TURCK

Your Global Automation Partner

REM...|RES...
PROFINET Encoder

Instructions for Use

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 Other documents

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

- Data sheet
- EU Declaration of Conformity (current version)
- Quick Start Guide

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 encoders with a PROFINET interface:

- RES-107
- RES-108
- REM-105
- REM-106
- REM-E-105
- REM-E-106

2.2 Scope of delivery

The delivery consists of the following:

- Encoder – sensor
- Quick Start Guide

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.

The contact data for Turck branches is provided at [▷ 45].

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

Encoders with a PROFINET interface are used to measure angular movements. To do this, the devices record mechanical rotary movements and convert them into digital output signals.

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 Obvious misuse

- The devices are not safety components and must not be used for personal or property protection.
- Any use that exceeds the maximum permissible mechanical speed (see technical data) is deemed to be not in accordance with the intended purpose.

3.3 General safety notes

- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- 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.
- If safe operation is no longer guaranteed: Take the device out of operation and ensure that it cannot be switched on again accidentally.

4 Product Description

The encoders in the REM… and RES… product series with PROFINET interface are available as solid shaft or hollow shaft versions. The devices are available in two sizes: 58 and 63 mm (hollow shaft) and 58 and 63.5 mm (solid shaft).

The PROFINET encoders supply the current angle position in digital form using process data objects (PDO).

4.1 Device overview

Fig. 1: Hollow shaft

Fig. 2: Solid shaft

4.1.1 Display elements

The device has five LED displays.

4.1.2 Connection overview

The device has two 4-pin M12 × 1 connections (D-coded) for Ethernet and one 4-pin M12 × 1 connection (A-coded) for power supply.

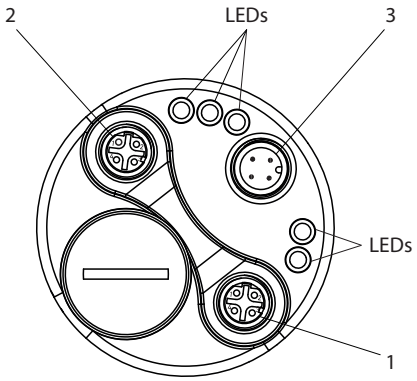


Fig. 3: Overview of connections

Position	Connection
1	Ethernet 1 (M12 × 1, D-coded)
2	Ethernet 2 (M12 × 1, D-coded)
3	Power supply (M12 × 1, A-coded)

4.2 Operating principle

Encoders detect rotational movements, such as the angle velocity of a shaft. Encoders convert the rotational movements into electrical signals. The devices pass on the electrical signals to a higher-level controller for evaluation. Encoders are designed as absolute and incremental encoders with hollow or solid shafts.

Absolute encoders also supply the angle value after a startup if the value has changed when deactivated. Incremental encoders only detect position changes when active by counting periodic patterns. This normally involves the optical scanning of a rotating disk.

4.3 Functions and operating modes

4.3.1 Output function

The device has a PROFINET interface that complies with the following standards:

- RT_CLASS_1
- RT_CLASS_2 (RT)
- RT_CLASS_3 (IRT)
- DCP
- RTA
- LLDP
- SNMP
- MIB-II
- LLDP-MIB
- PTCP
- MRP
- FSU
- Conformance class C
- Application class 6
- Encoder class 4
- Net load class III
- I&M 0…3
- Min. device interval = 250 µs
- Isochronous mode
- Encoder profile V4.2
- PROFIdrive profile V4.2
- Basic web server firmware update and reset

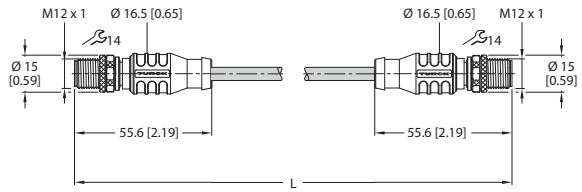
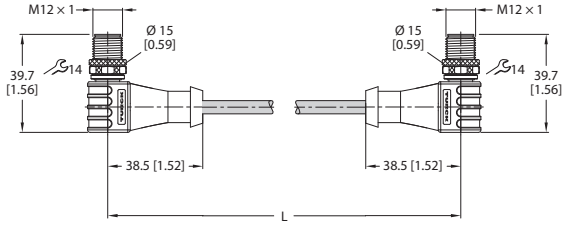
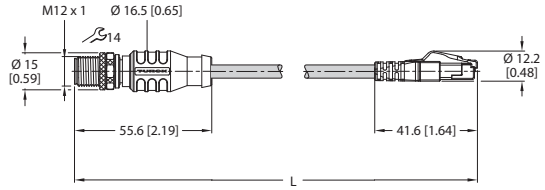
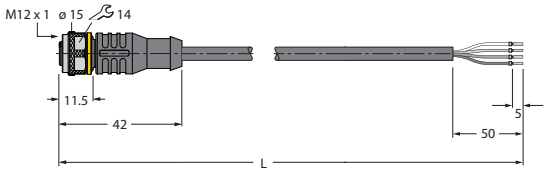
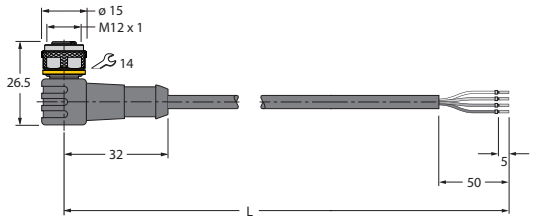
Various device functions can be set and parameterized by using the control software (see "Setting" section). All measured values and parameters can be accessed via the object directory.

4.3.2 Optional PROFINET features

The following overview provides information about the features implemented in the device.

Feature	Description
Network Redundancy with Media Redundancy Protocol (MRP)	Media redundancy protocol provides network ring redundancy for real-time PROFINET I/O networks
System Redundancy	Enables a primary and backup controller for redundant applications with PROFINET
Supervisor Access	Allows an I/O supervisor to take over an I/O device for the purpose of verifying inputs, outputs and device functionality
Extended Device Information (Identification and Maintenance Records 1–3)	Extended Device Identification (Location Designation, Installation Date, etc.)
Simple Network Management Protocol (SNMP)	Allows you to read out simple network management protocols and topology information
Simple Device Replacement	Allows a controller to automatically name a replaced I/O device in the event of device failure and replacement
Fast Startup (FSU)	Fast startup of the device after powercycling for specific applications (e.g. tool changer)
Isochronous Real Time (IRT)	Isochronous real time allows synchronous communication with bandwidth reservation and scheduling up to 250 µs with < 1 µs jitter for motion control applications
Application and Device Profiles	Specific application/device profiles for different applications (e.g. safety, energy, drives) or device data sets for specific device types (e.g. encoders)
Manufacturer-Specific Alarms	Manufacturer-specific PROFINET diagnostic alarms (e.g. redundant power supply error, manufacturer-specific error code)
Link Layer Discovery Protocol (LLDP)	Manufacturer-independent layer-2 protocol. LLDP is enabled by default and is used to facilitate the replacement of defective devices. The new device automatically receives an LLDP alias to log on to the network without programming software. A message is sent every second to neighboring devices in order to carry out self-identification and to transmit network-related information about the device and the type of integration into the respective topology (port description, IP address, device name, etc.). The data can be read out via connected programming software.

4.4 Technical accessories

Dimension drawing	Type	ID	Description
	RSSD-RSSD-4422-2M	6635150	Cable for Industrial Ethernet, M12 male connector, D-coded, straight to M12 male connector, D-coded, straight, cable length: 2 m, jacket material: PUR, green; other cable lengths and versions available, see www.turck.com
	WSSD-WSSD-4422-2M	6635188	Cable for Industrial Ethernet, M12 male connector, D-coded, angled to M12 male connector, D-coded, angled, cable length: 2 m, jacket material: PUR, green; other cable lengths and versions available, see www.turck.com
	RSSD-RJ45S-4422-2M	6635170	Cable for Industrial Ethernet, M12 male connector, D-coded, straight to RJ45 male connector, straight, cable length: 2 m, jacket material: PUR, green; other cable lengths and versions available, see www.turck.com
	RKC4.4T-2/TXL	6625503	Connection cable, M12 female connector, straight, 4-pin, cable length: 2 m, jacket material: PUR, black; cULus approval; other cable lengths and versions available, see www.turck.com
	WKC4.4T-2/TXL	6625515	Connection cable, M12 female connector, angled, 4-pin, cable length: 2 m, jacket material: PUR, black; cULus approval; other cable lengths and versions available, see www.turck.com

5 Installing

NOTICE
Incorrect mounting
Risk of damage to the sensor

- Do not modify or disassemble the encoder.
- Do not make adjustments to the shaft after mounting.
- Do not use a hammer to align the device.
- Avoid impact loads.
- Load the encoder shaft only within the permissible values (see technical data).
- Do not rigidly connect the rotary encoder to shafts and flanges at the same time. Use the coupling between the drive shaft and the encoder shaft or the hollow shaft encoder flange.

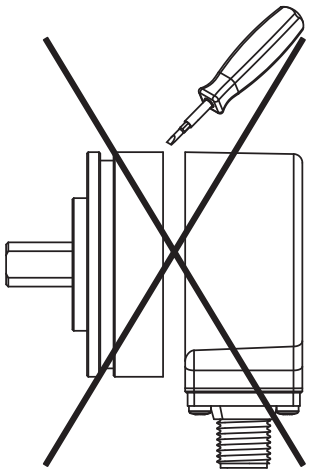


Fig. 4: Mounting view — do not open

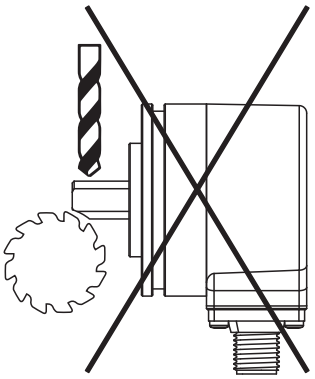


Fig. 5: Mounting view — do not make adjustments after mounting

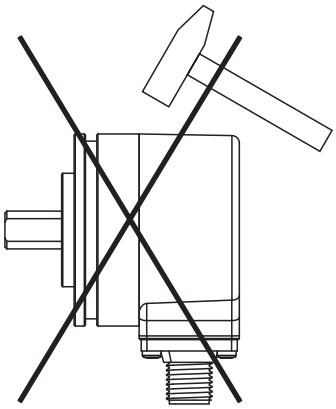


Fig. 6: Mounting view — do not use a hammer to align the device

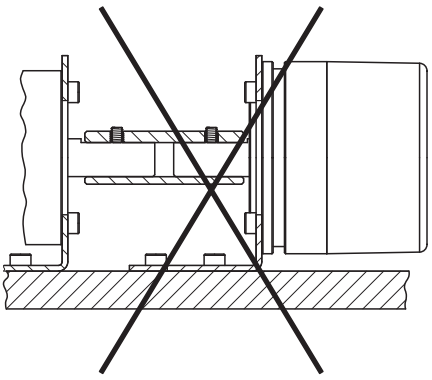


Fig. 7: Mounting view — do not rigidly connect the device to shafts and flanges at the same time

5.1 Installing the solid shaft encoder

- Check shaft for displacement.
- Refer to the technical data for the coupling for the maximum axial displacement, radial displacement, and angular displacement values.

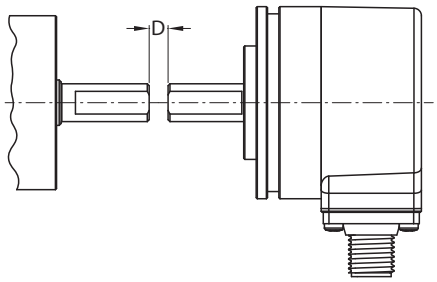


Fig. 8: Axial displacement

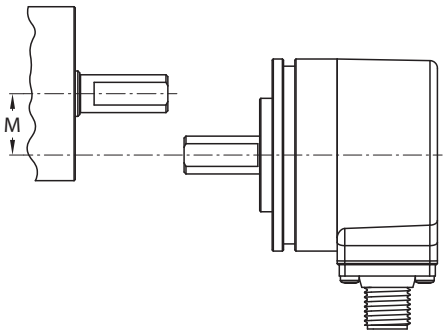


Fig. 9: Radial displacement

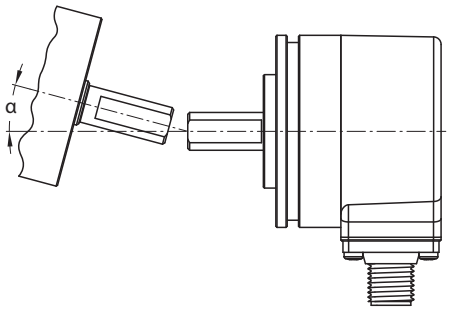


Fig. 10: Angular displacement

- During mounting, protect the coupling against excessive bending and damage.
- Align the coupling on the shaft.
- Secure the coupling on the device using tensioning screws or clamping screws. For the maximum tightening torque, refer to the data sheet of the screws used.

5.2 Installing the hollow shaft encoder

- Slide the encoder onto the shaft.

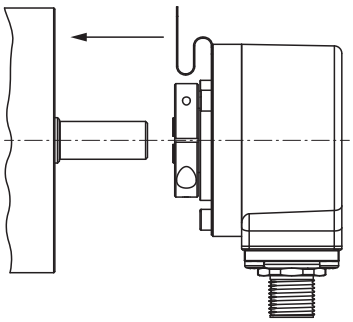


Fig. 11: Sliding the encoder onto the shaft

- Screw the female connector to the drive flange.

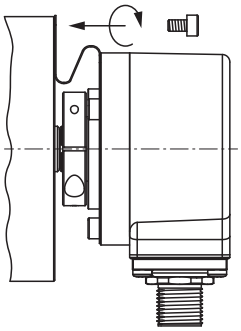


Fig. 12: Screwing the female connector to the drive flange

- Tighten the clamping hub by hand.

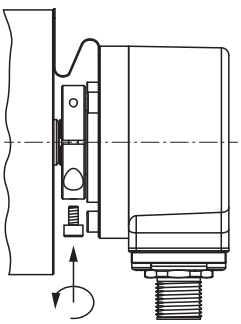


Fig. 13: Tightening the clamping hub

6 Connection

The encoder has two 4-pin M12 × 1 connections (D-coded) for Ethernet and one 4-pin M12 × 1 connection (A-coded) for power supply.

NOTE
Both Ethernet ports come with a plastic cover. If only one of the two ports is being used, the cover must be tightened to 1 Nm to ensure IP protection.

Turck recommends the following cable lengths:

- Between two field devices: max. 100 m
- The maximum distance can be extended by coupled switches.

- ▶ Follow the operating instructions for the connection cable used.
- ▶ Disconnect the encoder from the connection cable only when the encoder is de-energized.
- ▶ Connect the shielding (if present) to the encoder housing.
- ▶ The encoder and processor must always be switched on and off simultaneously.
- ▶ Observe the operating voltage and maximum permissible output current (see technical data).

EMC-compliant installation

- ▶ Use shielded connection cables as control cables.
- ▶ For symmetrical transmission (e.g. via RS422): Use twisted pair cables.
- ▶ Connect protective earth to the rotary encoder and the evaluation unit (low impedance).
- ▶ Route the connection cables separately from cables with high noise levels.
- ▶ Do not connect devices with high noise levels to the encoder's power supply (e.g. frequency converters, solenoid valves, or contactors), or ensure that suitable voltage filtering is in place.

6.1 Wiring diagrams

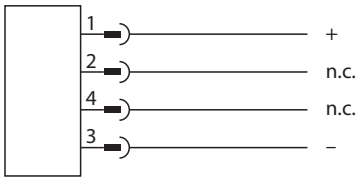


Fig. 14: Wiring diagram for power supply

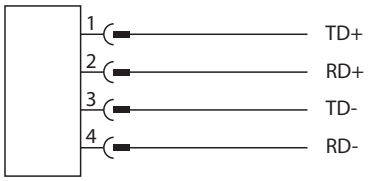


Fig. 15: Wiring diagram for Ethernet

7 Commissioning

Once the cables and the supply voltage are connected, the device automatically goes into operation.

7.1 Connecting the device to a PROFINET master using the TIA Portal

The following example describes the connection of the device to a Siemens controller in PROFINET with the SIMATIC STEP7 Professional V17 programming software (TIA Portal).

Hardware used

This example uses the following hardware components:

- Siemens S7-1500 controller
- PROFINET encoder

Software used

This example uses the following software:

- SIMATIC STEP7 Professional V17 (TIA Portal)
- GSDML file for PROFINET encoder (download free of charge from www.turck.com)

Requirements

- The programming software has been opened.
- A new project has been created.
- The controller has been added to the project.

7.1.1 Installing a GSDML file

The GSDML file is available free of charge for download from www.turck.com.

- Include a GSDML file: Click **Options** → **Manage device description files (GSD)**.

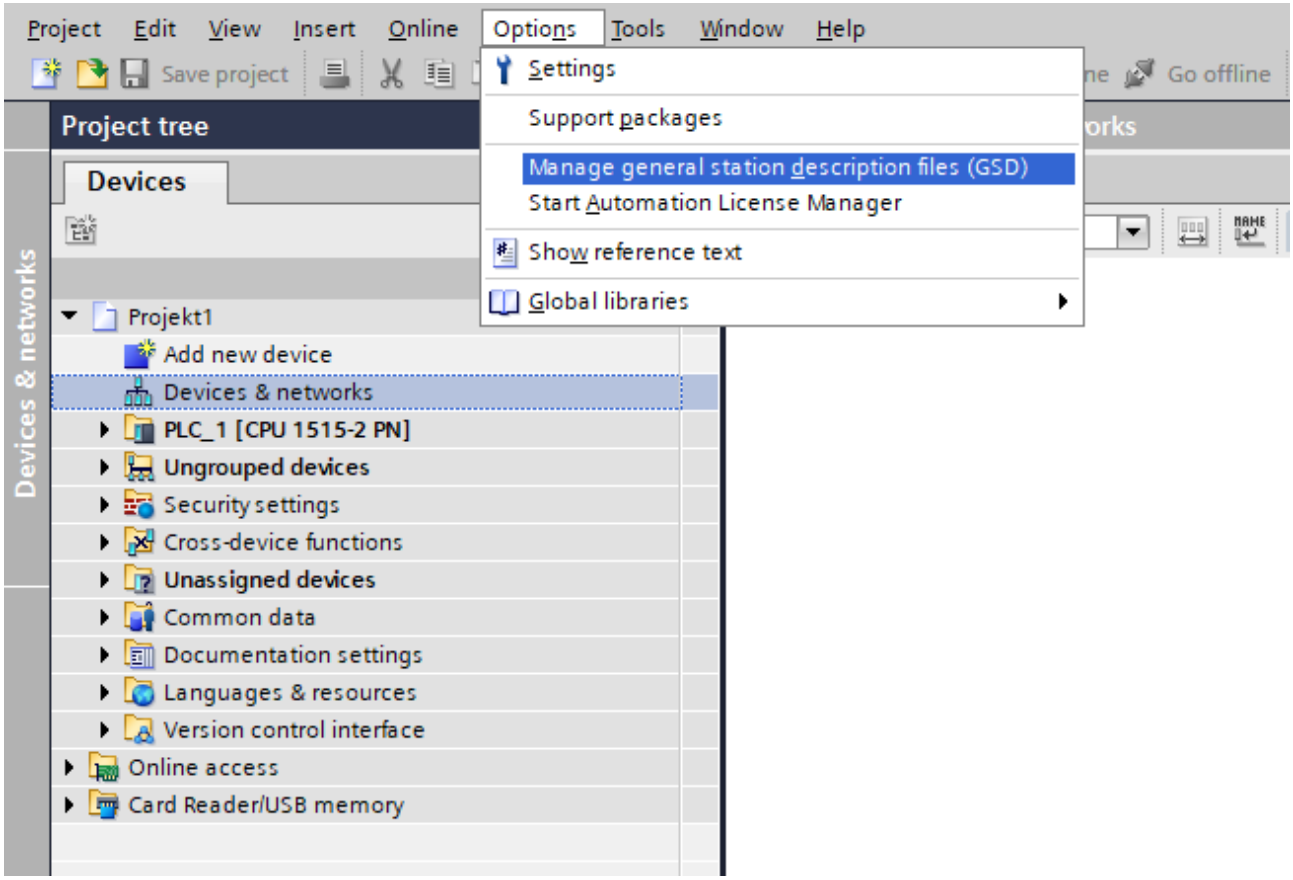


Fig. 16: Manage device description files (GSD)

- ▶ Install a GSDML file: Enter the memory location of the GSDML file and click **Install**.
- ⇨ The device is entered in the hardware catalog of the programming software.

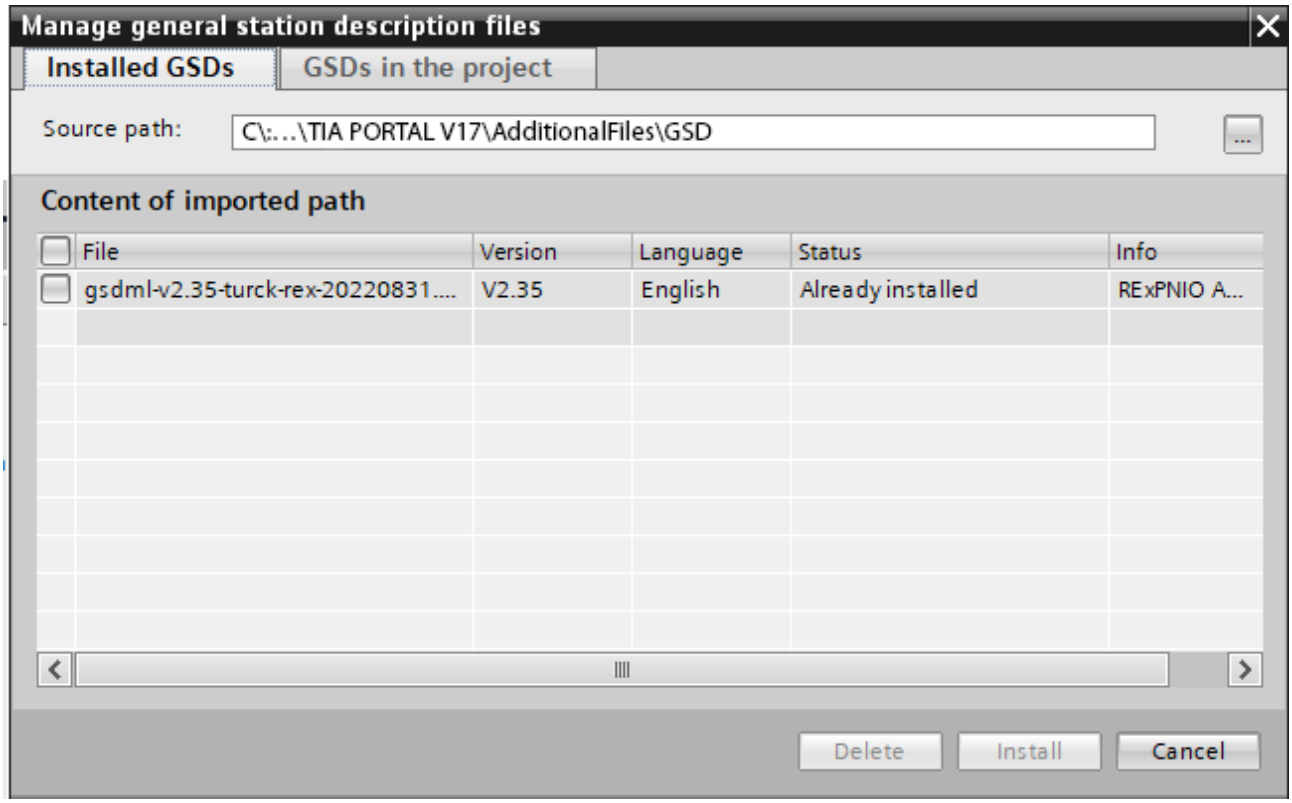


Fig. 17: Select a GSDML file

7.1.2 Connecting the device with the controller

- ▶ Select the PROFINET encoder from the hardware catalog and drag it to the hardware window.
- ▶ Connect the device with the controller in the hardware window.

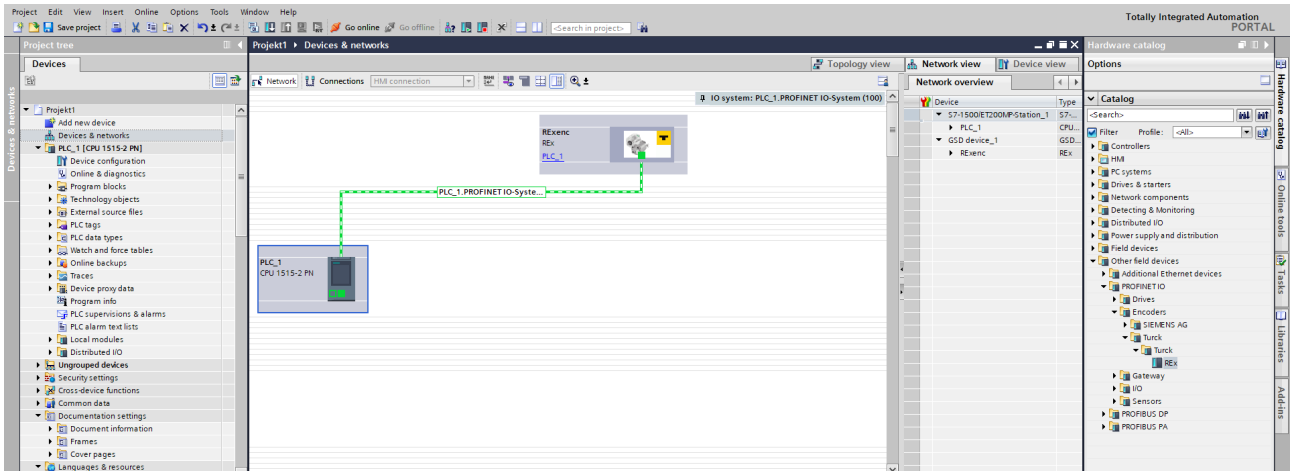


Fig. 18: Connecting the device with the controller

7.1.3 Assigning the PROFINET device name

- Select **Online accesses** → **Online & diagnostics**.
- Select **Functions** → **Assign PROFINET device name**.
- Assign the required PROFINET device name.

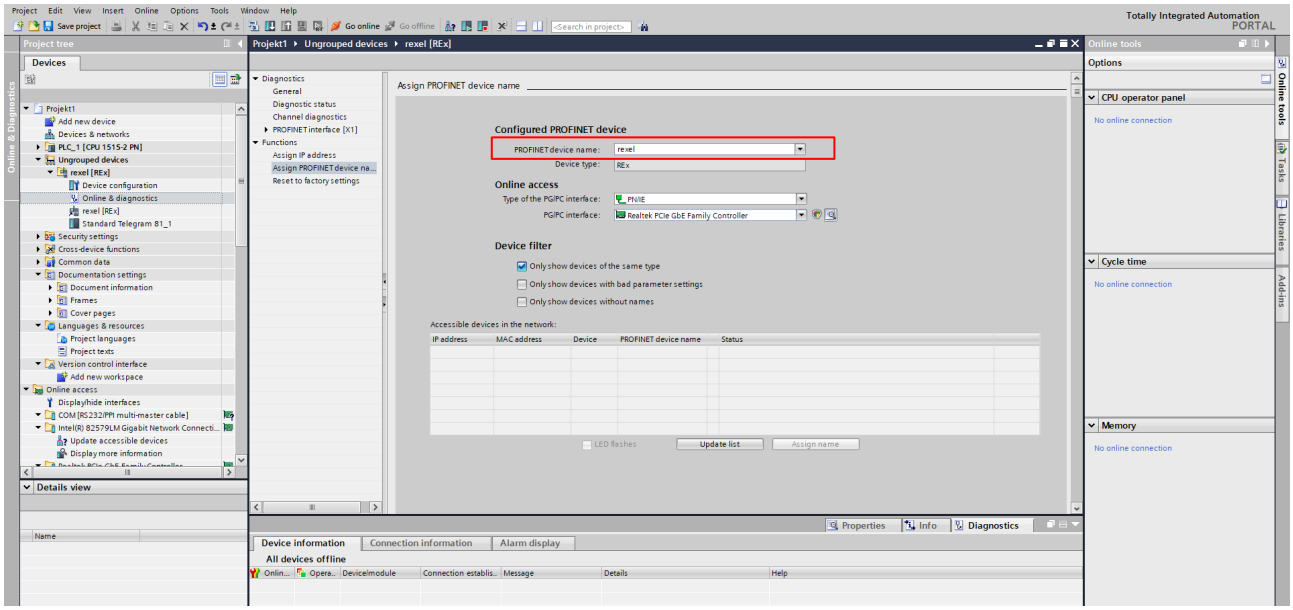


Fig. 19: Assigning the PROFINET device name

7.1.4 Set the IP address in the TIA Portal

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

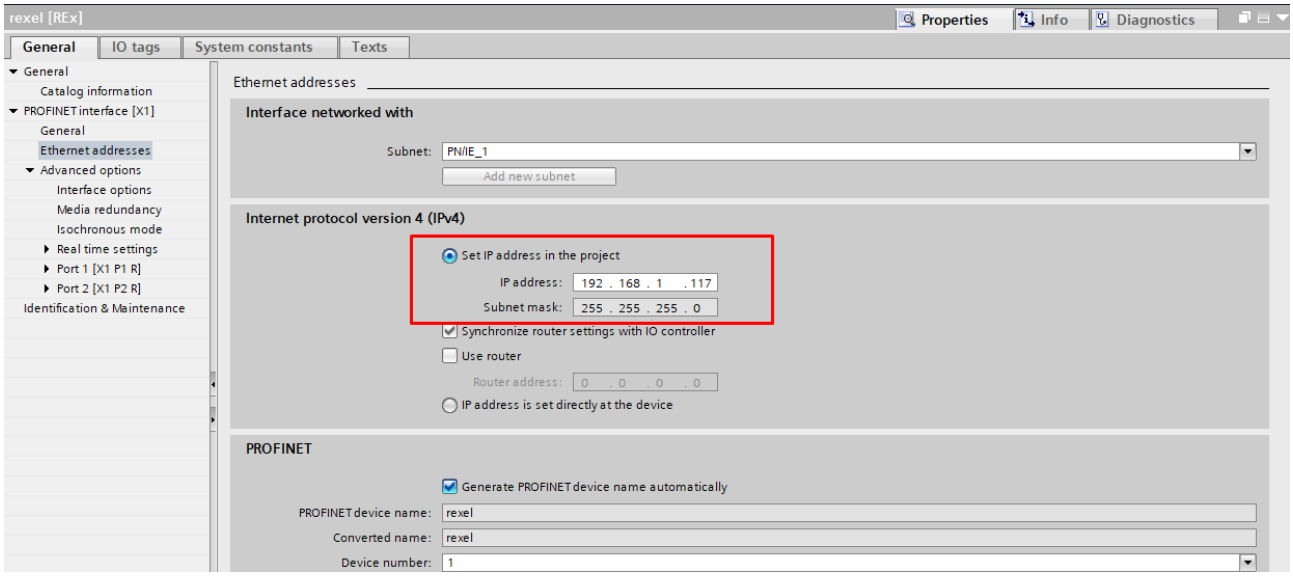


Fig. 20: Assigning the IP address

7.1.5 Connecting the device online with the controller

- ▶ Start online mode (connect online).

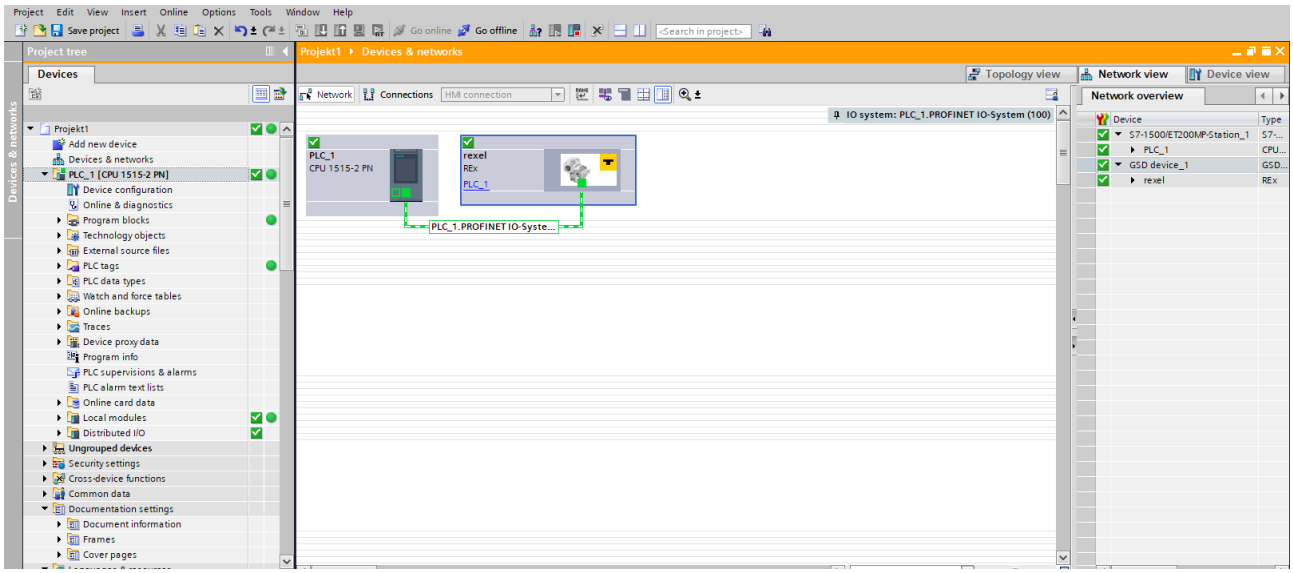


Fig. 21: Online mode

- ⇨ The device was successfully connected to the controller.

7.1.6 Setting module parameters

- ▶ Select **Device view** → **Device overview**.
- ▶ Select the module to be set.
- ▶ Click **Properties** → **General** → **Module parameters**.
- ▶ Set the **station parameters**.

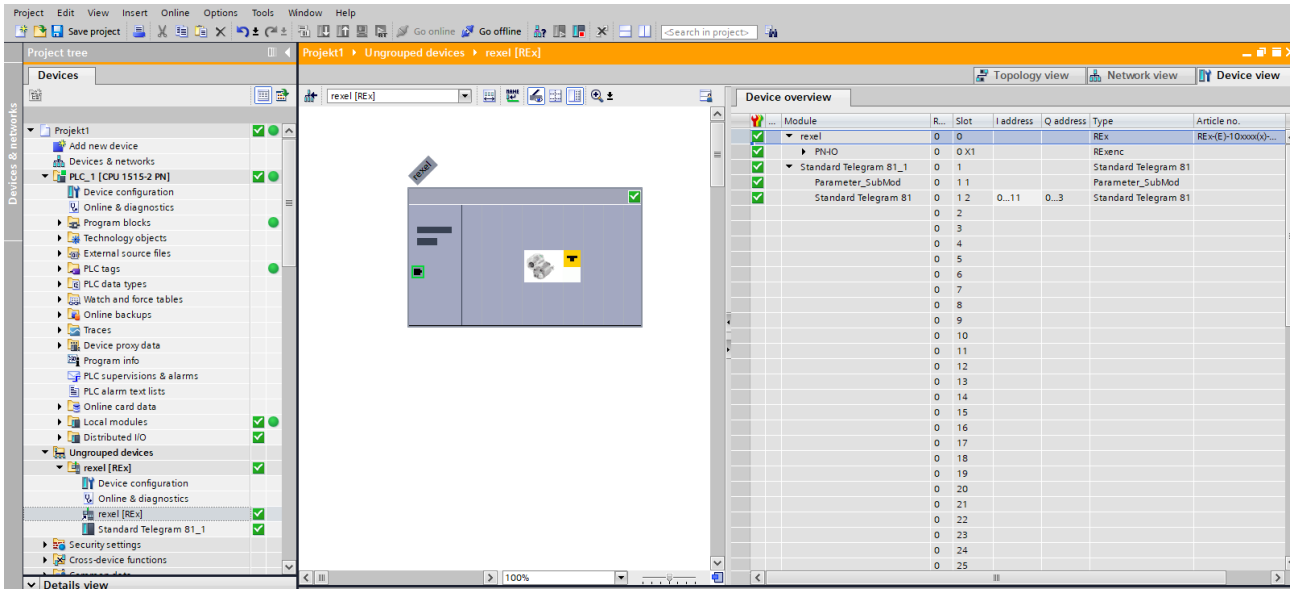


Fig. 22: Setting module parameters

7.1.7 PROFINET mapping

The PROFINET mapping is the same as the data mapping described in the “Settings” chapter.

7.2 Disabling the "parking sensor" parameter

The "parking sensor" parameter must be disabled to output the measured values.

- ▶ Enable control via the PLC.
- ▶ Set STW2_ENC bit 10 = 1 and G1_STW bit 14 = 0.
- ⇨ The function is disabled and the measured values of the sensor can be read out.

7.3 Integrating the encoder as a technology object

The encoder can be integrated as a technology object in the configuration:

- ✓ Ensure that the rotary encoder is already in the configuration.
- ▶ Select **Technology objects** — **Add new object** in the navigation.
  - ⇨ The **Add new object** window opens.
- ▶ In the **Motion Control** folder, select the **TO_ExternalEncoder** object.
- ▶ Assign a type designation for the encoder in the **Type** field and click **OK** to confirm.

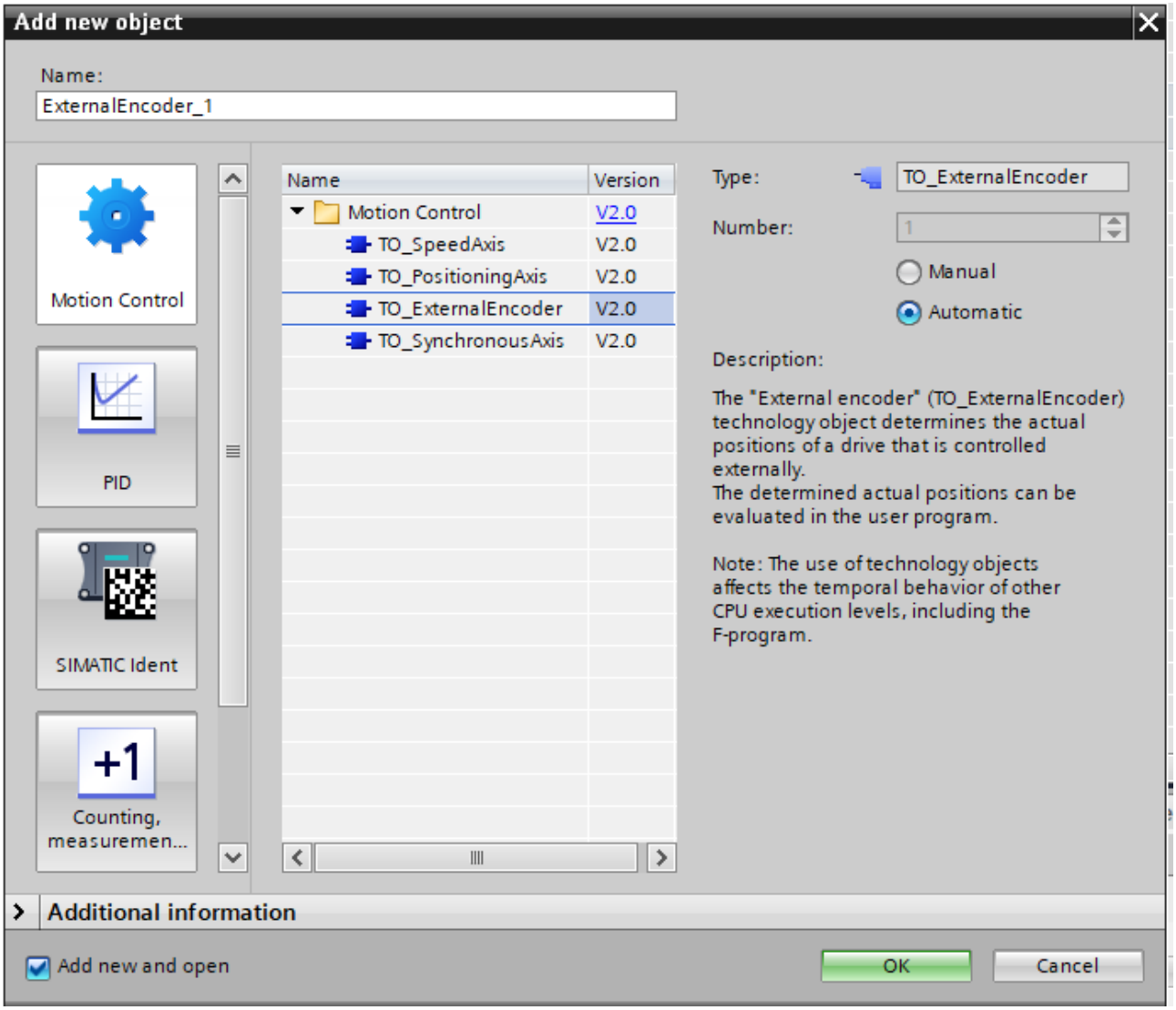


Fig. 23: Add new object

⇨ The technology object is displayed in the navigation.

- Expand the newly created object and select **Configuration**.
- Under **Basic parameters**, select **Rotary** and then acknowledge the warning message.

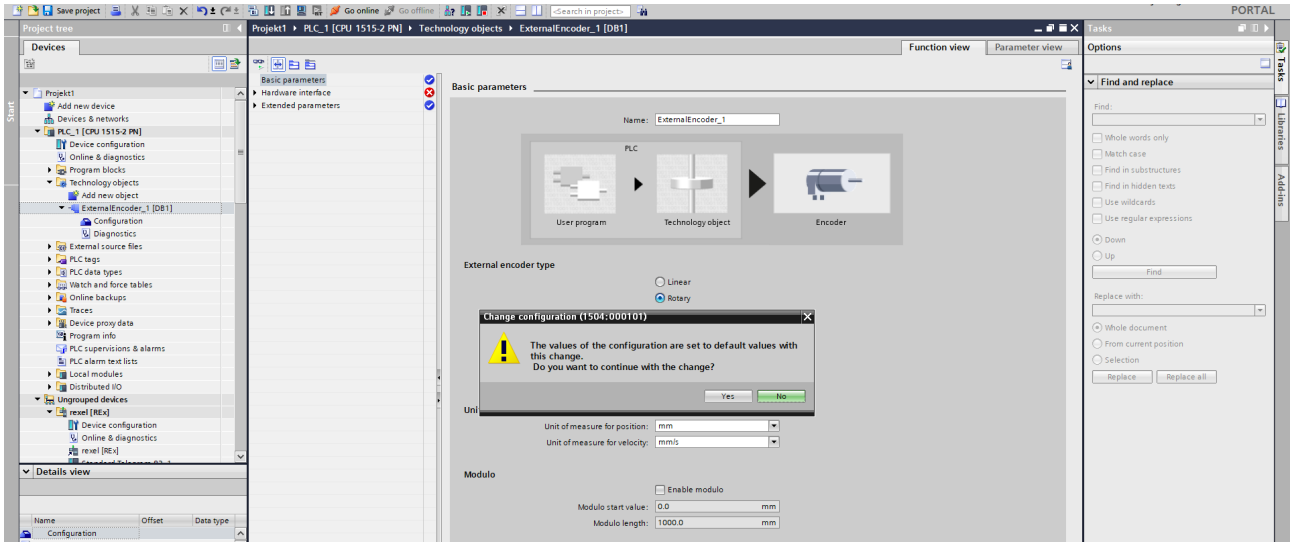


Fig. 24: Warning message

▶ Under **Hardware interface**, select the **PROFIdrive encoder on PROFINET/PROFIBUS** option and add the corresponding encoder from the GSDML file to the selection field.

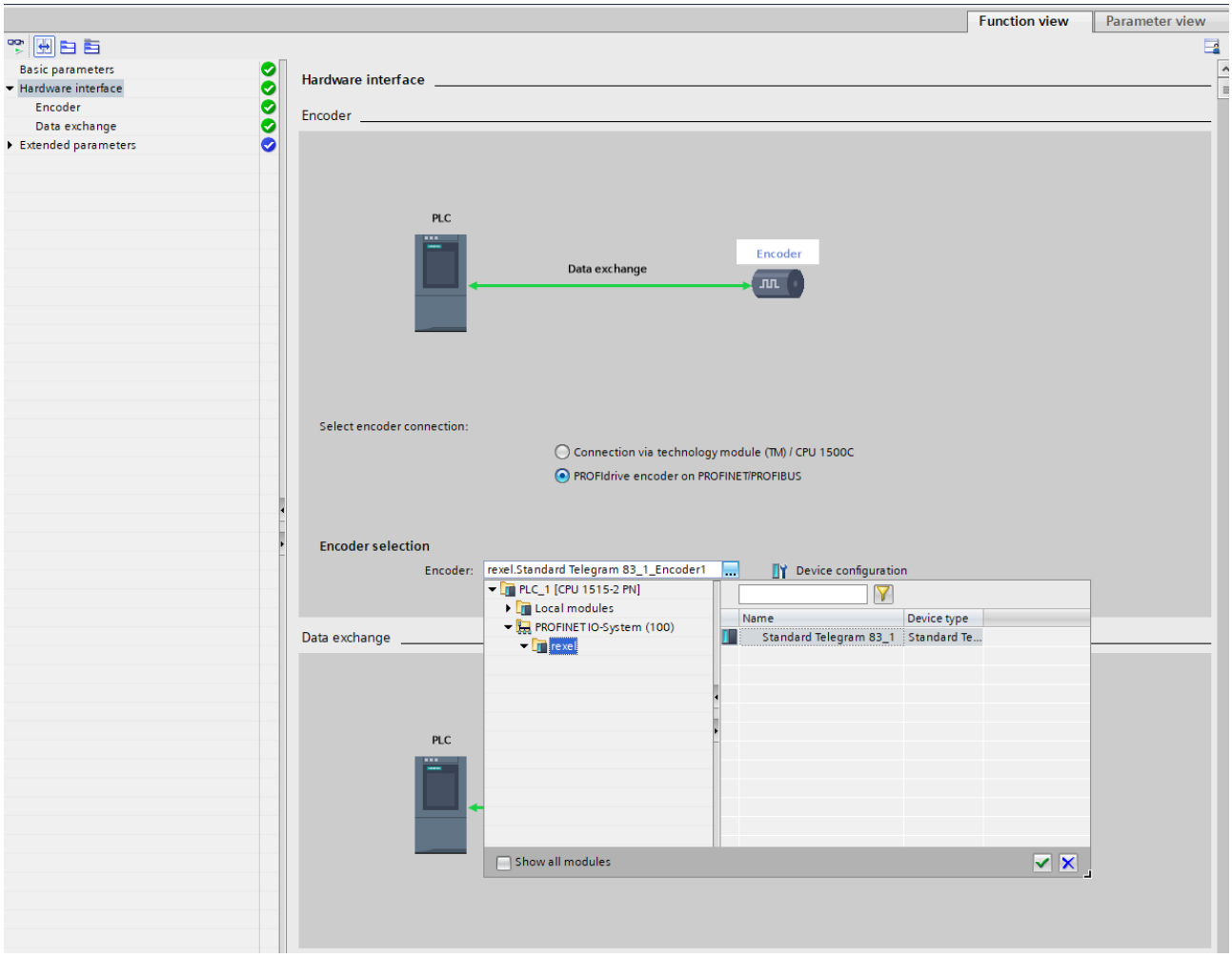


Fig. 25: Hardware_interface

⇨ The encoder can be parameterized.

- Under **Telegram**, select the same telegram that was selected when the encoder was integrated. Only telegrams 81 and 83 are supported.
- For **Increments per revolution**, enter their MUR value (e.g. 524,288) and enter the NDR value in the
Number of revolutions field: 8192 → 19 bit ST/32 bit TMR.

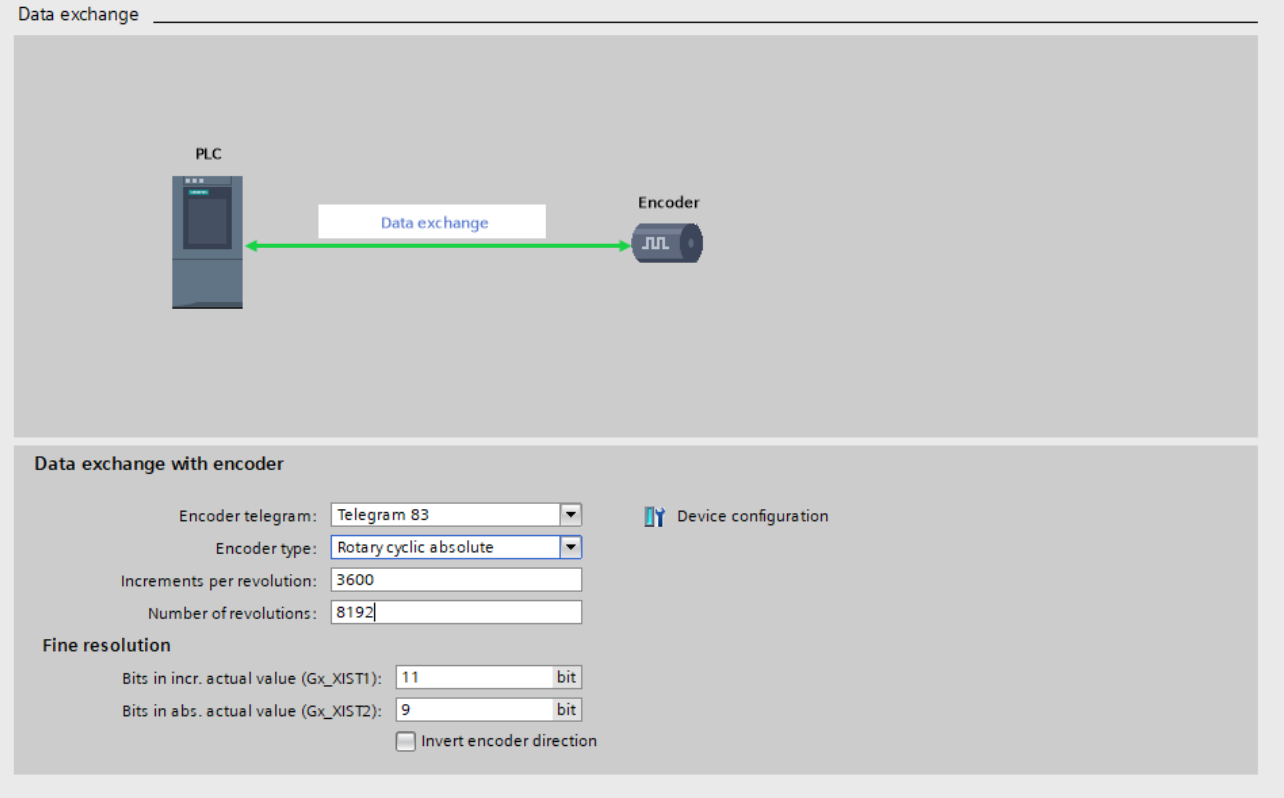


Fig. 26: Parameterizing encoders

- Click **Device Configuration** to fully parameterize the encoder.
  ⇨ The device view opens.
- Set the desired parameters under **Module parameters** via the **Properties** submodule used.

⇨ The encoder is fully integrated as a technology object.

8 Operation

The encoder provides the process data at the output in proportion to the position of the positioning element. The process data contains the following information:

- Current angle information (single-turn data)
- Number of rotations of the positioning element:
  The multiturn process data is calculated internally from the number of single-turn zero crossings.

8.1 LED display

There are five LED displays in different colors on the encoder.

Summary

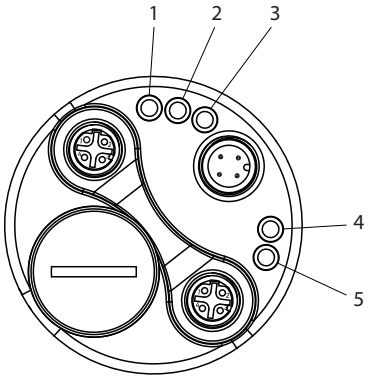


Fig. 27: Overview of LEDs

Position	Label	Color
1	Link 2	Yellow
2	BF	Red
3	SF	Red
4	ENC	Green
5	Link 1	Yellow

LEDs

Link 1/2	Meaning
Illuminated	PROFINET connection established Link 1/2
Flashing	Data exchange in progress (activity) Link 1/2

ENC	Meaning
Illuminated	Process data traffic active

SF	Meaning
Illuminated	No PROFINET connection established
Flashing	Device passivated
Flashing (0.5 Hz)	PROFINET connection established, "User parameter data" (BF00 telegram) is missing
Flashing (1 Hz)	Internal memory error (FLASH or RAM)
Flashing (5 Hz)	Internal position sensor (ICLG): No valid data available

BF	Meaning
Illuminated	No configuration/no or limited physical connection
Flashing	No data exchange

9 Setting

The device can be set via the PROFINET interface.

9.1 Configuration parameters

9.1.1 General module parameters

The encoder has various parameters that can be set in the same way for each telegram.

CODE SEQUENCE COUNTER CLOCKWISE

Affects the counting behavior depending on the direction of rotation. When looking at the shaft side of the encoder:

- CW: The encoder position increases as the shaft rotates clockwise.
- CCW: The encoder position increases when the shaft is rotated counterclockwise.

CLASS 4 FUNCTIONALITY

Affects the how the scaling, preset and direction of rotation setting is taken into account in all telegrams or in the position data G1_XIST1, 2 and 3:

- Disabled: Application class 3 — scaling, preset and direction of rotation setting disabled.
- Enabled: Application class 4 — scaling, preset and direction of rotation setting enabled.

DISABLE G1_XIST1 PRESET CONTROL

Affects how the preset (0xB02E) is taken into account:

- Disabled: G1_XIST1 displays the current position, taking into account the preset (G1_XIST1 = G1_XIST2, but without any error code).
- Enabled: G1_XIST1 displays the current position without taking into account the preset.

SCALING FUNCTION CONTROL

Affects the how the scaling is taken into account:

- Disabled: The position is displayed in the maximum possible total resolution (ST+MT = TMR) for each telegram used.
- Enabled: The encoder position is displayed in scaled format (according to MUR and TMR).

MUR — MEASURING UNITS PER REVOLUTION

Sets the number of different positions per revolution (ideally a power of two). This depends on the resolution of the respective device and the maximum permissible number of bits for the telegram used.

Standard telegram (StdTel)	MUR max. device resolution	TMR max. device resolution	Bits max. allowed per telegram
81, 82, 83, 84	16	32	32
86, 88	19	43	64

TMR — TOTAL MEASURING RANGE

Total number of different positions to be reported, over all revolutions to be distinguished. The following applies:

- TMR/MUR — highest value to be set = max. multiturn value
- TMR/MUR = 1 → singleturn
- MUR > TMR is also possible

Without scaling via. USF

- TMR/MUR = power of two (e.g. ¼, ½, 1, 2, 4, 8,…, 4096)

With scaling via. USF

- TMR/MUR = decimal or power of two

PRESET value (0xB02E)

NOTE
The PRESET value (0xB02E) cannot be used via the manufacturer telegram 860 or via standard telegrams 86 or 88.
The PRESET value is defined and triggered via the cyclic output data.

Defines an absolute or relative position that can be accessed when a preset is executed, for example, by the standard telegram 81.

Permissible value range:

- Absolute preset: 0 … ("TMR"-1)
- Relative preset: 0…±("TMR"-1)

When the PROFINET connection is established, the preset value specified here is set automatically by the controller. If necessary, the preset value can also be changed later.

9.1.2 I&M data

The encoder supports I&M 0…3 in accordance with encoder profile V4.2 or IEC 61158-6-10 (PROFINET). Access is gained via the 0xAFF0 **Record Read** index or via the TIA module GET_IM_DATA **Read I&M data**.

The standard I&M 0 data is defined in the following data block:

	Data	Data type	Contents
Block Header	Block Type	UINT16	0x0020
	Block Length	UINT16	0x0038
	Block Version High	UINT8	0x01
	Block Version Low	UINT8	0x00
I&M Block	Manufacturer-ID	UINT16	0x013D (Turck)
	Order_ID	STRING	"08.F58x8.xxCN.C122"
	Serial Number	STRING	"12345678"
	Hardware Revision	STRING	"6"
	Software Revision	STRING	"V1.0.0"
	Revision Counter	UINT16	0x0000
	Profile-ID	UINT16	0x3D00
	Profile Specific Type	UINT16	0x0001
	I&M Version (major)	UINT8	0x01
	I&M Version (minor)	UINT8	0x01
	I&M Supported	UINT16	0x000E

In addition to the standard I&M 0 data, additional I&M data can be stored.

These are structured as follows:

1. I&M 1 = System ID and location ID
2. I&M 2 = Installation date
3. I&M 3 = Manufacturer-specific additional information in the device

The I&M data can also be found directly in the device in the TIA Portal. This can be read or adjusted in the inspector window under

Properties/General/Catalog Information or

Properties/General/Identification & Maintenance

9.1.3 Acyclic data transmission

Acyclic data transmission is used to send information from the encoder and to write parameterization data to the encoder. All encoder parameters are referenced to what are known as PARAMETER NUMBERS — PNU using reference numbers. This is accessed via RECORD DATA OBJECTS, which communicate with the Parameter Manager via PAP.

PROFINET provides various access options depending on the area.

RECORD DATA OBJECT	Parameter access service	Slot	Subslot
0xAFF0	I&M 0 parameter	0x01	0x01
0xAFF1	I&M 1 parameter		
0xAFF2	I&M 2 parameter		
0xAFF3	I&M 3 parameter		
0xB02E	Base Mode Parameter Access	0x01	0x01
0xBF00	Start-up Configuration	0x01	0x01

The "standard blocks" can be used for acyclic communication on a Siemens PLC (S7).

- SFB52=RDREC (READ RECORD)
- SFB53= WRREC (WRITE RECORD)

The function blocks implement the BASE MODE PARAMETER ACCESS 0xB02E.

9.2 Telegrams

9.2.1 Available submodules/telegrams

Submodule/telegram	Number of input data words	Number of output data words
StdTel81	2	6
StdTel82	7	2
StdTel83	8	2
StdTel84	10	2
StdTel86	4	2
StdTel88	6	4

9.2.2 Submodule — StdTel81 (encoder profile V4.1)

Standard data format according to encoder profile V4.1.

Input data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	ZSW2_ENC (MSB…LSB)							
	1								
1	2	G1_ZSW (MSB…LSB)							
	3								
2	4	G1_XIST1 (MSB…LSB)							
	5								
3	6								
	7								
4	8	G1_XIST2 (MSB…LSB)							
	9								
5	10								
	11								

Output data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	STW2_ENC (MSB…LSB)							
	1								
1	2	G1_STW (MSB…LSB)							
	3								

9.2.3 Submodule — StdTel81 (encoder profile V4.2)

Standard data format according to encoder profile V4.2.

Input data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	ZSW2_ENC							
	1								
1	2	G1_ZSW							
	3								
2	4	G1_XIST1							
	5								
3	6								
	7								
4	8	G1_XIST2							
	9								
5	10								
	11								

Output data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	STW2_ENC							
	1								
1	2	G1_STW							
	3								

9.2.4 Submodule — StdTel82 (encoder profile V4.2)

Standard data format according to encoder profile V4.2.

Input data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	ZSW2_ENC							
	1								
1	2	G1_ZSW							
	3								
2	4	G1_XIST1							
	5								
3	6								
	7								
4	8	G1_XIST2							
	9								
5	10								
	11								
6	12	NIST_A							
	13								

Output data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	STW2_ENC							
	1								
1	2	G1_STW							
	3								

9.2.5 Submodule — StdTel83 (encoder profile V4.2)

Standard data format according to encoder profile V4.2.

Input data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	ZSW2_ENC							
	1								
1	2	G1_ZSW							
	3								
2	4	G1_XIST1							
	5								
3	6								
	7								
4	8	G1_XIST2							
	9								
5	10								
	11								
6	12	NIST_B							
	13								
7	14								
	15								

Output data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	STW2_ENC							
	1								
1	2	G1_STW							
	3								

9.2.6 Submodule — StdTel84 (encoder profile V4.2)

Standard data format according to encoder profile V4.2.

Input data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	ZSW2_ENC							
	1								
1	2	G1_ZSW							
	3								
2	4	G1_XIST3							
	5								
3	6								
	7								
4	8								
	9								
5	10								
	11								
6	12	G1_XIST2							
	13								
7	14								
	15								
8	16	NIST_B							
	17								
9	18								
	19								

Output data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	STW2_ENC							
	1								
1	2	G1_STW							
	3								

9.2.7 Submodule — StdTel86 (encoder profile V4.2)

Standard data format according to encoder profile V4.2.

Input data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	G1_XIST1							
	1								
1	2								
	3								
2	4	NIST_B							
	5								
3	6								
	7								

Output data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	G1_XIST_PRESET_B							
	1								
1	2								
	3								

9.2.8 Submodule — StdTel88 (encoder profile V4.2)

Standard data format according to encoder profile V4.2.

Input data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	G1_XIST3							
	1								
1	2								
	3								
2	4								
	5								
3	6								
	7								
4	8	NIST_B							
	9								
5	10								
	11								

Output data

Word	Byte	Bit							
		7	6	5	4	3	2	1	0
0	0	G1_XIST_PRESET_C							
	1								
1	2								
	3								
2	4								
	5								
3	6								
	7								

9.2.9 Telegram data

Input data

Data	Data type	Description	Bit	Value	Meaning
G1_XIST1	UINT32	Sensor 1 position value 1	0…31		Current absolute position value at max. 32 bit. Affected by scaling and preset. The preset can be disabled via "Disable G1_XIST1 Preset Control". Default: G1_XIST1 G1_XIST1 displays the scaled position set by TMR+MUR.
G1_XIST2	UINT32	Sensor 1 position value 2 without taking into account the preset	0…31		Current absolute position value at max. 32 bit. Affected by scaling and preset. G1_XIST2 is enabled by STW2_ENC bit 13. G1_XIST2 will then show the same position as G1_XIST1. In the event of an error, the following error codes are output: 0x0001: Sensor/device error 0x0F01: Syntax error 0x0F02: Master Sign-Of-Life error 0x0F04: Sync error
G1_XIST3	UINT64	Sensor 1 position value 3	0…63		Current absolute position value at max. 64 bit
NIST_A	UINT16	Current speed 16 bit	0…14		Current speed value max. ± 15 bit
			15	0	Positive sign (+)
				1	Negative sign (-)
NIST_B	UINT32	Current speed 32 bit	0…30		Current speed value max. ± 31 bit
			31	0	Positive sign (+)
				1	Negative sign (-)
G1_ZSW	UINT64	Sensor 1 status word	0…10	0	
			11		Fault signal detected 0 → 1: Error Further causes: Controller sets or deletes fault signal with bit G1_STW 15 Fault signal G1_ZSW bit 15 is present and error code in G1_XIST2. Controller deletes G1_ZSW bit 15. G1_XIST2 again contains a position value.
			12	0	Absolute preset value is set. 1 → 0: Bit 12 in G1_STW 1 → 0
				1	0 → 1: according to preset, up to bit 12 in G1_STW 1 → 0
			13	0	Transfer of absolute position value G1_ZSW bit 14/bit 15 = 1
				1	Valid position in G1_XIST2
			14		"Parking sensor" 0 → 1: G1_STW bit 14 0 → 1 The reported position is fixed.

Data	Data type	Description	Bit	Value	Meaning
G1_ZSW			15		0 → 1: Hardware error (error code is displayed in G1_XIST2) G1_ZSW bit 13 0 → 1: G1_ZSW bit 13 must be acknowledged via G1_STW bit 15 in order to set G1_ZSW bit 15 = 0. Requirement: The error is resolved.
ZSW2_ENC	UINT16	Encoder 2 status word	0	0	The offset value of the last preset operation is stored. The encoder is ready for a new preset operation.
				1	The selected preset value has been set as the new position actual value.
			1	0	The position value in G1_XIST x is invalid.
				1	The position value in G1_XIST x is valid.
			2	0	The speed value in NIST x is invalid.
				1	The speed value in NIST x is valid.
			3	0	The encoder has not detected an error.
				1	The encoder has detected one or more errors.
			4…6		Reserved
			7	0	No warning
				1	Warning
			8		Reserved
			9	0	No connection to the PLC.
				1	Connection with the PLC established.
			10, 11		Reserved
			12…15	0…15	If the controller sends the Master Sign-Of-Life (M-LS), the encoder sends back an Encoder Sign-Of-Life (E-LS) to confirm its operational readiness. Bit-by-bit incremented signal with the values 0…15. Default: 0

Output data

Data	Data type	Description	Bit	Value	Meaning
G1_STW	UINT32	Sensor 1 control word	0…7		Reserved
			8…10		Reserved
			11	0	Absolute preset (new position = preset value)
				1	Relative preset (new position = old position + preset value)
			12	0	Preset disabled
				1	0 → 1: Preset operation is triggered
			13	0	Query absolute position value G1_XIST2 is not transferred.
				1	G1_XIST2 is transferred.
			14	0	"Parking sensor" disabled.
				1	The controller disables the encoder ("park"/"parking sensor"). "Parking sensor" enabled: ■ Bit 14 in G1-ZSW 0 → 1 ■ Current position data is frozen. ■ No new errors are output.
			15	0	Transfer of encoder errors disabled.
				1	Transfer of encoder errors enabled.
STW2_ENC	UINT16	Encoder 2 control word	0	0	Idle Requirement: STW2_ENC bit 0 = 0 set by PLC
				1	Trigger Preset 0 → 1: Preset value from G1_XIST_PRESET_x becomes the new actual position value. The actual position value is corrected by a calculated offset value. The offset value is saved via ZSW2_ENC bit 0.
			1…6		Reserved
			7	0	No meaning
				1	Error Confirmation
			8, 9		Reserved
			10	0	No PLC control. Data is not valid except M-LS. G1_XIST2 is disabled.
				1	Control via PLC Control via the interface, I/O data is valid
			11		Reserved
			12…15	0…15	Master Sign-Of-Life This is only required when isochronous mode is activated. The encoder expects bit-by-bit incrementation of bits 12…15. M-LS ≠ 0: Encoder LS is output. If a deviation from the expected count sequence is detected in the M-LS, the error counter increases and the 0x0F02 error is output in G1_XIST2.

Data	Data type	Description	Bit	Value	Meaning
G1-XIST_ PRESET_B	UINT32	Encoder control word 31 bit with trigger bit	0…30		Preset value (bit 31) is set to G1_XIST1.
			31		Run Preset 0 → 1: Preset is carried out.
G1-XIST_ PRESET_C	UINT64	Encoder control word 63 bit with trigger bit	0…62		Preset value (bit 63) is set to G1_XIST3.
			63		Run Preset 0 → 1: Preset is carried out.

10 Troubleshooting

DANGER
Ignitable atmosphere
Explosion by ignitable sparks

- ▶ Do not disconnect the device in an ignitable atmosphere when energized.
- ▶ Disconnect the device from the power supply before replacing or connecting modules.

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.

11 Maintenance

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

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

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	
Singleturn technology	Optical
Multiturn technology	Battery-backed, electronic counter, flash technology
Multiturn resolution (MUR)	Max. 19 bit (default 13 bit)
Multiturn resolution (NDR)	Max. 24 bit
Multiturn resolution (TMR)	Max. 43 bit (default 25 bit)
Scaling	Supports USF
Accuracy	± 0.0137 ° (over the entire temperature range)
Mechanical characteristics	
Max. speed	9000 rpm (short-term operation, < 10 min) 6000 rpm (continuous operation)
Starting torque (at 20 °C)	< 0.01 Nm
Moment of inertia Solid shaft version Hollow shaft version	 3.0×10^{-6} kgm^2 6.0×10^{-6} kgm^2
Torque shaft load (radial/axial)	80 N/40 N
Protection class	IP67
Ambient temperature	-40…+80 °C
Materials Solid shaft/hollow shaft Receptacle/housing	 Stainless steel Aluminum
Shock resistance (EN 60068-2-27)	2500 m/s^2, 6 ms
Vibration resistance (EN 60068-2-6)	100 m/s^2, 55…2000 Hz
Electrical characteristics	
Power supply	10…30 VDC
Current consumption (without load) 10… 30 VDC	Max. 100 mA
Reverse polarity protection of the supply voltage	Yes
Output	PROFINET Ethernet 100Base-TX in accordance with IEEE 802.x
Connection mode	Male connector
Interface	PROFINET IO
Vendor ID	0x013D
Device ID	0x0001
Parameter memory	FRAM

15 Turck branches — contact data

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