

Temperature Measurement Products

Spring Loaded Sensor Assembly - V10186
Welded Sensor Assembly - V10187
Sensor Assembly Without Thermowell - V10188
Sensor Only - V10189

■ Design

- Can be built from standardized components
- Standard lengths for fewer spare parts on stock
- Immersion lengths can be selected individually
- Sensor can be replaced during operation
- No welding seams coming into contact with media

■ Technical Features

- Approvals according to FM and ATEX for intrinsically safe installation of the transmitter
- Thermowell materials and designs adapted to operating conditions
- Installation of a transmitter in the connection head eliminates the need for multi-wire circuit
- Interference-immune standard output signal 4 to 20 mA

■ Applications

- Chemical process engineering
- Petroleum/natural gas supply and processing
- Power generation and heat distribution

■ FM Approved Sensor Assemblies

- Sensors approved for Intrinsic Safe Class 1, Div 1
- Sensors approved for Non-incendive Class 1, Div 2



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Sensor Design

All of the sensors assemblies are FM certified for Intrinsic Safe Class 1, Div 1; and Non-incendive Class 1, Div 2 applications, as well as, general purpose.

The thermocouple thermometers are used primarily for measuring temperatures in process systems which have corrosive media in the operating range up to 1832 °F (800 °C). RTD thermometers have an operating range up to 752 °F (400 °C).

They are composed of a thermowell made from bar stock material, with an extension and a connection head with a spring loaded or welded exchangeable sensor.

The design of the thermowell matches the mechanical requirements in both measurement and mechanical terms, thus enabling it to withstand high levels of stress caused by pressure (up to 10,000 psi), flow and vibration.

This sensor design is ideal for mating the sensors to virtually any enclosure and assembly. The sensor:

- can be removed while the system is running without dismantling the entire sensor,
- can be calibrated in a standard test facility,
- can be stocked as a universal standard component in order to assure availability of the system during replacement.

Spring Loaded Sensor Assembly V10186

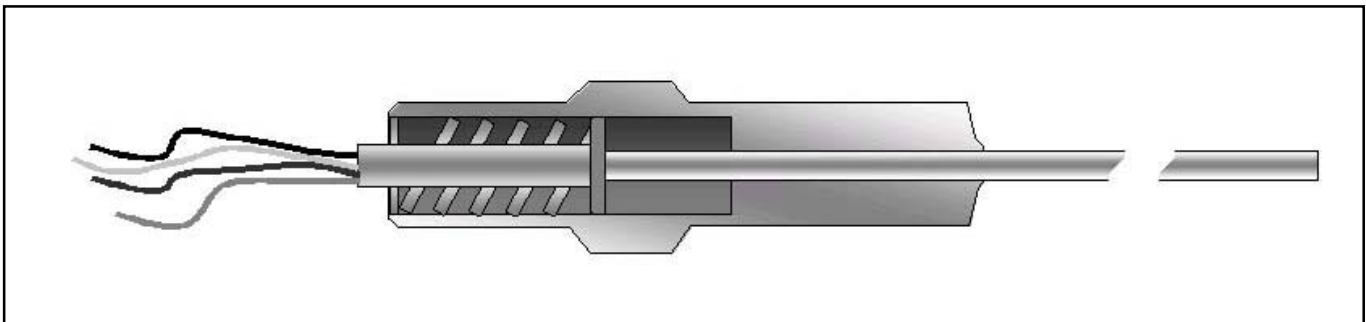


Figure 1

Welded Sensor Assembly V10187

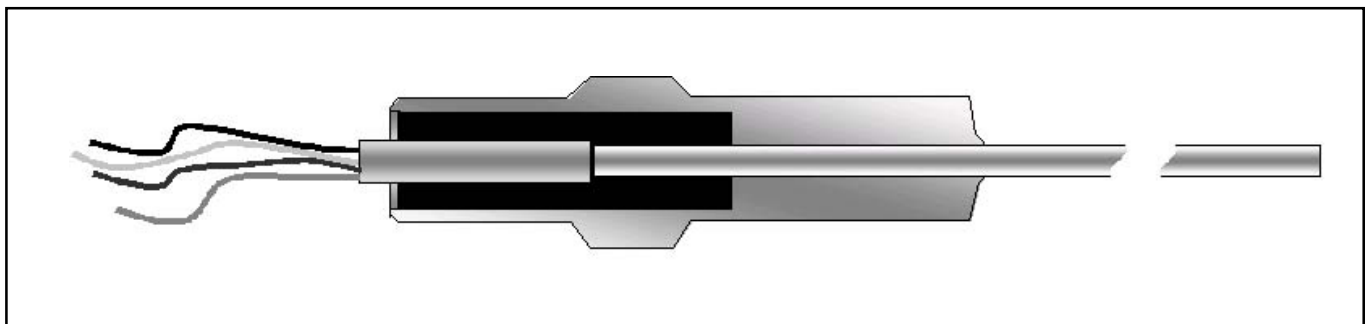


Figure 2

Response times

Apart from the thermowell mass at the measuring point, the factors governing the heat transfers, which are the chief determinants for the response time, are the heat capacity, pressure, density, moisture and flow velocity of the medium. The following table features approximate values, referring to water or air.

Greater flow velocities and heat capacities considerably reduce the time intervals. The values T0.5 and T0.9 give information on the time period after which 50 % or 90 % of a sudden temperature change is displayed.

TABLE 1

Sensor	Thermowell		In water 1.3 ft/s		In air 10 ft/s	
	Type	U-length	T 0.5	T 0.9	T 0.5	T 0.9
			Resistance Thermometer RTD	Tapered	2.5 inch	20 sec
	Tapered	5 inch	14 sec	44 sec	235 sec	706 sec
Thermocouple	Tapered	2.5 inch	16 sec	50 sec	235 sec	705 sec
	Tapered	5 inch	10 sec	40 sec	150 sec	500 sec

Resistance Temperature Detectors (RTD)

Nominal resistance/Standard/Tolerance

Resistance elements with platinum measurement windings are used. In accordance with DIN EN 60 751 the nominal resistance is defined as follows:

- 100 ohms at 0 °C
- Temperature coefficient $3.85 \times 10^{-3} (K^{-1})$ - Averaged between 0 °C and 100 °C.

For your quick reference some typical permissible values are shown in the table below for Class A and B.

For practical reasons we recommend a maximum long-term operating temperature of max. 400 °C for Class A tolerance.

Operational temperature

The temperature range is from -392 to +1110°F (-200 to +600°C)

Sheath material

The standard material used for all resistance thermometer measuring insets is 316 Ti.

Number of lead wires/measuring circuits/sheath diameters

Sensors can be supplied with:

- 1 or 2 measurement RTD's and in 2, 3 and 4-wire circuits.

However, in some particular cases the combinations are restricted.

TABLE 2

Resistance of platinum RTD according to IEC 60 751							
Temperature	0°C/32°F	100°C/212°F	200°C/392°F	300°C/572°F	400°C/852°F	500°C/932°F	600°C/1112°F
Ω	100	138.51	175.86	212.05	247.09	280.98	313.71
Allowed Deviation for platinum RTD according to IEC 60 751							
Class B	0.3°C/2.1°F	0.8°C/2.6°F	1.3°C/3.1°F	1.8°C/3.6°F	2.3°C/4.1°F	2.8°C/4.6°F	3.3°C/5.1°F
Class A	0.15°C/1.95°F	0.35°C/2.15°F	0.55°C/2.35°F	0.75°C/2.55°F	0.95°C/2.75°F	1.15°C/2.95°F	N/A

Resistance vs. Temperature Tables

The condensed Resistance VS Temperature Tables on the following pages are provided to aid in the proper RTD element selection.

Notice that the tables for the various platinum curves are for the standard 100 ohm @ 0°C sensor.

To calculate the resistance of:

50 ohm multiply the values by .5
200 ohm multiply the values by 2
500 ohm multiply the values by 5
100 ohm multiply the values by 10

Table C100 for the 100 ohm @ 25°C Copper (90.35 ohms @ 0°C) is published. To calculate the resistance of the 10 ohm at 25°C (9.035 ohms @ 0°C) multiply the value shown by .1.

100Ω PLATINUM (.00385 Ω/Ω/°C) @ 0°C (DIN 43760)

TEMP. °C	-100	-0	TEMP. °C	0	100	200	300	400	500	600
-0	60.25	100.00	0	100	138.50	175.84	212.03	247.06	280.90	313.59
-10	56.19	96.09	10	103.90	142.29	179.51	215.58	250.50	284.22	316.80
-20	52.11	92.16	20	107.79	146.06	183.17	219.13	253.93	287.53	319.99
-30	48.00	88.22	30	111.67	149.82	185.82	222.65	257.32	290.83	323.18
-40	43.67	84.27	40	115.54	153.58	190.46	226.18	270.72	294.11	326.35
-50	39.71	80.31	50	119.40	157.32	194.08	229.69	264.11	297.39	329.51
-60	35.53	76.33	60	123.24	161.04	197.69	233.19	267.49	300.65	332.66
-70	31.32	72.33	70	127.07	164.76	201.30	236.67	270.86	303.91	335.79
-80	27.08	68.33	80	130.89	168.47	204.88	240.15	274.22	307.15	338.92
-90	22.80	64.30	90	134.70	172.16	208.46	243.61	277.56	310.38	342.03
-100	18.49	60.25	100	138.50	175.84	212.03	247.05	280.90	313.59	345.13

Table 3

Thermocouples

Standard/Tolerance

For thermocouples conforming to DIN EN 60 584 various different classes are defined for the permissible deviation from the e.m.f. reference table. The measured thermoelectric emf. corresponds to the temperature difference between hot junction and reference junction. The reference table conforming to DIN EN 60 584 relates to a reference temperature at 0 °C. Because of the fact that, as the temperature rises, the effects of oxidation can have significant adverse effects on the characteristics and service life of a measuring inset, the specified operating temperatures (dependent on thermocouple type, tolerance class and sheath diameter) should never be exceeded.

Accessories, components

Many of the components of the models listed in the catalog can be ordered as separate components or modules. In this respect, please consult your nearest representative.

TABLE 4

Thermoelectric Voltage (mV) acc. to IEC 60584 / ASTM 230						
Temperature	200°C	350°C	500°C	700°C	900°C	1100°C
Temperature	392°F	662°F	932°F	1292°F	1652°F	1832°F
Type J (mV)	10.78	19.09	27.39	39.13	51.88	63.79
Type K (mV)	8.14	14.29	20.64	29.13	37.33	45.12
Type N (mV)	5.91	11.14	16.75	24.53	32.37	40.09
Allowed Deviation for Type K thermocouple acc. to IEC 60584						
Class 2	2.5°C/4.3°F	2.6°C/4.4°F	3.8°C/5.6°F	5.3°C/7.1°F	6.8°C/8.6°F	8.3°C/10.1°F
Class 1	1.5°C/3.3°F	1.5°C/3.3°F	2.0°C/3.8°F	2.8°C/4.6°F	3.6°C/5.4°F	N/A

TABLE 5

Standard and special combinations				
Type of thermocouple		Standards	Tolerance	
Type	Special	Standard Type	Standard Type	Special Type
J (Fe-CuNi)	E (NiCr-CuNi)	IEC 60584	Class 2	Class 1
K (NiCr-Ni)	T (Cu-CuNi)	IEC 60584	Standard	Special
N (NiCrSi-NiSi)	R (Pt13Rh-Pt)	IEC 60584	See Std	See Std
S (Pt10Rh-Pt) B (Pt30Rh-Pt6Rh)	L (Fe-CuNi) U (Cu-CuNi)	DIN43 710	DIN	½ DIN

TABLE 6

Operating temperature, lead resistance, sheath material				
Type	Measuring inset 6 mm Ø			Sheath material
	Long-term temperature for tolerance		Lead resistance	
	Class 1	Class 2		
T	-	500°C / 932°F	0.7	321
E	-	800°C / 1472°F	1.8	316 Ti
J	600°C / 1112°F	700°C / 1292°F	0.9	316 Ti
K	800°C / 1472°F	1000°C / 1832°F	1.5	INCONEL 600
N	800°C / 1472°F	1000°C / 1832°F	1.5	INCONEL 600
L	600°C / 1112°F	700°C / 1292°F 400°C / 752°F	0.9	321
U	-		0.7	321

Other versions

This data sheet contains only a small selection of our range of thermometers with thermowells and transmitter. Please consult your nearest representative for other models.

Other options:

- *Special Insertion Length*
- *Special process connection*
- *Thermowell material*
- *Design style of thermowell*
- *Conduit connections*
- *Connection head painting*
- *Tests and certificate*

Application and Technical Data

TABLE 7 - Limit of Error - Reference Junction at 32°F

Thermocouple Calibration	Temperature Range	Limits of Error			
		Standard (Whichever is Greater)		Special (Whichever is Greater)	
T	-200 to 350°C	± 1°C	or 0.759% above 0°C	± .5°C	or ± .4%
	-328 to 852°F	± 2°F	or 1.5° below 0°C	± 1°C=F	
J	0 to 750°C	± 2.2°C	or ± .75%	± 1.1°C	or ± .4%
	32 to 1382°F	± 4°F		± 2°F	
E	-200 to 900°C	± 1.7°C	or 0.5% above 0°C	± 1°C	or ± .4%
	-328 to 1652°F	± 3°F	or 1.0% below 0°C	± 2°F	
K	-200 to 1250°C	±2.2°C	or 0.75% above 0°C	± 1.1°C	or ± .4%
	-328 to 2282°F	± 4°F	or 2.0% below 0°C	± 2°F	
R,S	400 to 1400°C	±1.5°C	or ± .25%	Or ± .1%	
	752 to 2550°F	± 3°F			
B	800 to 1800°C	±0.5%	or ± .50%	Or ± .25%	
	1475 to 3270°F	over 900°C (1470°F)			
N	0 to 1250°C	±2.2°C	or 0.75% above 0°C	± 1.1°C	or ± .4%
	32 to 2282°F	± 4.0°F	or 2.0% below 0°C	± 2°F	

When the limit of error is given in %, the percentage applies to the temperature being measured, not the range.

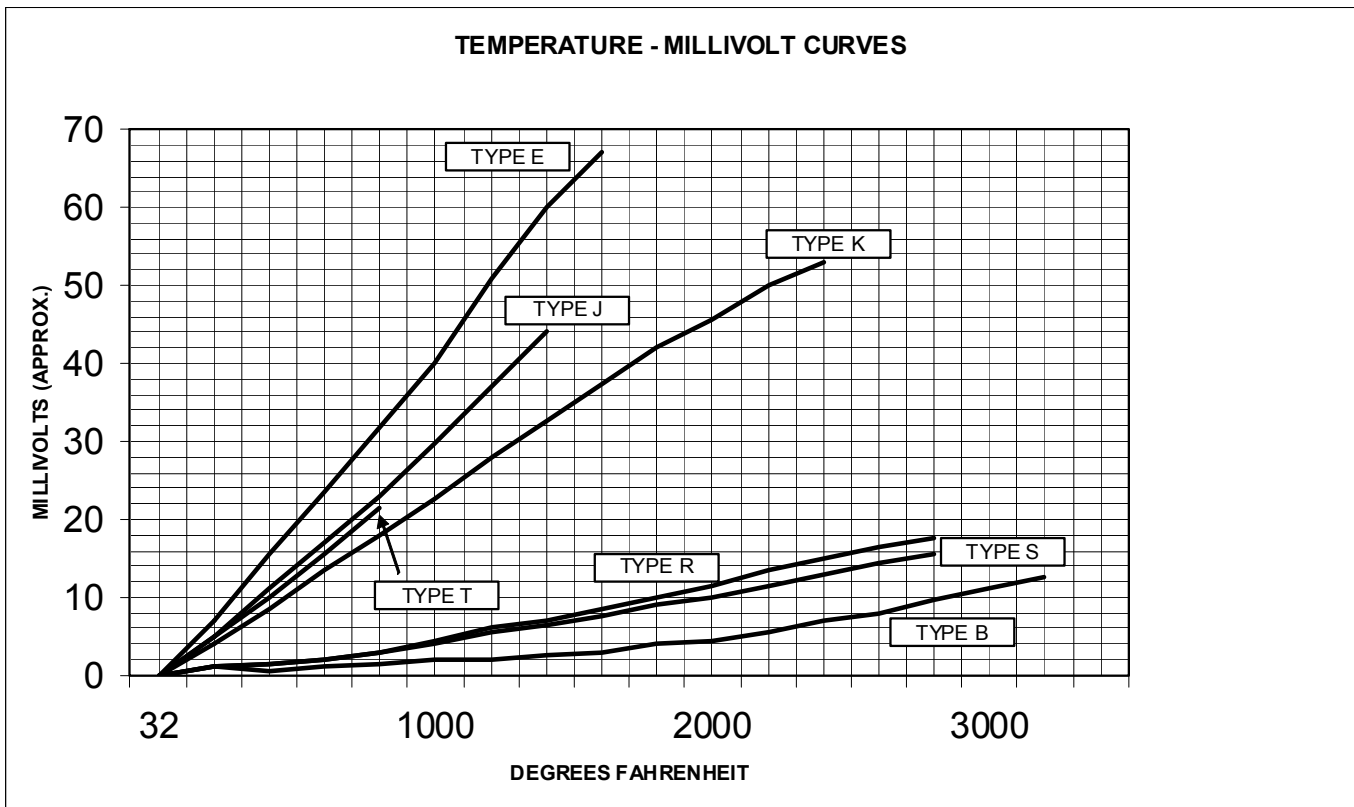
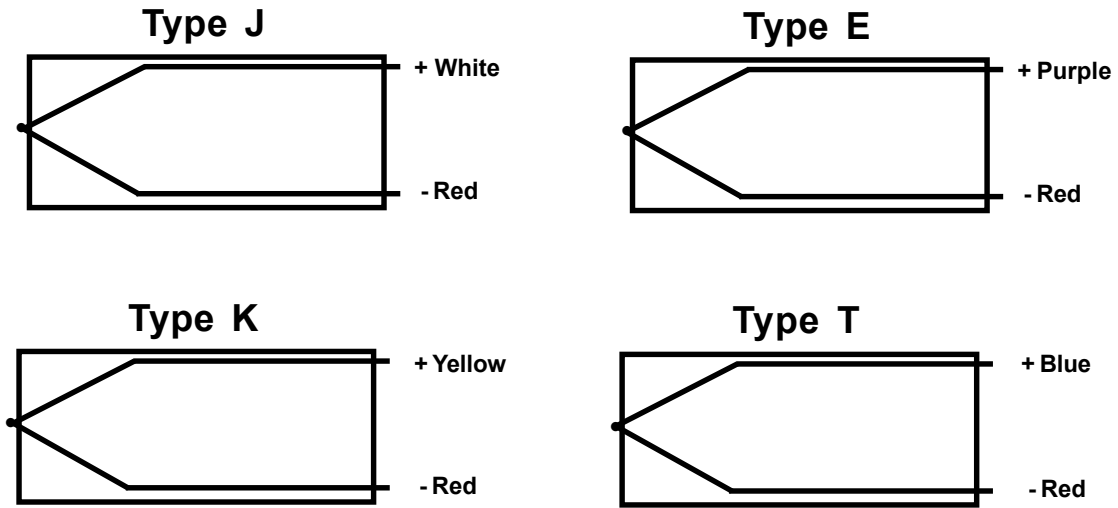


Figure 3

Thermocouple Lead-Wire Configurations



Thermocouple Junction Configurations

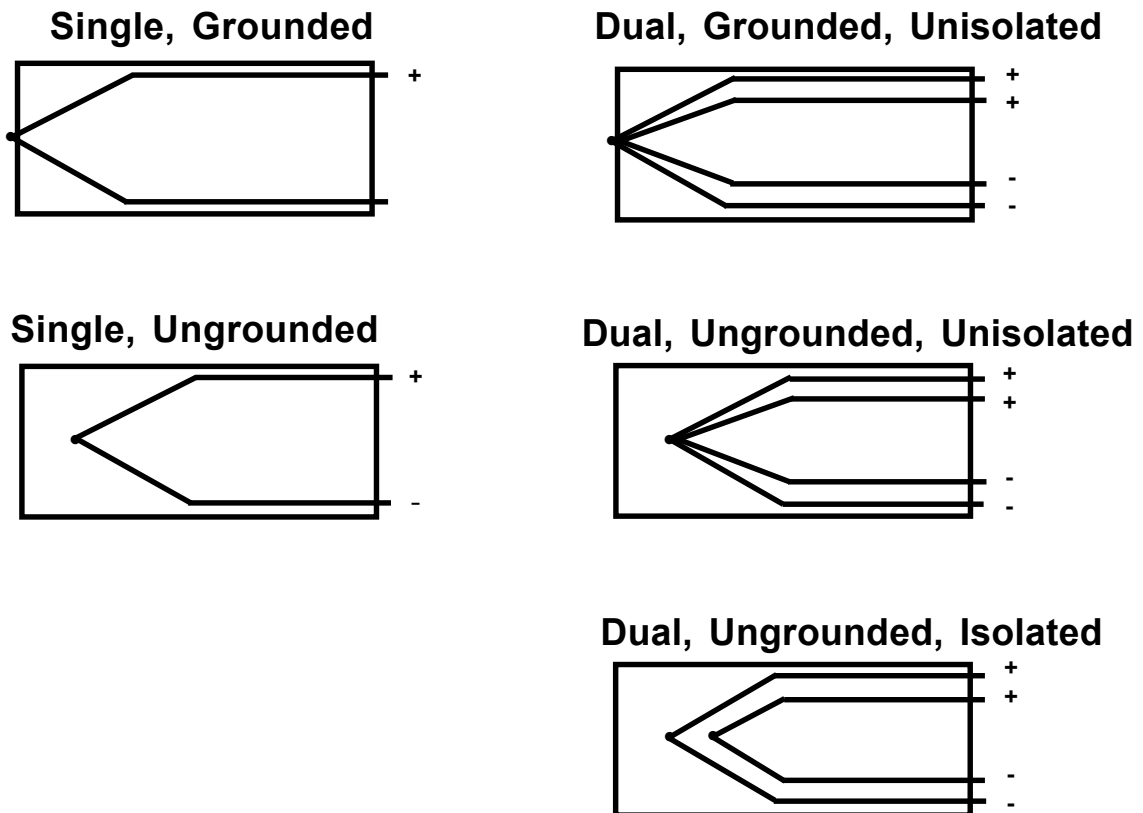


Figure 4

Thermowells

In most temperature measurement applications within process industry the sensitive element can not be placed directly into contact with the medium whose temperature is to be measured.

In such cases a thermowell must be used. The design of the well depends on the existing pressure, temperature, consistency and velocity of the medium.

ABB's thermowells are made from bar stock material and are available in 3 basic designs. For optimal response times different tip designs are available.

The design and selection of the thermowell matches the mechanical requirements in both measurement and mechanical terms, thus enabling it to withstand high levels of stress caused by pressure, flow and vibration.

Captions

- A = Well Bore depth
- B = Thermowell stem diameter
- L = Thermowell length
- P = Process Connection
- T = Lag Extension length
- U = Immersion length

Threaded

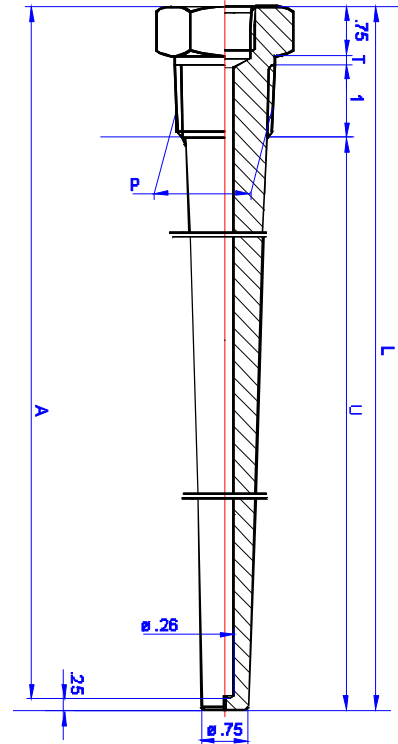


Figure 5

Flanged

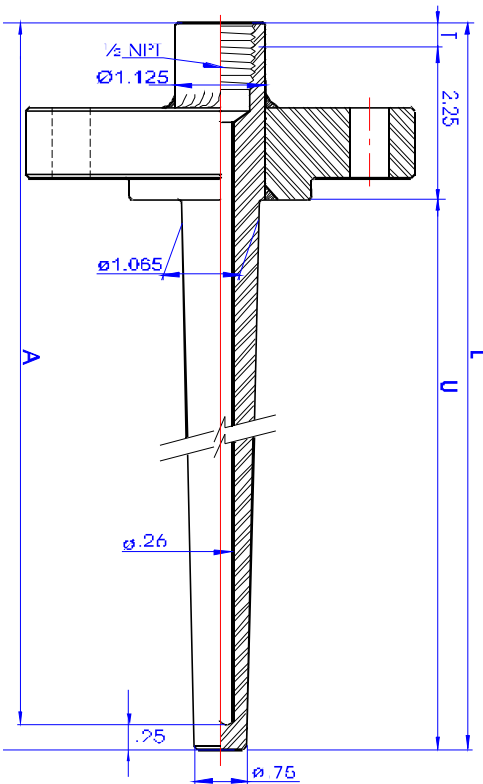


Figure 6

Socket Welded

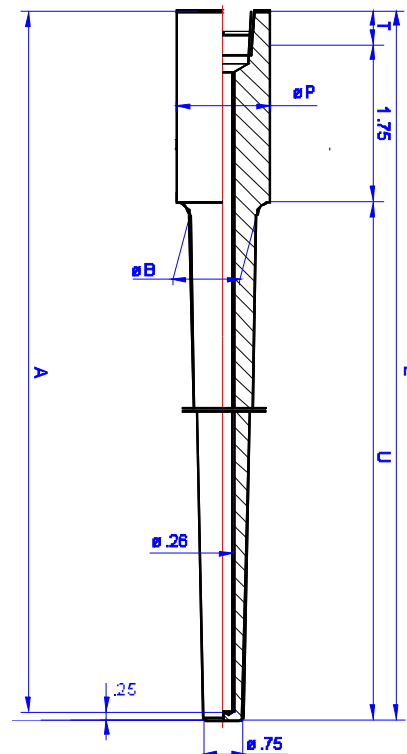


Figure 7

Material options

- Brass
- Carbon Steel
- 304 and 304/L Stainless Steel
- 316 and 316/L Stainless Steel
- Inconel 600
- Incoloy 800
- Monel 400
- Titanium GR2
- Hastelloy C276 and Hastelloy B
- PTFE

All thermowells in this data sheet are drilled from bar stock material and their outside shape machined. The thermowell designs represent common models conforming to US standards. Custom designed thermowells can also be supplied to any specification.

Operational data

The permissible stress depends on medium and installation related data:

General application specifications cannot be given in view of the wide range of choices. If stress values are needed, a Murdock or Dittrich stress analysis test is recommended.

Medium related	Installation related
- Medium	- Material
- Viscosity	- Thermowell design
- Flow velocity	- Immersion length
- Pressure	- Pressure at process connection
- Temperature	- Vibration

How to Select Thermowells

Thermowells are used to shield thermocouple elements against mechanical damage and corrosion. Many variations are available in a variety of materials to meet individual job specifications.

The chemical and physical properties of all standard bar stock materials are rigidly controlled. Use of specially designed and constructed measuring equipment enables standard guaranteed bore concentricity to be within $\pm 10\%$ of wall thickness. Internal threads are within 1/2 turn of standard plug gauge. External threads are within 1/4 turn of standard ring gauge.

If required by purchase order, your thermowells undergo an internal hydrostatic test as a final precaution against pressure failure. Test pressures and duration are determined by the customer. Radiograph and other tests can be performed and results furnished upon request.

A variety of alloys suitable for every thermowell requirement is available. Thermowell material should be selected for ability to withstand the process environments, high thermal conductivity and low porosity to gases.

Choosing Bore Sizes for Maximum Flexibility

Where several types of temperature measuring instruments are used, the selection of a standard bore diameter can provide greater efficiency and flexibility of use. The same well can accommodate either thermocouple, resistance thermometer, bi-metal thermometer or test thermometer. The bore sizes of wells shown in this catalog accommodate the most commonly used temperature sensing elements. For example:

.260 Diameter Bore:

- Bi-Metal Thermometers (1/4" stem)
- Thermocouples (#14 Awg)
- RTD's
- Other elements having .252 max. O.D.

When to Use Tapered or Straight Thermowells

Tapered thermowells provide greater strength without sacrificing sensitivity. Because of its higher strength-to-weight ratio, the tapered thermowell provides greater resistance to high frequency vibrations than straight thermowells. This permits reliable operation at high fluid velocities. Thus, for higher fluid velocities, the tapered well should be chosen; for lower fluid velocities, the straight well.

Choosing the Material

A most important factor in selecting thermowell material is to determine the corrosive conditions to which the well will be exposed. The high mirror polish given to all wells enhances its corrosion resistance capability.

Occasionally, the material consideration is one of strength rather than corrosion. For example, a stainless steel well may be required for high pressure water service, where a brass well might have been satisfactory from a corrosion viewpoint.

Choosing the Proper Connection

In this catalog you will find standardized wells of threaded, flanged (ASA and Van Stone), and socket weld types with standard bore sizes. A provision for customer specifying design parameters or “weld-in” thermowells is also provided.

Threaded wells are made in readily weldable material. Standard flanged wells (other than Van Stone) have flanges welded front and back with “V” or “J” groove design. Full penetration double welded flanges are also available.

Socket weld of wells are especially simple to install. They fit ASA standard socket weld couplings or flanges to produce a clean, tight installation.

Connection heads

There are several connection heads available:

Connection head types	Material	Cable Entry	Degree of protection	Lid closure	Surface
B	Aluminum	1/2" NPT	NEMA 4	2 Screws	Epoxy Painted
BUZH	Aluminum	1/2" NPT	NEMA 4	Hinged	Epoxy Painted
AGL	Aluminum	1/2" NPT	NEMA 4X	Screwed Lid	Epoxy Painted
AGLHD	Aluminum	1/2" NPT	NEMA 4X	Screwed Lid	Epoxy Painted

Type B, Aluminum, epoxy painted

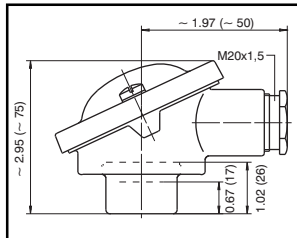


Figure 8

Type BUZH, Aluminum, epoxy p.

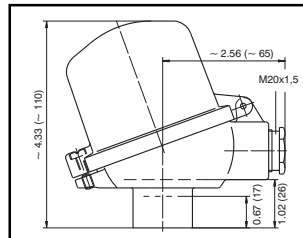


Figure 9
For use with a Transmitter

Type AGL, Aluminum, epoxy painted

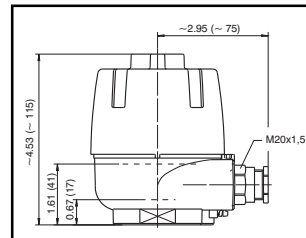


Figure 10
For use with a Transmitter

Type AGLHD, Aluminum, epoxy p.

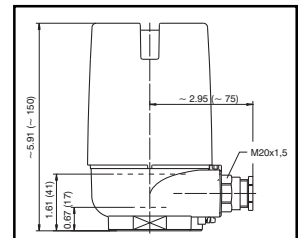


Figure 11
For use with a prometer or cometer

Extension

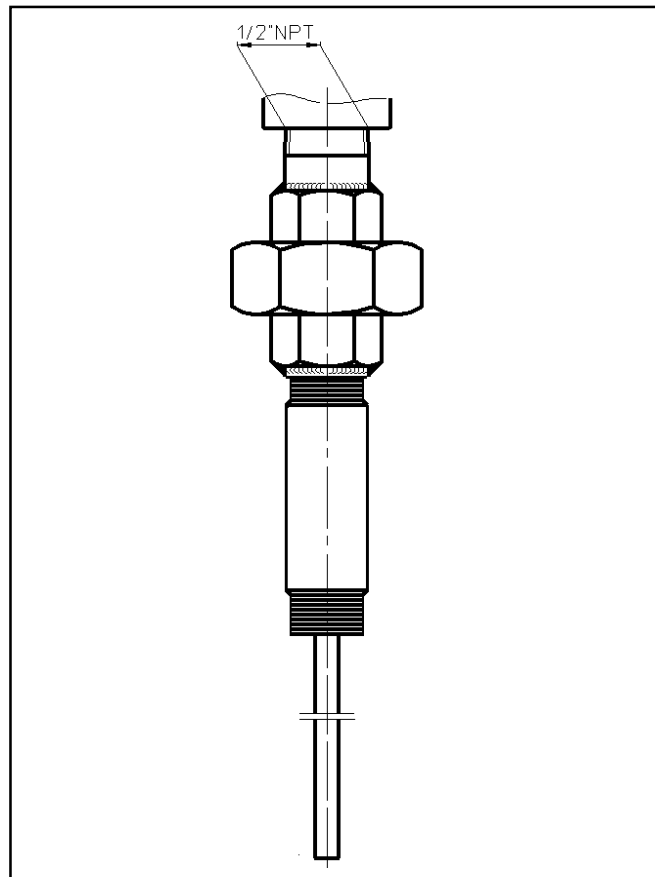


Figure 12
Nipple - Union

Transmitter Options

General Purpose

TF02	Foundation Fieldbus
TF12	PROFIBUS PA
TH 02	HART® programmable
TS04	Programmable via push button. (2/3 wire RTD)
TS05	Programmable via push button (Type J & K TC)

Hazardous Areas (intrinsically safe)

TH 02-Ex	HART® programmable
TF 12-Ex	PROFIBUS PA
TF 02-Ex	Foundation Fieldbus

TH02/TH02-ex – Head-mounted temperature transmitter, HART programmable via push-button, Pt 100 (RTD), thermocouples, electrical isolation

Technical Data

Output

Output signal (temperature-linear)	4 to 20 mA
Current consumption	<3.6 mA
Max. output current	23.6 mA
Residual ripple	<0.3%

Parameterizable current error signal

Underranging	3.6 mA
Overranging	22 mA
Default value	3.6 to 23.6 mA

Damping

t63 = 0 to 30

Input

Resistance	
Resistance thermometer	Pt 100 (IEC751,JIS,SAMA) n - Pt 100/Ni 100 to Pt 1000/ Ni 1000: Cu (n=0.1, 0.2, 0.5, 1, 2, 3, to 10) Min. measuring span 15K/50 K
Resistance	0 to 500 ohm/0 to 5000 ohm Min.measuring span 5 ohm/50 ohm

Maximum line resistance (Rw) per core 2,3,4 wire	7.5 ohm, 10 ohm, 50 ohm
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Measuring current 300 uA

Sensor short-circuit <5 ohm (for RTD)

Sensor break (temperature/resistance
measurement 2,3,4 wire)

Measuring range	0 to 500 ohm	>530 ohm
Measuring range	0 to 5000 ohm	>5.3 K ohm

Sensor wire break monitoring in accordance with NAMUR NE 89

Sensor wire break detection	
3 wire resistance measurement	>35 ohm
4 wire resistance measurement	>3.7 K ohm

Thermocouples

Voltages	-125 mV to +125 mV -125 mV to +1200 mV
Minimum measuring span	2 mV/50 mV
Sensor wire break monitoring in accordance with NAMUR NE 89	Pulsed with 1 uA outside of the measuring interval
Monitoring disconnectible	
Thermocouple measurement	> 5 k ohm
Voltage measurement	> 5 k ohm
Internal reference junction	Pt 100, via software switchable (no jumper necessary)

Power Supply (poling protected)

Supply voltage

Non-Ex-application	Us = 8.5 to 30 V DC
For Ex-Application, max. Ui	= 8.5 to 29.4 V DC
2 wire method: power supply wires =	signal wires

Influence of supply voltage <0.05 % / 10

Maximum residual ripple < or = 1% Us
(<500 Hz)

Power demand of indicators (only with AGL head)

(Power demand of transmitter and indicator have to be added)

Prometer and Cometer	Usd = 2.9 V DC
Maximum load	(Usmax – Usmin)
R(k ohm) =	23.6

General characteristics

Output signal refreshment rate

Pt 100	0.4 s (Input signal change < 0.25 K/s)
Thermocouples	0.2 s (Input signal change < 0.25 K/s)

Vibration resistance

Vibration in operation 2g acc. to DIN IEC 68T. 2-6

Resistance to shock acc. to DIN IEC 68T.2-27

Electrical isolation (I/O) 1.5 kV AC (60 s)

Long-term stability < or = 0.1 % p.a.

Environment conditions

Ambient temperature range -40 to 85 dg. C

Transport and storage temperature
-40 to 100 dg. C

Relative humidity <100 %
(100% humidity with
isolated terminals only)

Condensation Permitted

Mechanical construction

Dimension	Refer to dimensional drawing
Weight	2 ounces
Housing material	
Polycarbonate	
Black (Non-Ex-type)	
Blue (Ex-type)	
Electrical connection	
Terminals , pluggable	2.5 mm 2. screw terminals (stainless steel screws)

Characteristics at rated conditions

According to IEC 770 (related to 25 dg. C)¹⁾

Digital measured error	
Pt 100	+ or = 0.1 K
Thermocouples	+ or = 20uV
Linear resistance	500 ohm / 5000 ohm
	+ or = 40m ohm/200 m ohm
Linear voltage	120 mV / 1200 mV
	+ or = 20 uV / 50 uV
D/A measured error	+ or = 0.05% of measuring span

¹⁾ Percentage related to set measuring span

For more detail information on this temperature transmitter, refer to Spec/Data sheet D-TH-TH02

Connection Diagram

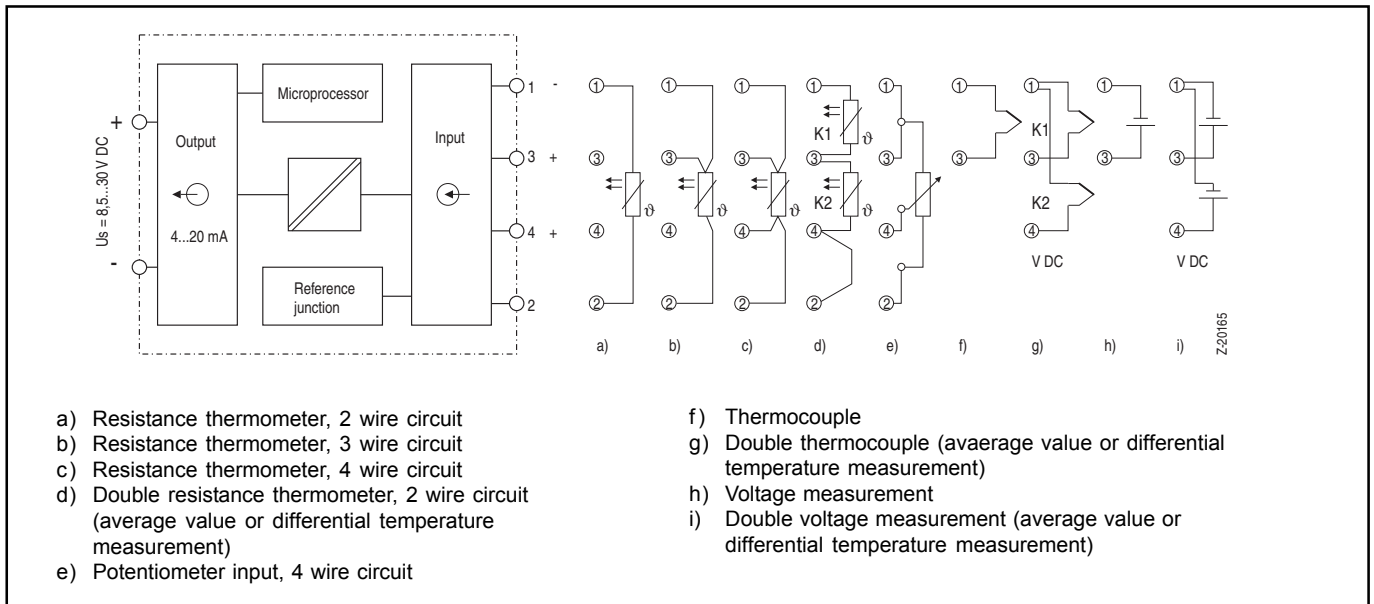


Figure 13

Dimensional Diagram (dimensions in mm)

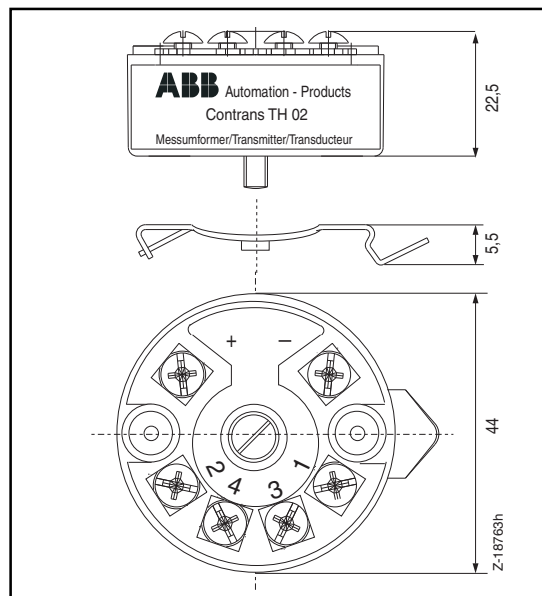


Figure 14

TS04 – Head-mounted temperature transmitter,programmable via push-button, Pt 100 2/3-wire (RTD)

Technical Data

Output

Output signal(temperature-linear)	4 to 20 mA
Current consumption	3.8 mA
Max. output	22 mA
Error current signal	22 mA
(Sensor or sensor cable break, or sensor signal out of range between –200 and 850 dg. C (-328 and 1562 dg. F), short-circuit or device error)	
Optical error current signalling through permanently lit LED	

Input

Resistance thermometer Pt 100 (IEC 751)	2-wire or 3-wire
Max. span	1050 K
Min. span	40 K
Conversion in dg.F: $T[dg.F] = 9/5 \times T[dg.C] + 32K$	
Max. sensor cable resistance.	
3-wire circuitry	<10 ohm per feed cable (Sensor cable resistances must be identical)
2-wire circuitry	to be added to Pt 100 value
(Sensor cable resistance is directly considered for the measuring accuracy)	
Max. length of sensor feed cable	< 10 ft. (For up to 10 ft. of length the specified EMC can be ensured)
Pt 100 measuring current	approx. 1 mA

Power Supply (protected against polarity reversal)
(2-wire technique: power cable=signal cable)

Supply voltage Vs = 8 to 30 V DC

Max. load

$$R(k\ ohm) = \frac{(Vs_{max} - Vs_{min})}{20}$$

(e.g. Vs = 24 V, R = 800 ohms)

General Specifications

Measuring rate	500 ms
Response time (T70%)	500 ms
Electrical isolation (I/O)	none

Electromagnetic compatibility

Compliance with	89/336/EEC
RFI suppression	EN50081-1
EMI/RFI shielding to	EN50082-2
	EN61000-4-2/-3/-4/-6/-8

Note: Observe the max length of 10 ft for the sensor feed cable. Use shielded power/signal cables, ground on one side

Meets the requirements for CE conformity
Installation category II
Degree of pollution 1
Insulation class II
Inflammability class UL 94 HB

Environmental Capabilities

Ambient temperature range	-20 to 70 dg.C (-4 to 158 dg.F)
Storage temperature	-40 to 70 dg.C (-40 to 158 dg.F)
Relative humidity (non-condensing)	max. 95%

Mechanical construction

Dimensions	see dimensional drawing
Weight	30 g
Housing material	ABS
Color	black
Terminals	max. 2.5 mm ²

Characteristics at rated conditions⁽¹⁾

acc to IEC 770 (referred to 25 dg.C/77 dg. F)	
Balancing uncertainty	<0.15% or <0.15K The greater value is valid
Linearity deviation	<0.05% or <0.05K The greater value is valid

Influences

Ambient temperature drift	<0.1%/10 K or <0.1 K/10 K The greater value is valid
Long-term drift (can be re-adjusted)	<0.1% per year
Supply voltage influence	0.008% / V referred to 20V

Standard measuring range

Pt 100, 3-wire, 0-100 dg. C (32 –212 dg. F)
Overranging (22 mA) in case of error

⁽¹⁾ Percentage related to measuring span

For more detail information on this temperature transmitter, refer to Spec/Data sheet D-TH-TS04

Dimensional drawing (dimensions in mm)

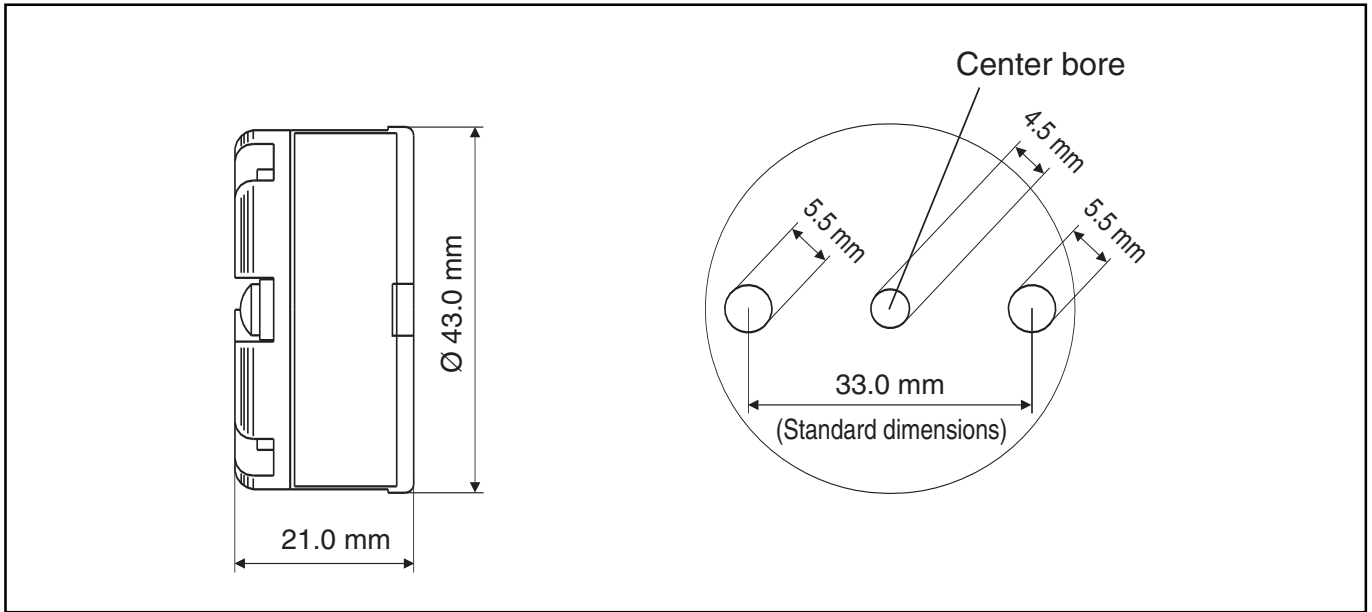


Figure 15

Connecting Diagram

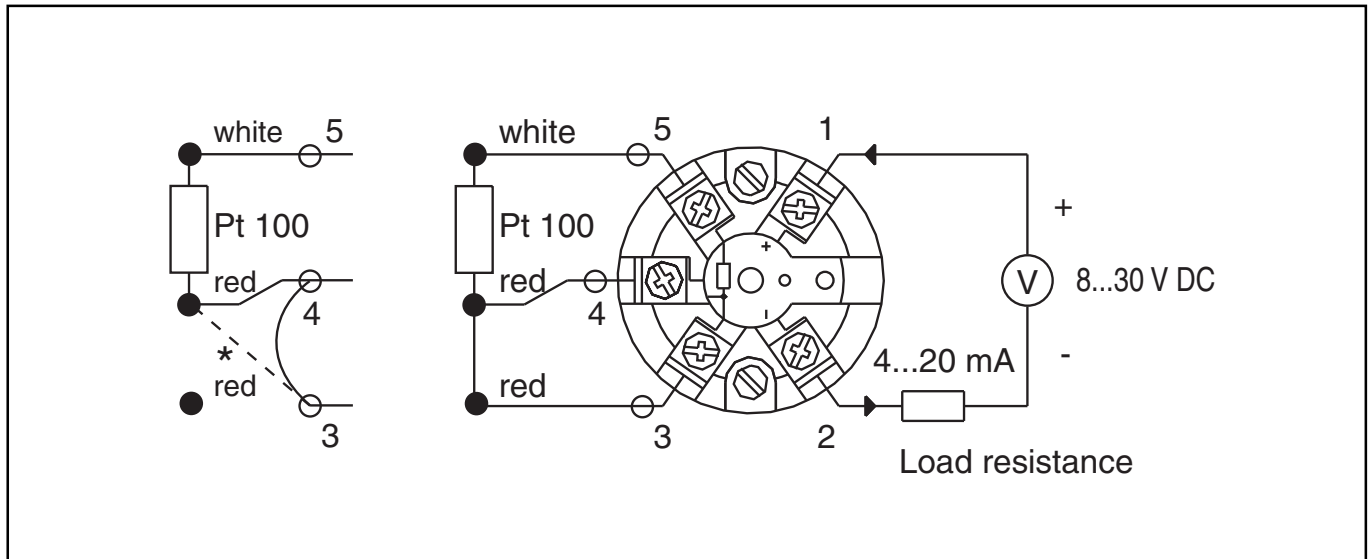


Figure 16

TS05 – Head-mounted temperature transmitter, programmable via push-button, thermocouples

Technical Data

Output

Output signal(temperature-linear)	4 to 20 mA
Current consumption	3.8 mA
Max. output	22 mA
Error current signal	22 mA
(Sensor or sensor cable break, or sensor signal out the max measuring range of the respective thermocouple; error current optically indicated via permanently lit LED)	

Input

Thermocouple	
Transmitter type	max. measuring range
V11507-1100	Type K: -200 to 1370 dg.C (-328 to 2498 dg.F) Type J: -200 to 1200 dg.C (-328 to 2192 dg.F) Type T: -200 to 400 dg.C (-328 to 2192 dg.F)
V11507-1300	Type J: -200 to 1200 dg.C (-328 to 2192 dg.F) Type F: -200 to 1200 dg.C (-328 to 2192 dg.F) Type E: -200 to 1000 dg.C (-328 to 1832 dg.F)

Min. measuring range
4 mV or min. temperature range, depending on thermocouple type, e.g. Type K 4 mV corresponds to 100 K
Conversion in dg.F: $T[\text{dg.F}] = 9/5 \times T[\text{dg.C}] + 32 \text{ K}$

Power Supply (protected against polarity reversal)

(2-wire technique: power cable=signal cable)
Supply voltage $V_s = 8 \text{ to } 30 \text{ V DC}$

Max. load

$$R(\text{k ohm}) = \frac{(V_{s\text{max}} - V_{s\text{min}})}{20}$$

(e.g. $V_s = 24 \text{ V}$, $R = 800 \text{ ohms}$)

General Specifications

Measuring rates	500 ms
Response time (T70%)	500 ms
Electrical isolation (I/O)	50 V DC (Test: 200 V DC 1 min.)

Electromagnetic compatibility

Meets the requirements for CE conformity
Installation category II
Degree of pollution 1 Insulation class II
Inflammability class UL 94 HB

Environmental Capabilities

Ambient temperature range	-20 to 70 dg.C (-4 TO 158 dg.F)
Storage temperature	-40 to 70 dg.C (-40 to 158 dg.F)
Relative humidity (non-condensing)	max. 95%

Mechanical construction

Dimensions	see dimensional drawing
Weight	30 g
Housing material	ABS
Color	black
Terminals	max. 2.5 mm2
Characteristics at rated conditions ⁽¹⁾ acc to IEC 770 (referred to 25 dg.C/77 dg. F)	
Balancing uncertainty	<0.15% or <0.15K The greater value is valid
Linearity deviation	<0.05% or <0.05K The greater value is valid

Influences

Ambient temperature drift	<0.1%/10 K or <0.1 K/10 K The greater value is valid
Influence of reference junction	<0.05%/10 K bzw. <0.05 K/ 10K The greater value is valid
Long-term drift	<0.1% per year
Supply voltage influence	0.008% / V referred to 20V

Standard measuring range

V11507-1100	Type K: 0 to 1000 dg. C (32 to 212 dg. F)
V11507-1300	Type J: 0 to 1000 dg. C (32 to 212 dg. F)
Overranging (22 mA) in case of error	

⁽¹⁾Percentage related to measuring span

Compliance with	89/336/EEC
RFI suppression	EN50081-1
EMI/RFI shielding to	EN50082-2 EN61000-4-2/-3/-4/-6/-8
Note: Observe the max length of 10 ft for the sensor feed cable.	
Use shielded power/signal cables, ground on one side	

For more detail information on this temperature transmitter, refer to Spec/Data sheet D-TH-TS05

Connecting Diagram

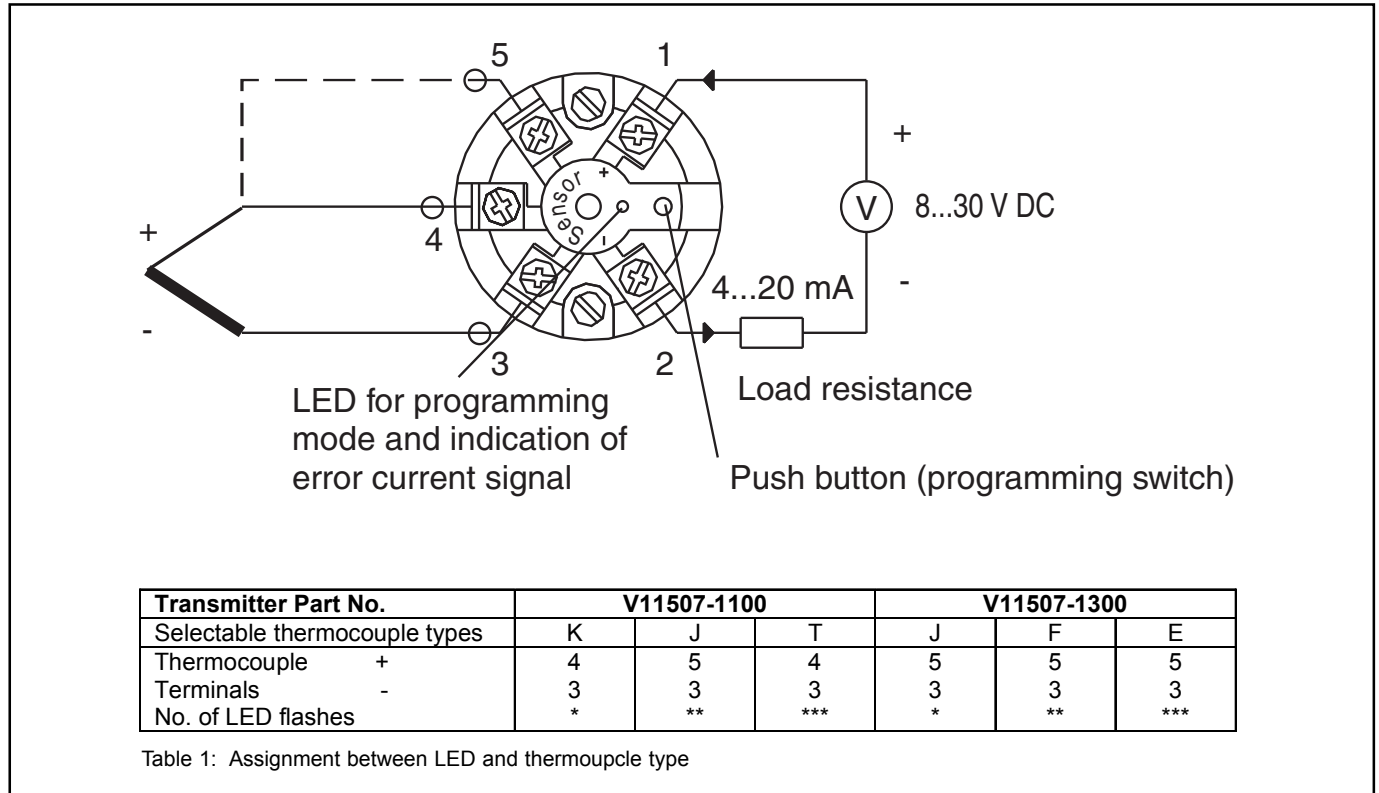


Figure 17

Dimensional drawing (dimensions in mm)

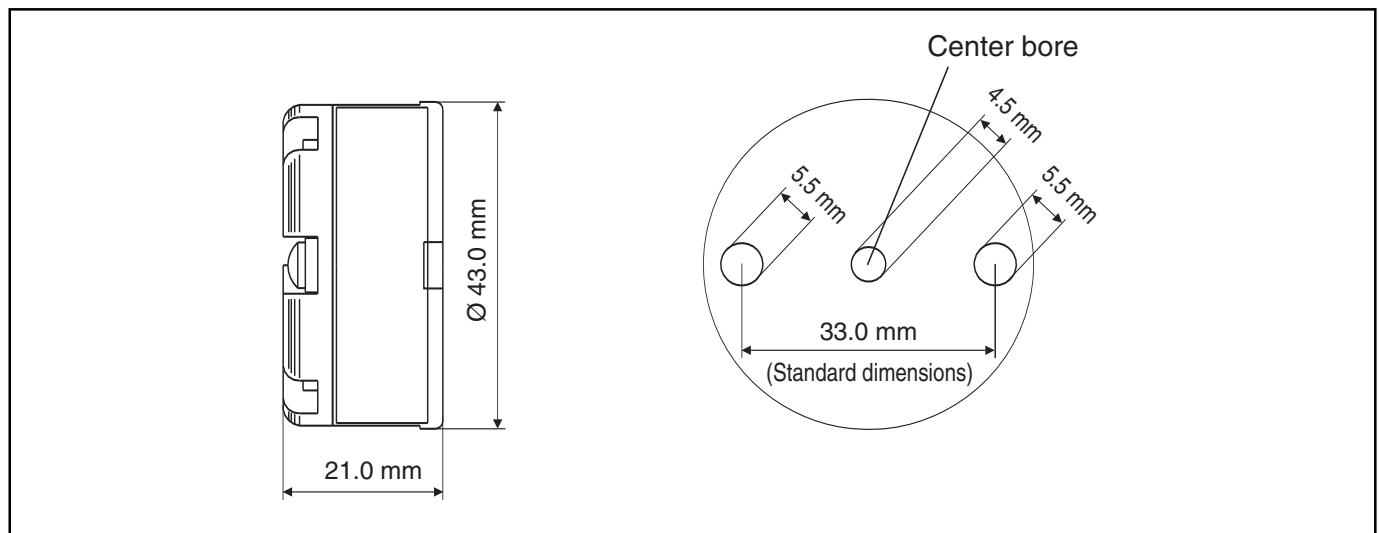


Figure 18

TF02 / TF02-ex – Head-mounted temperature transmitter, FOUNDATION Fieldbus (H1)

Technical Data

Output

Digital output signal	FOUNDATION Fieldbus (H1)
Nominal current consumption	10.5 mA
Max. current in case of device error	15 mA
Transmission rate (Baud rate)	31.25 kbit/s
Damping (programmable)	t63 = 0 to 10 ³⁸ s

Input

Resistance (temperature linear)		
Resistance thermometer	n - Pt100 bis Pt1000 (IEC 751: n = 0.1; 0.5; 1; 2; 5; 10) (JIS 1604: n = 0.1; 0.5; 1; 2; 10) (SAMA: n = 0.1; 0.5; 1) Ni50, Ni100, Ni120, Ni1000, Cu10, Cu100	
Resistance	Range	Accuracy
	0-500 ohm	2 m ohm
	0-4000 ohm	20 m ohm
Max.lead resistance (Rw) per core		
2,3,4 wire	5 ohm , 10 ohm , 50 ohm	
Measuring current	300 uA	
Sensor short-circuit	<5 ohm	
Sensor break(temperature/resistance measurement, 2,3,4 wire)		
Measuring range	0 to 500 ohm	> 520 ohm
Measuring range	0 to 4000 ohm	> 4200 ohm
Sensor wire break monitoring in accordance with NAMUR		
Sensor wire break detection		
3 wire resistance measurement	> 35 ohm	
4 wire resistance measurement	> 3.7 k ohm	
Input filter	50/60 hz	

Thermocouples

Types	B,C,D,E,J,K,L,N,R,S,T,U	
Voltages	Range	Accuracy
	-100 mV to +1200 mV	10µV
	-75 mV to +75 mV	2µV
Sensor monitoring current	1uA between the measuring cycles	
Sensor wire break monitoring in accordance with NAMUR		
Thermocouple measurement	> 5 k ohm	
Voltage measurement	> 5 k ohm	
Input filter	50/60 hz	
Internal reference junction	Pt 100, via software switchable (no jumper necessary)	

Power supply (at transmitter terminals)

Supply voltage	Us = 9 to 32 V DC
for explosion protection application	Ui = 9 to 24 V DC
Supply voltage, poling protected	

General characteristics

Rise time	<0.5 s
Vibration resistance	
Vibration in operation	2g acc. to DIN IEC 68T .2-6
Resistance to shock	2g acc. to DIN IEC 68T .2-27
Electrical isolation (I/O)	1.5 kV AC
Long –term stability	< or = 0.1% p.a. or 0.2 K p.a.

Environmental conditions

Ambient temperature range	-40 to +85 dg. C
Transport and storage temperature	-40 to +100 dg. C
Relative humidity	<100% (100% humidity with isolated terminals only)
Condensation	permitted

Electromagnetic compatibility (EMC)

According to NAMUR NE 21 recommendation
With PT100 Sensor and Thermocouple

Type of test	Degree	Standard
Burst to signal/data lines	1 kV	EN61000-4-4 EN61326
Static Disgauge contact discharge to: contact plate terminals	8 kV 6 kV	EN61000-4-2
Radiated field - 80 MHz...2 GHz	10 V/m	EN61000-4-3
Coupling – 150 kHz-80 MHz	10 V	EN61000-4-6

Mechanical construction

Dimensions refer to dimensional drawing
 Weight 2 ounces
 Housing material polycarbonate
 Color black / blue (Ex version)
 Terminals, pluggable screw terminals 2.5 mm²
 (stainless steel screws)

Influences

Influence of ambient temperature
 Pt100 + or = 0.25 K/ 10 K
 Resistance measurement
 0 to 500 ohm + or = 10 m ohm / 10 K
 0 to 4000 ohm + or = 100 m ohm / 10 K
 Thermocouple e.g. Type K + or = 0.25 K / 10 K
 Voltage measurement
 -100 mV to +1200 mV + or = 150 uV / 10 K
 -75 mV to +75 mV + or = 10 uV / 10 K

Characteristics at rated conditions

acc. to IEC 770 (related to 25 dg. C)

Measuring error incl. characteristic deviation

Pt 100 + or = 0.1 K

Resistance measurement

0 to 500 ohm + or = 40 m ohm
 0 to 4000 ohm + or = 320 m ohm

Thermocouple e.g. Type K + or = 0.25 K

Voltage measurement

-100 mV to +1200 mV + or = 50 uV
 -75 mV to +75 mV + or = 10 uV

Additional influence of the Pt100

DIN IEC 751 Kl. B internal reference junction

Parameterization / structure

Type of input(2 independent channels),
 measuring range, Input filter, damping, alarm
 function, limit values, saving

All data proof against mains failure.

Standard parameter (factory settings)

Channel 1

Pt 100, 4 wire circuit, 0 to 100 dg. C

Damping 0 s, unit dg. C

Channel 2

disabled

Standard	Input Element		Measuring Range	
		Sensor		
IEC 584-1		Thermocouple Type B	0 to +1820°C	(+32 to +3308°F)
		Thermocouple Type E	-270 to +1000°C	(-454 to +1832°F)
		Thermocouple Type J	-210 to +1200°C	(-346 to +2192°F)
		Thermocouple Type K	-270 to +1372°C	(-454 to +2502°F)
		Thermocouple Type R	-50 to +1768°C	(-58 to +3215°F)
		Thermocouple Type S	-50 to +1768°C	(-58 to +3215°F)
		Thermocouple Type T	-270 to +400°C	(-454 to +752°F)
		Thermocouple Type N	-270 to +1300°C	(-454 to +2372°F)
W3, ASTME 998		Thermocouple Type C	0 to +2315°C	(+32 to +4200°F)
		Thermocouple Type D	0 to +2315°C	(+32 to +4200°F)
DIN 43710		Thermocouple Type L	-200 to +900°C	(-328 to +1652°F)
		Thermocouple Type U	-200 to +600°C	(-328 to +1112°F)
IEC 751; JIS; SAMA ¹ 2,3 and 4-wire		Resistance thermometer Pt100	-200 to +850°C	(-328 to +1562°F)
		Resistance thermometer Pt1000	-200 to +850°C	(-328 to +1562°F)
DIN 43760 ² 2,3 and 4-wire (a = 0.00618)		Resistance thermometer Pt100	-60 to +250°C	(-76 to +482°F)
		Resistance thermometer Pt1000	-60 to +250°C	(-76 to +482°F)
Resistance 2,3 and 4-wire		Ω	0 to 500Ω / 0 to 4000Ω	
Voltage		MV	-100mV to +1200mV -75mV to +75mV	

Note: ¹ IEC 751 a = 0.00385; JIS a = 0.003916; SAMA a = 0.003902
² Edison Curve No. 7 for Ni120

Table 8

For more detail information on this temperature transmitter, refer to Spec/Data sheet D-TH-TF02

Block Diagram

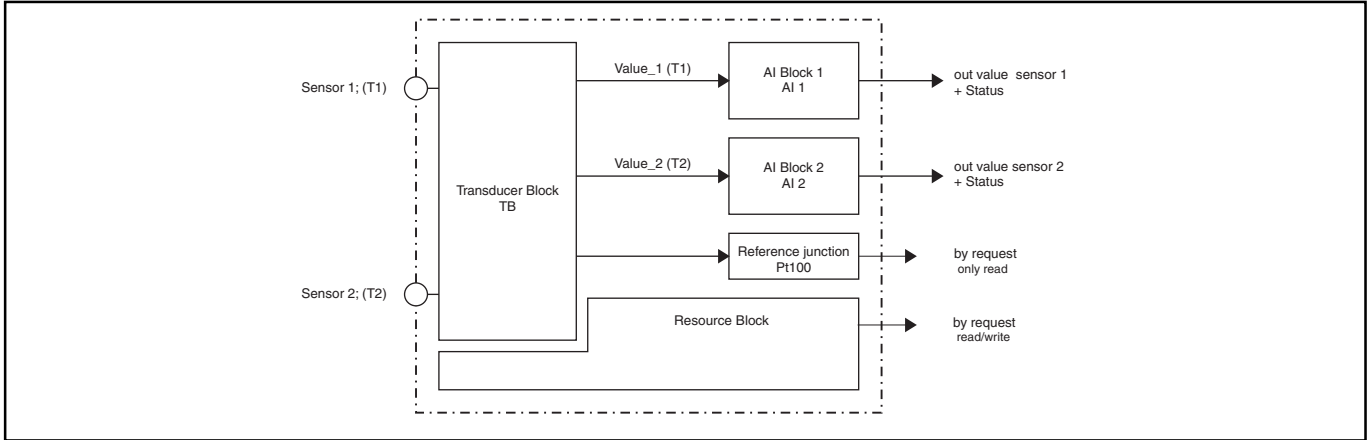


Figure 19

TF02/TF02-Ex
Head Mounted Temperature Transmitters, FOUNDATION Fieldbus (H1)
Connection Diagram

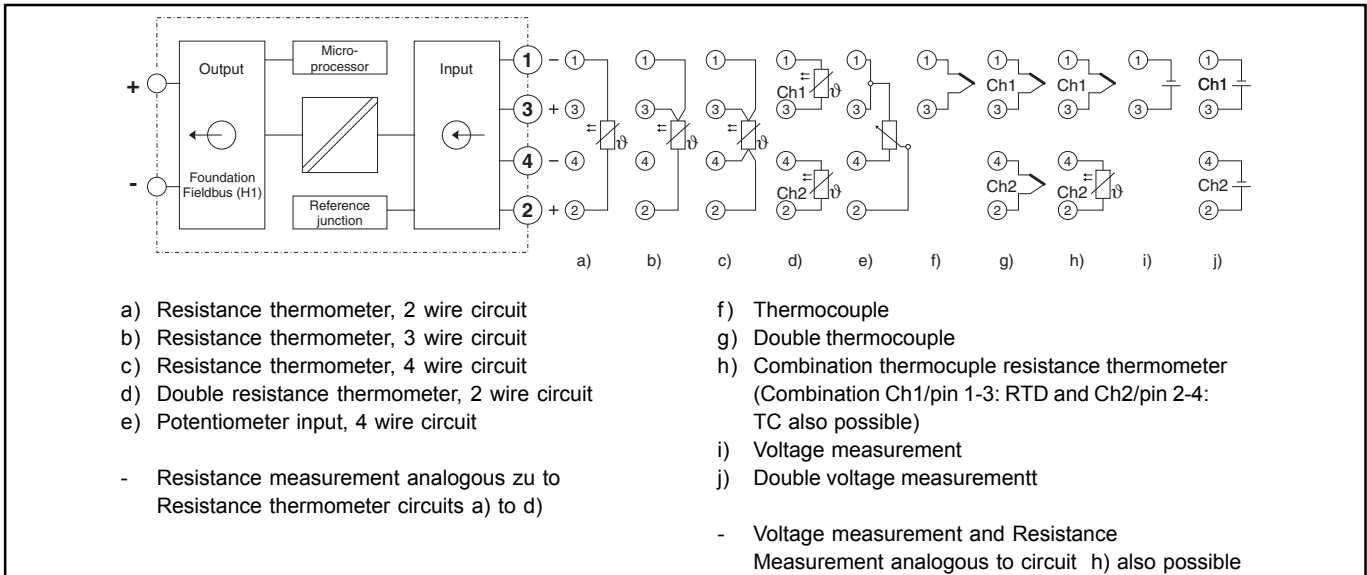


Figure 20

Dimensional Diagram (dimensions in mm)

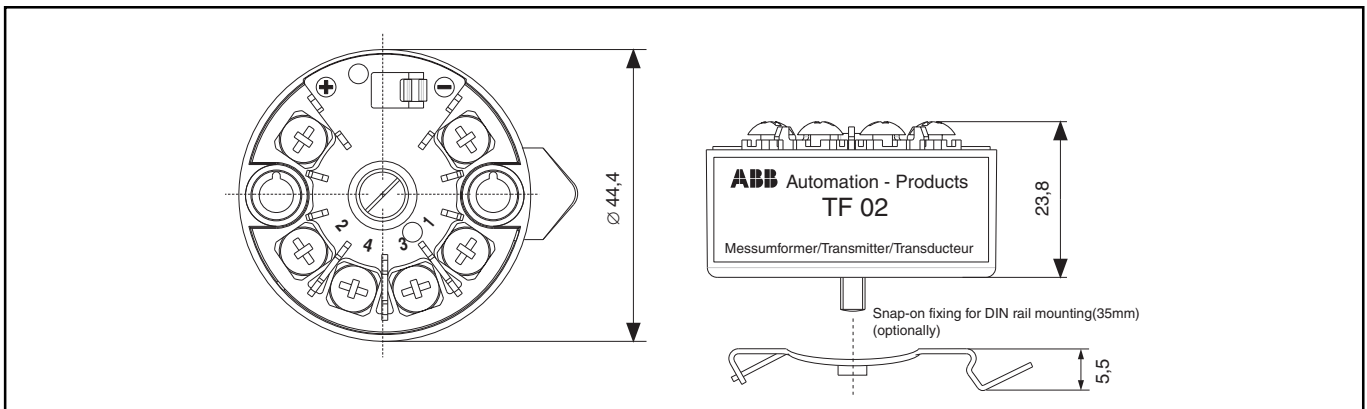


Figure 21

TF12 / TF12-ex – Head-mounted temperature transmitter, Profibus PA

Technical Data

Output

Digital output signal	PROFIBUS PA profile V3.0 Type A and B
Nominal current consumption	11.8 mA
Max. current in case of device error	15 mA
Transmission rate	31.25 kbit/s
Damping	t63 = 0 to 60

Input

Resistance(temperature linear)	
Resistance thermometer	Pt50 – Pt100 – Pt1000
Resistance	0 to 400 ohm / 0 to 4000 ohm
lead resistance (Rw) per core	< 5 ohm
Measuring current	200 uA
Sensor short-circuit	<5 ohm (for RTD)
Sensor break	> 5 M ohm

Thermocouples

Types	B,C,D,E,J,K,L,N, R,S,T,U
-------	--------------------------

Voltages

Sensor monitoring current	200 Ua
Input resistance	5 M ohm
Input filter	50/60 hz
Internal reference junction	Pt 100, programmable

Power supply

Supply voltage, poling protected for explosion protection application	Us = 9 to 32 V DC Ui = 9 to 17.5 V DC
---	--

General characteristics

Rise time	<0.1 to 1.25 s
Vibration resistance	
Vibration in operation	2 g acc. to DIN IEC 68 part 2-6
Electrical isolation	1.5 kV

Environment conditions

Ambient temperature range	-40 to 85 dg. C
Transport and storage temperature	-40 to 100 dg. C
Relative humidity	< 100% (100% humidity with isolation terminals only)
Condensation	permissible

Characteristics at rated conditions¹⁾

(acc.to IEC770, related to 25 dg. C)	
Measuring error includes characteristic deviation	
Pt 100 / resistance measurement	typ. <0.2% min. < 0.2 K
Thermocouple / mV	min. < 20 uV
Additional influence of the internal reference junction	Pt100 DIN IEC 751 cl. B

Mechanical construction

Housing material	polycarbonate
Color	black / blue (Ex version)
Weight	8.8 ounces
Terminals	Screw terminals 2.5 mm2

¹⁾ Percentage related to set measuring span

Standard	Input element Sensor	Measuring range	Basis Measuring error
IEC 584-1	Thermocouple Type B	400 to +1820°C (752 to +3308°F)	0.8 K
	Thermocouple Type E	-100 to +1000°C (-148 to +1832°F)	0.2 K
	Thermocouple Type J	-100 to +1200°C (-148 to +2192°F)	0.2 K
	Thermocouple Type K	-189 to +1370°C (-292 to +3200°F)	0.2 K
	Thermocouple Type R	-50 to +1760°C (-58 to +3200°F)	0.8 K
	Thermocouple Type S	-50 to +1760°C (-58 to +3200°F)	0.8 K
	Thermocouple Type T	-200 to +400°C (-328 to +752°F)	0.2 K
	Thermocouple Type N	-180 to +1300°C (-292 to +2372°F)	0.2 K
W3, ASTM E 998	Thermocouple Type C	0 to +2300°C (32 to +4172°F)	0.2 K
	Thermocouple Type D	0 to +2300°C (32 to +4172°F)	0.2 K
DIN 43710	Thermocouple Type L	-100 to +900°C (-148 to +1652°F)	0.8 K
	Thermocouple Type U	-200 to +600°C (-328 to +1112°F)	0.8 K
IEC 751 ¹⁾	Resistance thermometer Pt100	-200 to +850°C (-328 to +1562°F)	0.4 K
	Resistance thermometer Pt1000	-200 to +850°C (-328 to +1562°F)	0.4 K
	Resistance thermometer Pt100/Pt1000	-100 to +250°C (-148 to +482°F)	0.2 K
DIN 43760 (a = 0.00618)	Resistance thermometer Ni 100	-60 to +250°C (-76 to +482°F)	0.2 K
Resistance	2, 3, 4-wire	0 to 400 Ω 0 to 4000 Ω	0.10%
Voltage		-15 mV to 115 mV	20 µV

Note: 1) a = 0.00385

Table 9

For more detail information on this temperature transmitter, refer to Spec/Data sheet D-TH-TF12

Block Diagram

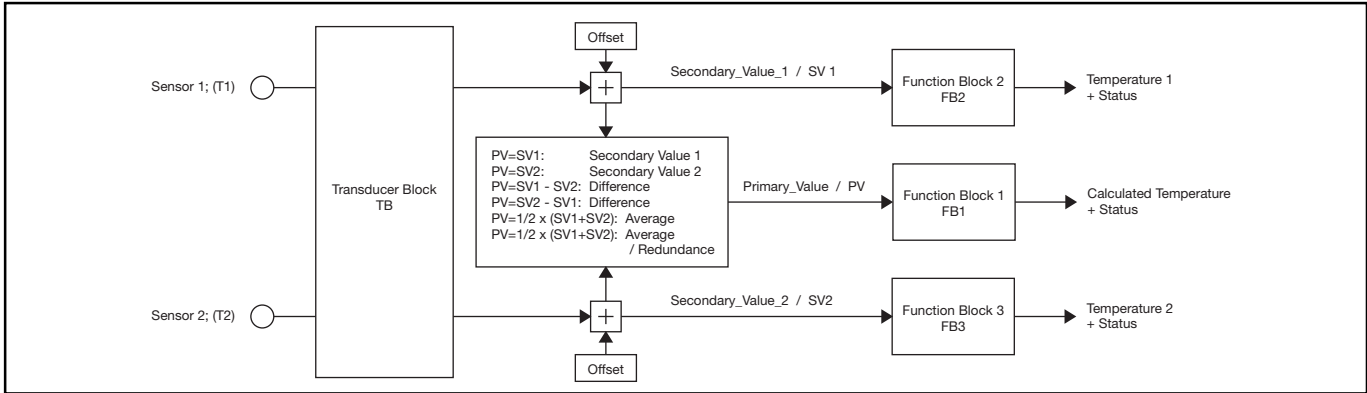


Figure 22

Connection Diagrams

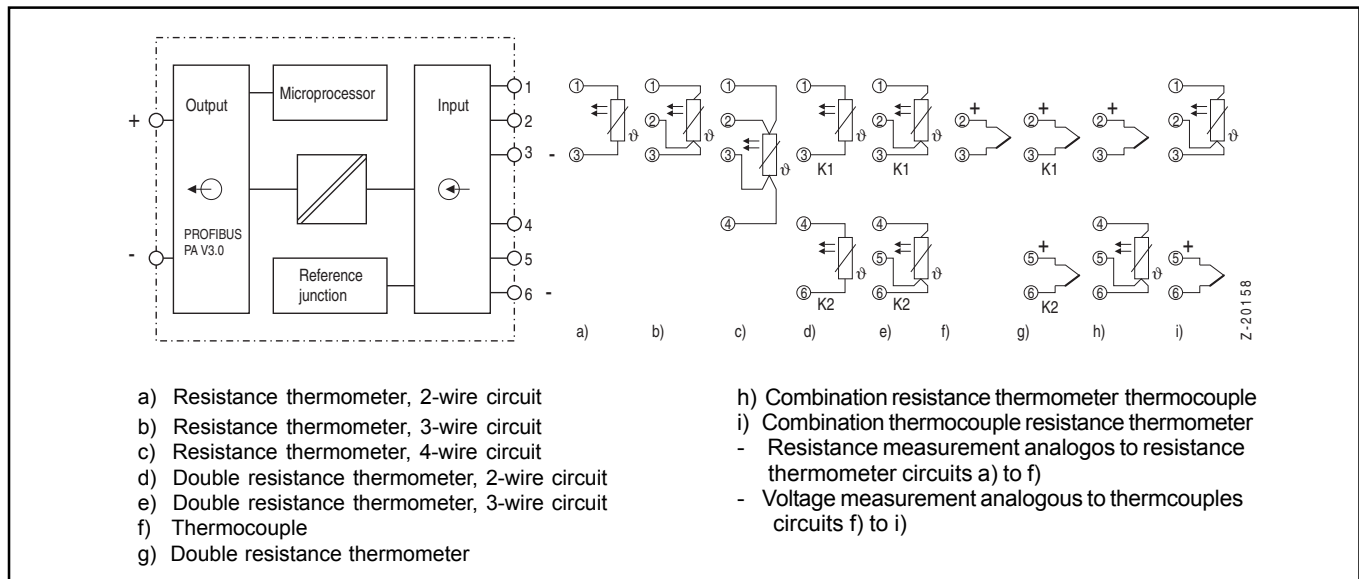


Figure 23

Dimensional Diagram (dimensions in min.)

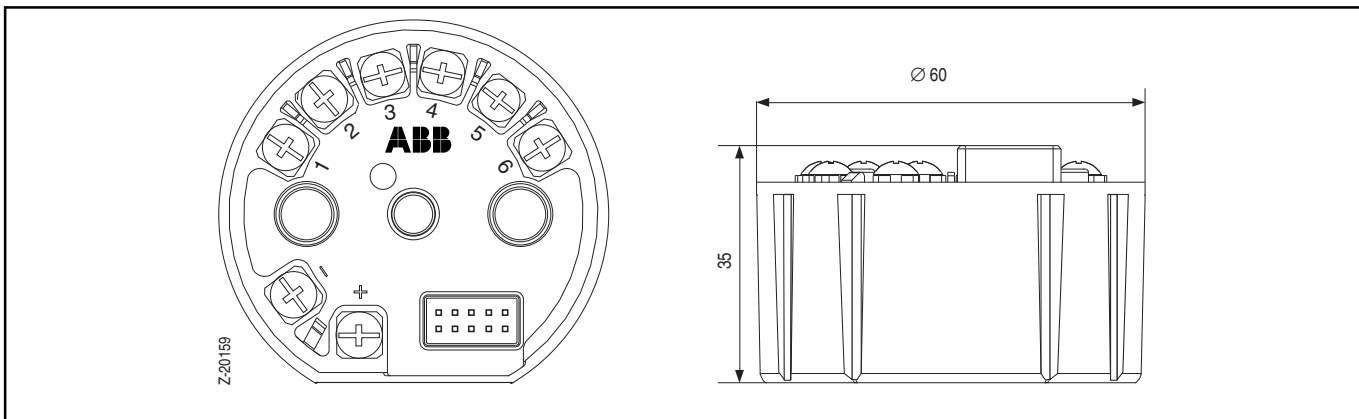


Figure 24

Sensor Design

Captions:

- A = Well Bore Depth
- B = Thermowell stem diameter
- E = Extension length (nominal)
- H = Extension tube diameter
- L = Thermowell length
- OAL = Over all lengths
- P = Process Connection
- T = Lag Extension length
- U = Immersion length

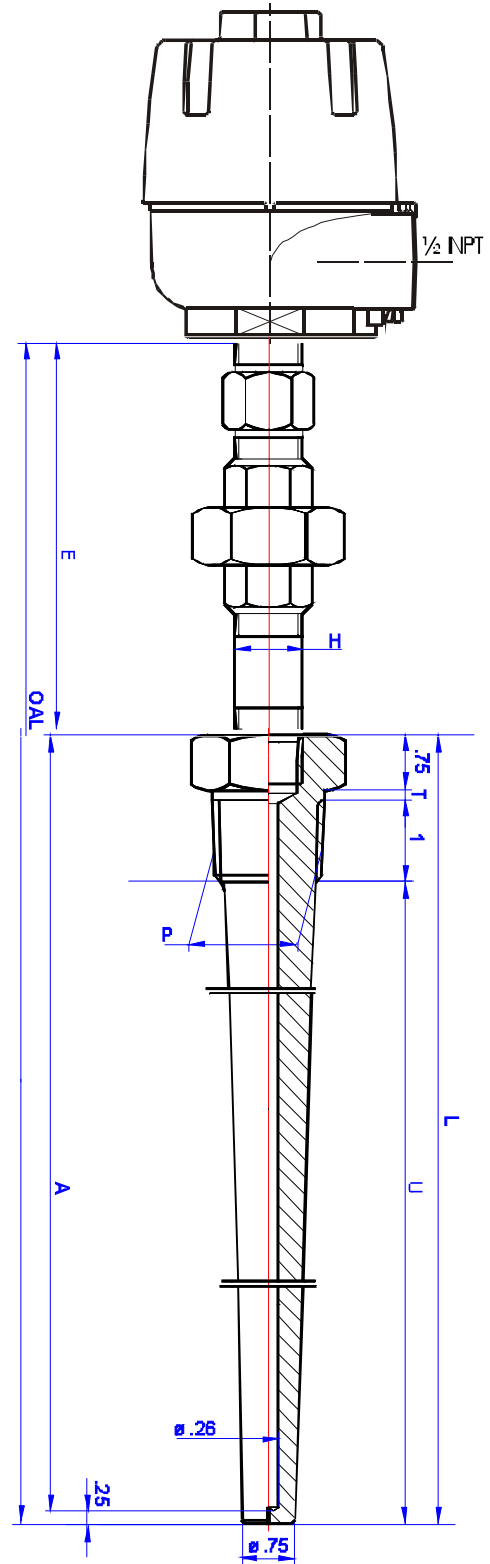


Figure 25

Standard Products=

Code

Spring Loaded Sensor Assembly with Thermowell

V10186

1 : Reserved

Reserved	-
----------	---

2 : Thermowell Material

AISI 304 / 304L SST (1.4301 / 1.4306)	H
AISI 316 / 316L SST (1.4401 / 1.4404)	L
Hastelloy C-276 (2.4819)	U
Inconel 600 (2.4816)	P
Carbon Steel	D
Titanium	T
Chrome Molybdenum F22	G
Monel	R
Other	X

3 : Process Connection

Flange, 1 in. 150 lbs. AISI 316 SST (1.4401)	F1
Flange, 1.5 in. 150 lbs. AISI 316 SST (1.4401)	F2
Flange, 2 in. 150 lbs. AISI 316 SST (1.4401)	F5
Flange, 3 in. 150 lbs. AISI 316 SST (1.4401)	F7
Flange, 1 in. 300 lbs. AISI 316 SST (1.4401)	F8
Flange, 1.5 in. 300 lbs. AISI 316 SST (1.4401)	F3
Flange, 2 in. 300 lbs. AISI 316 SST (1.4401)	F4
Flange, 1 in. 600 lbs. AISI 316 SST (1.4401)	FB
Flange, 1.5 in. 600 lbs. AISI 316 SST (1.4401)	FC
Flange, 2 in. 600 lbs. AISI 316 SST (1.4401)	FD
Flange 1 in., 900 / 1500 lbs., AISI 316 SST (1.4401)	FG
Flange, 1.5 in. 900 / 1500 lbs. AISI 316 SST (1.4401)	FH
Flange, 2 in. 900 / 1500 lbs. AISI 316 SST (1.4401)	FJ
Threaded, 1/2 in.	T1
Threaded, 3/4 in.	T2
Threaded, 1 in.	T3
Socket Weld, 3/4 in.	W2
Socket Weld, 1 in.	W3
Other	XX

4 : Tip Design

Tapered	T
Reduced Tip	R
Straight	S

V10186

Code

5 : Thermowell Dimensions

U Length 2.0 in. (51 mm)	(Note: 13)	020
U Length 2.5 in. (64 mm)	(Note: 13)	025
U Length 3.0 in. (76 mm)	(Note: 13)	030
U Length 3.5 in. (89 mm)	(Note: 13)	035
U Length 4.0 in. (102 mm)	(Note: 13)	040
U Length 4.5 in. (114 mm)	(Note: 13)	045
U Length 5.0 in. (127 mm)	(Note: 13)	050
U Length 5.5 in. (140 mm)	(Note: 13)	055
U Length 6.0 in. (152 mm)	(Note: 13)	060
U Length 6.5 in. (165 mm)	(Note: 13)	065
U Length 7.0 in. (178 mm)	(Note: 13)	070
U Length 7.5 in. (191 mm)	(Note: 13)	075
U Length 8.0 in. (203 mm)	(Note: 13)	080
U Length 8.5 in. (216 mm)	(Note: 13)	085
U Length 9.0 in. (229 mm)	(Note: 13)	090
U Length 9.5 in. (241 mm)	(Note: 13)	095
U Length 10.0 in. (254 mm)	(Note: 13)	100
U Length 10.5 in. (267 mm)	(Note: 13)	105
U Length 11.0 in. (279 mm)	(Note: 13)	110
U Length 11.5 in. (292 mm)	(Note: 13)	115
U Length 12.0 in. (305 mm)	(Note: 13)	120
U Length 12.5 in. (318 mm)	(Note: 13)	125
U Length 13.0 in. (330 mm)	(Note: 13)	130
U Length 13.5 in. (343 mm)	(Note: 13)	135
U Length 14.0 in. (356 mm)	(Note: 13)	140
U Length 14.5 in. (368 mm)	(Note: 13)	145
U Length 15.0 in. (381 mm)	(Note: 13)	150
U Length 15.5 in. (394 mm)	(Note: 13)	155
U Length 16.0 in. (406 mm)	(Note: 13)	160
U Length 16.5 in. (419 mm)	(Note: 13)	165
U Length 17.0 in. (432 mm)	(Note: 13)	170
U Length 17.5 in. (445 mm)	(Note: 13)	175
U Length 18.0 in. (457 mm)	(Note: 13)	180
U Length 18.5 in. (470 mm)	(Note: 13)	185
U Length 19.0 in. (483 mm)	(Note: 13)	190
U Length 19.5 in. (495 mm)	(Note: 13)	195
U Length 20.0 in. (508 mm)	(Note: 13)	200
U Length 20.5 in. (520 mm)	(Note: 13)	205
U Length 21.0 in. (533 mm)	(Note: 13)	210
U Length 21.5 in. (546 mm)	(Note: 13)	215
U Length 22.0 in. (559 mm)	(Note: 13)	220
U Length 22.5 in. (572 mm)	(Note: 13)	225
U Length 23.0 in. (584 mm)	(Note: 13)	230
U Length 23.5 in. (597 mm)	(Note: 13)	235
U Length 24.0 in. (610 mm)	(Note: 13)	240
U Length 24.5 in. (622 mm)	(Note: 13)	245
U Length 25.0 in. (635 mm)	(Note: 13)	250

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Code

5 : Thermowell Dimensions (cont.)

U Length 25.5 in. (648 mm)	(Note: 13)	255
U Length 26.0 in. (660 mm)	(Note: 13)	260
U Length 26.5 in. (673 mm)	(Note: 13)	265
U Length 27.0 in. (686 mm)	(Note: 13)	270
U Length 27.5 in. (699 mm)	(Note: 13)	275
U Length 28.0 in. (711 mm)	(Note: 13)	280
U Length 28.5 in. (724 mm)	(Note: 13)	285
U Length 29.0 in. (737 mm)	(Note: 13)	290
U Length 29.5 in. (749 mm)	(Note: 13)	295
U Length 30.0 in. (762 mm)	(Note: 13)	300
U Length 30.5 in. (775 mm)	(Note: 13)	305
U Length 31.0 in. (787 mm)	(Note: 13)	310
U Length 31.5 in. (800 mm)	(Note: 13)	315
U Length 32.0 in. (813 mm)	(Note: 13)	320
U Length 32.5 in. (826 mm)	(Note: 13)	325
U Length 33.0 in. (838 mm)	(Note: 13)	330
U Length 33.5 in. (851 mm)	(Note: 13)	335
U Length 34.0 in. (864 mm)	(Note: 13)	340
U Length 34.5 in. (876 mm)	(Note: 13)	345
U Length 35.0 in. (889 mm)	(Note: 13)	350
U Length 35.5 in. (902 mm)	(Note: 13)	355
U Length 36.0 in. (914 mm)	(Note: 13)	360
U Length 36.5 in. (927 mm)	(Note: 13)	365
U Length 37.0 in. (940 mm)	(Note: 13)	370
U Length 37.5 in. (953 mm)	(Note: 13)	375
U Length 38.0 in. (965 mm)	(Note: 13)	380
U Length 38.5 in. (978 mm)	(Note: 13)	385
U Length 39.0 in. (991 mm)	(Note: 13)	390
U Length 39.5 in. (1003 mm)	(Note: 13)	395
U Length 40.0 in. (1016 mm)	(Note: 13)	400
Other	(Note: 17)	XXX

6 : Thermowell Lag Length T

No Lag	0
3.00 in. (76 mm)	3
6.00 in. (152 mm)	6
Other	X

7 : Extension Tube / Length E / Material

Union-Nipple 3 in. AISI 316 SST (1.4401)	S
Union-Nipple 6 in. AISI 316 SST (1.4401)	U
Without	N

V10186

Code

8 : Sensor Type / Sheath Material

1 x Pt100, 2-wire / AISI 316Ti SST (1.4571)		2
1 x Pt100, 3-wire / AISI 316Ti SST (1.4571)		3
1 x Pt100, 4-wire / AISI 316Ti SST (1.4571)		4
2 x Pt100, 3-wire / AISI 316Ti SST (1.4571)		6
1 x Type K, Ungrounded / Inconel 600 (2.4816)	(Note: 14)	H
1 x Type J, Ungrounded / AISI 316Ti SST (1.4571)	(Note: 14)	G
1 x Type E, Ungrounded / Inconel 600 (2.4816)	(Note: 14)	E
1 x Type T, Ungrounded / AISI 316Ti SST (1.4571)	(Note: 14)	T
2 x Type K, Ungrounded / Inconel 600 (2.4816)	(Note: 14)	J
2 x Type J, Ungrounded / AISI 316Ti SST (1.4571)	(Note: 14)	I
2 x Type E, Ungrounded / Inconel 600 (2.4816)	(Note: 14)	F
2 x Type T, Ungrounded / AISI 321 SST (1.4541)	(Note: 14)	U
Other		X

9 : Accuracy according to IEC 60 751 & IEC 60 584

Class B RTD only	(Note: 1)	A
Class 2 Thermocouples only	(Note: 2)	G
Class A RTD only, High	(Note: 1)	E
Class 1 Thermocouples only, High	(Note: 2)	H

10 : Connection Head / Material / Cable Entry / Class of Protection

Without		0
B, Aluminum, 1/2 in. NPT, IP 54	(Note: 18)	1
BUZH, Aluminum, 1/2 in. NPT, IP 68		5
AGL, Aluminum, 1/2 in. NPT, IP 66, IP 67, NEMA 4X	(Note: 19)	B
AGLHD Pro-Meter, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X	(Note: 15)	D
AGLHD Co-Meter, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X	(Note: 15)	C
AGLHD LCD Integral Display, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X (TTH300, TH300EX, EXN Only)		L
AGLHD Digital Display, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X (TF02, TF02EX, Only)		F
Other		X

11 : Head Mounted Transmitter

Without		0
TH02 HART Protocol, General Purpose	(Note: 16)	9
TF12 PROFIBUS PA (only with BUZH or AGL Connection Head)	(Notes: 3, 16)	K
TH02-Ex HART Protocol, Intrinsically Safety	(Note: 16)	J
TH02-ExN HART Protocol, Non-incendive	(Note: 16)	P
TS04 Programmable via Pushbutton, General Purpose (for 2 / 3 Wire RTD only)	(Notes: 4, 5, 16)	2
TS05-1 Programmable via Pushbutton, General Purpose, Type K, 0 ... 1000 °C (32 ... 1832 °F)	(Notes: 2, 4, 16)	5
TS05-3 Programmable via Pushbutton, General Purpose Type J	(Notes: 2, 4, 16)	4
TF02 FOUNDATION Fieldbus, LAS Function Standard, General Purpose	(Notes: 4, 16)	M
TF02-Ex FOUNDATION Fieldbus, LAS Function Standard, Intrinsically Safe	(Note: 16)	N
TTH300 HART Protocol, General Purpose	(Notes: 4, 16)	6
TTH300-Ex, ExN HART Protocol, FM Intrinsically Safe (Class I, Div. 1) and Nonincendive (Class I, Div. 2)	(Notes: 4, 16)	7
Other		X

V10186 - ADDITIONAL ORDERING CODE

12 : Sensor Type

Ground Thermocouple		33
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13 : Thermowell Option

Tantalum Sheath (Straight Tip Only)	(Note: 6)	KK
4 ... 12 RMS High Polish Stem Finish		4F

14 : Name Plate

Tag No. on Stainless Steel Label		SL
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15 : Pressure Test - Internal

Internal Pressure Test of the Thermowell		IP
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16 : Pressure Test - External

External Pressure Test for Flanged Tw of up to U = 36 In.	(Notes: 7, 8)	EP
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17 : Heat Treat

NACE per MR 0175		NA
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18 : Dye Penetration Test

Dye Penetration Test		DP
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19 : Option: Oxygen Service

Oxygen Clean		OC
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20 : Thermowell Calculation

Velocity Calculation (Tapered Thermowells Only)	(Note: 9)	VC
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21 : PMI Test

Positive Material Identification of the Thermowell (PMI)		PM
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22 : Calibration

2 PT Certified Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 10)	2P
5 PT Certified Calibration (TTH300, TTH300-Ex, TTH300-ExN Only)	(Note: 11)	5P
9 PT Certified Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 10)	9P
Calendar-van Dusen Sensor Match Calibration (TTH300, TTH300-Ex, TTH300-ExN Only)	(Note: 11)	CD
9 PT Sensor Match Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 10)	MC

23 : SIL2 TUV Certificate

TUV Certificate for Functional Safety SIL2 acc. IEC61508	(Note: 12)	S2
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24 : Other Options

Specify		XX
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25: Registration Number

CRN-Canadian Registration Number		CR
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Note 1: Not available with Sensor Type / Sheath Material code H, G, E, T, J, I, F, U, X

Note 2: Not available with Sensor Type / Sheath Material code 2, 3, 4, 6

Note 3: Not available with Connection Head / Material / Cable Entry / Class of Protection code 1, 5, B, D, C, X

Note 4: Not available with Connection Head / Material / Cable Entry / Class of Protection code D, C

Note 5: Not available with Sensor Type / Sheath Material code 4

Note 6: Not available with Tip Design code T, R

Note 7: Not available with Process Connection code T1, T2, T3, W2, W3, XX

Note 8: Not available with Thermowell Dimensions code 365, 370, 375, 380, 385, 390, 395, 400, XXX

Note 9: Not available with Tip Design code R, S

Note 10: Not available with Head Mounted Transmitter code 0, K, 2, 5, 4, M, N, X

Note 11: Not available with Head Mounted Transmitter code 0, 9, K, J, P, 2, 5, 4, M, N, X

Note 12: Not available with Head Mounted Transmitter code 0, K, 2, 5, 4, M, N

Note 13: Minimum Length U = 2.0 in.

Note 14: Operating Range varies between the Thermocouples

Note 15: AG - Connection Heads are Epoxy. Not with TF12, TS04, TS05, TF02, TF02 EX, TTH300, TTH300 EX, TTH300EXN

Note 16: Specify min. Value (LRV for 4 mA Signal), max. Value (URV for 20 mA Signal) and °C or °F

Note 17: Fill-In xxx with Desired Length U (Example 9 in. = 090)

Note 18: Not with TF12 Transmitter

Note 19: AG - Connection Heads are Epoxy

Welded Sensor Assembly with Thermowell **V10187**

1 : Dash **Characteristic 07**

Dash	-
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2 : Thermowell Material

AISI 304 / 304L SST (1.4301 / 1.4306)	H
AISI 316 / 316L SST (1.4401 / 1.4404)	L
Hastelloy C-276 (2.4819)	U
Inconel 600 (2.4816)	P
Carbon Steel	D
Titanium T	T
Chrome Molybdenum F22	G
Monel	R
Other	X

3 : Process Connection

Flange 1 in., 150 lbs., AISI 316 SST (1.4401)	F1
Flange 1.5 in., 150 lbs., AISI 316 SST (1.4401)	F2
Flange 2 in., 150 lbs., AISI 316 SST (1.4401)	F5
Flange 3 in., 150 lbs., AISI 316 SST (1.4401)	F7
Flange 1 in., 300 lbs., AISI 316 SST (1.4401)	F8
Flange 1.5 in., 300 lbs., AISI 316 SST (1.4401)	F3
Flange 2 in., 300 lbs., AISI 316 SST (1.4401)	F4
Flange 1 in., 600 lbs., AISI 316 SST (1.4401)	FB
Flange 1.5 in., 600 lbs., AISI 316 SST (1.4401)	FC
Flange 2 in., 600 lbs., AISI 316 SST (1.4401)	FD
Flange 1 in., 900 / 1500 lbs., AISI 316 SST (1.4401)	FG
Flange 1.5 in., 900 / 1500 lbs., AISI 316 SST (1.4401)	FH
Flange 2 in., 900 / 1500 lbs., AISI 316 SST (1.4401)	FJ
Threaded, 1/2 in.	T1
Threaded, 3/4 in.	T2
Threaded, 1 in.	T3
Socket Weld, 3/4 in.	W2
Socket Weld, 1 in.	W3
Other	XX

4 : Tip Design

Tapered	T
Reduced Tip	R
Straight	S

V10187

Code

5 : Thermowell Dimensions

U Length 2.0 in. (51 mm)	(Note: 13)	020
U Length 2.5 in. (64 mm)	(Note: 13)	025
U Length 3.0 in. (76 mm)	(Note: 13)	030
U Length 3.5 in. (89 mm)	(Note: 13)	035
U Length 4.0 in. (102 mm)	(Note: 13)	040
U Length 4.5 in. (114 mm)	(Note: 13)	045
U Length 5.0 in. (127 mm)	(Note: 13)	050
U Length 5.5 in. (140 mm)	(Note: 13)	055
U Length 6.0 in. (152 mm)	(Note: 13)	060
U Length 6.5 in. (165 mm)	(Note: 13)	065
U Length 7.0 in. (178 mm)	(Note: 13)	070
U Length 7.5 in. (191 mm)	(Note: 13)	075
U Length 8.0 in. (203 mm)	(Note: 13)	080
U Length 8.5 in. (216 mm)	(Note: 13)	085
U Length 9.0 in. (229 mm)	(Note: 13)	090
U Length 9.5 in. (241 mm)	(Note: 13)	095
U Length 10.0 in. (254 mm)	(Note: 13)	100
U Length 10.5 in. (267 mm)	(Note: 13)	105
U Length 11.0 in. (279 mm)	(Note: 13)	110
U Length 11.5 in. (292 mm)	(Note: 13)	115
U Length 12.0 in. (305 mm)	(Note: 13)	120
U Length 12.5 in. (318 mm)	(Note: 13)	125
U Length 13.0 in. (330 mm)	(Note: 13)	130
U Length 13.5 in. (343 mm)	(Note: 13)	135
U Length 14.0 in. (356 mm)	(Note: 13)	140
U Length 14.5 in. (368 mm)	(Note: 13)	145
U Length 15.0 in. (381 mm)	(Note: 13)	150
U Length 15.5 in. (394 mm)	(Note: 13)	155
U Length 16.0 in. (406 mm)	(Note: 13)	160
U Length 16.5 in. (419 mm)	(Note: 13)	165
U Length 17.0 in. (432 mm)	(Note: 13)	170
U Length 17.5 in. (445 mm)	(Note: 13)	175
U Length 18.0 in. (457 mm)	(Note: 13)	180
U Length 18.5 in. (470 mm)	(Note: 13)	185
U Length 19.0 in. (483 mm)	(Note: 13)	190
U Length 19.5 in. (495 mm)	(Note: 13)	195
U Length 20.0 in. (508 mm)	(Note: 13)	200
U Length 20.5 in. (520 mm)	(Note: 13)	205
U Length 21.0 in. (533 mm)	(Note: 13)	210
U Length 21.5 in. (546 mm)	(Note: 13)	215
U Length 22.0 in. (559 mm)	(Note: 13)	220
U Length 22.5 in. (573 mm)	(Note: 13)	225
U Length 23.0 in. (584 mm)	(Note: 13)	230
U Length 23.5 in. (597 mm)	(Note: 13)	235
U Length 24.0 in. (610 mm)	(Note: 13)	240
U Length 24.5 in. (622 mm)	(Note: 13)	245
U Length 25.0 in. (635 mm)	(Note: 13)	250
U Length 25.5 in. (640 mm)	(Note: 13)	255

V10187

Code

8 : Sensor Type / Sheath Material (Cont)

1 x Type T, Ungrounded / AISI 316Ti SST (1.4571)	(Note: 15)	T
2 x Type K, Ungrounded / Inconel 600 (2.4816)	(Note: 15)	J
2 x Type J, Ungrounded / AISI 316Ti SST (1.4571)	(Note: 15)	I
2 x Type E, Ungrounded / Inconel 600 (2.4816)	(Note: 15)	F
2 x Type T, Ungrounded / AISI 321 SST (1.4541)	(Note: 15)	U
Other		X

9 : Accuracy according to IEC 60751 & IEC 60584

Class B RTD only	(Note: 1)	A
Class 2 Thermocouples only	(Note: 2)	G
Class A RTD only, High	(Note: 1)	E
Class 1 Thermocouples only, High	(Note: 2)	H

10 : Connection Head / Material / Cable Entry / Class of Protection

Without		0
B, Aluminum, 1/2 in. NPT, IP 54	(Note: 16)	1
BUZH, Aluminum, 1/2 in. NPT, IP 68		5
AGL, Aluminum, 1/2 in. NPT, IP 66, IP 67, NEMA 4X	(Note: 17)	B
AGLHD Pro-Meter, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X	(Note: 18)	D
AGLHD Co-Meter, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X	(Note: 18)	C
AGLHD LCD Integral Display, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X (TTH300, TTH300 EX, Only)		L
AGLHD Digital Display, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X (TF02,TF02EX Only)		F
Other		X

11 : Head Mounted Transmitter

Without		0
TH02 HART Protocol, General Purpose	(Note: 19)	9
TF12 PROFIBUS PA (only with BUZH or AGL Connection Head)	(Notes: 3, 19)	K
TH02-Ex HART Protocol, Intrinsically Safety	(Note: 19)	J
TH02-ExN HART Protocol, Non-incendive	(Note: 19)	P
TS04 Programmable via Pushbutton, General Purpose (for 2 / 3 wire RTD only)	(Notes: 4, 5, 1)	2
TS05-1 Programmable via Pushbutton, General Purpose Type K, 0 ... 1000 °C (32 ... 1832 °F)	(Notes: 4, 19)	5
TS05-3 Programmable via Pushbutton, General Purpose, Type J	(Notes: 4, 19)	4
TF02 FOUNDATION Fieldbus, LAS function standard, General Purpose	(Notes: 4, 19)	M
TTH300 HART Protocol, General Purpose		6
TTH300-Ex, ExN HART Protocol, FM Intrinsically Safe (Class I, Div. 1) and Nonincendive (Class I, Div. 2)		7
TF02-Ex FOUNDATION Fieldbus, LAS function standard, Intrinsically Safe	(Note: 19)	N
Other		X

ADDITIONAL ORDERING CODE

12 : Sensor Type

Ground Thermocouple	33
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13 : Thermowell Option

Tantalum Sheath (Straight Tip Only)	(Note: 6)	KK
4 ... 12 RMS High Polish Stem Finish		4F

14 : Name Plate

Tag No. on Stainless Steel Label	SL
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15 : Pressure Test - Internal

Internal Pressure Test of the Thermowell	IP
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V10187

Code

16 : Pressure Test - External

External Pressure Test for Flanged Tw of up to U = 36 In.	(Notes: 7, 8)	EP
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17 : Heat Treat

NACE per MR 0175		NA
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18 : Dye Penetration Test

Dye Penetration Test		DP
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19 : Option: Oxygen Service

Oxygen Clean		OC
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20 : Thermowell Calculation

Velocity Calculation (Tapered Thermowells Only)	(Note: 9)	VC
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21 : PMI Test

Positive Material Identification of the Thermowell (PMI)		PM
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22 : Calibration

2 PT Certified Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 10)	2P
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5 PT Certified Calibration (TTH300, TTH300-Ex, TTH300-ExN Only)	(Note: 11)	5P
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9 PT Certified Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 10)	9P
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Callendar-van Dusen Sensor Match Calibration (TTH300, TTH300-Ex, TTH300-ExN Only)	(Note: 11)	CD
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9 PT Sensor Match Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 10)	MC
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23 : SIL2 TUV Certificate

TUV Certificate for Functional Safety SIL2 acc. IEC61508	(Note: 12)	S2
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24 : Other Options

Specify		XX
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25: Registration Number

CRN-Canadian Registration Number		CR
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Note 1: Not available with Sensor Type / Sheath Material code H, G, E, T, J, I, F, U, X

Note 2: Not available with Sensor Type / Sheath Material code 2, 3, 4, 6

Note 3: Not available with Connection Head / Material / Cable Entry / Class of Protection code 1, 5, B, D, C, X

Note 4: Not available with Connection Head / Material / Cable Entry / Class of Protection code D, C

Note 5: Not available with Sensor Type / Sheath Material code 4

Note 6: Not available with Tip Design code T, R

Note 7: Not available with Process Connection code T1, T2, T3, W2, W3, XX

Note 8: Not available with Thermowell Dimensions code 365, 370, 375, 380, 385, 390, 395, 400, XXX

Note 9: Not available with Tip Design code R, S

Note 10: Not available with Head Mounted Transmitter code 0, K, 2, 5, 4, M, N, X

Note 11: Not available with Head Mounted Transmitter code 0, 9, K, J, P, 2, 5, 4, M, N, X

Note 12: Not available with Head Mounted Transmitter code 0, K, 2, 5, 4, M, N

Note 13: Minimum Length U = 2.0 in.

Note 14: Fill-In xxx with Desired Length U (Example 9 in. = 090)

Note 15: Operating Range varies between the Thermocouples

Note 16: Not with TF12 Transmitter

Note 17: AG - Connection Heads are Epoxy

Note 18: AG - Connection Heads are Epoxy. Not with TF12, TS04, TS05, TF02, TF02 EX, TTH300, TTH300 EX, TTH300 EXN

Note 19: Specify min. Value (LRV for 4 mA Signal), max. Value (URV for 20 mA Signal) and °C or °F

Standard Products=

Code

Sensor Assembly without Thermowell

V10188

1 : Reserved

Reserved	-
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2 : Design

Used In V10186 Sensor Assembly, Spring-Loaded	2
Used In V10187 Sensor Assembly, Welded	3

3 : Length X - See Sensor Design - Part 1 (10 in.) Increment

0	0
10 in. (254 mm)	1
508 mm (20 in.)	2
762 mm (30 in.)	3
Other	X

4 : Length X - See Sensor Design - Part 2 (1 in.) Increment

0	0
1 in. (25 mm)	1
2 in. (51 mm)	2
3 in. (76 mm)	3
4 in. (102 mm)	4
5 in. (127 mm)	5
6 in. (152 mm)	6
7 in. (178 mm)	7
8 in. (203 mm)	8
9 in. (229 mm)	9

5 : Length X - See Sensor Design - Part 3 (0.25 in.) Increment

0	0
0.25 in. (6 mm)	2
0.5 in. (13 mm)	5
0.75 in. (19 mm)	7

6 : Extension Tube Material

Union-Nipple, 3 in. (75 mm), AISI 316 SST (1.4401)	S
Union-Nipple, 4 in. (100 mm), AISI 316 SST (1.4401)	U
Without	N

7 : Sensor Type / Sheath Material

1 x Pt100, 2-wire / AISI 316Ti SST (1.4571)	(Note: 11)	2
1 x Pt100, 3-wire / AISI 316Ti SST (1.4571)	(Note: 11)	3
1 x Pt100, 4-wire / AISI 316Ti SST (1.4571)	(Note: 11)	4
2 x Pt100, 3-wire / AISI 316Ti SST (1.4571)	(Note: 14)	6
1 x Type K / Inconel 600 (2.4816)	(Note: 11)	H
1 x Type J / AISI 316Ti SST (1.4571)	(Note: 11)	G
1 x Type E / Inconel 600 (2.4816)	(Note: 11)	E
1 x Type T / AISI 316Ti SST (1.4571)	(Note: 11)	T
2 x Type K / Inconel 600 (2.4816)	(Note: 14)	J
2 x Type J / AISI 316Ti SST (1.4571)	(Note: 14)	I
2 x Type E / Inconel 600 (2.4816)	(Note: 14)	F
2 x Type T / AISI 321 SST (1.4541)	(Note: 14)	U
Other		X

V10188

Code

8 : Accuracy according to IEC 60751 & IEC 60582

Class B RTD only	(Note: 1)	A
Class 2 Thermocouples only	(Note: 2)	G
Class A RTD only	(Note: 1)	E
Class 1 Thermocouples only	(Note: 2)	H

9 : Connection Head / Material / Cable Entry / Class of Protection

Without		0
B (Basic), Aluminum, 1/2 in. NPT, IP 54 (Not with TF 12 Xmt.)	(Note: 15)	1
BUZH, Aluminum, 1/2 in. NPT, IP 68		5
AGL Heavy Duty Aluminum, 1/2 in. NPT, IP 66, IP 67 / NEMA 4X	(Note: 12)	B
AGLHD Pro-Meter, Connection Head Aluminum, 1/2 in. NPT, IP 66, IP 67, NEMA 4X	(Note: 13)	D
AGLHD Co-Meter, Aluminum, IP 66, IP 67, NEMA 4X	(Note: 13)	C
AGLHD LCD Integral Display, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X (THX300, TTH300EX, EXN Only)		L
AGLHD Digital Display, Aluminum 1/2 in. NPT, IP 66, IP 67, NEMA 4X (TF02, TF02EX Only)		F
Other		X

10 : Head Mounted Transmitter

Without		0
TH02 HART Protocol, General Purpose	(Note: 10)	9
TF 12 PROFIBUS PA (only with BUZH or AGL Connection Head)	(Notes: 3, 10)	K
TH02-Ex HART Protocol, Intrinsically Safe	(Note: 10)	J
TH02-ExN HART Protocol, Nonincendive	(Note: 10)	P
TS04 Programmable via Pushbutton, General Purpose (for 2 / 3 wire RTD only)	(Notes: 4, 5, 10)	2
TS05-1, Programmable via Pushbutton, General Purpose Type K, 0 ... 1000 °C (32 ... 1832 °F)	(Notes: 4, 5, 10)	5
TS05-3, Programmable via Pushbutton, General Purpose, Type J	(Notes: 4, 6, 10)	4
TF02 FOUNDATION Fieldbus, LAS function standard, General Purpose	(Notes: 4, 10)	M
TTH300 HART Protocol, General Purpose		6
TTH300-Ex, ExN HART Protocol, FM Intrinsically Safe (Class I, Div. 1) and Nonincendive (Class I, Div. 2)		7
TF02-Ex FOUNDATION Fieldbus, LAS function standard, FM Intrinsically Safe	(Notes: 4, 10)	N
Other		X

ADDITIONAL ORDERING CODE

11 : Sensor Type

Ground Thermocouple		33
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12 : Name Plate

Tag No. on Stainless Steel Label		SL
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13 : Calibration

2 PT Certified Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 7)	2P
5 PT Certified Calibration (TTH300, TTH300-Ex, TTH300-ExN Only)	(Note: 8)	5P
9 PT Certified Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 7)	9P
Calendar-van Dusen Sensor Match Calibration (TTH300, TTH300-Ex, TTH300-ExN Only)	(Note: 8)	CD
9 PT Sensor Match Calibration (TH02, TH02-Ex, TH02-ExN Only)	(Note: 7)	MC

14 : SIL2 TUV Certificate

TUV Certificate for Functional Safety SIL2 acc. IEC61508	(Note: 9)	S2
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15 : Other Options

Specify		XX
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V10188

Note 1: Not available with Sensor Type / Sheath Material code H, G, E, T, J, I, F, U, X

Note 2: Not available with Sensor Type / Sheath Material code 2, 3, 4, 6

Note 3: Not available with Connection Head / Material / Cable Entry / Class of Protection code 1, D, C

Note 4: Not available with Connection Head / Material / Cable Entry / Class of Protection code D, C
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Note 5: Not available with Sensor Type / Sheath Material code 4, H, G, E, T, J, I, F, U, X

Note 6: Not available with Sensor Type / Sheath Material code 2, 3, 4, 6, H, E, T, J, F, U, X

Note 7: Not available with Head Mounted Transmitter code 0, K, 2, 5, 4, M, N, X, 6,7

Note 8: Not available with Head Mounted Transmitter code 0, 9, K, J, P, 2, 5, 4, M, N, X

Note 9: Not available with Head Mounted Transmitter code 0, K, 2, 5, 4, M, N

Note 10: Specify min. Value (LRV for 4 mA Signal), max. Value (URV for 20 mA Signal) and °C or °F

Note 11: Operating Range varies between the Thermocouples

Note 12: AG - Connection Heads are Epoxy

Note 13: AG - Connection Heads are Epoxy. Not with TF12, TF12-Ex, TF02, TF02-Ex, TS04, TS05

Note 14: One Set of Wires will be Taped Off. Operating Range varies between the Thermocouples

Note 15: Not with TF12, TF12-Ex Transmitters

Standard Products=

Sensor Only without Thermowell **V10189**

1 : Reserved

Reserved	-
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2 : Design

Used In V10186 Sensor Assembly, Spring-Loaded	2
Used In V10187 Sensor Assembly, Welded	3

3 : Length X - See Sensor Design - Part 1 (10 in.) Increment

0	0
10 in. (254 mm)	1
20 in. (508 mm)	2
30 in. (762 mm)	3
Other	X

4 : Length X - See Sensor Design - Part 2 (1 in.) Increment

0	0
1 in. (25 mm)	1
2 in. (51 mm)	2
3 in. (76 mm)	3
4 in. (102 mm)	4
5 in. (127 mm)	5
6 in. (152 mm)	6
7 in. (178 mm)	7
8 in. (203 mm)	8
9 in. (229 mm)	9

5 : Length X - See Sensor Design - Part 3 (0.25 in.) Increment

0	0
0.25 in. (6 mm)	2
0.5 in. (13 mm)	5
0.75 in. (19 mm)	7

6 : Extension Tube Material

Without (Must be used for V10189 Sensor)	N
--	---

7 : Sensor Type / Sheath Material

1 x Pt100, 2-wire / AISI 316Ti SST (1.4571)	(Note: 3)	2
1 x Pt100, 3-wire / AISI 316Ti SST (1.4571)	(Note: 3)	3
1 x Pt100, 4-wire / AISI 316Ti SST (1.4571)	(Note: 3)	4
2 x Pt100, 3-wire / AISI 316Ti SST (1.4571)	(Note: 4)	6
1 x Type K / Inconel 600 (2.4816)	(Note: 3)	H
1 x Type J / AISI 316Ti SST (1.4571)	(Note: 3)	G
1 x Type E / Inconel 600 (2.4816)	(Note: 3)	E
1 x Type T / AISI 316Ti SST (1.4571)	(Note: 3)	T
2 x Type K / Inconel 600 (2.4816)	(Note: 4)	J
2 x Type J / AISI 316Ti SST (1.4571)	(Note: 4)	I
2 x Type E / Inconel 600 (2.4816)	(Note: 4)	F
2 x Type T / AISI 321 SST (1.4541)	(Note: 4)	U
Other		X

V10189

Code

8 : Accuracy according to IEC 60751 & IEC 60583

Class B RTD only	(Note: 1)	A
Class 2 Thermocouples only	(Note: 2)	G
Class A RTD only	(Note: 1)	E
Class 1 Thermocouples only	(Note: 2)	H

9 : Connection Head / Material / Cable Entry / Class of Protection

Without (for V10189 Sensor only)	0
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10 : Head Mounted Transmitter

Without (for V10189 Sensor only)	0
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Note 1: Not available with Sensor Type / Sheath Material code H, G, E, T, J, I, F, U, X

Note 2: Not available with Sensor Type / Sheath Material code 2, 3, 4, 6

Note 3: Operating Range varies between the Thermocouples

Note 4: One Set of Wires will be Taped Off. Operating Range varies between the Thermocouples

V10188-2 & V10189-L Calculation of the "X" Dimension

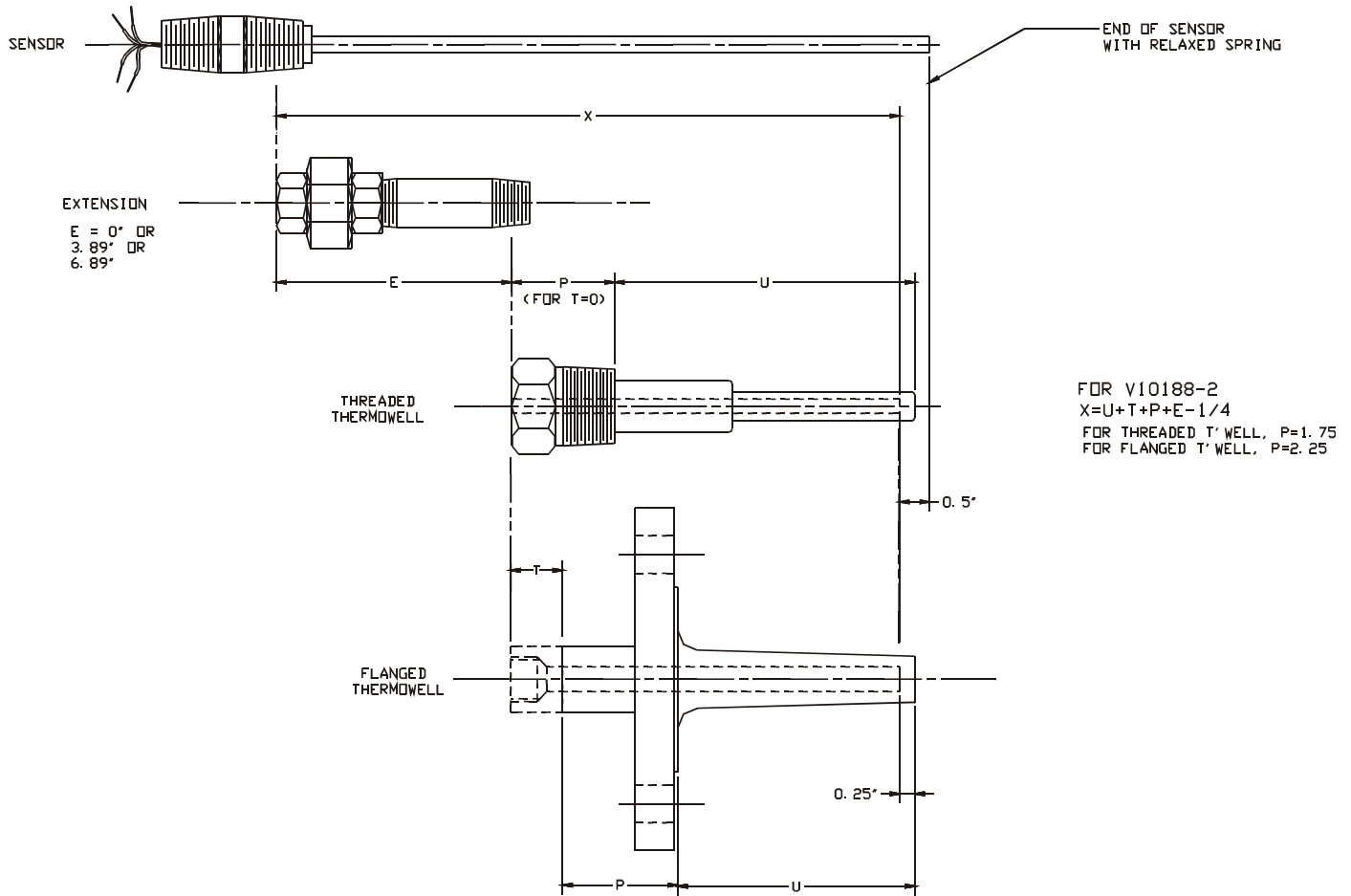


Figure 26

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The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

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