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Technical Information
iTHERM TMS11 MultiSens Linear

Modular TC and RTD multipoint with primary thermowell

Application

- Easy-to-use device with modular design, provided of its own primary thermowell and ready to be installed
- Specifically designed for Oil & Gas and Petrochemical processing industries
- Measuring range:
  - Resistance insert (RTD): −200 to 600 °C (−328 to 1 112 °F)
  - Thermocouple (TC): −270 to 1 100 °C (−454 to 2 012 °F)
- Static pressure range: Up to 240 bar (3 481 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

- High degree of customization thanks to a modular product design for easy installation, process integration and maintenance
- Easy integration due to inserts according to standards as per standard IEC 60584, ASTM E230 and IEC 60751
- Electrical and Pressure Directive compliance for an easy and fast process integration
- Compliance to different types of protection for use in hazardous locations for a wide and easy process integration
- Possibility to individually replace inserts, even in operating conditions
- Superior mechanical strength thanks to a primary thermowell for temperature sensors protection in a wide range of process conditions
- Increased safety due to the possibility to continuously monitor the integrity of the thermowell thanks to a pressure port during operating conditions

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

Thermocouples (TC)

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

Resistance thermometer (RTD)

These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. The 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:

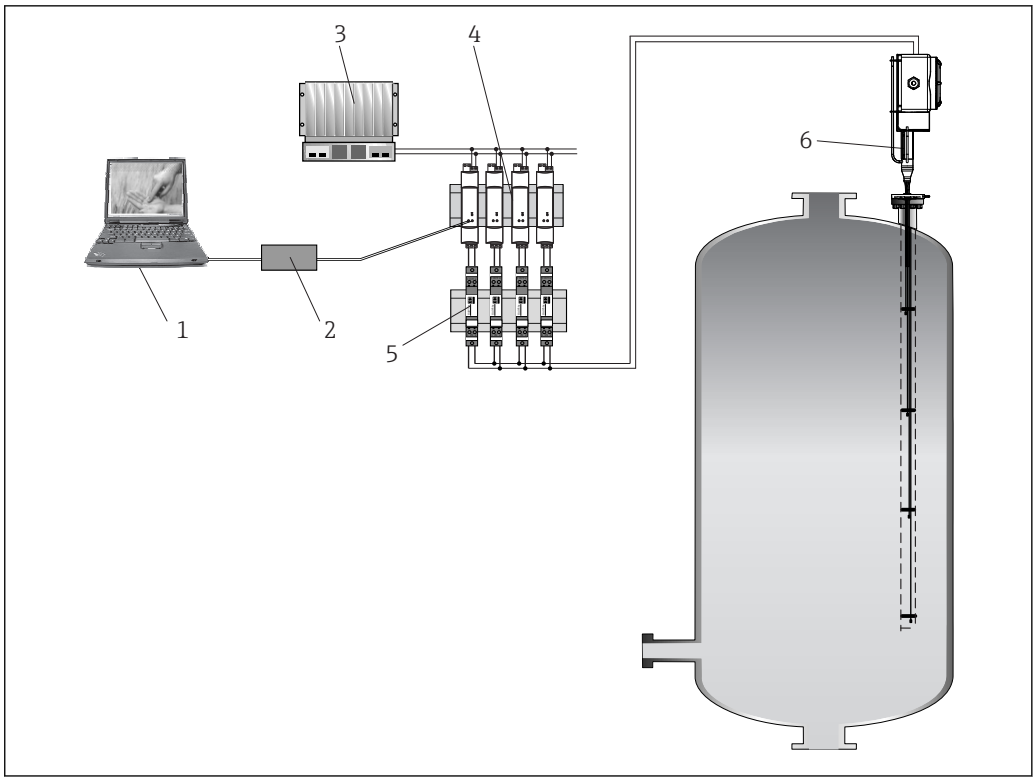
- **Wire wound (WW):** Here, a double coil of fine, high-purity platinum wire is located in a ceramic support. This is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 °C (1 112 °F). This type of sensor is relatively large in size and it 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 category 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.

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.

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 HAW562 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 → 27*
6 *Mounted multipoint thermometer with its own primary thermowell, optionally with built-in transmitters in the junction box for 4 to 20 mA-, HART-, PROFIBUS® PA-, FOUNDATION Fieldbus™ communication or terminal blocks for remote wiring.*

Equipment architecture

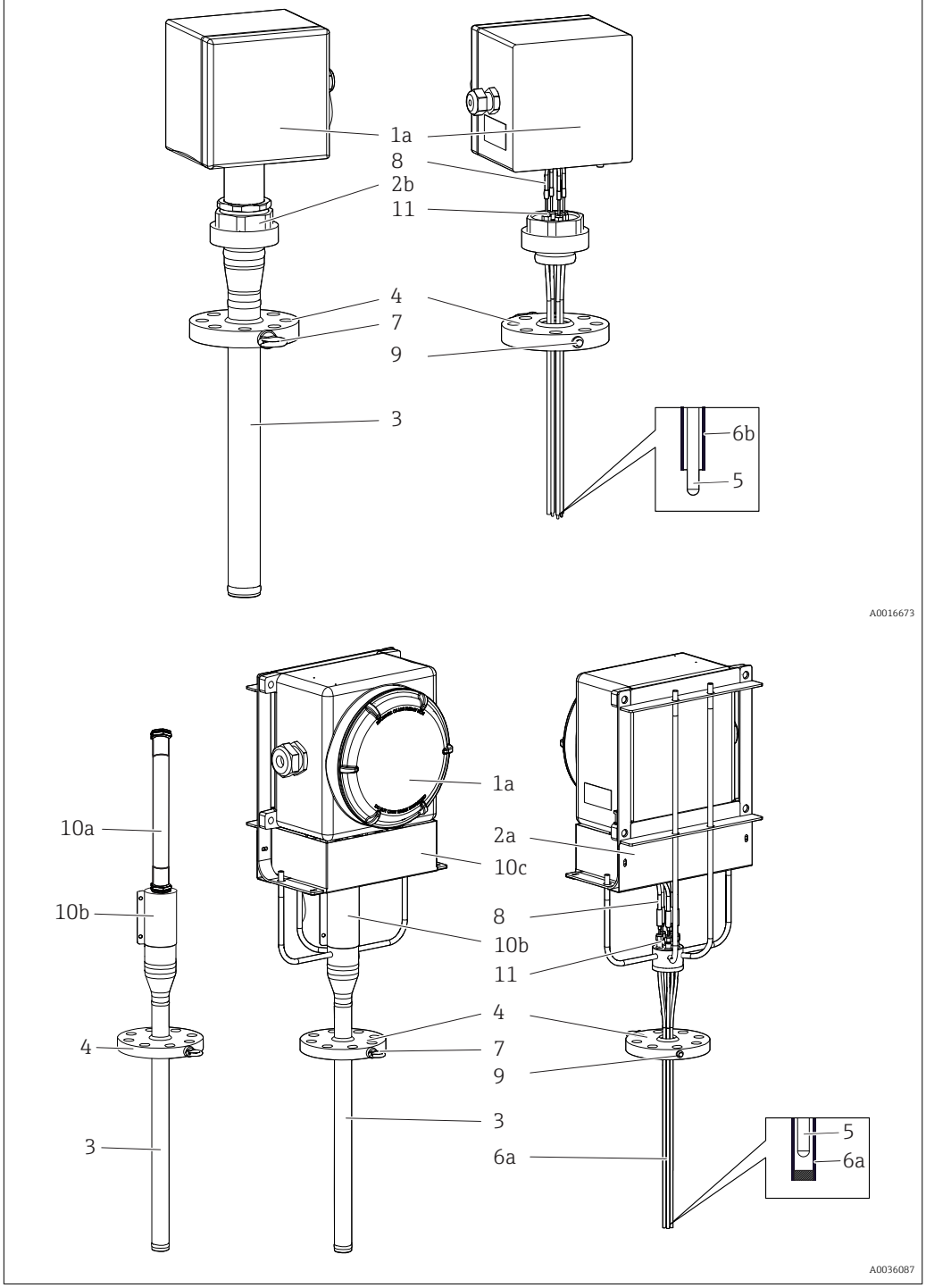
The multipoint thermometer belongs to a range of modular product configuration for multipoint temperature detection with a design where subassemblies and components can be managed individually for easy maintenance and spare part ordering.

It consists of the following main sub-assemblies:

- **Insert:** Composed by individual metal sheathed sensing elements (thermocouples or thermos-resistance) protected by the primary thermowell welded to the process connection. In addition, individual guiding tubes or protecting themowells allow inserts replacement during operating conditions. When applicable, each insert can be handled as an individual spare part and ordered via specific standard product order codes (e.g. TSC310, TST310) or special codes. For the specific order code please contact your Endress+Hauser specialist.
- **Process Connection:** Represented by an ASME or EN flange. It can be provided with pressure port and it might be provided with eyebolts for lifting the device.
- **Head:** It is composed of a junction box provided with its components such as cable glands, draining valves, earth screws, terminals, head transmitters, etc.
- **Head Support Frame:** It is designed to support the junction box. Two different types are available:
  - Direct mounted support frame
  - Three pieces union joint
- **Additional Accessories:** They can be ordered for any configuration, and they are recommended in case of replaceable sensors configuration (such as pressure transducers, manifolds, valves and fitting).
- **Primary Thermowell:** It is directly welded to the process connection, designed to guarantee high degree of mechanical protection and corrosion resistance.

In general, the system measures a linear temperature profile inside the process environment. It is also possible to obtain a three-dimensional temperature profile by installing more than one Multisens Linear (either horizontally, vertically or obliquely).

Design



Description, available options and materials	
1: Head 1a: Directly mounted 1b: Remote	Hinged or screwed cover junction box for electrical connections. It includes components such as electrical terminals, transmitters and cable glandes. ▪ 316/316L ▪ Aluminium alloys ▪ Other materials on request
2: Support System 2a: With rods and protection cover	Support frame for explosion proof requirements. 316/316L
2b: With three pieces union joint	Support frame for intrinsically safe requirements. 316/316L
3: Primary thermowell	The primary thermowell is made by a tube with calculated and selected thickness according to reference international standards. It is designed to protect the sensors against harsh process conditions such as dynamic and static loads and corrosion. It is composed of two main zones, one inside the process and the other one outside of the process (thermowell head). The main thermowell goes across the process connection and on the upper part there are compression fitting to allow insert replacement (when possible) ▪ 316/316L ▪ 321 ▪ 304/304L ▪ 310L
4: Process connection, flanged according to ASME, or EN standards	Represented by a flange according to international standards, or engineered to satisfy specific process requirements → 🖹 13. ▪ 316 + 316L ▪ 304/304L ▪ 310L ▪ 321 ▪ Other materials on request
5: Insert	Mineral insulated grounded and ungrounded thermocouples or RTD (Pt100 wire wound). For details, refer to the Ordering information table
6 Tip design of: 6a: protecting thermowells	The sensors inside the primary thermowell can be kept in the right measuring location by means of closed-end protecting thermowells which end with: ▪ welded thermal block discs to ensure the optimal heat transfer thorough the primary thermowell wall and the temperature sensors. Sensors are replaceable. ▪ individual thermal blocks pressed against the internal wall to ensure the optimal heat transfer between the primary thermowell and the replaceable temperature sensor. ▪ straight tip. For details, refer to the Ordering information table
6b: guiding tubes	The sensors inside the primary thermowell can be kept in the right measuring location by means of open-end guiding tubes which end with: ▪ bimetallic stripes to push the sensor in contact with the internal wall of the main thermowell and allow faster response time. Sensors not replaceable. ▪ bent tip.
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 Hyflon MFA ▪ Unshielded PVC flying leads

Description, available options and materials	
9: Optional connection (Pressure Port threaded hole)	Auxiliary connections and fittings for pressure detection.
10: Protections 10a: Cable conduit system (in case of remote head) 10b: Cable conduit cover 10c: Extension cable cover	Cable conduit system: made by flexible polyamide to connect the top of the primary thermowell and the remote junction box. Cable conduit cover: composed of two half shields installed between the top of the primary thermowell and the junction box. Extension cable cover: made by a shaped stainless stell plate fixed to the junction box frame in order to protect the cable connections.
11: Compression fitting	High performing fittings for the tightness between the thermowell-head and the external environment, suitable for a wide range of process fluids and severe combination between temperature and pressure.

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)	−210 to +720 °C (−346 to +1 328 °F) −270 to +1 150 °C (−454 to +2 102 °F) −270 to +1 100 °C (−454 to +2 012 °F)
	Internal cold junction (Pt100) Cold junction accuracy: ± 1 K Max. sensor resistance: 10 kΩ	

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.

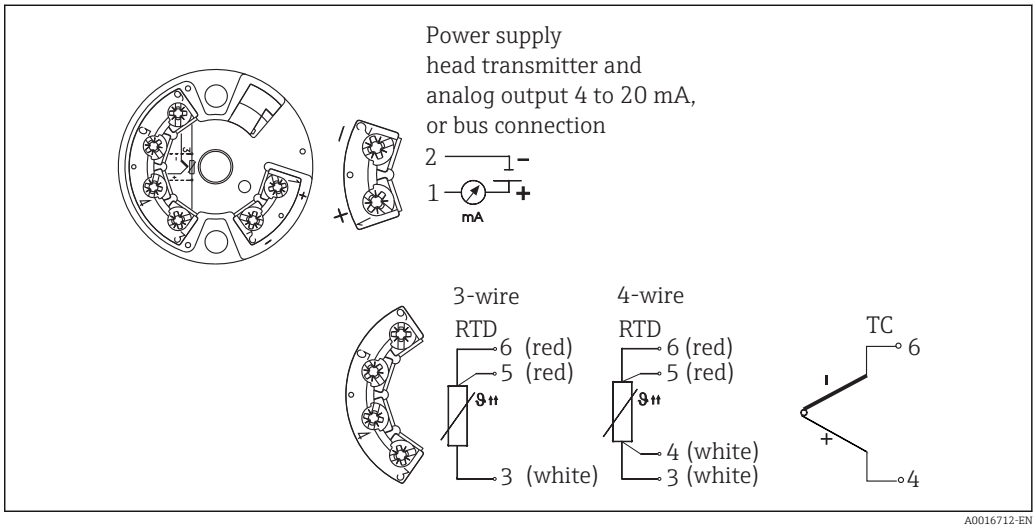
Advantages of the iTEMP transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions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

Power supply

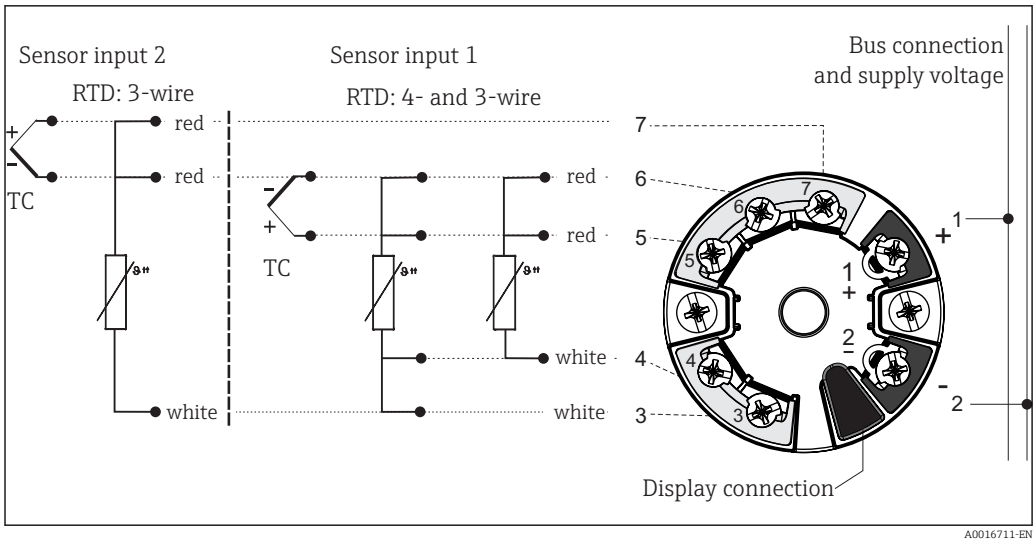
- Electrical connecting cables must be smooth, corrosion resistant, easy to be cleaned and inspected, robust against mechanical stresses, no-humidity sensitivity.
- Grounding or shielding connections are possible via ground terminals on the junction box.

Wiring diagrams

Wiring diagrams for TC and RTD connection



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

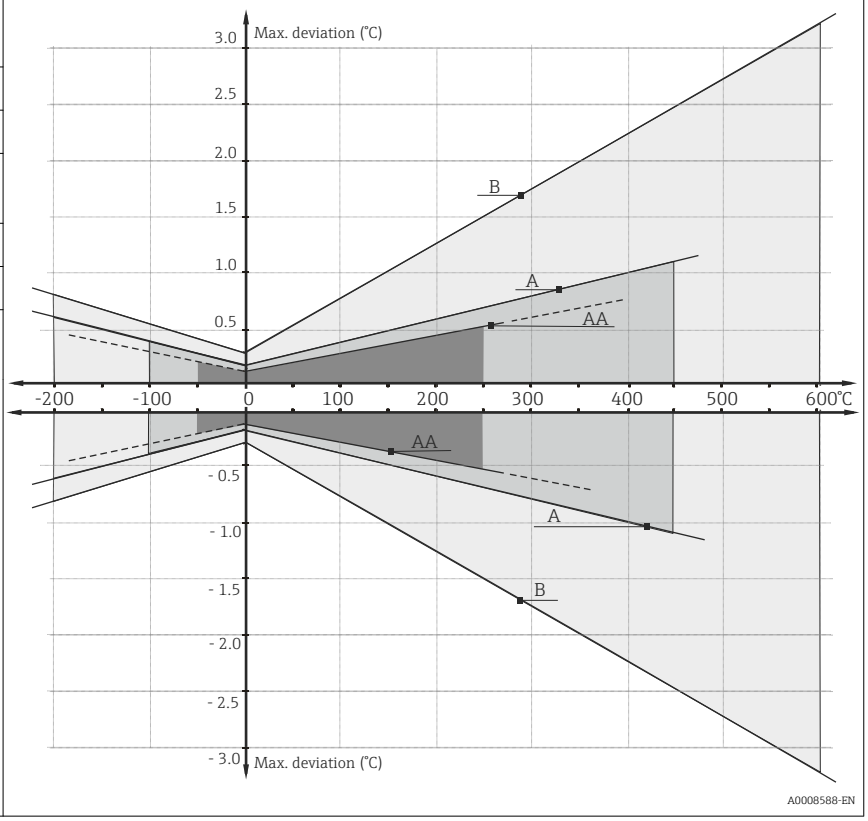


3 Wiring diagram of the dual sensor input head transmitters (TMT8x)

Performance characteristics

Accuracy RTD resistance thermometer as per IEC 60751

Class	Max. tolerances (°C)		Characteristics
Cl. AA, former 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	



1) |t| = absolute value °C

In order to obtain the maximum tolerances in °F, the results in °C must be multiplied 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	Type	Standard tolerance		Special tolerance	
IEC 60584		Class	Deviation	Class	Deviation
	J (Fe-CuNi)	2	±2.5 °C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 750 °C)	1	±1.5 °C (−40 to 375 °C) ±0.004 |t| [1] (375 to 750 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	2	±2.5 °C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 1 200 °C)	1	±1.5 °C (−40 to 375 °C) ±0.004 |t| [1] (375 to 1 000 °C)

1) |t| = absolute value °C

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

1) |t| = absolute value °C

Response time

Response time for the sensor assembly without transmitter. When response time of the complete assembly is requested (including primary thermowell), a dedicated calculation depending on the sensor layout will be preformed.

RTD

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

Insert diameter	Response time	
As an example, in case of thermowell thickness, 3.6 mm (0.14 in), bent guiding tubes design	t_{90}	108 s

Thermocouple (TC)

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

Insert diameter	Response time	
As an example, in case of thermowell thickness, 3.6 mm (0.14 in), bent guiding tubes design	t_{90}	52 s

Shock and vibration resistance

- RTD: 3G / 10 to 500 Hz according to IEC 60751
- TC: 4G / 2 to 150 Hz according to IEC 60068-2-6

Calibration

Calibration is a service that can be performed on each individual insert, either in order phase, or after multipoint installation (only in case of replaceable sensors).

When calibration shall be performed once the multipoint is installed, please contact the Endress+Hauser service to get full support. Together with the Endress +Hauser service any further activity can be organised to achieve the calibration of the target sensor. In any case it is forbidden to unscrew any threaded component on the process connection under operating conditions (running process), without knowing the pressure inside the primary thermowell.

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

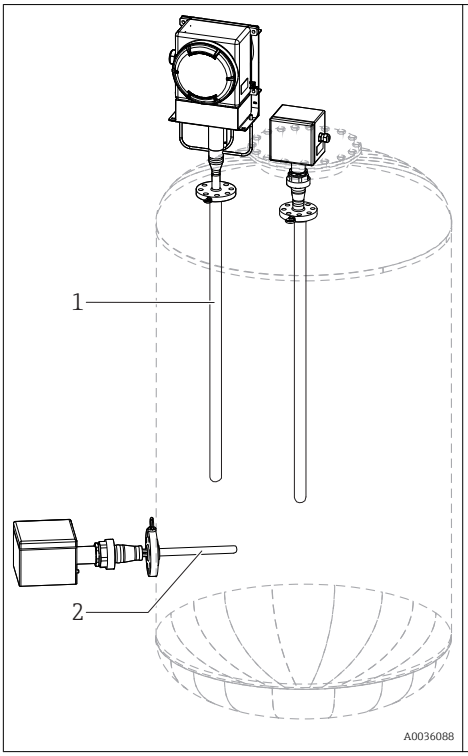
Mounting location

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

No restrictions. The multipoint thermometer can be installed either in horizontal, oblique or in vertical configuration. The measurement of a threedimensional temperature profile can be achieved in different ways:

- by installing several vertical multipoint thermometers in the longitudinal direction (1) of the reactor.
- by installing the multipoint thermometer systems in horizontal (2) or inclined direction.



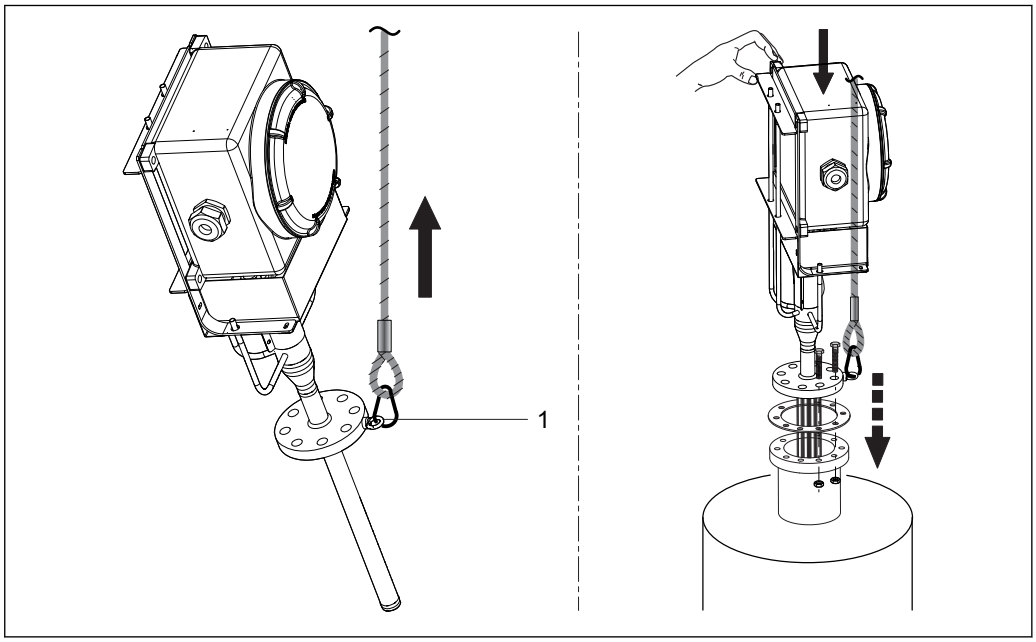
Vertical configuration (1):
The different sensors are aligned along the straight direction coinciding with the longitudinal axis of the vessel (linear multipoint measurement).
Radial configuration (2):
The different sensors are aligned along the straight direction coinciding with an horizontal diameter of the vessel (in combination with a nozzle entry). Adequate support systems have to be foreseen.
Inclined configuration:
The different sensors are mounted obliquely along a straight direction coinciding with an inclined vessel entry. Adequate support have to be foreseen.

Installation instructions

The modular multipoint thermometer is designed to be installed with a flanged 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.
- Friction between the primary thermowell and the internals of the reactor.
- Fixing the primary thermowell to the reactor's infrastructures without allowing axial displacements or movements.

When internals are not usable as interface, Endress + Hauser provides dedicated support components with minimum process invasiveness to achieve the desired measuring points.



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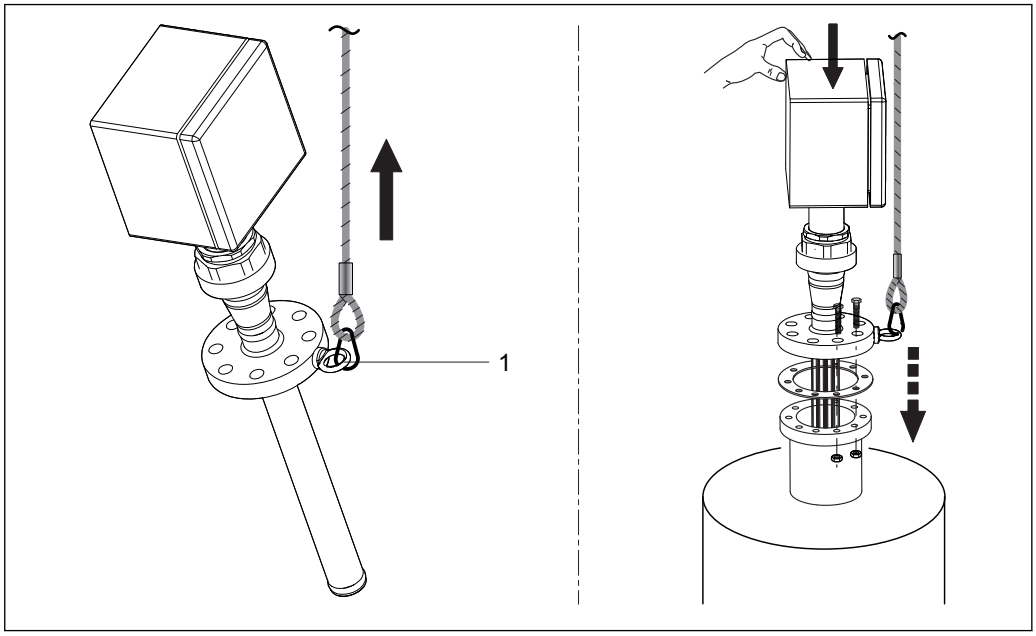

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During installation the whole thermometer must only be lifted and moved by using ropes properly mounted on the eyebolt of the flange (1) or careful on the thermowell.

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

Process temperature range

Up to +816 °C (+1 501 °F) (Based on standard process connection materials).

Process connection flanges with their specific ratings, selected according to the plant requirements, define the maximum process conditions, which the device has to operate.

Process pressure range

0 to 240 bar (0 to 3 481 psi)

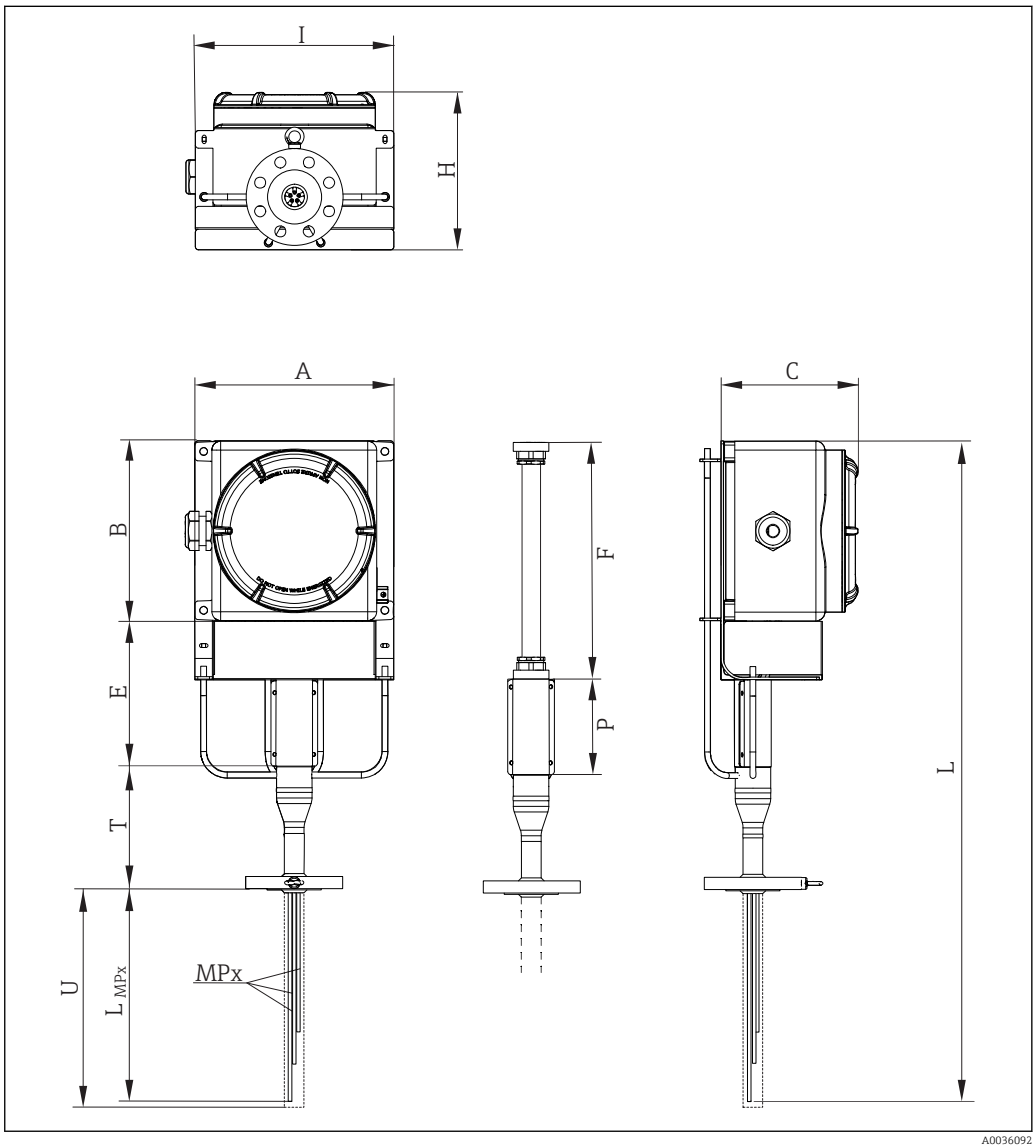
Anyhow, the maximum required process pressure has to be combined with the maximum design process temperature. Process connections like compression fittings, flanges with their specific ratings, thermowells, selected according to the plant requirements, define the maximum process conditions at which the device has to operate. Endress+Hauser experts can support the customer on any related questions.

Process applications:
- Atmospheric/Vacuum Distillation
- Catalytic Cracking/Hydrocracking
- Catalytic reforming
- Hydrodesulphurization
- N-based inorganics
- Ammonia
- Urea
- NGTL
- Distillation units and hydrogenation

Mechanical construction

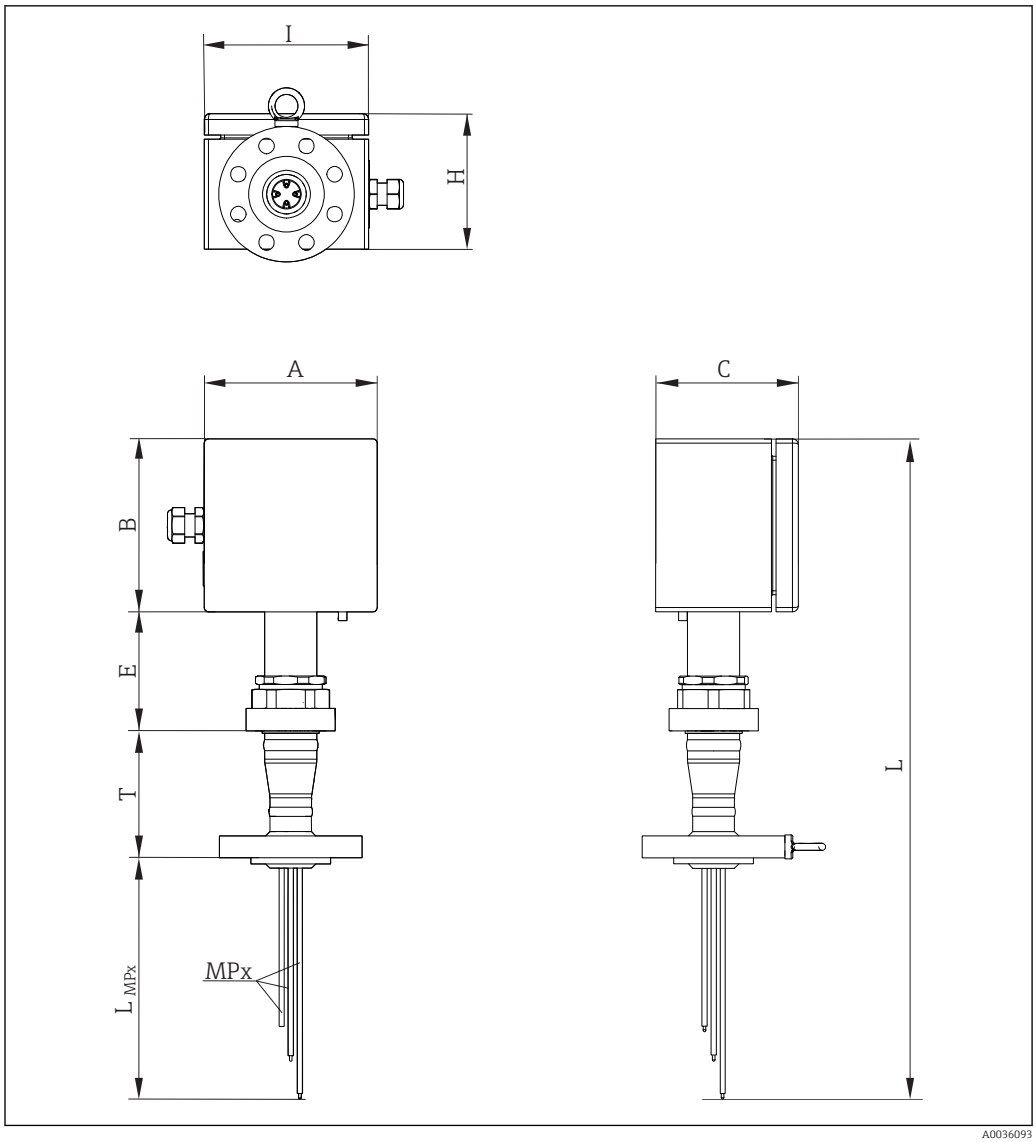
Design, dimensions

The overall multipoint assembly is composed of different sub-assemblies. Different inserts are available, based upon specific process conditions, in order to have the highest accuracy and an extended lifetime. The primary thermowell should be selected to increase mechanical performances and corrosion resistance. Associated shielded extension cables are available with high resistance sheath materials to withstand different environmental conditions and to ensure steady and noiseless signals. The transition between the inserts and the extension cable is obtained by the usage of specially sealed bushings, ensuring the declared IP degree protection.



4 *Design of the modular multipoint thermometer, with frame neck. All dimensions in mm (in)*

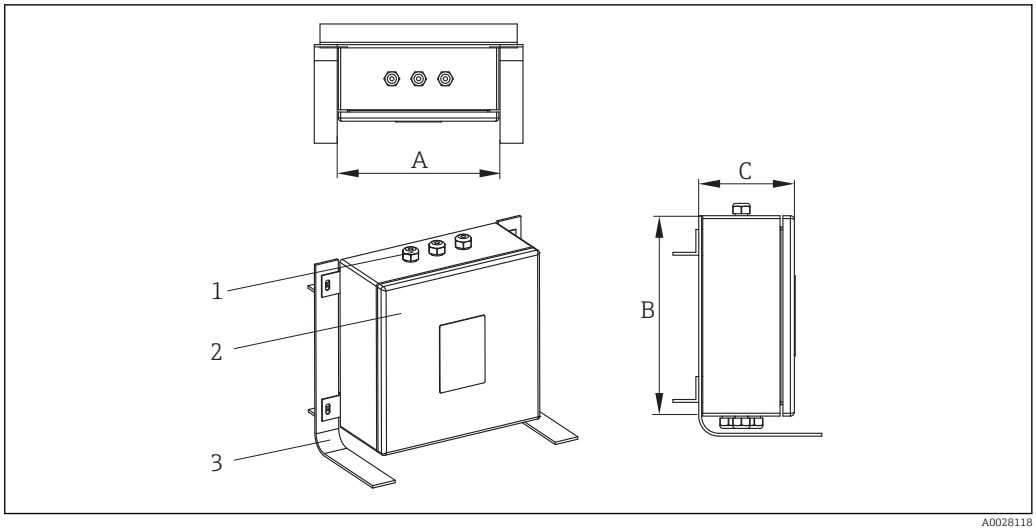
A, B, Dimensions of the junction box, see following figure
C
MPx Numbers and distribution of measuring points: MP1, MP2, MP3 etc.
L_{MPx} Immersion length of sensing elements or protecting thermowells
I, H Encumbrance of the junction box and support system
E Extension length
L Device length
T Lagging length
U Immersion length
P Protection: 250 mm
F Flexible hose length



5 Design of the modular multipoint thermometer, with tube neck design. All dimensions in mm (in)

A, B, Dimensions of the junction box, see following figure
C
MPx Numbers and distribution of measuring points: MP1, MP2, MP3 etc.
L_{MPx} Immersion length of sensing elements or protecting thermowells
I, H Encumbrance of the junction box and support system
E Extension length
L Device length
T Lagging length
U Immersion length

Junction box



1 Cable glands
2 Junction box
3 Frame

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 installed.

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

A	B	C
150 (5.9)	150 (5.9)	100 (3.93)
200 (7.87)	200 (7.87)	160 (6.29)
270 (10.6)	270 (10.6)	160 (6.29)
270 (10.6)	350 (13.78)	160 (6.29)
350 (13.78)	350 (13.78)	160 (6.3)
350 (13.78)	500 (19.68)	160 (6.3)
500 (19.68)	500 (19.68)	160 (6.3)
280 (11.02)	305 (12)	228 (8.98)
420 (16.53)	420 (16.53)	285 (11.22)
332 (13.07)	332 (13.07)	178 (7)
330 (12.99)	495 (19.49)	171 (6.73)

Type of specification	Junction box	Cable glands
Material	AISI 316 / Aluminium	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	ATEX approval for use in hazardous area	ATEX approval for use in hazardous area

Type of specification	Junction box	Cable glands
Marking	▪ ATEX II 2GD Ex e IIC/ Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4 ▪ IECEX II 2GD Ex e IIC/ Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4 ▪ IECEX II 2GD Ex e IIC/ Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4 ▪ ATEX II 2GD Ex d IIC T6-T3/Ex tDA21 IP66 T85oC-T200oC ▪ IECEX II 2GD Ex d IIC T6-T3/ Ex tDA21 IP66 T85oC-T200oC ▪ 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	→ 17
Cover	Hinged and threaded	-
Maximum sealing diameter	-	6 to 12 mm (0.24 to 0.47 in)

Support system

A modular system or a union joint is foreseen in case of direct mounted junction box.

It ensures the connection between the head of the primary thermowell and the junction box. The system design ensures easy access for monitoring and maintaining inserts and extension cables. Rods and protection cover guarantee a high stiffness connection for the junction box and vibration loads. No closed volumes are present in the frame design although it allows protection to the cables. This avoids the accumulation of waste and potentially dangerous fluids coming from the environment that can damage the instrumentation allowing continuous ventilation.

In case of three pieces union joint design the junction box can be orientated and the extension cables remain accessible thanks to the disassembling of the joint.

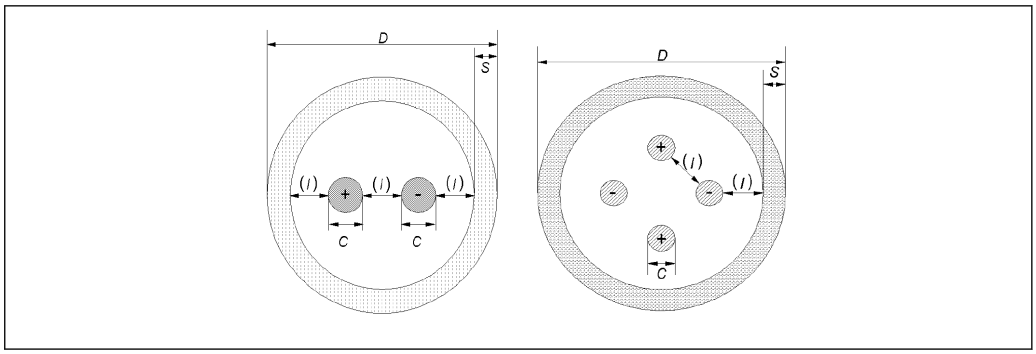
Inserts, guiding tubes and protecting thermowells

Thermocouple

Diameter in mm (in)	Type	Standard	Hot junction type	Sheath material
3 (0.12)	1x type K 2x type K 1x type J 2x type J 1x type N 2x type N	IEC 60584 /ASTM E230	Grounded/Ungrounded	Alloy600 / AISI 316L / Pyrosil

Conductor thickness

Sensor Type	Diameter in mm (in)	Wall	Min. Sheath Thickness (S)	Min. Conductors Diameter (C)
Single Thermocouple	3 mm (0.11 in)	Standard	0.3 mm (0.01 in)	0,45 mm = 25 AWG
Double Thermocouple	3 mm (0.11 in)	Standard	0.27 mm (0.01 in)	0,33 mm = 28 AWG



RTD

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

Protecting thermowells or guiding tubes

External diameter in mm (in)	Sheath material	Type	Thickness in mm (in)
6 (0.24)	AISI 316L	closed or open	0.5 (0.02) or 1 (0.04)
8 (0.32)	AISI 316L	closed or open	1 (0.04)

Sealing components

The sealing components (compression fittings) are welded on the thermowell head to guarantee proper tightness under all the foreseen operating conditions and to allow the maintenance/ replacement of the sensors (when applicable).

Material: AISI 316/AISI 316H

Cable Glands

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

Material	Marking	IP Rating	Ambient T range	Max. sealing diameter
NiCr Plated brass	Atex II 2/3 GD Ex d IIC, Ex e II, Ex nR II, Ex tD A21 IP66	IP66	−52 to +110 °C (−61.6 to +230 °F)	6 to 12 mm (0.23 to 0.47 in)
AISI 316/AISI 316L	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 function

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. Thanks to the pressure port, it is possible to detect and monitor possible leakages (or gases permeation) occurring through the primary thermowell, and plan the maintenance.

Weight

The weight can vary based upon the configuration, depending on the junction box and the frame design. The approximate weight of a typically configured multipoint thermometer (number of inserts = 12, main body = 3", medium size junction box) = 30 kg (66.1 lb).

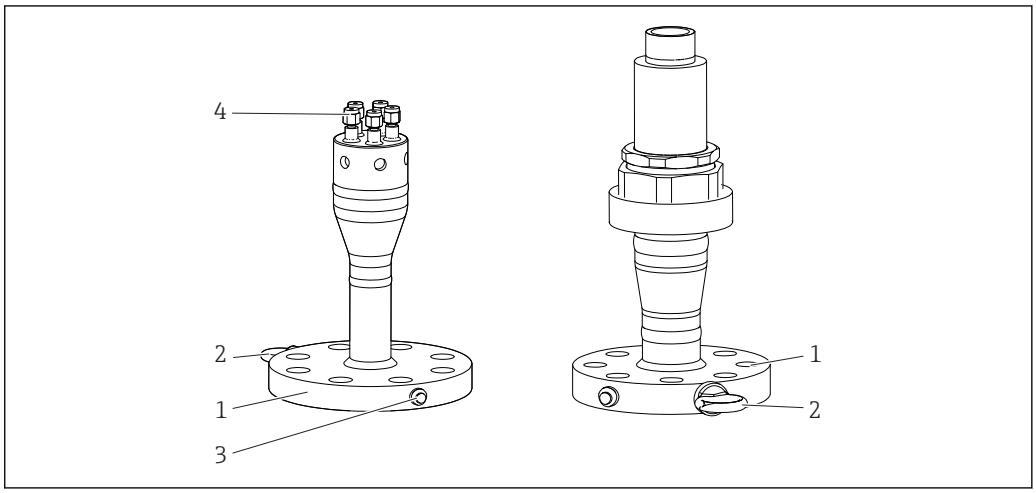
The eyebolt, which is part of the process connection, must be used as the only lifting component to move the entire device.

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 (1 202 °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 (1 202 °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
INCONEL® 600 / 2.4816	NiCr15Fe	1 100 °C (2 012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures. ▪ Resistant to corrosion caused by chlorine gas and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water. ▪ Not to be used in a sulfur-containing atmosphere.
AISI 304/1.4301	X5CrNi18-10	850 °C (1 562 °F)	▪ Austenitic, stainless steel ▪ 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 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °F)	▪ Properties comparable to AISI316L. ▪ Addition of titanium means increased resistance to intergranular corrosion even after welding ▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ▪ Can only be polished to a limited extent, titanium streaks can form
AISI 321/1.4541	X6CrNiTi18-10	815 °C (1 499 °F)	▪ Austenitic stainless steel ▪ High resistance to intergranular corrosion even after welding ▪ Good welding characteristics, suitable 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 (1 472 °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



6 *Flange as process connection*

1 Flange
2 Eyebolt
3 Pressure port
4 Compression fittings

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

Standard [1]	Size	Rating	Material
ASME	1 1/2", 2", 3"	150#, 300#, 400#, 600#, 900#	AISI 316/L, 304/L, 310L, 321
EN	DN40, DN50, DN80	PN10, PN16, PN25, PN 40, PN 63, PN100, PN150	316/1.4401, 316L/1.4404, 321/1.4541, 310L/1.4845, 304/1.4301, 304L/ 1.4307

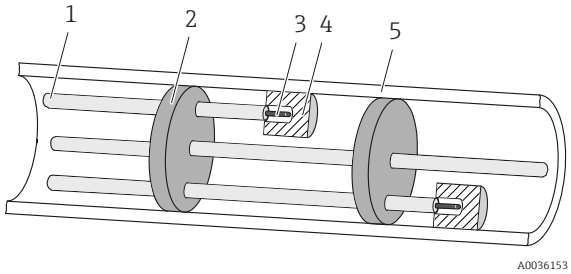
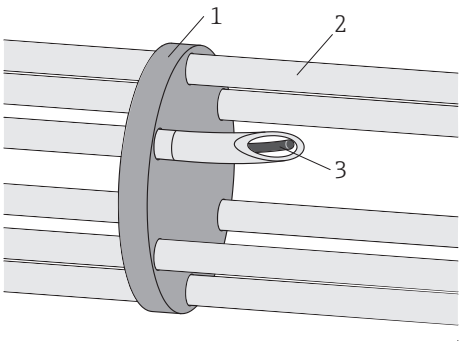
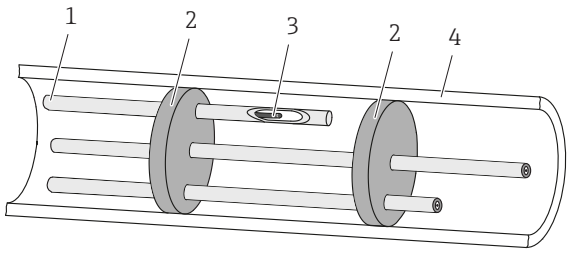
1) Flanges according to GOST standard are available on request.

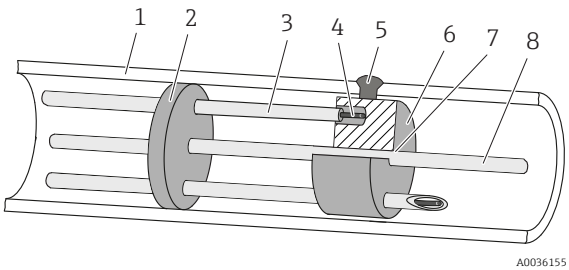
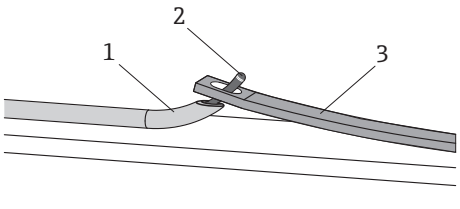
Compression fittings

The compression fittings are welded onto the thermowell head to ensure the sensors replacement(when applicable). Dimensions are coherent with the insert dimensions. Compression fittings comply with the highest standards of reliability in terms of materials and performances required

Material	AISI 316/316H

Thermal contact components

A: Thermal contact block  A0036153 *1 Guiding tube* *2 Spacer* *3 Insert* *4 Thermal block* *5 Primary thermowell wall*	The thermal blocks are forced against the internal wall to ensure the optimal heat transfer between the primary thermowell and the replaceable temperature sensor
B: Bent guiding tubes and spacers  A0028783 *1 Spacer* *2 Guiding tube* *3 Insert*	▪ Allow sensor replacement ▪ Guarantee thermal contact between the sensor tip and the existing thermowell
C: Protecting thermowells and spacers  A0036632 *1 Protection thermowell* *2 Spacer* *3 Insert* *4 Primary thermowell wall*	Each sensor is protected by its protecting thermowell with straight tip

D: Thermal block disc (welded to the primary thermowell)  *1 Primary thermowell wall* *2 Spacer* *3 Guiding tube* *4 Insert* *5 Welded contact* *6 Thermal block disc* *7 Welding seam* *8 Supporting rod*	▪ Ensure the optimal heat transfer thorough the primary thermowell wall and the temperature sensors. Sensors are replaceable ▪ Sensors can be replaced
E: Bimetallic stripes  *7 Bimetal strips with or without guiding tubes* *1 Guiding tube* *2 Insert* *3 Bimetallic stripe*	▪ Doesn't allow sensor replacement ▪ Guarantee thermal contact between the sensor tip and the thermowell due to bimetallic stripes activated by temperature difference ▪ No friction during installation even with already installed sensors

Operability

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

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.

PED approval

The thermometer assembly can be provided with PED approval if required as the European Directive 2014/68/UE says. Calculation reports, testing procedures, certificates , are provided according the required calculation code and as foreseen in the product technical dossier.

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

- IEC 61326-1:2007: Electromagnetic compatibility (EMC requirements)
- IEC 60529: Degree of protection of housing (IP code)
- IEC 60584 and ASTM E230/ANSI MC96.1: Thermocouples
- ASME B16.5, B16.36, EN 1092-1, GOST 12820-20: Flange

Material certification

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

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.

Ordering information

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

Insert design	
Replaceable	☐
Not replaceable	☐

Process connection: Flange		
Standard	▪ Asme B16 ▪ En1092-1	☐ ☐
Material	▪ 316/1.4401 ▪ 316L/1.4404 ▪ 321/1.4541 ▪ 310L/1.4845 ▪ 304/1.4301 ▪ 304L/1.4307	☐ ☐ ☐ ☐ ☐ ☐
Face	▪ RF ▪ RTJ ▪ Type A ▪ Type B1	☐ ☐ ☐ ☐
Size	▪ 1 1/2", 2", 3" ▪ DN40, DN50, DN80	_____ _____

Other process connections, have to be specified in terms of dimensions and overall characteristics.

		Max n. points depending on insert layout [1]	
Thermal contact design:		A=B=C=D	E
Thermowell size	1 1/2	7	7
	2	10	8
	2 1/2	16	10
	3	16	16

1) In case of order , the maximum number of points are subjected to a feasibility check.

Primary Thermowell		
Thermowell dimension	▪ 1 1/2" ▪ 2" ▪ 2 1/2" ▪ 3"	☐ ☐ ☐ ☐ ☐
Thermowell material	▪ 316/1.4401 ▪ 316L/1.4435 ▪ 321/1.4541 ▪ 310L/1.4845 ▪ 304/1.4301 ▪ 304L/1.4307	☐ ☐ ☐ ☐ ☐ ☐

Insert, sensor		
Measuring principle	▪ Thermocouple (TC) ▪ Resistance Temperature Detection (RTD)	☐ ☐
Type	TC: J, K, N RTD: Pt100	_____
Design	▪ TC: Single, duplex ▪ RTD: 3-wire, 4-wire, 2x3-wire	☐ ☐
Execution	▪ TC: Grounded, Ungrounded ▪ RTD: Wire wound (WW), Thin Film (TF)	☐ ☐
Sheath material	316L, Alloy 600, Pyrosil	_____
Approvals	Intrinsic Safety Non hazardous	☐ ☐
Standard/Class	▪ IEC/Class 1 ▪ ASTM/Class special ▪ IEC/Class A ▪ IEC/Class AA	☐ ☐ ☐ ☐

Measurement point distribution		
Positioning	▪ Equi spaced ▪ Customized	☐ ☐
Number	2, 4, 6, 8, 10, 12 ... 16 [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) ▪ Others 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 ▪ Quantity	 ☐ / _____ ☐ / _____ ☐ / _____ ☐ ☐ ☐ _____
Approvals	Ex e / Ex ia / Ex d	_____
Cable entries (process side)	Single or multiple, type: M20 Quantity Other on request	_____ / _____ _____ / _____
Cable entries (wiring side)	Single or multiple, type: M20, M25, NPT ½", NPT 1" Quantity Other on request	_____ / _____ _____ / _____

Junction box supporting frame	
▪ Remote ▪ Direct mounted support frame ▪ Three pieces union joint ▪ Other on request	☐ ☐ ☐ _____

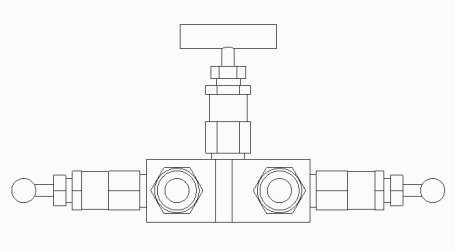
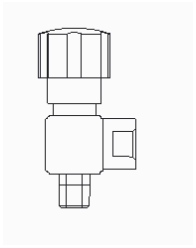
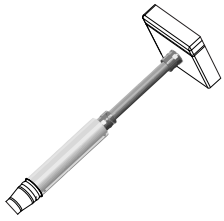
TAG		
Device information	Refer to customer specification / As specified	☐ ☐ (table)
Measuring point information	Refer to customer specification Location, as specified: ▪ Tagging (TAG), on device (black foil) ▪ Tagging (TAG), by customer ▪ Tagging (TAG), on Transmitter ▪ Tagging (TAG), on device (metal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

Additional requests		
Extension wire lengths, only for remote head	Specification in mm:	_____
Extension wires material	▪ PVC, -20...105°C ▪ Hyflon MFA, -200...250°C ▪ Others on request	☐ ☐ _____

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 is available from your local Endress+Hauser sales center.

Device-specific accessories

Accessories	Description
Tags	Nameplate can be applied to identify each measuring points and the whole assembly. Tags can be placed on the extension cables in the extension area and/or in to the junction box on individual wires or on other device.
Pressure transducer	Digital or analogical pressure transmitter with welded metal sensor for measurement in gases, steam or liquids. Ref to Endress+Hauser PMP sensors family
  A0034865 Fitting / manifolds / valves	Fitting, manifolds and valves are available for the installation of the pressure transmitter on the pressure port connection, and so allows the continuous monitoring of the device under the operating conditions.
 A0036534 Remote cable conduit system	Composed by a polyamide cable conduit to connect the top of the top of the thermowell and the remote junction box, already provided of a shaped stainless steel cover fixed to the junction box frame to protect the cable connections.

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://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 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

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

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