Technical Information
Omnigrad M TC10

Modular TC assembly
Extension neck and thermowell, threaded connection



Application

- Universal range of application
- Measuring range: -40...1100 °C (-40...2012 °F)
- Pressure range up to 75 bar (1088 psi)
- 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
- Highest possible 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)

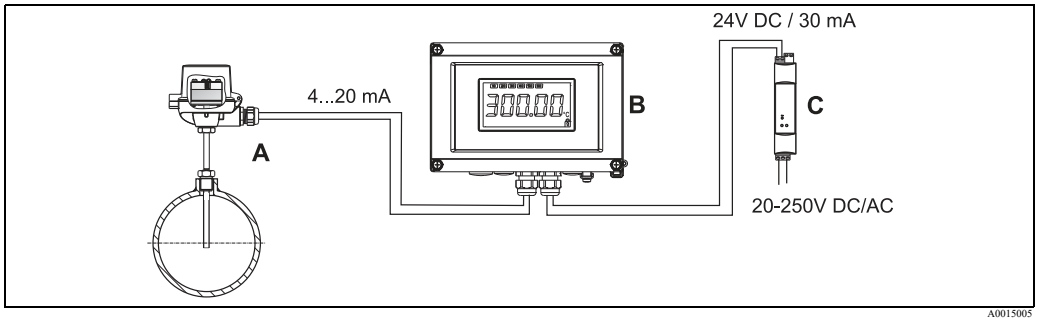
Endress+Hauser
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Function and system design

Measuring principle

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



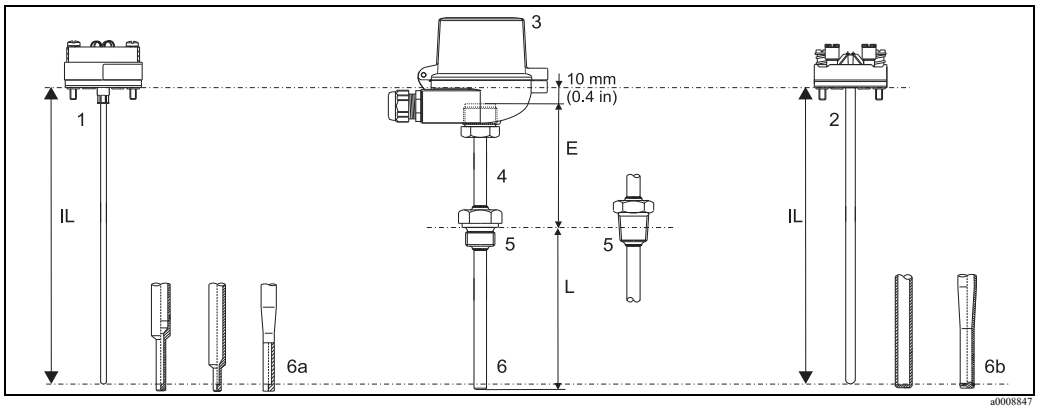
Example of an application

A Thermometer with fitted head transmitter

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

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 Protection armature
5 Threads as process connection
6 Various tip shapes - detailed information see chapter 'tip shape':
6a Reduced or tapered for inserts with ∅ 3 mm (0.12 in)
6b Straight or tapered for inserts with ∅ 6 mm (0.24 in)
E Neck tube
L Immersion length
IL Insertion length = E + L + 10 mm (0.4 in)

The Omnigrad M TC10 thermocouple 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 measuring point of the thermocouple is located close to the tip of the insert and is 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. Where required, threads or compression fittings can be fixed onto the protection armature.

Measuring range

Input	Designation	Measuring range limits	Min. span
Thermocouples (TC) as per IEC 60584, part 1 - using an Endress+Hauser - iTEMP® temperature head transmitter	Type J (Fe-CuNi) Type K (NiCr-Ni)	-40 to +750 °C (-40 to 1382 °F) -40 to +1100 °C (-40 to 2012 °F)[1]	50 K 50 K
	▪ Internal cold junction (Pt100) ▪ Cold junction accuracy: ± 1 K ▪ Max. sensor resistance 10 kΩ		
Thermocouples (TC) - flying leads - as per IEC 60584 and ASTM E230	Type J (Fe-CuNi) Type K (NiCr-Ni)	-210 to +760 °C (-346 to 1400 °F), Typical sensitivity above 0 °C ≈ 55 µV/K -270 to +1100 °C (-454 to 2012 °F)[1], Typical sensitivity above 0 °C ≈ 40 µV/K	- -

1) Limited by jacket material of insert

Performance characteristics

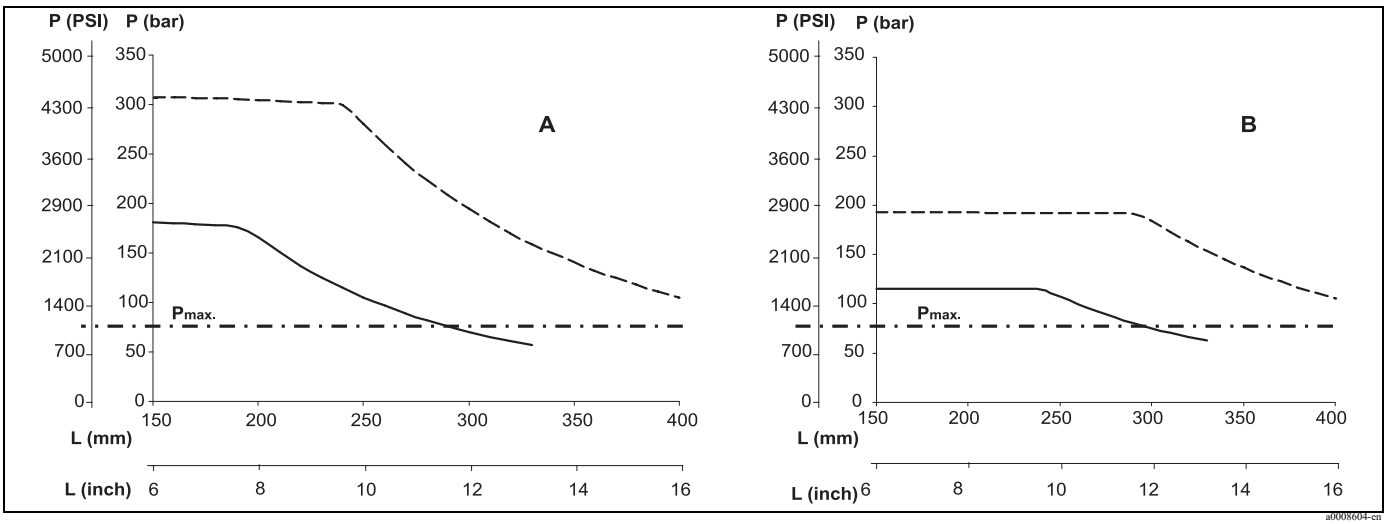
Operating conditions

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

The pressure values to which the actual protection tube 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.

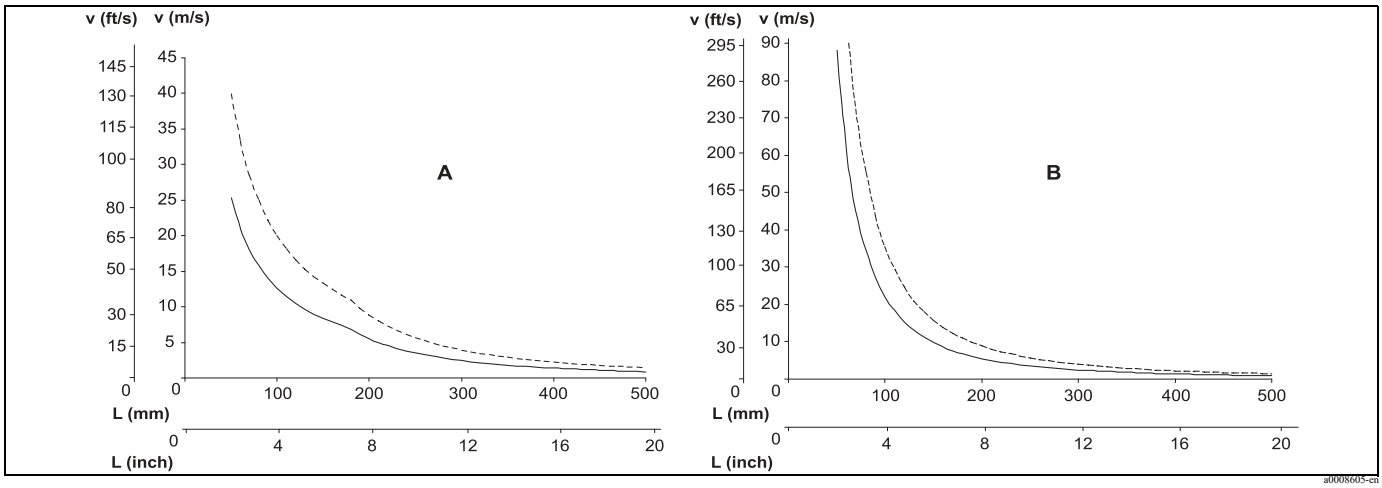


Maximum permitted process pressure for tube diameter, limited to 75 bar (1088 psi) by the threaded process connection
- *Protection tube diameter 9 x 1 mm (0.35 in) ----------*
- *Protection tube diameter 12 x 2.5 mm (0.47 in) - - - - - -*

A	Medium water at T = 50 °C (122 °F)	P	Process pressure
B	Medium superheated steam at T = 400 °C (752 °F)	$P_{max.}$	Maximum permitted process pressure, limited by the process connection
L	Immersion length		

Maximum flow velocity

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



Flow velocity depending on the immersion length
- *Protection tube diameter 9 x 1 mm (0.35 in) ----------*
- *Protection tube diameter 12 x 2.5 mm (0.47 in) - - - - - -*

A	Medium water at T = 50 °C (122 °F)	L	Immersion length
B	Medium superheated steam at T = 400 °C (752 °F)	v	Flow velocity

Shock and vibration resistance

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

Accuracy

Permissible deviation limits of thermoelectric voltages from standard characteristic for thermocouples as per IEC 60584 and 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-Ni)	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)

Standard	Type	Standard tolerance	Special tolerance
ASTM E230/ MC 96.1		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-Ni)	±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 temperature value in °C

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

Response time

Tests in water at 0.4 m/s (1.3 ft/s); 10 K temperature step change. Measuring probe TC type J, K (grounded):

Protection tube				
Diameter	**Response time**	**Reduced tip ∅ 5.3 mm (0.2 in)**	**Tapered tip ∅ 6.6 mm (0.26 in) or ∅ 9 mm (0.35 in)**	**Straight tip**
9 x 1 mm (0.35 in)	t_{50} t_{90}	5.5 s 13 s	9 s 31 s	15 s 46 s
11 x 2 mm (0.43 in)	t_{50} t_{90}	5.5 s 13 s	not available not available	15 s 46 s
12 x 2.5 mm (0.47 in)	t_{50} t_{90}	not available not available	8.5 s 20 s	32 s 106 s

Response time for TC 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.

Calibration specifications

Endress+Hauser provides comparison temperature calibration from -80 to +1400 °C (-110 °F to 2552 °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 (in)	
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 1400 °C (1020 °F to 2552 °F)	450 (17.72)	

Material

Neck and protection tube, 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.
Endress+Hauser supplies DIN/EN threaded process connections and flanges made of stainless steel according to AISI 316L (DIN/EN material number 1.4404 or 1.4435). With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

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 °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 ▪ 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 (1472 °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
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
INCONEL® 600 / 2.4816	NiCr15Fe	1100 °C (2012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures ▪ Resistant to corrosion caused by chlorine gas and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water ▪ Not to be used in a sulfur-containing atmosphere

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

	iTEMP® TMT181 PCP	iTEMP® TMT182 HART®	iTEMP® TMT82[1] HART®	iTEMP® TMT84 PA iTEMP® TMT85 FF
Measurement accuracy	0.5 °C (0.9 °F) or 0.08% % is related to the adjusted measurement range (the larger value applies)		± typ. 0.25 K (0.45 °F)	
Galvanic isolation (input/output)	U = 2 kV AC			

1) Entire accuracy = ± typ. 0.25 K (0.45 °F) + 0.03% (D/A-accuracy)

Transmitter long-term stability

≤ 0.1 °C/year (≤ 0.18 °F / year) or ≤ 0.05% / year
Data under reference conditions; % relates to the set span. The larger value applies.

Components

Family of temperature transmitters

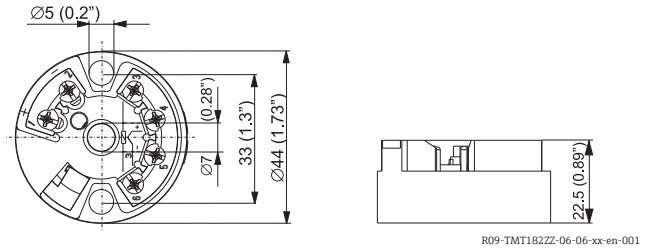
Thermometers fitted with iTEMP® transmitters are an installation ready complete solution to improve temperature measurement by increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

PC programmable head transmitters iTEMP® 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® programmable head transmitters iTEMP® TMT182

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').

Transmitter iTEMP® TMT18x	Specification
	▪ Material: Housing (PC), Potting (PUR) ▪ Terminals: Cable up to max. ≤ 1.75 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')

HART® programmable head transmitter iTEMP® TMT82

The iTEMP® TMT82 is a 2-wire device with two measurement inputs and one analog output. The device transmits both converted signals from resistance thermometers and thermocouples as well as resistance and voltage signals via the HART® communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the flat face terminal head to DIN EN 50446. Fast and easy operation, visualization and maintenance via PC using configuration software such as FieldCare, Simatic PDM or AMS.

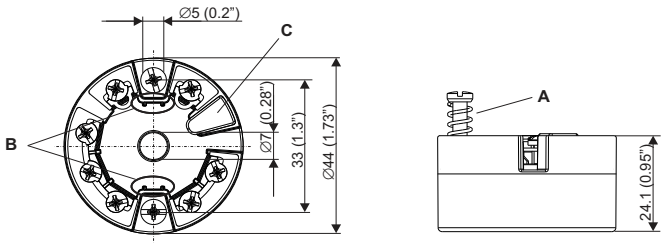
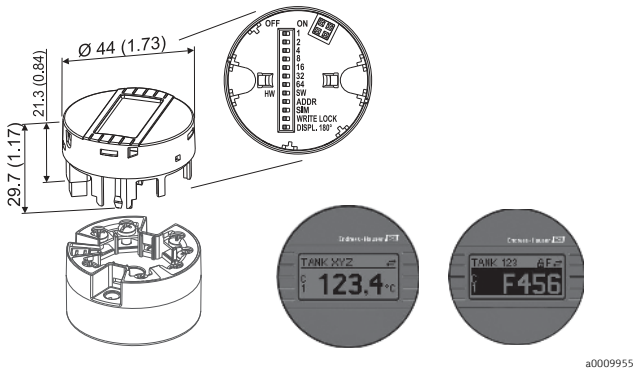
Benefits are: Dual sensor input, maximum reliability, accuracy and long-term stability for critical processes, mathematical functions, monitoring of thermometer drift, backup function of the sensor, diagnostic functions of the sensor and sensor-transmitter matching based on the Callendar/Van Dusen coefficient. For more information, refer to the Technical Information (see chapter 'Documentation').

PROFIBUS® PA head transmitter iTEMP® TMT84

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').

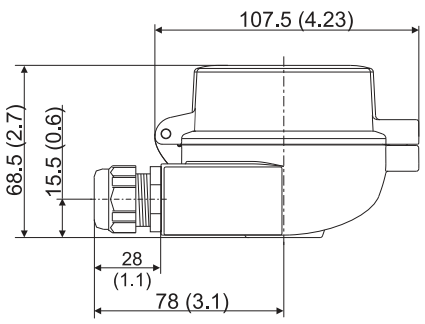
FOUNDATION Fieldbus™ head transmitter iTEMP® TMT85

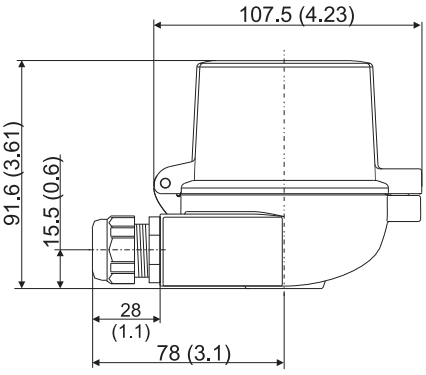
Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Converting various input signals into a digital output signal. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel,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

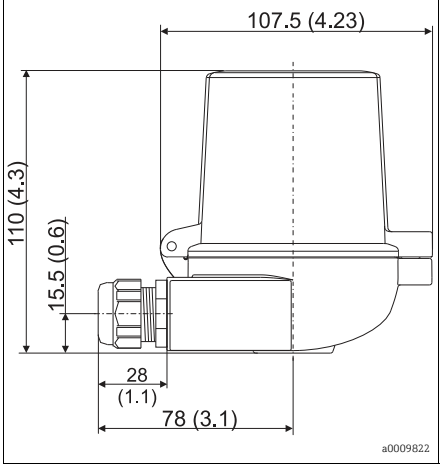
Transmitter iTEMP® TMT82, TMT84 and TMT85	Specification
	▪ Spring range L ≥ 5 mm (0.2"), see Pos. A ▪ Fixing elements for pluggable measured value display, see Pos. B ▪ Interface for contacting measured value display, see Pos. C ▪ Material (RoHS-compliant) Housing: PC Potting: PU ▪ Terminals: Screw terminals (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 Display is only compatible with suitable terminal head with display window, e.g. TA30.

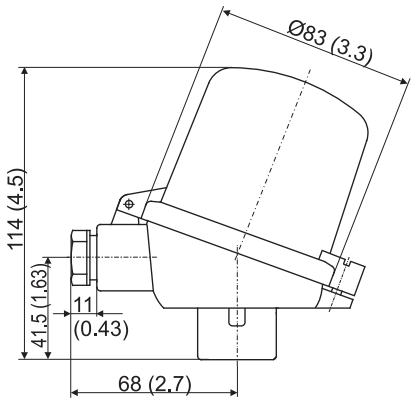
Terminal heads

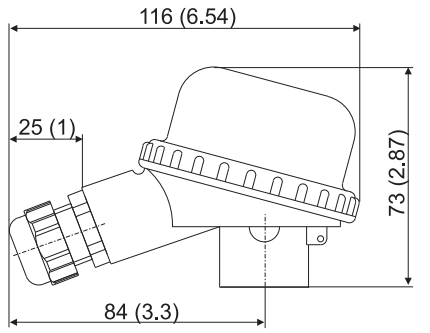
All terminal heads have an internal shape and size in accordance with DIN EN 50446, flat face and a thermometer connection of M24x1.5.
All dimensions in mm (in). The cable glands in the diagrams correspond to M20x1.5 connections.
Specifications without head transmitter installed. For ambient temperatures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

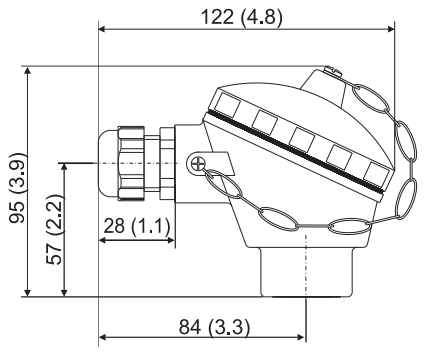
TA30A	Specification
	▪ Degree of protection: IP66/68 ▪ Degree of protection: IP66/67 (for ATEX) ▪ Max. temperature: 150 °C (300 °F) ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" FF ▪ Protection armature connection: M24x1.5 ▪ Head color: blue RAL 5012 ▪ Cap color: grey RAL 7035 ▪ Weight: 330 g (11.64 oz)

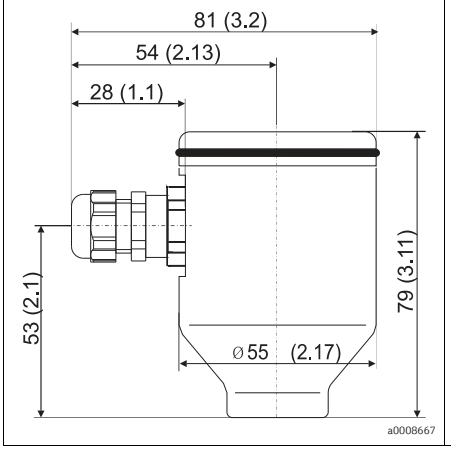
TA30A with display window	Specification
	▪ Degree of protection: IP66/68 ▪ Degree of protection: IP66/67 (for ATEX) ▪ Max. temperature: 150 °C (300 °F) ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry incl. glands: ½" NPT and M20x1.5, only thread: G ½", plugs: M12x1 PA, 7/8" 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 ▪ Degree of protection: IP66/67 (for ATEX) ▪ 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)

TA30P	Specification
	▪ Degree of protection: IP65 ▪ Max. temperature: 120 °C (248 °F) ▪ Material: polyamide (PA), antistatic Seals: silicone ▪ Cable entry: M20x1.5 ▪ Head and cap color: black ▪ Weight: 135 g (4.8 oz) ▪ Types of protection for use in hazardous locations: Intrinsic Safety (G Ex ia)

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

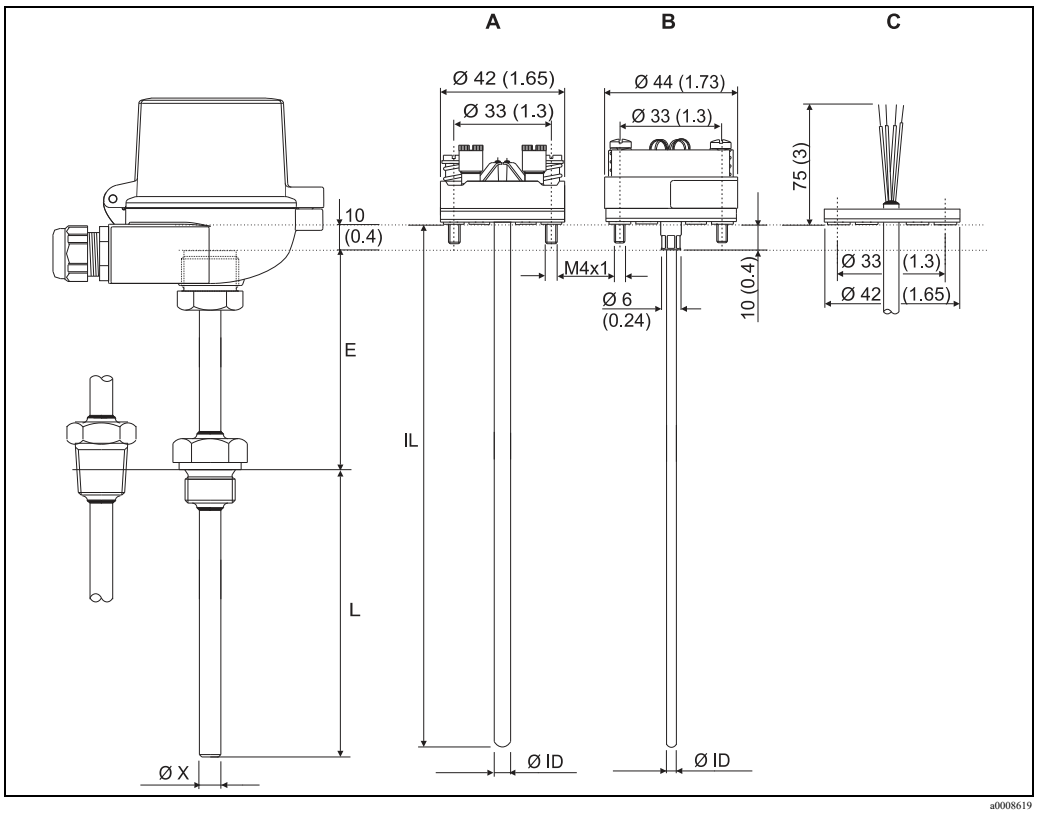
TA21E	Specification
	▪ Degree of protection: IP65 ▪ Max. temperature: 130 °C (266 °F) silicone, 100 °C (212 °F) rubber (observe max. permitted temperature of the cable gland!) ▪ Material: aluminum alloy with polyester or epoxy coating; rubber or silicone seal under the cover ▪ Cable entry: M20x1.5 or 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

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)

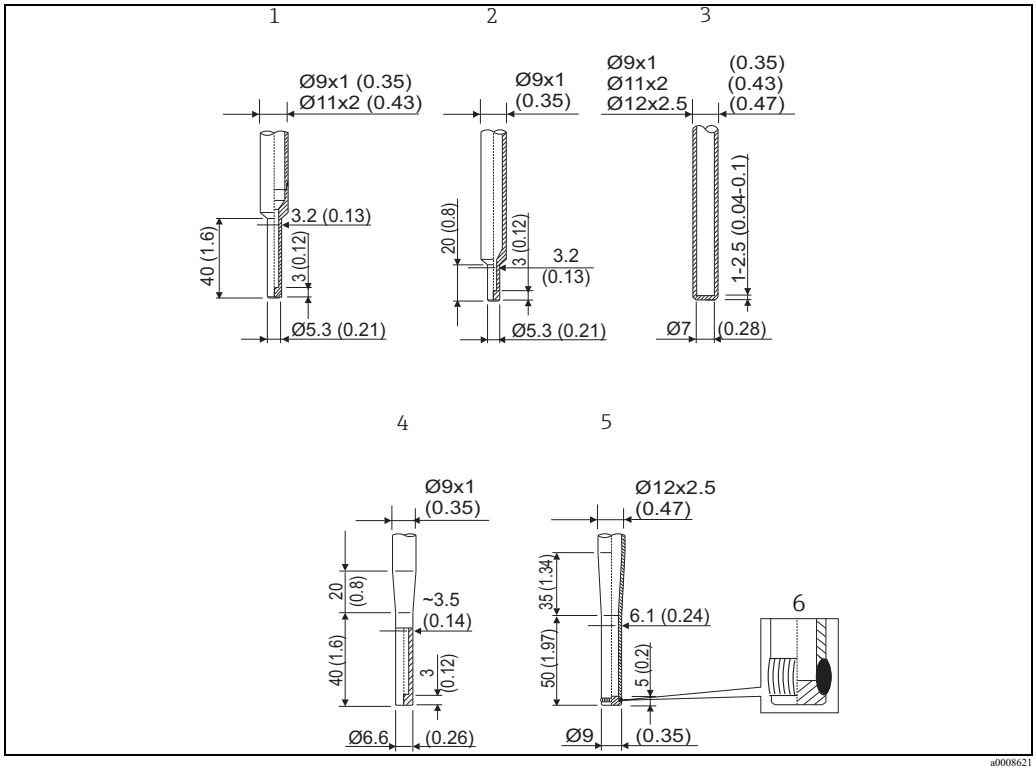
Design, dimensions

All dimensions in mm (in).



A	Model with terminal block mounted	∅ ID	Insert diameter
B	Model with head transmitter mounted	IL	Insertion length = E + L + 10 mm (0.4 in)
C	Model with flying leads	L	Immersion length
E	Neck tube length	∅ X	Protection tube diameter

Tip shape



Available versions of protection tube tips (reduced, straight, tapered). Maximum surface roughness ≤ Ra 0.8 µm (31.5 µin)

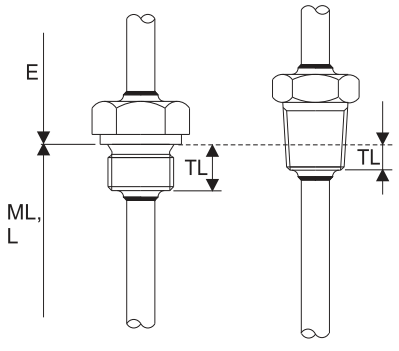
Pos. No.	Tip shape, L = Immersion length	Insert Diameter
1	Reduced, L ≥ 70 mm (2.76 in)	∅ 3 mm (0.12 in)
2	Reduced, L ≥ 50 mm (1.97 in)[1)]	∅ 3 mm (0.12 in)
3	Straight	∅ 6 mm (0.24 in)
4	Tapered, L ≥ 90 mm (3.54 in)	∅ 3 mm (0.12 in)
5	Tapered DIN43772-3G, L ≥ 115 mm (4.53 in)	∅ 6 mm (0.24 in)
6	Welded tip, weld quality according to EN ISO 5817 - quality class B	

1) not with material Hastelloy® C276/2.4819

Weight

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

Process connection

Threaded process connection		Version		Thread length TL in mm (in)	Width across flats SW/AF
Cylindrical (version M, G, R)	Conical (version NPT)	M	M20x1.5	14 (0.55)	24
 *E = Length of extended neck* *ML, L = Insertion length, immersion length*		G	G½" DIN / BSP	15 (0.6)	27
			G1" DIN / BSP	18 (0.71)	41
			G¾" BSP	15 (0.6)	32
		NPT	NPT ½"	8 (0.32)	22
			NPT ¾"	8,5 (0.33)	27
		R	R ¾" JIS B 0203	8 (0.32)	27
			R ½" JIS B 0203		22

Spare parts

- A thermowell is available as spare part TW10 (see Technical Information in chapter 'Documentation').
- The TC insert is available as spare part TPC100 (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.
Gasket M21-G½", copper	60001328
Gasket M27-G¾", copper	60001344
Gasket M33-G1", copper	60001346
Gasket set M24x1.5, aramid+NBR (10 pieces)	60001329

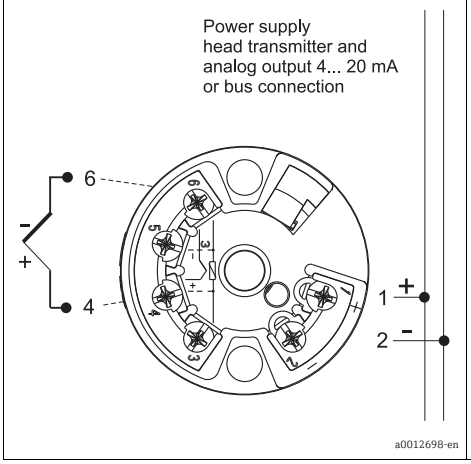
Wiring

Wiring diagrams

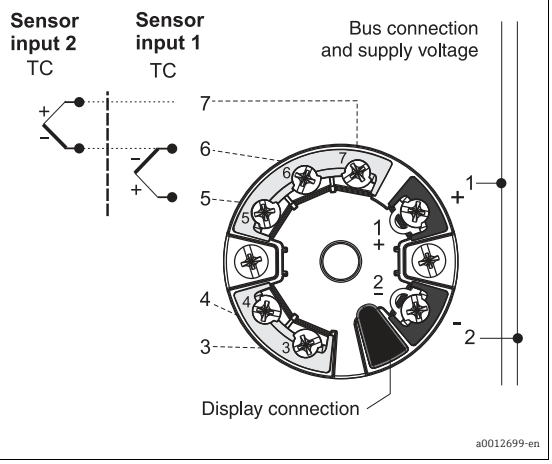
Thermocouple wire colors

As per IEC 60584	As per ASTM E230/ANSI MC96.1
▪ Type J: black (+), white (-) ▪ Type K: green (+), white (-)	▪ Type J: white (+), red (-) ▪ Type K: yellow (+), red (-)

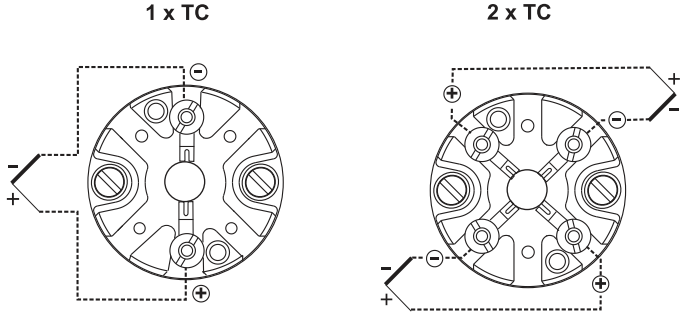
Head mounted transmitter TMT18x (single input)



Head mounted transmitter TMT8x (dual input)



Terminal block mounted

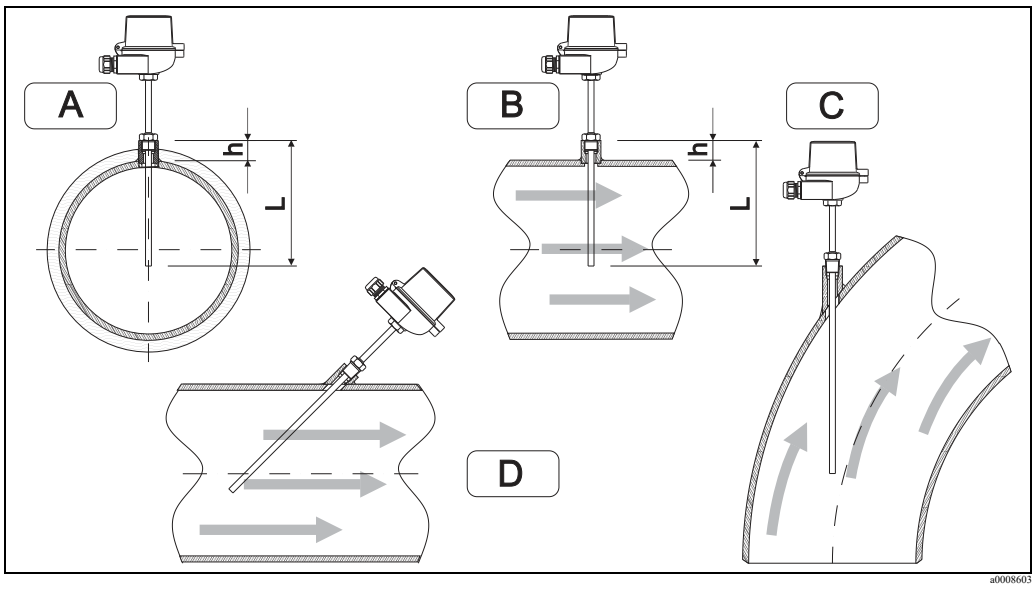


Installation conditions

Orientation

No restrictions.

Installation instructions



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.

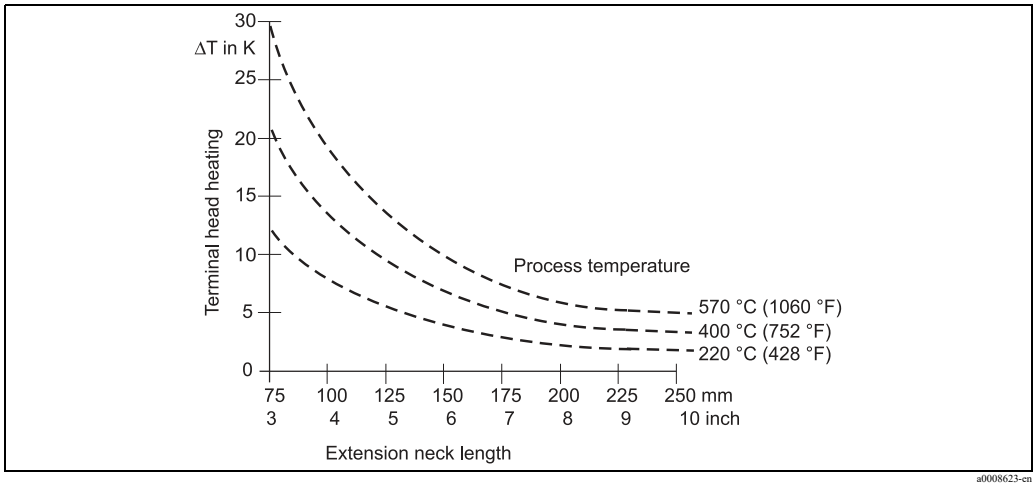
The immersion length of the thermometer influences the accuracy. If the immersion length is too small then errors in the measurement are caused by heat conduction via the process connection and the container wall. If installing into a pipe then the immersion length must be half of the pipe diameter,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

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.
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 60584 and ASTM E230/ANSI MC96.1:
  Thermocouples
- DIN43772:
  Thermowells
- DIN EN 50446, DIN 47229:
  Terminal heads
- IEC 61326-1:
  Electromagnetic compatibility (EMC requirements)

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

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

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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

Documentation

Technical Information:
- TC insert for Temperature Sensor Omniset TPC100 (TI278t/02/en)
- Thermowell for temperature sensors Omnigrad M TW10 (TI261t/02/en)
- Temperature head transmitter:
  - iTEMP® TMT181, PC programmable, single input, RTD, TC, W, mV (TI070r/09/en)
  - iTEMP® TMT182 HART®, single input, RTD, TC, W, mV (TI078r/09/en)
  - iTEMP® TMT82 HART®, dual input, RTD, TC, W, mV (TI01010t/09/en)
  - iTEMP® TMT84 PROFIBUS® PA, dual input, RTD, TC, W, mV (TI138r/09/en)
  - iTEMP® TMT85 FOUNDATION Fieldbus™, dual input, RTD, TC, W, mV (TI134r/09/en)

Hazardous area supplementary documentation:
- Omnigrad TRxx/TCxx RTD, TC thermometer ATEX II1GD 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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