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Technical Information
iTHERM MultiSens Flex TMS02

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

Application

- User-friendly multipoint thermometer in modular and flexible design. For installation with a flanged process connection in a vessel, reactor or tank.
- Measuring range:
  - Resistance insert (RTD): −200 to 600 °C (−328 to 1 112 °F)
  - Thermocouple (TC): −40 to 1 150 °C (−40 to 2 102 °F)
- Static pressure range: Up to 200 bar (2 900 psi). Specific maximum process pressure achievable depending on process type and temperature
- Degree of protection: IP66/67

Head transmitter

All Endress+Hauser transmitters are available with enhanced accuracy and reliability compared to directly wired sensors. Easy customizing by choosing one of the following outputs and communication protocols:

- Analog output 4 to 20 mA
- HART®
- PROFIBUS® PA
- FOUNDATION Fieldbus™

Your benefits

- Modular design, individual 3D arrangement of the sensors for monitoring any process.
- Advanced safety and advanced diagnostics to monitor thermometer behavior during its operating time and to plan any maintenance measures.
- Compliance with electrical apparatus directive and Pressure Equipment Directive for easy and fast process integration, compliance with various types of protection for use in explosive atmospheres.
- Inserts can be replaced individually, even in operating conditions.

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People for Process Automation

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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)

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:

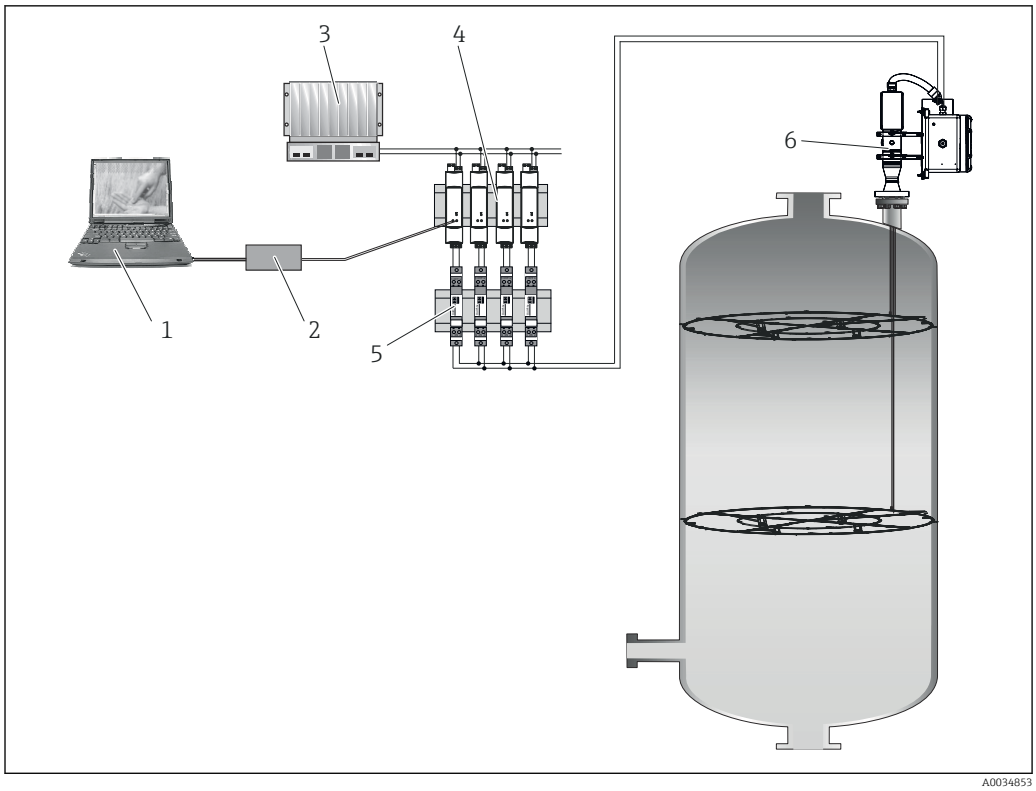
- **Wire-wound (WW):** In these thermometers, a double coil of fine, high-purity platinum wire is located in a ceramic support. This support is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good 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. The primary advantages of thin film temperature sensors over wire wound versions are their smaller sizes and better vibration resistance. A relatively low principle-based deviation of the resistance/temperature characteristic from the standard characteristic of IEC 60751 can frequently be observed among TF sensors at high temperatures. As a result, the tight limit values of tolerance class A as per IEC 60751 can only be observed with TF sensors at temperatures up to approx. 300 °C (572 °F). For this reason, thin-film sensors are generally only used for temperature measurements in ranges below 400 °C (752 °F).

Measuring system

Endress+Hauser offers a complete portfolio of optimized components for the temperature measuring point – everything you need for the seamless integration of the measuring point into the overall facility.

These include:
- Power supply unit/active barrier
- Configuration units
- Overvoltage protection

For more information, see the brochure 'System Components - Solutions for a Complete Measuring Point' (FA00016K/09)



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. More information can be found in the associated 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 and FOUNDATION Fieldbus™ communication or with 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, spacers, support frames for thermocouple mounting, pressure transmitters, manifolds, valves, purging systems and assemblies.
- **Thermowells:** They are directly welded on the process connection and are designed to guarantee a high degree of mechanical protection and corrosion resistance for each sensor.
- **Diagnostic chamber:** This subassembly consists of a closed housing that ensures the continuous monitoring of device conditions during its entire operating life and safe leakage containment of the process fluid. The chamber has connections integrated for accessories (e.g. valves, manifolds). A wide range of accessories is available to get the highest level of system information (pressure, temperature, and fluid composition).

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

Design without thermowells

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

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

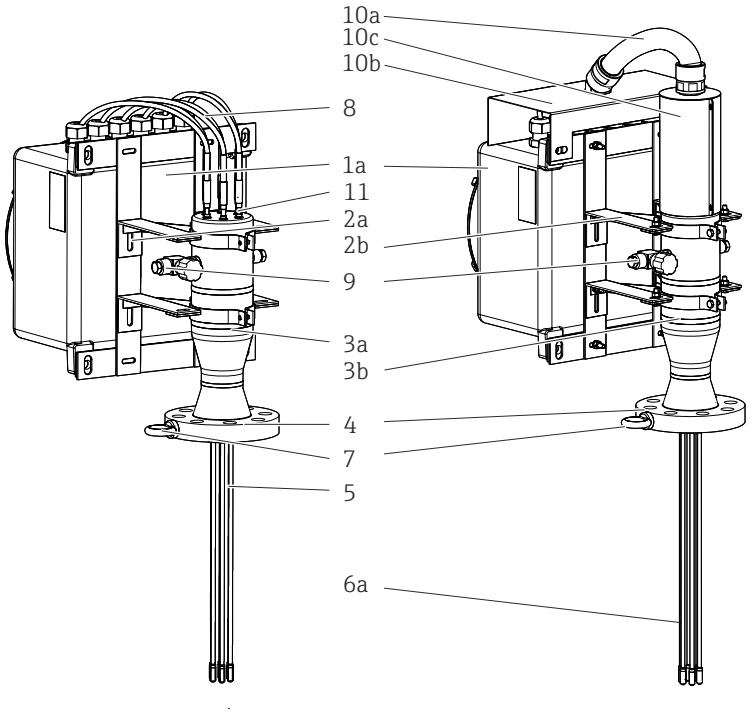
Design with thermowells

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

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

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

Design



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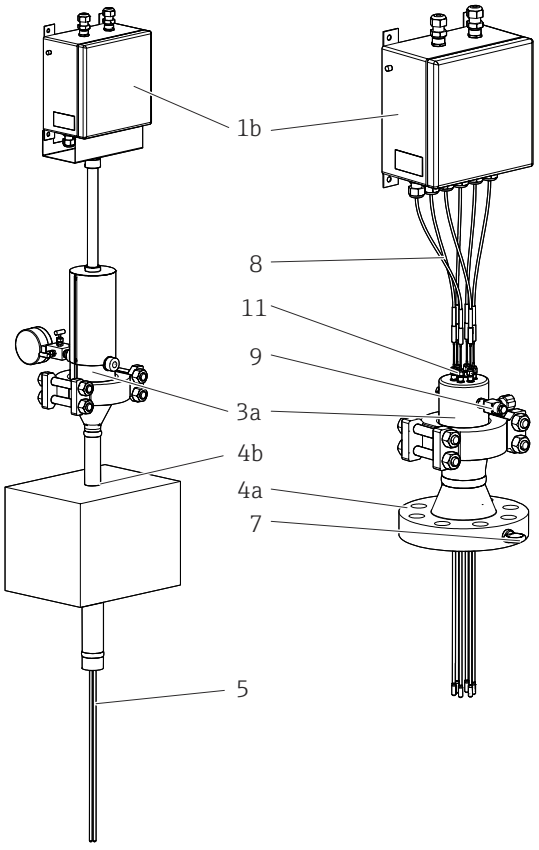

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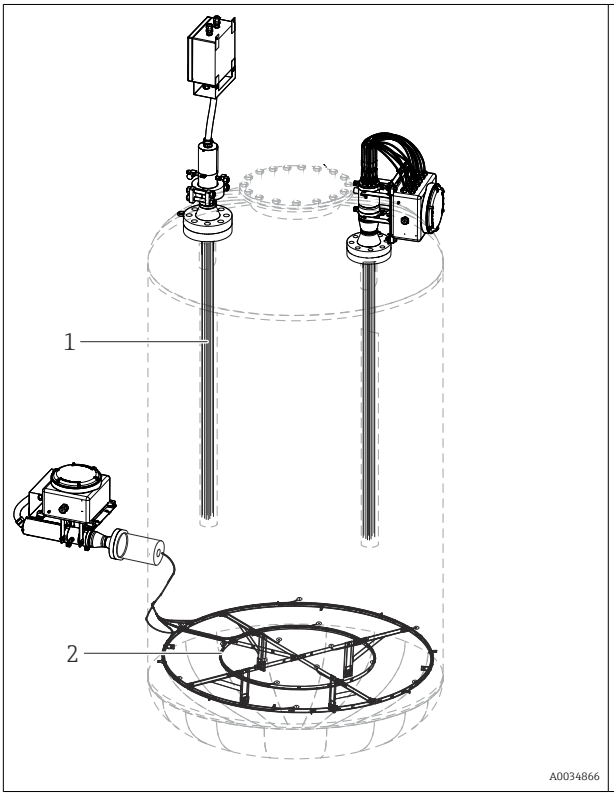
Description, available options and materials	
1: Head 1a: Directly mounted 1b: Remote	Junction box with hinged or screwed cover for electrical connections. It includes components such as electrical terminals, transmitters and cable glands. ▪ 316/316L ▪ Aluminum alloys ▪ Other materials on request
2: Support frame 2a: With accessible extension cables 2b: With protected extension cables	Modular frame support that is adjustable for all available junction boxes. 316/316L
3: Diagnostic chamber 3a: Basic chamber 3b: Advanced chamber	Diagnostic chamber for leakage detection and safe containment of leaking fluids. Continuous monitoring of pressure in the diagnostic chamber. Basic configuration: For fluids that are not dangerous Advanced configuration: For dangerous fluids Advanced and modular: For dangerous fluids and replaceable inserts ▪ 316/316L ▪ 321 ▪ 347
4: Process connection 4a: Flanged according to ASME or EN standards 4b: Welded thermowell insert engineered according to reactor design	Represented by a flange according to international standards or designed for specific process conditions → 🖹 29. Alternatively, a process connection with a clamp and quick release fastener is also possible to meet the requirements of the reactor design and process conditions. ▪ 304 + 304L ▪ 316 + 316L ▪ 316Ti ▪ 321 ▪ 347 ▪ Other materials on request
5: Insert	Mineral-insulated grounded and ungrounded thermocouples or RTDs (Pt100 wire wound). For details, refer to the 'Ordering information' table.
6a: Thermowells or open guiding tubes	The thermometer can be equipped: ▪ either with thermowells for increased mechanical strength, corrosion resistance for sensor replacement ▪ or open guiding tubes for installation in an existing thermowell For details, refer to the 'Ordering information' table.
7: Eyebolt	Lifting device for easy handling during installation phase. SS 316
8: Extension cables	Cables for electrical connections between the inserts and junction box. ▪ Shielded PVC ▪ Shielded FEP
9: Accessories connection	Auxiliary connections for pressure detection, fluid draining, purging, spilling, sampling and analysis. ▪ 316/316L ▪ 321 ▪ 347

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

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



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

Input

Measured variable

Temperature (temperature-linear transmission behavior)

Measuring range

RTD:

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

Thermocouple:

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

1) Restricted by the material of the insert outer sheath

Output

Output signal

Generally, the measured value can be transmitted in one of two ways:
- Directly-wired sensors - sensor measured values forwarded without a transmitter.
- Via all common protocols by selecting an appropriate Endress+Hauser iTEMP temperature transmitter. All the transmitters listed below are mounted directly in the junction box and wired with the sensory mechanism.

Family of temperature transmitters

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

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

HART programmable head transmitters
The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the terminal head (flat face) as per DIN EN 50446. Quick and easy operation, visualization and maintenance using universal configuration software such as FieldCare, DeviceCare or FieldCommunicator 375/475. More information can be found in the Technical Information.

PROFIBUS PA head transmitter
Universally programmable head transmitter with PROFIBUS PA communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. PROFIBUS PA functions and device-specific parameters are configured via fieldbus communication. For more information, see the Technical Information.

FOUNDATION fieldbus head transmitter
Universally programmable head transmitter with FOUNDATION fieldbus communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. All transmitters are approved for use in all the main distributed control systems. The integration tests are performed in Endress+Hauser's 'System World'. For more information, see the Technical Information.

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

intrinsically safe electrical apparatus in Zone 1 hazardous areas. The device can be used for instrumentation purposes in the terminal head form B (flat face) according to DIN EN 50446.

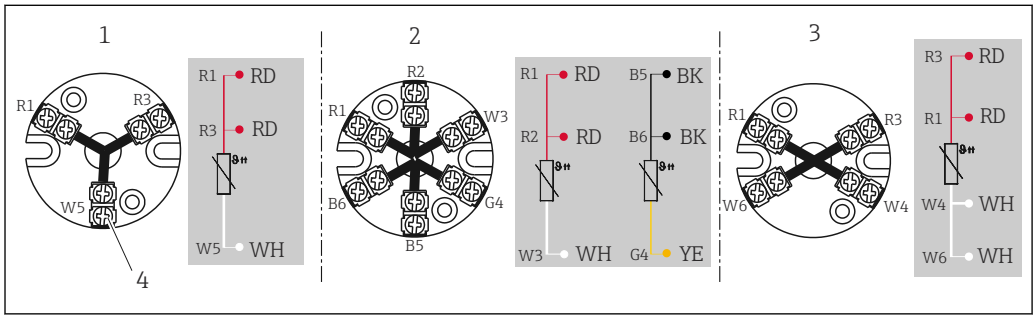
Advantages of the iTEMP transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions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

Power supply

- Electrical connecting cables must be smooth, corrosion resistant, easily cleaned and inspected, robust against mechanical stresses and not susceptible to moisture.
- Grounding or shielding connections are possible via ground terminals on the junction box.

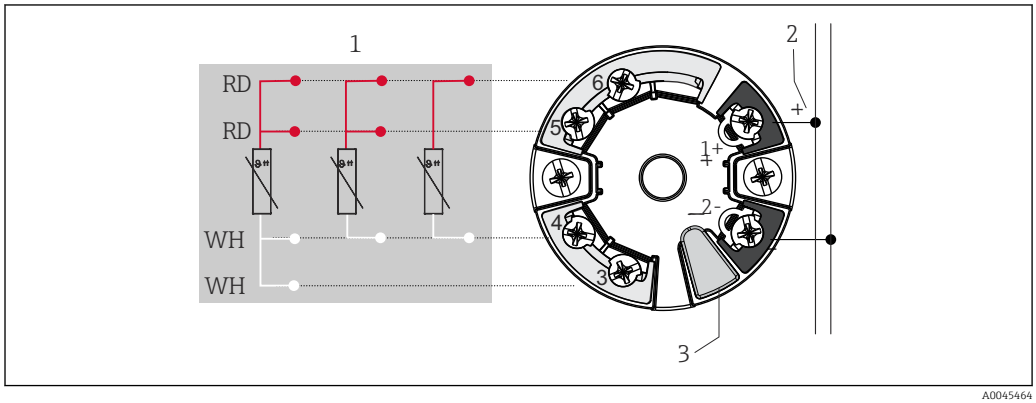
Wiring diagrams

RTD sensor connection type



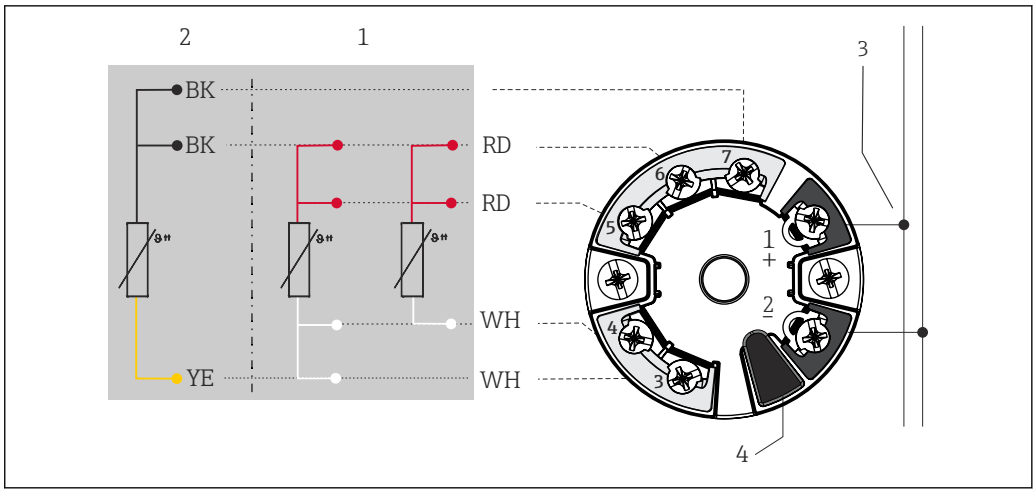
2 *Mounted terminal block*

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)*

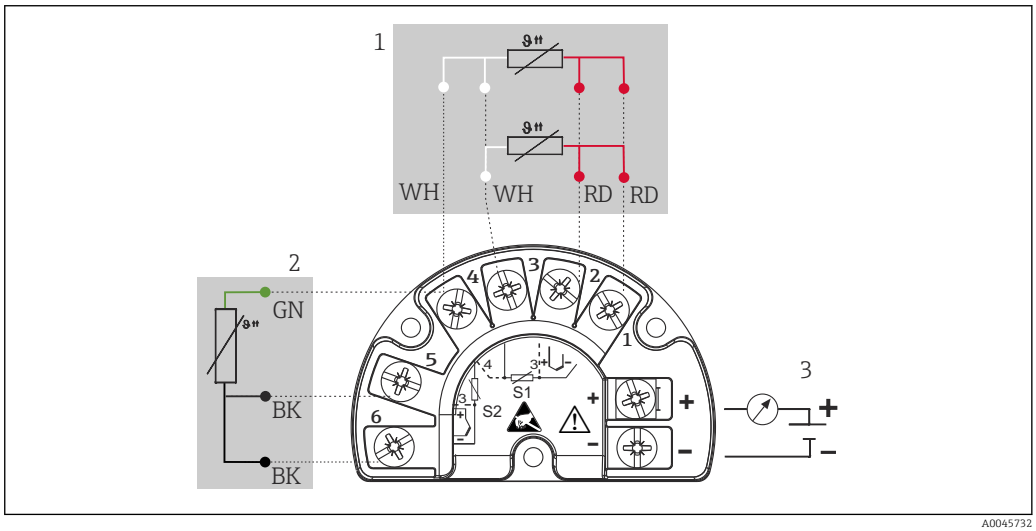
1 *Sensor input, RTD and Ω: 4-, 3- and 2-wire*
2 *Power supply or fieldbus connection*
3 *Display connection/CDI interface*



4 *Head mounted transmitter TMT8x (dual input)*

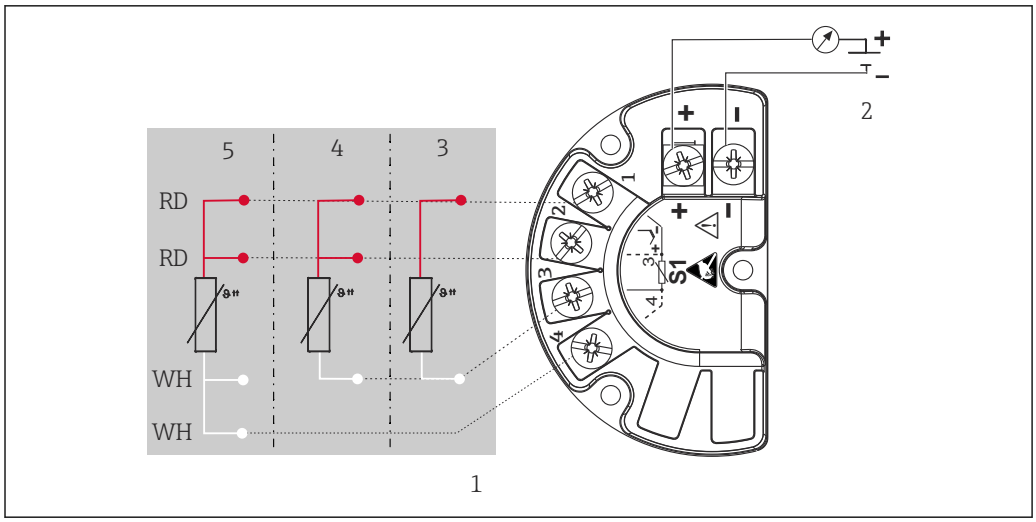
1 *Sensor input 1, RTD: 4- and 3-wire*
2 *Sensor input 2, RTD: 3-wire*
3 *Power supply or fieldbus connection*
4 *Display connection*

Mounted field transmitter: Fitted with screw terminals



5 *TMT162 (dual input)*

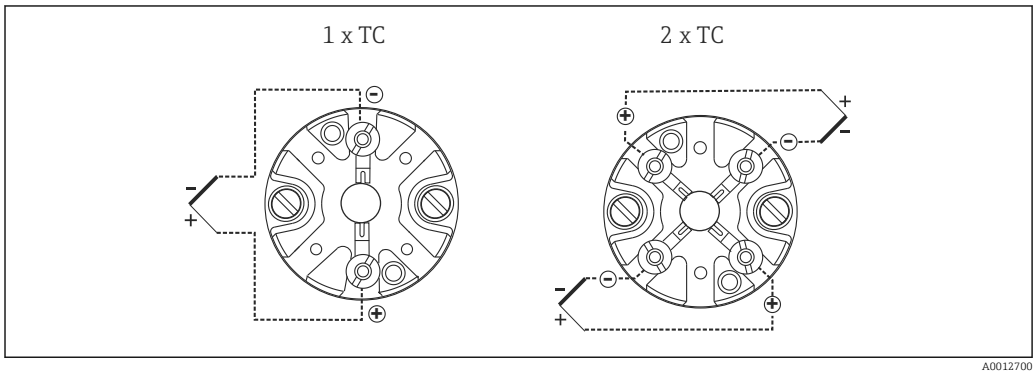
1 *Sensor input 1, RTD: 3- and 4-wire*
2 *Sensor input 2, RTD: 3-wire*
3 *Power supply, field transmitter and analog output 4 to 20 mA or fieldbus connection*



6 *TMT142B (single input)*

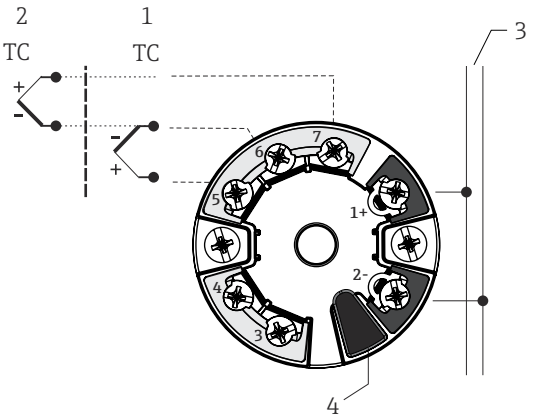
1 *Sensor input RTD*
2 *Power supply, field transmitter and analog output 4 to 20 mA, HART® signal*
3 *2-wire*
4 *3-wire*
5 *4-wire*

Thermocouple (TC) sensor connection type



7 *Mounted terminal block*

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



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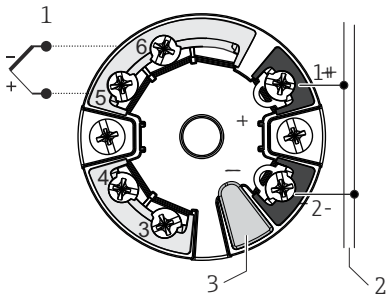
1 Sensor input 1
2 Sensor input 2
3 Fieldbus communication and power supply
4 Display connection

Head mounted transmitter TMT7x (single input) [1]



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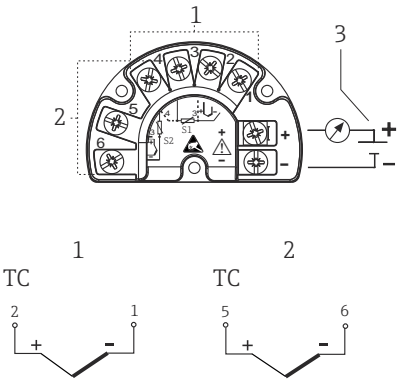
1 Sensor input TC, mV
2 Power supply, bus connection
3 Display connection/CDI interface

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 4 to 20 mA analog output or fieldbus communication

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

Thermocouple wire colors

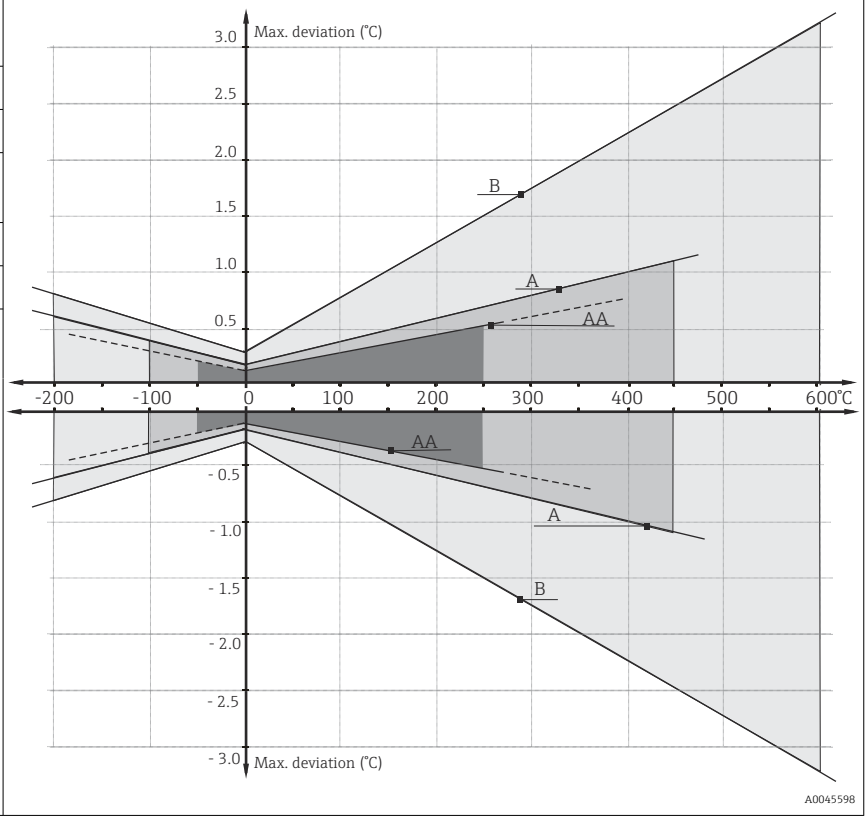
As per IEC 60584	As per ASTM E230
▪ Type J: black (+), white (-) ▪ Type K: green (+), white (-) ▪ Type N: pink (+), white (-) ▪ Type T: brown (+), white (-)	▪ Type J: white (+), red (-) ▪ Type K: yellow (+), red (-) ▪ Type N: orange (+), red (-) ▪ Type T: blue (+), red (-)

Performance characteristics

Accuracy RTD resistance thermometer corresponding to IEC 60751

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

Characteristics



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

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

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

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

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

Thermocouples made of non-precious metals are generally supplied such that they meet the manufacturing tolerances for temperatures > −40 °C (−40 °F) as specified in the table. These materials are not usually suitable for temperatures < −40 °C (−40 °F). The tolerances for Class 3

cannot be observed. For this temperature range, a separate material selection is required. This cannot be processed using the standard product.

Standard	Model	Standard tolerance	Special tolerance
ASTM E230/ANSI MC96.1		Deviation; the larger value applies in each case	
	J (Fe-CuNi)	±2.2 K or ±0.0075 |t| [1] (0 to 760 °C)	±1.1 K or ±0.004 |t| [1] (0 to 760 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	±2.2 K or ±0.02 |t| [1] (−200 to 0 °C) ±2.2 K or ±0.0075 |t| [1] (0 to 1260 °C)	±1.1 K or ±0.004 |t| [1] (0 to 1260 °C)

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

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

Reaction time

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

RTD

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

Insert diameter	Reaction time	
Mineral-insulated cable, 3 mm (0.12 in)	t_{50}	2 s
	t_{90}	5 s
StrongSens RTD insert, 6 mm (¼ in)	t_{50}	< 3.5 s
	t_{90}	< 10 s

Thermocouple (TC)

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

Insert diameter	Reaction time	
Grounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t_{50}	0.8 s
	t_{90}	2 s
Ungrounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t_{50}	1 s
	t_{90}	2.5 s
Grounded thermocouple 6 mm (¼ in)	t_{50}	2 s
	t_{90}	5 s
Ungrounded thermocouple 6 mm (¼ in)	t_{50}	2.5 s
	t_{90}	7 s
Grounded thermocouple 8 mm (0.31 in)	t_{50}	2.5 s
	t_{90}	5.5 s
Ungrounded thermocouple 8 mm (0.31 in)	t_{50}	3 s
	t_{90}	6 s

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

Shock and vibration resistance

- RTD: 3 G/10 to 500 Hz according to IEC 60751
- RTD iTHERM StrongSens Pt100 (TF, vibration resistant): Up to 60G
- TC: 4 G/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. In any case, it is not permitted to unscrew any threaded component on the process connection under operating conditions (i.e. while the process is running).

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

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

Two different methods are used for the inserts:
- Calibration at fixed-point temperatures, e.g. at the freezing point of water at 0 °C (32 °F).
- Calibration compared against a precise reference thermometer.

Evaluation of inserts

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

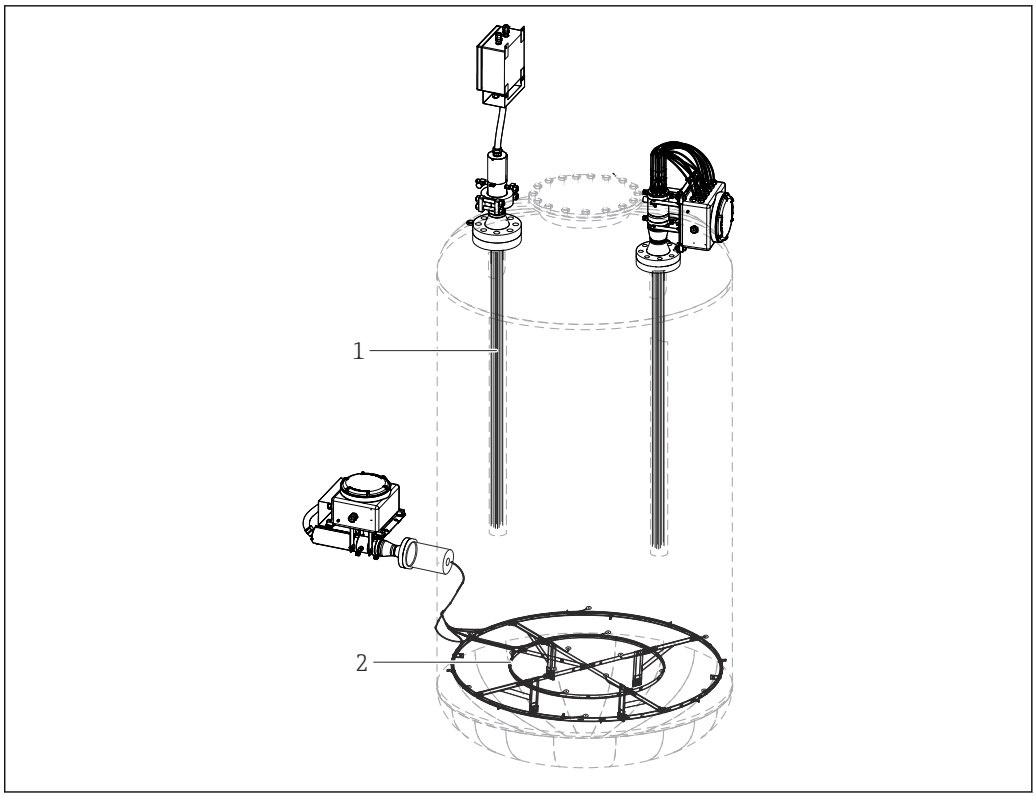
Installation

Mounting location

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

Orientation

No restrictions. The multipoint thermometer can be installed either in horizontal or in vertical configuration, related to the reactor or vessel vertical axis. The modular support frame ensures an orientable placement of the junction box, considering the available space in the installation plant.



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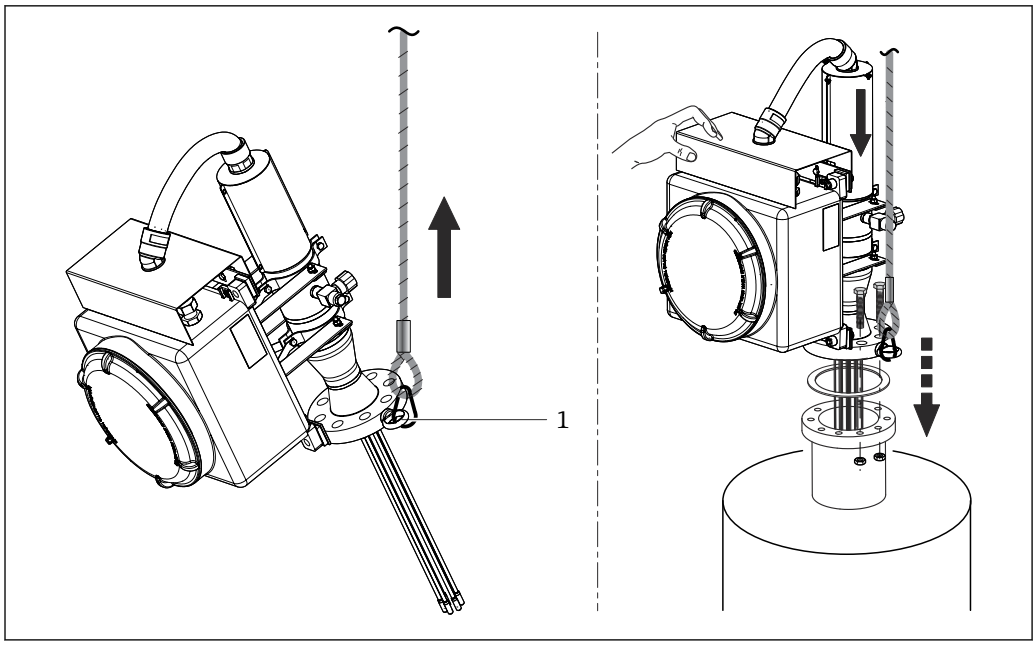
Installation instructions

The modular multipoint thermometer is designed to be installed with a flanged or clamped process connection into a vessel, reactor, tank or similar environment. All parts and components have to be handled with care. During the installation phase, lifting and introduction of the equipment through the preset nozzle, the following must be avoided:

- Misalignment with the nozzle axis.
- Any load on the welded or threaded parts due to the action of the weight of the device.
- Deformation or crushing of the threaded components, bolts, nuts, cable glands and compression fittings.
- Bending radius of the thermowells smaller than 20 times its 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 internals of the reactor.
- Fixing the temperature probes to the reactor's infrastructures without allowing axial displacements or movements.

Vessel’s internals have to be kept into consideration for the interaction with the multipoint inserts. These internals can be considered as the interface between multipoint and the process, when they are used to fix the tips of the inserts, or constraints when the route of the thermocouples has to be performed as per installation instructions. When internals are not usable as interface of insert, Endress + Hauser provides dedicated support frames with minimum process invasiveness to achieve the desired measuring points. Frames components are always designed to be mechanically jointed without any thermal effect and impact on the material internals.



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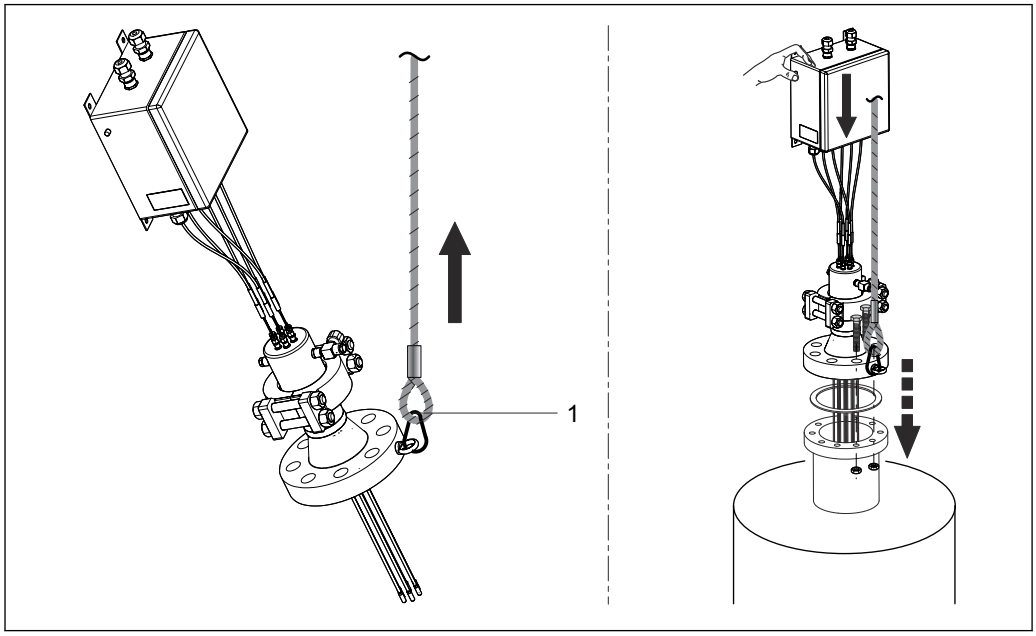

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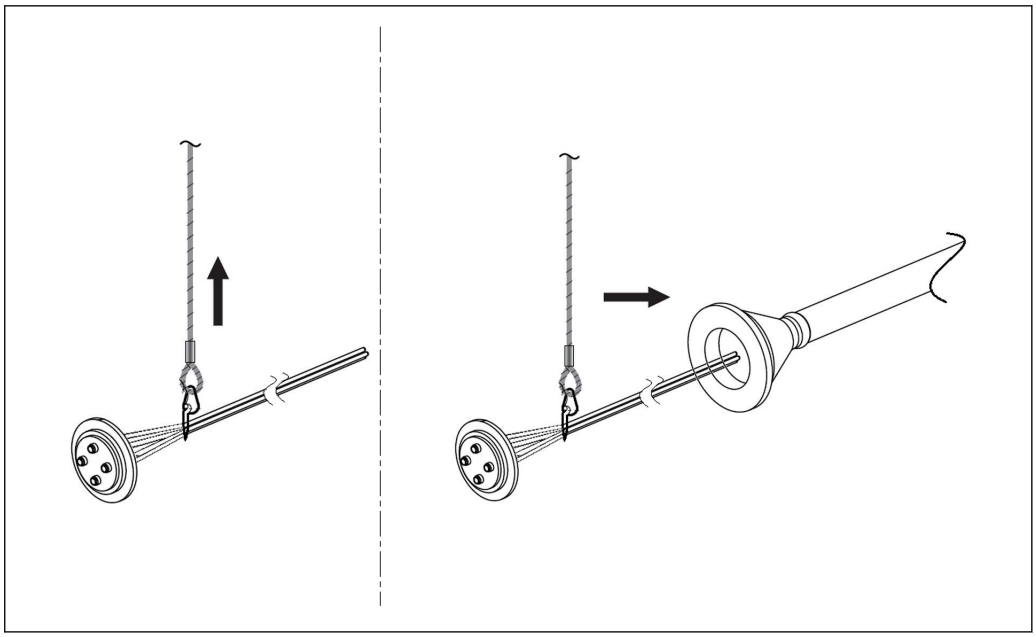

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During installation the whole thermometer must only be lifted and moved by using ropes properly mounted on the eyebolt of the flange (1) or careful on the thermowells.

Environment

Ambient temperature range

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

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)

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

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.

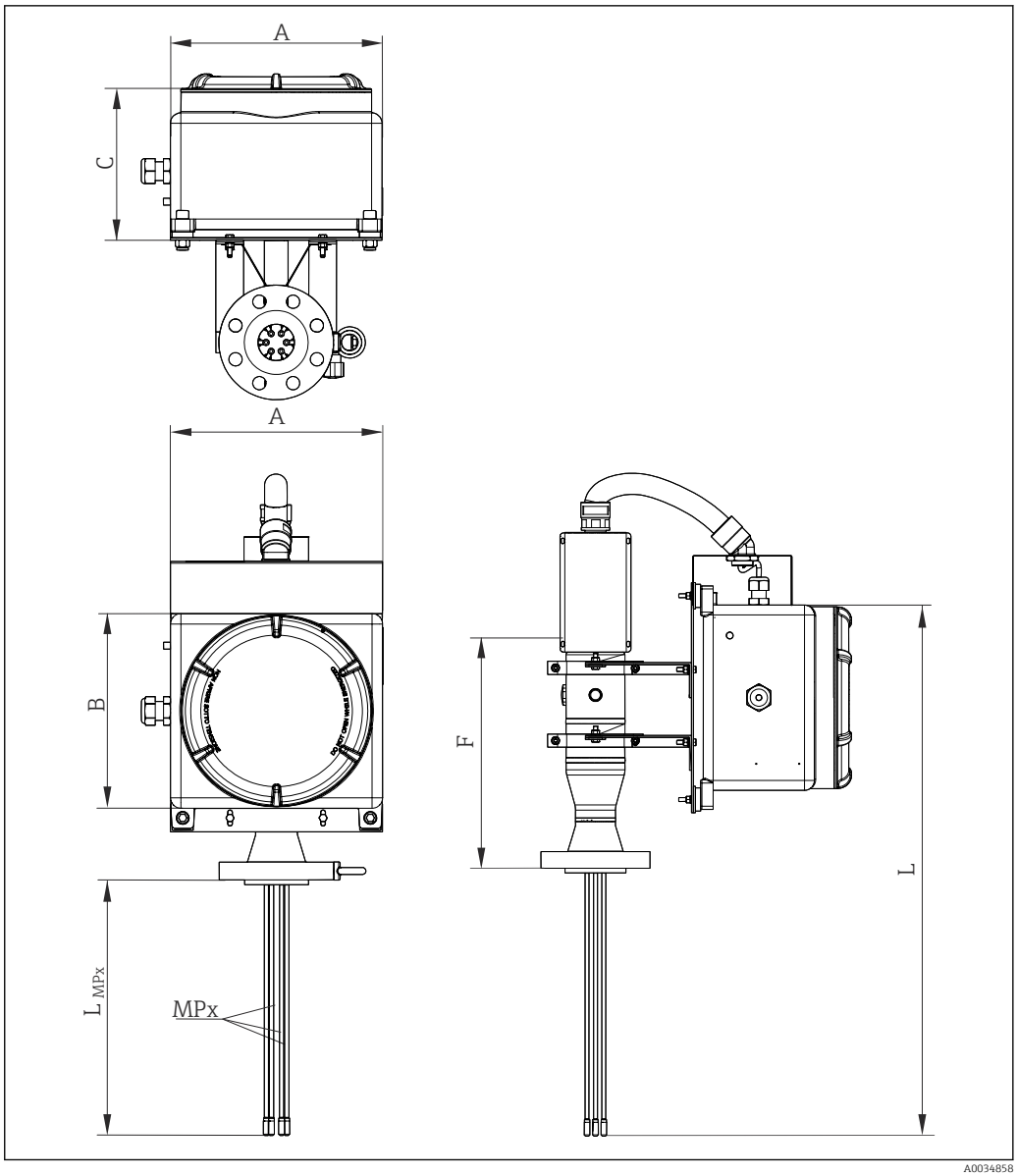
In any case, the maximum required process pressure has to be combined according to the maximum allowable process temperature. Process connections like compression fittings, flanges with their specific pressure classes, and thermowells that are selected according to the plant requirements define the maximum 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 overall multipoint assembly is composed of different subassemblies. Both linear and 3D configurations have the same features, dimensions and materials. Different inserts are available, based on specific process conditions, in order to have the highest accuracy and an extended lifetime. In addition, thermowells can be selected to further increase mechanical performance and corrosion resistance, and to allow insert replacement. Associated shielded extension cables are provided with high resistance sheath materials to withstand different environmental conditions and to ensure steady and noiseless signals. The transition between the inserts and the extension cable is achieved using specially sealed bushings, thus ensuring the specified IP degree of protection.


A
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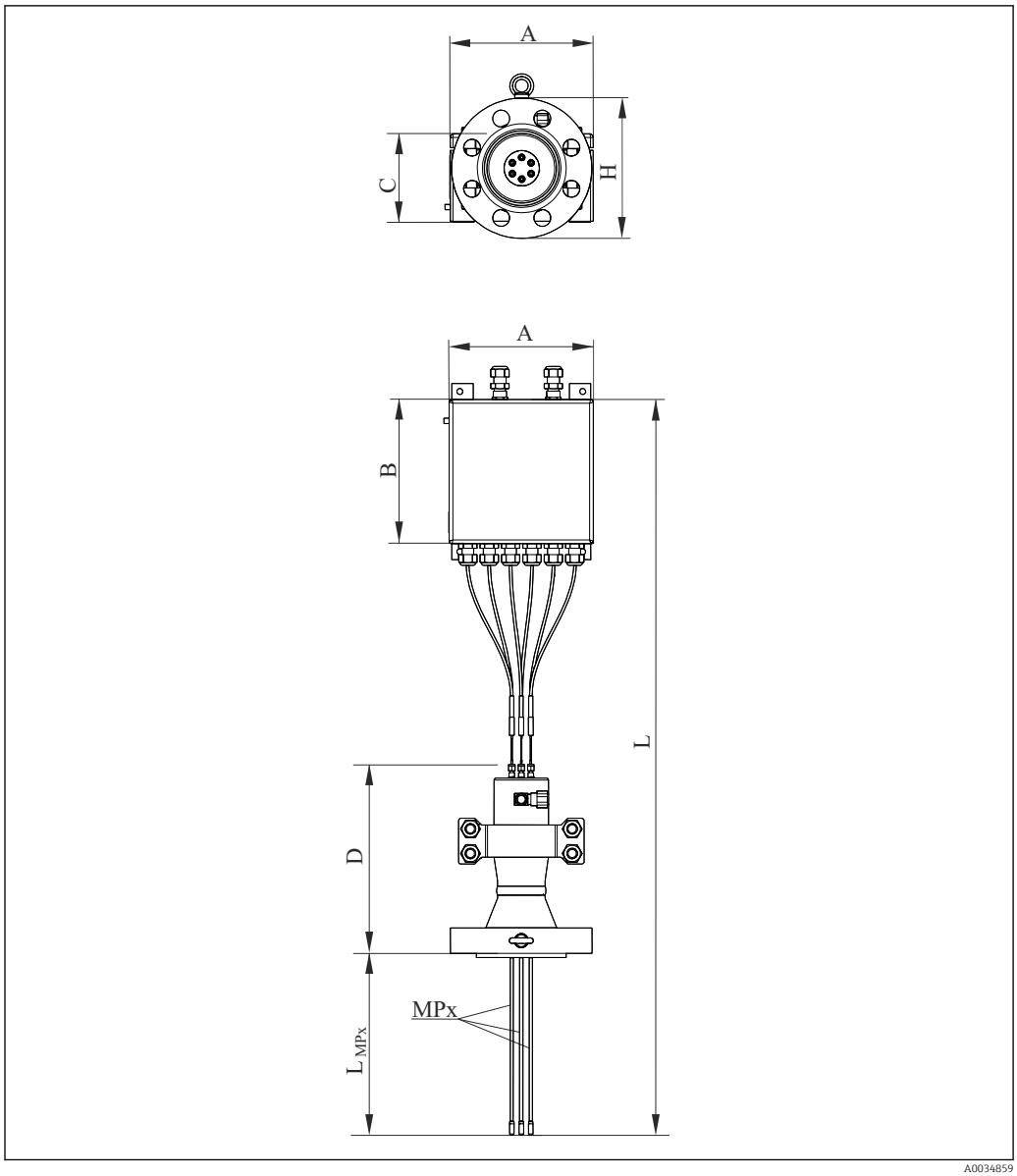
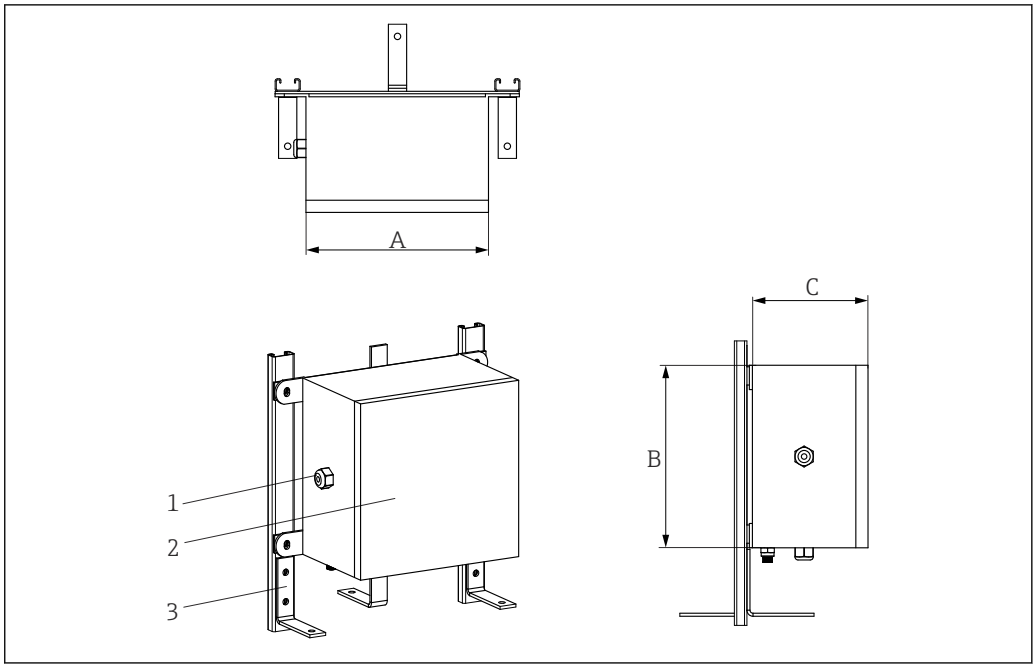


8 Design of the modular multipoint thermometer. All dimensions in mm (in)

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

Junction box



1 Cable glands
2 Junction box
3 Frame

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

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

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

Type of specification	Junction box	Cable glands
Material	AISI 316/Aluminum	NiCr-coated brass AISI 316/316L
Degree of protection (IP)	IP66/67	IP66
Ambient temperature range	−50 to +60 °C (−58 to +140 °F)	−52 to +110 °C (−61.1 to +140 °F)
Device approvals	ATEX UL, FM, CSA approval for use in hazardous area	ATEX approval for use in hazardous area
Identification	ATEX II 2GD Ex e IIC/Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4 UL913 Class I, Division 1 Groups B,C,D T6/T5/T4 FM3610 Class I, Division 1 Groups B,C,D T6/T5/T4 CSA C22.2 No.157 Class I, Division 1 Groups B,C,D T6/T5/T4	→ 🖹 25- According to the junction box approval

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

Support frame

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

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

Insert and thermowells

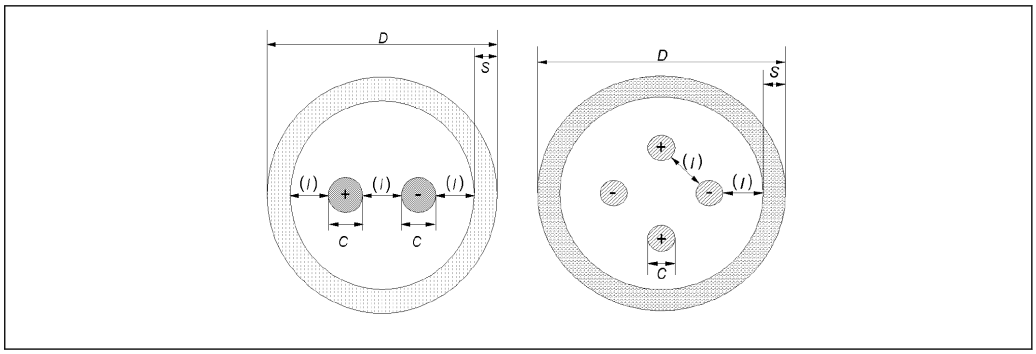
Different insert and thermowell types are available. For other requirements not described here, please contact the Endress+Hauser sales department.

Thermocouple

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

Conductor thickness

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



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RTD

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

Thermowells

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

Sealing components

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

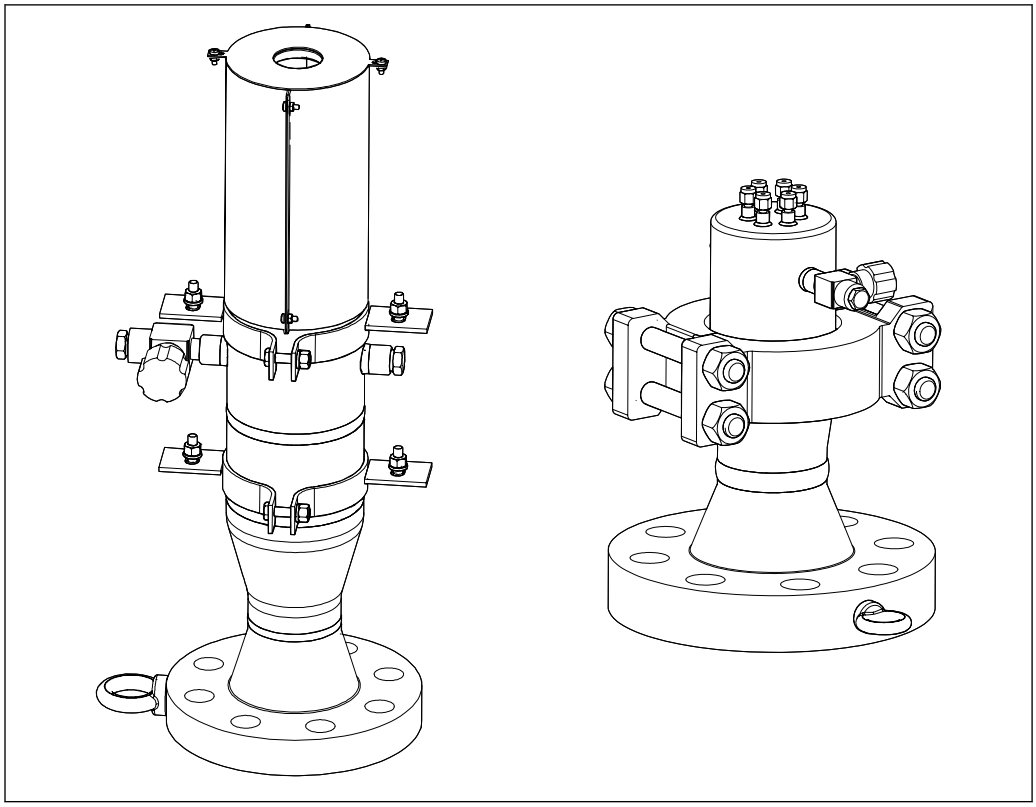
Material: AISI 316/AISI 316H

Cable glands

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

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

Diagnostic chamber



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Diagnostic function

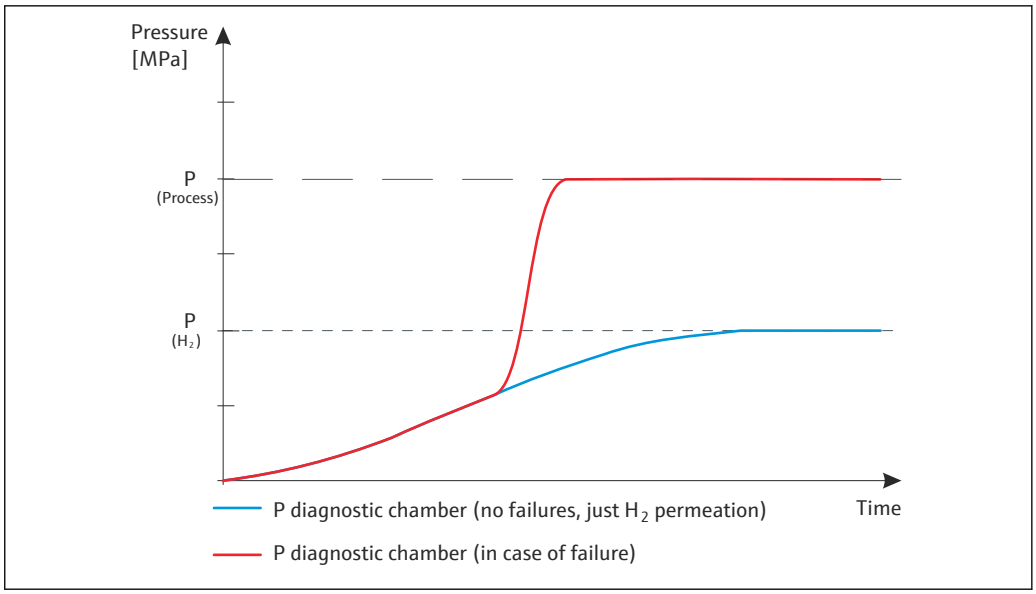
The diagnostic chamber is a module designed to monitor the behavior of the multipoint thermometer in the event of leaks or substances escaping from the process through permeation and to safely contain them. By processing all of the acquired information, it enables evaluation of the measurement accuracy,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

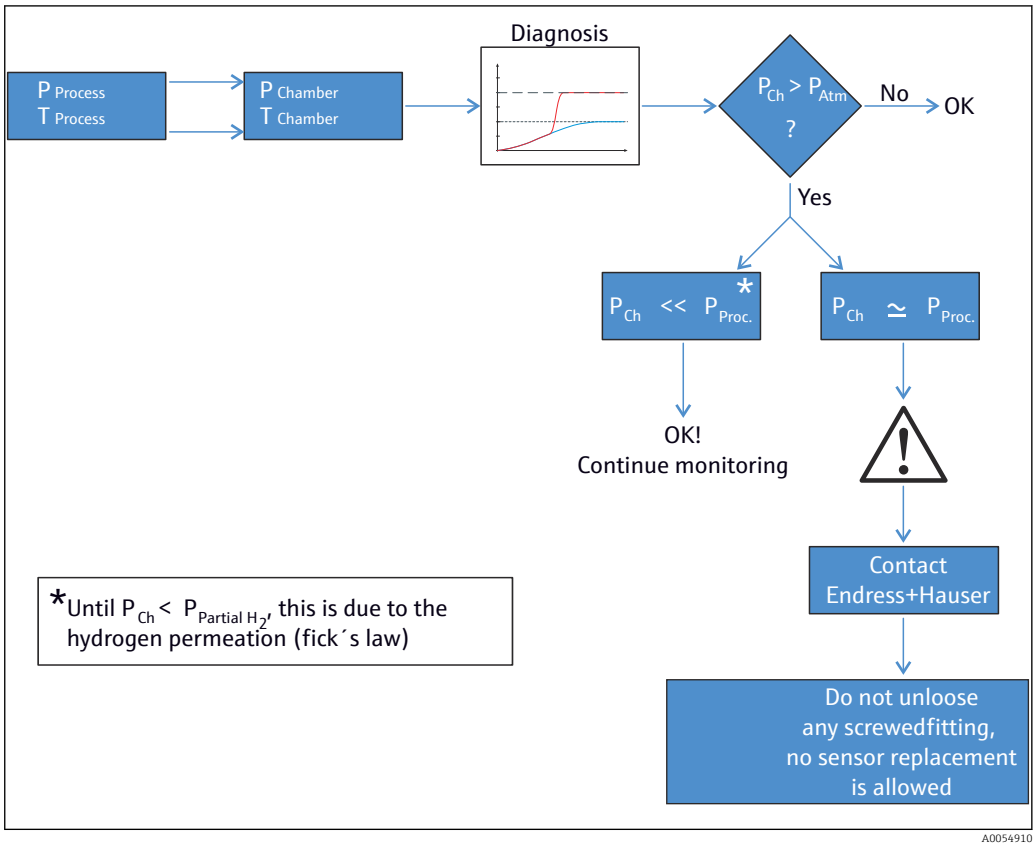
The reactors where the multipoint assembly operates are usually characterized by severe conditions in terms of pressure, temperature, corrosion and dynamics of the process fluids. Pressurization of the diagnostic chamber may be caused by permeation, or process leakages that can occur through the:

- insert sheath
- welding seams between the inserts and chamber disk
- thermowells

The fluids contained inside the chamber can be sampled on site using an E+H portable system, and are then analyzed by E+H and the customer. Pressure and temperature data should be continuously recorded by the user for self-diagnostic evaluation or shared with Endress+Hauser for advanced diagnostic analysis.

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





Weight

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

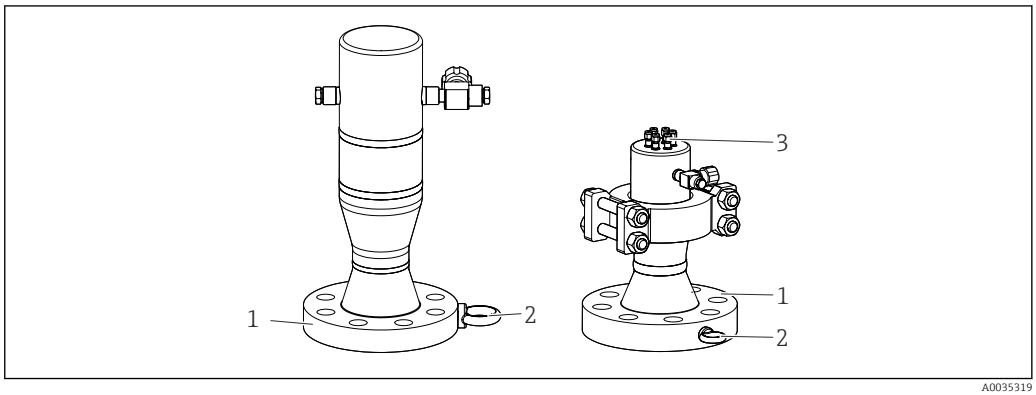
The eyebolt, which is part of the process connection, must be used as the only lifting component to move the entire device.

Materials

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

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316/1.4401	X2CrNiMo17-12-2	650 °C (1202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorinated and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorinated and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ▪ Increased resistance to intergranular corrosion and pitting ▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content
INCONEL® 600/2.4816	NiCr15Fe	1100 °C (2012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures. ▪ Resistant to corrosion caused by chlorine gas and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water. ▪ Not to be used in a sulfur-containing atmosphere.
AISI 304/1.4301	X5CrNi18-10	850 °C (1562 °F)	▪ Austenitic, stainless steel ▪ Usable in water and slightly polluted waste water ▪ Resistant to organic acids, saline solutions, sulphates, alkaline solutions, etc. at relatively low temperatures only
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1292 °F)	▪ Properties comparable to AISI316L. ▪ Addition of titanium means increased resistance to intergranular corrosion even after welding ▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ▪ Can only be polished to a limited extent, titanium streaks can form
AISI 321/1.4541	X6CrNiTi18-10	815 °C (1499 °F)	▪ Austenitic, stainless steel ▪ High resistance to intergranular corrosion even after welding ▪ Good welding characteristics, suitable for all standard welding methods ▪ It is used in many sectors of the chemical industry, petrochemical, and pressurized vessels
AISI 347/1.4550	X6CrNiNb10-10	800 °C (1472 °F)	▪ Austenitic, stainless steel ▪ Good resistance to a wide variety of environments in the chemical, textile, oil refining, dairy and food industries ▪ Added niobium makes this steel impervious to intergranular corrosion ▪ Good weldability ▪ Main applications are furnace fire walls, pressure vessels, welded structures, turbine blades

Process connection and chamber body



9 *Flange as process connection*

1 Flange
2 Eyebolt
3 Compression fittings

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

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

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

Compression fittings

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

Material	AISI 316/316H

Thermowell insert (alternative process connection)

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

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

Operability

For details on operability, see the Technical Information of the Endress+Hauser temperature transmitters or the manuals of the related operating software. → 38

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**.

For an overview of the scope of delivery, see the configuration table below.

Insert design	
Replaceable	☐
Not replaceable	☐

MultiSens version design	
Basic	☐
Advanced	☐
Advanced and modular	☐

Process connection: flange		
Standard	▪ ASME B16.5 ▪ En1092-1	☐ ☐
Material	▪ 316/1.4401 ▪ 316L/1.4435 ▪ 316Ti/1.4571 ▪ 321/1.4541 ▪ 347/1.4550 ▪ Alloy 625/2.4856 ▪ Alloy 800/1.4876 ▪ Alloy 825/2.4858	☐ ☐ ☐ ☐ ☐
Face	▪ RF ▪ RTJ ▪ Type A ▪ Type B1	☐ ☐ ☐ ☐
Size	▪ 2", 3", 4", 6", 8" ▪ DN50, DN80, DN100, DN125, DN150, DN 200	_____ _____

Other process connections, including the "thermowell insert" design, have to be specified in terms of dimensions and overall characteristics.

Flange size [1] **(Schedule 40 nozzle)**	**Basic**		**Advanced**			
	Maximum number of inserts		**Maximum number of inserts**			
	Insert diameter		**Insert diameter**			
	6 mm	**8 mm**	**6 mm 1x**	**6 mm 2x**	**8 mm 1x**	**8 mm 1x**
2"	4	4	4	3	4	3
3"	9	7	7	7	7	7
4"	18	14	14	12	14	12
5"	30	22	22	20	22	20

Flange size [1] (Schedule 40 nozzle)	Basic		Advanced			
	Maximum number of inserts		Maximum number of inserts			
	Insert diameter		Insert diameter			
	6 mm	8 mm	6 mm 1x	6 mm 2x	8 mm 1x	8 mm 1x
6"	35	30	30	30	30	30
8"	52	48	48	45	48	45

1) In the case of the thermowell insert design, the maximum number of sensors depends on the internal diameter. Please ask your Endress+Hauser sales organization.

Flange size (Schedule 40 nozzle)	Advanced		Advanced and modular	
	Maximum number of thermowells with insert Ø: 1.5 mm (0.06 in) or 2 mm (0.08 in) or 3 mm (0.12 in) 3 mm (0.12 in)		Maximum number of thermowells with insert Ø: 1.5 mm (0.06 in) or 2 mm (0.08 in) or 3 mm (0.12 in) 3 mm (0.12 in)	
	Thermowell diameter		Thermowell diameter	
	6 mm	8 mm	6 mm	8 mm
2"	4	4	4	4
3"	7	7	7	7
4"	14	14	14	14
5"	22	22	22	22
6"	30	30	/	/
8"	48	45	/	/

Thermowell		
Thermowell dimension	▪ 6 mm ▪ 8 mm ▪ 1/8"	☐ ☐ ☐
Thermowell material	▪ 316/1.4401 ▪ 316L/1.4435 ▪ 321/1.4541 ▪ 347/1.4550 ▪ Alloy 600	☐ ☐ ☐ ☐ ☐

Insert, sensor		
Measuring principle	▪ Thermocouple (TC) ▪ Resistance temperature detector (RTD)	☐ ☐
Type	TC: J, K, N RTD: Pt100	_____
Design	▪ TC: Single, duplex ▪ RTD: 3-wire, 4-wire, 2x3-wire	☐ ☐
Version	▪ TC: Grounded, ungrounded ▪ RTD: Wire wound (WW), thin film (TF)	☐ ☐
Sheath material	316L, 321, 347, Alloy 600, Pyrosil	_____
Device approvals	Intrinsic safety Non-hazardous	☐ ☐

Insert, sensor		
Insert diameter	▪ 1.5 mm (0.05 in) ▪ 2 mm (0.08 in) ▪ 3 mm (0.12 in) ▪ 6 mm (0.23 in) ▪ 8 mm (0.31 in)	☐ ☐ ☐ ☐ ☐
Standard/Class	▪ IEC/Class 1 ▪ ASTM/"Special" class ▪ IEC/Class A ▪ IEC/Class AA	☐ ☐ ☐ ☐

Measuring point distribution		
Positioning	▪ Equi-spaced ▪ Customized	☐ ☐
Number	2, 4, 6, 8, 10, 12 ... 30 [1]	_____

Insertion length	TAG (description)	(L_{MPx}) in mm (in)
MP_1	_____	_____
MP_2	_____	_____
.....3	_____	_____
MP_x	_____	_____

1) Different numbers/configurations are available on request

Junction box (head)		
Material	Stainless steel (standard) Aluminum (to be specified) More on request	☐ ☐
Electrical connection	Terminal block wiring: ▪ Terminal block - standard/number ▪ Terminal block - compensated/number ▪ Terminal block - spare/number Transmitter wiring: ▪ HART protocol, e.g.: TMT182, TMT82 ▪ PROFIBUS PA protocol, e.g.: TMT84 ▪ FOUNDATION Fieldbus protocol, e.g.: TMT85, TMT125 (multi-channel transmitter) ▪ Quantity	 ☐ / _____ ☐ / _____ ☐ / _____ ☐ ☐ ☐ _____
Device approvals	Ex e/Ex ia/Ex d /UL 913/CSA C22.2/UL 1203	_____
Cable entries (process side)	Single or multiple, type: M20, NPT 1/2" Quantity More on request	_____ / _____ _____ / _____
Cable entries (wiring side)	Single or multiple, type: M20, M25, NPT ½", NPT 1" / Quantity More on request	_____ / _____ _____ / _____

Junction box supporting frame	
▪ Remote ▪ With accessible extension cables ▪ With protected extension cables ▪ More on request	☐ ☐ ☐ _____

TAG		
Device information	Refer to customer specification / As specified	☐ ☐ (table)
Measuring point information	Refer to customer specification Location, as specified: ▪ Tagging (TAG), on device (black foil) ▪ Tagging (TAG), by customer ▪ Tagging (TAG), on transmitter ▪ Tagging (TAG), on device (metal tag) ▪ *Tagging (TAG), on tip ▪ Tagging (TAG), on extension cable ▪ *Tagging (TAG), on insert bushing ▪ Tagging (TAG), RFID ▪ To be specified	 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

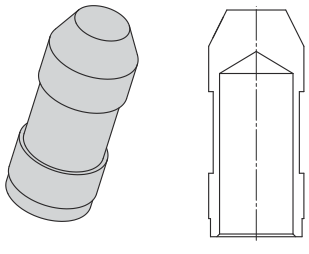
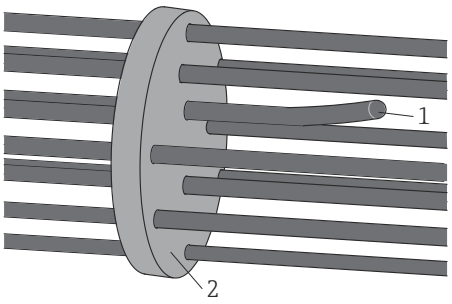
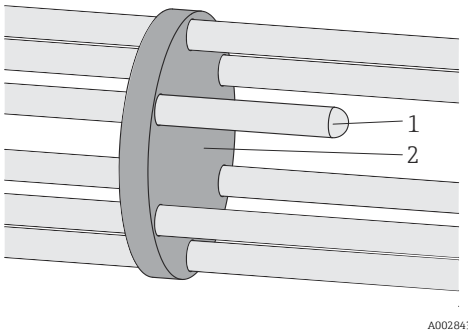
Additional requests		
Extension wire lengths, only for remote head	Specification in mm:	_____
Extension wires material	▪ PVC, -60 to 105°C ▪ FEP, -200 to 250 °C ▪ More on request	☐ ☐ _____
On-site existing thermowell	Yes No	☐ ☐

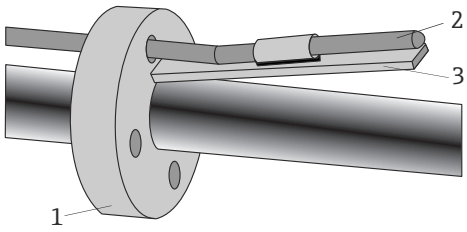
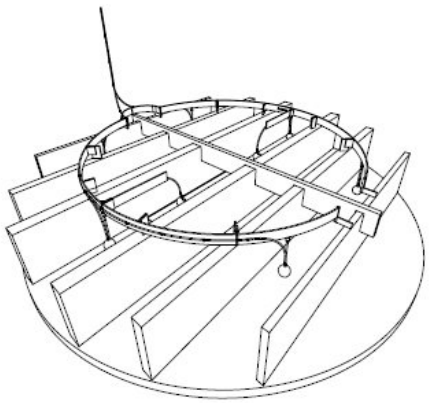
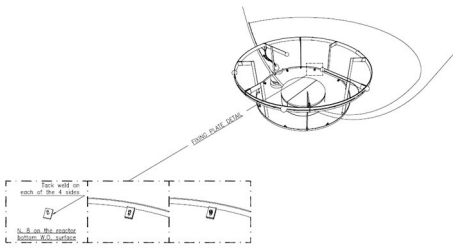
Accessories

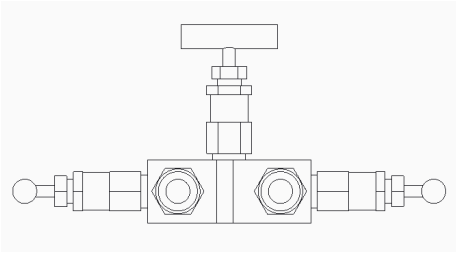
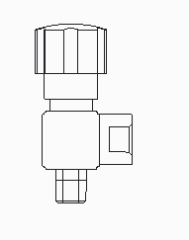
The accessories currently available for the product can be selected at www.endress.com:

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	Terminal closure welded at the tip end of the probe in order to protect the insert from aggressive process conditions, to facilitate attachment by means of metallic tie wraps and to ensure proper thermal contact.
Thermal contact system	
Insert and spacers  A0033485 *1 Insert* *2 Spacer*	▪ Used on straight configurations and existing thermowells for axial centering of the insert bundle ▪ Prevent the twisting of the inserts ▪ Give flexural stiffness to the sensor bundle
Thermowells and spacers  A0028434 *1 Thermowell* *2 Spacer*	

Accessories	Description
Bimetal strips  A0028435 *10 Bimetal strips with or without guiding tubes* *1 Guiding tube* *2 Insert* *3 Bimetal strips*	▪ Used on straight configurations and inside existing thermowells ▪ The inserts are replaceable ▪ Guarantee thermal contact between the sensor tip and the thermowell by means of bimetallic strips that are activated by the temperature difference ▪ No friction during installation even with sensors already installed
  A0034864 Frame	Support structure that keeps the thermocouples fixed along the defined routing.
Tags	Nameplate can be applied to identify each measuring point and the whole assembly. Tags can be placed on the extension cables in the extension area and/or in the junction box on individual wires.
Diagnostic chamber	
Pressure transmitter	Digital or analog pressure transmitter with welded metal sensor for measurement in gases, steam or liquids. Refer to the Endress+Hauser PMP sensor family

Accessories	Description
  A0034865 Fitting/manifolds/valves	Fitting, manifolds and valves are available for the installation of the pressure transmitter on the system body, and thus allow the continuous monitoring of the device under operating conditions. Used also to vent out any gas/liquids.
Purging system	A purging system for the depressurization of the diagnostic chamber. The system consists of: ▪ 2- and 3-way trunnion valves ▪ Pressure transmitter ▪ Two-way pressure relief valves The system enables the connection of multiple number of diagnostic chambers installed in the same reactor.
Portable sampling system	A portable field system that allows sampling of the fluid inside the diagnostic chamber so that the sample can be chemically analyzed in an external laboratory. The system consists of: ▪ Three cylinders ▪ Pressure regulator ▪ Rigid and flexible tubes ▪ Vent lines ▪ Quick connectors and valves

Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see "Technical Information" TI00405C
HART loop converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA061S

Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all necessary data to identify the optimum measuring device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://portal.endress.com/webapp/applicator ▪ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All device information is available for every device during the entire life cycle, such as device status, device-specific documentation, spare parts etc. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
FieldCare	FDT-based plant asset management tool from Endress+Hauser. FieldCare can configure all smart field devices in your system and help you manage these devices. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S

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 documentation may be available depending on the device version ordered:

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** These Operating Instructions contain all the information that is required in the various life cycle phases 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. The Safety Instructions are a constituent part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.
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.

www.addresses.endress.com

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