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

Technical Information

Omnigrad S TR62

RTD thermometer EEx-d or EEx-ia certified, replaceable inset , complete of niple and union to thermowell connection
PCP (4...20 mA), HART® or PROFIBUS-PA® electronics

Range of uses

The Omnigrad S TR62 is an RTD industrial thermometer, developed for heavy duty and/or generic industrial applications.
In compliance to EN 50014/18 (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 TR62 is available in several standard versions and different configurations, can also be configured with specific dimensions and characteristics depending on process requirements.
The installation on the plants, require separately order of the thermowell (form pipe or from bar-stock).

Application areas

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

Features and benefits

- Customized immersion length
- Aluminium housing, with protection grade from IP66 / IP 68
- PCP, HART® and PROFIBUS-PA®, (4...20 mA 2-wire transmitters)
- Thermoresistance insert insulated with mineral oxide cable (MgO cable) diameter: 3 or 6 mm
- Pt100 sensing element with accuracy in class A or 1/3 DIN B (IEC 60751)
- The Pt100 available are: wire-wound WW (-200...600°C) or thin-film TF (-50...400°C)
- Single or double Pt100 to 2,3 or 4 wires connection
- ATEX II 1/2 GD EEx-ia IIC certification
- ATEX II 2 G EEx-d IIC certification

CE Ex

TI281T/02/en
71098796

Endress+Hauser
People for Process Automation

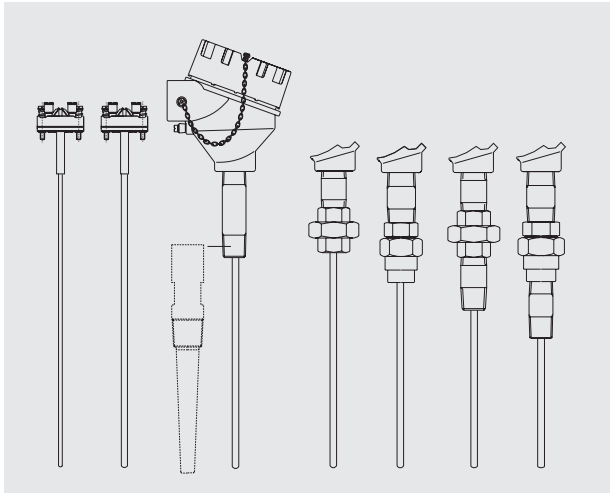
Function and system design

Measuring principle

The RTD (Resistance Temperature Detector), is a sensor where the electrical resistance varies with the temperature. 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 DIN 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 Omnigrad S TR62 temperature sensor is based on the following standards:
- EN 50014/18 (assembly)
- Neck (ASME style: nipple and 3 elements coupling)
- IEC 60751 (insert).



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).

Fig. 1: TR62 with the various types of thermowell connections and end parts of the probe

Material & Weight

Housing	Insert	Extension neck	Weight
aluminium epoxy coated	sheath in SS 316L/1.4404	SS 316/1.4401 or ASTM A105	From 0,5 to 1.0 kg for standard options

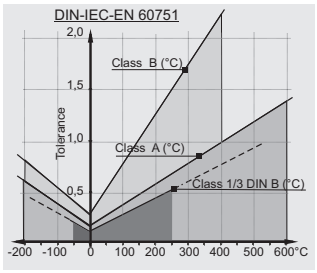
Performance

Operating conditions

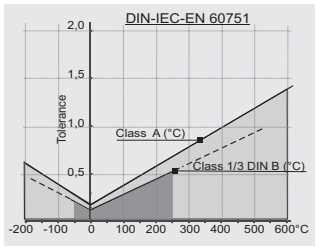
Operating condition or test	Product type or rules		Value or data of test
Ambient temperature	housing (without head-mounted transmitter)		-40÷130°C
	housing (with head-mounted transmitter)		-40÷85°C
Shock and vibration resistance test	RTD Inset in according to the rule IEC 60751	Acceleration	3 g of peak
		Frequency	from 10Hz to 500Hz and back
		Time of the test	10 hours

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, 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 step changes:

Stem diameter of the insert	Pt100 type	$t_{(x)}$	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 Omnigrad S TR62 thermometers can be installed on pipes or tanks by means of threaded or flanged thermowell connections. 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 thermometer with a small diameter on well and an immersion length (**L**) of at least 80÷100 mm.
In small section ducts the tubing's axis must be reached and preferibly slightly exceeded by the tip of the probe (see fig. 2A-2C).
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. 2B-2D).
For a best installation, in the industries, it's better to follow the rule: h ≃ d, L > D/2 + h.

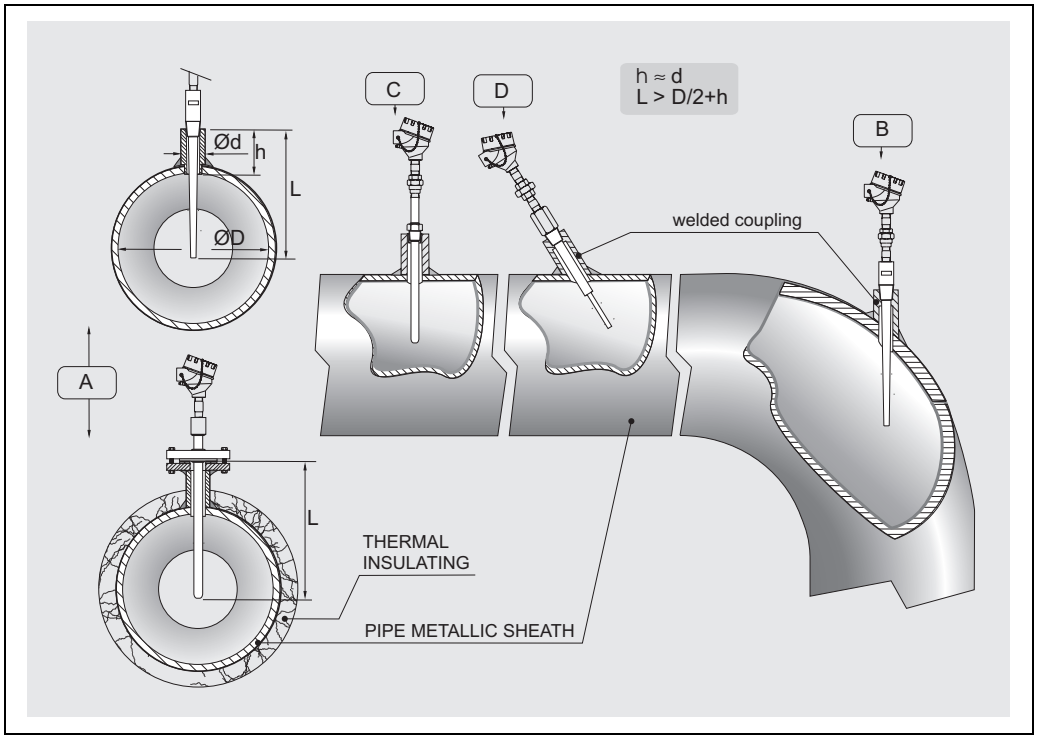


Fig. 2: Installation examples

With regard to corrosion, the base material of the wetted parts (SS 316L, SS 316Ti, Hastelloy C) can tolerate the common corrosive media right 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 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.

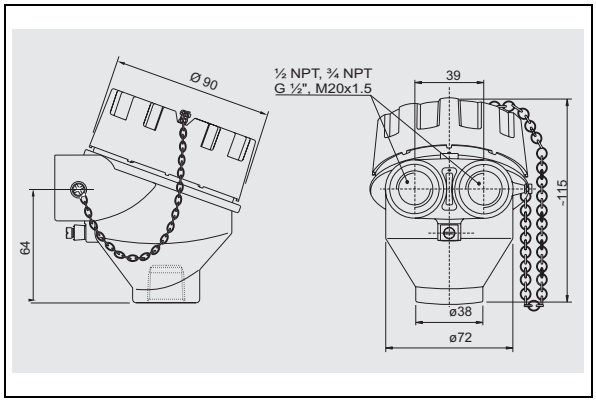


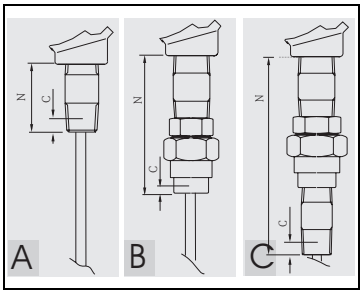
Fig. 3: Housing TA21H

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 housing and the thermowell connection, this part is called: neck. 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 TR62 the standard lengths (N) and the versions of the extension neck can be selected among the following options:

Type	Material	Length N (mm)	Thread	C (mm)	Neck draw
N	316/A105	77	1/2" NPT M	8 (male)	A
N	316/A105	117	1/2" NPT M	8 (male)	A
NU	316/A105	104	1/2" NPT F	8 (female)	B
NUN	316/A105	156	1/2" NPT M	8 (male)	C



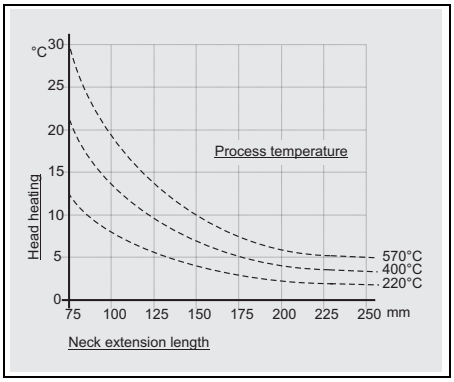


Fig. 4:Heating of the head caused by the process temperature

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.

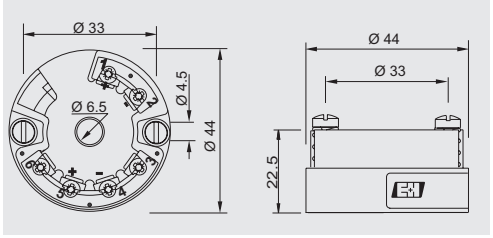
Electronic head transmitter

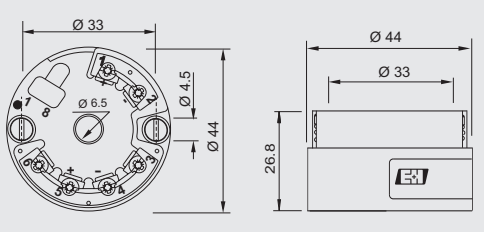
The required type of output signal can be obtained by choosing the correct head mounted transmitter. Endress+Hauser supplies "state-of-the-art" transmitters (the iTEMP® series) built in 2-wire technology and with 4…20 mA output signal, HART® or PROFIBUS-PA®. All of the transmitters can be easily programmed 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®.	

Description	Dwg
TMT184: PROFIBUS-PA®. For the TMT184, with PROFIBUS-PA® output signal, the communication address may be set via software or via mechanical dip-switch.	

Probe

The measuring probe (generally Pt 100) of sensor TR62 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.
To improve heat transmission, the insert tip is pushed, by means of a spring system, to the inside bottom of the thermowell (to order separately).
The length of the sensor can be chosen within a range from 50 to 5000 mm.
Sensors with a length above 5000 mm can also be ordered and supplied after a technical analysis of the application (max length 30.000 mm).
The immersion length (ML) must be calculated according to the total length of the thermowell (A) and the type of thermowell used. Also if spare part inserts are necessary, consult the table below (applicable to standard thickness well bottoms).

General purpose or ATEX certified assembly						
Insert	**Ø, ..mm**	**N , tp.**	**N, mm**	**N, material**	**N, thread**	**IL, (mm)**
TPR100 / TPR300	3 or 6	N	77	SS 316/A105	1/2"NPT M	IL = ML + 77 + 33
TPR100 / TPR300	3 or 6	N	117	SS 316/A105	1/2"NPT M	IL = ML + 117 + 33
TPR100 / TPR300	3 or 6	NU	104	SS 316/A105	1/2"NPT F	IL = ML + 104 + 33
TPR100 / TPR300	3 or 6	NUN	156	SS 316/A105	1/2"NPT M	IL = ML + 156 + 33

Although the wiring diagram of single Pt100s is always supplied with 4 wires configuration, the connection of a transmitter can be executed with 3 wires as well, by avoiding to connect whichever of the terminals (fig. 5).
The configuration Pt100 double with 2 wires is only available for the ATEX intrinsically safe certified inserts.

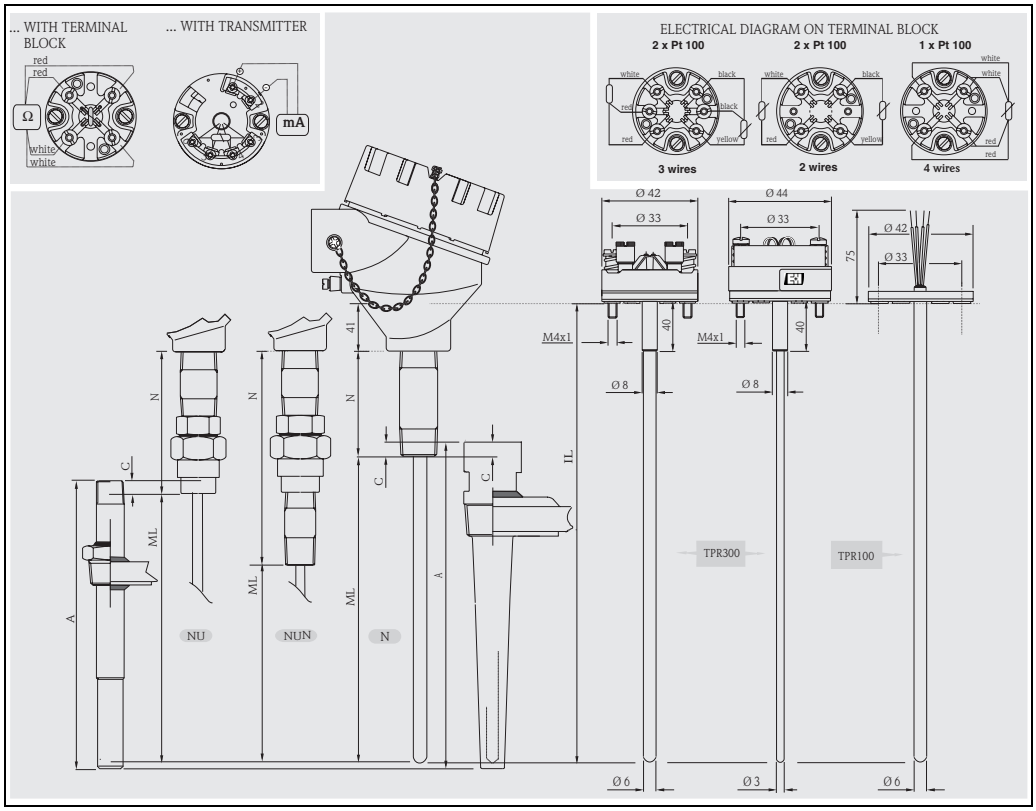


Fig. 5: Functional components and standard electrical diagrams (ceramic terminal block and transmitter)

Certificates & approvals

Ex approval

- ATEX Certificate CESI 05ATEX038 for explosion proof type of protection: ATEX II 2 G EEx-d IIC T6..T5 T85°...T100°C. The TR62 is CE marked.
- ATEX Certificate KEMA 01ATEX1169 X for intrinsically safe type of protection: 1GD or 1/2 GD EEx-ia IIC T6...T1 T85...450°C. The TR62 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.

Further details

Maintenance

The Omnigrad S TR62 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

TR62-	Omnigrad S TR62 RTD thermometer Thermometer complete of nipple without 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-hazardous area
C	*ATEX II 1/2 GD EEx ia IIC
F	*ATEX II 2 G EEx d IIC

Head, material, IP grade

A	TA21H, Aluminium 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	77 mm, SS 316, N, 1/2"NPT M
C	117 mm, SS 316, N, 1/2"NPT M
D	104 mm, SS 316, NU, 1/2"NPT F
E	156 mm, SS 316, NUN, 1/2"NPT M
F	77 mm, A 105, N, 1/2"NPT M
G	117 mm, A 105, N, 1/2"NPT M
H	104 mm, A 105, NU, 1/2"NPT F
J	156 mm, A 105, NUN, 1/2"NPT M
Y	Special version, to be specified

Insert diameter; Material (price for 100 mm of ML)

3	6 mm MgO: SS316L
9	Special version, to be specified

Insertion length ML

X	... mm
Y	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
											1 Complete with thermowell, separate item
											Y Special version, to be specified

TR62-												⇐ **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	TI088R/09/en
❑ Temperature head transmitter iTEMP® PCP –TMT181	TI070R/09/en
❑ Temperature head transmitter iTEMP® HART® –TMT182	TI078R/09/en
❑ Temperature head transmitter iTEMP® PROFIBUS-PA® –TMT184	TI079R/09/en
❑ RTD insert for temperature sensors – Omniset TPR100	TI268T/02/en
❑ RTD insert for temperature sensors – Omniset TPR300	TI290T/02/en
❑ Safety instructions for use in hazardous areas (TPR100)	XA003T/02/z1
❑ Industrial thermometers, RTD and thermocouples	TI236T/02/en

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