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Technical Information
iTHERM CompactLine TM311 Compact thermometer

Metric/imperial, compact RTD thermometer with 4-20 mA/IO-Link output for industrial and hygienic applications

Application

The compact thermometer measures the process temperature with an RTD sensor element (Pt100 Class A, 4-wire). An optional built-in transmitter converts the Pt100 input signal. The version of the device with integrated electronics automatically detects the connection version (IO-Link or 4-20 mA).

- Developed for universal use in hygienic and aseptic applications in the food & beverages and pharmaceutical industries, and for optimum standardization for machine and skid builders.
- Measuring range: −50 to +200 °C (−58 to +392 °F)
- Pressure range: up to 50 bar (725 psi)
- Protection class: IP69
- Output

Your benefits

Quick installation and easy commissioning:
- Small, compact design, made entirely of stainless steel
- M12 connection with IP69 protection for easy electrical connection
- Pt100, 4-wire connection or self-detecting, universal output (IO-Link and 4 to 20 mA)
- Can also be ordered with preconfigured measuring range

Outstanding measurement properties thanks to innovative sensor technology:
- Extremely short response times
- Very accurate even with short immersion lengths
- Sensor-transmitter-matching increases measurement accuracy

Safe operation with certificates and approvals:
- Device safety according to EN 610101-1 and CSA C/US
- Electromagnetic compatibility as per NAMUR NE21
- Diagnostics information can be selected according to NAMUR NE43
- Hygiene-compliant design with 3-A marking
- Marine approval

Endress+Hauser
People for Process Automation

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Function and system design

Measuring principle

Resistance thermometer (RTD):

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

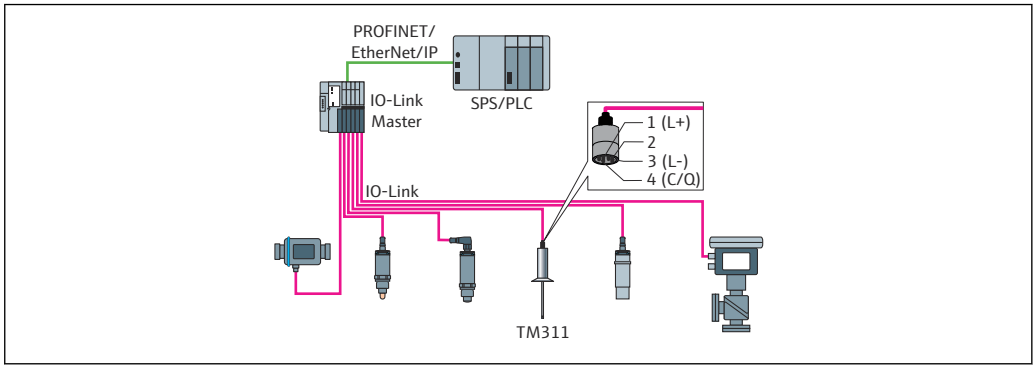
Thin film resistance sensors (TF):

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 are their smaller sizes and better vibration resistance.

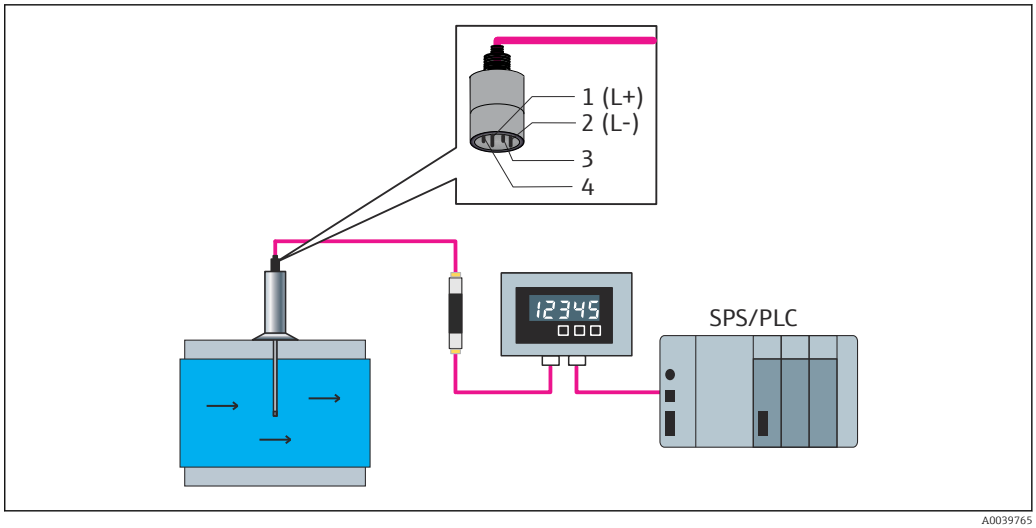
Measuring system

The device measures the process temperature with a Pt100 sensor element (class A, 4-wire). An optional built-in transmitter converts the Pt100 input signal. The version of the device with integrated electronics automatically detects the connection version (IO-Link or 4 to 20 mA).

A broad portfolio of optimized components for the temperature measuring point is available to ensure seamless integration of the measuring point:
- Power supply unit/barrier
- Display units
- Overvoltage protection
- IO-Link master
- IO-Link configuration tool

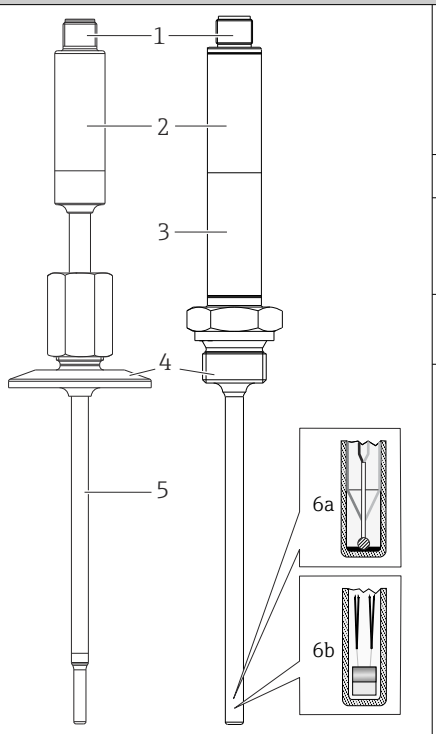


1 M12 connection with IO-Link communication mode



2 M12 connection with 4 to 20 mA communication mode, RIA15 indicator and RN22/RN42 active barrier.

Equipment architecture

Design		Options
	1: Electrical connection, output signal 2: Transmitter housing	**Your benefits:** ▪ M12, 4-pin connector, reduced cost and effort, incorrect wiring is prevented ▪ Optimum protection, IP69 as standard ▪ Compact, integrated transmitter (IO-Link and 4 to 20 mA)
	3: Extension neck	Optionally available if process temperature is too high for the electronics
	4: Process connection → 🖹 25	Over 50 different versions for industrial, hygienic and aseptic applications.
	5: Thermowell	▪ Versions with and without thermowell (insert in direct contact with process) ▪ Thermowell diameter 6 mm and optimized tee and elbow thermowells
	6: Insert with: 6a: iTHERM TipSens 6b: Pt100 (TF), basic	**Your benefits:** ▪ **iTHERM TipSens** - insert with shortest response times: ▪ 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 ▪ **Pt100 (TF), basic** ▪ Excellent cost-performance ratio

Input

Measuring range

Pt100 (TF) basic	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens	−50 to +200 °C (−58 to +392 °F)

Output

Output signal

Order code 020, option A

Sensor output	Pt100, 4-wire connection, class A

Order code 020, option B

Analog output	4 to 20 mA; variable measuring range
Digital output	C/Q (IO-Link or switch output)

Order code 020, option C

Analog output	4 to 20 mA; measuring range 0 to 150 °C (32 to 302 °F)
Digital output	C/Q (IO-Link or switch output)

Switching capacity

- 1 × PNP switch output
- Switch status ON Ia ≤ 200 mA; switch status OFF Ia ≤ 10 µA
- Switch cycles>10 000 000
- Voltage drop PNP ≤ 2 V
- Overload protection
  - Automatic load testing of switching current
  - If a current of over 220 mA flows in the ON switch state, the device switches to a safe state
  - Diagnostic message **Overload at switch output**
- Switch functions
  - Hysteresis or window function
  - Normally-closed contact or normally-open contact
- No pull-down resistor is integrated in the device for the switch output.

Switch output

Response time ≤ 100 ms

Failure information

Failure information is generated if the measuring information is missing or not valid. The device displays the three diagnostic messages with the highest priority.

In the IO-Link mode, the device transmits all the failure information digitally.

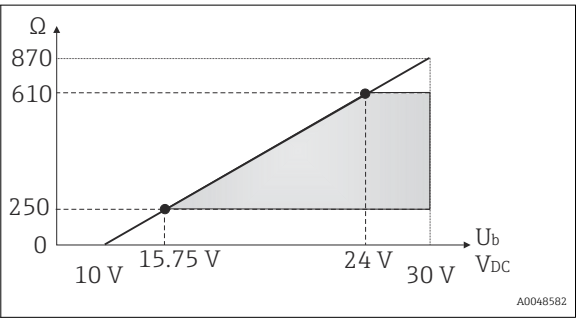
In the 4 to 20 mA mode, the device transmits the failure information according to NAMUR NE43:

Switch output	The switch output switches to **open** in the fault state.

Underranging	Linear decrease from 4.0 to 3.8 mA
Overranging	Linear increase from 20.0 to 20.5 mA
Failure e.g. sensor defective	≤ 3.6 mA (**low**) or ≥ 21 mA (**high**) can be selected The **high** alarm setting can be set between 21.5 mA and 23 mA, thus providing the flexibility needed to meet the requirements of various control systems.

Load

$R_{b\ max.} = (U_{b\ max.} - 10\ V) / 0.023\ A$ (current output)



Linearization/transmission behavior

Temperature - linear

Damping

Configurable sensor input damping	0 to 120 s
Factory setting	0 s

Input current required

- ≤ 3.5 mA for 4 to 20 mA
- ≤ 9 mA for IO-Link

Maximum current consumption

≤ 23 mA for 4 to 20 mA

Switch-on delay

2 s

Protocol-specific data

IO-Link information

IO-Link is a point-to-point connection for communication between the device and an IO-Link master. The IO-Link communication interface offers the following options:
- Direct access to the process data
- Direct access to the diagnostic data
- Parameter configuration during operation

The device supports the following features:

IO-Link specification	Version 1.1
IO-Link Smart Sensor Profile 2nd Edition	Supported: ▪ Identification ▪ Diagnosis ▪ Digital Measuring Sensor (as per SSP type 3.1)
SIO mode	Yes
Transmission rate	COM2; 38.4 kBaud
Minimum period	10 ms
Process data width	4 byte
IO-Link data storage	Yes
Block configuration according to V1.1	Yes
Device operational	The device is operational 0.5 s after the supply voltage is applied (first valid measured value after 2 s).

Device description

To integrate field devices into a digital communication system, the IO-Link system requires a description of the device parameters.

This information is contained in the device description (IODD [1]), which is provided to the IO-Link master via generic modules during commissioning of the communication system.

The IODD can be downloaded as follows:
- Endress+Hauser: www.endress.com
- IODDfinder: http://ioddfinder.io-link.com

Write protection for device parameters

Write protection for device parameters is implemented via system commands.

Power supply

Supply voltage

Electronic version	Supply voltage
IO-Link/4 to 20 mA	U_b = 10 to 30 V_{DC}, protected against reverse polarity IO-Link communication is guaranteed only if the supply voltage is at least 15 V. If the supply voltage is <15 V, the device displays a diagnostic message and deactivates the switch output.

The device must be operated with a type-examined transmitter power supply unit.

Additional overvoltage protection is required for marine applications.

1) Input/Output Device Description

Power supply failure

- To comply with electrical safety standards CAN/CSA-C22.2 No. 61010-1 or UL 61010-1, the device must be operated using a power supply with a suitably limited current circuit in accordance with UL/EN/IEC 61010-1 Chapter 9.4 or Class 2 as per UL 1310, "SELV or Class 2 circuit".
- Overvoltage behavior (> 30 V)
  The device works continuously up to 35 V_{DC} without any damage. If the supply voltage is exceeded, the specified characteristics are no longer guaranteed.
- Behavior in the event of undervoltage
  If the supply voltage falls below the minimum value ~7 V, the device switches off in a defined manner (status as if not supplied with power).

Electrical connection

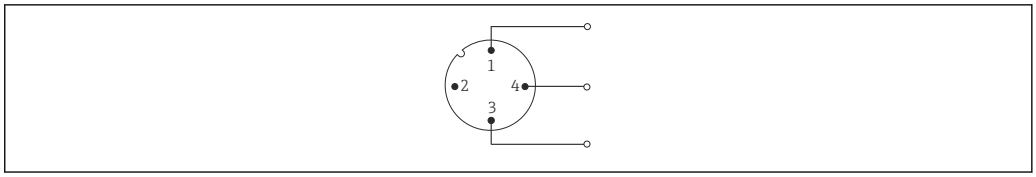
According to the 3-A Sanitary Standard and EHEDG, electrical connecting cables must be smooth, corrosion-resistant and easy to clean.

M12 plug with 4 pins and "A" coding, in accordance with IEC 61076-2-101

▶ Do not overtighten the M12 plug, as this could damage the device. Maximum torque: 0.4 Nm (M12 knurl)

In the version with electronics, the device function is defined by the pin assignment of the M12 connector. Communication is either IO-Link or 4 to 20 mA.

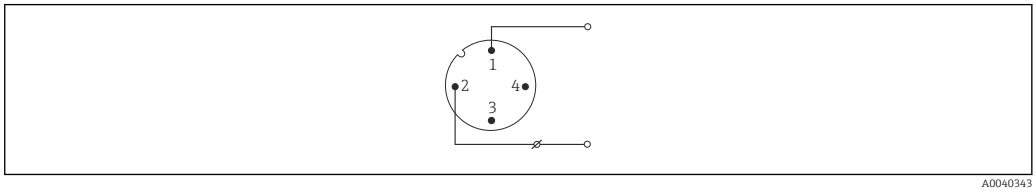
IO-Link operating mode



3 Pin assignment, device plug

1 Pin 1 - power supply 15 to 30 V_{DC}
2 Pin 2 - not used
3 Pin 3 - power supply 0 V_{DC}
4 Pin 4 - C/Q (IO-Link or switch output)

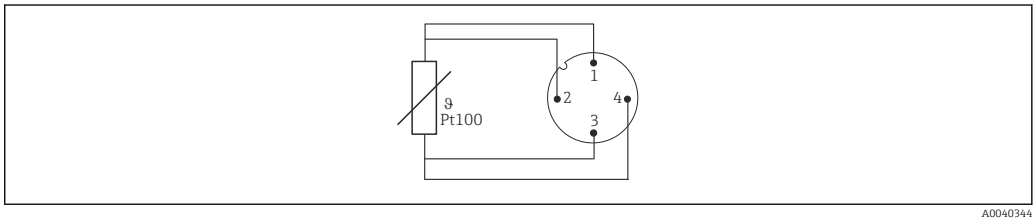
4 to 20 mA operating mode



4 Pin assignment, device plug

1 Pin 1 - power supply 10 to 30 V_{DC}
2 Pin 2 - power supply 0 V_{DC}
3 Pin 3 - not used
4 Pin 4 - not used

Without electronics



5 Pin assignment of device plug: Pt100, 4-wire connection

Performance characteristics

Reference operating conditions

Adjustment temperature (ice bath)	0 °C (32 °F) for sensor
Ambient temperature range	25 °C ± 3 °C(77 °F ± 5 °F) for electronics
Supply voltage	24 V_{DC} ± 10 %
Relative humidity	< 95 %

Maximum measured error

In accordance with DIN EN 60770 and the reference conditions specified above. The measured error data correspond to ±2 σ (Gaussian distribution). The data include non-linearities and repeatability.

Measured error (according to IEC 60751) in °C = 0.15 + 0.002 |T|

|T| = Numerical value of the temperature in °C without regard to algebraic sign.

Thermometer without electronics

Standard	Description	Measuring range	Measured error (±)	
			Maximum [1]	Based on measured value [2]
IEC 60751	Pt100 Cl. A	−50 to +200 °C (−58 to +392 °F)	0.55 °C (0.99 °F)	ME = ± (0.15 °C (0.27 °F) + 0.002 * |T|)

1) Maximum measured error for the specified measuring range.
2) Deviations from maximum measured error possible due to rounding.

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

Thermometer with electronics

Standard	Description	Measuring range	Measured error (±)		
			Digital [1]		D/A [2]
			Maximum	Based on measured value	
IEC 60751	Pt100 Cl. A	−50 to +200 °C (−58 to +392 °F)	≤ 0.48 °C (0.86 °F)	ME = ± (0.215 °C (0.39 °F) + 0.134% * (MV - LRV))	0.05 % (≙ 8 µA)

1) Measured value transmitted via IO-Link.
2) Percentages based on the configured span of the analog output signal.

Thermometer with electronics and sensor-transmitter-matching / increased accuracy

Standard	Description	Measuring range	Measured error (±)		
			Digital [1]		D/A [2]
			Maximum	Based on measured value	
IEC 60751	Pt100 Cl. A	−50 to +200 °C (−58 to +392 °F)	≤ 0.14 °C (025 °F)	ME = ± (0.127 °C (0.23 °F) + 0.0074% * (MV - LRV))	0.05 % (≙ 8 µA)

1) Measured value transmitted via IO-Link.
2) Percentages based on the configured span of the analog output signal.

MV = measured value

LRV = lower range value of the sensor in question

Total measured error of transmitter at current output = $\sqrt{(\text{Measured error digital}^2 + \text{Measured error D/A}^2)}$

Sample calculation with Pt100, measuring range 0 to +150 °C (+32 to +302 °F), ambient temperature+25 °C (+77 °F), supply voltage24 V and sensor-transmitter matching:

Measured error digital = 0.127 °C (0.229 °F) + 0.0074 % x [150 °C (302 °F) - (−50 °C (−58 °F))]:	0.14 °C (0.25 °F)
Measured error D/A = 0.05 % x 150 °C (302 °F)	0.08 °C (0.14 °F)
Measured error digital value (IO-Link):	0.14 °C (0.25 °F)
Measured error analog value (current output): √(Measured error digital² + Measured error D/A²)	0.16 °C (0.29 °F)

Sample calculation with Pt100, measuring range 0 to +150 °C (+32 to +302 °F), ambient temperature +35 °C (+95 °F), supply voltage 30 V:

Measured error digital = 0.215 °C (0.387 °F) + 0.134% x [150 °C (302 °F) - (−50 °C (−58 °F))]:	0.48 °C (0.86 °F)
Measured error D/A = 0.05 % x 150 °C (302 °F)	0.08 °C (0.14 °F)
Influence of ambient temperature (digital) = (35 - 25) x (0.004 % x 200 °C (360 °F)), at least 0.008 °C (0.014 °F)	0.08 °C (0.14 °F)
Influence of ambient temperature (D/A) = (35 - 25) x (0.003 % x 150 °C (302 °F))	0.05 °C (0.09 °F)
Influence of supply voltage (digital) = (30 - 24) x (0.004 % x 200 °C (360 °F)), at least 0.008 °C (0.014 °F)	0.05 °C (0.09 °F)
Influence of supply voltage (D/A) = (30 - 24) x (0.003 % x 150 °C (302 °F))	0.03 °C (0.05 °F)
Measured error digital value (IO-Link): √(Measured error digital² + Influence of ambient temperature (digital)² + Influence of supply voltage (digital)²	0.49 °C (0.88 °F)
Measured error analog value (current output): √(Measured error digital² + Measured error D/A² + Influence of ambient temperature (digital)² + Influence of ambient temperature (D/A)² + Influence of supply voltage (digital)² + Influence of supply voltage (D/A)²	0.50 °C (0.90 °F)

Long-term drift

	1 month	3 months	6 months	1 year	3 years	5 years
Digital output IO-Link	± 9 mK	± 15 mK	± 19 mK	± 23 mK	± 28 mK	± 31 mK
Current output Measuring range −50 to +200 °C (−58 to +360 °F)	± 2.5 µA	± 4.3 µA	± 5.4 µA	± 6.4 µA	± 8.0 µA	± 8.8 µA

Operating influences

The measurement error data correspond to ±2 σ (Gaussian distribution).

Standard	Designation	Ambient temperature Influence (+-) per 1 °C (1.8 °F) change			Supply voltage Influence (+-) per 1 V change		
		Digital [1]		D/A [2]	Digital [1]		D/A [2]
		Maximum [3]	Based on measured value [4]		Maximum [3]	Based on measured value [4]	
IEC 60751	Pt100 Cl. A	0.014 °C (0.025 °F)	0.004 % * (MV - LRV), min. 0.008 °C (0.0144 °F)	0.003 % (≙0.48 µA)	0.014 °C (0.025 °F)	0.004 % * (MV - LRV), min. 0.008 °C (0.0144 °F)	0.003 % (≙0.48 µA)

1) Measured value transmitted via IO-Link.
2) Percentages based on the configured span of the analog output signal.
3) Maximum measurement error for the specified measuring range.
4) Deviations from maximum measurement error possible due to rounding.

MV = measured value

LRV = lower range value of the sensor in question

Total measurement error of transmitter at current output = √(Measurement error digital² + Measurement error D/A²)

Device temperature

The displayed device temperature has a maximum measured error of ±8 K.

Response time T_{63} and T_{90}

Tests in water at 0.4 m/s (1.3 ft/s) according to IEC 60751; temperature changes in increments of 10 K. Response times measured for the version without electronics.

Response time without heat transfer paste

Design	Sensor	t63	t_{90}
6 mm direct contact, straight tip	Pt100 (TF) basic	5 s	< 20 s
6 mm direct contact, straight tip	iTHERM TipSens	1 s	1.5 s
6 mm thermowell, reduced tip (4.3 × 20 mm)	iTHERM TipSens	1 s	3 s

Response time with heat transfer paste [1)]

Design	Sensor	t63	t_{90}
6 mm thermowell, reduced tip (4.3 × 20 mm)	iTHERM TipSens	1 s	2.5 s

1) Between the insert and the thermowell

Electronics response time

Max. 1 s

When recording step responses, it is important to bear in mind that the response times of the sensor might be added to the specified times.

Sensor current

≤ 1 mA

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 into which the DUT and the reference thermometer, where necessary, can project to a sufficient degree, are typically used for thermometer calibrations.

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 at 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 temperature transmitters are used, this conversion error can be reduced significantly by sensor-transmitter-matching:

- Calibration at least at three temperatures and determination of the actual temperature sensor characteristic curve
- Adjustment of the sensor-specific polynomial function using appropriate 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 the connected resistance thermometer

The manufacturer offers this sensor-transmitter-matching as a separate service. Furthermore, the sensor-specific polynomial coefficients of platinum resistance thermometers are indicated on every calibration protocol where possible, e.g. at least three calibration points.

For the device, the manufacturer offers standard calibrations at a reference temperature of −50 to +200 °C (−58 to +392 °F) based on the ITS90 (International Temperature Scale). Calibrations in other temperature ranges are available from your local sales center on request. Calibrations are traceable to national and international standards. The calibration certificate is referenced to the serial number of the device.

Installation

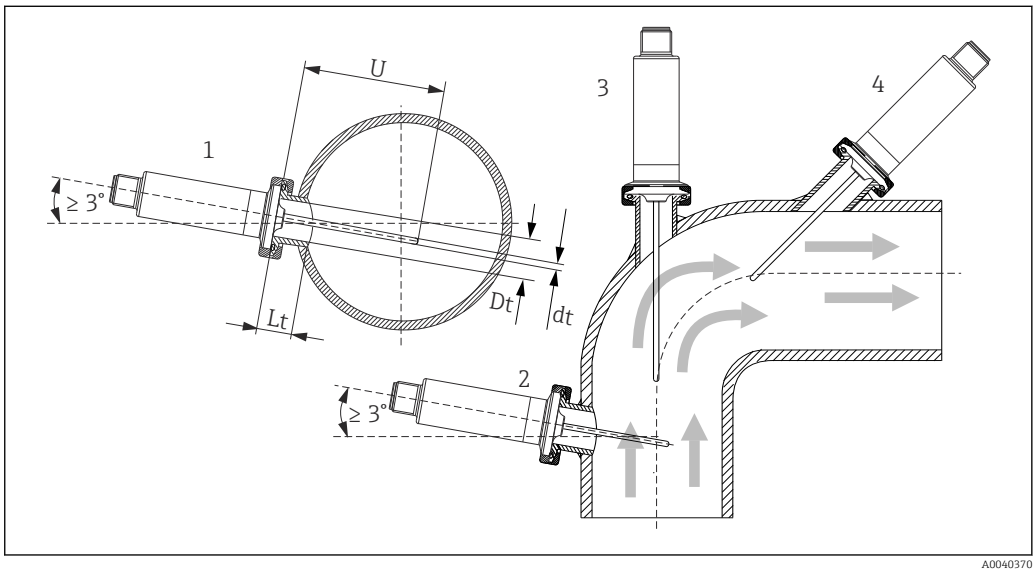
Orientation

No restrictions. Ensure self-draining in the process. 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 compact thermometer can considerably influence the measurement accuracy. If the immersion length is too short, measurement errors can occur as a result of heat dissipation via the process connection and the vessel wall. For installation in a pipe, an immersion length is therefore recommended that ideally corresponds to half the pipe diameter.

Installation possibilities: pipes, tanks or other plant components.



6 *Installation examples*

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

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

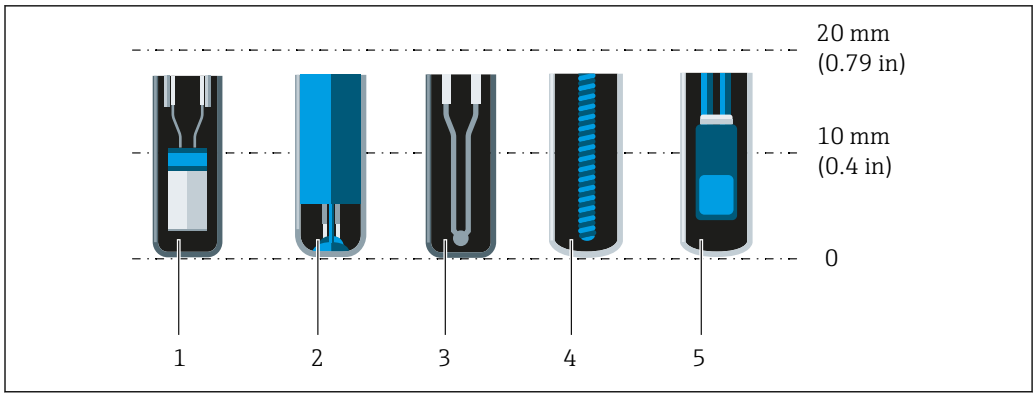
Installation instruction EHEDG/cleanability: Lt ≤ (Dt-dt)

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

The exact position of the sensor element in the thermometer tip must be observed. Available options depend on product and configuration.

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

Available options depend on product and configuration.



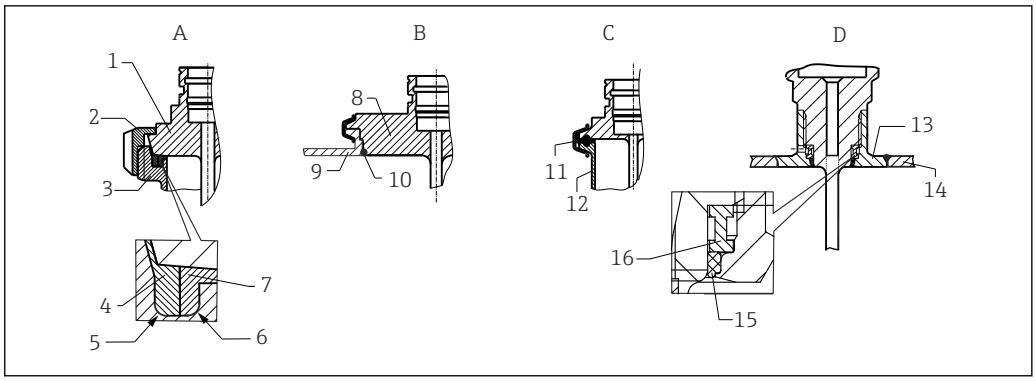
1 *iTHERM StrongSens or iTHERM TrustSens for 5 to 7 mm (0.2 to 0.28 in)*
2 *iTHERM QuickSens for 0.5 to 1.5 mm (0.02 to 0.06 in)*
3 *Thermocouple (not grounded) for 3 to 5 mm (0.12 to 0.2 in)*
4 *Wire-wound sensor for 5 to 20 mm (0.2 to 0.79 in)*
5 *Standard thin-film sensor for 5 to 10 mm (0.2 to 0.39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

To minimize the heat dissipation, 20 to 25 mm of the sensor should extend into the medium beyond the sensor element.

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

Special consideration should be given to tee thermowells, as the immersion length is very short on account of their design, and the measurement error is higher as a result. It is therefore recommended to use elbow thermowells with iTHERM QuickSens sensors.

In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to extend far enough into the process to reach beyond the pipe axis. Installation at an angle (4) could be another solution. When determining the immersion or insertion length, all the parameters of the thermometer and of the medium to be measured must be taken into account (e.g. flow velocity, process pressure).



7 *Detailed installation instructions for hygiene-compliant installation*

A Milk pipe connection according to DIN 11851, only in conjunction with EHEDG-certified, self-centering sealing ring
1 Sensor with milk pipe connection
2 Grooved union 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

⚠ CAUTION

In the event of a defective sealing ring (O-ring) or seal, perform the following steps:

- ▶ Remove the thermometer.
- ▶ Clean the thread and the O-ring joint/sealing surface.
- ▶ Replace the sealing ring or seal.
- ▶ Perform process cleaning after installation.

For welded connections, perform welding work on the process side as follows:

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

Welding work has been carried out properly.

To maintain cleanability, observe the following when installing the thermometer:

1. The installed sensor is suitable for CIP (cleaning in place). Cleaning is carried out in combination with piping or tank. For tank installation, use process connection nozzles to ensure the cleaning assembly directly sprays this area to clean it effectively.
2. The Varivent® connections enable flush-mounted installation.

Cleanability is retained after installation.

Environment

Ambient temperature range

T_a	−40 to +85 °C (−40 to +185 °F)

Storage temperature

T_s	−40 to +85 °C (−40 to +185 °F)

Operating altitude

Up to 2 000 m (6 600 ft) above sea level

Climate class

In accordance with IEC/EN 60654-1, climate class Dx, class 4K4H

Degree of protection

As per IEC/EN 60529 IP69

Depends on the degree of protection of the connection cable → 🖹 37

Shock and vibration resistance

The thermometer meets the requirements of IEC 60751, which specifies shock and vibration resistance of 3 g in the 10 to 500 Hz range.

Electromagnetic compatibility (EMC)

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

- Maximum measurement error during EMC tests: < 1 % of the measuring span
- Interference immunity as per IEC/EN 61326 series, requirements for industrial environments
- Interference emission as per IEC/EN 61326 series, Class B equipment

IO-Link

In I/O-Link mode, only the requirements of IEC/EN 61131-9 are fulfilled.

The connection between the IO-Link master and thermometer is via an unshielded 3-wire cable, maximum 20 m (65.6 ft) in length.

4 to 20 mA

Electromagnetic compatibility complies with all relevant requirements of the IEC/EN 61326 series and NAMUR recommendation EMC (NE21). For more information, see the Declaration of Conformity.

If the connection cable length is 30 m (98.4 ft), a shielded cable must be used.

Electrical safety

- Protection class III
- Overvoltage category II
- Pollution level 2

Process

Process temperature range

The thermometer electronics must be protected against temperatures over 85 °C (185 °F) by an extension neck of the appropriate length.

Device version without electronics (order code 020, option A)

Pt100 TF, basic, without extension neck	−50 to +150 °C (−58 to +302 °F)
Pt100 TF, basic, with extension neck	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens, without extension neck	−50 to +200 °C (−58 to +392 °F)
iTHERM TipSens, with extension neck	−50 to +200 °C (−58 to +392 °F)

Device version with electronics (order code 020, option B, C)

Pt100 TF, basic, without extension neck	−50 to +150 °C (−58 to +302 °F)
Pt100 TF, basic, with extension neck	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens, without extension neck	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens, with extension neck	−50 to +200 °C (−58 to +392 °F)

Thermal shock

Resistant to thermal shock during the CIP/SIP process with a temperature increase 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. Maximum possible process pressures for the individual process connections. → 🖹 25

It is possible to verify the mechanical loading capacity as a function of the installation and process conditions using the online TW Sizing Module for thermowells in the Endress+Hauser Applicator software. → 🖹 35

State of aggregation of the medium

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

Mechanical construction

Design, dimensions

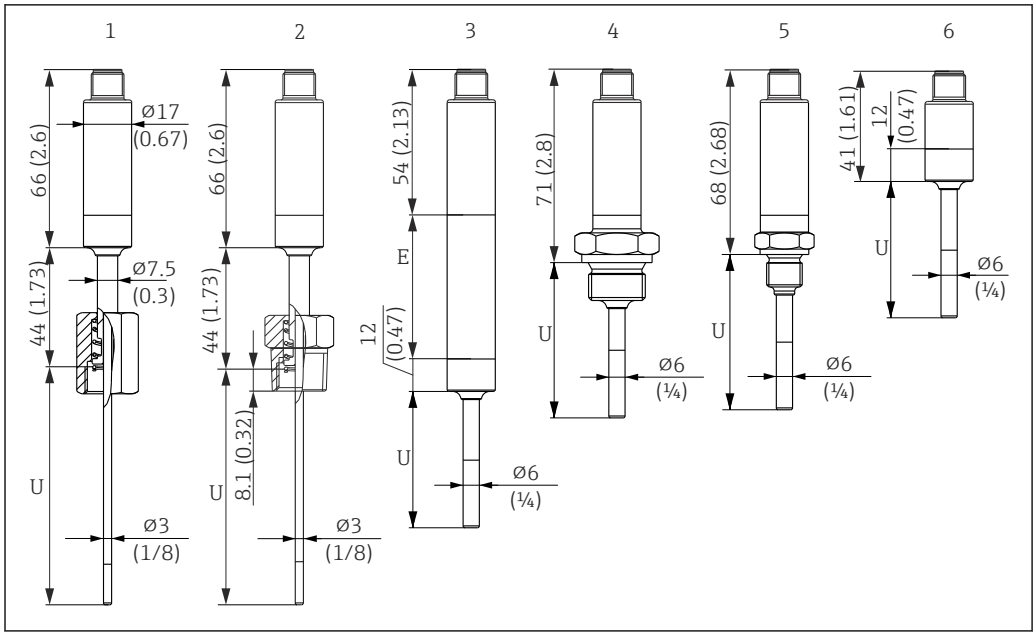
All dimensions in mm (in). The design of the thermometer depends on the thermowell version used:
- Thermometer without a thermowell
- Thermowell diameter 6 mm (¼ in)
- Thermowell version as tee thermowell and elbow thermowell as per DIN 11865/ASME BPE for welding in

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:

Position	Description
B	Thermowell bottom thickness
E	Extension neck length, optional
T	Length of thermowell lagging, pre-defined, depending on the thermowell version
U	Variable immersion length, depending on the configuration

Without thermowell



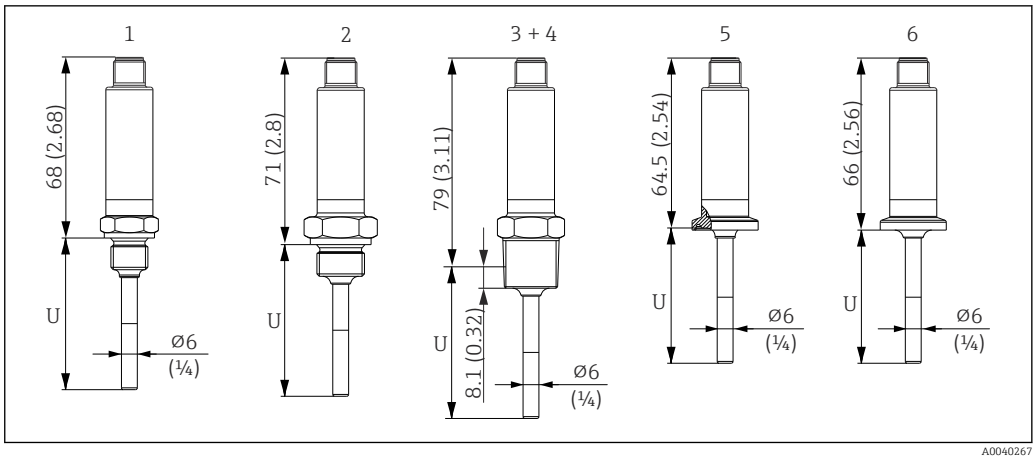
Unit of measurement mm (in)

1 *Thermometer with spring-loaded union nut, G3/8" thread 3 mm for existing thermowell*
2 *Thermometer with spring-loaded NPT½" male thread 3 mm for existing thermowell*
3 *Thermometer without process connection for compression fitting, with extension neck*
4 *Thermometer with G½" male thread*
5 *Thermometer with G¼" male thread*
6 *Thermometer without electronics*

When using an extension neck, the overall length of the device always increases by the length in question, E = 50 mm (1.97 in), regardless of the process connection.

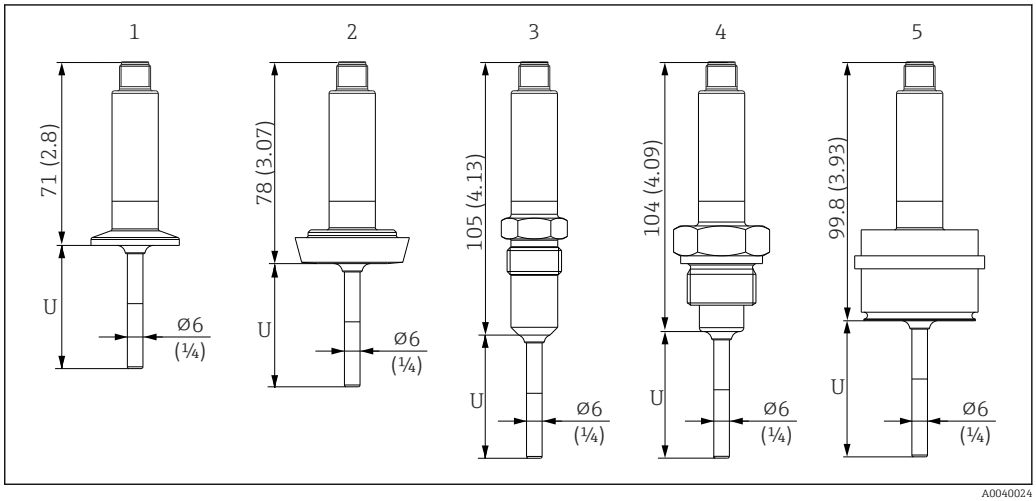
Pay attention to the following equations when calculating the immersion length U for an existing thermowell:

Version 1 (G3/8" union nut)	$U = U_{(thermowell)} + T_{(thermowell)} + 3\ mm - B_{(thermowell)}$
Version 2 (NPT½" male thread)	$U = U_{(thermowell)} + T_{(thermowell)} - 5\ mm$ (-8 mm screw-in depth + 3mm spring travel) $- B_{(thermowell)}$



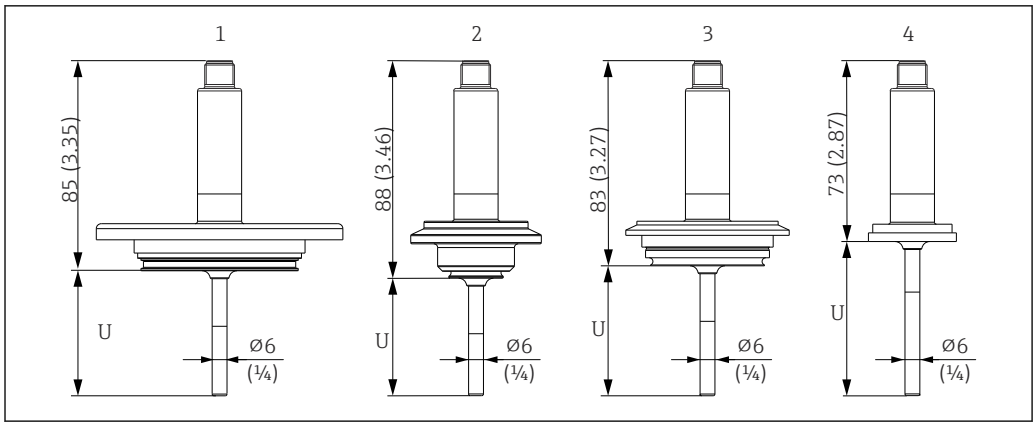
Unit of measurement mm (in)

1 Thermometer with M14 male thread
2 Thermometer with M18 male thread
3 Thermometer with NPT½" male thread
4 Thermometer with NPT¼" male thread
5 Thermometer with Microclamp, DN18 (0.75")
6 Thermometer with Tri-Clamp, DN18 (0.75")



Unit of measurement mm (in)

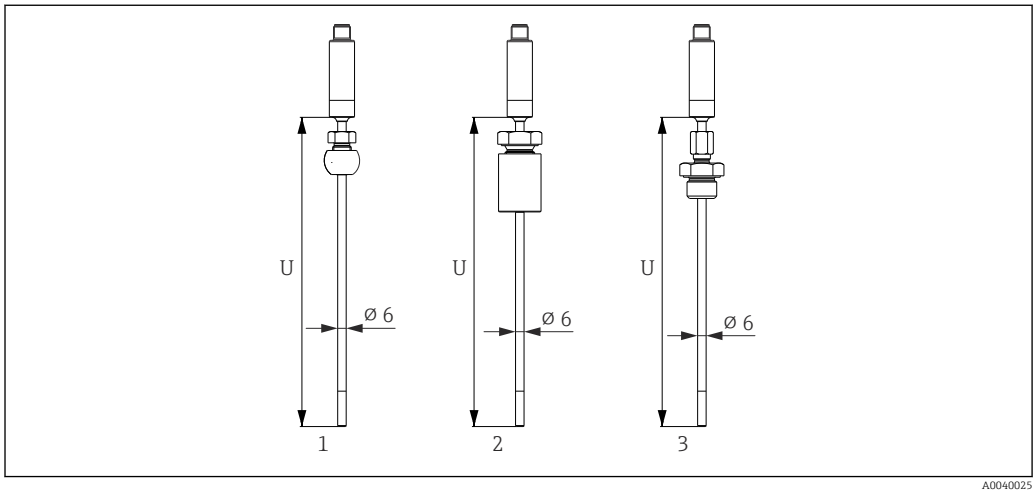
1 Thermometer with Clamp ISO2852 for DN12 to 21.3, DN25 to 38, DN40 to 51
2 Thermometer with milk pipe connection DIN11851 for DN25/DN32/DN40/DN50
3 Thermometer with metal sealing system G½"
4 Thermometer with G¾" male thread ISO228 for FTL31/33/20/50 Liquiphant adapter
5 Thermometer with D45 process adapter



Unit of measurement mm (in)

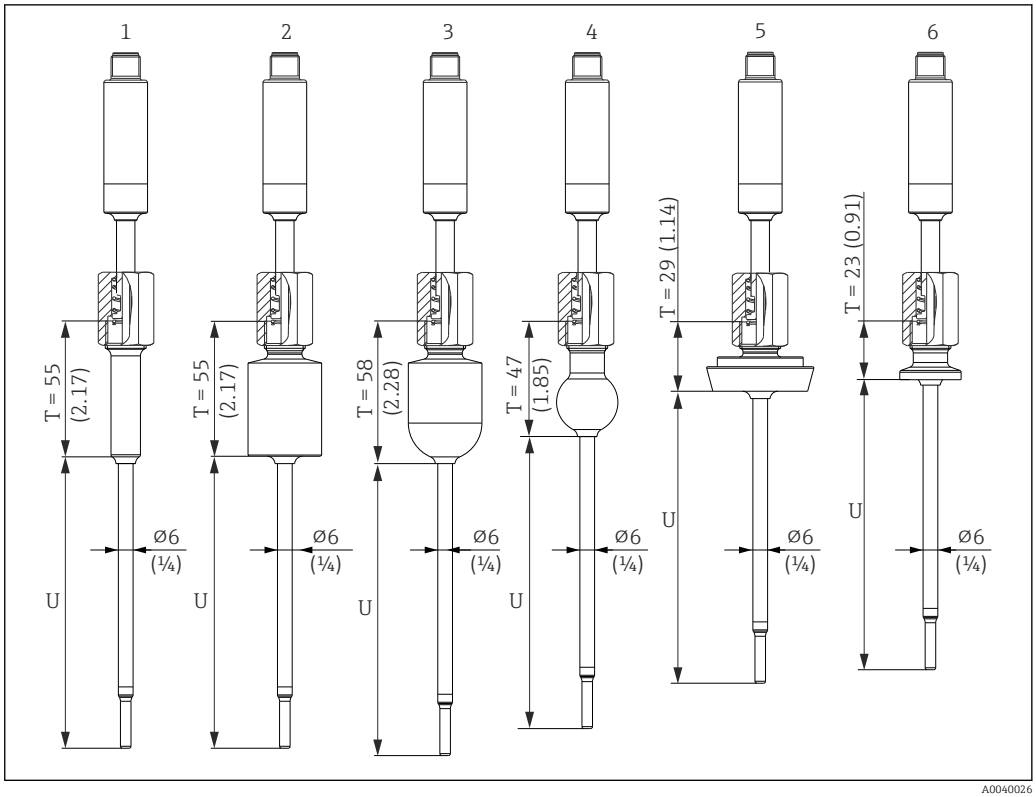
1 Thermometer with APV Inline, DN50
2 Thermometer with Varivent type B, D 31 mm
3 Thermometer with Varivent type F, D 50 mm and Varivent type N, D 68 mm
4 Thermometer with SMS 1147, DN25/DN38/DN51

With compression fitting



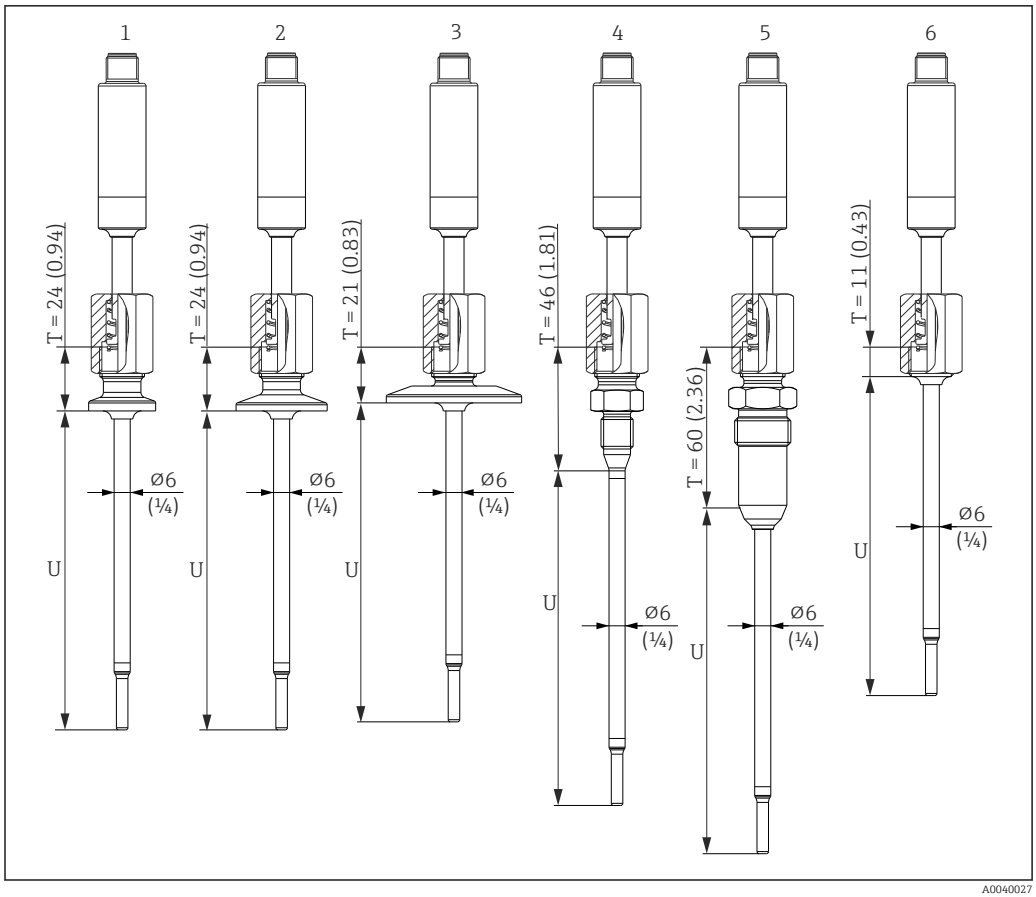
1 Thermometer with compression fitting TK40 spherical, PEEK/316L, sleeve, Ø 25 mm, for welding in
2 Thermometer with compression fittingTK40 cylindrical, ELASTOSIL® sleeve, Ø 25 mm, for welding in
3 Thermometer with compression fitting G½" male thread, TK40-BADA3C, 316L

With thermowell diameter 6 mm (¼ in)



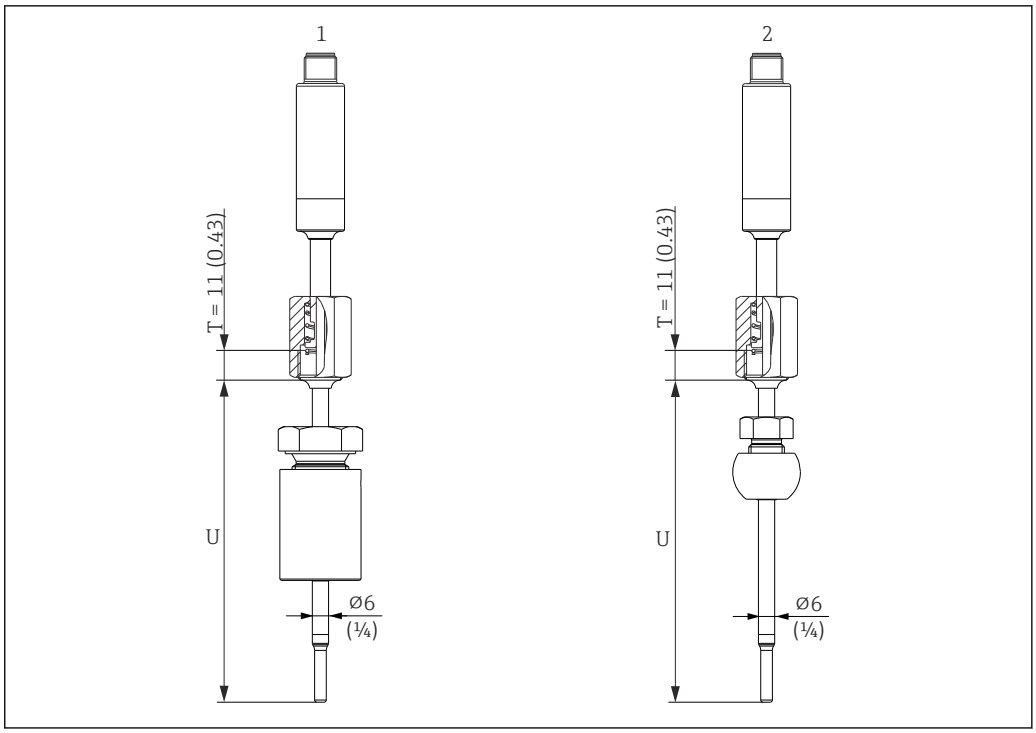
Unit of measurement mm (in)

1 Thermometer with weld-in adapter, cylindrical, D 12 x 40 mm
2 Thermometer with weld-in adapter, cylindrical, D 30 x 40 mm
3 Thermometer with weld-in adapter, spherical-cylindrical, D 30 x 40 mm
4 Thermometer with weld-in adapter, spherical, D 25 mm
5 Thermometer with milk pipe connection DIN11851, DN25/DN32/DN40
6 Thermometer with Microclamp, DN18 (0.75")



Unit of measurement mm (in)

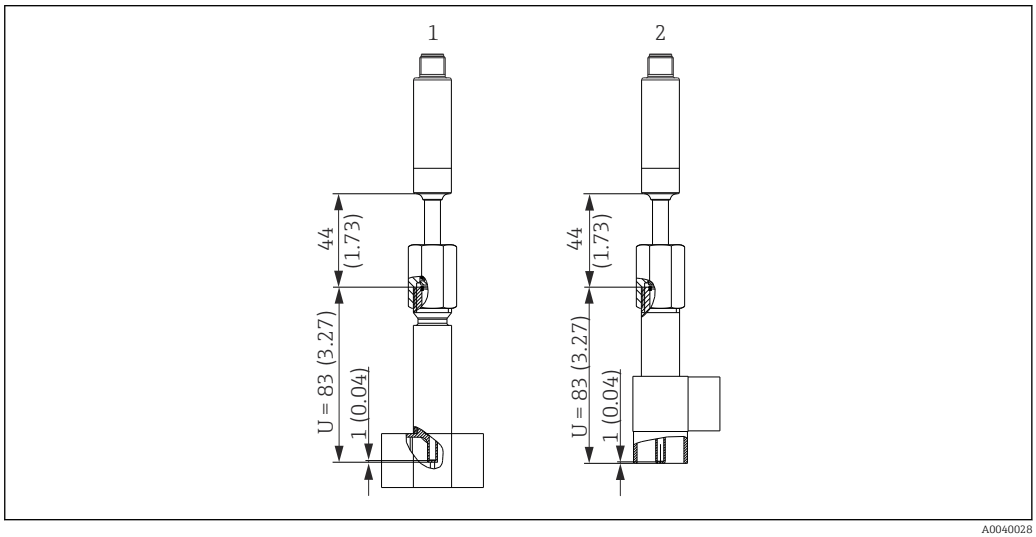
1 *Thermometer with Tri-Clamp version DN18*
2 *Thermometer with Clamp version DN12 to 21.3*
3 *Thermometer with Clamp version DN25 to 38/DN40 to 51*
4 *Thermometer with metal sealing system version, M12 × 1.5*
5 *Thermometer with metal sealing system version, G½"*
6 *Thermometer without process connection*



Unit of measurement mm (in)

1 Thermometer with compression fitting TK40, cylindrical, ELASTOSIL® sleeve, Ø30 mm, for welding in
2 Thermometer with compression fitting TK40, spherical, PEEK/316L sleeve, Ø25 mm, for welding in

Thermowell version as tee thermowell or elbow thermowell



Unit of measurement mm (in)

1 Thermometer with tee thermowell
2 Thermometer with elbow thermowell

- Pipe sizes as per DIN 11865 series A (DIN), B (ISO) and C (ASME BPE)
- 3-A mark for nominal diameters ≥ DN25
- IP69 protection
- Material 1.4435+316L, 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 TipSens inserts is recommended.

Possible combinations of the thermowell versions with the available process connections

Process connection and size	Direct contact,6 mm (¼ in)	Thermowell,6 mm (¼ in)
Without process connection (for installation with compression fitting)	☑	☑
Process adapter D45	☑	-
Compression fitting		
Thread G½"	☑	☑
Cylindrical Ø30 mm	☑	☑
Spherical Ø25 mm	☑	☑
Thread		
G½"	☑	-
G¼"	☑	-
M14x1.5	☑	-
M18x1.5	☑	-
NPT½"	☑	-
Weld-in adapter		
Cylindrical Ø30 x 40 mm	-	☑
Cylindrical Ø12 x 40 mm	-	☑
Spherical-cylindrical Ø30 x 40 mm	-	☑
Spherical Ø25 mm (0.98 in)	-	☑
Clamps according to ISO 2852		
Microclamp/Tri-Clamp DN18 (0.75 in)	☑	☑
DN12 - 21.3	☑	☑
DN25 -38 (1 - 1.5 in)	☑	☑
DN40 - 51 (2 in)	☑	☑
Milk pipe connection according to DIN 11851		
DN25	☑	☑
DN32	☑	☑
DN40	☑	☑
DN50	☑	-
Metal sealing system		
M12x1	-	☑
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	☑	-
SMS 1147		

Process connection and size	Direct contact,6 mm (¼ in)	Thermowell,6 mm (¼ in)
DN25	☑	-
DN38	☑	-
DN51	☑	-

Weight

0.2 to 2.5 kg (0.44 to 5.5 lbs) for standard versions

Material

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

Description	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
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 parts in contact with the process is limited to <1% or <0.5%. ≤3% for weld seams (in accordance with 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. More information is available from the sales organization.

Surface roughness

Specifications for product wetted parts in accordance with EN ISO 21920:

Standard surface, mechanically polished [1]	R_a ≤ 0.76 µm (30 µin)
Mechanically polished [1], buffed [2]	R_a ≤ 0.38 µm (15 µin) [3]
Mechanically polished [1], buffed and electropolished	R_a ≤ 0.38 µm (15 µin) [3]+ electropolished

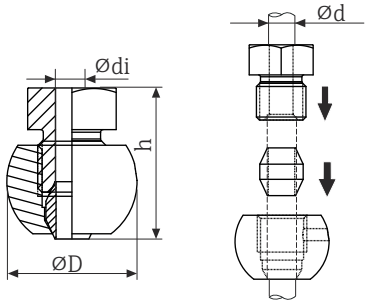
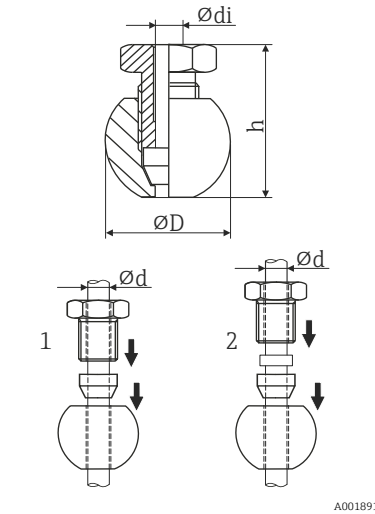
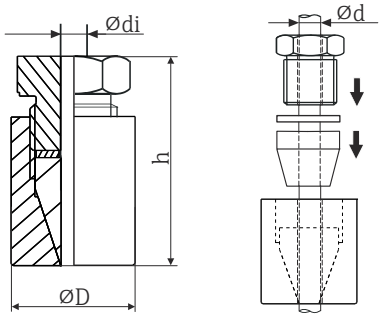
1) Or equivalent treatment that guarantees R_a max.
2) Not compliant with ASME BPE
3) T16% for direct-contact measuring inserts without thermowell, not compliant with ASME BPE

Process connections

The 316L compression fittings can only be used once due to deformation. This applies to all the compression fitting components. 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.

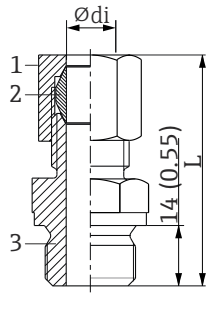
SWAGELOCK or similar fittings are strongly recommended for higher requirements.

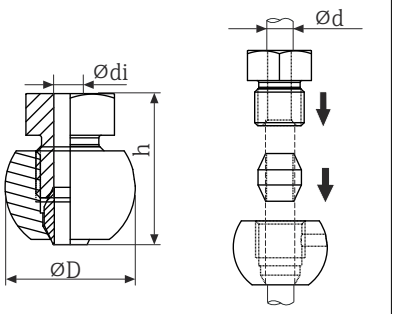
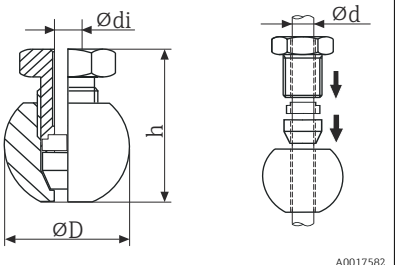
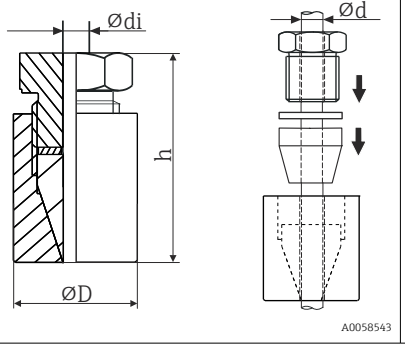
Compression fitting

Model	Type of fitting [1]	Dimensions			Technical properties [2]
	Spherical or cylindrical	Ødi	ØD	h	
	Spherical Sealing taper material 316L	6.3 mm (0.25 in) [3]	25 mm (0.98 in)	33 mm (1.3 in)	▪ $P_{max.}$ = 50 bar (725 psi) ▪ $T_{max.}$ for 316L sealing taper = +200 °C (+392 °F), tightening torque = 40 Nm
Compression fitting TK40 for weld-in  *1 Movable* *2 Fixed*	Spherical Sealing taper material PEEK Thread G¼"	6.3 mm (0.25 in) [3]	25 mm (0.98 in)	33 mm (1.3 in)	▪ $P_{max.}$ = 10 bar (145 psi) ▪ $T_{max.}$ for PEEK sealing taper = +200 °C (+392 °F), tightening torque = 10 Nm ▪ The TK40 PEEK sealing taper is EHEDG tested and 3-A marked
	Cylindrical Material of sealing taper ELASTOSIL® Thread G½"	6.2 mm (0.24 in) [3] 9.2 mm (0.36 in)	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

1) Options depend on product and configuration
2) All the pressure specifications apply for cyclic temperature load
3) For insert or thermowell diameter Ød = 6 mm (0.236 in).

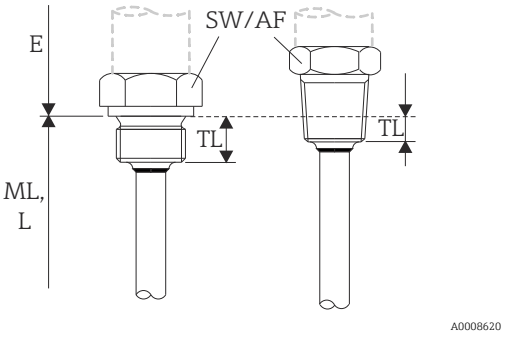
Compression fitting

Type TK40	Type of fitting	Dimensions			Technical properties
		Ød*i*	L	Width across flats	
 *Unit of measurement mm (in)* *1 Nut* *2 Ferrule* *3 Process connection*	G ½" , ferrule material 316L	6 mm (0.24 in)	Approx. 47 mm (1.85 in)	G ½": 27 mm (1.06 in)	▪ $P_{max.}$ = 40 bar (104 psi) at T = +200 °C (+392 °F) for 316L material ▪ $P_{max.}$ = 25 bar (77 psi) at T = +400 °C (+752 °F) for 316L material Tightening torque = 40 Nm

Type TK40 for weld-in	Type of fitting	Dimensions			Technical properties [1]
	Spherical or cylindrical	Ød*i*	Ø*D*	h	
	Spherical Sealing taper material 316L	6.3 mm (0.25 in) [2]	25 mm (0.98 in)	33 mm (1.3 in)	▪ $P_{max.}$ = 50 bar (725 psi) ▪ $T_{max.}$ for 316L sealing taper = +200 °C (+392 °F), tightening torque = 40 Nm
	Spherical Sealing taper material PEEK 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) ▪ $T_{max.}$ for PEEK sealing taper = +200 °C (+392 °F), tightening torque = 10 Nm ▪ The TK40 PEEK sealing taper is EHEDG tested and 3-A marked
	Cylindrical Sealing taper material 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 TK40 Elastosil sealing taper is EHEDG tested and 3-A marked

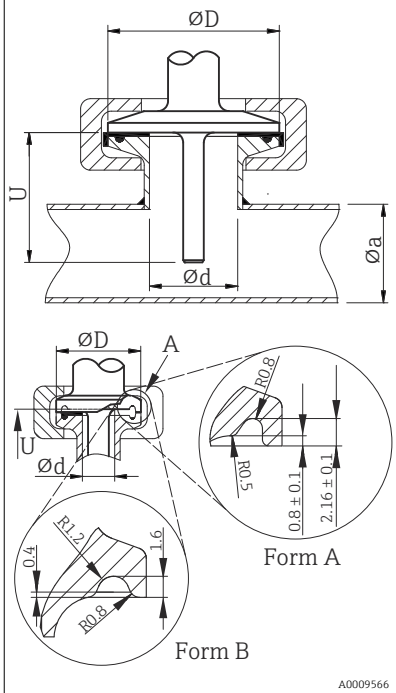
1) All the pressure specifications apply for cyclic temperature load
2) For insert or thermowell diameter Ød = 6 mm (0.236 in).

Releasable process connection

Threaded process connection Male thread	Type of fitting		Thread length TL	Width across flats	Max. process pressure
	M	M14x1.5	12 mm (0.47 in)	19 mm (0.75 in)	Maximum static process pressure for threaded process connection: [1] 400 bar (5 802 psi) at +400 °C (+752 °F)
		M18x1.5	12 mm (0.47 in)	24 mm (0.95 in)	
	G [2]	G ¼" DIN/BSP	12 mm (0.47 in)	19 mm (0.75 in)	
		G ½" DIN/BSP	14 mm (0.55 in)	27 mm (1.06 in)	
	NPT	NPT ¼"	5.8 mm (0.23 in)	19 mm (0.75 in)	
		NPT ½"	8 mm (0.32 in)	22 mm (0.87 in)	

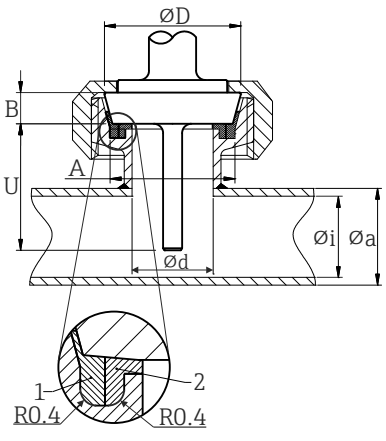
8 Cylindrical (left side) and conical (right side) version

1) Maximum pressure specifications only for the thread. The failure of the thread is calculated, taking the static pressure into consideration. The calculation is based on a fully tightened thread (TL = thread length)
2) DIN ISO 228 BSPP

Type	Version [1]	Dimensions		Technical properties	Conformity
	Φd [2]	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	Micro clamp [3] DN8-18 (0.5"-0.75") [4], 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") [4], Form B		-		Based on ISO 2852 [5]
	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) Options depend on product and configuration
2) Pipes in accordance with ISO 2037 and BS 4825 Part 1
3) Micro clamp (not in ISO 2852); no standard pipes
4) DN8 (0.5") only possible with thermowell diameter = 6 mm (¼ in)
5) Groove diameter = 20 mm

Releasable process connection

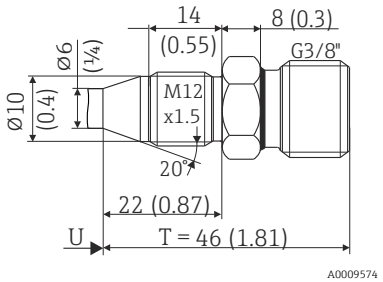
Type	Technical properties
Sanitary connection according to DIN 11851  *1 Centering ring* *2 Sealing ring*	▪ 3-A marked and EHEDG certified (only with EHEDG-certified and self-centering sealing ring). ▪ ASME BPE compliance

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

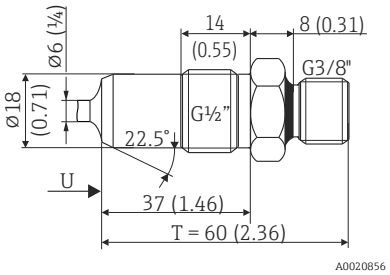
Model	Type of fitting	Technical properties
Metal sealing system	Thermowell diameter 6 mm (¼ in)	$P_{max.}$ = 16 bar (232 psi) Maximum torque = 10 Nm (7.38 lbf ft)

M12x1.5

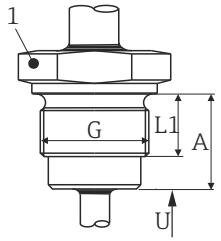


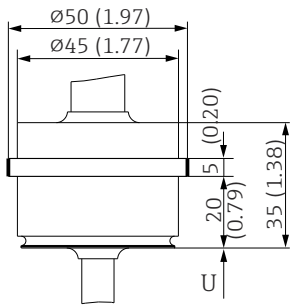
Unit of measurement mm (in)

G½"

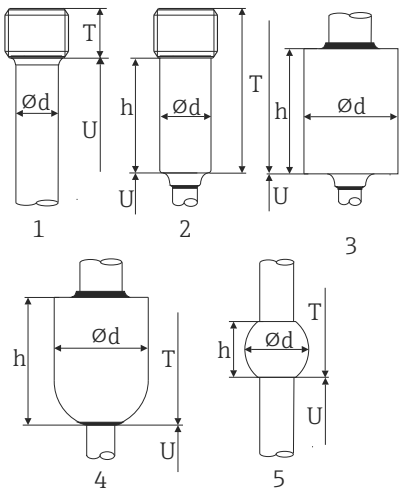


Unit of measurement mm (in)

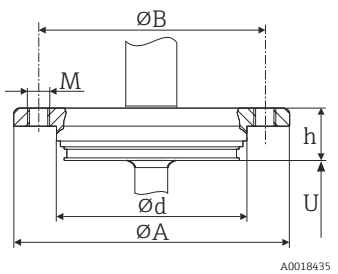
Type	Version G	Dimensions			Technical properties
		L1 thread length	A	1 (SW/AF)	
Thread according to ISO 228 (for Liquiphant weld-in adapter) 	G¾" for FTL20/31/33 adapter	16 mm (0.63 in)	25.5 mm (1 in)	32	▪ $P_{max.}$ = 25 bar (362 psi) at max. 150 °C (302 °F) ▪ $P_{max.}$ = 40 bar (580 psi) at max.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

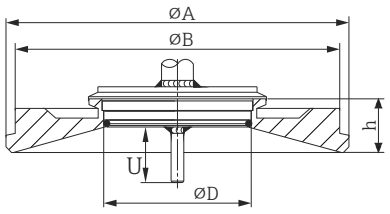
Type	Version	Technical properties
Process adapter  *Unit of measurement mm (in)*	D45	

Weld-in

Model	Type of fitting [1]	Dimensions	Technical properties
Weld-in adapter 	1: Cylindrical [2]	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 [3]	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)	

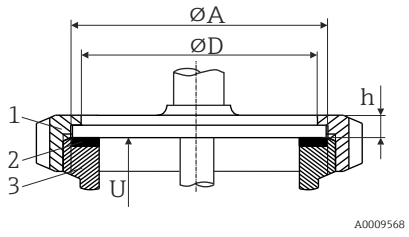
1) Options depend on product and configuration
2) For thermowell Φ12.7 mm (½ in)
3) For thermowell Φ6 mm (¼ in)

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) ▪ 3-A marked and EHEDG certified ▪ ASME BPE compliance

Type	Type of fitting [1]	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)		

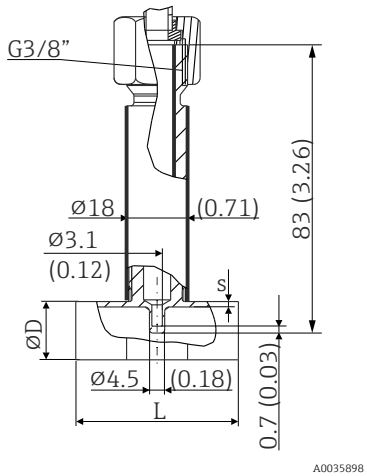
The VARINLINE® housing connection flange is suitable for welding into the conical or torispherical head in tanks or containers with a small diameter (≤ 1.6 m (5.25 ft)) and up to a wall thickness of 8 mm (0.31 in).
Varivent® Type F cannot be used for installations in pipes in combination with the VARINLINE® housing connection flange.

1) Options depend on product and configuration

Model	Type of fitting	Dimensions			Technical properties
		ϕD	ϕA	h	
SMS 1147  *1 Cap 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)	

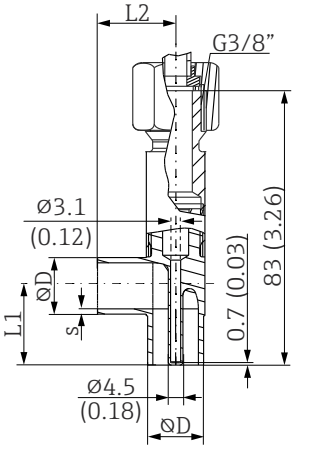
The counterpart connection must fit the sealing ring and fix it in place.

Tee thermowell, optimized (no welding, no dead legs)

Model	Type of fitting [1]		Dimensions in mm (in)			Technical properties
			ØD	L	s [2]	
Tee thermowell for welding 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 [3] and EHEDG certified [3] ▪ ASME BPE compliance [3]
		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) Options depend on product and configuration
2) Wall thickness
3) Applies to ≥ DN25. The radius ≥ 3.2 mm (⅛ in) cannot be maintained for smaller nominal diameters.

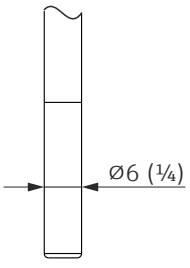
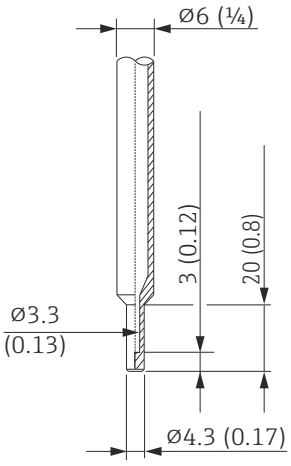
Elbow thermowell, optimized (no welding, no dead legs)

Model	Type of fitting		Dimensions				Technical properties
			ØD	L1	L2	s [1]	
Elbow thermowell for welding in as per DIN 11865 (series A, B and C)  *Unit of measurement mm (in)*	Series A	DN10 PN25	13 mm (0.51 in)	22 mm (0.86 in)	24 mm (0.95 in)	1.5 mm (0.06 in)	▪ $P_{max.}$ = 25 bar (362 psi) ▪ 3-A marked and EHEDG certified for ≥ DN25 ▪ ASME BPE compliance for ≥ DN25
		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 (0.86 in)	24 mm (0.95 in)	1.6 mm (0.063 in)	
		DN17.2 PN25	17.2 mm (0.68 in)	24 mm (0.95 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") [2]	12.7 mm (0.5 in)	22 mm (0.86 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) Pipe dimensions as per ASME BPE

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.
- Optimized flow characteristics
- Thermowell stability is increased.

Direct contact, 6 mm (¼ in)	Thermowell, 6 mm (¼ in)
 	

User interface

Operating concept

The device-specific parameters are configured via IO-Link. There are specific configuration or operating programs from different manufacturers available to the user for this purpose. The device description file (IODD) is provided for the thermometer.

IO-Link operating concept

Operator-oriented menu structure for user-specific tasks. Guided menus divided by user category:

- Operator
- Maintenance
- Specialist

Efficient diagnostic behavior increases measurement reliability

- Diagnostic messages
- Remedial action
- Simulation options

IODD download

http://www.endress.com/download

- Select **Software** as the media type.
- Select **Device Driver** as the software type.
  Select IO-Link (IODD).
- In the "Text Search" field enter the device name.

https://ioddfinder.io-link.com/

Search by
- Manufacturer
- Article number
- Product type

Local operation

There are no operating elements directly on the device. The temperature transmitter is configured via remote operation.

Local display

There are no display elements directly on the device. The measured value and diagnostic messages, for instance, can be accessed via IO-Link.

Remote operation

IO-Link functions and device-specific parameters are configured via the device's IO-Link communication.

Special configuration kits are available, e.g. the FieldPort SFP20. Every IO-Link device can be configured with it.

IO-Link devices are typically configured via the automation system (e.g. Siemens TIA Portal and Port Configuration Tool). Parameters for device replacement can be stored in the IO-Link master.

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**.

MTBF

For the transmitter: 327 years, according to Siemens Standard SN29500

Hygiene standard

- EHEDG certificate, type EL CLASS I. EHEDG-certified/tested process connections. → 25
- 3-A certificate authorization no. 1144, 3-A Sanitary standard 74-07. Listed process connections. → 25
- ASME BPE (latest edition), certificate of conformity can be ordered for indicated options
- FDA-compliant
- All surfaces in contact with the medium are free from materials derived from bovine animals or other livestock (ADI/TSE)

Materials in contact with food/product (FCM)

The process contact parts (FCM) are in conformity with the following European Regulations:
- Regulation (EC) No 1935/2004, on materials and articles intended to come into contact with food, article 3, paragraph 1, article 5 and 17.
- Regulation (EC) No 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.
- Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food.

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 roughness

Free from oil and grease for O_2 applications, optional

Material resistance

Material resistance - including resistance of housing - to the following Ecolab cleaning/disinfection agents:
- P3-topax 66
- P3-topactive 200
- P3-topactive 500
- P3-topactive OKTO
- And 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 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

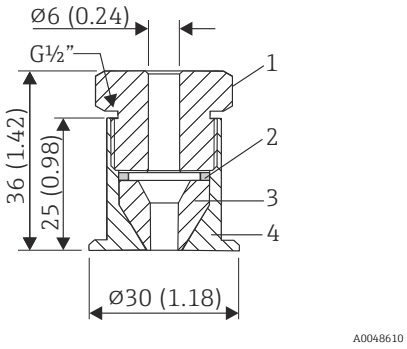
Accessories

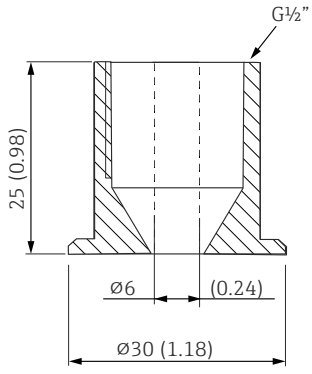
The accessories currently available for the product can be selected at www.endress.com:

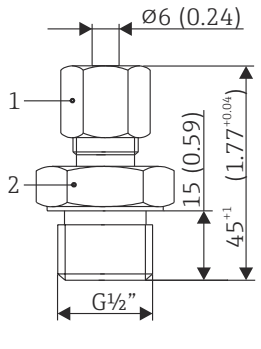
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

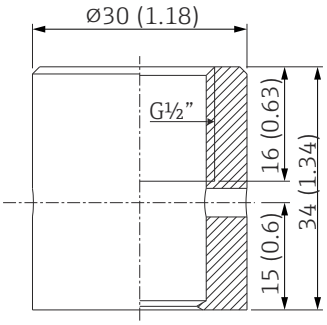
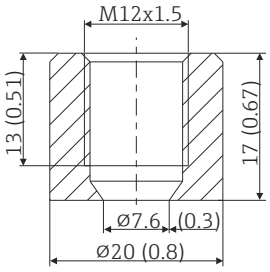
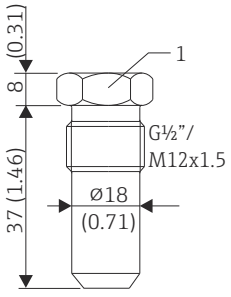
Device-specific accessory

All dimensions in mm (in).

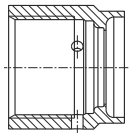
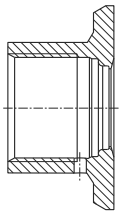
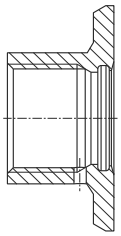
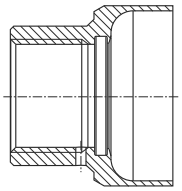
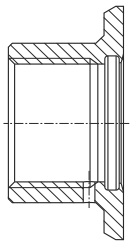
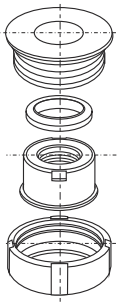
Accessory	Description
Welding boss with sealing taper  *1 Pressure screw, 303/304, width across flats 24 mm* *2 Washer, 303/304* *3 Sealing taper, PEEK* *4 Collar welding boss, 316L*	▪ Collar welding boss movable with sealing taper, washer and pressure screw G½" ▪ Material of parts in contact with the process 316L, PEEK ▪ Max. process pressure 10 bar (145 psi)

Accessory	Description
Collar welding boss  	Material of parts in contact with the process 316L

Accessory	Description
Compression fitting  *1 AF14* *2 AF27*	▪ Movable clamping ring, process connection G½" ▪ Material of compression fitting and parts in contact with the process, 316L

Accessory	Description
Welding boss with sealing taper (metal-metal)  	▪ Welding boss for G½" or M12x1.5 thread ▪ Metal-sealing; conical ▪ Material of parts in contact with the process 316L/1.4435 ▪ Max. process pressure 16 bar (232 PSI)
Dummy plug  *1 AF22*	▪ Dummy plug for G½" or M12x1.5 conical metal-sealing welding boss ▪ Material: SS 316L/1.4435

Weld-in adapter

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)

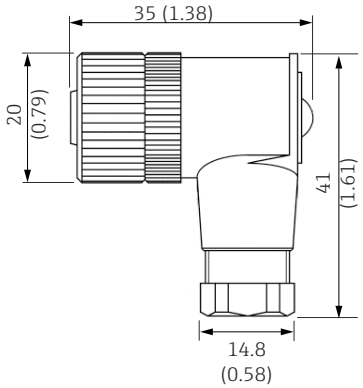
Maximum process pressure for the weld-in adapters:
- 25 bar (362 PSI) at maximum 150 °C (302 °F)
- 40 bar (580 PSI) at maximum 100 °C (212 °F)

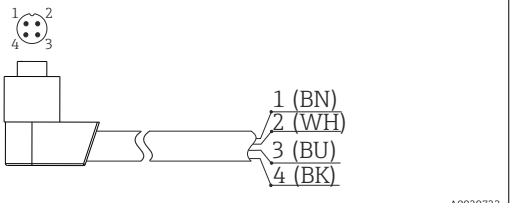
Communication-specific accessory

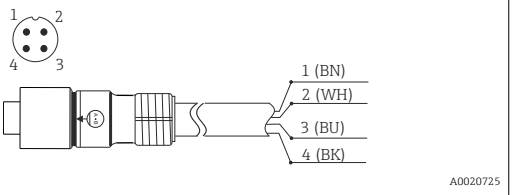
IO-Link

Accessory	Description
FieldPort SFP20	**Mobile configuration tool for all IO-Link devices:** ▪ The FieldPort SFP20 is a USB interface for the configuration of IO-Link devices. The FieldPort SFP20 can be connected to a laptop or tablet via a USB cable. ▪ A point-to-point connection between the laptop and IO-Link devices is possible with the FieldPort SFP20. ▪ M12 connection for IO-Link field devices
IO-Link master BL20	IO-Link master for DIN rails from Turck supports PROFINET, Ethernet/IP and Modbus TCP, including web server for simple configuration.
Field Xpert SMT50	Universal, high-performance tablet PC for device configuration in non-hazardous areas.

Coupling

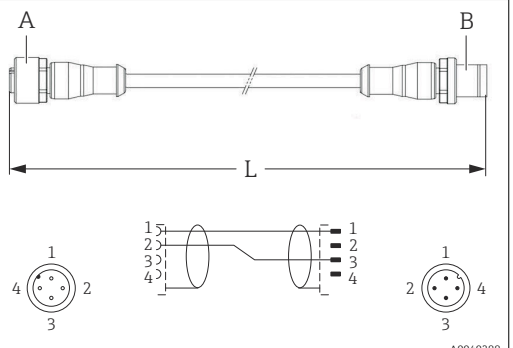
Accessory	Description
▪ M12x1 coupling; elbowed, for termination of connecting cable by user ▪ Connection to M12x1 housing connector ▪ Body materials PBT/PA, ▪ Union nut GD-Zn, nickel-plated ▪ IP67 degree of protection (fully locked) ▪ Voltage: max. 250 V ▪ Current carrying capacity: max. 4 A ▪ Temperature: −40 to +85 °C	 A0020722

Accessory	Description
▪ PVC cable, 4 x 0.34 mm² (22 AWG) with M12x1 coupling, elbow plug, screw plug, length 5 m (16.4 ft) ▪ IP69K protection (optional) ▪ Voltage: max. 250 V ▪ Current carrying capacity: max. 4 A ▪ Temperature: −25 to +70 °C Wire colors: ▪ 1 = BN brown ▪ 2 = WH white ▪ 3 = BU blue ▪ 4 = BK black	

Accessory	Description
▪ PVC cable, 4 x 0.34 mm² (22 AWG) with M12x1 coupling nut made of epoxy coated zinc, straight socket contact, screw plug, 5 m (16.4 ft) ▪ IP69K protection (optional) ▪ Voltage: max. 250 V ▪ Current carrying capacity: max. 4 A ▪ Temperature: −20 to +105 °C Wire colors: ▪ 1 = BN brown ▪ 2 = WH white ▪ 3 = BU blue ▪ 4 = BK black	

Adapter cable

Since the IO-Link thermometers have a different pin assignment than 4-20 mA thermometers, the assignment must be adjusted in the event of device changes. To do this, either modify the wiring in the cabinet or use the adapter cable for the pin assignment between the device and the existing wiring.

Accessory	Description
▪ Cable: PVC; 2-pin; 2 × 0.34 mm² (AWG22) shielded ▪ Cable length ~ 100 mm (3.94 in) without socket and connector ▪ Color: black ▪ Connector 1: M12, 4-pin, A-coded, socket, straight ▪ Connector 2: M12, 4-pin, A-coded, connector, straight ▪ Metal parts: stainless steel ▪ Voltage: max. 60 V_{DC} ▪ Current carrying capacity: max. 4 A ▪ Degree of protection: IP66, IP67 and IP69 in accordance with IEC 60529 (when connected); NEMA 6P ▪ Temperature: −40 to +85 °C (−40 to +185 °F)	 *A M12 socket* *B M12 plug* *L 200 mm (7.87 in)*

Online tools

Product information about the entire life cycle of the device is available at:
www.endress.com/onlinetools

Service-specific accessories

Netilion
With the Netilion IIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem

designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

www.netilion.endress.com

Applicator
Software for selecting and sizing Endress+Hauser measuring devices:
- Calculation of all the necessary data for identifying the optimum measuring 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:
https://portal.endress.com/webapp/applicator

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 Configurator is 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 **Configuration**.

System components

Process indicators from the RIA product family

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

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

For more information, please refer to: www.endress.com

RN series active barrier

Single- or two-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively.

For more information, please refer to: www.endress.com

Documentation

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

Document type	Purpose and content of the document
Operating Instructions (BA)	**Your reference document** The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

Registered trademarks

IO-Link

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People for Process Automation