BA01598T/09/EN/03.23-00
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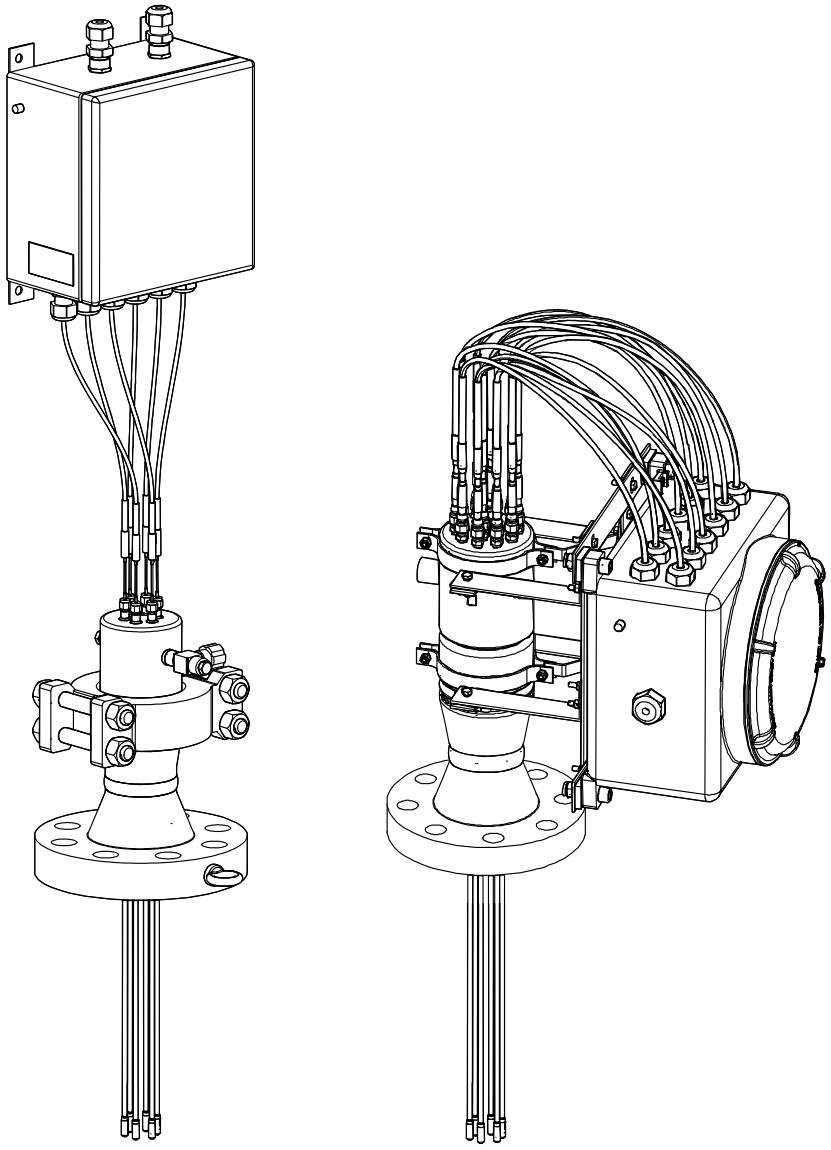
2023-09-29

Operating Instructions
iTHERM
MultiSens Flex TMS02

Modular direct contact TC and RTD multipoint thermometer for direct contact with the medium or with a shared or individual thermowell



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 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

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning	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 ground connection** A terminal which must be connected to ground prior to establishing any other connections.	⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 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.

Symbol	Meaning
	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
1., 2., 3. ...	Series of steps
	Result of a sequence of actions
	Help in the event of a problem
	Visual inspection

1.2.4 Documentation

Document	Purpose and content of the document
iTHERM TMS02 MultiSens Flex(TI01361T/09)	**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.

The document types listed are available:
In the Download Area of the Endress+Hauser Internet site: 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 in this manual is believed to be accurate, be advised that the information provided 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 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 using RTD or thermocouple technologies. The various designs of the multipoint thermometers are configurable. However, the process parameters (temperature, pressure, density and flow velocity) must be taken into account. It is the responsibility of the operator to select the thermometer and thermowell, in particular the material used, to ensure safe operation of the temperature measuring point. The manufacturer is not liable for damage caused by improper or unintended use. The process-wetted materials of the measuring device must have an adequate level of resistance to the process fluids.

The following points must be taken into account during the design stage:

Condition	Description
Internal pressure	The design of joints, threaded connections and sealing elements must correspond to the maximum allowable pressure inside the reactor.
Operating temperature	The materials must be 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 plant internals.
Process fluids	The correct dimensions and the correct material selection can minimize the following signs of wear: ▪ distributed and localized corrosion, ▪ erosion and abrasion, ▪ signs of corrosion caused by 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 operation are not included.
Vibrations	The sensing elements can be subjected to vibrations, due to high immersion lengths from the constraint located in the process connections. These vibrations can be minimized by correctly routing the sensor element into the plant, e.g. by attaching it to internal fixtures using accessories such as clips or end tips. The extension neck has been designed for withstanding vibratory loads to preserve the junction box from cyclic loading, and to avoid the unscrewing of the threaded components.

Condition	Description
Mechanical stress	The maximum stress on the measuring device multiplied by the safety factor is guaranteed to stay below the yielding stress of the material for every working condition of the plant.
Ambient conditions	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.

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

With regard to special process fluids and media used for cleaning, the manufacturer is glad to assist in clarifying the corrosion resistance of wetted materials, but does not accept any warranty or liability.

2.3 Workplace safety

When working on and with the device:
- ▶ Wear the required personal protective equipment as per 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 measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and 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 to the device.

3 Product description

3.1 Equipment architecture

The multipoint thermometer belongs to a series of modular products for multiple temperature measurements. The design allows for the replacement of individual subassemblies and components, making maintenance and spare parts management easier.

It consists of the following main subassemblies:
- **Insert:** Composed of individual metal sheathed sensing elements (thermocouples or RTD resistance sensors) in direct contact with the process, welded to the process flange using reinforced bushings. Alternatively, multiple individual thermowells can be welded with the process connection. This allows the replacement of inserts under operating conditions and protects the thermocouples from the ambient conditions. In this case, the inserts can be treated as individual spare parts and ordered via standard product structures (e.g. TSC310, TST310) or as special inserts. For the specific order code, please contact your Endress+Hauser specialist.
- **Process connection:** Represented by an ASME or EN flange, it may be supplied with eyebolts for lifting the device. As an alternative to the flanged process connection, a welded thermowell insert can also be provided.
- **Head:** It is composed of a junction box with the relevant components such as cable glands, draining valves, earth screws, terminals, head transmitters etc.
- **Head support frame:** Designed to support the junction box by means of components such as adjustable supporting systems.
- **Accessories:** Can be ordered independently of the selected product configuration (e.g. fastening elements, weld-on clips, reinforced sensor tips, spacers, support frames for thermocouple mounting, pressure transmitters, manifolds, valves, purging systems and assemblies.
- **Thermowells:** They are directly welded on the process connection and are designed to guarantee a high degree of mechanical protection and corrosion resistance for each sensor.
- **Diagnostic chamber:** This subassembly consists of a closed housing that ensures the continuous monitoring of device conditions during its entire operating life and safe leakage containment of the process fluid. The chamber has connections integrated for accessories (e.g. valves, manifolds). A wide range of accessories is available to get the highest level of system information (pressure, temperature, and fluid composition).

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 integrity of the process.

Design without thermowells

The MultiSens Flex TMS02 without thermowell is available in a **basic** and **advanced** configuration, both with the same features, dimensions and materials. The differences are as follows:

- **"Basic" deisgn** The extension cables are directly connected to the diagnostic chamber and the inserts are not replaceable (welded to the chamber). The diagnostic chamber can contain leakages of process fluids coming from the welded junctions between the sensors and the process connection.
- **"Advanced" design** The extension cables are connected to removable stump-inserts that can be individually inspected and replaced for ease of maintenance. The stump-inserts are released by means of compression fittings on the head of the diagnostic chamber. A disconnection (provided for in the design of the stump-inserts) is located inside the diagnostic chamber and enables leakages to be directed into the chamber and detected there. The leakages can come from the welded joints between the sensors and process connection or from the sensor itself. This phenomenon might occur when unexpected high corrosion rates compromise the insert sheath integrity.

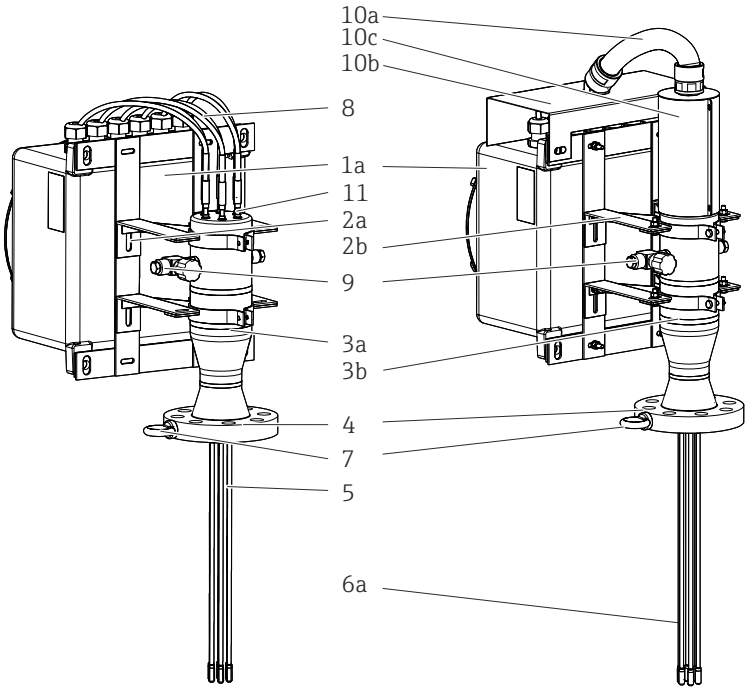
Design with thermowells

The MultiSens Flex TMS02 with thermowells is available in an **"Advanced"** and **"Advanced & modular"** configuration both with the same features, dimensions and materials. The differences are as follows:

- **"Advanced" design** The inserts can be replaced individually (including under operating conditions). The inserts are released by means of compression fittings on the head of the diagnostic chamber. All thermowells end in the diagnostic chamber. In the event of a leak, the media are thus directed into the diagnostic chamber and can be detected. The leakages can come from the welded joints between the thermowells and process connection or from the thermowell itself. This can happen if unexpectedly high corrosion rates affect the thermowell wall or permeation/permeability is not negligible.
- **"Advanced & modular" design** The inserts can be replaced individually (including under operating conditions). The inserts are released by means of compression fittings on the head of the diagnostic chamber. All thermowells end in the diagnostic chamber. In the event of a leak, the media are thus directed into the diagnostic chamber and can be detected. The diagnostic chamber can be opened to replace the entire thermowell bundle (not under operating conditions), while all other multipoint components remain in use (e.g. head of chamber, process connection etc.). The leakages can come from the welded joints between the thermowells and process connection or from the thermowell itself. This can happen if unexpectedly high corrosion rates affect the thermowell wall or diffusion/permeability is not negligible.

Sensor replaceability			
	Basic	Advanced	Advanced and modular
Without thermowells	Sensors are not replaceable	Only the outer stump-sensors are replaceable (connection cables from the diagnostic chamber)	Special version. The complete bundle of sensors can be replaced following system shut-down
With thermowells	Not available	Sensors are replaceable in any conditions	Sensors are replaceable in any conditions

Design



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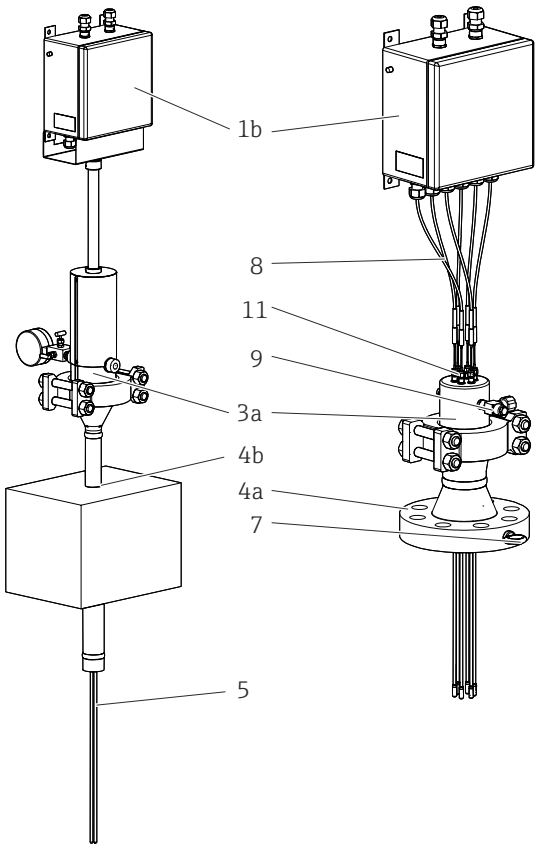

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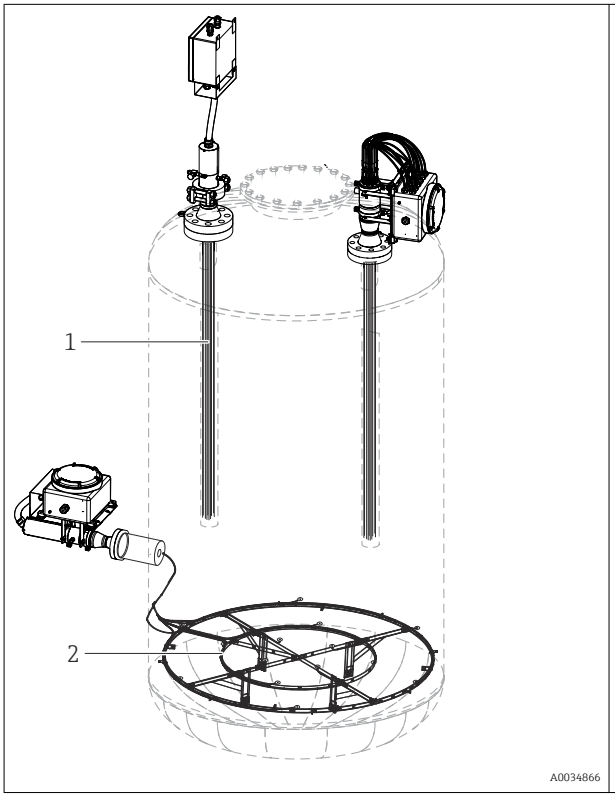
Description, available options and materials	
1: Head 1a: Directly mounted 1b: Remote	Junction box with hinged or screwed cover for electrical connections. It includes components such as electrical terminals, transmitters and cable glands. ▪ 316/316L ▪ Aluminum alloys ▪ Other materials on request
2: Support frame 2a: With accessible extension cables 2b: With protected extension cables	Modular frame support that is adjustable for all available junction boxes. 316/316L
3: Diagnostic chamber 3a: Basic chamber 3b: Advanced chamber	Diagnostic chamber for leakage detection and safe containment of leaking fluids. Continuous monitoring of pressure in the diagnostic chamber. Basic configuration: For fluids that are not dangerous Advanced configuration: For dangerous fluids Advanced and modular: For dangerous fluids and replaceable inserts ▪ 316/316L ▪ 321 ▪ 347
4: Process connection 4a: Flanged according to ASME or EN standards 4b: Welded thermowell insert engineered according to reactor design	Represented by a flange according to international standards or designed for specific process conditions → 🖹 52. Alternatively, a process connection with a clamp and quick release fastener is also possible to meet the requirements of the reactor design and process conditions. ▪ 304 + 304L ▪ 316 + 316L ▪ 316Ti ▪ 321 ▪ 347 ▪ Other materials on request
5: Insert	Mineral-insulated grounded and ungrounded thermocouples or RTDs (Pt100 wire wound). For details, refer to the 'Ordering information' table.
6a: Thermowells or open guiding tubes	The thermometer can be equipped: ▪ either with thermowells for increased mechanical strength, corrosion resistance for sensor replacement ▪ or open guiding tubes for installation in an existing thermowell For details, refer to the 'Ordering information' table.
7: Eyebolt	Lifting device for easy handling during installation phase. SS 316
8: Extension cables	Cables for electrical connections between the inserts and junction box. ▪ Shielded PVC ▪ Shielded FEP
9: Accessories connection	Auxiliary connections for pressure detection, fluid draining, purging, spilling, sampling and analysis. ▪ 316/316L ▪ 321 ▪ 347

Description, available options and materials	
10: Protections 10a: Cable conduit 10b: Cover for cable glands 10c: Extension cables cover	The extension cables cover consists of two half-shells that, together with the cable conduit, protect the extension cables of the sensors. The two half-shells are clamped together by means of screws (clamp connection) and tightened to the chamber head. The cable conduit cover consists of a shaped stainless steel plate fixed to the junction box support frame in order to protect the cable connections.
11: Compression fitting	Compression fittings to ensure leak-tightness between the head of the diagnostic chamber and the external environment. For many process fluids and various combinations of high temperatures and pressures. Not for basic design.

The modular multipoint thermometer is characterized by the following possible main configurations:



- **Linear configuration (1)**
  The different sensors are aligned in a row coinciding with the longitudinal axis of the multipoint assembly itself (linear multipoint measurement). This configuration can be used to install the multipoint either in an existing thermowell as part of the reactor or in direct contact with the process.
- **3D distribution configuration (2)**
  All the inserts, irrespective of whether individual thermowells are used or not, can be bent and arranged in a three dimensional configuration by fixing them through clips or other equivalent accessories. This configuration is commonly used to reach multiple measurement points distributed at different cross sections and levels. Specific support frames can be provided and installed on request if they are not already available on site.

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	–50 to +100 °C (–58 to +212 °F)
With multi-channel transmitter	–40 to +80 °C (–40 to +176 °F)
With DIN rail transmitter	–40 to +100 °C (–40 to +212 °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 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

- 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 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.

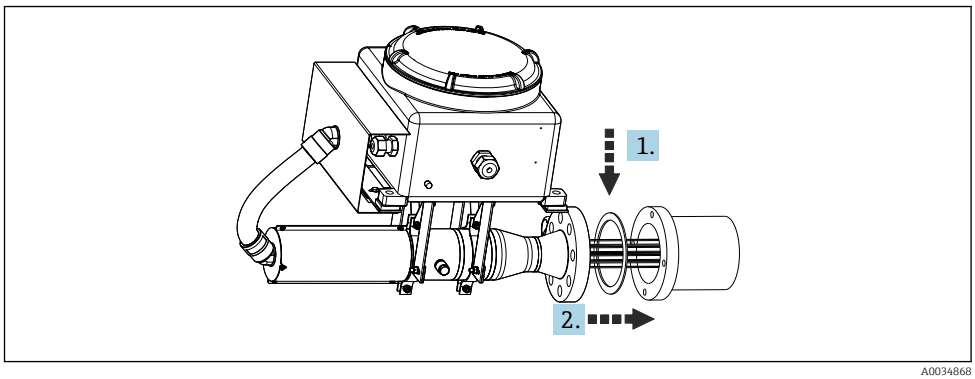
- Is it not allowed to apply additional loads or external moments to the system coming from the connection with another system not foreseen from installation plan.
- The system is not suitable for being installed in locations where vibrations are present. The deriving loads can undermine the sealing 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 → 44
- When installing in an existing thermowell, an internal inspection of the thermowell is recommended to check if any internal obstruction or deformation is present before starting with the insertion activities of the whole device. While installing the measurement system, avoid any friction, specifically avoid sparks generation. Ensure the thermal contact between the inserts and the bottom/wall of the existing thermowell. When accessories like spacers are provided, make sure that no distortions are occurred and the original geometry and position are maintained.
- When the installation is performed by direct contact with the process, ensure that any applied external loads (i.e. due to the tip fixing of the probe to any reactor internals) don't generate deformations and strains on the probe and on welds.

5.2 Mounting the assembly

The following instructions are divided into two cases: mounting of a flanged device and mounting of a device with thermowell insert. The instructions have to be followed for a safe installation of the MultiSens.

5.2.1 Mounting in case of flanged device

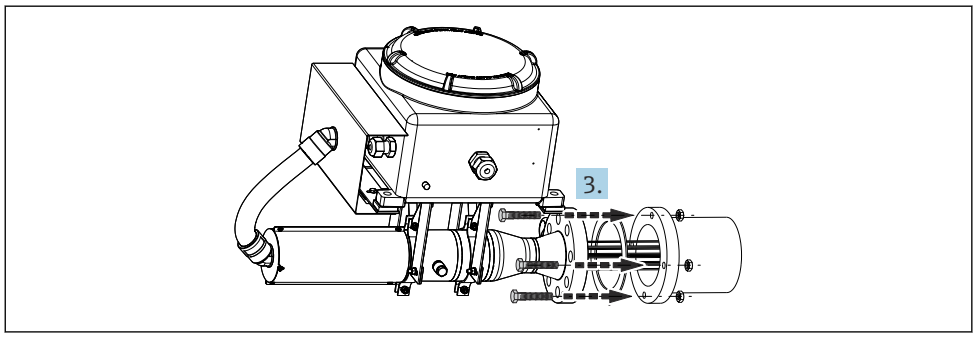
1.



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 close to the nozzle, insert either the thermoelements bundle (with or without guiding tube system) or the protecting thermowells bundle through the nozzle avoiding interlacing and deformation of the same.

3.



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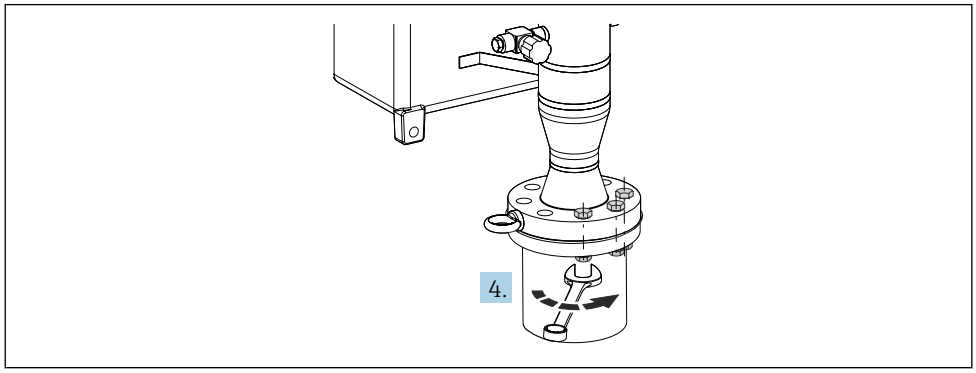
Start the bolts insertion through the flanges' holes and tighten them with the nuts by using a suitable wrench tool - but do not tighten them completely.

4.



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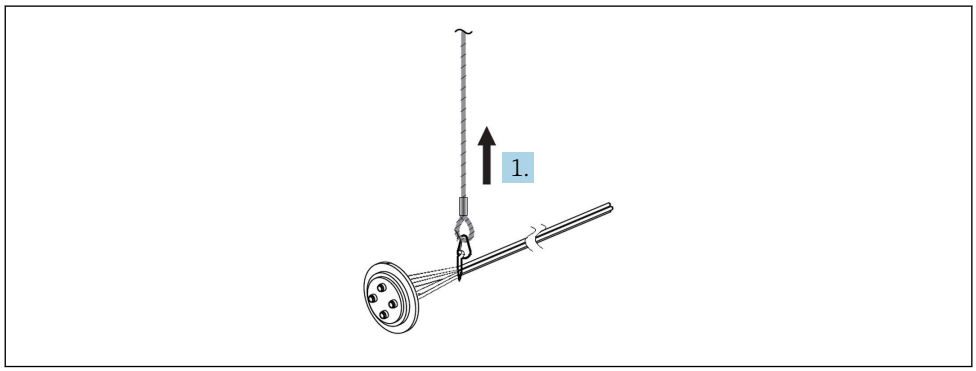
Complete the bolts insertion through the flanges' holes and tight them with the crossed method by means of an appropriate equipment (i.e. controlled tensioning according to the applicable standards).

5.2.2 Mounting in case of thermowell insert

Mounting sequence in case of sealring provided of thermowells

1.



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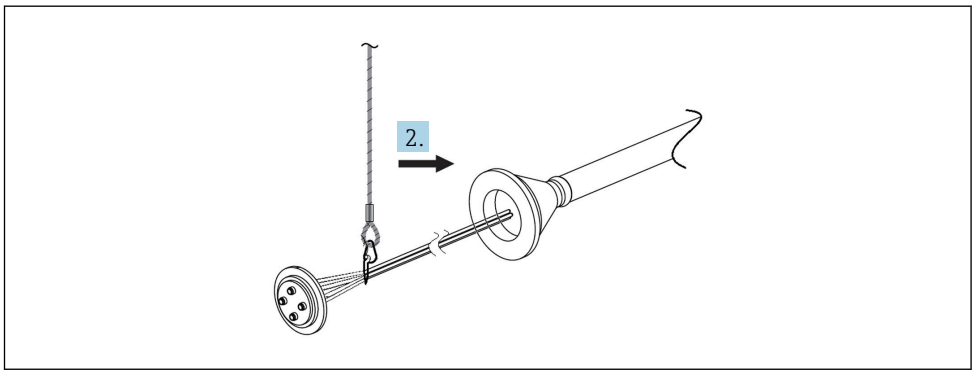
Lift up the sealring already provided of thermowells.

2.



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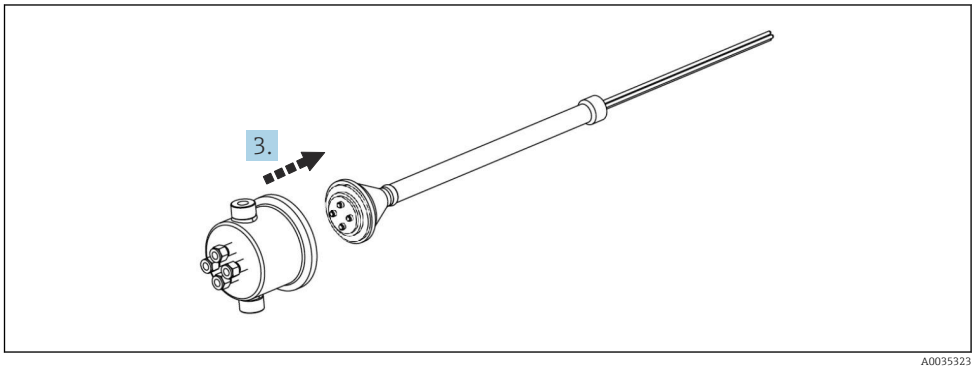
Insert the sealring and the thermowells in the “thermowell insert“ avoiding interlacing and deformation of the same. If necessary, complete the thermowells routing by adding additional thermowell parts till the desire lengths

3.



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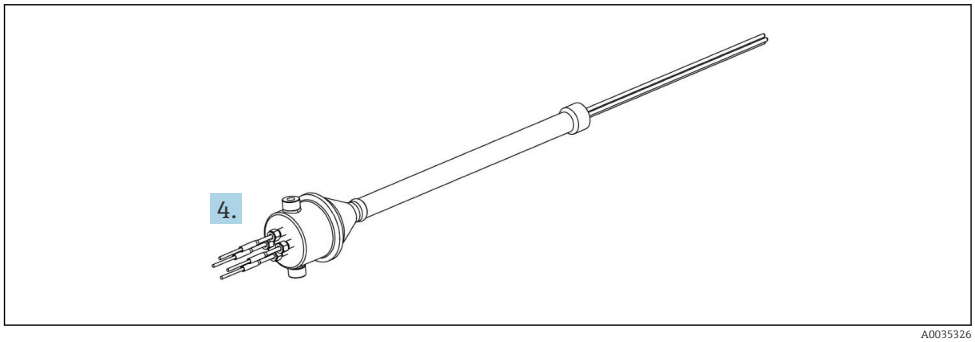
Couple the diagnostic chamber hub with the thermowell insert, after having checked the cleanliness of the sealring.

4.



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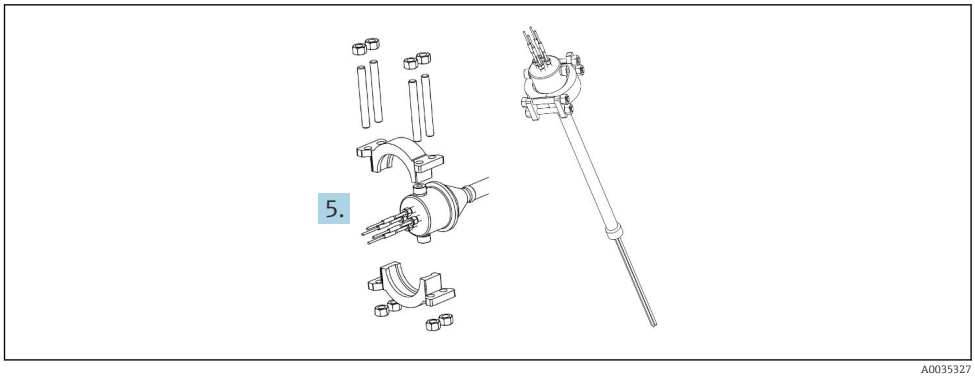
Insert the thermoelements in the compression fittings, having care to match the right TAG with the right position. Refer to the technical drawings.

5.



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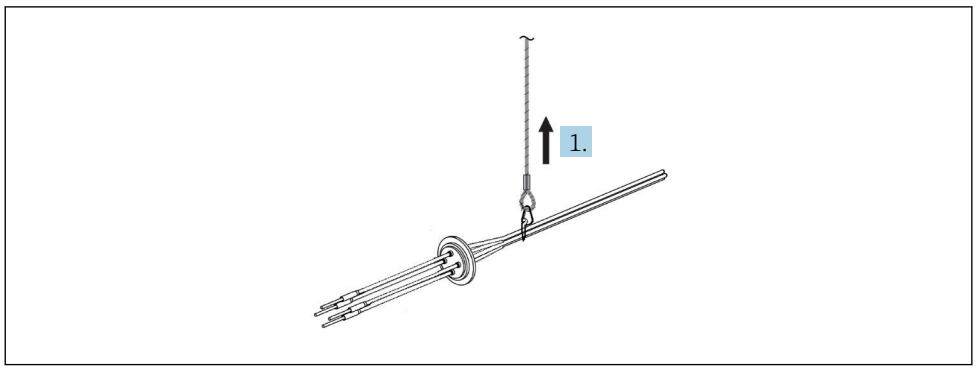
Mount the clamp and then screw the compression fittings.

Mounting sequence in case of sealring already provided of thermoelements

1.



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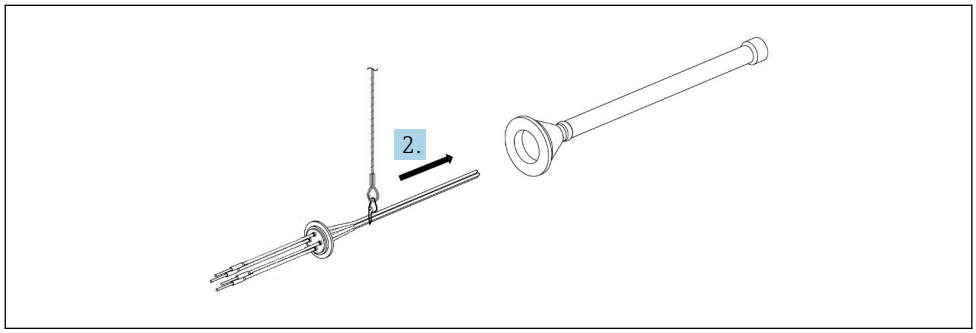
Lift up the sealring already provided of sensors.

2.



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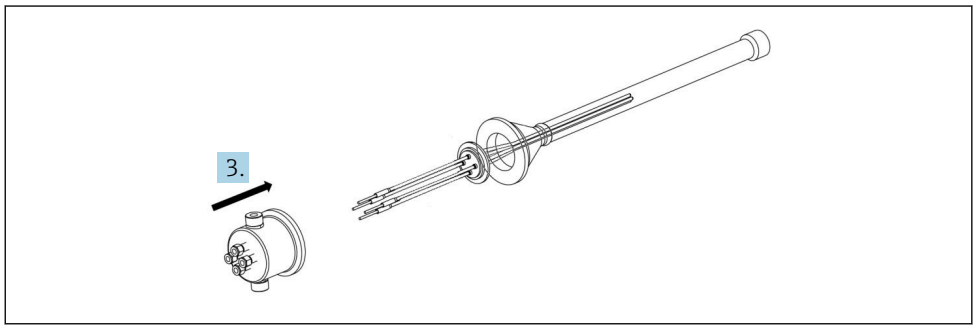
Insert the sensors in the “thermowell insert” avoiding interlacing and deformation of the same.

3.



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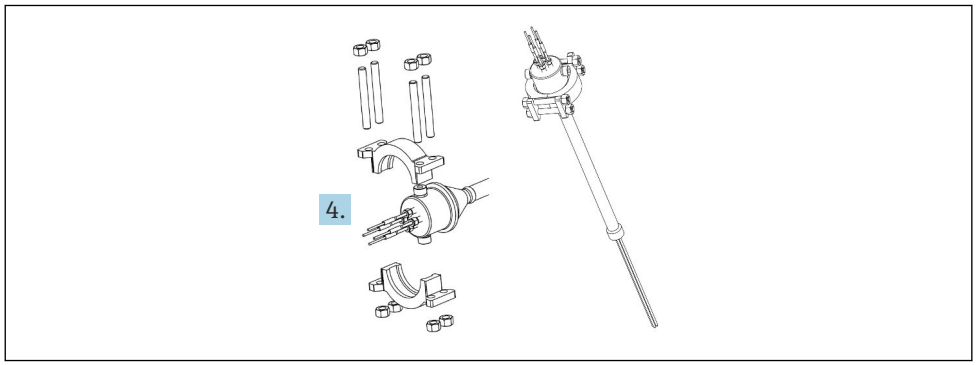
Couple the chamber hub with the rest of the MultiSens system.

4.



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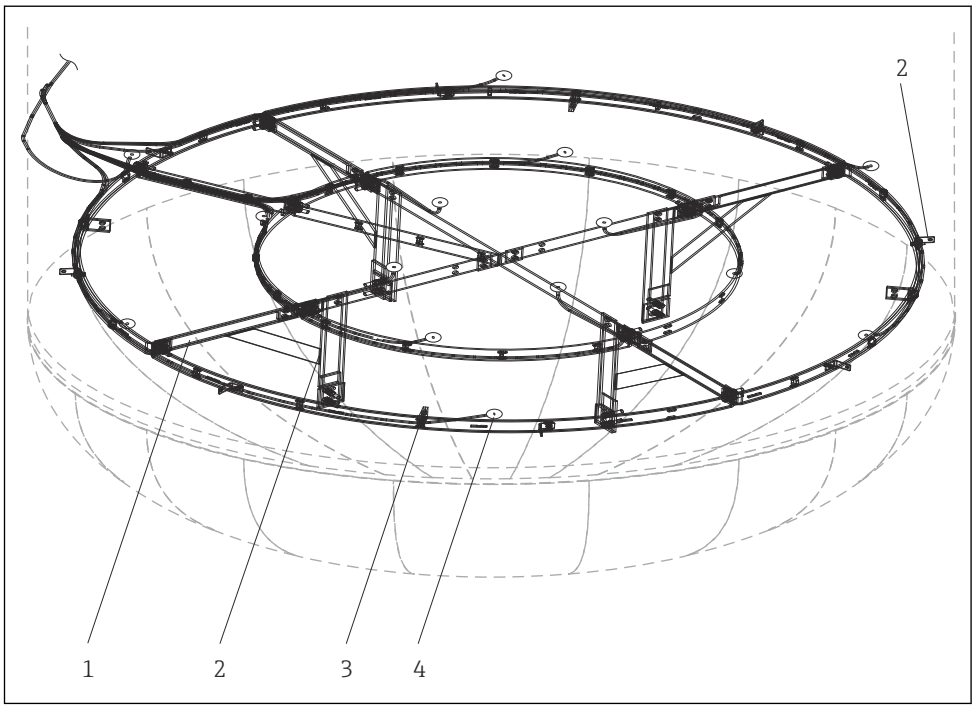
Mount the clamp and then screw the compression fittings.

5.2.3 Finishing the mounting

The following instructions have to be followed for the proper installation of the device:

1.

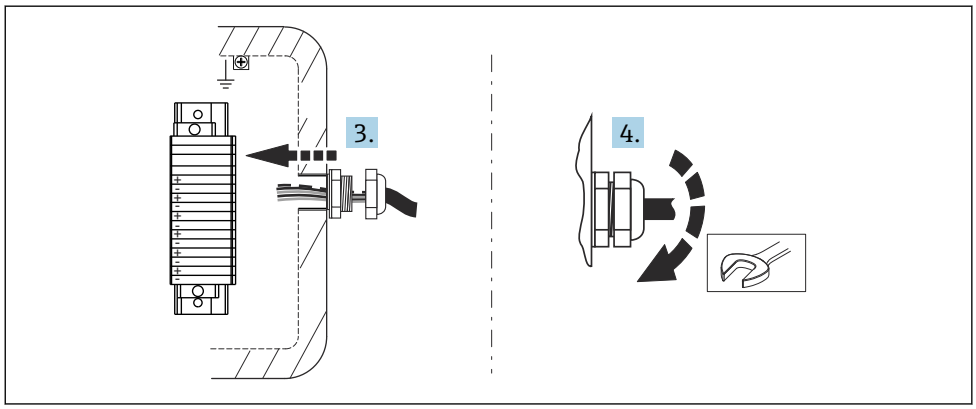


1 Support frame
2 Fixing bar
3 Fixing clip
4 Inserts or protecting thermowells tip

A) For 3D installation fix all the inserts or thermowells to the support structures (frame, bars, clips and all the accessories foreseen) according to drawings starting from the tip fixing and bending the rest along its length. When the complete path is defined, **permanently** fix the inserts or thermowells from the nozzle to the tip having the chance to leave the extra-length close to the measuring point by means of U or Ω curves (when necessary). Remark: Bend each probe with a minimum radius of 5 times its external diameter and fix it to the pre-mounted structures inside the reactor by means of clips, tie wraps or welding it.

2. B) When installing in an existing thermowell, it is recommended to perform an internal inspection of the thermowell. Check if there is any obstacle, with the aim of making an easy insertion. While installing the measurement system, avoid any friction during installation, specifically avoid sparks generation. Ensure that the thermal contact between the tip end of the inserts and the existing thermowell wall is guaranteed. When accessories such as spacers and/or centered rods are provided, make sure that no distortions can occur and that the original geometry is maintained.

3.



After having opened the lid of the junction box, introduce the extension or compensating cables through the respective cable glands in the junction box.

4. Tighten the cable glands on the junction box.
5. Connect the compensating cables to the terminals or temperature transmitters inside the junction box following the wiring instruction provided, ensuring the right matching between the cable tag numbers and the terminals tag numbers.
6. Close the lid ensuring the right gasket position to avoid any impact on the IP degree of protection and set the draining valve in the right position (for humidity condensation control).

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 by applying the proper torque.
- ▶ Check for correct wiring, test the electrical continuity of the thermocouples (warming up the thermocouple hot junction, 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)?	❑
Do the ambient conditions match the device specification? For example: ▪ Ambient temperature ▪ Proper conditions	❑
Are the threaded components undeformed?	❑
Are the gaskets not permanently deformed?	❑
Installation	
Is the equipment aligned with the nozzle axis?	❑
Are the gasket seats of flanges clean?	❑
Is the coupling between the flange and its counter flange reached?	❑
Are the thermoelements not interlaced and undeformed?	❑
Are the bolts completely inserted in the flange? Make sure the flange is completely attached to the nozzle.	❑

Are the thermoelements fixed to the support structures? → 🖹 18	❑
Are the cable glands tightened on the extension cables?	❑
Are the extension cables connected to the junction box terminals?	❑
Is the thermal contact between the inserts and the existing thermowell reached?	❑
Are the extension cable protections (when ordered) properly assembled and closed?	❑

6 Wiring

⚠ CAUTION

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

- ▶ Switch off power supply before installing or connecting the device.
- ▶ When installing 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 Instructions 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
5. On completion of the wiring, tighten the screw terminals. Tighten the cable glands again. Close the housing cover.
6. Before commissioning, ensure you follow the instructions provided in the checklist for the "Post-connection check"! → 🖹 27

6.1 Quick wiring guide

Terminal assignment

NOTICE

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

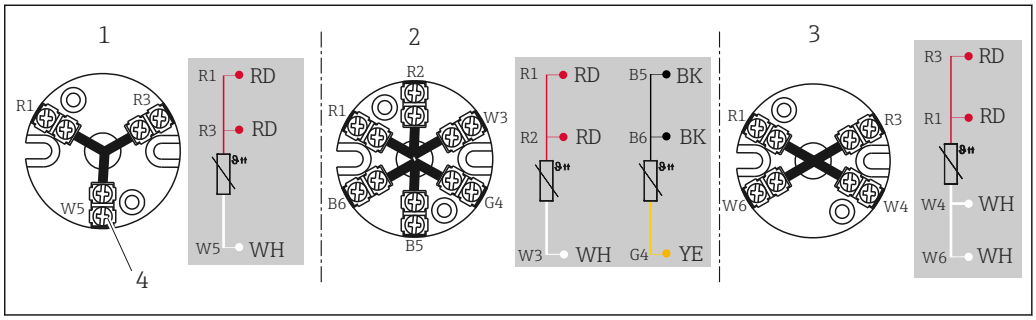
- ▶ Take measures to protect the terminals from electrostatic discharge.

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.

6.2 Wiring diagrams

6.2.1 RTD sensor connection type



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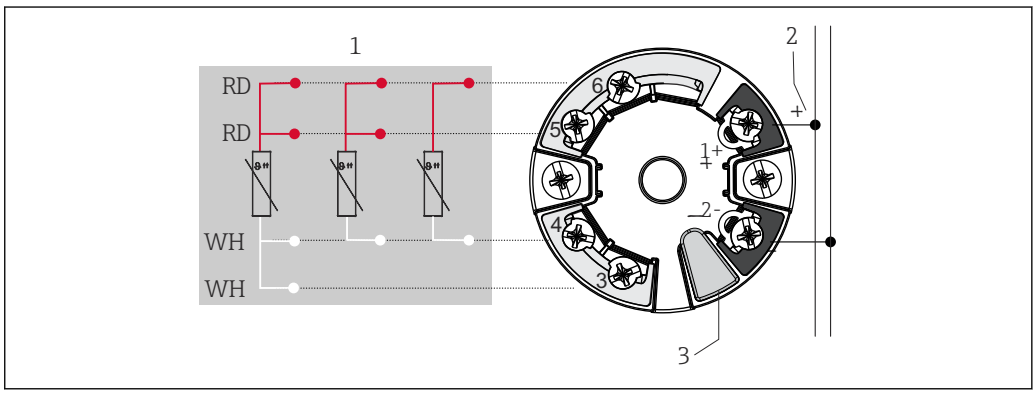
1 *Mounted terminal block*

1 *3-wire, single*
2 *2 x 3-wire, single*
3 *4-wire, single*
4 *Outside screw*



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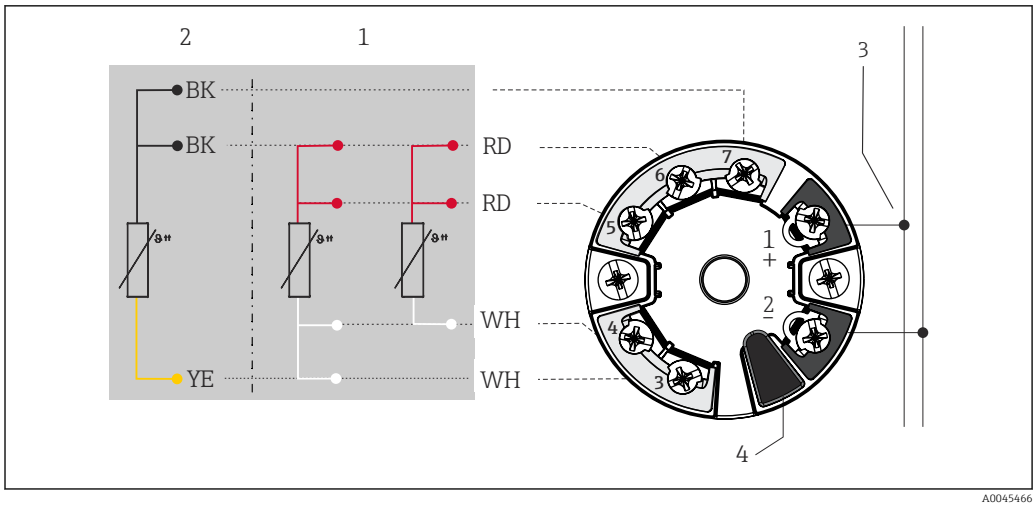
2 *Head mounted transmitter TMT7x or TMT31 (single input)*

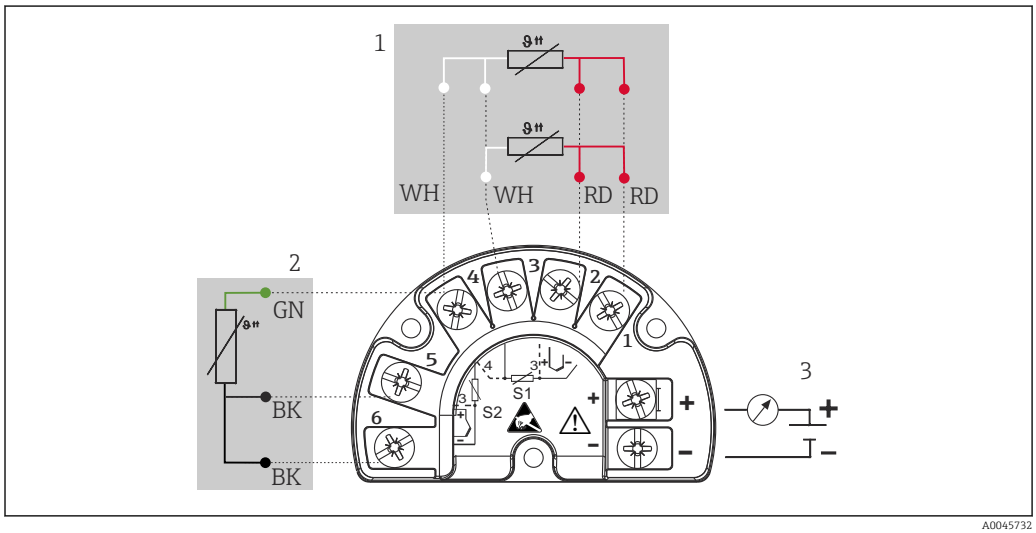
1 *Sensor input, RTD and Ω: 4-, 3- and 2-wire*
2 *Power supply or fieldbus connection*
3 *Display connection/CDI interface*



3 *Head mounted transmitter TMT8x (dual input)*

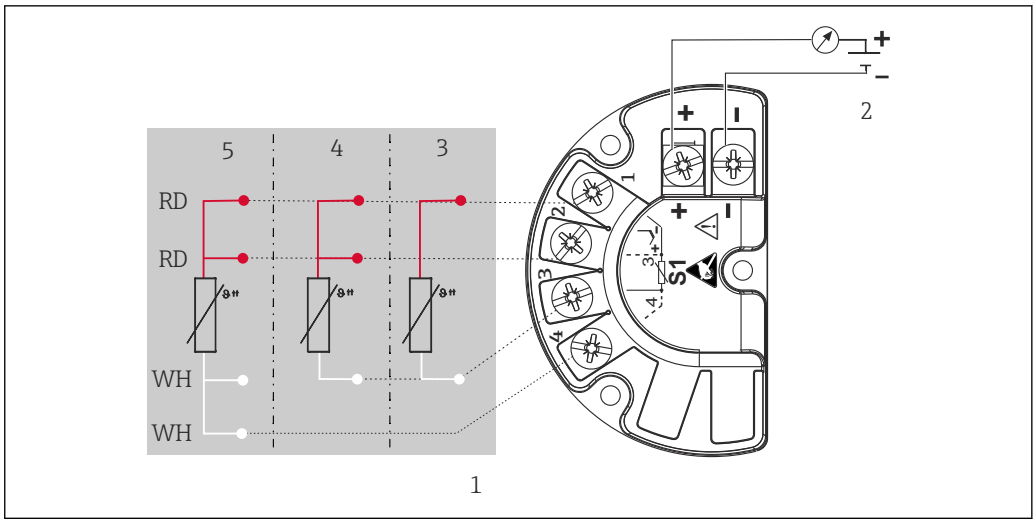
1 *Sensor input 1, RTD: 4- and 3-wire*
2 *Sensor input 2, RTD: 3-wire*
3 *Power supply or fieldbus connection*
4 *Display connection*

Mounted field transmitter: Fitted with screw terminals



4 *TMT162 (dual input)*

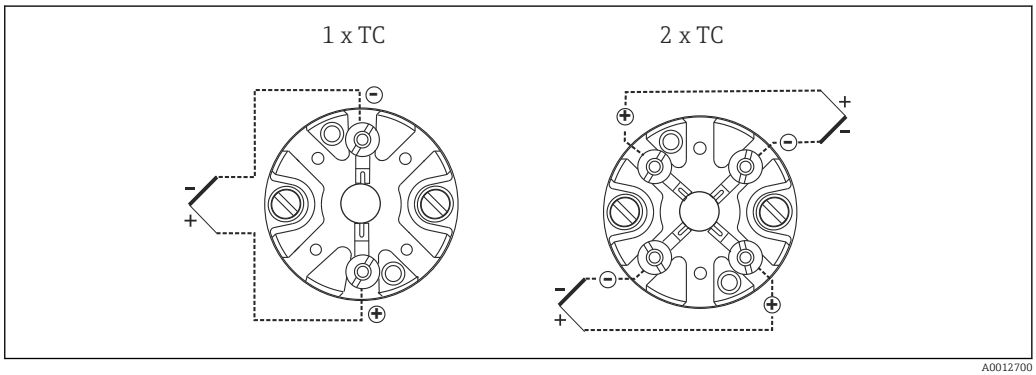
1 *Sensor input 1, RTD: 3- and 4-wire*
2 *Sensor input 2, RTD: 3-wire*
3 *Power supply, field transmitter and analog output 4 to 20 mA or fieldbus connection*



5 *TMT142B (single input)*

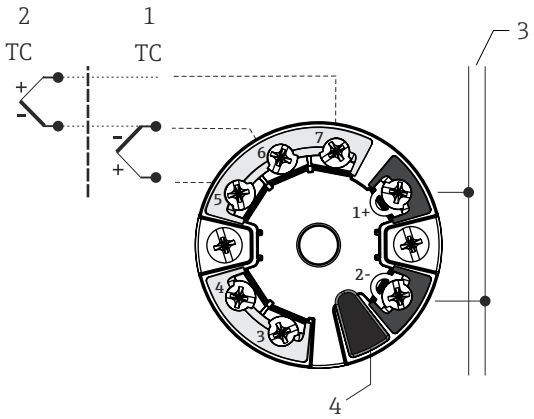
1 *Sensor input RTD*
2 *Power supply, field transmitter and analog output 4 to 20 mA, HART® signal*
3 *2-wire*
4 *3-wire*
5 *4-wire*

6.2.2 Thermocouple (TC) sensor connection type



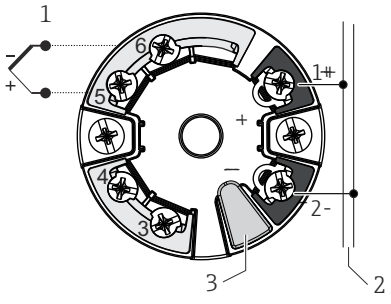
6 *Mounted terminal block*

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



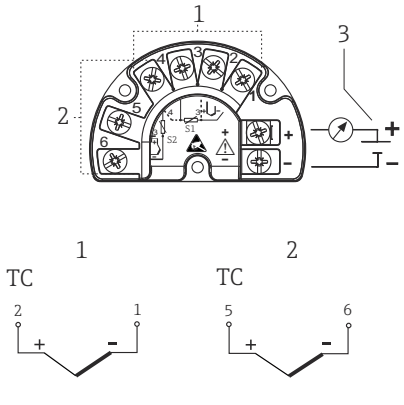
1 Sensor input 1
2 Sensor input 2
3 Fieldbus communication and power supply
4 Display connection

Head mounted transmitter TMT7x (single input) [1)]



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

Mounted field transmitter TMT162 or TMT142B



1 Sensor input 1
2 Sensor input 2 (not TMT142B)
3 Supply voltage for field transmitter and analog output 4 to 20 mA or fieldbus communication

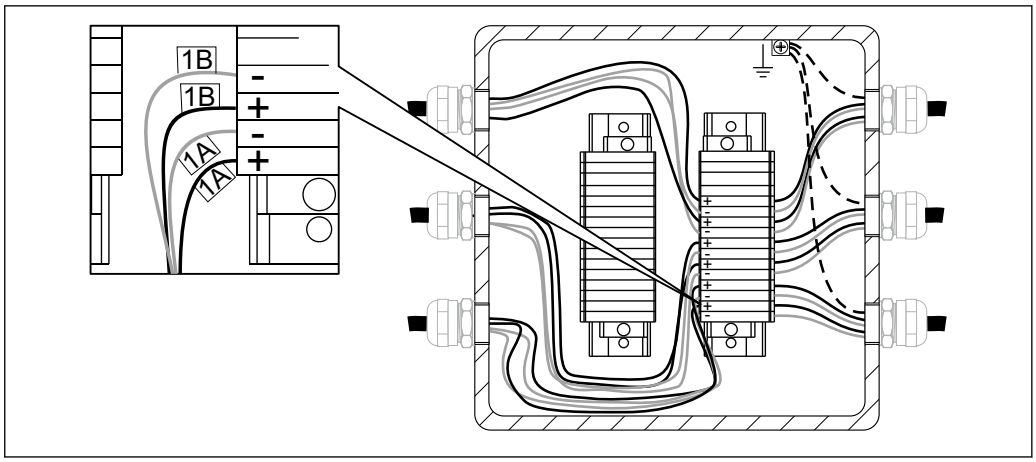
1) Fitted with spring terminals if screw terminals are not explicitly selected or a dual sensor is installed.

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 (-)

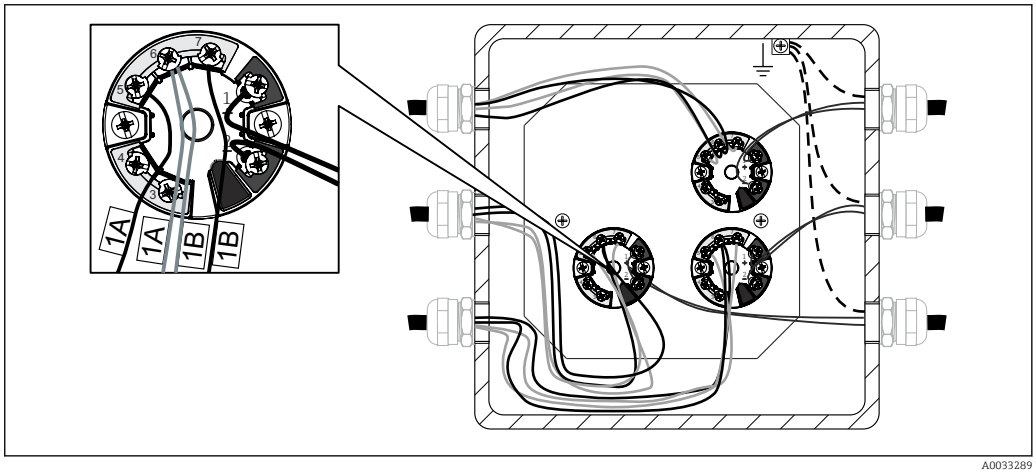
6.3 Connecting the sensor wires

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



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

The wiring is done in consecutive order, 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 numbered throughout the insert, starting with 1. When using dual sensors (2x Pt100 or 2x TC), 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 1.



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

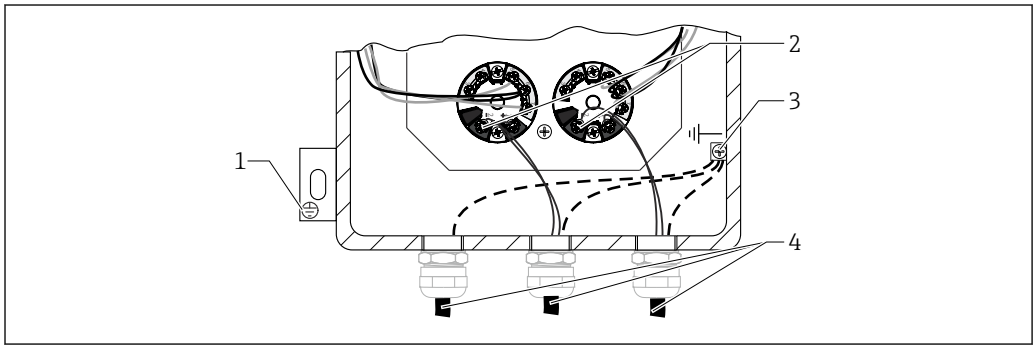
Sensor type	Transmitter type	Wiring rule
1 x RTD or TC	▪ Single input (one channel) ▪ Dual input (two channels) ▪ Multi-channel input (8 channels)	▪ 1 Head transmitter per insert ▪ 1 Head transmitter for 2 inserts ▪ 1 Multi-channel transmitter for 8 inserts
2 x RTD or TC	▪ Single input (one channel) ▪ Dual input (two channels) ▪ Multi-channel input (8 channels)	▪ Not available, wiring excluded ▪ 1 Head transmitter per insert ▪ 1 Multi-channel transmitter for 4 inserts

6.4 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 mm² (14 AWG) for screw terminals
  - Max. 1.5 mm² (16 AWG) for spring terminals

Always observe the general procedure on → 20.



9 *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*

6.5 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.

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

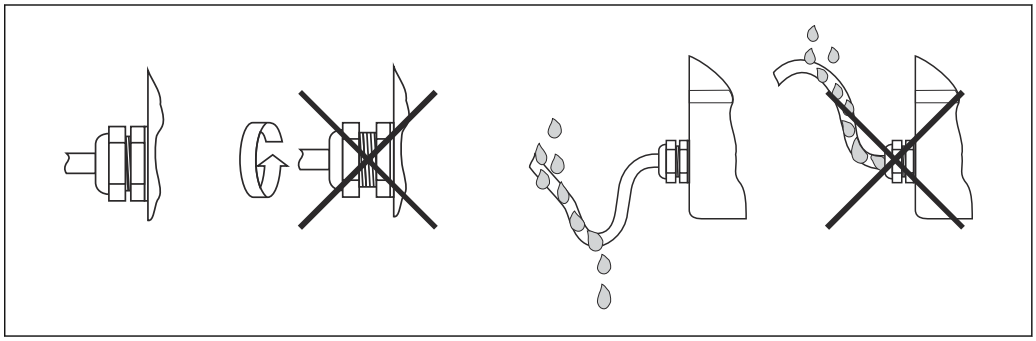
If the shielding of the cable is grounded at more than one point in systems without potential matching, power supply frequency equalizing currents can occur that damage the signal cable or have a serious effect on signal transmission.

- ▶ 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!

6.6 Ensuring the degree of protection

The device fulfils the IP 66 degree of protection. In order to fulfil the degree of protection after installation or service, the following points must be taken into consideration:
→ 10, 27

- 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 the 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.



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10 Connection hints to maintain IP protection

6.7 Post-connection check

Is the device undamaged (internal equipment inspection)?	❑
Electrical connection	
Does the supply voltage match the specifications on the nameplate?	❑
Do the mounted cables have suitable strain relief?	❑
Are the power supply and signal cables correctly connected? → 🖹 20	❑
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 housing covers installed and securely tightened?	❑
Does the marking of the terminals and cables match?	❑
Is the electrical continuity of the thermocouple 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
- "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 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

For electronic, always start troubleshooting with the checklists available in the related operating manuals. The checklists take you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

For the complete temperature device, please refer to the following instruction.

The diagnostic chamber allows MultiSens TMS02 behavior monitoring in any working conditions (with or without fluids in the chamber). The processing of the measured data and the information from the chamber can be used to evaluate the measurement accuracy, the remaining operating life and the maintenance plan. Two different diagnostic approaches are used:

Self customer diagnosis:

1. Monitoring and recording of the pressure sequence in the diagnostic chamber since startup.
2. Compare the detected Chamber Pressure (Cp) with the partial process Hydrogen pressure (Hp).
3. In case of Cp<=Hp, the physical permeation is occurring, no maintenance actions are needed.
4. In case of Cp>Hp, physical hydrogen permeation and leakages from the process to the chamber are occurring, maintenance have to be planned. The chamber is safely containing the fluids by being designed according to the process design conditions.

Advanced diagnosis:

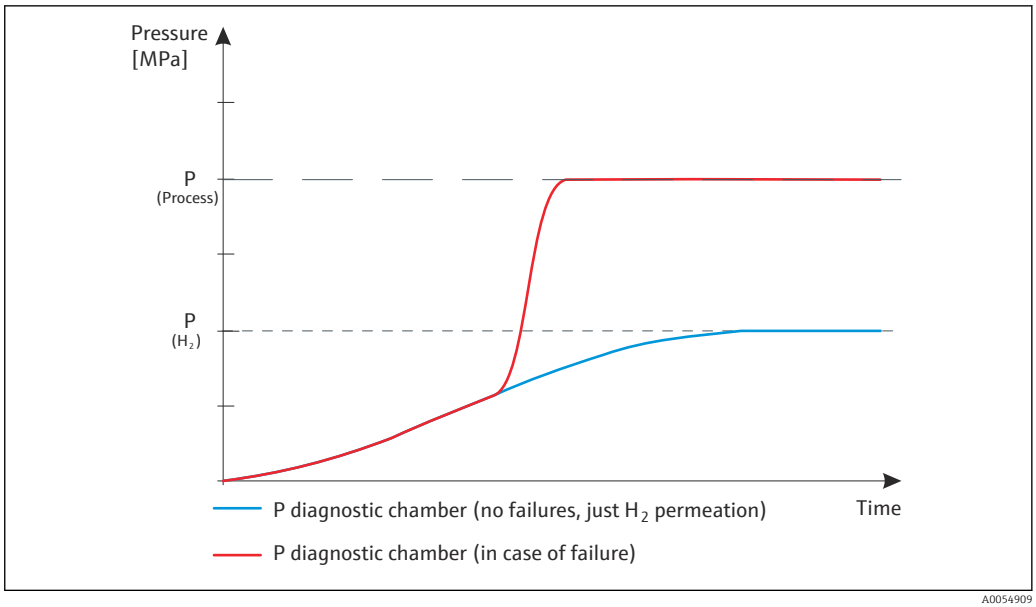
1. Monitoring and recording of the pressure sequence in the diagnostic chamber since startup.
2. Compare the detected Chamber Pressure (Cp) with the partial process Hydrogen pressure (Hp).
3. In case of Cp<=Hp, the physical permeation is occurring, no maintenance actions are needed.
4. In case of Cp>Hp, physical hydrogen permeation and leakages from the process to the chamber are occurring, maintenance have to be planned. The chamber is safely containing the fluids by being designed according to the process design conditions. Endress+Hauser shall be informed to be able to analyze the reasons of the pressure threshold exceeding and to suggest focused actions. Close cooperation with the manufacturer is necessary to exchange process and system information. This includes the chemical composition of the fluid contained in the chamber and the temperature pattern, for example.

Pressurization of the diagnostic chamber may be caused by permeation, or process leakages that can occur through:

- Insert sheath
- Welding seams between inserts and chamber disk
- Thermowells

The fluids contained inside the chamber can be sampled on site by a E+H portable system, and analyzed between E+H and the customer.

The permeation phenomena can be quantitatively analyzed by comparing the theoretical Fick's law with the recorded data to analyze the ongoing multipoint operating conditions.



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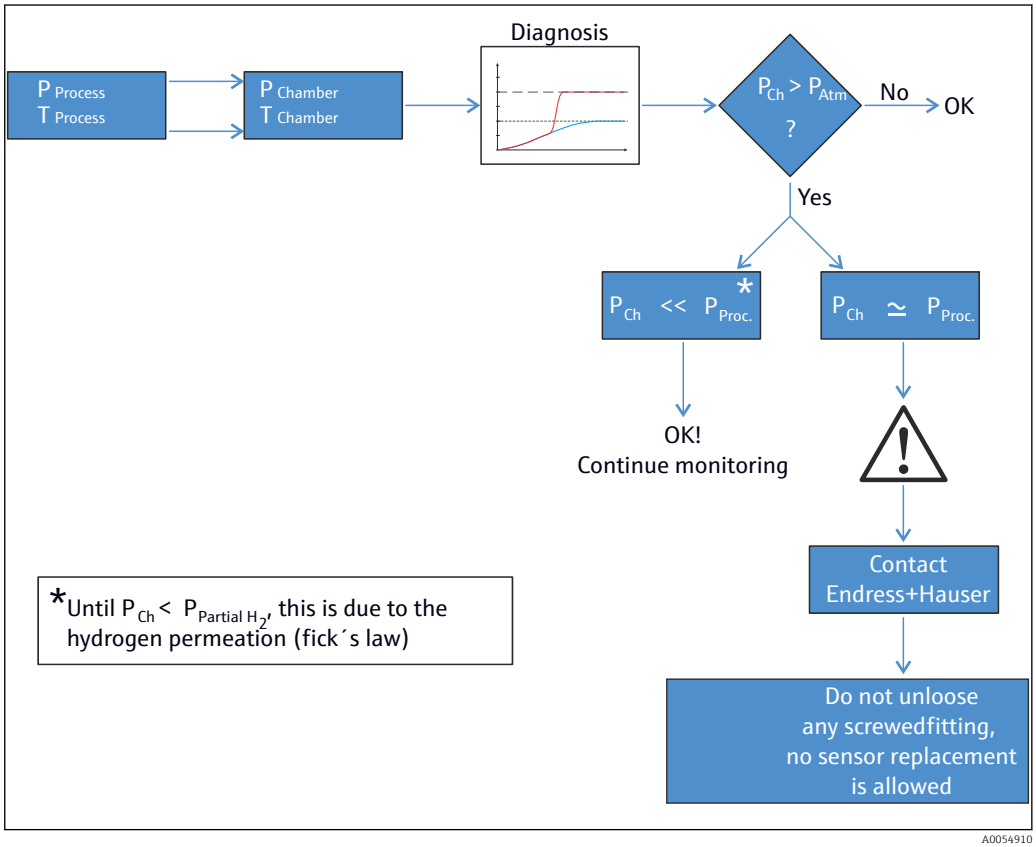

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NOTICE

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' → 34.

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

- Follow the checklist in 'Post-mounting check' section → 13
- Follow the checklist in 'Post-connection check' section → 20

If transmitters are used, please refer to the documentation of the transmitter installed for diagnostic and troubleshooting procedures → 54.

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

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

If ordering spare parts, please specify the serial number of the device!

9.2.1 Design without protecting thermowells

Spare parts of the Multipoint thermometer assembly are:

"Basic" design

- Complete junction box
- Temperature transmitter
- Electrical connection
- DIN rail
- Plate for electric terminals
- Cable gland
- Sealing sleeve for cable gland
- Adapter for cable gland
- Support frame (complete)
- Parts of support frame
- Junction box support system

"Advanced" design

- Complete junction box
- Temperature transmitter
- Electrical connection
- DIN rail
- Plate for electric terminals
- Cable gland
- Sealing sleeve for cable gland
- Adapter for cable gland
- Sensor stump + Extension cables
- Nut for compression fitting
- Support frame (complete)
- Plates for support frame
- Junction box support system

9.2.2 Design with protecting thermowells

Spare parts of the Multipoint thermometer assembly are:

"Advanced" design

- Complete junction box
- Temperature transmitter
- Electrical connection
- DIN rail
- Plate for electric terminals
- Cable gland
- Sealing sleeve for cable gland
- Adapter for cable gland
- Sensor (complete)
- Nut for compression fitting
- Support frame (complete)
- Back ferrule for compression fitting
- Plates for support frame
- Junction box support system

"Advanced and modular" design

- Complete junction box
- Temperature transmitter
- Electrical connection
- DIN rail
- Plate for electric terminals
- Cable gland
- Sealing sleeve for cable gland
- Adapter for cable gland
- Sensor (complete)
- Nut for compression fitting
- Back ferrule for compression fitting
- Disc + guiding tubes bundle
- Disc + thermowell bundle

The following accessories can be selected (when replaceable) independently from the product configuration:

- Pressure transmitter
- Pressure manometer
- Assembly
- Manifolds
- Valves
- Purging systems
- Portable sampling system

9.3 Endress+Hauser services

Service	Description
Certificates	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 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.

Service	Description
Mounting	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: ▪ Penetrant testing according to ASME V Art. 6, UNI EN 571-1 and ASME VIII Div. 1 App 8 Standards ▪ PMI test according to ASTM E 572 ▪ HE test according to EN 13185 / EN 1779 ▪ Radiographic testing according to ASME V Art. 2, Art. 22 and ISO 17363-1 (requirements and methods) and ASME VIII Div. 1 and ISO 5817 (acceptance criteria). Thickness up to 30 mm ▪ Hydrostatic test according to the PED Directive, EN 13445-5 and harmonized ▪ Ultrasonic test available by qualified external partners according to ASME V Art. 4.

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/support/return-material
   ↳ Select the region.
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 offers 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.

⚠ WARNING

Danger to persons from process conditions!

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

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

9.5.3 Battery disposal

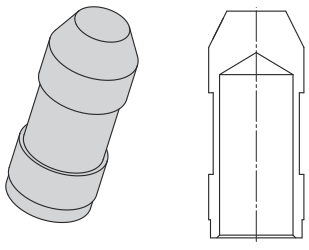
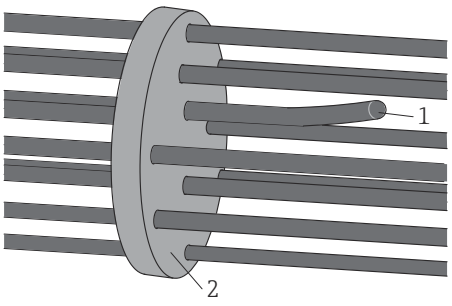
Dispose of batteries according to local regulations.

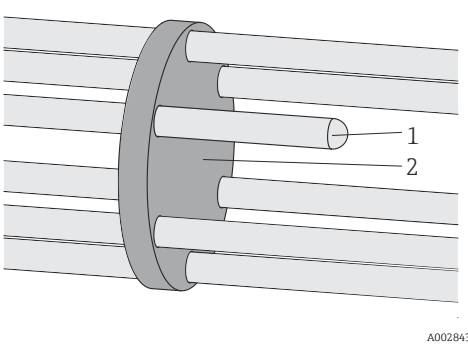
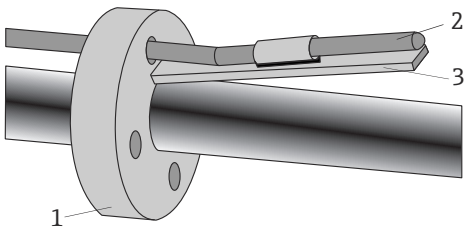
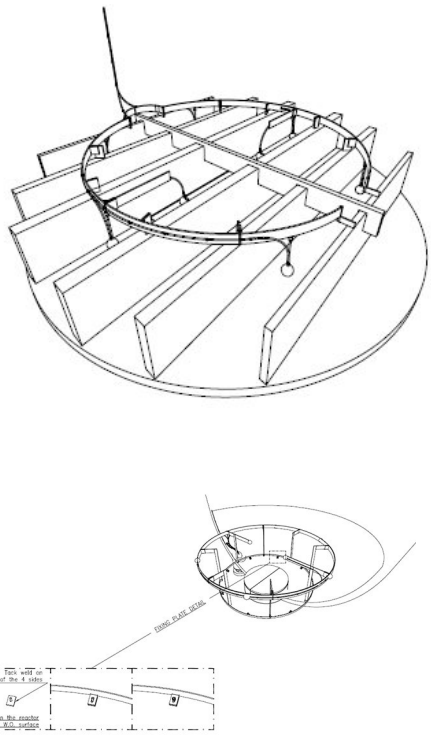
10 Accessories

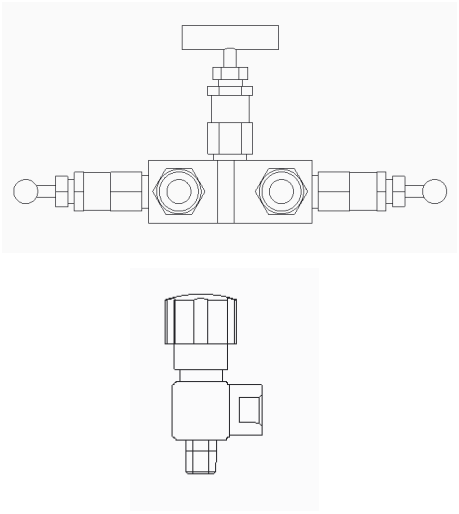
The accessories currently available for the product can be selected at www.endress.com:

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
Tip end  A0028427	Terminal closure welded at the tip end of the probe in order to protect the insert from aggressive process conditions, to facilitate attachment by means of metallic tie wraps and to ensure proper thermal contact.
Thermal contact system	
Insert and spacers  A0033485 *1 Insert* *2 Spacer*	▪ Used on straight configurations and existing thermowells for axial centering of the insert bundle ▪ Prevent the twisting of the inserts ▪ Give flexural stiffness to the sensor bundle

Accessories	Description
Thermowells and spacers  A0028434 *1 Thermowell* *2 Spacer*	
Bimetal strips  A0028435 *11 Bimetal strips with or without guiding tubes* *1 Guiding tube* *2 Insert* *3 Bimetal strips*	▪ Used on straight configurations and inside existing thermowells ▪ The inserts are replaceable ▪ Guarantee thermal contact between the sensor tip and the thermowell by means of bimetallic strips that are activated by the temperature difference ▪ No friction during installation even with sensors already installed
 A0034864 Frame	Support structure that keeps the thermocouples fixed along the defined routing.

Accessories	Description
Tags	Nameplate can be applied to identify each measuring point and the whole assembly. Tags can be placed on the extension cables in the extension area and/or in the junction box on individual wires.
Diagnostic chamber	
Pressure transmitter	Digital or analog pressure transmitter with welded metal sensor for measurement in gases, steam or liquids. Refer to the Endress+Hauser PMP sensor family
 Fitting/manifolds/valves	Fitting, manifolds and valves are available for the installation of the pressure transmitter on the system body, and thus allow the continuous monitoring of the device under operating conditions. Used also to vent out any gas/liquids.
Purging system	A purging system for the depressurization of the diagnostic chamber. The system consists of: ▪ 2- and 3-way trunnion valves ▪ Pressure transmitter ▪ Two-way pressure relief valves The system enables the connection of multiple number of diagnostic chambers installed in the same reactor.
Portable sampling system	A portable field system that allows sampling of the fluid inside the diagnostic chamber so that the sample can be chemically analyzed in an external laboratory. The system consists of: ▪ Three cylinders ▪ Pressure regulator ▪ Rigid and flexible tubes ▪ Vent lines ▪ Quick connectors and valves

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	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all necessary data to identify the optimum measuring 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 ▪ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant 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 device information is available for every device during the entire life cycle, such as device status, device-specific documentation, spare parts etc. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
FieldCare	FDT-based plant asset management tool from Endress+Hauser. FieldCare can configure all smart field devices in your system and help you manage these devices. 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 BA00059S

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) Type K (NiCr-Ni) Type N (NiCrSi-NiSi)	−40 to +720 °C (−40 to +1 328 °F) −40 to +1 150 °C (−40 to +2 102 °F) −40 to +1 100 °C (−40 to +2 012 °F)
	Internal cold junction (Pt100) Accuracy of cold junction: ± 1 K Max. sensor resistance 10 kΩ:	
Thermocouples (TC) - flying leads - as per IEC 60584 and ASTM E230	Type J (Fe-CuNi) Type K (NiCr-Ni) Type N (NiCrSi-NiSi)	−40 to +720 °C (−40 to +1 328 °F), typical sensitivity above 0 °C ≈ 55 µV/K −40 to +1 150 °C (−40 to +2 102 °F) [1], typical sensitivity above 0 °C ≈ 40 µV/K −40 to +1 100 °C (−40 to +2 012 °F), typical sensitivity above 0 °C ≈ 40 µV/K

1) Restricted by the material of the insert outer sheath

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 directly 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. Quick and easy operation, visualization and maintenance using universal configuration software such as FieldCare, DeviceCare or FieldCommunicator 375/475. More information can be found in the Technical Information.

PROFIBUS PA head transmitter
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. PROFIBUS PA functions and device-specific parameters are configured via fieldbus communication. For more information, see the Technical Information.

FOUNDATION fieldbus head transmitter
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. All transmitters are approved for use in all the main distributed control systems. The integration tests are performed in Endress+Hauser's 'System World'. For more information, see the Technical Information.

Head transmitter with PROFINET® and Ethernet-APL
The temperature 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 transmitter 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.

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 based on Callendar/Van Dusen coefficients

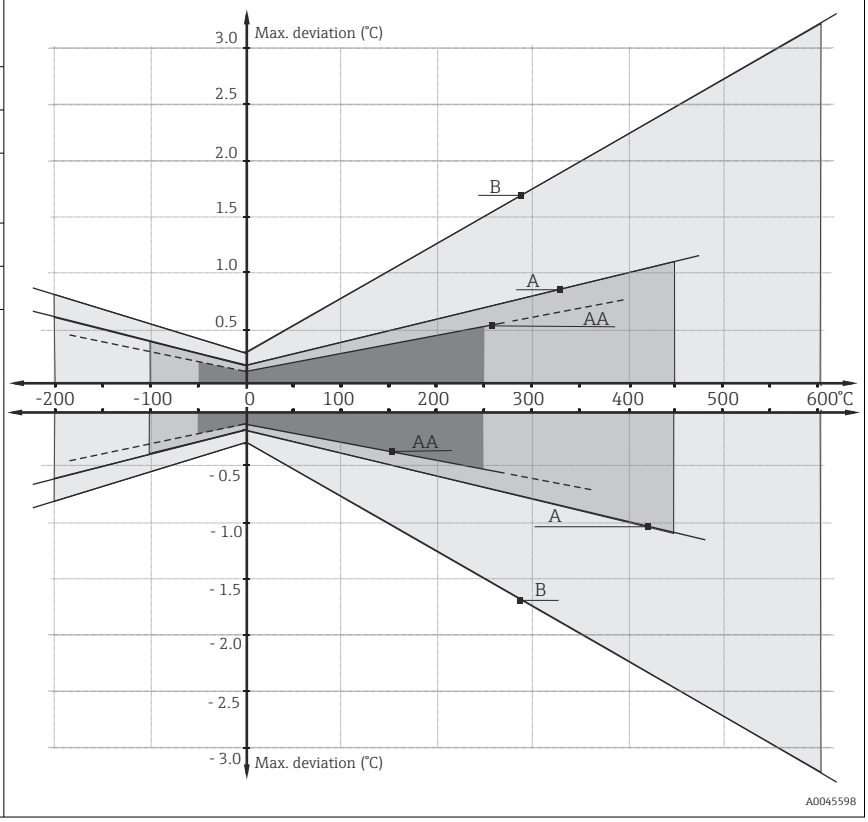
11.3 Performance characteristics

11.3.1 Accuracy

RTD resistance thermometer corresponding to IEC 60751

Class	Max. tolerances (°C)	
Cl. AA, formerly 1/3 Cl. B	± (0.1 + 0.0017 · |t| [1])	
Cl. A	± (0.15 + 0.002 · |t| [1])	
Cl. B	± (0.3 + 0.005 · |t| [1])	
Temperature ranges for compliance with the tolerance classes		
Wire-wound sensor (WW):	Cl. A	Cl. AA
	−100 to +450 °C	−50 to +250 °C
Thin-film version (TF):	Cl. A	Cl. AA
Standard	−30 to +300 °C	0 to +150 °C

Characteristics



1) |t| = Absolute temperature value in °C

To obtain the maximum tolerances in °F, multiply the results in °C 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	Model	Standard tolerance		Special tolerance	
IEC60584		Class	Deviation	Class	Deviation
	J (Fe-CuNi)	2	±2.5 °C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 750 °C)	1	±1.5 °C (−40 to 375 °C) ±0.004 |t| [1] (375 to 750 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	2	±2.5°C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 1200 °C)	1	±1.5°C (−40 to 375 °C) ±0.004 |t| [1] (375 to 1000 °C)

1) |t| = Absolute temperature value in °C

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.

Standard	Model	Standard tolerance	Special tolerance
ASTM E230/ANSI MC96.1		Deviation; the larger value applies in each case	
	J (Fe-CuNi)	±2.2 K or ±0.0075 |t| [1] (0 to 760 °C)	±1.1 K or ±0.004 |t| [1] (0 to 760 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	±2.2 K or ±0.02 |t| [1] (−200 to 0 °C) ±2.2 K or ±0.0075 |t| [1] (0 to 1 260 °C)	±1.1 K or ±0.004 |t| [1] (0 to 1 260 °C)

1) |t| = Absolute temperature value in °C

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.

11.3.2 Reaction time

Response time for the sensor assembly without transmitter. It refers to inserts in direct contact with the process. When thermowells are selected, a specific evaluation should be done.

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	Reaction time	
Mineral-insulated cable, 3 mm (0.12 in)	t_{50}	2 s
	t_{90}	5 s
StrongSens RTD insert, 6 mm (¼ in)	t_{50}	< 3.5 s
	t_{90}	< 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	Reaction time	
Grounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t_{50}	0.8 s
	t_{90}	2 s
Ungrounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t_{50}	1 s
	t_{90}	2.5 s
Grounded thermocouple 6 mm (¼ in)	t_{50}	2 s
	t_{90}	5 s
Ungrounded thermocouple 6 mm (¼ in)	t_{50}	2.5 s
	t_{90}	7 s
Grounded thermocouple 8 mm (0.31 in)	t_{50}	2.5 s
	t_{90}	5.5 s

Insert diameter	Reaction time	
Ungrounded thermocouple 8 mm (0.31 in)	t_{50}	3 s
	t_{90}	6 s

Cable sensor diameter (ProfileSens)	Reaction time	
8 mm (0.31 in)	t_{50}	2.4 s
	t_{90}	6.2 s
9.5 mm (0.37 in)	t_{50}	2.8 s
	t_{90}	7.5 s
12.7 mm (½ in)	t_{50}	3.8 s
	t_{90}	10.6 s

11.3.3 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

11.3.4 Calibration

Calibration is a service that can be performed on each individual insert, either during the multipoint production phase in the factory or after multipoint installation in the plant.

If calibration is to be performed after the multipoint is installed, please contact the Endress+Hauser service team for support. Together with the Endress+Hauser service team, any further measures can be arranged to complete the calibration of the target sensor. In any case, it is not permitted to unscrew any threaded component on the process connection under operating conditions (i.e. while the process is running).

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.

In the case of a multipoint cable sensor, temperature-controlled calibration baths from −80 to 550 °C (−112 to 1022 °F) can be used for a factory calibration or an accredited calibration for the last measuring point only (if NL-L_{MPx} < 100 mm (3.94 in)). Special boreholes in the calibration furnaces are used for factory calibration of the thermometers, which ensure even distribution of the temperature from 200 to 550 °C (392 to 1022 °F) on the corresponding section.

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 against a precise reference thermometer.

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 +100 °C (−58 to +212 °F)
With multi-channel transmitter	−40 to +80 °C (−40 to +176 °F)
With DIN rail transmitter	−40 to +100 °C (−40 to +212 °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

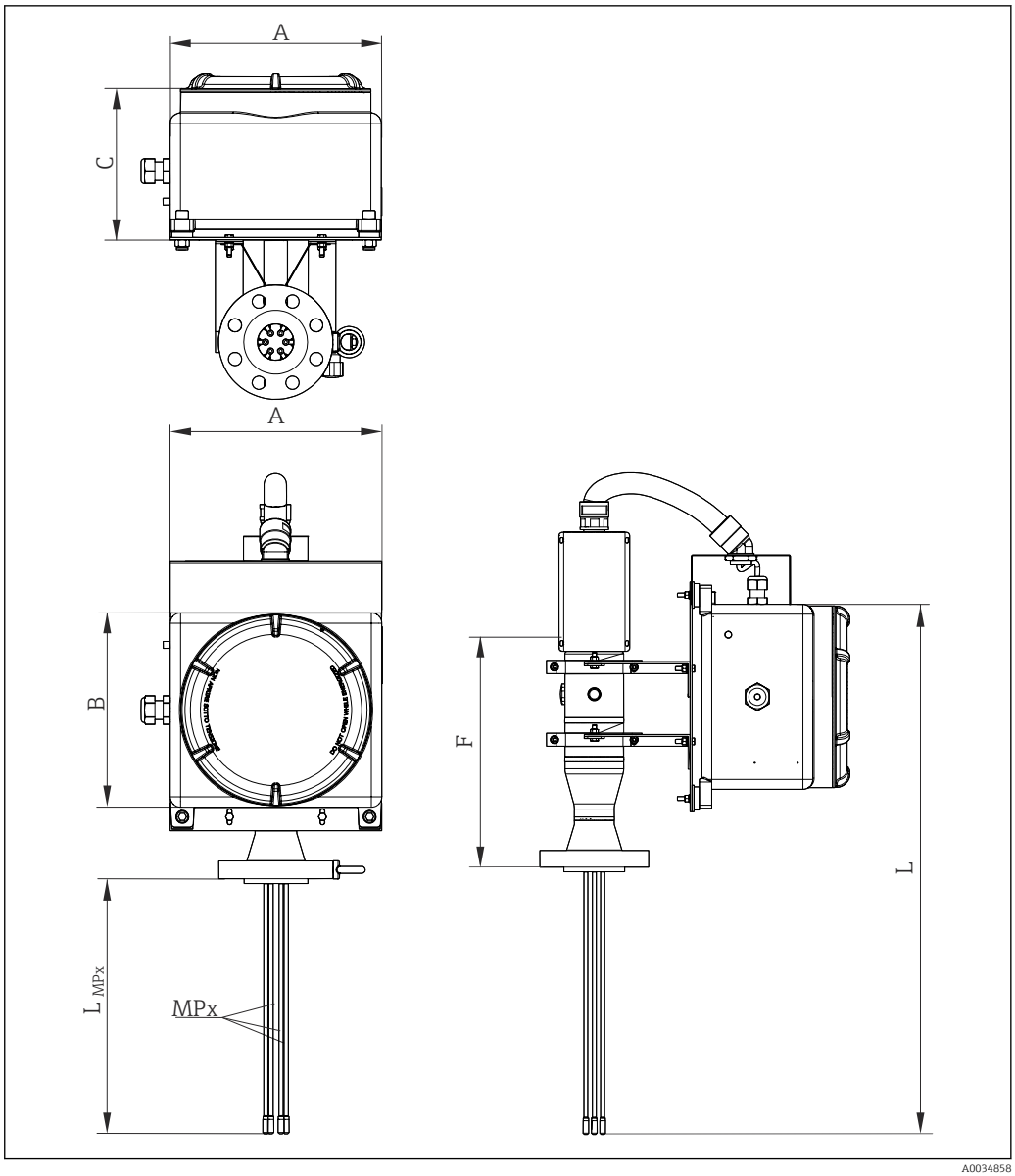
11.4.5 Electromagnetic compatibility (EMC)

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 multipoint assembly is composed of different subassemblies. Both linear and 3D configurations have the same features, dimensions and materials. Different inserts are available, based on specific process conditions, in order to have the highest accuracy and an extended lifetime. In addition, thermowells can be selected to further increase mechanical performance and corrosion resistance, and to allow insert replacement. Associated shielded extension cables are provided with high resistance sheath materials to withstand different environmental conditions and to ensure steady and noiseless signals. The transition between the inserts and the extension cable is achieved using specially sealed bushings, thus ensuring the specified IP degree of protection.


A
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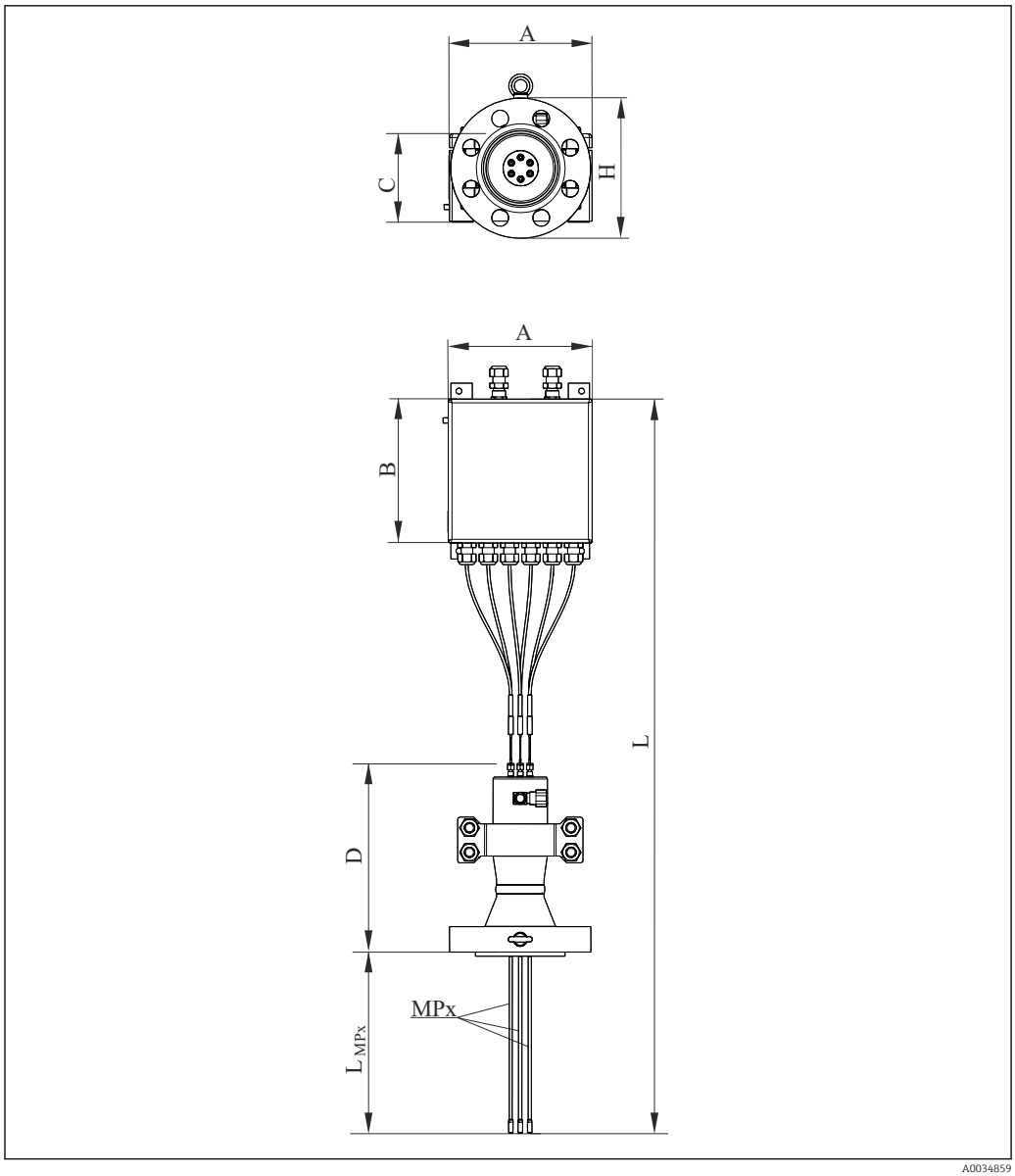
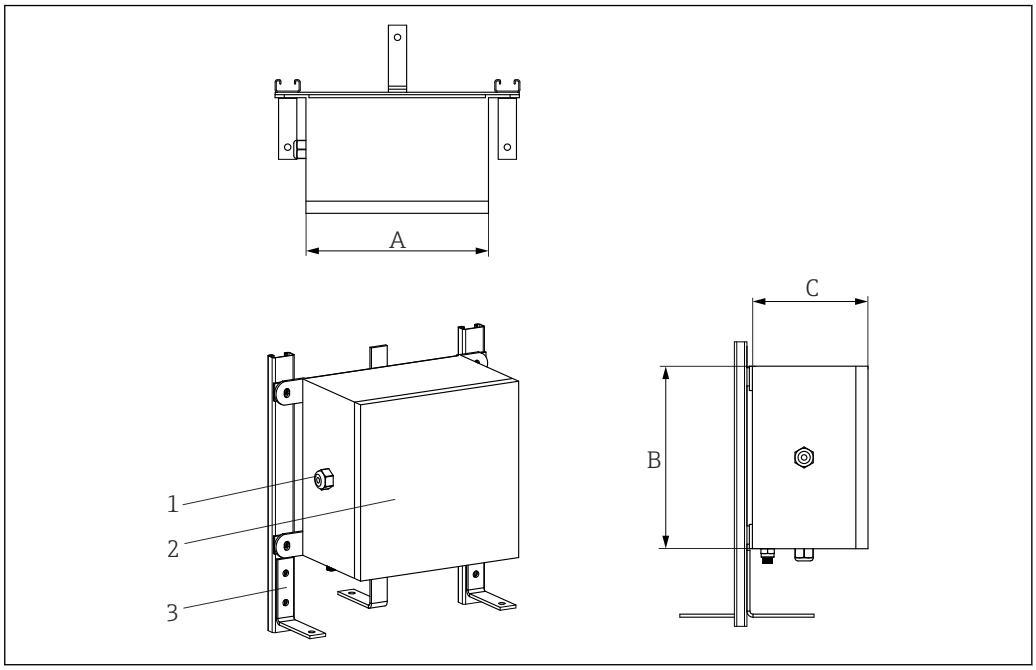


12 Design of the modular multipoint thermometer. All dimensions in mm (in)

A, B, Dimensions of the junction box, see following figure
C
D Diagnostic chamber length ~345 mm
F Diagnostic chamber and extension neck length ~600 mm
H Diameter of process connection
L_{MPx} Different immersion length of sensing elements or thermowells
L Overall device length
MPx Numbers and distribution of measuring points: MP1, MP2, MP3 etc.

Junction box



1 Cable glands
2 Junction box
3 Frame

The junction box is suited to environments where chemical agents are used. 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
Stainless steel	Min. setting	170 (6.7)	170 (6.7)	130 (5.1)
	Max.	500 (19.7)	500 (19.7)	240 (9.5)
Aluminum	Min. setting	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/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)
Device approvals	ATEX UL, FM, CSA approval for use in hazardous area	ATEX approval for use in hazardous area
Identification	ATEX II 2GD Ex e IIC/Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4 UL913 Class I, Division 1 Groups B,C,D T6/T5/T4 FM3610 Class I, Division 1 Groups B,C,D T6/T5/T4 CSA C22.2 No.157 Class I, Division 1 Groups B,C,D T6/T5/T4	→ 📄 49- According to the junction box approval

Type of specification	Junction box	Cable glands
Cover	Hinged and threaded	-
Maximum sealing diameter	-	6 to 12 mm (0.24 to 0.47 in)

Support frame

The modular frame is designed for integrated installation in different angular positions with respect to the system body.

It ensures the connection between the diagnostic chamber and the junction box. The design was developed to facilitate different installation options and to address potential obstacles and restrictions that are present in all plants. This includes the infrastructure of the reactor, for example, (platforms, load-bearing structures, support rails, stairs, etc.) and the thermal insulation of the reactor. The frame design ensures easy access for monitoring and maintaining inserts and extension cables. It provides a very firm (rigid) connection for the junction box and vibration loads. Designed without a closed housing, the frame protects the cables by means of the covers and the cable conduit of the junction box. On the one hand, this prevents residual substances and potentially hazardous fluids from the environment from accumulating and damaging the appliance, while ensuring continuous ventilation on the other.

Insert and thermowells

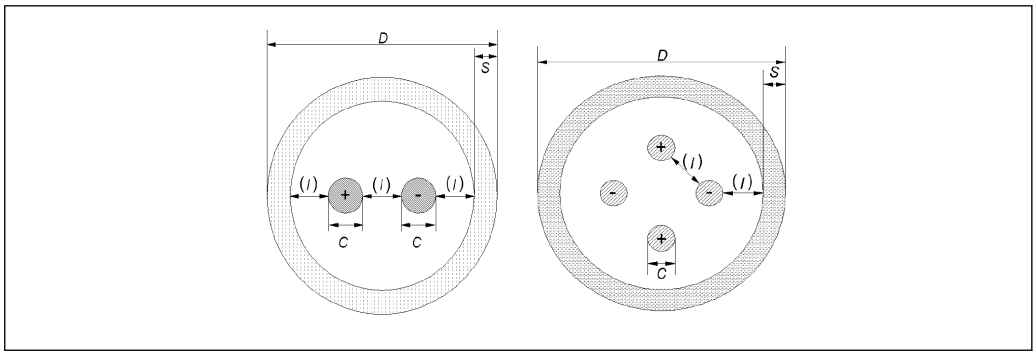
Different insert and thermowell types are available. For other requirements not described here, please contact the Endress+Hauser sales department.

Thermocouple

Diameter in mm (in)	Type	Standard	Sensor design	Sheath material
8 (0.31) 6 (0.23) 3 (0.12) 2 (0.08) 1.5 (0.06)	1x type K 2x type K 1x type J 2x type J 1x type N 2x type N	IEC 60584/ASTM E230	Grounded/ Ungrounded	Alloy 600/AISI 316L/ Pyrosil/321/347

Conductor thickness

Sensor type	Diameter in mm (in)	Wall	Min. sheath wall thickness	Min. conductor diameter (C)
Single Thermocouple	6 mm (0.23 in)	Heavy wall	0.6 mm (0.023 in)	0.90 mm = 19 AWG
Double thermocouple	6 mm (0.23 in)	Heavy wall	0.54 mm (0.021 in)	0.66 mm = 22 AWG
Single thermocouple	8 mm (0.31 in)	Heavy wall	0.8 mm (0.031 in)	1.20 mm = 17 AWG
Double thermocouple	8 mm (0.31 in)	Heavy wall	0.64 mm (0.025 in)	0.72 mm = 21 AWG
Single thermocouple	1.5 mm (0.05 in)	Standard	0.15 mm (0.005 in)	0.23 mm = 31 AWG
Double thermocouple	1.5 mm (0.05 in)	Standard	0.14 mm (0.005 in)	0.17 mm = 33 AWG
Single thermocouple	2 mm (0.07 in)	Standard	0.2 mm (0.007 in)	0.30 mm = 28 AWG
Double thermocouple	2 mm (0.07 in)	Standard	0.18 mm (0.007 in)	0.22 mm = 31 AWG
Single thermocouple	3 mm (0.11 in)	Standard	0.3 mm (0.01 in)	0.45 mm = 25 AWG
Double thermocouple	3 mm (0.11 in)	Standard	0.27 mm (0.01 in)	0.33 mm = 28 AWG



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RTD

Diameter in mm (in)	Type	Standard	Sheath material
3 (0.12) 6 (¼)	1x Pt100 WW/TF 1xPt100 WW/TF/StrongSens or 2xPt100 WW	IEC 60751	AISI 316L

Thermowells

External diameter in mm (in)	Sheath material	Type	Thickness in mm (in)
6 (0.24)	AISI 316L or AISI 321 or AISI 347 or Alloy 600	closed or open	1 (0.04) or 1.5 (0.06)
8 (0.32)	AISI 316L or AISI 321 or AISI 347 or Alloy 600	closed or open	1 (0.04) or 1.5 (0.06) or 2 (0.08)
10.24 (⅛)	AISI 316L or AISI 321 or AISI 347 or Alloy 600	closed or open	1.73 (0.06) (SCH. 40) or 2.41 (0.09) (SCH. 80)

Sealing components

The sealing components (compression fittings) are welded on the chamber head to guarantee proper tightness under all foreseen operating conditions and to allow the maintenance/replacement of the stump-insert (**advanced** solution without thermowells) or inserts (**advanced** solution with thermowells and **advanced and modular**).

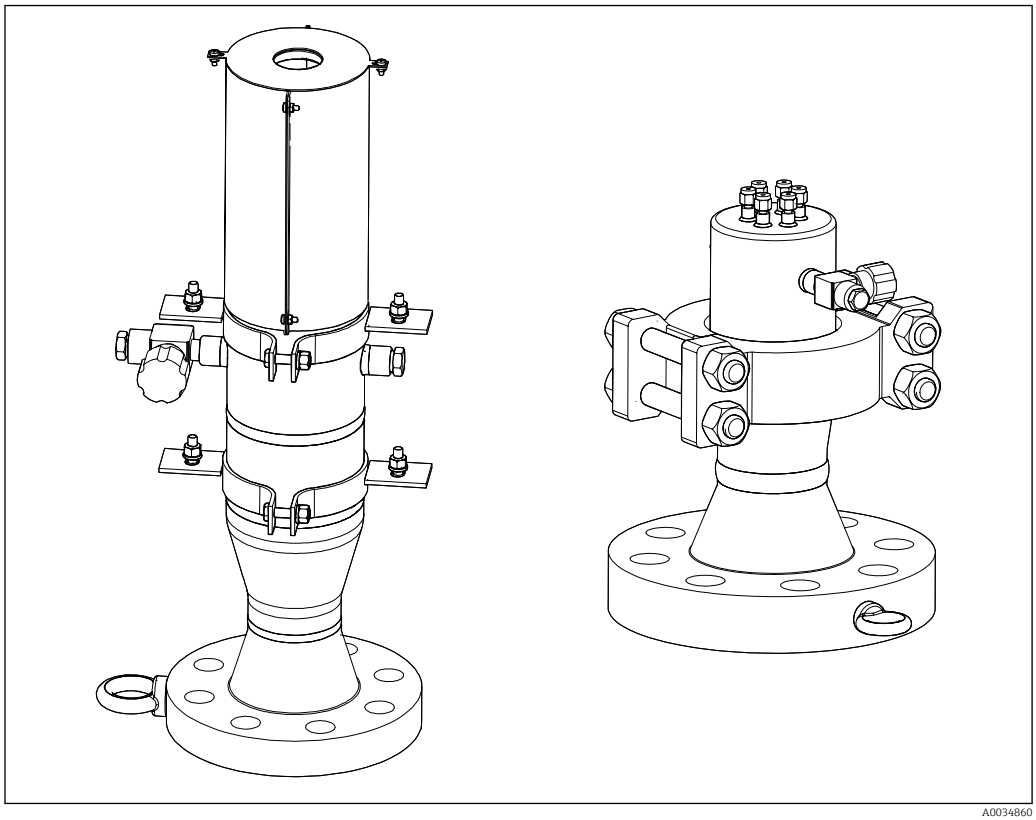
Material: AISI 316/AISI 316H

Cable glands

Installed cable glands provide the proper level of reliability under the specified ambient and operating conditions.

Material	Identification	IP protection class	Ambient temperature range	Max. sealing diameter
NiCr-coated brass/AISI 316/AISI 316L	Atex II 2/3 GD Ex d IIC, Ex e II, Ex nR II, Ex tD A21 IP66 Atex II 2G, II 1D, Ex d IIC Gb, Ex e IIC Gb, Ex ta IIIC Da, II 3G Ex nR IIC Gc	IP66	−52 to +110 °C (−61.6 to +230 °F)	6 to 12 mm (0.23 to 0.47 in)

Diagnostic chamber



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Diagnostic function

The diagnostic chamber is a module designed to monitor the behavior of the multipoint thermometer in the event of leaks or substances escaping from the process through permeation and to safely contain them. By processing all of the acquired information, it enables evaluation of the measurement accuracy, residual lifetime and maintenance plan.

11.5.2 Weight

The weight can vary based on the configuration, depending on the junction box and the frame design, the diagnostic chamber and the presence of the clamp or the number of inserts and potentially the accessories. The approximate weight of a typically configured multipoint thermometer (number of inserts = 12, main body = 3", medium size junction box) = 70 kg (154.3 lb).

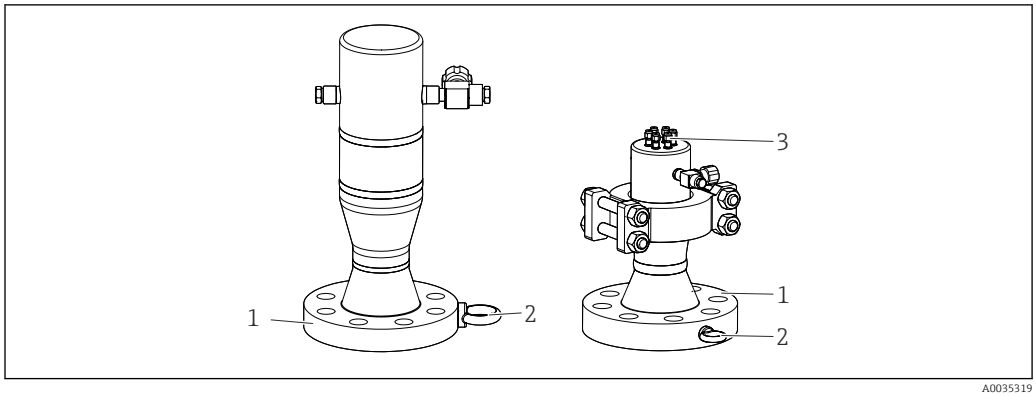
The eyebolt, which is part of the process connection, must be used as the only lifting component to move the entire device.

11.5.3 Materials

The listed material properties have to be taken into account when selected for wetted parts:

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316/1.4401	X2CrNiMo17-12-2	650 °C (1202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorinated 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 chlorinated 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
INCONEL® 600/2.4816	NiCr15Fe	1100 °C (2012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures. ▪ Resistant to corrosion caused by chlorine gas and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water. ▪ Not to be used in a sulfur-containing atmosphere.
AISI 304/1.4301	X5CrNi18-10	850 °C (1562 °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 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1292 °F)	▪ Properties comparable to AISI316L. ▪ 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 (1499 °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 (1472 °F)	▪ Austenitic, stainless steel ▪ Good resistance to 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

11.5.4 Process connection and chamber body



13 Flange as process connection

1 Flange
2 Eyebolt
3 Compression fittings

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

Standard [1]	Size	Pressure rating	Material
ASME	2”, 3”, 4”, 6", 8”	600#, 900#, 1500#, 2500#	AISI 316, 347
EN	DN15, DN80, DN100, DN125, DN150, DN200	PN40, PN63, PN100, PN 160	316/1.4401, 316L/1.4435 316Ti; 1.4571 321; 1.4541, 347; 1.4550

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

11.5.5 Compression fittings

The compression fittings are welded onto the diagnostic chamber head to enable sensor replacement (when applicable). Dimensions correspond to the insert dimensions. Compression fittings comply with the highest standards of reliability in terms of materials and performances required.

Material	AISI 316/316H

11.5.6 Thermowell insert (alternative process connection)

The thermowell insert process connection is designed and provided to meet plant requirements where the standard nozzle is replaced by a compact round drilled bar. This round drilled bar, named thermowell insert, is welded on the internal reactor wall by means of a specific support already provided by the reactor's manufacturer. This kind of process connection allows the installation of the MultiSens system using a fast and compact clamped connection. In the case of new plants or new reactors, the counterpart of the MultiSens system process connection has to be butt welded to the thermowell insert. In the case of maintenance or repair installations, no additional welding work must be performed. Simply connect the MultiSens system to the existing counterpart.

Material of the thermowell insert	AISI 321 - AISI 347 - AISI 316/L - Incoloy 825 - Inconel 625

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, UL, FM, CSA, IEC-EX, NEPSI, EAC-EX), please contact your nearest Endress+Hauser sales organization. All relevant data for hazardous areas can be found in separate Ex documentation.

ATEX Ex ia inserts are available only for diameters ≥ 1.5 mm (0.6 in). For further details contact an Endress+Hauser technician.

11.6.3 PED approval

The diagnostic chamber is provided with PED approval if required as the European Directive 97/23/EC says. Calculation reports, testing procedures, certificates , are provided according the required calculation code and as foreseen in the product technical dossier.

11.6.4 Certification HART

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

11.6.5 Certification FOUNDATION Fieldbus

The FOUNDATION Fieldbus™ 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™ specification
- FOUNDATION Fieldbus™ 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™

11.6.6 Certification PROFIBUS® PA

The PROFIBUS® PA temperature transmitter is certified and registered by the PNO (PROFIBUS® Nutzerorganisation e. V.), PROFIBUS user organization. The device meets all the requirements of the following specifications:
- Certified according to FOUNDATION Fieldbus™ specification
- Certified in accordance with PROFIBUS® 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)

11.6.7 Other standards and guidelines

- IEC 61326-1:2007: Electromagnetic compatibility (EMC requirements)
- IEC 60529: Degree of protection of housing (IP code)
- IEC 60584 and ASTM E230/ANSI MC96.1: Thermocouples
- ASME B16.5, EN 1092-1, GOST 12820-20: Flange

11.6.8 Material certification

The material certificate 3.1 (according to standard EN 10204) can be requested separately. The certificate includes a declaration related to the materials used in the construction of the single sensor and guarantees the traceability of the materials through the identification number of the multipoint. The data related to the origin of the materials can subsequently be requested by the client if necessary.

11.6.9 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

This guide is referred to the complete assembly. To have a complete overview of the technical and operative instructions of the parts refer to the other documents of the individual components manufactured by Endress+Hauser:

- Technical Information iTEMP temperature transmitters:
  - HART® TMT82, two-channel, RTD, TC, Ω, mV (TI01010TEN_1715)
  - HART® TMT182, two-channel, RTD, TC, Ω, mV (TI078ren_1310)
  - TMT181, PC-programmable, single-channel, RTD, TC, Ω, mV (ti070ren)
  - PROFIBUS® PA TMT84, two-channel, RTD, TC, Ω, mV (TI00138ren_0412)
  - FOUNDATION Fieldbus™ TMT85, two-channel, RTD, TC, Ω, mV (TI00134REN_0313)
  - FOUNDATION Fieldbus™ TMT125, 8 channel, RTD, TC, Ω, mV (TI00131ren_0111)
- Technical Information of inserts:
  Thermocouple thermometer iTHERM TSC310 (TI00255ten_0111)
- Technical Information of pressure transmitter:
  CERABAR S PMP71 (TI00451PEN_0111)

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