Your Global Automation Partner

TURCK

REM…|RES…
Encoders with
IO-Link Interface

Instructions for Use

Contents

1 About these instructions

These instructions for use describe the structure, functions and the use of the product and will help you to operate the product as intended. Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain the instructions for future use during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

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

1.2 Explanation of symbols used

The following symbols are used in these instructions:

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

1.3 Other documents

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

- Data sheet
- Quick Start Guide
- IO-Link parameters manual
- Commissioning manual IO-Link devices

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 an IO-Link interface:

- REM-…IOL…-H1141
- RES-…IOL…-H1141

2.2 Scope of delivery

The scope of delivery includes:

- Encoder – sensor
- Quick Start Guide

2.3 Turck service

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

The contact details of Turck subsidiaries worldwide can be found on p. .

3 For your safety

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

3.1 Intended use

The rotary encoders with an IO-Link interface are used for measuring speeds and angle movements. To do this the devices detect mechanical rotary movements and convert them into a digital IO-Link telegram. The devices can be operated and parameterized via an IO-Link interface with IO-Link masters compliant with specification 1.1. Process and diagnostics data can be exchanged with the higher controller level during operation via IO-Link.

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

3.2 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 industrial areas. When used in residential areas, take measures to avoid radio interference.
- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- 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 with an IO-Link interface are available as solid shaft or hollow shaft versions. Available are devices in three sizes from 36 to 58 mm.

The encoders can be connected via a standard 4-pin connector. The devices can be operated and set via IO-Link.
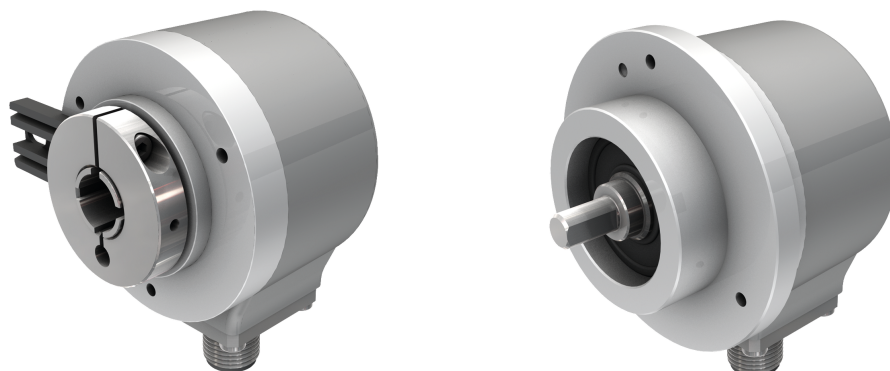
4.1   Device overview

Fig. 1: Example — encoder with hollow shaft   Fig. 2: Example — encoder with solid shaft

4.1.1   Display elements

The device has two LED displays.

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

The devices can be operated in IO-Link mode. The devices must be connected to an IO-Link master for operation in IO-Link mode. Different device functions can be configured via the IO-Link interface.

4.3.1 IO-Link mode

IO-Link mode provides bidirectional IO-Link communication between an IO-Link master and the sensors. For this the devices are integrated in the controller level via an IO-Link master. The switching signals are processed via the process data of the IO-Link interface. Besides the switching information, diagnostics and identification messages can be queried via IO-Link. The following device parameters can be adapted to the particular application via IO-Link:

- Device access protection
- Rotation direction
- Zero setting
- Multiturn reset
- Reset settings

4.4 Technical accessories

Dimension drawing	Type	Description
	USB-2-IOL-0002	IO-Link adapter with integrated USB interface
	RKC4.4T-2-RSC4.4T/TXL	Connection cable, M12 female connector, straight 4-pin, M12 male connector, straight 4-pin, cable length: 2 m, jacket material: PUR, black; cULus approval; other cable lengths and types available, see www.turck.com
	RKC4.4T-2/TXL	Connection cable, M12 female connector, straight, 4-pin, cable length: 2 m, jacket material: PVC, black; cULus approval; other cable lengths and types 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.
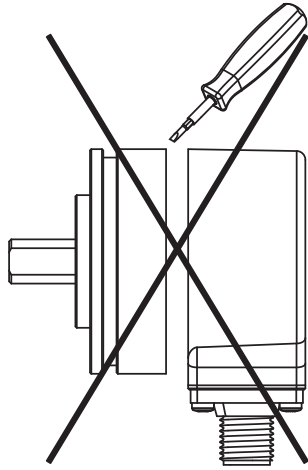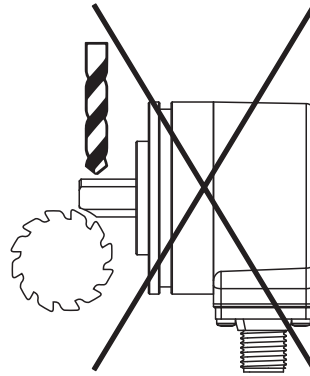

Fig. 3: Mounting view — do not open

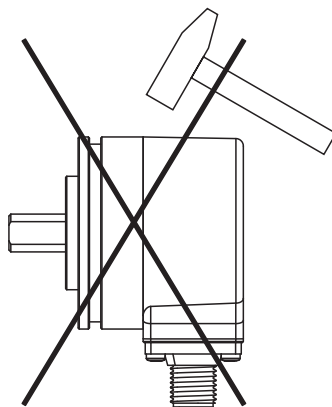Fig. 4: Mounting view — do not make adjustments after mounting

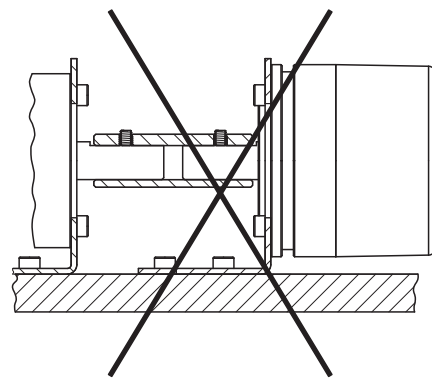Fig. 5: Mounting view — do not use a hammer to align the device

Fig. 6: Mounting view — do not rigidly connect the device to shafts and flanges at the same time

5.1 Mounting the solid shaft encoder using a coupling

▶ Check shaft for displacement.
▶ Refer to the technical data for the coupling for the maximum axial displacement, radial displacement, and angular displacement values.
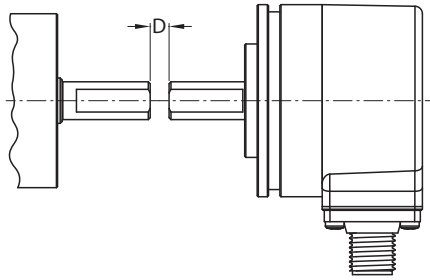
Fig. 7: Axial displacement   Fig. 8: Radial displacement
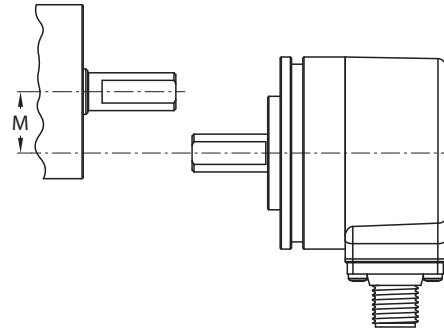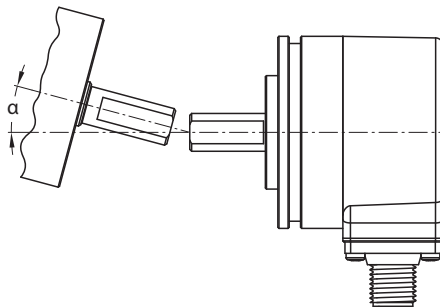
Fig. 9: Angular displacement

▶ 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 Mounting the hollow shaft encoder using a coupling

▶ Mount the encoder with the coupling on the shaft.

Fig. 10: Mounting on the shaft with the coupling

▶ Screw the coupling to the drive flange.

Fig. 11: Screwing the coupling to the drive flange

▶ Carefully tighten the clamping hub.

Fig. 12: Tightening the clamping hub

6   Connection

The encoder is provided with a 4-pin M12 ×1 male connector with an IO-Link interface. Refer to the sensor label or data sheet for the pin layout.

Turck recommends the following cable lengths:

- For asymmetrical transmission (no inverted signals): max. 10 m
- For symmetrical transmission (e.g. RS422 standard): max. 50 m with twisted pairs

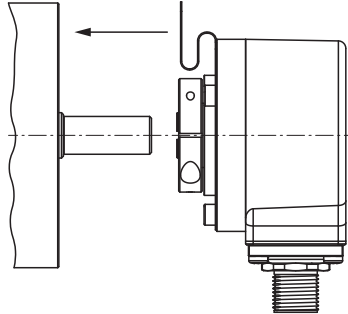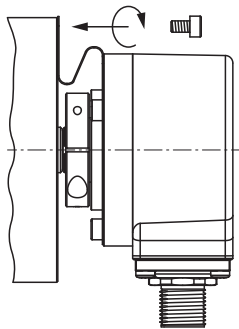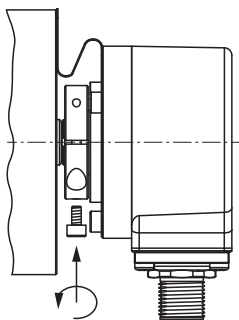▶ Connect all required cable cores as per the wiring diagram. Insulate the cable ends that are not required to avoid short circuits.

▶ Follow the operating instructions for the connecting cable used.

▶ Disconnect the encoder from the connecting 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 diagram
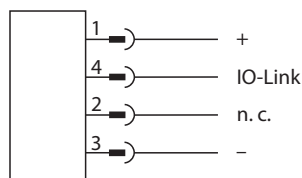
Fig. 13: REM…|RES…-IO-Link – wiring diagram

7 Commissioning

After connecting and switching on the power supply, the device is automatically ready for operation.

8 Operation

The encoder supplies at the output the IO-Link process data corresponding proportionally to the position of the positioning element. The IO-Link process data contains the following information:

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

8.1 LED display

In normal operation the LEDs have the following indication functions:

Color/state	Meaning
Green	Device is in idle state and waiting for IO-Link WakeUp request.
Green flashing	IO-Link communication is active.
Flashing 3 × green	A firmware download is executed.
Red	Device is faulty
Red flashing	An IO-Link error has occurred.
Flashing 1 × red	IO-Link warning is displayed.

9 Setting

The encoder can be set via the IO-Link interface.

9.1 Setting via IO-Link

The devices can be parameterized via the IO-Link communication interface within the limits of their technical specifications. For further information on IO-Link see the IO-Link commissioning manual (D900634).

9.1.1 IO-Link parameters

Different parameters can be set for the particular application via the IO-Link interface. Further information on the IO-Link parameters can be obtained from the IO-Link parameter manual or the IODDfinder.

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

Parameter	Parameter value
Block device access (switch off parameter server function)	On
	Off
Rotation direction	**Clockwise**
	Counter clockwise
Set zero point and reset multiturn	
Multiturn reset	
Reset to factory setting	
Application-specific marking	

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Different multiturn and scaling parameters can also be set in the device via the IO-Link interface.

Parameter	Meaning
Lower limit position	An alarm can be set for the lower limit of the total measuring range (TMR) Default: **0**
Upper limit position	An alarm can be set for the upper limit of the total measuring range (TMR). Default: **4294967295**
Limit control position	The alarm messages for the lower and upper limit of the total measuring range (TMR) can be activated or deactivated. Default: **Activated**
Preset value	A start value for the total measuring range can be set via this parameter. The start value must be less than the total measuring range, otherwise the **Preset value** is set to **0**. Default: **0**
Measuring units per revolution (MUR)	The maximum resolution per revolution can be set via this parameter. The resolution must be between 1…16384 (2^{14}). Default: **16384**
Total measuring range (TMR)	The upper limit for the total measuring range can be set via this parameter. The TMR must be greater than the MUR. Calculation formula: MUR $\times$ 2^n (number of revolutions) The adjustable upper limit value for the total measuring range is 4…4294967296 (2^{32}). Default: **4294967296** The maximum number of revolutions must not exceed 262144 (2^{18}).
Scaling control	The parameter must be activated in order to use the MUR parameter. The number of revolutions must be set via the scaling of 2^n and cannot therefore assume any value. The **Endless shaft control** parameter must be deactivated. Default: **Activated**
Endless shaft control	The **Scaling control** parameter must be deactivated The number of revolutions can be defined precisely via the **Numerator** and **Denominator** parameters. Default: **Deactivated**

Calculation example for the maximum possible TMR (Scaling control)

Formula for calculating the maximum possible TMR:

MUR $\times$ 2^m (number of revolutions) $\leq$ 4294967296 (2^{32})

Example: The MUR value is 3600 for a 0.1° revolution of the encoder.

The maximum possible TMR is calculated as follows:

- 3600 $\times$ 2^m $\leq$ 4294967296 (2^{32})
- Maximum possible TMR: 3600 $\times$ 2^{18} = 943718400

Calculation example for the TMR (Scaling control)

Formula for calculating the TMR:

MUR $\times$ 2^m (number of revolutions) $\leq$ 4294967296 (2^{32})

Example: The MUR value is 360 for a 1° revolution of the encoder. The TMR parameter is reset to **0** after 1000 revolutions. If the **Scaling control** parameter is activated, the number of revolutions can be defined approximately.

The TMR is calculated as follows:

- 360 $\times$ 2^m $\leq$ 4294967296 (2^{32})
- 512 (2^9) < 1000 < 1024 (2^{10})
- Choose the higher factor for further calculation (here: 10).
- TMR with 1024 revolutions: 360 $\times$ 2^{10} = 368640

Calculation example for the TMR (Endless shaft control)

Formula for calculating the TMR:

MUR $\times$ (numerator/denominator) $\leq$ 4294967296 (2^{32})

Example: The MUR value is 360 for a 1° revolution of the encoder. The TMR parameter is reset to **0** after 1000 revolutions. If the **Endless shaft control** paramter is activated, the number of revolutions can be defined precisely.

The TMR is calculated as follows:

- 360 $\times$ (1000/1) = 360000

9.2 Setting via FDT/IODD

The devices can be set via a PC with an FDT frame application (e.g. PACTware). All the required Turck software components can be downloaded via the Turck Software Manager:

- PACTware
- IODD
- DTM for USB-2-IOL-002 IO-Link adapter
- IODD DTM Configurator

The Turck Software Manager can be downloaded free of charge from **www.turck.com**.

The USB-2-IOL-002 USB IO-Link adapter (ID 6825482) is required for connecting to the PC.

A 4-pin standard sensor cable (e.g. RKC4.4T-2- RSC4.4T/TXL, ID 6625608) is required for connecting the sensor to the USB-2-IOL-002 IO-Link adapter.

Further information on setting the devices via IODD with a configuration tool is provided in the IO-Link commissioning manual.

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.

11   Maintenance

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

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

12   Repair

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

12.1   Returning devices

Returns to Turck can only be accepted if the device has been equipped with a Decontamination declaration enclosed. The decontamination declaration can be downloaded from
https://www.turck.de/en/retoure-service-6079.php
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

13   Disposal

The devices must be disposed of correctly and must not be included in general household garbage.

14 Turck subsidiaries — contact information

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South Africa	Turck Banner (Pty) Ltd Boeing Road East, Bedfordview, ZA-2007 Johannesburg www.turckbanner.co.za
Turkey	Turck Otomasyon Ticaret Limited Sirketi Inönü mah. Kayisdagi c., Yesil Konak Evleri No: 178, A Blok D:4, 34755 Kadiköy/ Istanbul www.turck.com.tr
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