

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 mounting, 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: <ul style="list-style-type: none"> ▪ Interior ground terminal: potential equalization 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 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.

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 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 messages 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 beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- ▶ Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- ▶ Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- ▶ Following the instructions in these Operating Instructions

2.2 Designated use

The product is intended to measure the temperature profile inside a tank, a silo or any storage system, through RTD or thermocouple technologies.

The manufacturer is not liable for damage 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 allowable pressure inside the storage vessel.
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 sensing elements are fixed to the internals.
Stored material	Dimensions and choice of materials minimize: distributed and localized corrosion.
Fatigue	Cyclic loads during operations have been taken into consideration.
Vibrations	During normal operation the multipoint is not subjected to vibration phenomena. In case of external vibration induced by other equipment near the multipoint, the rope system is able to compensate for them.

Condition	Description
Mechanical stress	The maximum stress on the measuring device is guaranteed to stay below the yielding stress of the material, for every working condition.
External environment	The junction box (with and without head transmitters), wires, cable glands and other fittings have 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

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 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 Equipment architecture

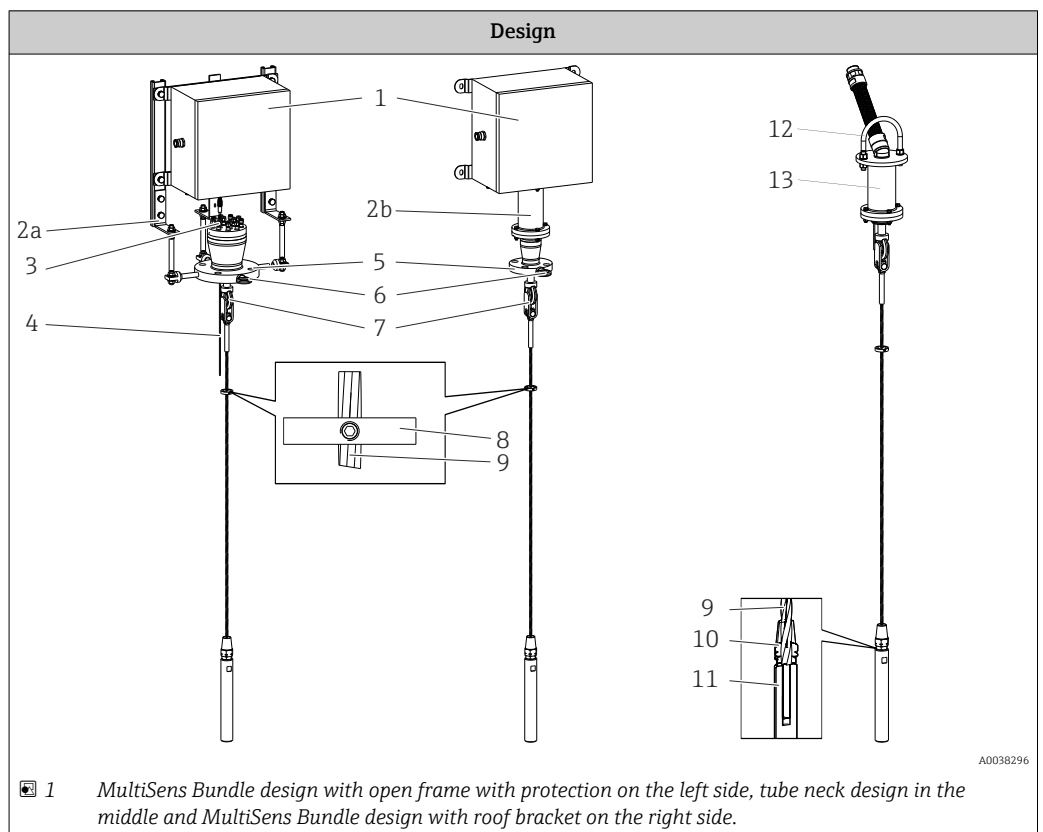
The multipoint thermometer belongs to a range of modular product configuration for multipoint temperature detection with a design where subassemblies and components can be managed individually for easy maintenance and spare part ordering.

The temperature probe-only version consists of many sub-assemblies:

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

In general the instrument measures the temperature profile inside the process environment by means of many sensors wrapped around a rope, jointed to a suitable process connection which ensures the right tightness level.

Output communication protocols available are: Analog output 4 to 20 mA, HART®, PROFIBUS® PA, FOUNDATION Fieldbus™. In case of Memograph M RSG45: Ethernet TCP/IP, Modbus (TCP) USB-B (webserver, 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). Externally the extension cables are wired into the junction box, which can be directly mounted or remotely as an option.




Description and available options	
1: Head	Hinged cover junction box for electrical connections. It includes components such as electrical terminals, transmitters and cable glands. <ul style="list-style-type: none"> ■ 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: Tube neck	Modular tube frame support adjustable for all available junction boxes. 316/316L
3: Compression fitting	High reliability for tightness between process and external environment, for a wide range of process fluids concentration and severe combination between temperature and pressure. 316L
4: Temperature sensor	Thermocouple grounded and ungrounded execution or RTD (Pt100 wire wound).
5: Process connection	Represented by a flange according to international standards or engineered to satisfy specific process requirements.
6: Eyebolt	Lifting device for easy handling during installation phase. 316
7: Toggle joint	Connection between the rope and the process connection. 316
8: Ogives	Insert guide for the correct positioning of the measuring sensing element. 316/316L
9: Rope	Metallic rope 316
10: Swage thread	Swageless threaded end connection. 316
11: Weight	Weight to maintain the rope pretensioned and in a straight position during working condition (i.e. tank filling). 316/316L
12: U-bolt	Hanging device to connect the multipoint to the silo roof. Material A4 according to DIN ISO 3506
13: Neck	Tube extension for multipoint hanging. 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 Wetzler 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 Mounting

5.1 Mounting requirements

⚠ WARNING

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

- ▶ Make sure only qualified personnel perform the installation.

⚠ WARNING

Explosions could result in serious or fatal injury

- ▶ Do not remove the junction box cover in explosive atmospheres when the circuit is live.
- ▶ 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 incandive 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 serious or fatal 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 →  37
- ▶ While installing the measurement system, avoid any friction during installation, specifically avoid sparks generation.
- ▶ Make sure that the load of the stored material (like grain, clinker, pellet, etc.) does not lead to deformation or stress to the probes or welds (if the probe is fixed on internals).

5.2 Mounting the device

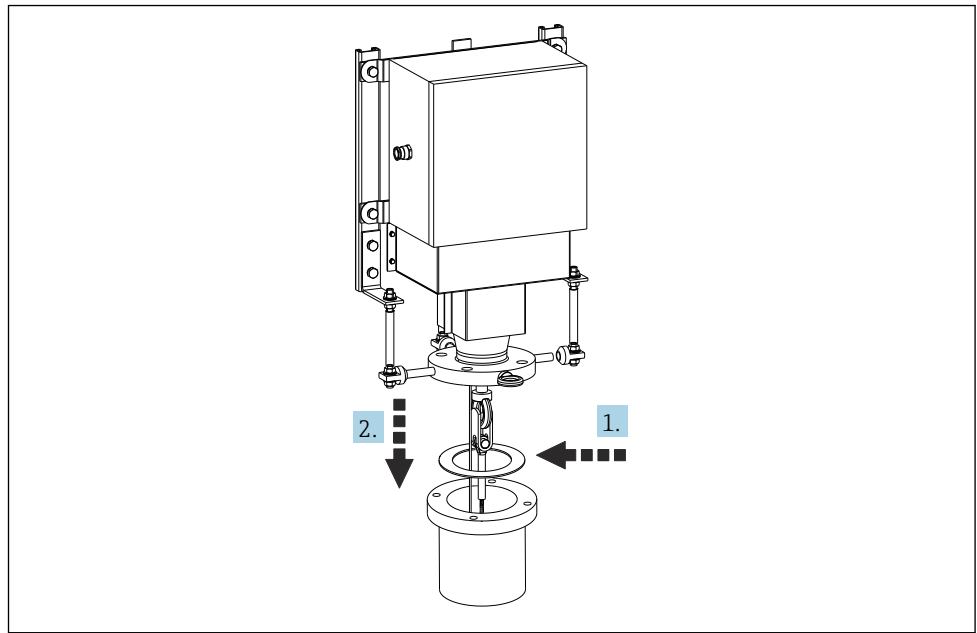
The bundle rope thermometer is packed in a coil setup for a simple and compact transportation. It is recommended to keep it in its coiled configuration until the thermometer is close to the storage connection; a long and straight vertical rope would result in a more difficult lifting and installing operations.

5.2.1 Junction box directly mounted on board

The following instructions must be followed for the proper installation of the device (please note that this applies to “Open supporting frame”, “Supporting frame with covers” and “Tube neck” version).

Assembly sequence

1.



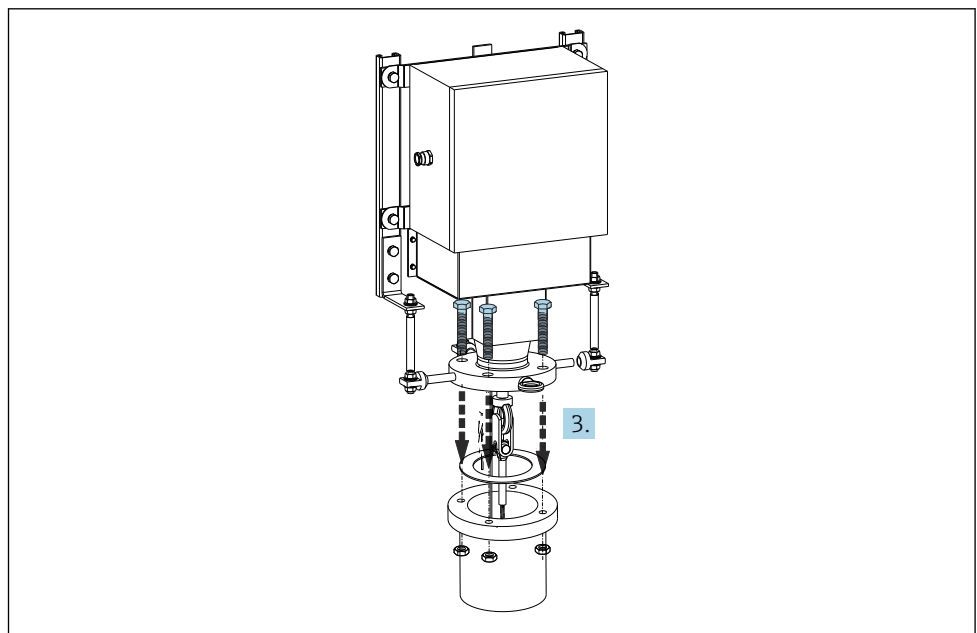
A0038308

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

2.

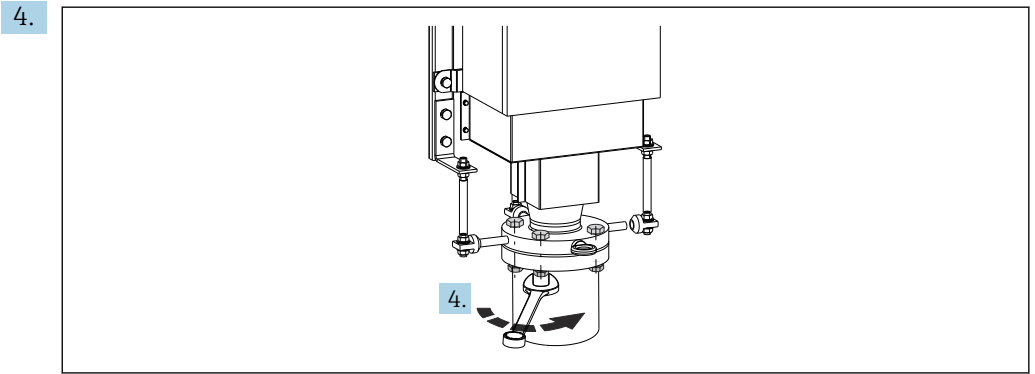
Bring the device to the nozzle, inserting the thermoelements bundle rope through the nozzle, avoiding interlacing and deformation of the thermoelement probes and twisting of the rope system as well.

3.



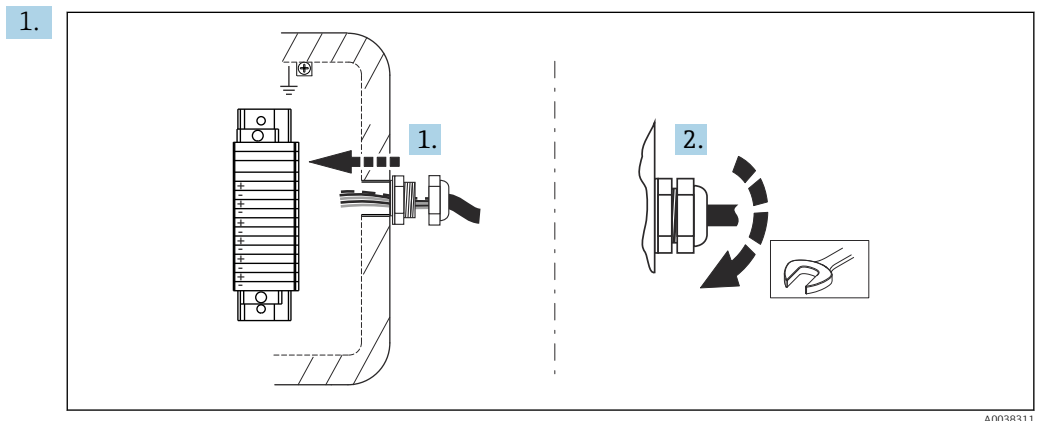
A0038309

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.



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).

Wiring sequence (Connection customer side)




In case of direct wiring, introduce completely the extension or compensating cables through the respective cable glands in the junction box.

2. Tighten the cable glands on the junction box.
3. After having opened the cover of the junction box, connect the compensating cables to the terminals of the junction box following the wiring instruction provided, ensuring the right matching between the cable tag numbers and the terminals tag numbers.
4. Close the cover ensuring the right gasket position to avoid any impact on the IP degree of protection.
5. In case of using the supporting frame with covers, check if all its components are still coupled properly one each other.

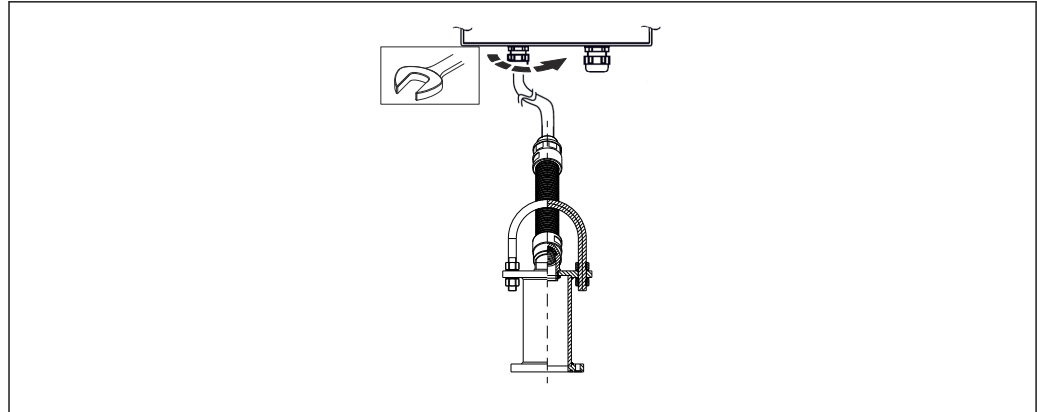
5.2.2 Junction box remote connection

Junction box not supplied. Assembly sequence

Please refer to →  14 for a correct assemble process.

Conduit connection

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



Wiring sequence (connection customer side)

Please refer to → [15](#) for a correct wiring sequence.

Junction box supplied but not connected to the multipoint. Assembly sequence

Before any assemble and wiring operation, please make sure to fix the junction box to a stable metallic support according to your needs and in a place easy to access.

Please refer to → [14](#) for a correct assemble process.

Conduit connection

Please refer to → [15](#) for a correct assemble process.

Wiring sequence (connection customer side)

Please refer to → [15](#) and → [22](#) for a correct wiring sequence.

Junction box supplied and connected to the multipoint.

Assembly sequence

Before any assemble and wiring operation, please make sure to fix the junction box to a stable metallic support according to your needs and in a place easy to access.

Please refer to paragraph 5.2.1.1 for a correct assemble process.

Wiring sequence (connection customer side)

Please refer to paragraph 5.2.1.1 for a correct assemble process.

NOTICE

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

- ▶ Check the tightness of the threaded connections. If any part is loosened, tight it applying the proper torque.
- ▶ Check the proper straight tensioning of the rope bundle to avoid any inconvenient bending which may result in an improper positioning of the thermoelements inside the storage system.
- ▶ Check the proper positioning of the weight at the rope.
- ▶ Check the proper connection of the swage eye to the selected anchor point inside the vessel (no weight version).
- ▶ Check for correct wiring, test the electrical continuity of the sensors (by warming up the tip, 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)?	<input type="checkbox"/>
Do the ambient conditions match the device specification? For example: <ul style="list-style-type: none"> ▪ Ambient temperature ▪ Proper conditions 	<input type="checkbox"/>
Are the threaded components undeformed?	<input type="checkbox"/>
Are the gaskets not permanently deformed?	<input type="checkbox"/>
Installation	
Is the equipment aligned with the nozzle axis?	<input type="checkbox"/>
Are the gasket seats of flanges clean?	<input type="checkbox"/>
Is the coupling between the flange and its counter flange reached?	<input type="checkbox"/>
Are the thermoelements not interlaced, undeformed or twisted?	<input type="checkbox"/>
Is the rope bundle in a proper straight tensioned configuration with no twisting or wrapping?	<input type="checkbox"/>
Is the toggle joint connected properly to the flange eyebolt?	<input type="checkbox"/>
Are the bolts completely inserted in the flange? Make sure the flange is completely attached to the nozzle?	<input type="checkbox"/>
Are the cable glands tightened on the extension cables?	<input type="checkbox"/>
Are the extension cables connected to the junction box terminals?	<input type="checkbox"/>

6 Electrical connection




CAUTION

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

- ▶ Switch off power supply before installing or connecting the device.
- ▶ When installing Ex-approved 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 manuals of 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 →  18
5. On completion of the wiring, screw the screw terminals tight. Tighten the cable glands again. In doing so, also pay particular attention to →  24. Close the housing cover again.
6. In order to avoid connection errors always take note of the hints given in the post connection check! →  24

NOTICE

- ▶ The unit must only be powered by a power supply that operates using an energy-limited electric circuit that is compliant with IEC 61010-1, "SELV or Class 2 circuit".


6.1 Connecting the device

Terminal assignment

NOTICE

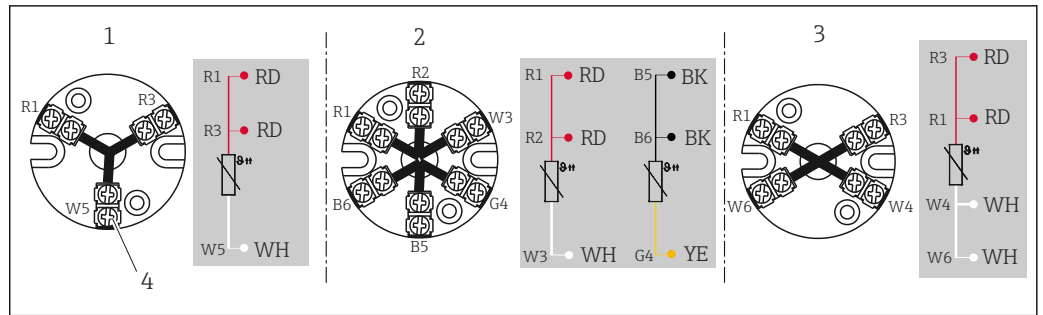
Destruction or malfunction of parts of the electronics through ESD - electrostatic discharge.

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

 To avoid incorrect measuring values an extension or compensation cable for direct wiring of thermocouple and RTD sensors for the signal transmission has to be used. The polarity indication on the respective terminal block and the wiring scheme has to be observed.

The planning and the installation of the bus connection cables of the plant is not to be concerned of the manufacturer of the device. Therefore the manufacturer cannot be considered to be responsible for possible damages due to the choice of materials that are not suitable for that application or to a faulty installation.

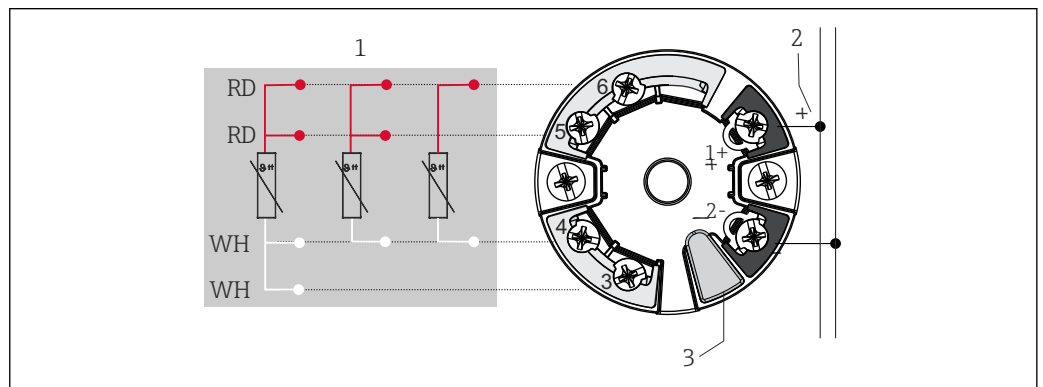
6.2 RTD sensor connection type



A0045453

2 Mounted terminal block

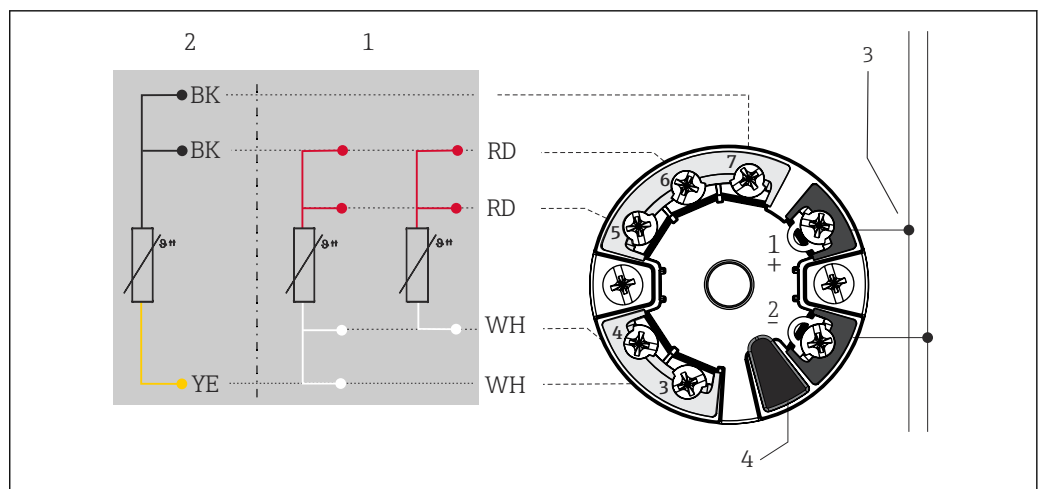
- 1 3-wire, single
- 2 2 x 3-wire, single
- 3 4-wire, single
- 4 Outside screw



A0045464

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

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

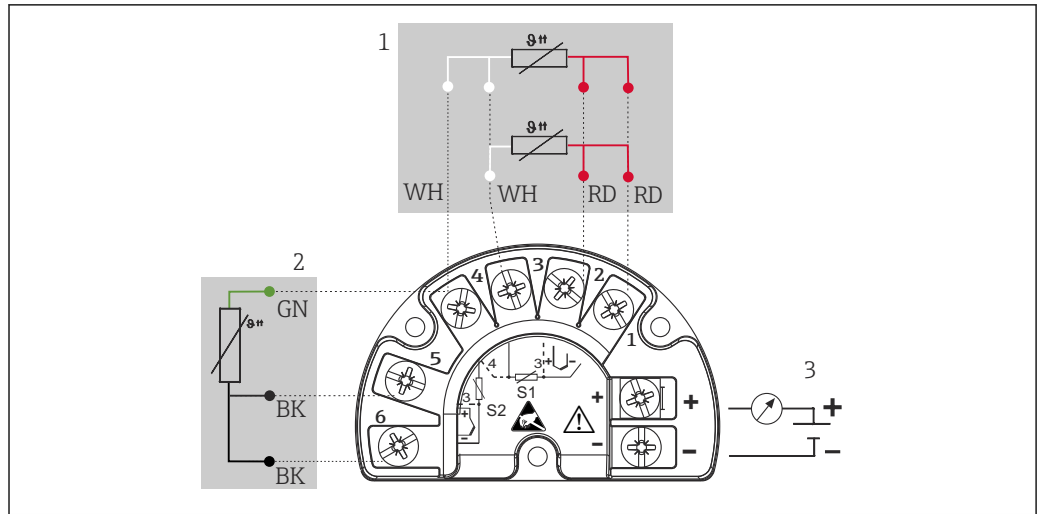


A0045466

4 Head mounted transmitter iTEMP TMT8x (dual 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

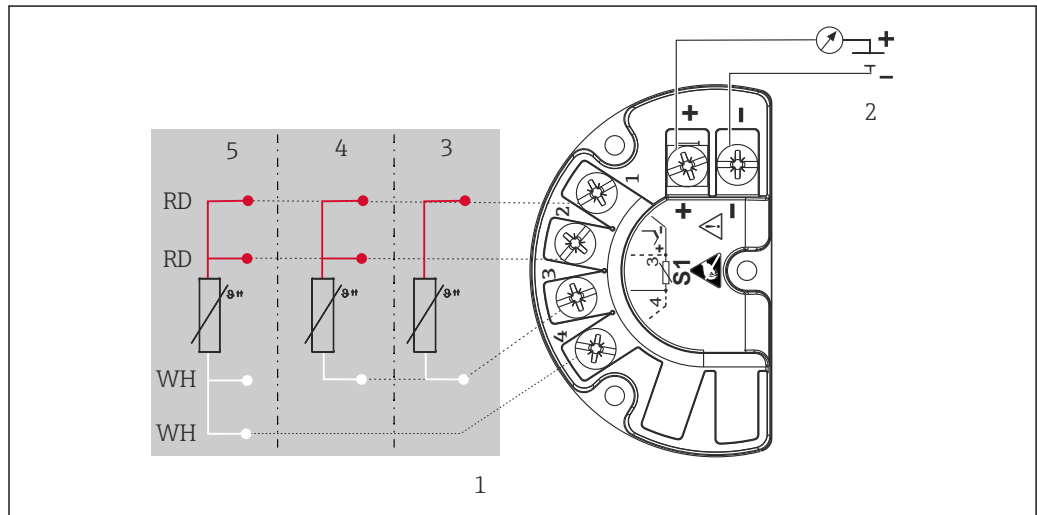
Mounted field transmitter: Fitted with screw terminals



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

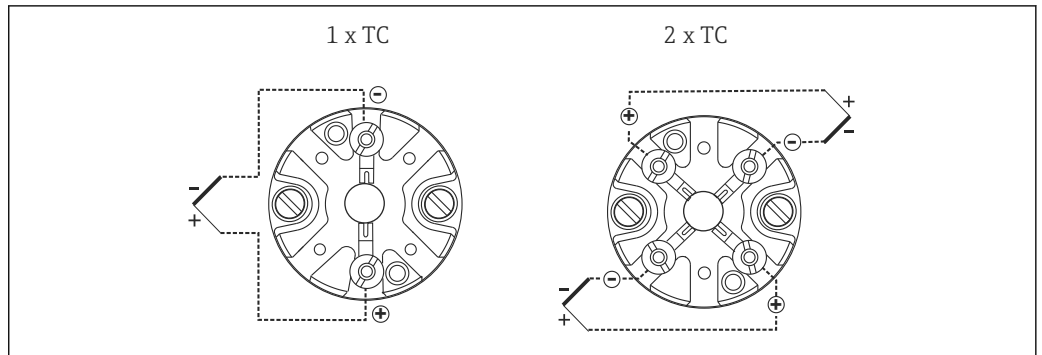


A0045733

6 iTEMP TMT142B (single 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



A0012700

7 Mounted terminal block

<p>Head mounted transmitter iTEMP TMT8x (dual sensor input) ¹⁾</p> <p>1 Sensor input 1 2 Sensor input 2 3 Fieldbus communication and power supply 4 Display connection</p>	
<p>Head mounted transmitter iTEMP TMT7x (single input) ¹⁾</p> <p>1 Sensor input TC, mV 2 Power supply, bus connection 3 Display connection/CDI interface</p>	<p>Mounted field transmitter iTEMP TMT162 or iTEMP TMT142B</p> <p>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</p>

A0045474

A0045353

A0045636

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

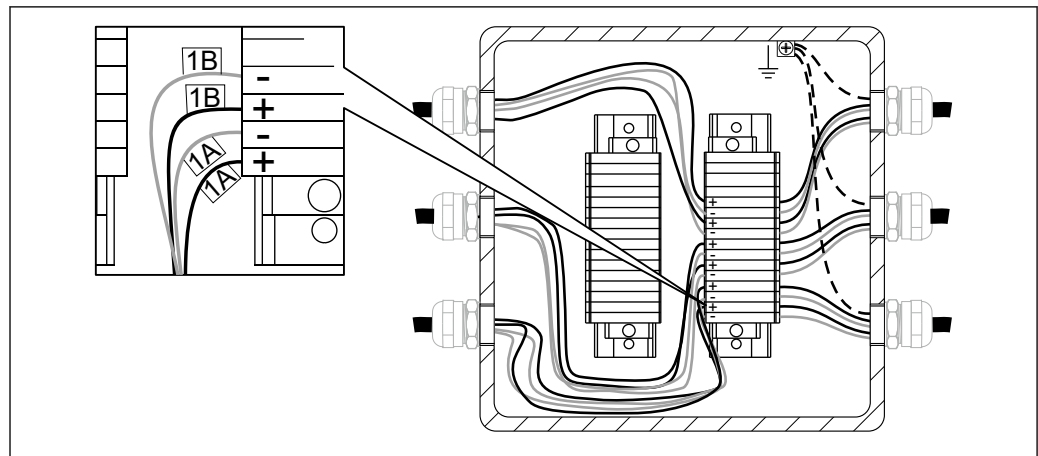
Thermocouple wire colors

As per IEC 60584	As per ASTM E230
<ul style="list-style-type: none"> ■ Type J: black (+), white (-) ■ Type K: green (+), white (-) ■ Type N: pink (+), white (-) ■ Type T: brown (+), white (-) 	<ul style="list-style-type: none"> ■ Type J: white (+), red (-) ■ Type K: yellow (+), red (-) ■ Type N: orange (+), red (-) ■ Type T: blue (+), red (-)

6.4 Connecting the sensor cables

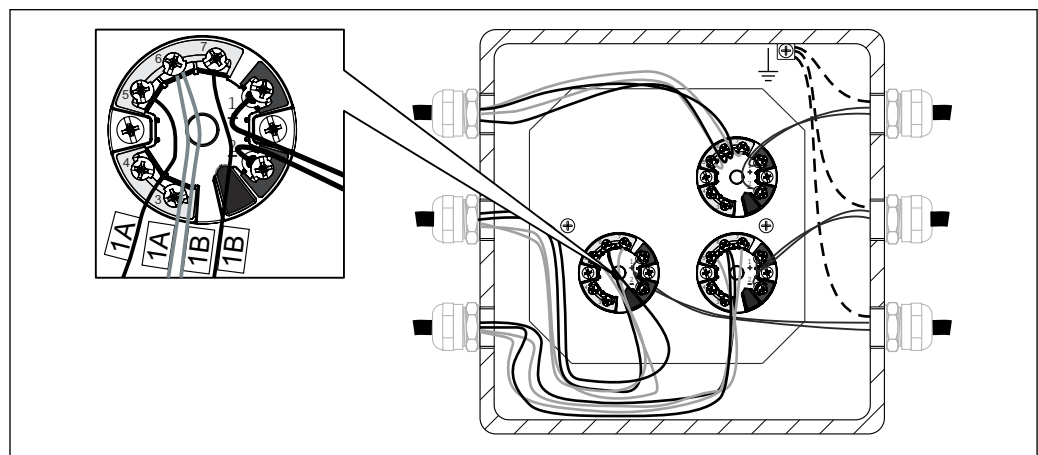
i Each sensor is marked with an individual TAG number. As default configuration, all wires are always connected to the installed transmitters or terminals and generally checked in house before final shipment. In case of remote junction box it might be that the following steps have to be executed for the multipoint side as well.

The wiring is done in consecutive order, which 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.



A0033288

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



A0033289

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

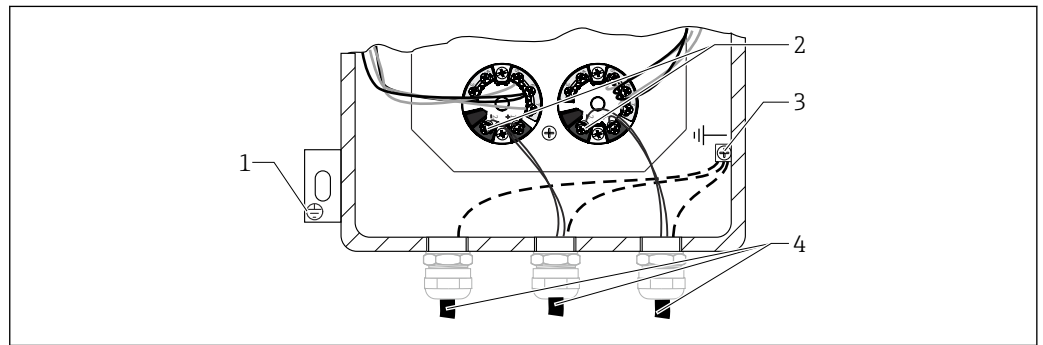
Sensor type	Transmitter type	Wiring rule
1 x RTD or TC	<ul style="list-style-type: none"> ▪ Single input (one channel) ▪ Double input (two channel) ▪ Multi-channel input (8 channel) 	<ul style="list-style-type: none"> ▪ 1 Head transmitter per insert ▪ 1 Head transmitter for 2 inserts ▪ 1 Multi-channel transmitter for 8 inserts
2 x RTD or TC	<ul style="list-style-type: none"> ▪ Single input (one channel) ▪ Double input (two channel) ▪ Multi-channel input (8 channel) 	<ul style="list-style-type: none"> ▪ Not available, wiring excluded ▪ 1 Head transmitter per insert ▪ 1 Multi-channel transmitter for 4 inserts


6.5 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 mm² (14 AWG) for screw terminals
 - Max 1.5 mm² (16 AWG) for spring terminals


Always observe the general procedure on →  18.



 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

6.6 Shielding and grounding

 For any specific electrical shielding and grounding regarding the transmitter wiring please refer to the appropriate operating manual 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.

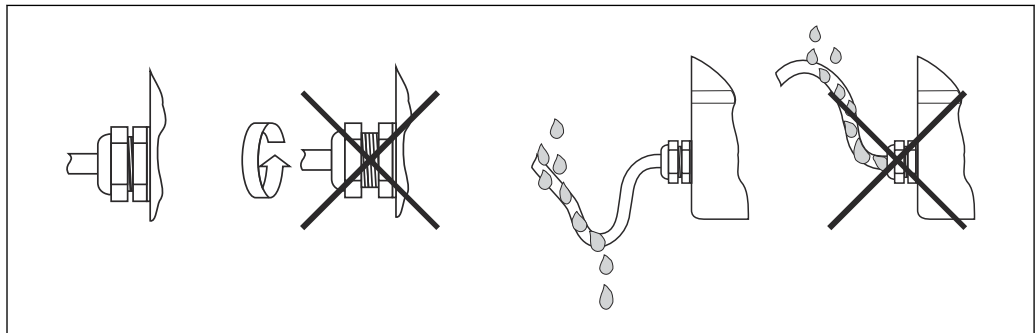
- ▶ In such cases the shielding of the signal cable is to be grounded on only one side, i.e. it must not be connected to the ground terminal of the housing (terminal head, field housing). The shield that is not connected should be insulated!

6.7 Ensuring the degree of protection

The device components can comply with requirements up to the IP 68 degree of protection.

The following points must be taken into account to ensure that the degree of protection is met: →  11,  24


- 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 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.



A0011260

 11 Connection hints to maintain IP protection

6.8 Post-connection check

Is the device undamaged (internal equipment inspection)?	<input type="checkbox"/>
Electrical connection	
Does the supply voltage match the specifications on the nameplate?	<input type="checkbox"/>
Do the cables have adequate strain relief?	<input type="checkbox"/>
Are the power supply and signal cables correctly connected? →  18	<input type="checkbox"/>
Are all the screw terminals well tightened and have the connections of the spring terminals been checked?	<input type="checkbox"/>
Are all the cable glands installed, tightened and sealed?	<input type="checkbox"/>
Are all the housing covers installed and tightened?	<input type="checkbox"/>
Does the marking of the terminals and cables match?	<input type="checkbox"/>
Is the electrical continuity of the thermocouple verified?	<input type="checkbox"/>

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 solid or fluid is being measured (observe safety data sheet).
- Be aware of the temperature 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 storage system when disconnecting inputs/outputs or when simulating signals.
- Ensure our tools, equipment and the customer storage area 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

Always start troubleshooting with the checklists below if faults occur after start up or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

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' →  28.
- ▶ It is always important to check the connection between the cables and terminals, in order to guarantee the proper strain relief to the cables, and the tightening and the sealing of the screw terminals.

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

- Follow the checklist in section 'Post-mounting check' →  17
- Follow the checklist in section 'Post-connection check' →  24

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

9 Repair

9.1 General notes

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

9.2 Spare parts



For spare parts currently available for the product, see online at:
<https://www.endress.com/deviceviewer> (→ Enter serial number)

9.3 Endress+Hauser services

Service	Description
Certifications	Endress+Hauser is able to fulfill requirements belonging to the design, product manufacturing, tests and commissioning according to specific approvals by handling or supplying individual certified components and by checking the integration on the whole system.
Maintenance	All Endress+Hauser systems are designed for an easy maintenance due to a modular design, allowing the replacement of old or wear out parts. Standardized parts ensure fast reaction for 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 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: <ul style="list-style-type: none"> ▪ Dye penetration 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 ▪ X-ray test according to ASME V art. 2, art. 22 and ISO 17363-1 (requirements and methods) and ASME VIII div. 1 and to ISO 5817 (acceptance criteria). Thickness up to 30 mm

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



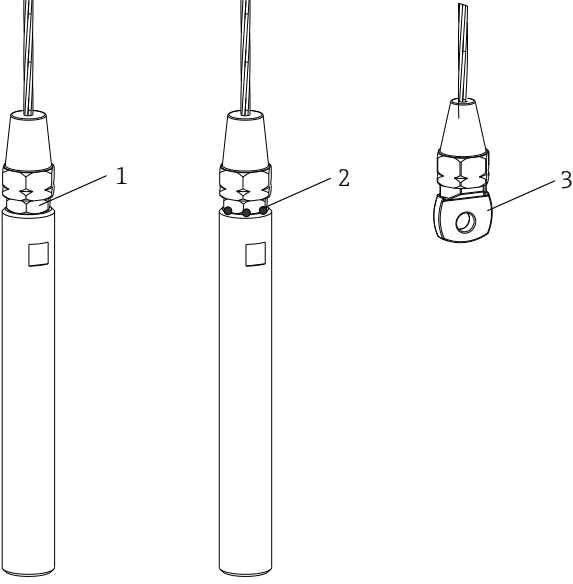
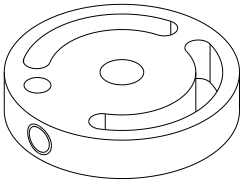
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return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

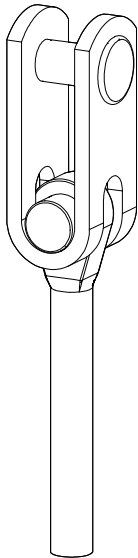
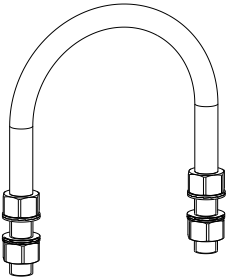
10 Accessories

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
<p style="text-align: center;">Anchor weight</p>  <p style="text-align: right; font-size: small;">A0038304</p>	<p>The installation of the anchor weight ensures a straight vertical position of the rope, please make sure to have enough space for a correct weight positioning inside the storage system. The dimensions will be established during the order development according to the rope multipoint dimension.</p> <ul style="list-style-type: none"> ■ 1: Removable/Replaceable by thread ■ 2: Fixed with welding spots ■ 3: Not applicable
<p style="text-align: center;">Ogives</p>  <p style="text-align: right; font-size: small;">A0038305</p>	<p>Ogives are integrated in the multipoint rope, they provide a correct positioning of the probe thermoelement along the rope length and maintain them in position under working condition.</p>

Accessories	Description
<p data-bbox="395 250 593 280">Toggle joint terminal</p>  <p data-bbox="783 875 834 887">A0038306</p>	<p data-bbox="849 250 1469 304">Toggle joint connection between rope and flange to allow reciprocal rotation.</p>
 <p data-bbox="783 1193 834 1205">A0055454</p>	<p data-bbox="849 904 1469 958">Tool for suspension of the multipoint probe inside silos or any other supporting mean</p>

10.2 Communication-specific accessories

Netilion

IIoT ecosystem: Unlock knowledge

With the Netilion IIoT ecosystem, Endress+Hauser enables you to optimize plant performance, digitize workflows, share knowledge, and enhance collaboration. Drawing on decades of experience in process automation, Endress+Hauser provides the process industry with an IIoT ecosystem that unlocks valuable insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, and reliability - ultimately resulting in a more profitable plant.

 www.netilion.endress.com

DeviceCare SFE100

Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices

DeviceCare is available for download at www.software-products.endress.com. You need to register in the Endress+Hauser software portal to download the application.

 Technical Information TI01134S

FieldCare SFE500

FDT-based plant asset management tool

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.



Technical Information TI00028S

10.3 System products

Advanced Data Manager Memograph M

The Advanced Data Manager Memograph M is a flexible and powerful system for organizing process values. Optional HART input cards are available, each having 4 inputs (4/8/12/16/20), with highly accurate process values from the HART devices directly connected for the purpose of calculation and data logging. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. Via common communication protocols, the measured and calculated values can be easily communicated to higher-level systems or individual plant modules can be interconnected.



Technical information: TI01180R

RN22

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. The RN22 requires a supply voltage of 24 V_{DC}.



Technical Information TI01515K

11 Technical data

11.1 Input

11.1.1 Measured variable

Temperature (temperature-linear transmission behavior)

11.1.2 Measuring range

RTD:

Input	Designation	Measuring range limits
RTD as per IEC 60751	Pt100	-200 to +600 °C (-328 to +1112 °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)	-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		

11.2 Output

11.2.1 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.

11.2.2 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 to 20 mA 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.

HART® head transmitters

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 E+H SmartBlue (app), optional.

PROFIBUS® PA head transmitters

Universally programmable iTEMP 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.

FOUNDATION Fieldbus™ head transmitters

Universally programmable iTEMP transmitter with FOUNDATION Fieldbus™ communication. Conversion of various input signals into digital output signals. High measurement accuracy over the complete ambient 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 measurement 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.

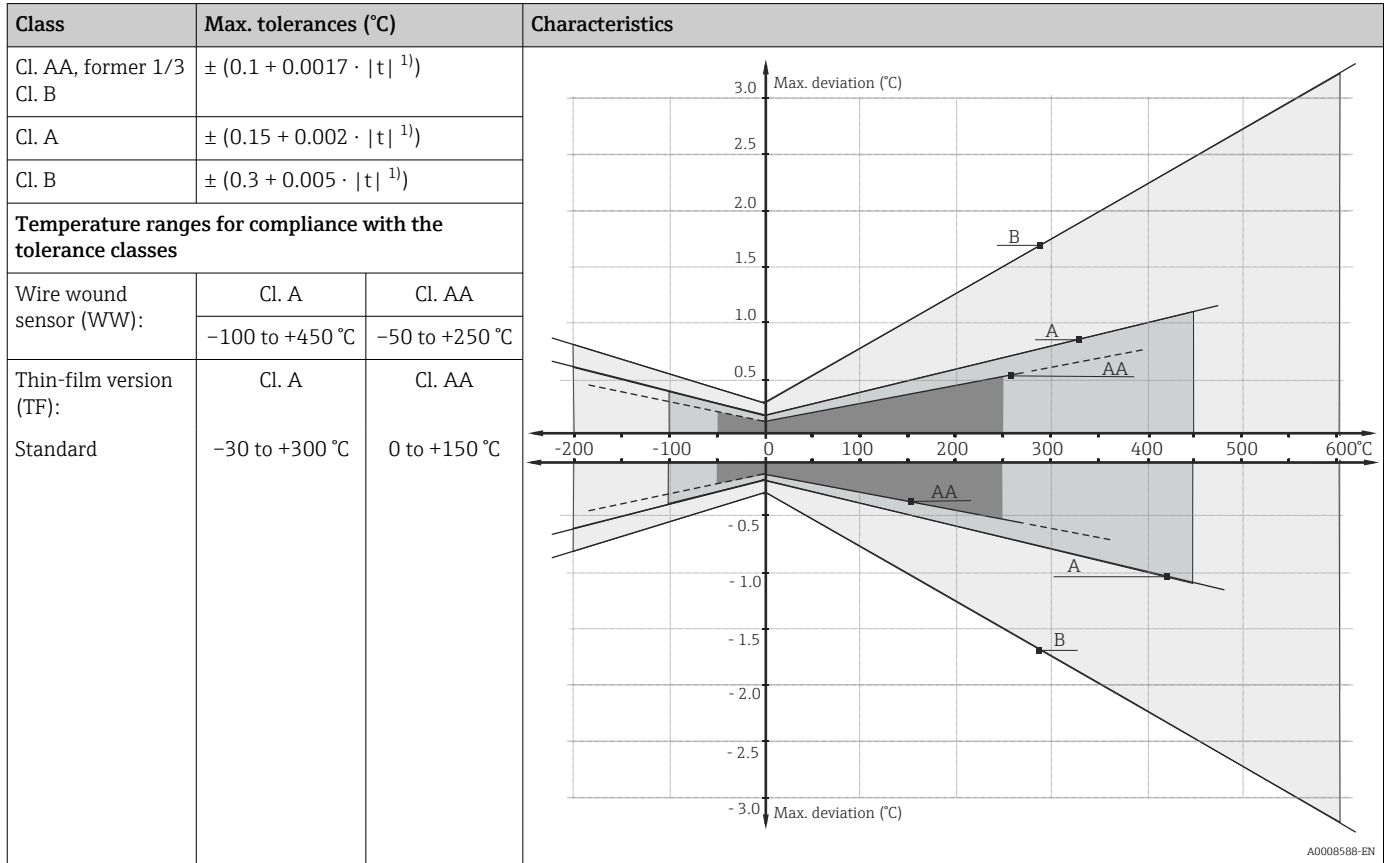
Advantages of the iTEMP transmitters:

- Double 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 Callendar van Dusen coefficients (CvD).

11.3 Performance characteristics

11.3.1 Maximum measured error

RTD resistance thermometer as per IEC 60751



1) |t| = absolute value °C

i In order to obtain the maximum tolerances in °F, the results in °C must be multiplied by a factor of 1.8.

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

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

1) |t| = absolute value °C

In general, the base-metal thermocouples that are delivered comply with the production tolerances for temperatures > -40 °C (-40 °F) indicated in the table. These materials are mostly unsuitable for temperatures < -40 °C (-40 °F). The tolerances for Class 3 cannot be

respected. A special choice of material is required for this temperature range. This cannot be processed through the standard product selection system.

Standard	Type	Standard tolerance	Special tolerance
ASTM E230/ANSI MC96.1		Deviation, the larger respective value applies	
	J (Fe-CuNi)	$\pm 2.2 \text{ K or } \pm 0.0075 t ^{1)}$ (0 to 760 °C)	$\pm 1.1 \text{ K or } \pm 0.004 t ^{1)}$ (0 to 760 °C)
	K (NiCr-NiAl)	$\pm 2.2 \text{ K or } \pm 0.02 t ^{1)}$ (-200 to 0 °C) $\pm 2.2 \text{ K or } \pm 0.0075 t ^{1)}$ (0 to 1260 °C)	$\pm 1.1 \text{ K or } \pm 0.004 t ^{1)}$ (0 to 1260 °C)


1) |t| = absolute value °C

In general, the thermocouple materials that are delivered comply with the tolerances for temperatures > 0 °C (32 °F) indicated in the table. These materials are mostly unsuitable for temperatures < 0 °C (32 °F). The tolerances indicated cannot be respected. A special choice of material is required for this temperature range. This cannot be processed through the standard product selection system.

11.3.2 Influence of ambient temperature

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

11.3.3 Response time

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

RTD

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

Diameter	Response time	
Mineral-insulated cable, 3 mm (0.12 in)	t ₅₀	2 s
	t ₉₀	5 s
RTD insert StrongSens, 6 mm (1/4 in)	t ₅₀	< 3.5 s
	t ₉₀	< 10 s


Thermocouple (TC)

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

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

11.3.4 Calibration

Calibration is a service that can be performed on each individual temperature sensor, either in order phase, or after multipoint installation.

 When calibration shall be performed once the multipoint is installed, please contact the Endress+Hauser service to get full support. Together with the Endress +Hauser service any further activity can be organised to achieve the calibration of the target sensor. In any case it is forbidden to unscrew any threaded component on the process connection under operating conditions = running process.

Calibration involves comparing the measured values of the sensing elements of the multipoint (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 temperature sensors:

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

Evaluation

If a calibration with an acceptable uncertainty of measurement and transferable measurement results is not possible, Endress+Hauser offers an evaluation measurement service, if technically feasible.

11.4 Environment

11.4.1 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 respective hazardous area approval. Details see Ex documentation.

11.4.2 Storage temperature

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)

11.4.3 Relative humidity

Condensation according to IEC 60068-2-14:

- Head transmitter: Permitted
- DIN rail transmitter: Not permitted

Maximum relative humidity: 95% according to IEC 60068-2-30

11.4.4 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

11.4.5 Degree of protection

- Specification for conduit: IP68
- Specification for the junction box: IP66/67

11.4.6 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

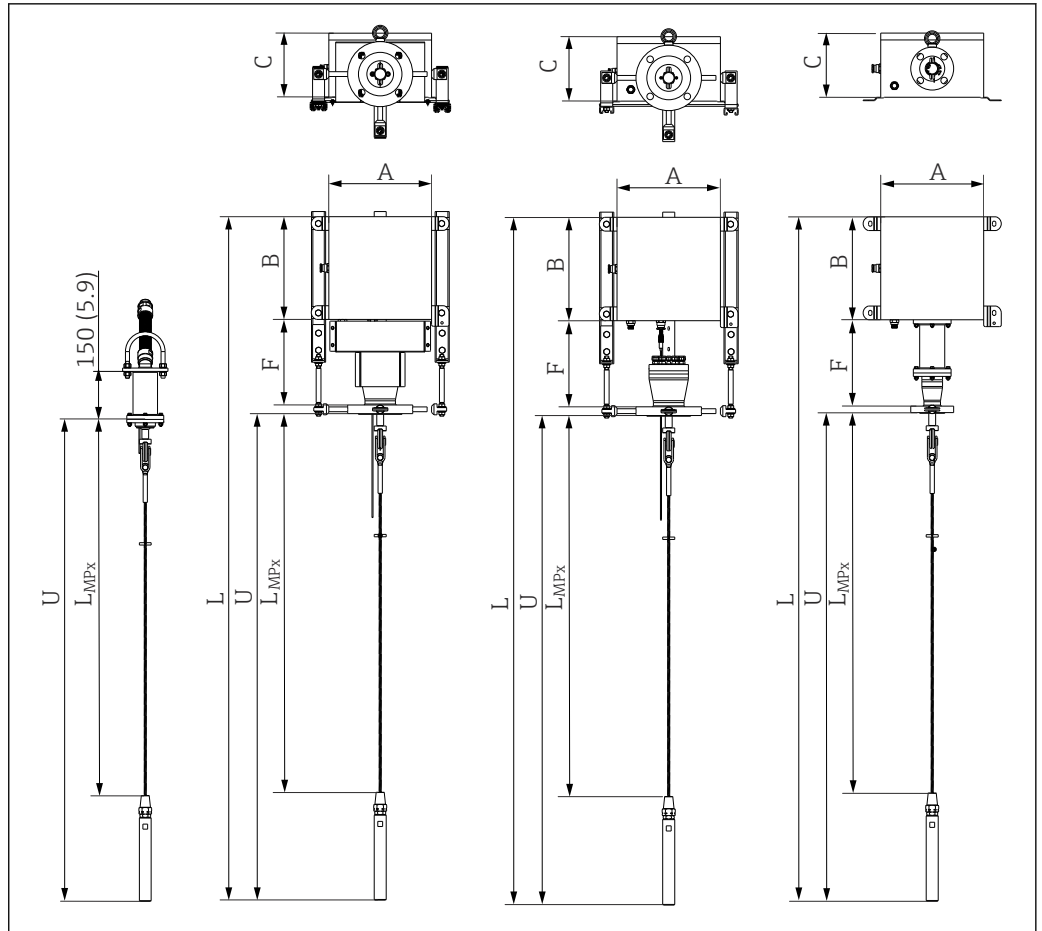
11.4.7 Electromagnetic compatibility (EMC)

Depending on the transmitter used. For detailed information see the related Technical Information.

11.5 Mechanical construction

11.5.1 Design, dimensions

The overall rope assembly is made of different parts. The rope joint ensures sufficient degree of freedom to the rope system allowing movements during filling and emptying operations. This guarantees low stresses (no extra tensioning) on the rope due to possible lateral force acting on it, therefore a lateral sag of 0.3 m (0.98 ft) per 10 m (32.81 ft) rope length is recommended. The transition between the temperature sensors and the extension cable is obtained by the usage of compression fittings, ensuring the declared IP degree protection.



A0038299

12 Design of the modular multipoint thermometer, with roof bracket on the left, supporting frame neck (with covers or open) in the middle and with tube neck design on the 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 sensing elements or thermowells

F Extension neck length

L Device length

U Immersion length


Extension neck E in mm (in)

Standard 250 (9.84)

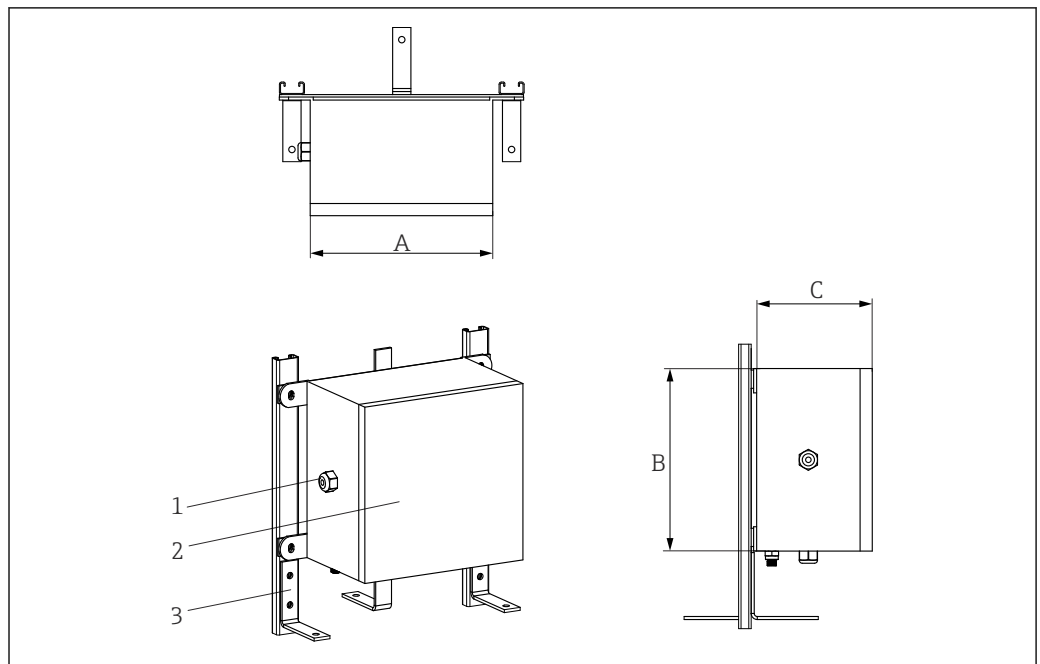
Specifically customized extension necks are available on request.

Immersion lengths MPx of sensing elements/thermowells:

Based on customer requirements

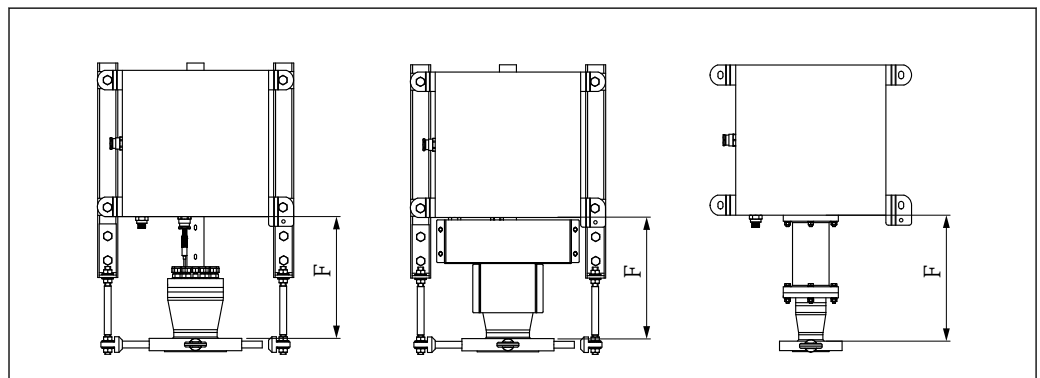
Rope maximum load:					
	Rope Ø mm	Construction	Weight kg/m	MBL	
				kN	kg
 <p>A0038300</p> <ul style="list-style-type: none"> Stainless steel AISI 316 Rope according to EN 10264-4 Rope grade 1.570 N/mm² 	6	1x19	0,1786	29,5	3000
	8	1x19	0,322	53	5400
	10	1x19	0,502	84	8500

Junction box (directly mounted)



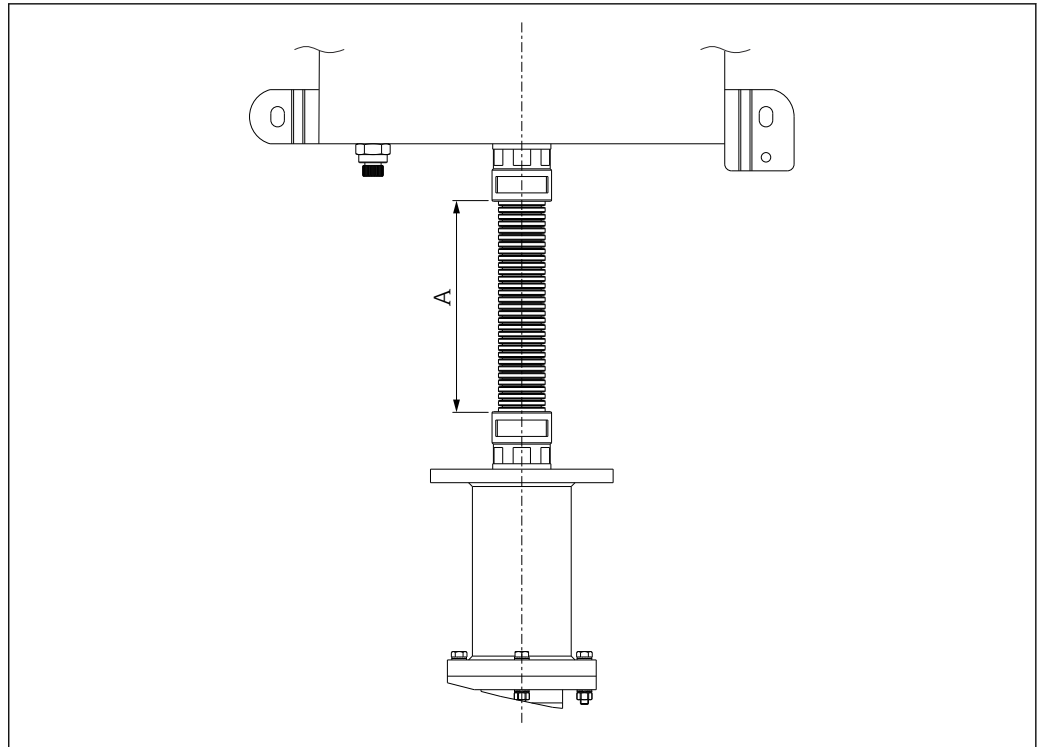
A0028118

- 1 Cable glands
- 2 Junction box
- 3 Frame



A0038301

13 Open supporting frame design on the left side, supporting frame with cover design in the middle and tube neck design on the right side



A0038302

14 Remote junction box, flexible conduit cable length A

The junction box is suited for chemical agents environments. Sea water corrosion resistance and extreme temperature variation stability is guaranteed. Ex-e Ex-i terminals can be installed.

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

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

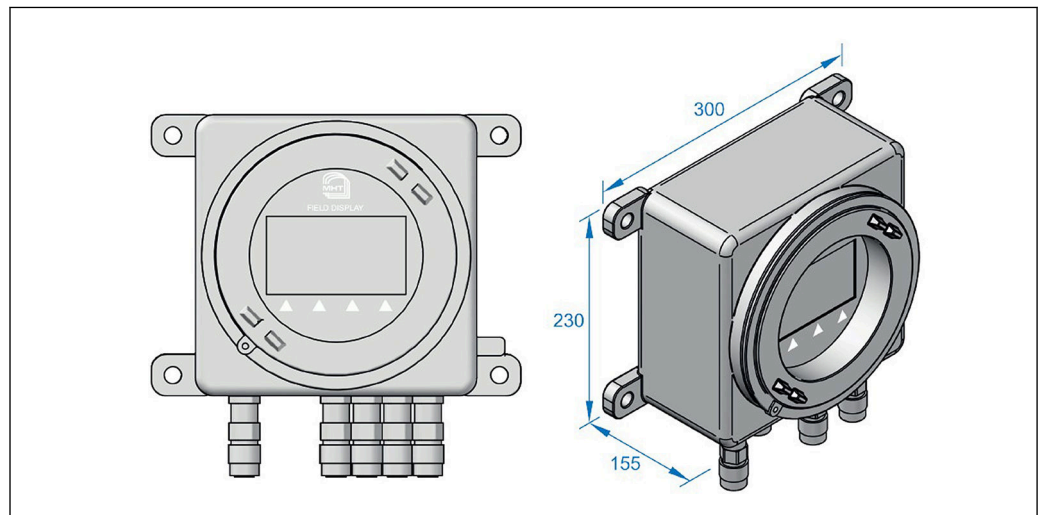
Type of specification	Junction box	Cable glands
Material	AISI 316/Aluminium	NiCr Plated brass AISI 316 / 316L
Ingress protection (IP)	IP66/67	IP66
Ambient temperature range	-50 to +60 °C (-58 to +140 °F)	-52 to +110 °C (-61.1 to +140 °F)
Approvals	ATEX, UL, CSA approval for use in hazardous area IEC	-
Marking	<ul style="list-style-type: none"> ▪ 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	Hinged	-
Maximum sealing diameter	-	6 to 12 mm (0.24 to 0.47 in)

		On board	Remote
Type of protection	Intrinsically safe and increased safety	<ul style="list-style-type: none"> ■ With frame ■ Tube neck 	Flexible conduit
	Flameproof	With supporting frame	

Field display

Power:	100-240 Vac, 50-60 Hz, 25 VA, 0.375 A max
Certification:	ATEX II 2 G D Ex 'd' IIC T6, IP 66
Environment:	Hazardous Area Zone 1
Operating temperature:	-20 °C to +55 °C
Storage temperature:	-40 °C to +85 °C
Enclosure:	Aluminium alloy Painted RAL 7035 grey epoxy
IP rating:	IP66
Entries:	M20 threaded entries (quantity 5 off)
External dimensions:	300 x 230 x 155 mm
Fixings:	To suit M12 bolts, four positions
Weight:	7.5 kg
No. of host ports:	4 Ports
Interfaces supported:	RS-232, RS-422/485, Modbus RTU HART®



A0038303

Neck extension

The neck extension ensures the connection between the flange and the junction box. The design has been developed to ensure several mounting layouts to deal with possible obstacles and constraints that can be met in any plant such as the storage tank infrastructure (step ways, loading structures, stairs, etc.) and an eventual thermal

insulation. It guarantees a high stiffness connection for the junction box and vibration loads.

11.5.2 Weight

The weight can vary depending on the configuration: Dimension and content of the junction box, neck length, dimensions of process connection, the number of temperature sensors and the weight of the rope end. The approximate weight of a typically configured multipoint rope (number of sensors = 12, flange size = 3", medium size junction box) = 55 kg (121 lb)


11.5.3 Materials

It refers to the sheath, neck extension, junction box and all wetted parts.

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load. The maximum operation temperatures are reduced considerably in some cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316/1.4401	X5CrNiMo 17-12-2	650 °C (1202 °F)	<ul style="list-style-type: none"> ▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1202 °F)	<ul style="list-style-type: none"> ▪ 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 (1292 °F)	<ul style="list-style-type: none"> ▪ 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

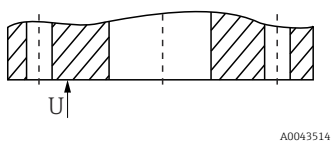
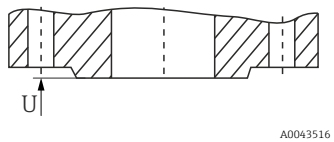
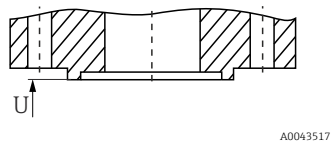
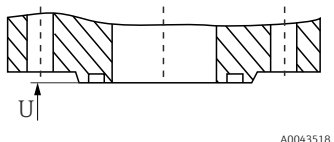
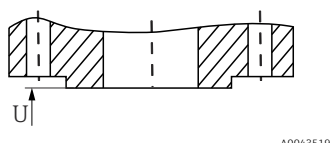
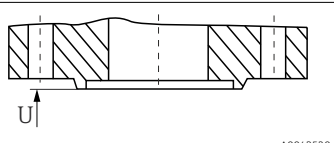
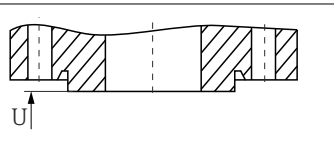
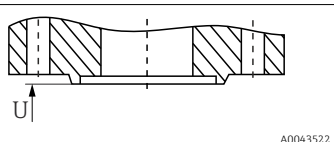
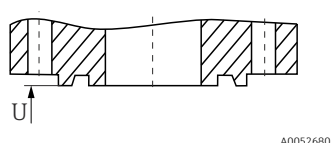
11.5.4 Process connection

 The flanges are supplied in stainless steel AISI 316L with material number 1.4404 or 1.4435. With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in DIN EN 1092-1 Tab.18 and under 023b in JIS B2220:2004 Tab. 5. The ASME flanges are grouped together under Tab. 2-2.2 in ASME B16.5-2013. Inches are converted into metric units (in - mm) using the factor 2.54. 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)	
Tongue		F	-	C D	3.2 to 12.5	0.8 to 3.2	Tongue (T)	3.2
Groove		N	-				Groove (G)	
Projection		V 13	-	E F	12.5 to 50	3.2 to 12.5	Male (M)	3.2
Recess		R 13	-				Female (F)	
Projection		V 14	for O-rings	H G	3.2 to 12.5	3.2 to 12.5	-	-
Recess		R 14	-					
With ring-type joint		-	-	-	-	-	Ring-type joint (RTJ)	1.6

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

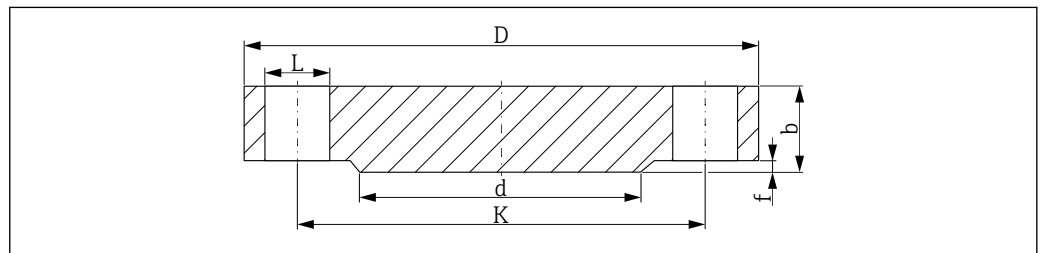
Flanges according to the old DIN standard are compatible with the new DIN EN 1092-1 standard. Change in pressure ratings: Old DIN standards PN64 → DIN EN 1092-1 PN63.

Height of raised face¹⁾

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	3 (0.12)	0 -2 (-0.08)
	> DN 32 to DN 250		
	> 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)
	≥ 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)

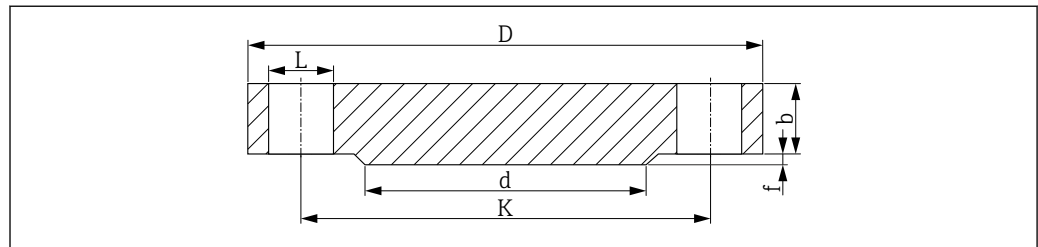
DN	D	b	K	d	L	approx. kg (lbs)
200	340 (13.4)	24 (0.94)	295 (11.6)	268 (10.6)	12xØ22 (0.87)	16.5 (36.38)
250	405 (15.9)	26 (1.02)	355 (14.0)	320 (12.6)	12xØ26 (1.02)	25.0 (55.13)
300	460 (18.1)	28 (1.10)	410 (16.1)	378 (14.9)	12xØ26 (1.02)	35.0 (77.18)

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)
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)



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)

DN	D	b	K	d	L	approx. kg (lbs)
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)

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)	<p>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.</p>
Brief Operating Instructions (KA)	<p>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.</p>
Operating Instructions (BA)	<p>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.</p>
Description of Device Parameters (GP)	<p>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.</p>
Safety Instructions (XA)	<p>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.</p> <p> Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.</p>
Supplementary device-dependent documentation (SD/FY)	<p>Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.</p>



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