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LENNTECH
WATER TREATMENT SOLUTIONS

Technical Information
iTHERM MultiSens Flex TMS02
Multipoint thermometer

Direct-contact RTD/TC multipoint thermometer for 3D temperature profiling, with flexible sensors and a diagnostics chamber for applications in the oil, gas, and petrochemical industries

Applications

- For use in the oil & gas and petrochemical industries
- Ideal for capturing a 3D temperature profile
- For installation with flanged process connections on vessels, reactors, and tanks
- For applications requiring advanced safety and diagnostic functions, such as hydro-treating or catalytic cracking

Your benefits

- Spatial monitoring of the temperature profile through flexible sensor arrangement
- More accurate temperature profiling thanks to a high measuring point density using iTHERM ProfileSens sensor technology
- Easy installation, process integration, and maintenance thanks to modular product design and replaceable, standardised measuring elements
- Increased safety and enhanced diagnostics through continuous monitoring of thermometer behavior
- Endress+Hauser iTEMP temperature transmitters support all common communication protocols and optional Bluetooth® connectivity.
- International certifications: explosion protection according to e.g. ATEX, IECEx, EAC; functional safety (SIL).

Endress+Hauser
People for Process Automation

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Function and system design

Measuring principle

Thermocouples (TC)

Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors are subjected to a thermal gradient. This voltage is called thermoelectric voltage or electromotive force (emf). Its magnitude depends on the type of conducting materials and the temperature difference between the "measuring point" (the junction of the two conductors) and the "cold junction" (the open conductor ends). Accordingly, thermocouples primarily only measure differences in temperature. The absolute temperature at the measuring point can be determined from these if the associated temperature at the cold junction is known or is measured separately and compensated for. The material combinations and associated thermoelectric voltage/temperature characteristics of the most common types of thermocouple are standardized in the IEC 60584 and ASTM E230/ANSI MC96.1 standards.

Resistance thermometers (RTD assemblies)

Resistance thermometers use a Pt100 temperature sensor in accordance with IEC 60751. This temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100 Ω at 0 °C (32 °F) and a temperature coefficient α = 0.003851 °C-1.

There are generally two different kinds of platinum resistance thermometers:

There are two different versions of platinum resistance thermometers:

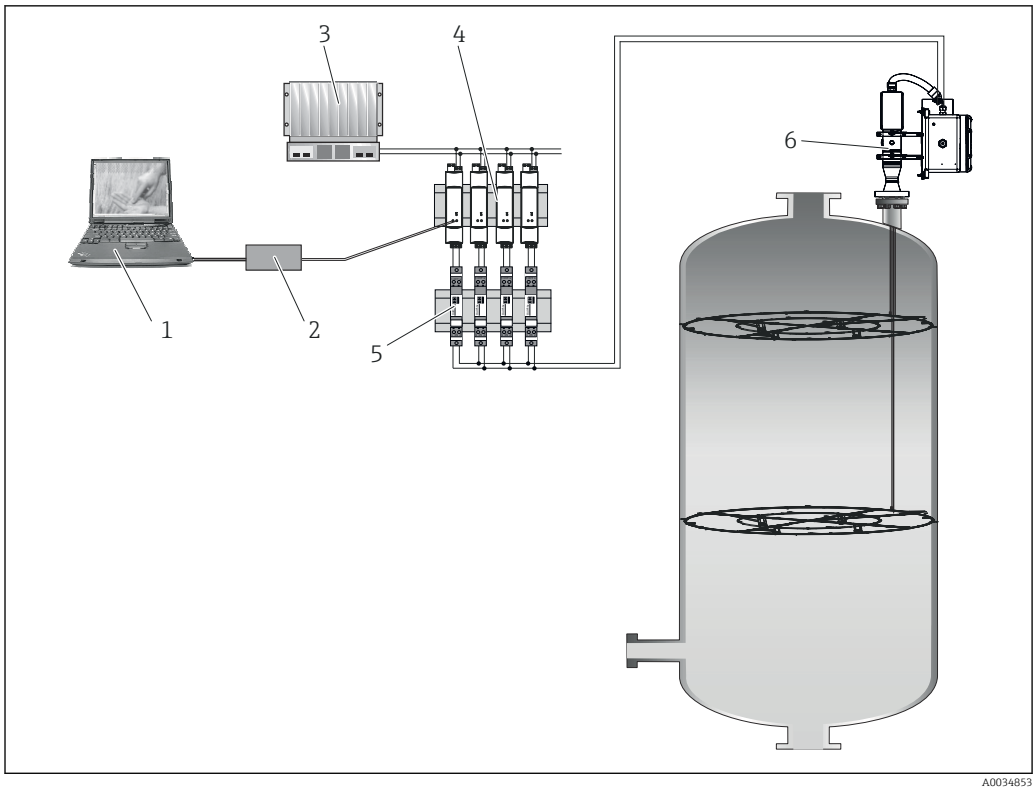
- **Wire-wound (WW):WW** In these thermometers, a double coil of fine, high-purity platinum wire is accommodated in a ceramic support. This support is then sealed top and bottom with a ceramic protective layer. These resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 °C (1 112 °F). This type of sensor is relatively large in size and is comparatively sensitive to vibrations.
- **Thin-film platinum resistance thermometers(TF):** A very thin, ultrapure platinum layer, approx. 1 µm thick, is vaporized in a vacuum on a ceramic substrate and then structured photolithographically. The platinum conductor paths formed in this way create the measuring resistance. Additional covering and passivation layers are applied and reliably protect the thin platinum layer from contamination and oxidation, even at high temperatures.

Measuring system

The manufacturer provides a complete portfolio of optimized components for the temperature measuring point – everything needed for seamless integration of the measuring point into the overall facility.

These include:

- Power supply unit/active barrier
- Configuration units
- Overvoltage protection



1 Application example in a reactor.

1 *Device configuration with application software FieldCare*
2 *Commubox*
3 *PLC*
4 *Active barrier of the RN series (24 V_{DC}, 30 mA) with galvanically isolated output for the power supply of loop-powered transmitters. The universal power supply works with an input supply voltage of 20 to 250 V DC/AC; 50/60 Hz, which means that it can be used in all international power grids.*
5 *Overvoltage protection devices from the HAW product family for protection of signal lines and components in hazardous areas, e.g. 4 to 20 mA, PROFIBUS® PA and FOUNDATION Fieldbus™ signal lines. Further information is available in the corresponding Technical Information.*
6 *Mounted multipoint thermometer in a thermowell available on site, optionally with built-in transmitters in the junction box for 4 to 20 mA-, HART-, PROFIBUS® PA-, FOUNDATION Fieldbus™ communication or terminal blocks for remote wiring.*

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, centering stars, 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 functions, dimensions and materials. They differ as follows:

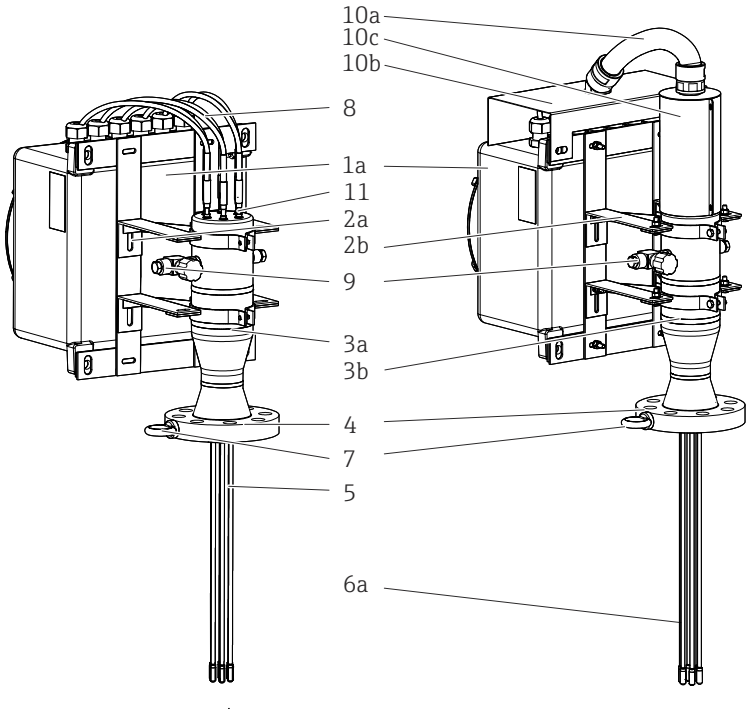
- **"Basic" design** The extension cables are directly connected to the diagnostic chamber and the inserts are not replaceable (welded to the chamber). Leakages at the welded joints between the sensors and the process connection can be detected in the diagnostic chamber, which also contains the escaping process medium.
- **"Advanced" design** The extension cables are connected to removable stump-inserts that can be individually inspected and replaced for ease of maintenance. Compression fittings on the upper part of the diagnostic chamber ensure that the stump-inserts can be replaced. An interruption in the MI cable (provided for in the design with stump-inserts) is located inside the diagnostic chamber, so that process medium can be directed into the chamber and detected there in the event of a leakage. Leakages can come from the welded joints between the sensors and process connection or from the sensor itself. This phenomenon may occur if unexpectedly high corrosion rates compromise the insert sheath integrity.

Design with thermowells

The MultiSens Flex TMS02 with thermowells is available in the **"Advanced"** configuration:

"Advanced" design The inserts can be replaced individually (including under operating conditions). Compression fittings on the upper part of the diagnostic chamber ensure that the inserts are replaceable. 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.

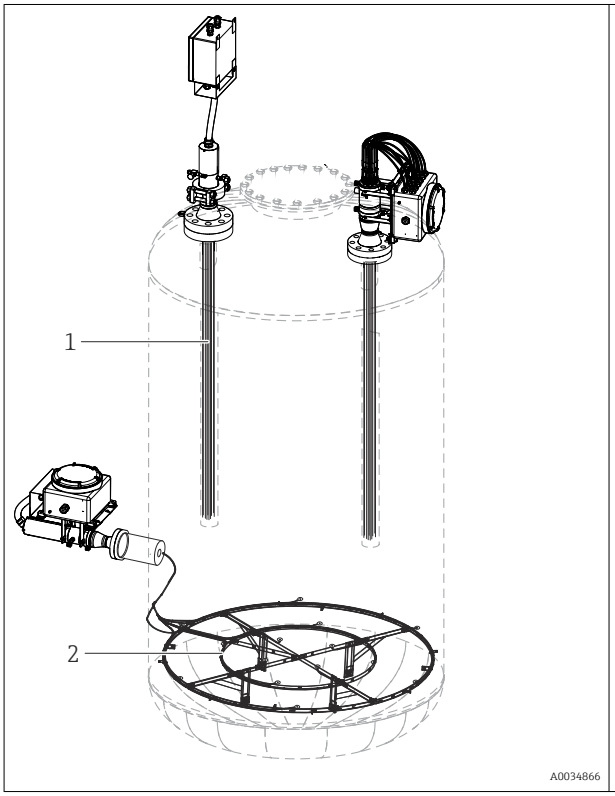
Sensor replaceability		
	Basic	Advanced
Without thermowells	Sensors are not replaceable	Only the external sensor section (connecting cables from the diagnostic chamber onwards) is replaceable.
With thermowells	Not available	Sensors are replaceable in any conditions

Construction


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 non-hazardous media Advanced configuration: For hazardous media ▪ 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 → 🖹 26. 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 resistance thermometers (Pt100). For details, refer to the 'Ordering information' table.

Description, available options and materials	
6a: Thermowells or open guiding tubes	The thermometer can be equipped with: ▪ thermowells for higher mechanical strength and corrosion resistance, as well as for sensor replacement ▪ open guide 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 cable	Cable for electrical connections between the inserts and junction box. ▪ Shielded PVC ▪ Shielded FEP
9: Accessories connection	Auxiliary connections for pressure detection, fluid draining, purging, overflow, sampling and analysis. ▪ 316/316L ▪ 321 ▪ 347
10: Protection 10a: Cable conduit 10b: Cover for cable glands 10c: Extension cables cover	The cover for the extension cables consists of two half-shells, which 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 fastened to the upper part of the chamber. The cover for the cable conduit consists of a shaped stainless-steel plate, which is fastened to the junction box 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. Suitable for many process media 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 various sensor elements are arranged in a straight line corresponding to the longitudinal axis of the multipoint thermometer (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.

Input

Measured variable

Temperature (temperature-linear transmission behavior)

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) 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:	

Output

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.

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.

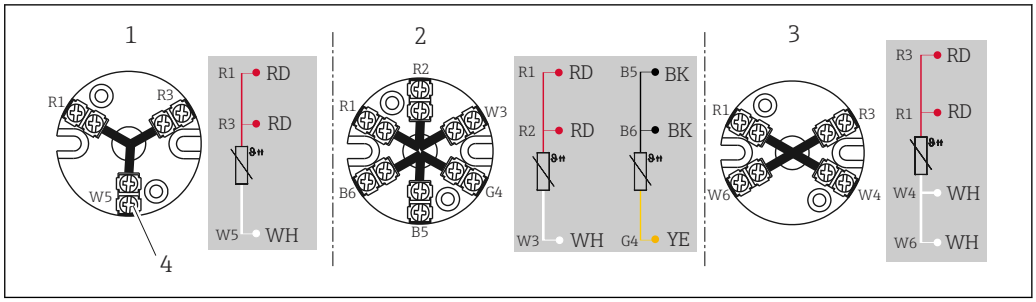
Advantages of the iTEMP transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Attachable display (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer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

Power supply

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

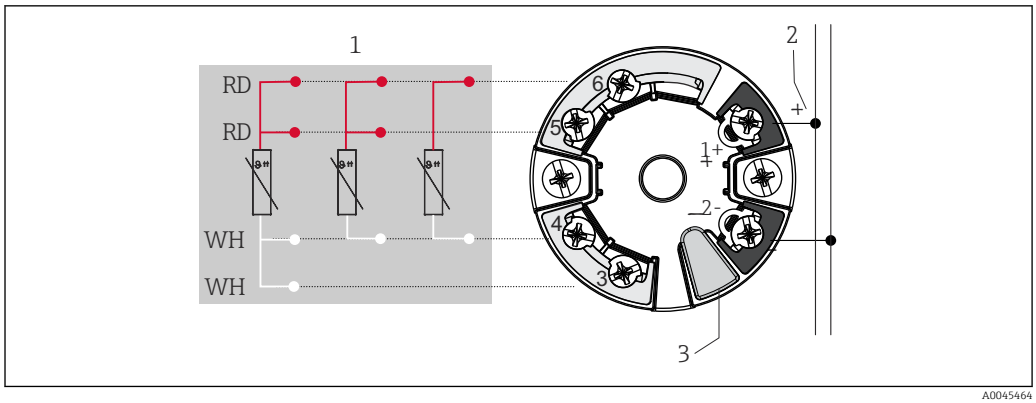
Wiring diagrams

RTD sensor connection type



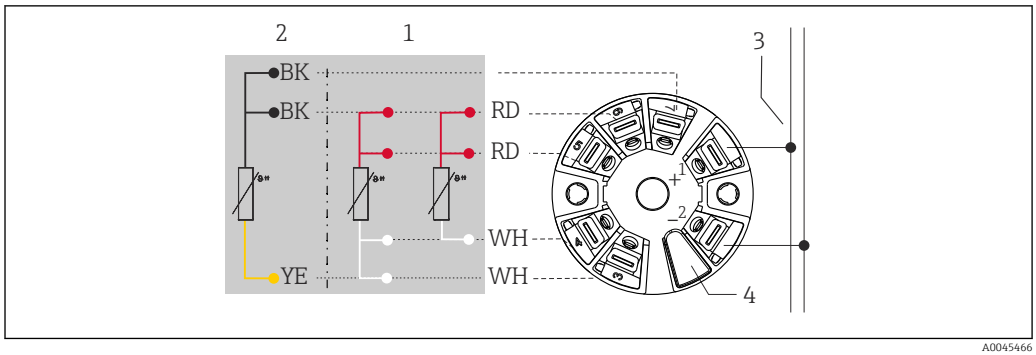
2 *Mounted terminal block*

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



3 *Head-mounted transmitter TMT7x or TMT31 (single input)*

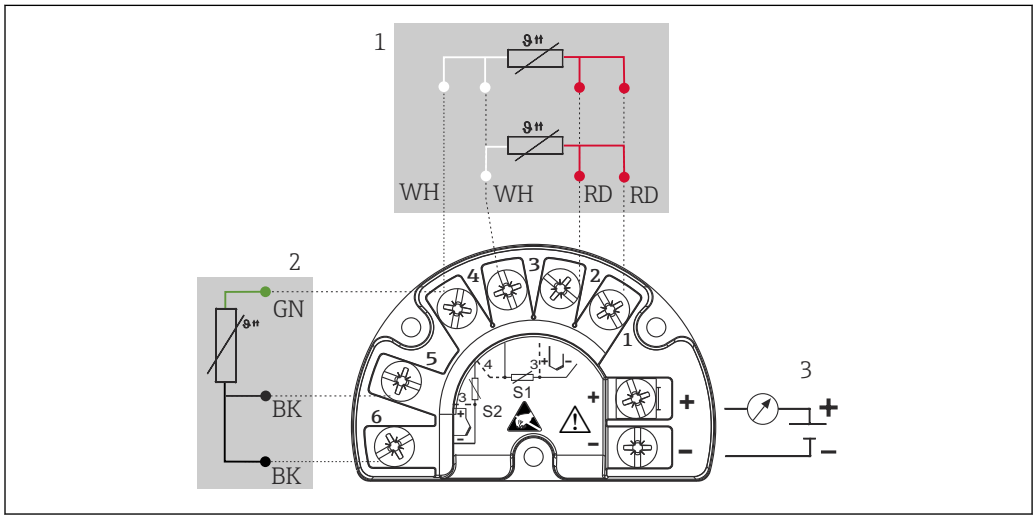
1 *Sensor input, RTD and Ω: 4-, 3- and 2-wire*
2 *Power supply or fieldbus connection*
3 *Display connection/CDI interface*



4 *Head-mounted transmitter TMT8x (dual input)*

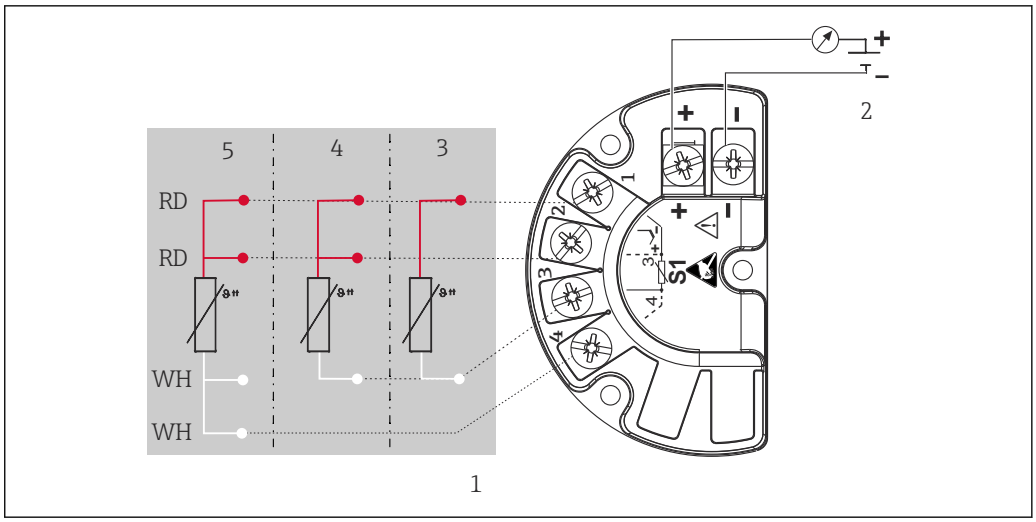
1 *Sensor input 1, RTD: 4- and 3-wire*
2 *Sensor input 2, RTD: 3-wire*
3 *Power supply or fieldbus connection*
4 *Display connection*

Mounted field transmitter: Fitted with screw terminals



5 *TMT162 (dual input)*

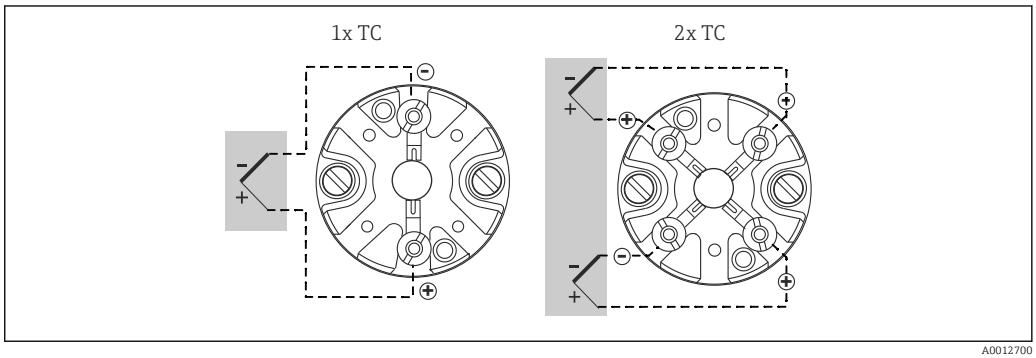
1 *Sensor input 1, RTD: 3- and 4-wire*
2 *Sensor input 2, RTD: 3-wire*
3 *Power supply, field transmitter and analog output 4 to 20 mA or fieldbus connection*



6 *TMT142B (single input)*

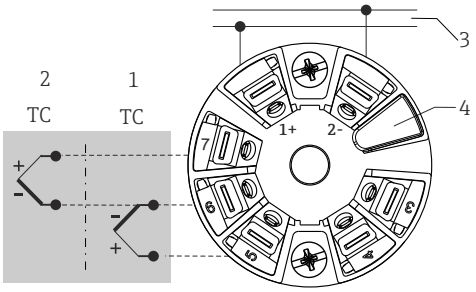
1 *Sensor input RTD*
2 *Power supply, field transmitter and analog output 4 to 20 mA, HART® signal*
3 *2-wire*
4 *3-wire*
5 *4-wire*

Thermocouple (TC) sensor connection type



7 *Mounted terminal block*

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



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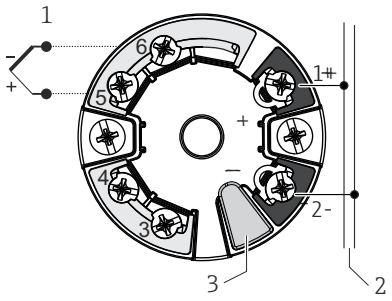
1 Sensor input 1
2 Sensor input 2
3 Fieldbus communication and power supply
4 Display connection

Head-mounted transmitter TMT7x or TMT31 (single input) [1)]



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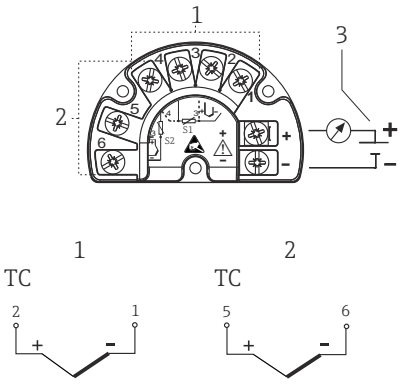
1 Sensor input TC, mV
2 Power supply, bus connection
3 Display connection/CDI interface

Mounted field transmitter TMT162 or TMT142B



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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 (-)

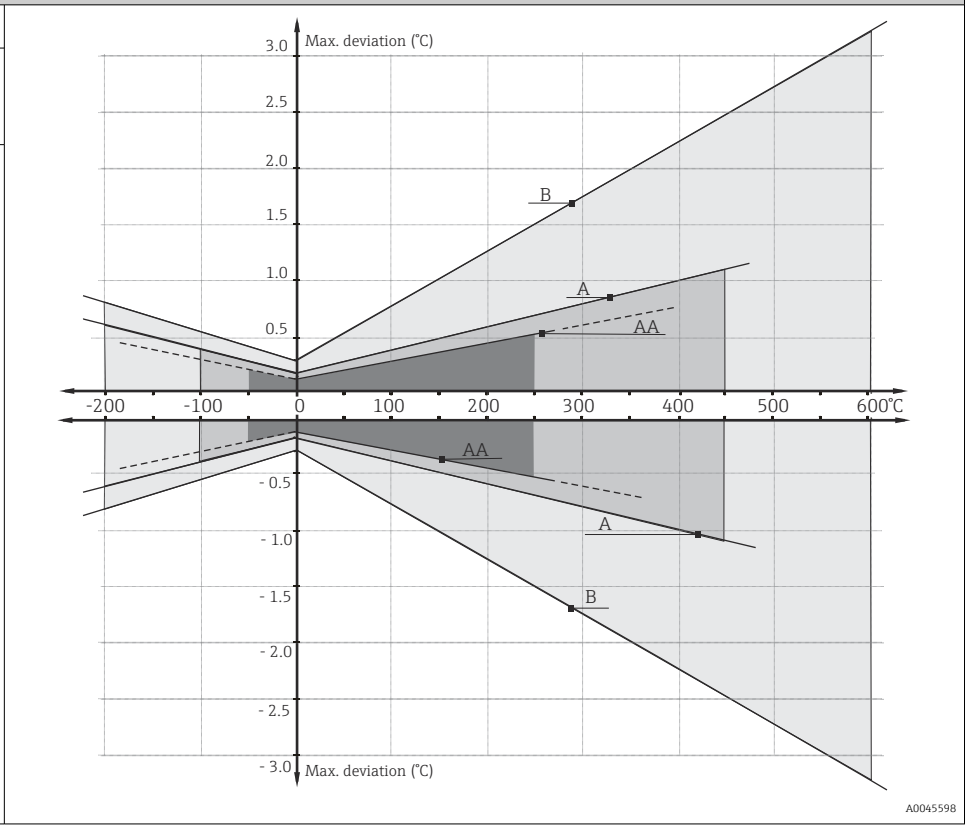
Performance characteristics

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.

Maximum measurement error

RTD resistance thermometer according to IEC 60751

Class	Max. tolerances (°C)	Characteristics
RTD maximum sensor error		
Cl. A	± (0.15 + 0.002 · |t| [1])	
Cl. AA, previously 1/3 Cl. B	± (0.1 + 0.0017 · |t|) [1]	
Cl. B	± (0.3 + 0.005 · |t| [1])	

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	±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	±0.0075 |t| [1] (333 to 1200 °C) ±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 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)	±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 1260 °C)	±1.1 K or ±0.004 |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.

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

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

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

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.

In the case of a multipoint cable sensor, temperature-controlled calibration baths from −80 to 550 °C (−112 to 1 022 °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 1 022 °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.

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.

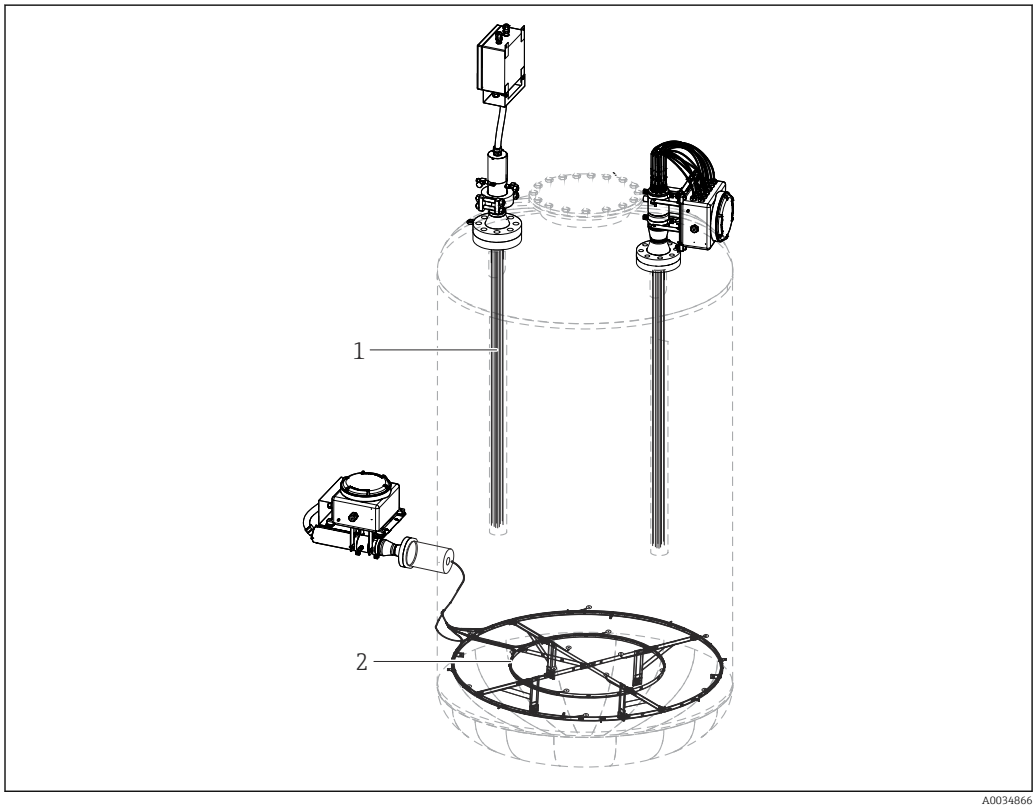
Installation

Installation location

The installation location must meet the requirements listed in this document – such as Ambient temperature, protection class, climate class etc. etc. Carefully check the dimensions 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.

Installation position

No restrictions. The multipoint thermometer can be installed either horizontally or vertically relative to the vertical axis of the reactor or vessel . The modular support frame ensures that the junction box can be positioned as required according to the available space at the installation site.



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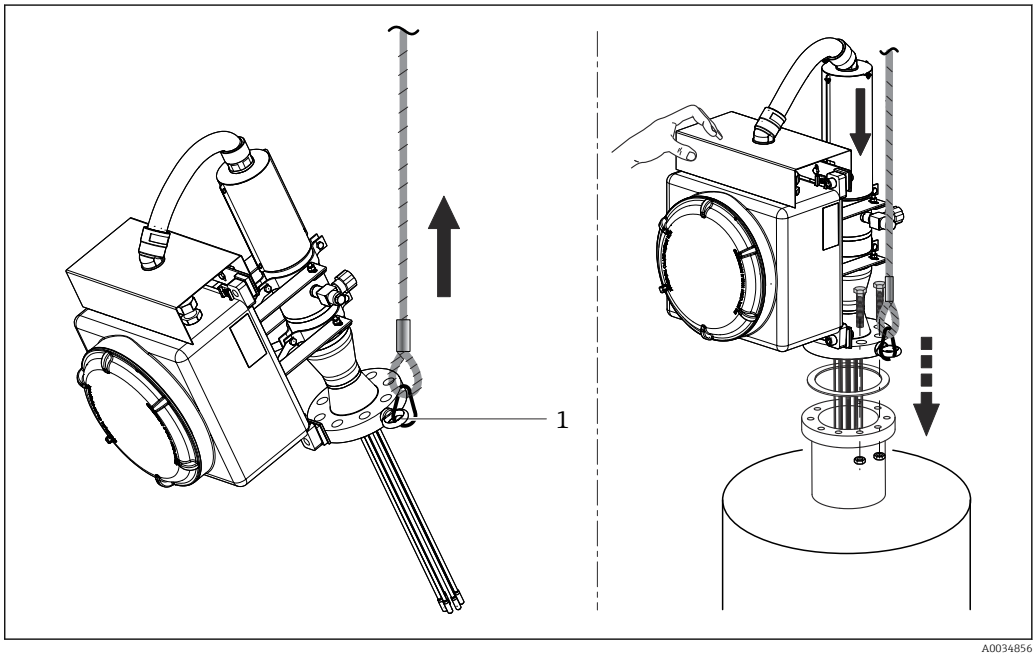
Installation instructions

The modular multipoint thermometer is designed for installation with a flanged or clamped process connection into a vessel, reactor, tank or similar application. All parts and components have to be handled with care. During installation, lifting or insertion of the device through the existing nozzle, the following must be avoided:

- Misalignment with the nozzle axis
- Any load on the welded or threaded parts caused by the weight of the device
- Deformation of or damage to the threaded components, bolts, nuts, cable glands and compression fittings
- Bending radius of the thermowells smaller than 20 times the thermowell outer diameter

- Bending radius of the sheathed cables (inserts) smaller than 5 times the outer diameter of the sheathed cable
- Friction between the temperature probes and the components inside the reactor
- Attaching the temperature probes to the reactor structure without compensation lines that allow axial movement and displacement

Existing internal fixtures inside the vessel must be taken into account when installing the multipoint inserts. These internal fixtures can serve as an interface between the multipoint thermometer and the process if they are used to mount the measuring tips, or they can act as constraints if the thermocouples have to be routed according to the installation instructions. If the internal fixtures cannot be used as an interface for the insert, Endress+Hauser can supply special support frames that have only minimal impact on the process and enable the required measuring points to be implemented. The components of the frame are always mechanically jointed to ensure there is no thermal influence or adverse affect on the internal fixtures.



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During installation, the entire thermometer may only be lifted and moved using ropes that are properly attached to the eyebolt of the flange (1) or carefully secured to the thermowells.

Ambient conditions

Ambient temperature

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 transmitter	−40 to +85 °C (−40 to +185 °F)	Depends on Ex area approval. For 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)

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)

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

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

Electromagnetic compatibility (EMC)

Depends on the head transmitter used and can be found in the Technical Documentation for the device.

Process

The process temperature and process pressure are the minimum input parameters for the selection of the right product configuration. If special product features are requested, additional data such as process fluid type, phases, concentration, viscosity, flow, turbulences and corrosion rate are required for the entire product definition.

Process temperature range

Up to +1 150 °C (+2 102 °F). Depends on the configuration.

The flanges for the process connection define the maximum process conditions under which the devices can work based on their specific pressure classes, which are designed according to the requirements of the plant.

Process pressure range

0 to 200 bar (0 to 2 900 psi). Depends on the configuration.

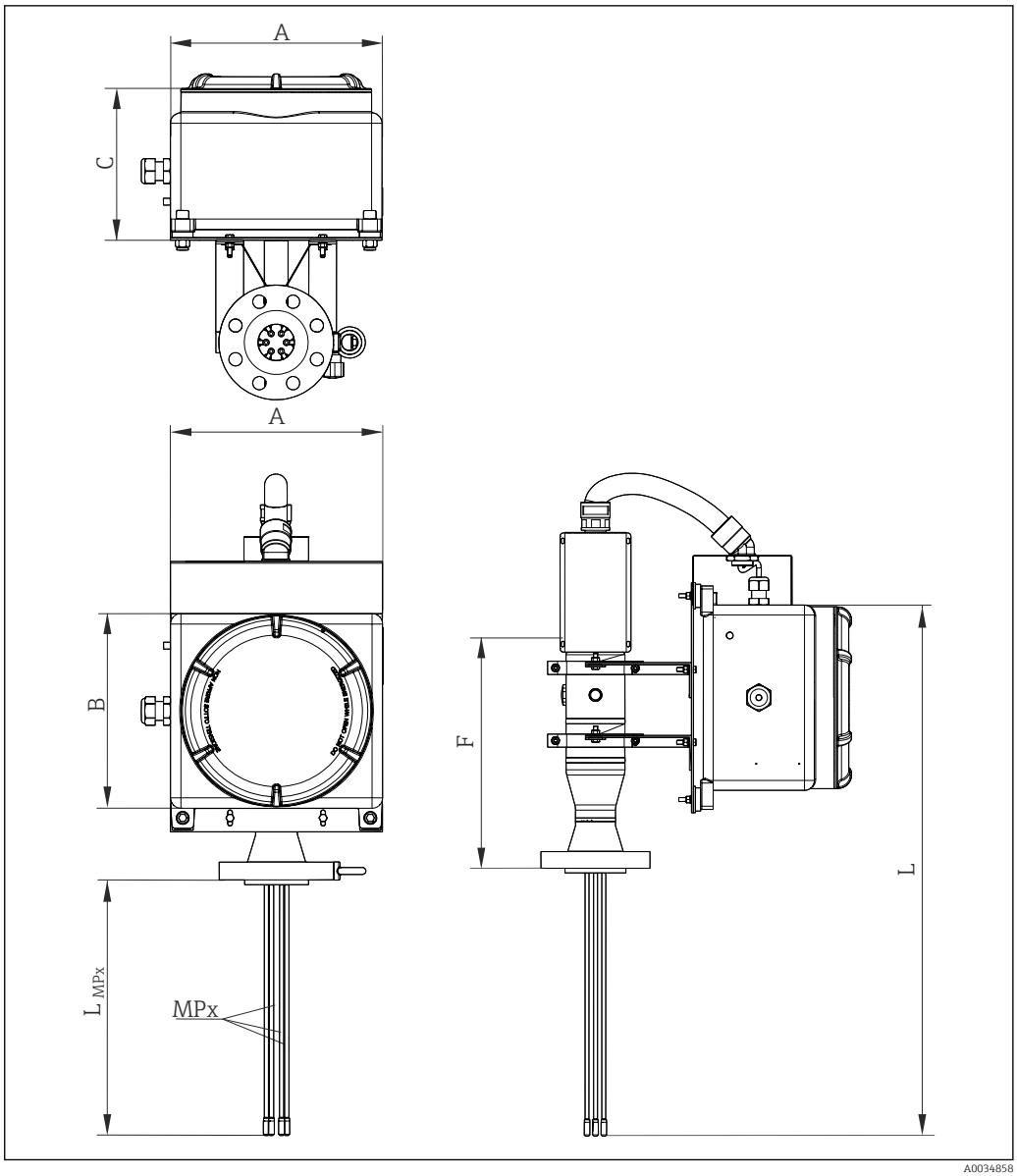
In any case, the maximum required process pressure has to be combined according to the maximum allowable process temperature. Process connections like compression fittings, flanges with their specific pressure classes, and thermowells that are selected according to the plant requirements define the maximum process conditions at which the device can operate. Endress+Hauser experts can advise the customer on any related questions.

Process applications:
- Atmospheric/vacuum distillation
- Catalytic cracking/hydrocracking
- Hydrotreating
- Catalytic reforming
- Visbreaking
- Delayed cocking
- Hydrodesulphurization

Mechanical construction

Design, dimensions

The multipoint thermometer is composed of four subassemblies. Both linear and 3D configurations have the same features, dimensions and materials. Different inserts are available for specific process conditions to ensure maximum accuracy and long service life. In addition, thermowells can be selected to further increase mechanical performance and corrosion resistance and to allow replacement of the insert. 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 degree of protection.


A
C
A
B
F
L
L MPx
MPx
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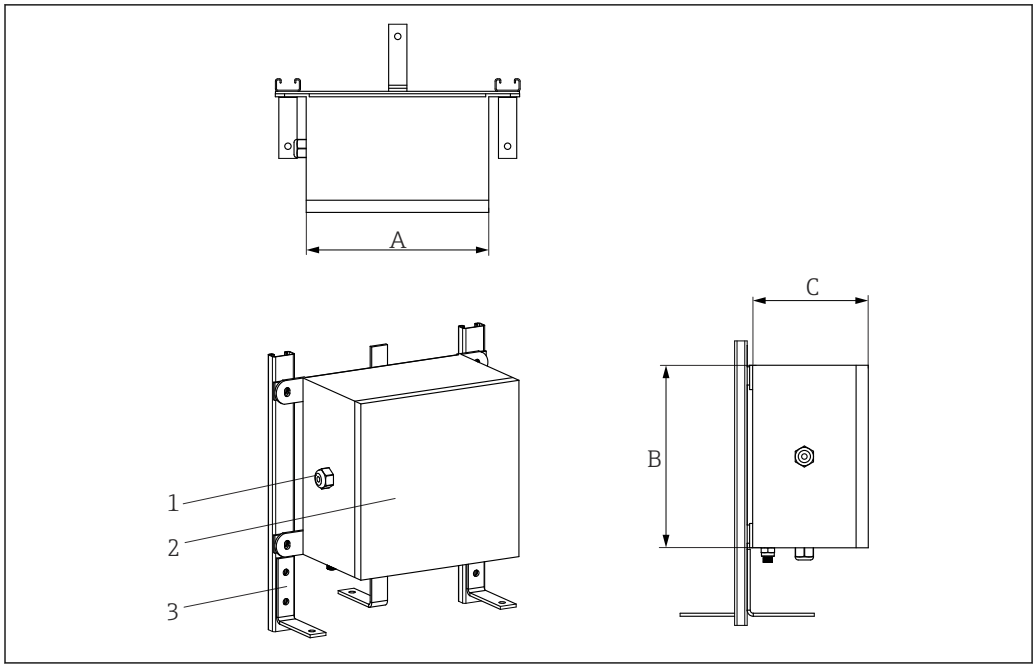
Junction box



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
Marking	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	→ 🖹 22- 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 at various mounting angles with respect to the device base.

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 fixed (rigid) connection to the junction box and is vibration-resistant. Without an enclosed housing, the frame protects the cables by means of the covers and the cable conduit of the junction box. 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

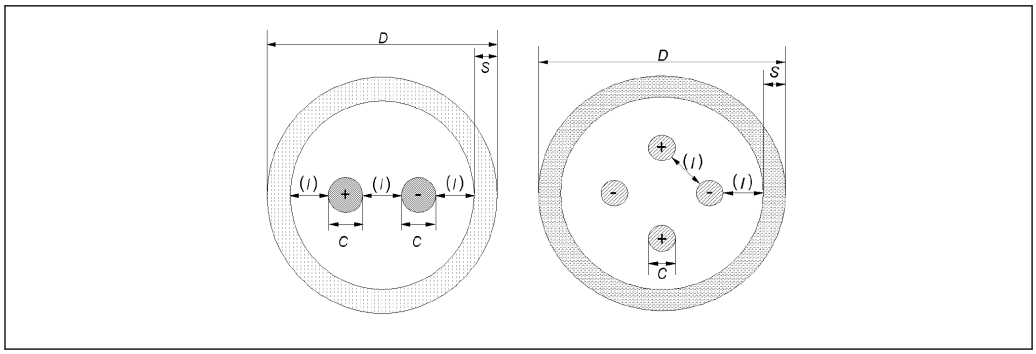
Different insert and thermowell types are available. For other requirements not described here, please contact the Endress+Hauser sales department.

Thermocouple

Diameter in mm (in)	Type	Standard	Sensor configuration	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



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 to the upper part of the diagnostic chamber to ensure proper sealing under all specified operating conditions and to allow maintenance or replacement of the stump-insert (**"Advanced"** solution without thermowells) or the insert (**"Advanced"** solution with thermowells).

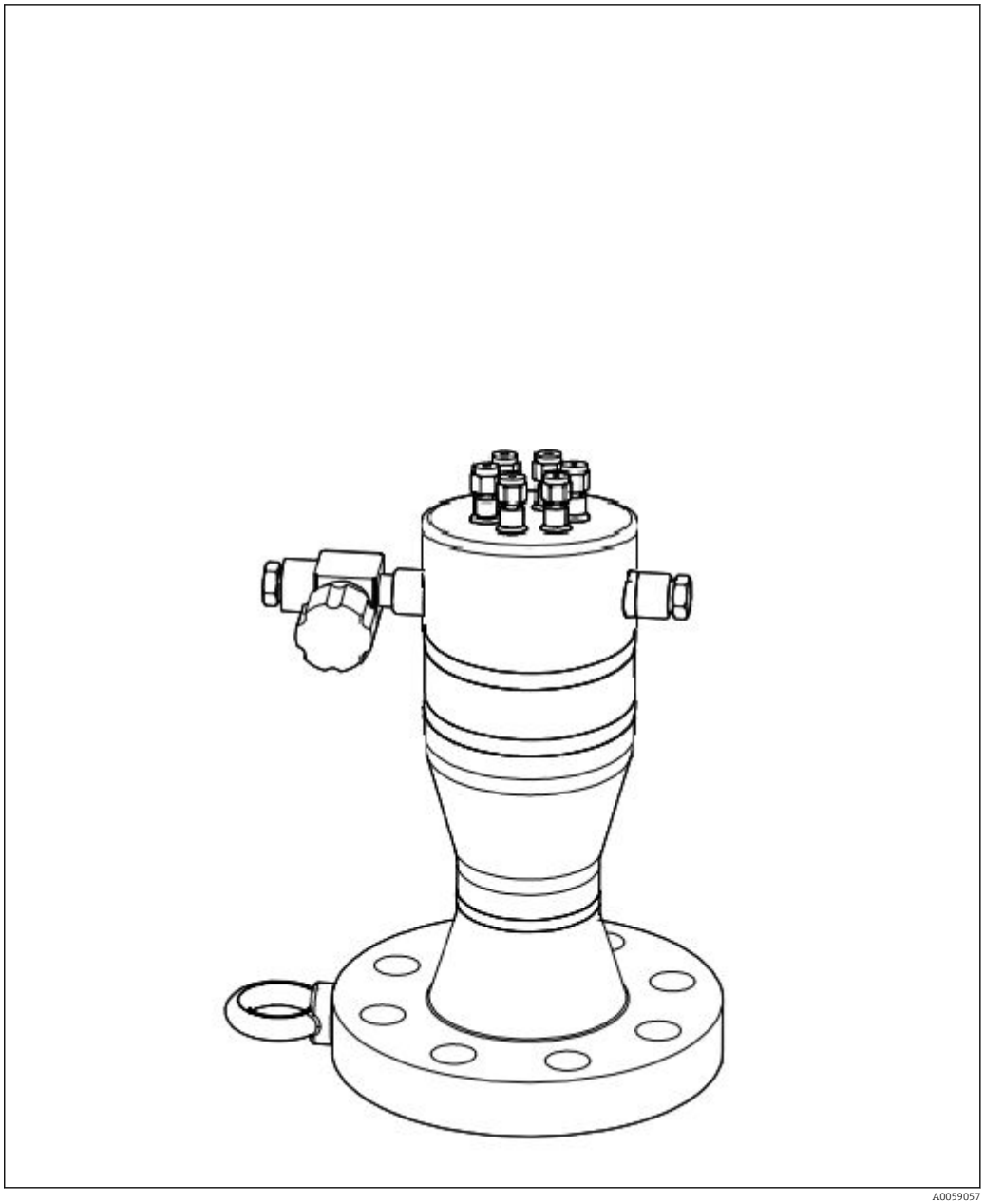
Material: AISI 316/AISI 316H

Cable glands

The installed cable glands provide the appropriate degree of reliability under the specified ambient and process conditions.

Material	Marking	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

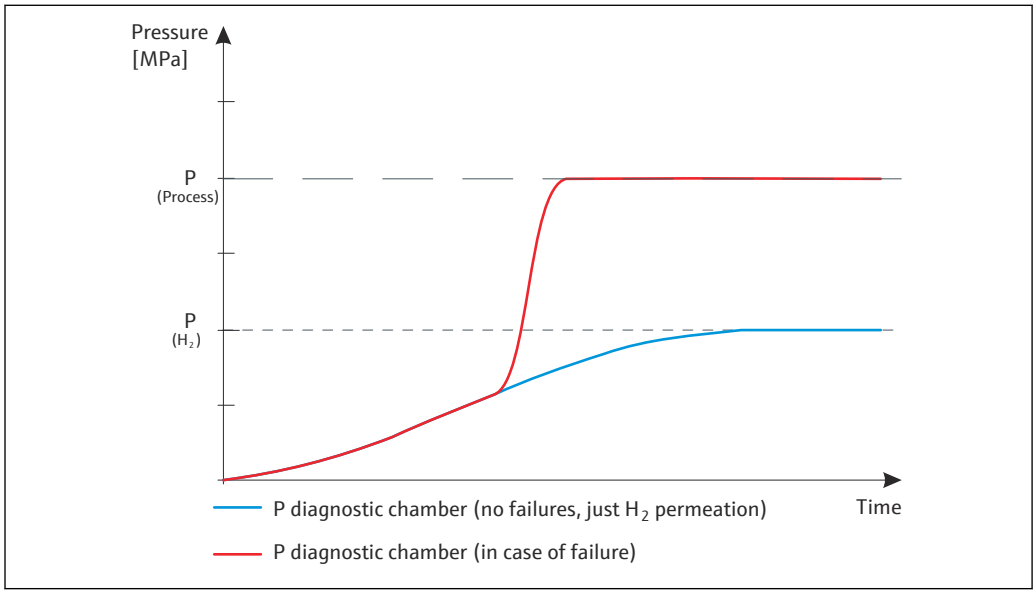
The diagnostic chamber is a module designed to monitor the behavior of the multipoint thermometer in the event of leaks or substances escaping from the process through permeation and to safely contain them. By processing all recorded data, it enables assessment of the measurement accuracy, remaining service life, and maintenance schedule.

Reactors in which the multipoint assembly operates are typically subject to harsh conditions in terms of pressure, temperature, corrosion, and dynamics of the process fluids. A pressure build-up in the diagnostic chamber may be caused by permeation or leakage during the process. Possible causes include:

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

Using a E+H portable sampling system, samples of the fluids contained inside the chamber can be taken directly on site and analyzed by E+H in cooperation with the customer. The pressure and temperature data should be continuously recorded by the user for self-diagnostic purposes, but can also be forwarded to Endress+Hauser for extended diagnostic analysis.

The phenomenon of permeation can be quantitatively analyzed by comparing the recorded data with the theoretical values derived from Fick's law in order to analyze the actual operating conditions of the multipoint thermometer.



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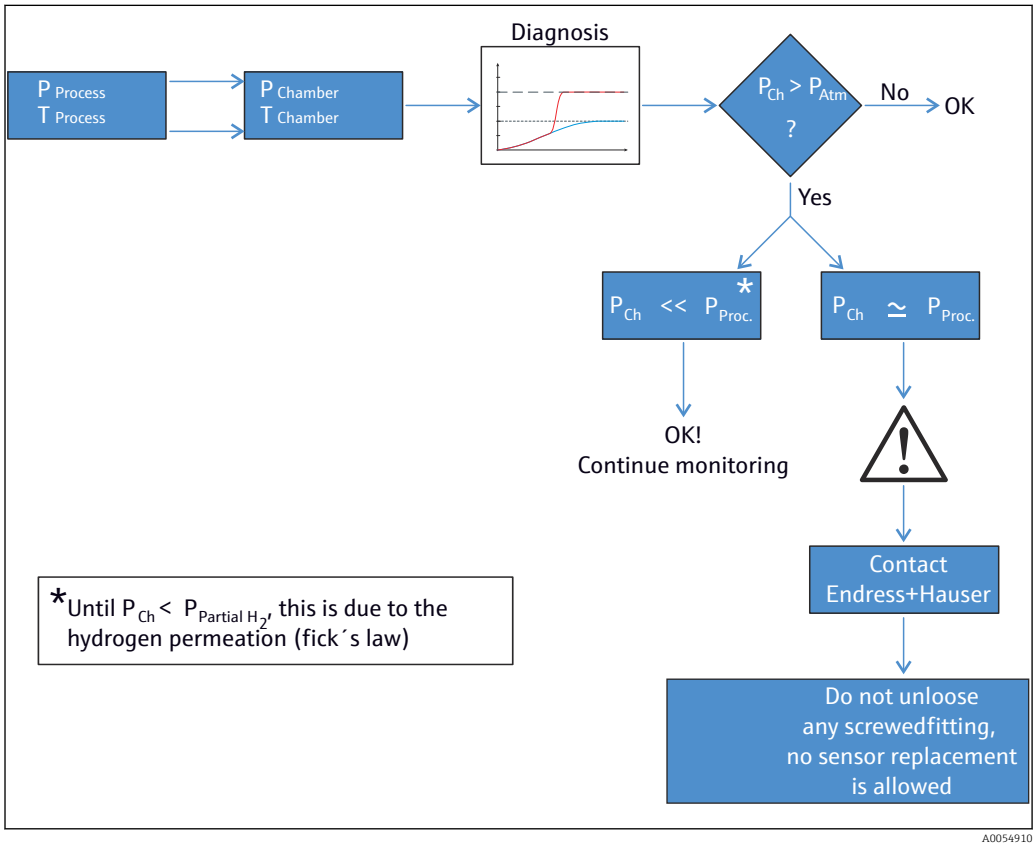

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Weight

The weight may vary based on the configuration, depending on the junction box and the frame design, the diagnostic chamber and the clamp (if used), as well as the number of inserts and any 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).

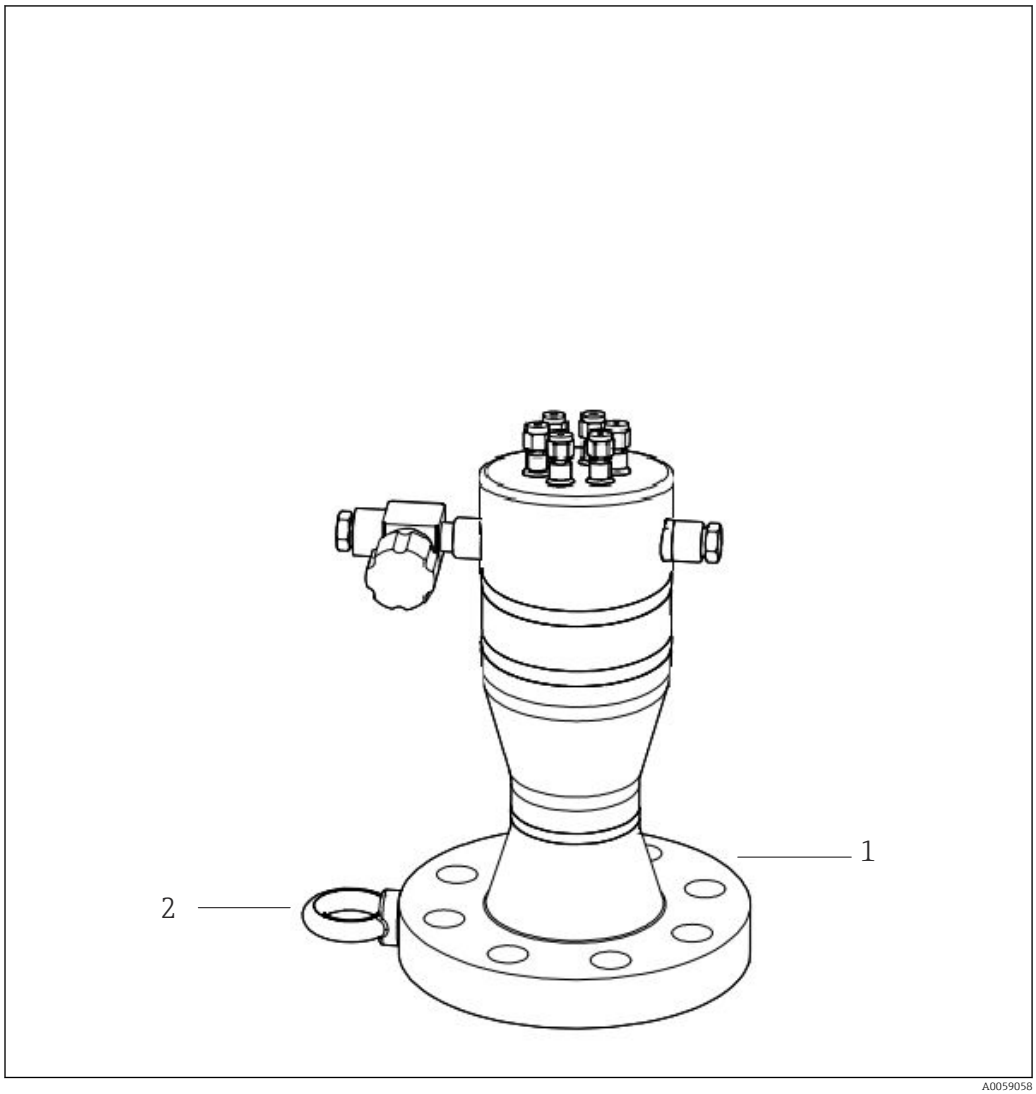
The device must only be lifted and moved using the eyebolt, which is part of the process connection.

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 (1 202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion-resistance in chlorinated and acidic, non-oxidizing atmospheres by adding molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with low concentration)
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1 202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion-resistance in chlorinated and acidic, non-oxidizing atmospheres by adding molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with 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	1 100 °C (2 012 °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 (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 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °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 (1 499 °F)	▪ Austenitic, stainless steel ▪ High resistance to intergranular corrosion even after welding ▪ Good welding characteristics, suitable for all standard welding methods ▪ It is used in many sectors of the chemical industry, petrochemical, and pressurized vessels
AISI 347/1.4550	X6CrNiNb10-10	800 °C (1 472 °F)	▪ Austenitic, stainless steel ▪ High resistance in a wide variety of environments in the chemical, textile, oil refining, dairy and food industries ▪ Added niobium makes this steel impervious to intergranular corrosion ▪ Good weldability ▪ Main applications are furnace fire walls, pressure vessels, welded structures, turbine blades

Process connection and chamber body



8 Flange as process connection

1 Flange
2 Eyebolt

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.

Compression fittings

The compression fittings are welded to the upper part of the diagnostic chamber to allow the inserts to be replaced. The dimensions correspond to those of the insert. The compression fittings meet the highest standards of reliability in terms of materials and design.

Material	AISI 316/316H

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 type of process connection allows the MultiSens system to be installed using a quick and compact clamped connection. For new plants or new reactors, the

counterpart of the process connection of the MultiSens system must 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

Operability

For details on operability, see the Technical Information of the Endress+Hauser temperature transmitters or the manuals of the related operating software. → 32

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**.

Ordering information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

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

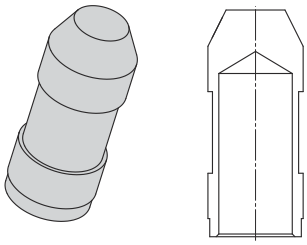
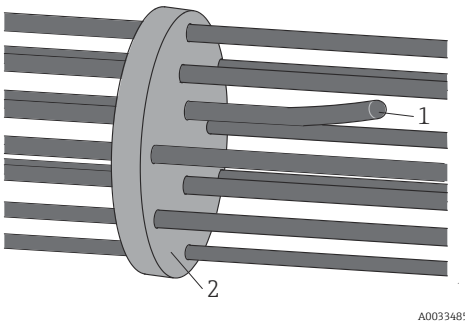
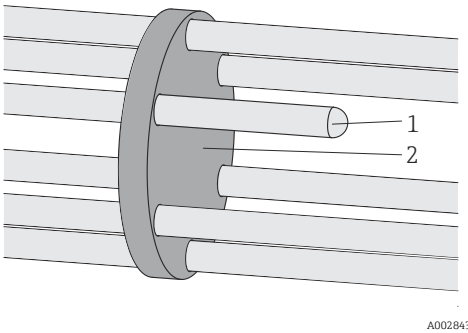
Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic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

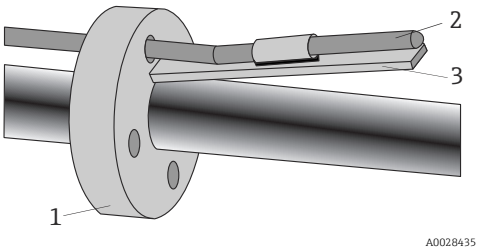
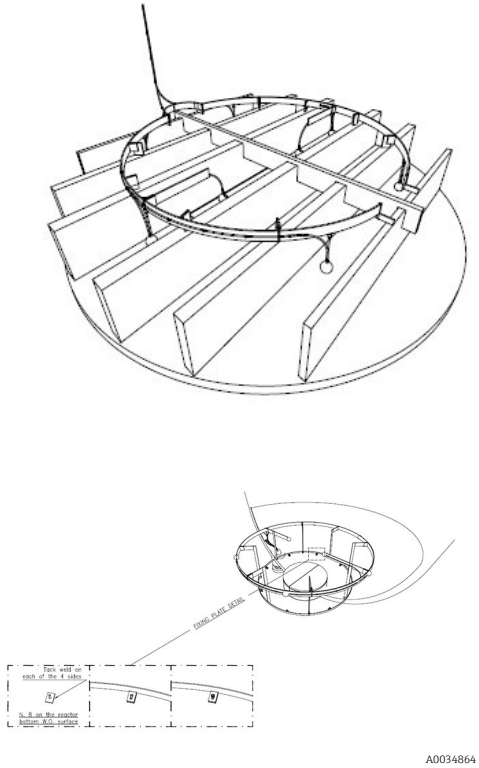
Accessories

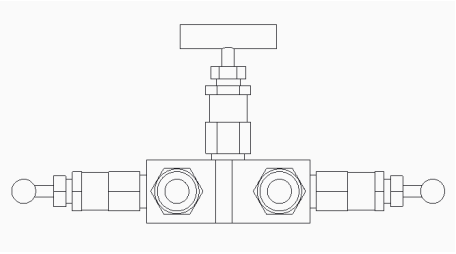
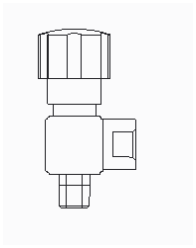
The accessories currently available for the product can be selected at www.endress.com:

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

Device-specific accessories

Accessories	Description
Tip end  A0028427	Protective cap welded to the sensor tip in order to protect the insert from aggressive process conditions, simplify fastening with metallic tie wraps, and ensure proper thermal contact.
Thermal contact system	
Insert and centering stars  A0033485 *1 Insert* *2 Centering stars*	▪ Used on straight configurations and existing thermowells for axial centering of the insert bundle ▪ Prevent the inserts from twisting ▪ Give flexural stiffness to the sensor bundle
Thermowells and centering stars  A0028434 *1 Thermowell* *2 Centering stars*	

Accessories	Description
Bimetallic strips  *9 Bimetallic strips with or without guiding tubes* *1 Guiding tube* *2 Insert* *3 Bimetallic strips*	▪ Used on straight configurations and inside existing thermowells ▪ The inserts are replaceable. ▪ 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
 Frame	Support structure used to secure the thermocouples along the defined path
Tags	Nameplate that can be attached to identify each measuring point and the entire thermometer. Tags can be attached to the extension cables in the area between the process connection and the junction box and/or in the junction box on individual wires.
Diagnostic chamber	
Pressure transmitter	Digital or analog pressure transmitter with welded metallic measuring cell for measurement in gases, steam, or liquids. Refer to the Endress+Hauser PMP sensor family

Accessories	Description
  A0034865 Fitting/manifolds/valves	Fitting, manifolds and valves are available for mounting the pressure transmitter on the system body, and for continuous monitoring of the device under operating conditions. They are also used for venting or draining gas/liquids.
Purging system	A purging system for the depressurization of the diagnostic chamber. The system consists of: ▪ 2- and 3-way valves ▪ Pressure transmitter ▪ Two-way pressure relief valves The system allows the connection of multiple diagnostic chambers installed in the same reactor.
Portable sampling system	Portable system for field use that enables sampling of the fluid present inside the diagnostic chamber, so that it 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

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	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 instruments 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 instruments 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

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

Documentation

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.