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Technical Information
iTHERM FlameLine TAF11, TAF12x, TAF16

High-temperature thermometer

Metric TC thermometer with robust single, double or triple ceramic or metallic thermowell for high-temperature ranges

Application

iTHERM FlameLine TAF11
Suitable for use in steel processing (heat treatment), in furnaces for concrete, non-ferrous metals and similar applications. The thermometer comprises a single or double thermocouple insert and a ceramic thermowell.

iTHERM FlameLine TAF12x
The S/D/T versions are thermometers with single, double or triple ceramic thermowells, designed specifically for applications such as ceramic kilns, brickworks, porcelain production and the glass industry. They comprise a single or double thermocouple insert in a ceramic insulator.

iTHERM FlameLine TAF16
Suitable for use in cement production, steel processing, combustion furnaces and fluidized bed furnaces. The thermometer comprises a single or double thermocouple insert and a metal or ceramic thermowell.

Process temperatures:
- iTHERM FlameLine TAF11 up to 1 600 °C (2 912 °F)
- iTHERM FlameLine TAF12x up to 1 700 °C (3 092 °F)
- iTHERM FlameLine TAF16 up to 1 700 °C (3 092 °F)

Advantages

- Long operating life due to the use of innovative thermowell materials with increased wear resistance and chemical resistance
- Long-term stable measurement thanks to sensor protection with non-porous materials
- Flexible product selection thanks to modular design
- Optimized life cycle costs through replaceable spare parts

Endress+Hauser
People for Process Automation

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About this document

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

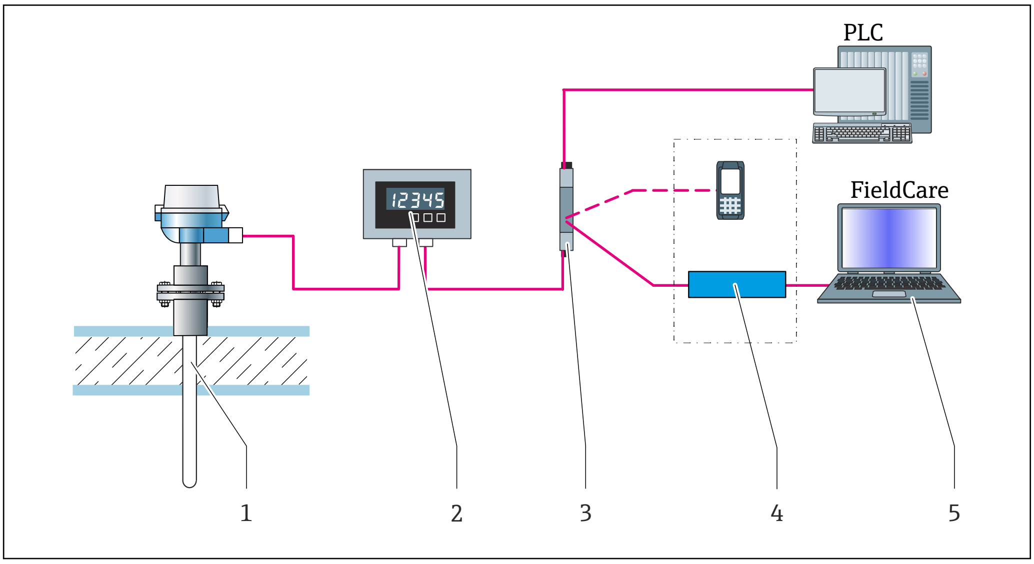
Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers	1., 2., 3....	Series of steps
A, B, C, ...	Views	**A-A, B-B, C-C, ...**	Sections
EX	Hazardous area	EX	Safe area (non-hazardous area)

Function and system design

Measuring principle

Thermocouples are robust sensors for temperature measurement based on the Seebeck effect. They record temperature differences between the measuring point and cold junction; the absolute temperature is determined by compensation. The material combinations and associated thermoelectric voltage/temperature characteristics are standardized in the IEC 60584 and ASTM E230/ANSI MC96.1 standards.

Measuring system



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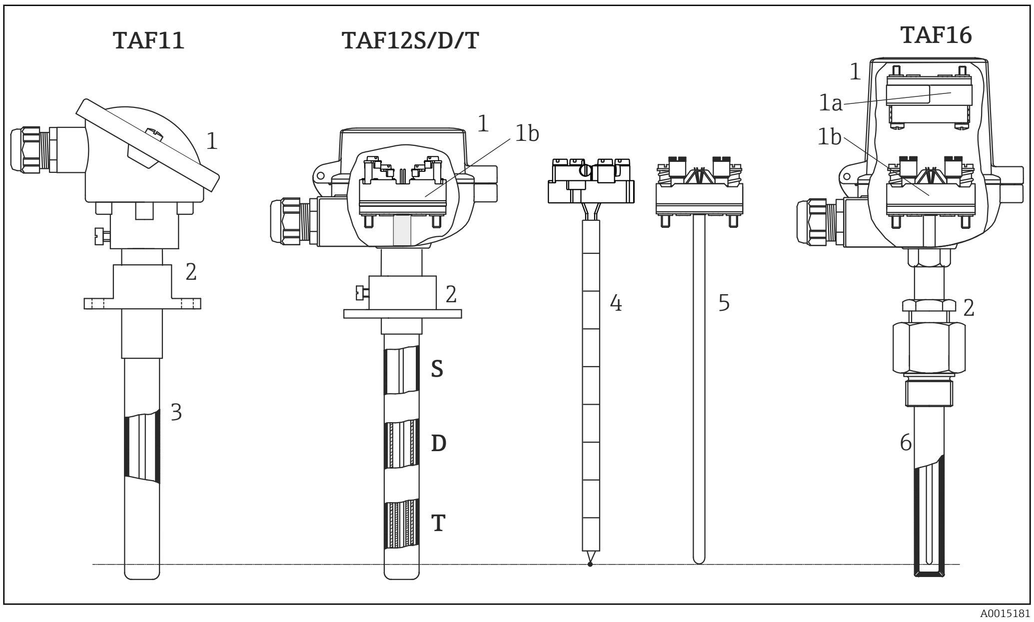
1 Application example, measuring point setup with additional manufacturer components

1. *Installed iTHERM FlameLine thermometer with HART® communication protocol*
2. *Process indicator from the RIA product family: The process indicator is incorporated into the current loop and displays the measuring signal or the HART® process variables in digital form. The process indicator does not require an external power supply. It is powered directly from the current loop.*
3. *RN series active barrier: The active barrier (17.5 V_{DC}, 20 mA) has a galvanically isolated output for supplying power to 2-wire transmitters. The universal power supply works with an input supply voltage of 24 to 230 V AC/DC, 0/50/60 Hz, which means that it can be used in all international power grids.*
4. *Communication examples: HART® Communicator (handheld device), FieldXpert, Commubox FXA195 for intrinsically safe HART® communication with FieldCare via a USB port.*
5. *FieldCare is an FDT-based plant asset management tool; for information on this, see the "Accessories" section.*

Equipment architecture



2 *Thermometer designs for high-temperature applications*

1 *Terminal head DIN A, left or DIN B, right, with the following available electrical connections:*
1a *Terminal block DIN B with head transmitter (only in terminal heads with high cover)*
1b *Terminal block (DIN B) or flying leads (only for MgO-insulated insert)*
2 *Available process connections: stop flange according to DIN EN 50446, adjustable flange, or gas-tight compression fitting*
3 *Ceramic thermowell (external sheath for TAF11)*
4 *TPC200 insert with ceramic insulation*
5 *TPC100 insert with MgO-insulation and metal sheath, selectable for TAF11 and TAF16*
6 *Metal or ceramic thermowell for TAF16*
S *Single ceramic thermowell (external sheath for TAF12)*
D *Double ceramic thermowell, external and internal sheath for TAF12*
T *Triple ceramic thermowell, external, middle and internal sheath for TAF12*

The high-temperature thermometers of the TAF series are manufactured in accordance with the international standard DIN EN 50446. These products comprise an insert, a thermowell, a metal sleeve (iTHERM FlameLine TAF11/TAF12x only) and a terminal head with a transmitter or terminal block for electrical connection.

Insert

The measuring point of the thermocouple is located at the tip of the insert. The measuring ranges and permitted limit value deviations of the thermoelectric voltages from the standard characteristic vary depending on the type of thermocouple used. The thermocouple wires are embedded in suitable high-temperature ceramic insulators or in a mineral-insulated insert.

Thermowell

Two types of thermowells are used for these thermometers:
- Metal thermowells made from pipe or barstock material
- Ceramic thermowells

The selection of thermowell materials depends primarily on the following material properties, which directly affect the sensor's operating life:

- Hardness
- Chemical resistance
- Maximum operating temperature
- Wear/abrasion resistance
- Brittleness
- Porosity to process gases
- Creep resistance

Ceramic materials are usually used for high-temperature ranges and - due to their hardness - in processes with high wear rates. If these materials are subjected to significant mechanical stress in the process, pay particular attention to their brittleness. If porous ceramic materials are used as the outer protective sheath, an additional non-porous inner protective sheath is required. This protects the sensor elements from contamination, which could otherwise cause temperature drift.

Metal alloys offer higher mechanical strength, but are less resistant to high temperatures and abrasion. Since metal alloys are non-porous, no additional internal protective sheath is required.

Metal sleeve and process connection

The iTHERM FlameLine TAF11 and TAF12 ceramic thermowells are mounted in a metal sleeve, which connects them to the terminal head. Due to the higher mechanical strength, the process connection is also attached to the metal sleeve. The sleeve dimensions and material type depend on the process temperatures and the immersion length of the ceramic thermowells.

All high-temperature thermometers are available with adjustable flange, stop flanges, or gas-tight compression fittings as the process connection.

Input

Measured variable

Temperature (temperature-linear transmission behavior)

Input	Designation	Measuring range limits [1]	Min. measuring span
Thermocouples (TC) as per IEC 60584, Part 1 - when using an Endress+Hauser - iTEMP temperature transmitter	Type J (Fe-CuNi) Type K (NiCr-NiAl) Type N (NiCrSi-NiSi) Type S (PtRh10-Pt) Type R (PtRh13-Pt) Type B (PtRh30-PtRh6)	typically −200 to 1 200 °C (−328 to 2 192 °F) typically −200 to 1 372 °C (−328 to 2 502 °F) typically −270 to 1 300 °C (−454 to 2 372 °F) typically 0 to 1 768 °C (32 to 3 214 °F) typically −50 to 1 768 °C (−58 to 3 214 °F) typically 40 to 1 820 °C (104 to 3 308 °F)	50K 50K 50K 500K 500K 500K
	▪ Internal cold junction: (Pt100) ▪ Cold junction accuracy: ± 1 K ▪ Max. sensor resistance: 10 kΩ		
Thermocouples (TC) [2] - flying leads - according to IEC 60584	Type J (Fe-CuNi) Type K (NiCr-NiAl) Type N (NiCrSi-NiSi) Type S (PtRh10-Pt) Type R (PtRh13-Pt) Type B (PtRh30-PtRh6)	−210 to 1 200 °C (−346 to 2 192 °F), typically sensitivity ≈ 55 µV/K −270 to 1 300 °C (−454 to 2 372 °F), typically sensitivity ≈ 40 µV/K −270 to 1 300 °C (−454 to 2 372 °F), typically sensitivity ≈ 40 µV/K 0 to 1 768 °C (32 to 3 214 °F), typically sensitivity ≈ 11 µV/K −50 to 1 768 °C (−58 to 3 214 °F), typically sensitivity ≈ 13 µV/K 0 to 1 820 °C (32 to 3 308 °F), typically sensitivity ≈ 9 µV/K	

1) For defined ranges, see the corresponding Technical Information of the relevant iTEMP head transmitter.
2) Typical sensitivity above 0 °C (32 °F)

Output

Output signal

The measured values can be transmitted in two ways:

- Directly wired sensors: Sensor measured values forwarded without an iTEMP transmitter. Use thermocouple extension cables or compensation cables for high accuracy.
- Via all common protocols by selecting the appropriate iTEMP transmitter.

All iTEMP transmitters are mounted directly in the terminal head and wired to the sensory mechanism.

Family of temperature transmitters

Thermometers fitted with iTEMP transmitters are an installation-ready complete solution to improve temperature measurement by significantly increasing measurement accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

4-20 mA head transmitter
They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP transmitters can be configured quickly and easily at a PC. Endress+Hauser offers free configuration software which can be downloaded from the Endress+Hauser website.

HART head transmitter
The iTEMP transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART communication. Swift and easy operation, visualization and maintenance using universal configuration software like FieldCare, DeviceCare or FieldCommunicator 375/475. Integrated Bluetooth® interface for the wireless display of measured values and configuration via Endress +Hauser SmartBlue app, optional.

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

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

Head transmitter with PROFINET and Ethernet-APL™
The iTEMP transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using the PROFINET protocol. Power is supplied via the 2-wire Ethernet connection according to IEEE 802.3cg 10Base-T1. The iTEMP transmitter can be installed as an intrinsically safe electrical apparatus in Zone 1 hazardous areas. The device can be used for instrumentation purposes in the terminal head form B (flat face) according to DIN EN 50446.

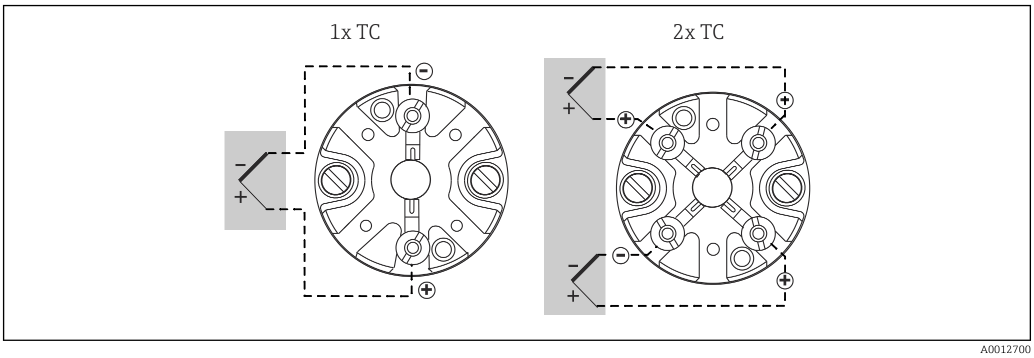
Head transmitter with IO-Link
The iTEMP transmitter is an IO-Link device with a measurement input and an IO-Link interface. It offers a configurable, simple and cost-effective solution thanks to digital communication via IO-Link. The device is mounted in a terminal head form B (flat face) as per DIN EN 5044.

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

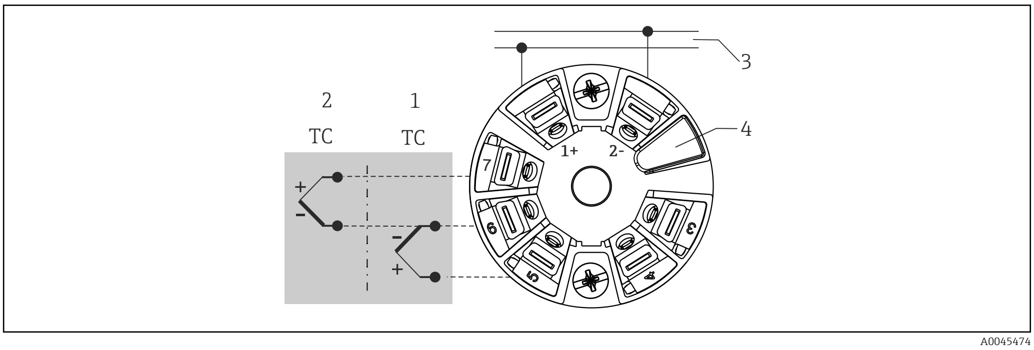
Energy supply

Terminal assignment

Thermocouple (TC) sensor connection type

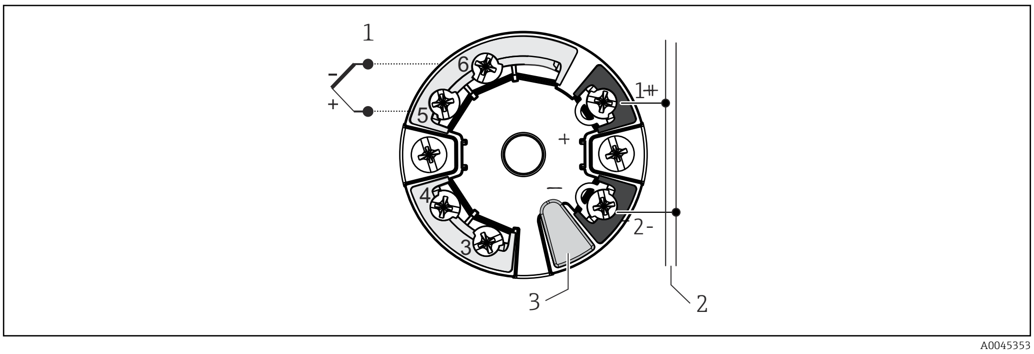


3 *Installed ceramic terminal block for thermocouples.*



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

1 *Sensor input 1*
2 *Sensor input 2*
3 *Fieldbus connection and power supply*
4 *Display connection*



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

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

Thermocouple wire colors

As per IEC 60584	
▪ Type J: black (+), white (-) ▪ Type K: green (+), white (-) ▪ Type N: pink (+), white (-)	▪ Type B: gray (+), white (-) ▪ Type R: orange (+), white (-) ▪ Type S: orange (+), white (-)

Performance characteristics

Reference operating conditions

This data is relevant for determining the measurement accuracy of the iTEMP transmitters used. See technical documentation of the specific iTEMP transmitter.

Maximum measurement error

Permissible limits of deviation of the thermoelectric voltages from the standard curve for thermocouples in new condition according to IEC 60584:

<table>
<tr><th>Standard</th><th>Type</th><th colspan="2">Standard tolerance</th><th colspan="2">Special tolerance</th></tr>
<tr><td rowspan="8">IEC 60584</td><td></td><td>Class</td><td>Deviation</td><td>Class</td><td>Deviation</td></tr>
<tr><td>J (Fe-CuNi)</td><td>2</td><td>±2.5 °C (-40 to 333 °C)
±0.0075 |t| [1]) (333 to 750 °C)</td><td>1</td><td>±1.5 °C (-40 to 375 °C)
±0.004 |t| [1]) (375 to 750 °C)</td></tr>
<tr><td>K (NiCr-NiAl)</td><td>2</td><td rowspan="2">±2.5 °C (-40 to 333 °C)
±0.0075 |t| [1]) (333 to 1200 °C)</td><td>1</td><td rowspan="2">±1.5 °C (-40 to 375 °C)
±0.004 |t| [1]) (375 to 1000 °C)</td></tr>
<tr><td>N (NiCrSi-NiSi)</td><td>2</td><td>1</td></tr>
<tr><td>R (Ptrh13-Pt) and S (Ptrh10-Pt)</td><td>2</td><td rowspan="2">±1.5°C (0 to 600°C)
±0.0025 |t| [1]) (600 to 1600 °C)</td><td>1</td><td rowspan="2">±1°C (0 to 1100°C)
±[1 + 0.003(|t| [1]) -1100)] (1100°C to 1600 °C)</td></tr>
<tr><td>S (PtRh13-Pt)</td><td>2</td><td>1</td></tr>
<tr><td>B (PtRh30-PtRh6)</td><td>2</td><td>±1.5 °C or ±0.0025 |t| [1]) (600 to 1700 °C)</td><td>-</td><td>-</td></tr>
</table>

1) |t| = absolute temperature value in °C

Thermocouples made of non-precious metals are generally supplied such that they meet the manufacturing tolerances for temperatures ≥ −40 °C (−40 °F). These materials are generally not suitable for temperatures ≤ −40 °C (−40 °F). Class 3 tolerances cannot be met. A separate material must be selected for this temperature range. This is not handled via the standard product.

Response time

<table>
<tr><th>Thermometer sensing element</th><th colspan="2">Response time [1] for rapid temperature changes around 1000 °C (1832 °F) in still air</th></tr>
<tr><td>iTHERM FlameLine TAF12T with Ø26/Ø14/Ø9 mm triple ceramic thermowell (material C530+C610)</td><td>t50
t90</td><td>195 s
500 s</td></tr>
</table>

1) ~For TC insert without transmitter.

Insulation resistance

Insulation resistance between the terminals and the thermowell is measured with a voltage of 500 V_{DC}DC.

Insulation resistance ≥ 1 000 MΩ at ambient temperature 25 °C (77 °F).

Insulation resistance ≥ 5 MΩ at 500 °C (932 °F).

For iTHERM FlameLine TAF16 with 6 mm (0.24 in) mineral-insulated inserts, the DIN EN 61515 standard is applied.

Calibration

Calibration of thermometers
Calibration refers to the comparison between the display of a piece of measuring equipment and the true value of a variable provided by the calibration standard under defined conditions. The aim is to determine the deviation or measurement errors of the UUT from the true value of the measured variable. For thermometers, calibration is usually only performed on the inserts. This checks only the deviation of the sensor element caused by the insert design. However, in most applications, the deviations caused by the design of the measuring point, integration into the process, the influence of ambient conditions, and other factors are significantly greater than the deviations related to the insert. Calibration of inserts is generally carried out using two methods:
- Calibration at fixed points, e.g. at the freezing point of water at 0 °C,
- Calibration against a precise reference thermometer.

The thermometer to be calibrated must display either the fixed point temperature or the temperature of the reference thermometer as accurately as possible. Temperature-controlled calibration baths with very homogeneous thermal values, or special calibration furnaces are typically used for thermometer calibrations. The measurement uncertainty may increase due to heat conduction errors and short immersion lengths. The existing measurement uncertainty is recorded on the individual calibration certificate. For accredited calibrations in accordance with ISO 17025, a measurement uncertainty that is twice as high as the accredited measurement uncertainty is not permitted. If this limit is exceeded, only a factory calibration is possible.

Endress+Hauser provides comparison temperature calibration from −80 to 1 400 °C (−110 to 2 552 °F) based on the International Temperature Scale (ITS90). Calibrations are traceable to national and international standards. The calibration certificate is referenced to the serial number of the thermometer. Only the insert is calibrated. Thermometers without replaceable inserts are calibrated completely - from the process connection to the tip of the thermometer.

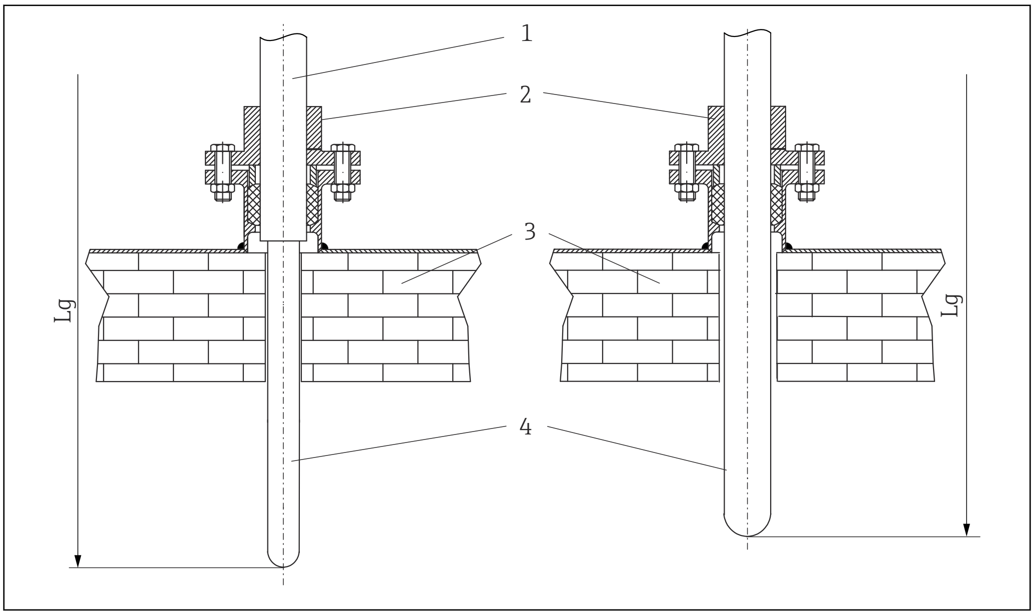
Temperature range	Minimum insertion length of insert in mm (in)	
	without head transmitter	with head transmitter
−80 to 80 °C (−112 to 176)	No minimum insertion length required	
81 to 250 °C (177 to 482)	No minimum insertion length required	50 mm (1.97 in)
250 to 550 °C (480 to 1 020 °F)	300 mm (11.81 in)	
550 to 1 400 °C (1 020 to 2 552 °F)	450 mm (17.75 in)	

Installation

Orientation

Vertical and horizontal installation. Vertical installation is preferable as the metal thermowells may otherwise bend or the ceramic thermowells may be irreversibly damaged by falling parts due to the brittleness of the materials.

Installation instructions



6 *Examples of the recommended vertical installation*

1 *Metal sleeve*
2 *Stop flange according to DIN EN 50446*
3 *Chamber wall of a combustion furnace*
4 *Thermowell*
Lg *Immersion length*

In the case of horizontal orientation in a high-temperature environment, the thermowell may bend or break irreversibly under its own weight.

Recommended maximum immersion length Lg for horizontal installation:

- 1500 mm (59 in) for diameter > Ø20 mm (0.8 in)
- 1200 mm (47.3 in) for diameter < Ø20 mm (0.8 in)

Installation of ceramic sheaths

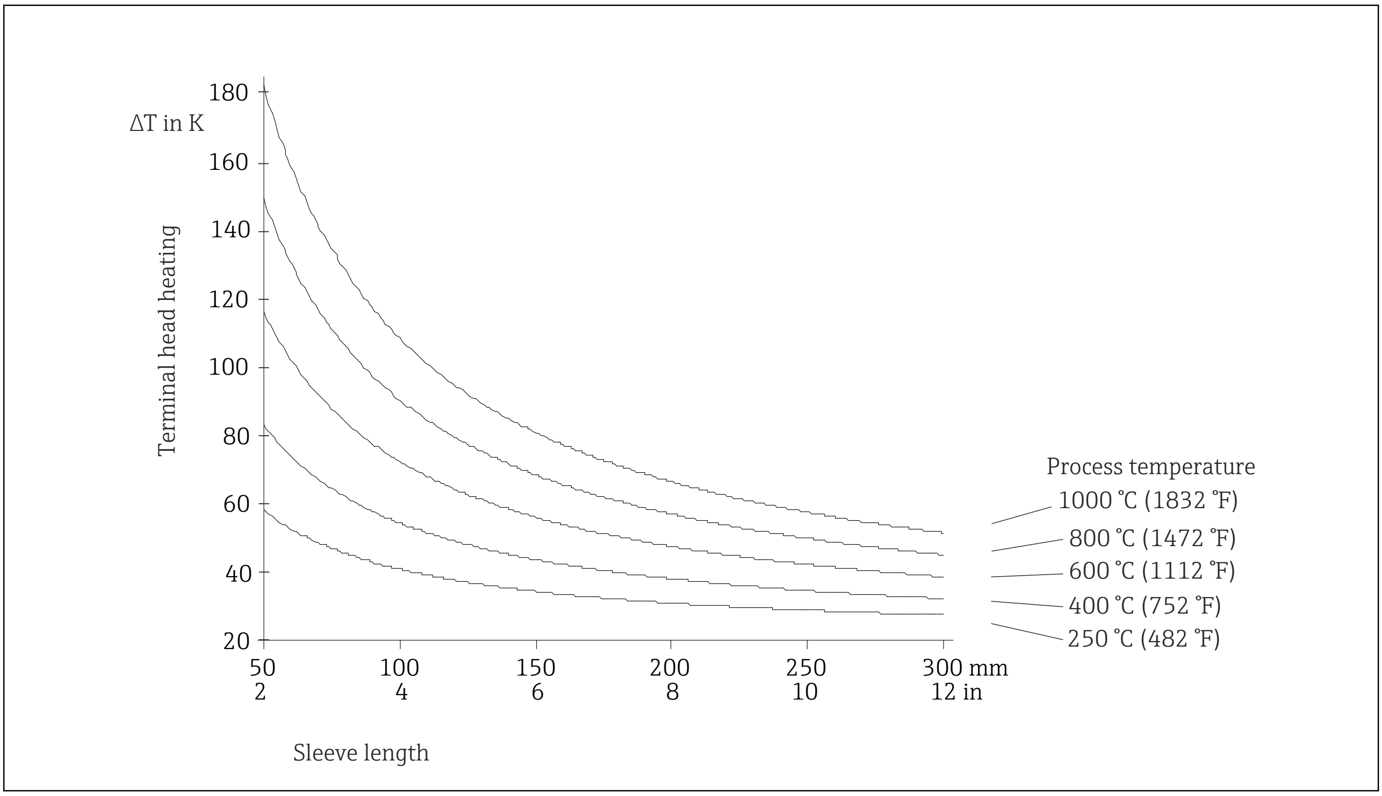
Gas-tight ceramic thermowells and inserts are sensitive to rapid temperature changes. To reduce the risk of thermal shock and to protect the ceramic materials from cracking, gas-tight ceramic sheaths must be preheated before installation. There are two possibilities to do so:

- Installation with preheating
  At process temperatures ≥ 1000 °C (1932 °F) preheat the ceramic part of the thermowell from room temperature to 400 °C (752 °F). Use a horizontal, cylindrical cross-section oven or cover the ceramic part with electric heating elements. Do not expose the ceramic sheath to direct flames. Preheat the ceramic sheath in situ and then proceed immediately with the insertion.
  Install the thermowell or insert carefully to avoid mechanical shocks, at an insertion speed of 100 mm/min. If preheating is not carried out near the system, the insertion speed must be reduced to 30 mm/min due to cooling during transport.
- Installation without preheating
  Install the insert at the process operating temperature in such a way that the ceramic sheath is inserted into the system to a depth corresponding to the wall thickness, including insulation material. Leave the insert in this position for two hours. Afterwards, fit the insert at an insertion speed of 30 mm/min, avoiding mechanical shocks.
  For process temperatures < 80 °C (176 °F) the insertion speed can be disregarded. Any kind of shock or collision between the ceramic sheath and system components must be avoided.

Sleeve length

The sleeve is the part between the process connection and the terminal head.

As illustrated in the following diagram, the sleeve length influences the temperature in the terminal head. This temperature must remain within the limit values defined in the "Operating conditions" section.



7 *Heating of the terminal head as a function of the process temperature. Temperature in terminal head = ambient temperature 20 °C (68 °F)+ ΔT*

Diameter of sleeve = ¾" schedule 40

Environment

Ambient temperature

Terminal head	Temperature in °C (°F)
Without head transmitter installed	Depends on the terminal head used and the cable gland; see chapter "Terminal heads"
With mounted head transmitter	−40 to 85 °C (−40 to 185 °F)

Relative humidity

Depends on the iTEMP transmitter used. When using iTEMP head transmitters:
- Condensation permitted as per IEC 60068-2-33
- Max. relative humidity: 95% in accordance with IEC 60068-2-30

Operating altitude

Depends on the transmitter used. When using iTEMP head transmitters: Up to 4 000 m (13 123 ft) above sea level as per IEC 61010-1, CAN/CSA C22.2 No. 61010-1

Degree of protection

Max. IP 66 (NEMA Type 4x encl.)	Depending on the design (terminal head, connector, etc.)

Shock and vibration resistance

Applicable to MgO-insulated measuring inserts: 4 g/2 to 150 Hz in accordance with IEC 60068-2-6

Ceramic thermowells and ceramic-insulated inserts are very sensitive to shocks and oscillations.

Electromagnetic compatibility (EMC)

Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details refer to the EU Declaration of Conformity.

Maximum measurement error < 1% of the measuring range.

Interference immunity as per IEC/EN 61326 series, industrial requirements

Interference emission as per IEC/EN 61326 series, Class B equipment

Process

Process temperature range

Depends on the material used, max.:
- iTHERM FlameLine TAF11 up to 1 600 °C (2 912 °F)
- iTHERM FlameLine TAF12x and iTHERM FlameLine TAF16 up to 1 700 °C (3 092 °F)

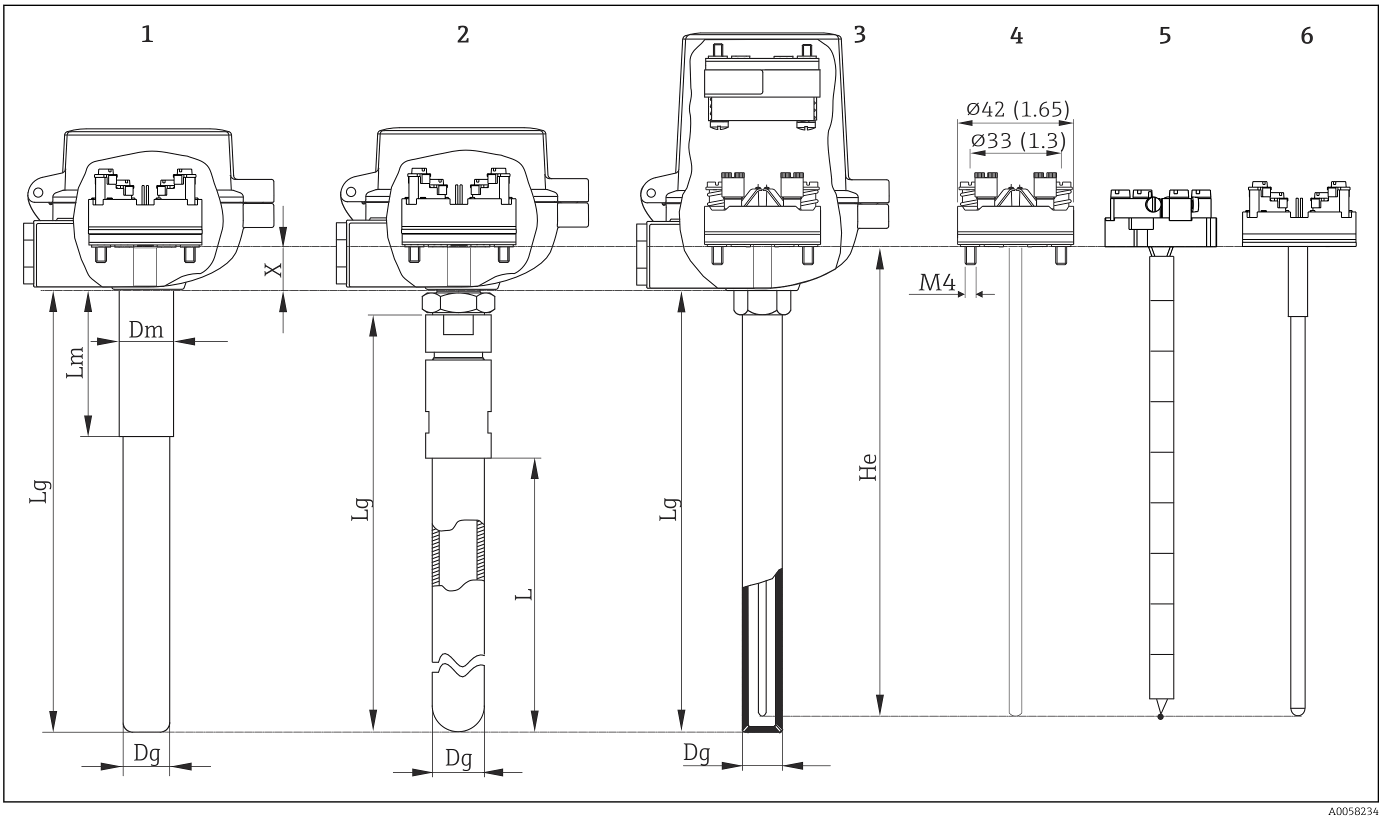
Process pressure range

High-temperature thermometers are designed for use in unpressurized processes. The available process connections are partially up to 1 bar (14.5 psi) gas-tight, see the "Process connections" section.

Mechanical construction

Design, dimensions

All dimensions in mm (in).



1 iTHERM FlameLine TAF11/TAF12
2 iTHERM FlameLine TAF16 with SiN thermowell
3 iTHERM FlameLine TAF16 with metal thermowell
4 TPC100: mineral-insulated (MgO powder) insert, metal sheath and mounted terminal block (DIN B) for TC types J, K and N
5 TPC200: Segmented, ceramic-insulated insert with mounted terminal block (DIN B) for TC types J and K
6 TPC200: Ceramic-insulated insert with mounted terminal block for TC types B, R and S
Lg Immersion length
L Usable immersion length, L = Lg - 97 mm (3.82 in)
Lm Sleeve length
Dg Thermowell diameter
Dm Sleeve diameter = 33.4 mm (1.31 in)
He Installed length of insert; for iTHERM FlameLine TAF16 simplified: He = Lg + 80 mm (3.15 in), for measuring insert replacement: He = Lg + X
X Additional length, see the table in the "Inserts" section

In the Product Configurator, the thermowell inner diameter is specified in combination with the thermowell outer diameter for the iTHERM FlameLine TAF16. Example: feature 20 thermowell diameter, option A: 17.2x14.2 mm

Weight

The weight depends on the product and configuration. Some examples:

Configuration	Weight
iTHERM FlameLine TAF11	
Thermowell material C610, SiC or SiN, sleeve material AISI 304 Terminal head DIN B Lg = 1 000 mm (39.4 in) Lm = 100 mm (3.93 in)	**2 kg (4.4 lb)**
iTHERM FlameLine TAF12S	
Thermowell material C610 or C799, sleeve material AISI 304 Lg = 1 000 mm (39.4 in) Lm = 100 mm (3.93 in)	**2 kg (4.4 lb)**

Configuration	Weight
Terminal head DIN B	
iTHERM FlameLine TAF12D	
Thermowell material 2xC610 or 2xC799, sleeve material AISI 304 Lg = 1 000 mm (39.4 in) Lm = 100 mm (3.93 in) Terminal head DIN B	**2.5 kg (5.5 lb)**
iTHERM FlameLine TAF12T	
Thermowell material C530+C610, C530+C799 or 2xC799, sleeve material AISI 304 Lg = 1 000 mm (39.4 in) Lm = 185 mm (7.3 in) Terminal head DIN B	**3 kg (6.6 lb)**
iTHERM FlameLine TAF16	
Thermowell material AISI 310 Lg = 1 000 mm (39.4 in) Dg = 21.3 mm (0.84 in) Terminal head DIN B	**3 kg (6.6 lb)**

Materials

Thermowell and ceramic sheath

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

Name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1 200 °F) [1]	▪ Austenitic stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ▪ Increased resistance to intergranular corrosion and pitting ▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content
AISI 310/ 1.4841	X15CrNiSi25-20	1 100 °C (2 012 °F)	▪ Austenitic stainless steel ▪ Generally good resistance to oxidizing and reducing atmospheres ▪ Due to the higher chromium content, good resistance to oxidizing aqueous solutions and neutral salts melting at higher temperatures ▪ Only low resistance to sulfur-containing gases
AISI 304/ 1.4301	X5CrNi18-10	850 °C (1 562 °F)	▪ Austenitic stainless steel ▪ Suitable for use in water and slightly contaminated wastewater ▪ Only resistant to organic acids, salt solutions, sulfates, basic solutions, etc., at relatively low temperatures
AISI 446/ ~1.4762/ ~1.4749	X10CrAl24 / X18CrNi24	1 100 °C (2 012 °F)	▪ Ferritic, heat resistant, high-chromium stainless steel ▪ Very high resistance to sulfurous and low-oxygen gases and salts ▪ Very good corrosion resistance under both constant and cyclic temperature stress, and against combustion ash, copper, lead, and zinc smelting ▪ Low resistance to gases containing nitrogen

Name	Short form	Recommended max. temperature for continuous use in air	Properties
INCONEL® 600/ 2.4816	NiCr15Fe	1 100 °C (2 012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures ▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water, and much more ▪ Prone to corrosion in ultrapure water ▪ Not to be used in sulfur-containing atmospheres
INCONEL®60 1 / 2.4851	NiCr23Fe	1 200 °C (2 192 °F)	▪ Enhanced corrosion resistance at high temperatures due to aluminum content ▪ Resistant to oxidation and carburization under stress caused by temperature changes ▪ Good resistance to corrosion from molten salts ▪ Particularly sensitive to sulfidation
INCOLOY® 800HT / 1.4959	X8NiCrAlTi32-21	1 100 °C (2 012 °F)	▪ A nickel/chromium/iron alloy with the same base composition as INCOLOY ® 800, but with improved long-term temperature resistance due to restricted carbon, aluminum and titanium content ▪ Excellent strength and resistance to oxidation and carburization in high-temperature environments ▪ Good resistance to stress corrosion cracking, sulfur, internal oxidation, boiler scale formation and corrosion in a wide range of industrial environments. Suitable for sulfur-containing environments
Kanthal AF	FeCrAl	1 300 °C (2 372 °F)	▪ A ferritic iron/chromium/aluminum alloy for high temperatures ▪ High resistance to sulfur-containing, carburizing and oxidizing environments ▪ Good hardness and weldability ▪ Good form stability at high temperatures ▪ Must not be used in chloride-containing atmospheres and nitrogenous gases (cracked ammonia)

Special nickel/cobalt alloy	NiCo	1 200 °C (2 192 °F)	▪ Excellent resistance to sulfidizing and chlorine-containing environments
			▪ Outstanding resistance to oxidation, high-temperature corrosion, carburization, metal dusting, and nitriding
			▪ Good creep resistance
			▪ Average surface hardness
			▪ High wear resistance
			Recommended applications
			▪ Cement industry
			  ▪ Gas riser pipes: Successfully tested with up to 20 times the operating life compared to AISI310
			  ▪ Clinker coolers: Successfully tested with up to 5 times the operating life compared to AISI310
			▪ Waste incineration plants: Successfully tested with up to 12 times the operating life of INCONEL®600 and C276
			▪ Fluidized bed reactors (biogas reactors): Successfully tested with up to 5 times the operating life of, for example, INCOLOY®800HT or INCONEL®600.

Ceramic materials as per DIN VDE0335			
C530		1 400 °C (2 552 °F)	▪ Al_2O_3 content approx. 73 - 75% ▪ Least expensive porous ceramic material ▪ Very resistant to temperature shocks; mainly used as external thermowell
C610		1 500 °C (2 732 °F)	▪ Al_2O_3 content approx. 60%, alkali content 3% ▪ Most cost-effective, non-porous ceramic material ▪ Highly resistant to hydrofluoric acid, thermal shock, and mechanical stress; use for internal and external thermowells as well as insulators
C799		1 800 °C (3 272 °F)	▪ Al_2O_3 content approx. 99.7% ▪ Can be used for both internal and external thermowells and insulators ▪ Resistant to fluorine-containing acids, alkaline vapors, and oxidizing, reducing, and neutral atmospheres, as well as changes in temperature ▪ This material is very pure, with very low porosity (gas-tight) compared to other ceramic types

Name	Short form	Recommended max. temperature for continuous use in air	Properties
Sintered silicon carbide	SiC	1600 °C (2912 °F)	▪ High resistance to thermal shocks due to its porosity ▪ Good thermal conductivity ▪ Very hard and stable at high temperatures **Recommended applications** ▪ Glass industry: glass feeders, float glass fabrication ▪ Ceramic industry ▪ Industrial ovens
Kanthal Super	$MoSi_2$ with a glass-phase component	1700 °C (3092 °F)	▪ High resistance to thermal shocks ▪ Very low porosity (< 1%) and very high hardness ▪ Must not be used in environments containing chlorine or fluorine compounds ▪ Not suitable for applications where the material is exposed to mechanical impact ▪ Must not be used in powder applications

Special silicon nitride ceramic	SiN	1400 °C (2552 °F)	▪ Excellent wear resistance and resistance to thermal shocks
			▪ No porosity
			▪ Rapid heat reaction
			Recommended applications
			▪ Cement industry
			  ▪ Cyclone preheaters: Successfully tested with up to 5 times the operating life compared to AISI310
			  ▪ Secondary air ducts
			▪ In general, any application with extremely aggressive conditions, where mechanical impact/shock must be absorbed due to brittleness

1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Contact the manufacturer's sales department for further information.

Terminal heads

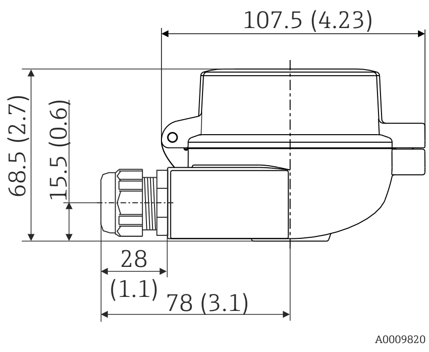
The terminal heads have an internal geometry in accordance with DIN EN 50446, typically in Form B, and a thermometer connection with M24×1.5 thread. All dimensions in mm (in). The sample cable glands in the diagrams correspond to M20x1.5 connections with non-Ex polyamide cable glands. Specifications without head transmitter installed. For ambient temperatures with head transmitters installed, see the "Environment" section.

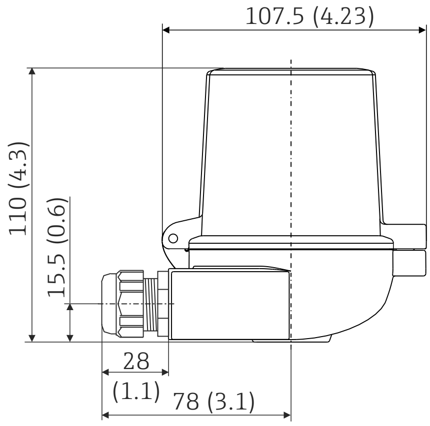
As a special feature, the manufacturer offers terminal heads with optimum access to the terminals for easy installation and maintenance.

IP 68 = 1.83 m (6 ft), 24 h, with cable gland without cable (with plug), type 6P as per NEMA 250-2003

Maximum ambient temperatures for cable glands	
Type	**Temperature range**
Cable gland ½" NPT, M20x1.5 (non Ex)	–40 to 100 °C (–40 to 212 °F)
Cable gland M20x1.5 (for dust ignition-proof area)	–20 to 95 °C (–4 to 203 °F)

TA30A	Specification

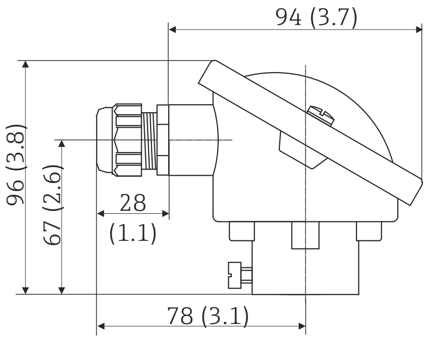
	▪ Degree of protection:
	  ▪ IP66/68 (NEMA Type 4x encl.)
	  ▪ For ATEX: IP66/67
	▪ Temperature: –50 to 150 °C (–58 to 302 °F) without cable gland
	▪ Material: aluminum, polyester powder coated
	Seals: silicone
	▪ Threaded cable entry: G ½", NPT ½" and M20x1.5;
	▪ Head color: blue, RAL 5012
	▪ Cap color: gray, RAL 7035
	▪ Weight: 330 g (11.64 oz)
	▪ Ground terminal, internal and external
	▪ Available with sensors with 3-A® symbol

<table>
<tr><th>TA30D</th><th>Specification</th></tr>
<tr><td>

A0009822</td><td>

- Degree of protection:
  - IP66/68 (NEMA Type 4x encl.)
  - For ATEX: IP66/67
- Temperature: –50 to 150 °C (–58 to 302 °F) without cable gland
- Material: aluminum, polyester powder coated
Seals: silicone
- Threaded cable entry: G ½", NPT ½" and M20x1.5
- Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert.
- Head color: blue, RAL 5012
- Cap color: gray, RAL 7035
- Weight: 390 g (13.75 oz)
- Ground terminal, internal and external
- Available with sensors with 3-A® symbol

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

<table>
<tr><th>DIN A</th><th>Specification</th></tr>
<tr><td>

A0015176</td><td>

- Degree of protection: IP66
- Max. temperature: 130 °C (266 °F)
- Material: aluminum, polyester powder coated
Seals: CR (neoprene® rubber)
- Cable entry thread: G ½"
- Head and cap color: white, RAL 9006
- Weight: 270 g (9.52 oz)

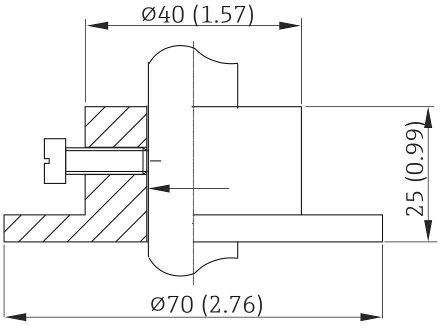
</td></tr>
</table>

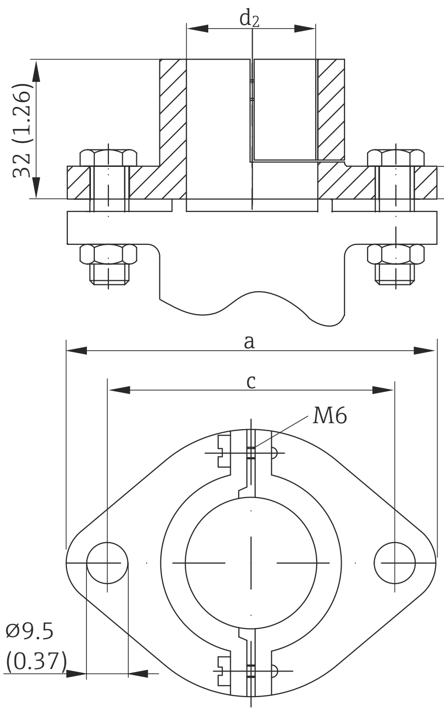
Thermowells

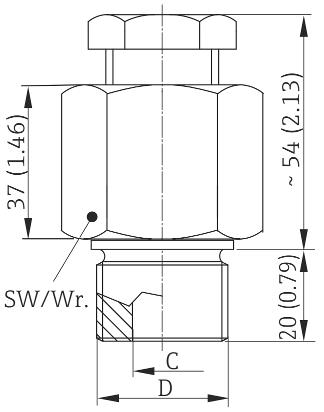
Diameters of ceramic tubes. Dimensions in mm.

Version	Order options - sheath material, diameter, max. Length	Outer tube (Ø outer x inner)	Wall thickness	Material	Intermediate tube (Ø outer x inner)	Wall thickness	Material	Inner tube (Ø outer x inner)	Wall thickness	Material
TAF11	AA/AB/AC	14 x 10	2	C610	-	-	-	-	-	-
	AD/AE/AF	17 x 13	2		-	-	-	-	-	-
	AG/AH/AJ	24 x 19	2.5		17 x 13	2	-	-	-	-
	BA/BB/BC	17 x 7	5	SiC, sintered	-	-	-	-	-	-
	BD/BE/BF/BG/ BH/BI	26.6 x 13	6.8		-	-	-	-	-	-
	CA/CB/CC	16 x 9	3.5	SiN	-	-	-	-	-	-
	CD/CE/CF/CG	22x12	5		-	-	-	-	-	-
TAF12S	SA/SB/SC/SD/SE / SF	9 x 6	1.5	C610 or C799	-	-	-	-	-	-
TAF12D	DA/DB/DC	14 x 10	2	C610	-	-	-	9 x 6	1.5	C610
	DD/DE/DF	15 x 11		C799	-	-	-	9 x 6	1.5	C799
TAF12T	TA/TB/TC	26 x 18	4	C530	14 x 10	2	C610	9 x 6	1.5	C610
	TD/TE/TF				15 x 11	2	C799	9 x 6	1.5	C799
	TG/TH/TJ	24 x 18	3	C799	15 x 11	2	C799	9 x 6	1.5	C799

Process connections

<table>
<tr><th colspan="5">Type of fitting</th></tr>
<tr><td rowspan="2">Adjustable flange


A0015177</td><td colspan="4">▪ Maximum temperature: 350 °C (662 °F)
▪ Material: Aluminum
▪ Inner diameter depends on diameter of metal sleeve or thermowell
▪ Not gas-tight</td></tr>
<tr><td colspan="4">Inner diameter in mm (in):
▪ 22 mm (0.87 in)
▪ 14.5 mm (0.57 in)</td></tr>
<tr><td rowspan="6">Stop flange according to DIN EN 50446


A0015178</td><td colspan="4">▪ Maximum temperature: 400 °C (752 °F)
▪ Material: cast iron
▪ Not gas-tight
▪ Counterflange and seal are not included in the delivery</td></tr>
<tr><td>d_2 in mm (in)</td><td>a in mm (in)</td><td>c in mm (in)</td><td>Clampable sleeve diameter in mm (in):</td></tr>
<tr><td>23 mm (0.91 in)</td><td>90 mm (3.54 in)</td><td>70 mm (2.76 in)</td><td>21 to 22 mm (0.83 to 0.87 in)</td></tr>
<tr><td>34 mm (1.34 in)</td><td>90 mm (3.54 in)</td><td>70 mm (2.76 in)</td><td>31 to 33.7 mm (1.22 to 1.33 in)</td></tr>
<tr><td>16 mm (0.63 in)</td><td>75 mm (2.95 in)</td><td>55 mm (2.16 in)</td><td>14 to 15 mm (0.55 to 0.59 in)</td></tr>
<tr><td>29 mm (1.14 in)</td><td>90 mm (3.54 in)</td><td>70 mm (2.76 in)</td><td>27 to 28 mm (1.06 to 1.1 in)</td></tr>
<tr><td rowspan="6">Gas-tight coupling


A0015179</td><td colspan="4">▪ Maximum temperature: 350 °C (662 °F)
▪ Material: AISI 316Ti
▪ Maximum process pressure ≤ 1 bar (14.5 psi)</td></tr>
<tr><td>Thread D</td><td>C in mm (in)</td><td>Clampable sleeve diameter in mm (in)</td><td>Width across flats AF (mm)</td></tr>
<tr><td>G ½</td><td>15.5 mm (0.61 in)
17.5 mm (0.69 in)</td><td>13.7 to 15 mm (0.54 to 0.6 in)
17 to 17.2 mm (0.67 to 0.67 in)</td><td>36</td></tr>
<tr><td>G ¾</td><td>15.5 mm (0.61 in)
18 mm (0.71 in)
19 mm (0.75 in)
22.5 mm (0.89 in)</td><td>13.7 to 15 mm (0.54 to 0.6 in)
17 to 17.2 mm (0.67 to 0.67 in)
17.5 to 18 mm (0.69 to 0.71 in)
21.3 to 22 mm (0.84 to 0.86 in)</td><td>36
36
36
41</td></tr>
<tr><td>G1</td><td>15.5 mm (0.61 in)
18 mm (0.71 in)
19 mm (0.75 in)
22.5 mm (0.89 in)
28 mm (1.1 in)</td><td>13.7 to 14 mm (0.54 to 0.55 in)
13.7 to 14 mm (0.54 to 0.55 in)
17.5 to 18 mm (0.69 to 0.71 in)
21.3 to 22 mm (0.84 to 0.86 in)
26.7 to 27 mm (1.05 to 1.06 in)</td><td>41
41
41
41
46</td></tr>
<tr><td>G 1¼</td><td>29 mm (1.14 in)</td><td>27.5 to 28 mm (1.1 to 1.06 in)</td><td>55</td></tr>
</table>

Type of fitting				
	G 1¼	32 mm (1.26 in)		
	G 1½	22.5 mm (0.89 in) 29 mm (1.14 in) 35 mm (1.38 in)	21.3 to 22 mm (0.84 to 0.86 in) 27.5 to 28 mm (1.1 to 0.86 in) 33.4 to 34 mm (1.32 to 1.34 in)	55

Inserts

The wire diameter of the thermocouple must be defined when configuring high-temperature thermometers. The higher the temperature, the larger the wire diameter that must be selected. A large wire diameter increases the operating life of the thermocouple. The insert diameter depends on the internal diameter of the thermowell. If possible, the larger insert diameter is installed, which leads to stable high-temperature measurement.

Replaceable insert TPC100:

Insert version	MgO sheath material	Max. temperature according to IEC EN 60584-1	Max. recommended continuous operating temperature	Insert diameter in mm (in)
1x K, 2x K	INCONEL® 600	1 100 °C (2 012 °F)	1 100 °C (2 012 °F)	6 mm (0.24 in)
1x J, 2x J	INCONEL® 600	750 °C (1 382 °F)	750 °C (1 382 °F)	
1x N, 2x N	Pyrosil®	1 150 °C (2 102 °F)	1 150 °C (2 102 °F)	

Replaceable insert TPC200:

Insert version	Wire diameter in mm(in)	Max. temperature according to IEC EN 60584-1	Max. recommended continuous operating temperature	Insert diameter in mm (in)
1x K, 2x K	1.63 mm (0.06 in)	1 200 °C (2 192 °F)	1 100 °C (2 012 °F)	8 mm (0.31 in), 12 mm (0.47 in), 14 mm (0.55 in)
1x K, 2x K	2.3 mm (0.09 in)			
1x K, 2x K	3.26 mm (0.13 in)			12 mm (0.47 in), 14 mm (0.55 in)
1x J, 2x J	1.63 mm (0.06 in)	750 °C (1 382 °F)	700 °C (1 292 °F)	8 mm (0.31 in), 12 mm (0.47 in), 14 mm (0.55 in)
1x J, 2x J	2.3 mm (0.09 in)			
1x J, 2x J	3.26 mm (0.13 in)			12 mm (0.47 in), 14 mm (0.55 in)
1x S, 2x S	0.35 mm (0.014 in)	1 600 °C (2 912 °F)	1 300 °C (2 372 °F)	6 mm (0.24 in),
1x S, 2x S	0.5 mm (0.02 in)		1 500 °C (2 732 °F)	
1x R, 2x R	0.5 mm (0.02 in)			
1x B, 2x B	0.5 mm (0.02 in)	1 700 °C (3 092 °F)	1 600 °C (2 912 °F)	

For cases where the insert is replaced, the following table must be observed. The insert length is calculated from the total length of the thermowell (Lg) and a specific additional length (X) that depends on the thermowell material. Dimensions in mm (in).

Calculation rules for measuring insert length (He = Lg + X)						
Material	**Insert TPC 200**		**Insert TPC100, MgO-insulated**			
			Without internal ceramic sheath 14x10 (contact with tip)		With internal ceramic sheath 14x10 (-10 mm)	
	Terminal head DIN A (41 mm)	Terminal head DIN B (26 mm)	Terminal head DIN A (41 mm)	Terminal head DIN B (26 mm)	Terminal head DIN A (41 mm)	Terminal head DIN B (26 mm)
Thermowell for iTHERM FlameLine TAF11:						
C610 + sleeve	Lg + 30 (1.2)	Lg + 15 (0.6)	Lg + 30 (1.2)	Lg + 15 (0.6)	-	-
Sintered silicon carbide SIC + sleeve	Lg + 20 (0.8)	Lg + 5 (0.2)	Lg + 20 (0.8)	Lg + 5 (0.2)	-	-
Special silicon nitride ceramic SiN + sleeve	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 25 (1.0)	Lg + 10 (0.4)	-	-
Thermowell for iTHERM FlameLine TAF16:						
Special nickel/cobalt alloy NiCo (metal cap)	Lg + 20 (0.8)	Lg + 5 (0.2)	Lg + 30 (1.2)	Lg + 15 (0.6)	Lg + 20 (0.8)	Lg + 5 (0.2)
All metal thermowells, e.g. 310, 446, 316, etc.	Lg + 30 (1.2)	Lg + 15 (0.6)	Lg + 40 (1.57)	Lg + 25 (1.0)	Lg + 30 (1.2)	Lg + 15 (0.6)
Thermowell tip made of barstock NiCo and INCOLOY 800HT	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 30 (1.2)	Lg + 15 (0.6)	Lg + 20 (0.8)	Lg + 5 (0.2)
Kanthal Super [1]	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 15 (0.6)	Lg + 0 (0)
SiN (special silicon nitride ceramic)	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 15 (0.6)	Lg + 0 (0)
Kanthal AF [1]	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 40 (1.57)	Lg + 25 (1.0)	Lg + 30 (1.2)	Lg + 15 (0.6)
Thermowell made of barstock and INCOLOY 800HT, end thickness: 12 (0.47)	Lg + 20 (0.8)	Lg + 5 (0.2)	Lg + 25 (1.0)	Lg + 10 (0.4)	Lg + 15 (0.6)	Lg + 0 (0)

1) Due to tolerances in Kanthal thermowell manufacturing, deviations in immersion length of ±5% may occur.

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

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

Ordering information

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

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

3. Select **Configuration**.

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

Accessories

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

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

Device-specific accessories

Type
Inserts TPC100, for high-temperature thermometers iTHERM FlameLine TAF11 and TAF16 TPC200, for high-temperature thermometers iTHERM FlameLine TAF11 and TAF16 The inserts for TAF12x are available as Technical Special Products (TSP). [1] orders.
Process connections Adjustable flange, stop flange as per DIN EN 50446 and gas-tight coupling.

1) Contact the manufacturer's sales department for TSP

Service-specific accessories

DeviceCare SFE100
DeviceCare is an Endress+Hauser configuration tool for field devices using the following communication protocols: HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, IO/Link, Modbus, CDI and Endress+Hauser Common Data Interfaces.

Technical Information TI01134S

www.endress.com/sfe100

FieldCare SFE500
FieldCare is a configuration tool for Endress+Hauser and third-party field devices based on DTM technology.
The following communication protocols are supported: HART, WirelessHART, PROFIBUS, FOUNDATION Fieldbus, Modbus, IO-Link, EtherNet/IP, PROFINET and PROFINET APL.

Technical Information TI00028S

www.endress.com/sfe500

Netilion
With the Netilion lIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

www.netilion.endress.com

Online tools

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

System components

Data Manager of the RSG product family

Data Managers are flexible and powerful systems to organize process values. Up to 20 universal inputs and up to 14 digital inputs for direct connection of sensors, optionally with HART, are available as an option. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. The values can be forwarded via common communication protocols to higher-level systems and connected to one another via individual plant modules.

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

Surge arrester modules from the HAW product family

Surge arrester modules for DIN rail and field device mounting, for the protection of plants and measuring instruments with power supply and signal/communication lines.

More detailed information: www.endress.com

Process indicators from the RIA product family

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

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

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

RN series active barrier

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

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

Documentation

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

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

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Document type	Purpose and content of the document
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

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