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TURCK

TBEN-LL-4RMC-4DIP-4DXP
Motor Roller Controller

Instructions for Use

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1 About these instructions

These instructions for use describe the structure, functions and the use of the product and will help you to operate the product as intended. Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain the instructions for future use 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 aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of symbols used

The following symbols are used in these instructions:

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

1.3 Additional documents

- Data sheet
- Declarations of conformity (current versions)
- Notes on Use in Ex zone 2 and 22 (100022986)
- 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 motor roller controller:

- TBEN-LL-4RMC-4DIP-4DXP

2.2 Scope of delivery

The scope of delivery includes:

- Motor roller controller
- IP67 sealing caps for the I/O connectors
- Labelling clips

2.3 Turck service

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

The contact details of Turck subsidiaries worldwide can be found on p. [▷ 119].

3 For your Safety

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

3.1 Intended use

The multiprotocol I/O module TBEN-LL-4RMC-4DXP-4DIP is a motor controller for connecting motors and can be used in the three Ethernet protocols PROFINET, Ethernet/IP and Modbus TCP. The module detects the bus protocol automatically during the start-up.

The module has four motor controller channels for connecting motors with CANopen interface according to CANopen Drives profile. In addition, the device has four universal DXP channels and four digital input channels to which digital sensors or actuators can be connected directly.

The device is designed in IP67 and can be mounted directly in the field.

The devices can be used in safety functions up to SIL 2 (acc. to EC 61508) and Performance Level d (acc. to ISO 13849). For the outputs at the connectors X4… X7, the supply voltage V2 can be safely switched off by an external safety relay or a safety controller.

The devices may 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 notes

- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for industrial areas. When used in residential areas, take measures to avoid radio interference.
- Change the default password of the integrated web server after the first login. Turck recommends using a secure password.

3.3 Notes on UL approval

- Only use the device in an area of not more than pollution degree 2.

4 Product description

The devices are designed in a fully encapsulated housing with degree of protection IP65/IP67/IP69K.

The motor roller controller has four B-coded M12 sockets for controlling up to four 24 VDC and 48 VDC motors with CANopen interface according to the CANopen Drives profile. The motor controller channels are specially designed for connecting roller motors that support CANopen drive modes 1 (Position), 3 (Velocity) and 6 (Homing) (e.g. Interroll RollerDrive EC5000 BI).

The device provides four digital input channels and four universal digital DXP channels for connecting digital sensors or actuators at four A coded M12 sockets. The DXP channels can be used as inputs and outputs without configuration. Two D-coded M12 sockets are available for connection to Ethernet.

For connecting the supply voltage, 5-pin, L-coded M12 connectors with device specific pin assignment are available [▷ 19].

The multiprotocol device can be operated with the three Ethernet protocols PROFINET, EtherNet/IP and Modbus TCP by automatic protocol detection without user intervention

4.1 Device overview

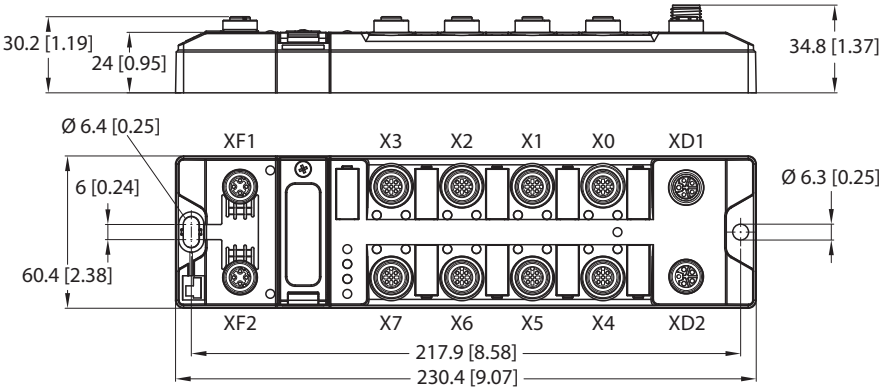


Fig. 1: Dimensions TBEN-LL-4RMC-4DIP-4DXP

4.1.1 Display elements

The device has the following LED indicators:

- Power supply
- Group and bus errors
- Status
- Diagnostics

4.1.2 Operating elements

The device has the following operating elements:

- Rotary coding switches for adjusting the network settings
- Reset button for executing a device restart

4.2 Properties and features

- Fibre-glass reinforced housing
- Shock and vibration tested
- Fully potted module electronics
- Protection class IP65/IP67/IP69K
- UV-resistant according to DIN EN ISO 4892-2
- Metal connectors
- Separated power groups for safety shutdown
- 4 universal digital DXP channels (PNP)
- 4 digital input channels (PNP)
- 4 channels for controlling motor rollers (24 VDC and 48 VDC) with CANopen interface

4.3 Functional principle

The motor controller modules provide a multiprotocol Ethernet interface for Modbus TCP, EtherNet/IP and PROFINET. Via the Ethernet interface, the device is connected to an Ethernet network as Ethernet /IP device, Modbus TCP slave or PROFINET device. The motor controller channels are specially designed for the operation of roller motors. Connected motors that support the CANopen drives modes 1 (Position), 3 (Velocity) and 6 (Homing) can be operated without knowledge of the CANopen indices.

In addition the devices can process signals from up to eight sensors and actuators via eight digital channels.

The integrated FLC function allows running a control logic, such as decentralized accumulating conveyor logic, to be executed directly on the device. The programming is done via the web-based engineering ARGEE.

4.4 Functions and operating modes

4.4.1 Multiprotocol technology

The devices can be used in the following three Ethernet protocols:

- Modbus TCP
- EtherNet/IP
- PROFINET

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 profile-specific functions:

PROFINET

- Topology detection
- Address allocation with LLDP
- Media redundancy protocol (MRP)

EtherNet/IP

- QC (QuickConnect)
- Device Level Ring (DLR)

4.4.2 Motor channels – motor mode

The motor control of the four motor controller channels of the device is done according to the CANopen Drives profile (object 0x6060, sub index 0x00 "Modes of operation"). The motor mode of the connected motor is activated in EtherNet/IP and Modbus TCP via the parameter "Motor mode" on the TBEN-LL-4RMC-4DIP-4DXP [▶ 87]. In PROFINET, a distinction is made between universal operation (including positioning mode and homing mode) and velocity operation (velocity mode only) [▶ 30].

The following motor modes (according to CANopen Drives profile, object 0x6060:00) are supported:

Value	Motor mode
0	No change
1	Profile position mode
3	Profile velocity mode
6	Homing mode

Velocity mode (Profile velocity mode)

In velocity mode, the connected motor is driven at a defined velocity. The acceleration and deceleration behavior of the motor is defined via the **ramp acceleration** and **ramp deceleration** parameters and is also dependent on the application.

Position mode (Profile position mode)

In positioning mode, the connected motor moves to a defined absolute or relative setpoint position at a defined speed. The acceleration and deceleration behavior of the motor depends on the application and can either be defined via the **Ramp acceleration** and **Ramp deceleration** parameters [▶ 87] or adjusted directly via the process output data [▶ 105].

Homing mode

In homing mode, the connected motor moves to a defined, absolute reference position. All further positions of the motor refer to this reference position.
Application example (positioning mode):
Homing after start to align the position value at the machine.

4.4.3 Motor channels – digital mode

When digital mode is activated, the motor runs continuously at a defined speed.
Possible applications:

- Fast and immediate clearing of a conveyor belt in case of need
- Control of conveyor sections via digital signals without Industrial Ethernet.

Digital mode is activated via one or more control inputs. Which digital inputs (DIP or DXP channel) are used as control input and which state at the control input triggers the digital mode is defined at the respective motor channel via the **Control input Kx (CICx)** and **Logic level Kx (ILLx)** parameters [▶ 87].

In this operating mode, a motor error can be signaled via one or more digital outputs. Which digital output switches in the event of a motor fault is determined via the **Motor fault output** parameter.

Parameters			
Control input (value)	**Logic level (value)**	**Digital input (value)**	**Motor behavior**
0	0	0	No change
1	0	0	Digital mode activated
1	1	0	No change
1	1	1	Digital mode activated

4.4.4 Universal digital channels – functions

The device has four universal digital channels that can be used as inputs or outputs without configuration. Up to four 3-wire PNP sensors or four PNP DC actuators can be connected. The maximum output current per output is 2 A.

Activating outputs permanently

The outputs of the DXP channels can be switched on permanently via the **Output permanently on** parameter. Output process data no longer have any influence on the output.

Use case:
Permanent supply of stations that are connected to a port.

4.4.5 Turck Field Logic Controller (FLC)

The device supports logic processing with the Turck Field Logic Controller (FLC) function. This enables the device to perform small to medium complexity control tasks in order to relieve the processing load on the central controller. The FLCs can be programmed in the ARGEE engineering environment.

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

The Zip archive SW_ARGEE_Environment_Vx.x.zip also contains the documentation for the programming environment in addition to the software.

4.5 Technical accessories

Accessories for mounting, connecting and parameterizing can be found in product database under **www.turck.com**. The accessories are not part of the scope of delivery.

5 Installing

5.1 Mounting onto a mounting plate

NOTICE
Mounting on uneven surfaces
Device damage due to stresses in the housing
- ▶ Fix the device on a flat mounting surface.
- ▶ Use two M6 screws to mount the device.

The device can be screwed onto a flat mounting plate.

- ▶ Attach the module to the mounting surface with two M6 screws. The maximum tightening torque for the screws is 1.5 Nm.
- ▶ Avoid mechanical stresses.
- ▶ Optional: Ground the device.

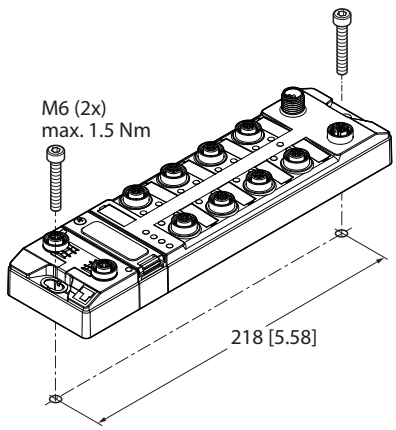


Fig. 2: Mounting the device onto a mounting plate

5.2 Mounting the device outdoors

The device is UV-resistant according to DIN EN ISO 4892-2. Direct sunlight can cause material abrasion and color changes. The mechanical and electrical properties of the device are not affected.

- ▶ To avoid material abrasion and color changes: Protect the device from direct sunlight, e.g. by using protective shields.

5.3 Grounding the device

5.3.1 Equivalent wiring diagram and shielding concept

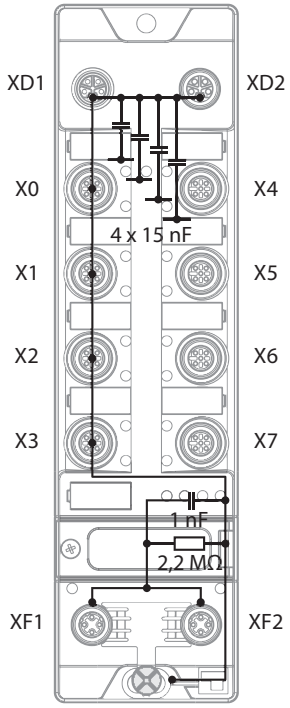


Fig. 3: Equivalent wiring diagram and shielding concept

5.3.2 Shielding of the fieldbus and I/O level

The fieldbus and the I/O level of the modules can be grounded separately.

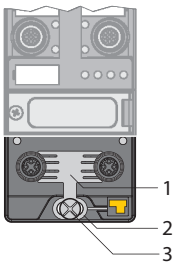


Fig. 4: Grounding clip (1), grounding ring (2) and metal screw (3)

The grounding ring (2) is the module grounding. The shielding of the I/O level is permanently connected to the module grounding. The module grounding is only connected to the reference potential of the installation when the module is mounted.

I/O level shielding

In the case of direct mounting on a mounting plate, the module grounding is connected to the reference potential of the system via the metal screw in the lower mounting hole (3). If module grounding is not desired, the electrical connection to the reference potential must be interrupted, e.g. by using a plastic screw.

Fieldbus level shielding

The grounding of the fieldbus level can either be connected directly via the grounding clip (1) or connected and routed indirectly via an RC element to the module grounding. If the grounding is to be routed via an RC element, the grounding clip must be removed.

In the delivery state, the grounding clip is mounted.

5.3.3 Disconnecting the direct grounding of the fieldbus level: removing the grounding clip

- ▶ Use a flat screwdriver to slide the grounding clip forward and remove it.

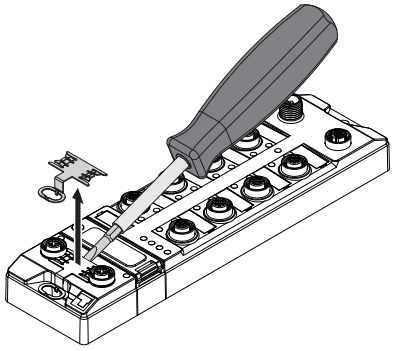


Fig. 5: Removing the grounding clamp

5.3.4 Grounding the fieldbus level directly: inserting the grounding clip

- ▶ Place the grounding clip between the fieldbus connectors by using a screwdriver in such way that the clip contacts the metal housing of the connectors.
- ▶ The shielding of the fieldbus cables is connected to the grounding clip.

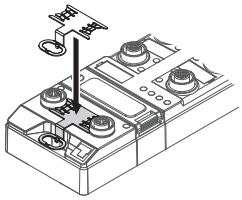


Fig. 6: Mounting the grounding clip

5.3.5 Grounding the device – mounting on a mounting plate

- ▶ For mounting onto a mounting plate: Fix the device with a metal screw through the lower mounting hole.
- ⇨ The module grounding is connected to the reference potential of the installation via the metal screw.
- ⇨ With mounted grounding clip: The shielding of the fieldbus and the module grounding are connected to the reference potential of the installation.

6 Connecting

NOTE
Intrusion of liquids or foreign bodies through leaking connections
Loss of protection class IP65/IP67/IP69K, device damage possible

- Tighten M12 connectors with a tightening torque of 0.6 Nm.
- Only use accessories that guarantee the protection class.
- Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

6.1 Connecting the device to Ethernet

For the connection to Ethernet the device has an integrated auto-crossing switch with two 4-pin, D-coded M12 x 1-Ethernet-connectors. The maximum tightening torque is 0.6 Nm.

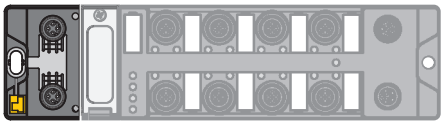


Fig. 7: M12 Ethernet connector

- Connect the device to Ethernet according to the pin assignment below.
- Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

Fig. 8: Pin assignment Ethernet connectors

6.1.1 QuickConnect and Fast Start-Up applications

- Do not use crossover cables in QuickConnect and Fast StartUp applications.
- Connect incoming Ethernet cables to XF1.
- Connect outgoing Ethernet cables to XF2.

6.2 Connecting the power supply

For the connection to the power supply, the device has two 5-pin, L coded M12 connectors. V1 and V2 are galvanically isolated. The maximum tightening torque is 0.8 Nm.

▶ Connect the device to the power supply according to the pin assignment shown below.

NOTE
The pin assignment of the supply voltage terminals differs from the standard pin assignment.

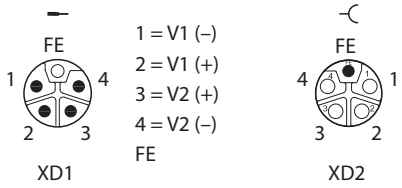


Fig. 9: Pin assignment power supply connectors

Connector	Function
XD1	Power feed
XD2	Continuation of the power to the next node
V1	System voltage (24 V): power supply 1 (incl. supply of electronics)
V2	Load voltage (24 V or 48 V): power supply 2

NOTE
The system voltage (V1) and the load voltage (V2) are fed in and monitored separately. In case of an undercut of the admissible voltage, the connectors are switched-off according to the module's supply concept. In case of an undervoltage at V2, the LED PWR changes from green to red. In case of an undervoltage at V1, the LED PWR is turned off.

6.2.1 Supply concept

The Device is supplied via two separate voltages V1 and V2.

V1 = supply of the module electronics and the respective slots
V2 = supply of module electronics and the respective connectors (separately detachable)

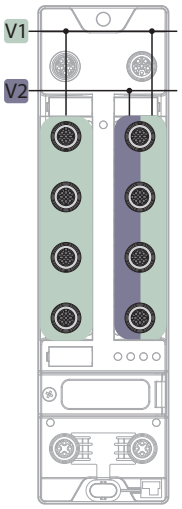


Fig. 10: Power supply TBEN-LL-4RMC-4DXP-4DIP

6.3 Connecting digital sensors and actuators

The device has four 5-pin, A coded M12 connectors for connecting digital sensors and actuators. The maximum tightening torque is 0.8 Nm.

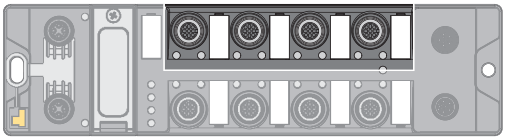


Fig. 11: M12 connectors for connecting digital sensors and actuators

X0…X1: Digital input channels (DIP) for connecting digital sensors

X2…X3: universal, digital channels (DXP) for connecting digital sensors and actuators

- ▶ Connect the sensors and actuators to the device according to the pin assignment.

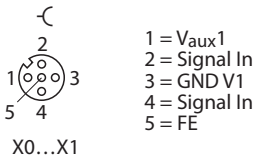


Fig. 12: Connectors for digital sensors at X0…X1 – pin assignment

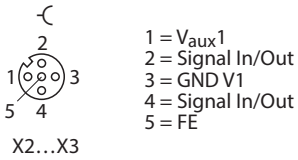


Fig. 13: Connectors for digital sensors and actuators at X2…X3 – pin assignment

6.4 Connecting motors

The device has four 5-pin, B coded M12 sockets for connecting motors. The maximum tightening torque is 0.8 Nm.

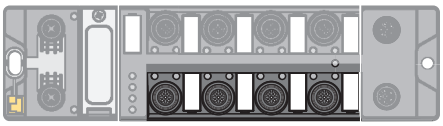


Fig. 14: M12 connector for connecting motors

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

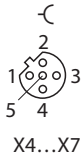


Fig. 15: Pin assignment of the connectors for motor roller control, X4…X7

Pin	Signal
1	Vaux2
2	CAN High
3	GND V2
4	CAN Low
5	GND V2

7 Commissioning

7.1 Adjusting network settings

The network settings can be adjusted via three decimal rotary coding switches on the device, via the web server or via the Turck Service Tool.

7.1.1 Adjusting network settings via rotary coding switches

The rotary coding switches are located together with the reset button under a service window.

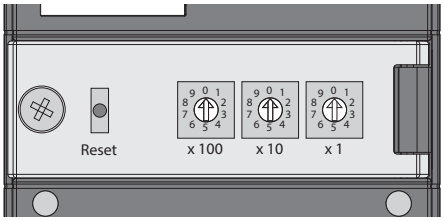


Fig. 16: Service window

- ▶ Open the service window above the switches.
- ▶ Set the rotary coding switch to the desired mode according to the table below.
- ▶ Carry out a voltage reset.
- ▶ NOTICE! IP67 or IP69K protection is not guaranteed when the service window above the rotary coding switches is opened. Damage to the device due to foreign material or liquids penetrating the device is possible. Tightly close the service window above the switches.

Switch positions

The network settings of the device depend on the selected mode. Changes to the settings become active after a voltage reset.

Switch settings 000 and 900 are no operation modes. After each reset of the device to the default values, the setting of an operating mode is necessary.

Switch position	Mode	Description
000	Network reset	The network reset resets the following network settings to the default values: IP address: 192.168.1.254 Subnet mask: 255.255.255.0 Gateway: 192.168.1.1
1…254	Rotary	In rotary mode (static rotary), the last byte of the IP address can be set manually at the device. The other network settings are stored non-volatile in the memory of the device and cannot be changed in rotary mode. Addresses from 1...254 can be set.
300	BootP	In BootP mode, the network settings are automatically assigned by a BootP server in the network. The subnet mask assigned by the BootP server and the default gateway address are stored non-volatile in the memory of the device.

Switch position	Mode	Description
400	DHCP	In DHCP mode, the network settings are by a DHCP server in the network. The subnet mask assigned by the DHCP server and the default gateway address are stored non-volatile in the memory of the device. DHCP supports three mechanisms for IP address allocation: ■ Automatic address assignment: The DHCP server assigns a permanent IP address to the client. ■ Dynamic address assignment: The IP address assigned by the server is only reserved for a certain period of time. After this time has elapsed or after the explicit release by a client, the IP address is reassigned. ■ Manual address assignment: A network administrator assigns an IP address to the client. In this case, DHCP is only used to transmit the assigned IP address to the client.
500	PGM	In PGM mode, the network settings are assigned manually via the Turck Service Tool, FDT/DTM or via a web server. The setting are stored to non-volatile the device.
600	PGM-DHCP	In PGM DHCP mode, the device initially operates a DHCP client and sends DHCP requests until it is assigned a permanent IP address. The DHCP client is automatically deactivated as soon as the device has received an IP address via the DTM, the Turck Service Tool or the web server If a DHCP server is used in the network, problems may occur when assigning the IP address, since in this case both the DHCP server and the PROFINET controller (via DCP), try to assign the IP address.
701…899	Name	The "Name" mode is used to set the DNS name of the device in Ethernet/IP networks. This mode is mainly used for DNS-based addressing in Schneider Electric controllers. The IP address is assigned automatically. The devices are addressed via the prefix "TBEN" and the address set on the rotary coding switches as follows: ■ Switch position 701: TBEN_701 … ■ Switch position 899: TBEN_899
900	Factory reset	The factory reset resets all settings to the default values: ■ Network setting (IP address, subnet mask, gateway) ■ PROFINET device name ■ Device parameters

7.1.2 Adjusting network setting via Turck Service Tool

- Connect the device to the PC via the Ethernet interface.
- Open the Turck Service Tool.
- Click **Search** or press [F5].

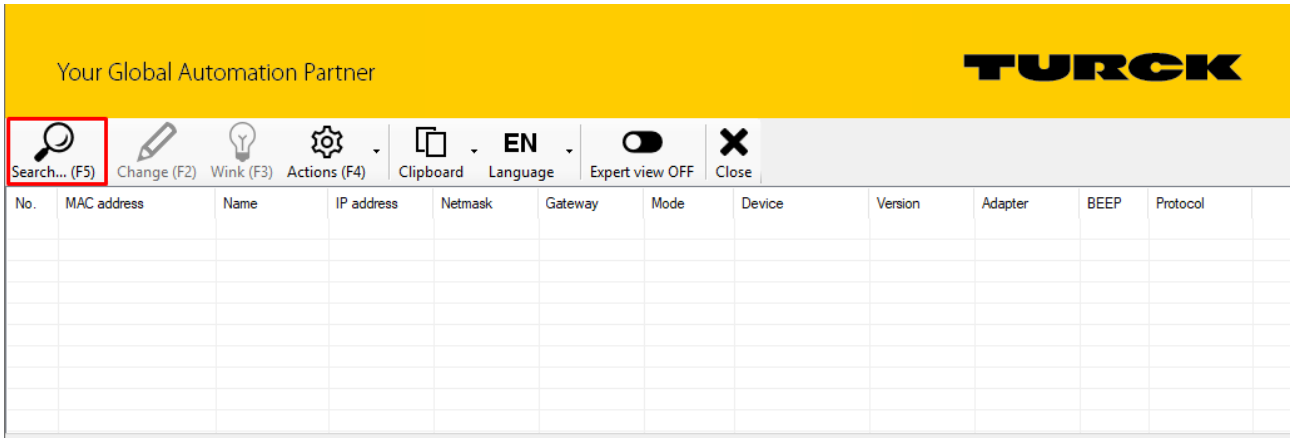


Fig. 17: Turck Service Tool – start dialog

Turck Service Tool shows the devices found.

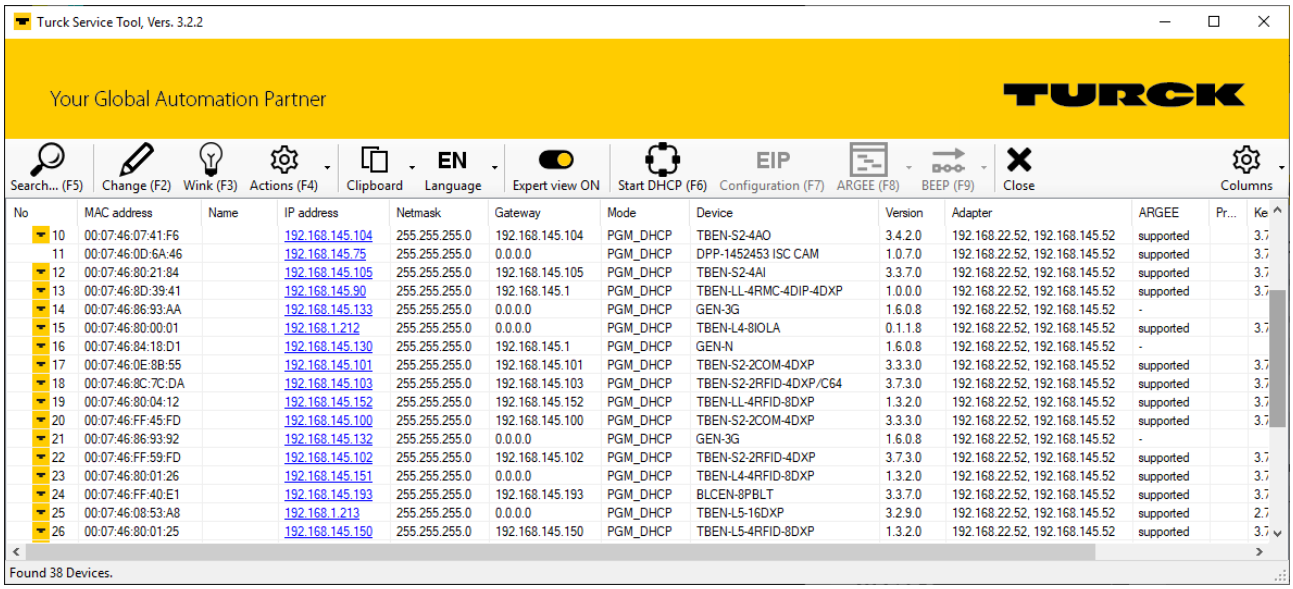
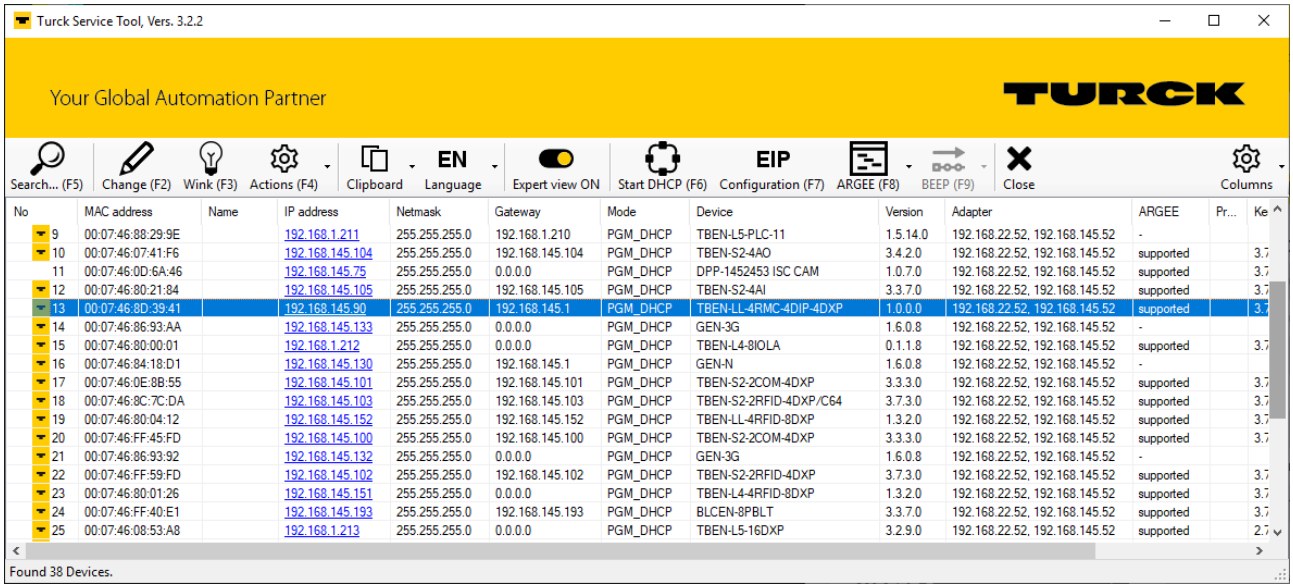


Fig. 18: Turck Service Tool – found devices

- ▶ Click on the desired device.
- ▶ Click **Change** or press [F2].

NOTE
Virtual network adapters may cause communication problems when accessing the found devices.

- ▶ Disable virtual network adapters.



No	MAC address	Name	IP address	Netmask	Gateway	Mode	Device	Version	Adapter	ARGEE	Pr...	Ke
9	00:07:46:88:29:9E		192.168.1.211	255.255.255.0	192.168.1.210	PGM_DHCP	TBEN-L5-PLC-11	1.5.14.0	192.168.22.52, 192.168.145.52	-		
10	00:07:46:07:41:F6		192.168.145.104	255.255.255.0	192.168.145.104	PGM_DHCP	TBEN-S2-4AO	3.4.2.0	192.168.22.52, 192.168.145.52	supported		3.7
11	00:07:46:0D:6A:46		192.168.145.75	255.255.255.0	0.0.0.0	PGM_DHCP	DPP-1452453 ISC CAM	1.0.7.0	192.168.22.52, 192.168.145.52	supported		3.7
12	00:07:46:80:21:84		192.168.145.105	255.255.255.0	192.168.145.105	PGM_DHCP	TBEN-S2-4AI	3.3.7.0	192.168.22.52, 192.168.145.52	supported		3.7
13	00:07:46:8D:39:41		192.168.145.90	255.255.255.0	192.168.145.1	PGM_DHCP	TBEN-LL-4RMC-4DIP-4DXP	1.0.0.0	192.168.22.52, 192.168.145.52	supported		3.7
14	00:07:46:86:93:AA		192.168.145.133	255.255.255.0	0.0.0.0	PGM_DHCP	GEN-3G	1.6.0.8	192.168.22.52, 192.168.145.52	-		
15	00:07:46:80:00:01		192.168.1.212	255.255.255.0	0.0.0.0	PGM_DHCP	TBEN-L4-8IOLA	0.1.1.8	192.168.22.52, 192.168.145.52	supported		3.7
16	00:07:46:84:18:D1		192.168.145.130	255.255.255.0	192.168.145.1	PGM_DHCP	GEN-N	1.6.0.8	192.168.22.52, 192.168.145.52	-		
17	00:07:46:0E:8B:55		192.168.145.101	255.255.255.0	192.168.145.101	PGM_DHCP	TBEN-S2-2COM-4DXP	3.3.3.0	192.168.22.52, 192.168.145.52	supported		3.7
18	00:07:46:8C:7C:DA		192.168.145.103	255.255.255.0	192.168.145.103	PGM_DHCP	TBEN-S2-2RFID-4DXP/C64	3.7.3.0	192.168.22.52, 192.168.145.52	supported		3.7
19	00:07:46:80:04:12		192.168.145.152	255.255.255.0	192.168.145.152	PGM_DHCP	TBEN-LL-4RFID-8DXP	1.3.2.0	192.168.22.52, 192.168.145.52	supported		3.7
20	00:07:46:FF:45:FD		192.168.145.100	255.255.255.0	192.168.145.100	PGM_DHCP	TBEN-S2-2COM-4DXP	3.3.3.0	192.168.22.52, 192.168.145.52	supported		3.7
21	00:07:46:86:93:92		192.168.145.132	255.255.255.0	0.0.0.0	PGM_DHCP	GEN-3G	1.6.0.8	192.168.22.52, 192.168.145.52	-		
22	00:07:46:FF:59:FD		192.168.145.102	255.255.255.0	192.168.145.102	PGM_DHCP	TBEN-S2-2RFID-4DXP	3.7.3.0	192.168.22.52, 192.168.145.52	supported		3.7
23	00:07:46:80:01:26		192.168.145.151	255.255.255.0	0.0.0.0	PGM_DHCP	TBEN-L4-4RFID-8DXP	1.3.2.0	192.168.22.52, 192.168.145.52	supported		3.7
24	00:07:46:FF:40:E1		192.168.145.193	255.255.255.0	192.168.145.193	PGM_DHCP	BLCEN-8PBLT	3.3.7.0	192.168.22.52, 192.168.145.52	supported		3.7
25	00:07:46:08:53:A8		192.168.1.213	255.255.255.0	0.0.0.0	PGM_DHCP	TBEN-L5-16DXP	3.2.9.0	192.168.22.52, 192.168.145.52	supported		2.7

Fig. 19: Turck Service Tool – select the device to be addressed

NOTE
Clicking the device's IP address opens the web server.

- Change the IP address and the network mask if necessary.
- Accept the changes with **Set in device**.

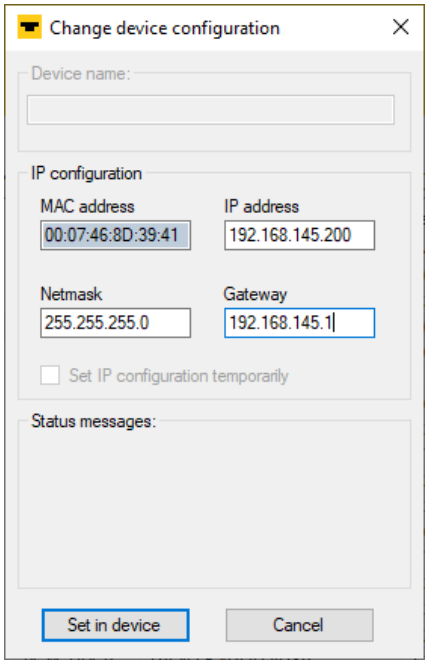


Fig. 20: Turck Service Tool – Change device configuration

7.1.3 Adjusting network settings via the web server

NOTE
To be able to adjust the network settings via the web server, the device must be in PGM mode.

- Open the web server.
- Log on to the device as administrator. The default password for the web server is “password”.
- Click **Station** → **Network Configuration**.
- Adjust the network settings.
- Write the changes into the device via **Submit**.

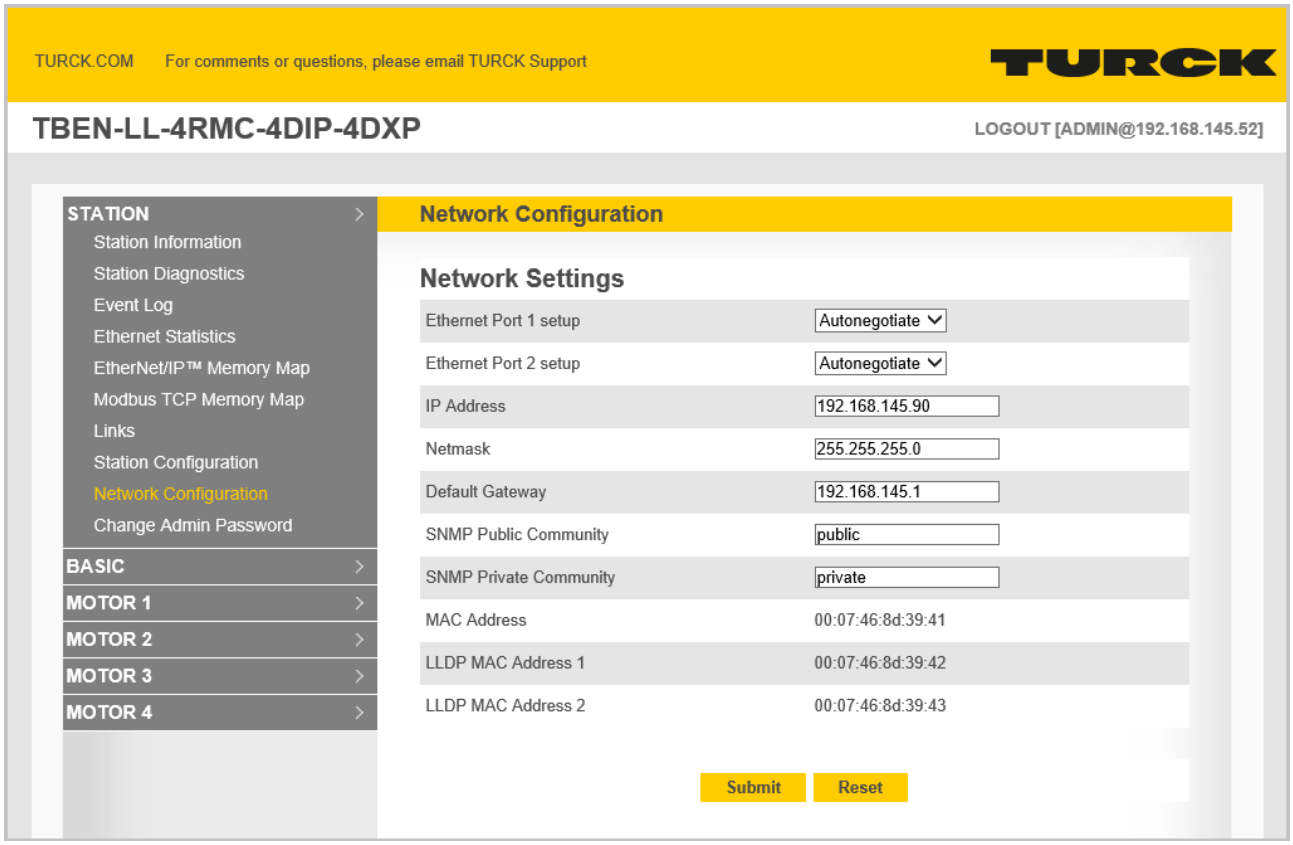


Fig. 21: Adjusting network settings via the web server

7.2 Commissioning the device in PROFINET

7.2.1 PROFINET IO device model

The technical properties of PROFINET IO devices are defined via their device description file, the GSDML file. A PROFINET IO device consists of 1…n slots, which can also contain 1…n sub slots. Sub slots are placeholders for sub modules and establish the interface to the process. Sub modules can contain parameters, data and diagnostics.

Slot 0 is always reserved as Device Access Point (DAP). The DAP contains the physical interface to the Ethernet network and represents the device. The other slots and sub slots represent the other device functions. The structure is defined by the manufacturer of field devices. It is not necessary that every slot or respectively sub slot is related to physical functions. The allocation of the slots and sub slots and thus the assignment of functions (operation mode, diagnostics, etc.) is done in the configuration software of the PROFINET controller. This device model allows manufacturers to design modular and flexible decentralized field devices. User are flexible in configuring decentralized field devices.

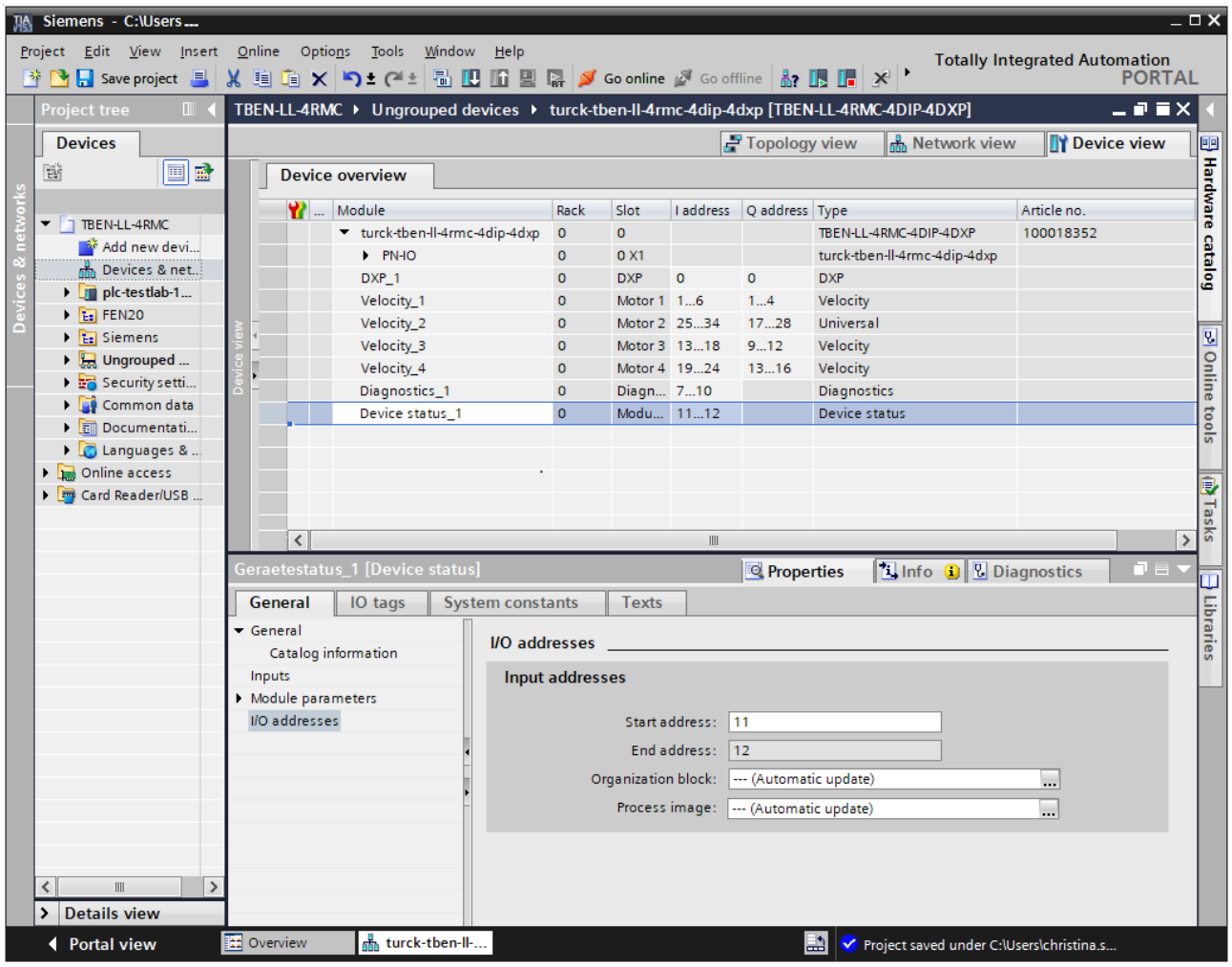


Fig. 22: TIA-Portal – allocation of the slots and sub slots

7.2.2 TBEN-LL-4RMC-4DIP-4DXP – slots and sub slots

Besides slot 0 (DAP) all other slots of device contain only one sub slot. For this reason slots and sub slots are described as synonyms in the following.

Slot no.	Name	Description	Pluggable devices
0	TBEN-LL-4RMC-4DIP-4DXP	Interface of the device to PROFINET IO, Device Access Point	■ Device Access Point ■ Ethernet interface ■ Ethernet port 0 ■ Ethernet port 1
1	DXP	Device parameters and parameters of digital outputs	Cannot be changed
2	Motor 1	Function motor 1	■ Velocity (default) [▶ 31] ■ Universal [▶ 32]
3	Motor 2	Function motor 2	
4	Motor 3	Function motor 3	
5	Motor 4	Function motor 4	
6	Diagnostics	This slot is used to cyclically map diagnostic data.	Diagnostics [▶ 34]
7	Module status	This slot is used to cyclically map device status data.	Device status [▶ 34]

Sub module "Velocity"

The sub module "Velocity" can be plugged into slots 2…5.

- **Parameters**, [▶ 87]

Parameters	Value	Description
Operation Mode	Velocity	Operation mode of the motor channel, pre-set
Lock Motor Mode	Yes	Motor mode locked, pre-set
Lock Ramp	Yes	Ramp acceleration/ramp deceleration locked, pre-set
Lock Position	Yes	Position locked, pre-set
Velocity		
Ramp acceleration		
Ramp deceleration		
Control inputs Ch…Ch7		
Logic level Ch0…Ch7		

- **Process Input data**, [▶ 102]

Process value	Offset	Data type
Inputs	%IW0	
Motor mode	%IB0	USINT
Diagnostics	%IB1	USINT
■ Generic error	%IX1.0	BOOL
■ Current error	%IX1.1	BOOL
■ Voltage error	%IX1.2	BOOL
■ Temperature error	%IX1.3	BOOL
■ Communication error	%IX1.4	BOOL
■ Device profile specific error	%IX1.5	BOOL
■ Manufacturer specific error	%IX1.7	BOOL
	%IW1	
Status	%IB2	USINT
■ Missing device	%IX2.0	BOOL
■ Velocity out of valid range	%IX2.1	BOOL
■ Digital mode	%IX2.2	BOOL
■ Connected	%IX2.4	BOOL
■ Enabled	%IX2.5	BOOL
■ Fault	%IX2.6	BOOL
■ Fault is pending	%IX2.7	BOOL
Reserved	%IB3	
Velocity	%IW2	INT

- Process output data, [▶ 105]

Process value	Offset	Data type
Outputs	%QW0	
Motor mode – Enable – Fault reset – Halt – Quick Stop	%QB0	USINT
Reserved	%QB1	

Sub module „Universal"

The sub module "Universal" can be plugged into slots 2…5.

- **Parameters**, [▶ 87]

Parameters	Value	Description
Operation Mode	No change	Operation mode of the motor channel
	Position mode	
	Velocity	
	Homing	
Lock Motor Mode	No	Motor mode can be changed during operation via the process output data
	Yes	Motor mode locked, pre-set
Lock Ramp	No	Ramp acceleration and ramp deceleration can be changed during operation via the process output data
	Yes	Ramp acceleration and ramp deceleration locked, pre-set
Lock Position	No	Position can be changed during operation via the process output data
	Yes	Position locked, pre-set
Velocity	See parameters [▶ 87]	
Ramp acceleration		
Ramp deceleration		
Control inputs Ch…Ch7		
Logic level Ch0…Ch7		

- **Process Input data**, [▶ 102]

Process value	Offset	Data type
Inputs	%ID0	
Motor mode – Target reached – Busy – Following error	%IB0	USINT
Diagnostics	%IB1	USINT
■ Generic error	%IX1.0	BOOL
■ Current error	%IX1.1	BOOL
■ Voltage error	%IX1.2	BOOL
■ Temperature error	%IX1.3	BOOL
■ Communication error	%IX1.4	BOOL
■ Device profile specific error	%IX1.5	BOOL
■ Manufacturer specific error	%IX1.7	BOOL

Process value	Offset	Data type
	%IW1	
Status	%IB2	USINT
■ Missing device	%IX2.0	BOOL
■ Velocity out of valid range	%IX2.1	BOOL
■ Digital mode	%IX2.2	BOOL
■ Connected	%IX2.4	BOOL
■ Enabled	%IX2.5	BOOL
■ Fault	%IX2.6	BOOL
■ Fault is pending	%IX2.7	BOOL
Reserved	%IB3	
Velocity	%IW2	INT

■ **Process output data**, [▶ 105]

Process value	Offset	Data type
Outputs	%QD0	
	%QW0	
Motor mode – Enable – Fault reset – Halt – Quick Stop	%QB0	USINT
Motor 1	%QB1	USINT
■ New setpoint	%QX1.0	BOOL
■ Position mode	%QX1.1	BOOL
■ Change set immediately	%QX1.2	BOOL
■ Change on setpoint	%QX1.3	BOOL
Velocity	%QW1.0	INT
Position	%QD1	DINT
	%QD2	
Ramp acceleration	%QW4	UINT
Ramp deceleration	%QW5	UINT

Sub module "Diagnostics"

The sub module "Diagnostics" can be plugged into slot 6.

- **Parameters**
  This sub module requires no configuration and has thus no parameters.
- **Process Input data**, [▶ 102]

Process value	Offset	Data type
Diagnostic channel – byte 0	%IB0	USINT
Overcurrent VAUX1 pin 1 X0 (Ch0/1)	%IX0.0	BOOL
Overcurrent VAUX1 pin 1 X1 (Ch2/3)	%IX0.1	BOOL
Overcurrent VAUX1 pin 1 X2 (Ch4/5)	%IX0.2	BOOL
Overcurrent VAUX1 pin 1 X3 (Ch6/7)	%IX0.3	BOOL
Diagnostic channel – byte 1	%IB1	USINT
Reserved		
Diagnostic channel – byte 2	%IB2	USINT
Overcurrent output 4	%IX2.0	BOOL
Overcurrent output 5	%IX2.1	BOOL
Overcurrent output 6	%IX2.3	BOOL
Overcurrent output 7	%IX2.4	BOOL

Sub module "Device status"

The sub module "Device status" can be plugged into slot 7.

- **Parameters**
  This sub module requires no configuration and has thus no parameters.
- **Process Input data**, [▶ 102]

Process value	Offset	Data type
Module state – byte 0	%IB0	USINT
Undervoltage V1	%IX0.1	BOOL
I/O-ASSISTANT Force Mode active	%IX0.6	BOOL
Module state – byte 1	%IB1	USINT
Module diagnostics available	%IX1.0	BOOL
ARGEE	%IX1.1	BOOL
Undervoltage V2	%IX1.7	BOOL

7.2.3 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.

When delivered, each field device has, among other things, a MAC address. This information 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 names are assigned via DCP. The device name is checked for correct spelling during input. The following rules apply for the use of the device name according to 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 device name must not start with "port-xyz" (y…z = 0…9).
- The name must not have the form of an IP address (n.n.n, n = 0…999).
- Do not use special characters.
- Do not use capital letters.

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 Services for acyclic data

The device provides the following acyclic services in PROFINET per motor channel for mapping the CANopen objects according to the CANopen Drives profile (CiA 402 - Drives and motion control device profile, Part 2).

Index	CANopen Object	Description according to CANopen Drives Profile	Access Type	Unit	Data type
0x1800	0x4048	Nominal Power	ro		UINT8
0x1801	0x6403	Motor Catalogue Number	ro		ARRAY
0x1802	0x6404	Motor Manufacturer	ro		ARRAY
0x1803	0x6091.1	Gear Ratio Motor Revolutions	ro		UINT32
0x1804	0x6091.2	Gear Ratio Motor Revolutions	ro		UINT32
0x1805	0x6092.1	Feed Constant Feed	ro		UINT32
0x1806	0x6092.2	Feed Constant Shaft Revolutions	ro		UINT32
0x1807	0x607F	Maximum Profile Velocity	ro		INT32
0x1808	0x60C5	Maximum Profile Acceleration	ro		UINT32
0x1809	0x60C6	Maximum Profile Deceleration	ro		UINT32

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 V16 (TIA-Portal).

Used hardware

The following hardware components are used in this example:

- Siemens PLC S7-1500
- Motor controller module TBEN-LL-4RMC-4DXP-4DIP with Interroll RollerDrive EC5000 BI at motor channel X6 (Motor 3)

Used software

The following software tools are used in this example:

- SIMATIC STEP7 Professional V16 (TIA-Portal)
- GSDML file for TBEN-LL-4RMC-4DXP-4DIP (can be downloaded for free as part of the ZIP archive "TBEN-L_PROFINET.zip" under www.turck.com)

Prerequisites

- The programming software has been started.
- A new project has been created.
- The PLC has been added to the project.

7.3.1 Installing the GSDML file

The GSDML file can be downloaded for free from 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 of the programming software.

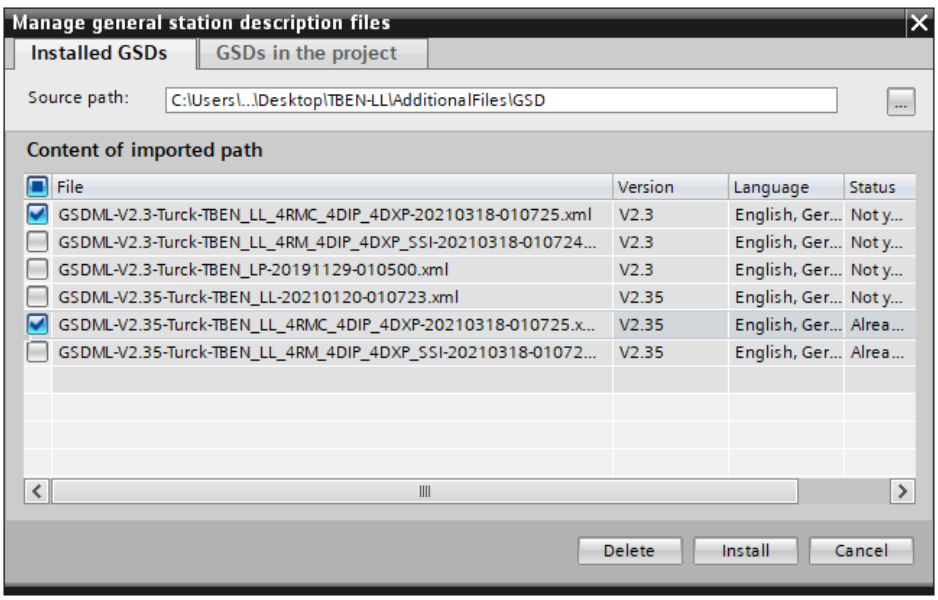


Fig. 23: TIA-Portal – Installing the GSDML-file

7.3.2 Connecting the devices to the PLC

- Select the device from the Hardware catalog and drag it into the **Device & networks** editor.
- Connect the devices to the PLC in the **Devices & networks** editor.

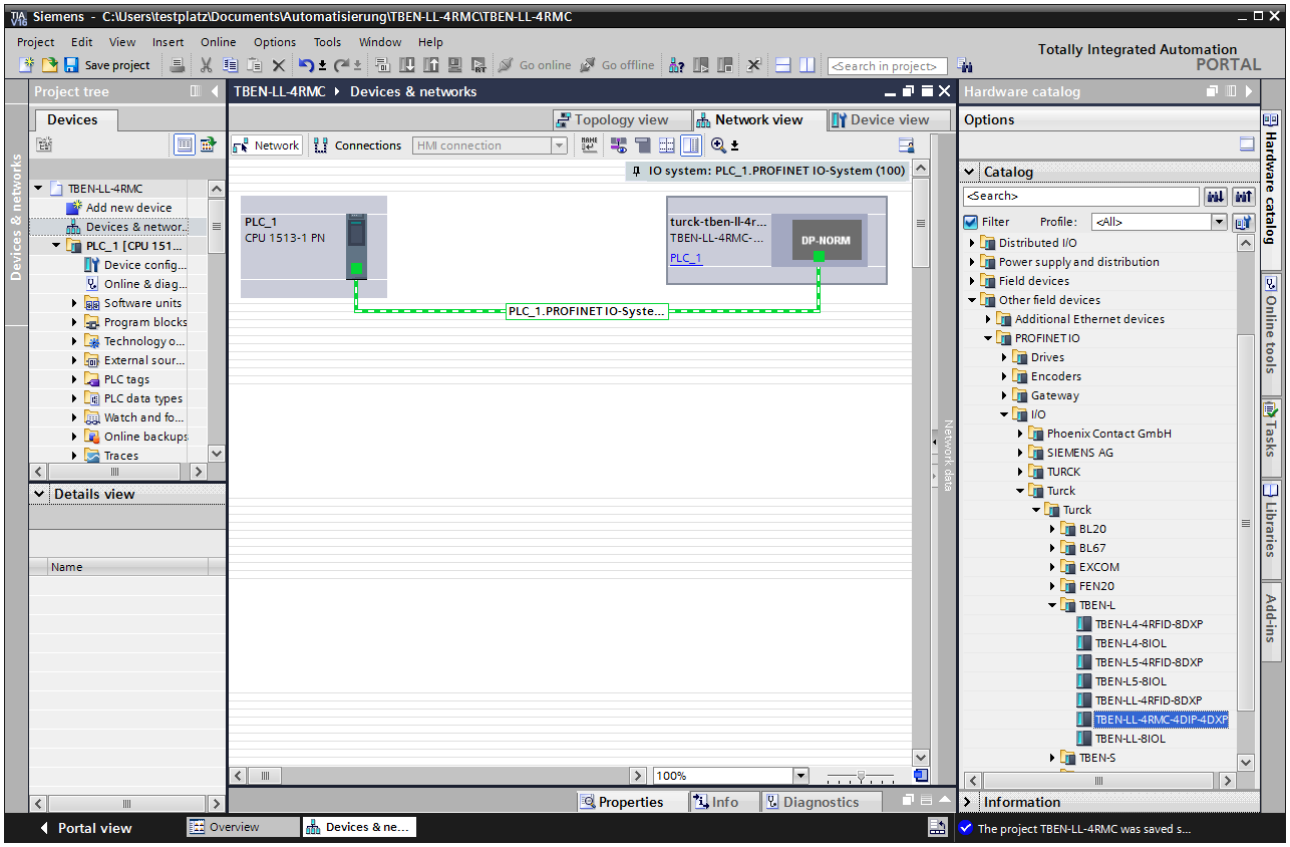


Fig. 24: TIA-Portal – Connecting the device to the PLC

7.3.3 Assigning the PROFINET device name

- Select **Online access → Online & diagnostics.**
- **Functions → Assign PROFINET device name.**
- Assign the desired PROFINET device name with **Assign name.**

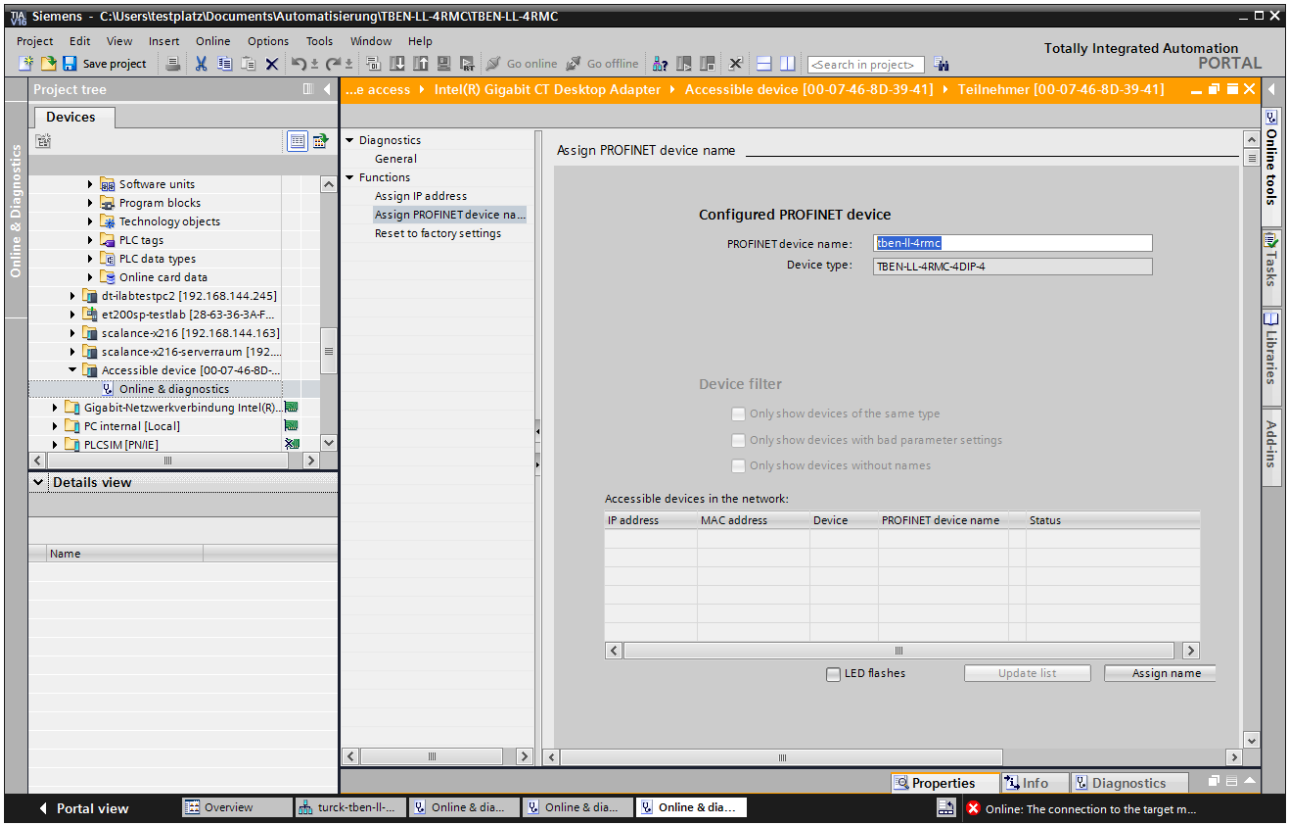


Fig. 25: TIA-Portal – assigning the PROFINET device name

7.3.4 Setting the IP address in TIA Portal

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

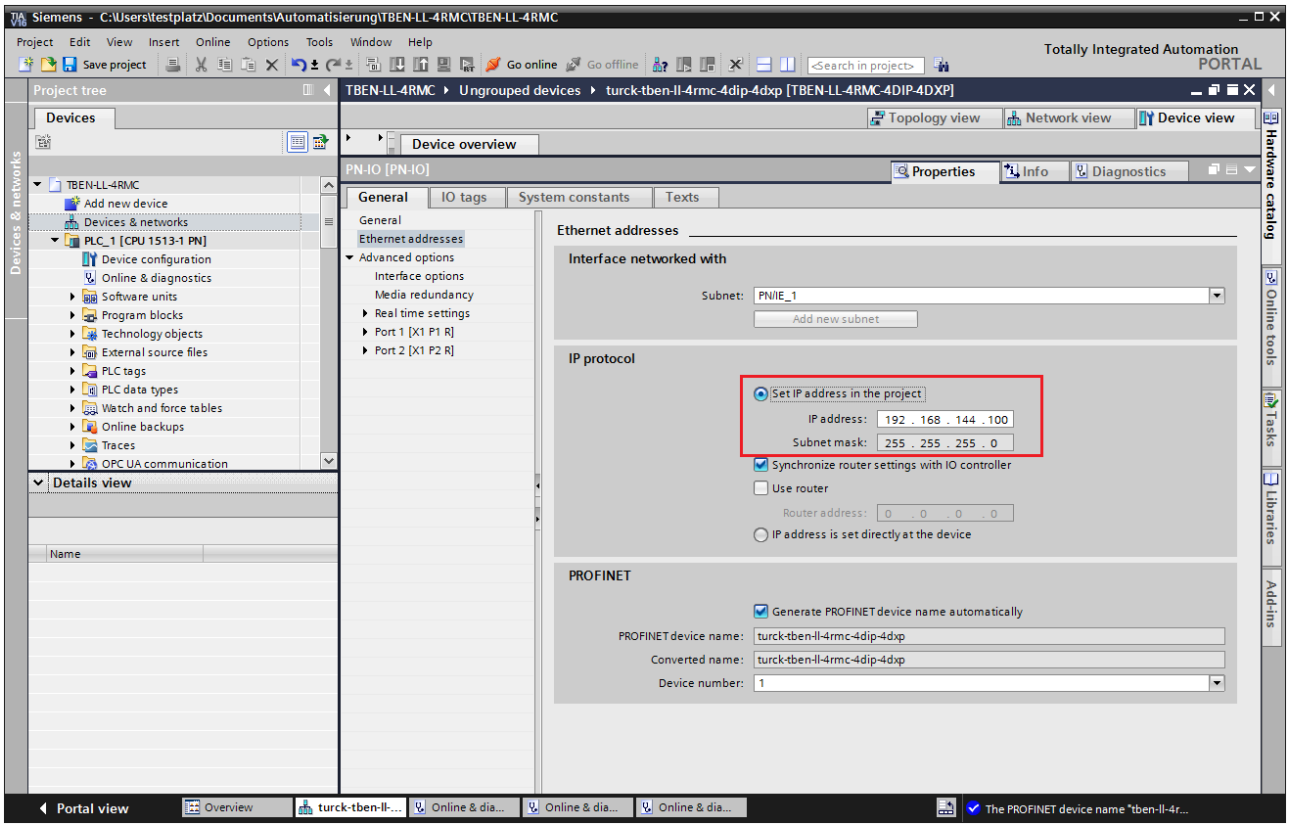


Fig. 26: TIA-Portal – Assigning the IP address

7.3.5 Configuring device functions

The TBEN-LL-4RMC-4DXP-4DIP appears as a modular slave with four configured motor controller slots. Slots 0 and **Basic** are pre-configured.

In addition, the free slots **Diagnostics** and **Module** status are available.

Slot		Meaning
0		Main module tben-ll 4rmc-4rmc-4dip (default name) Parameterization of functions (protocol deactivation, etc.), which concern the complete module.
	0 X1	Parameterization of PROFINET functions (MRP etc.)
	X1 P1	Parameterization of the Ethernet port properties (topology, connection options, etc.).
	X1 P2	
DXP		Parameters and diagnostics of the DXP channels
Motor 1		Motor controller channels, pre-set with operation mode **Velocity**, alternative configuration as **Universal**
Motor 2		
Motor 3		
Motor 4		
Diagnostics		Optional mapping of the diagnostics into the process image of the master
Module status		Optional mapping device status into the masters process image

Configuring slots (example)

- Select **Device view** → **Device overview.**
- Configure the device per drag & drop depending on the application.
- Define the function of the four motor controller (Motor 1… Motor 4) and define the other slots by assigning the suitable sub modules.

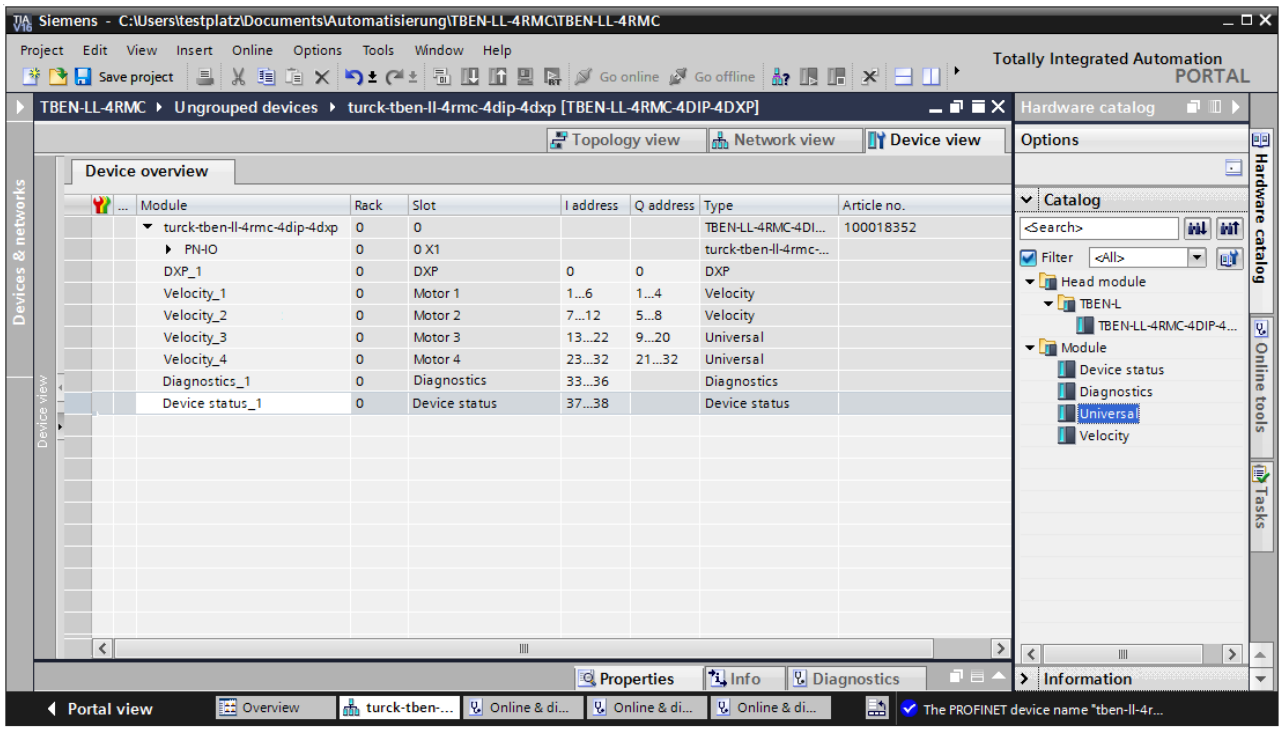


Fig. 27: TIA-Portal – Configuring device slots

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.

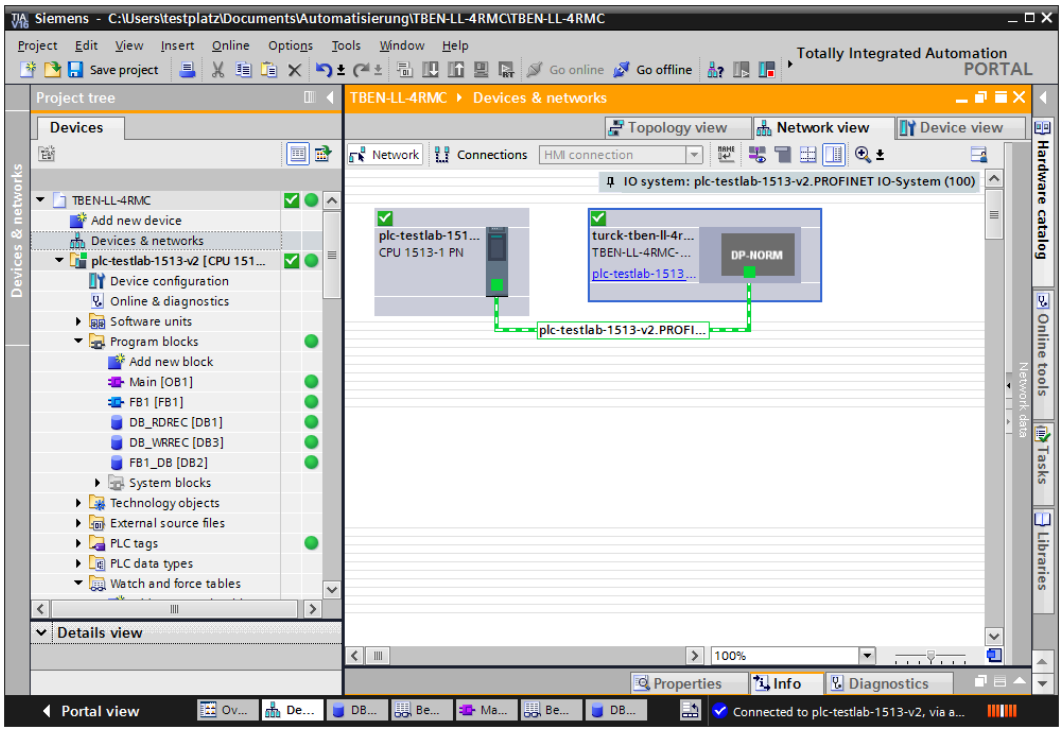


Fig. 28: TIA-Portal – Online mode

7.3.7 Acyclic reading (RDREC) and writing (WRREC) data

The TBEN-LL-4RMC-4DXP-4DIP provides some CANopen objects according to the CANopen Drives profile (CiA 402 - Drives and motion control device profile, Part 2) as PROFINET indices [▶ 37]. These indices are accessed acyclically via the Siemens function blocks RDREC and WRREC.

NOTE
The acyclic services provided via PROFINET in are all read-only indices.

Acyclic reading via RDREC

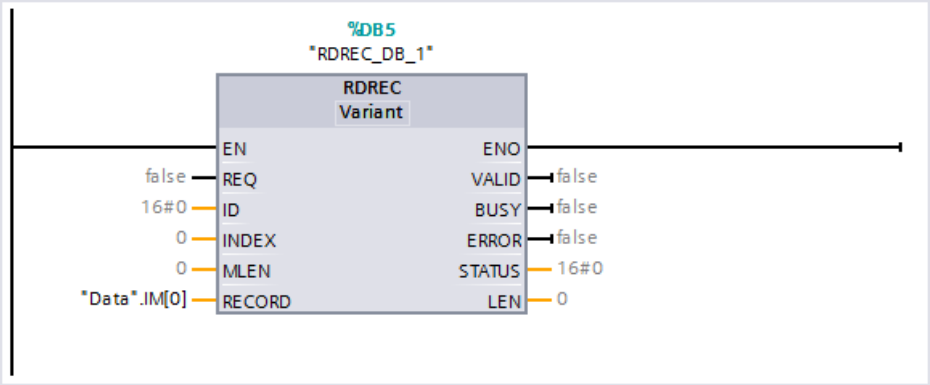


Fig. 29: Function block RDREC

Select	Meaning
IN	
REQ	REQ = 1, starts data transmission
ID	Hardware identifier of the channel
INDEX	Number of the data set to be read (index)
MLEN	Maximum length of the data to be read
OUT	
VALID	New data set read and complete
BUSY	BUSY = 1: Read operation not yet completed
ERROR	ERROR = 1: Error while reading
STATUS	Error code of the function block
LEN	Length of the read data
IN/OUT	
RECORD	Destination memory area for the read data (here in the example DB10)

Acyclically reading data (example)

Index 0x1802 (Motor Manufacturer) of motor at slot **Motor 3** is read.

The hardware identifier for the channel is 270.

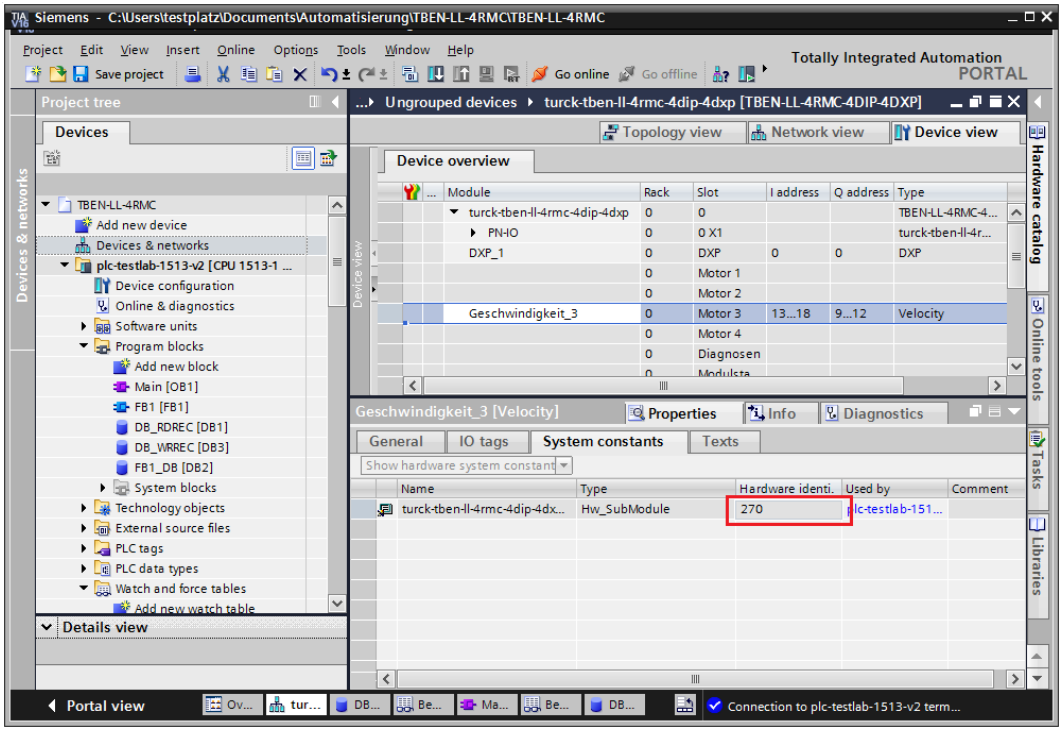


Fig. 30: TIA-Portal – Hardware identifier of the channel

Prerequisites

- The function block RDREC is used in the project and the corresponding data blocks have been created.
- An watch table was created to control and read out the data.

▶ Force the variables **ID**, **Index** and **MLEN** as follows:

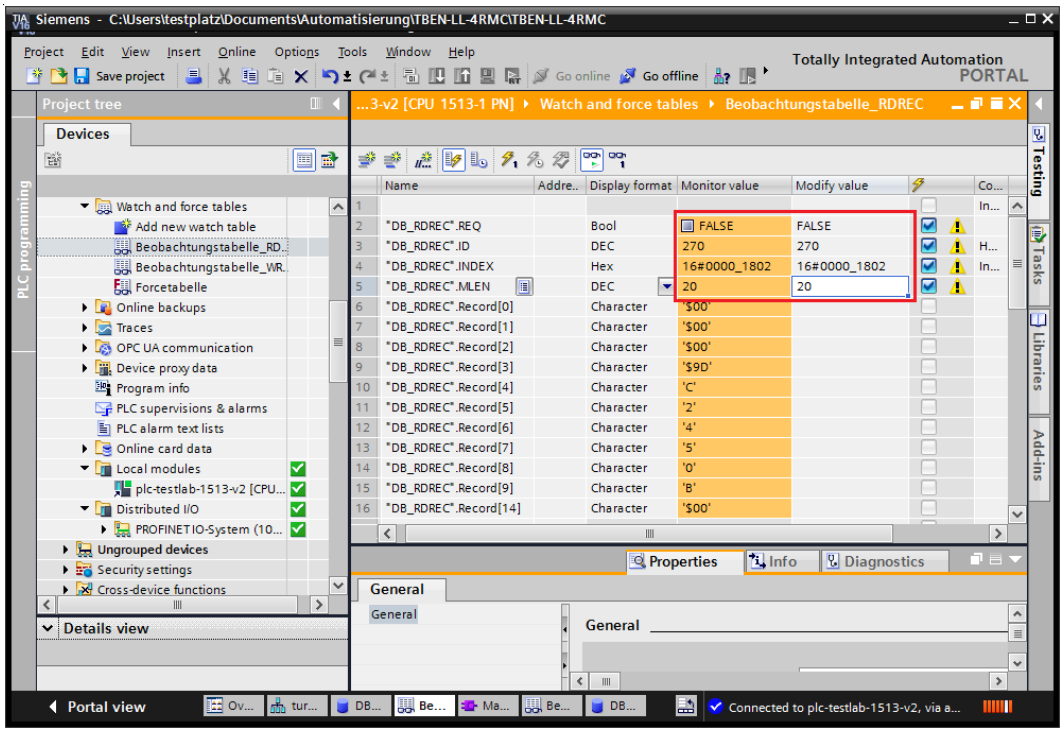


Fig. 31: TIA-Portal – Forcing variables RDREC

▶ Set variable **REQ** to TRUE.

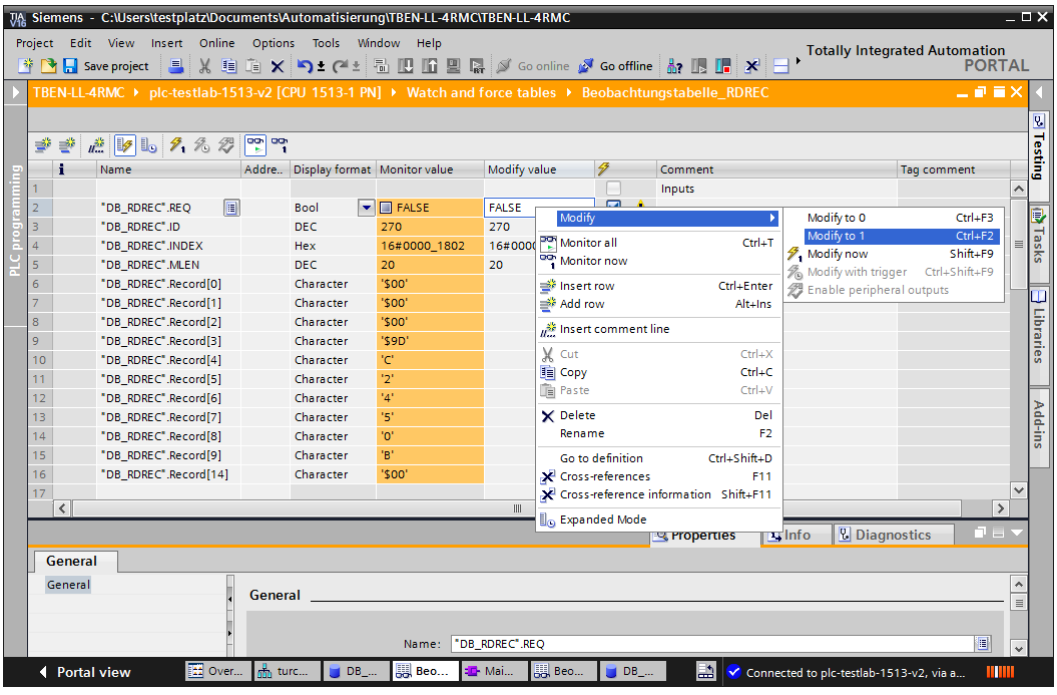


Fig. 32: TIA-Portal – Start read operation

➪ The manufacturer name is read out.

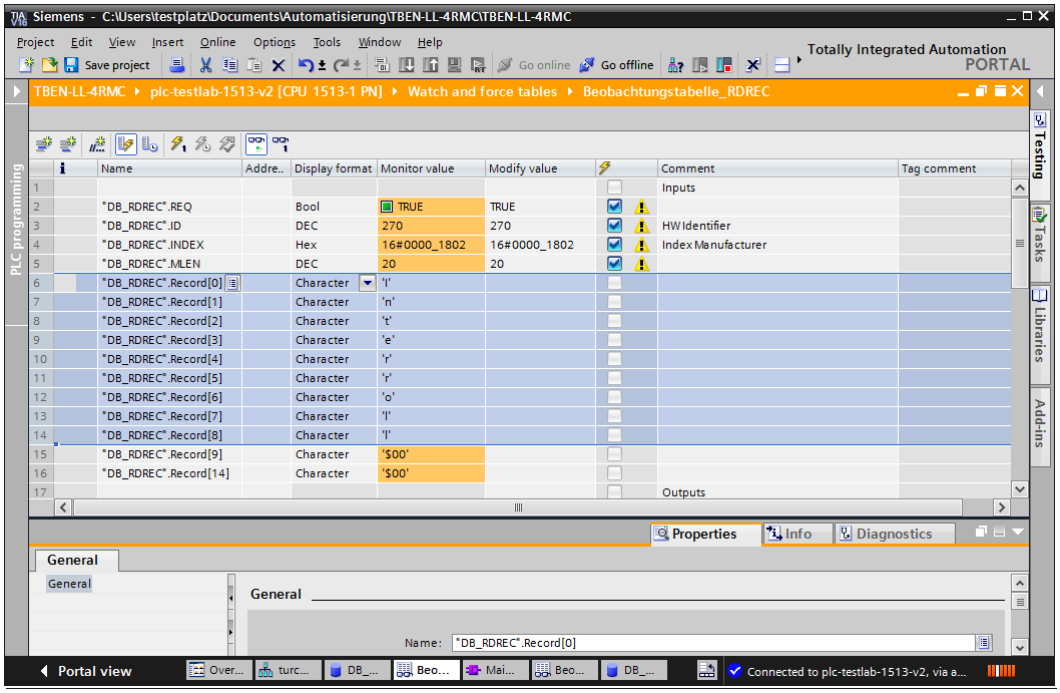


Fig. 33: TIA-Portal – Manufacturer name of motor at X6 (Motor 3)

Acyclic writing via WRREC

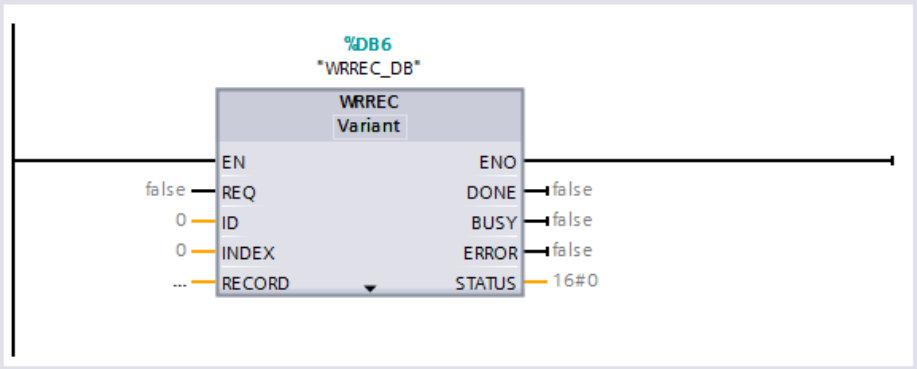


Fig. 34: Function block WRREC

Select	Meaning
IN	
REQ	REQ = 1, starts data transmission
ID	Hardware identifier of the channel
INDEX	Number of the data set to be written (index)
MLEN	Maximum length of the data to be written
OUT	
VALID	New data set written and complete
BUSY	BUSY = 1: Write operation not yet completed
ERROR	ERROR = 1: Error while writing
STATUS	Error code of the function block
LEN	Length of the written data
IN/OUT	
RECORD	Destination memory area for the written data (here in the example DB10)

7.4 Commissioning the evice 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	
1	Read Coils – reading multiple output bits
2	Read Discrete Inputs – reading multiple input bits
3	Read Holding Registers – reading multiple output registers
4	Read Input Registers – reading multiple input registers
5	Write Single Coil – writing single output bit
6	Write Single Register – writing single output register
15	Write Multiple Coils – writing multiple output bits
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 [ms]
0x1120	read/write	Watchdog, predefined time [ms] (default: 500 ms)
0x1130	read/write	Modbus connection mode register
0x1131	read/write	Modbus connection timeout in s (default: 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

Address	Access Type	Meaning
0x1150	read only	LED behavior (PWR) at V2 undervoltage bit 0: 0 = red 1 = green flashing
0x2400	read only	V1 in mV: 0 at undervoltage
0x2401	read only	V2 in mV: 0 at undervoltage
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	Parameters

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

Description	Hex	Decimal	5 digit	Modicon
Inputs	0x0000…0x01FF	0…511	40001…40512	400001…400512
Outputs	0x0800…0x09FF	2048…2549	42049…42560	402049…402560
Module identifier	0x1000…0x1006	4096…4102	44097…44103	404097…404103
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
LED behavior (PWR) at V2 undervoltage	0x1150	4432	44433	404433
V1 in mV	0x2400	9216	49217	409217
V2 in mV	0x2401	9217	49218	409218
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_ImmediateWrite Permission	**0**	With the first write access, a write authorization for the respective Modbus connection is requested. If this request fails, an exception response with exception-code 0x01 is generated. 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 Modbus connection thus receives the write authorization, all following connections don't (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 tot 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 data	Process output data	Alignment
TBEN-LL-4RMC-4DXP-4DIP	44 byte	48 byte	Word by word

7.4.4 Register mapping

Input registers

Process input data [▶ 102]

Register no.	Byte	Bit no.							
		7	6	5	4	3	2	1	0
Digital channels (connector X0…X3)									
0x0000	0	DXP7	DXP6	DXP5	DXP4	DI3	DI2	DI1	DI0
	1	Reserved							
Motor control – motor 1 (connector X4)									
0x0001	0	Status position				Motor mode			
		-	F_ER	BUSY	TR				
0x0002	1	Error register							
		MSERR	res.	DPSERR	COMERR	TERR	VOLTERR	CURRERR	GERR
	2	Status							
		FAULT_ PENDING	FAULT	ENABLED	CON	res.	DIGMOD	VELEXC	MISDEV
	3	Reserved							
0x0003	4	Velocity							
	5								
0x0004	6	Position							
	7								
0x0005	8								
	9								
Motor control – motor 2 (connector X5)									
0x0006 … 0x000A	0…9	Assignment similar to motor 1 (0x0001...0x0005)							
Motor control – motor 3 (connector X6)									
0x000B … 0x000F	0…9	Assignment similar to motor 1 (0x0001...0x0005)							
Motor control – motor 4 (connector X7)									
0x0010 … 0x0014	0…9	Assignment similar to motor 1 (0x0001...0x0005)							
Sensor supply and digital channels (diagnostics)									
0x0015	0	Reserved				VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)	VAUX1 pin1 X0 (Ch0/1)
	1	Reserved							
0x0016	2	ERR_DXP7	ERR_DXP6	ERR_DXP5	ERR_DXP4	Reserved			
	3	Reserved							

Output registers

Process output data [▶ 105]

Register no.	Byte	Bit no.							
		7	6	5	4	3	2	1	0
Digital channels									
0x0800	0	DXP7	DXP6	DXP5	DXP4	Reserved			
	1	Reserved							
Motor control – motor 1 (connector X4)									
0x0801	0	Control				Motor mode (MOMODE_IO)			
		Q_STOP	HALT	FAULT_ RST	ENABLE				
	1	Reserved				Position control (POSCTRL)			
						COSP	CSI	ABS_REL	NSP
0x0802	2	Velocity							
	3								
0x0803	4	Position							
	5								
0x0804	6								
	7								
0x0805	8	Ramp acceleration							
	9								
0x0806	10	Ramp deceleration							
	11								
Motor control – motor 2 (connector X5)									
0x0807 … 0x080C	0…11	Assignment similar to motor 1 (0x0801…0x0806)							
Motor control – motor 3 (connector X6)									
0x080D … 0x0812	0…11	Assignment similar to motor 1 (0x0801…0x0806)							
Motor control – motor 4 (connector X7)									
0x0813 … 0x0818	0…11	Assignment similar to motor 1 (0x0801…0x0806)							

Diagnostic registers

Diagnostic messages [▶ 110]

Register no.	Byte	Bit no.							
		7	6	5	4	3	2	1	0
Sensor supply and digital channels									
0xA000	0	Reserved				VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)	VAUX1 pin1 X0 (Ch0/1)
	1	Reserved							
0xA001	0	ERR_DXP7	ERR_DXP6	ERR_DXP5	ERR_DXP4	Reserved			
	1	Reserved							
Motor control – motor 1 (connector X4)									
0xA002	0	res.	FAULT	Reserved					MISDEV
	1	MSERR	res.	DPSERR	COMERR	TERR	VOLTERR	CURRERR	GERR
Motor control – motor 2 (connector X5)									
0xA003	0…1	Assignment similar to motor 1 (0xA002)							
Motor control – motor 3 (connector X6)									
0xA004	0…1	Assignment similar to motor 1 (0xA002)							
Motor control – motor 4 (connector X7)									
0xA005	0…1	Assignment similar to motor 1 (0xA002)							

Parameter registers

Parameter description [▶ 87]

Register no.	Byte	Bit no.							
		7	6	5	4	3	2	1	0
Parameters – DXP channels									
0xB000	0	DXP7_ SRO	DXP6_ SRO	DXP5_ SRO	DXP4_ SRO	Reserved			
	1	Reserved							
0xB001	2	DXP7_ EN DO	DXP6_ EN DO	DXP5_ EN DO	DXP4_ EN DO	Reserved			
	3	Reserved							
0xB002	4	DXP7_ OPO	DXP6_ OPO	DXP5_ OPO	DXP4_ OPO	Reserved			
	5	Reserved							
Motor control – motor 1 (connector X4)									
0xB003	0		Reserved			Motor mode			
	1	Reserved				LOCK_POS	LOCK_ RAMP	LOCK_ MOMO	MOT_ ATT
0xB004	2	Velocity (for digital mode)							
	3								
0xB005		Control inputs (for digital mode)							
	4	CIC7	CIC6	CIC5	CIC4	CIC3	CIC2	CIC1	CIC0
		Logic level (for digital mode)							
	5	ILL7	ILL6	ILL5	ILL4	ILL3	ILL2	ILL1	ILL0
0xB006	6	Motor Fault Output				Reserved			
		MFO7	MFO6	MFO5	MFO4				
	7	Reserved							
0xB007 … 0xB00B	8…17	Reserved							
0xB00C	18	Ramp acceleration							
	19								
0xB00D	20	Ramp deceleration							
	21								
Motor control – motor 2 (connector X5)									
0xB00E … 0xB018		Assignment similar to motor 1 (0xB000…0xB00D)							
Motor control – motor 3 (connector X6)									
0xB019 … 0xB023		Assignment similar to motor 1 (0xB000…0xB00D)							
Motor control – motor 4 (connector X7)									
0xB024 … 0xB02E		Assignment similar to motor 1 (0xB000…0xB00D)							

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

If the watchdog triggers, the BUS LED behaves as follows:

Watchdog	BUS LED
Tripped	Red

Behavior of the device in case of loss of Modbus communication

If Modbus is the active protocol and all Modbus connections are closed, the watchdog switches all outputs to "0" after the watchdog time has expired, unless another protocol (PROFINET, EtherNet/IP) has been activated in the meantime.

7.5 Commissioning the device in EtherNet/IP

7.5.1 Common EtherNet/IP features

Features	Description
QuickConnect	No
Device Level Ring (DLR)	yes
Number of TCP connections	3
Number of CIP connections	10
Input assembly instance	103
Output assembly instance	104
Configuration assembly Instance	106

7.5.2 EDS files and catalog files

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

7.5.3 Diagnostic messages via process data

The diagnostic messages are directly mapped into the process data [▶ 102].

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	-	CAN COM ERR	-	-	V1	-	V2	-	-	CAN COM WARN	-	-	ARGEE	DIAG

7.5.4 EtherNet/IP standard classes

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.

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: 27247_{dec} = 0x6A6F
4	0x04	Size	G	UINT	Number of bytes in attribute 3: 256 or variable

Common services

Service code		Class	Instance	Service name
Dec.	Hex.			
14	0x0E	Yes	Yes	Get_Attribute_Single Returns the content of a specified attribute.

Configuration Assembly (Instance 106)

The devices support Configuration Assembly.

The Configuration Assembly contains:

10 bytes module configuration data (EtherNet/IP specific)

+ 136 bytes (parameter data, depending on device)

The description of the parameters can be found in chapter “Parameterizing and configuring” [▶ 87].

Byte no.		**Bit no.**							
Dec.	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Device Configuration Data									
0…8	0x00… 0x08	Reserved							
9	0x09	Reserved					Eth2 port setup	Eth1 port setup	QuickConnect (not supported)
Digital channels									
10	0x0A	Reserved							DXP4_SRO
11	0x0B	Reserved							DXP5_SRO
12	0x0C	Reserved							DXP6_SRO
13	0x0D	Reserved							DXP7_SRO
14	0x0E	Reserved							DXP4_EN DO
15	0x0F	Reserved							DXP5_EN DO
16	0x10	Reserved							DXP6_EN DO
17	0x11	Reserved							DXP7_EN DO
18	0x12	Reserved							DXP4_OPO
19	0x13	Reserved							DXP5_OPO
20	0x14	Reserved							DXP6_OPO
21	0x15	Reserved							DXP7_OPO
Motor control – motor 1 (X4)									
22	0x16	Reserved				Motor Mode			
23	0x17	Reserved							MOT_ATT
24	0x18	Reserved							LOCK_MOMO
25	0x19	Reserved							LOCK_RAMP
26	0x1A	Reserved							LOCK_POS
27	0x1B	Reserved							
28	0x1C	Velocity (for digital mode)							
29	0x1D								
30	0x1E	Ramp acceleration							
31	0x1F								
32	0x20	Ramp deceleration							
33	0x21								
34	0x22	Reserved							CIC0
35	0x23	Reserved							CIC1
36	0x24	Reserved							CIC2

Byte no.		Bit no.							
Dec.	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
37	0x25	Reserved							CIC3
38	0x26	Reserved							CIC4
39	0x27	Reserved							CIC5
40	0x28	Reserved							CIC6
41	0x29	Reserved							CIC7
42	0x2A	Reserved							ILL0
43	0x2B	Reserved							ILL1
44	0x2C	Reserved							ILL2
45	0x2D	Reserved							ILL3
46	0x2E	Reserved							ILL4
47	0x2F	Reserved							ILL5
48	0x30	Reserved							ILL6
49	0x31	Reserved							ILL7
50	0x32	Reserved							MFO4
51	0x33	Reserved							MFO5
52	0x34	Reserved							MFO6
53	0x35	Reserved							MFO7
Motor control – motor 2 (X5)									
54…85	0x36… 0x55	Assignment similar to motor 1							
Motor control – motor 3 (X6)									
86…117	0x56… 0x75	Assignment similar to motor 1							
Motor control – motor 4 (X7)									
118…149	0x76… 0x95	Assignment similar to motor 1							

Device configuration data

Parameter name	Value		Meaning
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 instance (instance 103)

The description of the input data can be found in chapter “Operating” [▶ 102]

Word no.		**Bit no.**														
Hex.	**Dec.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
0x00	0	**Status word**														
		res.	FCE	res.	CAN COM ERR	res.		V1	res.	V2	res.		CAN COM WARN	Reserved		ARGEE
Digital channels																
0x01	1	Reserved								DXP 7	DXP 6	DXP 5	DXP 4	DI3	DI2	DI1
Motor control – motor 1 (X4)																
0x02	2	MS ERR	-	DPS ERR	COM ERR	T ERR	VOLT ERR	CURR ERR	G ERR	res.	F_ ER	BUSY	TR	Motor mode		
0x03	3	Reserved								FAULT PEN-DING	FAU LT	EN-ABLED	CON	res.	DIG MOD	VEL EXC
0x04	4	Velocity														
0x05	5	Position														
0x06	6															
Motor control – motor 2 (X5)																
0x07 … 0x0B	7… 11	Assignment similar to motor 1														
Motor control – motor 3 (X6)																
0x0C … 0x10	12 … 16	Assignment similar to motor 1														
Motor control – motor 4 (X7)																
0x11 … 0x15	17 … 21	Assignment similar to motor 1														
Sensor supply and digital channels (diagnostics)																
0x16	22	Reserved												VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)
0x17	23	ERR DX P7	ERR DXP 6	ERR DXP 5	ERR DXP 4	Reserved										

Output Assembly instance (instance 104)

The description of the output data can be found in chapter “Operating” [▶ 105]

Word no.		Bit no.															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Hex.	**Dec.**																
Control Word																	
0x00	0																
Digital channels																	
0x01	1	Reserved								DO7	DO6	DO5	DO4	Reserved			
Motor control – motor 1 (X4)																	
0x02	2	Reserved								Control				Motor mode (MOMODE_IO)			
										Q_STOP	HALT	FAULT_ RST	ENABLE				
0x03	3	Velocity															
0x04	4	Position															
0x05	5																
0x06	6	Ramp acceleration															
0x07	7	Ramp deceleration															
Motor control – motor 2 (X5)																	
0x08… 0xD	8…13	Assignment similar to motor 1															
Motor control – motor 3 (X6)																	
0x0E… 0x13	14… 19	Assignment similar to motor 1															
Motor control – motor 4 (X7)																	
0x14… 0x19	20… 25	Assignment similar to motor 1															

Connection Manager Object (0x05)

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

Identity Object (0x01)

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.

Instance attributes

Attr. no.		Attribute name	Get/Set	Type	Value
Dec.	Hex.				
1	0x01	Vendor	G	UINT	Contains the manufacturer ID. Turck = 0x46
2	0x02	Product type	G	UINT	Shows the general product type. Communications Adapter 12_{dez} = 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.: TBEN-LL-4RMC-4DIP-4DXP

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 is 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 Modifies a single attribute

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

Attr. no.		Designation	Get/Set	Type	Value
Dec.	Hex.				
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.

7.5.5 VSC-Vendor Specific Classes

Gateway Class (VSC 100)

This class contains all information concerning the whole device.

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 the substitute value.
					1: SWITCH IO OFF (1): The outputs are set 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.
139	0x8B	GW Control - Register	G/S	DWORD	Activates or deactivates the mapping of the control word into the device's output data.
140	0x8C	Disable Protocols	G/S	UINT	Deactivation of the used Ethernet protocol.
					Bit 0: deactivates EtherNet/IP (can not be disabled via EtherNet/IP-interface)
					Bit 1: Deactivates Modbus TCP
					Bit 2: Deactivates PROFINET
					Bit 15: Deactivates the web server

Class 190 (0xBE) – Motor 1…4

This class contains one instance per channel for motor control "Motor 1...4" (connector X4...X7).

Attr.		Meaning	Get/set	Type	Description
Dec.	Hex.				
1	0x01	Motor 1 - Operation mode	G/S	USINT	0: no change
					1: position mode
					2: reserved
					3: velocity
					4: reserved
					5: reserved
					6: homing
2	0x02	Motor 1 - Motor attached	G/S	USINT	0: no
					1: yes
3	0x03	Motor 1 - Lock Motor Mode	G/S	USINT	0: no
					1: yes
4	0x04	Motor 1 - Lock Ramp	G/S	USINT	0: no
					1: yes
5	0x05	Motor 1 - Lock Position	G/S	USINT	0: no
					1: yes
6	0x06	Motor 1 - Velocity for digital mode [mm/s]	G/S	UINT	
7	0x07	Motor 1 - Ramp Acceleration [mm/s^2]	G/S	UINT	
8	0x08	Motor 1 - Ramp Deceleration [mm/s^2]	G/S	UINT	
9	0x09	Motor 1 - Control input Ch0	G/S	USINT	0: not assigned
					1: assigned
10	0x0A	Motor 1 - Control input Ch1	G/S	USINT	0: not assigned
					1: assigned
11	0x0B	Motor 1 - Control input Ch2	G/S	USINT	0: not assigned
					1: assigned
12	0x0C	Motor 1 - Control input Ch3	G/S	USINT	0: not assigned
					1: assigned
13	0x0D	Motor 1 - Control input Ch4	G/S	USINT	0: not assigned
					1: assigned
14	0x0E	Motor 1 - Control input Ch5	G/S	USINT	0: not assigned
					1: assigned
15	0x0F	Motor 1 - Control input Ch6	G/S	USINT	0: not assigned
					1: assigned
16	0x10	Motor 1 - Control input Ch7	G/S	USINT	0: not assigned
					1: assigned
17	0x11	Motor 1 - Input logic level Ch0	G/S	USINT	0: low level
					1: high level
18	0x12	Motor 1 - Input logic level Ch1	G/S	USINT	0: low level
					1: high level

Attr.		Meaning	Get/set	Type	Description
Dec.	Hex.				
19	0x13	Motor 1 - Input logic level Ch2	G/S	USINT	0: low level
					1: high level
20	0x14	Motor 1 - Input logic level Ch3	G/S	USINT	0: low level
					1: high level
21	0x15	Motor 1 - Input logic level Ch4	G/S	USINT	0: low level
					1: high level
22	0x16	Motor 1 - Input logic level Ch5	G/S	USINT	0: low level
					1: high level
23	0x17	Motor 1 - Input logic level Ch6	G/S	USINT	0: low level
					1: high level
24	0x18	Motor 1 - Input logic level Ch7	G/S	USINT	0: low level
					1: high level
25	0x19	Motor 1 - Motor Fault Output Ch4	G/S	USINT	0: not assigned
					1: assigned
26	0x1A	Motor 1 - Motor Fault Output Ch5	G/S	USINT	0: not assigned
					1: assigned
27	0x1B	Motor 1 - Motor Fault Output Ch6	G/S	USINT	0: not assigned
					1: assigned
28	0x1C	Motor 1 - Motor Fault Output Ch7	G/S	USINT	0: not assigned
					1: assigned
29	0x1D	Motor 1 - Missing device	G	USINT	0: -
					1: active
30	0x1E	Motor 1 - Fault	G	USINT	0: -
					1: active
31	0x1F	Motor 1 - Generic error	G	USINT	0: -
					1: active
32	0x20	Motor 1 - Current error	G	USINT	0: -
					1: active
33	0x21	Motor 1 - Voltage error	G	USINT	0: -
					1: active
34	0x22	Motor 1 - Temperature error	G	USINT	0: -
					1: active
35	0x23	Motor 1 - Communication error	G	USINT	0: -
					1: active
36	0x24	Motor 1 - Device profile specific error	G	USINT	0: -
					1: active
37	0x25	Motor 1 - Manufacturer specific error	G	USINT	0: -
					1: active

Attr.		Meaning	Get/set	Type	Description
Dec.	Hex.				
38	0x26	Motor 1 - Motor mode	G	USINT	0: no change
					1: position mode
					2: reserved
					3: velocity
					4: reserved
					5: reserved
					6: homing
39	0x27	Motor 1 - Target reached	G	USINT	0: not active
					1: active
40	0x28	Motor 1 - Busy	G	USINT	0: not active
					1: active
41	0x29	Motor 1 - Communication error	G	USINT	0: not active
					1: active
42	0x2A	Motor 1 - Generic error	G	USINT	0: -
					1: active
43	0x2B	Motor 1 - Current error	G	USINT	0: -
					1: active
44	0x2C	Motor 1 - Voltage error	G	USINT	0: -
					1: active
45	0x2D	Motor 1 - Temperature error	G	USINT	0: -
					1: active
46	0x2E	Motor 1 - Communication error	G	USINT	0: -
					1: active
47	0x2F	Motor 1 - Device profile specific error	G	USINT	0: -
					1: active
48	0x30	Motor 1 - Manufacturer specific error	G	USINT	0: -
					1: active
49	0x31	Motor 1 - Missing device	G	USINT	0: not active
					1: active
50	0x32	Motor 1 - Velocity out of valid range	G	USINT	0: not active
					1: active
51	0x33	Motor 1 - Digital mode	G	USINT	0: not active
					1: active
52	0x34	Motor 1 - Connected	G	USINT	0: no
					1: yes
53	0x35	Motor 1 - Enabled	G	USINT	0: no
					1: yes
54	0x36	Motor 1 - Fault	G	USINT	0: not active
					1: active
55	0x37	Motor 1 - Fault is pending	G	USINT	0: not active
					1: active
56	0x38	Motor 1 - Velocity [mm/s]	G	UINT	

Attr.		Meaning	Get/set	Type	Description
Dec.	Hex.				
57	0x39	Motor 1 - Position [mm]	G	UDINT	
58	0x3A	Motor 1 - Motor mode	G	USINT	0: no change
					1: position mode
					2: reserved
					3: velocity
					4: reserved
					5: reserved
					6: homing
59	0x3B	Motor 1 - Enable	G	USINT	0: no
					1: yes
60	0x3C	Motor 1 - Fault reset	G	USINT	0: no
					1: yes
61	0x3D	Motor 1 - Halt	G	USINT	0: not active
					1: active
62	0x3E	Motor 1 - Velocity [mm/s]	G	UINT	
63	0x3F	Motor 1 - Quick Stop	G	USINT	0: not active
					1: active
64	0x40	Motor 1 - Position [mm]	G	UDINT	
65	0x41	Motor 1 - New setpoint	G	USINT	0: not active
					1: active
66	0x42	Motor 1 - Ramp Acceleration [mm/s^2]	G	UINT	
67	0x43	Motor 1 - Positioning mode	G	USINT	0: absolute
					1: relative
68	0x44	Motor 1 - Ramp Deceleration [mm/s^2]	G	UINT	
69	0x45	Motor 1 - Change set immediately	G	USINT	0: not active
					1: active
70	0x46	Motor 1 - Change on setpoint	G	USINT	0: not active
					1: active

Class 191 (0xBF) – DXP

This class data and parameters for the digital channels of the device.

Attr. no.		Designation	Get/set	Type	Meaning
Dec.	Hex.				
Parameters					
1	0x01	DXP 4 – Manual reset after overcurr.	G/S	USINT	0: no
					1: yes
2	0x02	DXP 5 – Manual reset after overcurr.	G/S	USINT	0: no
					1: yes
3	0x03	DXP 6 – Manual reset after overcurr.	G/S	USINT	0: no
					1: yes
4	0x04	DXP 7 – Manual reset after overcurr.	G/S	USINT	0: no
					1: yes
5	0x05	DXP 4 - Activate output	G/S	USINT	0: no
					1: yes
6	0x06	DXP 5 - Activate output	G/S	USINT	0: no
					1: yes
7	0x07	DXP 6 - Activate output	G/S	USINT	0: no
					1: yes
8	0x08	DXP 7 - Activate output	G/S	USINT	0: no
					1: yes
9	0x09	DXP 4 - Output permanently on	G/S	USINT	0: no
					1: yes
10	0x0A	DXP 5 - Output permanently on	G/S	USINT	0: no
					1: yes
11	0x0B	DXP 6 - Output permanently on	G/S	USINT	0: no
					1: yes
12	0x0C	DXP 7 - Output permanently on	G/S	USINT	0: no
					1: yes
13	0x0D	DXP - Overcurrent VAUX1 pin1 X0 (Ch0/1)	G	USINT	0: -
					1: active
14	0x0E	DXP - Overcurrent VAUX1 pin1 X1 (Ch2/3)	G	USINT	0: -
					1: active
15	0x0F	DXP - Overcurrent VAUX1 pin1 X2 (Ch4/5)	G	USINT	0: -
					1: active
16	0x10	DXP - Overcurrent VAUX1 pin1 X3 (Ch6/7)	G	USINT	0: -
					1: active
17	0x11	DXP 4 - Overcurrent output	G	USINT	0: -
					1: active
18	0x12	DXP 5 - Overcurrent output	G	USINT	0: -
					1: active
19	0x13	DXP 6 - Overcurrent output	G	USINT	0: -
					1: active

Attr. no.		Designation	Get/set	Type	Meaning
Dec.	Hex.				
20	0x14	DXP 7 - Overcurrent output	G	USINT	0: - 1: active
21	0x15	DXP - input value 0	G	BYTE	Bit 0: input value DI0 Bit 1: input value DI1 Bit 2: input value DI2 Bit 3: input value Ch4
22	0x16	DXP - input value 4	G	BYTE	Bit 0: input value DI4 Bit 1: input value DI5 Bit 2: input value DI6 Bit 3: input value Ch7
19	0x13	DXP – output value 4	G	BYTE	Bit 0: output value DXP4 Bit 1: output value DXP5 Bit 2: output value DXP6 Bit 3: output value Ch7

7.6 Connecting the device to a Rockwell PLC with EtherNet/IP

Used hardware

The following hardware components are used in this example:

- Rockwell PLC ControlLogix 1756-L72, Logix 5572
- Rockwell Scanner 1756-EN2TR
- Block module TBEN-LL-4RMC-4DIP-4DXP

Used software

The following software tools are used in this example:

- Rockwell RS Logix
- EDS file „TBEN-LL-4RMC-4DIP-4DXP.eds" as part of the file „TBEN-L_ETHERNETIP.zip" (can be downloaded for free under www.turck.com)

Prerequisites

- A new project has been created in instance of RSLogix/Studio5000.
- The PLC and the Scanner mentioned above have been added

7.6.1 Installing the EDS file

▶ Open the EDS Wizard via **Tools** → **Hardware Installation Tool**.

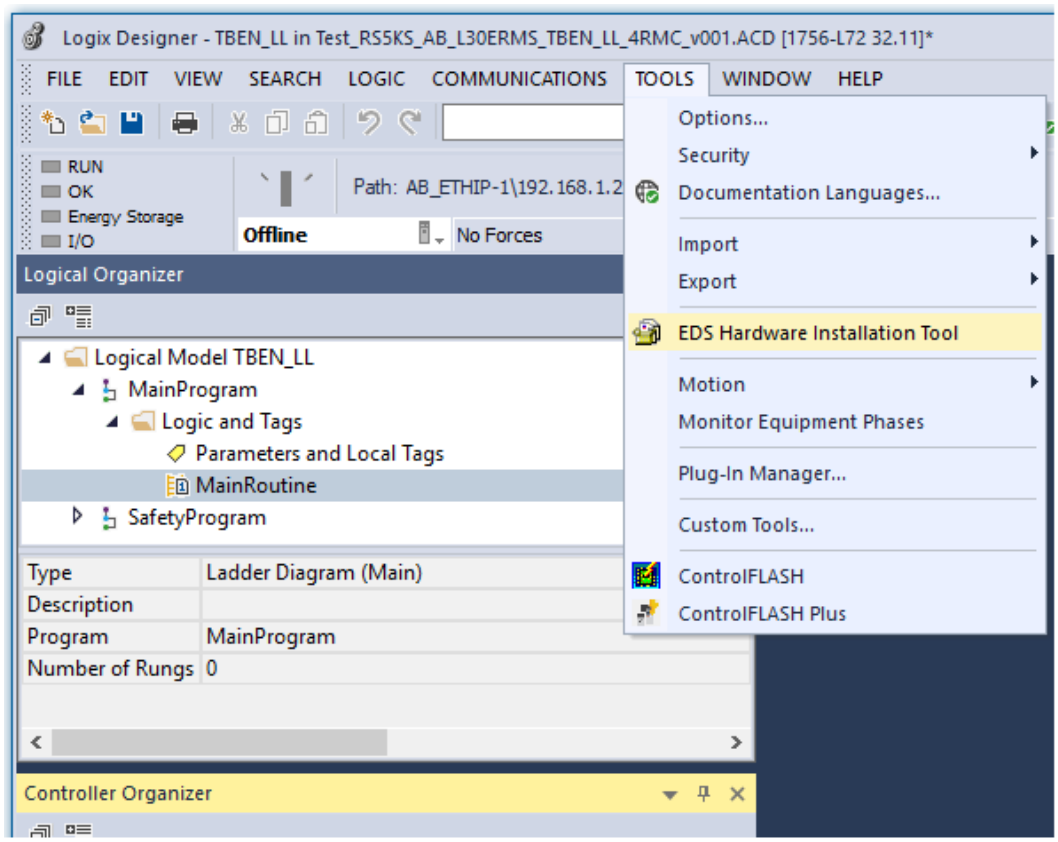


Fig. 35: Studio 5000 – Opening the Hardware Installation Tool

▶ Follow the instructions in the wizard to install the EDS file.

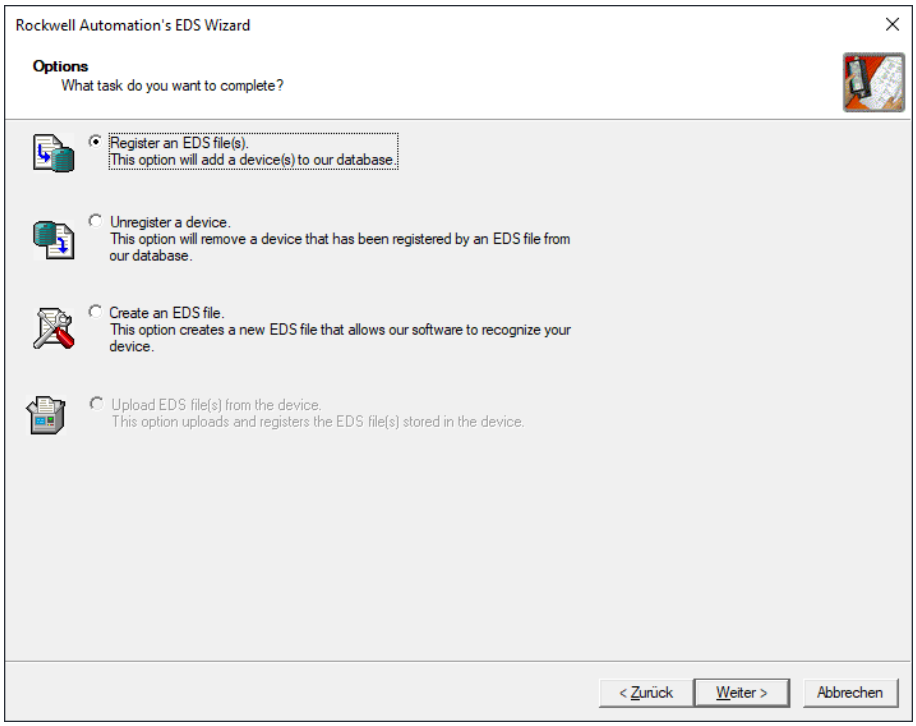


Fig. 36: Studio 5000 – EDS Wizard

⇨ The device is registered as a Communications Adapter and can be added to the project later as a slave.

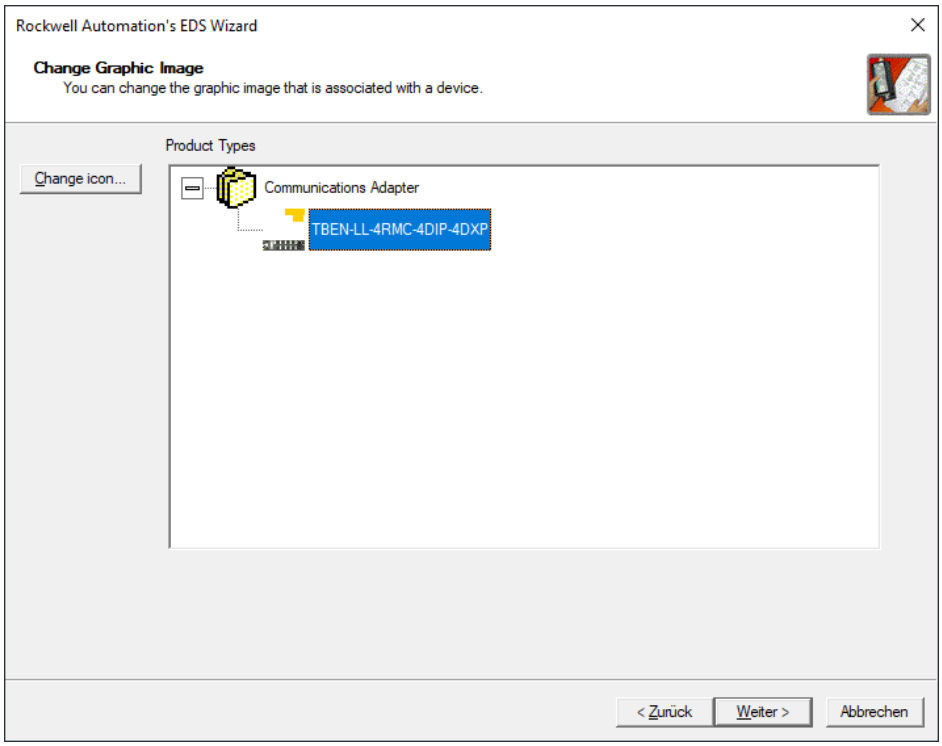


Fig. 37: Studio 5000 – Registering the device as Communications Adapter

7.6.2 Adding the device to the project

▶ In the project tree open the context menu by right-clicking on the entry of the scanner and click **New Module**.

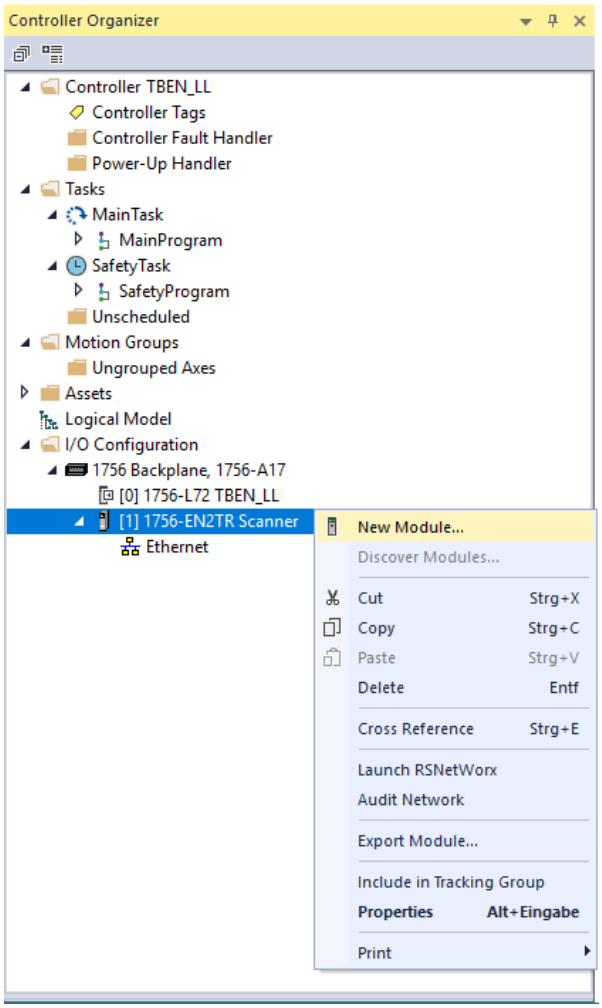


Fig. 38: Studio 5000 – Adding the device to the project

▶ Select TBEN-LL-4RMC-4DIP-4DXP and add it to the project.

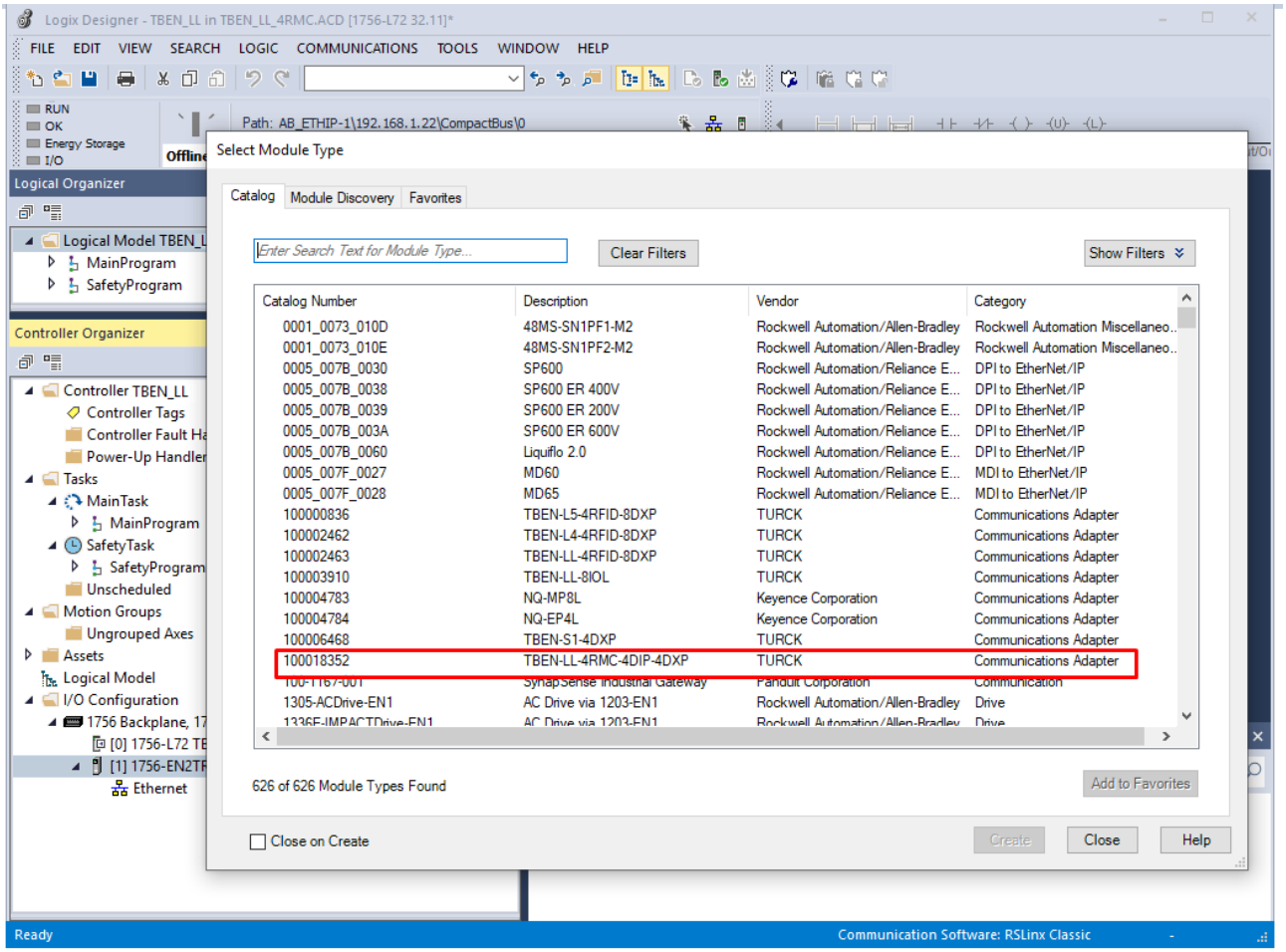


Fig. 39: Studio 5000 – Selecting the device

▶ In the window **New Module** → **General** enter the device name and IP address of the device.

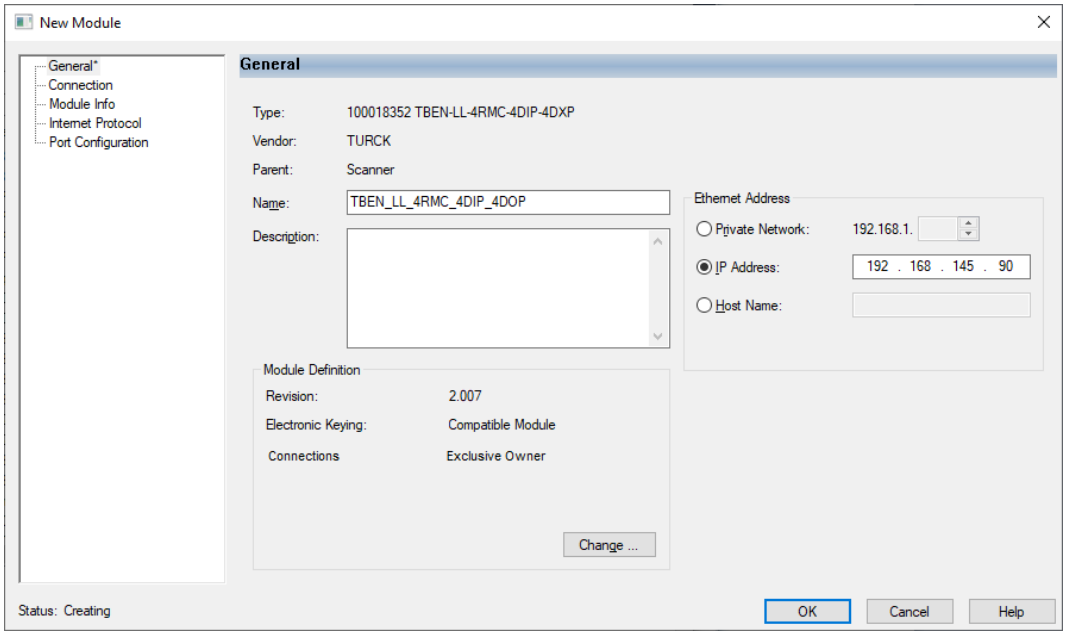


Fig. 40: Studio 5000 – New Module, setting name and IP address

▶ Optional: Set the connection parameters.

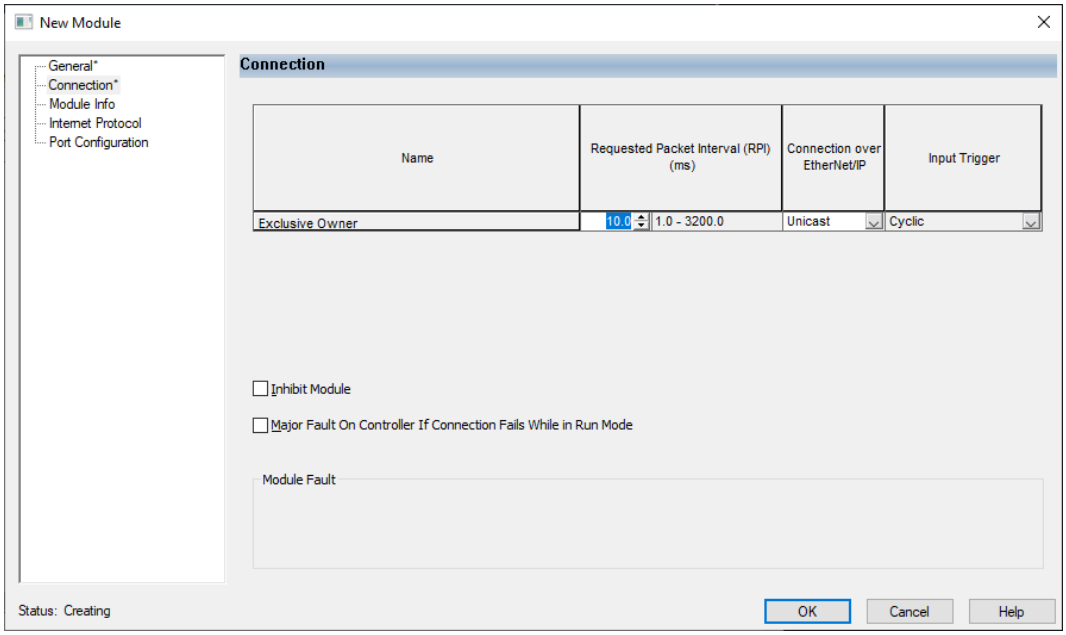


Fig. 41: Studio 5000 – New Module, connection parameters

➪ The device appears as Ethernet slave in the project tree.

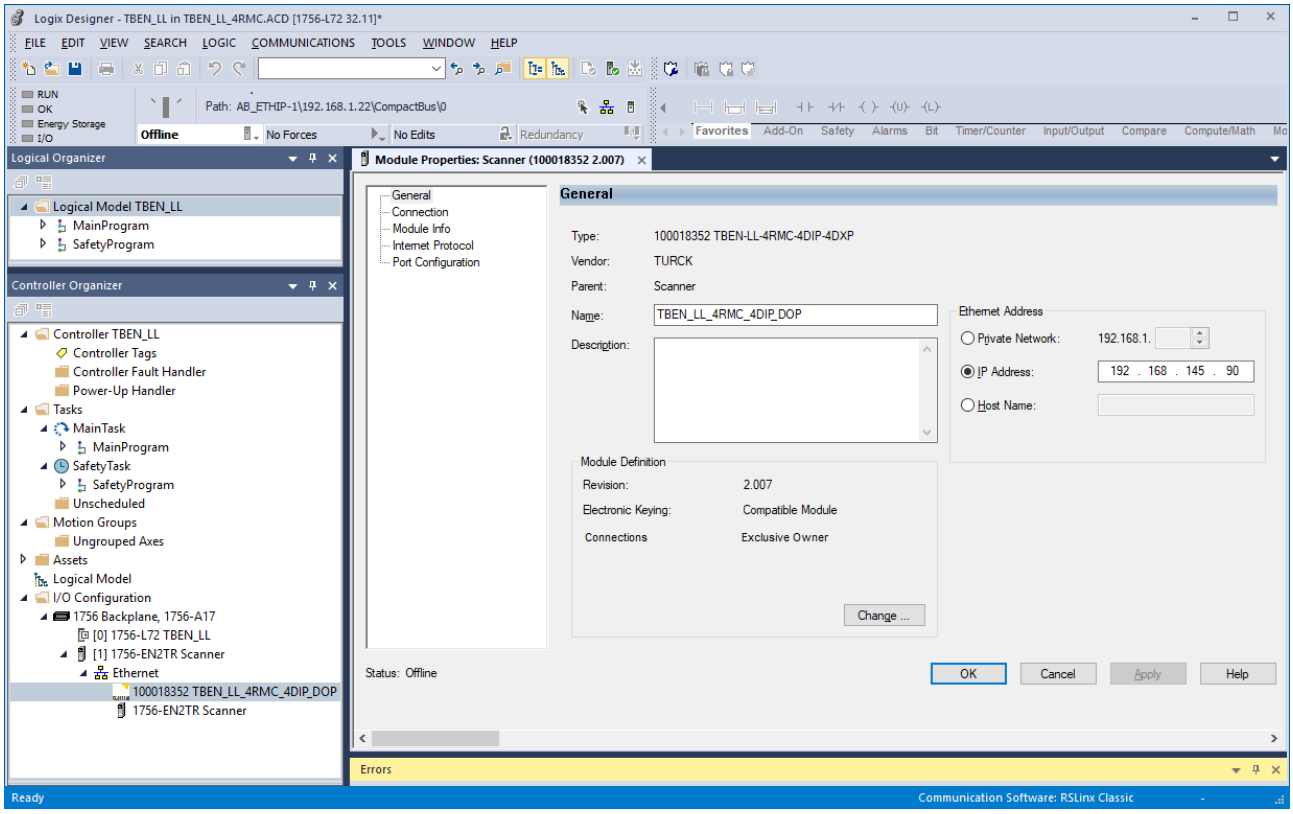


Fig. 42: Studio 5000 – Device in the project tree

7.6.3 Parameterizing the device

- Open the Controller Tags of the device.
- Configure the device by using the Controller Tags TBEN_LL_4RMC_4DIP_4DXP:C for configuration and TBEN_LL_4RMC_4DIP_4DXP:O for process output data. The chapter "Parameterizing and configuring" contains examples for configuring the device [▶ 91].

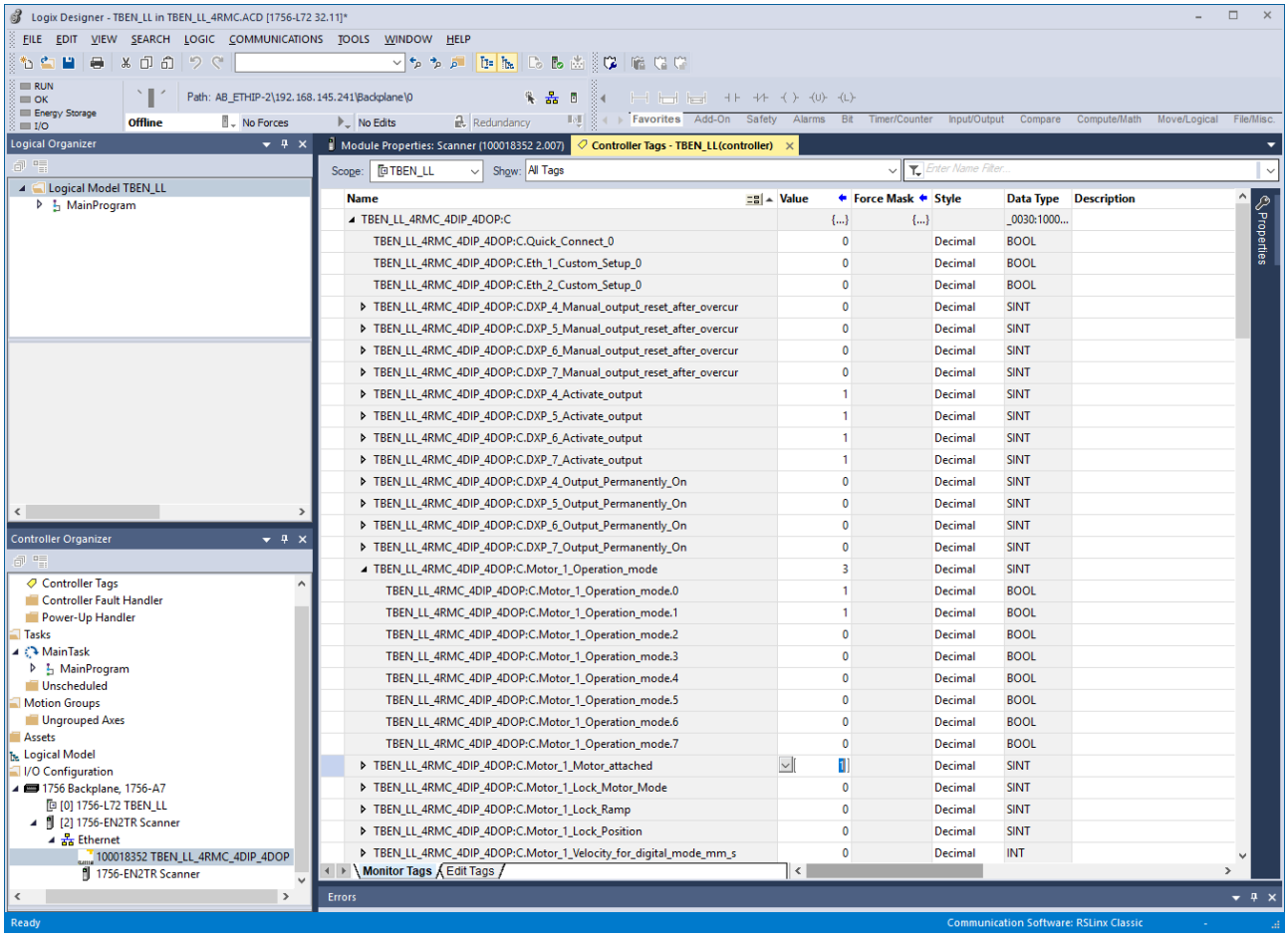


Fig. 43: Studio 5000 – Controller Tags (parameters)

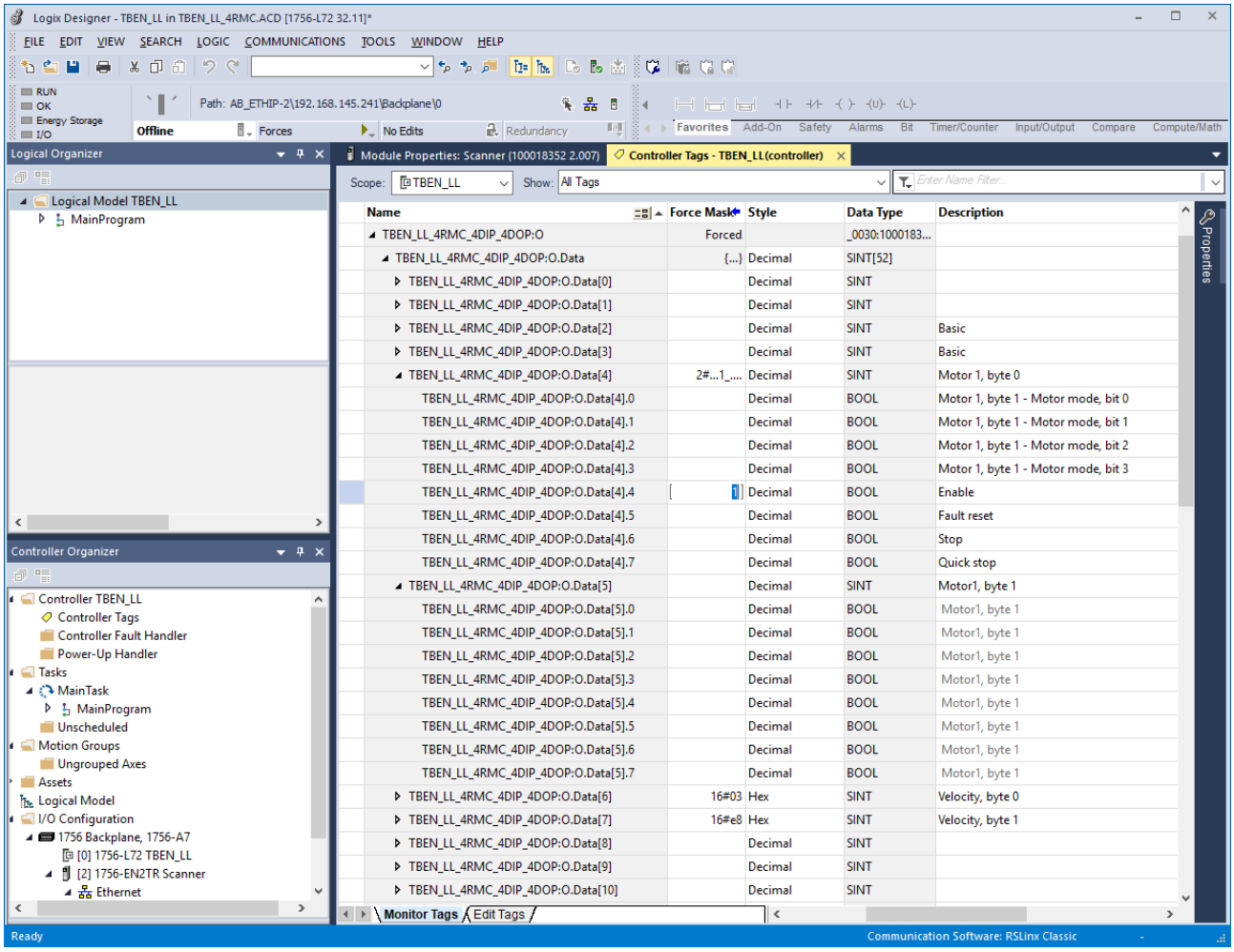


Fig. 44: Studio 5000 – Controller Tags (outputs)

7.6.4 Going online with the PLC

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

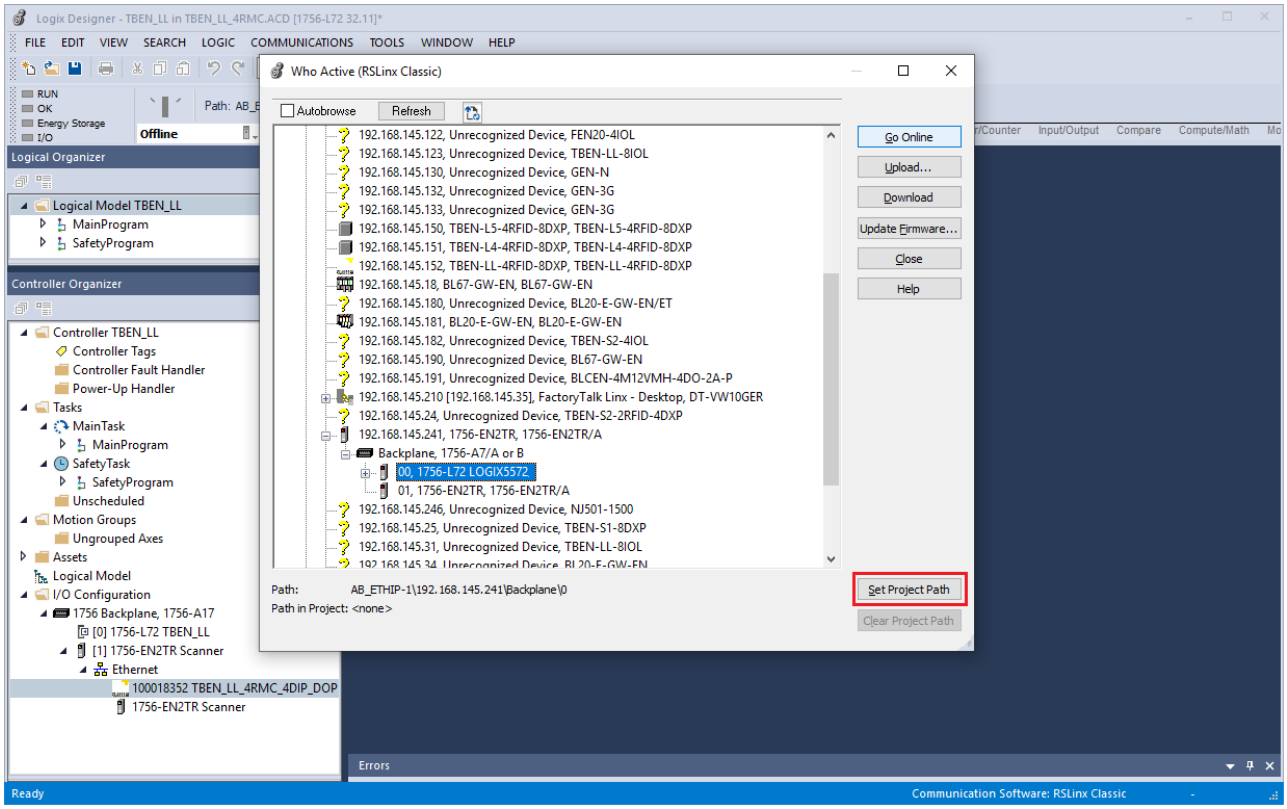


Fig. 45: Studio 5000 – Setting the communication path

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

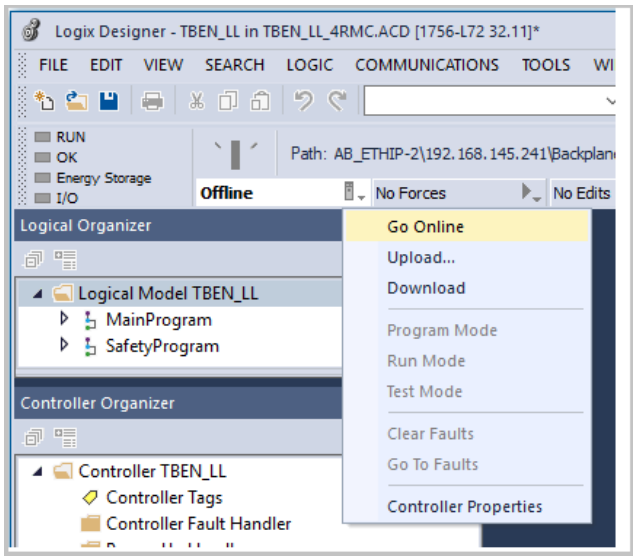


Fig. 46: Studio 5000 – Going online with the device

- ▶ Click **Download** In the following dialog (Connect To Go Online)
- ▶ Confirm all following messages.
- ⇨ The project is loaded down to the controller. The connection is established.

7.6.5 Reading process data

- ▶ Open the Controller Tags in the project tree by double-clicking the entry.
- ⇨ The access to the input data (TBEN_LL_4RMC_4DIP_4DXP_…:I) and output data (TBEN_LL_4RMC_4DIP_4DXP_…:O) is possible.

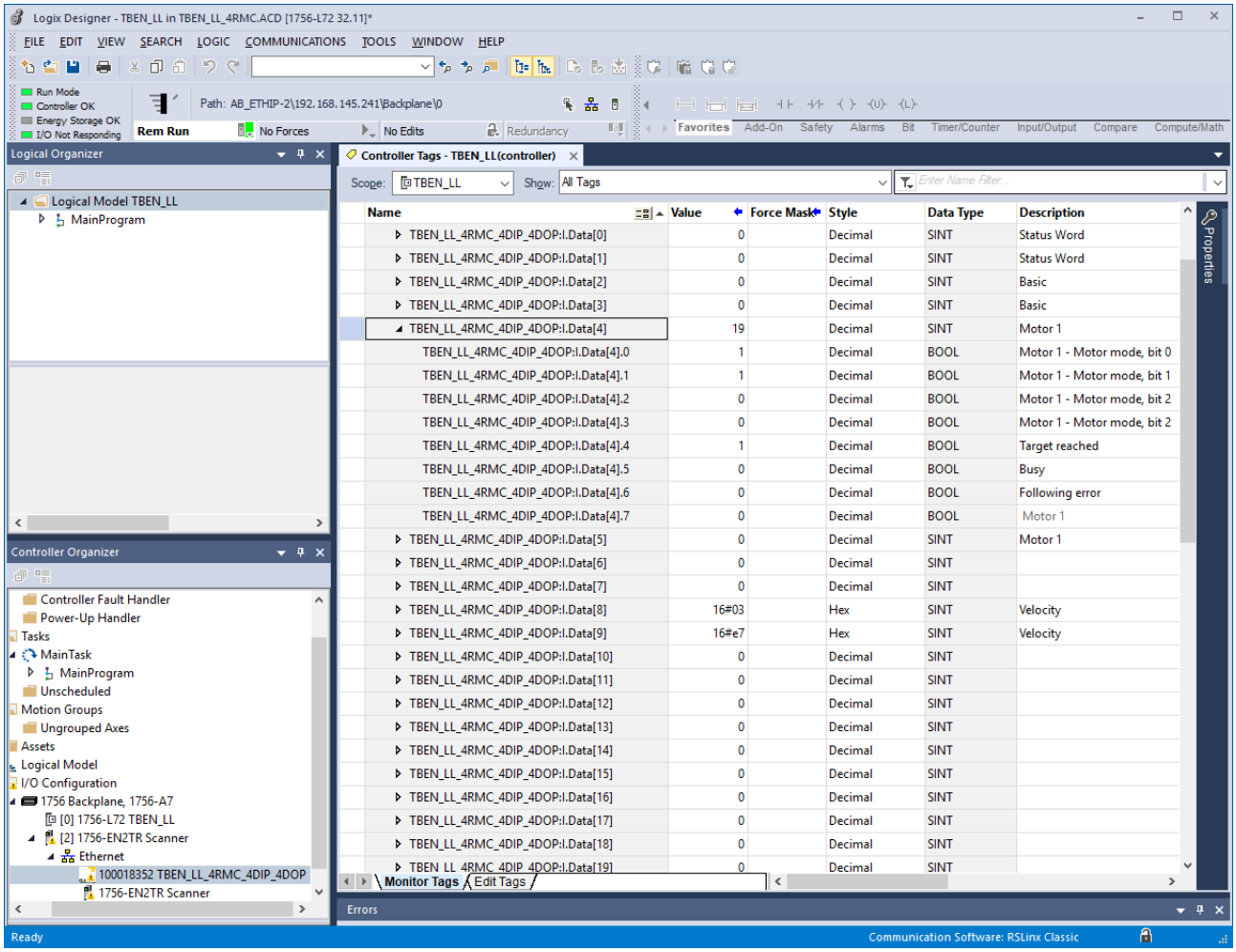


Fig. 47: Studio 5000 – Controller Tags (inputs)

8 Parameterizing and configuring

8.1 Parameters

The device has two bytes of general module parameters, six bytes of parameters for the digital channels and 22 bytes of parameters for each motor channel.

Word no.		Byte no.		Bit no.							
Dec.	**Hex.**	**Dec.**	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
DXP channels											
0	0x00	0	0x00	DXP7_ SRO	DXP6_ SRO	DXP5_ SRO5	DXP4_ SRO	Reserved			
		1	0x01	Reserved							
1	0x01	2	0x02	DXP7_ EN DO	DXP6_ EN DO	DXP5_ EN DO	DXP4_ EN DO	Reserved			
		3	0x03	Reserved							
2	0x03	4	0x04	DXP7_ OPO	DXP6_ OPO	DXP5_ OPO	DXP4_ OPO	Reserved			
		5	0x05	Reserved							
Motor control – motor 1 (X4)											
3	0x03	0	0x00	MOT ATT	Reserved			Operation mode			
		1	0x01	Reserved					LOCK POS	LOCK RAMP	LOCK MOMO
4	0x04	2	0x02	Velocity (for digital mode)							
		3	0x03								
5	0x05	4	0x04	Control inputs (for digital mode)							
				CIC7	CIC6	CIC5	CIC4	CIC3	CIC2	CIC1	CIC0
		5	0x05	Input logic level (for digital mode)							
				ILL7	ILL6	ILL5	ILL4	ILL3	ILL2	ILL1	ILL0
6	0x06	6	0x06	Motor fault output (for digital mode)				Reserved			
				MFO7	MFO6	MFO5	MFO4				
		7	0x07	Reserved							
7…11	0x07… 0x0B	8…17	0x08… 0x11	Reserved							
12	0x0C	18	0x12	Ramp acceleration							
		19	0x13								
13	0x0D	20	0x14	Ramp deceleration							
		21	0x15								
Motor control – motor 2 (X5)											
14…24	0x0E … 0x18	0…21	0x00… 0x15	Assignment similar to motor channel – motor 1							
Motor control – motor 3 (X6)											
25… 35	0x19… 0x23	0…21	0x00… 0x15	Assignment similar to motor channel – motor 1							
Motor control – motor 4 (X7)											
36…46	0x24… 0x2E	0…21	0x00… 0x15	Assignment similar to motor channel – motor 1							

Meaning of parameter bits

Parameter name	Value		Meaning	Description
	Dec.	Hex.		
Manual output reset after overcurrent (DXPx_SRO)	**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).
Activate output Chx (DXPx_ENDO)	**0**	**0x00**	**No**	The output at pin 2 is deactivated.
	1	0x01	Yes	The output at pin 2 is activated.
Output permanently on (DXPx_OPO)	**0**	**0x00**	**No**	The output is triggered via the process data.
	1	0x01	Yes	The output at the channel is always switched on if activated via the **Activate output** parameter. Output process data no longer have any influence on the output. Use case: Permanent supply of stations that are connected to digital output.
Operation mode	Selection of the operating mode (motor mode) of the channel at the start of the connected motor. The motor mode is defined according to the CANopen Drives profile (object 0x6060, sub index 0x00 "Modes of operation") and depends on the connected motor.			
	Interroll EC5000BI			
	0	0x00	No change	
	1	0x01	Position mode	Profile position mode (according to the CANopen Drives profile object 0x6060:00) The connected motor moves to a defined absolute or relative target position.
	3	0x03	Velocity	Profile velocity mode (according to the CANopen Drives profile object 0x6060:00) The connected motor runs at a defined speed. The acceleration and deceleration behavior of the motor is defined via the **ramp acceleration** and **ramp deceleration** parameters and is also dependent on the application.
	6	0x06	Homing	Homing mode (according to the CANopen Drives profile object 0x6060:00) The connected motor moves to a defined, absolute reference position. All further positions of the motor refer to this reference position.
Motor attached (MOT_ATT)	**0**	**0x00**	**No**	The channel is deactivated. Note: In PROFINET the default setting of parameter 1 = yes (motor attached).
	1	0x01	Yes	If this bit is set, the module expects that a motor is connected to the channel.
Lock motor mode (LOCK_MOMO)	**0**	**0x00**	**No**	Output data for setting the motor mode not locked. The motor mode can be changed during operation via the process output data [▶ 105].
	1	0x01	Yes	Output data for setting the motor mode locked. The configured motor mode cannot be changed during operation via the process output data.

Parameter name	Value		Meaning	Description
	Dec.	Hex.		
Lock ramp (LOCK_RAMP)	**0**	**0x00**	**No**	Output data for setting the ramp acceleration or ramp deceleration not locked. The ramp acceleration or ramp deceleration can be changed during operation via the process output data [▶ 105].
	1	0x01	Yes	Output data for setting the ramp acceleration or ramp deceleration locked. The configured ramp acceleration or ramp deceleration cannot be changed during operation via the process output data.
Lock position (Lock_POS)	**0**	**0x00**	**No**	Output data for the position not locked. The position can be changed during operation via the process output data [▶ 105].
	1	0x01	Yes	Output data for the position locked. The position cannot be changed during operation via the process output data. This value should always be set to **no**.
Ramp acceleration Ramp deceleration	0… **65535**	0x0000 … **0xFFFF**		Value for the acceleration and deceleration of the ramp. 0 = reserved, the previously saved setting is used The unit depends on the connected motor: e.g. mm/s² (Interroll EC5000 BI) The value can be controlled during operation via the process output data. To prevent this, the access to the data in the process output data can be locked via the **Lock ramp acceleration (LOCK_RAMP)** parameter.
Parameters for digital mode				
Velocity	-2000… 2000	0xF830 … 0x07D0		Velocity The unit depends on the connected motor: e.g. mm/s (Interroll EC5000 BI).
Logic level Chx (ILLx)	**0**	**0x00**	Low level	The input is active when 0 is present.
	1	0x01	High level	The input is active when 1 is present.
Control input Chx (CICx)	One or more input bits can be linked to the "Digital mode" function of the connected motor. The motor is operated in digital mode as soon as one of the control inputs has reached the defined logic level.			
	0	**0x00**	0: Not assigned	No link with the **Digital mode** function.
	1	0x01	1: Assigned	Links the bit with the **Digital mode** function. As soon as the bit is set to 1 in the process data, the motor is switched to digital mode.
Motor fault output (MFOx)	Sets one or more outputs on the channel (X4...X7) to 1 if a connected motor has an error.			
	0	**0x00**	0: Not assigned	Output remains unchanged in case of a fault of the connected motor.
	1	0x01	1: Assigned	Output is set to 1 in case of a fault of the connected motor if: ■ the **Motor attached (MOT_ATT)** bit is set for the channel for motor control (X4...X7) and ■ the motor has an error at the output.

8.1.1 PROFINET parameters

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

PROFINET device parameters

Default values are shown in **bold**.

Parameter name	Value	Meaning	Description
Output behavior at communication loss	**0**	**set to 0**	The device switches the outputs to "0". No error information sent.
	1	Hold current value	The device maintains the actual output data.
Deactivate all diagnostics	**0**	**No**	Diagnostic and alarm messages are generated.
	1	Yes	Diagnostic and alarm messages are suppressed.
Deactivate load voltage diagnostics	**0**	**No**	The monitoring of voltage V2 is activated.
	1	Yes	The sending of the diagnosis is deactivated.
LED behavior (PWR) at V2 undervoltage	**0**	**Red**	PWR-LED is red at V2 undervoltage.
	1	green	PWR-LED is blinking green at V2 undervoltage.
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	
Deactivate module-specific PROFINET alarms exclusively	**0**	**No**	PROFINET alarms are shown.
	1	Yes	PROFINET alarms of the slots ≥ 1 are deactivated.

8.2 Configuring the motor mode

The following sample configurations describe the handling of the different motor modes with the TBEN-LL-4RMC-4DIP-4DXP with a connected motor (Interroll RollerDrive EC5000 BI) at slot X5 (motor 2).

The configurations are shown using the integrated web server as an example and are transferable for the Industrial Ethernet protocols PROFINET, EtherNet/IP and Modbus TCP.

NOTE
The motor modes (speed, positioning mode and homing mode) can only be used if the digital mode [▶ 14] is completely deactivated (assignment of control inputs, etc.), i.e. all parameters (assignment of control inputs, logic level, etc.) must be reset.

8.2.1 Velocity mode

The following parameters [▶ 87] and process output data [▶ 105] must be set for velocity mode.

Setting parameters

- Set **Operation mode** to **Velocity** (3).
- Set **Motor attached** to **yes** (1) to activate the channel.
- Set **Lock Ramp** to **no** (0), if a ramp acceleration or deceleration is to be configured dynamically via the process image of the outputs. Set **Lock Ramp** to **yes** (1) if the values from the configuration parameters are to be permanently applied.
- Accept values via **Submit**.

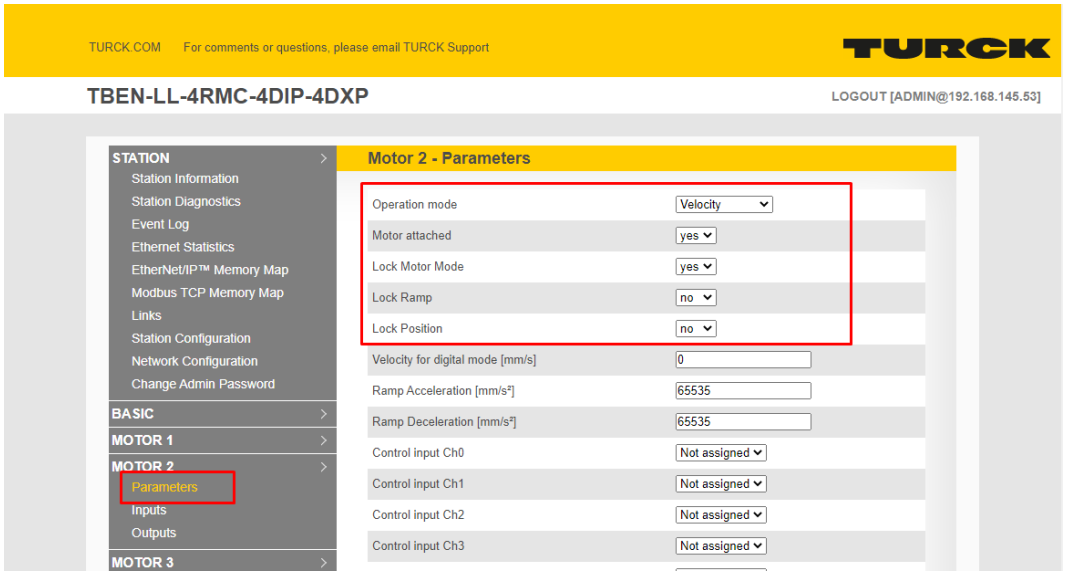


Fig. 48: Web server – parameters for velocity mode

Setting process output data

- Set **Enable** to **yes** (1) to start the motor.
- Set **Velocity** to the desired value, here 1000 mm/s.
- Optional: Set **Ramp Acceleration** and **Ramp Deceleration** to the desired value, here 200 mm/s^2.
- Accept values via **Submit**.

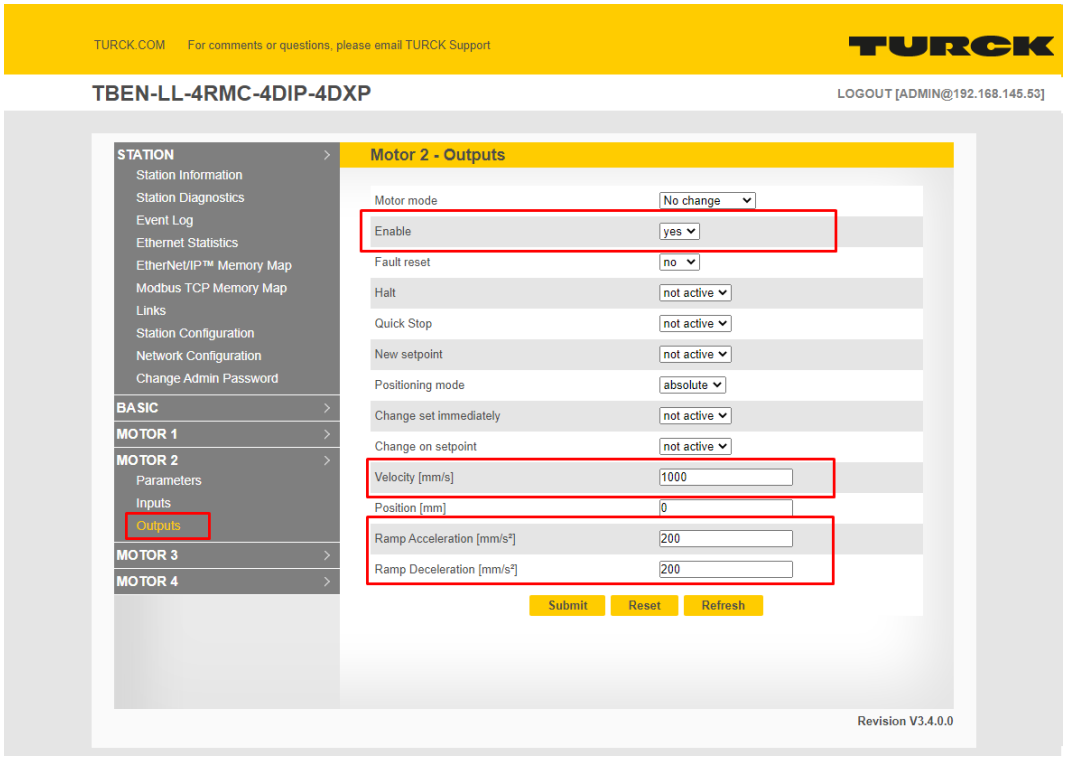


Fig. 49: Web server – process output data for velocity mode

➪ The motor runs at the defined speed. In addition to the velocity, the process input data also show the current position of the motor, as well as status and error messages.

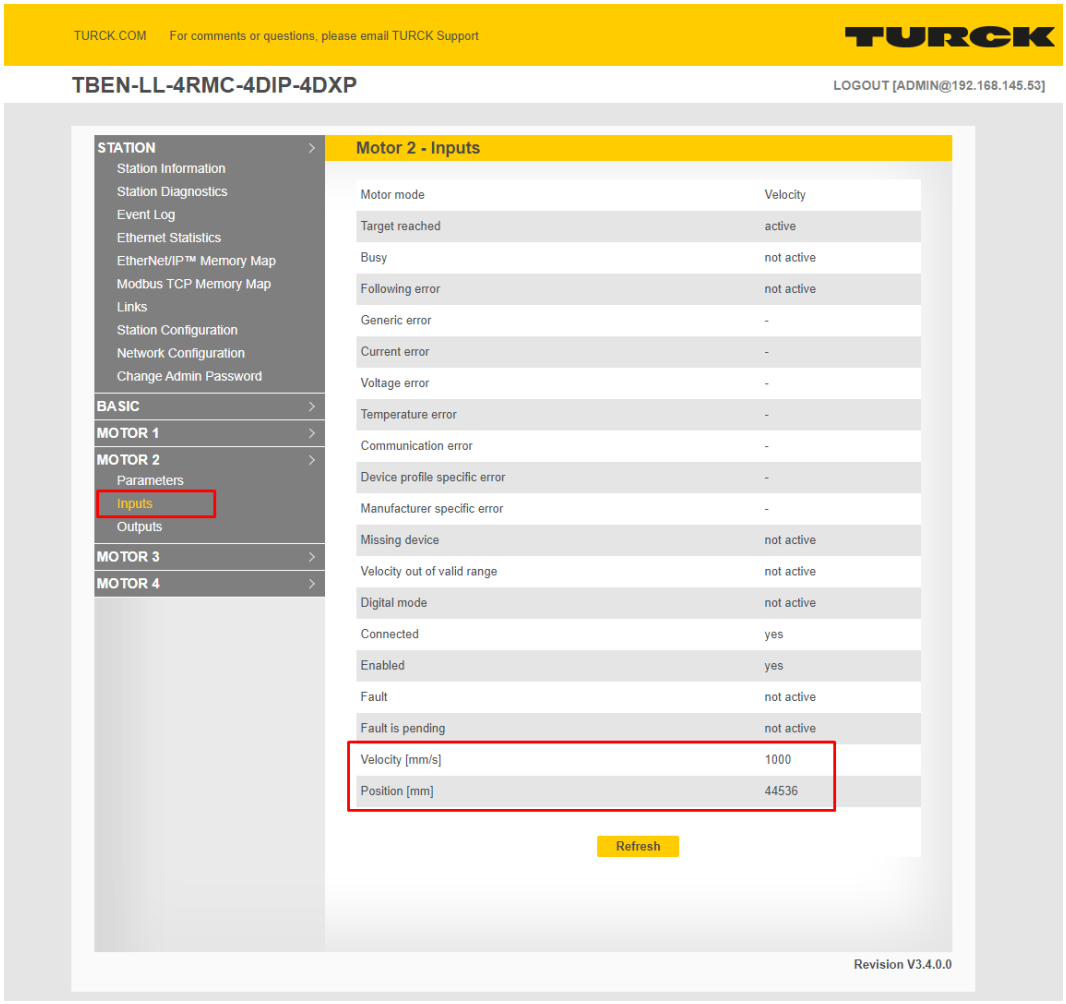


Fig. 50: Web server – process input data for velocity mode

8.2.2 Position mode

The following parameters [▶ 87] and process output data [▶ 105] must be set for homing mode.

Setting parameters

- Set **Operation mode** to **Position** (1).
- Set **Motor attached** to **yes** (1) to activate the channel.
- Set **Lock Ramp** to **no** (0), if a ramp acceleration or deceleration is to be configured dynamically via the process image of the outputs. Set **Lock Ramp** to **yes** (1) if the values from the configuration parameters are to be permanently applied.
- Set **Lock Position** to **no** (0).
- Accept values via **Submit**.

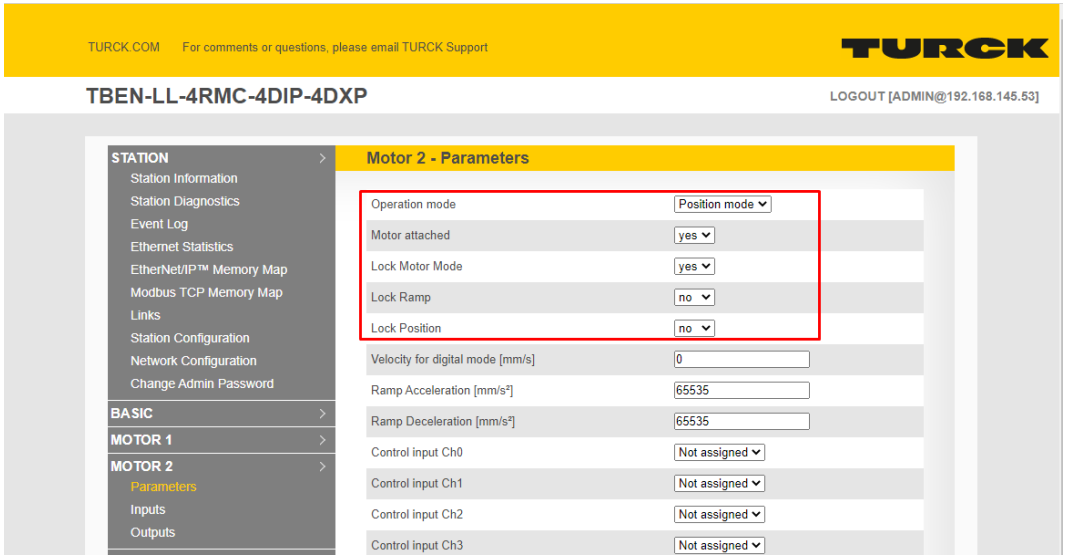


Fig. 51: Web server – Parameters for position mode

Setting process output data

- Set **Enable** to **yes** (1) to start the motor.
- Set **Velocity** to the desired value, here 1000 mm/s.
- Set **Position** to the desired value, here 50000 mm.
- Optional: Set **Ramp Acceleration** and **Ramp Deceleration** to the desired value, here 200 mm/s^2.
- Accept values via **Submit**.

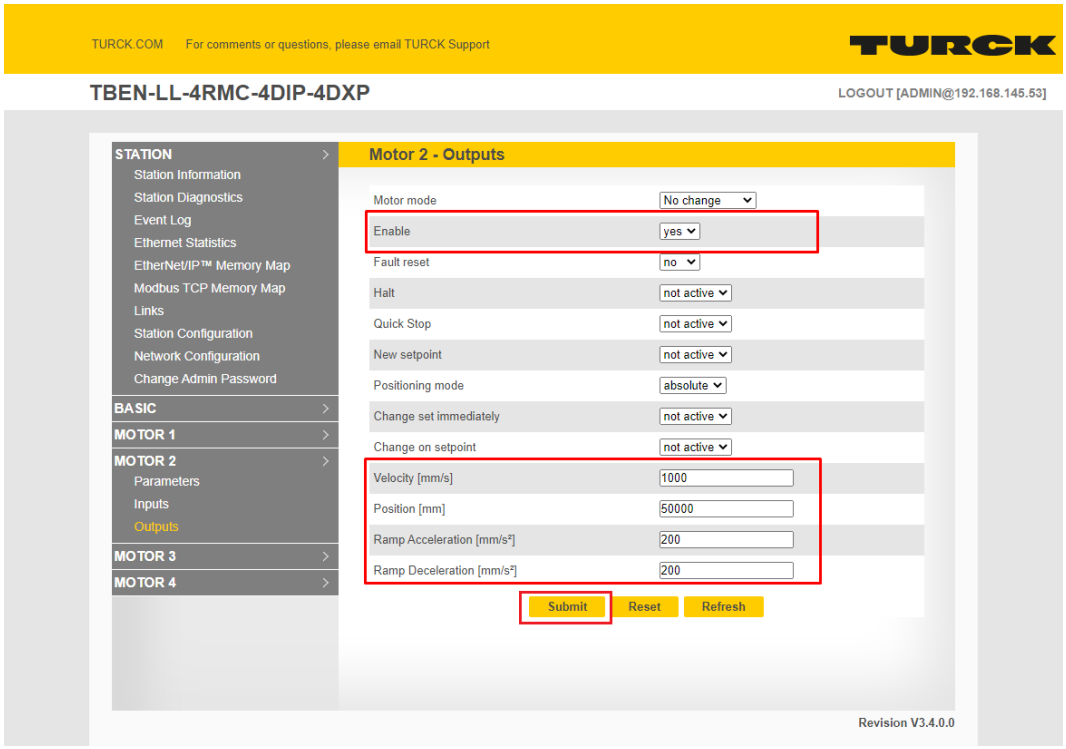


Fig. 52: Web server – Process output data for position mode

▶ Set **New Setpoint** to **active** (0 → 1) to apply the new position.

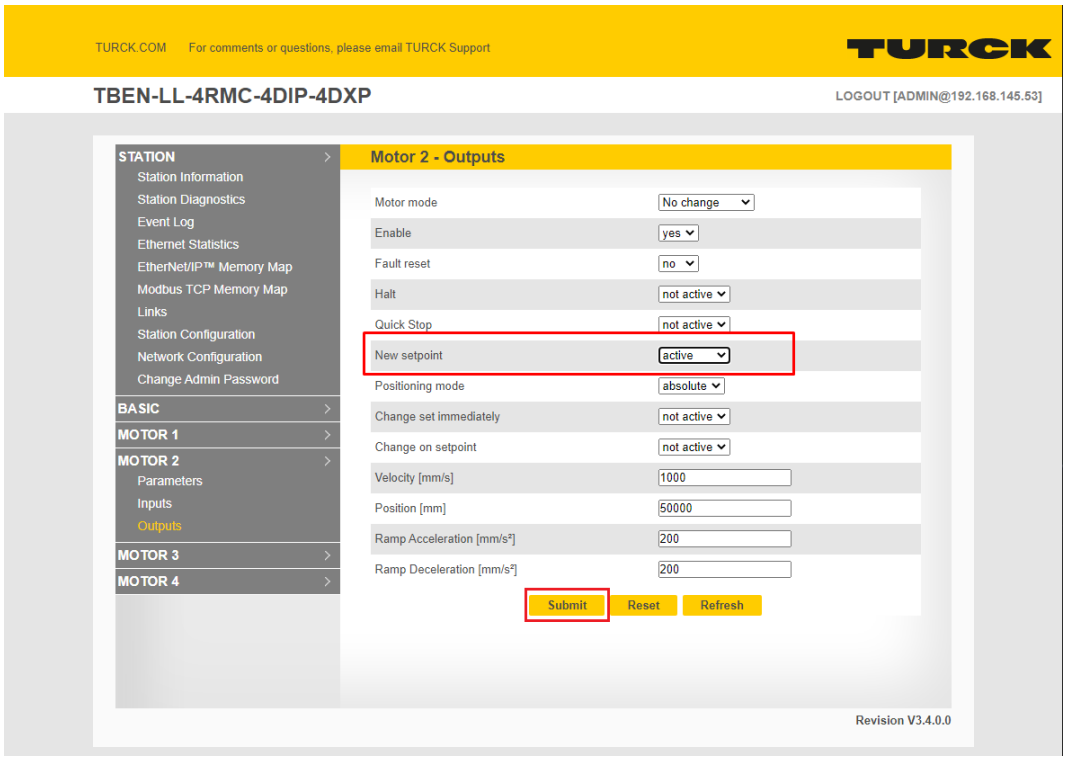


Fig. 53: Web server – Accept setpoint for position mode

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⇨ The motor stops at the defined position.

⇨ Process input data: Bits BUSY = 1, TR (Target Reached) = 1, positioning is not yet completed.

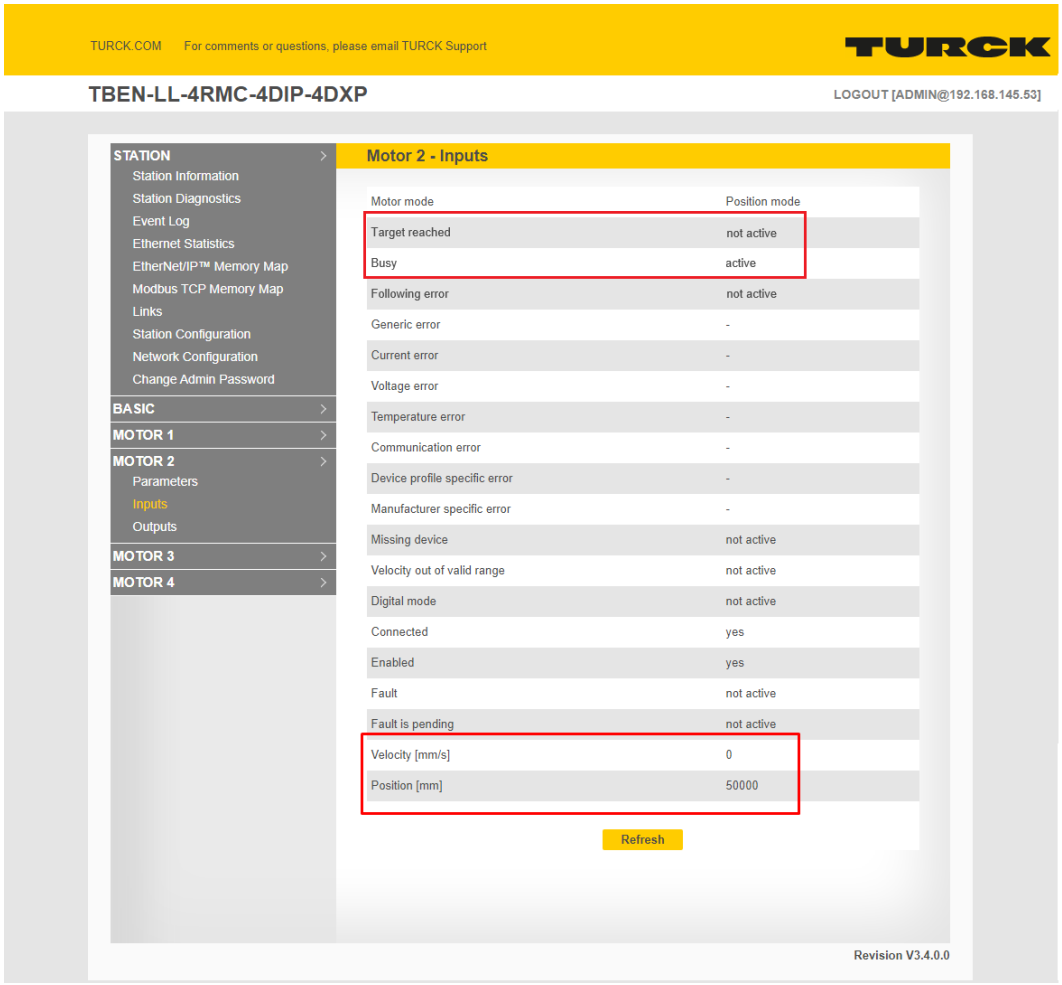

Fig. 54: Web server – Position in process input data

▶ Set **New Setpoint** to **inactive** (1 → 0) to complete the positioning.

⇨ Process input data: Bits BUSY = 0, TR (Target Reached) =1, a new positioning can be triggered.

8.2.3 Homing mode

The following parameters [▶ 87] and process output data [▶ 105] must be set for homing mode.

Setting parameters

- ▶ Set **Operation mode** to **Homing** (6).
- ▶ Set **Motor attached** to **yes** (1) to activate the channel.
- ▶ Accept values via **Submit**.

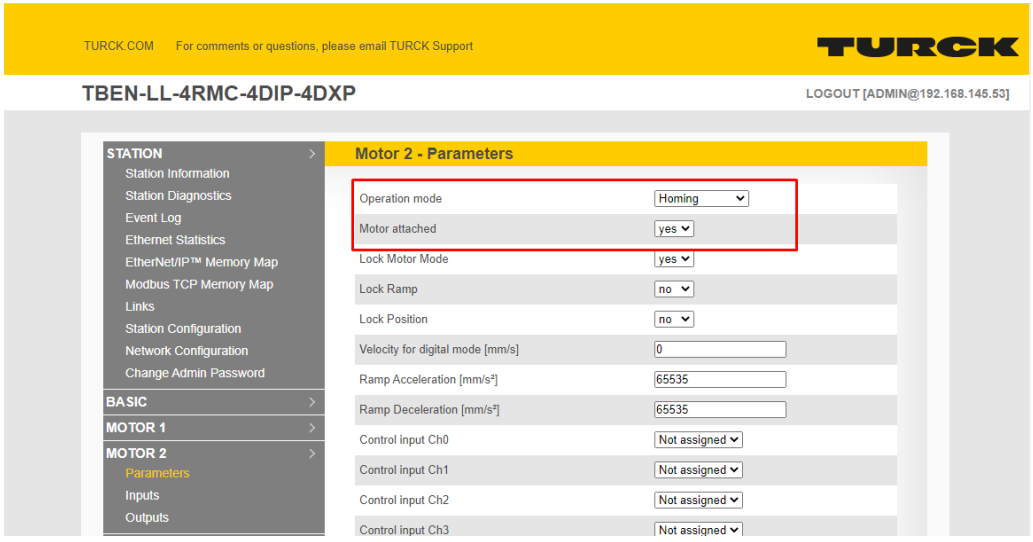

Fig. 55: Web server – Parameters for homing mode

Setting process output data

- ▶ Set **New Setpoint** to **active** to define the actual position as the new zero position.

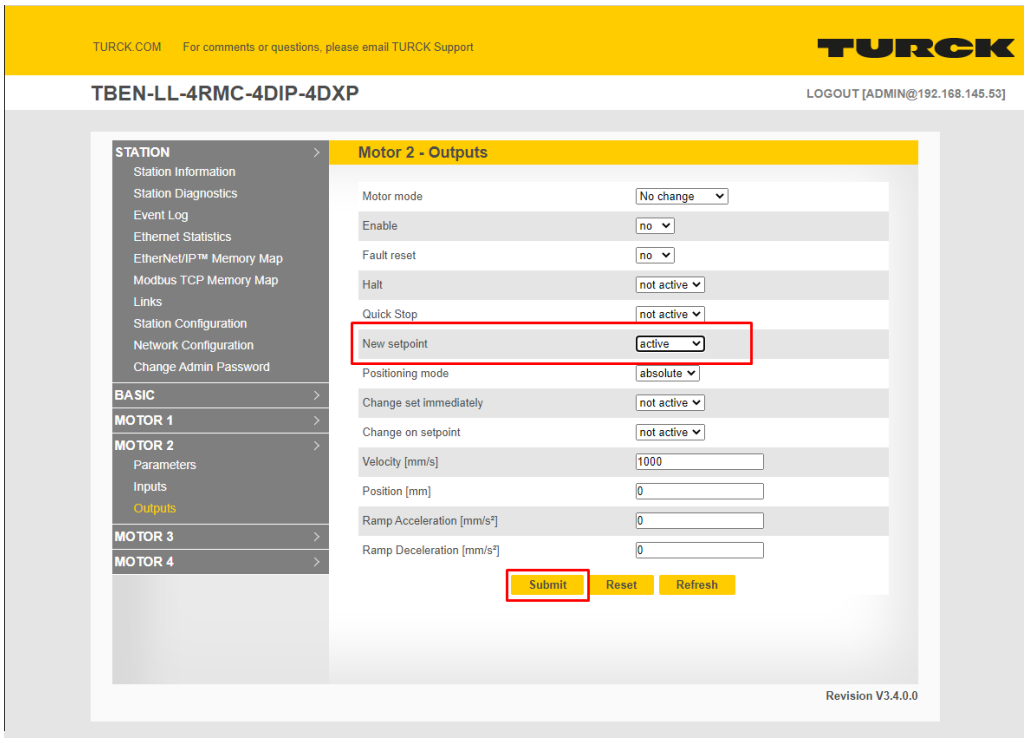

Fig. 56: Web server – Accept setpoint for homing mode

➪ The actual position is set as new zero position.

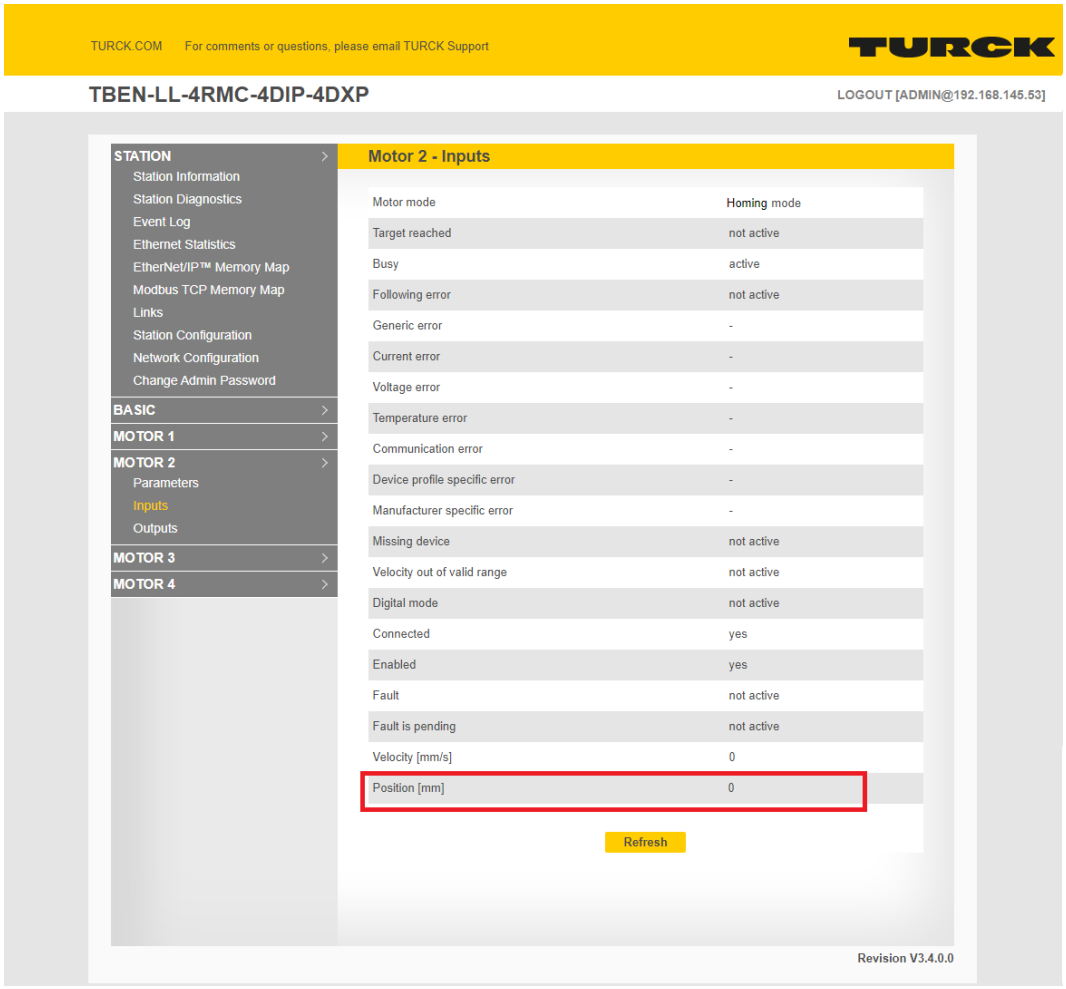

Fig. 57: Web server – Process input data with new zero position

8.3 Configuring the digital mode

The following parameters [▶ 87] are used in digital mode [▶ 14].

Setting parameters

- Set **Motor attached** to **yes** (1) to activate the channel.
- Define the **Velocity for digital mode** as well as the ramp acceleration and deceleration if necessary.
- Define the **Control inputs** which trigger the digital mode (here: digital input channel 4 and 5).
- Define the **Input logic level** for the previously set channels (here: high level, i.e. a 1 at digital input channel 4 or 5 triggers digital mode).
- Optional: Define **Motor Fault Output** which is switched in case of a motor fault (here: output channel 4).
- Accept values via **Submit**.

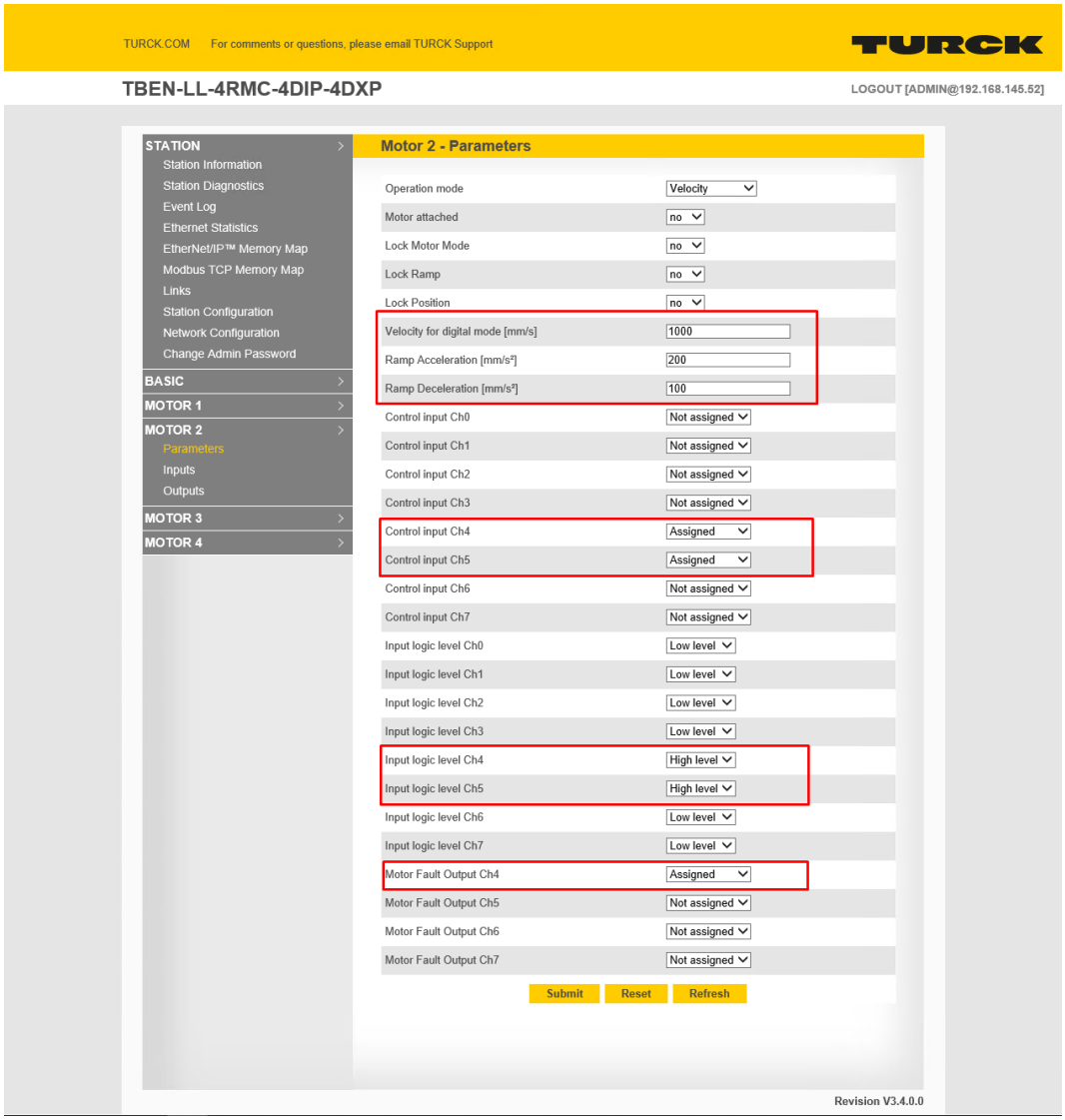

Fig. 58: Web server – Parameters for digital mode

⇨ A high level at one of the control inputs 4 or 5 starts the digital mode, i.e. the motor starts immediately with the specified speed and the defined acceleration and deceleration.

⇨ In case of a motor error, the output at channel 4 is set.

NOTE

To switch from digital mode back to one of the three motor modes (speed, positioning mode and homing mode), the digital mode [▷ 14] must be completely deactivated, i.e. all parameters (assignment of control inputs, logic level, etc.) must be reset.

9 Operating

9.1 Process input data

Word no.		Byte no.		Bit no.							
Dec.	**Hex.**	**Dec.**	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Digital channels (connector X0…X3)											
0	0x00	0	0x00	DXP7	DXP6	DXP5	DXP4	DI3	DI2	DI1	DI0
		1	0x01	Reserved							
Motor control – motor 1 (connector X4)											
1	0x01	0	0x00	Status position				Motor mode			
				-	F_ER	BUSY	TR				
		1	0x01	Diagnostics – Error Register							
				MSERR	res.	DPSERR	COMERR	TERR	VOLTERR	CURRERR	GERR
2	0x02	2	0x02	Status							
				FAULT_ PENDING	FAULT	EN- ABLED	CON	res.	DIGMOD	VELEXC	MIS- DEV
		3	0x03	Reserved							
3	0x03	4	0x04	Velocity							
		5	0x05								
4	0x04	6	0x06	Position							
		7	0x07								
5	0x05	8	0x08								
		9	0x09								
Motor control – motor 2 (connector X5)											
6… 10	0x06… 0x0A	0… 9	0x00… 0x09	Assignment similar to motor 1 (0x01…0x05)							
Motor control – motor 3 (connector X6)											
11… 15	0x0B… 0x0F	0… 9	0x00… 0x09	Assignment similar to motor 1 (0x01…0x05)							
Motor control – motor 4 (connector X7)											
16… 20	0x10… 0x14	0… 9	0x00… 0x09	Assignment similar to motor 1 (0x01…0x05)							
Sensor supply and digital channels (diagnostics)											
21	0x15	0	0x00	Reserved				VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)	VAUX1 pin1 X0 (Ch0/1)
		1	0x01	Reserved							
22	0x16	0	0x00	ERR DXP7	ERR DXP6	ERR DXP5	ERR DXP4	Reserved			
		1	0x01	Reserved							
Module status (device status)											
23	0x17	0	0x00	res.	FCE	res.	CAN COM ERR	res.		V1	res.
		1	0x01	V2	res.		CAN COM WARN	res.		ARGEE	DIAG

Meaning of process data bits

Name	Value	Meaning
DIx	Digital input x	
	0	Kein Signal an DI (Pin 4, SIO)
	1	Signal at DI (pin 4, SIO)
DXPx	Configurable digital channel (DXP channel)	
	0	No input signal at DXP channel (pin 2)
	1	Input signal at DXP channel (pin 2)
Motor mode	Currently parameterized and active motor mode [▶ 87]:	
	0	No change
	1	Position mode
	3	Velocity
	6	Start position (Homing)
Status position (only for motor mode position)		
Target reached (TR)	1	Target reached: The motor has reached the defined target position. The bit is only set (1) when the process output data bit **NSP** (New Setpoint) has been reset after a positioning.
BUSY	1	The motor moves to the target position, but has not yet reached it. The bit is only reset (0) when the process output data bit **NSP** (New Setpoint) has been reset after a positioning. The bit corresponds to the **Set-point acknowledge** bit (bit 7) in the CANopen status word (object 0x6041) of the device profile.
Following error (F_ER)	1	Following error according to ”CANopen – Drives and Motion Control Device Profile” The actual value of the position is outside the permissible range.
Error register		The error register corresponds to the CANopen Error Register (Object 0x1001) according to "CANopen - Drives and Motion Control Device Profile". The errors are generated by the connected CANopen device. Their meaning depends on the connected device.
Generic error (GERR)		
Current Error (CURRERR)		
Voltage error (VOLTERR)		
Temperature error (TERR)		
Communication error (COMERR)		
Device profile specific error (DPSERR)		
Manufacturer specific error (MSERR)		
Status		
Missing device (MISDEV)	1	The **Motor attached** parameter [▶ 87] on the channel is set, but no motor is detected.
Velocity out of valid range (VELEXC)	1	The velocity defined in the output data exceeds the maximum velocity of the connected motor.
Digital mode (DIGMOD)	1	The digital mode of the connected motor is active.
Connected (CON)	1	A motor is connected to the channel and is in the Operational state (according to CANopen-Basic profile). CANopen communication is established, PDO transfer is taking place, CANopen Drives profile not yet activated.

Name	Value	Meaning
ENABLED	1	The connected motor is ready for operation, CANopen communication is running. Prerequisite: ■ The **ENABLE** bit in the process output data is set. ■ Motor error-free, input bit **FAULT** = 0.
Error (FAULT)	1	CANopen Drives error (Drive in Fault State) The motor is in FAULT state (error). Possible causes: ■ Drive blocked ■ Load on drive too high The FAULT state can only be reset via an error acknowledgement with the **FAULT_RST** output if the cause of the error has been eliminated.
FAULT_PENDING	1	Specific for Interroll RollerDrive EC5000 BI: The cause of the error has not yet been eliminated. The error cannot be reset.
Module status		Status word Status- and control word

9.2 Process output data

Word no.		Byte no.		Bit no.							
Dec.	**Hex.**	**Dec.**	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Digital channels (connector X0…X3)											
0	0x00	0	0x00	DXP7	DXP6	DXP5	DXP4	Reserved			
		1	0x01	Reserved							
Motor control – motor 1 (connector X4)											
1	0x01	0	0x00	Motor control				Motor mode			
				Q_STOP	HALT	FAULT_ RST	ENABLE				
		1	0x01	Reserved				Position control (POSCTRL)			
								COSP	CSI	ABS_REL	NSP
2	0x02	2	0x02	Velocity							
		3	0x03								
3	0x03	4	0x04	Position							
		5	0x05								
4	0x04	6	0x06								
		7	0x07								
5	0x05	8	0x08	Ramp acceleration							
		9	0x09								
6	0x06	10	0x0A	Ramp deceleration							
		11	0x0B								
Motor control – motor 2 (connector X5)											
7…12	0x07… 0x0C	0…11	0x00… 0x0B	Assignment similar to motor 1 (0x0801…0x0806)							
Motor control – motor 3 (connector X6)											
13…18	0x0D …0x12	0…11	0x00… 0x0B	Assignment similar to motor 1 (0x0801…0x0806)							
Motor control – motor 4 (connector X7)											
19…24	0x13… 0x18	0…11	0x00… 0x0B	Assignment similar to motor 1 (0x0801…0x0806)							

Meaning of process data bits

Name	Data type	Value	Meaning	Comment
DXP	Configurable digital channel (DXP channel)			
	BOOL	0	Output inactive	
		1	Output active, max. output current 2 A	
Motor mode	Defines the desired motor mode during operation. The motor mode can only be changed during runtime if this is not locked via the **Lock Motor Mode** parameter.			Whether the connected motor adopts the specified mode immediately depends on the device. Prerequisite for Interroll EC5000 BI: Mode change only at standstill, **HALT** bit must be set.
	ARRAY of bits	0	No change	
		1	Position mode	
		3	Velocity	
		6	Start position (Homing)	
Velocity	INT16		Reference value for the velocity at which the motor is to run. Default: 0 The meaning of the entered values depends on the connected motor. Mapping (e. g. for motor 1): ■ PROFINET: byte 0x02 (high byte) byte 0x03 (low byte) ■ Modbus TCP and EtherNet/IP: byte 0x03 (high byte) byte 0x02 (low byte)	Unit: ■ mm/s (Interroll EC5000 BI) Prerequisite: ■ Motor in motor mode **velocity**
Position	INT32		Reference value for the position to which the motor is to move. The positioning is absolute or relative to the current position of the motor, depending on the setting in the **Positioning mode (ABS_REL)** process data bit. In homing mode the absolute position defined there is valid as reference position.. Default: 0 The meaning of the entered values depends on the connected motor. Mapping (e. g. for motor 1): ■ PROFINET: byte 0x04 (high byte) byte 0x07 (low byte) ■ Modbus TCP and EtherNet/IP: byte 0x07 (high byte) byte 0x04 (low byte)	Unit: ■ mm (Interroll EC5000 BI) Prerequisite: ■ Motor in motor mode **position**
Ramp acceleration	USINT16		Values for the ramp acceleration and ramp deceleration of the connected motor Default: 65535 0 = reserved, the previously saved setting is used The meaning of the entered values depends on the connected motor.	Unit: ■ mm^2 (Interroll EC5000 BI)
Ramp deceleration	USINT16			

Name	Data type	Value	Meaning	Comment
Motor control				
ENABLE	BOOL	1	The motor roller controller attempts to set the connected motor to the Operational Enabled state (according to the CANopen Drives profile). The bit should always be set during operation.	Prerequisites: ■ Motor connected, input bit **CON** (Connected) = 1 ■ No error at the connected motor, input bit **FAULT** = 0
Fault reset (FAULT_RST)	BOOL	1	The bit is set to acknowledge an error (**FAULT** = 1).	Prerequisite: ■ Error cause eliminated The bit corresponds to the **FR** bit (bit 7) in the CANopen control word (object 0x6040) of the device profile.
HALT	BOOL	1	The motor is stopped with the configured ramp deceleration.	The bit corresponds to the **HALT** bit (bit 8) in the CANopen control word (object 0x6040) of the device profile.
Quick Stop (Q_STOP)	BOOL	1	The motor is stopped immediately without ramp.	The bit corresponds to the **QS** bit (bit 2) in the CANopen control word (object 0x6040) of the device profile.
Position control (POSCTRL)				
New Set Point (NSP)	BOOL	1	Edge signal (0 → 1 → 0) A positive edge (0 → 1) starts the positioning. The bit must be reset after the start of positioning (1 → 0). Only then the process input data bits **BUSY** = 0 and **TR** (Target Reached) = 1 are set and a new positioning can be triggered.	The bit corresponds to the **New Setpoint** bit (bit 4) in the CANopen control word (object 0x6040) of the device profile, if the position mode is activated.
Positioning mode (ABS_REL)	BOOL	0	Absolute positioning mode activated. The target position is an absolute value.	The bit corresponds to the **Abs/Rel** bit (bit 6) in the CANopen control word (object 0x6040) of the device profile, if the position mode is activated.
		1	Relative positioning mode activated. The target position is a relative value.	
Change set immediately (CSI)	BOOL	1	Immediately starts the next positioning. A previously written position is overwritten.	The bit corresponds to the **Change set immediately** bit (bit 5) in the CANopen control word (object 0x6040) of the device profile, if the position mode is activated.
Change on setpoint (COSP)	BOOL	1	The last defined position is approached. A new position is stored and approached after the first position has been reached.	The bit corresponds to the **Change on setpoint** bit (bit 9) in the CANopen control word (object 0x6040) of the device profile, if the position mode is activated.

NOTE
The units and the maximum values for speed, position, ramp acceleration and ramp deceleration depend on the connected motor.
▶ Observe the documentation of the connected motor.

9.3 LED displays

The device has the following LED indicators:

- Supply voltage (PWR)
- Group and bus errors (BUS)
- Ethernet status (L/A)
- I/O status (channel LEDs)
- Diagnostics (ERR)
- Localization (WINK)

LED PWR	Meaning
Off	No voltage connected or under voltage at V1
Green	Voltage V1 and V2 OK
Green flashing	No voltage or under voltage at V2 (depending on the configuration of the parameter **LED behavior (PWR) at V2 undervoltage**)
Red	

LED BUS	Meaning
Off	No voltage connected
Green	Active connection to a master
Green flashing 3 × in 2 s	ARGEE/FLC active
Green flashing (1 Hz)	Device is ready for operation
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 waiting for DHCP-/BootP-address assignment

ERR LED	Meaning
Off	No voltage connected
Green	No diagnostics
Red	Diagnostic message pending

The Ethernet ports XF1 and XF2 each have an LED L/A.

LED L/A	Meaning
Off	No Ethernet connection
Green	Ethernet connection established, 100 Mbps
Yellow	Ethernet connection established, 10 Mbps
Green flashing	Data trafic, 100 Mbps
Yellow blinking	Data transfer, 10 Mbps

DIP/DXP channel LEDs	Meaning (input)	Meaning (output)
Off	Input not active	Output not active
Green	Input active	Output active (max. 2 A)
Red	–	Actuator overload
Red flashing (1 Hz)	Short-circuit at the supply voltage for the respective connector. Both connector LEDs are flashing.	

RM channel LEDs	Meaning (input)
LED 8, 10, 12, 14	
Off	No motor connected
Green	Motor connected, CANopen PDO transfer running
Green flashing	Motor parameterized but not connected or ready
Red	Motor reports an error
Red flashing (1 Hz)	Overload motor
LED 9, 11, 13, 15	
Off	Motor at standstill
Green	Motor ready, CANopen communication acc. To CANopen Device Profile
Green blinking	Motor in motion

LED WINK (without designation on the device)	Meaning
White flashing	Wink command active

9.4 Software diagnostic messages

The device provides the following diagnostics:

- V1 overcurrent diagnostics
  Overcurrent diagnostics for the sensor-/ actuator supply VAUX1
- Diagnostics of the digital channels (DIP and DXP)
- General module diagnostics

9.4.1 Diagnostic telegram

Word no.		Byte no.		Bit no.							
Dec.	**Hex.**	**Dec.**	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0x00	0	0x00	Reserved				VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)	VAUX1 pin1 X0 (Ch0/1)
		1	0x01	Reserved							
1	0x01	2	0x02	ERR_ DXP7	ERR_ DXP6	ERR_ DXP5	ERR_ DXP4	Reserved			
		3	0x03	Reserved							

Meaning of Diagnostic Bits

Diagnostics	Meaning	Comment
VAUX1 pin1 Xx Ch (y/z)	Overcurrent VAUX1 (pin1) at connector (channel group)	
ERR_DXPx	Overcurrent at output	DXP channel used as output

9.4.2 PROFINET diagnostics

Module diagnostics (slot 0, according to configuration tool)		**PROFINET diagnostics**	
	Connector	**Error code**	**Channel**
Undervoltage V1	-	0x0002	0
Undervoltage V2	-	0x0002	0

DXP diagnostics			**PROFINET diagnostics**	
	Channel	**Connector**	**Error code**	**Channel**
Overcurrent output	DXP4	X2	0x0001	4
	DXP5		0x0001	5
	DXP6	X3	0x0001	6
	DXP7		0x0001	7

VAUX1 diagnostics	Connector	**PROFINET diagnostics**	
		Error code	**Channel**
Overcurrent VAUX1 (pin 1) at X0, channel 0/1	X0	0x0600	0
Overcurrent VAUX1 (pin 1) at X1, channel 2/3	X1	0x0601	
Overcurrent VAUX1 (pin 1) at X2, channel 4/5	X2	0x0602	
Overcurrent VAUX1 (pin 1) at X3, channel 6/7	X3	0x0603	

Motor channel diagnostics			PROFINET diagnostics	
	Error description, s. [▶ 110]	**Connector**	**Error code**	**Channel**
Motor 1				0
Generic error (GERR)	CANopen, generic error	X4	1600 (0x0640)	
Current Error (CURRERR)	CANopen, current error		1601 (0x0641)	
Voltage error (VOLTERR)	CANopen, voltage error		1602 (0x0642)	
Communication error (COMERR)	CANopen, communication error		1603 (0x0643)	
Temperature error (TERR)	CANopen, temperature error		1604 (0x0644)	
Device profile specific error (DPSERR)	CANopen, profile specific error		1605 (0x0645)	
Manufacturer specific error (MSERR)	CANopen, manufacturer specific error		1606 (0x0646)	
Fault	There is a CANopen Drives error.		1607 (0x0647)	
Missing device (MISDEV)	The configured motor is not connected.		1868 (0x0648)	
Motor 2		X5		
Similar to motor channel 1				
Motor 3		X6		
Similar to motor channel 1				
Motor 4		X7		
Similar to motor channel 1				

10 Troubleshooting

If the device does not function as expected, first check whether ambient interference is present. If there is no ambient interference present, check the connections of the device for faults.

If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

10.1 Fixing motor channel errors

If a connected motor cannot be switched on:

- ▶ Check the power supply. The TBEN-LL-4RMC-4DIP-4DXP must be supplied with both V1 and V2 [▷ 19].
- ▶ Check the configuration of the motor channel.
  The parameter **Motor attached (MOT_ATT)** [▷ 87] has to be set at the motor channel. Additionally, the motor channel has to be activated via the ENABLE bit in the process output data [▷ 105].
- ▶ Check the connected motor.
- ⇨ If the connected motor has no defect and does not switch on despite correct supply and configuration, the motor channel may be defective.

Checking the motor channel

The motor supply of each motor channel is protected by a Littlefuse E10480 fuse (rated, 5 A). The fuse is designed for rated currents of up to 5 A and starting currents of up to 10 A (max. 20 s). Continuous overcurrent or short circuit can cause the fuse to trip.

- ▶ Check the power supply.
  If the supply is correct, either 24 VDC or 48 VDC (depending on the V2 supply for the motor) can be measured between pin 1 (Vaux2) and pin 3 (GND V2) on the motor channel.
- ⇨ If no voltage can be measured between pin 1 and pin 3 of the motor channel although the power supply has been applied correctly, the fuse on the channel has probably tripped. The fuse cannot be replaced. Operation of a motor on this channel is no longer possible if the fuse has tripped.

10.2 Reducing emitted interferences from motors (HW-Rev. 1)

Connected motors can cause EMC interference in devices with hardware revision 1 (device printing: HW: 1) when the motor is at active standstill (HALT state).

To reduce interference emissions:

- ▶ Provide motor cables with folding ferrites at one cable end.

Tested and recommended folding ferrites:

- Würth STAR-TEC Snap-on 74271132
- KEMET ESD-SR-H/HL Snap-on ESD-SR-S12

11 Maintenance

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

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

12 Repair

The device must not be repaired 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

Returns to Turck can only be accepted if the device has been equipped with a Decontamination declaration enclosed. The decontamination declaration can be downloaded from
https://www.turck.de/en/retoure-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 correctly and must not be included in general household garbage.

14 Technical data

Technical data	
Supply	
Supply voltage	V1: 24 VDC V2: 24 VDC/48 VDC
Permissible range	V1: 18…30 VDC V2: 18…56 VDC
Power consumption	
Operating current (at 24 VDC nominal voltage)	< 120 mA (outputs inactive)
Operating current	At 20 °C (operating temperature) V1: 24 VDC, 80 mA V2: 48 VDC, 20 mA V2: 24 VDC, 40 mA ■ V1: 120… 180 mA ■ V2: 90… 40 mA Operating conditions: ■ All outputs active without load ■ Ethernet communication active
Sensor/actuator supply V_{AUX1}	X0…X3: Supply from V1 short-circuit proof, 120 mA per connector
Sensor/actuator supply V_{AUX2}	X4…X7: Supply from V2 short-circuit proof, irreversible (melting fuse), rated current 5 A, tripping delay at 10 A: approx. 20 s
Potential isolation	Galvanic isolation from V1 and V2 voltage group, voltages up to 500 VDC
Connectors	
Power supply	M12, 5-pin, L coded
Ethernet	M12, 4-pin, D coded
Digital in-/outputs	M12, 5-pin, A coded
Motor channels	M12, 5-pin, B coded
Permissible torques ■ Ethernet ■ I/O channels/supply ■ Mounting (M6 screws)	 0.6 Nm 0.8 Nm 1.5 Nm
Max. cable length	
■ Ethernet	100 m (per segment)
Isolation voltages	
V1 to V2	≥ 500 VAC
V1/V2 to field bus	≥ 500 VAC
System data	
Transmission rate	10 Mbps/100 Mbps
Protocol detection	automatic
Web server	Integrated, 192.168.1.254
Service interface	Ethernet via XF1 or XF2

Technical data	
Field Logic Controller (FLC)	
Released as of ARGEE version	3.2.217.0
Modbus TCP	
Address assignment	Static IP, DHCP
Supported Function Codes	FC1, FC2, FC3, FC4, FC5, FC6, FC15, FC16, FC23
Number of TCP connections	8
Input register start address	0 (0x0000)
Output register start address	2048 (0x0800)
Local port	Port 502, fixed setting
EtherNet/IP	
Address assignment	According to EtherNet/ IP standard
Device Level Ring (DLR)	Supported
Quick Connect (QC)	< 150 ms
Number of Class 3 (TCP) connections	3
Number of Class 1 (CIP) connections	10
Input Assembly Instances	103
Output Assembly Instances	104
Input Assembly Instances	106
PROFINET	
PROFINET specification	V 2.35
Conformance Class	B (RT)
Address assignment	DCP
Min. cycle time	1 ms
Fast Start-Up (FSU)	< 150 ms
Diagnostics	According to PROFINET Alarm Handling
Topology detection	Supported
Automatic address setting	Supported
Media Redundancy Protocol (MRP)	Supported
Network load class	3
Motor channels	
Number of channels	4
Interface	Interroll RollerDrive EC5000 BI (from firmware version V1.00.8)
Profile	CANopen Drives Profile
Digital inputs	
Number of channels	8
Input type	PNP
Type of input diagnostics	Channel diagnostics
Switching threshold	EN 61131-2, type 3, PNP
Signal voltage low level	< 5 V
Signal voltage high level	> 11 V
Signal current low level	< 1.5 mA
Signal current high level	> 2 mA

Technical data	
Input delay	0.05 ms
Potential isolation	Galvanic isolation to P1/P2, voltage proof up to 500 VAC
Digital outputs	
Number of channels	4
Output type	PNP
Type of output diagnostics	Channel diagnostics
Output voltage	24 VDC from potential group
Output current per channel	2 A, short-circuit proof, max. 2.0 A per connector
Load type	EN 60947-5-1: DC-13
Potential isolation	Galvanic isolation to P1/P2, voltage proof up to 500 VAC
Mounting	
Type of mounting	Via 2 mounting holes, Ø 6.3 mm
Mounting distance (device to device)	≥ 50 mm Valid for operation in the ambient temperatures mentioned below, with sufficient ventilation as well as maximum load (horizontal mounting). At ambient temperatures of < 30 °C, the devices can also be mounted directly next to each other.
Standard/Directive conformity	
Vibration test	According to EN 60068-2-6
Acceleration	Up to 20 g
Shock test	According to EN 60068-2-27
Drop and topple	According to IEC 60068-2-31/IEC 60068-2-32
Electro magnetic compatibility	According to EN 61131-2
Approvals and certificates	CE, FCC
UL certificate	cURus Recognized Component E517268, IND.CONT.EQ For installation and use see „Conditions of Acceptability”.
General Information	
Dimensions (B × L × H)	60.4 × 230.4 × 39 mm
Operating temperature	-40…+70 °C
Storage temperature	-40…+85 °C
Operating altitude	Max. 5000 m
Protection class	IP65/IP67/IP69K
MTTF	130 years acc. to SN 29500 (Ed. 99) 20 °C
Housing material	PA6-GF30
Housing color	Black
Material window	Lexan
Material label	Polycarbonate
Halogen-free	Yes

15 Appendix: approvals and markings

15.1 Conditions of Acceptability

For use only in complete equipment where the acceptability of the combination is determined by UL LLC:

(1) This device is to be supplied from an isolated power supply. The device is evaluated for use in Overvoltage Category II only.

(2) This device provides overcurrent protection to each output. The protection is achieved by means of internal supplementary fuses rated 5 A DC.

(3) This device is provided with terminals suitable for factory wiring only.

(4) The enclosure was evaluated for Type 1.

(5) This device does not provide internal over temperature and overload protection for the motor.

(6) This device is not evaluated for functional safety.

16 Turck subsidiaries — contact information

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