Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Technical Information

Omnigrad S TR66

RTD thermometer EEx-d or EEx-ia certified, replaceable insert, thermowell from bar stock, process connection: threaded or flanged PCP (4...20 mA), HART® or PROFIBUS-PA® electronics

Range of uses

The Omnigrad S TR66 is an RTD industrial thermometer with a inset (Pt100) and thermowell from bar stock.
It is developed for the use in the chemical, petrochemical and energy industries, but suitable also for other generic heavy duty applications.
In compliance to EN 50014/18/20 (ATEX certification) it is therefore particularly suitable also for hazardous areas.
When required, it's also available with a transmitter (PCP, HART® or PROFIBUS-PA®) into the housing.
The process connection of the thermowell is threaded or flanged in compliance to a wide variety of process requirements.

Application areas

- Chemicals industry
- Energy industry
- Gas Processing industry
- Petrochemical industry
- General industrial services

Features and benefits

- Several types of process connection
- Several type of materials available for the thermowells
- Customized immersion length
- Aluminium housing, with protection grade from IP66 to IP68
- Mineral oxide replaceable insulated insert (MgO), diameter 3 or 6 mm
- PCP, HART® and PROFIBUS-PA®, (4...20 mA 2-wire transmitters)
- The accuracy of the sensing element (Pt100) is: class A or 1/3 DIN B (IEC 60751) with electrichal connection to 2, 3 or 4 wires
- The sensing elements (Pt100) are available in wire-wound WW (range:-200...600°C) or thin-film TF (range:-50...400°C) with single or double Pt100 execution
- ATEX 1/2 GD EEx-ia certification
- ATEX 1/2 GD EEx-d certification
- ATEX 2 GD EEx-d certification

CE Ex

TI284T/02/en

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

The RTD (Resistance Temperature Detector), is a sensor where the electrical resistance varies with the tem perature. The material of the RTD is Platinum (Pt) with a value of the resistance (R), referred to a nominal value at the temperature of **0°C = 100,00** Ω (in compliance to rule IEC 60751; it is called Pt100). The very important is to define the RTD; it is defined with a standard **"α"** value measured between 0°C and 100°C.

This value is: α = **3.85 x 10^{-3} °C^{-1}.**

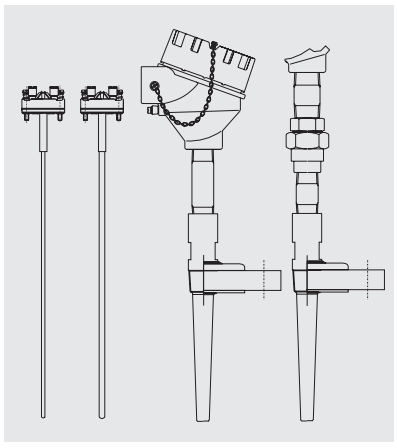
The temperature is measured indirectly by reading the voltage drop across the sensing resistor in the presence of a constant current flowing through it using Ohm's. The measuring current should be as small as possible to minimise possible sensor selfheating; normally this current is around 1mA, no higher.

The resistance value measured for each degree is about = **0,391 Ohm/K**; over 0°C it is opposite proportional at the temperature. The standard RTD connection at the plant instrument can be to 2, 3 or 4 wires to simple or double RTD element.

Equipment architecture

The construction of the TR66 temperature sensor is based on the following standards:

- EN 50014/18 (assembly)
- Neck (ASME style: nipple and 3 elements coupling)
- IEC 60751 (insert).
- Thermowells standard according to ASTM, DIN, and other customized std. (ESSO, ENI, MONTEDISON, ENEL, ...)



The housing is in painted aluminium alloy; it is suitable to contain a transmitter and/or the ceramic block of the inset; the "Ingress Protection" is: IP66 to IP68.

The neck is composed by one or two nipples and 3 elements coupling. It is the extension between the head and the thermowell.

The replaceable insert 3 or 6 mm diameter, is composed by MgO cable (SS 316L sheath) with a sensing element (Pt100 ohm/0°C) positioned at the MgO cable tip.

The standard electrical connection is to 2, 3 or 4 wires for sensing element (Pt100).

The thermowell is from bar stock, with execution, on wetted part, conical, straight or tapered.

The process connection on the thermowell is: threaded or flanged, in some case it can be to weld also.

Fig. 1: TR66 with the various types of process connections and end parts of the probe

Material & Weight

Housing	Insert	Neck	Thermowell	Weight
aluminium epoxy coated	sheath in SS 316L/1.4404	nipple and 3 union: SS 316/1.4401	thermowells: SS 316/1.4401, SS 316Ti /1.4571, (Hastelloy C276/2.4819, Monel® 400/2.4360, Inconel® 600/2.4816.)	From 1.5 to 5.0 kg for standard options

Performance

Operating conditions

Operating condition or test	Product type or rules	Value or data of test
Ambient temperature	housing (without head-mounted transmitter	-40÷130°C
	housing (with head-mounted transmitter)	-40÷85°C
Process temperature	Same of measurement range (see below).	
Process pressure (Maximum)	The pressure values that the thermowell can withstand at different temperatures, are shown in the following graphs, which can be used for some reference configurations	
Maximum flow velocity	The maximum flow rate tolerated by the thermowell decreases as the immersion length increases (U). The methods used to verify the resistance of thermowells with pressure, temperature and flow rate data can also be compliant with those indicated in standard ASME/ANSI PTC 19.3. For assistance on resistance tests, please contact the E+H Customer Service Department.	

Shock and vibration resistance test	RTD Inset in according to the rule IEC 60751:	Acceleration	3 g of peak
		Frequency	from 10Hz to 500Hz and back
		Time of the test	10 hours

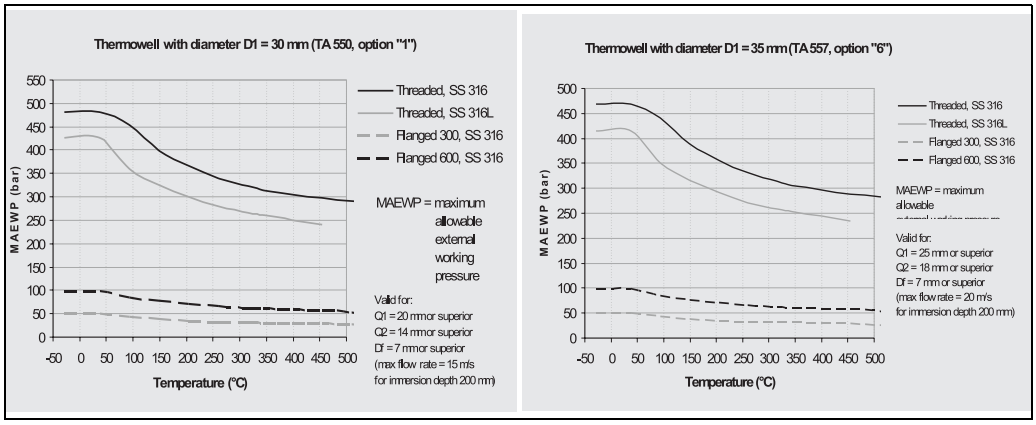
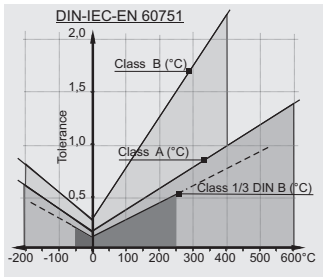


Fig. 2: Pressure/temperature grafic for thermowell from bar stock

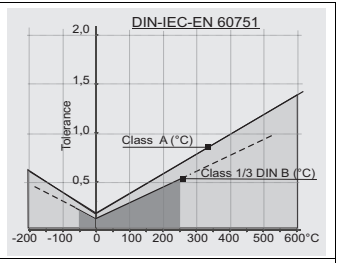
Accuracy

RTD maximum error type TF - Range: -50 to 400°C		
Cl. A	3σ = 0.15+0.0020|t| 3σ = 0.30+0.0050|t|	= -50…250°C = +250…400°C
Cl. 1/3 DIN B	3σ = 0.10+0.0017|t| 3σ = 0.15+0.0020|t| 3σ = 0.15+0.0020|t| 3σ = 0.30+0.0050|t|	= 0…100°C = -50...0 = 100...250°C = 250…400°C



±3σ = range including 99.7% of the readings. (|t|= absolute value of the temperature in °C).

RTD maximum error type WW - Range: -200 to 600°C		
Cl. A	3σ = 0.15+0.0020|t|	= -200…600°C
Cl. 1/3 DIN B	3σ = 0.10+0.0017|t| 3σ = 0.15+0.0020|t| 3σ = 0.15+0.0020|t|	= -50...250°C = -200...-50 = 250…600°C



±3σ = range including 99.7% of the readings. (|t|= absolute value of the temperature in °C).

Others errors	
Transmitter maximum error	See the corresponding documentation (codes at the end of the document)
Display maximum error	0.1% FSR + 1 digit (FSR = Full Scale Range)

The "4 wires" configuration, is provided as a standard connection for the single Pt 100's excludes additional errors in every condition. Generally in the "4 wires" configuration there is a higher guarantee of accurancy.

Response time

Tests, with the RTD insert, in water at 0.4 m/s (according to IEC 60751); from 23 to 33°C:

Stem diameter of the insert	Sensing element type	Time for 50% or 90% of temperature step	Response time
6 mm	TF / WW	t_{50}	3.5 s
		t_{90}	8.0 s
3 mm	TF / WW	t_{50}	2.0 s
		t_{90}	5.0 s

Insulation

Measurement Insulation type	Result
Insulation resistance between terminals and probe sheath	above 100 MΩ at 25°C
According to IEC 60751, test voltage 250 V	above 10 MΩ at 300°C

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

Installation

The TR66 can be installed on pipes or tanks by means of threaded or flanged connections. The counterparts for process connections and gaskets, when required, are not supplied with the sensor and must be purchased separately by the user. The immersion length must take into account all the parameters of the thermometer and the process to measure. 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. To prevent measuring errors of this kind, it is advisable to use thermowells with a small diameter and an immersion length of at least 100÷150 mm. In small section ducts the tubing's axis must be reached and preferibly slightly exceeded by the tip of the probe (see fig. 3A-3C). Insulation of the outer part of the sensor reduces the effect produced by a low immersion. Alternatively, it is also possible to adopt a tilted installation (see fig. 3B-3D).

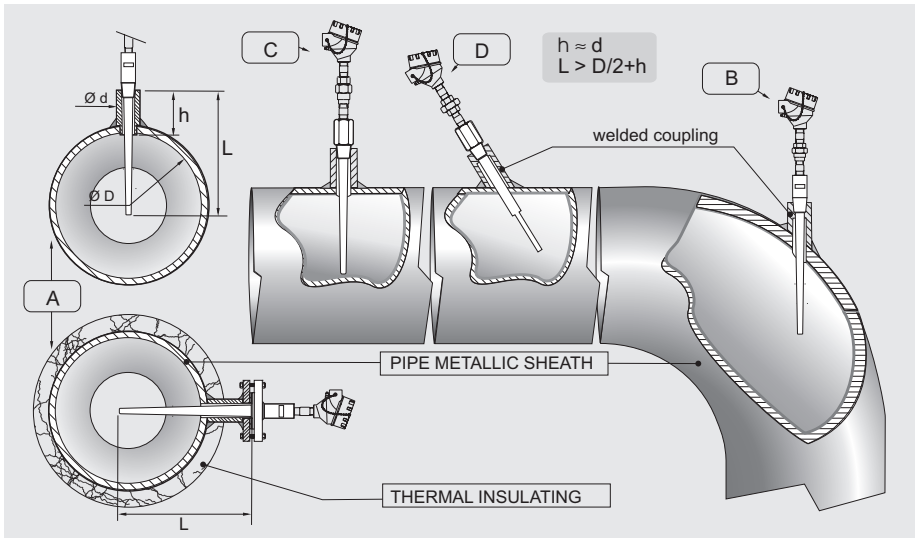


Fig. 3: Installation examples

For a best installation, in the industries, it's better to follow the rule: h ≃ d, L > D/2 + h. As far as corrosion is concerned, the base material for parts in contact with the fluid is able to withstand the most common corrosive agents up to the highest temperatures. For further information on specific applications, contact the E+H Customer Service Department. Disassembled components of the sensors must be reassembled with the recommended clamping torques in order to ensure the appropriate IP protection class within the sensor-housing coupling. In the case of vibrations the thin film sensing element Pt100 (TF) may offer advantages; the wire wound Pt100 (WW), besides having a larger measurement and accuracy range, guarantees greater long term stability.

System components

Housing

The protection housing, our "TA21H", commonly referred to the “connection head”, is used to contain and protect the terminal block or the transmitter and to join the electric connections to the mechanical component.

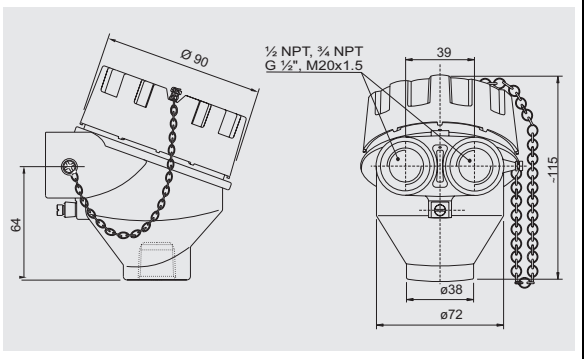


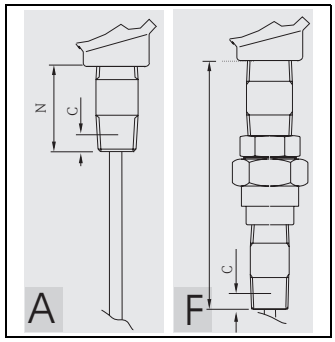
Fig. 4: Housing TA21H

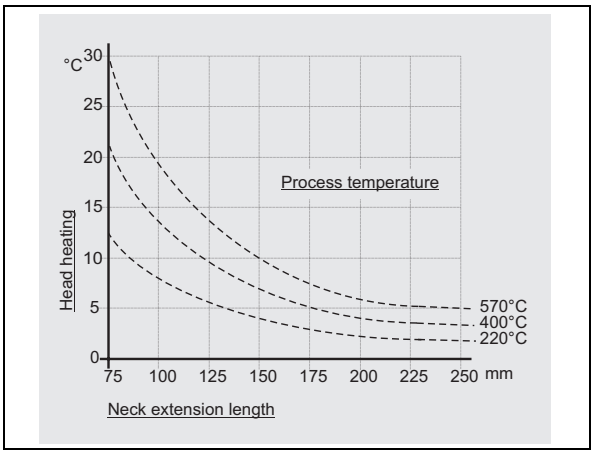
The TA21H used for the TR66 is compliant with EN 50014/18 and EN 50281-1-1, EN 50281-1-2 standards (EEx-d certification for explosion proof type of protection).
The matching of the head with the extension below the head and the cover (threaded) ensures a degree of protection from IP66 to IP68.
The head also has a chain to connect the body to the cover, which facilitates the use of the instrument during the maintenance on systems. The single or double threaded electrical cable entry can be: M20x1.5, 1/2” NPT or 3/4” NPT, G1/2".

Extension neck

A special extension is inserted between the husing and the thermowell connection, this part is calledneck. The neck is constituted by a tube assembled to hydraulic hardware (nipples or joints) that is suitable to allow the adjustment of the sensor to the thermowell.
In addition to the standard versions listed below, it is also possible to order the extension neck by specifying the desired length (see “Sales structure” chart at the end of this document). In the TR66 the standard lengths (N) and the versions of the extension neck can be selected among the following options:

Tp	Material	N length mm	Thread	C mm	Neck dwg type
N	SS 316/A 105	69	1/2" NPT M	8	A
N	SS 316/A 105	109	1/2" NPT M	8	A
NUN	SS 316/A 105	148	1/2" NPT M	8	F





As illustrated by the drawing in fig. 5, 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”.
Before choosing the connection, it is better to verify this graphic and therefore to choose a suitable extension to avoid the heating of the head.

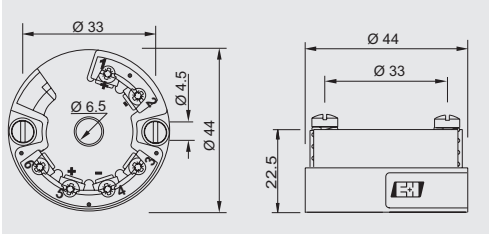
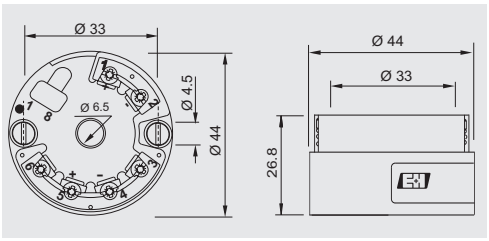
Fig. 5:Heating of the head caused by the process temperature

Electronic head transmitter

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 PC:

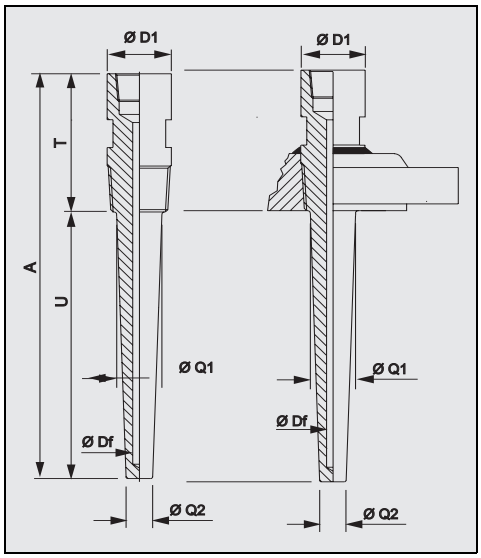
Head transmitter	Communication software
PCP TMT181	ReadWin® 2000
HART® TMT182	ReadWin® 2000, FieldCare, Hand held module DXR275, DXR375
PROFIBUS PA® TMT184	FieldCare

In the case of PROFIBUS-PA® transmitters, E+H recommends the use of PROFIBUS® dedicated connectors. The Weidmüller type 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). The customer may specify the configuration desired during the order phase.
The head-mounted transmitters available are:

Description	Dwg
TMT180 and TMT181:PCP 4…20 mA. The TMT180 and the TMT181 are PC programmable transmitters. The TMT180 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 TMT182 output consists of 4…20 mA and HART® superimposed signals. TMT182: Smart HART®.	
TMT184: PROFIBUS-PA®. For the TMT184, with PROFIBUS-PA® output signal, the communication address may be set via software or via mechanical dip-switch.	

Thermowell

The thermowell is the component of the TR66 that must tolerate most of the mechanical stress transmitted by the process.
It is made from a round bar and supplied in different materials and dimensions, according the chemical/physical characteristics of the process: corrosion, temperature, pressure and speed of the fluid.



The thermowell consists of three parts:
- the extension neck (indicated as T), usually with a cylindrical shape (and standard diameters of 30 or 35 mm and lengths of 70/100 mm), represents the external part of the thermowell and is connected with the head of the probe by means of a neck (usually a nipple)
- the immersed part (identified as U), with a conical or cylindrical shape (the standard diameter of the area below the fitting is 20 or 25 mm), is situated next to the process connection in direct contact with the process fluid
- the threaded or flanged process connection represents the part inserted between the extension and the immersed part and guarantees the mechanical and hydraulic sealing of the thermometer and plant.

The external finishing of the thermowell stem is available with a standard value of Ra = 1.6 μm (different finishes are available on request).

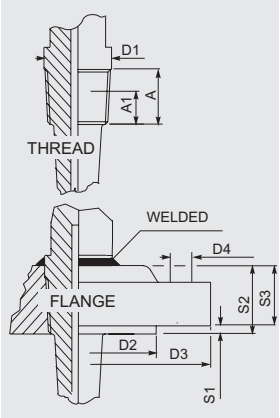
Fig. 6:Thermowell with threaded or flanged process connection

Warning:
The total standard length (A) of the thermowell must never exceed 1200 mm (that represents the maximum drilling limit; higher lengths are available only on request).

Process connection

The standard process connections are threaded or flanged. When the process connection is threaded the material of connection is the same at the thermowell instead, when the process connection is flanged the material can be different: SS 316/1.4401or ASTM A105/St 52.3 U standard material.
When it is necessary to have a flange in special material, more resistant at the corrosion (example Hastelloy C276), it is cheaper to choose an economic version composed by a flange in SS316/1.4401 with on wetted part platted a disk in Hastelloy C276/2.4819 (this solution is very less expensive).

Type	Thread or Flange	Ø D1	Ø D2	Ø D3	Ø D4	D4 Nr	S1	S2	S3	A	A1
Flange	1" ANSI 150 RF SO	//	50,8	107,9	15,9	4	1,6	17,5	//	//	//
Flange	1" ANSI 300 RF SO	//	50,8	123,8	19,0	4	1,6	27,0	//	//	//
Flange	1" ANSI 600 RF SO	//	50,8	123,8	19.0	4	6,4	//	27,0	//	//
Flange	1" 1/2 ANSI 150 RF SO	//	73,0	127,0	15,9	4	1,6	22,2	//	//	//
Flange	1" 1/2 ANSI 300 RF SO	//	73,0	155,6	22,2	4	1,6	30,2	//	//	//
Flange	1" 1/2 ANSI 600 RF SO	//	73,0	155,6	22.2	4	6,4	//	31,7	//	//
Flange	2" ANSI 300 RF SO	//	92,1	165.1	19,0	8	1,6	33,3	//	//	//
Flange	2" ANSI 600 RF SO	//	92,1	165,1	19,0	8	6,4	//	36,5	//	//
All the dimension are in "mm"											
Thread	1/2" NPT	≥ 21,4	//	//	//	//	//	//	//	19,9	8,1
Thread	3/4" NPT	≥ 26,7	//	//	//	//	//	//	//	20,2	8,6



Type and dimention of the process connections (ANSI B16.5, ANSI B2.1) and drawings
On request, it is possible to select also different materials, finishings and connections.

Probe

The measuring probe (generally Pt 100) of sensor TR66 consists of a 3 or 6 mm diameter thermometric insert (TPR100 for general purpose and intrinsecally safe model, or TPR300 for explosion-proof model) whose stem is made in compressed MgO with SS 316L sheath.
Both of the probe are made in mineral insulated cable (MgO), with sheath in AISI316/1.4401.
The Immersion length (U) of the sensor can be chosen within a standard range from 50 to 1000 mm (see "Warning" in the "thermowell" section).
The sensors with a Immersion length U > 1000 mm can be supplied after a technical verification of the specific applications from our technical office in the E+H Customer Service Department.

For replacement of the insert, it is necessary to refer the following table to have the IL (applicable only to standard thickness well bottoms). The immersion length of the insert spare part (IL) is calculated adding the total length of the thermowell (A = U + T) and the length of neck (N) used.

General purpose or ATEX certified assembly						
Insert general purpose	**Ø, ..mm**	**N , tp.**	**N, mm**	**N, material**	**N, thread**	**IL, (mm)**
TPR100 / TPR300	3 or 6	N	69	A105/SS316	1/2"NPT M	IL = U+T+ 69 + 41
TPR100 / TPR300	3 or 6	N	109	A105/SS316	1/2"NPT M	IL = U+T+ 109 + 41
TPR100 / TPR300	3 or 6	NUN	148	A105/SS316	1/2"NPT M	IL = U+T + 148 + 41

Although the wiring diagram of single Pt100s is always supplied with 4 wires configuration, the connection of a trasmitter is executed with 3 wires as well, by avoiding to connect whichever of the terminals (fig. 7).
The configuration Pt100 double with 2 wires is only available for the ATEX certified inserts.

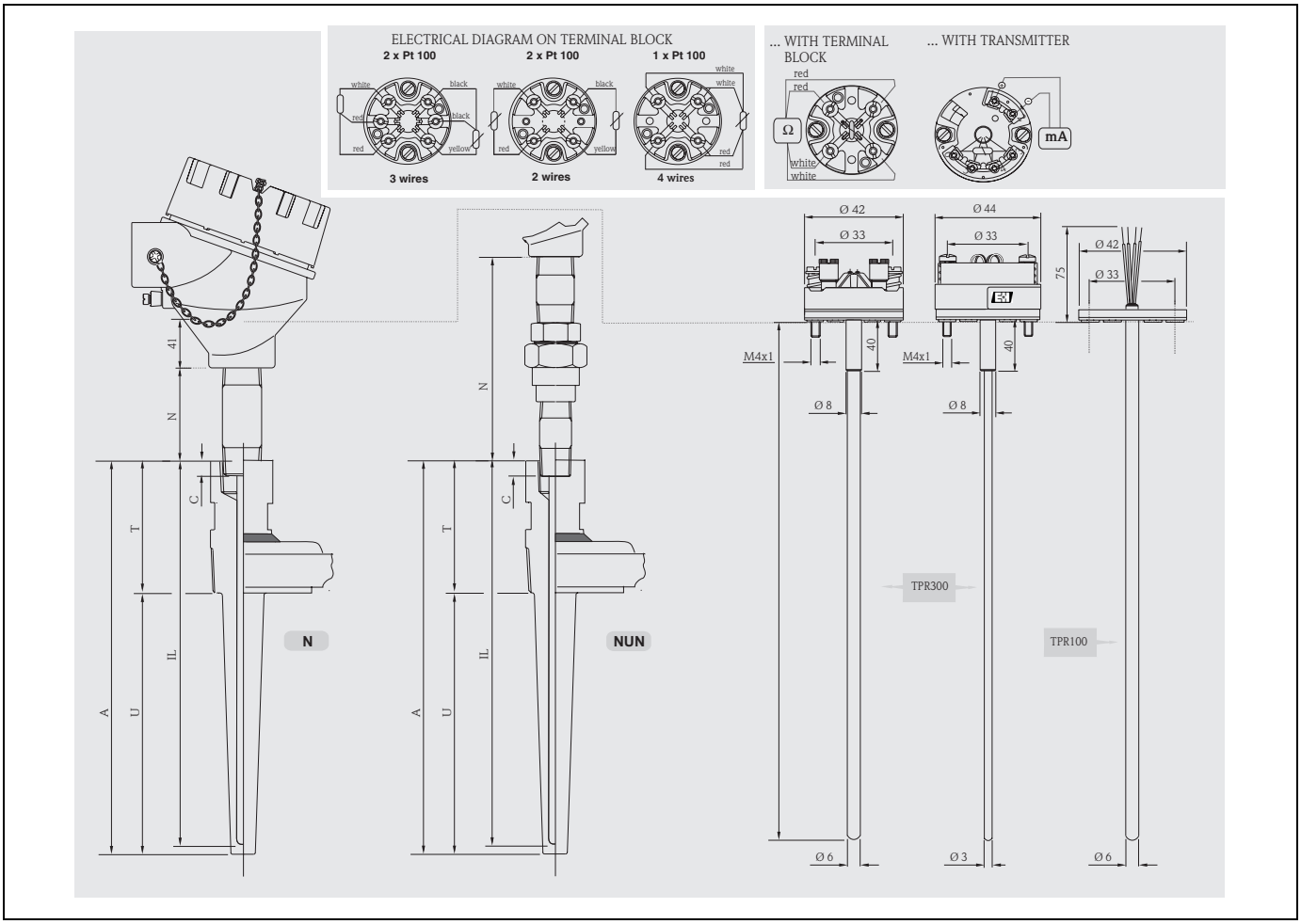


Fig. 7: Functional components, standard electrical diagrams (ceramic terminal block)

Certificates & approvals

Ex approval

- ATEX Certificate CESI 05ATEX038 for explosion proof type of protection: ATEX II 2 GD EEx-d IIC T6..T5 T85°...T100°C, ATEX II 1/2 GD EEx-d IIC T6..T5 T85°...T100°C. The TR66 is CE marked.
- ATEX Certificate KEMA 01ATEX1169 X for intrinsecaly safe type of protection: 1GD or 1/2 GD EEx-ia IIC T6...T1 T85...450°C. The TR66 is CE marked.

With regards to the NAMUR NE 24 certificate and the Manufacturer's Declaration according to the standard EN 50018, EN 50020, EN 50281-1-1, EN 50281-1-2, 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 according to PED Directive is not requested.

Material certification

The material certificate EN 10204 3.1 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 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 ASME PTC 19.3.
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 use in Ex Zones, are always tested to pressure according to the same criterions.

Further details

Maintenance

The Omnigrad S TR66 thermometers do not require any specific maintenance.
In the case of ATEX certified components (transmitter, insert or thermowell) please refer to the corresponding specific relevant documentation (at the end of the document).

Ordering information

Sales structure

TR66-	**Omnigrad S TR66. RTD thermometer** Thermometer with bar stock thermowell. Replaceable mineral insulated inset, spring loaded in terminal head, IP66 connection with epoxy coating. Two operating and measurement ranges: from -50 to 400°C (with TF); -200 to 600°C (with WW)						
	Approval:						
	A	Non-harzarus area					
	C	*ATEX II 1/2 GD EEx ia IIC					
	E	*ATEX II 2 GD EEx d IIC					
	M	*ATEX II 1/2 GD EEx d IIC					
		Head, material, IP grade					
		A	TA21H Alu. epoxy coating, , IP66				
		Y	Special version, to be specified				
			Cable entry				
			A	1 x 1/2 NPT			
			B	2 x 1/2 NPT			
			C	1 x 3/4 NPT			
			D	2 x 3/4 NPT			
			E	1 x M20 x1,5			
			F	2 x M20 x1,5			
			Y	Special version, to be specified			
				Neck length N; Material; Fitting			
				B	69 mm, SS 316, N, 1/2"NPT M		
				C	109 mm, SS 316, N, 1/2"NPT M		
				E	148 mm, SS 316, NUN, 1/2"NPT M		
				F	69 mm, A105, N, 1/2"NPT M		
				G	109 mm, A 105, N, 1/2"NPT M		
				J	148 mm, A 105, NUN, 1/2"NPT M		
				Y	Special version, to be specified		
					Thermowell material:		
					B	SS 316Ti	
					C	SS 316	
					D	SS 316L	
					Y	Special version, to be specified	
						Extension T; D1; Df; Q1; Q2	
						1	70 mm, 30 mm, 7 mm, 20 mm, 14 mm,
						2	75 mm, 35 mm, 7 mm, 24 mm, 14 mm,
						6	100 mm, 35 mm, 7 mm, 25 mm, 14 mm,
						9	Special version, to be specified

Insertion Length IL:	
X	mm
Y	Special version, to be specified

Process connection:	
11	thread 1/2" NPT - M
22	thread 3/4" NPT - M
CA	1" ANSI 150 RF SO, A105
CB	1" ANSI 150 RF SO, 316
CC	1" ANSI 300 RF SO, A105
CD	1" ANSI 300 RF SO, 316
CE	1" ANSI 600 RF SO, A105
CF	1" ANSI 600 RF SO, 316
CG	1"1/2 ANSI 150 RF SO, A105
CH	1" 1/2 ANSI 150 RF SO, 316
CI	1" 1/2 ANSI 300 RF SO, A105
CK	1" 1/2 ANSI 300 RF SO, 316
CL	1" 1/2 ANSI 600 RF SO, A105
CM	1" 1/2 ANSI 600 RF SO, 316
CQ	2" ANSI 300 RF SO, A105
CS	2" ANSI 600 RF SO, A105
CT	2" ANSI 300 RF SO, 316
CV	2" ANSI 600 RF SO, 316
YY	Special version, to be specified

Head transmitter; Range:	
F	Flying leads
C	Terminal block
2	TMT180-A21 fix; 0.2K, from..to..°C, span limit -200/650°C
3	TMT180-A22 fix; 0.1K, from..to..°C, span limit -50/250°C
4	TMT180-A11 prog.; 0.2K, from..to..°C, span limit -200/650°C
5	TMT180-A12 prog.; 0.1K, from..to..°C, span limit -50/250°C
P	TMT181-A, PCP, from...to...°C, 2-wire, isolated
Q	TMT181-B, PCP ATEX, from...to...°C, 2-wire, isolated
R	TMT182-A, HART®, from...to...°C, 2-wire, isolated
T	TMT182-B, HART® ATEX, from...to...°C, 2-wire, isolated
S	TMT184-A, Profibus PA®, from...to...°C, 2-wire, isolated
V	TMT184-B, Profibus PA® ATEX, from...to...°C, 2-wire, isolated
1	THT1 separate item

RTD Class; Wiring	
3	1 x Pt100 TF, cl. A, range: -50/400°C; 4-wire
7	1 x Pt100 TF, cl. 1/3 DIN B, range: -50/400°C; 4-wire
B	2 x Pt100 WW, cl. A, range: -200/600°C; 3-wire
C	1 x Pt100 WW, cl. A, range: -200/600°C; 4-wire
D	2 x Pt100 WW, cl. A, range: -200/600°C; 2-wire
F	2 x Pt100 WW, cl. 1/3 DIN B, range: -200/600°C; 3-wire
G	1 x Pt100 WW, cl. 1/3 DIN B, range: -200/600°C; 4-wire
Y	Special version, to be specified

Additional options	
0	Not needed
Y	Special version, to be specified

TR66-	**⇐ Order code (complete)**

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	
	A21	TMT180-A21 fixed range, accuracy 0.2 K, span limit -200...650°C, from...to...°C	
	A22	TMT180-A22 fixed range, accuracy 0.1 K, span limit -50...250°C, from...to...°C	
	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 II3D, 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 II3D, 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, programmable from...to...°C	
	K21	TMT184-B PROFIBUS-PA® ATEX, 2-wire, programmable from...to...°C	
	K22	TMT184-C PROFIBUS-PA® FM IS, 2-wire, programmable from...to...°C	
	K23	TMT184-D PROFIBUS-PA® CSA, 2-wire, programmable from...to...°C	
	K24	TMT184-E PROFIBUS-PA® CSA, 2-wire, 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-			**⇐ Order code (complete)**

Supplementary documentation

❑ Brochure Field of activities – Temperature measurement	FA006T/09/en
❑ Temperature head transmitter iTEMP® Pt TMT180	TI 088R/09/en
❑ Temperature head transmitter iTEMP® PCP TMT181	TI 070R/09/en
❑ Temperature head transmitter iTEMP® HART® TMT182	TI 078R/09/en
❑ Temperature head transmitter iTEMP® PA TMT184	TI 079R/09/en
❑ RTD insert for temperature sensors – Omniset TPR 100	TI 268T/02/en
❑ RTD insert for temperature sensors – Omniset TPR 300	TI 290T/02/en
❑ Safety instructions for use in hazardous areas (TPR100)	XA 003T/02/z1
❑ Industrial thermometers, RTD and thermocouples	TI 236T/02/en

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