Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Omnigrad M TR15

Modular RTD assembly
neck tube, barstock thermowell,
available with a flange or as a weld-in unit

Application

- Universal range of application
- Particularly suitable for steam and gas applications with high process pressures and temperatures
- Measuring range: -200...600 °C (-328...1112 °F)
- Pressure range up to 400 bar (5800 psi) for the weld-in units
- Degree of protection: up to IP 68

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 flexibility due to modular assembly with standard terminal heads and customized immersion length
- High compatibility with a design according to DIN 43772
- Neck tube for heat protection of head transmitter
- Fast response time with reduced/tapered tip form
- Types of protection for use in hazardous locations:
  Intrinsic Safety (Ex ia)
  Non-Sparking (Ex nA)

CE

TI260T/02/en
71088514

Endress+Hauser

People for Process Automation

Function and system design

Measuring principle

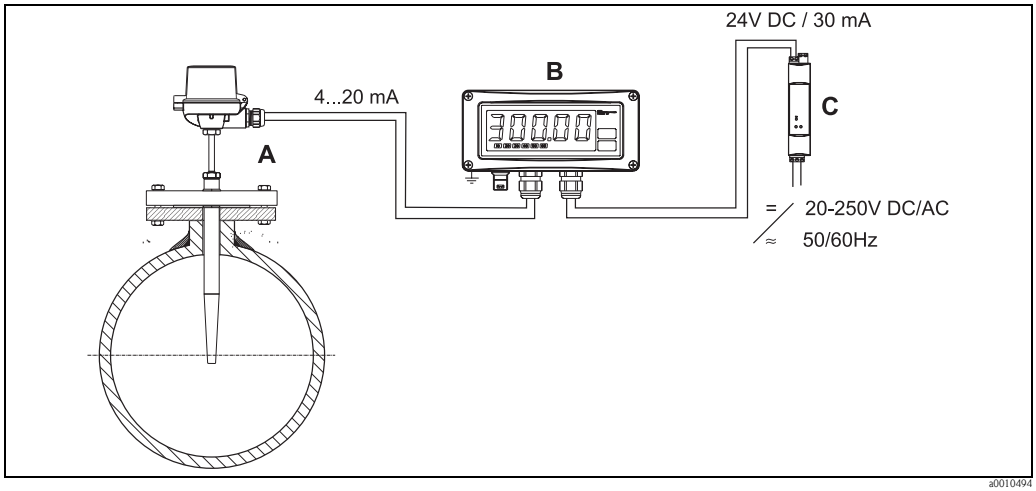
These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. This temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100 Ω at 0 °C (32 °F) and a temperature coefficient $\alpha = 0.003851\ °C^{-1}$.

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 (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 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).

Measuring system



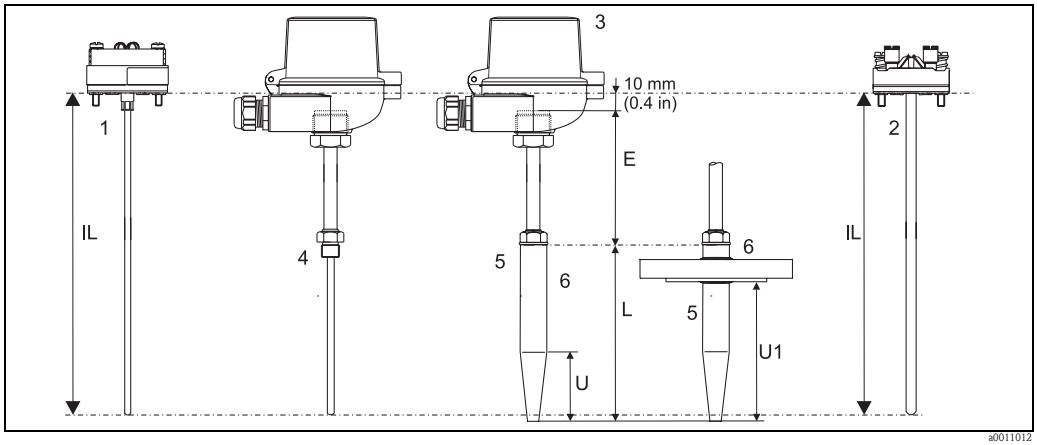
Example of an application

A Built-in RTD assembly TR15 with head transmitter

B RIA261 Field display
- The display measures an analog measurement signal and indicates this on the display. The display is connected in a 4 to 20 mA current loop and also derives its supply from the loop. The voltage drop is almost negligible (< 2.5 V). The dynamic internal resistance (load) makes sure that independently from the loop current, the maximum voltage drop is never exceeded. The analog signal at the input is digitalized, analyzed, and shown in the rear illuminated display. For details see Technical Information (see chapter "Documentation").

C Active barrier RN221N
- The RN221N active barrier (24 V DC, 30 mA) has a galvanically isolated output for supplying voltage to loop powered transmitters. The power supply has a wide-range input for mains power, 20 to 250 V DC/AC, 50/60 Hz to be used in any electrical circuit. For details see Technical Information (see chapter "Documentation").

Equipment architecture



Equipment architecture of the Omnigrad M TR15

1 Insert (∅ 3 mm, 0.12 in) with mounted head transmitter, for example
2 Insert (∅ 6 mm, 0.24 in) with mounted ceramic terminal block, for example
3 Terminal head
4 Version without thermowell
5 Thermowell from barstock material
6 Process connection: with or without a flange

E Neck tube length
L Total thermowell length
IL Insertion length = E + L + 10 mm (0.4 in)
U Length of conical tip
U1 Immersion length; length of the part of the thermowell in contact with the process from the tip to the sealing surface of the flange

The Omnigrad M TR15 RTD assemblies are modular. The terminal head serves as a connection module for the protection armature in the process as well as for the mechanical and electrical connection of the measuring insert. The actual RTD sensor element is fitted in and mechanically protected within the insert. The insert can be exchanged and calibrated even during the process. Either ceramic terminal blocks or transmitters can be fitted to the internal base washer.
The thermowell is made from barstock and is available with diameters measuring 18 or 24 mm (0.71 or 0.94 in). The tip of the thermowell is tapered. The resistance thermometer is installed in the system (pipe or tank) using a flange connection or by welding the thermometer in place (→ 🖹 12).

Measurement range

-200 ... 600 °C (-328...1112 °F)

Performance characteristics

Operating conditions

Ambient temperature

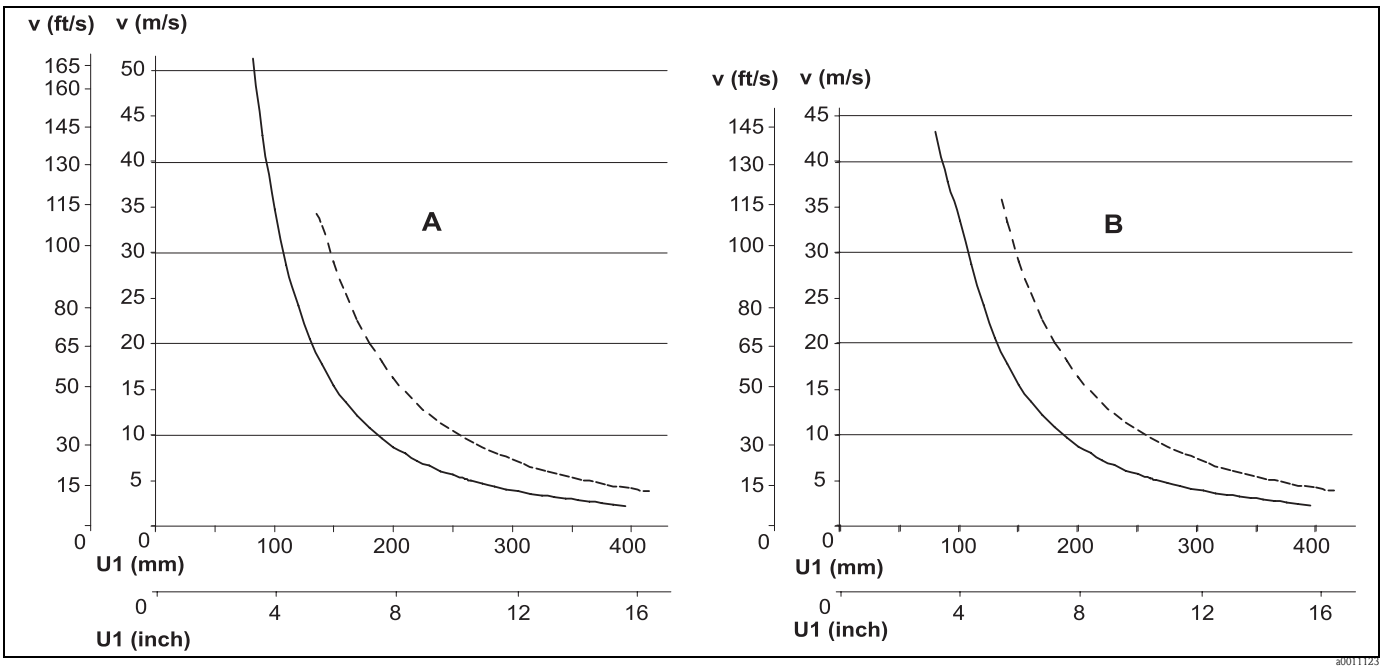
Terminal head	Temperature in °C (°F)
Without mounted head transmitter	Depends on the terminal head used and the cable gland or fieldbus connector, see 'Terminal heads' section, → 🖹 9
With mounted head transmitter	-40 to 85 °C (-40 to 185 °F)
With mounted head transmitter and display	-20 to 70 °C (-4 to 158 °F)

Process pressure (static)

Process connection	Standard	Max. process pressure
Weld-in version	-	≤ 400 bar (5800 psi)
Flange	EN1092-1 or ISO 7005-1	20, 40, 50, or 100 bar depending on the flange pressure rating PNxx
	ASME B16.5	150, 300 or 600 psi depending on the flange pressure rating

Permitted flow velocity depending on the immersion length

The highest flow velocity tolerated by the thermometer diminishes with increasing immersion length exposed to the stream of the fluid. In addition it is dependent on the diameter of the thermometer tip, on the kind of measuring medium, on the process temperature and on the process pressure. The following figures exemplify the maximum permitted flow velocities in water and superheated steam at a process pressure of **5 MPa (50 bar = 725 PSI)**.



Thermowell with D = 18 mm (0.71 in), U = 65 mm (2.56 in) ————
Thermowell with D = 24 mm (0.94 in), U = 125 mm (4.9 in) - - - - - -

A Medium water at T = 50 °C (122 °F)
B Medium superheated steam at T = 400 °C (752 °F)
U1 Immersion length thermowell, material 1.4571 (316Ti)
v Flow velocity

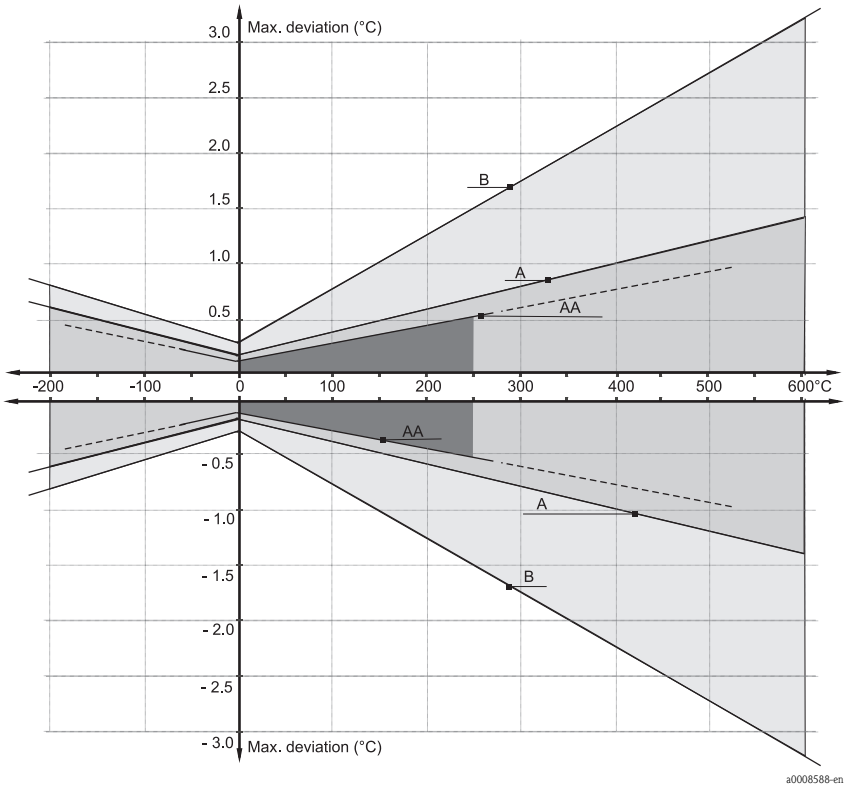
Shock and vibration resistance

4g / 2 to 150 Hz as per IEC 60068-2-6

Accuracy

RTD corresponding to IEC 60751

Class	max. Tolerances (°C)	Temperature range	Characteristics
RTD max. error type TF - range: -50 to +400 °C			
Cl. A	± (0.15 + 0.002 · |t|[1)])	-50 °C to +250 °C	
Cl. AA, former 1/3 Cl. B	± (0.1 + 0.0017 · |t|[1)])	0 °C to +150 °C	
Cl. B	± (0.3 + 0.005 · |t|[1)])	-50 °C to +400 °C	
RTD max. error type WW - range: -200 to +600 °C			
Cl. A	± (0.15 + 0.002 · |t|[1)])	-200 °C to +600 °C	
Cl. AA, former 1/3 Cl. B	± (0.1 + 0.0017 · |t|[1)])	0 °C to +250 °C	
Cl. B	± (0.3 + 0.005 · |t|[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:

Thermowell, U = length of tapered tip					
Outer-∅	**Response time**	**U = 65/73 mm (2.26/2.87 in)**	**U = 125/133 mm (4.9/5.24 in)**	**U = 275 mm (10.83 in)**	**Outer-∅ (tapered tip)**
18 mm (0.71 in)	t_{50}	22 s	22 s	-	9 mm (0.35 in)
	t_{90}	60 s	60 s	-	
24 mm (0.94 in)	t_{50}	31 s	31 s	31 s	12.5 mm (0.5 in)
	t_{90}	96 s	96 s	96 s	

Note!
Response time for RTD insert without transmitter.

Insulation resistance

Insulation resistance ≥100 MΩ 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® temperature transmitter (very small measurement current) is connected.

Calibration specifications

Endress+Hauser provides comparison temperature calibration from –80 to +600 °C (–110 °F to 1112 °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)**	
Temperature range	**without head transmitter**	**with head transmitter**
–80 °C to –40 °C (–110 °F to –40 °F)	200 (7.87)	
–40 °C to 0 °C (–40 °F to 32 °F)	160 (6.3)	
0 °C to 250 °C (32 °F to 480 °F)	120 (4.72)	150 (5.9)
250 °C to 550 °C (480 °F to 1020 °F)	300 (11.81)	
550 °C to 650 °C (1020 °F to 1202 °F)	400 (15.75)	

Material

Extension neck and thermowell
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	X2CrNiMo17-12-2	650 °C (1200 °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
Hastelloy C276/ 2.4819	NiMo16Cr15W	1100 °C (2012 °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
AISI A182 F11/ 1.7335	13CrMo4-5	550 °C (1022 °F)	■ Low alloy, heat-resistant steel with chromium and molybdenum additions ■ Better corrosion resistance compared to non-alloy steels, not suitable for acids and other aggressive media ■ Often used in steam generators, water and steam pipes, pressure vessels
Titanium/3.7035	-	600 °C (1112 °F)	■ A light metal with very high corrosion resistance and strength values ■ Very good resistance to many oxidizing mineral and organic acids, saline solutions, sea water etc. ■ Prone to fast embrittlement at high temperatures through the absorption of oxygen, nitrogen and hydrogen ■ Compared to other metals, titanium reacts readily with many media (O_2, N_2, Cl_2, H_2) at higher temperatures and/or increased pressure ■ Can only be used in chlorine gas and chlorinated media at comparatively low temperatures, < 400 °C (752 °F)
Duplex SAF2205/ 1.4462	X2CrNiMoN22-5-3	280 °C (536 °F)	■ Austenitic ferritic steel with good mechanical properties ■ High resistance to general corrosion, pitting, chlorine-induced or transgranular stress corrosion ■ Comparatively good resistance to hydrogen-induced stress corrosion

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI A105/1.0460	C22.8	450 °C (842 °F)	■ Heat-resistant steel ■ Resistant in nitrogen-containing atmospheres and atmospheres that are low in oxygen; not suitable for acids or other aggressive media ■ Often used in steam generators, water and steam pipes, pressure vessels

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 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		

System components

Family of temperature transmitters

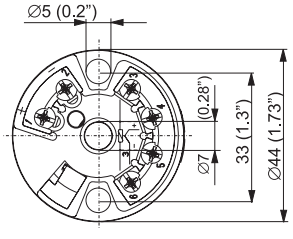
Thermometers fitted with iTEMP® transmitters are an installation ready complete solution to improve temperature measurement by increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

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**. 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').

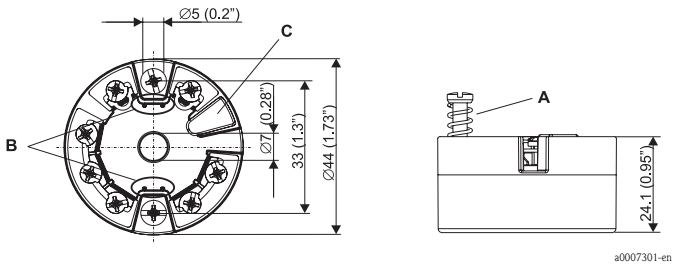
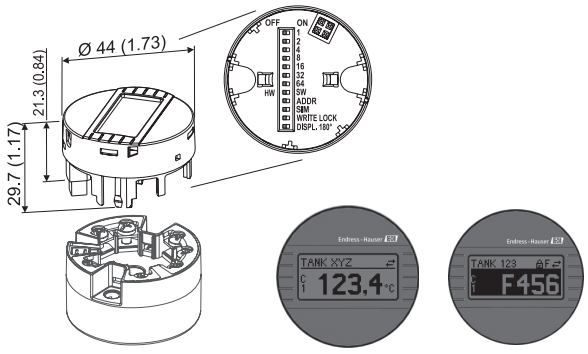
Type of transmitter	Specification
iTEMP® TMT18x  	■ Material: Housing (PC), Potting (PUR) ■ Terminals: Cable up to max. max. ≤ 2.5 mm² / 16 AWG (secure screws) or with wire end ferrules ■ Eyelets for easy connection of a HART®-handheld terminal with alligator clips ■ Degree of protection NEMA 4 (see also type of terminal head) 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').

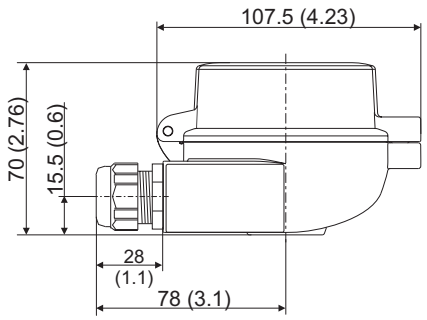
FOUNDATION Fieldbus™ TMT85 head transmitter

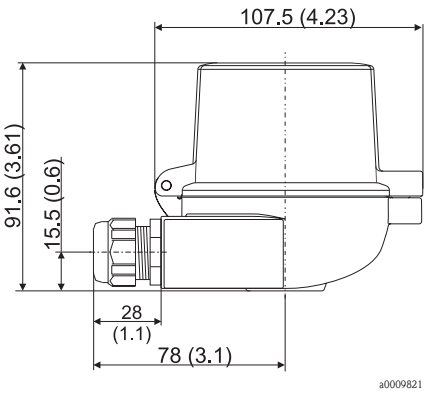
Universally programmable head transmitter with FOUNDATION fieldbus™ communication. Converting various input signals into a digital output signal. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, 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').

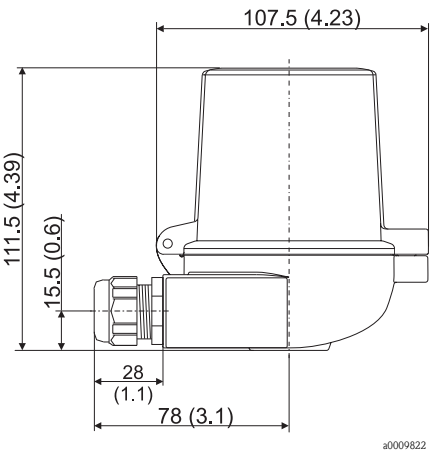
Type of transmitter	Specification
iTEMP® TMT84 and TMT85  	■ Spring range L ≥ 5 mm (0.2"), see Pos. A ■ Fixing elements for pluggable measured value display, see Pos. B ■ Interface for contacting measured value display, see Pos. C ■ Material (RoHS-compliant) Housing: PC Potting: PU ■ Terminals: Screw terminals (cable up to max. ≤ 2.5 mm² / 16 AWG) or spring terminals (e. g. from 0.25 mm² to 0.75 mm²/ 24 AWG to 18 AWG for flexible wires with wire-end ferrules with plastic ferrule) ■ Degree of protection NEMA 4 (see also type of terminal head) Details see Technical Information (see chapter 'Documentation')
Pluggable display TID10 as option  	■ Displays the actual measured value and the measurement point identification ■ Displays fault events in inverse color with channel ident and diagnostics code ■ DIP-switches on the rear for hardware set-up, e. g. PROFIBUS® PA bus address Note! Display is only available with suitable terminal head with display window, e.g. TA30

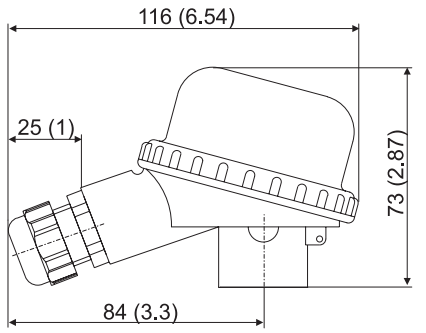
Terminal heads

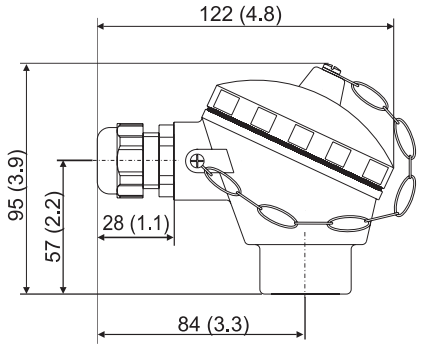
All terminal heads have internal geometry according to DIN 43729, form B and thermometer connection M24x1.5.
All dimensions in mm (inch). All cable gland dimensions in the graphics are based on SKINTOP ST M20x1.5

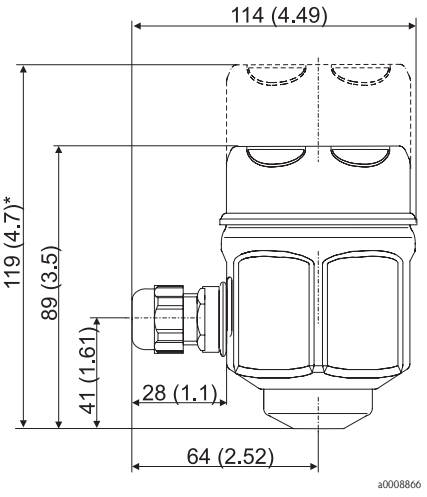
TA30A	Specification
	■ Degree of protection: IP66/68 ■ Max. temperature: 150 °C (300 °F) ■ Material: aluminum, polyester powder coated Seals: silicone ■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF ■ Protection armature connection: M24x1.5 ■ Head color: blue RAL 5012 ■ Cap color: grey RAL 7035 ■ Weight: 330 g (11.64 oz)

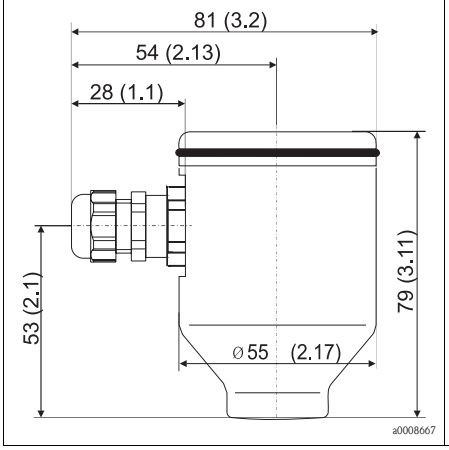
TA30A with display window	Specification
	■ Degree of protection: IP66/68 ■ Max. temperature: 150 °C (300 °F) ■ Material: aluminum, polyester powder coated Seals: silicone ■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF ■ Protection armature connection: M24x1.5 ■ Head color: blue RAL 5012 ■ Cap color: grey RAL 7035 ■ Weight: 420 g (14.81 oz) ■ Head transmitter optional with TID10 display

TA30D	Specification
	■ Degree of protection: IP66/68 ■ Max. temperature: 150 °C (300 °F) ■ Material: aluminum, polyester powder coated Seals: silicone ■ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF ■ 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: grey RAL 7035 ■ Weight: 390 g (13.75 oz)

TA20B	Specification
	■ Degree of protection: 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
	■ Degree of protection: IP65 ■ Max. temperature: 130 °C (266 °F) silicone, 100 °C (212 °F) rubber (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 ½" or NPT ½" ■ Head color: blue RAL 5012 ■ Cap color: grey RAL 7035 ■ Weight: 300 g (10.58 oz) ■ 3-A® marked

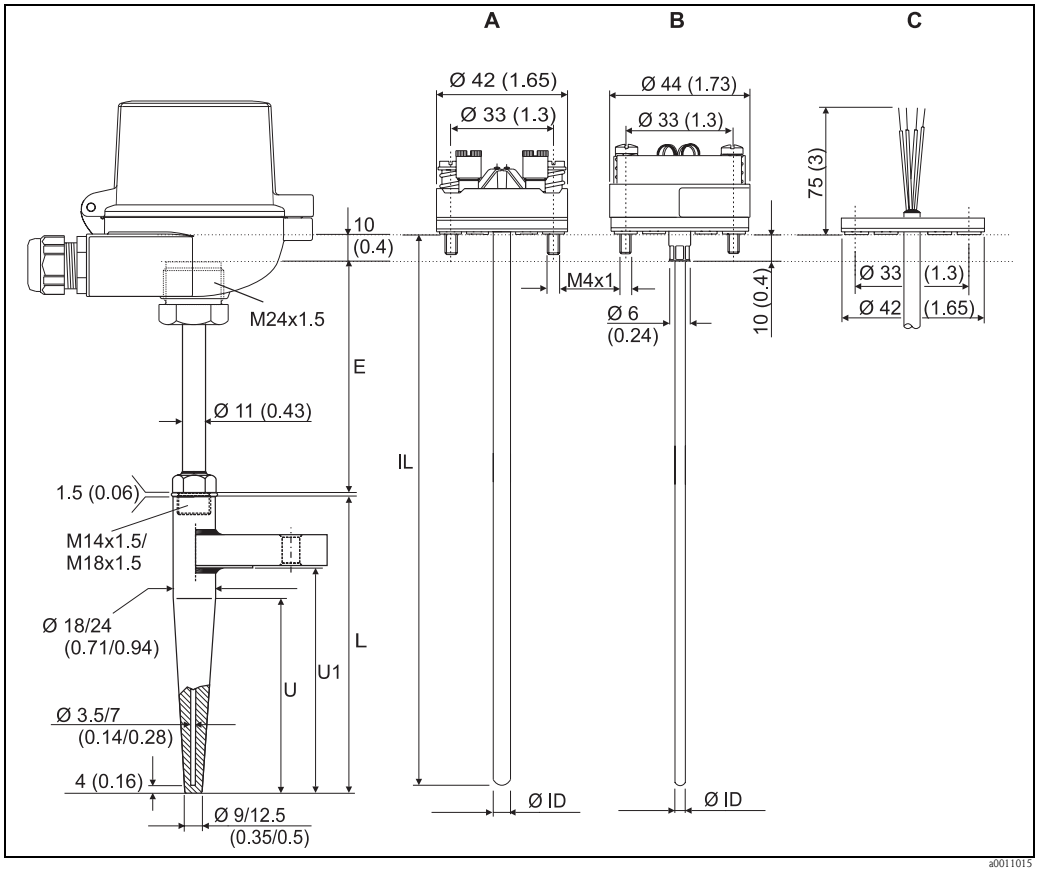
TA20J	Specification
 ** dimensions with optional display*	■ Degree of protection: IP66/IP67 ■ Material: 316L (1.4404) stainless steel, rubber seal under the cover (hygienic design) ■ 4 digits 7-segments LC display (loop powered with 4...20 mA transmitter) ■ Cable entry: ½" NPT, M20x1.5 or plug M12x1 PA ■ Protection armature connection: M24x1.5 or ½" 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
	■ Degree of protection: IP66/67 ■ Max. temperature: 100 °C (212 °F) ■ Material: SS 316L (1.4404) stainless steel ■ Cable entry: ½" 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)

Thermowell

All dimensions in mm (inches).



Dimensions of the Omnigrad M TR15

A	Model with terminal block mounted	IL	Insertion length = E + L + 10 mm (0.4 in)
B	Model with head transmitter mounted	U	Length of conical tip
C	Model with flying leads	U1	Immersion length; length of the part of the thermowell in contact with the process from the tip to the sealing surface of the flange
E	Neck tube length		
L	Total thermowell length		
∅ ID	Diameter of insert ∅ 3 mm (0.12 in) or 6 mm (0.24 in)		

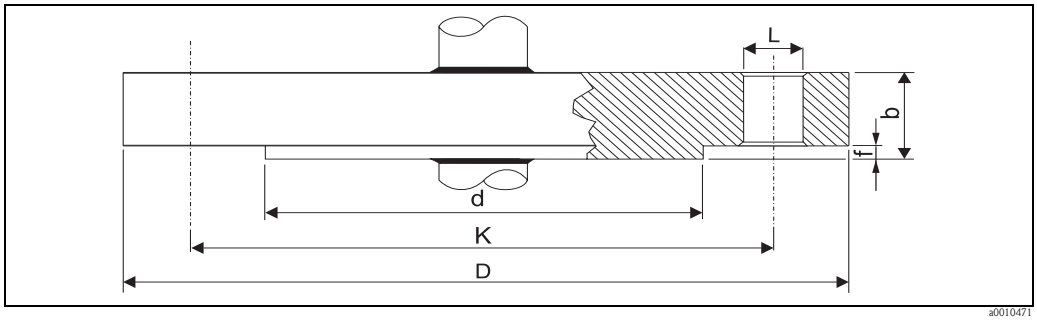
Note!
The thermowell with ∅ 18 mm (0.71 in) is available with a total length L of up to max. 200 mm (7.87 in).

Weight

From 1 to 5 kg (2.2 to 11 lbs) for standard options.

Process connection

Standard connections are available as weld-in connection (without flange) or with flange.
The following figure shows the basic dimensions of the available flanges (see chapter "Ordering information").



Basic dimensions of the flange process connections

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

Further information you can find in the Technical Information 'Flanges' (TI432F/00).
The flange material must be the same as of the stem of the thermowell. For this reason, connections are available both in SS 316L/1.4404 and in SS 316Ti/1.4571. Models in Hastelloy® C have flanges in basic material SS 316L and a disc in Hastelloy® C on the surface in contact with the process media.

Spare parts

- A thermowell is available as spare part TW15 (see Technical Information in chapter 'Documentation').
- The RTD insert is available as spare part TPR100 (see Technical Information in chapter 'Documentation').

If spare parts are required, refer to the following equation: **Insertion length IL = E + L + 10 mm (0.4 in)**

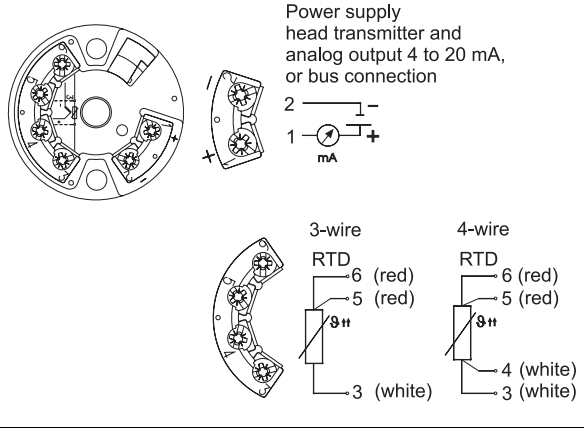
Spare part	Material-No.
Thermo-conductive paste HS340-100gr	60007126
Ceramic terminal block DIN B (42 mm) 3 term. 5 pieces	60005544
Ceramic terminal block DIN B (42 mm) 6 term. 5 pieces	60005545
Ceramic terminal block DIN B (42 mm) 4 term. 5 pieces	60007934

Wiring

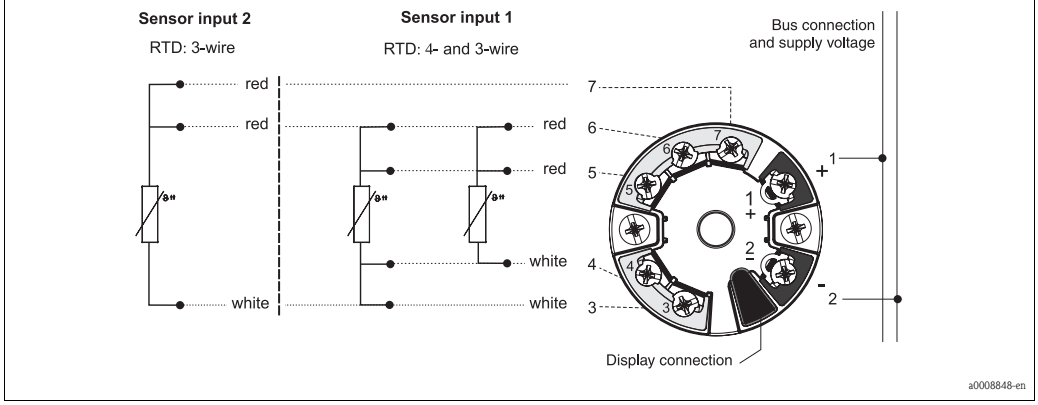
Wiring diagrams

Type of sensor connection

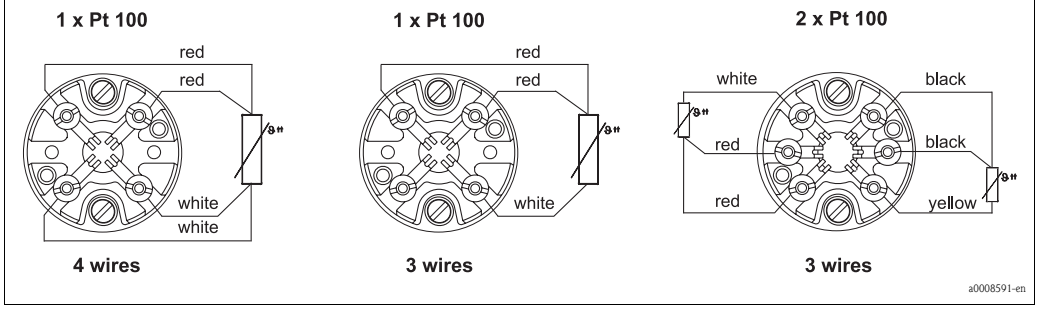
Head mounted transmitter TMT18x (single input)



Head mounted transmitter TMT84 and TMT85 (dual input)



Terminal block mounted

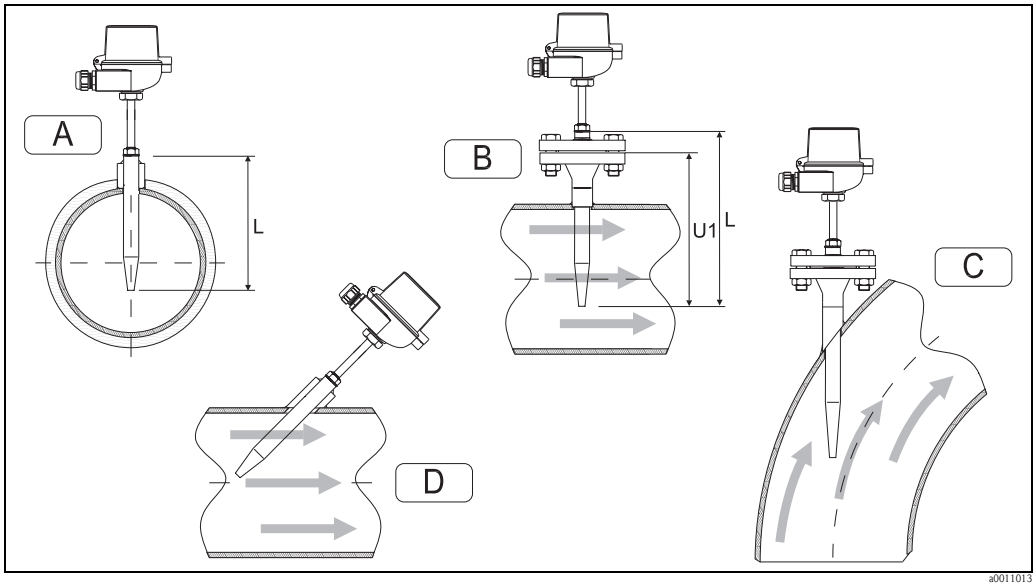


Installation conditions

Orientation

No restrictions.

Installation instructions



Installation examples

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

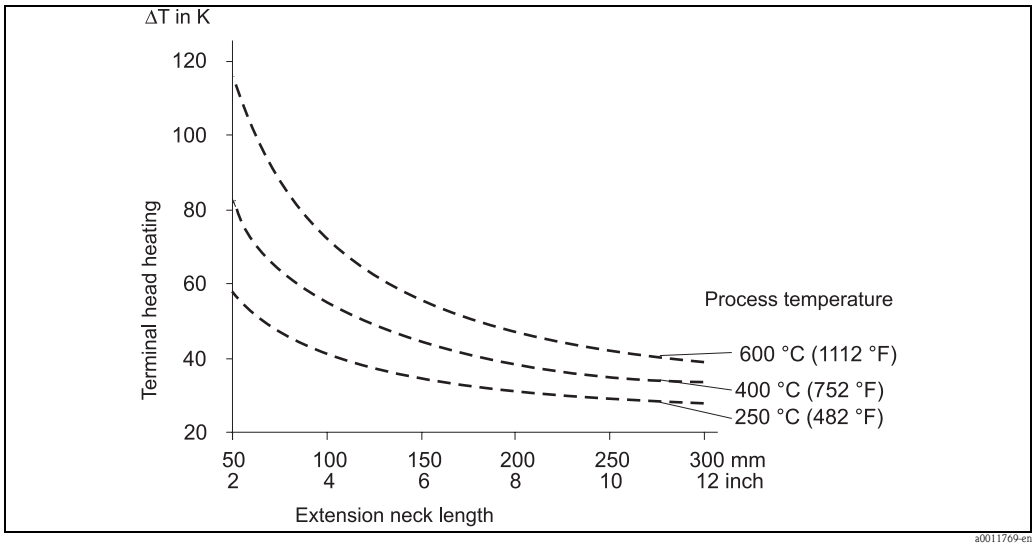
The immersion length of the thermometer influences the accuracy. If the immersion length is too small then errors in the measurement are caused by heat conduction via the process connection and the container wall. If installing into a pipe then the immersion length must be half of the pipe diameter, ideally.

- Installation possibilities: Pipes, tanks or other plant components
- 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!

Note!
When operating in small nominal bore pipes it must be guaranteed that the thermowell tip is extending far enough into the process to reach out past the pipe center line (see Pos. A and B). A further solution could be an angled (tilted) installation (see Pos. 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).

Neck tube length

The neck tube is the part between the process connection and the housing. It is normally made of a tube with dimensional and physical characteristics (diameter and material) which are the same as of the tube in contact with the medium.
The connection situated in the upper part of the neck allows for orientation of 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
- EN 50014/18, 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.

Material certification

The material certificate 3.1 (according to standard EN 10204) can be directly selected from the sales structure of the product and refers to the parts of the sensor in contact with the process fluid. Other types of certificates related to materials can be requested separately. The "short form" certificate includes a simplified declaration with no enclosures of documents related to the materials used in the construction of the single sensor and guarantees the traceability of the materials through the identification number of the thermometer. The data related to the origin of the materials can subsequently be requested by the client if necessary.

Test on thermowell

Thermowell pressure tests are carried out in accordance with the specifications in the DIN 43772 standard. With regards 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 certified for use in Ex Zones, are always tested to pressures according to the same criteria. Tests according to other specifications can be carried out on request. Dye penetration tests verify the absence of cracks on the thermowell welding.

Test report and calibration

For the tests and calibration, the "Acceptance report" comprises a declaration of conformity with the primary points as per IEC 60751.
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 TR15

				Approval:
			A	Non-hazardous area
			B	ATEX II 1 GD EEx ia IIC
			E	ATEX II 1/2 GD EEx ia IIC
			G	ATEX II 1 G EEx ia IIC
			H	ATEX II 3 GD EEx nA II
			K	TIIS Ex ia IIC T4
			L	TIIS Ex ia IIC T6

				Version:
			1	With thermowell
			2	w/o thermowell

				Head; Cable Entry:
			B	TA30A Alu, IP66/IP68; M20
			C	TA30A Alu, IP66/IP68; NPT ½"
			D	TA30A Alu, IP66/IP67; M12 plug PA
			E	TA21E Alu, screw cap IP65; M12 plug PA
			F	TA30A Alu+display, IP66/IP68; M20
			G	TA30A Alu+display, IP66/IP68; NPT ½"
			H	TA30A Alu+display, IP66/IP67; M12 plug PA
			I	TA30A Alu, G½" w/o gland
			J	TA20J 316L, IP66/IP67; M20
			K	TA20J 316L, + display, IP66/IP67; M20
			M	TA20J 316L, IP66/IP67; M12 plug PA

Head; Cable Entry:	
N	TA20R 316L, screw cap IP66/IP67; M20 silicone free
O	TA30D Alu, high cover, IP66/IP68; M20
P	TA30D Alu, high cover, IP66/IP68; NPT ½"
Q	TA30D Alu, IP66/IP67; M12 plug PA
R	TA20R 316L screw cap IP66/IP67; M20
S	TA20R 316L screw cap IP66; M12 plug
T	TA30A Alu, IP66/IP67; 7/8" plug FF
U	TA30A Alu+display, IP66/IP67; 7/8" plug FF
V	TA30D Alu, IP66/IP67; 7/8" plug FF
3	TA30D Alu, high cover; G½" w/o gland
7	TA20B PA black, IP65; M20

Neck length E; Material:	
1	155 mm; 316Ti
2	165 mm; 316Ti
8	..... mm, 316Ti
9	..... mm; as specified

Diameter; Material; Finishing:	
A	24 mm; 316Ti; Ra<=1.6 µm (D=6 mm, M18x1.5)
B	24 mm; 13 Cr Mo 4-5; Ra<=1.6 µm (D=6 mm, M18x1.5)
C	18 mm; 316Ti; Ra<=1.6 µm (D=3 mm, M14x1.5)
D	18 mm; 13 Cr Mo 4-5; Ra<=1.6 µm (D=3 mm, M14x1.5)
0	Not needed
1	24 mm; 316Ti; Ra<=0.8 µm (D=6 mm, M18x1.5)
2	18 mm; 316Ti; Ra<=0.8 µm (D=6 mm, M14x1.5)
3	24 mm; Hastelloy C276; Ra<=0.8 µm (D=6 mm, M18x1.5
5	24 mm; Titanium Gr2; Ra<=0.8 µm (D=6 mm, M18x1.5)
7	24 mm; Duplex SAF2205; Ra<=0.8 µm (D=6 mm, M18x1.5)
8	24 mm; C22.8, Ra<=0.8 µm, (M18x1.5)

Inner Diameter d; Outer Diameter D:	
1	d = 7.0 mm; D = 24.0 mm to 12.5 mm
2	d = 3.5 mm; D = 18.0 mm to 9.0 mm

Total Length L; U; U1:	
A	110 mm; 65mm; 0mm; Form 4
B	110 mm; 73mm; 0mm; Form 4
C	140 mm; 65mm; 0mm; Form 4
D	170 mm; 133mm; 0mm; Form 4
E	200 mm; 125mm; 0mm; Form 4
F	200 mm; 65mm; 130mm; Form 4F
G	260 mm; 125mm; 190mm; Form 4F
H	410 mm; 275mm; 340mm; Form 4F
J	200 mm; 65mm; 0mm; Form 4
K	260 mm; 125mm; 0mm; Form 4
L	410 mm; 275mm; 0mm; Form 4
M	350 mm; 125mm; 0mm; Form4
N	350 mm; 125mm; 280mm; Form 4F
Y	..... mm, as specified

Process Connection:	
A	Flange DN25 PN40 B1 EN1092-1; 316Ti
B	Flange DN40 PN40 B1 EN1092-1; 316Ti
C	Flange DN50 PN40 B1 EN1092-1; 316Ti
L	Flange DN50 PN40 B1 EN1092-1, C276>316L
M	DN50 PN40 B1, Titanium Gr2 EN1092-1
0	Not needed
1	Flange 1" ANSI 150 RF B16.5; 316Ti
2	Flange 1" ANSI 300 RF B16.5; 316Ti
3	Flange DN25 PN20 B1 ISO7005-1, 316Ti
4	Flange DN25 PN50 B1 ISO7005-1, 316Ti
5	Flange 5K25A FF, JIS B 2220, 316Ti
6	Flange 10K25A FF, JIS B 2220, 316Ti

Head Transmitter; Range:	
B	TMT84 PA
C	Terminal block
D	TMT85 FF
F	Flying leads
G	TMT181 (PCP); temp. range to be specified

								Head Transmitter; Range:					
								H	TMT182 (HART); temp. range to be specified				
								2	TMT180-A21 fix; 0.2 K, temp. range to be specified, Span limit -200/650 °C				
								3	TMT180-A22 fix; 0.1 K, temp. range to be specified, Span limit -50/250 °C				
								4	TMT180-A11 PCP; 0.2 K, temp. range to be specified, Span limit -200/650 °C				
								5	TMT180-A12 PCP; 0.1 K, temp. range to be specified, Span limit -50/250 °C				
									RTD; wire; meas. range; class; validity:				
									A	1x Pt100 WW; 3; -200/600 °C; A: -200/600 °C			
									B	2x Pt100 WW; 3; -200/600 °C; A: -200/600 °C			
									C	1x Pt100 WW; 4; -200/600 °C; A: -200/600 °C			
									F	2x Pt100 WW; 3; -200/600 °C; 1/3B; 0/250 °C			
									G	1x Pt100 WW; 3; -200/600 °C; 1/3B; 0/250 °C			
									Y	Special version, to be specified			
									2	1x Pt100 TF; 3; -50/400 °C; A; -50/250 °C increased vibration resistance			
									3	1x Pt100 TF; 4; -50/400 °C; A; -50/250 °C increased vibration resistance			
									6	1x Pt100 TF; 3; -50/400 °C; 1/3B; 0/150 °C increased vibration resistance			
									7	1x Pt100 TF; 4; -50/400 °C; 1/3B; 0/150 °C increased vibration resistance			
										Material Certificate:			
										0	Not needed		
										1	EN10204-3.1 Material		
										2	EN10204-3.1 Material, shortform		
											Test Report:		
											A	Internal hydrost. pressure test	
											B	External hydrost. pressure test	
											C	Dye penetrant test, TW welding	
											0	Not needed	
												Factory test:	
												A	0, 100 °C, RTD-Signal
												B	0, 100 °C, RTD-Signal, 4-20 mA/loop
												C	0, 100 °C, RTD-Signal, 2 Sensors
												E	0, 100, 150 °C, RTD-Signal
												F	0, 100, 150 °C, RTD-Signal, 4-20 mA/loop
												G	0, 100, 150 °C, RTD-Signal, 2 Sensors
												0	Not needed
TR15-													**← Order code (complete)**

Documentation

Technical Information:
- RTD Insert for Temperature Sensor Omniset TPR100 (TI268t/02/en)
- Thermowell for temperature sensors Omnigrad M TW15 (TI265t/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)
- Flanges (TI432F/00/en)

Hazardous area supplementary documentation:
- Omnigrad TRxx, TCxx, TxCxxx RTD/TC Thermometer ATEX II1GD or II 1/2GD (XA072r/09/a3) or measuring inserts Omniset (TPR100, TPC100 (XA087r/09/a3)
- Omnigrad TRxx, Omniset TPR100, TET10x, TPC100, TEC10x ATEX II 3GD EEx nA (XA044r/09/a3)

Application example

Technical Information:
- Field display RIA261 (TI083r/09/en)
- Active barrier with power supply RN221N (TI073R/09/en)

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