

Operating Instructions

iTHERM MultiSens Bundle

TMS31

Multipoint thermometer

Direct contact TC/RTD temperature profiling solution with flexible metal rope for silos and storage tank applications



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1 About this document

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION

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

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Potential equalization connection (PE: Protective earth) 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: potential equalization connection is connected to the supply network. ■ Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.

Symbol	Meaning
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.3 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 document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

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 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.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions.  The nameplate indicates which Safety Instructions (XA) apply to the device.
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.

1.4 Registered trademarks

- FOUNDATION™ fieldbus
Registered trademark of the Fieldbus Foundation, Austin, Texas, USA
- HART®
Registered trademark of the HART® FieldComm Group
- PROFIBUS®
Registered trademark of the PROFIBUS Nutzerorganisation e.V. (Profibus User Organization), Karlsruhe - Germany

2 Basic safety requirements

Observe the special precautions and the instructions and procedures contained in this document to ensure the safety of operating personnel. Safety pictograms and symbols are used to identify safety-relevant information. Observe the safety instructions before carrying out any operation marked accordingly. No express or implied warranty or guarantee is given regarding performance. The manufacturer reserves the right to modify the design or specifications of the device without prior notice in order to improve it.

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 device is designed to measure the temperature profile in a tank, silo, or storage system using RTD or thermocouple technology.

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

The device has been designed as follows:

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 storage vessel.
Operating temperature	The materials used were chosen according to the operating and design minimum and maximum temperatures. Thermal expansion has been taken into account to avoid intrinsic stresses and ensure proper integration between the device and the plant. Take particular care when fastening the device's sensor elements to the internal fixtures.
Stored material	Dimensions and choice of materials minimize: General and localized corrosion
Fatigue	Cyclic loads during operations have been taken into consideration.
Vibrations	Under normal operation, no vibrations occur that could affect the device. If external vibrations occur due to another device located near the device, the rope system can compensate for them.
Mechanical load	The permissible material stress must not exceed the maximum stress acting on the measuring instrument under the operating conditions of the plant.
Ambient conditions	The junction box (with and without head transmitters), cables, cable glands and other fittings have been selected to work within the permissible ambient temperature range.

2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

Risk of injury!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for 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 from the manufacturer.

Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):

- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It 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.

3 Product description

3.1 Device architecture

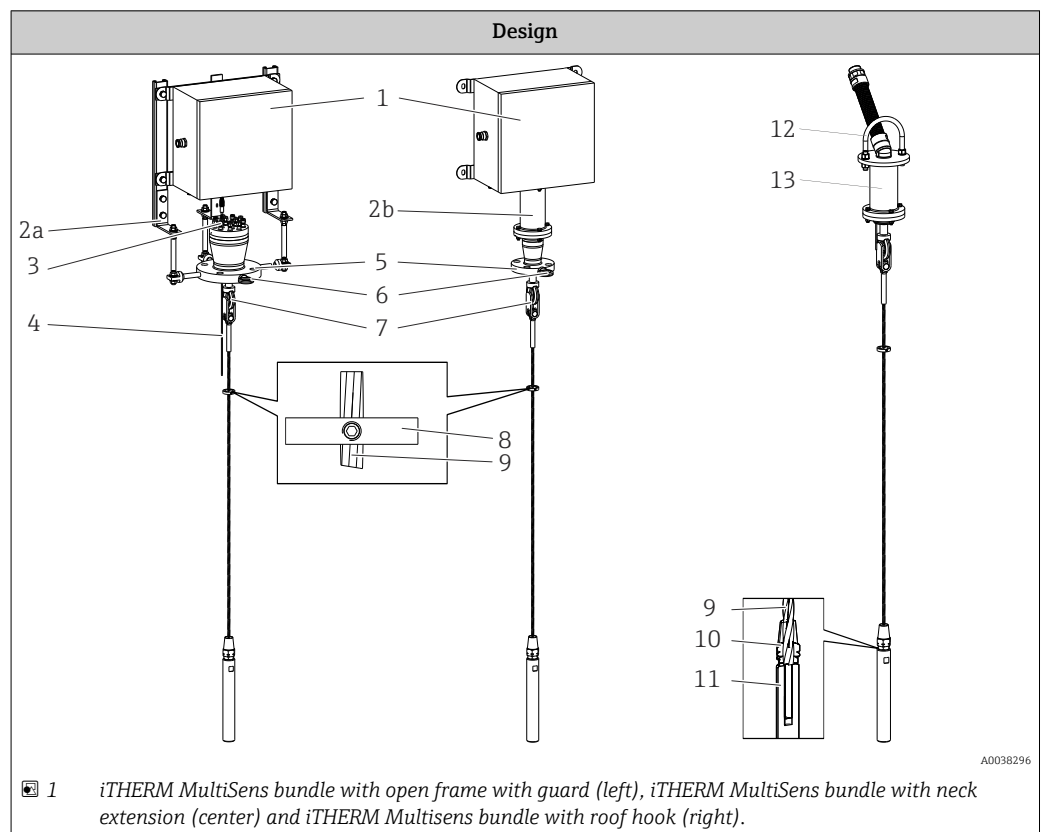
The device belongs to a series of modular products for multiple temperature measurements. The design allows for the replacement of individual subassemblies and components, making maintenance and spare parts management easier.

The unit consists of several sub-assemblies:

- Temperature sensors
- Stainless steel rope
- Stabilization weight
- Process connection
- Neck extension (see below for a more detailed description)

The device measures the temperature profile in the process environment using multiple sensors. These are connected to an appropriate process connection that ensures the process is leak-tight.

Output communication protocols available are: Analog output 4 to 20 mA, HART®, PROFIBUS® PA, FOUNDATION Fieldbus™. For the Memograph M RSG45: Ethernet TCP/IP, Modbus (TCP) USB-B (web server etc.) USB-A (USB stick, data storage, barcode reader, printer etc.) SD card for data storage, PROFINET, Ethernet/IP, PROFIBUS DP, RS232/RS485 (Modbus RTU). On the other side, the extension cables are wired to the junction box, which can either be mounted directly or installed remotely.



Description and available options	
1: Head	Hinged cover junction box for electrical connections. It includes components such as electrical terminals, transmitters and cable glands. ■ 316/316L ■ Aluminum ■ Other materials on request
2a: Open supporting frame	Modular support that is adjustable for all available junction boxes and ensures extension cable inspection. 304
2b: Neck extension	Modular tube frame support adjustable for all available junction boxes. Material: 316/316L
3: Compression fitting	Provides highly reliable sealing between the process and external environment. Suitable for a wide range of media and combinations of high temperature and pressure. Material: 316L
4: Temperature sensor	Thermocouple (grounded or ungrounded) or resistance thermometer (R100 wire-wound type).
5: Process connection	Flange according to international standards or customer-specific flange to meet process requirements.
6: Eyebolt	Lifting device for easy handling during installation phase. Material: ■ 316 ■ Size 8.8
7: Toggle joint	Connection between the rope and the process connection Material: 316
8: Positioning guides	Insert guide for correct positioning of the measuring element Material: 316/316L
9: Rope	Metallic rope Material: 316
10: Locking screw	Locking screw used as a closure element. Material: 316
11: Weight	Weight to keep the rope tensioned and in a straight position during operation (e.g. when the tank is being filled). Material: 316/316L
12: Bracket	Device for suspending the multipoint thermometer from the silo roof. Material: A4 in accordance with DIN ISO 3506
13: Extension	Tube extension for suspending the multipoint thermometer. Material: 316/316L

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
 - ↳ Report all damage immediately to the manufacturer.
Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.



If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

The device can be identified in the following ways:

- Nameplate specifications
- Enter the serial number from the nameplate into *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 from 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

Do you have the correct 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) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

- 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

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)

4.3.1 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



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

5 Installation

5.1 Installation requirements

WARNING

Failure to observe the installation steps can result in death or serious injury!

- ▶ Ensure that the device is installed only by appropriately qualified personnel.

WARNING

Explosions can result in death or serious injury.

- ▶ When the circuit is live, never remove the junction box cover in explosive atmospheres.
- ▶ Before connecting any additional electric and electronic devices in an explosive atmosphere, make sure the devices in the loop are installed in accordance with intrinsically safe or non-sparking wiring practices.
- ▶ Verify that the operating atmosphere of the transmitters is consistent with the relevant certification for hazardous areas.
- ▶ Tighten all covers and threaded components to meet explosion protection requirements.

WARNING

Leaks in the process can result in death or serious injury.

- ▶ Install and tighten fittings before applying pressure.
- ▶ Do not loosen the threaded parts during operation.

NOTICE

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

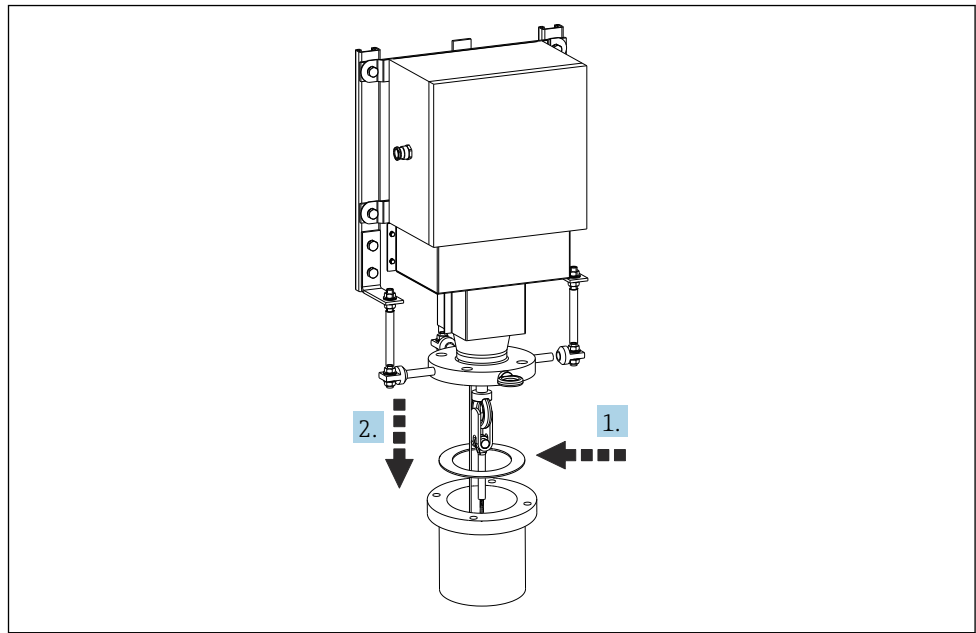
- ▶ Additional loads or external torques on the system caused by connection to another system and not provided for in the installation plan are not permitted.
- ▶ The device is not suitable for installations in locations where vibrations occur. Any resulting loads may impair junction seals and thus affect the operation of the sensor elements.
- ▶ The end user is responsible for checking that suitable equipment has been installed to ensure that the permissible limits are not exceeded.
- ▶ For information on ambient conditions, see the Technical data.
- ▶ When installing the measurement system, avoid any friction and spark generation in particular.
- ▶ Make sure that the load of the stored material (such as grain, clinker, pellets, etc.) does not deform or stress the probes or welds (if the probe is mounted on internal fixtures).

5.2 Installing the device

For easier transport, the device with rope probe is supplied in a compact coiled form. Keep the rope probe coiled until the device has been transported to the installation site.

5.2.1 Junction box mounted directly

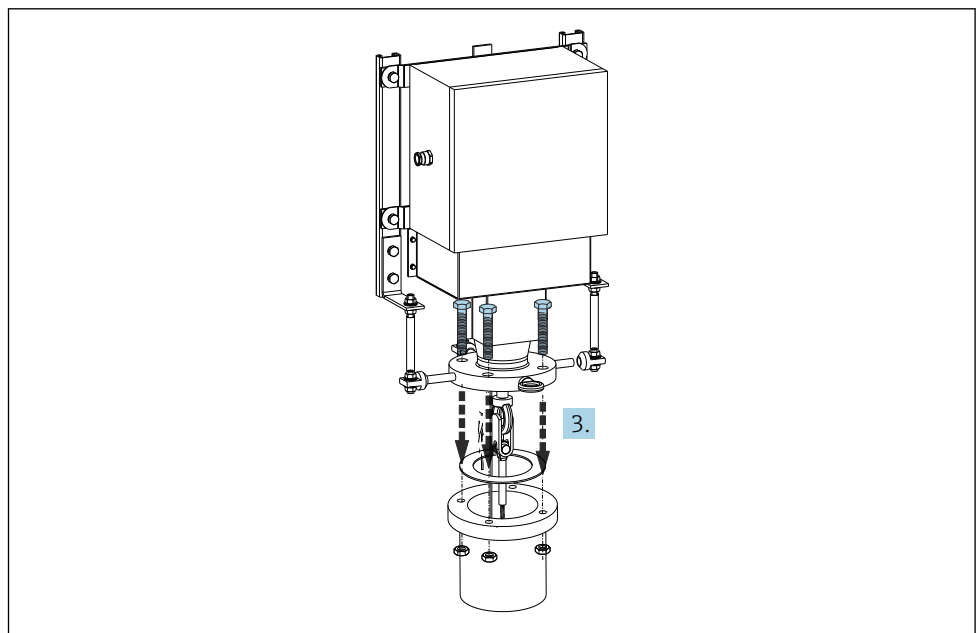
Follow the instructions below to ensure proper installation of the device. Note that this applies to the versions “open support frame”, “support frame with cover”, and “neck extension”.

Installation procedure**1.**

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First check that the sealing surfaces on the flanges are clean. Place the sealing ring between the flanged nozzle and the device flange.

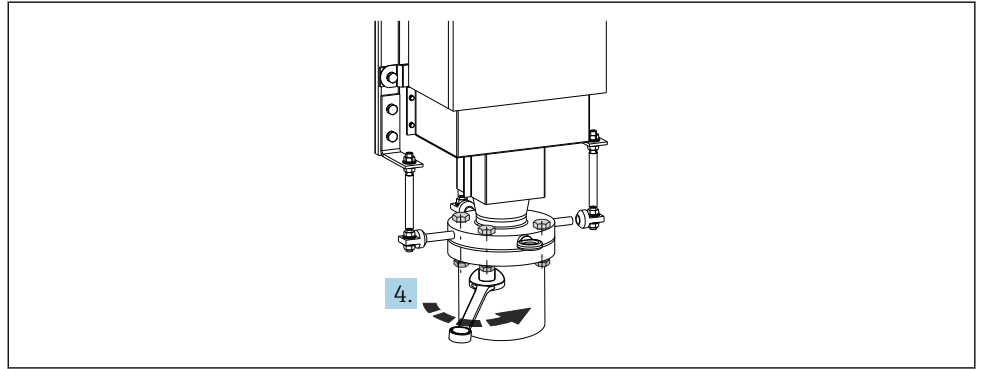
- 2.** Place the device on the nozzle and guide the rope probe into the nozzle. Make sure that the thermocouple probes do not become entangled or deformed. Ensure that the rope system does not twist.

3.

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Insert bolts part way into the intended holes on the flange and tighten loosely with nuts. Use a suitable screwdriver – do not tighten fully yet.

4.



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Now insert the screws fully into the drilled holes on the flange and tighten them using a suitable tool. Perform controlled tightening in accordance with the applicable standards.

The junction box is mounted on the flange.

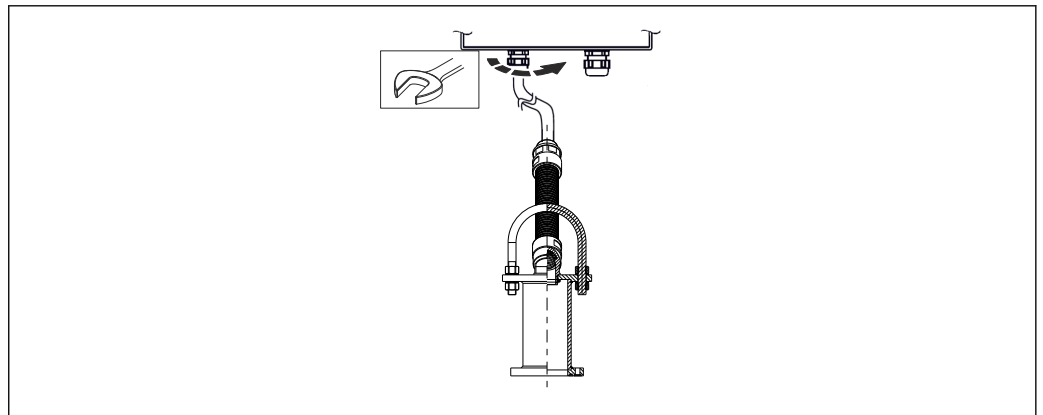
5.2.2 Junction box remote connection

Junction box not supplied. Installation procedure

Please refer to → 14 for the correct installation process.

Conduit connection

Make sure the cable gland is properly tightened after the wiring connections.



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Wiring sequence (customer-side connection)

For correct wiring, see the section "Electrical connection".

Junction box supplied but not connected to the multipoint. Installation procedure

Before installation or wiring, always ensure that the junction box is securely mounted on a stable metal support.

For correct installation, see the section "Installation".

Conduit connection

For correct installation, see the section "Installation".

Wiring sequence (customer-side connection)

For correct wiring, see the section "Electrical connection".

Junction box supplied and connected to the multipoint.**Assembly sequence**

Before installation or wiring, always ensure that the junction box is securely mounted on a stable metal support.

For correct installation, see the section "Installation".

5.3 Post-installation check

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

Device condition and specifications	
Is the device undamaged (visual check)?	☐
Do the ambient conditions match the device specification? For example: ▪ Ambient temperature ▪ Proper conditions	☐
Are the threaded components free of deformation?	☐
Are the seals intact and free from permanent deformation?	☐
Installation	
Is the device aligned with the nozzle axis?	☐
Are the seal seats of flanges clean?	☐
Are the flange and its counter flange properly bolted together?	☐
Are the thermocouples free of entanglement, twisting and deformation?	☐
Is the rope probe in a proper straight tensioned configuration with no twisting or wrapping?	☐
Is the toggle joint connected properly to the flange eyebolt?	☐
Are the bolts completely inserted in the flange? Make sure the flange is fitted tightly and flush against the nozzle.	☐

6 Electrical connection

CAUTION

Failure to observe the following may result in destruction of electronic components.

- ▶ Do not install or wire the device when it is connected to the operating voltage.
- ▶ When installing Ex-certified devices in hazardous areas, observe the relevant notes and wiring diagrams in the specific Ex supplementary documentation to this operating instructions.

NOTICE

- ▶ Power the device exclusively from a power supply operating with a limited-energy circuit in accordance with IEC 61010-1 ("SELV or Class 2 circuit").

 For wiring with a transmitter, refer to the technical documentation of the relevant transmitter.

To wire 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; see section "Connecting the device".
5. Once wiring is complete, tighten the screw terminals.
6. Tighten the cable glands. Refer to the instructions in the section "Ensuring the degree of protection".
7. Close the housing cover.
8. Before commissioning, refer to the checklist in the section "Post-connection check" to prevent connection errors.

The device is wired.

6.1 Connecting the device

Terminal assignment

NOTICE

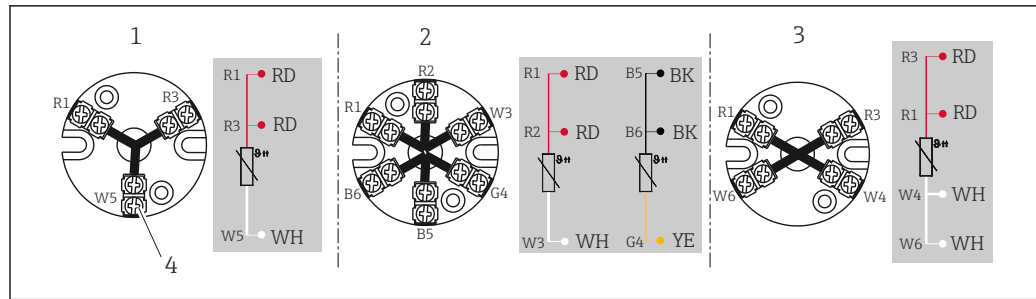
Destruction or malfunction of electronic components due to ESD - electrostatic discharge.

- ▶ Take appropriate measures to protect the terminals from electrostatic discharge.

 When directly wiring the thermocouple and RTD sensors, use an extension or compensation cable to avoid incorrect measured values. The polarity specified on the relevant terminal block and in the wiring diagram must be observed.

The manufacturer is not responsible for the design or installation of the fieldbus connection cable. Consequently, the manufacturer cannot be held liable for any damage caused by the selection of incorrect fieldbus cables or by improper cable installation.

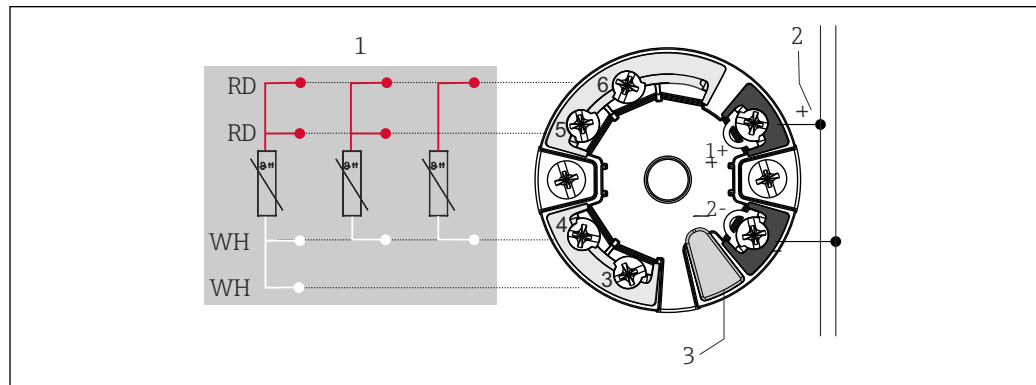
6.2 RTD sensor connection type



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2 Mounted terminal block

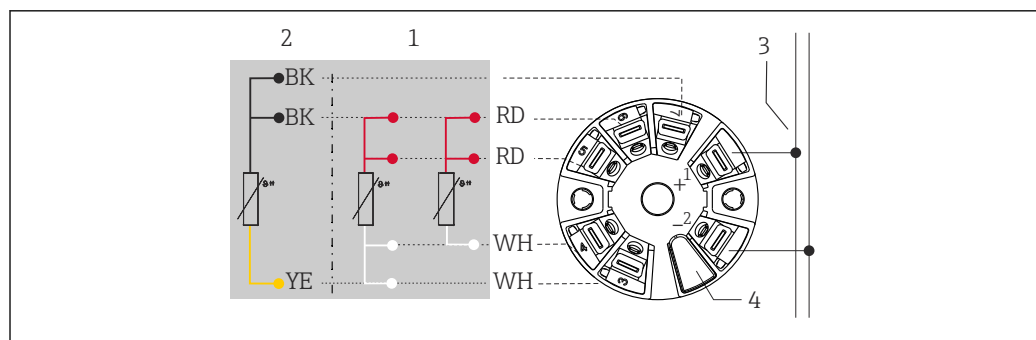
- 1 3-wire, single
- 2 2 x 3-wire, single
- 3 4-wire, single
- 4 Outside screw



A0045464

3 Head-mounted iTEMP TMT7x transmitter or iTEMP TMT31 (single sensor input)

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

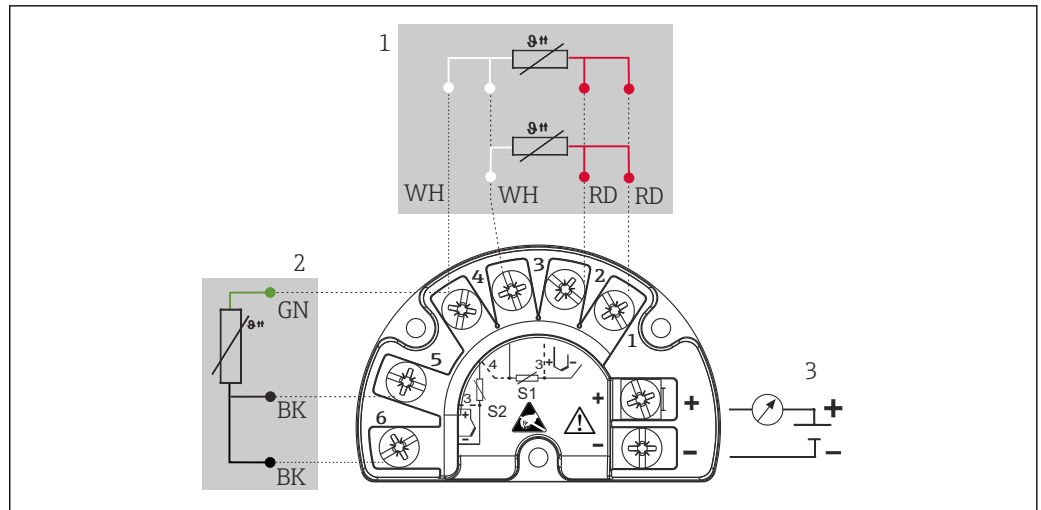


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4 Head-mounted iTEMP TMT8x transmitter (dual sensor input)

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

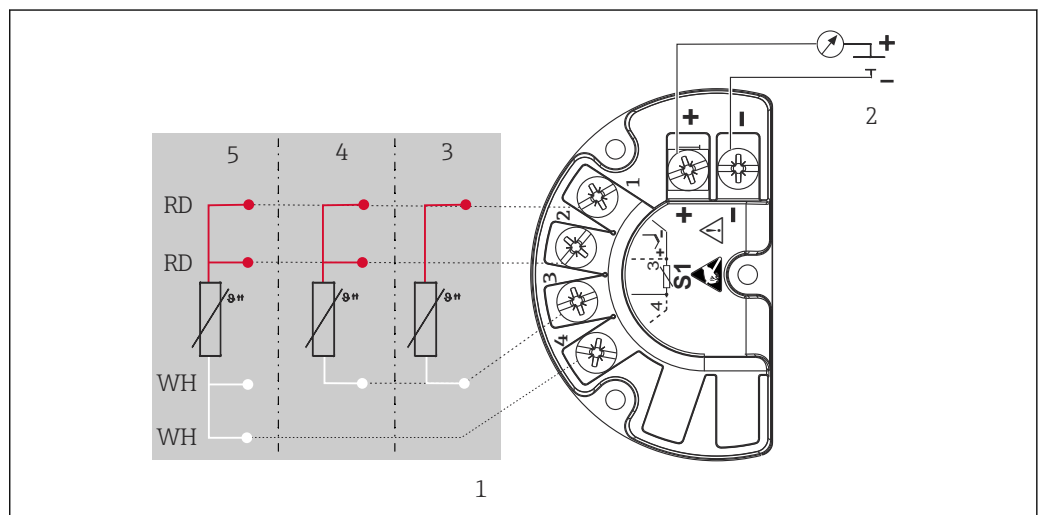
Mounted field transmitter: Fitted with screw terminals



A0045732

5 iTEMP TMT162 (dual input)

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

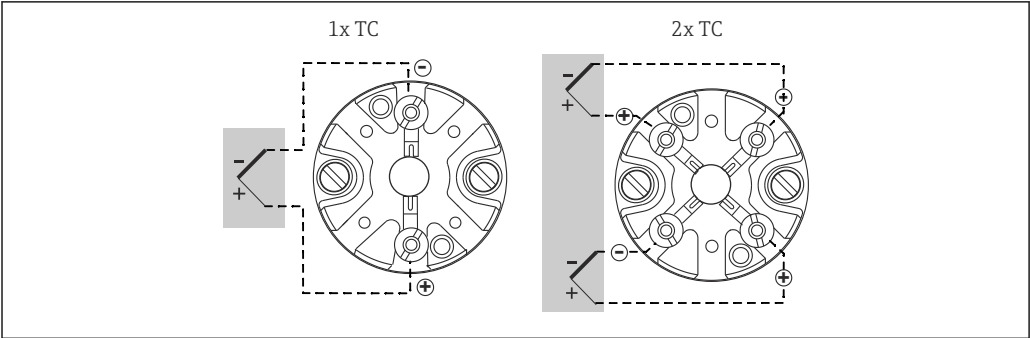


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6 iTEMP TMT142B (single sensor input)

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

6.3 Thermocouple (TC) sensor connection type



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7 Mounted terminal block

Head-mounted transmitter iTEMP TMT8x (dual sensor input) ¹⁾	
1 Sensor input 1 2 Sensor input 2 3 Fieldbus communication and power supply 4 Display connection	
Head-mounted transmitter iTEMP TMT7x (single input) ¹⁾	Mounted field transmitter iTEMP TMT162 or iTEMP TMT142B
1 Sensor input TC, mV 2 Power supply, bus connection 3 Display connection/CDI interface	1 Sensor input 1 2 Sensor input 2 (not iTEMP TMT142B) 3 Supply voltage for field transmitter and 4 to 20 mA analog output or fieldbus communication

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

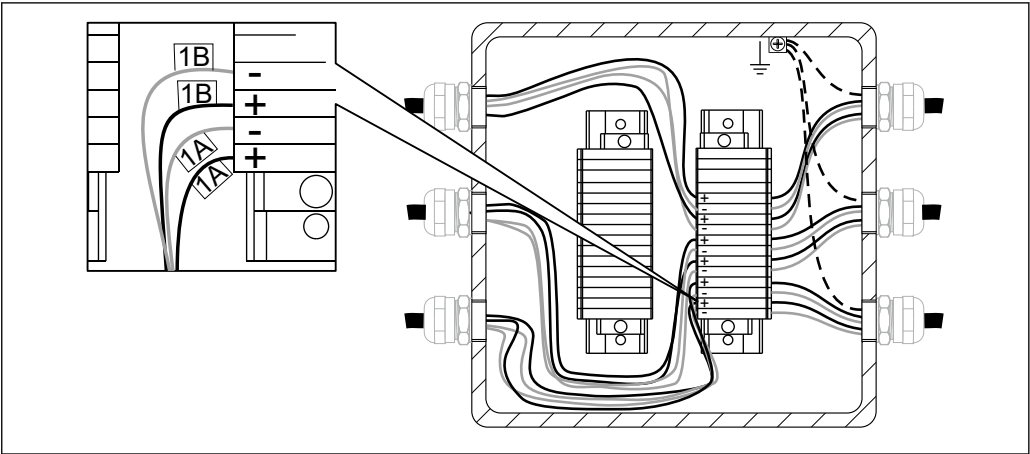
Thermocouple wire colors

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

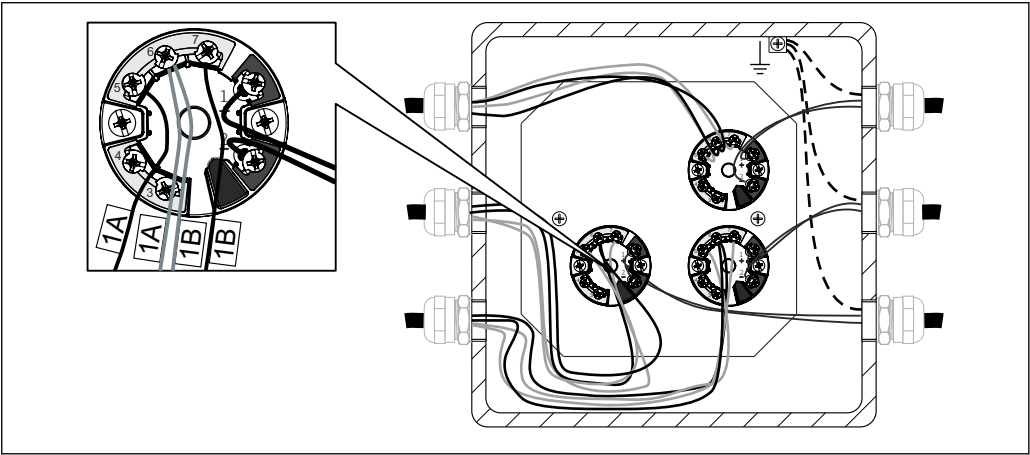
6.4 Connecting the sensor cables

i Each sensor is marked with an individual TAG number. As default configuration, all wires are always connected to the installed transmitters or terminals and generally checked in house before final shipment. For a remote connection box on the multipoint side, also carry out the following steps.

Wiring is performed sequentially. The input channels of transmitter no. 1 are connected to the cables of the insert, starting with insert no. 1. Transmitter no. 2 is used only after all channels of transmitter no. 1 have been connected. The cables of each insert are numbered consecutively, starting with 1. When two sensors are used, the internal identification is given an additional suffix to distinguish between the two sensors - for example, 1A and 1B for two sensors in the same insert or measuring point 1.



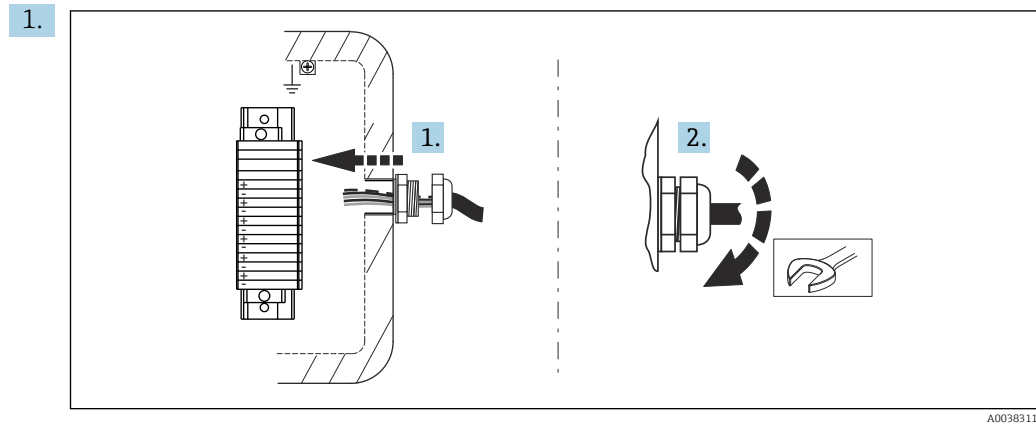
8 Direct wiring on the mounted terminal block Example of the internal sensor wires marking with 2 x TC sensors in insert no. 1.



9 Mounted and wired head transmitter. Example of the internal sensor wires marking with 2 x TC

Sensor type	Transmitter type	Wiring rule
1 x RTD or TC	- Single input (one channel) - Dual input (two channels)	1 head transmitter per insert 1 head transmitter for 2 inserts
2 x RTD or TC	- Single input (one channel) - Dual input (two channels)	- Not available, wiring excluded 1 head transmitter per insert

6.5 Wiring sequence (plant-side connection)



A0038311

For direct wiring, completely insert the extension or compensation cables through the corresponding cable glands on the junction box.

2. Tighten the cable glands on the junction box.
3. After opening the junction box cover, connect the compensating cables to the terminals in the junction box. Comply with the wiring instructions provided and ensure that the marking of the terminals and cables match.
4. Close the cover, ensuring that the seal is correctly positioned to maintain the IP degree of protection.
5. When using a supporting frame with covers, check that all components are correctly connected to each other.

6.6 Wiring sequence (customer-side connection)

Please refer to paragraph 5.2.1.1 for a correct assemble process.

NOTICE

After installation, check the assembled thermometric system by performing a few simple tests.

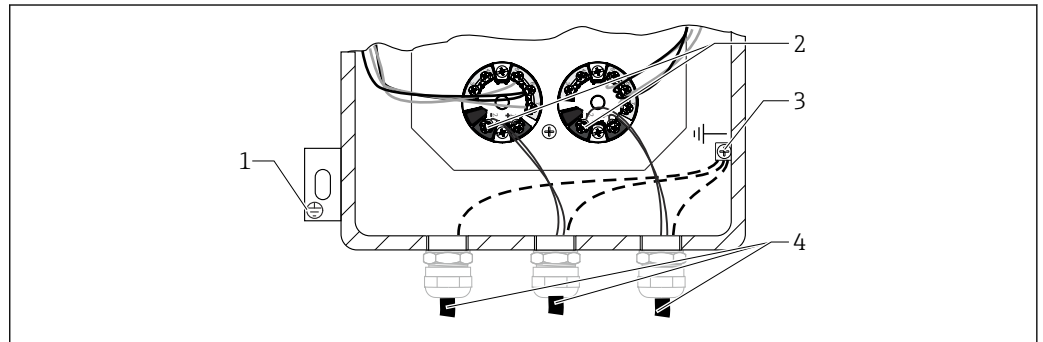
- ▶ Check the tightness of the threaded connections. If any parts are loose, tighten them to the specified torque.
- ▶ Make sure that the rope probe is straight and correctly tensioned to prevent bending, which could result in improper positioning of the thermocouples in the storage system.
- ▶ Check the proper positioning of the weight on the rope.
- ▶ Check that the suspension eye is correctly fastened to the selected fixing point inside the vessel (version without weight).
- ▶ Check for correct wiring, test the electrical continuity of the sensors (by heating the tip, if possible) and ensure no short-circuits are present.

6.7 Connecting the power supply and signal cables

Cable specification

- Observe the grounding concept of the plant.
- Use a shielded cable for the fieldbus communication.
- The terminals for connecting the signal cable (1+ and 2-) are protected against reverse polarity.
- Conductor cross-section:
 - Max 2.5 mm² (14 AWG) for screw terminals
 - Max. 1.5 mm² (16 AWG) for push-in-terminals

For the general procedure, see section "Electrical connection".



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 10 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

6.8 Shielding and grounding

 For specific information on electrical shielding and grounding of transmitter wiring, refer to the technical documentation for the relevant iTEMP transmitter.

Observe national regulations and standards when making electrical connections. 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 plants without potential equalization, cable shields for fieldbus systems should therefore be grounded at only one end (at the power supply unit or safety barriers).

NOTICE

If the cable shield is grounded at more than one point in plants without potential equalization, mains-frequency equalizing currents may occur that can damage the signal cable or significantly impair signal transmission.

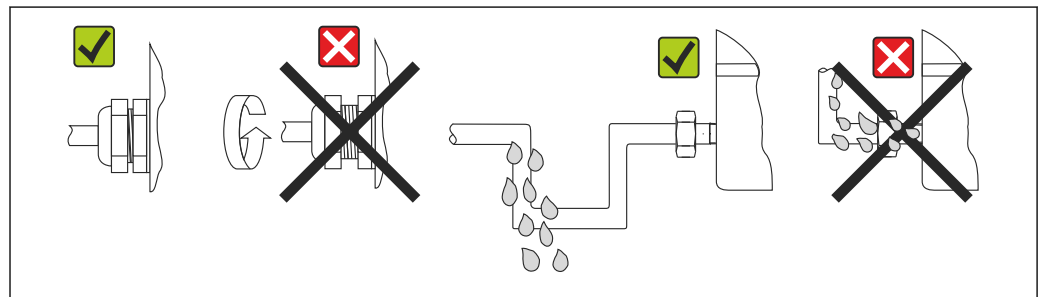
- In such cases, the signal cable shield must be grounded at only one end, i.e. it must not be connected to the housing ground terminal (terminal head, field housing). The unconnected shield must be insulated!

6.9 Ensuring the degree of protection

The device meets all of the requirements in accordance with the degree of protection indicated on the nameplate. Compliance with the following points is mandatory following

installation in the field or servicing in order to ensure that the housing degree of protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. If the seal or sealing groove is dirty, dry, clean or replace it.
- All housing screws and screw caps must be firmly tightened.
- The cables used for the connection must have the specified outer diameter (e.g. M20x1.5, cable diameter 8 to 12 mm).
- Firmly tighten the cable gland, and use it only in the specified clamping area (the cable diameter must be appropriate to the cable gland).
- The cables must loop down before they enter the cable gland ("water trap"). This means that any moisture that may form cannot enter the gland. The device must be installed so that the cable glands are not facing upwards.
- Do not twist the cables, and use only round cables.
- Replace unused cable glands with a dummy plug (included in the scope of delivery).
- Do not remove the grommet from the cable gland.
- Repeated opening/closing of the device is possible but has a negative impact on the degree of protection.



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11 Connection instructions for compliance with the degree of protection

6.10 Post-connection check

Is the device undamaged (internal equipment inspection)?	☐
Electrical connection	
Does the supply voltage match the specifications on the nameplate?	☐
Are the mounted cables strain-relieved?	☐
Are the power supply and signal cables correctly connected? → 17	☐
Are all the screw terminals correctly tightened and have the connections of the push-in terminals been checked?	☐
Are all cable glands installed, securely tightened and leak-tight?	☐
Are all the housing covers installed and tightened?	☐
Does the marking of the terminals and cables match?	☐
Has the electrical continuity of the thermocouple been verified?	☐
Are the cable glands tightened on the extension cables?	☐
Are the extension cables connected to the junction box terminals?	☐

7 Commissioning

7.1 Preparatory steps

To ensure proper operation of the device, use the setup guides for the manufacturer's commissioning types "Standard", "Extended" and "Advanced", in accordance with:

- Operating instructions
- Customer specifications for commissioning or
- application and process conditions

Inform the operator and personnel responsible for the process that commissioning will be carried out. Take the following steps:

1. Determine which chemical or which medium is being measured. Observe the safety data sheet.
2. Disconnect the sensors connected to the process.
3. Observe temperature and pressure conditions.
4. Only open process fittings and loosen flange screws after ensuring that this can be done safely.
5. Be sure not to disturb the process when disconnecting input/output signal lines or when simulating signals.
6. Make sure that tools, equipment and the customer process are protected from contamination. Include and plan any required cleaning steps.
7. Make sure that the chemicals used do not pose any safety risks. This includes agent used for normal operation or for cleaning. Observe and comply with the relevant safety instructions.

7.1.1 Tools and equipment

Multimeter and device-specific configuration tools as required according to the action list above.

7.2 Post-installation check

Before commissioning the device, make sure that all final checks have been carried out.

- "Post-installation 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 device for damage.
2. Check that the device has been installed as specified in the operating instructions.
3. Check that the wiring has been carried out according to the operating instructions and the local regulations.
4. Check that the device is dust-tight and watertight.
5. Check whether the safety precautions have been observed.
6. Connect the power supply to the device.

The visual inspection of the device is complete.

Ambient conditions:

1. Ensure that the devices are operated under suitable ambient conditions. These include ambient temperature, humidity (IPxx protection rating), vibration, explosion-hazard areas (Ex, dust-Ex), RFI/EMC, and sun protection.
2. Check that the devices are accessible for operation and maintenance purposes.

Ambient conditions have been checked.

Configuration parameters:

- Configure the device according to the information in the operating instructions, using the parameters specified by the customer or defined in the design specification.

The device has been configured correctly.

Verifying the output signal value

- Check and confirm that the optional local display and the device's output signals correspond to the indication in the control room.

The output value has been verified.

Standard commissioning is complete.

7.2.2 Extended commissioning

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

Device conformity:

1. Compare the received device with the order or design specification, including accessories, documentation and certificates.
2. Check the software version, if available.

Device conformity has been verified.

Function test :

1. Check device outputs - including switching points, auxiliary inputs/outputs - using the internal or an external simulator.
2. Compare measurement data/results with a reference provided by the customer.
3. If necessary, adjust the device according to the description in the operating instructions.

Functional test has been completed.

Extended commissioning is complete.

7.2.3 Advanced commissioning

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

Verifying the measuring circuit:

1. Simulate a minimum of 3 output signals that are transmitted from the device to the control room.
2. Read out the simulated and displayed values.
3. Record the values.
4. Check linearity.

The measuring circuit has been verified.

Advanced commissioning is complete.

7.3 Switching on the device

After completing the final check, connect the supply voltage. The multipoint thermometer is then ready for operation.

8 Diagnostics and troubleshooting

8.1 General troubleshooting

If electronic problems occur, start troubleshooting using the queries described in the operating instructions. These queries systematically guide you to the cause of the fault and the corresponding remedial actions.

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

NOTICE

Repair of device components

- Replace the device in the event of a major fault. See the section "Return".

If iTEMP transmitters from Endress+Hauser are used, refer to the technical documentation for the relevant device for troubleshooting information.

9 Maintenance

No special maintenance work is required for the device.

9.1 Cleaning

A clean, dry cloth can be used to clean the device.

10 Repair

10.1 General notes

Ensure that the device is easily accessible for maintenance purposes. Any component that is part of the device must, if replaced, be exchanged with an original spare part of Endress+Hauser that guarantees the same characteristics and performance. To ensure continued operational safety and reliability, repairs on the device may only be carried out if they have been expressly approved by Endress+Hauser. In addition, regional or national regulations and laws governing the repair of electrical equipment must be observed.

10.2 Spare parts

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

10.3 Endress+Hauser services

Service	Description
Certifications	Endress+Hauser can meet the requirements relating to design, product manufacturing, testing, and commissioning of the device in accordance with specific approvals and device certifications by designing or supplying individual certified components and verifying their integration into the overall 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.
Calibration	Endress+Hauser's range of calibration services covers on-site verification tests, accredited laboratory calibrations, certificates and traceability to ensure compliance.
Installation	Endress+Hauser helps you commission plants while minimizing costs. Fault-free installation is crucial for the measurement system's quality and durability and for reliable plant operation. We provide the highest level of expertise at the right time to meet agreed project performance targets.
Testing	In order to ensure product quality and to guarantee efficiency during the entire lifetime the following tests are available: ■ Penetrant testing 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 ■ Radiographic testing 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

10.4 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>
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 provides the best protection.

10.5 Disposal



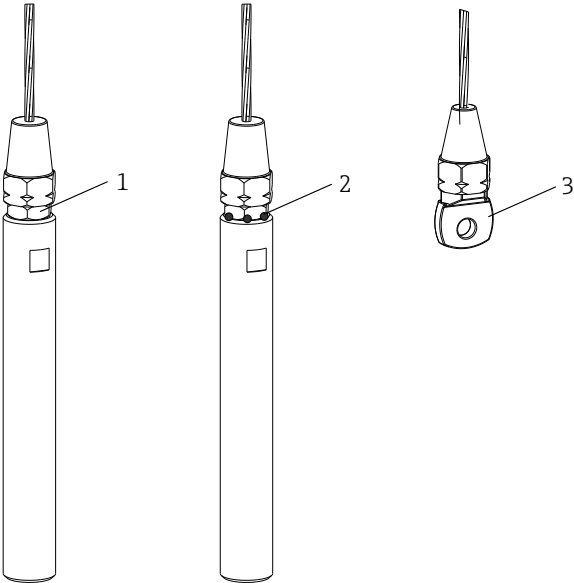
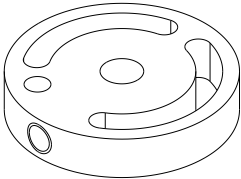
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return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

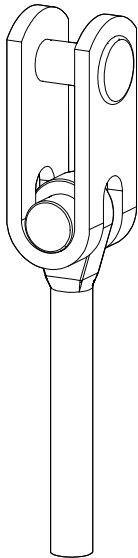
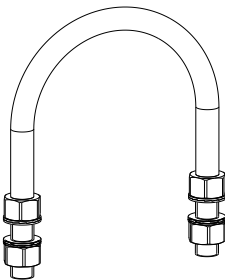
11 Accessories

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**.

11.1 Device-specific accessories

Accessories	Description
Anchor weight  A0038304	Installing an anchor weight ensures that the rope is positioned vertically and runs straight. Ensure that there is sufficient space in the storage tank to position the weight correctly. The dimensions are specified during ordering according to the dimensions of the multipoint cable. ■ 1: Removable/replaceable via thread connection ■ 2: Permanently attached by spot welding ■ 3: Not applicable
Positioning guides  A0038305	The multipoint rope is equipped with positioning guides. They ensure that the sensor element is correctly positioned along the entire length of the cable and remains in position under operating conditions.

Accessories	Description
Swivel clamp  A0038306	Joint connection between the rope and the flange to allow relative rotation.
 A0055454	Tool for suspending the multipoint probe inside silos or any other supporting structures.

11.2 Communication-specific accessories

Netilion

With the Netilion IIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

 www.netilion.endress.com

DeviceCare SFE100

DeviceCare is an Endress+Hauser configuration tool for field devices using the following communication protocols: HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, IO/Link, Modbus, CDI and Endress+Hauser Common Data Interfaces.

 Technical Information TI01134S
www.endress.com/sfe100

FieldCare SFE500

FieldCare is a configuration tool for Endress+Hauser and third-party field devices based on DTM technology.

The following communication protocols are supported: HART, WirelessHART, PROFIBUS, FOUNDATION Fieldbus, Modbus, IO-Link, EtherNet/IP, PROFINET and PROFINET APL.



Technical Information TI00028S

www.endress.com/sfe500

11.3 System products

Data Manager of the RSG product family

Data Managers are flexible and powerful systems to organize process values. Up to 20 universal inputs and up to 14 digital inputs for direct connection of sensors, optionally with HART, are available as an option. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. The values can be forwarded via common communication protocols to higher-level systems and connected to one another via individual plant modules.

For more information, please refer to: www.endress.com

RN series active barrier

Single- or two-channel active barrier for safe separation of 0/4 to -20 mA standard signal circuits with bidirectional HART transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively.

For more information, please refer to: www.endress.com

12 Technical data

12.1 Input

Measured variable Temperature (temperature-linear transmission behavior)

Measuring range

RTD:

Input	Description	Measuring range limits
RTD	WW	-200 to +600 °C (-328 to +1112 °F)
RTD	TF 6 mm	-50 to +400 °C (-58 to +752 °F)
RTD	TF 3 mm	-50 to +250 °C (-58 to +482 °F)
RTD	iTHERM StrongSens 6 mm	-50 to +500 °C (-58 to +932 °F)

Thermocouple:

Input	Description	Measuring range limits
Thermocouples (TC) as per IEC 60584, part 1 - using an Endress+Hauser - iTEMP temperature head transmitter	Type J (Fe-CuNi)	-40 to +520 °C (-40 to +968 °F)
	Type K (NiCr-Ni)	-40 to +800 °C (-40 to +1472 °F)
Internal cold junction (Pt100) Accuracy of cold junction: ± 1 K Max. sensor resistance: 10 kΩ		

12.2 Output

Output signal

The measured values are transmitted in 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.

4-20 mA head transmitter

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.

HART head transmitter

The iTEMP 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. Swift and easy operation, visualization and maintenance using universal configuration software like FieldCare, DeviceCare or FieldCommunicator 375/475. Integrated Bluetooth® interface for the wireless display of measured values and configuration via Endress +Hauser SmartBlue app, optional.

PROFIBUS PA head transmitter

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

FOUNDATION Fieldbus™ head transmitters

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

Head transmitter with PROFINET and Ethernet-APL™

The iTEMP transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using the PROFINET protocol. Power is supplied via the 2-wire Ethernet connection according to IEEE 802.3cg 10Base-T1. The iTEMP transmitter can be installed as an intrinsically safe electrical apparatus in Zone 1 hazardous areas. The device can be used for instrumentation purposes in the terminal head form B (flat face) according to DIN EN 50446.

Head transmitter with IO-Link

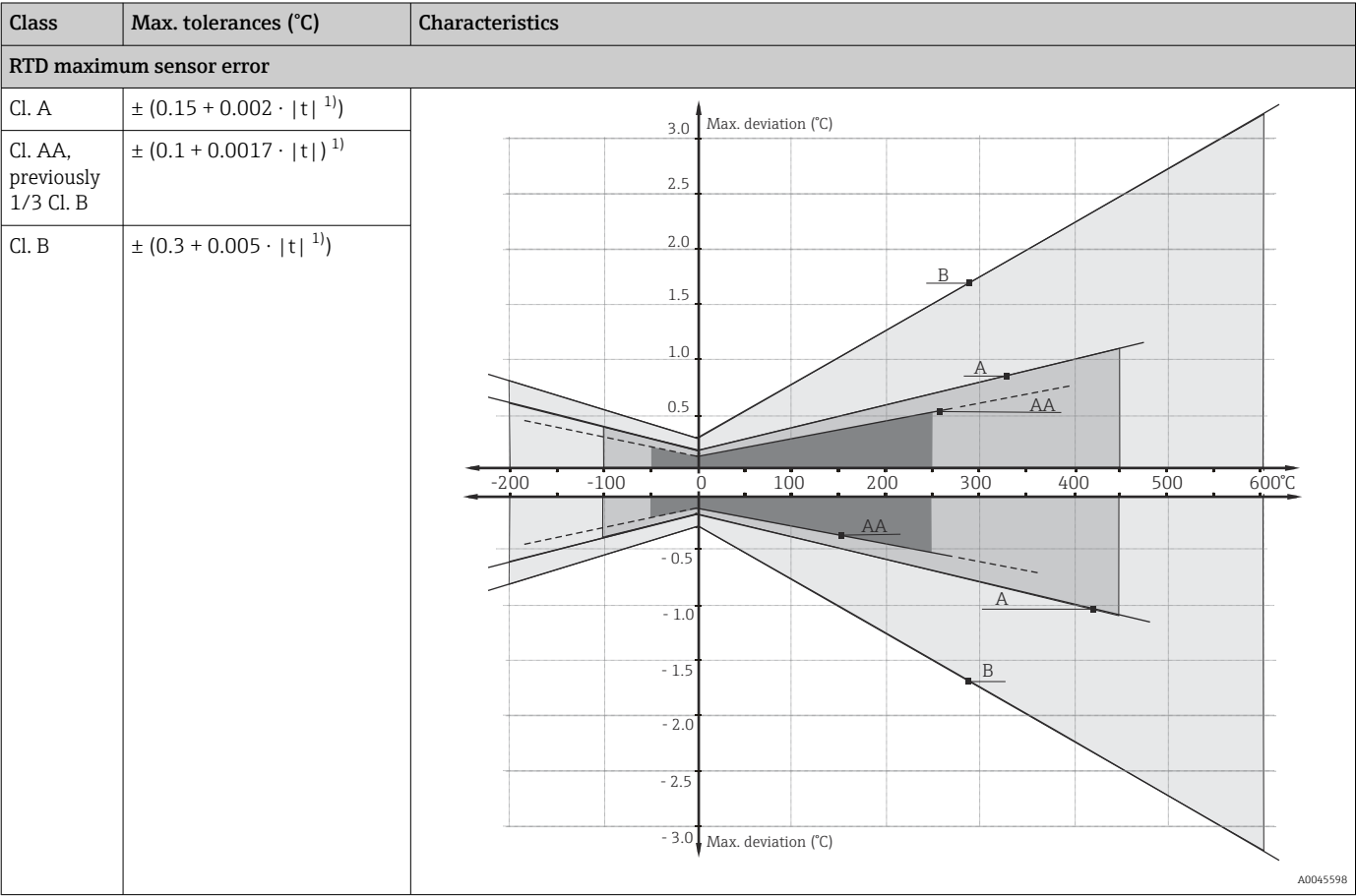
The iTEMP transmitter is an IO-Link device with a measurement input and an IO-Link interface. It offers a configurable, simple and cost-effective solution thanks to digital communication via IO-Link. The device is mounted in a terminal head form B (flat face) as per DIN EN 5044.

Advantages of the iTEMP transmitters:

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

12.3 Performance characteristics

Maximum measurement error RTD resistance thermometer according to IEC 60751



1) |t| = Temperature absolute value in °C

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

Temperature ranges

Sensor type ¹⁾	Operating temperature range	Class B	Class A	Class AA
Pt100 (TF) Standard	-50 to +400 °C (-58 to +752 °F)	3 mm: -50 to +250 °C (-58 to +482 °F) 6 mm: -50 to +400 °C (-58 to +752 °F)	-30 to +250 °C (-22 to +482 °F)	0 to +150 °C (+32 to +302 °F)
Pt100 (TF) iTHERM StrongSens	-50 to +500 °C (-58 to +932 °F)	-50 to +500 °C (-58 to +932 °F)	-30 to +300 °C (-22 to +572 °F)	0 to +150 °C (+32 to +302 °F)
Pt100 (WW)	-200 to +600 °C (-328 to +1 112 °F)	-200 to +600 °C (-328 to +1 112 °F)	-100 to +450 °C (-148 to +842 °F)	-50 to +250 °C (-58 to +482 °F)

1) Options depend on product and configuration

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

Standard	Type	Standard tolerance		Special tolerance	
IEC 60584		Class	Deviation	Class	Deviation
	J (Fe-CuNi)	2	$\pm 2.5\text{ °C}$ (–40 to +333 °C) $\pm 0.0075\text{ t }^{1)}$ (333 to 750 °C)	1	$\pm 1.5\text{ °C}$ (–40 to +375 °C) $\pm 0.004\text{ t }^{1)}$ (375 to 750 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	2	$\pm 0.0075\text{ t }^{1)}$ (333 to 1200 °C) $\pm 2.5\text{ °C}$ (–40 to +333 °C) $\pm 0.0075\text{ t }^{1)}$ (333 to 1200 °C)	1	$\pm 1.5\text{ °C}$ (–40 to +375 °C) $\pm 0.004\text{ t }^{1)}$ (375 to 1000 °C)

1) |t| = absolute value in °C

Thermocouples made of base metals are generally supplied so that they comply with the manufacturing tolerances specified in the tables for temperatures > –40 °C (–40 °F). These materials are generally not suitable for temperatures < –40 °C (–40 °F). The tolerances of Class 3 cannot be met. A separate material must be selected for this temperature range. This cannot be handled via the standard product.

Standard	Type	Tolerance class: Standard	Tolerance class: Special
ASTM E230/ANSI MC96.1		Deviation; the larger value applies in each case	
	J (Fe-CuNi)	$\pm 2.2\text{ K}$ or $\pm 0.0075\text{ t }^{1)}$ (0 to 760 °C)	$\pm 1.1\text{ K}$ or $\pm 0.004\text{ t }^{1)}$ (0 to 760 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	$\pm 2.2\text{ K}$ or $\pm 0.02\text{ t }^{1)}$ (–200 to 0 °C) $\pm 2.2\text{ K}$ or $\pm 0.0075\text{ t }^{1)}$ (0 to 1260 °C)	$\pm 1.1\text{ K}$ or $\pm 0.004\text{ t }^{1)}$ (0 to 1260 °C)

1) |t| = absolute value in °C

The materials for thermocouples are generally supplied in such a way that they comply with the tolerances specified in the table for temperatures > 0 °C (32 °F). These materials are generally not suitable for temperatures < 0 °C (32 °F). The specified tolerances cannot be satisfied. A separate material must be selected for this temperature range. This cannot be handled via the standard product.

Influence of ambient temperature

Depends on the head transmitter used. For details, see the relevant Technical Information.

Response time



Response time for the sensor assembly without transmitter. Refers to temperature sensors in direct contact with the process.

RTD

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

Diameter	Response time	
Mineral-insulated cable, 3 mm (0.12 in)	t ₅₀	2 s
	t ₉₀	5 s
RTD insert StrongSens, 6 mm (¼ in)	t ₅₀	< 3.5 s
	t ₉₀	< 10 s

Thermocouple (TC)

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

Diameter	Response time	
Grounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t ₅₀	0.8 s
	t ₉₀	2 s
Ungrounded thermocouple: 3 mm (0.12 in), 2 mm (0.08 in)	t ₅₀	1 s
	t ₉₀	2.5 s

Calibration

Calibration is a service that can be performed on each individual temperature sensor, either during the multipoint production phase in the factory or after multipoint installation in the plant.

 If calibration is to be performed after the multipoint is installed, please contact the Endress+Hauser service team for support. The manufacturer's service team can assist in organizing all additional activities required for calibration of the intended sensor. Components screwed to the process connection must not be loosened under operating conditions while the process is running.

Calibration involves comparing the measured values of the measuring elements of the multipoint thermometer (unit 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 temperature sensors:

- Calibration at fixed point, e.g. at the freezing point of water at 0 °C (32 °F).
- Calibration by comparison with a precise reference thermometer

** Evaluation**

If calibration with acceptable measurement uncertainty and transferable measurement results is not possible, the manufacturer offers verification measurements (evaluation) as a service, where technically feasible.

12.4 Environment

Ambient temperature range	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 relevant hazardous area approval. Details see Ex documentation.

Storage temperature	Junction box	
	With head transmitter	-40 to +95 °C (-40 to +203 °F)

Relative humidity

Condensation according to IEC 60068-2-14:

Head transmitter: 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
- Terminal blocks: Class B2 according to EN 60654-1

Degree of protection	■ Specification for conduit: IP68 ■ Specification for the junction box: IP66/67
Vibration-resistance and shock-resistance	■ RTD: 3g / 10 to 500 Hz according to IEC 60751 ■ RTD iTHERM StrongSens Pt100 (TF, vibration resistant): Up to 60g ■ TC: 4g / 2 to 150 Hz according to IEC 60068-2-6
Electromagnetic compatibility (EMC)	Depends on the transmitter used. For detailed information see the related Technical Information.

12.5 Process

Agriculture:

To select the appropriate product configuration, the forces acting during loading and unloading as well as the connection to the tank or silo must be known. If a special configuration is required, additional data such as the type of stored material, vessel geometry and connection type are essential for the complete product specification.

Petrochemicals, oil & gas:

To select the appropriate product configuration, process temperature and process pressure must be specified as parameters. If special product features are requested, additional data such as process fluid type, phases, concentration, viscosity, flow, turbulences and corrosion rate are required for the complete product specification.

Process temperature range	0 to +100 °C (+32 to +212 °F).
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Process pressure range	Up to 40 bar (580.1 psi)
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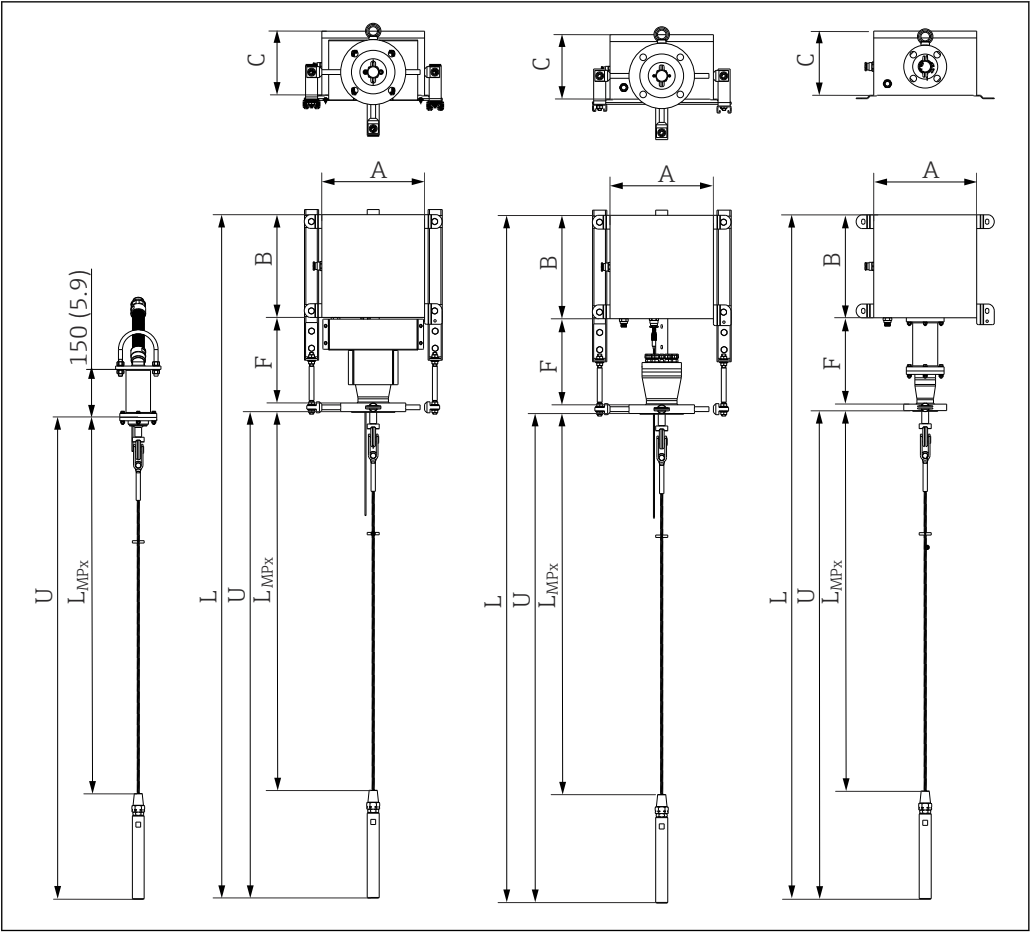
The maximum required process pressure must also be achievable at the maximum permissible process temperature. The maximum operating conditions are defined by the specific pressure ratings of the process connections (e.g. compression fittings and flanges).

Applications:

- Storage of hydrocarbons
- LPG/LNG
- Liquid nitrogen
- Storage of organic bulk materials (grain, corn, etc.)
- Grain silos
- Storage tanks for liquid bulk materials
- Beverage processing

12.6 Mechanical construction

Design, dimensions	The complete rope assembly consists of several components. The articulated connection of the rope ensures that the rope system has sufficient freedom of movement during filling and emptying.. This design ensures that the rope is exposed to only minor mechanical stress, even when lateral forces act on it (no additional tensioning required). For this reason, a lateral deflection of 3 m (9.84 ft) per 10 m (32.81 ft) rope length is recommended. The connection between the temperature sensors and the extension cable is achieved using compression fittings, ensuring the specified degree of protection.
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A0038299

12 Design of the modular multipoint thermometer: with roof hook (left), with mounting frame (center; with cover or open), and with extension neck (right). All dimensions in mm (in)

A, B, Dimensions of the junction box; see following figure.

C

MPx Numbers and distribution of measuring points: MP1, MP2, MP3 etc.

L_{MPx} Immersion length of measuring elements or thermowells

F Neck extension length

L Device length

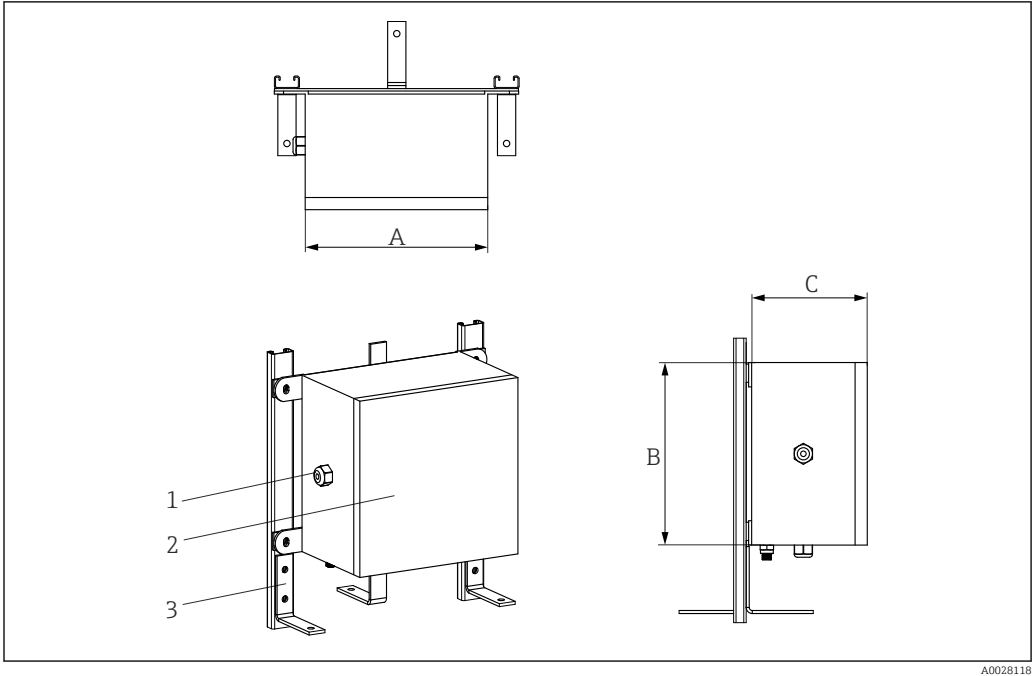
U Immersion length

Neck extension F in mm (in)
Standard 250 (9.84)
Specifically customized neck extensions are available on request.

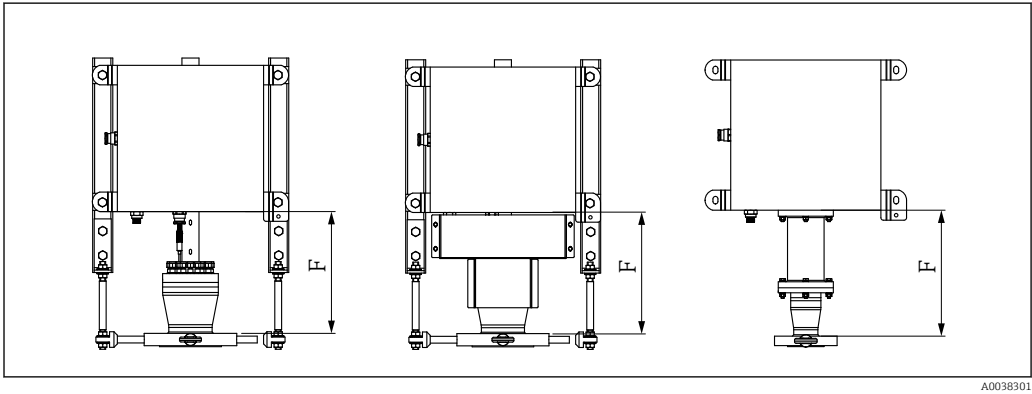
Immersion lengths MPx of measuring elements/thermowells:
Based on customer requirements

Rope maximum load:					
	Rope Ø mm	Construction	Weight kg/m	MBL	
				kN	kg
 A0038300 - Stainless steel AISI 316 - Rope according to EN 10264-4 - Rope grade 1.570 N/mm2	6	1x19	0.1786	29.5	3000
	8	1x19	0.322	53	5400
	10	1x19	0.502	84	8500

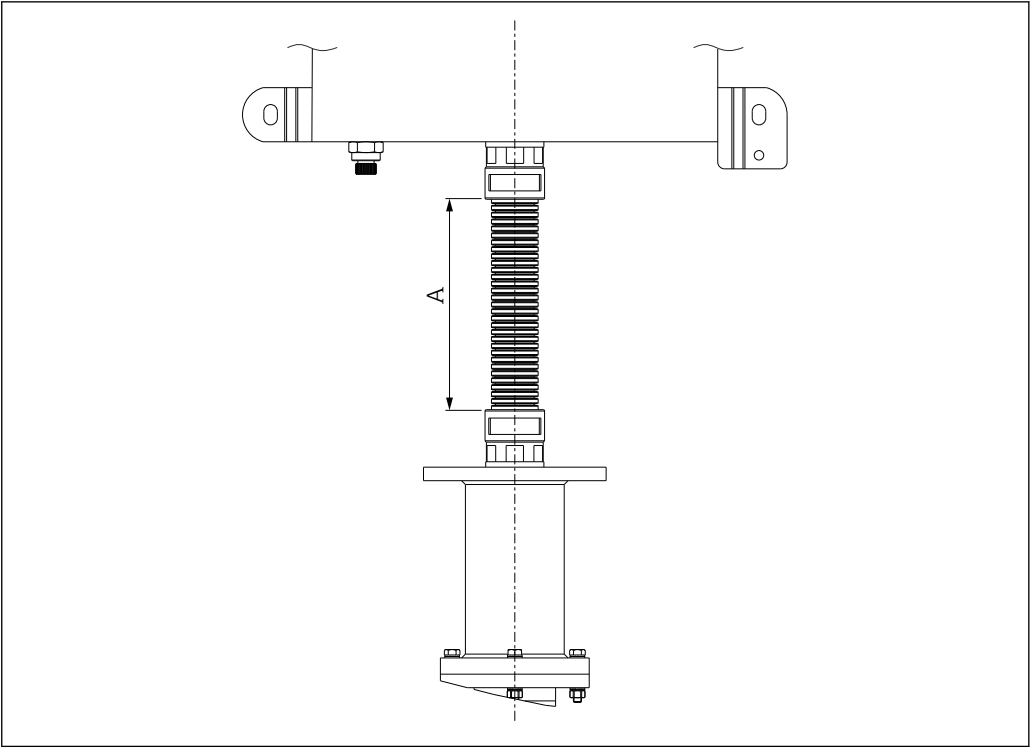
Junction box (directly mounted)



- 1 Cable glands
- 2 Junction box
- 3 Frame



13 Design with open support frame (left), design with support frame with cover (center) and design with neck extension (right)



A0038302

14 Remote junction box, flexible conduit cable length A

The connection box is suitable for environments where chemical substances are used. Resistance to seawater corrosion and to extreme temperature variation stability is ensured. Ex-e Ex-i connections can be installed.

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

		A	B	C
Stainless steel	Min.	260 (10.3)	260 (10.3)	200 (7.9)
	Max.	590 (23.2)	450 (17.7)	215 (8.5)
Aluminum	Min.	203 (8.0)	203 (8.0)	130 (5.1)
	Max.	650 (25.6)	650 (25.6)	270 (10.6)

Type of specification	Junction box	Cable glands
Material	AISI 316/aluminum	NiCr plated brass AISI 316/316L
Degree of protection (IP)	IP66/67	IP66
Ambient temperature range	-50 to +60 °C (-58 to +140 °F)	-52 to +110 °C (-61.1 to +140 °F)
Approvals	ATEX, UL, CSA approval for use in hazardous area IEC	-
Marking	■ ATEX II 2 GD Ex e IIC /Ex ia Ga IIC Ex tb IIIC Db T6/T5/T4 ■ UL913 Class I, Division 1 Groups B, C, D T6/T5/T4 ■ CSA C22.2 No. 157 Class 1, Division 1 Groups B, C, D T6/T5/T4	-

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

		On board	Remote
Type of protection	Intrinsically safe and increased safety	■ With frame ■ Neck extension	Flexible conduit
	Flameproof	With supporting frame	

Neck extension

The neck extension provides the connection between the flange and the junction box. The design was developed to accommodate different installation options and to address potential obstacles and restrictions that are present in all plants. This includes the infrastructure of storage tanks (platforms, load-bearing structures, stairways, etc.) as well as any existing thermal insulation. The neck extension provides a rigid connection for the junction box and is resistant to vibration.

Weight	The weight may vary depending on the configuration and is determined by the dimensions and contents of the junction box, neck extension length, dimensions of the process connection, the number of temperature sensors and the weight at the end of the rope. Approximate weight of a typically configured multipoint rope (number of sensors = 12, flange size = 3", medium size junction box) = 55 kg (121 lb)
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Materials	Refers to the sheath, neck extension, junction box, and all parts in contact with the medium. 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 under negligible compressive load. The maximum operating temperatures may be significantly reduced in
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some cases where abnormal conditions such as high mechanical load or aggressive media are present.

Material name	Short form	Recommended max. continuous operating temperature 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
AISI 316Ti/1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °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

Process connection

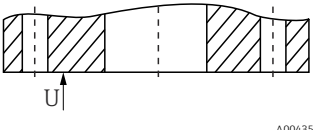
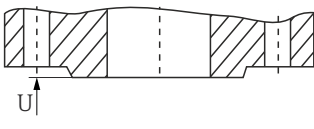


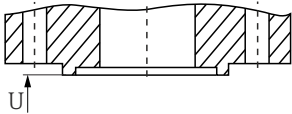
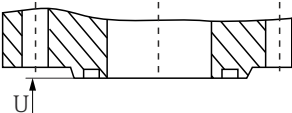
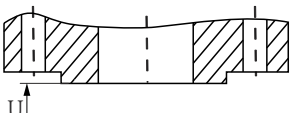
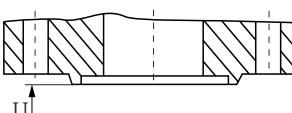
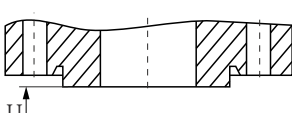
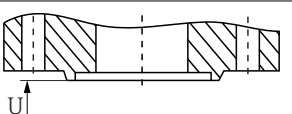
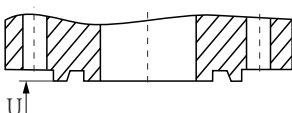
The flanges are supplied in stainless steel AISI 316L with material number 1.4404 or 1.4435. Materials 1.4404 and 1.4435 are classified according to their strength and temperature properties in DIN EN 1092-1, Table 18 under 13EO, and in JIS B2220:2004, Table 5 under 023b. The ASME flanges are classified in ASME B16.5-2013, Table 2-2.2. Inches are converted into metric units (in - mm) using the factor 25.4. In the ASME standard, the metric data is rounded to 0 or 5.

Versions

- EN flanges: European standard DIN EN 1092-1:2002-06 and 2007
- ASME flanges: American Society of Mechanical Engineers ASME B16.5-2013

Geometry of sealing surfaces

Flanges	Sealing surface	DIN 2526 ¹⁾		DIN EN 1092-1			ASME B16.5	
		Form	Rz (µm)	Form	Rz (µm)	Ra (µm)	Form	Ra (µm)
without raised face		A B	- 40 to 160	A ²⁾	12.5 to 50	3.2 to 12.5	Flat face (FF)	3.2 to 6.3 (AARH 125 to 250 µin)
with raised face		C D E	40 to 160 40 16	B1 ³⁾ B2	12.5 to 50 3.2 to 12.5	3.2 to 12.5 0.8 to 3.2	Raised face (RF)	

Flanges	Sealing surface	DIN 2526 ¹⁾		DIN EN 1092-1			ASME B16.5	
		Form	Rz (µm)	Form	Rz (µm)	Ra (µm)	Form	Ra (µm)
Spring	 A0043517	F	-	C	3.2 to 12.5	0.8 to 3.2	Tongue (T)	3.2
Groove	 A0043518	N		D			Groove (G)	
Projection	 A0043519	V 13	-	E	12.5 to 50	3.2 to 12.5	Male (M)	3.2
Recess	 A0043520	R 13		F			Female (F)	
Projection	 A0043521	V 14	for O-rings	H	3.2 to 12.5	3.2 to 12.5	-	-
Recess	 A0043522	R 14		G			-	-
With ring-type joint	 A0052680	-	-	-	-	-	Ring-type joint (RTJ)	1.6

- 1) Contained in DIN 2527
- 2) Typically PN2.5 to PN40
- 3) Typically from PN63

Flanges according to the old DIN standard are compatible with the new DIN EN 1092-1 standard. Change in pressure ratings: Old DIN standards PN64 → DIN EN 1092-1 PN63.

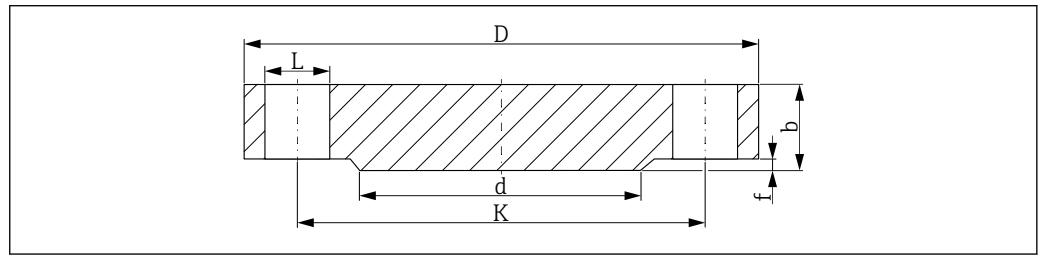
Height of raised face ¹⁾

Standard	Flanges	Height of raised face f	Tolerance
DIN EN 1092-1:2002-06	all types	2 (0.08)	0 -1 (-0.04)
DIN EN 1092-1:2007	≤ DN 32		
	> DN 32 to DN 250	3 (0.12)	0 -2 (-0.08)
	> DN 250 to DN 500	4 (0.16)	0 -3 (-0.12)
	> DN 500	5 (0.19)	0 -4 (-0.16)
ASME B16.5 - 2013	≤ Class 300	1.6 (0.06)	±0.75 (±0.03)

Standard	Flanges	Height of raised face f	Tolerance
	≥ Class 600	6.4 (0.25)	0.5 (0.02)
JIS B2220:2004	< DN 20	1.5 (0.06) 0	-
	> DN 20 to DN 50	2 (0.08) 0	
	> DN 50	3 (0.12) 0	

1) Dimensions in mm (in)

EN flanges (DIN EN 1092-1)



A0029176

15 Raised face B1

L Bore diameter
d Diameter of raised face
K Diameter of pitch circle
D Flange diameter
b Total flange thickness
f Height of raised face (generally 2 mm (0.08 in))

PN16¹⁾

DN	D	b	K	d	L	approx. kg (lbs)
25	115 (4.53)	18 (0.71)	85 (3.35)	68 (2.68)	4xØ14 (0.55)	1.50 (3.31)
32	140 (5.51)	18 (0.71)	100 (3.94)	78 (3.07)	4xØ18 (0.71)	2.00 (4.41)
40	150 (5.91)	18 (0.71)	110 (4.33)	88 (3.46)	4xØ18 (0.71)	2.50 (5.51)
50	165 (6.5)	18 (0.71)	125 (4.92)	102 (4.02)	4xØ18 (0.71)	2.90 (6.39)
65	185 (7.28)	18 (0.71)	145 (5.71)	122 (4.80)	8xØ18 (0.71)	3.50 (7.72)
80	200 (7.87)	20 (0.79)	160 (6.30)	138 (5.43)	8xØ18 (0.71)	4.50 (9.92)
100	220 (8.66)	20 (0.79)	180 (7.09)	158 (6.22)	8xØ18 (0.71)	5.50 (12.13)
125	250 (9.84)	22 (0.87)	210 (8.27)	188 (7.40)	8xØ18 (0.71)	8.00 (17.64)
150	285 (11.2)	22 (0.87)	240 (9.45)	212 (8.35)	8xØ22 (0.87)	10.5 (23.15)
200	340 (13.4)	24 (0.94)	295 (11.6)	268 (10.6)	12xØ22 (0.87)	16.5 (36.38)
250	405 (15.9)	26 (1.02)	355 (14.0)	320 (12.6)	12xØ26 (1.02)	25.0 (55.13)
300	460 (18.1)	28 (1.10)	410 (16.1)	378 (14.9)	12xØ26 (1.02)	35.0 (77.18)

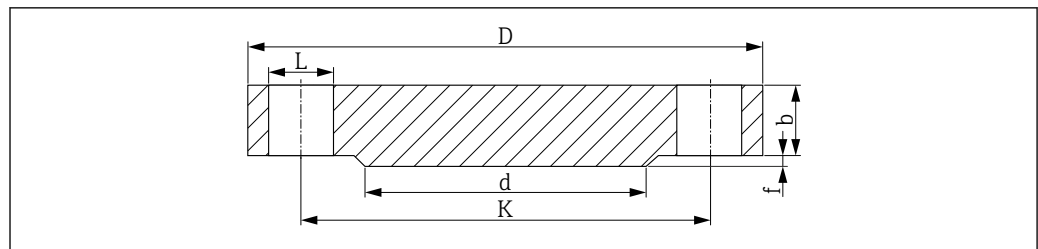
1) The dimensions in the following tables are in mm (in), unless otherwise specified

PN40

DN	D	b	K	d	L	approx. kg (lbs)
15	95 (3.74)	16 (0.55)	65 (2.56)	45 (1.77)	4xØ14 (0.55)	0.81 (1.8)
25	115 (4.53)	18 (0.71)	85 (3.35)	68 (2.68)	4xØ14 (0.55)	1.50 (3.31)

DN	D	b	K	d	L	approx. kg (lbs)
32	140 (5.51)	18 (0.71)	100 (3.94)	78 (3.07)	4xØ18 (0.71)	2.00 (4.41)
40	150 (5.91)	18 (0.71)	110 (4.33)	88 (3.46)	4xØ18 (0.71)	2.50 (5.51)
50	165 (6.5)	20 (0.79)	125 (4.92)	102 (4.02)	4xØ18 (0.71)	3.00 (6.62)
65	185 (7.28)	22 (0.87)	145 (5.71)	122 (4.80)	8xØ18 (0.71)	4.50 (9.92)
80	200 (7.87)	24 (0.94)	160 (6.30)	138 (5.43)	8xØ18 (0.71)	5.50 (12.13)
100	235 (9.25)	24 (0.94)	190 (7.48)	162 (6.38)	8xØ22 (0.87)	7.50 (16.54)
125	270 (10.6)	26 (1.02)	220 (8.66)	188 (7.40)	8xØ26 (1.02)	11.0 (24.26)
150	300 (11.8)	28 (1.10)	250 (9.84)	218 (8.58)	8xØ26 (1.02)	14.5 (31.97)
200	375 (14.8)	36 (1.42)	320 (12.6)	285 (11.2)	12xØ30 (1.18)	29.0 (63.95)
250	450 (17.7)	38 (1.50)	385 (15.2)	345 (13.6)	12xØ33 (1.30)	44.5 (98.12)
300	515 (20.3)	42 (1.65)	450 (17.7)	410 (16.1)	16xØ33 (1.30)	64.0 (141.1)

ASME flanges (ASME B16.5-2013)



A0029175

16 Raised face RF

L Bore diameter

d Diameter of raised face

K Diameter of pitch circle

D Flange diameter

b Total flange thickness

f Height of raised face, Class 150/300: 1.6 mm (0.06 in) or from Class 600: 6.4 mm (0.25 in)

Surface quality of sealing surface $R_a \leq 3.2$ to $6.3 \mu\text{m}$ (126 to 248 μin).

Class 150¹⁾

DN	D	b	K	d	L	approx. kg (lbs)
1"	108.0 (4.25)	14.2 (0.56)	79.2 (3.12)	50.8 (2.00)	4xØ15.7 (0.62)	0.86 (1.9)
1¼"	117.3 (4.62)	15.7 (0.62)	88.9 (3.50)	63.5 (2.50)	4xØ15.7 (0.62)	1.17 (2.58)
1½"	127.0 (5.00)	17.5 (0.69)	98.6 (3.88)	73.2 (2.88)	4xØ15.7 (0.62)	1.53 (3.37)
2"	152.4 (6.00)	19.1 (0.75)	120.7 (4.75)	91.9 (3.62)	4xØ19.1 (0.75)	2.42 (5.34)
2½"	177.8 (7.00)	22.4 (0.88)	139.7 (5.50)	104.6 (4.12)	4xØ19.1 (0.75)	3.94 (8.69)
3"	190.5 (7.50)	23.9 (0.94)	152.4 (6.00)	127.0 (5.00)	4xØ19.1 (0.75)	4.93 (10.87)
3½"	215.9 (8.50)	23.9 (0.94)	177.8 (7.00)	139.7 (5.50)	8xØ19.1 (0.75)	6.17 (13.60)
4"	228.6 (9.00)	23.9 (0.94)	190.5 (7.50)	157.2 (6.19)	8xØ19.1 (0.75)	7.00 (15.44)
5"	254.0 (10.0)	23.9 (0.94)	215.9 (8.50)	185.7 (7.31)	8xØ22.4 (0.88)	8.63 (19.03)
6"	279.4 (11.0)	25.4 (1.00)	241.3 (9.50)	215.9 (8.50)	8xØ22.4 (0.88)	11.3 (24.92)
8"	342.9 (13.5)	28.4 (1.12)	298.5 (11.8)	269.7 (10.6)	8xØ22.4 (0.88)	19.6 (43.22)
10"	406.4 (16.0)	30.2 (1.19)	362.0 (14.3)	323.8 (12.7)	12xØ25.4 (1.00)	28.8 (63.50)

1) The dimensions in the following tables are in mm (in), unless otherwise specified.

Class 300

DN	D	b	K	d	L	approx. kg (lbs)
1"	124.0 (4.88)	17.5 (0.69)	88.9 (3.50)	50.8 (2.00)	4xØ19.1 (0.75)	1.39 (3.06)
1¼"	133.4 (5.25)	19.1 (0.75)	98.6 (3.88)	63.5 (2.50)	4xØ19.1 (0.75)	1.79 (3.95)
1½"	155.4 (6.12)	20.6 (0.81)	114.3 (4.50)	73.2 (2.88)	4xØ22.4 (0.88)	2.66 (5.87)
2"	165.1 (6.50)	22.4 (0.88)	127.0 (5.00)	91.9 (3.62)	8xØ19.1 (0.75)	3.18 (7.01)
2½"	190.5 (7.50)	25.4 (1.00)	149.4 (5.88)	104.6 (4.12)	8xØ22.4 (0.88)	4.85 (10.69)
3"	209.5 (8.25)	28.4 (1.12)	168.1 (6.62)	127.0 (5.00)	8xØ22.4 (0.88)	6.81 (15.02)
3½"	228.6 (9.00)	30.2 (1.19)	184.2 (7.25)	139.7 (5.50)	8xØ22.4 (0.88)	8.71 (19.21)
4"	254.0 (10.0)	31.8 (1.25)	200.2 (7.88)	157.2 (6.19)	8xØ22.4 (0.88)	11.5 (25.36)
5"	279.4 (11.0)	35.1 (1.38)	235.0 (9.25)	185.7 (7.31)	8xØ22.4 (0.88)	15.6 (34.4)
6"	317.5 (12.5)	36.6 (1.44)	269.7 (10.6)	215.9 (8.50)	12xØ22.4 (0.88)	20.9 (46.08)
8"	381.0 (15.0)	41.1 (1.62)	330.2 (13.0)	269.7 (10.6)	12xØ25.4 (1.00)	34.3 (75.63)
10"	444.5 (17.5)	47.8 (1.88)	387.4 (15.3)	323.8 (12.7)	16xØ28.4 (1.12)	53.3 (117.5)

12.7 Operability

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

12.8 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**.

12.9 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

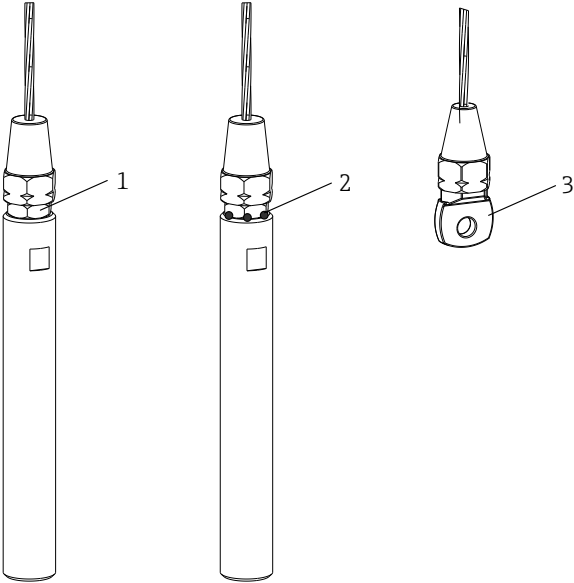
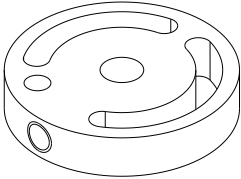
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output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

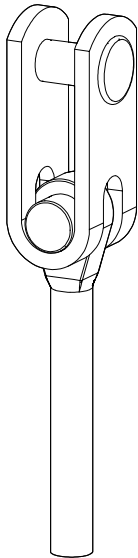
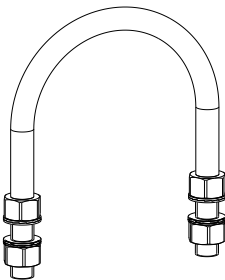
12.10 Accessories

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**.

Device-specific accessories

Accessories	Description
Anchor weight  A0038304	Installing an anchor weight ensures that the rope is positioned vertically and runs straight. Ensure that there is sufficient space in the storage tank to position the weight correctly. The dimensions are specified during ordering according to the dimensions of the multipoint cable. ■ 1: Removable/replaceable via thread connection ■ 2: Permanently attached by spot welding ■ 3: Not applicable
Positioning guides  A0038305	The multipoint rope is equipped with positioning guides. They ensure that the sensor element is correctly positioned along the entire length of the cable and remains in position under operating conditions.

Accessories	Description
Swivel clamp  A0038306	Joint connection between the rope and the flange to allow relative rotation.
 A0055454	Tool for suspending the multipoint probe inside silos or any other supporting structures.

Communication-specific accessories

Netilion

With the Netilion IIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

 www.netilion.endress.com

DeviceCare SFE100

DeviceCare is an Endress+Hauser configuration tool for field devices using the following communication protocols: HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, IO/Link, Modbus, CDI and Endress+Hauser Common Data Interfaces.

 Technical Information TI01134S
www.endress.com/sfe100

FieldCare SFE500

FieldCare is a configuration tool for Endress+Hauser and third-party field devices based on DTM technology. The following communication protocols are supported: HART, WirelessHART, PROFIBUS, FOUNDATION Fieldbus, Modbus, IO-Link, EtherNet/IP, PROFINET and PROFINET APL.

 Technical Information TI00028S
www.endress.com/sfe500

System products

Data Manager of the RSG product family

Data Managers are flexible and powerful systems to organize process values. Up to 20 universal inputs and up to 14 digital inputs for direct connection of sensors, optionally with HART, are available as an option. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. The values can be forwarded via common communication protocols to higher-level systems and connected to one another via individual plant modules.

For more information, please refer to: www.endress.com

RN series active barrier

Single- or two-channel active barrier for safe separation of 0/4 to -20 mA standard signal circuits with bidirectional HART transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively.

For more information, please refer to: www.endress.com



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www.addresses.endress.com
