

# Temperature transmitter

## *iTEMP*<sup>®</sup> PCP DIN rail TMT 121

**Universal temperature transmitter for resistance thermometers (RTD), thermocouples, resistance and voltage transmitters, configurable via a PC**



ReadWin<sup>®</sup> 2000  
*iTEMP*<sup>®</sup>  
PCP



### Application areas

- PC programmable (PCP) DIN rail temperature transmitter for converting various input signals into an scalable 4 to 20 mA analogue output signal
- Input:
  - Resistance thermometer (RTD)
  - Thermocouple (TC)
  - Resistance transmitter ( $\Omega$ )
  - Voltage transmitter (mV)
- Online configuration using PC with TMT 180A, TMT 181A or TMT 121A configuration kit

### Features and benefits

- Universally PC programmable 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
- Ex-Certification:
  - ATEX Ex ia
  - FM IS
  - CSA IS
- Ship building approval GL
- Galvanic isolation
- Output simulation
- Customer-specific linearisation
- Linearisation curve match
- Online configuration during measurement using SETUP connector
- Customer-specific measurement range settings or expanded SETUP (see questionnaire, page 7)



Endress + Hauser

The Power of Know How



## Operation and system construction

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

**Measurement system** The iTEMP® PCP DIN rail TMT 121 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. The TMT 121 is set up using the TMT 180A, TMT 181A or TMT 121A configuration kit.

## Input

**Measured variable** Temperature (temperature linear), resistance and voltage.

**Measuring range** Dependent on the sensor connection and input signal the transmitter evaluates a number of different measurement ranges.

### Type of input

	Type	Measurement ranges	Minimum measurement range
<i>Resistance thermometer (RTD)</i>	Pt100 Pt500 Pt1000 acc. to IEC 751	-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 10 K 10 K
	Ni100 Ni500 Ni1000 acc. to DIN 43760	-60 to 180 °C (-76 to 356 °F) -60 to 150 °C (-76 to 302 °F) -60 to 150 °C (-76 to 302 °F)	10 K 10 K 10 K
	<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 20 Ω)</li> <li>• Sensor cable resistance max. 40 Ω per cable</li> <li>• Sensor current: ≤ 0.6 mA</li> </ul>		
<i>Resistance transmitter</i>	Resistance Ω	10 to 400 Ω 10 to 2000 Ω	10 Ω 100 Ω
<i>Thermocouples (TC)</i>	B (PtRh30-PtRh6) C (W5Re-W26Re) <sup>I</sup> D (W3Re-W25Re) <sup>I</sup> E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) L (Fe-CuNi) <sup>II</sup> N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi) U (Cu-CuNi) <sup>II</sup> 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) -200 to + 915 °C (-328 to 1679 °F) -200 to +1200 °C (-328 to 2192 °F) -200 to +1372 °C (-328 to 2501 °F) -200 to +900 °C (-328 to 1652 °F) -270 to +1300 °C (-454 to 2372 °F) 0 to +1768 °C (32 to 3214 °F) 0 to +1768 °C (32 to 3214 °F) -200 to +400 °C (-328 to 752 °F) -200 to +600 °C (-328 to 1112 °F)	500 K 500 K 500 K 50 K 50 K 50 K 50 K 50 K 500 K 500 K 50 K 50 K
	<ul style="list-style-type: none"> <li>• Cold junction internal (Pt100) or external (0 to 80 °C)</li> <li>• Cold junction accuracy: ± 1 K</li> <li>• Sensor current = 30 nA</li> </ul>		
<i>Voltage transmitters</i>	Millivolt transmitter	-10 to 100 mV	5 mV

I. according to ASTM E988

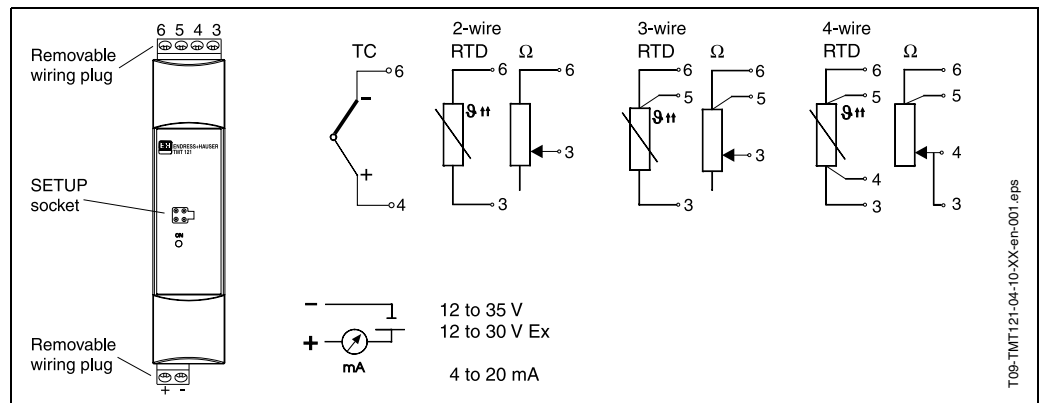
II. according to DIN 43710

## Output

<b>Output signal</b>	Analogue 4 to 20 mA, 20 to 4 mA
<b>Signal on alarm</b>	<ul style="list-style-type: none"> <li>• Measurement range undercut: Linear drop to 3.8 mA</li> <li>• Exceeding measurement range: Linear rise to 20.5 mA</li> <li>• Sensor breakage; Sensor short circuit<sup>1</sup>: ≤ 3.6 mA or ≥ 21.0 mA</li> </ul>
<b>Load</b>	Max. $(V_{\text{Power supply}} - 12 \text{ V}) / 0.022 \text{ A}$ (Current output)
<b>Linearisation / transmission behaviour</b>	Temperature linear, resistance linear, voltage linear
<b>Filter</b>	Digital filter 1. degree: 0 to 8 s
<b>Galvanic isolation</b>	U = 2 kV AC (Input/output)
<b>Min. current consumption</b>	≤ 3.5 mA
<b>Current limit</b>	≤ 23 mA
<b>Switch on delay</b>	4 s (during power up $I_a \approx 3.8 \text{ mA}$ )

## Auxiliary energy

### Electrical connection



Temperature transmitter terminal connections

<b>Power supply</b>	$U_b = 12 \text{ to } 35 \text{ V}$ , polarity protected
<b>Residual ripple</b>	Allowable ripple $U_{ss} \leq 3 \text{ V}$ at $U_b \geq 15 \text{ V}$ , $f_{\text{max.}} = 1 \text{ kHz}$

1. Not for thermocouple

## Performance characteristics

**Response time** < 1 s

**Reference operating conditions** Calibration temperature: +23 °C (+73.4 °F) ± 5 K

### Maximum measured error

	Type	Measur. accuracy <sup>l</sup>
<b>Resistance thermometer RTD</b>	Pt100, Ni100	0.2 K or 0.08%
	Pt500, Ni500	0.5 K or 0.20%
	Pt1000, Ni1000	0.3 K or 0.12%
<b>Thermocouple TC</b>	K, J, T, E, L, U	typ. 0.5 K or 0.08%
	N, C, D	typ. 1.0 K or 0.08%
	S, B, R	typ. 2.0 K or 0.08%

	Measurement range	Measur. accuracy <sup>l</sup>
<b>Resistance transmitter (Ω)</b>	10 to 400 Ω	± 0.1 Ω or 0.08%
	10 to 2000 Ω	± 1.5 Ω or 0.12%
<b>Voltage transmitter (mV)</b>	-10 to 100 mV	± 20 μV or 0.08%

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

**Influence of power supply** ≤ ± 0.01%/V deviation from 24 V  
All data is related to a measurement end value

### Influence of ambient temperature (temperature drift)

- Resistance thermometer (RTD):  
 $T_d = \pm (15 \text{ ppm/K} * \text{max. meas. range} + 50 \text{ ppm/K} * \text{preset meas. range}) * \Delta \vartheta$
- Resistance thermometer Pt100:  
 $T_d = \pm (15 \text{ ppm/K} * (\text{range end value} + 200) + 50 \text{ ppm/K} * \text{preset meas. range}) * \Delta \vartheta$
- Thermocouple (TC):  
 $T_d = \pm (50 \text{ ppm/K} * \text{max. meas. range} + 50 \text{ ppm/K} * \text{preset meas. range}) * \Delta \vartheta$

$\Delta \vartheta$  = Deviation of the ambient temperature according to the reference condition (+73.4 °F ± 5 K).

**Long term stability** ≤ 0.1K/Year or ≤ 0.05%/Year  
According to reference conditions. % is related to the adjusted measurement range (the value to be applied is the greater).

**Influence of load** ≤ ±0.02%/100 Ω  
All data is related to a measurement end value

**Influence of cold junction** Pt100 DIN IEC 751 Cl. B (internal reference junction for thermocouples TC)

## Installation conditions

**Installation instructions** **Orientation**  
No limit

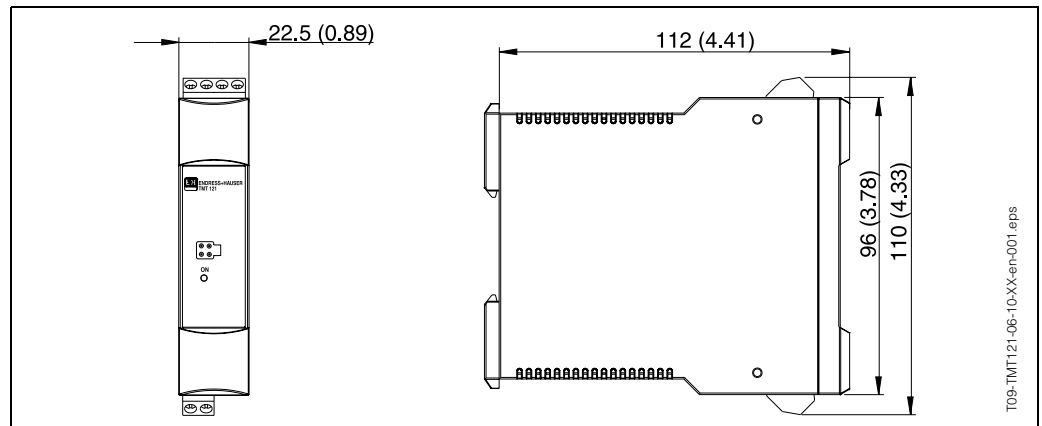
## Environmental conditions

**Ambient temperature limits** -40 to +85 °C (-40 to 185 °F) - for Ex-areas see Ex-certification

<b>Storage temperature</b>	-40 to +100 °C (-40 to 212 °F)
<b>Climate class</b>	According to EN 60 654-1, Class C
<b>Ingress protection</b>	IP 20
<b>Shock and vibration resistance</b>	4g / 2 to 150 Hz as per IEC 60 068-2-6
<b>Electromagnetic compatibility (EMC)</b>	Interference immunity and interference emission according to EN 61 326-1 (IEC 1326) and NAMUR NE 21
<b>Condensation</b>	Allowable

## Mechanical construction

### Design, dimensions



Dimensions in mm (inch)

<b>Weight</b>	Approx. 90 g
<b>Material</b>	Housing: Plastic PC/ABS, UL 94V0
<b>Terminals</b>	Keyed plug-in screw terminals, core size max. 2.5 mm <sup>2</sup> solid, or strands with ferrules

## Human interface

<b>Display elements</b>	At the temperature transmitter no display elements are available directly. With the PC software ReadWin <sup>®</sup> 2000 the current measured value can be displayed.
<b>Operating elements</b>	At the temperature transmitter no operating elements are available directly. The temperature transmitter will be configured by remote operation with the PC software ReadWin <sup>®</sup> 2000.

<b>Remote operation</b>	<b>Configuration</b> Configuration kit TMT 180A, TMT 181A or TMT 121A, configurable using PC programme (ReadWin <sup>®</sup> 2000). Starting from version Rel. 2.00.00 of TMT 180A, TMT 181A and TMT 121A the temperature transmitter is configurable without voltage supply.
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**Interface**

PC-Interface connection cable TTL -/- RS232 with plug

**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 (8 characters), output simulation

## 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.

**Ex approval**


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.

**Other standards and guidelines**

- EN 60529:  
Degrees of protection by housing (IP code)
- EN 61010:  
Safety requirements for electrical measurement, control and laboratory instrumentation
- EN 61326 (IEC 1326):  
Electromagnetic compatibility (EMC requirements)
- NAMUR  
Standardization association for measurement and control in chemical and pharmaceutical industries

# Ordering information

**Questionnaire**

<b>Questionnaire Endress+Hauser iTEMP temperature transmitter</b>		<b>Customer specific setup / Kundenspezifische Einstellung</b>	
			
<b>Standard setup / Standardeinstellung</b>			
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 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 type="checkbox"/> 3 wire <input type="checkbox"/> 4 wire	
Unit / Einheit		<input type="checkbox"/> °C <input type="checkbox"/> °F	
Range / Messbereich (not / nicht PROFIBUS-PA)	Low scale Anfang	<input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> , <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/>	Bitte beachten! Messbereich und min. Spanne (s. Techn. Daten)
	High scale Ende	<input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> , <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/>	Note! Range and min. span (s. Techn. data)
Bus address / Busadresse (only / nur PROFIBUS-PA)		<input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/>	<b>[0...126]</b>
<b>Expanded setup / Erweiterte Einstellung</b>			
Reference junction / Vergleichsstelle	<input type="checkbox"/> intern <input type="checkbox"/> extern	<input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/>	<input type="checkbox"/> [0...80°C; 32...176°F] (only / nur TC)
Compensation wire resistance / Kompensation Leitungswiderstand		<input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/>	<input type="checkbox"/> [0...20 Ohm] (only / nur RTD 2 wire) <input type="checkbox"/> [0...30 Ohm] (only / nur HART, PA RTD 2 wire)
Failure mode / Fehlverhalten	<input type="checkbox"/> ≤ 3,6 mA <input type="checkbox"/> ≥ 21,0 mA		(not / nicht PROFIBUS-PA)
Output / Ausgang	<input type="checkbox"/> 4...20 mA <input type="checkbox"/> 20...4 mA		(not / nicht PROFIBUS-PA)
Filter		<input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/>	<input type="checkbox"/> [0, 1, 2, ..., 8s] (only / nur PCP) <input type="checkbox"/> [0, 1, 2, ..., 100s]
Offset		<input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/> , <input style="width: 20px; height: 15px; border: 1px solid black;" type="text"/>	<input type="checkbox"/> [-9,9...0...+9,9K]
TAG	PCP	<input style="width: 100%; height: 15px; border: 1px solid black;" type="text"/>	
	HART	(HART: 8 char. TAG + 16 char. Descriptor , PROFIBUS-PA: 32 char.)	
	PROFIBUS-PA	<input style="width: 100%; height: 15px; border: 1px dashed black;" type="text"/>	

**Product structure**

**Temperature transmitter iTEMP® PCP DIN rail TMT 121**  
 PC programmable temperature transmitter, for RTDs, TCs, Ohm and mV, Analogue output 4 to 20 mA, 2-wire techn., Galv. isol., fail. mode to NAMUR NE 43, 22.5 mm wide, for 35 mm top hat DIN rail, according to EN 50022, UL recognized, ship building approval GL

Certification	
<b>A</b>	Version for non Ex areas
<b>B</b>	ATEX II 2(1) G 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 II 3G EEx nA IIC T4/T5/T6

Configuration transmitter connection	
<b>A</b>	Standard factory configuration 3-wire
<b>1</b>	Configuration connection TC
<b>2</b>	Configuration connection RTD 2-wire
<b>3</b>	Configuration connection RTD 3-wire
<b>4</b>	Configuration connection RTD 4-wire

Configuration temperature sensor	
<b>A</b>	Standard factory configuration Pt100
<b>1</b>	Config. Pt100      -200 to 850 °C      (-328 to 1562 °F)      min. span 10 K to IEC 751 (a = 0.00385)
<b>2</b>	Config. Ni100      -60 to 180 °C      (-76 to 356 °F)      min. span 10 K
<b>3</b>	Config. Pt500      -200 to 250 °C      (-328 to 482 °F)      min. span 10 K
<b>4</b>	Config. Ni500      -60 to 150 °C      (-76 to 302 °F)      min. span 10 K
<b>5</b>	Config. Pt1000      -200 to 250 °C      (-328 to 482 °F)      min. span 10 K
<b>6</b>	Config. Ni1000      -60 to 150 °C      (-76 to 302 °F)      min. span 10 K
<b>7</b>	Config. resistance transm. 10 to 400 Ohm, min. span. 10 Ohm
<b>8</b>	Config. resistance transm. 10 to 2000 Ohm, min. span. 100 Ohm
<b>B</b>	Config. Typ B      0 to 1820 °C      (32 to 3308 °F)      min. span 500 K
<b>C</b>	Config. Typ C      0 to 2320 °C      (32 to 4208 °F)      min. span 500 K
<b>D</b>	Config. Typ D      0 to 2495 °C      (32 to 4523 °F)      min. span 500 K
<b>E</b>	Config. Typ E      -200 to 1000 °C      (-328 to 1832 °F)      min. span 50 K
<b>J</b>	Config. Typ J      -200 to 1200 °C      (-328 to 2192 °F)      min. span 50 K
<b>K</b>	Config. Typ K      -270 to 1372 °C      (-454 to 2501 °F)      min. span 50 K
<b>L</b>	Config. Typ L      -200 to 900 °C      (-328 to 1652 °F)      min. span 50 K
<b>N</b>	Config. Typ N      -270 to 1300 °C      (-454 to 2372 °F)      min. span 50 K
<b>R</b>	Config. Typ R      0 to 1768 °C      (32 to 3214 °F)      min. span 500 K
<b>S</b>	Config. Typ S      0 to 1768 °C      (32 to 3214 °F)      min. span 500 K
<b>T</b>	Config. Typ T      -200 to 400 °C      (-328 to 752 °F)      min. span 50 K
<b>U</b>	Config. Typ U      -200 to 600 °C      (-328 to 1112 °F)      min. span 50 K
<b>V</b>	Config. voltage transmitter -10 to 100 mV, min. span 5 mV

Setup	
<b>A</b>	Standard factory configuration (Pt100/3-wire/0 to 100 °C)
<b>B</b>	Customised measurement range
<b>C</b>	Customised expanded configuration for TC (see questionnaire)
<b>D</b>	Customised expanded configuration for RTD (see questionnaire)

Model	
<b>A</b>	Standard model
<b>B</b>	Works calibration certificate 6 test points
<b>TMT121-</b>	← <b>Order code</b>

**Customised options**

51002391	TAG print 2 x 16 char
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## Accessories

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TMT 121A-VK - Configuration kit iTEMP PCP/Pt:

Set up programme (ReadWin® 2000) and PC serial interface connection cable (TTL/RS 232C) for configuration of the TMT 121.

Order No.: TMT 121A-VK

ReadWin® 2000 can be downloaded free of charge from the internet from the following address:  
**[www.endress.com/readwin](http://www.endress.com/readwin)**

## Further Documentation

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- System information 'iTEMP® Temperature transmitter' (SI 008R/09/en)
- Short operating manual "iTEMP® PCP DIN rail TMT 121" (KA 126R/09/a3)
- Additional documentation for use in explosion-hazardous areas:
  - ATEX II2(1)G (XA 013R/09/a3)
  - ATEX II3G (XA 018R/09/a3)
  - FM, CSA, etc.

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**Subject to modification**

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