Technical Information
iTEMP TMT84
Dual Input Temperature Transmitter

PROFIBUS® PA communication

Application

- Temperature transmitter with 2 universal input channels and PROFIBUS® PA protocol for the conversion of different input signals into digital output signals
- The transmitter stands out due to signal reliability, long-term stability, high precision and advanced diagnostics function (important in critical processes)
- For the highest level of safety, availability and risk reduction
- Universal input usable for RTD thermometer, thermocouple (TC), resistance (Ω) or voltage transmitter (mV)
- DIN B style transmitter to fit in the smallest terminal heads or in remote housings in accordance with DIN EN 50446
- Optional installation in field housings even for use in Ex d areas

Your benefits

- Easy and standardized communication via PROFIBUS® PA Profile 3.02
- Straightforward design of measuring points in Ex-areas through FISCO/FNICO conformity in accordance with IEC 600079-27
- Diagnostics information according to NAMUR NE107
- Safe operation in hazardous areas thanks to international approvals
- High accuracy through sensor-transmitter matching
- Reliable operation with sensor monitoring and device hardware fault recognition
- Rapid no-tools wiring due to optional spring terminal technology
- Compatibility mode for easy replacement of the previous model iTEMP TMT184

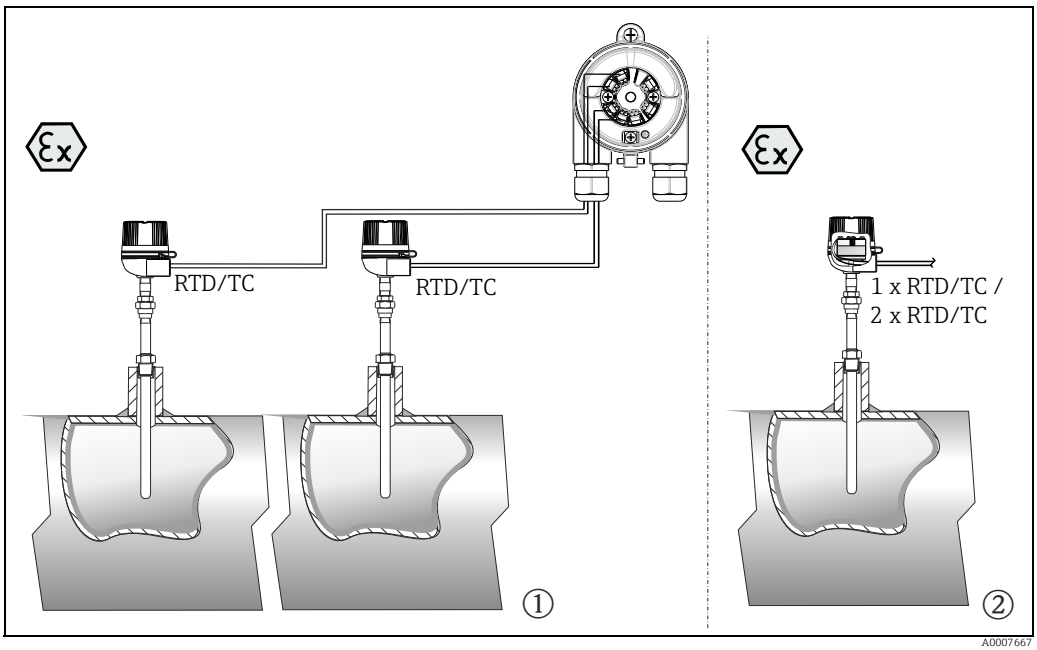
Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

Electronic recording and conversion of various input signals in industrial temperature measurement.

Measuring system

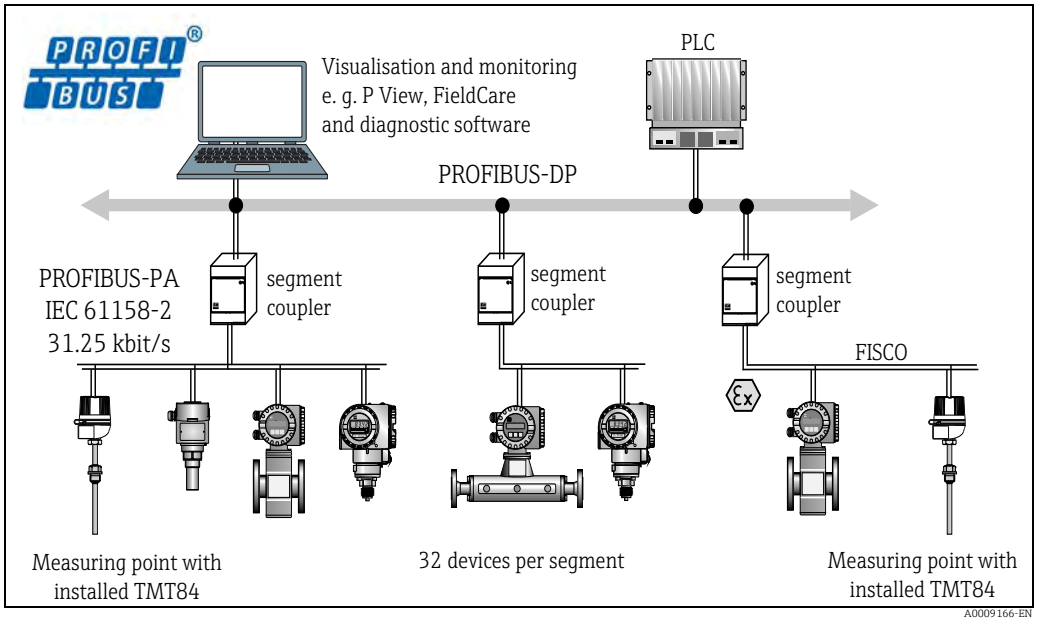


Application examples

m Two sensors with measuring input (RTD or TC) in remote installation with the following advantages: drift warning, sensor backup function and temperature-dependent switching
n Built-in head transmitter - 1 x RTD/TC or 2 x RTD/TC as redundancy

Endress+Hauser offers a wide range of resistance thermometers, thermocouples and matching thermowells.
In conjunction with these components, the temperature transmitter forms a complete measuring point for various applications in the industrial sector.

Device architecture



System integration via PROFIBUS® PA

The temperature transmitter is a two-wire device with two measuring inputs. Using PROFIBUS® PA, the device transfers converted signals from resistance thermometers and thermocouples in addition to other resistance and millivolt signals. The device is powered via the PROFIBUS® PA bus and can be installed as an intrinsically safe apparatus in zone 1 hazardous areas. The device is used for instrumentation purposes in the terminal head form B as per DIN EN 50446. Data transfer takes place via 4 analog input (AI) function blocks:

Sensor diagnosis functions
Sensor diagnoses such as cable open circuit, short-circuit, cable corrosion, wiring error and device hardware error are supported. In addition, the work area of the sensor and the ambient temperature are monitored.

2-channel functions

These functions increase the reliability and availability of the process values:
- Sensor backup switches to the second sensor if the primary sensor fails.
- Drift warning or alarm if the deviation between sensor 1 and sensor 2 is less than or greater than a predefined limit value.
- Temperature-dependent switching between sensors which have advantages in different ranges.

Compatibility mode
For a easy replacement of the previous model iTEMP TMT184 with the TMT84 a compatibility mode is available. The switching between the standard mode and compatibility mode in the iTEMP TMT84 is done automatically during the connection establishment of the cyclic communication.

The Following points have to receive attention:
- Only PROFIBUS® PA-Profile 3.0 is supported.
- Only 1-channel operation possible.
- The diagnostics and status handling is equal to the previous model TMT184.
- The previous model TMT184 software locking is not available.

Input

Measured variable	Temperature (temperature linear transmission behavior), resistance and voltage.
Measuring range	The transmitter records different measuring ranges depending on the sensor connection and input signals (see "Type of input").

Type of input

It is possible to connect two sensors which are independent of each other. The measuring inputs are not galvanically isolated from each other.

Type of input	Designation	Measuring range limits	
Resistance thermometer (RTD) as per IEC 60751 (α = 0.00385)	Pt100 Pt200 Pt500 Pt1000	-200 to 850 °C (-328 to 1562 °F) -200 to 850 °C (-328 to 1562 °F) -200 to 250 °C (-328 to 482 °F) -200 to 250 °C (-238 to 482 °F)	
as per JIS C1604-81 (α = 0.003916)	Pt100	-200 to 649 °C (-328 to 1200 °F)	
as per DIN 43760 (α = 0.006180)	Ni100 Ni1000	-60 to 250 °C (-76 to 482 °F) -60 to 150 °C (-76 to 302 °F)	
as per Edison Copper Winding No.15 (α = 0.004274)	Cu10	-100 to 260 °C (-148 to 500 °F)	
as per Edison Curve (α = 0.006720)	Ni120	-70 to 270 °C (-94 to 518 °F)	
as per GOST (α = 0.003911)	Pt50 Pt100	-200 to 1100 °C (-328 to 2012 °F) -200 to 850 °C (-328 to 1562 °F)	
as per GOST (α = 0.004280)	Cu50, Cu100	-200 to 200 °C (-328 to 392 °F)	
	Pt100 (Callendar-Van Dusen) Polynomial nickel Polynomial copper	10 to 400 Ω 10 to 2000 Ω 10 to 400 Ω 10 to 2000 Ω 10 to 400 Ω 10 to 2000 Ω	
	▪ Connection type: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ For 2-wire circuit, compensation for wire resistance possible (0 to 30 Ω) ▪ For 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire		
Resistance transmitter	Resistance Ω	10 to 400 Ω 10 to 2000 Ω	
Thermocouples (TC) as per IEC 584, Part 1			Recommended temperature range:
	Type A (W5Re-W20Re) (30)	0 to +2 500 °C (+32 to +4 532 °F)	0 to +2500 °C (+32 to 4532 °F)
	Type B (PtRh30-PtRh6) (31)	40 to +1820 °C (104 to 3308 °F)	+500 to +1820 °C (+932 to +3308 °F)
	Type E (NiCr-CuNi) (34)	-270 to +1000 °C (-454 to 1832 °F)	-150 to +1000 °C (-238 to +1832 °F)
	Type J (Fe-CuNi) (35)	-210 to +1200 °C (-346 to 2192 °F)	-150 to +1200 °C (-238 to +2192 °F)
	Type K (NiCr-Ni) (36)	-270 to +1372 °C (-454 to 2501 °F)	-150 to +1200 °C (-238 to +2192 °F)
	Type N (NiCrSi-NiSi) (37)	-270 to +1300 °C (-454 to 2372 °F)	-150 to +130 °C (-238 to +2372 °F)
	Type R (PtRh13-Pt) (38)	-50 to +1768 °C (-58 to 3214 °F)	+50 to +1768 °C (+122 to +3214 °F)
	Type S (PtRh10-Pt) (39)	-50 to +1768 °C (-58 to 3214 °F)	+50 to +1768 °C (+122 to +3214 °F)
	Type T (Cu-CuNi) (40)	-260 to +400 °C (-436 to 752 °F)	-150 to +400 °C (-238 to +752 °F)
as per ASTM E988	Type C (W5Re-W26Re) (32)	0 to +2315 °C (32 to 4199 °F)	0 to +2000 °C (+32 to +3632 °F)
	Type D (W3Re-W25Re) (33)	0 to +2315 °C (32 to 4199 °F)	0 to +2000 °C (+32 to +3632 °F)
as per DIN 43710	Type L (Fe-CuNi) (41)	-200 to +900 °C (-328 to 1652 °F)	-150 to +900 °C (-238 to +1652 °F)
	Type U (Cu-CuNi) (42)	-200 to +600 °C (-328 to 1112 °F)	-150 to +600 °C (-238 to +1112 °F)
as per GOST R8.8585-2001	Type L (NiCr-CuNi) (43)	-200 to +800 °C (-328 to 1472 °F)	-200 to +800 °C (-328 to +1472 °F)
	▪ Internal cold junction (Pt100) ▪ External cold junction: value adjustable from -40 to +85 °C (-40 to +185 °F) ▪ Maximum sensor resistance 10 kΩ (if the sensor resistance is greater than 10 kΩ, an error message is output in accordance with NAMUR NE89)		
Voltage transmitter (mV)	Millivolt transmitter (mV)	-20 to 100 mV -5 to 30 mV	

When assigning both sensor inputs, the following connection combinations are possible:

		Sensor input 1			
		RTD or resistance transmitter, 2-wire	RTD or resistance transmitter, 3-wire	RTD or resistance transmitter, 4-wire	Thermocouple (TC), voltage transmitter
Sensor input 2	RTD or resistance transmitter, 2-wire	✔	✔	-	✔
	RTD or resistance transmitter, 3-wire	✔	✔	-	✔
	RTD or resistance transmitter, 4-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	✔	✔	✔	✔

Input signal

Input data: The transmitter is able to receive a cyclic value and its status sent by a master via PROFIBUS® PA. That value and status is represented and can be read acyclically.

Output

Output signal

- PROFIBUS® PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated;
- FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: supported baud rate = 31.25 kBit/s
- Signal coding = Manchester II
- Output data:
  Available values via AI blocks: temperature (PV), temp sensor 1 + 2, terminal temperature
- In a control system the transmitter always operates as a slave and, dependent on the application, can exchange data with one or more masters.
- In accordance with IEC 60079-27, FISCO/FNICO

Breakdown information

Status message in accordance with PROFIBUS® PA Profile 3.01/3.02 specification.

Linearization/transmission behavior

Temperature linear, resistance linear, voltage linear

Mains voltage filter

50/60 Hz

Galvanic isolation

U = 2 kV AC (sensor input to the output)

Current consumption

≤ 11 mA

Switch-on delay

8 s

PROFIBUS® PA basic data

Manufacturer spec. ID-no.:	Profile 3.0 ID-no.:	Manufacturer specific GSD
1551 (Hex)	9700 (Hex) 9701 (Hex) 9702 (Hex) 9703 (Hex)	EH021551.gsd (Profile 3.01 EH3x1551.gsd)
Profile 3.0 GSD	**Device address or bus address**	**Bitmaps**
Pa139700.gsd Pa139701.gsd Pa139702.gsd Pa139703.gsd	**126** (default)	EH_1551_d.bmp EH_1551_n.bmp EH_1551_s.bmp

If the TMT84 operates in the compatibily mode, the device is identifying with the manufacturer specific ID-no.: 1523 (Hex) - TMT184 in the cyclic data exchange.

Brief description of the blocks

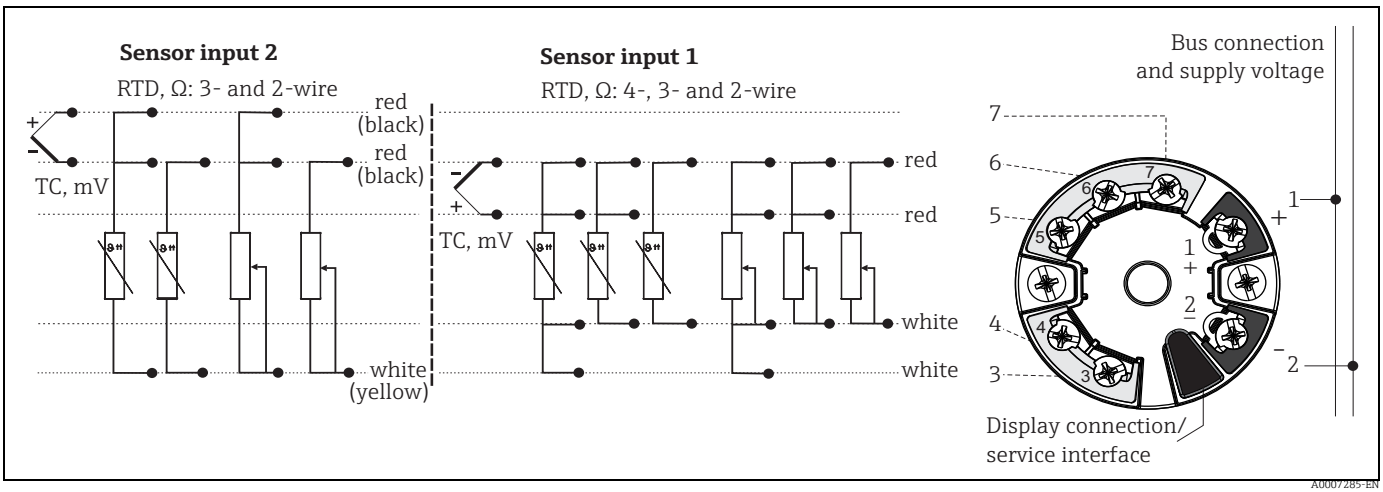
Physical Block
The Physical Block contains all the data that clearly identify and characterize the device. It is like an electronicdevice nameplate. In addition to parameters that are needed to operate the device on the fieldbus, the Physical Block makes other information available such as the order code, device ID, hardware revision, software revision, device release, etc. Furthermore the display settings can be configured via the Physical Block.

Transducer Block "Sensor 1" and "Sensor 2"
The Transducer Blocks of the transmitter contain all the measurement-related and device-specific parameters that are relevant for measuring the input variables.

Analog Input (AI)
In the AI function block, the process variables from the Transducer Blocks are prepared for subsequent automation functions in the control system (e.g. scaling, limit value processing).

Power supply

Electrical connection



Terminal assignment of transmitter.

Supply voltage

U = 9 to 32 V DC, polarity independent (max. voltage U_b = 35 V)

Performance characteristics

Response time

1 s per channel

Reference operating conditions

- Calibration temperature: + 25 °C ± 5 K (77 °F ± 9 °F)
- Supply voltage: 24 V DC
- 4-wire circuit for resistance adjustment

Resolution

Resolution A/D converter = 18 bit

Maximum measured error

Typical values, according to DIN EN 60770, 25 °C ± 3 °C (77 °F ± 5,4 °F), supply voltage 24 V_{DC}. The data concerning the various measured errors correspond to a standard deviation of 2 σ (Gaussian normal distribution). These data include nonlinearity and repeatability.

	Designation	Measuring range	Typical measured error (±)
Resistance thermometer (RTD) according to standard			Digital value[1)]
IEC 60751:2008	Pt100 (1)	0 to +200 °C (32 to +392 °F)	0.08 °C (0.14 °F)
IEC 60751:2008	Pt1000 (4)		0.08 °C (0.14 °F)
GOST 6651-94	Pt100 (9)		0.07 °C (0.13 °F)
Thermocouples (TC) according to standard			
IEC 60584-1	Typ K (36)	0 to +800 °C (32 to +1472 °F)	0.31 °C (0.56 °F)
IEC 60584-1	Typ S (39)		0.97 °C (1.75 °F)
GOST R8.8585-2001	Typ L (43)		2.18 °C (3.92 °F)

1) Using fieldbus transmitted measured value

Measured error for resistance thermometer (RTD) and resistance transmitters

Standard	Designation	Measuring range	Measured error (±)		Non-repeatability (±)
			Digital[1)]		
			Maximum	Relating to measured value	
IEC 60751:2008	Pt100 (1)	-200 to +850 °C (-328 to +1562 °F)	≤ 0.12 °C (0.21 °F)	0.06 °C (0.11 °F) + 0.006% x (MW - MBA)	≤ 0.05 °C (0.09 °F)
IEC 60751:2008	Pt100 (2)		≤ 0.30 °C (0.54 °F)	0.11 °C (0.2 °F) + 0.018% x (MW - MBA)	≤ 0.13 °C (0.23 °F)
IEC 60751:2008	Pt500 (3)	-200 to +510 °C (-328 to +950 °F)	≤ 0.16 °C (0.29 °F)	0.05 °C (0.09 °F) + 0.015% x (MW - MBA)	≤ 0.08 °C (0.14 °F)
IEC 60751:2008	Pt1000 (4)	-200 to +250 °C (-328 to +482 °F)	≤ 0.09 °C (0.16 °F)	0.03 °C (0.05 °F) + 0.013% x (MW - MBA)	≤ 0.05 °C (0.09 °F)
JIS C1604:1984	Pt100 (5)	-200 to +510 °C (-328 to +950 °F)		0.05 °C (0.09 °F) + 0.006% x (MW - MBA)	≤ 0.04 °C (0.07 °F)
GOST 6651-94	Pt50 (8)	-185 to +1100 °C (-301 to +2012 °F)	≤ 0.20 °C (0.36 °F)	0.1 °C (0.18 °F) + 0.008% x (MW - MBA)	≤ 0.11 °C (0.2 °F)
GOST 6651-94	Pt100 (9)	-200 to +850 °C (-328 to +1562 °F)	≤ 0.11 °C (0.2 °F)	0.05 °C (0.09 °F) + 0.006% x (MW - MBA)	≤ 0.05 °C (0.09 °F)
DIN 43760 IPTS-68	Ni100 (6)	-60 to 250 °C (-76 to 482 °F)	≤ 0.05 °C (0.09 °F)		≤ 0.03 °C (0.05 °F)
DIN 43760 IPTS-68	Ni120 (7)				

OIML R84:2003 / GOST 6651-2009	Cu50 (10)	-60 to +250 °C (-76 to +482 °F)	≤ 0.11 °C (0.2 °F)	0.09 °C (0.16 °F) + 0.006% x (MW - MBA)	≤ 0.05 °C (0.09 °F)
OIML R84:2003 / GOST 6651-2009	Cu100 (11)		≤ 0.06 °C (0.11 °F)	0.05 °C (0.09 °F) + 0.003% x (MW - MBA)	≤ 0.04 °C (0.07 °F)
OIML R84:2003 / GOST 6651-2009	Ni100 (12)	-60 to +180 °C (-76 to +356 °F)	≤ 0.05 °C (0.09 °F)		≤ 0.03 °C (0.05 °F)
OIML R84:2003 / GOST 6651-2009	Ni120 (13)				
OIML R84:2003 / GOST 6651-94	Cu50 (14)	-50 to +200 °C (-58 to +392 °F)	≤ 0.11 °C (0.2 °F)	0.1 °C (0.18 °F) + 0.004% x (MW - MBA)	≤ 0.07 °C (0.13 °F)
Resistance transmitters	Resistance Ω	10 to 400 Ω	32 mΩ	-	15 mΩ
		10 to 2000 Ω	300 mΩ	-	≤ 200 mΩ

1) Using fieldbus transmitted measured value

MW = Measured value
MBA = Measuring range start of the respective sensor

Measured error for thermocouples (TC) and voltage transmitters

Thermocouples (TC) according to standard	**Designation**	**Measuring range**	**Measured error (±)**		**Non-repeatability (±)**
			Digital[1]		
			Maximum	Relating to measured value	
IEC 60584-1	Type A (30)	0 to +2500 °C (+32 to +4532 °F)	≤ 1.33 °C (2.39 °F)	0.8 °C (1.44 °F) + 0.021% x MW	≤ 0.52 °C (0.94 °F)
IEC 60584-1	Type B (31)	+500 to +1820 °C (+932 to +3308 °F)	≤ 1.50 °C (2.7 °F)	1.5 °C (2.7 °F) - 0.06% x (MW - MBA)	≤ 0.67 °C (1.21 °F)
IEC 60584-1 / ASTM E988-96	Type C (32)	0 to +2000 °C (+32 to +3632 °F)	≤ 0.66 °C (1.19 °F)	0.55 °C (1 °F) + 0.0055% x MW	≤ 0.33 °C (0.59 °F)
ASTM E988-96	Type D (33)		≤ 0.75 °C (1.35 °F)	0.75 °C (1.44 °F) - 0.008% x MW	≤ 0.41 °C (0.74 °F)
IEC 60584-1	Type E (34)	-150 to +1000 °C (-238 to +2192 °F)	≤ 0.22 °C (0.4 °F)	0.22 °C (0.40 °F) - 0.006% x (MW - MBA)	≤ 0.07 °C (0.13 °F)
IEC 60584-1	Type J (35)	-150 to +1200 °C (-238 to +2192 °F)	≤ 0.27 °C (0.48 °F)	0.27 °C (0.49 °F) - 0.005% x (MW - MBA)	≤ 0.08 °C (0.14 °F)
IEC 60584-1	Type K (36)		≤ 0.35 °C (0.63 °F)	0.35 °C (0.63 °F) - 0.005% x (MW - MBA)	≤ 0.11 °C (0.20 °F)
IEC 60584-1	Type N (37)	-150 to +1300 °C (-238 to +2372 °F)	≤ 0.48 °C (0.86 °F)	0.48 °C (0.86 °F) - 0.014% x (MW - MBA)	≤ 0.16 °C (0.29 °F)
IEC 60584-1	Type R (38)	+50 to +1768 °C (+122 to +3214 °F)	≤ 1.12 °C (2.0 °F)	1.12 °C (2 °F) - 0.03% x MW	≤ 0.76 °C (1.37 °F)
IEC 60584-1	Type S (39)		≤ 1.15 °C (2.07 °F)	1.15 °C (2.07 °F) - 0.022% x MW	≤ 0.74 °C (1.33 °F)
IEC 60584-1	Type T (40)	-150 to +400 °C (-238 to +752 °F)	≤ 0.36 °C (0.47 °F)	0.36 °C (0.47 °F) - 0.04% x (MW - MBA)	≤ 0.11 °C (0.20 °F)
DIN 43710	Type L (41)	-150 to +900 °C (-238 to +1652 °F)	≤ 0.29 °C (0.52 °F)	0.29 °C (0.52 °F) - 0.009% x (MW - MBA)	≤ 0.07 °C (0.13 °F)
DIN 43710	Type U (42)	-150 to +600 °C (-238 to +1112 °F)	≤ 0.33 °C (0.6 °F)	0.33 °C (0.6 °F) - 0.028% x (MW - MBA)	≤ 0.10 °C (0.18 °F)
GOST R8.8585-2001	Type L (43)	-200 to +800 °C (-328 to +1472 °F)	≤ 2.2 °C (4.0 °F)	2.2 °C (4 °F) - 0.015% x (MW - MBA)	≤ 0.15 °C (0.27 °F)
Voltage transmitter (mV)		-20 to 100 mV	10 µV	-	4 µV

1) Using fieldbus transmitted measured value

Sample calculation with Pt100, measuring range 0 to +200 °C (32 to +392 °F), ambient temperature +25 °C (+77 °F), supply voltage 24 V:	
Measured error = 0.06 °C + 0.006% x (200 °C - (-200 °C)):	0.084 °C (0.151 °F)

Sample calculation with Pt100, measuring range 0 to +200 °C (32 to +392 °F), ambient temperature +35 °C (+95 °F), supply voltage 30 V:	
Measured error = 0.06 °C + 0.006% x (200 °C - (-200 °C)):	0.084 °C (0.151 °F)
Influence of ambient temperature = (35 - 25) x (0.002% x 200 °C - (-200 °C)), min. 0.005 °C	0.08 °C (0.144 °F)
Influence of supply voltage = (30 - 24) x (0.002 % x 200 °C - (-200 °C)), min. 0.005 °C	0.048 °C (0.086 °F)
Total measured error: √(Measured error² + influence of ambient temperature² + influence of supply voltage²:	**0.126 °C (0.227 °F)**

Sensor transmitter matching

RTD sensors are one of the most linear temperature measuring elements. Nevertheless, the output must be linearized. To improve temperature measurement accuracy significantly, the device enables the use of two methods:

- Callendar-Van Dusen coefficients (Pt100 resistance thermometer)
  The Callendar-Van Dusen equation is described as:

$$R_T = R_0[1+AT+BT^2+C\,(T\text{-}100)\,T^3]$$

  The coefficients A, B and C are used to match the sensor (platinum) and transmitter in order to improve the accuracy of the measuring system. The coefficients for a standard sensor are specified in IEC 751. If no standard sensor is available or if greater accuracy is required, the coefficients for each sensor can be determined specifically by means of sensor calibration.

- Linearization for copper/nickel resistance thermometers (RTD)
  The polynomial equations for nickel are described as:

$$R_T = R_0[1+AT+BT^2+C\,(T\text{-}100)\,T^3]$$

  The equations for copper, subject to temperature, are described as:

$$R_T = R_0(1+AT)$$

  T = -50 °C to 200 °C (-58 °F to 392 °F)

$$R_T = R_0[1+AT+B(T+6.7)+CT^2]$$

  T = -180 °C to -50 °C (-292 °F to -58 °F)

  These coefficients A, B and C are used for the linearization of nickel or copper resistance thermometers (RTD). The exact values of the coefficients derive from the calibration data and are specific to each sensor.

Sensor transmitter matching using one of the above-named methods significantly improves the temperature measurement accuracy of the entire system. This is due to the fact that to calculate the temperature measured, the transmitter uses the specific data pertaining to the connected sensor instead of using the standardized sensor curve data.

Operational influences

The data concerning the various measured errors correspond to a standard deviation of 2 σ (Gaussian normal distribution)

Designation	**Standard**	**Ambient temperature: effect (±) when ambient temperature changes by 1 °C (1.8 °F)**		**Supply voltage: effect (±) when supply voltage changes by 1 V**	
		Digital[1)]		**Digital[1)]**	
		Maximum	Relating to measured value	Maximum	Relating to measured value
Resistance thermometer (RTD)					
Pt100 (1)	IEC60751:2008	≤ 0.02 °C (0.036 °F)	0.002% x (MW - MBA). min. 0.005 °C (0.009 °F)	≤ 0.12 °C (0.21 °F)	0.002% x (MW - MBA). min. 0.005 °C (0.009 °F)
Pt200 (2)		≤ 0.026 °C (0.047 °F)	-	≤ 0.026 °C (0.047 °F)	-
Pt500 (3)		≤ 0.014 °C (0.025 °F)	0.002% x (MW - MBA), min. 0.009 °C (0.016 °F)	≤ 0.014 °C (0.025 °F)	0.002% x (MW - MBA), min. 0.009 °C (0.016 °F)
Pt1000 (4)		≤ 0.01 °C (0.018 °F)	0.002% x (MW - MBA), min. 0.004 °C (0.007 °F)	≤ 0.01 °C (0.018 °F)	0.002% x (MW - MBA), min. 0.004 °C (0.007 °F)
Pt100 (5)	JIS C1604:1984		0.002% x (MW - MBA), min. 0.005 °C (0.009 °F)		0.002% x (MW - MBA), min. 0.005 °C (0.009 °F)
Pt50 (8)	GOST 6651-94	≤ 0.03 °C (0.054 °F)	0.002% x (MW - MBA), min. 0.01 °C (0.018 °F)	≤ 0.03 °C (0.054 °F)	0.002% x (MW - MBA), min. 0.01 °C (0.018 °F)
Pt100 (9)		≤ 0.02 °C (0.036 °F)	0.002% x (MW - MBA), min. 0.005 °C (0.009 °F)	≤ 0.02 °C (0.036 °F)	0.002% x (MW - MBA), min. 0.005 °C (0.009 °F)
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.005 °C (0.009 °F)	-	≤ 0.005 °C (0.009 °F)	-
Ni120 (7)			-		-
Cu50 (10)	OIML R84:2003 / GOST 6651-2009	≤ 0.008 °C (0.014 °F)	-	≤ 0.008 °C (0.014 °F)	-
Cu100 (11)			0.002% x (MW - MBA), min. 0.004 °C (0.007 °F)		0.002% x (MW - MBA), min. 0.004 °C (0.007 °F)
Ni100 (12)		≤ 0.004 °C (0.007 °F)	-	≤ 0.004 °C (0.007 °F)	-
Ni120 (13)			-		-
Cu50 (14)	OIML R84:2003 / GOST 6651-94	≤ 0.008 °C (0.014 °F)	-	≤ 0.008 °C (0.014 °F)	-
Resistance transmitters (Ω)					
10 to 400 Ω	-	≤ 6 mΩ	0.0015% x (MW - MBA), min. 1.5 mΩ	≤ 6 mΩ	0.0015% x (MW - MBA), min. 1.5 mΩ
10 to 2000 Ω		≤ 30 mΩ	0.015% x (MW - MBA), min. 15 mΩ	≤ 30 mΩ	0.015% x (MW - MBA), min. 15 mΩ

1) Using fieldbus transmitted measured value

Designation	**Standard**	**Ambient temperature: effect (±) when ambient temperature changes by 1 °C (1.8 °F)**		**Supply voltage: effect (±) when supply voltage changes by 1 V**	
		Digital[1)]		**Digital[1)]**	
		Maximum	Relating to measured value	Maximum	Relating to measured value
Thermocouples (TC)					
Type A (30)	IEC 60584-1	≤ 0.14 °C (0.25 °F)	0.0055% x MW, min. 0.03 °C (0.05 °F)	≤ 0.14 °C (0.25 °F)	0.0055% x MW, min. 0.03 °C (0.005 °F)
Type B (31)	IEC 60584-1	≤ 0.06 °C (0.11 °F)	-	≤ 0.06 °C (0.11 °F)	-
Type C (32)	IEC 60584-1 / ASTM E988-96	≤ 0.09 °C (0.16 °F)	0.0045% x MW, min. 0.03 °C (0.05 °F)	≤ 0.09 °C (0.16 °F)	0.0045% x MW, min. 0.03 °C (0.05 °F)

Designation	Standard	Ambient temperature: effect (±) when ambient temperature changes by 1 °C (1.8 °F)		Supply voltage: effect (±) when supply voltage changes by 1 V	
		Digital[1]		Digital[1]	
Type D (33)	ASTM E988-96	≤ 0.08 °C (0.14 °F)	0.004% x MW, min. 0.035 °C (0.063 °F)	≤ 0.08 °C (0.14 °F)	0.004% x MW, min. 0.035 °C (0.063 °F)
Type E (34)	IEC 60584-1	≤ 0.03 °C (0.05 °F)	0.003% x (MW - MBA), min. 0.016 °C (0.029 °F)	≤ 0.03 °C (0.05 °F)	0.003% x (MW - MBA), min. 0.016 °C (0.029 °F)
Type J (35)		≤ 0.02 °C (0.04 °F)	0.0028% x (MW - MBA), min. 0.02 °C (0.036 °F)	≤ 0.02 °C (0.04 °F)	0.0028% x (MW - MBA), min. 0.02 °C (0.036 °F)
Type K (36)		≤ 0.04 °C (0.07 °F)	0.003% x (MW - MBA), min. 0.013 °C (0.023 °F)	≤ 0.04 °C (0.07 °F)	0.003% x (MW - MBA), min. 0.013 °C (0.023 °F)
Type N (37)		≤ 0.04 °C (0.07 °F)	0.0028% x (MW - MBA), min. 0.020 °C (0.036 °F)	≤ 0.04 °C (0.07 °F)	0.0028% x (MW - MBA), min. 0.020 °C (0.036 °F)
Type R (38)		≤ 0.06 °C (0.11 °F)	0.0035% x MW, min. 0.047 °C (0.085 °F)	≤ 0.06 °C (0.11 °F)	0.0035% x MW, min. 0.047 °C (0.085 °F)
Type S (39)		≤ 0.05 °C (0.09 °F)	-	≤ 0.05 °C (0.09 °F)	-
Type T (40)		≤ 0.01 °C (0.02 °F)	-	≤ 0.01 °C (0.02 °F)	-
Type L (41)	DIN 43710	≤ 0.02 °C (0.04 °F)	-	≤ 0.02 °C (0.04 °F)	-
Type U (42)	DIN 43710	≤ 0.01 °C (0.02 °F)	-	≤ 0.01 °C (0.02 °F)	-
Type L (43)	GOST R8.8585-2001	≤ 0.02 °C (0.04 °F)	-	≤ 0.02 °C (0.04 °F)	-
Voltage transmitter (mV)					
-20 to 100 mV	-	≤ 3 µV	-	≤ 3 µV	-

1) Using fieldbus transmitted measured value

MW = Measured value
MBA = Measuring range start of the respective sensor

Long term drift resistance thermometer (RTD) and resistance transmitter

Designation	Standard	Long term drift (±)		
		After 1 year	After 3 years	After 5 years
		Maximum		
Pt100 (1)	IEC 60584-1	≤ 0.03 °C (0.05 °F) + 0.024% x measuring span	≤ 0.042 °C (0.076 °F)+ 0.035% x measuring span	≤ 0.051 °C (0.092 °F) + 0.037% x measuring span
Pt200 (2)	IEC 60584-1	≤ 0.17 °C (0.31 °F) + 0.016% x measuring span	≤ 0.28 °C (0.5 °F) + 0.022% x measuring span	≤ 0.343 °C (0.617 °F) + 0.025% x measuring span
Pt500 (3)	IEC 60584-1 / ASTM E988-96	≤ 0.067 °C (0.121 °F) + 0.018% x measuring span	≤ 0.111 °C (0.2 °F)+ 0.025% x measuring span	≤ 0.137 °C (0.246 °F) + 0.028% x measuring span
Pt1000 (4)	ASTM E988-96	≤ 0.034 °C (0.06 °F) + 0.02% x measuring span	≤ 0.056 °C (0.1 °F) + 0.029% x measuring span	≤ 0.069 °C (0.124 °F)+ 0.032% x measuring span

Designation	Standard	Long term drift (±)		
		After 1 year	After 3 years	After 5 years
Pt100 (5)	IEC 60584-1	≤ 0.03 °C (0.054 °F)+ 0.022% x measuring span	≤ 0.042 °C (0.076 °F) + 0.032% x measuring span	≤ 0.051 °C (0.092 °F) + 0.034% x measuring span
Pt50 (8)		≤ 0.055 °C (0.01 °F) + 0..023% x measuring span	≤ 0.089 °C (0.16 °F) + 0.032% x measuring span	≤ 0.1 °C (0.18 °F)+ 0.035% x measuring span
Pt100 (9)		≤ 0.03 °C (0.054 °F)+ 0.024% x measuring span	≤ 0.042 °C (0.076 °F) + 0.034% x measuring span	≤ 0.051 °C (0.092 °F) + 0.037% x measuring span
Ni100 (6)		≤ 0.025 °C (0.045 °F) + 0.016% x measuring span	≤ 0.042 °C (0.076 °F) + 0.02% x measuring span	≤ 0.047 °C (0.085 °F) + 0.021% x measuring span
Ni120 (7)		≤ 0.02 °C (0,036 °F) + 0.018% x measuring span	≤ 0.032 °C (0.058 °F) + 0.024% x measuring span	≤ 0.036 °C (0.065 °F) + 0.025% x measuring span
Cu50 (10)		≤ 0.053 °C (0.095 °F) + 0.013% x measuring span	≤ 0.084 °C (0.151 °F) + 0.016% x measuring span	≤ 0.094 °C (0.169 °F) + 0.016% x measuring span
Cu100 (11)		≤ 0.027 °C (0.049 °F) + 0.019% x measuring span	≤ 0.042 °C (0.076 °F) + 0.026% x measuring span	≤ 0.047 °C (0.085 °F) + 0.027% x measuring span
Ni100 (12)	DIN 43710	≤ 0.026 °C (0.047 °F)+ 0.015% x measuring span	≤ 0.04 °C (0.076 °F) + 0.02% x measuring span	≤ 0.046 °C (0.083 °F) + 0.02% x measuring span
Ni120 (13)	DIN 43710	≤ 0.021 °C (0.038 °F) + 0.017% x measuring span	≤ 0.034 °C (0.061 °F) + 0.022% x measuring span	≤ 0.038 °C (0.068 °F) + 0.023% x measuring span
Cu50 (14)	GOST R8.8585-2001	≤ 0.056 °C (0.1 °F)+ 0.009% x measuring span	≤ 0.089 °C (0.16 °F) + 0.011% x measuring span	≤ 0.1 °C (0.18 °F) + 0.011% x measuring span
Resistance transmitters (Ω)				
10 to 400 Ω	-	≤ 10 mΩ + 0.022% x measuring span	≤ 14 mΩ + 0.031% x measuring span	≤ 16 mΩ + 0.033% x measuring span
10 to 2000 Ω	-	≤ 144 mΩ + 0.019% x measuring span	≤ 238 mΩ + 0.026% x measuring span	≤ 294 mΩ + 0.028% x measuring span

Long term drift thermocouple (TC) and voltage transmitter

Designation	Standard	Long term drift (±)		
		After 1 year	After 3 years	After 5 years
		Maximum		
Type A (30)	IEC60751:2008	≤ 0.17 °C (0.306 °F) + 0.021% x measuring span	≤ 0.27 °C (0.486 °F) + 0.03% x measuring span	≤ 0.38 °C (0.683 °F) + 0.035% x measuring span
Type B (31)		≤ 0.5 °C (0.9 °F)	≤ 0.75 °C (1.35 °F)	≤ 1.0 °C (1.8 °F)
Type C (32)		≤ 0.15 °C (0.27 °F) + 0.018% x measuring span	≤ 0.24 °C (0.43 °F) + 0.026% x measuring span	≤ 0.34 °C (0.61 °F) + 0.027% x measuring span
Type D (33)		≤ 0.21 °C (0.38 °F) + 0.015% x measuring span	≤ 0.34 °C (0.61 °F)+ 0.02% x measuring span	≤ 0.47 °C (0.85 °F)+ 0.02% x measuring span
Type E (34)	JIS C1604:1984	≤ 0.06 °C (0.11 °F) + 0.018% x measuring span	≤ 0.09 °C (0.162 °F) + 0.025% x measuring span	≤ 0.13 °C (0.234 °F) + 0.026% x measuring span
Type J (35)	GOST 6651-94	≤ 0.06 °C (0.11 °F) + 0.019% x measuring span	≤ 0.1 °C (0.18 °F) + 0.025% x measuring span	≤ 0.14 °C (0.252 °F) + 0.027% x measuring span
Type K (36)		≤ 0.09 °C (0.162 °F) + 0.017% x (MW + 150 °C (270 °F))	≤ 0.14 °C (0.252 °F) + 0.023% x measuring span	≤ 0.19 °C (0.342 °F) + 0.024% x measuring span
Type N (37)	DIN 43760 IPTS-68	≤ 0.13 °C (0.234 °F) + 0.015% x (MW + 150 °C (270 °F))	≤ 0.2 °C (0.36 °F) + 0.02% x measuring span	≤ 0.28 °C (0.5 °F) + 0.02% x measuring span
Type R (38)		≤ 0.31 °C (0.558 °F) + 0.011% x (MW - 50 °C (90 °F))	≤ 0.5 °C (0.9 °F) + 0.013% x measuring span	≤ 0.69 °C (1.241 °F) + 0.011% x measuring span

Designation	Standard	Long term drift (±)		
		After 1 year	After 3 years	After 5 years
Type S (39)	OIML R84:2003 / GOST 6651-2009	≤ 0.31 °C (0.558 °F) + 0.011% x measuring span	≤ 0.5 °C (0.9 °F) + 0.013% x measuring span	≤ 0.7 °C (1.259 °F) + 0.011% x measuring span
Type T (40)		≤ 0.09 °C (0.162 °F) + 0.011% x measuring span	≤ 0.15 °C (0.27 °F)+ 0.013% x measuring span	≤ 0.2 °C (0.36 °F) + 0.012% x measuring span
Type L (41)		≤ 0.06 °C (0.108 °F) + 0.017% x measuring span	≤ 0.1 °C (0.18 °F)+ 0.022% x measuring span	≤ 0.14 °C (0.252 °F) + 0.022% x measuring span
Type U (42)		≤ 0.09 °C (0.162 °F) + 0.013% x measuring span	≤ 0.14 °C (0.252 °F)+ 0.017% x measuring span	≤ 0.2 °C (0.360 °F)+ 0.015% x measuring span
Type L (43)	OIML R84:2003 / GOST 6651-94	≤ 0.08 °C (0.144 °F) + 0.015% x measuring span	≤ 0.12 °C (0.216 °F) + 0.02% x measuring span	≤ 0.17 °C (0.306 °F) + 0.02% x measuring span
Voltage transmitter (mV)				
-20 to 100 mV	-	≤ 2 µV + 0.022% x measuring span	≤ 3.5 µV + 0.03% x measuring span	≤ 4.7 µV + 0,033% x measuring span

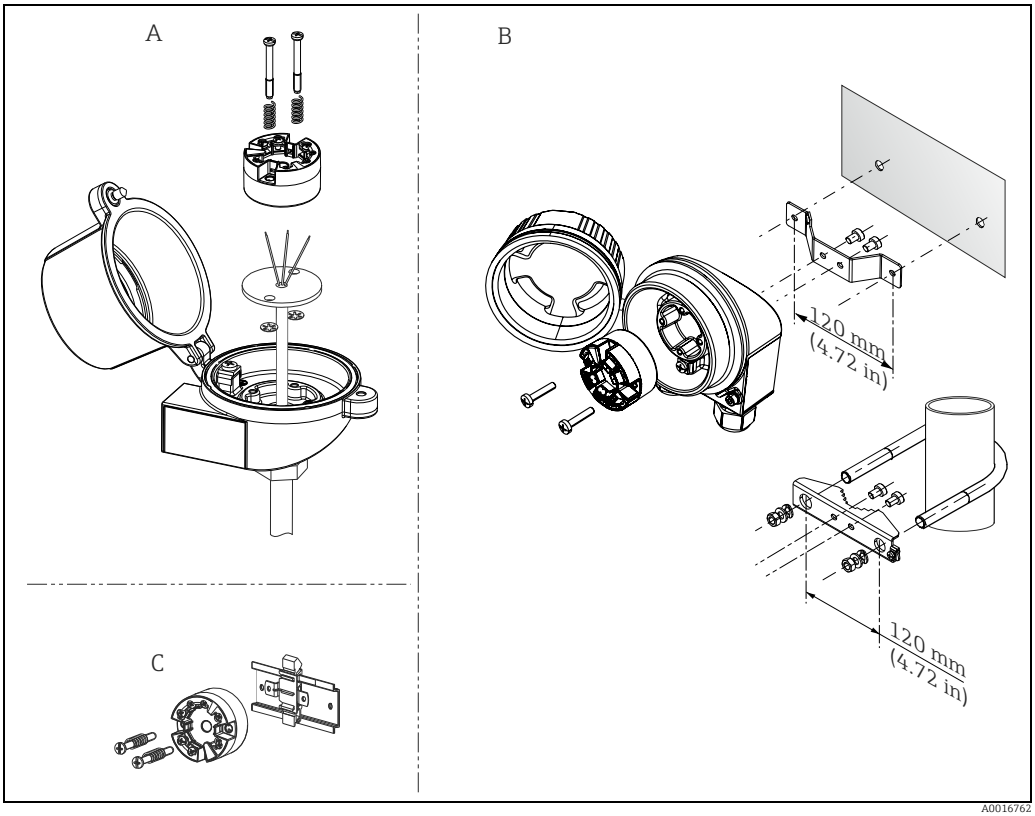
Influence of reference point (cold junction)

Pt100 DIN EN 60751 Cl. B, internal reference point for thermocouples TC

Installation

Installation instructions

- Mounting location:



A: Terminal head as per DIN EN 50446 form B, direct installation onto insert with cable entry (middle hole 7 mm (0.28 in))
B: Separated from process in field housing, wall or pipe mounting
C: With DIN rail clip on top-hat rail as per IEC 60715 (TH35)

- Orientation:
  No restrictions

Environment

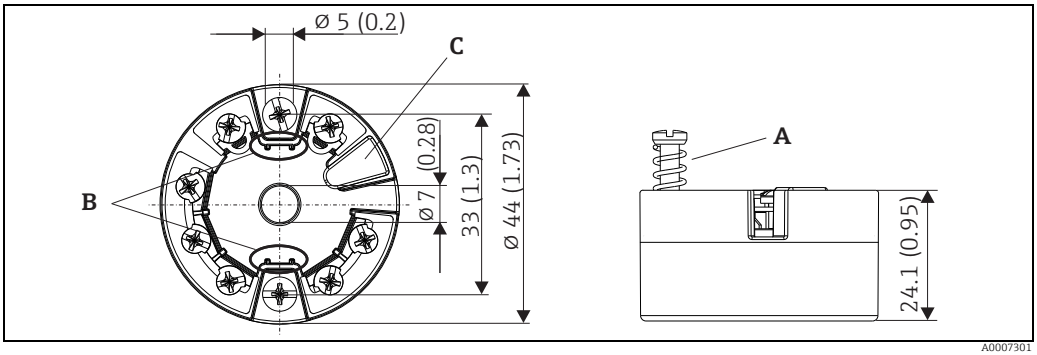
Ambient temperature range	-40 to +85 °C (-40 to +185 °F), for hazardous areas see Ex documentation (XA, CD)
Storage temperature	-40 to +100 °C (-40 to +212 °F)
Altitude	up to 4000 m (4374.5 yd) above mean sea level in accordance with IEC 61010-1, CSA 1010.1-92
Climate class	as per IEC 60654-1, Class C
Humidity	▪ Condensation as per IEC 60068-2-33 permitted ▪ Max. rel. humidity: 95% as per IEC 60068-2-30
Degree of protection	▪ IP00 with screw terminals. In the installed state, it depends on the terminal head or field housing used. ▪ IP30 with spring terminals ▪ IP66/67 (NEMA Type 4x encl.) when installed in field housing TA30A, TA30D or TA30H
Shock and vibration resistance	10 to 2000 Hz for 5g as per IEC 60068-2-6
Electromagnetic compatibility (EMC)	**CE compliance** EMC to all relevant requirements of the IEC/EN 61326- series and NAMUR NE21. For details see declaration of conformity. Maximum measured error <1% of measuring range Interference immunity: as per IEC/EN 61326 series (industrial environment) / NAMUR NE21 Interference emissions: as per IEC 61326-1 Class B
Measuring category	Measuring category II as per IEC 61010-1. The measuring category is provided for measuring on power circuits that are directly connected electrically with the low-voltage network.
Degree of contamination	Pollution degree 2 as per IEC 61010-1.

Mechanical construction

Design, dimensions

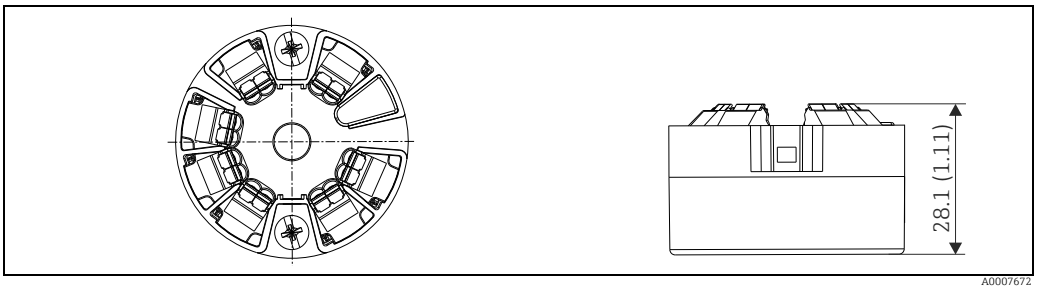
Specifications in mm (in)

Head transmitter



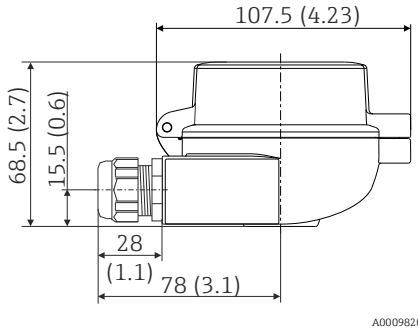
Model with screw terminals

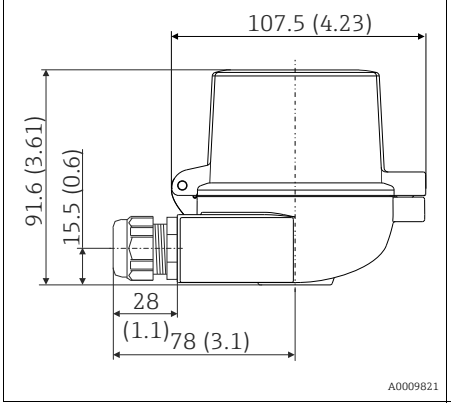
Pos. A: Spring range L ≥5 mm (not applicable to US - M4 mounting screws)
Pos. B: Fixing elements for detachable measured value display
Pos. C: Interface for contacting measured value display

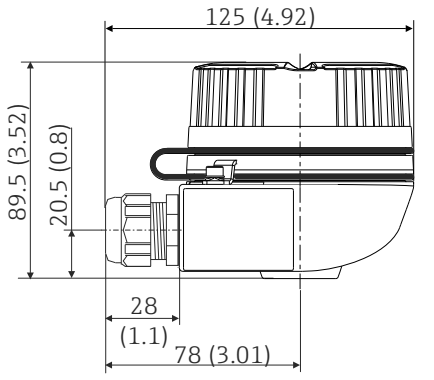


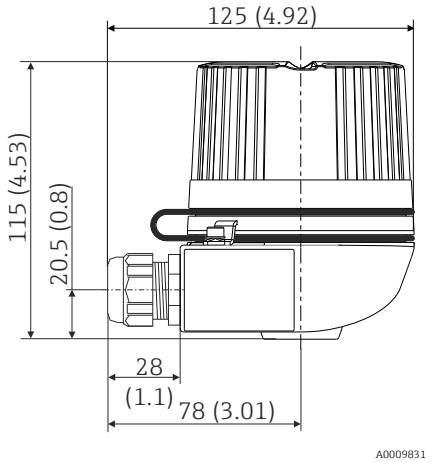
Model with spring terminals. The same dimensions except for height of housing.

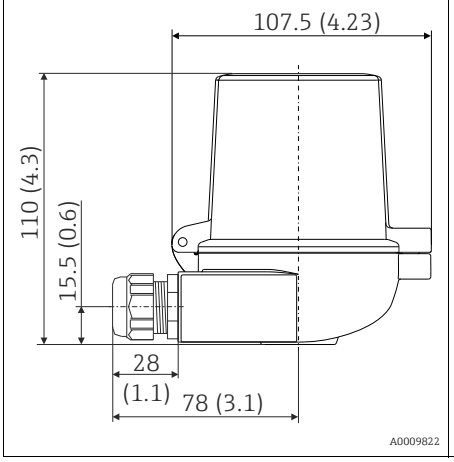
Field housings
All terminal heads have an internal shape and size in accordance with DIN EN 50446, flat face and a thermometer connection of M24x1.5. Cable glands: M20x1.5

TA30A	Specification
	▪ Two cable entries ▪ Temperature: -50 °C to +150 °C (-58 °F to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry incl. glands: ½"NPT and M20x1.5 ▪ Head color: blue RAL 5012 ▪ Cap color: gray RAL 7035 ▪ Weight: 330 g (11.64 oz)

TA30A with display window in cover	Specification
	▪ Two cable entries ▪ Temperature: -50 °C to +150 °C (-58 °F to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry incl. glands: ½"NPT und M20x1.5 ▪ Head color: blue RAL 5012 ▪ Cap color: gray RAL 7035 ▪ Weight: 420 g (14.81 oz)

TA30H	Specification
	▪ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries ▪ Temperature: -50 °C to +150 °C (-58 °F to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of the cable gland!) ▪ Material: aluminum; polyester powder coated ▪ Cable entry glands: ½"NPT, M20x1.5 ▪ Head color: blue RAL 5012 ▪ Cap color: gray RAL 7035 ▪ Weight: 640 g (22.6 oz)

TA30H with display window in cover	Specification
	▪ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries ▪ Temperature: -50 °C to +150 °C (-58 °F to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of the cable gland!) ▪ Material: aluminum; polyester powder coated ▪ Cable entry glands: ½"NPT, M20x1.5 ▪ Head color: blue RAL 5012 ▪ Cap color: gray RAL 7035 ▪ Weight: 860 g (30.33 oz)

TA30D	Specification
	▪ Two cable entries ▪ Temperature: -50 °C to +150 °C (-58 °F to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry incl. glands: ½"NPT, M20x1.5 ▪ Two head transmitters can be mounted. In the standard version, one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Head color: blue RAL 5012 ▪ Cap color: gray RAL 7035 ▪ Weight: 390 g (13.75 oz)

Maximum ambient temperature for cable glands and fieldbus connectors	
Type	**Temperature range**
Cable gland polyamide ½" NPT, M20x1.5 (non-Ex)	-40...+100 °C (-40...+212 °F)
Cable gland polyamide M20x1.5 (for dust ignition-proof area)	-20...+95 °C (-4...+203 °F)
Cable gland brass ½" NPT, M20x1.5 (for dust ignition-proof area)	-20...+130 °C (-4...+266 °F)
Fieldbus connector (M12x1 PA, 7/8" FF)	-40...+105 °C (-40...+221 °F)

Weight

- Head transmitter: approx. 40 to 50 g (1.4 to 1.8 oz)
- Field housing: see specifications

Material

All materials used are RoHS-compliant.

Head transmitter
- Housing: Polycarbonate (PC), complies with UL94 HB flammability standard (HB: horizontal burning test)
- Terminals
  Screw terminals: Nickel-plated brass and gold-plated contact
  Spring terminals: Tin-plated brass, contact spring V2A
- Potting: WEVO PU 403 FP / FL, according to UL94 V0 flammability standard (V0: vertical burning test)

Field housing: see specifications

Terminals

Choice of screw or spring terminals (see "Design, dimensions" diagram) for sensor and fieldbus wires:

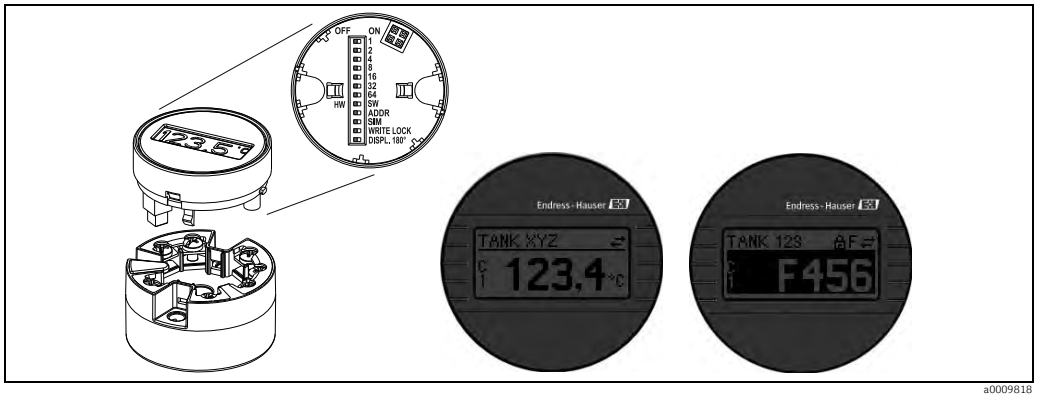
Terminals version	Wire version	Conductor cross-section
Screw terminals (with latches at the fieldbus terminals for easy connection of a handheld terminal, e.g. DXR375)	Rigid or flexible	≤ 2.5 mm² (14 AWG)
Spring terminals Stripped length = min. 10 mm (0.39 in)	Rigid or flexible	0.2...1.5 mm² (24...16 AWG)
	Flexible with wire-end ferrules without plastic ferrule	0.25...1.5 mm² (24...16 AWG)
	Flexible with wire-end ferrules with plastic ferrule	0.25...0.75 mm² (24...18 AWG)

No ferrules have to be used when connecting flexible wires to spring terminals.

Operability

Display and operating elements

There are no display or operating elements present at the transmitter.
Optional the plug-on display TID10 can be used in connection with the transmitter. It will display information regarding the actual measured value and the measurement point identification. In the event of a fault in the measurement chain this will be displayed in inverse color showing the channel ident and diagnostics code. DIP-switches can be found on the rear of the display. This enables the hardware set-up such as the PROFIBUS® device address.



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Pluggable display TID10

If the transmitter is installed in a field housing and used with a display, a housing with glas window needs to be used.

Remote operation

The configuration of PROFIBUS® PA functions and of device-specific parameters is performed via fieldbus communication. Special configuration systems provided by various manufacturers are available for this purpose.

Configuration software
Endress+Hauser FieldCare (DTM)
SIMATIC PDM (EDD)

Sources of supply of the device data files (GSD) and device drivers:
- GSD-file: www.endress.com (→ Download → Software)
- Profile GSD-file: www.profibus.com
- FieldCare/DTM, SIMATIC PDM (EDD): www.endress.com (→ Download → Software)

Bus address

The device address or bus address is set up either with the configuration software or via DIP switches on the optional display.

Certificates and approvals

CE-Mark	The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
Hazardous area approvals	For further details on the ailable Ex versions (ATEX, CSA, FM, etc.), please contact your nearest Endress+Hauser sales organisation. All relevant data for hazardous areas can be found in separate Ex documentation. If required, please request copies from us or your Endress+Hauser sales organisation.
UL	UL recognized component (see www.ul.com/database, search for keyword "E225237"
Other standards and guidelines	▪ IEC 60529: Degrees of protection through housing (IP code) ▪ IEC 61158-2: Fieldbus standard ▪ IEC 61326-1:2007: Electromagnetic compatibility (EMC requirements) ▪ IEC 60068-2-27 and IEC 60068-2-6: Shock and vibration resistance ▪ NAMUR International user association of automation technology in process industries
CSA GP	CSA General Purpose
Certification PROFIBUS® PA	The temperature transmitter is certified and registered by the PNO (PROFIBUS® user organization e.V.). The device thus meets all the requirements of the specifications following: ▪ Certified according to PROFIBUS® PA Profile 3.02 ▪ The device can also be operated with certified devices of other manufacturers (interoperability)

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website:
  www.endress.com → Click "Corporate" → Select your country → Click "Products" → Select the product using the filters and search field → Open product page
  → The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

Product Configurator - the tool for individual product configuration:
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website:www.endress.com.

The following accessories are contained in the scope of delivery:
- Multi-language Brief Operating Instructions as hard copy
- Supplementary documentation ATEX:
  ATEX Safety instructions (XA), **C**ontrol **D**rawings (CD)
- Mounting material for head transmitter
- Mounting material for field housings (pipe or wall mounting)

Type			Order code
Display TID10 for Endress+Hauser transmitters iTEMP TMT8x, pluggable			TID10-xx
Field housing TA30x for Endress+Hauser head transmitter			TA30x-xx
DIN rail clip according to IEC 60715 (TH35) for head transmitter mounting without securing screws			51000856
Standard - DIN mounting set (2 screws + springs, 4 securing disks and 1 display connector cover)			71044061
US - M4 mounting screws (2 screws M4 and 1 display connector cover)			71044062
Fieldbus connector (PROFIBUS® PA):	Threaded connection ▪ M20x1.5 ▪ NPT ½" ▪ M20x1.5	Cable connecting thread ▪ M12 ▪ M12 ▪ 7/8"	71090687 71005802 71089147
Stainless steel wall mounting bracket Stainless steel pipe mounting bracket			71123339 71123342

Documentation

- Operating instructions "iTEMP TMT84" (BA00257R/09/en) and associated Brief Operating Instructions "iTEMP TMT84" (KA00258R/09/a2)
- Ex supplementary documentation:
  ATEX II 1G Ex ia IIC: XA00069R/09/a3
  ATEX II 2(1)G Ex ia IIC: XA01012T/09/a3
  ATEX II 2G Ex d IIC and ATEX II 2D Ex tb IIIC: XA01007T/09/a3
- Operating instructions "Display TID10" (BA262R/09/c4)
- Guidelines for planning and commissioning "PROFIBUS® DP/PA" (BA034S/04/en)

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