

Temperature Measurement

Thermometers and transmitters for the process industry



Thermometer product overview

Endress+Hauser offers a complete assortment of compact thermometers, modular thermometers, thermowells, measurement inserts and accessories for all types of process industries such as Oil & Gas, Chemicals, Food & Beverage, Life Sciences, Primaries & Metal, Power & Energy.

Product group	Cable probes and compact thermometers	Industrial modular	Hygienic modular & compact
Model			
Description	Cable probes, compact thermometers, temperature switches Simple design without thermowell	Modular thermometers for industrial general purposes	Compact thermometers, modular thermometers with hygienic process connections
Application/ Branches	Universal, Power	Universal, Chemical, Power	Food & beverage, Life sciences
Approvals	ATEX Ex i, ATEX Ex nA, IECEx Ga Ex ia, NEPSI Ex ia	ATEX Ex i, ATEX Ex nA, FM/CSA IS, IECEx Ga/Gb Ex ia, NEPSI Ex ia	ATEX Ex ia, ATEX Ex ta/tb, IECEx Ga/Gb Ex ia, FM/CSA IS, EHEDG, 3-A, FDA, ASME BPE, NEPSI Ex ia
Measurement range	RTD: -50 to +400 °C (-58 to +752 °F) TC: -40 to +1100 °C (-40 to +2012 °F)	RTD: -200 to +600 °C (-328 to +1112 °F) TC: -40 to +1100 °C (-40 to +2012 °F)	RTD: -200 to +600 °C (-328 to +1112 °F)
Process connection	Insertion, compression fitting, thread	Insertion, compression fitting, thread, flange, welded connection	Almost all common hygienic process connections, welded connections
For detailed information see...	pages 16 and 17	pages 18 and 19	pages 20 and 21



Heavy duty (XP/Ex d)	High temperature	Temperature solutions
		
<p>Pressure tight thermometers for Ex d applications</p>	<p>High temperature thermometers with metal /ceramic thermowell and thermocouple</p>	<p>Tube skin thermometers for surface temperature measurement, Multipoint thermometers, application specific solutions</p>
<p>Universal, Oil & Gas, Chemicals</p>	<p>Power, Primary industry, Metal preparation, Flue gas</p>	<p>Oil & Gas, Power, Chemical</p>
<p>ATEX Ex i, Ex d; Ex nA; IECEX Ga/Gb Ex ia, Ex d; FM/CSA: IS, XP NEPSI Ex ia, Ex d</p>	<p>-</p>	<p>PED, CRN; ATEX Ex d; FM/CSA: XP</p>
<p>RTD: -200 to +600 °C (-328 to +1112 °F) TC: -40 to +1100 °C (-40 to +2012 °F)</p>	<p>TC: 0 to +1800 °C (32 to +3272 °F)</p>	<p>RTD: -200 to +600 °C (-328 to +1112 °F) TC: -40 to +1100 °C (-40 to +2012 °F)</p>
<p>Thread, flange, welded connections</p>	<p>Flange, gas tight glands</p>	<p>Customer specific solutions</p>
<p>pages 22 and 23</p>	<p>pages 24 and 25</p>	<p>pages 26 and 27</p>



Construction of a thermometer

The mechanical construction of a thermometer used in process plants is the same for resistance thermometers and thermocouples and consists of the following components:

- Measurement insert with ceramic terminal block or head transmitter
- Thermowell
- Process connection
- Neck/lagging
- Terminal head with cable glands

Metric-style



The **terminal head** is fitted to the thermowell or the neck of the thermometer.

Benefits:

- Protection and installation for terminal block or transmitter
- Cable entry and wiring
- Display (as option)



The **neck** or **lagging** is the connection between terminal head and process connection/thermowell.

Benefits:

- Protection of the head transmitter from overheating
- Guarantees access to the terminal head in the case of pipe insulation



The **process connection** is the connection between the process and the thermometer.

Normally used are:

- Threads
- Flanges
- Weld-in connections
- Compression fitting



The **thermowell** is the process wetted component of the thermometer.

Benefits:

- Increases the life cycle of the measurement insert through protection against process influence.
- Possible measurement insert exchange under process conditions.
- Mechanical stability against pressure and flow

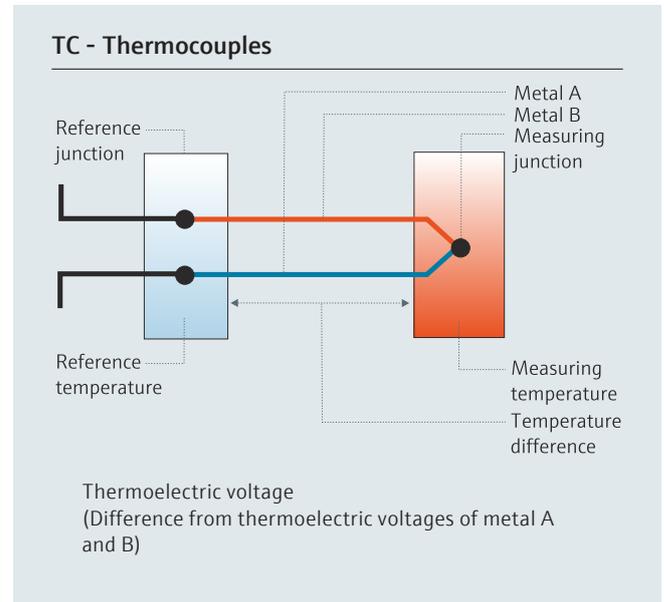
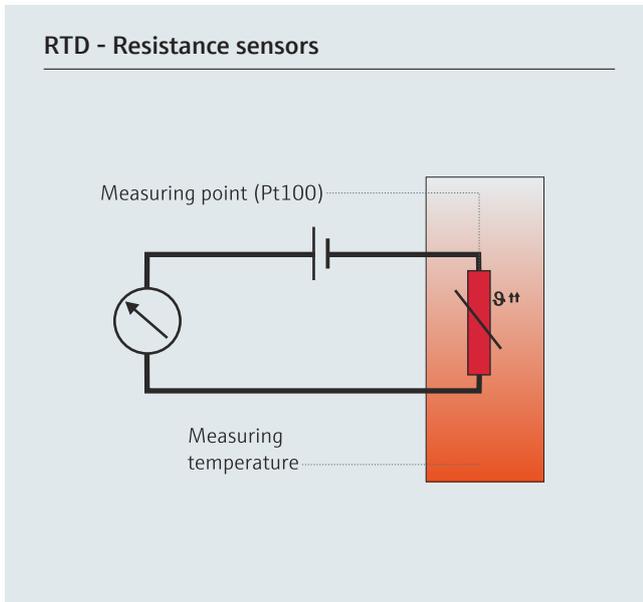
US-Style (imperial)



Measurement inserts

Basics and measurement principles

Temperature is the most frequently measured parameter in the process industry. In electrical, contact thermometers two measurement principles have asserted themselves as a standard.



In RTD resistance sensors the electrical resistance changes with a change in temperature. They are suitable for the measurement of temperatures between -200 °C and approx. 600 °C and stand out due to high measurement accuracy and long-term stability. The resistance sensor element most frequently used is a Pt100.

It is about a temperature-sensitive measuring resistance made of platinum with a resistance value of $100\ \Omega$ at 0 °C . The temperature coefficient is fixed with $\alpha = 0.003851\text{ °C}^{-1}$. Pt100 sensors are manufactured in different formats:

- Wire wound ceramic sensors:** In a ceramic tube there is a double coil with capillary ultra-pure platinum wire. This tube is sealed at the top and bottom by a ceramic protective coating. These sensors ensure good long-term stability of their resistance/temperature characteristic in the temperature range of up to 600 °C .
- Thin-layer sensors:** In a vacuum a very thin platinum coating of about $1\ \mu\text{m}$ is sputtered onto a ceramic plate and is then photo-lithographically structured. The emerging platinum conductors form the sensor resistance. The advantages over the wire-wound versions are the smaller dimensions and the better vibration resistance. Thin-layer sensors are used for temperature measurements in temperature ranges of up to 500 °C .

As a standard, Endress+Hauser RTD resistance sensors fulfill the IEC 60751 accuracy class A.

A thermocouple is a component made of two different metals connected with each other at one end. An electrical potential (thermoelectric force) is caused due to the Seebeck effect at the open end if the connection and the free ends are exposed to different temperatures.

With the help of the so-called thermocouples reference tables (see IEC 60584) the temperature at the connection (measuring junction) can be concluded.

Thermocouples are suitable for temperature measurement in the range of 0 °C to $+1800\text{ °C}$. They stand out due to the fast response time and high vibration resistance.

Sensor types

Resistance sensors (RTD)				
Model	iTHERM® QuickSens	iTHERM® StrongSens	Standard thin film	Wire wound (WW)
Design				
Measurement range	-50 to +200 °C	-50 to +500 °C	-50 to +400 °C	-200 to +600 °C
Number of sensors		1x Pt100		1x/2x Pt100
Electrical connection	3-/4-wires			
Insert diameter	3 mm / 6 mm	6 mm	3 mm / 6 mm	
Accuracy	Class A / AA			
Vibration resistance	3 mm: 3g 6 mm: > 60g	> 60g	3g	
Response times t_{90} (for 1x Pt100)	3 mm: 0.75 s 6 mm: 1.5 s	6 mm: 9.5 s	3 mm: 5.5 s 6 mm: 13 s	3 mm: 5 s 6 mm: 11.5 s

Design

Measurement inserts consist of a SS316L stainless steel, INCONEL® 600 or Pyrosil tube inside which the internal leads (RTD) or thermal leads (TC) are placed and insulated from each other by magnesium oxide (MgO) powder.

The sensor is at the tip of the measurement insert. The electrical contact at the top end of the measurement insert is made, in the simplest case, by the use of flying leads, a terminal block or a head transmitter. Measurement inserts are available with a single sensor or, for redundant measurement, with two sensors.

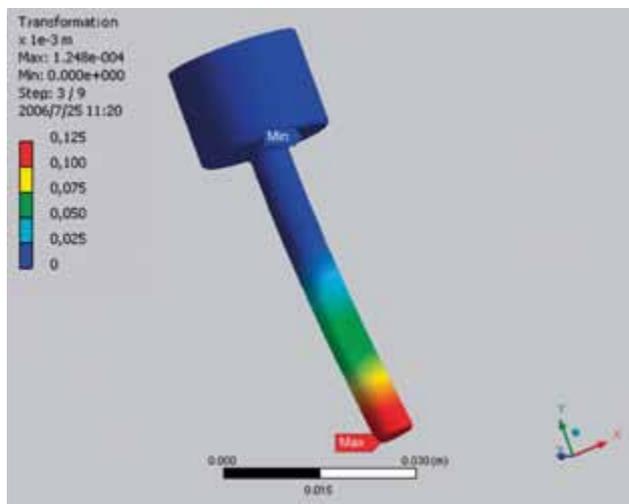
In order to guarantee thermal contact to the process the measurement inserts are pushed onto the base of the thermowell by means of two springs on the fixing screws or one spring on the collar (U.S. style: 'spring loaded').



Measurement insert:
Flying leads, US-Style 'spring loaded', ceramic block and head transmitter

Thermowells

The thermowell is the process wetted part of the thermometer. Basically, thermowells are divided into thermowells constructed from welded tubes and thermowells made of drilled barstock material.



Computer simulation showing the loading of a thermowell in process

Thermowell construction In many cases thermometers cannot be placed directly into the medium but need protection from rough process conditions. Furthermore the thermowell makes sure that an exchange of the measurement insert is possible without interrupting the process.

Correct construction and design of a thermowell requires exact calculations. The load capacity of thermowells in individual processes is calculated at Endress+Hauser according to the Dittrich /Kohler method which represents the basis of the DIN 43772.

The calculation can alternatively be carried out according to ASME / ANSI PTC 19.3, i.e. the Murdock method.

Thermowell calculation tool

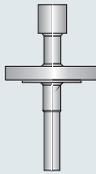
The new "Thermowell Calculation Tool" can be found on the Endress+Hauser website for online calculation and engineering of all Endress+Hauser thermometer thermowells.

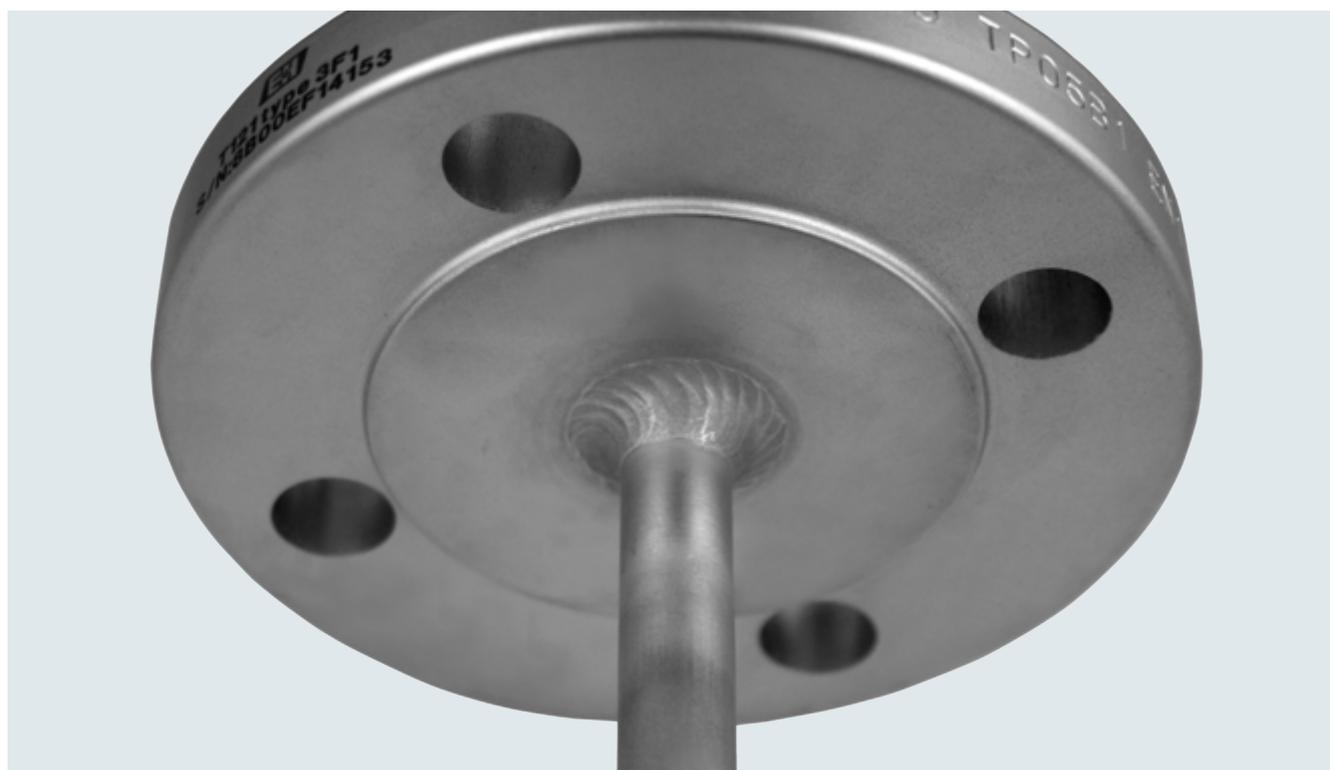
 Interested? Have a look:
www.endress.com/appliator

Fabricated thermowells

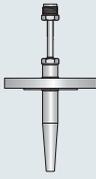
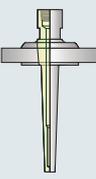
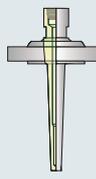
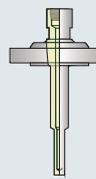
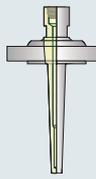
Model	TA414	TW10	TW11	TW12	TW13	TT411
Design						
Thermometer connection	Matched adapter for TST414	M24 x 1.5, 1/2" NPT				M24 x 1.5, G3/8", iTHERM® QuickNeck
Process connection	G 1/2"	G 1/4", G 1/2", G 3/4", G 1", 1/2" NPT, 3/4" NPT		Without, TA50 with Ø9 mm or Ø11 mm	Flange according to EN 1092-1 or ASME	Clamp according to ISO 2852, DIN 11851, DIN 11864, Varivent, Ingold, SMS 1147, APV-Inline
Neck/extension	Without	As per DIN 43772	Double nipple	Without	According to DIN 43772	
Material	1.4571	1.4435, 1.4571, 2.4819, 2.4816	1.4435, 1.4571	1.4435, 1.4571, 2.4816	1.4435, 1.4571, 2.4819, 2.4816	1.4404, 1.4435; 1.4435+316L, delta-ferrite < 1%
Suitable for	Only TST414	Replacement thermowell for Tx10 and TST90	Replacement thermowell for TR11	Replacement thermowell for Tx12	Replacement thermowell for Tx13	Replacement thermowell Ø6 mm or Ø9 mm for TM411
Order number for detailed technical information	TI228T/02	TI261T/02	TI262T/02	TI263T/02	TI264T/02	TI01099T/09

Fabricated thermowells

Model	TW251	TA535	TA540	TA541
Design				
Thermometer connection	Compression fitting ø9 mm	G 1/2", 1/2" NPT	1/2" NPT, 3/4" NPT	1/2" NPT male
Process connection	G 1/2", G 3/4", 1/2" NPT, weld-in adapter 25 x 30 mm, cylindrical or spherical	G 1/2", G 3/4", 1/2" NPT, 3/4" NPT	Flange according to EN 1092 or ASME; thread 1/2" NPT, 3/4" NPT, 1" NPT	Flange according to EN 1092 or ASME, thread 3/4" NPT, 1" NPT
Neck/extension	Without	50 to 500 mm	100 to 300 mm	80 to 300 mm
Material	1.4435		1.4401, 1.4749	1.4401
Suitable for	Thermowell for TST410, TEC410, TST310 or TSC310	TR88, TC88, TR24, TR25	TR88, TMT162R, TC88, TMT162C	-
Order number for detailed technical information	TI245T/02	TI00250T/09	TI00166T/09	TI188T/02

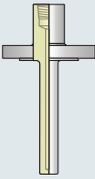
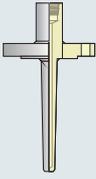


Barstock thermowells

Model	TW15	TT411*	TA550	TA555	TA556	TA557	TA560	TA562
Design								
Thermometer connection	M24 x 1.5, 1/2" NPT male	G3/8" male	1/2" NPT		3/4" NPT	1/2" NPT		1/2" NPT, 1/2" BSP
Process connection	Flange according to EN 1092/ASME, or weld-in	Clamp according to ISO 2852, DIN 11851, Varivent, weld-in adapter, thread	Flange according to ASME, thread 3/4" NPT	Flange according to ASME, thread 1" NPT	Flange according to ASME, thread 1" NPT		Thread 3/4" NPT	Thread 3/4" NPT, 1/2" NPT, G1/2"
Neck/extension	40 to 400 mm	65 mm	50 to 300 mm				45 to 300 mm	
Material	1.4435, 1.4571, 2.4819, 2.4816	1.4404, 1.4435; 1.4435+316L, delta-ferrite < 1%	1.4401, 1.4435, 1.4571					
Suitable for	TR15 / TC15	Replacement thermowell ø12.7 mm for TM411	TR88 / TC88, TMT162R / TMT162C, TR62 / TC62, TR65 / TC65, TST90					
Order number for detailed technical information	TI00265T/02	TI01099T/09	TI153T/02	TI154T/02	TI155T/02	TI156T/02	TI159T/02	TI00230T/02

*Made from solid bar stock for L ≤ 200 mm

Barstock thermowells

Model	TA565	TA566	TA570	TA571	TA572	TA575	TA576
Design							
Thermometer connection	1/2" NPT		1/2" NPT, 1/2" BSP			1/2" NPT	
Process connection	1" NPT		Weld-in			Flange according to EN 1092 or ASME	
Neck/extension	30 to 300 mm		30 to 400 mm			50 to 300 mm	50 to 400 mm
Material	1.4401, 1.4435, 1.4571						
Suitable for	TR88 / TC88, TMT162R / TMT162C, TR62 / TC62, TR65 / TC65, TST90						
Order number for detailed technical information	TI160T/02	TI177T/02	TI161T/02	TI178T/02	TI179T/02	TI162T/02	TI163T/02

Process connections

The process connection is the connection between the process and the thermometer. The following process connections are those most commonly used in the process industries:



Thread: The most commonly used thread types are NPT-, G- and M-threads:

- The ANSI B 1.20.1 NPT thread is a U.S. thread norm for self-sealing pipe threads. Sealing is achieved through conical threads.
- G threads are cylindrical pipe threads and seal using the sealing area above the thread.
- M threads are metric threads which are used at low process pressures. M threads are frequently used on thermometers that are to be screwed into already existing thermowells on site.



Welded joint: The thermowell is directly welded into the container or pipe wall via a welding sleeve or a welding adapter.

Compression fitting: The thermometer is put into a sleeve in the compression fitting and then clamped using either a reusable compression ring or destroyed olive.

The compression fitting is either screwed or welded into the process.



Flange: Flanges are subject to the DIN or ANSI / ASME standards. They are classified according to material, diameter and pressure rating.

To fulfill the strongly varying process conditions a variety of sealing geometries are available.

Process connections for hygienic and aseptic application

Seals in hygienic process connections must be replaced at fixed intervals. Fast and simple exchange of the complete thermometer as well as simple cleaning in the process have led to special hygienic process connections for the Food & Life Sciences industry.

Connection	Clamp according to ISO 2852	DIN 11851	DIN 11864	SMS	Weld-in adapter	Screw-in adapter	Varivent	Ingold	Metallic sealing connection
Design									
Size	DN8/18 DN12/21,3 DN25/38 DN40/51 Tri-Clamp 1/2", 3/4", 1 1/2", 2"	DN 25 DN 32 DN 40 DN 50	DN 25 DN 40	DN 25	Cylindrical or spheric cylinder 30 x 40 mm	G 1", as for Liquiphant M	DN32/125, D = 68 mm DN25, D = 50 mm DN10/15, D = 31 mm	25 x 30 mm, 25 x 50 mm	M12x1.5, G 1/2"
Available for	Metrical design: TM401, TM411, TMR35, TTR35 Imperial design: TM402, TM412								

Terminal heads

The terminal heads, in which the terminal block or transmitter is installed, differ in shape and material depending on the application. Materials used are: Plastic, varnished aluminum or stainless steel. All terminal heads have an internal form according to DIN 43729 (form B). Various threads for thermometer connection (M24, NPT $\frac{1}{2}$ ") or cable connection (M20, NPT $\frac{1}{2}$ " , NPT $\frac{3}{4}$ " , G $\frac{1}{2}$ ") are available. Moreover, a large selection of cable glands and connectors is available.

TA30A	IP	TA30A double cable entry	IP	TA30H	IP	TA30H double cable entry	IP
	66/ 67		66/ 67		66/ 67		66/ 67
Form B standard (also with display)		(also with display)					
TA30D	IP	TA21E	IP	TA20B	IP	TA30R	IP
	66		65		65		IP 69K
Form BUZH							
TA30P	IP	TA30S	IP	TA21H	IP		
	65		66		66/ 68	(also with display)	

Terminal heads offering maximum comfort

- With high or low hinged cover.
- With screw-on cover even in explosion proof version (XP).
- Cover with display window for process value and diagnostic messaging display.
- Internal and external grounding screws.
- Simple connection cable feed by means of a spiral cable guide well.
- Easy access to mounting platform for head transmitter or terminal block installation.
- Simple identification due to explicit nameplate positioning.
- Double cable entry
- Optional with wall or pipe mounting
- Connectors

iTHERM® TA30R - Stainless steel terminal head for hygienic applications



Your benefits:

- Improved handling, reduced installation and maintenance costs by optimal access to the terminals due to a low housing edge for example
- Optional display - safety due to on-site process display
- Protection class IP69K - optimal protection even when using high-pressure cleaners



Transmitter

The task of transmitters is the transformation of the sensor signal into a stable and standardized signal. In the past, transmitters were built using analog technology. In the meantime digital technology has gained acceptance, however, because it offers better measurement accuracy at simultaneously higher flexibility.



Transmitters are typically offered in three distinctive types of housing:

- As DIN rail mounted devices suitable for panel installation.
- As head transmitters for direct installation in thermometer terminal heads.
- As field transmitters for direct connection in the process areas.

Transmitters are configurable and support both numerous resistance sensor types and thermocouples. In order to obtain the highest measurement precision, linearization characteristics for every type of sensor are stored in the transmitter.

In addition, the measurement accuracy in modern transmitters can be improved by use of a specific 'sensor-transmitter-matching' software. The complete measuring chain consisting of transmitter and sensor is then matched with each other.

On the one hand, the standardized output signal in the process measurement is a 4...20 mA signal, but also the internationally standardized field buses, such as HART®, PROFIBUS® and FOUNDATION™ Fieldbus are used. The HART® protocol serves mainly for a more convenient operation in combination with the 4 to 20 mA analog measured signal. PROFIBUS® and FOUNDATION™ Fieldbus, however, transfer the real measured value digitally and therefore offer cost savings by simplifying the wiring.

The plug-on display TID10 can be used in connection with a TMT82, TMT84 or TMT85 head transmitter. Simply plug it onto the head transmitter and the display will be switched on.

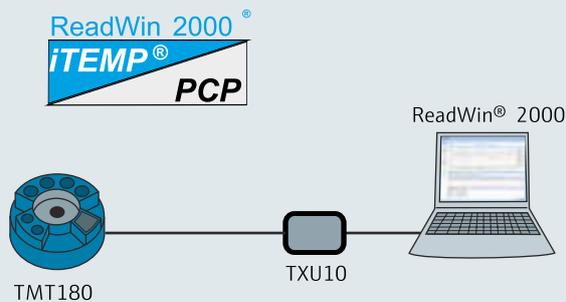
It displays information regarding the actual measured value, the measurement point identification and events of fault in the measurement chain. DIP-switches can be found on the rear of the display. This enables the hardware set-up such as the PROFIBUS® device address. With the optional field housing TA30x the device is suitable for use in the field, even a use for Ex d applications is possible without problems.



Device configuration

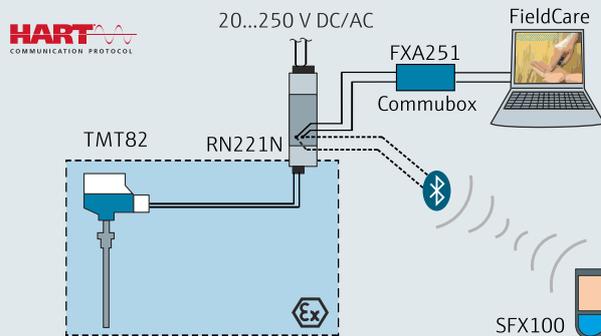
PC programmable (PCP)

Online configuration with SETUP connector, socket and ReadWin® 2000 operating software.



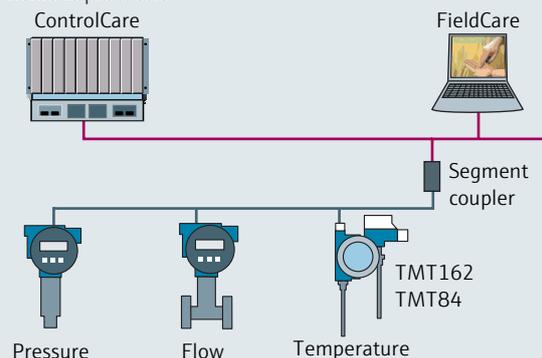
HART[®]

HART[®] signal for on-site or centralized device set-up using a hand-held terminal or PC. Operation, visualization and maintenance at the PC using FieldCare, AMS, PDM or ReadWin[®] 2000 software.



Fieldbus

Temperature transmitter for PROFIBUS[®] PA and FOUNDATION[™] Fieldbus enables data exchange and operation using standardized fieldbus protocols.



Endress+Hauser is one of the pioneers in fieldbus technology and plays a worldwide leading role in the application of the HART[®]-, PROFIBUS[®] DP/PA and FOUNDATION[™] fieldbus technology.

- Accredited PROFIBUS[®] competence center
- Engineering of field bus networks
- System integration checks
- Training courses, seminars
- Customer service
- Endress+Hauser's own fieldbus laboratory

iTEMP® temperature transmitters at a glance

Head and DIN rail transmitters						
Type						
Model	TMT180	TMT181 TMT121/ TMT111	TMT182 TMT122/ TMT112	TMT82	TMT84	TMT85
Design						
DIN rail	-				-	-
Special features	Economical, no galvanic isolation	PC-interface, universal	HART® interface, SIL2, universal	HART®, 2-channel, back-up, drift, SIL2/3, universal	PROFIBUS® PA, 2-channel, back-up, drift, universal	FOUNDATION™ Fieldbus, 2-channel, back-up, drift, universal
RTD input	Pt50/100, Cu50/100, GOST: Pt50/100, Cu50/100	Pt50/100/500/1000 Ni100/500/1000 Cu50/100 GOST: Pt50/100, Cu50/100, Polynom RTD	Pt100/500/1000, Ni100/500/1000, Polynom RTD	Pt100/ 200/500/1000 Ni100/120/1000 Cu10/50/100 (Cu50 for TMT82) Ni100/500/1000, GOST: Pt50/100, Cu50/100 (Cu50 for TMT82) Polynom RTD, Callendar/Van Dusen		
TC input	-	B, C, D, R, S, E, J, K, L, N, T, U (additionally type A for TMT82)				
Ω input	-	10 to 2000 Ω				
mV input	-	-10 to 100 mV	-10 to 75 mV	-20 to 100 mV		
Accuracy (Pt100)	≤ 0.1 K / 0.08 % (as option)	≤ 0.2 K		digital: 0.1 K analog: 0.03% of the set span		
Approvals	FM/CSA: NI, GL ship building approval, UL to 3111-1	ATEX: Ex ia, FM/CSA: IS, UL to 3111-1, Dust-Ex Zone 22, GL ship building approval, GOST, NEPSI		ATEX: Ex ia, FM/CSA: IS, Dust-Ex Zone 22; NEPSI, IEC Ex		
Order number for Technical Information	TI088R/09	TI070R/09 TI087R/09 TI00135R/09	TI078R/09 TI090R/09 TI114R/09	TI01010T/09	TI00138R/09	TI00134R/09

Field transmitters

Type				
Model	TMT162		TMT142	TMT125
Design				
DIN rail				
Special features	Safe, illuminated display, 2-chamber device, 2-channel, back-up, drift, (SIL2, NE89 for HART®), universal		Safe, illuminated display, rotatable, universal	For up to 8 input channels, universal
RTD input	Pt100/ 200/500/1000 Ni100/120/1000 Cu10/50/100 GOST: Pt50/100, Cu50/100 (not for TMT142) Polynom RTD, Callendar/Van Dusen			Pt50/100/200/500/ 1000 Ni100/120/200 Cu10
TC input	B, C, D, R, S, E, J, K, L, N, T, U			B, E, J, K, N, R, S, T
Ω input	0 to 2000 Ω			0 to 5200 Ω
mV input	-20 to 100 mV			-100 to 150 mV
Accuracy (Pt100)	digital: 0.1 K analog: 0.02% of the set span		≤ 0.2 K (≤ 0.15 K)	≤ 0.2 K
Approvals	ATEX: Ex ia, Ex d, FM/CSA: IS, XP, DIP, Dust-Ex Zone 21, GL ship building approval, GOST (for HART®), NEPSI, IEC Ex		ATEX: Ex ia Ex d, FM/CSA: IS, XP, DIP, NEPSI, IEC Ex	ATEX: Ex ia, Ex nA, FM: IS NI, NEPSI, IEC Ex
Order number for Technical Information	TI00086R/09		TI107R/09	TI00131R/09



Compact thermometers

Simple, fast and economical Cost efficiency and optimal use of space indicate modern process measuring technology. Particularly OEM applications require fast delivery times, reliable operation as well as simple assembly and calibration of the measurement technology used.

The compact families completely fulfill these requirements. They are easily commissioned, measure reliably, and when required convert into standard signals and alert at alarm limit violation.

- Precise primary sensors, long-term stable electronics.
- Robust construction in stainless steel, compatible connection technology.
- Versatile process adapters, flexible sensor lengths.
- Simplest assembly as well as on-site and PC parameter set-up.
- Patented sensor concept

Output signals Direct access to the primary signal using highgrade cables in 3- or 4-wire connection or 4...20 mA access at the standard connection socket – all selectable.

The electronics The dimensions of the freely programmable measurement PCB in the Easytemp TMR31 are only 40 x 18 mm. The Thermophant TTR31 can be set up using push buttons and switches in the case of an alarm limit violation.



The process connections Stainless steel compression fittings, inch and metric threads ensure complete compatibility. Hygienic process adapters and thermowells fulfill the EHEDG-, 3A- and FDA requirements.

The sensors Vibration-proof integrated thin-film Pt100 sensors guarantee the highest operational security at the fastest response times.



Fast response sensor:
Thin film RTD with optimized thermal contact

Temperature switch
Thermophant TTR31



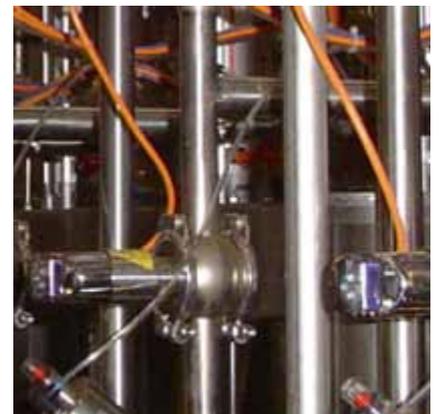
Compact thermometer
Easytemp TMR31 -
with electronics and large
immersion length



Without electronics,
with smallest possible
immersion length

Cable probes and compact thermometers overview

Type	Metric style				US-style		
Model	TST310	TSC310	TTR31	TMR31	TH12	TH52	TH56
Design							
Special features	Compact thermometer with non-detachable cable for plug-in or screw-in connection		Temperature switch with 1/2 PNP switching outputs, 4 to 20 mA	Compact thermometer with integrated transmitter. Short immersion length, very fast response times	Compact RTD resistance thermometer with non-detachable cable for plug-in or screw-in connection	Compact TC thermometer with non-detachable cable (TH52) or plug (TH56) for plug-in or screw-in connection	
Approvals	ATEX Ex ia, ATEX Ex nA, IECEx Ga Ex ia NEPSI Ex ia		UL 61010B-1 and CSA C22.2 No. 1010.1-92	UL to 3111-1, GL	-		
Principle	RTD	TC	RTD		RTD	TC	
Measurement range	-50 to +200 °C	Type J: -40 to +750 °C Type K: -40 to +1100 °C	-50 to +150 °C	-50 to +200 °C	-58 to +392 °F (-50 to +200 °C)	Type J: -346 to 1330 °F (-210 to +720 °C) Type K: -454 to 2100 °F (-270 to +1150 °C)	
Process pressure	≤ 100 bar (dependent on process connection)						
Material	1.4404	1.4404, 2.4816	1.4404		SS316L Ra: 32 μ-inch electro-polished		
Order number for Technical Information	TI00085T/09	TI00255T/09	TI105R/09	TI123R/09	TI00108R/24	TI00111R/24	



Monitoring of a supply pipework using compact thermometers and temperature switches

Modular thermometers for industrial applications

Endress+Hauser offers a broad portfolio of temperature measurement technology for comprehensive solutions for almost all branches of industry. The measurement principles used are RTD resistance sensors and thermocouples. Important points for the inclusion of the measurement point into the process are the protection of the thermometers through thermowells and the process connection.

These thermometers are mainly used in the chemical industry, but they also find their use in other areas of the process industry, both in core as well as peripheral processes.

Type	Metric design								
Model	TR10	TR11	TR12	TR13	TR15	TR88	TC10	TC12	TC13
Design									
Thermowell armature	Thermowell, thread with neck	Thermowell, thread without neck	Thermowell, compression fitting	Thermowell, flange with neck	Weld-in thermowell, flange with neck	Without thermowell, thread with neck	Thermowell, thread with neck	Thermowell, compression fitting	Thermowell, flange with neck
Measurement insert	MgO-sheathing, exchangeable; diameter: 6 mm, 3 mm								
Sensor measurement range	RTD: -200 to +600 °C						TC: Type J, Type K 0 to +1100 °C		
Ex approvals	ATEX I GD Ex ia ATEX 1/2 GD Ex ia, Ex nA IECEx Ga/Gb Ex ia NEPSI Ex ia								
Process connection	Thread		Compression fitting	Flange according to DIN and ANSI	Flange according to DIN and ANSI or for welding	Threaded connection to existing thermowell	Thread	Compression fitting	Flange according to DIN and ANSI
Thermowell	Fabricated thermowell out of tubing with welded tip				Drilled barstock thermowell	-	Fabricated thermowell out of tubing with welded tip		
Thermowell material	1.4435, 1.4571, 2.4819, 1.4816					-	1.4435, 1.4571, 2.4819, 1.4816		
Order number for Technical Information	TI256 T/02	TI257 T/02	TI258 T/02	TI01097 T/09	TI01100 T/09	TI01098 T/09	TI274 T/02	TI275 T/02	TI01097 T/09



Metric design		Imperial design							
TC15	TC88	TH11	TH13	TH14	TH15	TH51	TH53	TH54	TH55
									
Weld-in thermowell, flange with neck	Without thermowell, thread with neck	Without thermowell, with nipple	Thermowell, with nipple	Thermowell, with nipple, flange	Without thermowell, with nipple		Thermowell, with nipple	Thermowell, with nipple, flange	Without thermowell, with nipple
MgO-sheathing, exchangeable; diameter: 6 mm, 3 mm		MgO-sheathing, exchangeable; diameter: 6 mm							
TC: Type J, Type K 0 to +1100 °C		RTD: -328 to 1112 °F (-200 to +600 °C)				TC: Type J, Type K, Type E, Type N, Type T -330 to +1600 °F (-200 to +870 °C)			
ATEX I GD Ex ia ATEX 1/2 GD Ex ia, Ex nA IECEx Ga/Gb Ex ia NEPSI Ex ia		-	CSA (IS, NI)			-	CSA (IS, NI)		
Flange according to DIN and ANSI or for welding	Threaded connection to existing thermowell	Thread or compression fitting, fixed or movable	Thread or for welding	Flange according to ANSI	Threaded connection to existing thermowell	Thread or compression fitting, fixed or movable	Thread or for welding	Flange according to ANSI	Threaded connection to existing thermowell
Drilled barstock thermowell	-	-	Drilled barstock thermowell		-	-	Drilled barstock thermowell		-
1.4435, 1.4571, 2.4819, 1.4816	-	-	SS316 or INCONEL® 600		-	-	SS316L, INCONEL® 600, Hastelloy® C276, Titan, Monel®		-
TI01100 T/09	TI01098 T/09	TI00108 R/24	TI00110R/24			TI00111 R/24	TI00112R/24		

Temperature measurement in the Food & Life Sciences industry

The innovative iTHERM® thermometers of the new, modular hygienic line have been designed to meet the requirements of the Food & Life Sciences industries and comply with highest quality standards.

For the first time a comprehensive, global product portfolio with a large selection of process connections, transmitters and further constructive variants is offered. All products - both metric and imperial - are available with the relevant international approvals.

The product choice is very simple:

- A consistent segmentation into **2 product structures** each for **basic** (TM40x) and **advanced technology** (TM41x) supports the preselection of the suitable thermometer
- For each segment a device with **metrical** (TM4x1) and **imperial** (TM4x2) design is available
- Support from a cost-free, graphical product configurator with integrated knowledge data base

All this saves time and costs and increases the planning security – misorders are practically impossible.

Device configuration	Basic technology		Advanced technology	
	TM401 metric	TM402 imperial	TM411 metric	TM412 imperial
Insert	Not replaceable		Replaceable	
Transmitter	1-channel; no display		1- or 2-channel; plug-on display (optional)	
Ex-certificate	No		Yes (ATEX, IEC, FM, CSA, NEPSI)	
Sensor	1x Pt100 standard thin film sensor		1x Pt100 standard thin film sensor, 1x Pt100 iTHERM® QuickSens or StrongSens, 1x or 2x Pt100 wire wound	
Extension neck	Standard		Standard, optional iTHERM® QuickNeck	

iTEMP® Transmitter
Accurate and reliable measured value transmission

iTHERM® QuickSens
Shortest response times worldwide:

- Fast, high-precision measurements
- Minimization of the needed insertion length
- Use of thermowells without affecting the measuring performance

iTHERM® StrongSens
Unmatched robustness:

- Vibration resistance > 60g
- Automated, traceable production

iTHERM® TA30R
Stainless steel terminal head:

- Optimal access to the terminals due to a low housing edge
- Optional display
- Protection class IP69K

iTHERM® QuickNeck
Divisible neck with quick release:

- Removal of the insert without tools
- Protection class IP69K

A3

ehedg

FDA

ASME
SETTING THE STANDARD
1880

Hygienic Equipment
STANDARDS COMMITTEE

Food & Life Sciences Product Overview

Type	Metric design				Imperial design		
Model	TTR35	TMR35	TM401	TM411	TMR35	TM402	TM412
Design							
Special features	Temperature switch	Compact thermometer	Basic technology	Advanced technology	Compact thermometer	Basic technology	Advanced technology
Certificates, Conformity	3-A, UL	EHEDG, 3-A, UL	EHEDG, 3-A, ASME BPE, FDA, TSE (Animal Fat Free Production)		EHEDG, 3-A, UL	EHEDG, 3-A, ASME BPE, FDA, TSE (Animal Fat Free Production)	
Measurement principle	RTD						
Measuring range	-50 to +150 °C (-58 to +302 °F)	-50 to +200 °C (-58 to +392 °F)	-200 to +600 °C (-328 to +1112 °F)		-58 to +392 °F (-50 to +200 °C)	-328 to +1112 °F (-200 to +600 °C)	
Process pressure	≤ 40 bar, dependent on the process connection						
Material and surface finish	316L, Ra < 0.8 µm or < 0.4 µm; optionally electro-polished	316L, Ra < 0.76 µm or < 0.38 µm	316L or 1.4435+316L, delta-ferrite < 1%, Ra < 0.76 µm or < 0.38 µm; optionally electro-polished	316L, Ra < 0.8 µm or < 0.4 µm; optionally electro-polished	316L, Ra < 0.76 µm or < 0.38 µm	316L, Ra < 0.76 µm or < 0.38 µm	316L or 1.4435+316L, delta-ferrite < 1%, Ra < 0.76 µm or < 0.38 µm; optionally electro-polished
Response time	t ₉₀ : 2.0 s	t ₉₀ : 7 s	t ₉₀ : 1.5 s	t ₉₀ : 2.0 s	t ₉₀ : 7 s	t ₉₀ : 1.5 s	t ₉₀ : 1.5 s
Process connection	Clamp according to ISO 2852, DIN 11851, DIN 11864-1, metallic sealing system, weld-in adapter, APV-Inline, Varivent®, Ingold connection, SMS 1147, compression fitting; For TM41x additionally: Neumo Biocontrol as well as T- and corner pieces according to DIN 11865 (also for TMR35)						
Output signal	1/2 PNP, 4 to 20 mA	Pt100 4-wire, 4 to 20 mA	Pt100 3/4-wire; 1-channel iTEMP® transmitter (4 to 20 mA; HART®)	Pt100 3/4-wire; 1-channel or 2-channel iTEMP® transmitter (4 to 20 mA; HART®, FF, PA)	Pt100 4-wire, 4 to 20 mA	Pt100 3/4-wire; 1-channel iTEMP® transmitter (4 to 20 mA; HART®)	Pt100 3/4-wire; 1-channel or 2-channel iTEMP® transmitter (4 to 20 mA; HART®, FF, PA)
Order number for Technical Information	TI105R/09	TI123R/09	TI01058 T/09	TI01038T/09	TI123R/09	TI01059 T/09	TI01057T/09

E+H = °C - Innovative Temperature Measurement

 Benefits at a glance:

- Global portfolio (metric/imperial) with international certificates
- User friendliness and security from product choice to maintenance
- iTHERM® inserts: fully automated production - worldwide unique. Complete traceability and constantly high product quality for reliable measurement values
- iTHERM® QuickSens: shortest response times (t₉₀: 1.5 s) for optimal process control
- iTHERM® StrongSens: unmatched vibration resistance (> 60g) for highest plant safety
- iTHERM® QuickNeck: cost and time savings through toolfree, easy recalibration
- iTHERM® TA30R: terminal head from 316L with improved handling for reduced installation and maintenance costs and highest protection class IP69K
- More than 50 hygienic process connections

Temperature measurement in Oil & Gas

The Oil & Gas industry is divided into the areas, “Up-stream – exploration and support”, “Mid-stream – transportation” and “Downstream– processing”. Different, very high requirements are made in these areas on the measurement technology used.



Requirements at a glance



with display

Terminal head/Communication

Field transmitter with display in 316L stainless steel for off-shore applications

Terminal head with screw cap

PC-programmable, with HART® protocol, PROFIBUS® PA or FOUNDATION™ Fieldbus

Neck/Extension

Coupling piece with integrated flame path barrier, Nipple-Union-Nipple (NUN)

Process connection

Flange according to ASME/ANSI, “full penetration welding”, “Greylock” connections, weld-in connections

Process wetted parts/thermowell

Process wetted parts in stainless steel: 316L / 1.4404, 316Ti / 1.4571 or Hastelloy® C 276 / 2.4819; barstock material for highest process pressures



without display

Heavy Duty Product Overview									
Type	Metric design						Imperial design		
Model	TR61/TC61	TR62/TC62	TR63/TC63	TR65/TC65	TR66/TC66	TMT162R/C, TMT142R/C	T13/T53	T14/T54	T15/T55
Design									
Special features	Fabricated thermowell	For screwing into an existing thermowell	Fabricated thermowell with flange	Without thermowell - direct medium contact	Barstock thermowell	Fabricated or barstock thermowell, with field transmitter TMT162 (2-channel) or TMT142 (1-channel)	Stepped thermowell and spring loaded measurement insert	Fabricated thermowell with flange and spring loaded measurement insert	For screwing into an existing thermowell
Approvals	ATEX Ex d, ATEX Ex ia, IECEx						FM/CSA XP Class 1, Div. 1		
Measurement principle	RTD, TC: Type J or K						RTD, TC: Type J, Type K, Type E, Type N, Type T		
Measurement range	RTD: -328 to 1112 °F (-200 to +600 °C) TC: -40 to 2012 °F (-40 to +1100 °C)						RTD: -58 to +392 °F (-50 to +200 °C) TC: -328 to +1600 °F (-200 to +870 °C)		
Process pressure	≤ 100 bar	Dependent on thermowell	≤ 80 bar	≤ 100 bar	≤ 480 bar	dependent on process connection			
Material	1.4404/SS316L; 1.4571/SS316Ti; 2.4819/Hastelloy® C276	Dependent on thermowell	1.4404/SS316L; 1.4749/SS446; 2.4816/INCONEL® 600	1.4404/SS316L	Wetted parts 1.4404/SS316L; 1.4749/SS446; 2.4819/Hastelloy® C276 Monel® 2.4816/INCONEL® 600		1.4404/SS316L, 2.4816/INCONEL® 600, 2.4819/Hastelloy® C276, Titanium, Monel®	Dependent on thermowell	
Process connection	Thread, compression fitting, flange	Thread	Thread, compression fitting, flange	Thread, compression fitting	Thread, flange		Thread, welded connection	Flange	Thread
Output signal	4 to 20 mA, HART®, PROFIBUS® PA, FOUNDATION™ Fieldbus						4 to 20 mA, HART®, PROFIBUS® PA, FOUNDATION™ Fieldbus		
Order number for Technical Information	TR61, TC61: TI01029T	TR62, TC62: TI01024T	TR63, TC63: TI01030T	TR65, TC65: TI01031T	TR66, TC66: TI01032T	TMT162R: TI266T/02 TMT162C: TI267T/02 TMT142R: TI128R/09 TMT142C: TI129R/09	T13, T14, T15: TI126R/24 T53, T54, T55: TI127R/24		

Approvals/certificates/tests

- **NACE (MR0175):** Suitability test of materials for acid gas surroundings by approval test EN 10204, 3.1 listed in the NACE standard MR0175.
- **Dye penetrant testing:** Dye penetrant testing according to the ASME V and ASME VIII guidelines.
- **X-ray test certificate:** X-ray test certificate for thermowell welding seams in accordance with ASME V – ASME VIII.
- **Thermowell calculation:** Thermowell calculation according to ASME PTC 19.3 using customer specific pressure, temperature and flow rate values.
- **Helium leakage test:** Sealing tightness test.
- **Pressure test:** Thermowell internal and external pressure test according to PED (Pressure Equipment Directive) in Europe or CRN (Canadian Registration Number) in North- and Central America.

High temperature applications

In glass smelters, flue gas applications and in the brick and ceramics industries temperatures up to 1700 °C can occur. This requires special thermometers with ceramic thermowells and thermocouples made from special metals, such as platinum and rhodium.

The ceramic thermowell external and sandwich coatings act as diffusion barriers. They serve as protection of the measurement point from mechanical and chemical damages in the process, e.g. from abrasive gases.

The ceramic thermowell inner sheath is the ceramic capillary.

It has the purpose of feeding and insulating the thermo wires. A higher number of ceramic protection coatings increases the life time of the measurement point.

Important influences are:

- Ceramic thermowell material and temperature limit values
- Temperature shocks in the process
- Gases and vapors
- Reducing and neutral atmospheres



High temperature measurement in cement production - with remote mounted head transmitter

Requirements at a glance



Terminal head

Form A terminal head
Form B terminal head

Process connection

Gas tight compression fitting, adjustable flange or flat face flange according to DIN 43734

Process wetted parts/thermowell

Ceramic thermowell - external and dividing coating as diffusion barrier,
Ceramic thermowell - internal coating as thermo wire feeder and insulation

Sensor/measurement insert

Thermocouples type J, K or type B, S, R for application at high temperatures, with ceramic or mineral coating



The diameter of the thermo wires for thermometers in the TAF series must be defined for high temperatures. The higher the process temperature is, the larger the thermo wire diameter has to be chosen.

Product overview high temperature thermometers

Model	TAF11	TAF12S	TAF12D	TAF12T	TAF16
Design					
Special features	Temperature measurement in glass or ceramic furnaces. With thermowell and internal sheath made of ceramic	Temperature measurement in glass or ceramic furnaces. With ceramic thermowell	Temperature measurement in glass or ceramic furnaces. With thermowell and internal sheath made of ceramic	Temperature measurement in glass or ceramic furnaces. With thermowell and two internal sheaths made of ceramic	Temperature measurement in metal and cement industries or incinerators. With metal or ceramic thermowell, internal ceramic sheath
Measurement principle	1x or 2x TC				
Measurement range	Type B: 0 to +1820 °C Type J: -210 to +1200 °C Type K: -270 to +1300 °C Type N: -270 to +1300 °C Type S: -50 to +1768 °C Type R: -50 to +1768 °C		Type B: 0 to +1820 °C Type S: -50 to +1768 °C Type R: -50 to +1768 °C		Type J: -210 to +1200 °C Type K: -270 to +1300 °C Type N: -270 to +1300 °C Type S: -50 to +1768 °C
Max. immersion length/ diameter (mm)	1700 14, 16, 17, 22 24, 26,6	1500 9	1500 14, 15	1500 24, 26	2200 14, 15, 17,2, 18, 21,3, 26,7
Material:					
Thermowell	Ceramic C610, sinterized silicon carbide (SiC), special silicon nitride ceramic (SiN)	Ceramic C610, C799		Ceramic C530, C610, C799	AISI: 316L, 310, 304, 446, INCONEL®: 600, 601; INCOLOY® 800HT, HASTELLOY® X, Kanthal AF and Kanthal Super, special nickel/cobalt alloy (NiCo), special silicon nitride ceramic (SiN)
Intermediate sheath	-	-	-	Ceramic C610, C799	-
Internal sheath	Ceramic C610	-		Ceramic C610, C799	
Process connection	Adjustable flange, gas tight compression fitting or stop flange according to DIN 50446				
Order number for Technical Information	TI00251T/09				

Materials

Among a various number of industry standard materials, e. g. ceramics as C530, C610 and C799 or metals like AISI 316L, 310, 304, 446, INCONEL®: 600, 601, INCOLOY® 800HT or HASTELLOY® X, Kanthal AF and Kanthal Super Endress+Hauser offers exclusive special materials for high temperature measurement.

For further information concerning special materials please contact your Endress+Hauser sales representative.

Benefits at a glance:

These exclusive special materials increase the life span of the sensors. This leads to:

- Cost savings for maintenance of the measuring point
- Quality improvements of the products
- Increased plant safety

The thermometer lines TAF11 and TAF16 have a modular design. The measurement inserts and thermowells can be ordered as spare parts via a standard order structure. This saves costs,

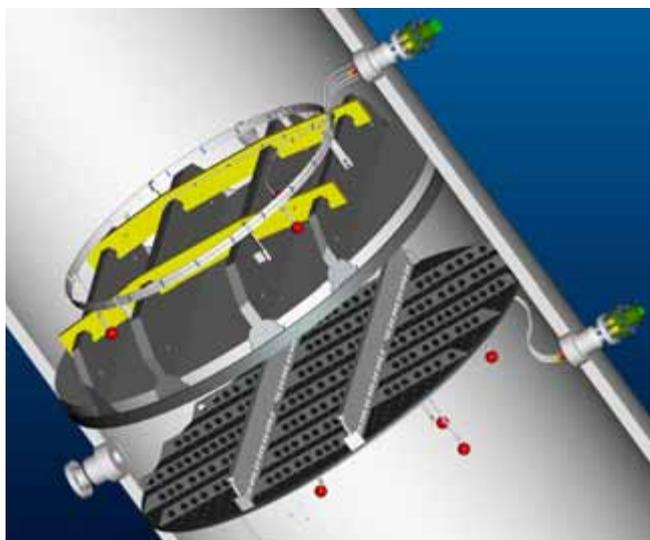
- as only actually defective parts need to be exchanged
- due to optimized stock keeping

Temperature Solutions

Temperature Solutions comprise custom-designed equipment which is conceived for special applications. Examples are measurement points for multi-point sensors, tube skin (surface measurement) sensors, thermocouples and thermowells. The combination of process conditions which bring about high temperatures as well as high flow velocities in aggressive and corrosive media requires special design and engineering of custom-made thermowells and sensors. With these components temperature measurement can be handled in applications such as hydro desulfurization, hydro crackers, reactors, storage tanks, process containers and boilers with the required reliability and precision.

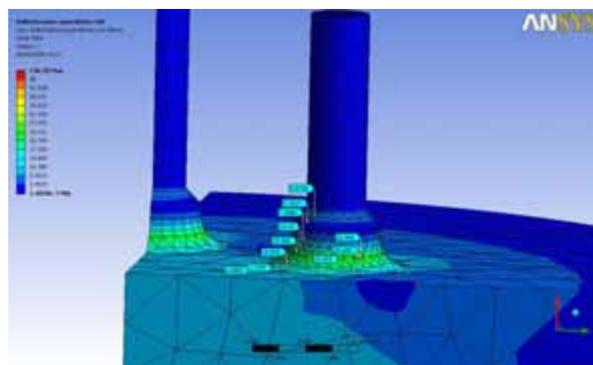
Temperature measurement in process reactors

Engineering services Endress+Hauser is a provider of technical solutions - therefore it is a matter of course that not only complete thermometers are provided but also the necessary engineering is implemented. "State-of-the-art" methods are used for engineering the solution e.g. the Finite Elements method, 3D-CAD models, etc.



The Endress+Hauser specialists also offer on-site support during installation in order to monitor a technically correct installation. This ensures that experts are available from the beginning of the project up to start-up.

Moreover, Endress+Hauser offers support in the internal reactor design e.g. the engineering of the support options within the reactor. When engineering these support structures it is important that no channeling occurs which would lead to deterioration in the reactor performance. The necessary engineering information is obtained through onsite customer visits where the best solution is developed in cooperation with the process engineers.



Maintenance of an installed diagnosis chamber

Diagnosis chamber concept

The diagnosis chamber is the heart of the system. It is simultaneously process connection, second safety barrier and interface for service activities and maintenance.

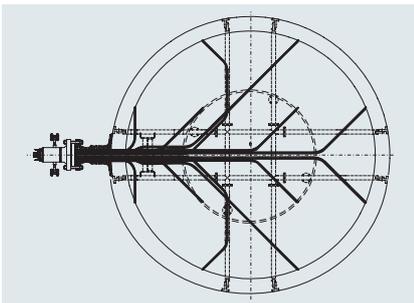
✓ Advantages:

- Defective thermocouples can be replaced without switching off the process
- The process can be contained in the case of thermowell break (PED certified chamber)
- Up to 15 thermocouples can be installed through one reactor connection

Multi-point thermocouples

Multi-point thermocouples are custom-made for applications in high pressure process reactors.

In these applications a temperature profile for control of the process in the reactor is measured and recorded. The challenge is to use as little space as possible for the measurement points and to obtain a response time of only a few seconds. With up-to-date manufacturing and sensor technology, up to 15 measurement points can be built in a pipe with external diameter of 6 mm. Each of these measurement points is able to obtain a fastest response time of 3 seconds.



Measurement point positioning in a process reactor (top view)

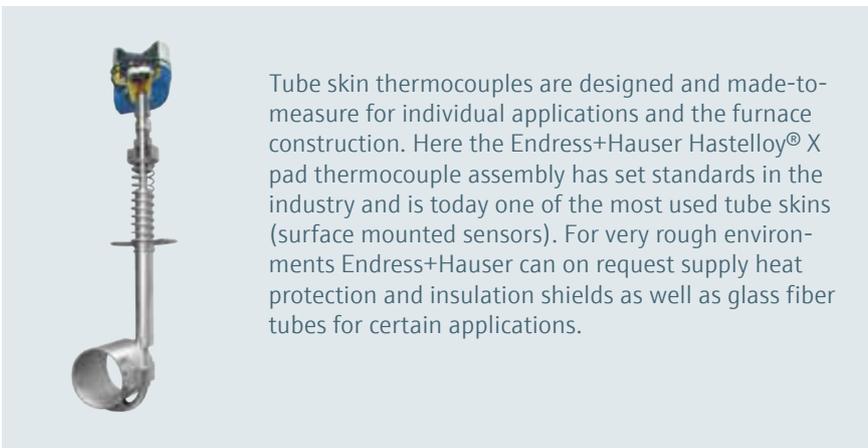


Multi-point connection flange

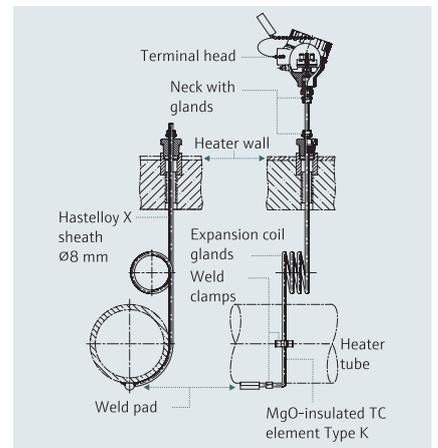


Installation of a multi-point thermocouple

Tube-skin thermocouples



Tube skin thermocouples are designed and made-to-measure for individual applications and the furnace construction. Here the Endress+Hauser Hastelloy® X pad thermocouple assembly has set standards in the industry and is today one of the most used tube skins (surface mounted sensors). For very rough environments Endress+Hauser can on request supply heat protection and insulation shields as well as glass fiber tubes for certain applications.



Approvals and certificates

High standards at the engineering, design stages and different tests during the production as well as final tests and controls counteract an early wear and tear failure of the equipment.



Qualified electric arc welding



DNV-Type tested high pressure thermowell



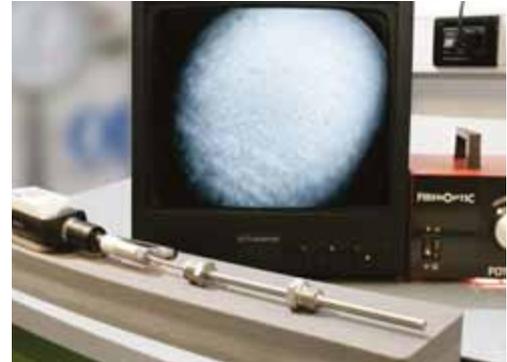
Diagnosis chamber, PED approval (97/23/EC)

Test center

Extensive measurement and test equipment are available for safeguarding the quality and continuous optimization of the thermometer, thermowell and transmitters.

Here, for example, the quality of welding and soldered connections are visually tested with micro- and endoscope and by X-ray examination.

Using dye penetration tests, ultrasound test, helium leakage test, pressure endurance test, insulation and vibration checks as well as various, non-destructive material tests the quality of materials and processing is proven.



Positive material identification (PMI) and optical quality control



Performance test at 900 °C in a furnace and hydrostatic pressure test

The response time of measurement insert with and without thermowell is measured and tested in a water velocity test installation according to VDI/VDE 3522 or IEC EN 60751.



Checking the sensor response time in a water velocity test unit



Wire spiral of a wire wound sensor with approx. 20 µm wire diameter

Smallest details up to 1 µm in thermometers can be recognized with precise X-ray equipment without having to open it or to destroy it.

Calibration and approvals



Accredited calibration laboratory according to ISO 17025

With their know-how and excellent equipment (high stable temperature baths and furnaces, fixed point cells, precision thermometers) the accredited calibration laboratories realize calibration of thermometers to the lowest possible measurement uncertainty and traceable to national standards and the ITS90 international temperature scale:

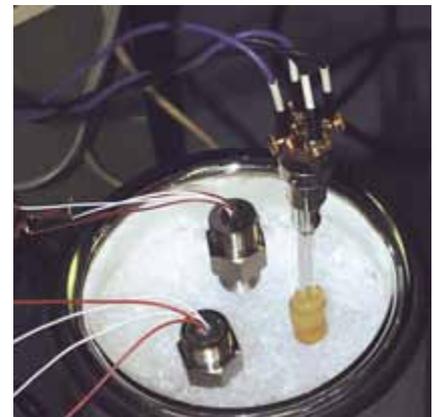
- Fixed point calibration at the water triple point cell (0.01 °C) and the ice point (0.0 °C) with a measurement uncertainty of < 5 mK and at the nitrogen fixed point of -196 °C.
- Comparison calibration of resistance thermometers and thermocouples with precision thermometers from -80 to +400 °C in very homogenous and stable calibration baths (measurement uncertainty 20 to 100 mK) and up to 1500 °C in calibration furnaces with a measurement uncertainty of ≤ 500 mK.
- High precision resistance measurements (1 ppm accuracy) and thermo voltage measurements (sub- μ V accuracy).
- Sensor-transmitter-matching for additional reduction of the thermometer measurement uncertainty.



Water triple point cell



ITS90 calibrated, SPRT (Standard Platinum Resistance Thermometer) reference thermometer



Ice bath zero point calibration



Certificates issued:

- Detailed works or Accredia-/DAkkS calibration certificates with measurement results according to ISO 17025, calibrating uncertainties according to GUM or DIN V ENV 13005 and identification curve approximations like Callendar/Van Dusen coefficients
- Testimonials in accordance with paragraph 3.1 EN 10204 regarding material compositions (if necessary with smelt composition), surface roughness and ferrite content

Planning, commissioning and maintenance tools

Temperature measurement technology is the oldest measuring principle with an correspondingly long history. Over the years more than 50 important standards to be observed by process industries have established themselves worldwide. Through these standards the individual components of a temperature measurement point such as the measurement insert, thermowell, terminal head, transmitter etc. are easily defined. With modern software tools it is possible today to manage the complexity and easily design the suitable thermometer for the right application.



Selection

Applicator selection

During the planning of measurement points the course is set right at the beginning, in the basic engineering phase. An optimally designed thermometer has many advantages:

- Reliable and accurate measured values
- Low risk of later device failures
- Constant process quality

For the choice of the suitable thermometer the most important parameters such as medium, pressure and temperature are requested in the Applicator Selection. With these details the tool makes an initial suggestion which can then be filtered further. The suggested device type technical data can be compared in a table. The result is a thermometer type which, on the one hand, meets all requirements but, on the other hand, is also not technically over dimensioned.

The efficient choice of a suitable thermometer saves engineering time and cost.

Configuration

Configurator^{+Temperature}

When configuring a measurement point numerous standards and guidelines must be taken into account. This software supports the necessary detailed engineering:

- Avoids time consuming catalog research.
- Automatically delivers the correct order code.
- Increases the engineering productivity.

The Configurator^{+Temperature} is a software which graphically supports the configuration of the selected thermometer type. The selected thermometer is put together in detail step by step. This starts with the geometry of the sensor tip, the process connection, the neck and ends with the choice of the terminal head and transmitter. Every step is supported in detail by illustrations and a knowledge database.

Not only all worldwide standards are deposited in the knowledge database for temperature measurement technology but also background information about the process industries, such as explosion protection and hygienic processes. The Configurator^{+Temperature} therefore leads to an ordering structure and increases the quality of the detail engineering.



Further information can be found under:

www.endress.com/applicator



Production

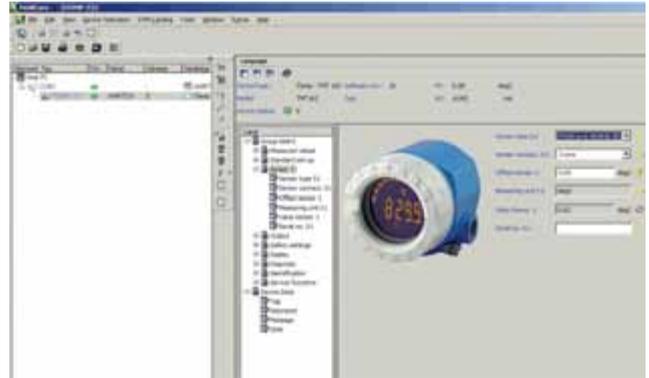
Common Equipment Record

When ordering a thermometer the result of the engineering is submitted to Endress+Hauser in form of an order structure. The associated data is not lost but is saved electronically as a birth certificate at the production of the thermometer. This database is called the “Common Equipment Record” and in turn is available to the customer for the complete life cycle of the thermometer.

This function is part of the Web supported Asset Management (W@M) software from Endress+Hauser. The customer can load all data to the device from the Internet and therefore optimize his own asset management. This is becoming more and more important in the process industries because, by optimizing supplies, considerable cost savings can be made in the life cycle of a production plant.

Therefore, in addition to the order details, the thermometer serial number and, if required, a measurement point identifier (TAG), calibration details and test certificates can be placed into the “Common Equipment Record”. Since the customer can access all this data during operation:

- Access to information on the measurement point is easy.
- Spare parts are quickly found during the operation phase.
- Down time is minimized.



Set-up

Fieldcare

For the operation and maintenance of field devices completely new prospects open up for the use of globally standardized “Field Device Technology” (FDT).

With the assistance of “Device Type Managers” (DTM):

- all commonly used field devices,
- independent from manufacturer,
- can be set up using an operating software.

The software Fieldcare is used for these worldwide FDT/DTM standards and therefore simplifies the parameter setting of thermometers and other field devices.

Basis functions of Fieldcare are:

- Maintenance of the connection to the field devices (point to point or per fieldbus systems)
- Easily read display of all device parameters
- Configuration of measurement devices (online and offline)
- Documentation of configuration and measurement point data (also in PDF format)
- Archiving and storage of device data as files (up-/download)
- Device status display for fast fault diagnosis

Furthermore Fieldcare offers extended functions which support the asset management of the customer. There is an automatic interface to W@M and the birth certificate of the field device. All data from the engineering phase is therefore passed on electronically via “Common Equipment Record” up to the device commissioning. This not only saves time but also avoids faults caused by mix-up.



Further Information:

- Competence in Temperature CP002R/09/en
- Calibration of Thermometers CP004R/09/en
- Engineered Temperature for the petrochemical industry CP003R/09/en
- System Components and Data Managers - FA00016K/09/en
- Tailor-made field instrumentation Measurement and control in the process industries FI001Z/00/en
- W@M Web enabled Asset Management supporting your business CP001Z/00/en



Further documentation and order code for detailed information on thermometers, transmitters and thermowells see last lines of the tables inside.



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