TI01058T/09/EN/07.24-00
71661802
2024-03-29

Technical Information
iTHERM ModuLine TM401

Resistance thermometer for hygienic and aseptic applications

Metric version with basic technology for all standard applications, permanent insert

Applications

- Specially designed for use in hygienic and aseptic applications in the Food & Beverages and Life Sciences industries
- Measuring range: –50 to +200 °C (–58 to +392 °F)
- Pressure range up to 50 bar (725 psi)
- Protection class: up to IP69K
- Can be used in non-hazardous areas

Head transmitters

All Endress+Hauser transmitters are available with enhanced measurement accuracy and reliability compared to directly wired sensors. Outputs and communication protocol:

- 4 to 20 mA analog output, HART®
  HART® SIL transmitter, optional
- PROFINET® over Ethernet-APL
- IO-Link®

Your benefits

- Best price-performance ratio and fast delivery time
- User-friendly and reliable from product selection to maintenance
- International certification: hygiene standards as per 3-A, EHEDG, ASME BPE, FDA, TSE Certificate of Suitability
- Wide range of process connections

Endress+Hauser
People for Process Automation

Table of contents

Function and system design

iTHERM ModuLine, hygienic

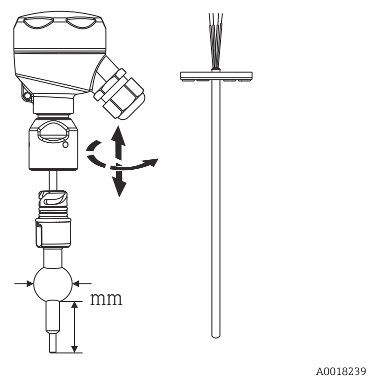
This thermometer is part of the product line of modular thermometers for hygienic and aseptic applications.

Differentiating factors when selecting a suitable thermometer

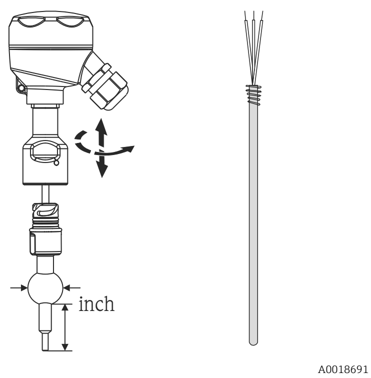
TM4x**1**	TM4x**2**
Metric version	Imperial version
↓	↓

TM4**1**x characterizes the device that uses cutting-edge technology, with features such as a replaceable insert, quick-fastening extension neck (iTHERM QuickNeck), vibration-resistant and fast-response sensor technology iTHERM StrongSens and QuickSens) and approval for use in hazardous areas

TM411



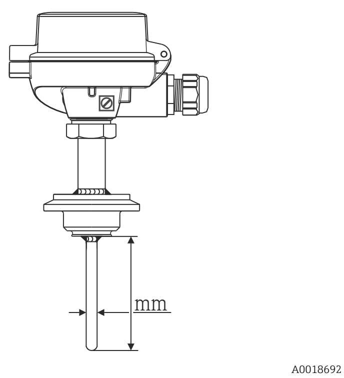
TM412



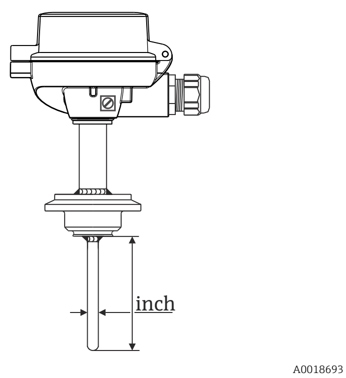
↓ ↓

TM4**0**x characterizes the device that uses basic technology, with features such as a fixed, non-replaceable insert, application in non-hazardous areas, standard extension neck, low-cost unit

TM401



TM402



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).

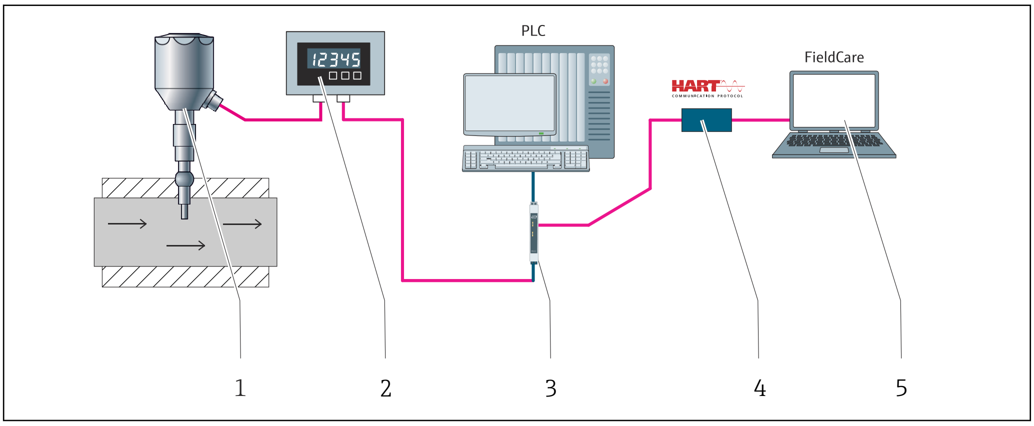
Thermocouples (TC)

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

Endress+Hauser offers 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
- Overvoltage protection

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



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

1 *Installed iTHERM compact thermometer with HART communication protocol*
2 *2-wire RIA15 process indicator – The process indicator is looped into the current loop and displays the measuring signal or the HART process variables in digital form. The process indicator does not require an external power supply, as it gets its energy directly from the current loop. More information on this can be found in the Technical Information, under "Documentation".*
3 *Active barrier RN22 – 1- or 2-channel active barrier for the separation of 0/4 to 20 mA standard signal circuits, optionally available as a signal doubler, 24 V DC. HART-transparent. More information on this can be found in the Technical Information, under "Documentation".*
4 *Commubox FXA195 for intrinsically safe HART communication with FieldCare via the USB port.*
5 *FieldCare is a FDT-based plant asset management tool from Endress+Hauser, more details see section 'accessories'. The acquired self-calibration data is stored in the device (1) and can be read using FieldCare. This also enables an auditable calibration certificate to be created and printed.*

Input

Measured variable

Temperature (temperature-linear transmission behavior)

Measuring range

Sensor type	Measuring range
Pt100 thin-film	−50 to +200 °C (−58 to +392 °F)

Output

Output signal

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

- Directly-wired sensors - sensor measured values forwarded without a transmitter.
- Via all common protocols by selecting an appropriate Endress+Hauser iTEMP temperature transmitter. All the transmitters listed below are mounted directly in the 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 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 indication of measured values and configuration via Endress+Hauser SmartBlue (app), optional.

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

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

Head transmitter with PROFINET® and Ethernet-APL
The temperature transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using the PROFINET® protocol. Power is supplied via the 2-wire Ethernet connection according to IEEE 802.3cg 10Base-T1. The 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 temperature transmitter is an IO-Link® device with a measurement input and an IO-Link® interface. Configurable, simple and cost-effective solution through digital communication via IO-Link®. The device is mounted in a terminal head form B (flat face) as per DIN EN 5044.

Advantages of the iTEMP transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Attachable display (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes

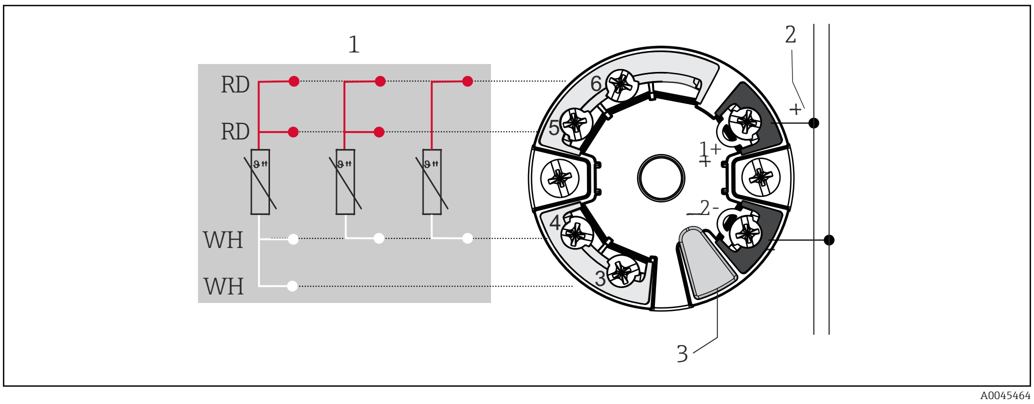
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions
- Sensor-transmitter matching based on the Callendar van Dusen coefficients (CvD).

Power supply

- According to the 3-A Sanitary Standard and the EHEDG, electrical connecting cables must be smooth, corrosion-resistant and easy to clean.
- Grounding or shield connections are possible via special ground terminals on the terminal head.

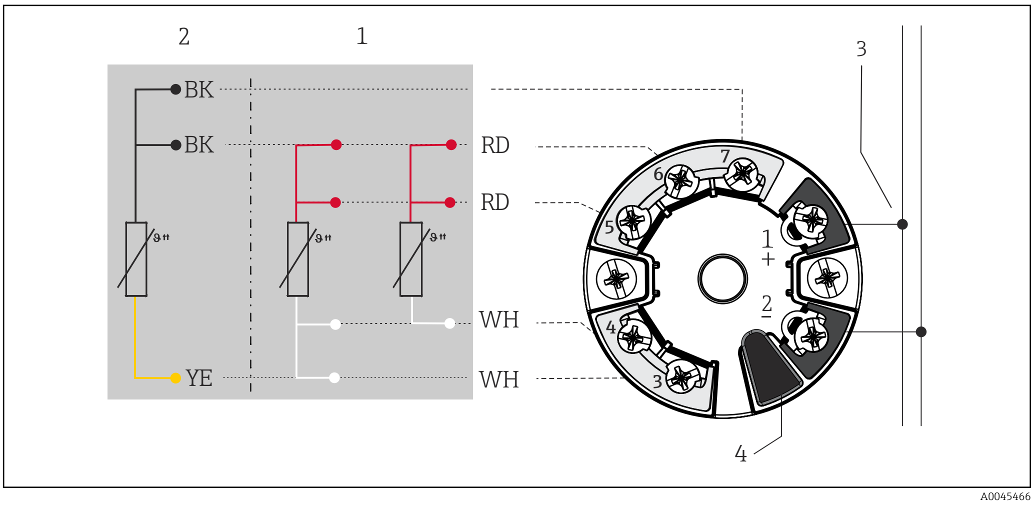
Wiring diagram for RTD

Type of sensor connection



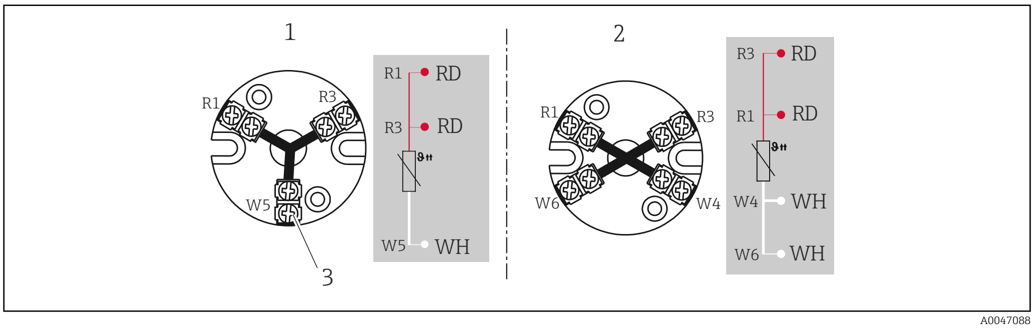
2 *Head mounted transmitter TMT7x or TMT31 (single input)*

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



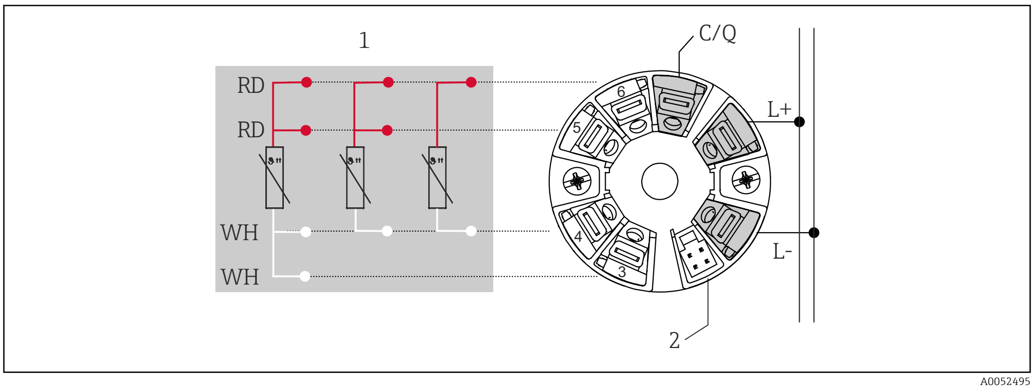
3 *Head-mounted transmitter TMT8x (dual sensor input)*

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



4 *Terminal block mounted*

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



5 *Head-mounted transmitter TMT36 (single 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

Terminals

iTEMP head transmitters fitted with push-in terminals unless screw terminals are explicitly selected, the second process seal is chosen or a double sensor is installed.

Cable entries

See "Terminal heads" section.

The cable entries must be selected during the configuration of the device. Different terminal heads offer different possibilities with regard to threads and the number of available cable entries.

Connectors

Endress+Hauser 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.

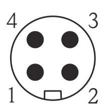
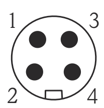
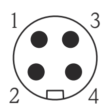
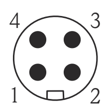
We do not recommend connecting thermocouples directly to connectors. The direct connection to the pins of the plug might generate a new 'thermocouple' which influences the accuracy of the measurement. Therefore we do not connect thermocouples directly to connectors. The thermocouples are connected in combination with a 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

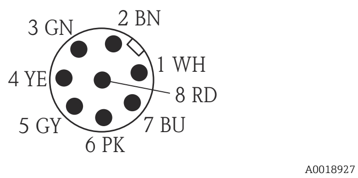
GND	Grounded. Wires marked 'GND' are connected to the internal grounding screw in the terminal head.	RD	Red
BN	Brown	WH	White
GNYE	Green-yellow	PK	Pink
BU	Blue	GN	Green
GY	Gray	BK	Black

Terminal head with one cable entry

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)	RD	RD	WH	WH	RD	RD	WH	WH	RD	RD	WH	WH	RD	RD	WH	WH
6-wire terminal block (2x Pt100)	RD (#1) 1)	RD (#1)	WH (#1)		RD (#1)	RD (#1)	WH (#1)		RD (#1)	RD (#1)	WH (#1)		RD	RD	WH (#1)	
1x TMT 4 to 20 mA or HART®	+	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	-	GND 2)	+	i	-	GND 2)	Cannot be combined							
2x TMT PROFIBUS® PA	+(#1)	i	-(#1)	GND 2)	+	i	-	GND 2)	Cannot be combined							
1x TMT FF	Cannot be combined				Cannot be combined				-	+	GND	i	Cannot be combined			
2x TMT FF	Cannot be combined				Cannot be combined				-(#1)	+(#1)	GND	i	Cannot be combined			
1x TMT PROFINET®	Cannot be combined				Cannot be combined				Cannot be combined				APL signal -	APL signal +	GND	-
2x TMT PROFINET®	Cannot be combined				Cannot be combined				Cannot be combined				APL signal - (#1)	APL signal + (#1)	GND	-
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			

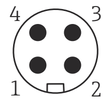
1) Second Pt100 is not connected
2) If using a head without a grounding screw, e.g. plastic housing TA30S or TA30P, insulated 'i' instead of grounded GND

Terminal head with one cable entry

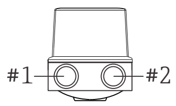
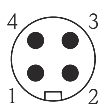
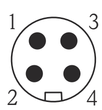
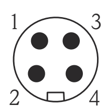
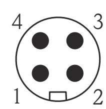
<table>
<tr><th>Plug</th><th colspan="8">4-pin/8-pin</th></tr>
<tr><td>Plug thread</td><td colspan="8">M12</td></tr>
<tr><td>PIN number</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><th colspan="9">Electrical connection (terminal head)</th></tr>
<tr><td>Flying leads and TC</td><td colspan="8">Not connected (not insulated)</td></tr>
<tr><td>3-wire terminal block (1x Pt100)</td><td rowspan="3">RD</td><td rowspan="3">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>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>
<tr><td>2x TMT PROFINET®</td><td colspan="8">Cannot be combined</td></tr>
<tr><td>PIN position and color code</td><td colspan="4"></td><td colspan="4"></td></tr>
</table>

Terminal head with one cable entry

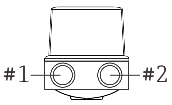
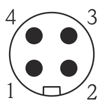
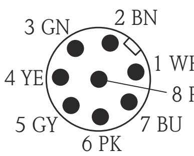
<table>
<tr><th>Plug</th><th colspan="4">1x IO-Link®, 4-pin</th></tr>
<tr><td>Plug thread</td><td colspan="4">M12</td></tr>
<tr><td>PIN number</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><th colspan="5">Electrical connection (terminal head)</th></tr>
<tr><td>Flying leads</td><td colspan="4">Not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

<table>
<tr><th>Plug</th><th colspan="4">1x IO-Link®, 4-pin</th></tr>
<tr><td>2x TMT IO-Link®</td><td>L+ (#1)</td><td>-</td><td>L- (#1)</td><td>C/Q</td></tr>
<tr><td>PIN position and color code</td><td colspan="4">1 BN
3 BU
4 BK
A0055383</td></tr>
</table>

Terminal head with two cable entries

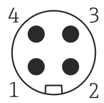
<table>
<tr><th>Plug</th><th colspan="8">2x PROFIBUS® PA</th><th colspan="4">2x FOUNDATION™ Fieldbus (FF)</th><th colspan="4">2x PROFINET® and Ethernet-APL</th></tr>
<tr><td>Plug thread
A0021706</td><td colspan="4">M12(#1) / M12(#2)</td><td colspan="4">7/8"(#1)/7/8"(#2)</td><td colspan="4">7/8"(#1)/7/8"(#2)</td><td colspan="4">M12 (#1)/M12 (#2)</td></tr>
<tr><td>PIN number</td><td>1</td><td>2</td><td>3</td><td>4</td><td>1</td><td>2</td><td>3</td><td>4</td><td>1</td><td>2</td><td>3</td><td>4</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td colspan="17">Electrical connection (terminal head)</td></tr>
<tr><td>Flying leads and TC</td><td colspan="16">Not connected (not insulated)</td></tr>
<tr><td>3-wire terminal block (1x Pt100)</td><td rowspan="2">RD/i</td><td rowspan="2">RD/i</td><td colspan="2">WH/i</td><td rowspan="2">RD/i</td><td rowspan="2">RD/i</td><td colspan="2">WH/i</td><td rowspan="2">RD/i</td><td rowspan="2">RD/i</td><td colspan="2">WH/i</td><td rowspan="2">RD/i</td><td rowspan="2">RD/i</td><td colspan="2">WH/i</td></tr>
<tr><td>4-wire terminal block (1x Pt100)</td><td>WH/i</td><td>WH/i</td><td>WH/i</td><td>WH/i</td><td>WH/i</td><td>WH/i</td><td>WH/i</td><td>WH/i</td></tr>
<tr><td>6-wire terminal block (2x Pt100)</td><td>RD/BK</td><td>RD/BK</td><td colspan="2">WH/YE</td><td>RD/BK</td><td>RD/BK</td><td colspan="2">WH/YE</td><td>RD/BK</td><td>RD/BK</td><td colspan="2">WH/YE</td><td>RD/BK</td><td>RD/BK</td><td colspan="2">WH/YE</td></tr>
<tr><td>1x TMT 4 to 20 mA or HART®</td><td>+/i</td><td rowspan="4">i/i</td><td>-/i</td><td rowspan="2">i/i</td><td>+/i</td><td rowspan="4">i/i</td><td>-/i</td><td rowspan="2">i/i</td><td>+/i</td><td rowspan="2">i/i</td><td>-/i</td><td rowspan="2">i/i</td><td>+/i</td><td rowspan="2">i/i</td><td>-/i</td><td rowspan="2">i/i</td></tr>
<tr><td>2x TMT 4 to 20 mA or HART® in the terminal head with a high cover</td><td>+(#1)/+(#2)</td><td>-(#1)/-(#2)</td><td>+(#1)/+(#2)</td><td>-(#1)/-(#2)</td><td>+(#1)/+(#2)</td><td>-(#1)/-(#2)</td><td>+(#1)/+(#2)</td><td>-(#1)/-(#2)</td></tr>
<tr><td>1x TMT PROFIBUS® PA</td><td>+/i</td><td>-/i</td><td rowspan="2">GND/GND</td><td>+/i</td><td>-/i</td><td rowspan="2">GND/GND</td><td colspan="8" rowspan="2">Cannot be combined</td></tr>
<tr><td>2x TMT PROFIBUS® PA</td><td>+(#1)/+(#2)</td><td>-(#1)/-(#2)</td><td>+(#1)/+(#2)</td><td>-(#1)/-(#2)</td></tr>
<tr><td>1x TMT FF</td><td colspan="4" rowspan="2">Cannot be combined</td><td colspan="4" rowspan="2">Cannot be combined</td><td>-/i</td><td>+/i</td><td rowspan="2">i/i</td><td rowspan="2">GND/GND</td><td colspan="4" rowspan="2">Cannot be combined</td></tr>
<tr><td>2x TMT FF</td><td>-(#1)/-(#2)</td><td>+(#1)/+(#2)</td></tr>
<tr><td>1x TMT PROFINET®</td><td colspan="4">Cannot be combined</td><td colspan="4">Cannot be combined</td><td colspan="4">Cannot be combined</td><td>APL signal -</td><td>APL signal +</td><td rowspan="2">GND</td><td rowspan="2">i</td></tr>
<tr><td>2x TMT PROFINET®</td><td colspan="4">Cannot be combined</td><td colspan="4">Cannot be combined</td><td colspan="4">Cannot be combined</td><td>APL signal - (#1) and (#2)</td><td>APL signal + (#1) and (#2)</td></tr>
<tr><td>PIN position and color code</td><td colspan="4">1 BN
2 GNYE
3 BU
4 GY
A0018929</td><td colspan="4">1 BN
2 GNYE
3 BU
4 GY
A0018930</td><td colspan="4">1 BU
2 BN
3 GY
4 GNYE
A0018931</td><td colspan="4">1 RD
2 GN
A0052119</td></tr>
</table>

Terminal head with two cable entries

<table>
<tr><th>Plug</th><th colspan="8">4-pin/8-pin</th></tr>
<tr><td>Plug thread
</td><td colspan="8">M12 (#1)/M12 (#2)</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><td colspan="9">Electrical connection (terminal head)</td></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/i</td><td rowspan="2">RD/i</td><td colspan="2">WH/i</td><td colspan="4" rowspan="5">i/i</td></tr>
<tr><td>4-wire terminal block (1x Pt100)</td><td>WH/i</td><td>WH/i</td></tr>
<tr><td>6-wire terminal block (2x Pt100)</td><td>RD/BK</td><td>RD/BK</td><td colspan="2">WH/YE</td></tr>
<tr><td>1x TMT 4 to 20 mA or HART®</td><td>+/i</td><td rowspan="2">i/i</td><td>-/i</td><td rowspan="2">i/i</td></tr>
<tr><td>2x TMT 4 to 20 mA or HART® in the terminal head with a high cover</td><td>+(#1)/ +(#2)</td><td>-(#1)/-(#2)</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>
<tr><td>2x TMT PROFINET®</td><td colspan="8">Cannot be combined</td></tr>
<tr><td>PIN position and color code</td><td colspan="4"></td><td colspan="4"></td></tr>
</table>

Terminal head with two cable entries

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

Plug	2x IO-Link®, 4-pin			
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

Insert	Transmitter connection 1)			
	TMT31/TMT7x		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 2)	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 3)	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) 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.
2) Only in the terminal head with a high cover, only 1 transmitter possible. A ceramic terminal block is automatically fitted on the insert.
3) Individual sensors each connected to channel 1 of a transmitter

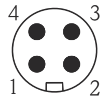
Cable entries

See 'Terminal heads' section

Connectors

PIN assignment of the M12 plugs, connection combinations

Plug	M12 plug, 4-pin			
PIN number	1	2	3	4
Electrical connection (terminal head)				
Flying leads	Not connected (not insulated)			
3-wire terminal block (1x Pt100)	RD	RD	WH	
4-wire terminal block (1x Pt100)			WH	WH

1x TMT 4 to 20 mA or HART	+	i	-	i
PIN position and color code	 1 BN 2 GNYE 3 BU 4 GY A0018929			

Abbreviations

i	RD	WH	BN	GNYE	BU	GY
Insulated [1)]	Red	White	Brown	Green-yellow	Blue	Gray

1) Wires marked 'i' are not connected and are insulated with heat shrink tubes.

Overvoltage protection

To protect against overvoltage in the power supply and signal/communication cables for the thermometer electronics, Endress+Hauser offers the HAW562 surge arrester for DIN rail mounting and the HAW569 for field housing installation.

For more information see the Technical Information 'HAW562 Surge arrester' TI01012K and 'HAW569 Surge arrester' TI01013K.

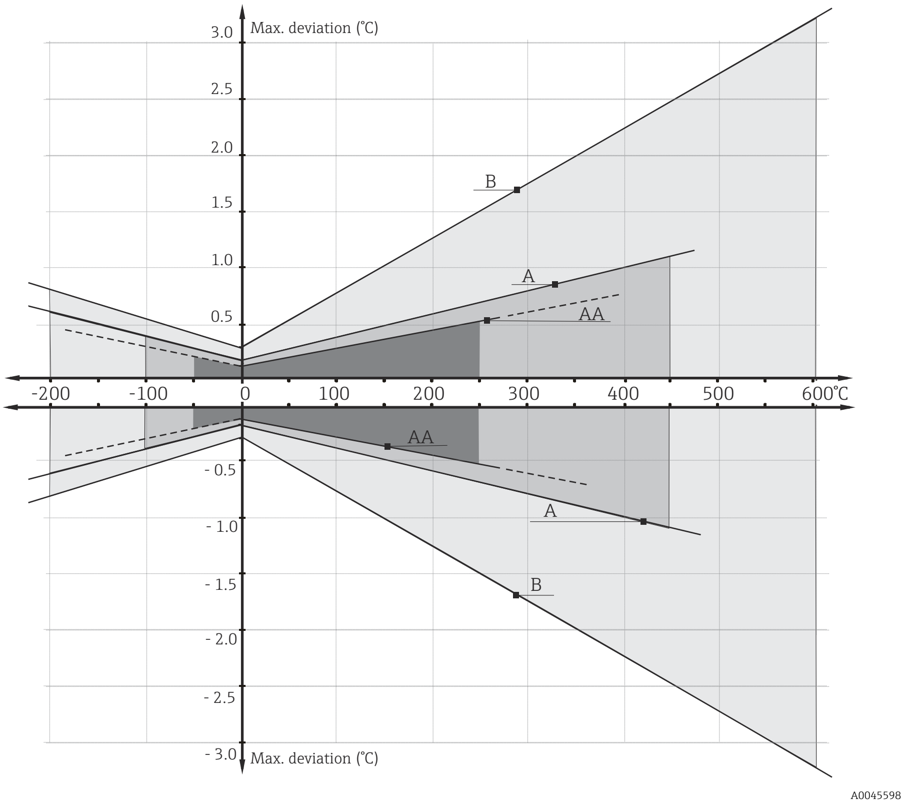
Performance characteristics

Reference conditions

These data are relevant for determining the measurement accuracy of the transmitters used. For details, see the relevant Technical Information.

Maximum measurement error

RTD resistance thermometer corresponding to 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| = absolute temperature value in °C

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

Temperature ranges

Sensor type [1)]	Operating temperature range	Class B	Class A	Class AA
Pt100 (TF) 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)
Pt100 (WW)	−200 to +600 °C (−328 to +1 112 °F)	−200 to +600 °C (−328 to +1 112 °F)	−100 to +450 °C (−148 to +842 °F)	−50 to +250 °C (−58 to +482 °F)

1) Selection depending on product and configuration

Influence of ambient temperature

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

Self-heating

RTD elements are passive resistors 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 low measured current) is used.

Response time

Tests have been performed in water at 0.4 m/s (according to IEC 60751) and with a 10 K temperature change.

Pipe diameter	Shape of tip	1x Pt100 thin-film sensor	
		Response time	
		t_{50}	t_{90}
Ø6 mm (¼ in)	Straight	5 s	11 s
	Reduced 4.5 mm (0.18 in) x 18 mm (0.71 in)	3.5 s	9 s
Ø8 mm (0.31 in)	Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in)	5 s	10.5 s

Response time without transmitter.

Calibration

Calibration of thermometers
Calibration involves comparing the measured values of a device under test (DUT) with those of a more precise calibration standard using a defined and reproducible measurement method. The aim is to determine the deviation of the DUT'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 measuring uncertainty may increase due to heat conduction errors and short immersion lengths. The existing measuring uncertainty is recorded on the individual certificate of calibration. For accredited calibrations in accordance with ISO17025, a measuring uncertainty that is twice as high as the accredited measuring uncertainty is not permitted. If this limit is exceeded, only a factory calibration is possible.

For the device, Endress+Hauser offers standard calibrations at a reference temperature of −50 to +200 °C (−58 to +392 °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 thermometer.

Insulation resistance

Insulation resistance ≥ 100 MΩ at ambient temperature, measured between the terminals and the outer jacket with a minimum voltage of 100 V_{DC}.

Mounting

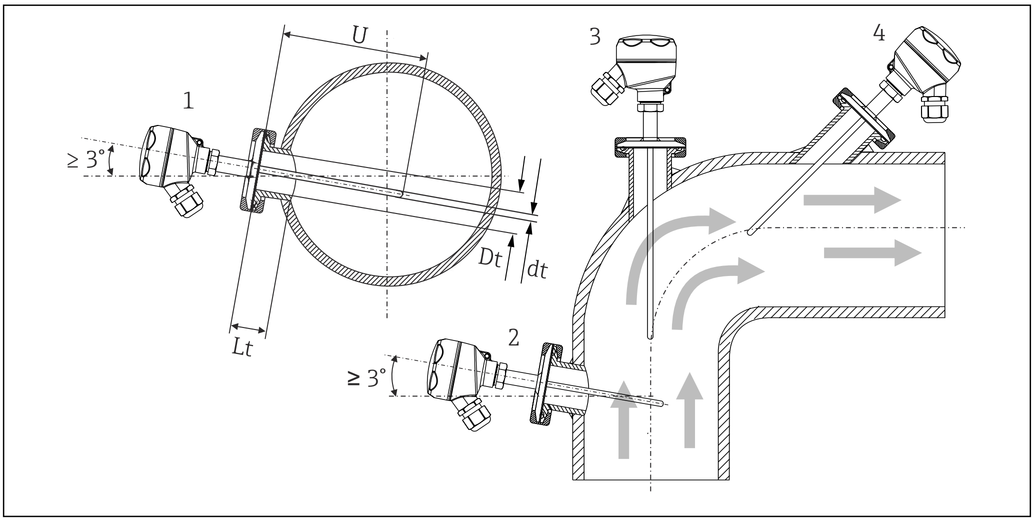
Orientation

No restrictions. However, self-draining in the process must be guaranteed. If there is an opening to detect leaks at the process connection, this opening must be at the lowest possible point.

Installation instructions

The immersion length of the thermometer can influence the measurement accuracy. If the immersion length is too small then measurement errors are caused by heat conduction via the process connection and the container wall. Therefore, if installing in a pipe, the immersion length should ideally correspond to half of the pipe diameter.

- Installation options: Pipes, tanks or other plant components
- To minimize the heat conduction error, a minimum immersion length, which corresponds to the calibration, is recommended depending on the type of sensor used.



6 Installation examples

1, 2 Perpendicular to the flow direction, installed at a min. angle of 3° to ensure self-draining
3 On elbows
4 Inclined installation in pipes with a small nominal diameter
U Immersion length

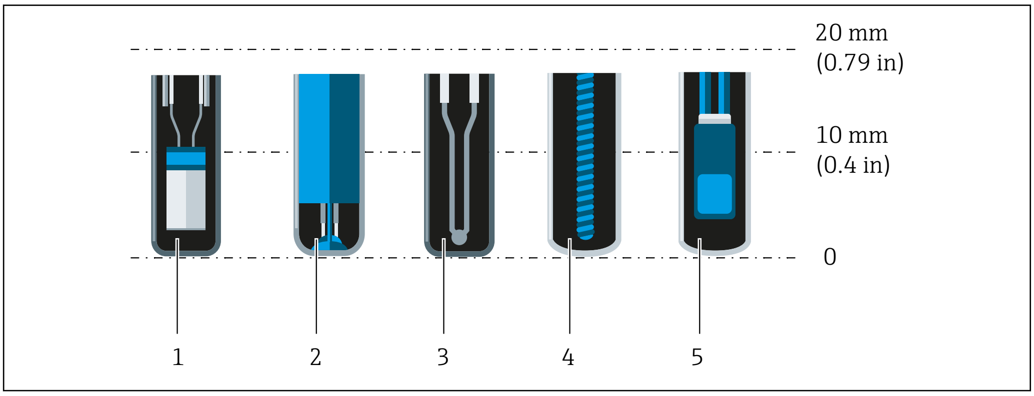
In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to project well into the process so that it extends past the pipe axis. Installation at an angle (4) could be another solution. When determining the immersion length or installation depth, all the parameters of the thermometer and of the medium to be measured must be taken into account (e.g. flow velocity, process pressure).

The requirements of the EHEDG and the 3-A Sanitary Standard must be adhered to.

Installation instructions EHEDG/cleanability: Lt ≤ (Dt-dt)

Installation instructions 3-A/cleanability: Lt ≤ 2(Dt-dt)

Pay attention to the exact position of the sensor element in the thermometer tip.

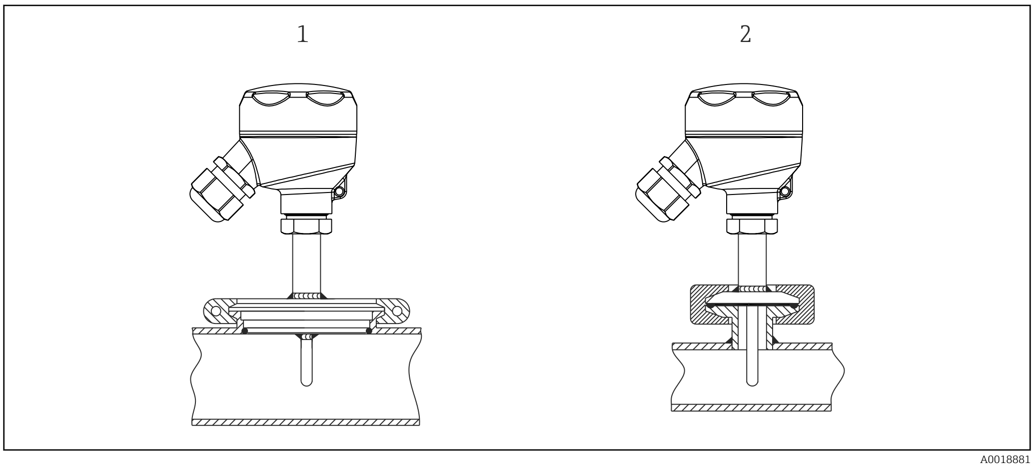


1 StrongSens or TrustSens at 5 to 7 mm (0.2 to 0.28 in)
2 QuickSens at 0.5 to 1.5 mm (0.02 to 0.06 in)
3 Thermocouple (not grounded) at 3 to 5 mm (0.12 to 0.2 in)
4 Wire wound sensor at 5 to 20 mm (0.2 to 0.79 in)
5 Standard thin-film sensor at 5 to 10 mm (0.2 to 0.39 in)

To keep the influence of heat dissipation to a minimum and to achieve the best possible measurement results, 20 to 25 mm (0.79 to 0.98 in) should be in contact with the medium in addition to the actual sensor element.

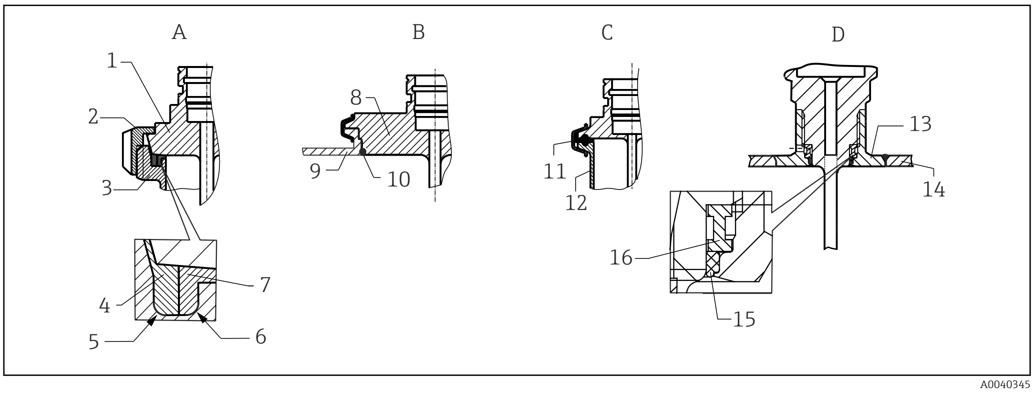
This results in the following recommended minimum immersion lengths
- TrustSens or StrongSens 30 mm (1.18 in)
- QuickSens 25 mm (0.98 in)
- Wire wound sensor 45 mm (1.77 in)
- Standard thin-film sensor 35 mm (1.38 in)

It is particularly important to take this into consideration for T-pieces, as the immersion length is very short on account of their design, and the measured error is higher as a result. It is therefore recommended to use elbow pieces with QuickSens sensors.



7 *Process connections for thermometer installation in pipes with small nominal diameters*

1 *Varivent® - process connection D = 50 mm for DN25 pipes*
2 *Clamp or micro-clamp*



8 *Detailed installation instructions for hygiene-compliant installation (depends on the version ordered)*

A *Milk pipe connection according to DIN 11851, only in connection with EHEDG certified and self-centering sealing ring*
1 *Sensor with milk pipe connection*
2 *Groove slip-on nut*
3 *Counterpart connection*
4 *Centering ring*
5 *R0.4*
6 *R0.4*
7 *Sealing ring*
B *Varivent® process connection for VARINLINE® housing*
8 *Sensor with Varivent connection*
9 *Counterpart connection*
10 *O-ring*
C *Clamp according to ISO 2852*
11 *Molded seal*
12 *Counterpart connection*
D *Process connection Liquiphant-M G1", horizontal installation*
13 *Weld-in adapter*
14 *Vessel wall*
15 *O-ring*
16 *Thrust collar*

NOTICE

The following actions must be taken if a sealing ring (O-ring) or seal fails:
- The thermometer must be removed.
- The thread and the O-ring joint/sealing surface must be cleaned.
- The sealing ring or seal must be replaced.
- CIP must be performed after installation.

The counterpieces for the process connections and the seals or sealing rings are not supplied with the thermometer. Liquiphant M weld-in adapters with related seal kits are available as accessories. → 30.

In the case of weld-in connections, exercise the necessary degree of care when performing the welding work on the process side:

1. Use suitable welding material.
2. Flush-weld or weld with welding radius ≥ 3.2 mm (0.13 in).
3. Avoid crevices, folds or gaps.
4. Ensure the surface is honed and polished, Ra ≤ 0.76 µm (30 µin).

1. As a general rule, the thermometers should be installed in such a way that does not impact their ability to be cleaned (the requirements of the 3-A Sanitary Standard must be observed).
2. The Varivent® and Liquiphant-M weld-in adapter and Ingold (+ weld-in adapter) connections enable flush-mounted installation.

For the requirements for installation according to the EHEDG and 3-A Sanitary Standard, see the Operating Instructions for the modular hygienic thermometers.

Operating Instructions BA02023T

Environment

Ambient temperature range

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 head transmitter	−40 to +85 °C (−40 to +185 °F)
With mounted head transmitter and display	−20 to +70 °C (−4 to +158 °F)

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 head transmitter	−40 to +85 °C (−40 to +185 °F)

Storage temperature

For information, see the ambient temperature.

Humidity

Depending on the transmitter used. If using Endress+Hauser iTEMP 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 C

Degree of protection

Max. IP69K, depending on the design (terminal head, connector, etc.)

Shock and vibration resistance

The Endress+Hauser inserts meet the requirements of IEC 60751 which specify shock and vibration resistance of 3g in the range from 10 to 500 Hz. The vibration resistance at the measuring point depends on the sensor type and design, see the following table:

Version	Vibration resistance for the sensor tip
Pt100 (TF)	30 m/s² (3g)

Electromagnetic compatibility (EMC)

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

Process

Process temperature range

Maximum −50 to +200 °C (−58 to +392 °F)

Thermal shock

Thermal shock resistance in CIP/SIP process (temperature increase within 2 seconds from +5 to +130 °C (+41 to +266 °F)).

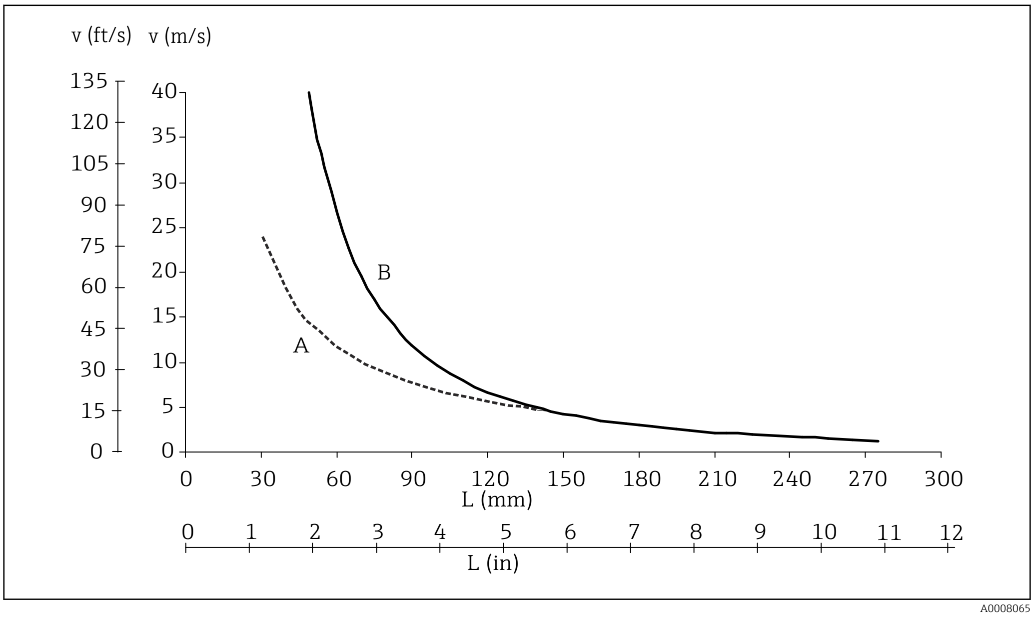
Process pressure range

The maximum possible process pressure depends on various influencing factors, such as the thermometer design, process connection and process temperature. For information on the maximum possible process pressures for the individual process connections, see the 'Process connection' section. → 25

It is possible to verify the mechanical loading capacity depending on the installation and process conditions using the online TW Sizing Module for thermowells in the Endress+Hauser Applicator software. See also the 'Accessories' section.

Example of the permitted flow rate as a function of the immersion length and medium

The highest flow velocity tolerated by the thermometer diminishes with increasing thermometer immersion length exposed to the stream of the fluid. It is also dependent on the diameter of the thermometer tip, the type of medium being measured, the process temperature and the process pressure. The following figures exemplify the maximum permitted flow velocities in water and superheated steam at a process pressure of 40 bar (580 PSI).



9 *Permitted flow velocities, thermowell diameter 6 mm (¼ in)*

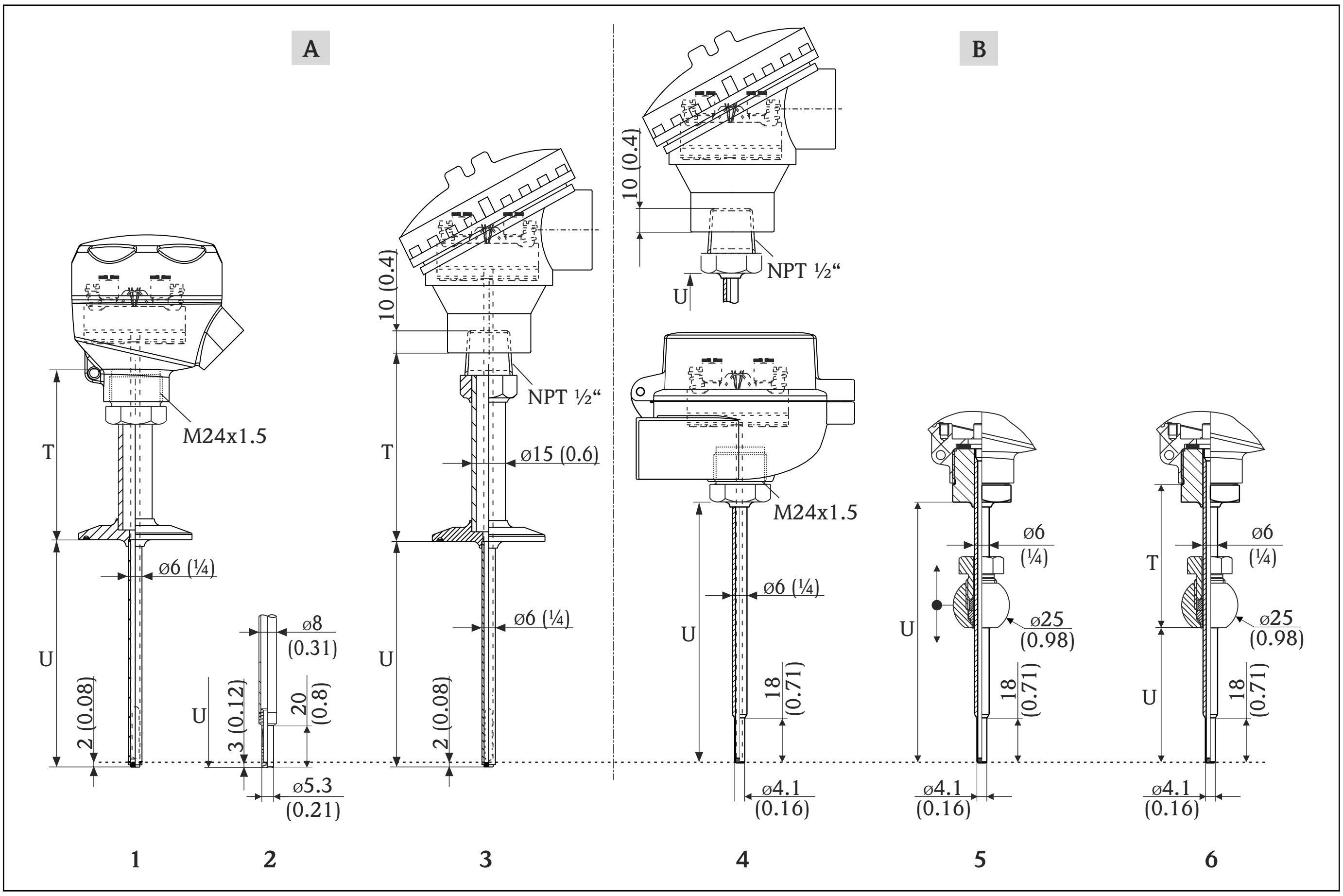
A *Medium water at T = 50 °C (122 °F)*
B *Medium superheated steam at T = 400 °C (752 °F)*
L *Immersion length exposed to flow*
v *Flow velocity*

Medium - state of aggregation	Gaseous or liquid (also with high viscosity, e.g. yogurt).

Mechanical construction

Design, dimensions

All dimensions in mm (in).



A0018909

A Version with process connection
B Version without process connection or optionally with compression fitting
1 Thermometer with process connection and M24x1.5 thread to terminal head - shape of tip Ø6 mm (0,25 in) straight or
2 Optional shape of tip: Ø6 mm (0.25 in) reduced to 5.3 mm (0.21 in) 5.3 mm (0.21 in)
3 Thermometer with process connection and NPT ½" thread to the terminal head
4 Thermometer without process connection with M24x1.5 thread (optional NPT ½" thread) to terminal head - shape of tip Ø6 mm (0.25 in) reduced
5 Thermometer with spherical, movable TK40 compression fitting for weld-in - shape of tip Ø6 mm (0.25 in) reduced
6 Thermometer with spherical, fixed TK40 compression fitting for weld-in - shape of tip Ø6 mm (0.25 in) reduced
T Length of extension neck (T = 0, for version without process connection or for version with movable compression fitting)
U Immersion length

Weight

0.5 to 2.5 kg (1 to 5.5 lbs) for standard options.

Material

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.

Designation	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L (corresponds to 1.4404 or 1.4435)	X2CrNiMo17-13-2, X2CrNiMo18-14-3	650 °C (1202 °F) 1)	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ▪ Increased resistance to intergranular corrosion and pitting ▪ The wetted part in a protective tube is made of 316L or 1.4435+316L passivated with 3% sulfuric acid.

1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Contact your Endress+Hauser sales team for further information.

Surface roughness

Values for wetted surfaces:

Standard surface, mechanically polished 1)	$R_a \leq 0.76$ µm (30 µin)
Mechanically polished, buffed 2)	$R_a \leq 0.38$ µm (15 µin)

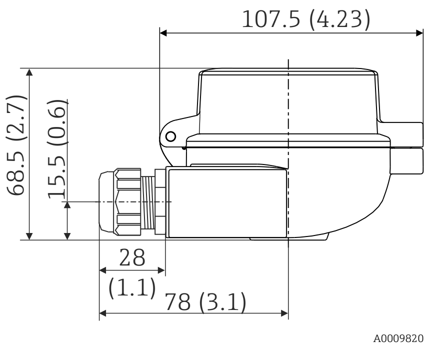
1) Or any other finishing method that meets the R_a max
2) Not compliant with ASME BPE

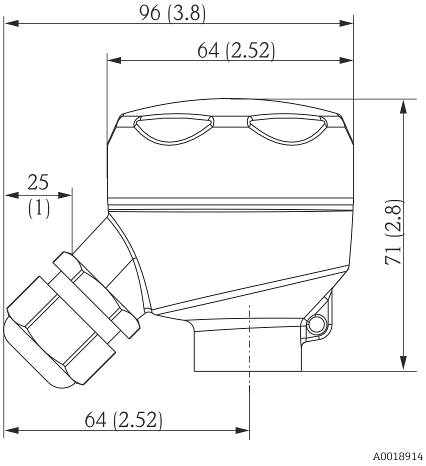
Terminal heads

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 'Environment' section. → 📄 19

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

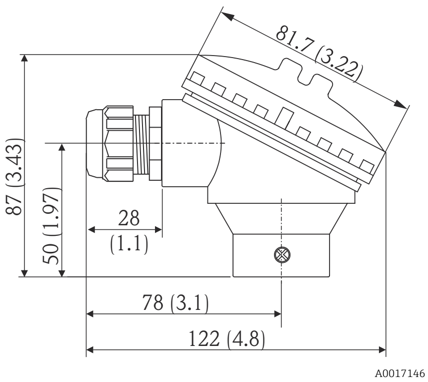
TA30A	Specification

	▪ Degree of protection:
	  ▪ 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
	▪ Cable entry thread: G ½", ½" NPT and M20x1.5;
	▪ Protective fitting connection: M24x1.5
	▪ 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

<table>
<tr><th>TA30R</th><th>Specification</th></tr>
<tr><td>
</td><td>

- 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 hand-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 in standard version
- Not allowed for Class II and III applications
- Available with 3-A marked sensors

</td></tr>
</table>

<table>
<tr><th>TA30S</th><th>Specification</th></tr>
<tr><td>
</td><td>

- Degree of protection: IP65 (NEMA Type 4x encl.)
- Temperature: −40 to +85 °C (−40 to +185 °F) without cable gland
- Material: polypropylene (PP), FDA-compliant, seals: O-ring EPDM
- Cable entry thread: ¾" NPT (with adapter for ½" NPT), M20x1.5
- Protective assembly connection: ½" NPT
- Color: white
- Weight: approx. 100 g (3.5 oz)
- Ground terminal: only internal via auxiliary terminal
- Not allowed for Class II and III applications
- Available with 3-A marked sensors

</td></tr>
</table>

Cable glands and connectors [1)]

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

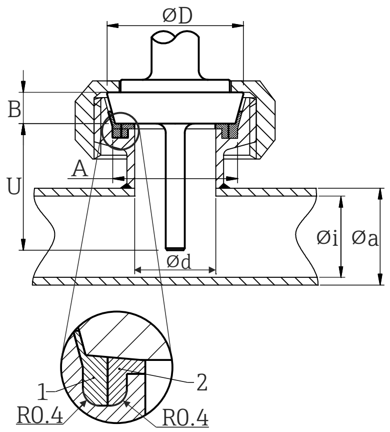
Type	Suitable for cable entry	Degree of protection	Temperature range	Suitable cable diameter
M12 plug, 8-pin, 316	M20x1.5	IP67	−30 to +90 °C (−22 to +194 °F)	-
7/8" plug, 4-pin, 316 (FOUNDATION ™ Fieldbus, PROFIBUS® PA)	½" NPT, M20x1.5	IP67	−40 to +105 °C (−40 to +221 °F)	-

1) Depending on product and configuration

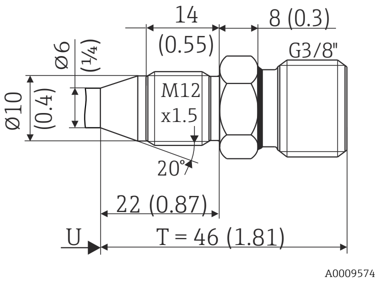
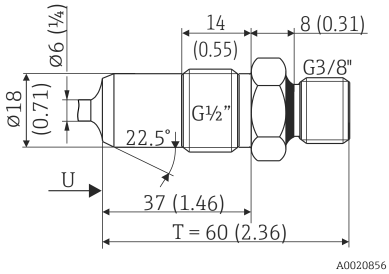
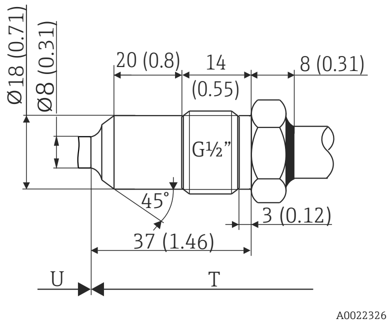
For explosion proof thermometers no cable glands are assembled.

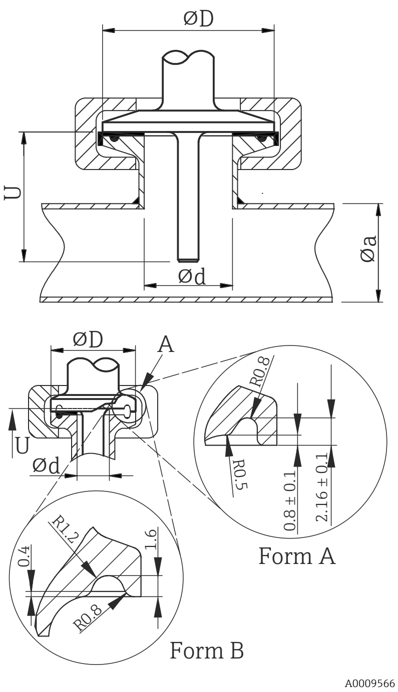
Process connections All dimensions in mm (in).

Releasable process connection

Type						Technical properties
Sanitary connection according to DIN 11851  A0009561 *1 Centering ring* *2 Sealing ring*						▪ 3-A marked and EHEDG certified (only with EHEDG-certified and self-centering sealing ring). ▪ ASME BPE compliance
Version 1)	Dimensions					$P_{max.}$
	ΦD	A	B	Φi	Φa	
DN25	44 mm (1.73 in)	30 mm (1.18 in)	10 mm (0.39 in)	26 mm (1.02 in)	29 mm (1.14 in)	40 bar (580 psi)
DN32	50 mm (1.97 in)	36 mm (1.42 in)	10 mm (0.39 in)	32 mm (1.26 in)	35 mm (1.38 in)	40 bar (580 psi)
DN40	56 mm (2.2 in)	42 mm (1.65 in)	10 mm (0.39 in)	38 mm (1.5 in)	41 mm (1.61 in)	40 bar (580 psi)
DN50	68 mm (2.68 in)	54 mm (2.13 in)	11 mm (0.43 in)	50 mm (1.97 in)	53 mm (2.1 in)	25 bar (363 psi)

1) Pipes in accordance with DIN 11850

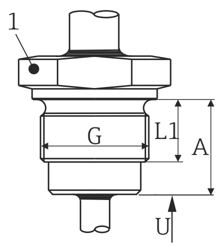
<table>
<tr><th colspan="2">Type</th><th>Version</th><th>Technical properties</th></tr>
<tr><td colspan="2">Metal sealing system</td><td rowspan="2">Thermowell diameter 6 mm (¼ in)</td><td rowspan="2">$P_{max.}$ = 16 bar (232 psi)
Maximum torque = 10 Nm (7.38 lbf ft)</td></tr>
<tr><td>M12x1.5

</td><td>G½"

</td></tr>
<tr><td>-</td><td>
</td><td>Thermowell diameter 8 mm (0.31 in)</td><td>$P_{max.}$ = 16 bar (232 psi)
Maximum torque = 10 Nm (7.38 lbf ft)</td></tr>
</table>

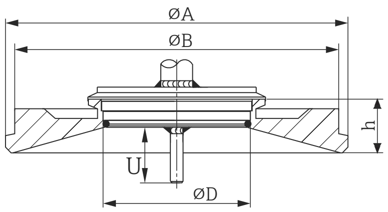
<table>
<tr><th rowspan="2">Type</th><th>Version</th><th colspan="2">Dimensions</th><th rowspan="2">Technical properties</th><th rowspan="2">Conformity</th></tr>
<tr><th>Φd [1]</th><th>ΦD</th><th>Φa</th></tr>
<tr><td rowspan="3">Clamp according to ISO 2852


Form A: In compliance with ASME BPE Type A
Form B: In compliance with ASME BPE Type B and ISO 2852</td><td>Microclamp [2] DN8-18 (0.5"-0.75") [3], Form A</td><td rowspan="2">25 mm (0.98 in)</td><td>-</td><td rowspan="3">$P_{max.}$ = 16 bar (232 psi), depends on clamp ring and suitable seal
With 3-A symbol</td><td>ASME BPE type A</td></tr>
<tr><td>Tri-clamp DN8-18 (0.5"-0.75"), Form B</td><td>-</td><td>Based on ISO 2852 [4]</td></tr>
<tr><td>Clamp DN12-21.3, Form B</td><td>34 mm (1.34 in)</td><td>16 to 25.3 mm (0.63 to 0.99 in)</td><td>ISO 2852</td></tr>
</table>

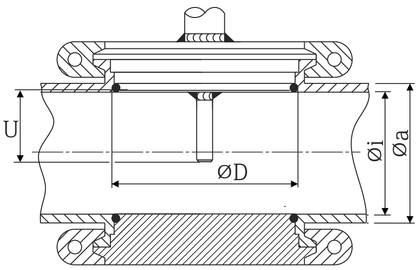
Type	Version	Dimensions		Technical properties	Conformity
	Φd 1)	ΦD	Φa		
	Clamp DN25-38 (1"-1.5"), Form B	50.5 mm (1.99 in)	29 to 42.4 mm (1.14 to 1.67 in)	▪ $P_{max.}$ = 16 bar (232 psi), depends on clamp ring and suitable seal ▪ 3-A marked and EHEDG certified (in connection with Combifit seal) ▪ Can be used with 'Novaseptic Connect (NA Connect)' which enables flush-mount installation	ASME BPE Type B; ISO 2852
	Clamp DN40-51 (2"), Form B	64 mm (2.52 in)	44.8 to 55.8 mm (1.76 to 2.2 in)		ASME BPE Type B; ISO 2852

1) Pipes in accordance with ISO 2037 and BS 4825 Part 1
2) Microclamp (not in ISO 2852); no standard pipes
3) DN8 (0.5") only possible with thermowell diameter = 6 mm (¼ in)
4) Groove diameter = 20 mm

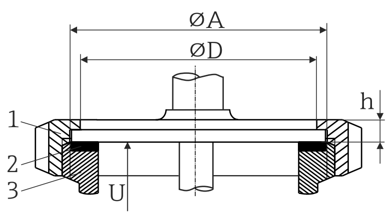
Type	Version G	Dimensions			Technical properties
		L1 thread length	A	1 (SW/AF)	
Thread according to ISO 228 (for Liquiphant weld-in adapter) 	G¾" for FTL20/31/33 adapter	16 mm (0.63 in)	25.5 mm (1 in)	32	▪ $P_{max.}$ = 25 bar (362 psi) at max. 150 °C (302 °F) ▪ $P_{max.}$ = 40 bar (580 psi) at max. 100 °C (212 °F) ▪ For information on hygienic compliance in conjunction with FTL31/33/50 adapter, see TI00426F
	G¾" for FTL50 adapter				
	G1" for FTL50 adapter	18.6 mm (0.73 in)	29.5 mm (1.16 in)	41	

Type	Version	Dimensions				Technical properties	
		ΦD	ΦA	ΦB	h	$P_{max.}$	
Varivent® 	Type F	50 mm (1.97 in)	145 mm (5.71 in)	135 mm (5.31 in)	24 mm (0.95 in)	10 bar (145 psi)	▪ With 3-A symbol and EHEDG certification ▪ ASME BPE compliance
	Type N	68 mm (2.67 in)	165 mm (6.5 in)	155 mm (6.1 in)	24.5 mm (0.96 in)		

The VARINLINE® housing connection flange is suitable for welding into the conical or torispherical head in tanks or containers with a small diameter (≤ 1.6 m (5.25 ft)) and up to a wall thickness of 8 mm (0.31 in).

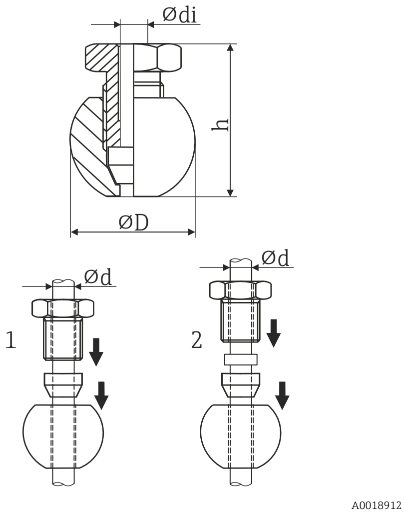
Type	Technical properties
Varivent® for VARINLINE® housing for installation in pipes  A0009564	▪ With 3-A symbol and EHEDG certification ▪ ASME BPE compliance

Version	Dimensions			$P_{max.}$
	ϕD	ϕi	ϕa	
Type N, according to DIN 11866, series A	68 mm (2.67 in)	DN40: 38 mm (1.5 in)	DN40: 41 mm (1.61 in)	DN40 to DN65: 16 bar (232 psi)
		DN50: 50 mm (1.97 in)	DN50: 53 mm (2.1 in)	
		DN65: 66 mm (2.6 in)	DN65: 70 mm (2.76 in)	
		DN80: 81 mm (3.2 in)	DN80: 85 mm (3.35 in)	DN80 to DN150: 10 bar (145 psi)
		DN100: 100 mm (3.94 in)	DN100: 104 mm (4.1 in)	
		DN125: 125 mm (4.92 in)	DN125: 129 mm (5.08 in)	
		DN150: 150 mm (5.9 in)	DN150: 154 mm (6.06 in)	
Type N, according to EN ISO 1127, series B	68 mm (2.67 in)	38.4 mm (1.51 in)	42.4 mm (1.67 in)	42.4 mm (1.67 in) to 60.3 mm (2.37 in): 16 bar (232 psi)
		44.3 mm (1.75 in)	48.3 mm (1.9 in)	
		56.3 mm (2.22 in)	60.3 mm (2.37 in)	
		72.1 mm (2.84 in)	76.1 mm (3 in)	76.1 mm (3 in) to 114.3 mm (4.5 in): 10 bar (145 psi)
		82.9 mm (3.26 in)	42.4 mm (3.5 in)	
		108.3 mm (4.26 in)	114.3 mm (4.5 in)	
Type N, according to DIN 11866, series C	68 mm (2.67 in)	OD 1½": 34.9 mm (1.37 in)	OD 1½": 38.1 mm (1.5 in)	OD 1½" to OD 2½": 16 bar (232 psi)
		OD 2": 47.2 mm (1.86 in)	OD 2": 50.8 mm (2 in)	
		OD 2½": 60.2 mm (2.37 in)	OD 2½": 63.5 mm (2.5 in)	
Type N, according to DIN 11866, series C	68 mm (2.67 in)	OD 3": 73 mm (2.87 in)	OD 3": 76.2 mm (3 in)	OD 3" to OD 4": 10 bar (145 psi)
		OD 4": 97.6 mm (3.84 in)	OD 4": 101.6 mm (4 in)	

Type	Version	Dimensions			Technical properties
		ϕD	ϕA	h	
SMS 1147  A0009568 *1 Union nut* *2 Sealing ring* *3 Counterpart connection*	DN25	32 mm (1.26 in)	35.5 mm (1.4 in)	7 mm (0.28 in)	$P_{max.}$ = 6 bar (87 psi)
	DN38	48 mm (1.89 in)	55 mm (2.17 in)	8 mm (0.31 in)	
	DN51	60 mm (2.36 in)	65 mm (2.56 in)	9 mm (0.35 in)	

The counterpart connection must fit the sealing ring and fix it in place.

Without process connection (for compression fitting)

Type	Version	Dimensions			Technical properties [1]
		Φdi	ΦD	h	
Compression fitting TK40 for weld-in  1 *Movable* 2 *Fixed*	Spherical Material of sealing taper PEEK or 316L Thread G¼"	6.3 mm (0.25 in) for thermowell diameter Ød = 6 mm (0.236 in)	25 mm (0.98 in)	33 mm (1.3 in)	▪ $P_{max.}$ = 10 bar (145 psi), $T_{max.}$ = +150 °C (+302 °F) for PEEK material, tightening torque = 10 Nm ▪ $P_{max.}$ = 50 bar (725 psi), $T_{max.}$ = +200 °C (+392 °F) for 316L material, tightening torque = 25 Nm ▪ PEEK compression fitting is EHEDG tested, 3-A marked

1) All the pressure specifications apply for cyclic temperature load

The 316L compression fittings can only be used once due to deformation. This applies to all the components of the compression fittings! A replacement compression fitting must be secured at another point (grooves in thermowell). PEEK compression fittings must never be used at a temperature that is lower than the temperature present when the compression fitting is secured. This is because the fitting would no longer be leak-tight as a result of heat contraction of the PEEK material.

For higher requirements: SWAGELOCK or similar fittings are strongly recommended.

Minimum extension neck lengths, dependent on respective process connection

Process connection	Extension next length T
▪ None ▪ Compression fitting, movable	Predefined (cannot be selected, T = 0)
▪ Thread according to ISO 228 ▪ Compression fitting, fixed ▪ Metal sealing system	≥82 mm (3.23 in)
▪ Clamp according to ISO 2852 ▪ Sanitary connection according to DIN 11851 ▪ Varivent® ▪ SMS 1147	≥55 mm (2.17 in)

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**.

Materials in contact with food/product (FCM)

The materials of the thermometer in contact with food/product (FCM) comply with the following European regulations:
- (EC) No. 1935/2004, Article 3, paragraph 1, Articles 5 and 17 on materials and articles intended to come into contact with food.
- (EC) No. 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.
- (EU) No. 10/2011 on plastic materials and articles intended to come into contact with food.
- EHEDG certification, type EL CLASS I. EHEDG certified/tested process connections. → 25
- 3-A authorization no. 1144, 3-A Sanitary Standard 74-07. Listed process connections. → 25
- ASME BPE, certificate of conformity can be ordered, option 580/KW in the Product Configurator, → 32
- FDA-compliant
- All surfaces in contact with the medium are free of animal derived ingredients (ADI/TSE) and do not contain any materials derived from bovine or animal sources.

CRN approval

The CRN approval is only available for certain thermowell versions. These versions are identified and displayed accordingly during the configuration of the device.

Detailed ordering information is available for your nearest sales organization www.addresses.endress.com or in the Download Area under www.endress.com :

1. Select the country
2. Select Downloads
3. In the search area: select Approvals/approval type
4. Enter the product code or device
5. Start the search

Surface cleanliness

Free from oil and grease for O_2 applications, optional

Material resistance

Material resistance (including housing) to the following cleaning agents/disinfectants from the company Ecolab: P3-topax 66, P3-topactive 200, P3-topactive 500 and P3-topactive OKTO as well as demineralized water.

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:

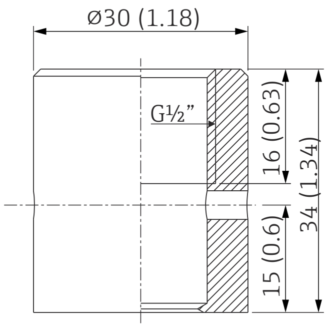
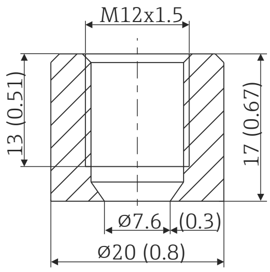
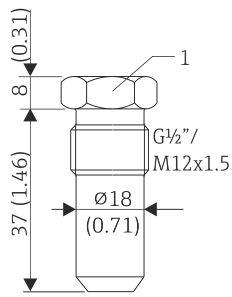
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

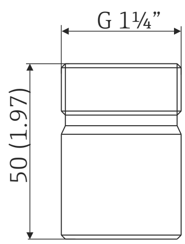
Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation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

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

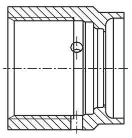
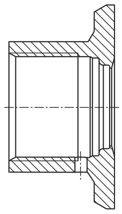
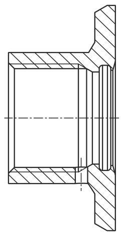
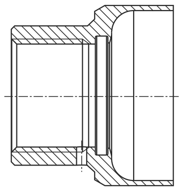
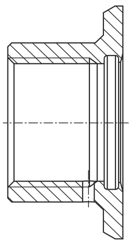
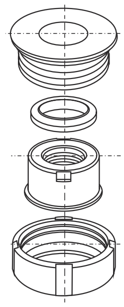
Device-specific accessories

Accessory	Description
Welding boss with sealing taper (metal - metal)  A0006621  A0018236	Welding boss for G½" and M12x1.5 thread Metal-sealing; conical Material of wetted parts: 316L/1.4435 Max. process pressure 16 bar (232 PSI) **Order number:** ▪ 71424800 (G½") ▪ 71405560 (M12x1.5)
Dummy plug  A0045726 *1 Size across flats SW22*	Dummy plug for G½” or M12x1.5 conical metal-sealing welding boss Material: SS 316L/1.4435 **Order number:** ▪ 71424800 (G½") ▪ 71535692 (M12x1.5)

Weld-in adapter for Ingold process connection (OD25 mm (0.98 in)x50 mm (1.97 in)  A0008956	Material of wetted parts: 316L/1.4435 Weight: 0.32 kg (0.7 lb) Adapter for Ingold process connection with 3.1 material certificate, **order number:** 71531585 Adapter for Ingold process connection, **order number:** 71531588 O-ring seal set ▪ Silicone O-ring in accordance with FDA CFR 21 ▪ Maximum temperature: 230 °C (446 °F) ▪ **Order number:** 60018911

Weld-in adapter

For more information about order codes and hygienic compliance of the adapters and spare parts, see Technical Information (TI00426F).

Weld-in adapter	 A0008246	 A0008251	 A0008256	 A0011924	 A0008248	 A0008253
	G ¾", d=29 for pipe-mounting	**G ¾", d=50 for vessel-mounting**	**G ¾", d=55 with flange**	**G 1", d=53 without flange**	**G 1", d=60 with flange**	**G 1" adjustable**
Material	316L (1.4435)	316L (1.4435)	316L (1.4435)	316L (1.4435)	316L (1.4435)	316L (1.4435)
Roughness µm (µin) process side	≤1.5 (59.1)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)

Maximum process pressure for the weld-in adapters:
- 25 bar (362 PSI) at maximum 150 °C (302 °F)
- 40 bar (580 PSI) at maximum 100 °C (212 °F)

Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring instruments via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser devices: ▪ Calculation of all the necessary data for identifying the optimum device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator

Accessories	Description
Configurator	Product Configurator - the tool for individual product configuration ▪ Up-to-the-minute configuration data ▪ Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language ▪ Automatic verification of exclusion criteria ▪ Automatic creation of the order code and its breakdown in PDF or Excel output format ▪ Ability to order directly in the Endress+Hauser Online Shop The Product Configurator is available on the Endress+Hauser website: www.endress.com-> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
DeviceCare SFE100	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices. For details, see Operating Instructions BA00027S
FieldCare SFE500	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00065S

System components

Accessory	Description
RIA15 field indicator	The process indicator is looped into the current loop and displays the measuring signal or the HART process variables in digital form. The process indicator does not require an external power supply. It is powered directly from the current loop. For details, see "Technical Information" TI01043K
RN22	Single-channel or two-channel active barrier for separation of 0/4 to 20 mA standard signal circuits, optionally available as a signal doubler, 24 V DC. HART-transparent. For details, see "Technical Information" TI01515K

Supplementary documentation

The following document types are available in the Downloads section of the Endress+Hauser website (www.endress.com/downloads):

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

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

Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

Functional Safety Manual (FY/SD)

Depending on the SIL approval, the Functional Safety Manual (FY/SD) is an integral part of the Operating Instructions and applies in addition to the Operating Instructions, Technical Information and ATEX Safety Instructions.

The different requirements that apply for the protective function are described in the Functional Safety Manual (FY / SD).

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