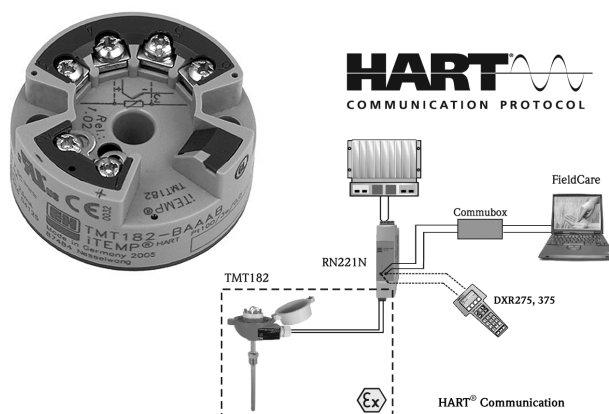


# Technical Information

## iTEMP HART® TMT182

Universal temperature Head transmitter for RTD, TC, resistance and voltage transmitters, HART® -protocol, for installation in a sensor head Form B



### Application

- Temperature head transmitter with HART® -protocol for converting various input signals into an scalable 4 to 20 mA analog output signal
- Input:
  - Resistance thermometer (RTD)
  - Thermocouple (TC)
  - Resistance transmitter ( $\Omega$ )
  - 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)

### Your benefits

- Universal settings with HART® -protocol for various input signals
- Operation, visualisation and maintenance via PC, e. g. FieldCare operating software
- 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
- Marine approval
- CSA General Purpose
- Ex-Certification
  - ATEX Ex ia and dust zone 22 in compliance with EN 50281-1
  - FM IS
  - CSA IS
- Galvanic isolation
- Output simulation
- Min./max. process value indicator function
- Customer specific linearization
- Linearization curve match

## Function and system design

**Measuring principle** Electronic monitoring and conversion of input signals in industrial temperature measurement.

**Measuring system** The iTEMP HART® TMT182 temperature head transmitter is a 2-wire transmitter with analog output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connection, thermocouples and voltage transmitters. Setting up of the TMT182 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 transmission behaviour), 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 60751 ( $\alpha = 0.00385$ )	-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 to JIS C1604-81 ( $\alpha = 0.003916$ )	-200 to 649 °C (-328 to 1200 °F)	10 K (18 °F)
	Ni100 Ni500 Ni1000 acc. to DIN 43760 ( $\alpha = 0.006180$ )	-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)
	<ul style="list-style-type: none"> <li>■ Connection type: 2-, 3- or 4-wire connection</li> <li>■ Software compensation of cable resistance possible in the 2 wire system (0 to 30 Ω)</li> <li>■ Sensor cable resistance max. 20 Ω per cable in the 3 and 4 wire system</li> <li>■ Sensor current: ≤ 0.2 mA</li> <li>■ Corrosion detection as per NAMUR NE 89 for Pt100 4-wire connection (optional for 'Advanced Diagnostic' version, see 'Product structure'). If corrosion detection is active, the response time is 2 s.</li> </ul>		
Resistance transmitter	Resistance Ω	10 to 400 Ω 10 to 2000 Ω	10 Ω 100 Ω
Thermocouple (TC)	B (PtRh30-PtRh6) C (W5Re-W26Re) <sup>1)</sup> D (W3Re-W25Re) <sup>1)</sup> E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) L (Fe-CuNi) <sup>2)</sup> N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi) U (Cu-CuNi) <sup>2)</sup> acc. to IEC 584 Part 1	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)
	<ul style="list-style-type: none"> <li>■ Cold junction: internal (Pt100)</li> <li>■ Cold junction accuracy: ± 1 K</li> </ul>		
Voltage transmitters	Millivolt transmitter	-10 to 75 mV	5 mV

1) acc. to ASTM E988

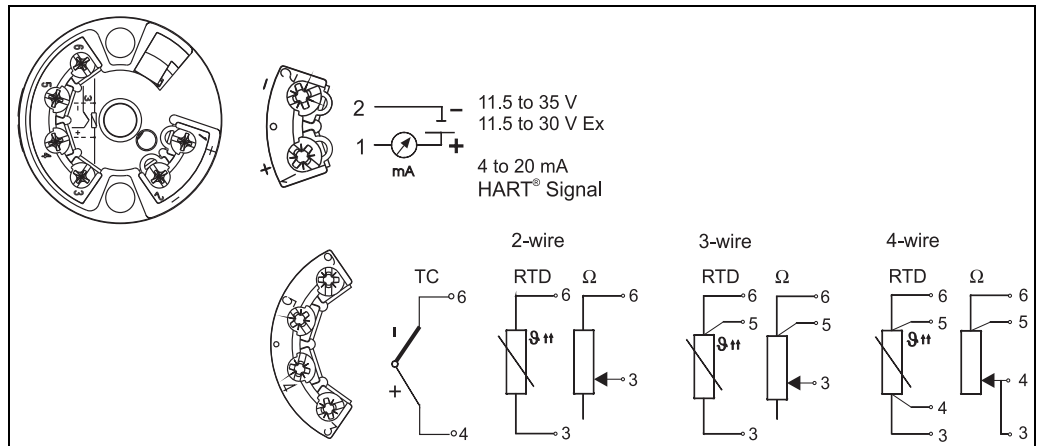
2) acc. to DIN 43710

## Output

<b>Output signal</b>	Analog 4 to 20 mA, 20 to 4 mA
<b>Signal on alarm</b>	<ul style="list-style-type: none"> <li>■ Underranging; linear drop to 3.8 mA</li> <li>■ Overranging; linear rise to 20.5 mA</li> <li>■ Sensor break; sensor short-circuit (not for thermocouples TC): <math>\leq 3.6</math> mA or <math>\geq 21.0</math> mA</li> </ul> <p> Guaranteed values for setting "high alarm" (<math>\geq 21</math> mA):</p> <ul style="list-style-type: none"> <li>■ Standard model: <math>&gt; 21.5</math> mA</li> <li>■ Advanced diagnostic model: <math>\geq 22.5</math> mA</li> </ul>
<b>Load</b>	max. $(V_{\text{Power supply}} - 11.5 \text{ V}) / 0.022 \text{ A}$ (Current output)
<b>Linearization/transmission behaviour</b>	Temperature linear, resistance linear, voltage linear
<b>Filter</b>	1st order digital filter: 0 to 100 s
<b>Galvanic isolation</b>	$U = 2 \text{ kV AC}$ (input/output)
<b>Min. current consumption</b>	$\leq 3.5 \text{ mA}$
<b>Current limit</b>	$\leq 23 \text{ mA}$
<b>Switch on delay</b>	4 s (during power up $I_a = 3.8 \text{ mA}$ )

## Power supply

### Electrical connection



Head transmitter terminal connections

For the unit operation via HART® protocol (terminals 1 and 2) a minimum load resistance of  $250 \Omega$  is necessary in the signal circuit!

<b>Supply voltage</b>	$U_b = 11.5$ to $35 \text{ V}$ , polarity protection
<b>Undervoltage detection</b>	Optional for 'Advanced Diagnostic' version. If the supply voltage is not sufficient to output the output signal corresponding to the measured temperature, a signal on alarm $\leq 3.6$ mA is generated. After approx. 2 to 3 s, the system makes another attempt to output the signal corresponding to the temperature.

**Residual ripple** Allowable ripple  $U_{ss} \leq 3 \text{ V}$  at  $U_b \geq 13 \text{ V}$ ,  $f_{\max} = 1 \text{ kHz}$

## Performance characteristics

**Response time** 1 s (TC), 1.5 s (RTD)

**Reference operating conditions** Calibration temperature:  $+25 \text{ °C}$  ( $77 \text{ °F}$ )  $\pm 5 \text{ K}$  ( $9 \text{ °F}$ )

**Maximum measured error**



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

	Type	Measurement accuracy <sup>1)</sup>
<b>Resistance thermometer RTD</b>	Pt100, Ni100 Pt500, Ni500 Pt1000, Ni1000	0.2 K or 0.08% 0.5 K or 0.20% 0.3 K or 0.12%
<b>Thermocouple TC</b>	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 <sup>1)</sup>
<b>Resistance transmitter (<math>\Omega</math>)</b>	10 to 400 $\Omega$ 10 to 2000 $\Omega$	$\pm 0.1 \Omega$ or 0.08% $\pm 1.5 \Omega$ or 0.12%
<b>Voltage transmitters (mV)</b>	-10 to 75 mV	$\pm 20 \mu\text{V}$ 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 $\Omega$	Polynom RTD, Pt100, Ni100
10 to 2000 $\Omega$	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 supply voltage**  $\leq \pm 0.01\%/V$  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 $\Omega$	typ. 0.0015% of measured value, min. 4 m $\Omega$
Input 10 to 2000 $\Omega$	typ. 0.0015% of measured value, min. 20 m $\Omega$
Input -10 to 75 mV	typ. 0.005% of measured value, min. 1.2 $\mu\text{V}$
Input -10 to 35 mV	typ. 0.005% of measured value, min. 0.6 $\mu\text{V}$
Output 4 to 20 mA	typ. 0.005% of span

**Typical sensitivity of resistance thermometers:**

Pt: $0.00385 * R_{\text{nominal}}/K$	Ni: $0.00617 * R_{\text{nominal}}/K$
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Example Pt100:  $0.00385 \times 100 \Omega/K = 0.385 \Omega/K$

**Typical sensitivity of thermocouples:**

B: 10 $\mu V/K$	C: 20 $\mu V/K$	D: 20 $\mu V/K$	E: 75 $\mu V/K$	J: 55 $\mu V/K$	K: 40 $\mu V/K$
L: 55 $\mu V/K$	N: 35 $\mu V/K$	R: 12 $\mu V/K$	S: 12 $\mu V/K$	T: 50 $\mu V/K$	U: 60 $\mu V/K$

**Example for calculating measured error for ambient temperature drift:**

Input temperature drift  $\Delta T = 10 K (18 ^\circ F)$ , Pt100, measuring range 0 to  $100 ^\circ C (32 \text{ to } 212 ^\circ F)$

Maximum process temperature:  $100 ^\circ C (212 ^\circ F)$

Measured resistance value:  $138.5 \Omega$  (IEC 60751) at maximum process temperature

Typical temperature drift in  $\Omega$ :  $(0.0015\% \text{ of } 138.5 \Omega) * 10 = 0.02078 \Omega$

Conversion to Kelvin:  $0.02078 \Omega / 0.385 \Omega/K = 0.05 K (0.09 ^\circ F)$

<b>Influence of load</b>	$\pm 0.02\%/100 \Omega$ Values refer to the full scale value
<b>Long-term stability</b>	$\leq 0.1 K/\text{year}$ or $\leq 0.05\%/\text{year}$ Values under reference operating conditions. % refer to the set span. The highest value is valid.
<b>Influence of cold junction</b>	Pt100 DIN IEC 60751 Cl. B (internal cold junction with thermocouples TC)

## Installation conditions

<b>Installation instructions</b>	<ul style="list-style-type: none"> <li>▪ Installation angle: no limit</li> <li>▪ Installation area: Terminal head accord. to DIN 43 729 Form B; TAF10 field housing</li> </ul>
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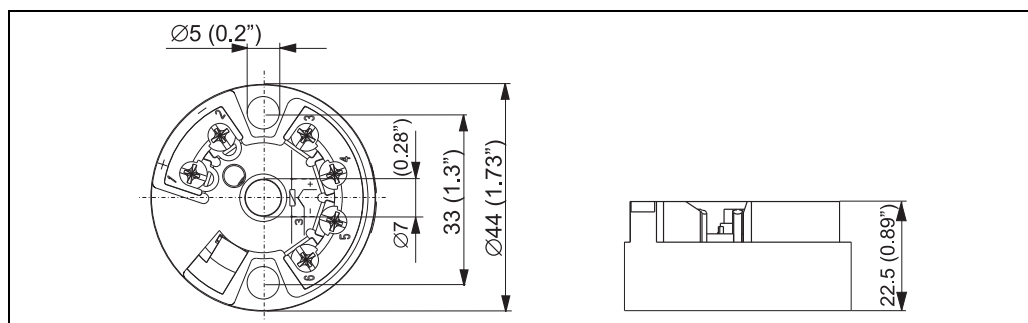
## Environment conditions

<b>Ambient temperature limits</b>	$-40 \text{ to } +85 ^\circ C (-40 \text{ to } 185 ^\circ F)$ for Ex-area, see Ex-certificate
<b>Storage temperature</b>	$-40 \text{ to } +100 ^\circ C (-40 \text{ to } 212 ^\circ F)$
<b>Climate class</b>	According to IEC 60 654-1, class C
<b>Condensation</b>	Permitted
<b>Degree of protection</b>	IP 00, IP 66 installed
<b>Shock and vibration resistance</b>	$4g / 2 \text{ to } 150 \text{ Hz}$ 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**

Dimensions of the head transmitter in mm (in)

**Weight**

approx. 40 g (1.4 oz)

**Material**

- Housing: PC
- Potting: PUR

**Terminals**

- Cable up to max. 1.75 mm<sup>2</sup> (secure screws)
- or 1.5 mm<sup>2</sup> with wire end ferrules
- eyelets for easy connection of a HART®-handheld terminal with alligator clips

## Human interface

**Display elements**

No display elements are present directly on the temperature transmitter.  
 The measured value display can be called up using the ReadWin® 2000 or FieldCare PC software.

**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/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 of wire resistance with 2-wire connection, failure mode, output signal (4 to 20/20 to 4 mA), digital filter (damping), offset, TAG + descriptor (8 + 16 characters), output simulation, customer specific linearization, min./max. process value indicator function

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## Certificates and approvals

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<b>CE-Mark</b>	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.
<b>Hazardous area approvals</b>	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.
<b>Marine approval</b>	For further details on the available "Type Approval Certificates" (DNVGL, BV, etc.), please contact your nearest Endress+Hauser sales organisation. All relevant data for marine approval can be found in separate "Type Approval Certificates". If required, please request copies from us or your Endress+Hauser sales organisation.
<b>Other standards and guidelines</b>	<ul style="list-style-type: none"> <li>■ IEC 60529: Degree of protection provided by housing (IP-Code)</li> <li>■ IEC 61010: Safety requirements for electrical measurement, control and laboratory use.</li> <li>■ IEC 61326: Electromagnetic compatibility (EMC requirements)</li> <li>■ NAMUR Standards working group for measurement and control technology in the chemical industry. (<a href="http://www.namur.de">www.namur.de</a>)</li> </ul>
<b>UL approval</b>	UL recognized component (see <a href="http://www.ul.com/database">www.ul.com/database</a> , search for Keyword "E225237")
<b>CSA GP</b>	CSA General Purpose

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## Ordering information

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Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: [www.endress.com](http://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](http://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

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## Accessories

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- 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](http://www.endress.com/readwin)
- Hand operating module 'HART® Communicator DXR375'  
**Order code:** DXR375-...
- DIN rail clip according to IEC 60715 (TH35) for head transmitter mounting  
**Order code:** 51000856
- Field housing TAF10 for Endress+Hauser head transmitter, aluminum, IP 66, dimensions W x H x D: 100 x 100 x 60 mm (3.94" x 3.94" x 2.36")  
**Order code:** TAF10-...

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## Documentation

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- Operating short manual iTEMP HART® TMT182 (KA142R/09/a3)
- Additional documentation for use in explosion-hazardous areas:  
ATEX II1G: XA006R/09/a3  
ATEX II3G: XA011R/09/a3  
ATEX II3D: XA027R/09/a3
- Operating short manual TAF10 Field housing (KA093R/09/a2)

[www.addresses.endress.com](http://www.addresses.endress.com)

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