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

Technical Information

omnigrad T – TSM 480, TR 480

RTD Temperature Sensor
Hygienic design
TSM 480 with electronics programmable via PC

Application areas

The onmigrad T easytemp® TSM 480 and TR 480 thermometers are used for measuring temperatures from -50 to 200°C.
The typical application is in plants or machinery for food & beverage production.

Features and benefits

- PC programmable transmitter with 4...20 mA output
- Configuration and Visualisation with PC operating software ReadWin® 2000
- Preset measuring range
- Highly accurate sensor and electronics
- Breakdown information in event of sensor break or sensor short-circuit, adjustable to NAMUR NE43
- Reliable measurements despite fluc-tuations in ambient temperature
- Small, compact design
- M12 plug-in connector
- 3-A® approval
- Hygienic process connections: metal-to-metal with thread, clamp, Diary and Varivent®
- Various insertion lengths
- Optional: reduced gauge tip for quick response times
- Compact thermometer completely made of stainless steel, components in contact with the process in SS 316L/1.4435
- Surface finishing of wetted parts: Ra ≤ 0.8 µm
- Pt100 accuracy class A (DIN EN 60751)

3-A® 74-02

TI 273T/02/en
60021667

Endress+Hauser
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Function and system design

Measuring principle

In the 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°C and 100°C.

Measuring system

The compact thermometer TSM 480 consists of a complete sensor with Pt100 (class A, 4 wires connection),a transmitter and a housing with various process connections.
The built-in electronics can be programmed via a PC using the M12 plug-in connector and converts the Pt100 input signal into a temperature linear 4 to 20 mA signal.
The TR 480 temperature gauge is completely similar to TSM 480, but it does not include any transmitter.

Input values

Measured variable

Temperature

Measuring range

Designation	Measuring range limits	Min. span (TSM 480)
Pt 100 as per DIN EN 60751	-50...200°C	10 K
Sensor current: ≤ 0.6 mA (TSM 480)		

Output values

Output signal

Type of thermometer	Type of signal
TSM 480	analogue 4...20 mA, 20...4 mA
TR 480	analogue, Ω

Signal on alarm (TSM 480)

Signal type	Signal range
Undershooting measuring range	linear decrease to 3.8 mA
Exceeding measuring range	linear increase to 20.5 mA
Sensor break; Sensor short-circuit	≤ 3.6 mA or ≥ 21.0 mA

Load (TSM 480)

Max. ($V_{power\ supply}$ – 10V) / 0.023 A (current output)

Induced current requirement (TSM 480)

≤ 3.5 mA

Current limitation (TSM 480)

≤ 23 mA

Switch-on delay (TSM 480)

2 s

Power supply

Electrical connection

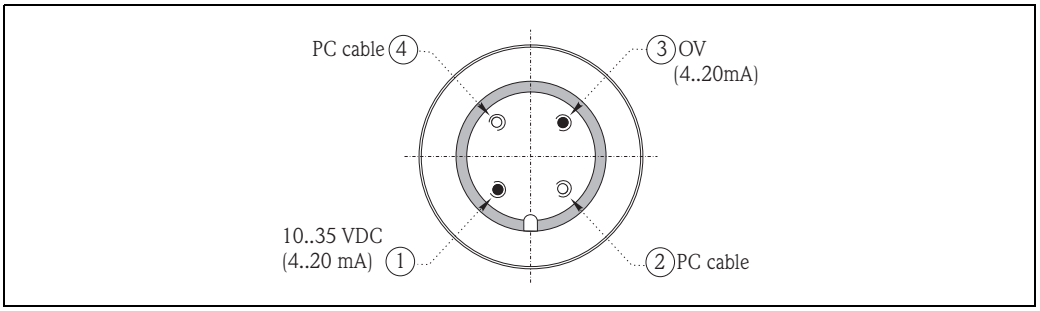


Fig. 1: Electrical connection of the TSM 480 compact thermometer (viewed from above), M12 plug, 4-pin

- Item 1: Power supply 10...35 V DC; Current output 4...20 mA
- Item 2: PC configuration cable connection
- Item 3: Power supply 0 V DC; Current output 4...20 mA
- Item 4: PC configuration cable connection

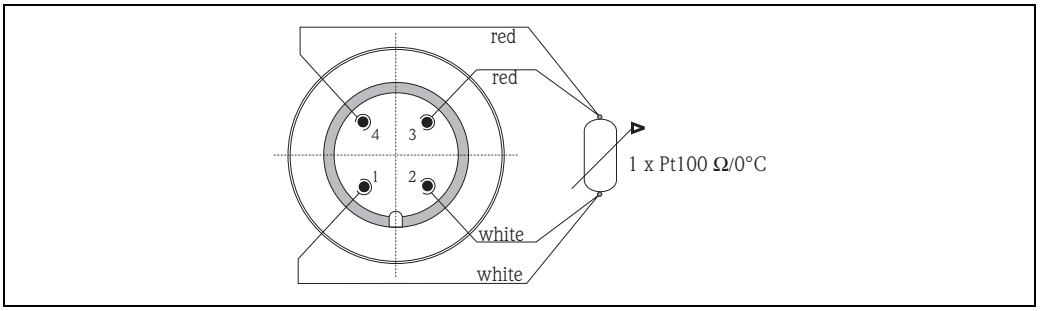


Fig. 2: Electrical connection of the TR 480 temperature gauge (viewed from above), M12 plug, 4-pin

Supply voltage (TSM 480)

U_b= 10...35 V DC

Residual ripple (TSM 480)

Permitted residual ripple $U_{ss} \leq 3V$ at $U_b \geq 13V$, $f_{max.} = 1$ kHz

Accuracy

Electronics response time (TSM 480)

1 s

Reference operating conditions (TSM 480)

Calibration temperature: +23°C ± 5 K

Measuring error

Measuring	Error
Electronics (TSM 480)	– 0.1 K or 0.08% (% refer to the set span. The highest value is valid.)
Sensor	– Class A tolerance as per DIN EN 60751, with operating temperature range of -50...200 °C – Measuring error in °C = 0.15 + 0.002 . ItI ItI = numerical value of the temperature in °C, unsigned.

Electronics long-term stability (TSM 480)

≤ 0.1 K/year or ≥ 0.05%/year
Values under reference operating conditions. % refer to the set span. The highest value is valid.

Influence of ambient temperature (temperature drift, TSM 480)

– Pt100 resistance thermometer:
$T_d = \pm$ (15 ppm/K * (full scale value + 200) + 50 ppm/K * of set measuring range) * $\Delta\vartheta$
$\Delta\vartheta$ = deviation of ambient temperature from the reference operating condition.

Influence of load (TSM 480)

± 0.02%/100 Ω
Values refer to the full scale value.

Sensor response time

As per DIN EN 60751 in water flowing at 0.4 m/s:

Sensor tip	t_{50}	t_{90}
∅ 6 mm	≤ 3.0 s	≤ 8.0 s
∅ 4 mm	≤ 2.5 s	≤ 5.0 s

Influence of supply voltage (TSM 480)

≤ ±0.01%/V deviation from 24 V
Percentages refer to the full scale value.

Installation conditions

Installation instructions

Mounting location

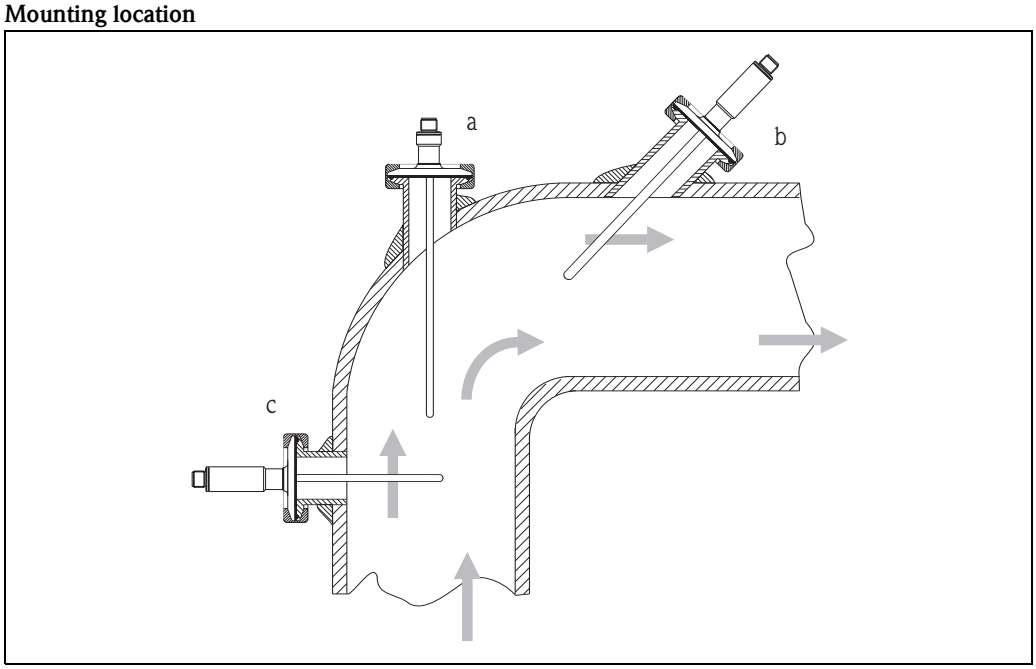


Fig. 3: Pipe installation of TSM 480 and TR 480 sensors

a At angle sections, against the direction of flow
b In smaller pipes, turned against the direction of flow
c Perpendicular to the direction of flow

Environmental conditions

Ambient temperature limits

Sensor type	Temperature limits
TSM 480	-40...85°C
TR 480	90°C max for the M12 connector

Storage temperature

-40...90°C

Climate class

As per EN 60654-1, class C

Degree of protection

IP67

Shock resistance

4g / 2...150 Hz as per IEC 60068-2-6

Vibration resistance

See 'Shock resistance'

Electromagnetic compatibility (EMC, TSM 480)

Shock resistance and interference emission as per EN 61326-1 (IEC 1326) and NAMUR NE 21

Condensation

Permitted

Process

Process temperature limits

-50...200°C

⚠ Caution!

Restrictions dependent on ambient temperature are possible for TSM 480:

max. ambient temperature	max. process temperature
to 25°C	no restrictions
to 40°C	145°C
to 60°C	130°C
to 85°C	110°C

Process pressure limits

With a limited flow velocity, the maximum tolerated pressures are the following:

max. pressure	ambient temperature
5 MPa (50 bar)	at 20°C
4.3 MPa (43 bar)	at 100°C
3.5 MPa (35 bar)	at 200°C
to 85°C	110°C

Flow velocity limits

The highest flow velocity tolerated by the sensor stem diminishes with increasing lengths of the probe exposed to the stream of fluid.

Mechanical construction

Design, dimensions

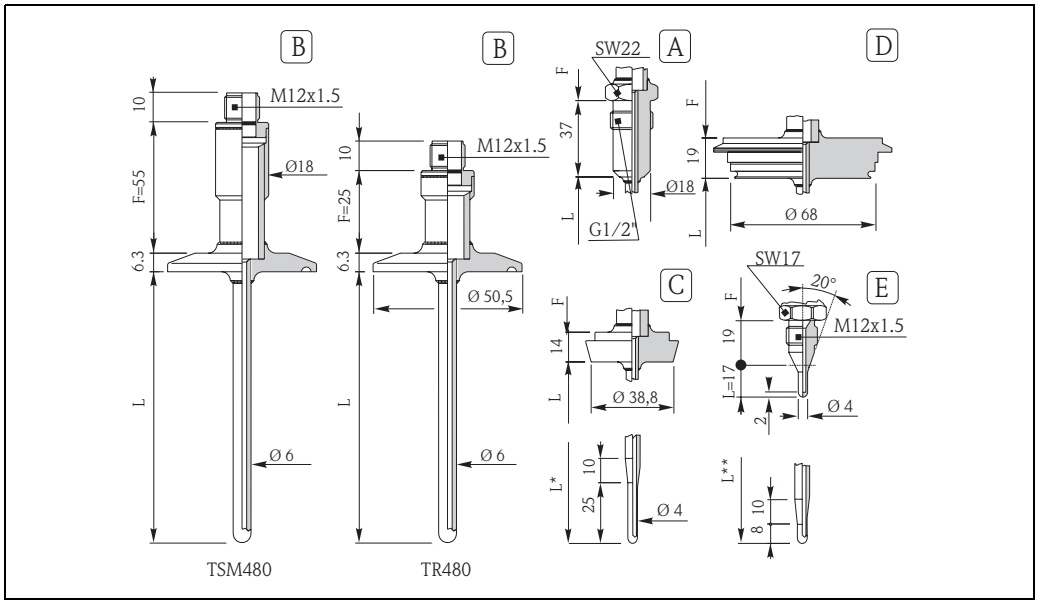


Fig. 4: Mechanical construction

- Item A: conical metal-to-metal process connection, with thread G1/2" (to be tightened with a torque of about 40 Nm)
- Item B: Tri-clamp® 1" 1-1/2" process connection, also ISO 2852 DN 25/38
- Item C: Dairy process connection DIN 11851 DN 25
- Item D: Varivent® D=68 mm process connection, for pipes DN 32/125
- Item E: M12x1,5 metal-to-metal, process connection
- L and L* versions in 50, 100, 150, 200 mm
- L** version in 17, 30 mm

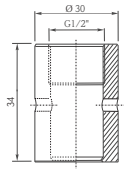
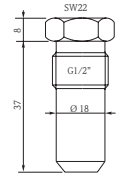
Weight

Approximately from 80 to 600 g, mainly depending on process connection.

Material

Transmitter housing (TSM 480): stainless steel (SS).
Components in contact with the process: SS 316L/1.4435, $R_a \leq 0.8$ mm.

Adapter

Designation	Dimensions in mm
Weld-in adapter for conical metal-to-metal connection, with G1/2" female thread. Material: SS 316L/1.4435. See Accessories, order code: **60021387**.	
Blind plug. Material: SS 316L/1.4435. See Accessories, order code: **60022519**.	

Terminals

M12 plug-in connector (see Chap. Power supply).

Human interface

Display elements (TSM 480)

No display elements are present directly on the display.
The measured value display, for example, can be called up using the ReadWin® 2000 PC software.

Operating elements (TSM 480)

No operating elements are present directly on the display. The temperature transmitter is configured via remote operation with the ReadWin® 2000 PC software.

Remote operation (TSM 480)

Configuration
TSM470A configuration kit, can be configured using a PC operating program (ReadWin® 2000).

Interface
PC-interface connecting cable TTL -/- RS232 with plug-in connection.

Configurable parameters
Measuring dimension (°C/°F), measuring ranges, failure mode, output signal (4...20 / 20...4 mA), offset, set tag number (8 characters), output simulation.

Certificates and approvals

CE-Mark (TSM 480)

The measurement system fulfils the requirements demanded by the EU regulations. Endress+Hauser acknowledges successfull unit testing by adding the CE mark.

Sanitary compatibility

3-A® Authorization no. 1144 for the declaration of compliance with Standard 74-02.

Other standards and guidelines

EN 60529:
Degrees of protection by housing (IP-Code)

EN 61010:
Safety requirements for electrical measurement, control and laboratory instrumentation.

EN 61326 (IEC 1326):
Electromagnetic compatibility (EMC requirements)

NAMUR:
Standardization association for measurement and control in chemical and pharmaceutical industries. (www.namur.de)

Ordering information

Product structure

TSM 480-	**omnigrad T TSM480, RTD Thermometer** Thermometer with M12 plug-in connector, integrated 2-wire 4...20 mA PCP transmitter, and hygienic process connection. Designed for food & beverage industry. Pt100 4 wires; temperature range -50...200°C.	
	Process connection	
	A	Conical metal-to-metal connection, with G1/2"
	B	Tri-clamp® flange 1" 1-1/2", ISO 2852 DN 25/38
	C	Dairy connection DIN 11851 DN 25
	D	Varivent® D=68 mm for pipes DN 32/125
	E	M12x1,5 metal-to-metal
	Y	Special version, to be specified
		Neck length L (material stainless steel)
		1 55 mm neck length
		Immersion length L
		1 17 mm immersion length L, tapered
		A 30 mm immersion length L, tapered
		B 50 mm immersion length L
		C 100 mm immersion length L
		D 150 mm immersion length L
		E 200 mm immersion length L
		X mm immersion length L, (price for 100 mm)
		Diameter;Material;Finishing;
		A 6 mm = D, SS 316L/1.4435, Ra ≤ 0.8 mm
		B 4 mm = D, SS 316L/1.4435, Ra ≤ 0.8 mm
		Tip shape:
		S Straight tip
		R Tapered/reduced tip
		RTD type
		3 1 Pt100 TF class A
		Housing
		0 No needed
		Transmitter range:
		BA Transmitter range: -50...100°C
		CA Transmitter range: -40...60°C
		DA Transmitter range: -30...60°C
		DB Transmitter range: -30...150°C
		DC Transmitter range: -30...70°C
		EA Transmitter range: -20...20°C
		EB Transmitter range: -20...60°C
		EN Transmitter range: -10...40°C
		FC Transmitter range: 0...50°C
		FE Transmitter range: 0...100°C
		FG Transmitter range: 0...150°C
		FH Transmitter range: 0...200°C
		YY Special version, to be specified
		Additional options
		0 not needed
		1 EN10204 3.1B material certificate
TSM480-		⇐ **Order code (complete)**

Ordering information

Product structure

TR 480-	**Omnigrad T TR 480, RTD Thermometer** Thermometer with M12 plug-in connector and with hygienic process connection. Designed for food & beverage industry. Pt100 4 wires; temperature range -50...200°C.	
	Process connection	
	A	Conical metal-to-metal connection, with G1/2"
	B	Tri-clamp® flange 1" 1-1/2", ISO 2852 DN 25/38
	C	Dairy connection DIN 11851 DN 25
	D	Varivent® D=68 mm for pipes DN 32/125
	E	M12x1,5 metal-to-metal
	Y	Special version, to be specified
		Neck length L (material stainless steel)
		1 25 mm neck length
		Immersion length L
		1 17 mm immersion length L, tapered
		A 30 mm immersion length L, tapered
		B 50 mm immersion length L
		C 100 mm immersion length L
		D 150 mm immersion length L
		E 200 mm immersion length L
		X ... mm immersion length L, (price for 100 mm)
			Diameter;Material;Finishing;
			A 6 mm = D, SS 316L/1.4435, Ra ≤ 0.8 mm
			B 4 mm = D, SS 316L/1.4435, Ra ≤ 0.8 mm
				Tip shape:
				S Straight tip
				R Tapered/reduced tip
					RTD type
					3 1 Pt100 TF class A
						Housing
						0 No needed
							Connection:
							A plug M12
								Additional options
								0 not needed
								1 EN10204 3.1B material certificate
TR480-										⇐ **Order code (complete)**

Accessories

Order number	Accessory
60021387	**G1/2 metal-to-metal, weld-in adapter** – Weld-in adapter for conical metal-to-metal connection with G1/2" female thread. – Material: SS 316L/1.4435.
60022519	**Blind plug for weld-in adapter** – Blind plug for weld-in adapter for conical metal-to-metal connection, with G1/2" male thread. – Material: SS 316L/1.4435.
TSM470A-VK	**Configuration kit:** – Setup program (ReadWin® 2000) and PC interface cable (TTL/RS232C) for configuring the compact thermometer.
51005148	**Cable** – Cable for sensor TSM 480, mith M12x1 plug-in connector, length = 5 m
51006327	**plug M12** – M12x1 elbow plug ready for cable, IP67, Pg 7

Documentation

- ❑ E+H Thermolab – Calibration certificates for industrial thermometers. RTD's and thermocouples (TI 236T/02/en)
- ❑ System Information "Temperature Measurement" (SI 008R/09/en)

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