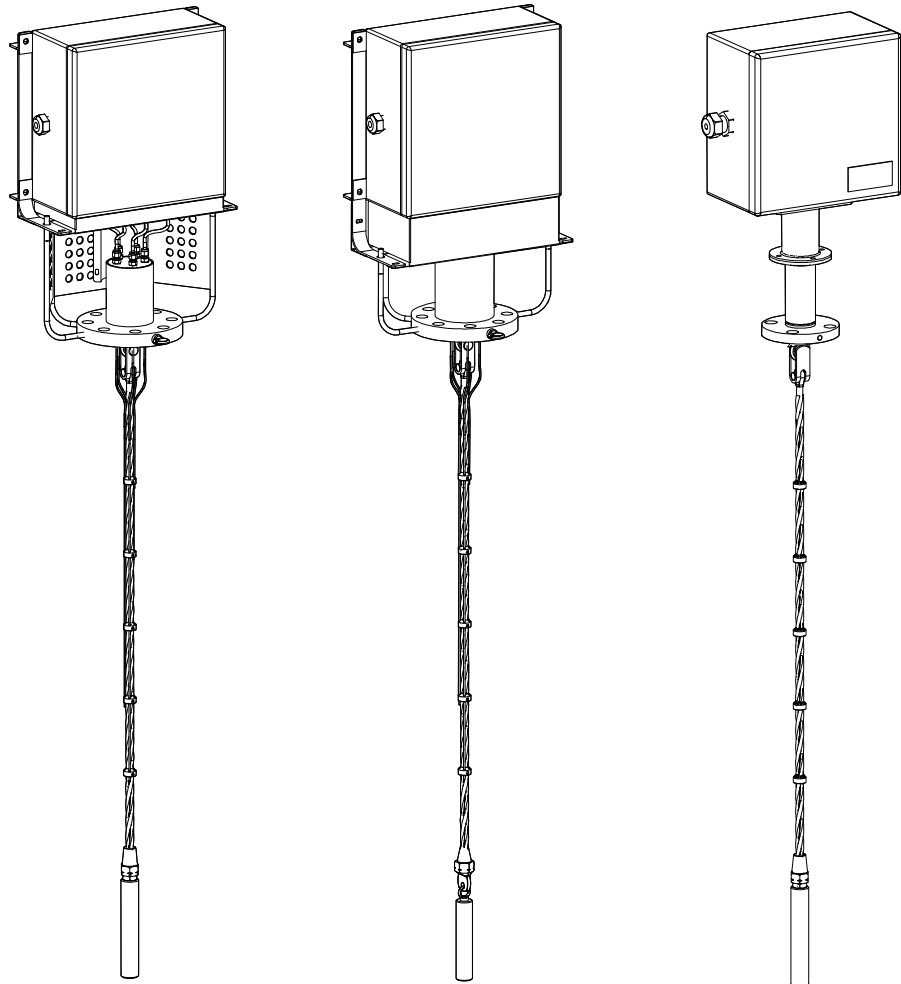


# Operating Instructions

## iTHERM

### MultiSens Bundle TMS31

Metallic flexible rope multipoint for silos and storage tank applications





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# 1 About this document

## 1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

## 1.2 Symbols

### 1.2.1 Safety symbols

#### DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

#### WARNING

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.






#### CAUTION

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.



#### NOTICE










This symbol contains information on procedures and other facts which do not result in personal injury.

### 1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	<b>Protective Earth (PE)</b> A terminal which must be connected to ground prior to establishing any other connections.  The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> <li>▪ Inner ground terminal: Connects the protective earth to the mains supply.</li> <li>▪ Outer ground terminal: Connects the device to the plant grounding system.</li> </ul>


### 1.2.3 Symbols for certain types of information

Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted.
	<b>Preferred</b> Procedures, processes or actions that are preferred.

Symbol	Meaning
	<b>Forbidden</b> Procedures, processes or actions that are forbidden.
	<b>Tip</b> Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

#### 1.2.4 Documentation

Document	Purpose and content of the document
iTHERM TMS31 MultiSens Bundle (TI1443T/01/xx)	<b>Planning aid for your device</b> The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

 The document types listed are available:  
In the Download Area of the Endress+Hauser Internet site: [www.endress.com](http://www.endress.com) → Downloads

#### 1.2.5 Registered trademarks

- FOUNDATION™ Fieldbus  
Registered trademark of the Fieldbus Foundation, Austin, Texas, USA
- HART®  
Registered trademark of the HART® FieldComm Group
- PROFIBUS®  
Registered trademark of the PROFIBUS Nutzerorganisation e.V. (Profibus User Organization), Karlsruhe - Germany

## 2 Basic safety instructions

Instructions and procedures in the operating instructions may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by safety pictograms and symbols. Please refer to the safety messages before performing an operation preceded by pictograms and symbols. Although the information provided herein is believed to be accurate, be advised that the information contained herein is NOT a guarantee of satisfactory results. Specifically, this information is neither a warranty nor guarantee, expressed or implied, regarding performance. Please note that the manufacturer reserves the right to change and / or improve the product design and specifications without notice.

### 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- ▶ Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- ▶ Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- ▶ Following the instructions in these Operating Instructions

### 2.2 Designated use

The product is intended to measure the temperature profile inside a tank, a silo or any storage system, through RTD or thermocouple technologies.

The manufacturer is not liable for damage caused by improper or non-designated use.

The product has been designed according to the following conditions:

Condition	Description
Internal pressure	The design of joints, threaded connections and sealing elements has been executed as a function of the maximum allowable pressure inside the storage vessel.
Operating temperature	The materials used were chosen according to the operating and design minimum and maximum temperatures. Thermal displacement has been taken into account to avoid intrinsic stresses and to ensure proper integration between the instrument and the plant. Specific care has to be taken when the instrument's sensing elements are fixed to the internals.
Stored material	Dimensions and choice of materials minimize: distributed and localized corrosion.
Fatigue	Cyclic loads during operations have been taken into consideration.
Vibrations	During normal operation the multipoint is not subjected to vibration phenomena. In case of external vibration induced by other equipment near the multipoint, the rope system is able to compensate for them.

Condition	Description
Mechanical stress	The maximum stress on the measuring device is guaranteed to stay below the yielding stress of the material, for every working condition.
External environment	The junction box (with and without head transmitters), wires, cable glands and other fittings have been selected to work within the allowed ranges in terms of external temperature.

## 2.3 Workplace safety

The external installation area must be free of interferences to avoid any injury during installation, and to avoid any damage to the measuring device.

## 2.4 Operational safety

- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for interference-free operation of the device.

### Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection or safety equipment):

- ▶ Based on the technical data on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area. The nameplate can be found on the side of the junction box or on the extension neck.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.



### Electromagnetic compatibility

The measuring system complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendation NE 21 and NE 89.

### NOTICE

- ▶ The unit must only be powered by a power supply that operates using an energy-limited electric circuit that is compliant with IEC 61010-1, "SELV or Class 2 circuit".

## 2.5 Product safety

The unit is constructed using the most up-to-date production equipment and complies with the safety requirements of the local guidelines. The temperature measuring system is fully factory tested according to the specifications indicated on the order and/or any additional test which is considered as safety-relevant. However, if it is installed incorrectly or is misused, certain application dangers can occur. Installation, wiring and maintenance of the unit must only be done by trained, skilled personnel who are authorized to do so by the plant operator. This skilled staff must have read and understood these instructions and must follow them. The plant operator must make sure that the measurement system has been installed by tightening the threaded components (e.g bolts and nuts) with the predefined torques and tools →  12, and correctly wired according to the wiring diagrams →  17.

## 3 Product description

### 3.1 Equipment architecture

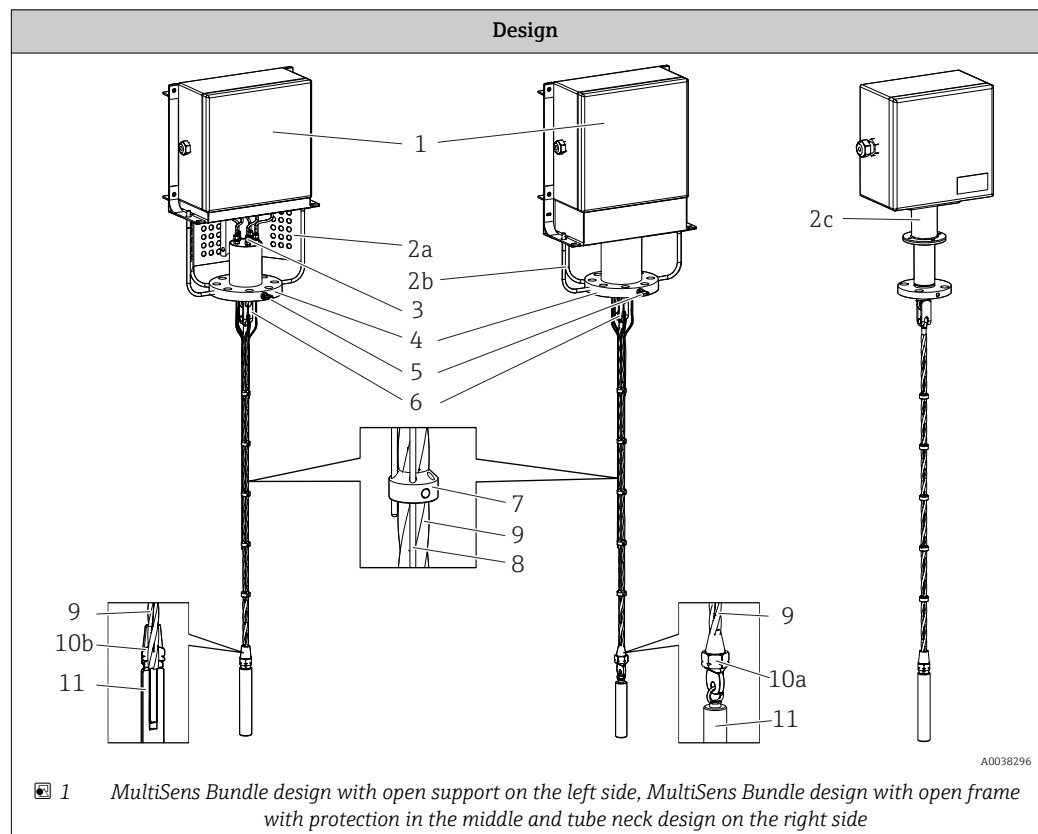
The multipoint thermometer belongs to a range of modular product configuration for multipoint temperature detection with a design where subassemblies and components can be managed individually for easy maintenance and spare part ordering.

The temperature probe-only version consists of many sub-assemblies:

- Insert
- Rope
- Weight
- Process connection
- Neck (see below for a more detailed description)

In general the instrument measures the temperature profile inside the process environment by means of many sensors wrapped around a rope, jointed to a suitable process connection which ensures the right tightness level.

The temperature probe + diagnostic version combines the temperature probe with a head transmitter, which is available with enhanced accuracy and reliability compared to directly wired sensors. Output communication protocols available are: Analog output 4 to 20 mA, HART®, PROFIBUS® PA, FOUNDATION Fieldbus™. Externally the extension cables are wired into the junction box, which can be directly mounted or remotely as an option.





Description and available options	
1: Head	Hinged cover junction box for electrical connections. It includes components such as electrical terminals, transmitters and cable glandes. <ul style="list-style-type: none"> <li>▪ 316/316L</li> <li>▪ Other materials on request</li> </ul>
2a: Open supporting frame	Modular frame support that is adjustable for all available junction boxes. 316/316L
2b: Supporting frame with cover	Modular support that is adjustable for all available junction boxes and ensures extension cable inspection. 316/316L
2c: Tube neck	Modular tube frame support adjustable for all available junction boxes 316/316L
3: Compression fitting	High reliability for tightness between process and external environment, for a wide range of process fluids concentration and severe combination between temperature and pressure. <ul style="list-style-type: none"> <li>▪ 316L</li> <li>▪ 316H</li> </ul>
4: Process connection	Represented by a flange according to international standards, or engineered to satisfy specific process requirements. → 43
5: Eyebolt	Lifting device for easy handling during installation phase. 316
6: Toggle joint	Connection between the rope and the process connection. 316
7: Ogives	Insert guide for the correct positioning of the measuring sensing element. <ul style="list-style-type: none"> <li>▪ 316</li> <li>▪ 316L</li> </ul>
8: Insert	Thermocouple (type J, K) grounded and ungrounded execution or RTD (Pt100 wire wound).
9: Rope	Metallic rope. 316
10a: Swage eye	Ring-bolt end connection. 316
10b: Metric swage thread	Threaded end connection. 316
11: Weight	Weight to maintain the rope pretensioned and in a straight position during working condition (i.e. tank filling). <ul style="list-style-type: none"> <li>▪ 316</li> <li>▪ 316L</li> </ul>

## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance

Before proceeding with the installation the following incoming acceptance procedures are suggested:

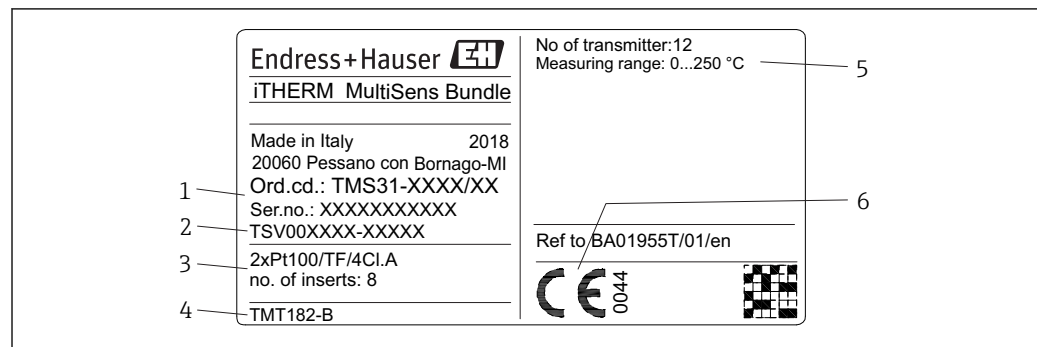
- Once the device is received it is always suggested to verify the integrity of the packaging and possible damages. Non-compliances should be immediately reported to the manufacturer. Damaged material shall not be installed: in these conditions, in fact, the manufacturer cannot guarantee the original safety requirements and cannot be considered responsible for any consequential effect.
- Compare the scope of delivery with the order content.
- Carefully remove all packaging/protection related to the freight.

### 4.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Enter the serial number from the nameplate in the *W@M Device Viewer* [www.endress.com/deviceviewer](http://www.endress.com/deviceviewer): All data relating to the device and an overview of the Technical Documentation supplied with the device are displayed.

The following nameplate layout serves to identify the specific product information from the serial number, design conditions, sizes, configuration to approvals:



2 Nameplate of the multipoint thermometer (example as landscape format)

Field number	Description	Examples
1	Order code and serial number	TMS31-xxxxx
2	TSV drawing number	TSV301237-XXXXX
3	Sensor and product configuration	e.g. number of measuring points
4	Assembled transmitter	-
5	Sensor measuring temperature range	-

Field number	Description	Examples
6	CE marking	-
-	Approval number, hazardous area classification and Ex logo (if applicable) Safety instructions number (if applicable) Ambient temperature (if hazardous area classification is applicable)	e.g. -50 to 60 °C (-58 to 140 °F) for hazardous area application


 Compare and check the data on the nameplate of the device against the requirements of the measurement environment.


### 4.3 Storage and transport


Carefully remove each package and protection relative to the transportation packaging.

#### NOTICE

##### Transportation of the device to the installation area

- ▶ Handle the device by always using the provided eyebolt as the main lifting part.
- ▶ Handle with care. During mounting phases avoid each load to welded or threaded parts, under the action of the weight of the device.
- ▶ When necessary, use additionally ropes to keep the device straight in the area between the junction box and the first part of the metallic rope.
- ▶ It is strictly requested to avoid bumping against obstacles nearby the place where the device is to be installed.
- ▶ Avoid any friction between the device and the other surrounding bodies.
- ▶ Avoid twisting of the sensing element twisting.
- ▶ For ease, keep the thermometer bundle rope in its coil configuration during lifting operation →  15.

 Pack the device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.

For permitted storage temperature →  36

## 5 Mounting

### 5.1 Mounting requirements

#### **⚠ WARNING**

**Failure to follow these installation guidelines could result in death or serious injury**

- ▶ Make sure only qualified personnel perform the installation.

#### **⚠ WARNING**

**Explosions could result in death or serious injury**

- ▶ Do not remove the junction box cover in explosive atmospheres when the circuit is live.
- ▶ Before connecting any additional electric and electronic device in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non incensive field wiring practices.
- ▶ Verify that the operating atmosphere of the transmitters is consistent with the appropriate hazardous locations certifications.
- ▶ All covers and threaded components must be fully engaged to meet explosion-proof requirements.


#### **⚠ WARNING**

**Process leaks could result in death or serious injury**

- ▶ Do not release screwed parts while in operation. Install and tighten the fittings before applying pressure.

#### **NOTICE**

**Additional loads and vibrations from other plant components can affect the operation of the sensor elements.**

- ▶ Is it not allowed to apply additional loads or external moments to the system coming from the connection with another system not foreseen from installation plan.
- ▶ The system is not suitable for being installed in locations where vibrations are present. The deriving loads can undermine the sealing of the junctions and damage the operation of the sensing elements.
- ▶ It will be care of the final user to verify the installation of suitable devices in order to avoid the overcoming of the admitted limits.
- ▶ For the environment conditions please refer to the technical data →  36
- ▶ While installing the measurement system, avoid any friction during installation, specifically avoid sparks generation.
- ▶ Make sure that the load of the stored material (like grain, clinker, pellet, etc.) does not lead to deformation or stress to the probes or welds (if the probe is fixed on internals).

### 5.2 Mounting the assembly

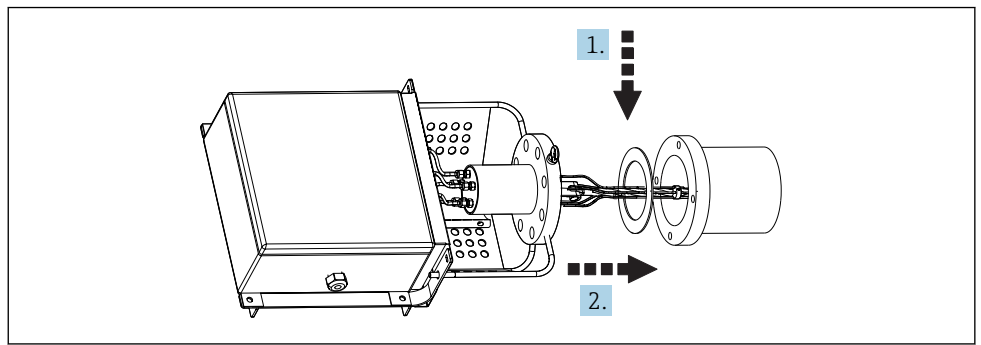
The bundle rope thermometer is packed in a coil setup for a simple and compact transportation. It is recommended to keep it in its coiled configuration until the thermometer is close to the storage connection; a long and straight vertical rope would result in a more difficult lifting and installing operations.

#### 5.2.1 Junction box directly mounted on board

The following instructions must be followed for the proper installation of the device (please note that this applies to “Open supporting frame”, “Supporting frame with covers” and “Tube neck” version).

### Assembly sequence

1.



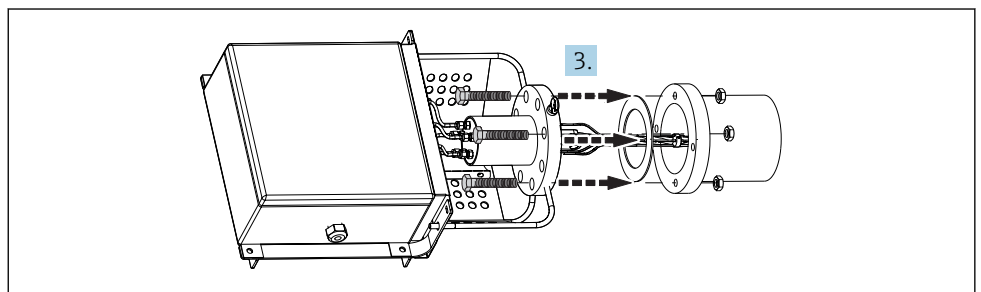
A0038308

Place the gasket between the flanged nozzle and the flange of the device (after checking the cleanliness of gasket seats on the flanges).

2.

Bring the device to the nozzle, inserting the thermoelements bundle rope through the nozzle, avoiding interlacing and deformation of the thermoelement probes and twisting of the rope system as well.

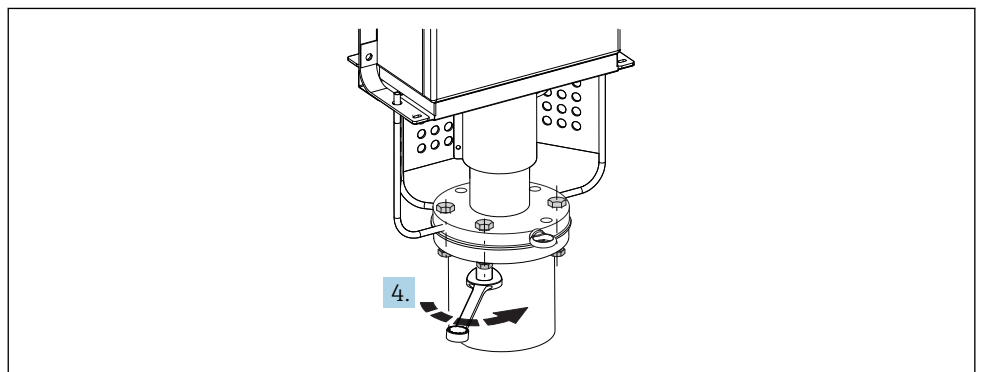
3.



A0038309

Start the bolts insertion through the flanges' holes and tighten them with the nuts by using a suitable wrench tool - but do not tighten them completely.

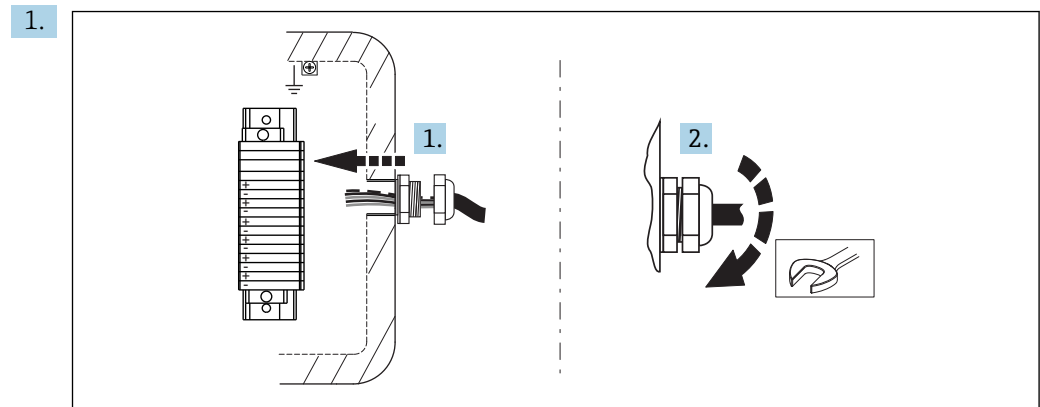
4.



A0038310

Complete the bolts insertion through the flanges' holes and tight them with the crossed method by means of an appropriate equipment (i.e. controlled tensioning according to the applicable standards).

### Wiring sequence (Connection customer side)



In case of direct wiring, introduce completely the extension or compensating cables through the respective cable glands in the junction box.

2. Tighten the cable glands on the junction box.
3. After having opened the cover of the junction box, connect the compensating cables to the terminals of the junction box following the wiring instruction provided, ensuring the right matching between the cable tag numbers and the terminals tag numbers.
4. Close the cover ensuring the right gasket position to avoid any impact on the IP degree of protection.
5. In case of using the supporting frame with covers, check if all its components are still coupled properly one each other.

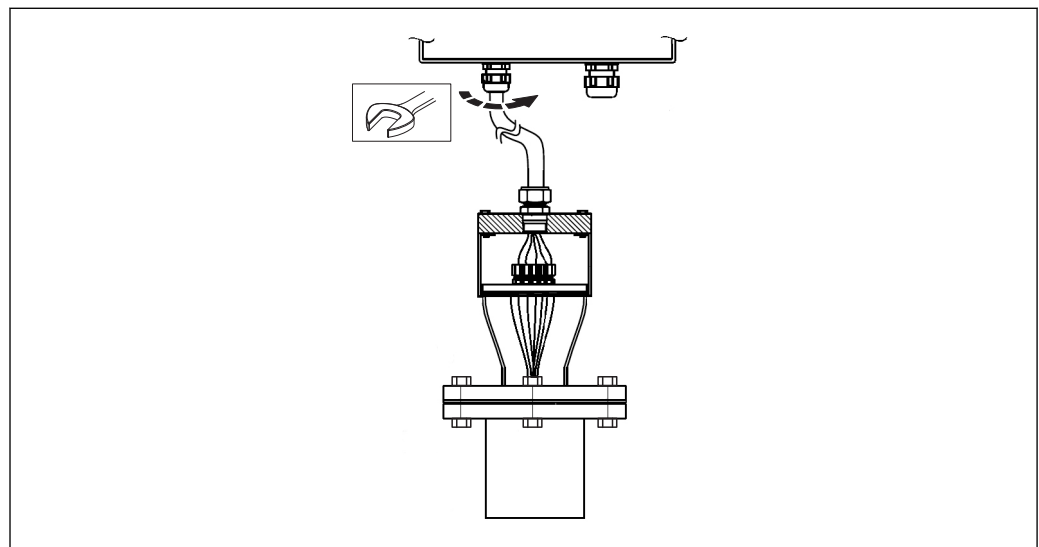
### 5.2.2 Junction box remote connection

#### Junction box not supplied. Assembly sequence


Please refer to → 13 for a correct assemble process.

#### Conduit connection

Make sure the cable gland is properly tightened after the wiring connections.




**Wiring sequence (connection customer side)**


Please refer to →  14 for a correct wiring sequence.

**Junction box supplied but not connected to the multipoint. Assembly sequence**



Before any assemble and wiring operation, please make sure to fix the junction box to a stable metallic support according to your needs and in a place easy to access.

Please refer to →  13 for a correct assemble process.

**Conduit connection**

Please refer to →  14 for a correct assemble process.

**Wiring sequence (connection customer side)**

Please refer to →  14 and →  19 for a correct wiring sequence.

**Junction box supplied and connected to the multipoint.**

**Assembly sequence**

Before any assemble and wiring operation, please make sure to fix the junction box to a stable metallic support according to your needs and in a place easy to access.

Please refer to paragraph 5.2.1.1 for a correct assemble process.

**Wiring sequence (connection customer side)**

Please refer to paragraph 5.2.1.1 for a correct assemble process.

**NOTICE**

**After the mounting, perform few simple checks on the thermometric system installed.**

- ▶ Check the tightness of the threaded connections. If any part is loosened, tight it applying the proper torque.
- ▶ Check the proper straight tensioning of the rope bundle to avoid any inconvenient bending which may result in an improper positioning of the thermoelements inside the storage system.
- ▶ Check the proper positioning of the weight at the rope.
- ▶ Check the proper connection of the swage eye to the selected anchor point inside the vessel (no weight version).
- ▶ Check for correct wiring, test the electrical continuity of the sensors (by warming up the tip, when feasible) and then verify the absence of short circuits.

**5.3 Post-mounting check**

*Before commissioning the measuring system make sure that all final checks have been carried out:*

Device conditions and specifications	
Is the device undamaged (visual inspection)?	<input type="checkbox"/>
Do the ambient conditions match the device specification? For example: ▪ Ambient temperature ▪ Proper conditions	<input type="checkbox"/>
Are the threaded components undeformed?	<input type="checkbox"/>
Are the gaskets not permanently deformed?	<input type="checkbox"/>
<b>Installation</b>	

Is the equipment aligned with the nozzle axis?	<input type="checkbox"/>
Are the gasket seats of flanges clean?	<input type="checkbox"/>
Is the coupling between the flange and its counter flange reached?	<input type="checkbox"/>
Are the thermoelements not interlaced, undeformed or twisted?	<input type="checkbox"/>
Is the rope bundle in a proper straight tensioned configuration with no twisting or wrapping?	<input type="checkbox"/>
Is the toggle joint connected properly to the flange eyebolt?	<input type="checkbox"/>
Are the bolts completely inserted in the flange? Make sure the flange is completely attached to the nozzle?	<input type="checkbox"/>
Are the cable glands tightened on the extension cables?	<input type="checkbox"/>
Are the extension cables connected to the junction box terminals?	<input type="checkbox"/>




## 6 Electrical connection




### CAUTION

**Failure to observe this may result in destruction of parts of the electronics.**

- ▶ Switch off power supply before installing or connecting the device.
- ▶ When installing Ex-approved devices in a hazardous area please take special note of the instructions and connection schematics in the respective Ex documentation added to these Operating Instructions. The local Endress+Hauser representative is available for assistance if required.

 When wiring to a transmitter also observe the wiring instructions in the enclosed Brief Operating manuals of the relevant transmitter.

For wiring the device proceed as follows:

1. Open the housing cover on the junction box.
2. Open the cable glands on the sides of the junction box.
3. Feed the cables through the opening in the cable glands.
4. Connect the cables as shown on →  17
5. On completion of the wiring, screw the screw terminals tight. Tighten the cable glands again. In doing so, also pay particular attention to →  21. Close the housing cover again.
6. In order to avoid connection errors always take note of the hints given in the post connection check! →  21


### 6.1 Quick wiring guide

Terminal assignment

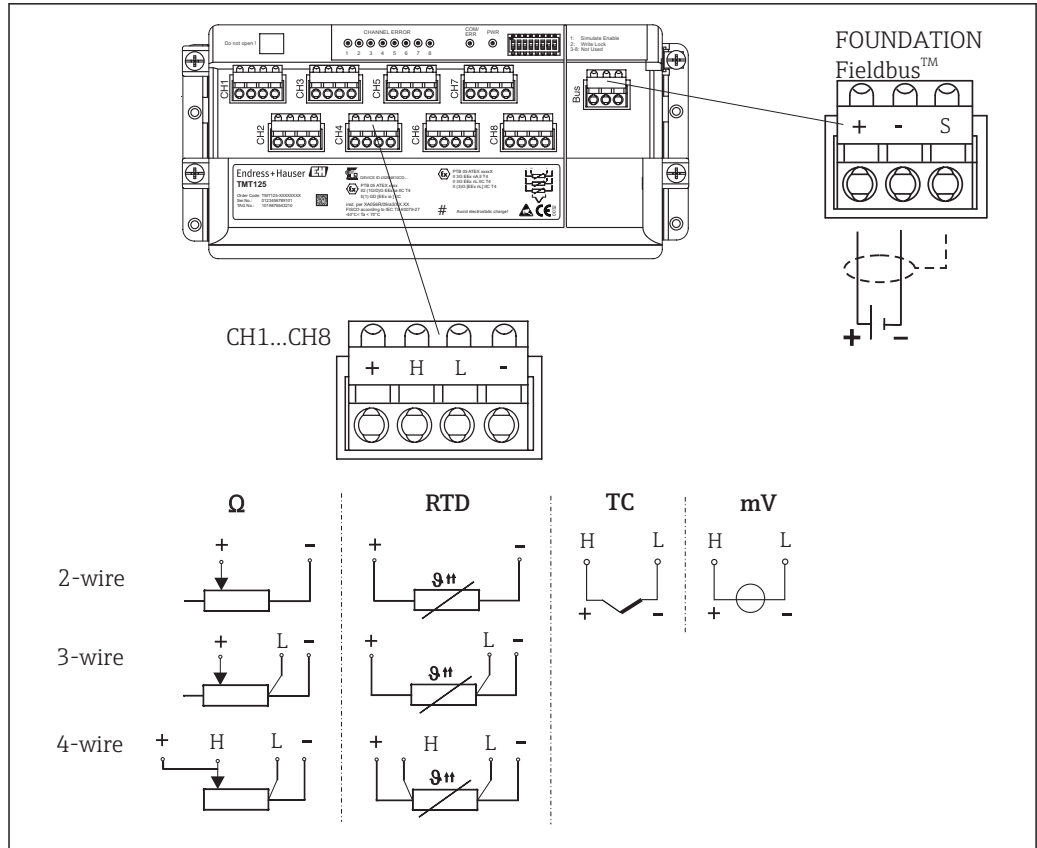
#### NOTICE

**Destruction or malfunction of parts of the electronics through ESD - electrostatic discharge.**

- ▶ Take measures to protect the terminals from electrostatic discharge.

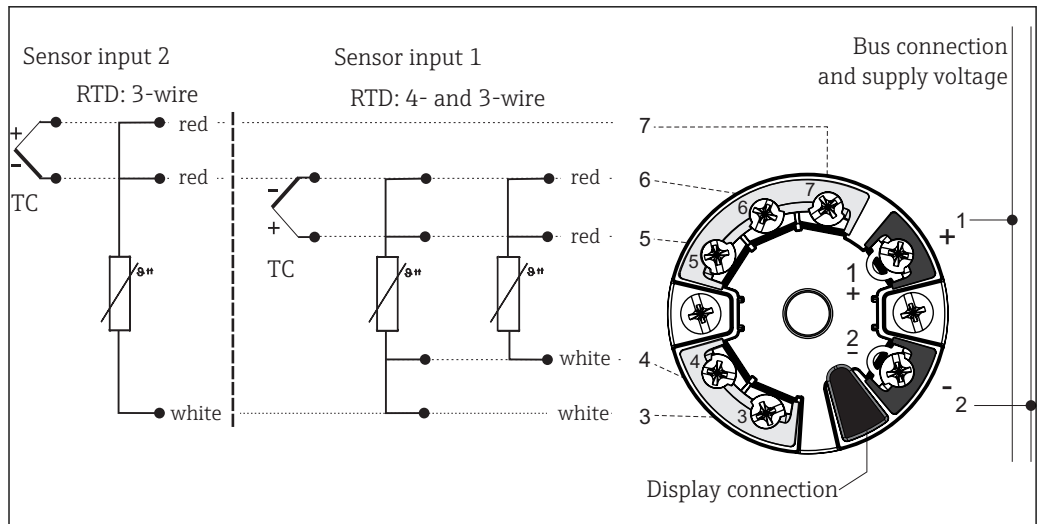
 To avoid incorrect measuring values an extension or compensation cable for direct wiring of thermocouple and RTD sensors for the signal transmission has to be used. The polarity indication on the respective terminal block and the wiring scheme has to be observed.

The planning and the installation of the bus connection cables of the plant is not to be concerned of the manufacturer of the device. Therefore the manufacturer cannot be considered to be responsible for possible damages due to the choice of materials that are not suitable for that application or to a faulty installation.



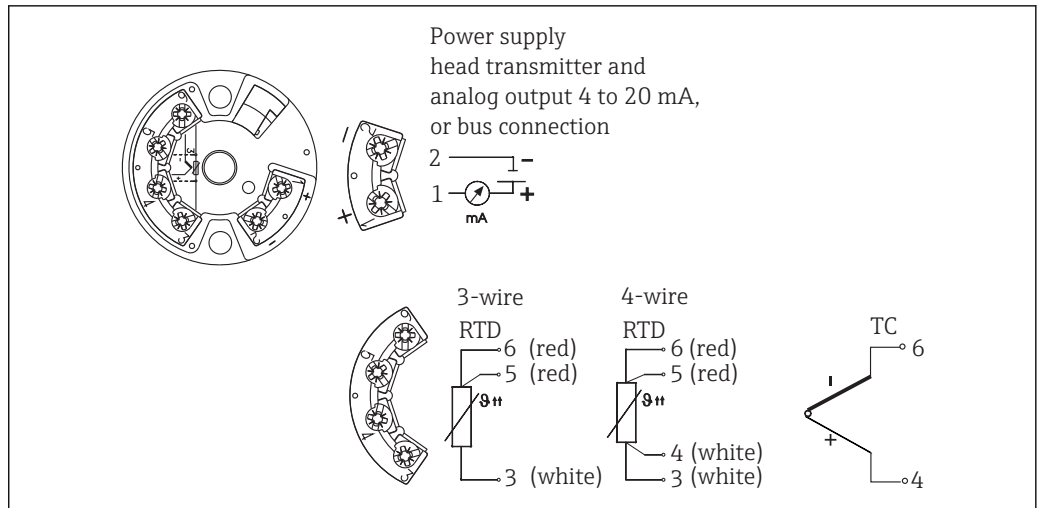
A0006330-EN

3 Wiring diagram of multi channel transmitter



A0016711-EN

4 Wiring diagram of the dual sensor input head transmitters (TMT8x)



A0016712-EN

5 Wiring diagram of the single sensor input head transmitters (TMT18x)

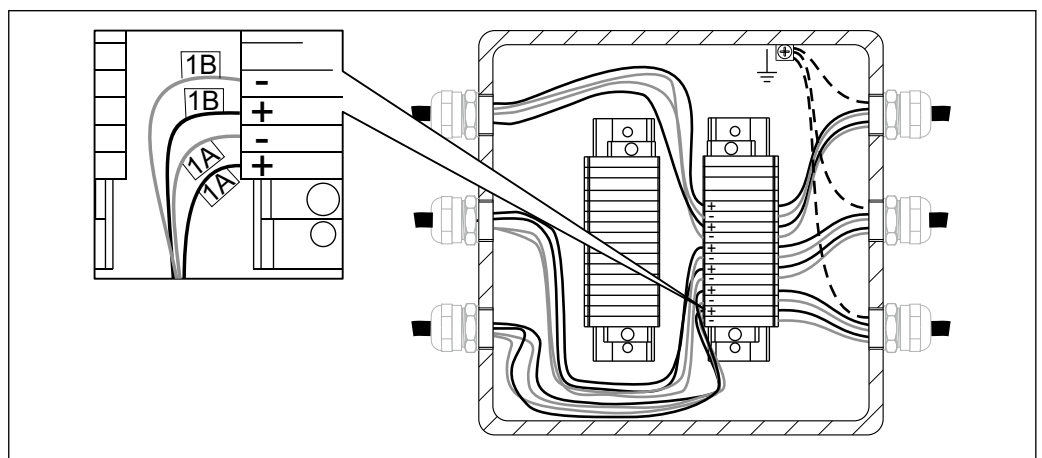
Thermocouple cable colors

According to IEC 60584	According to ASTM E230
<ul style="list-style-type: none"> <li>Type J: Black (+), white (-)</li> <li>Type K: Green (+), white (-)</li> </ul>	<ul style="list-style-type: none"> <li>Type J: White (+), red (-)</li> <li>Type K: Yellow (+), red (-)</li> </ul>

## 6.2 Connecting the sensor cables

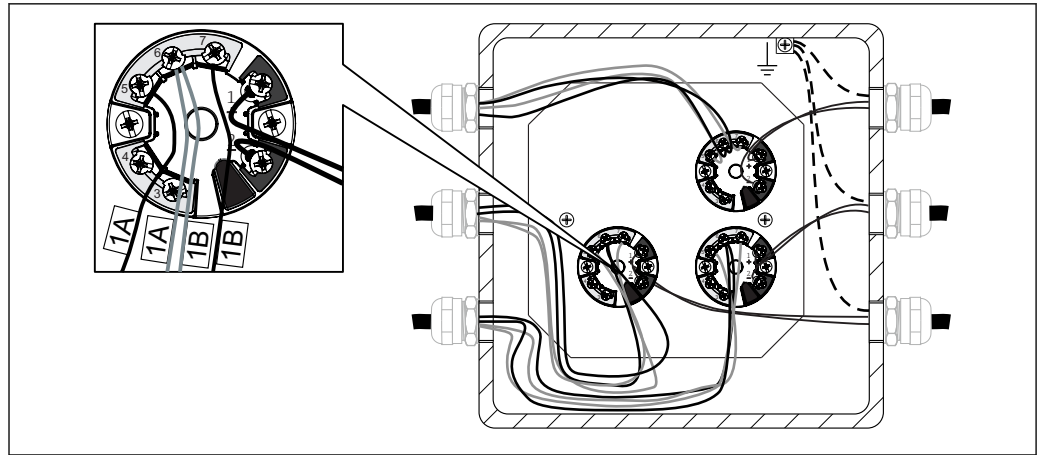
**i** Each sensor is marked with an individual TAG number. As default configuration, all wires are always connected to the installed transmitters or terminals and generally checked in house before final shipment. In case of remote junction box it might be that the following steps have to be executed for the multipoint side aswell.

The wiring is done in consecutive order, which means that the input channel(s) of transmitter no. 1 are connected to the insert wires starting from insert no. 1. Transmitter no. 2 is not used until all channels of transmitter no. 1 are fully connected. The wires of each insert are marked with consecutive numbers starting from 1. If double sensors are used the internal marking has a suffix to distinguish the two sensors, e.g. 1A and 1B for double sensors in the same insert or measuring point no. 1.



A003328B

6 Direct wiring on the mounted terminal block. Example for the internal sensor wires marking with 2 x TC sensors in insert no. 1.



A0033289

7 Mounted and wired head transmitter. Example for the internal sensor wires marking with 2 x TC

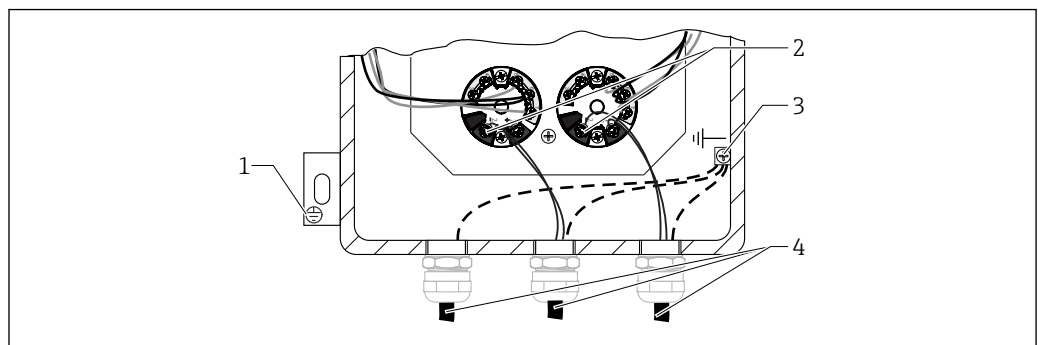
Sensor type	Transmitter type	Wiring rule
1 x RTD or TC	<ul style="list-style-type: none"> <li>▪ Single input (one channel)</li> <li>▪ Double input (two channel)</li> <li>▪ Multi-channel input (8 channel)</li> </ul>	<ul style="list-style-type: none"> <li>▪ 1 Head transmitter per insert</li> <li>▪ 1 Head transmitter for 2 inserts</li> <li>▪ 1 Multi-channel transmitter for 8 inserts</li> </ul>
2 x RTD or TC	<ul style="list-style-type: none"> <li>▪ Single input (one channel)</li> <li>▪ Double input (two channel)</li> <li>▪ Multi-channel input (8 channel)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Not available, wiring excluded</li> <li>▪ 1 Head transmitter per insert</li> <li>▪ 1 Multi-channel transmitter for 4 inserts</li> </ul>

### 6.3 Connecting the power supply and signal cables

#### Cable specification

- A shielded cable is recommended for fieldbus communication. Take the plant grounding concept into consideration.
- The terminals for connecting the signal cable (1+ and 2-) are protected against reverse polarity.
- Conductor cross-section:
  - Max 2.5 mm<sup>2</sup> (14 AWG) for screw terminals
  - Max 1.5 mm<sup>2</sup> (16 AWG) for spring terminals

Always observe the general procedure on → 17.



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8 Connecting the signal cable and power supply to the installed transmitter

- 1 External ground terminal
- 2 Terminals for signal cable and power supply
- 3 Internal ground terminal
- 4 Shielded signal cable, recommended for fieldbus connection

### 6.4 Shielding and grounding

**i** For any specific electrical shielding and grounding regarding the transmitter wiring please refer to the appropriate operating manual of the installed transmitter.



Where applicable, national installation regulations and guidelines must be observed during the installation! Where there are large differences in potential between the individual grounding points, only one point of the shielding is connected directly with the reference ground. In systems without potential equalization, therefore, cable shielding of fieldbus systems should only be grounded on one side, for example at the supply unit or at safety barriers.

**NOTICE**

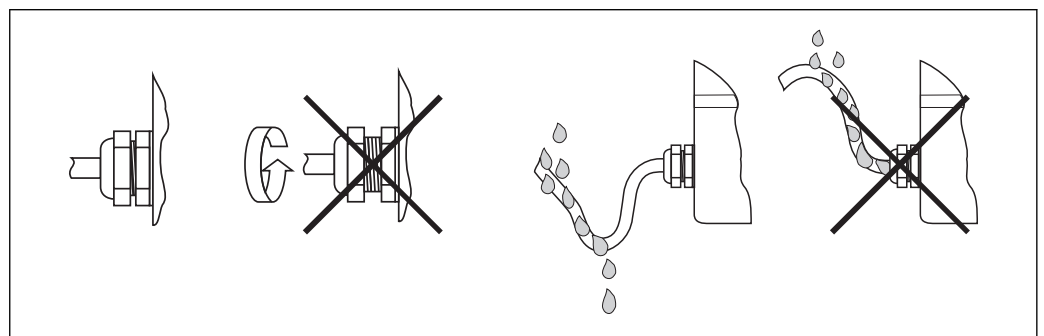
**If the shielding of the cable is grounded at more than one point in systems without potential matching, power supply frequency equalizing currents can occur that damage the signal cable or have a serious effect on signal transmission.**


- ▶ In such cases the shielding of the signal cable is to be grounded on only one side, i.e. it must not be connected to the ground terminal of the housing (terminal head, field housing). The shield that is not connected should be insulated!

### 6.5 Degree of protection

The device components can be conform to the requirements up to IP 68 ingress protection. In order to fulfil the degree of protection after installation or service, the following points must be taken into consideration: →  9,  21

- The housing seals must be clean and undamaged before they are replaced in the sealing rebate. If they are found to be too dry, they should be cleaned or even replaced.
- All housing screws and covers must be tightened.
- The cables used for connection must be of the correct specified outside diameter (e.g. M20 x 1.5, cable diameter from 0.315 to 0.47 in; 8 to 12 mm).
- Tighten cable gland.
- Loop the cable or conduit before placing into the entry ("Water sack"). This means that any moisture that may form cannot enter the gland. Install the device so that the cable or conduit entries are not facing upwards.
- Entries not used are to be blanked off using the blanking plates provided.
- The protective grommet must not be removed from the NPT fitting.




 9 Connection hints to maintain IP protection

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### 6.6 Post-connection check

Is the device undamaged (internal equipment inspection)?	<input type="checkbox"/>
<b>Electrical connection</b>	
Does the supply voltage match the specifications on the nameplate?	<input type="checkbox"/>

Do the cables have adequate strain relief?	<input type="checkbox"/>
Are the power supply and signal cables correctly connected? →  17	<input type="checkbox"/>
Are all the screw terminals well tightened and have the connections of the spring terminals been checked?	<input type="checkbox"/>
Are all the cable glands installed, tightened and sealed?	<input type="checkbox"/>
Are all the housing covers installed and tightened?	<input type="checkbox"/>
Does the marking of the terminals and cables match?	<input type="checkbox"/>
Is the electrical continuity of the thermocouple verified?	<input type="checkbox"/>

## 7 Commissioning

### 7.1 Preliminaries

Set-up guidelines of Standard, Extended and Advanced Commissioning for Endress+Hauser instruments in order to guarantee the function of the instrument according to:

- Endress+Hauser operating manual
- Customer set up specification, and/or
- Application conditions, when applicable under process conditions

Both the operator and the person responsible for the process should be informed that a commissioning job will be carried out, observing the following actions:

- If applicable, before disconnecting any sensor that is attached to the process, determine what solid or fluid is being measured (observe safety data sheet).
- Be aware of the temperature conditions.
- Never open a process fitting or loosen flange bolts before you have confirmed it is safe to do so.
- Be sure not to disturb the storage system when disconnecting inputs/outputs or when simulating signals.
- Ensure our tools, equipment and the customer storage area are protected from cross contamination. Consider and plan necessary cleaning steps.
- When commissioning requires chemicals (e.g. as reagents for standard operation or for cleaning purposes), always follow and observe the safety regulations.

#### 7.1.1 Reference documents

- Endress+Hauser Standard Operating Procedure for Health and Safety (see documentation code: BP01039H)
- Operating Manual of relevant tools and equipment to perform the commissioning job.
- Relevant Endress+Hauser Service Documentation (operating manual, work instructions, service info, service manual, etc.).
- Calibration certificates of the quality relevant equipment if available.
- If applicable, safety data sheet.
- Customer specific documents (safety instructions, setup points, etc.).

#### 7.1.2 Tools and equipment

Multimeter and instrument related configuration tools as necessary from the above mentioned action list.

### 7.2 Function check

Before commissioning the device make sure that all final checks have been carried out

- "Post-mounting check" checklist
- "Post-connection check" checklist

The commissioning should be performed according to our commissioning segmentation (Standard, Extended and Advanced).

#### 7.2.1 Standard commissioning

Visual inspection of device

1. Check the instrument(s) for damage which may have been caused during transport/shipping or mounting/wiring
2. Check that the installation is done according to the operating manual

3. Check that the wiring is done according to the operating manual and the local regulations (e.g. grounding)
4. Check the dust/water tightness of the instrument(s)
5. Check safety precautions (e.g., radiometric measurements)
6. Power up the instrument(s)
7. Check the alarm list if applicable

#### Environmental conditions

1. Check that the environmental conditions are appropriate for the instrument(s): Ambient temperature, humidity (ingress protection IPxx), vibrations, hazardous areas (Ex, Dust-Ex), RFI/EMC, sun protection, etc.
2. Check access to the instrument(s) for utilization and maintenance

#### Configuration parameters

- ▶ Configure the instrument(s) according to the Operating Manual with the parameters specified by the customer or mentioned on the design specification

#### Output signal value check

- ▶ Check and confirm that the local display and the output signals of the instrument(s) conform with the customer's display

### 7.2.2 Extended commissioning

In addition to the steps of Standard Commissioning, the following should be additionally completed:

#### Instrument Conformity

1. Check the received instrument(s) with the purchase order or design specification including accessories, documentation and certificates
2. Check Software Version (e.g. application software such as "Batching") when provided
3. Check that the documentation has the correct issue and version

#### Functional test

1. Test of the instrument outputs, including switching points, auxiliary inputs/outputs with the internal or an external simulator (e.g. FieldCheck)
2. Compare the measuring data/results with a reference from the customer. (e.g. laboratory result in case of an analyzer, weight scale in the case of a batching application, etc.)
3. Adjust the instrument(s) if necessary and as described in the operating manual

### 7.2.3 Advanced commissioning

The Advanced Commissioning provides a loop test in addition to the steps covered in the Standard and Extended Commissioning.

#### Loop test

1. Simulate a minimum of 3 output signals from the instrument(s) to the control room
2. Read out/note the simulated and indicated values and check for linearity



## 7.3 Switching on the device

Once the final checks have been successfully completed, it is time to switch on the supply voltage. Afterwards the multipoint thermometer is operational. If there are Endress +Hauser temperature transmitter in use, please refer to the enclosed Brief Operating Instructions for commissioning.


# 8 Diagnostics and troubleshooting

## 8.1 General troubleshooting

Always start troubleshooting with the checklists below if faults occur after start up or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

### NOTICE

#### Repair of parts of the device

- ▶ In the event of a serious fault, a measuring device might have to be replaced. In the case of replacement see section 'Return' →  26.
- ▶ It is always important to check the connection between the cables and terminals, in order to guarantee the proper strain relief to the cables, and the tightening and the sealing of the screw terminals.

Before commissioning the measuring system make sure that all final checks have been carried out:

- Follow the checklist in section 'Post-mounting check' →  15
- Follow the checklist in section 'Post-connection check' →  21

If transmitters are used, please refer to the documentation of the transmitter installed for diagnostic and troubleshooting procedures .

## 9 Repair

### 9.1 General notes

The accessibility around the device for maintenance has to be guaranteed. Each component that is part of the device must be – in the case of replacement – replaced by an original spare part of Endress+Hauser which guarantees the same characteristics and performance. To ensure continued operational safety and reliability it is suggested to carry out repairs on the device only if they are expressly permitted by Endress+Hauser, observing federal/national regulations pertaining to repair of an electrical device.

### 9.2 Spare parts

When ordering spare parts, please specify the serial number of the unit!

Spare parts of the Multipoint thermometer assembly are:

- Cable glands
- Transmitters or electrical terminals
- Junction box and related accessories
- Ferrule sets of the compression fittings

### 9.3 Endress+Hauser services

Service	Description
Certifications	Endress+Hauser is able to fulfill requirements belonging to the design, product manufacturing, tests and commissioning according to specific approvals by handling or supplying individual certified components and by checking the integration on the whole system.
Maintenance	All Endress+Hauser systems are designed for an easy maintenance due to a modular design, allowing the replacement of old or wear out parts. Standardized parts ensure fast reaction for maintenance.
Calibration	Endress+Hauser's range of calibration services covers on-site verification tests, accredited laboratory calibrations, certificates and traceability to ensure compliance.
Installation	Endress+Hauser helps you commission plants while minimizing costs. Fault free installation is decisive for the quality and longevity of the measurement system and plant running. We provide the right expertise at the right time to meet project deliverables.
Tests	In order to ensure product quality and to guarantee efficiency during the entire lifetime the following tests are available: <ul style="list-style-type: none"> <li>■ Dye penetration test according to ASME V art. 6, UNI EN 571-1 and ASME VIII Div. 1 App 8 standards</li> <li>■ PMI test according to ASTM E 572</li> <li>■ X-ray test according to ASME V art. 2, art. 22 and ISO 17363-1 (requirements and methods) and ASME VIII div. 1 and to ISO 5817 (acceptance criteria). Thickness up to 30 mm</li> </ul>

### 9.4 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:  
<http://www.endress.com/support/return-material>
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

## 9.5 Disposal

### 9.5.1 Removing the measuring device

1. Switch off the device.

**⚠ WARNING**

**Danger to persons from process conditions.**

- ▶ Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

### 9.5.2 Disposing of the measuring device

**⚠ WARNING**

**Danger to personnel and environment from fluids that are hazardous to health.**

- ▶ Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

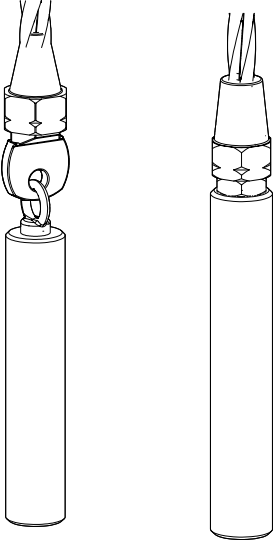
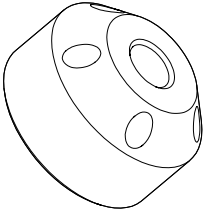
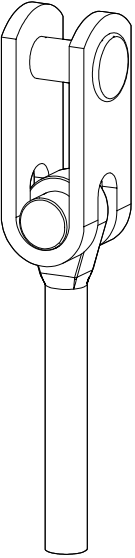
Observe the following notes during disposal:

- ▶ Observe valid federal/national regulations.
- ▶ Ensure proper separation and reuse of the device components.








## 10 Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center.

### 10.1 Device-specific accessories


Accessories	Description
<p data-bbox="678 331 818 353">Anchor weight</p>  <p data-bbox="933 936 986 952">A0038304</p>	<p data-bbox="1002 331 1516 488">The installation of the anchor weight ensures a straight vertical position of the rope, please make sure to have enough space for a correct weight positioning inside the storage system. The dimensions will be established during the order development according to the rope multipoint dimension.</p> <ul data-bbox="1002 504 1340 555" style="list-style-type: none"> <li>▪ Left side - Removable/Replaceable</li> <li>▪ Right side - Fixed</li> </ul>
<p data-bbox="715 974 782 996">Ogives</p>  <p data-bbox="933 1243 986 1258">A0038305</p>	<p data-bbox="1002 974 1524 1075">Ogives are integrated in the multipoint rope, they provide a correct positioning of the probe thermoelement along the rope length and maintain them in position under working condition.</p>
<p data-bbox="651 1281 842 1303">Toggle joint terminal</p>  <p data-bbox="933 1892 986 1908">A0038306</p>	<p data-bbox="1002 1281 1524 1332">Toggle joint connection between rope and flange to allow reciprocal rotation.</p>

## 10.2 Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface.  For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.  For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.  For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity.  For details, see Operating Instructions BA061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser.  For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser.  For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA).  For details, see Operating Instructions BA00060S

## 10.3 Service-specific accessories

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> <li>■ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections.</li> <li>■ Graphic illustration of the calculation results</li> </ul> <p>Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.</p> <p>Applicator is available:</p> <ul style="list-style-type: none"> <li>■ Via the Internet: <a href="https://wapps.endress.com/applicator">https://wapps.endress.com/applicator</a></li> <li>■ On CD-ROM for local PC installation.</li> </ul>

W@M	<p>Life cycle management for your plant</p> <p>W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle.</p> <p>The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.</p> <p>W@M is available:</p> <ul style="list-style-type: none"> <li>▪ Via the Internet: <a href="http://www.endress.com/lifecyclemanagement">www.endress.com/lifecyclemanagement</a></li> <li>▪ On CD-ROM for local PC installation.</li> </ul>
FieldCare	<p>FDT-based plant asset management tool from Endress+Hauser.</p> <p>It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.</p> <p> For details, see Operating Instructions BA00027S and BA00059S</p>

# 11 Technical data

## 11.1 Input

### 11.1.1 Measured variable

Temperature (temperature linear transmission behavior)

### 11.1.2 Measuring range

*RTD:*

Input	Designation	Measuring range limits
RTD as per IEC 60751	Pt100	-200 to +600 °C (-328 to +1 112 °F)

*Thermocouple:*

Input	Designation	Measuring range limits
Thermocouples (TC) as per IEC 60584, part 1 - using an Endress+Hauser - iTEMP temperature head transmitter	Type J (Fe-CuNi)	-40 to +520 °C (-40 to +968 °F)
	Type K (NiCr-Ni)	-40 to +800 °C (-40 to +1 472 °F)
Internal cold junction (Pt100) Cold junction accuracy: ± 1 K Max. sensor resistance: 10 kΩ		
Thermocouples (TC) - flying leads - as per IEC 60584 and ASTM E230	Type J (Fe-CuNi)	-210 to +520 °C (-346 to +968 °F), typical sensitivity above 0 °C ≈ 55 µV/K
	Type K (NiCr-Ni)	-270 to +800 °C (-454 to +1 472 °F) <sup>1)</sup> , typical sensitivity above 0 °C ≈ 40 µV/K

1) Limited by jacket material of insert

## 11.2 Output

### 11.2.1 Output signal

Generally, the measured value can be transmitted in one of two ways:

- Directly-wired sensors - sensor measured values forwarded without a transmitter.
- Via all common protocols by selecting an appropriate Endress+Hauser iTEMP temperature transmitter. All the transmitters listed below are mounted directly in the junction box and wired with the sensory mechanism.

### 11.2.2 Family of temperature transmitters

Thermometers fitted with iTEMP transmitters are an installation-ready complete solution to improve temperature measurement by significantly increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

#### PC programmable head transmitters

They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP transmitters can be configured quickly and easily at a PC. Endress+Hauser offers free configuration software which can be downloaded from the Endress+Hauser Website. More information can be found in the Technical Information.



**HART® programmable head transmitters**

The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART® communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the terminal head (flat face) as per DIN EN 50446. Swift and easy operation, visualization and maintenance by PC using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

**PROFIBUS® PA head transmitters**

Universally programmable head transmitter with PROFIBUS® PA communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

**FOUNDATION Fieldbus™ head transmitters**

Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e.g. using operating software such as ControlCare from Endress+Hauser or NI Configurator from National Instruments. For more information, see the Technical Information.

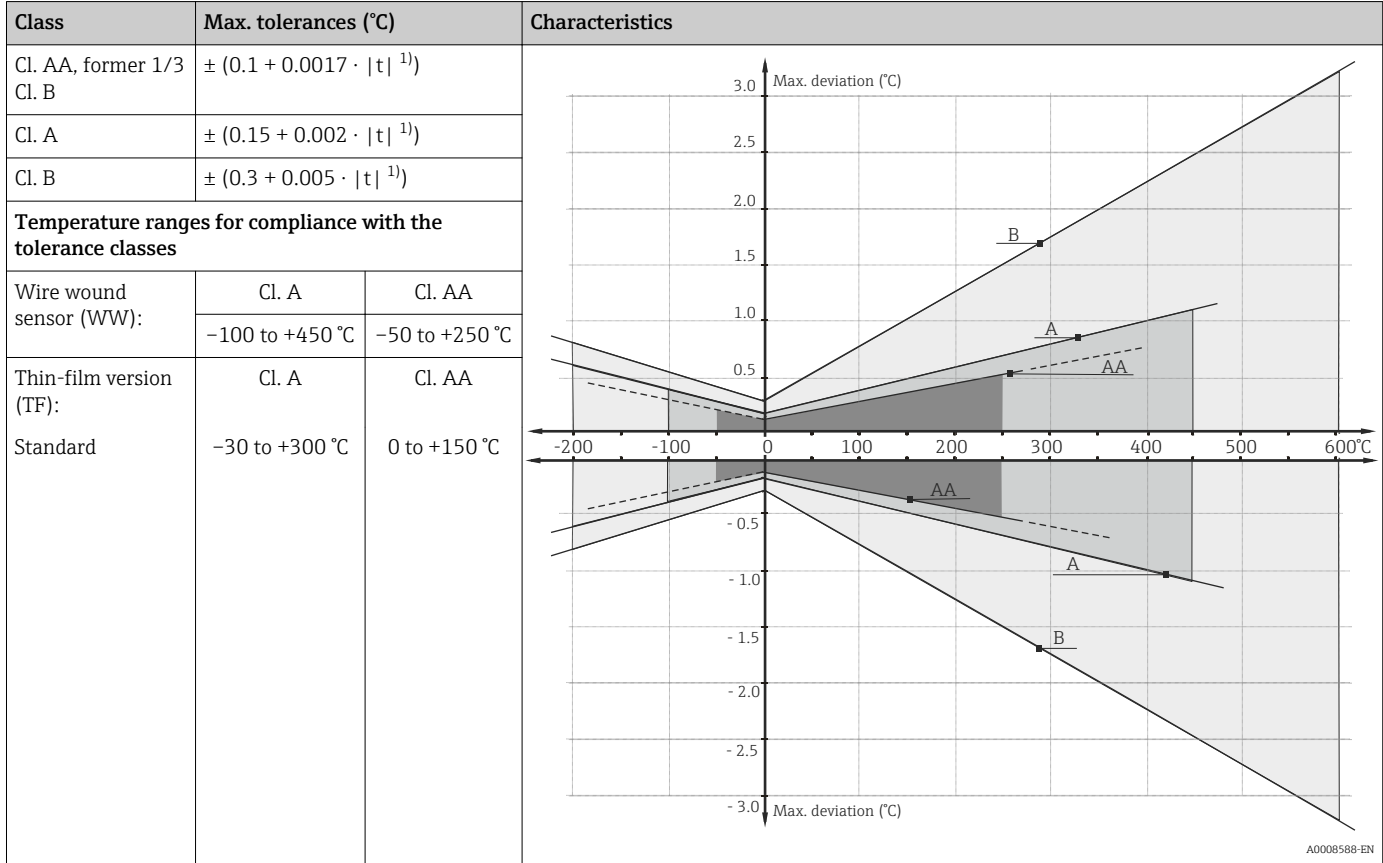
Advantages of the iTEMP transmitters:

- Dual or single sensor input (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions
- Sensor-transmitter matching for dual sensor input transmitter, based on Callendar/Van Dusen coefficients

## 11.3 Performance characteristics

### 11.3.1 Accuracy

RTD resistance thermometer as per IEC 60751



1) |t| = absolute value °C

**i** In order to obtain the maximum tolerances in °F, the results in °C must be multiplied by a factor of 1.8.

Permissible deviation limits of thermoelectric voltages from the standard characteristic for thermocouples as per IEC 60584 or ASTM E230/ANSI MC96.1:

Standard	Type	Standard tolerance		Special tolerance	
		Class	Deviation	Class	Deviation
IEC 60584	J (Fe-CuNi)	2	$\pm 2.5 \text{ °C (-40 to 333 °C)}$ $\pm 0.0075  t ^{1} \text{ (333 to 750 °C)}$	1	$\pm 1.5 \text{ °C (-40 to 375 °C)}$ $\pm 0.004  t ^{1} \text{ (375 to 750 °C)}$
	K (NiCr-NiAl)	2	$\pm 2.5 \text{ °C (-40 to 333 °C)}$ $\pm 0.0075  t ^{1} \text{ (333 to 1200 °C)}$	1	$\pm 1.5 \text{ °C (-40 to 375 °C)}$ $\pm 0.004  t ^{1} \text{ (375 to 1000 °C)}$

1) |t| = absolute value °C


Standard	Type	Standard tolerance	Special tolerance
ASTM E230/ANSI MC96.1		Deviation, the larger respective value applies	
	J (Fe-CuNi)	$\pm 2.2 \text{ K or } \pm 0.0075  t ^{1)}$ (0 to 760 °C)	$\pm 1.1 \text{ K or } \pm 0.004  t ^{1)}$ (0 to 760 °C)
	K (NiCr-NiAl)	$\pm 2.2 \text{ K or } \pm 0.02  t ^{1)}$ (-200 to 0 °C) $\pm 2.2 \text{ K or } \pm 0.0075  t ^{1)}$ (0 to 1260 °C)	$\pm 1.1 \text{ K or } \pm 0.004  t ^{1)}$ (0 to 1260 °C)

1) |t| = absolute value °C

### 11.3.2 Influence of ambient temperature

Depends on the head transmitter used. For details, see the Technical Information.

### 11.3.3 Response time

 Response time for the sensor assembly without transmitter. It refers to inserts in direct contact with process.

#### RTD

Calculated at an ambient temperature of approx. 23 °C by immersing the insert in running water (0.4 m/s flow rate, 10 K excess temperature):

Insert diameter	Response time	
Mineral-insulated cable, 3 mm (0.12 in)	t <sub>50</sub>	2 s
	t <sub>90</sub>	5 s
RTD insert StrongSens, 6 mm (¼ in)	t <sub>50</sub>	< 3.5 s
	t <sub>90</sub>	< 10 s

#### Thermocouple (TC)

Calculated at an ambient temperature of approx. 23 °C by immersing the insert in running water (0.4 m/s flow rate, 10 K excess temperature):

Insert diameter	Response time	
Grounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t <sub>50</sub>	0.8 s
	t <sub>90</sub>	2 s
Ungrounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t <sub>50</sub>	1 s
	t <sub>90</sub>	2.5 s

### 11.3.4 Shock and vibration resistance

- RTD: 3G / 10 to 500 Hz according to IEC 60751
- RTD iTHERM StrongSens Pt100 (TF, vibration resistant): Up to 60G
- TC: 4G / 2 to 150 Hz according to IEC 60068-2-6

### 11.3.5 Calibration

Calibration is a service that can be performed on each individual insert, either in order phase, or after multipoint installation.

**i** When calibration shall be performed once the multipoint is installed, please contact the Endress+Hauser service to get full support. Together with the Endress +Hauser service any further activity can be organised to achieve the calibration of the target sensor. In any case it is forbidden to unscrew any threaded component on the process connection under operating conditions = running process.

Calibration involves comparing the measured values of the sensing elements of the multipoint inserts (DUT device under test) with those of a more precise calibration standard using a defined and reproducible measurement method. The aim is to determine the deviation of the DUT measured values from the true value of the measured variable.

Two different methods are used for the inserts:

- Calibration at fixed-point temperatures, e.g. at the freezing point of water at 0 °C (32 °F).
- Calibration compared against a precise reference thermometer.

#### **i** Evaluation of inserts

If a calibration with an acceptable uncertainty of measurement and transferable measurement results is not possible, Endress+Hauser offers an insert evaluation measurement service, if technically feasible.

## 11.4 Environment

### 11.4.1 Ambient temperature range

Junction box	Non-hazardous area	Hazardous area
Without mounted transmitter	-50 to +85 °C (-58 to +185 °F)	-50 to +60 °C (-58 to +140 °F)
With mounted head transmitter	-40 to +85 °C (-40 to +185 °F)	Depends on the respective hazardous area approval. Details see Ex documentation.
With mounted multi-channel transmitter	-40 to +85 °C (-40 to +185 °F)	-40 to +70 °C (-40 to +158 °F)

### 11.4.2 Storage temperature

Junction box	
With head transmitter	-50 to +95 °C (-58 to +203 °F)
With multi-channel transmitter	-40 to +80 °C (-40 to +176 °F)
With DIN rail transmitter	-40 to +95 °C (-40 to +203 °F)

### 11.4.3 Humidity

Condensation according to IEC 60068-2-33:

- Head transmitter: Permitted
- DIN rail transmitter: Not permitted

Maximum relative humidity: 95% according to IEC 60068-2-30

#### 11.4.4 Climate class

Determined when the following components are installed into the junction box:

- Head transmitter: Class C1 according to EN 60654-1
- Multi-channel transmitter: Tested as per IEC 60068-2-30, meets the requirements regarding class C1-C3 in accordance with IEC 60721-4-3
- Terminal blocks: Class B2 according to EN 60654-1

#### 11.4.5 Degree of protection

- Specification for conduit: IP68
- Specification for the junction box: IP66/67

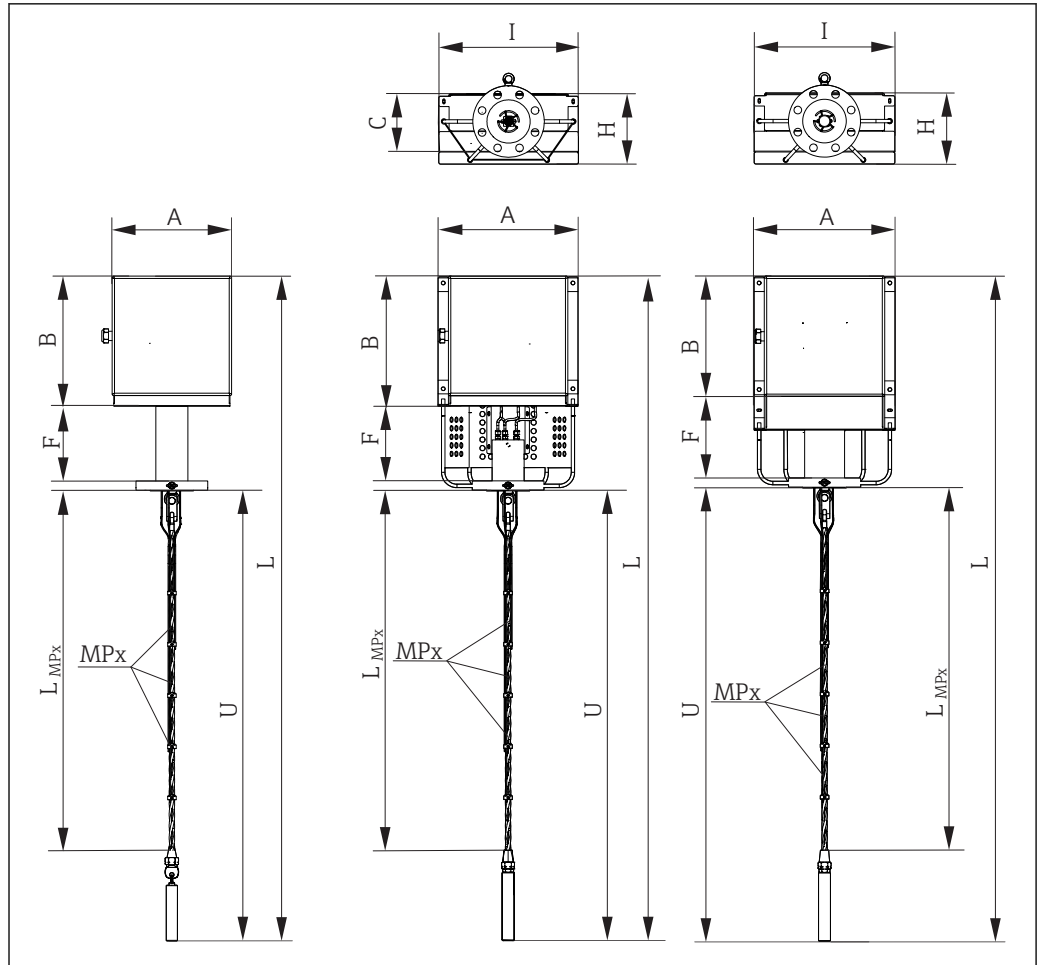
#### 11.4.6 Electromagnetic compatibility (EMC)

Depending on the head transmitter used. For detailed information see the related Technical Information, listed at the end of this document.

### 11.5 Mechanical construction

#### 11.5.1 Design, dimensions

The overall rope assembly is made of different parts. The rope joint ensures sufficient degree of freedom to the rope system allowing movements during filling and emptying operations. This guarantees low stresses (no extra tensioning) on the rope due to possible lateral force acting on it, therefore a lateral sag of 30cm per 10m rope length is recommended. The transition between the inserts and the extension cable is obtained by the usage of compression fittings, ensuring the declared IP degree protection.



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10 Design of the modular multipoint thermometer, with tube neck on the left side, frame neck on the middle or with tube neck design as option on the right side. All dimensions in mm (in)

A, B, Dimensions of the junction box, see following figure

C

MPx Numbers and distribution of measuring points: MP1, MP2, MP3 etc.

$L_{MPx}$  Immersion length of sensing elements or thermowells

I, H Encumbrance of the junction box and support system


F Extension neck length

L Device length

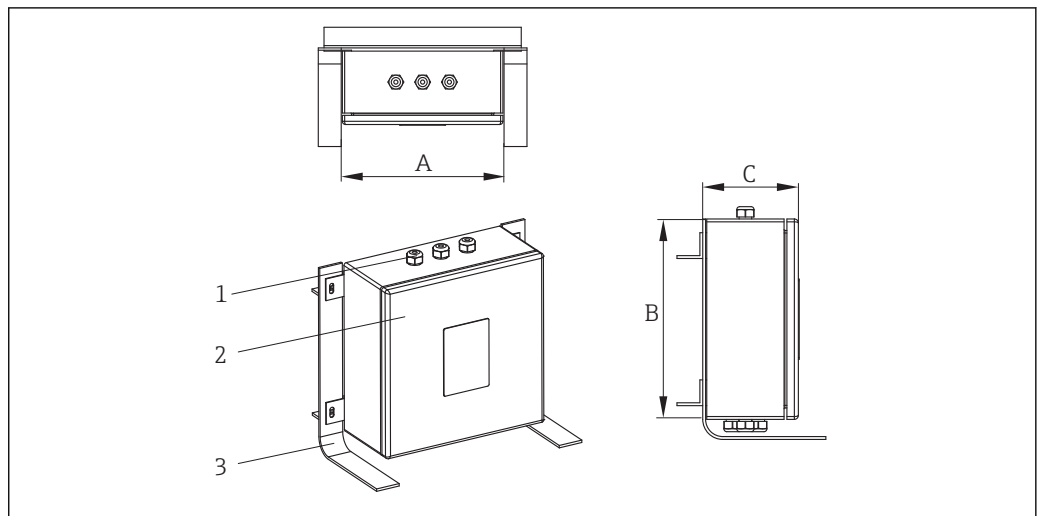
U Immersion length

Extension neck F in mm (in)
Standard 250 (9.84)
Specifically customized extension necks are available on request.

Immersion lengths MPx of sensing elements/thermowells:
Based on customer requirements

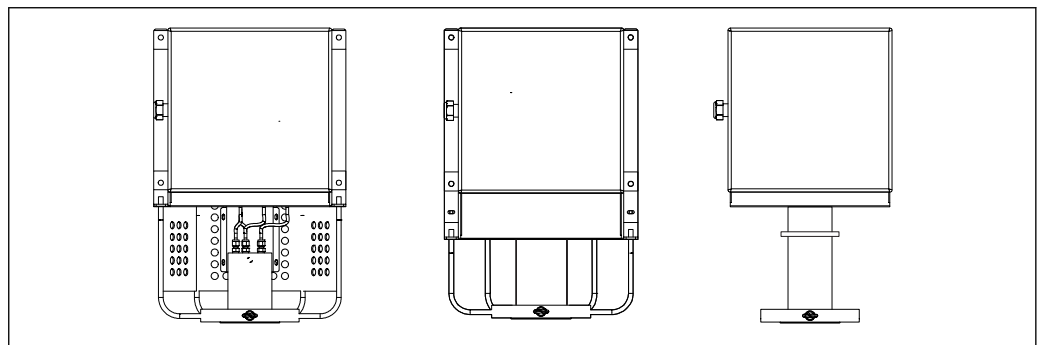
Rope maximum load:					
	Rope Ø mm	Construction	Weight kg/m	MBL	
				kN	kg
 <p>A0038300</p> <ul style="list-style-type: none"> <li>Stainless steel AISI 316</li> <li>Rope according to EN 10264-4</li> <li>Rope grade 1.570 N/mm<sup>2</sup></li> </ul>	6	1x19	0,1786	29,5	3000
	8	1x19	0,322	53	5400
	10	1x19	0,502	84	8500

**Junction box (directly mounted)**



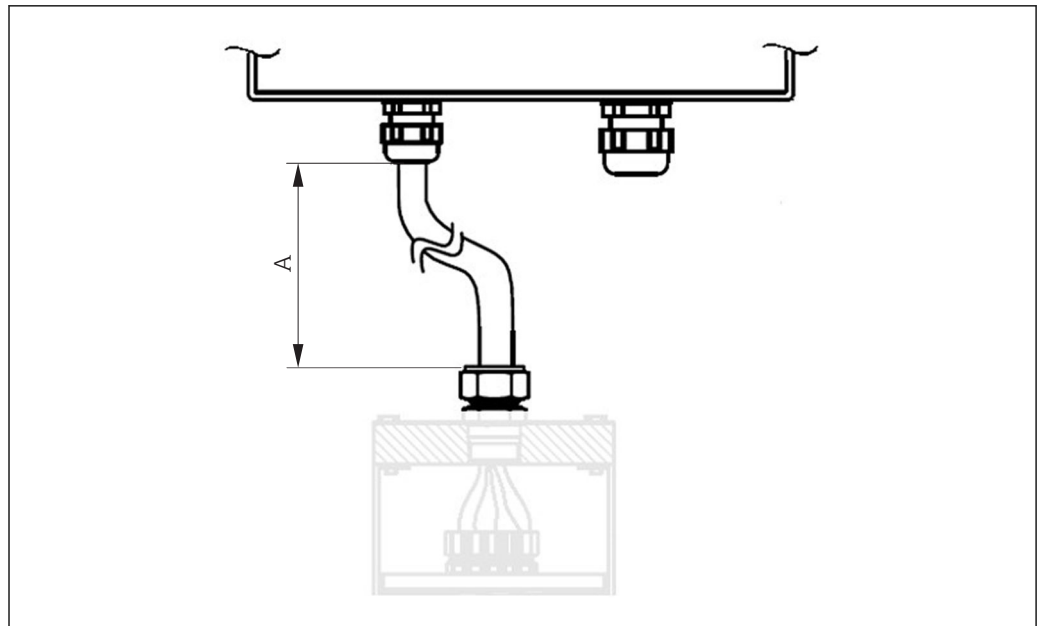
A0028118

- 1 Cable glands
- 2 Junction box
- 3 Frame



A0038301

11 Open design on the left side, with cover design in the middle and tube neck design on the right side



A0038302

12 Remote junction box design

The junction box is suited for chemical agents environments. Sea water corrosion resistance and extreme temperature variation stability is guaranteed. Ex-e Ex-i terminals can be installed.

Possible junction box dimensions (A x B x C) in mm (in):

		A	B	C
<b>Stainless Steel</b>	Min.	170 (6.7)	170 (6.7)	130 (5.1)
	Max.	500 (19.7)	500 (19.7)	240 (9.5)
<b>Aluminium</b>	Min.	100 (3.9)	150 (5.9)	80 (3.2)
	Max.	330 (13)	500 (19.7)	180 (7.1)

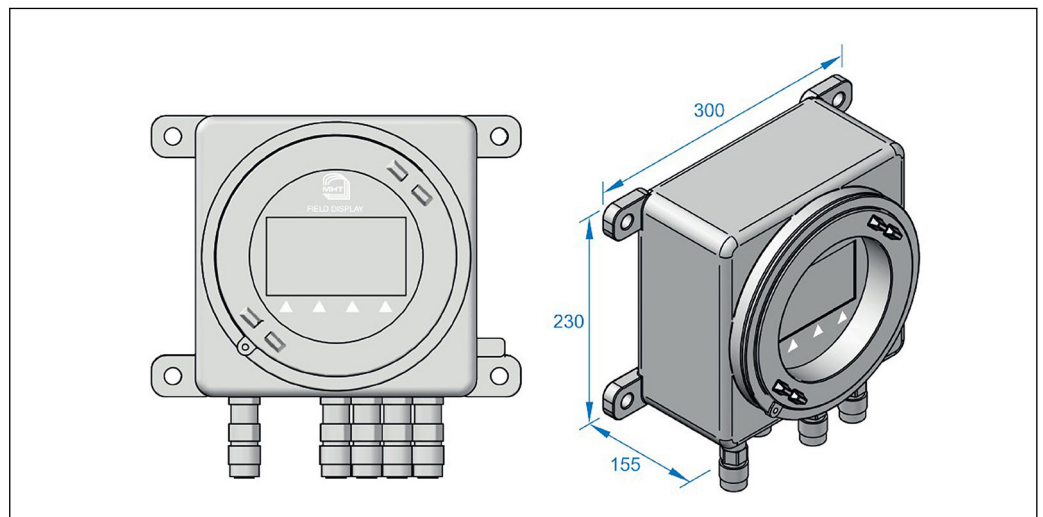
Type of specification	Junction box	Cable glands
Material	AISI 316/Aluminium	NiCr Plated brass AISI 316 / 316L
Ingress protection (IP)	IP66/67	IP66
Ambient temperature range	-50 to +60 °C (-58 to +140 °F)	-52 to +110 °C (-61.1 to +140 °F)
Approvals	ATEX, FM, UL, CSA approval for use in hazardous area IEC	-
Marking	<ul style="list-style-type: none"> <li>■ ATEX II 2 GD Ex e IIC /Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4</li> <li>■ UL913 Class I, Division 1 Groups B, C, D T6/T5/T4</li> <li>■ FM3610 Class I, Division 1 Groups B, C, D T6/T5/T4</li> <li>■ CSA C22.2 No. 157 Class 1, Division 1 Groups B, C, D T6/T5/T4</li> </ul>	-
Cover	Hinged	-
Maximum sealing diameter	-	6 to 12 mm (0.24 to 0.47 in)



		On board	Remote
Type of protection	Intrinsically safe and increased safety	<ul style="list-style-type: none"> <li>■ With frame</li> <li>■ Tube neck</li> </ul>	Flexible conduit
	Flameproof	With supporting frame	

**Field display**

Power:	100-240 Vac, 50-60 Hz, 25 VA, 0.375 A max
Certification:	ATEX II 2 G D Ex 'd' IIC T6, IP 66
Environment:	Hazardous Area Zone 1
Operating temperature:	-20 °C to +55 °C
Storage temperature:	-40 °C to +85 °C
Enclosure:	Aluminium alloy Painted RAL 7035 grey epoxy
IP rating:	IP66
Entries:	M20 threaded entries (quantity 5 off)
External dimensions:	300 x 230 x 155 mm
Fixings:	To suit M12 bolts, four positions
Weight:	7.5 kg
No. of host ports:	4 Ports
Interfaces supported:	RS-232, RS-422/485, Modbus RTU HART®



A0038303

**Neck extension**

The neck extension ensures the connection between the flange and the junction box. The design has been developed to ensure several mounting layouts to deal with possible obstacles and constraints that can be met in any plant such as the storage tank infrastructure (step ways, loading structures, stairs, etc.) and an eventual thermal insulation. The neck extension design allows easy access for monitoring extension cables. It guarantees a high stiffness connection for the junction box and vibration loads. No closed volumes are present in the neck extension (not for tube neck design). This avoids the accumulation of waste and potentially dangerous fluids coming from the environment that can damage the instrumentation allowing continuous ventilation.

**Inserts**

**i** Different insert types are available. For any different requirement that is not described here, please contact the Endress+Hauser sales department.

*Thermocouple*

Diameter in mm (in)	Type	Standard	Hot junction type	Sheath material
3 (0.12)	1x type K 2x type K 1x type J 2x type J	IEC 60584 /ASTM E230	Grounded/Ungrounded	AISI 316L

*RTD*

Diameter in mm (in)	Type	Standard	Sheath material
3 (0.12) 6 (¼)	1x Pt100 WW 2x Pt100 WW 1x Pt100 TF 2x Pt100 TF	IEC 60751	AISI 316L

**11.5.2 Weight**

The weight can vary depending on the configuration: Dimension and content of the junction box, neck length, dimensions of process connection, the number of inserts and the weight of the rope end. The approximate weight of a typically configured multipoint rope (number of inserts = 12, flange size = 3", medium size junction box) = 55 kg (121 lb)

**11.5.3 Materials**

It refers to insert sheath, neck extension, junction box and all wetted parts.

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load. The maximum operation temperatures are reduced considerably in some cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316/1.4401	X5CrNiMo 17-12-2	650 °C (1202 °F)	<ul style="list-style-type: none"> <li>▪ Austenitic, stainless steel</li> <li>▪ High corrosion resistance in general</li> <li>▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)</li> </ul>
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1202 °F)	<ul style="list-style-type: none"> <li>▪ Austenitic, stainless steel</li> <li>▪ High corrosion resistance in general</li> <li>▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)</li> <li>▪ Increased resistance to intergranular corrosion and pitting</li> <li>▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content</li> </ul>

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Alloy600/ 2.4816	NiCr15Fe	1 100 °C (2 012 °F)	<ul style="list-style-type: none"> <li>▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures</li> <li>▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc.</li> <li>▪ Corrosion from ultrapure water</li> <li>▪ Not to be used in sulfur-containing atmospheres</li> </ul>
AISI 304/1.4301	X5CrNi18-10	850 °C (1 562 °F)	<ul style="list-style-type: none"> <li>▪ Austenitic, stainless steel</li> <li>▪ Well usable in water and lowly pollute waste water</li> <li>▪ Only at relatively low temperatures resistant to organic acids, saline solutions, sulphates, alkaline solutions, etc.</li> </ul>
AISI 304L/ 1.4307	X2CrNi18-9	850 °C (1 562 °F)	<ul style="list-style-type: none"> <li>▪ Good welding properties</li> <li>▪ Impervious to intergranular corrosion</li> <li>▪ High ductility, excellent drawing, forming, and spinning properties</li> </ul>
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °F)	<ul style="list-style-type: none"> <li>▪ Addition of titanium means increased resistance to intergranular corrosion even after welding</li> <li>▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry</li> <li>▪ Can only be polished to a limited extent, titanium streaks can form</li> </ul>
AISI 321/1.4541	X6CrNiTi18-10	815 °C (1 499 °F)	<ul style="list-style-type: none"> <li>▪ Austenitic stainless steel</li> <li>▪ High resistance to intergranular corrosion even after welding</li> <li>▪ Good welding characteristics, suitable to all standard welding methods</li> <li>▪ It is used in many sectors of the chemical industry, petrochemical, and pressurized vessels</li> </ul>
AISI 347/1.4550	X6CrNiNb10-10	800 °C (1 472 °F)	<ul style="list-style-type: none"> <li>▪ Austenitic stainless steel</li> <li>▪ Good resistance to a wide variety of environments in the chemical, textile, oil-refining, dairy and food industries</li> <li>▪ Added niobium makes this steel impervious to intergranular corrosion</li> <li>▪ Good weldability</li> <li>▪ Main applications are furnace fire walls, pressure vessels, welded structures, turbine blades</li> </ul>

#### 11.5.4 Process connection

Standard process connection flanges are designed according to the following standards:

Standard <sup>1)</sup>	Size	Rating	Material
ASME	1½", 2", 3", 4"	150#, 300#	AISI 316, 316L, 316Ti
EN	DN40, DN50, DN80, DN100	PN16, PN40	

1) Flanges according to GOST standard are available on request.

## 11.6 Certificates and approvals

### 11.6.1 CE Mark

The complete assembly is provided with individual components CE marked, to ensure safe use in hazardous areas and pressurized environments.

### 11.6.2 Hazardous area approvals

The Ex approval applies to individual components like junction box, cable glands, terminals. For further details on the available Ex versions (ATEX, CSA, FM, IEC-EX, UL, NEPSI, EAC-EX), please contact your nearest Endress+Hauser sales organization. All relevant data for hazardous areas can be found in separate Ex documentation.

### 11.6.3 Certification HART

The HART<sup>®</sup> temperature transmitter is registered by the FieldComm Group. The device meets the requirements of the HART<sup>®</sup> Communication Protocol Specifications.

### 11.6.4 Certification FOUNDATION Fieldbus

The FOUNDATION Fieldbus<sup>™</sup> temperature transmitter has successfully passed all test procedures and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specification:

- Certified according to FOUNDATION Fieldbus<sup>™</sup> specification
- FOUNDATION Fieldbus<sup>™</sup> H1
- Interoperability Test Kit (ITK), up to date revision status (device certification no. available on request): the device can also be operated with certified devices of other manufacturers
- Physical layer conformance test of the FOUNDATION Fieldbus<sup>™</sup>

### 11.6.5 Certification PROFIBUS<sup>®</sup> PA

The PROFIBUS<sup>®</sup> PA temperature transmitter is certified and registered by the PNO (PROFIBUS<sup>®</sup> Nutzerorganisation e. V.), PROFIBUS user organization. The device meets all the requirements of the following specifications:

- Certified according to FOUNDATION Fieldbus<sup>™</sup> specification
- Certified in accordance with PROFIBUS<sup>®</sup> PA Profile (the up to date profile version is available on request)
- The device can also be operated with certified devices of other manufacturers (interoperability)

### 11.6.6 Other standards and guidelines

- EN 60079: ATEX certification for hazardous areas
- IEC 60529: Degree of protection of housing (IP code)
- IEC 60584 and ASTM E230/ANSI MC96.1: Thermocouples

### 11.6.7 Material certification

The material certificate 3.1 (according to EN 10204) can be requested separately. The certificate includes a declaration related to the materials used to produce the thermometer. It guarantees the traceability of the materials through the identification number of the rope multipoint thermometer.

### 11.6.8 Test report and calibration

The "Factory calibration" is carried out according to an internal procedure in a laboratory of Endress+Hauser accredited by the European Accreditation Organization (EA) to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT/Accredia) or (DKD/DAkKS) may be requested separately. The calibration is performed on the inserts of the multipoint.

## 11.7 Documentation

- Operating manuals iTEMP temperature transmitters:
  - TMT180, PC-programmable, single-channel, Pt100 (KA00118R/09/a3)
  - TMT181, PC programmable, single-channel, RTD, TC,  $\Omega$ , mV (KA141R/09/a3)
  - HART<sup>®</sup> TMT182, single-channel, RTD, TC,  $\Omega$ , mV (KA142R/09/c4)
  - HART<sup>®</sup> TMT82, two-channel, RTD, TC,  $\Omega$ , mV (BA01028T/09/en)
  - PROFIBUS<sup>®</sup> PA TMT84, two-channel, RTD, TC,  $\Omega$ , mV (BA00257R/09/en)
  - FOUNDATION Fieldbus<sup>™</sup> TMT85, two-channel, RTD, TC,  $\Omega$ , mV (BA00251R/09/en)
  - FOUNDATION Fieldbus<sup>™</sup> TMT125, 8-channel, RTD, TC,  $\Omega$ , mV (BA00240R/09/en)
  - Safety requirements: DIN EN 61010-1:2011-07
  - EMC requirements : DIN EN 61326-1:2013-07
  - RSG45 DIN RAIL
  - TMT162
  - TMT142
  - Field Display (FD188)
- Technical Information of inserts:
  - Resistance thermometer insert Omnigrad T TST310 (TI00085T/09/en)
  - Thermocouple insert Omnigrad T TSC310 (TI00255t/09/en)
- Technical Information application example:
  - RN221N active barrier, for supplying loop-powered 2-wire transmitters (TI073R/09/en)
  - HAW562 surge arresters, (TI01012K/09/en)





[www.addresses.endress.com](http://www.addresses.endress.com)

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