



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services



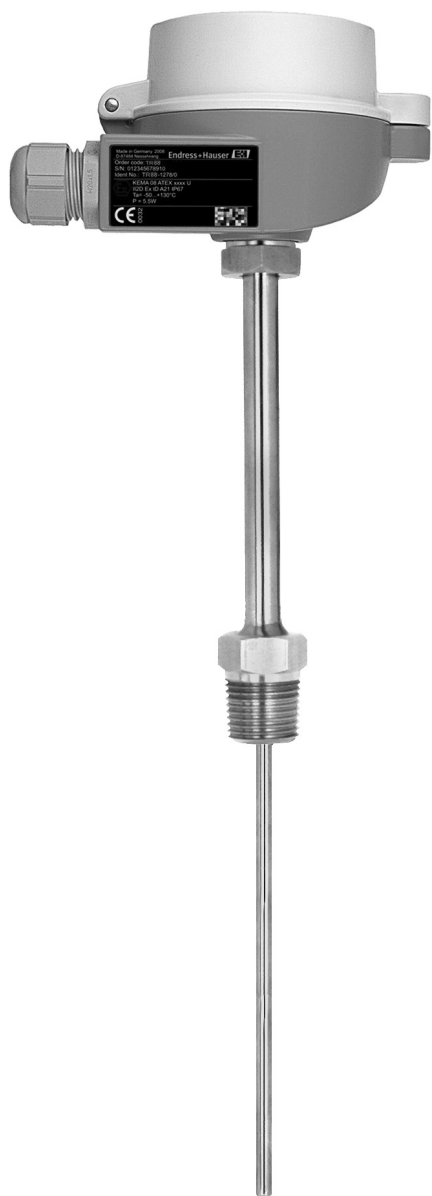
Solutions

## Technical Information

# Omnigrad S TR88

Modular RTD assembly

Extension neck and threaded connection for installation in an existing thermowell



### Application

- Universal application
- Suitable for installation in already existing thermowells
- Measuring range: -200 to +600 °C (-328 to +1112 °F)
- Installation without thermowell possible in unpressurized processes
- Degree of protection up to IP 68
- Replaceable insert

### Head transmitters

All Endress+Hauser transmitters 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...20 mA
- HART®
- PROFIBUS® PA
- FOUNDATION Fieldbus™

### Your benefits

- High degree of flexibility thanks to modular design with standard terminal heads and customer-specific immersion lengths
- Variable total length in suitable thermowells thanks to compression fitting on extension neck
- Types of protection for use in hazardous locations:
  - Intrinsic Safety (Ex ia)
  - Non-sparking (Ex nA)



## Function and system design

### Measuring principle

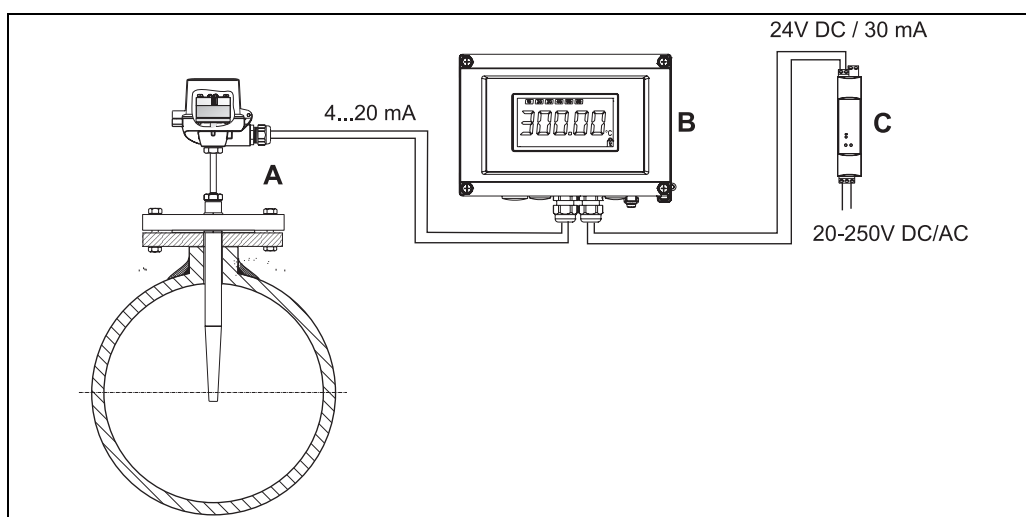
These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. This temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100  $\Omega$  at 0 °C (32 °F) and a temperature coefficient  $\alpha = 0.003851 \text{ } ^\circ\text{C}^{-1}$ .

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 (1112 °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  $\mu\text{m}$  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).

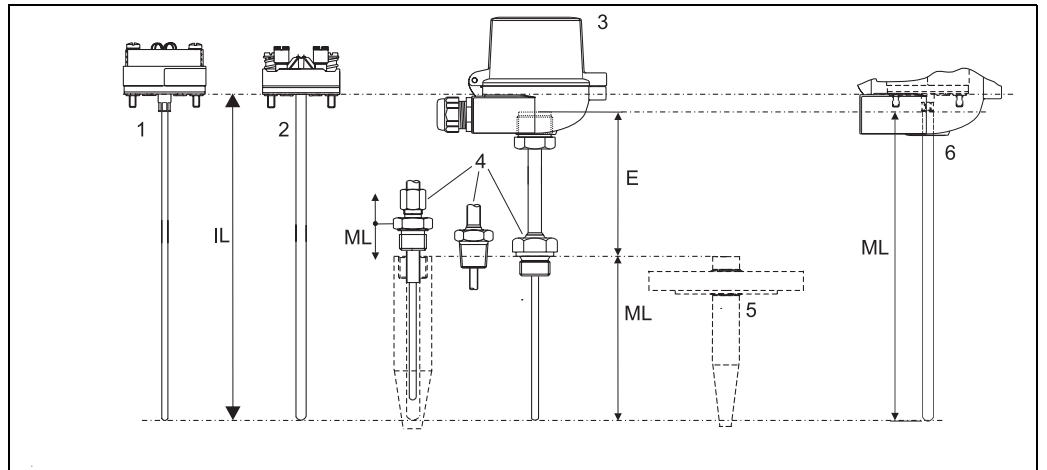
### Measuring system



Example of an application

- A Thermometer with fitted head transmitter mounted in an existing onsite thermowell
- 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 active barrier (24 V DC, 30 mA) has an 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").

## Equipment architecture



Thermometer design

- |  |   |
|--|---|
| <p>1 Insert (<math>\varnothing</math> 3 mm, 0.12 in) with mounted head transmitter (example)</p> <p>2 Insert (<math>\varnothing</math> 6 mm, 0.24 in) with mounted ceramic connection socket (example)</p> <p>3 Terminal head</p> <p>4 Thermowell connection: Threaded connection or compression fitting on extension neck</p> | <p>5 Existing onsite thermowell located in the process</p> <p>6 Version without extension neck, if thermowell and extension neck are present on site in the process</p> <p>E Length of extension neck</p> <p>IL Total length of insert = <math>ML + E + 10 \text{ mm}</math> (0.4 in)</p> <p>ML Insertion length for existing onsite components</p> |
|--|---|

The resistance thermometers from the Omnigrad S TR88 series have a modular design. The terminal head is used as a connection module for the mechanical and electrical connection of the insert. The actual sensor element of the resistance thermometer sits in the insert and is mechanically protected. If installed in a thermowell, the insert can be replaced and calibrated directly in the process. Either ceramic connection sockets or transmitters can be mounted on the internal connection socket.

The TR88 is designed for installation in an existing onsite thermowell. Different threaded connections are available on the bottom of the extension neck for installation in the thermowell. Insofar as the thermowell is suited to this purpose, the thermometer may also be mounted using a suitable compression fitting on the extension neck. This means that thermometers with a fixed insertion length can be used variably, even in thermowells of varying length, and can be installed in such a way that an optimum thermal contact is guaranteed between the tip of the insert and the bottom of the thermowell.

**Measurement range** -200...+600 °C (-328...+1112 °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, → 8
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 maximum process pressure depends on the thermowell into which the thermometer is screwed. For an overview of the Endress+Hauser thermowells which may be used, see → 17.

### Permitted flow rate as a function of immersion length

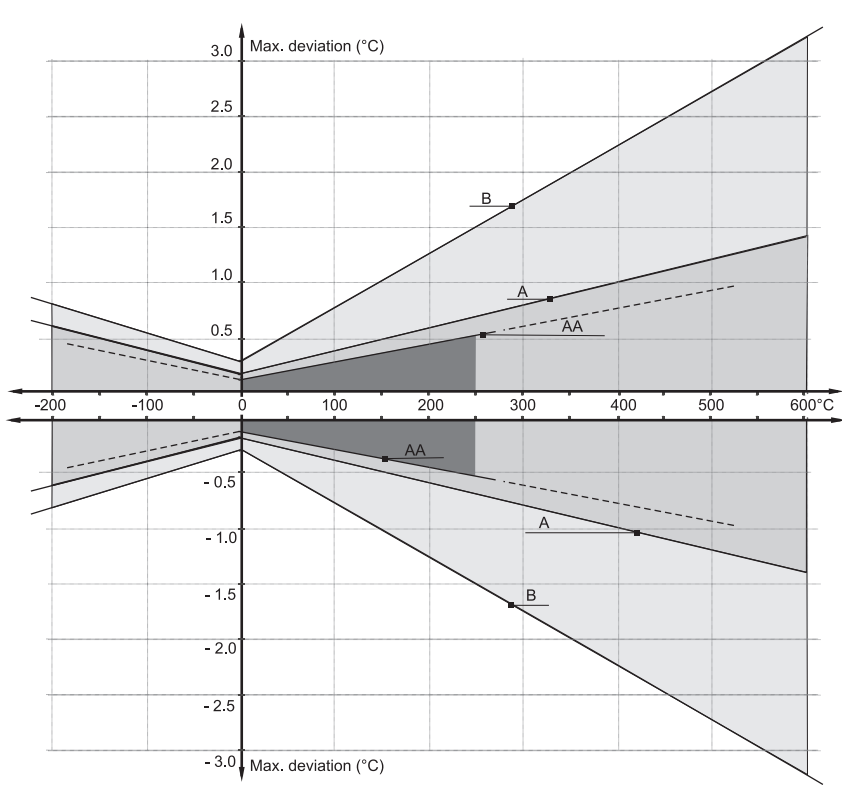
The maximum permitted flow rate to which the thermometer can be subjected, reduces the greater the immersion depth of the thermowell in the flowing medium. In addition, it is dependent on the diameter of the tip of the thermowell, the medium type, process temperature and process pressure. For an overview of the Endress+Hauser thermowells which may be used, see →  17.

### Shock and vibration resistance

3g / 10 to 500 Hz as per IEC 60751 (RTD-Thermometer)

### Accuracy

RTD corresponding to IEC 60751

Class	max. Tolerances (°C)	Temperature range	Characteristics
<b>RTD max. error type TF - range: -50 to +400 °C</b>			
Cl. A	$\pm (0.15 + 0.002 \cdot  t ^{1.1})$	-50 °C to +250 °C	
Cl. AA, former 1/3 Cl. B	$\pm (0.1 + 0.0017 \cdot  t ^{1.1})$	0 °C to +150 °C	
Cl. B	$\pm (0.3 + 0.005 \cdot  t ^{1.1})$	-50 °C to +400 °C	
<b>RTD max. error type WW - range: -200 to +600 °C</b>			
Cl. A	$\pm (0.15 + 0.002 \cdot  t ^{1.1})$	-200 °C to +600 °C	
Cl. AA, former 1/3 Cl. B	$\pm (0.1 + 0.0017 \cdot  t ^{1.1})$	0 °C to +250 °C	
Cl. B	$\pm (0.3 + 0.005 \cdot  t ^{1.1})$	-200 °C to +600 °C	

1)  $|t|$  = absolute value °C



Note!  
For measurement errors in °F, calculate using equations above in °C, then multiply the outcome by 1.8.

### Response time

Tests in water at 0.4 m/s (1.3 ft/s), according to IEC 60751; 10 K temperature step change. Measuring probe Pt100, TF/WW:

Insert diameter	Response time	
6 mm (0.24 in)	$t_{50}$	3.5 s
	$t_{90}$	8 s
3 mm (0.12 in)	$t_{50}$	2 s
	$t_{90}$	5 s



Note!  
Response time for RTD insert without transmitter.

**Insulation resistance** Insulation resistance  $\geq 100 \text{ M}\Omega$  at ambient temperature.  
Insulation resistance between each terminal and the sheath is measured with a voltage of 100 V DC.

**Self heating** RTD elements are passive resistances that are measured using an external current. This measurement current causes a self heating in the RTD element itself which in turn creates an additional measurement error. In addition to the measurement current the size of the measurement error is also affected by the temperature conductivity and flow velocity of the process. This self heating error is negligible when an Endress+Hauser iTEMP<sup>®</sup> temperature transmitter (very small measurement current) is connected.

**Calibration specifications** Endress+Hauser provides comparison temperature calibration from  $-80$  to  $+600 \text{ }^\circ\text{C}$  ( $-110 \text{ }^\circ\text{F}$  to  $1112 \text{ }^\circ\text{F}$ ) based on the International Temperature Scale (ITS90). Calibrations are traceable to national and international standards. The calibration report is referenced to the serial number of the thermometer. Only the measurement insert is calibrated.

Insert-Ø: 6 mm (0.24 in) and 3 mm (0.12 in)	Minimum insertion length IL in mm (inch)	
	without head transmitter	with head transmitter
Temperature range		
$-80 \text{ }^\circ\text{C}$ to $-40 \text{ }^\circ\text{C}$ ( $-110 \text{ }^\circ\text{F}$ to $-40 \text{ }^\circ\text{F}$ )	200 (7.87)	
$-40 \text{ }^\circ\text{C}$ to $0 \text{ }^\circ\text{C}$ ( $-40 \text{ }^\circ\text{F}$ to $32 \text{ }^\circ\text{F}$ )	160 (6.3)	
$0 \text{ }^\circ\text{C}$ to $250 \text{ }^\circ\text{C}$ ( $32 \text{ }^\circ\text{F}$ to $480 \text{ }^\circ\text{F}$ )	120 (4.72)	150 (5.9)
$250 \text{ }^\circ\text{C}$ to $550 \text{ }^\circ\text{C}$ ( $480 \text{ }^\circ\text{F}$ to $1020 \text{ }^\circ\text{F}$ )	300 (11.81)	
$550 \text{ }^\circ\text{C}$ to $650 \text{ }^\circ\text{C}$ ( $1020 \text{ }^\circ\text{F}$ to $1202 \text{ }^\circ\text{F}$ )	400 (15.75)	

**Material** Neck, measuring 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
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	$650 \text{ }^\circ\text{C}$ ( $1200 \text{ }^\circ\text{F}$ ) <sup>1)</sup>	<ul style="list-style-type: none"> <li>■ Austenitic, stainless steel</li> <li>■ High corrosion resistance in general</li> <li>■ 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)</li> <li>■ Increased resistance to intergranular corrosion and pitting</li> <li>■ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content</li> </ul>
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	$700 \text{ }^\circ\text{C}$ ( $1292 \text{ }^\circ\text{F}$ ) <sup>1)</sup>	<ul style="list-style-type: none"> <li>■ Properties comparable to AISI316L</li> <li>■ Addition of titanium means increased resistance to intergranular corrosion even after welding</li> <li>■ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry</li> <li>■ Can only be polished to a limited extent, titanium streaks can form</li> </ul>

1) Can be used to a limited extent up to  $800 \text{ }^\circ\text{C}$  ( $1472 \text{ }^\circ\text{F}$ ) for low compressive loads and in non-corrosive media. Please contact your Endress+Hauser sales team for further information.

## Transmitter specifications

	TMT180 PCP Pt100	TMT181 PCP Pt100, TC, Ω, mV	TMT182 HART® Pt100, TC, Ω, mV	TMT84 PA / TMT85 FF Pt100, TC, Ω, mV
Measurement accuracy	0.2 °C (0.36 °F), optional 0.1 °C (0.18 °F) or 0.08%  % is related to the adjusted measurement range (the larger value applies)	0.2 °C (0.36 °F) or 0.08%		0.1 °C (0.18 °F)
Sensor current	I ≤ 0.6 mA		I ≤ 0.2 mA	I ≤ 0.3 mA
Galvanic isolation (input/output)	-		Û = 2 kV AC	

## Components

### Family of temperature transmitters

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

#### PC programmable head transmitter TMT180 and TMT181

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 the ReadWin® 2000 configuration software for this purpose. This software can be downloaded free of charge at [www.readwin2000.com](http://www.readwin2000.com). More information can be found in the Technical Information (see "Documentation" section).

#### HART® TMT182 head transmitter

HART® communication is all about easy, reliable data access and getting additional information about the measurement point more inexpensively. iTEMP® transmitters integrate seamlessly into your existing control system and provide painless access to numerous diagnostic information.

Configuration with a hand-held (Field Xpert SFX100 or DXR375) or a PC with configuration program (FieldCare, ReadWin® 2000) or configure with AMS or PDM. Details see Technical Information (see chapter 'Documentation').

Type of transmitter	Specification
iTEMP® TMT18x 	<ul style="list-style-type: none"> <li>■ Material: Housing (PC), Potting (PUR)</li> <li>■ Terminals: Cable up to max. ≤ 2.5 mm<sup>2</sup> / 16 AWG (secure screws) or with wire end ferrules</li> <li>■ Eyelets for easy connection of a HART®-handheld terminal with alligator clips</li> <li>■ Degree of protection NEMA 4 (see also type of terminal head)</li> </ul> Details see Technical Information (see chapter 'Documentation')

#### PROFIBUS® PA TMT84 head transmitter

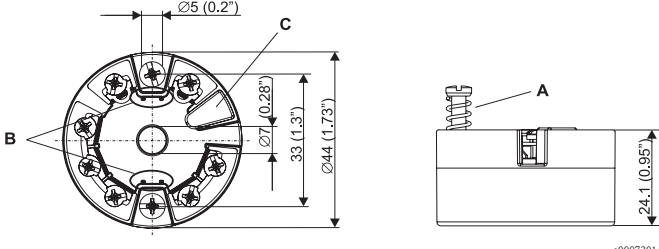
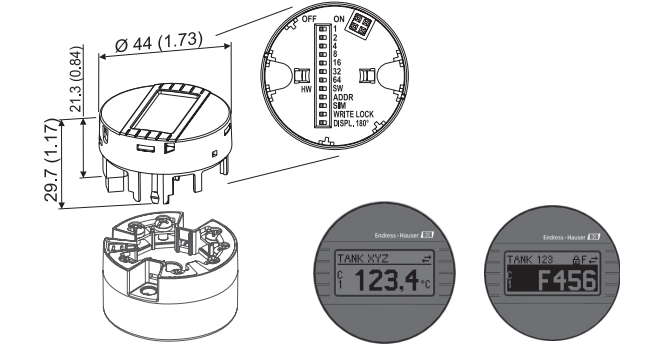

Universally programmable head transmitter with PROFIBUS® PA communication. Converting various input signals into a digital output signal. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software such as FieldCare, Simatic PDM or AMS.

Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, sensor diagnosis functions and sensor-transmitter matching using Callendar-Van Dusen coefficients. Details see Technical Information (see chapter 'Documentation').

### FOUNDATION Fieldbus™ TMT85 head transmitter

Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Converting various input signals into a digital output signal. 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 Endress+Hauser or the NI Configurator from National Instruments.

Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, sensor diagnosis functions and sensor-transmitter matching using Callendar-Van Dusen coefficients. Details see Technical Information (see chapter 'Documentation').

Type of transmitter	Specification
<p>iTEMP® TMT84 and TMT85</p>  <p style="text-align: right; font-size: small;">a0007301-en</p>	<ul style="list-style-type: none"> <li>■ Spring range <math>L \geq 5 \text{ mm (0.2\"}</math>), see Pos. A</li> <li>■ Fixing elements for pluggable measured value display, see Pos. B</li> <li>■ Interface for contacting measured value display, see Pos. C</li> <li>■ Material (RoHS-compliant)</li> </ul> <p>Housing: PC Potting: PU</p> <ul style="list-style-type: none"> <li>■ Terminals:</li> </ul> <p>Screw terminals (cable up to max. <math>\leq 2.5 \text{ mm}^2 / 16 \text{ AWG}</math>) or spring terminals (e. g. from <math>0.25 \text{ mm}^2</math> to <math>0.75 \text{ mm}^2 / 24 \text{ AWG}</math> to 18 AWG for flexible wires with wire-end ferrules with plastic ferrule)</p> <ul style="list-style-type: none"> <li>■ Degree of protection NEMA 4 (see also type of terminal head)</li> </ul> <p>Details see Technical Information (see chapter 'Documentation')</p>
<p>Pluggable display TID10 as option</p>  <p style="text-align: right; font-size: small;">a0009955</p>	<ul style="list-style-type: none"> <li>■ Displays the actual measured value and the measurement point identification</li> <li>■ Displays fault events in inverse color with channel ident and diagnostics code</li> <li>■ DIP-switches on the rear for hardware set-up, e. g. PROFIBUS® PA bus address</li> </ul> <p> <b>Note!</b> Display is only available with suitable terminal head with display window, e.g. TA30</p>

## 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.

All dimensions in mm (inch). The cable glands in the diagrams correspond to M20x1.5 connections.

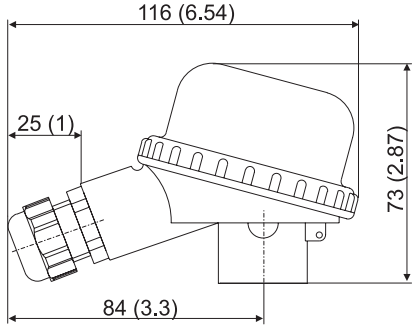
Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see 'Operating conditions' section.

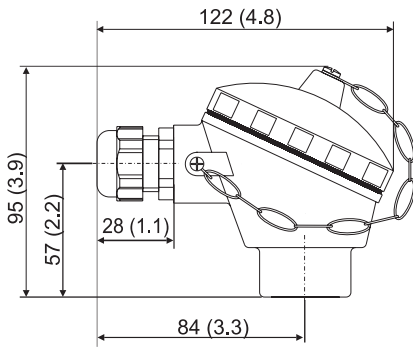
TA30A	Specification
	<ul style="list-style-type: none"> <li>■ Degree of protection: IP66/68</li> <li>■ Max. temperature: 150 °C (300 °F)</li> <li>■ Material: aluminum, polyester powder coated</li> <li>Seals: silicone</li> <li>■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF</li> <li>■ Protection armature connection: M24x1.5</li> <li>■ Head color: blue RAL 5012</li> <li>■ Cap color: grey RAL 7035</li> <li>■ Weight: 330 g (11.64 oz)</li> </ul>

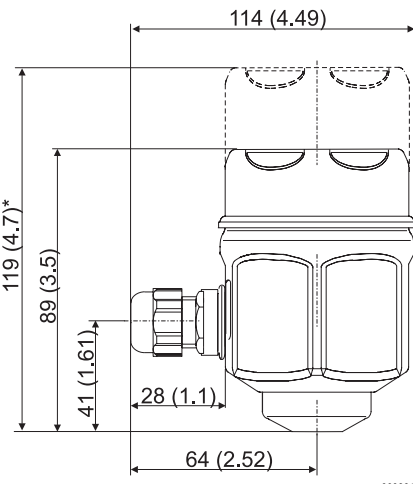
TA30A with display window	Specification
	<ul style="list-style-type: none"> <li>■ Degree of protection: IP66/68</li> <li>■ Max. temperature: 150 °C (300 °F)</li> <li>■ Material: aluminum, polyester powder coated</li> <li>Seals: silicone</li> <li>■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF</li> <li>■ Protection armature connection: M24x1.5</li> <li>■ Head color: blue RAL 5012</li> <li>■ Cap color: grey RAL 7035</li> <li>■ Weight: 420 g (14.81 oz)</li> <li>■ Head transmitter optional with TID10 display</li> </ul>

TA30D	Specification
	<ul style="list-style-type: none"> <li>■ Degree of protection: IP66/68</li> <li>■ Max. temperature: 150 °C (300 °F)</li> <li>■ Material: aluminum, polyester powder coated</li> <li>Seals: silicone</li> <li>■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF</li> <li>■ Protection armature connection: M24x1.5</li> <li>■ 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.</li> <li>■ Head color: blue RAL 5012</li> <li>■ Cap color: grey RAL 7035</li> <li>■ Weight: 390 g (13.75 oz)</li> </ul>



TA20B	Specification
 <p style="text-align: right; font-size: small;">a0008663</p>	<ul style="list-style-type: none"> <li>■ Degree of protection: IP65</li> <li>■ Max. temperature: 80 °C (176 °F)</li> <li>■ Material: polyamide (PA)</li> <li>■ Cable entry: M20x1.5</li> <li>■ Head and cap color: black</li> <li>■ Weight: 80 g (2.82 oz)</li> <li>■ 3-A<sup>®</sup> marked</li> </ul>

TA21E	Specification
 <p style="text-align: right; font-size: small;">a0008669</p>	<ul style="list-style-type: none"> <li>■ Degree of protection: IP65</li> <li>■ Max. temperature: 130 °C (266 °F) silicone, 100 °C (212 °F) rubber (observe max. permitted temperature of the cable gland!)</li> <li>■ Material: aluminum alloy with polyester or epoxy coating; rubber or silicone seal under the cover</li> <li>■ Cable entry: M20x1.5 or plug M12x1 PA</li> <li>■ Protection armature connection: M24x1.5, G 1/2" or NPT 1/2"</li> <li>■ Head color: blue RAL 5012</li> <li>■ Cap color: grey RAL 7035</li> <li>■ Weight: 300 g (10.58 oz)</li> <li>■ 3-A<sup>®</sup> marked</li> </ul>

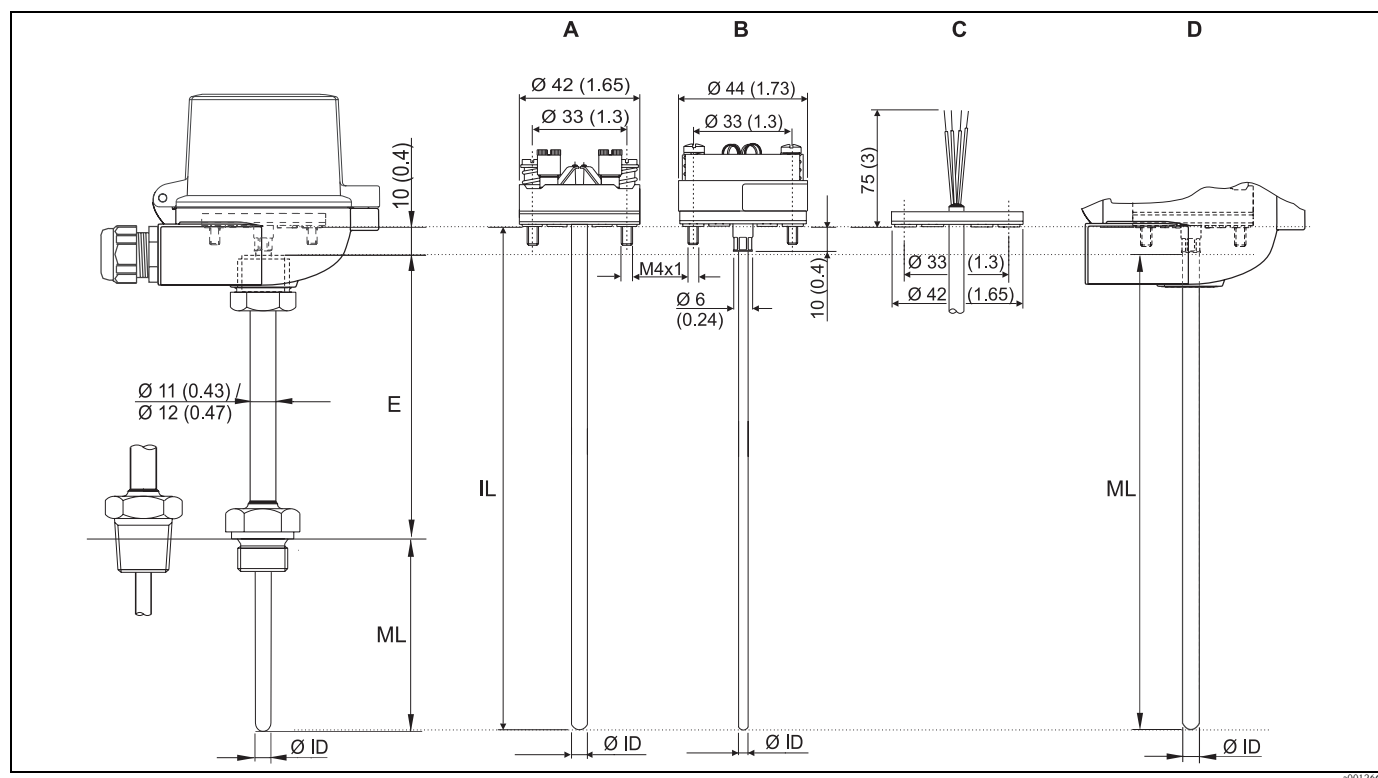
TA20J	Specification
 <p style="text-align: right; font-size: small;">a0008866</p> <p><i>* dimensions with optional display</i></p>	<ul style="list-style-type: none"> <li>■ Degree of protection: IP66/IP67</li> <li>■ Max. temperature: 70 °C (158 °F)</li> <li>■ Material: 316L (1.4404) stainless steel, rubber seal under the cover (hygienic design)</li> <li>■ 4 digits 7-segments LC display (loop powered with 4...20 mA transmitter)</li> <li>■ Cable entry: 1/2" NPT, M20x1.5 or plug M12x1 PA</li> <li>■ Protection armature connection: M24x1.5 or 1/2" NPT</li> <li>■ Head and cap color: stainless steel, polished</li> <li>■ Weight: 650 g (22.93 oz) with display</li> <li>■ Humidity: 25 to 95%, no condensation</li> <li>■ 3-A<sup>®</sup> marked</li> </ul> <p>The programming is executed through 3 keys at the bottom of the display.</p>

TA20R	Specification
	<ul style="list-style-type: none"> <li>■ Degree of protection: IP66/67</li> <li>■ Max. temperature: 100 °C (212 °F)</li> <li>■ Material: SS 316L (1.4404) stainless steel</li> <li>■ Cable entry: ½" NPT, M20x1.5 or plug M12x1 PA</li> <li>■ Head and cap color: stainless steel</li> <li>■ Weight: 550 g (19.4 oz)</li> <li>■ LABS - free</li> <li>■ 3-A® marked</li> </ul>

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, dimensions

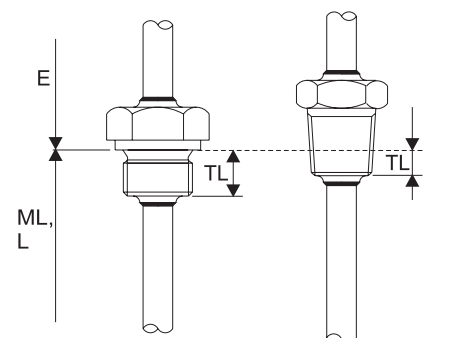
All dimensions in mm (inch).



A	Insert with mounted terminal block	Ø ID	Insert diameter
B	Insert with mounted head transmitter		6 mm (0.24 in) or 3 mm (0.12 in)
C	Insert with flying leads	E	Length of extension neck
D	Model without extension neck, intended for mounting in an existing onsite extension neck	IL	Total length of insert = ML + E + 10 mm (0.4 in)
		ML	Insertion length

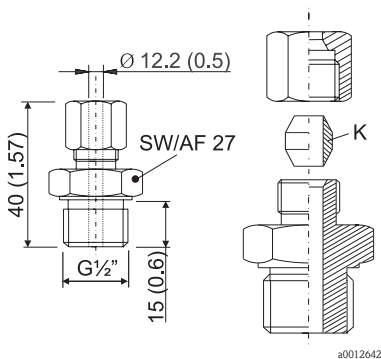
**Weight** From 0.5 to 2.5 kg (1 to 5.5 lbs) for standard options.

**Process connection** The thermometer is designed for installation in an existing onsite thermowell or in a thermowell which can be ordered separately. The installation is done using the threaded connection on the bottom of the extension neck or using a compression fitting.

Threaded connection		Version		Thread length TL in mm (inch)	Width across flats AF
Cylindrical (version M, G, R)	Conical (version NPT)	M	M14x1.5	12 (0.47)	17
			M18x1.5		24
 <p><i>E = Length of extended neck</i> <i>ML, L = Insertion length, immersion length</i></p>		G	G½" as per ISO 6149	15 (0.6)	27
		NPT	NPT ½" as per ANSI B1.20.1	8 (0.32)	22
		R	R ¾", JIS B 0203		27
			R ½", JIS B 0203		22

**Compression fitting**

The insert is pushed through a coupling together with the extension neck, Ø 12 mm (0.47 in), and secured using a clamping ring made of 316L stainless steel. The clamping ring can not be reused. The compression fitting must be secured again using a new clamping ring. The insertion length is completely adjustable.

Process connection compression fitting with thread	
 <p><i>K = Clamping ring</i></p>	<ul style="list-style-type: none"> <li>Can be used in the case of thermowells with a sufficiently large internal bore, Ø &gt; 12 mm (0.47 in), to hold the extension neck.</li> <li>Coupling may be used only in unpressurized processes.</li> </ul>

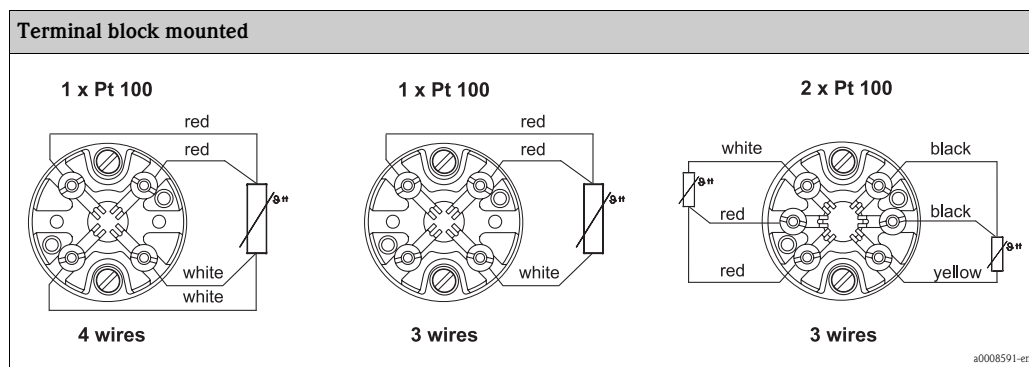
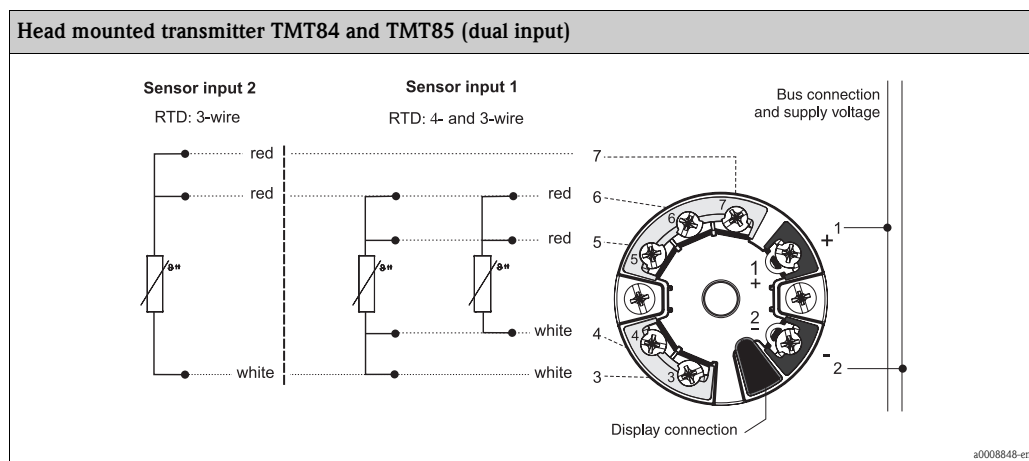
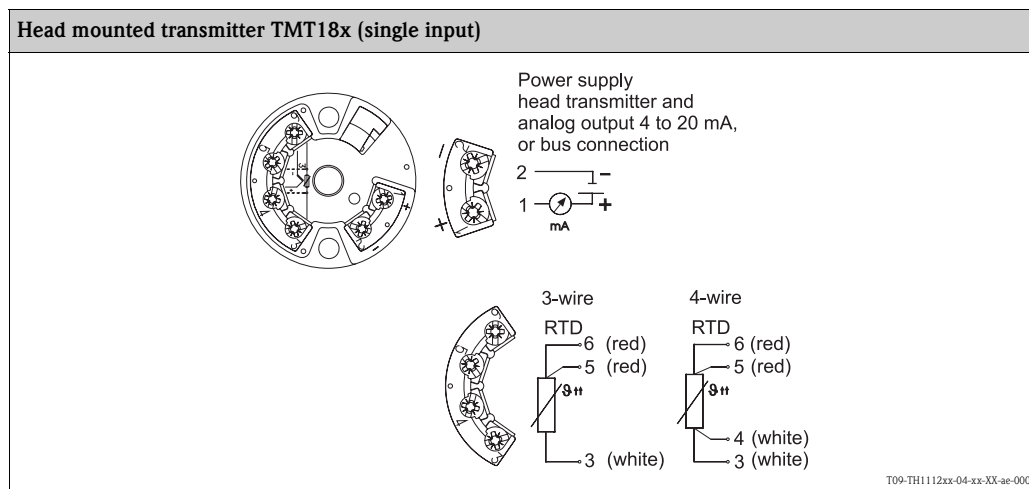
**Spare parts**

- The RTD insert is available as spare part TPR100 (see "Documentation" section in the Technical Information).  
If the insert is required as a spare part, please note the following formula:  
**Total length of insert IL = ML + E + 10 mm (0.4 in)**
- Extension neck welded with threaded connection to terminal head. DIN flat face, different connections to separate thermowell, **order number TN15-...**
- Compression fitting with thread, Ø 12 mm (0.47 in), process connection thread G½", clamping ring made of 316L stainless steel, **order number TA50-KC**

# Wiring

## Wiring diagrams

Type of sensor connection

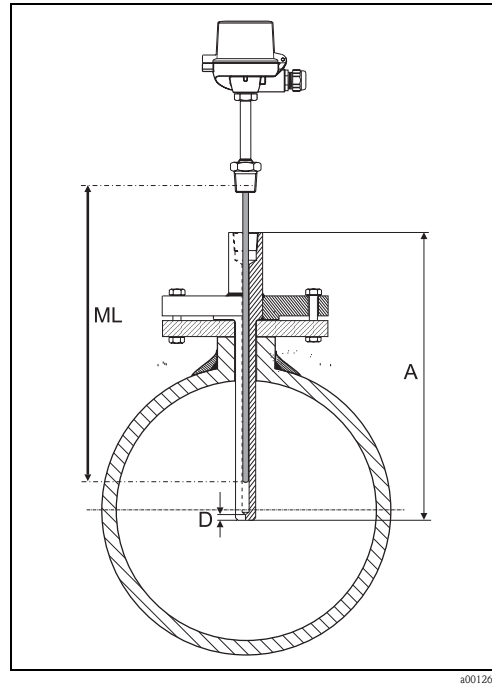


## Installation conditions

### Orientation

No restrictions.

### Installation instructions



Thermometer installation

The thermometer is designed for installation in an existing thermowell or in a thermowell which can be ordered separately. Different threaded connections to suit the thermowell are available on the thermometer's extension neck (→ 11).

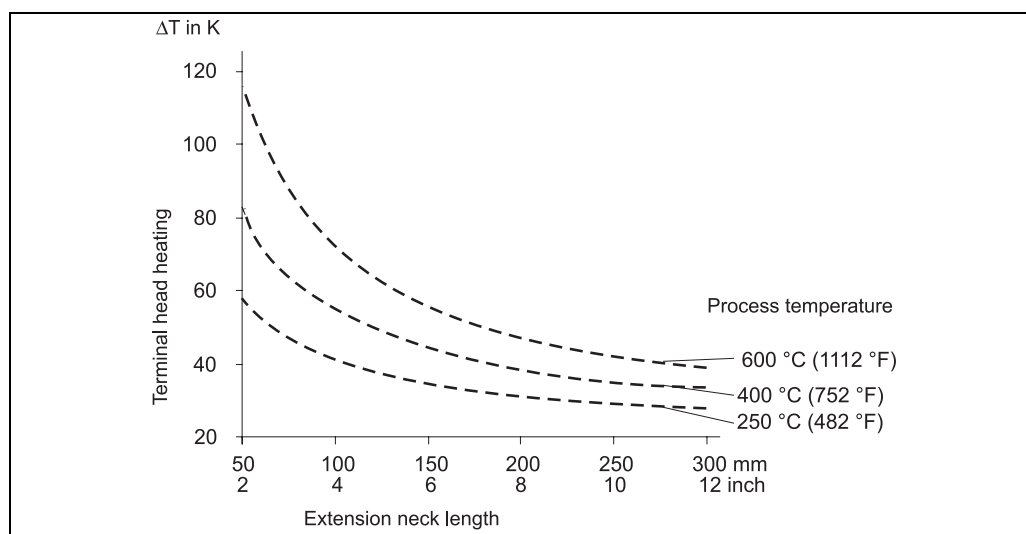
The necessary insertion length (ML) of the insert depends on the total length of the thermowell (A) and the type of thermowell used. It can be freely selected within the range of 100 to 5000 mm (3.94 and 197 in). Longer insertion lengths are available on request. The same also applies when ordering an insert as a spare part. More detailed information on determining the insertion length (ML) required in each case can be found in the following table (applies to Endress+Hauser thermowells with standard base thicknesses).

Type of thermowell	ML in mm (inch)	Type of thermowell	ML in mm (inch)	Type of thermowell	ML in mm (inch)
TA535	ML = A	TW15	ML = A	TA570	ML = A - 3 (0.12)
TA540	ML = A - 2 (0.08)	TA560	ML = A - 3 (0.12)	TA571	
TA550	ML = A - 3 (0.12)	TA562		TA572	
TA555	ML = A - 2 (0.08)	TA565		TA575	
TA557		TA566	TA576	ML = A - 2 (0.12)	

In the case of thermowells with a noncompliant standard base thickness (D), the following formula must be used: **ML = A - D + 3 (0.12)** in mm (inch).

**Neck tube length**

The neck tube is the part between the process connection and the terminal head. As illustrated in the following figure, the neck tube length may influence the temperature in the terminal head. It is necessary that this temperature is kept within the limit values defined in the chapter "Operating conditions".



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. Endress+Hauser 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 Endress+Hauser sales organization. All relevant data for hazardous areas can be found in separate Ex documentation. If required, please request copies.

**Other standards and guidelines**

- IEC 60529:  
Degrees of protection by housing (IP-Code).
- IEC 61010-1:  
Safety requirements for electrical measurement, control and laboratory instrumentation.
- IEC 60751:  
Industrial platinum resistance thermometer
- DIN43772:  
Thermowells
- DIN EN 50446, DIN 47229:  
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.

**Test report and calibration**

The "Factory calibration" is carried out according to an internal procedure in a laboratory of Endress+Hauser accredited by the European Accreditation Organization (EA) to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT or DKD 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

### Product structure

This information provides an overview of the order options available. The information is not exhaustive, however, and may not be fully up to date. **More detailed** information is available from your local Endress+Hauser representative.

RTD Thermometer TR88			
<b>Approval:</b>			
<b>A</b>			Non-hazardous area
<b>B</b>			ATEX II 1 GD Ex ia IIC
<b>E</b>			ATEX II 1/2 GD Ex ia IIC
<b>G</b>			ATEX II 1 G Ex ia IIC
<b>H</b>			ATEX II 3 GD EEx nA II
<b>K</b>			TIIS Ex ia IIC T4
<b>L</b>			TIIS Ex ia IIC T6
<b>Head; Cable entry:</b>			
<b>B</b>			TA30A Alu, IP66/IP68; M20
<b>C</b>			TA30A Alu, IP66/IP68; NPT 1/2"
<b>D</b>			TA30A Alu, IP66/IP67; M12 plug PA
<b>E</b>			TA21E Alu, screw cap IP65; M20
<b>F</b>			TA30A Alu+Display, IP66/IP68; M20
<b>G</b>			TA30A Alu+Display, IP66/IP68; NPT 1/2"
<b>H</b>			TA30A Alu+Display, IP66/IP67; M12 plug PA
<b>I</b>			TA30A Alu, G1/2" w/o gland
<b>J</b>			TA20J 316L, IP66/IP67; M20
<b>K</b>			TA20J 316L, display, IP66/IP67; M20
<b>L</b>			TA30A Alu +Display; G1/2" w/o gland
<b>M</b>			TA20J 316L, IP66/IP67; M12 plug PA
<b>O</b>			TA30D Alu, high cover, IP66/IP68; M20
<b>P</b>			TA30D Alu, high cover, IP66/IP68; NPT 1/2"
<b>Q</b>			TA30D Alu, IP66/IP67; M12 plug PA
<b>R</b>			TA20R 316L screw cap IP66/IP67; M20
<b>S</b>			TA20R 316L screw cap IP66; M12 plug
<b>T</b>			TA30A Alu, IP66/IP67; 7/8" plug FF
<b>U</b>			TA30A Alu+Display, IP66/IP67; 7/8" plug FF
<b>V</b>			TA30D Alu, IP66/IP67; 7/8" plug FF
<b>3</b>			TA30D Alu, high cover; G1/2" w/o gland
<b>7</b>			TA20B PA black, IP65; M20
<b>Extension E:</b>			
<b>0</b>			w/o neck
<b>1</b>			80 mm
<b>2</b>			100 mm
<b>3</b>			155 mm
<b>4</b>			165 mm
<b>5</b>			200 mm
<b>8</b>			..... mm
<b>9</b>			..... mm, as specified
<b>Process connection:</b>			
<b>A</b>			Thread M14x1.5, 316Ti
<b>B</b>			Thread M18x1.5, 316Ti
<b>C</b>			Thread G1/2", 316Ti
<b>E</b>			Thread 1/2" NPT, 316Ti
<b>F</b>			Compression fitting G1/2"
<b>G</b>			Thread R 3/4", JIS B 0203, 316Ti
<b>H</b>			Thread R 1/2", JIS B 0203, 316Ti
<b>Y</b>			Special version, TSP-no. to be specified
<b>0</b>			not needed
<b>Neck diameter; Material:</b>			
<b>1</b>			11 mm; 316Ti
<b>2</b>			w/o neck to build in on side existing neck
<b>3</b>			12 mm; 316 Ti
<b>Insertion length ML:</b>			
<b>A</b>			110 mm
<b>B</b>			140 mm
<b>C</b>			170 mm

							<b>Insertion length ML:</b>
						<b>D</b>	200 mm
						<b>E</b>	260 mm
						<b>F</b>	410 mm
						<b>X</b>	..... mm
						<b>Y</b>	..... mm, as specified
						<b>1</b>	100 mm
						<b>2</b>	160 mm
						<b>3</b>	400 mm
							<b>Insert diameter; Material:</b>
						<b>1</b>	3mm; 316L
						<b>2</b>	6mm; 316L
							<b>Head transmitter; Range:</b>
						<b>B</b>	TMT84 PA
						<b>C</b>	Terminal block
						<b>D</b>	TMT85 FF
						<b>F</b>	Flying leads
						<b>G</b>	TMT181 (PCP); temperature range to be specified
						<b>H</b>	TMT182 (HART, SIL2); temperature range to be specified
						<b>K</b>	TMT182 (HART), diagnostic, advanced
						<b>2</b>	TMT180-A21 fix; 0.2 K, temperature range to be specified, span limit -200/650 °C
						<b>3</b>	TMT180-A22 fix; 0.1 K, temperature range to be specified, span limit -50/250 °C
						<b>4</b>	TMT180-A11 PCP; 0.2 K, temperature range to be specified, span limit -200/650 °C
						<b>5</b>	TMT180-A12 PCP; 0.1 K, temperature range to be specified, span limit -50/250 °C
							<b>RTD; wire; measurement range; class; validity:</b>
						<b>A</b>	1x Pt100 WW; 3; -200/600 °C; A: -200/600 °C
						<b>B</b>	2x Pt100 WW; 3; -200/600 °C; A: -200/600 °C
						<b>C</b>	1x Pt100 WW; 4; -200/600 °C; A: -200/600 °C
						<b>F</b>	2x Pt100 WW; 3; -200/600 °C; 1/3B; 0/250 °C
						<b>G</b>	1x Pt100 WW; 3; -200/600 °C; 1/3B; 0/250 °C
						<b>Y</b>	Special version, TSP-no. to be specified
						<b>2</b>	1x Pt100 TF; 3; -50/400 °C; A; -50/250 °C increased vibration resistance
						<b>3</b>	1x Pt100 TF; 4; -50/400 °C; A; -50/250 °C increased vibration resistance
						<b>6</b>	1x Pt100 TF; 3; -50/400 °C; 1/3B; 0/150 °C increased vibration resistance
						<b>7</b>	1x Pt100 TF; 4; -50/400 °C; 1/3B; 0/150 °C increased vibration resistance
							<b>Material certificate:</b>
						<b>0</b>	Not needed
						<b>9</b>	Special version, TSP-no. to be specified
							<b>Factory test:</b>
						<b>A</b>	0, 100 °C, RTD-Signal
						<b>B</b>	0, 100 °C, RTD-Signal, 4-20 mA/loop
						<b>C</b>	0, 100 °C, RTD-Signal, 2 Sensors
						<b>E</b>	0, 100, 150 °C, RTD-Signal
						<b>F</b>	0, 100, 150 °C, RTD-Signal, 4-20 mA/loop
						<b>G</b>	0, 100, 150 °C, RTD-Signal, 2 Sensors
						<b>0</b>	not needed
						<b>1</b>	Inspection RTD-Signal
						<b>2</b>	Inspection RTD-Signal, 4-20 mA/loop
							<b>Additional option:</b>
						<b>0</b>	not needed
						<b>9</b>	Special version, TSP-no. to be specified
TR88-							← Order code (complete)



## Documentation

Technical Information:

- RTD Insert for Temperature Sensor Omniset TPR100 (TI268t/02/en)
- Temperature head transmitter:
  - iTEMP® PCP TMT181 (TI070r/09/en)
  - iTEMP® Pt TMT180 (TI088r/09/en)
  - iTEMP® HART® TMT182 (TI078r/09/en)
  - iTEMP® TMT84 PA (TI138r/09/en)
  - iTEMP® TMT85 FF (TI134r/09/en)

Technical Informations thermowells:

Type of thermowell					
TA535	TI250t/02/en	TW15	TI265t/02/en	TA570	TI161t/02/en
TA540	TI166t/02/en	TA560	TI159t/02/en	TA571	TI178t/02/en
TA550	TI153t/02/en	TA562	TI230t/02/	TA572	TI179t/02/en
TA555	TI154t/02/en	TA565	TI160t/02/en	TA575	TI162t/02/
TA557	TI156t/02/en	TA566	TI177t/02/en	TA576	TI163t/02/

Hazardous area supplementary documentation:

- Omnigrad TRxx RTD Thermometer ATEX II 1GD or II 1/2GD (XA072r/09/a3)
- Omnigrad TRxx/TCxx RTD/TC Thermometer ATEX II 3GD (XA044r/09/a3)

### Application example

Technical Information:

- Field display RIA16 (TI144r/09/en)
- Active barrier with power supply RN221N (TI073R/09/en)





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