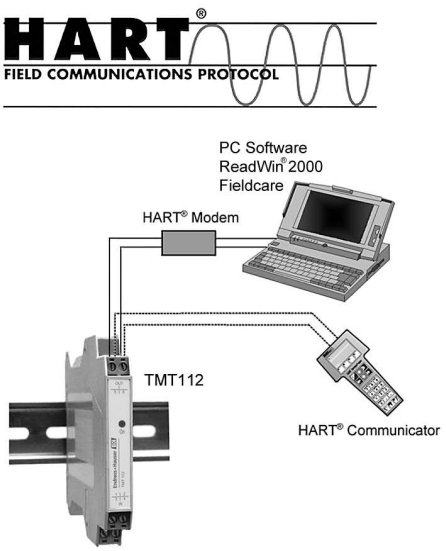
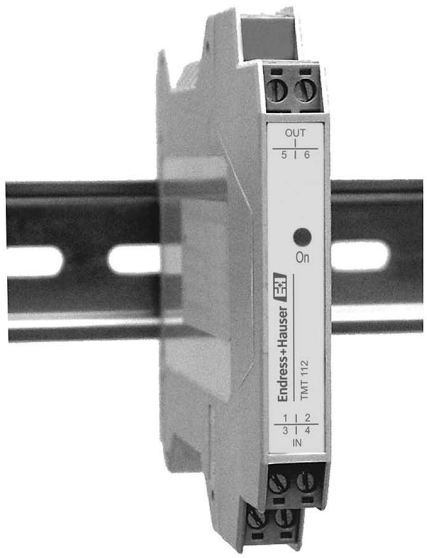
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Temperature transmitter

iTEMP® HART® DIN rail TMT112

Universal temperature transmitter for resistance thermometers (RTD), thermocouples, resistance and voltage transmitters, incorporating HART® protocol





Application areas
- Temperature transmitter with HART® protocol for converting various input signals into a scalable 4 to 20 mA analogue output signal
- Input:
  Resistance thermometer (RTD)
  Thermocouple (TC)
  Resistance transmitter (Ω)
  Voltage transmitter (mV)
- HART® protocol for front end unit or panel unit operation using the hand operating module (DXR275, DXR375) or PC (e.g. ReadWin® 2000 or FieldCare)
- Installation on DIN rail according to IEC 60715

Features and benefits
- Universal settings with HART® protocol for various input signals
- 2-wire technology, 4 to 20 mA analogue output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit, presettable to NAMUR NE 43
- EMC to NAMUR NE 21, CE
- UL recognized component to UL 3111-1
- CSA General Purpose
- Ex-Certification:
  - ATEX Ex ia
  - CSA IS
  - FM IS
- SIL2 compliant
- Galvanic isolation
- Output simulation
- Min./max. process value indicator function
- Customer-specific linearisation
- Linearisation curve match
- Customer-specific measurement range settings or expanded SETUP (see Questionnaire, page 7)

TI114R/09/en
51009802

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Function and system design

Measuring principle

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

Measuring system

The iTEMP® HART® DIN rail TMT112 temperature transmitter is a 2-wire transmitter with an analogue output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connection, thermocouples and voltage transmitters. Setting up of the TMT112 is done using the HART® protocol with hand operating module (DXR275, DXR375) or PC (e.g. configuration software ReadWin® 2000 or FieldCare).

Input

Measured variable

Temperature (temperature linear), resistance and voltage.

Measuring range

Depending upon the sensor connection and input signal. The transmitter evaluates a number of different measurement ranges.

Type of input

	Type	Measurement ranges	Minimum measurement range
Resistance thermometer (RTD)	Pt100 Pt500 Pt1000 acc. to IEC 751 (α = 0.00835)	-200 to 850 °C (-328 to 1562 °F) -200 to 250 °C (-328 to 482 °F) -200 to 250 °C (-238 to 482 °F)	10 K (18 °F) 10 K (18 °F) 10 K (18 °F)
	Pt100 acc. to JIS C 1604-81 (α = 0.003916)	-200 bis 649 °C (-328 bis 1200 °F)	10 K (18 °F)
	Ni100 Ni500 Ni1000 acc. to DIN 43760 (α = 0.006180)	-60 to 250 °C (-76 to 482 °F) -60 to 150 °C (-76 to 302 °F) -60 to 150 °C (-76 to 302 °F)	10 K (18 °F) 10 K (18 °F) 10 K (18 °F)
	■ Connection type: 2-, 3- or 4-wire connection ■ Software compensation of cable resistance possible in the 2-wire system (0 to 30 Ω) ■ Sensor cable resistance max. 40 Ω per cable ■ Sensor current: ≤ 0.2 mA		
Resistance transmitter	Resistance Ω	10 to 400 Ω 10 to 2000 Ω	10 Ω 100 Ω
Thermocouples (TC)	B (PtRh30-PtRh6) C (W5Re-W26Re)[a] D (W3Re-W25Re)[a] E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) L (Fe-CuNi)[b] N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi) U (Cu-CuNi)[b] acc. to IEC 584 Part1	0 to +1820 °C (32 to 3308 °F) 0 to +2320 °C (32 to 4208 °F) 0 to +2495 °C (32 to 4523 °F) -270 to +1000 °C (-454 to 1832 °F) -210 to +1200 °C (-346 to 2192 °F) -270 to +1372 °C (-454 to 2501 °F) -200 to +900 °C (-328 to 1652 °F) -270 to +1300 °C (-454 to 2372 °F) -50 to +1768 °C (-58 to 3214 °F) -50 to +1768 °C (-58 to 3214 °F) -270 to +400 °C (-454 to 752 °F) -200 to +600 °C (-328 to 1112 °F)	500 K (900 °F) 500 K (900 °F) 500 K (900 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 500 K (900 °F) 500 K (900 °F) 50 K (90 °F) 50 K (90 °F)
	■ Cold junction internal (Pt100) ■ Cold junction accuracy: ± 1 K		
Voltage transmitters	Millivolt transmitter	-10 to 75 mV	5 mV

a. According to ASTM E988

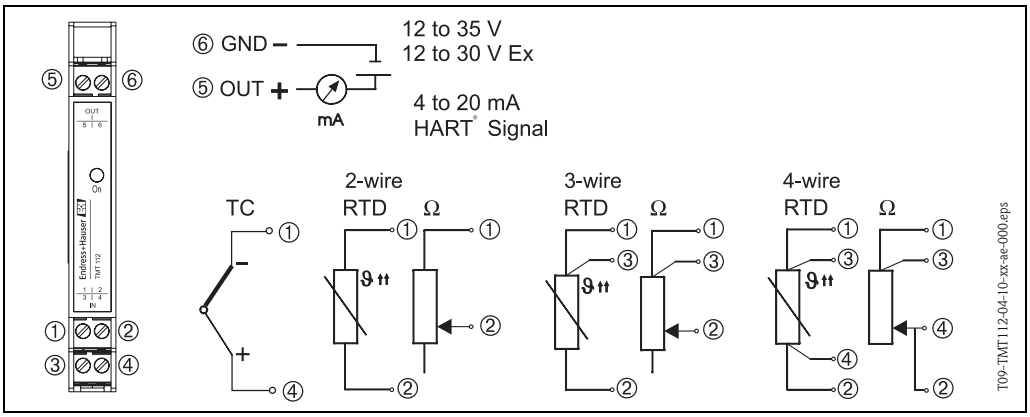
b. According to DIN 43710

Output

Output signal	Analogue 4 to 20 mA, 20 to 4 mA
Signal on alarm	■ Measurement range undercut: Linear drop to 3.8 mA ■ Exceeding measurement range: Linear rise to 20.5 mA ■ Sensor breakage; Sensor short circuit[1]: ≤ 3.6 mA or ≥ 21.0 mA (for configuration ≥ 21.0 mA, output is ≥ 21.5 mA)
Load	Max. ($V_{Power\ supply}$ – 12 V) / 0.022 A (Current output)
Linearisation / transmission behaviour	Temperature linear, resistance linear, voltage linear
Filter	Digital filter 1. degree: 0 to 100 s
Galvanic isolation	U = 2 kV AC (Input/output)
min. current consumption	≤ 3.5 mA
Current limit	≤ 23 mA
Switch on delay	4 s (during power up $I_a \approx 3.8$ mA)

Power supply

Electrical connection



Temperature transmitter terminal connections

For the unit operation via HART® protocol (terminals 5 and 6) a minimum load resistance of 250 Ω is necessary in the signal circuit!

Supply voltage	U_b = 12 to 35 V, polarity protected
Residual ripple	Allowable ripple $U_{ss} \leq 3$ V at $U_b \geq 15$ V, $f_{max.} = 1$ kHz

1. Not for thermocouple

Performance characteristics

Response time

1 s

Reference operating conditions

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

Maximum measured error

	Type	Measurement accuracy[3]
Resistance thermometer RTD	Pt100, Ni100 Pt500, Ni500 Pt1000, Ni1000	0.2 K (0.36 °F) or 0.08% 0.5 K (0.9 °F) or 0.20% 0.3 K (0.54 °F) or 0.12%
Thermocouple TC	K, J, T, E, L, U N, C, D S, B, R	typ. 0.5 K (0.9 °F) or 0.08% typ. 1.0 K (1.8 °F) or 0.08% typ. 2.0 K (3.6 °F) or 0.08%

	Measurement range	Measurement accuracy[3]
Resistance transmitter (Ω)	10 to 400 Ω 10 to 2000 Ω	± 0.1 Ω or 0.08% ± 1.5 Ω or 0.12%
Voltage transmitter (mV)	-10 to 75 mV	± 20 µV or 0.08%

Influence of power supply

≤ ± 0.01%/V deviation from 24 V[1]

Influence of ambient temperature (temperature drift)

- Resistance thermometer (RTD):
  T_d = ± (15 ppm/K * max. meas. range + 50 ppm/K * preset meas. range) * Δ ϑ
- Resistance thermometer Pt100:
  T_d = ± (15 ppm/K * (range end value + 200) + 50 ppm/K * preset meas. range) * Δ ϑ
- Thermocouple (TC):
  T_d = ± (50 ppm/K * max. meas. range + 50 ppm/K * preset meas. range) * Δ ϑ

Δ ϑ = Deviation of the ambient temperature according to the reference condition +25 °C ± 5 K (77 °F ± 9 °F).

Long term stability

≤ 0.1K/Year[2] (≤ 0.18 °F/Year) or ≤ 0.05%/Year[2 3]

Influence of load

≤ ±0.02%/100 Ω[1]

Influence of cold junction

Pt100 DIN IEC 751 Cl. B (internal reference junction for thermocouples TC)

Installation conditions

Installation instructions

Orientation
No limit

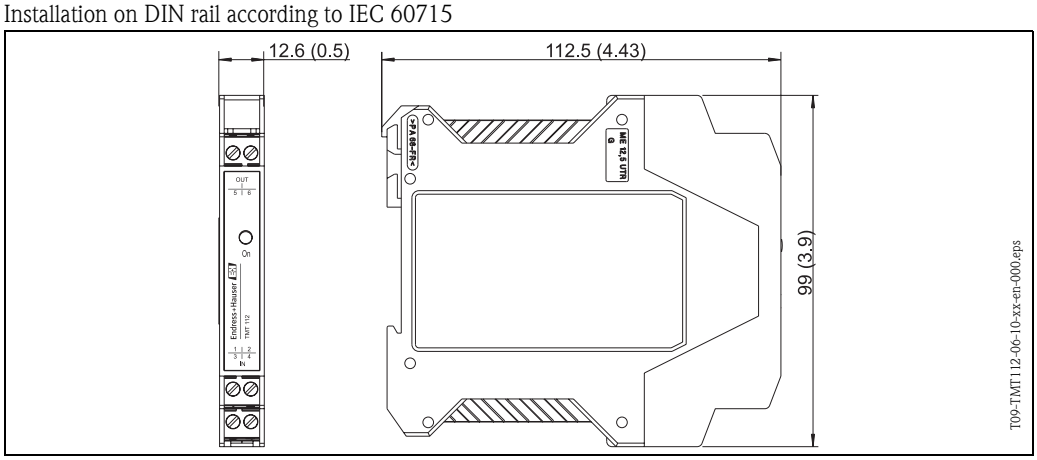
1. All data is related to a measurement end value
2. According to reference conditions
3. % is related to the adjusted measurement range (the value to be applied is the greater one).

Environment conditions

Ambient temperature range	Preferably reference conditions
Ambient temperature limits	–40 to +85 °C (-40 to 185 °F), for Ex-areas see Ex-certification
Storage temperature	-40 to +100 °C (-40 to 212 °F)
Climate class	According to IEC 60654-1, Class C
Degree of protection	IP20 (NEMA 1)
Electromagnetic compatibility (EMC)	Interference immunity and interference emission according to IEC 61326 and NAMUR NE 21
Condensation	Allowable

Mechanical construction

Design, dimensions	Installation on DIN rail according to IEC 60715



Dimensions in mm (inches)

Weight	Approx. 90 g (3.2 oz)
Material	Housing: Plastic PC/ABS, UL 94V0
Terminals	Keyed plug-in screw terminals, core size max. 2.5 mm² (16 AWG) solid, or strands with ferrules

Human interface

Display elements

A yellow illuminated LED signalizes: Device is operational.
With the PC software ReadWin® 2000 or FieldCare the current measured value can be displayed.

Operating elements

At the temperature transmitter no operating elements are available directly. The temperature transmitter will be configured by remote operation with the PC software ReadWin® 2000 or FieldCare.

Remote operation

Configuration
Hand operating module DXR275, DXR375 or PC with Commubox FXA191 and operating software (ReadWin® 2000 or FieldCare).

Interface
PC interface RS232 and Commubox FXA191.

Configurable parameters
Sensor type and connection type, engineering units (°C/°F), measurement range, internal/external cold junction compensation, cable resistance compensation on 2-wire connection, fault conditioning, output signal (4 to 20/20 to 4 mA), digital filter (damping), offset, measurement point identification + descriptor (8 + 16 characters), output simulation, customer specific linearisation, min./max. process value indicator function.

Certificates and approvals

CE approval

The measurement system fulfils the requirements demanded by the EU regulations. Endress+Hauser acknowledges successful unit testing by adding the CE mark.

Hazardous area approvals

For further details on the available Ex versions (ATEX, CSA, FM, etc.), please contact your nearest E+H sales organisation. All relevant data for hazardous areas can be found in separate Ex documentation. If required, please request copies from us or your E+H sales organisation.

UL

Recognized component to UL 3111-1

CSA GP

CSA General Purpose

Other standards and guidelines

- IEC 60529: Degrees of protection by housing (IP code)
- IEC 61010: 'Safety requirements for electrical measurement, control and laboratory instrumentation'.
- IEC 61326: Electromagnetic compatibility (EMC requirements)
- NAMUR: Standardization association for measurement and control in chemical and pharmaceutical industries (www.namur.de).

Ordering information

Questionnaire

Questionnaire Endress+Hauser iTEMP temperature transmitter
Customer specific setup / Kundenspezifische Einstellung

Standard setup / Standardeinstellung

Sensor
TC: ( ) B ( ) C ( ) D ( ) E ( ) J ( ) K ( ) L ( ) N ( ) R ( ) S ( ) T ( ) U
RTD: **( ) Pt100** ( ) Pt500 ( ) Pt1000 ( ) Ni100 ( ) Ni500 ( ) Ni1000
( ) 2 wire **( ) 3 wire** ( ) 4 wire

Unit / Einheit: **( ) °C** ( ) °F

Range / Messbereich (not / nicht PROFIBUS-PA)
Low scale / Anfang [ ][ ][ ][ ][ ].[ ]
High scale / Ende [ ][ ][ ][ ][ ].[ ]
Bitte beachten!: Messbereich und min. Spanne (s. Techn. Daten)
Note!: Range and min. span (s. Techn. data)

Bus address / Busadresse (only / nur PROFIBUS-PA) [ ][ ][ ] **[0...126]**

Expanded setup / Erweiterte Einstellung

Reference junction / Vergleichsstelle: **( ) intern** ( ) extern [ ][ ][ ] [0...80°C; 32...176°F] (only / nur TC)

Compensation wire resistance / Kompensation Leitungswiderstand: [ ][ ] [**0**...20 Ohm] (only / nur RTD 2 wire) [**0**...30 Ohm] (only / nur HART, PA RTD 2 wire)

Failure mode / Fehlerverhalten: ( ) ≤ 3.6 mA **( ) ≥ 21.0 mA** (not / nicht PROFIBUS-PA)

Output / Ausgang: **( ) 4...20 mA** ( ) 20...4 mA (not / nicht PROFIBUS-PA)

Filter: [ ][ ][ ] [**0**, 1, 2,..., 8s] (only / nur PCP) [**0**, 1, 2,..., 100s]

Offset: [ ].[ ] [-9.9... **0**...+9.9K]

TAG PCP [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
HART (HART: 8 char. TAG + 16 char. Descriptor , PROFIBUS-PA: 32 char.)
PROFIBUS-PA [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

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Product structure

iTEMP® HART® Din rail TMT112
Temperature transmitter, Protocol HART. Application: RTD, TC, Ohm, mV. 2-wire 4 to 20 mA, Galvanic isolation.
Fault reaction: NAMUR NE 43. UL recognized, SIL2 compliant

	Certification								
	A	Version for non Ex areas							
	B	ATEX II 2(1) G EEx ia IIC T4/T5/T6							
	C	FM IS, Class I, Div. 1+2, Group A, B, C, D							
	D	CSA IS, Class I, Div. 1+2, Group A, B, C, D							
	E	ATEX II3G EEx nA IIC T4/T5/T6							
	J	CSA General Purpose							
		Configuration transmitter connection							
		A	Standard factory configuration						
		1	Configuration connection TC						
		2	Configuration connection RTD 2-wire						
		3	Configuration connection RTD 3-wire						
		4	Configuration connection RTD 4-wire						
			Configuration temperature sensor						
			A	Standard factory configuration					
			B	Config. Typ B	0 to 1820 °C	32 to 3308 °F	min. span 500 K (900 °F)		
			C	Config. Typ C	0 to 2320 °C	32 to 4208 °F	min. span 500 K (900 °F)		
			D	Config. Typ D	0 to 2495 °C	32 to 4523 °F	min. span 500 K (900 °F)		
			E	Config. Typ E	-200 to 1000 °C	-328 to 1832 °F	min. span 50 K (90 °F)		
			J	Config. Typ J	-200 to 1200 °C	-328 to 2192 °F	min. span 50 K (90 °F)		
			K	Config. Typ K	-200 to 1372 °C	-328 to 2501 °F	min. span 50 K (90 °F)		
			L	Config. Typ L	-200 to 900 °C	-328 to 1652 °F	min. span 50 K (90 °F)		
			N	Config. Typ N	-270 to 1300 °C	-454 to 2372 °F	min. span 50 K (90 °F)		
			R	Config. Typ R	-50 to 1768 °C	-58 to 3214 °F	min. span 500 K (900 °F)		
			S	Config. Typ S	-50 to 1768°C	-58 to 3214 °F	min. span 500 K (900 °F)		
			T	Config. Typ T	-200 to 400 °C	-328 to 752 °F	min. span 50 K (90 °F)		
			U	Config. Typ U	-200 to 600 °C	-328 to 1112 °F	min. span 50 K (90 °F)		
			1	Config. Pt100 acc. to IEC751	-200 to 850 °C	-328 to 1562 °F	min. span 10 K (18 °F)		
			2	Config. Ni100	-60 to 250 °C	-76 to 482 °F	min. span 10 K (18 °F)		
			3	Config. Pt500	-200 to 250 °C	-328 to 482 °F	min. span 10 K (18 °F)		
			4	Config. Ni500	-60 to 150 °C	-76 to 302 °F	min. span 10 K (18 °F)		
			5	Config. Pt1000	-200 to 250 °C	-328 to 482 °F	min. span 10 K (18 °F)		
			6	Config. Ni100	-60 to 150 °C	-76 to 302 °F	min. span 10 K (18 °F)		
			9	Config. Pt100 acc. to JIS C1604-81	-200 to 649 °C	-328 to 1200 °F	min. span 10 K (18 °F)		
				Setup					
				A	Standard factory configuration (Pt100/3-wire/0 to 100 °C; 0 to 212 °F)				
				B	Customised measurement range				
				C	Customised expanded configuration for TC (see questionnaire)				
				D	Customised expanded configuration for RTD (see questionnaire)				
					Model				
					A	Standard model			
					B	Works calibration certificate 6 test points			
					K	Standard model, North American region			
TMT112-						⇐ Order code			

Accessories

Commubox FXA191, PC operating software ReadWin® 2000 or FieldCare

Further Documentation

- Brief operating manual 'iTEMP® HART® DIN rail TMT112' (KA193R/09/a3)
- Operating manual 'iTEMP® HART® Communication' (BA139R/09/a3)
- Functional safety manual TMT112 (SD010R/09/en)
- Additional documentation for use in explosion-hazardous areas:
  ATEX II 2(1) G EEx ia IIC (XA022R/09/a3)
  ATEX II3G EEx nA II (XA055R/09/a3)

The operating software ReadWin® 2000 can be downloaded free of charge from the Internet from the following address:
www.products.endress.com/Readwin

Subject to modification

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