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Technical Information
iTHERM TMS21 MultiSens Slim

Minimally invasive, flexible TC multipoint thermometer for petrochemical and chemical applications

Application

- Easy-to-use thermometer with flexible design, for use in measuring applications with direct contact and fast measurements
- Specifically designed for light chemical processes
- Thermocouple (TC) measuring range:
  - Standard: −270 to 920 °C (−454 to 1 688 °F)
  - ATEX/IECEx: −50 to 440 °C (−58 to 824 °F)
- Static pressure range: Up to 90 bar (1 305 psi). Specific maximum pressure achievable depending on process type and temperature
- For installation in a container, reactor, tank, or similar

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

Endress+Hauser
People for Process Automation

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Function and system design

Measuring principle

Thermocouples (TC)

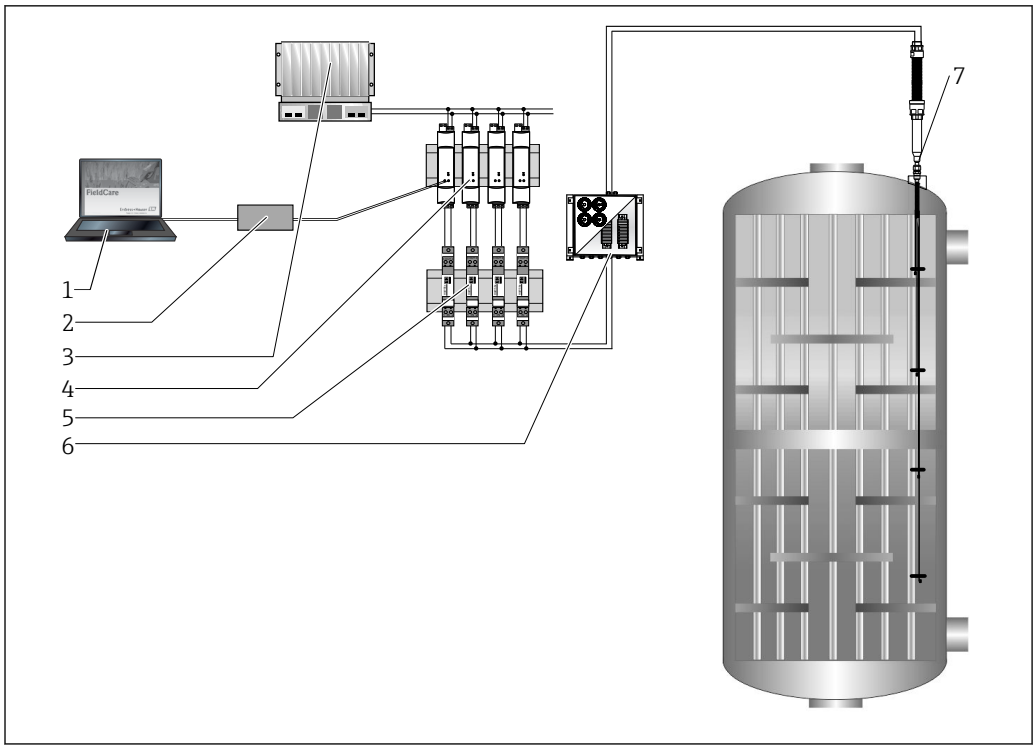
Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors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

Measurement system

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

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

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



1 *Application example in a reactor; 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 of the RN series (24 V_{DC}, 30 mA) that has a galvanically isolated output for power supply 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 from the HAW product family for protection of signal lines and components in hazardous areas, e.g. 4 to 20 mA- , PROFIBUS® PA, FOUNDATION Fieldbus™ signal lines. More information can be found in the associated Technical Information.*
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 conduit.*

Equipment architecture

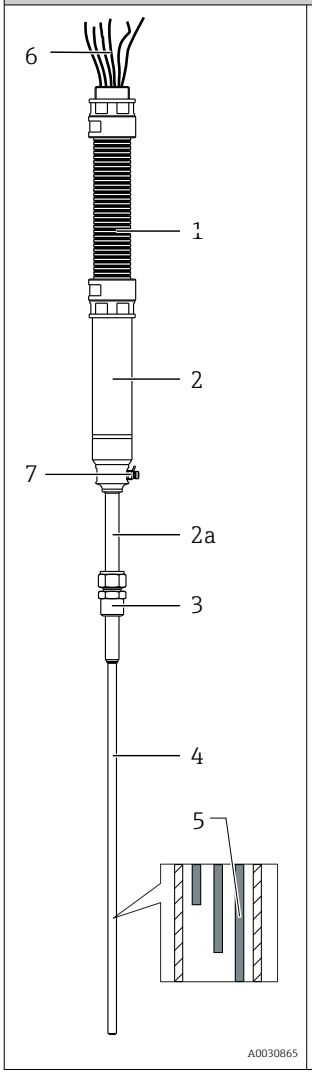
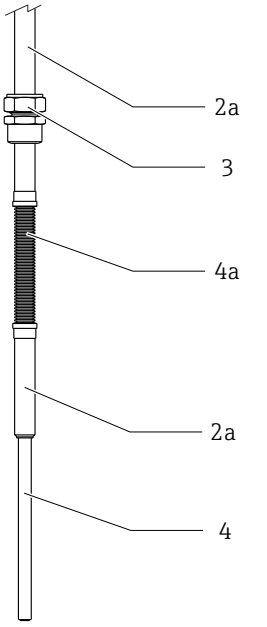
The new iTHERM MultiSens Slim has an innovative design able to allow a wide variety of options in terms of materials selection, nominal diameters and number of measuring points. In addition a portfolio of selectable accessories (not in contact with the process) individually managed for easy maintenance 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:** to seal and protect electrical junctions and to adjust immersion length.
- **Process connection:** 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 reinforcing sleeve.
- **Insert:** composed of metal sheathed sensing measuring elements (thermocouples), extension cable and transition bushing. The sensing elements are mounted inside a thermowell with a small pipe diameter.
  Part of the thermowell can be a flexible hose to guarantee additional bendability and thus better positioning of the probe in the process (above all 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 in the process environment using several sensors. These are connected with a suitable process connection, which guarantees the tightness of the process. 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.

Device type			Description
		1: Extension	Flexible conduit to protect extension cables against environmental pollutants and phenomena (such as abrasion, moisture, salt). Material: ▪ Polyamide ▪ Metal (for Atex version) ▪ 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 to guarantee tightness between the process and the external environment. For many media and different combinations of high temperatures and pressures. In the case of a flange, the process connection is welded on the flange (standard). Other versions available on request.
		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	For electrical connections between the inserts and junction box. ▪ Shielded PVC ▪ Shielded or unshielded FEP
		7: Ground terminal	For electric sensors grounding

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 measurement 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) according to DIN EN 50446. Quick and easy operation, visualization and maintenance using universal configuration software like FieldCare, DeviceCare or FieldCommunicator 375/475. For more information, see the Technical Information.

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

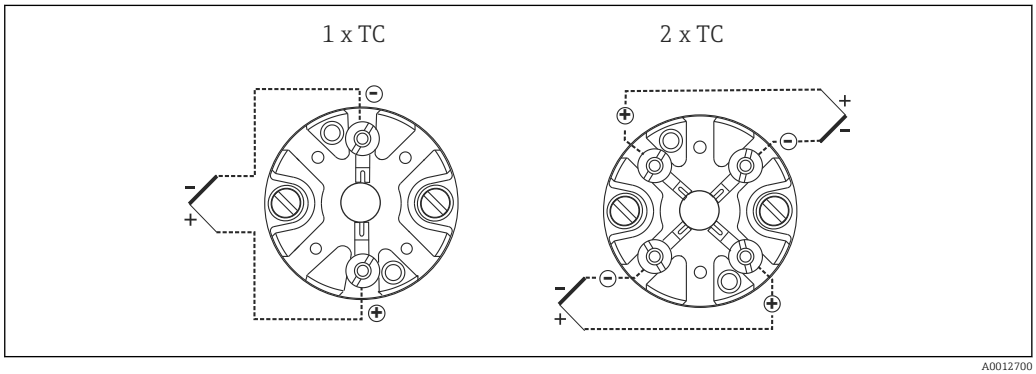
FOUNDATION Fieldbus head transmitter
Universally programmable head transmitter with FOUNDATION Fieldbus communication. Conversion of various input signals into digital output signals. High measurement accuracy over the complete ambient temperature range. All transmitters are approved for use in all the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

Advantages of the iTEMP transmitters:
- Double 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-channel transmitters, based on Callendar/Van Dusen coefficients

Power supply

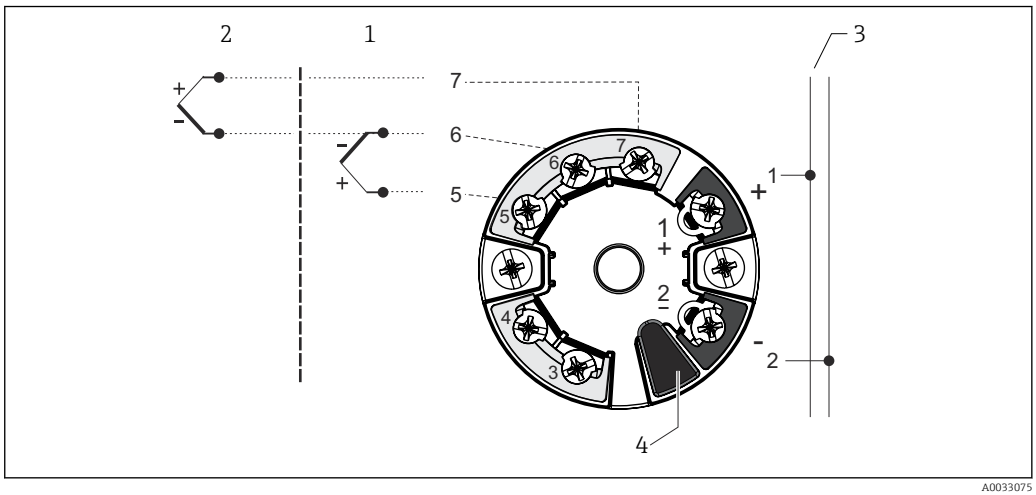
- Electrical connecting cables must be smooth, corrosion resistant, easy to be cleaned and inspected, robust against mechanical stresses, no-humidity sensitivity.
- Grounding or shielding connections are possible via ground terminals on the junction box.

Wiring diagrams



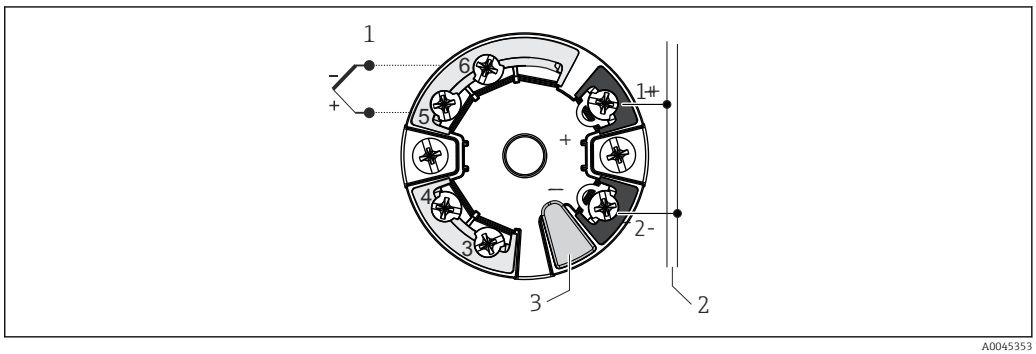
2 *Mounted terminal block*

Wiring diagrams for TC connection



3 *Wiring diagram of the double 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 the single input head transmitters (TMT7x)*

1 *Sensor input*
2 *Bus connection and supply voltage*
3 *Display connection and CDI interface*

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	Model	Standard tolerance	Special tolerance (on request)
ASTM E230/ MC.96.1	Deviation; the larger value applies in each case		
	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)

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

Standard	Model	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)

Thermocouples made of non-precious metals are generally supplied such that they meet the manufacturing tolerances for temperatures > −40 °C (−40 °F) as specified in the table. These materials are not usually suitable for temperatures < −40 °C (−40 °F). The tolerances for Class 3 cannot be observed. For this temperature range, a separate material selection is required. This cannot be processed using the standard product.

Response time

Response time for the sensor assembly without transmitter.

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. Measurement of the output values of the thermometer begins at the latest at the moment in which the thermometer is immersed in the bath. Recording continues until the thermometer has reached the temperature of the medium.

Tested thermowell diameter and length	Average response time at a temperature of 177 °C (350.6 °F)177 °C	
6 mm (0.24 in), 4520 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 multipoint reference 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 measuring elements of the multipoint inserts (DUT = device under test) with those of a more precise calibration standard using a defined and reproducible measurement method. The aim is to determine the deviation of the DUT measured values from the true value of the measured variable.

Two different methods are used for the inserts:
- Calibration at fixed points, 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 measurement uncertainty and transferable measurement results is not possible, Endress+Hauser offers an insert evaluation measurement service, if technically feasible.

Mounting procedure

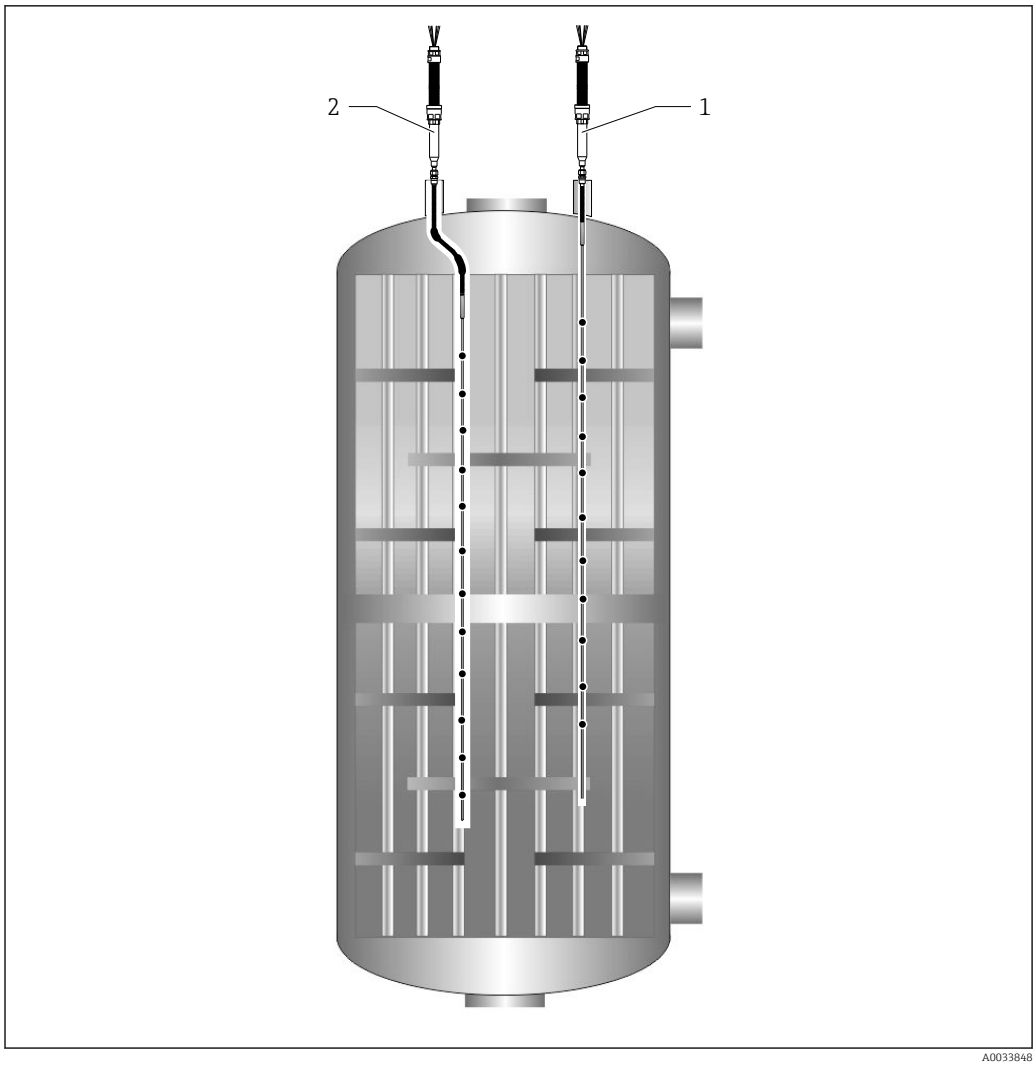
Installation point

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

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 offset routings, which do not correspond to the alignment of the longitudinal axis of the multipoint thermometer, 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 that 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: −40 to +95 °C (−40 to +203 °F)

Configuration with junction box, ordered as accessory:

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

Storage temperature

Configuration without junction box: −40 to +95 °C (−40 to +203 °F)

Configuration with junction box, ordered as accessory:

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

Humidity

Condensation according to IEC 60068-2-14:
- 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 transmitter used. For detailed information see the related Technical Information, listed at the end of this document.

Process

The process temperature and 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

T_{max} depending on thermocouple types

Diameter in mm (in)	Type N	Type K	Type J	Type E
1.5 (0.06)	920 °C (1688 °F)	920 °C (1688 °F)	440 °C (824 °F)	510 °C (950 °F)
1 (0.04)	700 °C (1292 °F)	700 °C (1292 °F)	260 °C (500 °F)	300 °C (572 °F)
0.5 (0.02)	700 °C (1292 °F)	700 °C (1292 °F)	260 °C (500 °F)	300 °C (572 °F)
0.8 (0.03)	700 °C (1292 °F)	700 °C (1292 °F)	260 °C (500 °F)	300 °C (572 °F)

Process pressure range

0 to 90 bar (0 to 1305 psi)

In any case, the maximum required pressure must be combined with 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

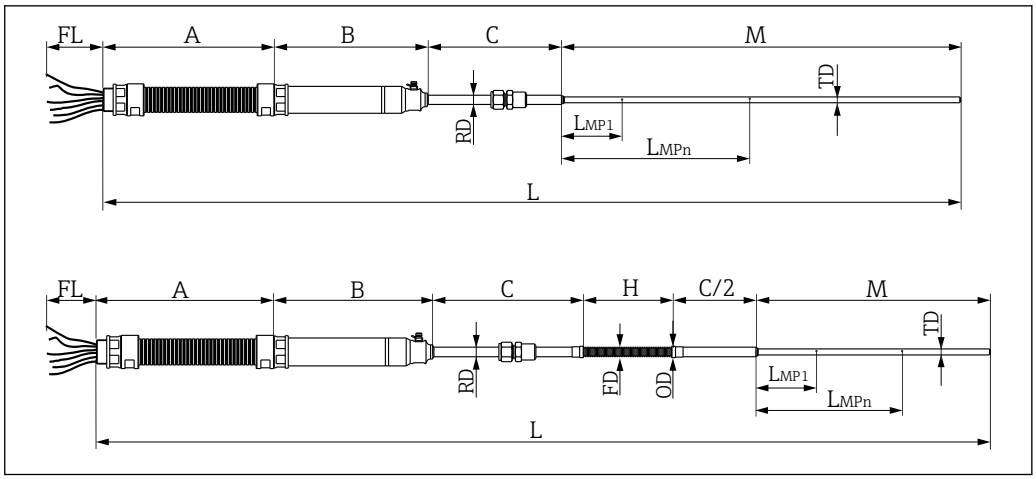
Higher pressures can be achieved according to the specific process requirements by selecting the correct flange, compression fittings and materials that are permanently consistent to the process temperature.

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, protected by a polymeric conduit 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 *Rigid and flexible design of the modular multipoint thermometer. All dimensions in mm (in)*

A Conduit cable length
B Main bushing length 190 mm (7.50 in)
C Reinforcing sleeve length, 200 mm (7.87 in)
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
OD Outer diameter

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

Reinforcing sleeve length C
200 mm (7.87 in) Specifically customized lengths are available on request.

Flexible part diameter FD
9.8 mm (0.39 in), 16.2 mm (0.64 in)

Outer diameter OD
14 mm (0.55 in), 21 mm (0.83 in)

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

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

Maximum circuits total length
For Ex-version, rigid design FL+L ≤ 50 m (164 ft) 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.

Thermowell			Sensor		
Diameter	**Available for Ex-version**	**Sheath material**	**Thermocouple type**	**Standard**	**Measuring point execution**
▪ 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)	Ex ia	316, 316L Inconel600 316Ti 321 347	1x type K 1x type J 1x type N 1x type E 2x type K 2x type J 2x type N 2x type E	IEC 60584 ASTM E230	Grounded Ungrounded

Rigid	Main bushing	316 + 316L
	Reinforced sleeve + thermowell	316 + 316L, 347, 321, Inconel600, 316Ti
Flexible	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 improved reliability, Endress+Hauser can offer duplicate measuring point sensors, in order to achieve a sensor backup. This is achieved either through duplicate thermocouples or through the coupling of two independent sensors (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 [1)]

		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 [2)]	59 [2)]
	0.8 (0.03)	3	15	12	24	30

		Thermowell OD in mm (in)				
		3.2 (0.13)	6 (0.24)	6.35 (0.25)	8 (0.31)	9.5 (0.37)
	1 (0.04)	2	10	8	18	22
	1.5 (0.06)	-	6	4	8	12

1) For Ex-version, the maximum number of sensors is limited to 20.
2) For this configuration the main bushing has 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 (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
Alloy600/ 2.4816	NiCr15Fe	1 100 °C (2 012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures ▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water ▪ Not to be used in sulfur-containing atmospheres
AISI 304/1.4301	X5CrNi18-10	850 °C (1 562 °F)	▪ Austenitic, stainless steel ▪ Can be used well in water and wastewater with low level of pollution ▪ Only at relatively low temperatures resistant to organic acids, saline solutions, sulphates, alkaline solutions, etc.
AISI 304L/ 1.4307	X2CrNi18-9	850 °C (1 562 °F)	▪ Good welding properties ▪ Impervious to intergranular corrosion ▪ High ductility, excellent drawing, forming, and spinning properties

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

Flange

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, DN80, DN100	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.

Operation

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

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

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

3. Select **Downloads**.

Ordering information

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

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

Product Configurator - the tool for individual product configuration

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

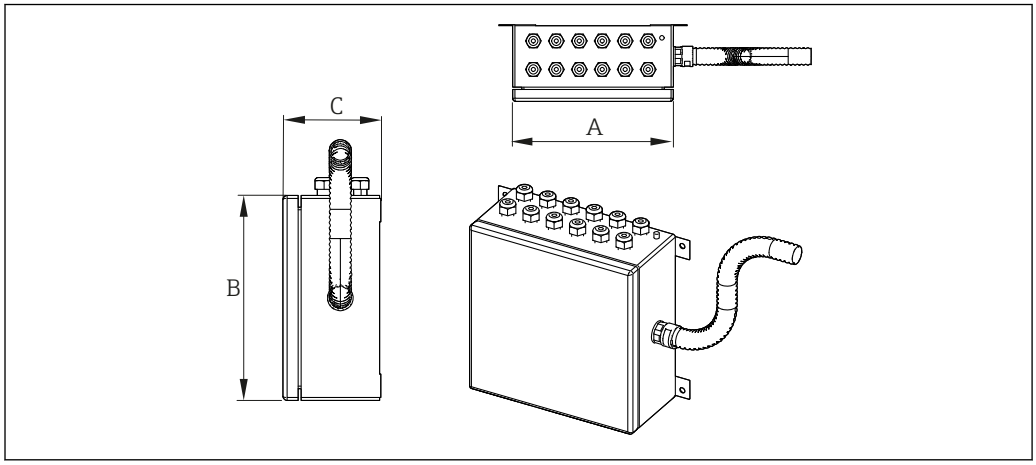
Accessories

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

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

Device-specific accessories

Accessories	Description
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 transmitter ▪ 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.	150 (5.9)	150 (5.9)	100 (3.9)
	Max.	500 (19.7)	500 (19.7)	160 (6.3)
Aluminum	Min.	305 (12)	280 (11)	238 (9.4)
	Max.	600 (23.6)	600 (23.6)	365 (14.4)

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	IECEx, ATEX, UL, CSA, NEPSI/ CCC, EAC Ex approval for use in hazardous area approval	-
Identification	ATEX II 2GD Ex e IIC T6/T5/T4 Gb/Ex ia IIC T6/T5/T4 Ga Ex tb IIIC T85°C/ T100°C/T135°C Db IP66 UL913 Class I, Zone 1, AEx e IIC; Zone 21, AEx tb IIIC IP66 CSA C22.2 No.157 Class I, Zone 1 Ex e IIC; Class II, Groups E, F and G IECEx Ex e IIC T6/T5/T4 Gb/Ex ia IIC T6/T5/T4 Ga Ex tb IIIC T85°C/T100°C/T135°C Db IP66 EAC 1 Ex e IIC T6/T5/T4 Gb X/1 Ex ia IIC T6/T5/T4 Gb X/ Ex tb IIIC T85°C/T100°C/ T135°C Db IP66	-
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 port. 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
Field Xpert SMT70	The tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance. For details, see "Technical Information" TI01342S
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

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

Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

Document function

The following documentation may be available depending on the version ordered:

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

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

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