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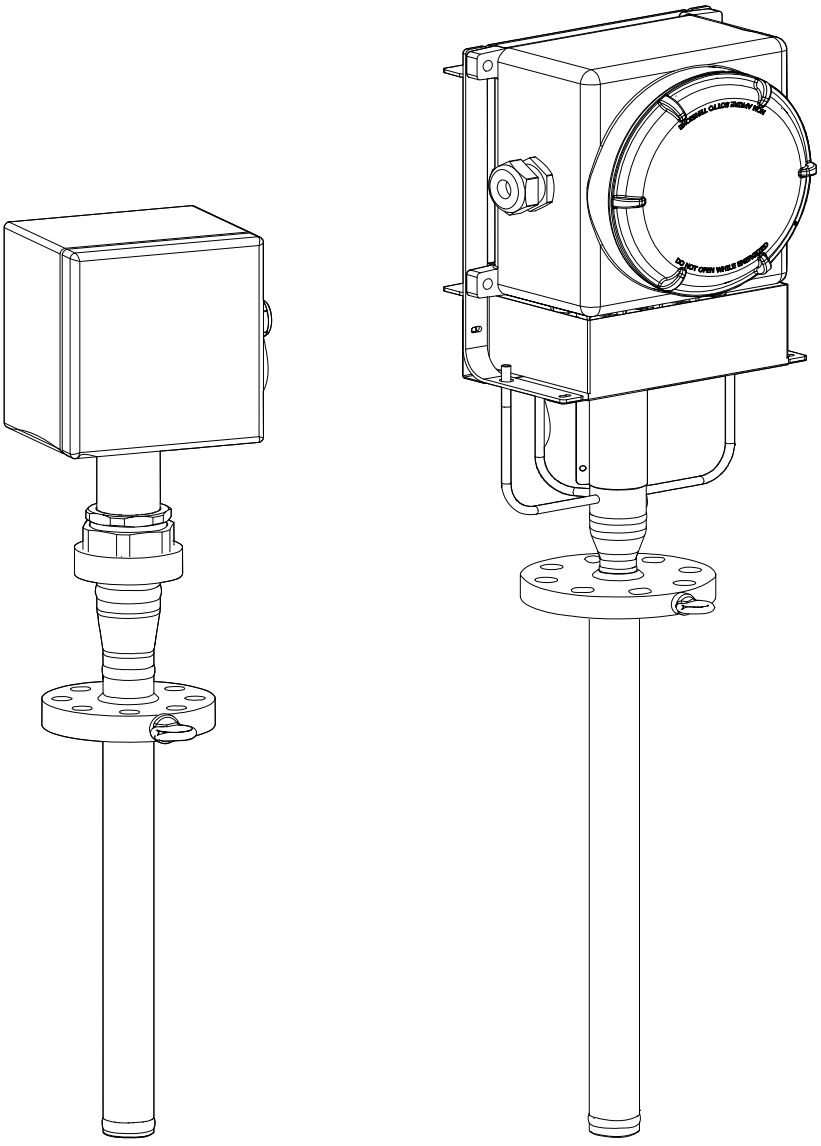
Operating Instructions
iTHERM TMS11
MultiSens Linear

Modular linear TC and RTD multipoint thermometer with primary thermowell



Endress+Hauser
People for Process Automation

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1 About this document

1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective earth (PE)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: protective earth is connected to the mains supply. ▪ Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers	1., 2., 3...	Series of steps
A, B, C, ...	Views	A-A, B-B, C-C, ...	Sections
EX	Hazardous area	EX	Safe area (non-hazardous area)

1.2.4 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.
	**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.
	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
▶	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.5 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.

1.2.6 Registered trademarks

FOUNDATION™ Fieldbus
Registration-pending trademark of the FieldComm Group, Austin, Texas, USA

HART®
Registered trademark of the FieldComm Group, Austin, Texas, USA

PROFIBUS®
PROFIBUS and the associated trademarks (The Association Trademark, the Technology Trademarks, the Certification Trademark and the Certified by PI Trademark) are registered trademarks of the PROFIBUS User Organization e.V. (Profibus User Organization), Karlsruhe - Germany

2 Basic safety instructions

Instructions and procedures in the Operating Instructions may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by safety pictograms and symbols. Please refer to the safety instructions before performing an operation preceded by pictograms and symbols. Although the information provided herein is believed to be accurate, be advised that the information contained herein is NOT a guarantee of satisfactory results. Specifically, this information is neither a warranty nor guarantee, expressed or implied, regarding performance. Please note that the manufacturer reserves the right to change and/or improve the product design and specifications without notice.

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

The product is intended to measure the temperature profile inside a reactor, vessel or pipe through thermocouple technology.

The manufacturer shall not be liable for harm caused by improper or non-designated use.

The product has been designed according to the following conditions:

Condition	Description
Internal pressure	The design of joints, threaded connections and sealing elements has been executed as a function of the maximum working pressure inside the reactor.
Operating temperature	The materials used were chosen according to the operating and design minimum and maximum temperatures. Thermal displacement has been taken into account to avoid intrinsic stresses and to ensure proper integration between the instrument and the plant. Specific care has to be taken when the instrument's thermowell is fixed to the plant internals.
Media	The choice of dimensions and, above all, material will minimize the following signs of wear: ▪ distributed and localized corrosion, ▪ erosion and abrasion, ▪ corrosion phenomena due to uncontrolled and unpredictable chemical reactions Specific process fluids analysis is necessary to properly ensure the maximum operating life of the device, through proper material selection.
Fatigue	Cyclic loads during operations are not foreseen.
Vibrations	The sensing elements can be subjected to vibrations, due to high immersion lengths from the constraint located in the process connections. This vibrations can be minimized by properly selecting the route of the thermowell into the plant, by fixing it on internals by means of accessories like clips and end tips. The extension neck has been designed for withstanding vibratory loads to preserve the junction box from cyclic loading, and to avoid the unscrewing of the threaded components.
Mechanical stress	The maximum stress on the measuring device multiplied by a safety factor is guaranteed to stay below the yielding stress of the material, for every working condition of the plant.
Ambient conditions	The junction box (with and without head transmitters), wires, cable glands and other fittings has been selected to work within the allowed ranges in terms of external temperature.

2.3 Workplace safety

When working on and with the device:
- ▶ Wear the required personal protective equipment as per national regulations.

2.4 Operational safety

Damage to the device!
- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for the interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!
- ▶ If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:
- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use only original spare parts and accessories.

2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. The manufacturer confirms this by affixing the CE mark to the device.

3 Product description

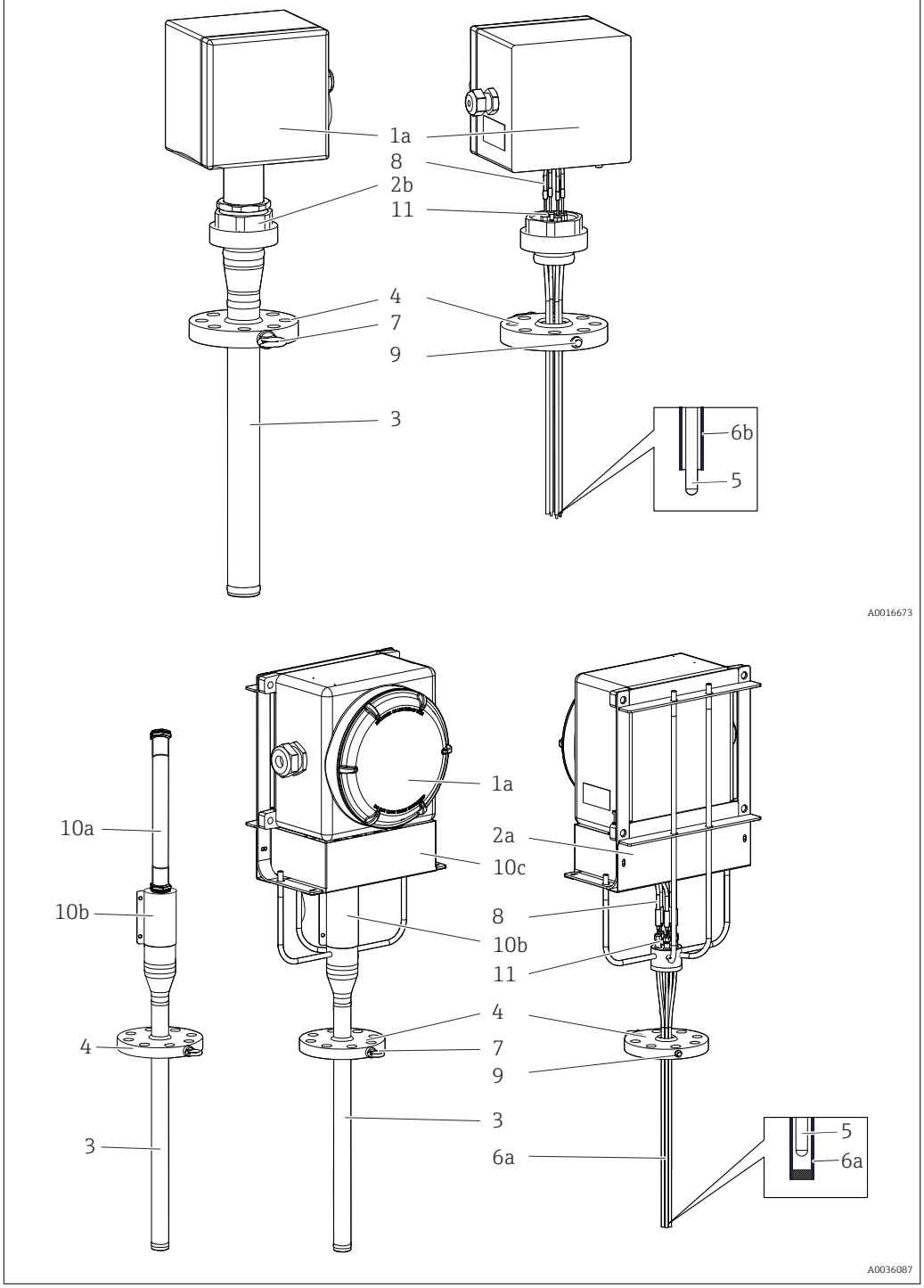
3.1 Device architecture

The multipoint thermometer is one of a series of modular products for multipoint temperature measurement. The design enables the individual use of subassemblies and components, making maintenance and spare parts management easy.

It consists of the following main sub-assemblies:
- **Insert:** Composed of individual metal sheathed measuring elements (thermocouples or RTD resistance sensors) protected by the primary thermowell welded to the process connection. In addition, individual conduits or themowells allow inserts to be replaced during operating conditions. In this case, the measuring inserts can be treated as individual spare parts and ordered using standard ordering structures (e.g. TSC310, TST310) or as special measuring inserts. 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 ring bolts 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.
- **Junction box support frame:** It is designed to support the junction box. Two different types are available:
  - Direct mounted support frame
  - Three-piece joint
- **Additional accessories:** Can be ordered for any configuration and is particularly recommended for a configuration with replaceable measuring inserts (such as pressure sensors, manifolds, valves and connectors).
- **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 ▪ Aluminum 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-piece joint	Support frame for intrinsically safe requirements. 316/316L
3: Primary thermowell	The primary thermowell consists of 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 runs through the process connection. At the top end, there is a compression fitting, which enables the replacement of the measuring insert (if 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→ 🖹 35. ▪ 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: Thermowells	There are thermowells with closed ends that ensure the sensors are held in the correct measuring position in the primary thermowell. The ends of these thermowells can be designed as follows: ▪ 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: Conduits	There are conduits with open ends that ensure the sensors are held in the correct measuring position in the primary thermowell. The ends of these conduits can be designed as follows: ▪ Bimetallic strips that press the sensor against the inner wall of the main thermowell. This contact results in a shorter response time. The inserts are not replaceable. ▪ Bent tip.
7: Ring bolt	Lifting device for easy handling during installation phase. SS 316
8: Extension cables	For electrical connections between the inserts and junction box. ▪ Shielded PVC ▪ Shielded FEP ▪ Unshielded PVC flying leads
9: Optional connection (Pressure Port threaded hole)	Auxiliary connections and fittings for pressure detection.

Description, available options and materials	
10: Safeguards 10a: Cable conduit (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 steel plate fixed to the junction box frame in order to protect the cable connections.
11: Compression fitting	High-performance sleeves to ensure tightness between the upper part of the thermowell and the outside environment. Ideal for a large range of media and rough conditions with high temperatures and pressures.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Proceed as follows on receipt of the device:

1. Check whether the packaging is intact.
2. If damage is discovered:
   Report all damage immediately to the manufacturer.
3. Do not install damaged components, as the manufacturer cannot otherwise guarantee the material resistance or compliance with the original safety requirements, and can also not be held responsible for the consequences that may result.
4. Compare the scope of delivery against the contents of your order.
5. Remove all the packaging material used for transportation.
6. Do the data on the nameplate match the ordering information on the delivery note?
7. Are the technical documentation and all other necessary documents provided, e.g. certificates?

If one of the conditions is not satisfied, contact your Sales Center.

4.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Enter the serial number from the nameplate in the *Device Viewer* (www.endress.com/deviceviewer): all the information about the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the device and the technical documentation pertaining to the device is displayed.

4.2.1 Nameplate

The right device?

The nameplate provides you with the following information on the device:
- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG)
- Technical values: supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols

▶ Compare the information on the nameplate with the order.

4.2.2 Name and address of manufacturer

Name of manufacturer:	Endress+Hauser Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang or www.endress.com

4.3 Storage and transport

Storage temperature: −40 to +85 °C (−40 to +185 °F)

Maximum relative humidity: < 95 % as per IEC 60068-2-30

Pack the device for storage and transportation in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

Avoid the following environmental influences during storage:
- direct sunlight
- proximity to hot objects
- mechanical vibration
- aggressive media

4.4 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**.

5 Mounting

5.1 Mounting requirements

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury

▶ Make sure only qualified personnel perform the installation.

⚠ WARNING

Explosions could result in death or serious injury

- Before connecting any additional electric and electronic device in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non incendive field wiring practices.
- Verify that the operating atmosphere of the transmitters is consistent with the appropriate hazardous locations certifications.
- All covers and threaded components must be fully engaged to meet explosion-proof requirements.

⚠ WARNING

Process leaks could result in death or serious injury

- Do not release screwed parts while in operation. Install and tighten the fittings before applying pressure.

NOTICE

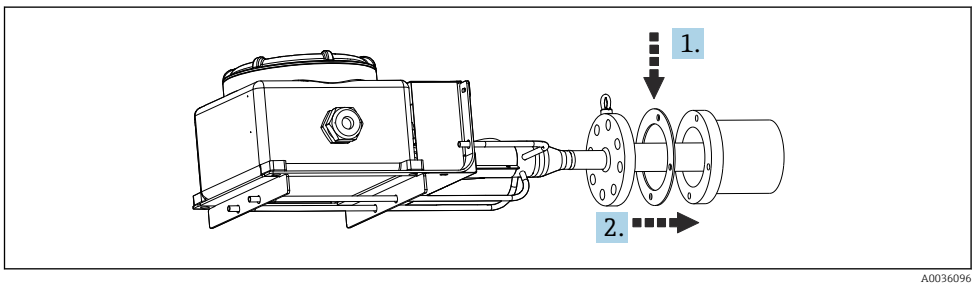
Additional loads and vibrations from other plant components can affect the operation of the sensor elements.

- Is it not allowed to apply additional loads or external moments to the system coming from the connection with another system not foreseen from installation plan.
- The system is not suitable for being installed in locations where vibrations are present. The deriving loads can undermine the sealing of the junctions and damage the operation of the sensing elements.
- It will be care of the final user to verify the installation of suitable devices in order to avoid the overcoming of the admitted limits.
- For the environment conditions please refer to the technical data → 34
- While installing the measurement system, avoid any friction, specifically avoid sparks generation.
- When the installation is performed by using existing vessel internal infrastructures, ensure that any applied external loads (i.e. to the tip of the primary thermowell) don't generate deformations and strains on the device and especially on welds.

5.2 Mounting the assembly

5.2.1 Mounting sequence

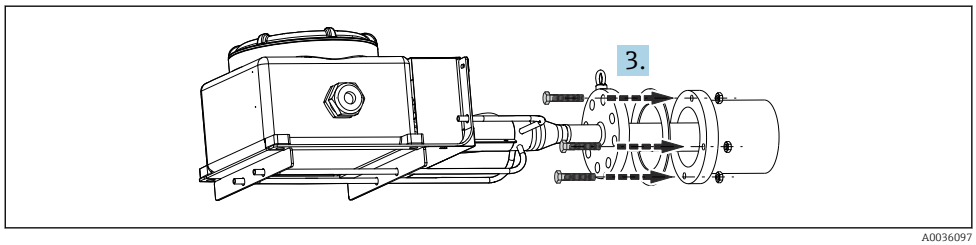
When installing the device, it is recommended to perform an internal inspection of the vessel. Check if there is any obstacle, with the aim of making an easy insertion. While installing the measurement system, avoid any friction during installation, specifically avoid sparks generation.

1. 

   Place the gasket between the flanged nozzle and the flange of the device (after checking the cleanliness of gasket seats on the flanges).

2. Bring the device to the nozzle, inserting the main thermowell through the nozzle avoiding deformation.

3.



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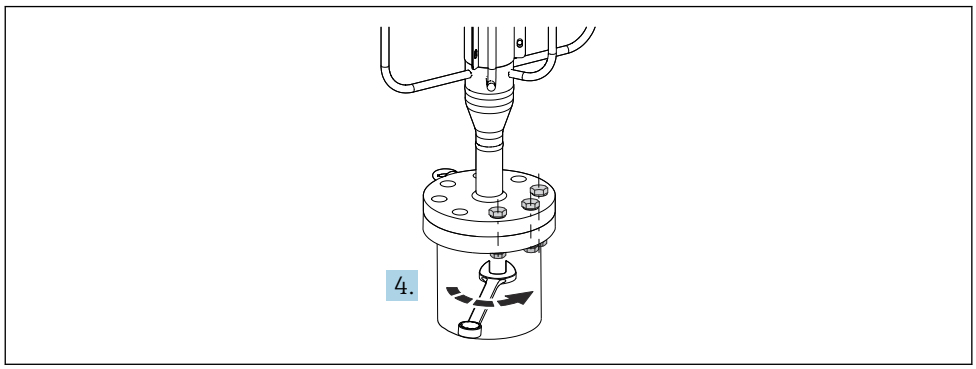
Start the bolts insertion through the flanges' holes and tighten them with the nuts by using a suitable wrench tool - but do not tighten them completely.

4.



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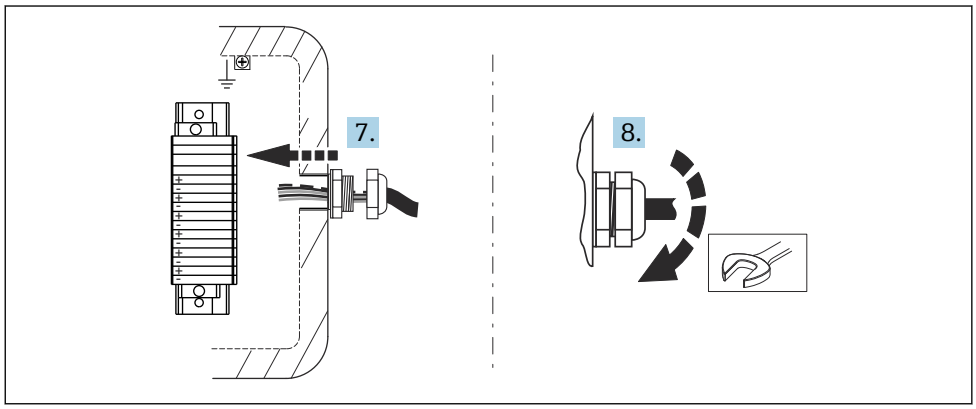
Complete the bolts insertion through the flanges' holes and tight them with the crossed method by means of an appropriate equipment (i.e. controlled tensioning according to the applicable standards).

5.



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1 *View from user side*

To wire the system, after having opened the cover of the junction box introduce the extension or compensating cables through the respective cable glands in the junction box.

6. Tighten the cable glands on the junction box.
7. Connect the cables to the terminals or temperature transmitters of the junction box following the wiring instruction provided, ensuring the right matching between the cable tag numbers and the terminals tag numbers.
8. Close the cover ensuring the right gasket position to avoid any impact on the IP degree of protection and set the draining valve in the right position (for humidity condensation control).

NOTICE

After the mounting, perform few simple checks on the installed thermometric system.

- ▶ Check the tightness of the threaded connections. If any part is loosened, tight it applying the proper torque.
- ▶ Check for correct wiring, test the electrical continuity of the thermocouples (warming up the thermocouple hot junction, when feasible) and then verify the absence of short circuits.

5.3 Post-mounting check

Before commissioning the measuring system make sure that all final checks have been carried out:

Device conditions and specifications	
Is the device undamaged (visual inspection)?	❑
Do the ambient conditions match the device specification? For example: ▪ Ambient temperature ▪ Proper conditions	❑
Are the threaded components undeformed?	❑
Are the gaskets not permanently deformed?	❑
Installation	
Is the equipment aligned with the nozzle axis?	❑
Are the gasket seats of flanges clean?	❑
Is the coupling between the flange and its counter flange reached?	❑
Is the primary thermowell undeformed?	❑
Are the bolts completely inserted in the flange? Make sure the flange is completely attached to the nozzle.	❑
Is the primary thermowell properly fixed to the internal infrastructures (when applicable)?	❑
Are the cable glands tightened on the extension cables?	❑
Are the extension cables connected to the junction box terminals?	❑
Are the extension cable protections (when ordered) properly assembled and closed?	❑

6 Wiring

CAUTION

Failure to observe this may result in the destruction of parts of the electronics.

- ▶ Switch off the power supply before installing or connecting the device.
- ▶ When installing devices in a hazardous area please take special note of the instructions and connection schematics in the respective Ex documentation added to these Operating Instructions. The local Endress+Hauser representative is available for assistance if required.

When wiring to a transmitter also observe the wiring instructions in the enclosed Brief Operating Instructions for the relevant transmitter.

For wiring the device proceed as follows:

1. Open the housing cover on the junction box.
2. Open the cable glands on the sides of the junction box.

3. Feed the cables through the opening in the cable glands.
4. Connect the cables as shown on
5. On completion of the wiring, screw the screw terminals tight. Tighten the cable glands again. Close the housing cover.
6. In order to avoid connection errors always take note of the hints given in the post connection check! → 18

6.1 Quick wiring guide

Terminal assignment

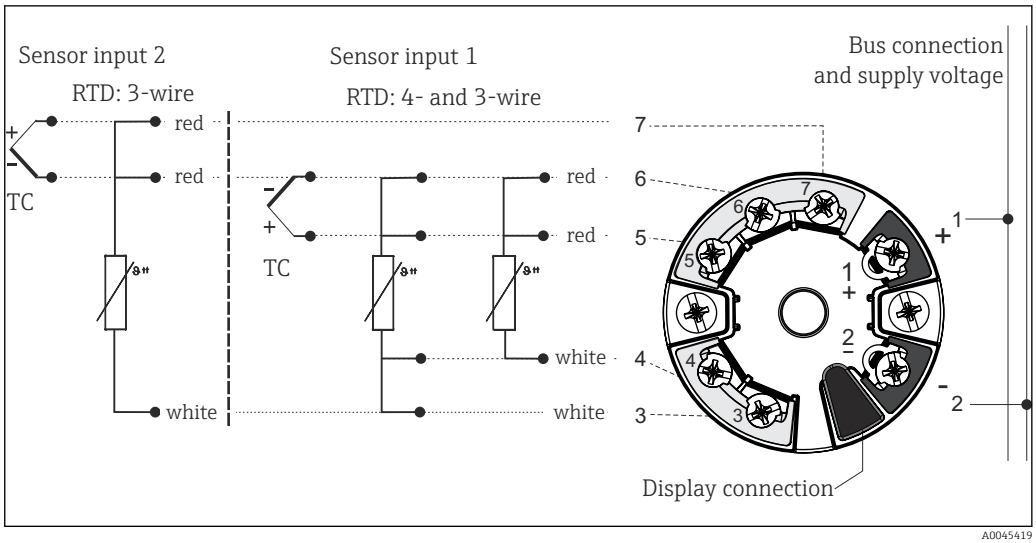
NOTICE

Destruction or malfunction of parts of the electronics through electrostatic discharge.

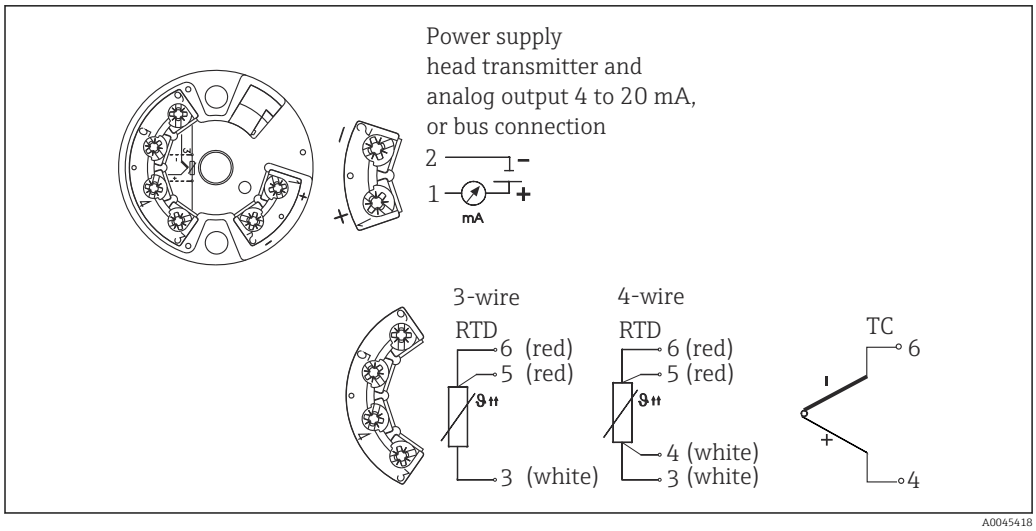
▶ Take measures to protect the terminals from electrostatic discharge.

To avoid incorrect measured values, an extension or compensation cable must be used for direct wiring of the thermocouple and the RTD sensors. The polarity indication on the respective terminal block and the wiring scheme must be observed.

The manufacturer of the device is not responsible for the planning or installation of the fieldbus connection cables. Therefore the manufacturer cannot be held liable for possible harm due to the choice of materials that are not suitable for the application or due to faulty installation.



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



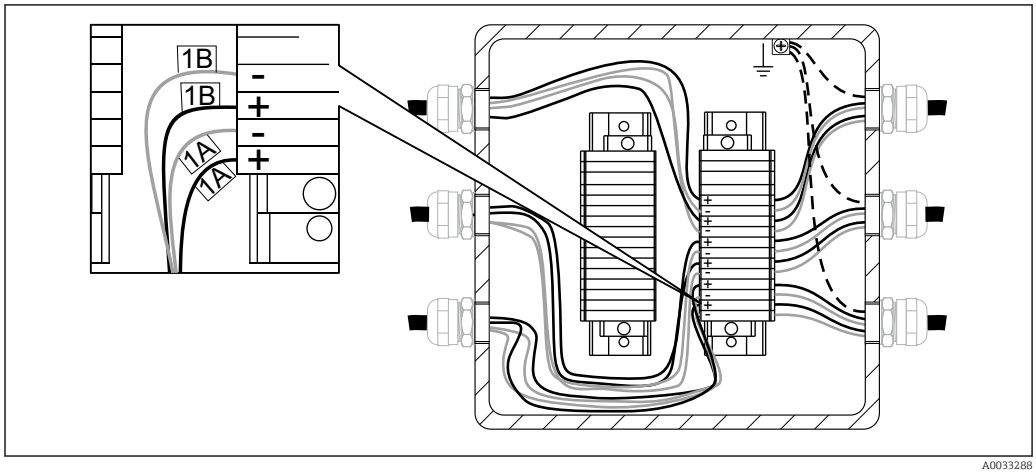
3 Wiring diagram of the single sensor input head transmitters (TMT18x)

Thermocouple cable colors

According to IEC 60584	According to ASTM E230
▪ Type J: Black (+), white (-) ▪ Type K: Green (+), white (-) ▪ Type N: Pink (+), white (-)	▪ Type J: White (+), red (-) ▪ Type K: Yellow (+), red (-) ▪ Type N: Orange (+), red (-)

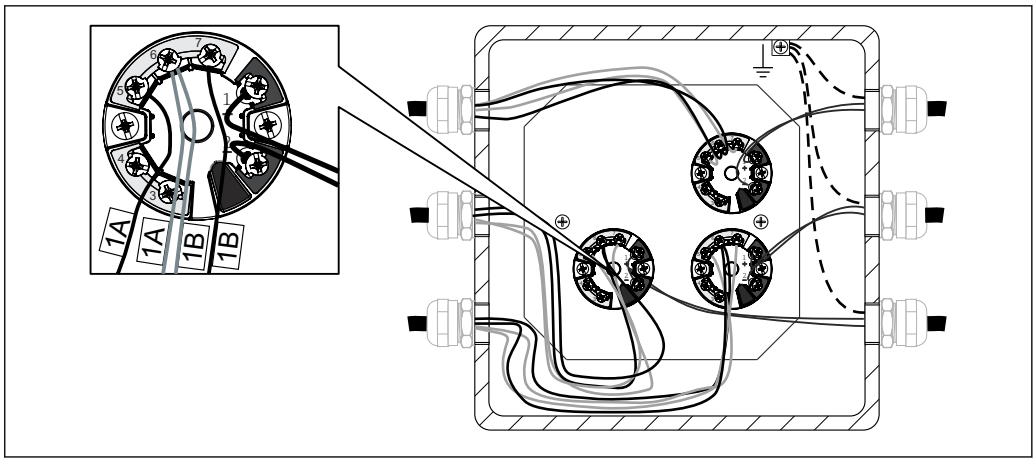
6.2 Connecting the sensor cables

Each sensor is marked with an individual TAG number. In the default configuration, all wires are always already connected to the installed transmitters or terminals.



4 Direct wiring on the mounted terminal block. Example for the internal sensor wires marking with 2 x TC sensors in insert no. 1.

The wiring is done in consecutive order. This means that the input channel(s) of transmitter no. 1 are connected to the insert wires starting from insert no. 1. Transmitter no. 2 is not used until all channels of transmitter no. 1 are fully connected. The wires of each insert are marked with consecutive numbers starting from 1. If double sensors are used the internal marking has a suffix to distinguish the two sensors, e.g. 1A and 1B for double sensors in the same insert or measuring point no. 1.



5 *Mounted and wired head transmitter. Example for the internal sensor wires marking with 2 x TC*

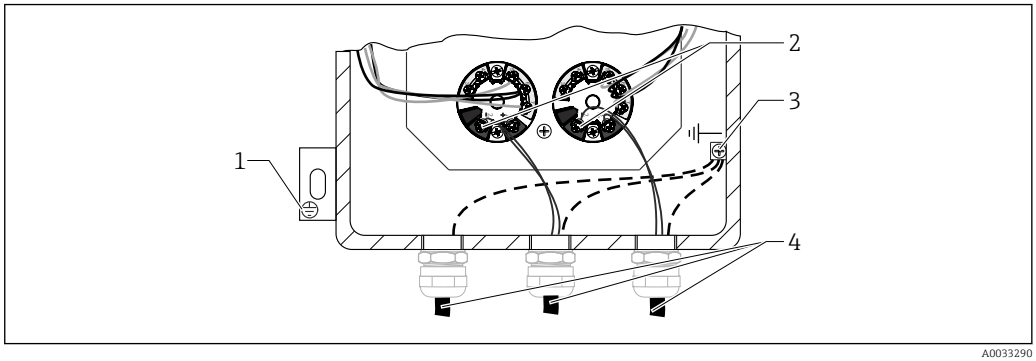
Sensor type	Transmitter type	Wiring rule
1 x RTD or TC	▪ Single input (one channel) ▪ Double input (two channel) ▪ Multi-channel input (8 channel)	▪ 1 head transmitter per insert ▪ 1 head transmitter for 2 inserts ▪ 1 multi-channel transmitter for 8 inserts
2 x RTD or TC	▪ Single input (one channel) ▪ Double input (two channel) ▪ Multi-channel input (8 channel)	▪ Not available, wiring excluded ▪ 1 head transmitter per insert ▪ 1 multi-channel transmitter for 4 inserts

6.3 Connecting the power supply and signal cables

Cable specification

- A shielded cable is recommended for fieldbus communication. Take the plant grounding concept into consideration.
- The terminals for connecting the signal cable (1+ and 2-) are protected against reverse polarity.
- Conductor cross-section:
  - Max 2.5 mm^2 (14 AWG) for screw terminals
  - Max 1.5 mm^2 (16 AWG) for spring terminals

Always observe the general procedure on → 14.



6 *Connecting the signal cable and power supply to the installed transmitter*

1 *External ground terminal*
2 *Terminals for signal cable and power supply*
3 *Internal ground terminal*
4 *Shielded signal cable, recommended for fieldbus connection*

6.4 Shielding and grounding

For any specific electrical shielding and grounding of the transmitter wiring, please refer to the appropriate Operating Instructions of the installed transmitter.

Where applicable, national installation regulations and guidelines must be observed during the installation! Where there are large differences in potential between the individual grounding points, only one point of the shielding is connected directly with the reference ground. In systems without potential equalization, therefore, cable shielding of fieldbus systems should only be grounded on one side, for example at the supply unit or at safety barriers.

NOTICE

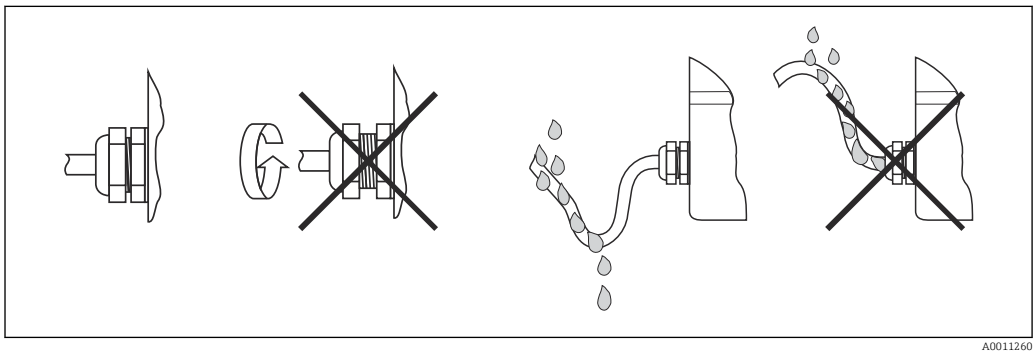
If the shielding of the cable is grounded at more than one point in systems without potential matching, power supply frequency equalizing currents can occur that damage the signal cable or have a serious effect on signal transmission.

- ▶ In such cases the shielding of the signal cable is to be grounded on only one side, i.e. it must not be connected to the ground terminal of the housing (terminal head, field housing). The shield that is not connected should be insulated!

6.5 Ensuring the degree of protection

The device fulfills degree of protection IP 66: In order to fulfill the degree of protection after installation or service, the following points must be taken into consideration:
→ 7, 18

- The housing seals must be clean and undamaged before they are replaced in the sealing rebate. If they are found to be too dry, they should be cleaned or even replaced.
- All housing screws and covers must be tightened.
- The cables used for connection must be of the correct specified outside diameter (e.g. M20 x 1.5, cable diameter from 0.315 to 0.47 in; 8 to 12 mm).
- Tighten the cable gland.
- Loop the cable or conduit before placing into the entry ("Water sack"). This means that any moisture that may form cannot enter the gland. Install the measuring device so that the cable or conduit entries are not facing upwards.
- Entries not used are to be blanked off using the blanking plates provided.
- The protective grommet must not be removed from the NPT fitting.



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7 *Connection hints to maintain IP protection*

6.6 Post-connection check

Is the device undamaged (internal equipment inspection)?	❑
Electrical connection	
Does the power supply match the specifications on the nameplate?	❑
Do the cables have adequate strain relief?	❑

Are the power supply and signal cables correctly connected? → 🖹 15	❑
Are all the screw terminals well tightened and have the connections of the spring terminals been checked?	❑
Are all cable glands installed, securely tightened and leak-tight?	❑
Are all housing covers installed and firmly tightened?	❑
Does the marking of the terminals and cables match?	❑
Is the electrical continuity of the thermocouple verified?	❑

7 Commissioning

7.1 Preliminaries

Set-up guidelines of Standard, Extended and Advanced Commissioning for Endress +Hauser instruments in order to guarantee the function of the instrument according to:
- Endress+Hauser operating manual
- Customer set up specification, and/or
- Application conditions, when applicable under process conditions

Both the operator and the person responsible for the process should be informed that a commissioning job will be carried out, observing the following actions:
- If applicable, before disconnecting any sensor that is attached to the process, determine what chemical or fluid is being measured (observe safety data sheet).
- Be aware of the temperature and pressure conditions.
- Never open a process fitting or loosen flange bolts before you have confirmed it is safe to do so.
- Be sure not to disturb the process when disconnecting inputs/outputs or when simulating signals.
- Ensure our tools, equipment and the customer process are protected from cross contamination. Consider and plan necessary cleaning steps.
- When commissioning requires chemicals (e.g. as reagents for standard operation or for cleaning purposes), always follow and observe the safety regulations.

7.1.1 Reference documents

- Endress+Hauser Standard Operating Procedure for Health and Safety (see documentation code: BP01039H)
- Operating Manual of relevant tools and equipment to perform the commissioning job.
- Relevant Endress+Hauser Service Documentation (operating manual, work instructions, service info, service manual, etc.).
- Calibration certificates of the quality relevant equipment if available.
- If applicable, safety data sheet.
- Customer specific documents (safety instructions, setup points, etc.).

7.1.2 Tools and equipment

Multimeter and instrument related configuration tools as necessary from the above mentioned action list.

7.2 Function check

Before commissioning the device make sure that all final checks have been carried out
- "Post-mounting check" checklist
- "Post-connection check" checklist

The commissioning should be performed according to our commissioning segmentation (Standard, Extended and Advanced).

7.2.1 Standard commissioning

Visual inspection of device

1. Check the instrument(s) for damage which may have been caused during transport/ shipping or mounting/wiring
2. Check that the installation is done according to the operating manual
3. Check that the wiring is done according to the operating manual and the local regulations (e.g. grounding)
4. Check the dust/water tightness of the instrument(s)
5. Check safety precautions (e.g.. radiometric measurements)
6. Power up the instrument(s)
7. Check the alarm list if applicable

Environmental conditions

1. Check that the environmental conditions are appropriate for the instrument(s): Ambient temperature, humidity (ingress protection IPxx), vibrations, hazardous areas (Ex, Dust-Ex), RFI/EMC, sun protection, etc.
2. Check access to the instrument(s) for utilization and maintenance

Configuration parameters

- ▶ Configure the instrument(s) according to the Operating Manual with the parameters specified by the customer or mentioned on the design specification

Output signal value check

- ▶ Check and confirm that the local display and the output signals of the instrument(s) conform with the customer's display

7.2.2 Extended commissioning

In addition to the steps of Standard Commissioning, the following should be additionally completed:

Instrument Conformity

1. Check the received instrument(s) with the purchase order or design specification including accessories, documentation and certificates
2. Check Software Version (e.g. application software such as "Batching") when provided
3. Check that the documentation has the correct issue and version

Functional test

1. Test of the instrument outputs, including switching points, auxiliary inputs/outputs with the internal or an external simulator (e.g. FieldCheck)
2. Compare the measuring data/results with a reference from the customer. (e.g. laboratory result in case of an analyzer, weight scale in the case of a batching application, etc.)

3. Adjust the instrument(s) if necessary and as described in the operating manual

7.2.3 Advanced commissioning

The Advanced Commissioning provides a loop test in addition to the steps covered in the Standard and Extended Commissioning.

Loop test

1. Simulate a minimum of 3 output signals from the instrument(s) to the control room
2. Read out/note the simulated and indicated values and check for linearity

7.3 Switching on the device

Once the final checks have been successfully completed, it is time to switch on the supply voltage. Afterwards the multipoint thermometer is operational. If there are Endress +Hauser temperature transmitter in use, please refer to the enclosed Brief Operating Instructions for commissioning.

8 Diagnostics and troubleshooting

8.1 General troubleshooting

For electronic, always start troubleshooting with the checklists available in the related operating manuals. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

For the complete temperature device, please refer to the following instruction.

NOTICE

Repair of parts of the device

- In the event of a serious fault, a measuring device might have to be replaced. In the case of replacement see section 'Return' → 27.

Before commissioning the measuring system make sure that all final checks have been carried out:

- Follow the checklist in section 'Post-mounting check'→ 14
- Follow the checklist in section 'Post-connection check'

If transmitters are used, please refer to the documentation of the transmitter installed for diagnostic and troubleshooting procedures.

9 Maintenance and repair

9.1 General information

Accessibility around the device for maintenance must be guaranteed. Each component that is part of the device must – in the case of replacement – be replaced by an original Endress+Hauser spare part that guarantees the same characteristics and performance. To ensure continued operational safety and reliability, repairs should only be carried out on the device if they are expressly permitted by Endress+Hauser, in compliance with federal/ national regulations pertaining to repair of an electrical device.

9.2 Spare parts

Product spare parts that are currently available can be found online at:
http://www.products.endress.com/spareparts_consumables.:

If ordering spare parts, please specify the serial number of the device!

Spare parts of the multipoint thermometer assembly are:

- Complete junction box
- Temperature inserts (when applicable)
- Temperature transmitter
- Electrical connection
- DIN rail
- Plate for electric terminals
- Cable gland
- Sealing sleeve for cable gland
- Adapter for cable gland
- Junction box support system

The additional following accessories can be selected independently from the product configuration:

- Pressure transmitter
- Pressure manometer
- Assembly
- Manifolds
- Valves

In case of a design with replaceable inserts, the following steps must be followed.

NOTICE

- ▶ Before replacing a sensor, it must be ensured that there is no longer any pressure in the primary thermowell. This is checked by means of the pressure value shown on the pressure-maintaining equipment (manometer or pressure transmitter) connected to the pressure port.

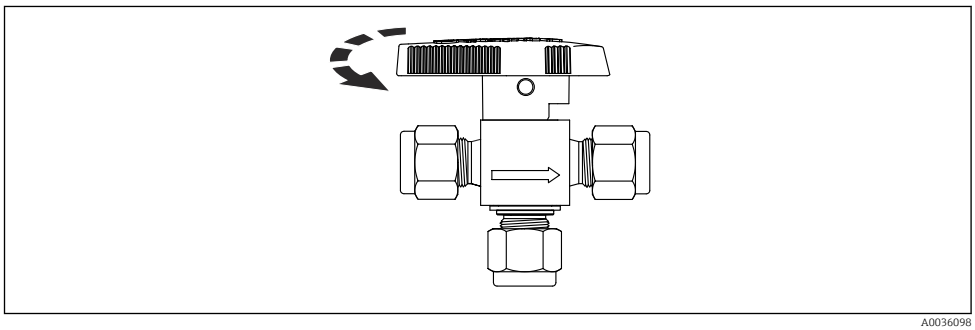
In case of pressurized conditions, if only a manometer/pressure transmitter is installed, no replacement of sensors is permitted.

NOTICE

- ▶ Please note: If there is no pressure port, direct maintenance work on the sensors is not permitted. Only work that is limited to the components of the junction box (cable glands, transmitters, connection terminals, etc.) is permitted.

When a manometer/pressure transmitter is mounted in combination with manifolds or multi-way valves, then sensors can be replaced even during operating conditions, once the safety actions listed below have been taken:

1.



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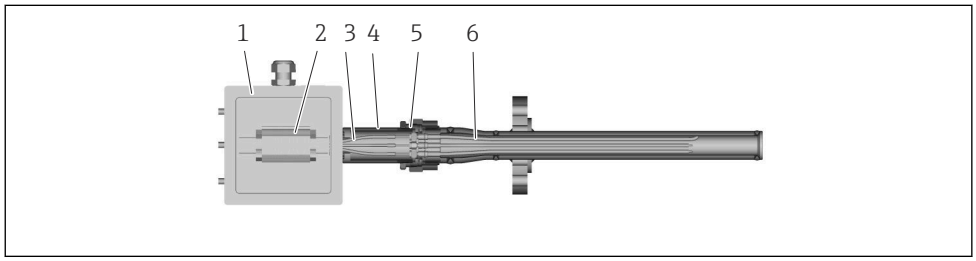
Switch the multi-way valve to drain position (when possible keeping pressure indicator active).

2. Safely drain the fluids to a blowdown line or by applying procedures in compliance with the local safety regulations.
3. Make sure that all the gage pressure is released.
4. Switch the multi-way valve back to the original position for pressure detection.
5. Monitor the pressure indicator for a reasonable period of time (depending on the specific process conditions). Only when the pressure is not rising again significantly (between 20–30 minutes), start with the following operations:

Case 1: Design with three-piece gland (Intrinsically safe design)

1. 

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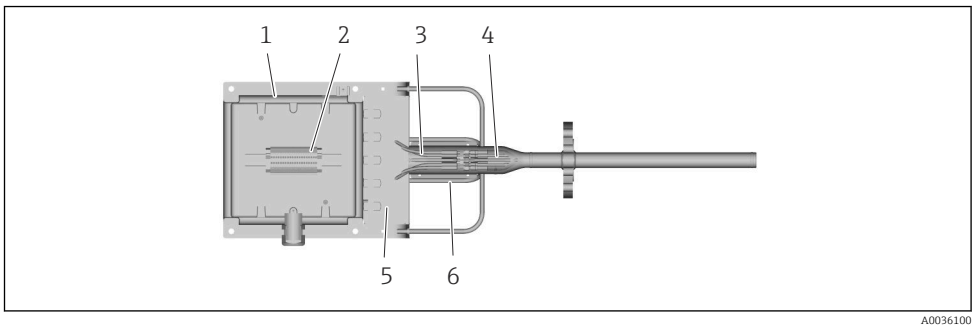
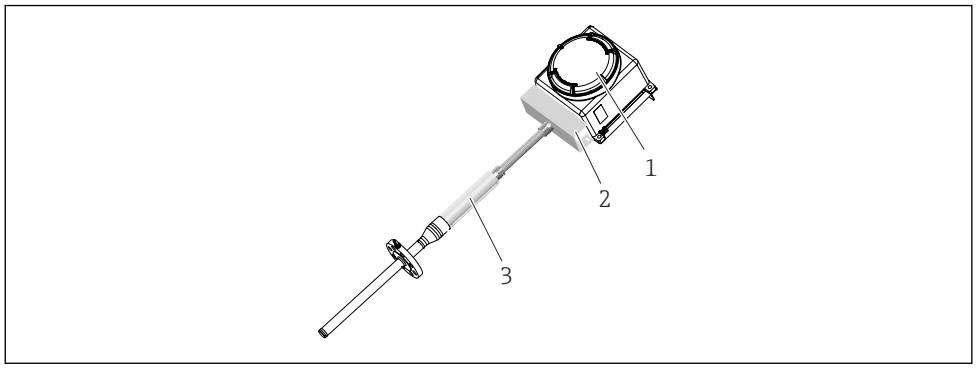
   Open the cover of the junction box (1).
2. Disconnect the sensor wires (3) of all measuring inserts (6) from the terminal block (2) or transmitter inside the junction box (process side).
3. Completely unscrew the hexagonal nut of the three-piece joint (5).
4. Remove the junction box with its adapter (4) so that all extension cables and compression fittings of the sensor are accessible.
5. Unscrew the compression fitting nuts.
6. Slowly and carefully pull the measurement inserts all the way out. Ensure that the thread and sealing seats of the compression fittings are not damaged.
7. Please note that the metal ferrule of the unscrewed compression fitting must be replaced during each such operation. A new set of metal ferrules is required in order to achieve the same specifications as the replaced part.
8. Guide a new measuring insert through the compression fitting starting with the tip. The length and specifications of the new measuring insert (by Endress+Hauser) must meet the specifications of the replaced part.
9. Tighten the nut of the compression fitting in accordance with the manufacturer's instructions.
10. If necessary clean the components of the three-piece joint, taking care to avoid any damages on its surface.
11. Return the junction box to its original position and with the same orientation. Ensure that the bundle of extension cables is fully inserted in the junction box.
12. Screw on and tighten the hexagonal nut of the gland.
13. Properly connect all cables of the measuring insert to the corresponding terminal block or transmitter inside the junction box, according to the wiring scheme.
14. Close the housing cover.

Case 2: Design with direct mounted support frame (Explosion-proof design)

1. 

   Open the cover of the junction box (1).
2. Disconnect the sensor wires (3) of the measuring insert (4) to be replaced (or the complete set in case of complete maintenance) from the terminal block (2) or transmitter inside the junction box (process side).
3. Remove the cable gland protection plate (5).
4. Remove the extension cables cover (6).
5. Loosen the cable gland sealing nut of the desired insert (or all inserts) and pull the extension cables out of the junction box.
6. Unscrew the compression fitting nuts.
7. Slowly and carefully pull the sensor(s) fully off. Ensure that the thread and sealing seats of the compression fittings are not damaged.
8. Please note that the metal ferrule of the unscrewed compression fitting must be replaced during each such operation. A new set of metal ferrules is required in order to achieve the same specifications as the replaced part.
9. Guide a new measuring insert through the compression fitting starting with the tip. The length and specifications of the new measuring insert (by Endress+Hauser) must meet the specifications of the replaced part.
10. Insert the extension cables of the new sensor into the cable gland.
11. Tighten the nut of the compression fitting in accordance with the manufacturer's instructions.
12. Tighten the cable gland sealing nut.
13. Properly connect all cables of the measuring insert to the corresponding terminal block or transmitter inside the junction box, according to the wiring scheme.
14. Remount the cable gland protection plate and the extension cables cover.
15. Close the housing cover.

Case 3: Design with remote junction box and protective conduit (Explosion-proof design)

1. 

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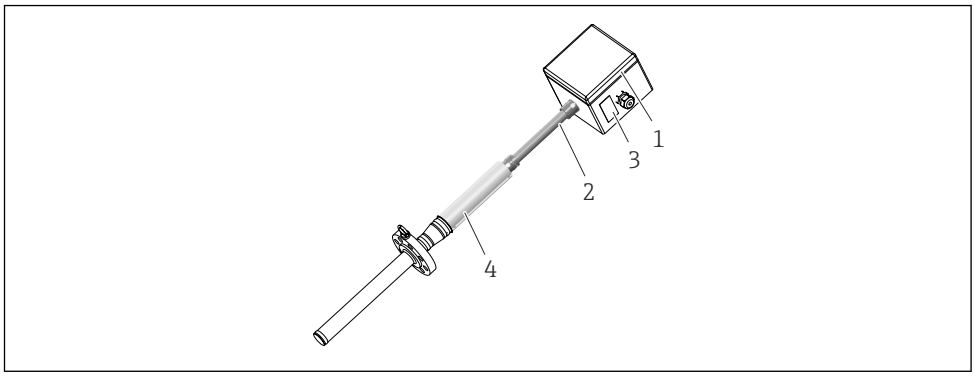
   Open the cover of the junction box (1).
2. Disconnect the sensor cables of all the measuring inserts to be replaced from the terminal blocks or transmitters inside the junction box (process side).
3. Remove the extension cables cover (2) from the junction box.
4. Open the cable conduit cover (3).
5. Loosen the cable gland sealing nuts of all the inserts and remove the extension cables from the junction box.
6. Pull out the complete bundle of extension cables.
7. Completely remove the cable conduit covers.
8. Unscrew the compression fitting nuts.
9. Slowly and carefully pull the sensor(s) fully off. Ensure that the thread and sealing seats of the compression fittings are not damaged.
10. Please note that the metal ferrule of the unscrewed compression fitting must be replaced during each such operation. A new set of metal ferrules is required in order to achieve the same specifications as the replaced part.
11. Slide the new bundle of extension cables into the conduit.
12. Guide all new measuring inserts through the compression fittings starting with the tips. The length and specifications of each new measuring insert (by Endress +Hauser) must meet the specifications of the replaced part.
13. Insert the different extension cables of the new sensors inside their cable glands.
14. Tighten the nut of the compression fitting in accordance with the manufacturer's instructions.
15. Tighten the cable gland sealing nut.
16. Properly connect all cables of the measuring insert to the corresponding terminal block or transmitter inside the junction box, according to the wiring scheme.
17. Remount the extension cable cover and the cable conduit covers.
18. Close the housing cover.

Case 4: Design with remote junction box and protective conduit (Intrinsically safe design)

1. 

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   Open the cover of the junction box (1).
2. Disconnect the sensor cables of all the measuring inserts to be replaced from the terminal blocks or transmitters inside the junction box (process side).
3. Remove the cable conduit (2) from the junction box (3).
4. Open the extension cables cover (4).
5. Pull out the complete bundle of extension cables.
6. Completely remove the extension cable covers (4).
7. Unscrew the compression fitting nuts.
8. Slowly and carefully pull the sensor(s) fully off. Ensure that the thread and sealing seats of the compression fittings are not damaged.
9. Please note that the metal ferrule of the unscrewed compression fitting must be replaced during each such operation. A new set of metal ferrules is required in order to achieve the same specifications as the replaced part.
10. Slide the new bundle of extension cables into the conduit.
11. Guide all new measuring inserts through the compression fittings starting with the tips. The length and specifications of each new measuring insert (by Endress +Hauser) must meet the specifications of the replaced part.
12. Tighten the nut of the compression fitting in accordance with the manufacturer's instructions.
13. Tighten the cable conduit (2) to the junction box.
14. Properly connect all cables of the measuring insert to the corresponding terminal block or transmitter inside the junction box, according to the wiring scheme.
15. Remount the extension cables covers (4).
16. Close the housing cover.

9.3 Endress+Hauser services

Service	Description
Certificates	Endress+Hauser is able to fulfill requirements regarding the design, product manufacturing, verification and commissioning according to specific approvals by handling or suppling individual certified components and by checking the integration on the whole system.
Maintenance	All Endress+Hauser systems are designed for easy maintenance thanks to a modular design that permits the replacement of old or worn parts. Standardized parts ensure fast maintenance.

Service	Description
Calibration	Endress+Hauser's range of calibration services covers on-site verification tests, accredited laboratory calibrations, certificates and traceability to ensure compliance.
Mounting procedure	Endress+Hauser helps you commission plants while minimizing costs. Fault free installation is decisive for the quality and longevity of the measurement system and plant running. We provide the right expertise at the right time to meet project deliverables.
Tests	In order to ensure product quality and to guarantee efficiency during the entire lifetime the following tests are available: ▪ Dye penetrant test according to ASME V Art. 6, UNI EN 571-1 and ASME VIII Div. 1 App 8 Standards ▪ PMI test according to ASTM E 572 ▪ HE test according to EN 13185 / EN 1779 ▪ X-ray test according to ASME V Art. 2, Art. 22 and ISO 17363-1 (requirements and methods) and ASME VIII Div. 1 and ISO 5817 (acceptance criteria). Thickness up to 30 mm ▪ Hydrostatic test according to Pressure Equipment Directive, EN 13445-5 and harmonized ▪ Ultrasonic test available by qualified external partners, according to ASME V Art. 4.

9.4 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the web page for information:
   https://www.endress.com/support/return-material
   ↳ Select the region.
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

9.5 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

9.5.1 Removing the measuring device

1. Switch off the device.

⚠ WARNING

Danger to persons from process conditions!

2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

9.5.2 Disposing of the measuring device

Observe the following notes during disposal:
- ▶ Observe valid federal/national regulations.
- ▶ Ensure proper separation and reuse of the device components.

9.5.3 Battery disposal

Dispose of batteries according to local regulations. Recycle used batteries wherever possible.

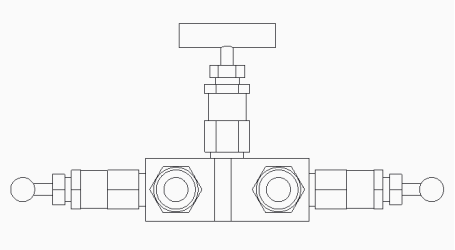
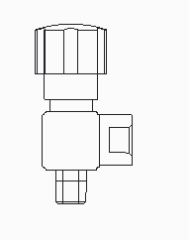
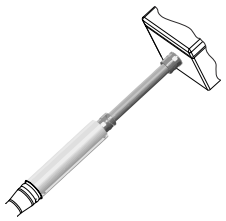
10 Accessories

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**.

10.1 Device-specific accessories

Accessories	Description
Tags	Nameplate can be applied to identify each measuring point and the whole thermometer. 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 analog pressure transmitter with welded metallic measuring cell for measurement in gases, steam or liquids. See Endress+Hauser PMP sensors range

Accessories	Description
  A0034865 Fittings / manifolds / valves	Fittings, manifolds and valves are available for installing the pressure transmitter on the pressure port connection, and so allow the continuous monitoring of the device under the operating conditions.
 A0036534 Remote cable conduit system	Consists of a polyamide cable conduit to connect the top end of the thermowell with the detached junction box, which already has a molded stainless steel cover. This is secured to the frame of the junction box, to protect the cable connections.

10.2 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
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

10.3 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

11 Technical data

11.1 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	

11.2 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.

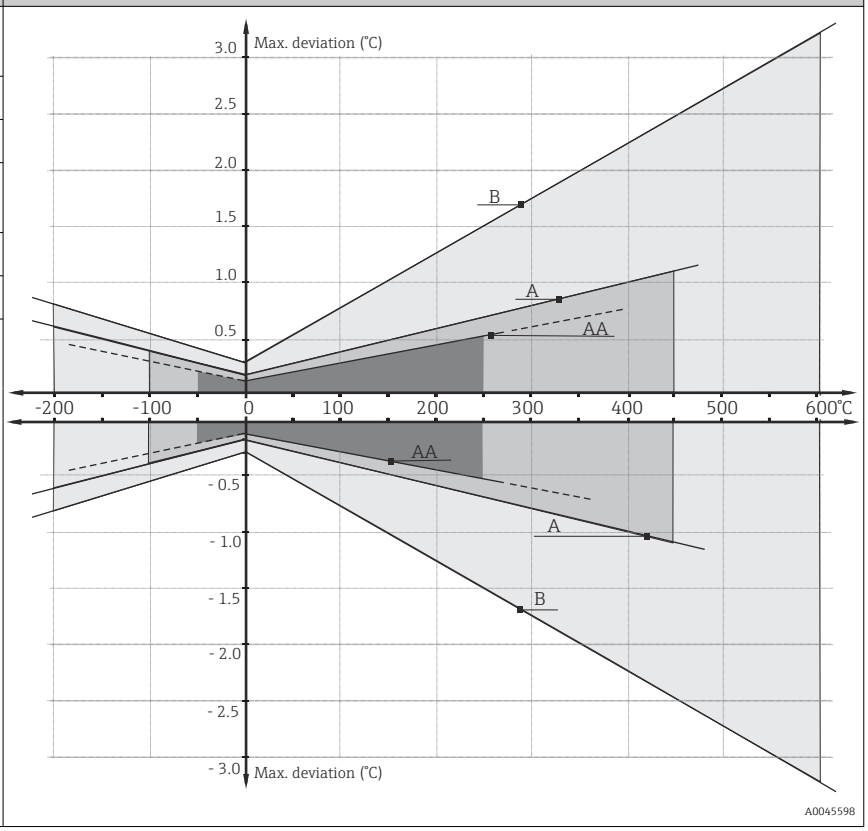
PROFIBUS PA head transmitter
Universally programmable head transmitter with PROFIBUS PA communication. Conversion of various input signals into digital output signals. High measurement accuracy over the complete ambient temperature range. PROFIBUS PA functions and device-specific parameters are configured 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

11.3 Performance characteristics

Accuracy — RTD resistance thermometer corresponding to IEC 60751

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

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

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

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

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

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

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

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

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

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

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 conduit 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 conduit design	t_{90}	52 s

Shock and vibration resistance

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

Calibration

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

If calibration is to be performed after the multipoint thermometer is installed, please contact the Endress+Hauser service to get full support. Together with the Endress +Hauser service, any further measures can be organized to achieve the calibration of the planned sensor. In any case it is forbidden to unscrew any threaded components at the process connection under operating conditions (running process), without knowing the pressure inside the primary thermowell.

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.

11.4 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

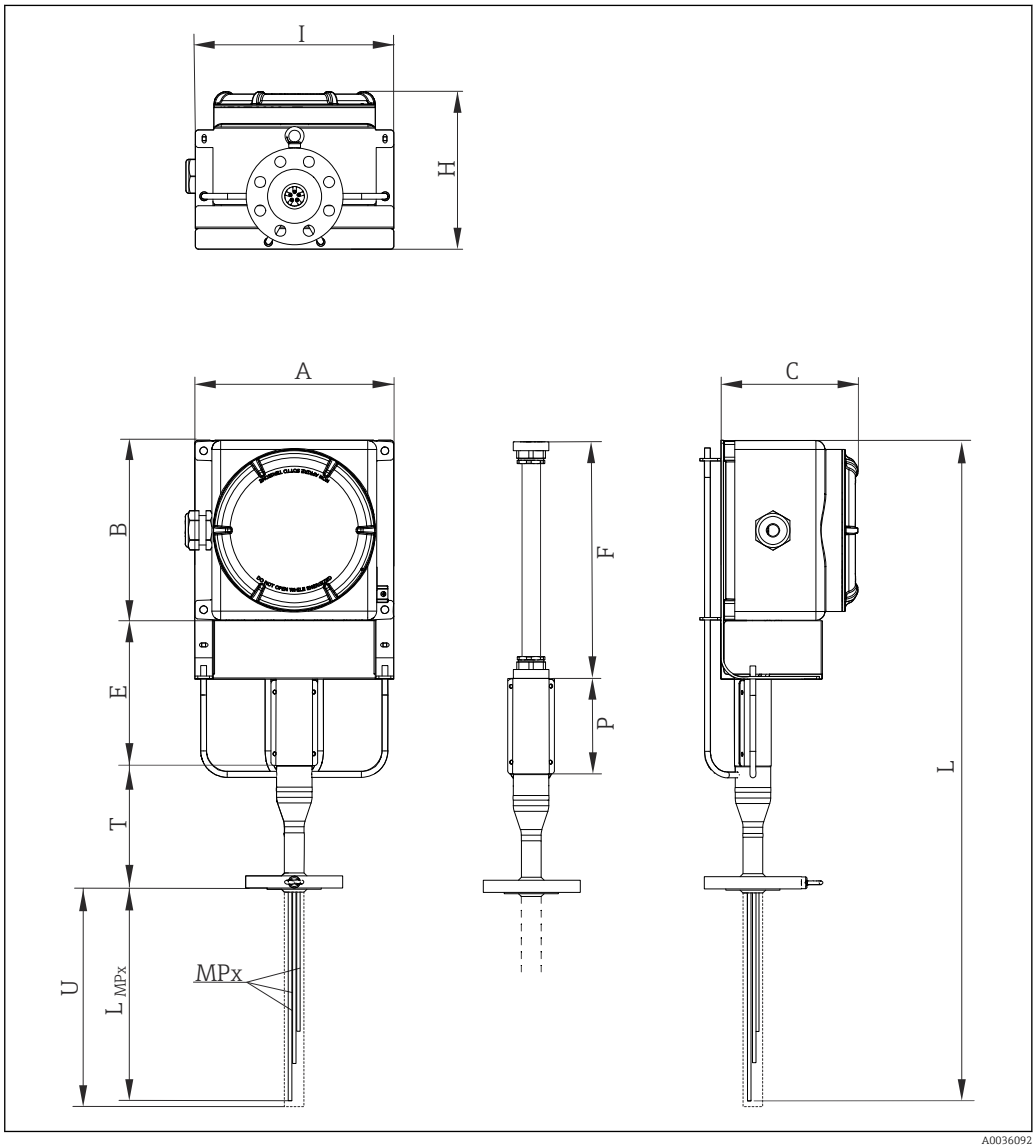
Electromagnetic compatibility (EMC)

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

11.5 Mechanical construction

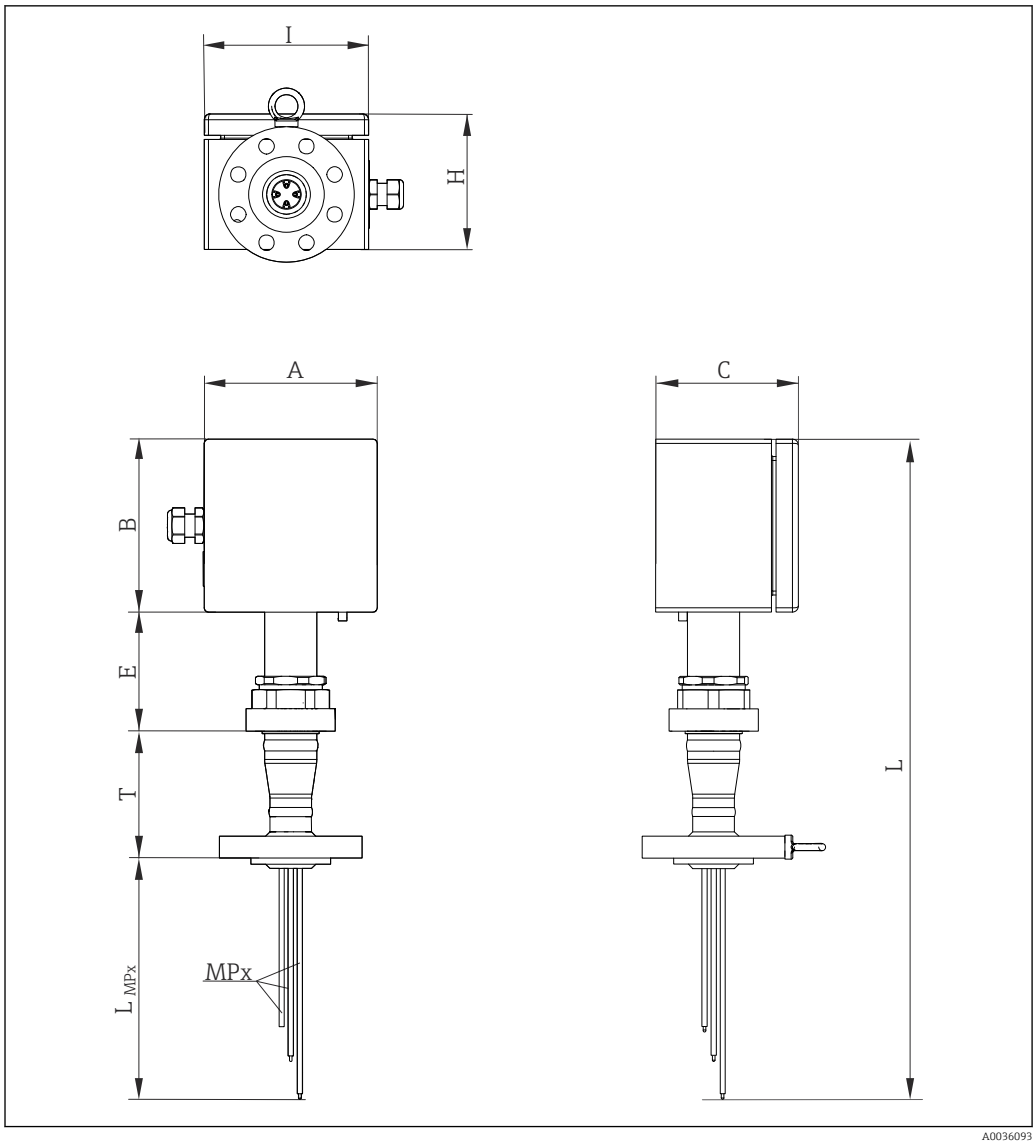
Design, dimensions

The multipoint thermometer 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 performance 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 of protection.



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

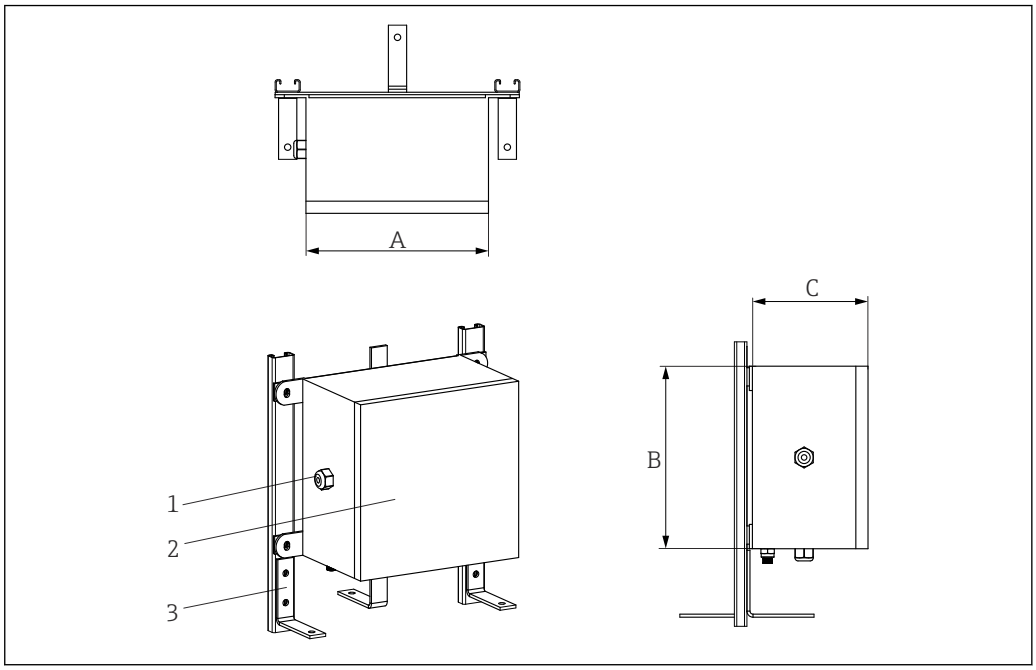
A, B, Dimensions of the junction box, see following figure
C
MPx Quantity and distribution of measuring points: MP1, MP2, MP3 etc.
L_{MPx} Immersion length of measuring elements or thermowells
I, H Frame of the junction box and support system
E Extension length
L Device length
T Lag length
U Immersion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



9 *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 Quantity and distribution of measuring points: MP1, MP2, MP3 etc.
L_{MPx} Immersion length of measuring elements or thermowells
I, H Frame of the junction box and support system
E Extension length
L Device length
T Lag length
U Immersion length

Junction box



1 Cable glands
2 Junction box
3 Frame

The junction box is suitable for environments in which chemical substances are used. Sea water corrosion resistance and extreme temperature variation stability is guaranteed. Ex-e Ex-i terminals can be installed.

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

A	B	C
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 / 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)

Type of specification	Junction box	Cable glands
Device approvals	ATEX approval for use in hazardous area	ATEX approval for use in hazardous area
Identification	▪ ATEX II 2GD Ex e IIC/ Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4 ▪ 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	→ 39
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 provided for in case of a directly mounted junction box.

This 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 a 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.

For the design with a three-piece gland, the junction box can be aligned. The extension cables also remain accessible, as the connection can be removed.

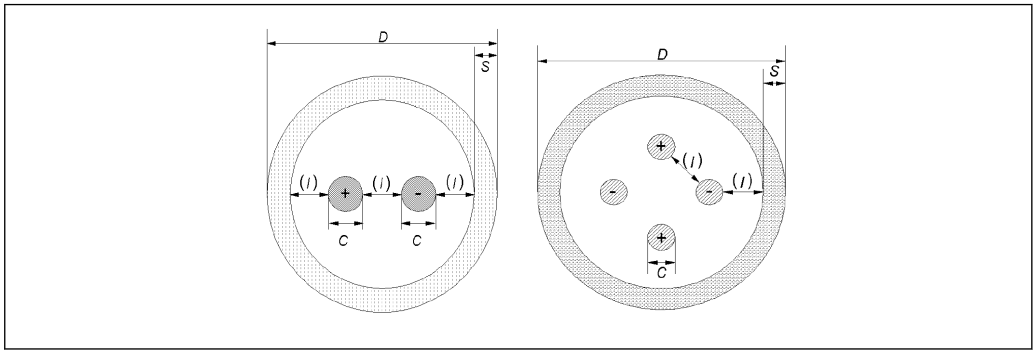
Inserts, conduits and thermowells

Thermocouple

Diameter in mm (in)	Model	Standard	Measuring point 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 thickness	Min. sheath wall thickness (S)	Min. conductor 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



A0035318

RTD

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

Thermowells or conduits

External diameter in mm (in)	Sheath material	Model	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	Identification	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, possible leaks (or the permeation of gases) that pass the primary thermowell can be detected and monitored. This enables planning for 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 eye bolt, which is part of the process connection, must be used as the only lifting component to move the entire device.

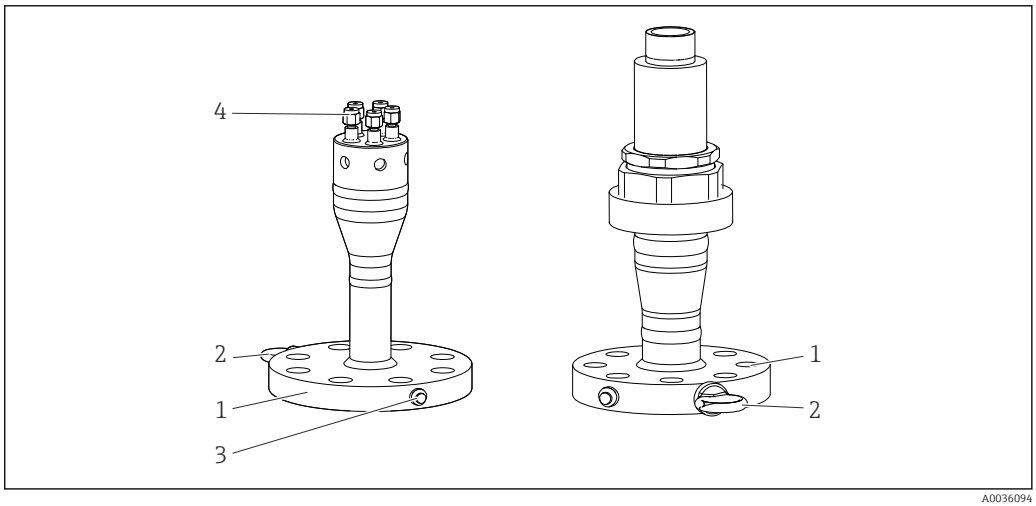
Materials

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 ▪ 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 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

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 321/1.4541	X6CrNiTi18-10	815 °C (1499 °F)	▪ Austenitic stainless steel ▪ High resistance to intergranular corrosion even after welding ▪ Good welding characteristics, suitable to all standard welding methods ▪ It is used in many sectors of the chemical industry, petrochemical, and pressurized vessels
AISI 347/1.4550	X6CrNiNb10-10	800 °C (1472 °F)	▪ Austenitic stainless steel ▪ Good resistance to a wide variety of environments in the chemical, textile, oil-refining, dairy and food industries ▪ Added niobium makes this steel impervious to intergranular corrosion ▪ Good weldability ▪ Main applications are furnace fire walls, pressure vessels, welded structures, turbine blades

Process connection



10 Flange as process connection

1 Flange
2 Ring bolt
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

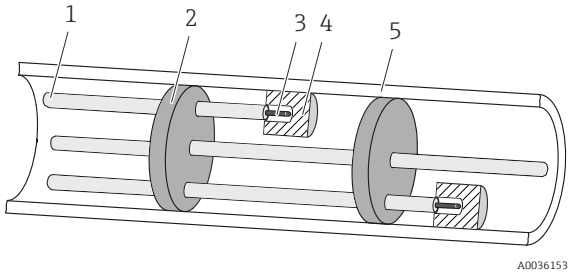
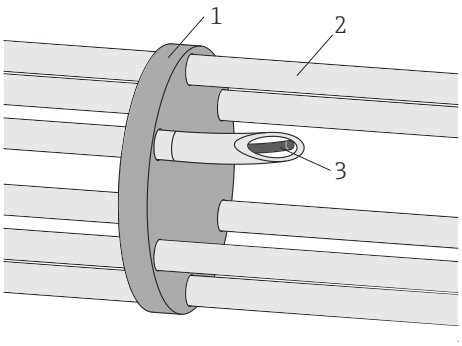
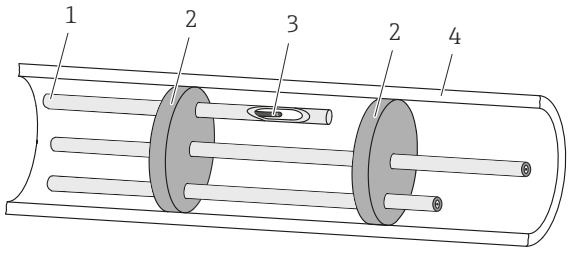
1) Flanges according to GOST standard are available on request.

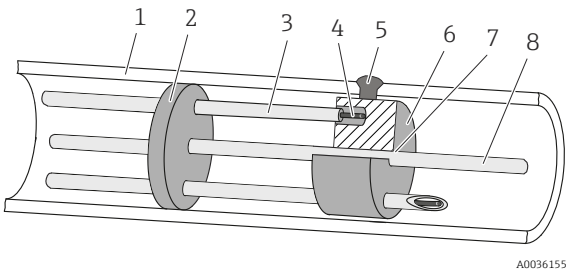
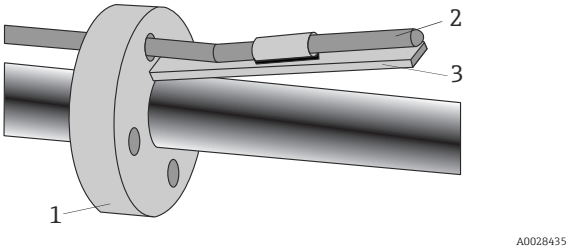
Compression fittings

The compression fittings are welded onto the thermowell head to enable sensor replacement. 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 Conduit* *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 conduits and spacers  A0028783 *1 Spacer* *2 Conduit* *3 Insert*	▪ Allow sensor replacement ▪ Guarantee thermal contact between the sensor tip and the existing thermowell
C: Thermowells and spacers  A0036632 *1 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 Conduit* *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 are replaceable
E: Bimetallic stripes  *11 Bimetallic strips with or without conduits* *1 Conduit* *2 Insert* *3 Bimetallic stripe*	▪ Doesn't allow sensor replacement ▪ Guarantee thermal contact between the sensor tip and the thermowell due to bimetallic strips activated by temperature difference ▪ No friction during installation even with already installed sensors

11.6 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**.

11.7 Documentation

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

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

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** These Operating Instructions contain all the information that is required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. The Safety Instructions are a constituent part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

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