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Operating Instructions
iTHERM TMS21 MultiSens Slim

Minimally invasive TC multipoint thermometer for petrochemical and chemical applications

Endress+Hauser
People for Process Automation

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1 About this document

1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

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

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective earth (PE)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: protective earth is connected to the mains supply. ▪ Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers	1., 2., 3...	Series of steps
A, B, C, ...	Views	A-A, B-B, C-C, ...	Sections
EX	Hazardous area	EX	Safe area (non-hazardous area)

1.2.4 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.
	**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.
	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
▶	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.5 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** 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.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The 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.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Document type	Purpose and content of the document
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

1.2.6 Registered trademarks

FOUNDATION™ Fieldbus
Registration-pending trademark of the FieldComm Group, Austin, Texas, USA

HART®
Registered trademark of the FieldComm Group, Austin, Texas, USA

PROFIBUS®
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2 Basic safety requirements

The instructions and procedures described in the operating instructions may require special precautions to ensure the safety of the personnel performing the operations. Information that may lead to potential safety issues is indicated by safety pictograms and symbols. Please refer to the safety messages before performing any operation identified by pictograms and symbols. Although the information provided herein is believed to be accurate, we nevertheless point out 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. 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 starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

The product is intended to measure the temperature profile inside a reactor, vessel or pipe through thermocouple technology.

The manufacturer is not liable for harm caused by improper or unintended use.

The product has been designed according to the following conditions:

Condition	Description
Internal pressure	The design of connection pieces, threaded connections and sealing elements corresponds to the maximum working pressure inside the reactor.
Operating temperature	The materials used were chosen according to the operating and design minimum and maximum temperatures. To avoid intrinsic stresses and ensure proper integration between the device and the plant, thermal expansion was taken into account. Specific care has to be taken when the instrument's thermowell is fixed to the plant internals.
Process fluids	The choice of dimensions and, above all, material will minimize the following signs of wear: ▪ Distributed and localized corrosion, ▪ Abrasion and wear ▪ Corrosion phenomena due to uncontrolled and unpredictable chemical reactions Specific process fluids analysis is necessary to properly ensure the maximum operating life of the device, through proper material selection.
Fatigue	Cyclic loads during operations are not foreseen.
Vibrations	The sensor elements may be subjected to vibrations due to high immersion lengths. This vibrations can be minimized by properly selecting the route of the thermowell into the plant, by fastening the thermowell to internal components by means of accessories like clips and end sleeves. The extension neck was designed to withstanding vibration loads to protect the junction box from cyclic loading and to prevent threaded components from loosening.
Mechanical stress	The maximum loads on the measuring instrument, multiplied by a safety factor, are within the permissible stresses for the construction material at each operating point of the plant.
Environmental conditions	The junction box (with and without head transmitters), cables, cable glands and other fittings have been selected to work within the permissible ambient temperature range.

2.3 Workplace safety

For work on and with the device:

► Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

Damage to the device!

► Operate the device in proper technical condition and fail-safe condition only.

► The operator is responsible for the interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!

► If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:
- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use only original spare parts and accessories.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

3 Product description

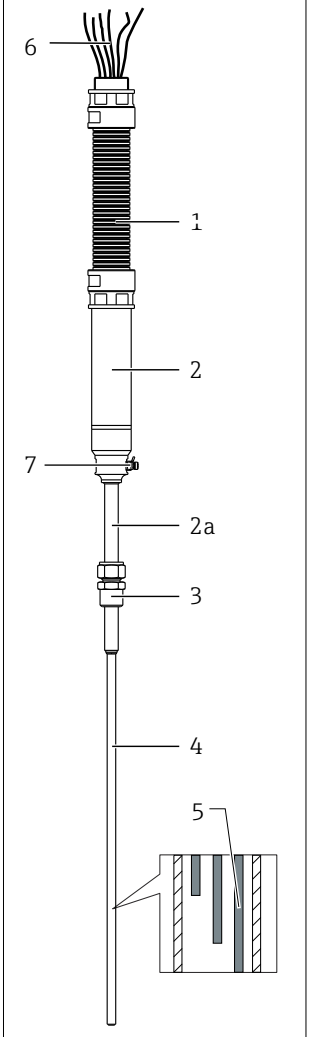
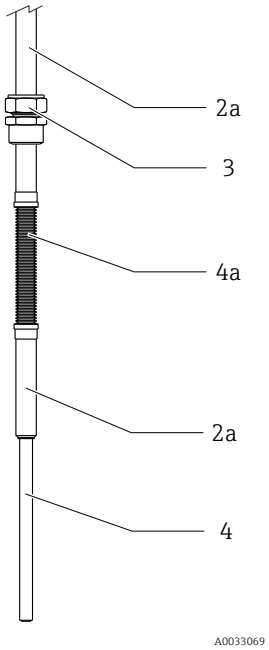
3.1 Product design

The new iTHERM MultiSens Slim features an innovative design offering a wide range of options in terms of materials selection, nominal diameters and number of measuring points. In addition a portfolio of selectable accessories (not in contact with the process) individually managed for easy maintenance and spare part ordering, like adapters and conduits, is available.

It consists of five main sub-assemblies:
- **Extension:** Consists of a threaded bushing that ensures sealed electrical connections and is matched to an adapter incorporating a flexible conduit for the extension cables.
- **Main bushing and reinforcing sleeve:** to seal and protect electrical junctions and to adjust immersion length.
- **Process connection:** represented by a compression fitting. When necessary, an ASME or EN flange is available on request.
  Other standards or connection types can be offered on request. The flanges are provided with welded compression fitting for process tightness.
- **Thermowell:** with reinforcing sleeve.
- **Insert:** composed of metal sheathed measuring elements (thermocouples), extension cable and transition bushing. The sensing elements are mounted inside a thermowell with a small pipe diameter.
  Part of the thermowell can be a flexible hose to guarantee additional bendability and thus better positioning of the probe in the process (above all in the case of misalignment between installation nozzle and the distribution of measuring points).
- **Additional accessories:** Components that can be ordered independently from the selected product configuration, such as junction boxes and transmitters, able to fit with all the already installed customer devices.

In general, the system measures the temperature profile in the process environment using multiple sensors. These are connected to an appropriate process connection that ensures the process is leak-tight. Externally, the extension cables (protected by the conduit) are wired into the junction box, which can be installed integrated or remote (optional).

Some of the options listed in this document may not be available in your country. Please contact your local Endress+Hauser representative.

Design		Description
 	1: Extension	Flexible conduit to protect extension cables against environmental pollutants and phenomena (such as abrasion, moisture, salt). Material: ▪ Polyamide ▪ Metal (version approved for hazardous areas) ▪ Other materials on request IP68 degree is guaranteed through the selected adapters.
	2: Main bushing	Used to seal and protect electrical junctions and to adjust immersion length.
	2a: Reinforcing sleeve	
	3: Process connection	High-pressure compression fitting to guarantee tightness between the process and the external environment. For many process fluids and various combinations of high temperatures and pressures. In the case of a flange, the process connection is welded on the flange (standard). Other versions available on request.
	4: Thermowell	Annealed tube that is used as a protective sheath for the measuring elements and comes into direct contact with the process.
	4a: Flexible thermowell part	Annealed tube provided of an upper flexible part (corrugated conduit) to allow to reach different paths into the installation environment.
	5: Inserts	Not replaceable grounded or ungrounded thermocouple inserts with high accuracy measurement performance, long-term stability and reliability.
	6: Extension cables	For electrical connections between the inserts and junction box. ▪ Shielded PVC ▪ Shielded or unshielded FEP
	7: Ground terminal	For electric sensors grounding

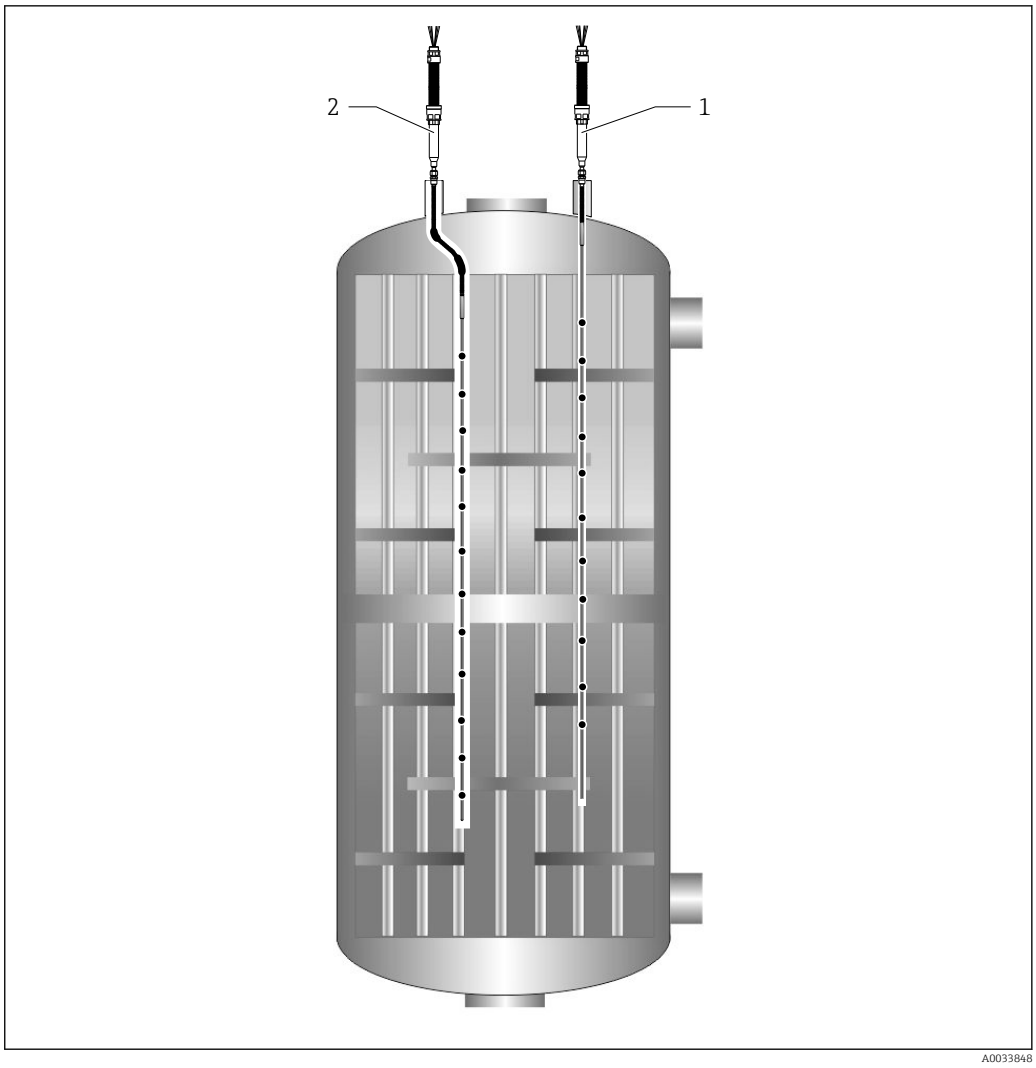
The modular multipoint thermometer is characterized by the following possible main configurations:
- Linear configuration
- Flexible configuration

3.1.1 Number of inserts

Maximum number of inserts for every combination of thermowell and insert diameter

		Thermowell OD in mm (in)				
		3.2 (0.13)	6 (0.24)	6.35 (0.25)	8 (0.31)	9.5 (0.37)
Insert diameter in mm (in)	0.5 (0.02)	8	28	22	46 [1]	59 [1]
	0.8 (0.03)	3	15	12	24	30
	1 (0.04)	2	10	8	18	22
	1.5 (0.06)	-	6	4	8	12

1) The main bushing must be specially designed for this configuration.



1 *Main configuration possibilities*

1 Vertical installation with rigid configuration
2 Installation with flexible configuration

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
   ↳ Report all damage immediately to the manufacturer.
   Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.

If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

The device can be identified in the following ways:
- Nameplate specifications
- Enter the serial number from the nameplate into *Device Viewer* (www.endress.com/deviceviewer): all the information about the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number from the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the device and the technical documentation pertaining to the device is displayed.

4.2.1 Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:
- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

► Compare the information on the nameplate with the order.

4.2.2 Name and address of manufacturer

Name of manufacturer:	Endress+Hauser Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang or www.endress.com

4.3 Storage and transport

Junction box	
With head transmitter	−40 to +95 °C (−40 to +203 °F)
With DIN rail transmitter	−40 to +95 °C (−40 to +203 °F)

4.3.1 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

Pack the device for storage and transportation in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

Avoid the following environmental influences during storage:
- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

4.4 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

5 Installation

5.1 Installation requirements

⚠ WARNING

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

- Make sure only qualified personnel perform the installation.

⚠ WARNING

Explosions could result in serious or fatal injury

- If junction box is included, 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 incendive 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 serious or fatal injury

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

NOTICE

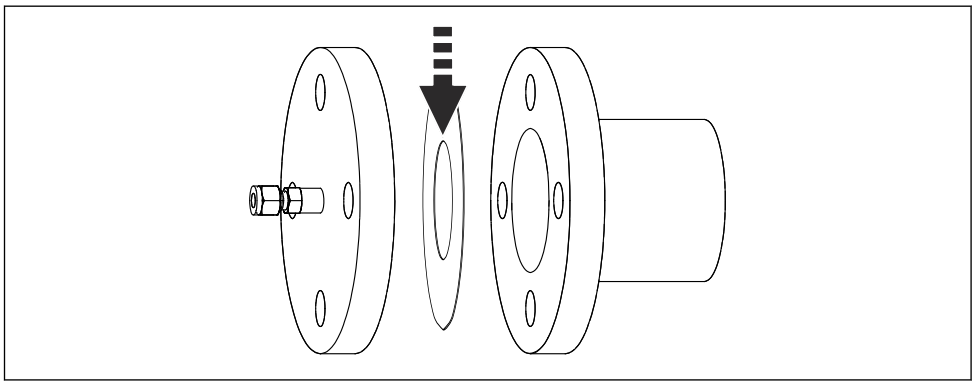
Additional loads and vibrations from other plant components can affect the operation of the sensor elements.

- 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 → 32

5.2 Installing the device

The following instructions must be followed for proper installation of the device.

1.



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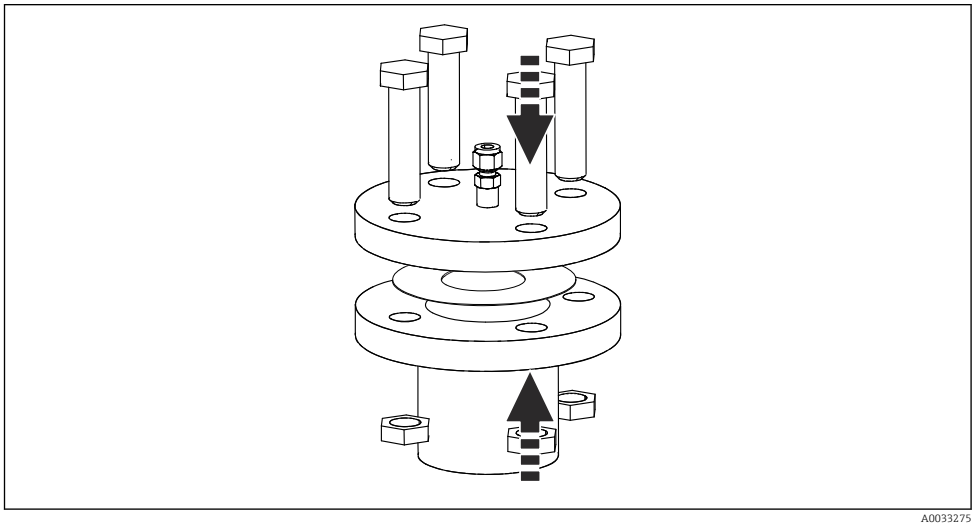
Place the gasket between the flanged nozzle and the flange of the device provided with a compression fitting (after checking the cleanliness of gasket seats on the flanges). If the process connection does not include a flange, place the compression fitting on the connection provided for this purpose and tighten or weld it.

2.



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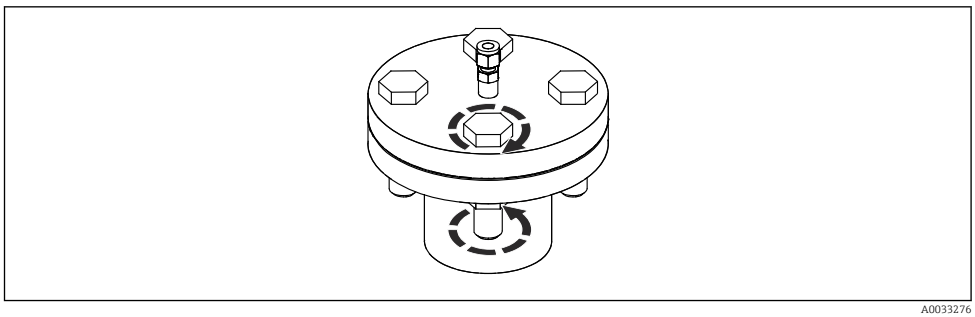
Insert the bolts through the holes on the flange and screw them in with the nuts, but do not fully tighten them yet.

3.



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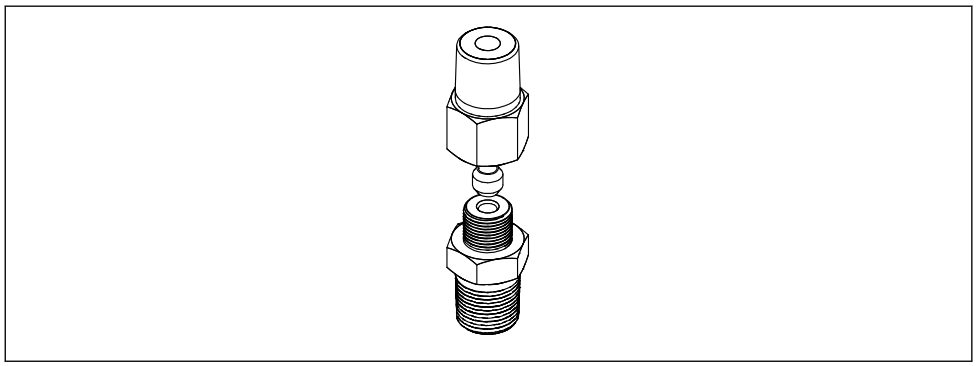
Insert the final bolts through the holes on the flange and tighten them cross-wise using an appropriate tool and method (controlled tightening).

4.



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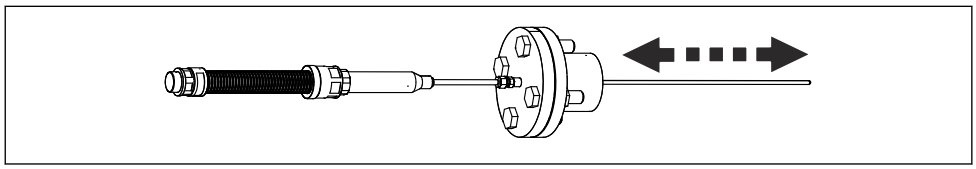
Check if the compression fitting is provided with all the necessary sealing metallic gaskets.

5. Place the device on the nozzle and guide the probe through the compression fitting. Avoid any deformation of the thermowell and the reinforcement bushing.

6.



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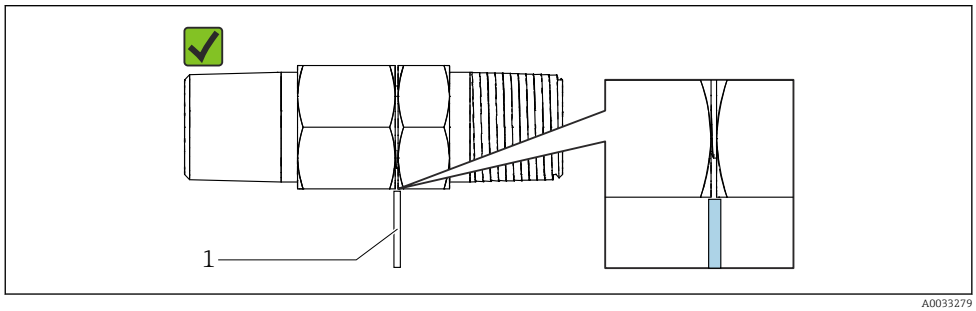
Adjust the immersion length of the probe by sliding the measuring system along the reinforcing sleeve.

7.



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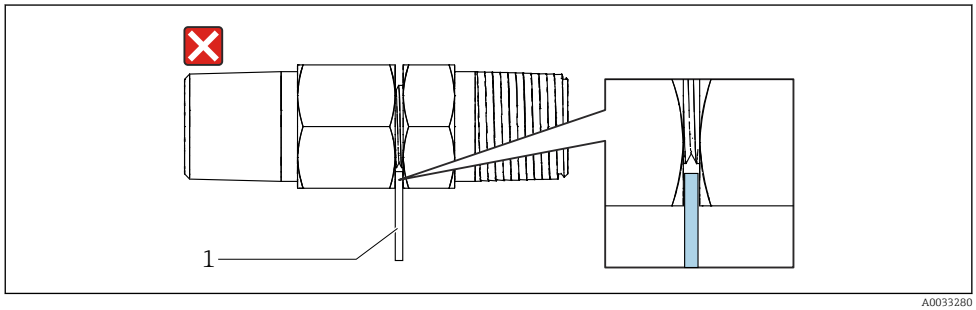

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Hold the measuring system still and tighten the compression fitting. Ensure that the seal is formed on the reinforcement bushing. If the gage (1) does not fit into the gap, the fitting is sufficiently tightened. If the gage fits into the gap, additional tightening is required.

8. When installing an existing thermowell, inspect the inside of the thermowell before insertion to ensure that no internal obstructions are present before. When installing the measurement system, avoid any friction and spark generation in particular. When accessories like spacers and/or centered parts are provided make sure that no distortions occur and the original geometry and position is maintained.

9. When the installation is in direct contact with the process, ensure that any applied external load does not generate deformations and strains on the probe and on the sealing welding.
10. Guide the extension (or compensating) cables through the cable glands of the junction box (if provided).
11. If the route for laying the extension conduit is fully defined, secure the conduit permanently onto the main bushing and the junction box. Ensure that no axial movement is possible. Note: When bending the conduit, observe a minimum radius of 1.5 times its outer diameter.
12. Tighten the cable glands on the junction box.
13. Connect the compensating cables to the junction box terminals or transmitters. Follow the supplied wiring instructions. This is the only way to ensure that the correct TAG numbers of the cables are connect to the correct TAG numbers of the connectors. Note: The electrical connection must be made with the correct compensating cable.

NOTICE

After installation, perform a few simple tests on the thermometric system installed.

- ▶ Check the tightness of the threaded connections. If any part is loose, tighten it applying the proper torque.
- ▶ Check for correct wiring, test the electrical continuity of the thermocouples (by heating the thermocouple measuring point) and ensure that no short-circuits are present.

5.3 Post-installation check

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

Device condition and specifications	
Is the device undamaged (visual check)?	☐
Do the ambient conditions match the device specification? For example: ▪ Ambient temperature ▪ Proper conditions	☐
Are the threaded components free of deformation?	☐
Are the gaskets and sealing components not permanently deformed?	☐
Installation	
Is the device aligned with the nozzle axis?	☐
Are the seal seats of flanges clean? (If applicable)	☐
Is the coupling between the flange and its counter flange reached? (If applicable)	☐
Is the probe straight and geometry maintained?	☐
Is the flexible conduit undamaged and not twisted?	☐
Are the bolts completely inserted in the flange? (If applicable, make sure the flange is completely attached to the nozzle.)	☐
Does the compression fitting have all the sealing components?	☐
Is the compression fitting properly tightened on the reinforcing sleeve?	☐
Are the cable glands tightened on the extension cables? (If applicable)	☐
Are the extension cables connected to the junction box terminals or transmitters? (If applicable)	☐

6 Wiring

⚠ CAUTION

Non-compliance may result in the destruction of electronics components.

- ▶ Switch off power supply before installing or connecting the device.
- ▶ When installing Ex-approved devices in hazardous areas, please observe the corresponding instructions and wiring diagrams in the specific Ex supplementary documentation to these Operating Instructions. The local Endress+Hauser representative is available for assistance if required.

When wiring with a transmitter, also observe the wiring instructions in the enclosed Brief Operating Instructions of the relevant transmitter.

To wire 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. → 11
3. Feed the cables through the opening in the cable glands.
4. Connect the cables as shown on → 15
5. Once wiring is complete, tighten the screw terminals. Tighten the cable glands again. In doing so, also pay particular attention to → 18. Close the housing cover again.
6. Before commissioning, ensure you follow the instructions provided in the checklist for the "Post-connection check" to avoid connection errors. → 19

6.1 Quick wiring guide

Terminal assignment

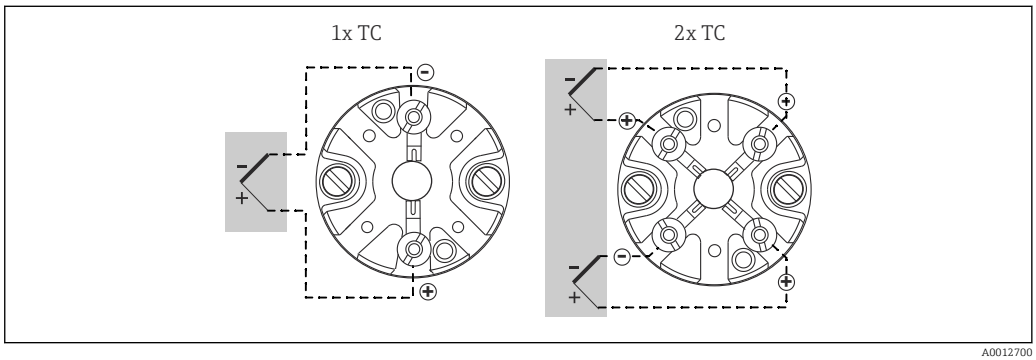
NOTICE

Destruction or malfunction of electronic components due to ESD - electrostatic discharge.

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

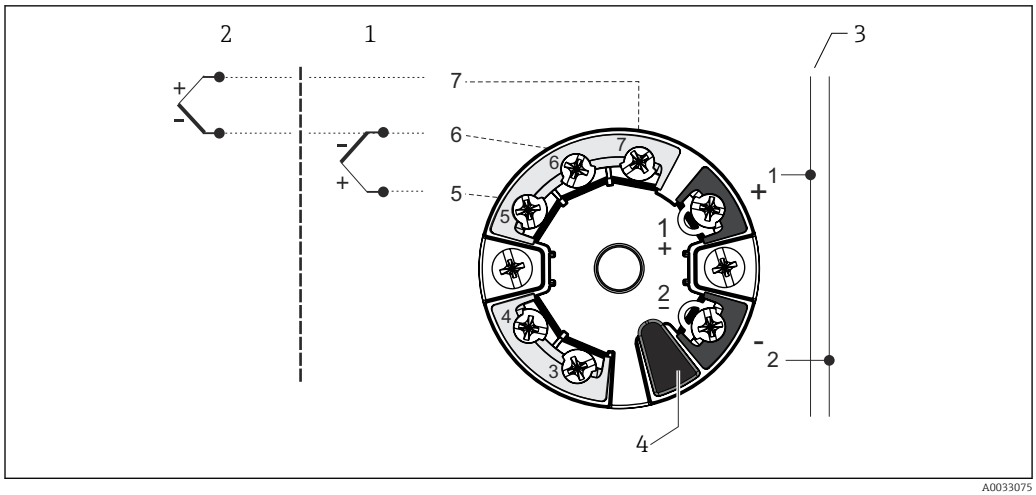
When directly wiring the thermocouple and the RTD sensors, an extension or compensation cable must be used to avoid incorrect measured values. The polarity specified on the relevant terminal block and in the wiring diagram must be observed.

The manufacturer of the device is not responsible for planning or installing the fieldbus connecting cables. Therefore the manufacturer cannot be held liable for possible damage caused by selecting materials that are not suitable for that application or due to a faulty installation.



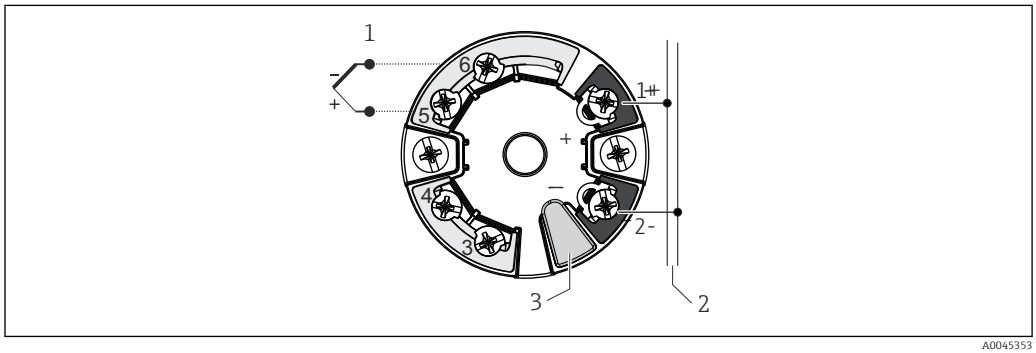
2 *Mounted terminal block*

Wiring diagrams for TC connection



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

1 *Sensor input 1*
2 *Sensor input 2*
3 *Bus connection and supply voltage*
4 *Display connection*



4 *Wiring diagram of the single input head transmitters (TMT7x)*

1 *Sensor input*
2 *Bus connection and supply voltage*
3 *Display connection and CDI interface*

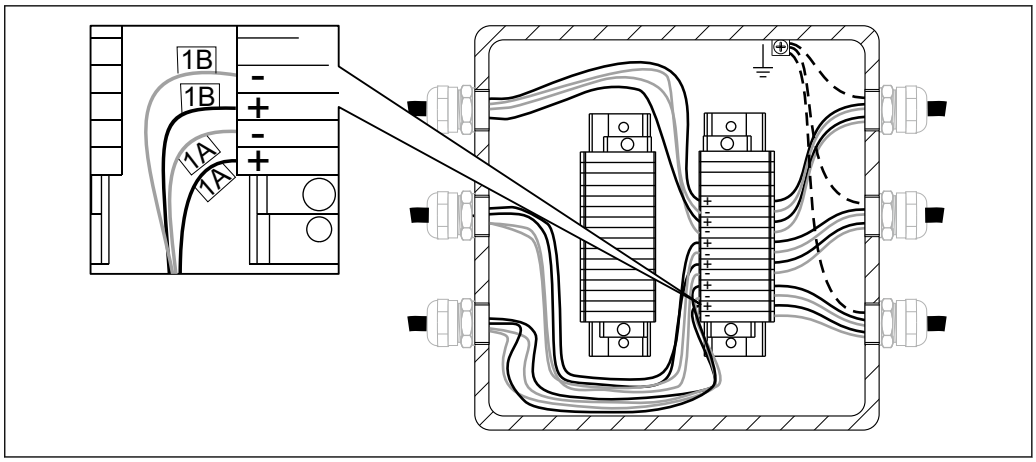
Thermocouple cable colors

According to IEC 60584	According to ASTM E230
▪ Type E: Violet (+), white (-) ▪ Type J: Black (+), white (-) ▪ Type K: Green (+), white (-) ▪ Type N: Pink (+), white (-)	▪ Type E: Purple (+), red (-) ▪ Type J: White (+), red (-) ▪ Type K: Yellow (+), red (-) ▪ Type N: Orange (+), red (-)

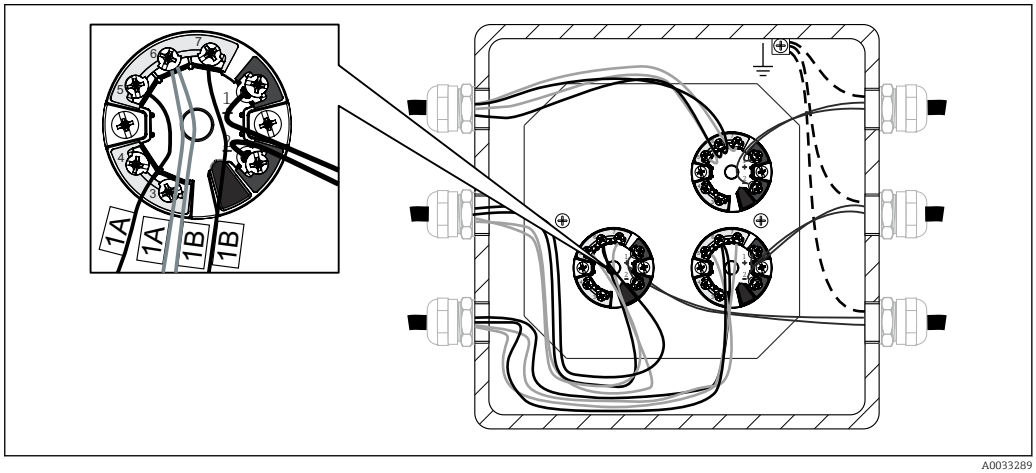
6.2 Connecting the sensor cables

Each sensor is marked with an individual TAG number. As default configuration, all wires are always connected to the installed transmitters or terminals (when applicable).

Wiring is performed sequentially, which means that the input channels 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 two sensors are used, the internal marking is provided with a suffix to distinguish between the two sensors, e.g. 1A and 1B for two sensors in the same insert or measuring point no. 1.



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



6 *Mounted and wired head transmitter. Example of the internal sensor wires marking with 2 x TC*

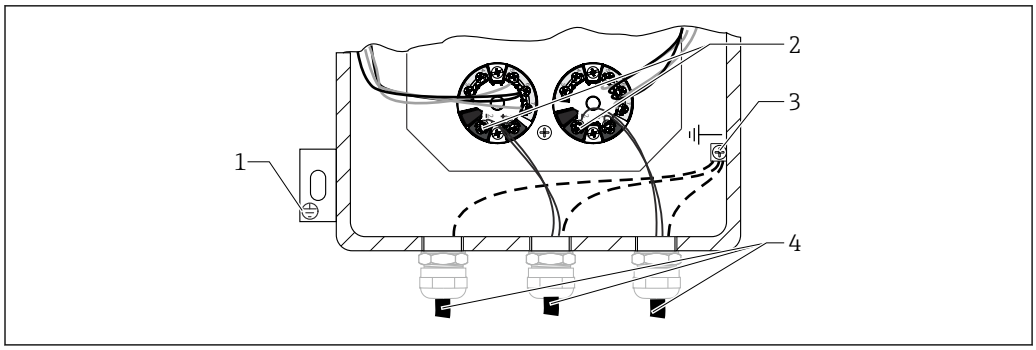
Sensor type	Transmitter type	Wiring rule
1 x TC	▪ Single input (one channel) ▪ Dual input (two channels)	▪ 1 head transmitter per insert ▪ 1 head transmitter for 2 inserts
2 x TC	▪ Single input (one channel) ▪ Dual input (two channels)	▪ Not available, wiring excluded ▪ 1 head transmitter per insert

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^2 (14 AWG) for screw terminals
  - Max. 1.5 mm^2 (16 AWG) for spring terminals

Always observe the general procedure on → 15.



7 *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

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

For shielding and grounding in hazardous applications, refer to the ATEX safety instructions: XA01647T

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 shields of fieldbus systems should only be grounded on one side, for example at the power supply unit or at safety barriers.

NOTICE

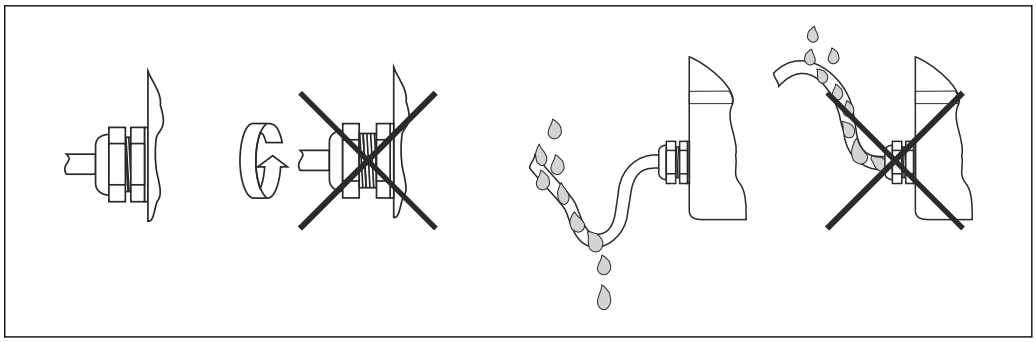
If, in systems without potential equalization, the cable shield is grounded at several points, mains-frequency equalizing currents may occur. These can damage the signal cable or significantly impair signal transmission.

- In such cases, the signal cable shield must 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 unconnected shield must be insulated!

6.5 Ensuring the degree of protection

To comply with the degree of protection, the following points must be taken into account:
→ 8, 19

- 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 and conduit 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 the cable gland.
- Lock adapter by means of the provided clip.
- 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 measuring instrument so that the cable or conduit entries are not facing upwards.
- Entries not used are to be blanked off using the blanking plates provided.



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8 Connection hints to maintain IP protection

6.6 Post-connection check

Is the device undamaged (internal equipment inspection)?	❑
Electrical connection	
Does the supply voltage match the specifications on the nameplate?	❑
Are the mounted cables strain-relieved?	❑
Are the power supply and signal cables correctly connected? → 🖹 15	❑
Are all the screw terminals well tightened and have the connections of the spring terminals been checked?	❑
Are all cable glands installed, securely tightened and leak-tight?	❑
Are all the housing covers installed and tightened?	❑
Does the marking of the terminals and cables match?	❑
Has the electrical continuity of the thermocouple been verified?	❑

7 Commissioning

7.1 Preparations

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 chemical or fluid is being measured (observe safety data sheet).
- Be aware of the temperature and pressure 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 process when disconnecting inputs/outputs or when simulating signals.
- Ensure our tools, equipment and the customer process are protected from 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-related equipment if available.
- Safety Datasheet if available.
- 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 Post-installation check

Before commissioning the device make sure that all final checks have been carried out
- "Post-installation check" checklist→ 14
- "Post-connection check" checklist → 19

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

7.2.1 Standard commissioning

Visual inspection of the 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 compliance with safety precautions (e.g. radiometric measurements)
6. Power up the instrument(s)
7. Check the alarm list if applicable

Ambient 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 the software version (e.g. application software such as "Batching") if provided
3. Check that the documentation has the correct issue and version

Function check

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 results for an analytical device, weighting on the scale for 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 transmitters in use, please refer to the enclosed Brief Operating Instructions for commissioning.

8 Diagnostics and troubleshooting

8.1 General troubleshooting

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' → 🖹 22.
- ▶ 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' → 🖹 14
- Follow the checklist in section 'Post-connection check' → 🖹 19

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

9 Repair

9.1 General information

Ensure that the device is easily accessible for maintenance purposes. Any component that is part of the device must, if replaced, be exchanged with an original spare part of Endress+Hauser that guarantees the same characteristics and performance. To ensure continued operational safety and reliability, repairs should only be carried out on the device if they are expressly permitted by Endress+Hauser, in compliance with federal/ national regulations regarding the repair of an electrical device.

9.2 Spare parts

Product spare parts that are currently available can be found online at:
http://www.products.endress.com/spareparts_consumables.

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

Spare parts for the multipoint thermometer are:
- Conduit and adapters
- Cable glands, transmitters or electrical terminals, if provided
- Other accessories when applied and replaceable

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 suppling individual certified components and by checking the integration on the whole system.
Maintenance	All Endress+Hauser systems are designed for easy maintenance thanks to a modular design that permits the replacement of old or worn parts. Standardized parts ensure fast maintenance.
Calibration	Endress+Hauser's range of calibration services covers on-site verification tests, accredited laboratory calibrations, certificates and traceability to ensure compliance.

9.4 Return

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

1. Refer to the web page for information: https://www.endress.com
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

9.5 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

9.5.1 Removing the measuring device

1. Switch off the device.
2. **WARNING**

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

   Carry out the mounting and connection steps from the chapters "Mounting the assembly" and "Wiring" in the logically reverse sequence (when applicable). Observe the safety instructions.

9.5.2 Disposing of the measuring device

Observe the following notes during disposal:
- ▶ Observe valid federal/national regulations.
- ▶ Ensure proper separation and reuse of the device components.

10 Accessories

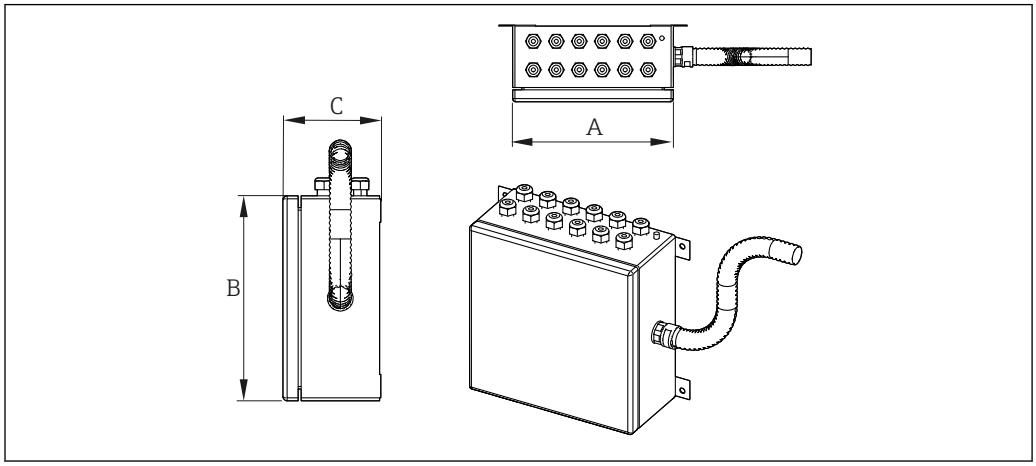
The accessories currently available for the product can be selected at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

10.1 Device-specific accessories

Accessories	Description
Junction box	The junction box is suitable for environments in which chemical substances are used. Sea water corrosion resistance and extreme temperature variation stability is guaranteed. Ex-e, Ex-i terminals can be generally installed.
Transmitter	Head transmitter ▪ PC programmable head transmitter ▪ With HART®-, PROFIBUS® PA or FOUNDATION Fieldbus™ communication protocol 8-channel DIN rail transmitter with FOUNDATION Fieldbus™ communication protocol

Accessories	Description
Pads, clips, spacers	▪ Pads and clips: in order to fix the multipoint thermometer along its immersion length. ▪ Spacers: Used in presence of an existing thermowell in order to guarantee the centering.
Specific extension for on-board junction box	When the junction box cannot be remotely installed, it has to be configured on-board at the multipoint thermometer. Therefore, a specific extension design has to be provided. This design is available on request only for flanged process connection.



9 Junction box as accessory for remote installation

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

		A	B	C
Stainless steel	Min.	150 (5.9)	150 (5.9)	100 (3.9)
	Max.	500 (19.7)	500 (19.7)	160 (6.3)
Aluminum	Min.	305 (12)	280 (11)	238 (9.4)
	Max.	600 (23.6)	600 (23.6)	365 (14.4)

Type of specification	Junction box	Cable glands
Material	AISI 316/aluminum	NiCr-coated brass AISI 316/316L
Degree of 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	IECEx, ATEX, UL, CSA, NEPSI/ CCC, EAC Ex approval for use in hazardous area approval	-

Type of specification	Junction box	Cable glands
Identification	ATEX II 2GD Ex e IIC T6/T5/T4 Gb/Ex ia IIC T6/T5/T4 Ga Ex tb IIIC T85°C/T100°C/T135°C Db IP66 UL913 Class I, Zone 1, AEx e IIC; Zone 21, AEx tb IIIC IP66 CSA C22.2 No.157 Class I, Zone 1 Ex e IIC; Class II, Groups E, F and G IECEx Ex e IIC T6/T5/T4 Gb/Ex ia IIC T6/T5/T4 Ga Ex tb IIIC T85°C/T100°C/T135°C Db IP66 EAC 1 Ex e IIC T6/T5/T4 Gb X/1 Ex ia IIC T6/T5/T4 Gb X/ Ex tb IIIC T85°C/T100°C/ T135°C Db IP66	-
Cover	Hinged	-
Maximum sealing diameter	-	6 to 12 mm (0.24 to 0.47 in)

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
Field Xpert SMT70	The tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance. For details, see "Technical Information" TI01342S.
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.

10.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser devices: ▪ Calculation of all the necessary data for identifying the optimum device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator

FieldCare SFE500	FDT-based plant asset management tool from Endress+Hauser. 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. For details, see Operating Instructions BA00027S and BA00065S

DeviceCare SFE100	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices. For details, see Operating Instructions BA00027S

11 Technical data

11.1 Input

Measured variable

Temperature (temperature-linear transmission behavior)

11.2 Output

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.

Family of temperature transmitters

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

4 to 20 mA 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.

HART® head transmitters
The iTEMP 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. Swift and easy operation, visualization and maintenance using universal configuration software like FieldCare, DeviceCare or FieldCommunicator 375/475. Integrated Bluetooth® interface for the wireless display of measured values and configuration via Endress +Hauser SmartBlue (app), optional.

PROFIBUS® PA head transmitters
Universally programmable iTEMP transmitter with PROFIBUS® PA communication. Conversion of various input signals into digital output signals. High measurement accuracy over the complete ambient temperature range. PROFIBUS PA functions and device-specific parameters are configured via fieldbus communication.

FOUNDATION Fieldbus™ head transmitter
Universally programmable iTEMP transmitter with FOUNDATION Fieldbus™ communication. Conversion of various input signals into digital output signals. High measurement accuracy over the complete ambient temperature range. All iTEMP are approved for use in all the main process control systems. The integration tests are performed in Endress+Hauser's 'System World'.

Head transmitter with PROFINET® and Ethernet-APL™
The iTEMP transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using the PROFINET® protocol. Power is supplied via the 2-wire Ethernet connection according to IEEE 802.3cg 10Base-T1. The iTEMP can be installed as an intrinsically safe electrical apparatus in Zone 1 hazardous areas. The device can be used for instrumentation purposes in the terminal head form B (flat face) according to DIN EN 50446.

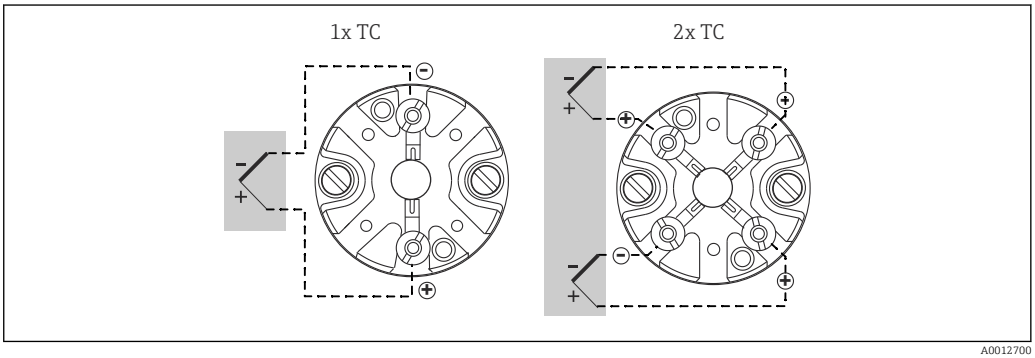
Head transmitter with IO-Link®
The iTEMP transmitter is an IO-Link® device with a measurement input and an IO-Link® interface. It offers a configurable, simple and cost-effective solution thanks to digital communication via IO-Link®. The device is mounted in a terminal head form B (flat face) as per DIN EN 5044.

Advantages of the iTEMP transmitters:
- Double or single sensor input (optionally for certain transmitters)
- Attachable display (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 based on the Callendar van Dusen coefficients (CvD).

11.3 Power supply

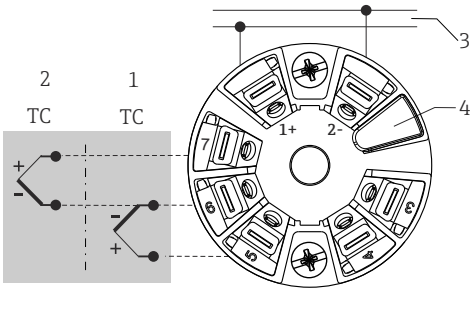
- Electrical connecting cables must be smooth, corrosion resistant, easy to be cleaned and inspected, robust against mechanical stresses, no-humidity sensitivity.
- Grounding or shielding connections are possible via ground terminals on the junction box.

Wiring diagrams



10 *Mounted terminal block*

Head-mounted transmitter TMT8x (dual sensor input) [1)]



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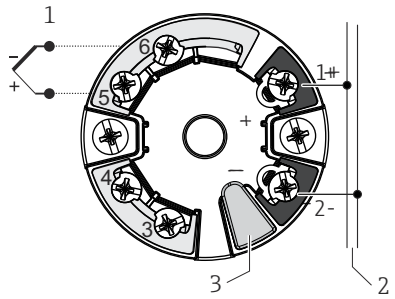
1 Sensor input 1
2 Sensor input 2
3 Fieldbus communication and power supply
4 Display connection

Head-mounted transmitter TMT7x or TMT31 (single input)



A0045353

1 Sensor input TC, mV
2 Power supply, bus connection
3 Display connection/CDI interface

1) Fitted with spring terminals if screw terminals are not explicitly selected or a dual sensor is installed.

Thermocouple wire colors

As per IEC 60584	As per ASTM E230
▪ Type J: black (+), white (-) ▪ Type K: green (+), white (-) ▪ Type N: pink (+), white (-) ▪ Type T: brown (+), white (-)	▪ Type J: white (+), red (-) ▪ Type K: yellow (+), red (-) ▪ Type N: orange (+), red (-) ▪ Type T: blue (+), red (-)

11.4 Performance characteristics

Accuracy

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

Standard	Model	Standard tolerance	Special tolerance (on request)
ASTM E230/ MC.96.1	Deviation; the larger value applies in each case		
	K (NiCr-Ni)	±2.2 K (±3.96 °F) or ±0.02 · |t| (−200 to 0 °C (−328 to 32 °F) ±2.2 K (±3.96 °F) or ±0.0075 · |t| (0 to 1 260 °C (32 to 2 300 °F)	±1.1 K (±1.98 °F) or ±0.004 · |t| (0 to 1 260 °C (32 to 2 300 °F)
	J (Fe-CuNi)	±2.2 K (±3.96 °F) or ±0.0075 · |t| (0 to 760 °C (32 to 1 400 °F)	±1.1 K (±1.98 °F) or ±0.004 · |t| (0 to 760 °C (32 to 1 400 °F)

Standard	Model	Standard tolerance	Special tolerance (on request)
	N (NiCrSi-NiSi)	±2.2 K (±3.96 °F) or ±0.02 · |t| (−200 to 0 °C (−328 to 32 °F) ±2.2 K (±3.96 °F) or ±0.0075 · |t| (0 to 1 260 °C (32 to 2 300 °F)	±1.1 K (±1.98 °F) or ±0.004 · |t| (0 to 1 260 °C (32 to 2 300 °F)
	E (NiCr-CuNi)	±1.7 K (±3.06 °F) or ±0.01 · |t| (−200 to 0 °C (−328 to 32 °F) ±1.7 K (±3.06 °F) or ±0.005 · |t| (0 to 870 °C (32 to 1 598 °F)	±1 K (±1.8 °F) or ±0.004 · |t| (0 to 870 °C (32 to 1 598 °F)

The materials for thermocouples are generally supplied such that they meet the tolerances for temperatures > 0 °C (32 °F) as specified in the table. These materials are not usually suitable for temperatures < 0 °C (32 °F). The specified tolerances cannot be observed. For this temperature range, a separate material selection is required. This cannot be processed using the standard product.

Standard	Model	Standard tolerance			Special tolerance (on request)
IEC60584		Class	Deviation	Class	Deviation
	K (NiCr-Ni)	2	±2.5 °C (±4.5 °F) (−40 to 333 °C (−40 to 631.4 °F) ±0.0075 · |t| (333 to 1 200 °C (631.4 to 2 192 °F)	1	±1.5 °C (±2.7 °F) (−40 to 375 °C (−40 to 707 °F)) ±0.004 · |t| (375 to 1 000 °C (707 to 1 832 °F)
	J (Fe-CuNi)	2	±2.5 °C (±4.5 °F) (−40 to 333 °C (−40 to 631.4 °F) ±0.0075 · |t| (333 to 750 °C (631.4 to 1 382 °F)	1	±1.5 °C (±2.7 °F) (−40 to 375 °C (−40 to 707 °F)) ±0.004 · |t| (375 to 750 °C (707 to 1 382 °F)
	N (NiCrSi-NiSi)	2	±2.5 °C (±4.5 °F) (−40 to 333 °C (−40 to 631.4 °F) ±0.0075 · |t| (333 to 1 200 °C (631.4 to 2 192 °F)	1	±1.5 °C (±2.7 °F) (−40 to 375 °C (−40 to 707 °F)) ±0.004 · |t| (375 to 1 000 °C (707 to 1 832 °F)
	E (NiCr-CuNi)	2	±2.5 °C (±4.5 °F) (−40 to 333 °C (−40 to 631.4 °F) ±0.0075 · |t| (333 to 900 °C (631.4 to 1 652 °F)	1	±1.5 °C (±2.7 °F) (−40 to 375 °C (−40 to 707 °F)) ±0.004 · |t| (375 to 800 °C (707 to 1 472 °F)

Thermocouples made of non-precious metals are generally supplied such that they meet the manufacturing tolerances for temperatures > −40 °C (−40 °F) as specified in the table. These materials are not usually suitable for temperatures < −40 °C (−40 °F). The tolerances for Class 3 cannot be observed. For this temperature range, a separate material selection is required. This cannot be processed using the standard product.

Response time

Response time for the sensor assembly without transmitter.

Test architecture

Multimeter Keithley 2000
Fluid bath for response time tests

Test description

Tests in water at 0.4 m/s (1.3 ft/s), according to IEC 60751 and ASTM E644; 10 K temperature step change.
At the beginning the thermometer to be tested is stabilized in its raised position, outside the fluid at ambient temperature, then it is immersed rapidly in the fluid bath.
Measurement of the output values of the thermometer begins at the latest at the moment in which the thermometer is immersed in the bath. Recording continues until the thermometer has reached the temperature of the medium.

Tested thermowell diameter and length	Average response time at a temperature of 177 °C (350.6 °F)177 °C	
6 mm (0.24 in), 4 520 mm (177.95 in)	t_{50}	3 s
	t_{63}	4.1 s
	t_{90}	9 s

Additional tests (on request)

- Functional test measurement at a fixed temperature over the entire thermowell: the multipoint product under test is simultaneously checked by comparing its individual sensors with a multipoint reference device having an already known behavior and accuracy. This test has not to be seen as a calibration test.
- Thermal excitation: this test allows the evaluation of the response time of each measuring point when a local thermal excitation is applied. Additionally it shows the effects of the local excitation on the closest points due to the thermal equalization effect of the thermowell sheath.

Calibration

Calibration is a service that can be performed in house, either on single sensors before assembling or on the complete device before dispatching.

Calibration involves comparing the measured values of the measuring 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 points, e.g. at the freezing point of water at 0 °C (32 °F).
- Calibration compared against a precise reference thermometer.

Evaluation of inserts

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

11.5 Installation

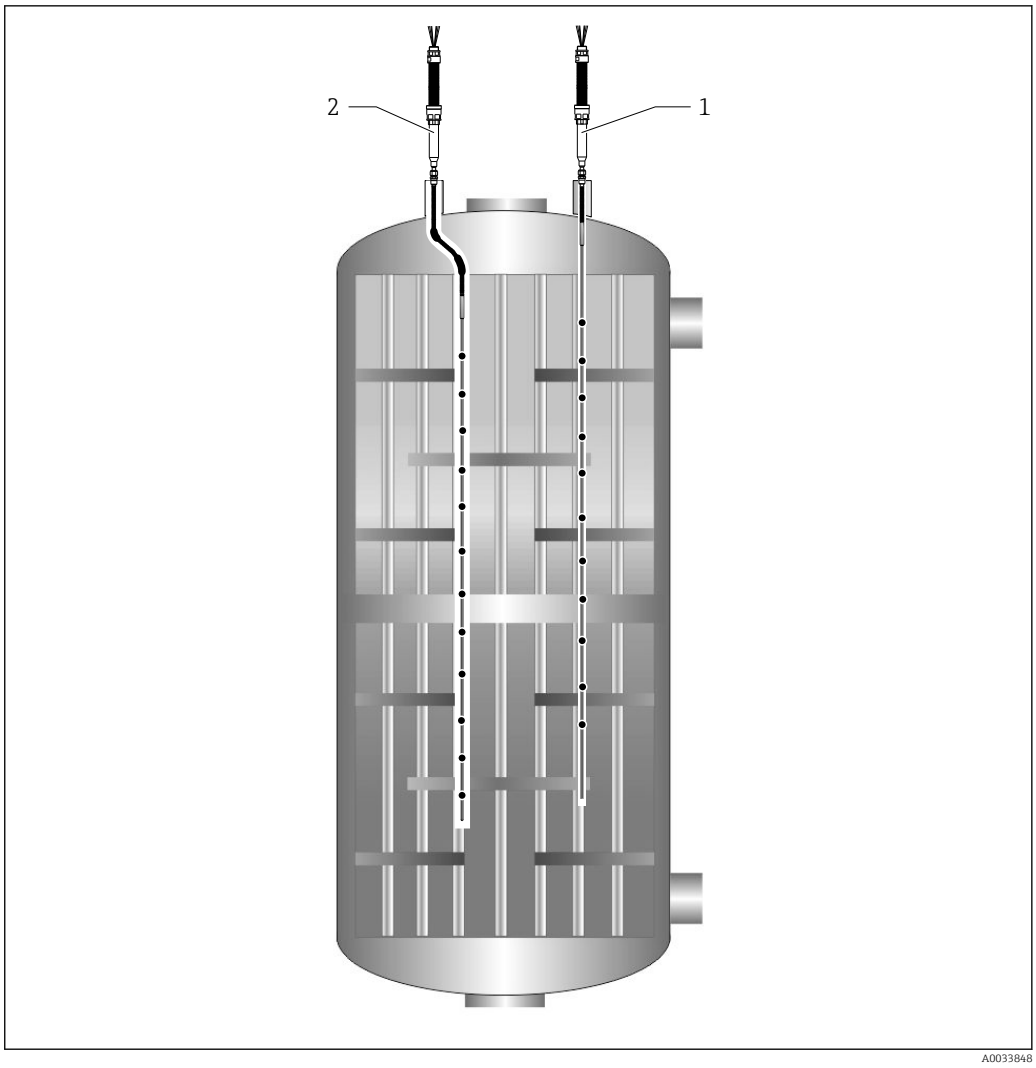
Installation location

The installation location must meet the requirements listed in this document – such as ambient temperature, ingress protection, climate class, etc. Care should be taken when checking the sizes of possible existing support frames or brackets welded on the reactor's wall (usually not included in the scope of delivery) or of any other existing frame in the installation area.

Orientation

It is recommended to install the multipoint thermometer in vertical configuration. When vertical installation is not possible, care has to be taken in order to ensure that the reinforcing sleeve is not under bending loads due to the any conduit cable tension.

When the flexible configuration is ordered, offset routing is possible thanks to the flexible part of the thermowell, even if this does not correspond to the alignment of the longitudinal axis of the multipoint thermometer.



11 Main configuration possibilities

1 Vertical installation with rigid configuration
2 Installation with flexible configuration

Installation instructions

The multipoint thermometer is designed to be installed by means of a compression fitting, when necessary with a flange mounted on a vessel, reactor, tank or similar environment.

The thermometer has been developed to provide maximum flexibility to enable routing past any potential obstacles in your plant. It guarantees a high sealing level, noiseless signals, and high mechanical protection of the extension cables.

All parts and components have to be handled with care. During the installation phase, lifting and introduction of the equipment through the preset nozzle, the following must be avoided:

- Misalignment with the nozzle axis.
- Any load on the welded or threaded parts due to the action of the weight of the device.
- Overtightening of the compression fittings.
- Any tensile and torsional load on the conduit cable.
- Any bending load on the conduit cable.
- Fixing the extension conduit on the plant's infrastructures without allowing axial displacements or movements.
- Deformation or crushing of the threaded components, bolts, nuts, cable glands and compression fittings.
- Bending radius of the flexible part of the thermowell smaller than 20 times the diameter of the flexible hose.

- Tension loads on the flexible part.
- Friction between the flexible part and the internals of the reactor.
- Fixing the flexible part on the reactor's infrastructures without allowing axial displacements or movements.

11.6 Environment

Ambient temperature range

Configuration without junction box: −40 to +95 °C (−40 to +203 °F)

Configuration with junction box, ordered as accessory:

Junction box	Non-hazardous area	Hazardous area
Without mounted transmitter	−40 to +85 °C (−40 to +185 °F)	−40 to +60 °C (−40 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.

Storage temperature

Configuration without junction box: −40 to +95 °C (−40 to +203 °F)

Configuration with junction box, ordered as accessory:

Junction box	
With head transmitter	−40 to +95 °C (−40 to +203 °F)
With DIN rail transmitter	−40 to +95 °C (−40 to +203 °F)

Relative humidity

Condensation according to IEC 60068-2-14:
- Head transmitter: Permitted
- DIN rail transmitter: Not permitted

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

Degree of protection

- Extension conduit: IP68
- Junction box: IP66/67

Vibration resistance and shock 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

Electromagnetic compatibility (EMC)

Depending on the transmitter used. For detailed information see the related Technical Information.

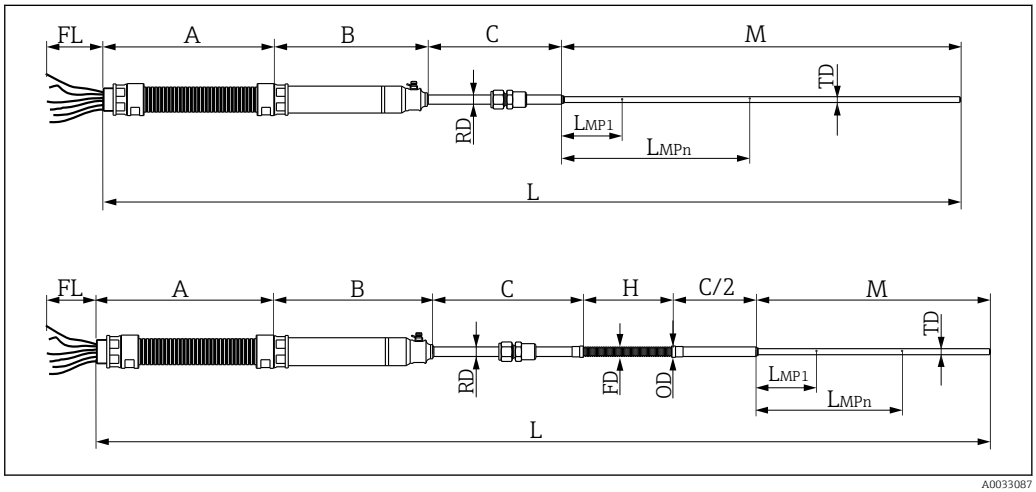
11.7 Mechanical construction

Design, dimensions

The overall multipoint assembly is composed of standardized parts with different features allowing a wide range of product configurations. Different inserts, in terms of TC types, standards, materials, lengths and thermowells are available. They can be selected based upon specific process conditions, in order to have the highest application match and the most extended lifetime. The associated extension cables are provided with high-resistance sheath materials and are shielded to ensure stable and noise-free signals; in addition, they are protected by a polymer sheathing to provide high durability under a wide range of environmental conditions (salt, sand, humidity, etc.). The transition between the probe

and the conduit is obtained by the usage of a main bushing, containing the electrical junctions between the TC sensors and the extension cables. It is completely sealed to ensure the declared degree of protection IP68.

It also works as the transition part between the reinforcing sleeve and the conduit cable for signal communication. The reinforcing sleeve is the dedicated probe's zone to adjust the immersion length through sliding compression fittings or flanges. For the flexible configuration the reinforcing sleeve has integrated the flexible thermowell that allows non-linear routings into the process. If there is a misalignment between the installation connection and the direction of the measurement given by the rigid part of the thermowell, the flex configuration is the proper solution.



12 *Rigid and flexible design of the modular multipoint thermometer. All dimensions in mm (in)*

A Conduit cable length
B Main bushing length 190 mm (7.50 in)
C Reinforcing sleeve length, 200 mm (7.87 in)
FD Flexible part diameter
FL Flying leads length
H Flexible part length
L_{MPx} Immersion length of sensing elements
L Device length
M Thermowell length
RD Reinforcement diameter
TD Thermowell diameter
OD Outer diameter

Conduit cable length A and flying leads length FL
A: Maximum 5 000 mm (197 in), minimum 1 000 mm (39.4 in) FL: 500 mm (19.7 in) as standard Specifically customized lengths are available on request.

Reinforcing sleeve length C
200 mm (7.87 in) Specifically customized lengths are available on request.

Flexible part diameter FD
9.8 mm (0.39 in), 16.2 mm (0.64 in)

Outer diameter OD
14 mm (0.55 in), 21 mm (0.83 in)

Flexible hose length H
Max. 4000 mm (157 in) Specifically customized lengths are available on request.

Immersion lengths MPx of measuring elements
Max. 13 m (512 in) Specifically customized lengths are available on request.

Maximum circuits total length
For Ex-version, rigid design FL+L ≤ 50 m (164 ft) Specifically customized lengths are available on request.

Compression fitting pressure rating at ambient temperature

NPT/ISO Size	bar	psi
1/4"	550	8000
1/2"	530	7700
3/4"	500	7300
1"	370	5300

Thermowell diameter

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

Thermowell			Sensor		
Diameter	Available for Ex-version	Sheath material	Thermocouple type	Standard	Measuring point design
▪ 3.2 mm (0.13 in) ▪ 6 mm (0.24 in) ▪ 6.35 mm (0.25 in) ▪ 8 mm (0.31 in) ▪ 9.5 mm (0.37 in)	Ex ia	316, 316L Inconel600 316Ti 321 347	1x type K 1x type J 1x type N 1x type E 2x type K 2x type J 2x type N 2x type E	IEC 60584 ASTM E230	Grounded Ungrounded

Rigid	Main bushing	316 + 316L
	Reinforced sleeve + thermowell	316 + 316L, 347, 321, Inconel600, 316Ti
Flexible	Main bushing	316 + 316L
	Reinforced sleeve	316 + 316L, 347, 321, Inconel600, 316Ti

	Thermowell	316 + 316L, 347, 321, Inconel600, 316Ti
	Flexible part	Inconel600, 347 (specification on request) 321, 316 + 316L (standard)

For improved reliability, Endress+Hauser can offer duplicate measuring point sensors, in order to achieve a sensor backup. This is achieved either through duplicate thermocouples or through the coupling of two independent sensors (same length). Improved monitoring can be achieved in combination with double channel transmitters TMT8x.

Maximum number of inserts for every combination of thermowell and insert diameter [1)]

		Thermowell OD in mm (in)				
		3.2 (0.13)	6 (0.24)	6.35 (0.25)	8 (0.31)	9.5 (0.37)
Insert diameter in mm (in)	0.5 (0.02)	8	28	22	46 [2)]	59 [2)]
	0.8 (0.03)	3	15	12	24	30
	1 (0.04)	2	10	8	18	22
	1.5 (0.06)	-	6	4	8	12

1) For Ex-version, the maximum number of sensors is limited to 20.
2) This configuration requires a specially engineered main bushing.

Weight

The weight can vary depending on the configuration: extension and thermowell length, type and dimensions of process connection as well as the number of inserts.

Materials of insert sheath, thermowell, main bushing 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)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ 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)
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ 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) ▪ Increased resistance to intergranular corrosion and pitting ▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Alloy 600/2.4816	NiCr15Fe	1 100 °C (2 012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures ▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water ▪ Not to be used in sulfur-containing atmospheres
AISI 304/1.4301	X5CrNi18-10	850 °C (1 562 °F)	▪ Austenitic, stainless steel ▪ Usable in water and slightly polluted waste water ▪ Resistant to organic acids, saline solutions, sulphates, alkaline solutions, etc. at relatively low temperatures only
AISI 304L/ 1.4307	X2CrNi18-9	850 °C (1 562 °F)	▪ Good welding properties ▪ Impervious to intergranular corrosion ▪ High ductility, excellent drawing, forming, and spinning properties
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °F)	▪ Addition of titanium means increased resistance to intergranular corrosion even after welding ▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ▪ Can only be polished to a limited extent, titanium streaks can form
AISI 321/1.4541	X6CrNiTi18-10	815 °C (1 499 °F)	▪ Austenitic, stainless steel ▪ High resistance to intergranular corrosion even after welding ▪ Good welding characteristics, suitable for all standard welding methods ▪ It is used in many sectors of the chemical industry, petrochemical, and pressurized vessels
AISI 347/1.4550	X6CrNiNb10-10	800 °C (1 472 °F)	▪ Austenitic, stainless steel ▪ High resistance in a wide variety of environments in the chemical, textile, oil refining, dairy and food industries ▪ Added niobium makes this steel impervious to intergranular corrosion ▪ Good weldability ▪ Main applications are furnace fire walls, pressure vessels, welded structures, turbine blades

Process connection

Flanges

Examples of most common flanges according to the following standards: ASME, EN

Standard [1]	Size	Rating	Material [2]
ASME	½", 1", 1½", 2", 3", 4"	150#, 300#	AISI 316 + 316L, 316Ti, 321, 347
EN	DN15, DN25, DN32, DN40, DN50, DN80, DN100	PN10,PN16, PN40	

1) Other flange standards are available on request. Please refer to our technicians for support.
2) Plated flanges with special alloys (i.e. Alloy 600) are available

Compression fittings

The compression fittings are used directly as the process connection or welded or threaded into the flange to ensure proper process tightness and performances. Dimensions are coherent with the reinforcing sleeve dimensions.

11.8 Operation

For details of operability, see the Technical Information of the Endress+Hauser temperature transmitters or the manuals of the related operating software.

11.9 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

11.10 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** 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.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The 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.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

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