

Technical Information iTHERM TrustSens TM371, TM372

Compact thermometer for hygienic and aseptic applications

HART® communication

Outstanding sensor technology with self-calibrating function

100% Compliance - 0% Effort



Applications

- Specially designed for use in hygienic and aseptic applications in the Food & Beverages and Life Sciences industries
- Measuring range: -40 to +160 °C (-40 to +320 °F)
- Pressure range up to 50 bar (725 psi)
- Protection class: IP67/68 or IP69K
- Communication: Analog output 4 to 20 mA, HART® protocol

Your benefits

- Risk and cost reduction thanks to self-calibration and 'Heartbeat technology'
- Fully automated, traceable, inline self-calibration
- Automatized documentation, memory for 350 self-calibration points
- Printable calibration certificate - audit proof
- Elimination of nonconformity or undetected failures
- International certifications, regulations (EC/EU), approvals and declarations of conformity:
 - EHEDG, ASME BPE, FDA, 3-A, EC 1935/2004, EC 2023/2006, EU 10/2011
 - CE/EAC, CRN, CSA General Purpose
- Highest measurement accuracy through sensor-transmitter matching
- Heartbeat Technology

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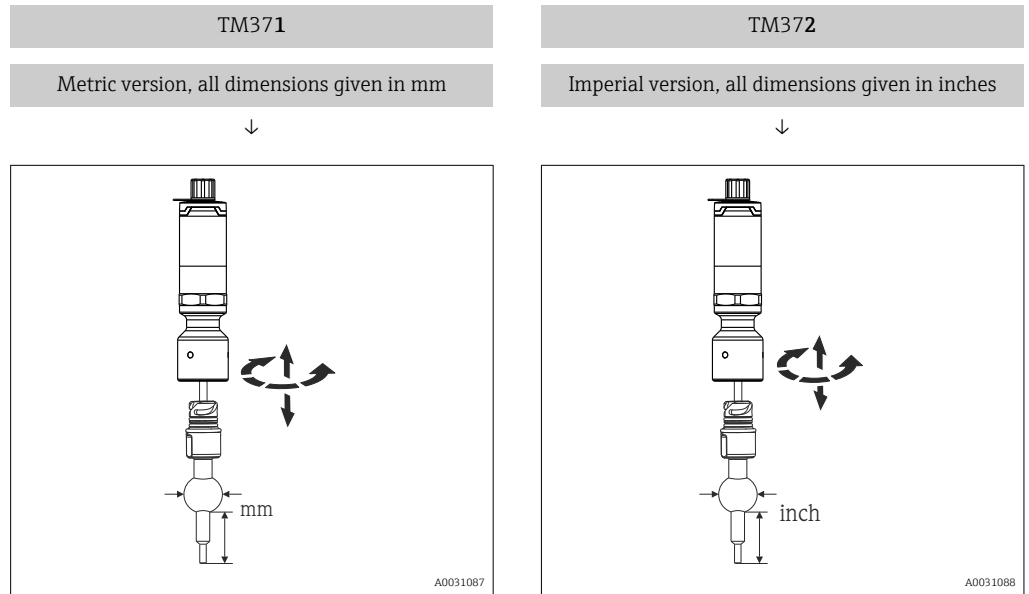
Function and system design

The iTHERM TrustSens thermometer incorporates a groundbreaking innovation – its self-calibration functionality. Under normal operation a standard Pt100 sensor element is being used. By means of a built-in, highly accurate reference sensor, the Pt100 measurement is automatically calibrated at a certain process temperature. This eliminates the need to remove the thermometer for calibration purposes. For more details please see chapter calibration.

iTHERM TrustSens

This thermometer is part of the compact thermometer line for hygienic and aseptic applications.

Differentiating factors when selecting a suitable thermometer



Measuring principle

Resistance thermometer (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 $\alpha = 0.003851 \text{ } ^\circ\text{C}^{-1}$.

Thin film platinum resistance thermometers (TF): A ultrapure platinum layer, about 1 μm thick, is applied by vapor deposition 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 small sizes and good vibration resistance.

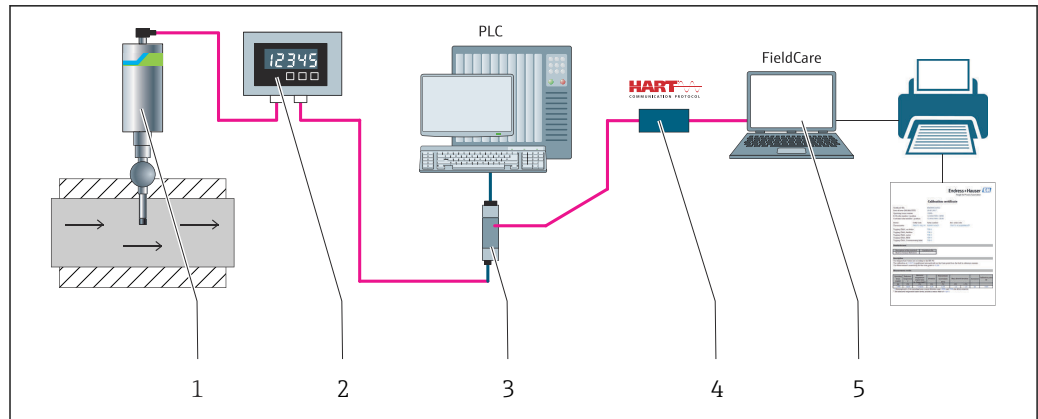
Measuring system

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 Products and Data Managers - Solutions for the loop' (FA00016K/EN)



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

- 1 Installed iTHERM compact thermometer with HART® communication protocol
- 2 RIA15 loop powered process display - It is integrated in the current loop and displays the measuring signal or HART® process variables in digital form. The process display unit does not require an external power supply. It is powered directly from the current loop. More information on this can be found in the Technical Information, see "Documentation", → 45.
- 3 Active barrier RN221N - The RN221N (24 V DC, 30 mA) active barrier has a galvanically isolated output for supplying voltage to loop-powered transmitters. The universal power supply works with an input supply voltage of 20 to 250 V DC/AC, 50/60 Hz, which means that it can be used in all international power grids. More information on this can be found in the Technical Information, see "Documentation", → 45.
- 4 Commubox FXA195 for intrinsically safe HART® communication with FieldCare via the USB interface.
- 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.

Equipment architecture

| Design | Options |
|--|--|
| <p style="text-align: right; font-size: small;">A0031106</p> | <p>1: Wiring, electrical connection, output signal 2: Transmitter housing</p> |
| | <p>3: Extension neck</p> <ul style="list-style-type: none"> ▪ Welded-in-place or removable ▪ Optional with iTHERM QuickNeck bayonet joint <p>i Your benefits:</p> <ul style="list-style-type: none"> ▪ iTHERM QuickNeck: tool-free removal of the compact thermometer ▪ IP69K protection: safety under extreme process conditions |
| | <p>4: Process connection → 27</p> <p>More than 50 different versions.</p> |
| | <p>5: Protection tube</p> <ul style="list-style-type: none"> ▪ Versions with and without protection tube (insert in direct contact with process). ▪ Various diameters ▪ Various tip shapes (straight or reduced) |
| | <p>6: Insert</p> <p>Sensor model: thin-film Pt100 sensor (TF) with iTHERM TrustSens technology.</p> <p>i Your benefits:</p> <ul style="list-style-type: none"> ▪ Risk and cost reduction thanks to Heartbeat technology ▪ Fully automated, traceable, inline self-calibration ▪ Automated documentation, memory for the last 350 calibration points ▪ Printable calibration certificate - audit proof ▪ No risk of nonconformity or undetected failures ▪ International certifications and approvals |

Input

| | | |
|-----------------|----------------------|---------------------------------|
| Measuring range | Pt100 thin-film (TF) | -40 to +160 °C (-40 to +320 °F) |
|-----------------|----------------------|---------------------------------|

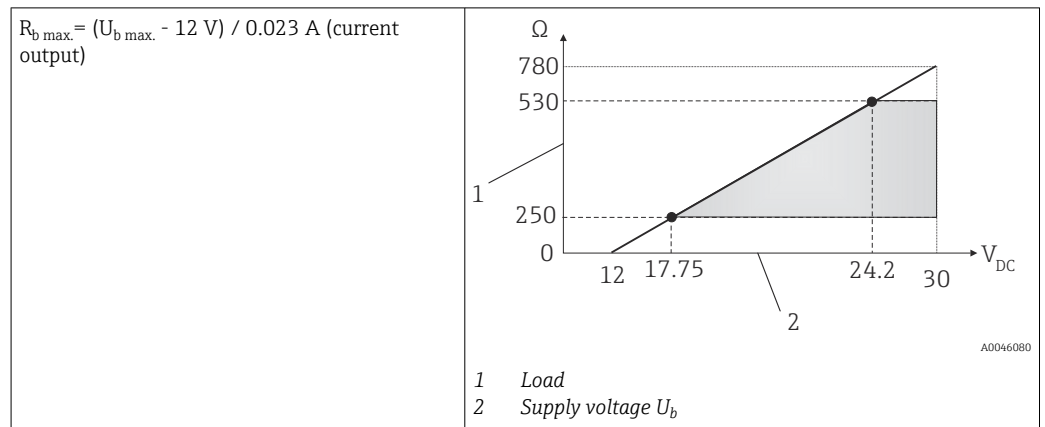
Output

| | | |
|---------------|----------------|-----------------------------|
| Output signal | Analog output | 4 to 20 mA |
| | Digital output | HART® protocol (revision 7) |

Failure information **Failure information as per NAMUR NE43:**
 Failure information is created if the measuring information is missing or not valid. A complete list of all the errors occurring in the measuring system is created.

| | |
|---|--|
| Underranging | Linear decrease from 4.0 to 3.8 mA |
| Overranging | Linear increase from 20.0 to 20.5 mA |
| Failure, e.g. sensor breakage, sensor short-circuit | ≤ 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 Maximum possible HART® communication resistance



Linearization/transmission behavior Temperature-linear

Filter 1st order digital filter: 0 to 120 s, factory setting: 0 s (PV)

Protocol-specific data HART


| | |
|------------------------------------|---|
| Manufacturer ID | 17 (0x11) |
| Device type ID | 0x11CF |
| HART revision | 7 |
| Device description files (DTM, DD) | Information and files at: <ul style="list-style-type: none"> ■ www.endress.com/downloads ■ www.fieldcommgroup.org |
| HART load | Min. 250 Ω |

| | |
|-----------------------|---|
| HART device variables | Measured value for PV (primary value) Temperature Measured values for SV, TV, QV (secondary, tertiary and quaternary variable) <ul style="list-style-type: none"> ▪ SV: Device temperature ▪ TV: Calibration counter ▪ QV: Calibration deviation |
| Supported functions | <ul style="list-style-type: none"> ▪ Additional transmitter status ▪ NE107 diagnostics |

Startup behavior / wireless HART data


| | |
|---------------------------|---|
| Minimum start-up voltage | 12 V _{DC} |
| Start-up current | 3.58 mA |
| Start-up time | < 7 s, until the first valid measured value signal is present at the current output |
| Minimum operating voltage | 12 V _{DC} |
| Multidrop current | 4 mA |
| Lead time | 0 s |

Wiring

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

Supply voltage


$U_b = 12 \text{ to } 30 \text{ V}_{DC}$

 The device may only be powered by a power supply unit with a limited energy electric circuit in accordance with UL/EN/IEC 61010-1 chapter 9.4 or Class 2 according to UL 1310, "SELV or Class 2 circuit".

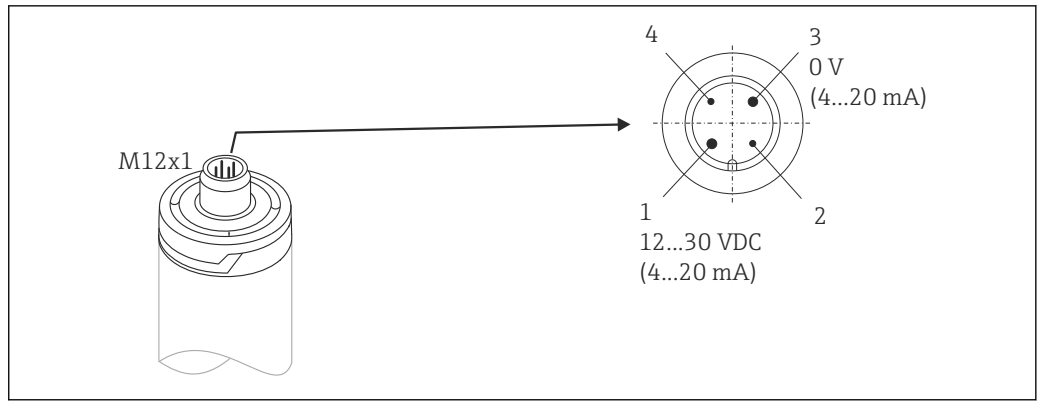
Current consumption

- $I = 3.58 \text{ to } 23 \text{ mA}$
- Minimum current consumption: $I = 3.58 \text{ mA}$, multi-drop mode $I = 4 \text{ mA}$
- Maximum current consumption: $I \leq 23 \text{ mA}$

Electrical connection

 To prevent any kind of damage from the device electronics, leave the pins 2 and 4 unconnected. They are reserved for the connection of the configuration cable.

Do not tighten the M12 plug too much, in order to prevent damage to the device. Maximum torque: 0.4 Nm (M12 knurl)

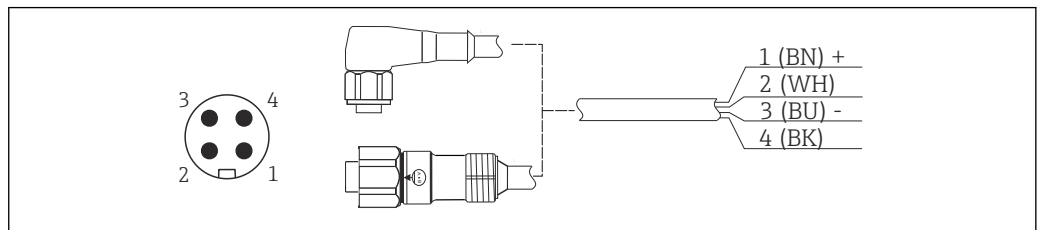


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2 Pin assignment of the device connecting socket

- 1 Power supply 12 to 30 V_{DC}; current output 4 to 20 mA
- 2 Reserved for configuration cable
- 3 Power supply 0 V_{DC}; current output 4 to 20 mA
- 4 Reserved for configuration cable

Device plug connection



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3 Pin assignment of the plug connector

- 1 Power supply +, wire color brown = BN
- 2 Connection of PC configuration cable, wire color white = WH
- 3 Power supply -, wire color blue = BU
- 4 Connection of PC configuration cable, wire color black = BK

i Appropriate cord sets with straight or angle plugs are available as accessory.

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.

i For more information see the Technical Information 'HAW562 Surge arrester' TI01012K

Performance characteristics

Reference operating conditions

- Ambient temperature: 25 °C ± 5 °C (77 °F ± 9 °F)
- Supply voltage: 24 V_{DC}


Internal calibration point

- 118 °C (244.4 °F) +1.2 K / -1.7 K
- Lowest possible calibration point = 116.3 °C (241.3 °F)
- Highest possible calibration point = 119.2 °C (246.6 °F)

i The individual calibration point of each TrustSens device is indicated in the ex-works calibration certificate enclosed with the shipment.

Measurement uncertainty


The given uncertainty values include non-linearity and non-repeatability and correspond to 2σ (95% confidence level according to the Gaussian distribution curve).

| | | |
|---|---|---|
| Uncertainty of self-calibration of digital output (HART® value) at the calibration point. | | < 0.35 °C (0.63 °F) |
| Uncertainty of the temperature sensor inclusive digital output (HART® value) at reference conditions in delivery state. | Process temperature: +20 to +135 °C (+68 to +275 °F) +135 to +160 °C (+275 to +320 °F) 0 to +20 °C (+32 to +68 °F) -20 to 0 °C (-4 to +32 °F) -40 to -20 °C (-40 to -4 °F) | < 0.22 °C (0.4 °F) < 0.38 °C (0.68 °F) < 0.27 °C (0.49 °F) < 0.46 °C (0.83 °F) < 0.8 °C (1.44 °F) |
|  Each iTHERM TrustSens is calibrated and matched by default before shipment to guarantee the given accuracy. | | |
| Uncertainty of D/A converter (analog output current) | | 0.03 % of the measurement range |

Long-term drift

| | |
|---|---------------------------------|
| Pt100 sensing element | < 1000 ppm/1000 h ¹⁾ |
| A/D converter (digital output - HART®) | < 500 ppm/1000 h ¹⁾ |
| D/A converter (analog output - current) | < 100 ppm/1000 h |

1) This would be detected by the self-calibration

 Long-term drift decreases at an exponential rate over time. So it may not be extrapolated in a linear way for time spans longer than the above given values.

Influence of ambient temperature

| | |
|--|---|
| A/D converter (digital output - HART®) at typical operating conditions | < 0.05 K (0.09 °F) |
| A/D converter (digital output - HART®) at maximum operating conditions | < 0.15 K (0.27 °F) |
| D/A converter (analog output - current) | ≤ 30 ppm/°C (2σ), related to the deviation from the reference temperature |

Typical operating conditions

- Ambient temperature: 0 to +40 °C (+32 to +104 °F)
- Process temperature: 0 to +140 °C (+32 to +284 °F)
- Power supply: 18 to 24 V_{DC}

Influence of supply voltage

According to IEC 61298-2:

| | |
|--|--------------------------|
| A/D converter (digital output - HART®) at typical operating conditions | < 15 ppm/V ¹⁾ |
| D/A converter (analog output - current) | < 10 ppm/V ¹⁾ |

1) Related to the deviation from the reference supply voltage

Sample calculation with Pt100, measuring range +20 to +135 °C (+68 to +275 °F), ambient temperature +25 °C (+77 °F), supply voltage 24 V:

| | |
|---|---------------------|
| Measured error digital | 0.220 °C (0.396 °F) |
| Measured error D/A = 0.03 % x 150 °C (302 °F) | 0.045 °C (0.081 °F) |
| Measured error digital value (HART): | 0.220 °C (0.396 °F) |
| Measured error analog value (current output): $\sqrt{(\text{Measured error digital}^2 + \text{Measured error D/A}^2)}$ | 0.225 °C (0.405 °F) |

Sample calculation with Pt100, measuring range +20 to +135 °C (+68 to +275 °F), ambient temperature +35 °C (+95 °F), supply voltage 30 V:

| | |
|--|----------------------------|
| Measured error digital | 0.220 °C (0.396 °F) |
| Measured error D/A = 0.03 % x 150 °C (302 °F) | 0.045 °C (0.081 °F) |
| Influence of ambient temperature (digital) | 0.050 °C (0.090 °F) |
| Influence of ambient temperature (D/A) = (35 °C - 25 °C) x (30 ppm/°C x 150 °C) | 0.045 °C (0.081 °F) |
| Influence of supply voltage (digital) = (30 V - 24 V) x 15 ppm/V x 150 °C | 0.014 °C (0.025 °F) |
| Influence of supply voltage (D/A) = (30 V - 24 V) x 10 ppm/V x 150 °C | 0.009 °C (0.016 °F) |
| Measured error digital value (HART): $\sqrt{(\text{Measured error digital})^2 + \text{Influence of ambient temperature (digital)}^2 + \text{Influence of supply voltage (digital)}^2}$ | 0.226 °C (0.407 °F) |
| Measured error analog value (current output): $\sqrt{(\text{Measured error digital})^2 + \text{Measured error D/A}^2 + \text{Influence of ambient temperature (digital)}^2 + \text{Influence of ambient temperature (D/A)}^2 + \text{Influence of supply voltage (digital)}^2 + \text{Influence of supply voltage (D/A)}^2}$ | 0.235 °C (0.423 °F) |

Response time

Tests in water at 0.4 m/s (1.3 ft/s), according to IEC 60751; 10 K temperature step change. t_{63} / t_{90} are defined as the time that passes until the instrument output reaches 63% / 90% of the new value.

Response time with heat transfer paste ¹⁾

| Protection tube | Shape of tip | Insert | t_{63} | t_{90} |
|-----------------|--|-----------------|----------|----------|
| Ø6 mm (0.24 in) | Reduced 4.3 mm (0.17 in) x 20 mm (0.79 in) | Ø3 mm (0.12 in) | 2.9 s | 5.4 s |
| Ø9 mm (0.35 in) | Straight | Ø6 mm (0.24 in) | 9.1 s | 17.9 s |
| | Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in) | Ø3 mm (0.12 in) | 2.9 s | 5.4 s |
| Ø12.7 mm (½ in) | Straight | Ø6 mm (0.24 in) | 10.9 s | 24.2 s |
| | Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in) | Ø3 mm (0.12 in) | 2.9 s | 5.4 s |
| | Reduced 8 mm (0.31 in) x 32 mm (1.26 in) | Ø6 mm (0.24 in) | 10.9 s | 24.2 s |

1) Between the insert and the protection tube.

Response time without heat transfer paste

| Protection tube | Shape of tip | Insert | t_{63} | t_{90} |
|-------------------------|--|-----------------|----------|----------|
| Without protection tube | - | Ø6 mm (0.24 in) | 5.3 s | 10.4 s |
| Ø6 mm (0.24 in) | Reduced 4.3 mm (0.17 in) x 20 mm (0.79 in) | Ø3 mm (0.12 in) | 7.4 s | 17.3 s |
| Ø9 mm (0.35 in) | Straight | Ø6 mm (0.24 in) | 24.4 s | 54.1 s |
| | Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in) | Ø3 mm (0.12 in) | 7.4 s | 17.3 s |
| Ø12.7 mm (½ in) | Straight | Ø6 mm (0.24 in) | 30.7 s | 74.5 s |
| | Reduced 5.3 mm (0.21 in) x 20 mm (0.79 in) | Ø3 mm (0.12 in) | 7.4 s | 17.3 s |
| | Reduced 8 mm (0.31 in) x 32 mm (1.26 in) | Ø6 mm (0.24 in) | 30.7 s | 74.5 s |

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,
- Comparison calibration against a precise reference thermometer.

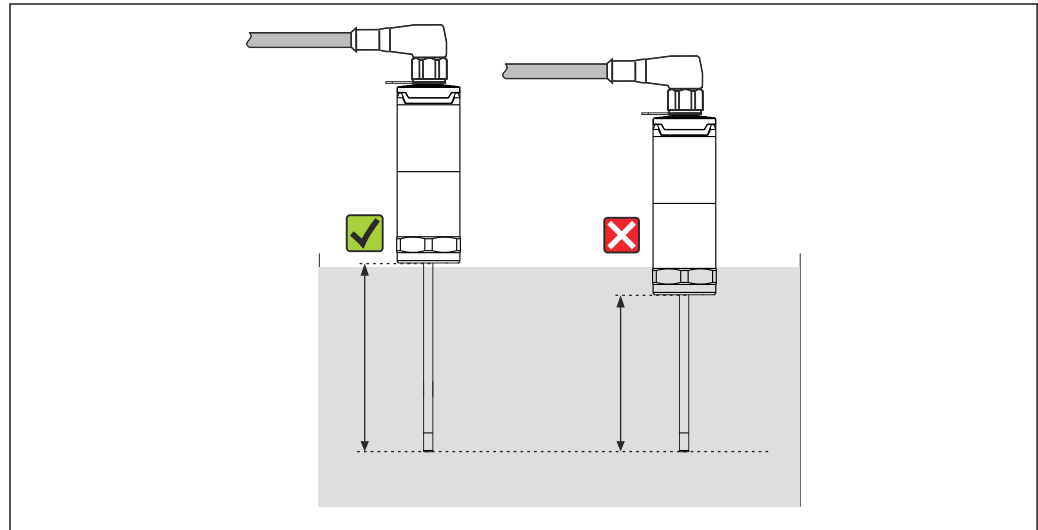
The thermometer to be calibrated must display the fixed point temperature or the temperature of the reference thermometer as accurately as possible. Temperature-controlled calibration baths or special calibration furnaces with homogeneous distribution of temperature are typically used for

thermometer calibrations. The DUT and the reference thermometer are placed closely together into the bath or furnace at a sufficient depth.

The measurement uncertainty can increase due to heat conduction errors and short immersion lengths. The existing measurement uncertainty is listed on the individual calibration certificate.

For accredited calibrations according to IEC/ISO 17025, the measurement uncertainty must not be twice as high as the accredited measurement uncertainty of the laboratory. If the limit value is exceeded, only a factory calibration can be carried out.

i For manual calibration in calibration baths the maximum immersion length of the device ranges from the sensor tip to the lower part of the electronic housing. Do not immerse the housing into the calibration bath!



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Self-calibration

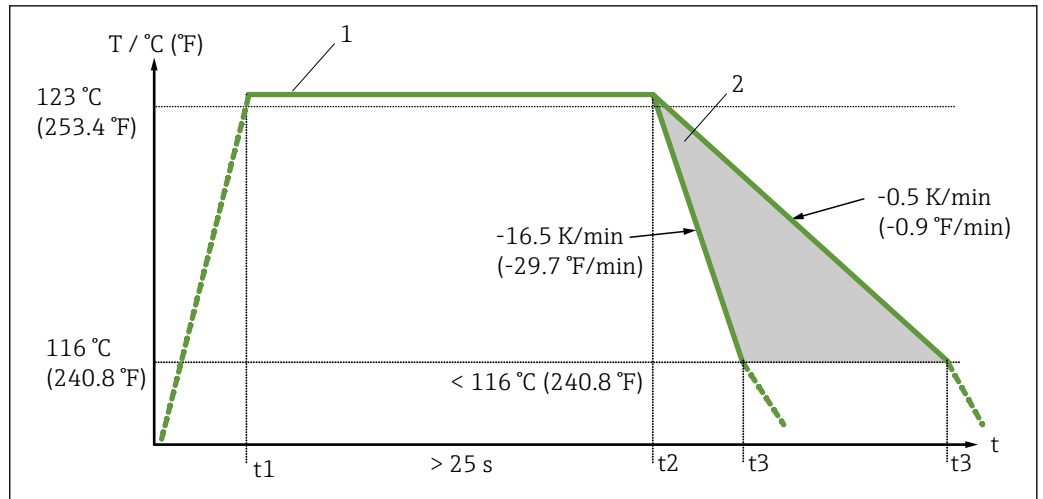
The self-calibration procedure uses the Curie temperature (T_c) of a reference material as a built-in temperature reference. A self-calibration is performed automatically, when the process temperature (T_p) falls below the nominal Curie Temperature (T_c) of the device. At the Curie temperature, a phase change of the reference material takes place, which is associated with a change in its electrical properties. The electronics automatically detects this change and simultaneously calculates the deviation of the measured Pt100-temperature to the known, physically fixed Curie temperature. The TrustSens thermometer is calibrated. A green flashing LED light indicates the ongoing self-calibration process. Subsequently the thermometer electronics stores the results of this calibration. The calibration data can be read via an asset management software like FieldCare or DeviceCare. A self-calibration certificate can be created automatically. This inline self calibration allows a continuous and repeated monitoring of changes to the Pt100 sensor and to the electronics' characteristics. As the inline calibration is being performed under real ambient or process conditions (e.g. heating of electronics), the result is closer to reality than a sensor calibration under laboratory conditions.

Process criteria for self-calibration

To ensure a valid self-calibration within the given measurement accuracy, the process temperature characteristics needs to fulfil the criteria, which are checked by the device automatically. Based on this, the device is ready to perform a self-calibration under the following conditions:

- Process temperature > calibration temperature +3 °C (5.4 °F) for 25 s before cooling down; $t_1 - t_2$.
- Cooling rate: 0.5 to 16.5 K/min (0.9 to 29.7 °F/min), while the process temperature crosses the Curie temperature; $t_2 - t_3 + 10$ s.

The process temperature ideally declines continuously below 116 °C (240.8 °F). A valid self-calibration process is done when the green LED flashes with a frequency 5 Hz for 5 s.



4 Needed process temperature profile for self-calibration

- 1 Process temperature 123 °C (253.4 °F)
- 2 Allowed self-calibration range

Calibration monitoring

Available in conjunction with Advanced Data Manager Memograph M (RSG45). → 45

Application package:

- Up to 20 devices can be monitored via the HART interface
- Self-calibration data displayed on screen or via the Web server
- Generation of a calibration history
- Creation of a calibration protocol as an RTF file directly at the RSG45
- Evaluation, analysis and further processing of the calibration data using "Field Data Manager" (FDM) analysis software

Insulation resistance

Insulation resistance $\geq 100 \text{ M}\Omega$ at ambient temperature, measured between the terminals and the outer jacket with a minimum voltage of $100 \text{ V}_{\text{DC}}$.

Installation

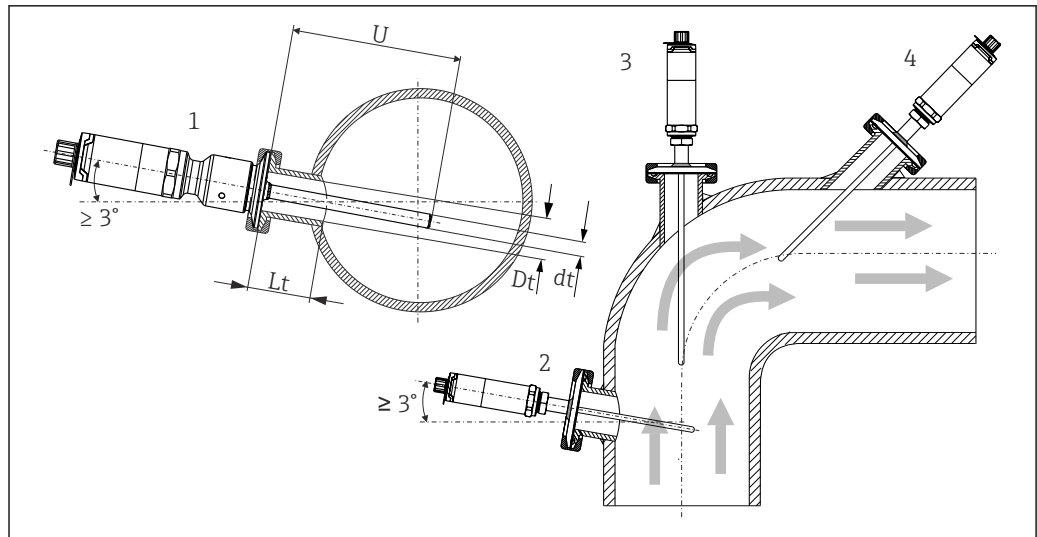
Orientation

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 accuracy. If the immersion length is too small then errors in the measurement are caused by heat conduction via the process connection. If installing into a pipe then the immersion length should ideally be half of the pipe diameter.

Installation possibilities: Pipes, tanks or other plant components



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5 Installation examples

- 1, 2 Perpendicular to 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

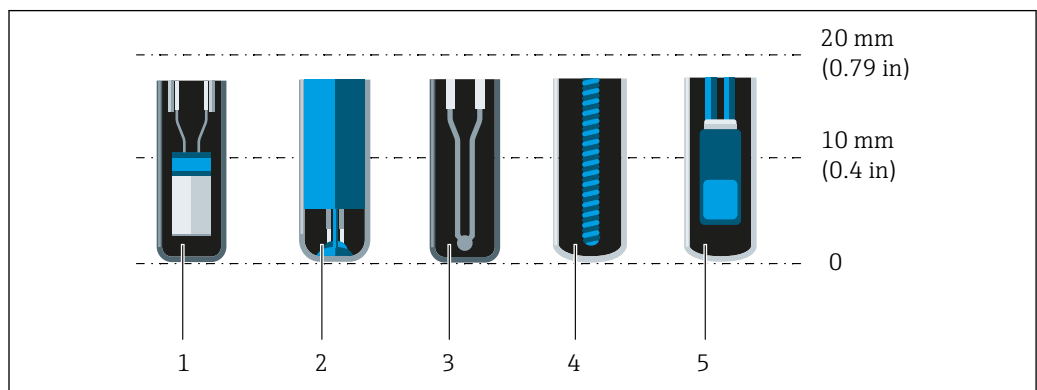
i The requirements of the EHEDG and the 3-A Sanitary Standard must be adhered to.

Installation instructions EHEDG/cleanability: $Lt \leq (Dt-dt)$

Installation instructions 3-A/cleanability: $Lt \leq 2(Dt-dt)$

i 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).

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



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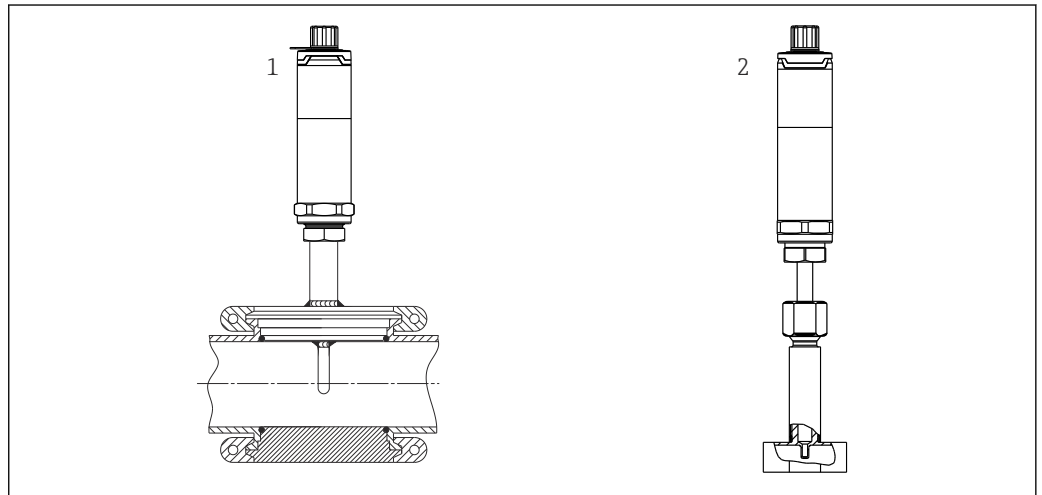
- 1 StrongSens or TrustSens at 5 to 7 mm (0.2 to 0.28 in)
- 2 QuickSens at 0.5 to 1.5 mm (0.02 to 0.06 in)
- 3 Thermocouple (not grounded) at 3 to 5 mm (0.12 to 0.2 in)
- 4 Wire wound sensor at 5 to 20 mm (0.2 to 0.79 in)
- 5 Standard thin-film sensor at 5 to 10 mm (0.2 to 0.39 in)

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.

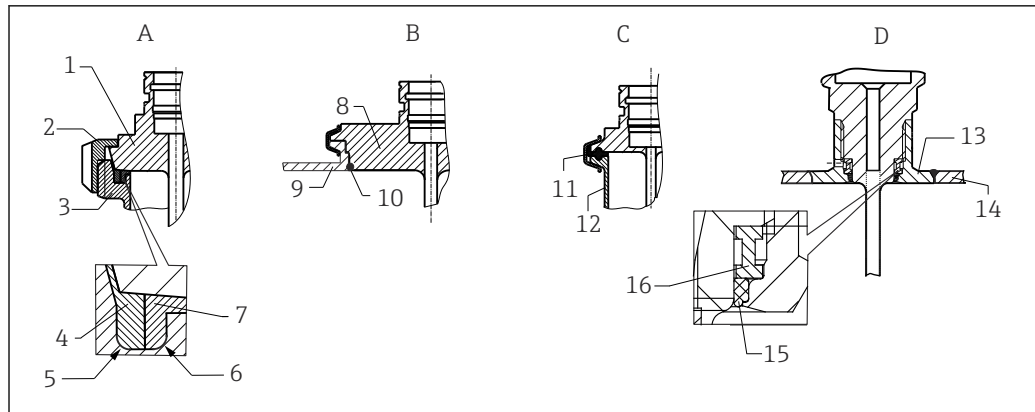


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6 Process connections for thermometer installation in pipes with small nominal diameters

1 Varivent® process connection type N for DN40

2 Corner-piece or T-piece (illustrated) for weld-in as per DIN 11865 / ASME BPE 2012



A0040345


 7 Detailed installation instructions for hygiene-compliant installation

- 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 included in the scope of supply for the thermometer. Liquiphant M weld-in adapters with associated seal kits are available as accessories.



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

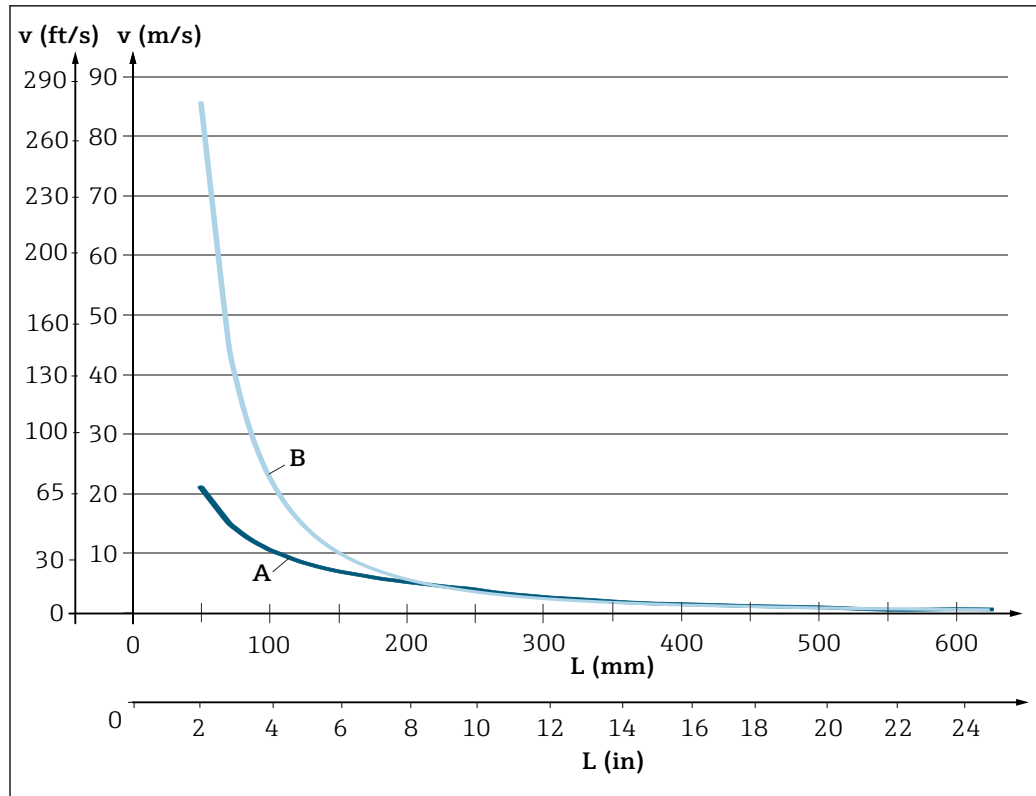
1. Use suitable welding material.
 2. Flush-weld or weld with welding radius ≥ 3.2 mm (0.13 in).
 3. Avoid crevices, folds or gaps.
 4. Ensure the surface is honed and polished, $Ra \leq 0.76$ μm (30 μin).
1. As a general rule, the thermometers should be installed in such a way that does not impact their 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.

Environment

| | | |
|--|--|--------------------------------|
| Ambient temperature range | Ambient temperature T_a | -40 to +60 °C (-40 to +140 °F) |
| | Maximum electronics temperature T | -40 to +85 °C (-40 to +185 °F) |
| Storage temperature range | T = -40 to +85 °C (-40 to +185 °F) | |
| Climate class | As per IEC 60654-1, Class Dx | |
| Degree of protection | <ul style="list-style-type: none"> ■ IP54 for the version without protection tube provided for installation in an existing protection tube ■ IP67/68 for housing with LED status indication ■ IP69K for housing without LED status indication and only if appropriate cord-set with M12x1 coupling is connected. →  43 <p> The specified rating IP67/68 or IP69K for the compact thermometer is only assured when an approved M12 connector with a suitable IP rating is installed according to its manual.</p> | |
| Shock and vibration resistance | Endress+Hauser temperature sensors meet the requirements of IEC 60751 which specify shock and vibration resistance of 3g in the range from 10 to 500 Hz. This also applies for the quick-fastening iTHERM QuickNeck. | |
| Electromagnetic compatibility (EMC) | <p>EMC to all relevant requirements of the IEC/EN 61326 - series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity. All tests were passed both with and without ongoing HART® communication.</p> <p>All EMC measurements were performed with a turn down (TD) = 5:1. Maximum fluctuations during EMC- tests: < 1% of measuring span.</p> <p>Interference immunity to IEC/EN 61326 - series, requirements for industrial areas.</p> <p>Interference emission to IEC/EN 61326 - series, electrical equipment Class B.</p> | |

Process

| | | |
|----------------------------------|---|---------------------------------|
| Process temperature range | T_p | -40 to +160 °C (-40 to +320 °F) |
| | Reference sensor defective if temperature range of -45 to +200 °C (-49 to +392 °F) is exceeded. Temperature measurement continues, but selfcalibration is out of function. | |
| 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 | <p>The maximum static process pressure is limited by the process connection, see respective section. →  27</p> <p> 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.</p> <p>Example of the permitted flow velocity depending on the immersion length and process medium</p> <p>The highest flow velocity tolerated by the thermometer diminishes with increasing 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 process medium, on the process temperature and on the process pressure. The following figures exemplify the maximum permitted flow velocities in water at a process pressure of 40 bar (580 PSI) and superheated steam at a process pressure of 6 bar (87 PSI).</p> | |



A0032462

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

A Medium water at $T = 50\text{ °C}$ (122 °F)

B Medium superheated steam at $T = 160\text{ °C}$ (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 protection tube version used:

- Thermometer without a protection tube
- Diameter 6 mm (0.24 in)
- Diameter 9 mm (0.35 in)
- Diameter 12.7 mm ($\frac{1}{2}$ in)
- T-piece and corner-piece protection tube version as per DIN 11865 / ASME BPE 2012 for weld-in

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

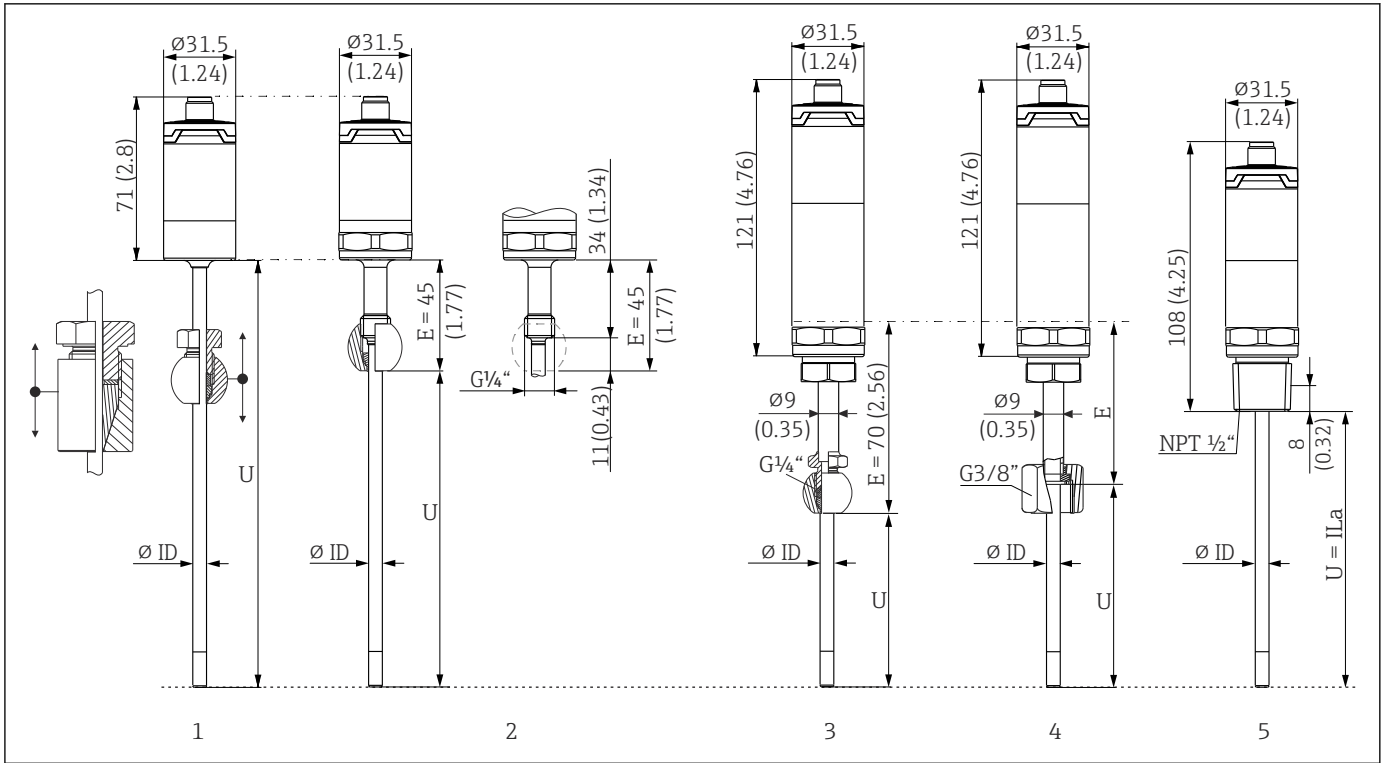
Variable dimensions:

| Item | Description |
|------|--|
| E | Extension neck length, variable depending on the configuration or predefined for the version with iTHERM QuickNeck |
| L | Protection tube length (U+T) |
| B | Protection tube bottom thickness: predefined, depends on protection tube version (see also the individual table data) |
| T | Length of protection tube shaft: variable or predefined, depends on protection tube version (see also the individual table data) |

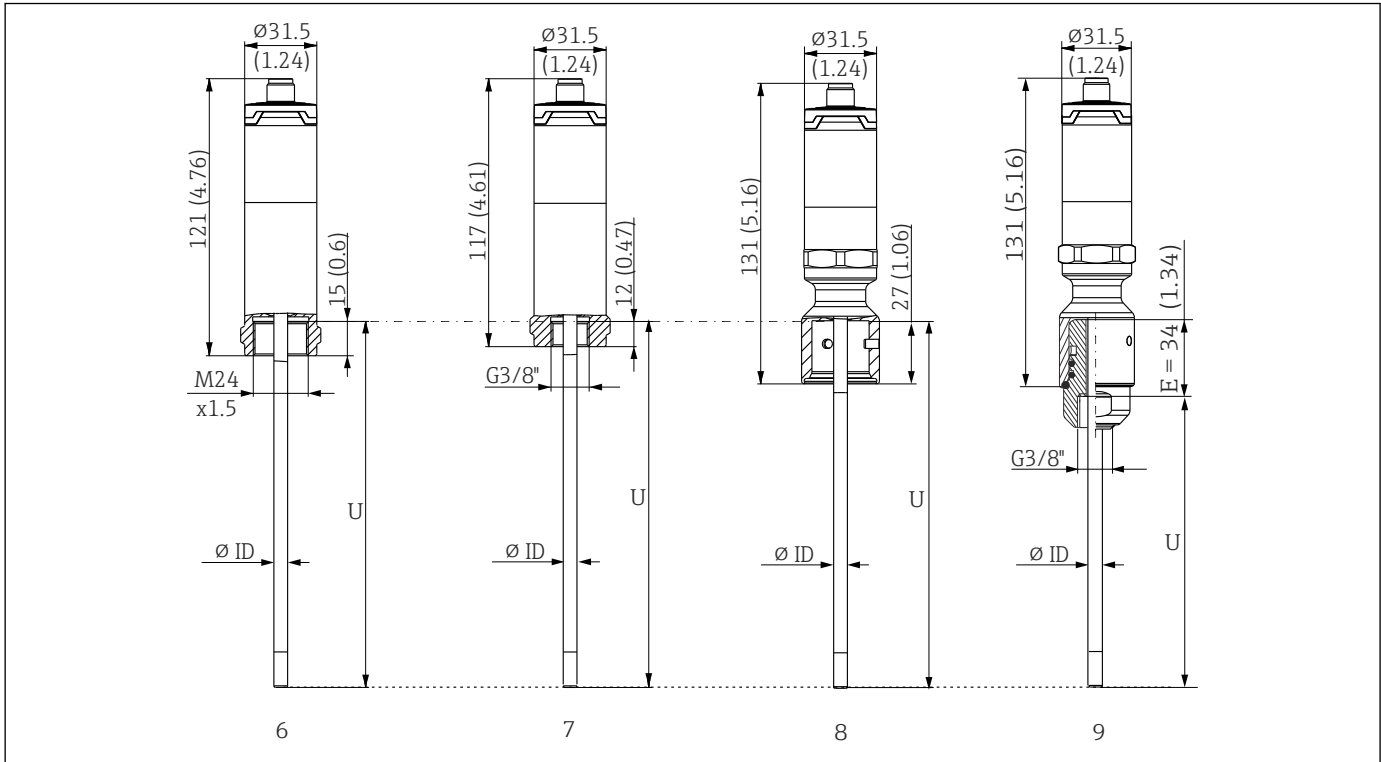
| Item | Description |
|------|--|
| U | Immersion length: variable, depending on the configuration |
| ∅ID | Insert diameter 6 mm (0.24 in) or 3 mm (0.12 in) |

Without protection tube

For installation with compression fitting TK40 as process connection and the insert in direct contact with the process or in an existing protection tube.



- 1 Thermometer without extension neck, for mounting with adjustable compression fitting TK40, spherically and cylindrically, only ∅ID = 6 mm
- 2 Thermometer with extension neck, for mounting with or in on-site existing compression fitting TK40 in fix position, only ∅ID = 6 mm
- 3 Thermometer with compression fitting TK40 fixed by extension neck, connection thread M24x1.5, ∅ID = 6 mm
- 4 Thermometer with neck tube TE411, G3/8" thread adapter nut
- 5 Thermometer with thread NPT 1/2" to mount in existing protection tube



A0044742

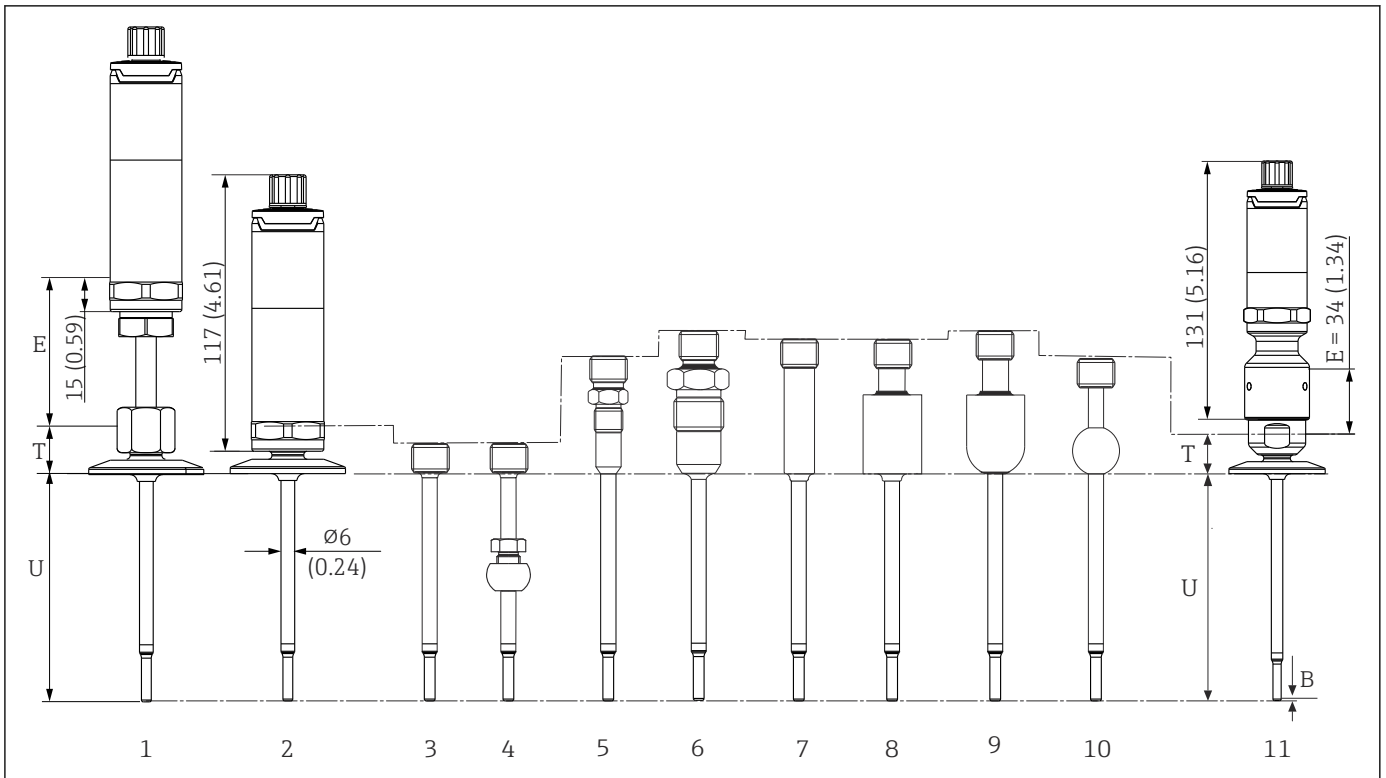
- 6 Thermometer with M24x1.5 female thread for protection tube connection, e.g. TT411, $\varnothing ID = 3 \text{ mm}$ or 6 mm
- 7 Thermometer with G3/8" female thread for protection tube connection, e.g. TT411, $\varnothing ID = 3 \text{ mm}$ or 6 mm
- 8 Thermometer with iTHERM QuickNeck top part for protection tube with QuickNeck connection, $\varnothing ID = 3 \text{ mm}$ or 6 mm
- 9 Thermometer with iTHERM QuickNeck to mount in existing thermowell with G3/8" female thread

| Item | Description |
|--------------------------------|---|
| $U_{(\text{protection tube})}$ | Immersion length of the protection tube available at point of installation |
| $T_{(\text{protection tube})}$ | Shaft length of protection tube available at point of installation |
| E | Length of the extension neck at point of installation (provided one is available) |
| $B_{(\text{protection tube})}$ | Base thickness of protection tube |

Pay attention to the following equations when calculating the immersion length U for immersion into a protection tube TT411 already available:

| | |
|--------------------|---|
| Version 6 and 8 | $U = U_{(\text{protection tube})} + T_{(\text{protection tube})} + E + 3 \text{ mm} - B_{(\text{protection tube})}$ |
| Version 3, 4 and 7 | $U = U_{(\text{protection tube})} + T_{(\text{protection tube})} + 3 \text{ mm} - B_{(\text{protection tube})}$ |

With protection tube diameter 6 mm (0.24 in)



A0031254

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

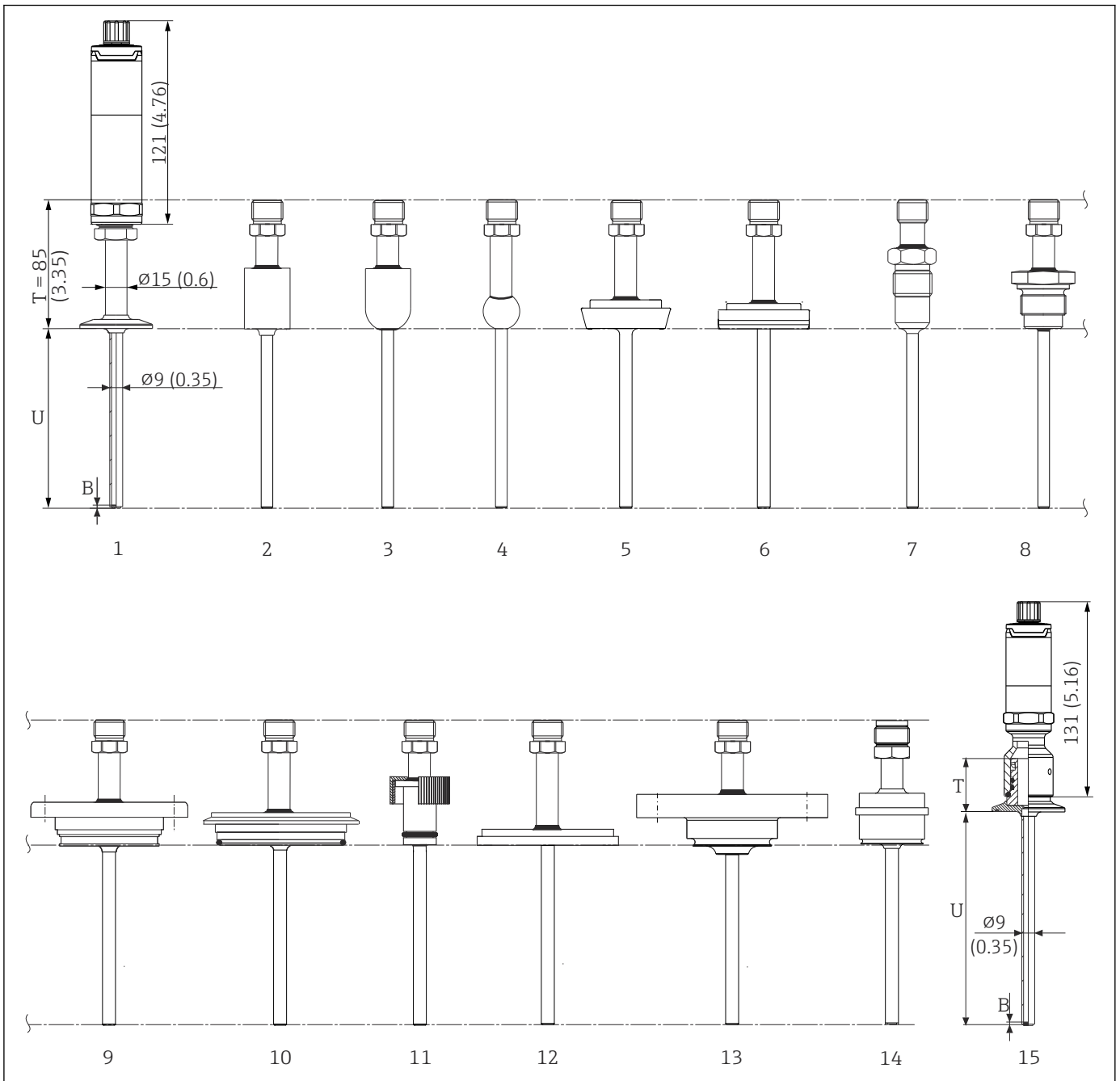
G3/8" thread for protection tube connection

| Item | Version | Length |
|---|---|--|
| Extension neck E | Without extension neck | - |
| | Replaceable extension neck, Ø9 mm (0.35 in) | Variable, depending on the configuration |
| | iTHERM QuickNeck | 34 mm (1.34 in) |
| Length of protection tube shaft T ¹⁾ | Clamp DN12 according to ISO 2852 | 24 mm (0.94 in) |
| | Clamp DN25/DN40 according to ISO 2852 | 21 mm (0.83 in) |
| | Without process connection (only G3/8" thread), where necessary with compression fitting TK40 | 12 mm (0.47 in) |
| | Metal sealing system M12x1 | 46 mm (1.81 in) |
| | Metal sealing system G½" | 60 mm (2.36 in) |
| | Cylindrical weld-in adapter Ø12 mm (0.47 in) | 55 mm (2.17 in) |
| Cylindrical weld-in adapter Ø30 mm (1.18 in) | 55 mm (2.17 in) | |
| Spherical-cylindrical weld-in adapter | 58 mm (2.28 in) | |

| Item | Version | Length |
|--------------------|---|--|
| | Spherical weld-in adapter | 47 mm (1.85 in) |
| | Tri-clamp (0.5"-0.75") | 24 mm (0.94 in) |
| | Microclamp (DN8-18) | 23 mm (0.91 in) |
| | Sanitary connection DN25/DN32/DN40 according to DIN 11851 | 29 mm (1.14 in) |
| Immersion length U | Independent of the version | Variable, depending on the configuration |
| Bottom thickness B | Reduced tip \varnothing 4.3 mm (0.17 in) | 2 mm (0.08 in) |

1) Depends on the process connection

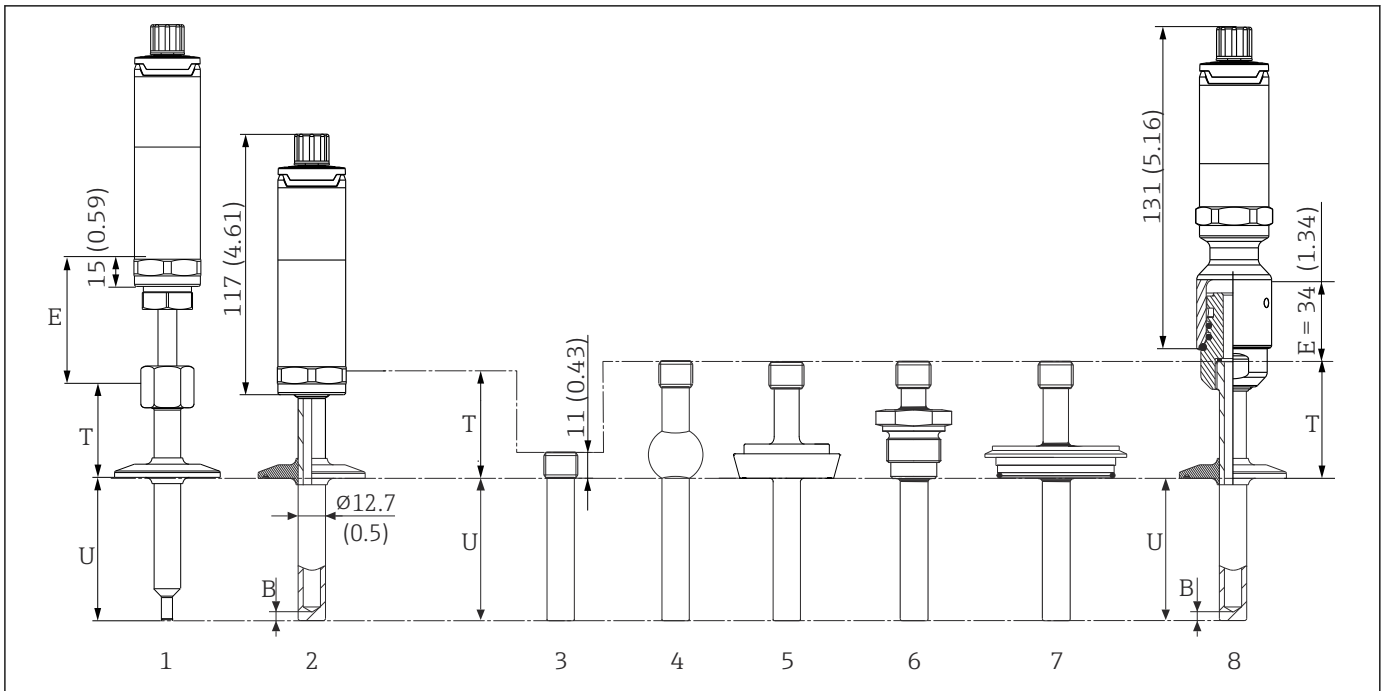
With protection tube diameter 9 mm (0.35 in)



- 1 Thermometer with extension neck, process connection as clamp version
- 2 Process connection version as cylindrical weld-in adapter $\varnothing 30 \times 40$ mm
- 3 Process connection version as spherical-cylindrical weld-in adapter $\varnothing 30 \times 40$ mm
- 4 Process connection version as spherical weld-in adapter $\varnothing 25 \times$ 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 $G\frac{1}{2}$ "
- 8 Process connection version as thread according to 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 Process adapter D45
- 15 Thermometer with quick-fastening iTHERM QuickNeck and process connection, as clamp version for example

| Item | Version | Length |
|--|--|--|
| Extension neck E | No separate extension neck available | - |
| Length of protection tube shaft T | Without quick-fastening iTHERM QuickNeck independent of the process connection | 85 mm (3.35 in) |
| | Without quick-fastening iTHERM QuickNeck in combination with Ingold connection Ø25 mm (0.98 in) x 46 mm (1.81 in) | 100 mm (3.94 in) |
| | With quick-fastening 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) |
| | Thread G1" 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 | 45 mm (1.77 in) |
| | Aseptic pipe union according to DIN11864-A, DN40 | |
| | 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 | |
| | Clamp according to ISO 2852, DN12 | 48 mm (1.89 in) |
| | Clamp according to ISO 2852, DN25 | |
| | Clamp according to ISO 2852, DN40 | |
| | Clamp according to ISO 2852, DN63.5 | |
| | Clamp according to ISO 2852, DN70 | 39 mm (1.54 in) |
| | Microclamp (DN18) | |
| | Tri-clamp (0.75") | |
| | 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" | 77 mm (3.03 in) | |
| APV-Inline, DN50 | 51 mm (2.01 in) | |
| Immersion length U | Independent of the version | Variable, depending on the configuration |
| Bottom thickness B | Reduced tip Ø5.3 mm (0.21 in)x 20 mm (0.79 in) | 2 mm (0.08 in) |
| | Straight tip | |

With protection tube diameter 12.7 mm (½ in)



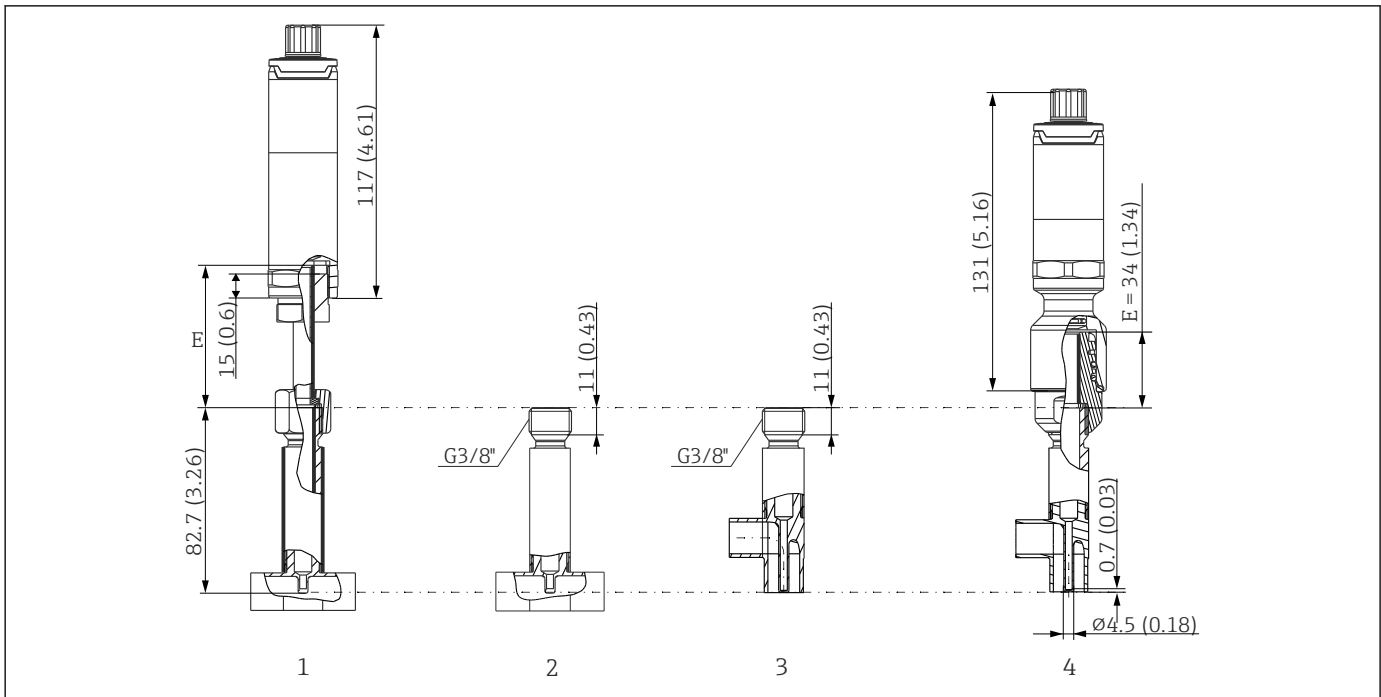
A0031372

- 1 Thermometer with standard extension neck, thread and process connection as clamp version
- 2 Thermometer with extension neck and process connection as clamp version
- 3 Process connection version as cylindrical weld-in adapter \varnothing 12.7 mm (½ in)
- 4 Process connection version as spherical weld-in adapter \varnothing 25 mm (1 in)
- 5 Process connection version as sanitary connection according to DIN 11851
- 6 Thread according to ISO 228 for Liquiphant weld-in adapter
- 7 Process connection version Varivent®
- 8 Thermometer with quick-fastening iTHERM QuickNeck and process connection, as clamp version for example

- G3/8" thread for protection tube connection
- Protection tube made from solid bar stock drilled for $L \leq 200$ mm (7.87 in)
- Welded protection tube for $L > 200$ mm (7.87 in)

| Item | Version | Length |
|-----------------------------------|--|--|
| Extension neck E | Without extension neck | - |
| | Replaceable extension neck, \varnothing 9 mm (0.35 in) | Variable, depending on the configuration |
| | iTHERM QuickNeck | 34 mm (1.34 in) |
| Length of protection tube shaft T | Weld-in adapter, cylindrical, \varnothing 12.7 mm (½ in) | 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 |
| Bottom thickness B | Reduced tip \varnothing 5.3 mm (0.21 in) x 20 mm (0.79 in) | 2 mm (0.079 in) |
| | Reduced tip \varnothing 8 mm (0.31 in) x 32 mm (1.26 in) | 4 mm (0.16 in) |
| | Straight tip | 6 mm (0.24 in) |

With tee- or elbow piece protection tube version



A0031515

- 1 Thermometer with extension neck and tee-piece protection tube
- 2 Version with tee-piece protection tube
- 3 Version with elbow piece
- 4 Thermometer with quick-fastening iTHERM QuickNeck and elbow piece protection tube

| Item | Version | Length |
|--------------------|--|--|
| Extension neck E | Without extension neck | - |
| | Replaceable extension neck, $\varnothing 9$ mm (0.35 in) | Variable, depending on the configuration |
| | iTHERM QuickNeck | 34 mm (1.34 in) |
| Bottom thickness B | Independent of the version | 0.7 mm (0.03 in) |
| Immersion length U | Independent of the version | 82.7 mm (3.26 in) |

- Pipe sizes according to DIN11865 series A (DIN), B (ISO) and C (ASME BPE)
- Nominal diameters > DN25, with 3-A symbol
- IP69K protection class
- Material 1.4435+316L, Delta ferrite content <0.5%
- Temperature measurement range: -60 to +200 °C (-76 to +392 °F)
- Pressure range: PN25 according to DIN11865

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

| Process connection and size | Protection tube diameter | | | iTHERM QuickNeck for Ø9 mm (0.35 in) ¹⁾ |
|--|------------------------------|----------------|------------------------------|--|
| | 6 mm (0.24 in) ²⁾ | 9 mm (0.35 in) | 12.7 mm (½ in) ²⁾ | |
| Without process connection (for installation with compression fitting) | ☑ | - | - | - |
| Process adapter D45 | - | ☑ | - | - |
| 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) | ☑ | ☑ | - | ☑ |
| 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 | ☑ | - | - | - |
| G½" | | ☑ | - | ☑ |
| Thread according to ISO 228 for Liquiphant weld-in adapter | | | | |
| G¾" for FTL31/33/20 | - | ☑ | ☑ | - |
| 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 | - | ☑ | - | ☑ |

| Process connection and size | Protection tube diameter | | | iTHERM QuickNeck for Ø9 mm (0.35 in) ¹⁾ |
|------------------------------|------------------------------|----------------|------------------------------|--|
| | 6 mm (0.24 in) ²⁾ | 9 mm (0.35 in) | 12.7 mm (½ in) ²⁾ | |
| Neumo Biocontrol | | | | |
| D25 PN16, D50 PN16, D65 PN16 | - | ☑ | - | - |

1) In the case of 6 mm (0.24 in) and 12.7 mm (½ in) diameters, the iTHERM QuickNeck is available for all process connection versions.

2) All versions available with iTHERM QuickNeck

Weight 0.2 to 2.5 kg (0.44 to 5.5 lbs) for standard options.

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

| Designation | Short form | Recommended max. temperature for continuous use in air | Properties |
|---|---|--|---|
| AISI 316L (corresponds to 1.4404 or 1.4435) | X2CrNiMo17-13-2, X2CrNiMo18-14-3 | 650 °C (1 202 °F) ¹⁾ | <ul style="list-style-type: none"> ▪ 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% - including the welding seams (following Basel Standard II); or <0.5% | | |

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

Surface roughness

Values for wetted surfaces:

| | |
|--|--|
| Standard surface, mechanically polished ¹⁾ | R _a ≤ 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 |

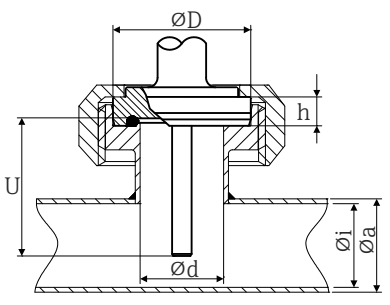
1) Or any other finishing method that meets the R_a max

2) Not compliant with ASME BPE

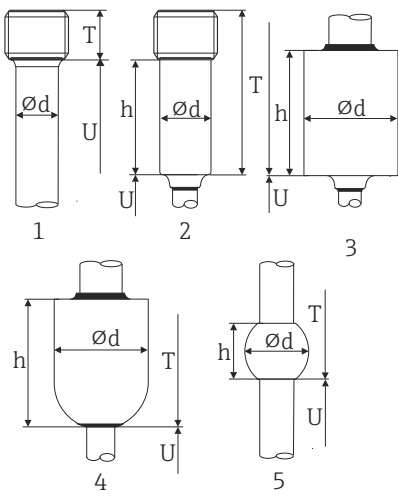
Protection tube

Process connections

All dimensions in mm (in).

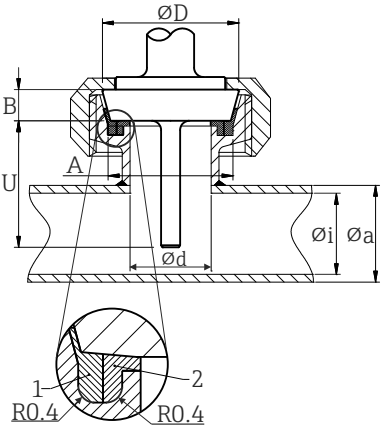
| Type | Version | Dimensions | | | | | Technical properties |
|--|---------|--------------------|----------------------|--------------------|--------------------|--------------------|--|
| | | ϕd | ϕD | ϕi | ϕa | h | |
| Aseptic pipe union according to DIN 11864-1, Form A  | DN25 | 26 mm (1.02 in) | 42.9 mm (1.7 in) | 26 mm (1.02 in) | 29 mm (1.14 in) | 9 mm (0.35 in) | <ul style="list-style-type: none"> ■ $P_{max.} = 40$ bar (580 psi) ■ 3-A® marked and EHEDG certified ■ 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) | |

For welding in

| Type | Version | Dimensions | Technical properties |
|---|------------------------------|---|--|
| Weld-in adapter  | 1: Cylindrical ¹⁾ | $\phi d = 12.7$ mm ($\frac{1}{2}$ in), U = immersion length from lower edge of thread, T = 12 mm (0.47 in) | <ul style="list-style-type: none"> ■ $P_{max.}$ depends on the weld-in process ■ 3-A® marked and EHEDG certified ■ ASME BPE compliance |
| | 2: Cylindrical ²⁾ | $\phi d \times h = 12$ mm (0.47 in) x 40 mm (1.57 in), T = 55 mm (2.17 in) | |
| | 3: Cylindrical | $\phi d \times h = 30$ mm (1.18 in) x 40 mm (1.57 in) | |
| | 4: Spherical-cylindrical | $\phi d \times h = 30$ mm (1.18 in) x 40 mm (1.57 in) | |
| | 5: Spherical | $\phi d = 25$ mm (0.98 in) h = 24 mm (0.94 in) | |

- 1) For thermowell $\phi 12.7$ mm ($\frac{1}{2}$ in)
- 2) For thermowell $\phi 6$ mm ($\frac{1}{4}$ in)

Releasable process connection

| Type | | | | | | Technical properties |
|--|--------------------|--------------------|--------------------|--------------------|--------------------|---|
| Sanitary connection according to DIN 11851  | | | | | | <ul style="list-style-type: none"> ■ 3-A® marked and EHEDG certified (only with EHEDG-certified and self-centering sealing ring). ■ ASME BPE compliance |
| A0009561 1 Centering ring 2 Sealing ring | | | | | | |
| Version ¹⁾ | Dimensions | | | | | P _{max.} |
| | ØD | A | B | Øi | Øa | |
| 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

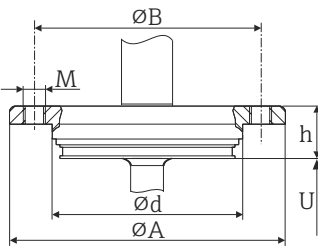
| Type | Version | Dimensions | | Technical properties | Conformity |
|--|--|----------------------|--------------------------------------|---|----------------------------------|
| | ϕd : ¹⁾ | ϕD | ϕa | | |
| <p>Clamp according to ISO 2852</p> <p>Form A: In compliance with ASME BPE Type A Form B: In compliance with ASME BPE Type B and ISO 2852</p> <p>A0009566</p> | Microclamp ²⁾ DN8-18 (0.5"-0.75") ³⁾ , Form A | 25 mm (0.98 in) | - | <ul style="list-style-type: none"> ■ $P_{max.} = 16$ bar (232 psi), depends on clamp ring and suitable seal ■ 3-A® marked | ASME BPE Type A |
| | Tri-clamp DN8-18 (0.5"-0.75") ³⁾ , Form B | | - | | Following 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) | <ul style="list-style-type: none"> ■ $P_{max.} = 16$ bar (232 psi), depends on clamp ring and suitable seal ■ 3-A® marked and EHEDG certified (in conjunction 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 |

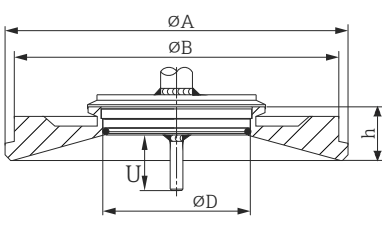
- 1) Pipes in accordance with ISO 2037 and BS 4825 Part 1
- 2) Microclamp (not in ISO 2852); no standard pipes
- 3) DN8 (0.5") only possible with thermowell diameter = 6 mm (¼ in)
- 4) Groove diameter = 20 mm

| Type | Version | Technical properties |
|-----------------------|-------------------|---|
| Metal sealing system | | |
| <p>M12x1.5</p> | <p>G½"</p> | <p>Thermowell diameter 6 mm (¼ in)</p> <p>$P_{max.} = 16 \text{ bar (232 psi)}$</p> <p> Maximum torque = 10 Nm (7.38 lbf ft)</p> |
| | | |

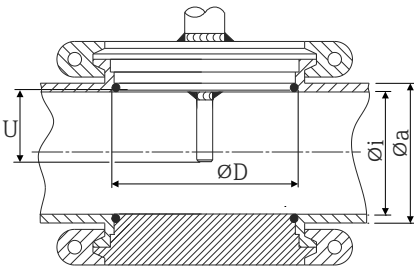
| Type | Version | Technical properties |
|------------------------|---------|----------------------|
| <p>Process adapter</p> | D45 | - |

| Type | Version G | Dimensions | | | Technical properties |
|---|-----------------------------|-------------------|-------------------|-----------|---|
| | | L1 thread length | A | 1 (SW/AF) | |
| <p>Thread according to ISO 228 (for Liquiphant weld-in adapter)</p> | G¾" for FTL20/31/33 adapter | 16 mm (0.63 in) | 25.5 mm (1 in) | 32 | <ul style="list-style-type: none"> ■ $P_{max.} = 25 \text{ bar (362 psi)}$ at max. 150 °C (302 °F) ■ $P_{max.} = 40 \text{ bar (580 psi)}$ at max. 100 °C (212 °F) ■ 3-A® marked and EHEDG tested in conjunction with FTL31/33/50 adapter ■ ASME BPE compliance |
| | 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 | |
| <p>APV Inline</p>  <p>A0018435</p> | DN50 | 69 mm (2.72 in) | 99.5 mm (3.92 in) | 82 mm (3.23 in) | 2xM8 | 19 mm (0.75 in) | <ul style="list-style-type: none"> ■ P_{max.} = 25 bar (362 psi) ■ 3-A® marked and EHEDG certified ■ ASME BPE compliance |

| Type | Version | Dimensions | | | | P _{max.} | Technical properties |
|---|---------|--------------------|---------------------|---------------------|----------------------|---------------------|--|
| | | ϕD | ϕA | ϕB | h | | |
| <p>Varivent®</p>  <p>A0021307</p> | Type B | 31 mm (1.22 in) | 105 mm (4.13 in) | - | 22 mm (0.87 in) | 10 bar (145 psi) | <ul style="list-style-type: none"> ■ 3-A® marked and EHEDG certified ■ 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) | | |

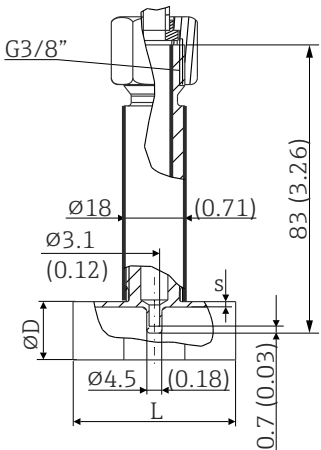
i The VARINLINE® housing connection flange is suitable for weld-in into the conical or torispherical head in tanks or vessels with a small diameter (≤ 1.6 m (5.25 ft)) and up to a wall thickness of 8 mm (0.31 in).

| Type | Technical properties |
|---|--|
| <p>Varivent® for VARINLINE® housing for installation in pipes</p>  <p>A0009564</p> | <ul style="list-style-type: none"> ■ 3-A® marked and EHEDG certified ■ 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) | |
| 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) | |

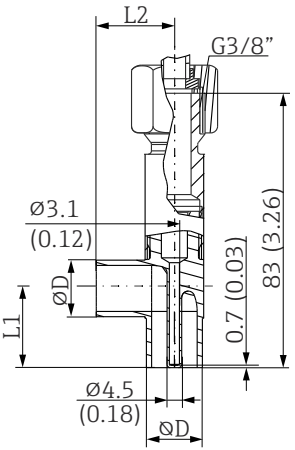
T-piece, optimized (no welding, no dead legs)

| 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) | <ul style="list-style-type: none"> ■ P_{max.} = 25 bar (362 psi) ■ 3-A® marked²⁾ and EHEDG certified²⁾ ■ ASME BPE compliance²⁾ |
| | | 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) | | 2 mm (0.08 in) | |
| | | DN33.7 PN25 | 33.7 mm (1.33 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) | | | |

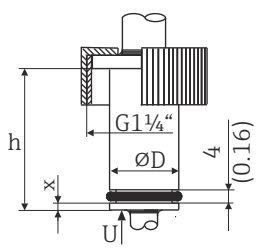
1) Wall thickness

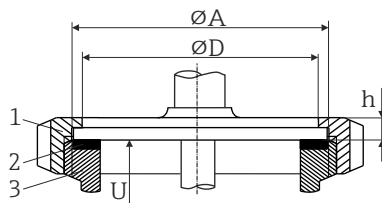

2) Valid for ≥ DN25. The radius ≥ 3.2 mm (1/8 in) cannot be maintained for smaller nominal widths.

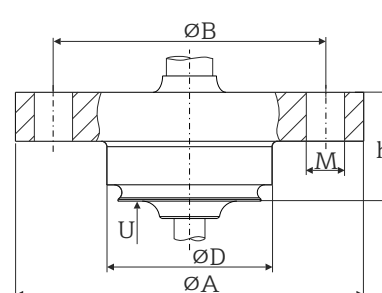
Elbow piece, optimized (no welding, no dead legs)

| Type | Version | | Dimensions | | | Technical properties |
|---|----------|-------------------|-----------------------|--------------------|-----------------------|--|
| | | | ØD | L1 | L2 | |
| Elbow piece for weld-in as per DIN 11865 (series A, B and C)  A0035899 | Series A | DN10 PN25 | 13 mm (0.51 in) | 24 mm (0.95 in) | 1.5 mm (0.06 in) | <ul style="list-style-type: none"> ■ P_{max.} = 25 bar (362 psi) ■ 3-A® marked²⁾ and EHEDG certified²⁾ ■ ASME BPE compliance²⁾ |
| | | 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) | 32 mm (1.26 in) | 1.6 mm (0.063 in) | |
| | | DN17.2 PN25 | 17.2 mm (0.68 in) | 34 mm (1.34 in) | | |
| | | DN21.3 PN25 | 21.3 mm (0.84 in) | 36 mm (1.41 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) | | |

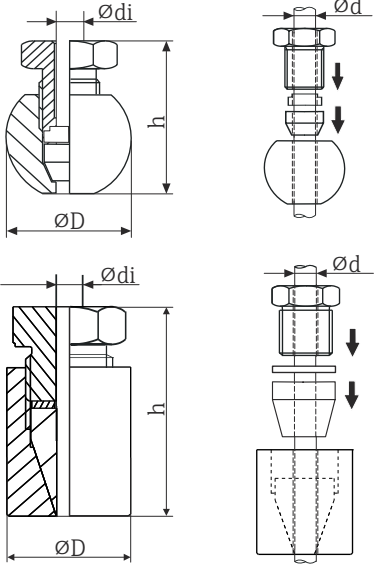
- 1) Wall thickness
- 2) Valid for ≥ DN25. The radius ≥ 3.2 mm (1/8 in) cannot be maintained for smaller nominal widths.

| Type | Version, dimensions ØD x h | Technical properties |
|--|---|---|
| Ingold connection  A0009573 | Ø25 mm (0.98 in) x30 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. Material V75SR: compliance with FDA, 3-A® Sanitary Standard 18-03 Class 1 and USP Class VI |
| | Ø25 mm (0.98 in) x46 mm (1.81 in) x = 6 mm (0.24 in) | |

| Type | Version | Dimensions | | | Technical properties |
|--|---------|--------------------|---------------------|----------------|-------------------------------------|
| | | ϕD | ϕA | h | |
| SMS 1147  1 Thread adapter nut 2 Sealing ring 3 Counterpart connection A0009568 | DN25 | 32 mm (1.26 in) | 35.5 mm (1.4 in) | 7 mm (0.28 in) | $P_{max.} = 6 \text{ bar (87 psi)}$ |
| | 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) | <ul style="list-style-type: none"> ■ $P_{max.} = 16 \text{ bar (232 psi)}$ ■ 3-A® marked |
| | 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 | ϕ_{di} | ϕ_D | h | |
| Compression fitting TK40 for weld-in  | Spherical Ferrule material PEEK or 316L Thread G $\frac{1}{4}$ " | 6.3 mm (0.25 in) ²⁾ | 25 mm (0.98 in) | 33 mm (1.3 in) | <ul style="list-style-type: none"> ■ 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 Ferrule material Wacker® ELASTOSIL Thread G $\frac{1}{2}$ " | 6.2 mm (0.24 in) ²⁾ | 9.2 mm (0.36 in) | 30 mm (1.18 in) | 57 mm (2.24 in) |

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

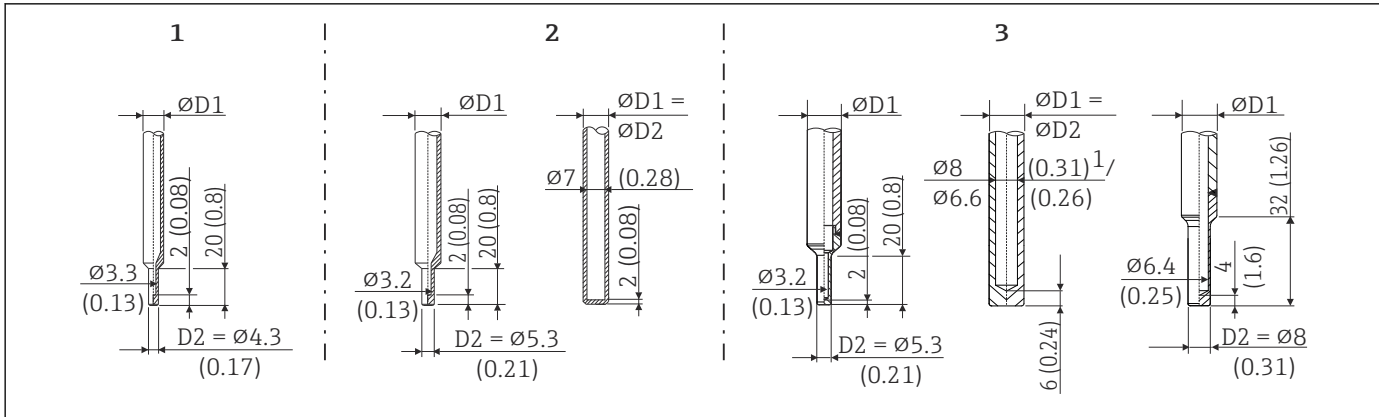
i The 316L compression fittings can only be used once due to deformation. This applies to all the components of the compression fittings! A replacement compression fitting must be fastened at another point (grooves in thermowell). PEEK compression fittings must never be used at a temperature that is 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.

If stricter requirements must be met, the use of SWAGELOCK or similar fasteners is urgently recommended.

Tip shape

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 $\phi 4.3$ mm (0.17 in) and $\phi 5.3$ mm (0.21 in): walls of lower thickness significantly reduce the response times of the overall measuring point.
 - Reduced tip with $\phi 8$ 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.).



A0044739

9 Thermowell tips available (reduced, straight or tapered)

| Item No. | Thermowell ($\varnothing D1$) | | Insert ($\varnothing ID$) |
|----------|---|--|---|
| 1 | $\varnothing 6$ mm ($\frac{1}{4}$ in) | Reduced tip | $\varnothing 3$ mm ($\frac{1}{8}$ in) |
| 2 | $\varnothing 9$ mm (0.35 in) | <ul style="list-style-type: none"> Reduced tip with $\varnothing 5.3$ mm (0.21 in) Straight tip | <ul style="list-style-type: none"> $\varnothing 3$ mm ($\frac{1}{8}$ in) $\varnothing 6$ mm ($\frac{1}{4}$ in) $\varnothing 3$ mm ($\frac{1}{8}$ in) |
| 3 | $\varnothing 12.7$ mm ($\frac{1}{2}$ in) | <ul style="list-style-type: none"> Reduced tip with $\varnothing 5.3$ mm (0.21 in) Straight tip Reduced tip with $\varnothing 8$ mm (0.31 in) | <ul style="list-style-type: none"> $\varnothing 3$ mm ($\frac{1}{8}$ in) $\varnothing 6$ mm ($\frac{1}{4}$ in) $\varnothing 6$ mm ($\frac{1}{4}$ in) |

i 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.

Operability

Operating concept

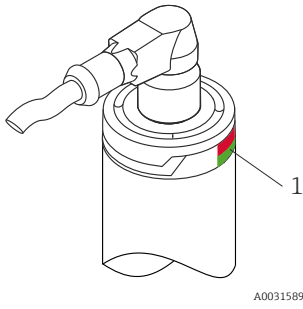
The configuration of device-specific parameters is done via the HART protocol or CDI interface (= Endress+Hauser Common Data Interface). There are specific configuration or operating programs from different manufacturers available to the user for this purpose. Both the DD (Device Description) as well as the DTM (Device Type Manager) files are being provided for the iTHERM TrustSens thermometers.

Self-calibration

A self-calibration certificate similar to laboratory calibration can be created with a DTM and can be printed on demand. The necessary measurement data is stored in the device and can be requested by the DTM.

Local operation

LED signals

| Position | LEDs | Function description |
|---|--|---|
|  <p>A0031589</p> <p>1 LED for device status indication</p> | LED green (gn) is illuminated | Voltage supply is correct. The device is operational and the set limit values are met. |
| | LED green (gn) is flashing | With a frequency 1 Hz: self-calibration currently being performed. With a frequency 5 Hz for 5 s: self-calibration finished and valid, all process criteria were within specifications. Calibration data stored. |
| | LED red (rd) and green (gn) are flashing alternating | Self-calibration process finished but not valid, violation of necessary process criteria. Calibration data not stored. |
| | LED red (rd) is flashing | Presence of a diagnostic event: "Warning" |
| | LED red (rd) is illuminated | Presence of a diagnostic event: "Alarm" |

Operating elements

To prevent manipulation, no operating elements are present directly on the device. The thermometer is configured only by remote operation.

Remote operation

Configuration

Configuration kits, e. g. Commubox FXA195 or TXU10, for PC-programmable thermometer with setup software and interface for PC with USB port.

HART® functions and device-specific parameters are configured by HART® communication or via the interface of the device. There are special configuration tools like FieldCare or DeviceCare by Endress+Hauser. For more information, contact your Endress+Hauser sales representative.

Operating tools

| Operating tool | Sources for obtaining the required device descriptions (DD) or device type manager (DTM) |
|--|---|
| FieldCare (Endress+Hauser) | <ul style="list-style-type: none"> ▪ www.endress.com → Download Area → Software ▪ DVD (contact Endress+Hauser) |
| DeviceCare (Endress+Hauser) | www.endress.com → Download Area → Software |
| FieldXpert SFX350, SFX370 (Endress+Hauser) | Use update function of handheld terminal |

Certificates and approvals

CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.

EAC mark



The product meets the legal requirements of the EEU guidelines. The manufacturer confirms the successful testing of the product by affixing the EAC mark.

cCSAus

The product complies with "CLASS 2252 05 - Process Control Equipment" and "CLASS 2252 85 - Process Control Equipment - Certified to US Standards" requirements.

MTBF

For the transmitter: 180 years - according to Siemens Standard SN29500

| | |
|--|---|
| Hygiene standard | <ul style="list-style-type: none"> ■ EHEDG certification, type EL CLASS I. EHEDG certified/tested process connections. →  27 ■ 3-A authorization no. 1144, 3-A Sanitary standard 74-07. Listed process connections. →  27 ■ ASME BPE, certificate of conformity can be ordered for indicated options ■ 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 |
| Materials in contact with food/product (FCM) | <p>The materials of the thermometer in contact with food/product (FCM) comply with the following European regulations:</p> <ul style="list-style-type: none"> ■ (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. |
| Other standards and guidelines | <ul style="list-style-type: none"> ■ IEC 60529: Degrees of protection provided by enclosures (IP code) ■ IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use ■ IEC 60751: Industrial platinum resistance thermometers ■ DIN 43772: Protection tubes |
| CRN approval | <p>The CRN approval is only available for certain options of protection tubes. These will be marked and shown during the configuration of this device.</p> <p>Detailed ordering information is available from the following sources:</p> <ul style="list-style-type: none"> ■ In the download area on the Endress+Hauser website: www.endress.com → Select your country → Downloads → Enter product code or device → Media type: Approvals & certificates → Select type of approval → Start search ■ From your nearest Endress+Hauser sales organization: www.addresses.endress.com |
| Surface purity | Cleaned from oil and grease for O ₂ applications, optional |
| Material resistance | Material resistance - including housing - to the following cleaning agents/disinfectants from the company Ecolab: P3-topax 66, P3-topactive 200, P3-topactive 500 and P3-topactive OKTO as well as demineralized water. |
| Material certification | <p>The material certificate 3.1 (according to standard EN 10204) can be requested separately. The "short form" certificate includes a simplified declaration with no enclosures of documents related to the materials used in the construction of the single sensor and guarantees the traceability of the materials through the identification number of the thermometer. The data related to the origin of the materials can subsequently be requested by the client if necessary.</p> |
| Calibration | <p>The "Factory calibration" is carried out according to an internal procedure in a laboratory of Endress+Hauser accredited by the European Accreditation Organization (EA) to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT/Accredia) or (DKD/DAkkS) may be requested separately.</p> <p>The analog current output of the device is calibrated.</p> |
| Protection tube testing and load capacity calculation | <ul style="list-style-type: none"> ■ Protection tube pressure tests are carried out in accordance with the specifications in DIN 43772. With regard to protection tubes with tapered or reduced tips that do not comply with this standard, these are tested using the pressure of corresponding straight protection tubes. Tests according to other specifications can be carried out on request. ■ Load capacity calculation for the protection tube as per DIN43772 |

Ordering information

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

1. Click Corporate
2. Select the country

3. Click Products
4. Select the product using the filters and search field
5. Open the product page

The Configuration button to the right of the product image opens the Product Configurator.



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

Application packages

Heartbeat diagnostics

Available in all device versions.

Function

- Continuous self-monitoring of the device
- Diagnostic messages output to:
 - the local display
 - an asset management system (e.g. FieldCare/DeviceCare)
 - an automation system (e.g. PLC)

Advantages

- Device condition information is available immediately and processed in time.
- The status signals are classified in accordance with VDI/VDE 2650 and NAMUR recommendation NE 107 and contain information about the cause of the error and remedial action.



For detailed information on Heartbeat functions, see the Operating Instructions → 45

Heartbeat verification

Available in all device versions.

Device functionality checked on demand

- Verification of the correct functioning of the measuring device within specifications
- The verification result provides information about the condition of the device: "Passed" or "Failed"
- The results are documented in a verification report
- The automatically generated report supports the obligation to demonstrate compliance with internal and external regulations, laws and standards
- Verification is possible without interrupting the process

Advantages

- No onsite presence is required to use the function
- The DTM¹⁾ triggers verification in the device and interprets the results. No specific knowledge is required on the part of the user.
- The verification report can be used to prove quality measures to a third party.
- Heartbeat Verification can replace other maintenance tasks (e.g. periodic check) or extend the test intervals.



For detailed information on Heartbeat functions, see the Operating Instructions → 45

Heartbeat Monitoring

Available in all device versions.



Function

Calibration information is logged in addition to the verification parameters. 350 calibration points are saved in the device (FIFO memory).

1) Device Type Manager: controls device operation via DeviceCare, FieldCare or a DTM-based process control system.

Advantages

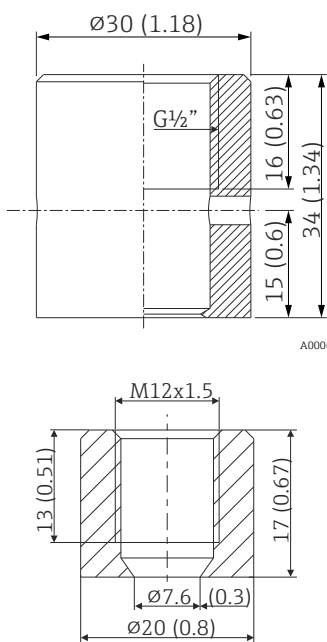
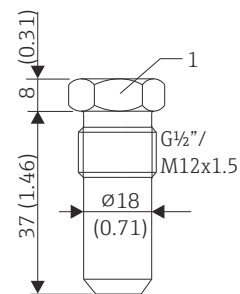
- Early detection of changes (trends) to ensure plant availability and product quality.
- Use of information for the proactive planning of measures (e.g. maintenance).

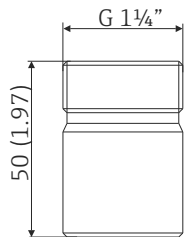
 For detailed information on Heartbeat functions, see the Operating Instructions →  45

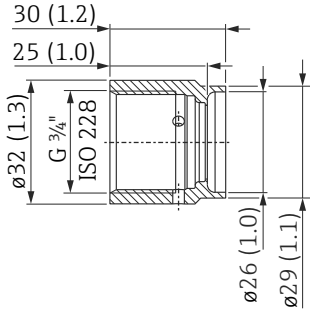
Accessories

Device-specific accessories

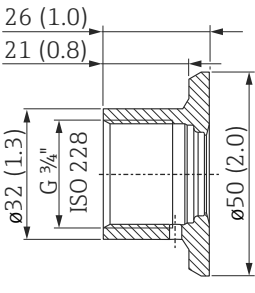
Device-specific accessories

| Accessories | Description |
|---|---|
| <p>Welding boss with sealing taper (metal - metal)</p>  <p style="text-align: right;">A0006621</p> <p style="text-align: right;">A0018236</p> | <p>Welding boss for G$\frac{1}{2}$" and M12x1.5 thread Metal-sealing; conical Material of wetted parts: 316L/1.4435 Max. process pressure 16 bar (232 PSI)</p> <p>Order number:</p> <ul style="list-style-type: none"> ▪ 71424800 (G$\frac{1}{2}$") ▪ 71405560 (M12x1.5) |
| <p>Dummy plug</p>  <p style="text-align: right;">A0045726</p> <p>1 Size across flats SW22</p> | <p>Dummy plug for G$\frac{1}{2}$" or M12x1.5 conical metal-sealing welding boss Material: SS 316L/1.4435</p> <p>Order number:</p> <ul style="list-style-type: none"> ▪ 60022519 (G$\frac{1}{2}$") ▪ 60021194 (M12x1.5) |

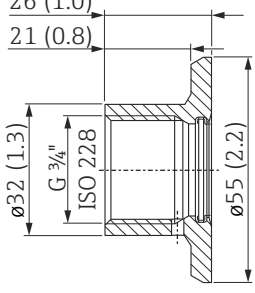
| | |
|---|---|
| <p>Weld-in adapter for Ingold process connection (OD 25 mm (0.98 in) x 46 mm (1.81 in)</p>  <p style="text-align: right;">A0008956</p> | <p>Material of wetted parts: 316L/1.4435 Weight: 0.32 kg (0.7 lb) Order number: 60017887</p> <p>O-ring seal set</p> <ul style="list-style-type: none"> ■ Silicone O-ring in accordance with FDA CFR 21 ■ Maximum temperature: 230 °C (446 °F) ■ Order number: 60018911 |
|---|---|

| | |
|--|--|
| <p>Weld-in adapter for FTL31/33/20, pipe-mounting</p>  <p style="text-align: right;">A0008265</p> | <p>G$\frac{3}{4}$\", d=29 mm, without flange Material: 316L Roughness in μm (μin): 1.5 (59.1) Order number: 52028295 (with inspection certificate EN10204-3.1 material) Order number seal (5-pc. set): silicone O-ring 52021717¹⁾, FDA-compliant</p> |
|--|--|

1) A seal is included in the delivery.

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| <p>Weld-in adapter for FTL31/33/20, vessel-mounting</p>  <p style="text-align: right;">A0008810</p> | <p>G$\frac{3}{4}$\", d=50 mm, with flange Material: 316L Roughness in μm (μin): 0.8 (31.5) Order number: 52018765 (with inspection certificate EN10204-3.1 material) Order number seal (5-pc. set): silicone O-ring 52021717¹⁾, FDA-compliant EHEDG tested and 3-A marked</p> |
|--|--|

1) A seal is included in the delivery.

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| <p>Weld-in adapter for FTL50</p>  <p style="text-align: right;">A0008274</p> | <p>G$\frac{3}{4}$\", d=55 mm, with flange Material: 316L Roughness in μm (μin): 0.8 (31.5) Order number: 52001052 (without inspection certificate EN10204-3.1 material) Order number: 52011897 (with inspection certificate EN10204-3.1 material) Order number seal (5-pc. set): silicone O-ring 52014473¹⁾, FDA-compliant Order number weld-in dummy: MVT2L0692 EHEDG tested and 3-A marked</p> |
|---|---|

1) A seal is included in the delivery.

| | |
|----------------------------------|---|
| <p>Weld-in adapter for FTL50</p> | <p>G1", d=53 mm, without flange Material: 316L Roughness in μm (μin): 0.8 (31.5) Order number: 71093129 (with inspection certificate EN10204-3.1 material) Order number seal (5-pc. set): silicone O-ring 52014472 ¹⁾, FDA-compliant Order number weld-in dummy: MVT2L0691</p> |
|----------------------------------|---|

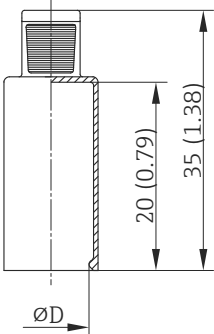
1) A seal is included in the delivery.

| | |
|----------------------------------|---|
| <p>Weld-in adapter for FTL50</p> | <p>G1", d=60 mm, with flange Material: 316L Roughness in μm (μin): 0.8 (31.5) Order number: 52001051 (without inspection certificate EN10204-3.1 material) Order number: 52011896 (with inspection certificate EN10204-3.1 material) Order number seal (5-pc. set): silicone O-ring 52014472 ¹⁾, FDA-compliant Order number weld-in dummy: MVT2L0691 EHEDG tested and 3-A marked</p> |
|----------------------------------|---|

1) A seal is included in the delivery.

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|----------------------------------|--|
| <p>Weld-in adapter for FTL50</p> | <p>G1", can be aligned Material: 316L Roughness in μm (μin): 0.8 (31.5) Order number: 52001221 (without inspection certificate EN10204-3.1 material) Order number: 52011898 (with inspection certificate EN10204-3.1 material) Order number seal (5-pc. set): silicone O-ring 52014424 ¹⁾, FDA-compliant Order number weld-in dummy: M40167</p> |
|----------------------------------|--|

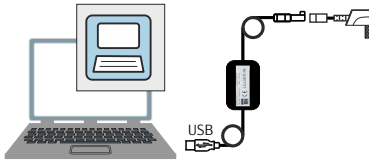
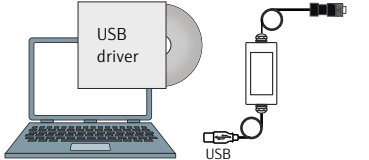
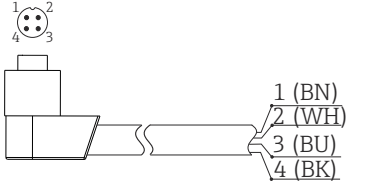
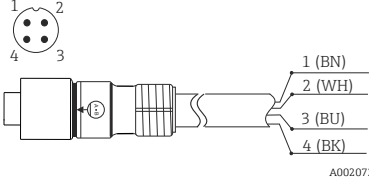
1) A seal is included in the delivery.

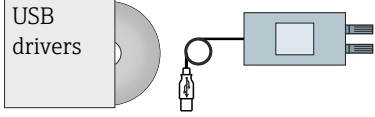



| | |
|--|--|
| <p>Flexible handle cap to cover the QuickNeck bottom part</p>  <p style="text-align: right;">A0027201</p> | <p>Diameter ØD: 24 to 26 mm (0.94 to 1.02 in) Material: Thermoplastic polyolefin - elastomer (TPE), free from plasticizers Maximum temperature: +150 °C (+302 °F) Order number: 71275424</p> |
|--|--|

- i** 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)


📖 For more information on the weld-in adapters, see Technical Information (TI00426F/00).


Communication-specific accessories

| | |
|---|---|
| <p>Configuration kit TXU10</p>  <p style="text-align: right;">A0028635</p> | <p>Configuration kit for CDI communication with PC-programmable devices. Includes interface cable for PC with USB port and M12x1 coupling (Non-Ex area). Order code: TXU10-BD</p> |
| <p>Commubox FXA291</p>  <p style="text-align: right;">A0034600</p> | <p>Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop (Non-Ex area and Ex area).</p> <p>📖 For details, see Technical Information TI00405C</p> |
| <p>Cordset M12x1, angle plug</p>  <p style="text-align: right;">A0020723</p> | <p>PVC cable, 4 x 0.34 mm² (22 AWG) with M12x1 coupling; angle plug; screw plug; length 5 m (16.4 ft); IP69K Order number: 52024216</p> <p>Core colours:</p> <ul style="list-style-type: none"> ■ 1 = BN brown (+) ■ 2 = WH white (nc) ■ 3 = BU blue (-) ■ 4 = BK black (nc) |
| <p>Cordset M12x1, straight</p>  <p style="text-align: right;">A0020725</p> | <p>PVC cable, 4 x 0.34 mm² (22 AWG) with M12x1 coupling nut made of epoxy coated zinc; straight female connector type; screw plug; length 5 m (16.4 ft); IP69K Order number: 71217708</p> <p>Core colors:</p> <ul style="list-style-type: none"> ■ 1 = BN brown (+) ■ 2 = WH white (nc) ■ 3 = BU blue (-) ■ 4 = BK black (nc) |


| | |
|---|---|
| <p>Commubox FXA195 HART</p>  <p>A0032846</p> | <p>For intrinsically safe HART communication with FieldCare via the USB interface.</p> <p> For details, see Technical Information TI00404F</p> |
| <p>HART Loop Converter HMX50</p> | <p>Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.</p> <p> For details, see Technical Information TI00429F and Operating Instructions BA00371F</p> |
| <p>Field Xpert SMT70</p> | <p>The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous (Ex Zone 2) and non-hazardous areas. It is suitable for commissioning and maintenance staff</p> <p> For details, see Technical Information TI01342S</p> |


Service-specific accessories


| Accessories | Description |
|-------------------------|---|
| <p>Applicator</p> | <p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> ■ 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 <p>Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.</p> <p>Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator</p> |
| <p>Configurator</p> | <p>Product Configurator - the tool for individual product configuration</p> <ul style="list-style-type: none"> ■ 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 <p>The Configurator is available on the Endress+Hauser website at: www.endress.com -> Click "Corporate" -> 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.</p> |
| <p>W@M</p> | <p>Life cycle management for your plant</p> <p>W@M offers assistance with a wide range of software applications over the entire process: from planning and procurement to the installation, commissioning and operation of the measuring devices. All the relevant information is available for every measuring device over the entire life cycle, such as the device status, device-specific documentation, spare parts etc.</p> <p>The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.</p> <p>W@M is available: Via the Internet: www.endress.com/lifecyclemanagement</p> |
| <p>FieldCare SFE500</p> | <p>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.</p> <p> For details, see Operating Instructions BA00027S and BA00065S</p> |

| | |
|-------------------|---|
| DeviceCare SFE100 | <p>Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols.</p> <p>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.</p> <p> For details, see Operating Instructions BA00027S</p> |
|-------------------|---|

System components

| | |
|-----------------------------------|---|
| Advanced Data Manager Memograph M | <p>The Advanced Data Manager Memograph M is a flexible and powerful system for organizing process values. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. Via common communication protocols, the measured and calculated values can be easily communicated to higher-level systems or individual plant modules can be interconnected.</p> <p> For details, see Technical Information TI01180R/09</p> |
|-----------------------------------|---|

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|--------|---|
| RN221N | <p>Active barrier with power supply for safe separation of 4-20 mA standard signal circuits. Offers bidirectional HART transmission.</p> <p> For details, see "Technical Information" TI00073R and Operating Instructions BA00202R</p> |
|--------|---|

| | |
|--------|--|
| RNS221 | <p>Supply unit for powering two 2-wire measuring devices in the non-Ex area. Bidirectional communication is possible via the HART communication jacks.</p> <p> For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R</p> |
|--------|--|

Documentation

- iTHERM TrustSens TM371, TM372 operating instructions (BA01581T) and associated printed brief operating instructions (KA01272T)
- Components of the application example:
 - RIA15 loop powered process display - Technical information (TI01043K)
 - Active barrier RN221N - Technical information (TI00073R)





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