

Your Global Automation Partner

TURCK

LTX

Linear Position Sensors with Analog Output

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:

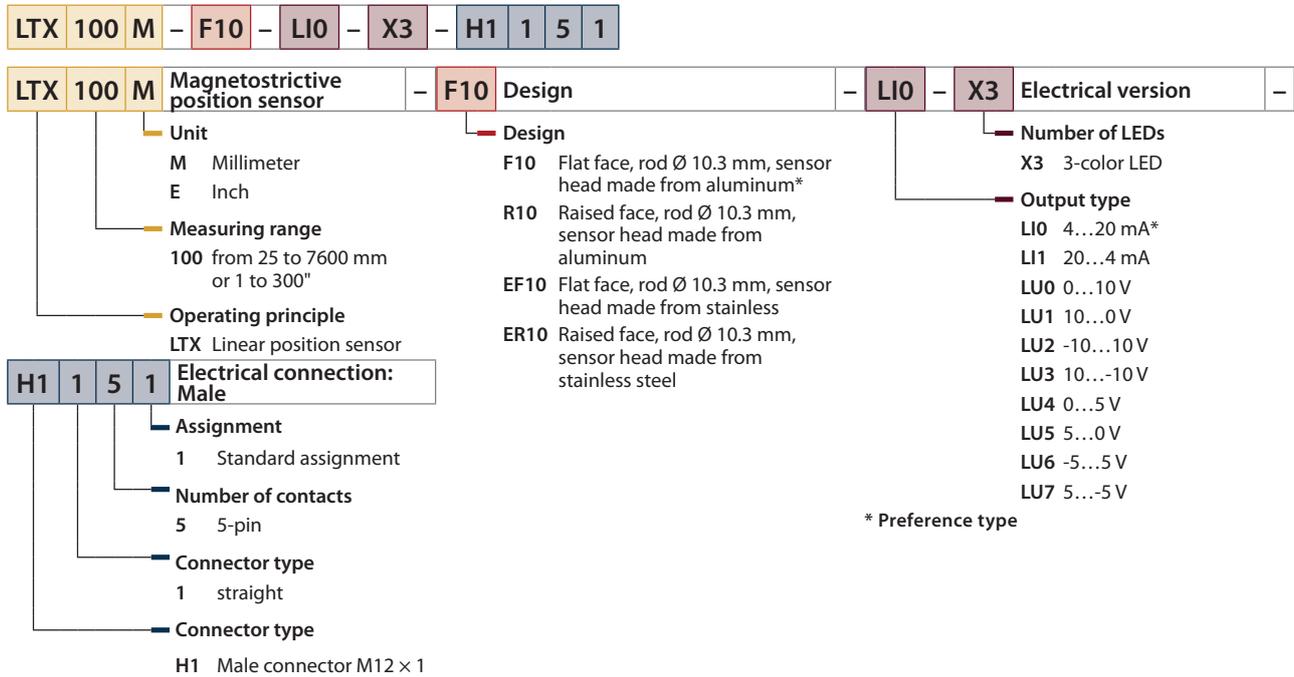
- Data sheet
- Declarations of conformity (current versions)

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



NOTE

Types with manufacturer-compatible connectors and models with customized blind zones are available on request.

The preferred types are the LTX...M-F10-LI0-X3-H1151 devices.

2.2 Scope of delivery

The scope of delivery includes:

- Linear position sensor (without positioning element)
- 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. [▶ 28].

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 magnetostrictive linear position sensors are used for contactless and wear-free linear position measuring. The devices are suitable for use in hydraulic cylinders. By adding float magnets (available as an option), the devices can also be used for level measurement. The measuring range is adjustable.

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

3.2 General safety instructions

- 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.
- Only operate the device within the limits stated in the technical specifications.

4 Product description

The linear position sensors with an analog output are available with a current or voltage output. An M12 connector is available for the connection. All devices feature a rod design with IP68 protection. The devices have contactless operation, which requires the use of a positioning element approved by Turck (see section "Technical accessories"). The measuring range is adjustable.

The devices operate in absolute mode. Voltage failures do not require renewed homing or recalibration. All position values are determined as absolute values. Homing movements after a voltage drop are unnecessary.

4.1 Device overview

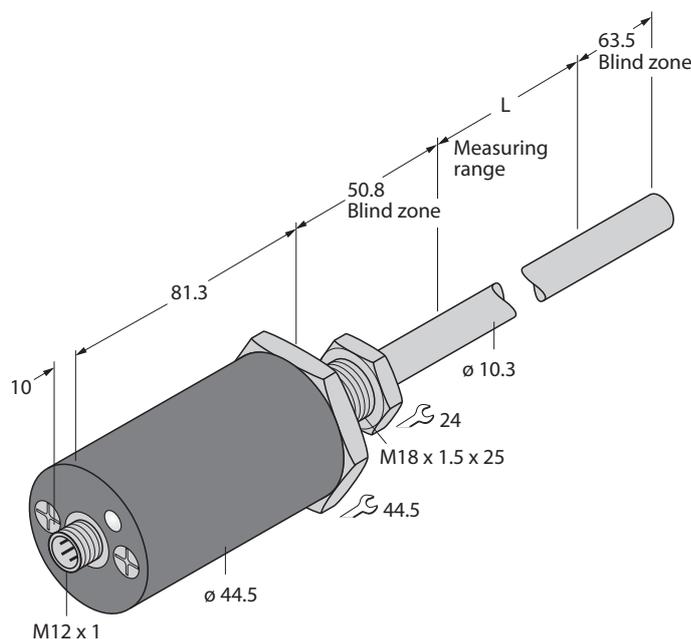


Fig. 1: LTX device dimensions with standard blind zones (in mm)

4.1.1 Indication elements

Each device has a 3-color LED for indicating the operating state and for fault diagnostics.

4.2 Properties and features

- Analog output
- Adjustable measuring range with adjustment protection
- Automatic signal control
- 7...30 VDC supply voltage
- Low power consumption
- High shock and vibration resistance
- Degree of protection IP68
- 16-bit resolution
- Status indication via 3-color LED
- Sensor and pressure pipe can be replaced separately
- M12 connector

4.3 Operating principle

The operation of the Turck LTX sensors is based on the magnetostrictive principle. A so-called “waveguide” is located in the measuring probe of the linear position sensor. If a current signal generated on the waveguide hits the magnetic field of the positioning element applied from outside, this produces a mechanical feedback in the waveguide. This feedback is evaluated in the sensor head and output as position information.

4.4 Functions and operating modes

The devices feature a current or voltage output. The device output provides a current or voltage signal proportional to the position of the positioning element (see output characteristics).

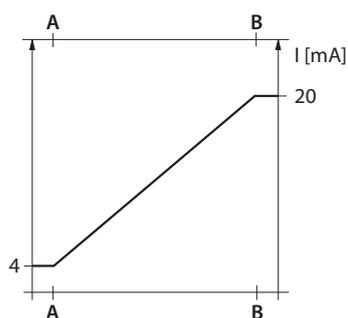


Fig. 2: Output characteristics — devices with 4...20 mA current output

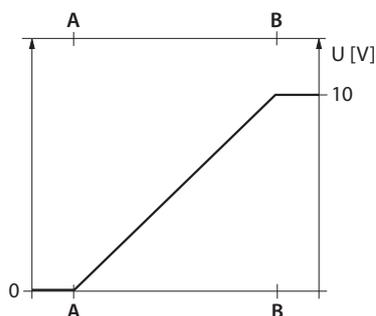


Fig. 3: Output characteristics — devices with 0...10 V voltage output

4.4.1 Automatic signal control

The device is automatically adjusted to the signal strength of the positioning element as soon as the sensor is supplied with power. The automatic signal control fully compensates for any tolerances.

4.4.2 Current output

LTX...LI... devices feature a current output, which outputs a current signal in line with the position of the positioning element (e.g. 4...20 mA, depending on design). The measuring range is adjustable.

4.4.3 Voltage output

LTX...LU... devices feature a voltage output, which outputs a voltage signal in line with the position of the positioning element (e.g. 0...10 V, depending on design). The measuring range is adjustable.

4.4.4 Preferred types LTX...M-F10-LI0-X3-H1151 — measuring range

Preferred types LTX...M-F10-LI0-X3-H1151 are available with the following measuring lengths as standard:

| Measuring range | Configured |
|------------------------|----------------------|
| 100...500 mm | in 25 mm increments |
| 500...2000 mm | in 50 mm increments |
| 2000...7600 mm | in 500 mm increments |

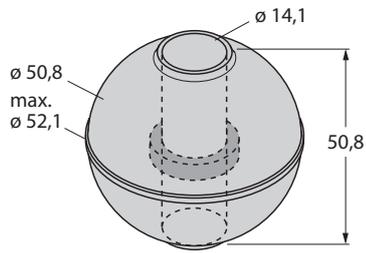
4.5 Technical accessories

The following accessories are not supplied with the device:

Positioning element

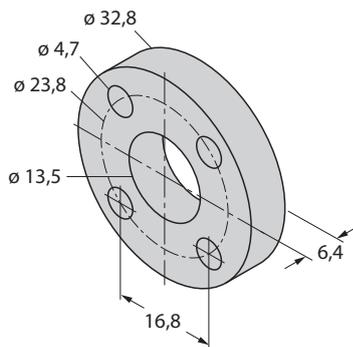
| Dimension drawing | Type | ID | Description |
|-------------------|-------------|---------|--|
| | STM-AL-R10 | 6900409 | Standard 4-hole positioning element, aluminum, suitable for mounting in the hydraulic cylinder |
| | CM-R10 | 6900416 | Standard positioning element, suitable for mounting in the hydraulic cylinder |
| | LSPM-AL-R10 | 6900414 | Ring positioning element with slot, aluminum, can be used for external mounting with RB-R10 mounting bracket |

| Dimension drawing | Type | ID | Description |
|-------------------|--------|---------|--|
| | EF-R10 | 6900417 | Float positioning element, stainless steel, specific gravity 0.62 kg/m ³ , for external mounting for level monitoring |



Spacer

| Dimension drawing | Type | ID | Description |
|-------------------|---------|---------|---|
| | STS-R10 | 6900411 | Standard spacer made from non-ferrous material, for separating the positioning element from the ferrous base of the hydraulic piston rod, suitable for mounting in the hydraulic cylinder |



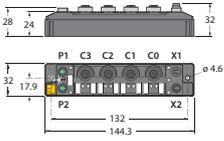
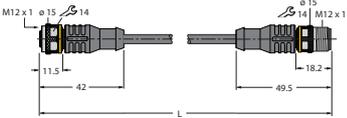
Accessories for external mounting

| Dimension drawing | Type | ID | Description |
|-------------------|---------|---------|--|
| | MMB-R10 | 6900004 | Mounting bracket for positioning element, for external mounting, with screws and standard STS-R10 spacer |
| | MB-R10 | 6900419 | Mounting bracket, sensor head and rod, for external mounting, with screws |
| | RB-R10 | 6900420 | Mounting bracket for rod, for external mounting, with screws |

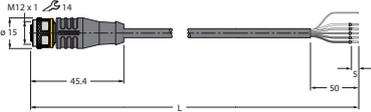
Teach adapter

| Dimension drawing | Type | ID | Description |
|-------------------|--------|---------|---|
| | RP-Q21 | 6900005 | Teach adapter to adjust the measuring range |

Fieldbus accessories

| Dimension drawing | Type | ID | Description |
|---|--------------------------|---------|---|
|  | TBEN-S2-4AI | 6814025 | Compact multiprotocol I/O module for Ethernet (EtherNet/IP, Modbus TCP or PROFINET slave) with four analog inputs |
|  | RKC4T-2-RSC4.301T/TXL320 | 6630836 | 2 m adapter cable, 3-pin, PUR, for direct connection of the sensor to the block I/O module TBEN-S2-4AI, required module parameter setting: common ground (asymmetrical) |

Connection cables

| Dimension drawing | Type | ID | Description |
|---|---------------|---------|--|
|  | RKS4.5T-2/TXL | 6626373 | Connection cable, M12 female connector, straight, 5-pin, cable length: 2 m, jacket material: PUR, black, cULus approval, other cable lengths and types available, see www.turck.com |
|  | RKS4T-2/TXL | 6626293 | Connection cable, M12 female, straight, 3-pin, cable length: 2 m, jacket material: PUR, black, cULus approval, other cable lengths and types available, see www.turck.com |

In addition to the above connection cables, Turck also offers other cable types for specific applications with the correct terminals for the device. More information on this is available from the Turck product database at www.turck.de/products in the Connectivity area.

5 Installing

The device can be mounted in a hydraulic cylinder or externally with a mounting bracket.



NOTICE

Incorrect mounting

Risk of damage to the sensor

- ▶ Secure the device in place using only the hexagon nut on the sensor head (max. tightening torque: 50 Nm).
- ▶ Do not fasten by turning the sensor head itself.
- ▶ Ensure that the positioning element is guided centrally over the pressure pipe along the entire measuring length (deviation < 0.5 mm).

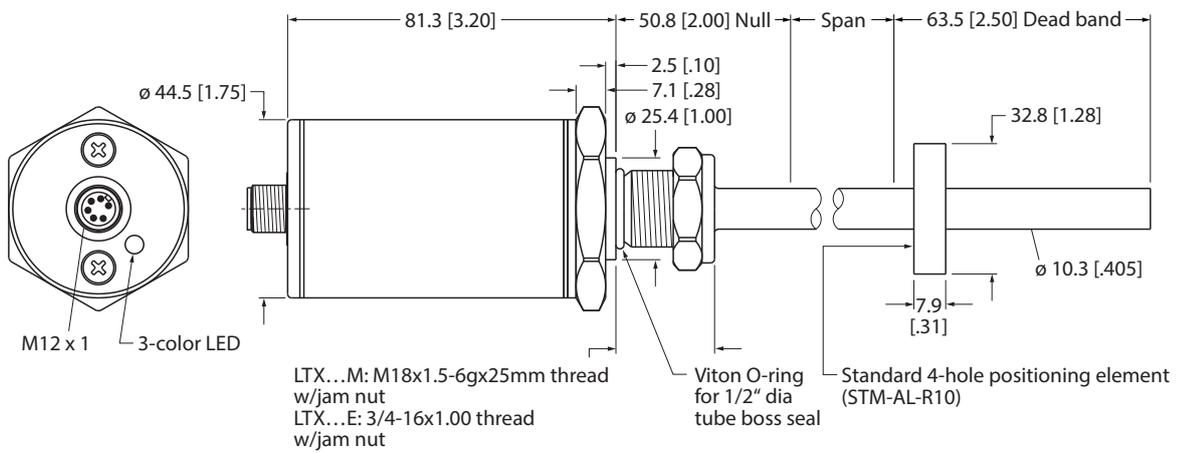


Fig. 4: Side view LTX-R10 with dimensions in mm [in] (design with raised face)

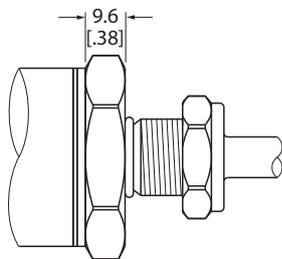


Fig. 5: Type with flat face (F10) — housing nut with thread

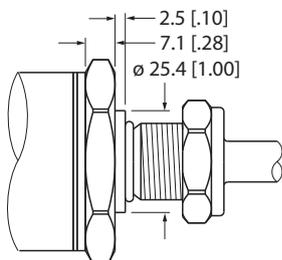


Fig. 6: Type with raised face (R10) — housing nut with thread

5.1 Mounting the device in a hydraulic cylinder

**NOTICE**

Incorrect mounting

Risk of damage to the hydraulic cylinder

- ▶ Observe the instructions of the cylinder manufacturer and the hydraulic cylinder specifications.
-

The devices can be mounted directly in a hydraulic cylinder. For this a hole with a recommended diameter of 13.5 mm must be provided in the cylinder piston rod (depending on the cylinder design). To fasten the device, an M18 × 1.5 threaded hole according to ISO 6149-1 is required in the end cap of the hydraulic cylinder.

5.1.1 Mounting the sensor

- ▶ Loosen the hexagon nut on the sensor and remove from the thread.
- ▶ Ensure that the pressure seal O-ring is located on the sensor head.
- ▶ Mount the non-ferrous spacer between the positioning element and base of the piston rod.
- ▶ Mount the positioning element. Observe a minimum distance of 51 mm between the positioning element and sensor head with the piston rod in the retracted position. If the minimum distance cannot be observed, sink the positioning element in the cylinder piston.
- ▶ Recommendation for sensors with probe lengths of ≥ 1500 mm: Use a protective ring, e.g. made of polymer (see figure below, item 2). The protecting ring prevents mechanical wear of positioning elements by the pressure pipe when the piston is fully extended.
- ▶ Fasten the positioning element and spacer with non-ferrous screws.
- ▶ Remove the protective cap on the hydraulic cylinder (if present). The bore hole in the cylinder piston rod should have a diameter of at least 13.5 mm.
- ▶ Insert the sensor pressure pipe into the cylinder piston.
- ▶ Screw the sensor into the M18 x 1.5 threaded bore of the hydraulic cylinder using the thread of the sensor head (max. tightening torque: 50 Nm).

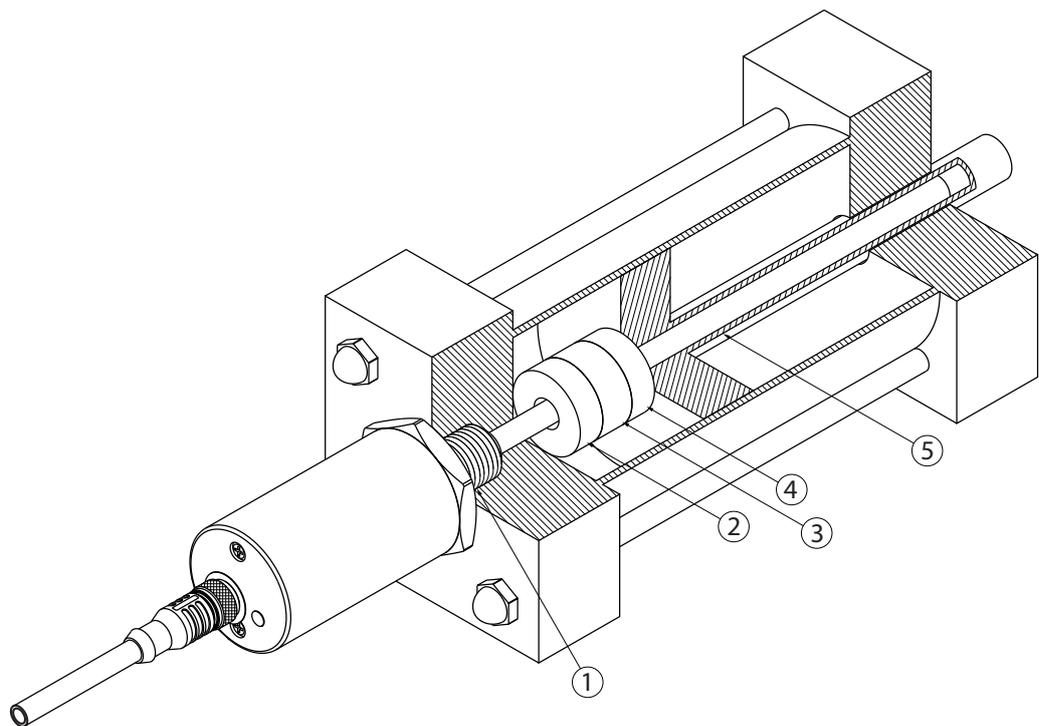


Fig. 7: Mounting the device in a hydraulic cylinder

| Position | Description |
|----------|--|
| 1 | Viton O-ring |
| 2 | Protective ring (optional) |
| 3 | 4-hole positioning element |
| 4 | Spacer for positioning element |
| 5 | 13.5 mm bore hole in the cylinder piston rod |

5.2 Fastening the device with mounting bracket externally



NOTICE

Magnetization of metal in close proximity with the measuring probe
Inaccurate measurements

- ▶ Mount the sensor measuring probe at least 7 mm away from ferromagnetic material.



NOTE

Non-ferrous materials, such as brass, copper, aluminum, demagnetized stainless steel or plastic do not impair the function of the sensor.

- ▶ Loosen the hexagon nut on the thread of the sensor head.
- ▶ Guide the mounting bracket over the pressure pipe up to the sensor head.
- ▶ If the mounting bracket has an M18 × 1.5 threaded hole, screw tight the sensor directly.
- ▶ Fasten the mounting bracket.
- ▶ Re-fasten the hexagon nut on the sensor head.

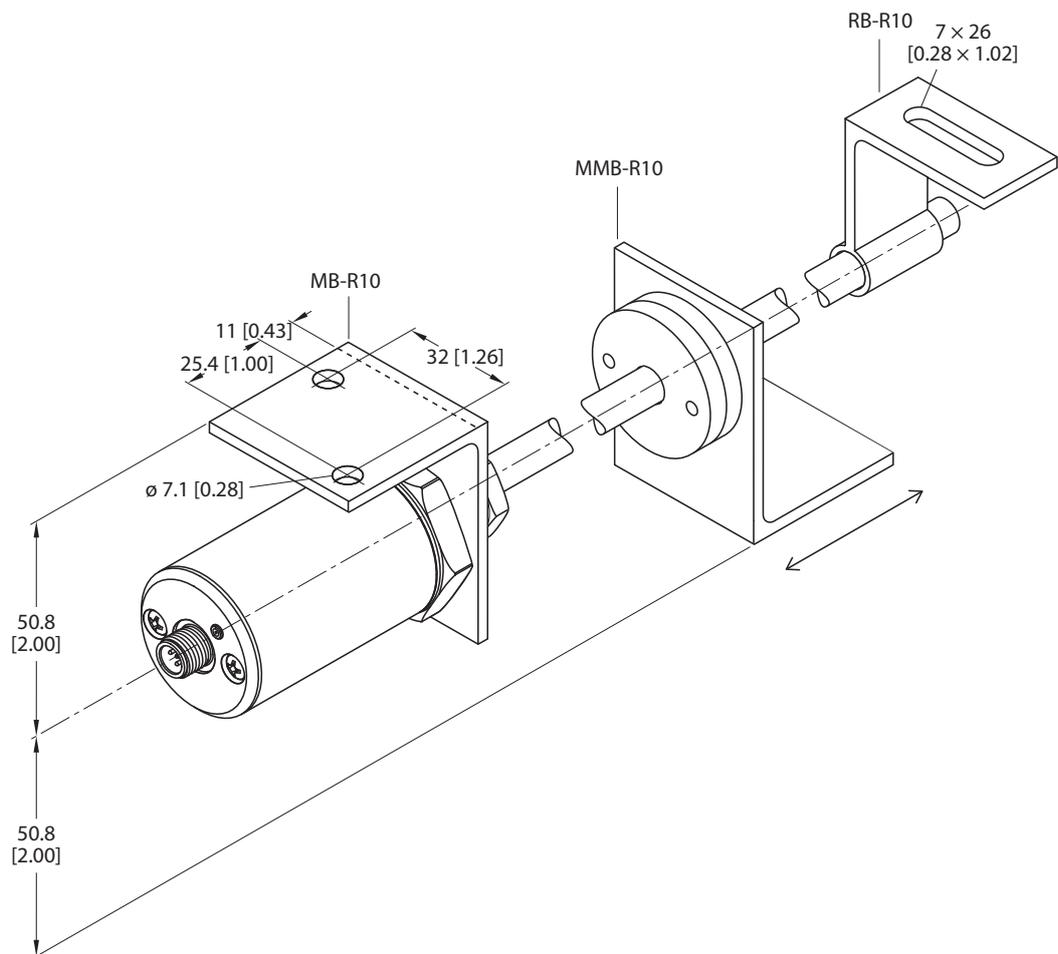


Fig. 8: Mounting a device with mounting brackets

5.2.1 Mounting additional mounting brackets (for external mounting)

On devices over 750 mm in length, additional mounting elements (RB-R10) increase protection against mechanical stresses such as impacts and vibrations. The mounting elements must be made from non-ferrous material.

- ▶ When using additional mounting elements, use a ring-type positioning element with slot as the positioning element.
- ▶ Fit mounting elements made from ferromagnetic (already magnetized) material at least 7 mm away from both the blind zone and the active measuring range of the sensor.
- ▶ Sensors with probe lengths of 750...1800 mm: Fit additional mounting elements as shown in fig. "Mounting positioning elements".
- ▶ Sensors with probe lengths > 1800 mm: Fit mounting elements at distances of 1200 mm.

5.2.2 Installing the positioning element (for external mounting)

- ▶ Observe a distance of 7 mm between the positioning element and ferrous material. If necessary, use a spacer.
- ▶ Observe a distance of 7 mm between the end of the measuring probe and ferrous material.

The positioning element must not touch the sensor along the entire measuring range.

- ▶ When using ring positioning elements with a slot: Observe ≤ 5 mm distance between the positioning element and measuring probe (nominal distance: 1.5 mm).
- ▶ Push the positioning element into the active measuring range of the sensor.
- ▶ Fasten the positioning element with non-ferrous screws.

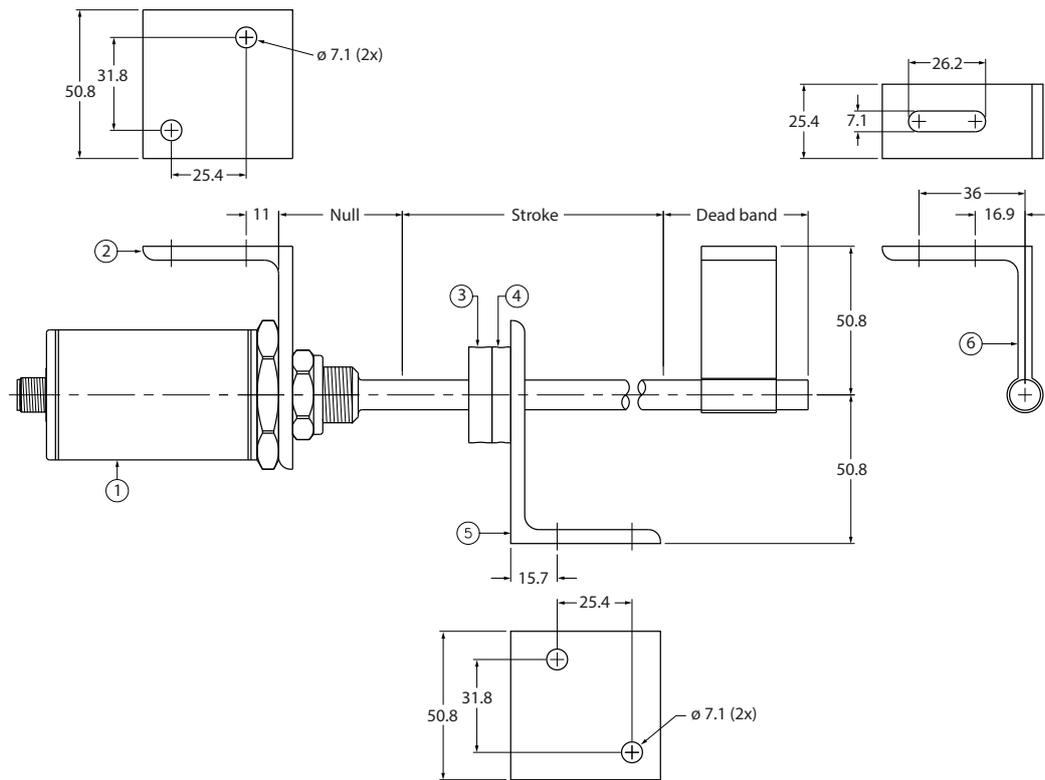


Fig. 9: Mounting positioning elements

| Position | Meaning |
|----------|--|
| 1 | Sensor |
| 2 | Mounting element for sensor head |
| 3 | 4-hole positioning element (aluminum) |
| 4 | Spacer for positioning element |
| 5 | Mounting element for positioning element |
| 6 | Mounting element for measuring probe |

6 Connection



NOTICE

Couplings on the sensor cable
Sensor fault

- ▶ Do not route the sensor cable close to high voltage power supplies.

- ▶ Keep the length of the connection lines as short as possible.
- ▶ Use shielded connection cables.
- ▶ Keep the sensor cables away from high-power AC cables and motor drive cables.
- ▶ Do not connect or disconnect the sensor when energized.
- ▶ Route the high-voltage and low-voltage cables separately.
- ▶ Connect the female connector of the connection cable to the male connector of the device.
- ▶ If the higher-level input is a differential (symmetrical) input, connect the sensor to the higher level as shown in the figure.
- ▶ If the higher-level input is a common ground (asymmetrical) input, connect the sensor to the higher level as shown in the figure.



NOTE

Keep pin 2 potential-free during operation to prevent any accidental teach-in operations.

6.1 Wiring diagrams



NOTE

The following figure shows the usual wire colors. The assignment may be different in exceptional cases.

Wiring diagram — higher-level input is differential (symmetrical)

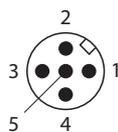


Fig. 10: Pin assignment

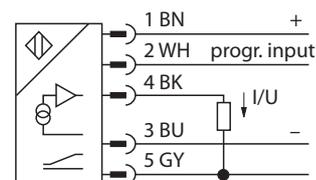


Fig. 11: Wiring diagram

Wiring diagram — higher-level input is common ground (asymmetrical)

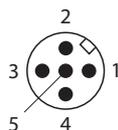


Fig. 12: Pin assignment

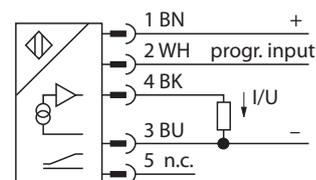


Fig. 13: Wiring diagram

7 Commissioning

**NOTE**

If the device is part of a closed and not yet fully configured system, the system may move in an uncontrolled manner the first time the power supply is connected.

The device is operational automatically once the cables are connected and the power supply is switched on. The positioning element must be located in the active measuring range of the sensor when the power supply is applied in order to ensure the correct tuning of the signal strength control.

8 Operation

8.1 LED indication

| Color | Meaning |
|--------|--|
| Off | No power supply present |
| Green | Positioning element signal detected within taught range |
| Yellow | Positioning element signal detected outside taught range |
| Red | No positioning element signal detected |

Proceed as follows if no magnetic signal is detected (red LED lit):

- ▶ Place the positioning element in the active measuring range of the device.
- ▶ Carry out a voltage reset.
- ⇒ The device is automatically adjusted to the signal strength of the positioning element.

8.2 Diagnostics

The LTX with an analog output (4...20 mA) has a diagnostic feedback function. The 4...20 mA range makes it possible to locate the position of the positioning element in the set measuring range. If the positioning element is outside of the set measuring range, the analog output supplies the following values:

- 3.8 mA: Positioning element is located in the blind zone or no positioning element detected
- 3.9 mA or 20.1 mA: Positioning element is located outside of the set measuring range

9 Setting

The devices have an adjustable analog output. The measuring range can be set by manual bridging or with the RP-Q21 teach adapter. The zero point and end point of the measuring range can be set in succession or independently of one another.

9.1 Setting via manual bridging

- ▶ Supply the device with voltage.
- ▶ Place positioning element at the zero point of the measuring range.
- ▶ Bridge pin 2 and pin 3 for 4 s.
- ▶ Interrupt bridge between pin 2 and pin 3 for 1 s.
- ⇒ Sensor starts teach mode.
- ▶ Bridge pin 2 and pin 3 within 5 s.
- ⇒ The zero point of the measuring range is stored.
- ▶ Place positioning element at end point of the measuring range.
- ▶ Bridge pin 2 and pin 3 for 4 s.
- ▶ Sensor starts teach mode.
- ▶ Interrupt bridge between pin 2 and pin 3 for 1 s.
- ▶ Bridge pin 1 and pin 2 within 5 s.
- ⇒ The end point of the measuring range is stored.

9.2 Setting via teach adapter RP-Q21

- ▶ Connect the sensor to the teach adapter.
- ▶ Place positioning element at the zero point of the measuring range.
- ▶ Press the Zero button of the teach adapter for 4 s.
- ▶ Release the Zero button of the teach adapter for 1 s.
- ⇒ Sensor starts teach mode.
- ▶ Press the Zero button of the teach adapter again within 5 s.
- ⇒ The zero point of the measuring range is stored.
- ▶ Place positioning element at end point of the measuring range.
- ▶ Press the Zero button of the teach adapter for 4 s.
- ▶ Release the Zero button of the teach adapter for 1 s.
- ⇒ Sensor starts teach mode.
- ▶ Press the Span button of the teach adapter again within 5 s.
- ⇒ The end point of the measuring range is stored.

10 Troubleshooting

If the device does not operate as expected, check the LED feedback signal (see the section “LED indication”) Check whether any ambient interference is present. If there is no ambient interference present, check the connections of the device for faults. If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

10.1 Replacing the sensor head and measuring element



WARNING

Overpressure in the sensor head

Risk of injury through uncontrolled ejection of sensor head

- ▶ Ensure in pressurized systems that the pressure pipe is not damaged and pressure-proof.



NOTE

The system does not have to be depressurized in a fluid cylinder application.

Sensor head and measuring element can be replaced independently of the pressure pipe.

- ▶ Loosen the screws on the sensor head.
- ▶ Pull the sensor and measuring element out of the housing. The end caps are not screwed separately to the sensor head.
- ▶ Insert a new sensor head and measuring element in the housing.
- ▶ Secure the screws, e.g. with Loctite 243.
- ▶ Fasten the screws on the sensor head (max. tightening torque < 1 Nm).

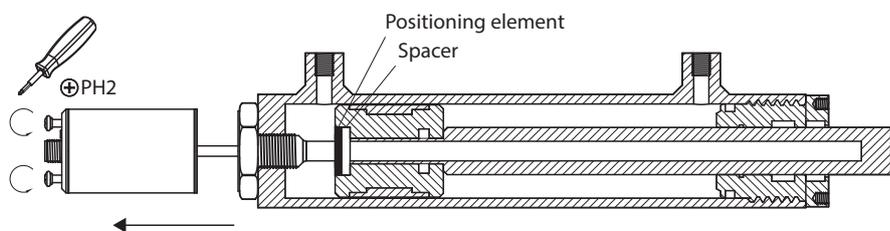


Fig. 14: Replacing the sensor head and measuring element

11 Maintenance

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

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

12 Repair

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

12.1 Returning devices

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

13 Disposal



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

14 Technical data

| Technical data | LTX-R10.../LTX-F10... | LTX-ER10.../LTX-EF10... |
|---------------------------------------|-----------------------------|-----------------------------|
| Measuring range specifications | | |
| Blind zone (connector end) | 50.8 mm | |
| Blind zone (end) | 63.5 mm | |
| Repetition accuracy | ≤ 0.01 % of full scale | |
| Resolution | 16 bit | |
| Linearity | ≤ 0.01 % of full scale | |
| Operating temperature, rod | -40...+105 °C | |
| Operating temperature, electronics | -40...+85 °C | |
| Temperature drift | ≤ 10 ppm/°C | |
| Electrical data | | |
| Operating voltage | 7...30 VDC | |
| Current consumption | ≤ 100 mA/15 VDC | |
| Short-circuit protection | Yes/cyclic | |
| Output function | 5-wire, analog | |
| Design | | |
| Design | Cylindrical/smooth | |
| Housing material | Metal, aluminum, black | Metal, stainless steel, 304 |
| Active face material | Metal, stainless steel, 316 | |
| Vibration resistance | 30 Hz (1 mm) | |
| Shock resistance | 100 g (11 ms) | |
| Pressure resistance (temporary) | 680 bar | |
| Pressure resistance (permanent) | 340 bar | |
| Type of protection | IP68 | |

14.1 Update time

| Measuring length | Update time |
|------------------|-------------|
| 50 mm | 0.5 ms |
| 300 mm | 1 ms |
| 750 mm | 2 ms |
| 1250 mm | 3 ms |
| 2500 mm | 4 ms |
| 3800 mm | 5 ms |
| 4550 mm | 6 ms |
| 6350 mm | 7 ms |
| 7600 mm | 8 ms |

15 Turck subsidiaries – contact information

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