TURCK

Your Global Automation Partner

TBEN-LL(H)-4RMC Motor Controller

Instructions for Use

Table of Contents

1 About these instructions

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

1.1 Target groups

These instructions are 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

The following symbols are used in these instructions:

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

1.3 Additional documents

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

- Data sheet
- Declarations of conformity (current version)
- 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 controller:

- TBEN-LL-4RMC (ID 100050634)
- TBEN-LLH-4RMC (ID 100018352)

2.2 Scope of delivery

The delivery consists of the following:

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

2.3 Turck service

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

For the contact details of our branches worldwide, please see page [▶ 128].

3 For your safety

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

3.1 Intended use

The multiprotocol I/O module TBEN-LL(H)-4RMC 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 a CANopen interface in accordance with the 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 TBEN-LL-4RMC is used to connect 24 V motors. The TBEN-LLH-4RMC is used to connect 24 V and 48 V motors.

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

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

3.2 General safety instructions

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

3.3 Notes on UL approval

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

3.3.1 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.

4 Product description

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

The motor 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).

In addition, the device provides four digital PNP inputs at four A-coded M12 sockets at slots X0 and X1 and four universal digital channels at slots X2 and X3. The DXP channels can be used as inputs and outputs without configuration. Up to eight 3-wire PNP sensors or four PNP DC actuators can be connected. The maximum output current per output is 2 A.

Two D-coded M12 sockets are available for connection to Ethernet. The TBEN-LL-4RMC is equipped with 5-pin, L-coded standard M12 connectors for connecting the supply voltage. The TBEN-LLH-4RMC is connected to the supply voltage via 5-pin M12 connectors with device-specific pin assignment due to the 48 VDC supply [▶ 18].

4.1 Device overview

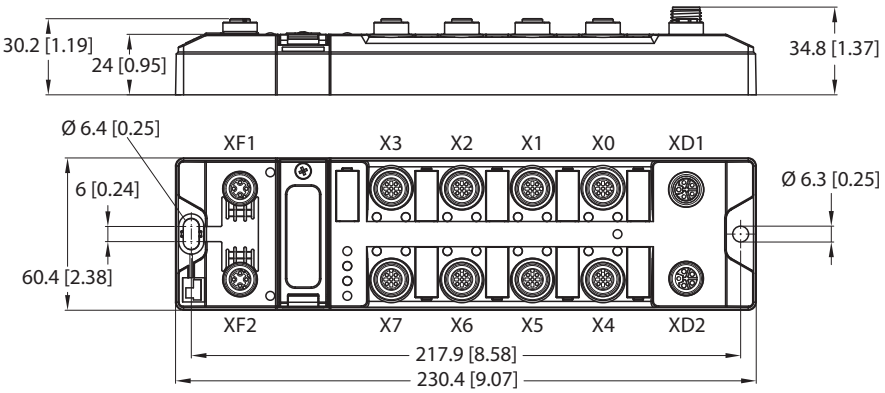


Fig. 1: Dimensions TBEN-LL(H)-4RMC

4.1.1 Indication elements

The device is provided with the following LEDs:

- Power supply voltage
- Group and bus error
- 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

- Fiber-glass reinforced housing
- Shock and vibration tested
- Fully potted module electronics
- Degree of protection IP65/IP67/IP69K
- UV-resistant according to DIN EN ISO 4892-2
- Metal plug connector
- Integrated Ethernet-switch for building up a line-topology
- Transmission speed 10 Mbps/100 Mbps
- Separated power groups for safety shutdown
- Integrated web server
- 4 universal digital DXP channels (PNP)
- 4 digital input channels (PNP)
- 4 channels for controlling 24 V and 48 V motor rollers with CANopen interface.
- ARGEE functionality

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 device can be used in the following Ethernet protocols:

- PROFINET
- EtherNet/IP
- Modbus TCP

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

Automatic protocol detection

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

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

Manual protocol selection

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

Protocol-dependent functions

The device supports the following Ethernet protocol-specific features:

PROFINET

- Fast Start Up (FSU), prioritized start-up, only digital I/O channels
- Topology detection
- Address allocation with LLDP
- Media redundancy protocol (MRP)
- S2 redundancy

EtherNet/IP

- QuickConnect (QC), only digital I/O channels
- Device Level Ring (DLR)

Ethernet ports used

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

4.4.2 Motor modes

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 can be defined either via the parameter **Operation mode** [▶ 80] or via the process data [▶ 109] of the device.

The following motor modes are supported:

Motor mode	Settable via:		
	Parameter operation mode	Process data motor mode	
No change			
Position Mode	Yes	Yes	(According to CANopen Drives Profile, Object 0x6060:00)
Velocity mode	Yes	Yes	
Homing mode	Yes	Yes	
Digital mode	Yes	Yes	
Referencing	No	Yes	
Fire mode	No	No	The fire mode is activated by setting the corresponding parameters (**velocity fire mode**, **ramp acceleration fire mode** and **input fire mode**).

Position mode

In position mode, the connected motor moves to a defined absolute or relative target position at a defined speed (configuration example, s. „Configuring the position mode" [▶ 92]).

The acceleration and deceleration behavior of the motor depends on the application and is adjusted directly via the process output data.

Velocity mode

In velocity mode, the connected motor is driven at a defined velocity (configuration example, s. "Configuring the velocity mode" [▶ 89]).

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 or adjusted directly via the process output data.

For the configuration in PROFINET, the GSDML file provides a special **velocity** [▶ 30].

Homing mode

In homing mode, the position of the motor is defined as the start position. All further positions of the motor refer to this position (configuration exapmle, s. "Configuring the homing mode" [▶ 96].

Application example (e.g. in position mode):

- Aligning the start position on the system during operation.

Referencing

In referencing mode, the connected motor moves to a defined, absolute reference position. All further positions of the motor refer to this position. The referencing mode can only be configured via the process outut data (**Motor mode**) of the device (configuration example, s. "Configuring the referencing" [▶ 102]).

Application example:

- Single reference run (homing) after switching on the system to align the start position of the motor roller or to set the position of the motor roller as the zero position when reaching a limit switch.

The acceleration and deceleration behavior of the motor depends on the application and can be adjusted via the process output data.

Digital mode

In digital mode, the connected motor runs at one of three speeds, which are defined in the parameters **velocity 1 digital mode**, **velocity 2 digital mode** and **velocity 3 digital mode** (configuration example, s. "Configuring the digital mode" [▶ 99]).

It depends on the combination of the parameters **input 1 digital mode** and **input 2 digital mode** at which speed the motor runs and which signal (active high or active low signal) at which of the input channels (channel 4...channel 7 at X4...X7) activates the digital mode.

Input 1 digital mode	Input 2 digital mode	Velocity
Logic status valid	Logic status valid	
No	No	Motor standstill
Yes	No	Velocity 1 digital mode
No	Yes	Velocity 2 digital mode
Yes	Yes	Velocity 3 digital mode

The acceleration and deceleration behavior of the motor depends on the application and can be defined via the **ramp acceleration** and **ramp deceleration** parameters.

For the configuration in PROFINET, the GSDML file provides a special sub module **digital** [▶ 29].

Fire mode

Fire mode is an emergency mode for clearing a conveyor belt quickly and immediately if necessary (configuration example, s. „Configuring the fire mode [▶ 104]).

When fire mode is activated, the motor connected to the the respective motor channel runs immediately and continuously at a defined speed (parameter **velocity fire mode**) and ramp (parameter **ramp acceleration fire mode**). All other settings of the device will be ignored.

The fire mode is activated via an active high or an active low signal at a digital input. Which signal level at which digital input activates the fire mode, is set on the respective motor channel via the parameter **input fire mode**.

4.4.3 Reporting of motor faults

Independent of the selected operating mode, motor faults can be signaled via one or more digital outputs. Which digital output switches in the event of a motor fault is determined via the parameter **motor status output** [▶ 80].

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 function (FLC ARGEE)

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

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

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

5 Installing

5.1 Mounting onto a mounting plate

NOTICE
Mounting on uneven surfaces
Device damage due to stresses in the housing
- ▶ Attach the device to the mounting plate with two M6 screws.

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

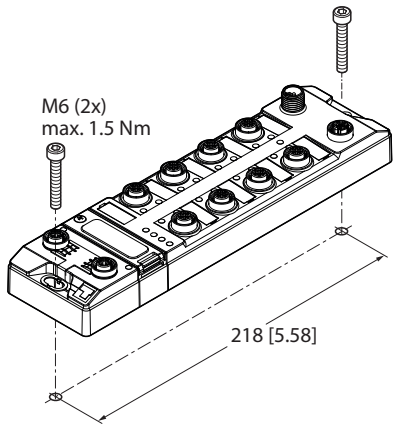


Fig. 2: Mounting the device onto a mounting plate

5.2 Outdoor device installation

The device is UV resistant in accordance with DIN EN ISO 4892-2. Direct sunlight may cause material wear and changes in color. The mechanical and electrical properties of the device are not impaired.

- ▶ To prevent material wear and color changes: Protect the device from direct sunlight with protective panels.

5.3 Grounding the device

5.3.1 Equivalent wiring diagram and shielding concept

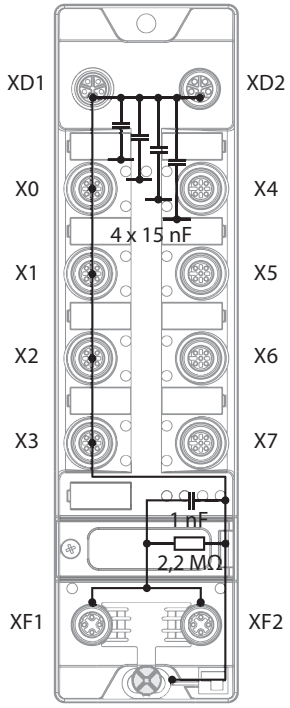


Fig. 3: Equivalent wiring diagram and shielding concept

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.

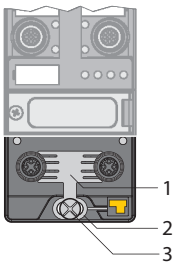


Fig. 4: Grounding clip (1), grounding ring (2) and metal screw (3)

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.

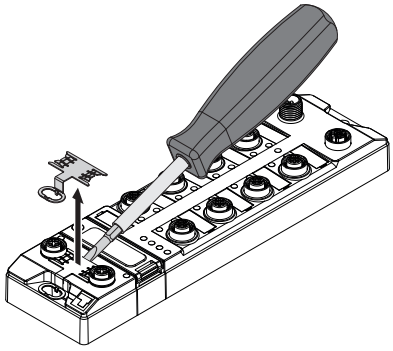


Fig. 5: Removing the grounding clamp

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.

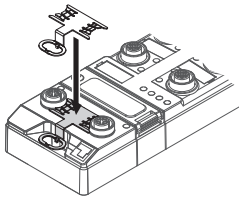


Fig. 6: Mounting the grounding clip

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 degree of protection IP65/IP67/IP69K, device damage possible

- Tighten M12 male connectors with a tightening torque of 0.6 Nm.
- Only use accessories that guarantee the protection class.
- Provide unused male connectors with suitable sealing or blanking caps. The tightening torque for the M4 screws 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 M12 x 1-Ethernet-connectors. The maximum tightening torque is 0.6 Nm.

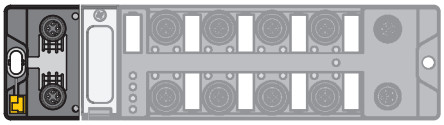


Fig. 7: M12 Ethernet connector

- Connect the device to Ethernet according to the pin assignment below.
- Provide unused male connectors with suitable sealing or blanking caps. The tightening torque for the M4 screws is 0.5 Nm.

Fig. 8: Pin assignment Ethernet connectors

6.1.1 Applications with QuickConnect (QC) and Fast Start Up (FSU)

- Do not use crossover cables in applications with QuickConnect (QC) and and Fast Start Up (FSU) applications.
- Connect incoming Ethernet cables to XF1.
- Connect outgoing Ethernet cables to XF2.

6.2 Connecting the supply voltage (TBEN-LLH-4RMC)

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 for the M12 connectors is 0.6 Nm.

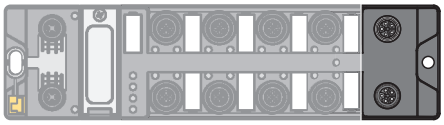


Fig. 9: M12 connector for connecting the supply voltage

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

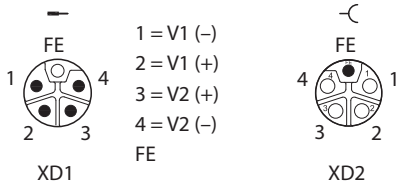


Fig. 10: Pin assignment power supply connectors

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

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.

6.3 Connecting the supply voltage (TBEN-LL-4RMC)

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 0.6 Nm.

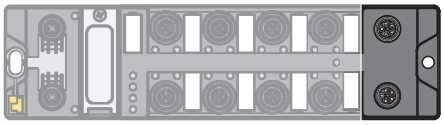


Fig. 11: M12 connector for connecting the supply voltage

- ▶ Connect the device to the power supply according to the pin assignment shown below.
- ▶ Provide unused male connectors with suitable sealing or blanking caps. The tightening torque for the M4 screws is 0.5 Nm.

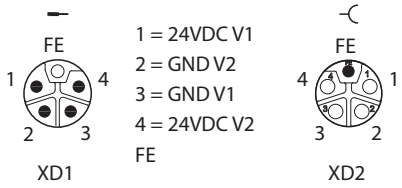


Fig. 12: Pin assignment power supply connectors

Connector	Function
XD1	Power feed
XD2	Continuation of the power to the next node

Voltage	Function
V1	System voltage: power supply 1 (incl. supply of electronics)
V2	Load voltage: power supply 2

NOTE
The system voltage (V1) and the load voltage (V2) are supplied and monitored separately. If the voltage goes below the permissible lower limit, the connectors are disconnected according to the supply concept of the module type. If V2 goes below the permissible minimum voltage, the PWR LED changes from green to green flashing or red (depending on the configuration). If V1 goes below the permissible minimum, the PWR LED goes out.

6.4 Supply concept

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

V1 = supply of the module electronics and the respective connectors
V2 = supply of the respective connectors (can be switched-off separately)

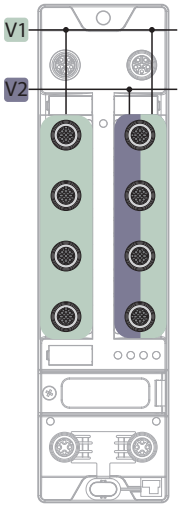


Fig. 13: Power supply TBEN-LL(H)-4RMC

6.5 Connecting sensors and actuators

The device has four 5-pin, A coded M12 connectors for connecting digital sensors and actuators. The maximum tightening torque is 0.6 Nm.

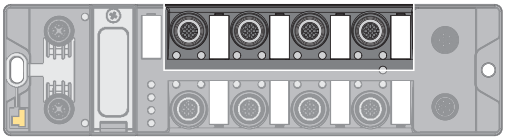


Fig. 14: M12 connectors for connecting digital sensors and actuators

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

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

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

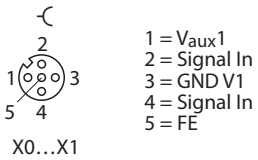


Fig. 15: : Connectors for digital sensors at X0…X1 – pin assignment

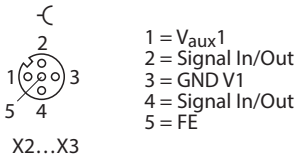


Fig. 16: : Connectors for digital sensors and actuators at X2…X3 – pin assignment

6.6 Connecting motors

The device has four B-coded M12 sockets for connecting motors. The maximum tightening torque is 0.6 Nm.

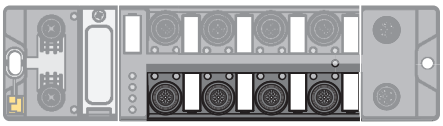
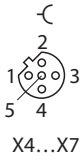


Fig. 17: M12 connector for connecting motors

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



1 = $V_{AUX}2$
2 = CAN High
3 = GND V2
4 = CAN Low
5 = GND V2

Fig. 18: Pin assignment of the connectors for motor roller control, X4…X7

7 Commissioning

7.1 Adjusting network settings and operation mode

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

Adjusting network settings

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

The setting is made during commissioning of the device and is necessary to establish a connection between the PLC and the device.

Configuring the operating mode

The operating mode of the device (Rotary, BootP, PGM-DHCP etc.) can only be adjusted using the decimal rotary coding switches on the device.

7.1.1 Adjusting network settings and operation mode via rotary coding switches

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

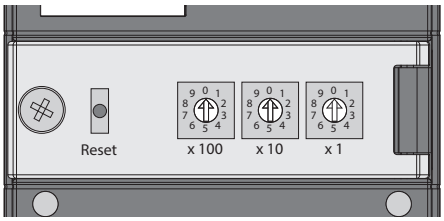


Fig. 19: Service window

- Open the service window.
- Set the rotary coding switch to the desired mode according to the table below.
- Carry out voltage reset.
- NOTICE! IP65, IP67 or IP69K protection is not guaranteed when the service window above the rotary coding switches is opened. Device damage through penetrating foreign objects or liquids is possible. Tightly close the service window.

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 the 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 gateway. The other network settings are stored in the non-volatile memory of the gateway 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 gateway.
400	DHCP	In DHCP mode, the network settings are automatically assigned 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 gateway, 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 complete network settings can be assigned manually via TAS (Turck Automation Suite), the DTM or a web server. The data are stored non-volatile in the device.
600	PGM-DHCP	In PGM-DHCP mode, the device is initially a DHCP client and sends DHCP requests until it is assigned a fixed IP address. The DHCP client is automatically deactivated as soon as the device has received an IP address via TAS (Turck Automation Suite), the DTM or the web server. The data are stored non-volatile in the device. In PROFINET: If a DHCP server is used in the network, problems may occur when assigning the IP address, as in this case both the DHCP server and the PROFINET controller (via DCP) attempt 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 settings via TAS (Turck Automation Suite)

In the delivery state the device has the IP address 192.168.1.254. The IP address can be set via TAS (Turck Automation Suite). TAS is available free of charge at www.turck.com.

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

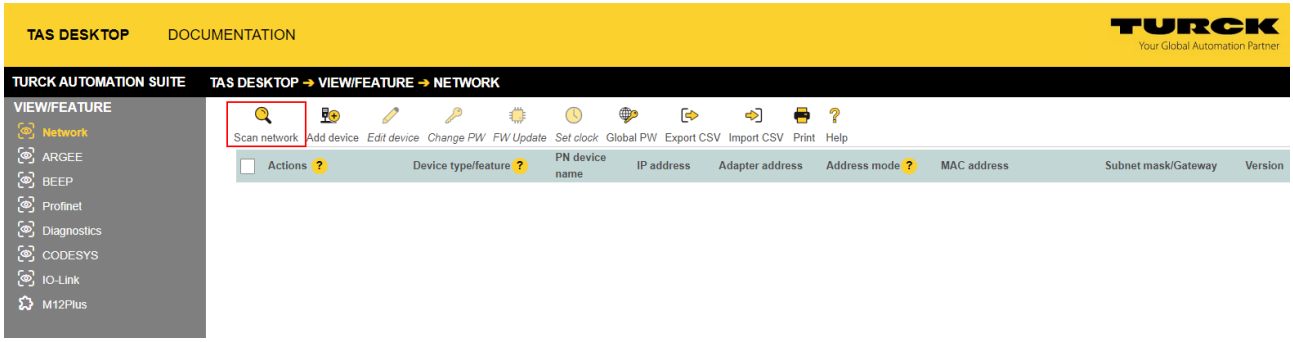


Fig. 20: Home screen in TAS

⇨ TAS shows the connected devices.

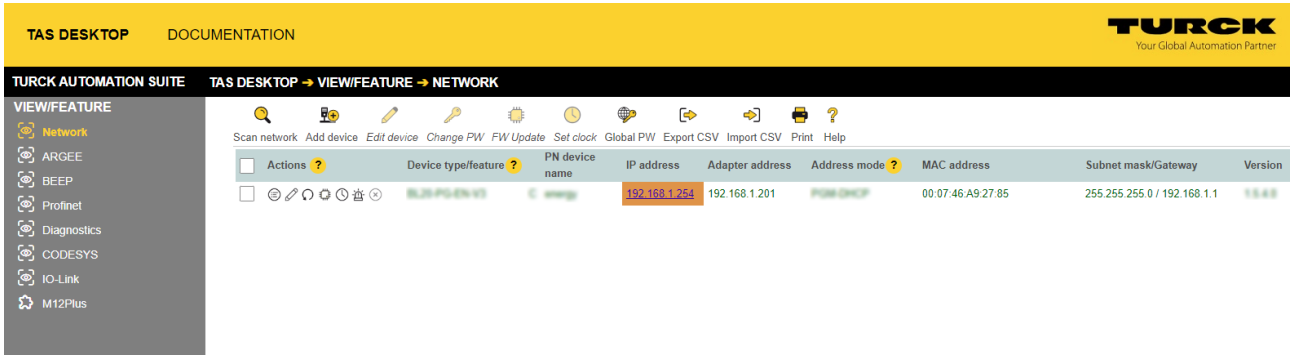


Fig. 21: Found devices in TAS

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

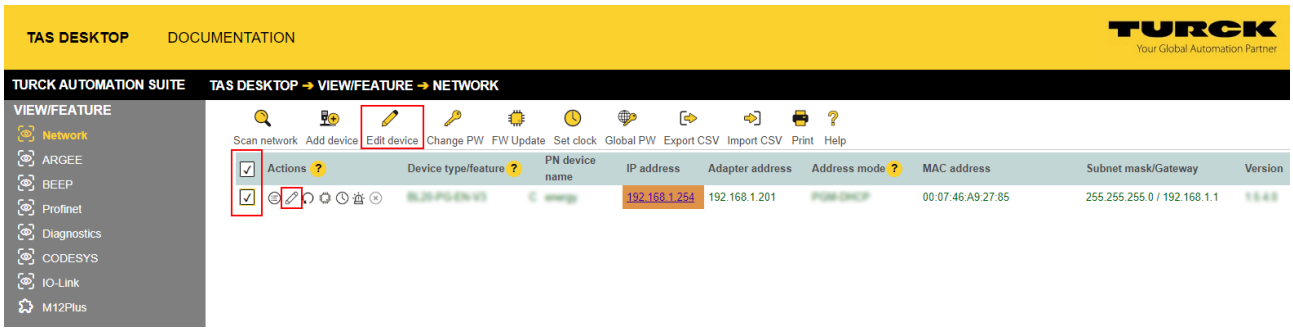


Fig. 22: Selecting the device in TAS

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

- ▶ Change the device name, the IP address and the network mask if necessary.
- ▶ Save changes by clicking on **APPLY** .

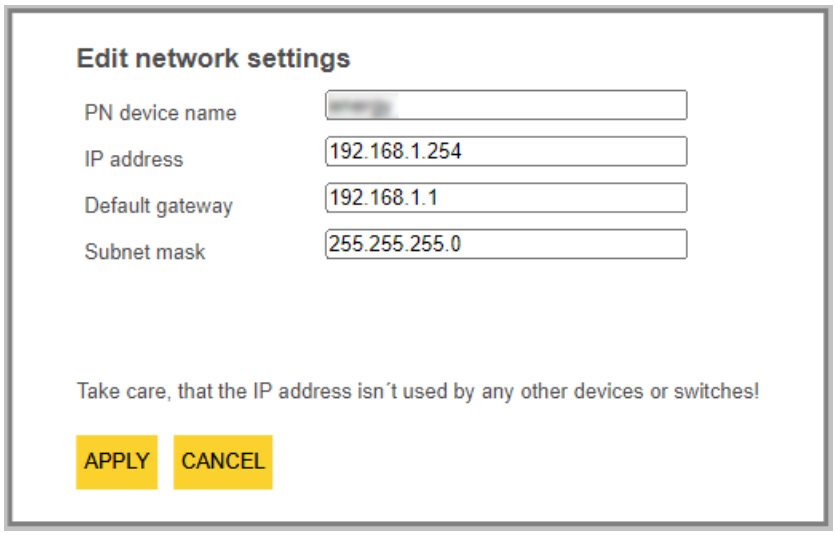


Fig. 23: Changing network settings in TAS

7.1.3 Adjusting network settings via the web server

A login is required to edit settings via the web server. The default password is "password".

NOTE
Turck recommends changing the password after the first login for security reasons.

- Open the device's web server.
- Enter **Username** and **Password**.
- Click **Login**

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

- Click **TBEN-L… → Parameter → Network**.
- Adjust the network settings.
- Write the changes into the device via **SET NETWORK CONFIGURATION**.

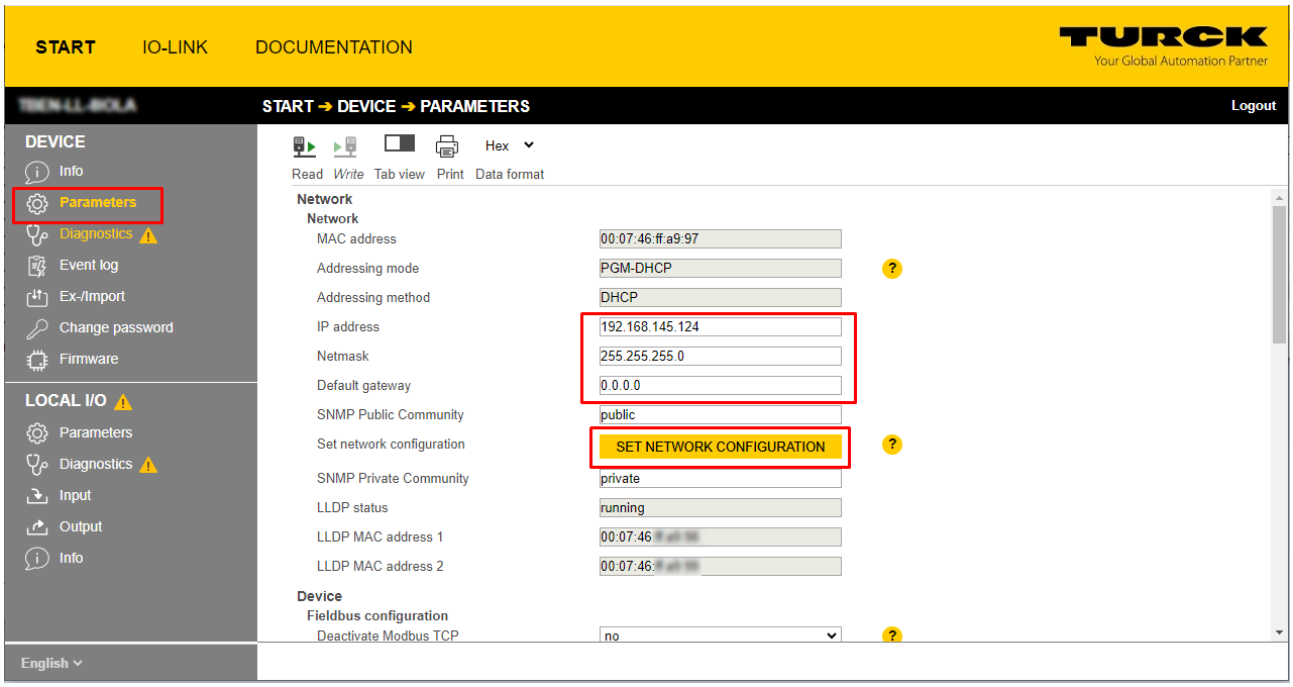


Fig. 24: Web server – adjusting network settings

7.2 Commissioning the device in PROFINET

7.2.1 Device model TBEN-LL(H)-4RMC, slots and sub slots

The TBEN-LL(H)-4RMC have seven virtual slots for different device functions (DXP channels, motor channels) and diagnostics or the module status.

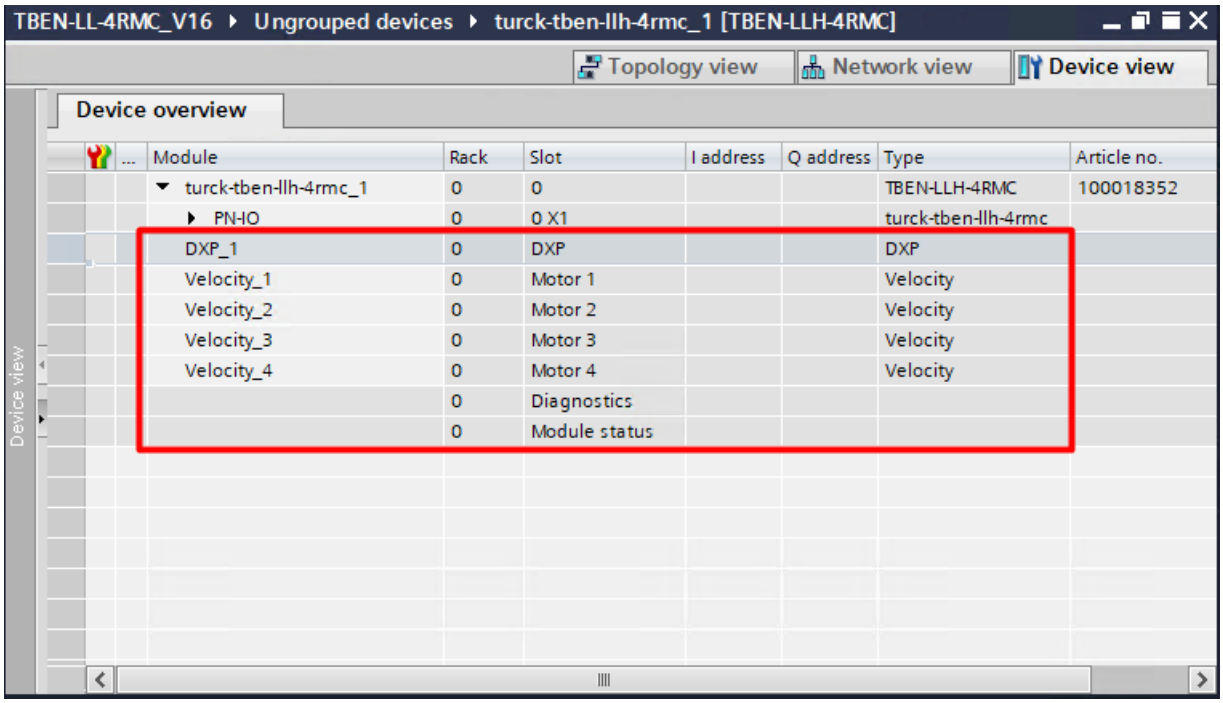


Fig. 25: Assignment of slots and sub slots in TIA Portal

Besides Slot 0 (DAP) all other slots of the 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 sub slots
0	TBEN-LL(H)-4RMC	Device interface 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 channel 1	■ Digital ■ Velocity (default setting) ■ Universal
3	Motor 2	Function motor channel 2	
4	Motor 3	Function motor channel 3	
5	Motor 4	Function motor channel 4	
6	Diagnostics	This slot is used to cyclically map diagnostic data.	Diagnostics
7	Module status	This slot is used to cyclically map device status data.	Device status

Sub module Digital

The sub module **Digital** can be plugged into slots 2…5.

- **Parameters** [▶ 80]

Parameter	Value	Description
Operation mode	Digital mode	Operation mode of the motor channel, pre-defined
Motor attached	Yes	Channel activated, pre-defined
Lock Motor Mode	Yes	Motor mode locked, pre-defined
Lock Ramp	Yes	Ramp acceleration and ramp deceleration locked, pre-defined
Lock Position	Yes	Position locked, pre-defined
Ramp acceleration	See parameters [▶ 80]	
Ramp deceleration		
Motor status output		
Input 1 digital mode		
Input 2 digital mode		
Velocity 1 digital mode		
Velocity 2 digital mode		
Velocity 3 digital mode		
Input fire mode		
Velocity fire mode		
Ramp acceleration fire mode		

- **Process input data** [▶ 106]

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
	%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

Process value	Offset	Data type
■ Fault is pending	%IX2.7	BOOL
Reserved	%IB3	
Velocity	%IW2	INT

■ **Process output data**: none

Sub module Velocity

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

■ **Parameters** [▶ 80]

Parameter	Value	Description
Operation mode	Velocity	Operation mode of the motor channel, pre-defined
Motor attached	Yes	Channel activated, pre-defined
Lock Motor Mode	Yes	Motor mode locked, pre-defined
Lock Ramp	Yes	Ramp acceleration and ramp deceleration locked, pre-defined
Lock Position	Yes	Position locked, pre-defined
Ramp acceleration	See parameters [▶ 80]	
Ramp deceleration		
Motor status output		
Input 1 digital mode		
Input 2 digital mode		
Velocity 1 digital mode		
Velocity 2 digital mode		
Velocity 3 digital mode		
Input fire mode		
Velocity fire mode		
Ramp acceleration fire mode		

■ **Process input data** [▶ 106]

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

Process value	Offset	Data type
■ Missing device	%IX2.0	BOOL
■ Velocity out of valid range	%IX2.1	BOOL
■ Fire 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** [▶ 109]

Process value	Offset	Data type
Outputs	%QW0	
Motor mode – Enable – Fault reset – Halt – Quick Stop	%QB0	USINT
Motor (position control)	%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	INT

Sub module Universal

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

- **Parameters** [▶ 80]

Parameter	Value	Description
Operation mode	No change	Operation mode of the motor channel
	Position mode	
	Velocity	
	Homing	
Motor attached	Yes	Channel activated, pre-defined
Lock Motor Mode	No	Motor mode can be changed during operation via the process output data
	Yes	Motor mode locked, pre-defined
Lock Ramp	No	Ramp acceleration and ramp deceleration can be changed during operation via the process output data
	Yes	Ramp acceleration and ramp deceleration can not be changed during operation via the process output data
Lock Position	No	Position can be changed during operation via the process output data
	Yes	Position locked, pre-defined
Motor status output	See parameters [▶ 80]	
Input 1 digital mode		
Input 2 digital mode		
Velocity 1 digital mode		
Velocity 2 digital mode		
Velocity 3 digital mode		
Input fire mode		
Velocity fire mode		
Ramp acceleration fire mode		
Input reference sensor		
Input positive limit switch		
Input negative limit switch		

- **Process input data** [▶ 106]

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

Process value	Offset	Data type
■ 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
Position	%ID2	DINT

■ **Process output data** [▶ 109]

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.

- **Parameter**
  This sub module requires no configuration and has thus no parameters.
- **Process input data** [▶ 106]

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.

- **Parameter**
  This sub module requires no configuration and has thus no parameters.
- **Process input data** [▶ 106]

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 pending	%IX1.0	BOOL
ARGEE program active	%IX1.1	BOOL
Undervoltage V2	%IX1.7	BOOL

7.2.2 Address setting in PROFINET

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

NOTE
DCP is a standard protocol and can also be used outside PROFINET, e.g. in IPC operating systems (Windows, Linux). DCP is available in tool packages such as WinPcap, Npcap, Wireshark etc.

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

The address is assigned in two steps:

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

PROFINET naming convention

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

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

7.2.3 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.

7.2.4 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	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 control S7-1500
- Motor controller module TBEN-LL(H)-4RMC 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(H)-4RMC (can be downloaded for free as part of the ZIP archive "TBEN-L_PROFINET.zip" under www.turck.com)

Prerequisites

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

7.3.1 Installing the GSDML-file

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

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

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

⇨ The device is added to the hardware catalog.

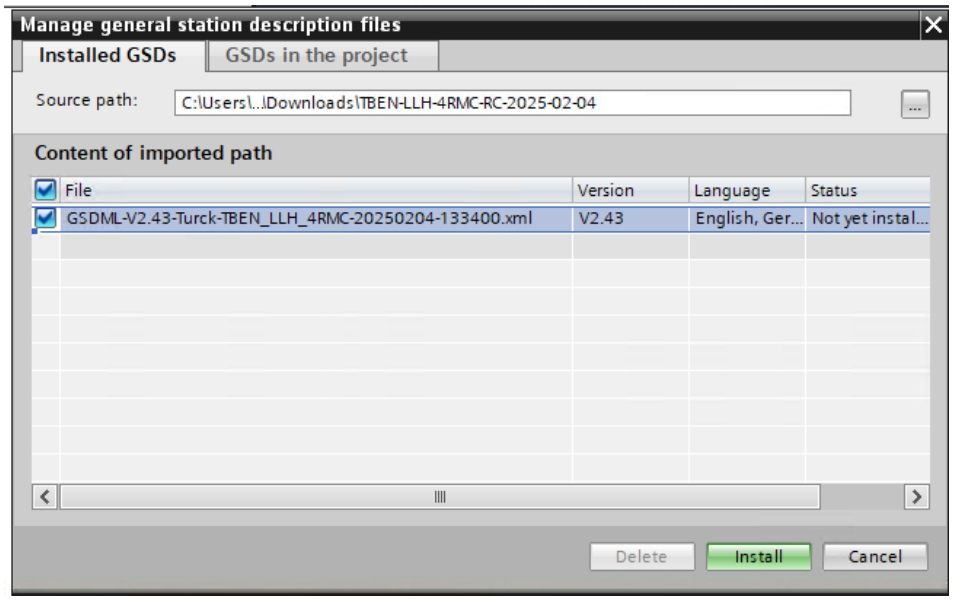


Fig. 26: TIA portal Installing the GSDML-file

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.

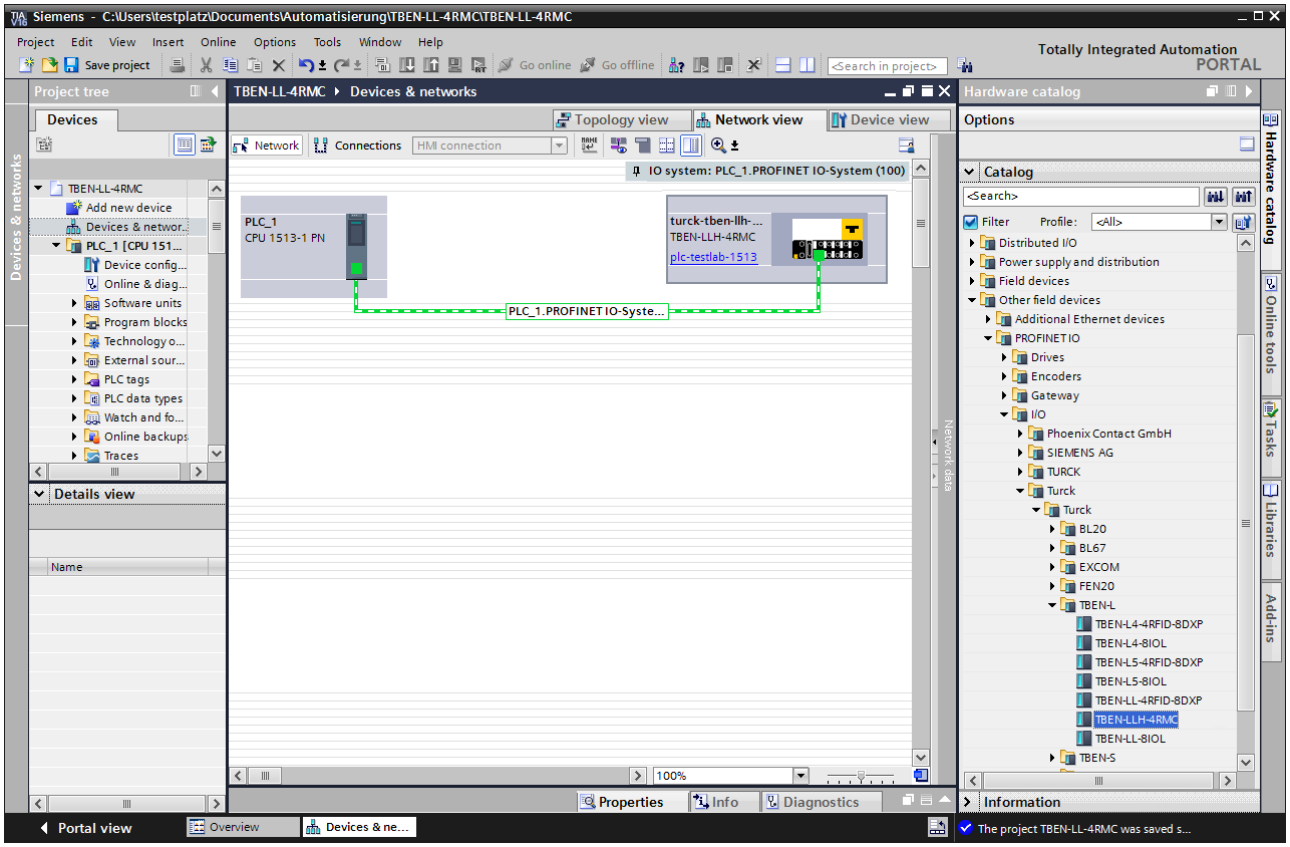


Fig. 27: TIA-Portal – Connecting the device to the PLC

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.**

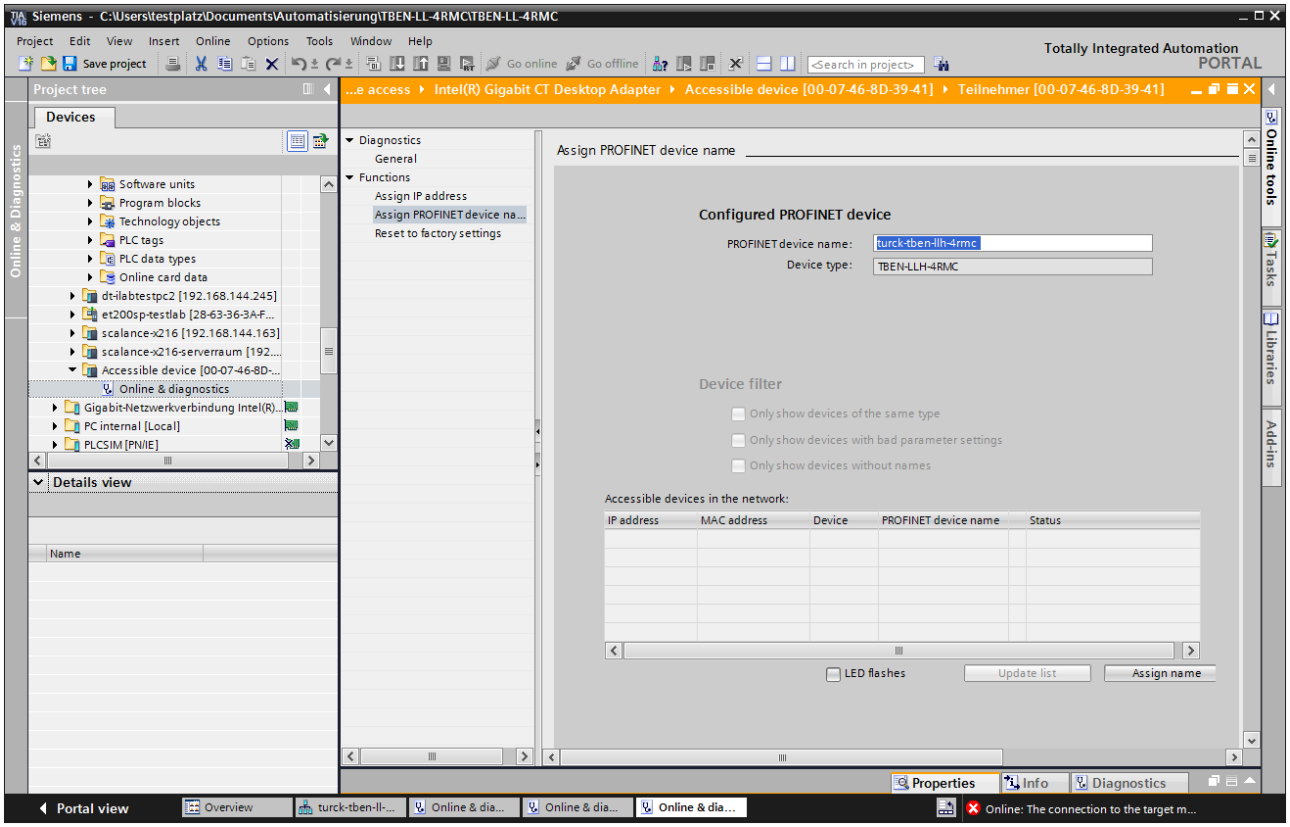


Fig. 28: TIA-Portal: Assigning the PROFINET device name

7.3.4 Setting the IP address in TIA Portal

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

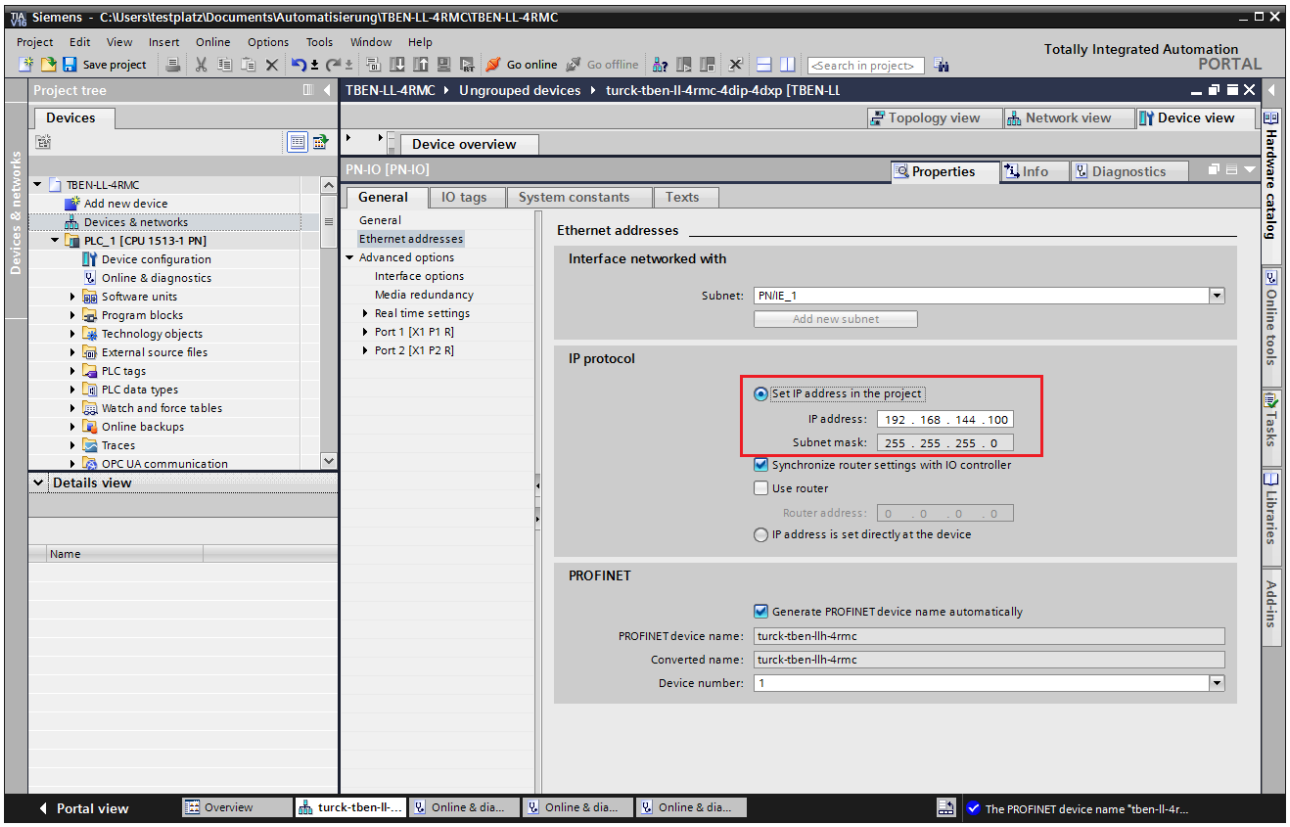


Fig. 29: TIA-Portal: Assigning the IP address

7.3.5 Configuring device functions

The TBEN-LL(H)-4RMC 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 **Device status** are available.

Slot		Meaning
0		Main module tben-llh-4rmc (Defaultname) Parameterization of functions (protocol deactivation, etc.), which are valid for the whole 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: **Digital** or **Universal**
Motor 2		
Motor 3		
Motor 4		
Diagnostics		Optional mapping of the diagnostics into the process image of the master
Device 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.

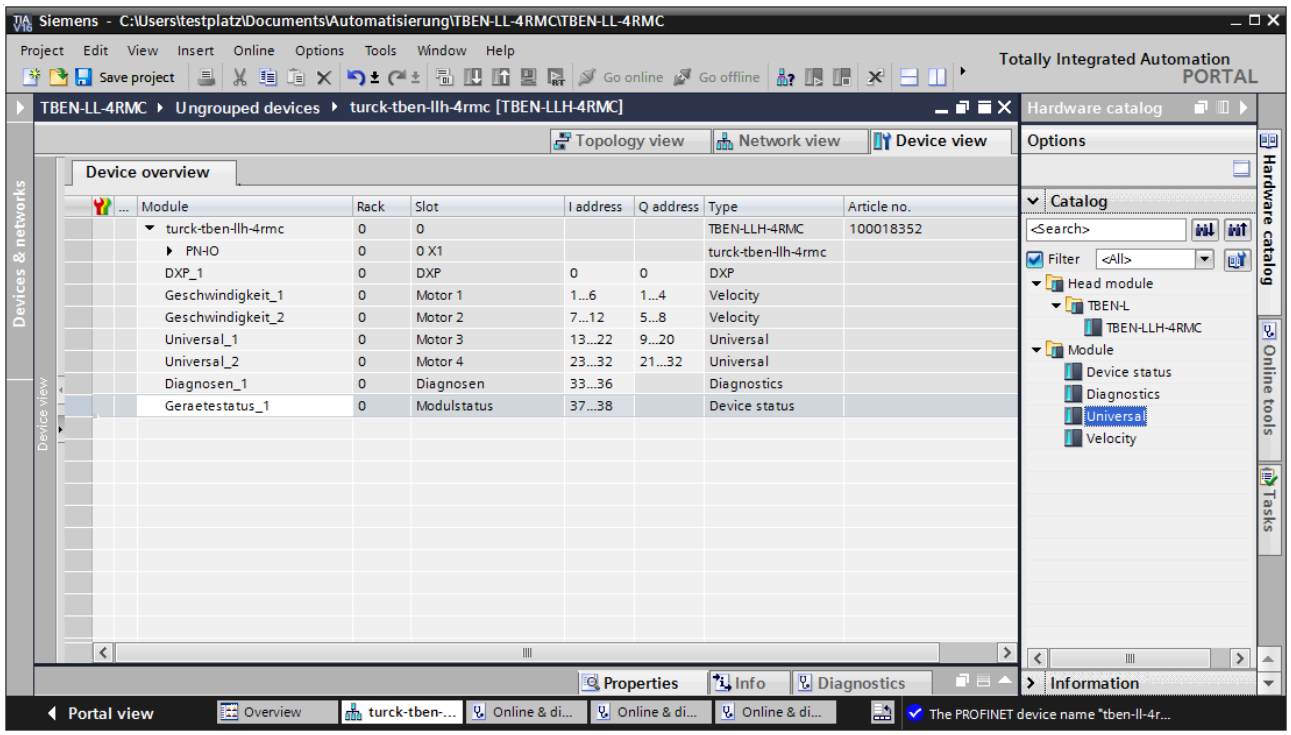


Fig. 30: Configuring the device slots in TIA Portal

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.

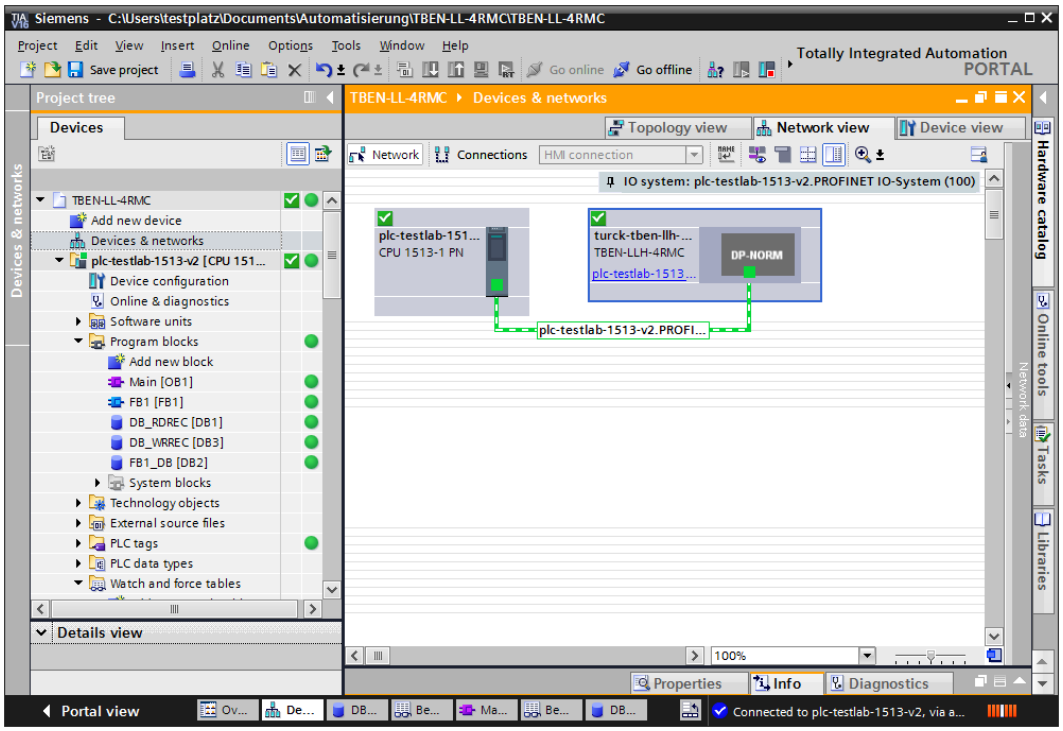


Fig. 31: TIA-Portal: Online mode

7.4 Commissioning the Device in Modbus TCP

7.4.1 Implemented Modbus functions

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

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

7.4.2 Modbus registers

Address	Access	Meaning
0x0000… 0x01FF	read only	Process data of the inputs (identical to registers 0x8000… 0x8400)
0x0800… 0x09FF	read/write	Process data of the outputs (identical to registers 0x9000…0x9400)
0x1000… 0x100B	read only	Module identifier, contains the first 24 characters of the device type
0x100C	read only	Module status
0x1017	read only	Register mapping revision (always 2, if not, mapping is incompatible with this description)
0x1020	read only	Watchdog, actual time in ms
0x1120	read/write	Watchdog, predefined time in ms (default: 500 ms
0x1130	read/write	Modbus Connection Mode Register
0x1131	read/write	Modbus Connection Timeout in s. (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
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

Address	Access	Meaning
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
Process data of the inputs	0x0000…0x01FF	0…511	40001…40512	400001…400512
Process data of the outputs	0x0800…0x09FF	2048…2559	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 do not (only if bit 0 = 1).
2…15	Reserved	-	-

Register 0x1131: Modbus connection timeout

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

Value range: 0…65535 s

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

Behavior of the BUS LED

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

Connection timeout	BUS LED
Timeout	Green flashing

Register 0x113C and 0x113D: Restore Modbus connection parameters

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

Procedure:

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

Register 0x113E and 0x113F: Save Modbus connection parameters

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

Procedure:

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

7.4.3 Data width

Module	Process input data	Process output data	Alignment
TBEN-LL(H)-4RMC	44 byte	48 byte	Word by word

7.4.4 Register mapping

Input registers

Process input data [▶ 106]

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			
		REFPOS_OK	F_ER	BUSY	TR				
	1	Error register							
		MSERR	-	DPSERR	COMERR	TERR	VOLTERR	CUR-RERR	GERR
0x0002	2	Status							
		FAULT_PENDING	FAULT	ENABLED	CON	res.	FIRMOD	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	-				VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)	VAUX1 pin1 X0 (Ch0/1)
	1	-							
0x0016	2	ERR_DXP7	ERR_DXP6	ERR_DXP5	ERR_DXP4	-			
	3	-							
Device status									
0x0017	0	V2	-	-	-	-	-	ARGEE	DIAG
	1	-	FCE	-	-	-	-	V1	-

Output registers

Process output data [▶ 109]

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_OUT)			
		Q_STOP	HALT	FAULT_RST	ENABLE				
	1	-				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 [▶ 114]

Register no.	Byte	Bit no.							
		7	6	5	4	3	2	1	0
Sensor supply and digital channels									
0xA000	0	-				VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)	VAUX1 pin1 X0 (Ch0/1)
	1	-							
0xA001	0	ERR_DXP7	ERR_DXP6	ERR_DXP5	ERR_DXP4	Reserved			
	1	-							
Motor control – motor 1 (connector X4)									
0xA002	0	-	FAULT	-					MISDEV
	1	MSERR	-	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 [▶ 80]

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	-			
	1	-							
0xB001	2	DXP7_ EN DO	DXP6_ EN DO	DXP5_ EN DO	DXP4_ EN DO	-			
	3	-							
0xB002	4	DXP7_ OPO	DXP6_ OPO	DXP5_ OPO	DXP4_ OPO	-			
	5	-							
Motor control – motor 1 (connector X4)									
0xB003	0		-			Motor mode			
	1	-				LOCK_ POS	LOCK_ RAMP	LOCK_ MOMO	MOT_ATT
0xB004	2	Velocity 1 digital mode							
	3								
0xB005	4	Input 1 digital mode							
	5	-							
0xB006	6	Velocity 2 digital mode							
	7								
0xB007	8	Input 2 digital mode							
	9	-							
0xB008	10	Velocity 3 digital mode							
	11								
0xB009	12	Motor status output							
	13	-							
0xB00A	14	Velocity fire mode							
	15								
0xB00B	16	Input fire mode							
	17	-							
0xB00C	18	Ramp acceleration fire mode							
	19								
0xB00D		-							
…	…								
0xB010									
0xB011	28	Ramp acceleration							
	29								
0xB012	30	Ramp deceleration							
	31								

Register no.	Byte	Bit no.							
		7	6	5	4	3	2	1	0
Motor control – motor 2 (connector X5)									
0xB013 … 0xB022		Assignment similar to motor 1 (0xB000…0xB012)							
Motor control – motor 3 (connector X6)									
0xB023 … 0xB032		Assignment similar to motor 1 (0xB000…0xB012)							
Motor control – motor 4 (connector X7)									
0xB0233 … 0xB042		Assignment similar to motor 1 (0xB000…0xB012)							

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 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 [▶ 106].

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

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 modules support Configuration Assembly.

The Configuration Assembly contains:

10 byte device configuration data (EtherNet/IP specific)

+ 136 Byte (parameter data, depending on device type)

The description of the parameters can be found in chapter [▶ 80].

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)
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	Ramp acceleration							
29	0x1D								
30	0x1E	Ramp deceleration							
31	0x1F								
32	0x20	Motor status output							
33	0x21	Input 1 digital mode							
34	0x22	Input 2 digital mode							
35	0x23	Reserved							
36	0x24	Velocity 1 digital mode							
37	0x25								
38	0x26	Velocity 2 digital mode							
39	0x27								
40	0x28	Velocity 3 digital mode							
41	0x29								
42	0x2A	Input fire mode							
43	0x2B	Reserved							
44	0x2C	Velocity fire mode							
45	0x2D								
46	0x2E	Ramp acceleration fire mode							
47	0x2F								
48	0x30	Input reference sensor							
49	0x31	Input positive limit switch							
50	0x32	Input negative limit switch							

Byte no.		Bit no.							
Dec.	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
51	0x33	Reserved							
Motor control – motor 2 (X5)									
52…81	0x34… 0x51	Assignment similar to motor 1							
Motor control – motor 3 (X6)									
82…111	0x52… 0x6F	Assignment similar to motor 1							
Motor control – motor 4 (X7)									
112…141	0x70… 0x8D	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” [▶ 106].

Word no.		**Bit no.**															
Hex.	**Dec.**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0x00	0	**Status word**															
		-	FCE	-	-	-		V1	-	V2	-		-	Reserved		ARGEE	DIAG
Digital channels																	
0x01	1	Reserved								DXP 7	DXP 6	DXP 5	DXP 4	DI3	DI2	DI1	DI0
Motor control – motor 1 (X4)																	
0x02	2	MS ERR	-	DPS ERR	COM ERR	T ERR	VOLT ERR	CURR ERR	G ERR	REF-POS_ OK	F_ER	BUSY	TR	Motor mode			
0x03	3	Reserved								FAULT _PEN DING	FAULT	ENA BLED	CON	CFG ERR	FIR MOD	VEL EXC	MIS DEV
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)	VAUX1 pin1 X0 (Ch0/1)
0x17	23	ERR DXP 7	ERR DXP 6	ERR DXP 5	ERR DXP 4	Reserved											

Output Assembly instance (instance 104)

The description of the outout data can be found in chapter “Operating” [▶ 109].

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			COSP	CSI	ABS_ REL	NSP	Q_STOP	HALT	FAULT_ RST	EN- ABLE	Motor mode (MOMODE_OUT)				
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 (0x06)

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

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

Common services

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

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 = 0x30
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-LLH-4RMC

Device status

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

Common services

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

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 Vendor Specific Classes (VSC)

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 substitute value.
					1: SWITCH IO OFF (1): The outputs are switched to 0.
					2: SWITCH IO HOLD (2): No further changes to I/O data. The outputs are held.
138	0x8A	GW status register	G/S	DWORD	Activates or deactivates the mapping of the status word into the device's input data. Activating or deactivating of the status word is only possible in Assembly Instance 103.
139	0x8B	GW Control Register	G/S	DWORD	Activates or deactivates the mapping of the control word into the device's output data. Activating or deactivating of the control word is only possible in Assembly Instance 104.
140	0x8C	Disable Protocols	G/S	UINT	Deactivation of the used Ethernet protocol.
					Bit 0: Deactivates EtherNet/IP (cannot be deactivated via the EtherNet/IP interface).
					Bit 1: Deactivates Modbus TCP
					Bit 2: Deactivates PROFINET
					Bit 15: Deactivates the web server

Class 199 (0xC7) – 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	Operation mode	G/S	USINT	0: No change
					1: Position mode
					3: Velocity
					6: Homing
					13: Digital mode
2	0x02	Motor attached	G/S	USINT	0: No
					1: Yes
3	0x03	Lock motor mode	G/S	USINT	0: No
					1: Yes
4	0x04	Lock ramp	G/S	USINT	0: No
					1: Yes
5	0x05	Lock position	G/S	USINT	0: No
					1: Yes
6	0x06	Ramp acceleration [mm/s^2]	G/S	UINT	
7	0x07	Ramp acceleration [mm/s^2]	G/S	UINT	
8	0x08	Motor status output	G/S	USINT	0: not execute 1: OK-high channel 4 2: OK-high channel 5 3: OK-high channel 6 4: OK-high channel 7 5: Fault-high channel 4 6: Fault-high channel 5 7: Fault-high channel 6 8: Fault-high channel 7
9	0x09	Input 1 digital mode	G/S	USINT	0: not execute 1: Active high - channel 0 2: Active high - channel 1 3: Active high - channel 2 4: Active high - channel 3 5: Active high - channel 4 6: Active high - channel 5 7: Active high - channel 6 8: Active high - channel 7 9: Active low - channel 0 10: Active low - channel 1 11: Active low - channel 2 12: Active low - channel 3 13: Active low - channel 4 14: Active low - channel 5 15: Active low - channel 6 16: Active low - channel 7

Attr.		Meaning	Get/Set	Type	Description
Dec.	Hex.				
10	0x0A	Input 2 digital mode	G/S	USINT	0: not execute 1: Active high - channel 0 2: Active high - channel 1 3: Active high - channel 2 4: Active high - channel 3 5: Active high - channel 4 6: Active high - channel 5 7: Active high - channel 6 8: Active high - channel 7 9: Active low - channel 0 10: Active low - channel 1 11: Active low - channel 2 12: Active low - channel 3 13: Active low - channel 4 14: Active low - channel 5 15: Active low - channel 6 16: Active low - channel 7
11	0x0B	Velocity 1 mode [mm/s]	G/S	INT	
12	0x0C	Velocity 2 mode [mm/s]	G/S	INT	
13	0x0D	Velocity 3 mode [mm/s]	G/S	INT	
14	0x0E	Input 1 digital mode	G/S	USINT	0: not execute 1: Active high - channel 0 2: Active high - channel 1 3: Active high - channel 2 4: Active high - channel 3 5: Active high - channel 4 6: Active high - channel 5 7: Active high - channel 6 8: Active high - channel 7 9: Active low - channel 0 10: Active low - channel 1 11: Active low - channel 2 12: Active low - channel 3 13: Active low - channel 4 14: Active low - channel 5 15: Active low - channel 6 16: Active low - channel 7
15	0x0F	Velocity 1 mode [mm/s]	G/S	INT	
16	0x10	Ramp acceleration mode[mm/s^2]	G/S	INT	

Attr.		Meaning	Get/Set	Type	Description
Dec.	Hex.				
17	0x11	Input reference sensor	G/S	USINT	0: No reference drive 1: Neg. to pos. edge - pos. limit-switch 2: Neg. to pos. edge - neg. limit-switch 3: Positive edge - channel 0 4: Negative edge - channel 0 5: Pos. to neg. edge - channel 0 6: Neg. to pos. edge - channel 0 7: Positive edge - channel 1 8: Negative edge - channel 1 9: Pos. to neg. edge - channel 1 10: Neg. to pos. edge - channel 1 11: Positive edge - channel 2 12: Negative edge - channel 2 13: Pos. to neg. edge - channel 2 14: Neg. to pos. edge - channel 2 15: Positive edge - channel 3 16: Negative edge - channel 3 17: Pos. to neg. edge - channel 3 18: Neg. to pos. edge - channel 3 19: Positive edge - channel 4 20: Negative edge - channel 4 21: Pos. to neg. edge - channel 4 22: Neg. to pos. edge - channel 4 23: Positive edge - channel 5 24: Negative edge - channel 5 25: Pos. to neg. edge - channel 5 26: Neg. to pos. edge - channel 5 27: Positive edge - channel 6 28: Negative edge - channel 6 29: Pos. to neg. edge - channel 6 30: Neg. to pos. edge - channel 6 31: Positive edge - channel 7 32: Negative edge - channel 7 33: Pos. to neg. edge - channel 7 34: Neg. to pos. edge - channel 7
18	0x12	Input positive limit switch	G/S	USINT	0: n.a. 1: Channel 0 2: Channel 1 3: Channel 2 4: Channel 3 5: Channel 4 6: Channel 5 7: Channel 6 8: Channel 7

Attr.		Meaning	Get/Set	Type	Description
Dec.	Hex.				
19	0x13	Input negative limit switch	G/S	USINT	0: n.a. 1: Channel 0 2: Channel 1 3: Channel 2 4: Channel 3 5: Channel 4 6: Channel 5 7: Channel 6 8: Channel 7
29	0x14	Missing device	G	USINT	0: -
					1: active
21	0x15	Fault	G	USINT	0: -
					1: active
22	0x16	Generic error	G	USINT	0: -
					1: active
23	0x17	Current error	G	USINT	0: -
					1: active
24	0x18	Voltage error	G	USINT	0: -
					1: active
25	0x19	Temperature error	G	USINT	0: -
					1: active
26	0x1A	Communication error	G	USINT	0: -
					1: active
27	0x1B	Device profile specific error	G	USINT	0: -
					1: active
28	0x1C	Manufacturer specific error	G	USINT	0: -
					1: active
29	0x1D	Motor mode	G	USINT	0: No change
					1: Position mode
					2: reserved
					3: Velocity
					4: reserved
					5: reserved
					6: Homing
30	0x1E	Target reached	G	USINT	0: not active
					1: active
31	0x1F	Busy	G	USINT	0: not active
					1: active
32	0x20	Communication error	G	USINT	0: not active
					1: active
33	0x21	Reference position valid			
34	0x22	Generic error	G	USINT	0: -
					1: active

Attr.		Meaning	Get/Set	Type	Description
Dec.	Hex.				
35	0x23	Current error	G	USINT	0: -
					1: active
36	0x24	Voltage error	G	USINT	0: -
					1: active
37	0x25	Temperature error	G	USINT	0: -
					1: active
38	0x26	Communication error	G	USINT	0: -
					1: active
39	0x27	Device profile specific error	G	USINT	0: -
					1: active
40	0x28	Manufacturer specific error	G	USINT	0: -
					1: active
41	0x29	Missing device	G	USINT	0: not active
					1: active
42	0x2A	Velocity out of valid range	G	USINT	0: not active
					1: active
43	0x2B	Motor mode	G	USINT	0: not active
					1: active
44	0x2C	Configuration error	G	USINT	0: not active
					1: active
45	0x2D	Connected	G	USINT	0: no
					1: yes
46	0x2E	Enabled	G	USINT	0: no
					1: yes
47	0x2F	Fault	G	USINT	0: not active
					1: active
48	0x30	Fault is pending	G	USINT	0: not active
					1: active
49	0x31	Velocity [mm/s]	G	UINT	
50	0x32	Position [mm]	G	UDINT	
51	0x33	Motor mode	G/S	USINT	0: No change
					1: Position mode
					2: reserved
					3: Velocity
					4: reserved
					5: reserved
					6: Homing
52	0x34	Enable	G/S	USINT	0: no
					1: yes
53	0x35	Fault reset	G/S	USINT	0: no
					1: yes

Attr.		Meaning	Get/Set	Type	Description
Dec.	Hex.				
54	0x36	Halt	G	USINT	0: not active
					1: active
55	0x37	Velocity [mm/s]	G/S	UINT	
56	0x38	Quick Stop	G/S	USINT	0: not active
					1: active
57	0x39	Position [mm]	G/S	UDINT	
58	0x3A	New setpoint	G/S	USINT	0: not active
					1: active
59	0x3B	Ramp acceleration [mm/s^2]	G/S	UINT	
60	0x3C	Positioning mode	G/S	USINT	0: absolute
					1: relative
61	0x3D	Ramp acceleration [mm/s^2]	G/S	UINT	
62	0x3E	Change set immediately	G/S	USINT	0: not active
					1: active
63	0x3F	Change on setpoint	G/S	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

Attr. no.		Designation	Get/ set	Type	Meaning
Dec.	Hex.				
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
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 Devices 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-LLH-4RMC

Used software

The following software tools are used in this example:

- Rockwell Studio5000
- Complex EDS file „TBEN-LLH-4RMC.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 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**.

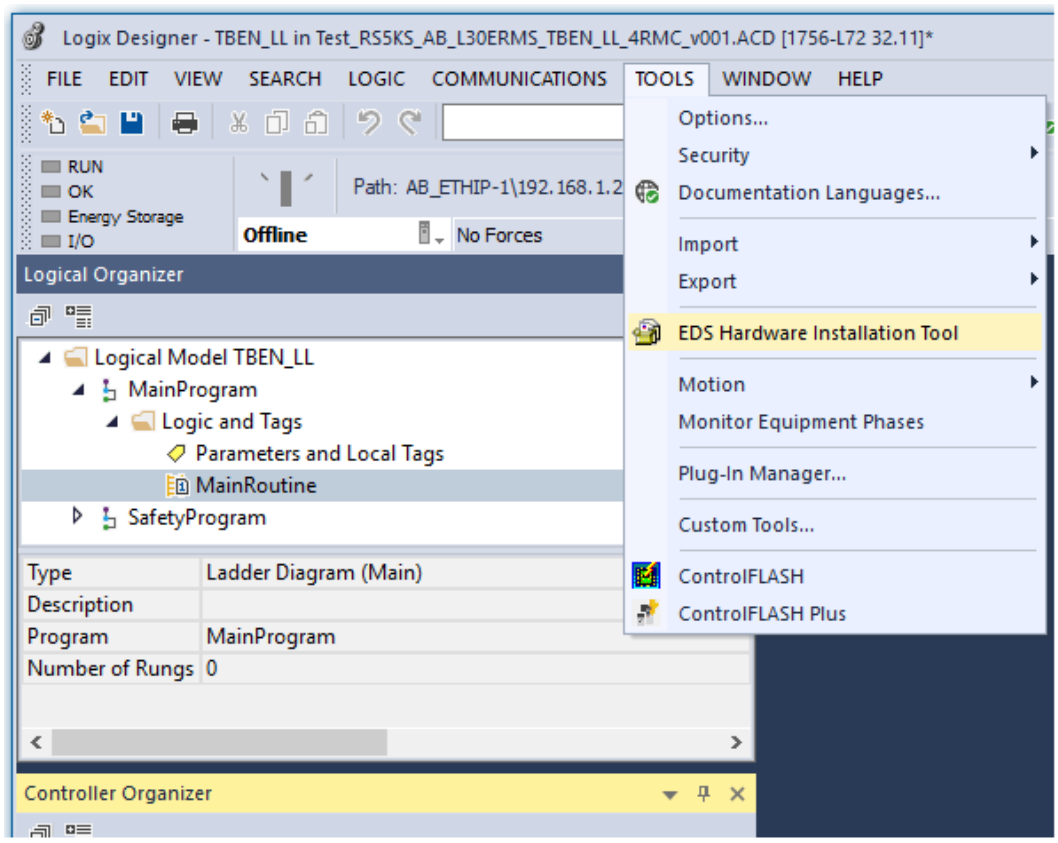


Fig. 32: Opening the Hardware Installation Tool

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

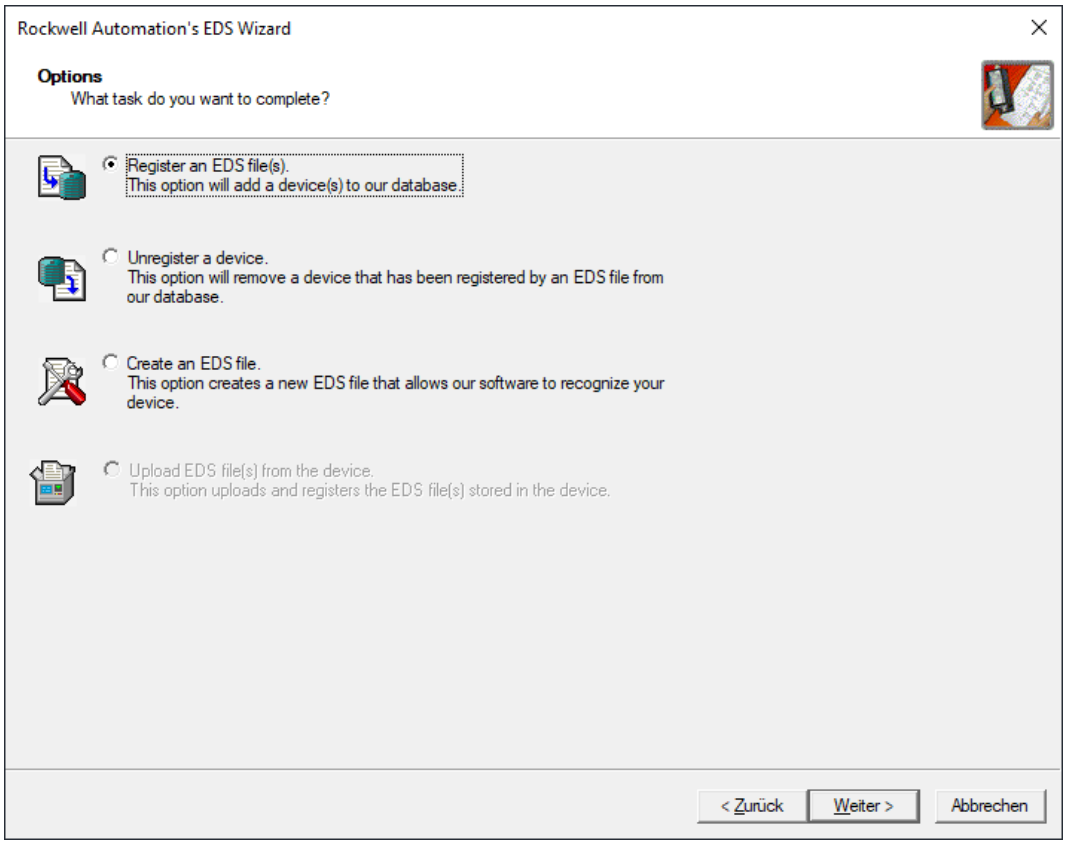


Fig. 33: EDS Wizard

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

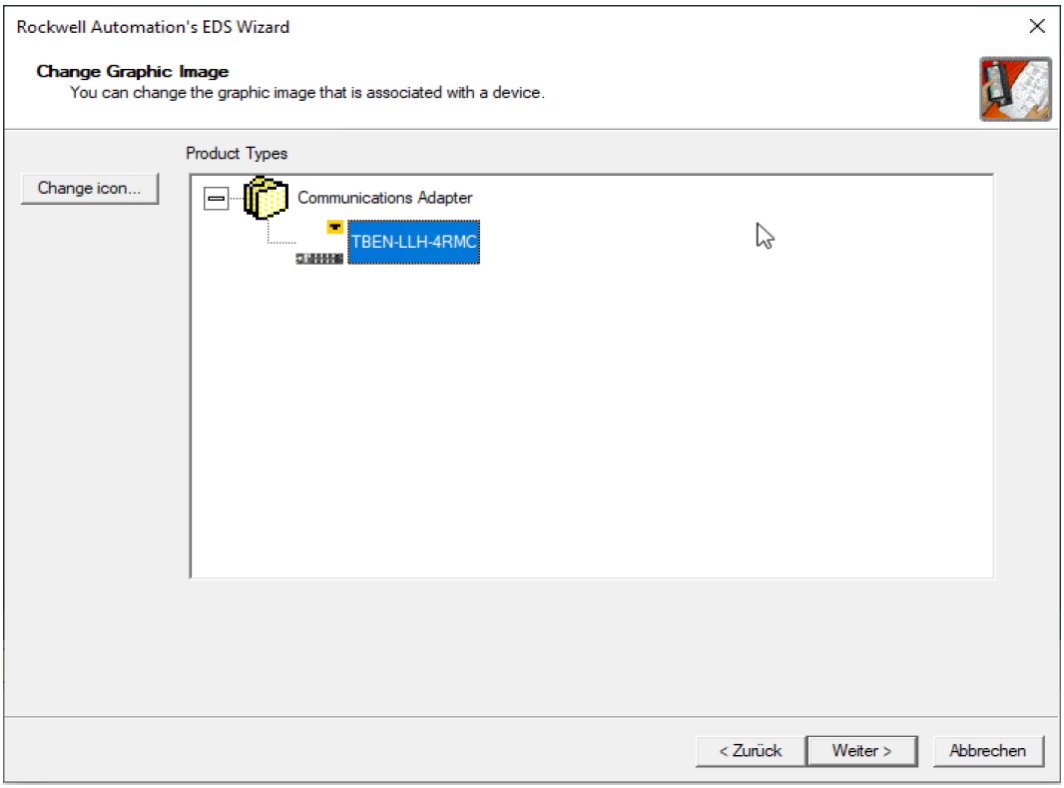


Fig. 34: Registering the device as Communications Adapter

7.6.2 Adding the device to the project

- Open the context menu by right-clicking the entry of the scanner In the project tree and select **New Module** .

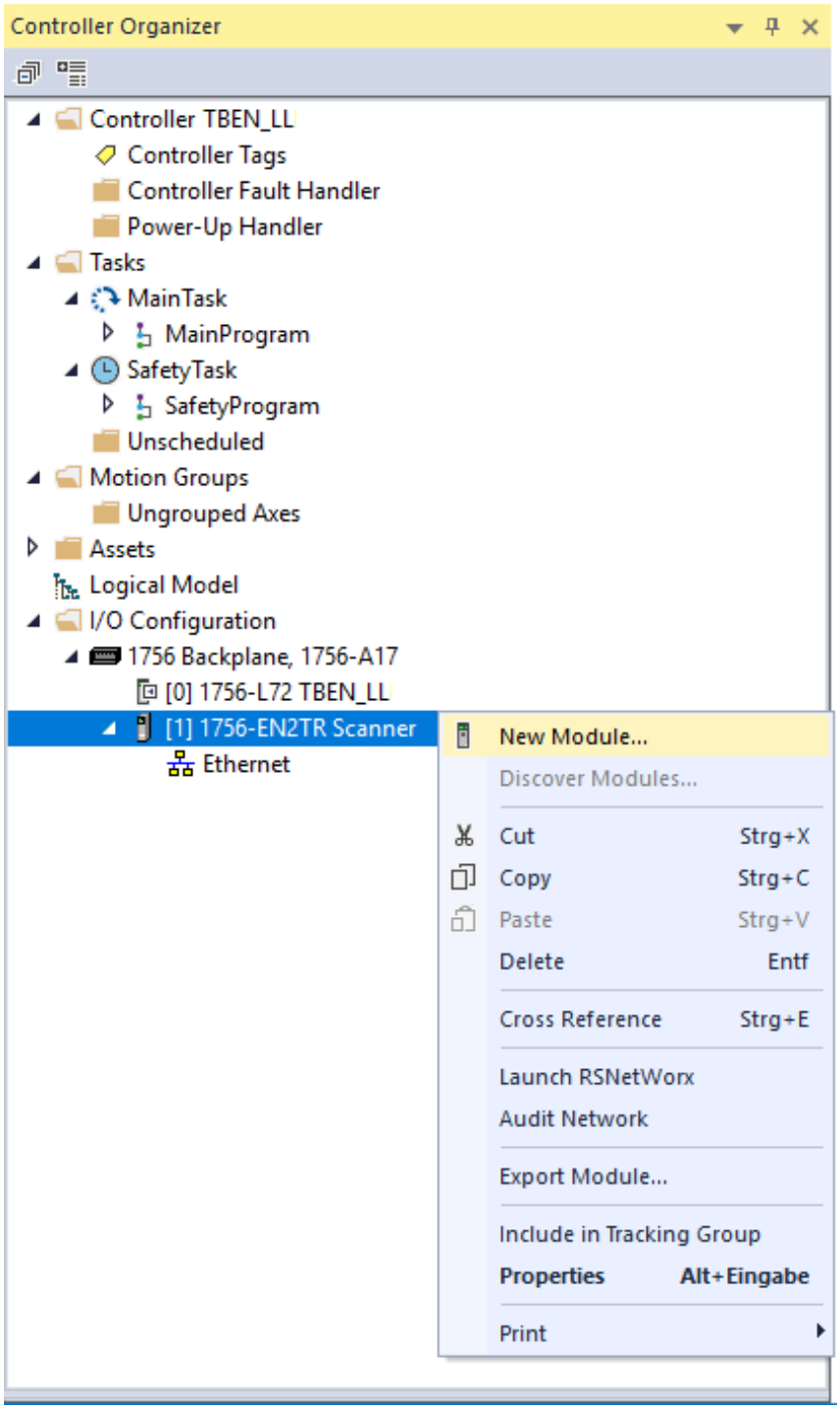


Fig. 35: Adding the device to the project

▶ Select TBEN-LLH-4RMC and add it to the project.

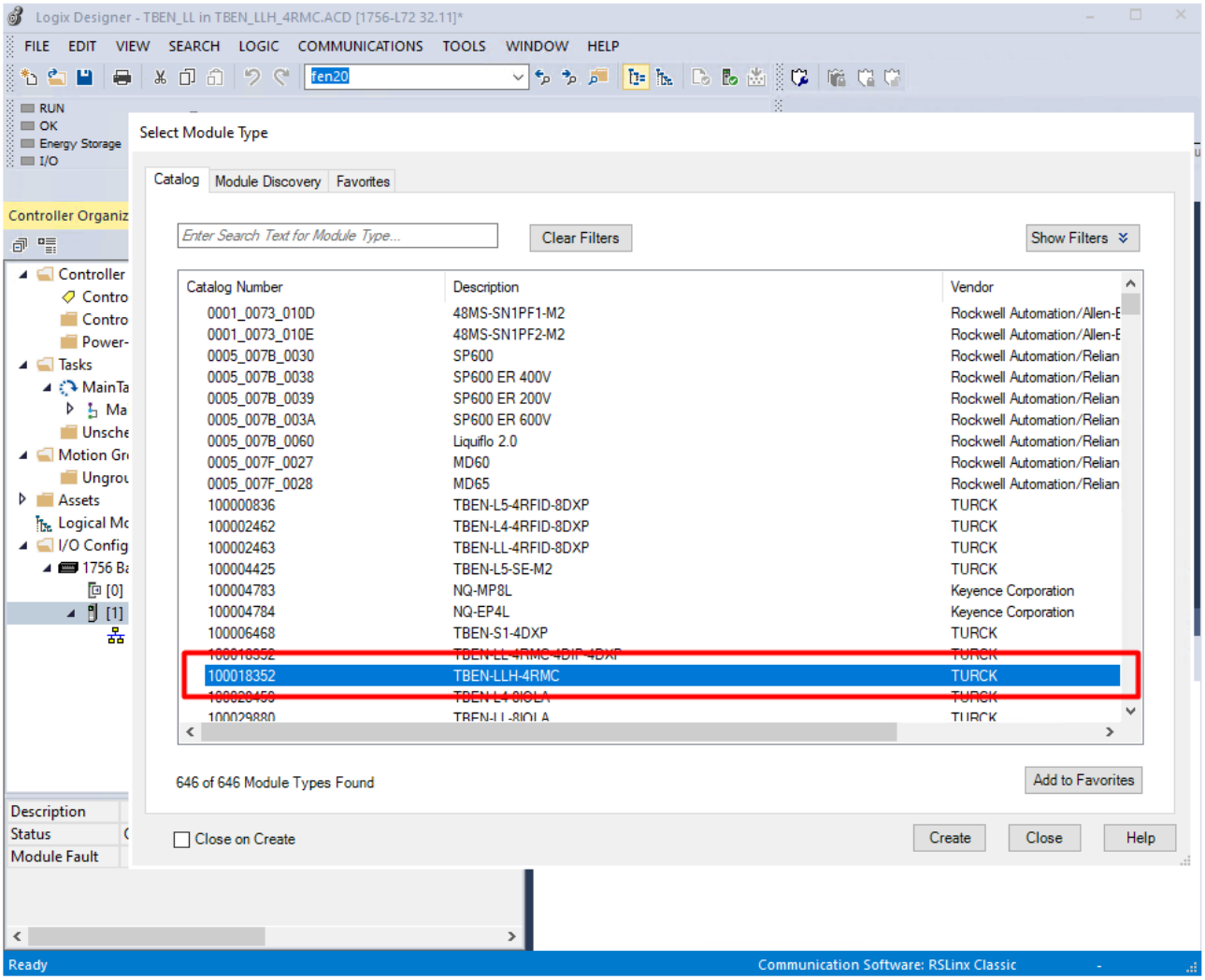


Fig. 36: Selecting the device

▶ Enter the device name and IP address of the deviceuUnder **New Module** → **General**.

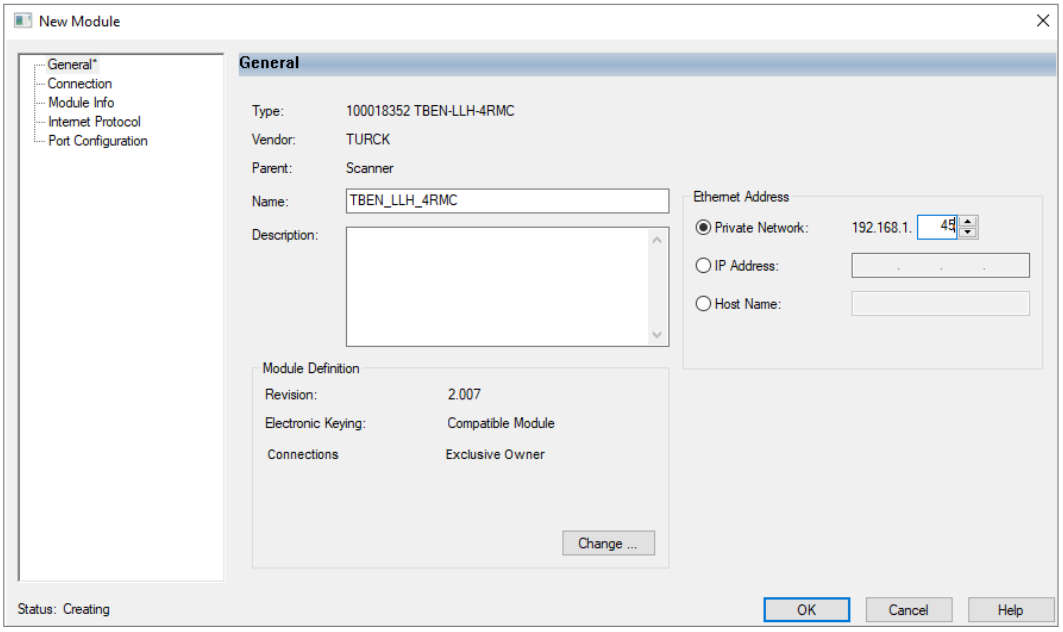


Fig. 37: New Module, setting name and IP address

▶ Optional: Set the connection parameters.

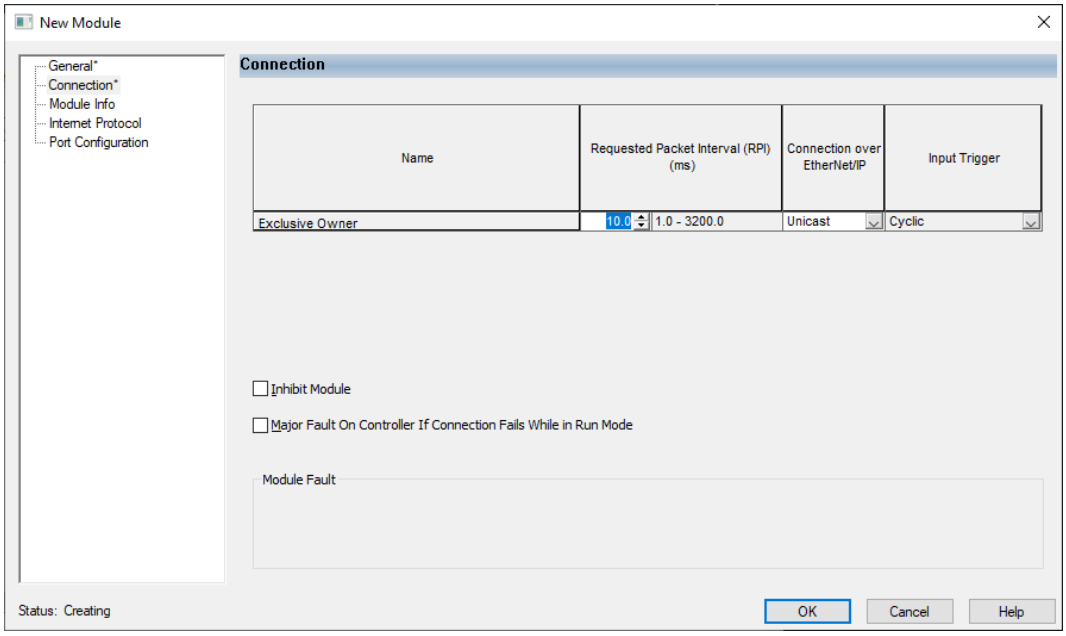


Fig. 38: New Module, connection parameters

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

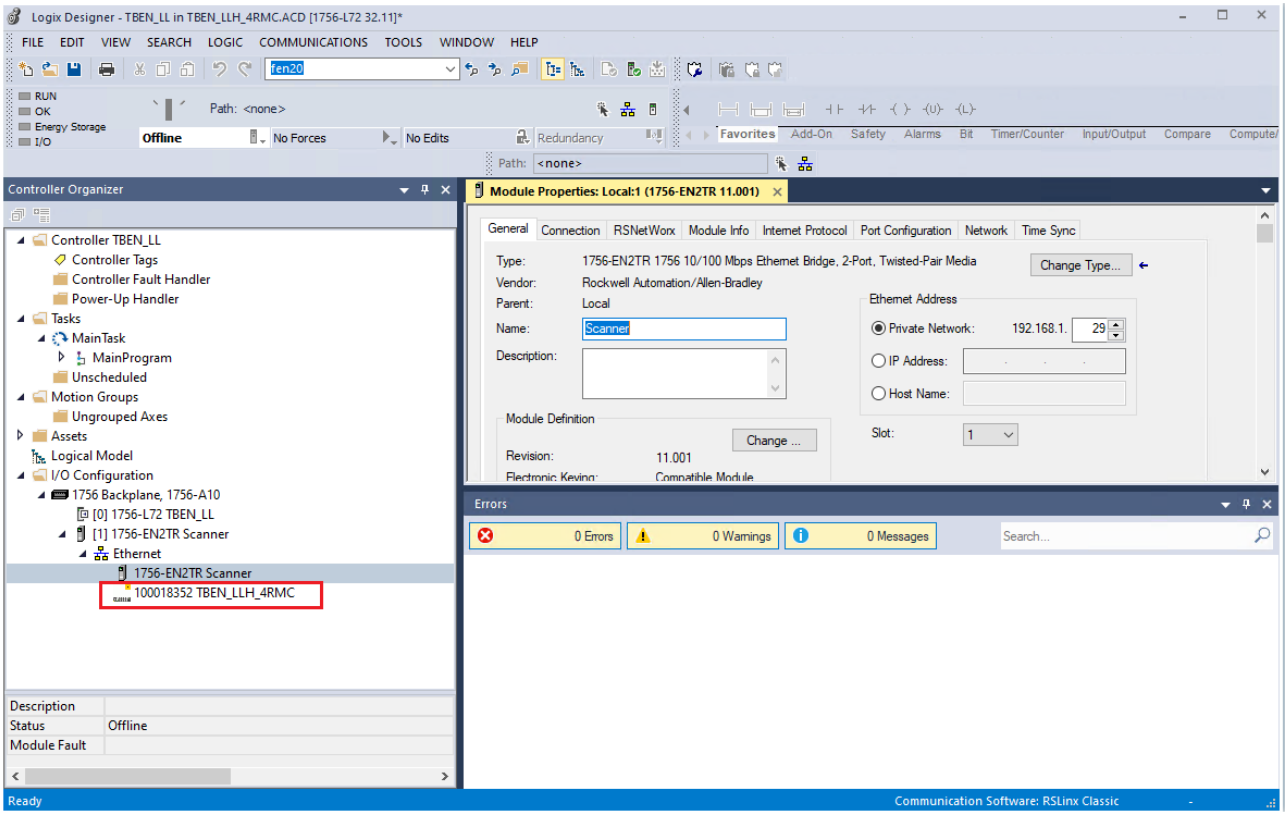


Fig. 39: Device in the project tree

7.6.3 Parameterizing the device

- Open the Controller Tags of the device.
- Configure the device by using the Controller Tags for configuration TBEN_LLH_4RMC:C and for process output data TBEN_LLH_4RMC:O. The chapter "Parameterizing and configuring" contains examples for configuring the device [▶ 89].

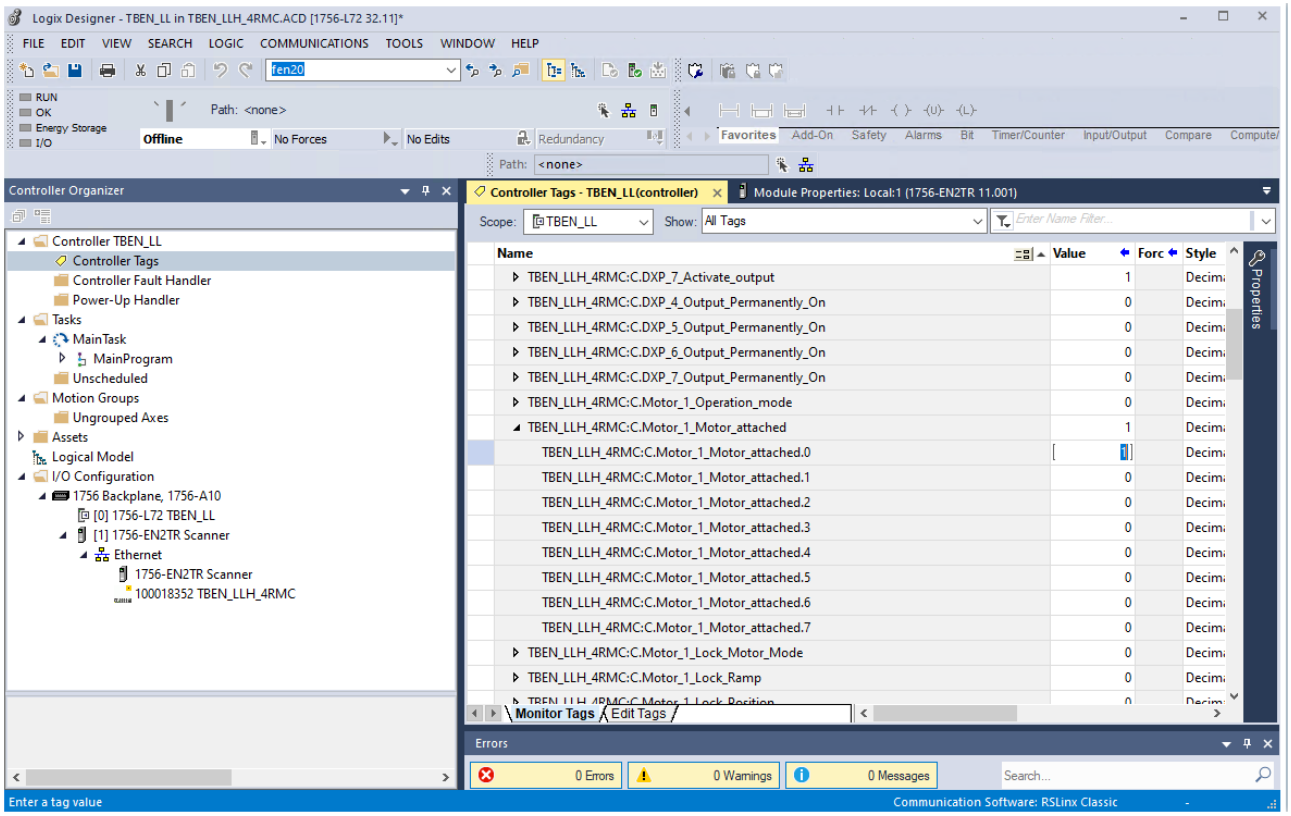


Fig. 40: Controller Tags (parameters)

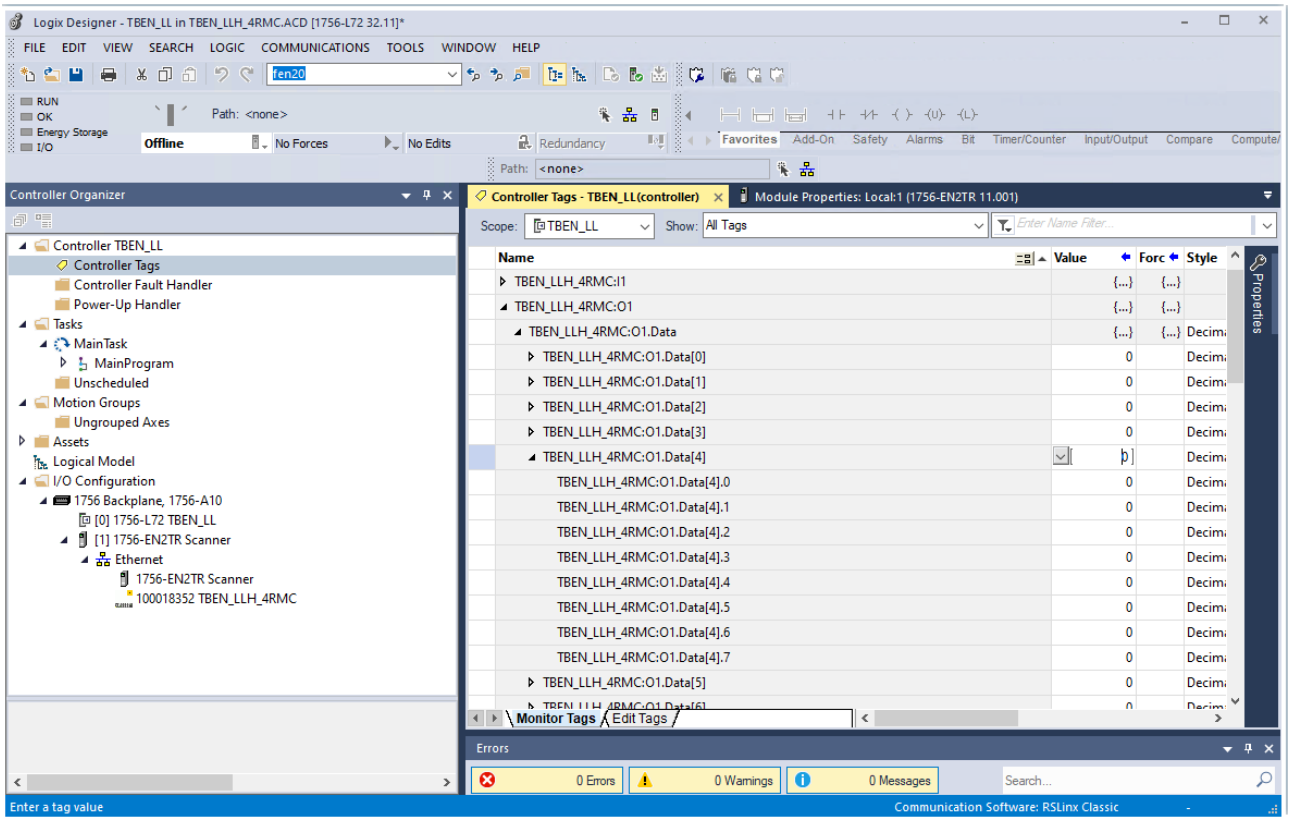


Fig. 41: Controller Tags (outputs)

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 32 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_ SRO	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 channel – 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 1 digital mode							
		3	0x03								
5	0x05	4	0x04	Input 1 digital mode							
		5	0x05	Reserved							
6	0x06	6	0x06	Velocity 2 digital mode							
		7	0x07								
7	0x07	8	0x08	Input 2 digital mode							
		9	0x09	Reserved							
8	0x08	10	0x0A	Velocity 3 digital mode							
		11	0x0B								
9	0x09	12	0x0C	Motor status output							
		11	0x0B	Reserved							
10	0x0A	14	0x0E	Velocity fire mode							
		15	0x0F								
11	0x0B	16	0x10	Input fire mode							
		17	0x11	Reserved							
12	0x0C	18	0x12	Ramp acceleration fire mode							
		12	0x0C								
13	0x0D	20	0x14	Input reference sensor							
		21	0x15	Reserved							
14	0x0E	22	0x16	Input positive limit switch							
		23	0x17	Input negative limit switch							

Word no.		Byte no.		Bit no.							
Dec.	**Hex.**	**Dec.**	**Hex.**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
15	0x0F	24	0x18	Reserved							
		25	0x19								
16	0x10	26	0x1A								
		27	0x1B								
17	0x11	28	0x1C	Ramp acceleration							
		29	0x1D								
18	0x12	30	0x1E	Ramp deceleration							
		31	0x1F								
Motor channel – motor 2 (X5)											
19…34	0x13…0x22	0…31	0x00…0x1F	Assignment similar to motor channel – motor 1							
Motor channel – motor 3 (X6)											
35…50	0x23…0x32	0…31	0x00…0x1F	Assignment similar to motor channel – motor 1							
Motor channel – motor 4 (X7)											
51…66	0x33…0x42	0…31	0x00…0x1F	Assignment similar to motor channel – motor 1							

Meaning of parameter bits

Parameter name	Data type	Value Dec.	Meaning	Description
Manual output reset after over-current (DXP…_SROx)	BOOL	**0**	**No**	The output switches on automatically after an overload.
		1	Yes	After an overcurrent, the output is only switched on again after the switching signal is reset and set again.
Activate output Ch… (DXP…_ENDO)	BOOL	**0**	**No**	The output at pin 2 is deactivated.
		1	Yes	The output at pin 2 is activated.
Output permanently on (DXP…_OPO)	BOOL	**0**	**No**	The output is triggered via the process data.
		1	Yes	The output at the channel is always switched on if activated via the "Activate output" parameter. Process data no longer have any influence on the output. Use case: Permanent supply of stations that are connected to digital output.

Parameter name	Data type	Value Dec.	Meaning	Description
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			
	ENUM	0	No change	
		1	Position mode	Profile position mode (acc. to the CANopen Drives profile) The connected motor moves to a defined absolute or relative target position. 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.
		3	Velocity	Profile velocity mode (acc. to CANopen Drives profile) 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	Homing	Homing mode (acc. to CANopen Drives profile object) The position of the motor is defined as the reference position. All further positions of the motor refer to this position.
		13	Digital mode	Digital mode (acc. to CANopen Drives profile) The connected motor moves depending on the status of two digital inputs.
		14	Referencing	Single reference run (homing) after switching on the system to align the start position of the motor roller or to set the position of the motor roller as the zero position when reaching a limit switch.
Motor attached (MOT_ATT)	BOOL	**0**	No	The channel is deactivated. Note: In PROFINET the default setting of parameter 1 = yes (motor attached).
		1	**Yes**	If this bit is set, the module expects that a motor is connected to the channel.
Lock Motor Mode (LOCK_MOMO)	BOOL	**0**	**No**	Output data for setting the motor mode not locked. The motor mode can be changed dynamically via the process output data [▶ 109].
		1	Yes	Output data for setting the motor mode locked. The configured motor mode cannot be changed dynamically via the process output data.
Lock Ramp (LOCK_RAMP)	BOOL	**0**	**No**	Output data for ramp acceleration or ramp deceleration not locked. Ramp acceleration or ramp deceleration can be changed dynamically via the process output data [▶ 109].
		1	Yes	Output data for ramp acceleration or ramp deceleration locked. Ramp acceleration and ramp deceleration cannot be changed dynamically via the process output data

Parameter name	Data type	Value Dec.	Meaning	Description
Lock Position (Lock_POS)	BOOL	**0**	**No**	Output data for the position not locked. The position can be changed dynamically via the process output data [▶ 109].
		1	Yes	Output data for the position locked. The position cannot be changed dynamically via the process output data.
Ramp acceleration Ramp deceleration	UINT16	0… **65535**		Value for the acceleration and deceleration of the motor 0 = reserved (previously saved setting is used) The unit depends on the connected motor: e.g. mm/s² (Interroll EC5000 BI) The value can be controlled dynamically 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.
Motor status output	Prerequisite: The "motor attached (MOT_ATT)" bit is set for the channel for motor control (X4…X7).			
	ENUM	**0**	not execute	
		1	OK-high channel 4	An active high signal at the output (X4…X7) indicates fault-free operation of the motor.
		2	OK-high channel 5	
		3	OK-high channel 6	
		4	OK-high channel 7	
		5	Fault-high channel 4	An active high signal at the output (X4…X7) indicates a motor fault.
		6	Fault-high channel 5	
		7	Fault-high channel 6	
		8	Fault-high channel 7	
Velocity fire mode	INT16	-3000… 3000	Motor velocity in fire mode.	
Input fire mode	ENUM	**0**	not execute	
		1	Active high channel 0	An active high signal at the input (X0…X7) activates the fire mode with one of the 3 speeds:
		…	…	
		8	Active high channel 7	
		9	Active low channel 0	An active low signal at the input (X0…X7) activates the fire mode with one of the 3 speeds:
		…	…	
		16	Active low channel 7	
Ramp acceleration fire mode	UINT16	0… **65535**	Value for the acceleration and deceleration of the Motor. 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.	

Parameter name	Data type	Value Dec.	Meaning	Description
Input reference sensor	ENUM	Configuration for the "referencing mode"		
		0	No reference drive	The motor does not perform a reference drive. The current position of the connected roller motor is set as the zero point (reference point).
		1	neg. to pos. edge - pos. limit switch	Reference run with limit switch at the positive end of a conveyor belt The motor moves until the limit switch is reached (negative edge) and then moves back in the opposite direction until it leaves the range of the limit switch again (positive edge). If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point). Prerequisite: The limit switch must be connected and the input must be defined via the **input positive limit** switch parameter. If the parameter **input positive limit switch** is set to 0 = do not execute, the process data bit **GFGERR** shows a configuration error.
		2	neg. to pos. edge– neg. limit switch	Reference run with limit switch at the negative end of a conveyor belt. The motor moves until the limit switch is reached (negative edge) and then moves back in the opposite direction until it leaves the range of the limit switch again (positive edge). If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point). Prerequisite: The limit switch must be connected and the input must be defined via the **input positive limit** switch parameter. If the parameter **input positive limit switch** is set to 0 = do not execute, the process data bit **GFGERR** shows a configuration error.
		3	Positive edge – channel 0	The motor moves until a positive or respectively negative edge is detected on channel 0 and stops. If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point).
		4	Negative edge – channel 0	
		5	Pos. to neg. edge – channel 0	The motor moves until a positive edge is detected on channel 0 and then reverses in the opposite direction until a negative edge is detected. If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point).

Parameter name	Data type	Value Dec.	Meaning	Description
		6	Neg. to pos. edge – channel 0	The motor moves until a negative edge is detected on channel 0 and then reverses in the opposite direction until a positive edge is detected. If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point).
		…		
		31	Positive edge – channel 7	The motor moves until a positive or respectively negative edge is detected on channel 7 and stops. If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point).
		32	Negative edge – channel 7	
		33	Pos. to neg. edge – channel 7	The motor moves until a positive edge is detected on channel 7 and then reverses in the opposite direction until a negative edge is detected. If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point).
		34	Neg. to pos. edge – channel 7	The motor moves until a negative edge is detected on channel 7 and then reverses in the opposite direction until a positive edge is detected. If no position has been defined, the current position of the roller motor is set as the zero point (reference point). If a position has been defined, the motor first moves to this position and the position is then set as the zero point (reference point).
Input positive limit switch	ENUM	**0**	not execute	
		1	Channel 0	Defines the channel to which the limit switch is connected that is used for the reference run (**input reference sensor** parameter = 1 = **neg. to pos. edge - pos. limit switch**).
		…	…	
		8	Channel 7	
Input negative limit switch	ENUM	**0**	not execute	
		1	Channel 0	Defines the channel to which the limit switch is connected that is used for the reference run (**input reference sensor** parameter = 2 = **neg. to pos. edge - pos. limit switch**).
		…	…	
		8	Channel 7	

Parameter name	Data type	Value Dec.	Meaning	Description
Parameters for digital mode				
Velocity 1 digital mode Velocity 2 digital mode Velocity 3 digital mode	INT16	-3000…3000		Motor velocity 1…3 in fire mode The speed at which the motor moves depends on the combination of the settings of the **input 1 digital mode** and **input 2 digital mode** parameters (see "Functions and operating modes: motor modes" [▶ 11]. The acceleration and deceleration behavior of the motor is defined via the **ramp acceleration** and **ramp deceleration** parameters and is dependent on the application. The unit depends on the connected motor: e.g. mm/ s (Interroll EC5000 BI).
Input… digital mode				The combination of the two parameters **input 1 digital mode** and **input 2 digital mode** defines the speed at which the motor runs in digital mode and which signal (active high or active low signal) at which of the input channels activates digital mode (see "Functions and operating modes: motor modes" [▶ 11].
Input 1 digital mode	ENUM	0 1		An active high signal at the input (X0…X7) activates the digital mode with one of the 3 speeds: ■ Bit 0: not execute ■ Bit 1: Active high channel 0 ■ Bit 2: Active high channel 1 ■ Bit 3: Active high channel 2 ■ Bit 4: Active high channel 3 ■ Bit 5: Active high channel 4 ■ Bit 6: Active high channel 5 ■ Bit 7: Active high channel 6 ■ Bit 8: Active high channel 7 An active low signal at the input (X0…X7) activates the digital mode with one of the 3 speeds: ■ Bit 9: Active low channel 0 ■ Bit 10: Active low channel 1 ■ Bit 11: Active low channel 2 ■ Bit 12: Active low channel 3 ■ Bit 13: Active low channel 4 ■ Bit 14: Active low channel 5 ■ Bit 15: Active low channel 6 ■ Bit 16: Active low channel 7

Parameter name	Data type	Value Dec.	Meaning	Description
Input 2 digital mode	ENUM	0		An active high signal at the input (X0…X7) activates the digital mode with one of the 3 speeds: ■ Bit 0: not execute ■ Bit 1: Active high channel 0 ■ Bit 2: Active high channel 1 ■ Bit 3: Active high channel 2 ■ Bit 4: Active high channel 3 ■ Bit 5: Active high channel 4 ■ Bit 6: Active high channel 5 ■ Bit 7: Active high channel 6 ■ Bit 8: Active high channel 7 An active low signal at the input (X0…X7) activates the digital mode with one of the 3 speeds: ■ Bit 9: Active low channel 0 ■ Bit 10: Active low channel 1 ■ Bit 11: Active low channel 2 ■ Bit 12: Active low channel 3 ■ Bit 13: Active low channel 4 ■ Bit 14: Active low channel 5 ■ Bit 15: Active low channel 6 ■ Bit 16: Active low channel 7
		1		

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 is sent.
	1	Hold current value	The device keeps the current data at the outputs.
Deactivate all diagnostics	**0**	**No**	Diagnostic and alarm messages are generated.
	1	Yes	Diagnostic and alarm messages are suppressed.
Disable output power diagnosis	**0**	**No**	Monitoring of voltage V2 is activated.
	1	Yes	The sending of the diagnosis is deactivated.
Disable output power diagnosis	**0**	**No**	No function
	1	yes	
LED behavior (PWR) at V2 undervoltage	**0**	**Red**	The PWR LED lights up red in the event of an undervoltage at V2.
	1	Green	The PWR LED is flashes green in the event of an undervoltage at V2.
Deactivate I/O-ASSISTANT Force Mode	**0**	**No**	
	1	Yes	The Force Mode of the DTM is deactivated.
Deactivate EtherNet/IP	**0**	**No**	Explicit disabling of the Ethernet protocols or the web server
	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(H)-4RMC 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 fire mode overwrites all other motor modes. To use a different motor mode, the fire mode must be completely deactivated, i.e. all parameters (velocity fire mode, fire mode input, etc.) must be reset.

8.2.1 Configuring the velocity mode

The following parameters [▶ 80] and process output data [▶ 109] must be set for the velocity mode.

Setting parameters

- Set **Operation mode** to **Velocity** (3).
- Set **Motor attached** to **yes** (1) to activate the channel.
- Optional: Set the values for **Ramp acceleration** and **Ramp deceleration**.
- Note: Set **Lock Ramp** to **no** (0), to allow a dynamic configuration of the ramp acceleration or deceleration via the process image of the outputs. **Lock Ramp** = **yes** (1) locks the possibility to adapt g the values in the process data.
- Set **Lock Position** to **no** (0).
- Optional: Set **Lock Motor Mode** to **yes** (1), to prevent the motor mode for the relevant channel from being changed in the process output data.
- Write the values to the device using the **Write** button.

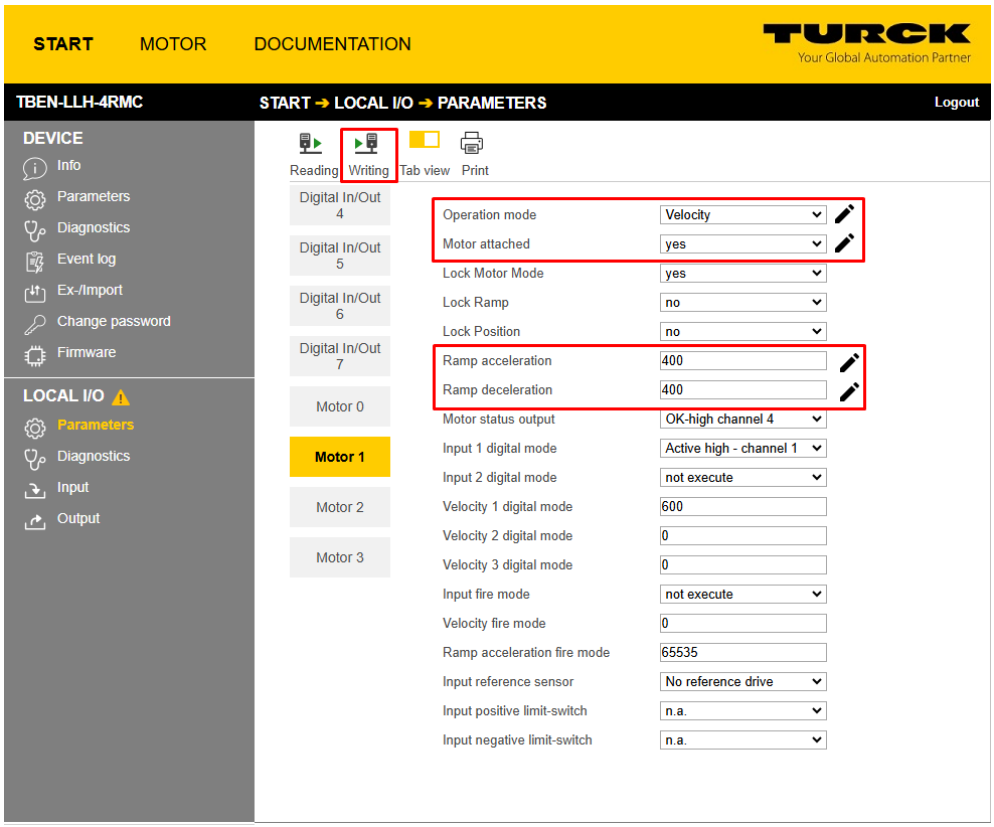


Fig. 42: Parameters for velocity mode

Setting process output data

- Set the **Velocity** to the desired value, here 1000 mm/s.
- Set **enable** to **yes** (1) to start the motor.
- The values are applied immediately.

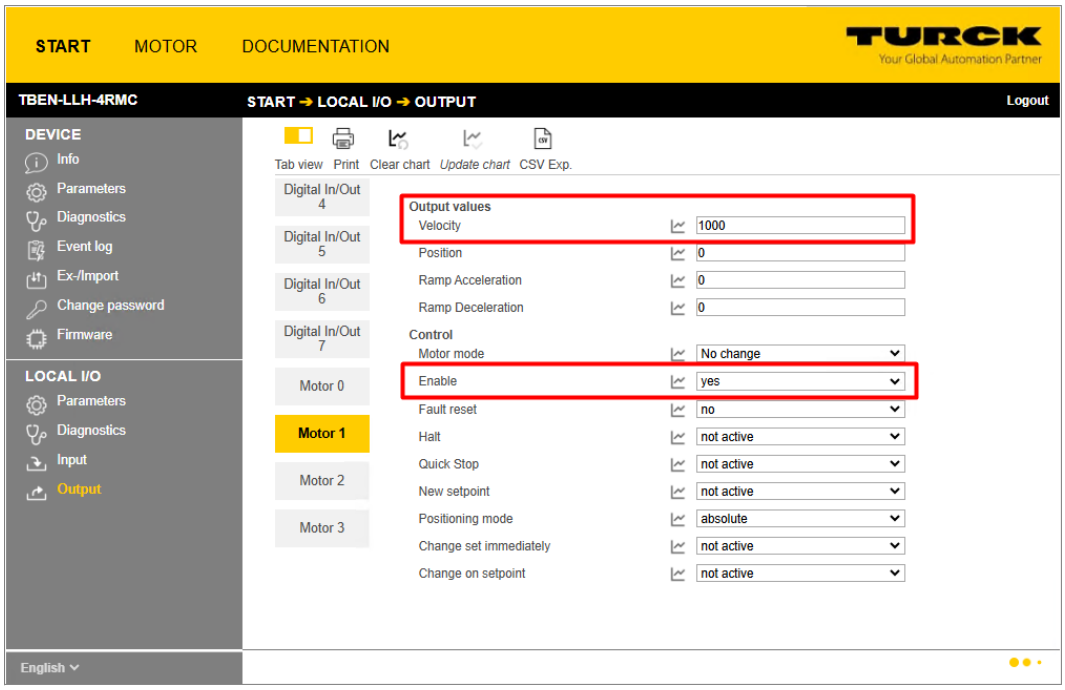


Fig. 43: Process output data for velocity mode

➪ 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.

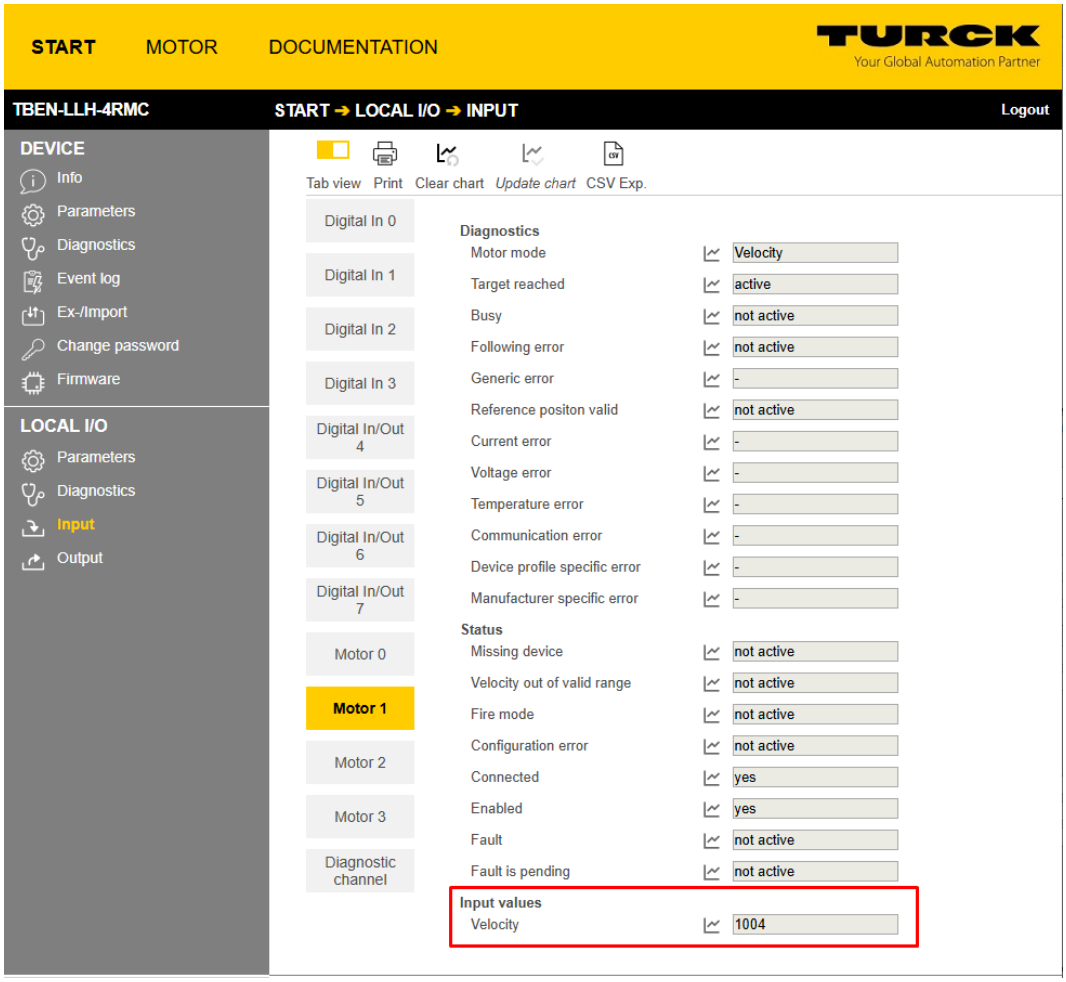


Fig. 44: Process input data data for velocity mode

8.2.2 Configuring the position mode

The following parameters [▶ 80] and process output data [▶ 109] must be set for the position mode.

Setting parameters

- **Set Operation mode** to **position** (1).
- **Set Motor attached** to **yes** (1) to activate the channel.
- Optional: Set **Lock Motor Mode** to **yes** (1), to prevent the motor mode for the relevant channel from being changed in the process output data.
- Write the values to the device using the **Write** button.

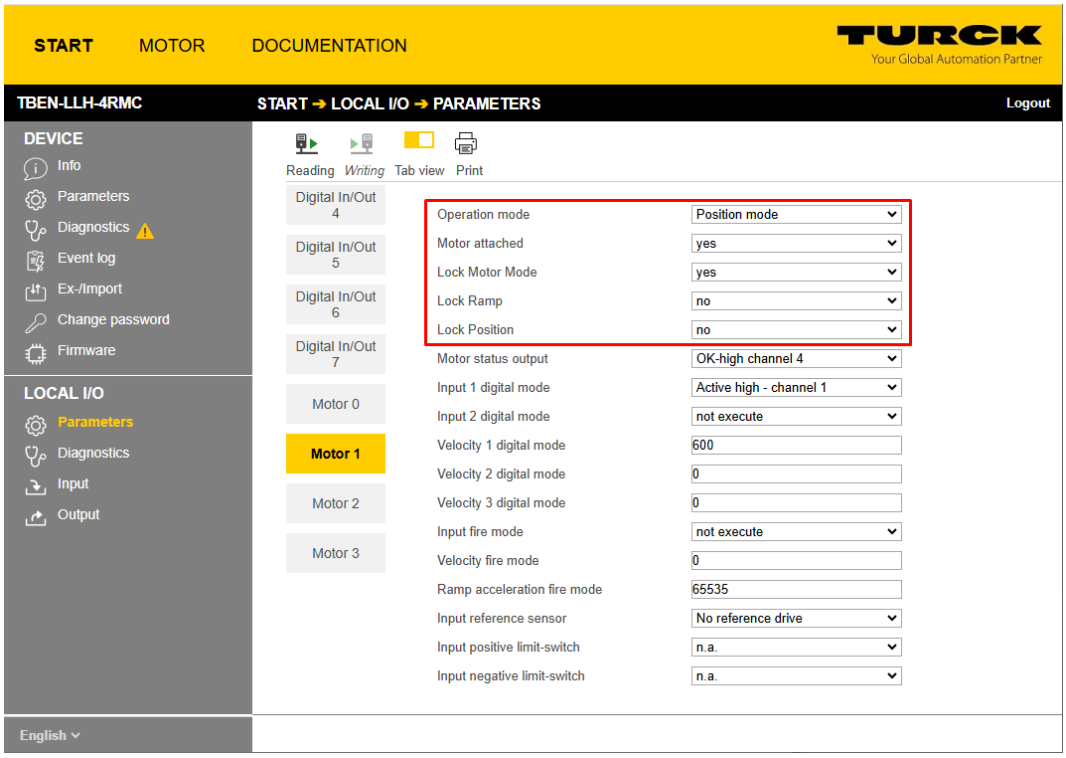


Fig. 45: Parameters for position mode

Setting process output data

- **Set the Velocity** to the desired value, here 1000 mm/s.
- **Set the Position** to the desired value, here 50000 mm
- Optional: **Set Ramp acceleration** and **Ramp deceleration** to the desired value, here 200 mm/s^2.
- **Set Enable** to **yes** (1).

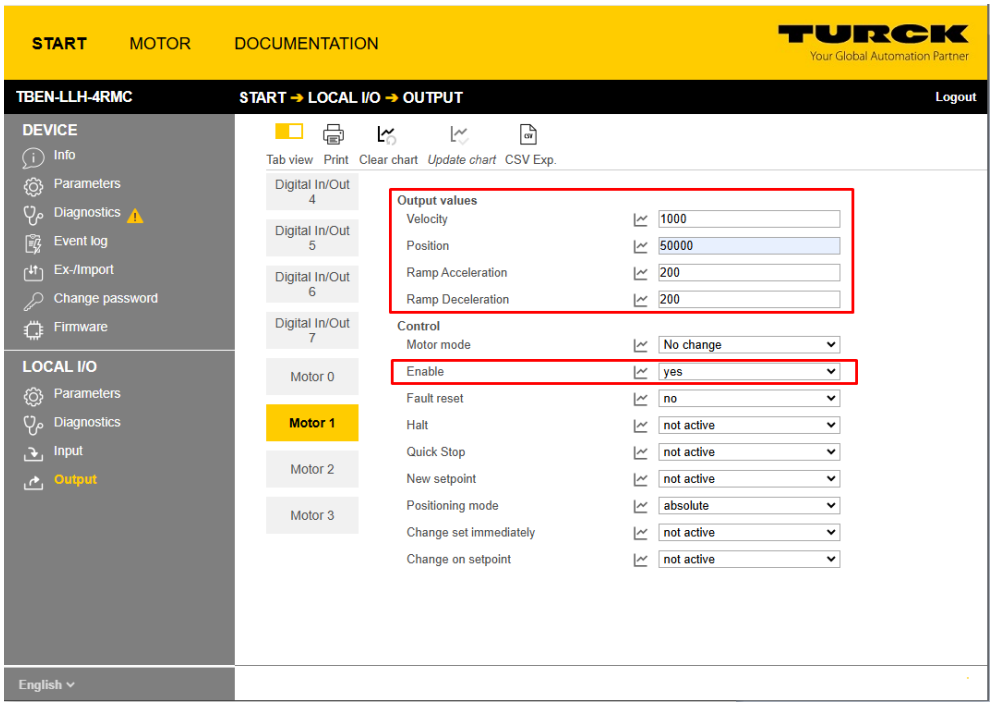


Fig. 46: Process output data for position mode

- **Set New setpoint** to **active** (0 → 1) to accept the new position.
- **Set New setpoint** (1 → 0) .

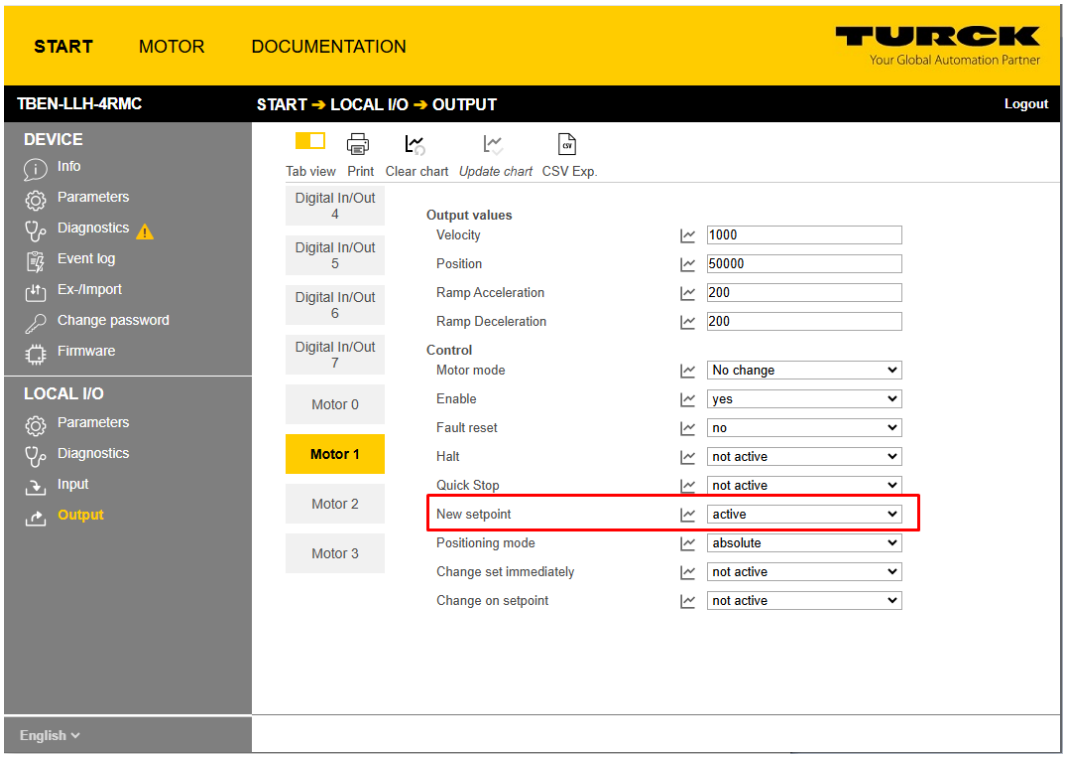


Fig. 47: Accepting the setpoint for position mode

- ▶ Optional: **Activate Change set immediately** to start the next positioning immediately. All other positions are overwritten. **Activate Change on setpoint** to save an additional position that is approached after the first defined position has been reached.
- ⇨ The motor stops at the defined position.
- ⇨ Process input data: Bit **Target reached** (R) = 0, the positioning is not yet complete.

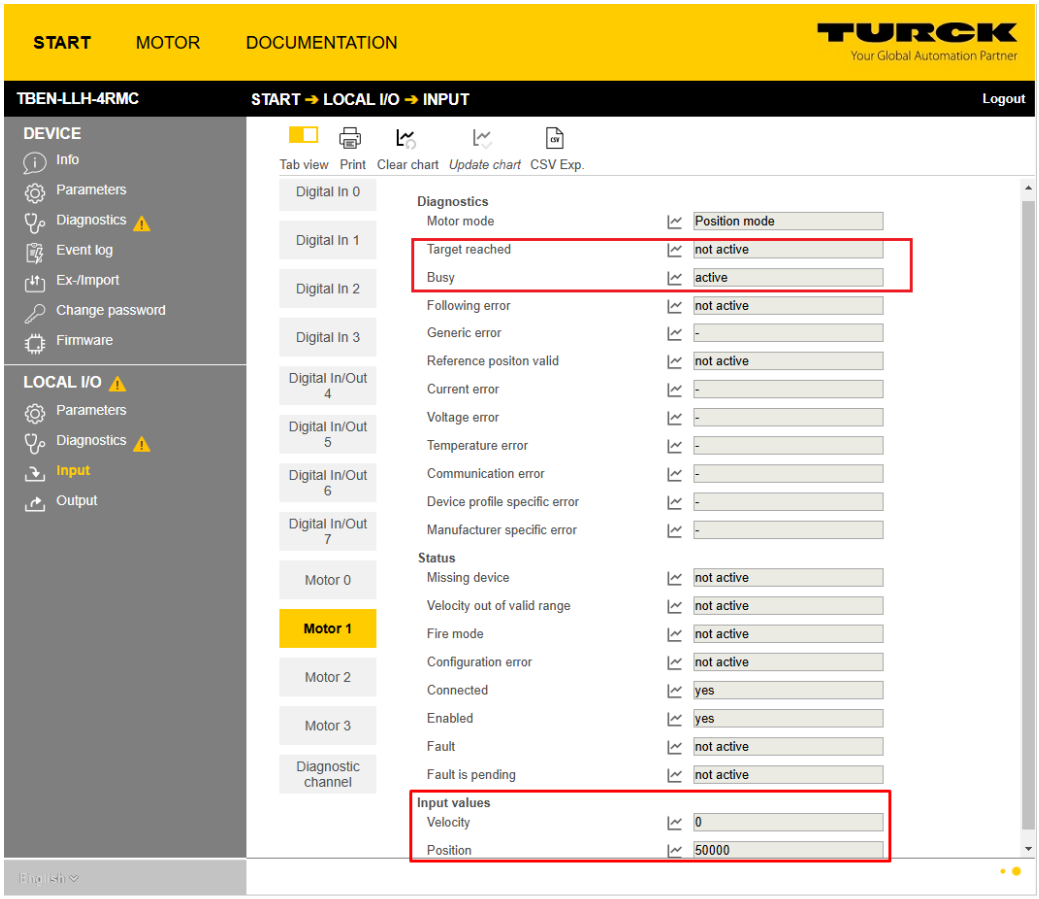


Fig. 48: Position in process input data

➪ Process input data: Bit **Target reached** (TR) = 1, a new positioning can be activated.

8.2.3 Configuring the homing mode

The following parameters [▶ 80] and process output data [▶ 109] must be set for the homing mode.

Setting parameters

- ▶ Set **Operation mode** to **Position** (1).
- ▶ Set **Motor attached** to **yes** (1) to activate the channel.
- ▶ Set **Lock motor mode** to **no**.
- ▶ Write the values to the device using the **Write** button.

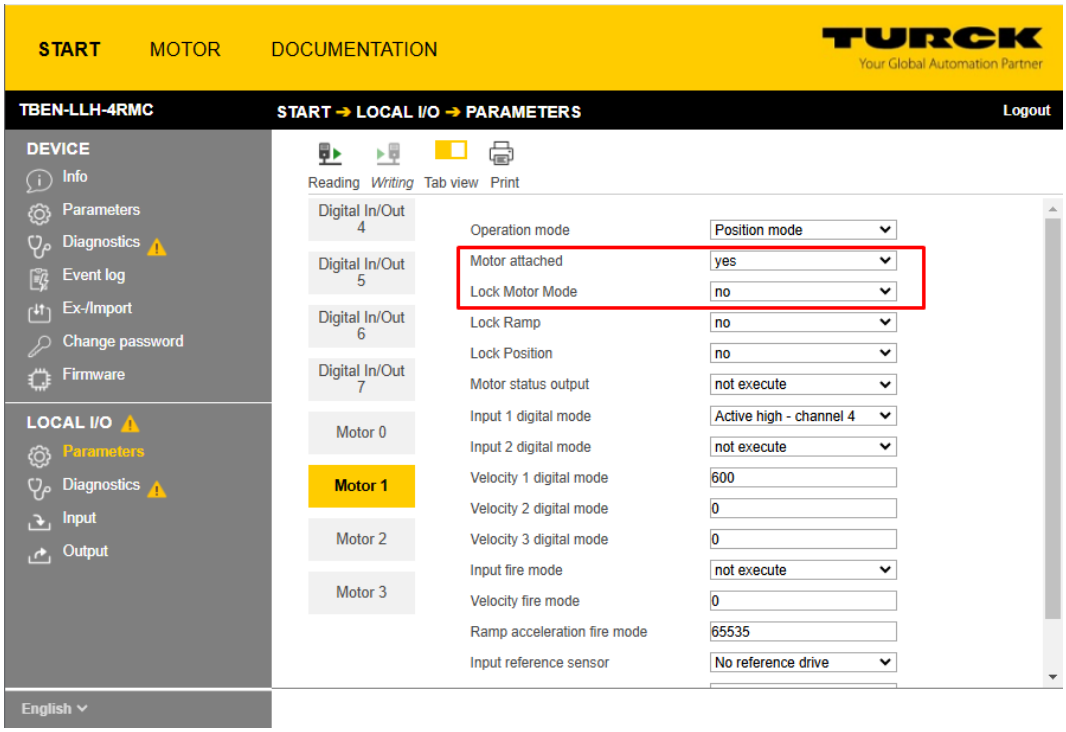


Fig. 49: Parameters for homing mode

Setting process output data

NOTE
The **output values** for velocity, position etc. have no influence in homing mode.

- Set **Motor mode** to **Homing**.
- Set **Enable** bit to **yes**.
- Set **New setpoint** to **active** to define the actual position as the new zero position.

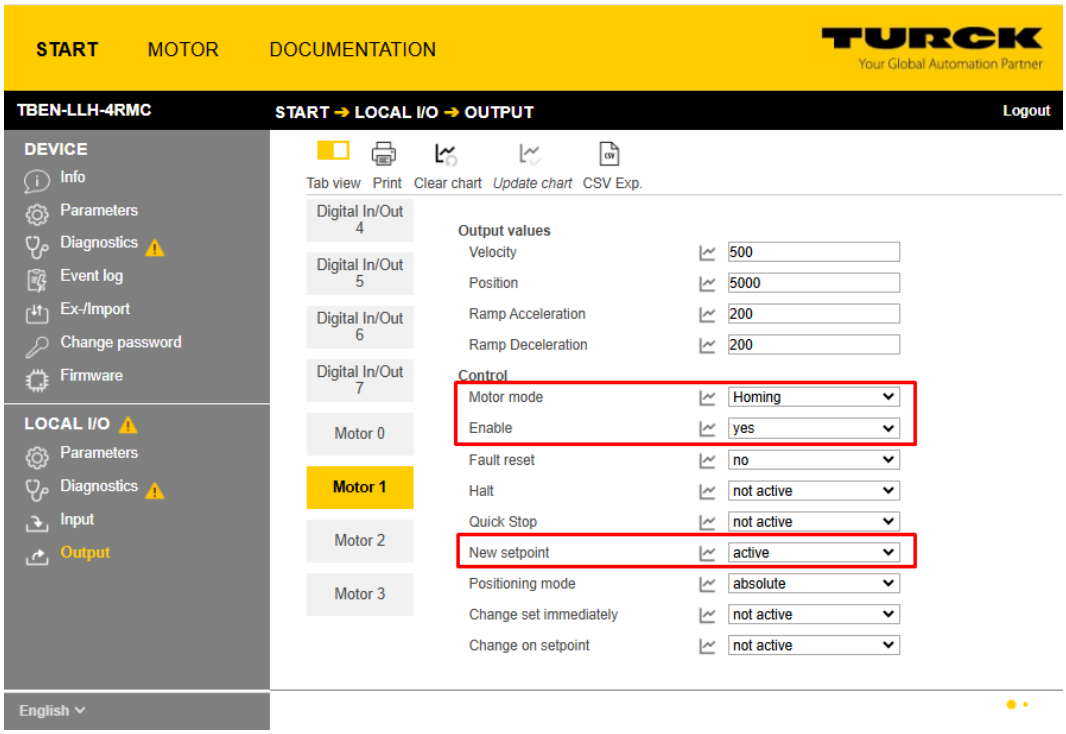


Fig. 50: Process output data in homing mode

⇨ The actual position is set as new zero position.

▶ Set **New setpoint** to **not active** (1 → 0) to complete the homing.

⇨ Process input data: Bit **Target reached** (TR)= 1 → the zero position has been set.

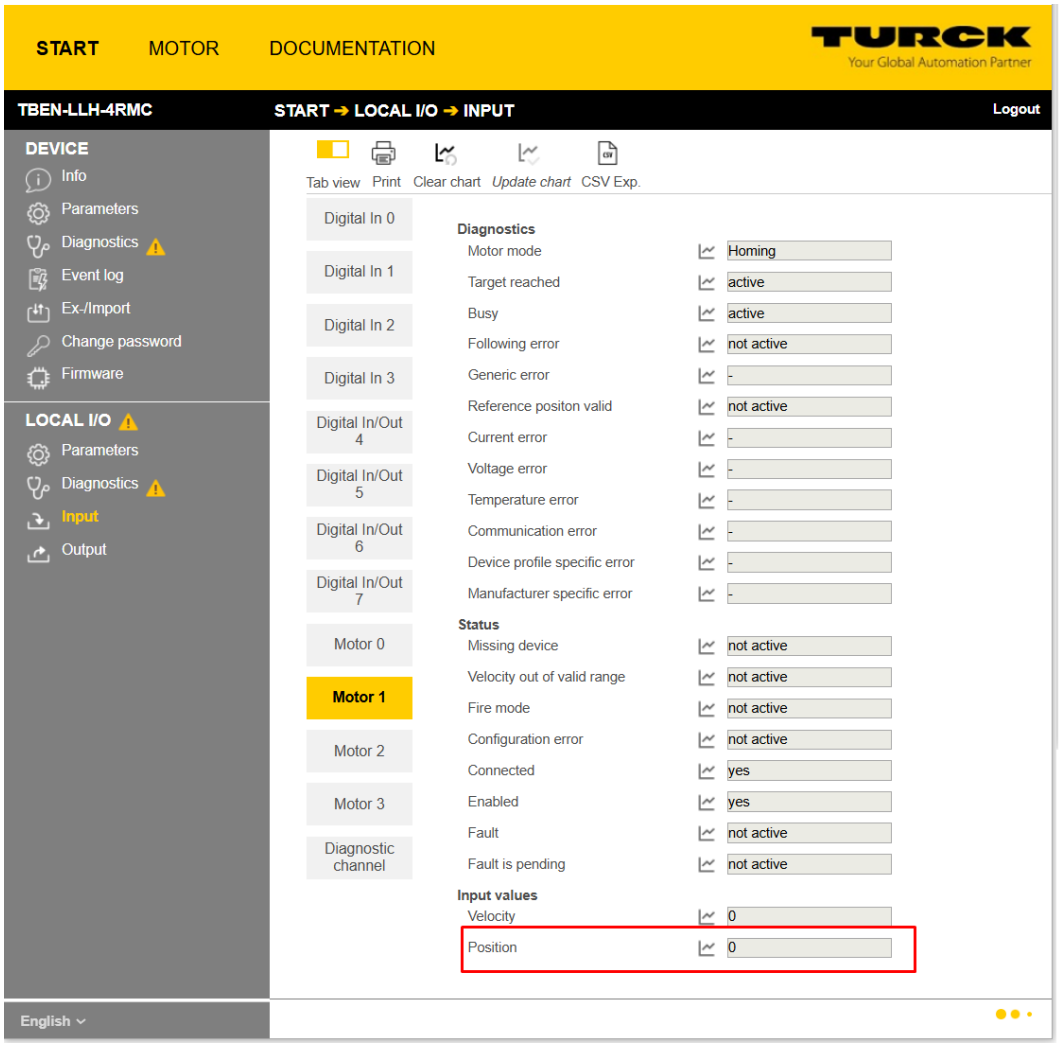


Fig. 51: Process input data with new zero position

8.2.4 Configuring the digital mode

In digital mode, the speed at which the motor runs depends on the parameters **Input 1 digital mode** and **Input 2 digital mode.**

Example configuration

Example	Input 1 digital mode	Value at channel	Input 2 digital mode	Value at channel	Velocity
1	**Active high** – channel 5	0	Not execute	Not relevant	Motor standstill
		1			Velocity 1
2	Not execute	Not relevant	**Active high** – channel 6	0	Motor standstill
				1	Velocity 2
3	**Active high** – channel 5	0	**Active high** – channel 6	0	Motor standstill
		1		0	Velocity 1
		1		1	Velocity 3
4	**Active high** – channel 5	0	**Active Low** – channel 6	0	Velocity 2
		1		0	Velocity 3
		1		1	Velocity 1

The following parameters [▶ 80] must be set for the digital mode.

Setting parameters (for example 1)

- Set **Operation mode** to **Digital mode** (13).
- Set **Motor attached** to **yes** (1) to activate the channel.
- Set the values for **Ramp acceleration** and **Ramp deceleration**. In digital mode, the ramps cannot be adapted dynamically via the process data.
- Optional: Set **Lock Motor Mode** to **yes** (1), to prevent the motor mode for the relevant channel from being changed in the process output data.
- Optional: Define the output **Motor status output** via which the motor status is reported.
- Use **Input 1 digital mode** and **Input 2 digital mode** to define which signal at which input of the device starts the digital mode and at what speed **Velocity … digital mode** the motor runs in digital mode [▷ 12]. In the following example, the motor starts with a positive signal on channel 5 and runs at the speed **Velocity 1 digital mode** (600 mm/s).
- Write the values to the device using the **Write** button.

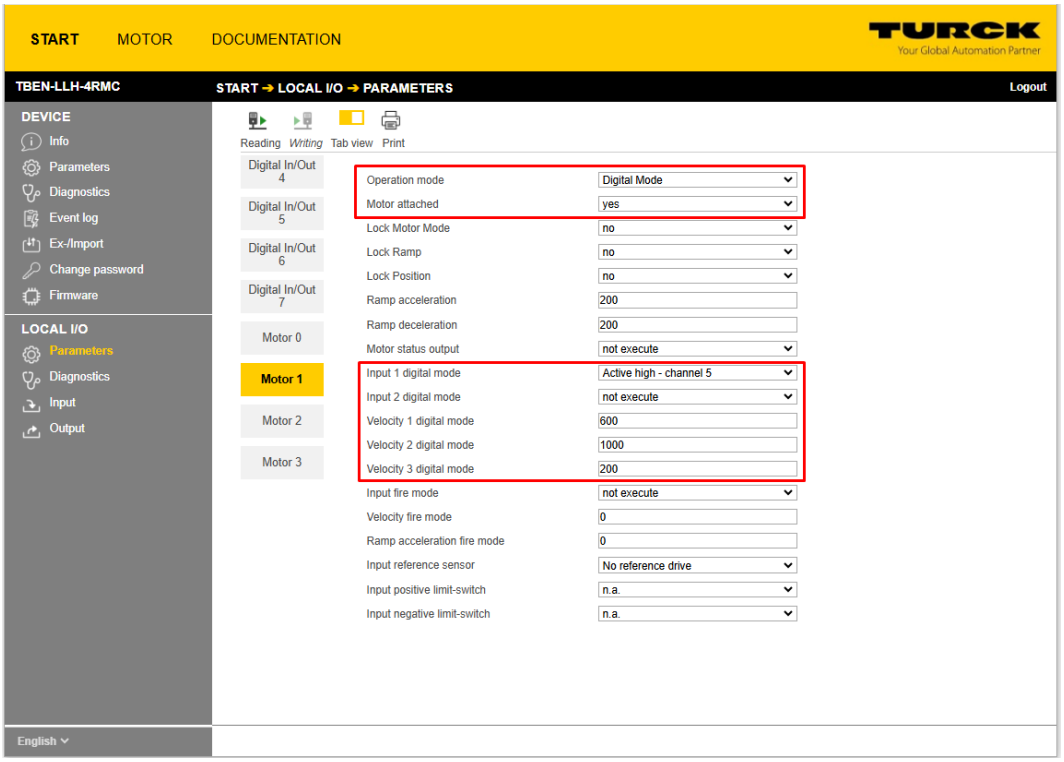


Fig. 52: Parameters for velocity mode

➪ With a positive signal on channel 5, the motor starts immediately with the speed **Velocity 1 digital mode** (600 mm/s).

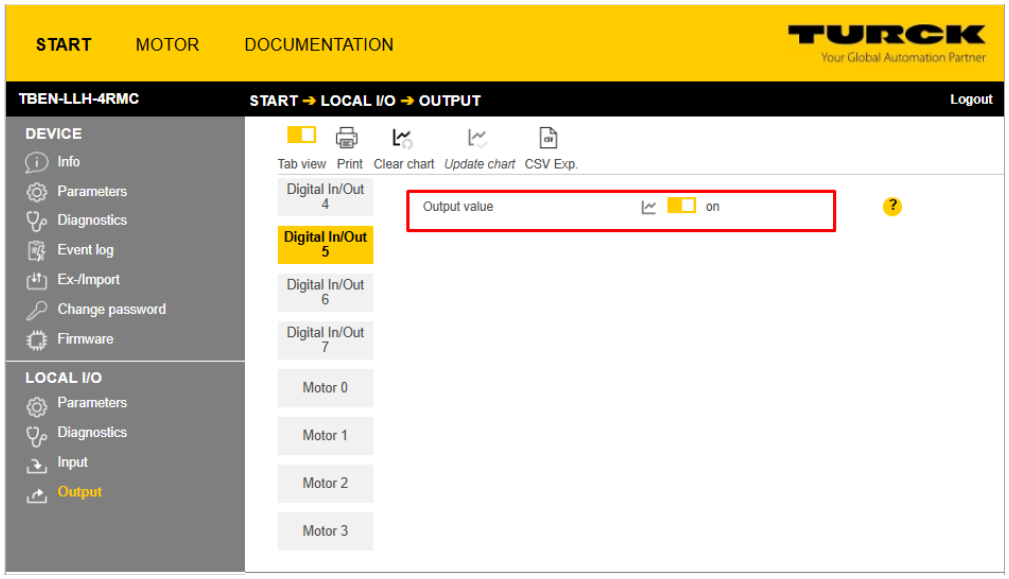


Fig. 53: Active high signal at channel 5

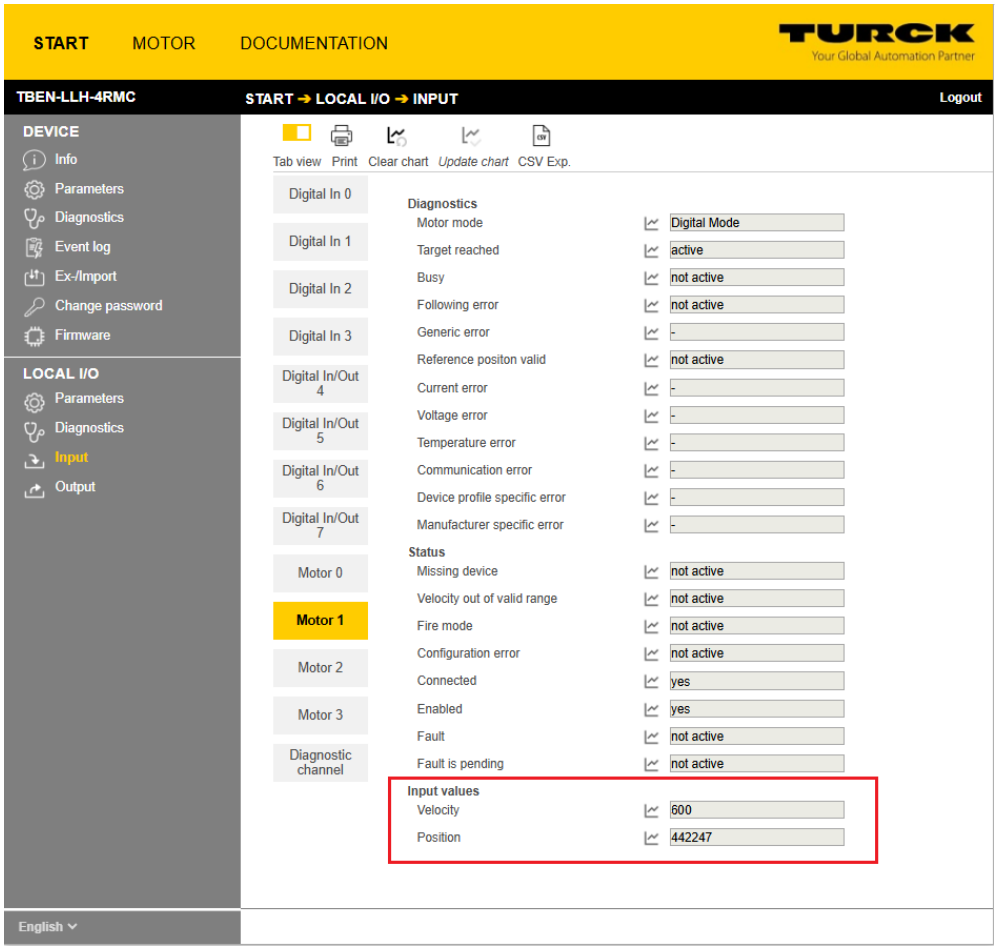


Fig. 54: Process input data for digital mode

8.2.5 Configuring the referencing

Referencing is used in positioning mode, for example, to perform a reference run during operation.

Setting parameters

- **Operation mode Position mode**.
- Set **Motor attached** to **yes** (1) to activate the channel.
- Set **Lock Motor Mode** auf **no** (0) to allow referencing to be started via the process output data.
- Use **Input reference sensor** to define how referencing is started (here: **Positive edge – channel 5**, i.e. referencing is performed on a positive edge on channel 5).
- Optional: Specify the channels to which the limit switches are connected under **Input positive/negative limit switch**.
- Write the values to the device using the **Write** button.

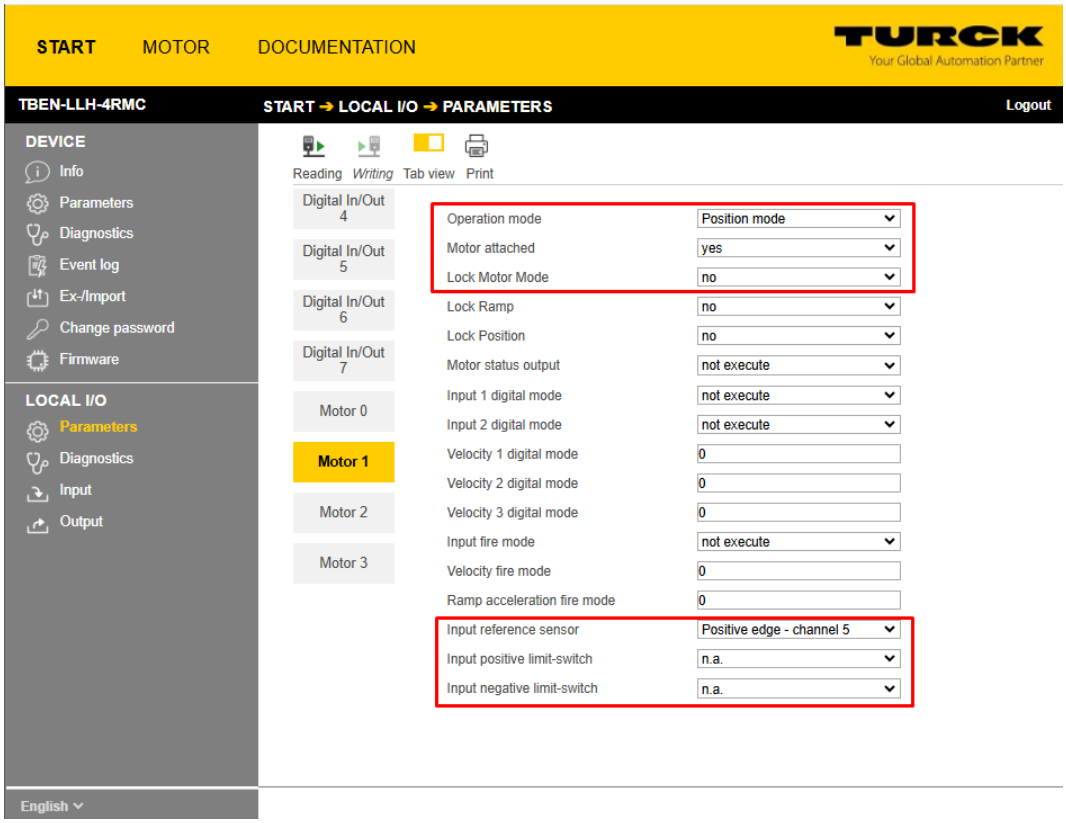


Fig. 55: Parameters for referencing

Setting process output data

- Set **Motor mode** to **Referencing**.
- Define the **Velocity** here 200 mm/s.
- Optional: Enter a reference position to which the motor should move after reaching the limit switch (here: 200) under **Position**.
- Optional: Set the values for **Ramp acceleration** and **Ramp deceleration**.
- The values are applied immediately.
- Set **New setpoint** to **active** to start the referencing.
  Note: If the **New setpoint** bit is reset before referencing is completed, referencing is canceled.

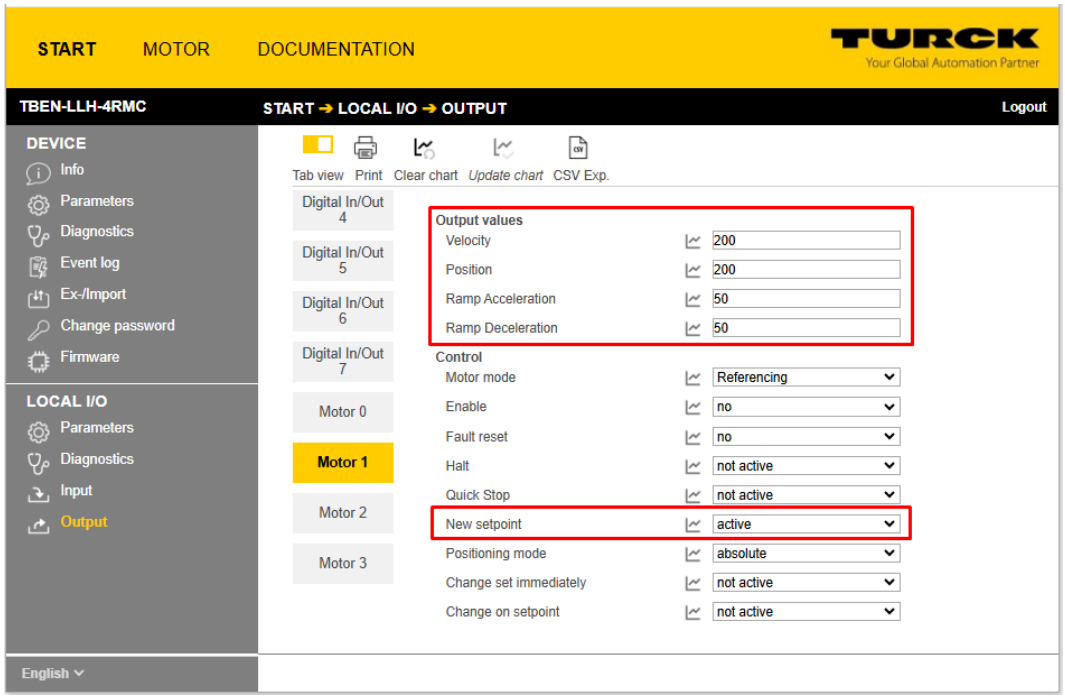


Fig. 56: Process output data for position mode

- ⇨ The position of the motor is set to 0 as soon as a positive edge is detected at the reference sensor. The motor then moves on to the defined absolute **Position**, in this case: 200.
- ⇨ When this position is reached, the position is reset to 0 and immediately serves as the new reference position.

8.3 Configuring the fire mode

The fire mode overwrites all other motor modes when activated. The following parameters [▶ 80] must be set for fire mode Motor modes: fire mode

Setting parameters

- **Set Motor attached** to **yes** (1) to activate the channel.
- Define **Velocity fire mode** as well as **ramp acceleration fire mode** .
- Define the digital input and the signal level that activate the fire mode (here: active high signal on channel 5) under **Input fire mode**.
- Write the values to the device using the **Write** button.

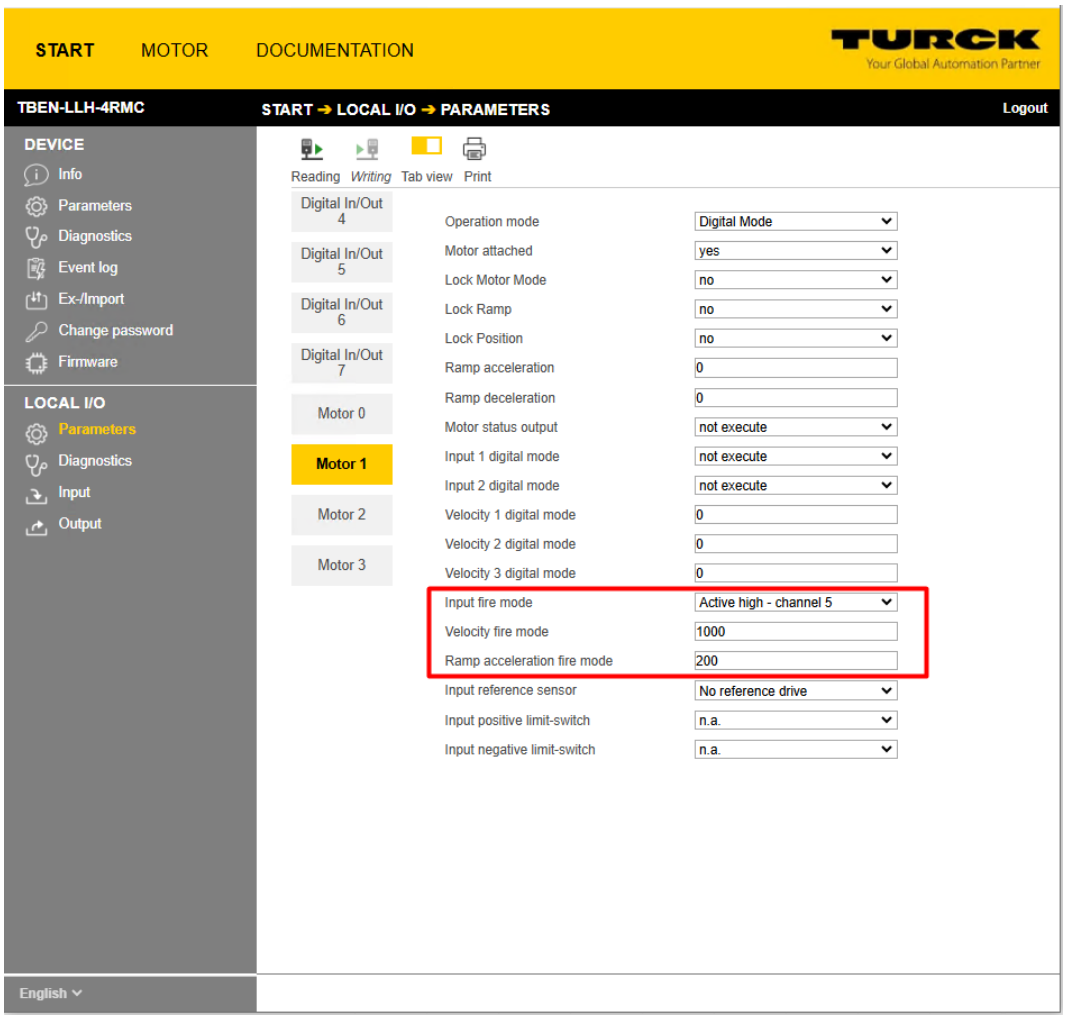


Fig. 57: Parameters for fire mode

➪ An active high signal on channel 5 immediately activates the fire mode, i.e. the motor starts immediately with the specified speed and the defined acceleration. All other settings of will be ignored.

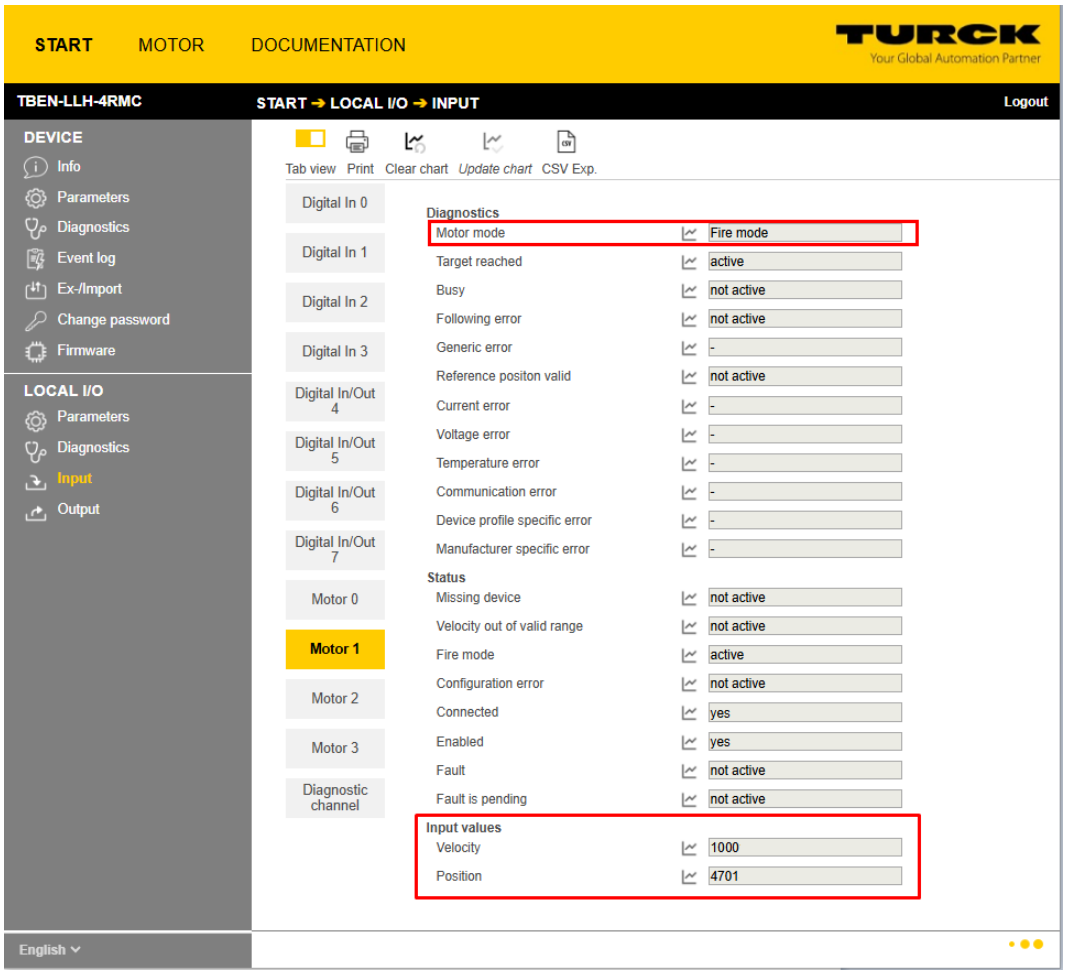


Fig. 58: Process input data for fire mode

NOTE
To switch from fire mode back to another motor mode, the fire mode has to be deactivated, i.e. the parameter **Input fire mode** must be deactivated (not execute) or the **Velocity fire mode** must be 0.

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			
				REF-POS_OK	F_ER	BUSY	TR				
		1	0x01	Diagnostics – Error Register							
				MSERR	-	DPSERR	COM ERR	TERR	VOLT ERR	CURR ERR	GERR
2	0x02	2	0x02	Status							
				FAULT_ PENDING	FAULT	ENABLED	CON	CFGERR	FIRMOD	VELEXC	MISDEV
		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	-	FCE	-	-	-		V1	-
		1	0x01	V2	-		-	-		ARGEE	DIAG

Meaning of the process data bits

Name	Value	Meaning
DI…	Digital input	
	0	No signal at DI (pin 4, SIO)
	1	Signal at DI (pin 4, SIO)
DXP…	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 [▶ 80]	
	0	No change
	1	Position mode
	3	Velocity
	6	Homing
	13	Digital mode
Status position (only for motor mode position)		
Target reached TR	0	Target not reached.
	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		The bit corresponds to the **Set-point acknowledge bit** in the CANopen status word (object 0x6041) of the device profile.
	0	0 = new position accepted
	1	1 = new position not accepted
Following error (F_ER)	0	No error
	1	Following error according to "CANopen – Drives and Motion Control Device Profile" The actual value of the position is outside the permissible range
Reference position valid REF-POS_OK	0	Referenzierung operation not yet completed
	1	Referencing successful The bit is reset to 0 as soon as a new reference movement is started.
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)		

Name	Value	Meaning
Status		
Missing device (MISDEV)	0	No error
	1	Parameter **Motor attached** [▶ 80] at the channel is set, but no motor is detected.
Velocity out of valid range (VELEXC)	0	No error
	1	The velocity defined in the output data exceeds the maximum velocity of the connected motor.
Fire mode (FIRMOD)	0	No error
	1	Fire mode at morot channel
Connected (CON)	0	No error
	1	Motor connected to channel and in Operational state (acc. to CANopen basic profile), CANopen communication established, PDO transfer taking place, CANopen Drives profile not yet activated
Configuration error (CFGERR)	0	No error
	1	Reference run with limit switch selected (**input reference sensor parameter** = 1= **Neg. to pos. edge – pos. limit switch** or 2 = **Neg. to pos. edge - neg. limit switch** [▶ 80]), but no input for the limit switch parameterized (parameter **Input positive limit switch** Or **Input negative limit switch**). Prerequisite: The referencing has been started by a positive edge in bit **NSP (New setpoint)** [▶ 109].
ENABLED	0	No error
	1	Connected motor ready for operation, CANopen communication running Prerequisite: ■ **ENABLE** The bit in the process output data is set. ■ Motor error-free, input bit **FAULT** = 0.
Error (FAULT)	0	No error
	1	CANopen Drives error (Drive in Fault State) Motor in the **FAULT state.** Possible causes: ■ Drive blocked ■ Load on drive too high The FAULT state can only be reset via an error acknowledgment with the **FAULT_RST** output if the cause of the error has been eliminated.
FAULT_PENDING	0	No error
	1	Specific for Interroll RollerDrive EC5000 BI: Cause of error not yet eliminated, error cannot be reset.
Velocity		Current speed
Position		Current position
Sensor supply and digital channels (diagnostics)		[▶ 114]
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 the 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. Prerequesite 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	Homing	
		13	Digital mode	
		14	Referencing	

Name	Data type	Value	Meaning	Comment
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 process data bit **Positioning mode (ABS_REL)**. In homing mode the absolute position defined there is valid as reference posi-tion.. 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			
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.

Name	Data type	Value	Meaning	Comment
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 withour 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.
Position 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	

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

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

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 transfer, 100 Mbps
Yellow flashing	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:

- Diagnostics of the digital channels (DIP and DXP)
- General module diagnostics

9.4.1 Status- and control word

Status word

Ether-Net/IP/ Modbus	PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Byte 1	V2	-	-	-	-	-	ARGEE	DIAG
Byte 1	Byte 0	-	FCE	-	-	-	-	V1	-

Bit 7	Description
ARGEE	ARGEE program running
DIAG	Diagnostic message at the device
FCE	The DTM force mode is activated, the output states may no longer correspond to the specifications sent by the fieldbus.
V1	V1 or V2 too low
V2	

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

NOTE
In EtherNet/IP the mapping can be deactivated via the Gateway Class (VSC 100). Activating or deactivating the status and control word modifies the process data mapping.

Control Word

The control word has no function.

9.4.2 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							
Error register (only Modbus and EtherNet/IP)											
2	0x02	4	0x04	MSERR	-	DPSERR	COMERR	TERR	VOL-TERR	CURRERR	GERR
		5	0x05	Reserved							

Meaning of diagnostic bits

Diagnostics	Meaning	Comment
VAUX1 pin1 Xx Slot Ch (y/z)	Overcurrent VAUX1 (pin1) at connector (channel group)	
ERR_DXP…	Overcurrent at output	DXP channel used as output
Error register	See Process input data [▶ 106]	

9.4.3 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, ch 0/1	X0	0x0600	0
Overcurrent VAUX1 (pin 1) at X1, ch 2/3	X1	0x0601	
Overcurrent VAUX1 (pin 1) at X2, ch 4/5	X2	0x0602	
Overcurrent VAUX1 (pin 1) at X3, ch 6/7	X3	0x0603	

Motor channel diagnostics			**PROFINET diagnostics**	
	Error description, s. [▶ 115]	**Connector**	**Error code**	**Channel**

Motor channel diagnostics			PROFINET diagnostics	
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.		1608 (0x0648)	
Motor 2		X5		
similar to port 1				
Motor 3		X6		
similar to port 1				
Motor 4		X7		
similar to port 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(H)-4RMC must be supplied with both V1 and V2 [▷ 18].
- ▶ Check the configuration of the motor channel.
  The parameter **Motor attached (MOT_ATT)** [▷ 80] 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 [▷ 109].
- ▶ 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 regularly that the plug connections and cables are in good condition.

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

11.1 Updating the firmware via TAS

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

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

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

Starting a firmware update for a device

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

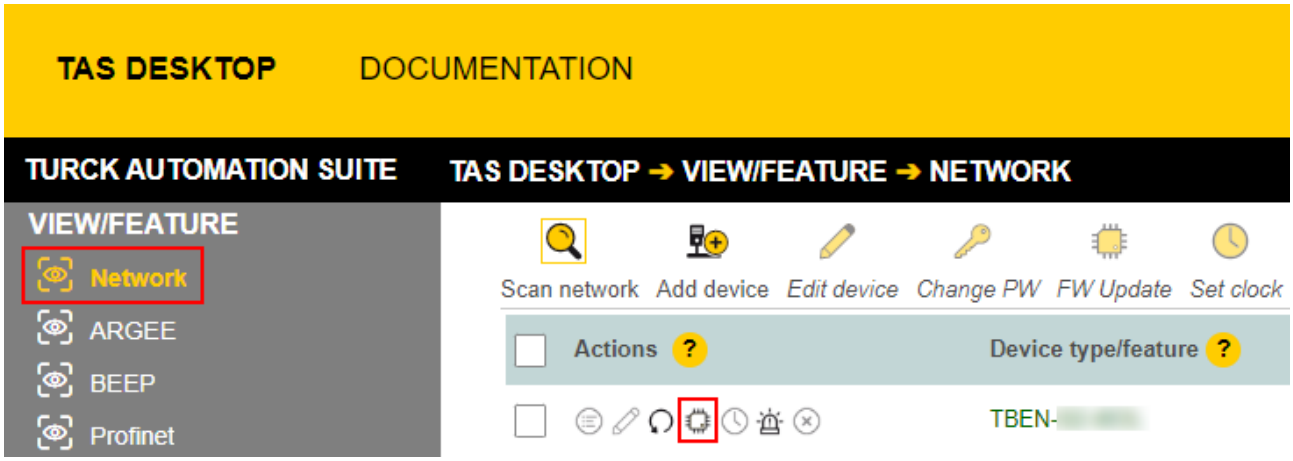


Fig. 59: Firmware update network view

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

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

Starting a firmware update for multiple devices

- In the network view, check the box for all desired devices.
- Click **FW update** in the header.

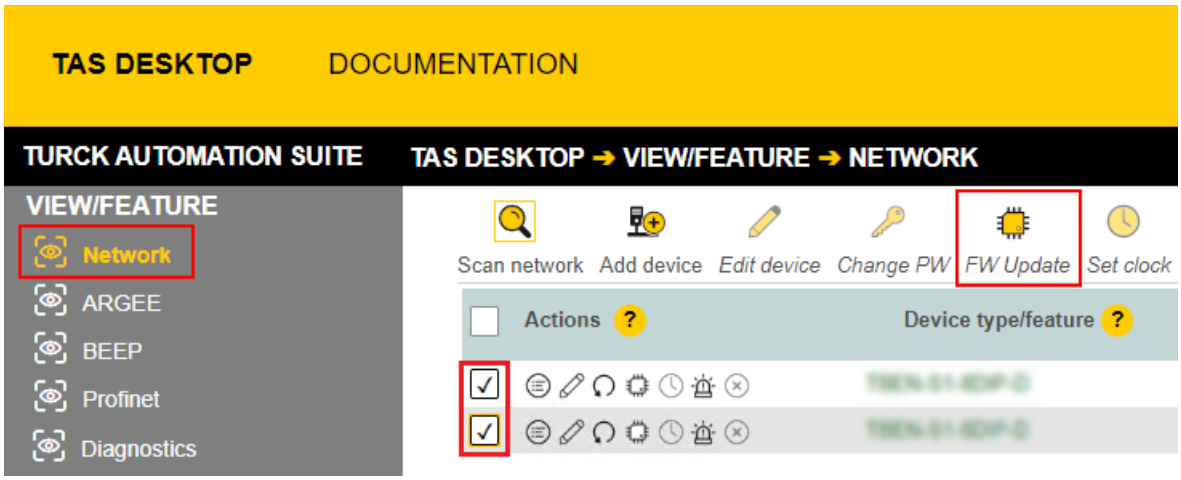


Fig. 60: Firmware update network view multiple devices

NOTE
For multiple devices of the same type, a global password can be set, which can be used to unlock all selected devices directly. This requires that all selected devices have the same device password and are in the same TCP network.

- Enter a global or device password. The default password is ”password”.
- Click **LOG IN**.
- Click **SELECT FILE**.
- Open the directory of the firmware file.
- Select a new firmware file and load it by clicking **Open**.
- Click **START** to start the firmware update.

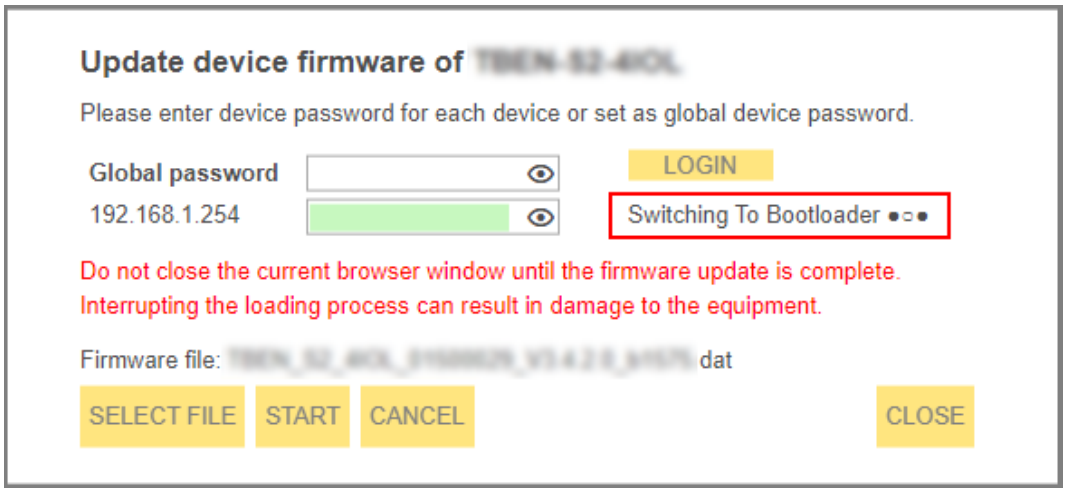


Fig. 61: Firmware update progress

➪ The progress of the firmware update is displayed.

11.2 Updating the firmware via web server

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

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

- Open the web server.
- Log on to the device as administrator. The default password for the web server is “password”.
- Click **Firmware** → **SELECT FIRMWARE FILE**.
- Select the new firmware file and load it via **Open**.

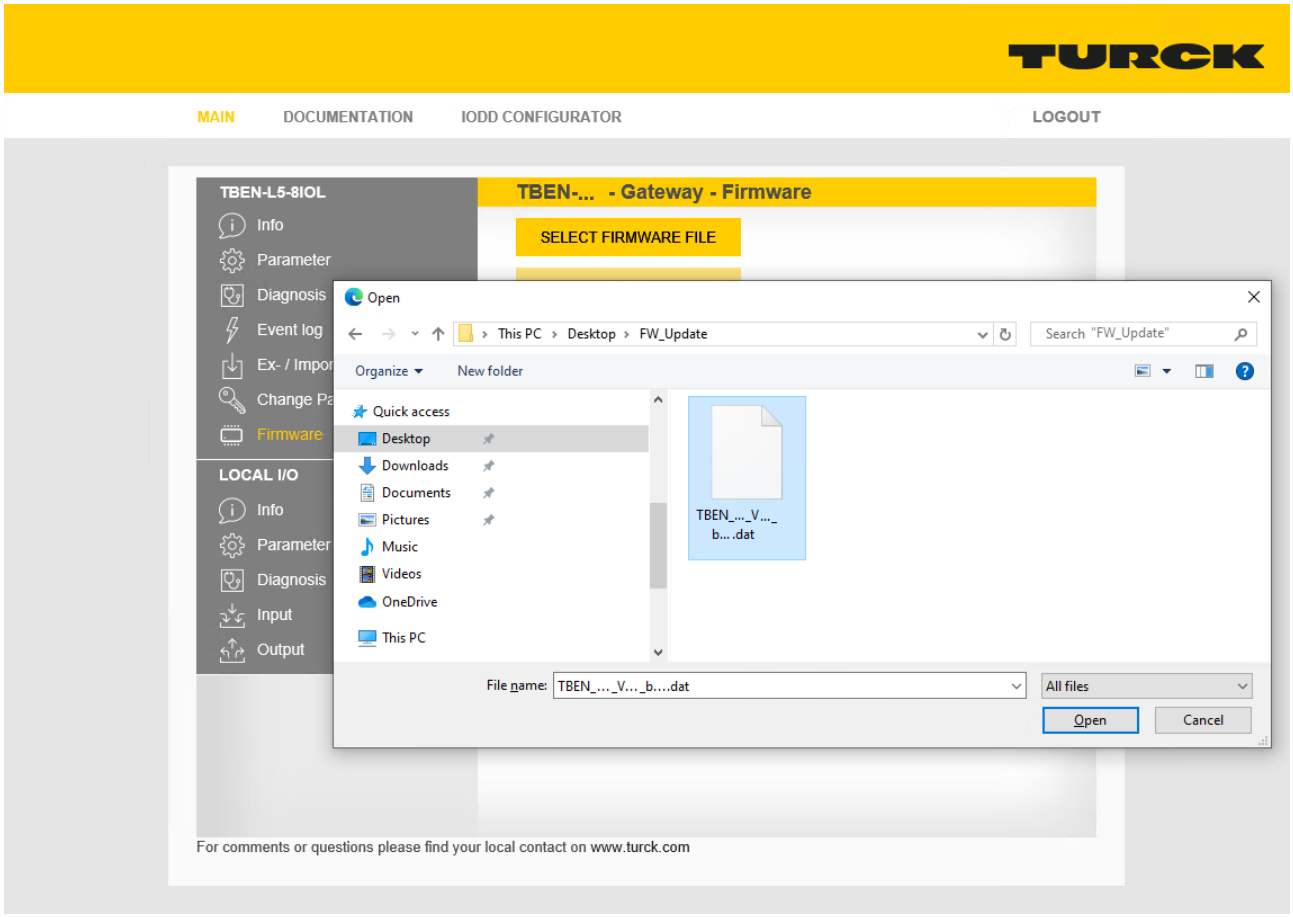


Fig. 62: Webserver – Selecting the firmware file

▶ Click **Update Firmware** and start the update.

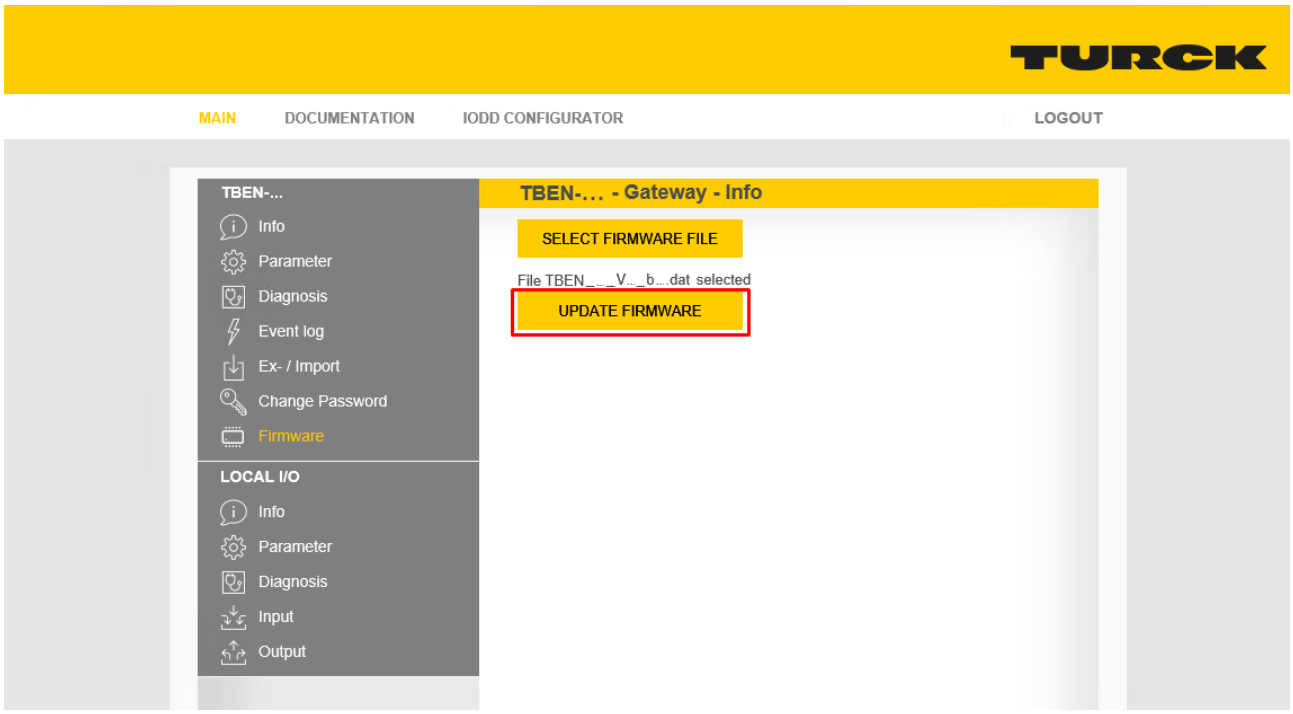


Fig. 63: Webserver – Starting the firmware update

➪ The progress of the firmware update is displayed.

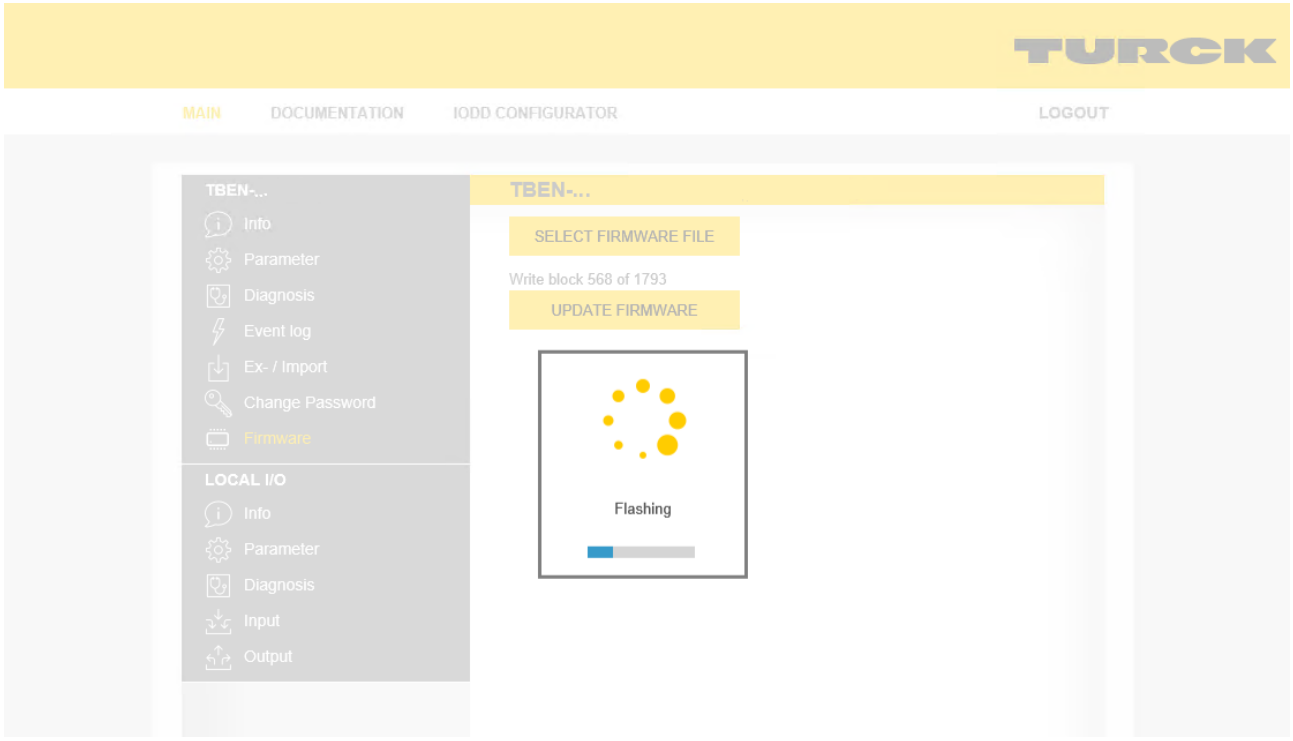


Fig. 64: Webserver – Firmware update running

▶ Restart the device after the update process has been completed.

12 Repair

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

12.1 Returning devices

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

13 Disposal

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

14 Technical data

Technical data	
Supply	
Supply voltage	
■ TBEN-LLH-4RMC	V1: 24 VDC V2: 24 VDC/48 VDC
■ TBEN-LL-4RMC	V1 and V2: 24 VDC
Permissible range	
■ TBEN-LLH-4RMC	V1: 18…30 VDC V2: 18…56 VDC
■ TBEN-LL-4RMC	V1 and V2: 18…30 VDC
Current feedthrough XD1 to XD2	max. 16 A per voltage group
Threshold or undervoltage diagnostics V1 and V2	According to IEC 61131 24 VDC - 15 %, with an accuracy of 5 %
Power consumption	
Operating current (at 24 VDC nominal voltage)	< 120 mA (outputs inactive)
Operating current	■ V1: 120…180 mA ■ V2: 90…40 mA At 20 °C (operating temperature) V1: 24 VDC, 80 mA V2: 48 VDC, 20 mA V2: 24 VDC, 40 mA Operating conditions: ■ All outputs active, no load ■ Ethernet connection 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, voltage proof 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. line length	
■ Ethernet	100 m (per segment)

Technical data	
Isolation voltages	
V1 to V2	≥ 500 VAC
V1/V2 to the fieldbus	≥ 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
Field Logic Controller (FLC)	
Released as of ARGEE version	3.2.217.0
Modbus TCP	
Address assignment	Static IP, DHCP
Supported Function Codes	FC3, FC4, FC6, FC16, FC23
Number of TCP connections	8
Input register start address	0 (0x0000)
Output register start address	2048 (0x0800)
Local port	Port 502, fix 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
Configuration Assembly Instance	106
PROFINET	
PROFINET specification	V 2.35
Conformance Class	B (RT)
Address assignment	DCP
MinCycle 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

Technical data	
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
Max. input frequency	100 Hz (for field bus communication)
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
Electromagnetic compatibility	According to EN 61131-2
Approvals and certificates	CE, FCC

Technical data	
UL certificate	cURus Recognized Component E517268, IND.CONT.EQ For installation and use see „Conditions of Acceptability”.
General Information	
Dimensions (w × l × h)	60.4 × 230.4 × 39 mm
Operating temperature	-40… +70 °C
Storage temperature	-40… +85 °C
Operating height	Max. 5000 m
Degree of protection	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

Note on FCC

NOTE
This device complies with the limit values for a Class A digital device in accordance with Part 15 of the FCC regulations. Operation of this device in a residential area may cause harmful interference. In this case users must rectify the interference at their own cost.

15 Turck branches — contact data

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