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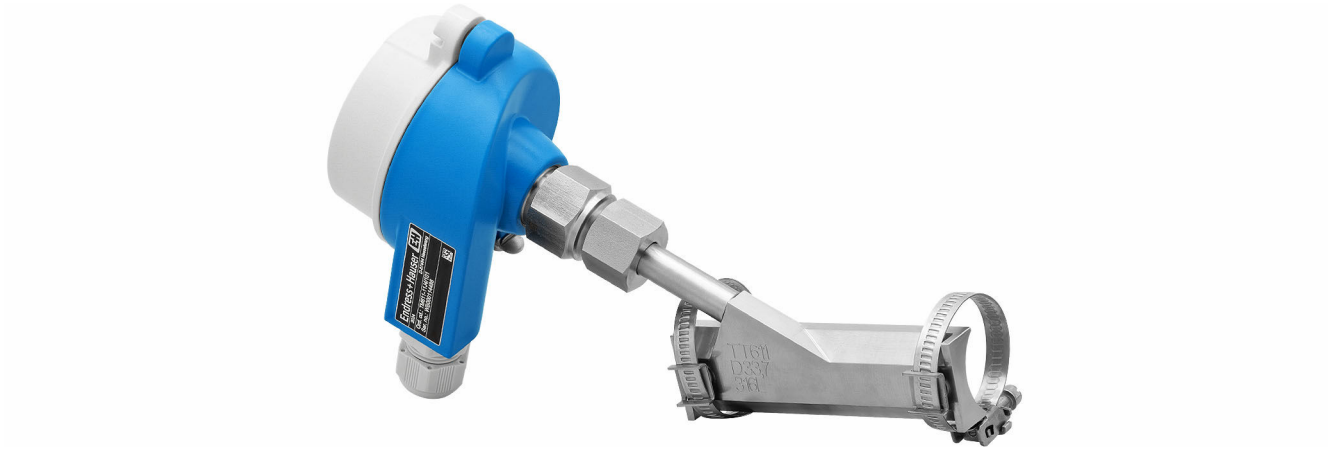
# Technical Information
# iTHERM SurfaceLine TM611

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



### Application

- Can be used universally in all industries
- Ideal for demanding process conditions such as high flow velocities, high process pressures, viscous or corrosive media, abrasion, pigging or small pipe diameters
- Perfect for subsequent installation for measurements in existing facilities for energy and safety monitoring

### Your benefits

- Measurement accuracy and response time comparable with invasive measurements
- No process opening required, no leakage risk
- Increased safety for personnel, plant and the environment
- User-friendly from product selection to installation and maintenance
- Significant cost savings: shorter development and project planning times, reduced expenses for installation, certification and inspections as well as no costs for thermowells, nozzles and flanges, weld seam inspections and pipe extensions
- iTEMP temperature transmitter with all common communication protocols and optional Bluetooth® connectivity
- International certification: e.g. explosion protection according to ATEX, IECEx, CSA and NEPSI; functional safety (SIL)

Endress+Hauser
People for Process Automation

# Table of contents

# Function and system design

## Measuring principle

### Resistance thermometers (RTD)

These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. The temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100 Ω at 0 °C (32 °F) and a temperature coefficient α = 0.003851 °C$^{-1}$.

**There are generally two different kinds of platinum resistance thermometers:**

- **Wire-wound (WW):Wire Wound, WW** In these thermometers, a double coil of fine, high-purity platinum wire is accommodated in a ceramic support. This support is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 °C (1 112 °F). This type of sensor is relatively large in size and is comparatively sensitive to vibrations.
- **Thin-film platinum resistance thermometers(Thin Film, TF):** A very thin, ultrapure platinum layer, approx. 1 µm thick, is vaporized in a vacuum on a ceramic substrate and then structured photolithographically. The platinum conductor paths formed in this way create the measuring resistance. Additional covering and passivation layers are applied and reliably protect the thin platinum layer from contamination and oxidation, even at high temperatures.

The primary advantages of thin film temperature sensors over wire wound versions are their smaller sizes and better vibration resistance. A relatively low principle-based deviation of the resistance/temperature characteristic from the standard characteristic of IEC 60751 can frequently be observed among TF sensors at high temperatures. As a result, the tight limit values of tolerance class A as per IEC 60751 can only be observed with TF sensors at temperatures up to approx. 300 °C (572 °F).

### Thermocouples (TC)

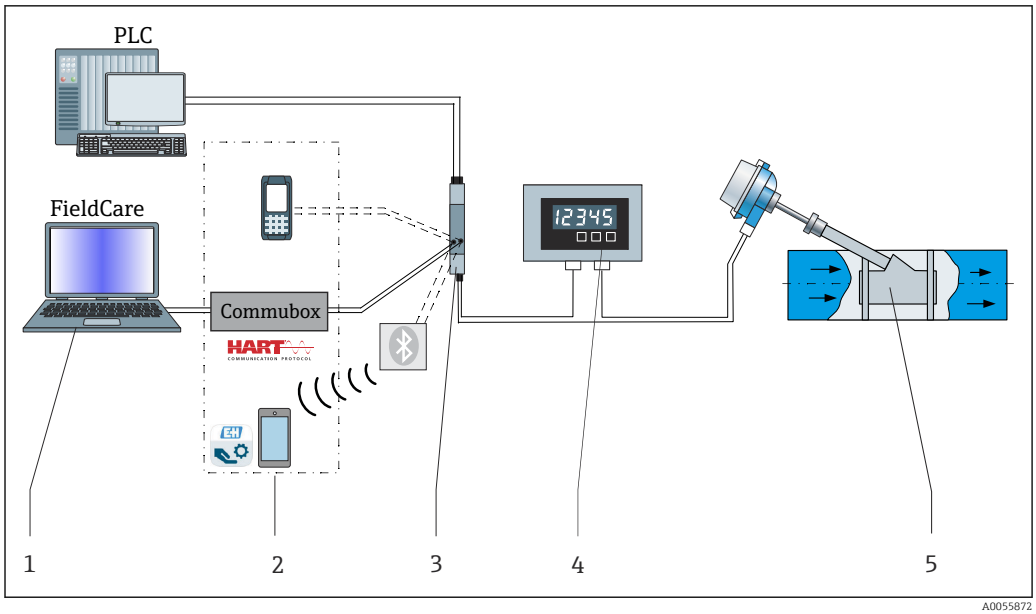
Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors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

## Measuring system

The manufacturer provides a complete portfolio of optimized components for the temperature measuring point – everything you need for the seamless integration of the measuring point into the overall facility. This includes:

- Power supply unit/barrier
- Display units

For more information, see the brochure "System Components - Solutions for a Complete Measuring Point" (FA00016K)




1 *Example of application, measuring point layout with additional Endress+Hauser components*

1 *FieldCare is a FDT-based plant asset management tool from Endress+Hauser, for details see section "accessories".*

2 *Communication examples: HART® Communicator (handheld terminal), FieldXpert, Commubox FXA195 for intrinsically safe HART® communication with FieldCare via the USB interface, Bluetooth® technology with SmartBlue app.*

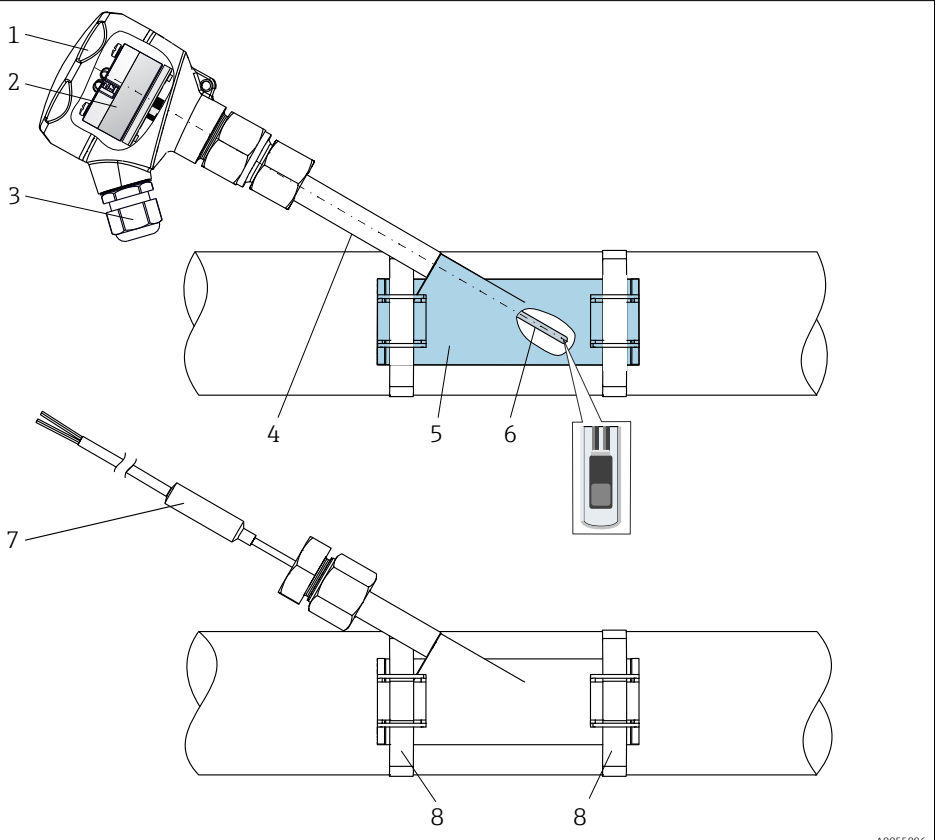
3 *RN series active barriers - The RN series active barrier (e.g. with 17.5 $V_{DC}$, 20 mA) has a galvanically isolated output for supplying voltage to 2-wire transmitters. The universal power supply works with an input supply voltage of 24 to 230 V AC/DC, 0/50/60 Hz, which means that it can be used in all international power grids. More information on this can be found in the Technical Information under "Documentation".→ 33*

4 *2-wire process indicator from the RIA product range. The process indicator is integrated into the current loop and displays the measuring signal or HART® process variables in digital form. The process indicator does not require an external power supply. It is powered directly from the current loop. More information on this can be found in the technical documentation under "Documentation".→ 33*

5 *Installed iTHERM thermometer with HART® communication protocol.*

## Device architecture

**Design**




| Options | |
|---|---|
| 1: Terminal head → 🖹 26 | Variety of terminal heads made of aluminum, polyamide or stainless steel<br>**Your benefits:**<br>▪ Optimum terminal access thanks to low housing edge of bottom section:<br>  ▪ Easier to use<br>  ▪ Lower installation and maintenance costs<br>▪ Optional display: local process indicator for added reliability |
| 2: Wiring, electrical connection, output signal → 🖹 6 | ▪ Ceramic terminal block<br>▪ Flying leads<br>▪ iTEMP head transmitter (4 to 20 mA, HART®, PROFINET® with Ethernet-APL™, PROFIBUS® PA, FOUNDATION™ Fieldbus), single channel or dual channel<br>▪ Plug-in display<br>▪ IO-Link® |
| 3: Plug or cable gland | ▪ M12 plug, PROFIBUS® PA/FOUNDATION™ Fieldbus/PROFINET® 4-pin<br>▪ Polyamide or nickel-plated brass cable glands |
| 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. |
| 6: Insert with sensor element→ 🖹 26 | 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. |

# Input

**Measured variable**

Temperature (temperature-linear transmission behavior)

**Measuring range**

*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)<br>Basic | −50 to +200 °C (−58 to +392 °F) |
| Pt100 (TF)<br>Standard | −50 to +400 °C (−58 to +752 °F) |
| Pt100 (TF)<br>iTHERM QuickSens | −50 to +200 °C (−58 to +392 °F) |
| Pt100 (TF)<br>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

# Output

**Output signal**

Generally, the measured value can be transmitted in one of two ways:

- Directly-wired sensors - sensor measured values 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.

**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.

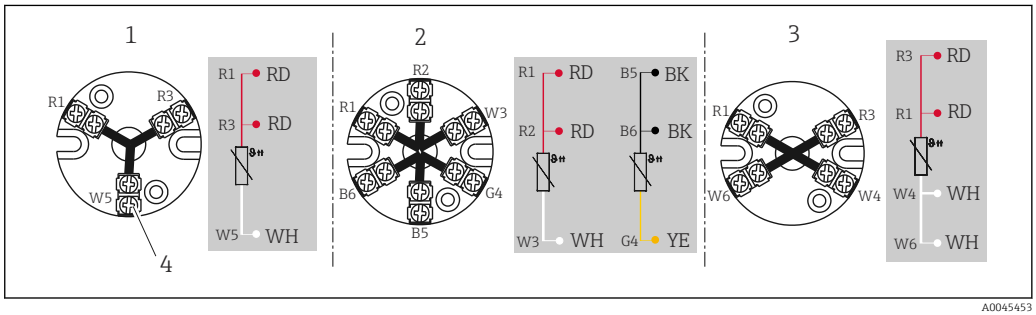
**Advantages of the iTEMP transmitters:**
- Double or single sensor input (optionally for certain transmitters)
- Attachable display (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer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

# Power supply

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).

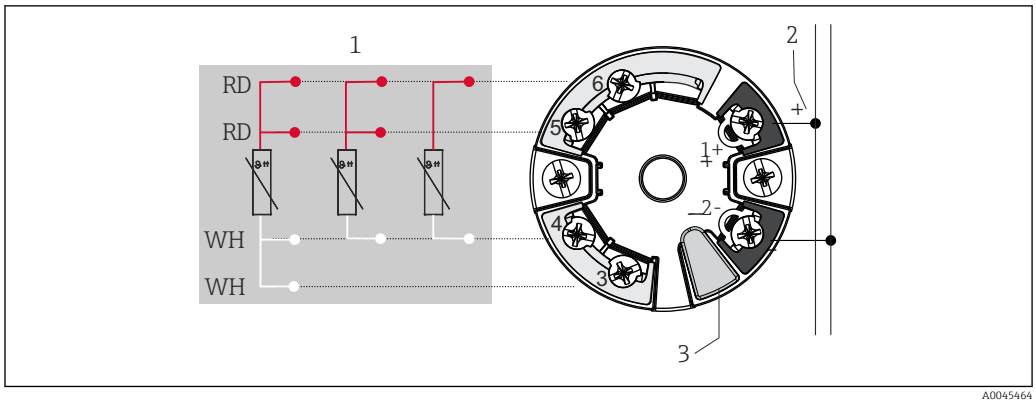
## Terminal assignment

**Sensor connection type: RTD industrial thermometer**



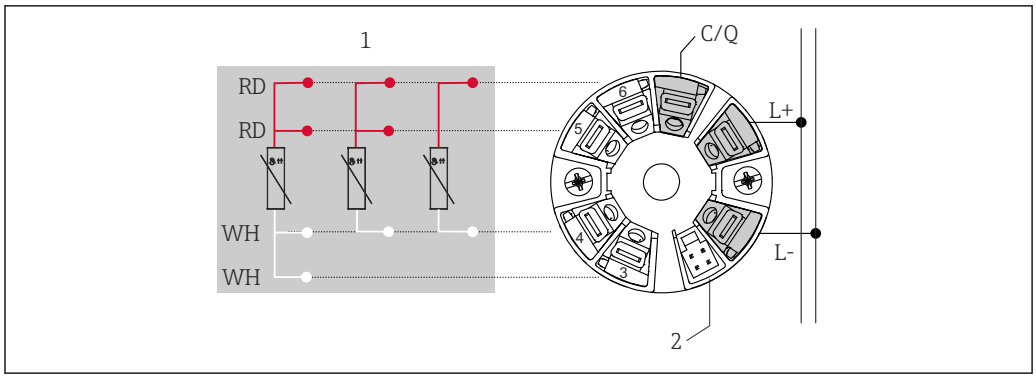

2 *Mounted ceramic terminal block*

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



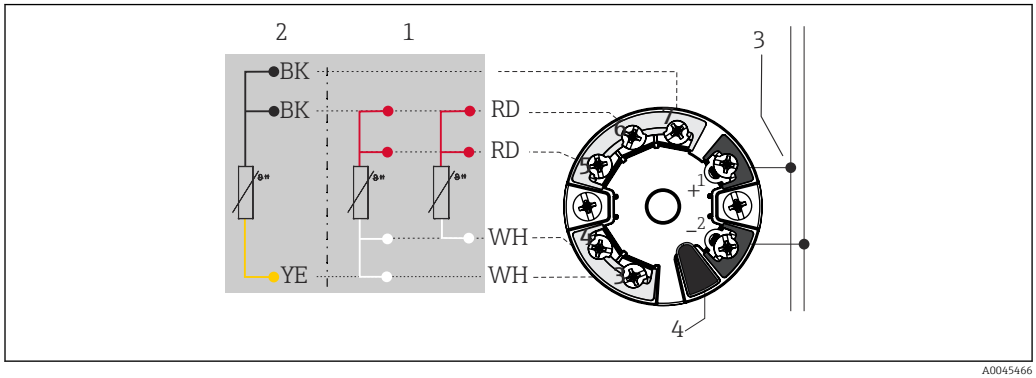

3 *Head-mounted iTEMP TMT7x transmitter or iTEMP TMT31 (single sensor input)*

*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)*

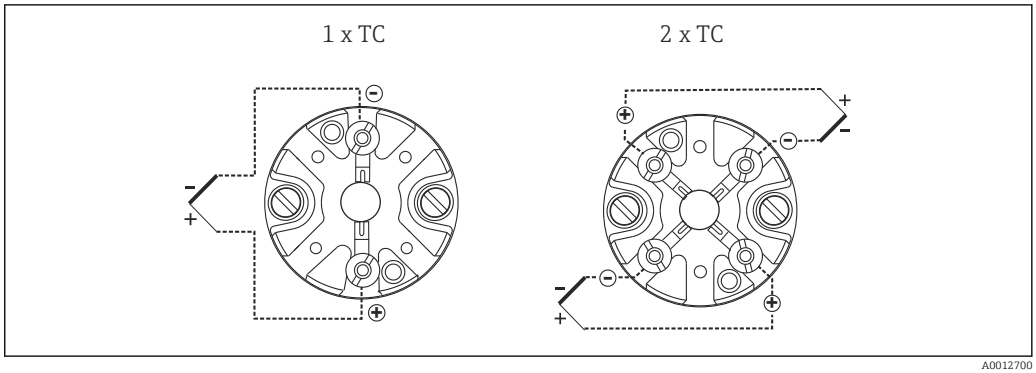
*1 RTD sensor input: 4-, 3- and 2-wire*
*2 Display connection*
*L+ 18 to 30 $V_{DC}$ power supply*
*L- 0 $V_{DC}$ power supply*
*C/Q IO-Link or switch output*



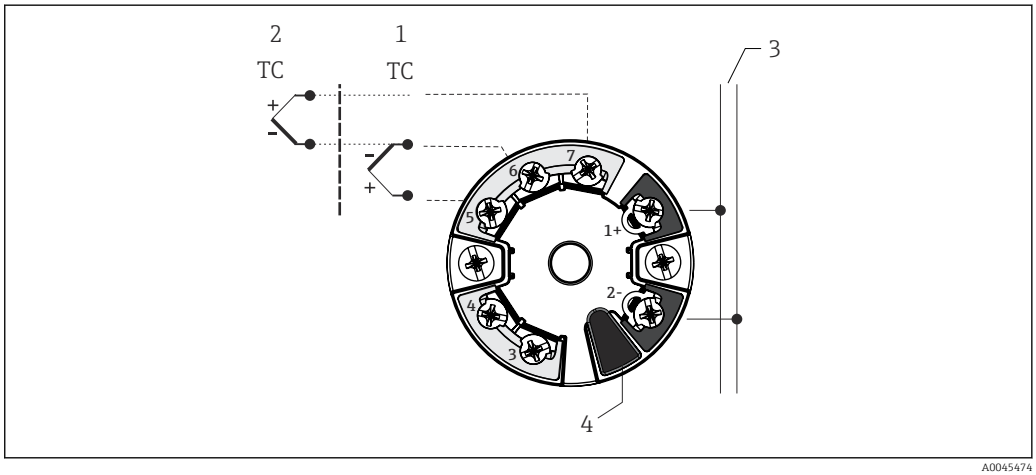

5 *Head-mounted iTEMP TMT8x transmitter (dual sensor input)*

*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*

### Sensor connection type: Thermocouple (TC) industrial thermometer

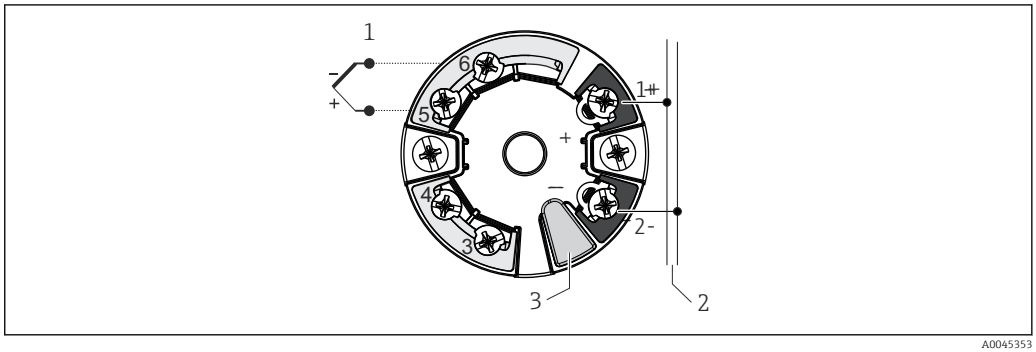



6 *Mounted ceramic terminal block*




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 (single sensor input)*

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

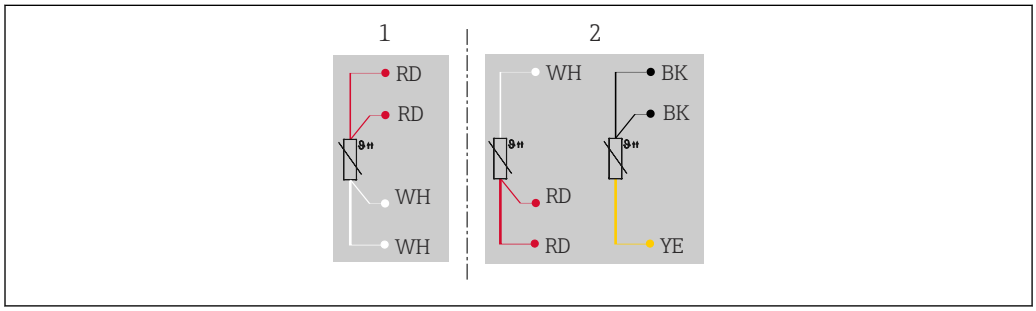
### Sensor connection type: RTD cable thermometer

The sensor connection cables of the cable thermometer are fitted with terminal lugs. The nominal diameter of the end 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.

**Sensor connection type: TC cable thermometer**

*Wiring diagram*

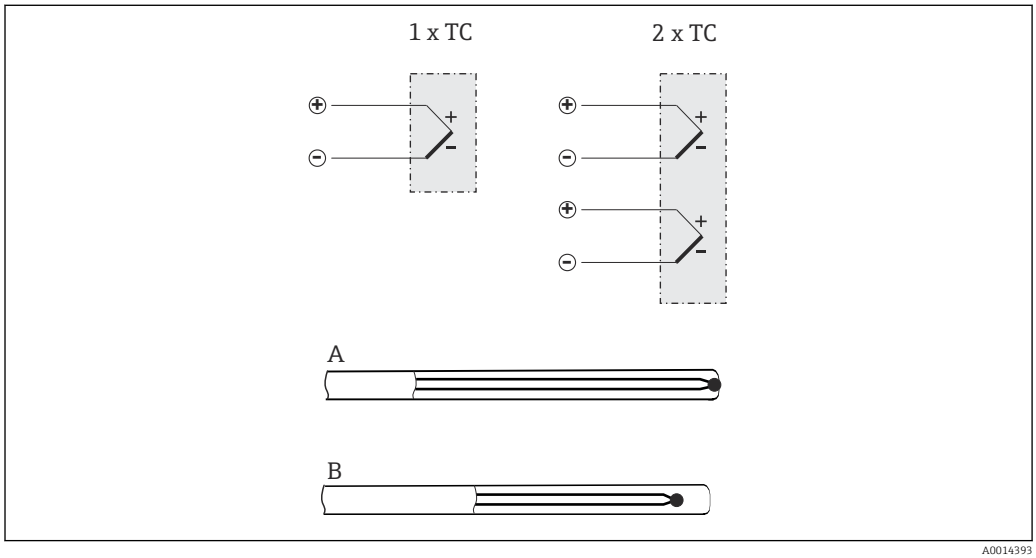
The cable thermometer is wired to the flying leads of the connection cable. The cable thermometer can be connected to a separate iTEMP temperature transmitter, for example.

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 (-)<br>▪ Type K: green (+), white (-) | ▪ Type J: white (+), red (-)<br>▪ Type K: yellow (+), red (-) |




10 *Wiring diagram*

*A Grounded connection*
*B Ungrounded connection*

**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.

### Connectors

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 does not recommend attaching 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 conjunction with an 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 one cable entry* [1)]

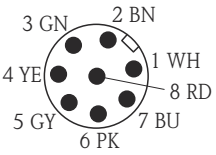
| **Plug** | **1x PROFIBUS® PA** | | | | | | | | **1x FOUNDATION™ Fieldbus (FF)** | | | | **1x PROFINET® and Ethernet-APL™** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plug thread | M12 | | | | 7/8" | | | | 7/8" | | | | M12 | | | |
| PIN number | 1 | 2 | 3 | 4 | 1 | 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 | + | i | - | i |

<table>
<tr><th>Plug</th><th colspan="8">1x PROFIBUS® PA</th><th colspan="4">1x FOUNDATION™ Fieldbus (FF)</th><th colspan="4">1x PROFINET® and Ethernet-APL™</th></tr>
<tr><td>2x TMT 4 to 20 mA or HART® in the terminal head with a high cover</td><td>+(#1)</td><td>+(#2)</td><td>-(#1)</td><td>-(#2)</td><td>+(#1)</td><td>+(#2)</td><td>-(#1)</td><td>-(#2)</td><td>+(#1)</td><td>+(#2)</td><td>-(#1)</td><td>-(#2)</td><td>+(#1)</td><td>+(#2)</td><td>-(#1)</td><td>-(#2)</td></tr>
<tr><td>1x TMT PROFIBUS® PA</td><td>+</td><td rowspan="2">i</td><td>-</td><td rowspan="2">GND 3)</td><td>+</td><td rowspan="2">i</td><td>-</td><td rowspan="2">GND 3)</td><td colspan="8" rowspan="2">Cannot be combined</td></tr>
<tr><td>2x TMT PROFIBUS® PA</td><td>+(#1)</td><td>-(#1)</td><td>+</td><td>-</td></tr>
<tr><td>1x TMT FF</td><td colspan="4" rowspan="3">Cannot be combined</td><td colspan="4" rowspan="3">Cannot be combined</td><td>-</td><td>+</td><td rowspan="2">GND</td><td rowspan="2">i</td><td colspan="4" rowspan="2">Cannot be combined</td></tr>
<tr><td>2x TMT FF</td><td>-(#1)</td><td>+(#1)</td></tr>
<tr><td>1x TMT PROFINET®</td><td colspan="4" rowspan="2">Cannot be combined</td><td rowspan="2">APL signal -</td><td rowspan="2">APL signal +</td><td rowspan="2">GND</td><td rowspan="2">-</td></tr>
<tr><td>2x TMT PROFINET®</td><td colspan="4">Cannot be combined</td><td>APL signal - (#1)</td><td>APL signal + (#1)</td></tr>
<tr><td>PIN position and color code</td><td colspan="4">  <br>1 BN<br>2 GNYE<br>3 BU<br>4 GY<br>A0018929</td><td colspan="4">  <br>1 BN<br>2 GNYE<br>3 BU<br>4 GY<br>A0018930</td><td colspan="4">  <br>1 BU<br>2 BN<br>3 GY<br>4 GNYE<br>A0018931</td><td colspan="4">  <br>1 RD<br>2 GN<br>A0052119</td></tr>
</table>

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 one cable entry* [1)]

<table>
<tr><th>Plug</th><th colspan="8">4-pin / 8-pin</th></tr>
<tr><td>Plug thread</td><td colspan="8">M12</td></tr>
<tr><td>PIN number</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td colspan="9"></td></tr>
<tr><th colspan="9">Electrical connection (terminal head)</th></tr>
<tr><td>Flying leads and TC</td><td colspan="8">Not connected (not insulated)</td></tr>
<tr><td>3-wire terminal block (1x Pt100)</td><td rowspan="2">RD</td><td rowspan="2">RD</td><td colspan="2">WH</td><td colspan="4" rowspan="2">i</td></tr>
<tr><td>4-wire terminal block (1x Pt100)</td><td>WH</td><td>WH</td></tr>
<tr><td>6-wire terminal block (2x Pt100)</td><td colspan="2">WH</td><td colspan="2">BK</td><td>BK</td><td colspan="2">YE</td></tr>
<tr><td>1x TMT 4 to 20 mA or HART®</td><td rowspan="2">+(#1)</td><td rowspan="2">i</td><td rowspan="2">-(#1)</td><td rowspan="2">i</td><td colspan="4">i</td></tr>
<tr><td>2x TMT 4 to 20 mA or HART® in the terminal head with a high cover</td><td>+(#2)</td><td>i</td><td>-(#2)</td><td>i</td></tr>
<tr><td>1x TMT PROFIBUS® PA</td><td colspan="8" rowspan="2">Cannot be combined</td></tr>
<tr><td>2x TMT PROFIBUS® PA</td></tr>
<tr><td>1x TMT FF</td><td colspan="8" rowspan="2">Cannot be combined</td></tr>
<tr><td>2x TMT FF</td></tr>
<tr><td>1x TMT PROFINET®</td><td colspan="8">Cannot be combined</td></tr>
</table>

| Plug | 4-pin / 8-pin | |
|---|---|---|
| 2x TMT PROFINET® | Cannot be combined | |
| PIN position and color code |  1 BN<br>2 GNYE<br>3 BU<br>4 GY<br>A0018929 |  <br>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 |
| **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<br>3 BU<br>4 BK<br>A0055383 | | | |

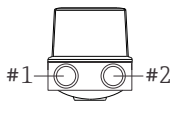
*Terminal head with two cable entries* [1)]

| Plug | 2x PROFIBUS® PA | | | | | | | | 2x FOUNDATION™ Fieldbus (FF) | | | | 2x PROFINET® and Ethernet-APL™ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plug thread  <br>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) | | | | | | | | | | | | | | | |

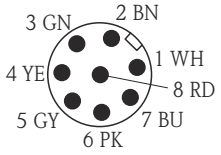
| Plug | 2x PROFIBUS® PA | | | | | | | | 2x FOUNDATION™ Fieldbus (FF) | | | | 2x PROFINET® and Ethernet-APL™ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3-wire terminal block (1x Pt100) | RD/i | RD/i | WH/i | | RD/i | RD/i | WH/i | | RD/i | RD/i | WH/i | | RD/i | RD/i | 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 | | | | | | | |
| 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 signal + | GND | i |
| 2x TMT PROFINET® | Cannot be combined | | | | Cannot be combined | | | | Cannot be combined | | | | APL signal - (#1) and (#2) | APL signal + (#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)]

| Plug | 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 | |

| Plug | 4-pin / 8-pin | | | | |
|---|---|---|---|---|---|
| 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 | | | | | |
| 1x TMT PROFINET® | Cannot be combined | | | | |
| 2x TMT PROFINET® | Cannot be combined | | | | |
| PIN position and color code |  1 BN<br>2 GNYE<br>3 BU<br>4 GY<br>A0018929 | | |  <br>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<br>3 BU<br>4 BK<br>A0055383 | | | |

*Insert connection combination - 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)<br>(Transmitter (#2) not connected) | Sensor (#1) : transmitter (#1) | Sensor (#1) : transmitter (#1)<br>Transmitter (#2) not connected |
| 2x sensor (2x Pt100 or 2x TC), flying leads | Sensor (#1) : transmitter (#1)<br>Sensor (#2) insulated | Sensor (#1) : transmitter (#1)<br>Sensor (#2): transmitter (#2) | Sensor (#1) : transmitter (#1)<br>Sensor (#2): transmitter (#1) | Sensor (#1) : transmitter (#1)<br>Sensor (#2): transmitter (#1)<br>(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<br>Sensor (#2) not connected | | Sensor (#1) : transmitter in cover<br>Sensor (#2): transmitter in cover | |
| 2x sensor (2x Pt100 or 2x TC) in conjunction with feature 600, option MG [4)] | Cannot be combined | Sensor (#1) : transmitter (#1)<br>Sensor (#2): transmitter (#2) | Cannot be combined | Sensor (#1): Transmitter (#1) - channel 1<br>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 2nd 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 with channel 1 of a transmitter

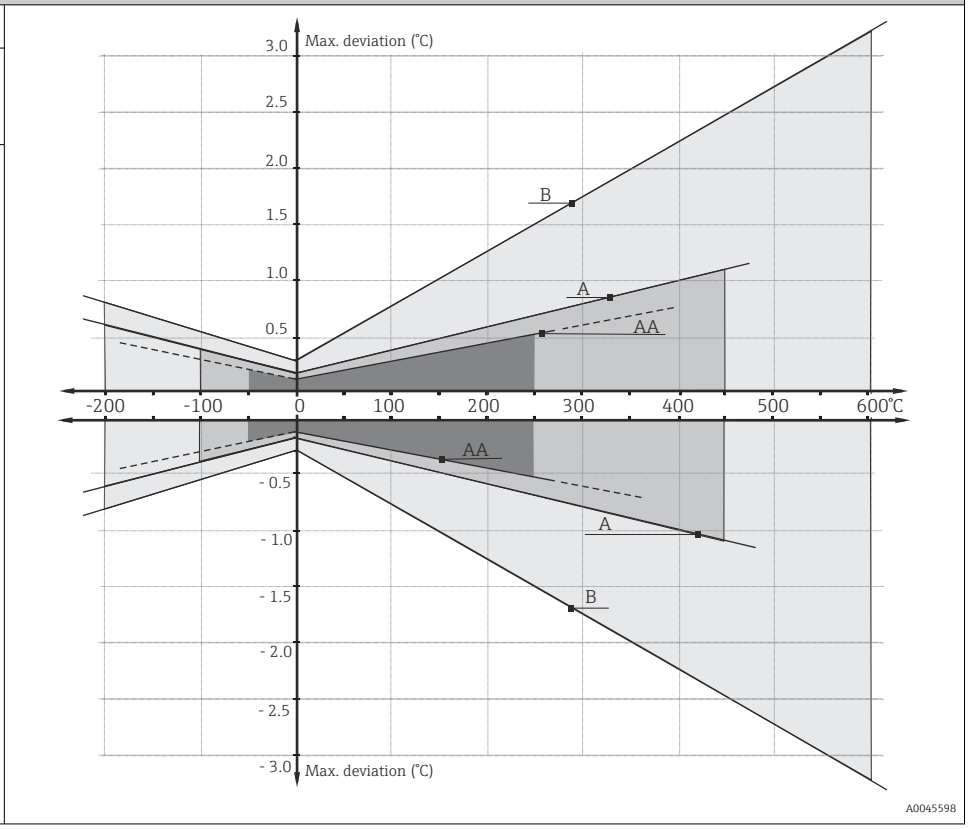
# Performance characteristics

**Reference conditions**

This data is relevant for determining the measurement accuracy of the iTEMP transmitters used. For details, see the relevant Technical Information.

**Maximum measurement error**

**RTD resistance thermometer 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)<br>±0.0075 \|t\| [2] (333 to 750 °C) | 1 | ±1.5 °C (−40 to +375 °C)<br>±0.004 \|t\| [2] (+375 to +750 °C) |
| | K (NiCr-NiAl)<br>N (NiCrSi-NiSi) | 2 | ±0.0075 \|t\| [2] (+333 to +1 200 °C)<br>±2.5 °C (−40 to +333 °C)<br>±0.0075 \|t\| [2] (+333 to +1 200 °C) | 1 | ±1.5 °C (−40 to +375 °C)<br>±0.004 \|t\| [2]<br>(+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 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] | Standard tolerance | Special tolerance |
|---|---|---|---|
| ASTM E230/ANSI MC96.1 | | Deviation; the larger value applies in each case | |
| | J (Fe-CuNi) | ±2.2 K or ±0.0075 \|t\| [2] (0 to 760 °C) | ±1.1 K or ±0.004 \|t\| [2]<br>(0 to 760 °C) |
| | K (NiCr-NiAl)<br>N (NiCrSi-NiSi) | ±2.2 K or ±0.02 \|t\| [2] (−200 to 0 °C)<br>±2.2 K or ±0.0075 \|t\| [2]<br>(0 to 1 260 °C) | ±1.1 K or ±0.004 \|t\| [2]<br>(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.

## 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 involves comparing the measured values of a unit under test (UUT) with those of a more precise measurement standard using a defined and reproducible measurement method. The aim is to determine the deviation of the UUT's measured values from the true value of the measured variable. Two different methods are used for thermometers:

- Calibration at fixed-point temperatures, 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 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 the coupling element.

**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 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 your 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 insertion 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 1022 °F) | 300 mm (11.81 in) |
| 551 to 600 °C (1023.8 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)

**Insulation resistance**

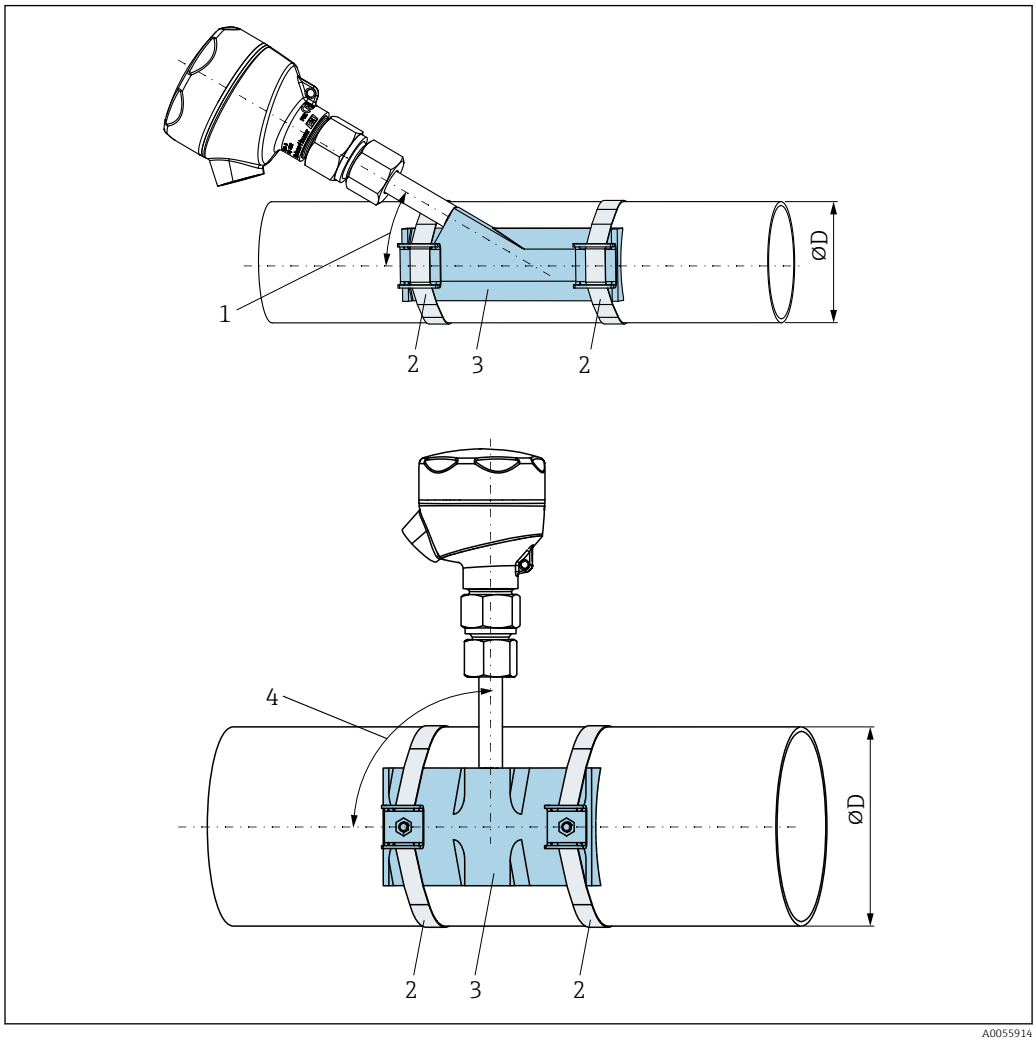
- RTD:
  Insulation resistance according to IEC 60751 > 100 MΩ at 25 °C between terminals and sheath material measured with a minimum test voltage of 100 V DC
- TC:
  Insulation resistance according to IEC 1515 between terminals and sheath material with a test voltage of 500 V DC:
  - > 1 GΩ at 20 °C
  - > 5 MΩ at 500 °C

# Mounting

**Orientation**

Installing the terminal head against the direction of flow ensures the highest level of measurement accuracy.

### Installation instructions

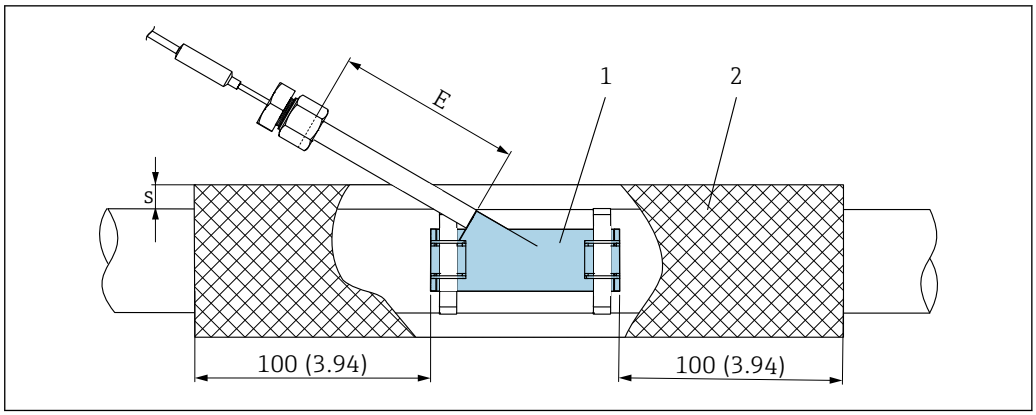



*11 Installation examples*

*1 Inclined connection angle 20°, 30° or 40 ° for pipe outer diameters of ØD < DN100*
*2 Hose clips*
*3 Coupling element*
*4 Vertical connection angle 90° for pipe outer diameters of ØD ≥ DN100*

### Insulation of the measuring point

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




*1 Coupling element*
*2 Heat insulation*
*E Extension neck length*
*s Insulation thickness*

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 |

# 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 | –20 to +70 °C (–4 to +158 °F) |

### RTD cable thermometers

| Material<br>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<br>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**

Depending on the transmitter used. If using head transmitters:
- Condensation permitted as per IEC 60 068-2-33
- Max. rel. humidity: 95% as per 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)<br>Basic | |
| Pt100 (TF)<br>Standard | ≤ 40 m/s² (≤ 4g) |
| Pt100 (TF)<br>iTHERM StrongSens | ≤ 600 m/s² (≤ 60g) |
| Pt100 (TF)<br>iTHERM QuickSens, version: ø6 mm (0.24 in) | ≤ 600 m/s² (≤ 60g) |
| Pt100 (TF)<br>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.

Test certificates for marine applications and rough handling tests at InterTek are available.

**Electromagnetic compatibility (EMC)**

EMC to all relevant requirements of the IEC/EN 61326-series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity.

Maximum fluctuations during EMC-tests: < 1 % of measuring span.

Interference immunity to IEC/EN 61326-series, requirements for industrial areas

Interference emission to IEC/EN 61326-series, electrical equipment Class B

**Pollution degree**

Pollution degree 2.

# Process

**Process temperature range**

Depends on sensor type and material used, max. −200 to +400 °C (−328 to +752 °F).

**Process pressure range**

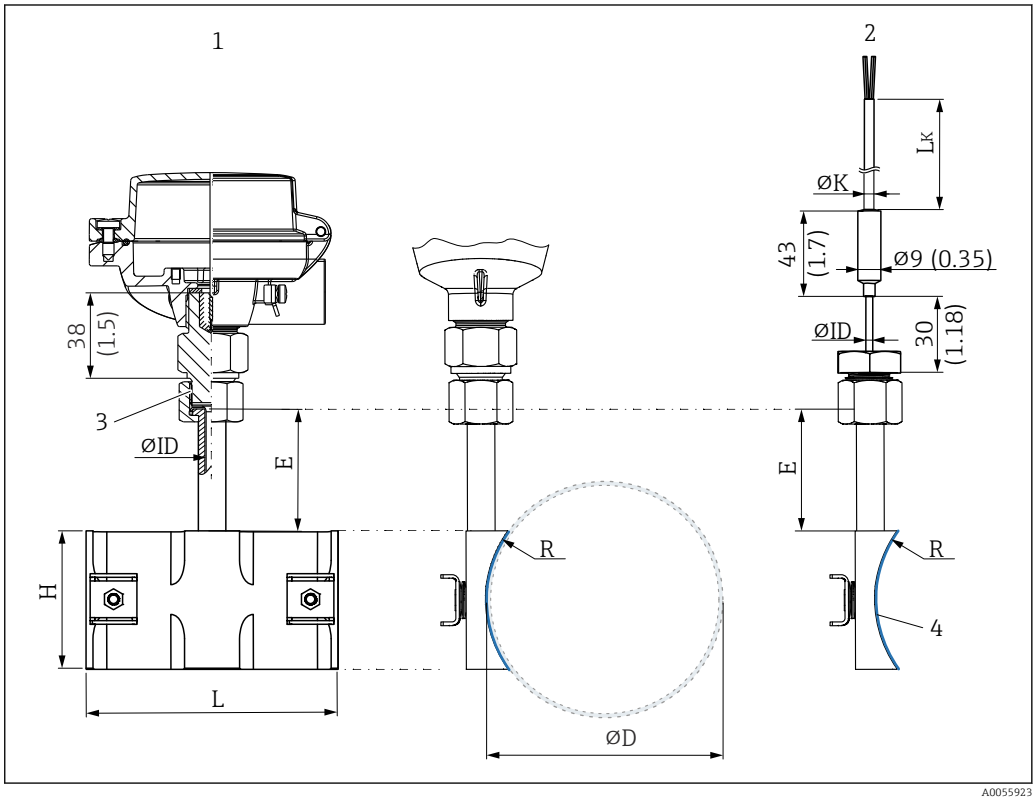
No restrictions as measurement by the thermometer is non-invasive.

# Mechanical construction

**Design, dimensions**

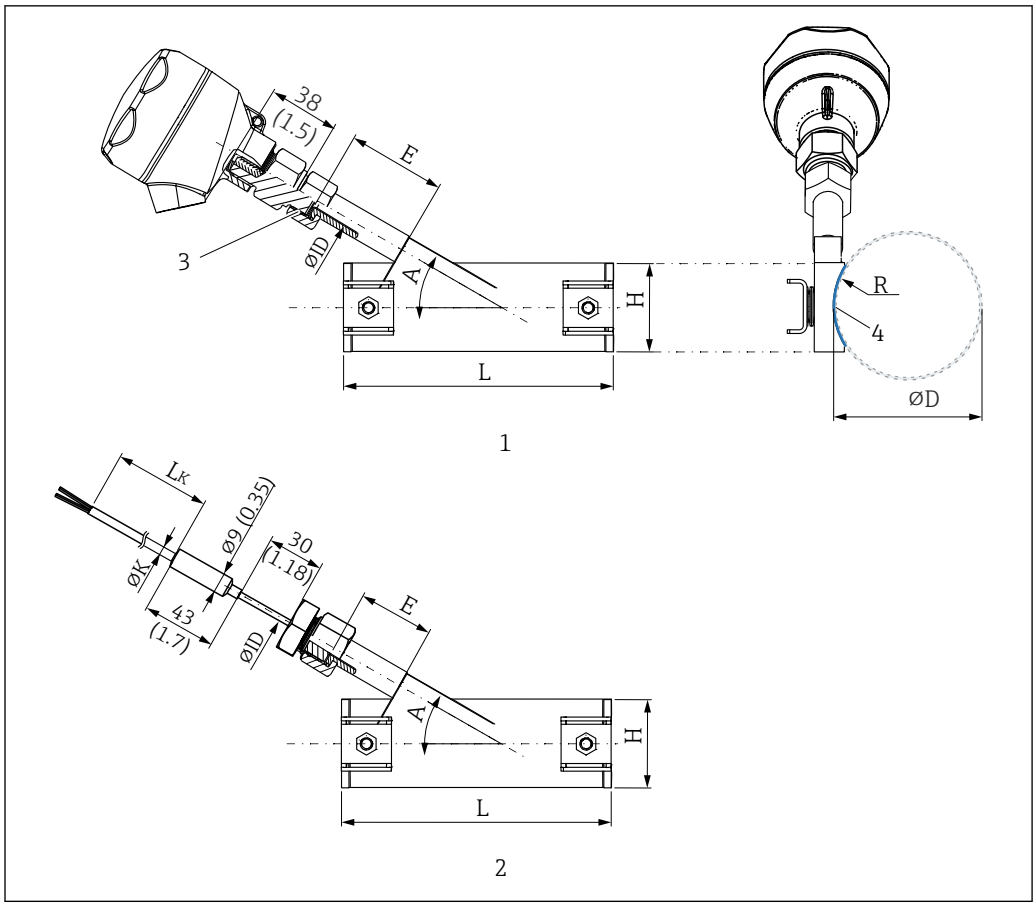
All dimensions in mm (in).

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




12 *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)*




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

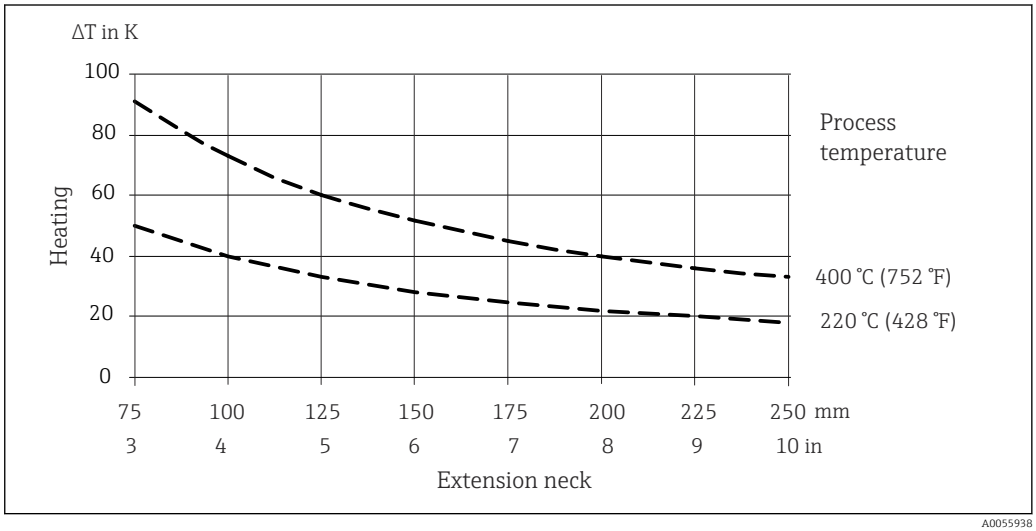
*1 Industrial thermometer with terminal head*
*2 RTD or TC cable thermometer*
*3 Thermometer connection thread - Coupling element G½" (AF 27)*
*4 Coupling foil*
*ØID Insert diameter: Ø3 mm (0.12 in)*

*Variable dimensions:*

| Item | Description | Dimensions |
|---|---|---|
| E | Extension neck length | Standard lengths<br>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<br>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<br>6 mm (0.24 in) 2x TC connection |




14 *Heating of the terminal head as a function of the process temperature. Temperature in terminal head = ambient temperature 20 °C+ ΔT*

The diagram can be used to calculate the transmitter temperature.

**Example:** At a process temperature of +220 °C and with a extension neck length of 100 mm (3.94 in), the heat conduction is +40 K. The transmitter temperature is therefore +40 K plus the ambient temperature, e.g. +25 °C: +40 K plus +25 °C = +65 °C.

Result: The temperature of the iTEMP transmitter is OK, the length of the extension neck is sufficient.

**Weight**

Depends on product and configuration.

1 kg for standard version. [1)]

**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.

Please note the maximum temperature depends on the temperature sensor used!

1) 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<br>▪ High corrosion resistance in general<br>▪ 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)<br>▪ 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), 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, mineral insulated | 1x Pt100, 3- or 4-wire, mineral insulated | 1x Pt100, 3- or 4-wire<br>▪ ø6 mm (0.24 in), mineral insulated<br>▪ 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 | Increased vibration resistance ≤ 60g | ▪ ø3 mm (0.12 in) ≤ 3g<br>▪ ø6 mm (0.24 in) ≤ 60g | ≤ 3g | |
| Measuring range; accuracy class | −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)<br>ø 6 mm (0.24 in) | ø 6 mm (0.24 in) | ø 3 mm (0.12 in)<br>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, Alloy 600 sheathed cable | Mineral insulated, stainless steel sheathed cable | Mineral insulated, 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)<br>ø 6 mm (0.24 in) | | |

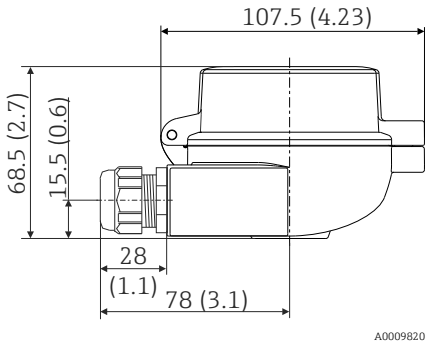
1) Options depend on product and configuration

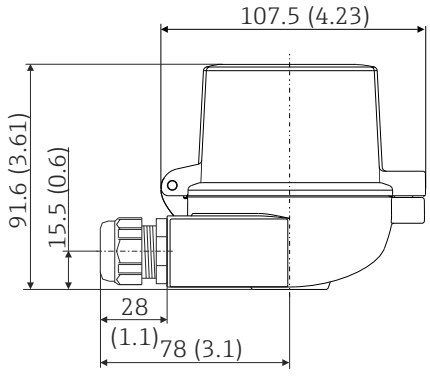
**Terminal heads**

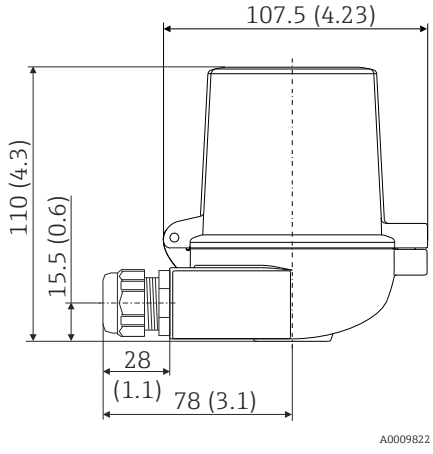
All terminal heads have an internal shape and size in accordance with DIN EN 50446, flat face, and a thermometer connection with a M24x1.5 or ½" NPT thread. All dimensions in mm (in). The sample cable glands in the diagrams correspond to M20x1.5 connections with non-Ex polyamide cable glands. Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see the "Ambient temperature range" section. → 🖹 21

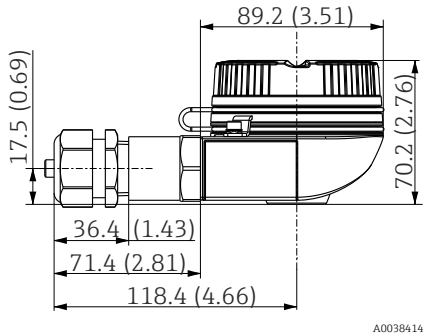
As a special feature, Endress+Hauser offers terminal heads with optimized terminal accessibility for easy installation and maintenance.

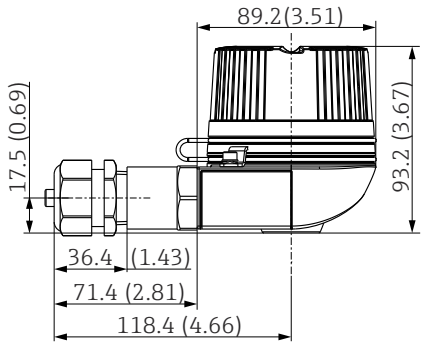
If the device is selected as a cable thermometer, no terminal head can be configured. See the "Function and system design" section.

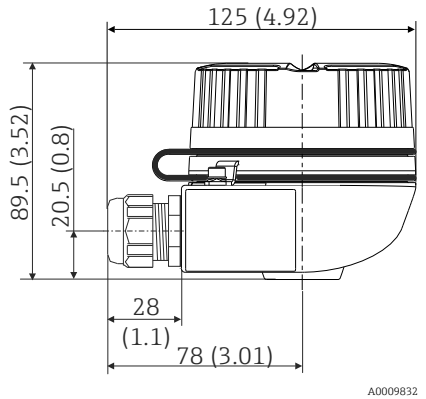
| TA30A | Specification |
|---|---|
|  | ▪ Protection degree:<br>▪ IP66/68 (NEMA Type 4x encl.)<br>▪ For ATEX: IP66/67<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland<br>▪ Material: aluminum, polyester powder coated<br>Seals: silicone<br>▪ Threaded cable entry: G ½", NPT ½" and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

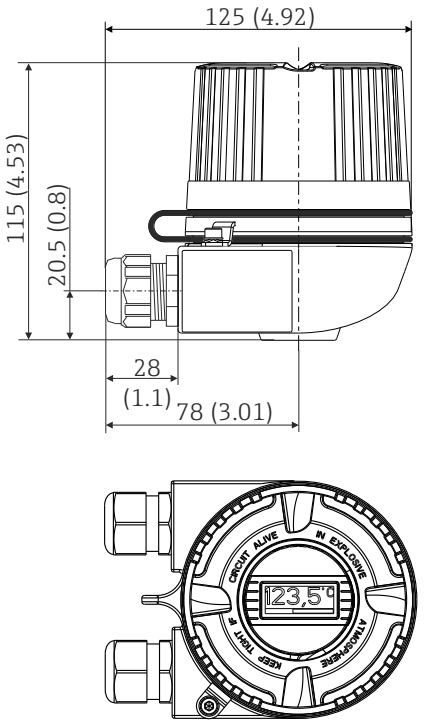
| TA30A with display window in cover | Specification |
|---|---|
|  | ▪ Protection degree:<br>▪ IP66/68 (NEMA Type 4x encl.)<br>▪ For ATEX: IP66/67<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland<br>▪ Material: aluminum, polyester powder coated<br>Seals: silicone<br>▪ Threaded cable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

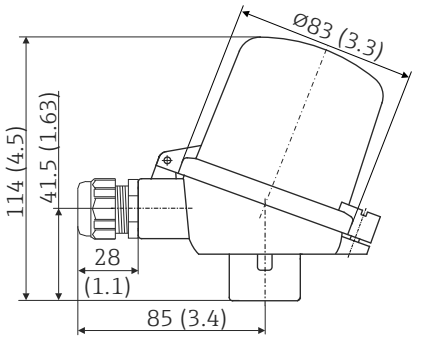
| TA30D | Specification |
|---|---|
|  | ▪ Protection degree:<br>▪ IP66/68 (NEMA Type 4x encl.)<br>▪ For ATEX: IP66/67<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland<br>▪ Material: aluminum, polyester powder coated<br>Seals: silicone<br>▪ Threaded cable entry: G ½", NPT ½" and M20x1.5<br>▪ 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.<br>▪ Color of head: blue, RAL 5012<br>▪ Color of cap: gray, RAL 7035<br>▪ Weight: 390 g (13.75 oz)<br>▪ Ground terminal, internal and external<br>▪ Available with sensors with 3-A® symbol |

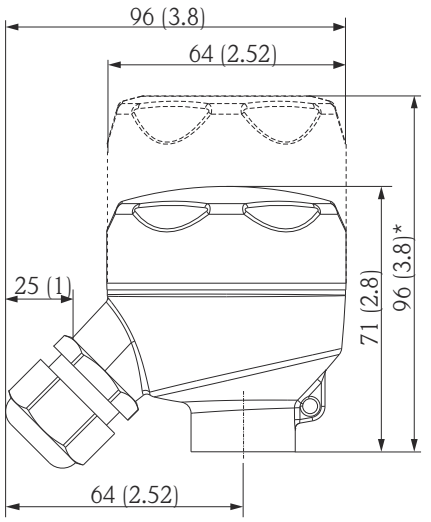
| TA30EB | Specification |
|---|---|
|  | ▪ Screw cap<br>▪ Degree of protection: IP 66/68, NEMA 4x<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F)<br>▪ Material: aluminum; polyester powder coating; Klüber Syntheso Glep 1 dry-film lubricant<br>▪ Thread: M20x1.5<br>▪ Color of head: blue, RAL 5012<br>▪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

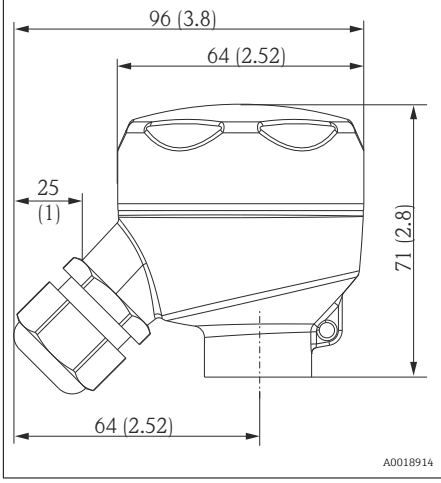
| TA30EB with display window in cover | Specification |
|---|---|
|  | ▪ Screw cap<br>▪ Degree of protection: IP 66/68, NEMA 4x<br>Ex-version: IP 66/68<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!)<br>▪ Material: aluminum; polyester powder coating; Klüber Syntheso Glep 1 dry-film lubricant<br>▪ Display window: single-pane safety glass according to DIN 8902<br>▪ Thread: NPT ½", NPT ¾", M20x1.5, G½"<br>▪ Color of head: blue, RAL 5012<br>▪ Color of cap: gray, RAL 7035<br>▪ Weight: approx. 400 g (14.11 oz)<br>When the housing cover is unscrewed: Before screwing it on, 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<br>▪ Degree of protection: IP 66/68, NEMA Type 4x Encl.<br>Ex-version: IP 66/67<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!)<br>▪ Material:<br>▪ Aluminum, with polyester powder coating<br>▪ Stainless steel 316L without coating<br>▪ Dry lubricant Klüber Syntheso Glep 1<br>▪ Thread: NPT ½", NPT ¾", M20x1.5, G½"<br>▪ Color of aluminum head: blue, RAL 5012<br>▪ Color of aluminum cap: gray, RAL 7035<br>▪ Weight:<br>▪ Aluminum: approx. 640 g (22.6 oz)<br>▪ Stainless steel: approx. 2 400 g (84.7 oz)<br>When the housing cover is unscrewed: Before screwing it on, 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<br>▪ Degree of protection: IP 66/68, NEMA Type 4x Encl.<br>Ex-version: IP 66/67<br>▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!)<br>▪ Material:<br>▪ Aluminum; polyester powder coated<br>▪ Stainless steel 316L without coating<br>▪ Dry lubricant Klüber Syntheso Glep 1<br>▪ Display window: single-pane safety glass according to DIN 8902<br>▪ Thread: NPT ½", NPT ¾", M20x1.5, G½"<br>▪ Color of aluminum head: blue, RAL 5012<br>▪ Color of aluminum cap: gray, RAL 7035<br>▪ Weight:<br>▪ Aluminium approx. 860 g (30.33 oz)<br>▪ Stainless steel approx. 2 900 g (102.3 oz)<br>▪ Head transmitter optionally available with TID10 display<br>When the housing cover is unscrewed: Before screwing it on, 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<br>▪ Max. temperature: −40 to +120 °C (−40 to +248 °F)<br>▪ Material: polyamide (PA12), antistatic<br>Seals: silicone<br>▪ Threaded cable entry: M20x1.5<br>▪ 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.<br>▪ Head and cap color: black<br>▪ Weight: 135 g (4.8 oz)<br>▪ Type of protection: intrinsic safety (G Ex ia)<br>▪ Ground terminal: only internal via auxiliary clamp<br>▪ Available with sensors with 3-A® symbol |

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

| TA30R | Specification |
|---|---|
|  | ▪ Degree of protection - standard version: IP69K (NEMA Type 4x encl.)<br>▪ Temperature: −50 to +130 °C (−58 to +266 °F) without cable gland<br>▪ Material: stainless steel 316L, abrasive-blasted or hand-polished<br>Seals: EPDM<br>▪ Cable entry thread ½" NPT and M20x1.5<br>▪ Weight: 360 g (12.7 oz)<br>▪ Protection armature connection: M24x1.5 or ½" NPT<br>▪ Ground terminal: internal in standard version<br>▪ Not allowed for Class II and III applications<br>▪ 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<br>(−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<br>(−40 to +212 °F) | 5 to 9 mm (0.19 to 0.35 in) |

| Type | Suitable for cable entry | Degree of protection | Temperature range | Suitable cable diameter |
|---|---|---|---|---|
| | 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.

## 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**.

**MID**

Test certificate (only in SIL mode). In compliance with:
- WELMEC 8.8, "Guide on the General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring Instruments."
- OIML R117-1 Edition 2007 (E) "Dynamic measuring systems for liquids other than water"
- EN 12405-1/A2 Edition 2010 "Gas meters - Conversion devices - Part 1: Volume conversion"
- OIML R140-1 Edition 2007 (E) "Measuring systems for gaseous fuel"

## Ordering information

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

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

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

# Accessories

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

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

## Service-specific accessories

### Modems/Edge devices

**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

### Software

**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

## Online tools

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

## 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

# 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**<br>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**<br>The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning. |
| Operating Instructions (BA) | **Your reference document**<br>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**<br>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.<br>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. |


www.addresses.endress.com

Endress+Hauser

People for Process Automation