BA02366T/09/EN/02.25-00
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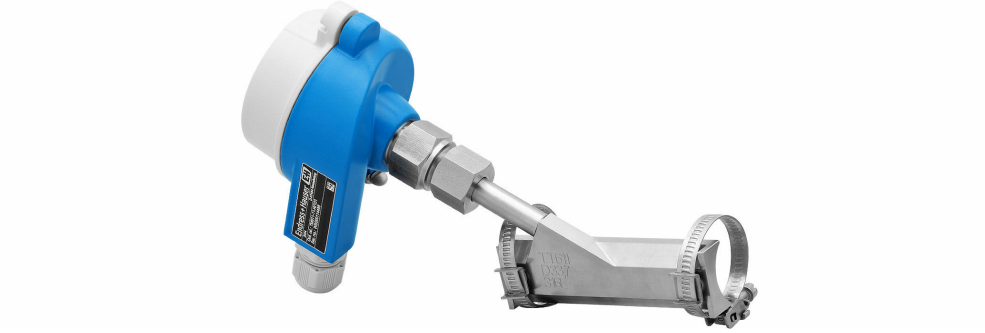
2025-01-31

Operating Instructions
iTHERM SurfaceLine TM611

Surface thermometer
Non-invasive RTD/TC thermometer with high measurement performance for demanding applications



Endress+Hauser
People for Process Automation

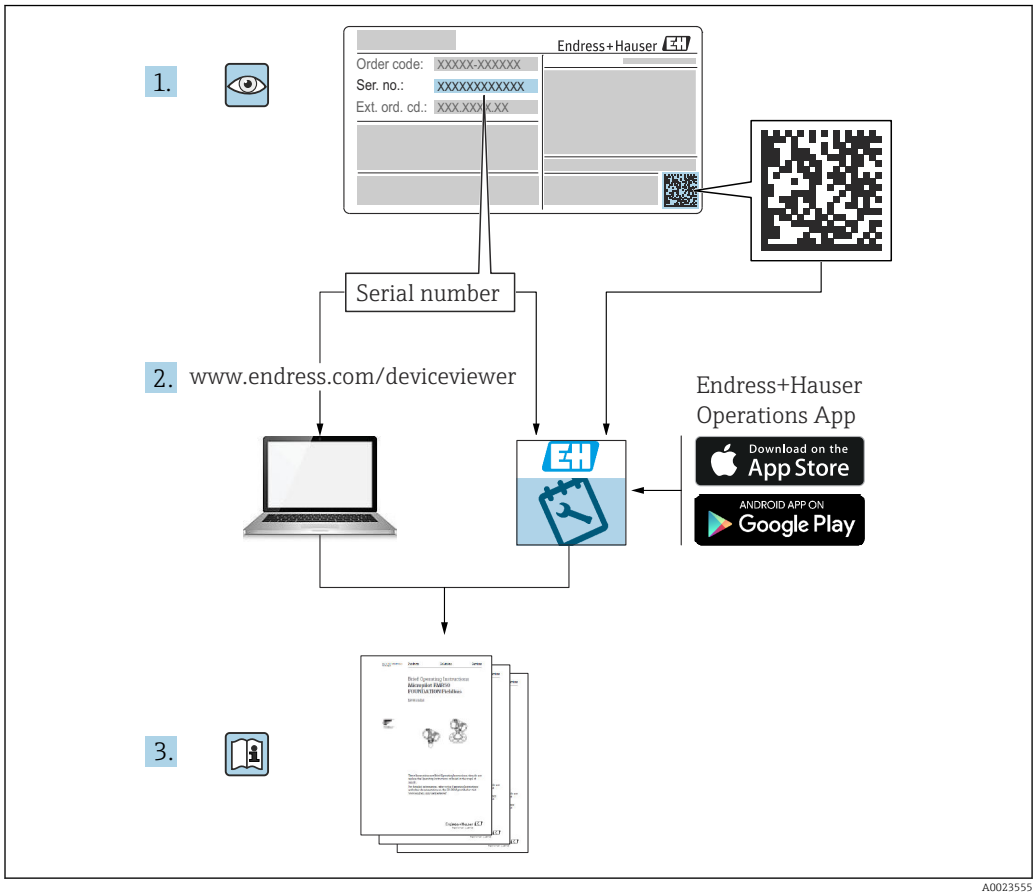

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
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Table of contents

1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

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

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

1.2.3 Symbols for certain types of information

Symbol	Meaning
✓	**Permitted** Procedures, processes or actions that are permitted.
✓✓	**Preferred** Procedures, processes or actions that are preferred.
✗	**Forbidden** Procedures, processes or actions that are forbidden.

Symbol	Meaning
	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.4 Symbols in graphics

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

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.

Document type	Purpose and content of the document
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

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- Registered trademark of the PROFIBUS Nutzerorganisation e.V. (Profibus User Organization), Karlsruhe - Germany

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2 Safety Instructions

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 described in this document is intended for non-invasive temperature measurement in industrial applications. Depending on the version, it can be configured as an industrial thermometer or cable thermometer and can be attached to the process by means of a coupling element. It is the responsibility of the operator to select the appropriate thermometer (RTD and TC) to ensure safe operation of the measuring point.

Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use. Use the device for non-invasive temperature measurement only.

2.3 Workplace safety

⚠ CAUTION

Extreme temperatures (hot and cold) can occur at the thermometer and in the terminal head. There is a risk of burning and damage to property.

- Wear appropriate protective equipment.

⚠ CAUTION

There is an the increased risk of electric shock if working on and with the device with wet hands:

- Wear appropriate protective equipment.

2.4 Operational safety

Damage to the device!

- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for ensuring that the device is in good working order.

Hazardous area

To avoid danger to individuals or the facility when the device is used in the approval-related area (e.g. explosion protection or safety instrumented systems):

- Based on the technical data on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area. The nameplate can be found on the side of the device.
- Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

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.

Temperature

NOTICE

During operation, heat conduction or heat radiation may cause the temperature in the terminal head to rise.

- Prevent transmitter or housing from exceeding the operating temperature by using appropriate heat insulation or a suitably long extension neck.

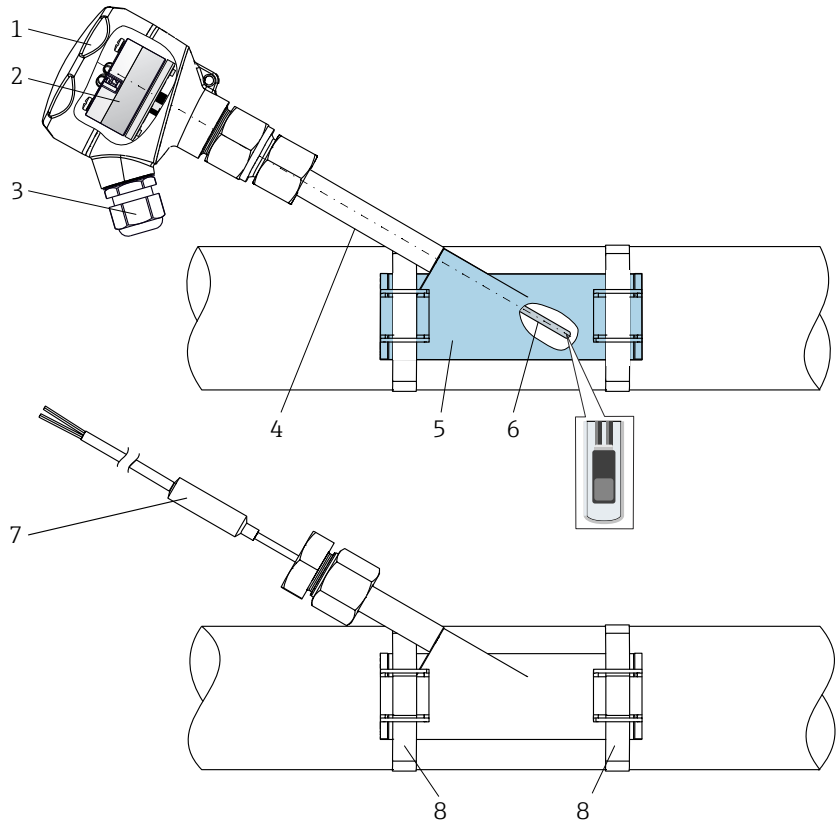
2.5 Product safety

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

Construction



Options	
1: Terminal head	Terminal heads made of aluminum, polyamide or stainless steel
2: Wiring, electrical connection, output signal	▪ Ceramic terminal block ▪ Flying leads ▪ iTEMP head transmitter (4 to 20 mA, HART®, PROFINET® with Ethernet-APL™, PROFIBUS® PA, FOUNDATION™ Fieldbus), single channel or dual channel ▪ Plug-in display ▪ IO-Link®
3: Plug or cable gland	▪ M12 plug, PROFIBUS® PA/FOUNDATION ™ Fieldbus/PROFINET®, 4-pin ▪ Cable glands of polyamide or nickel-plated brass
4: Extension neck	Extension piece to guide the connection to the thermometer through a pipe insulation to restrict the temperature in the terminal head if necessary.
5: Coupling element	Shape and size adapted to pipe diameter for optimized heat transfer from the pipe surface to the sensor element. A coupling foil is attached to the inside of the coupling element. The coupling foil is used to transfer heat and is therefore an essential part of the device. It can be reordered if necessary.
6: Insert with sensor element	Sensor models: RTD - wire wound (WW), thin-film sensor (TF) or thermocouples (TC) type J or K. Insert diameter Ø3 mm (0.12 in).
7: Cable thermometer	Thermometer with variable connecting cable without terminal head. Lightweight and flexible version, e.g. for use with remotely mounted field transmitter or DIN rail transmitter in cabinet.
8: Hose clips	Made from stainless steel for reliable mounting on the pipe.

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 following options are available for identification of the measuring device:
- The device label
- Order code with breakdown of the device features on the delivery note
- Enter the serial number on the device label in *W@M Device Viewer* (www.endress.com/deviceviewer): all the information about the measuring device is displayed.
- Enter the serial number on the device label into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the measuring device with the *Endress+Hauser Operations App*: all the information about the measuring 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

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

Avoid the following environmental influences during storage:
- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

Maximum relative humidity: < 95%

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

5 Installation

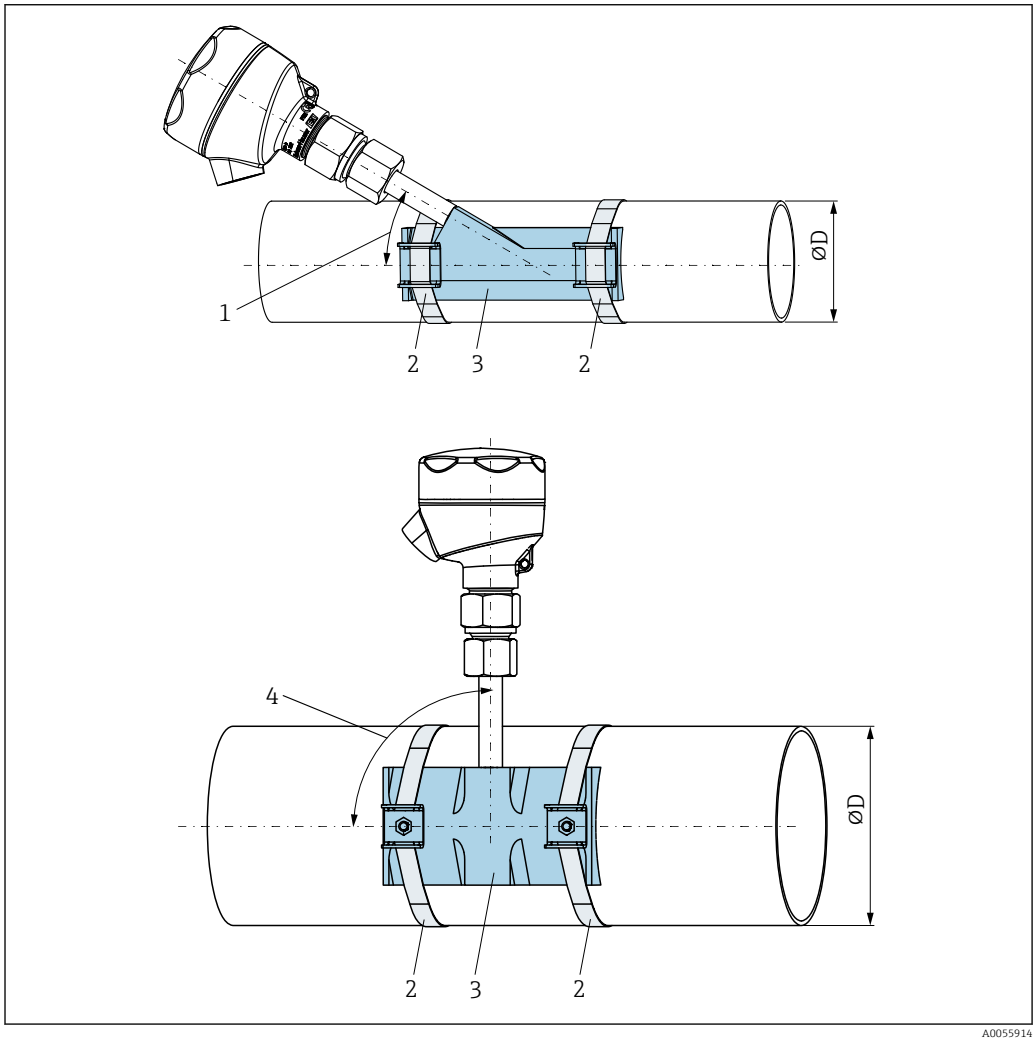
5.1 Installation requirements

Depending on the nominal width, the device is attached either at an angle or perpendicularly to the process:

- At an angle for pipe outer diameters øD < DN100, see "Installation examples" graphic.
- Perpendicularly for pipe outer diameters øD ≥ DN100, see "Installation examples " graphic.

Because of the coupling element, the device is not installed directly in the process so there is no leakage risk.

A coupling foil is attached to the inside of the coupling element for heat transfer. Do not remove the coupling foil from the coupling element.



1 Installation examples

1 Inclined connection angle 20°, 30° or 40 ° for pipe outer diameters øD < DN100
2 Hose clips, tightening torque = 5 Nm
3 Coupling element with coupling foil on the inner side
4 Vertical connection angle 90° for pipe outer diameters øD ≥ DN100

The extension neck length influences the heating of the head transmitter: The greater the distance between the outer pipe wall and terminal head, the lower the heating.

The following installation option achieves the highest measurement accuracy:

- Thermometer installed at an angle against the direction of flow of the medium
- Thermometer installed vertically above the pipe

- Installation options: pipes or other plant components
- ATEX certification: Observe the installation instructions in the Ex documentation!

If the device is used in the hazardous area, refer to the separate Ex documentation for all the information on explosion protection. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

The mounting location must be smooth and clean.

⚠ CAUTION

A pipe outer wall that is too hot can lead to injuries during installation of the device.

- ▶ Ensure appropriate surface temperature.
- ▶ Wear appropriate safety equipment during mounting.

⚠ CAUTION

There is a risk of injury from the hose clips when mounting the device.

- ▶ Be aware of the sharp edges of the hose clips.
- ▶ Wear appropriate safety equipment during mounting.

Before mounting the device:

1. Ensure that the nominal diameter engraved on the coupling element matches the pipe diameter.
2. Clean the mounting location before installing the device.
3. Prepare the necessary tools for mounting.

Tool:

- Clamp
- Hexagon wrench AF = 7 mm
- Hexagon wrench AF = 27 mm
- Phillips head screwdriver
- Flat-blade screwdriver

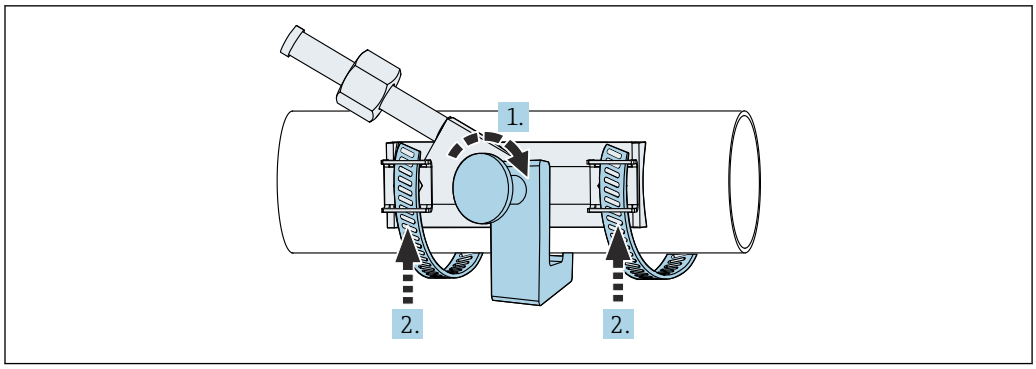
The coupling element is fixed to the outside of the pipe using the clamp. The hose clips are included with the packaging. They feature a combination screw head, which means that both the hexagon wrench AF = 7 mmand the Phillips or flat-blade screwdriver can be used for assembly. The thermometer is connected to the coupling element with a union nut, which is tightened with the hexagon wrench AF = 27 mm.

5.2 Mounting the measuring instrument

If the device is supplied with the iTHERM thermometer screwed to the coupling element, the iTHERM thermometer can be removed at the union nut to make it easier to fit the coupling element.

Mounting the coupling element

1. Place the coupling element on the pipe and secure with a clamp.
2. Guide the two supplied hose clips with the open ends on the left and right of the coupling element through the holder.



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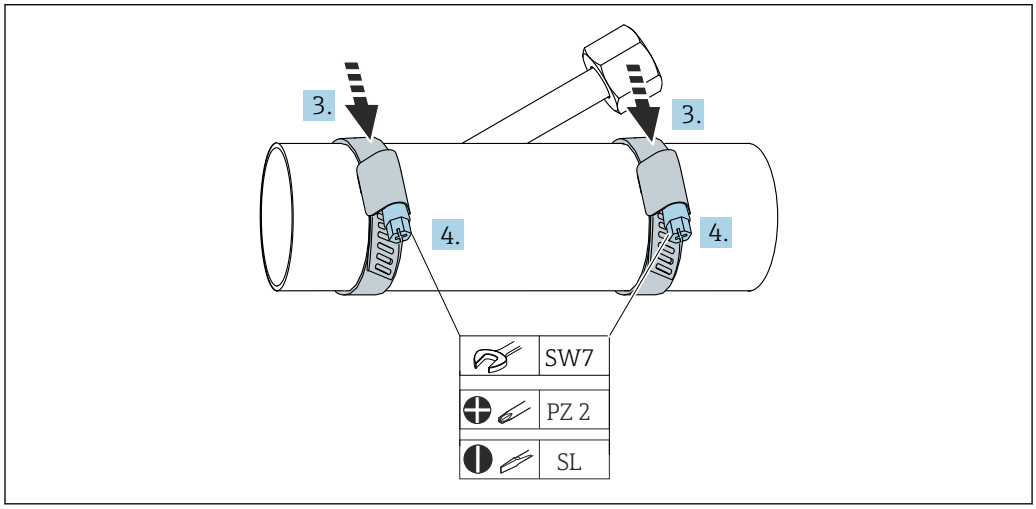
3. On the opposite side of the pipe, insert the open ends of each of the hose clips into the screw head.
4. Tighten and secure each of the hose clips to the screw head with a maximum torque of 5 Nm. Secure the screw head with the hexagon wrench AF = 7 mm, Phillips screwdriver (PZ 2) or flat-blade screwdriver (SL). On the opposite side of the pipe, insert the open ends of each of the hose clips into the screw head.



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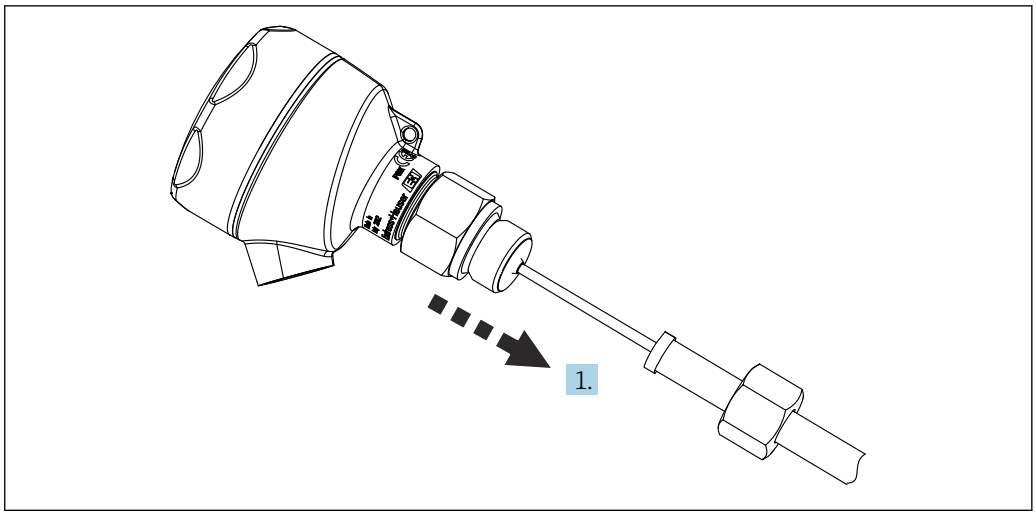
The coupling element is mounted on the pipe. Release and remove the clamp.

Installing the thermometer

1. Insert the thermometer as far as it will go into the extension neck of the coupling element.



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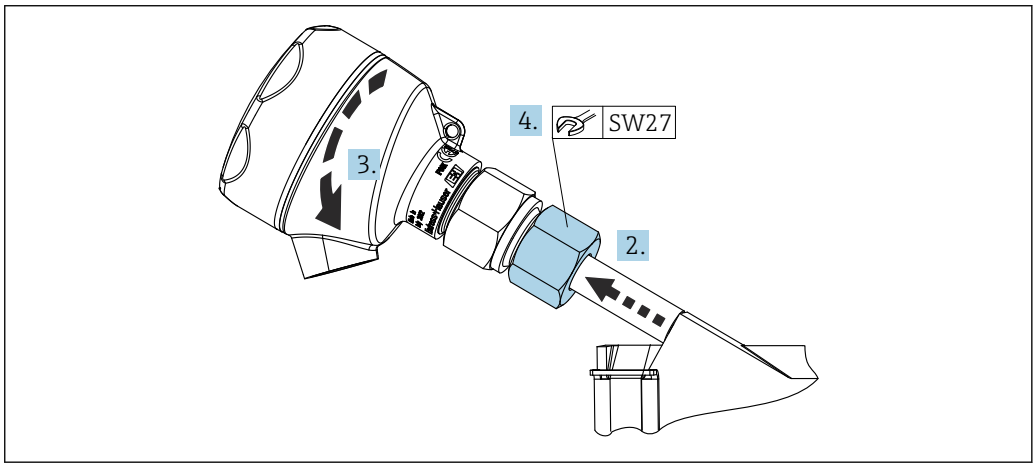
2. Push the union nut upwards to the extension neck of the thermometer.
3. Turn the terminal head so that no moisture can accumulate in the cable entry.
4. Tighten the union nut on the extension neck of the thermometer with a max. torque of 20 Nm.



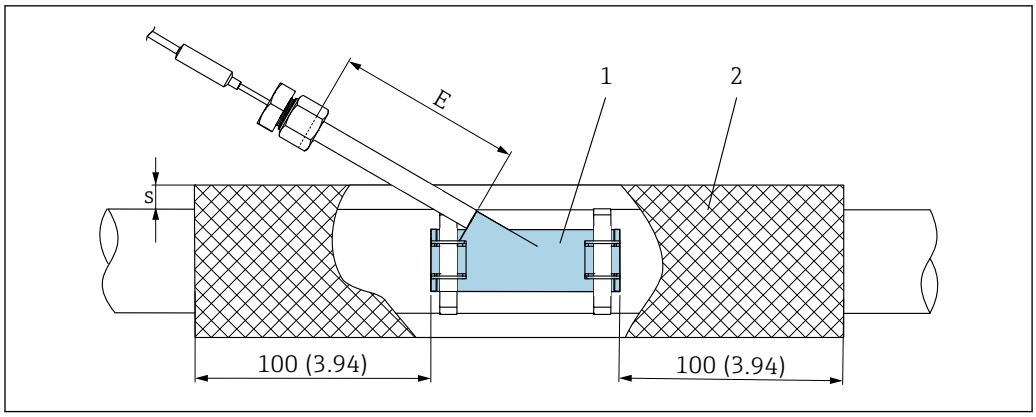
A0056405

Union nut is tightened. The thermometer is securely positioned in the coupling element.

5.3 Insulation of the measuring point

To ensure a high level of measurement accuracy, the manufacturer recommends thermal insulation of the coupling element against the environment over a length of 100 mm (3.94 in) on both sides of the coupling.

The accuracy tests were conducted with the measuring point insulated using insulation material with a U-value ≤ 0.85 W/m2/K.



1 Coupling element
2 Thermal insulation
E Extension neck length
s Thickness of the insulation

The maximum permissible thickness of the insulation depends on extension neck length E and can be calculated using the following formula:

Connection angle	Formula
90 °	0.85 x extension neck length E
20 °	0.33 x extension neck length E
30 °	0.46 x extension neck length E
40 °	0.54 x extension neck length E

5.4 Post-installation check

☐	Is the device undamaged (visual inspection)?
☐	Is the device correctly secured?
☐	Does the device correspond to the specifications at the measuring point, e.g. Ambient temperature, measuring range?

6 Electrical connection

NOTICE

Risk of short-circuit - can cause the device to malfunction.

▶ Check for damage to cables, wires and to connection points.

NOTICE

▶ ESD - Electrostatic discharge. Protect the terminals from electrostatic discharge. Failure to observe this may result in the destruction or malfunction of parts of the electronics.

For information on the electrical connection, see the technical documentation of the specific iTEMP transmitter.

6.1 Connection requirements

A Phillips screwdriver is required to wire the iTEMP head transmitter with screw terminals, e.g. Pozidriv Z1. The push-in terminals can be wired without any tools.

The RTD or TC cable thermometers can be wired, e.g. to a separate DIN rail transmitter in the cabinet, without any tools.

⚠ CAUTION

Danger due to uncontrolled activation of processes! Risk of short-circuit and injury!

▶ Switch off the supply voltage before connecting the device.

⚠ CAUTION

An incorrect connection compromises electrical safety! Risk of short-circuit and injury!

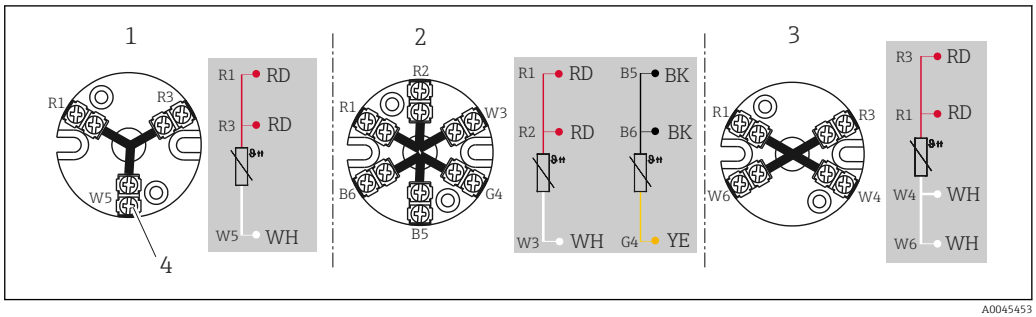
▶ Switch off the supply voltage before connecting the device.

If the device is used in the hazardous area, refer to the separate Ex documentation for all the information on explosion protection. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

6.2 Terminal assignment

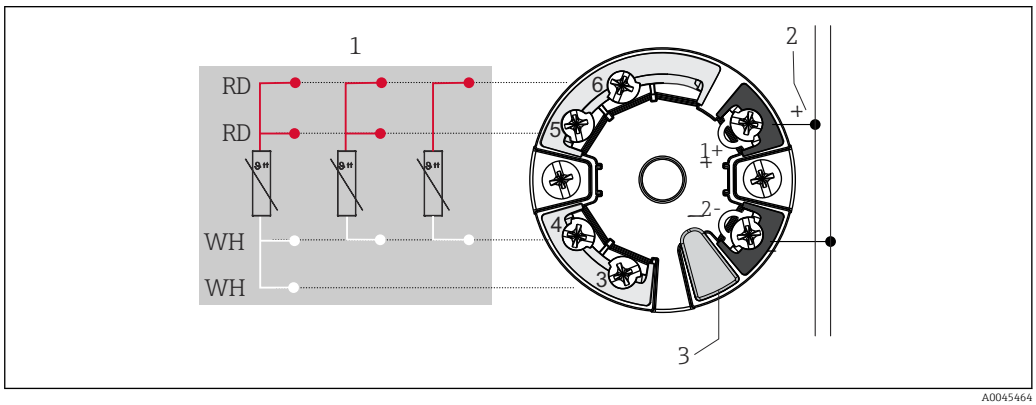
The sensor connection cables of the industrial thermometer are fitted with terminal lugs. The nominal diameter of the cable lugs is ø1.3 mm (0.05 in).

6.2.1 Sensor connection type: RTD industrial thermometer



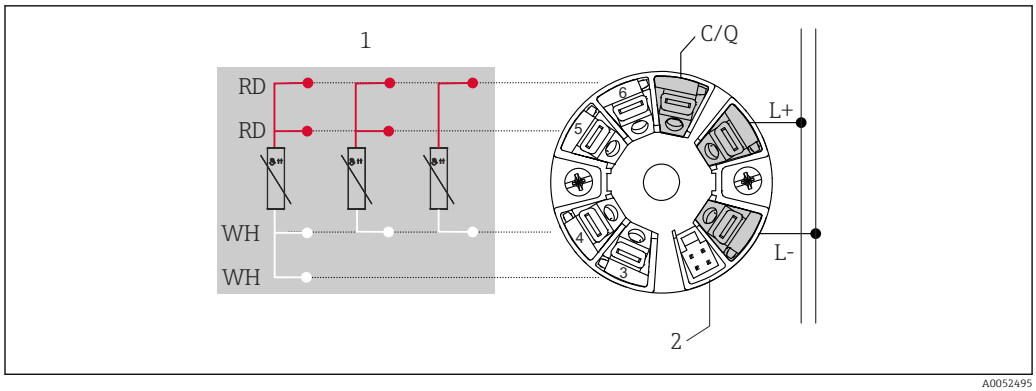
2 *Mounted ceramic terminal block*

1 3-wire
2 2x3-wire
3 4-wire
4 Outside screw



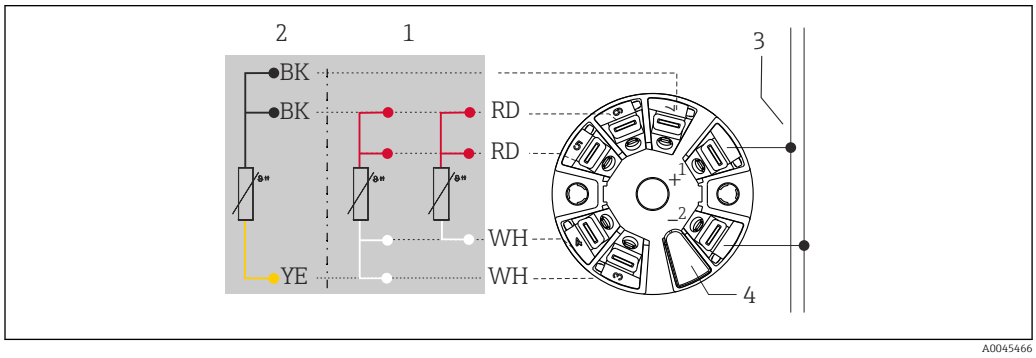
3 *Head-mounted iTEMP TMT7x transmitter or iTEMP TMT31 (single sensor input)*

1 Sensor input, RTD, 4-, 3- and 2-wire
2 Power supply/bus connection
3 Display connection/CDI interface



4 *Head-mounted iTEMP TMT36 transmitter (single sensor input)*

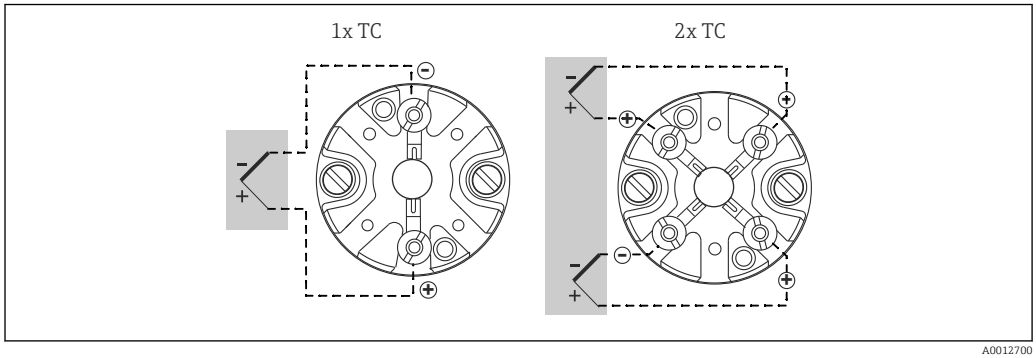
1 RTD sensor input: 4-, 3- and 2-wire
2 Display connection
L+ 18 to 30 V_{DC} power supply
L- 0 V_{DC} power supply
C/Q IO-Link or switch output



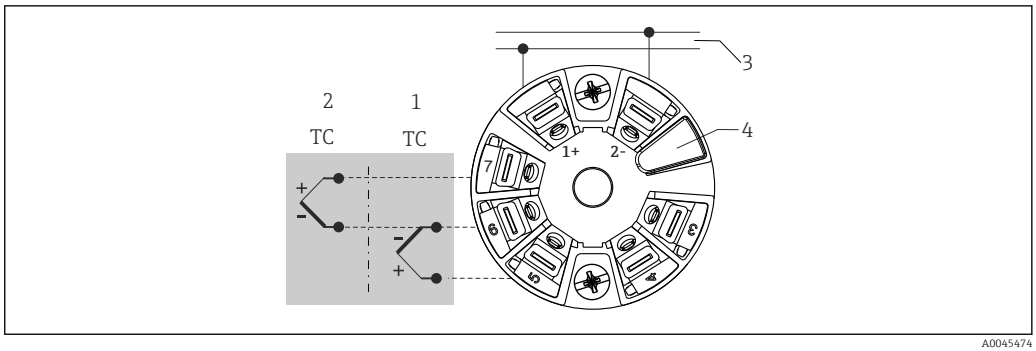
5 *Head-mounted iTEMP TMT8x transmitter (dual sensor input)*

1 Sensor input 1, RTD, 4- and 3-wire
2 Sensor input 2, RTD, 3-wire
3 Fieldbus connection and power supply
4 Display connection

6.2.2 Sensor connection type: TC industrial thermometer

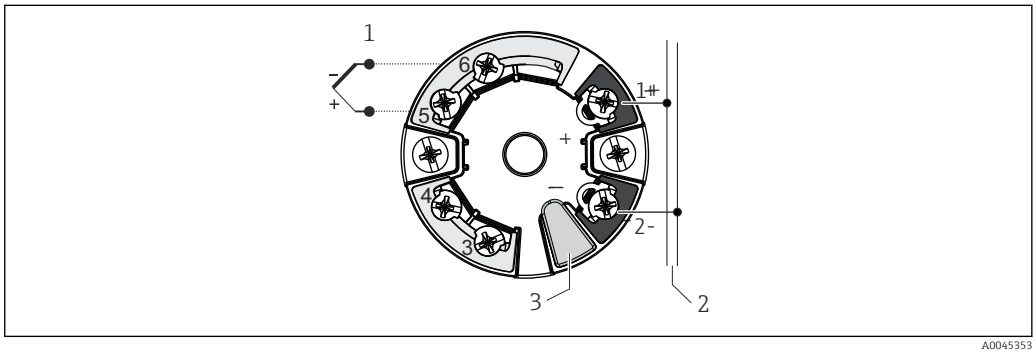


6 *Installed ceramic terminal block for thermocouples.*



7 *Head-mounted iTEMP TMT8x transmitter (dual sensor input)*

1 *Sensor input 1*
2 *Sensor input 2*
3 *Fieldbus connection and power supply*
4 *Display connection*



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

1 *Sensor input*
2 *Power supply and bus connection*
3 *Display connection and CDI interface*

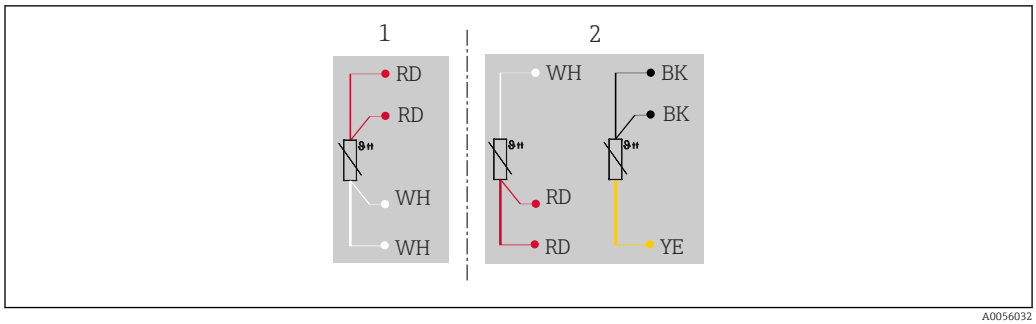
6.2.3 Sensor connection type: RTD cable thermometer

The sensor connection cables of the cable thermometer are fitted with ferrules. The nominal diameter of the ferrules is ø 1 mm (0.03 in).

Wiring diagram

The cable thermometer is wired to the flying leads of the connection cable. The cable thermometer can be connected to a separate iTEMP temperature transmitter, for example.

Wire cross-section: ≤ 0.382 mm² (AWG 22) with ferrules, length = 5 mm (0.2 in).



9 *Wiring diagram for RTD cable thermometer*

1 1x Pt100, 4-wire
2 2x Pt100, 3-wire

For the highest accuracy, a 4-wire connection is recommended or use of a transmitter.

6.2.4 Sensor connection type: TC cable thermometer

Wiring diagram

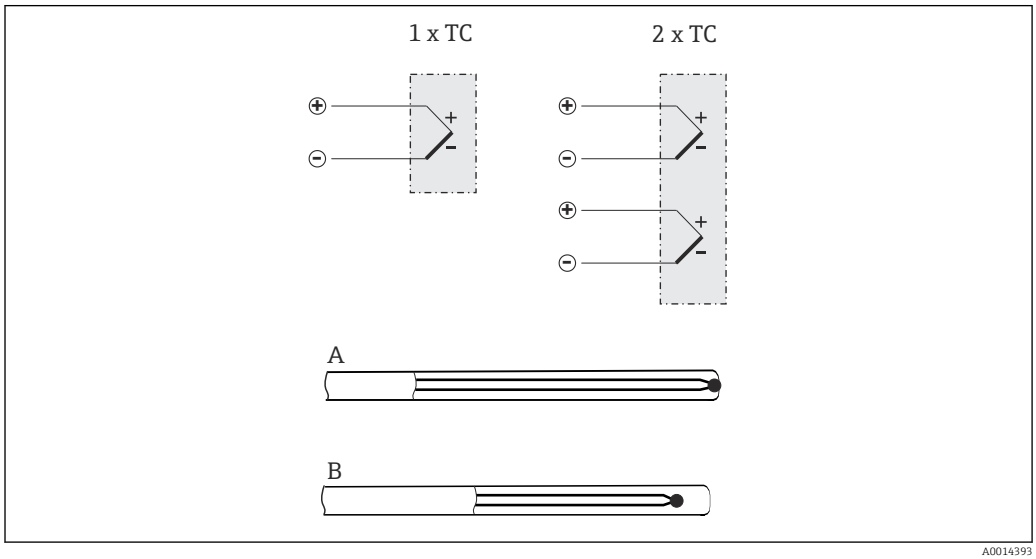
The cable thermometer is wired to the flying leads of the connection cable. The cable thermometer can be connected to a separate iTEMP temperature transmitter, for example.

Wire cross-section:

- ≤ 0.205 mm² (AWG 24) for 4-wire connection
- ≤ 0.518 mm² (AWG 20) for 2-wire connection

Thermocouple wire colors

As per IEC 60584	As per ASTM E230/ANSI MC96.1
▪ Type J: black (+), white (-) ▪ Type K: green (+), white (-)	▪ Type J: white (+), red (-) ▪ Type K: yellow (+), red (-)



10 *Wiring diagram*

A Grounded connection
B Ungrounded connection

6.3 Connecting the measuring instrument

Proceed as follows to wire a mounted iTEMP head transmitter:

1. Open the cable gland and the housing cover at the terminal head or the field housing.
2. Feed the cables through the opening in the cable gland.
3. Connect the cables in accordance with the electrical connection of the specific head transmitter. If the head transmitter is fitted with push-in terminals, pay particular attention to the "Connecting to push-in terminals" section.
4. Tighten the cable gland again and close the housing cover.

Proceed as follows to wire the cable thermometer:

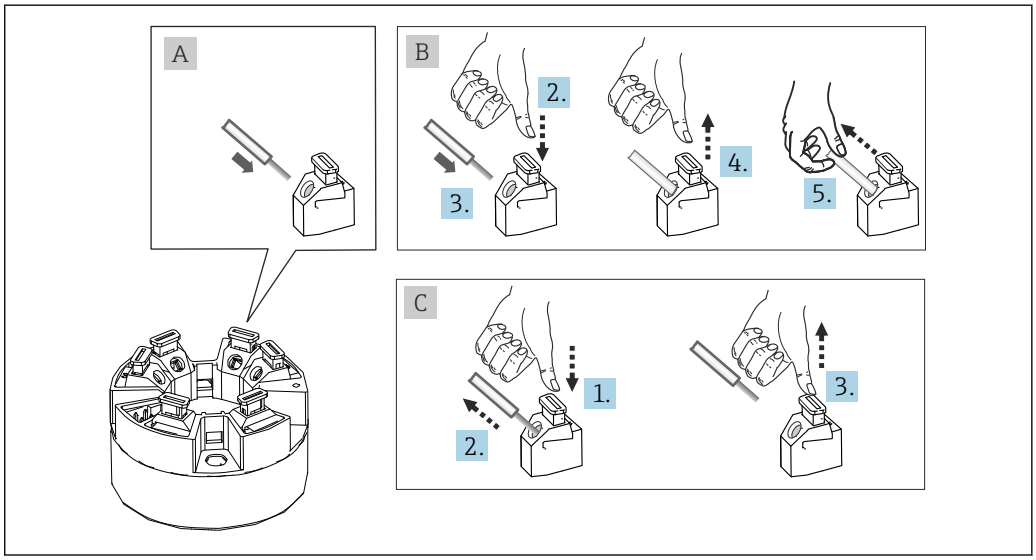
- Connect the cables according to the electrical connection of the specific cable thermometer → 19.

To avoid connection errors, always pay attention to the "Post-connection check" section before commissioning!

6.3.1 Connecting to screw terminals

Maximum torque for screw terminals = 0.35 Nm (¼ lbf ft), screwdriver: Pozidriv Z1

6.3.2 Connecting to push-in terminals



11 *Connecting to push-in terminals*

Item A, solid wire:

1. Strip wire end. Min. stripping length 10 mm (0.39 in).
2. Insert the wire end into the terminal.
3. Pull the wire gently to ensure it is connected correctly. Repeat from step 1 if necessary.

Item B, fine-strand wire without ferrule:

1. Strip wire end. Min. stripping length 10 mm (0.39 in).
2. Press down on the lever opener.
3. Insert the wire end into the terminal.
4. Release lever opener.

5. Pull the wire gently to ensure it is connected correctly. Repeat from step 1 if necessary.

Item C, releasing the connection:

1. Press down on the lever opener.
2. Remove the wire from the terminal.
3. Release lever opener.

6.4 Special connection instructions

Observe grounding concept of the plant.

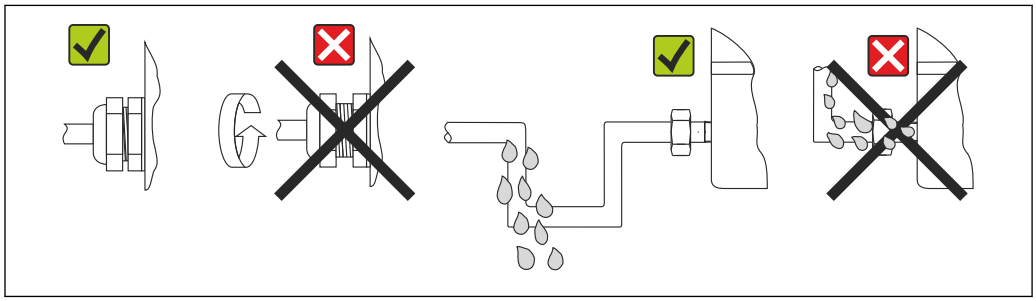
6.5 Ensuring the degree of protection

Make sure that the grommet is available in each case!

The device meets all of the requirements in accordance with the degree of protection indicated on the nameplate.

To ensure that the degree of protection of the housing is maintained following installation in the field or after servicing, compliance with the following points is mandatory:
- The housing seals must be clean and undamaged when inserted into their grooves. Dry, clean or replace in the case of moisture or wet seals.
- Tighten all housing screws and screw covers.
- The cables used for the connection must have the specified outer diameter (e.g. M20x1.5, cable diameters ø 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. Mount the device in such a way that the cable glands are pointing downwards.
- Do not twist the cables, and use only round cables.
- Cable glands not used are to be blanked off using the dummy plugs provided.
- Do not remove the grommet used from the cable gland.

Repeated opening/closing of the device is possible but has a negative impact on the degree of protection.



12 *Connection tips to retain IP67 protection*

6.6 Post-connection check

Device condition and specifications	Notes
Are the device and cable undamaged?	

Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate?	
Do the cables have adequate strain relief?	
Are the power supply and signal cables connected correctly?	--
Are all the screw terminals firmly tightened and have the push-in terminal connections been checked?	--
Are all the cable entries installed, tightened and leak-tight?	--

7 Operation options

See the technical documentation for the specific transmitter.

8 Commissioning

8.1 Function check

Perform the following final checks before commissioning the measuring point:

1. Perform the post-mounting check using the checklist. → 12
2. Perform the post-connection check using the checklist. → 16

8.2 Switching on the measuring instrument

Once you have completed the post-connection checks, switch on the supply voltage. During the switch-on procedure, the transmitter runs through internal test functions. Depending on the type of transmitter selected, the device operates after 5 to 33 s. Normal measuring mode commences as soon as the switch-on procedure is completed.

8.3 Configuring the measuring instrument

See the technical documentation for the specific transmitter.

9 Diagnostics and troubleshooting

See the technical documentation for the specific transmitter.

10 Maintenance

No special maintenance work is required for the device.

10.1 Cleaning

WARNING

Risk of explosion! Static charge in the potentially explosive atmosphere.

- Do not clean with a dry cloth in potentially explosive atmospheres.

10.1.1 Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (displays, housing, for example) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.

The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

10.2 Endress+Hauser services

Service	Description
Calibration	RTD measuring inserts may drift depending on the application. Regular recalibration to verify accuracy is recommended. The calibration can be performed by Endress+Hauser or by qualified specialist staff using calibration devices on site.

11 Repair

11.1 General notes

For the purpose of repair, individual components can be replaced by the customer's technical personnel.

11.1.1 Repair of Ex-certified devices

- Only specialist personnel or the manufacturer may undertake repairs on Ex-certified devices.
- Carry out repairs according to the instructions. On completion of the repair, carry out the routine test specified for the device.
- The prevailing standards, national hazardous area regulations, safety instructions and certificates must be observed.
- Only use original spare parts from the manufacturer.
- When ordering spare parts, check the device designation on the nameplate. Replace individual parts with the same parts.
- A certified device may only be converted to another certified device version by the manufacturer only.
- Document all repairs and modifications.

11.2 Spare parts

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

11.3 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.

11.4 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.

12 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**.

12.1 Service-specific accessories

12.1.1 Modems/Edge devices

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

12.1.2 Software

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

12.2 Online tools

Product information over the entire life cycle of the device: www.endress.com/onlinetools

12.3 System components

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

Process indicators from the RIA product family

Easily readable process indicators with various functions: loop-powered indicators for displaying 4 to 20 mAvalues, display of up to four HART variables, process indicators with control units, limit value monitoring, sensor power supply, and galvanic isolation.

Universal application thanks to international hazardous area approvals, suitable for panel mounting or field installation..

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

13 Technical data

13.1 Input

Measured variable

Temperature (temperature-linear transmission behavior)

Measuring range

Due to the design of the non-invasive thermometer, the measuring range is limited to temperatures between −196 to +400 °C.

Depends on the type of sensor used

Sensor type [1]	Measuring range
Pt100 (WW)	−200 to +600 °C (−328 to +1 112 °F)
Pt100 (TF) Basic	−50 to +200 °C (−58 to +392 °F)
Pt100 (TF) Standard	−50 to +400 °C (−58 to +752 °F)
Pt100 (TF) iTHERM QuickSens	−50 to +200 °C (−58 to +392 °F)
Pt100 (TF) iTHERM StrongSens	−50 to +500 °C (−58 to +932 °F)
Thermocouple TC, type J	−40 to +750 °C (−40 to +1 382 °F)
Thermocouple TC, type K	−40 to +1 100 °C (−40 to +2 012 °F)
Thermocouple TC, type N	

1) Options depend on product and configuration

13.2 Output

Output signal

The measured values can be transmitted in two ways:

- Via directly-wired sensors: sensor measured values are forwarded without an iTEMP transmitter.
- By selecting the appropriate iTEMP transmitter via all common protocols.

All iTEMP transmitters are mounted directly in the terminal head and wired with the sensory mechanism.

13.3 Power supply

Supply voltage

U = max. 9 to 42 V_{DC}, depending on the iTEMP temperature transmitter used.

See technical documentation of the specific iTEMP transmitter.

Current consumption

I ≤ 23 mA, depending on the iTEMP temperature transmitter used.

See technical documentation of the specific iTEMP transmitter.

Terminals

iTEMP head transmitters fitted with push-in terminals unless screw terminals are explicitly selected or a double sensor is installed.

Cable entries

The cable entries must be selected during configuration of the device. Different terminal heads offer different options in terms of the thread and number of available cable entries.

Plug-in connector

The manufacturer offers a wide variety of connectors for the simple and fast integration of the thermometer into a process control system. The following tables show the PIN assignments of the various plug connector combinations.

The manufacturer advises against connecting thermocouples directly to connectors. The direct connection to the pins of the plug might generate a new "thermocouple" which influences the accuracy of the measurement. The thermocouples are connected in combination with a iTEMP transmitter.

Abbreviations

#1	Order: first transmitter/insert	#2	Order: second transmitter/insert
i	Insulated. Wires marked 'i' are not connected and are insulated with heat shrink tubes.	YE	Yellow
GND	Grounded. Wires marked 'GND' are connected to the internal grounding screw in the terminal head.	RD	Red
BN	Brown	WH	White
GNYE	Green-yellow	PK	Pink
BU	Blue	GN	Green
GY	Gray	BK	Black

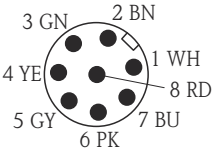
Terminal head with a cable entry [1)]

Connector	1x PROFIBUS® PA								1x FOUNDATION™ Fieldbus (FF)				1x PROFINET® and Ethernet-APL™			
Plug thread	M12				7/8"				7/8"				M12			
PIN number	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Electrical connection (terminal head)																
Flying leads and TC	Not connected (not insulated)															
3-wire terminal block (1x Pt100)	RD	RD	WH		RD	RD	WH		RD	RD	WH		RD	RD	WH	
4-wire terminal block (1x Pt100)			WH	WH			WH	WH			WH	WH			WH	WH
6-wire terminal block (2x Pt100)	RD (#1) [2)]	RD (#1)	WH (#1)		RD (#1)	RD (#1)	WH (#1)		RD (#1)	RD (#1)	WH (#1)				WH (#1)	
1x TMT 4 to 20 mA or HART®	+	i	-	i	+	i	-	i	+	i	-	i	Cannot be combined			
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover	+(#1)	+(#2)	-(#1)	-(#2)	+(#1)	+(#2)	-(#1)	-(#2)	+(#1)	+(#2)	-(#1)	-(#2)	Cannot be combined			
1x TMT PROFIBUS® PA	+	i	-	GND [3)]	+	i	-	GND [3)]	Cannot be combined							
2x TMT PROFIBUS® PA	+(#1)		-(#1)		+		-									
1x TMT FF	Cannot be combined				Cannot be combined				-	+	GND	i	Cannot be combined			
2x TMT FF									-(#1)	+(#1)						

Connector	1x PROFIBUS® PA		1x FOUNDATION™ Fieldbus (FF)	1x PROFINET® and Ethernet-APL™			
1x TMT PROFINET®			Cannot be combined	APL signal -	APL signal +	GND	-
2x TMT PROFINET®				APL signal - (#1)	APL signal + (#1)		
PIN position and color code	 1 BN 2 GNYE 3 BU 4 GY A0018929	 1 BN 2 GNYE 3 BU 4 GY A0018930	 1 BU 2 BN 3 GY 4 GNYE A0018931	 1 RD 2 GN A0052119			

1) Options depend on product and configuration
2) Second Pt100 is not connected
3) If a head is used without grounding screw, e.g. plastic housing TA30S or TA30P, insulated 'i' instead of grounded GND

Terminal head with a cable entry [1)]

Connector	4-pin/8-pin							
Plug thread	M12							
PIN number	1	2	3	4	5	6	7	8
Electrical connection (terminal head)								
Flying leads and TC	Not connected (not insulated)							
3-wire terminal block (1x Pt100)	RD	RD	WH		i			
4-wire terminal block (1x Pt100)			WH	WH				
6-wire terminal block (2x Pt100)			WH		BK	BK	YE	
1x TMT 4 to 20 mA or HART®	+(#1)	i	-(#1)	i	i			
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover					+(#2)	i	-(#2)	i
1x TMT PROFIBUS® PA	Cannot be combined							
2x TMT PROFIBUS® PA								
1x TMT FF	Cannot be combined							
2x TMT FF								
1x TMT PROFINET®	Cannot be combined							
2x TMT PROFINET®	Cannot be combined							
PIN position and color code	 1 BN 2 GNYE 3 BU 4 GY A0018929				 A0018927			

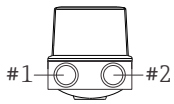
1) Options depend on product and configuration

Terminal head with one cable entry

Plug	1x IO-Link®, 4-pin			
Plug thread	M12			
PIN number	1	2	3	4

Plug	1x IO-Link®, 4-pin			
Electrical connection (terminal head)				
Flying leads	Not connected (not insulated)			
3-wire terminal block (1x Pt100)	RD	i	RD	WH
4-wire terminal block (1x Pt100)	Cannot be combined			
6-wire terminal block (2x Pt100)				
1x TMT 4 to 20 mA or HART®	Cannot be combined			
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover				
1x TMT PROFIBUS® PA	Cannot be combined			
2x TMT PROFIBUS® PA				
1x TMT FF	Cannot be combined			
2x TMT FF				
1x TMT PROFINET®	Cannot be combined			
2x TMT PROFINET®				
1x TMT IO-Link®	L+	-	L-	C/Q
2x TMT IO-Link®	L+ (#1)	-	L- (#1)	C/Q
PIN position and color code	 1 BN 3 BU 4 BK A0055383			

Terminal head with two cable entries [1)]

Connector	2x PROFIBUS® PA								2x FOUNDATION™ Fieldbus (FF)				2x PROFINET® and Ethernet-APL™			
Plug thread  A0021706	M12(#1) / M12(#2)				7/8"(#1)/7/8"(#2)				7/8"(#1)/7/8"(#2)				M12 (#1)/M12 (#2)			
PIN number	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Electrical connection (terminal head)																
Flying leads and TC	Not connected (not insulated)															
3-wire terminal block (1x Pt100)	RD/i	RD/i	WH/i		RD/i	RD/i	WH/i		RD/i	RD/i	WH/i		RD/i	RD/i	WH/i	
4-wire terminal block (1x Pt100)			WH/i	WH/i			WH/i	WH/i			WH/i	WH/i			WH/i	WH/i
6-wire terminal block (2x Pt100)	RD/BK	RD/BK	WH/YE		RD/BK	RD/BK	WH/YE		RD/BK	RD/BK	WH/YE		RD/BK	RD/BK	WH/YE	
1x TMT 4 to 20 mA or HART®	+/i	i/i	-/i	i/i	+/i	i/i	-/i	i/i	+/i	i/i	-/i	i/i	+/i	i/i	-/i	i/i
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover	+ (#1)/ + (#2)		- (#1)/ -(#2)		+ (#1)/ + (#2)		- (#1)/ -(#2)		+ (#1)/ + (#2)		- (#1)/ -(#2)		+ (#1)/ +(#2)		- (#1)/ -(#2)	
1x TMT PROFIBUS® PA	+/i		-/i	GND/ GND	+/i		-/i	GND/ GND	Cannot be combined							

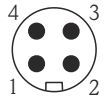
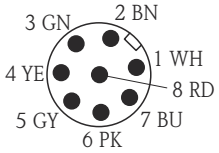
Connector	2x PROFIBUS® PA								2x FOUNDATION™ Fieldbus (FF)				2x PROFINET® and Ethernet-APL™			
2x TMT PROFIBUS® PA	+ (#1)/ + (#2)		- (#1)/ -(#2)		+ (#1)/ + (#2)		- (#1)/ -(#2)									
1x TMT FF	Cannot be combined				Cannot be combined				-/i	+/i	i/i	GND/ GND	Cannot be combined			
2x TMT FF									- (#1)/ -(#2)	+ (#1)/ + (#2)						
1x TMT PROFINET®	Cannot be combined				Cannot be combined				Cannot be combined				APL signal -	APL signa l +	GND	i
2x TMT PROFINET®	Cannot be combined				Cannot be combined				Cannot be combined				APL signal - (#1) and (#2)	APL signa l + (#1) and (#2)		
PIN position and color code	 1 BN 2 GNYE 3 BU 4 GY A0018929				 1 BN 2 GNYE 3 BU 4 GY A0018930				 1 BU 2 BN 3 GY 4 GNYE A0018931				 1 RD 2 GN A0052119			

1) Options depend on product and configuration

Terminal head with two cable entries [1)]

Connector	4-pin/8-pin							
Plug thread  A0021706	M12 (#1)/M12 (#2)							
PIN number	1	2	3	4	5	6	7	8

Electrical connection (terminal head)					
Flying leads and TC	Not connected (not insulated)				
3-wire terminal block (1x Pt100)	RD/i	RD/i	WH/i		i/i
4-wire terminal block (1x Pt100)			WH/i	WH/i	
6-wire terminal block (2x Pt100)	RD/BK	RD/BK	WH/YE		
1x TMT 4 to 20 mA or HART®	+/i	i/i	-/i	i/i	
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover	+(#1)/ +(#2)		-(#1)/-(#2)		
1x TMT PROFIBUS® PA	Cannot be combined				
2x TMT PROFIBUS® PA					
1x TMT FF	Cannot be combined				
2x TMT FF					

Connector	4-pin/8-pin	
1x TMT PROFINET®	Cannot be combined	
2x TMT PROFINET®	Cannot be combined	
PIN position and color code	 1 BN 2 GNYE 3 BU 4 GY A0018929	 A0018927

1) Options depend on product and configuration

Terminal head with two cable entries

Plug	2x IO-Link®, 4-pin			
Plug thread	M12(#1)/M12 (#2)			
PIN number	1	2	3	4
Electrical connection (terminal head)				
Flying leads	Not connected (not insulated)			
3-wire terminal block (1x Pt100)	RD	i	RD	WH
4-wire terminal block (1x Pt100)	Cannot be combined			
6-wire terminal block (2x Pt100)	RD/BK	i	RD/BK	WH/YE
1x TMT 4 to 20 mA or HART®	Cannot be combined			
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover				
1x TMT PROFIBUS® PA	Cannot be combined			
2x TMT PROFIBUS® PA				
1x TMT FF	Cannot be combined			
2x TMT FF				
1x TMT PROFINET®	Cannot be combined			
2x TMT PROFINET®				
1x TMT IO-Link®	L+	-	L-	C/Q
2x TMT IO-Link®	L+ (#1) and (#2)	-	L- (#1) and (#2)	C/Q
PIN position and color code	 1 BN 3 BU 4 BK A0055383			

Connection combination: insert - transmitter [1)]

Insert	Transmitter connection [2)]			
	iTEMP TMT31/iTEMP TMT7x		iTEMP TMT8x	
	1x 1-channel	2x 1-channel	1x 2-channel	2x 2-channel
1x sensor (Pt100 or TC), flying leads	Sensor (#1) : transmitter (#1)	Sensor (#1) : transmitter (#1) (Transmitter (#2) not connected)	Sensor (#1) : transmitter (#1)	Sensor (#1) : transmitter (#1) Transmitter (#2) not connected
2x sensor (2x Pt100 or 2x TC), flying leads	Sensor (#1) : transmitter (#1) Sensor (#2) insulated	Sensor (#1) : transmitter (#1) Sensor (#2): transmitter (#2)	Sensor (#1) : transmitter (#1) Sensor (#2): transmitter (#1)	Sensor (#1) : transmitter (#1) Sensor (#2): transmitter (#1) (Transmitter (#2) not connected)
1x sensor (Pt100 or TC),with terminal block [3)]	Sensor (#1) : transmitter in cover	Cannot be combined	Sensor (#1) : transmitter in cover	Cannot be combined
2x sensor (2x Pt100 or 2x TC) with terminal block	Sensor (#1) : transmitter in cover Sensor (#2) not connected		Sensor (#1) : transmitter in cover Sensor (#2): transmitter in cover	
2x sensors (2x Pt100 or 2x TC) in conjunction with feature 600, option MG [4)]	Cannot be combined	Sensor (#1) : transmitter (#1) Sensor (#2): transmitter (#2)	Cannot be combined	Sensor (#1): transmitter (#1) - channel 1 Sensor (#2): transmitter (#2) - channel 1

1) Options depend on product and configuration
2) If 2 transmitters are selected in a terminal head, transmitter (#1) is installed directly on the insert. Transmitter (#2) is installed in the high cover. A TAG cannot be ordered for the second transmitter as standard. The bus address is set to the default value and, if necessary, must be changed manually before commissioning.
3) Only in the terminal head with a high cover, only 1 transmitter possible. A ceramic terminal block is automatically fitted on the insert.
4) Individual sensors each connected to channel 1 of a transmitter

13.4 Performance characteristics

Conditions for accurate non-invasive temperature measurement

The measurement result and the measurement uncertainty of thermometers depend on many factors. For the iTHERM SurfaceLine TM611, these include in particular the type of medium, the flow velocity, and the properties of the pipe (type, material, and surface) to which the thermometer is mounted. In addition, the design of the thermometer and, above all, ambient conditions play a role in the measurement result and uncertainty.

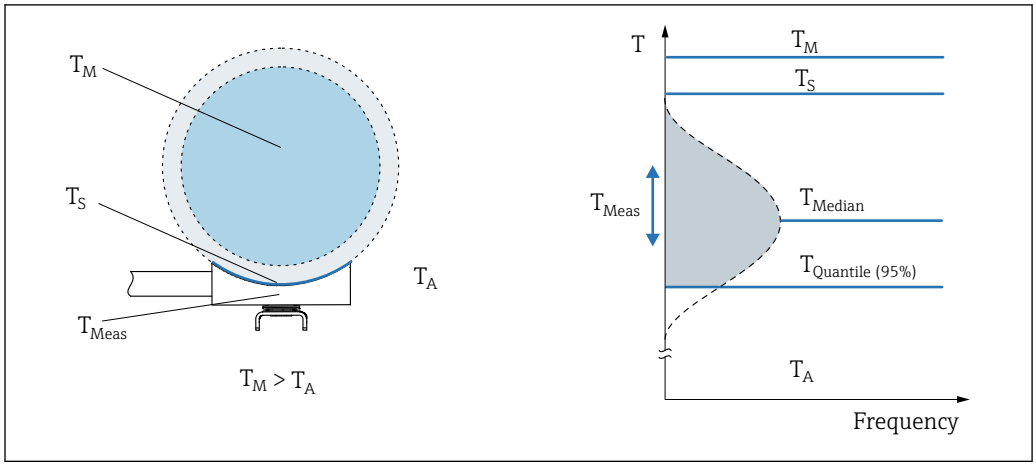
To enable fast and accurate temperature measurement with the non-invasive thermometer iTHERM SurfaceLine TM611, the following conditions must be met:
- The coupling element of the thermometer must match the outer diameter of the pipe to be measured.
- A clean, bare pipe surface ensures the best possible measurement results.
- Ensure the thermometer is firmly seated and that the coupling element is in good contact with the pipe.
- Thermal insulation of the measuring point (between coupling element and surrounding area) is recommended.

The pipe surface in the area of the coupling element must be smooth and free from damage. This area must not contain any weld seams or similar irregularities.

Measurement error in non-invasive applications

The target variable of the temperature measurement is the medium temperature T_M. Due to the design and application of iTHERM SurfaceLine TM611, thermal measurement errors ΔT_M occur when the ambient temperature T_A differs from T_M. In such cases, the temperature T_{Meas} measured by the sensor of the thermometer deviates from the medium temperature T_M. The meaurement errors or deviations are calculated using the following formula: $\Delta T_M = T_{Meas} - T_M$. As a result, it is not possible to determine the exact medium

temperature T_M, or in rarer cases, the exact measurement of the surface temperature T_S target variable of a pipe.



However, the thermometer is designed such that measurement errors are minimized, thereby optimising the accuracy of the temperature measurement.

Nevertheless, thermometers may display deviating values under identical measurement conditions - for example, due to variations during installation. This leads to a distribution of the measured values as shown in the figure above. The distribution of the measured values is characterized by T_{MEDIAN} [1] and the $T_{Quantile\ (95\%)}$ [2]

Thermal measurement errors

Thermal measurement errors ΔT_M occur with surface thermometers when the medium temperature T_M differs from the ambient temperature T_A. The greater the difference between these two values, the larger the ΔT_M. When $T_M = T_A$, there is no deviation. Based on this, the measurement errors can also be calculated using the formula: $\Delta T_M = B \times (T_M - T_A)$.

The factor B is a quality factor for the measurement and is specific to a thermometer. The lower the value of B, the lower the measurement error. If B is known, for example, the following factors may be calculated:

- $\Delta T_{M,\ Median} = B_{Median} \times (T_M - T_A)$
- $\Delta T_{M,\ Quantile\ (95\%)} = B_{Quantile\ (95\%)} \times (T_M - T_A)$

From this, the expected measurement error with iTHERM SurfaceLine TM611 for the predefined values T_M und T_A can be determined.

1) 50% of all measurement results are above and 50% are below T_{Median}.
2) 95% of all measurement results are closer to T_M than to $T_{Quantile\ (95\%)}$.

The following statements about measurement errors can be derived from the predefined values T_M and T_A:
- With a probability of 95% (k = 2) the measurement error at medium temperature T_M and ambient temperature T_A is less than $\Delta T_{M, Quantile}$.
- At medium temperature T_M and ambient temperature T_A, 50% of all measuring points will show a measurement error less than $\Delta T_{M, Median}$.

For the iTHERM SurfaceLine TM611 thermometer, the values for B_{Median} and $B_{Quantile\ (95\%)}$ in the temperature range 20 to 130 °C were determined under the following conditions:

- Installation of a iTHERM SurfaceLine TM611 on a pipe with a nominal diameter matching the thermometer.
- Uncoated surface with roughness as per standard and without geometric deformation.
- Wall thickness of pipe is ≤ the value defined in the standard.
- Thermal conductivity of pipe material is λ ≥ 15 W/m/K.
- Tightening torque of securing screws ≥ 2 Nm.
- The measuring point is insulated with insulation material with a U-value ≤ 0.85 W/m2/K.
- The insulating material fully encloses both the thermometer and the pipe. It is flush with the coupling element.
- Measurement conducted on water with v > 0.1 m/s.

If the above conditions are met for the iTHERM SurfaceLine TM611 thermometer, the values listed below apply for factor B. The measurement uncertainty of factor U(B) is 0.005 at k = 2.

Median

B_{Median}

Sensor	ø d_a ≥ 13.5 mm	ø d_a ≥ 33.7 mm	ø d_a ≥ 60.3 mm
Pt100 (TF), standard	0.015	0.007	0.004
Pt100 (WW), wire-wound	0.02	0.01	0.006

Quantile = 95 %

95% of measurements are better than the values given in the table.

$B_{Quantile\ (95\%)}$

Sensor	ø d_a ≥ 13.5 mm	ø d_a ≥ 33.7 mm	ø d_a ≥ 60.3 mm
Pt100 (TF), standard	0.02	0.014	0.010
Pt100 (WW), wire-wound	0.024	0.018	0.015

Maximum measurement error and measurement uncertainty

The iTHERM SurfaceLine TM611 thermometer can be configured with various thermometers, such as iTHERM ModuLine TM111 and temperature transmitters. Their measurement accuracy also contributes to the overall measurement accuracy in addition to the thermal measurement error ΔT_M.

The measurement errors are added according to the following formula:

$$\Delta T_{TM611} = B \times (T_M - T_A) + \Delta T_{TM111} + \Delta T_{Trans}$$

Here, ΔT_{TM111} is the measurement error of the thermometer used (in this case, the iTHERM ModuLine TM111) and ΔT_{Trans} is the measurement error of the temperature transmitter used.

This allows the measurement uncertainty of iTHERM SurfaceLine TM611 to be calculated as follows:

$$U(T_{TM611}) = \sqrt{((T_M - T_A) \times U(B))^2 + (U(T_{TM111}))^2 + (U(T_{Trans}))^2}$$

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The contribution $U(T_{Trans})$ is the overall accuracy of the temperature transmitter and can be found in the relevant Technical Documentation. $U(T_{TM111})$ is the contribution from the characteristic accuracy or tolerance of the thermometer used, here shown using the example of iTHERM ModuLine TM111.

The following table shows the procedure for a thermometer iTHERM SurfaceLine TM611 with a standard thin-film Pt100 insert, class A and iTEMP TMT71 with analog output, on a pipe with a nominal diameter of DN 60.3:

$B_{Quantile\ (95\ \%)}$ according to Table $B_{Quantile}$ $B_{Quantile\ (95\%)}$ = 0.01		**$U(T_{TM111})$ according to IEC 60751**		**$U(T_{Trans})$ according to data sheet**	
U(B) [1], k = 2 (2 σ)	u(B) [2], k = 1 (1 σ)	Tolerance class A	$u(T_{TM111})$, k = 1 (1 σ)	$U(T_{Trans})$, k = 2 (2 σ)	$u(T_{Trans})$, k = 1, (1 σ)
0.005	0.0025	0.15 °C + 0.002 x T_M	$\frac{1}{3}(0{,}15°C + 0{,}002 \times T_M)$	0.13 °C	0.065 °C

1) U = expanded uncertainty at k = 2.
2) u = expanded uncertainty at k = 1.

This results in a total uncertainty of:

$$u(T_{TM611}) = \sqrt{\frac{1}{3}(0{,}15°C + 0{,}002 \times (T_M))^2 + (0{,}065°C)^2 + (0{,}0025 \times (T_M - T_A))^2}$$

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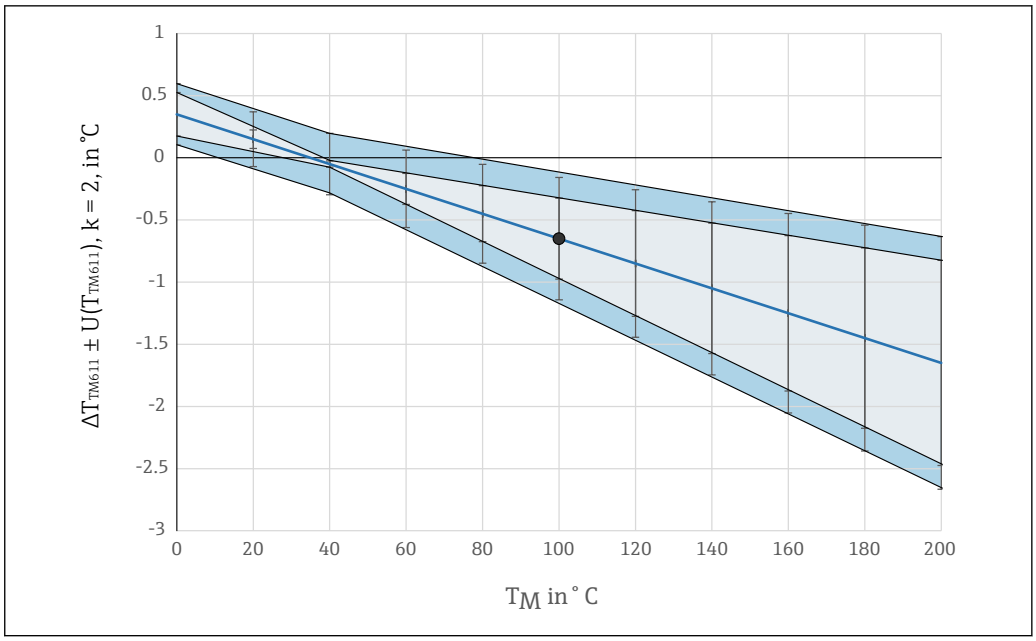
The expanded uncertainty for k = 2, (2 σ) is:
$U(T_{TM611}) = 2 \times u(T_{TM611})$.

As shown in the diagram below, for an ambient temperature of T_A = 35 °C, the measurement error ΔT_{TM611} and the uncertainty $U(T_{TM611})$ are as represented in the following diagram. From the marked data point, it can be read that for T_M = 100 °C and T_A = 35 °C on a pipe DN 60.3, in 95% of all measuring points, a deviation $\Delta T_{TM611} \leq 0.65$ °C will occur. The uncertainty $U(T_{TM611})$ = 0.5 °C (k = 2), where the contribution from $U(\Delta T_M)$ is 0.33 °C.



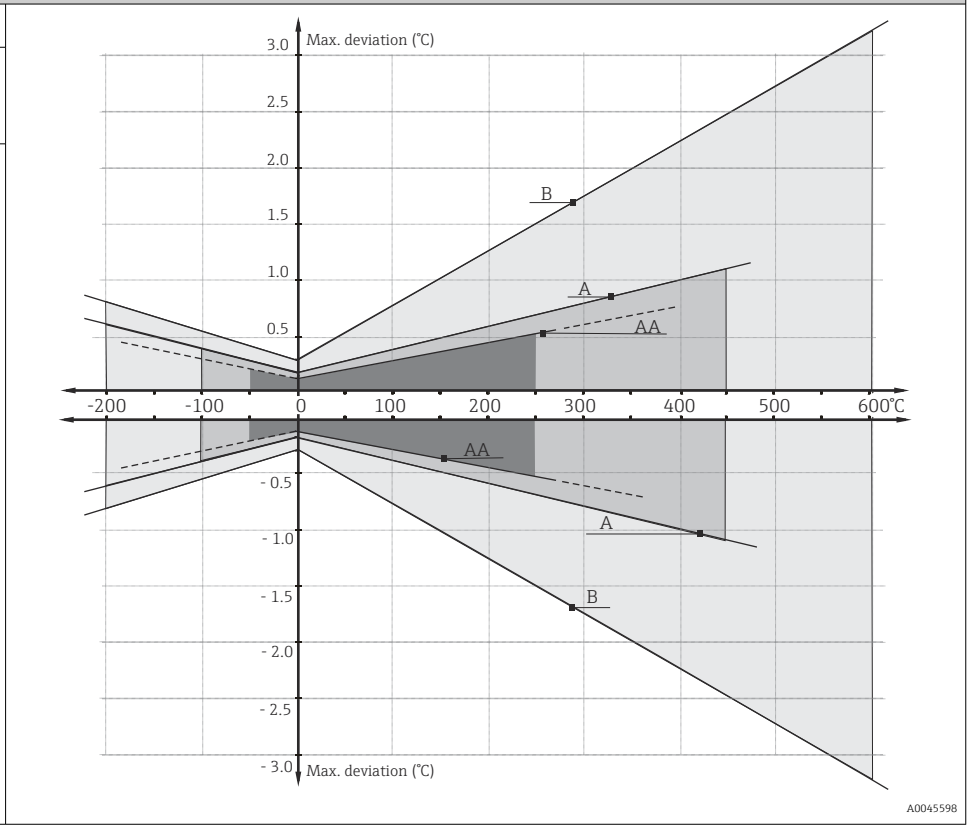
13 *Measurement error for B = 0.01 and T_A = 35 °C (95 °F)*

Reference operating conditions

This data is relevant for determining the measurement accuracy of the iTEMP transmitters used. See technical documentation of the specific iTEMP transmitter.

Maximum measurement error

RTD resistance thermometers as per IEC 60751:

Class	Max. tolerances (°C)	Characteristics
RTD maximum sensor error		
Cl. A	± (0.15 + 0.002 · |t| [1])	
Cl. AA, formerly 1/3 Cl. B	± (0.1 + 0.0017 · |t|) [1]	
Cl. B	± (0.3 + 0.005 · |t| [1])	

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

For measurement errors in °F, calculate using equation above in °C, then multiply the outcome by 1.8.

The measurement error of the system depends on the installation position, the environment and insulation of the coupling element.

Temperature ranges

Sensor type [1]	Operating temperature range	Class B	Class A	Class AA
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)
Pt100 (TF) Basic	−50 to +200 °C (−58 to +392 °F)	−50 to +200 °C (−58 to +392 °F)	−30 to +200 °C (−22 to +392 °F)	-
Pt100 (TF) Standard	−50 to +400 °C (−58 to +752 °F)	−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 QuickSens	−50 to +200 °C (−58 to +392 °F)	−50 to +200 °C (−58 to +392 °F)	−30 to +200 °C (−22 to +392 °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)

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 [1]	Standard tolerance		Special tolerance	
IEC 60584		Class	Deviation	Class	Deviation
	J (Fe-CuNi)	2	±2.5 °C (−40 to +333 °C) ±0.0075 |t| [2] (333 to 750 °C)	1	±1.5 °C (−40 to +375 °C) ±0.004 |t| [2] (+375 to +750 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	2	±0.0075 |t| [2] (+333 to +1 200 °C) ±2.5 °C (−40 to +333 °C) ±0.0075 |t| [2] (+333 to +1 200 °C)	1	±1.5 °C (−40 to +375 °C) ±0.004 |t| [2] (+375 to +1 000 °C)

1) Options depend on product and configuration
2) |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). Class 3 tolerances cannot be satisfied. A separate material must be selected for this temperature range. This cannot be processed via the standard product.

Standard	Type [1]	Tolerance class: Standard	Tolerance class: Special
ASTM E230/ANSI MC96.1		Deviation; the larger value applies in each case	
	J (Fe-CuNi)	±2.2 K or ±0.0075 |t| [2] (0 to 760 °C)	±1.1 K or ±0.004 |t| [2] (0 to 760 °C)
	K (NiCr-NiAl) N (NiCrSi-NiSi)	±2.2 K or ±0.02 |t| [2] (−200 to 0 °C) ±2.2 K or ±0.0075 |t| [2] (0 to 1 260 °C)	±1.1 K or ±0.004 |t| [2] (0 to 1 260 °C)

1) Options depend on product and configuration
2) |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 processed via the standard product.

Response time

The response time of non-invasive thermometers for water with a flow velocity 1 m/s ranges between 45 to 65 s and thus in the same range as invasive thermometers with a thermowell. The quality of the coupling, as well as the material and surface of the pipe, in addition to the insulation of the measuring point, have the greatest influence here.

Self-heating

RTD elements are passive resistances that are measured using an external current. This measurement current causes a self-heating effect in the RTD element itself, which in turn creates an additional measurement error. In addition to the measurement current, the size of the measurement error is also affected by the temperature conductivity and flow velocity of the process. This self-heating error is negligible when an Endress+Hauser iTEMP temperature transmitter (very small measurement current) is connected.

Calibration

Calibration of thermometers
Calibration refers to the comparison between the display of a piece of measuring equipment and the true value of a variable provided by the calibration standard under defined conditions. The aim is to determine the deviation or measurement errors of the UUT from the true value of the measured variable. For thermometers, calibration is usually only performed on the inserts. This checks only the deviation of the sensor element caused

by the insert design. However, in most applications, the deviations caused by the design of the measuring point, integration into the process, the influence of ambient conditions, and other factors are significantly greater than the deviations related to the insert. Calibration of inserts is generally carried out using two methods:
- Calibration at fixed points, e.g. at the freezing point of water at 0 °C,
- Calibration compared against a precise reference thermometer.

The thermometer to be calibrated must display either the fixed point temperature or the temperature of the reference thermometer as accurately as possible. Temperature-controlled calibration baths with very homogeneous thermal values, or special calibration furnaces are typically used for thermometer calibrations. The measurement uncertainty may increase due to heat conduction errors and short immersion lengths. The existing measurement uncertainty is recorded on the individual calibration certificate. For accredited calibrations in accordance with ISO 17025, a measurement uncertainty that is twice as high as the accredited measurement uncertainty is not permitted. If this limit is exceeded, only a factory calibration is possible.

The device is calibrated without a coupling element. The application and the installation position of the measuring point have a significant influence on the measurement accuracy.

Sensor-transmitter-matching
The resistance/temperature curve of platinum resistance thermometers is standardized but in practice it is rarely possible to keep to the values precisely over the entire operating temperature range. For this reason, platinum resistance sensors are divided into tolerance classes, such as Class A, AA or B as per IEC 60751. These tolerance classes describe the maximum permissible deviation of the specific sensor characteristic curve from the standard curve, i.e. the maximum temperature-dependent characteristic error that is permitted. The conversion of measured sensor resistance values to temperatures in temperature transmitters or other meter electronics is often susceptible to considerable errors as the conversion is generally based on the standard characteristic curve.

When Endress+Hauser iTEMP temperature transmitters are used, this conversion error can be reduced significantly by sensor-transmitter-matching:
- Calibration at three temperatures at least and determination of the actual temperature sensor characteristic curve,
- Adjustment of the sensor-specific polynomial function using Calendar-van Dusen (CvD) coefficients
- Configuration of the temperature transmitter with the sensor-specific CvD coefficients for resistance/temperature conversion, and
- another calibration of the reconfigured temperature transmitter with connected resistance thermometer.

Endress+Hauser offers its customers this kind of sensor-transmitter matching as a separate service. Furthermore, the sensor-specific polynomial coefficients of platinum resistance thermometers are always provided on every Endress+Hauser calibration certificate where possible, e.g. at least three calibration points, so that users themselves can also appropriately configure suitable temperature transmitters.

For the device, Endress+Hauser offers standard calibrations at a reference temperature of −80 to +600 °C (−112 to +1 112 °F) based on the ITS90 (International Temperature Scale). Calibrations in other temperature ranges are available from an Endress+Hauser sales center on request. Calibrations are traceable to national and international standards. The calibration certificate is referenced to the serial number of the device. Only the insert is calibrated.

Minimum immersion length (IL) for inserts required to perform a correct calibration

Due to the limitations of furnace geometries, the minimum immersion lengths must be observed at high temperatures to enable a calibration to be performed with an acceptable degree of measurement uncertainty. The same applies when using a head transmitter. Due to heat conduction, minimum lengths must be observed in order to guarantee the functionality of the transmitter −40 to +85 °C (−40 to +185 °F).

Calibration temperature	Minimum immersion length IL in mm without head transmitter
−196 °C (−320.8 °F)	120 mm (4.72 in) [1]
−80 to +250 °C (−112 to +482 °F)	No minimum immersion length required [2]
+251 to +550 °C (+483.8 to +1 022 °F)	300 mm (11.81 in)
+551 to +600 °C (+1 023.8 to +1 112 °F)	400 mm (15.75 in)

1) With iTEMP head transmitter min. 150 mm (5.91 in) is required
2) at a temperature of +80 to +250 °C (+176 to +482 °F), the iTEMP head transmitter requires min. 50 mm (1.97 in)

For the iTHERM SurfaceLine TM611, no replaceable insert is available. The measuring insert length relevant for calibration of the thermometer in the iTHERM SurfaceLine TM611 is calculated using the following formula: IL = extension neck length + 60 mm.

Insulation resistance

- RTD:
  Insulation resistance between the terminals and the extension neck, as per IEC 60751 > 100 MΩ at +25 °C, measured with a minimum testing voltage of 100 V_{DC}.
- TC:
  Insulation resistance as per IEC 61515 between terminals and sheath material for a test voltage of 500 V_{DC}:
  - > 1 GΩ at +20 °C
  - > 5 MΩ at +500 °C

13.5 Environment

Ambient temperature range

RTD and TC industrial thermometers

Terminal head	Temperature in °C (°F)
Without mounted head transmitter	Depends on the terminal head used and the cable gland or fieldbus connector; see "Terminal heads" section.
With mounted iTEMP head transmitter	−40 to +85 °C (−40 to +185 °F)
With mounted iTEMP head transmitter and display	−30 to +85 °C (−22 to 185 °F)

RTD cable thermometers

Material Connecting cable/tube insulation	Temperature in °C (°F)
PVC/PVC	80 °C (176 °F)
PTFE/silicone	180 °C (356 °F)
PTFE/PTFE	200 °C (392 °F)

TC cable thermometers

Material Connecting cable/tube insulation	Temperature in °C (°F)
PVC/PVC	80 °C (176 °F)
Glass fiber / glass fiber	400 °C (751 °F)

Storage temperature

−40 to +85 °C (−40 to +185 °F).

Operating altitude

Up to 2 000 m (6 561 ft) above sea level.

Humidity

Depends on the iTEMP transmitter used. When using iTEMP head transmitters:
- Condensation permitted as per IEC 60068-2-33
- Max. relative humidity: 95% in accordance with IEC 60068-2-30

Climate class

As per EN 60654-1, Class D

Degree of protection

Max. IP 66 (NEMA Type 4x encl.)	Depending on the design (terminal head, connector, etc.)
Partly IP 68	Tested in 1.83 m (6 ft) over 24 h

Shock and vibration resistance

The Endress+Hauser inserts exceed the requirements of IEC 60751 with regard to shock and vibration resistance of 3g in a range of 10 to 500 Hz. The vibration resistance of the measuring point depends on sensor type and design:

Sensor type [1]	**Vibration resistance for the sensor tip**
Pt100 (WW)	≤ 30 m/s² (≤ 3g)
Pt100 (TF) Basic	
Pt100 (TF) Standard	≤ 40 m/s² (≤ 4g)
Pt100 (TF) iTHERM StrongSens	600 m/s² (60g)
Pt100 (TF) iTHERM QuickSens, version: ø6 mm (0.24 in)	600 m/s² (60g)
Pt100 (TF) iTHERM QuickSens, version: ø3 mm (0.12 in)	≤ 30 m/s² (≤ 3g)
Thermocouple TC, type J, K, N	≤ 30 m/s² (≤ 3g)

1) Options depend on product and configuration

The vibration resistance of the entire device (thermometer and coupling element) for marine applications is ≤ 0.7 g.

Electromagnetic compatibility (EMC)

Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details refer to the EU Declaration of Conformity.

Maximum measurement error < 1% of the measuring range.

Interference immunity as per IEC/EN 61326 series, industrial requirements

Interference emission as per IEC/EN 61326 series, Class B equipment

Pollution degree

Pollution degree 2.

13.6 Process

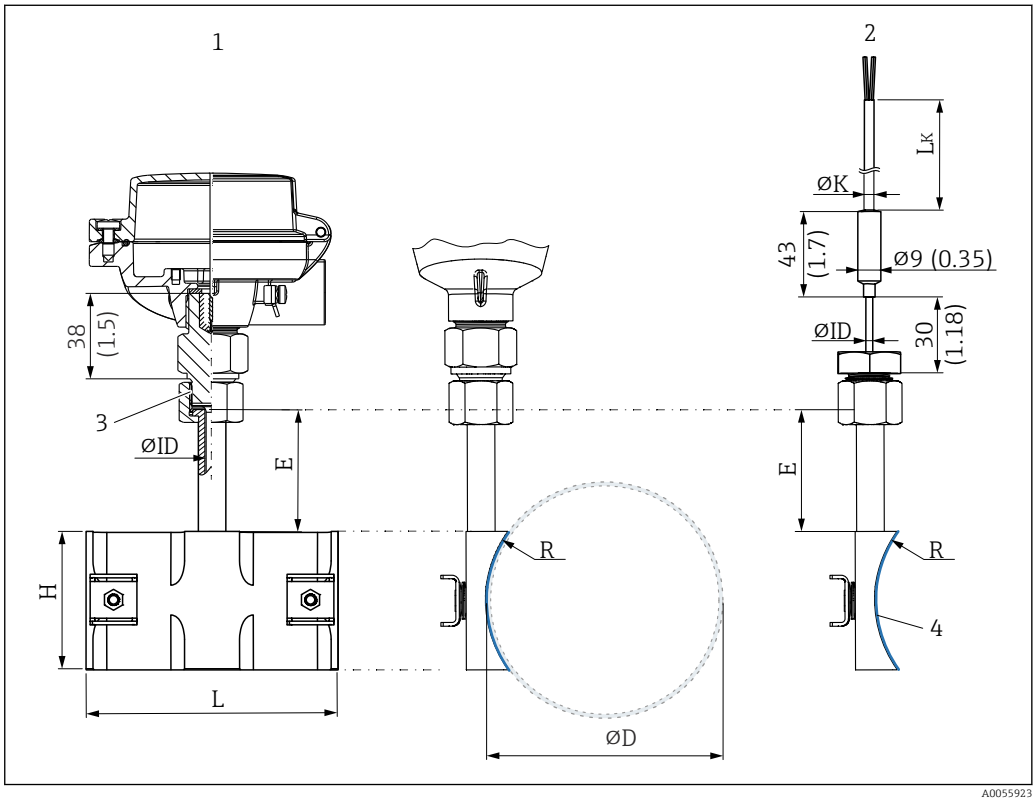
Process temperature range	Depends on sensor type and material used, max. −200 to +400 °C (−328 to +752 °F).
Process pressure range	No restrictions as measurement by the thermometer is non-invasive.

13.7 Mechanical construction

Design, dimensions

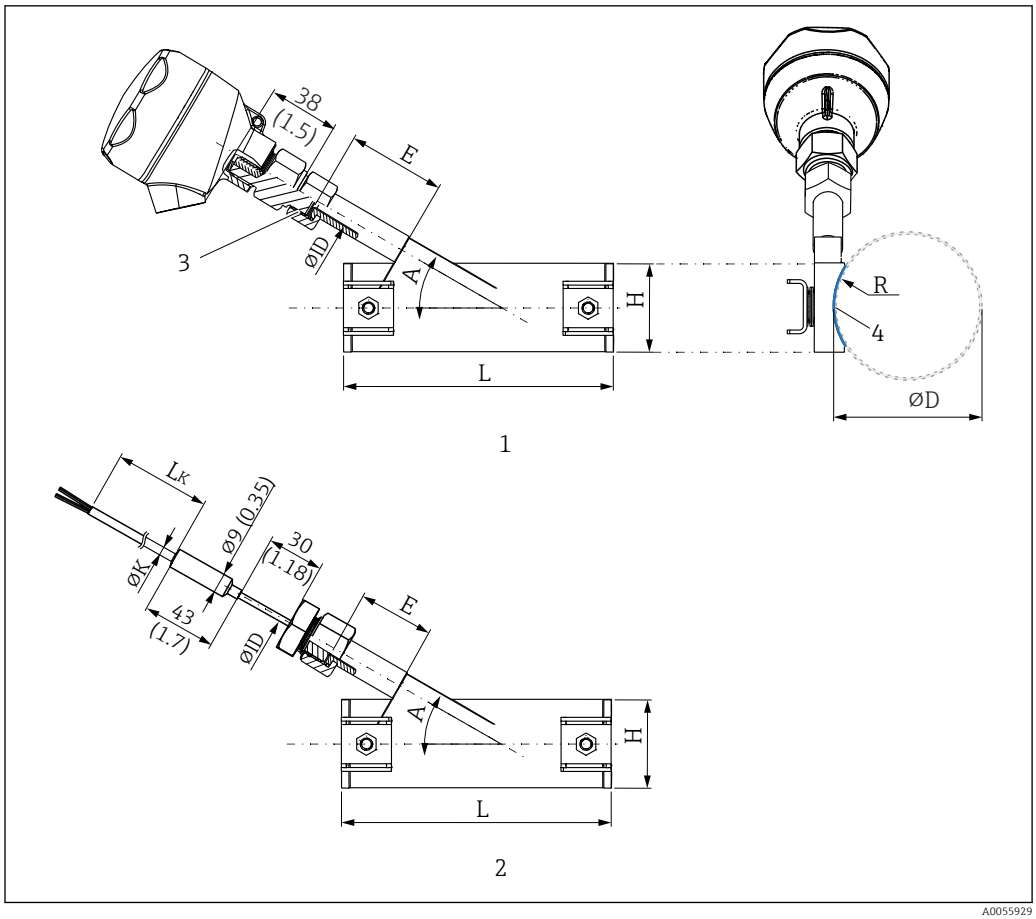
All dimensions in mm (in).

Various dimensions, such as extension neck length E for example, are variable values and are therefore indicated as items in the following dimensional drawings.



14 *Dimensions of iTHERM SurfaceLine TM611, vertical connection angle A = 90 °*

1 Industrial thermometer with terminal head
2 RTD or TC cable thermometer
3 Thermometer connection thread - Coupling element G½" (AF 27)
4 Coupling foil
ØID Insert diameter: Ø3 mm (0.12 in)



15 *Dimensions of iTHERM SurfaceLine TM611, inclined connection angle A < 90°*

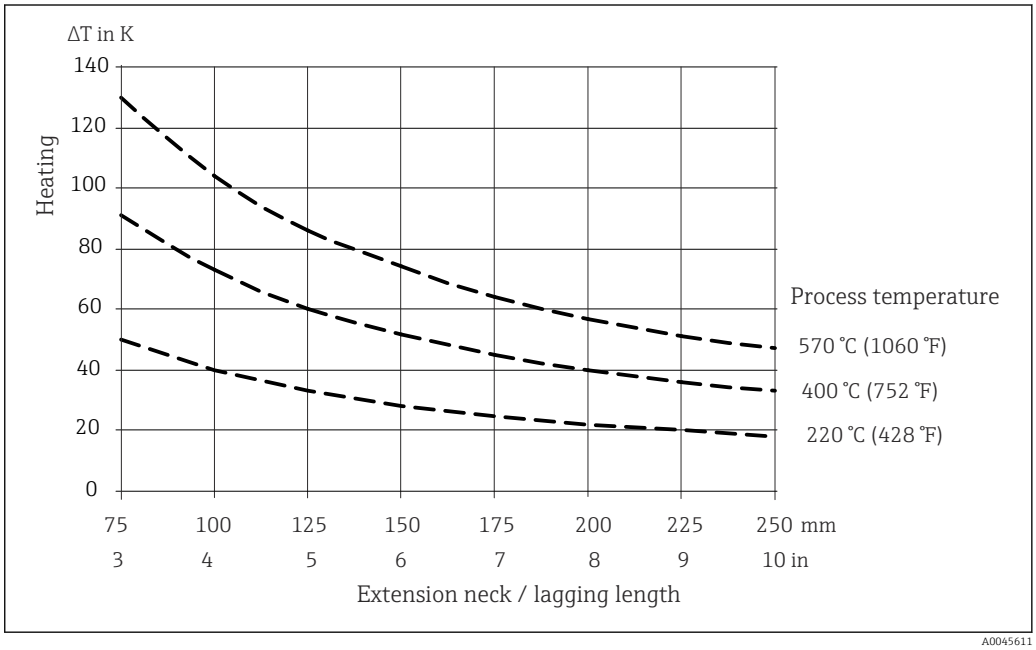
1 Industrial thermometer with terminal head
2 RTD or TC cable thermometer
3 Thermometer connection thread - Coupling element G½" (AF 27)
4 Coupling foil
ØID Insert diameter: Ø3 mm (0.12 in)

Variable dimensions:

Position	Description	Dimensions
E	Extension neck length	Standard lengths User configurable
L_K	Connecting cable length	User configurable

Pipe outer diameter ØD	Thermometer connection angle A	Coupling element radius R	Coupling element length L	Coupling element height H
DN8, ¼ in, 13.5 mm	20 °	6.75 mm (0.27 in)	120 mm	15 mm
DN15, ½ in, 21.3 mm		10.65 mm (0.42 in)	110 mm	20 mm
DN25, 1 in, 33.7 mm	30 °	16.85 mm (0.66 in)	110 mm	31 mm
DN40, 1½ in, 48.3 mm		24.15 mm (0.95 in)	110 mm	36 mm
DN50, 2 in, 60.3 mm		30.15 mm (1.19 in)	110 mm	36 mm
DN80, 3 in, 88.9 mm	40 °	44.45 mm (1.75 in)	110 mm	44 mm
DN100, 4 in, 114.3 mm	90 °	57.15 mm (2.25 in)	110 mm	65 mm
DN150, 6 in, 168.3 mm		84.15 mm (3.31 in)	110 mm	70 mm

Connecting cable; sheath insulation	Diameter ØK in mm (in)
PTFE; PTFE; 4-wire RTD	4.5 mm (0.178 in)
PTFE; silicone; 2x3-wire RTD	5.2 mm (0.2 in)
Glass fiber; 1x or 2x TC	3.6 mm (0.14 in) for 1x TC connection 4.1 mm (0.16 in) for 2x TC connection
PVC blue, 1x or 2x TC	5 mm (0.2 in) for 1x TC connection 6 mm (0.24 in) 2x TC connection



16 Heating of the terminal head as a function of the process temperature. Temperature in terminal head = ambient temperature 20 °C (68 °F)+ ΔT

The diagram can be used to calculate the transmitter temperature.

Example: At a process temperature of 220 °C (428 °F) and with a total lagging and extension neck length (T+ E) of 100 mm (3.94 in), the heat conduction is 40 K (72 °F). The determined transmitter temperature is less than 85 °C(maximum ambient temperature for iTEMP temperature transmitter).

Result: The temperature of the transmitter is OK; the length of the lagging is sufficient.

Weight

Depends on product and configuration.

1 kg for standard version. [3)]

Materials

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 operating temperatures can be reduced considerably in cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Note: The maximum temperature depends on the temperature sensor used!

3) E. g. Coupling element with short extension neck and iTHERM ModuLine TM111 with terminal head TA30R.

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L/ 1.4404	X2CrNiMo17-12-2	650 °C (1 202 °F) [1]	▪ Austenitic stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorinated 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

1) Contact the manufacturer's sales department for further information.

Inserts

The inserts are not replaceable due to the design of the device.

Sensor type RTD [1]	Pt100 (TF), basic thin film	Pt100 (TF), standard thin film	Pt100 (TF), iTHERM StrongSens	Pt100 (TF), iTHERM QuickSens [2]	Pt100 (WW), wire-wound	
Sensor design; connection method	1x Pt100, 3- or 4-wire	1x Pt100, 3- or 4-wire, mineral-insulated	1x Pt100, 3- or 4-wire, mineral-insulated	1x Pt100, 3- or 4-wire ▪ ø6 mm (0.24 in), mineral-insulated ▪ ø3 mm (0.12 in), Teflon-insulated	1x Pt100, 3- or 4-wire, mineral-insulated	2x Pt100, 3-wire, mineral-insulated
Vibration resistance of the insert tip	≤ 3g	≤ 4g	Increased vibration resistance 60 g	▪ ø3 mm (0.12 in) ≤ 3g ▪ ø6 mm (0.24 in) ≤ 60g	≤ 3g	
Measuring range; accuracy class	−50 to +200 °C (−58 to +392 °F), Class A or AA	−50 to +400 °C (−58 to +752 °F), Class A or AA	−50 to +500 °C (−58 to +932 °F), Class A or AA	−50 to +200 °C (−58 to +392 °F), Class A or AA	−200 to +600 °C (−328 to +1 112 °F), Class A or AA	
Diameter	ø 3 mm (0.12 in) ø 6 mm (0.24 in)	ø 3 mm (0.12 in) ø 6 mm (0.24 in)	ø 6 mm (0.24 in)	ø 3 mm (0.12 in) ø 6 mm (0.24 in)		

1) Options depend on product and configuration
2) Recommended for immersion lengths U < 70 mm (2.76 in)

Sensor type TC [1]	Type K	Type J	Type N
Sensor design	Mineral-insulated, with Alloy600 sheathed cable	Mineral-insulated, stainless steel sheathed cable	Mineral-insulated, with Alloy TD sheathed cable
Vibration resistance of the insert tip	≤ 3g		
Measuring range	−40 to +1 100 °C (−40 to +2 012 °F)	−40 to +750 °C (−40 to +1 382 °F)	−40 to +1 100 °C (−40 to +2 012 °F)
Connection type	Grounded or ungrounded		
Temperature-sensitive length	Insert length		
Diameter	ø 3 mm (0.12 in) ø 6 mm (0.24 in)		

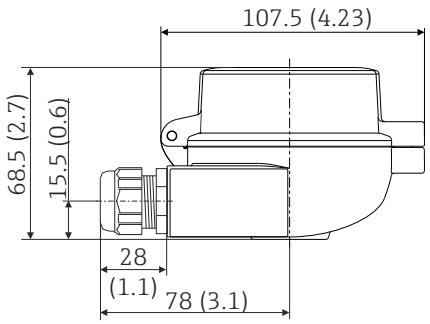
1) Options depend on product and configuration

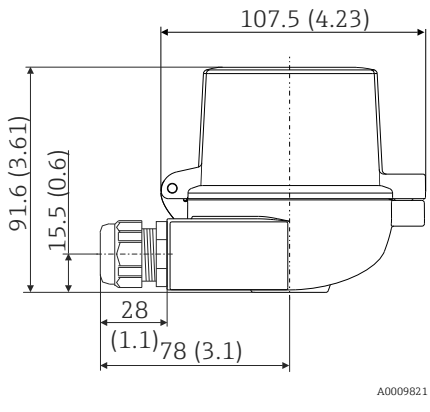
Terminal heads

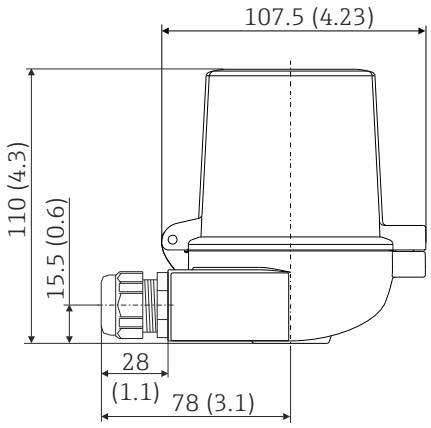
All terminal heads have an internal shape and size in accordance with DIN EN 50446, flat face, and a thermometer connection with a M24x1.5 or ½" NPT thread. All dimensions in mm (in). The sample cable glands in the diagrams correspond to M20x1.5 connections with non-Ex polyamide cable glands. Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see the "Ambient temperature range" section. → 📄 43

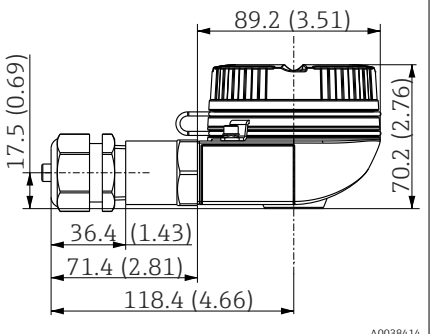
As a special feature, Endress+Hauser offers terminal heads with optimized terminal accessibility for easy installation and maintenance.

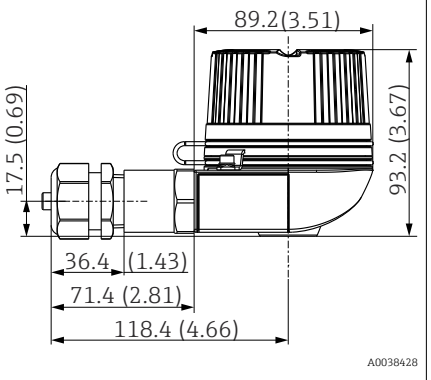
If the device is selected as a cable thermometer, no terminal head can be configured. See the "Function and system design" section.

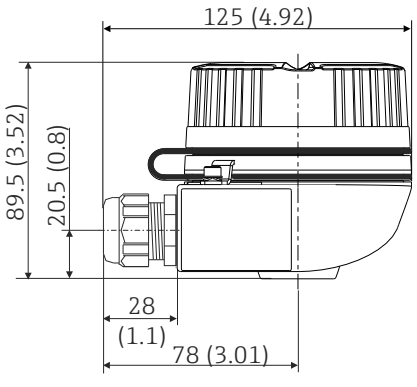
TA30A	Specification
	▪ Protection degree: ▪ IP66/68 (NEMA Type 4x encl.) ▪ For ATEX: IP66/67 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", NPT ½" and M20x1.5; ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 330 g (11.64 oz) ▪ Ground terminal, internal and external ▪ Available with sensors with 3-A® symbol

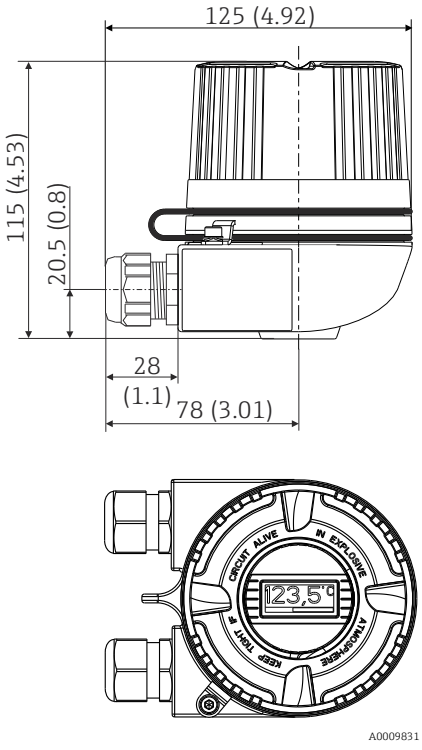
TA30A with display window in cover	Specification
	▪ Protection degree: ▪ IP66/68 (NEMA Type 4x encl.) ▪ For ATEX: IP66/67 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", NPT ½" and M20x1.5 ▪ Head color: blue, RAL 5012 Cap color: gray, RAL 7035 ▪ Weight: 420 g (14.81 oz) ▪ Display window: single-pane safety glass according to DIN 8902 ▪ Display window in cover for head transmitter with TID10 display ▪ Ground terminal, internal and external ▪ Available with sensors with 3-A® symbol

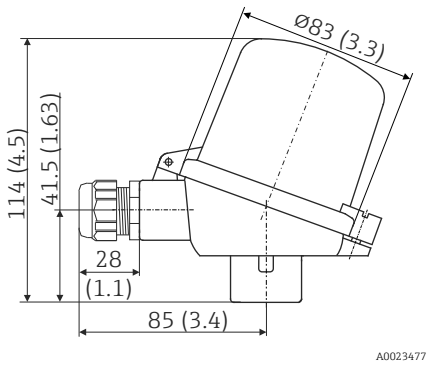
TA30D	Specification
	▪ Protection degree: ▪ IP66/68 (NEMA Type 4x encl.) ▪ For ATEX: IP66/67 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", NPT ½" and M20x1.5 ▪ Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 390 g (13.75 oz) ▪ Ground terminal, internal and external ▪ Available with sensors with 3-A® symbol

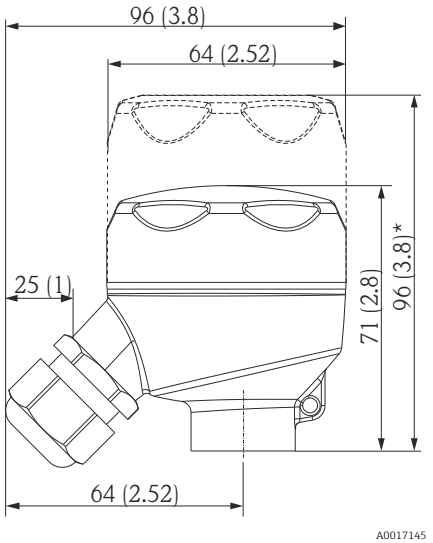
TA30EB	Specification
	▪ Screw cap ▪ Degree of protection: IP 66/68, NEMA 4x ▪ Temperature: −50 to +150 °C (−58 to +302 °F) ▪ Material: aluminum; polyester powder coating; Klüber Syntheso Glep 1 dry-film lubricant ▪ Thread: M20x1.5 ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: approx. 400 g (14.11 oz) ▪ Ground terminal: internal and external When the housing cover is unscrewed: Before fastening, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1)

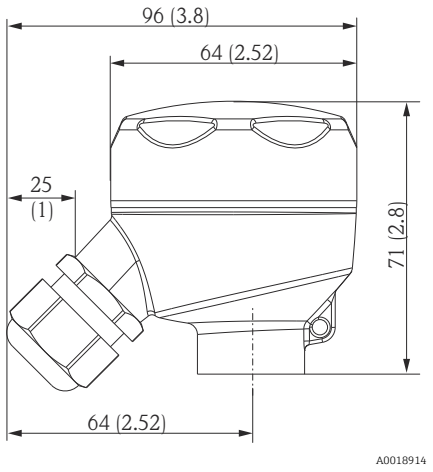
TA30EB with display window in cover	Specification
	▪ Screw cap ▪ Degree of protection: IP 66/68, NEMA 4x Ex-version: IP 66/68 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!) ▪ Material: aluminum; polyester powder coating; Klüber Syntheso Glep 1 dry-film lubricant ▪ Display window: single-pane safety glass according to DIN 8902 ▪ Thread: NPT ½", NPT ¾", M20x1.5, G½" ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: approx. 400 g (14.11 oz) When the housing cover is unscrewed: Before fastening, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1)

TA30H	Specification
	▪ Flameproof (XP) version, explosion-protected, captive screw cap, available with one or two cable entries ▪ Degree of protection: IP 66/68, NEMA Type 4x Encl. Ex-version: IP 66/67 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!) ▪ Material: ▪ Aluminum, with polyester powder coating ▪ Stainless steel 316L without coating ▪ Dry lubricant Klüber Syntheso Glep 1 ▪ Thread: NPT ½", NPT ¾", M20x1.5, G½" ▪ Color of aluminum head: blue, RAL 5012 ▪ Color of aluminum cap: gray, RAL 7035 ▪ Weight: ▪ Aluminum: approx. 640 g (22.6 oz) ▪ Stainless steel: approx. 2 400 g (84.7 oz) When the housing cover is unscrewed: Before fastening, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1)

TA30H with display window in cover	Specification
	▪ Flameproof (XP) version, explosion-protected, captive screw cap, available with one or two cable entries ▪ Degree of protection: IP 66/68, NEMA Type 4x Encl. Ex-version: IP 66/67 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!) ▪ Material: ▪ Aluminum; polyester powder coated ▪ Stainless steel 316L without coating ▪ Dry lubricant Klüber Syntheso Glep 1 ▪ Display window: single-pane safety glass according to DIN 8902 ▪ Thread: NPT ½", NPT ¾", M20x1.5, G½" ▪ Color of aluminum head: blue, RAL 5012 ▪ Color of aluminum cap: gray, RAL 7035 ▪ Weight: ▪ Aluminium approx. 860 g (30.33 oz) ▪ Stainless steel approx. 2 900 g (102.3 oz) ▪ Head transmitter optionally available with TID10 display When the housing cover is unscrewed: Before fastening, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1)

TA30P	Specification
	▪ Degree of protection: IP65 ▪ Max. temperature: −40 to +120 °C (−40 to +248 °F) ▪ Material: polyamide (PA12), antistatic Seals: silicone ▪ Threaded cable entry: M20x1.5 ▪ Two head transmitters can be mounted. In the standard version, one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Head and cap color: black ▪ Weight: 135 g (4.8 oz) ▪ Type of protection: intrinsic safety (G Ex ia) ▪ Ground terminal: only internal via auxiliary clamp ▪ Available with sensors with 3-A® symbol

TA30R (optionally with display window in cover)	Specification
 * Dimensions of version with display window in cover	▪ Degree of protection - standard version: IP69K (NEMA Type 4x encl.) Degree of protection - version with display window: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +130 °C (−58 to +266 °F) without cable gland ▪ Material: stainless steel 316L, abrasive-blasted or polished Seals: silicone, optional EPDM for applications free from paint-wetting impairment substances Display window: polycarbonate (PC) ▪ Cable entry thread NPT ½" and M20x1.5 ▪ Weight ▪ Standard version: 360 g (12.7 oz) ▪ Version with display window: 460 g (16.23 oz) ▪ Display window in cover optionally for head transmitter with display TID10 ▪ Ground terminal: internal as standard ▪ Available with sensors with 3-A® symbol ▪ Not allowed for Class II and III applications

TA30R	Specification
	▪ Degree of protection - standard version: IP69K (NEMA Type 4x encl.) ▪ Temperature: −50 to +130 °C (−58 to +266 °F) without cable gland ▪ Material: stainless steel 316L, abrasive-blasted or polished Seals: EPDM ▪ Cable entry thread ½" NPT and M20x1.5 ▪ Weight: 360 g (12.7 oz) ▪ Protection armature connection: M24x1.5 or ½" NPT ▪ Ground terminal: internal as standard ▪ Not allowed for Class II and III applications ▪ Available with 3-A marked sensors

Cable glands and connectors [1)]

Type	Suitable for cable entry	Degree of protection	Temperature range	Suitable cable diameter
Cable gland, polyamide blue (indication of Ex-i circuit)	½" NPT	IP68	−30 to +95 °C (−22 to +203 °F)	7 to 12 mm (0.27 to 0.47 in)
Cable gland, polyamide	½" NPT, ¾" NPT, M20x1.5 (optionally 2x cable entry)	IP68	−40 to +100 °C (−40 to +212 °F)	5 to 9 mm (0.19 to 0.35 in)
	½" NPT, M20x1.5 (optionally 2x cable entry)	IP69K	−20 to +95 °C (−4 to +203 °F)	
Cable gland for dust ignition-proof area, polyamide	½" NPT, M20x1.5	IP68	−20 to +95 °C (−4 to +203 °F)	
Cable gland for dust ignition-proof area, nickel-plated brass	M20x1.5	IP68 (NEMA Type 4x)	−20 to +130 °C (−4 to +266 °F)	
M12 plug, 4-pin, 316 (PROFIBUS® PA, Ethernet-APL™, IO-Link®	½" NPT, M20x1.5	IP67	−40 to +105 °C (−40 to +221 °F)	-
M12 plug, 8-pin, 316	M20x1.5	IP67	−30 to +90 °C (−22 to +194 °F)	-
7/8" plug, 4-pin, 316 (FOUNDATION ™ Fieldbus, PROFIBUS® PA)	½" NPT, M20x1.5	IP67	−40 to +105 °C (−40 to +221 °F)	-

1) Depending on product and configuration

Cable glands are not available for encapsulated, flameproof thermometers.

13.8 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**.

www.addresses.endress.com

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