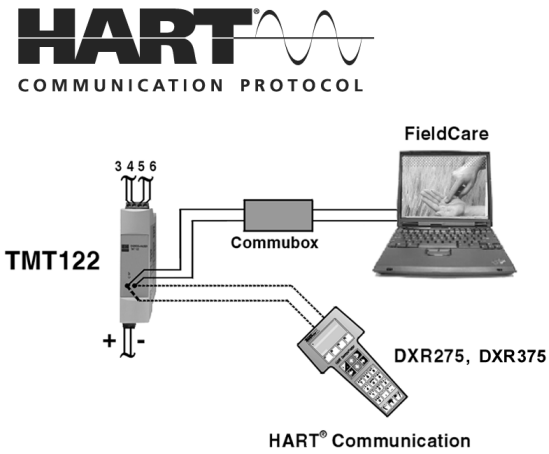
Technical Information

iTEMP HART® TMT122 DIN rail

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



Application

- Temperature transmitter with HART® protocol for converting various input signals into a scalable 4 to 20 mA analog 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 (DXR375) or PC (e.g. ReadWin® 2000 or FieldCare)
- Installation on DIN rail according to IEC 60715

Your benefits

- Universal settings with HART® protocol for various input signals
- 2-wire technology, 4 to 20 mA analog 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
- Ex-Certification:
  - ATEX Ex ia
  - CSA IS
  - FM IS
- Marine approval
- Galvanic isolation
- Output simulation
- Min./max. process value indicator function
- Customer-specific linearization
- Linearization curve match

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Function and system design

Measurement principle

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

Measurement system

The iTEMP HART® TMT122 DIN rail temperature transmitter is a 2-wire transmitter with an analog output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connection, thermocouples (TC) and voltage transmitters. Setup of the device is done using the HART® protocol with hand operating module (DXR375) or PC (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	Min. measurement range
Resistance thermometer (RTD)	Pt100 Pt500 Pt1000 acc. to IEC 751 (α = 0.00835) Pt100 acc. to JIS C 1604-81 (α = 0.003916)	-200 to 850 °C (-328 to 1562 °F) -200 to 250 °C (-328 to 482 °F) -200 to 250 °C (-238 to 482 °F) -200 to 649 °C (-328 to1200 °F)	10 K (18 °F) 10 K (18 °F) 10 K (18 °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)[1] D (W3Re-W25Re)[1] E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) L (Fe-CuNi)[2] N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi) U (Cu-CuNi)[2] acc. to IEC 584 Part 1	+40 to +1820 °C (104 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

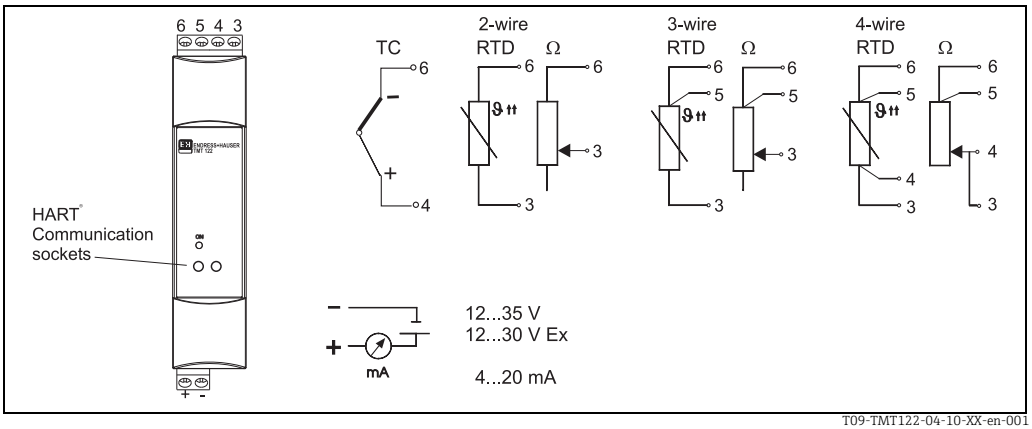
1. According to ASTM E988
2. According to DIN 43710

Output

Output signal	Analog 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 break; Sensor short circuit (not for thermocouples TC): ≤ 3.6 mA or ≥ 21.0 mA (if setting ≥ 21.0 mA the output is > 21.5 mA)
Load	Max. ($V_{Power\ supply}$ - 12 V) / 0.022 A (current output)
Linearization / 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 ≈ 3.8 mA)

Power supply

Electrical connection



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Temperature transmitter terminal connections

For the unit operation via HART® communication sockets 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} ≤ 3 V at U_b ≥ 15 V, $f_{max.}$ = 1 kHz

Performance characteristics

Response time

1 s

Reference operating conditions

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

Maximum measured error

The accuracy data are typical values and correspond to a standard deviation of ± 3σ (normal distribution), i.e. 99.8% of all the measured values achieve the given values or better values.

	Type	Measurement accuracy[1]
Resistance thermometer RTD	Pt100, Ni100 Pt500, Ni500 Pt1000, Ni1000	0.2 K or 0.08% 0.5 K or 0.20% 0.3 K or 0.12%
Thermocouple TC	K, J, T, E, L, U N, C, D R, S B	typ. 0.5 K or 0.08% typ. 1.0 K or 0.08% typ. 1.4 K or 0.08% typ. 2.0 K or 0.08%

	Measurement range	Measurement accuracy[1]
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%

1. % is related to the adjusted measurement range. The value to be applied is the greater.

Physical input range of the sensors	
10 to 400 Ω	Polynom RTD, Pt100, Ni100
10 to 2000 Ω	Pt500, Pt1000, Ni1000
-10 to 75 mV	Thermocouple type: C, D, E, J, K, L, N, U
-10 to 35 mV	Thermocouple type: B, R, S, T

Influence of power supply

≤ ± 0.01%/V deviation from 24 V
Percentages refer to the full scale value.

Influence of ambient temperature (temperature drift)

Total temperature drift = input temperature drift + output temperature drift

Effect on the accuracy when ambient temperature changes by 1 K (1.8 °F):	
Input 10 to 400 Ω	typ. 0.0015% of measured value, min. 4 mΩ
Input 10 to 2000 Ω	typ. 0.0015% of measured value, min. 20 mΩ
Input -10 to 75 mV	typ. 0.005% of measured value, min. 1.2 µV
Input -10 to 35 mV	typ. 0.005% of measured value, min. 0.6 µV
Output 4 to 20 mA	typ. 0.005% of span

Typical sensitivity of resistance thermometers:	
Pt: 0.00385 * $R_{nominal}$/K	Ni: 0.00617 * $R_{nominal}$/K

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

Typical sensitivity of thermocouples:					
B: 10 µV/K	C: 20 µV/K	D: 20 µV/K	E: 75 µV/K	J: 55 µV/K	K: 40 µV/K
L: 55 µV/K	N: 35 µV/K	R: 12 µV/K	S: 12 µV/K	T: 50 µV/K	U: 60 µV/K

Example for calculating measured error for ambient temperature drift:
Input temperature drift $\Delta\vartheta$ = 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: (0.0015% of 138.5 Ω) * 10 = 0.02078 Ω
Conversion to Kelvin: 0.02078 Ω / 0.385 Ω/K = 0.05 K (0.09 °F)

Influence of load
≤ ±0.02%/100 Ω
Values refer to the full scale value

Long term stability
≤ 0.1K/year or ≤ 0.05%/year
Values under reference operating conditions. % refer to the set span. The highest value is valid.

Influence of cold junction
Pt100 DIN IEC 60751 Cl. B (internal reference junction for thermocouples TC)

Installation conditions

Installation instructions
Orientation
No limit

Environment conditions

Ambient temperature limits
–40 to +85 °C (-40 to +185 °F) for Ex-area, see Ex-certificate

Storage temperature
-40 to +100 °C (-40 to +212 °F)

Climate class
According to IEC 60654-1, Class C

Condensation
Permitted

Degree of protection
IP 20 (NEMA 1)

Shock and vibration resistance
4g / 2 to 150 Hz as per IEC 60 068-2-6

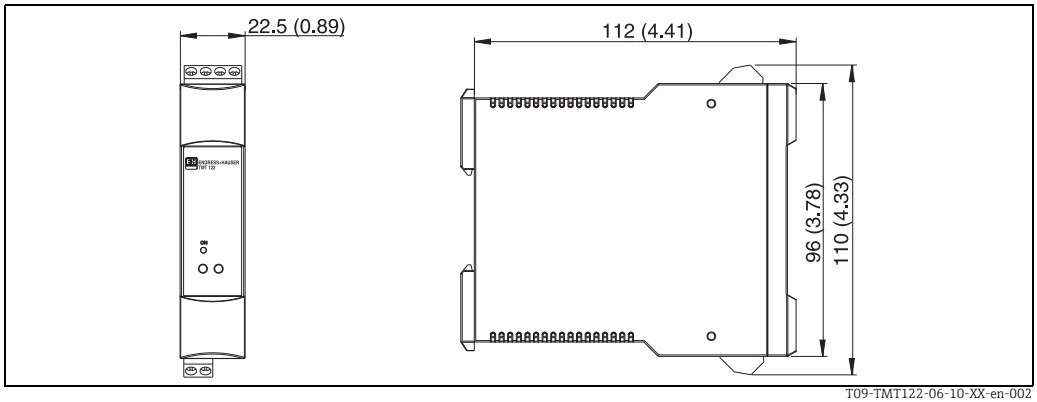
Electromagnetic compatibility (EMC)
CE conformity
EMC to all relevant requirements of the IEC/EN 61326 - series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity.

Maximum fluctuations during EMC- tests: < 1% of measuring span.

Interference immunity to IEC/EN 61326 - series, requirements for industrial areas
Interference emission to IEC/EN 61326 - series, electrical equipment Class B

Mechanical construction

Design, dimensions



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Housing for DIN rail mounting according to IEC 60715; Dimensions in mm (in)

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
- Front mounted HART® communication socket for 2 mm jack plugs

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 DXR375 or PC with Commubox FXA191/FXA195 and operating software (ReadWin® 2000 or FieldCare).
Interface
PC interface Commubox FXA191 (RS232) or FXA195 (USB).
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-Mark

The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

Hazardous area approvals

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

Marine approval

For further details on the available "Type Approval Certificiates" (DNVGL, BV, etc.), please contact your nearest Endress+Hauser sales organisation. All relevant data for marine approval can be found in

	separate "Type Approval Certificiates". If required, please request copies from us or your Endress+Hauser sales organisation.
UL approval	UL recognized component (see www.ul.com/database, search for Keyword "E225237")
Other standards and guidelines	IEC 60529: Degree of protection provided by housing (IP-Code) IEC 61010: Safety requirements for electrical measurement, control and laboratory use. IEC 61326: Electromagnetic compatibility (EMC requirements) NAMUR Standards working group for measurement and control technology in the chemical industry. (www.namur.de)
CSA GP	CSA General Purpose

Ordering information

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

Product Configurator - the tool for individual product configuration
- Up-to-the configuration
- 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

- Commubox FXA191 (RS232) or FXA195 (USB)
  Order code: FXA191-... or FXA195-...
- PC-operating software: ReadWin® 2000 or FieldCare
  ReadWin® 2000 can be downloaded free of charge from the internet from the following address:
  www.endress.com/readwin
- Hand operating module 'HART® Communicator DXR375', **Order code:** DXR375-...

Documentation

- Compact instructions 'iTEMP HART® DIN rail TMT122' (KA128R/09/a3)
- Additional documentation for use in explosion-hazardous areas:
  ATEX II2(1)G (XA016R/09/a3)
  ATEX II3G (XA019R/09/a3)

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