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

Technical Information

omnigrad M TR 44, TR 45

Hygienic RTD temperature sensor assembly
With or without thermowell and M.I. replaceable insert
PCP (4...20 mA), HART® or PROFIBUS-PA® electronic safety

The Omnigrad M type TR 44 and TR 45 temperature sensors are resistance thermometers especially designed for hygienic applications (food, pharmaceutical and fine chemicals industry).
They consists of a measurement probe with (TR 45) or without (TR 44) a protection well, and a housing, which may contain the transmitter for the conversion of the measured variable.
Due to their modular design, TR 44 and TR 45 fit to all sanitary industrial processes

3-A® 74-02

CERTIFIED EHEDG TYPE EL NOVEMBER 2001

Features and benefits

- 3-A® and EHEDG certification
- SS 316L/1.4435 for "wetted" parts (BN 2 compliance on request)
- Most common hygienic process connections supplied as standard; other on request
- Customized immersion length
- Small probe diameter or reduced tip for fast response time (TR 44)
- Tapered or reduced tip and thermoconductive paste for fast response time (TR45)
- Surface finishing down to Ra < 0.4 mm, with or without electropolishing
- Stainless steel, aluminum or plastic housing, all of which are easily cleanable and IP65 to IP67
- Replaceable mineral insulated insert (TR 45), which is installed inside the thermowell, avoids plant shut down during the substitution or the verification of the instrument
- PCP (4...20 mA, also with enhanced accuracy), HART® and PROFIBUS-PA® 2-wire transmitters
- Pt100 sensing element with class A accuracy (DIN EN 60751) or 1/3 DIN B
- Double Pt100, for redundancy purposes
- Pt100 with 4 wires connection, double Pt100 with 3 wires
- ATEX 1 or 1/2 GD EEx ia certification (TR 45)
- Material certification (3.1.B, ...)
- EA calibration certificate
- Ferrite content determination
- Sensor matching calibration

TI244T/02/en
N° 60018846

Endress+Hauser
People for Process Automation

Areas of application

- Food industry: milk, beer, fruit juice, syrup, chocolate, oils/fats, powders, auxiliary services, storage tanks/silos, CIP/SIP systems
- Biotechnology industry: fermenters, auxiliary services, CIP/SIP systems
- Pharmaceutical industry: fluids, acids, purified water, auxiliary services, CIP/SIP systems
- Fine chemicals industry: cosmetics, auxiliary services, CIP/SIP systems

Function and system design

Measuring principle

In the Platinum RTD (Resistance Temperature Detector) thermometers the sensing element consists of an electrical resistance with value of 100 Ω at 0°C (called Pt100, in compliance with standard DIN EN 60751), which increases at higher temperatures according to a coefficient characteristic of the resistor material (platinum). In industrial thermometers that comply with the DIN EN 60751 standard, the value of this coefficient is $\alpha = 3.85*10^{-3}\ °C^{-1}$, calculated between 0 and 100°C.

Equipment architecture

The Omnigrad M TR 44 and TR 45 temperature sensors are made up of a measurement probe, with (TR 45) or without (TR 44) a protection well, and a housing (head), which may contain a transmitter or the terminals for the electrical connection.
In TR 45 the probe is a sensing insert, placed inside the thermowell and spring loaded underneath it, so as to improve the heat transfer.
As in TR 44, the sensing element (Pt100) is positioned close to the tip of the probe.

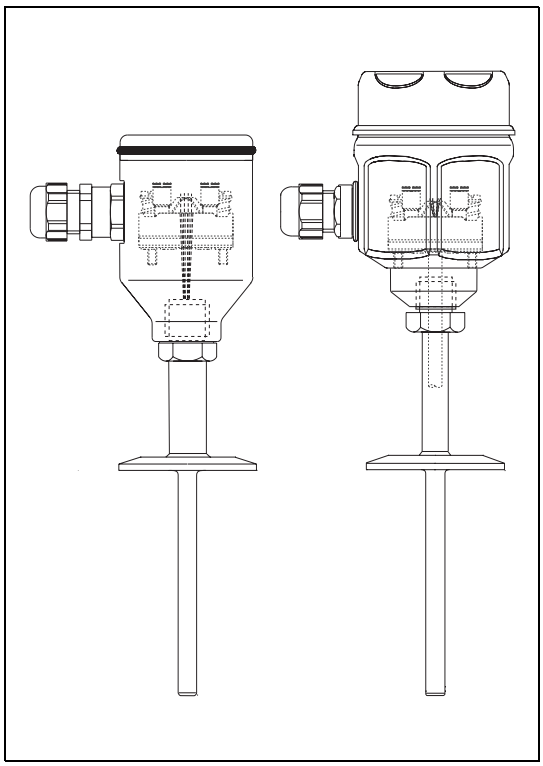


Fig. 1: TR 44 (left) and TR 45 (right)

The (TR 45) thermowell is obtained from a 9 mm diameter pipe. The final (sensing) part can be straight, tapered, i.e. with its diameter smoothly decreased by means of a swaging procedure, or reduced (stepped).
In the TR 44, the sheath of the probe is developed from a 8 mm or a 6 mm pipe. In the 8 mm, the final (sensing) part always has a reduced (stepped) diameter. In the 6 mm, the probe pipe is always straight.
The probe (TR 44) or thermowell (TR 45) can be installed on the plant (pipe or vessel) by means of a hygienic process connection, which can be chosen among the most common types (see "System components" section).
Both TR 44 and TR 45 with Varivent® process connections, are built to 3-A® and EHEDG design criteria, which allow the sensor to withstand any stress caused by CIP (Cleaning In Place) and SIP (Sterilization In Place) processes.
The electrical structure of the instruments always complies with DIN EN 60751 standard rules.
The housing can be of different types and materials (plastic, painted aluminium, stainless steel).
The way in which it fits to the rest of the probe and the gland for the cable entry ensures a minimum grade of IP65 (Ingress Protection).

Material

Wetted parts in SS 316L/1.4435.

Weight

From 0.5 to 2.5 kg for standard options.

Electronics

The required type of output signal can be obtained by choosing the right head-mounted transmitter.
Endress + Hauser supplies state-of-the-art transmitters (iTEMP® series) built in 2-wire technology and with 4…20 mA, HART® or PROFIBUS-PA® output signal. All the transmitters are easily programmable with a personal computer through the ReadWin® 2000 public domain software (for 4…20 mA and HART® transmitters) or CommuWin II software (for PROFIBUS-PA® transmitters).
HART® transmitters can be programmed also with the DXR 275 (Universal HART® Communicator) hand-held operating module.
A PCP (4…20 mA) model (TMT 180) with enhanced accuracy is available and is particularly suitable for hygienic applications.
E+H recommends the use of PROFIBUS dedicated connectors in the case of PROFIBUS-PA® transmitters. The Weidmüller type (Pg 13.5 - M12) is provided as standard option.
For detailed information regarding transmitters, please refer to the relevant documentation (see TI codes at the end of this document).
If a head-mounted transmitter is not employed, the sensor probe can be connected through the terminal block to a remote converter (i.e. DIN rail transmitter).

Performance

Operating conditions

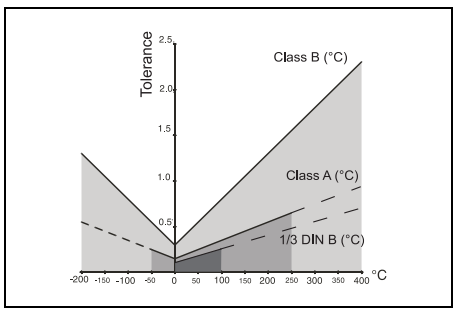
Ambient temperature (housing without head-mounted transmitter):
- metal housings -40÷130°C
- plastic housings -40÷85°C

Ambient temperature (housing with head-mounted transmitter) -40÷85°C
Ambient temperature (housing with display) -20÷70°C
Process temperature
The measurement range (see below) can be limited due to the the gasket employed in the process connection.
Maximum process pressure:
- TR 44, TR 45 5 MPa (50 bar) at 20°C
- TR 44, TR 45 3.3 MPa (33 bar) at 250°C
- TR 45 2.4 MPa (24 bar) at 400°C

Lower maximum pressures can be due to the process connection (i.e. clamp, …).
Maximum flow velocity
The highest flow velocity tolerated by the sensor stem diminishes with increasing lengths of the well/probe exposed to the stream of fluid.
Shock and vibration resistance
According to DIN EN 60751 3 g peak / 10÷500 Hz

Accuracy

Probe maximum error
- cl. A
  $3\sigma = 0.15+0.0020|t|$ -50…250°C
  $3\sigma = 0.30+0.0050|t|$ 250…400°C
- cl. 1/3 DIN B
  $3\sigma = 0.10+0.0017|t|$ 0…100°C
  $3\sigma = 0.15+0.0020|t|$ -50...0 / 100...250°C
  $3\sigma = 0.30+0.0050|t|$ 250…400°C
  (|t| = absolute value of temperature in °C)



Transmitter maximum error See relevant documentation (codes at the end of this document)
Display maximum error 0.1% of the set span + 1 digit
The "4 wires" configuration ensures no additional errors in case of long connecting cables (without head-mounted transmitter). Generally speaking, there is a higher guarantee of accuracy in the "4 wires" configuration.

Measurement range

- TR 44 -50…250°C
- TR 45 -50…400°C

Response time

Test in water at 0.4 m/s (according to DIN EN 60751; 23 to 33°C step changes)

Sensor type	Response time	Without thermo-conductive paste	With thermo-conductive paste
TR 44 (∅ 6 or 8 mm reduced)	t_{50}	5 s	-
	t_{90}	13 s	-
TR 45 straight tip	t_{50}	20 s	10 s
	t_{90}	60 s	30 s
TR 45 tapered tip	t_{50}	12 s	5 s
	t_{90}	40 s	12 s
TR 45 reduced tip	t_{50}	7,5 s	3.5 s
	t_{90}	21 s	8 s

Insulation

Insulation resistance between terminals and probe sheath (according to DIN EN 60751, test voltage 250 V)

more than 100 MOhm at 25°C
more than 10 MOhm at 300°C

Self heating

Negligible when E+H iTEMP® transmitters are employed.

Installation

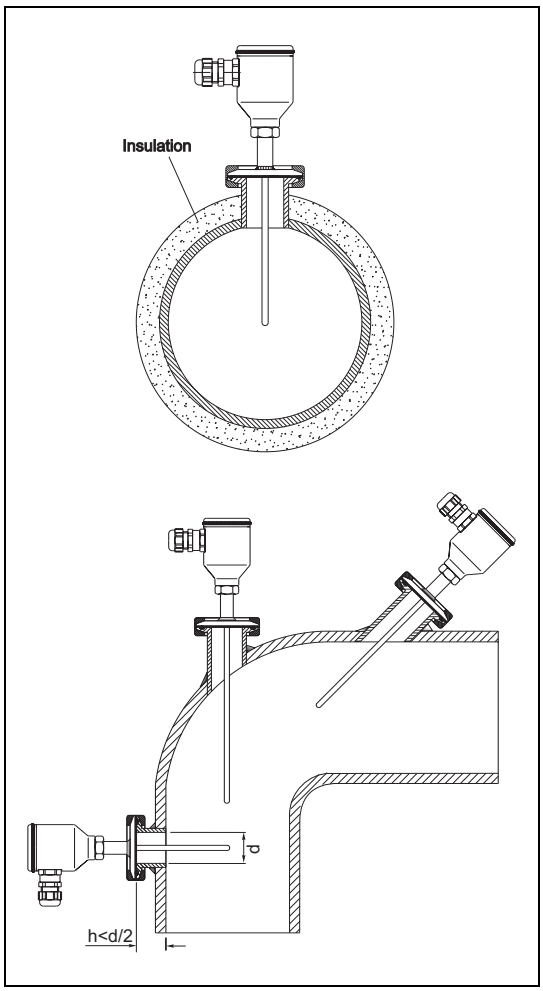


Fig. 2: General installation solutions

Omnigrad M TR 44 and TR 45 can be mounted on the wall of pipes or vessels.
The counterparts for the process connections and the respective gaskets or sealing rings, are generally not supplied with the sensors, and are considered to be the customer's responsibility (EHEDG and 3-A® requirements must be fulfilled).
The G1" connection is the only exception for which the sensor with the adaptor to be welded on the plant can be supplied.
As a general rule, the sensors should be installed in such a way that does not adversely affect their cleanability.
With regard to ATEX-certified components (transmitter, insert), please refer to the specific documentation (see the code at the end of this document).
The immersion length may affect the accuracy of the sensors. If it is too low, an error might be generated in the measurement of the temperature, due to the lower temperatures of the process fluid near the walls, and to the heat transfer which occurs through the sensor stem.
The incidence of such error could be not negligible if there is a big difference between the process and the ambient temperature.
To avoid this source of inaccuracy, probes with low diameter must be employed, and the immersion length (L) should be, if possible, at least about 80 mm. In small pipes, the axis line of the duct must be reached, and even slightly exceeded, by the tip of the probe (see figure 3).
Insulation on the outer part of the sensor reduces the effect of the low immersion. Another solution could be a tilted installation (see figure 2).

In case of two-phase flows, attention should be paid in the choice of the measurement point, which may cause fluctuations in the detected temperature value.

Suitable solutions for the installation of the sensors in small pipes are shown in figure 3.
In hygienic applications, a good, strict, installation rule consists in not to leave any dead spaces along the flow of the process fluid.
The required flush-mounting can be achieved by the connection Varivent®, G1" Liquiphant M type (+ purpose built adaptor).
The clamp flanges can also partly fulfil this requirement, if the Tri-Clamp® components 7IMPS or TL7IWWMS (Instrument Tees) are used (see the related figure 4).

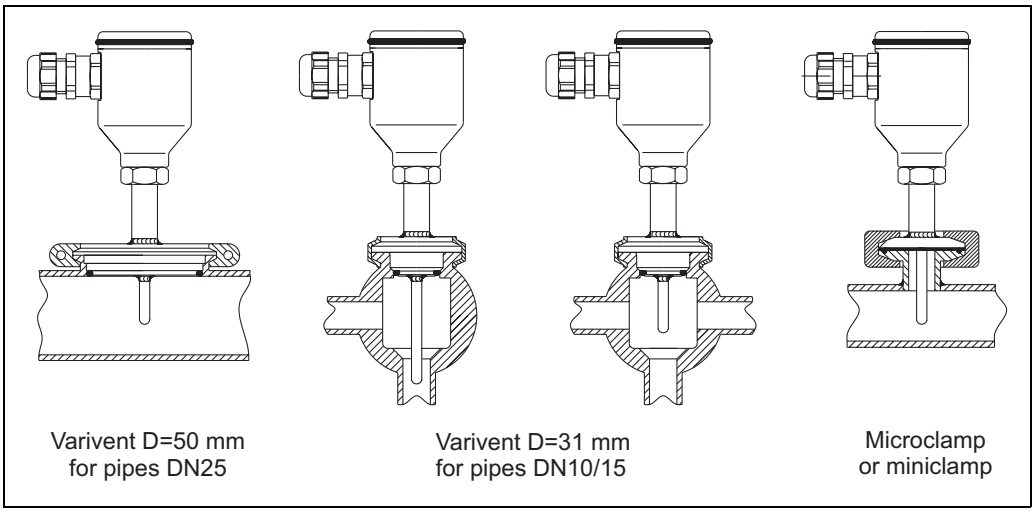
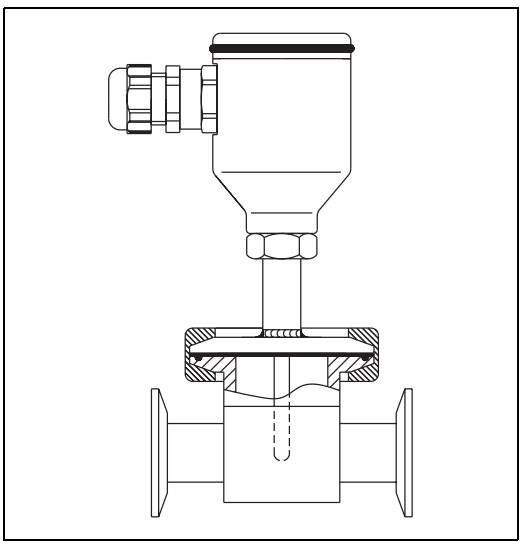


Fig. 3: Installation solutions in small pipes

For other connection arrangements, the diagram in figure 2 should be followed [h <= d/2].
For weld-in connections, care should be taken by the user in the execution of the welding on the process side (suitable weld material, welding radius > 3 mm, absence of pits, folds, crevices, …).
The use of purely threaded, Ingold and metal-to-metal joints is not recommended by some hygienic design standards (i.e. 3-A® Standard 74-02 and Document 8 from EHEDG). This is the reason why E+H Temperature division doesn't suggest those solutions in "sanitary" applications. Moreover often metal-to-metal couplings can only be used effectively once.



Regarding corrosion, the basic material of the wetted parts (SS 316L/1.4435) is capable to tolerate common corrosive media up to high temperatures.
When disassembling the sensors, new gaskets equivalent to the originals and specific torques must be employed for the re-assembling procedure. This will ensure the stated IP (Ingress Protection) grade of the enclosures.
To avoid problems due to condensation when the ambient has a high humidity rate and the process is at a low temperature, a plastic housing (i.e. model TA20B) can be an effective choice.

Fig. 4: Installation with the Tri-Clamp® component 7IMPS

System components

Housing

The housing which contains the electric terminals or the transmitter, can be of different types and materials (plastic, painted aluminium, stainless steel). The way in which it fits to the rest of the probe and the gland for the cable entry ensures an IP grade of 65 at minimum (also refer to the figure below). All the heads supplied have internal geometry according to DIN 43729 standard (form B), and thermometer connection M24x1.5.
Version IP66/IP67 of 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 or white polyamide housing, sometimes defined with the code BBK in the Temperature market.
In TA21E a screw cap is employed and is attached to the head body by a chain.
Head type TA20D (aluminium), also referred to as BUZH, is able to contain a terminal block and a transmitter, or two transmitters at the same time.
Head TA20J is the stainless steel housing with E+H corporate design. It can also be provided with a LCD display (4 digits), operating with 4…20 mA transmitters.
TA20R is the head suggested by E+H Temperature division for hygienic applications, because it comes in stainless steel and because of its "clean" design.
TA20W (BUS type) is a round grey coloured head made of aluminium, with a clip for the cap closure.
The cable glands M20x1.5 and Pg 16 supplied with the housings, accept cable diameters from 7 to 12 mm.

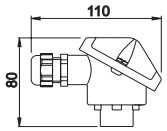
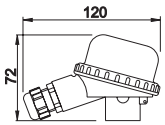
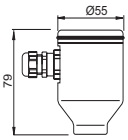
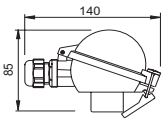
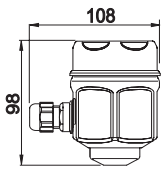
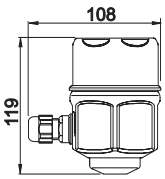
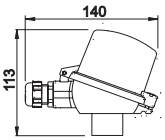
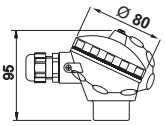
Housing type	IP	Housing type	IP	Housing type	IP	Housing type	IP
TA20A 	66 67 68	TA20B 	65	TA20R 	66 67	TA20W 	66
TA20J-(without display) 	66 67	TA20J-(with display) 	66 67	TA20D 	66	TA21E 	65

Fig. 5: Housing protection grade (IP)

Head transmitter

The head-mounted transmitters available are (see also the "Electronics" section):

- TMT 180 — PCP 4…20 mA
- TMT 181 — PCP 4…20 mA
- TMT 182 — Smart HART®
- TMT 184 — PROFIBUS-PA®

TMT 180 and TMT 181 are PC Programmable transmitters. TMT 180 can be supplied in a version with improved accuracy (0.1°C vs. 0.2°C) in the bandwidth -50…250°C, and a model with a fixed measurement range (specified by the customer in the order phase) is also available.
TMT 182 output consists of 4…20 mA and HART® superimposed signals.
For TMT 184, with PROFIBUS-PA® output signal, the communication address can be set via software or by means of a mechanical dip-switch. The customer may specify the desired configuration in the order phase.

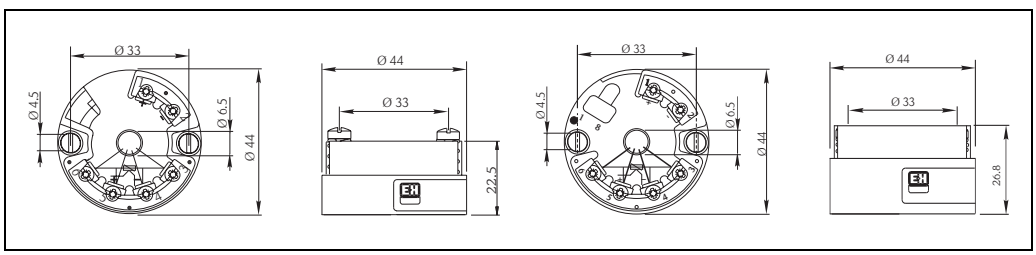


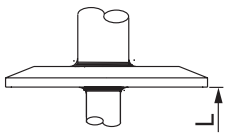
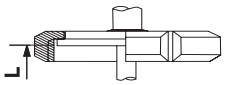
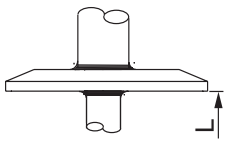
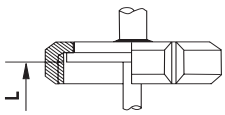
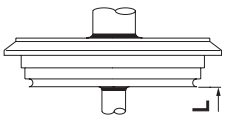
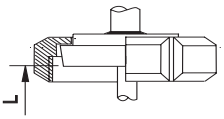
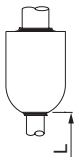
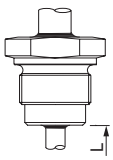
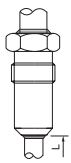
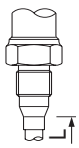
Fig. 6: TMT 180, 181, 182 (left), TMT 184 (right)

Extension neck

Manufactured in stainless steel, the extension neck (part between the process connection and the housing) is made up of a tube with a standard diameter of 15 mm and is 82 mm in length.
The upper connection of the neck permits adjustments to the orientation of the sensor head.

Process connection

This can be chosen form the following types:

ISO 2852 Clamp 	SMS 1147/8 
Tri-Clamp® 	DIN11864-1-A 
Varivent® 	DIN 11851 
Weld-in cylindrical 	Weld-in spherical 
G1" Liquiphant M 	Conical connection metal-to-metal G"1/2 
Conical connection metal-to-metal M12x1.5 	

Standard connections are available in several sizes. Others (i.e. Neumo, APV) are available on request.
The process connection is continuously welded on the probe or on the well so as to obtain a minimum welding radius of 3.2 mm between the lower surface of the connection and the sensor stem (according to EHEDG and 3-A® standards).
Please refer to paragraph on "Accessories" for information regarding availability of welding adaptors.
The Varivent® connections must be used with dedicated Tuchenhagen® in-line components or tank adaptors.
For Varivent® flanges with small nominal diameter, maximum immersion lengths for usual applications are listed in the following table (also refer to figure 3).
Please be aware that in the past the Varivent® connection DN25 has been used also for pipes with nominal diameter DN32.

	TR 44 (6 mm probe, straight tip)		**TR 45** (reduced tip)	
Varivent® nominal diameter	DN 10/15	DN 25	DN 10/15	DN 25
Suggested immersion length (L)	30÷50 mm (low viscosity fluids) 17 mm (high viscosity fluids)	17 mm	30 mm (low viscosity fluids) 17 mm (high viscosity fluids, special option)	17 mm (special option)

Probe

In TR 45, the measuring probe is constituted by a mineral insulated insert positioned inside the thermowell. For its replacement, the insert length (IL) must be chosen depending on the immersion length (L) of the thermowell. Should a spare part be required, please refer to the following table:

Sensor	Probe tip	Insert	Insert diam.	Extens. neck	Insert length mm
TR 45	straight	TPR 100	6 mm	82 mm	IL = L + 92
TR 45	red. / tapered	TPR 100	3 mm	82 mm	IL = L + 92
TR 45	straight	TPR 100	6 mm	E	IL = L + E + 10
TR 45	reduced. / tapered	TPR 100	3 mm	E	IL = L + E + 10

In TR 44 the protection well and the sensing part cannot be separated.
The immersion length is available in some standard values or it can be supplied in a "customized" version within a range (please see the product structures in the last pages of this document). Up to a length of 50 mm the TR 44 may have a probe with 6 mm diameter only.
For special versions of TR 45, where the immersion is shorter than 30 mm, the diameter of the thermowell, as in the reduced tip, should be 5.3 mm.
The starting material for the wetted parts can be supplied in compliance of Basler Norm 2 (BN2), which imposes a limited ferrite content and consequently enhances corrosion resistance, on request. In some sensor configurations, the compliance with the requirements of BN2 can also be assured after the welding and machining operations, that is in the finished product. The surface roughness (Ra) of the wetted parts is supplied down to 0.4 mm. Surface roughness below 0.4÷0.5 mm has not been proven to be advantageous in hygienic applications. Electro-polishing is an electrolytic treatment of the metal surface, which results in it being cleaned, levelled and passivated.
To improve the heat transfer between the well and the internal sensing insert in the TR 45, a thermo-conductive compound can be fitted inside the thermowell, on request. The compound should not be requested for immersion lengths longer than 300 mm, and where it would be used in temperatures of over 200°C.

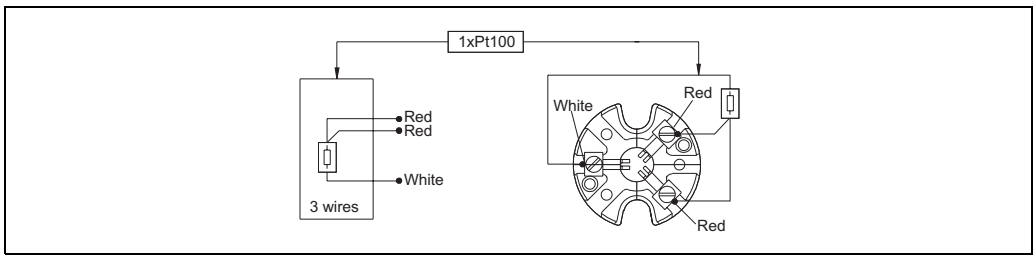


Fig. 7: Standard wiring (3 wires)

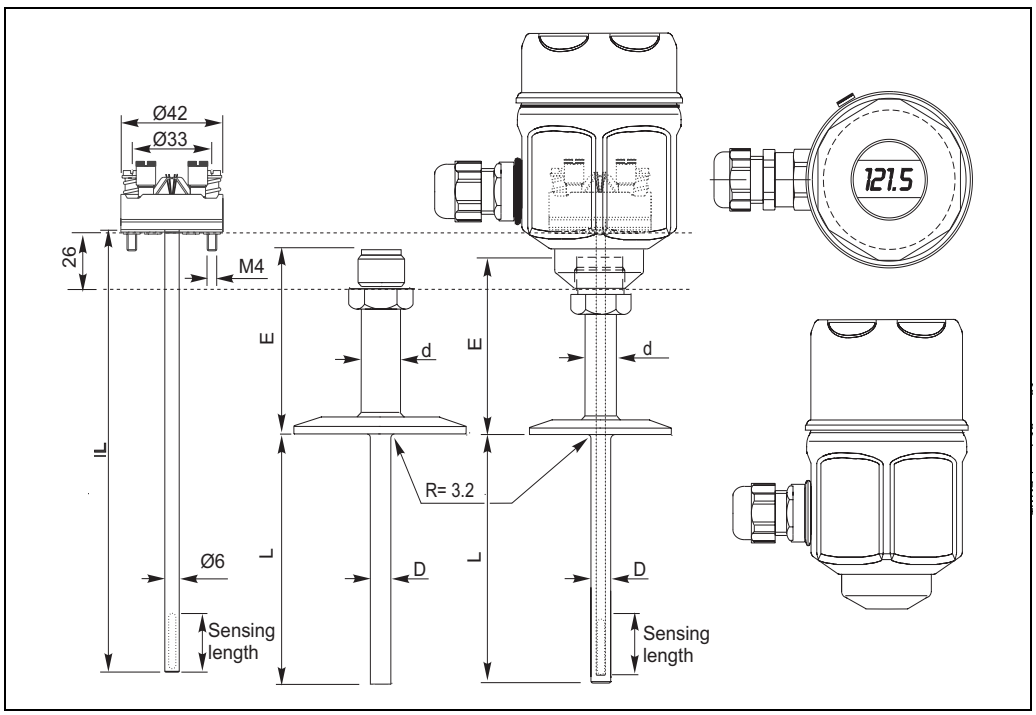


Fig. 8: Functional components in TR 45

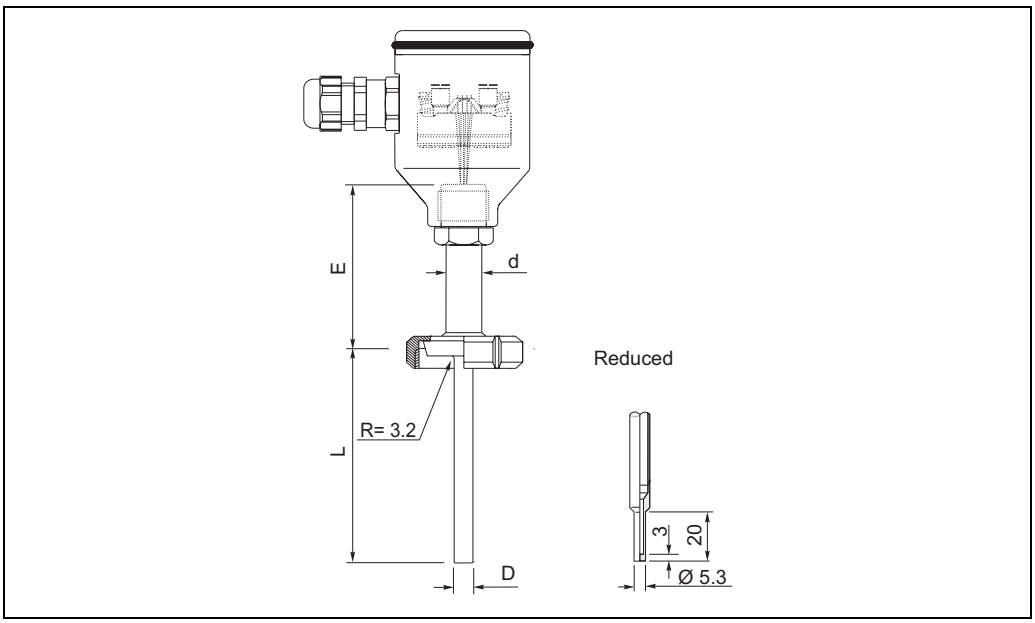


Fig. 9: TR 44 structure and tip designs

Certificates & Approvals

Sanitary compatibility

Certifications from external bodies:
- EHEDG Type EL certification (TNO report n. V3912). EHEDG accepted process connections are: Varivent®, IDF type ISO 2853, APV (acc. DIN 11864), APV Inline, DIN 11851 (only in combination with EHEDG certified gasket from Siersema), Suedmo, Naue, Neumo.
- 3-A® Authorization no. 1144 for the declaration of compliance with standard 74-02. 3-A® accept all the mentioned process connections.

Ex approval

ATEX certificate KEMA 01 ATEX1169 X (1 or 1/2 GD IIC EEx ia T6...T1 T85...450°C) for TR 45.

Material certification

The 3.1.B material certificate, according to standard EN 10204, is selectable directly from the sale structure of the product. Other types of material certifications can be requested separately.
The "standard" one is a simplified and cost-effective version, in which the documentation about the origin of the materials employed refers to each sensor. The "labelled" version also has a specific marking that relates to the wetted parts of the sensor and ensures that the relevant data are placed in the archives by means of the serial number of the thermometer.

Test report & calibration

Regarding testing and calibration, the "inspection test report" consists of a declaration of conformity with the essential points of standard DIN EN 60751.
The "Factory calibration" is carried out in the E+H EA (European Accreditation) accredited laboratory for temperature calibrations, following an internal procedure. A calibration performed according to an EA accredited procedure (SIT calibration) may be requested separately.
The calibration is executed on the thermometer insert, when that has been installed in the sensor (TR 45).
For TR 44 a minimum immersion length (120 mm) is required to ensure a precise calibration.
With the Sensor Matching Calibration, a preliminary Factory calibration of the sensor is carried out and subsequently the output curve of the transmitter is adjusted in order to minimize measurement error. In this way some of the sensor errors (probe or "loop" probe+transmitter) are compensated for through the transmitter.

Further details

Maintenance

Omnigrad M thermometers do not require specific maintenance. For the models supplied with process connections including seals, the integrity of the sealing ring should be checked regularly and it must be substituted when necessary.
In case of ATEX-certified components (transmitter, insert), please refer to the relevant documentation (see the code at the end of this document).

Delivery time

For small quantities (about 10 units) and standard options, generally 10 days.

Ordering information

Product structure

TR44-	Thermometer with sanitary process connection and neck. Designed for use in food and pharma industry. Not replaceable inset, in direct contact with process medium: fast response time. Wetted part built from same material. Temperature range: from -50 to 200°C.

Process connection

BM	Microclamp	flange	D = 25 mm for pipe DN 8/18
BA	ISO2852	clamp flange	DN 12/21.3 (miniclamp)
BB	ISO2852	clamp flange	DN 25/38
BC	ISO2852	clamp flange	DN 40/51
BF	Tri-Clamp®	flange	1" and 1 1/2"
BH	Tri-Clamp®	flange	2"
CD	Dairy	connection	DIN11851 DN 25
CF	Dairy	connection	DIN11851 DN 40
CG	Dairy	connection	DIN11851 DN 50
CH	Aseptic	connection	DIN11864-1-A DN 25
CJ	Aseptic	connection	DIN11864-1-A DN 40
DA	Welding	conn. cylindrical	D30xL40 mm
DB	Welding	conn. cyl./sph.,	D30xL40 mm
EA	G1"	for Liquiphant M type	weld-in adapter (weld-in adapter 60017886; not included)
FA	Varivent®	D = 68 mm for pipes	DN 32/125
FB	Varivent®	D = 50 mm for pipes	DN 25
FC	Varivent®	D = 31 mm for pipes	DN 10/15
JD	SMS	DN 25 (1")	
ND	Conical	metal-to-metal	connection with G1/2"
NE	Conical	metal-to-metal	connection with M12x1.5
YY	Special	version	

Neck dimensions: E (30-700 mm) and d (material stainless steel)

5	82 mm neck length E	15 mm diameter d
6	.... mm neck length E	to specify, 15 mm diameter d
9	.... mm special neck length E	and diameter d

Immersion length L (15-250 mm) (Up to 50 mm the pipe diameter must be 6 mm)

G	30	mm immersion length L,	only reduced tip
A	50	mm immersion length L	
B	90	mm immersion length L	
F	120	mm immersion length L,	
D	160	mm immersion length L	
E	220	mm immersion length L	
X	.....	mm immersion length L,	to specify
Y	.....	mm special immersion,	length L

Pipe diameter D,material and finishing of wetted parts

A	6 mm = D	SS 316L/1.4435, Ra <= 0.8 µm	
B	6 mm = D	SS 316L/1.4435, Ra <= 0.4 µm	
C	6 mm = D	SS 316L/1.4435, Ra <= 0.4 µm,	electropolishing
E	8 mm = D	SS 316L/1.4435, Ra <= 0.8 µm	
F	8 mm = D	SS 316L/1.4435, Ra <= 0.4 µm	
G	8 mm = D	SS 316L/1.4435, Ra <= 0.4 µm,	electropolishing
Y	...mm	Special version	

Tip design

S	Straight tip, for pipe D = 6 mm
R	Reduced tip (stepped), for pipe D = 8 mm
Y	Special version

Terminal type

2	Flying leads
3	Ceramic terminal block

RTD type and wiring diagram

H	1 Pt100 class A,	3-wire
L	2 Pt100 class A,	3-wire
M	1 Pt100 class A,	4-wire

P	1 Pt100 1/3 DIN B,	3-wire	
Q	2 Pt100 1/3 DIN B,	3-wire	
R	1 Pt100 1/3 DIN B,	4-wire	
Y	Special version		

Housing material, cable entry, IP grade

6	TA20D	Aluminium, high lid., M24x1.5	IP66
7	TA20B	Polyamide black, M20x1.5	IP65
A	TA20A	Aluminium, M20x1.5 conduit	IP66/IP67
3	TA20A	Aluminium, Pg16,	IP66/IP68
4	TA20A	Aluminium, PROFIBUS® connector,	IP66
B	TA20B	Polyamide white, Pg16,	IP65
C	TA20B	Polyamide black, Pg16,	IP65
E	TA21E	Aluminium, screw cap., M20x1.5	IP65
D	TA20D	Aluminium, high lid, Pg16,	IP66
5	TA20D	Aluminium, high lid, PROFIBUS® connector	IP66
J	TA20J	SS 316L, M20x1.5,	IP66/IP67
K	TA20J	SS 316L, M20x1.5, + display	IP66/IP67
M	TA20J	SS 316L, PROFIBUS® connector	IP66/IP67
R	TA20R	SS 316L, screw cap, M20x1.5	IP66/IP67
S	TA20R	SS 316L, screw cap, PROFIBUS® connector	IP66/IP67
W	TA20W	Aluminium, round lid, clip, Pg16	IP66
Y	Special version		

Built-in head transmitter

0	Without built-in transmitter
2	TMT180-A21, 0.2 K, span limit: -200...650°C, fixed range, from...to...°C
3	TMT180-A22, 0.1 K, span limit: -50...250°C, fixed range, from...to...°C
4	TMT180-A11, 0.2 K, span limit: -200...650°C, fixed range, from...to...°C
5	TMT180-A12, 0.1 K, span limit: -50...250°C, fixed range, from...to...°C
P	TMT181-A, PCP, 2-wire, isolated, programmable, from...to...°C
Q	TMT181-B, PCP ATEX, 2-wire, isolated, programmable, from...to...°C
R	TMT182-A, HART® 2-wire, isolated, programmable, from...to...°C
T	TMT182-B, HART® ATEX, 2-wire, isolated, programmable, from...to...°C
S	TMT184-A, PROFIBUS-PA® 2-wire, isolated, programmable, from...to...°C
V	TMT184-B, ROFIBUS-PA® ATEX, 2-wire, isolated, program., from...to...°C
1	Built in transmitter THT1,separate position

Material certification (wetted part)

0	Certificates not required
C	3.1.B EN10204, short form certificate
E	3.1.B EN10204, roughness short form
G	3.1.B EN10204, certificate for wetted parts
H	3.1.B EN10204, roughness certificate
J	3.1.B EN10204, roughness + ferrite content <= 0,5%
L	3.1.B EN10204, ferrite content certificate >= 0,5%

Tests and calibration

(Minim. immersion length for calibrations is L = 90 mm; the loop calibration is meant on the display when this is present)

0	Tests and calibration not required
1	Inspection test report (TZC135-A), sensor
2	Inspection test report (TZC135-D), loop
A	Factory calibration, single RTD, 0-100°C
B	Factory calibr., loop single RTD, 0-100°C
C	Factory calibration, double RTD, 0-100°C
E	Factory calibr., single RTD, 0-100-150°C
F	Factory. calibr., loop single RTD, 0-100-150°C
G	Factory calibr., double RTD, 0-100-150°C
J	Evaluation, single RTD, 0-100°C
K	Evaluation, single RTD, 0-100-140°C

Additional options

0	Additional options not required

TR44- ⇐ Order code

Ordering information

Product structure

TR45-	Thermometer with sanitary process connection, neck and thermowell. Designed for use in food and pharma industry. Replaceable mineral insulated inset with Pt100. Temperature range: from -50 to 400°C.

Process connection

BA	ISO2852	clamp flange	DN 12/21.3 (miniclamp)
BB	ISO2852	clamp flange	DN 25/38
BC	ISO2852	clamp flange	DN 40/51
BF	Tri-Clamp®	flange	1" and 1 1/2"
BH	Tri-Clamp®	flange	2"
CD	Dairy	connection	DIN11851 DN 25
CF	Dairy	connection	DIN11851 DN 40
CG	Dairy	connection	DIN11851 DN 50
CH	Aseptic	connection	DIN11864-1-A DN 25
CJ	Aseptic	connection	DIN11864-1-A DN 40
DA	Welding	conn. cylindrical	D30 x L40 mm
DB	Welding	conn. cyl./sph.,	D30 x L40 mm
EA	G1"	for Liquiphant M type	weld-in adapter (weld-in adapter 60017886; not included)
FA	Varivent®	D = 68 mm for pipes	DN 32/125
FB	Varivent®	D = 50 mm for pipes	DN 25
FC	Varivent®	D = 31 mm for pipes	DN 10/15
JD	SMS	DN 25 (1")	
ND	Conical	metal-to-metal	connection with G1/2"
YY	Special	version	

Neck dimensions: E (75-250 mm) and d (material: stainless steel)

5	82 mm neck length E	15 mm diameter d
6	.... mm neck length E	to specify, 15 mm diameter d
9	.... mm special neck length E	and diameter d

Immersion length L (30-700 mm) (Up to 50 mm the pipe diameter must be 6 mm)

G	30	mm immersion length L,	only reduced tip
A	50	mm immersion length L	
B	90	mm immersion length L	
F	120	mm immersion length L,	
D	160	mm immersion length L	
E	220	mm immersion length L	
X	.....	mm immersion length L,	to specify
Y	.....	mm special immersion,	length L

Pipe diameter D, material and finishing of wetted parts

1	9 mm = D	SS 316L/1.4435, Ra <= 0.8 µm	
3	9 mm = D	SS 316L/1.4435, Ra <= 0.4 µm	
4	9 mm = D	SS 316L/1.4435, Ra <= 0.4 µm,	electropolishing
9	...mm	Special version	

Tip design

S	Straight tip
p	Straight tip + thermoconductive paste
R	Reduced tip (stepped), only for L >= 30 mm
Q	Reduced, for L >= 30 mm + thermocond. paste
T	Tapered tip, only for L >= 65 mm
U	Tapered, for L >= 65 mm + thermocond. paste
Y	Special version

Terminal type

2	Flying leads
3	Ceramic terminal block

RTD type and wiring diagram

H	1 Pt100 class A,	3-wire
L	2 Pt100 class A,	3-wire
M	1 Pt100 class A,	4-wire
P	1 Pt100 1/3 DIN B,	3-wire

Q	2 Pt100 1/3 DIN B,	3-wire
R	1 Pt100 1/3 DIN B,	4-wire
Y	Special version	

Housing material, cable entry, IP grade

A	TA20A	Aluminium, M20x1.5 conduit	IP66/IP67
3	TA20A	Aluminium, Pg16,	IP66/IP68
4	TA20A	Aluminium, PROFIBUS® connector	IP66
B	TA20B	Polyamide white, Pg16,	IP65
C	TA20B	Polyamide black, Pg16,	IP65
7	TA20B	Polyamide black, M20x1.5	IP65
E	TA21E	Aluminium, screw cap., M20x1.5	IP65
6	TA20D	Aluminium, high lid., M24x1.5	IP66
D	TA20D	Aluminium, high lid, Pg16,	IP66
5	TA20D	Aluminium, high lid, PROFIBUS® connector	IP66
J	TA20J	SS 316L, M20x1.5,	IP66/IP67
K	TA20J	SS 316L, M20x1.5, display,	IP66/IP67
M	TA20J	SS 316L, PROFIBUS® connector	IP66/IP67
R	TA20R	SS 316L, screw cap, M20x1.5,	IP66/IP67
S	TA20R	SS 316L, screw cap, PROFIBUS® connector	IP66/IP67
W	TA20W	Aluminium, round lid, clip, Pg16	IP66
Y	Special version		

Built-in head transmitter

0	Without built-in transmitter
2	TMT180-A21, acc.0.2 K, span limit: -200...650°C, fixed range, from...to...°C
3	TMT180-A22, acc. 0.1 K, span limit: -50...250°C, fixed range, from...to...°C
4	TMT180-A11, acc. 0.2 K, span limit: -200...650°C, fixed range, from...to...°C
5	TMT180-A12, acc. 0.1 K, span limit: -50...250°C, fixed range, from...to...°C
P	TMT181-A, PCP, 2-wire, isolated, programmable, from...to...°C
Q	TMT181-B, PCP ATEX, 2-wire, isolated, programmable, from...to...°C
R	TMT182-A, HART® 2-wire, isolated, programmable, from...to...°C
T	TMT182-B, HART® ATEX, 2-wire, isolated, programmable, from...to...°C
S	TMT184-A, PROFIBUS-PA® 2-wire, isolated, programmable, rom...to...°C
V	TMT184-B, PROFIBUS-PA® ATEX, 2-wire, isol., programmable, from...to...°C
1	Built in transmitter THT1,separate position

Material certification (wetted part)

0	Certificates not required
C	3.1.B EN10204, short form certificate
E	3.1.B EN10204, roughness short form
G	3.1.B EN10204, certificate for wetted parts
H	3.1.B EN10204, roughness certificate
J	3.1.B EN10204, roughness + ferrite content
L	3.1.B EN10204, ferrite content certificate

Tests and calibration on inset

(Minim. immersion length for calibrations is L = 90 mm; the loop calibration is meant on the display when this is present)

0	Tests and calibration not required
1	Inspection test report (TZC135-A), sensor
2	Inspection test report (TZC135-D), loop
A	Factory calibration, single RTD, 0-100°C
B	Factory calibr., loop single RTD,0-100°C
C	Factory calibration, double RTD, 0-100°C
E	Factory calibr., single RTD, 0-100-150°C
F	Factory. calibr., loop single RTD, 0-100-150°C
G	Factory calibr., double RTD, 0-100-150°C

Additional options

A	ATEX II 1 GD EEx ia IIC certified
0	Additional options not required

TR45- ⇐ Order code

Built-in head transmitter

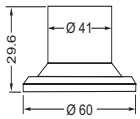
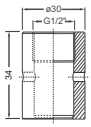
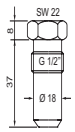
Structure

THT1-	Model and version of the head transmitter						
	A11	TMT180-A11	accuracy 0.2 K,	span limit: -200...650°C, programmable		from...to...°C	
	A12	TMT180-A12	accuracy 0.1 K,	span limit: -50...250°C, programmable		from...to...°C	
	A21	TMT180-A21	accuracy 0.2 K,	span limit: -200...650°C, fixed range		from...to...°C	
	A22	TMT180-A22	accuracy 0.1K,	span limit: -50...250°C, fixed range		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 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-			⇐ Order code

Accessories

G1" Liquiphant M type weld-in adapter for flush-mounting of "EA" process connection	– mat. nr.: 60017886	
Thermoconductive paste max temperature: 200°C	– mat. nr.: 60007126	----------
G1/2" metal-to-metal weld-in adapter for flus-mounting of "ND" process connection – material: SS 316L/1.4435 provided with leakage detectin port	– mat. nr.:60021387	
Blind plug for G1/2" metal-to-metal weld-in adapter – material: SS 316L/1.4435	– mat. nr.: 60022519 – mat. nr.: 60021194	

Supplementary documentation

❑ RTD thermometers Omnigrad TST - General information	TI 088T/02/en
❑ Terminal housings - Omnigrad TA 20	TI 072T/02/en
❑ Temperature head transmitter iTEMP® Pt TMT 180	TI 088R/09/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
❑ RTD insert for temperature sensors - Omniset TPR 100	TI 268T/02/en
❑ TA fittings & sockets Omnigrad TA50, TA55, TA60, TA70, TA75	TI 091T/02/en
❑ Safety instructions for use in hazardous areas	XA 003T/02/z1
❑ E+H Thermolab - Calibration certificates for industrial thermometers. *RTD and thermocouples*	TI 236T/02/en

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