Station (profile 1) [▶ 109]

RWr		Process input data	RWw		Process output data
Word (hex)	**Bit**		**Word (hex)**	**Bit**	
IO-Link input data			**IO-Link output data**		
RWr0…RWr1		IO-Link input data port 1	RWw0…RWw3		IO-Link output data port 1
RWr2…RWr3		IO-Link input data port 2	RWw4…RWw7		IO-Link output data port 2
RWr4…RWr5		IO-Link input data port 3	RWw8…RWwB		IO-Link output data port 3
RWr6…RWr7		IO-Link input data port 4	RWwC…RWwF		IO-Link output data port 4
RWr8…RWr9		IO-Link input data port 5	RWw10…RWw13		IO-Link output data port 5
RWrA…RWrB		IO-Link input data port 6	RWw14…RWw17		IO-Link output data port 6
RWrC…RWrD		IO-Link input data port 7	RWw18…RWw1B		IO-Link output data port 7
RWrE…RWrF		IO-Link input data port 8	RWw1C…RWw1F		IO-Link output data port 8
Overcurrent diagnostics					
RWr10	0	Overcurrent output C/Q (Ch0)			
	…	…			
	7	Overcurrent output C/Q (Ch7)			
	8	Overcurrent output V1+ (Ch0)			
	…	…			
	F	Overcurrent output V1+ (Ch7)			
Master and device diagnostics (IO-Link port 1…8)					
IO-Link port 1 (channel 0)					
RWr11	0	-			
	1	PPE			
	2	CFGERR			
	3	DSERR			
	4	HWERR			
	5	PDINV			
	6	EVT1			
	7	EVT2			
	8	PRMERR			
	9	OTEMP			
	10	LLVU			
	11	ULVE			
	12	VLOW			
	13	VLOW			
	14	OLV			
	15	GENERR			

RWr		Process input data	RWw		Process output data
Word (hex)	**Bit**		**Word (hex)**	**Bit**	
IO-Link port 2 (channel 2)					
RWr12	Assignment similar to IO-Link port 1				
IO-Link port 3 (channel 4)					
RWr13	Assignment similar to IO-Link port 1				
IO-Link port 4 (channel 6)					
RWr14	Assignment similar to IO-Link port 1				
IO-Link port 5 (channel 8)					
RWr15	Assignment similar to IO-Link port 1				
IO-Link port 6 (channel 10)					
RWr16	Assignment similar to IO-Link port 1				
IO-Link port 7 (channel 12)					
RWr17	Assignment similar to IO-Link port 1				
IO-Link port 8 (channel 14)					
RWr18	Assignment similar to IO-Link port 1				

2 Occupied Stations (profile 2) Occupied Stations

RWr		Process input data	RWw		Process output data
Word (hex)	**Bit**		**Word (hex)**	**Bit**	
IO-Link input data			**IO-Link output data**		
RWr0…RWr5		IO-Link input data port 1	RWw0…RWw7		IO-Link output data port 1
RWr6…RWrB		IO-Link input data port 2	RWw8…RWwF		IO-Link output data port 2
RWrC…RWr11		IO-Link input data port 3	RWw10…RWw17		IO-Link output data port 3
RWr12…RWr17		IO-Link input data port 4	RWw18…RWw1F		IO-Link output data port 4
RWr18…RWr1D		IO-Link input data port 5	RWw20…RWw27		IO-Link output data port 5
RWr1E…RWr23		IO-Link input data port 6	RWw28…RWw2F		IO-Link output data port 6
RWr24…RWr29		IO-Link input data port 7	RWw30…RWw37		IO-Link output data port 7
RWr2A…RWr2F		IO-Link input data port 8	RWw38…RWw3F		IO-Link output data port 8
Overcurrent diagnostics					
RWr30	0	Overcurrent output C/Q (Ch0)			
	…	…			
	7	Overcurrent output C/Q (Ch7)			
	8	Overcurrent output V1+ (Ch0)			
	…	…			
	F	Overcurrent output V1+ (Ch7)			
Master and device diagnostics (IO-Link port 1…8)					
IO-Link port 1 (channel 0)					
RWr31	0	-			
	1	PPE			
	2	CFGERR			
	3	DSERR			
	4	HWERR			
	5	PDINV			
	6	EVT1			
	7	EVT2			
	8	PRMERR			
	9	OTEMP			
	10	LLVU			
	11	ULVE			
	12	VLOW			
	13	VLOW			
	14	OLV			
	15	GENERR			

RWr		Process input data	RWw		Process output data
Word (hex)	**Bit**		**Word (hex)**	**Bit**	
IO-Link port 2 (channel 2)					
RWr32	Assignment similar to IO-Link port 1				
IO-Link port 3 (channel 4)					
RWr33	Assignment similar to IO-Link port 1				
IO-Link port 4 (channel 6)					
RWr34	Assignment similar to IO-Link port 1				
IO-Link port 5 (channel 8)					
RWr35	Assignment similar to IO-Link port 1				
IO-Link port 6 (channel 10)					
RWr36	Assignment similar to IO-Link port 1				
IO-Link port 7 (channel 12)					
RWr37	Assignment similar to IO-Link port 1				
IO-Link port 8 (channel 14)					
RWr38	Assignment similar to IO-Link port 1				

3 Occupied Stations (profile 3) Occupied Stations

RWr		Process input data	RWw		Process output data
Word (hex)	**Bit**		**Word (hex)**	**Bit**	
IO-Link input data			**IO-Link output data**		
RWr0…RWr5		IO-Link input data port 1	RWw0…RWwB		IO-Link output data port 1
RWr6…RWrB		IO-Link input data port 2	RWwC…RWw17		IO-Link output data port 2
RWrC…RWr11		IO-Link input data port 3	RWw18…RWw23		IO-Link output data port 3
RWr12…RWr17		IO-Link input data port 4	RWw24…RWw2F		IO-Link output data port 4
RWr18…RWr1D		IO-Link input data port 5	RWw30…RWw3B		IO-Link output data port 5
RWr1E…RWr23		IO-Link input data port 6	RWw3C…RWw47		IO-Link output data port 6
RWr24…RWr29		IO-Link input data port 7	RWw48…RWw53		IO-Link output data port 7
RWr2A…RWr2F		IO-Link input data port 8	RWw54…RWw5F		IO-Link output data port 8
Overcurrent diagnostics					
RWr30	0	Overcurrent output C/Q (Ch0)			
	…	…			
	7	Overcurrent output C/Q (Ch7)			
	8	Overcurrent output V1+ (Ch0)			
	…	…			
	F	Overcurrent output V1+ (Ch7)			
Master and device diagnostics (IO-Link port 1…8)					
IO-Link port 1 (channel 0)					
RWr31	0	-			
	1	PPE			
	2	CFGERR			
	3	DSERR			
	4	HWERR			
	5	PDINV			
	6	EVT1			
	7	EVT2			
	8	PRMERR			
	9	OTEMP			
	10	LLVU			
	11	ULVE			
	12	VLOW			
	13	VLOW			
	14	OLV			
	15	GENERR			

RWr		Process input data	RWw		Process output data
Word (hex)	**Bit**		**Word (hex)**	**Bit**	
IO-Link port 2 (channel 2)					
RWr32	Assignment similar to IO-Link port 1				
IO-Link port 3 (channel 4)					
RWr33	Assignment similar to IO-Link port 1				
IO-Link port 4 (channel 6)					
RWr34	Assignment similar to IO-Link port 1				
IO-Link port 5 (channel 8)					
RWr35	Assignment similar to IO-Link port 1				
IO-Link port 6 (channel 10)					
RWr36	Assignment similar to IO-Link port 1				
IO-Link port 7 (channel 12)					
RWr37	Assignment similar to IO-Link port 1				
IO-Link port 8 (channel 14)					
RWr38	Assignment similar to IO-Link port 1				
IO-Link events					
RWr39	0…7	Qualifier 1st event			
	8…15	Port 1st event			
RWr3A	0…15	Event code 1st event			
RWr3B	0…7	Qualifier 2nd event			
	8…15	Port 2nd event			
RWr3C	0…15	Event code 2nd event			
…					
RWr57	0…7	Qualifier 16th event			
	8…15	Port 16th event			
RWr58	0…15	Event code 16th event			

4 occupied station (profile 4) Occupied Stations

RWr		**Process input data**	**RWw**		**Process output data**
Word (hex)	**Bit**		**Word (hex)**	**Bit**	
IO-Link input data			**IO-Link output data**		
RWr0…RWrF		IO-Link input data port 1	RWw0…RWwF		IO-Link output data port 1
RWr1…RWr1F		IO-Link input data port 2	RWw10…RWw1F		IO-Link output data port 2
RWr20…RWr2F		IO-Link input data port 3	RWw20…RWw2F		IO-Link output data port 3
RWr30…RWr3F		IO-Link input data port 4	RWw30…RWw3F		IO-Link output data port 4
RWr40…RWr4F		IO-Link input data port 5	RWw40…RWw4F		IO-Link output data port 5
RWr50…RWr5F		IO-Link input data port 6	RWw50…RWw5F		IO-Link output data port 6
RWr60…RWr6F		IO-Link input data port 7	RWw60…RWw6F		IO-Link output data port 7
RWr70…RWr7F		IO-Link input data port 8	RWw70…RWw7F		IO-Link output data port 8

7.8.7 Parametermapping

The chapter "Parameterizing and configuring" [▶ 148] contains a detailed parameter description.

Parameter ID	Offset	Parameter name	Channel	Value	Meaning
B000	0.0	Manual output reset after overcurrent C/Q (Ch0)	0	0	No
				1	Yes
	0.1	Manual output reset after overcurrent C/Q (Ch1)	1	0	No
				1	Yes
	0.2	Manual output reset after overcurrent C/Q (Ch2)	2	0	No
				1	Yes
	0.3	Manual output reset after overcurrent C/Q (Ch3)	3	0	No
				1	Yes
	0.4	Manual output reset after overcurrent C/Q (Ch4)	4	0	No
				1	Yes
	0.5	Manual output reset after overcurrent C/Q (Ch5)	5	0	No
				1	Yes
	0.6	Manual output reset after overcurrent C/Q (Ch6)	6	0	No
				1	Yes
	0.7	Manual output reset after overcurrent C/Q (Ch7)	7	0	No
				1	Yes
	0.8	Manual output reset after overcurrent V1+ (Ch0)	0	0	No
				1	Yes
	0.9	Manual output reset after overcurrent V1+ (Ch1)	1	0	No
				1	Yes
	0.A	Manual output reset after overcurrent V1+ (Ch2)	2	0	No
				1	Yes
	0.B	Manual output reset after overcurrent V1+ (Ch3)	3	0	No
				1	Yes
	0.C	Manual output reset after overcurrent V1+ (Ch4)	4	0	No
				1	Yes
	0.D	Manual output reset after overcurrent V1+ (Ch5)	5	0	No
				1	Yes
	0.E	Manual output reset after overcurrent V1+ (Ch6)	6	0	No
				1	Yes
	0.F	Manual output reset after overcurrent V1+ (Ch7)	7	0	No
				1	Yes
	1.8	Mode V1+ (Ch0)	0	0	24 VDC
				1	Switchable
	1.9	Mode V1+ (Ch1)	1	0	24 VDC
				1	Switchable
	1.A	Mode V1+ (Ch2)	2	0	24 VDC
				1	Switchable

Parameter ID	Offset	Parameter name	Channel	Value	Meaning
	1.B	Mode V1+ (Ch3)	3	0	24 VDC
				1	Switchable
	1.C	Mode V1+ (Ch4)	4	0	24 VDC
				1	Switchable
	1.D	Mode V1+ (Ch5)	5	0	24 VDC
				1	Switchable
	1.E	Mode V1+ (Ch6)	6	0	24 VDC
				1	Switchable
	1.F	Mode V1+ (Ch7)	7	0	24 VDC
				1	Switchable
B001	0.0	Operation mode	IOL1	1	Family comp. device
				4	DI (with parameter access)
				8	DI
				9	DX
				10	deactivated
				11	No device check (autostart)
				12	Type comp. device V1.0
				13	Type comp. device V1.1
				14	Type comp. device V1.1, backup + restore
				15	Type comp. device V1.1, restore
	0.6	Activate Quick Start-Up		0	inactive
				1	active
	0.7	Device parameterirzation via GSD (GSD)		0	inactive
				1	active
	0.8	Cycle time		0	Automatic
				16…191	1.6…132.8 ms
				255	Automatic, compatible
	1.1	Process input data invalid (PZDE)		0	No diagnostics generated
				1	No diagnostics generated
B001	1.2	Deactivate diagnostics	IOL1	0	No
				1	Notifications
				2	Notifications and warnings
				3	Yes
	1.4	Process input data mapping (Mapping PDIN)		0	Direct
				1	Swap 16 bit
				2	Swap 32 bit
				3	Swap all
	1.6	Process output data mapping (Mapping PDOUT)		0	Direct
				1	Swap 16 bit
				2	Swap 32 bit
				3	Swap all
	4.0	Vendor ID		0…65535	
	5.0	Device ID		0…16777215	

Parameter ID	Offset	Parameter name	Channel	Value	Meaning
B002	Assignment s. B001 for IO-Link channel 1 (IOL1)		IOL2	Assignment s. B001 for IO-Link channel 1 (IOL1)	
B003			IOL3		
B004			IOL4		
B005			IOL5		
B006			IOL6		
B007			IOL7		
B008			IOL8		

7.8.8 Acyclic communication via SLMP – supported functions

The devices support acyclical access via SLMP command Device Read (0x0401) and Device Write (0x1401).

Supported Device Codes

Device Code	Description
0x0011	Device information (vendor ID, device code, device name, etc.)
0x00AC	Acyclic communication
0x00D8	Input data
0x00D9	Output data
0x00DD	Diagnostic data

Supported End Codes

End Code	Description
0x0000	Command successfully executed
0xC059	Command/subcommand: not supported command or subcommand
0xC05C	Wrong data: data content does not fit to the command data content does not fit to the command
0xC061	Data length: data length does not fit to the command

Read device information (Device Code 0x0011)

Address (Add)	Content	Access type	Data length in word (Len)	Description
0x0001	Vendor code	ro	1	Vendor ID Turck: 0x3355
0x0002	Model code	ro	2	ID of the device
0x0003	Model name	ro	2	Device name
0x0004	FW version	ro	2	Firmware version of the device
0x0005	Stack version	ro	2	Version of the CC-Link component

Acyclic I/O communication (Device Code 0x00AC)

Address (Add)	Read access	Write access	Data length in word (Len)	Content	Description
0xACAC	Open Connection		1	0xAD00… 0xADFF, 0x0000	A read access to this address opens an acyclic connection or returns an error. A valid connection handle is 0xAD00…0xADFF, or 0 in case of failure.
0xACAC		Close Connection	1	0xAD00… 0xADFF, 0xFFFF	Write access to this address closes an acyclic connection. Writing a previously opened connection address (0xAD00…0xADFF) closes this connection. If the value -1 (0xFFFF) is written, all acyclic connections opened for CC-Link are closed.
0xAD00 … 0xADFF			1…240	Acyclic data	

Example access:

1. **Open Connection**:
   Device Read (0x0401)
   Device Code = 0xAC
   Add = 0xACAC
   Len =1
   Result: 0xAD00 = Connection address: must be used for the following connection accesses, like read, write and close.

2. **Read Connection:**
   Device Read (0x0401)
   Device Code = 0xAC
   Add = 0xAD00
   Len =1
   Result: n words of received frame. The requested length is the maximum buffer size. If the available acyclic data does not fit in the buffer, the exceeding data is truncated.

3. **Write Connection**:
   Device Read (0x1401)
   Device Code = 0xAC
   Add = 0xAD00
   Len =1
   Result: n words of data to be sent.

4. **Close Connection**:
   Device Write (0x1401)
   Device Code = 0xAC
   Add=0xACAC,
   Len=1
   Data: 0xADxx (address of the previously used Open Connection)

Read input data (Device Code 0x00D8)

Address (Add)	Access type	Data length in word (Len)	Description
0x0000	ro	1…n	Access to all input data of the device regardless of profiles and restrictions due to the number of occupied stations, order: 1. Data from RWr area 2. Data from RX area
0x0001 … 0x00…	ro	1…n	Accesses the input data of one (sub)module. Data is structured in the native order of that (sub)module.

Write output data (Device Code 0x00D9)

Address (Add)	Access type	Data length in word (Len)	Description
0x0000	rw	1…n	Access to all output data of the device regardless of profiles and restrictions due to the number of occupied stations, order: 1. Data from RWw area 2. Data from RY area
0x0001 … 0x00…	rw	1…n	Accesses the output data of one (sub)module. Data is structured in the native order of that (sub)module.

Read Diagnostic data data (Device Code 0x00DD)

Address (Add)	Access type	Data length in word (Len)	Description
0x0000	ro	1…n	Access to all diagnostic data of the device regardless of profiles and restrictions due to the number of occupied stations
0x0001 … 0x00…	ro	1…n	Accesses the diagnostic data data of one (sub)module. Data is structured in the native order of that (sub)module.

7.9 Connecting devices to a CC-Link IE Field Basic client with GX Works3

Naming convention

Turck uses the terms "client" and "server". The following description uses the terms "Master Station" (client) and "Slave Station" (server) only because of the naming in Melsoft GX Works.

Used hardware

The following hardware components are used in this example:

- Mitsubishi MELSEC iQ-R controller
- Mitsubishi CPU 04ENCPU with local CC-Link IOs
- Turck components (as an example):
  - TBEN-LL-8DIP-8DOP (IP address: 192.168.3.10)
  - FEN20-8IOL (IP address: 192.168.3.12)

Used software

The following software tools are used in this example:

- Melsoft GX Works3

Prerequisites

- The GX Works3 software is open and a new project has been created.
- The controller including CPU and local IOs is configured in GX Works3.

7.9.1 Register the CSP+ files in GXWorks3

▶ Select and register CSP+ files via **Tools** → **Profile Management** → **Register**.
Note: CSP+ files can only be registered in GX Works3 if no project is open.

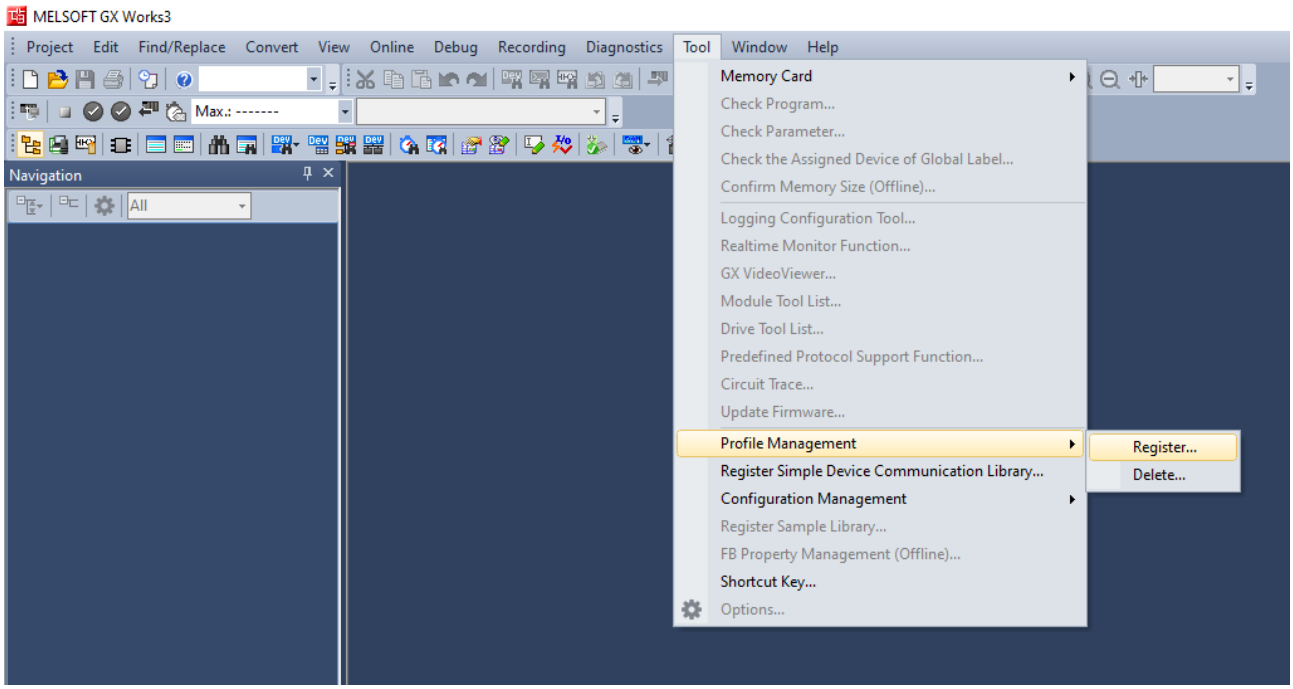


Fig. 52: Profile Management, Register Profile

7.9.2 Configuring the network settings

The network settings are configured at the CPU used under **Parameter → used CPU** (here: R04ENCPU) → **Module Parameters**.

Setting the IP address of the CPU

- Set the IP address of the CPU under **Own Node Settings → IP Address**.

Activate CC-Link Field Basic

The CC-Link IEF Basic protocol must be activated in the CPU.

- Under **CC-Link IEF Baisc Settings**, set the option **To Use or Not to Use CC-Link IEF Basic Setting** to **Use** in order to activate

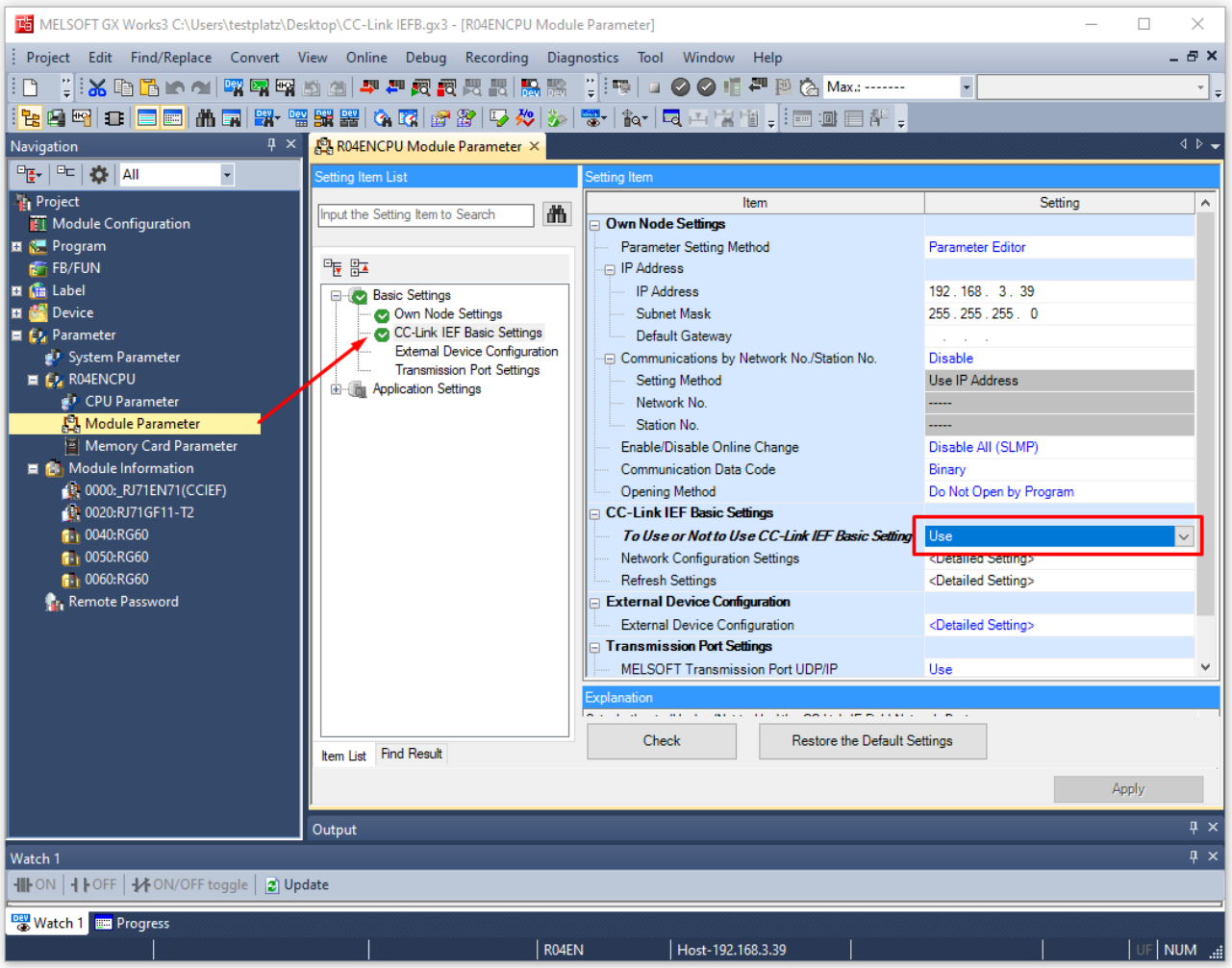


Fig. 53: GX Works3: Activate CC-Link IEF Basic on CPU

7.9.3 Configuring the CC-Link IE Field Basic network

Scanning the network

- Open **Network Configuration Settings** under **Module Parameters → CC-Link IEF Basic Settings**.

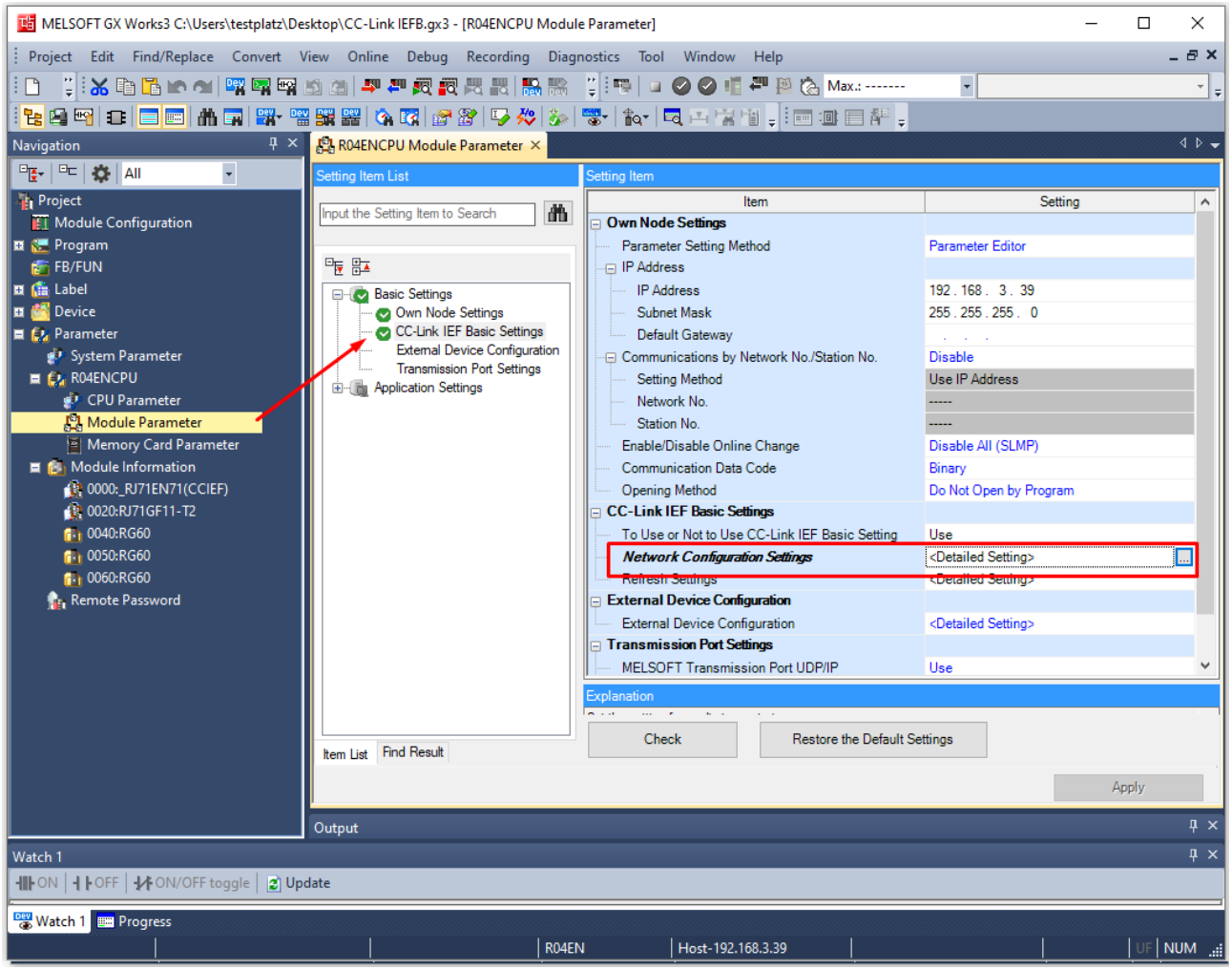


Fig. 54: GX Works3: Network Configuration Settings

- Scan the CC-Link IEF Basic network under **CC-Link IEF Basic Configuration** via **Detect Now**.

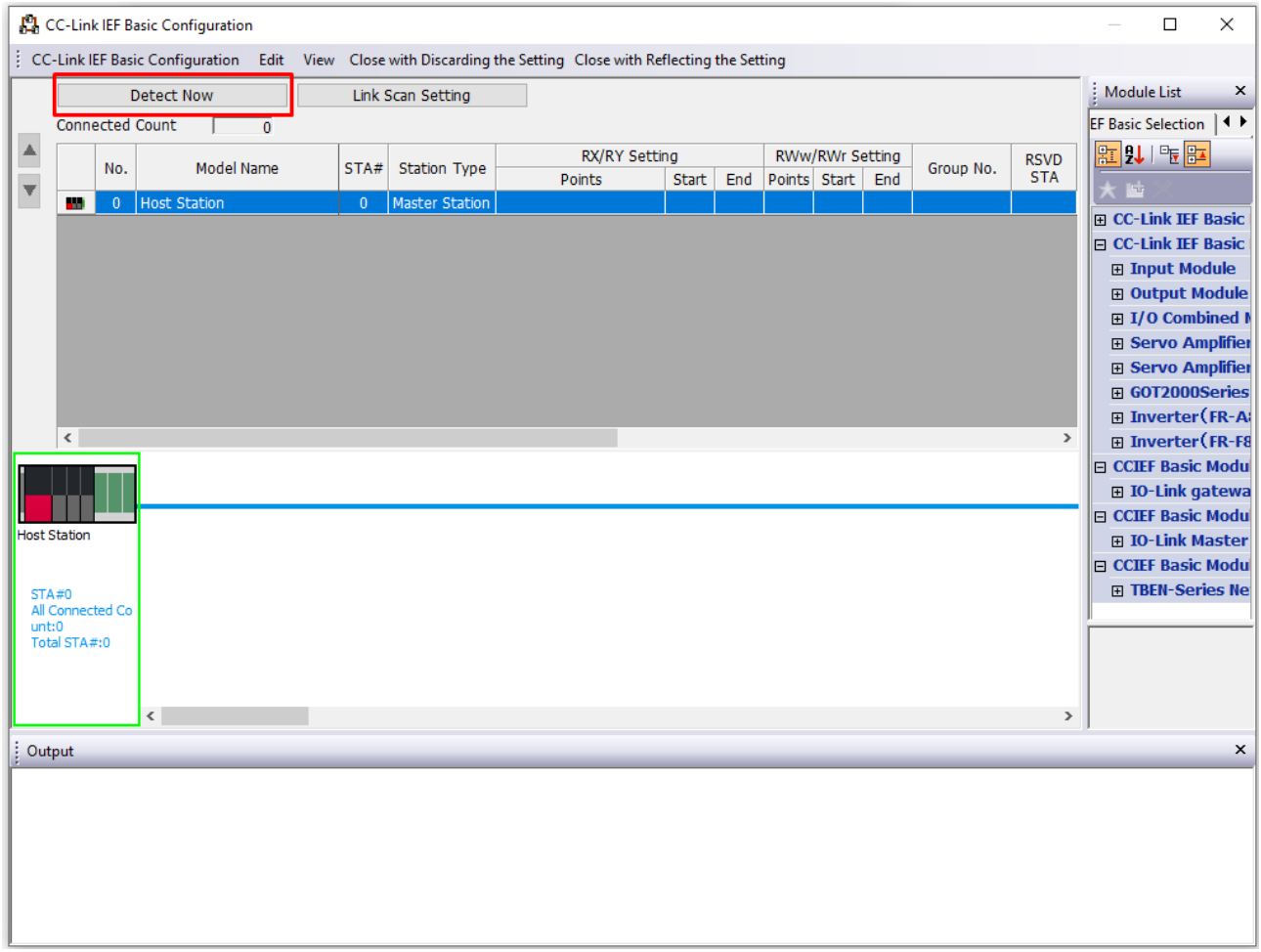


Fig. 55: GX Works3: scanning the CC-Link IEF Basic network

⇨ All CC-Link devices found in the Ethernet network are displayed in the order in which they are integrated in the network

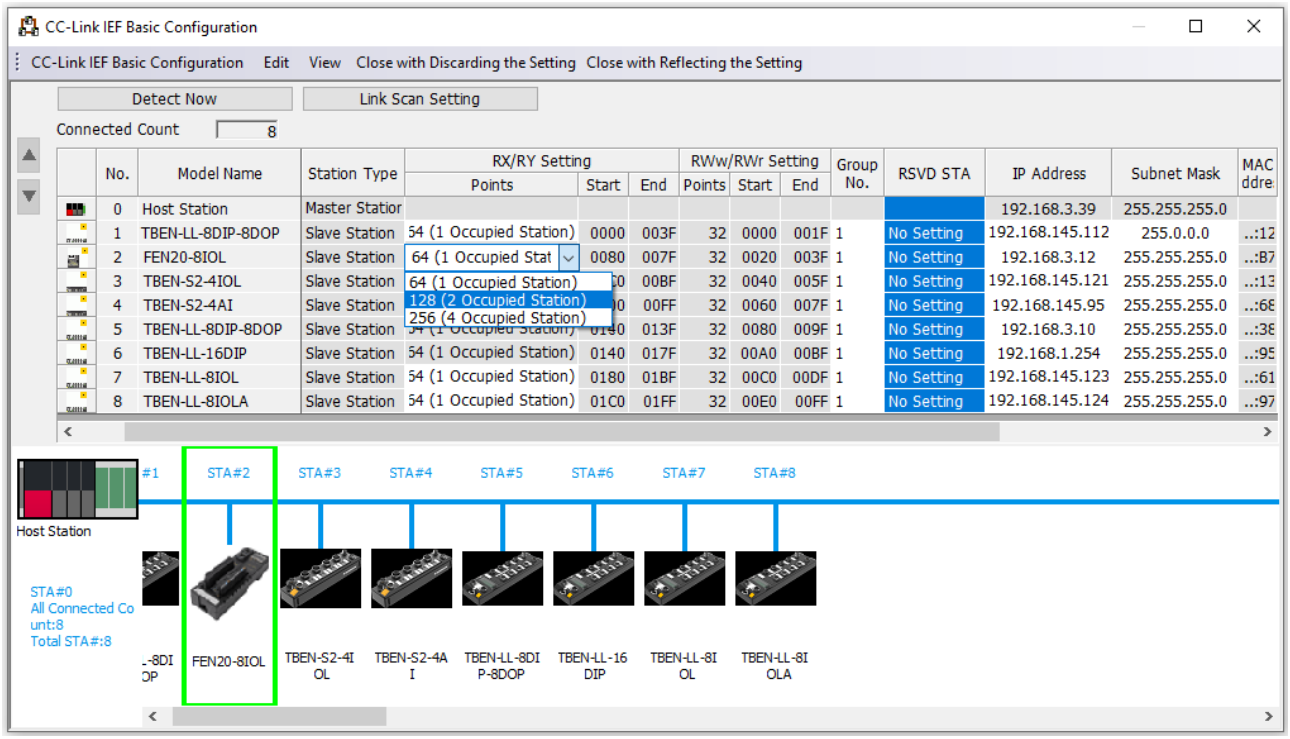


Fig. 56: GX Works3: Devices in the CC-Link IEF Basic network

Devices that do not match the IP address range of the controller cannot be added to the project.

- ▶ Remove devices with an IP address outside the IP address range of the controller from the list of network participants by right-clicking on the device → **Delete** or adjust the IP address of the devices in the **IP Address** column.
- ▶ For devices that can be integrated with different process data variables (profiles): select the profile under **RX/RY Setting** → **Points**.

Parameterizing CC-Link nodes

- Right-click on the device to be parameterized and select the device parameters via **Online → Parameter Processing of Slave Station**.

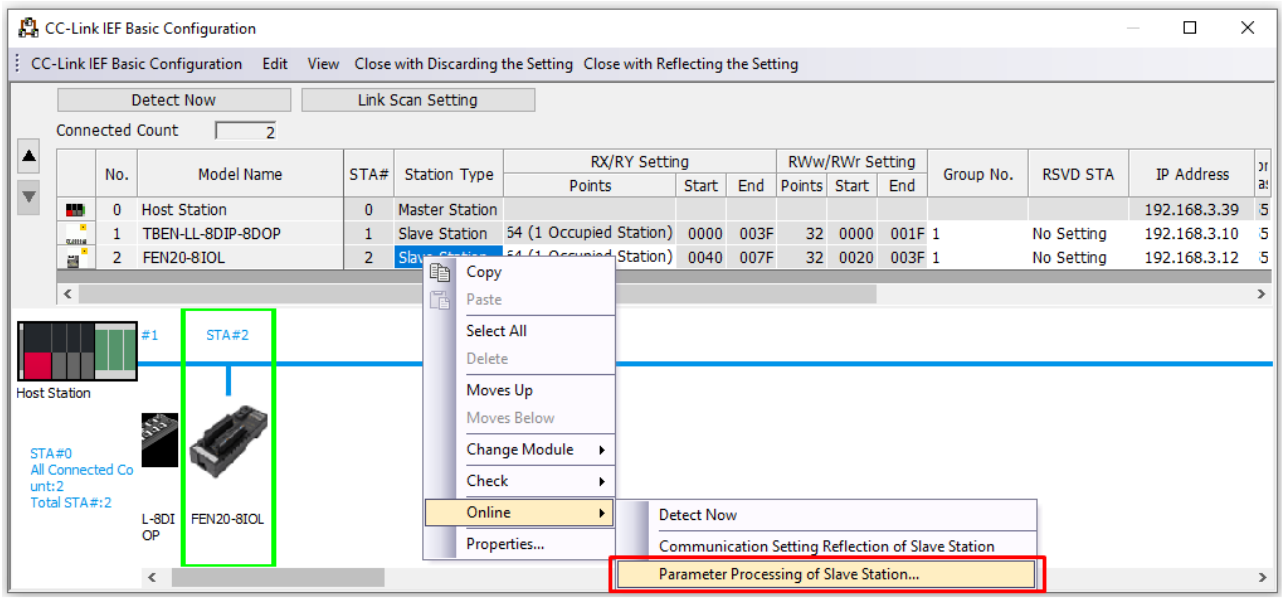


Fig. 57: GX Works3: Opening parameterization

- Activate the writing of parameters via **Method selection → Parameter write**.

NOTE
All parameters for one slot (in the example below: Slot 1) must be set. It is not possible to set individual parameters for a slot.

- Set the parameters and store the settings via **Execute**.

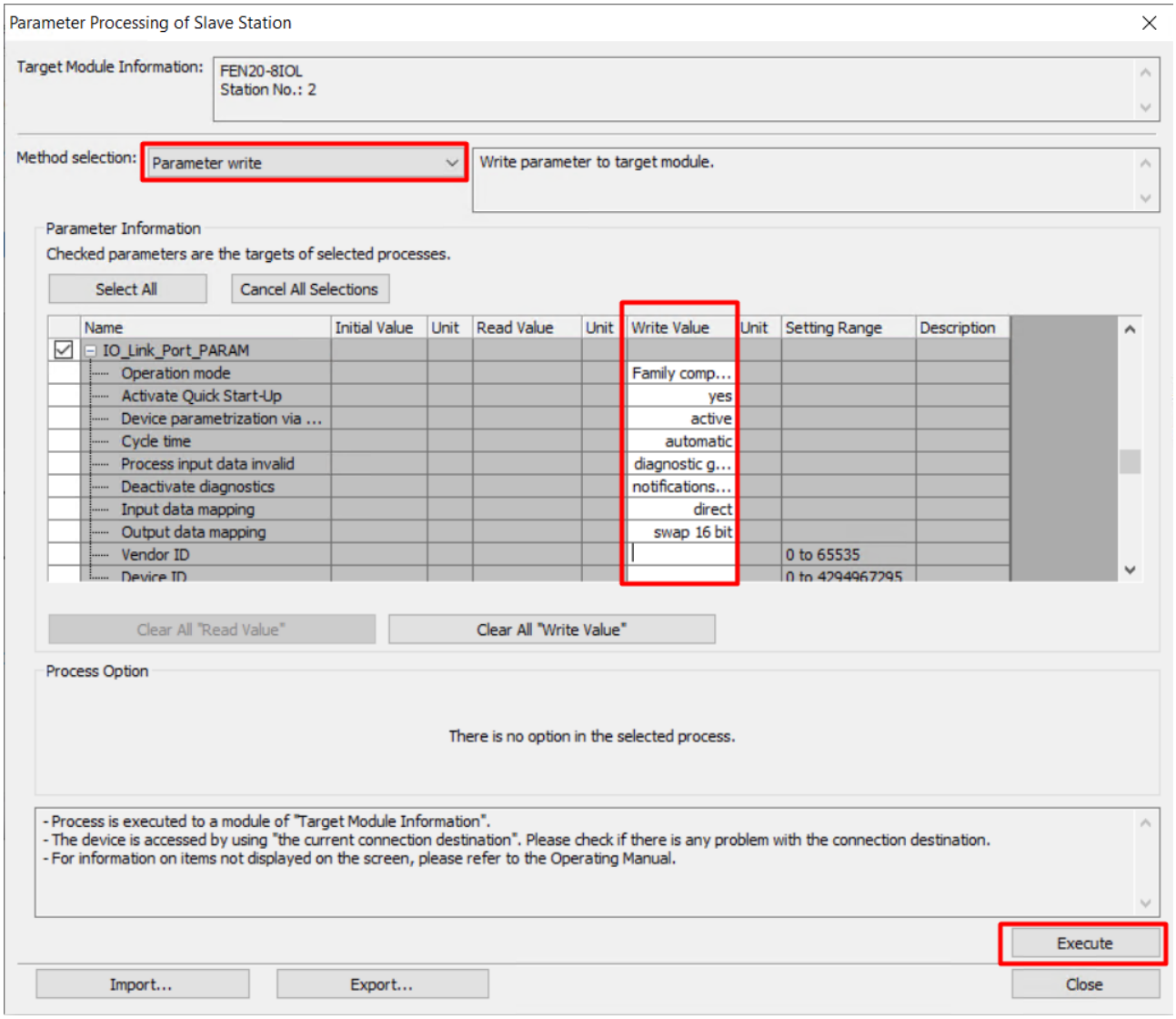


Fig. 58: GX Works3: Parameterizing the device

- Optional: Export the parameter settings as CSV file via **Method selection** → **Parameter read** and re-import them via **Method selection** → **Parameter write** in order to fill the **Write Values** column with the current parameter settings and then set individual parameters.

- Close the window and store the network structure via **CC-Link IEF Basic Configuration** über **Close with Reflecting the Setting**.

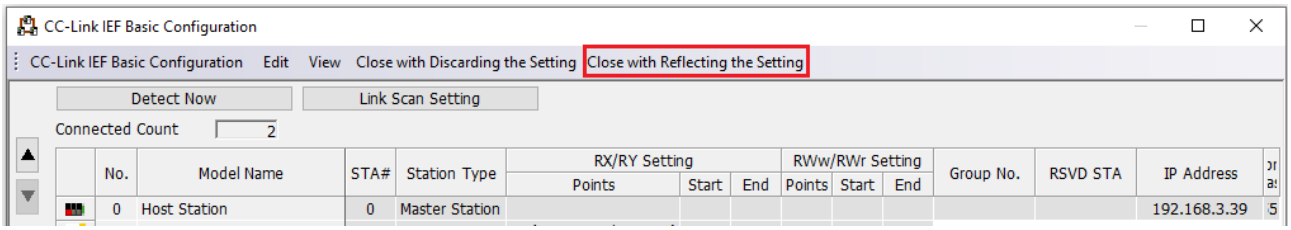


Fig. 59: GX Works3: Storing the network structure

- Apply changes to the network structure under **Module Parameters** with**Apply** .

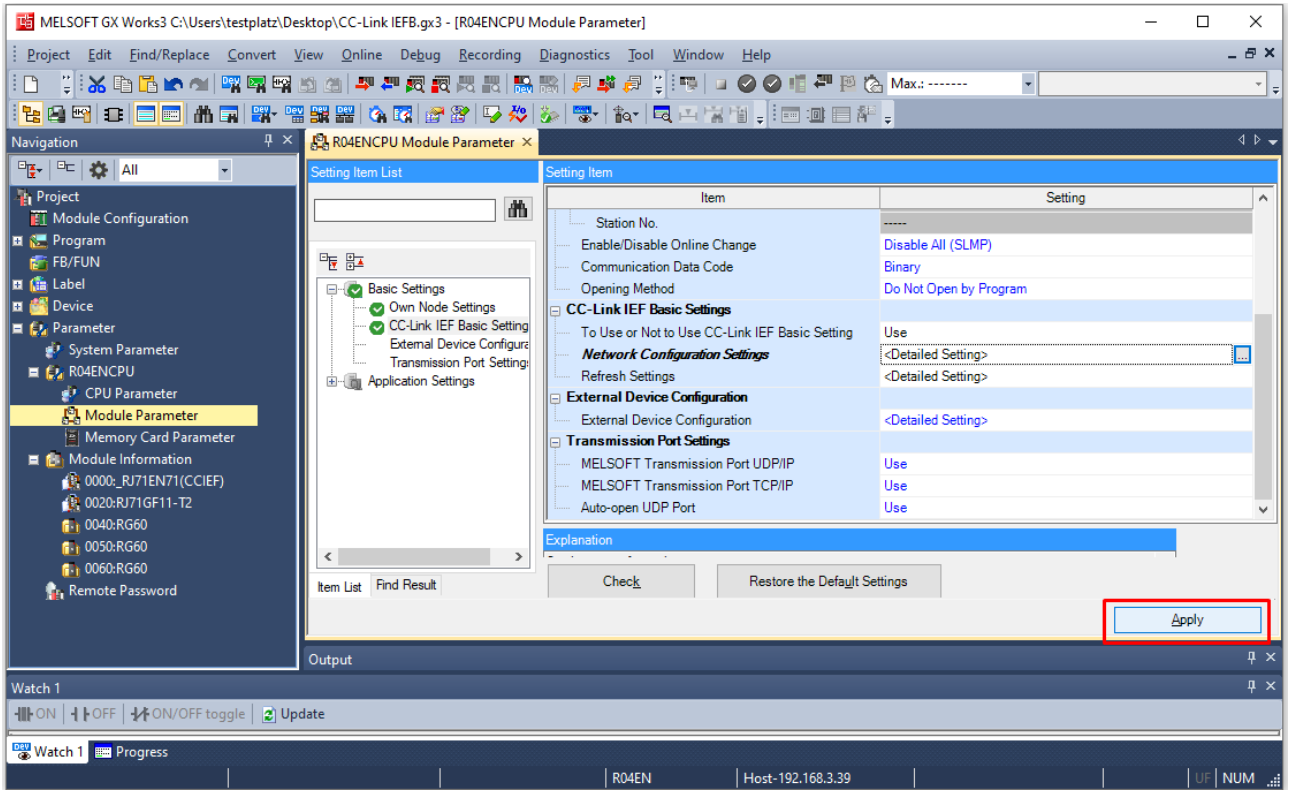


Fig. 60: GX Works3: Module Parameters, accept changes

7.9.4 Defining the process data mapping for CC-Link devices in the network

The start addresses of the process data for the devices that follow the **Master Station (Client)** (controller + local IOs) in the network are defined under **Module Parameters → CC-Link IEF Basic Settings** using the **Refresh Settings** function.

- Open the **Refresh Settings** function under **Module Parameters → CC-Link IEF Basic Settings**.
- Define the start addresses for the process data of the CC-Link devices in **CPU side**. **Check** can be used to verify whether the addresses are valid or overlap with the memory area occupied by the control unit.
- Accept the mapping settings with **Apply**.

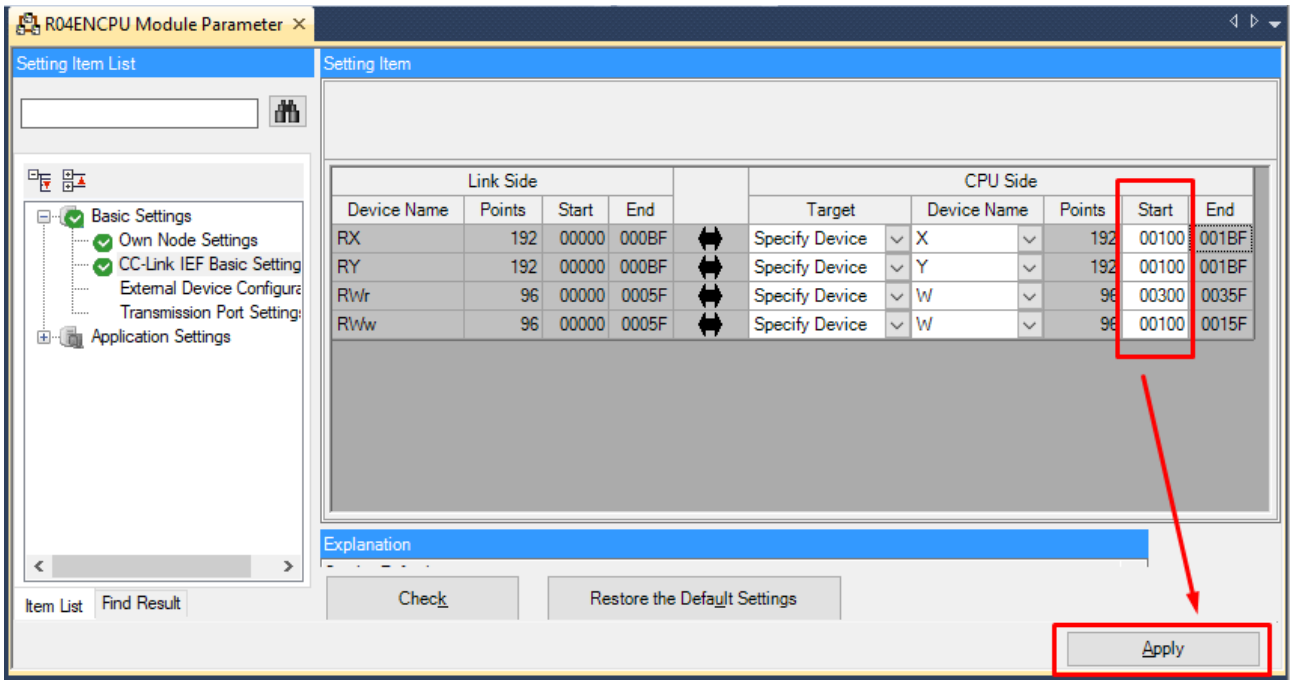


Fig. 61: GX Works3: Process data mapping in Refresh Settings

NOTE
Adjusting the mapping may require a voltage reset of the control unit.

7.9.5 Going online with the PLC

- Write the configuration to the PLC via **Online → Write to PLC**.

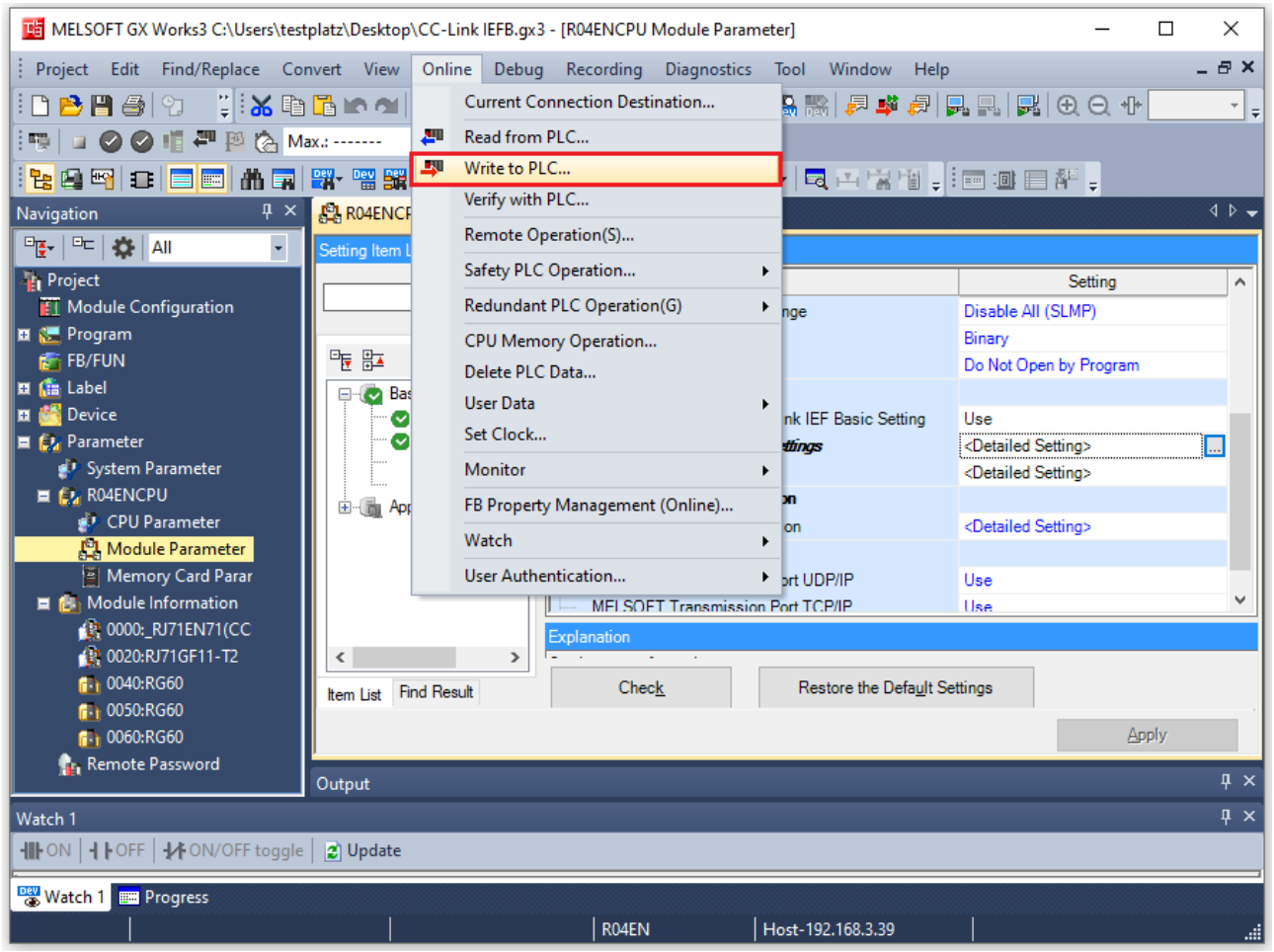


Fig. 62: GX Works3: Writing the configuration to the PLC

▶ If necessary, define which data have to be written and click **Execute**.

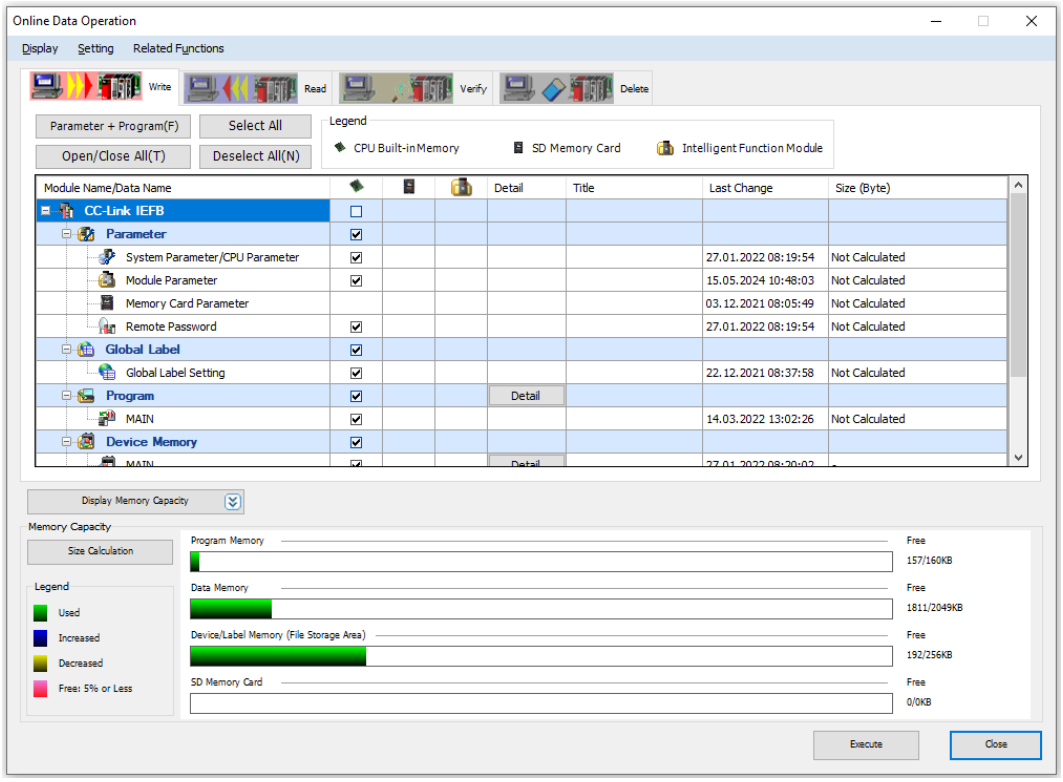


Fig. 63: GX Works3: Selecting data to be written

7.9.6 Reading process data

The monitoring of process data is done in the **Device/Buffer Memory Batch Monitor**.

▶ Open the monitoring via **Online** → **Monitor** → **Device/Buffer Memory Batch Monitor**.

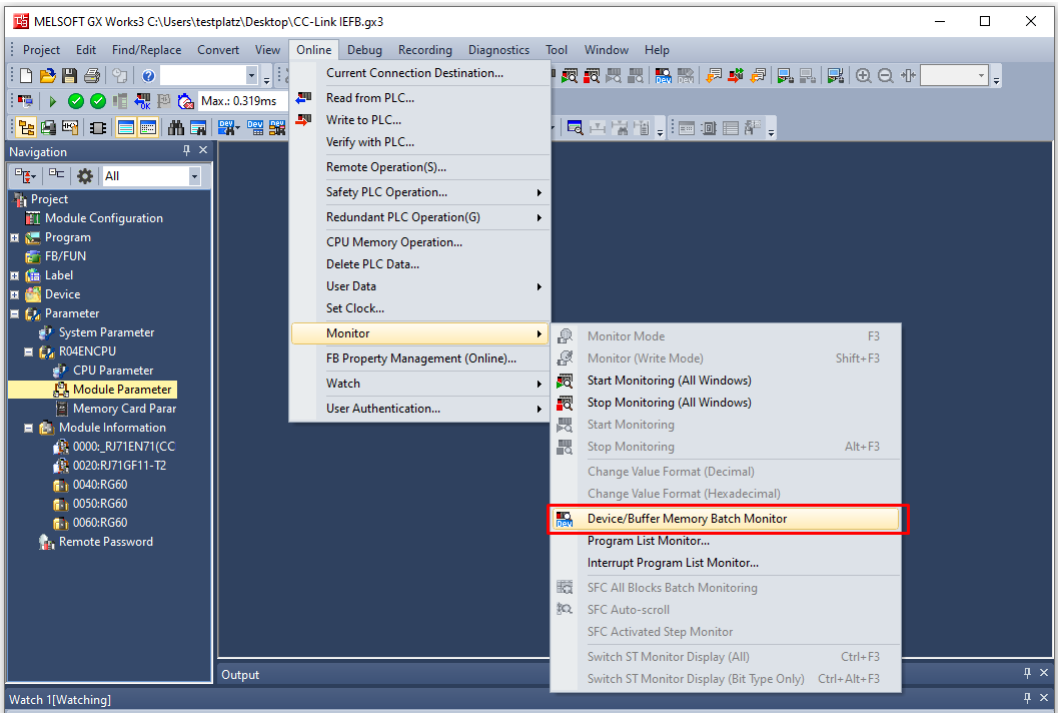


Fig. 64: GX Works3: Starting the monitoring of process data

▶ Enter the address of the process data to be read under **Device Name**. According to the defined process data mapping [▶ 131] **X100** is selected as start address.

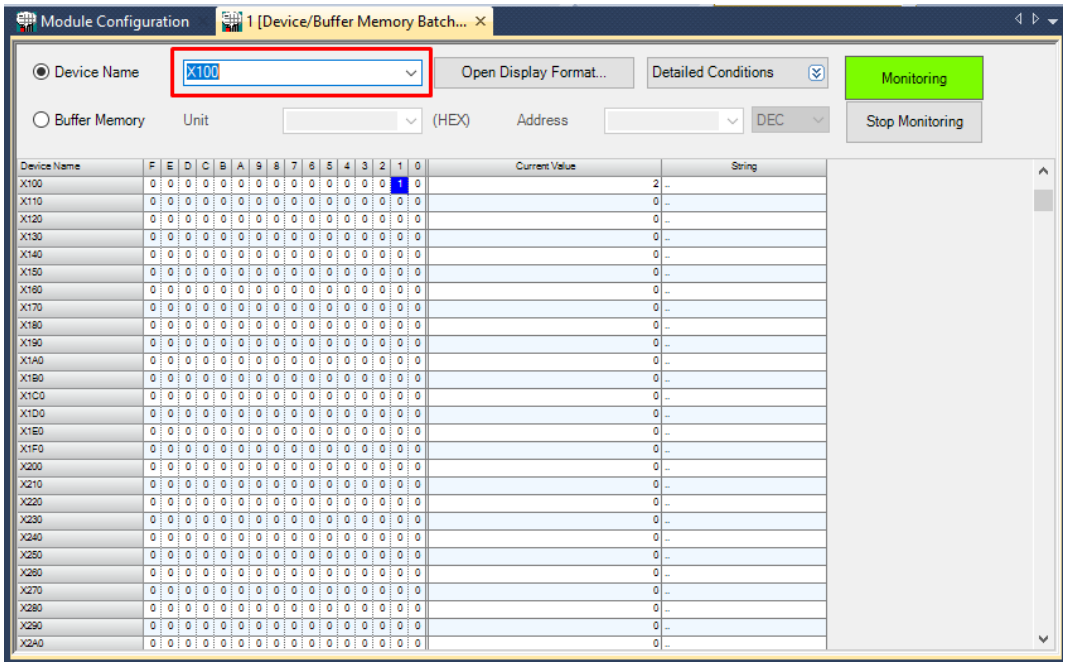


Fig. 65: GX Works3: Monitoring of process data

➪ The mapping shows a signal at the 2nd Digital input of the 1st CC-Link device (station address 2, TBEN-LL-8DIP-8DOP) [▶ 125].

7.10 Commissioning IO-Link devices

7.10.1 Commissioning IO-Link device-Link devices via IO-Link Device Application

The IO-Link devices connected to the IO-Link master can be commissioned via generic or device-specific IODDs in the IO-Link Device Application. The IO-Link Device Application is called up via the web server of the IO-Link device-Link master module.

NOTE
To be able to call up the IO-Link Device Application, a login to the web server of the IO-Link master is required [▶ 19].

Connected IO-Link devices are read in and initially mapped by a generic IODD.

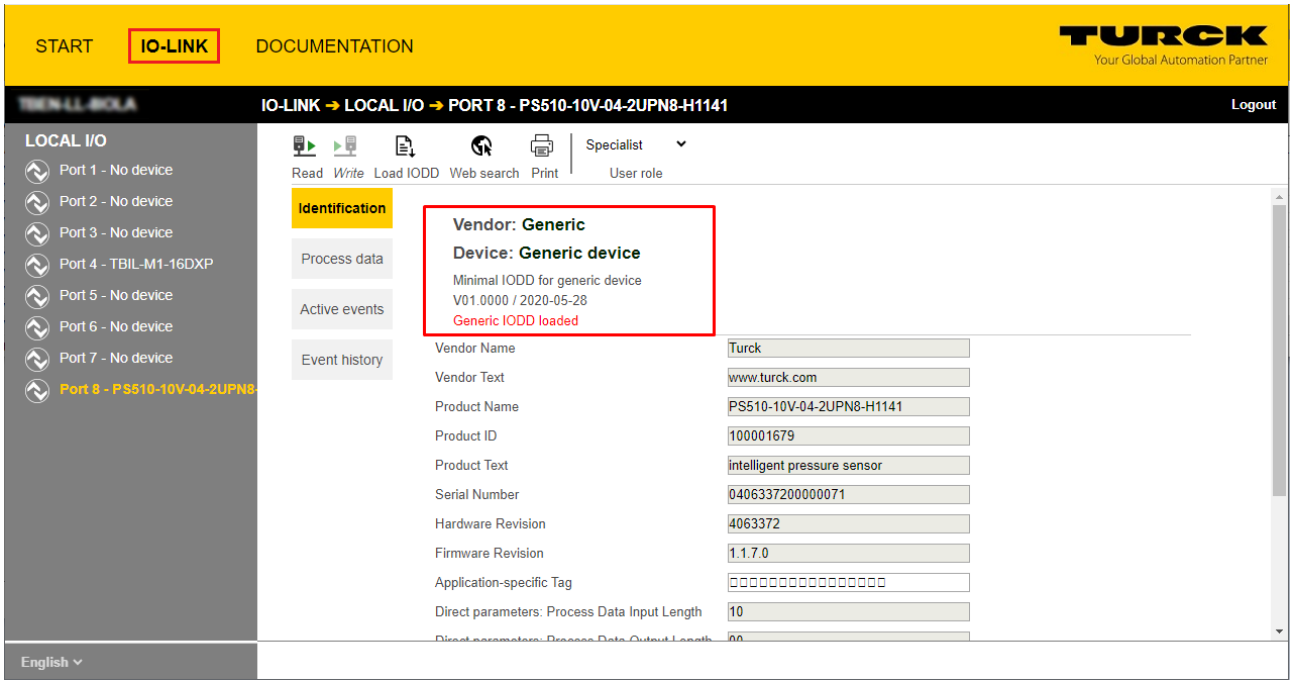


Fig. 66: IO-Link device with generic IODD

Device-specific IODDs can be loaded either directly from the local file system via **Load IODD** or from the database of the IO-Link consortium via **Websearch**. A PC with Internet access is required for the **Websearch** function.

When using a device-specific IODD, the IO-Link device is mapped with all IO-Link device-specific parameters, process data, etc. that are defined in the IODD.

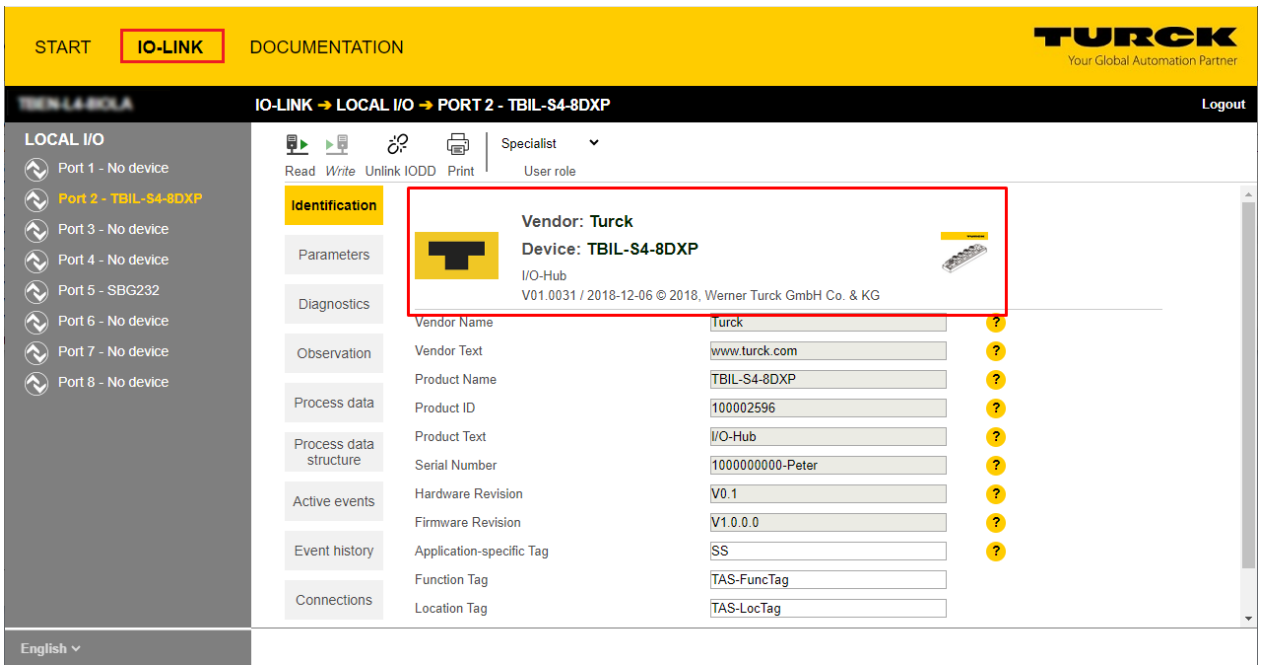


Fig. 67: IO-Link device with device specific IODD

Unlink IODD disconnects the connection to the device-specific IODD and causes the IO-Link device to be mapped again by a generic IODD. **Print** can be used to print the respective page content or save it as a PDF file, e.g., for system documentation.

Parameter settings for IO-Link devices can be exported or imported as *.json files in the **Parameter** section. **Set defaults** resets the values in the IO-Link Device Application interface to default settings. To reset IO-Link devices, the **RESTORE FACTORY SETTINGS** system command must be executed.

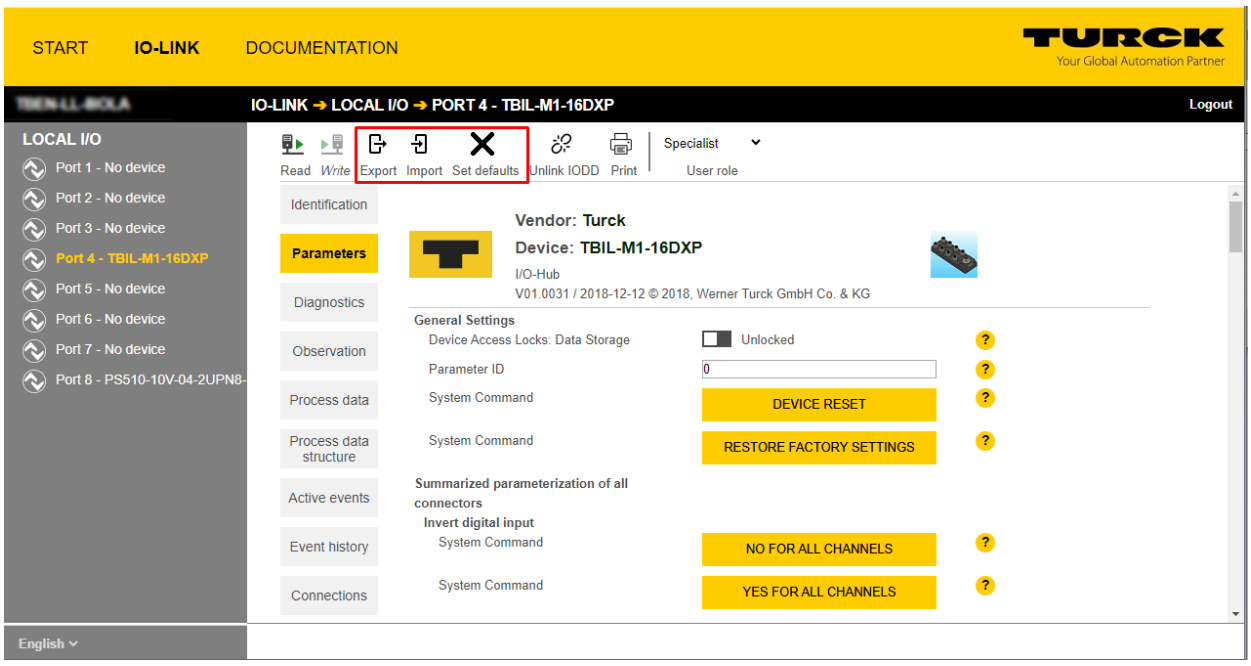


Fig. 68: Parameters of the IO-Link device

7.10.2 Commissioning IO-Link devices via SIDI (PROFINET only)

The IO-Link devices are defined in the GSMDL file of the IO-Link master. They can be selected directly in PROFINET engineering and assigned to the IO-Link ports of the IO-Link master module.

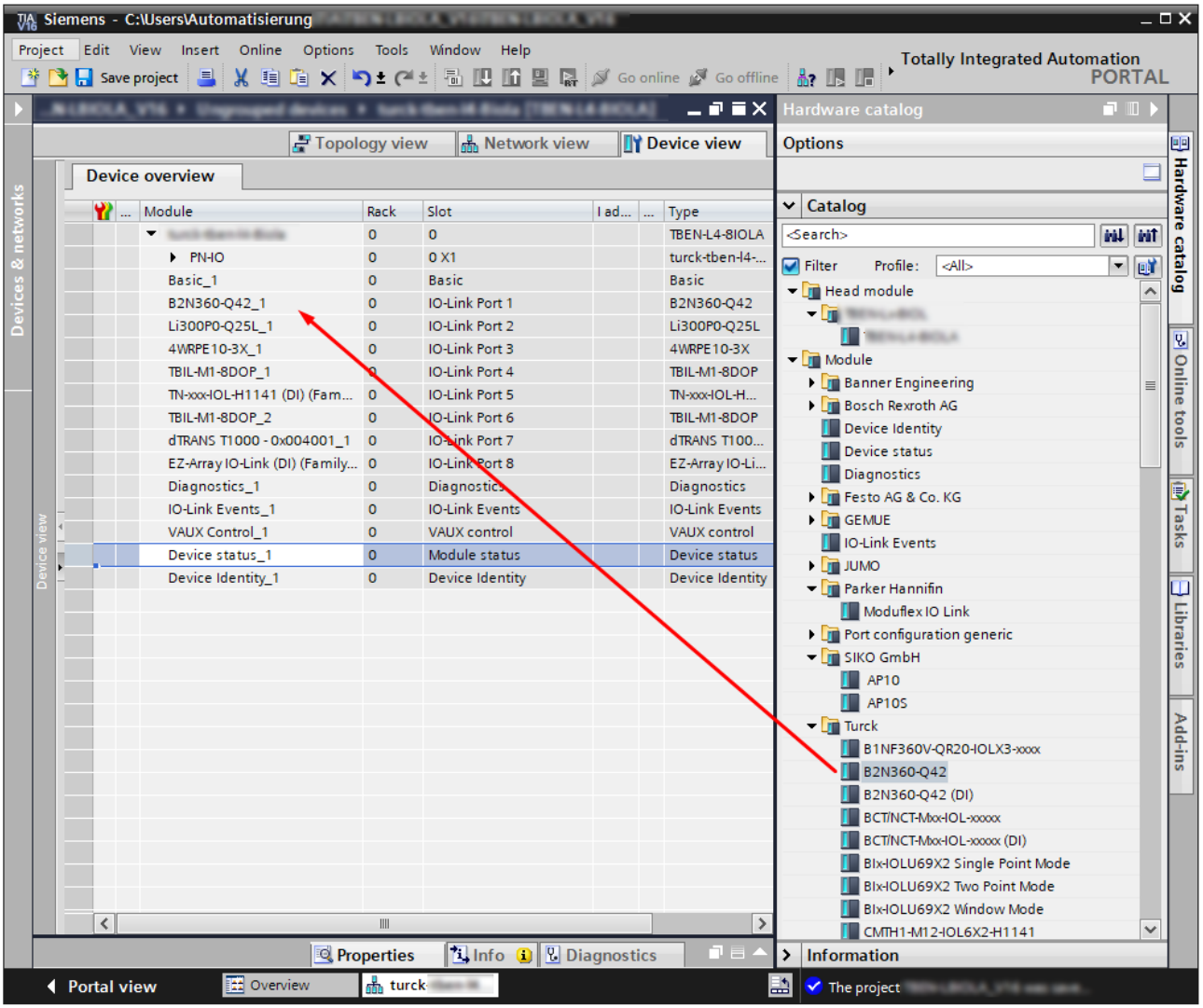


Fig. 69: Example: TIA Portal, IO-Link device in hardware catalog (SIDI)

Parameterizing IO-Link devices via PROFINET engineering

To be able to parameterize IO-Link devices via the GSDML, the "Device parameterization via GSD" parameter must be activated on the IO-Link master port (default setting).

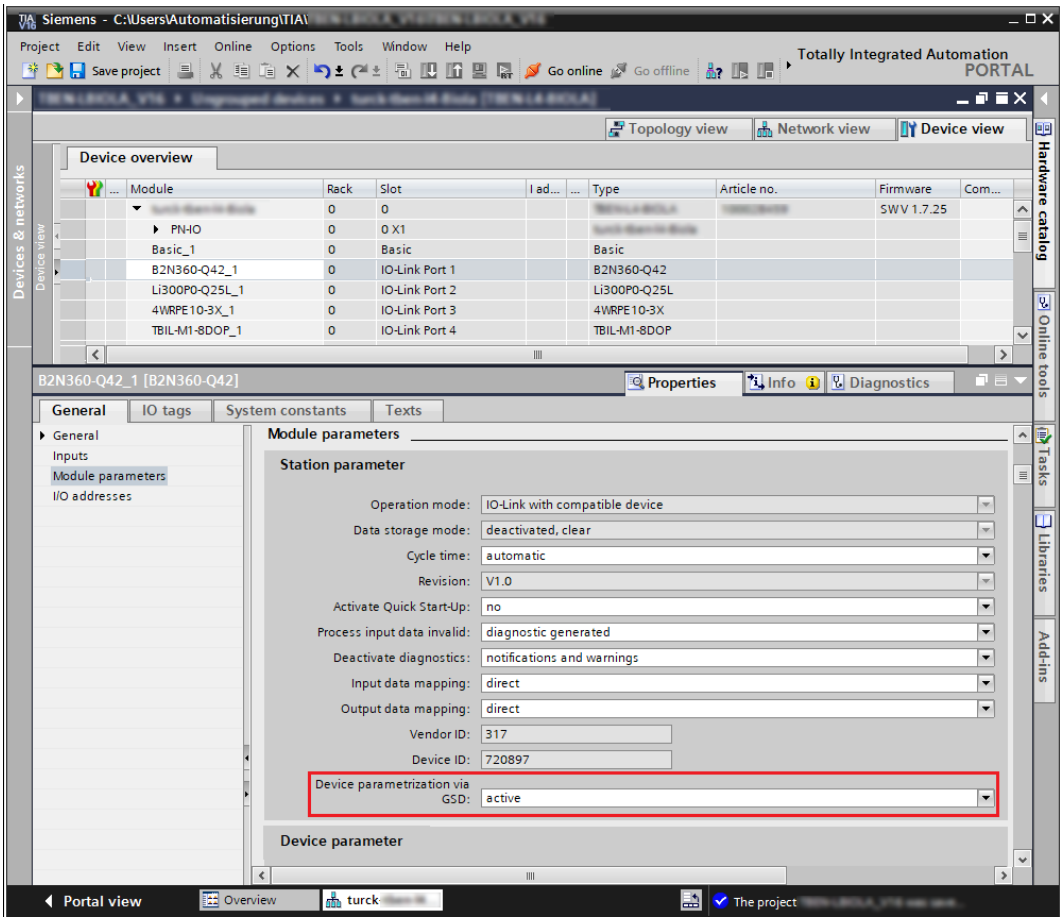


Fig. 70: Example: TIA Portal, "Device parameterization via GSD" parameter

The parameters of the IO-Link devices are set directly in PROFINET engineering.

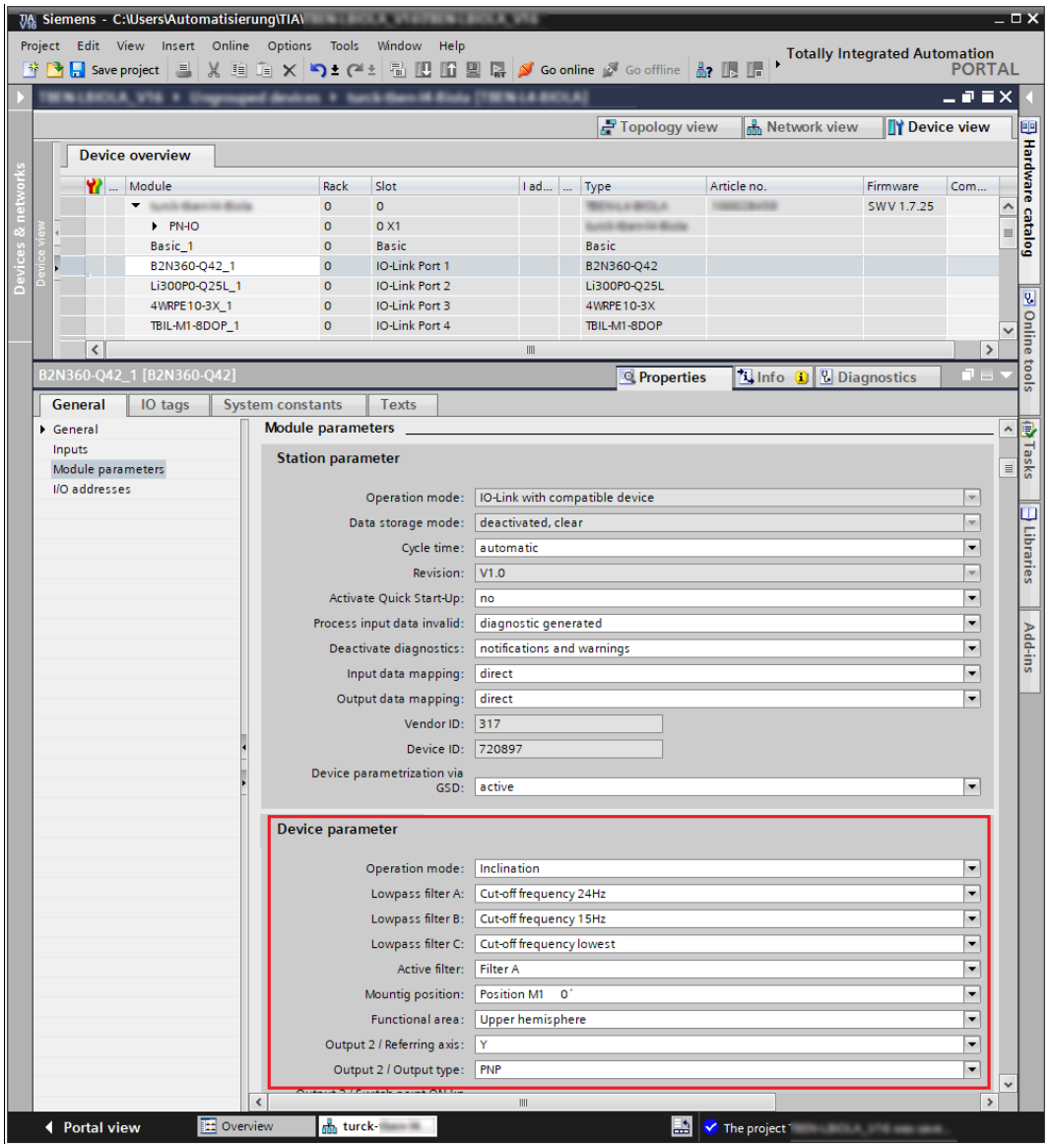


Fig. 71: Example: TIA Portal, IO-Link device parameters via GSDML

The parameterization of the IO-Link devices is controlled by the PLC. After a restart or an IO-Link device exchange, the start-up parameters stored in the PLC are written to the connected IO-Link devices. Parameter settings made during runtime either via the PLC (e.g. via IO-Link call accesses), directly at the IO-Link device (e.g. via operating elements) or at the IO-Link master (e.g. via web server or DTM) only apply temporarily and are overwritten with the parameter settings from the PLC at every restart.

Various IO-Link port parameters (station parameters) such as "operating mode", "data retention mode", "manufacturer ID" and "device ID" are defined via the GSDML file and cannot be changed.

NOTE
Data storage is not possible when configuring IO-Link devices with SIDI.

Parameterizing IO-Link devices via IO-Link mechanisms

The "Device parameterization via GSD" parameter must be deactivated. Parameters and process data structures of the IO-Link devices are structured via the GSDML and displayed in PROFINET engineering (e.g. in CODESYS) in a device-specific manner. However, parameter handling is performed via IO-Link mechanisms (e.g. data management).

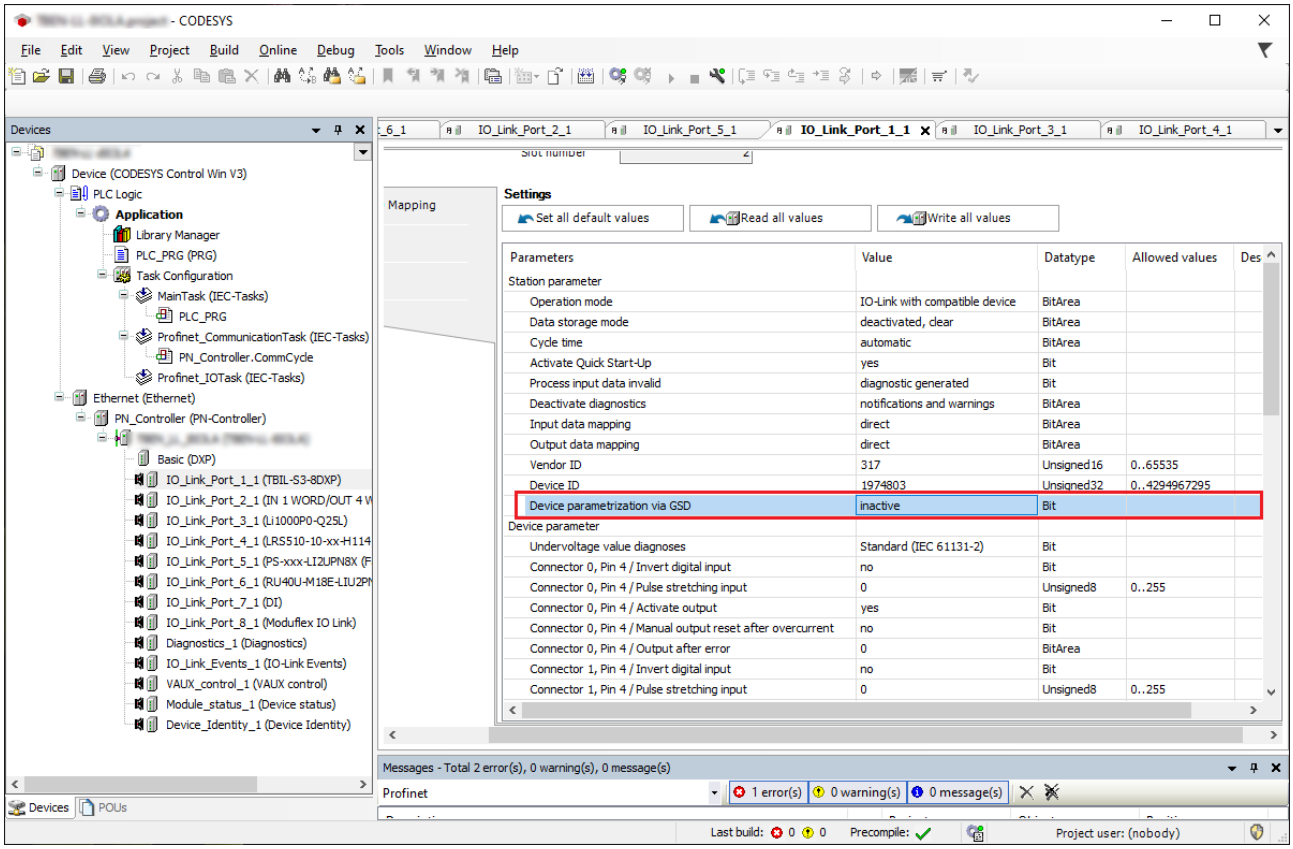


Fig. 72: PROFINET engineering (CODESYS); Device parameterization via GSD inactive

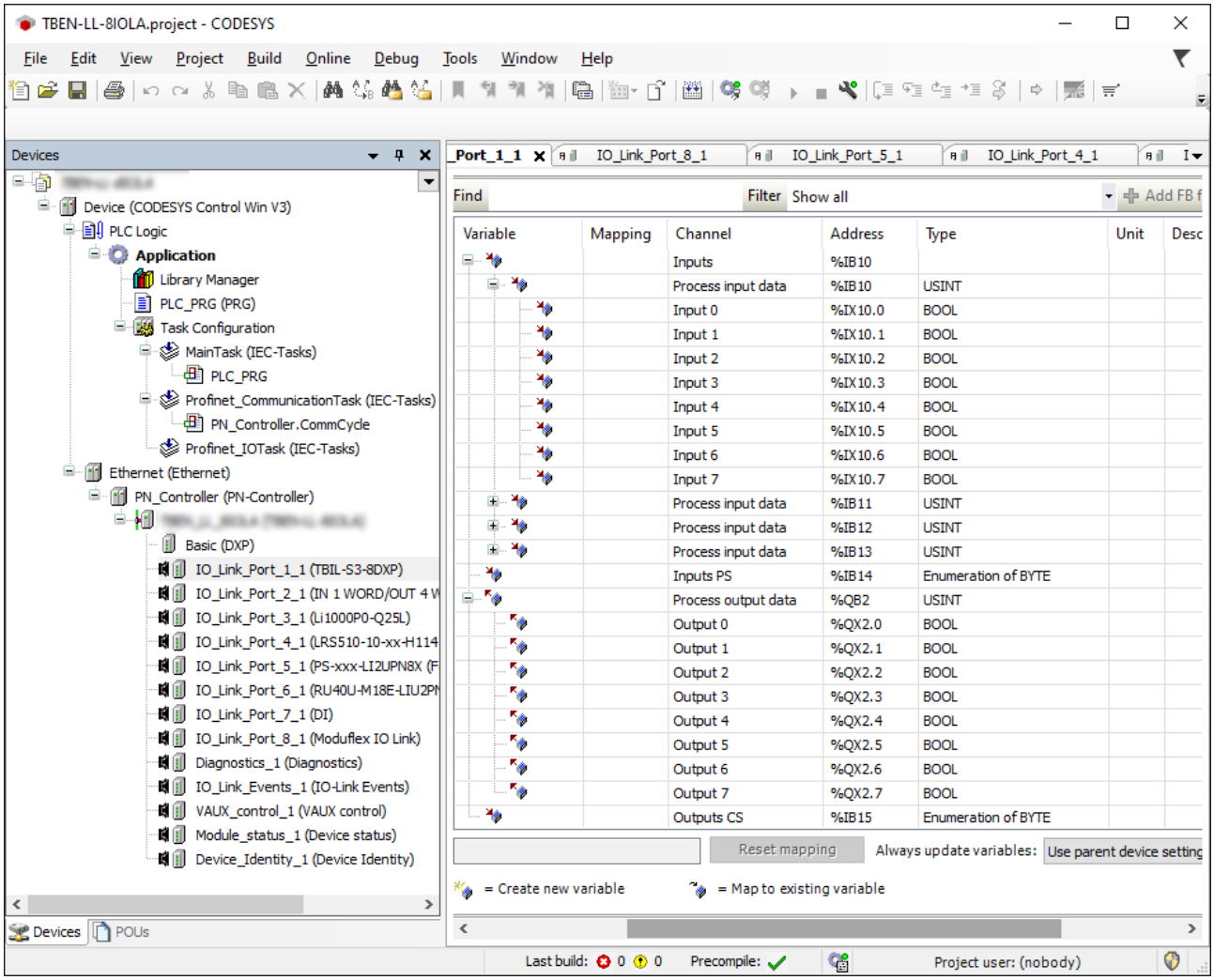


Fig. 73: PROFINET engineering (CODESYS): Process data structure IO-Link device with SIDI

7.10.3 IO-Link network scan in TAS desktop

The IO-Link network scan in TAS-Desktop scans a connected network for IO-Link masters and IO-Link devices connected to them.

- ▶ Scan network for IO-Link devices in the IO-Link view of TAS desktop via **Scan network.**

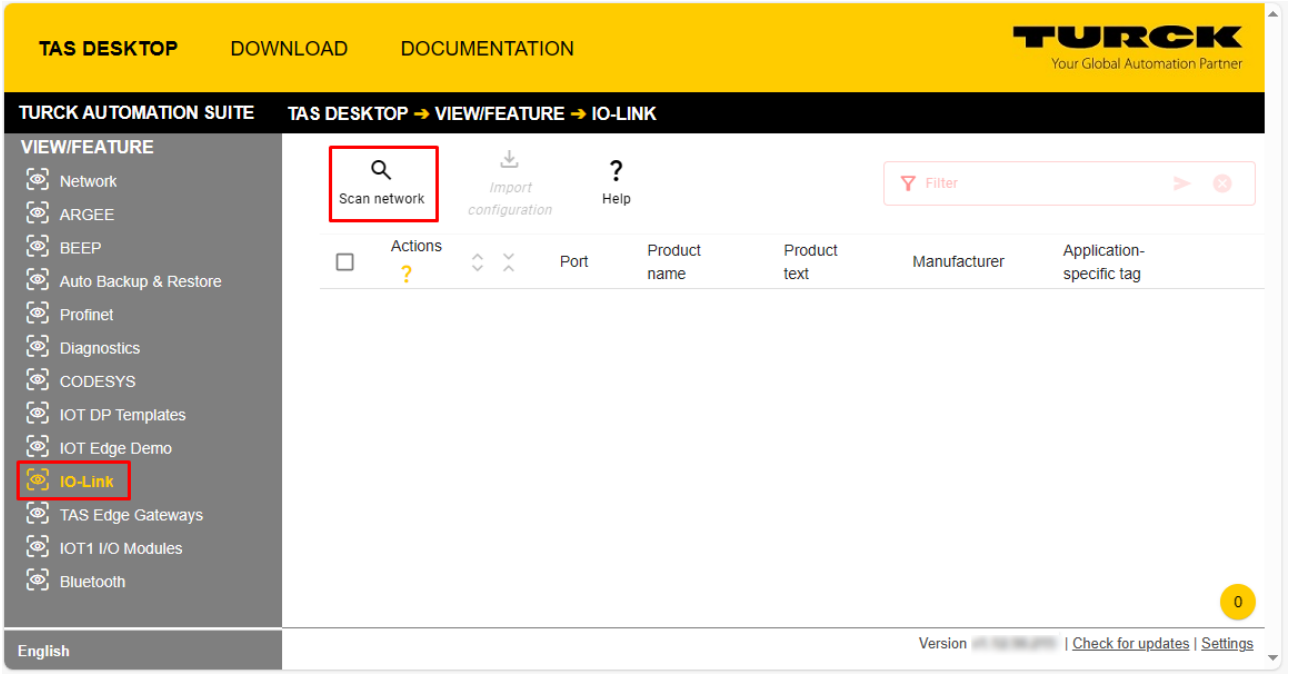


Fig. 74: TAS - scan network for IO-Link devices

➪ All IO-Link masters connected in the network, including the connected I/O-Link devices, are listed.

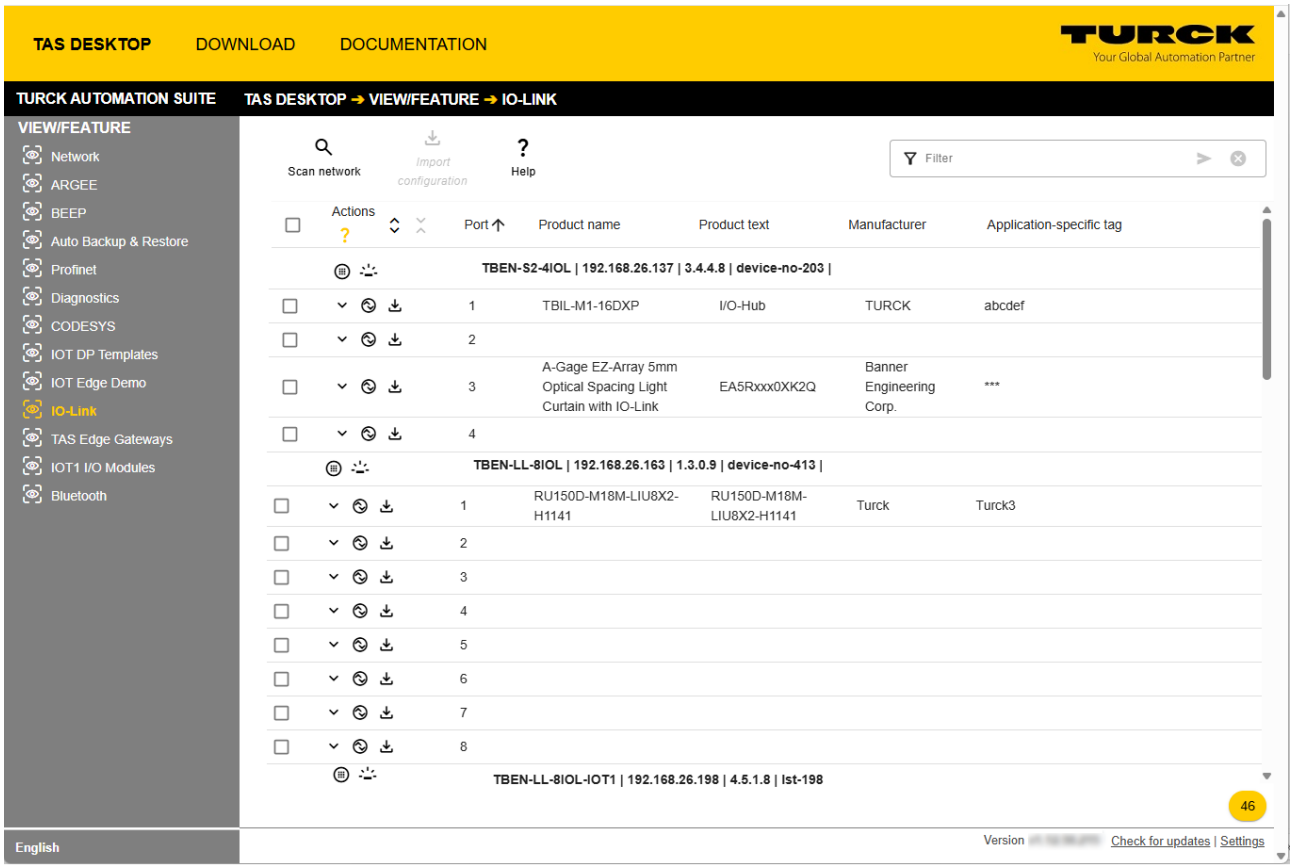


Fig. 75: TAS - IO-Link masters and devices found

Click on the **Open IO-Link in TAS** button to open the IO-Link device application ([▶ 135]).

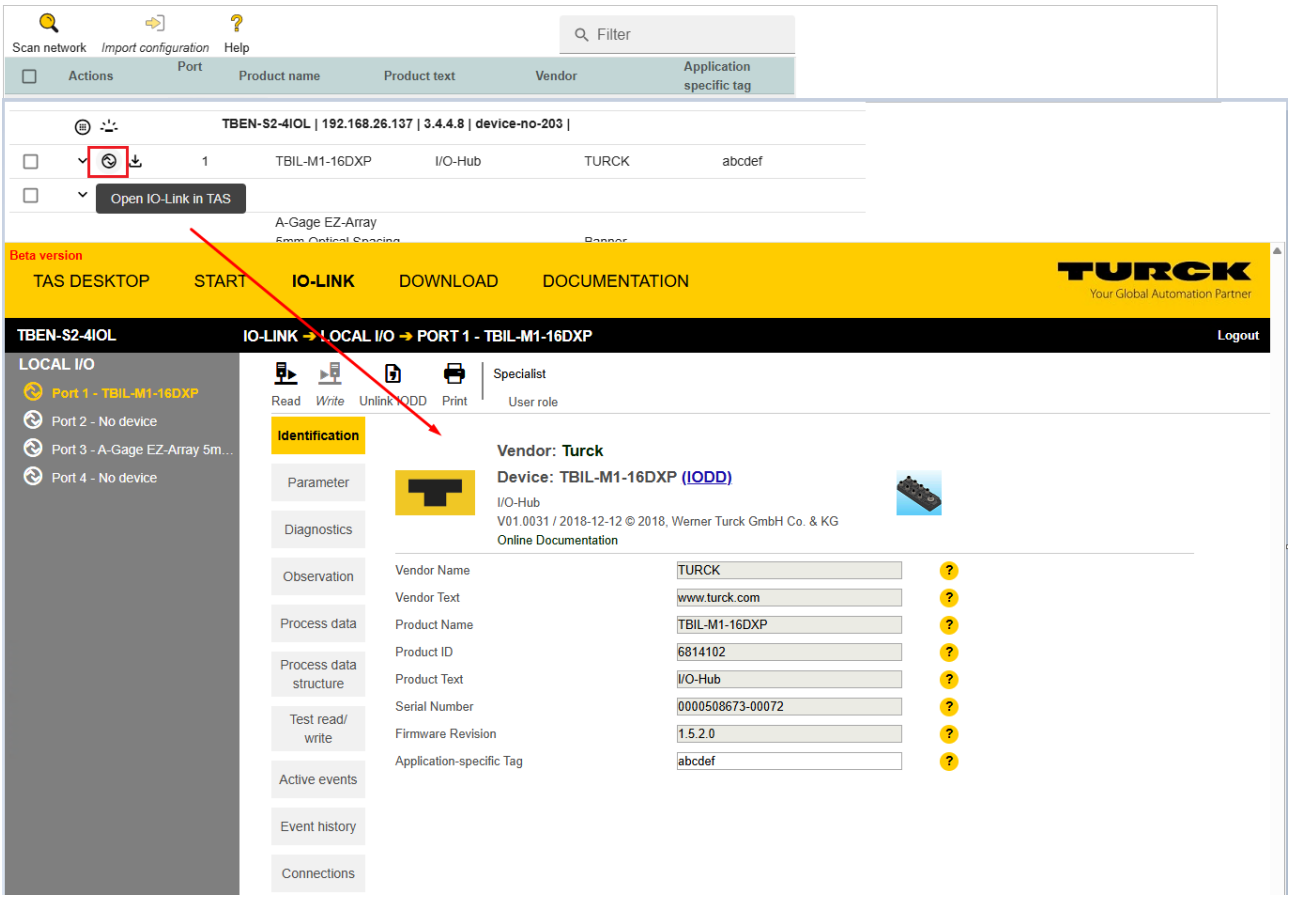


Fig. 76: IO-Link view - Open IO-Link device application

The **Import IO-Link configuration** button can be used to load a previously saved IO-Link device configuration into a new IO-Link device (example: device replacement).

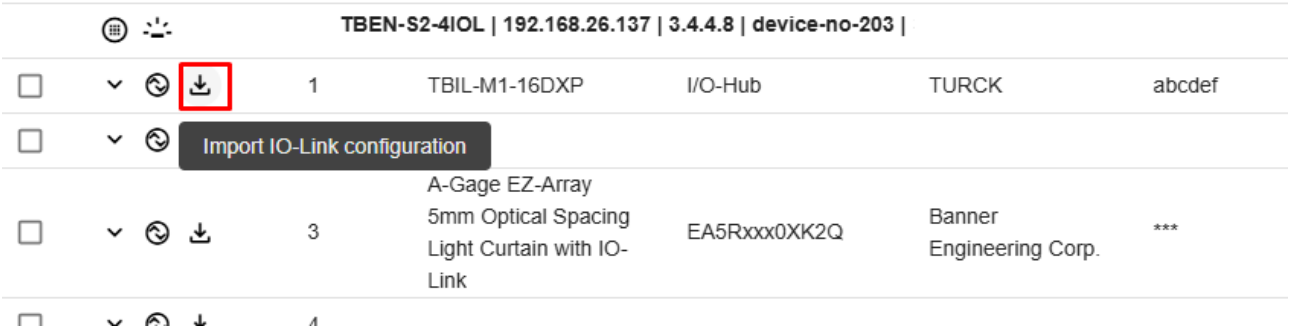


Fig. 77: IO-Link view 0 import IO-Link configuration

7.10.4 Commissioning IO-Link devices V1.0

IO-Link devices according to IO-Link specification V1.0 do not support data storage. If an IO-Link V1.0 device is used, the operating mode of the IO-Link master port must be set to compatibility mode **Type comp. V1.0 device.**

Setting the operation mode for IO-Link devices V1.0

- ▶ Set parameter **Operation mode** at the port to **Type comp. V1.0 device** setzen.
- ▶ Write the changes into the device via **Write**.
- ▶ Connect the IO-Link V1.0 device
- ⇨ The LED IOL at the IO-Link port is green, IO-Link communication active.

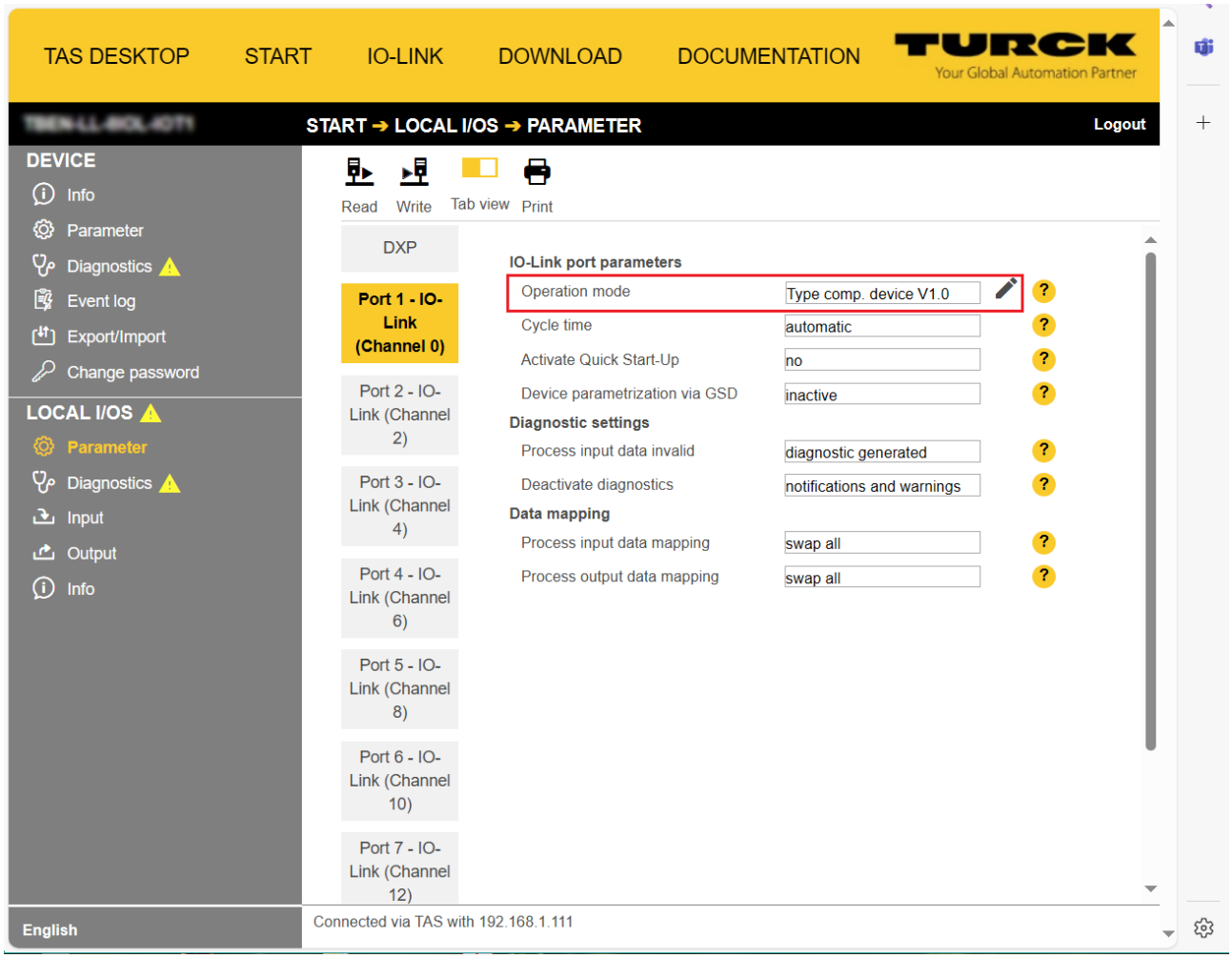


Fig. 78: TAS – parameter setting for IO-Link V1.0 devices

7.10.5 Commissioning IO-Link devices V1.1 (data storage)

If another device type is connected to an IO-Link port that has already been used, the data storage memory of the master should first be deleted, e.g. via the web server of the IO-Link master or via TAS.

The data storage memory of the master can be deleted in two ways:

- Reset the IO-Link master to the factory settings.
- Delete the data storage memory of the IO-Link master via the **Operation mode** → **deactivated** parameter.

Reset the IO-Link master to factory settings (example: TAS)

▶ In TAS Desktop, reset the IO-Link master to factory settings via **Start** → **Device** → **Parameter** by clicking **Factory reset and reboot** → **Execute reset** .

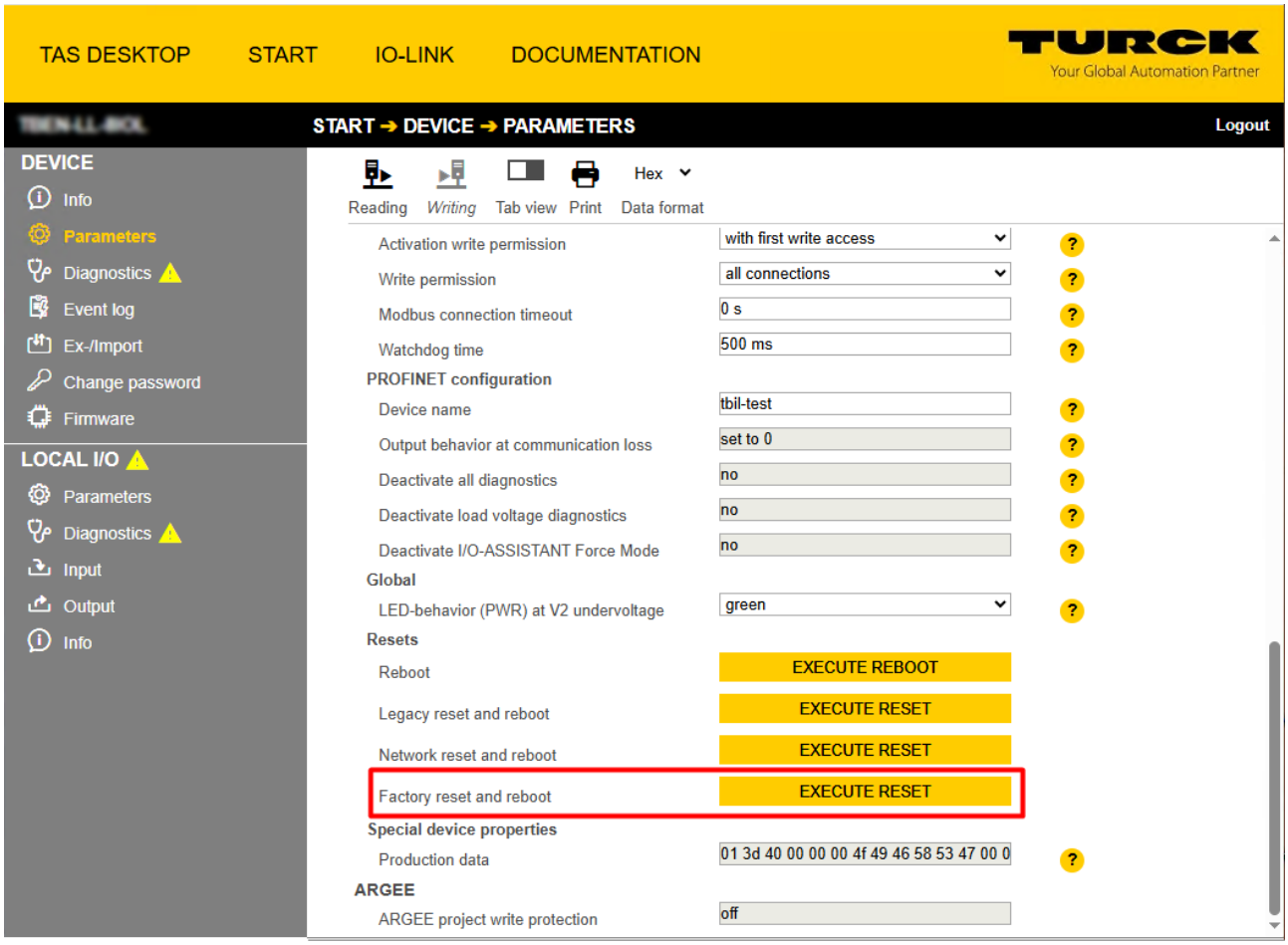


Fig. 79: TAS – resetting the device to factory settings

⇨ The device is reset.

Deleting the data storage memory via parameters (example: TAS)

- ▶ Set the parameter **Operation mode** to **deactivated**
- ▶ Write the changes into the device via **Write**.

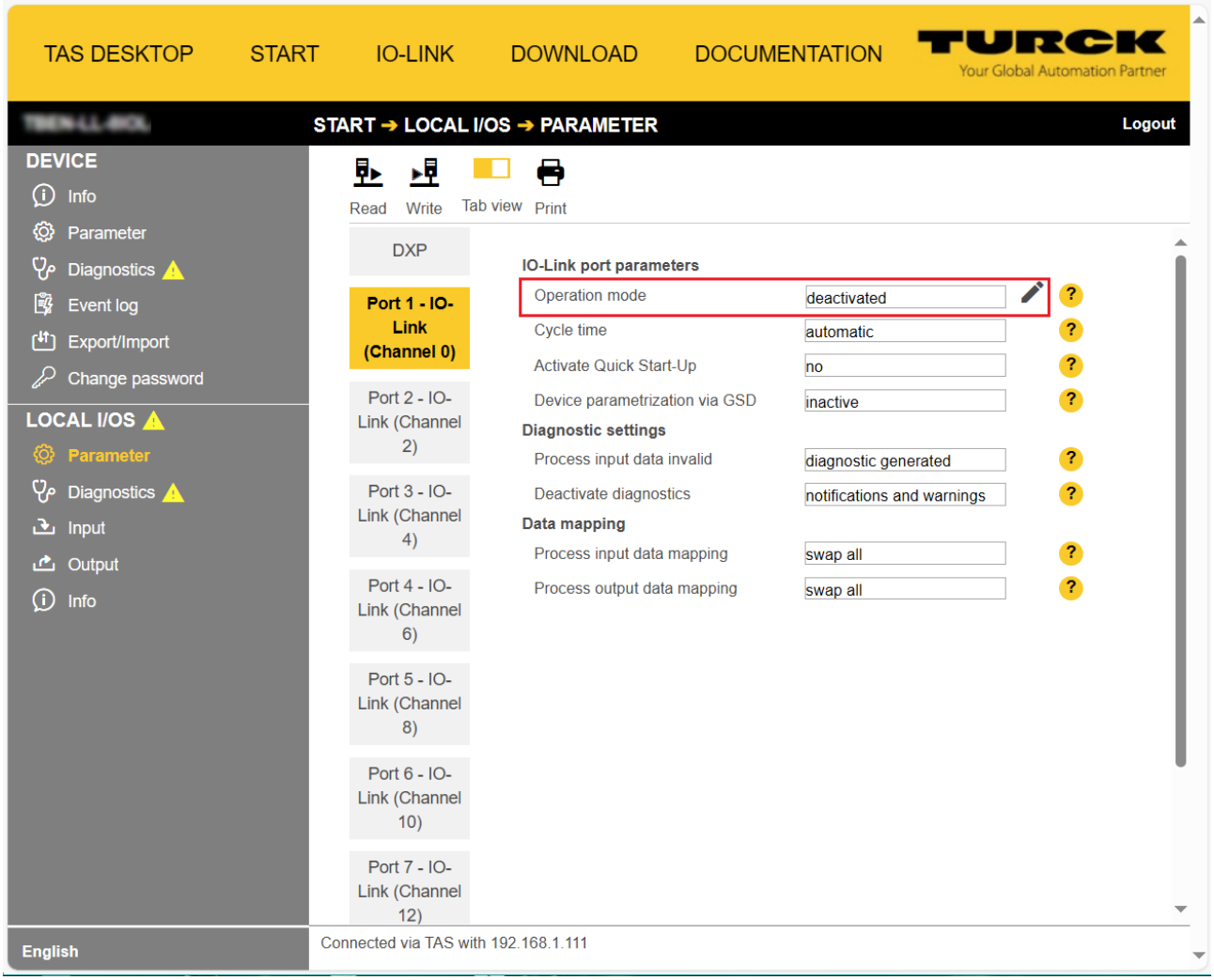


Fig. 80: TAS: Deleting the data storage memory via parameters

- ▶ Set the **Operation mode** back to a different value and load the parameter change into the device via **Write**.
- ▶ Connect the IO-Link V1.1 device
- ⇨ The LED IOL at the IO-Link port is green, IO-Link communication active.

8 Parameterizing and configuring

8.1 Parameters

Word no.	Bit no.															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Basic																
0x00	SRO V1+ (Ch7)	SRO V1+ (Ch6)	SRO V1+ (Ch5)	SRO V1+ (Ch4)	SRO V1+ (Ch3)	SRO V1+ (Ch2)	SRO V1+ (Ch1)	SRO V1+ (Ch0)	SRO C/Q (Ch7)	SRO C/Q (Ch6)	SRO C/Q (Ch5)	SRO C/Q (Ch4)	SRO C/Q (Ch3)	SRO C/Q (Ch2)	SRO C/Q (Ch1)	SRO C/Q (Ch0)
0x01	Mode V1+ (Ch7)	Mode V1+ (Ch6)	Mode V1+ (Ch5)	Mode V1+ (Ch4)	Mode V1+ (Ch3)	Mode V1+ (Ch2)	Mode V1+ (Ch1)	Mode V1+ (Ch)	Reserved							
IO-Link port 1																
0x02	Cycle time								GSD	Activate Quick Start-Up	Reserved		Operation mode			
0x03	Reserved								Mapping PCDO		Mapping PDOUT		Deactivate daignostics	PDIN In-valid	-	
0x04… 0x05	Reserved															
0x06	Vendor ID MSB								Vendor ID LSB							
0x07	Device ID								Device ID LSB							
0x08	Device ID MSB								Device ID							
0x09	Reserved															
IO-Link port 2																
0x0A… 0x11	Assignment similar to IO-Link port 1 (word 0x02…0x09)															
IO-Link port 3																
0x12… 0x19	Assignment similar to IO-Link port 1 (word 0x02…0x09)															
IO-Link port 4																
0x1A… 0x21	Assignment similar to IO-Link port 1 (word 0x02…0x09)															
IO-Link port 5																
0x22… 0x29	Assignment similar to IO-Link port 1 (word 0x02…0x09)															
IO-Link port 6																
0x2A… 0x31	Assignment similar to IO-Link port 1 (word 0x02…0x09)															
IO-Link port 7																
0x32… 0x39	Assignment similar to IO-Link port 1 (word 0x02…0x09)															
IO-Link port 8																
0x2A… 0x31	Assignment similar to IO-Link port 1 (word 0x02…0x09)															

The default values **are shown in bold** .

Parameter name	Value		Meaning	Description
	Dec.	Hex.		
Manual output reset after overcurrent (SRO… C/Q… or SRO V1+…)	**0**	**0x00**	**No**	The output switches on automatically after an overload.
	1	0x01	Yes	The output is manually switched-off after an overload until a new set command is given (rise and fall).
Mode V1+…	**0**	**0x00**	**24 VDC**	V1+ at the respective terminal connection is switched on.
	1	0x01	Switchable	V1+ at the respective terminal connection can be switched via the process data.
IO-Link channels				
Operation mode	1	0x01	Family comp- device	Pin 4 is operated in IO-Link mode. The master checks if the Vendor ID and the MSB of the Device ID (this byte defines the product family) of the connected device match those of the configured one. If the master detects a mismatch, the IO-Link communication is established, but there is no process data exchange. The device remains in the safe state (Pre-Operate). Parameters and diagnostic information can be read and respectively written. Data storage is deactivated.
	4	0x04	DI (with parameter access)	Pin 4 is generally operated as simple digital input. However, an acyclic parameter access from the PLC or the DTM is possible. The IO-Link master starts the port in IO-Link mode, parameterizes the device and sets the port back into SIO mode (DI). The port remains in SIO mode (DI) until a new IO-Link request is sent from the higher-level control. Data storage is not supported. Connected devices have to support the SIO mode (DI). In case of a parameter access, the IO-Link communication at the port is started. Switching signals are interrupted.
	8	0x08	DI	Pin 4 is operated as simple digital input. Data storage is not supported.
	9	0x09	DX	The channel is operated as universal digital DX channel
	10	0x0A	deactivated	The IO-Link port is deactivated and the data storage buffer of the IO-Link master is deleted.
	11	**0x0B**	**No device check (autostart)**	Pin 4 is operated in IO-Link mode. The master does not check if the connected device matches the configured one.

Parameter name	Value		Meaning	Description
	Dec.	Hex.		
	12	0x0C	Type comp. device V1.0	Pin 4 is operated in IO-Link mode. The master checks the Vendor ID of the connected device. It has to match that of the configured device. If the device ID or the revision ID of the connected device does not match that of the configured device, the master attempts to write the configured device ID and revision ID (V1.0) to the device. If the device accepts this, it is compatible, otherwise it is not compatible. Data storage is deactivated.
	13	0x0D	Type comp. device V1.1	Pin 4 is operated in IO-Link mode. The master checks the Vendor ID of the connected device. It has to match that of the configured device. If the device ID or the revision ID of the connected device do not match that of the configured device, the master attempts to write the configured device ID and revision ID (V1.1) to the device. If the device accepts this, it is compatible, otherwise it is not compatible. Data storage is deactivated.
	14	0x0E	Type comp. device V1.1, backup + restore	Pin 4 is operated in IO-Link mode. The master checks the Vendor ID of the connected device. It has to match that of the configured device. If the device ID or the revision ID of the connected device do not match that of the configured device, the master attempts to write the configured device ID and revision ID (V1.1) to the device. If the device accepts this, it is compatible, otherwise it is not compatible. Data storage is activated. Both uploading data from the connected device and overwriting data in the connected device are possible.
	15	0x0F	Type comp. device V1.1, restore	Pin 4 is operated in IO-Link mode. The master checks the Vendor ID of the connected device. It has to match that of the configured device. If the device ID or the revision ID of the connected device do not match that of the configured device, the master attempts to write the configured device ID and revision ID (V1.1) to the device. If the device accepts this, it is compatible, otherwise it is not compatible. Data storage is activated. After an initial upload of the data from the connected device, the import (upload) of data is deactivated, but it is possible to overwrite (download) data in the connected device.
Activate Quick Start-Up	For fast applications (e.g. tool changing applications) the start-up time of IO-Link devices can be shortened. The start-up time defined in the IO-Link specification (TSD = Device Detection Time) is reduced.			

Parameter name	Value		Meaning	Description
	Dec.	Hex.		
	0	**0x00**	**No**	The start-up time is within the specified range (0.5 s). All IO-Link devices in accordance with the specification can be operated.
	1	0x01	Yes	The start-up time is reduced to approx. 100 ms. It is not supported by every IO-Link device. It can thus be necessary to check if the used IO-Link device starts in this mode.
Device parameterization via GSD (GSD)	**0**	**0x00**	**inactive**	The port is generic or is not parameterized.
	1	0x01	active	In PROFINET the port is parameterized with a specific device type from the GSDML-file (SIDI).
Cycle time	**0**	**0x00**	**Automatic**	The lowest cycle time supported by the device is taken from the table.
	16…191	0x10 … 0xBF	1.6…132.8 ms	Settable in steps of 0.8 or 1.6 ms.
	255	0xFF	Automatic, compatible	Only available for compatibility reasons, no function
Process input data invalid (PDIN invalid)	**0**	**0x00**	**Diagnostic generated**	If the process data are invalid, a respective diagnostic message is generated.
	1	0x01	No diagnostic generated	Invalid process data do not cause a diagnostic message.
Deactivate diagnostics	Influences the sending of IO-Link-Events from the master to the fieldbus. Depending on the parameterization, the master transmits Events based on their priority to the fieldbus or not.			
	0	0x00	No	The master transmits all IO-Link Events to the fieldbus.
	1	0x01	Notifications	The master transmits all IO-Link Events to the fieldbus except for IO-Link notifications.
	2	**0x02**	**Notifications and warnings**	The master transmits all IO-Link Events to the fieldbus except for IO-Link notifications and warnings.
	3	0x03	Yes	The master doesn't transmit any IO-Link Event to the fieldbus.
Process input data mapping (Mapping PDIN)	Optimization of the process data mapping for the used fieldbus: The IO-Link-data can be swapped depending on the used fieldbus in order to achieve an optimized data mapping on the fieldbus side. Note: The default setting below does not apply to PROFINET. In PROFINET, the parameter is set to **0x00 = direct** .			
	0	0x00	Direct	The process data are not swapped. e.g. 0x0123 4567 89AB CDEF
	1	0x01	Swap 16 bit	The bytes are swapped per word. e.g. 0x2301 6745 AB89 EFCD
	2	0x02	Swap 32 bit	The bytes are swapped per double word. e.g. 0x6745 2301 EFCD AB89
	3	**0x03**	**Swap all**	All bytes are swapped. e.g.: 0xEFCD AB89 6745 2301
Process output data mapping (Mapping PDOUT)	see **Process output data mapping**			

Parameter name	Value		Meaning	Description
	Dec.	Hex.		
Vendor ID	0…65535	0x0000…0xFFFF		Vendor ID for the port configuration check
Device ID	0…16777215	0…0x00FFFFFF		Device ID for the port configuration check, 24 bit value

Values for the parameter "cycle time" in ms:

Time	Value	Time	Value	Time	Value	Time	Value	Time	Value	Time	Value
Auto	0x00	16	0x58	31.2	0x7E	60.8	0x92	91.2	0xA5	121.6	0xB8
1.6	0x10	16.8	0x5A	32	0x80	62.4	0x93	92.8	0xA6	123.2	0xB9
2.4	0x18	17.6	0x5C	33.6	0x81	64	0x94	94.4	0xA7	124.8	0xBA
3.2	0x20	18.4	0x5E	35.2	0x82	65.6	0x95	96	0xA8	126.4	0xBB
4	0x28	19.2	0x60	36.8	0x83	67.1	0x96	97.6	0xA9	128	0xBC
4.8	0x30	20	0x62	38.4	0x84	68.8	0x97	99.2	0xAA	129.6	0xBD
5.6	0x38	20.8	0x67	40	0x85	70.4	0x98	100.8	0xAB	131.2	0xBE
6.4	0x40	21.6	0x66	41.6	0x86	72	0x99	102.4	0xAC	132.8	0xBF
7.2	0x42	22.4	0x68	43.2	0x87	73.6	0x9A	104	0xAD	Reserved	
8	0x44	23.2	0x6A	44.8	0x88	75.2	0x9B	105.6	0xAE		
8.8	0x46	24.0	0x6C	46.4	0x89	76.8	0x9C	107.2	0xAF		
9.6	0x48	24.8	0x6E	48	0x8A	78.4	0x9D	108.8	0xB0		
10.4	0x4A	25.6	0x70	49.6	0x8B	80	0x9E	110.4	0xB1		
11.2	0x4C	26.4	0x72	51.2	0x8C	81.6	0x9F	112	0xB2		
12.0	0x4E	27.2	0x74	52.8	0x8D	83.2	0xA0	113.6	0xB3		
12.8	0x50	28	0x76	54.4	0x8E	84.8	0xA1	115.2	0xB4		
13.6	0x52	28.8	0x78	56	0x8F	86.4	0xA2	116.8	0xB5		
14.4	0x54	29.6	0x7A	57.6	0x90	88	0xA3	118.4	0xB6		
15.2	1x56	30.4	0x7C	59.2	0x91	89.6	0xA4	120	0xB7		

8.1.1 Adapting process data mapping

The mapping of process data can be adapted application-specifically via the IO-Link-master's parameterization.

Depending on the used fieldbus, it can be necessary to swap process data word-wise, double word-wise or completely in order to align them to the data structure in the PLC. The process data mapping is determined channel by channel through the parameters **process input data mapping** and **process output data mapping**.

Example mapping for fieldbuses with Little Endian-format

Mapping through the IO-Link master → fieldbus → PLC						
Byte	**Device at IO-Link port**	**Device process data in IO-Link master**		**Parameter: Process data mapping**	**Device process data to fieldbus**	
Byte 0		Status/Control			Status/Control	
Byte 1						
IO-Link port 1						
Byte 2	Temperature sensor TS…	Temperature	Low byte	**Swap 16 bit**	Temperature	High byte
Byte 3			High byte			Low byte
IO-Link port 2						
Byte 4	Linear position sensor Li…	Position	Low byte	**Swap 16 bit**	position	High byte
Byte 5			High byte			Low byte
IO-Link port 3						
Byte 6	I/O hub TBIL-…	Digital signals	0…7	**Direct**	Digital signal	0…7
Byte 7		Digital signals	8…15		Digital signal	8…15
IO-Link port 4						
Byte 8		Diagnostics		**Swap all**	Counter/position value	Most Significant Byte
Byte 9	Rotary encoder RI…	Counter/position value	Low byte			High byte
Byte 10			High byte			Low byte
Byte 11			Most Significant Byte		Diagnostics	

8.1.2 PROFINET parameters

For PROFINET, a distinction must be made in the parameters between the PROFINET device parameters and the parameters of the I/O channels.

PROFINET device parameters

Default values are **are shown in bold.** .

Parameter name	Value	Meaning	Description
Output behavior at communication loss	**0**	**set to 0**	The Device switches the outputs of to 0. No error information is transmitted.
	1	Hold current value	The device maintains the actual output data.
Deactivate diagnostics	**0**	**No**	Diagnostic and alarm messages are generated.
	1	Yes	Diagnostic and alarm messages are supressed.
Deactivate I/O ASS. Force Mode	**0**	**No**	Explicit deactivation of the Ethernet protocols or web server
	1	Yes	
Deactivate EtherNet/IP	**0**	**No**	
	1	Yes	
Deactivate Modbus TCP	**0**	**No**	
	1	Yes	
Deactivate WEB server	**0**	**No**	
	1	Yes	

8.2 IO-Link functions for acyclic communication

The acyclic access to the data of IO-Link devices is realized via IO-Link CALLs. A distinction must be made between data of the IO-Link master (IOLM) and data of connected IO-Link devices (IOLD).

The addressing of the IO-Link CALL defines which device is addressed via the CALL:

The addressing is defined by the so called Entitiy_Port:

- Entity_Port 0 = IO-Link master module (IOLM)
- Entity_Port 1 = IO-Link device at IO-Link port 1
- …
- Entity_Port 8 = IO-Link device at IO-Link port 8

8.2.1 Port functions for Port 0 (IO-Link Master)

IO-Link index (port function invocation)

The access to the IO-Link master functionalities (port 0) is done via index 65535.

Subindex 64: Master Port Validation Configuration

The object writes a specific configuration of the devices which have to be connected to the IO-Link port to the master. The master stores the data for the The IO-Link device expected at the port and then accepts only one device at the port with exactly matching data (vendor ID, device ID and serial number).

The Master Port Validation Configuration is only useful in combination with an operation mode with validation (e. g.: IO-Link with family compatible device).

Entity_Port	IO-Link sub index	Read/write	Length
0	64	Write	Max. 192 byte

Structure of the command IOL_Port_Config:

	Content	Size	Format	Comment
IOL1	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	
IOL2	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	
IOL3	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	
IOL4	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	

	Content	Size	Format	Comment
IOL5	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	
IOL6	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	
IOL7	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	
IOL8	VENDOR_ID	2 byte	Unsigned 16	
	DEVICE_ID	4 byte	Unsigned 32	
	FUNCTION_ID	2 byte	Unsigned 16	Value: 0
	SERIAL_NUMBER	16 byte	String	

Subindex 65: IO-Link events

The object reads IO-Link Event diagnostics.

Entity_Port	IO-Link sub index	Read/write	Length
0	65	Read	255 byte

NOTE
Only "appears" (coming diagnostics) and "Single Shot Events" are shown, as long as they are pending.

Structure of the read data:

- Byte 0 contains 2 bit per IO-Link port which show, if the process data of the connected device are valid or not.
- 4 byte per diagnostic event, which assign and specify the diagnostics more precisely. A maximum of 14 Events per IO-Link port are shown.

Byte no.	Bit no.								Description
	7	6	5	4	3	2	1	0	
0								x	PD_Valid Input Port 1
							x		PD_Valid Output Port 1
						x			PD_Valid Input Port 2
					x				PD_Valid Output Port 2
				x					PD_Valid Input Port 3
			x						PD_Valid Output Port 3
		x							PD_Valid Input Port 4
	x								PD_Valid Output Port 4
1								x	PD_Valid Input Port 5
							x		PD_Valid Output Port 5
						x			PD_Valid Input Port 6
					x				PD_Valid Output Port 6
				x					PD_Valid Input Port 7
			x						PD_Valid Output Port 7
		x							PD_Valid Input Port 8
	x								PD_Valid Output Port 8
2	Qualifier								Defines the type of the event (Warning, Notification, Single Shot Event, etc.) in accordance with IO-Link specification "IO-Link Interface and System".
3	Port								IO-Link port which sends an event
4	Event Code high byte								High or- low byte of the error code sent
5	Event Code low byte								
…									…
223	Qualifier								see byte 2…5
224	Port								
225	Event Code high byte								
226	Event Code low byte								

Subindex 66: Set Default Parameterization

Writing this object sets the IO-Link master back to factory settings. Any parameter setting and configuration is overwritten. The data storage buffer is deleted as well.

Entity_Port	IO-Link sub index	Read/write	Length
0	66	Write	4 byte

Structure of the reset command:

Byte 3	Byte 2	Byte 1	Byte 0
0xEF	0xBE	0xAD	0xDE

Subindex 67: Teach Mode

The master reads all data (device-Id, vendor-ID, serial number, etc.) from the connected device and saves them. All all previously saved device data are overwritten.

Entity_Port	IO-Link sub index	Read/write	Length
0	67	Write	1 byte

Structure of the Teach command:

Byte 0	
0x00	Teach all ports
0x01	Teach port 1
0x02	Teach port 2
0x03	Teach port 3
0x04	Teach port 4
0x05	Teach port 5
0x06	Teach port 6
0x07	Teach port 7
0x08	Teach port 8
0x09…0xFF	Reserved

Subindex 68: Master Port Scan Configuration

The object reads the configuration of the IO-Link devices connected to the IO-Link master.

28 byte are returned per IO-Link port.

Entity_Port	IO-Link sub index	Read/write	Length
0	68	Read	Max. 244 byte

Structure of the response telegram:

IO-Link-port	Content	Length	Format	Description
Port 1	Vendor ID	2 byte	UINT16	Vendor ID of the connected device
	Device ID	4 byte	UINT32	Device ID of the connected device
	Function ID	2 byte	UINT16	Reserved
	Serial Number	16 byte	UINT8	Serial number of the connected device
	COM_Revision	1 byte	UINT8	IO-Link version
	Proc_In_Length	1 byte	UINT8	Process input data length of the connected device [▶ 159]
	Proc_Out_Length	1 byte	UINT8	Process output data length of the connected device [▶ 159]
	Cycle time	1 byte	UINT8	Cycle time of the connected device
Port 2… port 8	Structure similar to port 1			

Length of the process data from the connected IO-Link device

The structure of the input and output data is identical except for bit 6. The SIO bit is only contained in the process input data.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	SIO	BYTE	LENGTH				

Bit 6: SIO (only valid for process input data)

SIO	
0	SIO mode not supported
1	SIO mode supported by device

Bit 7 and bits 0...4 in combination provide information about the length of the process data.

BYTE	LENGTH	Meaning
0	0	No process data
0	1	1 bit process data
0	n (2…15)	n bit of process data, structured in bits
0	16	16 bit of process data, structured in bits
0	17…31	Reserved
1	0, 1	Reserved
1	2	3 byte, structured in bytes
1	n (3…30)	n + 1 byte, structured in bytes
1	31	32 byte, structured in bytes

Subindex 69: Extended Port Diagnostics

The object reads the Extended Port Diagnostics.

Entity_Port	IO-Link sub index	Read/write	Length
0	69	Read	Max. 120 byte

Structure of the Extended Port Diagnostics:

Byte no.	Bit no.							
	7	6	5	4	3	2	1	0
0	NO_SIO	TCYC	-	-	DS_F	NO_DS	-	-
1	-	WD	MD	PDI_H	-	-	NO_PD	
2	-	-	-	-	-	-	-	-
3	Device status according to IO-Link specification							

Diagnostic bit	Meaning
NO_DS	The parameterized port mode does not support data storage. Remedy: ■ Change the parameterization of the port.
DS_F	Error in the data storage, synchronization not possible Possible causes: ■ Connected device does not support data storage ■ Overflow of the data storage buffer Remedy: ▶ Connect a device that supports data storage. ▶ Clear the data storage buffer. ▶ Deactivate the data storage.
TCYC	The device does not support the cycle time parameterized in the master. Remedy: ▶ Increase the cycle time set in the master.
NO_SIO	The device does not support the SIO mode. Remedy: ▶ Select the IO-Link mode for this port.
NO_PD	No process data available The connected device is not ready for operation. Remedy: ▶ Check the configuration.

Diagnostic bit	Meaning
PDI_E	The connected device reports invalid process data in accordance with IO-Link specification V1.0.
PDI_H	The connected device reports invalid process data in accordance with IO-Link specification V1.1.
MD	Missing device, no IO-Link device detected. Remedy: ■ Check the IO-Link cable. ■ Change the device.
WD	Wrong device detected: one or more parameters of the connected device (Vendor ID, Device ID, serial number) does not/do not match the data which are stored in the master for this device. Remedy: ■ Change the device. ■ Adapt the master parameterization.

Device Status

Value	Meaning
0	Device works correctly
1	Maintenance Event
2	Out-of-Specification Event
3	Functional check
4	Error
5…255	Reserved

9 Operating

9.1 Process input data

Word no.	Bit no.															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Basic																
0x00	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
0x01	Reserved								DVS (Ch7)	DVS (Ch6)	DVS (Ch5)	DVS (Ch4)	DVS (Ch3)	DVS (Ch2)	DVS (Ch1)	DVS (Ch0)
IO-Link process input data																
0x02… 0x11	IO-Link port 1, structure depends on the channel parameterization (max. 32 byte per channel incl. Port Qualifier Information (PQI [▶ 164])															
0x12… 0x21	IO-Link port 2, structure depends on the channel parameterization (max. 32 byte per channel incl. Port Qualifier Information (PQI [▶ 164])															
…	…															
0x62… 0x71	IO-Link port 7, structure depends on the channel parameterization (max. 32 byte per channel incl. Port Qualifier Information (PQI [▶ 164])															
0x72… 0x81	IO-Link port 8, structure depends on the channel parameterization (max. 32 byte per channel incl. Port Qualifier Information (PQI [▶ 164])															
Diagnostics																
	DX channels/VAUX															
0x82	ERR V1+ (Ch7)	ERR V1+ (Ch6)	ERR V1+ (Ch5)	ERR V1+ (Ch4)	ERR V1+ (Ch3)	ERR V1+ (Ch2)	ERR V1+ (Ch1)	ERR V1+ (Ch0)	ERR DXP C/Q (K7)	ERR DXP C/Q (K6)	ERR DXP C/Q (K5)	ERR DXP C/Q (K4)	ERR DXP C/Q (K3)	ERR DXP C/Q (K2)	ERR DXP C/Q (K1)	ERR DXP C/Q (K0)
	IO-Link port 1															
0x83	GEN-ERR	OVL	V HIGH	V LOW	ULVE	LLVU	O TMP	PRM ERR	EVT1	EVT2	PD INV	HW ERR	DS ERR	CFG ERR	PPE	-
0x43	IO-Link port 2, assignment similar to port 1															
0x84	IO-Link port 3, assignment similar to port 1															
…	…															
0x8A	IO-Link port 8, assignment similar to port 1															
IO-Link Events																
0x8B	Port (1st event)								Qualifier (1st event)							
0x8C	Event Code low byte (1st event)								Event Code high byte (1st event)							
…																
0xA9	Port 16th event)								Qualifier (16th event)							
0xAA	Event Code low byte (16th event)								Event Code high byte (16th event)							
Module status (status word)																
0xAB	-	FCE	-	-	-	COM	V1+A	-	V1+B	-	-	-	-	-	AR-GEE	DIAG

Meaning of the process data bits

Name	Value	Meaning
I/O data		
C/Q Ch…	Channel as digital input	
	0	No input signal at DI at CQ channel
	1	Input signal at DI at CQ channel
	Channel as digital output	
	0	No output signal at C/Q channel
	1	Output signal at CQ channel
V1+ Ch…	V1+ configured as "24 VDC"	
	0	Short circuit in power supply at channel
	1	24 V power supply switched on at channel
	V1+ configured as "switchable"	
	0	Output inactive
	1	Putput active or input signal present
DVS K…	Input value valid (Data Valid Signal)	
	0	The IO-Link data are invalid. Possible causes: ■ Sensor supply below the admissible range ■ IO-Link port parameterized as simple digital input ■ No device connected to the master ■ No input data received from the connected device (only valid for devices with an input data length > 0). ■ No reaction from the connected device to the sending of output data (only valid for devices with an output data length > 0). ■ The connected device sends an error "process input data invalid".
	1	The IO-Link data are valid.
IO-Link process input data	Process input data of the connected device The order of the IO-Link process input data can be changed via the parameter "Process input data mapping".	
Diagnostics	[▷ 167]	
IO-Link Events	[▷ 157]	
Module status	[▷ 167]	

Port Qualifier Information (PQI)

The Port Qualifier Information (PQI) provides 1 byte of diagnostic information per IO-Link port and is transmitted cyclically with the process data. The PQI is mapped (per IO-Link port) in the process image of the IO-Link master behind the process input data of the respective IO-Link device. The process input data of the IO-Link device and the PQI together must not exceed the maximum number of 32 bytes of input data per port.

Structure of the PQI:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
PQ	DevErr	DevCom	PortActive	SubstDev	Reserved		

Bit	Value	Meaning
PQ (Port Qualifier)	The bit corresponds to the "Data Valid Signal (DVS)" bit.	
	0	Process data from the connected device is invalid or master validation has failed
	1	Process data from the connected device is valid
DevErr	0	No error/warning at the port or the connected IO-Link device
	1	Error/warning at the port or the connected IO-Link device
DevCom	0	No IO-Link device detected at the port
	1	IO-Link device detected at the port, IO-Link communication active
PortActive	0	IO-Link port deactivated (parameter "Operation mode" = 10)
	1	IO-Link port activated and ready for operation
SubstDev	When replacing an IO-Link device:	
	0	The replacement device has the same serial number as the IO-Link device that was used before.
	1	The replacement device has a different serial number than the previously used IO-Link device.

9.2 Process output data

Word no.	Bit no.															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Basic																
0x00	V1+ (Ch7)	V1+ (Ch6)	V1+ (Ch5)	V1+ (Ch4)	V1+ (Ch3)	V1+ (Ch2)	V1+ (Ch1)	V1+ (Ch0)	DXP C/Q (Ch7)	DXP C/Q (Ch6)	DXP C/Q (Ch5)	DXP C/Q (Ch4)	DXP C/Q (Ch3)	DXP C/Q (Ch2)	DXP C/Q (Ch1)	DXP C/Q (Ch0)
IO-Link process output data																
0x01…0x10	IO-Link port 1, structure depends on the channel parameterization (0…32 byte per channel)															
0x11…0x20	IO-Link port 2, structure depends on the channel parameterization (0…32 byte per channel)															
0x21…0x30	IO-Link port 3, structure depends on the channel parameterization (0…32 byte per channel)															
…	…															
0x71…0x80	IO-Link port 8, structure depends on the channel parameterization (0…32 byte per channel)															

Name	Value	Meaning
I/O data		
C/Q Ch…	Output level at C/Q pins (3, 5, 8, 10, 15, 17, 20, 22) of the 10-pole terminal connector)	
	0	Output inactive
	1	Output activated, max. output current 250 mA per channel
V1+ Ch…	V1+ output or switching the 24 V supply at the V1+ pins (4, 6, 9, 11, 16, 18, 21, 23) of the 10-pole terminal connector)	
	0	-
	1	24 V supply activated or output switched on, max. output current 1 A per channel.

9.3 LED displays

The device has the following LED indicators:

BUS LED	Meaning
Off	No voltage present
Green	Connection to a master active
Flashing 3 × green in 2 s	ARGEE active
Green flashing (1 Hz)	Device is operational
Red	IP address conflict, Restore mode active, F_Reset active or Modbus connection timeout
Red flashing	Wink command active
Red/green (1 Hz)	Autonegotiation and/or wait for IP address allocation in DHCP or BootIP mode

ERR LED	Meaning
Off	No voltage present
Green	No diagnostics
Red	Diagnostics present

ETH1 and ETH2 LEDs	Meaning
Off	No Ethernet connection
Green	Ethernet connection established, 100 Mbit/s
Green flashing	Data transfer, 100 Mbit/s
Yellow	Ethernet connection established, 10 Mbit/s
Yellow flashing	Data transfer, 10 Mbit/s

$V1+_0$…$V1+_7$ LEDs	Meaning	
	Configured as "24 VDC"	Configured as "switchable"
Off	Short circuit at channel	Output inactive
Green	24 V power supply switched on at channel	■ Output active or ■ Input signal present

C/Q_0…C/Q_7 LEDs	Meaning (input)	Meaning (output)
Off	No input signal	Output inactive
Green	Input signal present	Output active

9.4 Software diagnostic messages

The device displays the following statuses via LEDs:

- Overcurrent diagnostics of outputs (C/Q (Ch0)…C/Q (Ch7))
- IOL diagnostics
  Diagnostic messages of the IO-Link channels if parameterized as digital in. or digital output.
- IO-Link master diagnostics
  The IO-Link master reports problems within the IO-Link communication.
- IO-Link device diagnostics
  The device diagnostics map the IO-Link Event Codes (according to the IO-Link specification) sent from the IO-Link devices to the diagnostic telegram of the master.
  Event Codes can be read from the connected devices by using appropriate device tools (e.g. IODD-Interpreter).
  Further information concerning the IO-Link Event Codes and their meaning can be found in the IO-Link specification or in the documentation of the connected devices.

9.4.1 Status- and control word

Status word

EtherNet/IP/ Modbus	Modbus PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Byte 1	$V1+_B$	-	-	-	-	-	ARGEE	DIAG
Byte 1	Byte 0	-	FCE	-	-	-	COM	$V1+_A$	-

Bit	Description
ARGEE	ARGEE program running
COM	Internal error The device-internal communication is disturbed.
DIAG	Diagnostic messages at the device
FCE	The DTM Force Mode is activated. The actual output values may no match the ones defined and sent by the fieldbus.

The status word is mapped into the module's process data.

In EtherNet/IP the mapping can be deactivated via the Gateway Class (VSC 100).

NOTE
Activating or deactivating the status and control word modifies the process data mapping in den standard Assembly Instances 103 and 104 EtherNet/IP standard classes, Assembly Object (0x04).

Control word

The control word has no function.

9.4.2 Diagnostic telegram

Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Overcurrent diagnostics outputs							
0	ERR_DO C/Q (Ch7)	ERR_DO C/Q (Ch6)	ERR_DO C/Q (Ch5)	ERR_DO C/Q (Ch4)	ERR_DO C/Q (Ch3)	ERR_DO C/Q (Ch2)	ERR_DO C/Q (Ch1)	ERR_DO C/Q (Ch0)
	Overcurrent diagnostics VAUX1 (V1+)							
1	ERR V1+ (Ch7)	ERR V1+ (Ch6)	ERR V1+ (Ch5)	ERR V1+ (Ch4)	ERR V1+ (Ch3)	ERR V1+ (Ch2)	ERR V1+ (Ch1)	ERR V1+ (Ch0)
	IO-Link port 1							
	IO-Link device diagnostics				**IO-Link master diagnostics**			
2	EVT2	EVT1	PDINV	HW ERR	DS ERR	CFG ERR	PPE	-
3	GEN ERR	OLV	V HIGH	V LOW	ULVE	LLVU	OTEMP	PRM ERR
4…5	**IO-Link port 2**							
	Assignment similar to IO-Link port 1							
…	…							
18…19	**IO-Link port 8**							
	Assignment similar to IO-Link port 1							

NOTE
The process data invalid diagnostic (PDINV) can be sent from both devices, IO-Link master or IO-Link device.

Meaning of diagnostic bits

Bit	Meaning
ERR_DO C/Q (Ch…)	Overcurrent at channel
ERR V1+ (Ch…)	
IO-Link master diagnostics	
CFGER	Wrong or missing device The connected device does not match the channel configuration or there is no device connected to the channel. This diagnostic message depends on the parameterization of the channel.
DSER	Data storage error Possible causes: ■ Data storage mismatch: IO-Link device in accordance with IO-Link V1.0 connected. The data storage buffer contains data of another device. ■ Overflow of the data storage buffer ■ The connected device may be locked for parameter changes or for data storage.

Bit	Meaning
PPE	Port parameterization The port parameters are inconsistent. The device parameterization via GSD is active, but not working. Possible causes: ■ The IO-Link-master did not receive GSDML-parameters for a connected device. The connected device was not parameterized by a PROFINET PLC via GSDML. ■ The port is in operation mode "IO-Link without validation" or "DI". These modes do not allow parameterization via GSDL file. ■ Data storage mode is active. The parameter is not set to "deactivated, clear". A device parameterization via GSDML is not possible with activated data storage. ■ Vendor or Device ID are "0". The connected device can not be identified and is thus not parameterizable.
IO-Link master/device diagnostics	
PDINV	Evaluating Process Input Data The IO-Link master or the IO-Link device report invalid process input data. The connected device is not in status "operate", which means, it is not ready for operation. Possible sources: ■ The connected device does not match the configured one, additional diagnostic message **Wrong or missing device**. ■ Diagnostic message **Process input data invalid** because the process value can not be measured (depends on the IO-Link device).
IO-Link device diagnostics	
	The IO-Link device diagnostics depend on the IO-Link device used. For more detailed information on the diagnoses, please refer to the documentation for the IO-Link device.
EVT1	Maintenance events A Maintenance Event in accordance with the IO-Link specification occurred, maintenance necessary.
EVT2	Out-of-specification events An Out-of-Specification Event in accordance with the IO-Link specification occurred.
GENERR	Common error The device sends an error (device status 4, in accordance with IO-Link specification), which is not clearly specified. Read out the device Event Codes in order to be able to specify the error more precisely.
HWER	Hardware error General hardware error or device malfunction of the connected device
LLVU	Lower limit value underrun The process value lies under the parameterized measurement range or the chosen measurement range has been chosen too high.
OLV	Overload The connected device detected an overload.
OTMP	Overtemperature A temperature diagnosis is available on the connected device.
PRMERR	Parameterization error The connected device reports a parameterization error (loss of parameters, no parameter initialization, etc.).

Bit	Meaning
ULVE	Upper limit value exceeded The process value exceeds the parameterized measurement range or the chosen measurement range has been chosen too low.
VLOW	Undervoltage One of the voltages at the connected device is below the defined range.
VHIGH	Overvoltage One of the voltages at the connected device exceeds the defined range.

9.4.3 PROFINET diagnostics

Module diagnostics (slot 0 according to configuration tool)	**PROFINET Diagnostics**	
	Error code	Channel
Undervoltage V1	0x0002	0

VAUX1 (V1+) diagnostics (slot 1, according ot configuration tool)	**PROFINET Diagnostics**	
	Error code	Channel
Overcurrent VAUX1 (pin 3)	0x0100	0
Overcurrent VAUX1 (pin 5)	0x0101	
Overcurrent VAUX1 (pin 7)	0x0102	
Overcurrent VAUX1 (pin 9)	0x0103	

IO-Link port diagnostics	**PROFINET Diagnostics**	
IO-Link port 1 (Slot 2, according to configuration tool)	Error code	Channel
Undervoltage (VLOW)	0x0002	0
Overcurrent (VHIGH)	0x0003	
Overload (OVL)	0x0004	
Over temperature (OTMP)	0x0005	
Wrong or missing device (CFGER)	0x0006	
Upper limit value exceeded (ULVE)	0x0007	
Lower limit value underrun (LLVU)	0x0008	
Data storage error (DSER)	0x0009	
Process input data invalid (PDINV)		
Maintenance events (EVT1)		
Out of specification error (EVT2)		
Port parameterization error (PPE)		
Parameterization error (PRMER)	0x0010	
Hardware error (HWER)	0x0015	
IO-Link port 2 (Slot 3, according to configuration tool)		
Similar to port 1		2
IO-Link port 3 (Slot 4, according to configuration tool)		
Similar to port 1		4
IO-Link port 4 (Slot 5, according to configuration tool)		
Similar to port 1		6

9.5 Operating IO-Link devices (IO-Link Device Application)

The IO-Link Device Application offers many functions for monitoring IO-Link devices during operation and for reading out and checking process data. The functions vary depending on the IO-Link device used and the associated IODD.

The **process data** currently present on the IO-Link is prepared and displayed according to the data structure of the IO-Link device. The chronological progresC/Qn can be displayed using the chart function.

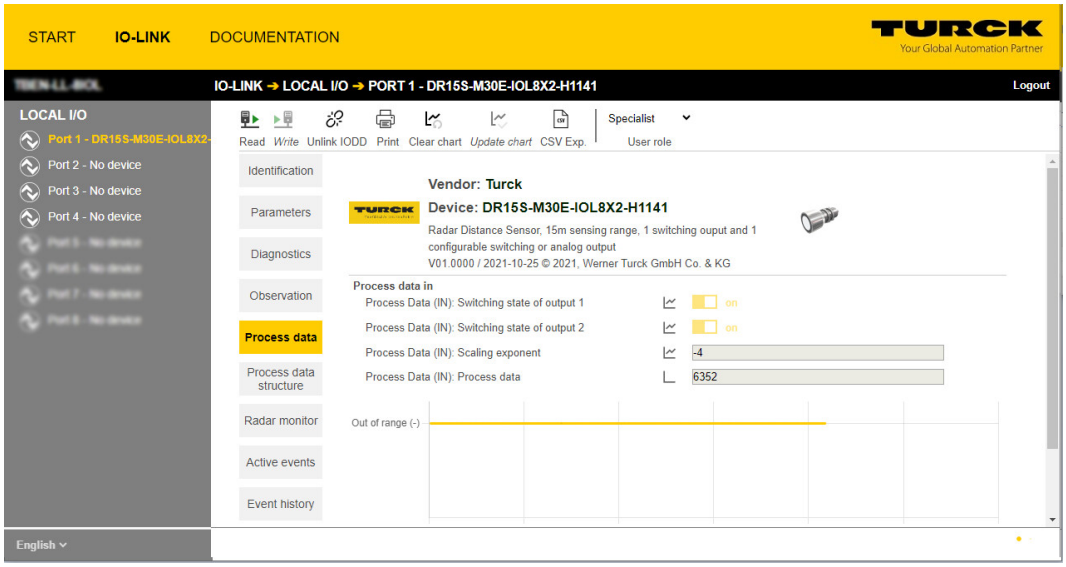


Fig. 81: Process data of an IO-Link device

Diagnostics present at the IO-Link device are displayed under **Diagnostics**.

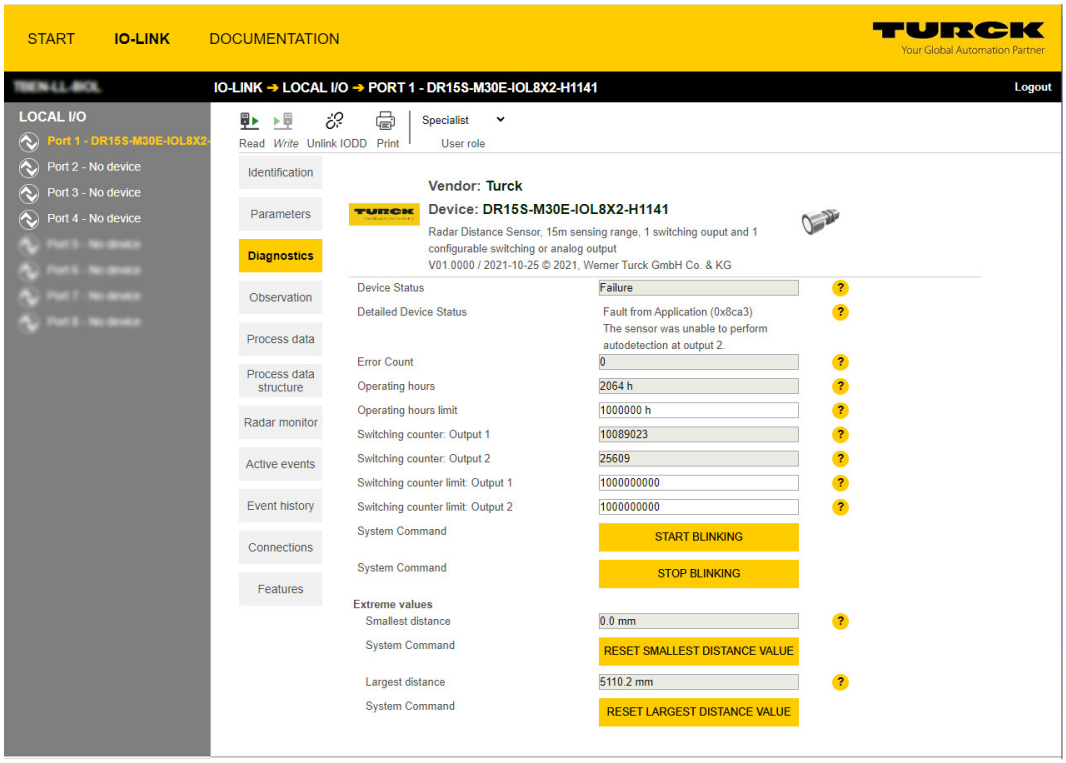


Fig. 82: Diagnostics at IO-Link device

Current IO-Link events are processed under **Active events** and displayed in plain text. The **Event history** provides past events.

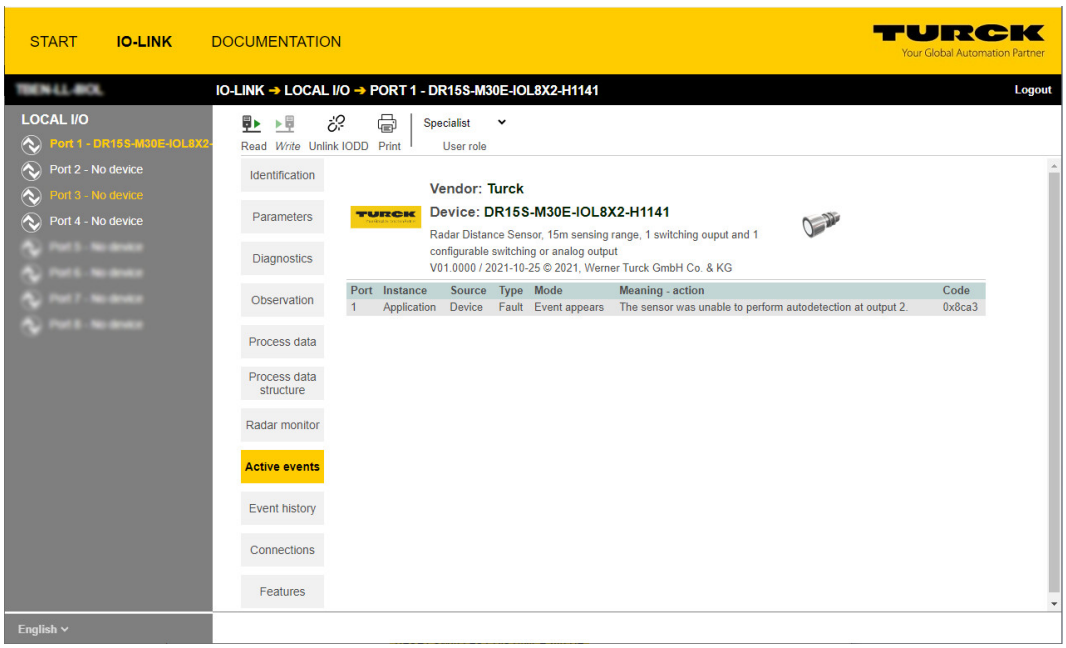


Fig. 83: Active events

In addition, the IO-Link Device Application offers the special functions of some sensors such as the **Radar monitor** for Turck radar sensors or the **Subsonic monitor** for Turck ultrasonic sensors.

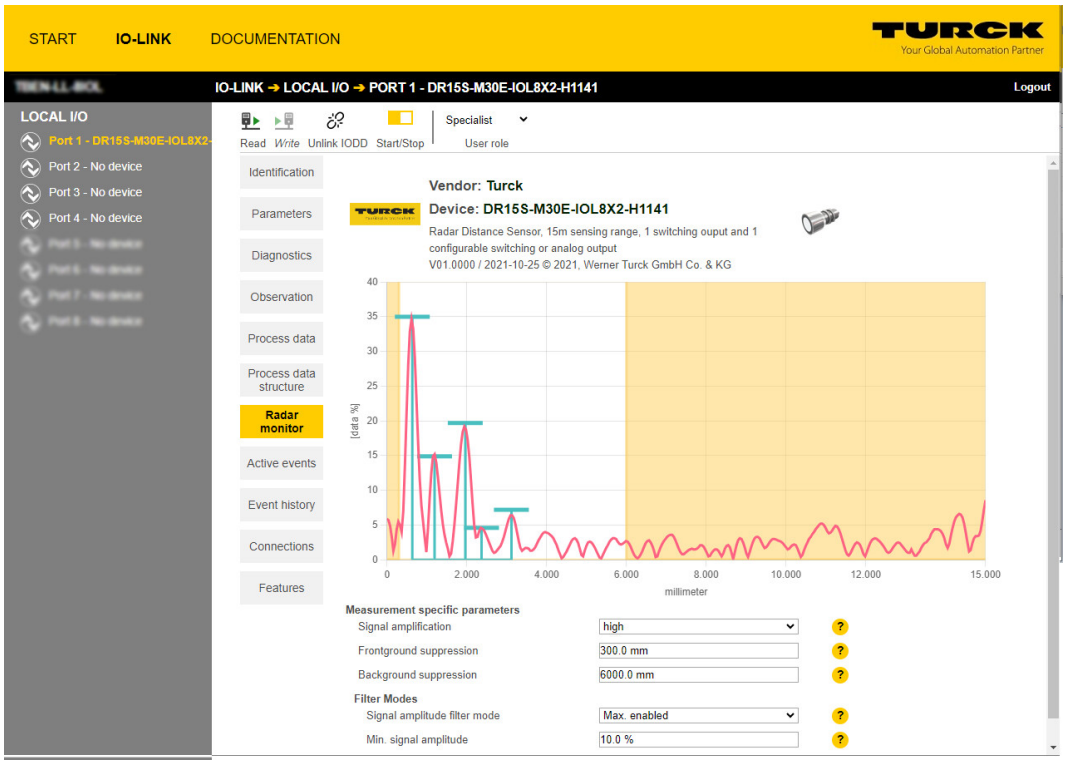


Fig. 84: Radar monitor

10 Troubleshooting

If the device does not work as expected, proceed as follows:

- ▶ Exclude environmental disturbances.
- ▶ Check the connections of the device for errors.
- ▶ Check device for parameterization errors.

If the malfunction persists, the device is faulty. In this case, decommission the device and replace it with a new device of the same type.

10.1 Eliminating parameterization errors in the IO-Link master

Error	Possible causes	Remedy
Digital output not switching	The IO-Link port was not parameterized as a DX channel	▶ Set the channel to DX via Operation mode parameter. **Operation mode** to **DX** .
No 24 VDC at V1+ terminal	The V1+ supply has not been switched on.	▶ Parameters **Mode V1+** For the channel to **24 VDC** or turn it on via the process output data.

IO-Link channels

Diagnostics	Possible causes	Remedy
Data storage error	An IO-Link device in accordance with IO-Link V1.0 is connected. Devices according to IO-Link V1.0 do not support data storage.	▶ Change the **Operation mode** at the IO-Link channel to **Comp. device V1.0** (compatibility mode for IO-Link V1.0 devices). ⇨ Data storage is deactivated.
	The data storage buffer of the IO-Link master contains data from another device.	▶ Set parameter **Operation mode** to **deactivated**. ⇨ The data storage buffer of the IO-Link master is deleted. ▶ Reset the **Operation mode** at the IO-Link port to the desired mode. ▶ If data storage is to be used, set the **Operation mode** parameter to **Comp. V1.1 device, backup + restore**.
	Invalid parameter or invalid parameter combination during parameterization via SIDI (PROFINET only).	▶ Check the device parameters.
Wrong or missing device	The connected device does not match the configured one (incorrect vendor ID, device ID, etc.).	▶ Adjust the parameters of the IO-Link port (vendor ID, device ID, etc) on the master. The parameters can be set either manually via the web server, TAS or similar or by teaching the master via an IO-Link call (port function 0, subindex 67: Teach mode).
Process input data invalid	Certain IO-Link devices send a **Process input data invalid** diagnostic if the process input value cannot be recorded.	▶ Deactivate the sending of the diagnostic for the IO-Link port via the parameter **Process input data invalid → no diagnostic generated**.

11 Maintenance

Ensure regularly that the plug connections and cables are in good condition.

The devices are maintenance-free, clean dry if required.

11.1 Updating the firmware via TAS

NOTICE
Interruption of the power supply during the firmware update
Risk of device damage due to faulty firmware update

- ▶ Do not interrupt the power supply during the firmware update.
- ▶ During the firmware update do not reset the power supply.
- ▶ Do not interrupt the Ethernet connection during the firmware update.

NOTE
The firmware update function in TAS is locked when the controller connection is active. The device must first be disconnected from the controller before performing the update.

Starting a firmware update for a device

- ▶ Open TAS.
- ▶ Open the network view and scan the network.
- ▶ Select the device.
- ▶ Click **Firmware update**.

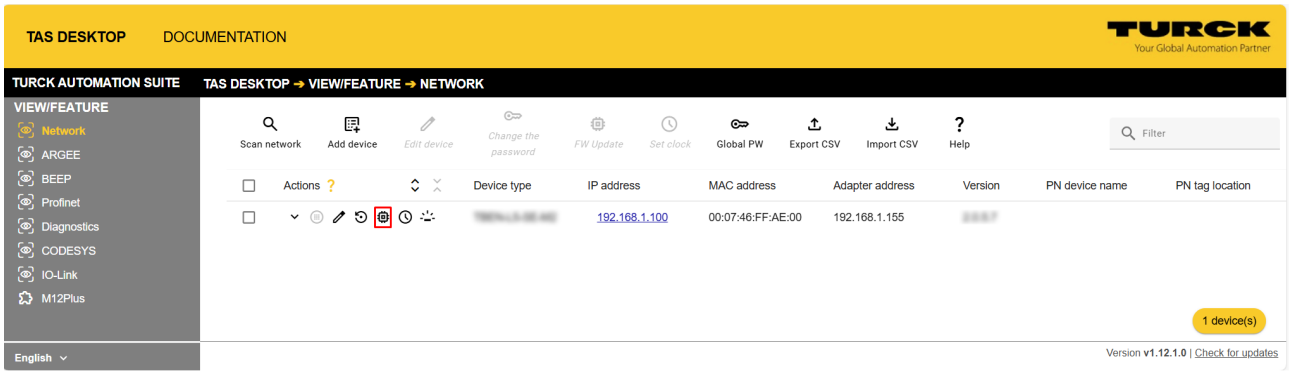


Fig. 85: Firmware update network view

- In the following dialog: Click **Select file** and open the directory of the firmware file.
- Select the new firmware file and load it via **Open**.
- Click **Start** to start the firmware update.
- Enter the device password and click **Login**

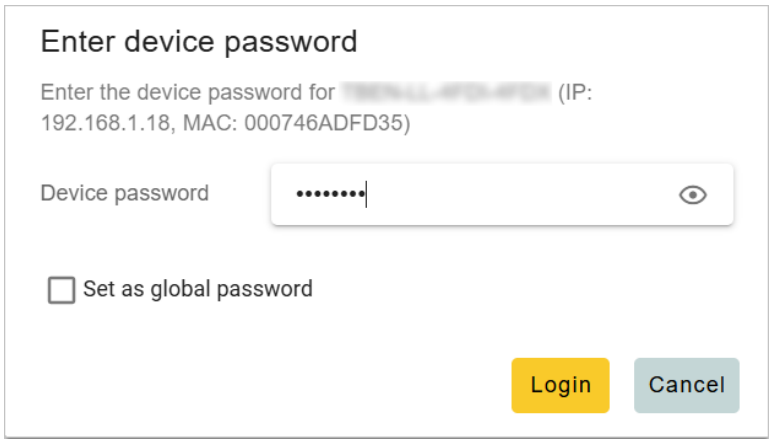


Fig. 86: Entering the device password

⇨ The progress of the firmware update is displayed.

NOTE
TAS makes it possible to set a global password with which all devices can be unlocked. This requires that all selected devices have the same device password and are in the same TCP network.

As an alternative to selecting a single device, it is also possible to select multiple devices. To do so, all devices to be updated must correspond to the same device type and be in the same TCP network.

This enables a firmware update to be performed for multiple devices at once.

Starting a firmware update for multiple devices

- Select all desired devices in the network view using the checkbox.
- Click **FW Update** in the header.

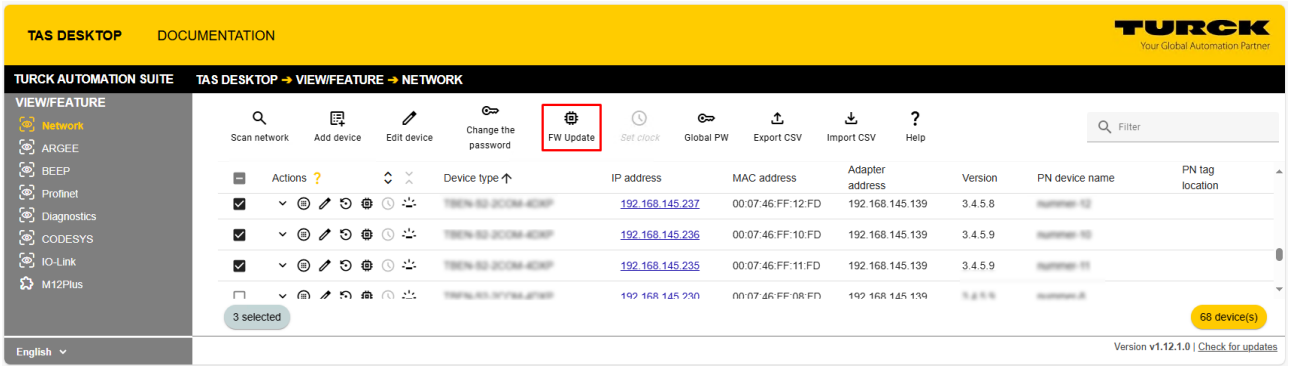


Fig. 87: Firmware update network view multiple devices

- In the following dialog: Click **Select file** and open the directory of the firmware file.
- Select the new firmware file and load it via **Open**.
- Click **Start** to start the firmware update.
- If a global password has not yet been defined: Enter the password and activate the **Set as global password** option.
  Note: If a global password has not yet been defined and the **Set as global password** option is not activated, the password is requested individually for each device.
- Click **Login**.

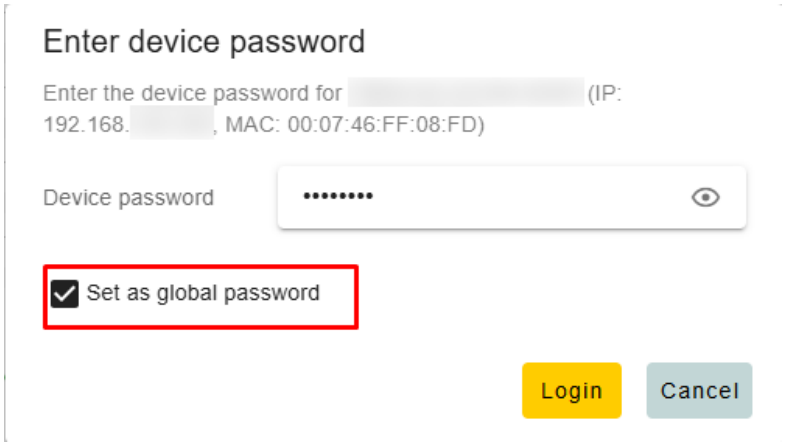


Fig. 88: Entering the device password and setting it as global password

➪ The progress of the firmware update is displayed.

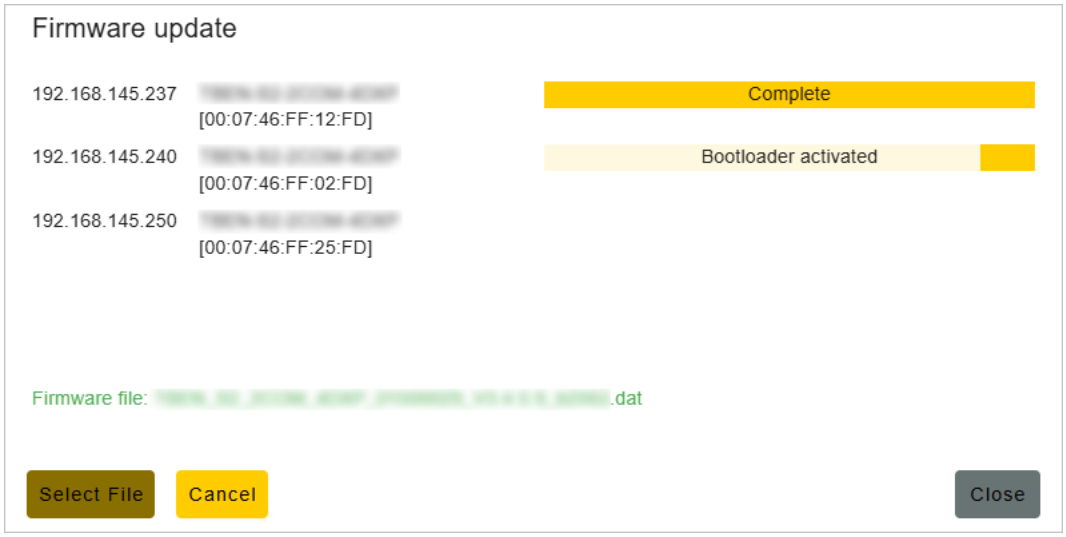


Fig. 89: Firmware update, progress

12 Repair

The device is not intended for repair by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to TURCK.

12.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
https://www.turck.de/en/return-service-6079.php
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

13 Disposal

The devices must be disposed of properly and do not belong in the domestic waste.

14 Technical data

Technical data	
Supply	
Supply voltage	24 VDC, from V1, Class 2 power supply unit necessary
Permissible range	18…30 VDC
■ IO-Link	20.4…28.8 VDC
Operating current	150 mA
Sensor/actuator supply	Supply from V1A and V1B, 5 A each V1 + V2 max. 5.5 A at 70 °C per module
Potential isolation	500 V galvanic, zone to zone and zone Ethernet
Power loss, typical	≤ 3.6 W
Connectors	
Ethernet	2 × RJ45
Supply	Screw terminal, 3-pin
IO-Link, digital in- and outputs	Screw connection, 2 × 12-pin terminal connection
Terminal cross-section	0.2…1.5 mm² (AWG 26…14)
Torque for screw connection	Max. 0,7 Nm
System data	
Transmission rate	10 Mbps, 100 Mbps, full/half duplex, auto negociation, auto crossing
Fieldbus connection technology	2 × RJ45
Protocol detection	Automatic
Web server	192.168.1.254 (default)
Service interface	Ethernet
Field Logic Controller (FLC)	
ARGEE compatible device	Yes
Modbus TCP	
Address assignment	Static IP, DHCP
Supported function codes	FC3, FC4, FC6, FC16, FC23
Number of TCP connections	6
Input data	Max. 1 register
Input registers, start address	0 (0x0000)
Output data	Max. 1 register
Output registers, start address	2048 (0x0800)
Local port	Port 502, fix setting
EtherNet/IP	

Technical data	
Address assignment	According to Ethernet/IP standard
Device Level Ring (DLR)	Supported
Quick Connect (QC)	< 400 ms
Number of class 1 (CIP connections)	6
Input assembly instances	103, 120, 121, 122, 123, 124, 125
Output assembly instances	104, 150, 151, 152
Configuration assembly instance	106
PROFINET	
Version	2.35
Address assignment	DCP
Conformance Class	B (RT)
MinCycle Time	< 1 ms
Fast Start-Up (FSU)	< 150 ms
Diagnostics	According to PROFINET alarm handling
Topology detection	Supported
Automatic address assignment	Supported
Media Redundancy Protocol (MRP)	Supported
System redundancy	S2
CC-Link	
CC-Link interface	CC-Link IE Field Basic
Type	Intelligent device station
Message Transmission	Yes
Profile specification	CSP+
Max. Occupied Stations	4
Ip change mechanism	Yes
Acyclic SLMP communication	Yes
Digital inputs	
No. of channels	8 DXP at $V1+_0$…$V1+_7$ 8 at C/Q_0…C/Q_7
Input type	PNP
Signal voltage, low level	-3...5 VDC (EN 61131-2, type 1 and 3)
Signal voltage, high level	11...30 VDC (EN 61131-2, type 1 and 3)
Signal current, low level	< 1.5 mA
Signal current, high level	> 2 mA
Input delay	< 2.5 ms
Digital outputs	
No. of channels	8 at $V1+_0$…$V1+_7$ 8 at C/Q_0…C/Q_7
Type of output diagnostics	Channel diagnostics
Output voltage	12…30 VDC
Output current per channel	DO: 1 A via V1+ SIO: 250mA via CQ
Load type	Resistive, inductive

Technical data	
Load type (UL)	Resistive, General Use, Pilot Duty
Short-circuit protection	Yes
IO-Link	
No. of channels	8
IO-Link specification	≥ Version 1.1.4
IO-Link port type	Class A
Frame type	Supports all specified frame types
Supported IO-Link devices	Max. 32 bytes of input data/32 bytes of output data
Transmission rate	4.8 kbps (COM 1) 38.4 kbps (COM 2) 230.4 kbps (COM 3)
Installing	
Type of mounting	Via 2 mounting holes
Standard/directive conformity	
Vibration test	According to IEC/EN 60068-2-6
Acceleration	Up to 20 g
Shock test	According to IEC/EN 60068-2-27
Approvals and certificates	cULus
■ UL conditions	Pollution degree 2, Class 2 power supply necessary
General information	
Dimensions (w × l × h)	57.1 × 152.2 × 46.7 mm
Operating temperature	-25…+60 °C
Storage temperature	-40…+85 °C
Degree of protection	IP20 (not assessed by UL)
MTTF	114 years acc. to SN 29500 (Ed. 99) 20 °C
Housing material	PA6-GF30
Housing color	Black

15 TURCK branches – contact data

Germany	TURCK GmbH Witzlebenstraße 7, 45472 Mülheim an der Ruhr www.turck.de
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria www.turck.com.au
Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna www.turck.at
Belgium	Turck Multiprox N. V. Lion d'Orweg 12, B-9300 Aalst www.multiprox.be
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo www.turck.com.br
Canada	Turck Canada Inc. 140 Duffield Drive, CDN-Markham, Ontario L6G 1B5 www.turck.ca
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin www.turck.com.cn
Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové www.turck.cz
France	TURCK BANNER S.A.S. 11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4 www.turckbanner.fr
Hungary	TURCK Hungary kft. Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest www.turck.hu
India	TURCK India Automation Pvt. Ltd. 401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra www.turck.co.in
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Mexico	Turck Comercial, S. de RL de CV Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga, Coahuila www.turck.com.mx
Netherlands	Turck B. V. Ruiterlaan 7, NL-8019 BN Zwolle www.turck.nl
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