

Operating Instructions

iTHERM

MultiSens Flex TMS01

Modular TC or RTD multipoint thermometer for direct contact with the medium for oil & gas and petrochemical applications



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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

1.2.2 Electrical symbols

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

1.2.3 Symbols in graphics

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

1.2.4 Symbols for certain types of information

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

1.2.5 Documentation

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

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

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

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	Your reference document The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

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

1.2.6 Registered trademarks

FOUNDATION™ Fieldbus

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

HART®

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

PROFIBUS®

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2 Basic safety requirements

Observe the special precautions and the instructions and procedures contained in this document to ensure the safety of operating personnel. Safety pictograms and symbols are used to identify safety-relevant information. Observe the safety instructions before carrying out any operation marked accordingly. No express or implied warranty or guarantee is given regarding performance. The manufacturer reserves the right to modify the design or specifications of the device without prior notice in order to improve it.

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 device is intended to measure the temperature profile inside a reactor, vessel or pipe using RTD or thermocouple technologies. The various designs of the multipoint thermometer are configurable. Process parameters such as 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 harm caused by improper or unintended use. The process-wetted materials of the measuring instrument must have an adequate level of resistance to the media.

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 working pressure inside the reactor.
Continuous 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. Particular care must be taken when the sensor elements of the device are mounted on plant components.
Process fluids	Correct dimensions and appropriate material selection minimize the following types of wear: ■ Surface and localized corrosion ■ Abrasion and wear ■ 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 sensor elements may be subjected to vibrations due to high immersion lengths. These vibrations can be minimized by properly routing the sensor element within the plant. This is achieved by fastening them to internal fixtures using accessories such as clips or locking sleeves. The neck extension is designed to withstand vibration loads. This protects the junction box against cyclic stresses, preventing loosening of screwed components.
Mechanical load	The maximum stresses acting on the measuring instrument, multiplied by a safety factor, must be below the permissible yielding stress of the material at any operating point of the plant.
Environmental conditions	The junction box (with and without head transmitter), cables, cable glands and other fittings have been selected for operation within the permissible ambient temperature range.

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

For work on and with the device:

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

2.4 Operational safety

Damage to the device!

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

Modifications to the device

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

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

Repair

To ensure continued operational safety and reliability:

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

2.5 Product safety

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

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

3 Product description

3.1 Product design

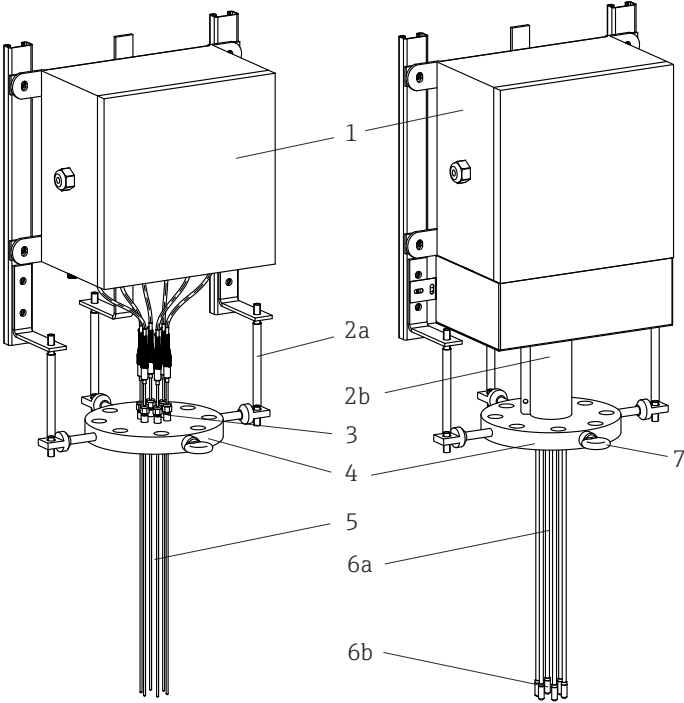
The multipoint thermometer belongs to a series of modular products for multiple temperature measurements. The design allows for the replacement of individual subassemblies and components, making maintenance and spare parts management easier.

It consists of the following main subassemblies:

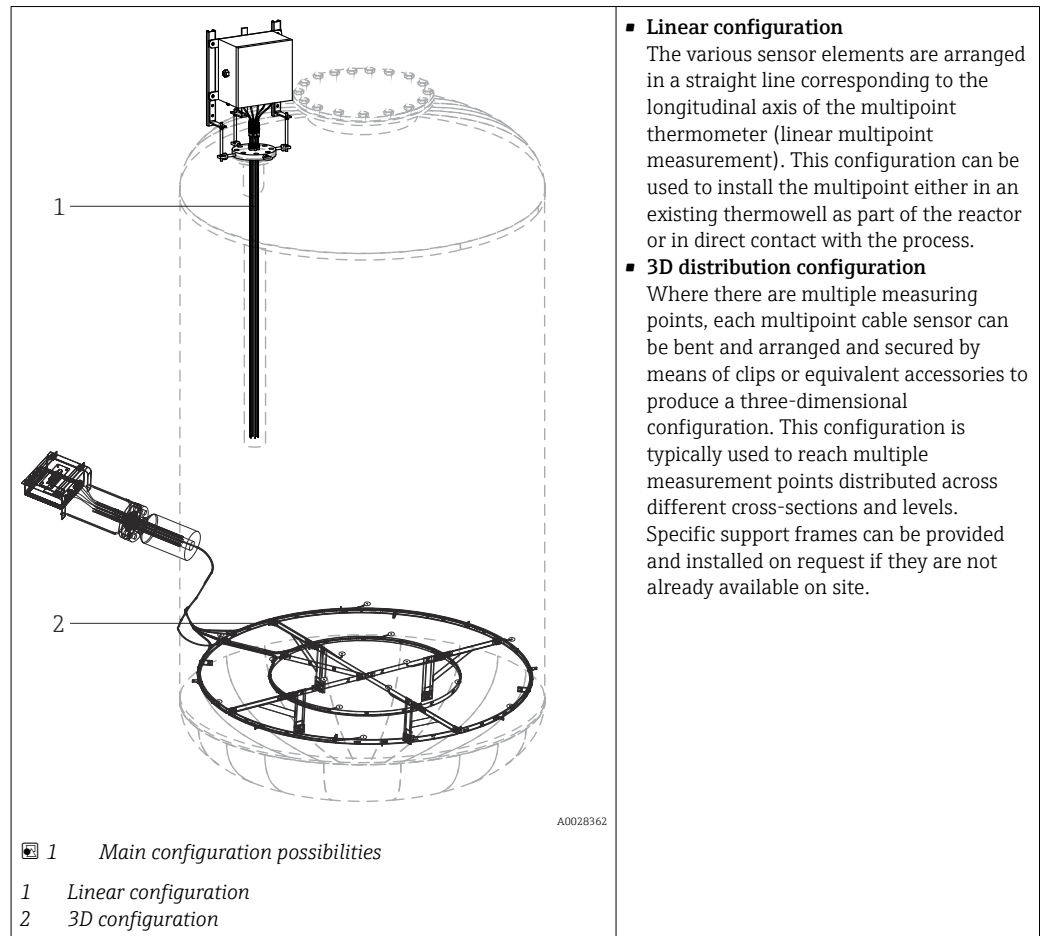
- **Single-point insert:** Consisting of a measuring element with metal sheathing (thermocouple or resistance thermometer), extension cable and bushing. If necessary, each insert can be treated as an individual spare part that can be replaced by releasing the compression fitting on the process connection. They can be ordered via specific standard product order codes (e.g. TSC310, TST310) or special codes. For the specific order code please contact the Endress+Hauser service department.
- **Multi-point insert:** Consisting of a number of independent thermocouple cables with metal sheathing in a probe, each of which is fitted with a potting seal and the relevant extension cable, resulting in a double-sealed design (Endress+Hauser ProfileSens).
- **Process connection:** ASME or EN flange; can be supplied with eyebolts for lifting the device.
- **Head:** Includes a junction box with the relevant components such as cable glands, draining valves, earth screws, terminals, head transmitters etc.
- **Neck:** It is designed to support the junction box by components such as supporting rods and plates or tube extension.
- **Additional accessories:** Components that can be ordered independently of the selected product configuration, e.g. clips, weld-on plates or blocks, sealing sleeves, centering stars and labels for sensor measuring point identification.
- **Thermowells:** These are directly welded to the process connection and designed to guarantee a higher degree of mechanical protection and corrosion resistance for each sensor.

In general, the system measures the temperature profile in the process environment using multiple sensors. These are connected to an appropriate process connection that ensures

the process is leak-tight. On the other side, the extension cables are wired to the junction box, which can either be mounted directly or installed remotely.

Design	Description, available options and materials
 A0028078	1: Head Hinged cover junction box for electrical connections. It includes components such as electrical terminals, transmitters and cable glands. ■ 316/316L ■ Other materials on request
	2a: Support frame Modular frame support that is adjustable for all available junction boxes. 316/316L
	2b: Tube neck Modular tube support that is adjustable for all available junction boxes and ensures extension cable inspection. 316/316L
	3: Compression fitting High-performance compression fitting to ensure leak-tightness between the process and external environment. For many process fluids and various combinations of high temperatures and pressures. ■ 316L ■ 316H
	4: Process connection A flange according to international standards, or customized to satisfy specific process requirements. → 39 ■ 304/304L ■ 316/316L ■ 316Ti ■ 321 ■ 347 ■ Other materials on request
	5: Insert ■ Mineral-insulated grounded and ungrounded thermocouples or RTDs (Pt100) ■ Mineral-insulated non-grounded multipoint cable insert with thermocouples (ProfileSens) For details, refer to the 'Ordering information' table.
	6a: Thermowells 6b: Tip closure, thermowells The thermometer can be equipped with: ■ thermowells for increased mechanical strength and corrosion resistance ■ open guiding tubes for installation in an existing thermowell ■ 316/316L ■ 321 ■ 347 ■ Alloy 600 ■ Other materials on request
	7: Eyebolt Lifting device for easy handling during installation phase. 316

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



4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

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



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

4.2 Product identification

The device can be identified in the following ways:

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

4.2.1 Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:

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

► Compare the information on the nameplate with the order.

4.2.2 Name and address of manufacturer

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

4.3 Storage and transport

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

4.3.1 Humidity

Condensation according to IEC 60068-2-33:

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

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

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

Avoid the following environmental influences during storage:

- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

4.4 Certificates and approvals

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

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

5 Installation

5.1 Installation requirements

WARNING

Failure to observe the installation steps can result in death or serious injury!

- ▶ Ensure that the device is installed only by appropriately qualified personnel.

WARNING

Explosions can result in death or serious injury.

- ▶ When the circuit is live, never remove the junction box cover in explosive atmospheres.
- ▶ Before connecting any additional electric and electronic devices in an explosive atmosphere, make sure the devices in the loop are installed in accordance with intrinsically safe or non-sparking wiring practices.
- ▶ Verify that the operating atmosphere of the transmitters is consistent with the relevant certification for hazardous areas.
- ▶ Tighten all covers and threaded components to meet explosion protection requirements.

WARNING

Leaks in the process can result in death or serious injury.

- ▶ Install and tighten fittings before applying pressure.
- ▶ Do not loosen the threaded parts during operation.

NOTICE

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

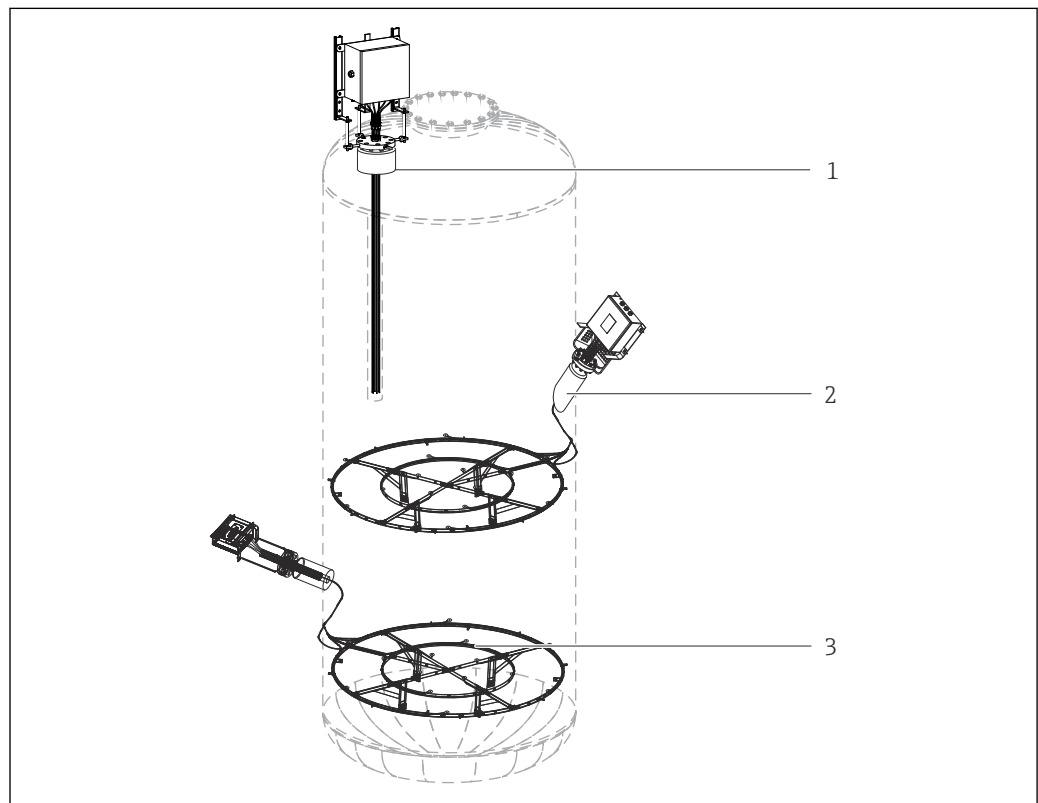
- ▶ Additional loads or external torques on the system caused by connection to another system and not provided for in the installation plan are not permitted.
- ▶ The device is not suitable for installations in locations where vibrations occur. Any resulting loads may impair junction seals and thus affect the operation of the sensor elements.
- ▶ The end user is responsible for checking that suitable equipment has been installed to ensure that the permissible limits are not exceeded.
- ▶ For information on ambient conditions, see the Technical data.
- ▶ When installing into an existing thermowell, check the interior of the thermowell to determine whether internal loads are present before immersing the device. When installing the measurement system, avoid any friction and spark generation in particular. Ensure thermal contact between the inserts and the bottom or wall of the existing thermowell. If accessories like centering stars are provided, make sure that they are not deformed and that the original geometry and position are maintained.
- ▶ If the installation involves direct contact with the process, ensure that any applied external loads, such as those resulting from fixing the sensor tip inside the reactor, do not deform or stress the probe or the welds.

5.2 Installation location

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

5.3 Orientation

No restrictions. The multipoint thermometer can be installed either in horizontal, oblique or in vertical configuration, related to the reactor or vessel vertical axis.



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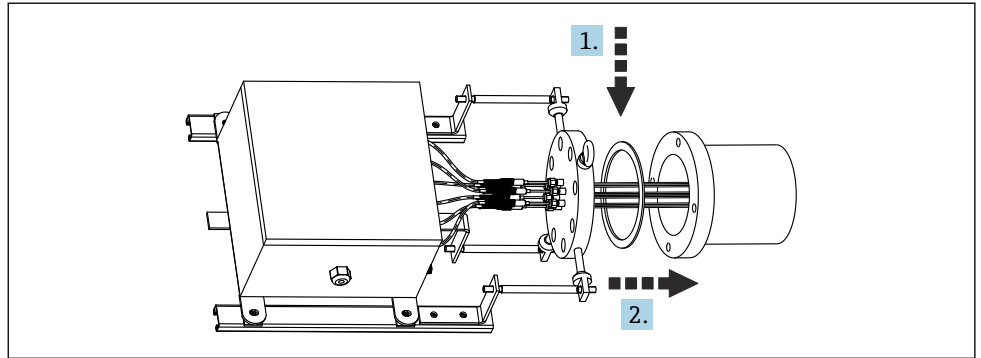
 2 Installation examples - no restrictions to the orientation

- 1 Vertical installation with linear configuration
- 2 Oblique installation with 3D configuration
- 3 Horizontal installation with 3D configuration

5.4 Installing the thermometer

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

1.



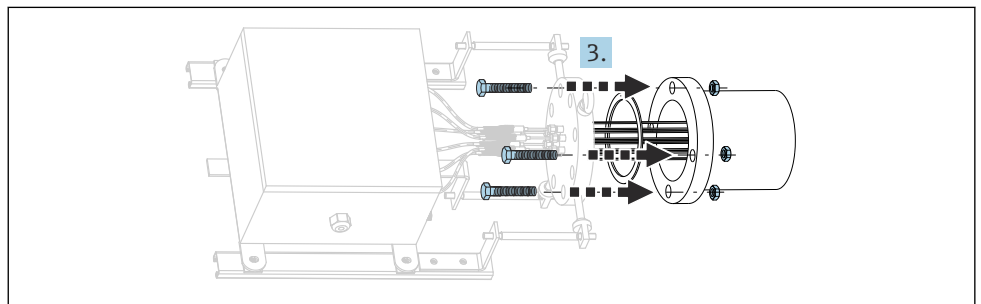
A0028369

Place the sealing ring between the flanged nozzle and the device flange (first check that the sealing surfaces on the flanges are clean).

2.

Move the device towards the nozzle and insert the thermocouples or the thermocouple bundle into the nozzle. Ensure that the thermocouples in the bundle do not become entangled or deformed.

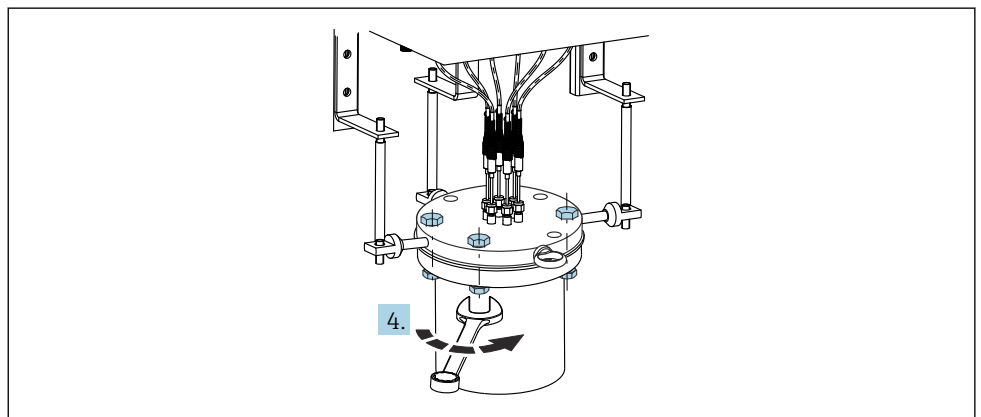
3.



A0028370

Insert the screws part way into the drilled holes provided on the flange and tighten them lightly with the nuts. Use a suitable wrench for this but do not tighten completely yet.

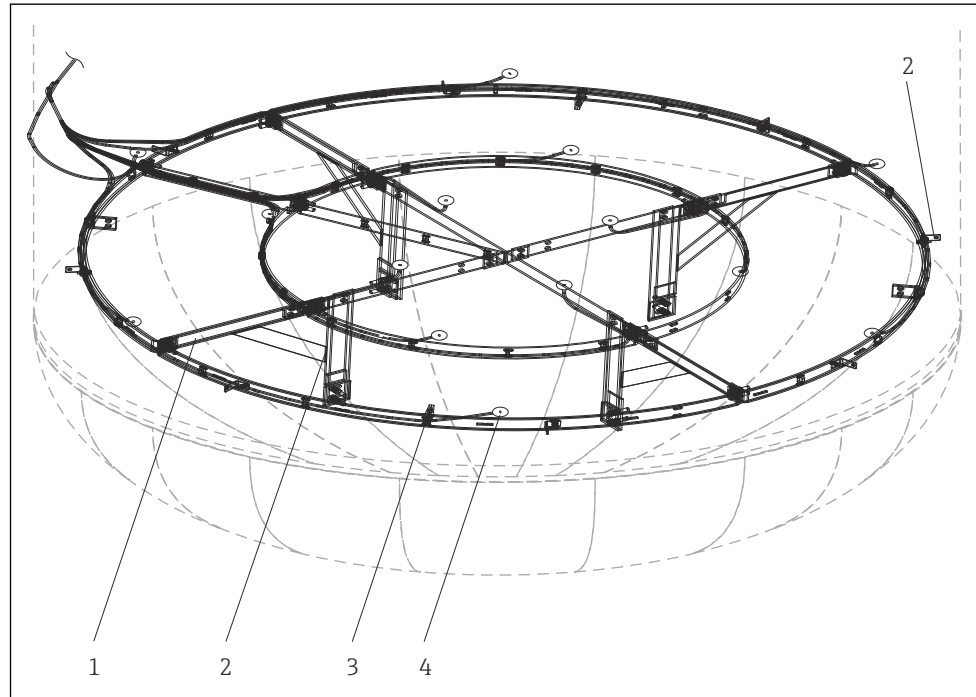
4.



A0050250

Now insert the screws fully into the drilled holes on the flange and tighten them crosswise using a suitable tool (i.e. controlled tightening in accordance with applicable standards).

5.



A0029266

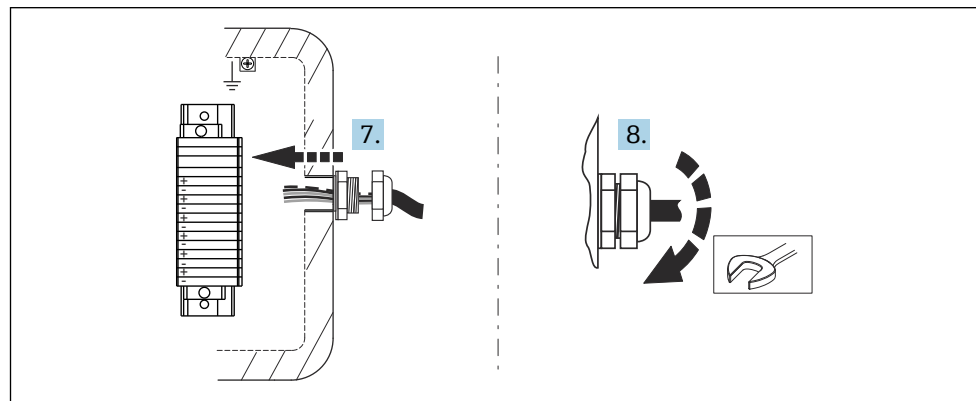
- 1 Support frame
- 2 Fixing bar
- 3 Fixing clip
- 4 Inserts or thermowell tip

A) For 3D installation, secure all inserts or thermowells to the support structures (frame, bars, clips and all accessories provided) in accordance with the drawings. Start by fixing the sensor tip and then bend the rest over the entire length. Once the full path is defined, secure the inserts or thermowells **permanently** from the nozzle to the tip. The remaining length can be routed as U-shaped or Ω curves close to the measuring point if 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.

6.

B) When installing in an existing thermowell, it is recommended to perform an internal inspection of the thermowell. To facilitate insertion, first check that there are no obstacles. When installing the measurement system, avoid any friction and spark generation in particular. Ensure that the thermal contact between the tip end of the inserts or thermowells and the existing thermowell wall is guaranteed. When accessories such as centering stars and/or centered rods are provided, make sure that no distortions can occur and that the original geometry is maintained.

7.



A0028375

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

8. Tighten the cable glands on the junction box.
9. After opening the junction box cover, connect the compensating cables to the terminals in the junction box. Comply with the wiring instructions provided and ensure that the marking of the terminals and cables match.
10. Close the cover and make sure the seal is in the right position to avoid any impact on the IP degree of protection.
11. In case of using the tube neck, check if all its components are still coupled properly one each other.

Installation of the device is completed.

NOTICE

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

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

5.5 Post-installation check

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

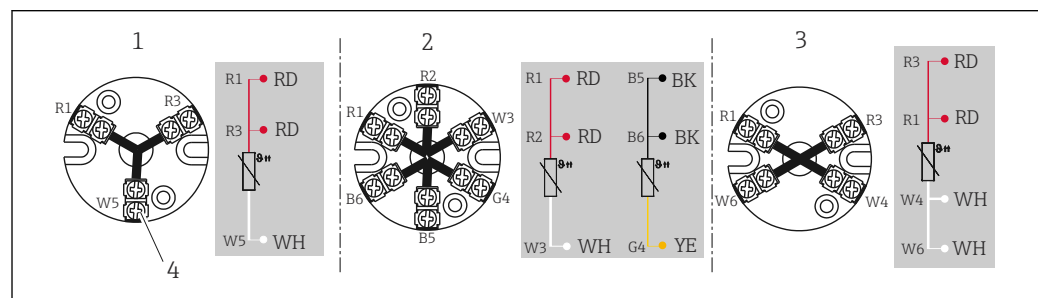
Device condition and specifications	
Is the device undamaged (visual check)?	☐
Do the ambient conditions match the device specification? For example: ▪ Ambient temperature ▪ Proper conditions	☐
Are the threaded components undeformed?	☐
Are the seals not permanently deformed?	☐
Installation	
Is the equipment aligned with the nozzle axis?	☐
Are the seal seats of flanges clean?	☐
Are the flange and its counter flange properly bolted together?	☐
Are the thermocouples free of entanglement and deformation?	☐
Are the bolts completely inserted in the flange? Make sure the flange is fitted tightly and flush against the nozzle.	☐
Are the thermocouples fixed to the support structures? →  14	☐
Are the cable glands tightened on the extension cables?	☐
Are the extension cables connected to the junction box terminals?	☐

6 Power supply

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

6.1 Wiring diagrams

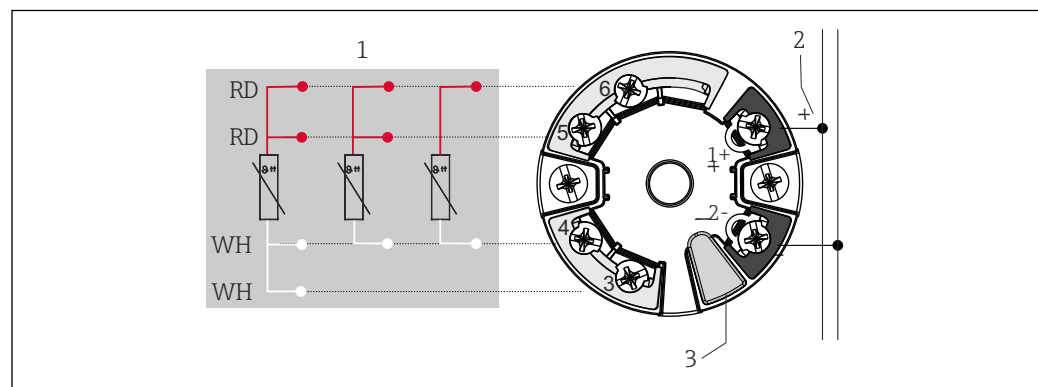
6.1.1 RTD sensor connection type



A0045453

3 Mounted terminal block

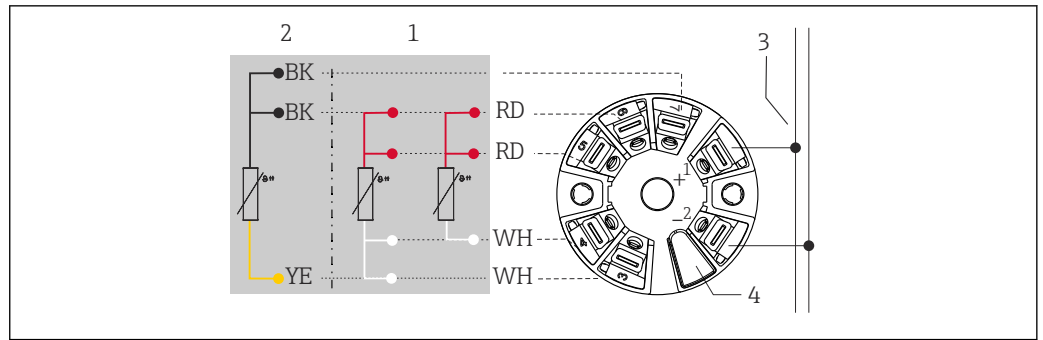
- 1 3-wire, single
- 2 2 x 3-wire, single
- 3 4-wire, single
- 4 Outside screw



A0045464

4 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

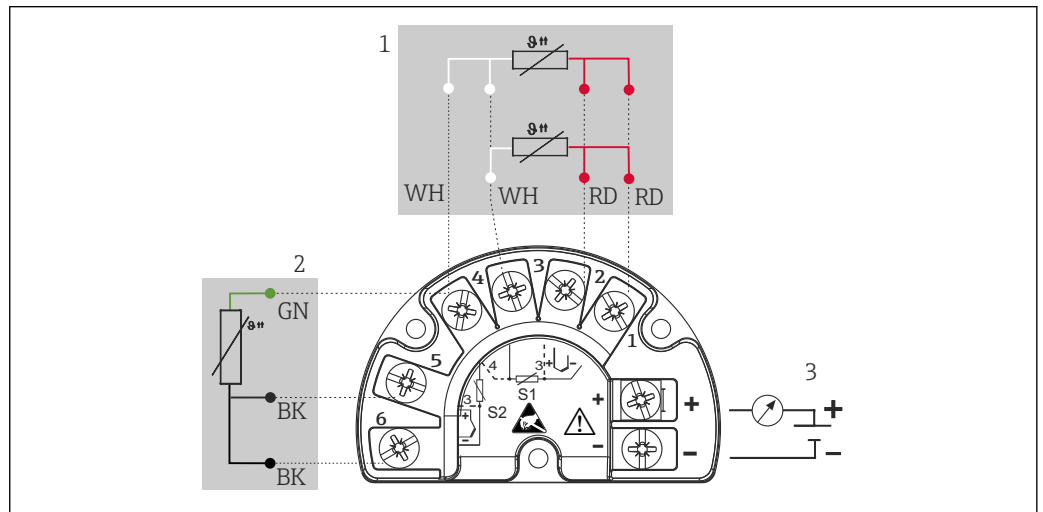


A0045466

5 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

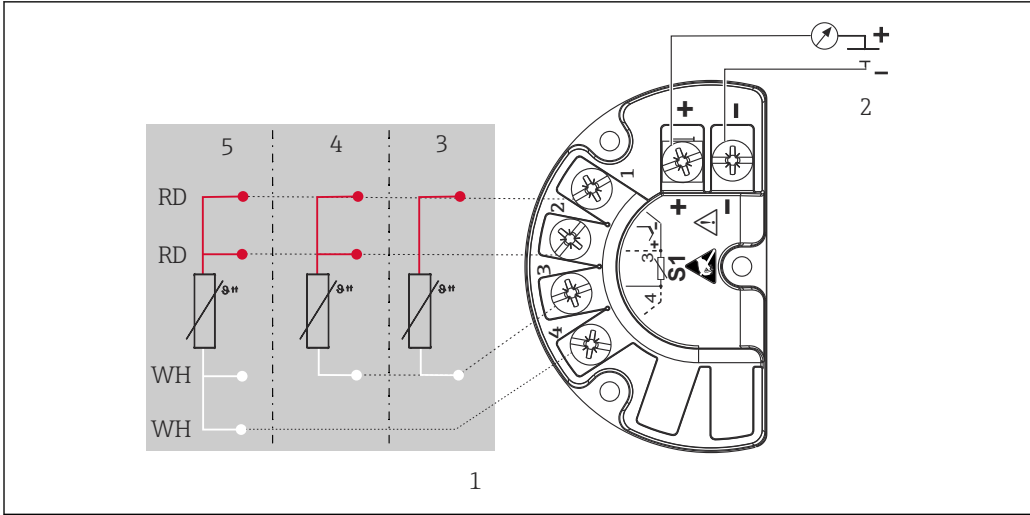
Mounted field transmitter: Fitted with screw terminals



A0045732

6 TMT162 (dual input)

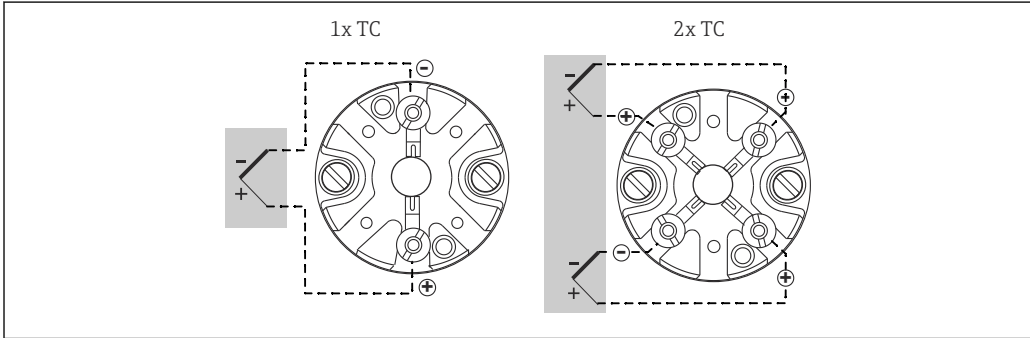
- 1 Sensor input 1, RTD: 3- and 4-wire
- 2 Sensor input 2, RTD: 3-wire
- 3 Power supply, field transmitter and analog output 4 to 20 mA or fieldbus connection



A0045733

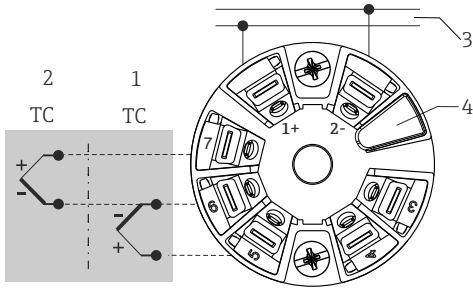
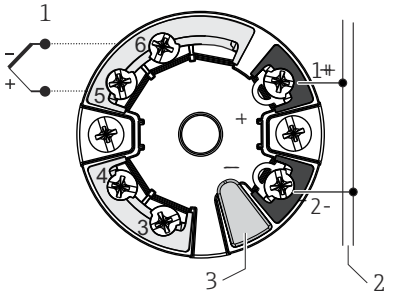
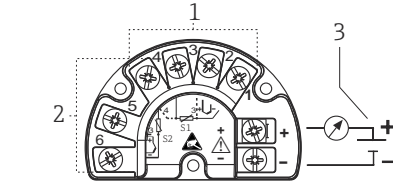
- 7 TMT142B (single input)
- 1 Sensor input RTD
 - 2 Power supply, field transmitter and analog output 4 to 20 mA, HART® signal
 - 3 2-wire
 - 4 3-wire
 - 5 4-wire

6.1.2 Thermocouple (TC) sensor connection type



A0012700

- 8 Mounted terminal block

Head-mounted transmitter TMT8x (dual sensor input) ¹⁾  1 Sensor input 1 2 Sensor input 2 3 Fieldbus communication and power supply 4 Display connection A0045474	
Head-mounted transmitter TMT7x or TMT31 (single input) ¹⁾  1 Sensor input TC, mV 2 Power supply, bus connection 3 Display connection/CDI interface A0045353	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 A0045636

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 (-)

7 Commissioning

7.1 Preparatory steps

To ensure proper operation of the device, use the setup guides for the manufacturer's commissioning types "Standard", "Extended" and "Advanced", in accordance with:

- Operating instructions
- Customer specifications for commissioning and application conditions (including process conditions)

Take the following steps:

1. Inform the operator and personnel responsible for the process that commissioning will be carried out.
2. Determine which chemical or which medium is being measured. Observe the safety data sheet.
3. Disconnect the sensors connected to the process.
4. Observe temperature and pressure conditions.
5. Only open process fittings and loosen flange screws after ensuring that this can be done safely.
6. Be sure not to disturb the process when disconnecting input/output signal lines or when simulating signals.
7. Make sure that tools, equipment and the process are protected from contamination. Include and plan any required cleaning steps.
8. Make sure that the chemicals used do not pose any safety risks. This includes agent used for normal operation or for cleaning. Observe and comply with the relevant safety instructions.

7.1.1 Tools and equipment

For commissioning, use multimeters and device-specific configuration tools as required according to the list of measures described above.

7.2 Post-installation check

Make sure that all post-connection checks have been carried out before putting your device into operation:

- "Post-installation check" checklist
- "Post-connection check" checklist

Commissioning must be carried out according to one of the following types of commissioning: Standard, Extended or Advanced.

7.2.1 Standard commissioning

Visual inspection of device:

1. Check the device for damage.
2. Check that the device has been installed as specified in the operating instructions.
3. Check that the wiring has been carried out according to the operating instructions and the local regulations.
4. Check that the device is dustproof and waterproof.
5. Check whether the safety precautions have been observed.
6. Supply power to the device.

The visual inspection of the device is complete.

Ambient conditions:

1. Ensure that the devices are operated under suitable ambient conditions. These include ambient temperature, humidity (IPxx protection rating), vibration, explosion-hazard areas (Ex, dust-Ex), RFI/EMC, and sun protection.
2. Check that the devices are accessible for operation and maintenance purposes.

Ambient conditions have been checked.

Configuration parameters:

1. Configure the device according to the instructions in the operating instructions using the parameters specified by the customer.
2. Alternatively, configure it using the parameters specified in the design specification.

The device has been configured correctly.

Verifying the output signal value

1. Check that the local display and the output signals of the device conform with the customer's display
2. Confirm that the local display and the output signals of the device conform with the customer's display

The output value has been verified.

Standard commissioning is complete.

7.2.2 Extended commissioning

To carry out commissioning in Extended mode, perform the following steps after completing Standard commissioning:

Device conformity:

1. Compare the received device with the order or design specification, including accessories, documentation and certificates.
2. Check the software version, if available.

Device conformity has been verified.

Function test :

1. Check device outputs - including switching points, auxiliary inputs/outputs - using the internal or an external simulator.
2. Compare measurement data/results with a reference provided by the customer.
3. If necessary, adjust the device according to the description in the operating instructions.

Functional test has been completed.

Extended commissioning is complete.

7.2.3 Advanced commissioning

In addition to the steps for Standard and Extended commissioning, Advanced commissioning also includes a loop test.

Verifying the measuring circuit:

1. Simulate a minimum of 3 output signals that are transmitted from the device to the control room.
2. Read out the simulated and displayed values.
3. Record the values.
4. Check linearity.

The measuring circuit has been verified.

Advanced commissioning is complete.

7.3 Switching on the device

After completing the final check, connect the supply voltage. The multipoint thermometer is then ready for operation.

8 Diagnostics and troubleshooting

8.1 General troubleshooting

If electronic problems occur, start troubleshooting using the queries described in the operating instructions. These queries systematically guide you to the cause of the fault and the corresponding remedial actions.

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

NOTICE

Repair of device components

- Replace the device in the event of a major fault. See the section "Return".

If iTEMP transmitters from Endress+Hauser are used, refer to the technical documentation for the relevant device for troubleshooting information.

9 Repair

9.1 General information

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

9.2 Spare parts

Product spare parts that are currently available can be found online at:

http://www.products.endress.com/spareparts_consumables.

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

Spare parts for the multipoint thermometer are:

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

9.3 Endress+Hauser services

Service	Description
Certifications	Endress+Hauser is able to fulfill requirements belonging to the design, product manufacturing, tests and commissioning according to specific approvals by handling or supplying individual certified components and by checking the integration on the whole system.
Maintenance	All Endress+Hauser systems are designed for easy maintenance thanks to a modular design that permits the replacement of old or worn parts. Standardized parts ensure fast maintenance.
Calibration	Endress+Hauser's range of calibration services covers on-site verification tests, accredited laboratory calibrations, certificates and traceability to ensure compliance.
Installation	Endress+Hauser helps you commission plants while minimizing costs. Fault free installation is decisive for the quality and longevity of the measurement system and plant running. We provide the right expertise at the right time to meet project deliverables.
Testing	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 ■ X-ray test 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 Pressure Equipment Directive, EN 13445-5 ■ 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>
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

9.5 Disposal



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

9.5.1 Removing the measuring device

1. Switch off the device.

2. **⚠ WARNING**

Danger to persons from process conditions.

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

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

9.5.2 **Disposing of the measuring device**

Observe the following notes during disposal:

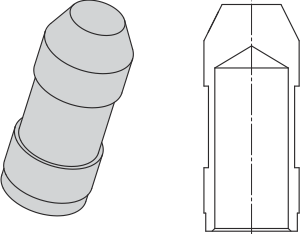
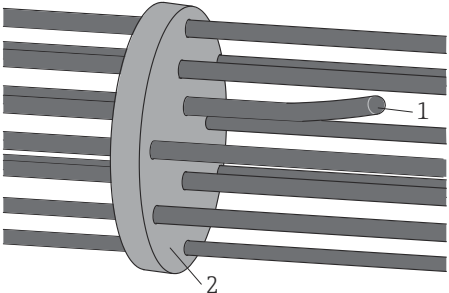
- ▶ Observe valid federal/national regulations.
- ▶ Ensure proper separation and reuse of the device components.

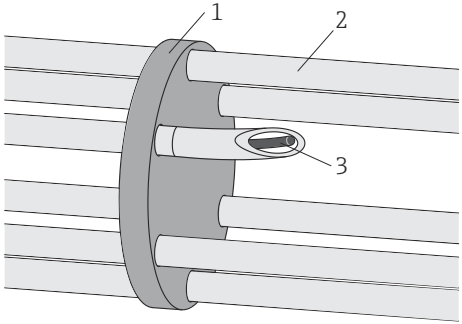
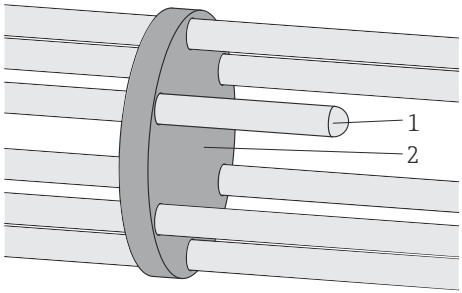
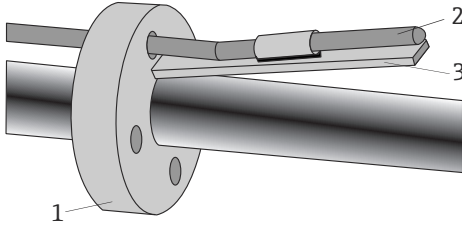
10 **Accessories**

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

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

10.1 **Device-specific accessories**

Accessories	Description
Tip end  A0028427	Terminal closure welded at the tip end of the probe in order to protect the insert (or the thermowell) from aggressive process conditions and to facilitate its fixing by means of metallic tie wraps.
Thermal contact system	
Insert and centering stars  1 Insert 2 Centering star A0033485	▪ Used on straight configurations and in case of an existing thermowell for axial centering of the insert bundle ▪ Prevents the inserts from twisting ▪ Give flexural stiffness to the sensor bundle

Accessories	Description
Guiding tubes and centering stars  A0028783 1 Centering star 2 Guiding tube 3 Insert	- Used on straight configurations and in case of an existing thermowell for axial centering of the insert bundle - Give flexural stiffness to the sensor bundle - The inserts are replaceable. - Ensures thermal contact between the sensor tip and the thermowell - Modular design ¹⁾
Thermowells and centering stars  A0028434 1 Thermowell 2 Centering star	Used on straight configurations and existing thermowells Prevents the sensor cables from twisting Give flexural stiffness to the sensor bundle Allows sensor replacement
Bimetallic strips  A0028435 9 Bimetallic strips with or without guiding tubes 1 Centering star 2 Guiding tube 3 Bimetallic strips	- Used on straight configurations and inside existing thermowells - Ensures thermal contact between the sensor tip and the thermowell by means of bimetallic strips activated by temperature difference - No friction during installation, even with sensors already installed

1) Can be mounted in-house or on-site

10.2 Service-specific accessories

Netilion

With the Netilion IIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data.

These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

 www.netilion.endress.com

Applicator

Software for selecting and sizing Endress+Hauser measuring devices:

- Calculation of all the necessary data for identifying 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:
<https://portal.endress.com/webapp/applicator>

Configurator

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

The Configurator is 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 **Configuration**.

FieldCare SFE500	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.  For details, see Operating Instructions BA00027S and BA00065S
DeviceCare SFE100	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices.  For details, see Operating Instructions BA00027S

11 Technical data

11.1 Input

11.1.1 Measured variable

Temperature (temperature-linear transmission behavior)

11.1.2 Measuring range

RTD:

Input	Description	Measuring range limits
RTD	WW	-200 to +600 °C (-328 to +1 112 °F)
RTD	TF 6 mm	-50 to +400 °C (-58 to +752 °F)
RTD	TF 3 mm	-50 to +250 °C (-58 to +482 °F)
RTD	iTHERM StrongSens 6 mm	-50 to +500 °C (-58 to +932 °F)

Thermocouple:

Input	Description	Measuring range limits
Thermocouples (TC) as per IEC 60584, part 1 - using an Endress+Hauser - iTEMP temperature head transmitter	Type J (Fe-CuNi)	-40 to +720 °C (-40 to +1 328 °F)
	Type K (NiCr-Ni)	-40 to +1 150 °C (-40 to +2 102 °F)
	Type N (NiCrSi-NiSi)	-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	

11.2 Output

11.2.1 Output signal

The measured values are transmitted in 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 measurement accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

4-20 mA head transmitter

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

HART head transmitter

The iTEMP transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART communication. Swift and easy operation, visualization and maintenance using universal configuration software like FieldCare, DeviceCare or FieldCommunicator 375/475. Integrated Bluetooth® interface for the wireless display of measured values and configuration via Endress +Hauser SmartBlue app, optional.

PROFIBUS PA head transmitter

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

FOUNDATION Fieldbus™ head transmitters

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

Head transmitter with PROFINET and Ethernet-APL™

The iTEMP transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using the PROFINET protocol. Power is supplied via the 2-wire Ethernet connection according to IEEE 802.3cg 10Base-T1. The iTEMP 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.

Head transmitter with IO-Link

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

Advantages of the iTEMP transmitters:

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

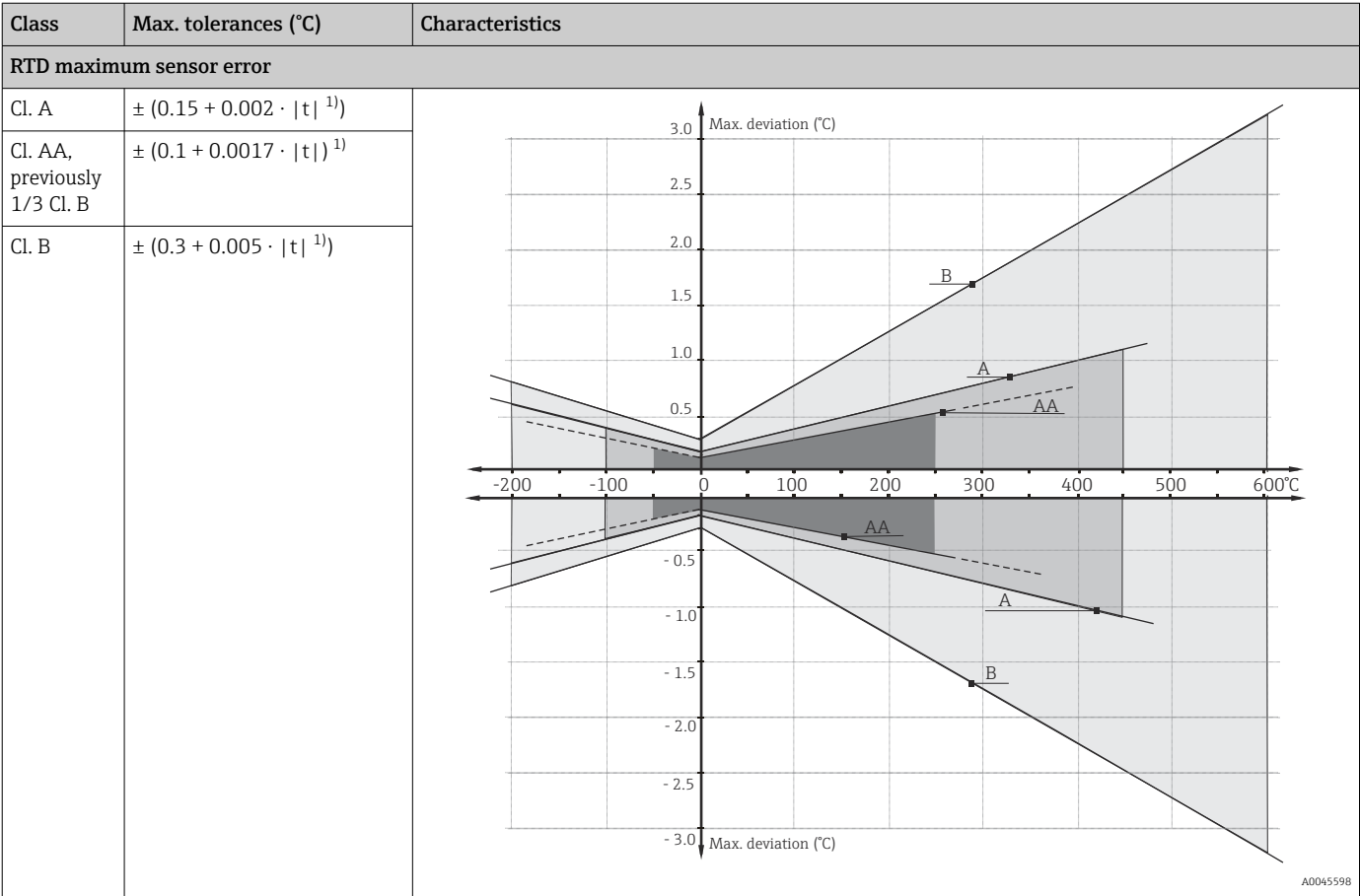
11.3 Performance characteristics

11.3.1 Reference operating conditions

This data is relevant for determining the measurement accuracy of the iTEMP transmitters used. See technical documentation of the specific iTEMP transmitter.

11.3.2 Maximum measurement error

RTD resistance thermometer according to IEC 60751



1) |t| = Temperature absolute value in °C

 To get the maximum tolerances in °F, multiply the results in °C by a factor of 1.8.

Temperature ranges

Sensor type ¹⁾	Operating temperature range	Class B	Class A	Class AA
Pt100 (TF) Standard	-50 to +400 °C (-58 to +752 °F)	3 mm: -50 to +250 °C (-58 to +482 °F) 6 mm: -50 to +400 °C (-58 to +752 °F)	-30 to +250 °C (-22 to +482 °F)	0 to +150 °C (+32 to +302 °F)
Pt100 (TF) iTHERM StrongSens	-50 to +500 °C (-58 to +932 °F)	-50 to +500 °C (-58 to +932 °F)	-30 to +300 °C (-22 to +572 °F)	0 to +150 °C (+32 to +302 °F)
Pt100 (WW)	-200 to +600 °C (-328 to +1 112 °F)	-200 to +600 °C (-328 to +1 112 °F)	-100 to +450 °C (-148 to +842 °F)	-50 to +250 °C (-58 to +482 °F)

1) Options depend on product and configuration

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

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

1) |t| = absolute value in °C

Thermocouples made of base metals are generally supplied so that they comply with the manufacturing tolerances specified in the tables for temperatures > –40 °C (–40 °F). These materials are generally not suitable for temperatures < –40 °C (–40 °F). The tolerances of Class 3 cannot be met. A separate material must be selected for this temperature range. This cannot be handled via the standard product.

Standard	Type	Tolerance class: Standard	Tolerance class: Special
ASTM E230/ANSI MC96.1		Deviation; the larger value applies in each case	
	J (Fe-CuNi)	$\pm 2.2\text{ K}$ or $\pm 0.0075\text{ t }^{1)}$ (0 to 760 °C)	$\pm 1.1\text{ K}$ or $\pm 0.004\text{ t }^{1)}$ (0 to 760 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	$\pm 2.2\text{ K}$ or $\pm 0.02\text{ t }^{1)}$ (–200 to 0 °C) $\pm 2.2\text{ K}$ or $\pm 0.0075\text{ t }^{1)}$ (0 to 1260 °C)	$\pm 1.1\text{ K}$ or $\pm 0.004\text{ t }^{1)}$ (0 to 1260 °C)

1) |t| = absolute value in °C

The materials for thermocouples are generally supplied in such a way that they comply with the tolerances specified in the table for temperatures > 0 °C (32 °F). These materials are generally not suitable for temperatures < 0 °C (32 °F). The specified tolerances cannot be satisfied. A separate material must be selected for this temperature range. This cannot be handled via the standard product.

11.3.3 Response time

 Response time for the sensor assembly without transmitter. It refers to inserts in direct contact with the process. When thermowells are used, a specific assessment should be carried out.

RTD

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

Insert diameter	Response time	
Mineral-insulated cable, 3 mm (0.12 in)	t ₅₀	2 s
	t ₉₀	5 s
StrongSens RTD insert, 6 mm (¼ in)	t ₅₀	< 5.5 s
	t ₉₀	< 16 s
Mineral-insulated cable, 4.8 mm (0.19 in)	t ₅₀	3.5 s
	t ₉₀	9 s

Thermocouple (TC)

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

Insert diameter	Response time	
Grounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t 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
Ungrounded thermocouple 8 mm (0.31 in)	t ₅₀	3 s
	t ₉₀	6 s

Cable sensor diameter (ProfileSens)	Response 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

11.3.4 Shock and vibration resistance

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

11.3.5 Calibration

Calibration is a service that can be performed on each individual insert, either 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. Under no circumstances is it 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 measuring elements of the multipoint inserts (DUT = device under test) with those of a more precise calibration

standard using a defined and reproducible measurement method. The aim is to determine the deviation of the DUT measured values from the true value of the measured variable.

i 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)). For factory calibration of the thermometers, special boreholes in the calibration furnaces are used to ensure even distribution of the temperature from 200 to 550 °C (392 to 1022 °F) over the corresponding section.

Two different methods are used for the inserts:

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

i Evaluation of inserts

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

11.4 Environment

11.4.1 Ambient temperature range

Junction box	Non-hazardous area	Hazardous area
Without mounted transmitter	-40 to $+85$ °C (-40 to $+185$ °F)	-40 to $+60$ °C (-40 to $+140$ °F)
With mounted head transmitter	-40 to $+85$ °C (-40 to $+185$ °F)	Depends on the relevant hazardous area approval. Details see Ex documentation.

11.4.2 Storage temperature

Junction box	
With head transmitter	-40 to $+95$ °C (-40 to $+203$ °F)

11.4.3 Relative humidity

Condensation according to IEC 60068-2-14:

Head transmitter: 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
- Terminal blocks: Class B2 according to EN 60654-1

11.4.5 Degree of protection

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

11.4.6 Vibration-resistance and shock-resistance

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

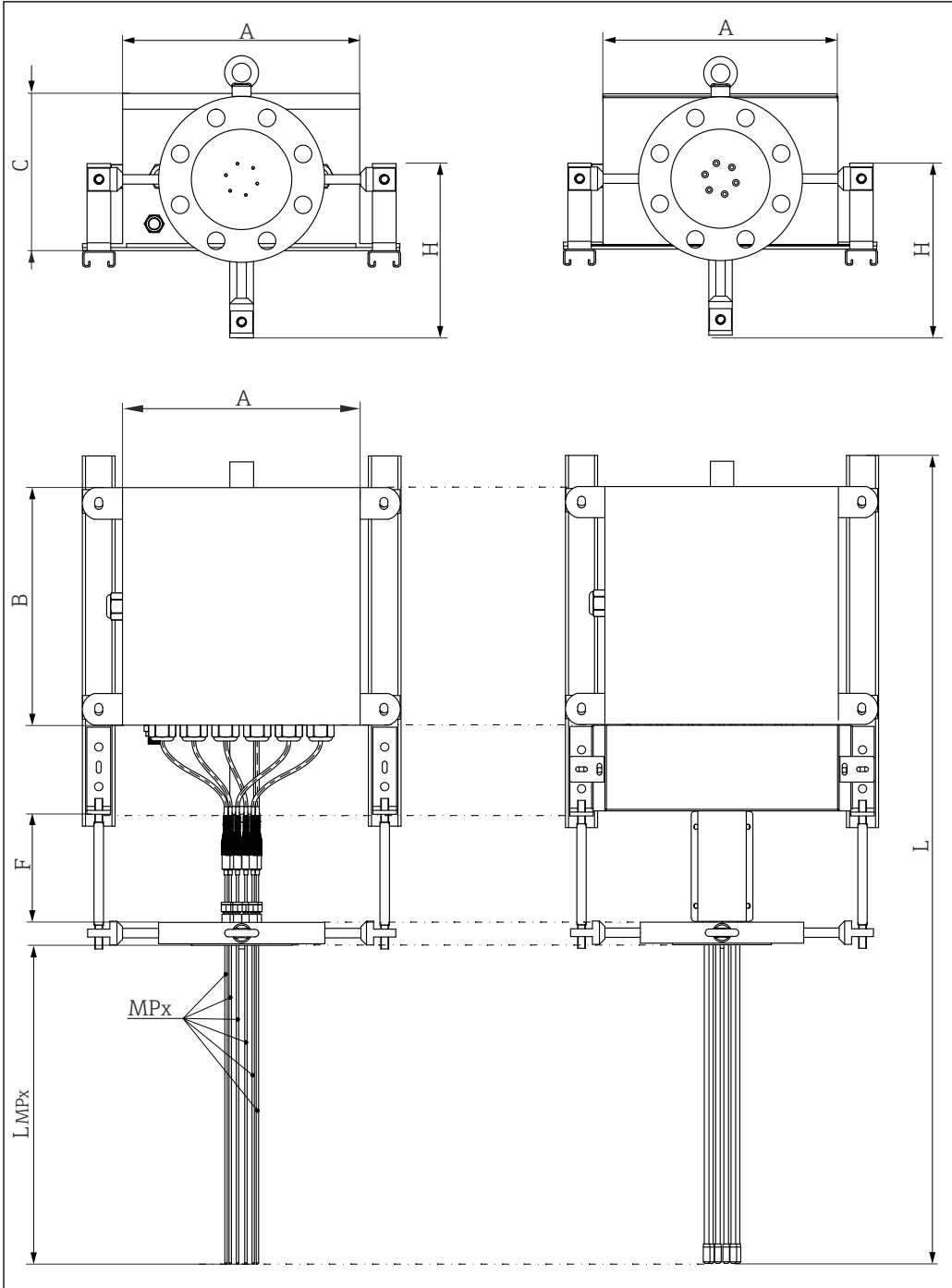
11.4.7 Electromagnetic compatibility (EMC)

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

11.5 Mechanical construction

11.5.1 Design, dimensions

The multipoint thermometer is composed of different sub-assemblies. Both linear and 3D configurations have the same features, dimensions and materials. Different inserts are available, based upon 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 obtained by the usage of specially sealed bushings, ensuring the declared IP degree protection.



10 Design of the modular multipoint thermometer, with frame neck on the left side or with frame neck and covers on the right side. All dimensions in mm (in)

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

C

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

L_{MPx} Different immersion length of sensor elements or thermowells

H Dimensions of the frame of the junction box and support system

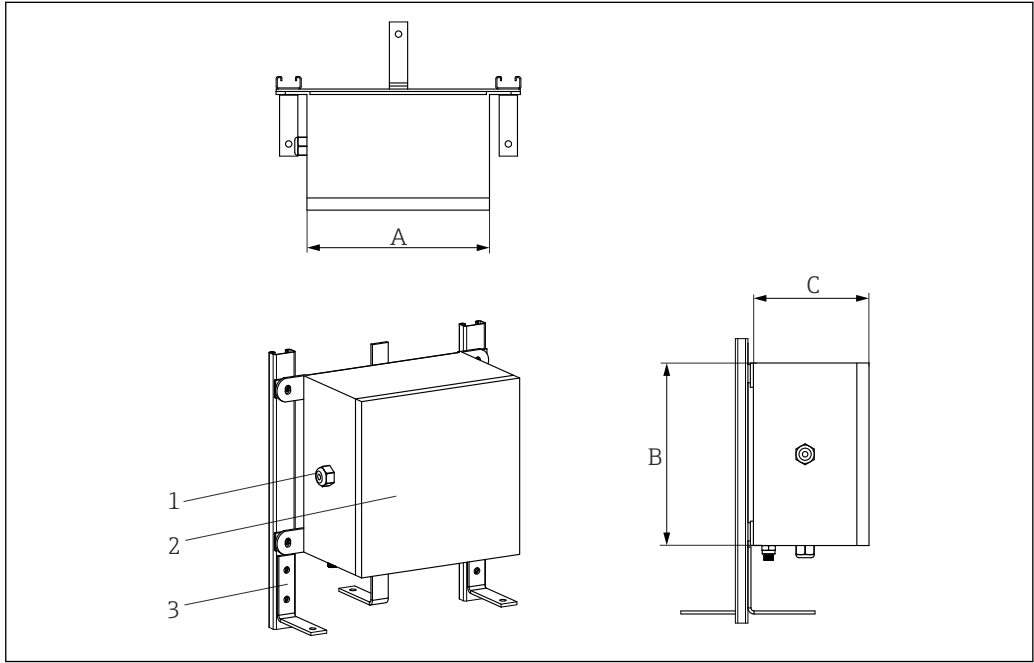
F Neck extension length

L Overall device length

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

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

Junction box



- 1 Cable gland
- 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 connections can be installed.

i The multipoint thermometer can be fitted with ground terminals and shielding connections. Please observe the system guidelines for correct connection of the cables.

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

		A	B	C
Stainless steel	Min.	170 (6.7)	170 (6.7)	130 (5.1)
	Max.	500 (19.7)	500 (19.7)	240 (9.5)
Aluminum	Min.	100 (3.9)	150 (5.9)	80 (3.2)
	Max.	330 (13)	500 (19.7)	180 (7.1)

Type of specification	Junction box	Cable glands
Material	AISI 316	NiCr-coated brass AISI 316/316L
Degree of protection (IP)	IP66/67	IP66
Ambient temperature range (ATEX)	-55 to +110 °C (-67 to +230 °F)	
Approvals	ATEX, IECEx, UL, CSA, EAC approval for use in hazardous areas	

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

Neck extension

The neck extension ensures the connection between the flange 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 neck extension 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. No closed volumes are present in the neck extension. This helps prevent the accumulation of residues and potentially hazardous fluids from the surroundings that could damage the device, while also ensuring continuous ventilation.

Insert and thermowells

 Different insert and thermowell types are available. For other requirements not listed here, please contact the manufacturer's sales department.

 In the case of a multipoint cable insert (ProfileSens), see Technical Information TI01346T

Thermocouple

Diameter in mm (in)	Type	Standard	Measuring point type	Sheath material
6 (0.24) 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 1x type T 2x type T	IEC 60584/ ASTM E230	Grounded/Ungrounded	Alloy 600/AISI 316L/Pyrosil

RTD

Diameter in mm (in)	Type	Standard	Sheath material
3 (0.12) 6 (1/4)	1x Pt100 WW 2x Pt100 WW 1x Pt100 TF 2x Pt100 TF	IEC 60751	AISI 316L

Thermowells

External diameter in mm (in)	Sheath material	Type	Thickness in mm (in)
6 (0.24)	AISI 316/316L AISI 316Ti AISI 321 AISI 347 Alloy 600	closed or open	1 (0.04) or 1.5 (0.06)
8 (0.32)	AISI 316/316L AISI 316Ti AISI 321 AISI 347 Alloy 600	closed or open	1 (0.04) or 1.5 (0.06) or 2 (0.08)
10.2 (½)	AISI 316/316L AISI 316Ti AISI 321 AISI 347 Alloy 600	closed or open	1.73 (0.068)

11.5.2 Weight

The weight can vary depending on the configuration: Dimension and content of the junction box, neck extension length, dimensions of process connection and the number of inserts. The approximate weight of a typically configured multipoint thermometer (number of inserts = 12, flange size = 3", medium size junction box) = 40 kg (88 lb)

11.5.3 Materials

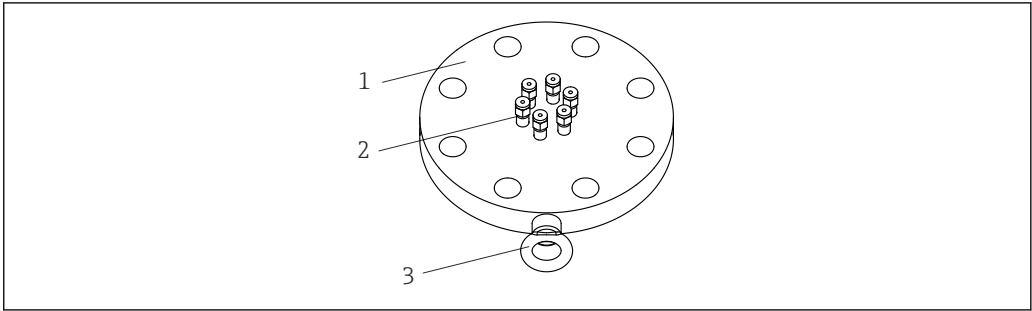
It refers to insert sheath, neck extension, junction box and all wetted parts.

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

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316/1.4401	X5CrNiMo 17-12-2	650 °C (1202 °F)	■ Austenitic, stainless steel ■ High corrosion resistance in general ■ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)
AISI 316L/1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1202 °F)	■ Austenitic, stainless steel ■ High corrosion resistance in general ■ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ■ Increased resistance to intergranular corrosion and pitting ■ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content

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

11.5.4 Process connection



A0028122

11 Flange as process connection

- 1 Flange
- 2 Compression fittings
- 3 Eyebolt

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

Standard ¹⁾	Size	Design	Material
ASME	1½", 2", 3", 4", 6", 8"	150#, 300#, 400#, 600#	AISI 316, 316L, 304, 304L, 316Ti, 321, 347
EN	DN40, DN50, DN80, DN100, DN150, DN200	PN10, PN16, PN25, PN40, PN63, PN100	

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

Compression fittings

The compression fittings are welded or threaded into the flange to ensure tightness to the process connection. 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
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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, CSA, IECEx, 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 Certification HART

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

11.6.4 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[™]

11.6.5 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)

11.6.6 Other standards and guidelines

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

11.6.7 Material certification

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

11.6.8 Test report and calibration

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

11.6.9 Material requirements

Endress+Hauser can supply components according to AD 2000 W2 And W10 standards.

11.6.10 Welding requirements

Endress+Hauser has been audited according to DIN EN ISO 3834-2:2005.

11.6.11 Pressure equipment requirements

Endress+Hauser can supply devices according to 2014/68/EU.

12 Documentation

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

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

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

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



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