TURCK

Your Global Automation Partner

CMVT…
Condition Monitoring
Sensors with IO-Link

Instructions for Use

Contents

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.
ℹ	**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
- IO-Link parameters manual
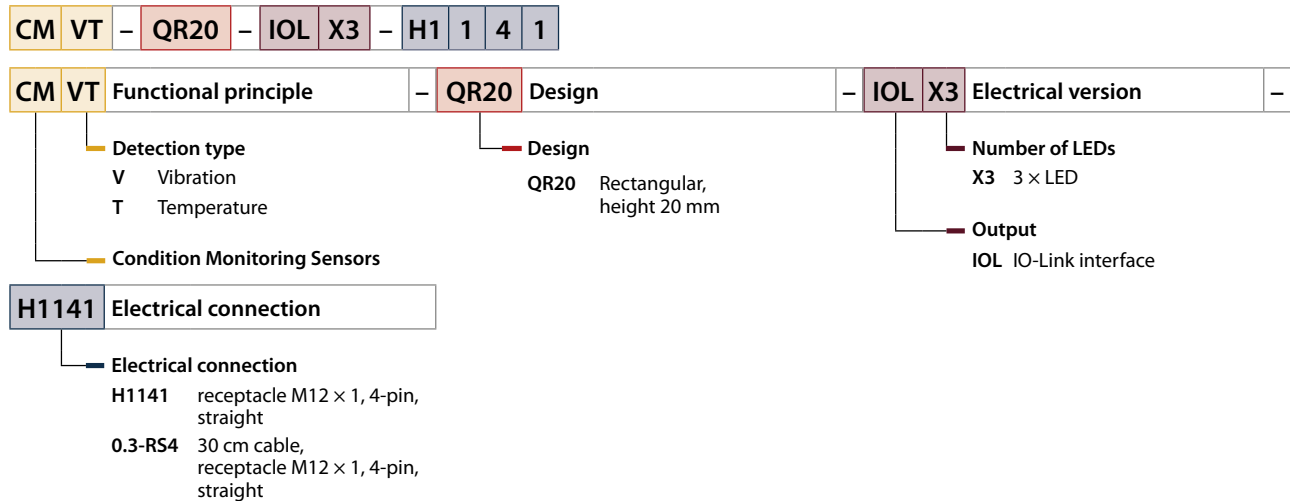- Declarations of conformity (current version)

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:

| CM | VT | – | QR20 | – | IOL | X3 | – | H1 | 1 | 4 | 1 |

| CM | VT | Functional principle | – | QR20 | Design | – | IOL | X3 | Electrical version | – |

Detection type
V   Vibration
T   Temperature

Condition Monitoring Sensors

Design
QR20   Rectangular, height 20 mm

Number of LEDs
X3   3 × LED

Output
IOL   IO-Link interface

| H1141 | Electrical connection |

Electrical connection
H1141   receptacle M12 × 1, 4-pin, straight
0.3-RS4   30 cm cable, receptacle M12 × 1, 4-pin, straight

2.2   Scope of delivery

The delivery consists of the following:

- Condition monitoring sensor
- Quick Start Guide

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.

For the contact details of our branches worldwide, please see page [▶ 27].

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 of the CMVT-QR20-IOL… series monitor the temperature and vibration of machines.

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

The devices also indicate via switching outputs any vibration speeds above the permissible limits. The devices are designed for condition monitoring or for predictive maintenance tasks.

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 provided with a 4-pin M12 connector or with 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.

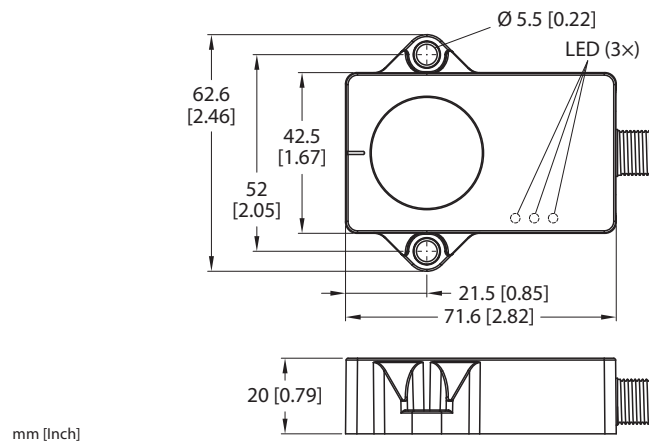The device functions can be set via IO-Link.

4.1 Device overview
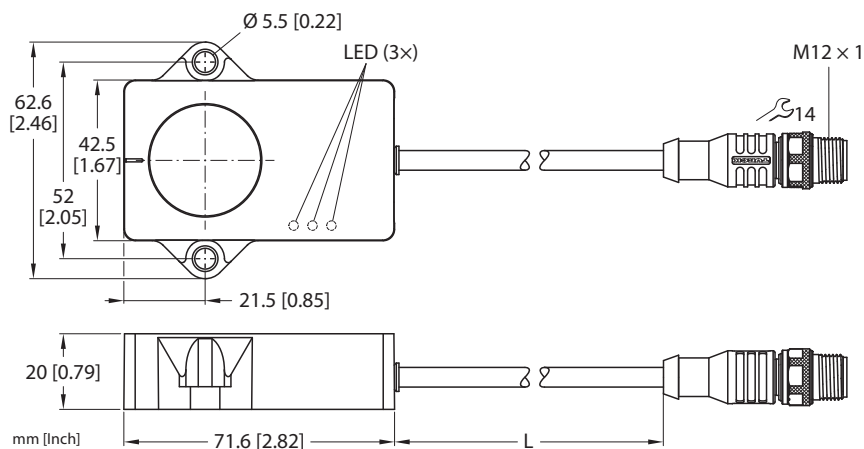
Fig. 1: Dimensions CMVT…-H1141

Fig. 2: Dimensions CMVT…-0.3-RS4

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

- Acceleration and speed output as RMS (effective) or peak-to-peak value
- Acceleration measuring range from 0…16 g on three axes
- Temperature measurement from -40…+85 °C, resolution 0.1 °C
- Degree of protection IP68/IP69K
- Communication via IO-Link
- Two configurable switching outputs (PNP/NPN)

4.3 Operating principle

The condition monitoring sensors use an acceleration measuring cell with capacitive measurement. The monitoring of vibrations and oscillations makes it possible to detect deviations early on and take countermeasures. The process value is transferred to the controller via IO-Link for monitoring. It is also possible to use switching outputs to signal specific limit value violations.

Temperature detection

The temperature is recorded 10 s after the supply voltage is switched on via an integrated temperature measuring cell. The temperature measured can deviate from the ambient temperature due to different electrical operating conditions in the sensor.

4.4 Functions and operating modes

The devices are provided with an IO-Link interface and can be set via an IO-Link master or an FDT frame (e.g. PACTware).

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 Measurement axes

The devices are provided with the following three measurement axes. 16-bit telegrams, representing vibration acceleration or vibration speed depending on the configuration, are output via IO-Link for each measurement axis. The vibration acceleration or vibration speed can be output as an RMS value or a peak-to-peak value. The vector sum is also output as a 16-bit telegram.
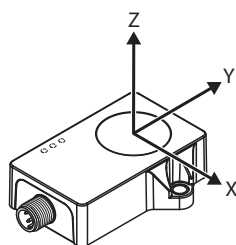
Fig. 3: CMVT-QR20-IOLX3-H1141
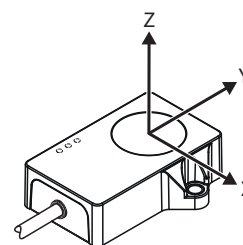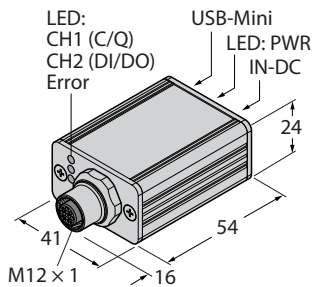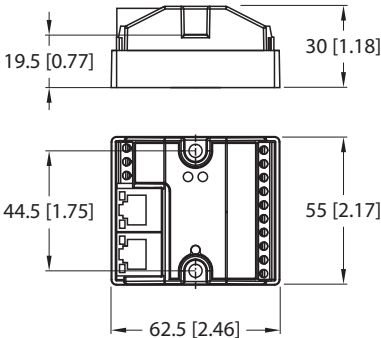— measurement axes
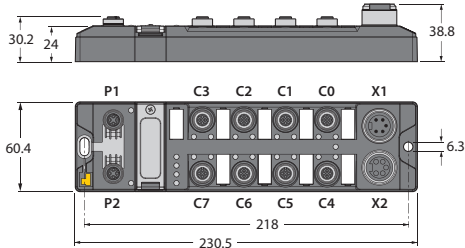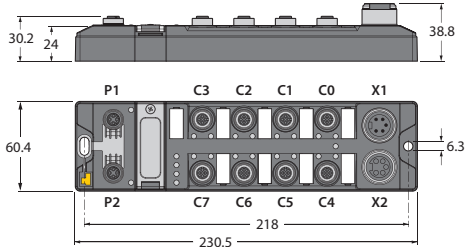
Fig. 4: CMVT-QR20-IOLX3-0.3-RS4
— measurement axes

4.4.4 Temperature measurement

The condition monitoring sensors can output the temperature via acyclic data and cyclic data (16-bit telegrams). The measurement range is -40…+85 °C with a resolution of 0.1 °C. The measurement has an accuracy of ±3 °C.

4.5 Technical accessories

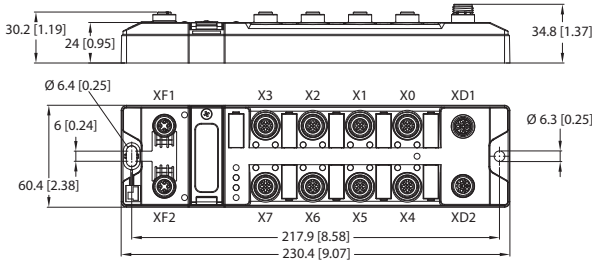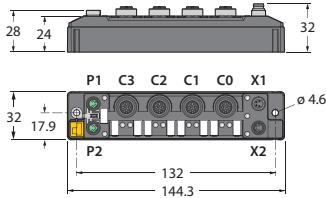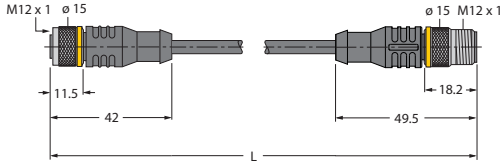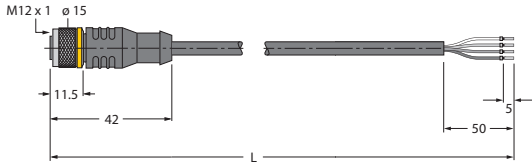| Dimension drawing	Type	ID	Description
LED: CH1 (C/Q) CH2 (DI/DO) Error; USB-Mini; LED: PWR IN-DC; 24; 54; 41; M12 × 1; 16	USB-2-IOL-0002	6825482	IO-Link adapter V1.1 with integrated USB interface
19.5 [0.77]; 30 [1.18]; 44.5 [1.75]; 55 [2.17]; 62.5 [2.46]	FEN20-4IOL	6814140	Compact multiprotocol I/O module for Ethernet, 4 IO-Link master channels, protection type IP20
30.2; 24; 38.8; P1 C3 C2 C1 C0 X1; 60.4; 6.3; P2 C7 C6 C5 C4 X2; 218; 230.5	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
30.2; 24; 38.8; P1 C3 C2 C1 C0 X1; 60.4; 6.3; P2 C7 C6 C5 C4 X2; 218; 230.5	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

> **NOTE**
> Ensure the rigid installation of the device in order to prevent inaccuracies caused by vibration. Protective covers can likewise reduce accuracy.

The maximum tightening torque of the screws is 3 Nm.

▶ Align one of the three measurement axes of the device to the direction of vibration.
▶ Position the device as close as possible to the vibration source.
▶ 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.
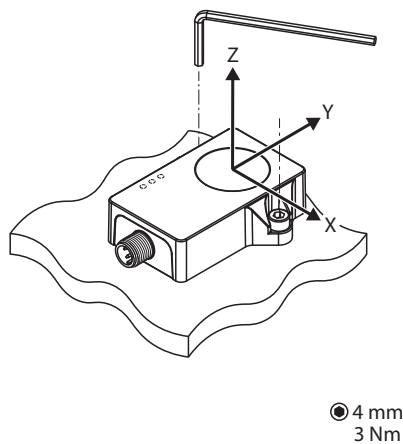
◉ 4 mm 3 Nm	◉ 4 mm 3 Nm
Fig. 5: CMVT-QR20-IOLX3-H1141 — installation and measurement axis	Fig. 6: CMVT-QR20-IOLX3-0.3-RS4 — installation and measurement axis
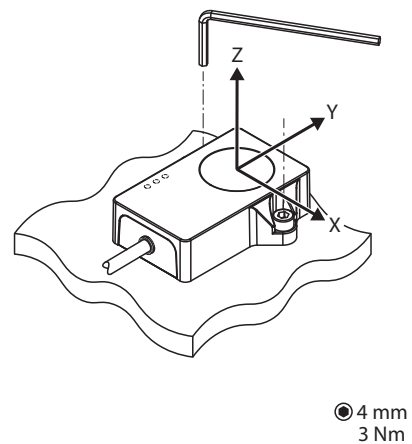
6 Connection

▶ Connect the female connector of the connection cable to the male connector of the sensor.

▶ Connect the open end of the connection cable to the power source and/or signal processors.

6.1 Wiring diagram

2 WH

3 BU · · 1 BN

4 BK

Fig. 7: Pin assignment

1 +
2 out 2: switch
4 out 1: switch/IO-Link
3 –
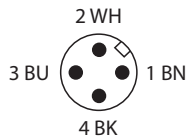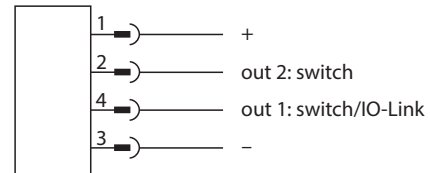
Fig. 8: Wiring diagram

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)

9 Setting

9.1 Settable functions and features

| Parameter	Meaning
Reset device	The device is restarted. Communication is interrupted momentarily. The measured maximum vibration values are reset.
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. The measured maximum vibration values are reset.
Restore factory settings	The factory settings of the device are restored. The device is restarted after the restoration.
Configuring process data	The following process data can be set: ■ RMS in mm/s ■ Peak-to-peak in mm/s ■ RMS in g ■ Peak-to-peak in g The values are determined within set time windows and output cyclically. The maximum value since the power supply was switched on can also be measured. The maximum values are reset if the power supply is interrupted.
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. PNP is active by default.
Output 1 function	The output can be set as a pre-alarm or warning and as an alarm.
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. PNP is active by default.
Output 2 function	The output can be set as a pre-alarm or warning and as an alarm.

Parameter	Meaning
ISO 10816-3	The precise vibration limit values for industrial machinery are specified in the ISO 10816-3 standard. The vibration limit values are used to assess industrial machinery with a rated power of ≥15 kW and a rated speed of 120…1500 rpm. Different values are given for machines with rigid or flexible mounting supports. Configurable switching outputs with PNP/NPN logic can indicate values exceeding the limit values defined in ISO 10816-3. The following limit value categories apply: ■ Newly installed machine ■ Suitable for continuous operation ■ Permissible for short-time operation ■ Not permissible The ISO 10816-3 classification consists of four groups of machines and pumps: ■ Group 1: Large machinery with a rated power between 300 kW and 50 MW or an electric motor with ≤ 315 mm shaft height ■ Group 2: Medium-sized machinery with a rated power between 15 kW and 300 kW or an electric motor with 160 mm ≤ 315 mm shaft height ■ Group 3: Pumps with a rated power > 15 kW and an external drive ■ Group 4: Pumps with a rated power > 15 kW and an integrated drive The classification of the machine supports into rigid and flexible systems is due to the relationship of the natural frequency of the overall machine and support system as well as the excitation frequency. If the lowest natural frequency of the overall system is at least 25 % above the excitation frequency, the machine support is classified as rigid. Flexibly mounted machinery is dampened and more tolerant of vibration than rigidly mounted machinery, which is not dampened. The following parameters can be set following the grouping from ISO-10816-3: ■ Group 1 rigid ■ Group 1 flexible ■ Group 2 rigid ■ Group 2 flexible ■ Group 3 rigid ■ Group 3 flexible ■ Group 4 rigid ■ Group 4 flexible ■ Temperature ■ Manual calibration Manual is used to manually define the limit values for the vibration speed in ms/s and temperature at which the switching outputs are activated in the event of an excess value.
Time slots	The rms values of the vibration speed, the acceleration or the peak-to-peak values are determined and output over the set period. The following time windows for calculating the vibration can be defined: ■ 20 ms ■ 100 ms ■ 250 ms ■ 500 ms ■ 1000 ms
Hysteresis	The hysteresis window of the switching outputs can be set as a percentage of the configured threshold value.
Threshold values	When setting the limit values for vibration speed and temperature manually, it is possible to set values for the pre-alarm and warning or alarm for each measurement axis.

9.2 Setting via FDT/IODD

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

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

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

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

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

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

9.3 Setting and visualization with the Turck Vibration 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 Vibration Monitor is also available for visualizing process data.

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

IO-Link master	Firmware version
FEN20-4IOL	V1.3.6.0
TBEN-L4-8IOL	V3.4.11.0
TBEN-L5-8IOL	V3.4.11.0
TBEN-LL-8IOL	V4.2.9.0
TBEN-S2-4IOL	V3.4.6.0

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 radar sensor to an IO-Link port of the IO-Link master.

If no IO-Link master is available with the appropriate firmware version, the CMVT… can be set 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.

9.3.1 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**).

A login is required on the IO-Link master in order to edit the settings via the web server and to call the Turck Vibration Monitor.

▶ Enter the password in the login field on the start screen of the web server. The default password is "password".

▶ Click **Login**.

9.3.2 Reading in IODD in the web server

▶ Set the input port of the IO-Link master as an IO-Link port.

▶ Open the **IODD Configurator** tab in the web server.

Fig. 9: Web server – IODD Configurator

▶ Load the device-specific IODD into the web server via **Load IODD**.
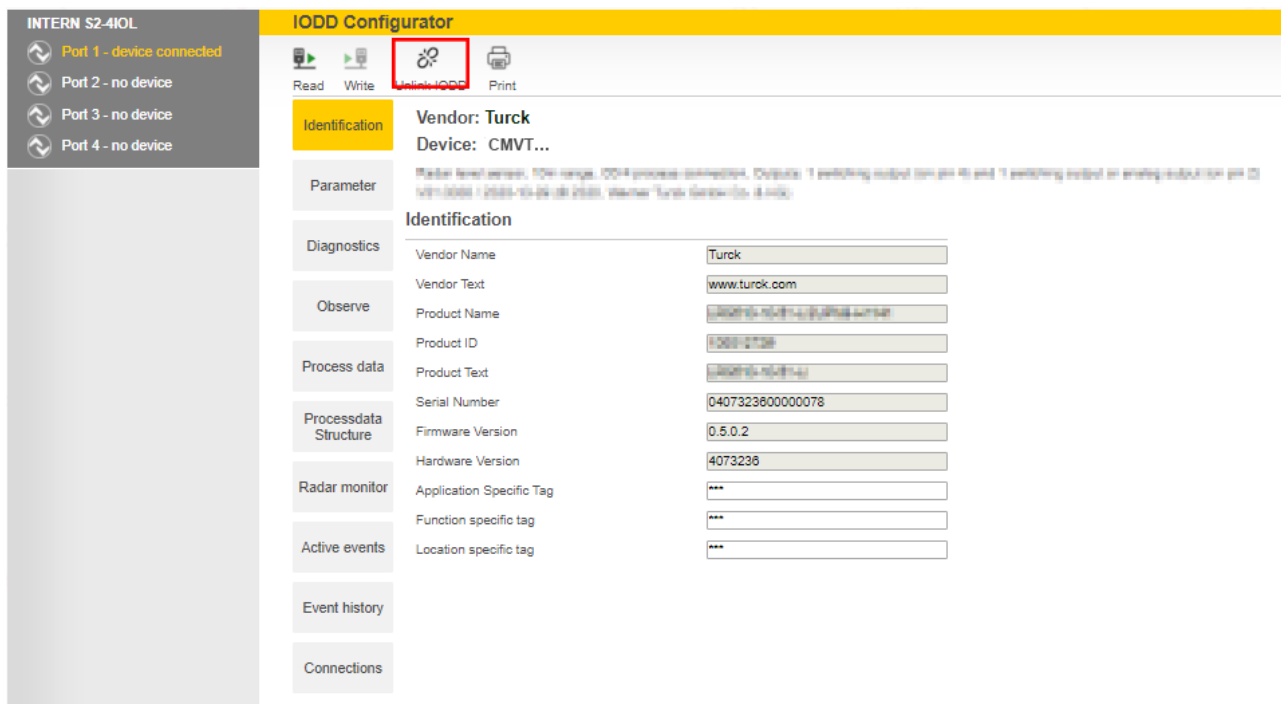
Fig. 10: Loading the IODD

9.3.3 Turck Vibration Monitor — overview

The process data of the sensor can be visualized via the Turck Vibration 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 warnings for the switching outputs or to determine the measurement axis with the largest vibration. It is also possible to export the process data via an Excel file in csv format.

▶ Choose **Vibration monitor** to start the Turck Vibration Monitor.

Fig. 11: Turck Vibration 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

10 Troubleshooting

If the device does not function as expected, first check whether ambient interference is present. If there is no ambient interference present, check the connections of the device for faults.

If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

11 Maintenance

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	CMVT-QR20-IOLX3-H1141	CMVT-QR20-IOLX3-0.3-RS4
ID	100016543	100029966
Vibration — acceleration		
Scan rate, acceleration measurement cell	6.6 kHz	
RMS measuring range	±16 g	
RMS resolution	0.01 g	
RMS linearity deviation	≤ 3 % at 78 Hz	
RMS repeatability	≤ ±5 % at 78 Hz	
Vibration — speed		
RMS measuring range	0…320 mm/s at 78 Hz	
RMS resolution	0.01 mm/sec	
RMS linearity deviation	≤ 1 % at 78 Hz	
RMS repeatability	≤ ±5 % at 78 Hz	
Temperature		
Temperature measuring range	-40…+85 °C	
Temperature linearity deviation	≤ 1 %	
Temperature repeatability	≤ ±2.4 %	
Electrical data		
Operating voltage	18…30 VDC	
Residual ripple	< 10 % U_{ss}	
Isolation test voltage	≤ 0.5 kV	
Reverse polarity protection	Yes	
Communication protocol	I/O link	
Current consumption	< 50 mA	
I/O link		
Communication mode	COM 3 (230.4 kbaud)	
Function Pin 4	IO-Link, SIO	
Function Pin 2	SIO	
Mechanical data		
Design	Rectangular, QR20	
Dimensions	71.6 × 62.6 × 20 mm	
Housing material	Plastic, Ultem	
Electrical connection	Connector, M12 × 1	
Cable	-	Ø 4.5 mm, PUR, 0.3 m
		Halogen-free, flame resistant acc. to IEC 60332-2-2 and UL FT2

Technical data	CMVT-QR20-IOLX3-H1141	CMVT-QR20-IOLX3-0.3-RS4
Environmental conditions		
Ambient temperature	-40…+85 °C	
Temperature changes (EN 60068-2-14)	-40…+85 °C	
Vibration resistance (EN 60068-2-6)	20 g; 5 h/axis; 3 axes	
Shock resistance (EN 60068-2-27)	200 g; 4 ms ½ sine	
Type of protection	IP68, IP69K	
Indication elements		
Operating voltage indication	1 × LED, green	
Switching state indication	2 × LED, yellow	

15   Turck branches — contact data

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

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

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

Hungary   TURCK Hungary kft.
Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest
www.turck.hu

India   TURCK India Automation Pvt. Ltd.
401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex,
Baner-Balewadi Link Rd., 411045 Pune - Maharashtra
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Via San Domenico 5, IT-20008 Bareggio (MI)
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Japan   TURCK Japan Corporation
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Mexico	Turck Comercial, S. de RL de CV Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga, Coahuila www.turck.com.mx
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