Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

RTD TH17 and TH18

Sanitary RTD temperature assembly with enclosure



Areas of application
The TH17 and TH18 sanitary temperature sensors are RTD's designed for use in dairy, food & beverage, pharmaceutical and bio-technology plants.

- Temperature dryers in food processes
- Pasteurization
- Heat exchangers
- Material storage tanks
- Cheese vats
- Brewhouse / cellar
- Cookers / freezers
- Dehydrator
- Fermentor / bio-reactor control
- CIP/SIP systems

Head transmitters
Instead of directly wiring your temperature sensors to your control system, use transmitters to reduce wiring and maintenance costs while increasing measurement accuracy.

Your benefits

- Sensor assemblies TH17 & TH18 meet 3-A® sanitary standards
- Sensor assemblies TH18 are based on ASME, BPE 2002 Standard for Bio-Pharma equipment
- Sensor assemblies TH17 meet PMO requirements by US FDA for dairies
- One source shopping for temperature measurement solutions. World class transmitter with integrated sensor offering.
- 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 ≤ 0.05 % per year

TI00109R/24/en
71148238

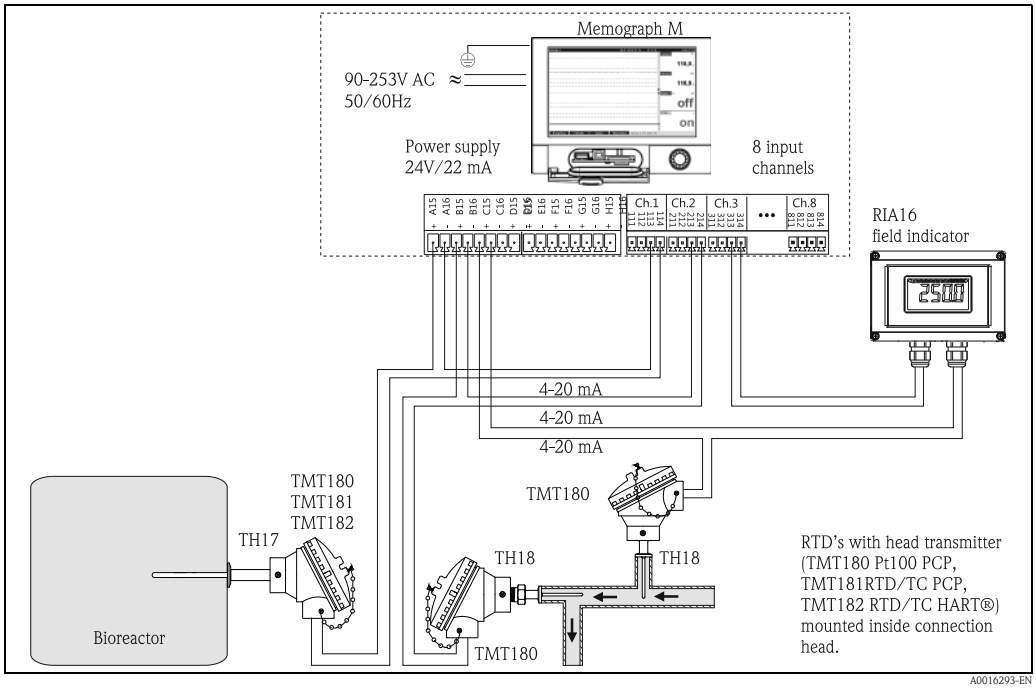
Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

The RTD (Resistance Temperature Detector) element consists of an electrical resistance with value of 100 Ω at 0 °C (called Pt100, in compliance with IEC 60751), which increases at higher temperatures according to a coefficient characteristic of resistor material (platinum). In industrial thermometers that comply with the IEC 60751 standard, the value of this coefficient is $\alpha = 0.00385\ °C^{-1}$, calculated between 0 and 100 °C (32 and 212 °F).

Measuring system



Example of an application of the temperature assemblies

Memograph M, RSG40
Multichannel data recording system with multicolored TFT display (170 mm/7 in screen size), galvanically isolated universal inputs (U, I, TC, RTD, pulse, frequency), digital input, transmitter power supply, limit relay, communication interfaces (USB, Ethernet, RS232/485), internal SD memory, external SD card and USB stick. 100 ms scan rate for all channels. ReadWin 2000 PC software for comprehensive device configuration and data evaluation. Details see Technical Information (see "Documentation").

RIA16 Field indicator
The field indicator records an analog measuring signal and shows this on the display. The LCD display shows the currently measured value digitally and as a bargraph with limit value violation signalling. The indicator is looped into the 4 to 20 mA circuit and obtains the required energy from there. The measuring range, decimal point and offset of the indicator can be configured comfortably by means of three keys in the device with the housing open or by means of a PC with the FieldCare PC software. Details see Technical Information (see "Documentation").

Equipment architecture

The single element RTDs are designed to measure temperature in Food, Dairy and Pharmaceutical applications. These RTDs are specifically designed for very short response time. The clean in place sanitary assemblies TH17 & TH18 with 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.

Measurement range

- Class A: -50 to 200 °C (-58 to 392 °F)
- Class 1/5DIN: -50 to 260 °C (-58 to 500 °F)

Electronics

Family of temperature transmitters

Measurement assemblies with iTEMP® transmitters are an installation ready solution to improve the functionality of temperature measurement by increasing accuracy and reliability when compared to direct wired sensors. Overall installation costs are lower than with direct wired sensors, since an inexpensive pair of signal (4 to 20 mA) wires can be run over long distances.

PC programmable devices TMT180 and TMT181

PC programmable head transmitters offer you extreme flexibility and help control costs with the ability to stock one device and program it for your needs. Regardless of your choice of output, all iTEMP® transmitters can be configured quickly and easily with a PC. To help you with this task, Endress+Hauser offers free software ReadWin® 2000 which can be downloaded from our website. Go to **www.readwin2000.com** to download ReadWin® 2000 today. For details see Technical Information.

HART® TMT182 head transmitter

HART® communication is all about easy, reliable data access and getting better information more inexpensively. iTEMP® transmitters integrate seamlessly into your existing control system and provide painless access to preventative diagnostic information.
Configuration with a DXR275 or 375 hand-held or a PC with configuration program (FieldCare, ReadWin® 2000) or configure with AMS or PDM. For details, see Technical Information.

HART® programmable head transmitter iTEMP® TMT82

The iTEMP® TMT82 is a 2-wire device with two measurement inputs and one analog output. The device transmits both converted signals from resistance thermometers and thermocouples as well as resistance and voltage signals via the HART® communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the flat face terminal head to DIN EN 50446. Fast and easy operation, visualization and maintenance via PC using configuration software such as FieldCare, Simatic PDM or AMS.
Benefits are: Dual sensor input, maximum reliability, accuracy and long-term stability for critical processes, mathematical functions, monitoring of thermometer drift, backup function of the sensor, diagnostic functions of the sensor and sensor-transmitter matching based on the Callendar/Van Dusen coefficient. For more information, refer to the Technical Information (see chapter "Documentation").

PROFIBUS® PA TMT84 head transmitter

Universally programmable head transmitter with PROFIBUS®-PA fieldbus communication. Converting various input signals into a digital output signal. High accuracy in the total ambient temperature range. Swift and easy operation, visualization and maintenance using a PC direct from the control panel, e. g. using operating software such as FieldCare, Simatic PDM or AMS. DIP switch for address setting, makes start up and maintenance safe and reliable. For details, see Technical Information.

FOUNDATION Fieldbus™ TMT85 head transmitter

Universally programmable head transmitter with FOUNDATION fieldbus™ communication. Converting various input signals into a digital output signal. High accuracy in the total ambient temperature range. Swift and easy operation, visualization and maintenance using a PC direct from the control panel, e. g. using operating software such as ControlCare from Endress+Hauser or the NI Configurator from National Instruments.
Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, sensor diagnosis functions and sensor-transmitter matching by accepting Callendar Van Dusen constants. For details, see Technical Information.

Field transmitter TMT162 - Dual compartment housing

Field transmitter with HART® communication, FOUNDATION Fieldbus™ protocol and blue backlit display. Can be read easily from a distance, in sunlight and at night. Large measurement value, bargraph and fault indication display. Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, corrosion detection and sensor transmitter matching by accepting Callendar Van Dusen constants. For details, see Technical Information.

Performance characteristics

Response time

63% response time per ASTM E644

Model	Tube diameter 1/4" OD, 316L	Tube diameter 3/8" OD reduced 3/16" OD, 316L	Tube diameter 5/32" OD, 316L
TH17	4 s	3 s	-
TH18	-	-	2 s

Response Time for the sensor assembly without Transmitter.

PMO* Version, Grade "A"
Option H: 3/8" reduced 3/16"; 316L HTST PMO
*PMO - Pasteurized Milk Ordinance

The response time of the versions in the table above complies to Grade "A" by US FDA; use TH17 with 3/16" (reduced tip - option "H").

Maximum measured error

Class A tolerance as per IEC 60751, at operating temperature range of -50 to 200 °C (-58 to 392 °F).

Class	max. Tolerance
A	± (0.15 + 0.002 · |t|[1)])
1/5 DIN	± (0.06 + 0.001 · |t|[1)])
1) |t| = absolute value °C	

For measurement errors in °F, calculate using equation 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
Measurment accuracy	± typ. 0.25 °C (0.45 °F)	0.2 °C (0.36 °F), optional 0.1 °C (0.18 °F) or 0.08%[1]	0.5 °C (0.9 °F) or 0.08%[1]		≤ 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	
Galvanic isolation (input/output)	U = 2 kV AC	-	U = 2 kV AC			

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

Transmitter long-term stability

≤ 0.1 °C / year (≤ 0.18 °F / year) or ≤ 0.05% / year
Data under reference conditions; % is related 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

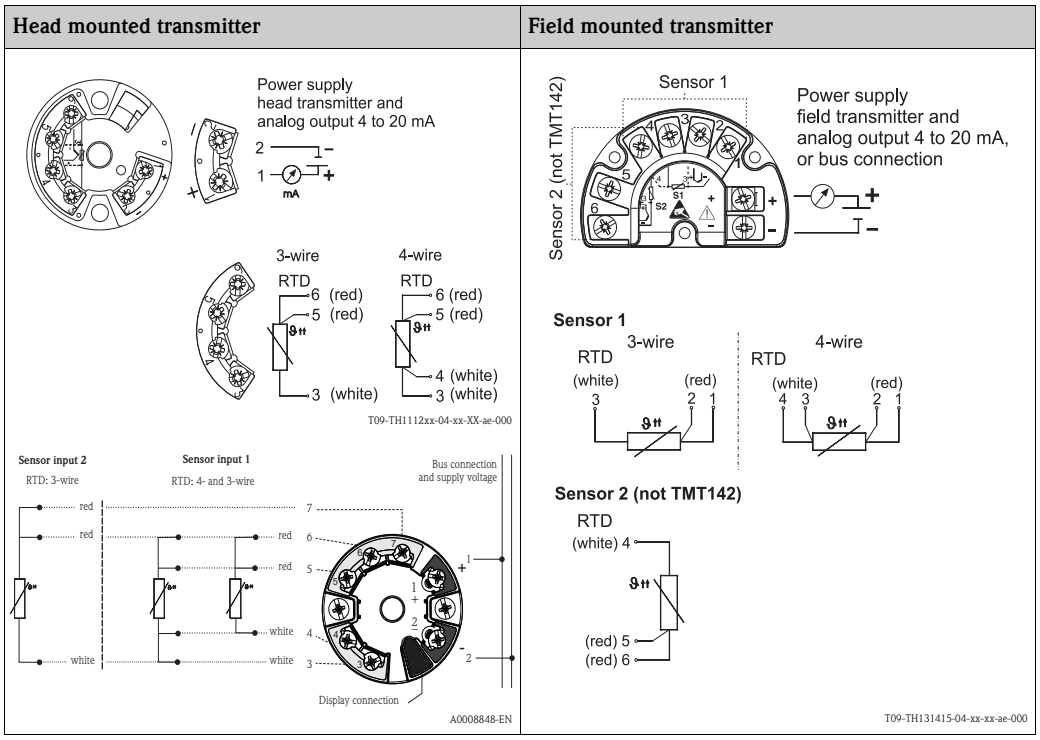
RTD elements are not self-powered and require a small current be passed through the device to provide a voltage that can be measured. Self-heating is the rise of temperature within the element itself, caused by the current flowing through the element. This self-heating appears as a measurement error 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.

Wiring

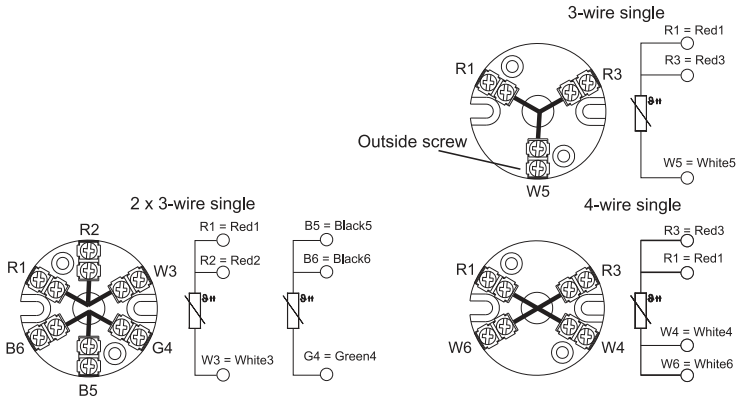
Electrical connection cables must comply with 3-A® standard, must be smooth, corrosion resistant and cleanable.

Wiring diagrams

Type of sensor connection



Terminal block mounted



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

Wire specifications

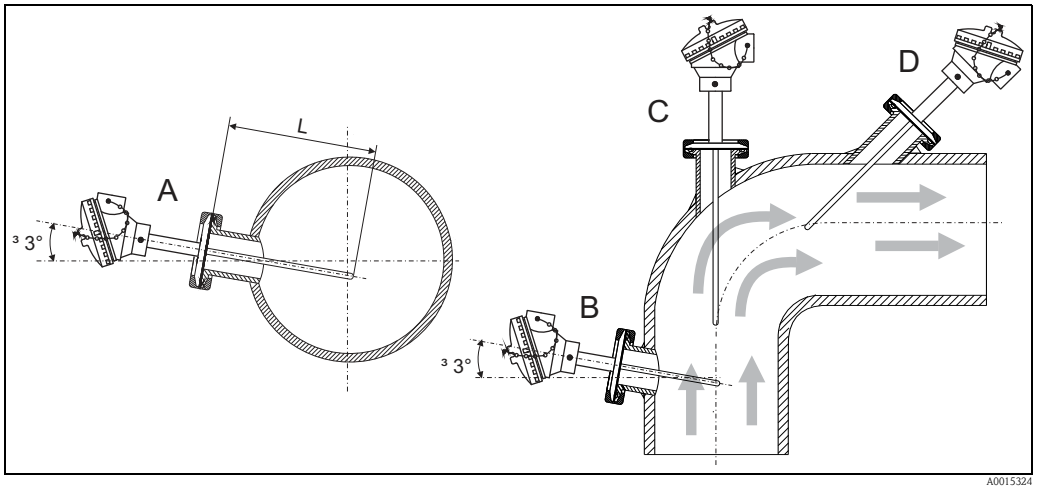
24AWG, 19 strand silver plated copper with 0.010" PTFE extruded outer, 5/32" OD sensors (TH18) have 28AWG seven strand wires with the same extrusion.

Installation conditions

Orientation

No restrictions, but self draining. If applicable leak detection hole must be at the lowest point.

Installation instructions



Installation examples

A - B: In pipes with a small cross section the sensor tip should reach or extend slightly past the center line of the pipe (= L). Installation with minimal 3° inclination because of self draining.
C - D: Tilted installation.

Care should be taken by the user in the execution of the welding on the process side (suitable weld material, welding radius > 3.2 mm, absence of pits, folds, crevices, ...). As a general rule, the assemblies should be installed in such a way that does not adversely affect their cleanability (3-A® requirements must be adhered to).

Immersion

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

Version	Minimum Immersion (in)
TH17	1¼ "
TH18	¾ "

Environmental conditions

Ambient temperature

Housing without head-mounted transmitter
- Aluminum pressure die-cast housing -40 to 150 °C (-40 to 300 °F)
- Plastic housing -40 to 85 °C (-40 to 185 °F)
- Deep drawn SS housing without display -40 to 150 °C (-40 to 300 °F)

Housing with head-mounted transmitter
- -40 to 85 °C (-40 to 185 °F)

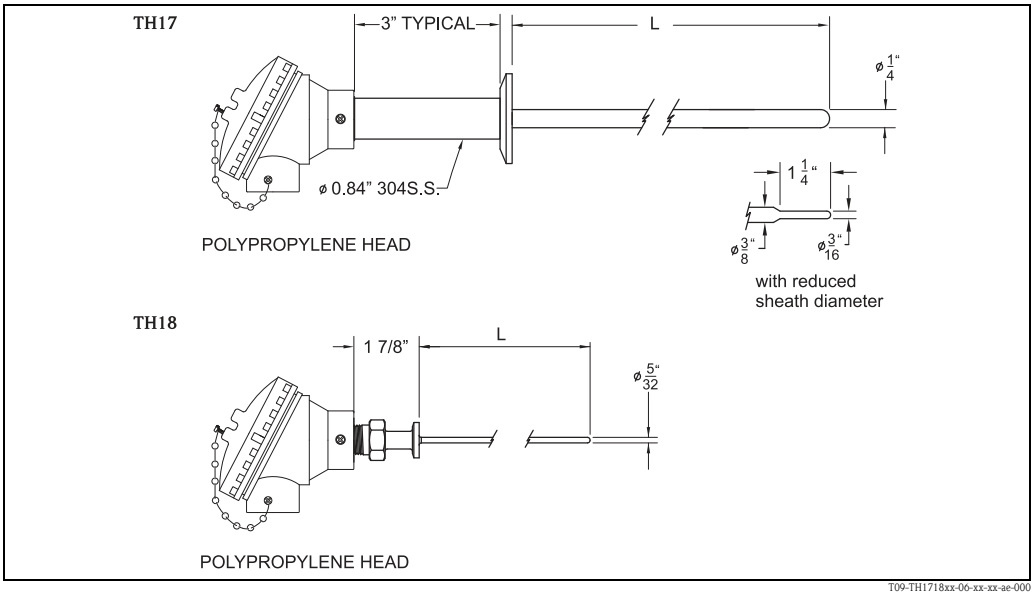
Field transmitter without display
- -40 to 85 °C (-40 to 185 °F)

Shock and vibration resistance

4g / 2 to 150 Hz as per IEC 60 068-2-6

Mechanical construction

Design, dimensions



For values related to this graphic please refer to the table below.

Dimensions in inches:

	TH17	TH18
Insertion length "L"	2", 2.5", 3", 4", 5", 6" specified length in ½" increments	¾", 1¼", 2¼", 2¾" specified length in ¼" increments

Weight

From 1 to 5.5 lbs

Material

Material: wetted parts 316L SS.

Surface finish TH17

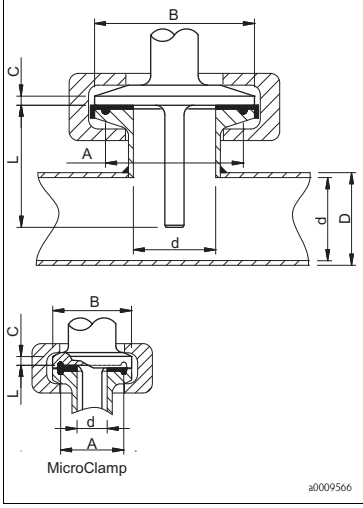
TH17 sensors are intended for use in food processing systems. The wetted surfaces of the sensors and sanitary fittings are mechanically polished to achieve a 32 micro-inch maximum surface finish, in accordance with "3-A Sanitary Standards for Sensors and Sensor Fittings and Connections used on Milk and Milk Products Equipment, Number 74-03". Minimal material has been removed to achieve the indicated surface finish. Residual polishing compounds are removed after polishing operations are completed on all surfaces and sanitary end fittings. The end fitting material and sensor sheath are both composed of 316L stainless steel.

Surface finish TH18

TH18 sensors are intended for use in food and pharmaceutical processing systems. The wetted surfaces of the sensors and sanitary fittings are mechanically polished to achieve a 20 micro-inch maximum surface finish, in accordance with "ASME BPE-2002, Bioprocessing Equipment Standard". Minimal material has been removed to achieve the indicated surface finish. Residual polishing compounds are removed after polishing operations are completed on all surfaces and sanitary end fittings. The end fitting material and sensor sheath are both composed of 316L stainless steel.

Process connection

Tri-clamp® connection (3-A® marked)



(*)							(**)
DN	A	B	C	d	D std.	D strong	PNmax (bar)
½"(***)	20,0	25,0	3,6	9,5	-	12,7	-
¾"(***)				15,8	-	19,0	-
1"	43,5	50,5	2,85	22,2	-	29,5	-
					25,4	-	9÷20,7
1½"				34,9	-	42,6	-
					38,1	-	9÷20,7
2"	56,5	64,0		47,6	-	55,7	-
					50,8	-	9÷17,2

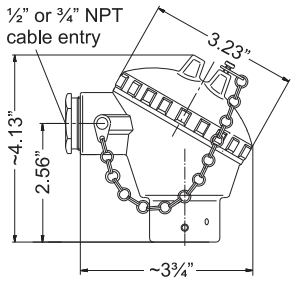
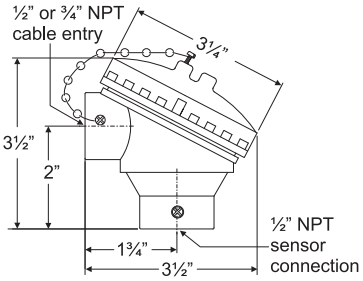
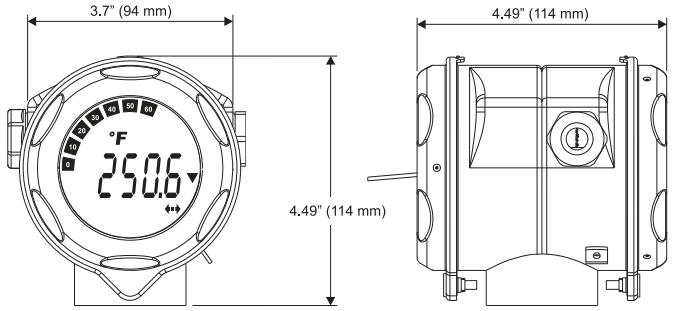
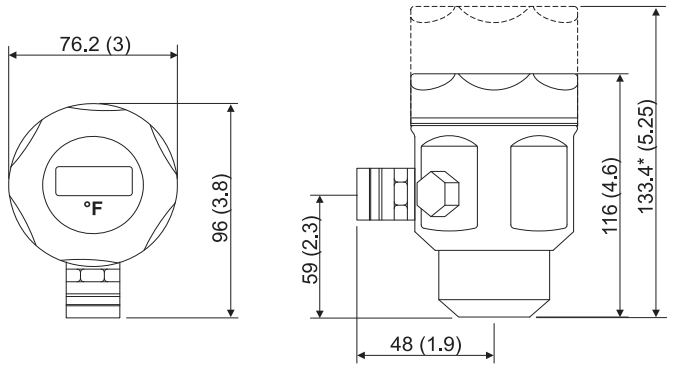
(*) Pipes according to ISO 2037 and BS 4825 Part1.
(**) Depends on clamping ring type, at 121°C with suitable gasket.
(***) MicroClamp.

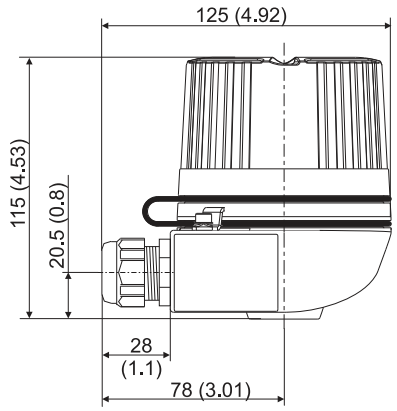
Packaging

Sanitary sensors and fittings are individually bagged and sealed to ensure cleanliness upon delivery to the final customer.

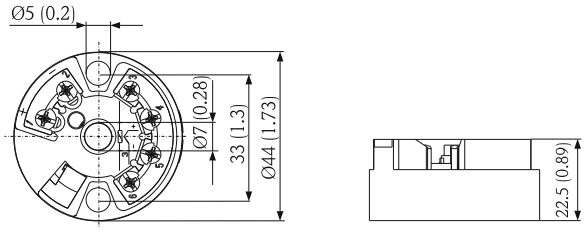
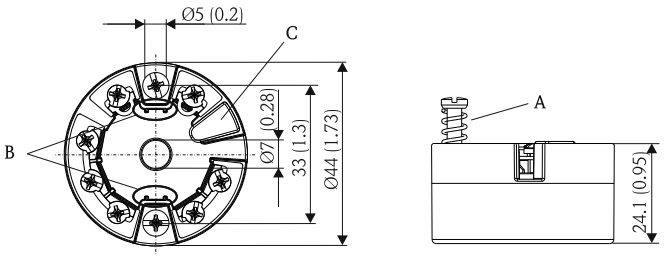
System components

Housing

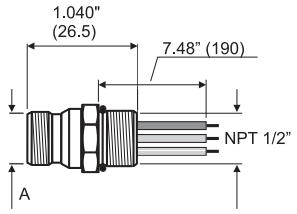
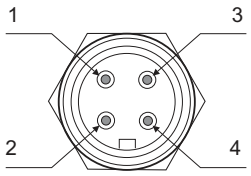
Type of housing	Specification
Terminal head Aluminum  T09-TH11xxxx-06-xx-xx-ae-001	■ Material: Die-cast Aluminum head ■ Sensor connection: ½" NPT Female ■ Cable entry: ½" NPT or ¾" NPT Female. ½" NPT has a Al reducer bushing ■ Body paint: Spray SPU, RAL5012 Cover paint: Spray SPU, RAL7035 ■ Coating thread (body-cover), lubricant acc. E+H standard, MgO coating; benefits include ease of opening/closing cover and improved thread engagement. Improves lifetime of the terminal head. ■ Degree of protection NEMA Type 4x Encl. (IP 66)
Terminal head plastic  T09-TH11xxxx-06-xx-xx-ae-000	■ Polyprolylene, FDA compliant ■ Sensor connection: ½" NPT Female ■ Cable entry: ½" NPT or ¾" NPT Female. ½" NPT with nylon reducer bushing (FDA compliant) ■ Degree of protection NEMA Type 4x Encl.
Temperature field transmitter iTEMP® TMT162  T09-TMT162ZZ-06-00-xx-ae-003	■ 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 blue backlit display with ease of visibility in bright sunshine or pitch darkness ■ Gold plated terminals to avoid corrosion and additional measurement errors Details see Technical Information (see 'Documentation')
Terminal head deep drawn stainless steel, TA20J style  a0005938 ** dimensions with optional display*	■ Material: Deep drawn stainless steel AISI 316L SS (hygienic design) ■ Optional with display and/or head transmitter ■ Sensor connection: ½" NPT female ■ Cable entry: ½" NPT female ■ Degree of protection NEMA Type 4x Encl. (IP 66) Display: ■ 4 digits 7-segments LC display (loop powered) ■ Maximum error: 0.1% of programmed range ■ Loop drop: 2.5 V at 22 mA ■ Max. ambient temperature: -20 to 70 °C (-4 to 160 °F) The programming is executed through 3 keys mounted on the bottom of the display.

Type of housing	Specification
TA30H with display window in cover 	■ Flameproof (XP) version, explosion-protected, captive screw cap ■ Protection class: IP 66/68 ■ Max. temperature: 150 °C (300 °F) for rubber seal (observe max. permitted temperature of the cable gland!) ■ Material: aluminum; polyester powder coated ■ Cable entry glands: ½" NPT, ¾" NPT, M20x1.5, only thread G½"; plug: M12x1 PA, 7/8" FF ■ Neck tube/thermowell connection: ½" NPT ■ Color of head: blue, RAL 5012 ■ Color of cap: gray, RAL 7035 ■ Weight: 860 g (30.33 oz) ■ Head transmitter optionally available with TID10 display

Head transmitter

Type of transmitter	Specification
iTEMP® TMT18x 	■ Material Housing: PC Potting: PUR ■ Terminals: Screw terminals: 2.5 mm² (16 AWG) with latches at the fieldbus terminals for easy connection of a handheld terminal, e.g. DXR375 Spring terminals: e.g. rigid wire version 0.14 mm² to 1 mm² (24 AWG to 18 AWG); stripped length = min. 10 mm (0.39 in) ■ Degree of protection NEMA Type 4x Encl. (see also type of terminal head) Details see Technical Information (see 'Documentation')
iTEMP® TMT8x 	■ Spring range L ≥ 5 mm (0.2 in), see Pos. A ■ Fixing elements for pluggable measured value display, see Pos. B ■ Interface for contacting measured value display, see Pos. C ■ Material (RoHS-compliant) Housing: PC Potting: PUR ■ Terminals: Screw terminals: 2.5 mm² (16 AWG) with latches at the fieldbus terminals for easy connection of a handheld terminal, e.g. DXR375 Spring terminals: e.g. rigid wire version 0.14 mm² to 1 mm² (24 AWG to 18 AWG); stripped length = min. 10 mm (0.39 in) ■ Degree of protection NEMA Type 4x Encl. (see also type of terminal head) Details see Technical Information (see 'Documentation')

Fieldbus connector

Type (dimensions in inches [mm])	Specification	
Fieldbus connector to PROFIBUS® -PA or FOUNDATION Fieldbus™  T09-FFCONNEC-06-xx-xx-ae-000 *Pos. A:* *M12 on PROFIBUS® -PA connector* *7/8-16 UNC on FOUNDATION Fieldbus™ connector*	■ Ambient temperature: -40 to 150 °C (-40 to 300 °F) ■ Degree of protection IP 67 Wiring diagram:  a0006023	
	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)

Certificates and approvals

CE Mark

The iTEMP® Series of temperature transmitters complies with the legal requirements laid out within the EU regulations.

Other standards and guidelines

- IEC 60529: Degrees of protection by housing (IP-Code).
- IEC 61010: Safety requirements for electrical measurement, control and laboratory instrumentation.
- IEC 60751: Industrial platinum resistance thermometer
- ASTM E644: American society for testing and materials, standard test methods for testing industrial resistance thermometers.
- PMO: Pasteurized Milk Ordinance 2001 Revision, U.S. Food and Drug Administration, Center for Food Safety & Applied Nutrition
- BPE: Bioprocessing Equipment, ASME - BPE - 2002 Standard
- NEMA - ANSI / NEMA 250 Standardization association for the electrical industry.

UL

Temperature transmitters are recognized components to UL 3111-1 (iTEMP® Series).

Sanitary compatibility

A sanitary standard for sensors, connections and sensor fittings used in milk and milk products equipment, 3-A®, Number 74-03.

Ordering information

Detailed ordering information is available from the following sources:

- In the **Product Configurator** on the Endress+Hauser web page:
  www.endress.com → Select country → Instruments → Select device → Product page function:
  Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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

Documentation

- Compact instructions TH17 RTD temperature sensor for Food & dairy applications (KA180r/24/ae)
- Compact instructions TH18 RTD temperature sensor for pharmaceutical applications (KA181r/24/ae)

Technical information temperature transmitter:
- iTEMP® TMT162 (TI086r/24/ae)
- iTEMP® Pt TMT180 (TI088r/24/ae)
- iTEMP® PCP TMT181 (TI070r/24/ae)
- iTEMP® HART® TMT182 (TI078r/24/ae)
- iTEMP® HART® TMT82 (TI01010T/09/en)
- iTEMP® PA® TMT84 (TI138r/24/ae)
- iTEMP® TMT85 FF (TI134r/24/ae)

Application example:

- Technical information Data Manager Memograph M, RSG40 (TI133R/09/en)
- Technical information Field indicator RIA16 (TI00144R/09/en)

USA	Canada	México	Instruments International
Endress+Hauser, Inc. 2350 Endress Place Greenwood, IN 46143 USA Tel.317-535-7138 Fax317-535-8498 Sales888-ENDRESS Service800-642-8737 inquiry@us.endress.com www.us.endress.com	Endress+Hauser Canada 1075 Sutton Drive Burlington, ON L7L 5Z8 Canada Tel.905-681-9292 800-668-3199 Fax905-681-9444 www.ca.endress.com	Endress+Hauser, México, S.A. de C.V.F Fernando Montes de Oca 21 Edificio A Piso 3 Fracc. Industrial San Nicolas 54030. Tlalnepantla de Baz Estado de México México Tel.+52 55 5321 2080 Fax+52 55 5321 2099 eh.mexico@mx.endress.com www.mx.endress.com	Endress+Hauser Instruments International AG Kaegenstrasse 2 4153 Reinach Switzerland Tel.+41 61 715 81 00 Fax+41 61 715 25 00 www.endress.com info@ii.endress.com

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