

# Technical Information

## iTEMP TMT162

Temperature field transmitter  
FOUNDATION Fieldbus™ or PROFIBUS® PA protocol



Temperature field transmitter with two sensor inputs and illuminated display

### Application

- Universal input for resistance thermometer (RTD), thermocouple (TC), resistance transmitter ( $\Omega$ ), voltage transmitter (mV)
- Output:
  - FOUNDATION Fieldbus™ ITK 6.1.2
  - PROFIBUS® PA Profile 3.02
- Diagnostics information according to NAMUR NE107
- Reliable operation thanks to sensor monitoring: failure information, sensor backup, drift alarm and corrosion detection
- International approvals such as FM, CSA (IS, NI, XP and DIP) and ATEX (Ex ia, Ex nA nL, Ex d and dust ignition-proof)
- Galvanic isolation 2 kV (sensor input/output)

### Your benefits

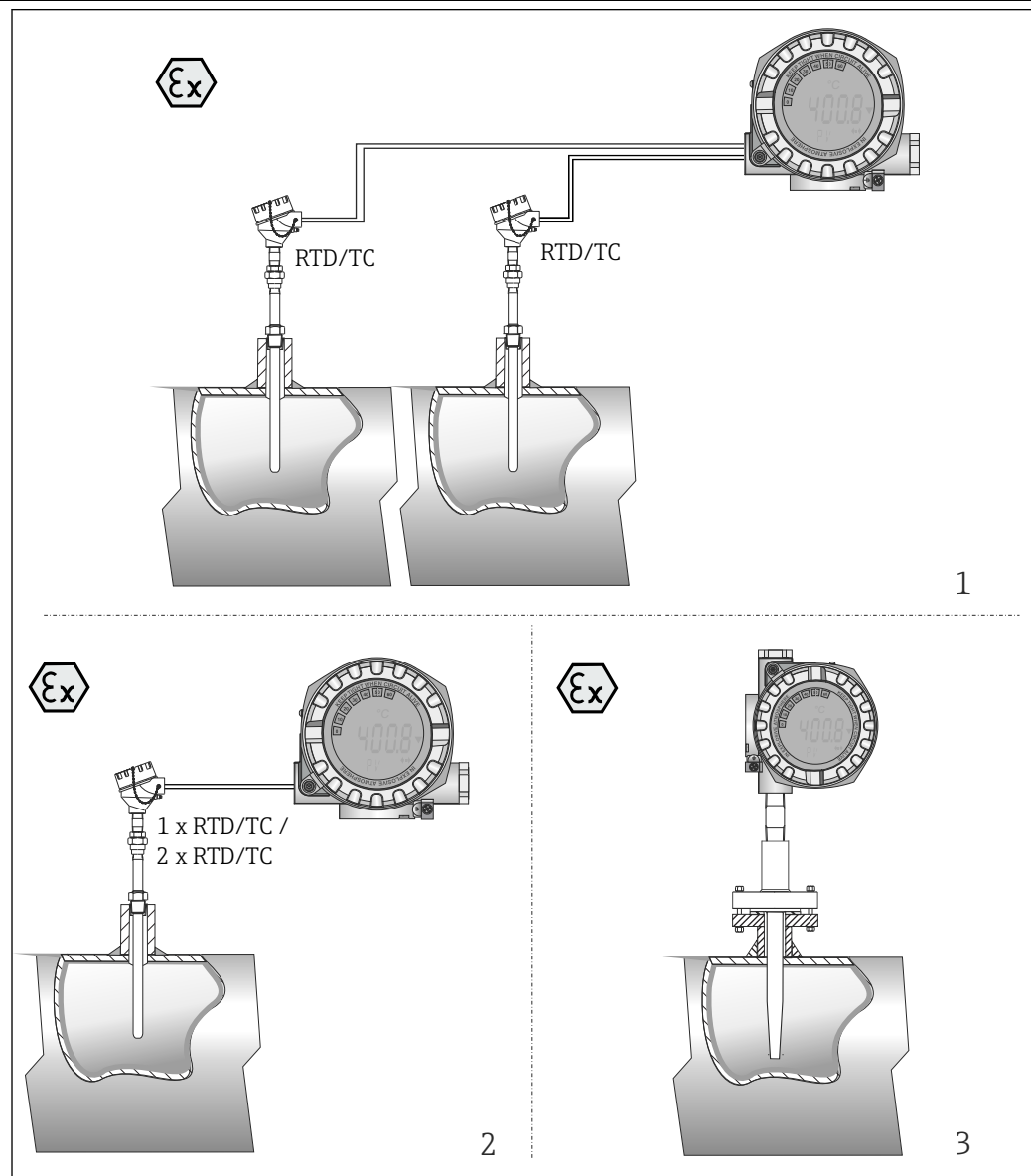
- Extremely reliable in harsh industrial environments thanks to dual-compartment housing and compact, fully encapsulated electronics
- Backlit display with large display of measured value, bar graph and status
- Two sensor inputs

## Function and system design

### Measuring principle

Electronic monitoring, conversion and display of input signals used 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 1 x RTD/TC or 2 x RTD/TC for redundancy
- 3 Temperature field transmitter in combination with a sensing element, insert and thermowell as compact thermometer

The iTEMP temperature field transmitter TMT162 is a two-wire transmitter with a PROFIBUS® PA or FOUNDATION Fieldbus™ protocol, two (optional) measuring inputs for resistance thermometers and resistance transmitters in 2-, 3- or 4-wire connection (for a resistance measuring input), thermocouples and voltage transmitters. The LC display shows the current measured value digitally and as a bar graph and also indicates the current status of the device.

**Standard diagnostic functions**

- Cable open circuit, short-circuit
- Incorrect wiring
- Internal device errors
- Overrange/underrange detection
- Ambient temperature out-of-range detection

**Corrosion detection as per NAMUR NE89**

Corrosion of the sensor connection cables can cause incorrect measured value readings. The field transmitter offers the possibility of detecting corrosion on thermocouples and resistance thermometers with a 4-wire connection before measured value corruption occurs. The transmitter prevents incorrect readings of measured values and can issue a warning on the display as well as through the fieldbus protocol if wire resistance values exceed plausible limits.

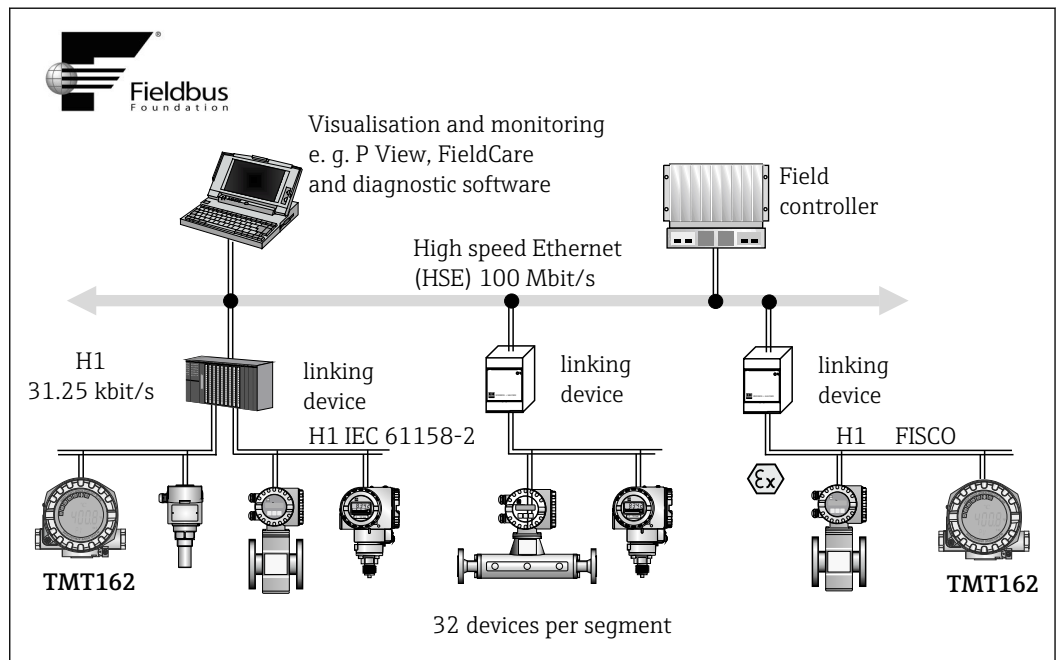
**Optional dual input functions**

These functions increase the reliability and availability of the process values:

- Sensor backup : If sensor 1 fails, the output signal is switched without interruption to the measured value of sensor 2.
- Temperature-dependent sensor switching: The measured value is recorded by sensor 1 or 2 depending on the process temperature.
- Sensor drift detection: If both measured values of sensor 1 and 2 deviate from a specified value, a drift warning or alarm is output.

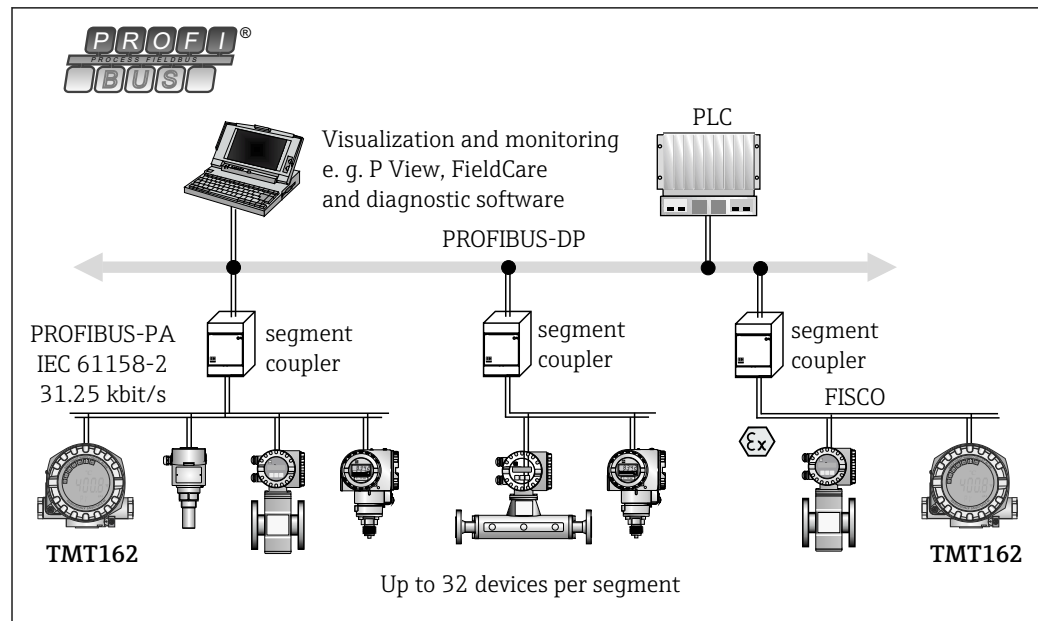
**Equipment architecture**

System integration via FOUNDATION Fieldbus™



A0026578-EN

## System integration via PROFIBUS® PA



## Input

## Measured variable

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

## Measuring range

Resistance thermometer (RTD) as per standard	Designation	$\alpha$	Measuring range limits	Min. span
IEC 60751:2008	Pt100 Pt200 Pt500 Pt1000	0.003851	-200 to +850 °C (-328 to +1562 °F) -200 to +850 °C (-328 to +1562 °F) -200 to +500 °C (-328 to +932 °F) -200 to +250 °C (-328 to +482 °F)	10 K (18 °F)
JIS C1604:1984	Pt100	0.003916	-200 to +510 °C (-328 to +950 °F)	10 K (18 °F)
SAMA	Pt100	0.003923	-100 to +700 °C (-148 to +1292 °F)	10 K (18 °F)
DIN 43760 IPTS-68	Ni100 Ni120 Ni1000	0.006180	-60 to +250 °C (-76 to +482 °F) -60 to +250 °C (-76 to +482 °F) -60 to +150 °C (-76 to +302 °F)	10 K (18 °F)
GOST 6651-94	Pt50 Pt100	0.003910	-185 to +1100 °C (-301 to +2012 °F) -200 to +850 °C (-328 to +1562 °F)	10 K (18 °F)
Edison Copper Winding No. 15	Cu10		-100 to +260 °C (-148 to +500 °F)	10 K (18 °F)
OIML R84: 2003, GOST 6651-2009	Cu50 Cu100	0.004280	-175 to +200 °C (-283 to +392 °F) -180 to +200 °C (-292 to +392 °F)	10 K (18 °F)
	Ni100 Ni120	0.006170	-60 to +180 °C (-76 to +356 °F) -60 to +180 °C (-76 to +356 °F)	10 K (18 °F)
OIML R84: 2003, GOST 6651-94	Cu50	0.004260	-50 to +200 °C (-58 to +392 °F)	10 K (18 °F)
-	Pt100 (Callendar van Dusen) Nickel polynomial Copper polynomial	-	10 to 400 $\Omega$ 10 to 2000 $\Omega$	10 $\Omega$ 10 $\Omega$

Resistance thermometer (RTD) as per standard	Designation	$\alpha$	Measuring range limits	Min. span
	<ul style="list-style-type: none"> <li>Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: <math>\leq 0.3</math> mA</li> <li>With 2-wire circuit, compensation of wire resistance possible (0 to 30 <math>\Omega</math>)</li> <li>With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 <math>\Omega</math> per wire</li> </ul>			
Resistance transmitter	Resistance $\Omega$		10 to 400 $\Omega$ 10 to 2 000 $\Omega$	10 $\Omega$ 10 $\Omega$

Thermocouples <sup>1)</sup> as per standard	Designation	Measuring range limits		Min. span
IEC 60584, Part 1	Type A (W5Re-W20Re)	0 to +2 500 °C (+32 to +4 532 °F)	Recommended temperature range: 0 to +2 500 °C (+32 to +4 532 °F)	50 K (90 °F)
	Type B (PtRh30-PtRh6) <sup>2)</sup>	+40 to +1 820 °C (+104 to +3 308 °F)	+100 to +1 500 °C (+212 to +2 732 °F)	50 K (90 °F)
	Type E (NiCr-CuNi)	-270 to +1 000 °C (-454 to +1 832 °F)	0 to +750 °C (+32 to +1 382 °F)	50 K (90 °F)
	Type J (Fe-CuNi)	-210 to +1 200 °C (-346 to +2 192 °F)	+20 to +700 °C (+68 to +1 292 °F)	50 K (90 °F)
	Type K (NiCr-Ni)	-270 to +1 372 °C (-454 to +2 501 °F)	0 to +1 100 °C (+32 to +2 012 °F)	50 K (90 °F)
	Type N (NiCrSi-NiSi)	-270 to +1 300 °C (-454 to +2 372 °F)	0 to +1 100 °C (+32 to +2 012 °F)	50 K (90 °F)
	Type R (PtRh13-Pt)	-50 to +1 768 °C (-58 to +3 214 °F)	0 to +1 400 °C (+32 to +2 552 °F)	50 K (90 °F)
	Type S (PtRh10-Pt)	-50 to +1 768 °C (-58 to +3 214 °F)	0 to +1 400 °C (+32 to +2 552 °F)	50 K (90 °F)
	Type T (Cu-CuNi)	-270 to +400 °C (-454 to +752 °F)	-185 to +350 °C (-301 to +662 °F)	50 K (90 °F)
ASTM E988-96	Type C (W5Re-W26Re)	0 to +2 315 °C (+32 to +4 199 °F)	0 to +2 000 °C (+32 to +3 632 °F)	50 K (90 °F)
	Type D (W3Re-W25Re)	0 to +2 315 °C (+32 to +4 199 °F)	0 to +2 000 °C (+32 to +3 632 °F)	50 K (90 °F)
DIN 43710	Type L (Fe-CuNi)	-200 to +900 °C (-328 to +1 652 °F)	0 to +750 °C (+32 to +1 382 °F)	50 K (90 °F)
	Type U (Cu-CuNi)	-200 to +600 °C (-328 to +1 112 °F)	-185 to +400 °C (-301 to +752 °F)	
	<ul style="list-style-type: none"> <li>Internal cold junction (Pt100)</li> <li>External cold junction: configurable value -40 to +85 °C (-40 to +185 °F)</li> <li>Maximum sensor wire resistance 10 k<math>\Omega</math> (if the sensor wire resistance is greater than 10 k<math>\Omega</math>, an error message as per NAMUR NE89 is output) <sup>3)</sup></li> </ul>			
Voltage transmitter (mV)	Millivolt transmitter (mV)	-5 to 30 mV -20 to 100 mV		5 mV

- When operating conditions are based on a large temperature range, the transmitter offers you the ability to split the range. For example, a Type S or R thermocouple can be used for the lower range and a Type B can be used for the upper range. The transmitter is then programmed by the end operator to switch at a predefined temperature. This allows for utilization of the best performance from each individual thermocouple and provides 1 output that represents the process temperature.
- High measuring uncertainty for temperatures below 300 °C (572 °F)
- Basic requirement of NE89: detection of increased wire resistance (e.g. corrosion of contacts and wires) of TC or RTD/4-wire. Warning - exceeding ambient temperature.

**Type of input**

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

		Sensor input 1			
		RTD or resistance transmitter, two-wire	RTD or resistance transmitter, three-wire	RTD or resistance transmitter, four-wire	Thermocouple (TC), voltage transmitter
Sensor input 2	RTD or resistance transmitter, two-wire	☑	☑	-	☑
	RTD or resistance transmitter, three-wire	☑	☑	-	☑
	RTD or resistance transmitter, four-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	☑	☑	☑	☑

## Output

### Output signal

FOUNDATION Fieldbus™	
Signal encoding	FOUNDATION Fieldbus™ H1, IEC 61158-2, Manchester Bus Powered (MBP)
Data transmission rate	31.25 kBit/s, voltage mode
Galvanic isolation	U = 2 kV AC (input/output)

PROFIBUS® PA	
Signal encoding	PROFIBUS® PA in accordance with EN 50170 Volume 2, IEC 61158-2, Manchester Bus Powered (MBP)
Data transmission rate	31.25 kBit/s, voltage mode
Galvanic isolation	U = 2 kV AC (input/output)

### Failure information

FOUNDATION Fieldbus™	
Status message in accordance with FOUNDATION Fieldbus™ specification	

PROFIBUS® PA	
Status messages and alarms in accordance with PROFIBUS® PA Profile 3.01/3.02 specification	

### Linearization/transmission behavior

Temperature-linear, resistance-linear, voltage-linear

### Filter

1st order digital filter: 0 to 60 s

### Protocol-specific data

FOUNDATION Fieldbus™	
Supported functions	Instantiation of function blocks. The following methods are supported: <ul style="list-style-type: none"> <li>▪ Quick Setup</li> <li>▪ User sensor trim</li> <li>▪ Factory trim settings</li> <li>▪ Callendar Van Dusen</li> <li>▪ Nickel/copper polynomial linearization</li> <li>▪ Sensor drift detection</li> </ul> For detailed descriptions, see the specific Operating Instructions.
Basic data	
Manufacturer ID	452B48 (Endress+Hauser)
Device type	10CC (Hex)
Device or bus address	247 (default)
Device revision	03 (hex)
ITK Version	6.1.2
ITK Certification Driver No.	IT099000
Link Master capability (LAS)	Yes
Choice of Link Master / Basic Device	Yes; factory setting: <b>Basic Device</b>
Virtual Communication Relationship (VCRs)	
Number of VCRs	44
Number of link objects in VFD	50
Permanent entries	44

FOUNDATION Fieldbus™		
Client VCRs	0	
Server VCRs	5	
Source VCRs	8	
Sink VCRs	0	
Subscriber VCRs	12	
Publisher VCRs	19	
Link settings		
Slot time	4	
Min. inter PDU delay	12	
Max. response delay	40	
Blocks		
Block description	Execution time (macro cycle ≤ 500 ms)	Block category
Resource Block	Permanent	Extended
Transducer Block Sensor 1	Pre-instantiated	Manufacturer-specific
Transducer Block Sensor 2	Pre-instantiated	Manufacturer-specific
Transducer Block Display	Pre-instantiated	Manufacturer-specific
Transducer Block Adv. Diag.	Pre-instantiated	Manufacturer-specific
Function Block AI1	35 ms (pre-instantiated)	Extended
Function Block AI2	35 ms (pre-instantiated)	Extended
Function Block AI3	35 ms (pre-instantiated)	Extended
Function Block AI4	35 ms (not instantiated)	Extended
Function Block AI5	35 ms (not instantiated)	Extended
Function Block AI6	35 ms (not instantiated)	Extended
Function Block PID	30 ms	Standard
Function Block ISEL	30 ms	Standard

Brief block description	
Resource Block	The Resource Block contains all the data that clearly identify and characterize the device. It is an electronic version of a nameplate on the device. In addition to parameters that are needed to operate the device on the fieldbus, the Resource Block makes information such as the order code, device ID, hardware revision, software revision, device release etc. available.
Transducer Block "Sensor 1" and "Sensor 2"	The Transducer Blocks of the field 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 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 realized: 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.

PROFIBUS® PA	
Profile version	3.02
Manufacturer-specific ID no.:	1549 (hex)
Device or bus address	126 (default) The device address or bus address is configured using either the configuration software, e.g. FieldCare, or the DIP switches on the electronics module. → 15
GSD files	Where to obtain GSD files and device drivers: <ul style="list-style-type: none"> <li>■ GSD file: <a href="http://www.de.endress.com">www.de.endress.com</a> → Downloads → Product code → Media type: Software</li> <li>■ Profile of GSD file: <a href="http://www.profibus.com">www.profibus.com</a></li> <li>■ FieldCare/DTM: <a href="https://portal.endress.com/webdownload/FieldCareDownloadGui">https://portal.endress.com/webdownload/FieldCareDownloadGui</a></li> <li>■ SIMATIC PDM: <a href="http://www.de.endress.com">www.de.endress.com</a> → Downloads → Product code → Media type: Software</li> </ul>
Write protection	Write protection activated by hardware setting (DIP switch)
Cyclical data exchange	
Output data	Value display
Input data	Process temperature, internal reference temperature

Brief block description	
Physical Block	The Physical Block contains all the data that clearly identify and distinguish the device. It is an electronic version of a nameplate on the device. In addition to parameters required to operate the device at the fieldbus, the Physical Block provides information such as order code, device ID, hardware revision, software revision etc. The Physical Block can also be used to configure the display.
Transducer Block "Sensor 1" and "Sensor 2"	The Transducer Blocks of the field transmitter contain all the measurement-specific and device-specific parameters which are relevant for the measurement of 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).

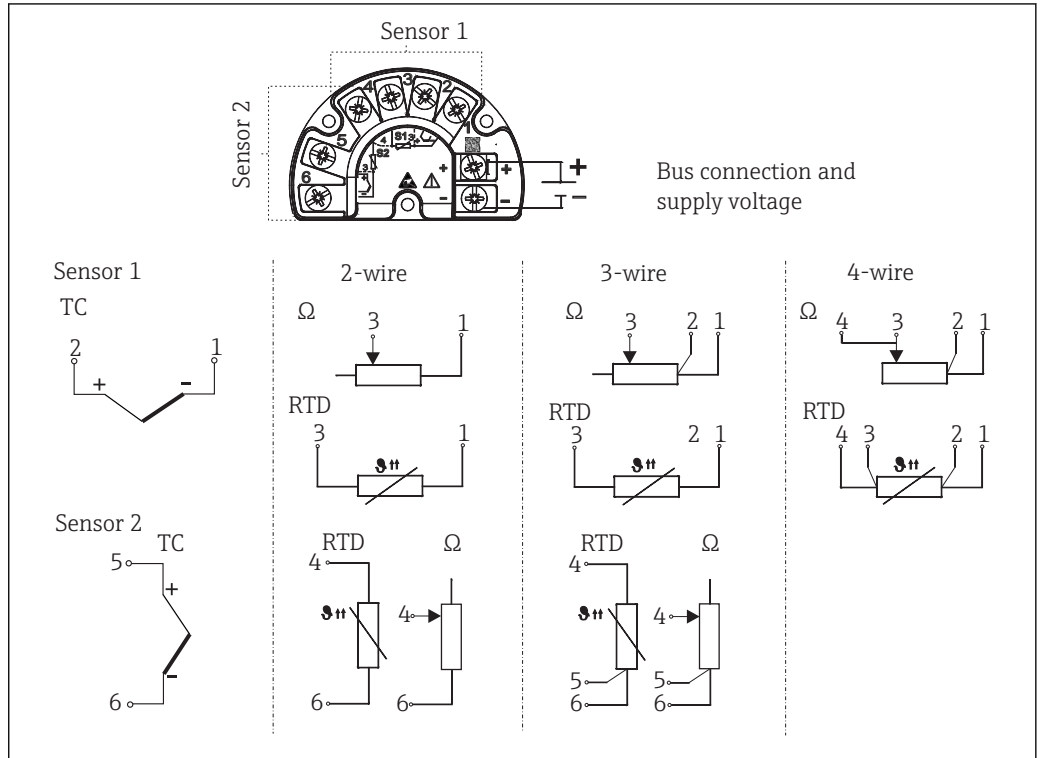
Switch-on delay 8 s

## Power supply

Supply voltage  $U_b = 9$  to 32 V, polarity-independent (reverse polarity protection for T17 housing), maximum voltage  $U_b = 35$  V. According to IEC 60079-27, FISCO/FNICO



**Terminal assignment**



A0024515-EN

2 Wiring the transmitter

A shielded cable that is grounded on both sides must be used for sensor cable lengths of 30 m (98.4 ft) and more. The use of shielded sensor cables is generally recommended.

Connection of the functional grounding may be needed for functional purposes. Compliance with the electrical codes of individual countries is mandatory.

**Current consumption**

Current consumption (device basic current)	≤ 11 mA
Switch-on current (device inrush current) <sup>1)</sup>	≤ 11 mA
failure current FDE (Fault Disconnection Electronic)	0 mA

1) Only FOUNDATION Fieldbus™

**Terminals**

2.5 mm<sup>2</sup> (12 AWG) plus ferrule

**Cable entries**

Version	Type
Thread	2x thread ½" NPT
	2x thread M20
	2x thread G½"
Cable gland	2x coupling M20

**Device connector**

Version	Type
Thread and fieldbus connector	2x thread ½" NPT 1x connector 7/8" FF
	2x thread M20x1.5 1x connector 7/8" FF

## Performance characteristics

**Response time** Measured value update < 1 s per channel, depending on the type of sensor and connection method

**Reference operating conditions**

- Calibration temperature: +25 °C ±3 K (77 °F ±5.4 °F)
- Supply voltage: 24 V DC
- 4-wire circuit for resistance adjustment

**Maximum measured error** The data relating to the measured error are typical values and correspond to a standard deviation of  $\pm 3 \sigma$  (normal distribution), i.e. 99.8% of all measured values achieve the specified values or better values.

	Designation	Accuracy
<b>Resistance thermometer (RTD)</b>	Cu100, Pt100, Ni100, Ni120	0.1 °C (0.18 °F)
	Pt500	0.3 °C (0.54 °F)
	Cu50, Pt50, Pt1000, Ni1000	0.2 °C (0.36 °F)
	Cu10, Pt200	1 °C (1.8 °F)
<b>Thermocouples (TC)</b>	K, J, T, E, L, U N, C, D S, B, R	typ. 0.25 °C (0.45 °F) typ. 0.5 °C (0.9 °F) typ. 1.0 °C (1.8 °F)
	Measuring range	Accuracy
<b>Resistance transmitter (Ω)</b>	10 to 400 Ω 10 to 2 000 Ω	±0.04 Ω ±0.08 Ω
<b>Voltage transmitter (mV)</b>	-20 to 100 mV	±10 μV

Physical input measuring range of sensors	
10 to 400 Ω	Cu10, Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120
10 to 2 000 Ω	Pt200, Pt500, Pt1000, Ni1000
-20 to 100 mV	Thermocouples type: C, D, E, J, K, L, N, U
-5 to 30 mV	Thermocouples type: B, R, S, T

**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:

- Customized linearization  
The transmitter can be programmed with sensor-specific curve data with the PC configuration software. As soon as the sensor-specific data have been entered, the transmitter uses these to create a customized curve.
- Callendar-Van-Dusen coefficients  
The Callendar-Van-Dusen equation is described as:  

$$R_T = R_0 [1 + AT + BT^2 + C(T - 100)T^3]$$

where A, B and C are constant. They are commonly referred as Callendar-Van-Dusen coefficients. The precise values of A, B and C are derived from the calibration data for the RTD and are specific for each RTD sensor. The process involves programming the transmitter with the curve data for a certain RTD instead of using a standardized curve.

Sensor transmitter matching using one of the methods explained above significantly improves the temperature measurement accuracy of the entire system. This is a result of the transmitter using the sensor's actual resistance vs. temperature curve data instead of the ideal curve data.

**Resolution** Resolution of A/D converter = 18 bit

**Non-repeatability**

According to EN 61298-2

Physical input measuring range of sensors		Non-repeatability
10 to 400 Ω	Cu10, Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120	15 mΩ
10 to 2 000 Ω	Pt200, Pt500, Pt1000, Ni1000	100 ppm x measured value
-20 to 100 mV	Thermocouples type: C, D, E, J, K, L, N, U	4 μV
-5 to 30 mV	Thermocouples type: B, R, S, T	3 μV

**Long-term drift**

≤ 0.1 °C/year (≤ 0.18 °F/year) under reference operating condition or ≤ 0.05 %/year. Data under reference operating conditions. % refers to the set span. The larger value is valid.

**Influence of ambient temperature**

Impact on accuracy when ambient temperature changes by 1 °C (1.8 °F):	
Input 10 to 400 Ω	15 ppm of measured value, min. 1.5 mΩ
Input 10 to 2 000 Ω	15 ppm of measured value, min. 15 mΩ
Input -20 to 100 mV	30 ppm of measured value, min. 0.3 μV
Input -5 to 30 mV	30 ppm of measured value, min. 0.15 μV

Typical sensitivities of resistance thermometers		
Pt: 0.00385 * R <sub>nom</sub> /K	Cu: 0.0043 * R <sub>nom</sub> /K	Ni: 0.00617 * R <sub>nom</sub> /K

Example of Pt100: 0.00385 x 100 Ω/K = 0.385 Ω/K

Typical sensitivities of thermocouples					
B: 10 μV/K at 1 000 °C (1 832 °F)	C: 20 μV/K at 1 000 °C (1 832 °F)	D: 20 μV/K at 1 000 °C (1 832 °F)	E: 75 μV/K at 500 °C (932 °F)	J: 55 μV/K at 500 °C (932 °F)	K: 40 μV/K at 500 °C (932 °F)
L: 55 μV/K at 500 °C (932 °F)	N: 35 μV/K at 500 °C (932 °F)	R: 12 μV/K at 1 000 °C (1 832 °F)	S: 12 μV/K at 1 000 °C (1 832 °F)	T: 50 μV/K at 1 000 °C (1 832 °F)	U: 60 μV/K at 500 °C (932 °F)

**Examples of calculating the measured error with ambient temperature drift****Example 1:**

Input temperature drift  $\Delta\theta = 10$  K (18 °F), Pt100, measuring range 0 to +100 °C (+32 to +212 °F)

Maximum process temperature: 100 °C (212 °F)

Measured resistance value: 138.5 Ω (IEC 60751) at maximum process temperature

Typical temperature drift in Ω: (0.001% of 138.5 Ω) \* 10 = 0.01385 Ω

Conversion to Kelvin: 0.01385 Ω / 0.385 Ω/K = 0.04 K (0.054 °F)

**Influence of the reference junction**

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

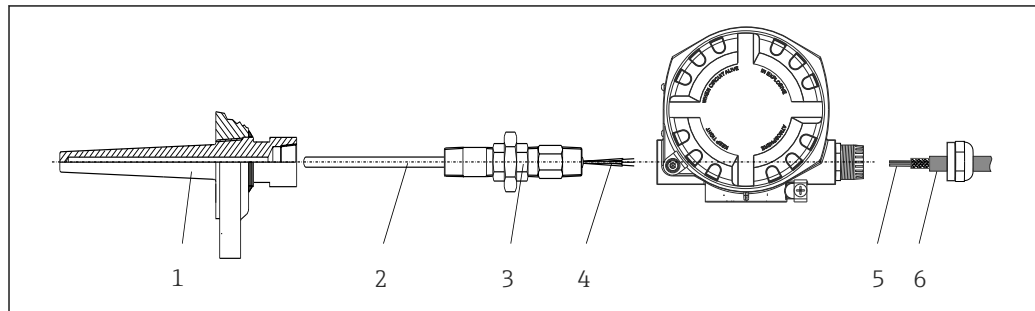
## Installation

**Mounting location**


If stable sensors are used, the device can be fitted directly to the sensor. For remote mounting to a wall or stand pipe, two mounting brackets are available. The illuminated display can be mounted in four different positions.

## Installation instructions

## Direct sensor mounting

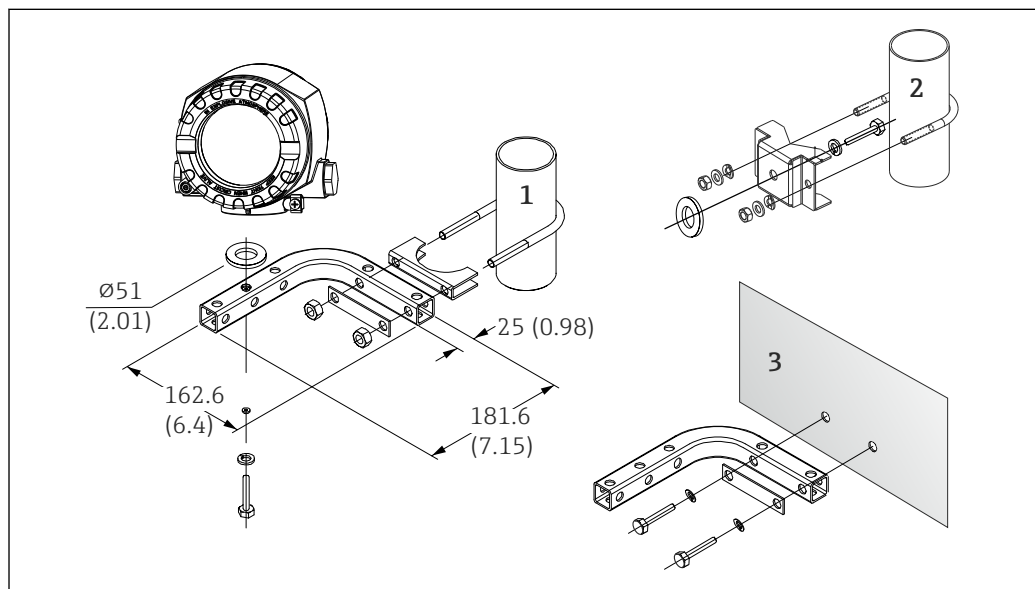


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 3 Direct field transmitter mounting on sensor

- 1 Thermowell
- 2 Insert
- 3 Neck tube nipple and adapter
- 4 Sensor cables
- 5 Fieldbus cables
- 6 Fieldbus shielded cable

## Remote mounting

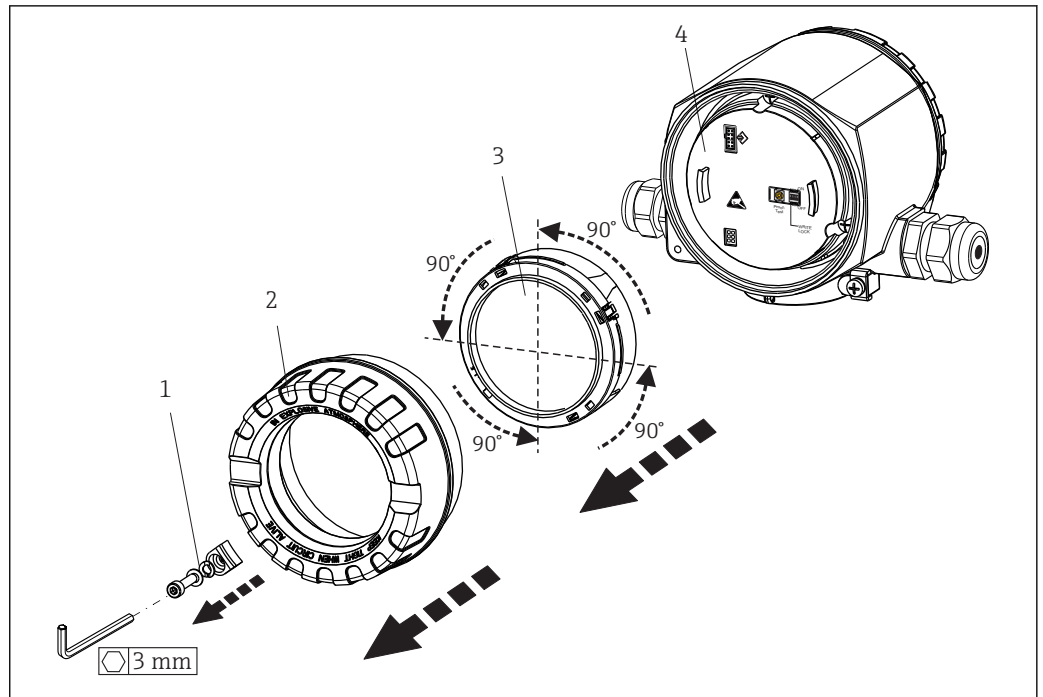


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 4 Installing the field transmitter using the mounting bracket, see "Accessories" section. Dimensions in mm (in)

- 1 Mounting with combined wall/pipe mounting bracket
- 2 Mounting with pipe mounting bracket 2"/V4A
- 3 Mounting with wall mounting bracket

## Display mounting



5 4 display installation positions, attachable in 90° stages

- 1 Cover clamp
- 2 Housing cover with O-ring
- 3 Display with retainer and twist protection
- 4 Electronics module

## Environment

### Ambient temperature

- Without display: -40 to +85 °C (-40 to +185 °F)
- With display: -40 to +80 °C (-40 to +176 °F)

For hazardous areas see Ex documentation → 20

**i** The display can react slowly at temperatures < -20 °C (-4 °F). The legibility of the display cannot be guaranteed at temperatures < -30 °C (-22 °F).

### Storage temperature

- Without display: -40 to +100 °C (-40 to +212 °F)
- With display: -40 to +80 °C (-40 to +176 °F)

### Humidity

Permitted: 0 to 95 %

### Altitude

Up to 2 000 m (6 560 ft) above sea level

### Climate class

As per IEC 60654-1, Class C

### Degree of protection

- Die-cast aluminum or stainless steel housing: IP66/67, Type 4X
- Stainless steel housing for hygienic applications (T17 housing): IP66 / IP68 (1.83 m H<sub>2</sub>O for 24 h), NEMA 4X, NEMA 6P

### Shock and vibration resistance

Shock resistance as per KTA 3505 (section 5.8.4 Shock test)

IEC 60068-2-6 test

Fc: Vibration (sinusoidal)

Vibration resistance according to DNV GL Guideline, Vibration: B

**i** The use of L-shaped mounting brackets can cause resonance (see wall/pipe 2" mounting bracket in the 'Accessories' section). Caution: vibrations at the transmitter may not exceed specifications.

### Electromagnetic compatibility (EMC)

#### CE compliance

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

**i** A shielded cable that is grounded on both sides must be used for sensor cable lengths of 30 m (98.4 ft) and more. The use of shielded sensor cables is generally recommended.

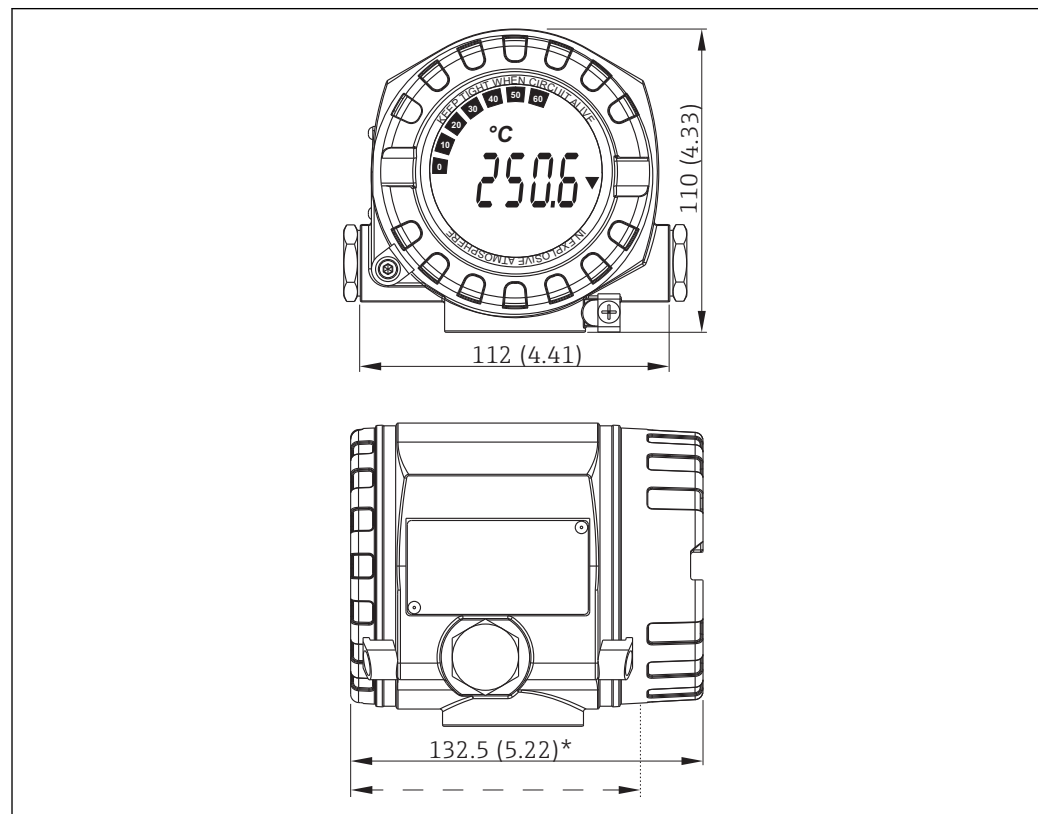
Connection of the functional grounding may be needed for functional purposes. Compliance with the electrical codes of individual countries is mandatory.

Overvoltage category II

Degree of contamination 2

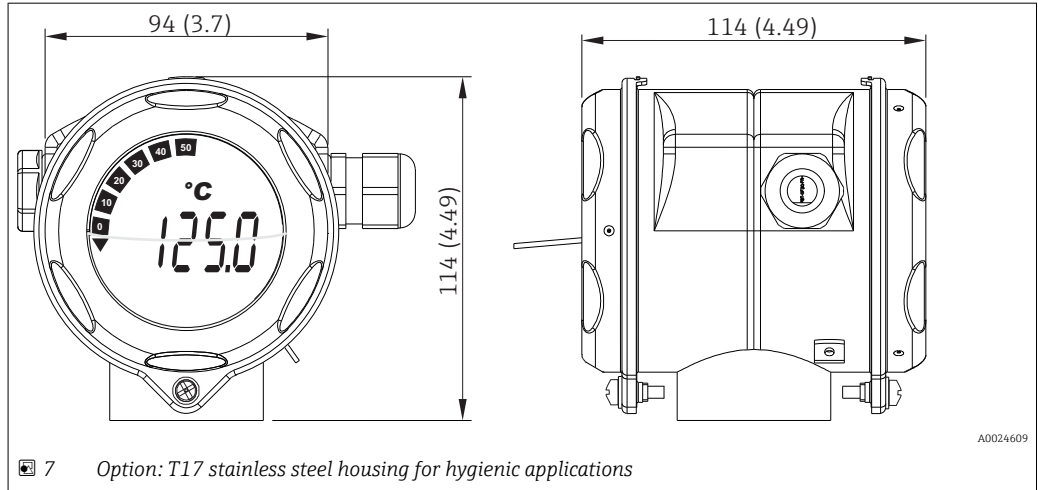
## Mechanical construction

Design, dimensions Dimensions in mm (in)



**6** Die-cast aluminum housing for general applications, or optional stainless steel housing (316L)

**i** \* Dimensions without display = 112 mm (4.41")



- Separate electronics module and connection compartment
- Display attachable in 90° stages

**Weight**

- Aluminum housing approx. 1.4 kg (3 lb), with display
- Stainless steel housing approx. 4.2 kg (9.3 lb), with display
- T17 housing approx. 1.25 kg (2.76 lb), with display

**Materials**

Housing	Sensor terminals	Nameplate
Die-cast aluminum housing AlSi10Mg/ AlSi12 with powder coating on polyester base	Nickel-plated brass 0.3 µm gold flashed / cpl., corrosion-free	Aluminum AlMg1, anodized in black
316L		1.4404 (AISI 316L)
Stainless steel 1.4435 (AISI 316L) for hygienic applications (T17 housing)		-
Display O-ring 88x3: EPDM70, PTFE anti-friction coating	-	-

**Cable entries**

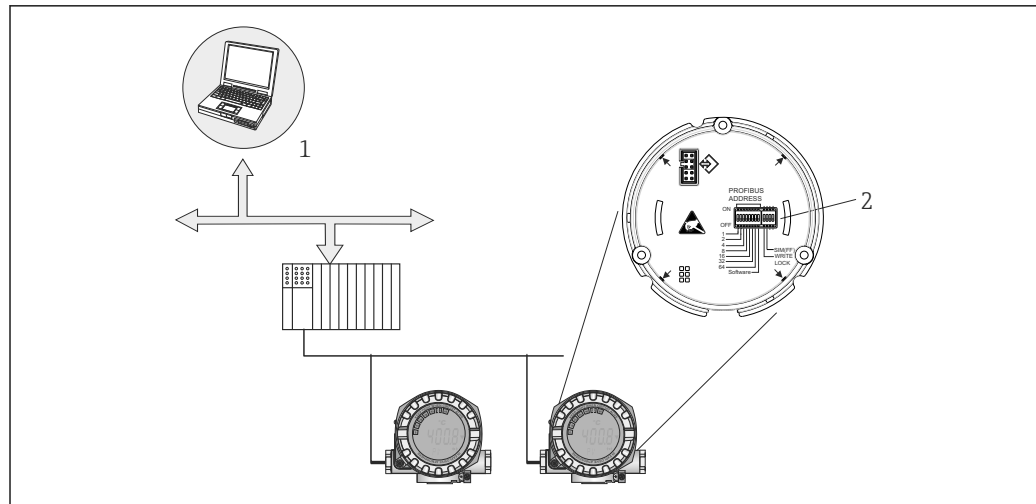
Version	Type
Thread	2x thread ½" NPT
	2x thread M20
	2x thread G½"
Cable gland	2x coupling M20

## Operability

**Operating concept**

There are different options available for configuring and commissioning the device:

- **Configuration programs**  
Device-specific parameters are configured and set via the fieldbus interface. Special configuration and operating programs are available from various manufacturers for this purpose.
- **Miniature switch (DIP switch) for diverse hardware settings**  
You can perform the following hardware settings for the fieldbus interface (PROFIBUS® PA and FOUNDATION Fieldbus™) using miniature switches (DIP switches) on the electronics module:
  - Enabling/disabling of simulation mode (FOUNDATION Fieldbus™)
  - Switching the hardware write protection on/off
  - Configuration of device address (PROFIBUS® PA)



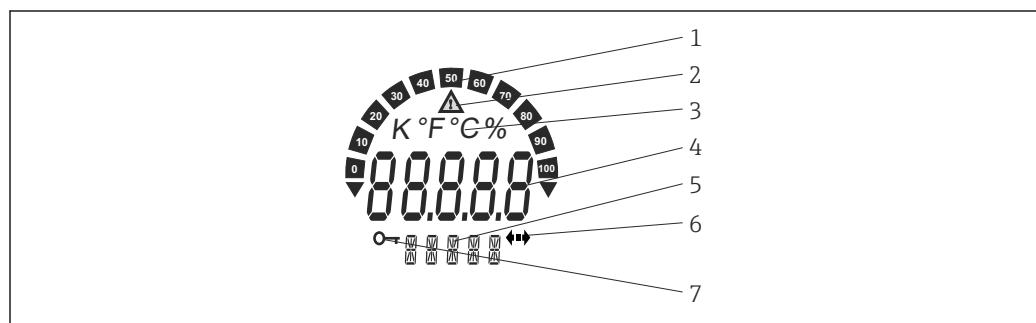
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### 8 Operating options of device

- 1 Configuration/operating programs for operation via fieldbus
- 2 DIP switches for hardware settings (write protection, simulation mode)

## Local operation

### Display elements



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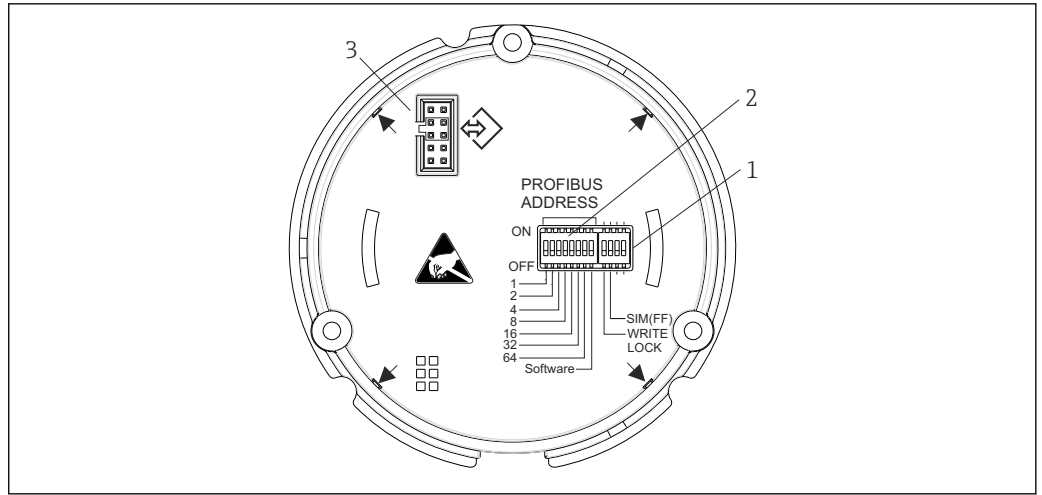
### 9 LC display of the field transmitter (illuminated, can be plugged in in 90° steps)

- 1 Bar graph display
- 2 'Caution' symbol
- 3 Unit display K, °F, °C or %
- 4 Measured value display, digit height 20.5 mm
- 5 Status and information display
- 6 'Communication' symbol
- 7 'Configuration locked' symbol

### Operating elements

To prevent manipulation, no operating elements are present directly on the display, but are provided on the electronics module behind the display.





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10 Hardware setup for FOUNDATION Fieldbus™ and PROFIBUS® PA system integration

- 1 DIP switch for write protection; simulation (precondition for FOUNDATION Fieldbus™ simulation mode)
- 2 DIP switch for PROFIBUS® device address
- 3 Electrical connection display

**Remote operation**

Remote operation via different fieldbus protocols:

- FOUNDATION Fieldbus™
- PROFIBUS® PA

## 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.

**MTBF**

- FOUNDATION Fieldbus™: **126 a**
  - PROFIBUS® PA: **126 a**
- according to Siemens Standard SN29500

**UL approval**

UL recognized component (see [www.ul.com/database](http://www.ul.com/database), search for Keyword "E225237")

**CSA GP**

CAN/CSA-C22.2 No. 61010-1, 2nd Edition

**FOUNDATION Fieldbus certification**

The temperature transmitter is certified and registered by the Fieldbus FOUNDATION. The measuring system meets all the requirements of the following specifications:

- Certified in accordance with FOUNDATION Fieldbus™ specification
- FOUNDATION Fieldbus™ H1
- Interoperability Test Kit (ITK), revision status 6.1.2, device certification number → 6: The device can also be operated with certified devices of other manufacturers.
- Physical Layer Conformance Test of the Fieldbus FOUNDATION™ (FF-830 FS 1.0)

**PROFIBUS® PA certification**

The temperature transmitter is certified and registered by the PNO (PROFIBUS® Nutzerorganisation e. V.), PROFIBUS user organization. The device meets all the requirements of the following specifications:

- Certified in accordance with PROFIBUS® PA Profile 3.02.
- The device can also be operated with certified devices of other manufacturers (interoperability).

## Other standards and guidelines

- IEC 60529:  
Degree of protection provided by housing (IP code)
- IEC/EN 61010-1:  
Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC/EN 61326-Series:  
Electromagnetic compatibility (EMC requirements)
- **NAMUR** - Standardization organization for measurement and control processes in the chemical and pharmaceutical industry. ([www.namur.de](http://www.namur.de))
- **NEMA** - Standardization organization for the electrical industry.

## Ordering information

Detailed ordering information is available for your nearest sales organization [www.addresses.endress.com](http://www.addresses.endress.com) or in the Product Configurator under [www.endress.com](http://www.endress.com) :

1. Click Corporate
2. Select the country
3. Click Products
4. Select the product using the filters and search field
5. Open the product page


The Configuration button to the right of the product image opens the Product 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

## 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](http://www.endress.com).

 Always quote the serial number of the device when ordering accessories!



### Device-specific accessories

Accessories	Description	
Dummy plug	<ul style="list-style-type: none"> <li>■ M20x1.5 EEx-d/XP</li> <li>■ G ½" EEx-d/XP</li> <li>■ NPT ½" ALU</li> <li>■ NPT ½" V4A</li> </ul>	
Cable glands	<ul style="list-style-type: none"> <li>■ M20x1.5</li> <li>■ NPT ½" D4-8.5, IP68</li> <li>■ NPT ½" cable gland 2 x D0.5 cable for 2 sensors</li> <li>■ M20x1.5 cable gland 2 x D0.5 cable for 2 sensors</li> </ul>	
Adapter for cable gland	M20x1.5 male/M24x1.5 female	
Wall and pipe mounting bracket	Stainless steel wall/2" pipe Stainless steel 2" pipe V4A	
Fieldbus device connector (FF)	<b>Threaded connection:</b>	<b>Cable connection thread:</b>
	M20	7/8"
	NPT ½"	7/8"



**Communication-specific accessories**

Accessories	Description
Field Xpert SMT70	<p>Universal, high-performance tablet PC for device configuration</p> <p>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.</p> <p> For details, see Technical Information TI01342S/04</p>

**Service-specific accessories**

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> <li>▪ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections.</li> <li>▪ Graphic illustration of the calculation results</li> </ul> <p>Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.</p> <p>Applicator is available: Via the Internet: <a href="https://portal.endress.com/webapp/applicator">https://portal.endress.com/webapp/applicator</a></p>
Configurator	<p>Product Configurator - the tool for individual product configuration</p> <ul style="list-style-type: none"> <li>▪ Up-to-the-minute configuration data</li> <li>▪ Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language</li> <li>▪ Automatic verification of exclusion criteria</li> <li>▪ Automatic creation of the order code and its breakdown in PDF or Excel output format</li> <li>▪ Ability to order directly in the Endress+Hauser Online Shop</li> </ul> <p>The Configurator is available on the Endress+Hauser website: <a href="http://www.endress.com">www.endress.com</a> -&gt; Click "Corporate" -&gt; Select country -&gt; Click "Products" -&gt; Select the product using the filters and search field -&gt; Open product page -&gt; The "Configure" button to the right of the product image opens the Product Configurator.</p>
DeviceCare SFE100	<p>Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols.</p> <p>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.</p> <p> For details, see Operating Instructions BA00027S</p>
FieldCare SFE500	<p>FDT-based plant asset management tool from Endress+Hauser.</p> <p>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.</p> <p> For details, see Operating Instructions BA00027S and BA00065S</p>
W@M	<p>Life cycle management for your plant</p> <p>W@M supports 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 device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle.</p> <p>The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.</p> <p>W@M is available: Via the Internet: <a href="http://www.endress.com/lifecyclemanagement">www.endress.com/lifecyclemanagement</a></p>

## System products

Accessories	Description
Graphic Data Manager Memograph M	<p>The Advanced Data Manager Memograph M is a flexible and powerful system for organizing process values. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. Via common communication protocols, the measured and calculated values can be easily communicated to higher-level systems or individual plant modules can be interconnected.</p> <p> For details, see Technical Information TI01180R/09</p>
RID14, RID16	<p>Field indicator with 8 input channels and FOUNDATION Fieldbus™ or PROFIBUS® PA protocol for displaying process values and calculated values. Optionally available also for Ex d applications. Onsite display of process parameters in fieldbus systems.</p> <p> For details</p> <ul style="list-style-type: none"> <li>▪ Technical Information RID14: TI00145R</li> <li>▪ Technical Information RID16: TI00146R</li> </ul>

## Supplementary documentation

- FOUNDATION Fieldbus™ Function Blocks manual (BA062S/04)
  - Supplementary ATEX documentation:
    - ATEX/IECEX II 2G Ex d IIC T6...T4 Gb: XA00031R/09/a3
    - ATEX/IECEX II 2D Ex tb IIIC T110 °C Db: XA00032R/09/a3
    - ATEX/IECEX II 1G Ex ia IIC T6/T5/T4: XA00033R/09/a3
    - ATEX II 3G Ex nA IIC T6...T4 Gc: XA00035R/09/a3
    - ATEX/IEC Installation type Ex ia + Ex d: XA01025R/09/a3
    - ATEX II 3G Ex ic IIC T6...T4 Gc: XA00062R/09/a3
  - iTEMP TMT162 FOUNDATION Fieldbus™ - Operating Instructions (BA00224R/09/en)  
iTEMP TMT162 FOUNDATION Fieldbus™ - Brief Operating Instructions (KA00189R/09)
  - iTEMP TMT162 PROFIBUS® PA - Operating Instructions (BA00275R/09/en)  
iTEMP TMT162 PROFIBUS® PA - Brief Operating Instructions (KA00276R/09)
- Technical Information Omnigrad S TMT162R and TMT162C (TI00266T/02/en and TI00267T/02/en)

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