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Technical Information
iTEMP TMT162

Temperature field transmitter with HART® protocol

Applications

- Universal input for resistance thermometer (RTD), thermocouple (TC), resistance transmitter (Ω), voltage transmitter (mV)
- Output:
  Conversion of various signals to the HART® protocol and a scalable 4 to 20 mA analog output signal. Transmitter operation with FieldXpert SMT70 and AMS Trex Device Communicator or via PC.

Your benefits

- Extremely reliable in harsh industrial environments thanks to dual-compartment housing and compact, fully potted electronics
- Backlit display with large characters
- Diagnostics information according to NAMUR NE107
- Reliable operation thanks to sensor monitoring: failure information, sensor backup, drift alarm, corrosion detection and device hardware error detection
- International approvals such as FM, CSA (IS, NI, XP and DIP) and ATEX (Ex ia, Ex nA, Ex d and dust ignition-proof)
- SIL certification as per IEC 61508:2010
- Galvanic isolation 2 kV (sensor input/current output)

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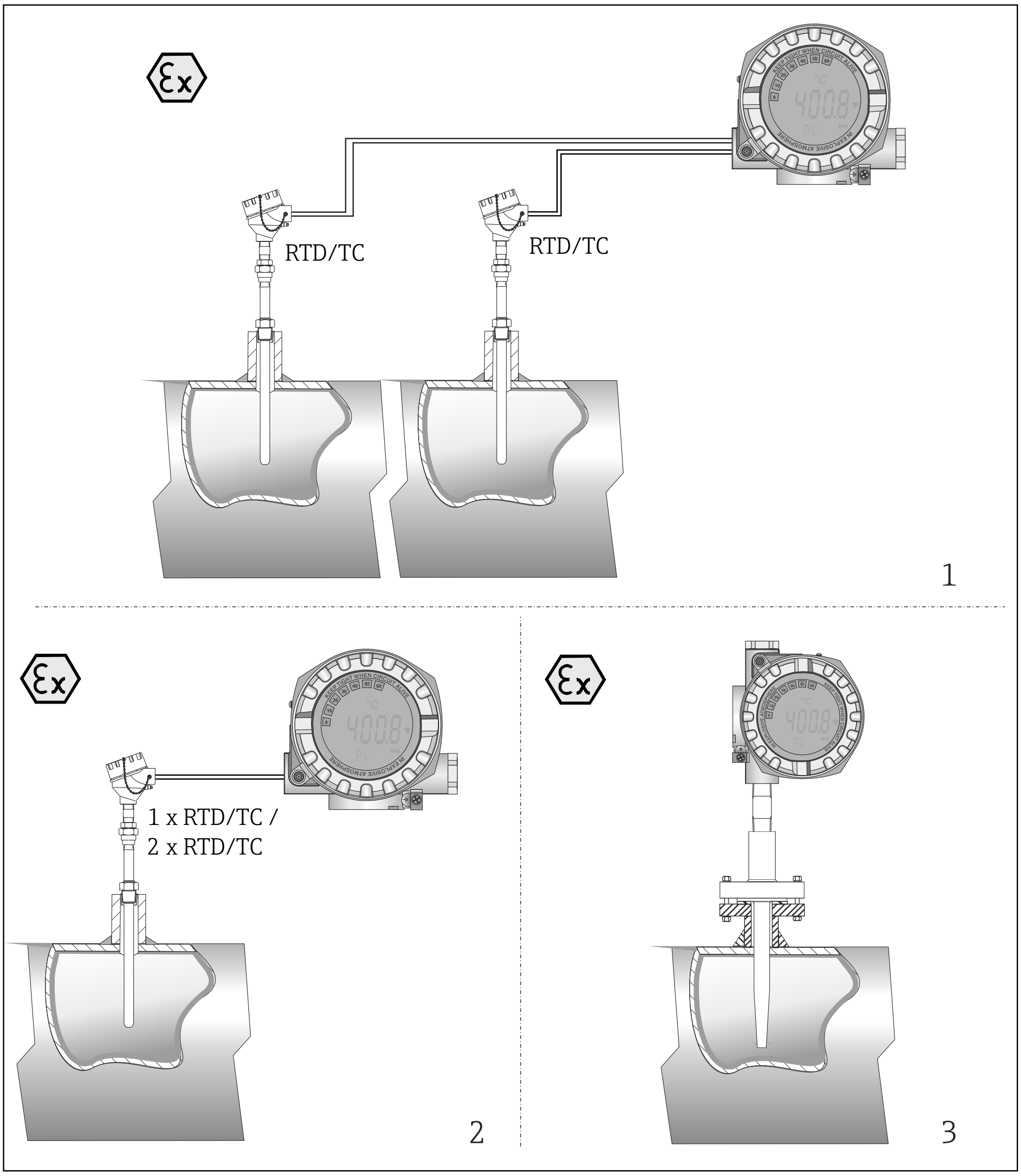
Function and system design

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 combined with sensor element, insert and thermowell as modular thermometer*

The temperature field transmitter is a 2-wire transmitter with an analog output or fieldbus protocol, two (optional) measuring inputs for resistance thermometers and resistance transmitters in 2-wire, 3-wire 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 of the sensor cables
- 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 HART or fieldbus protocol if wire resistance values exceed plausible limits.

Low voltage detection
The low voltage detection function prevents the device from continuously outputting an incorrect analog output value (i.e. due to a damaged or incorrect power supply or due to a damaged signal cable). If the supply voltage drops below the required value, the analog output value drops to < 3.6 mA for > 4 s. An error message is displayed. The device then cyclically tries to restart and output the normal analog output value. If the supply voltage is still too low, the analog output value drops again to < 3.6 mA.

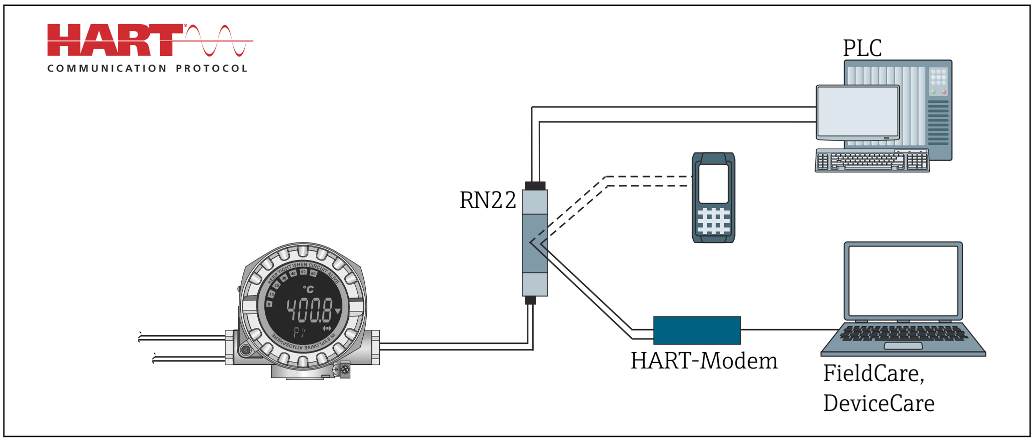
2-channel functions
These functions increase the reliability and availability of the process values:
- Sensor backup : If sensor 1 fails, the output signal is switched without interruption to the measured value of sensor 2.
- Temperature-dependent sensor switching: The measured value is recorded by sensor 1 or 2 depending on the process temperature.
- Sensor drift detection: Drift warning or alarm, if the measured values between sensor 1 and 2 deviate from a specified value.
- Mean value or differential measurement from two sensors
- Mean value measurement with sensor redundancy

Not all modes are available in SIL mode, for more detailed information see the 'Functional Safety Manual'.

Functional Safety Manual for temperature field transmitter iTEMP TMT162: FY01106T

Device architecture

Analog current output 4 to 20 mA with HART protocol



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Input

Measured variable

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

Measuring range

It is possible to connect two sensors that are independent of one another [1]. The measuring inputs are not galvanically isolated from each other.

Resistance thermometer (RTD) as per standard	Description	α	Measuring range limits	Min. measuring span
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 +500 °C (−328 to +932 °F) −200 to +250 °C (−328 to +482 °F)	10 K (18 °F)
JIS C1604:1984	Pt100 (5)	0.003916	−200 to +510 °C (−328 to +950 °F)	10 K (18 °F)
DIN 43760 IPTS-68	Ni100 (6) Ni120 (7)	0.006180	−60 to +250 °C (−76 to +482 °F) −60 to +250 °C (−76 to +482 °F)	10 K (18 °F)
GOST 6651-94	Pt50 (8) Pt100 (9)	0.003910	−185 to +1 100 °C (−301 to +2 012 °F) −200 to +850 °C (−328 to +1 562 °F)	10 K (18 °F)
OIML R84: 2003, GOST 6651-2009	Cu50 (10) Cu100 (11)	0.004280	−180 to +200 °C (−292 to +392 °F) −180 to +200 °C (−292 to +392 °F)	10 K (18 °F)
	Ni100 (12) Ni120 (13)	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 (14)	0.004260	−50 to +200 °C (−58 to +392 °F)	10 K (18 °F)
-	Pt100 (Callendar van Dusen) Nickel polynomial Copper polynomial	-	The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R0.	10 K (18 °F)
	▪ Connection type: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ With 2-wire circuit, compensation of the wire resistance 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	10 Ω 10 Ω

Thermocouples as per standard	Description	Measuring range limits		Min. measuring span
IEC 60584, Part 1 ASTM E230-3	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) −250 to +1 000 °C (−418 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) −200 to +400 °C (−328 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) +200 to +1 768 °C (+392 to +3 214 °F) +200 to +1 768 °C (+392 to +3 214 °F) −150 to +400 °C (−238 to +752 °F)	50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F)
IEC 60584, Part 1 ASTM E230-3 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)	50 K (90 °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)	50 K (90 °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)	50 K (90 °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)	50 K (90 °F)

1) In the case of 2-channel measurement the same measuring unit must be configured for the two channels (e.g. both °C or F or K). Independent 2-channel measurement of a resistance transmitter (Ohm) and voltage transmitter (mV) is not possible.

Thermocouples as per standard	Description	Measuring range limits	Min. measuring span
	▪ Internal reference junction (Pt100) ▪ External reference junction: 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	5 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

Analog output	4 to 20 mA, 20 to 4 mA (can be inverted)
Signal encoding	FSK ±0.5 mA via current signal
Data transmission rate	1200 baud
Galvanic isolation	U = 2 kV AC, 1 min. (input/output)

Failure information

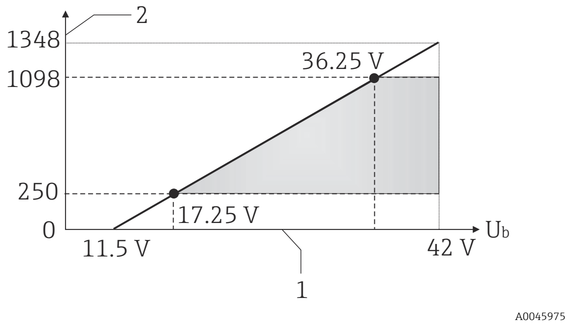
Failure information as per NAMUR NE43:

Failure information is created if the measuring information is missing or not valid. A complete list of all the faults occurring in the measuring system is created.

Underranging	Linear decrease from 4.0 to 3.8 mA
Overranging	Linear increase from 20.0 to 20.5 mA
Failure e.g. sensor failure; sensor short-circuit	≤ 3.6 mA ("low") or ≥ 21 mA ("high"), can be selected The "high" alarm setting can be set between 21.5 mA and 23 mA, thus providing the flexibility needed to meet the requirements of various control systems.

Load

$R_{b\ max.} = (U_{b\ max.} - 11.5\ V) / 0.023\ A$ (current output)



1 Supply voltage U_b (V_{DC})
2 Load (Ω)

Linearization/transmission behavior

Temperature-linear, resistance-linear, voltage-linear

Mains frequency filter

50/60 Hz

Filter

1st order digital filter: 0 to 120 s

Protocol-specific data

Manufacturer ID	17 (0x11)
Device type ID	0x11CE
HART specification	7
Device address in the multi-drop mode [1)]	Software setting addresses 0 to 63
Device description files (DTM, DD)	Information and files available at: www.endress.com www.fieldcommgroup.org
HART load	Min. 250 Ω
HART device variables	The measured values can be freely assigned to the device variables. Measured values for PV, SV, TV and QV (first, second, third and fourth device variable) ▪ Sensor 1 (measured value) ▪ Sensor 2 (measured value) ▪ Device temperature ▪ Average of the two measured values: 0.5 x (SV1+SV2) ▪ Difference between sensor 1 and sensor 2: SV1-SV2 ▪ Sensor 1 (backup sensor 2): If sensor 1 fails, the value of sensor 2 automatically becomes the primary HART value (PV): sensor 1 (OR sensor 2). ▪ Sensor switching: If the value exceeds the configured threshold value T for sensor 1, the measured value of sensor 2 becomes the primary HART value (PV). The system switches back to sensor 1 if the measured value of sensor 1 is at least 2 K below T: sensor 1 (sensor 2, if sensor 1 > T) ▪ Average: 0.5 x (SV1+SV2) with backup (measured value of sensor 1 or sensor 2 in the event of a sensor error in the other sensor)
Supported functions	▪ Burst mode [1)] ▪ Squawk ▪ Condensed status

1) Not possible in the SIL mode, see Functional Safety Manual FY01106T.

Wireless HART data

Minimum starting voltage	11.5 V_{DC}
Starting current	3.58 mA
Starting time	▪ Normal operation: 6 s ▪ SIL mode: 29 s
Minimum operating voltage	11.5 V_{AC}

Multidrop current	4.0 mA [1]
Time for connection setup	▪ Normal operation: 9 s ▪ SIL mode: 10 s

1) No Multidrop current in SIL mode

Write protection for device parameters

- Hardware: Write protection using DIP switch on electronics module in the device
- Software: Write protection using password

Switch-on delay

- Until the start of HART communication, approx. 10 s, while switch-on delay = $I_a \leq 3.6$ mA
- Until the first valid measured value signal is present at the current output, approx. 28 s, while switch-on delay = $I_a \leq 3.6$ mA

Power supply

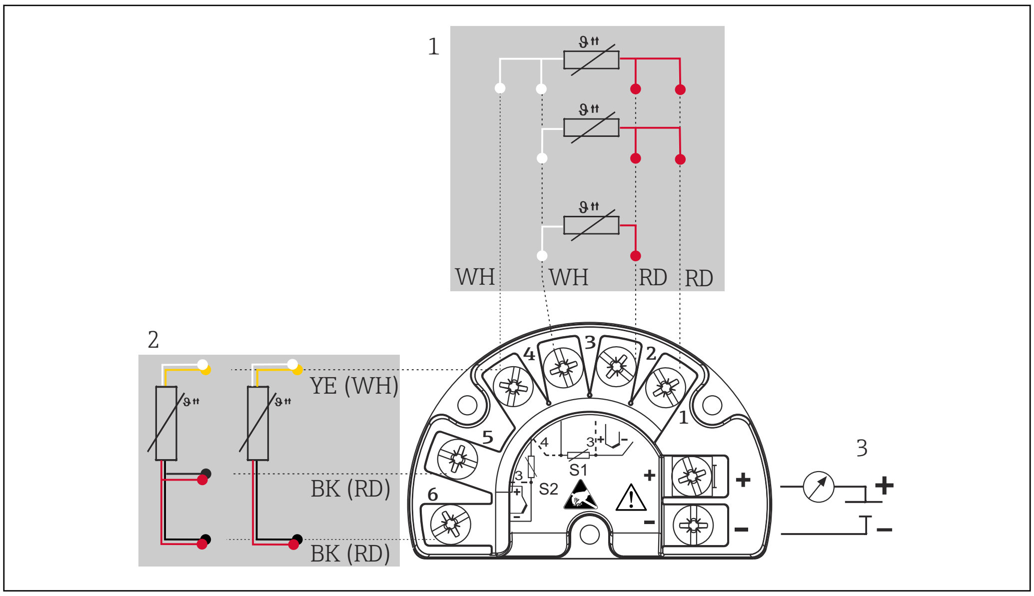
Supply voltage

Values for non-hazardous areas, protected against polarity reversal: ▪ 11.5 V ≤ Vcc ≤ 42 V (standard) ▪ I ≤ 23 mA Values for hazardous area, see Ex documentation.

The transmitter must be powered by a power supply 11.5 to 42 V_{DC} in accordance with NEC Class 02 (low voltage/low current) with restricted power limited to 8 A/150 VA in the event of a short-circuit (in accordance with IEC 61010-1, CSA 1010.1-92).

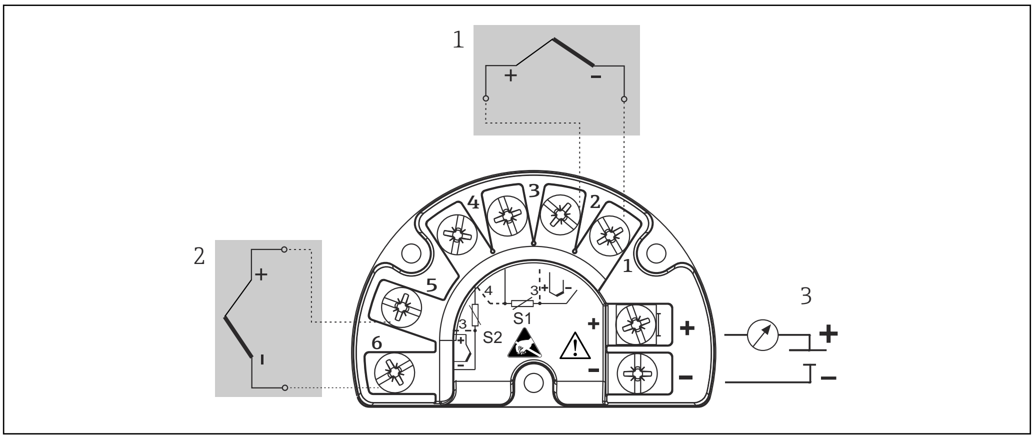
The device may only be powered by a power unit with an energy-limited circuit in accordance with UL/EN/IEC 61010-1, Section 9.4 and the requirements of Table 18.

Terminal assignment



2 Wiring of the field transmitter, RTD, dual sensor input

1 *Sensor input 1, RTD, : 2-, 3- and 4-wire*
2 *Sensor input 2, RTD: 2-, 3-wire*
3 *Field transmitter power supply and analog output 4 to 20 mA or fieldbus connection*



3 *Wiring of the field transmitter, TC, dual sensor input*

1 *Sensor input 1, TC*
2 *Sensor input 2, TC*
3 *Field transmitter power supply and analog output 4 to 20 mA or fieldbus connection*

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 Minimum current consumption Current limit	3.6 to 23 mA ≤ 3.5 mA, Multidrop mode 4 mA (not possible in SIL mode) ≤ 23 mA

Terminals

2.5 mm² (12 AWG) plus ferrule

Cable entries

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

Residual ripple

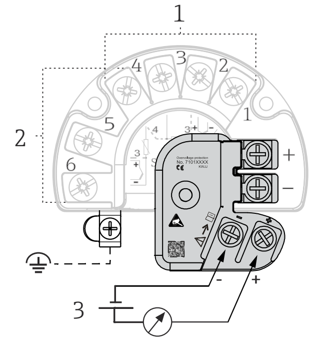
Permanent residual ripple U_{SS} ≤ 3 V at U_b ≥ 13.5 V, $f_{max.}$ = 1 kHz

Surge arrester

The surge arrester can be ordered as an optional extra. The module protects the electronics from damage from overvoltage. Overvoltage occurring in signal cables (e.g. 4 to 20 mA), communication lines (fieldbus systems), and power supply lines is diverted to ground. The functionality of the transmitter is not affected as no problematic voltage drop occurs.

Connection data:

Maximum continuous voltage (rated voltage)	U_C = 42 V_{DC}
Nominal current	I = 0.5 A at $T_{amb.}$ = 80 °C (176 °F)
Surge current resistance ▪ Lightning surge current D1 (10/350 μs) ▪ Nominal discharge current C1/C2 (8/20 μs)	▪ I_{imp} = 1 kA (per wire) ▪ I_n = 5 kA (per wire) I_n = 10 kA (total)
Series resistance per wire	1.8 Ω, tolerance ±5 %



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4 *Electrical connection of surge arrester*

1 *Sensor 1*
2 *Sensor 2*
3 *Bus connector and power supply*

Grounding

The device must be connected to the potential equalization. The connection between the housing and the local ground must have a minimum cross-section of 4 mm² (13 AWG). All ground connections must be secured tightly.

Performance characteristics

Response time

The measured value update depends on the type of sensor and connection method and moves within the following ranges:

Resistance temperature detector (RTD)	0.9 to 1.3 s (depends on the connection method 2-wire/3-wire/4-wire)
Thermocouples (TC)	0.8 s
Reference temperature	0.9 s

When recording step responses, it must be taken into account that the times for the measurement of the second channel and the internal reference measuring point are added to the specified times where applicable.

Update time

≤ 100 ms

Reference conditions

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

Maximum measurement error

In accordance with DIN EN 60770 and the reference conditions specified above. The measurement error data correspond to ±2 σ (Gaussian distribution), i.e. 95.45%. The data include non-linearities and repeatability.

Typical

Standard	Designation	Measuring range	Typical measurement error (±)	
Resistance thermometer (RTD) as per standard			Digital value 1)	Value at current output
IEC 60751:2008	Pt100 (1)	0 to +200 °C (32 to +392 °F)	0.08 °C (0.14 °F)	0.1 °C (0.18 °F)
IEC 60751:2008	Pt1000 (4)		0.06 °C (0.11 °F)	0.1 °C (0.18 °F)
GOST 6651-94	Pt100 (9)		0.07 °C (0.13 °F)	0.09 °C (0.16 °F)

Standard	Designation	Measuring range	Typical measurement error (±)	
Thermocouples (TC) as per standard			Digital value [1]	Value at current output
IEC 60584, Part 1	Type K (NiCr-Ni) (36)	0 to +800 °C (32 to +1 472 °F)	0.22 °C (0.4 °F)	0.33 °C (0.59 °F)
	Type S (PtRh10-Pt) (39)		0.57 °C (1.03 °F)	0.63 °C (1.1 °F)
	Type R (PtRh13-Pt) (38)		0.46 °C (0.83 °F)	0.52 °C (0.94 °F)

1) Measured value transmitted via HART

Measurement error for resistance thermometers (RTD) and resistance transmitters

Standard	Designation	Measuring range	Measurement error (±)	
			Digital [1]	D/A [2]
			Based on measured value [3]	
IEC 60751:2008	Pt100 (1)	−200 to +850 °C (−328 to +1 562 °F)	ME = ± (0.06 °C (0.11 °F) + 0.005% * (MV - LRV))	0.03 % (≙ 4.8 μA)
	Pt200 (2)		ME = ± (0.05 °C (0.09 °F) + 0.012% * (MV - LRV))	
	Pt500 (3)	−200 to +500 °C (−328 to +932 °F)	ME = ± (0.03 °C (0.05 °F) + 0.012% * (MV - LRV))	
	Pt1000 (4)	−200 to +250 °C (−328 to +482 °F)	ME = ± (0.02 °C (0.04 °F) + 0.012% * (MV - LRV))	
JIS C1604:1984	Pt100 (5)	−200 to +510 °C (−328 to +950 °F)	ME = ± (0.05 °C (0.09 °F) + 0.006% * (MV - LRV))	
GOST 6651-94	Pt50 (8)	−185 to +1 100 °C (−301 to +2 012 °F)	ME = ± (0.1 °C (0.18 °F) + 0.008% * (MV - LRV))	
	Pt100 (9)	−200 to +850 °C (−328 to +1 562 °F)	ME = ± (0.05 °C (0.09 °F) + 0.006% * (MV - LRV))	
DIN 43760 IPTS-68	Ni100 (6)	−60 to +250 °C (−76 to +482 °F)	ME = ± (0.05 °C (0.09 °F) - 0.006% * (MV - LRV))	
	Ni120 (7)			
OIML R84: 2003 / GOST 6651-2009	Cu50 (10)	−180 to +200 °C (−292 to +392 °F)	ME = ± (0.10 °C (0.18 °F) + 0.006% * (MV - LRV))	
	Cu100 (11)	−180 to +200 °C (−292 to +392 °F)	ME = ± (0.05 °C (0.09 °F) + 0.003% * (MV - LRV)) ME = ± (0.06 °C (0.11 °F) - 0.005% * (MV - LRV))	
	Ni100 (12)	−60 to +180 °C (−76 to +356 °F)		
	Ni120 (13)		ME = ± (0.05 °C (0.09 °F) - 0.005% * (MV - LRV))	
OIML R84: 2003, GOST 6651-94	Cu50 (14)	−50 to +200 °C (−58 to +392 °F)	ME = ± (0.1 °C (0.18 °F) + 0.004% * (MV - LRV))	
Resistance transmitter	Resistance Ω	10 to 400 Ω	ME = ± (21 mΩ + 0.003% * (MV - LRV))	0.03 % (≙ 4.8 μA)
		10 to 2 000 Ω	ME = ± (35 mΩ + 0.010% * (MV - LRV))	

1) Measured value transmitted via HART
2) Percentages based on the configured span of the analog output signal.
3) Deviations from maximum measurement error possible due to rounding.

Measurement error for thermocouples (TC) and voltage transmitters

Standard	Designation	Measuring range	Measurement error (±)	
			Digital [1]	D/A [2]
			Based on measured value [3]	
IEC 60584-1 ASTM E230-3	Type A (30)	0 to +2 500 °C (+32 to +4 532 °F)	ME = ± (0.63 °C (1.13 °F) + 0.017% * (MV - LRV))	0.03 % (≙ 4.8 μA)
	Type B (31)	+500 to +1 820 °C (+932 to +3 308 °F)	ME = ± (0.95 °C (1.71 °F) - 0.04% * (MV - LRV))	
IEC 60584-1 ASTM E988-96 ASTM E230-3	Type C (32)	0 to +2 000 °C (+32 to +3 632 °F)	ME = ± (0.33 °C (0.59 °F) + 0.0065% * MV - LRV))	
ASTM E988-96	Type D (33)		ME = ± (0.48 °C (0.86 °F) - 0.005% * MV - LRV))	

Standard	Designation	Measuring range	Measurement error (±)	
IEC 60584-1 ASTM E230-3	Type E (34)	−150 to +1 000 °C (−238 to +1 832 °F)	ME = ± (0.14 °C (0.25 °F) - 0.003% * (MV - LRV))	
	Type J (35)	−150 to +1 200 °C (−238 to +2 192 °F)	ME = ± (0.18 °C (0.32 °F) - 0.0025% * (MV - LRV))	
	Type K (36)		ME = ± (0.25 °C (0.45 °F) - 0.003% * (MV - LRV))	
	Type N (37)	−150 to +1 300 °C (−238 to +2 372 °F)	ME = ± (0.32 °C (0.58 °F) - 0.008% * (MV - LRV))	
	Type R (38)	+200 to +1 768 °C (+360 to +3 214 °F)	ME = ± (0.55 °C (0.99 °F) - 0.009% * (MV - LRV))	
	Type S (39)		ME = ± (0.60 °C (1.08 °F) - 0.005% * (MV - LRV))	
	Type T (40)	−150 to +400 °C (−238 to +752 °F)	ME = ± (0.25 °C (0.45 °F) - 0.027% * (MV - LRV))	
DIN 43710	Type L (41)	−150 to +900 °C (−238 to +1 652 °F)	ME = ± (0.21 °C (0.38 °F) - 0.005% * (MV - LRV))	
	Type U (42)	−150 to +600 °C (−238 to +1 112 °F)	ME = ± (0.29 °C (0.52 °F) - 0.023% * (MV - LRV))	
GOST R8.585-2001	Type L (43)	−200 to +800 °C (−328 to +1 472 °F)	ME = ± (2.2 °C (3.96 °F) - 0.015% * (MV - LRV))	
Voltage transmitter (mV)		−20 to +100 mV	ME = ±10 µV	4.8 µA

1) Measured value transmitted via HART
2) Percentages based on the configured span of the analog output signal.
3) Deviations from maximum measurement error possible due to rounding.

MV = measured value

LRV = lower range value of the sensor in question

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

Sample calculation with Pt100, measuring range 0 to +200 °C (+32 to +392 °F), measured value +200 °C (+392 °F), ambient temperature +25 °C (+77 °F), supply voltage 24 V:

Measurement error digital = 0.06 °C + 0.005% * (200 °C - (-200 °C)):	0.08 °C (0.15 °F)
Measurement error D/A = 0.03 % * 200 °C (360 °F)	0.06 °C (0.11 °F)
Measurement error digital value (HART):	0.08 °C (0.15 °F)
Measurement error analog value (current output): √(Measurement error digital² + Measurement error D/A²)	0.10 °C (0.19 °F)

Sample calculation with Pt100, measuring range 0 to +200 °C (+32 to +392 °F), measured value +200 °C (+392 °F), ambient temperature +35 °C (+95 °F), supply voltage 30 V:

Measurement error digital = 0.06 °C + 0.005% * (200 °C - (-200 °C)):	0.08 °C (0.15 °F)
Measurement error D/A = 0.03 % * 200 °C (360 °F)	0.06 °C (0.11 °F)
Influence of ambient temperature (digital) = (35 - 25) * (0.002% * 200 °C - (-200 °C)), min. 0.005 °C	0.08 °C (0.14 °F)
Influence of ambient temperature (D/A) = (35 - 25) * (0.001% * 200 °C)	0.02 °C (0.04 °F)
Influence of ambient temperature (digital) = (30 - 24) * (0.002% * 200 °C - (-200 °C)), min. 0.005 °C	0.05 °C (0.09 °F)
Influence of supply voltage (D/A) = (30 - 24) * (0.001% * 200 °C)	0.01 °C (0.02 °F)

Measurement error digital value (HART): √(Measurement error digital² + Influence of ambient temperature (digital)² + Influence of supply voltage (digital)²	**0.13 °C (0.23 °F)**
Measurement error analog value (current output): √(Measurement error digital² + Measurement error D/A² + Influence of ambient temperature (digital)² + Influence of ambient temperature (D/A)² + Influence of supply voltage (digital)² + Influence of supply voltage (D/A)²	**0.14 °C (0.25 °F)**

The measurement error data correspond to 2 σ (Gaussian distribution).

MV = measured value

LRV = lower range value of the sensor in question

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

Other measurement errors apply in SIL mode.

For detailed information, see the Functional Safety Manual FY01106T.

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.

1-point adjustment (offset)

Shifts the sensor value

2-point adjustment (sensor trimming)

Correction (slope and offset) of the measured sensor value at transmitter input

Current output adjustment

Correction of 4 or 20 mA current output value (not possible in SIL mode)

Operating influences The measurement error data correspond to ±2 σ (Gaussian distribution), i.e. 95.45%.

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

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change			Supply voltage: Influence (±) per V change		
		Digital [1]		D/A [2].	Digital [1]		D/A [2]
		Maximum	Based on measured value		Maximum	Based on measured value	
Pt100 (1)	IEC 60751:2008	≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	0.001 %	≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	0.001 %
Pt200 (2)		≤ 0.026 °C (0.047 °F)	-		≤ 0.026 °C (0.047 °F)	-	
Pt500 (3)		≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.009 °C (0.016 °F)		≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.009 °C (0.016 °F)	
Pt1000 (4)		≤ 0.01 °C (0.018 °F)	0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)		≤ 0.008 °C (0.014 °F)	0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)	
Pt100 (5)	JIS C1604:1984	≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)		≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	
Pt50 (8)	GOST 6651-94	≤ 0.03 °C (0.054 °F)	0.002% * (MV - LRV), at least 0.01 °C (0.018 °F)		≤ 0.01 °C (0.018 °F)	0.002% * (MV - LRV), at least 0.01 °C (0.018 °F)	
Pt100 (9)		≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)		≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.004 °C (0.007 °F)	-		≤ 0.005 °C (0.009 °F)	-	
Ni120 (7)			-			-	
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	≤ 0.007 °C (0.013 °F)	-		≤ 0.008 °C (0.014 °F)	-	
Cu100 (11)			0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)		≤ 0.004 °C (0.007 °F)	0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)	
Ni100 (12)		≤ 0.004 °C (0.007 °F)	-			-	
Ni120 (13)			-			-	
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	≤ 0.007 °C (0.013 °F)	-		≤ 0.008 °C (0.014 °F)	-	
Resistance transmitter (Ω)							
10 to 400 Ω		≤ 6 mΩ	0.0015% * (MV - LRV), at least 1.5 mΩ	0.001 %	≤ 6 mΩ	0.0015% * (MV - LRV), at least 1.5 mΩ	0.001 %
10 to 2 000 Ω		≤ 30 mΩ	0.0015% * (MV - LRV), at least 15 mΩ		≤ 30 mΩ	0.0015% * (MV - LRV), at least 15 mΩ	

1) Measured value transmitted via HART
2) Percentages based on the configured span of the analog output signal

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

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change			Supply voltage: Influence (±) per V change		
		Digital [1]		D/A [2]	Digital		D/A [2]
		Maximum	Based on measured value		Maximum	Based on measured value	
Type A (30)	IEC 60584-1	≤ 0.13 °C (0.23 °F)	0.0055% * (MV - LRV), at least 0.03 °C (0.054 °F)	0.001 %	≤ 0.07 °C (0.13 °F)	0.0054% * (MV - LRV), at least 0.02 °C (0.036 °F)	0.001 %
Type B (31)		≤ 0.06 °C (0.11 °F)	-		≤ 0.06 °C (0.11 °F)	-	
Type C (32)	IEC 60584-1/ ASTM E988-96	≤ 0.08 °C (0.14 °F)	0.0045% * (MV - LRV), at least 0.03 °C (0.054 °F)		≤ 0.04 °C (0.07 °F)	0.0045% * (MV - LRV), at least 0.03 °C (0.054 °F)	

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change			Supply voltage: Influence (±) per V change		
Type D (33)	ASTM E988-96		0.004% * (MV - LRV), at least 0.035 °C (0.063 °F)			0.004% * (MV - LRV), at least 0.035 °C (0.063 °F)	
Type E (34)	IEC 60584-1	≤ 0.03 °C (0.05 °F)	0.003% * (MV - LRV), at least 0.016 °C (0.029 °F)		≤ 0.02 °C (0.04 °F)	0.003% * (MV - LRV), at least 0.016 °C (0.029 °F)	
Type J (35)		≤ 0.04 °C (0.07 °F)	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)		≤ 0.05 °C (0.09 °F)	0.0035% * (MV - LRV), at least 0.047 °C (0.085 °F)		≤ 0.05 °C (0.09 °F)	0.0035% * (MV - LRV), at least 0.047 °C (0.085 °F)	
Type S (39)			-			-	
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)	-			-	
Type U (42)		≤ 0.01 °C (0.02 °F)	-			-	
Type L (43)	GOST R8.585-2001	≤ 0.02 °C (0.04 °F)	-			-	
Voltage transmitter (mV)				0.001 %			0.001 %
−20 to 100 mV	-	≤ 3 µV	-		≤ 3 µV	-	

1) Measured value transmitted via HART
2) Percentages based on the configured span of the analog output signal

MV = measured value

LRV = lower range value of the sensor in question

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

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

Designation	Standard	Long-term drift (±) [1]		
		after 1 year	after 3 years	after 5 years
		Based on measured value		
Pt100 (1)	IEC 60751:2008	≤ 0.016% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.025% * (MV - LRV) or 0.05 °C (0.09 °F)	≤ 0.028% * (MV - LRV) or 0.06 °C (0.10 °F)
Pt200 (2)		0.25 °C (0.44 °F)	0.41 °C (0.73 °F)	0.50 °C (0.91 °F)
Pt500 (3)		≤ 0.018% * (MV - LRV) or 0.08 °C (0.14 °F)	≤ 0.03% * (MV - LRV) or 0.14 °C (0.25 °F)	≤ 0.036% * (MV - LRV) or 0.17 °C (0.31 °F)
Pt1000 (4)		≤ 0.0185% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.031% * (MV - LRV) or 0.07 °C (0.12 °F)	≤ 0.038% * (MV - LRV) or 0.08 °C (0.14 °F)
Pt100 (5)	JIS C1604:1984	≤ 0.015% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.024% * (MV - LRV) or 0.07 °C (0.12 °F)	≤ 0.027% * (MV - LRV) or 0.08 °C (0.14 °F)
Pt50 (8)	GOST 6651-94	≤ 0.017% * (MV - LRV) or 0.07 °C (0.13 °F)	≤ 0.027% * (MV - LRV) or 0.12 °C (0.22 °F)	≤ 0.03% * (MV - LRV) or 0.14 °C (0.25 °F)
Pt100 (9)		≤ 0.016% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.025% * (MV - LRV) or 0.07 °C (0.12 °F)	≤ 0.028% * (MV - LRV) or 0.07 °C (0.13 °F)
Ni100 (6)	DIN 43760 IPTS-68	0.04 °C (0.06 °F)	0.05 °C (0.10 °F)	0.06 °C (0.11 °F)

Designation	Standard	Long-term drift (±) [1]		
Ni120 (7)				
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	0.06 °C (0.10 °F)	0.09 °C (0.16 °F)	0.11 °C (0.20 °F)
Cu100 (11)		≤ 0.015% * (MV - LRV) or 0.04 °C (0.06 °F)	≤ 0.024% * (MV - LRV) or 0.06 °C (0.10 °F)	≤ 0.027% * (MV - LRV) or 0.06 °C (0.11 °F)
Ni100 (12)		0.03 °C (0.06 °F)	0.05 °C (0.09 °F)	0.06 °C (0.10 °F)
Ni120 (13)		0.03 °C (0.06 °F)	0.05 °C (0.09 °F)	0.06 °C (0.10 °F)
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	0.06 °C (0.10 °F)	0.09 °C (0.16 °F)	0.10 °C (0.18 °F)
Resistance transmitter				
10 to 400 Ω		≤ 0.0122% * (MV - LRV) or 12 mΩ	≤ 0.02% * (MV - LRV) or 20 mΩ	≤ 0.022% * (MV - LRV) or 22 mΩ
10 to 2 000 Ω		≤ 0.015% * (MV - LRV) or 144 mΩ	≤ 0.024% * (MV - LRV) or 240 mΩ	≤ 0.03% * (MV - LRV) or 295 mΩ

1) The larger value is valid

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

Designation	Standard	Long-term drift (±) [1]		
		after 1 year	after 3 years	after 5 years
		Based on measured value		
Type A (30)	IEC 60584-1	≤ 0.048% * (MV - LRV) or 0.46 °C (0.83 °F)	≤ 0.072% * (MV - LRV) or 0.69 °C (1.24 °F)	≤ 0.1% * (MV - LRV) or 0.94 °C (1.69 °F)
Type B (31)		1.08 °C (1.94 °F)	1.63 °C (2.93 °F)	2.23 °C (4.01 °F)
Type C (32)	IEC 60584-1/ASTM E988-96	≤ 0.038% * (MV - LRV) or 0.41 °C (0.74 °F)	≤ 0.057% * (MV - LRV) or 0.62 °C (1.12 °F)	≤ 0.078% * (MV - LRV) or 0.85 °C (1.53 °F)
Type D (33)	ASTM E988-96	≤ 0.035% * (MV - LRV) or 0.57 °C (1.03 °F)	≤ 0.052% * (MV - LRV) or 0.86 °C (1.55 °F)	≤ 0.071% * (MV - LRV) or 1.17 °C (2.11 °F)
Type E (34)	IEC 60584-1	≤ 0.024% * (MV - LRV) or 0.15 °C (0.27 °F)	≤ 0.037% * (MV - LRV) or 0.23 °C (0.41 °F)	≤ 0.05% * (MV - LRV) or 0.31 °C (0.56 °F)
Type J (35)		≤ 0.025% * (MV - LRV) or 0.17 °C (0.31 °F)	≤ 0.037% * (MV - LRV) or 0.25 °C (0.45 °F)	≤ 0.051% * (MV - LRV) or 0.34 °C (0.61 °F)
Type K (36)		≤ 0.027% * (MV - LRV) or 0.23 °C (0.41 °F)	≤ 0.041% * (MV - LRV) or 0.35 °C (0.63 °F)	≤ 0.056% * (MV - LRV) or 0.48 °C (0.86 °F)
Type N (37)		0.36 °C (0.65 °F)	0.55 °C (0.99 °F)	0.75 °C (1.35 °F)
Type R (38)		0.83 °C (1.49 °F)	1.26 °C (2.27 °F)	1.72 °C (3.10 °F)
Type S (39)		0.84 °C (1.51 °F)	1.27 °C (2.29 °F)	2.23 °C (4.01 °F)
Type T (40)		0.25 °C (0.45 °F)	0.37 °C (0.67 °F)	0.51 °C (0.92 °F)
Type L (41)	DIN 43710	0.20 °C (0.36 °F)	0.31 °C (0.56 °F)	0.42 °C (0.76 °F)
Type U (42)		0.24 °C (0.43 °F)	0.37 °C (0.67 °F)	0.50 °C (0.90 °F)
Type L (43)	GOST R8.585-2001	0.22 °C (0.40 °F)	0.33 °C (0.59 °F)	0.45 °C (0.81 °F)
Voltage transmitter (mV)				
−20 to 100 mV		≤ 0.027% * (MV - LRV) or 5.5µV	≤ 0.041% * (MV - LRV) or 8.2µV	≤ 0.056% * (MV - LRV) or 11.2µV

1) The larger value is valid

Long-term drift analog output

Long-term drift D/A [1] (±)		
after 1 year	after 3 years	after 5 years
0.021%	0.029%	0.031%

1) Percentages based on the configured span of the analog output signal.

Influence of reference junction

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

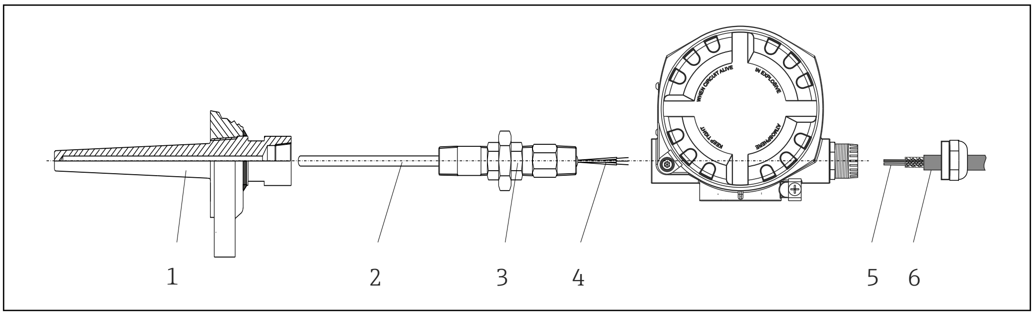
Mounting

Installation point

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 backlit display can be mounted in four different positions.

Installation instructions

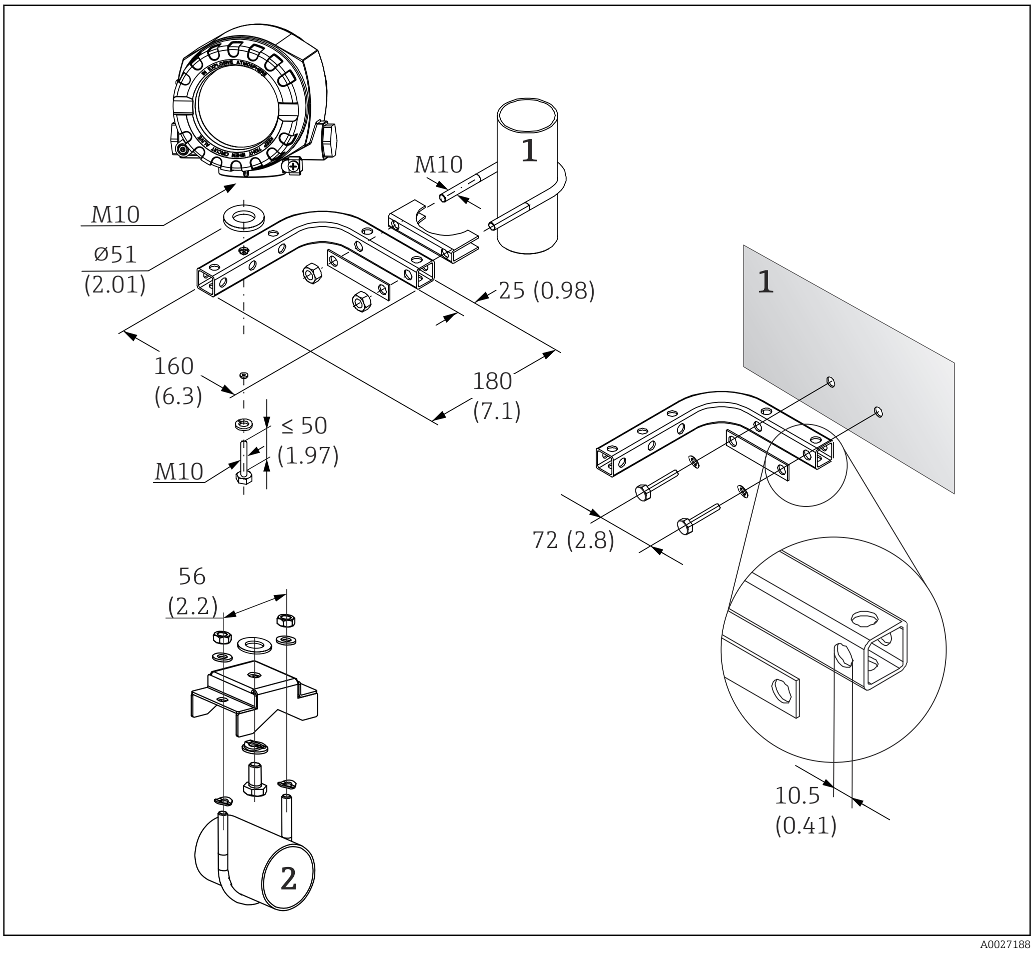
Direct sensor mounting



5 *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*

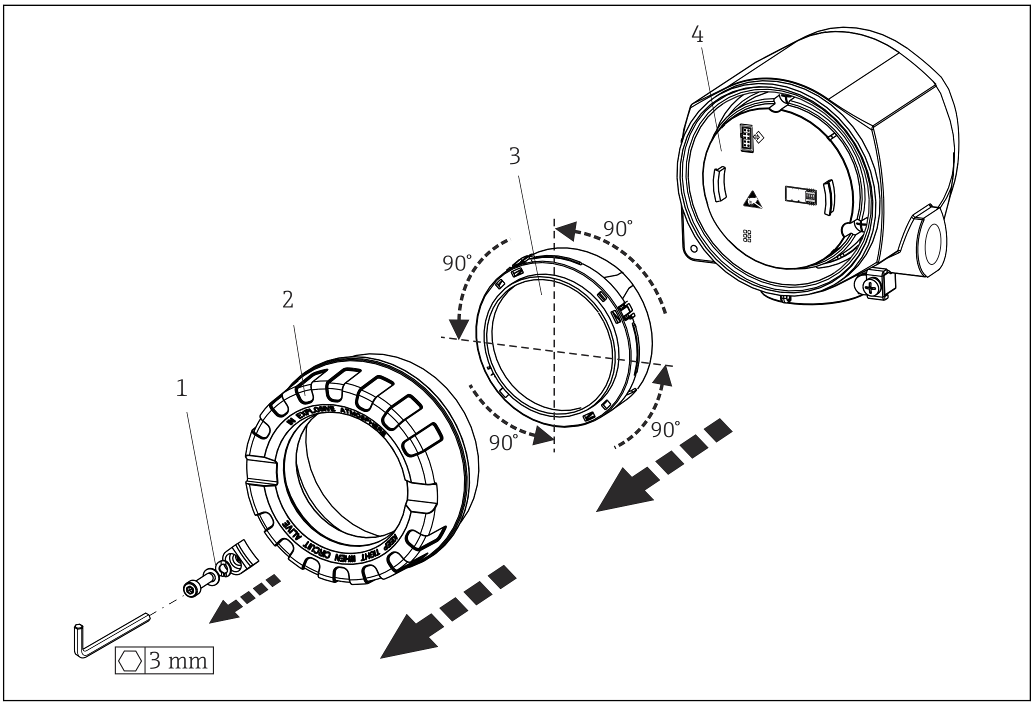
Remote mounting



6 *Mounting the field transmitter with mounting bracket Dimensions in mm (in)*

1 *Combined wall/pipe mounting bracket 2", L-shaped, material 304 (option 2)*
2 *Pipe mounting bracket 2", U-shaped, material 316L (option 3)*

Display mounting



7 *4 display installation positions, attachable in 90° increments*

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

Environment

Ambient temperature

For hazardous areas, see Ex documentation.

Without display	–40 to +85 °C (–40 to +185 °F)
With display	–40 to +80 °C (–40 to +176 °F)
With surge arrester module	–40 to +85 °C (–40 to +185 °F)
SIL mode	–40 to +75 °C (–40 to +167 °F)

The display may react slowly at temperatures < –20 °C (–4 °F). The readability 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)
With surge arrester module	–40 to +100 °C (–40 to +212 °F)

Relative humidity

Permitted: 0 to 95 %

Operating altitude

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

Climate class

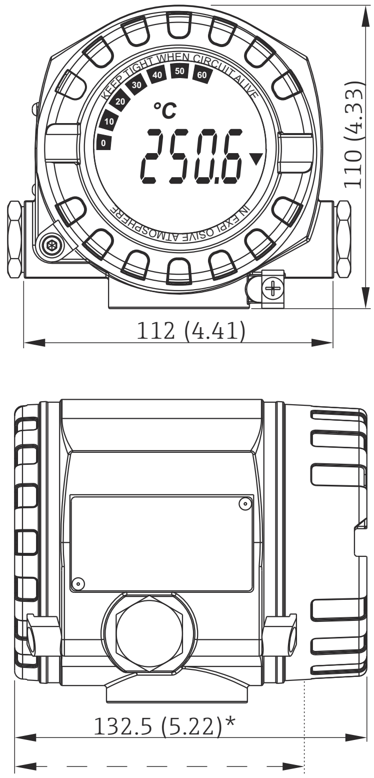
As per IEC 60654-1, Class Dx

Degree of protection	Die-cast aluminum or stainless steel housing: IP66/67, Type 4X
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:** Vibration resistance as per DNVGL-CG-0339 : 2021 and DIN EN 60068-2-6: ▪ 25 to 100 Hz at 4g ▪ 5 to 25 Hz, 1.6 mm The use of L-shaped mounting brackets can cause resonance (see wall/pipe 2" mounting bracket in the 'Accessories' section). Caution: Vibrations on the field transmitter must 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 measurement 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 SIL conformity according to IEC 61326-3-1 or IEC 61326-3-2 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
Pollution degree	2

Mechanical construction

Design, dimensions

Dimensions in mm (in)



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

* 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

Materials

Housing	Sensor terminals	Nameplate
Die-cast aluminum housing AlSi10Mg/ AlSi12 with powder coating on polyester base	Nickel-plated brass0.3 µm gold flashed/cpl., corrosion-free	Aluminum AlMgl, anodized in black
316L		1.4404 (AISI 316L)
		-
Display O-ring 88x3: HNBR 70° Shore PTFE coating	-	-

Cable entries

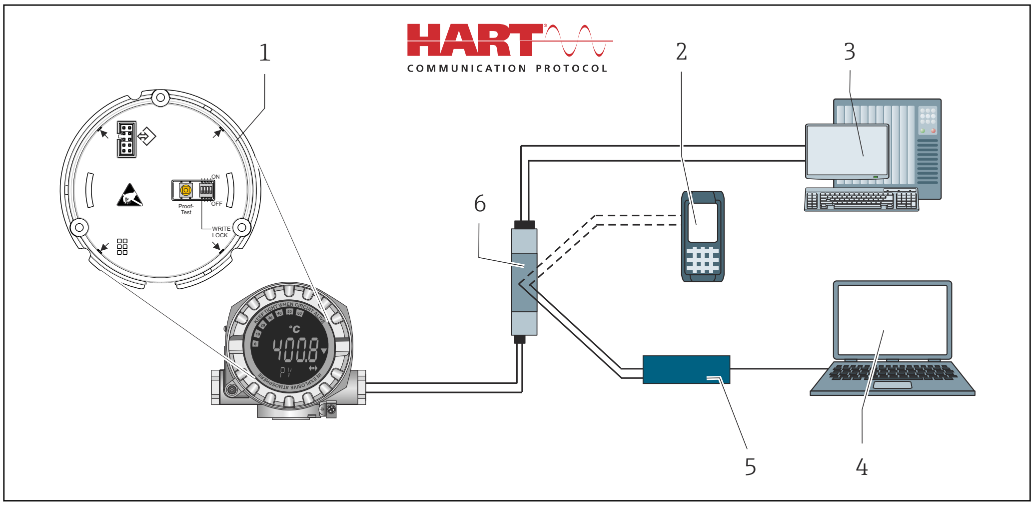
Version	Type
Thread	2x thread ½" NPT
	2x thread M20
	2x thread G½"
Cable gland	2x coupling M20

Operability

Operation concept

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

- **Configuration programs**
  The setup and the configuration of device-specific parameters is performed via the HART protocol. Special configuration and operating programs are available from various manufacturers for this purpose.
- **Miniature switch (DIP switch) and proof-test button for various hardware settings**
  - Hardware write protection is activated and deactivated via a miniature switch (DIP switch) on the electronics module.
  - Proof-test button for testing in SIL mode without HART operation. Pressing the button triggers a device restart. The proof test checks the functional integrity of the transmitter in the SIL mode during commissioning, in the event of changes to safety-related parameters or generally at appropriate intervals.



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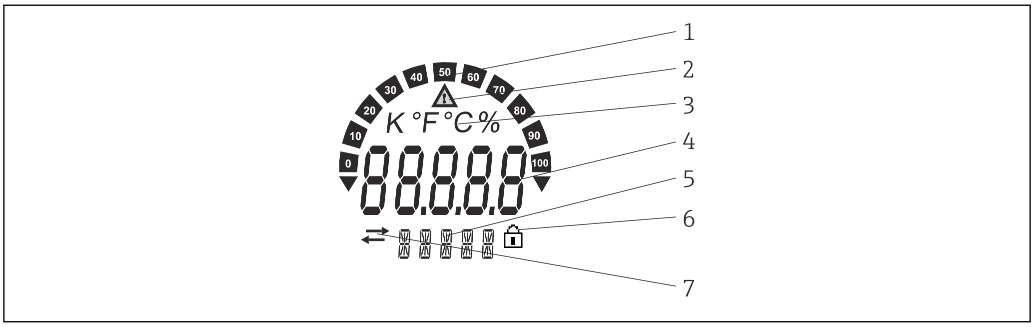
9 *Operation options of the device*

1 *Hardware settings via DIP switch and proof-test button*
2 *HART handheld communicator*
3 *PLC/process control system*
4 *Configuration software, e.g. FieldCare*
5 *Commubox: Power supply and modem for field devices with HART protocol*
6 *Active barrier, e.g. RN series from Endress+Hauser*

Onsite operation

Display elements



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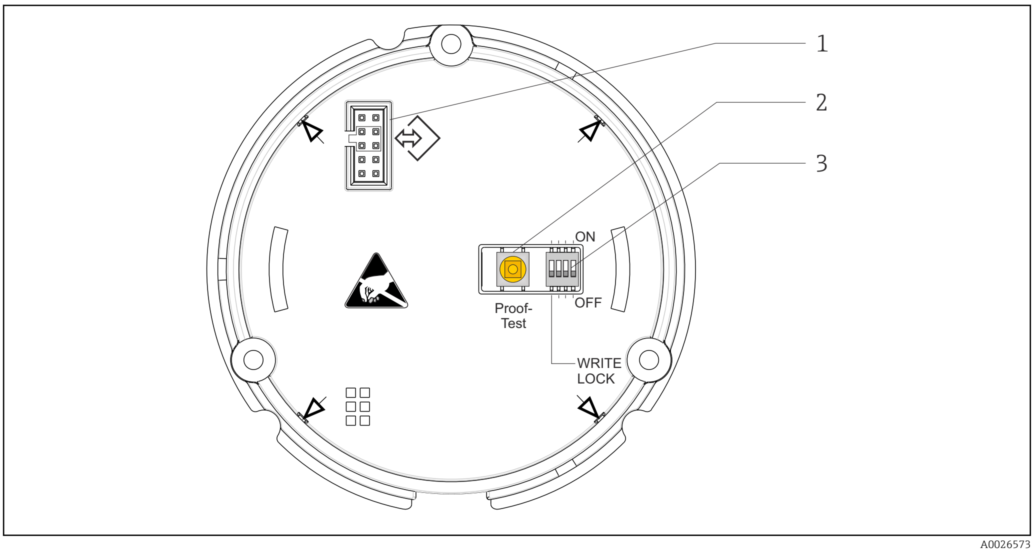
10 *LC display of the field transmitter (backlit, attachable in 90° increments)*

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 *'Configuration locked' symbol*
7 *'Communication' symbol*

Operating elements

To prevent device manipulation, no operating elements are present directly on the display. Various operating elements for configuring the device are located on the electronics module, which is located under the display.



1 Electrical connection for the display module
2 Proof-test button for testing in SIL mode without HART operation
3 DIP switch for activating or deactivating device write protection

Remote operation

All software parameters are accessible depending on the position of the write protection switch on the device.

Hardware and software for remote operation	Function
FieldCare, DeviceCare	FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard. FieldCare supports the following functions: ▪ Configuration of transmitters in offline and online mode ▪ Loading and saving of device data (upload/download) ▪ Documentation of the measuring point ▪ Connection options via Commubox FXA195 and the USB interface of a computer For further information, please contact your local Endress+Hauser Sales Center.
Commubox, e.g. FXA195	HART modem, for intrinsically safe HART communication with FieldCare via the USB interface.

Hardware and software for remote operation	Function
Field Xpert SMT70	Field Xpert is an industrial PDA with a high-resolution full VGA touchscreen (640x480 pixels) from Endress+Hauser based on Windows Embedded Handheld. It offers wireless communication via the optional VIATOR Bluetooth modem from Endress+Hauser. Field Xpert also works as a stand-alone device for asset management applications. The tablet PC for universal device configuration supports the protocols HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, Modbus, and Endress +Hauser service protocols (CDI, ISS, IPC, and PCP). The devices can be connected directly via a suitable interface, e.g. a modem (point-to-point) or a bus system (point-to-bus). For details, refer to TI01342S and BA01709S.
AMS Trex Device Communicator	The AMS Field Communicator is designed to facilitate your work in the field. Featuring a large touchscreen, it supports HART Version 5, 6, and 7 devices (including WirelessHART™), and can be updated via the Internet. It offers new, innovative functions, such as a color display, Bluetooth communication and powerful advanced diagnostic functions. The device is designed for universal use, can be upgraded by the user, is Ex(i)-approved, robust and reliable. For further information, please contact your local Endress+Hauser Sales Center.

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

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

MTTF

142 a according to Siemens SN-29500 at 40 °C (104 °F)
The mean time to failure (MTTF) denotes the theoretically expected time until the device fails during normal operation. The term MTTF is used for non-repairable systems such as temperature transmitters.

Functional safety

SIL 2/3 (hardware/software) certified to:
- IEC 61508-1:2010 (Management)
- IEC 61508-2:2010 (Hardware)
- IEC 61508-3:2010 (Software)

For more detailed information please refer to the 'Functional Safety Manual'.

HART certification

The temperature transmitter is registered by the FieldComm Group. The device meets the requirements of the FieldComm Group HART Specifications, Revision 7.

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.

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

Device-specific accessories

Accessories	Description
Dummy plugs	▪ M20x1.5 EEx-d/XP ▪ G ½" EEx-d/XP ▪ NPT ½" ALU ▪ NPT ½" V4A
Cable glands	▪ M20x1.5 ▪ NPT ½" D4-8.5, IP68 ▪ NPT ½" cable gland 2 x D0.5 cable for 2 sensors ▪ M20x1.5 cable gland 2 x D0.5 cable for 2 sensors
Adapters for cable gland	M20x1.5 external/M24x1.5 internal
Wall and pipe mounting bracket	Stainless steel wall/2" pipe Stainless steel 2" pipe V4A
Surge arrester	The module protects the electronics from overvoltage.

Service-specific accessories

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:
https://portal.endress.com/webapp/applicator

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: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and the search field -> Open the product page -> The "Configure" button to the right of the product image opens the Product Configurator.

FieldCare SFE500
FDT-based plant asset management tool
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.

Technical Information TI00028S

DeviceCare SFE100
Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices
DeviceCare is available for download at www.software-products.endress.com. You need to register in the Endress+Hauser software portal to download the application.

Technical Information TI01134S

System products

Advanced Data Manager Memograph M

The Advanced Data Manager Memograph M is a flexible and powerful system for organizing process values. Optional HART input cards are available, each having 4 inputs (4/8/12/16/20), with highly accurate process values from the HART devices directly connected for the purpose of calculation and data logging. 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.

Technical information: TI01180R

RN22

Single- or two-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively. The RN22 requires a supply voltage of 24 V_{DC}.

Technical Information TI01515K

RN42

Single-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART transmission The device has one active and one passive current input; the outputs can be operated actively or passively. The RN42 can be powered with a wide range voltage of 24 to 230 $V_{AC/DC}$.

Technical Information TI01584K

RIA15

Process display, digital loop-powered display for 4 to 20 mA circuit, panel mounting, with optional HART communication. Displays 4 to 20 mA or up to 4 HART process variables

Technical Information TI01043K

Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following documentation may be available depending on the device version ordered:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** These Operating Instructions contain all the information that is required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. The Safety Instructions are a constituent part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

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www.addresses.endress.com

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