TURCK

Your Global Automation Partner

CMTH…
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.
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
- Declarations of conformity (current version)
- 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

These instructions apply to the following condition monitoring sensors:

- CMTH-M12-IOLX2-H1141

2.2 Scope of delivery

The delivery consists of the following:

- Condition monitoring sensor
- 2 fixing nuts
- 2 lock washers (DIN 6797)

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 [▶ 22].

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 CMTH series monitor temperature and air humidity. The devices are designed for an operating range of 0…+60 °C, a relative air humidity of 20…80 % and an environmental pressure of 1013 hPa.

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

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.
- The values supplied by the sensor may be invalid if water, ice or condensation are present on the measuring element.
- Avoid use in aggressive media in order to prevent a drift in the humidity value. This includes the following media:
    - Toluene: C_7H_8
    - Acetone: $(CH_3)_2CO$
    - Ethanol: C_2H_6O
    - Methanol: CH_3OH
    - Isopropyl alcohol: C_3H_8O
    - Diisopropyl ether: $C_6H_{14}O$
    - Ethylene glycol: $(CH_2OH)_2$
    - Ethyl acetate: $C_4H_8O_2$
    - Acetic acid n-butyl ester: $C_6H_{12}O_2$
    - Methyl ethyl ketone C_4H_8O
    - Hydrochloric acid HCl
    - Sulfuric acid: H_2SO_4
    - Nitric acid HNO_3
    - Ammonia NH_3
    - Hydrogen peroxide: H_2O_2
    - Ozone: O_3
    - Formaldehyde: CH_2O
    - Other ketones

3.3   General safety instructions

- 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.

3.4　Notes on UL approval

- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- The equipment is intended to be powered by Limited Energy Source or Class 2 supply or Limited Energy Circuit.

4 Product description

The condition monitoring sensors of the CMTH series are contained in a metal housing with an M12 male thread. The front cap consists of a chrome plated brass. The sensor can be mounted in any direction.

The device has two outputs which can be set independently of each other. The temperature value is provided at output 1 and the humidity value at output 2. Temperature and air humidity are measured and output simultaneously.

4.1 Device overview
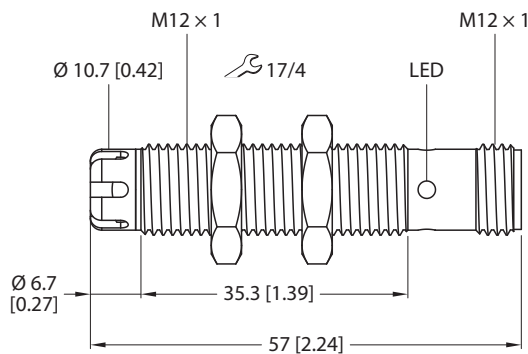
mm [Inch]

Fig. 1: Dimensions

4.1.1 Indication elements

The device includes a 2-color LED status indicator.

4.2 Properties and features

- Sensor for condition monitoring
- Accurate temperature and air humidity measurement
- Sensor-2-cloud compatible
- 18…30 VDC
- Male connector, M12 × 1, 4-pin
- Configuration and communication via IO-Link V1.1
- Continuous process values for temperature and humidity
- Limit values of preset values monitored in SIO mode
- Temperature monitoring with adjustable limits
- Humidity monitoring with adjustable limits
- Operating hours meter for further analysis options

4.3 Operating principle

Condition monitoring sensors are designed for use in plant sections where the ambient conditions significantly affect machine availability or process quality. The monitoring of temperature or air humidity makes it possible to detect deviations early on and introduce counter measures. The process value is transferred to the controller via IO-Link for monitoring. It is also possible to use switching bits to signal limit value violations for specific applications.

4.4 Functions and operating modes

The sensors monitor temperature and air humidity in condition monitoring applications. The device outputs a continuous process value for both variables via IO-Link. Two limit value pairs can also be defined (window function) for each detected variable. The overshooting or under-shooting of the defined limit value is indicated via a bit in the IO-Link process data. The device supports Smart Sensor Profile 4.1.2.

In operation without IO-Link communication, output 1 supplies the temperature value and output 2 the humidity value. A switch window can be set for each of these two outputs. The switching output is set if one of the limit values was reached.

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 $\rightarrow$ 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.
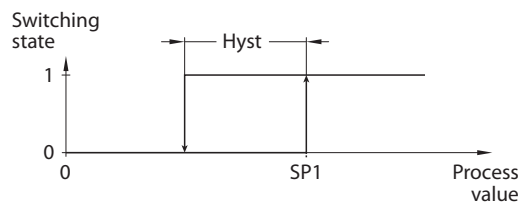
Fig. 2: Single point mode

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.
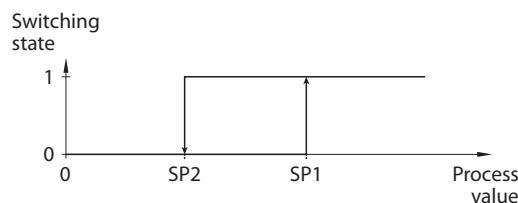
Fig. 3: Two point mode

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.
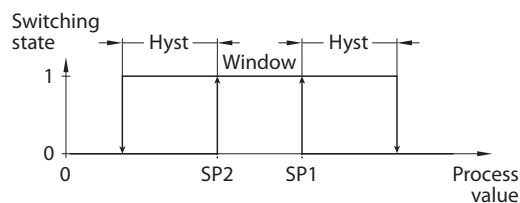

Fig. 4: Window mode

4.4.4 Counter for operating hours and switching cycles

The device is provided with an integrated counter for operating hours and switching cycles. The actual, total operating hours or the switching cycles can be read via the acyclic IO-Link parameter data. The values are stored at the following times:

- 1 minute after the device is started
- 5 minutes after the device is started
- 15 minutes after the device is started
- 30 minutes after the device is started
- Every 60 minutes
- After writing parameters to the non-volatile memory

4.4.5 Limit counter

The device is equipped with a limit counter. The counter value is automatically increased when the limit values set for the specific application are reached. The limit counter can be read out via the IO-Link interface. It is also possible to assign an alarm value to the limit values. When the alarm value is reached, the device issues a notification about an IO-Link event.

The limit counter can be reset via IO-Link.

4.4.6 Dew point calculation

The device calculates the dew point using the measured temperature and the relative humidity. The dew point can be read out via IO-Link.

The dew point is the temperature at which water vapor contained in the air begins to condense. The relative humidity at the dew point is 100 %. The air is saturated with water vapor.

4.4.7 Temperature and humidity histograms

The device creates histograms for temperature and humidity. The value ranges for the process values are divided into intervals of 10 K (temperature) or 10 % (humidity). The device records the time in which the process value lies within each of the relevant sections. Each section has a separate IO-Link index.

The values are stored at the following times:

- 1 minute after the device is started
- 5 minutes after the device is started
- 15 minutes after the device is started
- 30 minutes after the device is started
- Every 60 minutes
- After writing parameters to the non-volatile memory

5 Installing

The sensors may be mounted in any position. The position of the sensor can affect the accuracy values. The accuracy values in the technical data apply to horizontal mounting. The maximum tightening torque of the housing nuts is 7 Nm.

▶ Clean the mounting surface and mounting environment.
▶ If required, the sensor may be mounted in a mounting aid (mounting bracket or mounting clip).
▶ Mount the sensor or mounting aid at the intended location for use.
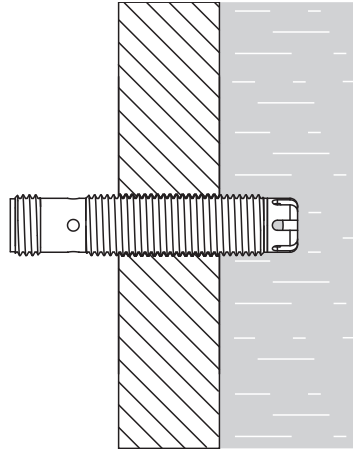
Fig. 5: Example of correct mounting   Fig. 6: Example of incorrect mounting
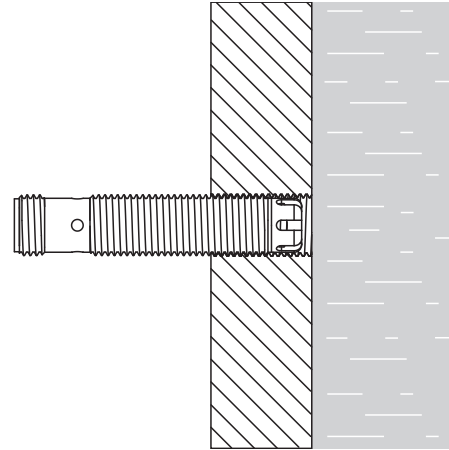
▶ Mount the sensor so that the front cap protrudes from the mounting surface (see example of correct installation).
▶ Select the mounting location accordingly so that the measuring element is not surrounded by liquid.
▶ For use in environments with humidity > 80 %: Mount the sensor with the front cap facing downward to avoid condensation residue on the measuring element.
▶ For precise accuracy values (see technical data): Do not cover the front cap. Ensure adequate air convection on the measuring element.

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 supply and/or processing units.

6.1 Wiring diagrams
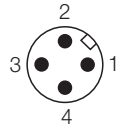
Fig. 7: Pin assignment

Fig. 8: Wiring diagram

1   +
2   out 2: switch
4   out 1: switch/IO-Link
3   −
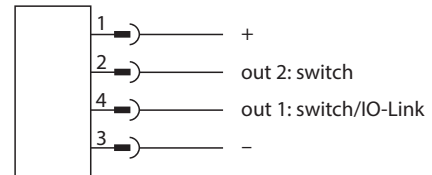
7　Commissioning

The device is operational automatically after max. 2 s once the cables are connected and the power supply is switched on. IO-Link communication starts automatically if the device is connected to an IO-Link master. For this the IO-Link master sends a wake-up request to the device.

7.1　Initiating SIO mode

▶　Connect the device to a standard I/O port.
⇨　The device is operational after a readiness delay of max. 2 s.

8 Operation

NOTE
The values supplied by the sensor may be invalid if water, ice or condensation are present on the measuring element.

8.1 LEDs

LED indication	Meaning
Green flashing (1 s on, 0.125 s off)	IO-Link communication
Green	Device is operational SIO mode: no switching output active
Yellow	SIO mode: Output 1 (temperature) active
Yellow flashing (1 Hz)	SIO mode: Output 2 (humidity) active
Yellow flashing (4 Hz)	SIO mode: Output 1 and 2 active
Green/yellow flashing	SIO mode: Short circuit at one output

9 Setting and parameterization

9.1 Setting via IO-Link

The device can be parameterized within the technical specifications (see data sheet) via the IO-Link communication interface – both offline, e.g. with the configuration tool as well as also online via the controller. An overview of the different functions and properties that can be set and used for IO-Link mode can be found in the chapter "Setting" and in the IO-Link parameter manual of the device. Detailed instructions on the parameterization of devices via the IO-Link interface are provided in the IO-Link commissioning manual.

All the parameters can changed in IO-Link mode via the controller during commissioning as well as during operation.

9.2 Settable functions and properties

The following functions and properties can be set and used via the IO-Link interface:

■ Switching limits for the window function
■ Output configuration
■ On/off switching of outputs

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.

Problem	Possible cause	Remedy
Air humidity and temperature: **No measurement data**	Measuring element surrounded by liquid	The liquid evaporates when it no longer fully surrounds the measuring element. This evaporation will affect the measured values for temperature and relative air humidity. Evaporation can take up to 40 minutes at room temperature. Once dried, the device outputs process values again that are not affected by the liquid.
Deviating measured values	Insufficient air convection	Do not cover the front cap. Ensure sufficient air convection at the measuring element.
Residual condensation on measuring element and front cap	Air humidity too high	Mount the sensor with the front cap pointing down in order to prevent residual condensation on the measuring element.

11   Maintenance

The device is maintenance-free. Clean with a dry 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	
Type	CMTH-M12-IOLX2-H1141
ID	100016580
General data	
Function	Temperature/humidity sensor
Temperature measuring range	-40…+100 °C (-40…+212 °F)
Accuracy	± 0.8 °C under laboratory conditions
Resolution	0.1 K
Air humidity measuring range	0…100 % RH
Accuracy	± 5 % RH (10…90 % RH) under laboratory conditions ± 7 % RH (0…10 % RH/90…100 % RH) under laboratory conditions
Resolution	0.1 % RH
Electrical data	
Operating voltage	18…30 VDC
Ripple	< 10 % U_{ss}
DC rated operational current	≤ 150 mA
No-load current	≤ 10 mA
Short-circuit protection	Yes/cyclic
Reverse polarity protection	yes
Output function	Programmable, IO-Link, SIO mode
Output 2	Switching output
Max. load current I_o	50 mA
Response time for the humidity value	6 s ($\tau_{63\,\%}$) under laboratory conditions
Setting option	IO-Link
IO-Link	
IO-Link specification	V1.1
IO-Link port type	Class A
Communication mode	COM 3 (230.4 kbaud)
Process data width	64 bits
Measured value information	24 bits
Switching point information	4 bits
Frame type	2.2
Minimum cycle time	10 ms
Function pin 4	IO-Link, SIO
Function pin 2	SIO
Maximum cable length	20 m
Profile support	Smart Sensor Profile 4.1.2

Technical data	
Mechanical data	
Design	Cylindrical/threaded, M12
Dimensions	Ø 12 × 57 mm
Housing material	Metal, CuZn, chrome-plated
Electrical connection	Male connector, M12 × 1
Ambient temperature	-40…+100 °C
Storage temperature	-40…+100 °C
Pressure resistance	10 bar
Protection class	IP67
Operating voltage indication	LED, green
Tests and approvals	
MTTF	610 years
Vibration resistance	IEC 60060-2-6: (10…150 Hz) 20 g
Shock testing	IEC 60068-2-27: 50 g (6 ms)
EMC	EN 61326-1
Approvals	CE, UL

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 **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 ISM Akihabara 1F, 1-24-2, Taito, Taito-ku, 110-0016 Tokyo **www.turck.jp**

Korea	Turck Korea Co, Ltd. A605, 43, Iljik-ro, Gwangmyeong-si 14353 Gyeonggi-do www.turck.kr
Malaysia	Turck Banner Malaysia Sdn Bhd Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C, 46200 Petaling Jaya Selangor www.turckbanner.my
Mexico	Turck Comercial, S. de RL de CV Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga, Coahuila www.turck.com.mx
Netherlands	Turck B. V. Ruiterlaan 7, NL-8019 BN Zwolle www.turck.nl
Poland	TURCK sp.z.o.o. Wroclawska 115, PL-45-836 Opole www.turck.pl
Romania	Turck Automation Romania SRL Str. Siriului nr. 6-8, Sector 1, RO-014354 Bucuresti www.turck.ro
Sweden	Turck AB Fabriksstråket 9, 433 76 Jonsered www.turck.se
Singapore	TURCK BANNER Singapore Pte. Ltd. 25 International Business Park, #04-75/77 (West Wing) German Centre, 609916 Singapore www.turckbanner.sg
South Africa	Turck Banner (Pty) Ltd Boeing Road East, Bedfordview, ZA-2007 Johannesburg www.turckbanner.co.za
Turkey	Turck Otomasyon Ticaret Limited Sirketi Inönü mah. Kayisdagi c., Yesil Konak Evleri No: 178, A Blok D:4, 34755 Kadiköy/ Istanbul www.turck.com.tr
United Kingdom	TURCK BANNER LIMITED Blenheim House, Hurricane Way, GB-SS11 8YT Wickford, Essex www.turckbanner.co.uk
USA	Turck Inc. 3000 Campus Drive, USA-MN 55441 Minneapolis www.turck.us

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