Technical Information
TI 258T/02/en
60019737

RTD Temperature Sensor
Omnigrad M TR 12

RTD assembly with compression fitting
With thermowell and replaceable insert
PCP (4...20 mA), HART® or PROFIBUS-PA® electronics

The TR 12 Omnigrad M range temperature sensors are resistance thermometers designed for use in the fine chemicals industry but also suitable for general applications.
They are made up of a measurement probe with a protection well, and a housing, which may contain the transmitter for conversion of the variable measured.
Thanks to its modular configuration and the structure defined by the DIN 43772 standard (form 2/3), the TR 12 is suitable for almost all industrial processes.

Features and benefits
- SS 316L/1.4404 e SS 316Ti/1.4571 for "wetted" parts
- The most common compression fittings are supplied as standard; others are available upon request
- Customized immersion length
- Surface finishing down to Ra < 0.8 µm
- Tip of the thermowell with a reduced diameter or tapered for a faster response time
- Stainless steel, aluminium or plastic housing, with protection grade from IP65 to IP67
- Replaceable mineral insulated insert
- PCP (4...20 mA, also with enhanced accuracy), HART® and PROFIBUS-PA® 2-wire transmitters
- Pt 100 sensing element with class A accuracy (DIN EN 60751) or 1/3 DIN B
- Pt 100 wire wound (-200...600°C) or thin film (-50...400°C)
- Double Pt 100, for redundancy purposes
- Single Pt 100 with 4 wires connection, double Pt 100 with 3 wires
- ATEX 1 GD EEx ia certification
- Material certification (3.1.B)
- Pressure test
- EA Calibration Certificate

Endress+Hauser
The Power of Know How

Areas of application

- Fine chemicals industry
- Light energy industry
- Food industry
- General industrial services

Function and system design

Measuring principle

In the RTD (Resistance Temperature Detector) thermometers, the sensing element consists of an electrical resistance with value of 100 Ω at 0°C (called Pt 100, in compliance with standard DIN EN 60751). which increases at higher temperatures according to a coefficient characteristic of the resistor material (platinum). In industrial thermometers that comply with the DIN EN 60751 standard, the value of this coefficient is $\alpha = 3.85*10^{-3}\ °C^{-1}$, calculated between 0 and 100°C.

Equipment architecture

The Omnigrad M TR 12 temperature sensor is made up of a measurement probe, with a thermowell and a housing (head), which may contain a transmitter or the terminals on the ceramic block for electrical connection.
Construction of sensor is based on the following standards: DIN 43729 (housing), 43772 (thermowell) and 43735 (probe), and can therefore guarantee a good level of resistance to the most typical and common industrial processes.
The measurement probe (replaceable insert) is placed inside the thermowell; the insert is spring loaded to its base in order to improve heat transfer. The sensing element (Pt 100) is positioned close to the tip of the probe.
The thermowell is made from a tube with a diameter of 9, 11 or 12 mm. The final part can be straight, tapered (i.e. rather with a gradual reduction of the stem achieved thanks to a swaging procedure), or reduced (stepped).
The TR 12 can be fitted onto the plant (tube or tank) through the use of a compression fitting, which can be chosen from the most common models (see section "Structure of the components"). The sensor can also be welded along the wall of the protecting tube (see fig. 2).

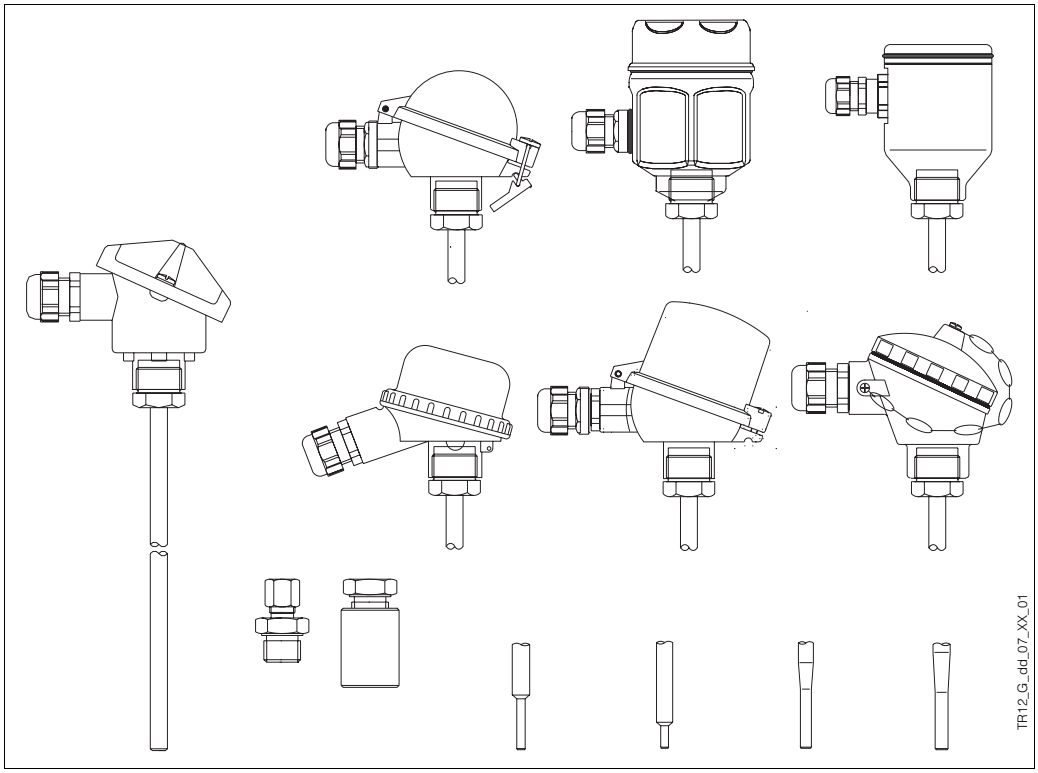


Fig. 1: TR 12 with the various types of heads, process connections and end parts of the thermowell

The electrical structure of the thermometer always complies with DIN EN 60751 standard rules. The sensing element is available in two versions with a thin film (TF) or wire wound (WW), the latter with a large measuring and accuracy range.
The housing can be of different types and materials (plastic, painted aluminium alloy, stainless steel). The way in which it fits to thermowell and the cable gland ensure a minimum grade of IP65 (Ingress Protection).

Material

Wetted parts in SS 316L/1.4404 or SS 316Ti/1.4571.

Weight

From 0.5 to 2.5 kg for standard options.

Electronics

The required type of output signal can be obtained by choosing the correct head-mounted transmitter. Endress+Hauser supplies "state-of-the-art" transmitters (the iTEMP® series) built in 2-wire technology and with 4…20 mA output signal, HART® or PROFIBUS-PA®. All of the transmitters can be easily programmed using a personal computer through the ReadWin® 2000 public domain software (for transmitters 4…20 mA and HART®) or the Commuwin II software (for PROFIBUS-PA® transmitters). The HART® transmitters can also be programmed with the hand-held operating module DXR 275 (Universal HART® Communicator).
A PCP (4…20 mA, TMT 180) model with enhanced accuracy is available.
In the case of PROFIBUS-PA® transmitters, E+H recommends the use of PROFIBUS® dedicated connectors. The Weidmüller type (Pg 13.5 - M12) is provided as a standard option.
For detailed information about transmitters, please refer to the relevant documentation (refer to the TI codes at the end of the document).
If a head-mounted transmitter is not employed, the sensor probe can be connected through the terminal block to a remote converter (i.e. DIN rail transmitter).

Performance

Operating conditions

Ambient temperature (housing without head-mounted transmitter)
- Metal housings -40÷130°C
- plastic housings -40÷85°C

Ambient temperature (housing with head-mounted transmitter) -40÷85°C
Ambient temperature (housing with display) -20÷70°C

Process temperature
- Sleeve in SS (TA 50 compression fitting) max 500°C
- Sleeve in PTFE (TA 50 compression fitting) max 200°C
- Sleeve in Viton® (TA70 compression fitting) max 180°C

If the thermowell is welded to the plant, the process temperature will be equivalent to the measuring range (see below).

Maximum process pressure
- Sleeve in SSI (TA 50 compression fitting) 4 MPa (40 bar) at 20°C
- Sleeve in PTFE (TA 50 compression fitting) 1 MPa (10 bar) at 20°C
- Sleeve in Viton® (TA 70 compression fitting) 2 MPa (20 bar) at 20°C

If the thermowell is welded to the plant, the thermowell can be exposed to different pressure values depending on the temperature values, as shown in the graphs below of figures 2 and 3.
For 9 mm diameter pipes, with a limited flow velocity, the maximum tolerated pressures are the following:

- 50 bar at 20°C
- 33 bar at 250°C
- 24 bar at 400°C.

Maximum flow velocity
The highest flow velocity tolerated by the thermowell diminishes with increasing lengths of the well/probe exposed to the stream of the fluid. Some information may be taken from the graphs in figures 2 and 3.

Shock and vibration resistance
According to DIN EN 60751 3 g peak / 10÷500 Hz

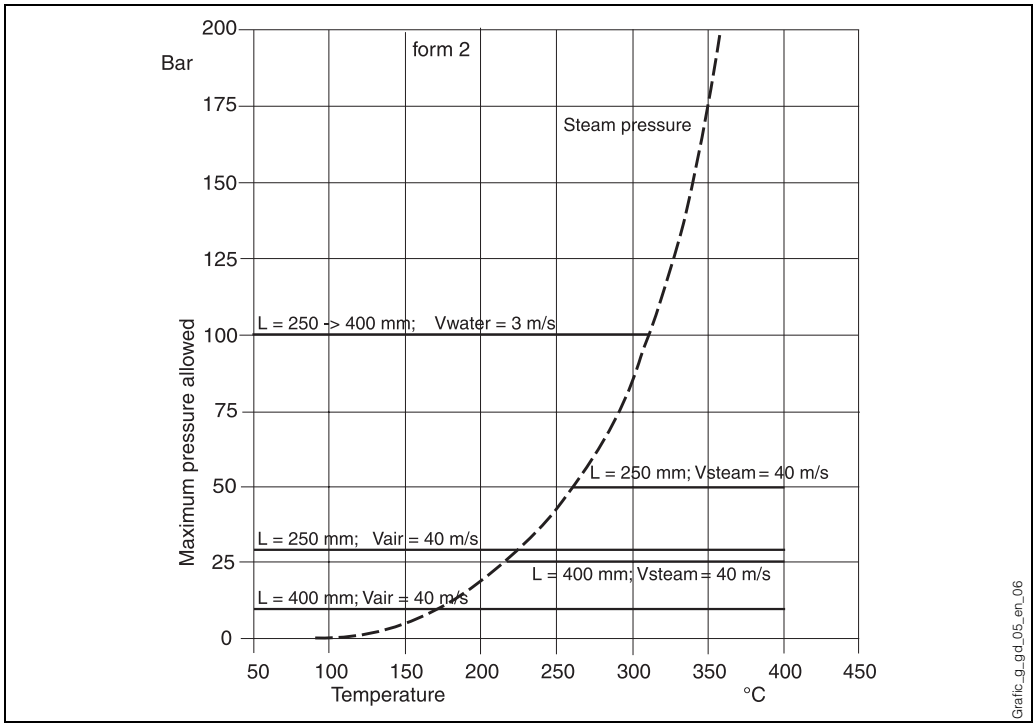


Fig. 2: Pressure/temperature for thermowell with straight tube Ø 11 mm in SS 316Ti/1.4571

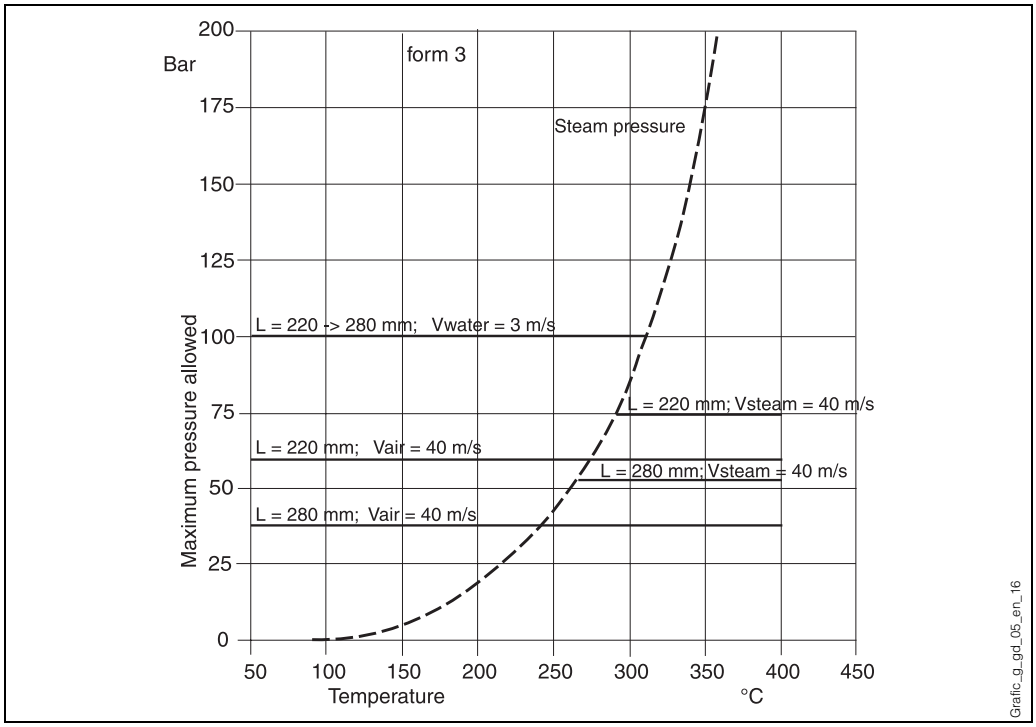
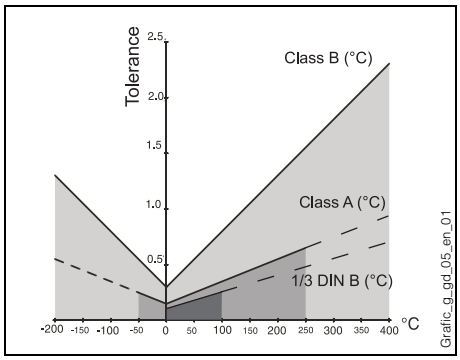


Fig. 3: Pressure drawing/temperature for thermowell with tapered tube Ø 12 mm in SS 316Ti/1.4571

Accuracy

Probe maximum error (type TF)

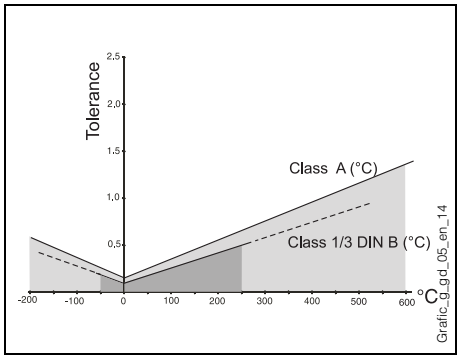
- cl. A
  $3\sigma = 0.15+0.0020|t|$ -50…250°C
  $3\sigma = 0.30+0.0050|t|$ 250…400°C
- cl. 1/3 DIN B
  $3\sigma = 0.10+0.0017|t|$ 0…100°C
  $3\sigma = 0.15+0.0020|t|$ -50...0 / 100...250°C
  $3\sigma = 0.30+0.0050|t|$ 250…400°C



Probe maximum error (type WW)

- cl. A
  $3\sigma = 0.15+0.0020|t|$ -200…600°C
- cl. 1/3 DIN B
  $3\sigma = 0.10+0.0017|t|$ -50…250°C
  $3\sigma = 0.15+0.0020|t|$ -200...-50 / 250…600°C

(|t|= absolute value of the temperature in °C)



Transmitter maximum error
See the corresponding documentation (codes at the end of the document).

Display maximum error
0.1% FSR + 1 digit

The "4" wires configuration, provided as a standard connection for the single Pt 100s excludes additional errors in every condition (eg. deep immersion lengths, long connection cables without head-mounted transmitters, ...). Generally speaking, in the "4 wires" configuration there is a higher guarantee of accuracy.
The "2 wires" connection, used in the version of the ATEX certified insert may create an additional error due to the resistance of the copper conductors of the mineral insulated cable; such resistance is added to the value of the Pt 100. The incidence of this source of inaccuracy increases with the increase of the insertion length.

Measurement range

- Type TF -50…400°C
- Type WW -200...600°C

Response time

Tests in water at 0.4 m/s (according to DIN EN 60751; 23 to 33°C step changes):

Diameter of the stem (mm)	Pt 100 Type	Response time	Reduced tip	Tapered tip	Straight tip
9	TF / WW	t_{50}	7.5	11	18
		t_{90}	21	37	55
11	TF / WW	t_{50}	7.5	-	18
		t_{90}	21	-	55
12	TF / WW	t_{50}	-	10	38
		t_{90}	-	24	125

Insulation

Insulation resistance between terminals and probe sheath (according to DIN EN 60751, test voltage 250 V)
above 100 MΩ at 25°C
Above 10 MΩ at 300°C

Self heating Negligible when the E+H iTEMP® transmitters are employed.

Installation

The Omnigrad M TR 12 thermometers can be mounted on pipes, vessels or other plant parts that may be necessary.
The interface components for the connection to the process are not normally provided with the sensors and are customer's responsibility.
The absence of the extension neck (situated between the process connection and the head) may expose the housing to overheating. To ensure that the head temperature does not exceed the limit values defined in paragraph "Operating conditions", refer to figure 5.
In the case of ATEX-certified components (transmitter, insert), please refer to the relevant documentation (refer to the code at the end of this document).
Immersion depth may have an effect on the accuracy of the measurement. If the immersion is too low, an error may be generated in the temperature recorded due to the lower temperature of the process fluid near to the walls and heat transfer, which takes place through the sensor stem. The incidence of such an error can be not negligible if there is a big difference between the process temperature and the ambient temperature. In order to avoid this source of inaccuracy, the thermowell should have a small diameter and the immersion length (L) should be, if possible, at least 80÷100 mm.
In pipes of a small section the axis line of the duct must be reached and if possible slightly exceeded by the tip of the probe (refer to fig. 4A-4B). Insulation of the outer part of the sensor reduces the effect produced by a low immersion. Another solution may be a tilted installation (see fig. 4C-4D). For use in the food industry, it is best to follow the rule h <= d/2.

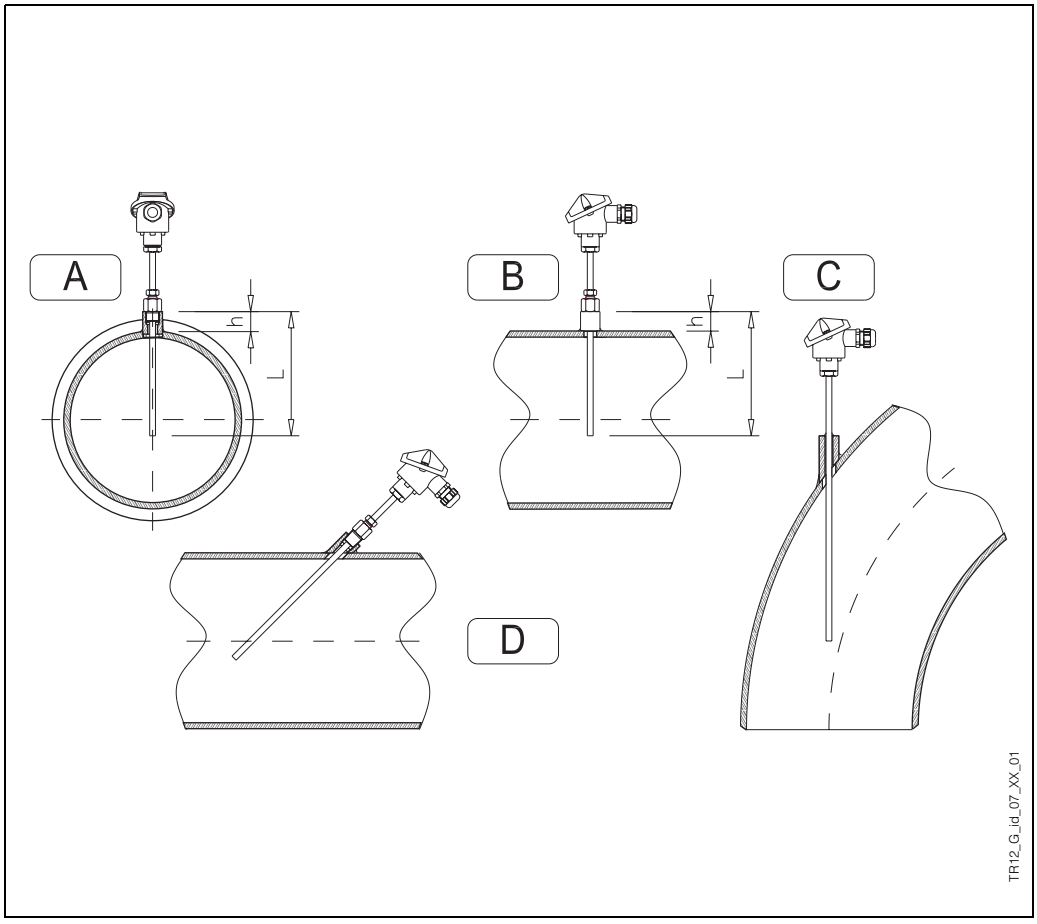


Fig. 4: Installation examples

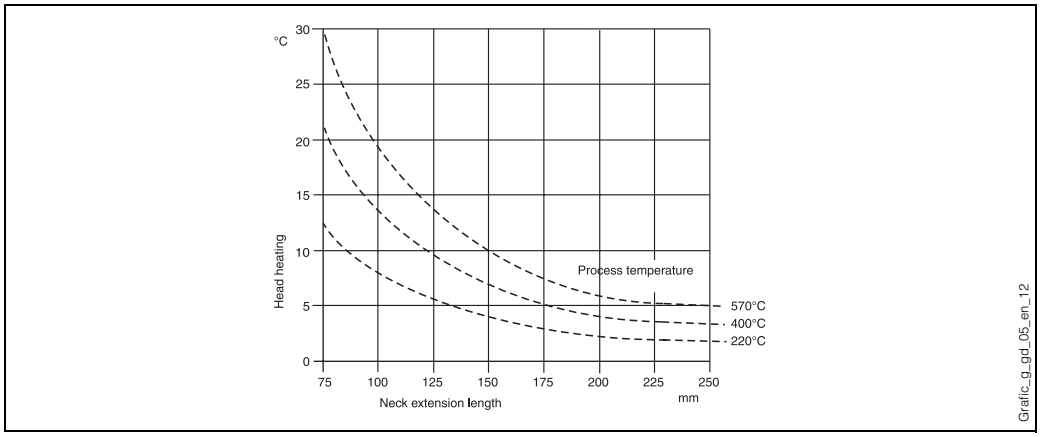


Fig. 5: Heating of the head due to the process temperature

In the case of two-phase flows, pay special attention to the choice of measurement point, as there may be fluctuations in the value of the detected temperature.
With regard to corrosion, the base material of the wetted parts in contact with the fluid (SS 316L/1.4404, SS 316Ti/1.4571, compression fitting in SS 316/1.4401 and several types of sleeves) can tolerate the common corrosive media up to even the highest temperatures. For further information on specific applications, please contact the E+H Customer Service Department.
In case that the sensor components are disassembled, in the following reassembly procedure the definite torques must be employed. This will assure the housings with the grade of IP grade protection defined.
When the surrounding environment has a high humidity rate and the process is at low temperature, a plastic housing is recommended (i.e. model TA20B) to avoid problems due to condensation.
In the case of vibrations the thin film sensing element (TF) may offer advantages, but the behaviour depends on the intensity, the direction and the dominating frequency in the vibration mode.
The wire wound Pt 100 (WW), besides having a larger measurement and accuracy range, guarantees greater long term stability.

System components

Housing

The housing, which contains the electric terminals or the transmitter, is available in different types and materials, e.g. plastic, painted aluminium alloy and stainless steel. The coupling method with the rest of the probe and the gland for the cable entry ensures a minimum IP65 grade (refer also to fig. 6).
All available heads have internal geometry according to DIN 43729 standard (form B), and thermometer connection M24x1.5.
Head type TA20A is the basic E+H aluminium housing for temperature sensors. It is supplied in the E+H corporate colours, without any extra charge.
Head TA20B is a black polyamide housing, sometimes referred to as the BBK in the “Temperature” market.
A screw cap is employed in TA21E and is joined to the head body by a chain.
The TA20D head (aluminium), also referred to as BUZH, is able to contain a terminal block or two transmitters at the same time. The order of the double transmitter must be carried out by choosing the option "flying wires" in the sales structure, and two transmitters in a separate position (THT1, see the table at the end of the document).
The TA20J head is a stainless steel housing used in other instruments made by E+H and can be provided with a LCD display (4 digits), which operates with 4…20 mA transmitters.
The TA20R is normally recommended by the Temperature division of E+H for hygienic applications.
The TA20W (BUS type) is a round blue/grey coloured head made of aluminium, with a clip for the cap closure.
The cable gland M20x1.5 provided with the housings, is compatible with cables of a diameter between 5 and 9 mm.

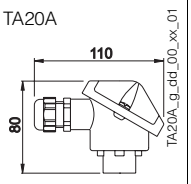
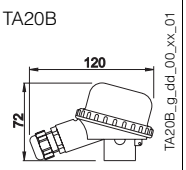
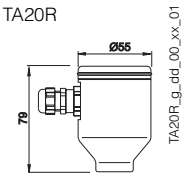
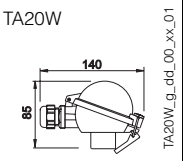
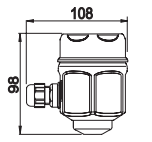
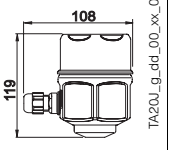
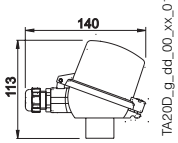
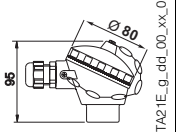
Housing Type	IP	Housing Type	IP	Housing Type	IP	Housing Type	IP
TA20A 	66 67	TA20B 	65	TA20R 	66 67	TA20W 	66
TA20J 	66 67	TA20J (display) 	66 67	TA20D 	66	TA21E 	65

Fig. 6: Housings and relative IP grade

Head Transmitter

The head-mounted transmitters available are (also refer to the section "Electronics" section):

- TMT 180 PCP 4…20 mA
- TMT 181 PCP 4…20 mA
- TMT 182 Smart HART®
- TMT 184 PROFIBUS-PA®.

The TMT 180 and the TMT 181 (see fig. 7) are PC programmable transmitters.
The TMT 180 is also available in a version with enhanced accuracy (0.1°C vs. 0.2°C) in the temperature range -50…250°C, and in a version with a fixed measurement range (specified by the customer in the order phase).
The TMT 182 output consists of 4…20 mA and HART® superimposed signals.
For the TMT 184 (see fig. 8), with PROFIBUS-PA® output signal, the communication address may be set via software or via mechanical dip-switch. The customer may specify the configuration desired during the order phase.

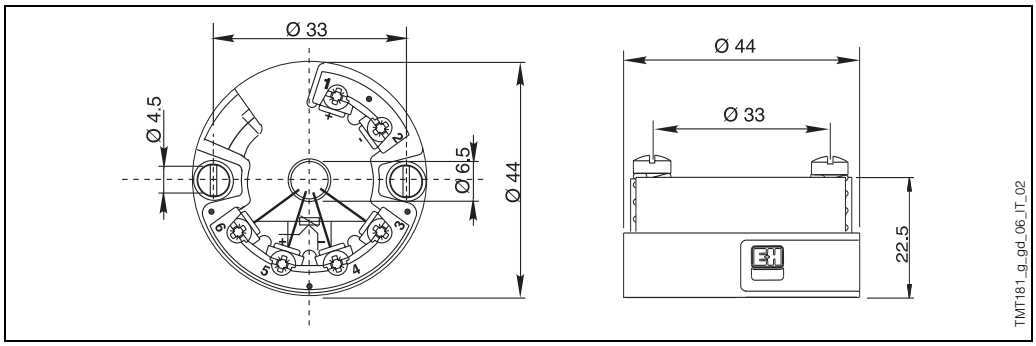


Fig. 7: TMT 180-181-182

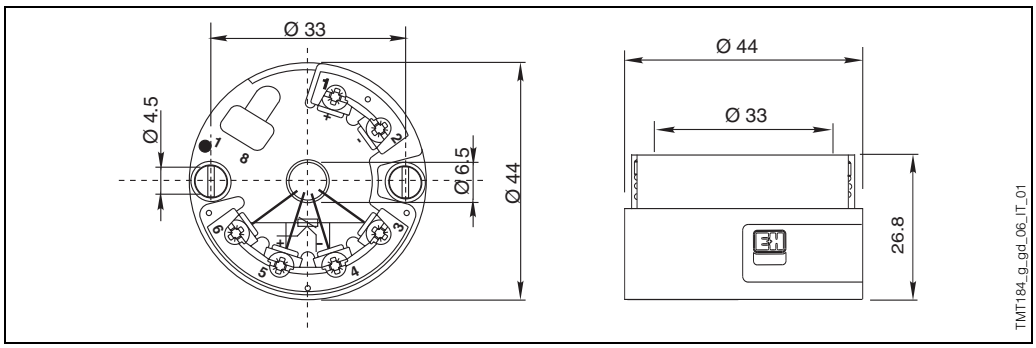
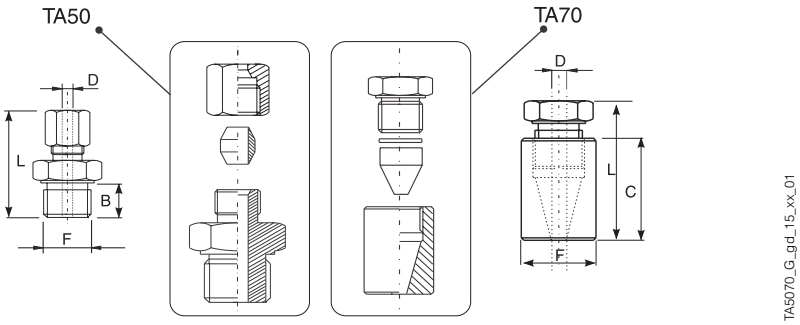


Fig. 8: TMT 184

Process connection

Standard compression fittings (in SS 316/1.4401) are available in the following types:
- Threaded G 1/2" and G 1", with sleeve in SS or PTFE (TA 50)
- Welded, with sleeve in Viton® (TA 70).

Other versions may be supplied upon request. Figure 9 illustrates the basic dimensions.



Model	F	L (mm)	C (mm)	B (mm)
TA50	G1"	70	-	25
TA50	G1/2"	47	-	15
TA70	Weld-in	76	34	-

Fig. 9: Basic dimensions of process connections

Probe

In the TR 12 the measuring probe is made up of a mineral (MgO) insulated insert positioned inside the thermowell.
The insert length is available in the standard dimensions DIN 43772 and in the most commonly used ones, or it can be personalized by the client within a range of values (refer to "Sales Structure" at the end of the document).
For replacement, the length of the insert (IL) must be chosen in compliance with the immersion length (L) of the thermowell. If spare parts are required, refer to the following table:

Tip of the sensor	Insert	Insert Diameter	Insert Length (mm)
Straight	TPR 100	6 mm	IL = L+35
Tapered on Ø 12	TPR 100	6 mm	IL = L+35
Reduced on Ø 9 and 11/ tapered on Ø 9	TPR 100	3 mm	IL = L+35

Although the wiring diagram of single Pt 100s is always supplied with 4 wires configuration, the connection of a trasmitter can be executed with 3 wires as well, by avoiding to connect whichever of the terminals.
The configuration Pt 100 double with 2 wires is only available for the ATEX certified inserts.
With regards to the thermowell, the surface roughness (Ra) of the wetted parts in contact with process fluid is 0.8 µm, while the various kinds of tips (reduced or tapered) are described in figure 10; if ordered as spare part, the thermowell is called TW 12 (see the code of the relative TI at the end of the document).
The reduced version "5x20 mm" (type R) is not recommended for the Pt 100 wire wound.
The use of thermowells with standard dimensions allows for the use of the inserts on sensors of various kinds and guarantees rapid delivery times; this allows our customers to reduce the amount of spare parts to be kept on stock.

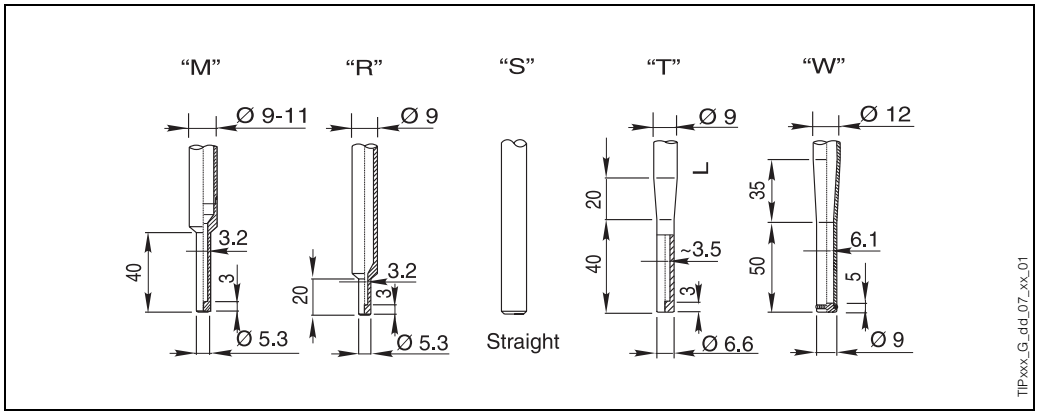


Fig. 10: Reductions (on the left) and tapers (on the right) of the thermowell

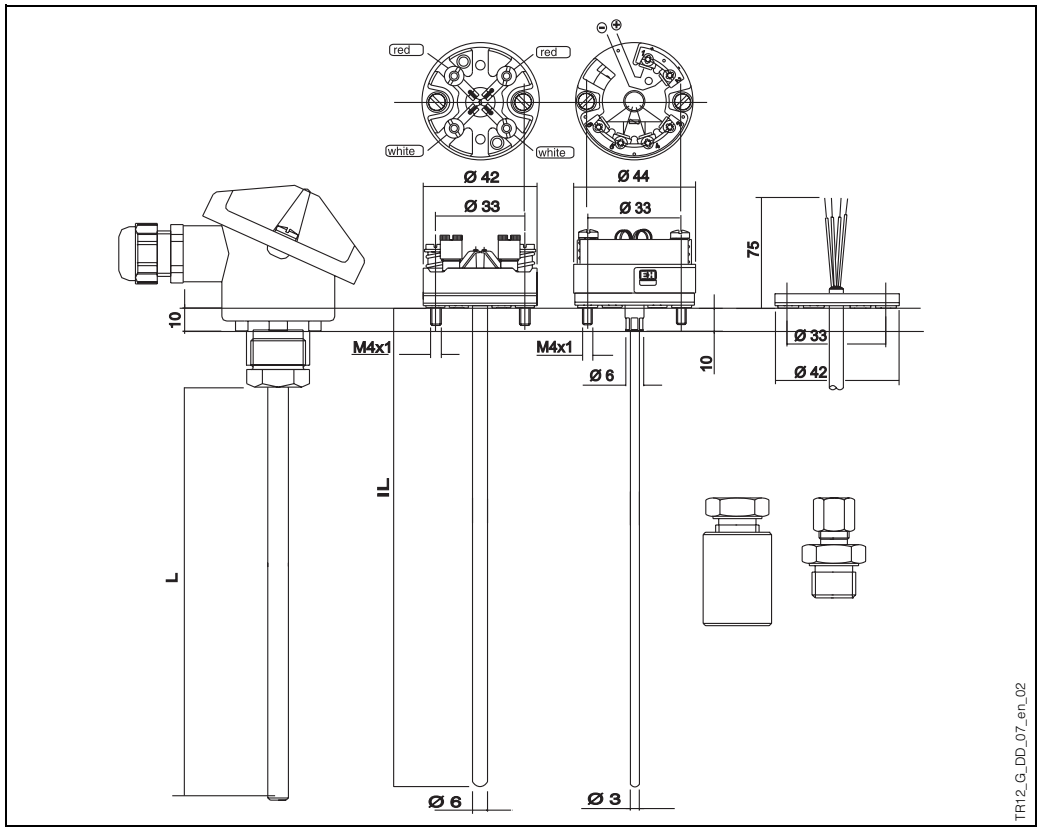


Fig. 11: Functional components

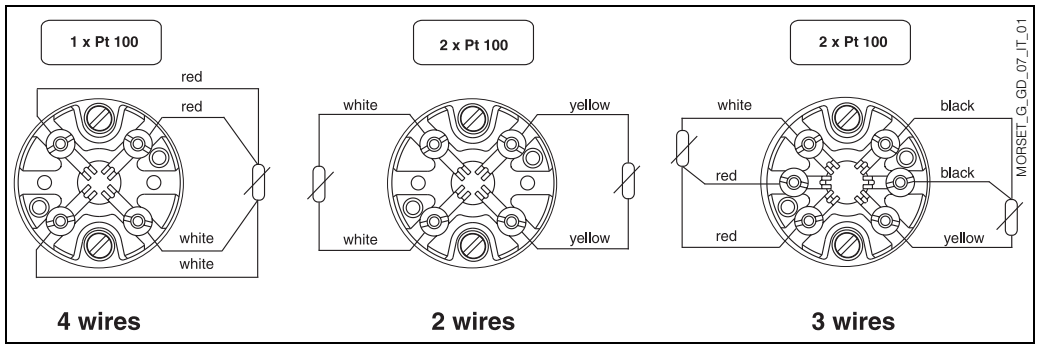


Fig. 12: Standard electrical diagrams (ceramic terminal block)

Certificates & Approvals

Ex approval

ATEX Certificate KEMA 01 ATEX1169 X (1 GD IIC EEx ia T6...T1 T85...450°C).
With regards to the NAMUR NE 24 certificate and the Compliance Statement according to the standard EN 50020, E+H Customer Service will be able to provide further detailed information.

PED approval

The Pressure Equipment Directive (97/23/CE) is respected. As paragraph 2.1 of article 1 is not applicable to these types of instruments, the CE mark is not requested for the TR 12 destined for general use.

Material certification

The material certificate 3.1.B (according to standard EN 10204) can be directly selected from the sale 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 declarations 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 the thermowell

The pressure tests are carried out at ambient temperature in order to verify the resistance of the thermowell to the specifications indicated by the norm DIN 43772. With regards to the thermowells that do not comply with this norm (with a reduced tip, a tapered tip on a 9 mm tube, special dimensions, ...), the pressure of the corresponding straight tube with similar dimensions is verified. The sensors certified for the Ex Zones, are always tested to the pressure according to the same criterions. Tests at different pressures can be carried out upon request.

Test report and calibration

With regards to the tests and calibration, the "Inspection Report" consists of a compliance declaration for the essential points of the standard DIN EN 60751.
The "Factory calibration" is carried out in an authorised laboratory EA (European Accreditation) of E+H according to an internal procedure. A calibration may be requested separately according to an accredited procedure EA (SIT calibration).
Calibration is carried out on the thermometer insert.

Further details

Maintenance

The Omnigrad M thermometers do not require any specific maintenance.
In the case of ATEX certified components (transmitter, insert) please refer to the corresponding specific relevant documentation (refer to the code at the end of the document).

Delivery time

For small quantities (approximately 10 units) and standard options, between 5 and 15 days depending on the configuration required.

Ordering Information

Sales structure

TR12	Safety (Ex) certification	
	A	Ex certification not required
	B	ATEX II 1 GD EEx ia IIC certified
	C	*Certification NAMUR NE 24
	D	*Manufacturer's declaration acc. standard EN 50020

		Head Material, conduit, IP grade	
	A	TA20A Aluminium, conduit M20x1.5, IP66/IP67	
	4	TA20A Aluminium, PROFIBUS® connector, IP66	
	2	TA20A Aluminium, conduit 1/2" NPT, IP66/IP67	
	7	TA20B Poliamide, black, conduit M20x1.5, IP65	
	E	TA21E Aluminium, screw cap, M20x1.5, IP65	
	6	TA20D Aluminium, high cap, conduit M20x1.5, IP66	
	5	TA20D Aluminium, high cap, PROFIBUS® connector, IP66	
	8	TA20D Aluminium, high cap, conduit 1/2" NPT, IP66	
	J	TA20J SS 316L, conduit M20x1.5, IP66/IP67	
	K	TA20J SS 316L, with display, conduit M20x1.5, IP66/IP67	
	M	TA20J SS 316L, PROFIBUS® connector, IP66	
	R	TA20R SS 316L, screw cap, conduit M20x1.5, IP66/IP67	
	S	TA20R SS 316L, screw cap, PROFIBUS® connector, IP66	
	W	TA20W Aluminium, round cap, clip, conduit M20x1.5, IP66	
	Y	Special version	

			Pipe diameter, type of material		
		A	Pipe diameter: 9 mm	Material: SS 316L/1.4404	
		D	Pipe diameter: 9 mm	Material: SS 316Ti/1.4571	
		B	Pipe diameter: 11 mm	Material: SS 316L/1.4404	
		E	Pipe diameter: 11 mm	Material: SS 316Ti/1.4571	
		F	Pipe diameter: 12 mm	Material: SS 316Ti/1.4571	
		Y	Special version		

				Process connection	
				(the material of the connection body: SS 316/1.4401)	
			0	Without process connection	
			1	Compression fitting TA50, G1/2", sleeve in SS	
			2	Compression fitting TA50, G1/2", sleeve in PTFE	
			3	Compression fitting TA50, G1", sleeve in SS	
			4	Compression fitting TA50, G1", sleeve in PTFE	
			5	Welded connection TA70, d.30x34, sleeve in Viton®	
			9	Special version	

					Type of tip	
				S	Straight tip without reduction	
				R	Reduced tip, L = 30 mm (from 9 mm tube in SS 316Ti)	
				M	Reduced tip, L = 50 mm (from 9 and 11 mm tube in SS 316Ti)	
				T	Tapered tip, L = 70 mm (from 9 mm tube in SS 316Ti	
				W	Tapered tip, L = 90 mm in compliance with DIN 43772 form 3 (SS 316Ti 12 mm pipe with length E ranging from 87 to 147 mm)	
				Y	Special version	

						Immersion length (50-3700)	
					A	125 mm, immersion length L (TL=150 mm)	
					B	180 mm, immersion length L (TL=205 mm)	
					C	240 mm, immersion length L (TL=265 mm)	
					D	280 mm, immersion length L (TL=305 mm)	
					E	340 mm, immersion length L (TL=365 mm)	
					F	370 mm, immersion length L (TL=395 mm)	
					G	400 mm, immersion length L (TL=425 mm)	
					K	520 mm, immersion length L (TL=545 mm)	
					M	700 mm, immersion length L (TL=725 mm)	
					X	... mm Immersion length L to be specified	
					Y	... mm Immersion length L special	

							Ceramic terminal or transmitter
						F	Flying leads
						C	Ceramic terminal block
						2	TMT180-A21, fixed range, from ... to ...°C accuracy 0.2 K, span limit: -200...650°C
						3	TMT180-A22, fixed range, from ... to ...°C accuracy 0.1 K, span limit: -50...250°C
						4	TMT180-A11, programmable, from ... to ...°C accuracy 0.2 K, span limit: -200...650°C

5	TMT180-A12, programmable, from ... to ...°C accuracy 0.1 K, span limit: -50...250°C
P	TMT181-A, programmable from … to ….°C, PCP, 2-wires, isolated
Q	TMT181-B, programmable from … to ….°C, PCP ATEX, 2-wires, isolated
R	TMT182-A, programmable from ... to ...°C HART®, 2-wires, isolated
T	TMT182-B, programmable from ... to ...°C HART® ATEX, 2-wires, isolated
S	TMT184-A, programmable, from ... to ...°C PROFIBUS-PA®, 2-wires
V	TMT184-B, programmable, from ... to ...°C PROFIBUS-PA® ATEX, 2-wires

RTD type, temp. range, wiring diagram

3	1 Pt 100, TF	Class A,	4 wires	- 50/400°C
7	1 Pt 100, TF	Class 1/3 DIN B,	4 wires	- 50/400°C
B	2 Pt 100, WW	Class A,	3 wires	-200/600°C
C	1 Pt 100, WW	Class A,	4 wires	-200/600°C
D	2 Pt 100, WW	Class A,	2 wires	-200/600°C
F	2 Pt 100, WW	Class 1/3 DIN B,	3 wires	-200/600°C
G	1 Pt 100, WW	Class 1/3 DIN B,	4 wires	-200/600°C
Y	Special version			

Material certification

0	Material certification not requested
1	3.1.B EN10204, standard for "wetted" parts
2	3.1.B EN10204, “short form” for "wetted" parts
9	Special version

Test on thermowell

0	Tests on thermowell not requested
A	Hydrostatic internal pressure test on the thermowell
Y	Special version

Test and calibration on the insert

0	Test and calibration not requested
1	Inspection report on sensor
2	Inspection report on loop
A	Factory calibration, RTD single, 0-100°C
B	Factory calibration, single RTD, loop 0-100°C
C	Factory calibration, double RTD, 0-100°C
E	Factory calibration, single RTD, 0-100-150°C
F	Factory calibration, single RTD, loop, 0-100-150°C
G	Factory calibration,double RTD, 0-100-150°C

Marking

Tagging according to customer specifications

TR12- Complete order code

Sales structure

THT1	Model and version of the head transmitter	
	A11	TMT180-A11 programmable from...to...°C, accuracy 0.2 K, span limit -200...650°C
	A12	TMT180-A12 programmable from...to...°C, accuracy 0.1 K, span limit -50...250°C
	A13	TMT180-A21AA fixed range, accuracy 0.2 K, span 0...50°C
	A14	TMT180-A21AB fixed range, accuracy 0.2 K, span 0...100°C
	A15	TMT180-A21AC fixed range, accuracy 0.2 K, span 0...150°C
	A16	TMT180-A21AD fixed range, accuracy 0.2 K, span 0...250°C
	A17	TMT180-A22AA fixed range, accuracy 0.1 K, span 0...50°C
	A18	TMT180-A22AB fixed range, accuracy 0.1 K, span 0...100°C
	A19	TMT180-A22AC fixed range, accuracy 0.1 K, span 0...150°C
	A20	TMT180-A22AD fixed range, accuracy 0.1 K, span 0...250°C
	F11	TMT181-A PCP, 2-wires, isolated, programmable from...to...°C
	F21	TMT181-B PCP ATEX, 2-wires, isolated, programmable from...to...°C
	F22	TMT181-C PCP FM IS, 2-wires, isolated, programmable from...to...°C
	F23	TMT181-D PCP CSA, 2-wires, isolated, programmable from...to...°C
	L11	TMT182-A HART®, 2-wires, isolated, programmable from...to...°C
	L21	TMT182-B HART® ATEX, 2-wires, isolated, programmable from...to...°C
	L22	TMT182-C HART® FM IS, 2-wires, isolated, programmable from...to...°C
	L23	TMT182-D HART® CSA, 2-wires, isolated, programmable from...to...°C
	K11	TMT184-A PROFIBUS-PA®, 2-wires, programmable from...to...°C
	K21	TMT184-B PROFIBUS-PA® ATEX, 2-wires, programmable from...to...°C
	K23	TMT184-C PROFIBUS-PA® FM IS, 2-wires, programmable from...to...°C
	K24	TMT184-D PROFIBUS-PA® CSA, 2-wires, programmable from...to...°C
	YYY	Special transmitter

		Application and services	
		1	Assembled into position
		9	Special version

THT1-			Complete order code

Supplementary Documentation

❑ RTD Thermometers omnigrad TST - general information	TI 088T/02/en
❑ Terminal housings - Omnigrad TA 20	TI 072T/02/en
❑ Temperature head transmitter iTEMP® Pt TMT 180	TI 088R/09/en
❑ Temperature head transmitter iTEMP® PCP TMT 181	TI 070R/09/en
❑ Temperature head transmitter iTEMP® HART® TMT 182	TI 078R/09/en
❑ Temperature head transmitter iTEMP® PA TMT 184	TI 079R/09/en
❑ RTD insert for temperature sensor - Omniset TPR 100	TI 268T/02/en
❑ Thermowell for temperature sensor - Omnigrad M TW 12	TI 263T/02/it
❑ TA Fittings & Sockets omnigrad TA50, TA55, TA60, TA70, TA75	TI 091T/02/en
❑ Safety instructions for use in hazardous areas	XA 003T/02/z1
❑ E+H Thermolab - Calibration certificates for industrial thermometers. *RTD and thermocouples*	TI 236T/02/en

Subject to modification

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