



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services



Solutions

## Technical Information

# iTEMP<sup>®</sup> TMT181

Universal head transmitter for resistance thermometers (RTD), thermocouples, resistance and voltage transmitters, PC programmable, for installation in a terminal head form B



### Application

- PC programmable (PCP) temperature head transmitter 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)
- Online configuration using PC with TXU10-AA configuration kit (accessory)

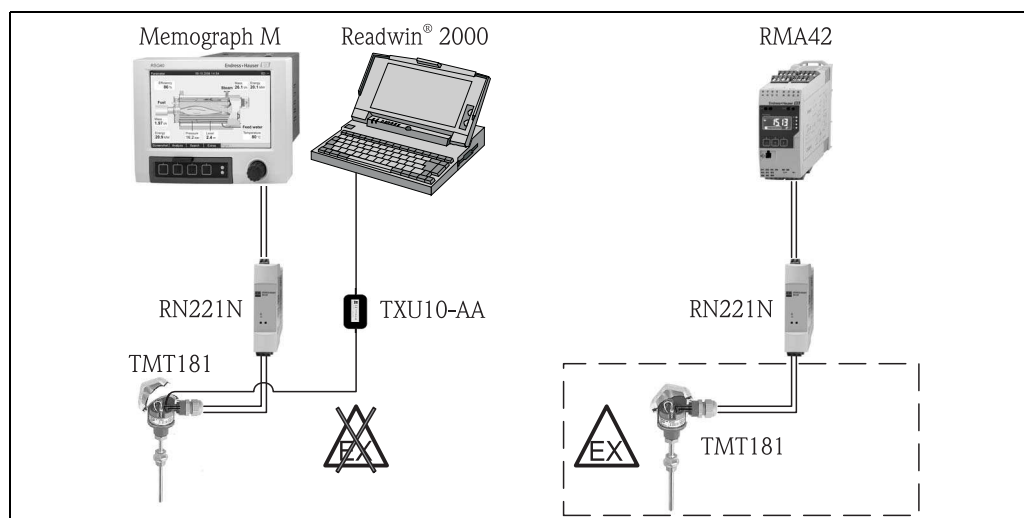
### Your benefits

- Universally PC programmable for various 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 to UL 3111-1
- GL Germanischer Lloyd marine approval
- Ex certification
  - ATEX Ex ia and dust ex zone 22 in compliance with EN 50281-1
  - FM IS
  - CSA IS
- Galvanic isolation
- Online configuration during measurement using SETUP connector
- Customer-specific linearization
- Adjustment of characteristic curve
- Output simulation

## Function and system design

### Measuring principle

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



Application example TMT181

### Measuring system

The iTEMP® PCP TMT181 temperature head transmitter is a two wire transmitter with an 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 TMT181 is done using the TXU10-AA configuration kit.

## Input

### Input signal

#### Resistance thermometer (RTD)

	Type	Measurement ranges	min. measurement range
as per IEC 751 ( $\alpha = 0.00385$ )	Pt100	-200 up to 850 °C (-328 up to +1562 °F)	10 K (18 °F)
	Pt500	-200 up to 250 °C (-328 up to +482 °F)	10 K (18 °F)
	Pt1000	-200 up to 250 °C (-328 up to +482 °F)	10 K (18 °F)
as per DIN 43760 ( $\alpha = 0.00618$ )	Ni100	-60 up to 180 °C (-76 up to +356 °F)	10 K (18 °F)
	Ni500	-60 up to 150 °C (-76 up to +302 °F)	10 K (18 °F)
	Ni1000	-60 up to 150 °C (-76 up to +302 °F)	10 K (18 °F)
Connection type		2-, 3- or 4-wire connection cable resistance compensation possible in the 2 wire system (0 up to 20 $\Omega$ ).	
Sensor cable resistance		max. 11 $\Omega$ per wire	
Sensor current		$\leq 0.6$ mA	

#### Resistance transmitter ( $\Omega$ )

Type	Measurement ranges	min. measurement range
Resistance ( $\Omega$ )	10 up to 400 $\Omega$ 10 up to 2000 $\Omega$	10 $\Omega$ 100 $\Omega$

**Thermocouple (TC)**

	Type	Measurement ranges		min. measurement range
as per NIST Monograph 175, IEC 584	B (PtRh30-PtRh6) <sup>1)</sup> E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi)	0 up to +1820 °C -200 up to +915 °C -200 up to +1200 °C -200 up to +1372 °C -270 up to +1300 °C 0 up to +1768 °C 0 up to +1768 °C -200 up to +400 °C	(32 up to 3308 °F) (-328 up to 1679 °F) (-328 up to 2192 °F) (-328 up to 2501 °F) (-454 up to 2372 °F) (32 up to 3214 °F) (32 up to 3214 °F) (-328 up to 752 °F)	500 °C (900 °F) 50 °C (90 °F) 50 °C (90 °F) 50 °C (90 °F) 50 °C (90 °F) 500 °C (900 °F) 500 °C (900 °F) 50 °C (90 °F)
as per ASTM E988	C (W5Re-W26Re) D (W3Re-W25Re)	0 up to 2320 °C 0 up to 2495 °C	(32 up to 4208 °F) (32 up to 4523 °F)	50 °C (90 °F) 50 °C (90 °F)
as per DIN 43710	L (Fe-CuNi) U (Cu-CuNi)	-200 up to +900 °C -200 up to +600 °C	(-328 up to 1652 °F) (-328 up to 1112 °F)	50 °C (90 °F) 50 °C (90 °F)
w/o	MoRe5-MoRe41	0 up to 2000 °C	(32 up to 3632 °F)	500 °C (900 °F)
Cold junction		internal (Pt100) or external (0 up to 80 °C (32 up to 176 °F))		
Accuracy of cold junction		± 1 K (± 1.8 °F)		
Sensor current		30 nA		

1) Higher measurement error for temperatures below 300 °C (572 °F).

**Voltage transmitter (mV)**

Designation	Measurement ranges	min. measurement range
Millivolt transmitter (mV)	-10 up to 100 mV	5 mV

**Output****Output signal****Current output**

4 up 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 <sup>1)</sup>	≤ 3.6 mA or ≥ 21.0 mA

1) Not for thermocouple

**Load**

Max. load:  $(V_{\text{supply}} - 8 \text{ V}) / 0.025 \text{ A}$

**Transmission behavior**

Temperature linear, resistance linear, voltage linear

**Galvanic isolation**

I/O: U = 2 kV AC

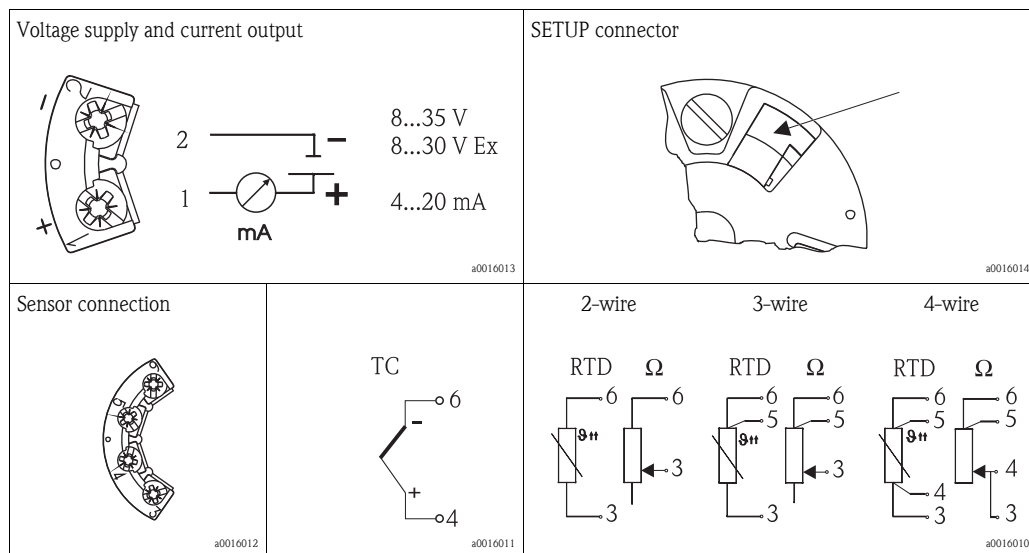
**Filter**

1st degree digital filter: 0 up to 8 s

<b>Current limit</b>	≤ 25 mA
<b>Switch-on delay</b>	4 s ( $I_a = 3.8$ mA during switch-on)

## Power supply

### Terminal assignment



<b>Supply voltage</b>	8 up to 35 V DC, polarity protected Ex version: 8 up to 30 V DC
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<b>Residual ripple</b>	Permissible residual ripple $U_{SS} \leq 5$ V at $U_b \geq 13$ V, $f_{max} = 1$ kHz
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## Performance characteristics

<b>Response time</b>	1 s
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<b>Reference operating conditions</b>	Calibration temperature $23$ °C $\pm 5$ K ( $73.4$ °F $\pm 9$ °F)
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### Maximum measured error

#### Resistance thermometer (RTD)

Type	Measurement accuracy <sup>1)</sup>
Pt100, Ni100	0.2 K (0.36 °F) or 0.08 %

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

#### Resistance transmitter (Ω)

Type	Measurement accuracy <sup>1)</sup>	Measurement range
Resistance	± 0.1 Ω or 0.08 %	10 up to 400 Ω
	± 1.5 Ω or 0.12 %	10 up to 2000 Ω

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

**Thermocouple (TC)**

Type	Measurement accuracy <sup>1)</sup>
K, J, T, E, L, U N, C, D S, B, R, MoRe5MoRe41	typ. 0.5 K (0.8 °F) or 0.08 % typ. 1.0 K (1.8 °F) or 0.08 % typ. 2.0 K (3.6 °F) or 0.08 %
Influence of the internal reference junction	Pt100 DIN IEC 751 Kl. B

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

**Voltage transmitter (mV)**

Type	Measurement accuracy <sup>1)</sup>	Measurement range
Millivolt transmitter	± 20 µV or 0.08 %	-10 up to 100 mV
Influence of the supply voltage	≤ ± 0.01 %/V deviation from 24 V <sup>2)</sup>	
Influence of the load	≤ ± 0.02 %/100 Ω <sup>2)</sup>	

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

2) All data is related to a measurement end value (FSD) of 20 mA.

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**Long-term drift** 0.1 K/year (0.18 °F/year) <sup>1)</sup> or 0.05 %/year <sup>1)2)</sup>

**Influence of ambient temperature**

$T_d$  = temperature drift  
 $\Delta\theta$  = deviation of ambient temperature from reference condition  
 For temperatures in °F, divide the result by 1.8.

**Resistance thermometer (RTD):**

$$T_d = \pm (15 \text{ ppm/K} * \text{max. measurement range} + 50 \text{ ppm/K} * \text{preset measurement range}) * \Delta\theta$$

**Resistance thermometer Pt100:**

$$T_d = \pm (15 \text{ ppm/K} * (\text{range end value} + 200) + 50 \text{ ppm/K} * \text{preset measuring range}) * \Delta\theta$$

**Thermocouple (TC):**

$$T_d = \pm (50 \text{ ppm/K} * \text{max. measurement range} + 50 \text{ ppm/K} * \text{preset measurement range}) * \Delta\theta$$

**Installation****Mounting location**

Terminal head as per DIN EN 50446 Form B; field housing TAF10

**Orientation**

No restrictions

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1) under reference conditions

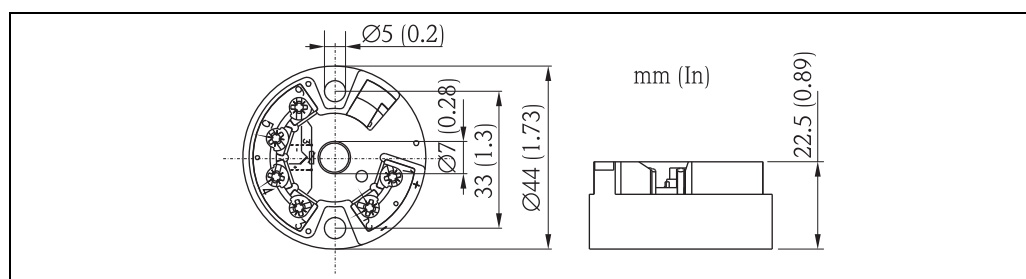
2) % is related to the adjusted measurement range (the value to be applied is the greater).

## Environment

<b>Ambient temperature range</b>	-40 up to +85 °C (-40 up to +185 °F) (for Ex-areas, see Ex-certification or control drawings)
<b>Storage temperature</b>	-40 up to +100 °C (-40 up to +212 °F)

## Mechanical construction

### Design, dimensions



Dimensions of the head transmitter

<b>Weight</b>	40 g (1.41 oz.)
<b>Materials</b>	Housing: PC Potting: PUR
<b>Terminals</b>	Cable up to max. 1.75 mm <sup>2</sup> (16 AWG)

## Operability

### Operating concept

#### Remote operation

Configuration kit TXU10-AA (accessory)  
 Interface cable plus PC software Readwin® 2000  
 Interface: PC interface connection cable TTL -/- RS232 with plug  
 Configurable parameters: sensor type and connection type, measurement dimension (°C/°F), measurement ranges, internal/external cold junction, compensation of cable resistance for 2-wire connection, signal on alarm, output signal (4 up to 20 mA/20 to 4 mA), digital filter (damping), offset, measurement point identification (8 characters), output simulation.

## Certificates and approvals

<b>CE mark</b>	This unit complies with the legal requirements laid out within the EU regulations.
<b>Ex approval</b>	For further details on the available Ex versions (ATEX, CSA, FM, etc.), please contact your nearest E+H sales organization. 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 organization.

## Ordering information

### Product structure

TMT181-	Universally PC programmable for resistance thermometers, thermocouples, resistance and voltage transmitters, 2-wire technology, 4 to 20 mA analog output, In/Out galvanic isolation, for mounting in Form B head to DIN EN 50446, UL recognized component, ship building approval GL Germanischer Lloyd
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Approval:	
<b>A</b>	Non-hazardous area
<b>B</b>	ATEX II1G EEx ia IIC T4/T5/T6
<b>C</b>	FM IS,NI,Class I,Div.1+2,Group ABCD
<b>D</b>	CSA IS,NI,Class I,Div.1+2,Group ABCD
<b>E</b>	ATEX II3G Ex nA II 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 II T6, II3D
<b>I</b>	FM+CSA IS,NI,Class I,Div.1+2,Group ABCD
<b>J</b>	CSA General Purpose
<b>K</b>	TIIS Ex ia IIC T4
<b>L</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 Pt 100 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>B</b>	Type B, 0 up to 1820°C, min. span 500K
<b>C</b>	Type C, 0 up to 2320°C, min. span 500K
<b>D</b>	Type D, 0 up to 2495°C, min. span 500K
<b>E</b>	Type E, -200 up to 1000°C, min. span 50K
<b>J</b>	Type J, -200 up to 1200°C, min. span 50K
<b>K</b>	Type K, -200 up to 1370°C, min. span 50K
<b>L</b>	Type L, -200 up to 900°C, min. span 50K
<b>N</b>	Type N, -270 up to 1300°C, min. span 50K
<b>R</b>	Type R, -50 up to 1768°C, min. span 500K
<b>S</b>	Type S, -50 up to 1768°C, min. span 500K
<b>T</b>	Type T, -200 up to 400°C, min. span 50K
<b>U</b>	Type U, -200 up to 600°C, min. span 50K
<b>V</b>	Voltage transmitter -10 up to 100mV, Min. span 5mV
<b>1</b>	Pt100, -200 up to 850°C, min. span 10K, IEC751 ( $\alpha = 0.00385$ )
<b>2</b>	Ni100, -60 up to 180°C, min. span 10K
<b>3</b>	Pt500, -200 up to 250°C, min. span 10K
<b>4</b>	Ni500, -60 up to 150°C, min. span 10K
<b>5</b>	Pt1000, -200 up to 250°C, min. span 10K
<b>6</b>	Ni1000, -60 up to 150°C, min. span 10K
<b>7</b>	Resistance transmitter 10 up to 400 Ohm, Min. span 10 Ohm
<b>8</b>	Resistance transmitter 10 up to 2000 Ohm, Min. span 100 Ohm

Configuration:	
<b>A</b>	Factory setup Pt100 3-wire 0-100°C
<b>B</b>	Measuring range, see additional spec.
<b>C</b>	TC config. range, see questionnaire
<b>D</b>	RTD config. range, see questionnaire

Additional option:	
<b>A</b>	Standard - DIN mounting set
<b>B</b>	Works calib.certif., 6-point, DIN mounting set
<b>K</b>	US - M4 mounting screws





## Accessories

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### Device-specific accessories

Configuration kit TXU10-AA  
Interface cable plus PC software Readwin® 2000

## Ergänzende Dokumentation

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### Standard documentation

- Operating instructions KA141R/09/
- ATEX Safety instructions:
  - ATEX II1G: XA004R/09
  - ATEX II3G: XA010R/09
  - ATEX II3D: XA026R/09

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