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Technical Information
iTHERM MultiSens Slim TMS21

Low invasive direct contact multipoint thermometer

Application

- Easy-to-use device with flexible design, ready to be installed in case of direct contact and fast response time measurements
- Specifically designed for light chemical processes
- Measuring range:
  Thermocouple (TC): −270 to 920 °C (−454 to 1 688 °F)
- Static pressure range: Up to 90 bar (1 305 psi). Specific maximum process pressure achievable depending on process type and temperature

Your benefits

- High degree of flexibility thanks to a wide variety of options for an easy product configuration selection and process integration
- High precision temperature profile detection due to an high number of measuring points - up to 59 points
- Easy process monitoring thanks to low invasiveness and high installation flexibility
- Fast response time
- Compliance to several national and international standards, such as IEC60584, ASTM E230 and IEC 60751
- Wide range of accessories for the best process integration and monitoring as well as for protection against mechanical shocks and environmental conditions
- Adjustable immersion length to reach the exact measuring point location

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People for Process Automation

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Function and system design

Measuring principle

Thermocouples (TC)

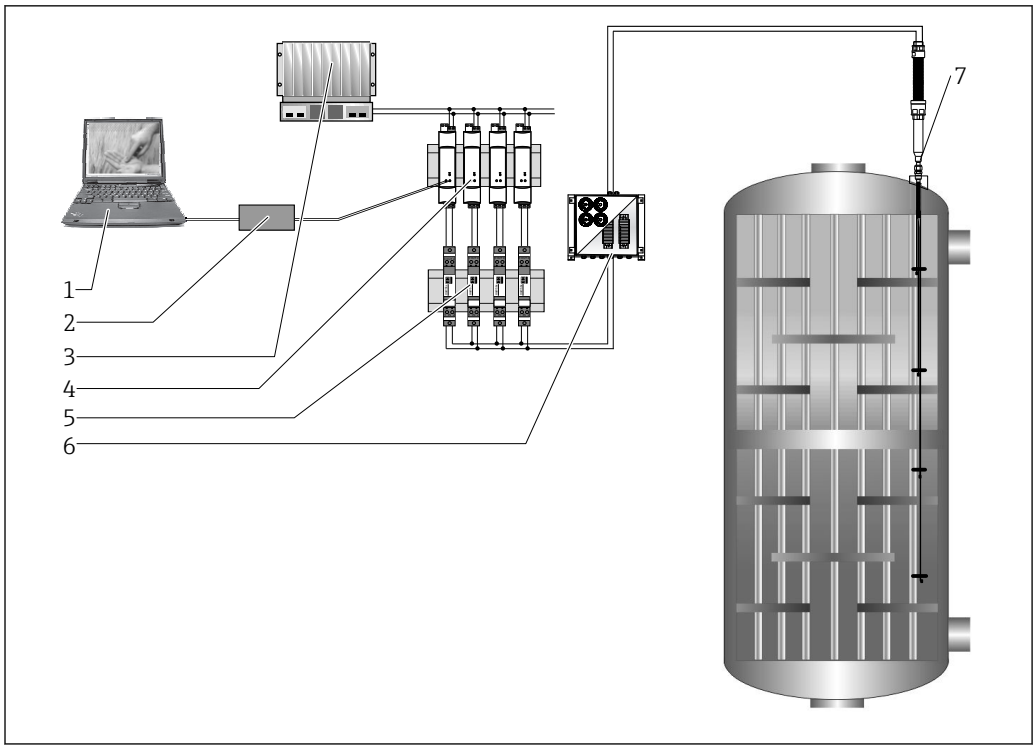
Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors 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.

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.

This includes:
- 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, mounted multipoint thermometer in a locally existing thermowell with four measurement points and four transmitters or terminal blocks in remote junction box.

1 *Device configuration with application software FieldCare*
2 *Commubox*
3 *PLC*
4 *Active barrier RN221N (24 V_{DC}, 30 mA) that has a galvanically isolated output for supplying voltage to 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 *Surge arrester modules HAW562Z for protection of signal lines and components in hazardous areas, e.g. 4 to 20 mA- , PROFIBUS® PA, FOUNDATION Fieldbus™ signal lines. More information on this can be found in the Technical Information → 24*
6 *Remote junction box available as an option with built-in transmitter for 4 to 20 mA, PROFIBUS® PA, FOUNDATION Fieldbus™ signal lines.*
7 *Mounted multipoint thermometer in a locally existing tube.*

Equipment architecture

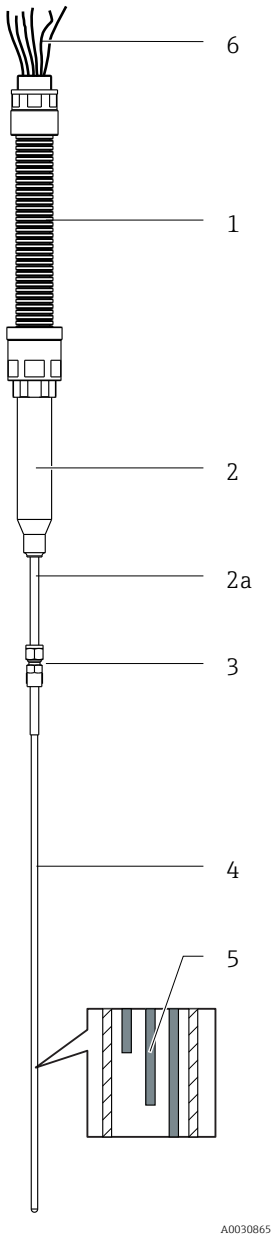
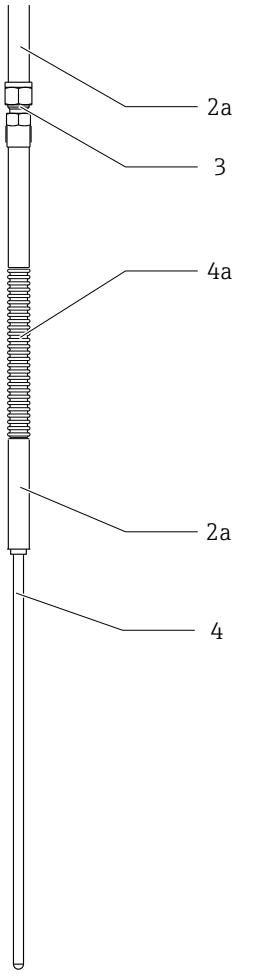
The new iTHERM MultiSens Slim has an innovative design able to allow a wide variety of options in terms of materials selection, sizes and number of measuring points. In addition a portfolio of selectable accessories (not in contact with the process) individually managed for easy maintenance and spare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

It consists of five main sub-assemblies:

- **Extension:** It consists of a threaded bushing for sealed electrical connections, matched to an adapter from which flexible conduit containing the extension cables.
- **Main bushing and reinforcing sleeve:**
- **Process connection:** The process connection is represented by a compression fitting. When necessary, an ASME or EN flange is available on request.
  Other standards or connection types can be offered on request. The flanges are provided with welded compression fitting for process tightness.
- **Thermowell:** with or without reinforcing sleeve
- **Insert:** Composed of metal sheathed sensing measuring elements (thermocouples), extension cable and transition bushing. The sensing elements are mounted inside a small diameter pipe thermowell.
  Part of the thermowell can be a flexible hose to guarantee additional bendability into the process of the sensing probe, to ensure internal routing in the case of misalignment between installation nozzle and the distribution of measuring points.
- **Additional accessories:** Components that can be ordered independently from the selected product configuration, such as junction boxes and transmitters, able to fit with all the already installed customer devices.

In general, the system measures the temperature profile inside the process environment by means of many sensors, jointed to a suitable process connection which ensures the right tightness levels. Externally, the extension cables (protected by the conduit) are wired into the junction box, which can be installed integrated or remote (optional).

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

	Design		Description
		1: Extension	Flexible conduit used to protect the extension cables from environmental agents and phenomena (e.g. abrasion, humidity, salt conditions). Material: ▪ Polyamide ▪ Other materials on request IP68 degree is guaranteed through the selected adapters.
		2: Main bushing	Used to seal and protect electrical junctions and to adjust immersion length.
		2a: Reinforcing sleeve	
		3: Process connection	High pressure compression fitting for the tightness between the process and the external environment, for a wide range of process fluids and different severe combination of temperature and pressure. In the case of a flange, the process connection is welded on the flange (standard). Other versions available on request. **Flange:** Different dimensions and sizes to meet specific standards (e.g. ASME, EN, DIN) and variable process requirements.
		4: Thermowell	Annealed tube used as protective sheath for sensing elements, inserted into the process
		4a: Flexible thermowell part	Annealed tube provided of an upper flexible part (corrugated conduit) to allow to reach different paths into the installation environment.
		5: Inserts	Not replaceable grounded or ungrounded thermocouple inserts with high accuracy measurement performance, long-term stability and reliability
		6: Extension cables	Not replaceable grounded or ungrounded thermocouple inserts with high accuracy measurement performance, long-term stability and reliability

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

Input

Measured variable	Temperature (temperature linear transmission behavior)

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 direct 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. Swift and easy operation, visualization and maintenance by PC using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

PROFIBUS® PA head transmitters
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. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

FOUNDATION Fieldbus™ head transmitters
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. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e.g. using operating software such as ControlCare from Endress +Hauser or NI Configurator from National Instruments. For more information, see the Technical Information.

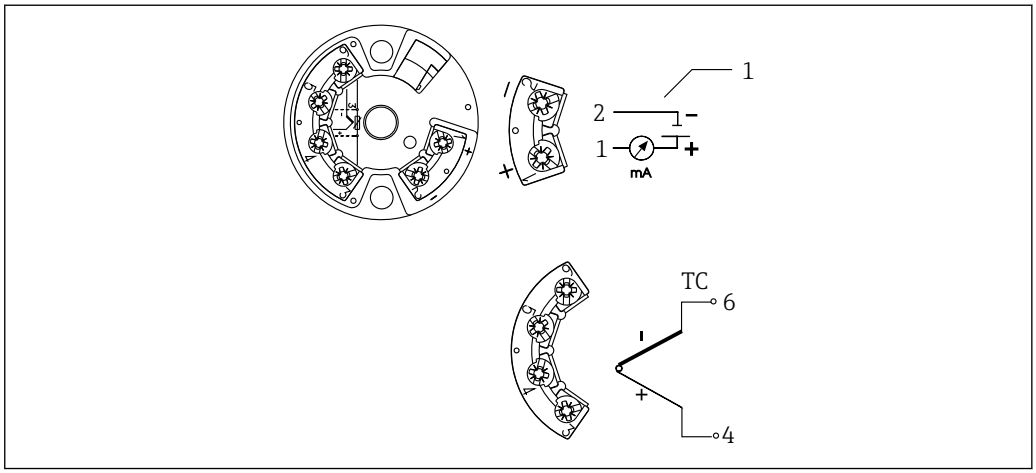
Advantages of the iTEMP transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions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

Wiring

- 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.

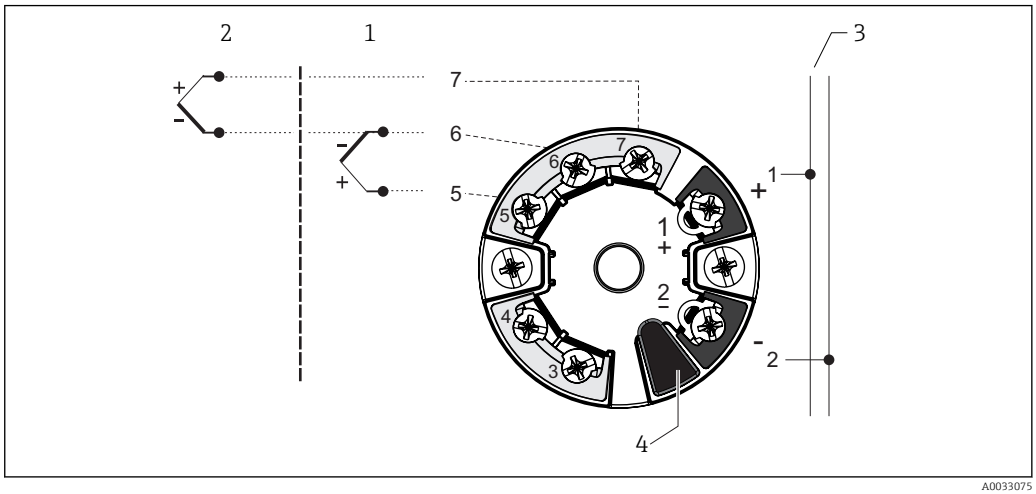
Wiring diagrams

Wiring diagrams for TC and RTD connection



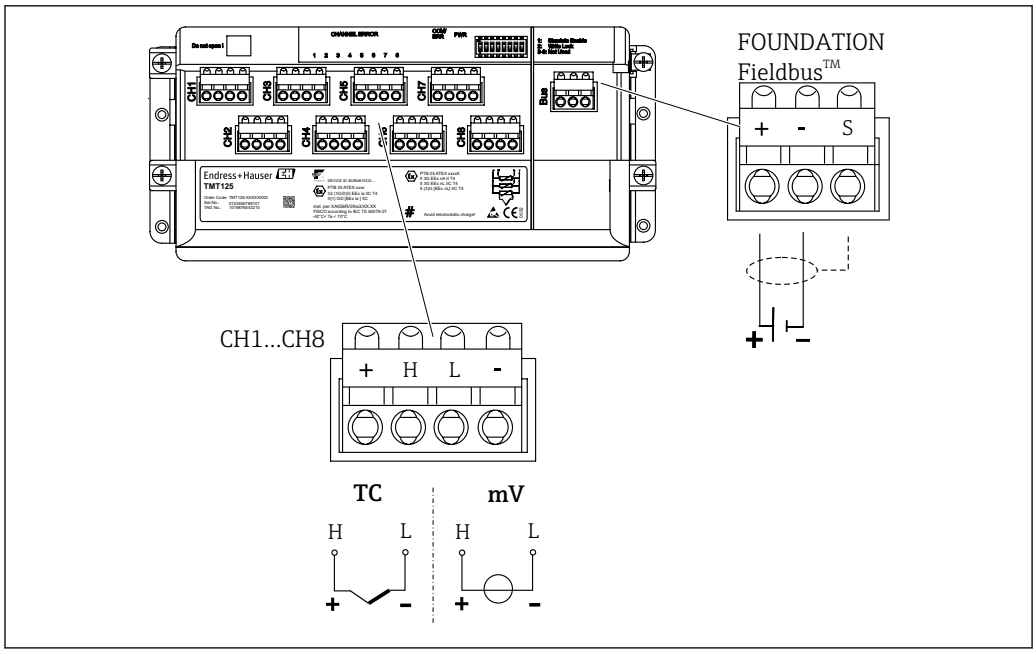
2 *Wiring diagram of the single sensor input head transmitters (TMT18x)*

1 Power supply head transmitter and analog output 4 to 20 mA, or bus connection



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

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



4 *Wiring diagram of multi-channel transmitter*

Performance characteristics

Accuracy

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

Standard	Type	Standard tolerance	Special tolerance (on request)
ASTM E230/ MC. 96.1	Deviation, the larger respective value applies		
	K (NiCr-Ni)	±2.2 K (±3.96 °F) or ±0.02 · |t| (−200 to 0 °C (−328 to 32 °F) ±2.2 K (±3.96 °F) or ±0.0075 · |t| (0 to 1 260 °C (32 to 2 300 °F)	±1.1 K (±1.98 °F) or ±0.004 · |t| (0 to 1 260 °C (32 to 2 300 °F)
	J (Fe-CuNi)	±2.2 K (±3.96 °F) or ±0.0075 · |t| (0 to 760 °C (32 to 1 400 °F)	±1.1 K (±1.98 °F) or ±0.004 · |t| (0 to 760 °C (32 to 1 400 °F)
	N (NiCrSI-NiSi)	±2.2 K (±3.96 °F) or ±0.02 · |t| (−200 to 0 °C (−328 to 32 °F) ±2.2 K (±3.96 °F) or ±0.0075 · |t| (0 to 1 260 °C (32 to 2 300 °F)	±1.1 K (±1.98 °F) or ±0.004 · |t| (0 to 1 260 °C (32 to 2 300 °F)
	E (NiCr-CuNi)	±1.7 K (±3.06 °F) or ±0.01 · |t| (−200 to 0 °C (−328 to 32 °F) ±1.7 K (±3.06 °F) or ±0.005 · |t| (0 to 870 °C (32 to 1 598 °F)	±1 K (±1.8 °F) or ±0.004 · |t| (0 to 870 °C (32 to 1 598 °F)

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

Response time

Response time for the sensor assembly without transmitter.

Tmax depending on thermocouple types [°C]

Diameter	N	K	J	E
1,5	920	920	440	510
1	700	700	260	300
0,5	700	700	260	300

Thermocouple (TC)

Test architecture
Multimeter Keithley 2000
Fluid bath for response time tests

Test description
Tests in water at 0.4 m/s (1.3 ft/s), according to IEC 60751 and ASTM E644; 10 K temperature step change.
At the beginning the thermometer to be tested is stabilized in its raised position, outside the fluid at ambient temperature, then it is immersed rapidly in the fluid bath. The measurement of the output values of the thermometer is started at latest at instant the thermometer enters the bath, and the recording is continued until the thermometer has reached the fluid temperature.

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

Additional tests (on request)

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

Calibration

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

Calibration involves comparing the measured values of the 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.

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

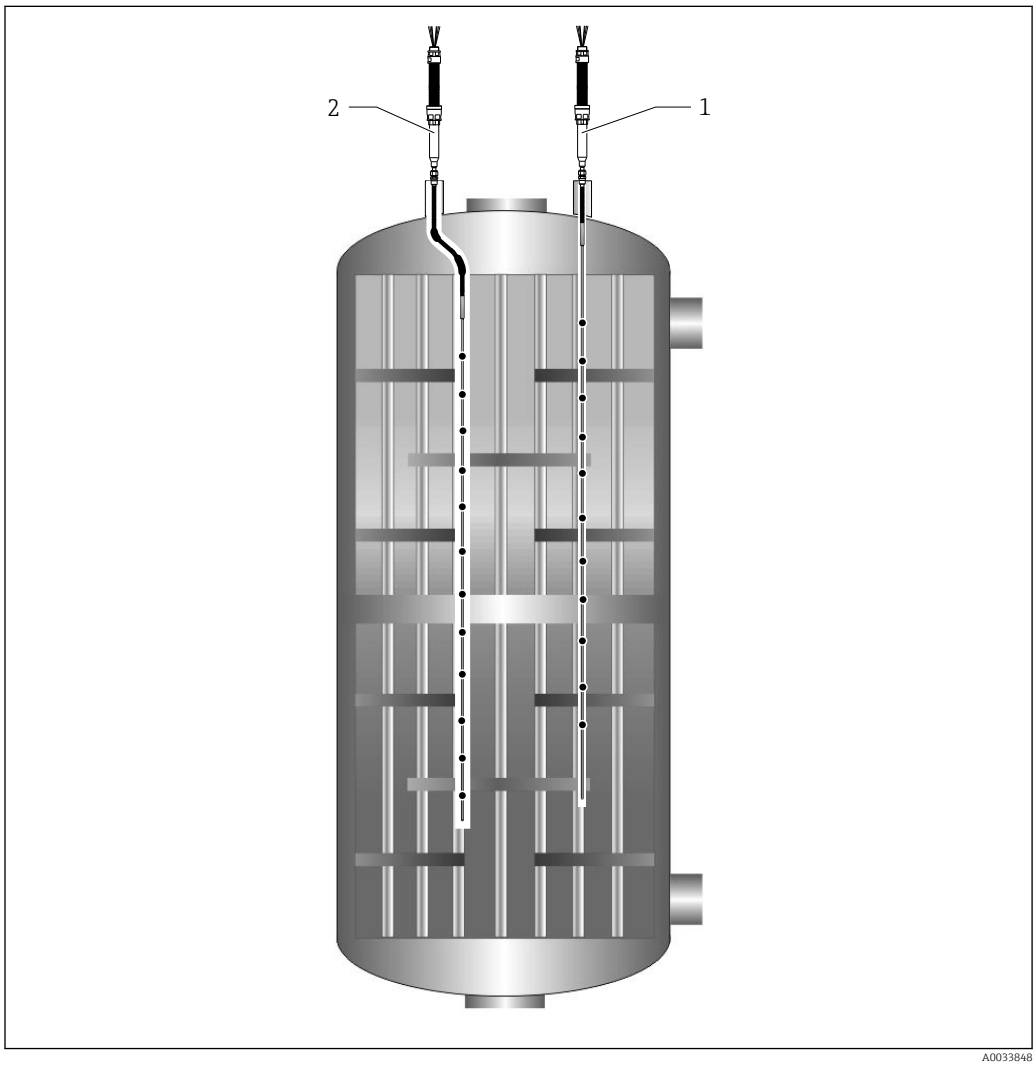
Mounting location

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

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

When the flexible configuration is ordered, even not aligned routings are allowed thanks to the flexible part of the thermowell.



5 Main configuration possibilities

1 Vertical installation with rigid configuration
2 Installation with flexible configuration

Installation instructions

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

The thermometer has been developed to ensure utmost flexibility in terms of possible routing through any encumbrance and constraint taht can be met in any plant. It guarantees a high sealing level, noiseless signals, and high mechanical protection of the extension cables.

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

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

- Bending radius of the flexible part of the thermowell smaller than 20 times the diameter of the flexible hose.
- Tension loads on the flexible part.
- Friction between the flexible part and the internals of the reactor.
- Fixing the flexible part on the reactor's infrastructures without allowing axial displacements or movements.

Environment

Ambient temperature range

Configuration without junction box: −50 to +95 °C (−58 to +203 °F)

Configuration with junction box, ordered as accessory:

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

Configuration without junction box: −50 to +95 °C (−58 to +203 °F)

Configuration with junction box, ordered as accessory:

Junction box	
With head transmitter	−50 to +95 °C (−58 to +203 °F)
With multi-channel transmitter	−40 to +80 °C (−40 to +176 °F)
With DIN rail transmitter	−40 to +95 °C (−40 to +203 °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

Degree of protection

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

Electromagnetic compatibility (EMC)

Depending on the head transmitter used. For detailed information see the related Technical Information, listed at the end of this document. → 24

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, stream and turbulences, corrosion rate have to be considered as mandatory for the whole product definition.

Process temperature range

Up to +500 °C (+932 °F).

Process pressure range

0 to 90 bar (0 to 1 305 psi)

Anyhow, the maximum required process pressure has to be combined according to the maximum allowable process temperature. Process connections like compression fittings and flanges with their specific ratings, selected according to the plant requirements, define the maximum process conditions at which the device has to operate.

Endress+Hauser experts can support the customer on any related questions.

Process applications

- Syngas Treatment
- Methanol and Urea production
- Ammonia process
- Ethylene Oxide / Ethylene Glycol production
- Purified Terephthalic Acid (PTA) production
- Polyethylene Terephthalate (PET) production
- Vinyl Chloride Monomer (VCM) production
- Methyl Methacrylat (MMA) production
- Polyurethane (PUR) production
- Tube bundle reactor
- Pilot plants temperature measurement

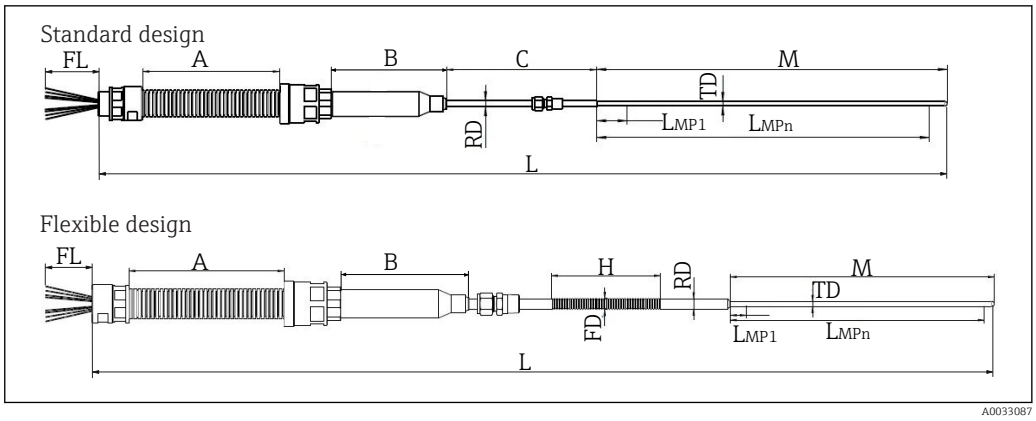
Higher pressures can be achieved according to the specific process requirements by selecting the correct flange, compression fittings and materials that are permanently consistent to the process temperature.

Mechanical construction

Design, dimensions

The overall multipoint assembly is composed of standardized parts with different features allowing a wide range of product configurations. Different inserts, in terms of TC types, standards, materials, lengths and thermowells are available. They can be selected based upon specific process conditions, in order to have the highest application match and the most extended lifetime. Associated extension cables are provided with high resistance sheath materials and shielded for steady and noiseless signals signals, protected by a polymeric condiut to withstand different environmental conditions (salt, sand, humidity, etc.). The transition between the probe and the conduit is obtained by the usage of a main bushing, containing the electrical junctions between the TC sensors and the extension cables. It is completely sealed to ensure the declared degree of protection IP68.

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



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

A Conduit cable length
B Main bushing length (for configuration with max. 39 points = 220 mm (8,66 in), for configuration with more than 39 points = 240 mm (9,45 in))
C Reinforcing sleeve length
FD Flexible part diameter
FL Flying leads length
H Flexible part length
L_{MPx} Immersion length of sensing elements
L Device length
M Thermowell length
RD Reinforcement diameter
TD Thermowell diameter

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

Reinforcing sleeve length C in mm (in)
180 (7.1) Specifically customized lengths are available on request.

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

Flexible hose length H:
Max. 4 000 mm (157 in) Specifically customized lengths are available on request.

Compression fitting pressure rating at ambient temperature

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

Thermowell diameter

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

Diameter in mm (in)	Sheath material	TC type	Standard	Hot junction type for TC
▪ 3.2 mm (0.13 in) ▪ 6 mm (0.24 in) ▪ 6.35 mm (0.25 in) ▪ 8 mm (0.31 in) ▪ 9.5 mm (0.37 in)	316, 316L Inconel600 316Ti 321 347	1x type K 1x type J 2x type K 2x type J	IEC 60584 ASTM E230	Grounded Ungrounded

Rigid	Main bushing	316 + 316L
	Reinforced sleeve + thermowell	316 + 316L, 347/321, Inconel600/316Ti
Flex	Main bushing	316 + 316L
	Reinforced sleeve	316 + 316L / 347 / 321, Inconel600 / 316Ti
	Thermowell	316 + 316L, 347/321, Inconel600/316Ti
	Flexible part	Inconel600 / 347 (specification on request) 321 / 316 + 316L (standard)

For increased reliability, Endress+Hauser can offer double hot junction sensors for a sensor backup function, either by mean of double thermocouples or by coupling two independent sensors (having the same length). Improved monitoring can be achieved in combination with double channel transmitters TMT8x.

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

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

1) for this configuration the main bushing have to be specially engineered

Weight

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

Materials of insert sheath, thermowell, main bushing and all wetted parts

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load.

The maximum operation temperatures are reduced considerably in some cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316/1.4401	X5CrNiMo 17-12-2	650 °C (1202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1202 °F)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ▪ Increased resistance to intergranular corrosion and pitting ▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content
Alloy600/ 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 ▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water ▪ Not to be used in sulfur-containing atmospheres
AISI 304/1.4301	X5CrNi18-10	850 °C (1562 °F)	▪ Austenitic, stainless steel ▪ Well usable in water and lowly pollute waste water ▪ Only at relatively low temperatures resistant to organic acids, saline solutions, sulphates, alkaline solutions, etc.
AISI 304L/ 1.4307	X2CrNi18-9	850 °C (1562 °F)	▪ Good welding properties ▪ Impervious to intergranular corrosion ▪ High ductility, excellent drawing, forming, and spinning properties
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1292 °F)	▪ Addition of titanium means increased resistance to intergranular corrosion even after welding ▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ▪ Can only be polished to a limited extent, titanium streaks can form

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
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 to 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

Flanges

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

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

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

Compression fittings

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

Operability

For details of operability, see the Technical Information of the Endress+Hauser temperature transmitters or the manuals of the related operating software. → 🖹 24

Certificates and approvals

CE Mark	The complete assembly is provided with individual components CE marked, to ensure safe use in hazardous areas and pressurized environments.
Hazardous area approvals	The Ex approval applies to individual components like junction box, cable glands, terminals. For further details on the available Ex versions (ATEX, UL, FM, CSA, IEC-EX, NEPSI, EAC-EX), please contact your nearest Endress+Hauser sales organization. All relevant data for hazardous areas can be found in separate Ex documentation. ATEX Ex ia inserts are available only for diameters ≥ 1.5 mm (0.6 in). For further details contact an Endress+Hauser technician.
Certification HART	The HART® temperature transmitter is registered by the FieldComm Group. The device meets the requirements of the HART® Communication Protocol Specifications.
Certification FOUNDATION Fieldbus	The FOUNDATION Fieldbus™ temperature transmitter has successfully passed all test procedures and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specification: ▪ Certified according to FOUNDATION Fieldbus™ specification ▪ FOUNDATION Fieldbus™ H1 ▪ Interoperability Test Kit (ITK), up to date revision status (device certification no. available on request): the device can also be operated with certified devices of other manufacturers ▪ Physical layer conformance test of the FOUNDATION Fieldbus™
Certification PROFIBUS® PA	The PROFIBUS® PA temperature transmitter is certified and registered by the PNO (PROFIBUS® Nutzerorganisation e. V.), PROFIBUS user organization. The device meets all the requirements of the following specifications: ▪ Certified according to FOUNDATION Fieldbus™ specification ▪ Certified in accordance with PROFIBUS® PA Profile (the up to date profile version is available on request) ▪ The device can also be operated with certified devices of other manufacturers (interoperability)
Other standards and guidelines	▪ EN 60079: ATEX certification for hazardous areas ▪ IEC 60529: Degree of protection of housing (IP code) ▪ IEC 60584 and ASTM E230/ANSI MC96.1: Thermocouples
Material certification	The material certificate 3.1 (according to EN 10204) can be requested separately. The certificate includes a declaration related to the materials used to produce the thermometer. It guarantees the traceability of the materials through the identification number of the multipoint thermometer.
Test report and calibration	The "Factory calibration" is carried out according to an internal procedure in a laboratory of Endress +Hauser accredited by the European Accreditation Organization (EA) to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT/Accredia) or (DKD/DAkkS) may be requested separately. The calibration is performed on the inserts of the multipoint.
Final assembly functional test, temperature profile test report	Measurement test performed with a given thermal gradient distributed over the entire thermowell length: this test allows to validate the positioning of each measuring point, its location and the relative correct wiring in case of a Junction box.
Final inspection report	It consists of a series of tests carried on the thermowell in order to ensure that the assembly has all the required characteristics according to the customer order and the product functionality. It comprises: ▪ Visual and dimensions test ▪ Dye penetrant test on weldings and on tip thermowell closure ▪ Helium leakage test (when foreseen) ▪ Material Certificate according to EN10204 3.1

Additional tests
- Visual and dimension test for all components (Insert, protecting sheath, conduit, adapters)
- Insulation resistance (TC insert) acc. to IEC 1515
- Continuity, polarity (0°C Test) and type (TC insert) acc. to IEC 584.
- Wiring check in combination with the junction box (when foreseen)

Ordering information

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

Detailed ordering information is available from your Endress+Hauser Sales Center:
www.addresses.endress.com

Process connection type: Compression fitting		
Material	316L, 316H Others on request	_____ _____
Thread	1", ¾", ½", ¼" Others on request	_____ _____

Process connection type: Flange		
Standard	▪ ANSI ▪ DIN ▪ Others on request	☐ ☐ _____
Material	316+316L, 316Ti, 304+304L, 321, 347 Others on request	_____
Face	▪ RF ▪ RTJ ▪ Others on request	☐ ☐ _____
Size	▪ ½", 1", 1½", 2", 3", 4" ▪ DN15, DN25, DN40, DN50, DN80, DN100 ▪ Others on request	_____ _____ _____

Insert and thermowell design		
Type	TC: K, J, N, E	_____
Design	▪ Single ▪ Duplex	☐ ☐
Execution	▪ Grounded ▪ Ungrounded	☐ ☐
Standard/Class	▪ IEC/Class 1 for TC ▪ ASTM/Class special for TC ▪ IEC/Class 2 for TC ▪ ASTM/Class standard for TC	☐ ☐ ☐ ☐
Thermowell material	316, 316L, Alloy600, 321, 347, 316Ti Others on request	_____ _____
Thermowell diameter TD in mm (in)	▪ 3.2 mm (0.13 in) ▪ 6 mm (0.24 in) ▪ 6.35 mm (0.25 in) ▪ 8 mm (0.31 in) ▪ 9.5 mm (0.37 in)	☐ ☐ ☐ ☐ ☐
Thermowell design	▪ Rigid ▪ Flexible	☐ ☐

Flexible conduit cable design		
Diameter/material/adapter	▪ DN 29/polyamide/M32 ▪ DN 36/polyamide/M40 ▪ DN 48/polyamide/M50 [1)]	☐ ☐ ☐

1) Different configuration on request

Measurement point distribution		
Positioning	▪ Equally spaced ▪ Customized	☐ ☐
Number	2 to 59 [1]	_____

1) Different numbers/configurations are available on request

Insertion length	TAG (description)	(L_{MPx}) in mm (in)
MP_1	_____	_____
MP_2	_____	_____
MP_3	_____	_____
MP_4	_____	_____
MP_5	_____	_____
MP_6	_____	_____
MP_x [1]	_____	_____

1) Different number/configuration on request

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

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

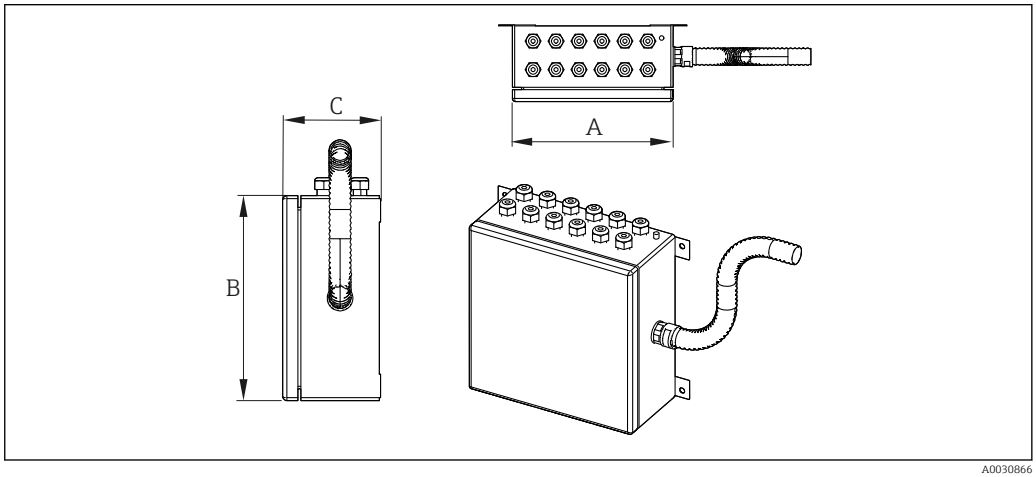
1) for this configuration the main bushing have to be specially engineered

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center.

Device-specific accessories

Accessories	Description
Junction box	The junction box is suited for chemical agents environments. Sea water corrosion resistance and extreme temperature variation stability is guaranteed. Ex-e, Ex-i terminals can be generally installed.
Transmitter	Head transmitters ▪ PC programmable head transmitter ▪ With HART®-, PROFIBUS® PA or FOUNDATION Fieldbus™ communication protocol 8-channel DIN rail transmitter with FOUNDATION Fieldbus™ communication protocol
Pads, clips, spacers	▪ Pads and clips: in order to fix the multipoint thermometer along its immersion length. ▪ Spacer: Used in presence of an existing thermowell in order to guarantee the centering.
Specific extension for on-board junction box	When the junction box cannot be remotely installed, it has to be configured on-board at the multipoint thermometer. Therefore, a specific extension design has to be provided. This design is available on request only for flanged process connection.



7 *Junction box as accessory for remote installation*

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

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

Maximal possible number [1] of head transmitters/terminal blocks:

Junction box size	N° of TMT8x/18x	N° of TMT125	N° of terminal blocks
150x150x100	2	0	12
200x200x160	4	0	20
280x280x160	6	1	60
270x350x130	12	2	90
350x350x160	12	2	135
380x380x160	20	2	159
350x500x160	28	4	225
500x500x160	42	6	360

1) Thermal dissipation ans so maximum number of transmitters has to be checked according to maximum ambient temperature.

Type of specification	Junction box	Cable glands
Material	AISI 316 / aluminum	NiCr Plated brass AISI 316 / 316L
Ingress protection (IP)	IP66/67	IP66
Ambient temperature range	−50 to +60 °C (−58 to +140 °F)	−52 to +110 °C (−61.1 to +140 °F)
Approvals	IEC-EX, ATEX, UL, FM, CSA, NEPSI, EAC-EX approval for use in hazardous area approval	-
Marking	II 2 GD Ex e IIC Gb Ex ia Ga IIC T Ex tb IIIC UL913 FM3610 CSA C22.2 No. 157 Class 1, Division 1, Groups B, C, D T6/T5/T4	-
Cover	Hinged	-
Maximum sealing diameter	-	6 to 12 mm (0.24 to 0.47 in)

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 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: ▪ Via the Internet: https://wapps.endress.com/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 the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. 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. 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 BA00059S

Documentation

- Operating manuals iTEMP temperature transmitters:
  - TMT181, PC programmable, single-channel, RTD, TC, Ω, mV (KA141R/09/a3)
  - HART® TMT182, single-channel, RTD, TC, Ω, mV (KA142R/09/c4)
  - HART® TMT82, two-channel, RTD, TC, Ω, mV (BA01028T/09/en)
  - PROFIBUS® PA TMT84, two-channel, RTD, TC, Ω, mV (BA00257R/09/en)
  - FOUNDATION Fieldbus™ TMT85, two-channel, RTD, TC, Ω, mV (BA00251R/09/en)
  - FOUNDATION Fieldbus™ TMT125, 8 channel, RTD, TC, Ω, mV (BA00240R/09/en)
- Technical Information of inserts:
  Thermocouple insert Omnigrad T TSC310 (TI00255t/09/en)
- Technical Information application example:
  - RN221N active barrier, for supplying loop-powered 2-wire transmitters (TI073R/09/en)
  - HAW562 surge arresters, (TI01012K/09/en)