Technical Information
TI 274T/02/en
60022266

# *Thermocouple Thermometer*
# ***omnigrad M TC 10***

*Replaceable insert and thermowell with threaded connection*
*PCP (4...20 mA), HART® or PROFIBUS-PA® electronics*

The TC 10 Omnigrad M range temperature sensors are thermocouples designed for use in the fine chemicals industry but also suitable for general applications.
They are made up of a measurement probe with a protection well, and a housing, which may contain the transmitter for conversion of the variable measured.
Thanks to its modular configuration and the structure defined by the DIN 43772 standard (form 2G/3G), the TC 10 is suitable for almost all industrial processes.

*Features and benefits*

- SS 316L, SS 316Ti, Hastelloy® C276 and Inconel 600® for the "wetted" parts
- The most common threaded process connections as standard; others are available upon request
- Customized immersion length
- Surface finishing Ra < 0.8 µm
- Tip of the thermowell with a reduced diameter or tapered for a faster response time
- Stainless steel, aluminium or plastic housing, with protection grade from IP65 to IP67
- Replaceable mineral insulated insert
- PCP (4...20 mA), HART® and PROFIBUS-PA® transmitters
- Thermocouple sensing element type K or J, DIN EN 60584 or ANSI MC96.1 standard
- Class 1/special accuracy
- Single or double, grounded or ungrounded measurement junction
- Material certification (3.1.B)
- Pressure test

Endress+Hauser
The Power of Know How

# Areas of application

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

# 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 M TC 10 temperature sensor is made up of a measurement probe, with a protection well 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) is positioned close to the tip of the probe. The thermowell is made from a tube with a diameter of 9, 11 or 12 mm. The final part can be straight, tapered (i.e. with a gradual reduction of the stem achieved thanks to a swaging procedure), or reduced (stepped). The TC 10 can be fitted onto the plant (tube or tank) through the use of a threaded connection, which can be chosen from the most common models (see the section "System components"). The electrical structure of the thermometer always complies with DIN EN 60584/61515 or ANSI MC96.1/ASTM E585 standard rules. The sensing element is available in two versions: insulated hot junction or grounded hot junction. The housing can be of different types and materials (plastic, painted aluminium alloy, stainless steel). The way in which it fits to thermowell and the cable gland ensure a minimum grade of IP65 (Ingress Protection).

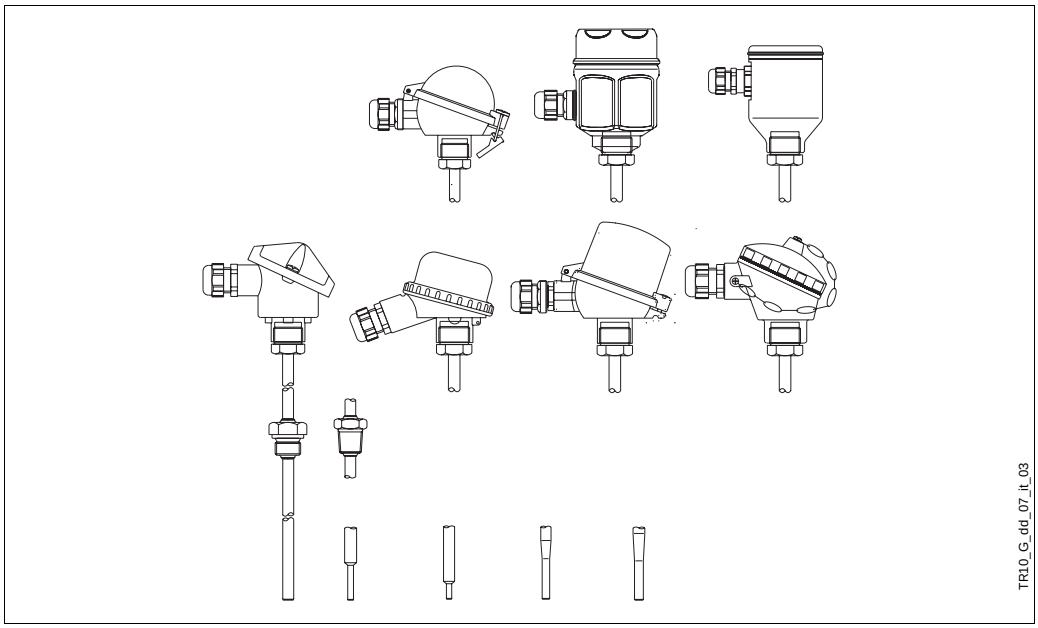



*Fig. 1: TC 10 with the various types of heads, process connections and end parts of the thermowell*

*Material*

Wetted parts in SS 316L/1.4404, SS 316Ti/1.4571, Hastelloy® C276/2.4819 or Inconel 600®/2.4816.

*Weight*

From 0.5 to 2.5 kg for standard options.

# Electronics

The required type of output signal can be obtained by choosing the correct head-mounted transmitter. Endress+Hauser supplies “state-of-the-art” transmitters (the iTEMP® series) built in 2-wire technology and with 4…20 mA output signal, HART® or PROFIBUS-PA®. All of the transmitters can be easily programmed using a personal computer through the ReadWin® 2000 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 hand-held 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 316L/1.4404 < 600°C
- SS 316Ti/1.4571 < 800°C
- Hastelloy® C276/2.4819 and Inconel 600®/2.4816 < 1100°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. For 9 mm diameter pipes, with a limited flow velocity, the maximum tolerated pressures are the following:
- 5 MPa (50 bar) at 20°C
- 3.3 MPa (33 bar) at 250°C
- 2.4 MPa (24 bar) at 400°C.

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

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

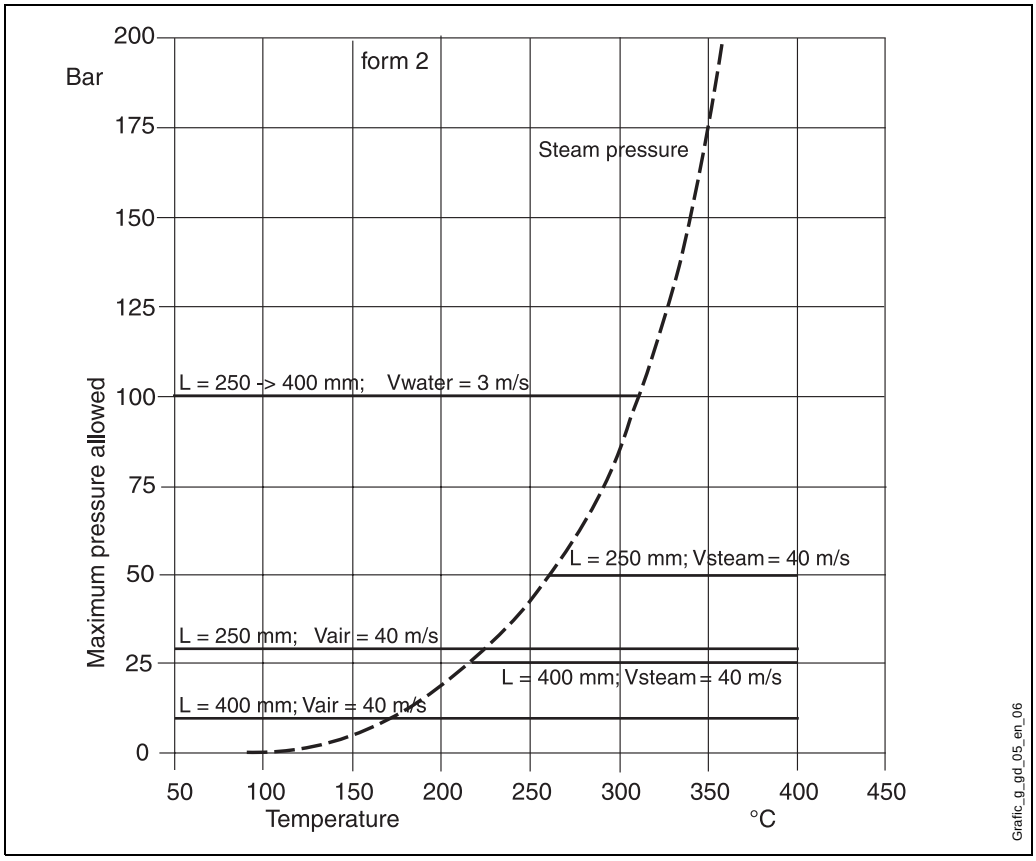



*Fig. 2: Pressure/temperature drawing for thermowell with straight tube Ø 11 mm in SS 316Ti/1.4571*

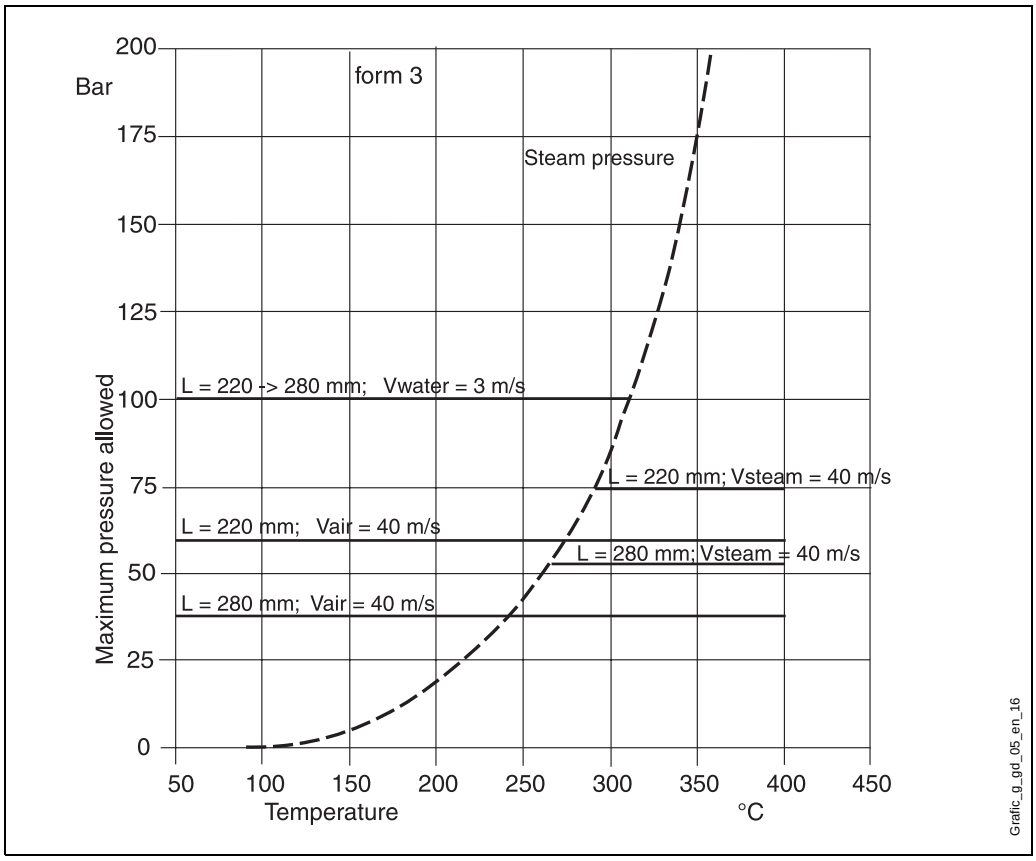



*Fig. 3: Pressure/temperature drawing for thermowell with tapered tube Ø 12 mm in SS 316Ti/1.4571*

*Accuracy*

The tolerances set by the standards 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)<br>+/-0.0075 \|t\| (333...750°C) | 1 | +/-1.5°C (-40...375°C)<br>+/-0.004 \|t\| (375...750°C) | + black<br>- white |
| K (NiCr-Ni) | 2 | +/-2.5°C (-40...333°C)<br>+/-0.0075 \|t\| (333...1200°C) | 1 | +/-1.5°C (-40...375°C)<br>+/-0.004 \|t\| (375...1000°C) | + green<br>- 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)<br>+/-0.75% (293...750°C) | Special | +/-1.1°C (0...275°C)<br>+/-0.4% (275...750°C) | + black<br>- red |
| K (NiCr-Ni) | Standard | +/-2.2°C (0...293°C)<br>+/-0.75% (293...1250°C) | Special | +/-1.1°C (0...275°C)<br>+/-0.4% (275...1250°C) | + yellow<br>- red |

Note! ItI = absolute temperature value in °C

*Table 1: 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:

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

*Table 2: 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 | | |
|---|---|---|---|---|---|---|---|---|
| | | | Reduced tip | Tapered tip | Straight tip | Reduced tip | Tapered tip | Straight tip |
| 9 mm | J, K | $t_{50}$ | 5.5 s | 9 s | 15 s | 6 s | 9.5 s | 16 s |
| | | $t_{90}$ | 13 s | 31 s | 46 s | 14 s | 33 s | 49 s |
| 11 mm | | $t_{50}$ | 5.5 s | -- | 15 s | 6 s | -- | 16 s |
| | | $t_{90}$ | 13 s | -- | 46 s | 14 s | -- | 49 s |
| 12 mm | | $t_{50}$ | -- | 8.5 s | 32 s | -- | 9 s | 34 s |
| | | $t_{90}$ | -- | 20 s | 106 s | -- | 22 s | 110 s |

*Table 3: 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 M TC 10 thermometers can be mounted on the wall of pipes or vessels or other plant parts that may be necessary.
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 length (L) should be, if possible, at least 80÷100 mm.
In pipes of a small section the axis line of the duct must be reached and if possible slightly exceeded by the tip of the probe (refer to fig. 4A-4B). Insulation of the outer part of the sensor reduces the effect produced by a low immersion. Another solution may be a tilted installation (see fig. 4C-4D). 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 base material of the wetted parts (SS 316L/1.4404, SS 316Ti/1.4571, Hastelloy® C276/2.4819, Inconel 600®/2.4816) 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 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.

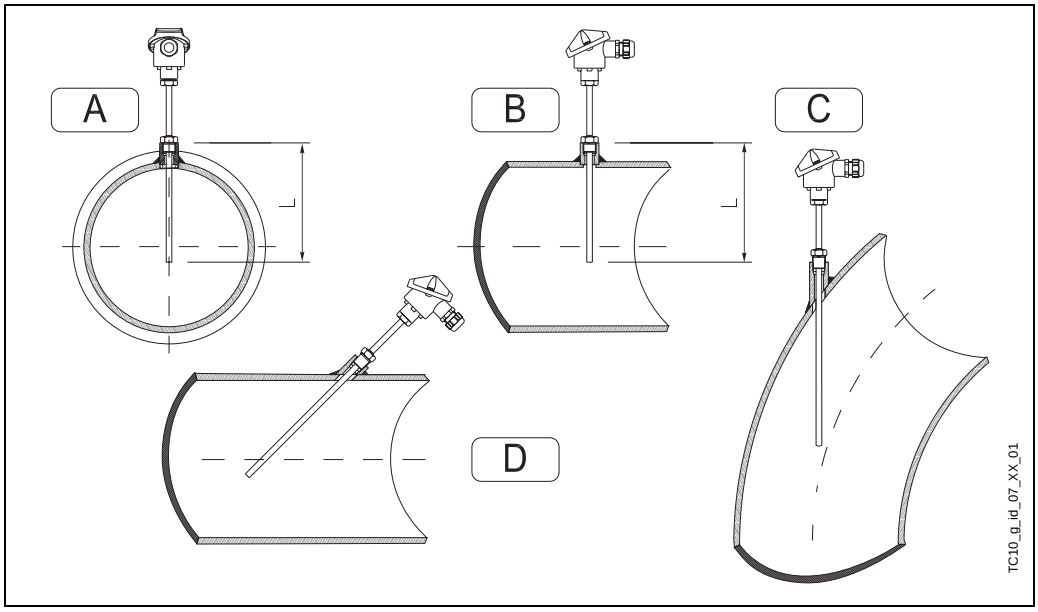



*Fig. 4: Installation examples*

# System components

*Housing*

The housing, which contains the electric terminals or the transmitter, is available in different types and materials, e.g. plastic or painted aluminium alloy and stainless steel. The coupling method with the rest of the probe and the gland for the cable entry ensures a minimum IP65 grade (refer also to fig. 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.
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).
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.

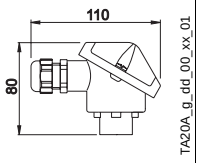
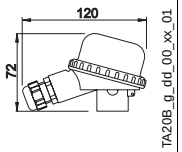
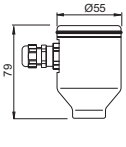
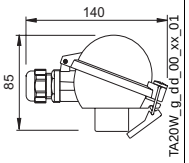
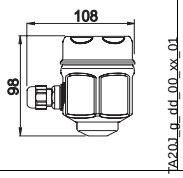
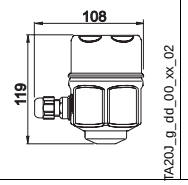
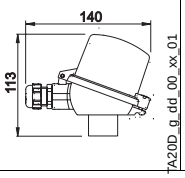
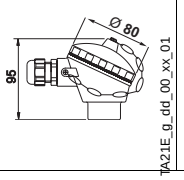
| Housing type | IP | Housing type | IP | Housing type | IP | Housing type | IP |
|---|---|---|---|---|---|---|---|
| TA20A   | 66<br>67 | TA20B   | 65 | TA20R   | 66<br>67 | TA20W   | 66 |
| TA20J   | 66<br>67 | TA20J (with display)   | 66<br>67 | TA20D   | 66 | TA21E   | 65 |

*Fig. 5: Housings and relative IP grade*

*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.

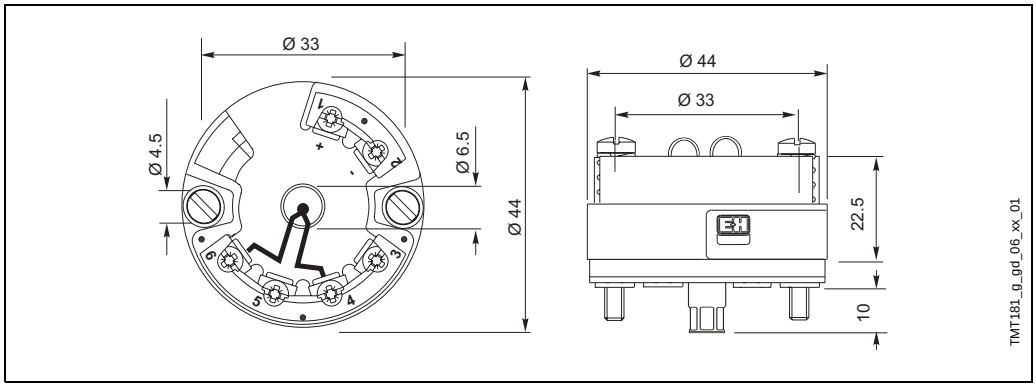



*Fig. 6: TMT 181-182*

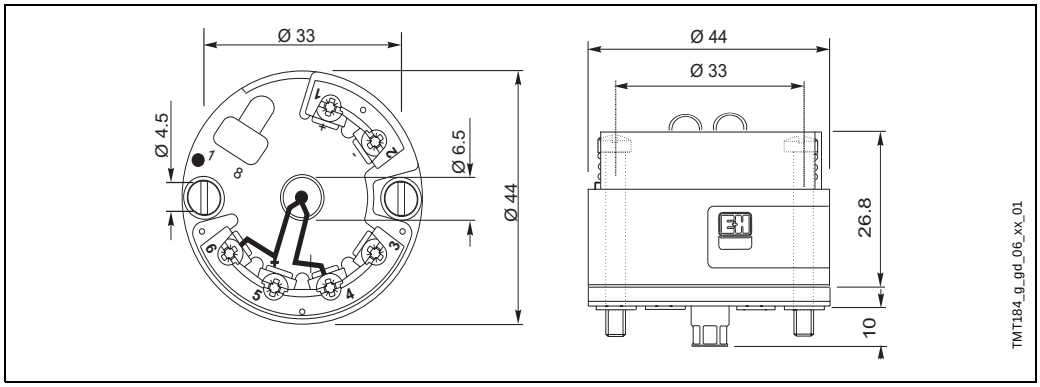



*Fig. 7: TMT 184*

*Extension neck*

The extension neck is the part between the process connection and the housing.
It is normally made of a tube with dimensional and physical characteristics (diameter and material) which are the same of the tube under the connection.
The standard lengths of the neck are 80 or 145 mm, according to the selected option. In accordance with the norm DIN 43772, in the case of a thermowell with a diameter of 12 mm and a tapered tip (form 3G), the extension neck will be respectively 82 or 147 mm.
The connection situated in the upper part of the neck allows for orientation of the sensor head.
As illustrated by the drawing in figure 8, 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”.

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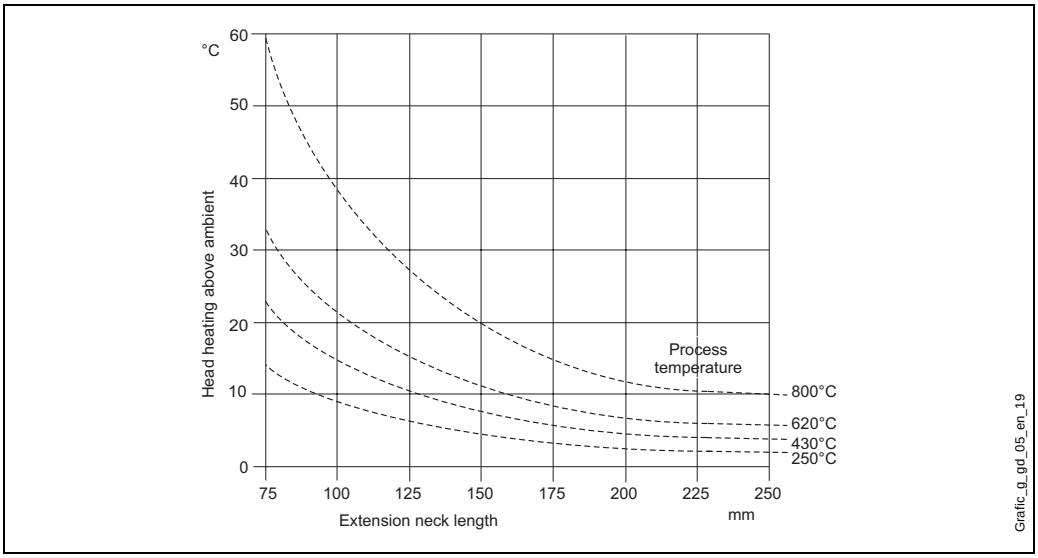



*Fig. 8: Heating of the head consequent to the process temperature*

*Process connection*

Standard connections are available in the following types:
- M20x1.5
- G 1/2” and G 1” DIN 43772 (DIN 3852 form A)
- G 1/2”, G 3/4” and G 1” BSP cylindrical
- 1/2” and 3/4” NPT.

Other versions may be supplied upon request.
Figure 9 illustrates the engaging lengths.

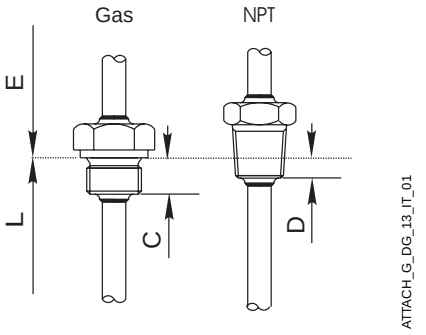
| Process connection | | Thread | mm |
|---|---|---|---|
|  | C | G 1/2” DIN | 15 |
| | | G 1” DIN | 18 |
| | | G 1/2” BSP | 15 |
| | | G 3/4” BSP | 15 |
| | | G 1” BSP | 20 |
| | | M 20X1.5 | 14 |
| | D | 1/2” NPT | 8 |
| | | 3/4” NPT | 8.5 |

*Fig. 9: Engaging lengths*

*Probe*

In the TC 10 the measuring probe is made up of a mineral (MgO) insulated insert positioned inside the thermowell. The employed MgO cable is compliant with the norm DIN EN 61515 (IEC 1515) or ASME E585 depending on the requested version.
The insert length is available in the standard dimensions DIN 43735/43772 and in the most commonly used ones, or it can be personalized by the client within a range of values (refer to “Sales structure” at the end of the document).
For replacement, the length of the insert (IL) must be chosen in compliance with the immersion length (L) of the thermowell.
If spare parts are required, refer to the following table:

| Tip of the sensor | Insert | Insert diameter | Extension neck | Insert length (mm) |
|---|---|---|---|---|
| Straight | TPC 100 | 6 mm | 80 mm | IL = L + 90 |
| Reduced on Ø 9 and 11 / tapered on Ø 9 | TPC 100 | 3 mm | 80 mm | IL = L + 90 |
| Tapered on Ø 12 | TPC 100 | 6 mm | 82 mm | IL = L + 90 |
| Straight | TPC 100 | 6 mm | 145 mm | IL = L + 155 |
| Reduced on Ø 9 and 11 / tapered on Ø 9 | TPC 100 | 3 mm | 145 mm | IL = L + 155 |
| Tapered on Ø 12 | TPC100 | 6 mm | 147 mm | IL = L + 155 |
| Straight / tapered on Ø 12 | TPC 100 | 6 mm | E | IL = L + E + 10 |
| Reduced on Ø 9 and 11/ tapered on Ø 9 | TPC 100 | 3 mm | E | IL = L + E + 10 |

*Table 4: Insert dimensions*

With regards to the thermowell, the surface roughness (Ra) of the wetted parts is 0.8 µm, up to a total length of 350 mm of the well; 1,6 µm for longer wells. The various kinds of tips (reduced or tapered) are described in figure 10. If ordered as a spare part, the thermowell is called TW 10 (consult 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 of the inserts on sensors of various kinds, and guarantees rapid delivery times; this allows our customers to reduce the amount of spare parts to be kept on stock.

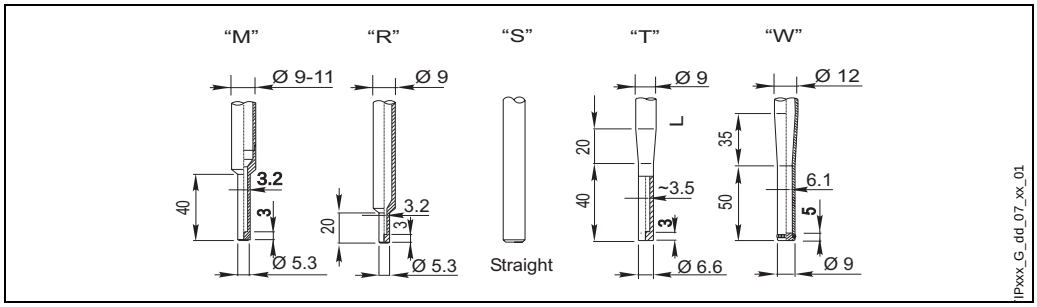



*Fig. 10: Reductions (on the left) and tapers (on the right) of the thermowell*

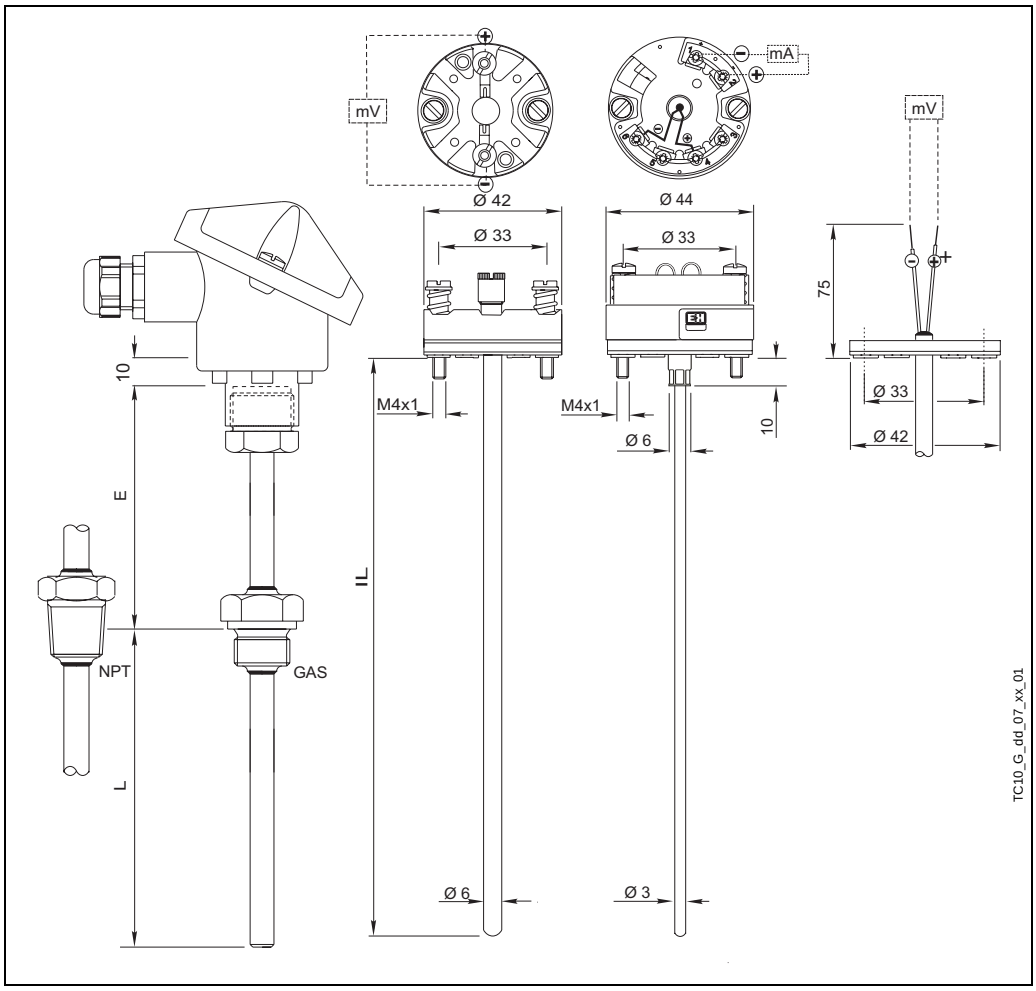



*Fig. 11: Functional components*

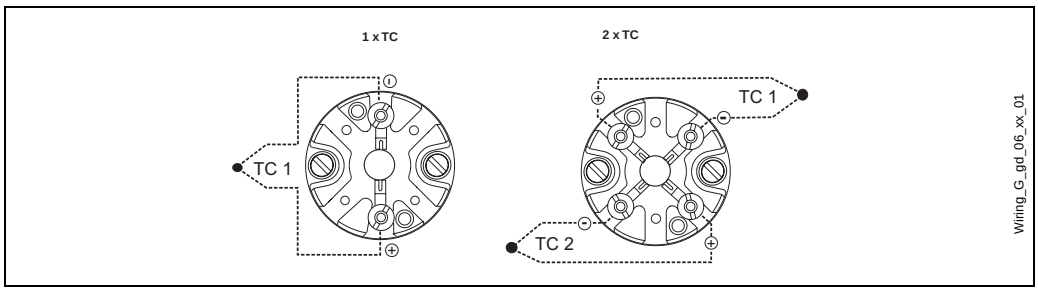



*Fig. 12: Standard wiring diagrams (ceramic terminal block)*

# 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 10 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 M 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*

| TC10 | Safety (Ex) certification |
|---|---|
| | A Ex certification not required |

| | | Head 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 |

| | | | Pipe size, material | |
|---|---|---|---|---|
| | | A | 9 mm | material: SS 316L/1.4404 |
| | | D | 9 mm | material: SS 316Ti/1.4571 |
| | | G | 9 mm | material: Hastelloy® C276/2.4819 |
| | | J | 9 mm | material: Inconel 600®/2.4816 |
| | | B | 11 mm | material: SS 316L/1.4404 |
| | | E | 11 mm | material: SS 316Ti/1.4571 |
| | | H | 11 mm | material: Hastelloy® C276/2.4819 |
| | | K | 11 mm | material: Inconel 600®/2.4816 |
| | | F | 12 mm | material: SS 316Ti/1.4571 |
| | | Y | Special version | |

| | | | | Neck length E (60-250 mm) | |
|---|---|---|---|---|---|
| | | | 1 | 80 | mm, extension length E (82 mm with tip model "W") |
| | | | 3 | 145 | mm, extension length E (147 mm with tip model "W") |
| | | | 8 | ... | mm, extension length E to be specified |
| | | | 9 | ... | mm, extension length E special |

| | | | | | Process connection, material (material must be the same of the pipe) |
|---|---|---|---|---|---|
| | | | | BG | M20x1.5, process connection, SS 316Ti |
| | | | | BH | G 1/2" A, process connection, DIN 43772, SS 316Ti |
| | | | | BJ | G 1" A, process connection, DIN 43772, SS 316Ti |
| | | | | CA | G 1/2" BSP (cyl.), process connection, SS 316L |
| | | | | CB | G 3/4" BSP (cyl.), process connection, SS 316L |
| | | | | CC | G 1" BSP (cyl.), process connection, SS 316L |
| | | | | CD | 1/2" NPT, process connection, SS 316L |
| | | | | CE | 3/4" NPT, process connection, SS 316L |
| | | | | HH | G 1/2" A, process connection, DIN 43772, Hastelloy® C276 |
| | | | | HD | 1/2" NPT, process connection, Hastelloy® C276 |
| | | | | LH | G 1/2" A, process connection, DIN 43772, Inconel 600® |
| | | | | LD | 1/2" NPT, process connection, Inconel 600® |
| | | | | YY | Special version |

| | | | | | | Tip design |
|---|---|---|---|---|---|---|
| | | | | | S | Straight tip |
| | | | | | R | Reduced tip, L >= 60 mm (SS 9 mm pipe) |
| | | | | | M | Reduced tip, L >= 80 mm (9 and 11 mm pipe) |
| | | | | | T | Tapered tip, L >= 100 mm (SS 9 mm pipe) |
| | | | | | W | Tapered tip, L >= 120 mm in compliance with DIN 43772 form 3G (SS 12 mm pipe, neck length 82/147 mm) |
| | | | | | Y | Special version |

| | | | | | | | Immersion length (50-3700) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | A | 70 | mm, immersion length L |
| | | | | | | | C | 120 | mm, immersion length L |
| | | | | | | | D | 160 | mm, immersion length L |
| | | | | | | | E | 220 | mm, immersion length L |
| | | | | | | | F | 250 | mm, immersion length L |
| | | | | | | | G | 280 | mm, immersion length L |
| | | | | | | | H | 310 | mm, immersion length L |
| | | | | | | | J | 400 | mm, immersion length L |

| | |
|---|---|
| K | 580 mm, immersion length L |
| X | ... immersion length L to be specified |
| Y | ... immersion length L special |

**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 |

**TC type, accuracy, inset sheath material**

| | | | |
|---|---|---|---|
| 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 junction ungrounded |
| 2 | EN 60584 standard, hot junction grounded |
| 3 | ANSI MC96.1standard, hot junction ungrounded |
| 4 | ANSI MC96.1 standard, hot junction 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 thermowell |
| B | Hydrostatic external pressure test on thermowell |
| C | Dye penetrant test on thermowell weldings |
| Y | Special version |

| | |
|---|---|
| TC10- | 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 10 | TI 261T/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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