

Your Global Automation Partner

TURCK

RI...-QR24...

Encoders with an Incremental Interface

Instructions for Use



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1 About these instructions

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

1.1 Target groups

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

1.2 Explanation of symbols used

The following symbols are used in these instructions:



DANGER

DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.



WARNING

WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided.



CAUTION

CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.



NOTICE

NOTICE indicates a situation which may lead to property damage if not avoided.



NOTE

NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work.



CALL TO ACTION

This symbol denotes actions that the user must carry out.



RESULTS OF ACTION

This symbol denotes relevant results of actions.

1.3 Other documents

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

- Data sheet
- 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

RI 360 P1 - QR24 M1 - INCR X2 - H1 1 8 1

RI	360	P1	Functional principle	-	QR24	M1	Design	-	INCR	X2	Electrical version	-	
			<p>Positioning element with adapter sleeve (for shaft diameters)</p> <p>P0 Without positioning element</p> <p>P1 P1-RI-QR24 (20 mm)/ P1-RI-EQR24 (20 mm)</p> <p>P2 P2-RI-QR24 (14 mm)</p> <p>P3 P3-RI-QR24 (12 mm)/ P3-RI-EQR24 (12 mm)</p> <p>P4 P4-RI-QR24 (10 mm)/ P4-RI-EQR24 (10 mm)</p> <p>P5 P5-RI-QR24 (6 mm)</p> <p>P6 P6-RI-QR24 (3/8")</p> <p>P7 P7-RI-QR24 (1/4")</p> <p>P8 P8-RI-QR24 (with blind plug)</p>				<p>Mounting aid</p> <p>M0 Without aluminum protecting ring</p> <p>M1 With aluminum protecting ring M1-QR24</p> <p>M2 Set M2-QR24 (M1-QR24 + shield plate SP1-QR24)</p> <p>M3 Set M3-QR24 (M1-QR24 + shield plate SP2-QR24)</p> <p>M4 Set M4-QR24 (M1-QR24 + shield plate SP3-QR24)</p> <p>M5 With plastic protecting ring</p>				<p>Number of LEDs</p> <p>X2 2 × LED</p>	<p>Number of pulses per revolution</p> <p>INCR Adjustable push-pull A, B, /A, /B, Z</p> <p>0001 Preset 1 pulse per revolution</p> <p>...</p> <p>5000 Preset 5000 pulses per revolution</p>	
			<p>Measuring range</p> <p>360 360°</p>				<p>Design</p> <p>EQR24 Stainless steel housing</p> <p>QR24 Die-cast zinc housing</p>						
			<p>Functional principle</p> <p>RI Rotary inductive</p>										

H1 1 8 1 Electrical connection

Assignment	
1	Standard assignment
Number of contacts	
8	8-pin, M12 × 1
Connector type	
1	Straight
Connector type	
H1	Connector, M12 × 1



NOTE

Sensor, mounting element and positioning element of the encoders are available both as individual components and as a complete set.

2.2 Scope of delivery

The scope of delivery includes:

- Encoder — sensor
- MT-QR24 mounting aid
- Quick Start Guide
- Optional: positioning element and mounting element

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. [▶ 38].

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 encoders of the RI360...-QR24... product series with incremental output are used to measure speeds and angular movements. To do this, the devices record mechanical rotary movements and convert them into electrical pulse sequences. Per revolution, a defined number of pulses is emitted.

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 may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- If safe operation can no longer be guaranteed: Shut down the device and lock out to prevent accidental startups.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for industrial areas. When used in residential areas, take measures to avoid radio interference.

4 Product description

The inductive encoders of the RI...-QR24... product series measure speeds and angular movements up to 360°. The sensor and the positioning element of the encoders are fully potted and designed as two independent and fully sealed units with protection to IP68K, which work together without contact. The optionally available adapter sleeves and mounting elements enable either the front or the rear of the encoder sensor to be fitted to shafts with a diameter of up to 20 mm. A mounting element for mounting on large rotatable machine parts is also provided in the program.

The devices are available as absolute encoders with different output functions and also as incremental encoders. A robust stainless steel EQR24 variant is available for use in the food and beverage industry.

The QR24 encoder with incremental output has a push-pull/HTL output with A-, A (inverse), B-, B (inverse) and Z-track. The number of pulses per revolution can be freely parameterized between 1 and 5000 for the RI...-QR24-INCR... devices with the PACTware FDT frame (FDT/IODD). Alternatively, the nine most common pulse counts can be set from the easy teach-in function of the encoder.

4.1 Device overview

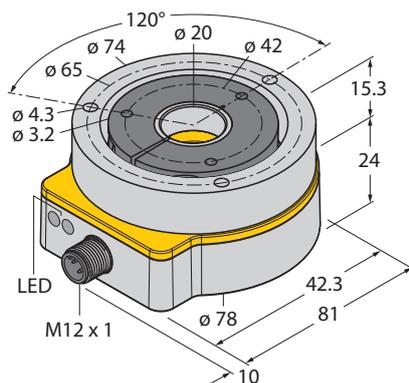


Fig. 1: QR24 encoder with sensor, P1 positioning element (optional) and protecting ring (optional)

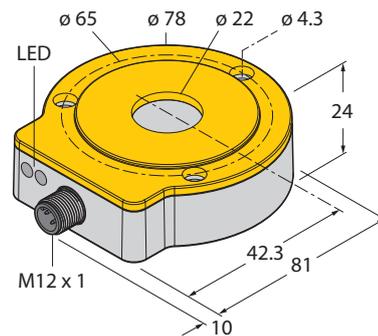


Fig. 2: Encoder — sensor (front)

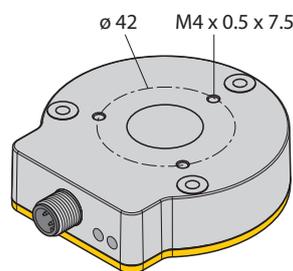


Fig. 3: Encoder — sensor (rear)

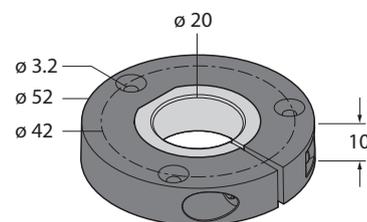


Fig. 4: Encoder — positioning element P1

4.1.1 Indication elements

The devices are provided with a green Power supply LED and a yellow Status LED.

4.2 Properties and features

- The number of pulses per revolution can be set using the Easy-Teach function (360, 512, 1000, 1024, 2048, 2500, 3600, 4096, 5000) (only available for RI...-QR24-INCR... devices)
- The number of pulses per revolution can be preset at the factory (1, 5, 6, 8, 10, 12, 36, 64, 100, 200, 250, 256, 360, 400, 500, 512, 600, 800, 1000, 1024, 2000, 2048, 4096, 5000)
- The number of pulses in the range from 1 to 5000 can be freely parameterized via PACTware (FDT/DTM) (only available for RI...-QR24-INCR... devices)
- Position of the Z-track freely selectable
- Burst output: incremental output of the absolute angular position
- Max. switching frequency 200 kHz
- CW/CCW rotation direction can be set
- Push-pull, track A, A (inverse), B, B (inverse), Z

4.3 Operating principle

The QR24 encoders have contactless operation based on the inductive resonant circuit measuring principle. This measuring principle makes it possible to design a fully encapsulated sensor housing without seals, which is separated from the positioning element. Magnetic fields cannot disturb the measuring process since the positioning element is not based on a magnet but on an inductive coil system, through which the sensor and the positioning element (resonator) can form an oscillation circuit. The inductive measuring principle of the QR24 encoder is absolute.

To generate an incremental output signal from the absolute rotation angle, the sensor detects the actual rotation angle per millisecond and from this calculates the resulting number of pulses to be output.

4.4 Functions and operating modes

4.4.1 Output function

The output signal of the incremental encoder is based on the HTL interface (high transistor logic). The inverted signals A (inverse) and B (inverse) are output in addition to tracks A and B. A Z-track is also available.

The QR24 is an absolute encoder that calculates the pulses of a clock cycle and emits these pulses according to the clock cycle within 800 μ s. The cycle duration is therefore not inversely proportional to the speed of rotation. The angle sensing for positioning is, however, carried out exactly according to the number of output pulses.

The number of pulses output can be configured from 1 to 5000 for the RI...-QR24-INCR... devices.

For the output signal evaluation, we recommend standard input cards or counter blocks that can process a minimum pulse frequency of 80 kHz, otherwise incorrect counting may occur (e.g. Motrona DX-345).

4.4.2 Burst output

By triggering a burst output, it is possible for the position measured as an absolute value by the encoder to be output uniquely as an incremental pulse sequence with a frequency of 10 kHz. The number of pulses corresponds to the angular distance to the zero point (single-turn) in the set effective direction and resolution. The burst output is triggered via the Easy-Teach function (see section "Setting").

4.5 Encoders — components and accessories

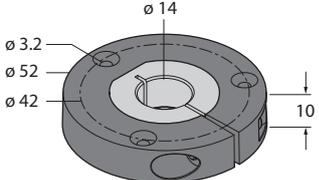
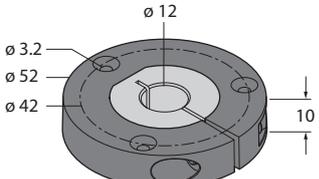
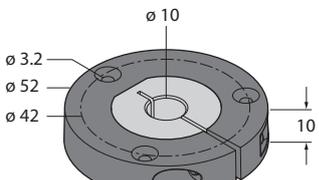
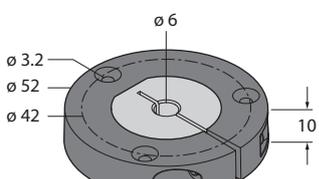
4.5.1 Encoder — QR24 sensor

Dimension drawing	Type	Description
	RI360P...-QR24	Encoder – sensor, QR24 design, die cast zinc housing (without positioning element)

4.5.2 Encoder — QR24 positioning element

The positioning elements are connected with the moving part of the machine (shaft) but move freely (without any mechanical connection to the sensor) over the active face of the sensor. Different reducing bushings are available to adapt the positioning element to the particular shaft diameter.

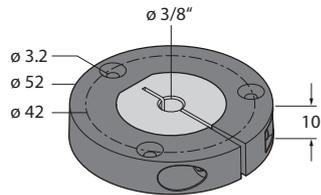
Dimension drawing	Type	Description
	PE1-QR24	Positioning element without reducing bushing with stainless steel fitting
	P1-RI-QR24	Positioning element with reducing bushing to connect to Ø 20 mm shafts

Dimension drawing	Type	Description
 <p>Technical drawing of a circular positioning element. It features a central hole with a diameter of $\varnothing 14$ mm. The outer diameter is $\varnothing 52$ mm. There are two smaller holes on the top surface with a diameter of $\varnothing 3.2$ mm. The diameter of the main body is $\varnothing 42$ mm. The thickness of the element is 10 mm.</p>	P2-RI-QR24	Positioning element with reducing bushing to connect to $\varnothing 14$ mm shafts
 <p>Technical drawing of a circular positioning element. It features a central hole with a diameter of $\varnothing 12$ mm. The outer diameter is $\varnothing 52$ mm. There are two smaller holes on the top surface with a diameter of $\varnothing 3.2$ mm. The diameter of the main body is $\varnothing 42$ mm. The thickness of the element is 10 mm.</p>	P3-RI-QR24	Positioning element with reducing bushing to connect to $\varnothing 12$ mm shafts
 <p>Technical drawing of a circular positioning element. It features a central hole with a diameter of $\varnothing 10$ mm. The outer diameter is $\varnothing 52$ mm. There are two smaller holes on the top surface with a diameter of $\varnothing 3.2$ mm. The diameter of the main body is $\varnothing 42$ mm. The thickness of the element is 10 mm.</p>	P4-RI-QR24	Positioning element with reducing bushing to connect to $\varnothing 10$ mm shafts
 <p>Technical drawing of a circular positioning element. It features a central hole with a diameter of $\varnothing 6$ mm. The outer diameter is $\varnothing 52$ mm. There are two smaller holes on the top surface with a diameter of $\varnothing 3.2$ mm. The diameter of the main body is $\varnothing 42$ mm. The thickness of the element is 10 mm.</p>	P5-RI-QR24	Positioning element with reducing bushing to connect to $\varnothing 6$ mm shafts

Dimension drawing	Type	Description
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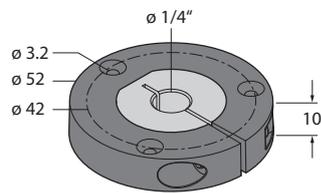
P6-RI-QR24

Positioning element with reducing bushing to connect to Ø 3/8" shafts



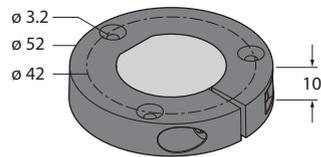
P7-RI-QR24

Positioning element with reducing bushing to connect to Ø 1/4" shafts

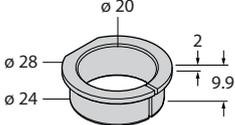
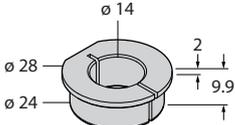
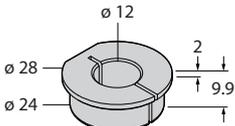
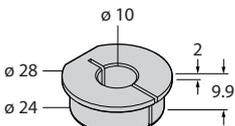


P8-RI-QR24

Positioning element with blanking plug, e.g. for mounting on large rotatable machine parts



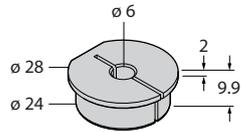
4.5.3 Encoders — QR24 adapter sleeves

Dimension drawing	Type	Description
 <p>Technical drawing of a cylindrical adapter sleeve. The outer diameter is labeled as $\varnothing 28$ and the inner diameter as $\varnothing 24$. The inner bore diameter is $\varnothing 20$. The total height is 9.9 mm, and the height of the inner bore is 2 mm.</p>	RA1-QR24	Reducing bushing to connect to $\varnothing 20$ mm shafts
 <p>Technical drawing of a cylindrical adapter sleeve. The outer diameter is labeled as $\varnothing 28$ and the inner diameter as $\varnothing 24$. The inner bore diameter is $\varnothing 14$. The total height is 9.9 mm, and the height of the inner bore is 2 mm.</p>	RA2-QR24	Reducing bushing to connect to $\varnothing 14$ mm shafts
 <p>Technical drawing of a cylindrical adapter sleeve. The outer diameter is labeled as $\varnothing 28$ and the inner diameter as $\varnothing 24$. The inner bore diameter is $\varnothing 12$. The total height is 9.9 mm, and the height of the inner bore is 2 mm.</p>	RA3-QR24	Reducing bushing to connect to $\varnothing 12$ mm shafts
 <p>Technical drawing of a cylindrical adapter sleeve. The outer diameter is labeled as $\varnothing 28$ and the inner diameter as $\varnothing 24$. The inner bore diameter is $\varnothing 10$. The total height is 9.9 mm, and the height of the inner bore is 2 mm.</p>	RA4-QR24	Reducing bushing to connect to $\varnothing 10$ mm shafts

Dimension drawing	Type	Description
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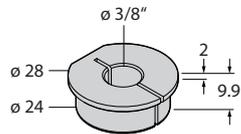
RA5-QR24

Reducing bushing to connect to Ø 6 mm shafts



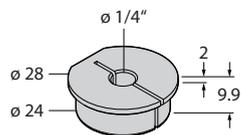
RA6-QR24

Reducing bushing to connect to Ø 3/8" shafts



RA7-QR24

Reducing bushing to connect to Ø 1/4" shafts



RA8-QR24

Blanking plug for mounting without reducing bushing (e.g. mounting the positioning element on large rotatable machine parts)

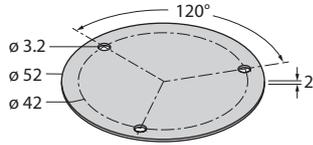


4.5.4 Encoders — protecting rings and mounting sets for QR24/EQR24 device types

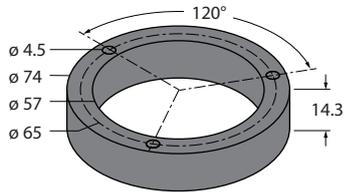
Different mounting sets are required for different mounting types (see section “Installing”). Each mounting set contains an aluminum protecting ring and an aluminum shield plate. The shield plates enable the quality of the signal between the positioning element and the sensor to be increased — depending on mounting type and application. The protecting rings are also available individually in aluminum and plastic.

Dimension drawing	Type	Description
	M1-QR24	Aluminum protecting ring
	SP1-QR24	Aluminum shielding plate SP1-QR24: Ø 74 mm for front mounting of the sensor on shafts up to Ø 20 mm
	SP2-QR24	SP2-QR24 aluminum shielding plate: Ø 74 mm, with Ø 22 mm hole for shaft feedthrough for rear mounting of the sensor on shafts up to Ø 20 mm

Dimension drawing	Type	Description
	SP3-QR24	SP3-QR24 aluminum shielding plate: Ø 52 mm for mounting the positioning element on large rotatable machine parts

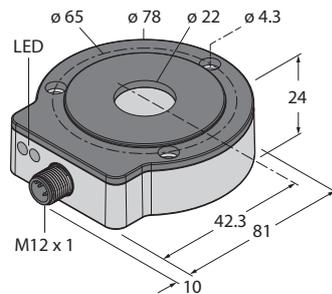


	M5-QR24	Plastic protective ring
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4.5.5 Encoder — EQR24 sensor

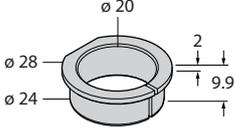
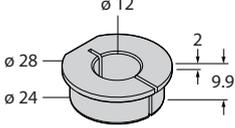
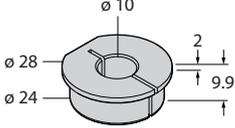
Dimension drawing	Type	Description
	RI360P...-EQR24	Encoder – sensor, QR24 design, stainless steel housing



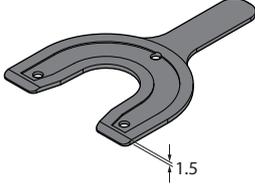
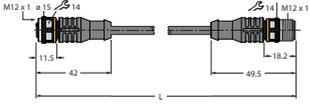
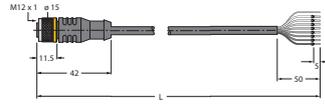
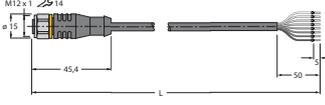
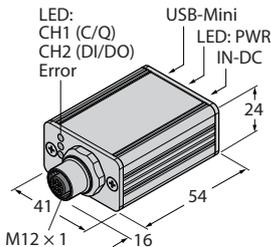
4.5.6 Encoder — EQR24 positioning element

Dimension drawing	Type	Description
	PE-EQR24	Positioning element without reducing bushing with stainless steel fitting
	P1-RI-EQR24	Positioning element with reducing bushing to connect to Ø 20 mm shafts, stainless steel fitting
	P3-RI-EQR24	Positioning element to connect to Ø 12 mm shafts, stainless steel fitting
	P4-RI-EQR24	Positioning element with reducing bushing to connect to Ø 10 mm shafts, stainless steel fitting

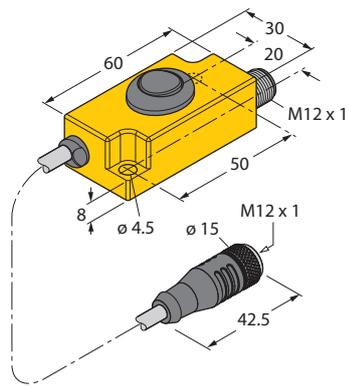
4.5.7 Encoder — EQR24 adapter sleeves

Dimension drawing	Type	Description
 <p>A technical drawing of a cylindrical adapter sleeve. The outer diameter is labeled as $\varnothing 28$ and the inner diameter as $\varnothing 20$. The total height is 9.9 mm, and the thickness of the sleeve is 2 mm.</p>	<p>RA1-EQR24</p>	<p>Stainless steel reducing bushing to connect to $\varnothing 20$ mm shafts</p>
 <p>A technical drawing of a cylindrical adapter sleeve. The outer diameter is labeled as $\varnothing 28$ and the inner diameter as $\varnothing 12$. The total height is 9.9 mm, and the thickness of the sleeve is 2 mm.</p>	<p>RA3-EQR24</p>	<p>Stainless steel reducing bushing to connect to $\varnothing 12$ mm shafts</p>
 <p>A technical drawing of a cylindrical adapter sleeve. The outer diameter is labeled as $\varnothing 28$ and the inner diameter as $\varnothing 10$. The total height is 9.9 mm, and the thickness of the sleeve is 2 mm.</p>	<p>RA4-EQR24</p>	<p>Reducing bushing to connect to $\varnothing 10$ mm shafts</p>

4.5.8 Encoders — general accessories

Dimension drawing	Type	Description
	MT-QR24	Mounting aid for optimal alignment of the position sensor (included in delivery)
	RKC8.302T-1.5-RSC4T/TX320	Adapter cable for connecting the sensor to the USB IO-Link adapter USB-2-IOL-0002; M12 female connector, straight, 8-pin, M12 male connector, straight, 3-pin; cable length 1.5 m, jacket material: PUR; jacket color: black; cULus approved; RoHS compliant; protection class IP67; other cable lengths and types available, see www.turck.com
	RKC8T-2/TXL	Connection cable, female M12, straight, 8-pin, cable length 2 m, jacket material: PUR, black; suitable for trailing, weld splatter resistant, chemical, UV and oil-resistant, flame-retardant, halogen, silicone, PVC and LABS-free, particularly abrasion-resistant; cULus approved; RoHS compliant; protection class IP67; other cable lengths and types available, see www.turck.com
	RKSV8T-5/TEL	Connection cable, M12 female, straight, 8-pin, stainless steel coupling nut, cable length 5 m, jacket material: PVC, black; cULus approval; other cable lengths and types available, see www.turck.com
	USB-2-IOL-0002	IO-Link adapter with integrated USB interface

Dimension drawing	Type	Description
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TX2-Q20L60

Teach adapter for parameterization

5 Installing

The optionally available adapter sleeves and mounting elements enable the front or rear of the encoder sensors to be fitted to the shafts with a diameter of up to 20 mm. With large rotatable machine parts, the positioning element is screwed directly onto the machine part and not fitted on the shaft.



WARNING

Improper fixing

Possible fatal injury from fast moving parts!

- ▶ Observe mounting instructions in all cases.
 - ▶ Check the secure seating of the positioning element, tightening torque:
M = 0.6...0.8 Nm.
-



NOTICE

Insufficient clearance from metal surrounding the positioning element

Loss of functionality due to weakening of resonant circuit

- ▶ Ensure sufficient clearance between the surrounding area and positioning element.
 - ▶ Carry out a function test prior to commissioning.
-



NOTE

The positioning element must be located in the middle of the measuring range of the sensor before the power supply is applied.

5.1 Front mounting — shaft diameters up to 20 mm

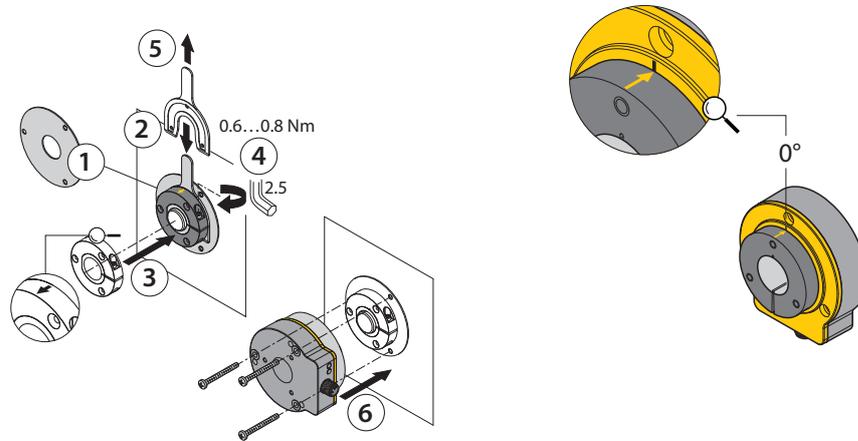


Fig. 5: Front mounting — shaft diameters up to 20 mm
 Fig. 6: Zero point default value

1. Use shield plate.
2. Mounting aid for optimum alignment of the positioning element.
3. Push the positioning element — with the front (active face) to the shaft — onto the shaft.
4. Fasten clamp fitting of the positioning element with hexagon spanner.
5. Remove mounting aid.
6. Place the encoder sensor including the protecting ring with the front to the shaft over the positioning element and align to the required position of the zero point. (factory setting for 0°: yellow arrow on the positioning element pointing to the black mark on the sensor, see figure “Zero point default value“.)
 - ▶ Fasten the encoder with three screws in order to obtain a closed and protected unit.

5.2 Rear mounting — shaft diameters up to 20 mm

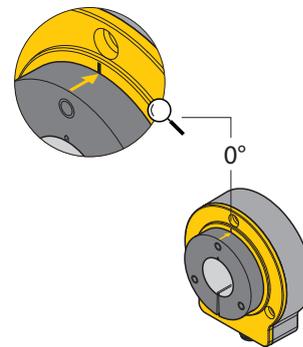
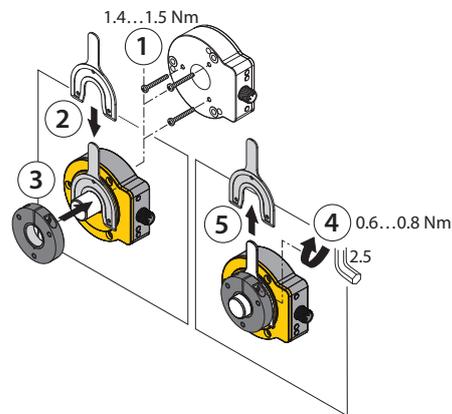


Fig. 7: Rear mounting — shaft diameters up to 20 mm Fig. 8: Zero point default value

1. Push the encoder sensor — with the rear to the shaft — onto the shaft and fasten with three screws.
2. Mounting aid for optimum alignment of the positioning element.
3. Push the positioning element onto the shaft and align to the required position of the zero point. (factory setting for 0°: yellow arrow on the positioning element pointing to the black mark on the sensor, see figure “Zero point default value”.)
4. Fasten clamp fitting of the positioning element with hexagon spanner.
5. Remove mounting aid.
 - ▶ Optional: Use protecting ring and shield plate.

5.3 Mounting on large rotatable machine part

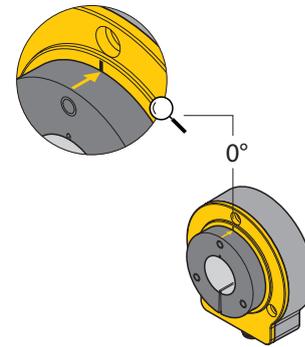
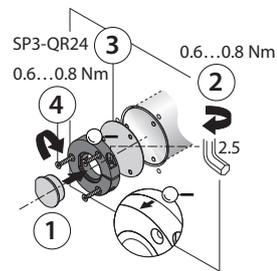


Fig. 9: Mounting on large rotatable machine part

Fig. 10: Zero point default value

1. If not yet present: Insert blanking plug into positioning element.
2. Fasten clamp fitting of the positioning element with hexagon spanner.
3. Use SP3-QR24 shield plate.
4. Fasten positioning element with three M3 countersunk screws (recommended: stainless steel screws).
 - ▶ Depending on the application, mount the encoder and align to the required position of the zero point (factory setting for 0°: yellow arrow on the positioning element pointing to the black mark on the sensor, see figure "Zero point default value".)

6 Connection

The encoder has an 8-pin M12 × 1 male connector with incremental output.

6.1 Wiring diagram



NOTE

Keep pin 8 potential-free in order to prevent any accidental teach operations.

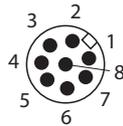


Fig. 11: M12 male connector — pin assignment

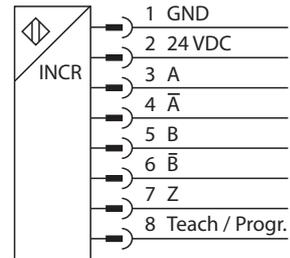


Fig. 12: M12 male connector — wiring diagram

7 Commissioning

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

8 Operation

8.1 Maximum speed



WARNING

Improper fixing

Possible danger to life from swinging components!

- ▶ Maximum speed of 10,000 rpm must not be exceeded.
- ▶ Observe mounting instructions in all cases.
- ▶ Check the secure seating of the positioning element regularly, tightening torque: $M = 0.6 \dots 0.8 \text{ Nm}$.

The maximum usable speed of the encoder is 10,000 rpm. However, at high resolutions it is limited by the maximum output frequency of 200 kHz. The dependence of the max. speed on the resolution is illustrated in the following diagram:

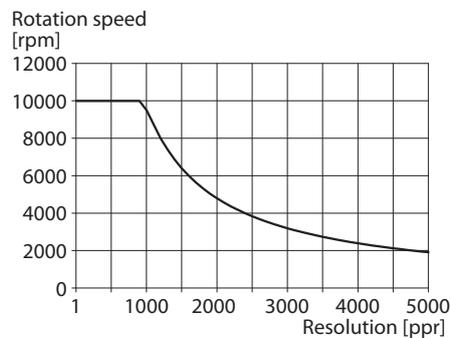


Fig. 13: Maximum usable speed depending on the resolution

8.2 LEDs

The green operating voltage LED and the yellow status LED have the following display functions:

Color/state	Meaning
Green	Sensor is being supplied properly.
Yellow	The positioning element is within the measuring range with reduced signal quality.
Yellow flashing	Positioning element is not within the measuring range.
Off	Positioning element is within the measuring range.

9 Setting

The encoder can be assigned parameters as follows:

- Setting via the Easy-Teach function
- Setting by manual bridging (shorting)
- Setting via PACTware (FDT/DTM)



NOTE

When the IO Link USB adapter is connected, it is possible that a single teach operation is triggered by accident.

The following parameters can be set:

Parameter	Description
Zero point	Zero point: Position of the Z-signal
Effective direction	CW/CCW: Feed A-track or B-track
Pulse number (only for RI...-QR24-INCR...devices)	Resolution: 1...5000 pulses per revolution (can be adjusted only via Easy-Teach and PACTware)
Trigger burst output	The position measured by the encoder as an absolute value is output once as an incremental pulse sequence. The number of pulses corresponds to the angular distance to the zero point (single-turn) in the set effective direction and resolution.

The factory settings can be found in the section "Technical data".

9.1 Setting via the Easy-Teach function

The devices can be taught as follows via the Easy-Teach function:

	Teach to GND	Teach to U _B
Teach adapter	Press the pushbutton to GND	Press the pushbutton to U _B
Manual bridging (short circuit)	Short circuit pin 1 with pin 8	Short circuit pin 2 with pin 8

A relay can also be used to set the device automatically via the Easy-Teach function.

9.1.1 Setting via teach adapter

The TX2-Q20L60 teach adapter is not supplied with the device and must be ordered additionally. To use the teach adapter connect it between the sensor and the connection cable.

Setting the position of the Z signal (zero point)

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Specify the selected zero point using the yellow arrow marking on the positioning element (factory setting for 0°: yellow arrow on the positioning element points to black marking on the sensor)
- ▶ Press and hold down the pushbutton on the adapter for 2 s to GND.
- ⇒ If the Status LED is permanently lit after 2 s, the position of the Z signal has been successfully taught.

Trigger burst output

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Press the button on the adapter for 2 s against U_B.
- ⇒ If the status LED is permanently lit after 2 s, the burst output was successfully triggered.

Setting the effective direction of the encoder clockwise

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Press the button on the adapter for 10 s against U_B.
- ⇒ If the status LED flashes rapidly for 2 s, the effective direction is set successfully in the clockwise direction.

Set the effective direction of the encoder counterclockwise

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Press the button on the adapter for 10 s against GND.
- ⇒ If the status LED flashes rapidly for 2 s, the effective direction is successful in the counterclockwise direction.

Resetting the device to factory settings

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Press the button on the adapter for 15 s against U_B.
- ⇒ If the power LED and the status LED flash alternately, the device has successfully been reset to the factory setting.

Set the pulses per revolution in the preset mode (360...2048 pulses per revolution)



NOTE

The setting is available only for RI...-QR24-INCR... devices.

- ▶ Remove the positioning element (yellow status LED flashes).
- ▶ Press and hold down the pushbutton on the adapter for 2 s to GND.
- ⇒ The pulse selection is enabled for 10 s.
- ▶ Select the desired pulse number in accordance with the following table:

Pulses per revolution	Teach to GND	Teach successful
360	Start value (do not press)	Status LED flashes 1 ×
512	1 ×	Status LED flashes 2 ×
1000	2 ×	Status LED flashes 3 ×
1024	3 ×	Status LED flashes 4 ×
2048	4 ×	Status LED flashes 5 ×

Set the pulses per revolution in the preset mode (2500...5000 pulses per revolution)



NOTE

The setting is available only for RI...-QR24-INCR... devices.

- ▶ Remove the positioning element (yellow status LED flashes).
- ▶ Press the button on the adapter for 2 s against U_B .
- ⇒ The pulse selection is enabled for 10 s.
- ▶ Select the desired pulse number in accordance with the following table:

Pulses per revolution	Teach to GND	Teach successful
2500	Start value (do not press)	Status LED flashes 1 ×
3600	1 ×	Status LED flashes 2 ×
4096	2 ×	Status LED flashes 3 ×
5000	3 ×	Status LED flashes 4 ×

9.1.2 Setting by manual bridging (shorting)

Setting the position of the Z signal (zero point)

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Specify the required zero point using the yellow arrow marking on the positioning element (factory setting for 0°: yellow arrow on the positioning element points to black marking on the sensor).
- ▶ Bridge pin 1 (GND) and pin 8 for 2 s.
- ⇒ If the Status LED is permanently lit after 2 s, the position of the Z signal has been successfully taught.

Trigger burst output

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Bridge pin 2 (U_b) and pin 8 for 2 s.
- ⇒ If the status LED is permanently lit after 2 s, the burst output was successfully triggered.

Setting the effective direction of the encoder clockwise

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Bridge pin 2 (U_b) and pin 8 for 10 s.
- ⇒ If the status LED flashes quickly for 2 s, the effective direction is set successfully in the clockwise direction.

Set the effective direction of the encoder counterclockwise

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Bridge pin 1 (GND) and pin 8 for 10 s.
- ⇒ If the status LED flashes rapidly for 2 s, the effective direction is successful in the counterclockwise direction.

Resetting the device to factory settings

Requirement: Positioning element must be mounted (yellow Status LED off).

- ▶ Bridge pin 2 (U_b) and pin 8 for 15 s.
- ⇒ If the power LED and the status LED flash alternately, the device has successfully been reset to the factory setting.

Set the pulses per revolution in the preset mode (360...2048 pulses per revolution)



NOTE

The setting is available only for RI...-QR24-INCR... devices.

- ▶ Remove the positioning element (yellow status LED flashes).
- ▶ Bridge pin 1 (GND) and pin 8 for 2 s.
- ⇒ The pulse selection is enabled for 10 s.
- ▶ Select the desired pulse number in accordance with the following table:

Pulses per revolution	Teach to GND	Teach successful
360	Start value (do not press)	Status LED flashes 1 ×
512	1 ×	Status LED flashes 2 ×
1000	2 ×	Status LED flashes 3 ×
1024	3 ×	Status LED flashes 4 ×
2048	4 ×	Status LED flashes 5 ×

Set the pulses per revolution in the preset mode (2500...5000 pulses per revolution)



NOTE

The setting is available only for RI...-QR24-INCR... devices.

- ▶ Remove the positioning element (yellow status LED flashes).
- ▶ Bridge pin 2 (U_B) and pin 8 for 2 s.
- ⇒ The pulse selection is enabled for 10 s.
- ▶ Select the desired pulse number in accordance with the following table:

Pulses per revolution	Teach to GND	Teach successful
2500	Start value (do not press)	Status LED flashes 1 ×
3600	1 ×	Status LED flashes 2 ×
4096	2 ×	Status LED flashes 3 ×
5000	3 ×	Status LED flashes 4 ×

9.2 Setting via FDT/IODD



NOTE

Only RI...-QR24...-INCR... can be set via PACTware (FDT/DTM).

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 is available at www.turck.com and can be downloaded free of charge.

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

The RKC8.302T-1.5-RSC4T/TX320 (ID 6625003) connection cable is required to connect 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

The strength of the resonance coupling is indicated by an LED. Any faults are indicated via the LEDs.

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 Decommissioning

- ▶ Disconnect the connection cable from the power supply and/or processing units.
- ▶ Disconnect the connection cable from the device.
- ▶ Undo the connections of the device or if necessary the mounting aid for the mounting area.
- ▶ If present: undo the connection between the device and the mounting aid.

14 Disposal



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

15 Technical data

Technical data	
Measuring function — information	
Angular range	0...360°
Max. mechanical speed	10,000 rpm Determined with standardized construction, with a steel shaft Ø 20 mm, L = 50 mm and reducer Ø 20 mm
Resolution, incremental	1...5000 pulses per revolution
Effective direction	CW/CCW (factory setting: CW)
Z-track (zero point setting)	Factory setting: 0° (yellow arrow on the positioning element pointing to the black marking on the sensor)
Starting torque, shaft load	Not applicable because of contactless measuring principle
System	
Repetition accuracy	≤ 0.01 % of full scale
Linearity deviation	≤ 0.05 % of full scale
Temperature drift	≤ ± 0.003 %/K
Ambient temperature	-25...+85 °C
Electrical data	
Operating voltage	10...30 VDC
Residual ripple	≤ 10 % U _{ss}
Rated insulation voltage	≤ 0.5 kV
Short-circuit protection	Yes/cyclic
Wire breakage/reverse polarity protection	Yes/yes (power supply)
Output function	8-pin, push pull/HTL
Output type	Incremental
Maximum pulse frequency	200 kHz
Signal level high	Min. U _B - 2 V
Signal level low	Max. 2 V
Rise time	Max. 750 ns
fall time	Max. 750 ns
Sampling rate	1000 Hz
Current consumption	<100 mA
Housing	
Dimensions	81 × 78 × 24 mm
Connection	Male connector, M12 × 1, 8-pin
Vibration resistance	55 Hz (1 mm)
Vibration resistance (EN 60068-2-6)	20 g, 10...3000 Hz, 50 cycles, 3 axes
Shock resistance (EN 60068-2-27)	100 g, 11 ms ½ sine; each 3 ×, 3 axes
Continuous shock resistance (EN 60068-2-29)	40 g, 6 ms ½ sine, 4000 × each, 3 axes
Type of protection	IP68/IP69K
MTTF	138 years acc. to SN 29500 (Ed. 99) 40 °C

Technical data	
LEDs	
Operating voltage indication	LED green
Status display	LED, yellow, yellow flashing

15.1 Factory settings

Factory settings	
Incremental resolution (RI...-QR24...-INCR...)	1024 (default)
Effective direction	CW
Z-track (zero point setting)	Factory setting: 0° (yellow arrow on the positioning element pointing to the black marking on the sensor)

16 Turck subsidiaries – contact information

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