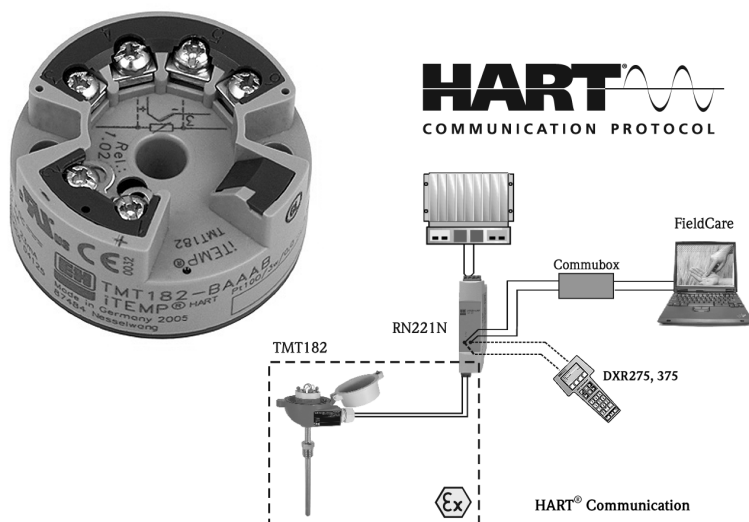


## Technical Information

# iTEMP® HART® TMT182

Temperature head transmitter

Head transmitter for resistance thermometers (RTD), thermocouples (TC), resistance and voltage transmitters (mV), 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 to UL 3111-1
- GL Germanischer Lloyd marine approval

- CSA General Purpose
- Ex-Certification
  - ATEX Ex ia and dust zone 22 in compliance with EN 50281-1
  - FM IS
  - CSA IS
- SIL2 compliant
- Galvanic isolation
- Output simulation
- Min./max. process value indicator function
- Customer specific linearization
- Linearization curve match
- Customer specific measurement range settings or expanded SETUP (see Questionnaire, → Page 8)



## Function and system design

<b>Measuring principle</b>	Electronic monitoring and conversion of input signals in industrial temperature measurement.
<b>Measuring system</b>	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

<b>Measured variable</b>	Temperature (temperature linear transmission behaviour), resistance and voltage
<b>Measuring range</b>	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
<i>Resistance thermometer (RTD)</i>	Pt100 Pt500 Pt1000 acc. to IEC 60751 ( $\alpha = 0.00385$ ) Pt100 to JIS C1604-81 ( $\alpha = 0.003916$ )	-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 to 1200 °F)	10 K (18 °F) 10 K (18 °F) 10 K (18 °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 <math>\Omega</math>)</li> <li>■ Sensor cable resistance max. 20 <math>\Omega</math> per cable in the 3 and 4 wire system</li> <li>■ Sensor current: <math>\leq 0.2</math> 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>		
<i>Resistance transmitter</i>	Resistance $\Omega$	10 to 400 $\Omega$ 10 to 2000 $\Omega$	10 $\Omega$ 100 $\Omega$
<i>Thermocouple (TC)</i>	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) 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: <math>\pm 1</math> K</li> </ul>		
<i>Voltage transmitters</i>	Millivolt transmitter	-10 to 75 mV	5 mV

1) acc. to ASTM E988

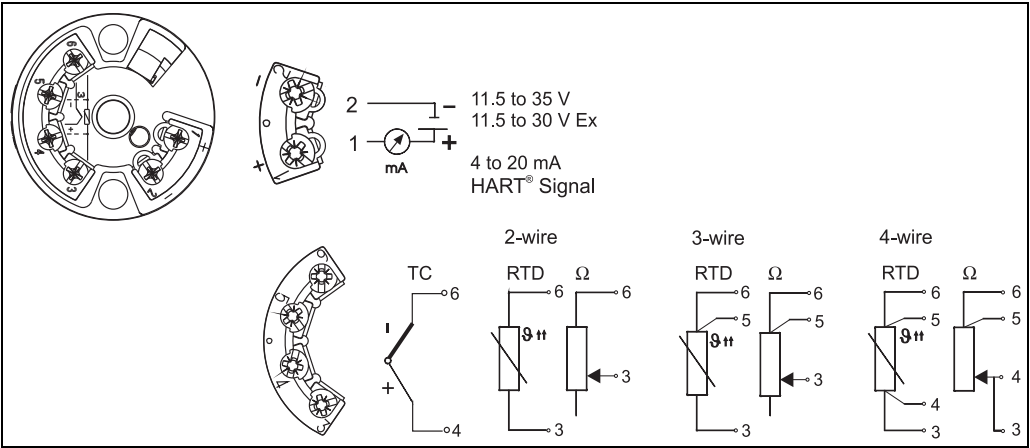
2) acc. to DIN 43710

# Output

Output signal	Analog 4 to 20 mA, 20 to 4 mA
Signal on alarm	<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): ≤ 3.6 mA or ≥ 21.0 mA</li> </ul> <p> Note! Guaranteed values for setting "high alarm" (≥ 21 mA):</p> <ul style="list-style-type: none"> <li>■ Standard model: &gt; 21.5 mA</li> <li>■ Advanced diagnostic model: ≥ 22.5 mA</li> </ul>
Load	max. $(V_{\text{Power supply}} - 11.5 \text{ V}) / 0.022 \text{ A}$ (Current output)
Linearization/transmission behaviour	Temperature linear, resistance linear, voltage linear
Filter	1st order digital filter: 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 $I_a = 3.8 \text{ mA}$ )

# 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 Ω is necessary in the signal circuit!

Supply voltage	$U_b = 11.5 \text{ to } 35 \text{ V}$ , 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.
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<b>Residual ripple</b>	Allowable ripple $U_{ss} \leq 3$ V at $U_b \geq 13$ V, $f_{max.} = 1$ kHz
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## Performance characteristics

<b>Response time</b>	1 s (TC), 1.5 s (RTD)
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<b>Reference operating conditions</b>	Calibration temperature: $+25$ °C ( $77$ °F) $\pm 5$ K ( $9$ °F)
---------------------------------------	--

### Maximum measured error



Note!

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	$\pm 20$ $\mu$ 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

<b>Influence of supply voltage</b>	$\leq \pm 0.01\%/V$ deviation from 24 V Percentages refer to the full scale value.
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<b>Influence of ambient temperature (temperature drift)</b>	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 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: $0.00385 \cdot R_{\text{nominal}}/K$	Ni: $0.00617 \cdot R_{\text{nominal}}/K$
--	--

Example Pt100:  $0.00385 \times 100 \Omega/K = 0.385 \Omega/K$

**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  $\Delta\theta = 10 \text{ K}$  (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:  $(0.0015\% \text{ of } 138.5 \Omega) \cdot 10 = 0.02078 \Omega$

Conversion to Kelvin:  $0.02078 \Omega / 0.385 \Omega/K = 0.05 \text{ K}$  (0.09 °F)

<b>Influence of load</b>	$\pm 0.02\%/100 \Omega$ Values refer to the full scale value
<b>Long-term stability</b>	$\leq 0.1 \text{ K/year}$ or $\leq 0.05\%/year$ 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

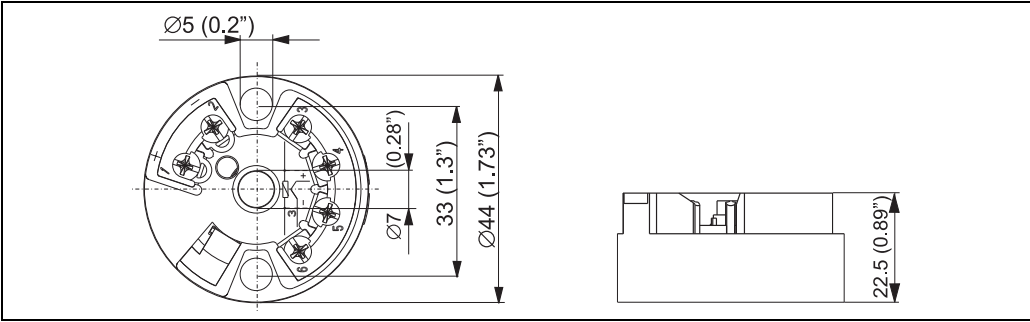
<b>Ambient temperature limits</b>	-40 to +85 °C (-40 to 185 °F) for Ex-area, see Ex-certificate
<b>Storage temperature</b>	-40 to +100 °C (-40 to 212 °F)
<b>Climate class</b>	According to IEC 60 654-1, class C
<b>Condensation</b>	Permitted
<b>Degree of protection</b>	IP 00, IP 66 installed

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

**Electromagnetic compatibility (EMC)**    Interference immunity and interference emission as per IEC 61326 and NAMUR NE 21

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

## Certificates and approvals

<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>GL</b>	Ship building approval (Germanischer Lloyd)
<b>UL</b>	Recognized component to UL 3111-1
<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>CSA GP</b>	CSA General Purpose

# Questionnaire Endress+Hauser iTEMP temperature transmitter

## Customer specific setup / Kundenspezifische Einstellung

### Standard setup / Standardeinstellung

Sensor	TC	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	<input type="checkbox"/> E	<input type="checkbox"/> J
		<input type="checkbox"/> K	<input type="checkbox"/> L	<input type="checkbox"/> N	<input type="checkbox"/> R	<input type="checkbox"/> S
		<input type="checkbox"/> T	<input type="checkbox"/> U			
	RTD	<input checked="" type="checkbox"/> Pt100	<input type="checkbox"/> Pt500	<input type="checkbox"/> Pt1000		
		<input type="checkbox"/> Ni100	<input type="checkbox"/> Ni500	<input type="checkbox"/> Ni1000		
		<input type="checkbox"/> 2 wire	<input checked="" type="checkbox"/> 3 wire	<input type="checkbox"/> 4 wire		

Unit / Einheit

☐ °C

☐ °F

Range / Messbereich

(not / nicht PROFIBUS-PA)

Low scale

Anfang

						.	
--	--	--	--	--	--	---	--

Bitte beachten!

Messbereich und min. Spanne  
(s. Techn. Daten)

High scale

Ende

						.	
--	--	--	--	--	--	---	--

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

(only / nur TC)

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[0...80°C; 32...176°F]

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 /

Fehlverhalten

☐ ≤ 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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Endress+Hauser

People for Process Automation



## Product structure

This information provides an overview of the order options available. The information is not exhaustive, however, and may not be fully up to date. **More detailed** information is available from your local Endress+Hauser representative.

**Head transmitter iTEMP® HART® TMT182**

Temperature transmitter with HART®-Protocol for RTD's, TC's, Ohm and mV, analog output 4 to 20 mA, SIL2, 2-wire-technology, galvanic isolation, fail. mode to NAMUR NE 43, for mounting in Form B head to DIN 43729, UL recognized component, ship building approval GL (Germanischer Lloyd)

Approval				
<b>A</b>	Non-hazardous area			
<b>B</b>	ATEX II1G EEx ia IIC T4/T5/T6			
<b>C</b>	FM IS, Class I, Div. 1+2, Group A, B, C, D			
<b>D</b>	CSA IS, Class I, Div. 1+2, Group A, B, C, D			
<b>E</b>	ATEX II3G Ex nA IIC T4/T5/T6			
<b>F</b>	ATEX II3D			
<b>G</b>	ATEX II1G EEx ia IIC T6, II3D			
<b>H</b>	ATEX II3G Ex nA IIC T4/T5/T6, II3D			
<b>I</b>	FM+CSA IS, NI, Class I, Div. 1+2, Group A, B, C, D			
<b>J</b>	CSA General Purpose			
<b>K</b>	IECEx Ex ia IIC T6/T5/T4			
<b>L</b>	TIIS Ex ia IIC T4			
<b>M</b>	TIIS Ex ia IIC T6			
<b>1</b>	NEPSI Ex ia IIC T4...T6			
<b>2</b>	NEPSI Ex nA II T4...T6			
Configuration connection				
<b>A</b>	Factory setup Pt100 3-wire 0...100 °C			
<b>1</b>	Thermocouple TC			
<b>2</b>	RTD 2-wire			
<b>3</b>	RTD 3-wire			
<b>4</b>	RTD 4-wire			
Configuration sensor type				
<b>A</b>	Factory setup Pt100 3-wire 0...100 °C			
<b>1</b>	Pt100 -200 °C to 850 °C (-328 to 1562 °F)	min. sp. 10 K, acc. to IEC 751 (a = 0.00385)		
<b>2</b>	Ni100 -60 °C to 250 °C (-76 to 482 °F)	min. sp. 10 K		
<b>3</b>	Pt500 -200 °C to 250 °C (-328 to 482 °F)	min. sp. 10 K		
<b>4</b>	Ni500 -60 °C to 150 °C (-76 to 302 °F)	min. sp. 10 K		
<b>5</b>	Pt1000 -200 °C to 250 °C (-328 to 482 °F)	min. sp. 10 K		
<b>6</b>	Ni1000 -60 °C to 150 °C (-76 to 302 °F)	min. sp. 10 K		
<b>7</b>	Resistance transmitter 10...400 Ohm, min. span 10 Ohm			
<b>8</b>	Resistance transmitter 10...2000 Ohm, min. span 100 Ohm			
<b>B</b>	Typ B 400 °C to 1820 °C (752 to 3308 °F)	min. sp. 500 K		
<b>C</b>	Typ C 500 °C to 2320 °C (932 to 4208 °F)	min. sp. 500 K		
<b>D</b>	Typ D 500 °C to 2495 °C (932 to 4523 °F)	min. sp. 500 K		
<b>E</b>	Typ E -270 °C to 1000 °C (-454 to 1832 °F)	min. sp. 50 K		
<b>J</b>	Typ J -210 °C to 1200 °C (-346 to 2192 °F)	min. sp. 50 K		
<b>K</b>	Typ K -270 °C to 1372 °C (-454 to 2501 °F)	min. sp. 50 K		
<b>L</b>	Typ L -200 °C to 900 °C (-328 to 1652 °F)	min. sp. 50 K		
<b>N</b>	Typ N -100 °C to 1300 °C (-148 to 2372 °F)	min. sp. 50 K		
<b>R</b>	Typ R -50 °C to 1768 °C (-58 to 3214 °F)	min. sp. 500 K		
<b>S</b>	Typ S -50 °C to 1768 °C (-58 to 3214 °F)	min. sp. 500 K		
<b>T</b>	Typ T -270 °C to 400 °C (-454 to 752 °F)	min. sp. 50 K		
<b>U</b>	Typ U -200 °C to 600 °C (-328 to 1112 °F)	min. sp. 50 K		
<b>V</b>	Voltage transmitter -10...75 mV, min. span 5 mV			
<b>W</b>	Pt100 -200 °C to 649 °C (-328 to 1200 °F)	min. sp. 10 K, acc. to JIS C1604-81 (a = 0.003916)		
Configuration				
<b>A</b>	Factory setup Pt100 3-wire 0...100 °C)			
<b>B</b>	Measuring range, see additional specification			
<b>C</b>	TC configuration range, see questionnaire			
<b>D</b>	RTD configuration range, see questionnaire			
Additional option				
<b>A</b>	Standard - DIN mounting set			
<b>B</b>	Works calibration certificate 6-point, DIN mounting set			
<b>C</b>	Diagnostic, advanced, DIN mounting set			
<b>K</b>	US - M4 mounting screws			
<b>L</b>	Diagnostic, advanced, US - M4 mounting screws			
TMT182-				← Order code (complete)

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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**
- ☐ 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)
- ☐ Functional safety manual TMT182 (SD006R/09/en)



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