Датчики температуры Omnigrad M TR13, TC13

Техническая информация

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Россия +7(495)268-04-70 Казахстан +7(7172)727-132 Киргизия +996(312)96-26-47

эл.почта: ehr@nt-rt.ru || сайт: https://endcounters.nt-rt.ru/

Technical Information
Omnigrad M TR13, TC13

Modular thermometer

TR13 with resistance insert (RTD)
TC13 with thermocouple insert (TC)

Application

- Universal range of application
- Measuring range:
  - Resistance insert (RTD): −200 to 600 °C (−328 to 1 112 °F)
  - Thermocouple (TC): −40 to 1 100 °C (−40 to 2 012 °F)
- Pressure range up to 100 bar (1 450 psi)
- Degree of protection: up to IP 68

Head transmitter

Alltransmitters are available with enhanced accuracy and reliability compared to directly wired sensors. Easy customizing by choosing one of the following outputs and communication protocols:

- Analog output 4 to 20 mA
- HART®
- PROFIBUS® PA
- FOUNDATION Fieldbus™

Your benefits

- High degree of flexibility thanks to modular design with standard terminal heads as per DIN EN 50446 and customer-specific immersion lengths
- High degree of insert compatibility and design as per DIN 43772
- Extension neck to protect the head transmitter from overheating
- Fast response time with reduced/tapered tip form
- Types of protection for use in hazardous locations:
  - Intrinsic Safety (Ex ia)
  - Non-sparking (Ex nA)

Function and system design

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 $\alpha = 0.003851\ °C^{-1}$.

There are generally two different kinds of platinum resistance thermometers:

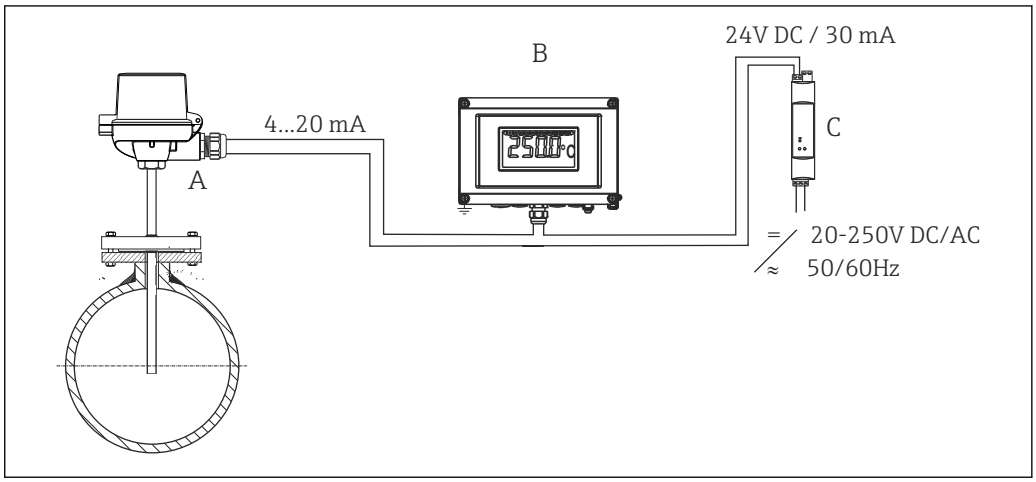
- **Wire wound (WW):** Here, a double coil of fine, high-purity platinum wire is located in a ceramic support. This is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 °C (1 112 °F). This type of sensor is relatively large in size and it is comparatively sensitive to vibrations.
- **Thin film platinum resistance thermometers (TF):** A very thin, ultrapure platinum layer, approx. 1 µm thick, is vaporized in a vacuum on a ceramic substrate and then structured photolithographically. The platinum conductor paths formed in this way create the measuring resistance. Additional covering and passivation layers are applied and reliably protect the thin platinum layer from contamination and oxidation, even at high temperatures.

The primary advantages of thin film temperature sensors over wire wound versions are their smaller sizes and better vibration resistance. A relatively low principle-based deviation of the resistance/temperature characteristic from the standard characteristic of IEC 60751 can frequently be observed among TF sensors at high temperatures. As a result, the tight limit values of tolerance category A as per IEC 60751 can only be observed with TF sensors at temperatures up to approx. 300 °C (572 °F). For this reason, thin-film sensors are generally only used for temperature measurements in ranges below 400 °C (932 °F).

Thermocouples (TC)

Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors are subjected to a thermal gradient. This voltage is called thermoelectric voltage or electromotive force (emf.). Its magnitude depends on the type of conducting materials and the temperature difference between the "measuring point" (the junction of the two conductors) and the "cold junction" (the open conductor ends). Accordingly, thermocouples primarily only measure differences in temperature. The absolute temperature at the measuring point can be determined from these if the associated temperature at the cold junction is known or is measured separately and compensated for. The material combinations and associated thermoelectric voltage/temperature characteristics of the most common types of thermocouple are standardized in the IEC 60584 and ASTM E230/ANSI MC96.1 standards.

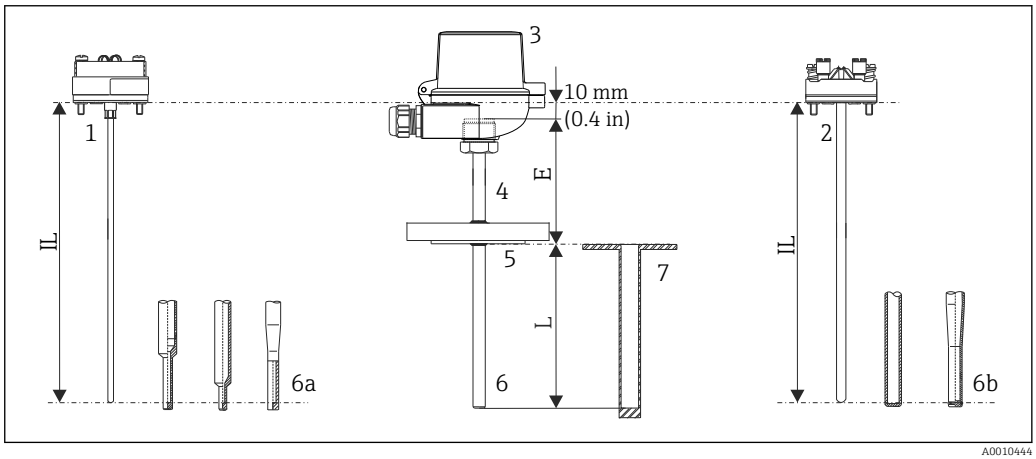
Measuring system



1 Application example

A Mounted thermometer with head transmitter installed.
B RIA16 field display unit - The display unit records the analog measuring signal from the head transmitter and shows this on the display. The LC display shows the current measured value in digital form and as a bar graph indicating a limit value violation. The display unit is looped into the 4 to 20 mA circuit and gets the required energy from there. More information on this can be found in the Technical Information (see "Documentation").
C 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").

Design



2 Thermometer design

1 Insert with head transmitter mounted (example with Φ3 mm (0.12 in))
2 Insert with terminal block mounted (example with Φ6 mm (0.24 in))
3 Terminal head
4 Thermowell
5 Process conneciton: flange
6 Various tip shapes - detailed information see chapter "Tip shape":
6a Reduced or tapered for inserts with Φ3 mm (0.12 in)
6b Straight or tapered for inserts with Φ6 mm (0.24 in)
7 Jacket (protective sheath)
E Extension neck length
L Immersion length
IL Insertion length

Thermometers from the Omnigrad M TR13 and TC13 series have a modular design. The terminal head is used as a connection module for the mechanical and electrical connection of the insert. The position of the actual thermometer sensor in the insert ensures that it is mechanically protected. The insert can be exchanged and calibrated without interrupting the process. Either ceramic terminal blocks or transmitters can be fitted to the internal base washer.

Measurement range

- RTD: −200 to 600 °C (−328 to 1 112 °F)
- TC: −40 to 1 100 °C (−40 to 2 012 °F)

Performance characteristics

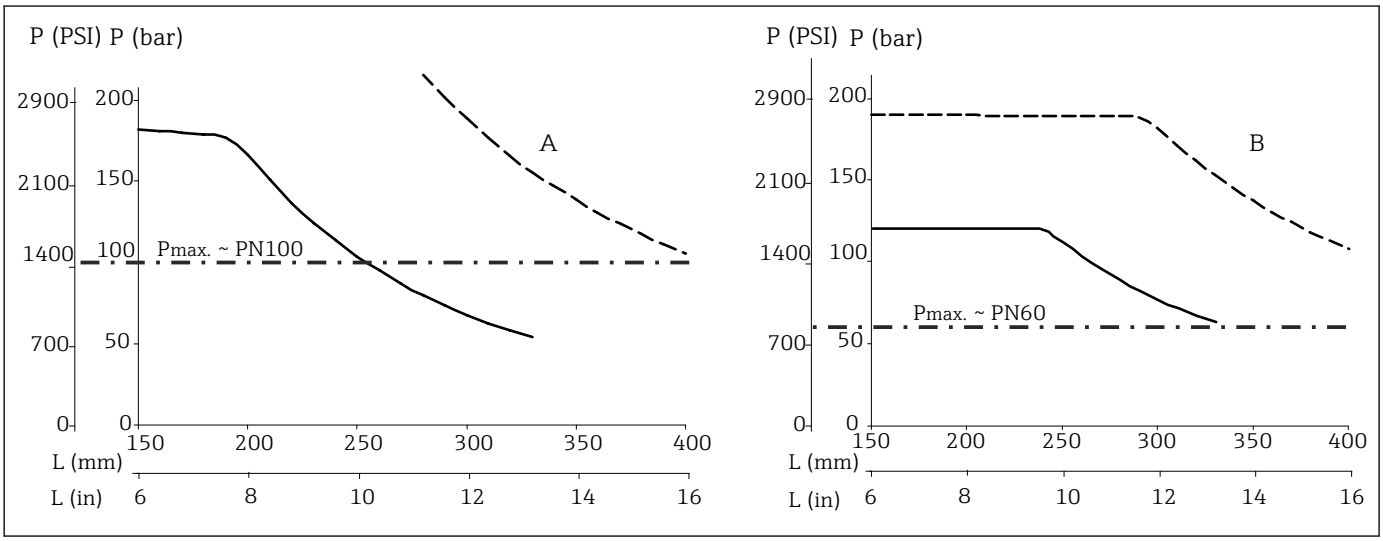
Operating conditions

Ambient temperature

Terminal head	Temperature in °C (°F)
Without mounted head transmitter	Depends on the terminal head used and the cable gland or fieldbus connector, see 'Terminal heads' section
With mounted head transmitter	−40 to 85 °C (−40 to 185 °F)
With mounted head transmitter and display	−20 to 70 °C (−4 to 158 °F)

Process pressure

The pressure values to which the actual thermowell can be subjected at the various temperatures and maximum permitted flow velocity are illustrated by the figure below. Occasionally, the pressure loading capacity of the process connection can be considerably lower. The maximum allowable process pressure for a specific thermometer is derived from the lower pressure value of the thermowell and process connection.



3 Maximum permitted process pressure for tube diameter

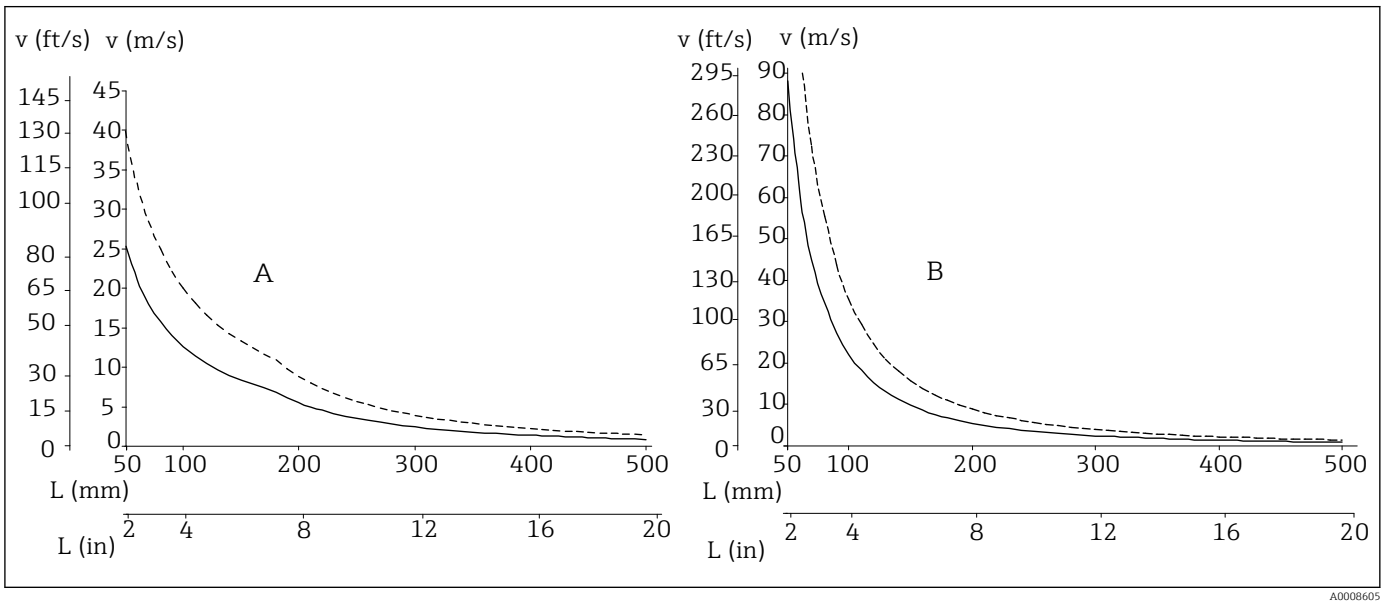
A Medium water T = 50 °C (122 °F)
B Medium superheated steam at T = 400 °C (752 °F)
L Immersion length
P Process pressure
___ Thermowell diameter 9 x 1 mm (0.35 in)
- - - Thermowell diameter 12 x 2.5 mm (0.47 in)

Note the limitation of the maximum process pressure to the flange pressure ratings indicated in the following table.

Process connection	Standard	Max. process pressure
Flange	EN1092-1 or ISO 7005-1	Depending on the flange pressure rating PNxx: 20, 40, 50 or 100 bar at 20 °C (68 °F)
	ASME B16.5	Depending on the flange pressure rating 150 or 300 psi at 20 °C (68 °F)
	JIS B 2220	Depending on the flange pressure rating 20K, 25K or 40K
	DIN2526/7	Depending on the flange pressure rating PN40 at 20 °C (68 °F)

Maximum flow velocity

The highest flow velocity tolerated by the thermowell diminishes with increasing immersion length exposed to the stream of the fluid. Detailed information may be taken from the figures below.



4 *Flow velocity depending on the immersion length*

A Medium water at T = 50 °C (122 °F)
B Medium superheated steam at T = 400 °C (752 °F)
L Immersion length
v Flow velocity
___ Thermowell diameter 9 x 1 mm (0.35 in)
- - - Thermowell diameter 12 x 2.5 mm (0.47 in)

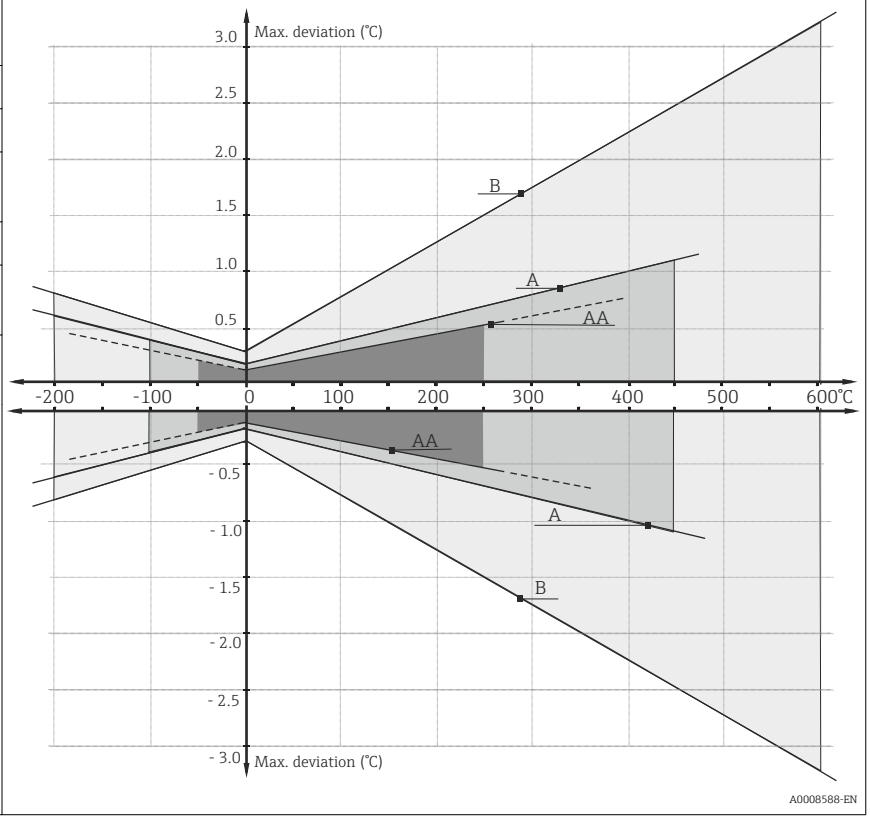
Shock and vibration resistance

- RTD: 3G / 10 to 500 Hz according to IEC 60751
- TC: 4G / 2 to 150 Hz according to IEC 60068-2-6

Accuracy RTD resistance thermometer as per IEC 60751

Class	Max. tolerances (°C)	
Cl. AA, former 1/3 Cl. B	± (0.1 + 0.0017 · |t| [1])	
Cl. A	± (0.15 + 0.002 · |t| [1])	
Cl. B	± (0.3 + 0.005 · |t| [1])	
Temperature ranges for compliance with the tolerance classes		
Wire wound sensor (WW):	Cl. A	Cl. AA
	−100 to +450 °C	−50 to +250 °C
Thin-film version (TF):	Cl. A	Cl. AA
▪ Standard	−30 to +300 °C	0 to +150 °C
▪ iTHERM® StrongSens	−30 to +300 °C	0 to +200 °C

Characteristics



1) |t| = absolute value °C

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

Permissible deviation limits of thermoelectric voltages from the standard characteristic for thermocouples as per IEC 60584 or ASTM E230/ANSI MC96.1:

Standard	Type	Standard tolerance		Special tolerance	
IEC 60584		Class	Deviation	Class	Deviation
	J (Fe-CuNi)	2	±2.5 °C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 750 °C)	1	±1.5 °C (−40 to 375 °C) ±0.004 |t| [1] (375 to 750 °C)
	K (NiCr-NiAl)	2	±2.5 °C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 1200 °C)	1	±1.5 °C (−40 to 375 °C) ±0.004 |t| [1] (375 to 1000 °C)

1) |t| = absolute value °C

Standard	Type	Standard tolerance	Special tolerance
ASTM E230/ANSI MC96.1		Deviation, the larger respective value applies	
	J (Fe-CuNi)	±2.2 K or ±0.0075 |t| [1] (0 to 760 °C)	±1.1 K or ±0.004 |t| [1] (0 to 760 °C)
	K (NiCr-NiAl)	±2.2 K or ±0.02 |t| [1] (−200 to 0 °C) ±2.2 K or ±0.0075 |t| [1] (0 to 1260 °C)	±1.1 K or ±0.004 |t| [1] (0 to 1260 °C)

1) |t| = absolute value °C

Response time

Calculated at an ambient temperature of approx. 23 °C by immersing in running water (0.4 m/s flow rate, 10 K excess temperature):

Complete assembly:

Thermometer type	Diameter	$t_{(x)}$	Reduced tip	Tapered tip	Straight tip
Resistance thermometer (measuring probe Pt100, TF/WW)	9 mm (0.35 in)	t_{50}	7.5 s	11 s	18 s
		t_{90}	21 s	37 s	55 s
	11 mm (0.43 in)	t_{50}	7.5 s	not available	18 s
		t_{90}	21 s	not available	55 s
	12 mm (0.47 in)	t_{50}	not available	11 s	38 s
		t_{90}	not available	37 s	125 s

Thermometer type	Diameter	$t_{(x)}$	Grounded			Ungrounded		
			Reduced tip	Tapered tip	Straight tip	Reduced tip	Tapered tip	Straight tip
Thermocouple	9 mm (0.35 in)	t_{50}	5.5 s	9 s	15 s	6 s	9.5 s	16 s
		t_{90}	13 s	31 s	46 s	14 s	33 s	49 s
	11 mm (0.43 in)	t_{50}	5.5 s	not available	15 s	6 s	not available	16 s
		t_{90}	13 s	not available	46 s	14 s	not available	49 s
	12 mm (0.47 in)	t_{50}	not available	8.5 s	32 s	not available	9 s	34 s
		t_{90}	not available	20 s	106 s	not available	22 s	110 s

Response times for insert without transmitter.

Tested in accordance with IEC 60751 in flowing water (0.4 m/s at 30 °C):

Insert:

Sensor type	Diameter ID	Response time	Thin film (TF)
iTHERM® StrongSens	6 mm (0.24 in)	t_{50}	<3.5 s
		t_{90}	<10 s
TF Sensor	3 mm (0.12 in)	t_{50}	2.5 s
		t_{90}	5.5 s
	6 mm (0.24 in)	t_{50}	5 s
		t_{90}	13 s
WW Sensor	3 mm (0.12 in)	t_{50}	2 s
		t_{90}	6 s
	6 mm (0.24 in)	t_{50}	4 s
		t_{90}	12 s
Thermocouple (TPC100) grounded	3 mm (0.12 in)	t_{50}	0.8 s
		t_{90}	2 s
	6 mm (0.24 in)	t_{50}	2 s
		t_{90}	5 s
Thermocouple (TPC100) ungrounded	3 mm (0.12 in)	t_{50}	1 s
		t_{90}	2.5 s
	6 mm (0.24 in)	t_{50}	2.5 s
		t_{90}	7 s

Response time for the sensor assembly without transmitter.

Insulation resistance

- RTD:
  Insulation resistance according to IEC 60751 > 100 MΩ at 25 °C between terminals and sheath material measured with a minimum test voltage of 100 V DC
- TC:
  Insulation resistance according to IEC 1515 between terminals and sheath material with a test voltage of 500 V DC:
  – > 1 GΩ at 20 °C
  – > 5 MΩ at 500 °C

Dielectric strength

Tested at a room temperature for 5 s:

- Φ6: ≥1 000 V DC between terminals and insert sheath
- Φ3: ≥250 V DC between terminals and insert sheath

Self heating

RTD elements are passive resistances that are measured using an external current. This measurement current causes a self-heating effect in the RTD element itself which in turn creates an additional measurement error. In addition to the measurement current, the size of the measurement error is also affected by the temperature conductivity and flow velocity of the process. This self-heating error is negligible when anTEMP® temperature transmitter (very small measurement current) is connected.

Calibration

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.

Insert: Ø6 mm (0.24 in) and 3 mm (0.12 in)	Minimum insertion length of insert in mm (in)	
Temperature range	without head transmitter	with head transmitter
−80 to −40 °C (−110 to −40 °F)	200 (7.87)	
−40 to 0 °C (−40 to 32 °F)	160 (6.3)	
0 to 250 °C (32 to 480 °F)	120 (4.72)	150 (5.91)
250 to 550 °C (480 to 1 020 °F)	300 (11.81)	
550 to 1 400 °C (1 020 to 2 552 °F)	450 (17.72)	

Material

Extension neck, thermowell and insert

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 operation temperatures are reduced considerably in some cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Wetted parts			
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1 202 °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 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °F) [1]	▪ Properties comparable to AISI316L ▪ Addition of titanium means increased resistance to intergranular corrosion even after welding ▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ▪ Can only be polished to a limited extent, titanium streaks can form
Inconel600/ 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 etc. ▪ Corrosion from ultrapure water ▪ Not to be used in sulfur-containing atmospheres

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Hastelloy C276/2.4819	NiMo16Cr15W	1 100 °C (2 012 °F)	▪ A nickel-based alloy with good resistance to oxidizing and reducing atmospheres, even at high temperatures ▪ Particularly resistant to chlorine gas and chloride as well as to many oxidizing mineral and organic acids
Jacket			
PTFE (Teflon)	Polytetrafluorethylen	200 °C (392 °F)	▪ Resistant to almost all chemicals ▪ High temperature stability
PVDF	Polyvinylidene fluoride	80 °C (176 °F)	▪ High stability ▪ A high creepage stability under continuous demand ▪ Good cold properties
Tantalum	-	250 °C (482 °F)	▪ With the exception of hydrofluoric acid, fluorine and fluorides, tantalum exhibits excellent resistance to most mineral acids and saline solutions ▪ Prone to oxidation and embrittlement at higher temperatures in air

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

Components

Family of temperature transmitters

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

PC programmable head transmitters
They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP® transmitters can be configured quickly and easily at a PC. offers free configuration software which can be downloaded from the Website. More information can be found in the Technical Information.

HART® programmable head transmitters
The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART® communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the terminal head (flat face) as per DIN EN 50446. Swift and easy operation, visualization and maintenance by PC using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

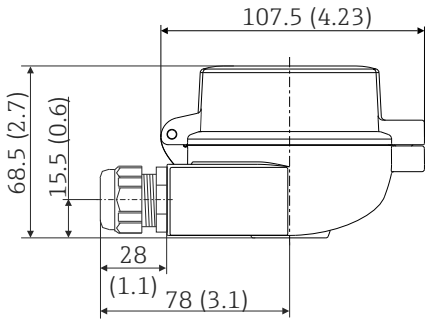
PROFIBUS® PA head transmitters
Universally programmable head transmitter with PROFIBUS® PA communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

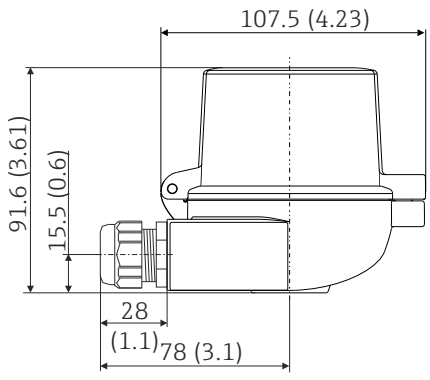
FOUNDATION Fieldbus™ head transmitters
Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e.g. using operating software such as ControlCare from +Hauser or NI Configurator from National Instruments. For more information, see the Technical Information.

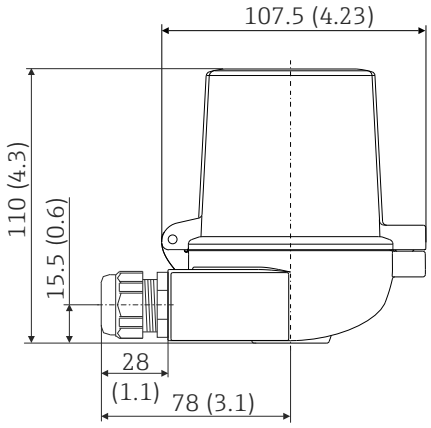
Advantages of the iTEMP® transmitters:
- Dual or single sensor input (optionally for HART® transmitter)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions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

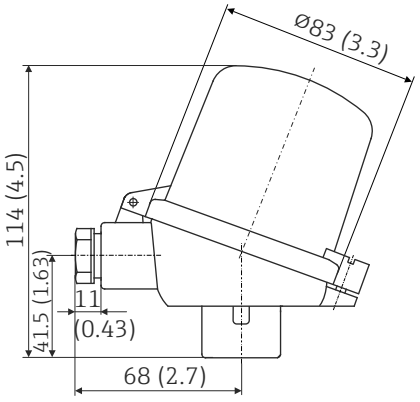
Terminal heads

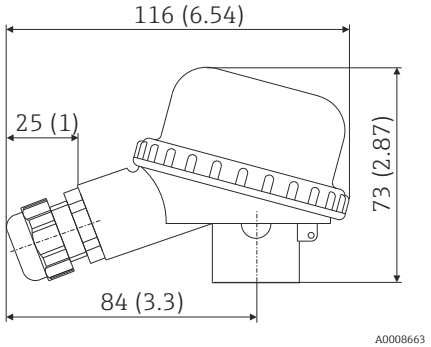
All terminal heads have an internal shape and size in accordance with DIN EN 50446 flat face and a thermometer connection of M24x1.5, G1/2" or 1/2" NPT thread. All dimensions in mm (in). The cable glands in the diagrams correspond to M20x1.5 connections. Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see "Operating conditions" section.

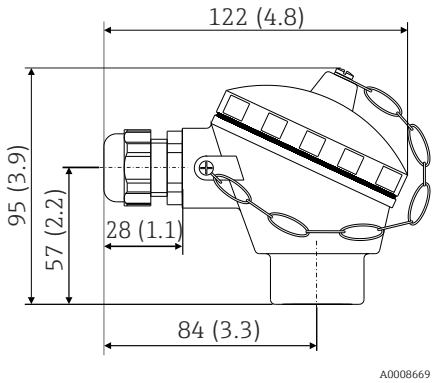
TA30A	Specification
	▪ Available with one or two cable entries ▪ Protection class: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", ½" NPT and M20x1.5; ▪ Protection armature connection: M24x1.5 ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 330 g (11.64 oz) ▪ Ground terminal, internal and external ▪ With 3-A® symbol

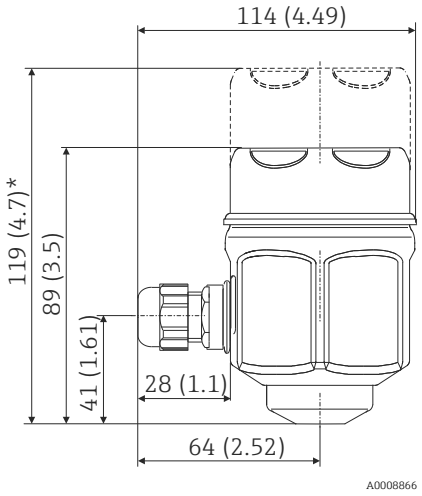
TA30A with display window	Specification
	▪ Available with one or two cable entries ▪ Protection class: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", ½" NPT and M20x1.5 ▪ Protection armature connection: M24x1.5 ▪ Head color: blue, RAL 5012 Cap color: gray, RAL 7035 ▪ Weight: 420 g (14.81 oz) ▪ With TID10 display ▪ Ground terminal, internal and external ▪ With 3-A® symbol

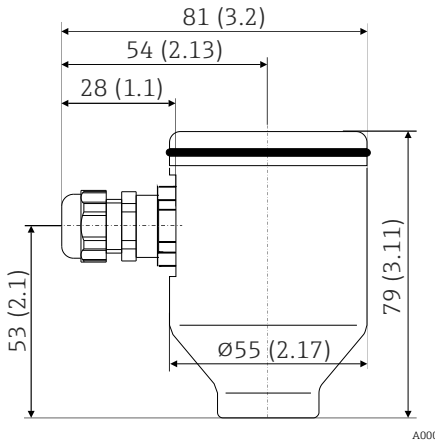
TA30D	Specification
	▪ Available with one or two cable entries ▪ Protection class: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", ½" NPT and M20x1.5 ▪ Protection armature connection: M24x1.5 ▪ Two head transmitters can be mounted. In the standard version, 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 ▪ With 3-A® symbol

TA30P	Specification
	▪ Protection class: IP65 ▪ Max. temperature: −40 to +120 °C (−40 to +248 °F) ▪ Material: polyamide (PA), antistatic Seals: silicone ▪ Threaded cable entry: M20x1.5 ▪ Protection armature connection: M24x1.5 ▪ Head and cap color: black ▪ Weight: 135 g (4.8 oz) ▪ Types of protection for use in hazardous locations: Intrinsic Safety (G Ex ia) ▪ Ground terminal: only internal via auxiliary clamp

TA20B	Specification
	▪ Protection class: IP65 ▪ Max. temperature: 80 °C (176 °F) ▪ Material: polyamide (PA) ▪ Cable entry: M20x1.5 ▪ Head and cap color: black ▪ Weight: 80 g (2.82 oz) ▪ 3-A® marked

TA21E	Specification
	▪ Protection class: IP65 ▪ Max. temperature: 130 °C (266 °F) silicone, 100 °C (212 °F) rubber seal without cable gland (observe max. permitted temperature of the cable gland!) ▪ Material: aluminum alloy with polyester or epoxy coating, rubber or silicone seal under the cover ▪ Cable entry: M20x1.5 or plug M12x1 PA ▪ Protection armature connection: M24x1.5, G 1/2" or NPT 1/2" ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 300 g (10.58 oz) ▪ 3-A® marked

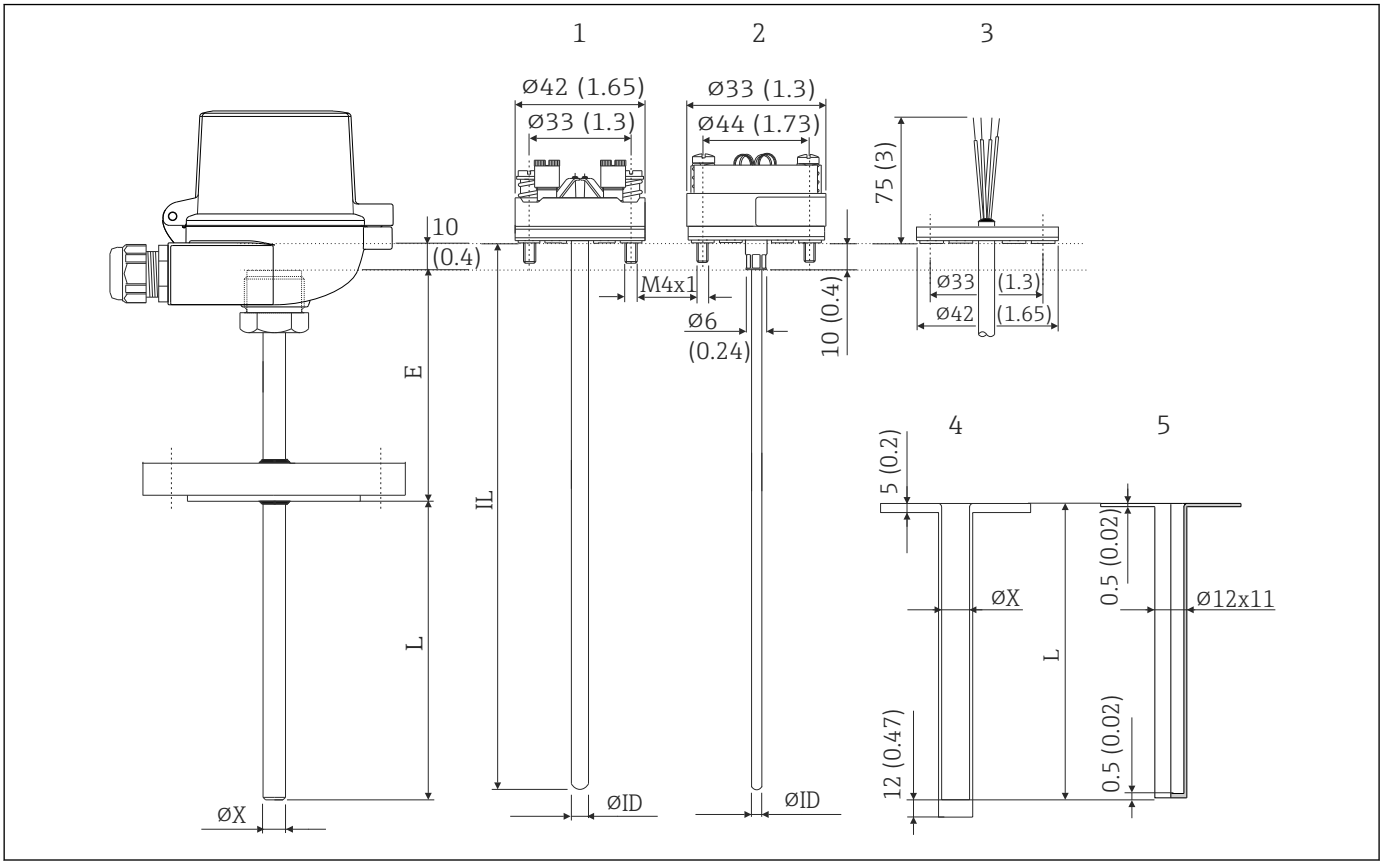
TA20J	Specification
 * dimensions with optional display	▪ Protection class: IP66/IP67 ▪ Max. temperature: 70 °C (158 °F) ▪ Material: 316L (1.4404) stainless steel, rubber seal under the cover (hygienic design) ▪ 4 digits 7-segments LC display (loop powered with optional4 to 20 mA transmitter) ▪ Cable entry: 1/2" NPT, M20x1.5 o plug M12x1 PA ▪ Protection armature connection: M24x1.5 or 1/2" NPT ▪ Head and cap color: stainless steel, polished ▪ Weight: 650 g (22.93 oz) with display ▪ Humidity: 25 to 95 %, no condensation ▪ 3-A® marked The programming is executed through 3 keys at the bottom of the display.

TA20R	Specification
	▪ Protection class: IP66/67 ▪ Max. temperature: 100 °C (212 °F) ▪ Material: SS 316L (1.4404) stainless steel ▪ Cable entry: 1/2" NPT, M20x1.5 or plug M12x1 PA ▪ Head and cap color: stainless steel ▪ Weight: 550 g (19.4 oz) ▪ LABS-free ▪ 3-A® marked

Maximum ambient temperatures for cable glands and fieldbus connectors	
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)
Fieldbus connector (M12x1 PA, 7/8" FF)	−40 to +105 °C (−40 to +221 °F)

Design

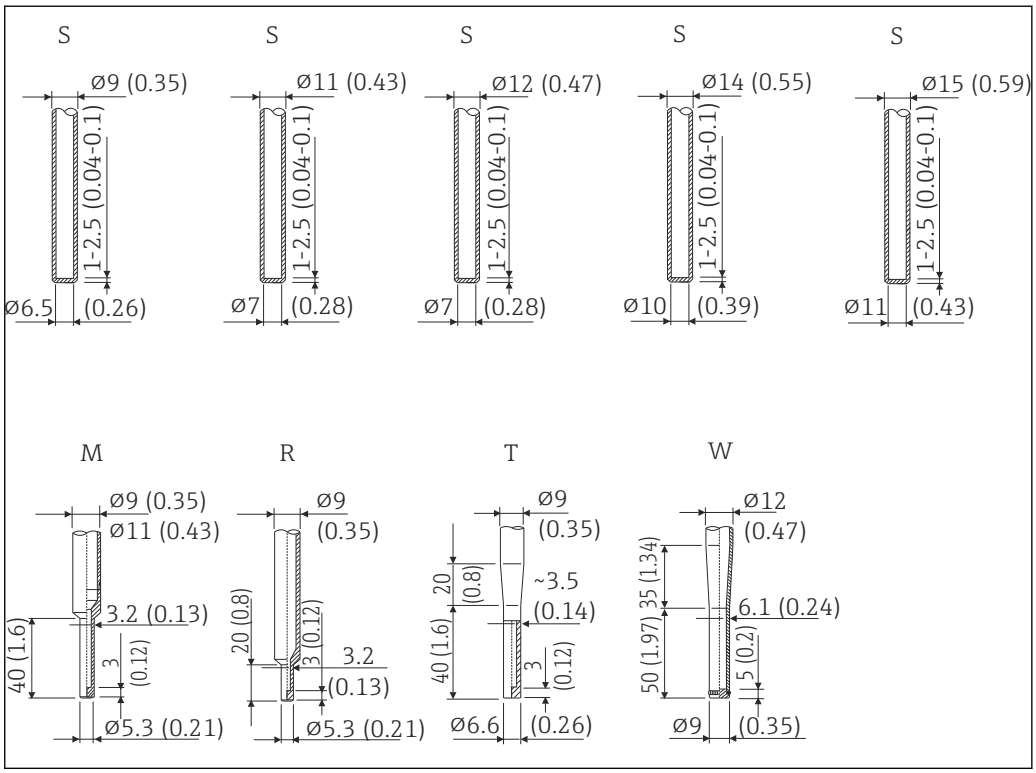
All dimensions in mm (in).



5 Dimensions of the Omnigrad M TR13 and TC13

1 Insert with terminal block mounted
2 Insert with head transmitter mounted
3 Insert with flying leads
4 Jacket (PTFE/PVDF)
5 Jacket (Tantalum)
E Extension neck length
ΦID Insert diameter
IL Total length of insert
L Immersion length
ΦX Thermowell diameter

Tip shape



6 *Available thermowell tips (reduced, straight or tapered). Maximum surface roughness Ra ≤ 1.6 µm (62.9 µin)*

Pos. No.	Tip shape, L = immersion length	Insert diameter
M	Reduced, L ≥70 mm (2.76 in)	3 mm (0.12 in)
R	Reduced, L ≥50 mm (1.97 in) [1]	3 mm (0.12 in)
S	Straight	6 mm (0.24 in)
T	Tapered, L ≥70 mm (2.75 in) [1]	3 mm (0.12 in)
W	Tapered DIN43772-3G, L ≥90 mm (3.54 in) [1]	6 mm (0.24 in)

1) not with material Hastelloy® C276/2.4819 and Inconel600

Jacket

For thermowells with straight tip shape and protection tube diameter 11 mm (PTFE/Tantalum) and 12 mm (PVDF) (0.43 and 0.47 in), a jacket in PTFE (Teflon®), PVDF or Tantalum is available. The external diameter of the thermowell stem will be 15 mm (PTFE) and 16 mm (PVDF) (0.6 and 0.63 in), for Tantalum 12 mm (0.47 in). The immersion length L will be slightly higher also because of the different thermal expansion of the thermowell and jacket. The upper part of the jacket is fitted with a disc of the same material that is inserted between the flange and counterflange.

Insert Depending on the application different inserts are available for the assembly:

RTD													
Selection in order code	A	B	C	F	G	2	3	6	7	S	T	U	V
Sensor design; wiring type	1x Pt100 WW; 3-wire	2x Pt100 WW; 3-wire	1x Pt100 WW; 4-wire	2x Pt100 WW; 3-wire	1x Pt100 WW; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire
Vibration resistance for the tip of the insert	Vibration resistance up to 3g					Increased vibration resistance up to 4g				iTHERM® StrongSens® vibration resistance > 60g			
Measuring range; accuracy class with temperature range	−200 to 600 °C; cl. A, −200 to 600 °C			−200 to 600 °C; cl. AA, 0 to 250 °C		−50 to 400 °C; cl. A, −50 to 250 °C		−50 to 400 °C; cl. AA, 0 to 150 °C		−50 to 500 °C; cl. A, −30 to 300 °C		−50 to 500 °C; cl. AA, 0 to 200 °C	
Insert type	TPR100									iTHERM® TS111			
Diameter	Φ3 mm (0.12 in) or Φ6 mm (0.24 in), depending on the selected tip shape									Φ6 mm (0.24 in)			

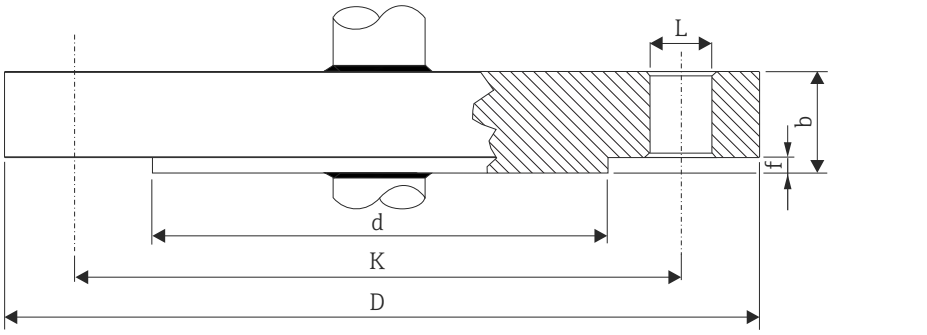
TC				
Selection in order code	A	B	E	F
Sensor design; material	1x K; INCONEL600	2x K; INCONEL600	1x J; 316L	2x J; 316L
Measuring range according to:				
DIN EN 60584	−40 to 1 200 °C		−40 to 750 °C	
ANSI MC 96.1	0 to 1 250 °C		0 to 750 °C	
TC Standard, accuracy	IEC 60584-2; class 1 ASTM E230-03; special			
Insert type	TPC100			
Diameter	Φ3 mm (0.12 in) or Φ6 mm (0.24 in), depending on the selected tip shape			

Weight From 1.5 to 3.5 kg (3.3 to 7.7 lbs) for standard options.

Process connection

The following figure shows the basic dimensions of the available flanges.

Flange



For detailed information on the flange dimensions refer to the following flange standards:

- ANSI/ASME B16.5
- ISO 7005-1
- EN 1092-1
- JIS B 2220 : 2004

The flange material must be the same as of the stem of the thermowell. For this reason, connections are available both in 316L/1.4404 and in 316Ti/1.4571. Models in Hastelloy® have flanges in basic material 316L/1.4404 and a disc in Hastelloy® on the surface in contact with the process media. For the specification PVDF/PTFE/Tantalum thermowell an additional jacket with a disc on the upper end will be used. The standard surface finish of the coupling side of flanges ranges from 3.2 to 6.4 µm (Ra). Other types of flanges can be supplied on request.

Spare parts

- The thermowell TW13 is available as spare part (→ 25)
- The Jacket (TA730) is available as spare part (→ 25)
- The gasket set M24x1.5, aramid+NBR (material no. 60001329) is available as spare part
- The RTD insert is available as spare part TPR100 (→ 25)
- The iTHERM® StrongSens is available as spare part TS111 (→ 25)
- The TC insert is available as spare part TPC100 (→ 25)

The inserts are made from mineral insulated cable (MgO) with a sheath in AISI316L/1.4404 (RTD) or Inconel600 (TC).

If spare parts are required, refer to the following equation:

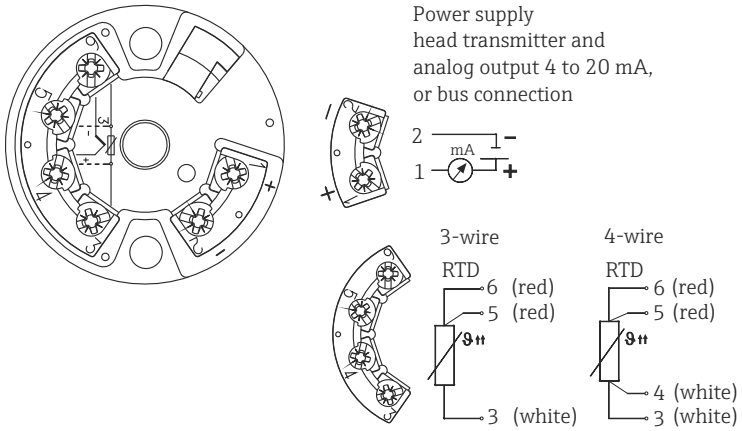
Insertion length IL = E + L + 10 mm (0.4 in)

Wiring

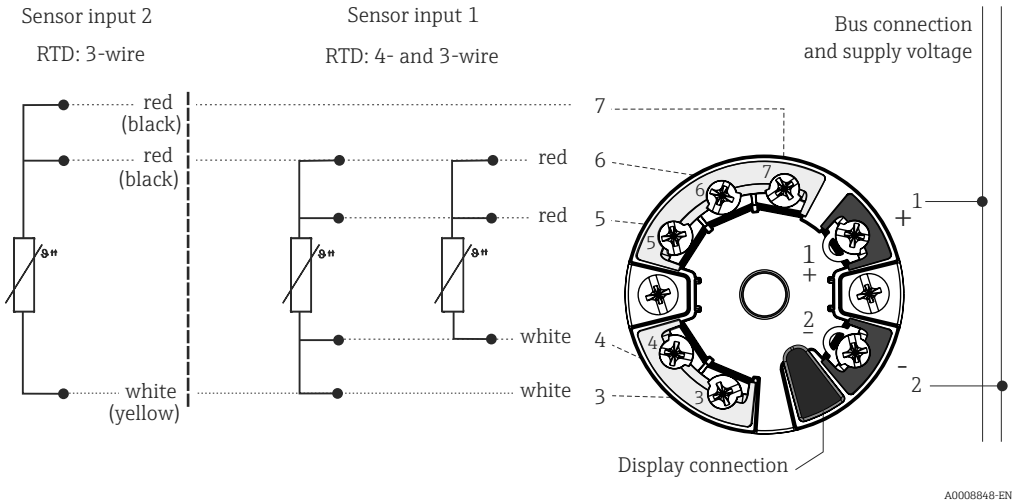
Wiring diagrams for RTD

Type of sensor connection

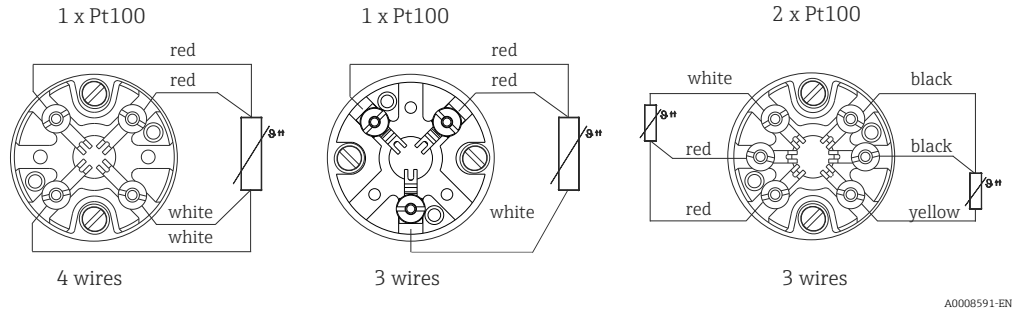
Head mounted transmitter TMT18x (single input)



Head mounted transmitter TMT8x (dual input)



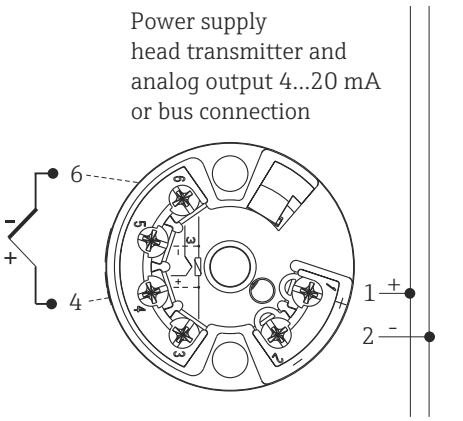
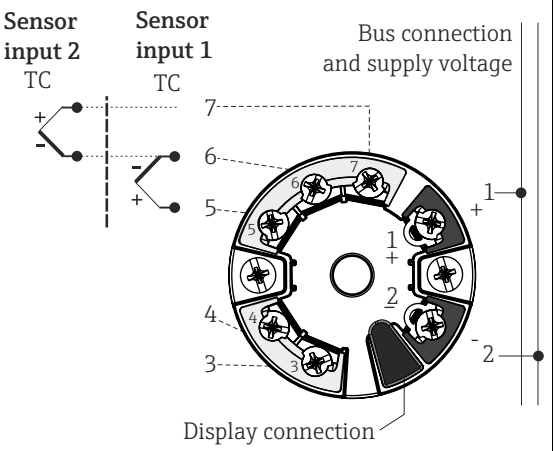
Terminal block mounted

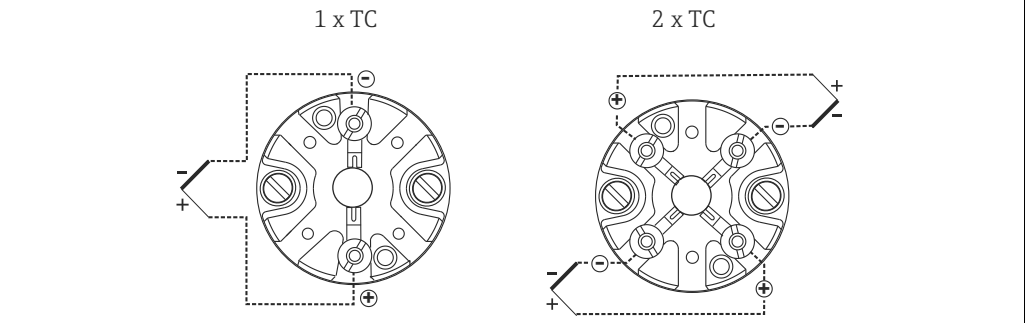


Wiring diagrams for TC

Thermocouple wire colors

As per IEC 60584	As per ASTM E230
▪ Type J: black (+), white (-) ▪ Type K: green (+), white (-)	▪ Type J: white (+), red (-) ▪ Type K: yellow (+), red (-)

Head mounted transmitter TMT18x (single input)	Head mounted transmitter TMT8x (dual input)
	

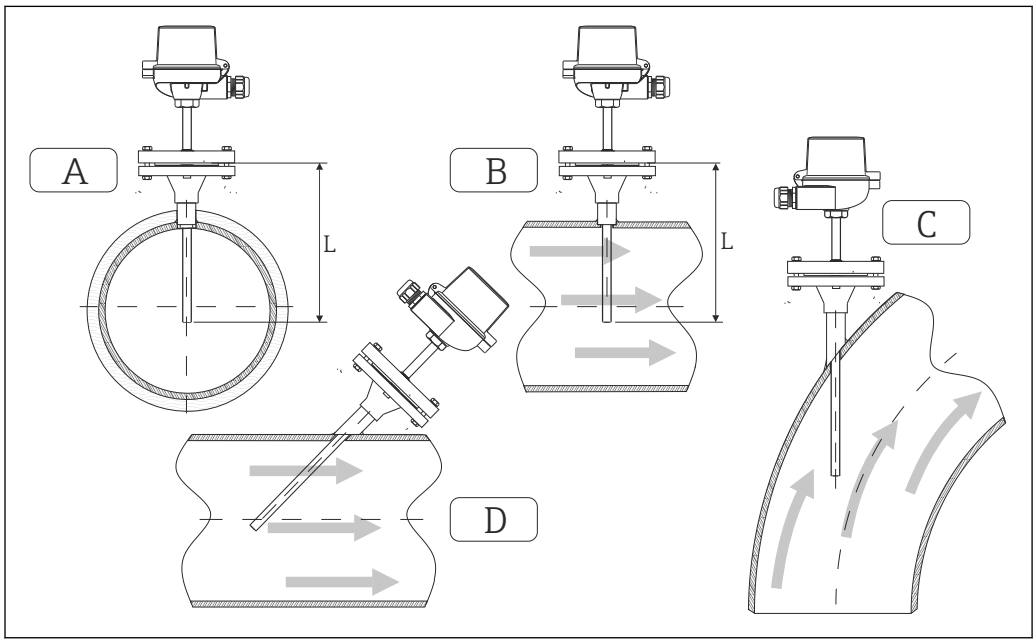
Terminal block mounted


Installation conditions

Orientation

No restrictions.

Installation instructions



7 *Installation examples*

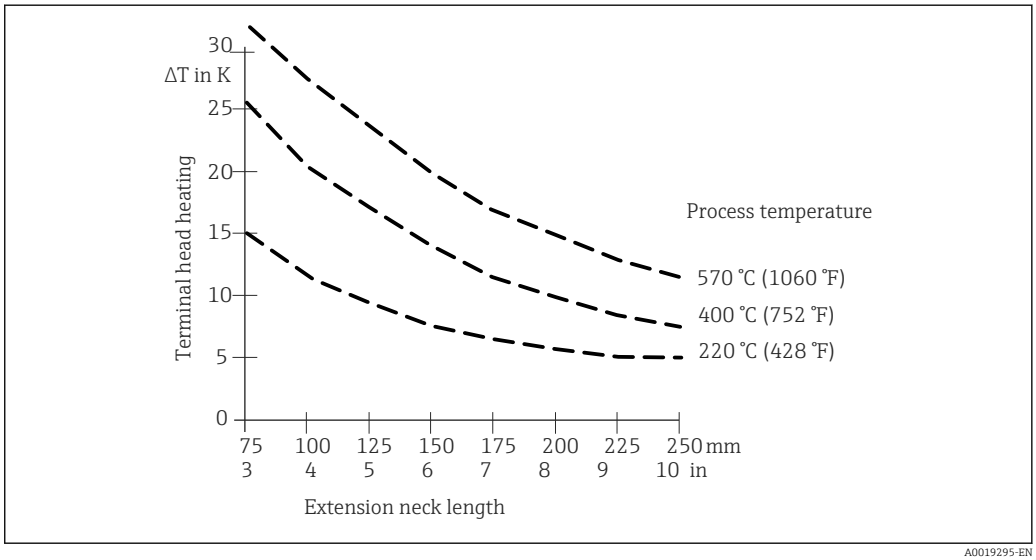
A-B In pipes with a small cross section the thermowell tip should reach or extend slightly past the center line of the pipe (=L).
C-D Angled installation.

The immersion length of the thermometer influences the accuracy. If the immersion length is too small then errors in the measurement are caused by heat conduction via the process connection and the container wall. If installing into a pipe then the immersion length should be at least half of the pipe diameter. A further solution could be an angled (tilted) installation (see C and D). When determining the immersion length all thermometer parameters and the process to be measured must be taken into account (e.g. flow velocity, process pressure).

- Installation possibilities: Pipes, tanks or other plant components
- Recommended minimum immersion length: 80 to 100 mm (3.15 to 3.94 in)
  The immersion length should correspond to at least 8 times of the thermowell diameter. Example: Thermowell diameter 12 mm (0.47 in) x 8 = 96 mm (3.8 in). A standard immersion length of 120 mm (4.72 in) is recommended.
- ATEX certification: Always take note of the installation regulations!

Extension neck length

The extension neck is the part between the process connection and the terminal head. As illustrated in the following diagram, the extension neck length influences the temperature in the terminal head. This temperature must remain within the limit values defined in the "Operating conditions" section.



8 Heating of the terminal head consequent to the process temperature. Temperature in terminal head = ambient temperature 20 °C (68 °F) + ΔT

Certificates and approvals

CE Mark	The device meets the legal requirements of the EC directives if applicable. confirms that the device has been successfully tested by applying the CE mark.
Hazardous area approvals	For further details on the available Ex versions (ATEX, CSA, FM etc.), please contact your nearest sales organization. All relevant data for hazardous areas can be found in separate Ex documentation.
Other standards and guidelines	▪ EN 60079: ATEX certification for hazardous areas ▪ IEC 60529: Degree of protection of housing (IP code) ▪ IEC 61010-1: Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ▪ IEC 60751: Industrial platinum resistance thermometers ▪ IEC 60584 and ASTM E230/ANSI MC96.1: Thermocouples ▪ DIN 43772: Thermowells ▪ DIN EN 50446: Terminal heads ▪ IEC 61326-1: Electromagnetic compatibility (EMC requirements)
PED approval	The thermometer complies with paragraph 3.3 of the Pressure Equipment Directive 97/23/CE and is not marked separately.
Material certification	The material certificate 3.1 (according to 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 if necessary.
Test on thermowell	Thermowell pressure tests are carried out in accordance with the specifications in DIN 43772. With regard to thermowells with tapered or reduced tips that do not comply with this standard, these are tested using the pressure of corresponding straight thermowells. Sensors for use in hazardous areas are also always subjected to a comparative pressure during the tests. Tests according to other specifications can be carried out on request. The liquid penetration test verifies that there are no cracks in the welded seams of the thermowell.
Test report and calibration	The "Factory calibration" is carried out according to an internal procedure in a laboratory of +Hauser accredited by the European Accreditation Organization (EA) according to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT/Accredia or DKD/DAkks calibration) may be requested separately. The calibration is performed on the replaceable insert of the thermometer. In the case of thermometers without a replaceable insert, the entire thermometer - from the process connection to the tip of the thermometer - is calibrated.

Ordering information

Detailed ordering information is available from the following sources:

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 Online Shop

Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
Commubox FXA291	Connectsfield devices with a CDI interface (= Common Data Interface) and the USB port of a computer or laptop. For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Emeasuring devices: ▪ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available:

Documentation

Technical Information
- iTEMP® Temperature head transmitter
  - TMT180, PC-programmable, single-channel, Pt100 (TI088R/09/en)
  - PCP TMT181, PC-programmable, single-channel, RTD, TC, Ω, mV (TI00070R/09/en)
  - HART® TMT182, single-channel, RTD, TC, Ω, mV (TI078R/09/en)
  - HART® TMT82, two-channel, RTD, TC, Ω, mV (TI01010T/09/en)
  - PROFIBUS® PA TMT84, two-channel, RTD, TC, Ω, mV (TI00138R/09/en)
  - FOUNDATION Fieldbus™ TMT85, two-channel, RTD, TC, Ω, mV (TI00134R/09/en)
- Inserts:
  - Resistance thermometer insert Omniset TPR100 (TI268t/02/en)
  - Thermocouple insert Omniset TPC100 (TI278t/02/en)
  - iTHERM® TS111 Insert for installation in thermometers (TI01014T/09/en)
- Thermowell and thermowell oversheats:
  - Thermowell for temperature sensors Omnigrad M TW13 (TI00264T/02/en)
  - Thermowell oversheats Omnigrad TA730 (TI233t/02/en)
- Application example:
  - RN221N Active barrier, for supplying loop-powered transmitters (TI073R/09/en)
  - RIA16 Field display unit, loop-powered (TI00144R/09/en)

Supplementary ATEX documentation:
- RTD/TC Thermometer Omnigrad TRxx, TCxx, TxCxxx, ATEX II 1GD or II 1/2GD Ex ia IIC T6 to T1 (XA00072R/09/a3)
- Omnigrad TRxx, Omniset TPR100, TET10x, TPC100, TEC10x ATEX II 3GD EEx nA (XA00044r/09/a3)
- Inserts Omniset TPR100, TPC100, ATEX/IECEx Ex ia (XA00100T/09/a3)

По вопросам продаж и поддержки обращайтесь:

Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Санкт-Петербург (812)309-46-40
Саратов (845)249-38-78
Севастополь (8692)22-31-93
Саранск (8342)22-96-24
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
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Ярославль (4852)69-52-93

Россия +7(495)268-04-70 Казахстан +7(7172)727-132 Киргизия +996(312)96-26-47

эл.почта: ehr@nt-rt.ru || сайт: https://endcounters.nt-rt.ru/