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Technical Information
iTHERM ModuLine TM411

Trend-setting, modular resistance thermometer for hygienic and aseptic applications

Easy-to-use metric version with outstanding sensor technology

Applications

- Specially designed for use in hygienic and aseptic applications in the Food & Beverages and Life Sciences industries
- Measuring range: –200 to +600 °C (–328 to +1 112 °F)
- Pressure range up to 50 bar (725 psi)
- Protection class: up to IP69K

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
- PROFIBUS® PA, FOUNDATION Fieldbus™
- PROFINET® over Ethernet-APL
- IO-Link®

Your benefits

- User-friendly and reliable from product selection to maintenance
- iTHERM inserts: globally unique, automated production. Full traceability and consistently high product quality for reliable measured values
- iTHERM QuickSens: fastest response times (t_{90s}: 1.5 s) for optimum process control
- iTHERM StrongSens: unsurpassed vibration resistance (> 60g) for ultimate plant safety
- iTHERM QuickNeck – cost and time savings thanks to simple, tool-free recalibration
- iTHERM TA30R: 316L terminal head for easier handling and lower installation and maintenance costs, and with highest IP69K rating
- International certification: explosion protection, e.g. ATEX/IECEx and in compliance with hygiene standards according to 3-A, EHEDG, ASME BPE, FDA, TSE Certificate of Suitability

Endress+Hauser
People for Process Automation

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Function and system design

iTHERM ModuLine, hygienic

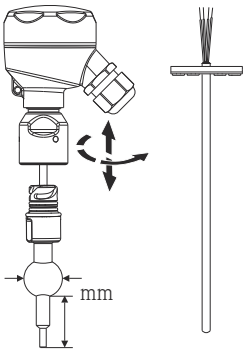
This thermometer is part of the product line of modular thermometers for hygienic and aseptic applications.

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



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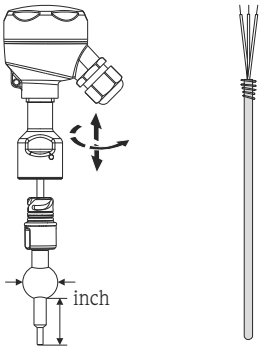
TM412



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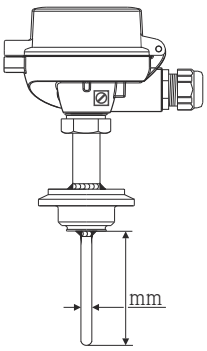
↓ ↓

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



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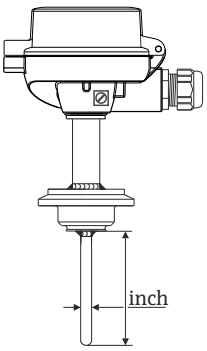
TM402



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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 $\alpha = 0.003851\ °C^{-1}$.

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)

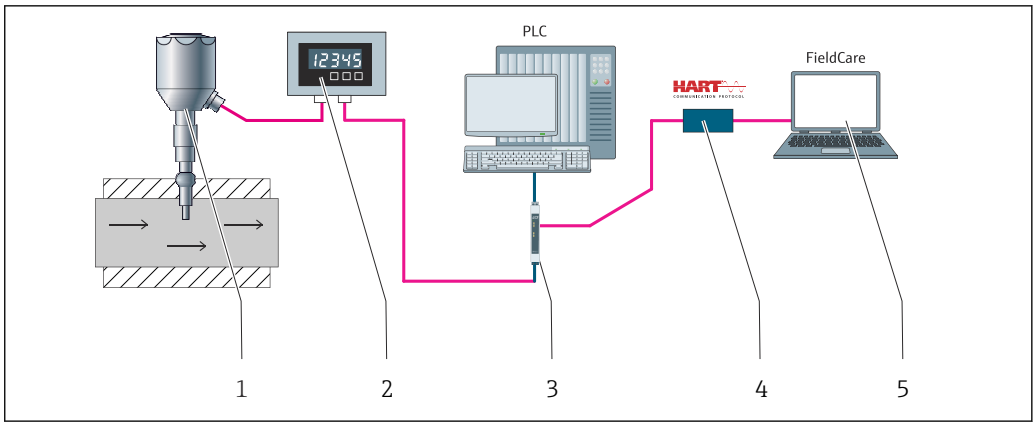
Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors 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

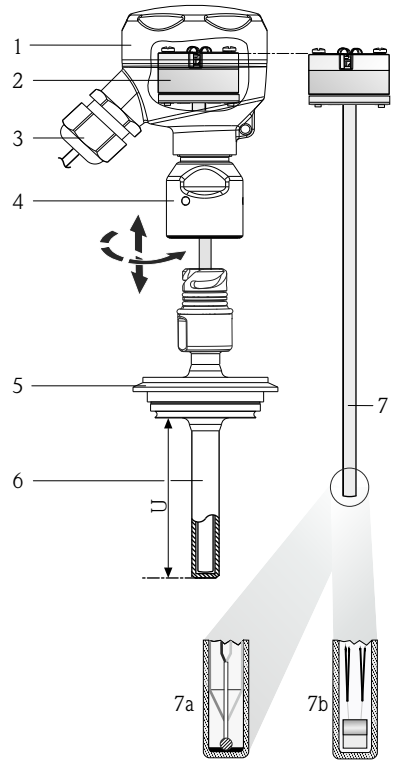
For more information, see the brochure 'System Components - Solutions for a Complete Measuring Point' (FA00016K/EN)



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.*

Modular design

Design		Options
	1: Terminal head → 38	▪ 316L, low head, optionally with display window ▪ Aluminum, high or low head, with or without display window ▪ Polypropylene, low head ▪ Polyamide, high head, without display window **Your benefits:** ▪ Optimum terminal access thanks to low housing edge of bottom section: ▪ Easier to use ▪ Lower installation and maintenance costs ▪ Optional display: local process display for added reliability ▪ IP69K protection: optimum protection even with high-pressure cleaning
	2: Wiring, electrical connection, output signal → 7	▪ Ceramic terminal block ▪ Flying leads ▪ Head transmitter (4 to 20 mA, HART, PROFIBUS PA, FOUNDATION Fieldbus, IO-Link), single-channel or two-channel, PROFINET® over Ethernet-APL ▪ Attachable display (optional)
	3: Plug or cable gland	▪ Polyamide or brass cable glands ▪ M12 plug, 4-pin/8-pin: PROFIBUS® PA, Ethernet-APL, IO-Link® ▪ 7/8" plug: PROFIBUS® PA, FOUNDATION™ Fieldbus
	4: Extension neck → 41	Welded-in-place or removable either with the quick fastener (iTHERM QuickNeck) or thread adapter nut G3/8" **Your benefits:** ▪ **iTHERM QuickNeck:** tool-free removal of the insert: ▪ Saves time/costs on frequently calibrated measuring points ▪ Wiring mistakes avoided ▪ IP69K protection: safety under extreme process conditions

Design		Options
	5: Process connection → 🖹 43	More than 50 different versions.
	6: Thermowell → 🖹 43	▪ Versions with and without thermowell (insert in direct contact with process). ▪ Various diameters ▪ Various tip shapes (straight or reduced)

	7: Insert
	→ 🖹 37 with:
	7a: iTHERM QuickSens
	7b: iTHERM StrongSens
		Sensor models: wire wound (WW) or thin-film sensor (TF).
		Your benefits:
		▪ **iTHERM QuickSens** - insert with the world's fastest response time:
		  ▪ Insert: Ø3 mm (⅛ in) or Ø6 mm (¼ in)
		  ▪ Fast, highly accurate measurements, delivering maximum process safety and control
		  ▪ Quality and cost optimization
		  ▪ Minimization of necessary immersion length: better product protection thanks to improved process flow
		▪ **iTHERM StrongSens** - insert with unbeatable durability:
		  ▪ Vibration resistance > 60g: lower life cycle costs thanks to longer operating life and high plant availability
		  ▪ Automated, traceable production: top quality and maximum process safety
		  ▪ High long-term stability: reliable measured values and high level of system safety

Input

Measured variable

Temperature (temperature-linear transmission behavior)

Measuring range

Depends on the type of sensor used

Sensor type	Measuring range
Pt100 thin-film	−50 to +400 °C (−58 to +752 °F)
Pt100 thin-film, iTHERM StrongSens, vibration-resistant > 60g	−50 to +500 °C (−58 to +932 °F)
Pt100 thin-film, iTHERM QuickSens, fast-response	−50 to +200 °C (−58 to +392 °F)
Pt100 wire wound, extended measuring range	−200 to +600 °C (−328 to +1 112 °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.

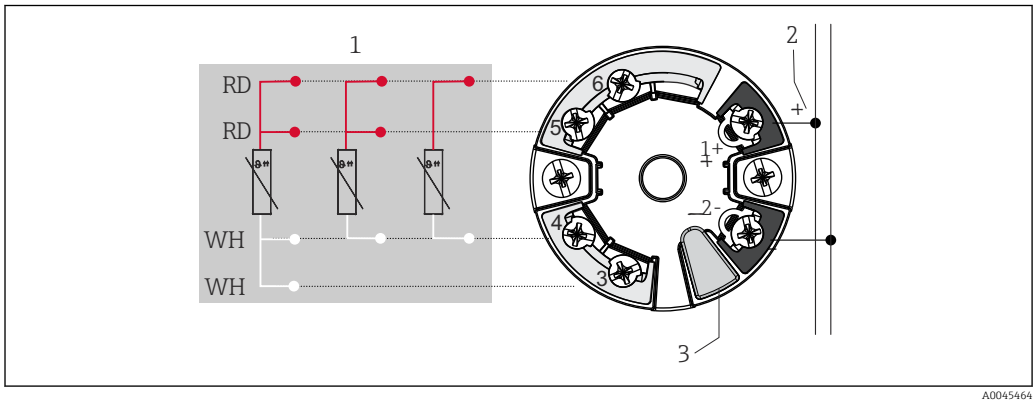
Advantages of the iTEMP transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Attachable display (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer 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. → 38

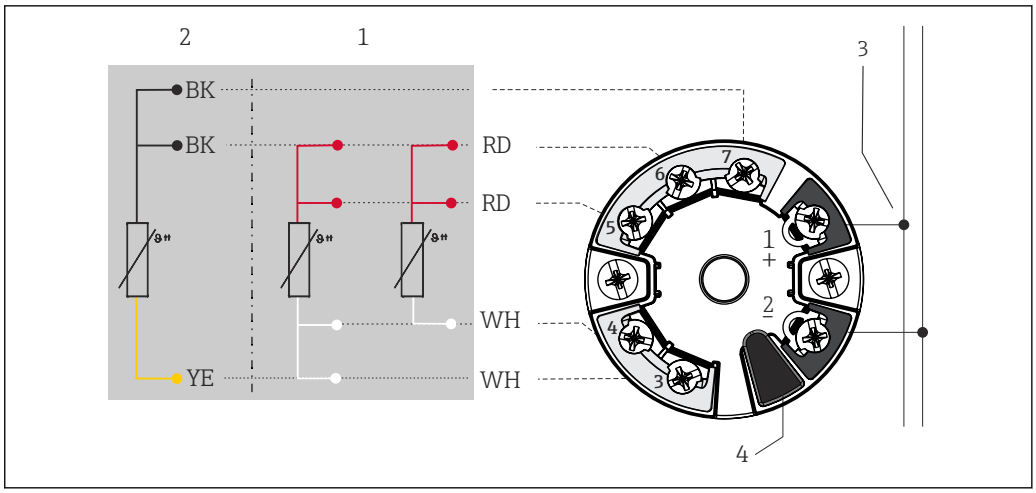
Wiring diagram for RTD

Type of sensor connection



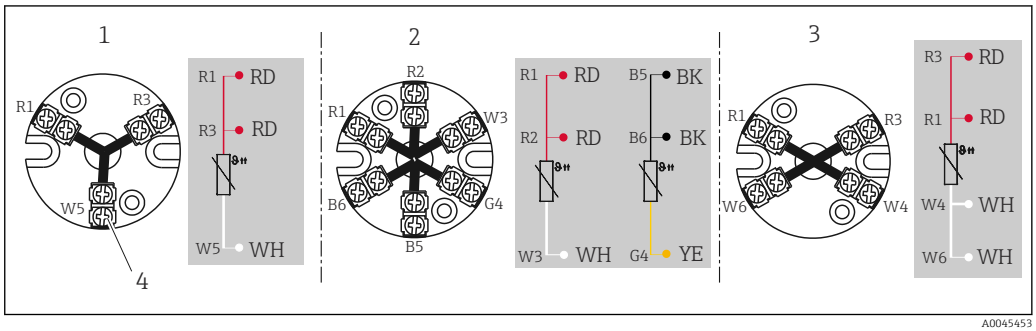
2 *Head mounted transmitter TMT7x or TMT31 (single input)*

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



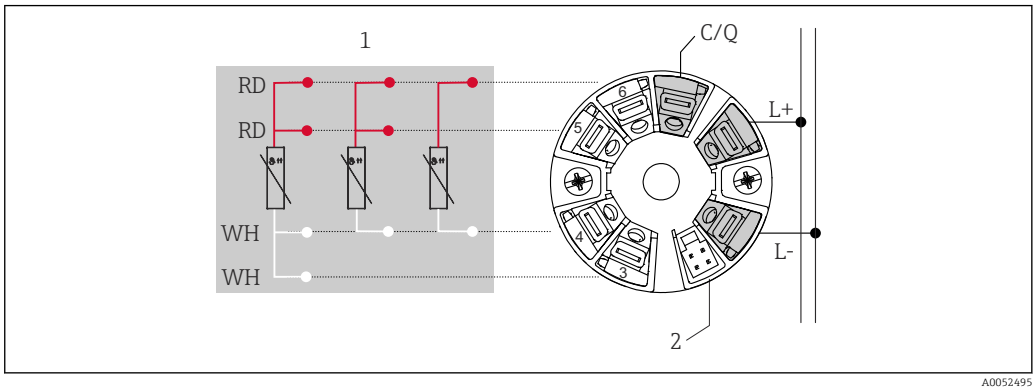
3 *Head-mounted transmitter TMT8x (dual sensor input)*

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 *2 x 3-wire, single*
3 *4-wire, single*
4 *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

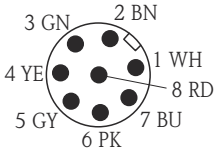
Terminal head with one cable entry

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)			WH	WH			WH	WH			WH	WH			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)				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							

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

1) 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

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

Terminal head with one cable entry

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

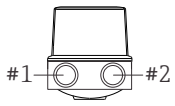
Plug	1x IO-Link®, 4-pin			
Electrical connection (terminal head)				
Flying leads	Not connected (not insulated)			
3-wire terminal block (1x Pt100)	RD	i	RD	WH
4-wire terminal block (1x Pt100)	Cannot be combined			
6-wire terminal block (2x Pt100)				
1x TMT 4 to 20 mA or HART®	Cannot be combined			
2x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

Terminal head with two cable entries

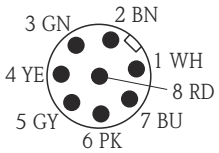
Plug	2x PROFIBUS® PA								2x FOUNDATION™ Fieldbus (FF)				2x PROFINET® and Ethernet-APL			
Plug thread  A0021706	M12(#1) / M12(#2)				7/8"(#1)/7/8"(#2)				7/8"(#1)/7/8"(#2)				M12 (#1)/M12 (#2)			
PIN number	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Electrical connection (terminal head)																
Flying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

Plug	2x PROFIBUS® PA								2x FOUNDATION™ Fieldbus (FF)				2x PROFINET® and Ethernet-APL			
2x TMT PROFIBUS® PA	+ (#1)/ + (#2)		- (#1)/ -(#2)		+ (#1)/ + (#2)		- (#1)/ -(#2)									
1x TMT FF	Cannot be combined				Cannot be combined				-/i	+/i	i/i	GND/ GND	Cannot be combined			
2x TMT FF									- (#1)/ -(#2)	+ (#1)/ + (#2)						
1x TMT PROFINET®	Cannot be combined				Cannot be combined				Cannot be combined				APL signal -	APL 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)	GND	i
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			

Terminal head with two cable entries

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	
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				

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

Terminal head with two cable entries

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

Connection combination: insert - transmitter

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

Insert	Transmitter connection [1]			
	TMT31/TMT7x		TMT8x	
	1x 1-channel	2x 1-channel	1x 2-channel	2x 2-channel
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

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.

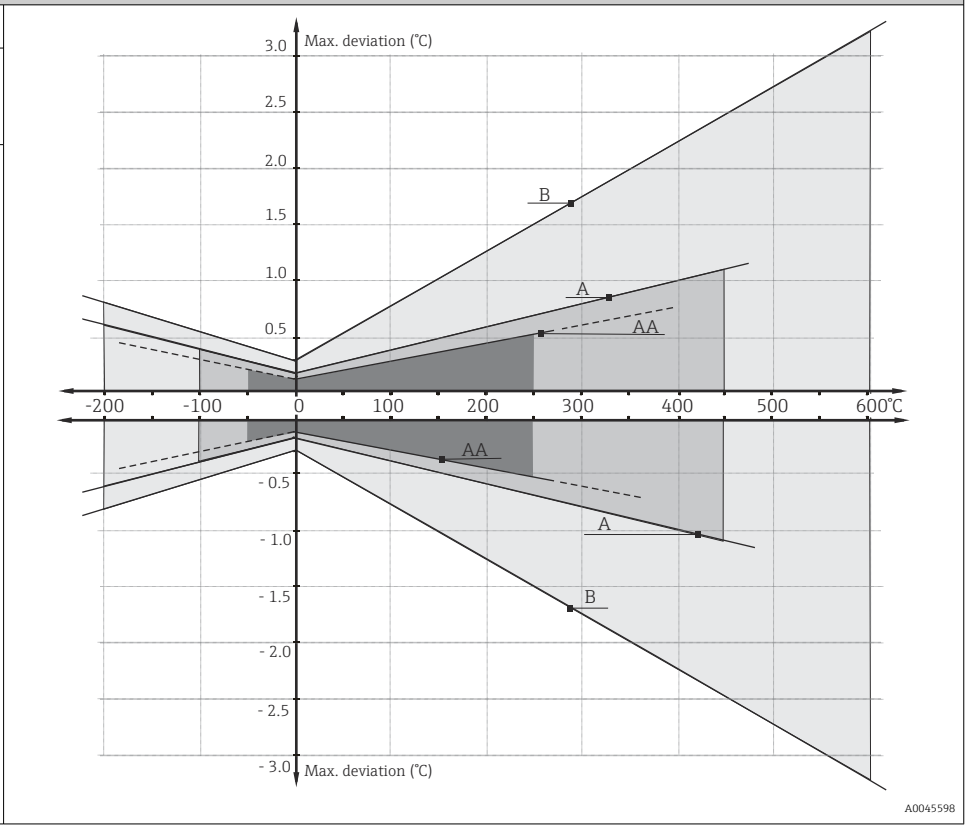
Performance characteristics

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.

Response time with heat transfer paste [1)]

Thermowell	Shape of tip	Insert	1x Pt100 iTHERM QuickSens, TF		1x Pt100 iTHERM StrongSens, TF		1x Pt100 wire wound WW		2x Pt100 wire wound WW		1x Pt100 standard thin-film TF	
			t_{50}	t_{90}	t_{50}	t_{90}	t_{50}	t_{90}	t_{50}	t_{90}	t_{50}	t_{90}
Without thermowell	-	Ø6 mm (¼ in)	0.5 s	1.5 s	2.5 s	9.5 s	4 s	11.5 s	4.5 s	12 s	4.75 s	13 s
Ø6 mm (¼ in)	Reduced 4.3 mm (0.17 in) x 20 mm (0.79 in)	Ø3 mm (⅛ in)	1 s	2.5 s	-		8.5 s	26 s	5.5 s	18 s	8 s	23 s
Ø9 mm (0.35 in)	Straight	Ø6 mm (¼ in)	2 s	9 s	8 s	27 s	15 s	45 s	15 s	45 s	9.5 s	27 s
	Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in)	Ø3 mm (⅛ in)	1.25 s	4 s	-		7 s	20 s	7 s	20 s	7 s	23 s
	Tapered 6.6 mm (0.26 in) x 60 mm (2.36 in)	Ø3 mm (⅛ in)	2.5 s	12 s	-		14 s	49 s	12 s	40 s	15 s	51 s
Ø12.7 mm (½ in)	Straight	Ø6 mm (¼ in)	4 s	26 s	12 s	54 s	23 s	81 s	23 s	81 s	31 s	100 s
	Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in)	Ø3 mm (⅛ in)	1.5 s	5.5 s	-		9 s	27 s	9 s	27 s	6.5 s	21 s
	Reduced 8 mm (0.31 in) x 32 mm (1.26 in)	Ø6 mm (¼ in)	6 s	36 s	11 s	44 s	22 s	69 s	22 s	69 s	26 s	90 s

1) If using a thermowell.

Response time without heat transfer paste [1)]

Thermowell	Shape of tip	Insert	1x Pt100 iTHERM QuickSens, TF		1x Pt100 iTHERM StrongSens, TF		1x Pt100 wire wound WW		2x Pt100 wire wound WW		1x Pt100 standard thin-film TF	
			t_{50}	t_{90}	t_{50}	t_{90}	t_{50}	t_{90}	t_{50}	t_{90}	t_{50}	t_{90}
Without thermowell	-	Ø3 mm (⅛ in)	0.5 s	0.75 s	-		1.75 s	5 s	2 s	6 s	2.5 s	5.5 s
		Ø6 mm (¼ in)		1.5 s	2.5 s	9.5 s	4 s	11.5 s	4.5 s	12 s	4.75 s	13 s
Ø6 mm (¼ in)	Reduced 4.3 mm (0.17 in) x 20 mm (0.79 in)	Ø3 mm (⅛ in)	1 s	3 s	-		9 s	27 s	7.5 s	24 s	8.5 s	28 s
Ø9 mm (0.35 in)	Straight	Ø6 mm (¼ in)	2 s	9 s	8 s	29 s	19 s	62 s	19 s	62 s	13.5 s	42 s
	Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in)	Ø3 mm (⅛ in)	1.5 s	5 s	-		7 s	21 s	7 s	21 s	8 s	22 s
	Tapered 6.6 mm (0.26 in) x 60 mm (2.36 in)	Ø3 mm (⅛ in)	5 s	23 s	-		13 s	45 s	13 s	45 s	15.5 s	60 s
Ø12.7 mm (½ in)	Straight	Ø6 mm (¼ in)	5.5 s	41 s	12 s	54 s	23 s	82 s	23 s	82 s	32 s	105 s
	Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in)	Ø3 mm (⅛ in)	2 s	6 s	-		10 s	30 s	10 s	30 s	8 s	30 s
	Reduced 8 mm (0.31 in) x 32 mm (1.26 in)	Ø6 mm (¼ in)	14.5 s	65 s	16 s	53 s	26 s	85 s	26 s	85 s	32 s	108 s

1) If using a thermowell.

Response time for directly wired insert 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.

Evaluation of thermometers

If a calibration with an acceptable uncertainty of measurement and transferable measurement results is not possible, Endress+Hauser offers customers a thermometer evaluation measurement service, if technically feasible. This is the case when:

- The process connections/flanges are too big or the immersion length (IL) is too short to allow the DUT to be immersed sufficiently in the calibration bath or furnace (see the following table), or
- Due to heat conduction along the thermometer tube, the resulting sensor temperature generally deviates significantly from the actual bath/furnace temperature.

The measured value of the DUT is determined using the maximum possible immersion depth and the specific measuring conditions and measurement results are documented on an evaluation certificate.

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 using E+H temperature transmitters, 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.

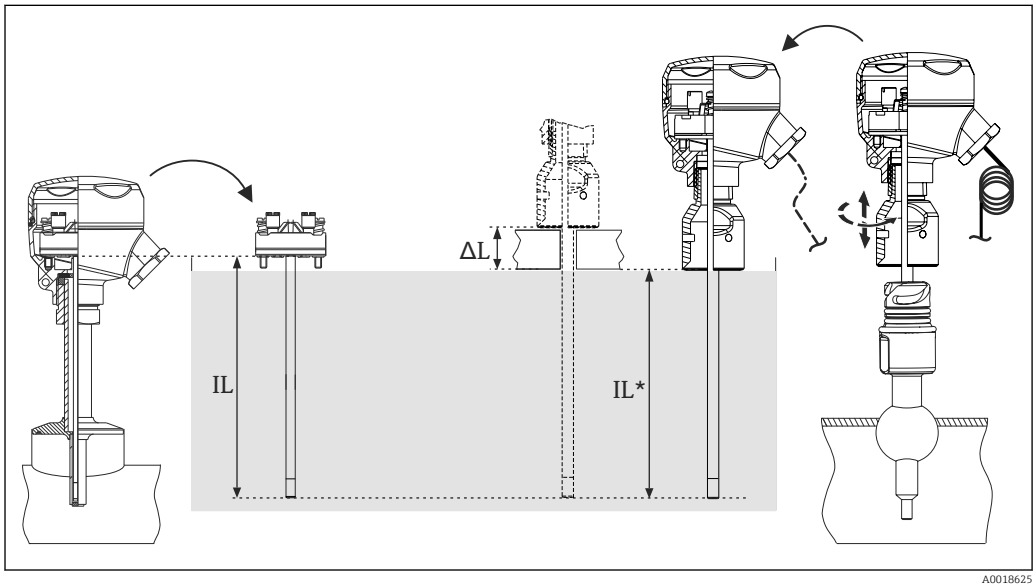
For the device, Endress+Hauser offers standard calibrations at a reference temperature of −80 to +600 °C (−112 to +1 112 °F) based on the ITS90 (International Temperature Scale). Calibrations in other temperature ranges are available from your Endress+Hauser sales center on request. Calibrations are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

Minimum insertion 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 measuring 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 insertion 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 insertion length required [2]
251 to 550 °C (483.8 to 1022 °F)	300 mm (11.81 in)
551 to 600 °C (1023.8 to 1112 °F)	400 mm (15.75 in)

1) Min. 150 mm (5.91 in) is required
2) At a temperature of +80 to +250 °C (+176 to +482 °F) and with TMT, min. 50 mm (1.97 in) is required



6 Insertion lengths for sensor calibration

IL Maximum possible insertion length for factory calibration or recalibration onsite without the iTHERM QuickNeck extension neck
IL Maximum possible insertion length for recalibration onsite with the iTHERM QuickNeck extension neck*
ΔL Additional length, depending on the calibration unit, if the insert cannot be fully immersed

- To check the actual accuracy rating of the thermometers installed, a cyclic calibration of the installed sensor is frequently performed. The insert is normally removed for comparison with a precise reference thermometer in the calibration bath (see graphic, left part).
- The iTHERM QuickNeck enables quick, tool-free removal of the insert for calibration purposes. The entire upper part of the thermometer is released by turning the terminal head. The insert is removed from the thermowell and directly immersed into the calibration bath (see graphic, right part). Make sure that the cable is long enough to be able to reach the mobile calibration bath with the cable connected. If this is not possible for the calibration, it is advisable to use a connector.

Advantages of iTHERM QuickNeck:
- Considerable time savings when recalibrating the device (up to 20 minutes per measuring point)
- Wiring mistakes avoided when re-installing
- Minimum plant downtime, thereby saving costs

Formulas for calculating the IL when recalibrating onsite with iTHERM QuickNeck*

Version, with M24x1.5 or NPT ½" thread to terminal head	Formula
Thermowell diameter 6 mm (¼ in)	IL* = U + T + 5 mm (0.2 in)
Thermowell diameter 9 mm (0.35 in)	IL* = U + T - 25 mm (0.98 in)
Thermowell diameter 12.7 mm (½ in)	IL* = U + T + 5 mm (0.2 in)

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

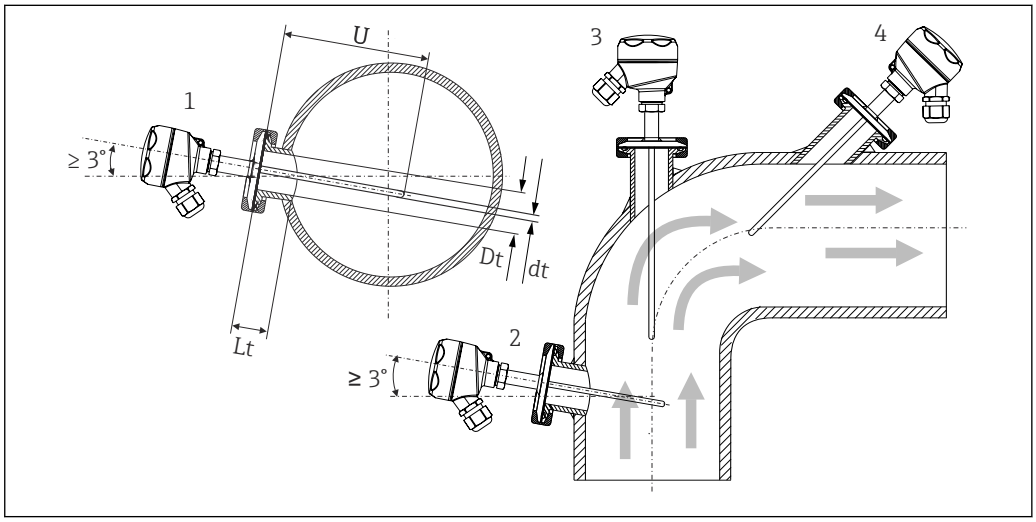
Orientation

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 is recommended depending on the type of sensor used and the design of the insert. This immersion length corresponds to the minimum insertion length for the calibration.
- ATEX certification: Observe the installation instructions in the Ex documentation!



7 *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

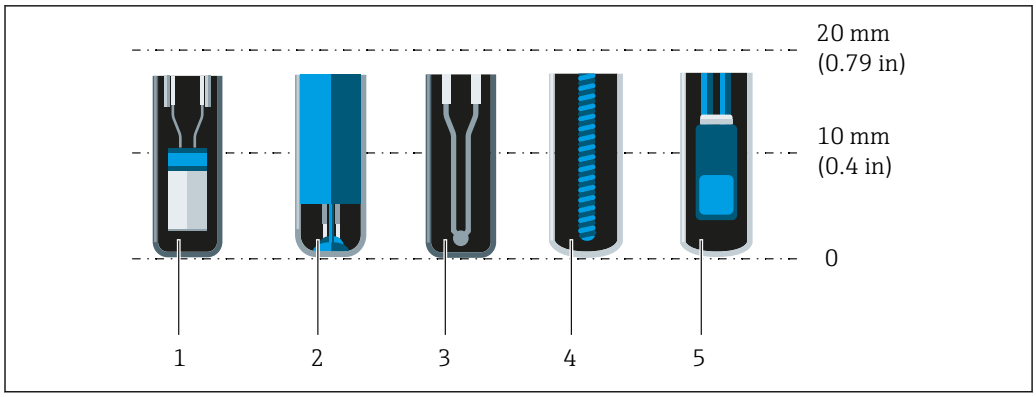
In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to project well into the process so that it extends past the pipe axis. Installation at an angle (4) could be another solution. When determining the immersion length or installation depth, all the parameters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

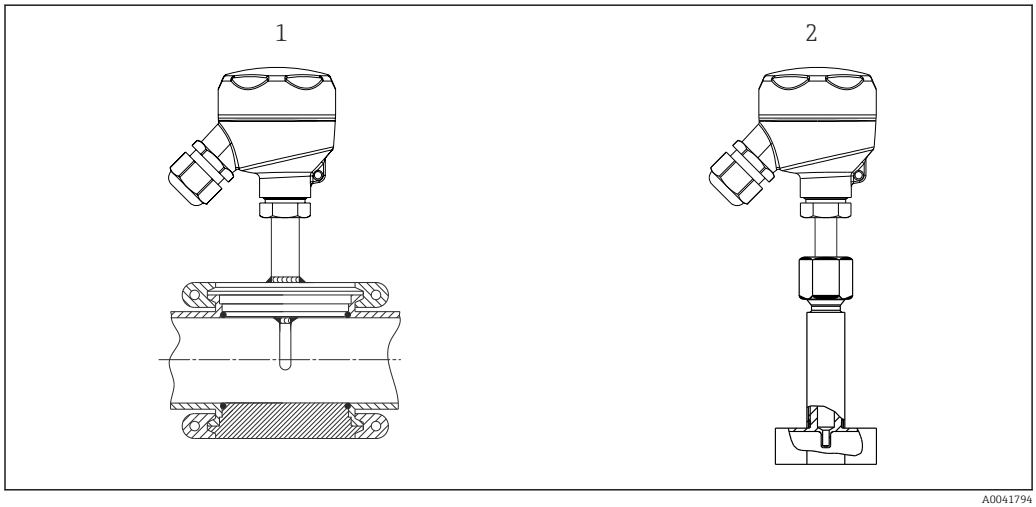


1 *StrongSens or TrustSens at 5 to 7 mm (0.2 to 0.28 in)*
2 *QuickSens at 0.5 to 1.5 mm (0.02 to 0.06 in)*
3 *Thermocouple (not grounded) at 3 to 5 mm (0.12 to 0.2 in)*
4 *Wire wound sensor at 5 to 20 mm (0.2 to 0.79 in)*
5 *Standard thin-film sensor at 5 to 10 mm (0.2 to 0.39 in)*

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.

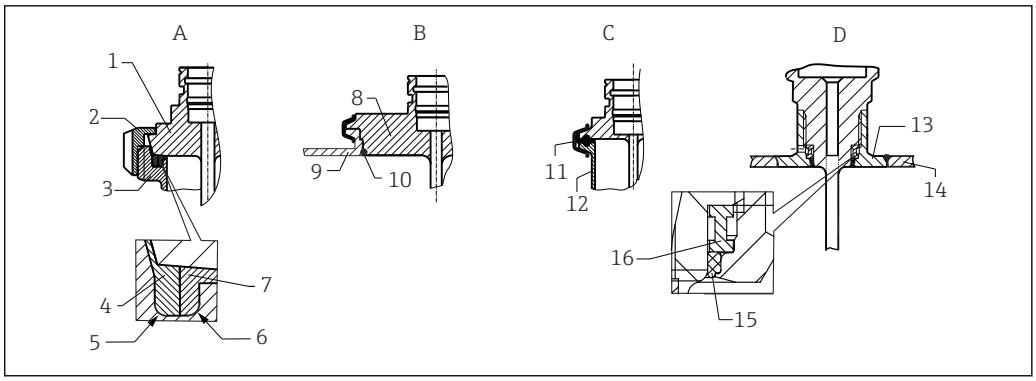
This results in the following recommended minimum immersion lengths
- TrustSens or StrongSens 30 mm (1.18 in)
- QuickSens 25 mm (0.98 in)
- Wire wound sensor 45 mm (1.77 in)
- Standard thin-film sensor 35 mm (1.38 in)

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.



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

1 *Varivent® process connection type N for DN40*
2 *Elbow piece or T-piece (illustrated) for weld-in as per DIN 11865 / ASME BPE*



9 *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. → 53.

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. → 38
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)

Extension neck	Temperature in °C (°F)
Quick-fastening iTHERM QuickNeck	−50 to +140 °C (−58 to +284 °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 (WW or TF)	30 m/s² (3g) [1]
iTHERM StrongSens Pt100 (TF) iTHERM QuickSens Pt100 (TF), version: Ø6 mm (0.24 in)	> 600 m/s² (60g)

1) Vibration resistance also applies to quick-fastening iTHERM QuickNeck.

Electromagnetic compatibility (EMC)

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

Process

Process temperature range

Depends on the type of sensor used, maximum −200 to +600 °C (−328 to +1 112 °F).

Thermal shock

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

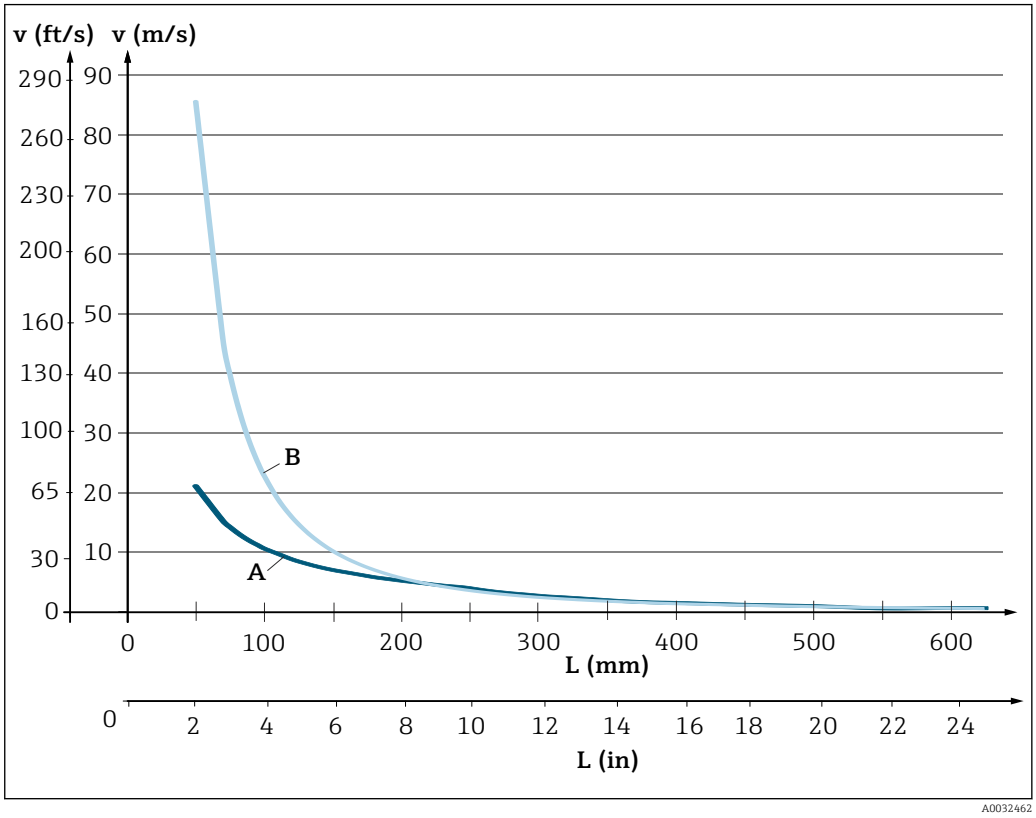
Process pressure range

The maximum possible process pressure depends on various influencing factors, such as the design, process connection and process temperature. For information on the maximum possible process pressures for the individual process connections, see the 'Process connection' section. → 43

It is possible to check the mechanical loading capacity as a function of the installation and process conditions online in the TW Sizing Module for protection tubes in the Endress+Hauser Applicator software. This is valid for DIN thermowell calculations. See 'Accessories' section.

Example of the permitted flow velocity depending on the immersion length and process medium

The highest flow velocity tolerated by the thermometer diminishes with increasing insert immersion length exposed to the stream of the fluid. In addition it is dependent on the diameter of the thermometer tip, on the kind of measuring medium, on the process temperature and on 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).



10 *Permitted flow velocities, protection tube diameter 9 mm (0.35 in)*

A Medium water at T = 50 °C (122 °F)
B Medium superheated steam at T = 160 °C (320 °F)
L Immersion length exposed to flow
v Flow velocity

Medium - state of aggregation

Gaseous or liquid (also with high viscosity, e.g. yogurt).

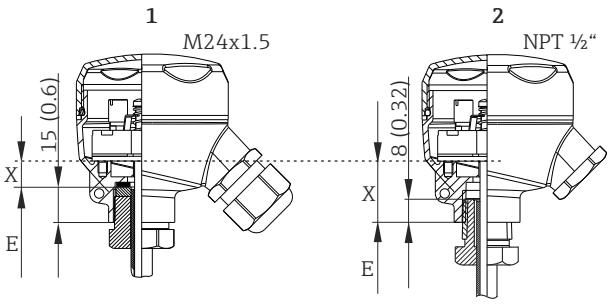
Mechanical construction

Design, dimensions

All dimensions in mm (in). The design of the thermometer depends on the thermowell version used:
- Thermometer without thermowell
- Diameter 6 mm (¼ in)
- Diameter 9 mm (0.35 in)
- Diameter 12.7 mm (½ in)
- T-piece and elbow piece thermowell version as per DIN 11865 / ASME BPE for weld-in

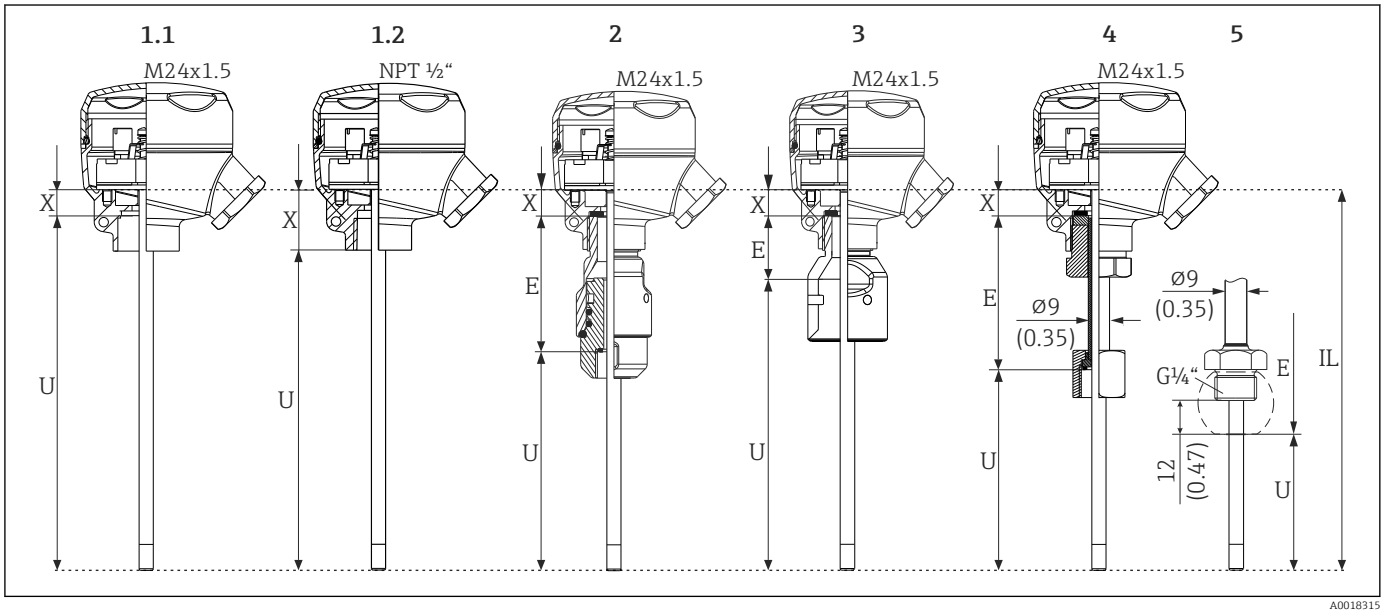
Various dimensions, such as the immersion length U for example, are variable values and are therefore indicated as items in the following dimensional drawings.

Variable dimensions:

Item	Description
E	Extension neck length, variable depending on configuration or optionally predefined for version with iTHERM QuickNeck
IL	Insertion length of insert
L	Thermowell length (U+T)
B	Thermowell bottom thickness: predefined, depends on thermowell version (see also the individual table data)
T	Length of thermowell lagging: variable or predefined, depends on thermowell version (see also the individual table data)
U	Immersion length: variable, depending on the configuration
X	Variable for calculating the insertion length of the insert, depends on different screw-in lengths in the terminal head thread M24x1.5 or NPT ½", see insert length calculation (IL) → 🖹 37  🖹 11 *Different screw-in lengths in terminal head thread for M24x1.5 and ½" NPT* *1 Thread M24x1.5: X = 11 mm (0.43 in), mat.: 1.4305 (gland)* *2 Thread NPT ½": X = 26 mm (1.02 in) or with terminal head TA30S = 31 mm (1.22 in), mat.: 1.4305 (gland)*
ØID	Insert diameter 6 mm (¼ in) or 3 mm (⅛ in)

Without thermowell

For installation in an existing thermowell



1.1 Thermometer without extension neck, insert surface not specified, product structure: feature 80, option A0; X = 11 mm (0.43 in) for connection thread M24x1.5
1.2 Thermometer without extension neck, insert surface not specified, product structure: feature 80, option A0; X = 26 mm (1.02 in) for connection thread NPT ½"; X = 31 mm (1.22 in) for connection thread NPT ½" and terminal head TA30S
2 Thermometer with quick-fastening iTHERM QuickNeck, top and bottom part, G3/8" female thread for thermowell connection
3 Thermometer with quick-fastening iTHERM QuickNeck, top part
4 Thermometer with replaceable extension neck TE411, G3/8" union nut for thermowell connection
5 Thermometer with replaceable extension neck TE411, male thread G¼" for compression fitting TK40

Can be selected for all versions: thread M24x1.5 or ½" NPT to terminal head

Pay attention to the following equations when calculating the immersion length U for immersion into an existing thermowell TT411:

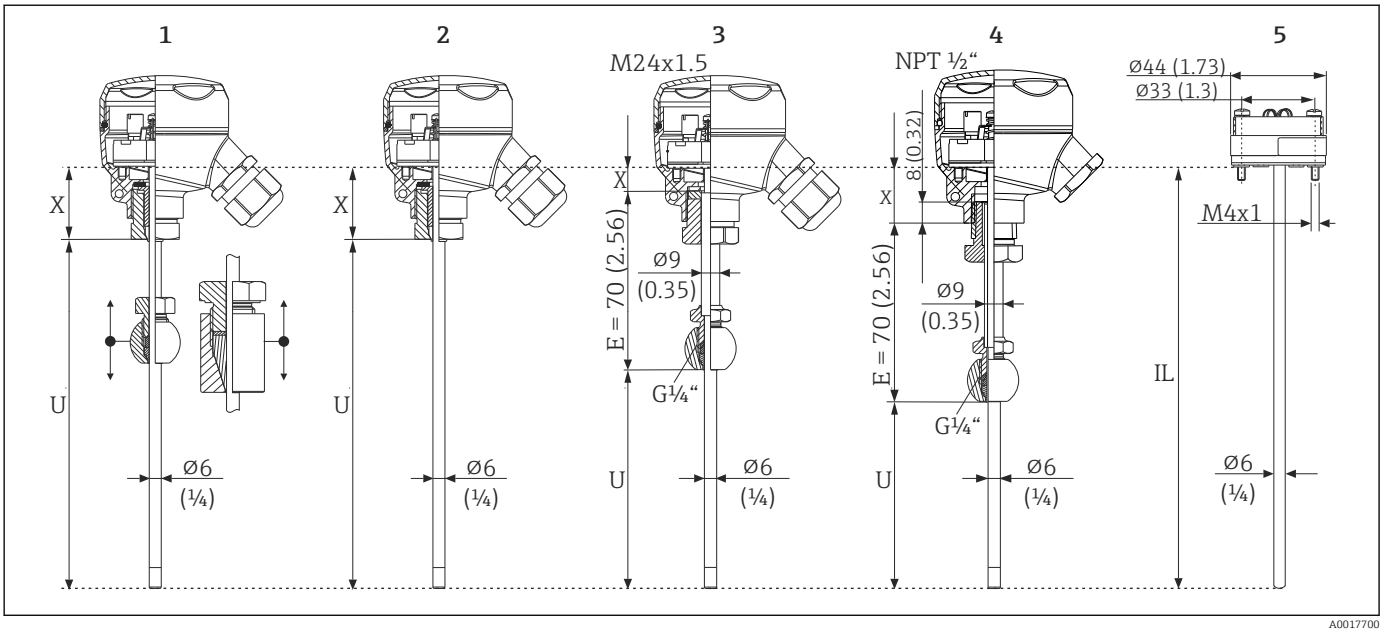
Version 1	U = L [1] + E [2] + 3 mm (0.12 in) - B
Version 2 and 4	U = L [1] + 3 mm (0.12 in) - B
Version 3, thermowell diameter 9 mm (0.35 in)	U = L [1] + 3 mm (0.12 in) (for spring pre-load) - B
Version 3, thermowell diameter 6 mm (¼ in)/12.7 mm (½ in)	U = L [1] + 36 mm (1.42 in)+ 3 mm (0.12 in) (for spring pre-load) - B
Version 5	U = $U_{(incl. TK40)}$

1) L = total length of the thermowell available onsite = $U_{thermowell}$ + $T_{thermowell}$
2) E = length of the extension neck provided onsite (if available)

Item (see drawing above)	Version	Length
Extension neck length E	**Version 1:** Without extension neck	E = 0
	Version 2: iTHERM QuickNeck with thread M24x1.5 to terminal head ▪ A0: E not required ▪ X1: E= variable length	▪ 62 mm (2.44 in) ▪ Variable, depending on the configuration
	iTHERM QuickNeck with thread NPT ½" to terminal head ▪ A0: E not required ▪ X1: E= variable length	▪ 51 mm (2.00 in) ▪ Variable, depending on the configuration

Item (see drawing above)	Version	Length
	Version 3: iTHERM QuickNeck top part with thread M24x1.5 to terminal head ▪ A0: E not required ▪ X1: E= variable length	▪ 28 mm (1.1 in) ▪ Variable, depending on the configuration
	iTHERM QuickNeck top part with thread NPT ½" to terminal head ▪ A0: E not required ▪ X1: E= variable length	▪ 19.5 mm (0.77 in) ▪ Variable, depending on the configuration
	Version 4: With replaceable extension neck, G3/8" union nut for thermowell connection	Variable, depending on the configuration
	Version 5: With replaceable extension neck and male thread G¼" for compression fitting TK40, with thread M24x1.5 or ½" NPT to terminal head	70 mm (2.76 in)
Immersion length U	Independent of the version	Variable, depending on the configuration
Variable length X	▪ Connection thread M24x1.5 ▪ Connection thread ½" NPT ▪ Connection thread ½" NPT and terminal head TA30S IL = U+E+X	13 mm (0.51 in) 28 mm (1.1 in) 31 mm (1.22 in)

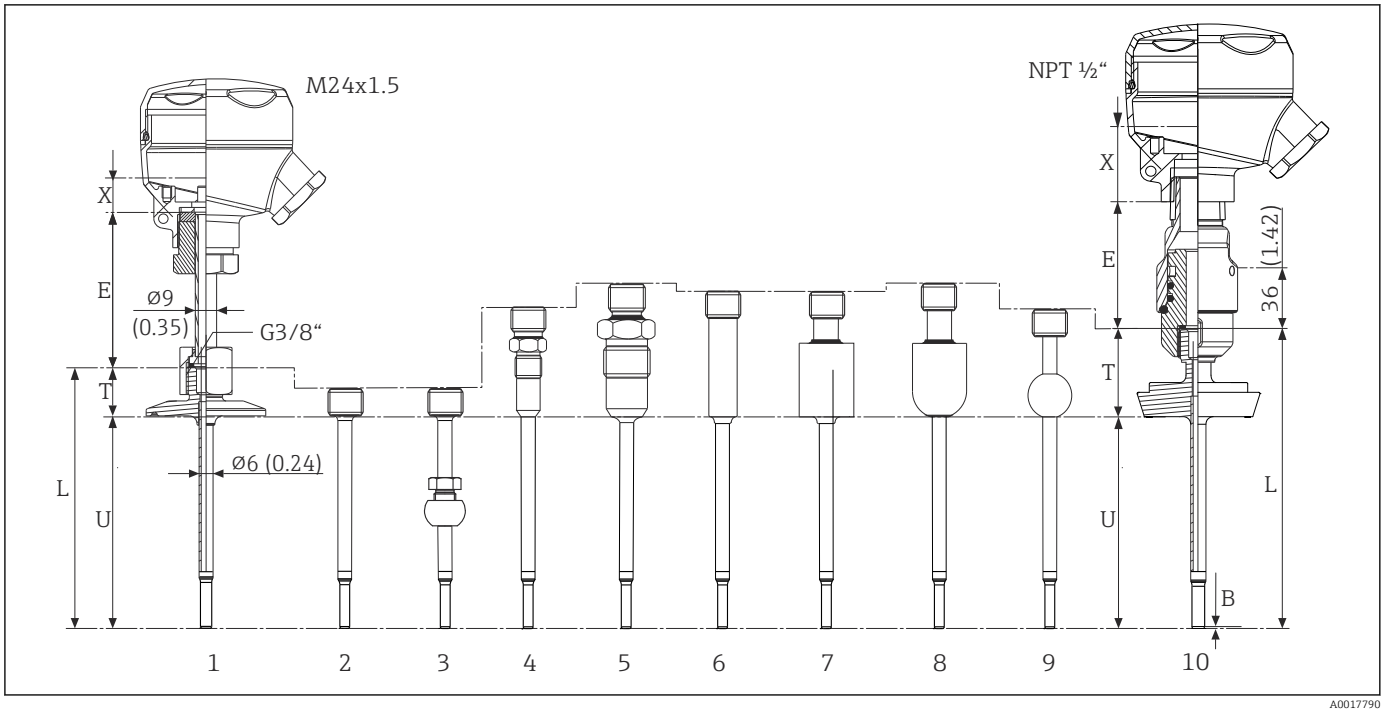
With compression fitting TK40 as process connection, insert in direct contact with the process



1 *Movable compression fitting TK40 - variably fixable immersion length U, only connection thread M24x1.5*
2 *Without compression fitting for use if compression fitting is available at point of installation, insert with polished surface - product structure: feature 80, option A1 or A3 - only connection thread M24x1.5*
3 *Compression fitting TK40 fixed by extension neck - fixed immersion length U, connection thread M24x1.5*
4 *Compression fitting TK40 fixed by extension neck - fixed immersion length U, connection thread ½" NPT*
5 *Insert, for example with mounted head transmitter*

Item	Version	Length
Extension neck length E	Extension neck Ø9 mm (0.35 in)	70 mm (2.76 in)
Immersion length U	Independent of the version	Variable, depending on the configuration
Variable length X	▪ **Versions 1 and 2:** Without extension neck, connection thread M24x1.5 IL = U+X ▪ **Version 3:** With extension neck, connection thread M24x1.5 IL = U+E+X ▪ **Version 4:** With extension neck, connection thread ½" NPT IL = U+E+X ▪ With extension neck and TA30S terminal head IL = U+E+X	39 mm (1.54 in) 11 mm (0.43 in) 26 mm (1.02 in) 31 mm (1.22 in)

With thermowell diameter 6 mm (¼ in)



1 Thermometer with replaceable extension neck TE411 and process connection as clamp version
2 Without process connection
3 Process connection version as spherical compression fitting TK40
4 Process connection version as metal sealing system M12x1.5
5 Process connection version as metal sealing system G½"
6 Process connection version as cylindrical weld-in adapter Ø12 x 40 mm
7 Process connection version as cylindrical weld-in adapter Ø30 x 40 mm
8 Process connection version as spherical-cylindrical weld-in adapter Ø30 x 40 mm
9 Process connection version as spherical weld-in adapter Ø25 mm
10 Thermometer with quick-fastening iTHERM QuickNeck and process connection as sanitary connection according to DIN 11851

- Replaceable extension neck or quick-fastening iTHERM QuickNeck
- Thread M24x1.5 or ½" NPT to terminal head
- G3/8" thread for thermowell connection

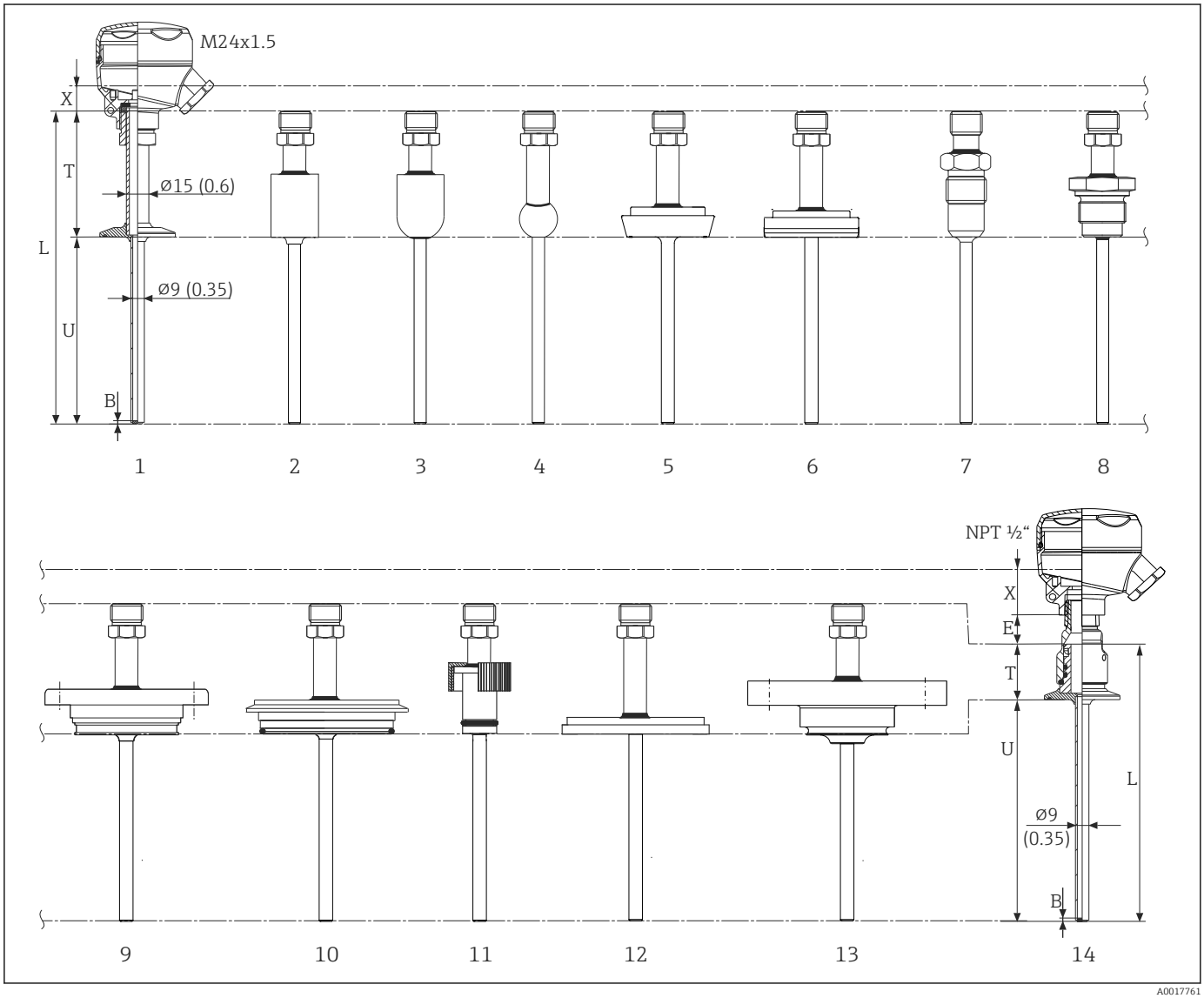
Item	Version	Length
Extension neck length E	Replaceable extension neck Ø9 mm (0.35 in)	Variable, depending on the configuration
	iTHERM QuickNeck with thread M24x1.5 to terminal head, with option: ▪ A0: E not required ▪ X1: E= variable length	▪ 60 mm (2.36 in) ▪ Variable, depending on the configuration
	iTHERM QuickNeck with thread NPT ½" to terminal head, with option: ▪ A0: E not required ▪ X1: E= variable length	▪ 51 mm (2.00 in) ▪ Variable, depending on the configuration
Length of thermowell lagging T [1)]	Metal sealing system M12x1.5	46 mm (1.81 in)
	Metal sealing system G½"	60 mm (2.36 in)
	Tri-clamp (0.5"-0.75")	24 mm (0.94 in)
	Microclamp (DN8-18)	23 mm (0.91 in)
	Clamp DN12 according to ISO 2852	24 mm (0.94 in)
	Clamp DN25/DN40 according to ISO 2852	21 mm (0.83 in)

Item	Version	Length
	Sanitary connection DN25/DN32/DN40 according to DIN 11851	29 mm (1.14 in)
	Spherical-cylindrical weld-in adapter	58 mm (2.28 in)
	Weld-in adapter, cylindrical, Ø12 mm (0.47 in)	55 mm (2.17 in)
	Without process connection (only G3/8" thread), where necessary with compression fitting TK40	11 mm (0.43 in)
	Cylindrical weld-in adapter	55 mm (2.17 in)
	Spherical weld-in adapter	47 mm (1.85 in)
Immersion length U	Independent of the version	Variable, depending on the configuration
Variable length X	▪ With connection thread M24x1.5 ▪ With connection thread ½" NPT ▪ With terminal head TA30S Calculation of IL for the insert: IL = U+T+E-B+X	14 mm (0.55 in) 29 mm (1.14 in) 34 mm (1.34 in)
Bottom thickness B	Reduced tip Ø4.3 mm (0.17 in)	3 mm (0.12 in)

1) Depends on the process connection

With thermowell diameter 9 mm (0.35 in)

Extension neck not replaceable, but can be separated with the option of the quick-fastening iTHERM QuickNeck.

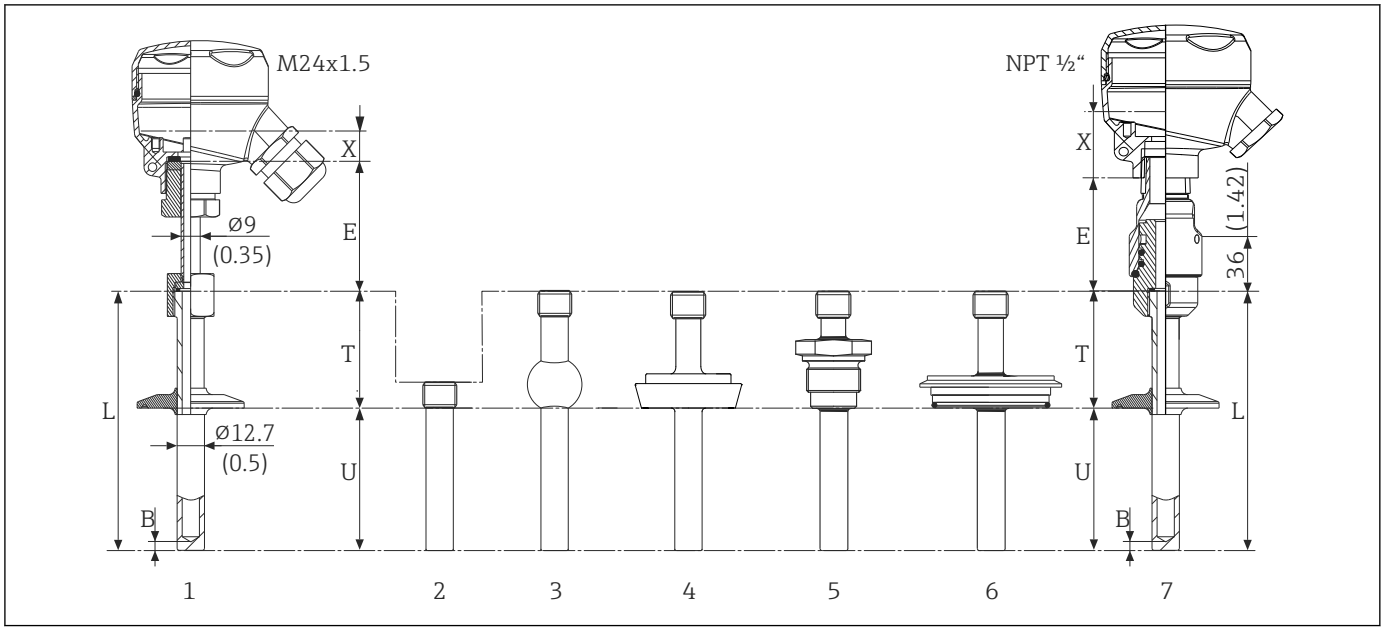


1 Thermometer without replaceable extension neck, connection thread M24x1.5, process connection as clamp version
2 Process connection version as cylindrical weld-in adapter Ø30 x 40 mm
3 Process connection version as spherical-cylindrical weld-in adapter Ø30 x 40 mm
4 Process connection version as spherical weld-in adapter Ø25 mm
5 Process connection version as sanitary connection according to DIN 11851
6 Process connection version as aseptic pipe union according to DIN 11864-1 Form A
7 Process connection version as metal sealing system G½"
8 Process connection thread as per ISO 228 for Liquiphant weld-in adapter
9 Process connection version APV Inline
10 Process connection version Varivent®
11 Process connection version Ingold connection
12 Process connection to SMS 1147
13 Process connection version Neumo Biocontrol
14 Thermometer with quick-fastening iTHERM QuickNeck and process connection, as clamp version for example

Item	Version	Length
Extension neck length E	Without iTHERM QuickNeck	0
	With iTHERM QuickNeck With thread M24x1.5 to terminal head ▪ A0: E not required ▪ X1: E= variable length	▪ 28 mm (1.1 in) ▪ Variable, depending on the configuration

Item	Version	Length
	With thread ½" NPT to terminal head ▪ A0: E not required ▪ X1: E= variable length	▪ 19.5 mm (0.8 in) ▪ Variable, depending on the configuration
Length of thermowell lagging T	Without iTHERM QuickNeck	Variable, depending on the configuration
	With iTHERM QuickNeck, depending on the process connection:	
	SMS 1147, DN25	40 mm (1.57 in)
	SMS 1147, DN38	41 mm (1.61 in)
	SMS 1147, DN51	42 mm (1.65 in)
	Varivent®, type F, D = 50 mm (1.97 in) Varivent®, type N, D = 68 mm (2.67 in)	52 mm (2.05 in)
	Varivent®, type B, D = 31 mm (1.22 in)	56 mm (2.2 in)
	G1" thread according to ISO 228 for Liquiphant weld-in adapter	77 mm (3.03 in)
	Spherical-cylindrical weld-in adapter	70 mm (2.76 in)
	Cylindrical weld-in adapter	67 mm (2.64 in)
	Aseptic pipe union according to DIN11864-A, DN25	42 mm (1.65 in)
	Aseptic pipe union according to DIN11864-A, DN40	43 mm (1.69 in)
	Sanitary connection according to DIN 11851, DN32	47 mm (1.85 in)
	Sanitary connection according to DIN 11851, DN40	
	Sanitary connection according to DIN 11851, DN50	48 mm (1.89 in)
	Clamp according to ISO 2852, DN12	
	Clamp according to ISO 2852, DN25	37 mm (1.46 in)
	Clamp according to ISO 2852, DN40	39 mm (1.54 in)
	Clamp according to ISO 2852, DN63.5	
	Clamp according to ISO 2852, DN70	
	Microclamp (DN18)	47 mm (1.85 in)
	Tri-clamp (0.75")	46 mm (1.81 in)
	Ingold connection Ø25 mm (0.98 in) x 30 mm (1.18 in)	78 mm (3.07 in)
	Ingold connection Ø25 mm (0.98 in) x 46 mm (1.81 in)	94 mm (3.7 in)
	Metal sealing system G½"	74 mm (2.91 in)
	APV-Inline, DN50	51 mm (2.01 in)
Immersion length U	Independent of the version	Variable, depending on the configuration
Variable length X	▪ Without iTHERM QuickNeck, connection thread M24x1.5 IL = U+T-B+X ▪ With iTHERM QuickNeck, connection thread M24x1.5 IL = U+E+T-B+X ▪ With iTHERM QuickNeck, connection thread NPT ½" IL = U+E+T-B+X ▪ With iTHERM QuickNeck, terminal head TA30S IL = U+E+T-B+X	14 mm (0.55 in) 14 mm (0.55 in) 29 mm (1.14 in) 34 mm (1.34 in)
Bottom thickness B	Reduced tip Ø4 mm (0.16 in) x 20 mm (0.79 in)	2 mm (0.08 in)
	Tapered tip Ø 6.6 mm (0.26 in) x 60 mm (2.36 in)	
	Straight tip	

With thermowell diameter 12.7 mm (½ in)



1 Thermometer with replaceable extension neck TE411 and process connection as clamp version
2 Process connection version as cylindrical weld-in adapter Ø12.7 mm (0.5 in)
3 Process connection version as spherical weld-in adapter Ø25 mm
4 Process connection version as sanitary connection according to DIN 11851
5 Thread according to ISO 228 for Liquiphant weld-in adapter
6 Process connection version Varivent®
7 Thermometer with quick-fastening iTHERM QuickNeck and process connection, as clamp version for example

- Replaceable extension neck or quick-fastening iTHERM QuickNeck
- G3/8" thread for thermowell connection
- Welded thermowell at the tip

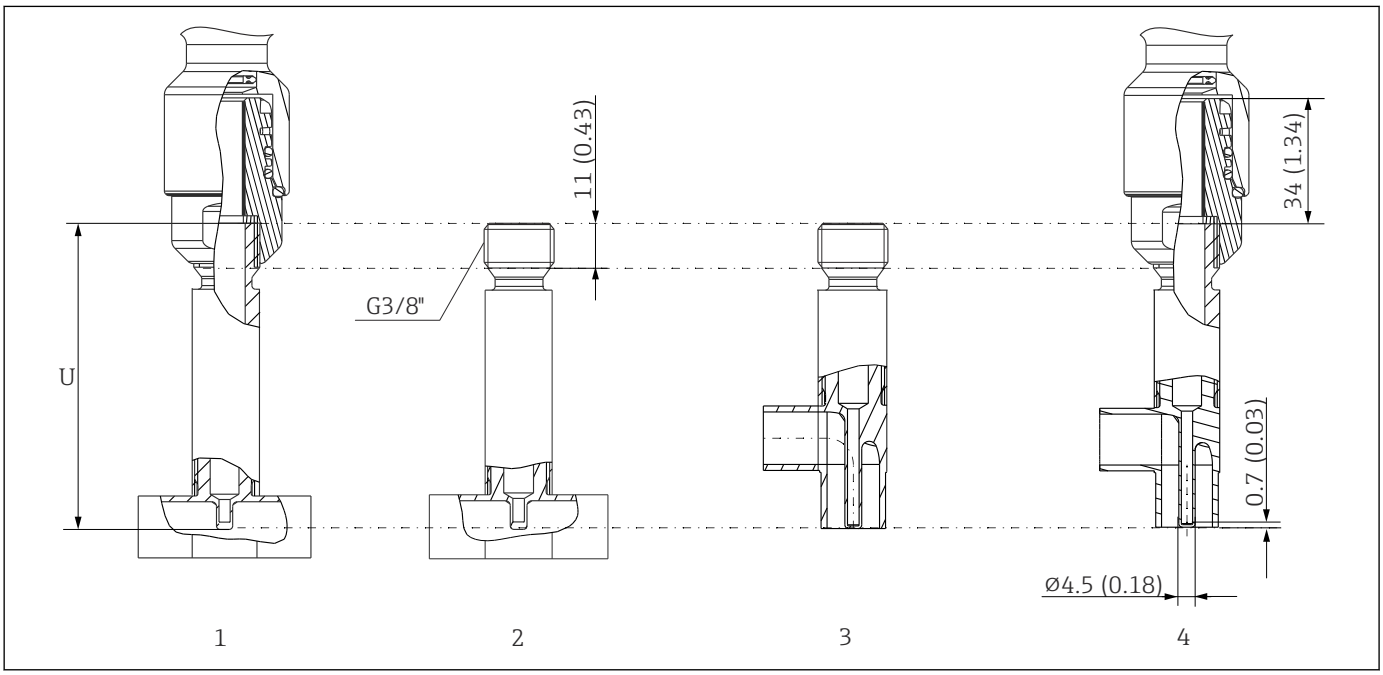
Item	Version	Length
Extension neck length E	Replaceable extension neck, Ø9 mm (0.35 in)	Variable, depending on the configuration
	iTHERM QuickNeck with thread M24x1.5 to terminal head, with option: ▪ A0: E not required ▪ X1: E= variable length	▪ 60 mm (2.36 in) ▪ Variable, depending on the configuration
	iTHERM QuickNeck with thread NPT ½" to terminal head, with option: A0: E not required	54 mm (2.13 in)
Length of thermowell lagging T	Weld-in adapter, cylindrical, Ø12.7 mm (0.5 in) [1]	12 mm (0.47 in)
	All other process connections	65 mm (2.56 in)
Immersion length U	Independent of the process connection	Variable, depending on the configuration
Variable length X	▪ With connection thread M24x1.5 ▪ With connection thread ½" NPT ▪ With terminal head TA30S Calculation of IL for the insert: IL = U+T+E-B+X	14 mm (0.55 in) 29 mm (1.14 in) 34 mm (1.34 in)
Bottom thickness B	Reduced tip Ø5.3 mm (0.21 in) x 20 mm (0.79 in)	2 mm (0.079 in)

Item	Version	Length
	Reduced tip Ø8 mm (0.31 in) x 32 mm (1.26 in)	4 mm (0.16 in)
	Straight tip	6 mm (0.24 in)

1) See Fig. version 2

Thermowell version as T-piece or elbow piece, optimized

No welds, no dead legs



12 Thermowell as per DIN 11865 or ASME BPE

1 T-piece with threaded QuickNeck bottom part, torque 5 Nm (3.69 lbf ft), and glued with threadlocking adhesive
2 T-piece with extension neck connection G3/8"
3 Elbow piece with extension neck connection G3/8"
4 Elbow piece with threaded QuickNeck bottom part, torque 5 Nm (3.69 lbf ft), and glued with threadlocking adhesive
U Immersion length

- Pipe sizes as per DIN 11865 series A (DIN), B (ISO) and C (ASME BPE) → 48
- 3-A marked for nominal diameters ≥ DN25
- EHEDG certified for nominal diameters ≥ DN25
- ASME BPE compliance for nominal diameters ≥ DN25
- IP69K protection class
- 1.4435+316L material, delta ferrite content < 0.5%
- Temperature range: −60 to +200 °C (−76 to +392 °F)
- Pressure range: PN25 as per DIN11865

Due to the short immersion length U in the case of small pipe diameters, the use of iTHERM QuickSens inserts is recommended.

As a general rule, the longer the immersion length U the better the measurement accuracy. For small pipe diameters it is advisable to use elbow pieces to enable a maximum immersion length U.

Suitable immersion lengths for the following thermometers with G3/8" extension neck connection:
- iTHERM CompactLine TMR35: 83 mm (3.27 in)
- iTHERM TM411: 85 mm (3.35 in)
- iTHERM TM311: 85 mm (3.35 in)
- iTHERM TrustSens TM371: 85 mm (3.35 in)

Suitable immersion lengths for the following thermometers with QuickNeck connection:
- iTHERM TM411: 119 mm (4.7 in)
- iTHERM TrustSens TM371: 119 mm (4.7 in)

Possible combinations of the thermowell versions with the available process connections and quick-fastening iTHERM QuickNeck

Process connection and size	Thermowell diameter			iTHERM QuickNeck for Ø9 mm (0.35 in) [1]
	6 mm (¼ in)	9 mm (0.35 in)	12.7 mm (½ in)	
Without process connection (for installation with compression fitting)	☑	-	-	-
Weld-in adapter				
Cylindrical Ø12.7 mm (0.5 in)	-	-	☑	-
Cylindrical Ø30 x 40 mm	☑	☑	-	☑
Cylindrical Ø12 x 40 mm		-	-	-
Spherical-cylindrical Ø30 x 40 mm	☑	☑	-	☑
Spherical Ø25 mm (0.98 in)	☑	☑	☑	-
Clamp according to ISO 2852				
Microclamp/Tri-clamp DN18 (0.75 in)	☑ [2]	☑	-	☑
DN12 - 21.3			☑	
DN25 -38 (1 - 1.5 in)	☑	☑	☑	☑
DN40 - 51 (2 in)				
DN63.5 (2.5 in)	-	☑	☑	☑
DN70 - 76.5 (3 in)				
Sanitary connection according to DIN 11851				
DN25	☑	☑	☑	-
DN32, DN40				☑
DN50	-			
Aseptic pipe union according to DIN 11864-1 Form A				
DN25, DN40	-	☑	-	☑
Metal sealing system				
M12x1.5	☑	-	-	-
G½"		☑		☑
Thread according to ISO 228 for Liquiphant weld-in adapter				
G¾" for FTL20, FTL31, FTL33	-	☑	☑	-
G¾" for FTL50				-
G1" for FTL50				☑
APV Inline				
DN50	-	☑	-	☑
Varivent®				
Type B, Ø31 mm; Type F, Ø50 mm ; Type N, Ø68 mm	-	☑	☑	☑
Ingold connection				
25 x 30 mm or 25 x 46 mm	-	☑	-	☑
SMS 1147				
DN25, DN38, DN51	-	☑	-	☑
Neumo Biocontrol				
D25 PN16, D50 PN16, D65 PN16	-	☑	-	-

1) In the case of 6 mm (¼ in) and 12.7 mm (½ in) diameters, the iTHERM QuickNeck is available for all process connection versions.
2) Microclamp/Tri-clamp DN8 (0.5") only possible in conjunction with a thermowell diameter = 6 mm (¼ in)

Insert

Depending on the application, iTHERM TS111 inserts with different RTD sensors are available for the thermometer:

Sensor	Standard thin-film	iTHERM StrongSens	iTHERM QuickSens [1]	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 ▪ Ø6 mm (¼ in), mineral insulated ▪ Ø3 mm (⅛ in), Teflon insulated	1x Pt100, 3- or 4-wire, mineral insulated	2x Pt100, 3-wire, mineral insulated
Vibration resistance of the insert tip	Up to 3g	Enhanced vibration resistance > 60g	▪ Ø3 mm (⅛ in) up to 3g ▪ Ø6 mm (¼ in) > 60g	Up to 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	3 mm (⅛ in), 6 mm (¼ in)	6 mm (¼ in)	3 mm (⅛ in), 6 mm (¼ in)		

1) Recommended for immersion lengths U < 70 mm (2.76 in)

The iTHERM TS111 insert is available as a spare part. The insertion length (IL) depends on the immersion length of the thermowell (U), the length of the extension neck (E), the thickness of the base (B), the length of the thermowell lagging (L) and the variable length (X). The insertion length (IL) must be taken into consideration when replacing the unit. Formulas for calculating IL → 🖹 26.

For more information on the deployed iTHERM TS111 insert with enhanced vibration resistance and fast-response sensor, see the Technical Information (TI01014T/09/).

Spare parts currently available for your product can be found online at: https://www.endress.com/en/instrumentation-services, product root: TM411. Always quote the serial number of the device when ordering spare parts! The insertion length IL is automatically calculated using the serial number.

Weight

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

Material

Extension neck and thermowell, insert, process connection.

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.
1.4435+316L, delta ferrite < 1% or < 0.5%	With regard to analytical limits, the specifications of both materials (1.4435 and 316L) are met simultaneously. In addition, the delta ferrite content of the wetted parts is limited to <1% or <0.5% ≤3% at weldings (following Basel Standard II)		

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 process/product contact surfaces:

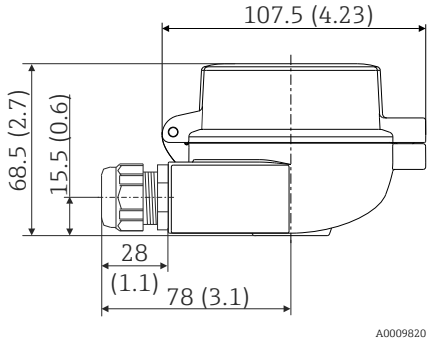
Standard surface, mechanically polished [1]	R_a ≤ 0.76 µm (30 µin)
Mechanically polished [1], buffed [2]	R_a ≤ 0.38 µm (15 µin)
Mechanically polished [1], buffed and electropolished	R_a ≤ 0.38 µm (15 µin)+ electropolished

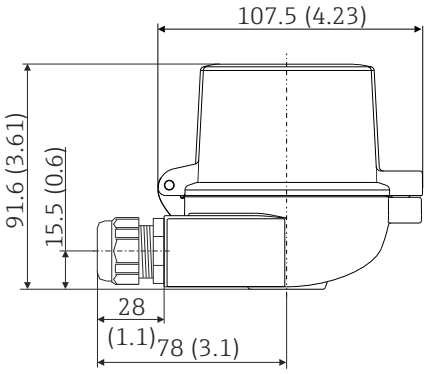
1) Or any other finishing method that meets the R_a max
2) Non-compliant with ASME BPE

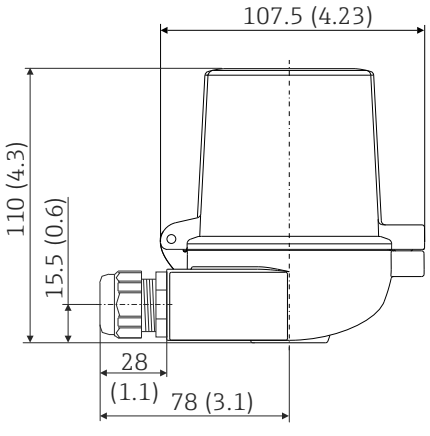
Terminal heads

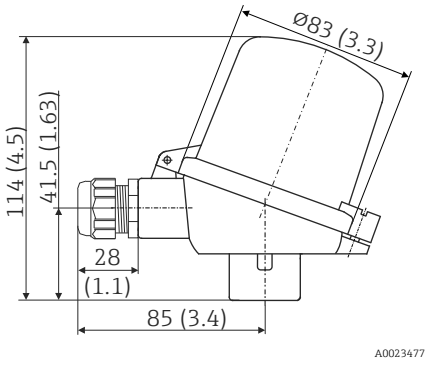
All terminal heads have an internal shape and size in accordance with DIN EN 50446, flat face and a thermometer connection with a M24x1.5 or ½" NPT thread. All dimensions in mm (in). The sample cable glands in the diagrams correspond to M20x1.5 connections with non-Ex polyamide cable glands. Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see the 'Environment' section. → 🖹 24

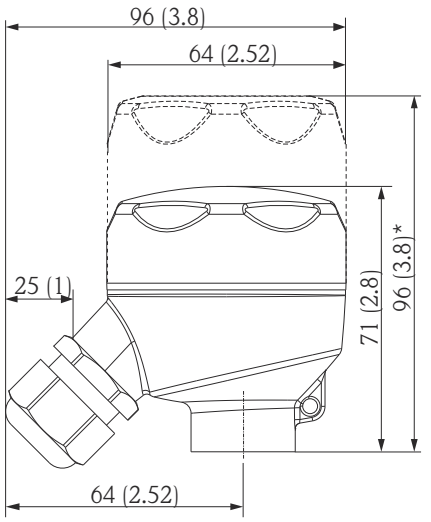
As a special feature, Endress+Hauser offers terminal heads with optimized terminal accessibility for easy installation and maintenance.

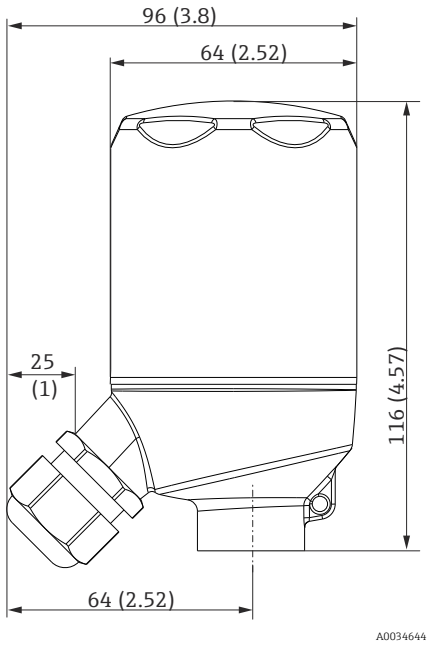
TA30A	Specification
	▪ Degree of protection: ▪ IP66/68 (NEMA Type 4x encl.) ▪ For ATEX: IP66/67 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry thread: G ½", ½" NPT and M20x1.5; ▪ Protective fitting connection: 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

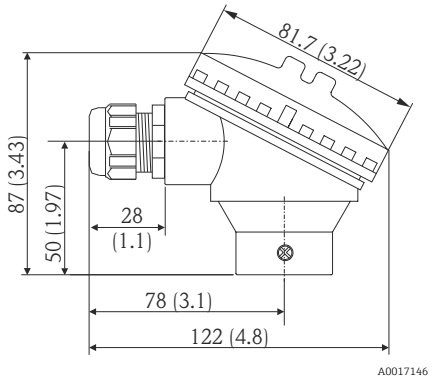
TA30A with display window in cover	Specification
	▪ Degree of protection: ▪ IP66/68 (NEMA Type 4x encl.) ▪ For ATEX: IP66/67 ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry thread: G ½", ½" NPT and M20x1.5 ▪ Protective fitting connection: M24x1.5 ▪ Color of head: blue, RAL 5012 Color of cap: gray, RAL 7035 ▪ Weight: 420 g (14.81 oz) ▪ Display window: single-pane safety glass according to DIN 8902 ▪ Display window in cover for head transmitter with TID10 display ▪ Ground terminal, internal and external ▪ Available with sensors with 3-A® symbol

TA30D	Specification
	▪ 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 ▪ Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 390 g (13.75 oz) ▪ Ground terminal, internal and external ▪ Available with sensors with 3-A® symbol

TA30P	Specification
	▪ Degree of protection: IP65 ▪ Max. temperature: −40 to +120 °C (−40 to +248 °F) ▪ Material: polyamide (PA12), antistatic Seals: silicone ▪ Threaded cable entry: M20x1.5 ▪ Protective fitting connection: M24x1.5 ▪ Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Head and cap color: black ▪ Weight: 135 g (4.8 oz) ▪ Type of protection: intrinsic safety (G Ex ia) ▪ Ground terminal: only internal via auxiliary terminal ▪ Available with sensors with 3-A® symbol

TA30R (optionally with display window in cover)	Specification
 * Dimensions of version with display window in cover	▪ Degree of protection - standard version: IP69K (NEMA Type 4x encl.) Degree of protection - version with display window: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +130 °C (−58 to +266 °F) without cable gland ▪ Material: stainless steel 316L, abrasive-blasted or polished Seals: silicone, optional EPDM for applications free from paint-wetting impairment substances Display window: polycarbonate (PC) ▪ Cable entry thread ½" NPT and M20x1.5 ▪ Weight ▪ Standard version: 360 g (12.7 oz) ▪ Version with display window: 460 g (16.23 oz) ▪ Display window in cover optionally for head transmitter with display TID10 ▪ Protection armature connection: M24x1.5 or ½" NPT ▪ Ground terminal: internal as standard ▪ Available with 3-A marked sensors ▪ Not allowed for Class II and III applications

TA30R (high version for two transmitters)	Specification
	▪ Degree of protection: IP69K (NEMA Type 4x encl.) ▪ Temperature: −50 to +130 °C (−58 to +266 °F) without cable gland ▪ Material: stainless steel 316L, abrasive-blasted or polished Seals: EPDM ▪ Cable entry thread ½" NPT and M20x1.5 ▪ Weight: 460 g (16.23 oz) ▪ For two head transmitter ▪ 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

TA30S	Specification
	▪ 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

Cable glands and connectors [1)]

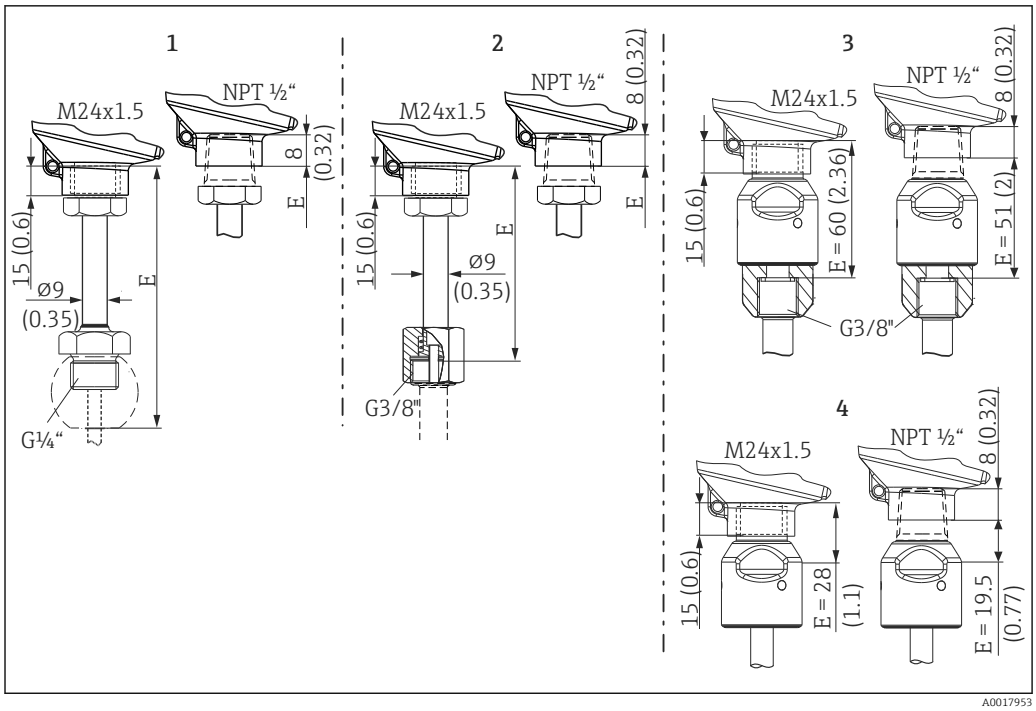
Type	Suitable for cable entry	Degree of protection	Temperature range	Suitable cable diameter
Cable gland, polyamide blue (indication of Ex-i circuit)	½" NPT	IP68	−30 to +95 °C (−22 to +203 °F)	7 to 12 mm (0.27 to 0.47 in)
Cable gland, polyamide	½" NPT, ¾" NPT, M20x1.5 (optionally 2x cable entry)	IP68	−40 to +100 °C (−40 to +212 °F)	5 to 9 mm (0.19 to 0.35 in)
	½" NPT, M20x1.5 (optionally 2x cable entry)	IP69K	−20 to +95 °C (−4 to +203 °F)	
Cable gland for dust ignition-proof area, polyamide	½" NPT, M20x1.5	IP68	−20 to +95 °C (−4 to +203 °F)	
Cable gland for dust ignition-proof area, 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

For explosion proof thermometers no cable glands are assembled.

Extension neck

Standard version of extension neck, or optionally with quick-fastening iTHERM QuickNeck.
- Tool-free removal of the insert:
  - Saves time/costs on frequently calibrated measuring points
  - Wiring mistakes avoided
- IP69K protection class

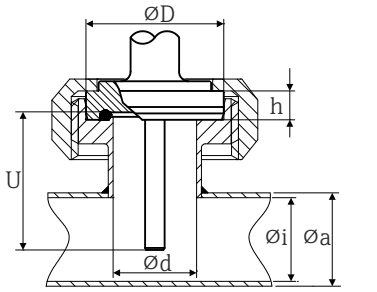


13 Dimensions of extension neck type TE411, different versions, each with M24x1.5 or NPT ½" thread to the terminal head

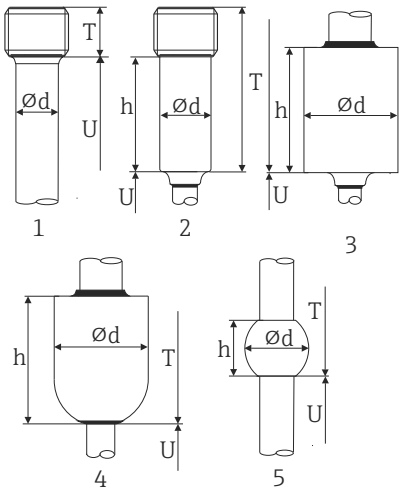
1 With G¼" male thread for compression fitting TK40, → 51 3-A marked
2 With G3/8" union nut for thermowell version: Ø6 mm (¼ in), Ø12.7 mm (0.5 in) and T-piece and elbow piece thermowell versions
3 Quick-fastening iTHERM QuickNeck for thermowell version: Ø6 mm (¼ in), Ø12.7 mm (0.5 in) and T-piece and elbow piece thermowell versions
4 Quick-fastening iTHERM QuickNeck - top part, for installation in an existing thermowell with iTHERM QuickNeck

Thermowell **Process connections**

All dimensions in mm (in).

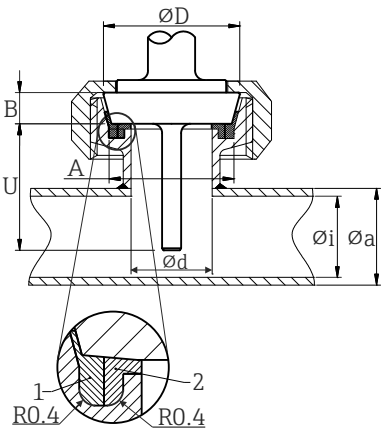
Type	Version	Dimensions					Technical properties
		Φd	ΦD	Φi	Φa	h	
Aseptic pipe union according to DIN 11864-1, Form A  	DN25	26 mm (1.02 in)	42.9 mm (1.7 in)	26 mm (1.02 in)	29 mm (1.14 in)	9 mm (0.35 in)	▪ $P_{max.}$ = 40 bar (580 psi) ▪ With 3-A symbol and EHEDG certification ▪ ASME BPE compliance
	DN40	38 mm (1.5 in)	54.9 mm (2.16 in)	38 mm (1.5 in)	41 mm (1.61 in)	10 mm (0.39 in)	

Weld-in

Type	Version	Dimensions	Technical properties
Weld-in adapter  	1: Cylindrical [1]	Φd = 12.7 mm (½ in), U = immersion length from lower edge of thread, T = 12 mm (0.47 in)	▪ $P_{max.}$ depends on the weld-in process ▪ With 3-A symbol and EHEDG certification ▪ ASME BPE compliance
	2: Cylindrical [2]	Φd x h = 12 mm (0.47 in) x 40 mm (1.57 in), T = 55 mm (2.17 in)	
	3: Cylindrical	Φd x h = 30 mm (1.18 in) x 40 mm (1.57 in)	
	4: Spherical-cylindrical	Φd x h = 30 mm (1.18 in) x 40 mm (1.57 in)	
	5: Spherical	Φd = 25 mm (0.98 in) h = 24 mm (0.94 in)	

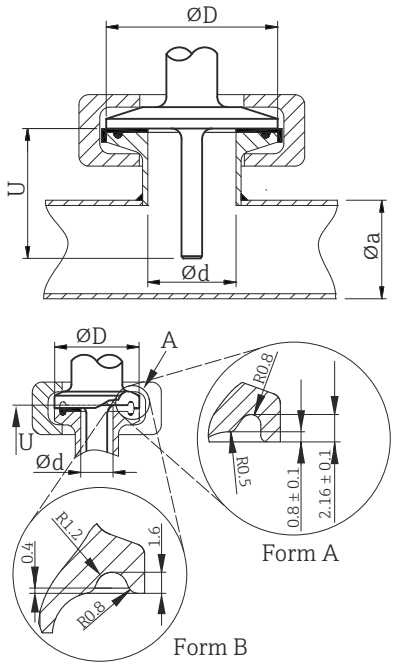
1) For Φ12.7 mm (½ in) thermowell
2) For Φ6 mm (¼ in) thermowell

Releasable process connection

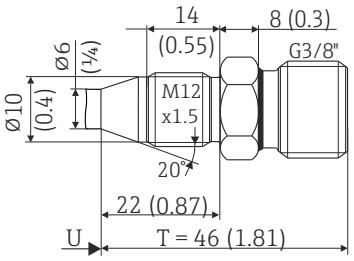
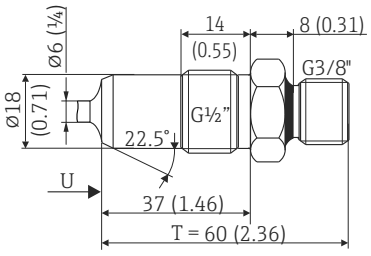
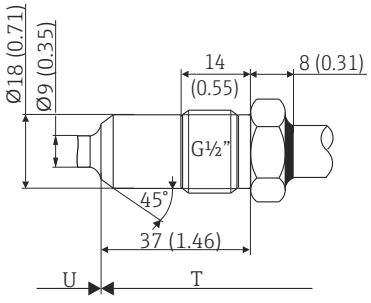
Type	Technical properties
Sanitary connection according to DIN 11851  A0009561 *1 Centering ring* *2 Sealing ring*	▪ 3-A marked and EHEDG certified (only with EHEDG-certified and self-centering sealing ring). ▪ ASME BPE compliance

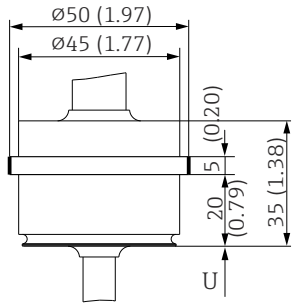
Version [1]	Dimensions					$P_{max.}$
	ΦD	A	B	Φi	Φa	
DN25	44 mm (1.73 in)	30 mm (1.18 in)	10 mm (0.39 in)	26 mm (1.02 in)	29 mm (1.14 in)	40 bar (580 psi)
DN32	50 mm (1.97 in)	36 mm (1.42 in)	10 mm (0.39 in)	32 mm (1.26 in)	35 mm (1.38 in)	40 bar (580 psi)
DN40	56 mm (2.2 in)	42 mm (1.65 in)	10 mm (0.39 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)

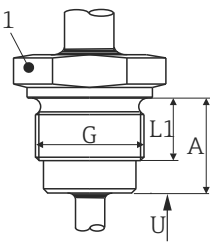
1) Pipes in accordance with DIN 11850

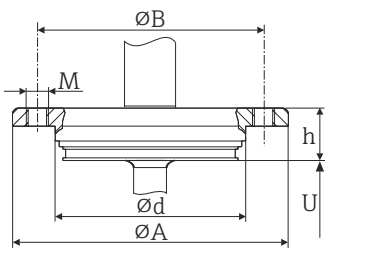
Type	Version	Dimensions		Technical properties	Conformity
	ϕd [1]	ϕD	ϕa		
Clamp according to ISO 2852  Form A: In compliance with ASME BPE Type A Form B: In compliance with ASME BPE Type B and ISO 2852	Microclamp [2] DN8-18 (0.5"-0.75") [3], Form A	25 mm (0.98 in)	-	▪ $P_{max.}$ = 16 bar (232 psi), depends on clamp ring and suitable seal ▪ With 3-A symbol	-
	Tri-clamp DN8-18 (0.5"-0.75") [3], Form B		-		Based on ISO 2852 [4]
	Clamp DN12-21.3, Form B	34 mm (1.34 in)	16 to 25.3 mm (0.63 to 0.99 in)		ISO 2852
	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
	Clamp DN63.5 (2.5"), Form B	77.5 mm (3.05 in)	68.9 to 75.8 mm (2.71 to 2.98 in)		ASME BPE Type B; ISO 2852
	Clamp DN70-76.5 (3"), Form B	91 mm (3.58 in)	> 75.8 mm (2.98 in)		ASME BPE Type B; ISO 2852

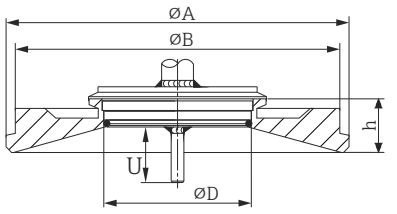
1) Pipes in accordance with ISO 2037 and BS 4825 Part 1
2) Microclamp (not in ISO 2852); no standard pipes
3) DN8 (0.5") only possible with thermowell diameter = 6 mm (¼ in)
4) Groove diameter = 20 mm

Type		Version	Technical properties
Metal sealing system		Thermowell diameter 6 mm (¼ in)	$P_{max.}$ = 16 bar (232 psi) Maximum torque = 10 Nm (7.38 lbf ft)
M12x1.5	**G½"**		
			
-		Thermowell diameter 9 mm (0.35 in)	$P_{max.}$ = 16 bar (232 psi) Maximum torque = 10 Nm (7.38 lbf ft)

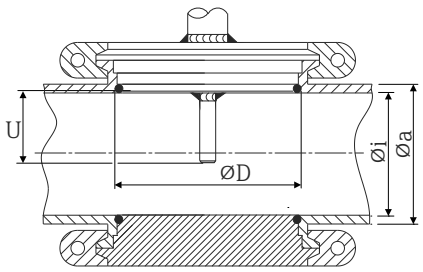
Type	Version	Technical properties
Process adapter 	D45	-

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	M	h	
APV Inline 	DN50	69 mm (2.72 in)	99.5 mm (3.92 in)	82 mm (3.23 in)	2xM8	19 mm (0.75 in)	▪ $P_{max.}$ = 25 bar (362 psi) ▪ With 3-A symbol and EHEDG certification ▪ ASME BPE compliance

Type	Version	Dimensions				Technical properties	
		ϕD	ϕA	ϕB	h	$P_{max.}$	
Varivent® 	Type B	31 mm (1.22 in)	105 mm (4.13 in)	-	22 mm (0.87 in)	10 bar (145 psi)	▪ With 3-A symbol and EHEDG certification ▪ ASME BPE compliance
	Type F	50 mm (1.97 in)	145 mm (5.71 in)	135 mm (5.31 in)	24 mm (0.95 in)		
	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).

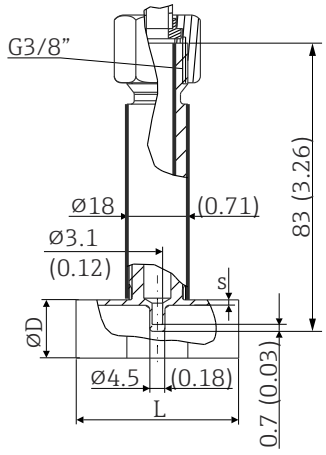
Type	Technical properties
Varivent® for VARINLINE® housing for installation in pipes 	▪ With 3-A symbol and EHEDG certification ▪ ASME BPE compliance

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)	

Type				Technical properties
		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)	

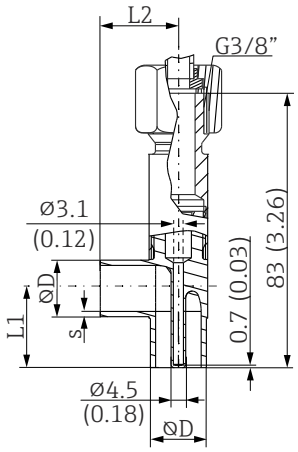
Due to the small immersion length U, the use of iTHERM QuickSens inserts is recommended.

T-piece, optimized (no welding, no dead legs)

Type	Version		Dimensions in mm (in)			Technical properties
			ØD	L	s [1]	
T-piece for weld-in as per DIN 11865 (series A, B and C) 	Series A	DN10 PN25	13 mm (0.51 in)	48 mm (1.89 in)	1.5 mm (0.06 in)	▪ $P_{max.}$ = 25 bar (362 psi) ▪ 3-A marked [2] and EHEDG certified [2] ▪ ASME BPE compliance [2]
		DN15 PN25	19 mm (0.75 in)			
		DN20 PN25	23 mm (0.91 in)			
		DN25 PN25	29 mm (1.14 in)			
		DN32 PN25	32 mm (1.26 in)			
	Series B	DN13.5 PN25	13.5 mm (0.53 in)		1.6 mm (0.063 in)	
		DN17.2 PN25	17.2 mm (0.68 in)			
		DN21.3 PN25	21.3 mm (0.84 in)			
		DN26.9 PN25	26.9 mm (1.06 in)			
		DN33.7 PN25	33.7 mm (1.33 in)		2 mm (0.08 in)	
	Series C	DN12.7 PN25 (½")	12.7 mm (0.5 in)		1.65 mm (0.065 in)	
		DN19.05 PN25 (¾")	19.05 mm (0.75 in)			
		DN25.4 PN25 (1")	25.4 mm (1 in)			
		DN38.1 PN25 (1½")	38.1 mm (1.5 in)			

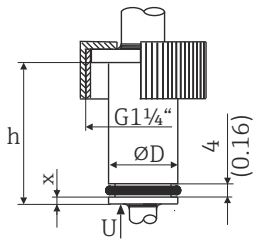
1) Wall thickness
2) Applies to ≥ DN25. The radius ≥ 3.2 mm (⅛ in) cannot be maintained for smaller nominal diameters.

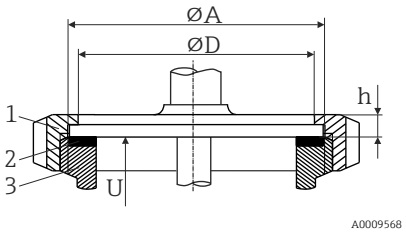
Elbow piece, optimized (no welding, no dead legs)

Type	Version		Dimensions				Technical properties
			ΦD	L1	L2	s [1]	
Elbow piece for weld-in as per DIN 11865 (series A, B and C)  	Series A	DN10 PN25	13 mm (0.51 in)	24 mm (0.95 in)		1.5 mm (0.06 in)	▪ $P_{max.}$ = 25 bar (362 psi) ▪ 3-A marked [2] and EHEDG certified [2] ▪ ASME BPE compliance [2]
		DN15 PN25	19 mm (0.75 in)	25 mm (0.98 in)			
		DN20 PN25	23 mm (0.91 in)	27 mm (1.06 in)			
		DN25 PN25	29 mm (1.14 in)	30 mm (1.18 in)			
		DN32 PN25	35 mm (1.38 in)	33 mm (1.3 in)			
	Series B	DN13.5 PN25	13.5 mm (0.53 in)	22 mm (0.87 in)		1.6 mm (0.063 in)	
		DN17.2 PN25	17.2 mm (0.68 in)	24 mm (0.94 in)			
		DN21.3 PN25	21.3 mm (0.84 in)	26 mm (1.02 in)			
		DN26.9 PN25	26.9 mm (1.06 in)	29 mm (1.14 in)			
		DN33.7 PN25	33.7 mm (1.33 in)	32 mm (1.26 in)		2.0 mm (0.08 in)	
	Series C	DN12.7 PN25 (½")	12.7 mm (0.5 in)	24 mm (0.95 in)		1.65 mm (0.065 in)	
		DN19.05 PN25 (¾")	19.05 mm (0.75 in)	25 mm (0.98 in)			
		DN25.4 PN25 (1")	25.4 mm (1 in)	28 mm (1.1 in)			
		DN38.1 PN25 (1½")	38.1 mm (1.5 in)	35 mm (1.38 in)			

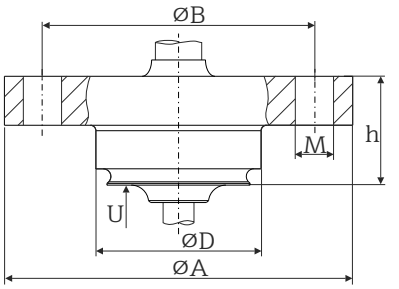
1) Wall thickness
2) Applies to ≥ DN25. The radius ≥ 3.2 mm (⅛ in) cannot be maintained for smaller nominal diameters.

Due to the short immersion length U, the use of iTHERM QuickSens inserts is generally recommended for T-piece/elbow piece process connections according to DIN 11865.

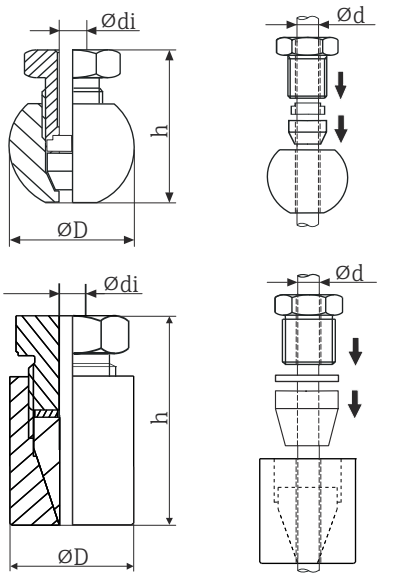
Type	Version, dimensions ΦD x h	Technical properties
Ingold connection  	ϕ25 mm (0.98 in) x 30 mm (1.18 in) x = 1.5 mm (0.06 in)	$P_{max.}$ = 25 bar (362 psi) A seal is included in the scope of delivery. V75SR material: Complies with FDA, 3-A Sanitary Standard 18-03 Class 1 and USP Class VI
	ϕ25 mm (0.98 in) x 46 mm (1.81 in) x = 6 mm (0.24 in)	

Type	Version	Dimensions			Technical properties
		ØD	ØA	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.

Type	Version	Dimensions					Technical properties
		ΦA	ΦB	ΦD	Φd	h	
Neumo Biocontrol  A0018497	D25 PN16	64 mm (2.52 in)	50 mm (1.97 in)	30.4 mm (1.2 in)	7 mm (0.28 in)	20 mm (0.79 in)	▪ $P_{max.}$ = 16 bar (232 psi) ▪ With 3-A symbol
	D50 PN16	90 mm (3.54 in)	70 mm (2.76 in)	49.9 mm (1.97 in)	9 mm (0.35 in)	27 mm (1.06 in)	
	D65 PN25	120 mm (4.72 in)	95 mm (3.74 in)	67.9 mm (2.67 in)	11 mm (0.43 in)		

Compression fitting

Type	Version	Dimensions			Technical properties [1]
	Spherical or cylindrical	Ødi	ØD	h	
Compression fitting TK40 for weld-in 	Spherical Material of sealing taper PEEK or 316L Thread G¼"	6.3 mm (0.25 in) [2]	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
	Cylindrical Material of sealing taper ELASTOSIL® Thread G½"	6.2 mm (0.24 in) [2]	30 mm (1.18 in)	57 mm (2.24 in)	▪ $P_{max.}$ = 10 bar (145 psi) ▪ $T_{max.}$ for ELASTOSIL® sealing taper = +200 °C (+392 °F), tightening torque = 5 Nm ▪ The Elastosil® compression fitting is EHEDG tested and 3-A marked
		9.2 mm (0.36 in)			

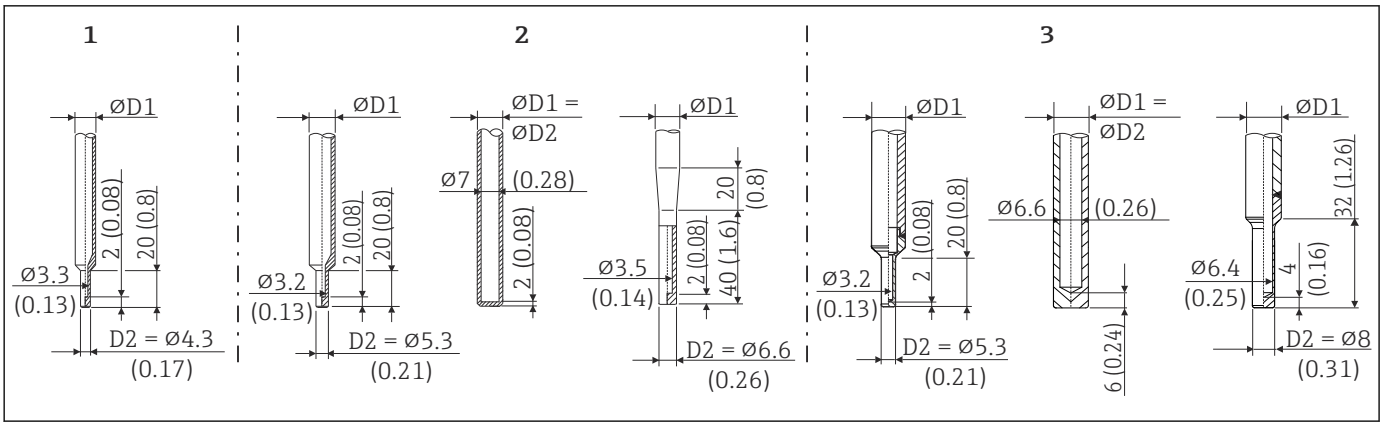
1) All the pressure specifications apply for cyclic temperature load
2) For insert or thermowell diameter Ød = 6 mm (0.236 in).

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.

Shape of tip

The thermal response time, the reduction of the flow cross-section and the mechanical load that occurs in the process are the criteria that matter when selecting the shape of the tip. Advantages of using reduced or tapered thermometer tips:
- A smaller tip shape has less impact on the flow characteristics of the pipe carrying the medium.
- The flow characteristics are optimized, thereby increasing the stability of the thermowell.
- Endress+Hauser offers users a range of thermowell tips to meet every requirement:
  - Reduced tip with Ø4.3 mm (0.17 in) and Ø5.3 mm (0.21 in): walls of lower thickness significantly reduce the response times of the overall measuring point.
  - Tapered tip with Ø6.6 mm (0.26 in) and reduced tip with Ø8 mm (0.31 in): walls of greater thickness are particularly well suited to applications with a higher degree of mechanical load or wear (e.g. pitting, abrasion etc.).



14 *Thermowell tips available (reduced, straight or tapered)*

Item no.	Thermowell (ØD1)		Insert (ØID)
1	Ø6 mm (¼ in)	Reduced tip	Ø3 mm (⅛ in)
2	Ø9 mm (0.35 in)	▪ Reduced tip with Ø5.3 mm (0.21 in) ▪ Straight tip ▪ Tapered tip with Ø6.6 mm (0.26 in)	▪ Ø3 mm (⅛ in) ▪ Ø6 mm (¼ in) ▪ Ø3 mm (⅛ in)
3	Ø12.7 mm (½ in)	▪ Reduced tip with Ø5.3 mm (0.21 in) ▪ Straight tip ▪ Reduced tip with Ø8 mm (0.31 in)	▪ Ø3 mm (⅛ in) ▪ Ø6 mm (¼ in) ▪ Ø6 mm (¼ in)

It is possible to check the mechanical loading capacity as a function of the installation and process conditions online in the TW Sizing Module for thermowells in the Endress+Hauser Applicator software. See 'Accessories' section.

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. → 43
- 3-A authorization no. 1144, 3-A Sanitary Standard 74-07. Listed process connections. → 43
- ASME BPE, certificate of conformity can be ordered, option 580/KW in the Product Configurator, → 56
- 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
- PWIS-free (PWIS = paint-wetting impairment substances as per DIL0301), 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**.

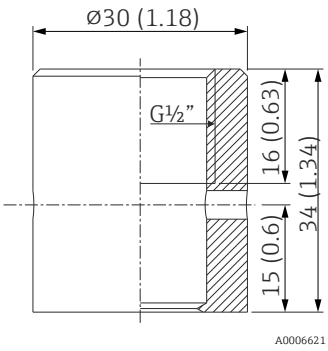
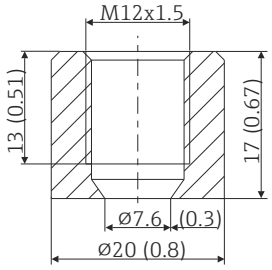
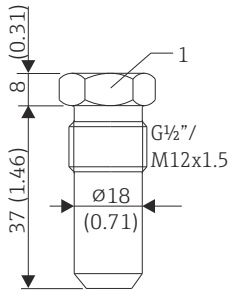
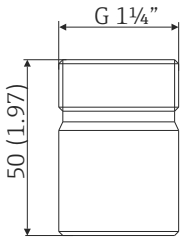
Product Configurator - the tool for individual product configuration

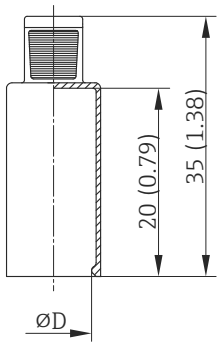
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability 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.

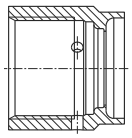
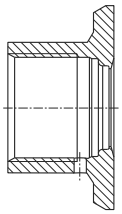
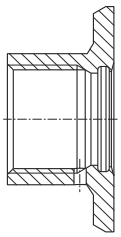
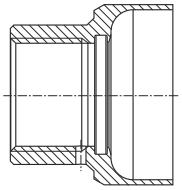
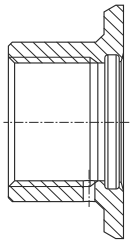
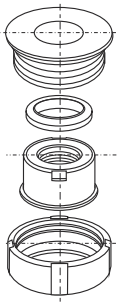
Device-specific accessories

Accessory	Description
Welding boss with sealing taper (metal - metal)  	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  *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) 	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

Flexible handle cap to cover the QuickNeck bottom part  A0027201	Diameter ØD: 24 to 26 mm (0.94 to 1.02 in) Material: Thermoplastic polyolefin - elastomer (TPE), free from plasticizers Maximum temperature: +150 °C (+302 °F) **Order number:** 71275424

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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