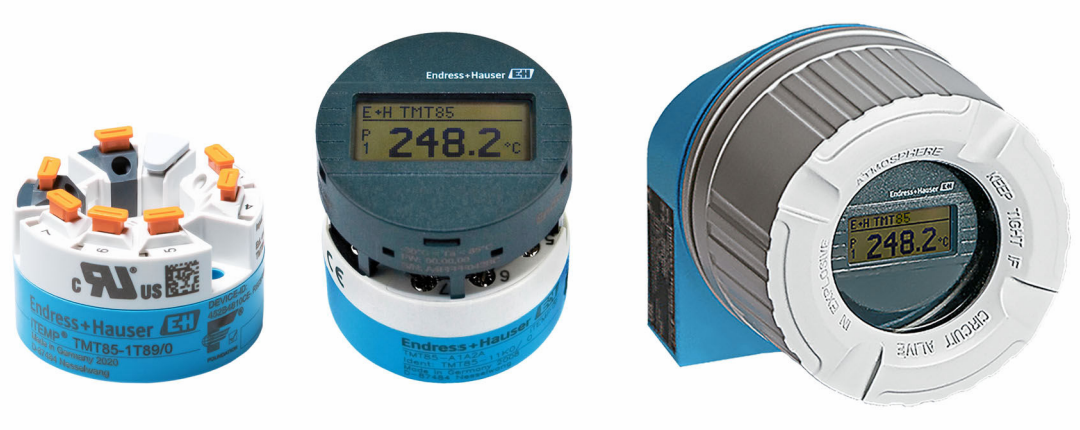
TI00134R/09/EN/08.22-00
71583580
2022-08-08

Technical Information
iTEMP TMT85

Dual-input temperature transmitter



with FOUNDATION Fieldbus™ protocol

Application

- Temperature transmitter with 2 universal input channels and FOUNDATION Fieldbus™ protocol for the conversion of different input signals into digital output signals
- The iTEMP TMT85 is characterized by its reliability, long-term stability, high precision and advanced diagnostic function (important in critical processes)
- For the highest level of safety, reliability and risk reduction
- Universal input for resistance thermometers (RTD), thermocouples (TC), resistance transmitters (Ω), voltage transmitters (mV)
- Installation in terminal head form B (flat face) as per DIN EN 50446
- Optional: installation in field housing for Ex d applications
- Wall or pipe mounting bracket for the field housing

Your benefits

- Easy and standardized communication via FOUNDATION Fieldbus™ H1
- Straightforward design of measuring points in explosive atmospheres owing to FISCO/FNICO conformity in accordance with IEC 600079-27
- Safe operation in hazardous areas thanks to international approvals
- High accuracy of measuring point through sensor-transmitter matching
- Reliable operation with sensor monitoring and device hardware fault recognition
- Various mounting versions and sensor combinations
- Rapid no-tools wiring due to optional spring terminal technology

Endress+Hauser
People for Process Automation

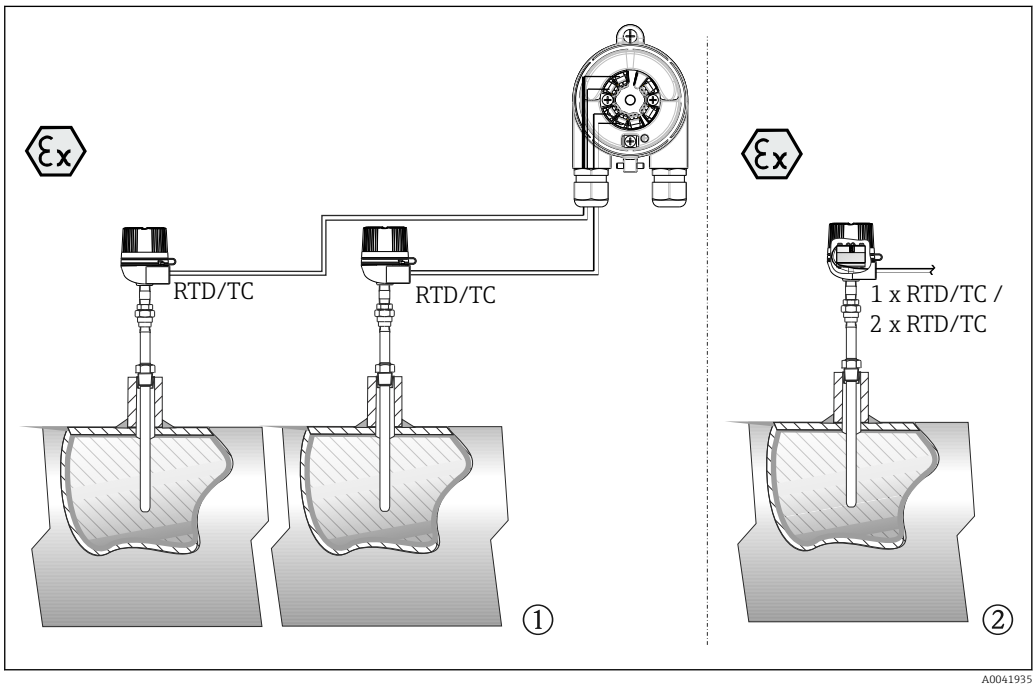
Table of contents

Function and system design

Measuring principle

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

Measuring system

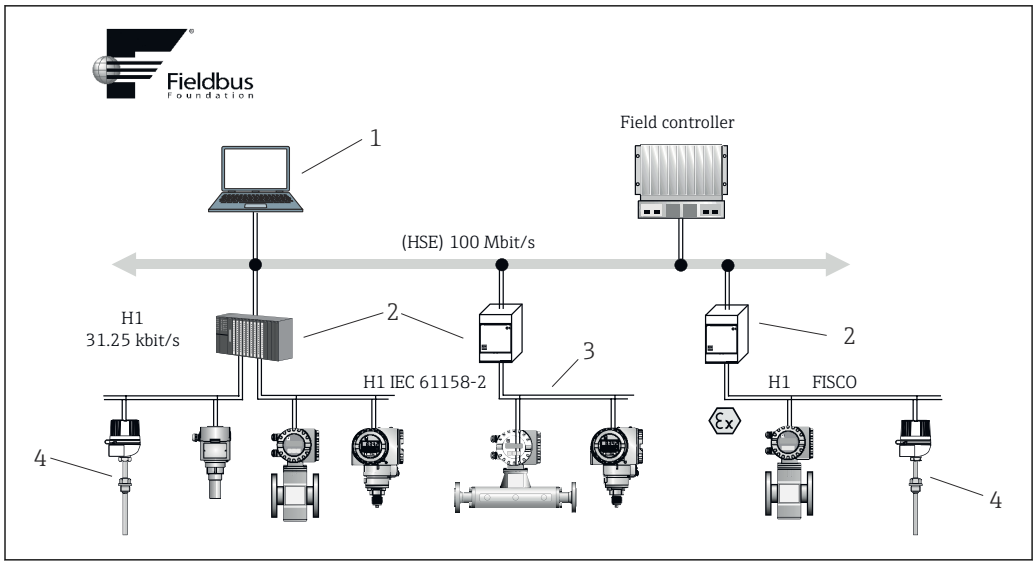


1 Application examples

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

Endress+Hauser offers a comprehensive range of industrial thermometers with resistance sensors or thermocouples.

When combined with the temperature transmitter, these components form a complete measuring point for a wide range of applications in the industrial sector.



2 System integration via FOUNDATION Fieldbus™

1 Visualization and monitoring e.g. P View, FieldCare and diagnostic software
2 Linking device
3 32 devices per segment
4 Measuring point with installed transmitter

The temperature transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using FOUNDATION Fieldbus™ communication. The device is powered via the FOUNDATION Fieldbus™ H1 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 according to DIN EN 50446. Data transfer takes place via the following function blocks:

- 2 x 3 Analog Input (AI)
- 1 x Standard PID controller (PID)
- 1 x Input Selector (ISEL)

Standard diagnostic functions

- Open circuit, short-circuit, corrosion of sensor cables
- Incorrect wiring
- Internal device errors
- Overrange/underrange detection
- Ambient temperature out-of-range detection

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 are used in different measuring ranges
- Mean value or differential measurement from two sensors
- Mean value measurement with sensor redundancy

Input

Measured variable Temperature (temperature-linear transmission behavior), resistance and voltage.

Measuring range Two independent sensors can be connected. The measuring inputs are not galvanically isolated from each other.

Resistance thermometer (RTD) as per standard	Description	α	Measuring range limits
IEC 60751:2008	Pt100 (1) Pt200 (2) Pt500 (3) Pt1000 (4)	0.003851	−200 to +850 °C (−328 to +1 562 °F) −200 to +850 °C (−328 to +1 562 °F) −200 to +250 °C (−328 to +482 °F) −200 to +250 °C (−328 to +482 °F)
JIS C1604:1984	Pt100 (5)	0.003916	−200 to +649 °C (−328 to +1 200 °F)
DIN 43760 IPTS-68	Ni100 (6) Ni1000	0.006180	−60 to +250 °C (−76 to +482 °F) −60 to +150 °C (−76 to +302 °F)
Edison Copper Winding No. 15	Cu10	0.004274	−100 to +260 °C (−148 to +500 °F)
Edison Curve	Ni120	0.006720	−70 to +270 °C (−94 to +518 °F)
GOST 6651-94	Pt50 (8) Pt100 (9)	0.003910	−200 to +1 100 °C (−328 to +2 012 °F) −200 to +850 °C (−328 to +1 562 °F)
OIML R84: 2003 GOST 6651-2009	Cu50 (10) Cu100 (11)	0.004280	−200 to +200 °C (−328 to +392 °F)
-	Pt100 (Callendar van Dusen) Nickel polynomial Copper polynomial	-	10 to 400 Ω, 10 to 2 000 Ω 10 to 400 Ω, 10 to 2 000 Ω 10 to 400 Ω, 10 to 2 000 Ω
	▪ Connection type: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ with 2-wire circuit, compensation of the wire resistance is possible (0 to 30 Ω) ▪ With 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 2 000 Ω

Thermocouples as per standard	Description	Measuring range limits	
IEC 60584, Part 1	Type A (W5Re-W20Re) (30) Type B (PtRh30-PtRh6) (31) Type E (NiCr-CuNi) (34) Type J (Fe-CuNi) (35) Type K (NiCr-Ni) (36) Type N (NiCrSi-NiSi) (37) Type R (PtRh13-Pt) (38) Type S (PtRh10-Pt) (39) Type T (Cu-CuNi) (40)	0 to +2 500 °C (+32 to +4 532 °F) +40 to +1 820 °C (+104 to +3 308 °F) −270 to +1 000 °C (−454 to +1 832 °F) −210 to +1 200 °C (−346 to +2 192 °F) −270 to +1 372 °C (−454 to +2 501 °F) −270 to +1 300 °C (−454 to +2 372 °F) −50 to +1 768 °C (−58 to +3 214 °F) −50 to +1 768 °C (−58 to +3 214 °F) −260 to +400 °C (−436 to +752 °F)	Recommended temperature range: 0 to +2 500 °C (+32 to +4 532 °F) +500 to +1 820 °C (+932 to +3 308 °F) −150 to +1 000 °C (−238 to +1 832 °F) −150 to +1 200 °C (−238 to +2 192 °F) −150 to +1 200 °C (−238 to +2 192 °F) −150 to +1 300 °C (−238 to +2 372 °F) +150 to +1 768 °C (+302 to +3 214 °F) +150 to +1 768 °C (+302 to +3 214 °F) −150 to +400 °C (−238 to +752 °F)
IEC 60584, Part 1; ASTM E988-96	Type C (W5Re-W26Re) (32)	0 to +2 315 °C (+32 to +4 199 °F)	0 to +2 000 °C (+32 to +3 632 °F)
ASTM E988-96	Type D (W3Re-W25Re) (33)	0 to +2 315 °C (+32 to +4 199 °F)	0 to +2 000 °C (+32 to +3 632 °F)
DIN 43710	Type L (Fe-CuNi) (41) Type U (Cu-CuNi) (42)	−200 to +900 °C (−328 to +1 652 °F) −200 to +600 °C (−328 to +1 112 °F)	−150 to +900 °C (−238 to +1 652 °F) −150 to +600 °C (−238 to +1 112 °F)
GOST R8.585-2001	Type L (NiCr-CuNi) (43)	−200 to +800 °C (−328 to +1 472 °F)	−200 to +800 °C (+328 to +1 472 °F)
	▪ 2-wire connection ▪ Internal reference junction (Pt100) ▪ External preset value: configurable value −40 to +85 °C (−40 to +185 °F) ▪ Maximum sensor wire resistance 10 kΩ (If the sensor wire 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	

Type of input

The following connection combinations are possible when both sensor inputs are assigned:

		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	☑	☑	☑	☑

Output

Output signal

- FOUNDATION Fieldbus™ H1, IEC 61158-2
- Failure current FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate, supported baudrate: 31.25 kBit/s
- Signal encoding = Manchester II
- Output data:
  Available values via AI blocks: temperature (PV), temp sensor 1 + 2, terminal temperature
- LAS (Link Active Scheduler), LM (Link Master) function is supported: Therefore, the head transmitter can assume the function of a Link Active Scheduler (LAS) if the current Link Master (LM) is no longer available. The device is supplied as a BASIC device. To use the device as an LAS, this must be defined in the control system and activated by downloading the configuration to the device.
- According to IEC 60079-27, FISCO/FNICO

Failure information

Status message in accordance with FOUNDATION Fieldbus™ specification.

Linearization/transmission behavior

Temperature-linear, resistance-linear, voltage-linear

Mains filter

50/60 Hz

Galvanic isolation

U = 2 kV AC (input/output)

Current consumption

≤ 11 mA

Switch-on delay

8 s

FOUNDATION Fieldbus™ basic data

Basic data

Device type	10CE (hex)
Device revision	02
Node address	Default: 247
ITK version	6.0.1
ITK Certification Driver No.	IT085900
Link Master capability (LAS)	Yes
Choice of Link Master / Basic Device	Yes; factory setting: Basic Device

Number of VCRs	44
Number of link objects in VFD	50

Virtual communication references (VCRs)

Permanent entries	1
Fully configurable entries	43

Link settings

Slot time	8
Min. inter PDU delay	10
Max. response delay slot time	24

Blocks

Block description	Block Index [1]	Execution time (macro-cycle ≤ 500 ms)	Block category
Resource Block	400	-	Extended
Transducer Block Sensor 1	500	-	Manufacturer-specific
Transducer Block Sensor 2	600	-	Manufacturer-specific
Transducer Block Display	700	-	Manufacturer-specific
Transducer Block Adv. Diag.	800	-	Manufacturer-specific
Function Block AI1	900	30 ms	Extended
Function Block AI2	1000	30 ms	Extended
Function Block AI3	1100	30 ms	Extended
Function Block AI4	(1200)	30 ms (not instantiated)	Extended
Function Block AI5	(1300)	30 ms (not instantiated)	Extended
Function Block AI6	(1400	30 ms (not instantiated)	Extended
Function Block PID	1200 (1500)	25 ms	Standard
Function Block ISEL	1300 (1600)	20 ms	Standard

1) The values in brackets are valid if all the AI blocks (AI1-AI6) are instantiated.

Brief description of the blocks

Resource Block

The Resource Block contains all the data that clearly identify and characterize the device. It is like an electronic version of the device nameplate. In addition to parameters required to operate the device on the fieldbus, the Resource Block makes information available such as the order code, device ID, hardware version, firmware version, etc.

Transducer Block "Sensor 1" and "Sensor 2"

The Transducer Blocks of the head transmitter contain all the measurement-specific and device-specific parameters which are relevant for the measurement of the input variables.

Display Transducer

The parameters of the "Display" Transducer Block enable the configuration of the optional display.

Advanced Diagnostic

All the parameters for self-monitoring and diagnostics are grouped in this Transducer Block.

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).

PID

This function block contains input channel processing, proportional integral-differential control (PID) and analog output channel processing. The following can be implemented: Basic controls, feedforward control, cascade control and cascade control with limiting.

Input Selector (ISEL)

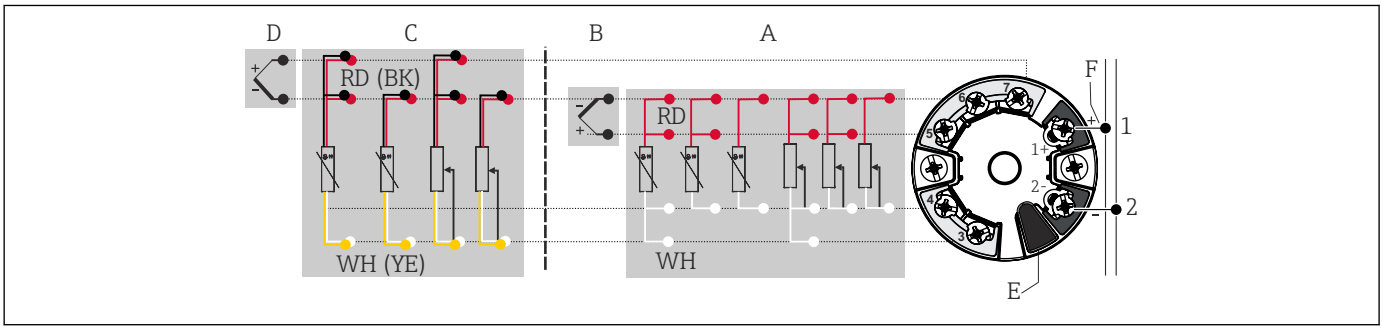
The Input Selector Block enables the selection of up to four inputs and generates an output based on the configured action.

Power supply

Supply voltage

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

Electrical connection



3 *Assignment of terminal connections for head transmitter*

A Sensor input 1, RTD and Ω, 2-, 3- and 4-wire
B Sensor input 1, TC and mV
C Sensor input 2, RTD and Ω, 2- and 3-wire
D Sensor input 2, TC and mV
E Display connection, service interface
F Bus terminator and power supply

Terminals

Choice of screw terminals or push-in terminals for sensor and power supply cables:

Terminal design	Cable design	Cable cross-section
Screw terminals (with tabs on the fieldbus terminals for easy connection of a handheld terminal, e.g. FieldXpert, FC475, Trex)	Rigid or flexible	≤ 2.5 mm² (14 AWG)
Push-in terminals (cable design, stripping length = min. 10 mm (0.39 in)	Rigid or flexible	0.2 to 1.5 mm² (24 to 16 AWG)
	Flexible with wire end ferrules with/without plastic ferrule	0.25 to 1.5 mm² (24 to 16 AWG)

Ferrules must be used with push-in terminals and when using flexible cables with a cable cross-section of ≤ 0.3 mm². Otherwise, the use of ferrules when connecting flexible cables to push-in terminals is not recommended.

Performance characteristics

Response time

1s per channel

Reference conditions

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

Resolution

Resolution of A/D converter = 18 bit

Maximum measured error

In accordance with DIN EN 60770 and the reference conditions specified above. The measured error data corresponds to ±2σ (Gaussian distribution). The data include non-linearities and repeatability.

Typical

Standard	Description	Measuring range	Typical measured error (±)
Resistance thermometer (RTD) as per 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 K (0.14 °F)
GOST 6651-94	Pt100 (9)		0.07 °C (0.13 °F)
Thermocouples (TC) as per standard			Digital value [1]
IEC 60584, Part 1	Type K (NiCr-Ni) (36)	0 to +800 °C (32 to +1 472 °F)	0.31 °C (0.56 °F)
IEC 60584, Part 1	Type S (PtRh10-Pt) (39)		0.84 °C (1.51 °F)
GOST R8.585-2001	Type L (NiCr-CuNi) (43)		2.18 °C (3.92 °F)

1) Measured value transmitted via FIELDBUS®.

Measured error for resistance thermometers (RTD) and resistance transmitters

Standard	Description	Measuring range	Measured error (±)	Non-repeatability: ±
			Digital [1]	
			Based on measured value [2]	
IEC 60751:2008	Pt100 (1)	−200 to +850 °C (−328 to +1 562 °F)	0.06 °C (0.11 °F) + 0.006% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
	Pt200 (2)		0.11 °C (0.2 °F) + 0.018% * (MV - LRV)	≤ 0.13 °C (0.23 °F)
	Pt500 (3)	−200 to +250 °C (−328 to +482 °F)	0.05 °C (0.09 °F) + 0.015% * (MV - LRV)	≤ 0.08 °C (0.14 °F)
	Pt1000 (4)	−200 to +250 °C (−328 to +482 °F)	0.03 °C (0.05 °F) + 0.013% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
JIS C1604:1984	Pt100 (5)	−200 to +649 °C (−328 to +1 200 °F)	0.05 °C (0.09 °F) + 0.006% * (MV - LRV)	≤ 0.04 °C (0.07 °F)
GOST 6651-94	Pt50 (8)	−200 to +1 100 °C (−328 to +2 012 °F)	0.10 °C (0.18 °F) + 0.008% * (MV - LRV)	≤ 0.11 °C (0.2 °F)
	Pt100 (9)	−200 to +850 °C (−328 to +1 562 °F)	0.05 °C (0.09 °F) + 0.006% * (MV - LRV)	≤ 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) - 0.006% * (MV - LRV)	≤ 0.03 °C (0.05 °F)
	Ni1000	−60 to +150 °C (−76 to +302 °F)		
OIML R84: 2003 / GOST 6651-2009	Cu50 (10)	−200 to +200 °C (−328 to +1 562 °F)	0.09 °C (0.16 °F) + 0.006% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
	Cu100 (11)		0.05 °C (0.09 °F) + 0.003% * (MV - LRV)	≤ 0.04 °C (0.07 °F)
Resistance transmitter	Resistance Ω	10 to 400 Ω	max. 32 mΩ	15mΩ
		10 to 2 000 Ω	max. 300 mΩ	≤ 200mΩ

1) Measured value transmitted via FIELDBUS®.
2) Deviations from maximum measured error possible due to rounding.

Measured error for thermocouples (TC) and voltage transmitters

Standard	Description	Measuring range	Measured error (±)	Non-repeatability: ±
			Digital [1]	
			Based on measured value [2]	
IEC 60584-1	Type A (30)	0 to +2 500 °C (+32 to +4 532 °F)	0.8 °C (1.44 °F) + 0.021% * MV	≤ 0.52 °C (0.94 °F)
	Type B (31)	+500 to +1 820 °C (+932 to +3 308 °F)	1.5 °C (2.7 °F) - 0.06% * (MV - LRV)	≤ 0.67 °C (1.21 °F)
IEC 60584-1 / ASTM E988-96	Type C (32)	0 to +2 000 °C (+32 to +3 632 °F)	0.55 °C (1 °F) + 0.0055% * MV	≤ 0.33 °C (0.59 °F)
ASTM E988-96	Type D (33)		0.75 °C (1.44 °F) - 0.008% * MV	≤ 0.41 °C (0.74 °F)
IEC 60584-1	Type E (34)	−150 to +1 000 °C (−238 to +2 192 °F)	0.22 °C (0.40 °F) - 0.006% * (MV - LRV)	≤ 0.07 °C (0.13 °F)
	Type J (35)	−150 to +1 200 °C (−238 to +2 192 °F)	0.27 °C (0.49 °F) - 0.005% * (MV - LRV)	≤ 0.08 °C (0.14 °F)
	Type K (36)		0.35 °C (0.63 °F) - 0.005% * (MV - LRV)	≤ 0.11 °C (0.20 °F)
	Type N (37)	−150 to +1 300 °C (−238 to +2 372 °F)	0.48 °C (0.86 °F) - 0.014% * (MV - LRV)	≤ 0.16 °C (0.29 °F)
	Type R (38)	+150 to +1 768 °C (+302 to +3 214 °F)	0.9 °C (1.62 °F) - 0.015% * MV	≤ 0.76 °C (1.37 °F)
	Type S (39)		0.95 °C (1.71 °F) - 0.013% * MV	≤ 0.74 °C (1.33 °F)
	Type T (40)	−150 to +400 °C (−238 to +752 °F)	0.36 °C (0.47 °F) - 0.04% * (MV - LRV)	≤ 0.11 °C (0.20 °F)
DIN 43710	Type L (41)	−150 to +900 °C (−238 to +1 652 °F)	0.29 °C (0.52 °F) - 0.009% * (MV - LRV)	≤ 0.07 °C (0.13 °F)
	Type U (42)	−150 to +600 °C (−238 to +1 112 °F)	0.33 °C (0.6 °F) - 0.028% * (MV - LRV)	≤ 0.10 °C (0.18 °F)
GOST R8.585-2001	Type L (43)	−200 to +800 °C (−328 to +1 472 °F)	2.2 °C (4.00 °F) - 0.015% * (MV - LRV)	≤ 0.15 °C (0.27 °F)
Voltage transmitter (mV)		−20 to +100 mV	≤ 10 µV	4 µV

1) Measured value transmitted via fieldbus.
2) Deviations from maximum measured error possible due to rounding.

MV = measured value

LRV = lower range value of the sensor in question

Total measured error of transmitter at current output = √(Measured error digital² + Measured error D/A²)

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)), at least 0.005 °C	0.08 °C (0.144 °F)
Influence of supply voltage = (30 - 24) x (0.002% x 200 °C - (-200 °C)), at least 0.005 °C	0.048 °C (0.086 °F)
Measured error: √(Measured error² + Influence of ambient temperature² + Influence of supply voltage²)	**0.126 °C (0.227 °F)**

Sensor adjustment

Sensor-transmitter matching

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

- Callendar van Dusen coefficients (Pt100 resistance thermometer)
  The Callendar-Van-Dusen equation is described as:
  $R_T = R_0[1+AT+BT^2+C(T-100)T^3]$

  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 with the aid of sensor calibration.

- Linearization for copper/nickel resistance thermometers (RTD)
  The polynomial equation for copper/nickel is as follows:
  $R_T = R_0(1+AT+BT^2)$

  The coefficients A and B 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. The sensor-specific coefficients are then sent to the transmitter.

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

Operating influences

The measured error data corresponds to ±2 σ (Gaussian distribution).

Influence of ambient temperature and supply voltage on operation for resistance thermometers (RTD) and resistance transmitters

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
		Digital [1]	Digital [1]
		Based on measured value	Based on measured value
Pt100 (1)	IEC 60751:2008	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)
Pt200 (2)		≤ 0.026 °C (0.047 °F)	≤ 0.026 °C (0.047 °F)
Pt500 (3)		0.002% * (MV -LRV), at least 0.009 °C (0.016 °F)	0.002% * (MV -LRV), at least 0.009 °C (0.016 °F)
Pt1000 (4)		0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)	0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)
Pt100 (5)	JIS C1604:1984	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)
Pt50 (8)	GOST 6651-94	0.002% * (MV -LRV), at least 0.01 °C (0.018 °F)	0.002% * (MV -LRV), at least 0.01 °C (0.018 °F)
Pt100 (9)		0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.005 °C (0.009 °F)	≤ 0.005 °C (0.009 °F)
Ni1000		≤ 0.005 °C (0.009 °F)	≤ 0.005 °C (0.009 °F)
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	≤ 0.008 °C (0.014 °F)	≤ 0.008 °C (0.014 °F)
Cu100 (11)		0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)	0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)
Resistance transmitter (Ω)			
10 to 400 Ω		0.0015% * (MV -LRV), at least 1.5 mΩ	0.0015% * (MV -LRV), at least 1.5 mΩ
10 to 2 000 Ω		0.0015% * (MV -LRV), at least 15 mΩ	0.0015% * (MV -LRV), at least 15 mΩ

1) Measured value transmitted via fieldbus.

Influence of ambient temperature and supply voltage on operation for thermocouples (TC) and voltage transmitters

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
		Digital [1]	Digital
		Based on measured value	Based on measured value
Type A (30)	IEC 60584-1	0.0055% * MV, at least 0.03 °C (0.005 °F)	0.0055% * MV, at least 0.03 °C (0.005 °F)
Type B (31)		≤ 0.06 °C (0.11 °F)	≤ 0.06 °C (0.11 °F)
Type C (32)	IEC 60584-1 / ASTM E988-96	0.0045% * MV, at least 0.03 °C (0.005 °F)	0.0045% * MV, at least 0.03 °C (0.005 °F)
Type D (33)	ASTM E988-96	0.004% * MV, at least 0.035 °C (0.063 °F)	0.004% * MV, at least 0.035 °C (0.063 °F)
Type E (34)	IEC 60584-1	0.003% * (MV -LRV), at least 0.016 °C (0.029 °F)	0.003% * (MV -LRV), at least 0.016 °C (0.029 °F)
Type J (35)		0.0028% * (MV -LRV), at least 0.02 °C (0.036 °F)	0.0028% * (MV -LRV), at least 0.02 °C (0.036 °F)
Type K (36)		0.003% * (MV -LRV), at least 0.013 °C (0.023 °F)	0.003% * (MV -LRV), at least 0.013 °C (0.023 °F)
Type N (37)		0.0028% * (MV -LRV), at least 0.020 °C (0.036 °F)	0.0028% * (MV -LRV), at least 0.020 °C (0.036 °F)
Type R (38)		0.0035% * MV, at least 0.047 °C (0.085 °F)	0.0035% * MV, at least 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)		≤ 0.01 °C (0.02 °F)	≤ 0.01 °C (0.02 °F)
Type L (43)	GOST R8.585-2001	≤ 0.02 °C (0.04 °F)	≤ 0.02 °C (0.04 °F)
Voltage transmitter (mV)			
−20 to 100 mV	-	≤ 3 µV	≤ 3 µV

1) Measured value transmitted via fieldbus.

MV = measured value

LRV = lower range value of the sensor in question

Total measured error of transmitter at current output = √(Measured error digital² + Measured error D/A²)

Long-term drift, resistance thermometers (RTD) and resistance transmitters

Description	Standard	Long-term drift (±)		
		after 1 year	after 3 years	after 5 years
		Maximum		
Pt100 (1)	IEC 60751:2008	≤ 0.03 °C (0.05 °F) + 0.024% * span	≤ 0.042 °C (0.076 °F) + 0.035% * span	≤ 0.051 °C (0.092 °F) + 0.037% * span
Pt200 (2)		≤ 0.17 °C (0.31 °F) + 0.016% * span	≤ 0.28 °C (0.5 °F) + 0.022% * span	≤ 0.343 °C (0.617 °F) + 0.025% * span
Pt500 (3)		≤ 0.067 °C (0.121 °F) + 0.018% * span	≤ 0.111 °C (0.2 °F) + 0.025% * span	≤ 0.137 °C (0.246 °F) + 0.028% * span
Pt1000 (4)		≤ 0.034 °C (0.06 °F) + 0.02% * span	≤ 0.056 °C (0.1 °F) + 0.029% * span	≤ 0.069 °C (0.124 °F) + 0.032% * span
Pt100 (5)	JIS C1604:1984	≤ 0.03 °C (0.054 °F) + 0.022% * span	≤ 0.042 °C (0.076 °F) + 0.032% * span	≤ 0.051 °C (0.092 °F) + 0.034% * span
Pt50 (8)	GOST 6651-94	≤ 0.055 °C (0.01 °F) + 0.023% * span	≤ 0.089 °C (0.16 °F) + 0.032% * span	≤ 0.1 °C (0.18 °F) + 0.035% * span
Pt100 (9)	GOST 6651-94	≤ 0.03 °C (0.054 °F) + 0.024% * span	≤ 0.042 °C (0.076 °F) + 0.034% * span	≤ 0.051 °C (0.092 °F) + 0.037% * span
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.025 °C (0.045 °F) + 0.016% * span	≤ 0.042 °C (0.076 °F) + 0.02% * span	≤ 0.047 °C (0.085 °F) + 0.021% * span
Ni1000	DIN 43760 IPTS-68	≤ 0.02 °C (0.036 °F) + 0.018% * span	≤ 0.032 °C (0.058 °F) + 0.024% * span	≤ 0.036 °C (0.065 °F) + 0.025% * span
Cu50 (10)	OIML R84:2003 / GOST 6651-2009	≤ 0.053 °C (0.095 °F) + 0.013% * span	≤ 0.084 °C (0.151 °F) + 0.016% * span	≤ 0.094 °C (0.169 °F) + 0.016% * span
Cu100 (11)		≤ 0.027 °C (0.049 °F) + 0.019% * span	≤ 0.042 °C (0.076 °F) + 0.026% * span	≤ 0.047 °C (0.085 °F) + 0.027% * span
Resistance transmitter				
10 to 400 Ω	-	≤ 10 mΩ + 0.022% * span	≤ 14 mΩ + 0.031% * span	≤ 16 mΩ + 0.033% * span
10 to 2 000 Ω	-	≤ 144 mΩ + 0.019% * span	≤ 238 mΩ + 0.026% * span	≤ 294 mΩ + 0.028% * span

Long-term drift, thermocouples (TC) and voltage transmitters

Description	Standard	Long-term drift (±)		
		after 1 year	after 3 years	after 5 years
		Maximum		
Type A (30)	IEC 60584-1	≤ 0.17 °C (0.306 °F) + 0.021% * span	≤ 0.27 °C (0.486 °F) + 0.03% * span	≤ 0.38 °C (0.683 °F) + 0.035% * 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)	IEC 60584-1 / ASTM E988-96	≤ 0.15 °C (0.27 °F) + 0.018% * span	≤ 0.24 °C (0.43 °F) + 0.026% * span	≤ 0.34 °C (0.61 °F) + 0.027% * span
Type D (33)	ASTM E988-96	≤ 0.21 °C (0.38 °F) + 0.015% * span	≤ 0.34 °C (0.61 °F) + 0.02% * span	≤ 0.47 °C (0.85 °F) + 0.02% * span
Type E (34)	IEC 60584-1	≤ 0.06 °C (0.11 °F) + 0.018% * span	≤ 0.09 °C (0.162 °F) + 0.025% * span	≤ 0.13 °C (0.234 °F) + 0.026% * span
Type J (35)	IEC 60584-1	≤ 0.06 °C (0.11 °F) + 0.019% * span	≤ 0.1 °C (0.18 °F) + 0.025% * span	≤ 0.14 °C (0.252 °F) + 0.027% * span
Type K (36)		≤ 0.09 °C (0.162 °F) + 0.017% * (MV+ 150 °C (270 °F))	≤ 0.14 °C (0.252 °F) + 0.023% * span	≤ 0.19 °C (0.342 °F) + 0.024% * span

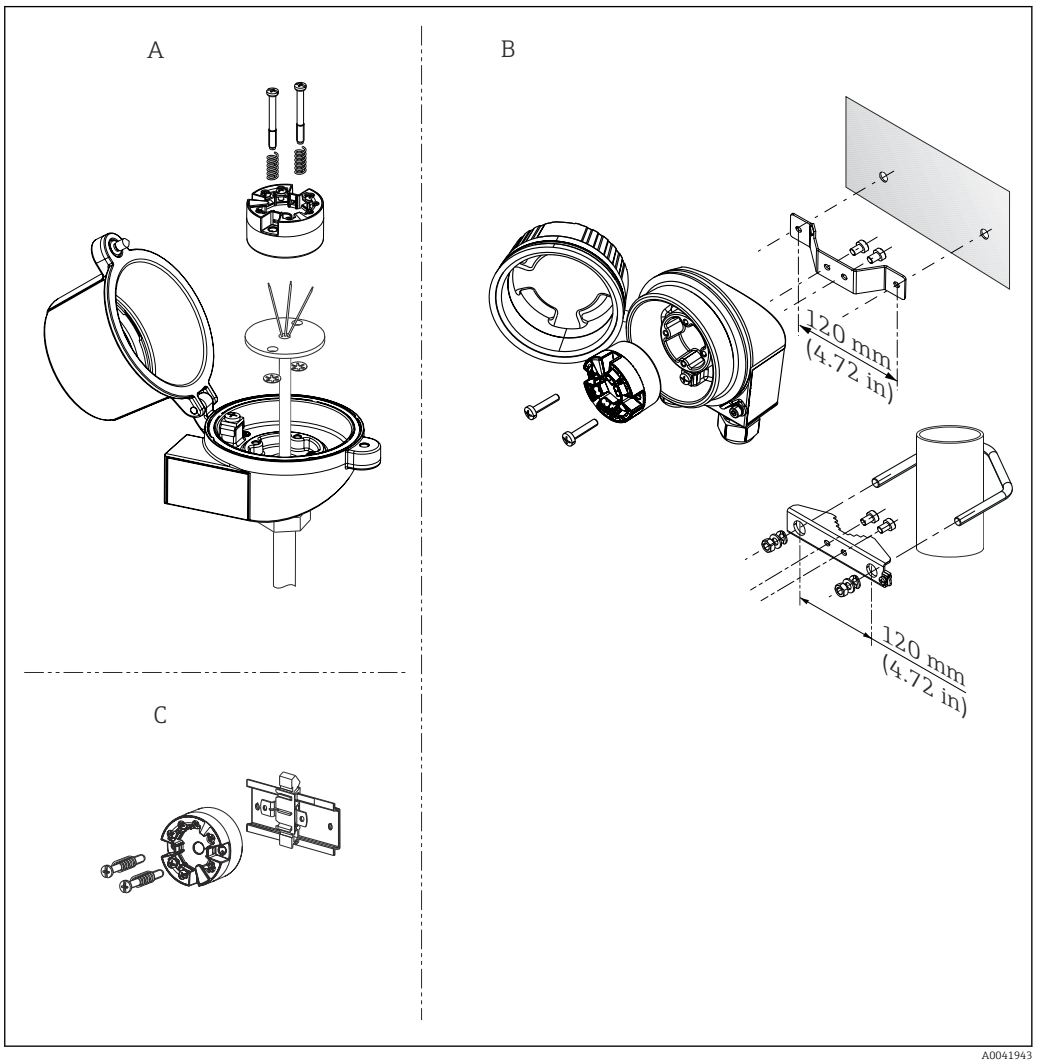
Description	Standard	Long-term drift (±)		
Type N (37)	IEC 60584-1	≤ 0.13 °C (0.234 °F) + 0.015% * (MV + 150 °C (270 °F))	≤ 0.2 °C (0.36 °F) + 0.02% * span	≤ 0.28 °C (0.5 °F) + 0.02% * span
Type R (38)		≤ 0.31 °C (0.558 °F) + 0.011% * (MV- 50 °C (90 °F))	≤ 0.5 °C (0.9 °F) + 0.013% * span	≤ 0.69 °C (1.241 °F) + 0.011% * span
Type S (39)	IEC 60584-1	≤ 0.31 °C (0.558 °F) + 0.011% * span	≤ 0.5 °C (0.9 °F) + 0.013% * span	≤ 0.7 °C (1.259 °F) + 0.011% * span
Type T (40)		≤ 0.09 °C (0.162 °F) + 0.011% * span	≤ 0.15 °C (0.27 °F) + 0.013% * span	≤ 0.2 °C (0.36 °F) + 0.012% * span
Type L (41)		≤ 0.06 °C (0.108 °F) + 0.017% * span	≤ 0.1 °C (0.18 °F) + 0.022% * span	≤ 0.14 °C (0.252 °F) + 0.022% * span
Type U (42)		≤ 0.09 °C (0.162 °F) + 0.013% * span	≤ 0.14 °C (0.252 °F) + 0.017% * span	≤ 0.2 °C (0.360 °F) + 0.015% * span
Type L (43)	GOST R8.585-2001	≤ 0.08 °C (0.144 °F) + 0.015% * span	≤ 0.12 °C (0.216 °F) + 0.02% * span	≤ 0.17 °C (0.306 °F) + 0.02% * span
Voltage transmitter (mV)				
−20 to 100 mV	-	≤ 2 µV + 0.022% * span	≤ 3.5 µV + 0.03% * span	≤ 4.7 µV + 0.033% * span

Influence of reference junction

Pt100 DIN IEC 60751 Cl. B (internal cold junction with thermocouples TC)

Mounting

Installation instructions



4 *Installation options for transmitter*

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

Orientation: No restrictions

When installing the head transmitter in a terminal head form B (flat face), make sure there is sufficient space in the terminal head!

Environment

Ambient temperature range	−40 to +85 °C (−40 to +185 °F), for hazardous areas see Ex documentation → 20
Storage temperature	−40 to +100 °C (−40 to +212 °F)
Operating altitude	Up to 4000 m (4374.5 yards) above mean sea level as per IEC 61010-1, CAN/CSA C22.2 No. 61010-1

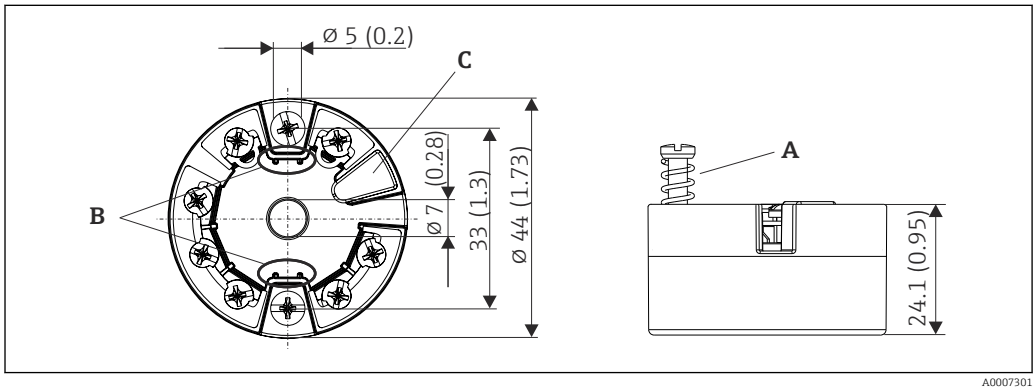
Relative humidity	▪ Condensation permitted as per IEC 60 068-2-33 ▪ Max. rel. humidity: 95% as per IEC 60068-2-30
Climate class	C as per EN 60654-1
Degree of protection	▪ Head transmitter with screw terminals: IP 00, with push-in terminals: IP 30. When the device is installed, the degree of protection depends on the terminal head or field housing used. ▪ When installing in field housing TA30A, TA30D or TA30H: IP 66/67 (NEMA Type 4x encl.)
Shock and vibration resistance	Vibration resistance as per IEC 60068-2-6: 10 to 2 000 Hz at 5g (increased vibration stress)
Electromagnetic compatibility (EMC)	**CE conformity** Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity. Maximum measured error <1% of measuring range. Interference immunity as per IEC/EN 61326 series, industrial requirements Interference emission as per IEC/EN 61326 series, Class B equipment
Overvoltage 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.
Pollution degree	Pollution degree 2 as per IEC 61010-1.

Mechanical construction

Design, dimensions

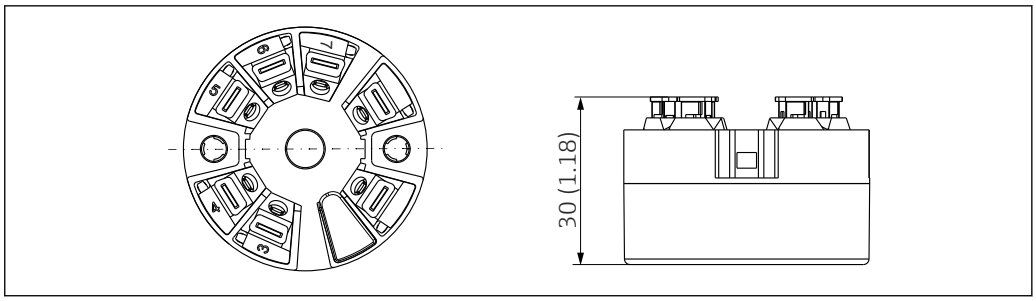
Dimensions in mm (in)

Head transmitter



5 Version with screw terminals

A Spring travel L ≥ 5 mm (not for US - M4 securing screws)
B Mounting elements for attachable measured value display TID10
C Service interface for connecting measured value display or configuration tool

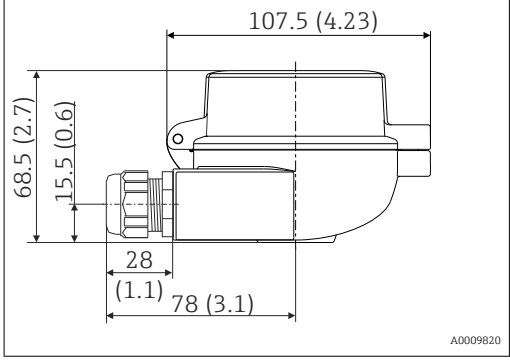


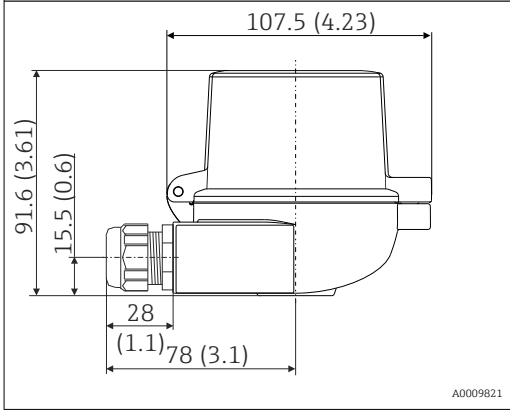
6 Version with push-in terminals. Dimensions are identical to the version with screw terminals, apart from housing height.

Field housing

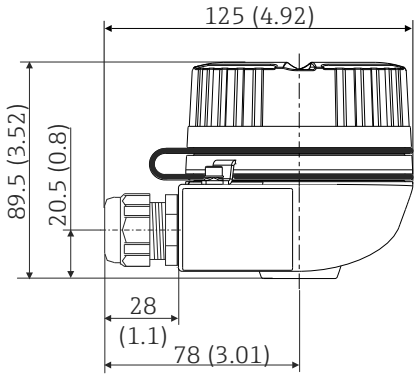
All field housings have an internal geometry in accordance with DIN EN 50446, form B (flat face).
Cable glands in the diagrams: M20x1.5

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

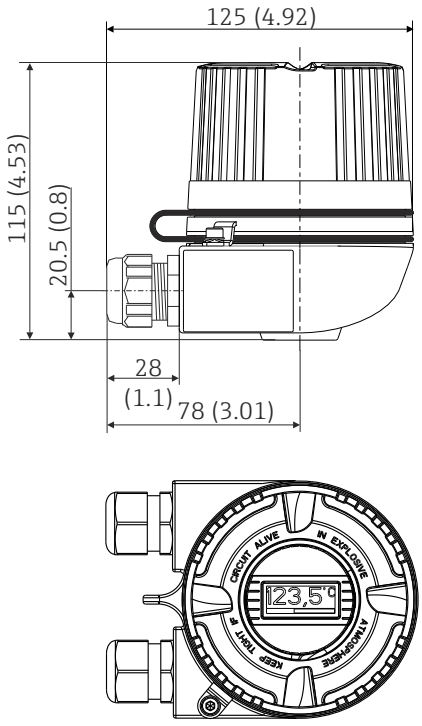
TA30A	Specification
	▪ Two cable entries ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Color of head: blue, RAL 5012 ▪ Color of cap: gray, RAL 7035 ▪ Weight: 330 g (11.64 oz)

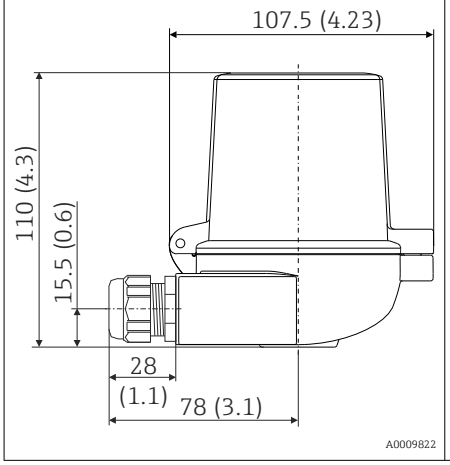
TA30A with display window in cover	Specification
	▪ Two cable entries ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Color of head: blue, RAL 5012 ▪ Color of cap: gray, RAL 7035 ▪ Weight: 420 g (14.81 oz)

TA30H	Specification

	▪ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries
	▪ Protection class: NEMA Type 4x Encl.
	▪ Material:
	  ▪ Aluminum with polyester powder coating
	  ▪ Stainless steel 316L without coating
	▪ Cable entry glands: ½" NPT, M20x1.5
	▪ Color of aluminum head: blue, RAL 5012
	▪ Color of aluminum cap: gray, RAL 7035
	▪ Weight:
	  ▪ Aluminum approx. 640 g (22.6 oz)
	  ▪ Stainless steel approx. 2 400 g (84.7 oz)

TA30H with display window in cover	Specification

	▪ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries
	▪ Protection class: NEMA Type 4x Encl.
	▪ Material:
	  ▪ Aluminum with polyester powder coating
	  ▪ Stainless steel 316L without coating
	▪ Cable entry glands: ½" NPT, M20x1.5
	▪ Color of aluminum head: blue, RAL 5012
	▪ Color of aluminum cap: gray, RAL 7035
	▪ Weight:
	  ▪ Aluminum approx. 860 g (30.33 oz)
	  ▪ Stainless steel approx. 2 900 g (102.3 oz)

TA30D	Specification
	▪ 2 cable entries ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Color of head: blue, RAL 5012 ▪ Color of cap: gray, RAL 7035 ▪ Weight: 390 g (13.75 oz)

Weight

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

Materials

All the materials used are RoHS-compliant.

- Housing: Polycarbonate (PC), complies with UL94 HB (fire resistance properties)
- Terminals:
  - Screw terminals: nickel-plated brass and gold-plated or tin-plated contacts
  - Push-in terminals: tin-plated brass, contact springs 1.4310, 301 (AISI)
- Potting: PU, corresponds to UL94 V0 WEVO PU 403 FP / FL (fire resistance properties)

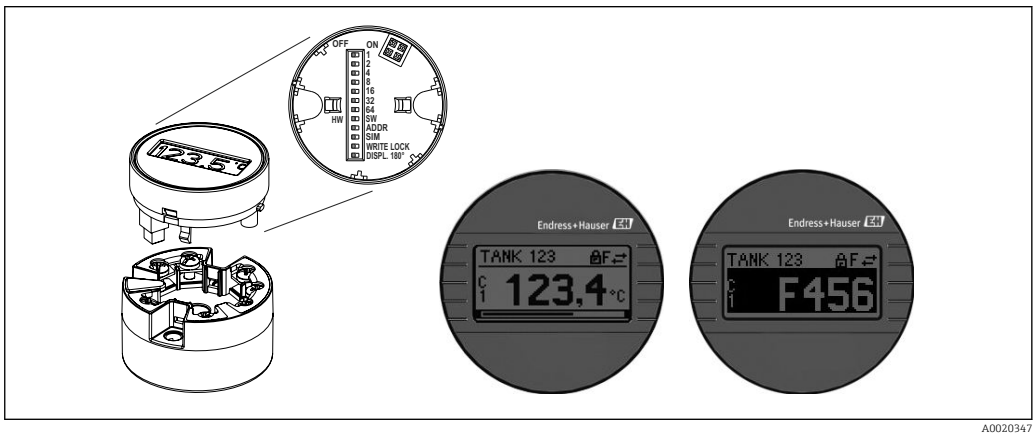
Field housing: see specifications

Operability

Local operation

Head transmitter

The head transmitter has no display or operating elements. There is the option of using the attachable measured value display TID10 together with the head transmitter. The display provides plain-text information on the current measured value and the tag name. An optional bar graph is also used. In the event of a fault in the measurement chain, this will be displayed in inverse color showing the channel ident and error number. DIP switches can be found on the rear of the display. These enable hardware settings to be made e.g. write protection.



7 *Attachable measured value display TID10 with bar graph indicator (optional)*

If the head transmitter is installed in a field housing and used with a display, an enclosure with a glass window in the cover must be used.

Remote operation	FOUNDATION Fieldbus™ and device-specific parameters are configured via fieldbus communication. Special configuration tools from different manufacturers are available for this purpose. For more information, contact your Endress+Hauser sales representative.

Certificates and approvals

CE mark	The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.
Ex approval	Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in separate documentation which is available upon request.
Other standards and guidelines	▪ IEC 60529: Degrees of protection provided by enclosures (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 User association of automation technology in process industries
UL approval	More information under UL Product iq™, search for keyword "E225237")
CSA GP	CSA General Purpose
FOUNDATION Fieldbus™ certification	The temperature transmitter is certified and registered by the Fieldbus FOUNDATION. The device meets all the requirements of the following specifications: ▪ Certified in accordance with FOUNDATION Fieldbus™ specification ▪ FOUNDATION Fieldbus™ H1 ▪ Interoperability Test Kit (ITK), revision status 6.0.1 (device certification number available on request): The device can also be operated with certified devices of other manufacturers ▪ Physical Layer Conformance Test of the Fieldbus FOUNDATION™ (FF-830 FS 2.0)

Ordering information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

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.

Accessories included in the scope of delivery:
- Printed copy of the Brief Operating Instructions
- ATEX supplementary documentation: ATEX Safety instructions (XA), **C**ontrol **D**rawings (CD)
- Mounting material for head transmitter
- Mounting material for field housing (wall or pipe mounting) as option

Device-specific accessories

Accessories	
TID10 display unit for Endress+Hauser head transmitter iTEMP TMT8x [1], attachable	
TID10 service cable for the remote operation of the display for service purposes; length 40 cm	
Field housing TA30x for Endress+Hauser head transmitter	
Adapter for DIN rail mounting, DIN rail clip as per IEC 60715 (TH35) without securing screws	
Standard - DIN mounting set (2 screws + springs, 4 lock washers and 1 display connector cover)	
US - M4 securing screws (2 M4 screws and 1 display connector cover)	
Fieldbus connector (FF):	▪ NPT ½" → 7/8" ▪ M20 → 7/8"
Stainless steel wall mounting bracket Stainless steel pipe mounting bracket	

1) Without TMT80

Communication-specific accessories

Accessories	Description
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see Technical Information TI405C/07
Field Xpert SMT70	Universal, high-performance tablet PC for device configuration The tablet PC enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as a comprehensive, all-in-one solution. With a pre-installed driver library, it is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. For details, see Technical Information TI01342S/04

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator

Accessories	Description
Configurator	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 The Configurator is available on the Endress+Hauser website at: 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.
DeviceCare SFE100	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices. For details, see Operating Instructions BA00027S
FieldCare SFE500	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00065S

Accessories	Description
W@M	Life cycle management for your plant W@M offers assistance with a wide range of software applications over the entire process: from planning and procurement to the installation, commissioning and operation of the measuring devices. All the relevant information is available for every measuring device over the entire life cycle, such as the device status, device-specific documentation, spare parts etc. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: Via the Internet: www.endress.com/lifecyclemanagement

Supplementary documentation

- Operating Instructions 'iTEMP TMT85' (BA00251R)
- Brief Operating Instructions 'iTEMP TMT85' (KA00252R)
- Operating Instructions "Guideline FOUNDATION Fieldbus Function Blocks" (BA00062S)
- Supplementary ATEX documentation:
  ATEX II 1G Ex ia IIC: XA00069R
  ATEX II 3G Ex nA II: XA01006T
  ATEX II 3D Ex tc IIIC: XA01006T
  ATEX II 2(1)G Ex ia IIC: XA01012T
  ATEX II 2G Ex d IIC and ATEX II 2D Ex tb IIIC: XA01007T
- Operating Instructions for "Display TID10" (BA00262R)

www.addresses.endress.com

Endress+Hauser

People for Process Automation