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

Technical information

easytemp® TSM470

Compact Thermometer
With Pt100, class A, programmable via PC.
Gauge slide with various process connections

Application

The easytemp® TSM470 compact thermometer is used for measuring temperatures from –50 to 150 °C (–58 to 302 °F). The preferred operating location is in tanks and pipes.

Features and benefits

- PC programmable transmitter with 4 to 20 mA output
- Configuration and Visualization 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
- GL (Germanische Lloyd) Marine approval
- Reliable measurements despite fluctuations in ambient temperature
- Small, compact design
- M12 plug-in connector
- Various insertion lengths
- Optional: reduced gauge tip for quick response times
- Compact thermometer completely made of stainless steel, components in contact with the process SST 316L
- Pt100, accuracy class A (IEC 60751)

TI101R/09/en
51005094

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

Electronic acquisition and conversion of input signals in industrial temperature measurement.

Measuring system

The compact thermometer consists of a complete sensor with Pt100 (class A, 4-wire connection), a transmitter and a housing with various process connections. Further process connections are available as accessories. The built-in electronics can be programmed via a PC using the M12 plug-in connector and convert the Pt100 input signal into a temperature linear 4 to 20 mA signal.

Input values

Measuring principle

Temperature (temperature linear transmission behavior)

Measuring range

Designation	Measuring range limits	Min. span
Pt100 as per IEC 751	-50 to 150 °C (-58 to 302 °F)	10 K (19 °F)
Sensor current: ≤ 0.6 mA		

Output values

Output signal

Analog 4 to 20 mA, 20 to 4 mA

Signal on alarm

- 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

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

Induced current requirement

≤ 3.5 mA

Current limitation

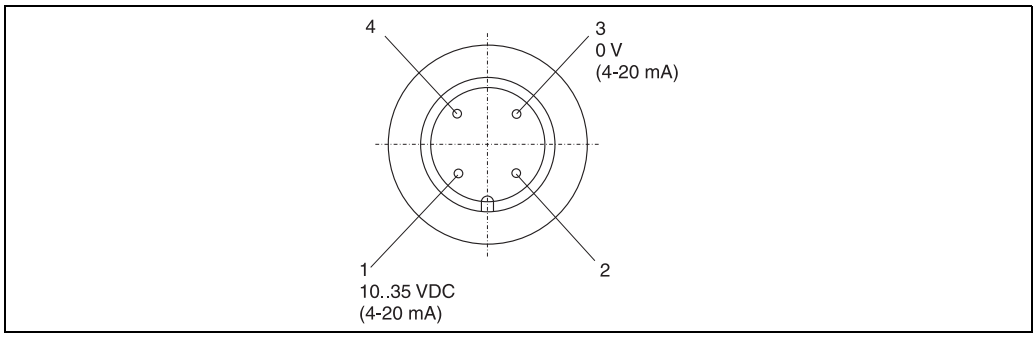
≤ 23 mA

Switch-on delay

2 s

Power supply

Electrical connection



Electrical connection of the compact thermometer (viewed from above)
– M12 plug, 4-pin

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

Supply voltage

U_b= 10 to 35 V DC

Residual ripple

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

Accuracy

Electronics response time

1 s

Reference operating conditions

Calibration temperature: 25 °C (77 °F) ± 5 K (9 °F)

Measuring error

Electronics

0.1 K (0.18 °F) or 0.08 %
% refer to the set span. The highest value is valid.

Sensor

- Class A tolerance as per IEC 751, with operating temperature range of -50 to 150 °C (-58 to 302 °F)
- Measuring error in °C = 0.15 + 0.002 · ItI

ItI = numerical value of the temperature in °C, unsigned.

Electronics long-term stability

≤ 0.1 K (0.18 °F)/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)

- Pt100 resistance thermometer:
  T_d= ± (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

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

Sensor response time

As per IEC 751 in water flowing at 0.4 m/s

Sensor tip	t_{50}	t_{90}
∅ 6 mm (0.24 in)	≤ 3.0 s	≤ 8.0 s
∅ 4 mm (0.18 in)	≤ 2.5 s	≤ 5 s

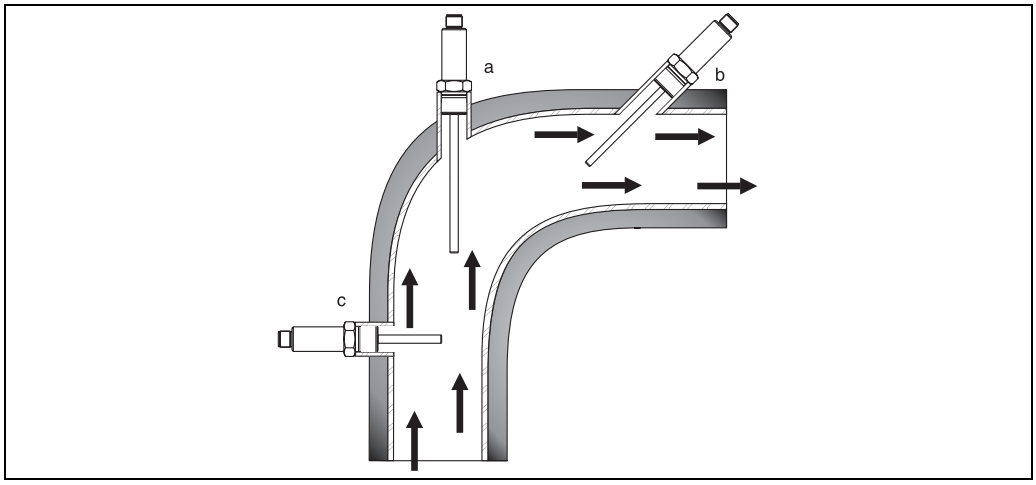
Influence of supply voltage

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

Installation conditions

Installation instructions

Mounting location



Pipe installation of compact thermometer

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

-40 to +85 °C (-40 to 185 °F)

Storage temperature

-40 to +100 °C (-40 to 212 °F)

Climate class

As per IEC 60 654-1, class C

Degree of protection

IP 67

Shock resistance

4g / 2 to 150 Hz as per IEC 60 068-2-6

Vibration resistance

see 'Shock resistance'

Electromagnetic compatibility (EMC)

Shock resistance and interference emission as per EN 61 326-1 (IEC 1326) and NAMUR NE21

Condensation

permitted

Process

Process temperature limits

-50 to 150 °C (-58 to 302 °F)

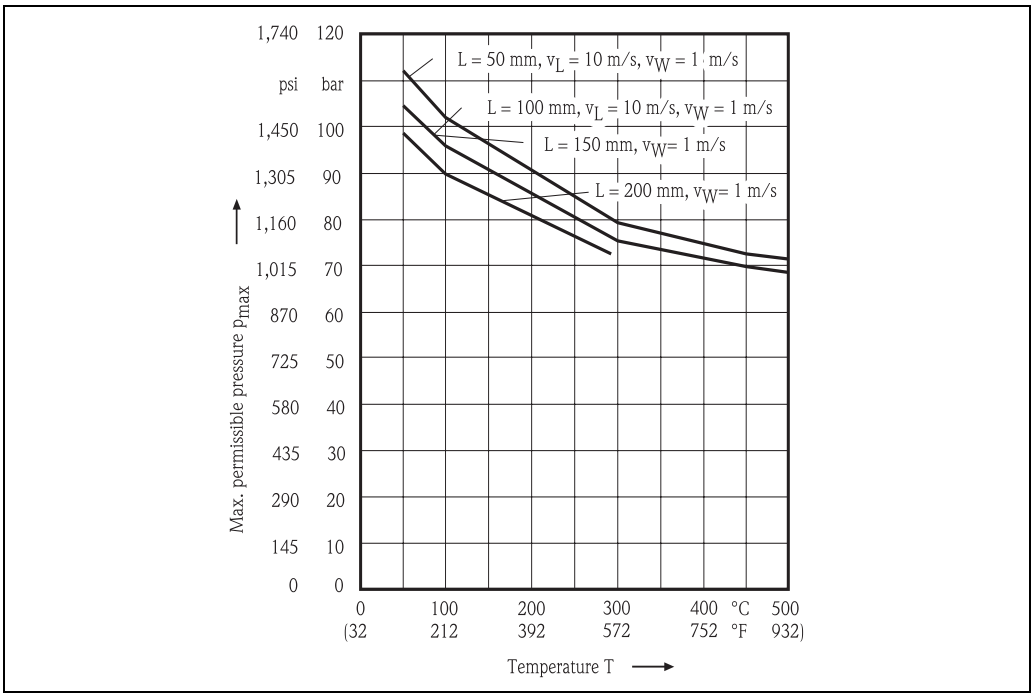
Caution!
Restrictions dependent on the process connection and ambient temperature are possible:

- No restrictions for TSM470 without process connection with accessory (Flange welding boss TSM470-A, order-no. **51004751**) and neck length of min. 20 mm (0.79 in).
- No restrictions for TSM470 without process connection with accessory (process connection G ½" TSM470-A, order-no. **51004753**).
- for TSM470 with process connection:

max. amb. temperature	max. process temperature
to 25 °C (77 °F)	no restrictions
to 40 °C (104 °F)	135 °C (275 °F)
to 60 °C (140 °F)	120 °C (248 °F)
to 85 °C (185 °F)	100 °C (212 °F)

Process pressure limits

p/T load curve according to DIN 43763

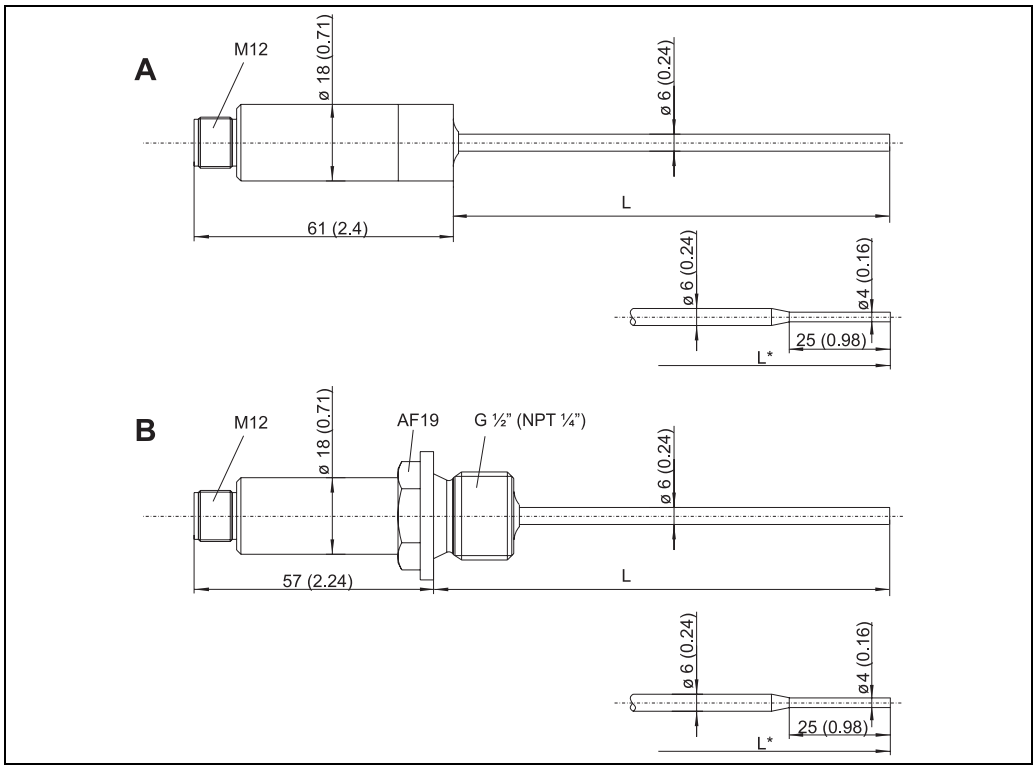


p/T load curve

L = insertion length
v_L = flow velocity air
v_W = flow velocity water

Mechanical construction

Design, dimensions



Item A: without process connection
Item B: with process connection
– L version in 50, 100, 120, 150, 200, 300 mm (1.97, 3.94, 4.72, 5.9, 7.87, 11.81 in)
– L version in 100, 120, 150, 200, 300 mm (3.94, 4.72, 5.9, 7.87, 11.81 in)*

Values in mm (inches)

Version B (with process connection) contents a sealing ring (Cu) in the scope of delivery.

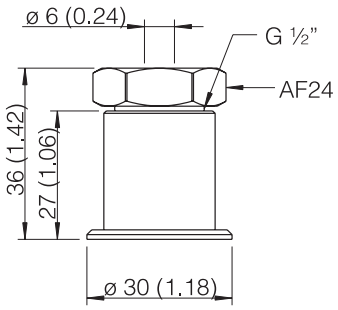
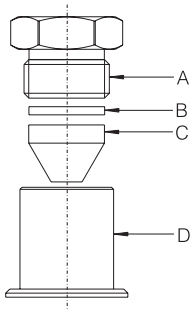
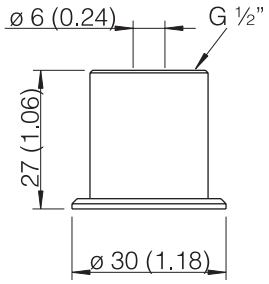
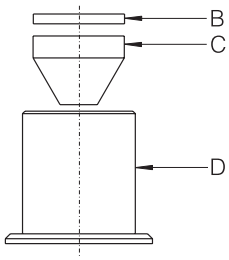
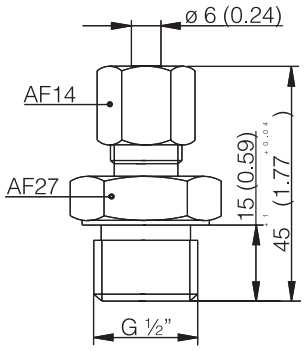
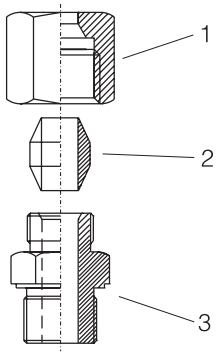
Weight

L in mm (Inches)	50 (1.97)	100 (3.94)	150 (5.9)	200 (7.87)
TSM470-A	approx. 60 g (2.12 oz)	approx. 65 g (2.29 oz)	approx. 70 g (2.47 oz)	approx. 75 g (2.65 oz)
TSM470-B	approx. 90 g (3.17 oz)	approx. 95 g (3.35 oz)	approx. 100 g (3.53 oz)	approx. 105 g (3.70 oz)

Material

Transmitter housing: stainless steel (SST);
components in contact with the process and process connection: SS 316L, $R_a \leq 0.8$ µm

Process connection

Designation	Dimensions in mm (inches)	Details/Material
Flange welding boss TSM470-A Seal, adjustable terminal screw connection, material of components in contact with the process: 316L s. accessories, order code: **51004751**		 *Pos A: Clamping screw (stainless steel)* *Pos B: Washer (stainless steel)* *Pos C: Sealing cone (PEEK)* *Pos D: Flange welding boss (316L)*
Flange welding boss TSM470-B Material of components in contact with the process: 316L s. accessories, order code.: **51004752**		 *Pos B: Washer (stainless steel)* *Pos C: Sealing cone (PEEK)* *Pos D: Flange welding boss (316L)*
Process connection G ½" , TSM470-A Seal, adjustable terminal screw connection, material of components in contact with the process: 316L s. accessories, order code: **51004753**		 *Pos. 1: Clamping nut (stainless steel)* *Pos. 2: Sealing cone (stainless steel)* *Pos. 3: Thread socket (316L) + sealing ring (Cu)*

Terminals

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

Human interface

Display elements

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

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

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 to 20 / 20 to 4 mA), offset, set tag number (8 characters), output simulation.

Certificates and approvals

CE-Mark

The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

GL

Germanische Lloyd - Marine approval

Other standards and guidelines

- IEC 60529:
  Degree of protection provided by housing (IP-Code)
- IEC 61010:
  Safety requirements for electrical measurement, control and laboratory use.
- IEC 61326:
  Electromagnetic compatibility (EMC requirements)
- NAMUR
  Standards working group for measurement and control technology in the chemical industry.
  (www.namur.de)

CSA GP

CSA General Purpose

UL

Recognized component to UL 3111-1

Ordering information

Product structure

TSM470-	TSM470 easytemp® Compact Thermometer Compact thermometer Pt100/4-wire, cl. A, PC programmable, M12 plug-in connector, analogue output 4 to 20 mA, 2-wire techn., failure mode as per NAMUR NE 43

Process connection / material

A	none
B	G ½", SS 316L
C	NPT ¼", SS 316L

Insertion length L

1B	Insertion length L 50 mm (1.97 in)
1C	Insertion length L 100 mm (3.94 in)
1D	Insertion length L 150 mm (5.9 in)
1E	Insertion length L 200 mm (7.87 in)
1G	Insertion length L 300 mm (11.81 in)
1H	Insertion length L 120 mm (4.72 in)

Sensor diameter/Material

1	∅ = 6 mm (0.24 in); SS 316L
2	∅ = 6 mm (0.24 in); SS 316L; 2-Point 0 + 100 °C (32 + 212 °F)
9	Other

Shape of the sensor tip

1	Standard sensor tip
2	Reduced sensor tip ∅ = 4 mm (0.18 in)
9	Special version, to be specified

Measuring range configuration

BA	Measuring range -50 to 100 °C (-58 to 212 °F)
CA	Measuring range -40 to 60 °C (-40 to 140 °F)
DA	Measuring range -30 to 60 °C (-22 to 140 °F)
DC	Measuring range -30 to 70 °C (-22 to 158 °F)
DB	Measuring range -30 to 150 °C (-22 to 302 °F)
EA	Measuring range -20 to 20 °C (-4 to 68 °F)
EB	Measuring range -20 to 60 °C (-4 to 140 °F)
EN	Measuring range -10 to 40 °C (14 to 104 °F)
FC	Measuring range 0 to 50 °C (32 to 122 °F)
FE	Measuring range 0 to 100 °C (32 to 212 °F)
FG	Measuring range 0 to 150 °C (32 to 302 °F)
xx	Customized conf. measuring range (min. span 10 K)

TSM470-	⇐ **Order code (complete)**

Customized option

Order no.: 51002391	TAG print 2 x 16 characters

Accessories

Order number	Accessory
51004751	TSM470-A flange welding boss, Seal, adjustable terminal screw connection, Material of components in contact with the process: 316L
51004752	TSM470-B flange welding boss, Material of components in contact with the process: 316L
51004753	Process connection G ½" TSM470-A, Seal, adjustable terminal screw connection, Material of components in contact with the process: 316L
51007599	Sealing cone G ½"
51005148	Cable M12x1, L = 5 m
51006327	M12 elbow plug ready for cable, IP67, PG7
TSM470A-VK	Configuration kit: Setup program (ReadWin® 2000) and PC interface cable (TTL/RS 232C) for configuring the compact thermometer.
TXU10	Configuration kit: Setup program (ReadWin® 2000) and PC interface cable with USB-port for configuring the compact thermometer.

Documentation

❑ Brief Operating Instructions 'easytemp® TSM470' (KA148R/09/a3)
❑ Brochure Field of activities 'Temperature measurement' (FA006T/09/en)

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