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TURCK

LTX

Linear Position Sensors with SSI 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
- Declarations of conformity
- Approvals

1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to techdoc@turck.com.

2 Notes on the product

2.1 Product identification

LTX 100 M - F10 - SSI 2 - G A F 1 - X3 - H1 1 6 1

LTX 100 M Magnetostrictive position sensor - **F10** Design -

<p>Unit M Millimeter E Inch</p> <p>Measuring range 100 from 25 to 7500 mm or 1 to 300"</p> <p>Operating principle LTX Linear position sensor</p>	<p>Design</p> <p>F10 Flat face, rod Ø 10.3 mm, sensor head made from aluminum*</p> <p>R10 Raised face, rod Ø 10.3 mm, sensor head made from aluminum</p> <p>EF10 Flat face, rod Ø 10.3 mm, sensor head made from stainless steel</p> <p>ER10 Raised face, rod Ø 10.3 mm, sensor head made from stainless steel</p>
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SSI 2 - G A F 1 - X3 Electrical version - **H1 1 6 1** Electrical connection: Male

<p>Number of LEDs X3 3-color LED</p> <p>Resolution 1 0.005 mm* 2 0.01 mm 3 0.05 mm 4 0.1 mm 5 0.02 mm 6 0.002 mm 7 0.001 mm</p> <p>Direction F forward* R backward V velocity</p> <p>Data type S synchronous A asynchronous*</p> <p>Data format B binary G gray*</p> <p>Data length 1 24 bit 2 25 bit* 3 26 bit</p> <p>Data mode</p>	<p>Assignment 1 Standard assignment</p> <p>Number of contacts 6 6-pin</p> <p>Connector type 1 straight</p> <p>Connector type H1 Male connector M12 x 1</p> <p>* Preference type</p>
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NOTE

Types with manufacturer compatible connectors and models with customized blind zones are available on request. The LTX...M-F10-SSI2-GAF1-X3-H1161 devices are preference types.

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 SSI interface provide a serial synchronous interface output signal (SSI) that is proportional to the position of the positioning element. Different device variants enable the following measuring functions to be performed:

- Position measurement, forward measuring direction
- Position measurement, backward measuring direction
- Speed measurement

The devices can be connected using an M12 plug connector. 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 devices operate in absolute mode, power failures do not require renewed homing or recalibration. All position values are determined as absolute values, homing runs after a voltage drop are unnecessary.

4.1 Device overview

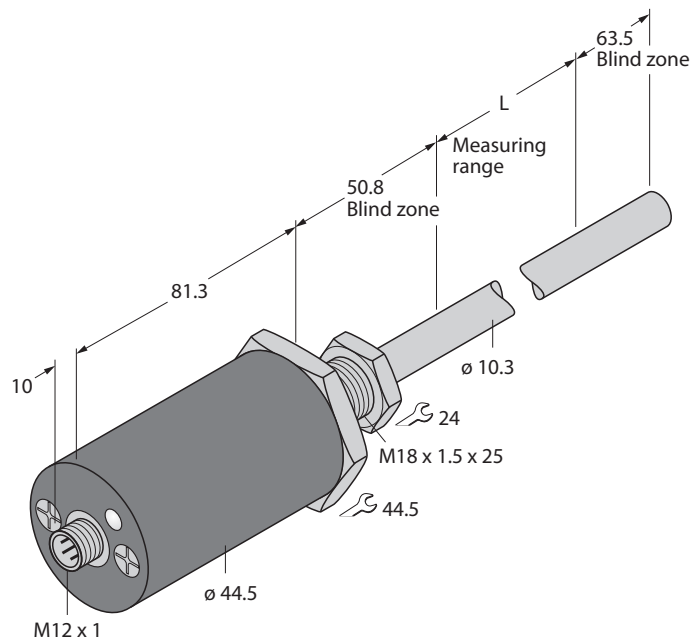


Fig. 1: LTX device dimensions with standard blind zones (in mm)

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

- SSI output
- Automatic signal control
- 7...30 VDC power supply
- Low power consumption
- High shock and vibration resistance
- Protection type 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 are provided with an SSI interface according to the RS422 standard. The process value is either transferred via the interface to the higher-level controller (with SSI card) directly or to a fieldbus device.

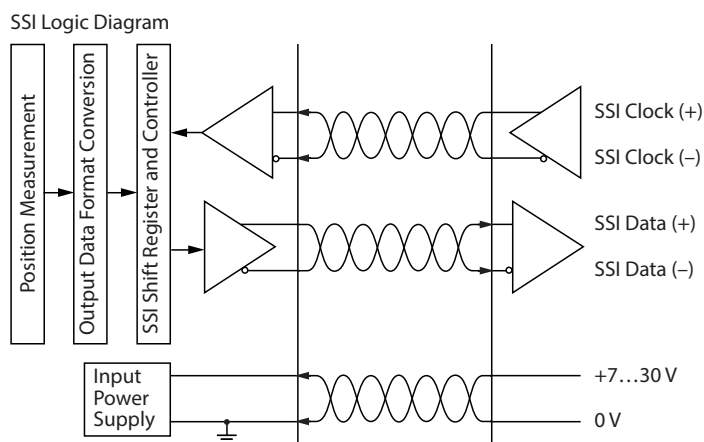


Fig. 2: Block diagram of the sensor control

The location of the positioning element on the sensor probe is determined by means of a propagation time measurement and transmitted to the controller via the SSI interface. All position values are determined as absolute values, homing runs after a voltage drop are unnecessary.

New incoming position data is transferred via the data signal 605 ns after the rising edge of the clock signal. This time frame, including the elapsed time caused by the length of the cable must be allowed for when defining the transmission rates.

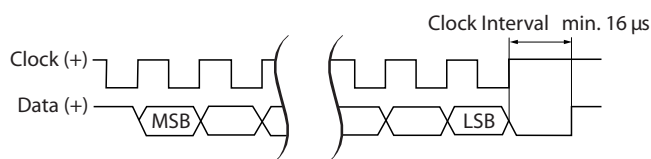


Fig. 3: SSI signal diagram: Bitwise transmission from most significant bit (MSB) to least significant bit (LSB)

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 Update mode

The devices can be operated in synchronous or asynchronous update mode. In asynchronous mode up to 2000 measurements (depending on length, see also section “Update time”) can be carried out per second to update the position values. In synchronous mode, the clock rate for the update depends on the controller (max. 2000 measurements per second, depending on length). If the controller queries the position data on the sensor faster than it is provided by the sensor, the sensor in synchronous mode switches automatically to asynchronous mode and continues to supply the latest position information to the controller.



NOTE

Turck recommends operating the device in asynchronous update mode if no highly dynamic control requirements are involved.

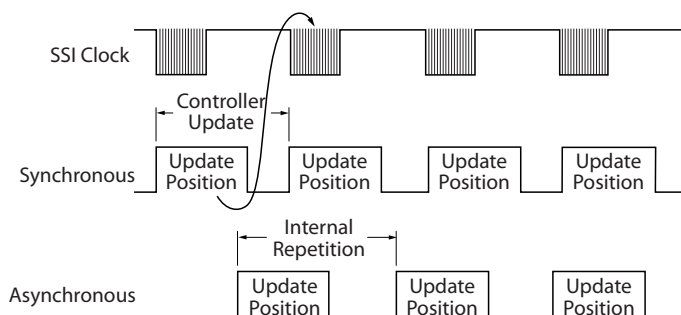


Fig. 4: Synchronous and asynchronous update mode

Synchronous update mode

The clock pulse rate of the controller sets the frequency for reading the position data. The sensor transmits one position data bit to the controller with each pulse. The first clock edge of the controller signals the sensor to carry out a new position measurement. The updated position data is transferred in the next read cycle.



NOTE

In synchronous mode, the position data available for the controller is no more than one update cycle old.

Asynchronous update mode

The sensor carries out position measurement according to a fixed internal scan rate (sensor internal measuring cycle) and supplies position information on request of the controller.

4.4.3 Measuring functions

Different device variants are available for performing the different measuring functions:

Device type	Measuring function	
LTX...SSI...F...	Position, forward measuring direction	The position value is incremented during the movement along the measuring probe starting from the sensor head.
LTX...SSI...R...	Position, backward measuring direction	The position value is incremented during the movement toward the sensor head starting from the end of the measuring probe.
LTX...SSI...V...	Speed measurement	The sensor provides speed information directly.

4.4.4 Preference type LTX...M-F10-SSI2-GAF1-X3-H1161 – Measuring range

The preference types LTX...M-F10-SSI2-GAF1-X3-H1161 are available with following measuring lengths as standard:

Measuring range	Configured
10...500 mm	In 25 mm steps
500...2000 mm	In 50 mm steps
2000...7600 mm	In 500 mm steps

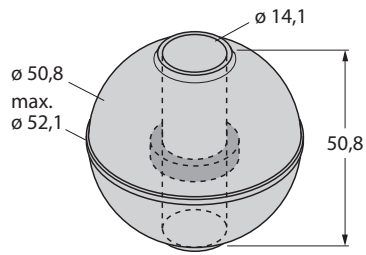
4.5 Technical accessories

The following accessories are not supplied with the device:

Positioning element

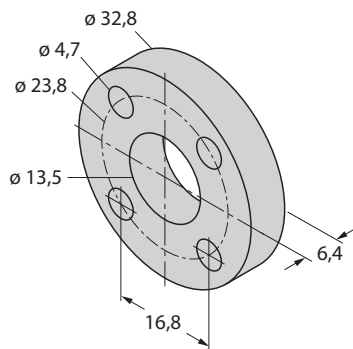
Dimension drawing	Type	ID	Description
	STM-AL-R10	6900409	Standard 4-hole positioning element, aluminum, suitable for mounting in the hydraulic cylinder
	CM-R10	6900416	Standard positioning element, suitable for mounting in the hydraulic cylinder
	LSPM-AL-R10	6900414	Ring positioning element with slot,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

Connection cables

Dimension drawing	Type	ID	Description
	RKC6T-2/TXL	6627031	Connection cable, M12 female connector, straight, 6-pin, cable length: 2 m, sheathing material: PUR, black, cULus approval, other cable lengths and types available, see www.turck.com
	RKC6T-2/S618	U5311-51	Connection cable, M12 female connector, straight, 6-pin, cable length: 2 m, sheathing material: PVC, gray, cable with foil shield, drain wire not connected to coupling nut, other cable lengths and types available, see www.turck.com

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 along the entire measuring length over the pressure pipe (deviation < 0.5 mm).

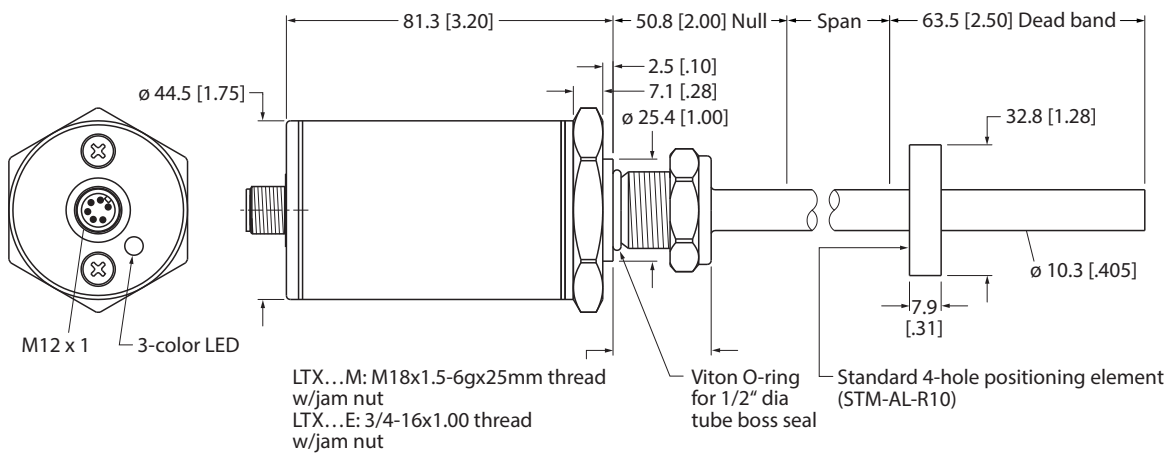


Fig. 5: Side view LTX-R10 with dimensions in mm [in] (design with raised face)

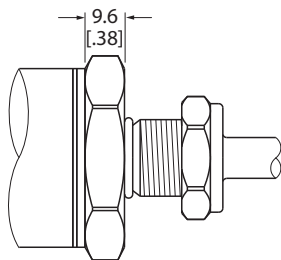


Fig. 6: Type with flat face (F10) – housing nut with thread

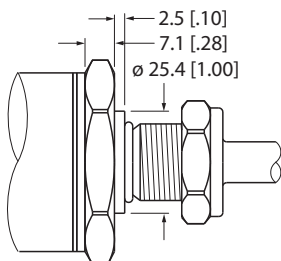


Fig. 7: Type with raised face (R10) – housing nut with thread

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 moved in. If the minimum distance cannot be observed, embed 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 fig. 8, no. 2). The protective ring prevents the mechanical wear of positioning elements by the pressure pipe with the piston fully extended.
- ▶ Fasten the positioning element and spacer with non-ferrous screws.
- ▶ Remove the protective cap on the hydraulic cylinder (if present). The 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 rod.
- ▶ Screw in the sensor via the thread of the sensor head in the $M18 \times 1.5$ threaded hole of the hydraulic cylinder (max. tightening torque: 50 Nm).

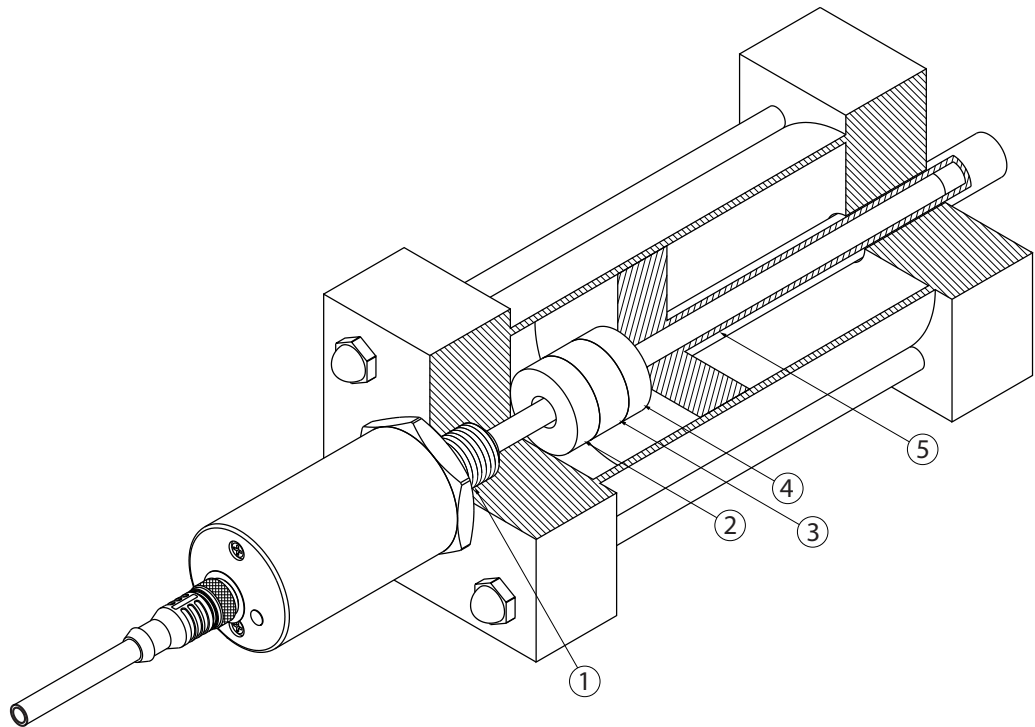


Fig. 8: Mounting the device in a hydraulic cylinder

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

5.2 Fastening the device with mounting bracket externally



NOTICE

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

- ▶ Mount the sensor 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.

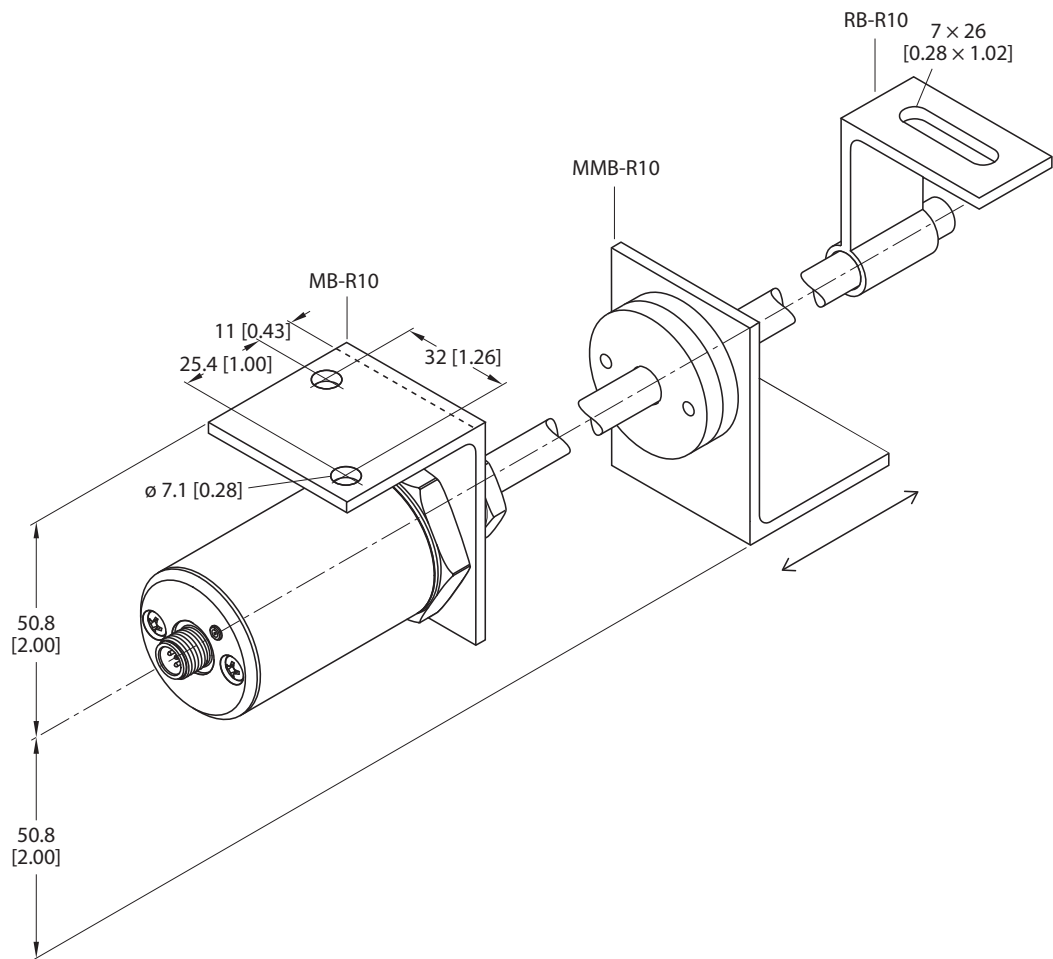


Fig. 9: Mounting a device with mounting brackets

5.2.1 Mounting additional mounting brackets (for external mounting)

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

- ▶ When using additional mounting brackets, use a ring-type positioning element with a slot.
- ▶ Fit the mounting brackets from ferromagnetic (already magnetized) material at least 7 mm away from the blind zone as well as from the active measuring range of the sensor.
- ▶ Sensors with probe lengths of 750...1800 mm: Fit additional mounting brackets as per fig. 10.
- ▶ Sensors with probe lengths > 1800 mm: Fit mounting brackets 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 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 positioning element and 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.

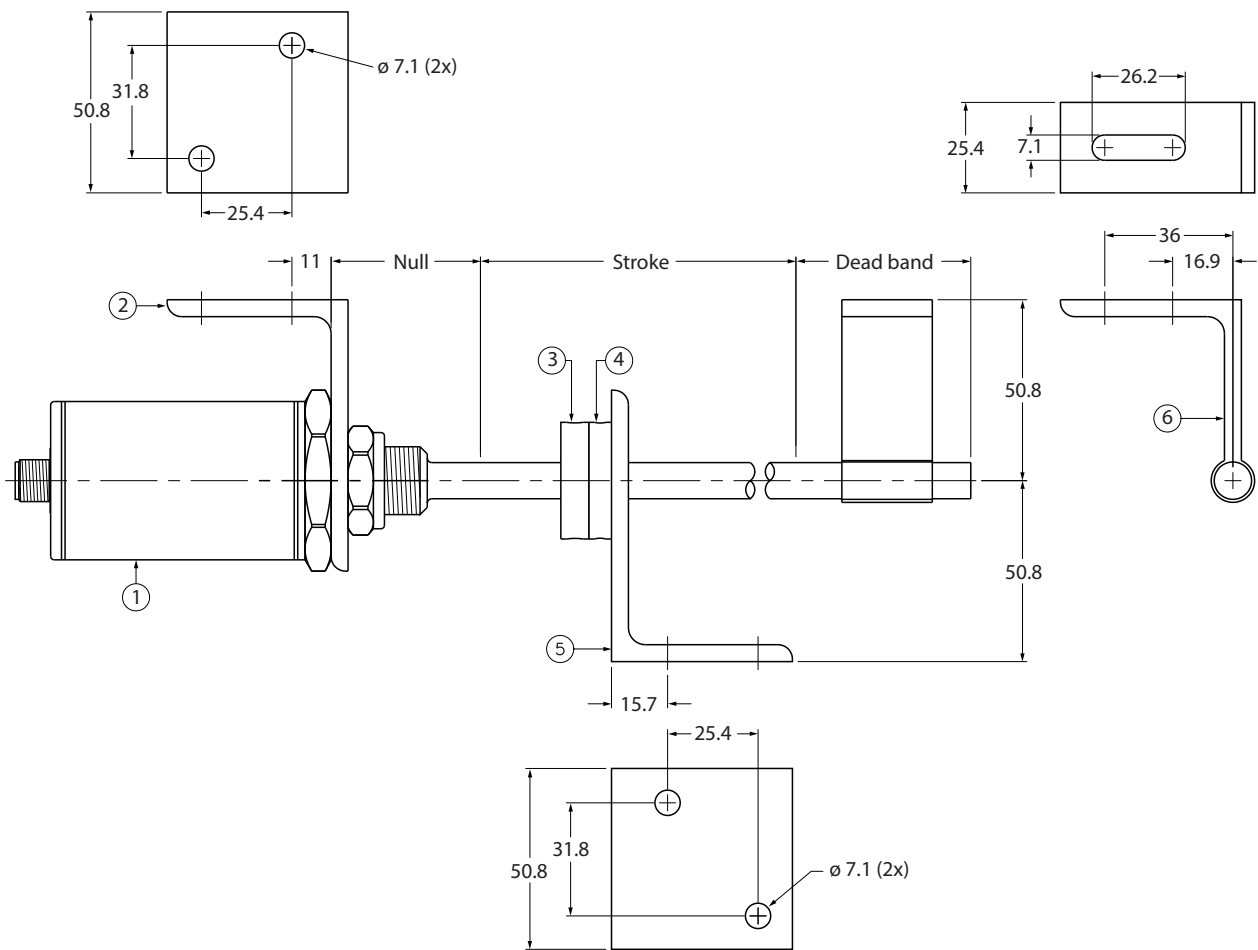


Fig. 10: Mounting positioning elements

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

6 Connection



NOTICE

Interference 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.

The running lengths of the connection cables are limited and depend on the SSI clock frequencies. Different clock rates are recommended depending on the length of the connection cables. The clock rate and data frame lengths are set by the master.

Cable length	Baud rate
< 3 m	1 MBd
< 50 m	< 400 kBd
< 100 m	< 300 kBd
< 200 m	< 200 kBd
< 300 m	< 100 kBd

- ▶ Route the high voltage and low voltage cables separately.
- ▶ Connect the female connector of the connection cable to the male connector of the device.
- ▶ Connect the sensor to the higher level as per the wiring diagram.

6.1 Wiring diagram



NOTE

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

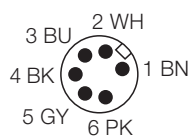


Fig. 11: Pin assignment

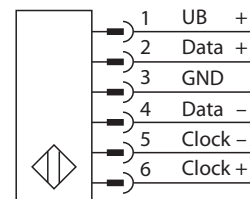


Fig. 12: Wiring diagram

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



NOTE

The minimum SSI clock frequency is 70 kHz.

8.1 LED indication

LED	Meaning
Off	No power supply present
Green	Positioning element signal detected in taught range, SSI clock signal operational
Yellow	No SSI clock signal detected
Red	No positioning element signal detected
Red or red/green flashing	Internal error
Green with brief yellow flash (1 s to 0.12 s)	Data not synchronous with controller (only in synchronous mode)
Green with brief red flash (1 s to 0.12 s)	SSI clock pulses do not match the SSI data length

If no positioning element is detected, the red LED lights up and the device transmits a zero position.

Proceed as follows if no positioning element 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.

If the data in synchronous mode is not synchronized with the controller (LED green with brief yellow flashing, 1 s to 0.12 s), proceed as follows:

- ▶ Increase the update time via the module settings of the SSI master.

9 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.

9.1 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).

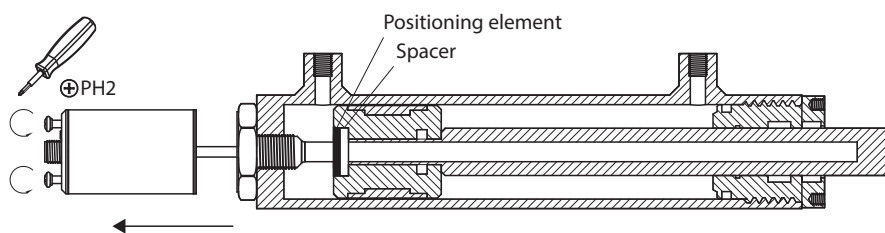


Fig. 13: Replacing the sensor head and measuring element

10 Maintenance

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

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

11 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.

11.1 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.

12 Disposal



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

13 Technical data

Technical data	LTX-R10.../LTX-F10...	LTX-ER10.../LTX-EF10...
Measuring range		
Blind zone (connector end)		50.8 mm
Blind zone (end)		63.5 mm
Resolution		Selectable, see type code
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		6-wire, SSI
Design		
Design		Cylindrical, smooth
Housing material	Metal, aluminum, black	Metal, stainless steel, 304
Material of active face		Metal, stainless steel, 316
Vibration resistance		30 Hz (1 mm)
Shock resistance		100 g (11 ms)
Pressure resistance (momentary)		680 bar
Pressure resistance (permanent)		340 bar
Type of protection		IP68

13.1 Update time

Measuring length	Update time
300 mm	500 μs
750 mm	850 μs
1000 mm	1 ms
2000 mm	2 ms
5000 mm	4 ms

14 Turck subsidiaries – contact information

Germany	Hans Turck GmbH & Co. KG Witzlebenstraße 7, 45472 Mülheim an der Ruhr www.turck.de
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria www.turck.com.au
Belgium	TURCK MULTIPROX Lion d'Orweg 12, B-9300 Aalst www.multiprox.be
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo www.turck.com.br
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin www.turck.com.cn
France	TURCK BANNER S.A.S. 11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4 www.turckbanner.fr
Great Britain	TURCK BANNER LIMITED Blenheim House, Hurricane Way, GB-SS11 8YT Wickford, Essex www.turckbanner.co.uk
India	TURCK India Automation Pvt. Ltd. 401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra www.turck.co.in
Italy	TURCK BANNER S.R.L. Via San Domenico 5, IT-20008 Bareggio (MI) www.turckbanner.it
Japan	TURCK Japan Corporation Syuuhou Bldg. 6F, 2-13-12, Kanda-Sudacho, Chiyoda-ku, 101-0041 Tokyo www.turck.jp
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