TURCK

Your Global Automation Partner

CMMT...
Condition Monitoring Sensor

Instructions for Use

Contents

1 About these instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

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

1.2 Explanation of symbols

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
	**NOTE** NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Other documents

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

- Data sheet
- Commissioning manual IO-Link devices
- Declarations of conformity (current version)

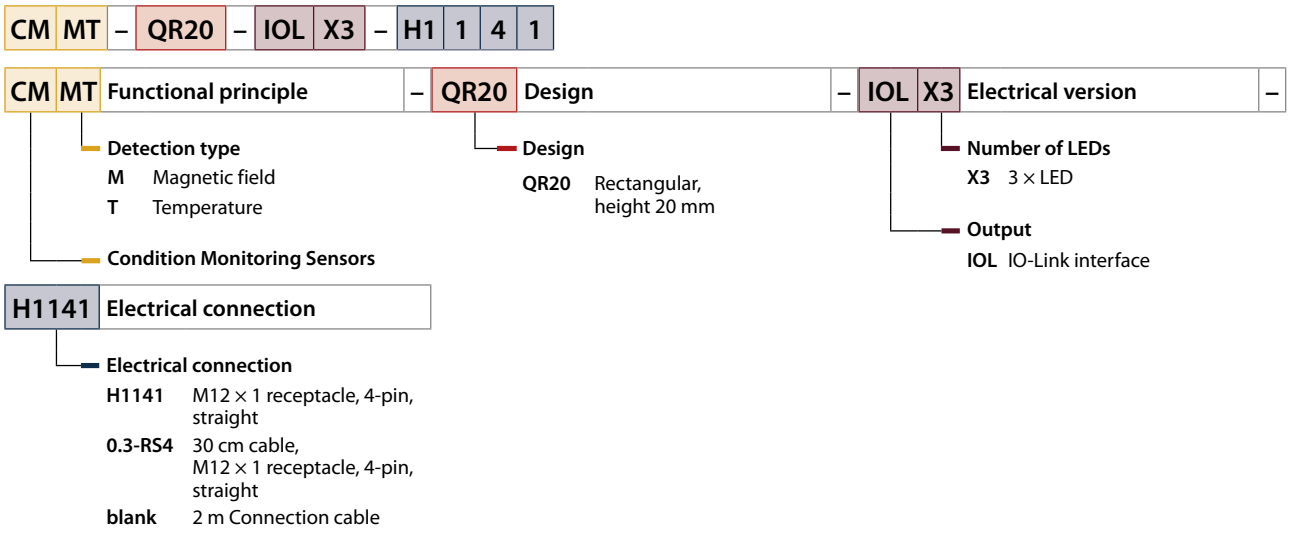
1.4 Feedback about these instructions

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

2 Notes on the product

2.1 Product identification

These instructions apply to the following condition monitoring sensors:



2.2 Scope of delivery

The delivery consists of the following:

- Condition monitoring sensor

2.3 Turck service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database at www.turck.com offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

The contact data for Turck branches is provided at [▷ 28].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. Turck accepts no liability for damage caused by failure to observe these safety instructions.

3.1 Intended use

The condition monitoring sensors in the CMMT… product series detect changes in the surrounding magnetic field caused by ferromagnetic objects and permanent magnets. The sensors also detect the temperature.

The process values are output by the device via IO-Link.

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

3.2 Obvious misuse

- The devices are not safety components and must not be used for personal or property protection.

3.3 General safety instructions

- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- Only operate the device within the limits stated in the technical specifications.

4 Product description

The condition monitoring sensors are equipped either with a 4-pin M12 connector, a 2-meter cable without male connector or a 30-cm cable and a 4-pin M12 connector for connecting the sensor cable. The housing is made from plastic and is a fully potted and sealed unit with protection to IP68/IP69K.

The device functions can be set via IO-Link.

4.1 Device overview

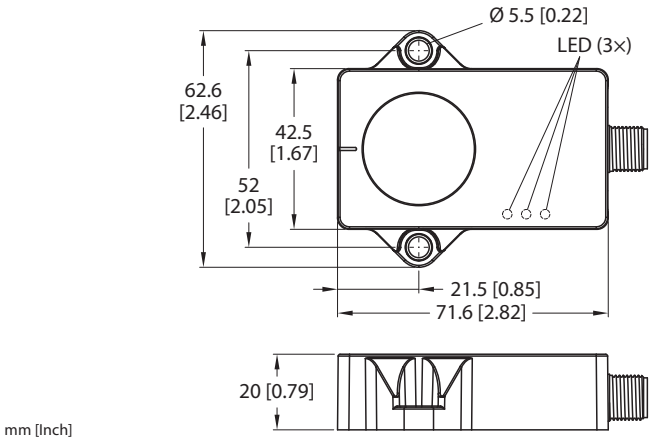


Fig. 1: CMMT…-H1141 dimensions

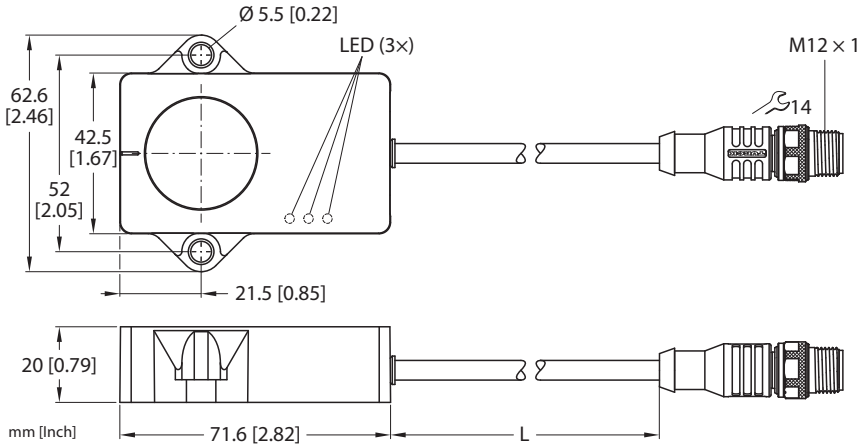


Fig. 2: CMMT…-0.3-RS4 dimensions

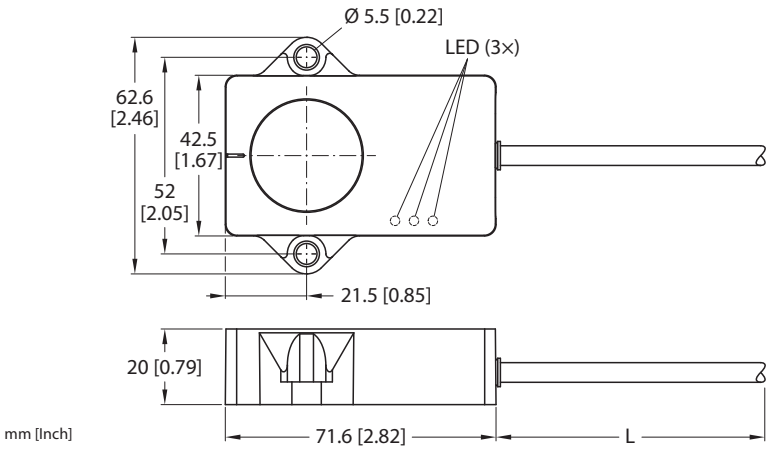


Fig. 3: CMMT-QR20-IOLX3 dimensions

4.1.1 Indication elements

The devices are provided with one green and two yellow LEDs. The green LED indicates the operating voltage and the device status. The yellow LEDs indicate the switching status of the switching outputs. Each switching output is assigned a yellow LED.

4.2 Properties and features

- Output of magnetic flux density (magnetic field) in microtesla
- Cartesian coordinates
- Measuring range on three axes and the amount
- Temperature detection from -25…+70 °C, resolution 0.1 °C
- Protection class IP68/IP69K
- Communication via IO-Link
- Two configurable switching outputs (PNP/NPN)

4.3 Operating principle

The condition monitoring sensors use three orthogonal magnetoresistive transducers to detect the magnetic field. The transducers can detect surrounding magnetic fields in the order of magnitude of the Earth's magnetic field and any changes to them. Changes in the magnetic field may be caused, for example, by a ferromagnetic object. The change in the magnetic field depends on the size, shape, orientation and composition of the object, as well as the surrounding magnetic field (strength and orientation).

Temperature detection

The temperature is detected by means of an integrated temperature measurement cell. The temperature measured can deviate from the ambient temperature due to different electrical operating conditions in the sensor. The sensor can permanently detect temperatures of -25…+70 °C. Temperatures of -40…+105 °C can be detected for a limited period of up to one hour of operating time.

4.4 Functions and operating modes

The sensors detect the magnetic field and temperature in condition monitoring applications. The device outputs a continuous process value for the magnetic field via IO-Link. No cyclic process values are output for the temperature. The temperature can be queried acyclically via index 0x0100. The magnetic field can be viewed via the Magnetic Field Monitor using the web server and TAS over three axes plus vector sum. In addition, two pairs of limit values can be defined for the magnetic field (window function). The overshooting or undershooting of the defined limit value is indicated via a bit in the IO-Link process data. The device supports Smart Sensor Profile 4.1.4.

Outputs 1 and 2 both indicate the switching state based on the set limit values for the magnetic field in two point mode (default vector sum for both outputs).

The following can be selected for output 1 and 2:

- x or
- y or
- z or
- Vector sum

4.4.1 IO-Link mode

In order to operate in IO-Link mode, the device must be connected to an IO-Link master. When the port is configured in IO-Link mode, bidirectional IO-Link communication takes place between the IO-Link master and the device. To make this possible, the device is integrated via an IO-Link master at the control level. First the communication parameters are exchanged, and then the cyclic data exchange of process data (objects) starts.

4.4.2 SIO mode (standard I/O mode)

In standard I/O mode no IO-Link communication takes place between the device and the master. The device only transfers the switching state of its binary outputs and can also be run via a fieldbus device or controller with digital PNP or NPN inputs. An IO-Link master is not required for operation.

The device parameters can be set via IO-Link and then operated at the digital inputs with the appropriate settings in SIO mode. Not all functions and properties of the device can be used in SIO mode.

4.4.3 Output functions — switching output

The switching logic can be inverted via IO-Link. The following examples apply to the **HIGH** (0 → 1) switching logic.

Single point mode

In single point mode, the switching behavior is defined via a SP1 limit value and a hysteresis. The output changes its switching state at limit value SP1.

The hysteresis can be set via IO-Link and must be within the detection range.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the SP1 limit value. If the process value increases above the SP1 limit value, the switching output becomes active.

If the process value decreases, the switching output is active as long as the process value is between the end of the detection range and the SP1 limit minus the set hysteresis (SP1-Hyst). If the process value decreases below the limit value (SP1-Hyst), the switching output becomes inactive.

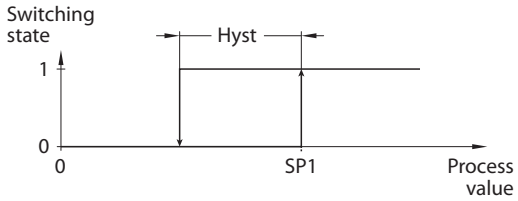


Fig. 4: Single point mode

Two point mode

In two point mode, the switching behavior is defined via a switch-on point SP1 and a switch-off point SP2. This mode can also be used as a freely adjustable hysteresis.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the switch-on point SP1. If the process value rises above the switch-on point SP1, the switching output becomes active.

If the process value decreases, the switching output is active as long as the process value is between the end of the detection range and the SP2 switch-off point. If the process value decreases below the switch-off point SP2, the switching output becomes inactive.

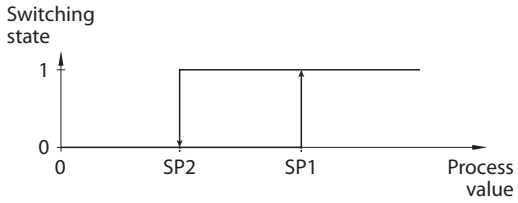


Fig. 5: Two point mode

Window mode

In window mode, an upper and lower window limit are set for the switching output. A hysteresis can be set for the window limits SP1 and SP2. The switching window must be within the detection range.

The hysteresis can be set via IO-Link and must be within the detection range.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the window limit SP2. The switching output remains active until the process value increases above the window limit SP1 plus the hysteresis (SP1+Hyst). If the process value increases above (SP1+Hyst), the switching output becomes inactive again.

If the process value decreases, the switching output is inactive as long as the process value is between the end of the detection range and the window limit SP1. The switching output remains active until the process value decreases below the window limit SP2 minus the hysteresis (SP2-Hyst). If the process value decreases below (SP2- Hyst), the switching output becomes inactive again.

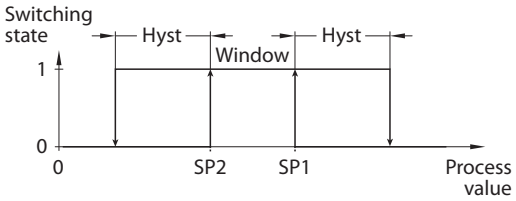


Fig. 6: Window mode

4.4.4 Measurement axes

The devices have three measurement axes. For each measurement axis, 32-bit telegrams (16-bit measured value, 8-bit vector, 6-bit reserved, 2-bit switching output) are output via IO-Link. Depending on the parameterization, these telegrams output the magnetic flux density in microtesla. The measured value of the magnetic field is output as a Cartesian vector sum. In addition, the vector sum is output as a 32-bit telegram. Values of -2500…+2500 µT can be output for each axis. The magnetic field strength can be output in values of 0…2500 µT.

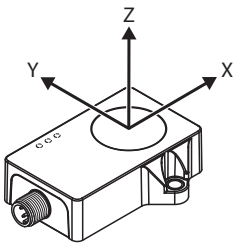


Fig. 7: CMMT-QR20-IOLX3-H1141 measurement axes

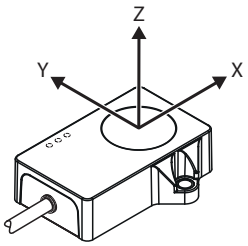
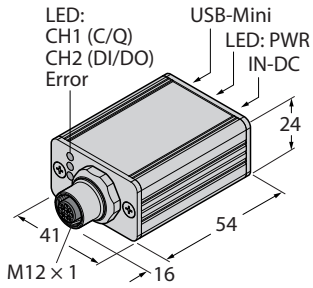
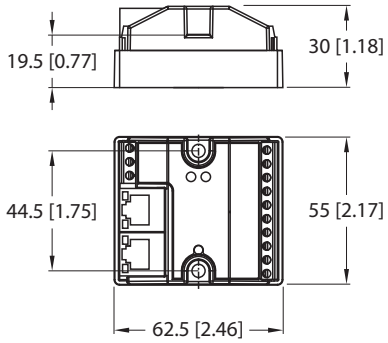
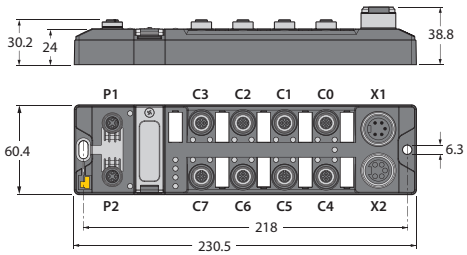
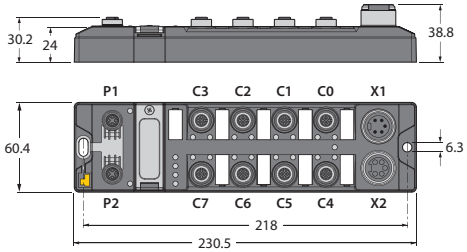


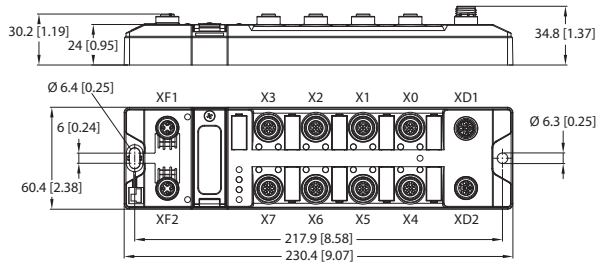
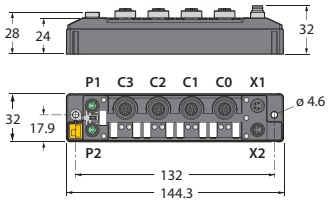
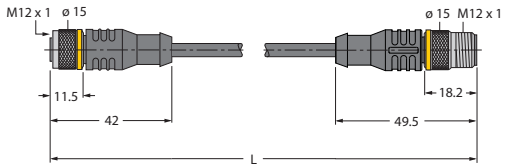
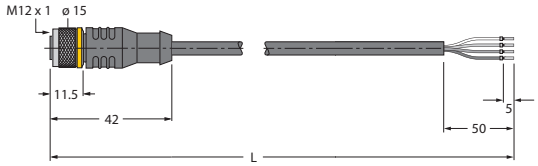
Fig. 8: CMMT-QR20-IOLX3-0.3-RS4 and CMMT-QR20-IOLX3 measurement axes

4.4.5 Temperature measurement

The condition monitoring sensors can output the temperature via acyclic data (16-bit). The detection range is -25…+70 °C at a resolution of 0.1 °C. The deviation is 3 K at room temperature.

4.5 Technical accessories

Dimension drawing	Type	ID	Description
	USB-2-IOL-0002	6825482	IO-Link adapter V1.1 with integrated USB interface
	FEN20-4IOL	6814140	Compact multiprotocol I/O module for Ethernet, 4 IO-Link master channels, protection type IP20
	TBEN-L4-8IOL	6814082	Compact multiprotocol I/O module for Ethernet, 8 IO-Link master channels, 4 universal digital PNP channels, 2 A, channel diagnostics, protection type IP65/IP67/IP69K
	TBEN-L5-8IOL	6814017	Compact multiprotocol I/O module for Ethernet, 4 IO-Link master channels, 4 universal digital PNP channels, 0.5 A, channel diagnostics, protection type IP65/IP67/IP69K

Dimension drawing	Type	ID	Description
	TBEN-LL-8IOL	100003910	Compact multiprotocol I/O module for Ethernet, 8 IO-Link master channels, 4 universal digital PNP channels, 2 A, channel diagnostics, protection type IP65/IP67/IP69K
	TBEN-S2-4IOL	6814024	Compact multiprotocol I/O module for Ethernet, 4 IO-Link master channels, 4 universal digital PNP channels, 0.5 A, channel diagnostics, protection type IP65/IP67/IP69K
	RKC4.4T-2-RSC4.4T/TXL	6625608	Connection cable, M12 female connector, straight, 4-pin, M12 male connector, straight, 4-pin, cable length: 2 m, sheathing material: PUR, black; cULus approval; other cable lengths and types available, see www.turck.com
	RKC4.4T-2/TXL	6625503	Connection cable, M12 female connector, straight, 4-pin, cable length: 2 m, sheathing material: PVC, 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 installed in any orientation. The maximum tightening torque of the screws is 3 Nm.

- ▶ Clean the installation surface and the surrounding area.
- ▶ Position the potted side of the device on an even surface so that the potting compound is covered.
- ▶ Fasten the device with two screws.

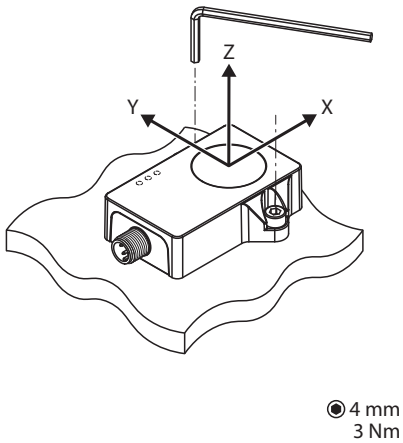


Fig. 9: CMMT…-H1141 — installation and detection axis

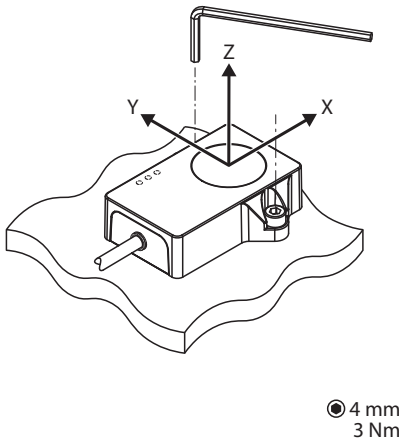


Fig. 10: CMMT…-0.3-RS4 and CMMT-QR20-IOLX3 — installation and detection axis

6 Connection

- Connect the female connector of the connection cable to the male connector of the sensor (CMMT-QR20-IOLX3-H1141 and CMMT-QR20-IOL6X3-0.3-RS4 only).
- Connect the open end of the connection cable to the power source and/or signal processors.

6.1 Wiring diagram

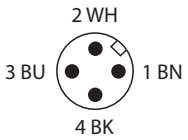


Fig. 11: Pin assignment

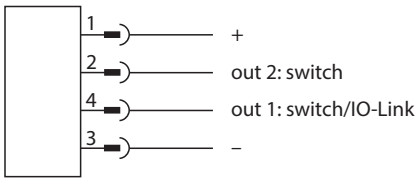


Fig. 12: Wiring diagram for CMMT-QR20-IOLX3-H1141 and CMMT-QR20-IOLX3-0.3-RS4

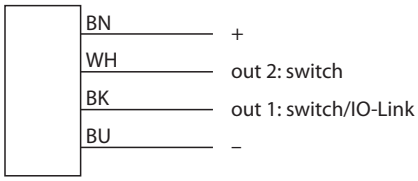


Fig. 13: And CMMT-QR20-IOLX3

7 Commissioning

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

8 Operation

8.1 LED display

LED	Color	Meaning
PWR/IOL	Green	Device is operational
	Green flashing	IO-Link communication active
Out 1	Yellow	Out 1 switching state (configurable)
Out 2	Yellow	Out 2 switching state (configurable)
Running light		Self-test running

The running light indicates that a self-test is running. The Out 1, PWR/IOL and Out 2 LEDs light up one after the other when the running light is on.

9 Setting

9.1 Settable functions and features

Parameter	Meaning
Reset device	The device is restarted. Communication is interrupted momentarily.
Reset application	The application-specific parameters are reset. Communication is not interrupted. The sensor is switched to a defined operating state. Identification parameters are not affected.
Restore factory settings	The factory settings of the device are restored. In order to restart the device, it must be disconnected from the power supply.
Process data display	The following process data can be displayed: ■ Microtesla
Process profile data	The following process data profiles can be set: ■ Cartesian coordinates ■ Amount ■ Vector sum
Process data profile	
Output 1	The switching outputs can be set either as NO contacts or as NC contacts.
Output 1 configuration	The switching outputs can be set for either PNP or NPN operation. Auto detection is active by default.
Output 1 function	Can be freely set.
Output 2	The switching outputs can be set either as NO contacts or as NC contacts.
Output 2 configuration	The switching outputs can be set for either PNP or NPN operation. Auto detection is active by default.
Output 2 function	Can be freely set.
Hysteresis	The hysteresis behavior window can be set in a value range of 10…4980 µT.
Threshold values	When manually configuring the limit values for the magnetic field strength, values for the pre-alarm/warning or alarm can be set for each detection axis.
Sensor self-test	The function of the sensor is checked. The self-test takes approx. 10 s. No process data can be read during the self-test.
Filter: Dynamic behavior	Dynamic behavior can be activated or deactivated. The time constant can be used to set how quickly the measured value adapts to interference or fluctuations. The measured value runs to zero, thereby counteracting a shift of the zero point. ■ Dynamic behavior: Activate/deactivate ■ Dynamic behavior: Time constant
Zero point offset calibration	The zero point can be set using the offset calibration. The following settings can be made: ■ Start calibration ■ Reset calibration

Parameter	Meaning
Magnetometer offset compensation	The magnetometer offset compensation cancels out the offset relative to the zero point of each axis. For this to happen, the sensor must be moved between 20 s and 60 s in each direction. 20 s after the compensation was started, the sensor compares the measured values and checks them for plausibility. 1. If the calibration is successful, the values are stored and the magnetic field sensor is ready for operation. 2. In the event of a timeout of more than 60 s without valid measured values, the error "Offset compensation failed" is returned via IO-Link. The magnetic field sensor is then ready for operation with the previous settings.
Output filter (switching output damping)	Prevents rapid oscillation of the output near the switching level due to a strongly oscillating input signal. ■ Minimum value: 0 s ■ Maximum value: 8 s ■ Default value: 0 s

9.2 Setting and visualizing with the Turck Magnetic Field Monitor

The device can be configured and tested with TAS (Turck Automation Suite) or via the integrated web server of a Turck IO-Link master (e.g. TBEN-S2-4IOL). The IODD can be read in via TAS or the web server, such that all parameters of the IODD can be accessed.

An overview of the IO-Link parameters and descriptions can be found via the IODDfinder. The Turck Magnetic Field Monitor is also available for visualizing process data.

A Turck IO-Link master is required to access the sensor parameters and the Turck Magnetic Field Monitor. The following table shows the firmware version of the IO-Link master that is required to use the Turck Magnetic Field Monitor:

NOTE
The Turck Magnetic Field Monitor can only be accessed via TAS (Turck Automation Suite).

IO-Link master	Firmware version
FEN20-4IOL	V1.1.0.0
TBEN-L4-8IOL	V3.3.2.0
TBEN-L5-8IOL	V3.3.2.0
TBEN-LL-8IOL	V1.1.1.0 or V4.2.2.0
TBEN-S2-4IOL	V3.4.1.0

Refer to the instructions for use of the relevant device for information on the Turck IO-Link masters.

- Connect the IO-Link master to the power supply.
- Connect the IO-Link master to a PC via the Ethernet interface.
- Connect the CMMT… to an IO-Link port of the IO-Link master.

If no IO-Link master is available with the appropriate firmware version, the CMMT… can be configured via the web demo and configuration tool. This requires the use of an IO-Link adapter (e.g. USB-2-IOL-0002; ID 6825482) for the connection between the PC and the sensor. The above-mentioned FEN20-4IOL and TBEN… IO-Link masters can also be used with older firmware versions. The web demo and configuration tool enable access to the sensor via the local web browser.

The web demo and configuration tool can be downloaded free of charge from www.turck.com.

9.2.1 IO-Link master — opening the web server

- In order to open the web server of the IO-Link master, enter the IP address in the address bar of a local web browser (default: http://192.168.1.254).

To edit the settings via the web server, you must log in to the IO-Link master.

- Enter the password in the Login field on the start page of the web server. The default password is "password".
- Click **Login**.

9.2.2 Reading IODD into TAS

- Set the input port of the IO-Link master as an IO-Link port.
- Open the **IO-LINK** tab in TAS.
- Load the device-specific IODD into TAS via **Load IODD**.

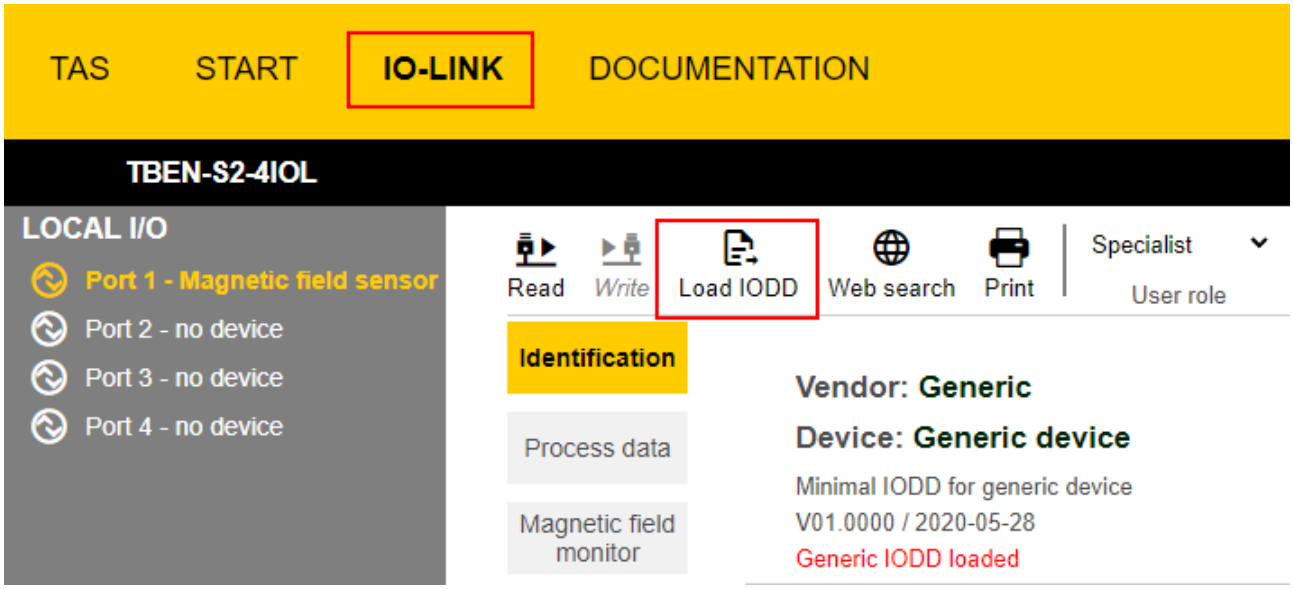


Fig. 14: Loading the IODD

9.2.3 Turck Magnetic Field Monitor — overview

The process data of the sensor can be visualized via the Turck Magnetic Field Monitor. The individual detection axes can be shown and hidden. The process data is recorded over time in seconds. The recorded process data is used, for example, to define limit values for the switching outputs. It is also possible to export the process data via an Excel file in csv format.

▶ To start the Turck Magnetic Field Monitor, select the **Magnetic Field Monitor** menu item.

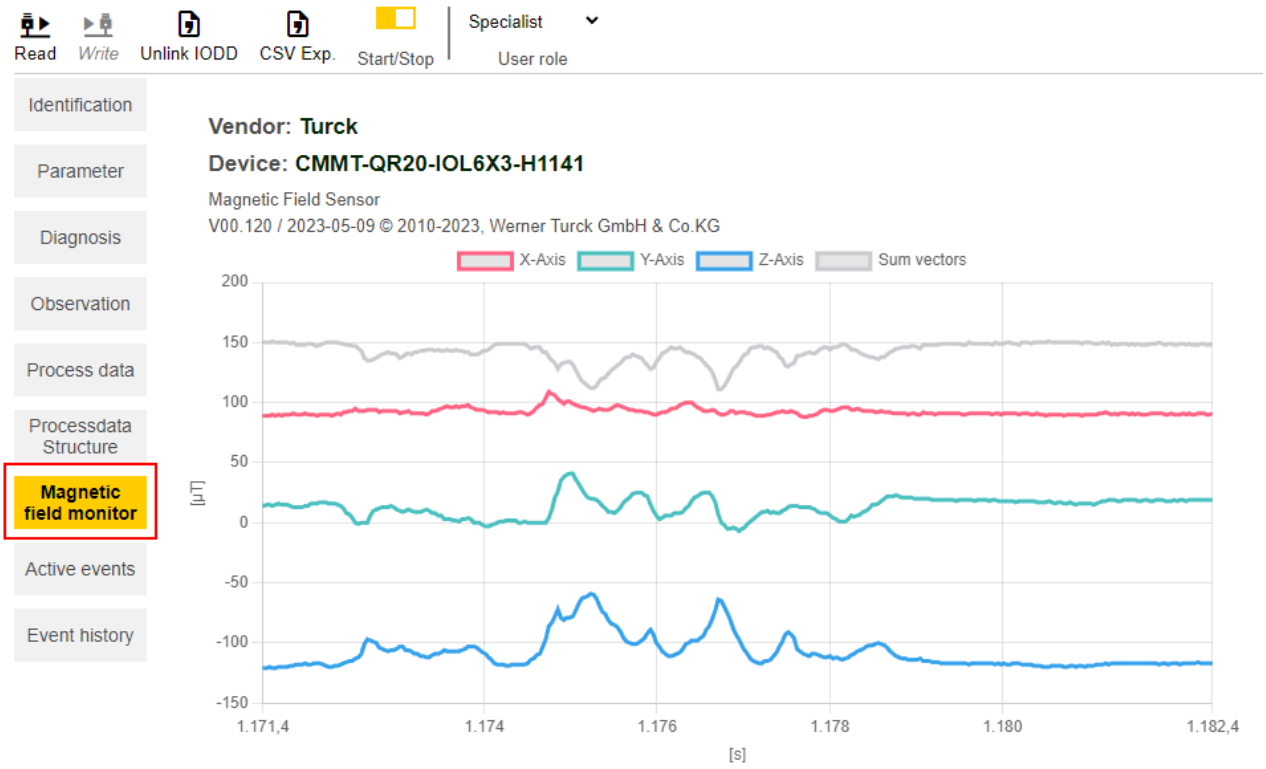


Fig. 15: Turck Magnetic Field Monitor — overview

The detection axes are visualized in different colors:

- X-axis: red
- Y-axis: green
- Z-axis: blue
- Vector sum of the three detection axes: gray

9.3 Setting via FDT/IODD

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

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

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

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

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

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

10 Troubleshooting

If the device does not function as expected, first check whether there is any ambient interference. If there is no ambient interference, check the connections of the device for faults. If the connections of the device are not defective, perform a sensor self-test.

If no faults are identified, this indicates that the device is faulty. In this case, decommission the device and replace it with a new device of the same type.

11 Maintenance

The device is maintenance-free. Clean with a damp cloth if required.

12 Repair

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

12.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
https://www.turck.de/en/return-service-6079.php
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

13 Disposal

The devices must be disposed of properly and do not belong in the domestic waste.

14 Technical data

Technical data	CMMT-QR20-IOLX3-H1141	CMMT-QR20-IOLX3-0.3-RS4	CMMT-QR20-IOLX3
ID	100041125	100041729	100047130
Magnetic field measuring range	-2500…+2500 µT		
Temperature measuring range	-25…+70 °C		
General data			
Hysteresis	10…4980 µT (varies by mode)		
Electrical data			
Operating voltage	18…30 VDC with IO-Link 10…30 VDC without IO-Link (SIO mode)		
Ripple	< 10 % U_{ss}		
Operating current	< 80 mA		
Max. output current I_e	250 mA		
Residual current I_o	≤ 0.1 mA		
Isolation test voltage	≤ 0.5 kV		
Short-circuit protection	Yes/cyclic		
Voltage drop at I_e	≤ 1.8 V		
Wire break/reverse polarity protection	Yes/yes		
Communication protocol	IO-Link		
Output function	4-wire, programmable, IO-Link, SIO mode		
Output 1	Switching output or IO-Link mode		
Output 2	Switching output		
IO-Link			
IO-Link specification	V1.1		
IO-Link port type	Class A		
Communication mode	COM 3 (230.4 kBaud)		
Process data width	128 bits		
Measured value information	96 bits (24 bits reserved/not used)		
Switching point information	8 bits		
Frame type	2.2		
Minimum cycle time	1.3 ms		
Function pin 4	IO-Link		
Function pin 2	DO		
Maximum cable length	20 m		
Profile support	Smart Sensor Profile Profile type SSP4.1.4		

Technical data	CMMT-QR20-IOLX3-H1141	CMMT-QR20-IOLX3-0.3-RS4	CMMT-QR20-IOLX3
Mechanical data			
Design		Rectangular, QR20	
Dimensions		71.6 × 62.6 × 20 mm	
Housing material		Plastic, Ultem	
Electrical connection	M12 × 1 connector	M12 × 1 connector	-
Cable	-	Ø 4.5 mm, PUR, 0.3 m Halogen free, flame resistant acc. to IEC 60332-2-2 and UL FT2	Ø 4.5 mm, PUR, 2 m Halogen free, flame resistant acc. to IEC 60332-2-2 and UL FT2
Ambient temperature		-25…+70 °C	
EMC		EN 61326-1	
Protection class		IP68/IP69K	
Indicators			
Operating voltage indicator		1 × LED, green	
Switching state indicator		2 × LED, yellow	

15 Turck branches — contact data

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Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria **www.turck.com.au**
Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna **www.turck.at**
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**
Canada	Turck Canada Inc. 140 Duffield Drive, CDN-Markham, Ontario L6G 1B5 **www.turck.ca**
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin **www.turck.com.cn**
Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové **www.turck.cz**
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