



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

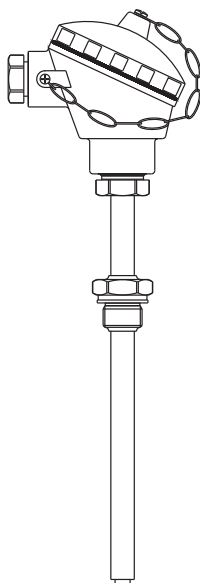


Solutions

## Operating instructions

# TM501

RTD/TC thermometer with thermowell



**zh** 带保护套管的 RTD/TC 温度计

**en** RTD/TC thermometer (from page 15)



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## 重要的注意事项



电击会导致人员死亡或者重大伤亡事故。如果将本装置安装在高压环境中，一旦出现故障或者安装错误，则接线端子或者传感器会有高压电。

只有在仔细阅读、完全理解并且遵守本操作说明书，才能保障安全操作温度传感器。

## 1 安全指示

### 1.1 用途

- 此装置是一个RTD/TC温度计，配置热保护套管和陶瓷接线终端，应用范围很广。温度计能在-50 °C至+650 °C(-58 °F至 +1202°F)的温度环境下使用，具体测量温度取决于所使用的环境。  
此产品具有测量精度高，响应时间快，成本效益高，同时可选用4...20mA输出，带HART协议的温度变送器
- 如果由于误操作或者未按照要求使用此装置而造成损失，制造商不承担任何责任。

### 1.2 安装、调试和运行

- 只能由有资质的、被授权的专业人员（例如：电气技术人员）严格按照本手册中所述的指南、相关规范、法规和合格证（具体根据应用而定）安装、连接和调试本装置。
- 专业人员必须阅读和理解本手册并且按照本手册所述的指南进行安装与操作。
- 损坏的装置不能被使用，必须在损坏的装置上贴上标识，以告知其他人员。

### 1.3 操作安全

- 本装置是按照现行最新的技术进行制造和测试的。在出厂时符合相关的规范和欧洲标准。
- 请参考铭牌上的技术数据！
- 使用的电源必须符合IEC 61010-1：“SELV或者2级电路”的要求。
- 此装置不可重复使用。在装置废弃后，按照当地规范处理此装置。

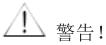
1.4 安全惯例和图标注释

应参考本操作手册中标注了以下标识的安全指示：



告诫！

此标识的含意是指在操作过程中或者在运行程序过程中，如果操作不当，则可能会损坏或者彻底毁坏此装置。



警告！

此标识的含意是指在操作过程中或者在运行程序过程中，如果操作不当，则可能造成人员伤亡，威胁到人员安全或者毁坏此装置。



注意！

此标识的含意是指在操作过程中或者在运行程序过程中，如果操作不当，则可能会对设备的运行造成间接影响或者引起设备产生意外的反应。

2 标识

2.1 设备标识

对照测量点要求，比较和检查装置铭牌上的细节。

1

2

3

4

Made in China 2010  
215021 Suzhou-SIP  
Ord. no. TM501-B113C11A1B 1TM1180-B  
Ser. no. 012345678910 Range: 0...100 °C  
1xPt100/TF/4/CL A: -50...400 °C  
Measuring range: -50...400 °C  
L = 250 mm P55

Endress+Hauser

CE

00013603

- 1、产品型号和序列号
- 2、订单要求：传感器、连接模式和测量范围
- 3、电气连接
- 4、追踪条形码

图1: 温度计铭牌如图示

## 2.2 装置清单

设备的交付范围包括：

- 订单上的RTD/TC温度计

管道连接附件不与温度计一起提供，客户需自备连接附件。在交付设备时会提供工艺连接所需要的垫圈。

- 多个语种的操作说明书。

## 3 安装

### 3.1 入库验收、运输和贮存

#### 3.1.1 入库验收

在收到货物后，检查以下几点：

- 产品或包装有无缺陷？
- 所有交付的产品是否齐全？

#### 3.1.2 运输与贮存

请注意以下几点：

- 在包装装置时，应确保其可以承受贮运过程中产生的冲击力。
- 贮存温度范围： -40 至 +85 °C (-40至185 °F)

# 3.2 安装条件

## 3.2.1 尺寸

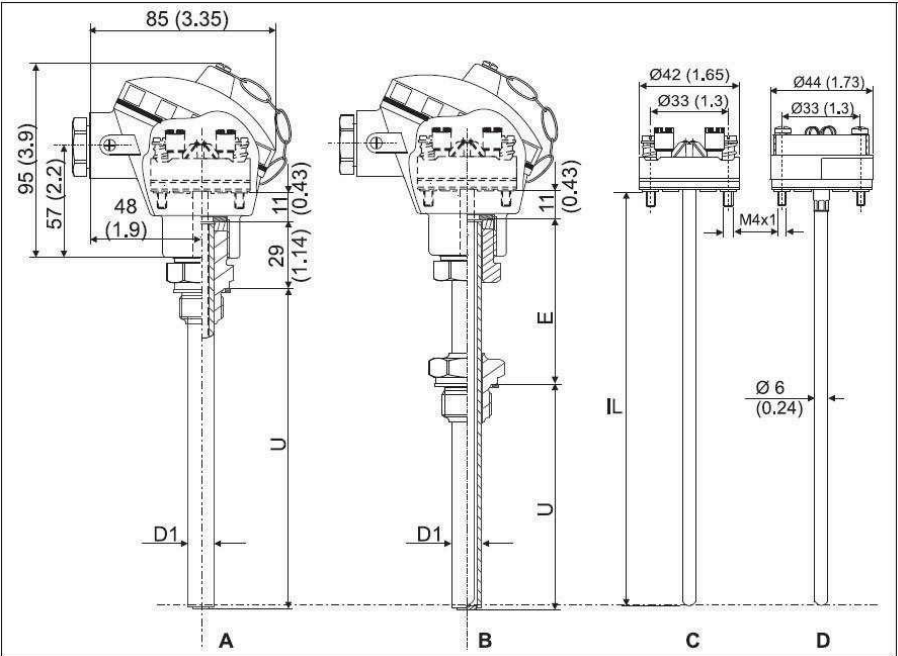
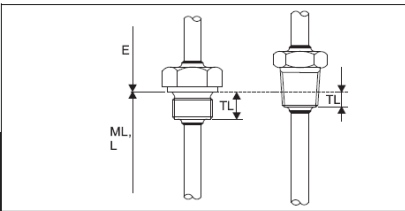


图2: 温度计的所有尺寸, 使用毫米 (英寸) 表示 (表面粗糙度Ra ≤ 3,2 μm (126 μinch))

- A 无延伸颈的型号
- B 有延伸颈的型号
- C 带接线端子块可更换的温度芯子
- D 带温度变送器可更换的温度芯子
- IL 热电阻铠芯长度

E 延伸颈的长度	U 浸没长度	D1 热保护套管的直径	电气接口
80毫米 (3.15英寸)	75毫米 (2.95英寸)	12 毫米 (0.47英寸)	M20x1.5
150毫米 (5.9英寸)	100毫米 (3.94英寸)	16 毫米 (0.63英寸)	½" NPT
200毫米 (7.9英寸)	150毫米 (5.9英寸)		
无延伸颈的型号 (= A型)	200毫米 (7.9英寸)		
	250毫米 (9.84英寸)		
	50...4000毫米		
	(1.97...157.5英寸)		

螺纹连接	型号	螺柱长度TL 毫米（英寸）	通过平面的 宽度AF
圆柱螺纹（M,G）      锥螺纹（NPT）	M27x2	16 (0.63)	32
	M33x2	18 (0.71)	41
	M20x1.5	15 (0.6)	24
	G1/2” DIN/BSP		27
	NPT1/2”	8(0.32)	22
	图3：过程来接管 E=颈长    ML,L=侵入长度		

3.2.2 常规信息

- 允许的环境温度范围：

接线端	温度°C (°F)
不带温度变送器	-40至130 °C (-40至266 °F)
带温度变送器	-40至85 °C (-40至185 °F)

- 测量范围：  
-50至+650°C (-58至+1202 °F)
- 最大许可过程压力：  
75 bar (1088 psi)
- 流速：  
最大流速(v)取决于热保护套管直径D1和浸入长度U，例如：在U=150毫米（5.9英寸）和水温T=50 °C(122 °F)，v= 11米/秒（36英尺/秒）。

3.3 安装指示



- 按照当地相关的规定安装装置。
- 避免由于任何冲击、摩擦和安装引起的火花,请采用防火花的扳手。
- 使用合适的电缆压盖和电缆进口将温度传感器与电源或者其他外部电线相连。
- 必须采用合适的电缆、导管和导线。只能使用经批准的电缆线。



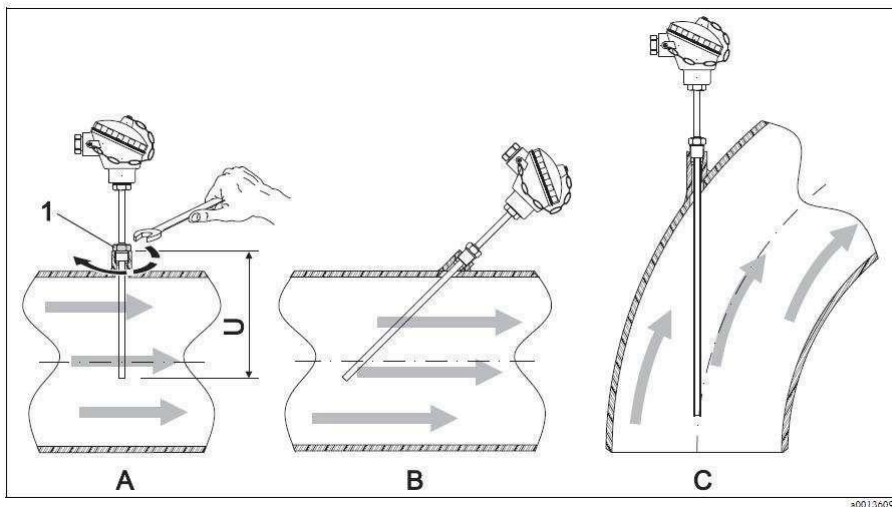


图4: 安装示例

A: 在横断面较小的管道中, 传感器末端应伸到或者稍微延伸到管道中心线 (=U)。

B - C: 倾斜安装。

热保护套管的浸入深度会直接影响到温度测量的精度。如果浸入深度过浅时,系统的过程连接和罐壁处的热传导效应会引起测量误差。因此,在管道上安装传感器时,探头的浸入深度至少应为管径的一半。

- 安装点：管道、贮箱或者其他设施。
- 浸入长度至少等于热保护套直径的8倍。

例如：热保护套管直径为12mm（0.47in）时，传感器的浸入深度应为96（12x8）毫米（3.8英寸）。建议选取符合DIN43772标准的浸入深度120毫米（4.72英寸）。

- 使用合适的开口扳手进行安装（参照图示A）。



△注意！

传感器安装在直径较小的管道中测量时，必须确保探头的末端到达或越过管道的轴心点(参照图示A)。也可以考虑斜插安装方式（参考图示B和C）。

在确定传感器浸入长度时，需综合考虑传感器的各项技术指标和过程参数（如介质流速，过程压力等）。

#### 4 接线



告诫！

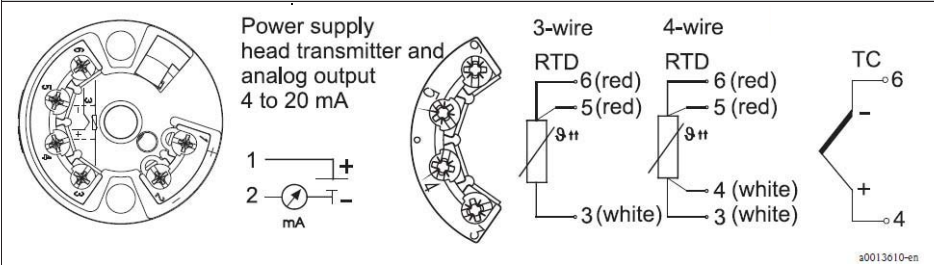
在安装或者连接传感器前应关闭电源。如不遵守此规定，则可以会损坏传感器。

按照以下步骤连接温度变送器或陶瓷接线板：

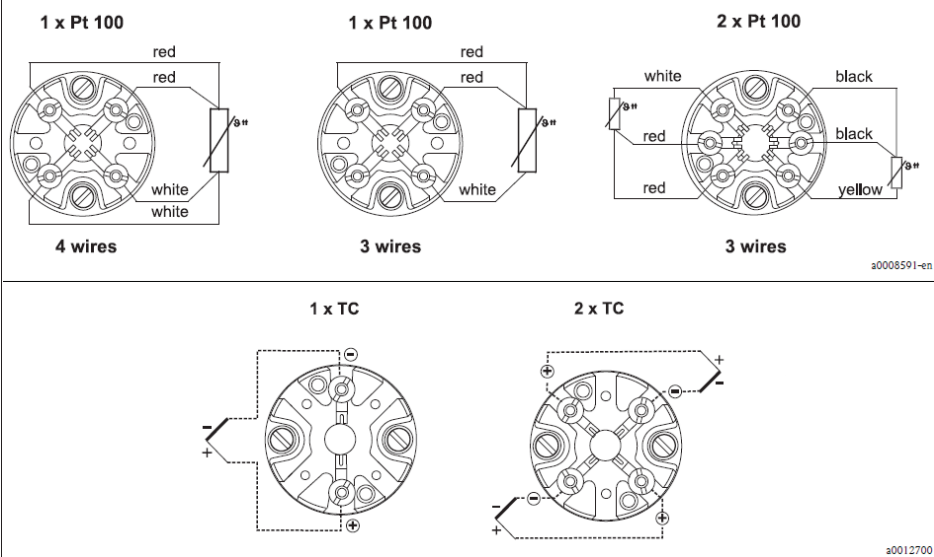
1. 打开电缆压盖和接线盒的上盖。
2. 将电缆穿过电缆压盖上的开口。
3. 按照下图所示连接电缆。
4. 再次拧紧电缆压盖和关闭上盖。

#### 安装温度变送器TMT18x (单输入)

电缆不超过 $1.75 \text{ mm}^2$  (用螺丝紧固) 或用不超过 $1.5 \text{ mm}^2$ 带接线端子的电缆。



接线端子块 用不超过 $2.5 \text{ mm}^2$ 带接线端子的电缆。



5 调试

在安装设备后，应按照以下步骤进行最终检查。

装置条件和规范	注释
装置和电缆有无损坏（目测）？	-
是否按照规范安装了装置？	-
电气条件	注释
电源电压是否与变送器铭牌上标注的规格相同（可选）？	-
是否消除了电缆的应变？	-
电源线和信号线连接是否正确？	参考接线图。
是否拧紧所有的螺丝终端？	-
是否安装、拧紧和密封了所有的电缆入口？	-
是否安装和拧紧了终端外盖？	

装置一旦通电，便可以运行。

6 维修

此装置无需要进行维修。

7 故障

7.1 备件

TPR100是RTD的备件，型号代码： TPR100-  
TPC100是T C 的备件， 型号代码： TPC100-

如果需要插入件的备件，请注意以下公式：

型号	插入件的总长度IL，毫米（英寸）
A, 无延伸颈	$IL = U + 29 (1.14) + 11 (0.43)$
B, 有延伸颈	$IL = E + U + 11 (0.43)$

7.2 返回

在装置返回至Endress+Hauser之前，应先实施以下程序：

- 随附一份填写完整的“设备去污声明”表格。在内网[www.endress.com/returned-material](http://www.endress.com/returned-material)中下载此声明表格。
- 清除所有的流体残余，如果流体对人体危害很大（例如：易燃物、有毒物、腐蚀物和致癌物），则这一点尤其重要。



警告！

如果你不能保证已经完全清除了残留危险物，例如：危险物已经渗入缝隙或者通过塑料进行了扩散，则不能返回此测量装置。

7.3 报废

本装置由电子元件组成，因此，在报废处理之时，应该按照电子废物的方式进行处理。请遵守本国的废物处理规定。

8 技术参数

8.1 输入

测量原理
热电阻温度测量

测量范围	
型号	测量范围
Pt100按照IEC 60751	-50 至+600 °C (-58 至+1112 °F)
TC K,J按照IEC 60584	-50 至+650 °C (-58 至+1202 °F)

8.2 输出

输出信号
<ul style="list-style-type: none"><li>• 标配：--Pt100, A 级, 4 线。 --TC 1*or 2* K, 1*ro 2* J</li><li>• 可选：4-20 Ma 或者 20-4 Ma 或者带有 HART®-协议。</li></ul>

8.3 性能特征

<b>参考装配条件</b>
<ul style="list-style-type: none"> <li>• Pt100 传感器的校正温度 0 ° C (32 ° F) (冰点)</li> <li>• 温度变送器的环境温度 25 ° C ± 5 ° C (77 ° F ± 9 ° F)</li> </ul>

<b>测量得到的最大误差</b>
<p>RTD 应符合 IEC 60751 的要求</p> <ul style="list-style-type: none"> <li>• 薄膜式 (TF) - 测量范围: -50 至 400 ° C, A 级: <math>\pm (0.15 + 0.002 \cdot  t )</math> 从 -50 至 +250 ° C</li> <li>• 绕线式 (WW) - 测量范围: -50 至 500 ° C, A 级: <math>\pm (0.15 + 0.002 \cdot  t )</math> - 50 至 +450 ° C</li> </ul> <p>TC 应符合 IEC 60584 的要求</p> <ul style="list-style-type: none"> <li>• 型号 J (Fe-CuNi) - 测量范围 -50 至 650 ° C, class 1:  <math>\pm 1.5^{\circ} \text{C}</math> (从 -40 至 375 ° C)  <math>\pm 0.004 t </math> (从 375 至 650 ° C)</li> <li>• 型号 K (NiCr-Ni) - 测量范围 -50 至 1100 ° C, class 1:  <math>\pm 1.5^{\circ} \text{C}</math> (从 -40 至 375 ° C)  <math>\pm 0.004 t </math> (从 375 至 1000 ° C)</li> </ul>

1)  $|t|$  = 绝对温度 ° C. 在采用 ° F 表示的测量误差中, 采用上述等式进行换算, 换算成使用 ° C 表示, 然后, 采用输出乘以 1.8。

<b>温度变送器规格 (可选)</b>
<p><b>长期稳定性</b></p> <p>≤ 0.1 K (0.18 ° F)/年或者 ≤ 0.05%/年</p>
<p><b>环境温度的影响(温度波动)</b></p> <p>• Pt100电阻温度计:</p> <p><math>T_d = \pm (15 \text{ ppm/K} * (\text{整个测量的刻度范围内} + 200) + 50 \text{ ppm/K} * \text{设置测量范围}) * \Delta \vartheta</math></p> <p><math>\Delta \vartheta</math> = 环境温度与参考运行条件下温度之间的偏差。</p>
<p><b>负荷影响</b></p> <p>± 0.02%/100。此规格依据测量的刻度范围而定。</p>

响应时间符合 IEC 60751。		
材料	热保护套管直径 D1 = 12 毫米 (0.47 英寸)	热保护套管直径 D1 = 16 毫米 (0.63 英寸)
RTD 响应时间符合 IEC60751		
SS 316L	t90≤190 s	t90≤260 s
1Cr18Ni9Ti	t90≤200 s	
TC		
SS 316L/1Cr18Ni9Ti	t90≤110 s	t90≤146 s

自热，RTD 的影响
量小，可忽略

传感器电流
< 0.6 mA

绝缘电阻
在环境温度下绝缘电阻是 100M $\Omega$ 。 100V DC 常温测试条件下，每个接线端子于其保护层间的绝缘阻抗大于 100M $\Omega$

8.4 机械结构

外观和尺寸
见 3.2.1

重量	
例如：U = 300 毫米 (11.8 英寸) 和 E = 150 毫米 (5.9 英寸)	0.6 千克 (21.2 oz)

材料
<ul style="list-style-type: none"><li>表头：铝合金ADC12</li><li>过程连接： SS 316L 或者1Cr18Ni9Ti.</li></ul>

8.5 环境条件

环境温度
3.2.2

保护等级
IP 65

抗震和振动
符合 IEC 60068-2-6， 4g / 2-150 Hz。

参考文件
如果需要温度变送器的操作说明，请参考内网 <a href="http://www.endress.com/temperature">www.endress.com/temperature</a> 。

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## Important Notice



### Warning!

Electrical shock could cause death or serious injury. If the sensor is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on the connection terminals or the probe itself.

Safe and secure operation of the temperature sensor can only be guaranteed if the operating instructions of the used transmitters and all included safety notes are read, understood and followed. For applied Endress+Hauser temperature transmitters see enclosed Operating Instructions.

## 1 Safety instructions

### 1.1 Designated use

- The device is a RTD/TC thermometer provided with thermowells and terminal head for an universal range of application. The thermometer is designed for use in a temperature range from -50 °C up to +650 °C (-58 °F up to 1202 °F) depending on the used option. Sensor is wired via terminal block or head transmitter with enhanced accuracy, reliability and cost effectiveness compared to directly wired sensors with the following outputs and protocols:
  - Analog output 4...20 mA
  - HART®
- The manufacturer is not liable for damage caused by improper or non-designated use.

### 1.2 Installation, commissioning, operation

- The device must only be installed, connected and commissioned by qualified and authorized expert staff (e.g. electrical technicians) strictly adhering to the instructions contained in this manual, the applicable norms, legal regulations and certificates (depending on the application).
- These experts must have read and understood this manual and follow the instructions it contains.
- Damaged devices must not be put into operation and they must be labeled as defective.

### 1.3 Operational safety


- The device is safely built and tested according to state-of-the-art technology and has left the factory in perfect condition as regards technical safety. The applicable regulations and European standards have been taken into account.
- Please observe the technical data on the nameplate!
- The device must only be powered by a power supply unit with a limited energy electric circuit in accordance with IEC 61010-1: "SELV or Class 2 circuit".





- Due to its design, the device is not repairable. When later disposing of the device, please observe the local regulations.

1.4 Notes on safety conventions and icons

Always refer to the safety instructions in these Operating Instructions labeled with the following symbols:

- 

**Caution!**  
This symbol draws attention to activities or procedures that can lead to defective operation or to destruction of the unit if not carried out properly.
- 

**Warning!**  
This symbol draws attention to activities or procedures that can lead to injuries to persons, safety risks or the destruction of the unit if not carried out properly.
- 

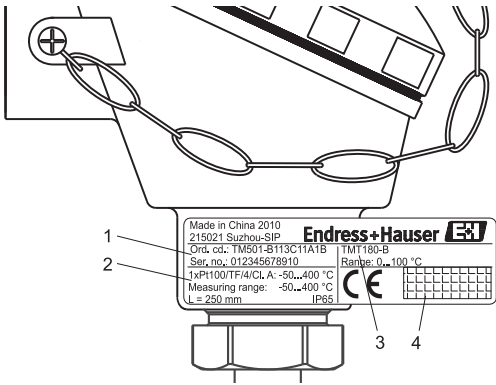
**Note!**  
This symbol draws attention to activities or procedures that have an indirect effect on operation, or can trigger an unforeseen unit reaction if not carried out properly.

2 Identification

2.1 Device designation

The right device?

Compare and check the details on the device nameplate against the measuring point requirements:



The diagram shows a thermometer with a nameplate. Callout 1 points to the top left of the nameplate. Callout 2 points to the top left of the nameplate. Callout 3 points to the CE mark. Callout 4 points to the 2D matrix code.

1	Order code and serial number
2	Order specification: Sensor, connection mode, measuring range
3	Electronical connection
4	2D Matrix code

*Fig. 1: Nameplate of the thermometer, as example*

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## 2.2 Scope of delivery

The scope of delivery of the device comprises:

- RTD/TC thermometer on order  
The accessories for pipe connections are not supplied with the thermometer. These are the customer's responsibility. The appropriate gaskets for the process connection are supplied with the device.
- Multilingual hard copy of Operating Instructions

## 3 Installation

### 3.1 Incoming acceptance, transport, storage

#### 3.1.1 Incoming acceptance

On receipt of the goods, check the following points:

- Are the contents or the packaging free of damage?
- Is the delivery complete? Check the scope of delivery against your order.

#### 3.1.2 Transport and storage

Note the following points:

- Pack the device in such a way as to protect it reliably against impact for storage (and transportation).
- The permitted storage temperature is: -40 to +85 °C (-40 to +185 °F).

# 3.2 Installation conditions

## 3.2.1 Dimensions

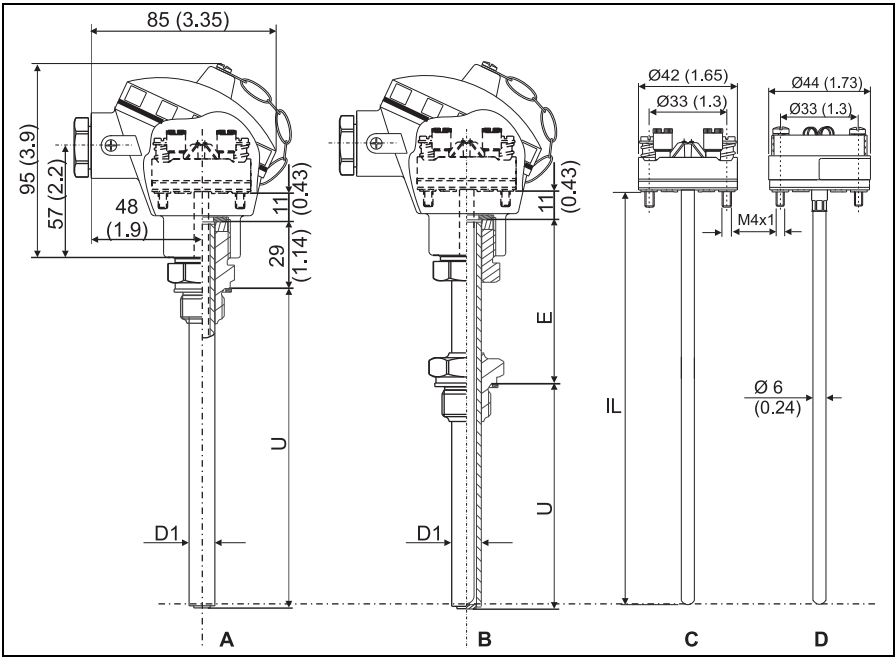


Fig. 2: All dimensions of the thermometer in mm (in). Surface roughness  $Ra \leq 3,2 \mu m$  (126  $\mu in$ )

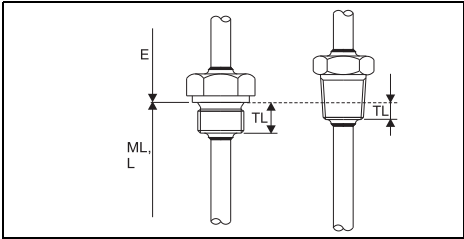
- A Model without extension neck

B Model with extension neck
- C Replaceable insert with terminal block mounted

D Replaceable insert with head transmitter mounted

IL Total length of insert

E length of extension neck	U immersion length	D1 thermowell diameter	Cable entry
80 mm (3.15 in) 150 mm (5.9 in) 200 mm (7.9 in) without (= model A)	75 mm (2.95 in) 100 mm (3.94 in) 150 mm (5.9 in) 200 mm (7.9 in) 250 mm (9.84 in) as specified 50...4000 mm (1.97...157.5 in)	12 mm (0.47 in) 16 mm (0.63 in)	M20x1.5 ½" NPT

Threaded process connection		Version	Thread length TL in mm (in)	Width across flats AF
Cylindrical (version M, G)	Conical (version NPT)	M27x2	16 (0.63)	32
		M33x2	18 (0.71)	41
		M20x1.5	15 (0.6)	24
		G½" DIN / BSP		27
		NPT½"	8 (0.32)	22

*Fig. 3: Process connection*

E = length of extended neck  
ML, L = immersion length

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3.2.2 General information

- Permitted ambient temperature range:

Terminal head	Temperature in °C (°F)
Without mounted head transmitter	-40 to 130 °C (-40 to 266 °F)
With mounted head transmitter	-40 to 85 °C (-40 to 185 °F)

- Process temperature limits:  
-50 to +650 °C (-58 to +1202 °F)
- Process pressure limits:  
75 bar (1088 psi)
- Flow rate:  
The maximum flow velocity (v) is depending on the thermowell diameter D1 and the immersion length U, e.g.: v = 11 m/s (36 ft/s) for U = 150 mm (5.9 in), water at T = 50 °C (122 °F).

3.3 Installation instructions

1. Install the unit according to the relevant local regulations.
2. Avoid any spark due to impact, friction and installation. Anti-sparking wrenches should be utilized.
3. The temperature sensor should be connected to the power supply or other external circuit using the appropriate cable glands and wire entries.
4. Suitable cables, conduit and conductors must be used. Only use approved wire entries.

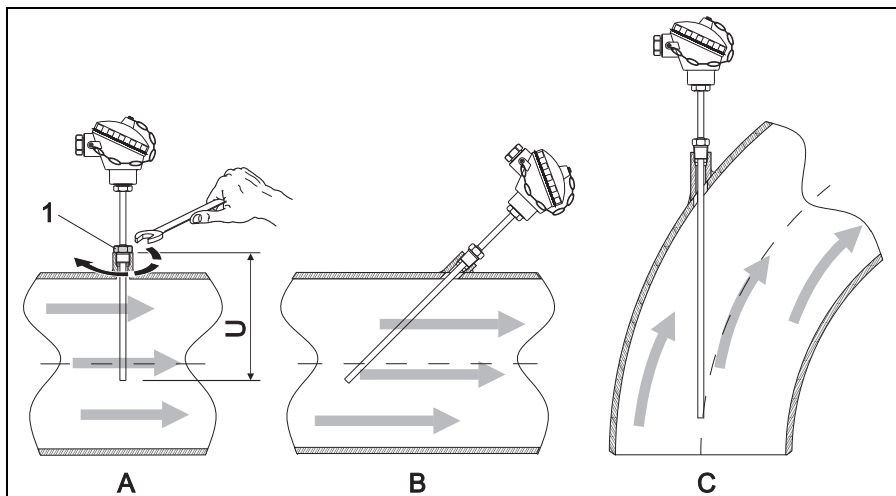


Fig. 4: Installation examples

A: In pipes with a small cross section the sensor tip should reach or extend slightly past the center line of the pipe (= U).  
B - C: Tilted installation.

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The immersion length of the thermometer influences the accuracy. If the immersion length is too small then errors in the measurement are caused by heat loss via the process connection and the container wall. If installing into a pipe then the immersion length must be half of the pipe diameter, ideally.

- Installation possibilities: Pipes, tanks or other plant components
- The immersion length should correspond to at least 8 times of the thermowell diameter.  
Example: Thermowell diameter 12 mm (0.47 in) x 8 = 96 mm (3.8 in). A standard immersion length of 120 mm (4.72 in) is recommended.
- Always install the device at the spanner flats (see item 1). Use a suitable open-ended wrench for this task (see table, → 19).



#### Note!

When operating in pipes with small nominal diameters it must be guaranteed that the thermowell tip is extending far enough into the process to reach out past the pipe center line (see Pos. A). A further solution could be an angled (tilted) installation (see Pos. B and C). When determining the immersion length all thermometer parameters and the process to be measured must be taken into account (e.g. flow velocity, process pressure).

# 4 Wiring

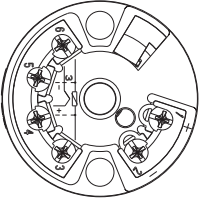


**Caution!**  
Switch off power supply before installing or connecting the device. Failure to observe this may result in destruction of the device.


For wiring a head mounted transmitter or a terminal block, proceed as follows:

- 1. Open the cable gland and the housing cover on the terminal head.
- 2. Feed the cables through the opening in the cable gland.
- 3. Connect the cables as shown in the figures below.
- 4. Retighten the cable gland and close the housing cover.


**Head mounted transmitter TMT18x (single input)**  
**Terminals: Cable up to max. 1.75 mm<sup>2</sup> - secure screws or 1.5 mm<sup>2</sup> with wire end ferrules**



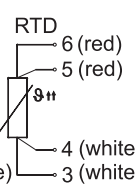
Power supply  
head transmitter and  
analog output  
4 to 20 mA



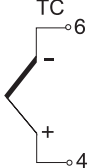
1 — +  
2 — - mA



3-wire  
RTD  
6 (red)  
5 (red)  
3 (white)



4-wire  
RTD  
6 (red)  
5 (red)  
4 (white)  
3 (white)

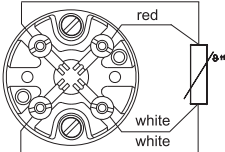


TC  
6  
4

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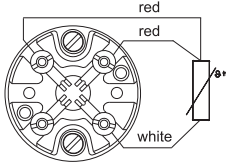
**Terminal block mounted**  
**Terminals: Cable up to max. 2.5 mm<sup>2</sup> with wire end ferrules**

**1 x Pt 100**



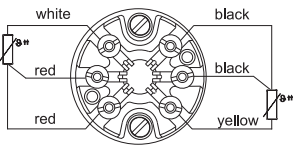
4 wires

**1 x Pt 100**



3 wires

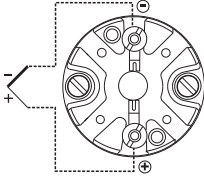
**2 x Pt 100**



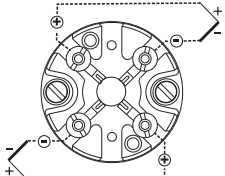
3 wires

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**1 x TC**



**2 x TC**



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# 5 Commissioning

After installation of the device, always perform the following final checks:

Device condition and specifications	Notes
Are the device and the cables free of damage (visual check)?	-
Has the device been mounted in accordance with specifications?	→ 19
Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate of the transmitter (as option)?	-
Do the cables have adequate strain relief?	-
Are the power supply and signal cables correctly connected?	see wiring diagram
Are all the screw terminals well tightened?	-
Are all the cable entries installed, tightened and sealed?	-
Is the terminal head cover installed and tightened?	

Once the supply voltage is applied, the device is in operation.

# 6 Maintenance

No maintenance work is required on the device.

# 7 Troubleshooting

## 7.1 Spare parts

The RTD/TC inserts are available as spare parts.

Order-codes:

**TPR100-...** (RTD)

**TPC100-...** (TC)

If the insert is required as a spare part, please note the following formula:

Model	Total length of insert IL in mm (in)
A, without extension neck	$IL = U + 29 \text{ (1.14)} + 11 \text{ (0.43)}$
B, with extension neck	$IL = E + U + 11 \text{ (0.43)}$

## 7.2 Return

The following procedures must be carried out before a device is returned to Endress+Hauser:

- Always enclose a fully completed “Declaration of Decontamination” form with the device. This declaration form can be downloaded from the internet at [www.products.endress.com/returned-material](http://www.products.endress.com/returned-material).
- Remove all fluid residues. This is particularly important if the fluid is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.



**Warning!**  
Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.

## 7.3 Disposal

The device contains electronic components and must, therefore, be disposed of as electronic waste in the event of disposal. Please observe in particular the local waste disposal regulations of your country.

# 8 Technical data

## 8.1 Input

Measuring principle
Temperature (temperature-linear transmission behavior)

Measuring range	
<b>Designation</b> Pt100 according to IEC 60751 TC type K and type J according to IEC 60584	<b>Measuring range limits</b> -50 to +600 °C (-58 to +1112 °F) -50 to +650 °C (-58 to +1202 °F)

## 8.2 Output

Output signal
<ul style="list-style-type: none"><li>■ Standard:<ul style="list-style-type: none"><li>– Pt100, Class A, 4-wire</li><li>– 1x or 2x TC type K or type J, class 1</li></ul></li><li>■ Optional: 4 to 20 mA or 20 to 4 mA, or with HART®-protocol</li></ul>



### 8.3 Performance characteristics

Reference operating conditions
<ul style="list-style-type: none"> <li>Calibration temperature (ice bath) 0 °C (32 °F) for Pt100 sensor</li> <li>Ambient temperature 25 °C ± 5 °C (77 °F ± 9 °F) for head transmitter</li> </ul>

Maximum measured error
<p>RTD corresponding to IEC 60751</p> <ul style="list-style-type: none"> <li>Type thin film (TF) – measurement range: -50 to 400 °C, Class A: <math>\pm (0.15 + 0.002 \cdot  t ^{1.1})</math> from -50 to +250 °C</li> <li>Type wire wound (WW) – measurement range: -50 to 500 °C, Class A: <math>\pm (0.15 + 0.002 \cdot  t )</math> from -50 to +450 °C</li> </ul> <p>TC corresponding to IEC 60584</p> <ul style="list-style-type: none"> <li>Type J (Fe-CuNi) – measurement range: -50 to 650 °C, Class 1: ±1.5 °C (from -40 to 375 °C) ±0.004 ·  t  (from 375 to 650 °C)</li> <li>Type K (NiCr-Ni) – measurement range: -50 to 1100 °C, Class 1: ±1.5 °C (from -40 to 375 °C) ±0.004 ·  t  (from 375 to 1000 °C)</li> </ul>

- 1) |t| = absolute value °C. For measurement errors in °F, calculate using equations above in °C, then multiply the outcome by 1.8.

Head transmitter specifications (as option)
<p><b>Long-term stability</b>  <math>\leq 0.1 \text{ K (0.18 °F)/year}</math> or <math>\leq 0.05\%/year</math>            Data under reference conditions. % relates to the set span. The larger value applies.</p>
<p><b>Influence of ambient temperature (temperature drift)</b></p> <ul style="list-style-type: none"> <li>Pt100 resistance thermometer:  <math>T_d = \pm (15 \text{ ppm/K} \cdot (\text{full scale value of measuring range} + 200) + 50 \text{ ppm/K} \cdot \Delta \vartheta)</math>  <math>\Delta \vartheta</math> = deviation of ambient temperature from the reference operating condition.</li> </ul>
<p><b>Influence of load</b>  <math>\pm 0.02\%/100 \Omega</math>. Specifications refer to the full scale value of the measuring range.</p>


Response time measured in water flow at 0.4 m/s (1.3 ft/s) and 10 K temperature step change		
Material	Thermowell diameter D1 = 12 mm (0.47 in)	Thermowell diameter D1 = 16 mm (0.63 in)
RTD according to IEC 60571		
SS 316L	t <sub>90</sub> ≤ 190 s	t <sub>90</sub> ≤ 260 s
1Cr18Ni9Ti	t <sub>90</sub> ≤ 200 s	
TC		
SS 316L / 1Cr18Ni9Ti	t <sub>90</sub> ≤ 110 s	t <sub>90</sub> ≤ 146 s

Self-heating, effect of the RTD
Negligible small

Sensor current
< 0.6 mA

Insulation resistance
Insulation resistance 100 MΩ at ambient temperature. Insulation resistance between each terminal and the sheath is tested with a voltage of 100 V DC.


8.4 Mechanical construction

Design, dimensions
→  19

Weight	
Version with U = 300 mm (11.8 in) and E = 150 mm (5.9 in) as example	0.6 kg (21.2 oz)

Material
<ul style="list-style-type: none"><li>Terminal head: Aluminum alloy ADC12</li><li>Parts in contact with process and process connection: SS 316L or 1Cr18Ni9Ti.</li></ul>

8.5 Environment conditions

Ambient temperature
→  19

Degree of protection
IP 65

Shock and vibration resistance
4g / 2 to 150 Hz as per IEC 60068-2-6

**Documentation**

The Operating Instructions for the head transmitter which are supplied and correspond to the assembled head transmitter type apply.  
Furthermore, all important Temperature Operating Instructions, particularly with regard to head transmitters are available on Internet: **[www.endress.com/temperature](http://www.endress.com/temperature)**

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