Technical Information
TI 277T/02/en
60022269

Thermocouple Thermometer
omnigrad S TC 15

Replaceable insert and bar stock thermowell
PCP (4...20 mA), HART® or PROFIBUS-PA® electronics

Omnigrad S type TC 15 temperature sensors are thermocouples specially designed for the heavy chemicals industry and particularly suitable for applications with high pressures, temperatures and high flows (i.e. tanks or pipes with steam or gas).
They are made up of a measurement probe with a protection well made from a bar, and a housing, which may contain the transmitter for conversion of the variable measured.
Thanks to its modular configuration and the structure defined in standard DIN 43772 (form 4/4F), TC 15 is suitable to be used in all industrial processes with severe thermal and mechanical stresses.

Features and benefits
- SS 316Ti/1.4571 and 13CrMo4-5/ 1.7335 for the "wetted" parts
- Customized immersion length
- Weld-in or flanged process connection
- Surface finishing down to Ra < 0.8 µm
- Separate extension neck
- Available with or without thermowell
- Stainless steel, aluminium or plastic housings, with protection grade from IP65 to IP67
- Replaceable mineral insulated insert
- PCP (4...20 mA), HART® and PROFIBUS-PA® transmitters
- Thermocouple sensing element type K or J, DIN EN 60584 or ANSI MC96.1
- Class 1/special accuracy
- Single or double, grounded or ungrounded measurement junction
- Material certification (3.1.B)
- Pressure test

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Areas of application

Heavy industrial processes and in particular applications where steam and gases are processed at high pressures and temperatures; for example those carried out in the following sectors:
- chemical industry
- energy industry.

Function and system design

Measuring principle

The thermocouple thermometer's sensing element consists of two metal wires that are homogeneous but different one from the other and insulated along their entire length. The two wires are welded together at one end, known as the "measurement or hot junction". The other end, where the wires are free, is known as the "cold or reference junction" and is connected to a electromotive force measurement circuit where the force is generated by the different thermoelectric power of each of the thermocouple's wires if there is a temperature difference between the hot joint (T1) and the cold joint (Seebeck effect). The cold junction has to be "compensated" with reference to the temperature of 0°C (T0). The function that links the electromotive force to the temperatures T1 and T0 is a curve whose characteristics depend on the materials used in the construction of the thermocouple. Some thermocouples curves, and particularly those most reliable for the purposes of industrial readings, are those compliant with standards DIN EN 60584 and ANSI MC96.1.

Equipment architecture

The Omnigrad S TC 15 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 ceramic block for electrical connection. Construction of the 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 (type K or J) are positioned close to the tip of the probe. The thermowell is made from a metal bar with a diameter of 18 or 24 mm. The end of the thermowell is conical with a tip diameter of 9 or 12.5 mm, respectively fitted with an insert with a diameter of 3 mm or of 6 mm. The TC 15 can be fitted onto the plant (tube or tank) by means of a weld-in or flanged connection that can be chosen among different models (see section "Structure of components"). The electrical structure of the thermometer always complies with DIN EN 60584/61515 or ANSI MC96.1/ASTM E585 standard rules. The housing can be of different types and materials (plastic, painted aluminium alloy, stainless steel). The way in which it fits to the housing, the thermowell and the cable gland ensure a minimum grade of IP65 (Ingress Protection).

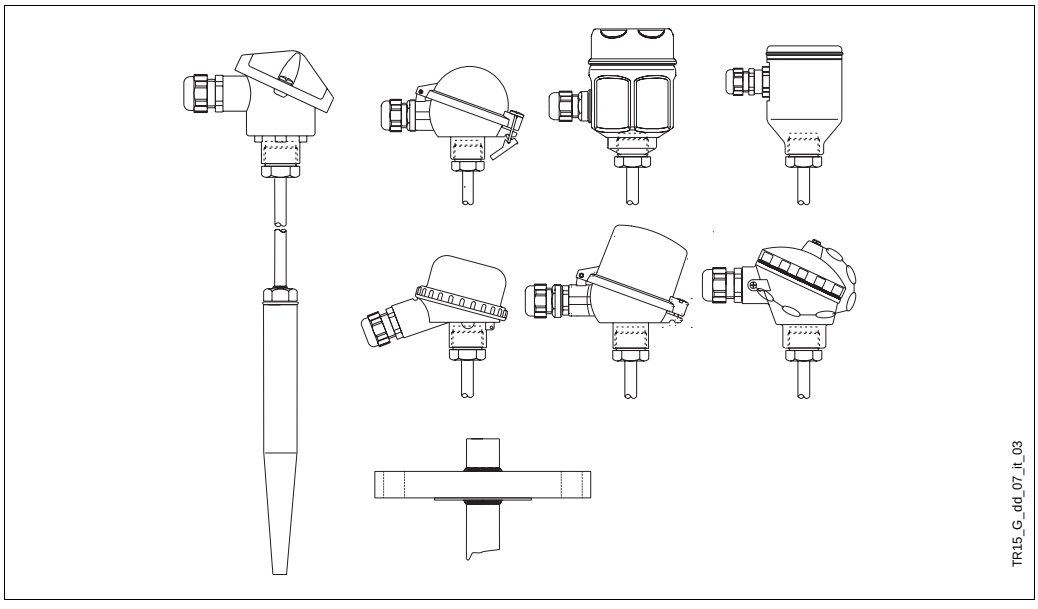


Fig. 1: TC 15 with the various types of heads, process connections and end parts of the thermowell

Material

Wetted parts in SS 316Ti/1.4571 or 13CrMo4-5/1.7335.

Weight

From 1 to 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 and FieldCare public domain softwares (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 handheld operating module DXR 275 (Universal HART® Communicator).
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 TI codes at the end of the document).
If a head-mounted transmitter is not employed, the sensor probe may 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
It is restricted by the thermowell material:

• SS 316 Ti/1.4571	< 800°C
• 13CrMo4-5/1.7335	< 800°C.

Maximum process pressure
The pressure values to which the thermowell can be subjected at the various temperatures are illustrated by the drawings in figures 2 and 3 and by table 1.

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 can be acquired from the drawing in figure 2.

Shock and vibration resistance

According to DIN EN 60751	3 g peak / 10÷500 Hz

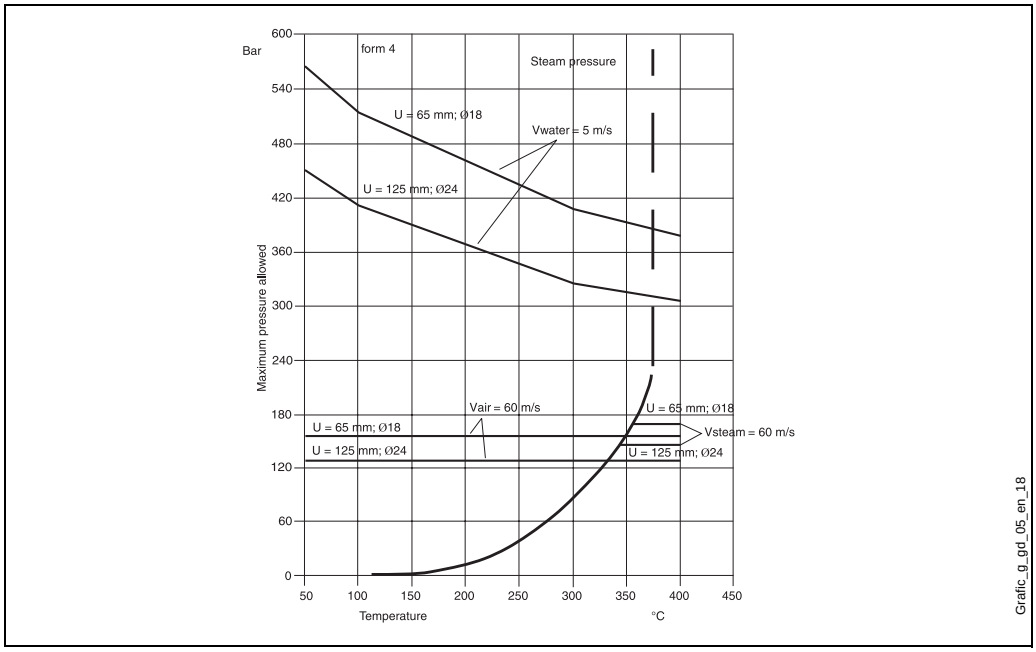


Fig. 2: Pressure/temperature drawing for the weld-in thermowell in SS 316Ti/1.4571

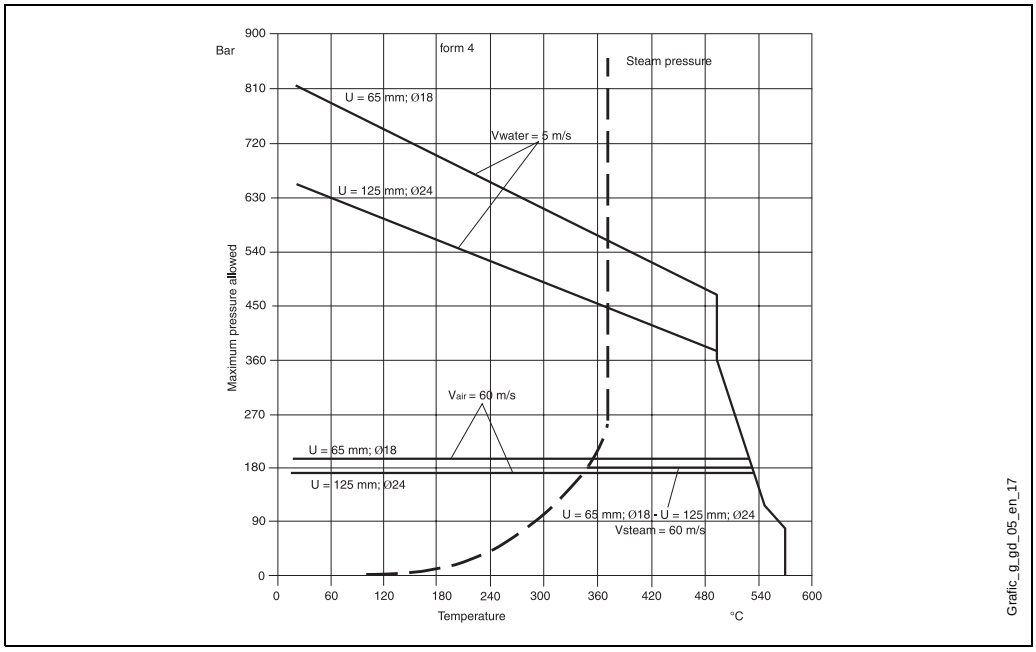


Fig. 3: Pressure/temperature drawing for the weld-in thermowell in 13CrMo4-5/1.7335

Temperature	Maximum acceptable pressure (barg); Values based on "1% proof stress"		
	SS 316Ti/1.4571		
	PN20 / cl.150 (ISO 7005)	PN40 (EN 1092)	PN50 / cl.300 (EN 1092)
-10...50°C	16	40* (37.3)	40
100°C	15.6	39.1 (33.8)	39.1
200°C	13.7	34.1 (29.3)	34.1
300°C	12.4	31.1 (25.8)	31.1
400°C	11.7	29.2 (24.0)	29.2
500°C	11.2	28.1 (23.1)	28.1
600°C	8.7	21.7 (21.3)	21.7

Note! * The values in brackets refer to values based on '0.2% proof stress' (EN 1092 and ISO 7005)

Table 1: Pressure/temperature ratings for flanged thermowell in SS 316Ti/1.4571

Accuracy

The tolerances set by the standard DIN EN 60584 and ANSI MC96.1 are the following:

Type of thermocouple	DIN EN 60584				
	Class	Max deviation	Class	Max deviation	Cable colours
J (Fe-CuNi)	2	+/-2.5°C (-40...333°C) +/-0.0075 |t| (333...750°C)	1	+/-1.5°C (-40...375°C) +/-0.004 |t| (375...750°C)	+ black - white
K (NiCr-Ni)	2	+/-2.5°C (-40...333°C) +/-0.0075 |t| (333...1200°C)	1	+/-1.5°C (-40...375°C) +/-0.004 |t| (375...1000°C)	+ green - white

Type of thermocouple	ANSI MC96.1				
	Class	Max deviation	Class	Max deviation	Cable colours
J (Fe-CuNi)	Standard	+/-2.2°C (0...293°C) +/-0.75% (293...750°C)	Special	+/-1.1°C (0...275°C) +/-0.4% (275...750°C)	+ black - red
K (NiCr-Ni)	Standard	+/-2.2°C (0...293°C) +/-0.75% (293...1250°C)	Special	+/-1.1°C (0...275°C) +/-0.4% (275...1250°C)	+ yellow - red

Note! ItI = absolute temperature value in °C

Table 2: Tolerances

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

Display maximum error 0.1% of the set span + 1 digit

Measurement range

The measurement ranges defined in standards are shown in the following table 3:

Type of thermocouple	DIN EN 60584	ANSI MC96.1
J	-40...750°C	0...750°C
K	-40...1200°C	0...1250°C

Table 3: Measurement ranges

Response time

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

Diameter of the stem	Type of TC	Response time	Grounded			Ungrounded		
			Tapering on 65/73 mm (U)	Tapering on 125/133 mm (U)	Tapering on 275 mm (U)	Tapering on 65/73 mm (U)	Tapering on 125/133 mm (U)	Tapering on 275 mm (U)
18 mm	J, K	t_{50}	7 s	7 s	--	7.5 s	7.5 s	--
		t_{90}	18 s	18 s	--	19 s	19 s	--
24 mm		t_{50}	17 s	15 s	15 s	18 s	16 s	16 s
		t_{90}	47 s	43 s	43 s	50 s	46 s	46 s

Table 4: Response times

Insulation

Insulation resistance between terminals and probe sheath (according to DIN EN 60584, test voltage 500 V) > 1GΩ at 25°C
> 5 MΩ at 500°C

Installation

The Omnigrad S TC 15 thermometers can be installed on pipes, tanks and any other plant parts where they may be required.
The interface components for the connection to the process and the relative gaskets are not normally provided with the sensors and are customer's responsibility.
In the case of ATEX-certified components (transmitter), 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 depth (L, U1) should be, if possible, at least 100÷150 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). In processes involving gases at very high temperature (>500÷600°C), where radiation effects are important, the immersion length may be a secondary problem.
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 basic material of the wetted parts (SS 316Ti/1.4571) 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 the 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 IP grade defined.
In enviroments with the presence of strong electromagnetic noise, the grounded hot junction is not recommended, because of the possible interferences which might be generated on the thermocouple wires.
Upon request, the Service Department of E+H can test the resistance of thermowells at specific operating conditions (pressure, temperature, fluid speed) taking into account also the forces and vibrations generated by the flow.

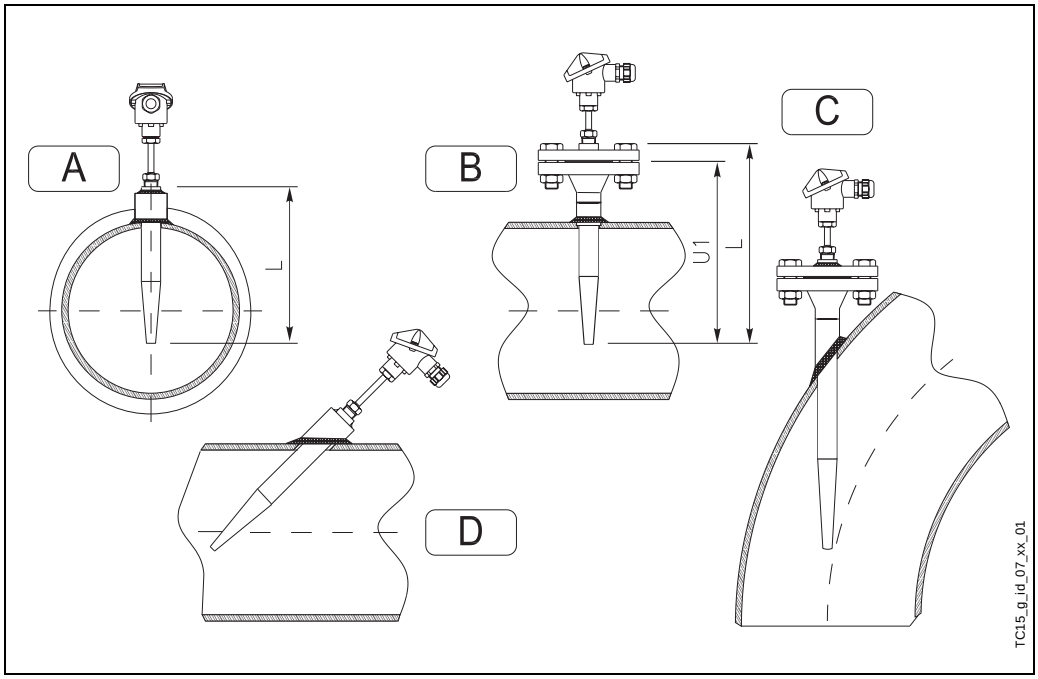


Fig. 4: Installation examples

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 figure 5).
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 type (aluminium), also referred to as BUZH, is able to contain a terminal block and a transmitter, or two transmitters at the same time.

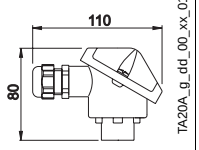
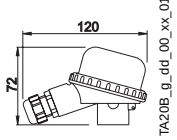
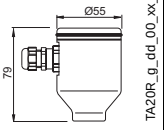
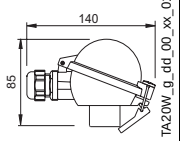
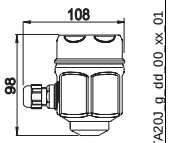
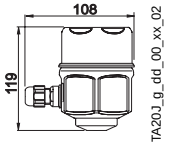
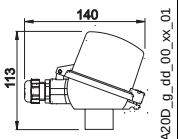
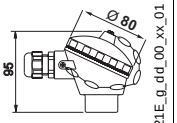
Housing type	IP	Housing type	IP	Housing type	IP	Housing type	IP
TA20A 	66 67	TA20B 	65	TA20R 	66 67	TA20W 	66
TA20J 	66 67	TA20J (with display) 	66 67	TA20D 	66	TA21E 	65

Fig. 5: Housings and relative IP grade

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 in stainless steel as well.
The TA20W (BUS type) is a round blue/grey coloured head made of aluminium, with a clip for the cap closure.The order of the double transmitter must be carried out by choosing the option “flying leads” in the sales structure, and two transmitters in a separate position (THT1, see the table at the end of the document).

Head transmitter

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

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

The TMT 181 is a PCP programmable transmitter (see fig. 6).
The TMT 182 output consists of 4…20 mA and HART® superimposed signals.
For the TMT 184 (see fig. 7), 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.

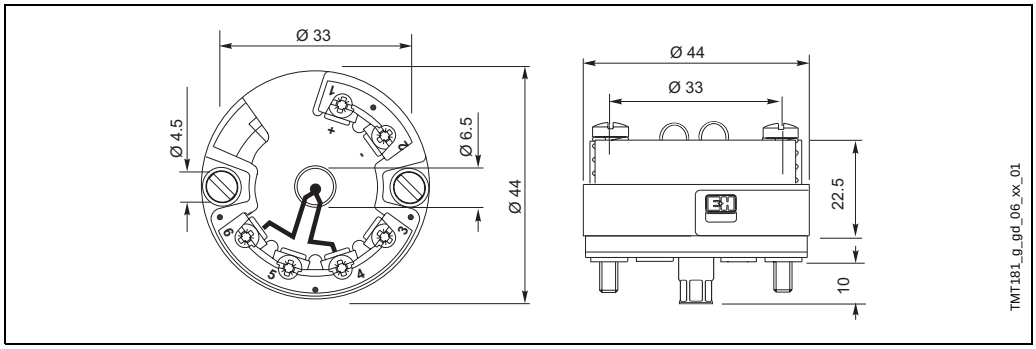


Fig. 6: TMT 181-182

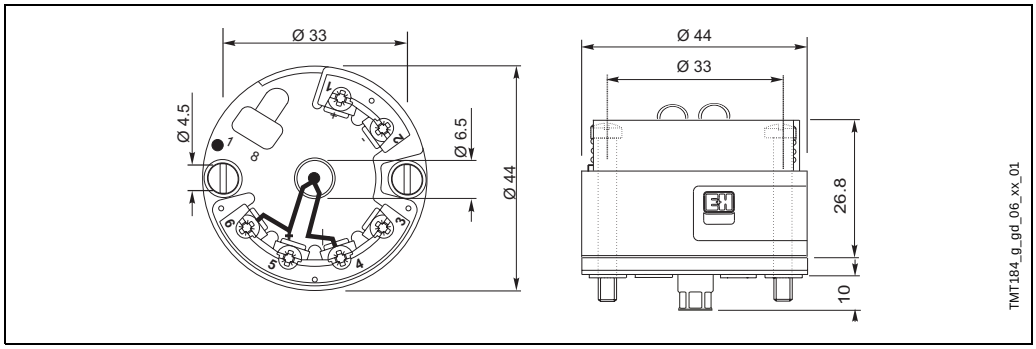


Fig. 7: TMT 184

Extension neck

The extension neck is the part between the thermowell and the head.
It is made up of a tube of 11 mm in SS 316Ti/1.4571 (see fig.8), with lower connection:
- M14x1.5 for thermowells with a diameter of 18 mm
- M18x1.5 for thermowells with a diameter of 24 mm.

The length of the neck (E) is:
- 155 mm for a thermowell length (L) of 110 mm
- 165 mm for other lengths (L).

The connection situated in the upper part of the neck allows for orientation of the sensor head. As illustrated by the chart in figure 9, the length of the extension neck may influence the temperature in the head. It is necessary that this temperature is kept within the limit values defined in the paragraph "Operating conditions".

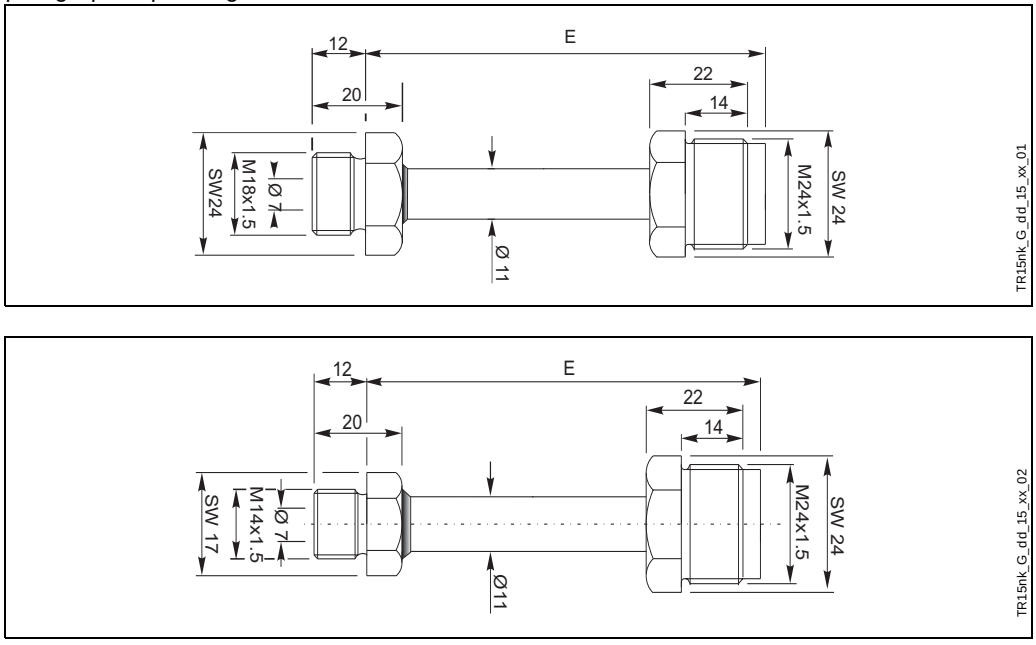


Fig. 8: Extension neck dimensions

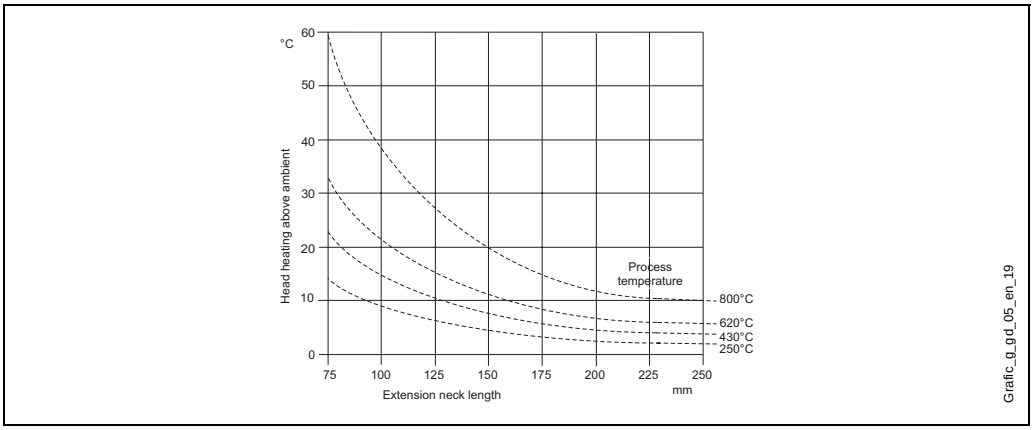
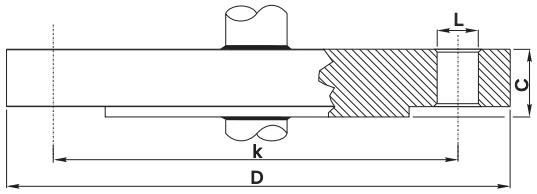


Fig. 9: Heating of the head in function of the process temperature

Process connection

Standard connections are available in the following types:
- weld-in
- with ANSI B16.5 cl. 150 and 300 RF flange (also ISO 7005)
- with EN 1092 flange (compatible with DIN 2526/7 form C).

Other versions may be supplied upon request.
The thermowell is marked near the process connection, in compliance with standard DIN 43772.
Figure 10 shows the basic dimensions of the flanges available from the sales structure (see paragraph "Ordering information" at the end of this document).



Type of flange	D (mm)	K (mm)	L (mm)	C (mm)
1” ANSI 150 RF	110	79.5	16	14.5
1” ANSI 300 RF	125	89	18	19.5
DN25 PN40 B1 EN 1092	115	85	14	16
DN40 PN40 B1 EN 1092	150	110	18	18
DN50 PN40 B1 EN 1092	165	125	18	20

Fig. 10: Basic dimensions of flanged connections

Probe

In the TC 15 the measuring probe is made up of a mineral oxide (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:

Diameter of the stem (mm)	Type of insert	Insert diameter	Extension neck	Insert length (mm)
24	TPC 100	6 mm	155 mm	IL = L+165
18		3 mm		
24		6 mm	165 mm	IL = L+175
18		3 mm		
24		6 mm	E	IL = L+E+10
18		3 mm		

Table 5: Insert dimensions

Attention! Thermowells with a diameter of 18 mm can be supplied with a maximum length (L) of 200 mm.
To order TC 15 without thermowell (head + neck + insert), an option in the blocks "Thermowell…" and "Tip…" has to be chosen as well, to define the extension neck connection (M14 or M18) to thermowell and the insert diameter (3 or 6 mm).
If ordered as spare part, the thermowell is called TW 15 (see the code of the relative TI at the end of the document).
The use of standard dimensions (extension neck and length of immersion) allows for the use inserts on sensors of different kinds and guarantees rapid delivery times; this allows our customers to reduce the amount of spare parts to be kept on stock.

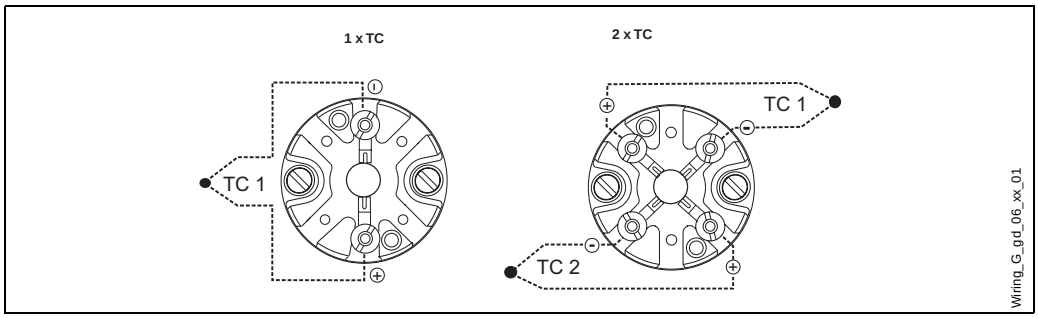


Fig. 11: Standard wiring diagrams (ceramic terminal block)

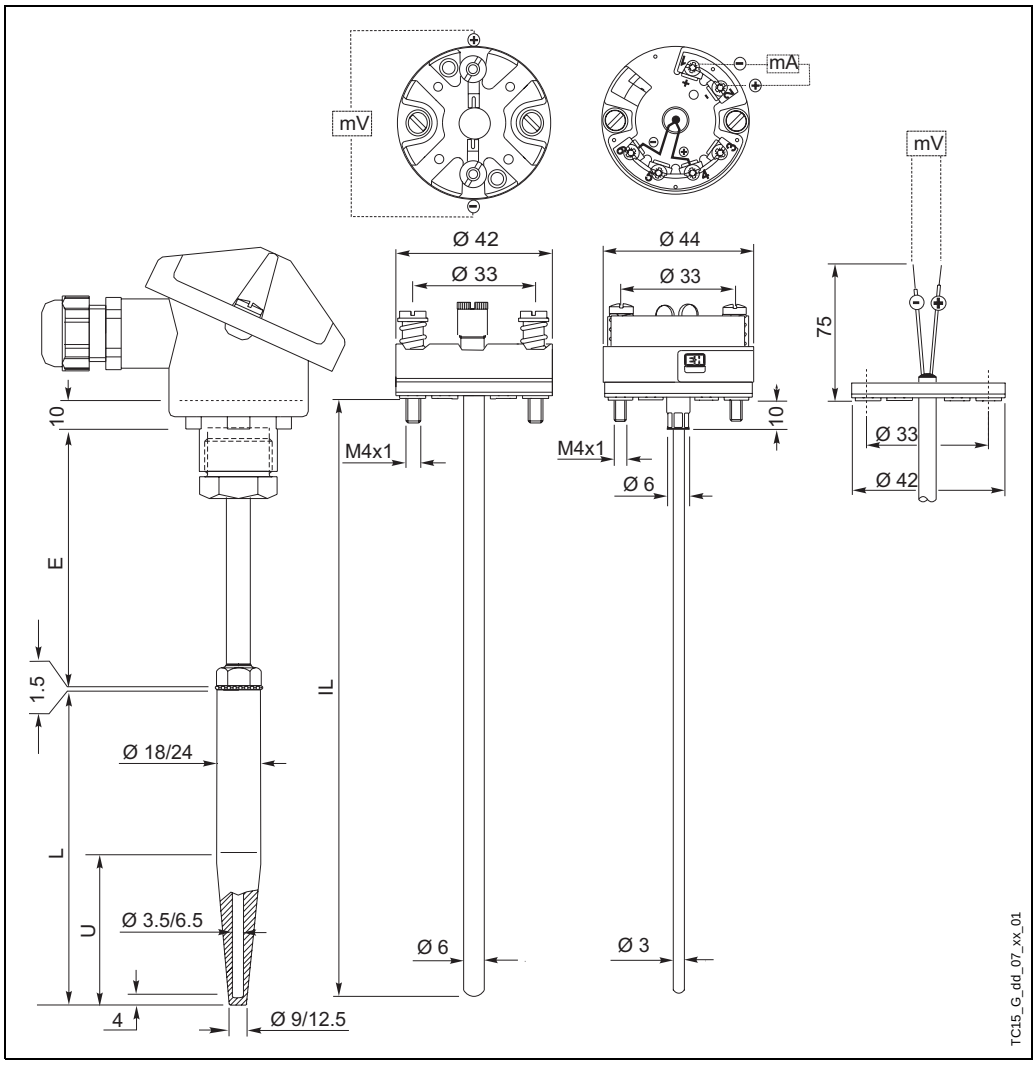


Fig. 12: Functional components

Certificates & Approvals

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 TC 15 destined for general use.

Material certification

The material certificate 3.1.B (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 semplified 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

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. Tests at different pressures can be carried out upon request.
The liquid penetrant test verifies the absence of crevices on the weldings of the thermowell.

Further details

Maintenance

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

Delivery time

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

Ordering information

Sales structure

TC15-	Safety (Ex) certification
	A No Ex certificate required

		Selection of combination
	1	Complete assembly
	2	Thermometer without thermowell with extension neck

			Housing material, cable entry, 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 Polyamide, 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

				Neck length E (60-250mm) SS 316Ti/1.4571
		1		155 mm extension neck E (only L = 110 mm)
		2		165 mm extension neck E
		8		... mm extension neck E to specify
		9		... mm special neck length E

					Thermowell diam. D, D1 and d, material finishing Ra < 1.6 µm
			0		Without thermowell, only inset
			A		D = 24 mm, SS 316Ti/1.4571, Ra <=1.6 µm
			B		D = 24 mm, 13CrMo4-5/1.7335, Ra <=1.6 µm
			C		D = 18 mm, SS 316Ti/1.4571, Ra <=1.6 µm
			D		D = 18 mm, 13CrMo4-5/1.7335, Ra <=1.6 µm
			1		D = 24 mm, SS 316Ti/1.4571, Ra <=0.8 µm
			2		D = 18 mm, SS 316Ti/1.4571, Ra <=0.8 µm
			Y		Special version

						Tip diameter D1, bore diameter d
				1		D1=12.5 mm, d=6.5 mm, (6 mm insert), (M18x1.5 neck/thermowell connection)
				2		D1=9 mm, d=3.5 mm, (3 mm inset), (M14x1.5 neck/thermowell connection)

							Lengths L, U, U1 (100-1000 mm)			
						A	110 mm= L,	U=65 mm,	U1=0 mm;	form 4
						B	110 mm= L,	U=73 mm,	U1=0 mm;	form 4
						C	140 mm= L,	U=65 mm,	U1=0 mm;	form 4
						D	170 mm= L,	U=133 mm,	U1=0 mm;	form 4
						E	200 mm= L,	U=125 mm,	U1=0 mm;	form 4
						F	200 mm= L,	U=65 mm,	U1=130 mm;	form 4F
						G	260 mm= L,	U=125 mm,	U1=190 mm;	form 4F
						H	410 mm= L,	U=275 mm,	U1=340 mm;	form 4F
						J	200 mm= L,	U=65 mm,	U1=0 mm;	form 4
						K	260 mm= L,	U=125 mm,	U1=0 mm;	form 4
						Y	... Special length L= ..., U= ..., U1= ..., on request			

								Flange type, std. finishing Ra 3.2-6.4 µm
							0	No flange selected (weld-in connection)
							1	1" ANSI 150 RF flange SS 316Ti (DN25 PN20 B ISO 7005)
							2	1" ANSI 300 RF flange SS 316Ti (DN25 PN50 B ISO 7005)
							A	DN25 PN40 B1 EN 1092 flange SS 316Ti (DIN 2526/7 form C)
							B	DN40 PN40 B1 EN 1092 flange SS 316Ti (DIN 2526/7 form C)
							C	DN50 PN40 B1 EN 1092 flange SS 316Ti (DIN 2526/7 form C)
							Y	Special version

									Terminal type or built-in trasmitter
								F	Flying leads
								C	Ceramic terminal block
								P	TMT181-A, programmable from … to …°C, PCP, 2-wire, isolated
								Q	TMT181-B, programmable from … to …°C, PCP ATEX, 2-wire, isolated
								R	TMT182-A, programmable from ... to ...°C, HART®, 2-wire, isolated

T	TMT182-B, programmable from ...to ...°C, HART® ATEX, 2-wire, isolated
S	TMT184-A, programmable, from ...to ...°C, PROFIBUS-PA®, 2-wire
V	TMT184-B, programmable, from ...to ...C, PROFIBUS-PA® ATEX, 2-wire
Y	Special version

TC type, sheath material, tolerance

A	1xTC type K	cl. 1/spc.	Inconel 600®/2.4816
B	2xTC type K	cl. 1/spc.	Inconel 600®/2.4816
E	1xTC type J	cl. 1/spc.	SS 316L/1.4404
F	2xTC type J	cl. 1/spc.	SS 316L/1.4404
Y	Special version		

TC reference standard, hot junction type

1	EN 60584 standard, hot jnction ungrounded
2	EN 60584 standard, hot jnction grounded
3	ANSI MC96.1 standard, hot jnction ungrounded
4	ANSI MC96.1 standard, hot jnction grounded
9	Special version

Material certification

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

Test on thermowell

0	Tests on the thermowell not requested
A	Hydrostatic internal pressure test on TW
B	Hydrostatic external pressure test on TW
C	Dye penetrant test on TW weldings
Y	Special version

TC15-	Complete order code

Sales structure

THT1	Model and version of the head transmitter						
	F11	TMT181-A	PCP	2-wire, isolated	programmable	from...to...°C	
	F21	TMT181-B	PCP	ATEX	2-wire, isolated	programmable	from...to...°C
	F22	TMT181-C	PCP	FM IS	2-wire, isolated	programmable	from...to...°C
	F23	TMT181-D	PCP	CSA	2-wire, isolated	programmable	from...to...°C
	F24	TMT181-E	PCP	ATEX II3G EEx-nA	2-wire, isolated	programmable	from...to...°C
	F25	TMT181-F	PCP	ATEX II3D	2-wire, isolated	programmable	from...to...°C
	L11	TMT182-A	HART®	2-wire, isolated	programmable	from...to...°C	
	L21	TMT182-B	HART®	ATEX	2-wire, isolated	programmable	from...to...°C
	L22	TMT182-C	HART®	FM IS	2-wire, isolated	programmable	from...to...°C
	L23	TMT182-D	HART®	CSA	2-wire, isolated	programmable	from...to...°C
	L24	TMT182-E	HART®	ATEX II3G EEx-nA	2-wire, isolated	programmable	from...to...°C
	L25	TMT182-F	HART®	ATEX II3D	2-wire, isolated	programmable	from...to...°C
	K11	TMT184-A	PROFIBUS-PA®	2-wire, isolated	programmable	from...to...°C	
	K21	TMT184-B	PROFIBUS-PA®	ATEX	2-wire, isolated	programmable	from...to...°C
	K22	TMT184-C	PROFIBUS-PA®	FM IS	2-wire, isolated	programmable	from...to...°C
	K23	TMT184-D	PROFIBUS-PA®	CSA	2-wire, isolated	programmable	from...to...°C
	K24	TMT184-E	PROFIBUS-PA®	ATEX II3G EEx-nA	2-wire, isolated	programmable	from...to...°C
	K25	TMT184-F	PROFIBUS-PA®	ATEX II3D	2-wire, isolated	programmable	from...to...°C
	YYY	Special transmitter					

		Application and services
	1	Assembled into position
	9	Special version

THT1-			Complete order code

Supplementary documentation

❑ TC thermometers Omnigrad TSC - General information	TI 090T/02/en
❑ Terminal housings - Omnigrad TA 20	TI 072T/02/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
❑ TC insert for temperature sensor - Omniset TPC 100	TI 278T/02/en
❑ Thermowell for temperature sensor - Omnigrad M TW 15	TI 265T/02/en
❑ E+H Thermolab - Calibration certificates for industrial thermometers. RTD's and thermocouples	TI 236T/02/en

Subject to modification

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