

# Technical Information

## RTD TH13, TH14 and TH15

RTD assemblies in thermowells with spring loaded insert and enclosure for process industry



### Application

The TH13, TH14 and TH15 temperature sensors are RTD assemblies installed in Thermowells and designed for use in all types of process industries, including harsh environments, due to their rugged design. The sensor is made up of a measurement probe with an insulated RTD element, sheath and a thermowell made of bar-stock material.

Among other applications the sensors can be used in process industries such as:

- Chemicals & petrochemical
- Power plants
- Refineries
- Offshore platforms

### Head Transmitter

All Endress+Hauser transmitters are available with enhanced accuracy and reliability compared to directly wired sensors. Instead of directly wiring your temperature sensors to your control system, use transmitters to reduce wiring and maintenance costs while increasing measurement accuracy.

### Field Transmitter

Temperature field transmitters with HART® or FOUNDATION Fieldbus™ protocol for highest reliability in harsh industrial environments. Backlit display with large measured value, bargraph and fault condition indication for ease of reading.

### Your benefits

- High flexibility due to modular assembly with standard terminal heads and customized immersion length
- One Source shopping for temperature measurement solutions. World class transmitter with integrated sensor offering for heavy process industry applications.
  - Remove and Install straight out of the box!
- Improved Galvanic Isolation on most devices (2 kV)
- Simplified Model Structure: Competitively priced, offers great value. Easy to order and reorder. A single model number includes sensor and transmitter assembly for a complete point solution
- All iTEMP transmitters provide long term stability  $\leq 0.05\%$  per year
- Fast response time with reduced/tapered tip form

## Function and system design

### Measuring principle

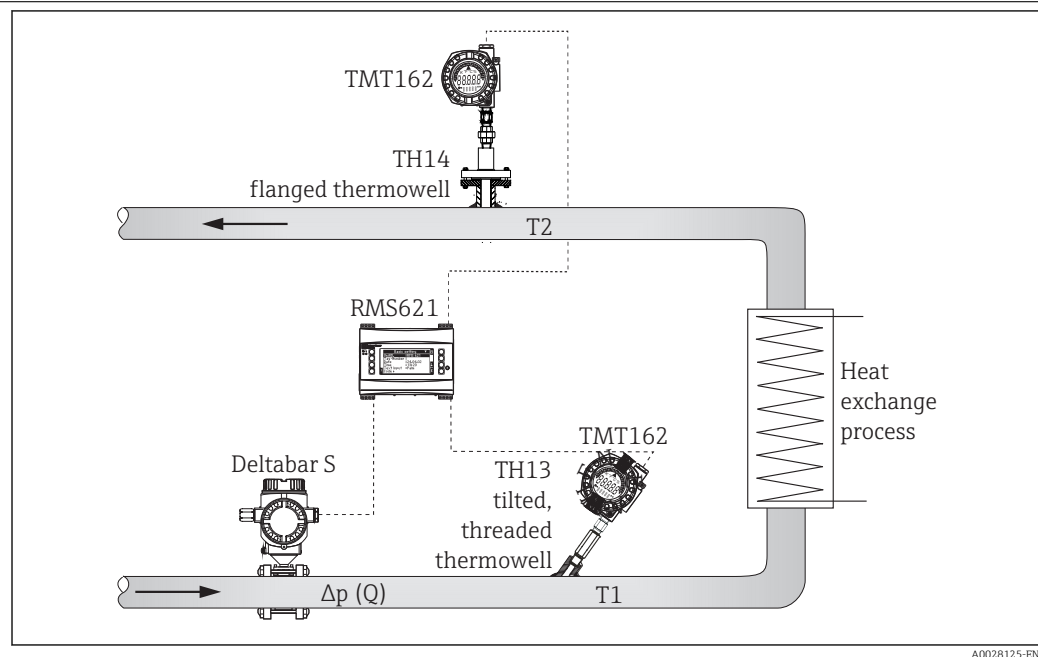
These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. This temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100  $\Omega$  at 0 °C (32 °F) and a temperature coefficient is  $\alpha = 0.003851 \text{ } ^\circ\text{C}^{-1}$ .

There are generally two different kinds of platinum resistance thermometers:

- Wire wound (WW):** Here, a double coil of fine, high-purity platinum wire is located in a ceramic support. This is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 °C (1 112 °F). This type of sensor is relatively large in size and it is comparatively sensitive to vibrations.
- Thin film platinum resistance thermometers (TF):** A very thin, ultrapure platinum layer, approx. 1  $\mu\text{m}$  thick, is vaporized in a vacuum on a ceramic substrate and then structured photolithographically. The platinum conductor paths formed in this way create the measuring resistance. Additional covering and passivation layers are applied and reliably protect the thin platinum layer from contamination and oxidation even at high temperatures.

The primary advantages of thin-film temperature sensors over wire wound versions are their smaller sizes and better vibration resistance. A relatively low principle-based deviation of the resistance/temperature characteristic from the standard characteristic of IEC 60751 can frequently be observed among TF sensors at high temperatures. As a result, the tight limit values of tolerance category A as per IEC 60751 can only be observed with TF sensors at temperatures up to approx. 300 °C (572 °F). For this reason, thin-film sensors are generally only used for temperature measurements in ranges below 400 °C (932 °F).

### Measuring system



1 Example of an application of the temperature assemblies

#### Water - heat Differential

Calculation of heat quantity which is emitted or absorbed by a water flow in a heating or cooling system. The quantity of heat is calculated from the process variable for  $\Delta p$  flow ( $Q$ ) and the differential from the feed and return temperature ( $T_2 - T_1$ ). Bidirectional energy calculations, such as the calculating systems with changing flow direction (charging/discharging the heat accumulator) are also possible.

#### Energy manager RMS621

Energy conservation and cost expenditures are significant issues in today's industry. Accurate flow monitoring and calculation is the basis for thorough analysis and billing of energy. This data can serve as a basis to maximize savings potential and help in controlling operational costs on a daily basis. Endress+Hauser's energy managers provide accurate and reliable calculations for the

monitoring and control of energy consumption (both produced and consumed) according to international standards, e.g. IAPWS-IF 97, AGA8, ISO 5167 etc. For RMS621 details see Technical Information.

**iTEMP TMT162 Temperature Field Transmitter**

Aluminum or stainless steel dual compartment explosion - proof enclosure and compact, fully potted electronics provide the ultimate protection in harshest environments. TMT162 prevents costly plant shutdowns by detecting corrosion on RTDs or thermocouples before it corrupts the measured value. Endress+Hauser's Field Temperature Transmitters with backlit display and sensor backup functionality are designed with safety in mind to keep your plant, equipment and personnel safe. For TMT162 details see Technical Information.

**Deltabar S/Cerabar S**

The evolution series of Cerabar S/Deltabar S represents a decisive step ahead in making pressure instrumentation better and safer for the process industry. The development of new products thrives especially on the knowledge, commitment and experience of staff members. Permanent high performance can only be achieved if dedicated and enthusiastic people provide their ideas. Endress +Hauser's instruments are not only supposed to distinguish themselves for customers and users by technological novelties but also by the presence of people supporting this progress, be it in service, sales or production. For Deltabar S & Cerabar S details see Technical Information.

**Equipment architecture**

The single and duplex element RTDs are designed to measure temperature in a variety of process and laboratory applications. These RTDs are specifically designed for use in two different process temperature ranges and they will provide accurate and repeatable temperature measurement through a broad range of -200 to 600 °C (-328 to 1 112 °F). Low range thin film RTDs -50 to 200 °C (-58 to 392 °F) are constructed using silver plated copper internal leads, PTFE wire insulations with potting compounds to resist moisture penetration. High range RTDs -200 to 600 °C (-328 to 1 112 °F) are constructed with nickel internal leads inside swaged MgO insulated cable to allow higher temperature measurements at the RTD element and to provide higher temperature lead protection along the sheath.

## Input

**Measured variable**

Temperature (temperature-linear transmission behavior)

**Measuring range**

Construction	Model code (class and type of sensor)	max. range
Low temperature range	TH13-_____(A/C/E/G/J/L)_____	-50 to 200 °C (-58 to 392 °F)
	TH14-_____(A/C/E/G/J/L)_____	
	TH15-_____(A/C/E/G/J/L)_____	
High temperature range	TH13-_____(B/D/F/H/K/M)_____	-200 to 600 °C (-328 to 1 112 °F)
	TH14-_____(B/D/F/H/K/M)_____	
	TH15-_____(B/D/F/H/K/M)_____	



Options J, K, L, M are duplex platinum elements of two sensors inside the same sheath.

## Output

**Output signal**

Generally, the measured value can be transmitted in one of two ways:

- Directly-wired sensors - sensor measured values forwarded without a transmitter.
- Via all common protocols by selecting an appropriate Endress+Hauser iTEMP temperature transmitter. All the transmitters listed below are mounted directly in the terminal head or as field transmitter and wired with the sensory mechanism.

**Family of temperature transmitters**

Thermometers fitted with iTEMP transmitters are an installation-ready complete solution to improve temperature measurement by significantly increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

**PC programmable head transmitters**

They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP transmitters can be configured quickly and easily at a PC. Endress+Hauser offers free configuration software which can be downloaded from the Endress+Hauser Website. More information can be found in the Technical Information.

**HART® programmable head transmitters**

The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART® communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the terminal head (flat face) as per DIN EN 50446. Swift and easy operation, visualization and maintenance using universal device configuration tools like FieldCare, DeviceCare or FieldCommunicator 375/475. For more information, see the Technical Information.

**PROFIBUS® PA head transmitters**

Universally programmable head transmitter with PROFIBUS® PA communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. The configuration of PROFIBUS PA functions and of device-specific parameters is performed via fieldbus communication. For more information, see the Technical Information.

**FOUNDATION Fieldbus™ head transmitters**

Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. All transmitters are released for use in all important process control systems. The integration tests are performed in Endress+Hauser's "System World". For more information, see the Technical Information.

Advantages of the iTEMP transmitters:

- Dual or single sensor input (optionally for certain transmitters)
- Pluggable display (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions
- Sensor-transmitter matching for dual sensor input transmitters, based on Callendar/Van Dusen coefficients

**Galvanic isolation**

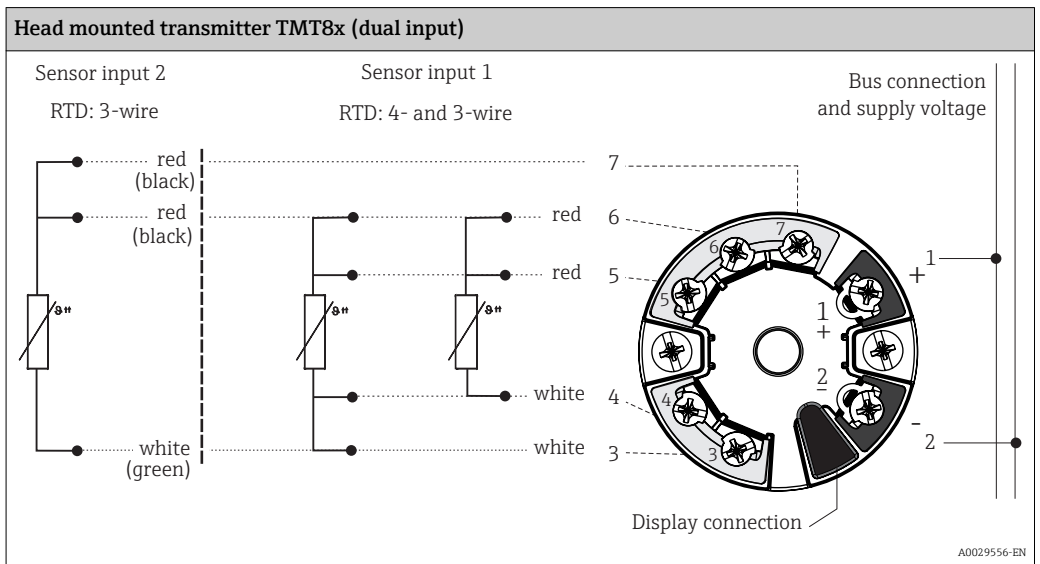
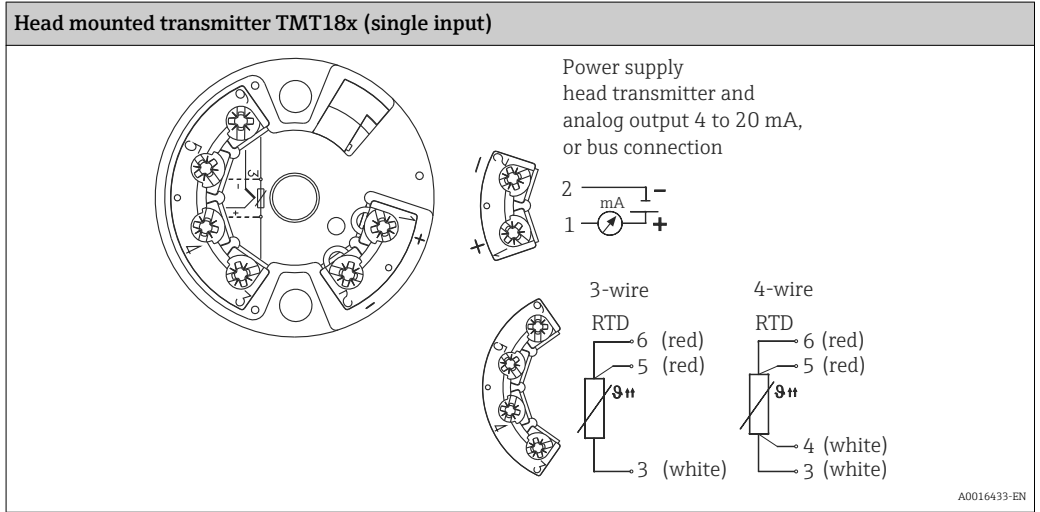
Galvanic isolation of Endress+Hauser iTEMP transmitters

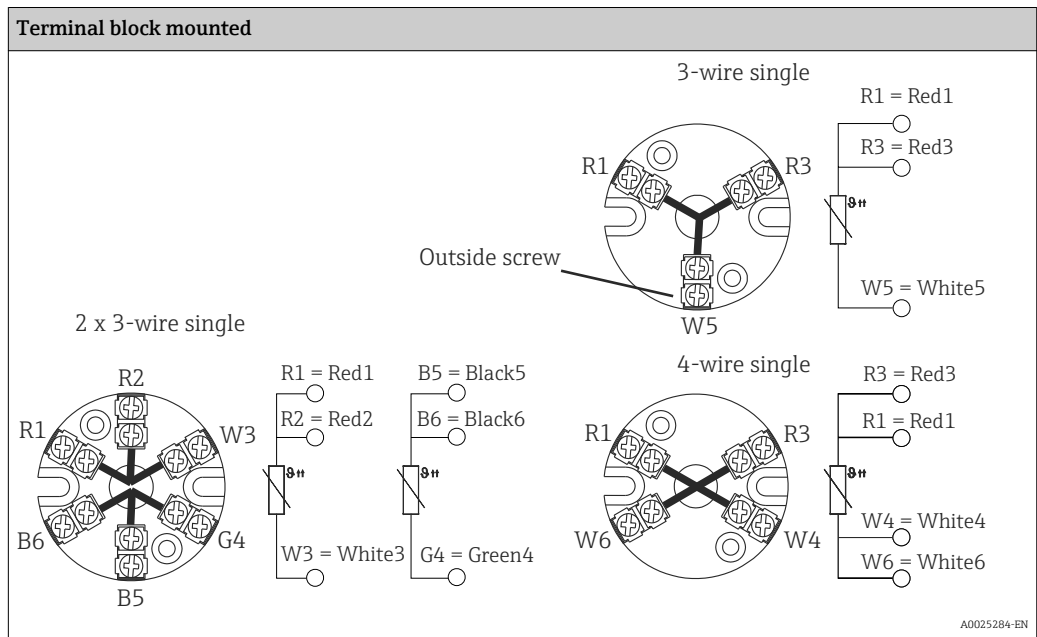
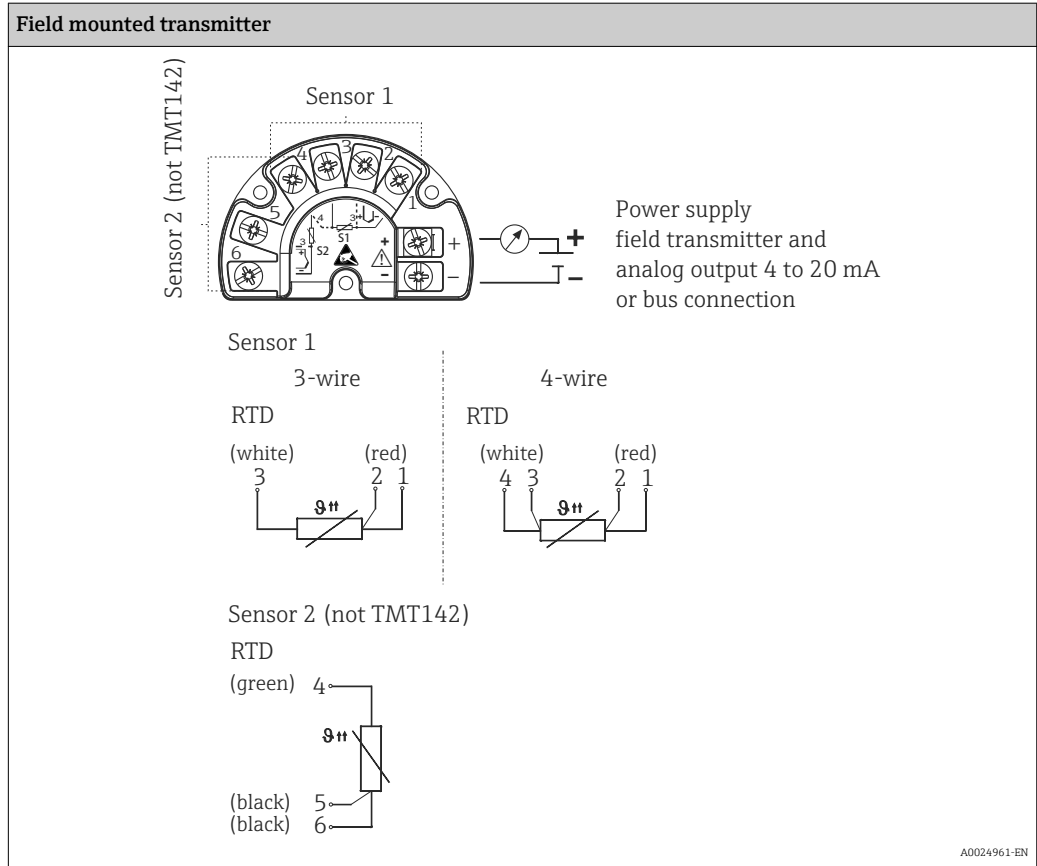
Transmitter type	Sensor
TMT181 PCP	$\hat{U} = 3.75 \text{ kV AC}$
TMT182 HART®	$U = 2 \text{ kV AC}$
TMT162 HART® Field transmitter	$U = 2 \text{ kV AC}$

# Power supply

Terminal assignment

Type of sensor connection





**i** The blocks and transmitters are shown as they sit inside the heads in reference to the conduit opening.

**Integrated overvoltage protection**

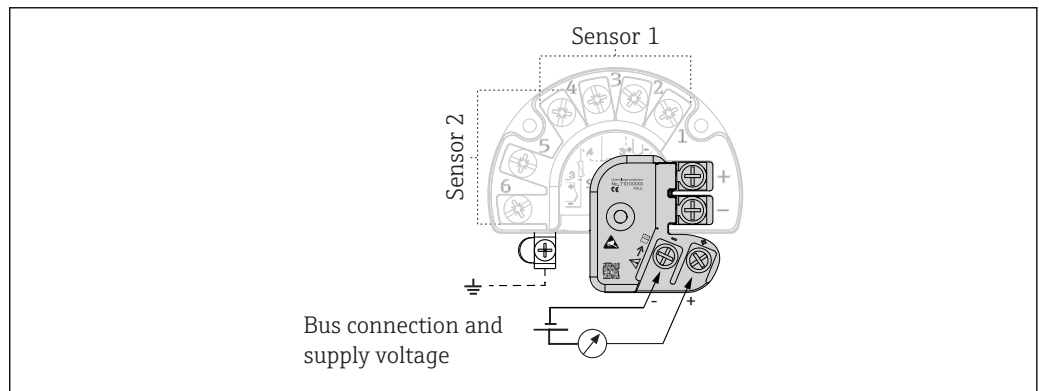
The integrated overvoltage protection module can be ordered as an optional extra <sup>1)</sup>. The module protects the electronics from damage from overvoltage. Overvoltage occurring in signal cables (e.g.

1) Available for the field transmitter with HART® 7 specification

4 to 20 mA, communication lines (fieldbus systems) and power supply is diverted to ground. The functionality of the transmitter is not affected as no problematic voltage drop occurs.

*Connection data:*

Maximum continuous voltage (rated voltage)	$U_C = 42 V_{DC}$
Nominal current	$I = 0.5 A$ at $T_{amb.} = 80\text{ }^\circ\text{C}$ (176 °F)
Surge current resistance <ul style="list-style-type: none"> <li>▪ Lightning surge current D1 (10/350 <math>\mu\text{s}</math>)</li> <li>▪ Nominal discharge current C1/C2 (8/20 <math>\mu\text{s}</math>)</li> </ul>	<ul style="list-style-type: none"> <li>▪ <math>I_{imp} = 1\text{ kA}</math> (per wire)</li> <li>▪ <math>I_n = 5\text{ kA}</math> (per wire)</li> <li>▪ <math>I_n = 10\text{ kA}</math> (total)</li> </ul>
Temperature range	-40 to +80 °C (-40 to +176 °F)
Series resistance per wire	1.8 $\Omega$ , tolerance $\pm 5\%$



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2 Electrical connection of the overvoltage protection

*Grounding*

The device must be connected to the potential equalization. The connection between the housing and the local ground must have a minimum cross-section of 4 mm<sup>2</sup> (13 AWG) . All ground connections must be secured tightly.

**Fieldbus connector**

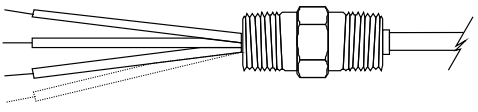
Type (dimensions in mm (in))	Specification		
Fieldbus connector to PROFIBUS® -PA or FOUNDATION Fieldbus™  A M12 on PROFIBUS® -PA connector or 7/8-16 UNC on FOUNDATION Fieldbus™ connector	<ul style="list-style-type: none"> <li>▪ Ambient temperature: -40 to 150 °C (-40 to 300 °F)</li> <li>▪ Degree of protection IP 67</li> </ul> Wiring diagram: 		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">                             PROFIBUS® -PA                              Pos. 1: grey (shield)                              Pos. 2: brown (+)                              Pos. 3: blue (-)                              Pos. 4: not connected                         </td> <td style="width: 50%;">                             FOUNDATION Fieldbus™                              Pos. 1: blue (-)                              Pos. 2: brown (+)                              Pos. 3: not connected                              Pos. 4: ground (green/yellow)                         </td> </tr> </table>	PROFIBUS® -PA Pos. 1: grey (shield) Pos. 2: brown (+) Pos. 3: blue (-) Pos. 4: not connected	FOUNDATION Fieldbus™ Pos. 1: blue (-) Pos. 2: brown (+) Pos. 3: not connected Pos. 4: ground (green/yellow)
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**Wire specifications**

24 AWG, 19 strand silver plated copper with 0.025 mm (0.010 in) PTFE extruded outer.

Electrical connection
Flying leads, standard 3" for wiring in terminal head, head mounted transmitter or terminal block mounted
Flying leads, 5½" for wiring with TMT162 or TMT142 assemblies

Design of leads
Flying leads 3" or 5½" with brass crimped sleeves



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## Performance characteristics

**Response time**

63% response time per ASTM E644

*RTD assembly TH15 without thermowell*

Construction	RTD Ø ¼"
High temperature range	3 s
Low temperature range	9 s

Response time for the sensor assembly without transmitter.

*Response time examples for RTD assemblies with thermowell TH13 and TH14*

Construction	Stepped thermowell	Tapered thermowell	¾" straight thermowell
High temperature range	20 s	25 s	30 s
Low temperature range	25 s	30 s	35 s

Response times for RTD assemblies with thermowell are provided for general design guidance without transmitter.

When the temperature of a process media changes, the output signal of a RTD assembly follows this change after a certain time delay. The physical cause is the time related to heat transfer from the process media through the thermowell and the insert to the sensor element (RTD). The manner in which the reading follows the change in temperature of the assembly over time is referred to as the response time. Variables that influence or impact the response time are:

- Wall thickness of thermowell
- Spacing between RTD insert and thermowell
- Sensor packaging
- Process parameters such as media, flow velocity, etc.



**Accuracy** RTD corresponding to IEC 60751

Class	max. Tolerances (°C)	Temperature range	Characteristics
<b>RTD max. error type TF - range: -50 to +500 °C</b>			
Cl. AA, former 1/3 Cl. B	$\pm (0.1 + 0.0017 \cdot  t ^{1})$	0 to +150 °C	
Cl. A	$\pm (0.15 + 0.002 \cdot  t ^{1})$	-30 to +300 °C	
Cl. B	$\pm (0.3 + 0.005 \cdot  t ^{1})$	-50 to +500 °C	
<b>RTD max. error type WW - range: -196 to +600 °C</b>			
Cl. AA, former 1/3 Cl. B	$\pm (0.1 + 0.0017 \cdot  t ^{1})$	-50 to +250 °C	
Cl. A	$\pm (0.15 + 0.002 \cdot  t ^{1})$	-100 to +450 °C	
Cl. B	$\pm (0.3 + 0.005 \cdot  t ^{1})$	-196 to +600 °C	

1) |t| = absolute value °C

For measurement errors in °F, calculate using equations above in °C, then multiply the outcome by 1.8.

**Transmitter specifications**

	TMT82 HART®/ TMT84 PA / TMT85 FF	TMT180 Pt100 PCP	TMT181 multifunctional PCP	TMT182 HART®	TMT162 HART® Field transmitter	TMT142
Measurement accuracy	± typ. 0.25 °C (0.45 °F)	0.2 °C (0.36 °F), optional 0.1 °C (0.18 °F) or 0.08% <sup>1)</sup>	0.5 °C (0.9 °F) or 0.08% <sup>1)</sup>		≤ 0.105 °C (0.19 °F)	0.2 °C (0.36 °F)
Sensor current	I ≤ 0.3 mA	I ≤ 0.6 mA		I ≤ 0.2 mA	I ≤ 0.3 mA	

1) % is related to the adjusted measurement range (the larger value applies)

**Transmitter long-term stability**

≤ 0.1 °C (0.18 °F)/year or ≤ 0.05% / year  
Data under reference conditions; % relates to the set span. The larger value applies.

**Insulation resistance**

Insulation resistance between terminals and probe sheath, test voltage 250 V.  
 ■ ≥ 100 MΩ at 25 °C (77 °F)  
 ■ ≥ 10 MΩ at 300 °C (572 °F)

**Self heating**

RTD elements are not self-powered and require a small current be passed through the device to provide a voltage that can be measured. Self-heating is the rise of temperature within the element itself, caused by the current flowing through the element. This self-heating appears as a measurement error and is affected by the thermal conductivity and velocity of the process being measured; it is negligible when an Endress+Hauser iTEMP temperature transmitter is connected.

**Calibration specifications**

3 point sensor calibration		
-40 to 0 °C (-40 to 32 °F)	0 to 100 °C (32 to 212 °F)	40 to 215 °C (104 to 420 °F)
Minimum length requirements for calibrated sensors = 6"		

Use option "B" (Block: Test; calibration) for RTD calibration, the three temperature points need to be specified in 5 °C (9 °F) increments.

The manufacturer provides comparison temperature calibrations from -40 to +215 °C (-40 to +420 °F) on the international temperature scale of 1990. Calibrations are traceable to standards maintained by the National Institute of Standards and Technology (NIST). Calibration services are in conformance with ASTM E220, IEC 17025 and ANSI/NC SL Z540-1-1994. The report of calibration is referenced to the serial number of the RTD assembly.

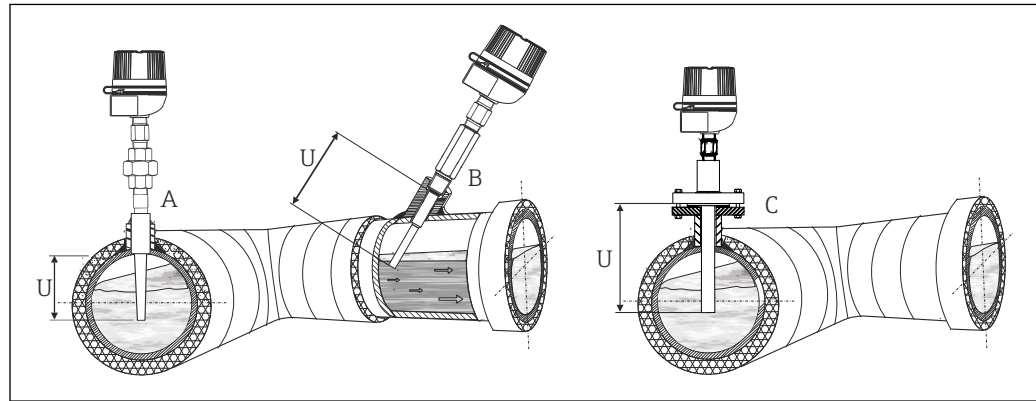
Three point calibrations are provided, given that the specified temperatures are within the recommended range and the minimum length requirements are met as specified. The minimum length is based on overall length 'x' of the spring loaded insert.

**Installation**

**Orientation**

No restrictions for installation orientation.

**Installation instructions**



3 Examples for pipe installation - In pipes with a small cross section the sensor tip should reach or extend slightly past the center line of the pipe (=U).

- A TH13 assembly socket weld installation
- B Threaded, tilted installation of TH13 assembly
- C Flange installation of TH14 assembly

**Immersion**

Minimum immersion per ASTM E644,  $\Delta T \leq 0.05 \text{ °C}$  (0.09 °F)

Immersion RTD assembly TH15 without thermowell

Construction	RTD Insert Ø ¼" Minimum Immersion (in)
High temperature range	1¼"
Low temperature range	¾"

For temperature assemblies with thermowell (TH13 and TH14) the minimum immersion is the depth to which the thermowell is immersed in the medium, measured from the tip. To minimize errors from ambient temperature the following minimum immersion lengths are recommended:

Construction	Minimum Immersion (in)
Stepped thermowell	2½"
Tapered thermowell	4½"
¾" straight thermowell	4"
Weld in thermowell	4½"

## Environment

Ambient temperature range	Terminal head	Temperature in °C (°F)
	Without mounted head transmitter	Depends on the terminal head used and the cable gland or fieldbus connector, see Terminal heads' section
	With mounted head transmitter	-40 to 85 °C (-40 to 185 °F) SIL mode (HART 7 transmitter): -40 to 70 °C (-40 to 158 °F)
	With mounted head transmitter and display	-20 to 70 °C (-4 to 158 °F)
	With mounted field transmitter	<ul style="list-style-type: none"> <li>▪ Without display: -40 to 85 °C (-40 to 185 °F)</li> <li>▪ With display and/or integrated overvoltage protection module: -40 to +80 °C (-40 to +176 °F)</li> <li>▪ SIL mode: -40 to +75 °C (-40 to +167 °F)</li> </ul>

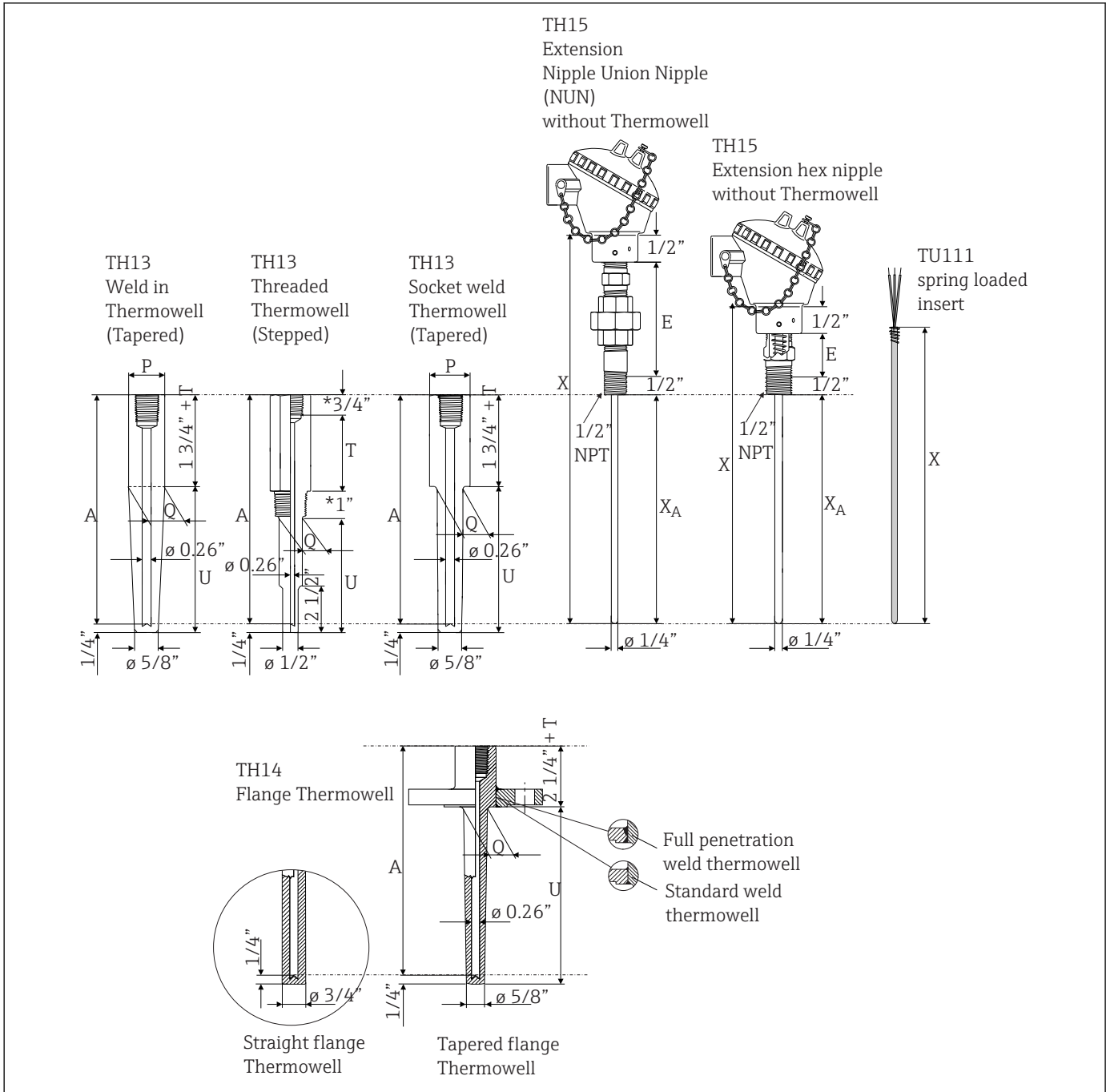
**Shock and vibration resistance** 4 g/2 to 150 Hz as per IEC 60068-2-6

## Process

Thermowells are used in measuring the temperature of a moving fluid in a conduit, where the stream exerts an appreciable force. The limiting value for the thermowells is governed by the temperature, the pressure and the speed of the medium, the immersion length, the materials of the thermowells and the medium, etc. Calculations for stress and vibration of thermowells can be done according to ASME PTC 19.3-1974 standard, please consult Endress+Hauser.

## Mechanical construction

**Design, dimensions** All dimensions in inches. For the values related to this graphic please refer to the tables and equations below.



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All thermowells are marked with:

- Material I.D.
- CRN# (Canadian Registration Number)
- Heat No.

Dimensions of TH13					
U	E	T	Process connection	Shape of Thermowell	ø Q
2½", 4½", 7½", 10½" specified length 2" to 18" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7" Material: Steel or 316SS	3" or specified length 1" to 6" in ½" increments	½" NPT	Stepped (Standard duty) Tapered (Heavy duty)	5/8" 1 1/16"
			¾" NPT	Stepped (Standard duty) Tapered (Heavy duty)	¾" 7/8"
			1" NPT	Stepped (Standard duty) Tapered (Heavy duty)	7/8" 1 1/16"

Dimensions of TH13					
U	E	T	Process connection	Shape of Thermowell	Ø Q
			¾" Socket weld	Stepped (Standard duty) Tapered (Heavy duty)	¾" ¾"
			1" Socket weld	Stepped (Standard duty) Tapered (Heavy duty)	7/8" 1"
			¾" weld in	Tapered (Heavy duty)	1.050"
			1" weld in	Tapered (Heavy duty)	1.315"
Immersion length RTD sensor = Thermowell drilled length $X_A = A = U + 1\frac{1}{2}" + T$ Insert overall length $X = A + E$					
P = Pipe size <ul style="list-style-type: none"> <li>■ Nom. ¾"; Dia. = 1.050"</li> <li>■ Nom. 1"; Dia. = 1.315"</li> </ul>					

Dimensions of TH14 Flange rating: ASME B16.5				
U	E	T	Flange size	Ø Q, Tapered version
2", 4", 7", 10" specified length 2" to 18" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7" Material: Steel or 316SS	specified length 1" to 10" in ½" increments	1"	7/8"
			1 ½"	1 1/16"
			2"	1 1/16"
Immersion length RTD sensor - Thermowell drilled length $X_A = A = U + 2" + T$ Insert overall length $X = A + E$				

Dimensions of TH15 (without thermowell)	
Immersion length RTD sensor $X_A$	
4", 6", 9", 12", 14" specified length 4" to 41" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7"

**Weight** From 1 to 5.5 lbs

**Material** Process connections, thermowells and enclosures.  
The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load.

The maximum operation temperatures are reduced considerably in some cases where abnormal conditions such as high mechanical load occur or in aggressive media.

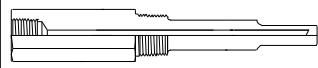
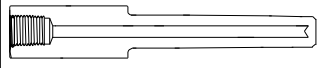

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1200 °F) <sup>1)</sup>	<ul style="list-style-type: none"> <li>▪ Austenitic, stainless steel</li> <li>▪ High corrosion resistance in general</li> <li>▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)</li> <li>▪ Increased resistance to intergranular corrosion and pitting</li> <li>▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content</li> </ul>
AISI 316/1.4401	X2CrNiMo17-12-2	650 °C (1200 °F) <sup>1)</sup>	<ul style="list-style-type: none"> <li>▪ Austenitic, stainless steel</li> <li>▪ High corrosion resistance in general</li> <li>▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration)</li> </ul>

1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Please contact your Endress+Hauser sales team for further information.

**Process connection**

The process connection is the means of connecting the thermometer to the process. The following process connections are available:

*TH13*

Thread	Version	
 <small>A0026110</small>	NPT thread	NPT 1/2"
		NPT 3/4"
		NPT 1"
 <small>A0026111</small>	NPS for socket weld	NPS 3/4"
		NPS 1"
 <small>A0026108</small>	NPS for weld-in	NPS 3/4"
		NPS 1"

TH14

Flange	
<small>A0010471</small>	
<p>For detailed information on the flange dimensions refer to the following flange standard: ANSI/ASME B16.5</p>	<p>The flange material must be the same as of the stem of the thermowell.</p>

TH15

Type	Thermowell connection	Extension neck lengths in mm (in)
	Type N	25.4 mm (1 in)
	Type NUN	101.6 mm (4 in) 177.8 mm (7 in)
<small>A0026181</small>		

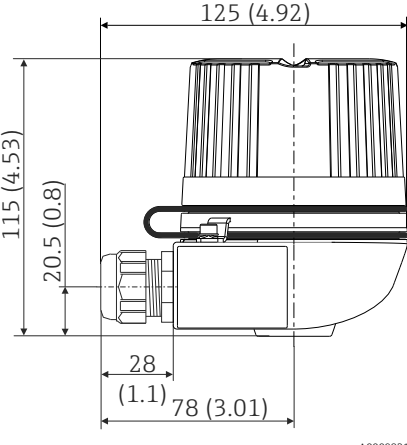
**Housing**

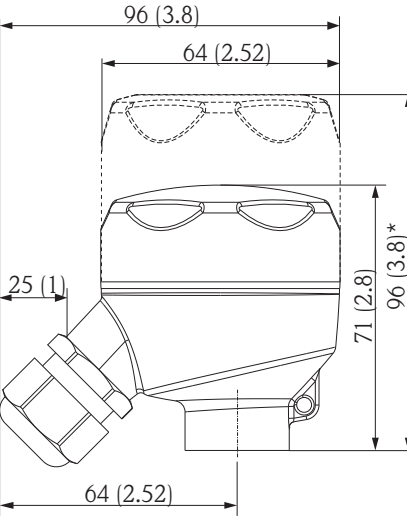
**Terminal heads**

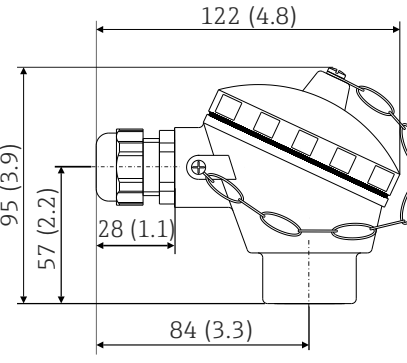
All terminal heads have an internal shape and size in accordance with DIN EN 50446, flat face and a thermometer connection with a 1/2" NPT thread. All dimensions in mm (in). Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see the 'Environment' section.

As a special feature, Endress+Hauser offers terminal heads with optimized terminal accessibility for easy installation and maintenance.

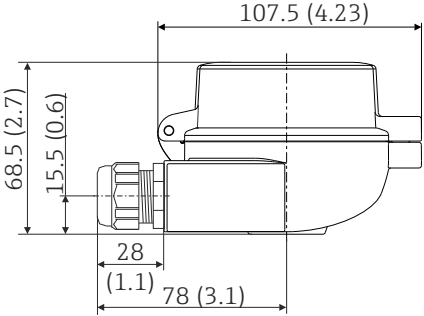
Some of the specifications listed below may not be available on this product line.

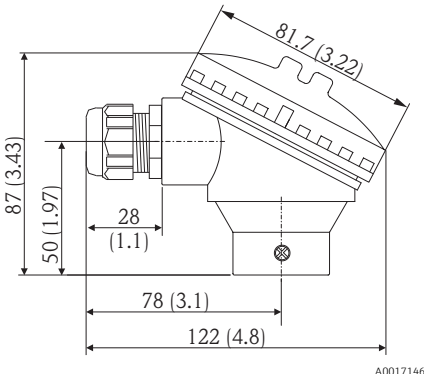
TA30H with display window in cover	Specification
 <p style="text-align: right; font-size: small;">A0009831</p>	<ul style="list-style-type: none"> <li>▪ Flameproof (XP) version, explosion-protected, captive screw cap, available with one or two cable entries</li> <li>▪ Degree of protection: IP 66/68, NEMA Type 4x Encl. Ex-version: IP 66/67</li> <li>▪ Temperature: -50 to +150 °C (-58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!)</li> <li>▪ Material:             <ul style="list-style-type: none"> <li>- Aluminum with polyester powder coating</li> <li>- Stainless steel 316L without coating</li> </ul> </li> <li>▪ Thread: ½" NPT, ¾" NPT, M20x1.5, G½"</li> <li>▪ Extension neck/thermowell connection: ½" NPT</li> <li>▪ Color of aluminum head: blue, RAL 5012</li> <li>▪ Color of aluminum cap: gray, RAL 7035</li> <li>▪ Weight:             <ul style="list-style-type: none"> <li>- Aluminum: approx. 860 g (30.33 oz)</li> <li>- Stainless steel: approx. 2 900 g (102.3 oz)</li> </ul> </li> <li>▪ Head transmitter optionally available with TID10 display</li> </ul>

TA30R (optionally with display window in cover)	Specification
 <p style="text-align: right; font-size: small;">A0017145</p>	<ul style="list-style-type: none"> <li>▪ Degree of protection - standard version: IP69K (NEMA Type 4x encl.) Degree of protection - version with display window: IP66/68 (NEMA Type 4x encl.)</li> <li>▪ Temperature: -50 to +130 °C (-58 to +266 °F) without cable gland</li> <li>▪ Material: stainless steel 316L, abrasive-blasted or polished Seals: EPDM Display window: polycarbonate (PC)</li> <li>▪ Cable entry thread ½" NPT and M20x1.5</li> <li>▪ Weight             <ul style="list-style-type: none"> <li>- Standard version: 360 g (12.7 oz)</li> <li>- Version with display window: 460 g (16.23 oz)</li> </ul> </li> <li>▪ Display window in cover optionally for head transmitter with display TID10</li> <li>▪ Protection armature connection: M24x1.5 or ½" NPT</li> <li>▪ Ground terminal: internal in standard version; external terminal optionally available</li> <li>▪ Available in conjunction with 3-A marked sensors</li> </ul>
<p>* Dimensions of version with display window in cover</p>	

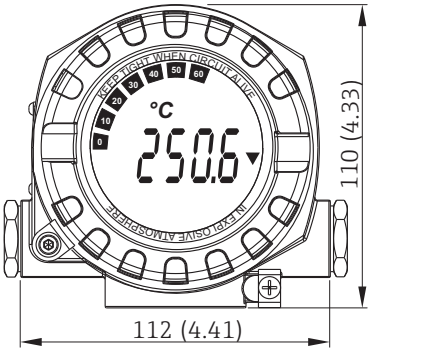
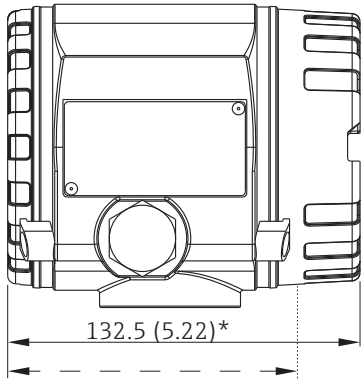
TU401	Specification
 <p style="text-align: right; font-size: small;">A0008669</p>	<ul style="list-style-type: none"> <li>▪ Protection class: IP65 (NEMA Type 4x encl.)</li> <li>▪ Temperature: -40 to 130 °C (-40 to 266 °F) silicone, up to 100 °C (212 °F) rubber seal without cable gland (observe max. permitted temperature of the cable gland!)</li> <li>▪ Material: aluminum alloy with polyester or epoxy coating, rubber or silicone seal under the cover</li> <li>▪ Cable entry: ½" NPT, ¾" NPT or plug 7/8" FF</li> <li>▪ Protection armature connection: M24x1.5, G 1/2" or NPT 1/2"</li> <li>▪ Head color: blue, RAL 5012</li> <li>▪ Cap color: gray, RAL 7035</li> <li>▪ Weight: 300 g (10.58 oz)</li> </ul>



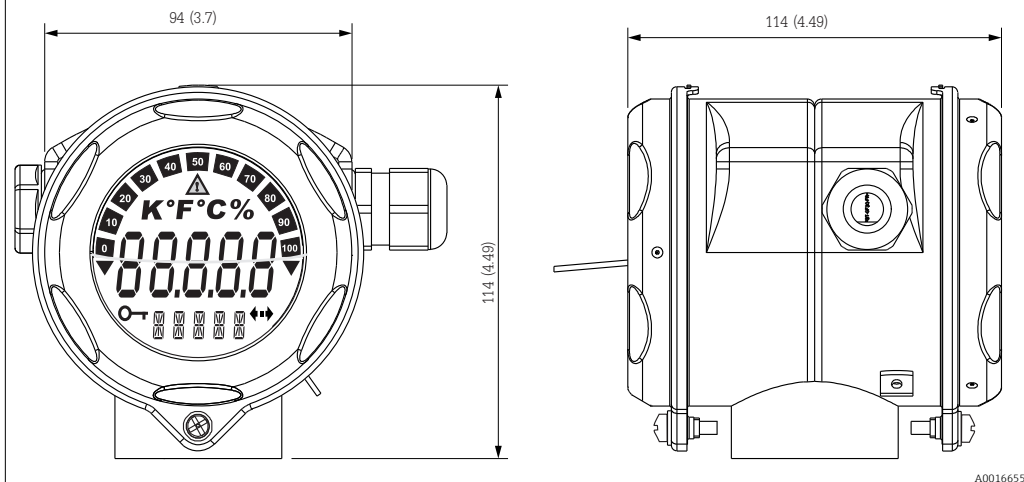
TU401 (TA30A style)	Specification
 <p style="text-align: right; font-size: small;">A0009820</p>	<ul style="list-style-type: none"> <li>▪ Available with one or two cable entries</li> <li>▪ Protection class: IP66/68 (NEMA Type 4x incl.)</li> <li>▪ Temperature: -50 to +150 °C (-58 to +302 °F) without cable gland</li> <li>▪ Material: aluminum, polyester powder coated</li> <li>▪ Seals: silicone</li> <li>▪ Threaded cable entry: ½" NPT, ¾" NPT or plug 7/8" FF</li> <li>▪ Protection armature connection: M24x1.5</li> <li>▪ Head color: blue, RAL 5012</li> <li>▪ Cap color: gray, RAL 7035</li> <li>▪ Weight: 330 g (11.64 oz)</li> <li>▪ Ground terminal, internal and external</li> <li>▪ With 3-A symbol</li> </ul>

TU401 (TA30S style)	Specification
 <p style="text-align: right; font-size: small;">A0017146</p>	<ul style="list-style-type: none"> <li>▪ Degree of protection: IP65 (NEMA Type 4x incl.)</li> <li>▪ Temperature: -40 to +85 °C (-40 to +185 °F) without cable gland</li> <li>▪ Material: polypropylene (PP), FDA-compliant, seals: O-ring EPDM</li> <li>▪ Cable entry thread: ¾" NPT, ½" NPT) or or plug 7/8" FF</li> <li>▪ Protective assembly connection: ½" NPT</li> <li>▪ Color: white</li> <li>▪ Weight: approx. 100 g (3.5 oz)</li> <li>▪ Ground terminal: only internal via auxiliary terminal</li> </ul> <p style="background-color: yellow; margin: 5px 0;"><b>CAUTION</b></p> <p><b>Potential electrostatic charging hazard</b></p> <ul style="list-style-type: none"> <li>▶ Not recommended for use in hazardous (classified) locations.</li> </ul>

**Field transmitters**

Temperature field transmitter iTEMP TMT162	
	
<p>* Dimensions without display = 112 mm (4.41 in)</p>	
<ul style="list-style-type: none"> <li>▪ Separate electronics compartment and connection compartment</li> <li>▪ Protection class: IP67, NEMA type 4x</li> <li>▪ Material: Die-cast aluminum housing AlSi10Mg with powder coating on polyester base, 316L</li> <li>▪ Display rotatable in 90° increments</li> <li>▪ Cable entry: 2x ½" NPT</li> <li>▪ Brilliant backlit display with ease of visibility in bright sunshine or pitch darkness</li> <li>▪ Gold plated terminals to avoid corrosion and additional measurement errors</li> <li>▪ SIL certification as per IEC 61508:2010 (HART-protocol)</li> </ul>	

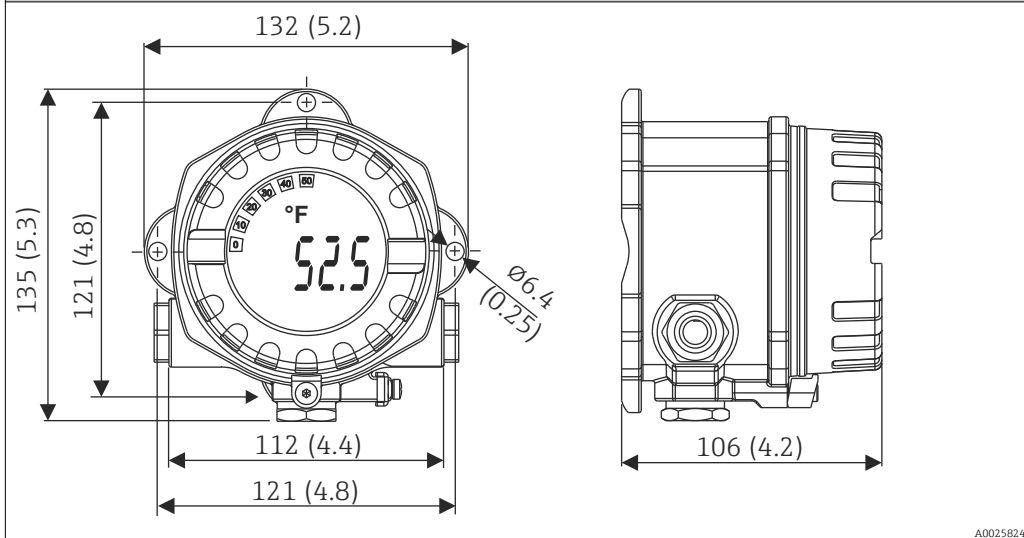
## Temperature field transmitter iTEMP TMT162 for hygienic applications



\* Dimensions without display = 112 mm (4.41 in)

- Material: Stainless steel 1.4435 (AISI 316L) for hygienic applications (T17 housing)
- Separate electronics compartment and connection compartment
- Display rotatable in 90° increments
- Cable entry: 2 x ½" NPT
- Degree of protection (IP69K)
- Brilliant backlit display with ease of visibility in bright sunshine or pitch darkness
- Gold plated terminals to avoid corrosion and additional measurement errors

## Temperature field transmitter iTEMP HART® TMT142



- Protection class: IP67, NEMA type 4x
- Material: Die-cast aluminum housing AISi10Mg with powder coating on polyester base
- Display rotatable in 90° increments
- Cable entry: 3x ½" NPT
- Brilliant blue backlit display with ease of visibility in bright sunshine or pitch darkness
- Gold plated terminals to avoid corrosion and additional measurement errors

## Certificates and approvals

### CE mark

The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. The manufacturer confirms successful testing of the device by affixing to it the CE mark.

**Other standards and guidelines**

- IEC 60529: Degree of protection of housing (IP code)
- IEC/EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use.
- ASTM E644: American society for testing and materials, standard test methods for testing industrial resistance thermometers.
- NEMA - ANSI / NEMA 250: Standardization association for the electrical industry.
- IEC 60751: Industrial platinum resistance thermometer
- ASME PTC 19.3 - 1974: Performance test codes

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**CSA GP**

The installed and assembled transmitters (iTEMP Series) are CSA GP approved.

## Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: [www.endress.com](http://www.endress.com) -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: [www.addresses.endress.com](http://www.addresses.endress.com)

### Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

## Accessories





Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website:


[www.endress.com](http://www.endress.com).

### Device-specific accessories

Adapter	M20x1.5 - 1/2" NPT cable entry Order code: 51004387
Cable gland	1/2" NPT, D4.5-8.5, IP 68 Order code: 51006845
Integrated overvoltage protection module	The module protects the electronics from overvoltage. Available for TMT162 housing (not T17 hygienic version).

### Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface.  For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.  For details, see "Technical Information" TI00405C
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity.  For details, see Operating Instructions BA061S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the <b>non-Ex area</b> .  For details, see Operating Instructions BA01202S


Field Xpert SFX370	<p>Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the <b>non-Ex area and the Ex area</b>.</p> <p> For details, see Operating Instructions BA01202S</p>
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Service-specific accessories

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> <li>▪ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections.</li> <li>▪ Graphic illustration of the calculation results</li> </ul> <p>Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.</p> <p>Applicator is available:</p> <ul style="list-style-type: none"> <li>▪ Via the Internet: <a href="https://portal.endress.com/webapp/applicator">https://portal.endress.com/webapp/applicator</a></li> <li>▪ On CD-ROM for local PC installation.</li> </ul>





Configurator	<p>Product Configurator - the tool for individual product configuration</p> <ul style="list-style-type: none"> <li>▪ Up-to-the-minute configuration data</li> <li>▪ Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language</li> <li>▪ Automatic verification of exclusion criteria</li> <li>▪ Automatic creation of the order code and its breakdown in PDF or Excel output format</li> <li>▪ Ability to order directly in the Endress+Hauser Online Shop</li> </ul> <p>The Configurator is available on the Endress+Hauser website: <a href="http://www.endress.com">www.endress.com</a> -&gt; Click "Corporate" -&gt; Select your country -&gt; Click "Products" -&gt; Select the product using the filters and the search field -&gt; Open the product page -&gt; The "Configure" button to the right of the product image opens the Product Configurator.</p>
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W@M	<p>Life cycle management for your plant</p> <p>W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle.</p> <p>The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.</p> <p>W@M is available:</p> <ul style="list-style-type: none"> <li>▪ Via the Internet: <a href="http://www.endress.com/lifecyclemanagement">www.endress.com/lifecyclemanagement</a></li> <li>▪ On CD-ROM for local PC installation.</li> </ul>
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FieldCare SFE500	<p>FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.</p> <p> For details, see Operating Instructions BA00027S and BA00065S</p>
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DeviceCare SFE100	<p>Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols.</p> <p>DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices.</p> <p> For details, see Operating Instructions BA00027S</p>
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## System components

Accessories	Description
Energy manager RMS621	<p>Accurate and reliable calculations for the monitoring and control of energy consumption (both produced and consumed) according to international standards.</p> <p> For details, see the "Technical Information" document TI00092R/09/EN</p>
Deltabar S/Cerabar S	<p>Pressure transmitters with diaphragm seal for level measurements in gases or liquids.</p> <p> For details, see "Technical Information"</p>
Process display RIA15	<p>Process display, digital loop-powered display for 4 to 20 mA circuit, panel mounting, with optional HART® communication. Displays 4 to 20 mA or up to 4 HART® process variables</p> <p> For details, see "Technical Information", TI01043K/09/en</p>
Active barrier RN221N	<p>Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits. Has bidirectional HART® transmission and optional HART® diagnostics if transmitters are connected with monitoring of 4 to 20 mA signal or HART® status byte analysis and an E+H-specific diagnostic command.</p> <p> For details, see "Technical Information", TI00073R/09/en</p>

## Documentation

### **Brief operating instructions - RTD assembly**

- TH13 with thermowell (KA00190R/09/)
- TH14 with flanged thermowell (KA00192R/09/)
- TH15 spring loaded insert (KA00195R/09/)

### **Technical information temperature transmitter iTEMP**

- HART® TMT82 (TI01010T/09/)
- PROFIBUS PA TMT84 (TI00138R/09/)
- FOUNDATION Fieldbus™ TMT85 (TI00134R/09/)
- Field transmitter:
  - TMT162 HART® 5, PROFIBUS PA and FOUNDATION Fieldbus™ (TI00086R/09/EN)
  - TMT162 HART® 7 and SIL certification (TI01344T/09/EN)
  - TMT142 HART® (TI00107R/09/EN)
- PCP TMT181 (TI00070R/09/)
- Pt TMT180 (TI00088R/09/)
- HART® TMT182 (TI00078R/09/)

### **Application example - Technical information**

- Energy manager RMS621 (TI00092R/09/)
- Cerabar S (TI00383P/00/)
- Deltabar S (TI00384P/00/)

[www.addresses.endress.com](http://www.addresses.endress.com)

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