

# 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**



### 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 50 K 50 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

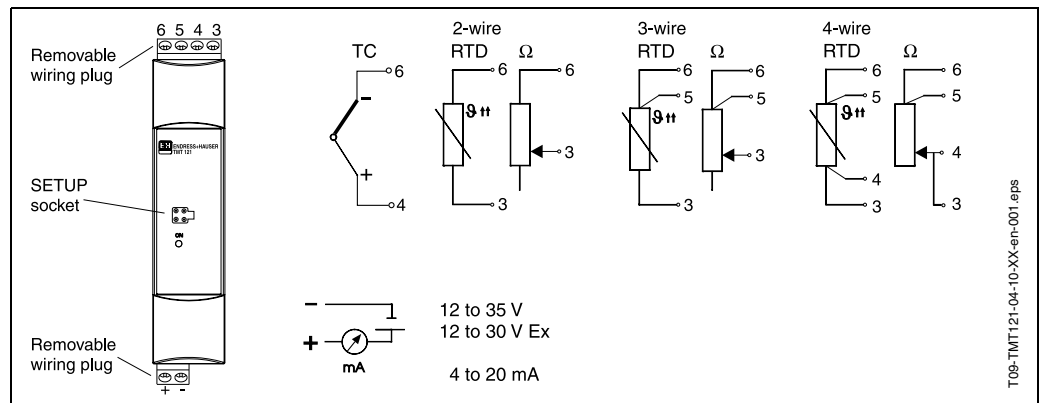
II. according to DIN 43710

## 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

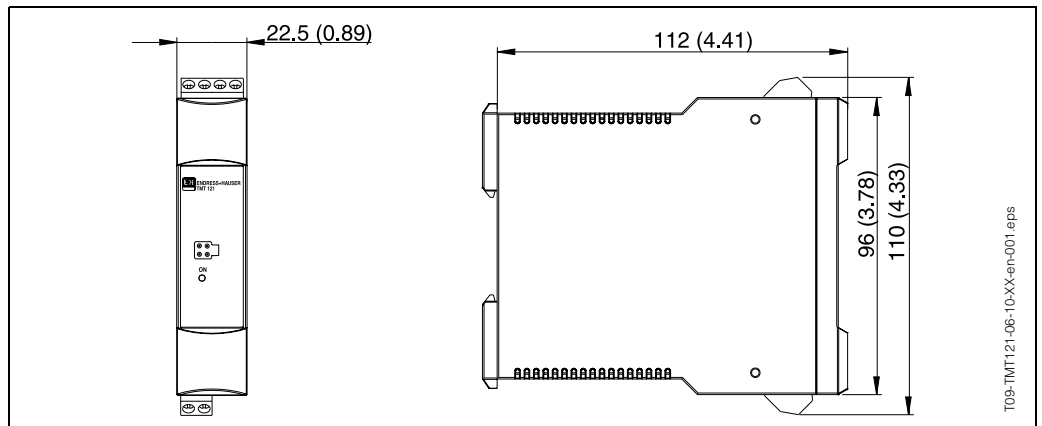
## Environmental conditions

**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>	<p><b>Configuration</b></p> <p>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.</p>
-------------------------	--

**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

Questionnaire Endress+Hauser iTEMP temperature transmitter				
Customer specific setup / Kundenspezifische Einstellung				
<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 type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> , <input type="text"/>	Bitte beachten! Messbereich und min. Spanne (s. Techn. Daten)	
	High scale Ende	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> , <input type="text"/>	Note! Range and min. span (s. Techn. data)	
Bus address / Busadresse (only / nur PROFIBUS-PA)		<input type="text"/> <input type="text"/> <input type="text"/>	<b>[0...126]</b>	
<b>Expanded setup / Erweiterte Einstellung</b>				
Reference junction / Vergleichsstelle	<input type="checkbox"/> intern <input type="checkbox"/> extern	<input type="text"/> <input type="text"/> <input type="text"/>	[0...80°C; 32...176°F] (only / nur TC)	
Compensation wire resistance / Kompensation Leitungswiderstand		<input type="text"/> <input type="text"/>	[0...20 Ohm] (only / nur RTD 2 wire) [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 type="text"/> <input type="text"/> <input type="text"/>	[0, 1, 2, ..., 8s] (only / nur PCP) [0, 1, 2, ..., 100s]	
Offset		<input type="text"/> , <input type="text"/>	[-9,9...0...+9,9K]	
TAG	PCP	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>		
	HART	(HART: 8 char. TAG + 16 char. Descriptor , PROFIBUS-PA: 32 char.)		
	PROFIBUS-PA	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>		

## Product structure

<b>Temperature transmitter iTEMP® PCP DIN rail TMT 121</b> 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
--

<b>Certification</b>			
<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		
<b>Configuration transmitter connection</b>			
<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		
<b>Configuration temperature sensor</b>			
<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		
<b>Setup</b>			
<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)		
<b>Model</b>			
<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
----------	-----------------------



## Accessories

---

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

---

- 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.

---

**Subject to modification**

---

Endress+Hauser  
GmbH+Co.  
Instruments International  
P.O. Box 2222  
D-79574 Weil am Rhein  
Germany

Tel. (07621) 975-02  
Tx 773926  
Fax (07621) 975 345  
<http://www.endress.com>  
[info@ii.endress.com](mailto:info@ii.endress.com)

**Endress + Hauser**  
The Power of Know How

