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Technical Information

Omnigrad S TC62

Thermocouple thermometer EEx-d certified, replaceable inset, complete from nipple and union to thermowell connection.

PCP (4...20 mA), HART® or PROFIBUS-PA® electronics



Range of uses

The Omnigrad S TC62 is an industrial thermometer (thermocouple TC: K or J) with a replaceable inset and a neck without thermowell.

It is developed for heavy duty and/or generic industrial applications, assembled with a thermowell from bar stock or pipe.

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 TC62 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 to IP68
- Thermocouple with hot junction grounded or ungrounded in mineral oxide cable (MgO cable) diameter: 3 or 6 mm
- PCP, HART® and PROFIBUS-PA®, (4...20 mA 2-wire transmitters)
- The accuracy of the thermocouple TC (K (NiCr-Ni) and J (Fe-CuNi)) are:
Cl. 1 - 2 (EN 60584) or Cl. Special - Standard (ANSI MC96.1)
- The thermocouple TC (K or J) are available in single or double element
- ATEX II 2 GD EEx-d IIC certification



Function and system design

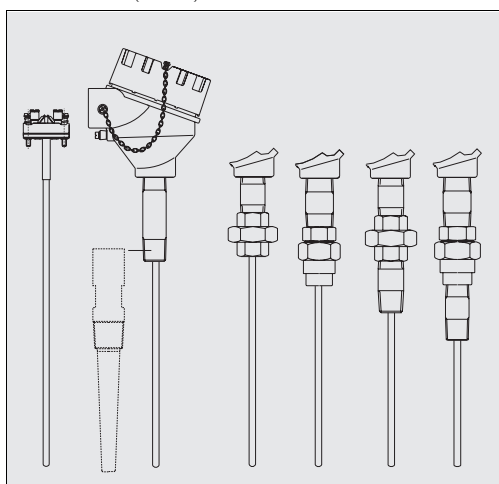
Measuring principle

The thermocouple (TC) 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 an 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 EN 60584 and ANSI MC96.1.

Equipment architecture

The construction of the TC62 temperature sensor is based on the following standards:

- EN 50014/18 (housing)
- Neck (Nipple and 3 elements)
- EN 60584 (insert).



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

The neck composed by one or two nipple and one "3 union", standard or EEx- execution, it is the extension between the head and the thermowell on the process. The replaceable insert is placed inside the thermowell; the insert is spring loaded to its base in order to improve heat transfer.

The hot junction of the thermocouple (type K or J) are positioned close to the tip of the probe. The thermocouple is available in two versions: grounded or ungrounded hot junction. The electrical structure of the thermocouple always complies with EN 60584/61515 or ANSI MC96.1/ASTM E585 standard rules.

Fig. 1: TC62 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 Inconel®600/2.4816	SS 316/1.4401 or 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
Process temperature	It is restricted by the thermowell material:	< 600°C
		< 800°C
		< 1100°C
		SS 316L/1.4404 SS 316Ti/1.4571 Hast.® C276/2.4819 - Inc.600®/2.4816
Process pressure (Maximum)	The pressure values to which the thermowell can be subjected at the various temperatures. Example: for 9 mm diameter pipes, with a limited flow velocity, the maximum tolerated pressures are the following:	50 bar to 20°C 33 bar to 250°C 24 bar to 400°C
Maximum flow velocity	The highest flow velocity, (of the stream or of the fluid), tolerated by the thermowell, diminishes with increasing lengths, of the thermowell/probe exposed.	
Shock and vibration resistance test	TC Inset in according to the rule IEC 60751:	Acceleration
		Frequency
		Time of the test
		3 g of peak from 10Hz to 500Hz and back 10 hours

Accuracy

Thermocouple and range °C	EN 60584				
	Class	Max deviation	Class	Max deviation	Cable colors
J (Fe-CuNi) -40° ... 750°C	2	+/-2.5°C (-40...333°C) +/-0.0075 Itl (333...750°C)	1	+/-1.5°C (-40...375°C) +/-0.004 Itl (375...750°C)	+ black - white
K (NiCr-Ni) -40 ... 1200°C	2	+/-2.5°C (-40...333°C) +/-0.0075 Itl (333...1200°C)	1	+/-1.5°C (-40...375°C) +/-0.004 Itl (375...1000°C)	+ green - white
Itl = absolute temperature value in °C					

Thermocouple and range °C	ANSI MC96.1				
	Class	Max deviation	Class	Max deviation	Cable colors
J (Fe-CuNi) 0 ...750°C	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) 0...1250°C	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
Itl = absolute temperature value 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)

Response time

Tests, with the TC 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	Temperature of test	Response time
SS 316 - d. 6 mm	K (NiCr-Ni), J (Fe-CuNi)	t ₅₀	2,5 s
		t ₉₀	7,0 s

Insulation

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

Self heating

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

Installation

The Omnigrad S TC62 thermometers can be installed on pipes or tanks by means of threaded or flanged 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 $80 \div 100$ mm, preferably (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).

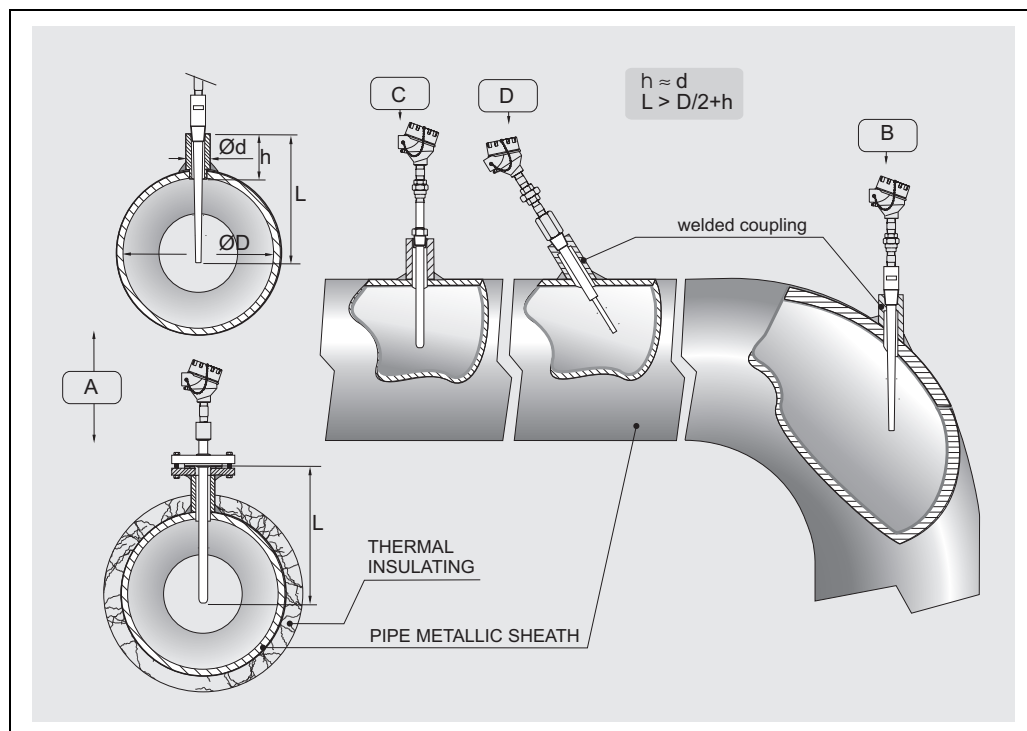


Fig. 2: Installation examples

For a best installation, in the industries, it's better to follow the rule: $h \approx d$, $L > D/2 + h$.

With regard to corrosion, the base material of the wetted parts (SS 316L, SS 316Ti, Hastelloy® C276 or Inconel®600) 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.

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.

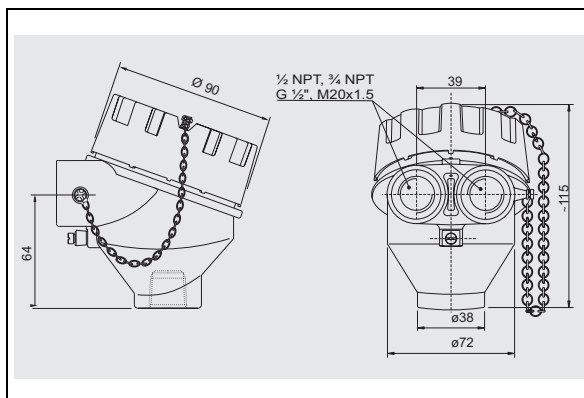


Fig. 3: Housing TA21H

The TA21H used for the TC62 is compliant with EN 50014/18 and EN 50281-1-1, EN 50281-1-2 standards (Ex-d certification for explosion proof type of protection).

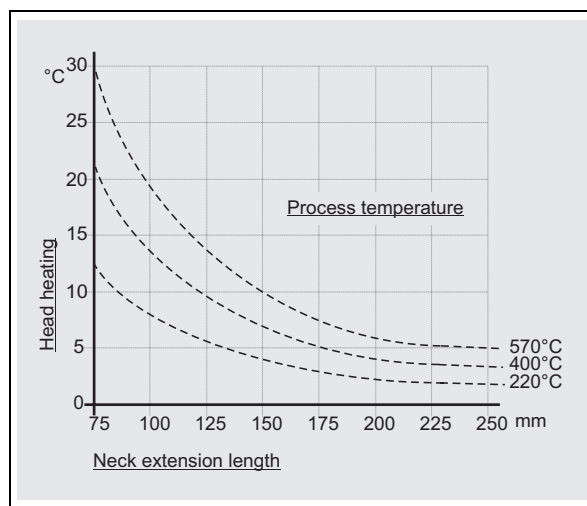
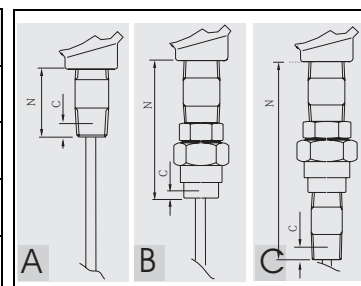
The matching of the head with the extension below the head and the cover (threaded) ensures a degree of protection from IP66 to IP68.

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 TC62 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



As illustrated by the drawing in figure 4, 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. 4: 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
<p>TMT181: PCP 4...20 mA. The TMT181 is a PC programmable transmitters</p> <p>TMT182: Smart HART®. The TMT182 output consists of 4...20 mA and HART® superimposed signals.</p>	
<p>TMT184: PROFIBUS-PA®. For the TMT184, with PROFIBUS-PA® output signal, the communication address may be set via software or via mechanical dip-switch.</p>	

Probe

In the TC62 the measuring probe are two: the TPC100 (General purpose) or the TPC300 (ATEX certified). They are made in mineral insulated cable (MgO), with sheath in AISI316 or Inconel®600. The immersion length (ML) is available in the standard dimensions and in the most commonly used ones or they can be personalized by the client within a range of values (refer to “Sales Structure” at the end of the document). The length of the sensor can be chosen within a standard 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).



Warning:
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 following table (applicable to standard thickness well bottoms).

General purpose or ATEX certified						
Insert	Ø, mm	N, tp.	N, mm	N, material	N, thread	IL, (mm)
TPC100 / TPC300	6,3	N	77	A105	1/2"NPT M	IL = ML + 77 + 33
TPC100 / TPC300	6,3	N	117	A105	1/2"NPT M	IL = ML + 117 + 33
TPC100 / TPC300	6,3	NU	104	A105	1/2"NPT F	IL = ML + 104 + 33
TPC100 / TPC300	6,3	NUN	156	A105	1/2"NPT M	IL = ML + 156 + 33
TPC100 / TPC300	6,3	N	77	SS316	1/2"NPT M	IL = ML + 77 + 33
TPC100 / TPC300	6,3	N	117	SS316	1/2"NPT M	IL = ML + 117 + 33
TPC100 / TPC300	6,3	NU	104	SS316	1/2"NPT F	IL = ML + 104 + 33
TPC100 / TPC300	6,3	NUN	156	SS316	1/2"NPT M	IL = ML + 156 + 33

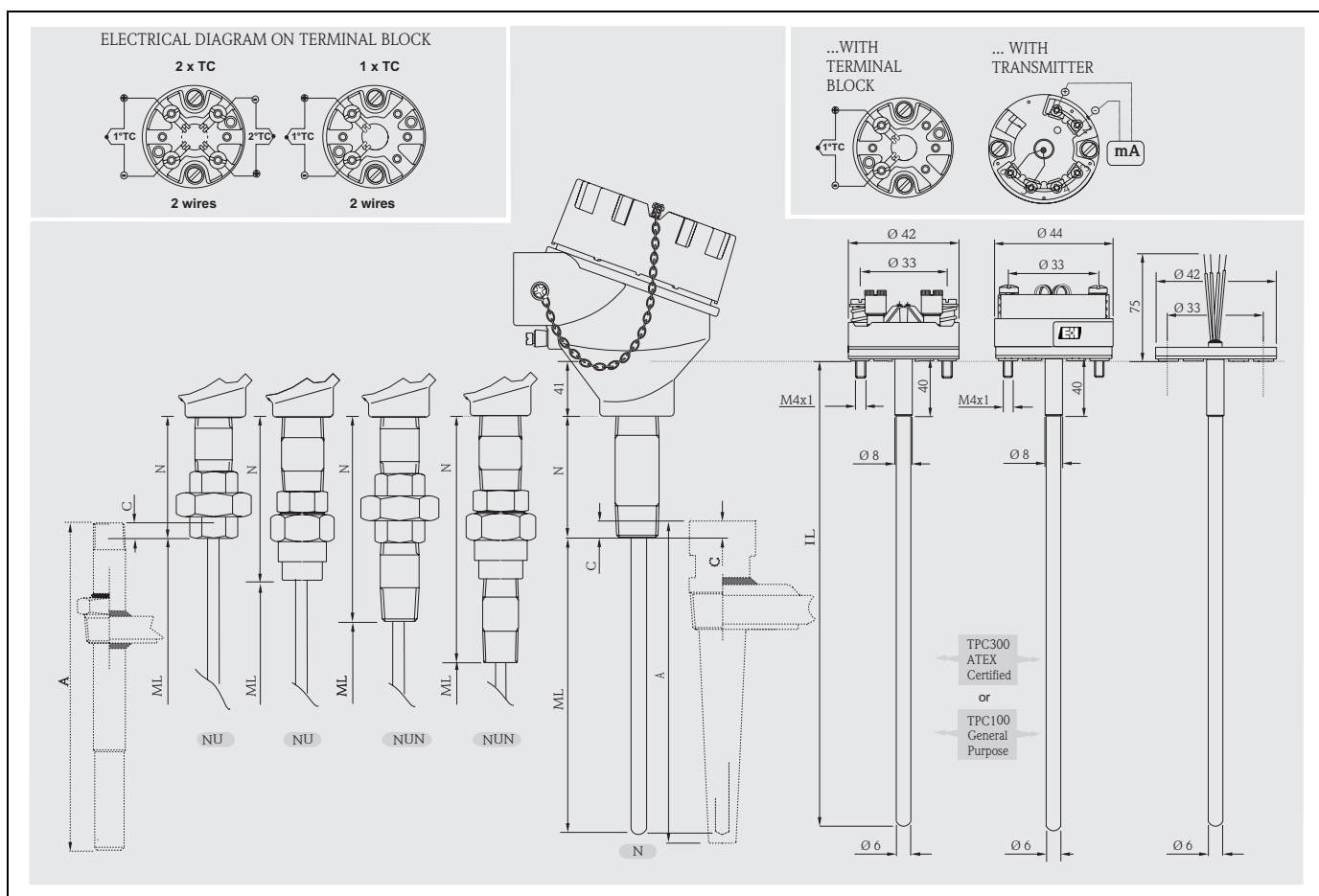


Fig. 5: Functional components and standard electrical diagrams (ceramic terminal block and transmitter)

Certificates & approvals

Ex approval

ATEX Certificate CESI 05ATEX038 for explosion proof type of protection: ATEX II 2 GD EEx-d IIC T6..T5 T85°...T100°C. ATEX II 1/2 GD EEx-d IIC T6..T5 T85°...T100°C. The TC62 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 4 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 simplified declaration with no enclosures of documents related to the materials used in the construction of the single sensor and guarantees the traceability of the materials through the identification number of the thermometer.

The data related to the origin of the materials can subsequently be requested by the client if necessary.

Further details**Maintenance**

The Omnigrad S TC62 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**

TC62-	Omnigrad S TC62 Thermocouple thermometer Thermometer complete of nipple or nipple/union but without thermowell. Replaceable mineral inset: grounded or ungrounded; Two operating and measurement temperature: with TC J: from -40 to 750°C with TC K: -40 to 1100°C
	Approval
A	Non-hazardous area
F	*ATEX II 2 GD EEx d IIC
	Head, material, IP grade
A	TA21H, Aluminium epoxy coating, , IP66 - IP68
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	... mm , as specified

										Head transmitter; Range	
										F	Flying leads
										C	Terminal block
										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
										I	THT1 separate item
										TC Accuracy; Material;	
										A	1x type K Cl. 1 special; Inconel®600
										B	2x type K Cl. 1 special; Inconel®600
										E	1x type J Cl. 1 special; SS 316L
										F	2x type J Cl. 1 special; SS 316L
										Y	Special version, to be specified
										TC standard; Hot junction;	
										1	EN 60584; ungrounded
										2	EN 60584; grounded
										3	ANSI MC96.1; ungrounded
										4	ANSI MC96.1; grounded
										9	Special version, to be specified
										Additional options	
										0	Not needed
										Y	Special version, to be specified
TC62-										⇐ Order code (complete)	

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 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

<input type="checkbox"/> Brochure Field of activities - Temperature measurement	FA006T/09/en
<input type="checkbox"/> Temperature head transmitter iTEMP® PCP -TMT181	TI070R/09/en
<input type="checkbox"/> Temperature head transmitter iTEMP® HART® -TMT182	TI078R/09/en
<input type="checkbox"/> Temperature head transmitter iTEMP® PROFIBUS-PA® -TMT184	TI079R/09/en
<input type="checkbox"/> Industrial thermometers, RTD and Thermocouples	TI236T/02/en
<input type="checkbox"/> TC insert for temperature sensors - Omniset TPC100	TI278T/02/en
<input type="checkbox"/> TC insert for temperature sensors - Omniset TPC300 (to be released)	TI291T/02/en
<input type="checkbox"/> Safety instructions for use in hazardous areas (TPC300 to be released)	XA017T/02/en
<input type="checkbox"/> TC thermometers Omnigrad TSC - General information	TI090T/02/en

International Head Quarter

Endress+Hauser
GmbH+Co. KG
Instruments International
Colmarer Str. 6
79576 Weil am Rhein
Germany

Tel. +49 76 21 9 75 02
Fax +49 76 21 9 75 34 5
www.endress.com
info@ii.endress.com

Endress+Hauser 

People for Process Automation