

ABB MEASUREMENT & ANALYTICS | DATA SHEET

SensyTemp TSP111, TSP121, TSP131

Temperature sensors



Measurement made easy

Modular design

Design in accordance with DIN 43772 for low and medium process requirements

Modular design

- Measuring inset, thermowell, extension tube, connection head, transmitter

Interchangeable measuring inset

- Interchangeable measuring inset

Transmitter in connection head

- Optional LCD indicator
- Optional display function (type AS) or display with configuration function (type A)
- SIL 2 for transmitter

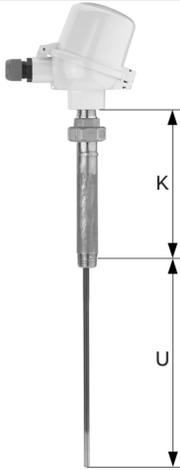
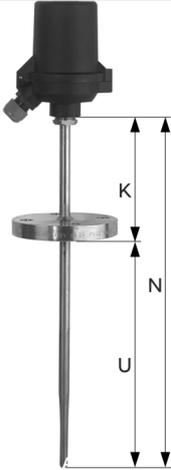
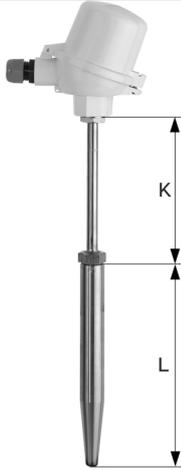
Approvals

- SIL 2 for sensors with integrated transmitter
- ATEX, IECEx, EAC-Ex (GOST), NEPSI, other approvals on request

Areas of application

- Chemical industry, energy industry, general process engineering, tank and piping construction, mechanical and plant engineering

Overview of temperature sensors

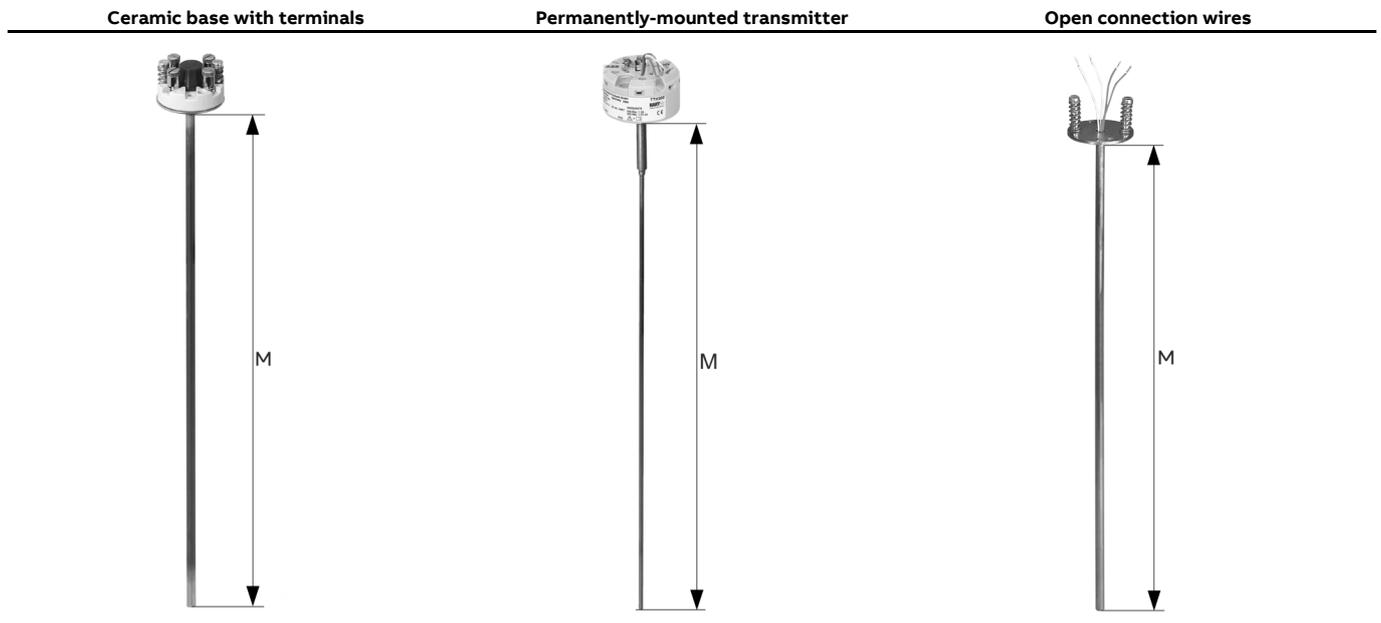
Type	TSP111	TSP121	TSP131
Legend:			
K = Extension tube length			
U = Installation length			
N = Nominal length			
L = Thermowell length			
			
Design	No thermowell, for installation in existing thermowell	Welded protective fitting manufactured from pipe material	Drilled thermowell manufactured from bar stock material
Process connection	Insertion in an existing thermowell. Functional reliability is only assured with an additional thermowell!	Screw-in thread, flange, compression fitting	Welded connections, screw-in thread, flange
Transport temperature / Storage temperature	-20 to 70 °C (-4 to 158 °F)		
Maximum temperature limits	(depending on the sensor and material selected, the lower temperature value in each case counts)		
Sensor	Thin film resistor: 400 °C (752 °F), wire wound resistor: 800 °C (1472 °F), thermocouples type K, N, J, E, L, S: 1600 °C (2912 °F)		
Material	316L / 1.4404	≤ 800 °C (1472 °F)	
(other materials on request)	316Ti / 1.4571	≤ 800 °C (1472 °F)	
	Inconel 600 / 2.4816	≤ 1100 °C (2012 °F)	
	Hastelloy C276 / 2.4819	—	≤ 1100 °C (2012 °F)
	Monel 400 / 2.4360	—	600 °C (1112 °F)
	1.7335	—	≤ 540 °C (1004 °F)
	1.7380	—	≤ 570 °C (1058 °F)
	1.5415	—	≤ 500 °C (932 °F)
	E-CTFE	≤ 120 °C (248 °F)	≤ 120 °C (248 °F)
	Tantalum	≤ 250 °C (482 °F)	≤ 250 °C (482 °F)
Designation of gas connections		maximum 40 to 100 bar (580.15 to 1450.38 psi)	Maximum 700 bar (10152.64 psi)

Note

The maximum temperatures and pressures specified are maximum values and do not take into consideration process-related stress. The effects of viscosity, medium velocity, pressure and temperature in the process usually cause these values to drop.

Overview of measuring insets TSA101

Industrial thermocouples and industrial resistance thermometers



- Flexible and vibration-resistant ABB mineral insulated cable. Sheath material for resistance thermometer made of stainless steel 1.4571 (316Ti) or nickel-basis alloy 2.4816 (alloy 600) for thermocouples.
- Sensors in accordance with IEC 60751 platinum resistance thermometer with measuring ranges of -196 to 800 °C (-320.8 to 1472 °F) in three tolerance classes or thermocouples in accordance with IEC 60584 and ANSI MC96.1 with measuring ranges of -40 to 1200 °C (-40 to 2192 °F), respectively in two tolerance classes.
- Type S thermocouple in an accuracy class of 0 to 1600 °C (32 to 2912 °F).
- Fitted with single- or double sensors.
- Optimum clamping at the measuring inset's holding plate is assured by generous spring travel (10 mm (0.39 inch)) on the part of the clamping springs.
- Measuring inserts are available with outer diameters of 3 mm (0.12 in), 4.5 mm (0.24 in), 6 mm (0.24 in) and for thermocouples also 8 mm (0.32 in).
 8 mm (0.32 in) tip with sleeve and 10 mm (0.39 in) tip with sleeve

M = Measuring inset length

Legend:

TSP111: $M = U + K + 25$ mm

TSP121: $M = N + 25$ mm

TSP131: $M = L + K + 25$ mm

K = Extension tube length

U = Installation length

N = Nominal length

L = Thermowell length

Installation instructions

The usual way of ensuring that thermal measurements are accurate is to comply with the minimum insertion depth of the temperature sensor. Ideally, the sensor on a thermometer should be located in the center of the pipe.

Recommended installation length

To avoid heat dissipation errors.

Medium	Installation length
Fluids	8 to 10 × Ø thermowell tip
Gases	10 to 15 × Ø thermowell tip

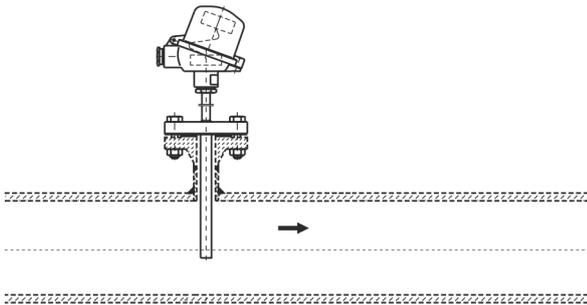


Figure 1: Recommended installation length

Insufficient nominal diameter

In the case of pipelines with very small nominal diameters, insertion inside an elbow pipe is recommended. The temperature sensor is set in opposition to the flow direction of the medium. Inserting the temperature sensor with an adapter at an angle of < 45° against the flow direction can also distort measurement results.

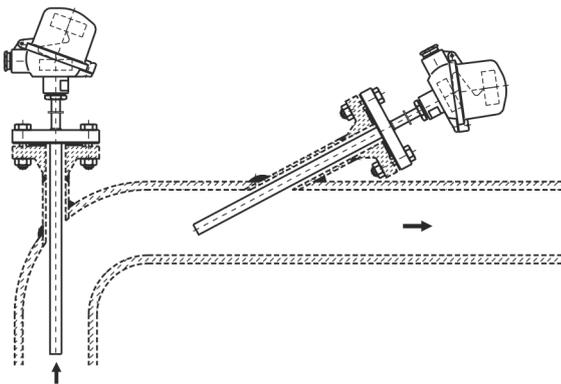


Figure 2: Insufficient nominal diameter

Specification

Resistance thermometer

The use of a mineral insulated cable and special installed measuring elements ensure very high vibration resistance of all measuring insets of the TSP temperature sensors. The acceleration values of 30 m/sec² (3 g), defined for already increased requirements in accordance with the standard IEC 60751, are exceeded by all measuring inset types for TSP temperature sensors.

The optimally suitable combination of measuring range, diameter, accuracy, and vibration resistance can be taken from the following tables.

Thin film resistor (TF) – base version

	Meas. range	Vibration resistance
Class B	-50 to 400 °C (-58 to 752 °F)	100 m/sec ² (10 g) at 10
Class A	-30 to 300 °C (-22 to 572 °F)	to 500 Hz
Class AA	0 to 100 °C (32 to 212 °F)	

	Single sensor			Double sensor		
	2-W	3-W	4-W	2-W	3-W	4-W
3.0 mm, class B	●	●	●			
3.0 mm, class A		●	●			
3.0 mm, class AA		●	●			
4.5 mm, class B	●	●	●			
4.5 mm, class A		●	●			
4.5 mm, class AA		●	●			
6.0 mm, class B	●	●	●	●	●	●
6.0 mm, class A		●	●		●	●
6.0 mm, class AA		●	●		●	●

... Specification

Thin film resistor (TF) – increased vibration resistance

	Meas. range	Vibration resistance
Class B	-50 to 400 °C (-58 to 752 °F)	600 m/sec ² (60 g) at 10
Class A	-30 to 300 °C (-22 to 572 °F)	to 500 Hz
Class AA	0 to 100 °C (32 to 212 °F)	

	Single sensor			Double sensor		
	2-W	3-W	4-W	2-W	3-W	4-W
3.0 mm, class B	●	●	●			
3.0 mm, class A		●	●			
3.0 mm, class AA		●	●			
6.0 mm, class B	●	●	●	●	●	●
6.0 mm, class A		●	●		●	●
6.0 mm, class AA		●	●		●	●

Wire wound resistor (WW) – extended measuring range

	Meas. range	Vibration resistance
Class B	-196 to 800 °C (-320.8 to 1472 °F)	100 m/sec ² (10 g) at 10 to 500 Hz
Class A, single WW	-100 to 450 °C (-148 to 842 °F)	
Class A, double WW	0 to 250 °C (32 to 482 °F)	

	Single sensor			Double sensor		
	2-W	3-W	4-W	2-W	3-W	4-W
3.0 mm, class B	●	●	●	●	●	
3.0 mm, class A		●	●		●	
4.5 mm, class B	●	●	●	●	●	
4.5 mm, class A		●	●		●	
6.0 mm, class B	●	●	●	●	●	●
6.0 mm, class A		●	●		●	●

Wire wound resistor (WW) – extended measuring range, increased vibration resistance

	Meas. range	Vibration resistance
Class B	-196 to 600 °C (-320.8 to 1112 °F)	600 m/sec ² (60 g) at 10 to 500 Hz
Class A, single WW	-100 to 450 °C (-148 to 842 °F)	
Class A, double WW	0 to 250 °C (32 to 482 °F)	

	Single sensor			Double sensor		
	2-W	3-W	4-W	2-W	3-W	4-W
6.0 mm, class B	●	●	●	●	●	●
6.0 mm, class A		●	●		●	●

Length specifications for the tip of the measuring inset

The following table shows the minimum immersion length, the temperature-sensitive length and the non-flexible length at the tip of the measuring inset.

Type	minimum immersion length	Temperature-sensitive length	Non-flexible length
Basic design	70 mm (2.75 in)	7 mm (0.28 in)	30 mm (1.18 in)
Increased vibration resistance	70 mm (2.75 in)	10 mm (0.39 in)	40 mm (1.57 in)
Extended measuring range, increased vibration resistance	70 mm (2.75 in)	50 mm (1.97 in)	60 mm (2.36 in)

Accuracy classes of measurement resistors in accordance with IEC 60751

Both thin film resistors and wire wound resistors in accordance with IEC 60751 can be used across the entire range of application. Subsequently, only the accuracy class of the temperature range used can remain valid.

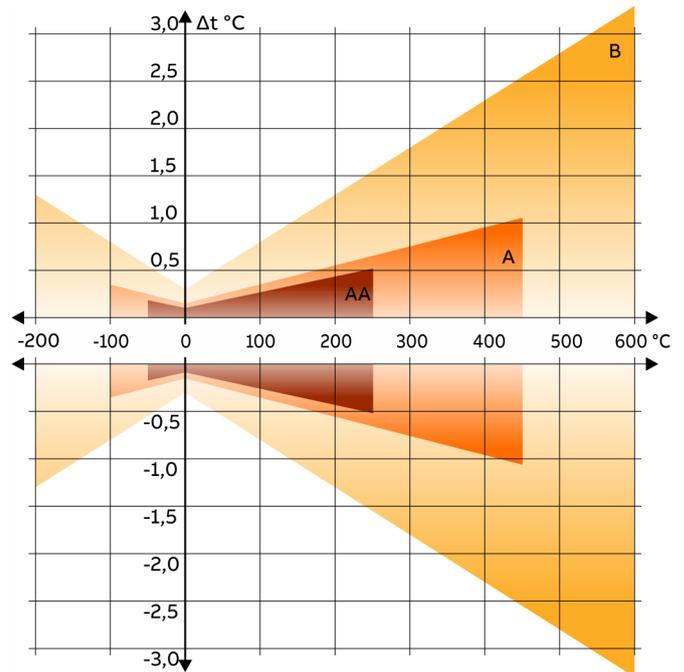
Example: A sensor of class AA is used at 290 °C (554 °F). After this albeit brief application, class A applies for this sensor.

Thin film resistor (TF), built-in

Class B	$\Delta t = \pm (0.30 + 0.0050 \times [t])$	-50 to 400 °C (-58 to 752 °F)
Class A	$\Delta t = \pm (0.15 + 0.0020 \times [t])$	-30 to 300 °C (-22 to 572 °F)
Class AA	$\Delta t = \pm (0.10 + 0.0017 \times [t])$	0 to 100 °C (32 to 212 °F)

Wire wound resistor (WW), built-in

Class B	$\Delta t = \pm (0.30 + 0.0050 \times [t])$	-196 to 600 °C (-320.8 to 1112 °F)
Class A	$\Delta t = \pm (0.15 + 0.0020 \times [t])$	-100 to 450 °C (-148 to 842 °F)



Colored areas: Temperature range in accordance with IEC 60751 (WW)

Figure 3: Graphical representation of accuracy classes

Measuring errors with two-wire circuits

The electrical resistance of the copper inner conductor for the measuring inset affects the measured value for two-wire circuits and must be taken into consideration. It depends on the diameter and length of the measuring inset.

If the error cannot be compensated metrologically, the following reference values shall apply:

- Ø Measuring inset 3.0 mm: (0.281 Ω/m ⇒ 0.7 °C/m)
- Ø Measuring inset 6.0 mm: (0.1 Ω/m ⇒ 0.25 °C/m)

It is for this reason that ABB supplies three-wire / four-wire circuits as standard.

... Specification

Thermocouples

The accuracy classes of the thermocouples are in accordance with the IEC 60584 international standard. On request, ABB also supplies in accordance with ANSI MC96.1 and DIN 43710. Since the values of both standards differ from each other only very slightly at low temperatures (up to approx. 300 °C(572 °F)), ABB recommends using thermocouples in accordance with IEC 60584. The tolerance specifications are presented in the table 'Accuracy classes in accordance with IEC 60584'

The following table shows the temperature-sensitive length, the minimum immersion length, and the non-flexible length at the tip of the temperature sensor.

Type	minimum immersion length	Temperature-sensitive length	Non-flexible length
Vibration-resistant up to 600 m/sec ² (60 g)	70 mm (2.76 in)	7 mm (0.28 in)	30 mm (1.18 in)

	1K	2K	3K	1J	2J	1L*	2L*	1N	2N	1T	2T	1E	2E	1S	2S
3.0 mm, class 2	●	●		●	●	●	●	●	●						
3.0 mm, class 1	●	●		●	●			●	●						
4.5 mm, class 2	●	●													
4.5 mm, class 1	●	●													
6.0 mm, class 2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
6.0 mm, class 1	●	●		●	●			●	●	●	●	●	●		

* Tolerance in accordance with DIN 43710

Accuracy classes in accordance with IEC 60584, DIN 43710 and ANSI MC96.1

IEC 60584	Class (CL)	Temperature range	Maximum measuring error
K (NiCr-Ni), N (NiCrSi-NiSi)	2	-40 to 333 °C (-40 to 631.4 °F)	±2.5 °C (±4.5 °F)
		333 to 1200 °C (631.4 to 2192 °F)	±0.0075 × [t]
	1	-40 to 375 °C (-40 to 707 °F)	±1.5 °C (±2.7 °F)
		375 to 1000 °C (707 to 1832 °F)	±0.004 × [t]
J (Fe-CuNi)	2	-40 to 333 °C (-40 to 631.4 °F)	±2.5 °C (±4.5 °F)
		333 to 750 °C (631.4 to 1382 °F)	±0.0075 × [t]
	1	-40 to 375 °C (-40 to 707 °F)	±1.5 °C (±2.7 °F)
		375 to 750 °C (707 to 1382 °F)	±0.004 × [t]
T (Cu-CuNi)	2	-40 to 133 °C (-40 to 271.4 °F)	±1.0 °C (±1.8 °F)
		133 to 350 °C (271.4 to 662 °F)	±0.0075 × [t]
	1	-40 to 125 °C (-40 to 257 °F)	±0.5 °C (±0.9 °F)
		125 to 350 °C (257 to 662 °F)	±0.005 × [t]
S (Pt10%Rh-Pt)	2	0 to 600 °C (32 to 1112 °F)	±1.5 °C (±2.7 °F)
		600 to 1600 °C (1112 to 2912 °F)	±0.0025 × [t]
E (NiCr-CuNi)	2	-40 to 333 °C (-40 to 631.4 °F)	±2.5 °C (±4.5 °F)
		333 to 900 °C (631.4 to 1652 °F)	±0.0075 × [t]
	1	-40 to 375 °C (-40 to 707 °F)	±1.5 °C (±2.7 °F)
		375 to 800 °C (707 to 1472 °F)	±0.004 × [t]

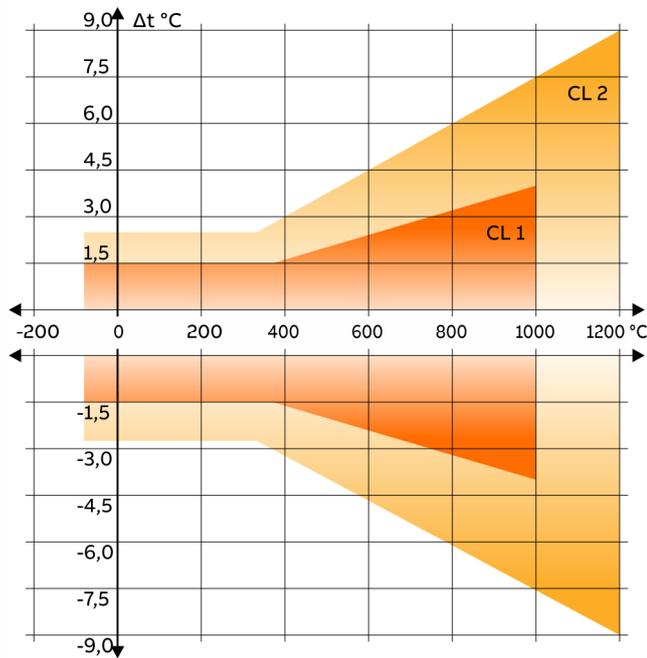


Figure 4: Graphical representation of accuracy classes using type K and N in accordance with IEC 60584 as examples. See tables for other types.

DIN 43710	Temperature range	Maximum measuring error
L (Fe-CuNi)	50 to 400 °C (122 to 752 °F)	±3.0 °C (±5.4 °F)
	400 to 900 °C (752 to 1652 °F)	±0.0075 × [t]

ANSI MC 96.1	Class (CL)	Temperature range	Maximum measuring error
K (NiCr-Ni), N (NiCrSi-NiSi)	Standard	0 to 293 °C (32 to 559.4 °F)	±2.2 °C (±3.96 °F)
		293 to 1250 °C (559.4 to 2282 °F)	±0.0075 × [t]
	Special	0 to 275 °C (32 to 527 °F)	±1.1 °C (±1.98 °F)
		275 to 1250 °C (527 to 2282 °F)	±0.0040 × [t]
J (Fe-CuNi)	Standard	0 to 293 °C (32 to 559.4 °F)	±2.2 °C (±3.96 °F)
		293 to 750 °C (559.4 to 1382 °F)	±0.0075 × [t]
	Special	0 to 275 °C (32 to 527 °F)	±1.1 °C (±1.98 °F)
		275 to 750 °C (527 to 1382 °F)	±0.0040 × [t]

Insulation resistance of measuring inset

The insulation resistance is measured between the outer sheath and measuring loop. If there are two measuring loops, the insulation resistance between both measuring loops is also measured.

Thanks to a special process used during manufacturing, ABB measuring insets can boast outstanding insulation values even at high temperatures.

Insulation resistance R_{iSO}

≥ 500 MΩ with a ambient temperature range from 15 to 35 °C (59 to 95 °F)

Air humidity

< 80 %

Thermowells

Thermowell functions

- Protection against aggressive media, high process pressures, and high medium velocity
- Replacement or recalibration of the sensor element without interrupting the process

Depending on the medium, temperature and process pressure, several different designs and materials are available.

The thermowells are divided into two categories:

- Welded protective fittings manufactured from pipe material for TSPX21
- Drilled thermowells manufactured from bar stock material for TSPX31

Available in accordance with DIN 43772 or ABB standard.

Use in contact with food

Selected welded and drilled thermowells are permitted for use with food in accordance with EU regulations no. 1935 and no. 2023. In this context, this involves the following thermowells:

Welded thermowells:

- Flange thermowell, straight (DIN 43772, Form 2F)
- Screw-in thermowell, straight (DIN 43772, Form 2G)
- Flange thermowell with stepped tip 9 mm (0.36 in) (ABB Form 2FS/9)
- Screw-in thermowell with stepped tip 9 mm (0.36 in) (ABB Form 2GS/9)

Drilled thermowells:

- Weld-in thermowell manufactured from bar stock material, (DIN 43772, Form 4)
- Flange thermowell manufactured from bar stock material, (DIN 43772, Form 4F)

The following thermowell materials are possible:

- Stainless steel 1.4571 (ASTM 316Ti)
- Ni alloy 2.4819 (Hastelloy C-276)
- Ni alloy 2.4610 (Hastelloy C-4)

Other thermowells and materials available on request.

Use in highly aggressive media

A special coating of PFA or ECTFE with a standard coat thickness of 0.5 mm (0.02 in) can be applied for the corresponding use.

Use in highly corrosive applications

For thermowells with flange, a tantalum sheath can be applied for the corresponding usage. The tantalum sleeve is brazed to the flange in two points.

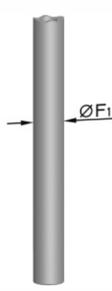
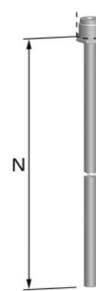
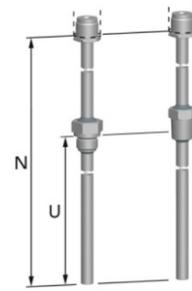
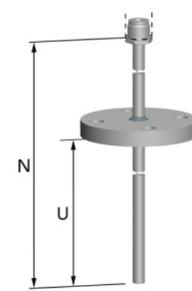
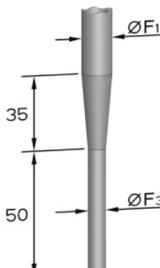
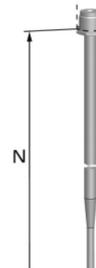
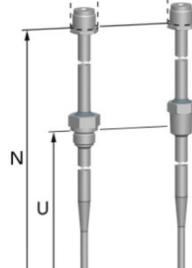
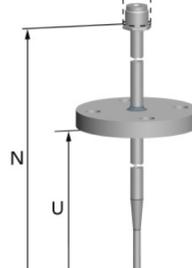
If required, contact your ABB partner.

Response times in accordance with IEC 60751 and IEC 60584

The thermowell used in each application and the thermal contact between thermowell and measuring inset have an impact on the response times of TSP temperature sensors. In the case of TSPX21 and TSPX31 temperature sensors, the design of the thermowell tip has been adapted to the measuring inset. This maximizes heat transmission. The following table shows typical response times for the SensyTemp TSP series, measured in accordance with IEC 60751 in water with 0.4 m/s and a temperature rise from 25 °C (77 °F) to 35 °C (95 °F).

Thermowell form	Diameter [mm]	In water 0.4 m/s	
		t _{0,5}	t _{0,9}
Resistance thermometer			
2, 2G, 2F, 2G0	9 × 1	23	64
	11 × 2	25	77
3, 3G, 3F	12 / 9 mm tip	15	38
2S, 2GS, 2FS, 2GS0	12 / 6 mm tip	21	55
Thermocouples			
2, 2G, 2F, 2G0	9 × 1	10	24
	11 × 2	12	28
3, 3G, 3F	12 / 9 mm tip	12	24
2S, 2GS, 2FS, 2GS0	12 / 6 mm tip	6	14
	14 / 6 mm tip	6	14

Welded thermowells (TSP121)

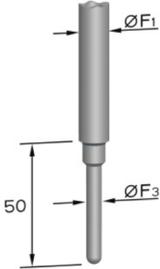
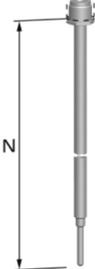
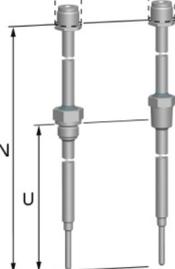
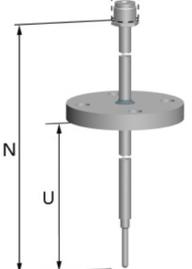
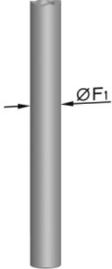
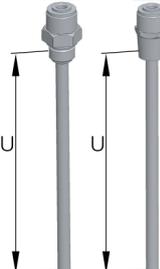
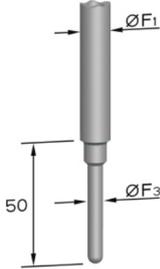
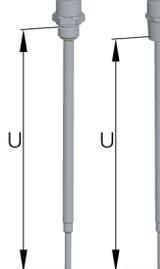
Straight shaft	DIN 43772 – form 2	DIN 43772 – form 2G	DIN 43772 – form 2F
M24 × 1.5 head connection			
			
1.4571/316Ti	F1 = 12, 14 mm	F1 = 9, 11, 12, 14 mm	F1 = 11, 12, 14 mm
1.4404/316L	F1 = 12, 14 mm	F1 = 12, 14 mm	F1 = 12, 14 mm
2.4819/C-276	—	F1 = 13.7 mm*	F1 = 13.7 mm**
Measuring inset	Ø 6 mm	Ø 6 mm	Ø 6 mm
Tapered tip***	DIN 43772 – form 3	DIN 43772 – form 3G	DIN 43772 – form 3F
M24 × 1.5 head connection			
			
1.4571/316Ti	F1/F3 = 12/9, 16/10 mm	F1/F3 = 12/9 mm	F1/F3 = 12/9, 16/10 mm
1.4404/316L	F1/F3 = 12/9 mm	F1/F3 = 12/9 mm	F1/F3 = 12/9 mm
Measuring inset	Ø 6 mm	Ø 6 mm	Ø 6 mm

* Only with G½A, ½" NPT thread

** Flange 1.4571/316Ti, flange disc 2.4819/C-276

*** With a diameter of the tapered tip of 9 mm, the bottom plug is welded in accordance with the NAMUR recommendation. The effective diameter is approx. 10 mm.

... Thermowells

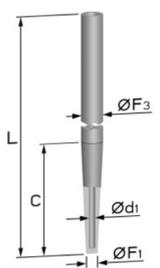
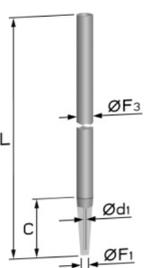
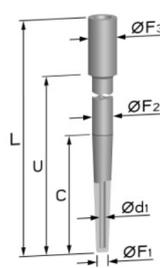
Stepped tip	ABB – form 2S	ABB – form 2GS	ABB – form 2FS
M24 × 1.5 head connection			
			
1.4571/316Ti	F1/F3 = 12/6, 14/6 mm	F1/F3 = 11/6, 12/6, 14/6 mm	F1/F3 = 11/6, 12/6, 14/6 mm
1.4404/316L	F1/F3 = 12/6, 14/6 mm	F1/F3 = 12/6, 14/6 mm	F1/F3 = 12/6, 14/6 mm
2.4819/C-276	—	F1/F3 = 13.7/6 mm*	F1/F3 = 13.7/6 mm**
Measuring inset	Ø 3 mm	Ø 3 mm	Ø 3 mm
Straight shaft, without extension tube	ABB – form 2G0	Recessed tip, without extension tube	ABB – form 2GS0
M24 × 1.5 head connection		M24 × 1.5 head connection	
			
1.4571/316Ti	F1 = 9, 11, 12 mm*	1.4571/316Ti	F1/F3 = 11/6, 12/6 mm*
Measuring inset	Ø 6 mm	Measuring inset	Ø 3 mm

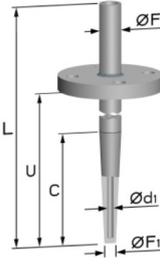
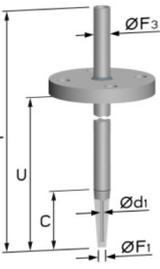
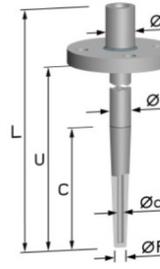
* Only with G½A, ½" NPT thread

** Flange 1.4571/316Ti, flange disc 2.4819/C-276

Other diameters and materials available on request.

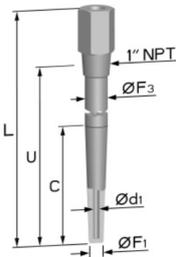
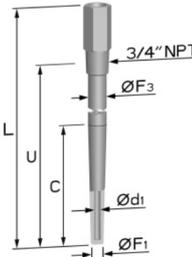
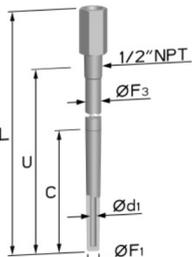
Drilled thermowells (TSP131)

Weld-in thermowell		DIN 43772 – form 4		DIN 43772 – form 4		ABB – form PW	
Extension tube connection		M18 × 1.5		M14 × 1.5		½ in NPT	
							
Material		1.4404/316L; 1.4571/316Ti; 1.7335/13CrMo4-5; 1.5415/15Mo3		1.4876/Incoloy® 800; 2.4360/Monel® 400		1.4404/316L; 1.4571/316Ti 2.4816/Inconel® 600; 2.4819/C-276	
F3/F2/F1	d1	24h7/12.5 mm	7 mm	18h7/9 mm	3.5 mm	32/23/13.5 mm	7 mm
Measuring inset		Ø 6 mm		Ø 3 mm		Ø 6 mm	

Flange thermowell		DIN 43772 – form 4F		DIN 43772 – form 4FS		ABB – form PF	
Extension tube connection		M18 × 1.5		M14 × 1.5		½ in NPT	
							
Material		1.4404/316L; 1.4571/316Ti		1.4404/316L; 1.4571/316Ti		1.4876/Incoloy® 800; 2.4360/Monel® 400* 2.4816/Inconel® 600; 2.4819/C-276*	
F3/F2/F1	d1	24/12.5 mm	7 mm	18/9 mm	3.5 mm	32/23/13.5 mm	7 mm
Measuring inset		Ø 6 mm		Ø 3 mm		Ø 6 mm	

* 1.4876/Incoloy® 800; 2.4360/Monel® 400; 2.4816/Inconel® 600; 2.4819/C-276 with flange in 1.4571/316Ti and flange disc

... Thermowells

Screw-in thermowell	ABB – form PS		ABB – form PS		ABB – form PS		
Extension tube connection	½ in NPT; WAF 36		½ in NPT; WAF 27		½ in NPT; WAF 27		
							
Material	1.4404/316L; 1.4571/316Ti; 1.4876/Incoloy® 800; 2.4360/Monel® 400; 2.4816/Inconel® 600; 2.4819/C-276						
F3/F1	d1	25/16 mm	7 mm	20/13.5 mm	7 mm	17/13.5 mm	7 mm
Measuring inset		Ø 6 mm		Ø 6 mm		Ø 6 mm	

Other diameters and materials available on request.

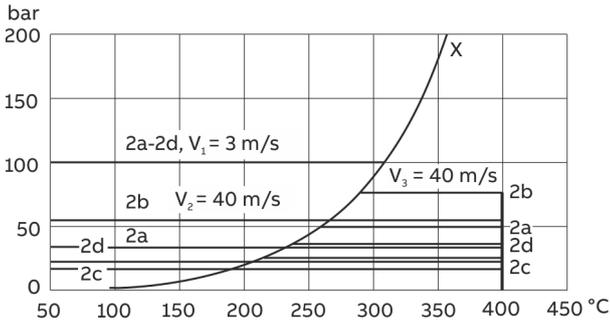
Standard lengths

Welded thermowells mm (in)		
Form	N = 230 (9.055)	U = 100 (3.94)
2; 2G; 2F;	N = 290 (11.42)	U = 160 (6.30)
3; 3G; 3F;	N = 380 (14.96)	U = 250 (9.84)
2S; 2GS; 2FS	N = 530 (20.87)	U = 400 (15.75)
Drilled thermowells mm (in)		
Form 4	L = 140 (5.51)	C = 65 (2.56)
	L = 200 (7.87)	C = 65 (2.56)
	L = 200 (7.87)	C = 125 (4.92)
	L = 260 (10.24)	C = 125 (4.92)
	L = 410 (16.14)	C = 275 (10.83)
Form 4S	L = 110 (4.33)	C = 65 (2.65)
	L = 140 (5.51)	C = 65 (2.65)
Form PW; PF; PS	U = 100 (3.94), 150 (5.91), 200 (7.87), 250 (9.84), 300 (11.81), 350 (13.78)	L = U + 65 (2.56)
Form 4F	U = 130 (5.12), L = 200 (7.87)	C = 65 (2.56)
	U = 190 (7.48), L = 260 (10.24)	C = 125 (4.92)
	U = 340 (13.39), L = 410 (16.14)	C = 275 (10.83)
Form 4FS	U = 130 (5.12), L = 200 (7.87)	C = 65 (2.65)

Pressure and vibration resistance of thermowell

The permissible compressive loads for thermowells at various temperatures are illustrated in the following figures (thermowells conforming to DIN 43772). The curves can also be applied to identical thermowell models.

Thermowell form 2 (material 1.4571)

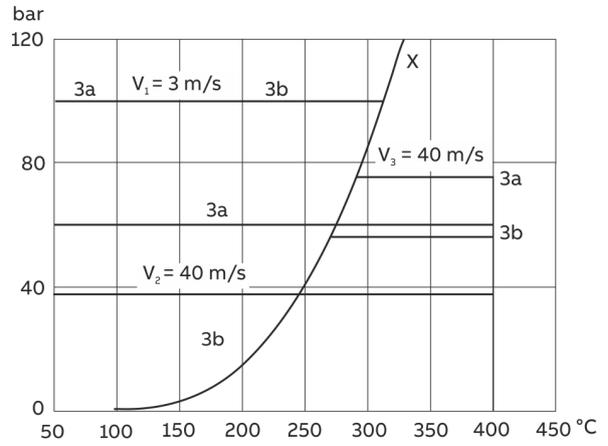


- X Vapor-pressure curve
- V₁ Medium velocity in water
- V₂ Medium velocity in air
- V₃ Medium velocity in vapor

Figure 5: Thermowell Form 2

Curve	Installation length (mm)	Thermowell diameter (mm)
2a	250	11
2b	250	14
2c	400	11
2d	400	14

Thermowell form 3 (material 1.4571)



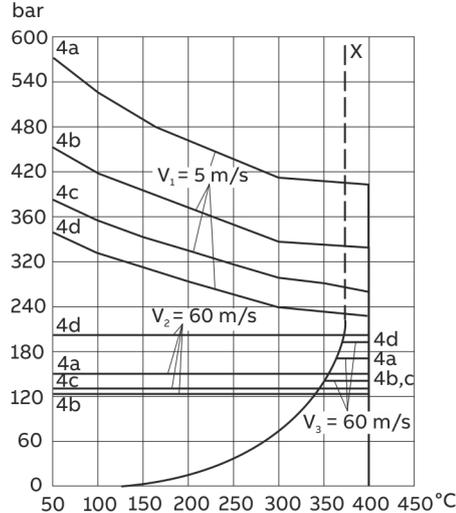
- X Vapor-pressure curve
- V₁ Medium velocity in water
- V₂ Medium velocity in air
- V₃ Medium velocity in vapor

Figure 6: Thermowell Form 3

Curve	Installation length (mm)	Thermowell diameter (mm)
3a	225	12/9
3b	285	12/9

... Thermowells

Thermowell form 4 (material 1.4571)



- X Vapor-pressure curve
- V₁ Medium velocity in water
- V₂ Medium velocity in air
- V₃ Medium velocity in vapor

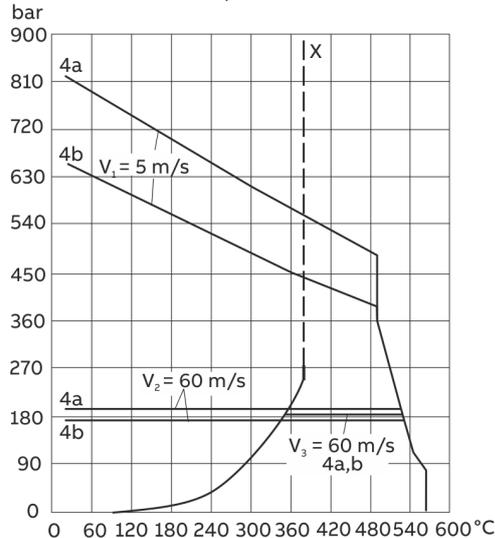
Figure 7: Thermowell Form 4

Curve	Installation length (mm)	Thermowell diameter (mm)
4a	65	18
4b	125	24
4c	125	26
4d	125	32

Note

The diagrams above have been taken from DIN 43772. They are based on the Dittrich calculation model. They do not take possible vibration caused by vortex excitation of the flowing medium into account. ABB's standard thermowells are sufficiently robust for most industrial applications provided that design, material, and length are properly selected. Most thermowell failures are caused by flow-related vibration. For this reason, ABB offers a stress analysis for ABB thermowells, based on the respective usage parameters.

Thermowell form 4 (material 1.7335 and 1.7380)



- X Vapor-pressure curve
- V₁ Medium velocity in water
- V₂ Medium velocity in air
- V₃ Medium velocity in vapor

Figure 8: Thermowell Form 4

Curve	Installation length (mm)	Thermowell diameter (mm)
4a	65	18
4b	125	24

The stress analysis conforms to ASME PTC 19.3-2010. It is based on recognized theoretical methods and is intended to support thermowell selection for critical applications. It is not, however, a guarantee against failure of the thermowell. Given the relatively unreliable computational estimation of the natural frequency of a thermowell and taking the numerous influencing factors into account, experimental testing is recommended in critical cases. For more detailed information about thermowell loads and calculation methods, please see DIN 43772.

Process connections

SensyTemp TSP121 temperature sensor

Plug-in thermowells, welded	Sliding connection
DIN 43772 – form 2, straight shaft	G $\frac{1}{2}$ in A, $\frac{1}{2}$ in NPT
DIN 43772 – form 3, tapered tip	
ABB – form 2S, stepped tip	

Note

In principle, ABB supplies compression fittings made from stainless-steel 1.4571 without material certification in accordance with EN 10204.

Screw-in thermowells, welded	Fixed connection
DIN 43772 – form 2G, straight shaft	G $\frac{3}{8}$ in A, G $\frac{1}{2}$ in A, G $\frac{3}{4}$ in A, G1 in A, $\frac{1}{2}$ in NPT, $\frac{3}{4}$ in NPT, 1 in NPT
DIN 43772 – form 3G, tapered tip	M20 × 1,5, M27 × 2,
ABB – form 2GS, stepped tip	$\frac{1}{2}$ in BSPT, $\frac{3}{4}$ in BSPT, 1 in BSPT
ABB – form 2G0, without extension tube	G $\frac{1}{2}$ in A, $\frac{1}{2}$ in NPT
ABB – form 2GS0, without extension tube	
Stepped tip	

Flange thermowells, welded	Flange in accordance with EN 1092-1	Flange in accordance with ASME B16.5 TW	Tri-clamp flange
	Form B1/B2 sealing surface*	Form RF sealing surface*	BS4825
DIN 43772 – form 2F, straight shaft	DN 15, PN 10 to PN 40	Nominal diameter 1 in.,	On request
	DN 20, PN 10 to PN 40	Nominal pressure 150, 300, 600 lbs.	
DIN 43772 – form 3F, tapered tip	DN 25, PN 10 to PN 40, PN 63 to PN 100	Nominal diameter 1 $\frac{1}{2}$ in, nominal pressure	
	DN 32, PN 16 to PN 40, PN 63 to PN 100	150, 300, 600, 900/1500 lbs.	
	DN 40, PN 10 to PN 40, PN 63 to PN 100	Nominal diameter 2 in, Nominal pressure	
ABB – form 2FS, stepped tip	DN 50, PN 6, PN 25 to PN 40	150, 300, 600, 900/1500 lbs.	
	PN 63 to PN 100		
	DN 80, PN 16		
	DN 100, PN 40		

* Others available on request

... Process connections

SensyTemp TSP131 temperature sensor

Weld-in thermowells, drilled

Weld-in thermowells are available as DIN 43772 form 4 and ABB form PW. Other forms are available on request.

Screw-in thermowells, drilled

DIN 43772 – form 6 and ABB – form PS

Screw-in thread

G½ in A, ½ in NPT, ¾ in NPT, 1 in NPT, M20 × 1,5

Flange thermowells, drilled

DIN 43772 – form 4F, F2 = 18 mm, 24 mm, 26 mm, thermowell manufactured from bar stock material

ABB – form PF, thermowell manufactured from bar stock material

Flange in accordance with EN 1092-1 Form B1/B2 sealing surface*

DN 25, PN 10 to PN 40, PN 63 to PN 100
DN 32, PN 16 to PN 40
DN 40, PN 10 to PN 40, PN 63 to PN 100

DN 50, PN 6, PN 25 to PN 40, PN 63 to PN 100
DN 80, PN 16
DN 100, PN 40

Flange in accordance with ASME B16.5 Form RF sealing surface*

Nominal diameter 1 in., Nominal pressure 150, 300, 600 lbs.
Nominal diameter 1 ½ in, nominal pressure 150, 300, 600, 900 / 1500 lbs.
Nominal diameter 2 in, Nominal pressure 150, 300, 600, 900/1500 lbs.

Tri-clamp flange BS4825

On request

* Others available on request

Note

Other process connections are available on request. If required, contact your ABB partner.

Extension tubes

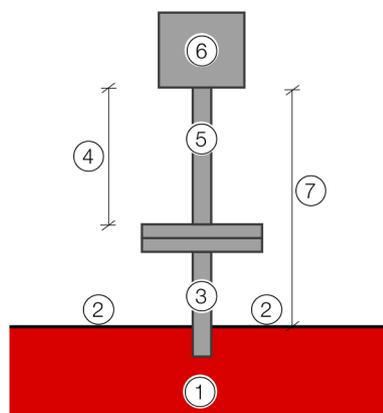
The extension tube is the component between thermowell and connection head. It is used to bridge any existing insulation or serves as a cooling section between the temperature-sensitive electronics of the transmitter in the connection head and the process.

Impact of process and ambient temperature on the connection head

In addition to the ambient temperature, the impact of process temperature on the connection head and an optional integrated transmitter should generally be observed, and this especially in potentially explosive atmospheres.

At high process temperatures, excessive heat transfer to the connection head must be prevented by adjusting the length of the neck and using a suitably long extension tube. Additional improvement can be achieved by using suited insulation.

The neck length is defined as the distance between the surface of the process-media carrying system parts and the lower edge of the connection head in accordance with the following figure. It is greater or equal to the extension tube length. The neck length therefore represents the cooling section between the connection head and the process.



- ① Process
- ② Surface of process media-carrying system parts
- ③ Thermowell
- ④ Extension tube length
- ⑤ Extension tube
- ⑥ Connection head
- ⑦ Neck length

Figure 9: Definition of the neck length

Affect of neck length on the temperature in the connection head

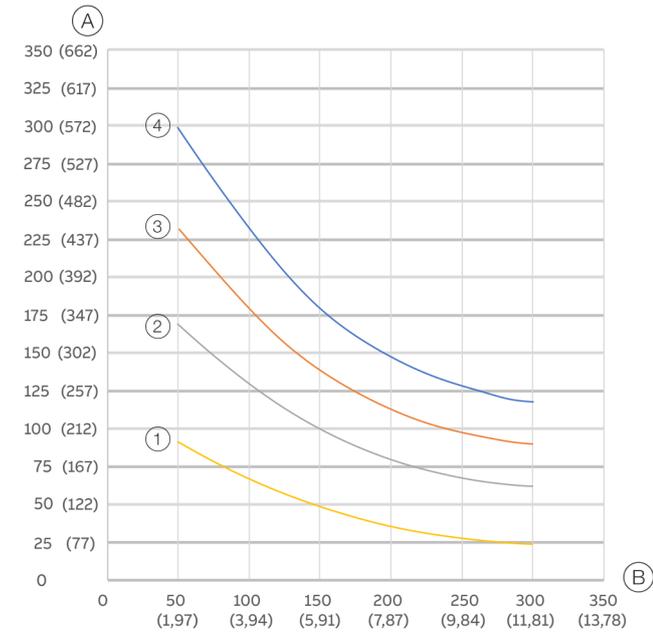
The temperature increase in the connection head as a function of the neck length for **operation without insulation** is shown below.

With regard to the heating behavior, there are three different groups of connection heads in different versions:

- Group 1: BEG, BBK head shape and similar head shapes
- Group 2: BUZ, BUS, AGS head shape and similar head shapes
- Group 3: AGL head and similar versions made from aluminum

The minimal neck length is a result of the maximum permissible temperature on or in the connection head. Depending on the selected version of the temperature sensor, this results in a minimum extension tube length.

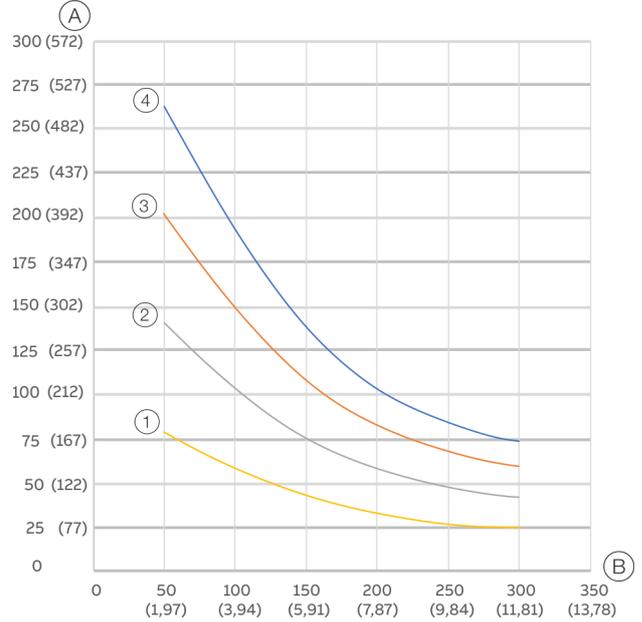
Group 1: BEG, BBK head shape and similar head shapes



- (A) Temperature rise in connection head °C (°F)
 (B) Neck length mm (in)
- Surface temperature of process media-carrying system parts °C (°F), see Figure 9 on page 18**
- ① 250 (482)
 - ② 450 (842)
 - ③ 620 (1148)
 - ④ 800 (1472)

Figure 10: BEG, BBK head shape and similar head shapes

Group 2: BUZ, BUS, AGS head shape and similar head shapes

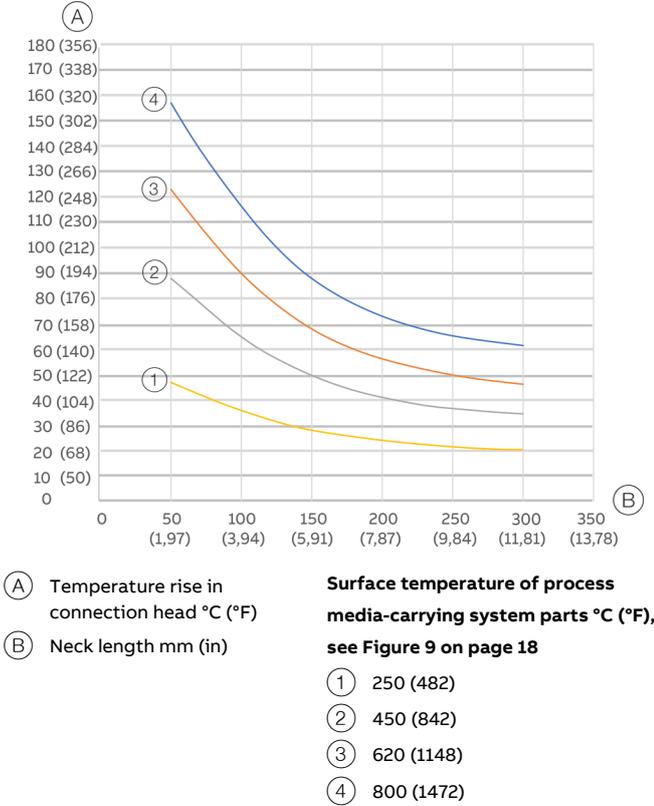


- (A) Temperature rise in connection head °C (°F)
 (B) Neck length mm (in)
- Surface temperature of process media-carrying system parts °C (°F), see Figure 9 on page 18**
- ① 250 (482)
 - ② 450 (842)
 - ③ 620 (1148)
 - ④ 800 (1472)

Figure 11: BUZ, BUS, AGS head shape and similar head shapes

... Process connections

Group 3: AGL head and similar versions made from aluminum



Note

- When determining the required extension tube length, you also need to guarantee that the maximum permissible ambient temperature for the device is considered correctly and is not up-scaled. The temperature range of -40 to 80° C (-40 to 176 °F) permissible in the area of electrical connections must be maintained for temperature classes T6...T1.
- The operator must make sure that the maximum permissible temperature of the transmitter electronics in the connection head is not up-scaled in intrinsically safe devices.

Figure 12: AGL head and similar versions made from aluminum

Extension tube models

	Cylindrical screw-in thread	Conical screw-in thread	Lock nut, rotatable	½" NPT - ½" NPT, not separable (nipple)	½" NPT - ½" NPT separable (nipple union)	½" NPT - ½" NPT separable (nipple-union-nipple)
Head connection	M24 × 1.5			½" NPT		
Thermowell connection	M14 × 1.5; M18 × 1.5; M20 × 1.5; G¾", G½"	½" NPT	G ½"	½" NPT		
Extension tube diameter (Standard)	12 mm (0.47 in)					
Material	1.4571/316Ti					

Note

TSP1x1 are also available without an extension tube.

Connection heads

Functions of the connection head

- Housing for a transmitter or a terminal block
- Protection of the connection area against adverse environmental influences

All ABB standard heads provide IP rating of at least IP 66, in combination with an ABB thermowell and the supplied M20 × 1.5 cable gland.

Note

The cable glands used are suitable for permanent cable installation.

As an option, the connection heads are also available with a ½" NPT cable entry (without cable gland). In this case, the user must put appropriate measures in place to ensure that the required IP rating is maintained.

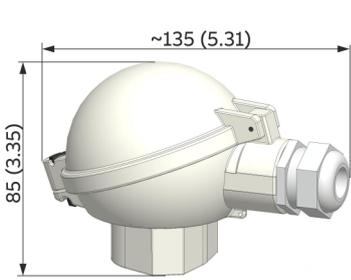
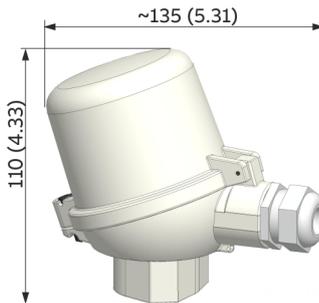
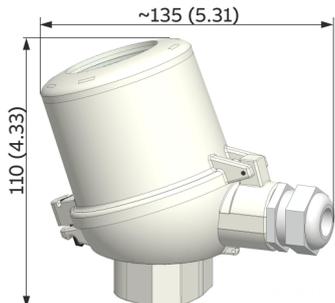
Ambient temperature at connection head

Connection head without transmitter and without cable gland	-40 to 120 °C (-40 to 248 °F)
Connection head with transmitter	-40 to 85 °C (-40 to 185 °F)
Connection head with LCD indicator	-20 to 70 °C (-4 to 158 °F)

Note

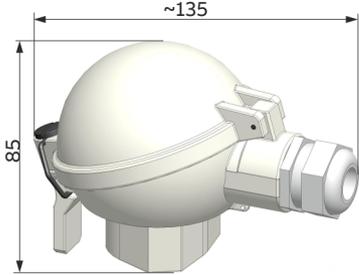
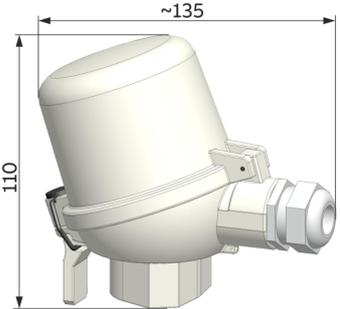
When using the device in potentially explosive atmospheres, restrictions of the ambient temperature range are possible. Comply with the notes in the corresponding declarations of conformity and type examination certificate.

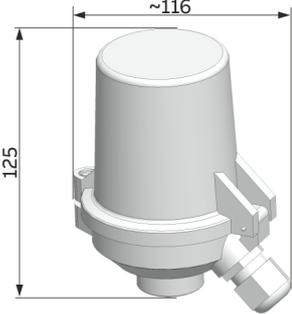
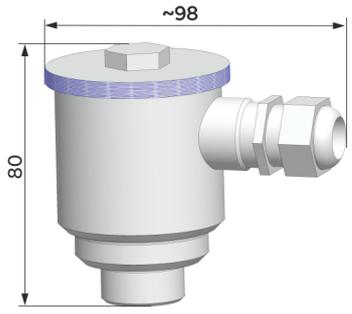
The plastic cable gland for cable outer diameters of 4 to 13 mm (0.16 to 0.51 in) used as standard is suited for a temperature range of -40 to 70 °C (-40 to 158 °F). For temperatures outside this range, an appropriate cable gland can be installed.

Head form	BUZ	BUZH	BUZHD
			
Material	Aluminum, epoxy-coated		
Cover locking system	Hinged cover with screw plug		
Cable gland	M20 × 1.5, optional cable entry ½" NPT, without screwed connection		
IP rating	IP 66		
Built-in LCD indicator	No	No	Yes
Transmitter mounting	On the measuring inset	On the cover (mounting on the measuring inset available as an option)	On the measuring inset

Dimensions in mm (in)

... Connection heads

Head form	BUS	BUSH
		
Material	Aluminum, epoxy-coated	
Cover locking system	Hinged cover with snap fastener	
Cable gland	M20 × 1.5, optional cable entry 1/2" NPT, without screwed connection	
IP rating	IP 66	
Built-in LCD indicator	No	
Transmitter mounting	On the measuring inset	On the cover (mounting on the measuring inset available as an option)

Head form	BUKH	BEG
		
Material	Polyamide	Stainless steel
Cover locking system	Hinged cover	Screw-on cap
Cable gland	M20 × 1.5	
IP rating	IP 66	
Built-in LCD indicator	No	
Transmitter mounting	On the cover (mounting on the measuring inset available as an option)	On the measuring inset

Dimensions in mm

Transmitter

Installing a transmitter has the following advantages:

- Cost savings due to reduced wiring costs
- Amplification of the sensor signal directly at the measuring point and conversion to a standard signal (thereby increasing the signal's interference immunity).
- Option to install an LCD indicator in the connection head.
- SIL 2 with accordingly classified transmitter.

The output signal of a temperature sensor is determined by the selection of the corresponding transmitter. When using ABB transmitters, self-heating can be ignored.

The following output signals are available:

Transmitter type	
TTH200 HART® 4 to 20 mA, HART®	
TTH300 HART® 4 to 20 mA, HART®	
TTH300 PA PROFIBUS PA®	
TTH300 FF FOUNDATION Fieldbus® H1	

Note

Further information on the transmitters listed above can be found in the data sheets DS/TTH200 and DS/TTH300.

Type A and type AS LCD indicator

The BUZHD connection head is equipped with a digital LC display. A suitable transmitter is connected via an add-on interface cable.

An LCD indicator with type AS display function suited for a combination with a TTH200. If the TTH300 transmitter is selected, the type A LCD indicator can also be used to configure the transmitter.

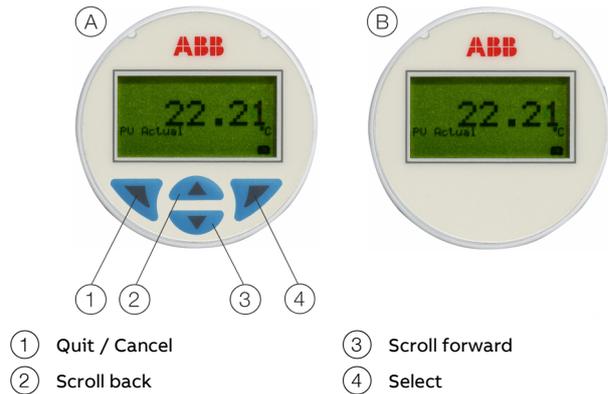


Figure 13: (A) LCD indicator Type A (B) LCD indicator Type AS

Functional safety (SIL)

The SensyTemp TSP temperature sensor with SIL-certified transmitters installed at the factory are available with conformity in accordance with IEC 61508 for use in safety relevant applications up to SIL 3 (redundant).

When using a transmitter the device fulfills the requirements in accordance with SIL 2.

When using redundantly operated transmitters, the requirements in accordance with SIL 3 can be fulfilled.

Notices regarding functional safety of the TTx300 and TTx200 temperature transmitters can be found in the corresponding SIL-Safety Manual.

Information about temperature sensors without built-in electronics can be found in the operating instruction.

Note

For a higher output power P_o in case of a malfunction of more than 38 mW, but also for a generally higher output power of a connected transmitter of more than 38 mW, the temperature rise Δt must be recalculated.

ATEX and IECEx 'Ex i' intrinsic safety

Note

For compliance with the maximum permissible temperature of the transmitter in the connection head for devices in intrinsically safe design, see section **Impact of process and ambient temperature on the connection head** on page 18.

In the zone of the electrical connections, the permissible ambient temperature range is -40 to 80°C (-40 to 176°F). Suited thermowells in accordance with PTB 01 ATEX 2200 X or IECEx PTB 11.0111 X should be used.

Electrical power limit Ex i

The TSP temperature sensors may only be operated in certified intrinsically safe category 'ia' or 'ib' circuits in the intrinsically safe Ex i type of protection.

The following electric values must not be up-scaled in the measurement current circuit of the temperature sensor:

U_i (input voltage)	I_i (input current)
30 V	101 mA
25 V	158 mA
20 V	309 mA

P_i (inner power) = max. 0.5 W

Notice: for the internal power P_i of the sensor and the output power P_o of the connected transmitter, the following must apply: $P_i \geq P_o$.

Likewise the following must apply: $U_i \geq U_o$ and $I_i \geq I_o$.

L_i (inner inductance of the sensor): negligible

C_i (inner capacitance of the sensor): negligible

The output values of a connected transmitter, both when mounting in the connection head and when mounting in the field, must not up-scale these electric values. The output values of ABB temperature transmitters (TTx300 and TTx200) are below these maximum values.

Output power P_o with ABB transmitters

Transmitter type	P_o
TTH200, TTF200, TTR200 HART	$\leq 29\text{ mW}^*$
TTH300, TTF300 HART	$\leq 29\text{ mW}^{**}$
TTH300, TTF300 PA	$\leq 38\text{ mW}$
TTH300, TTF300 FF	$\leq 38\text{ mW}$

* as of HW-Rev. 1.12, previously $P_o \leq 38\text{ mW}$

** as of HW-Rev. 2.00, previously $P_o \leq 38\text{ mW}$

The type examination certificates for the corresponding transmitter types contain all further information necessary to verify intrinsic safety (U_o , I_o , P_o , L_o , C_o , etc.).

Maximum process temperature T_{medium} in Zone 0 and Zone 1

To calculate the temperature classes for T3, T4, T5 and T6, deduct 5 K in each instance from the maximum surface temperature; for T1 and T2, deduct 10 K in each instance from this surface temperature.

For temperature T_{medium} , the temperature rise in the event of a fault of 8 K as calculated as an example in **Conditions for use in potentially explosive atmospheres** on page 24.

Temperature class	-5 K	-10 K	T_{medium}
T1 (450 °C (842 °F))	—	440 °C (824 °F)	432 °C (809.6 °F)
T2 (300 °C (572 °F))	—	290 °C (554 °F)	282 °C (539.6 °F)
T3 (200 °C (392 °F))	195 °C (383 °F)	—	187 °C (368.6 °F)
T4 (135 °C (275 °F))	130 °C (266 °F)	—	122 °C (251.6 °F)
T5 (100 °C (212 °F))	95 °C (203 °F)	—	87 °C (188.6 °F)
T6 (85 °C (185 °F))	80 °C (176 °F)	—	72 °C (161.6 °F)

Ordering Information

NOTE

Order codes cannot be combined at will. Your ABB partner will be happy to answer any questions you might have regarding installation feasibility. All documentation, declarations of conformity, and certificates are available in ABB's download area.

SensyTemp TSP111

Base model	TSP111	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
SensyTemp TSP111 Temperature Sensor, without thermowell, for light and medium duty applications											
Explosion Protection / Approvals											
Without		Y0									
Intrinsic Safety ATEX II 1 G Ex ia IIC T6...T1 Ga or II 2 G Ex ib IIC T6...T1 Gb or II 1/2 G Ex ib IIC T6...T1 Ga/Gb		A1									
Non-sparking and increased safety as well as dust explosion protection ATEX II 3 G Ex nA IIC T6...T1 Gc, ATEX II 3 G Ex ec IIC T6...T1 Gc und ATEX II 3 D Ex tc IIIB T133°C Dc		B1*									
Intrinsic safety IECEx ia IIC T6...T1 Ga		H1									
Intrinsic Safety IECEx ib IIC T6...T1 Gb or IECEx ib IIC T6...T1 Ga/Gb		H2									
Intrinsic Safety acc. NAMUR NE 24 and ATEX II 1 G Ex ia IIC T6...T1 Ga		N1									
GOST Russia - metrological approval		G1									
GOST Russia - metrological approval and EAC-Ex, Ex i - Zone 0		P2									
GOST Kazakhstan - metrological approval		G3									
GOST Kazakhstan - metrological approval and EAC-Ex, Ex i - Zone 0		T2									
GOST Belarus - metrological approval		M5									
GOST Belarus - metrological approval and EAC-Ex, Ex i - Zone 0		U2									
NEPSI Intrinsic Safety type of protection: Ex ia IIC T6 Ga		S1									
Extension Tube Length											
Without Extension Tube		Y0									
K = 150 mm (6 in)		K1									
Customer specific length		Z9									

* According EN 60079- and EN 60079-31, the application in hybrid mixtures (concomitance of potentially explosive dust and gas) is currently not allowed.

Continued see next page

... Ordering Information

Base model	TSP111	XX							
Thermowell Connection									
No extension / Connection head with thread M24 × 1,5		W1							
No extension / Connection head with thread 1/2 in NPT		W2							
No extension / Connection head with lock nut M24 × 1.5		W3							
Double nipple G ½ A		W4							
Double nipple ½ in NPT		W5							
Extension tube with Cylindrical thread G ½ A		G1							
Extension tube with Cylindrical thread G ¾ A		G2							
Extension tube with Cylindrical thread G ⅝ A		G3							
Extension tube with Cylindrical thread M14 × 1,5		M1							
Extension tube with Cylindrical thread M18 × 1,5		M2							
Extension tube with Cylindrical thread M20 × 1,5		M3							
Extension tube with Cylindrical thread M24 × 1,5		M4							
Extension tube with Cylindrical thread M27 × 2		M5							
Extension tube with conygal thread ½ in NPT		N1							
Nipple ½ in NPT-½ in NPT		N2							
Nipple- Union / ½ in NPT-½ in NPT		N3							
Nipple-Union ½ in NPT-½ in NPT		N4							
Extension tube / Gland nut M24 × 1.5 / Union G ½ A		U1							
Extension tube / Gland nut M24 × 1.5 / Union G ¾ A		U2							
Extension tube / Gland nut M24 × 1.5 / Union G 1 A		U3							
Extension tube / Gland nut M24 × 1.5 / Union M20 × 1.5		U4							
Extension tube / Gland nut M24 × 1.5 / Union M27 × 2		U5							
Extension with Male nut, thread G ½ in		U6							
Extension tube with adjustable compression fitting G ½ A		A1							
Extension tube with adjustable compression fitting ½ in NPT		A2							
Others		Z9							
Immersion Length									
U = 140 mm (5.6 in)			U2						
U = 200 mm (8 in)			U4						
U = 260 mm (10.3 in)			U6						
Customer specific length			Z9						

Continued see next page

Base model	TSP111	XX	XX	XX	XX	XX	XX
Measuring Inset Type							
RTD, TF, Basic application, measuring range -50 to 400 °C (-58 to 752 °F), 10 g		S1					
RTD, TF, Extended vibration resistance, measuring range -50 to 400 °C (-58 to 752 °F), 60 g		S2					
RTD, WW, Extended measuring range -196 to 600 °C (-321 to 1112 °F), 10 g		D1					
RTD, WW, Extended vibration resistance, extendend measuring range -196 to 600 °C (-321 to 1112 °F), 60 g		D3					
RTD, adjustable to German calibration regulations, sign of app. 000/308 - without calibration		E1					
RTD, custody preliminary, adjustable to German calibration regulations, sign of app. 000/308 - with calibration							
-10 °C and +50 °C		E2					
Thermocouple		T1					
Others		Z9					
Measuring Inset Diameter							
3 mm			D3				
4.5 mm			D4				
6 mm			D6				
8 mm			D8				
8 mm (0,32 in), tip with sleeve, DIN 43735 Sleeve 80 mm (RTD), 20 mm (TC)			H8				
10 mm (0,4 in), tip with sleeve Sleeve 80 mm (RTD), 20 mm (TC)			H1				
Others			Z9				
Sensor Type and Wiring							
1 × Pt100, 2-wire				P1			
1 × Pt100, 3- wire				P2			
1 × Pt100, 4- wire				P3			
2 × Pt100, 2- wire				P4			
2 × Pt100, 3- wire				P5			
2 × Pt100, 4- wire (with integrated transmitter only one Pt100 is connected)				P6			
1 × Pt1000, 2- wire				P8			
1 × Pt1000, 3- wire				P7			
1 × Pt1000, 4- wire				P9			
1 × Type K (NiCr-NiAl)				K1			
2 × Type K (NiCr-NiAl)				K2			
3 × Type K (NiCr-NiAl)				K3			
1 × Type J (Fe-CuNi)				J1			
2 × Type J (Fe-CuNi)				J2			
1 × Type L (Fe-CuNi)				L1			
2 × Type L (Fe-CuNi)				L2			
1 × Type N (NiCrSi-NiSi)				N1			
2 × Type N (NiCrSi-NiSi)				N2			
1 × Type T (Cu-CuNi)				T1			
2 × Type T (Cu-CuNi)				T2			
1 × Type E (NiCr-CuNi)				E1			
2 × Type E (NiCr-CuNi)				E2			
1 × Type S (Pt10Rh-Pt)				S1			
2 × Type S (Pt10Rh-Pt)				S2			
Others				Z9			

Continued see next page

... Ordering Information

Base model	TSP111	XX	XX	XX
Sensor Accuracy				
Accuracy Class B, IEC 60751		B2		
Wire Wound, Double, Accuracy Class A, IEC 60751, Range 0 to 250 °C (32 to 482 °F)		D2		
Wire Wound, Accuracy Class A, IEC 60751, Range -100 to 450 °C (-148 to 842 °F)		D1		
Thin Film, Accuracy Class A, IEC 60751, Range -30 to 300 °C (-22 to 572 °F)		S1		
Thin Film, Accuracy Class AA, IEC 60751, Range 0 to 100 °C (32 to 212 °F)		S3		
Thermocouple, Accuracy Class 2, IEC 60584		T2		
Thermocouple, Accuracy Class 1, IEC 60584		T1		
Thermocouple, Standard Accuracy ANSI MC96.1		T4		
Thermocouple, Special Accuracy ANSI MC96.1		T3		
Thermocouple, Accuracy according to DIN 43710		T5		
Others		Z9		
Connection Head Type / Material				
BUZ / Aluminum, flat cover, hinged			B1	
BUZH / Aluminum, high cover, hinged			B2	
BUZHD / Aluminium, high cover with display, hinged			B3	
BUKH / Polyamide, high cover, hinged			K1	
BEG / Stainless steel, screwed cover			E1	
BUS / Aluminium, hinged cover with snap lock			B4	
BUSH / Aluminium, high cover, hinged with snap lock			B5	
BBK / Polyamid, screwed cover			K2	
B / Aluminum, cover held on with screws			B6	
BH / Aluminium, high cover			B7	
BUG / Cast iron, hinged cover			G1	
Others			Z9	
Transmitter				
Without transmitter, sensor with ceramic terminal block - spring loaded				Y1
Without transmitter, sensor with flying leads and metal plate - spring loaded				Y2
TTH300-HART, programmable, output signal 4 to 20 mA, dual input				H4
TTH300-HART, Ex version, programmable, output signal 4 to 20 mA, dual input				H5
TTH300-PA, programmable, output PROFIBUS PA, dual input				P6
TTH300-PA, Ex version, programmable, output PROFIBUS PA, dual input				P7
TTH300-FF, programmable, output FOUNDATION Fieldbus H1, dual input				F6
TTH300-FF, Ex version, programmable, output FOUNDATION Fieldbus H1, dual input				F7
TTH200-HART, programmable, output signal 4 to 20 mA				H6
TTH200-HART, Ex version, programmable, output signal 4 to 20 mA				H7

Additional ordering information SensyTemp TSP111

	XX	XX	XX	XX
Transmitter Measuring Range				
Standard measuring range	A0			
Customer-specific measuring range	AZ			
Declarations and certificates				
Declaration of compliance according EN 10204-2.1, with the order			C4	
Test report according EN 10204-2.2 for batch values, MIC-TC			C5	
Test report according EN 10204-2.2 for measuring of insulationsresistance at ambient temperature			CN	
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test			C6	
Inspection certificate according EN 10204-3.1, helium leakage test			C7	
Inspection certificate according EN 10204-3.1, sensor tolerance			CC	
SIL2 declaration of conformity in accordance with IEC 61508 for sensor with integrated transmitter, HART			CS	
Inspection certificate according EN 10204-3.1, sensor calibration, single RTD			CD	
Inspection certificate according EN 10204-3.1, sensor calibration, double RTD			CE	
Inspection certificate according EN 10204-3.1, sensor calibration, single thermocouple			CF	
Inspection certificate according EN 10204-3.1, sensor calibration, double thermocouple			CG	
DAkKS sensor calibration, single RTD, calibration certificate per thermometer			CH	
DAkKS sensor calibration, double RTD, calibration certificate per thermometer			CJ	
DAkKS sensor calibration, single thermocouple, calibration certificate per thermometer			CK	
DAkKS sensor calibration, double thermocouple, calibration certificate per thermometer			CL	
Others			CZ	
Number of Calibration Test Points				
1 point			P1	
2 points			P2	
3 points			P3	
4 points			P4	
5 points			P5	
Temperatures for Sensor Calibration				
Standard calibration: 0 °C (32 °F)				V1
Standard calibration: 100 °C (212 °F)				V2
Standard calibration: 400 °C (752 °F)				V3
Standard calibration: 0 °C and 100 °C (32 °F and 212 °F)				V4
Standard calibration: 0 °C and 400 °C (32 °F and 752 °F)				V5
Standard calibration: 0 °C, 100 °C and 200 °C (32 °F, 212 °F and 392 °F)				V7
Standard calibration: 0 °C, 200 °C and 400 °C (32 °F, 392 °F and 752 °F)				V8
Standard calibration: Customer specific temperatures				V6
DAkKS calibration: 0 °C (32 °F)				D1
DAkKS calibration: 100 °C (212 °F)				D2
DAkKS calibration: 400 °C (752 °F)				D3
DAkKS calibration: 0 °C and 100 °C (32 °F and 212 °F)				D4
DAkKS calibration: 0 °C and 400 °C (32 °F and 752 °F)				D5
DAkKS calibration: 0 °C, 100 °C and 200 °C (32 °F, 212 °F and 392 °F)				D7
DAkKS calibration: 0 °C, 200 °C and 400 °C (32 °F, 392 °F and 752 °F)				D8
DAkKS calibration: Customer specific temperatures				D6

... Ordering Information

Additional ordering information SensyTemp TSP111 (Continuation)	XX						
Extension Tube Diameter Options							
Extension Diameter 14.0 mm	N1						
Extension Diameter 11.0 mm	N2						
Extension Tube Options							
Extension tube welded with measuring inset, gas tight		N3					
Extension tube oil tight up to 3 bar		N4					
Mounting bracket		N5					
Threaded Connection Options							
Adjustable compression fitting G ¼, stainless steel material						K1	
Adjustable compression fitting G ¼, stainless steel material, olive material PTFE						K2	
Adjustable compression fitting G ½, stainless steel material						K3	
Adjustable compression fitting G ½, stainless steel material, olive material PTFE						K4	
Adjustable compression fitting M18 × 1.5, stainless steel material						K5	
Adjustable compression fitting ½ in NPT, stainless steel material						K6	
Adjustable compression fitting ½ in NPT, stainless steel material, olive material PTFE						K7	
Spring loaded adjustable compression fitting G ½, stainless steel material						K8	
Spring loaded adjustable compression fitting M18 × 1.5, stainless steel material						K9	
Others						KZ	
Measuring Inset: Option							
Hot junction grounded						J1	
2 insets paired from 0 to 100 °C (32 to 212 °F), max. deviation 0.1 K						J3	
Upgrading Sensor Accuracy to Cl. A, 0 to 600°C						J7	
Improvement Sensor Accuracy to 0.5 Cl. A, 0 to 100°C, U>100 mm						J8	
Improvement Sensor Accuracy to 0.5 Cl. A, 0 to 400°C, U>250 mm						J9	
Measuring Inset: Transmitter Mounted							
Transmitter mounted on inset, without ceramic block							J2
Measuring Inset: Other Options							
Others							JZ
Connection Head Options							
Second transmitter mounted in connection head (same type as first one)							H1
Connection head seawater-resistant, painted grey-white							H3
Others							HZ

Additional ordering information SensyTemp TSP111 (Continuation)	XX	XX	XX	XX	XX	XX
Cable Entry Options						
1 × M20 × 1.5, without cable gland	U1					
1 × ½ in NPT, without cable gland	U2					
1 × ¾ in NPT, without cable gland	U3					
2 × M20 × 1.5, without cable gland	U4					
2 × M20 × 1.5, with cable gland skintop, temperature range -40 to +70 °C (-40 to +158 °F), cable diameter 4 to 13 mm (0.16 to 0.51 inch)	U7					
Harting Han 7D plug and socket connection	UG					
Harting Han 8D (8U) plug and socket connection	UH					
M12 plug for PROFIBUS PA	UJ					
¾ in plug for FOUNDATION Fieldbus	UK					
Others	UZ					
Display Type						
LCD indicator type AS		L1				
Configurable LCD Indicator type A		L2				
Other Options						
Thermometer silicone-free			PS			
With fastened gasket			PD			
Earth screw external			PG			
Each Thermometer single packed - Polyethylen			PN			
Documentation Language						
German				M1		
English				M5		
Language package Western Europe / Scandinavia (Languages: DA, ES, FR, IT, NL, PT, FI, SV)				MW		
Language package Eastern Europe (Languages: EL, CS, ET, LV, LT, HU, HR, PL, SK, SL, RO, BG)				ME		
Additional TAG Plate						
Stainless steel plate with TAG no.						T1
Additional Identification Plate						
Stainless steel plate with customer specific text						T2
Adhesive label						T3

... Ordering Information

SensyTemp TSP121

Base model	TSP121	XX	XX	XX	XXX	XX							
SensyTemp TSP121 Temperature Sensor, with tubular thermowell, for light and medium duty applications													
Explosion Protection / Approvals													
Without		Y0											
Intrinsic Safety ATEX II 1 G Ex ia IIC T6...T1 Ga or II 2 G Ex ib IIC T6...T1 Gb or II 1/2 G Ex ib IIC T6...T1 Ga/Gb		A1											
Non-sparking and increased safety as well as dust explosion protection													
ATEX II 3 G Ex nA IIC T6...T1 Gc, ATEX II 3 G		B1*											
Intrinsic safety IECEx ia IIC T6...T1 Ga		H1											
Intrinsic Safety IECEx ib IIC T6...T1 Gb or IECEx ib IIC T6...T1 Ga/Gb		H2											
Intrinsic Safety acc. NAMUR NE 24 and ATEX II 1 G Ex ia IIC T6...T1 Ga		N1											
GOST Russia - metrological approval		G1											
GOST Russia - metrological approval and EAC-Ex, Ex i - Zone 0		P2											
GOST Kazakhstan - metrological approval		G3											
GOST Kazakhstan - metrological approval and EAC-Ex, Ex i - Zone 0		T2											
GOST Belarus - metrological approval		M5											
GOST Belarus - metrological approval and EAC-Ex, Ex i - Zone 0		U2											
NEPSI Intrinsic Safety type of protection: Ex ia IIC T6 Ga		S1											

* According to EN 60079-0 and EN 60079-31, the application in hybrid mixtures (concomitance of potentially explosive dust and gas) is currently not allowed.

Continued see next page

Base model	TSP121	XX	XX	XXX	XX								
Wetted Thermowell Material													
Stainless Steel ASTM 316L (1.4404)		S1											
Stainless Steel ASTM 316Ti (1.4571)		S2											
Highly heat-resistant stainless steel ASTM A446-1 (1.4749)		H1											
Heat Resistant Steel 1.4762		H2											
Heat resistant steel ASTM A314 (CrNi, 1.4841)		H3											
Duplex stainless steel (CrNi, 1.4462)		S9											
Stainless steel ASTM 904L (CrNi, 1.4539); (Uranus B6)		S4											
Ni-Alloy Hastelloy C-276 (2.4819)		N1											
Ni-Alloy Hastelloy C-4 (2.4610)		N2											
2.4816 / Inconel 600		N5											
Others		Z9											
Thermowell Type													
Tubular thermowell with straight shaft (DIN 43772, Form 2)			A1										
Flanged tubular thermowell with straight shaft (DIN 43772, Form 2F)			A2										
Screwed tubular thermowell with straight shaft (DIN 43772, Form 2G)			A3										
Tubular thermowell, stepped tip (ABB Form 2S)			B1										
Flanged tubular thermowell, stepped tip (ABB Form 2FS)			B2										
Screwed tubular thermowell, stepped tip (ABB Form 2GS)			B3										
Tubular thermowell, tapered (DIN 43772, Form 3)			C1										
Flanged tubular thermowell, tapered (DIN 43772, Form 3F)			C2										
Screwed tubular thermowell, tapered (DIN 43772, Form 3G)			C3										
Screwed tubular thermowell without extension, straight shaft (ABB Form 2G0)			A4										
Screwed tubular thermowell without extension, stepped tip (ABB Form 2GS0)			B4										
Tubular thermowell d= 22mm, stepped tip d= 6mm			B5										
Tubular thermowell, stepped tip 9 mm (0.36 in) (ABB Form 2S/9)			K1										
Flanged tubular thermowell, stepped tip 9 mm (0.36 in) (ABB Form 2FS/9)			K2										
Screwed tubular thermowell, stepped tip 9 mm (0.36 in) (ABB Form 2GS/9)			K3										
Others			Z9										

Continued see next page

Base model	TSP121	XX							
Thermowell Diameter									
6 mm × 1 mm	A9								
8 mm × 2 mm	A5								
9 mm × 1 mm	A1								
10 mm × 1,5 mm	A6								
11 mm × 2 mm	A2								
12 mm × 2,5 mm	A3								
13,5 mm × 2,3 mm	B6								
13,7 mm × 2,24 mm	B2								
14 mm × 2,5 mm	A4								
15 mm × 2 mm	A7								
16 mm × 3 mm	A8								
22 mm × 2 mm	B1								
Immersion Length									
Without fixed immersion length					Y0				
U = 100 mm (4 in)					U1				
U = 160 mm (6.3 in)					U3				
U = 250 mm (10 in)					U5				
U = 400 mm (16 in)					U7				
Customer specific length					Z9				
Nominal Length									
N = 230 mm (9.1 in)						N1			
N = 290 mm (11.42 in)						N3			
N = 380 mm (15 in)						N5			
N = 530 mm (20.9 in)						N7			
Customer specific length						Z9			
Measuring Inset Type									
Without measuring inset							Y0		
RTD, TF, Basic application, measuring range -50 to 400 °C (-58 to 752 °F), 10 g							S1		
RTD, TF, Extended vibration resistance, measuring range -50 to 400 °C (-58 to 752 °F), 60 g							S2		
RTD, WW, Extended measuring range -196 to 600 °C (-321 to 1112 °F), 10 g							D1		
RTD, WW, Extended vibration resistance, extendend measuring range -196 to 600 °C (-321 to 1112 °F), 60 g							D3		
RTD, adjustable to German calibration regulations, sign of app. 000/308 - without calibration							E1		
RTD, custody preliminary, adjustable to German calibration regulations, sign of app. 000/308 - with calibration -10 °C and +50 °C							E2		
Thermocouple							T1		
Others							Z9		

Continued see next page

... Ordering Information

Base model	TSP121	XX	XX	XX	XX
Sensor Type and Wiring					
Without measuring inset		Y0			
1 × Pt100, 2-wire		P1			
1 × Pt100, 3-wire		P2			
1 × Pt100, 4-wire		P3			
2 × Pt100, 2-wire		P4			
2 × Pt100, 3-wire		P5			
2 × Pt100, 4-wire (with integrated transmitter only one Pt100 is connected)		P6			
1 × Pt1000, 2-wire		P8			
1 × Pt1000, 3-wire		P7			
1 × Pt1000, 4-wire		P9			
1 × Type K (NiCr-NiAl)		K1			
2 × Type K (NiCr-NiAl)		K2			
3 × Type K (NiCr-NiAl)		K3			
1 × Type J (Fe-CuNi)		J1			
2 × Type J (Fe-CuNi)		J2			
1 × Type L (Fe-CuNi)		L1			
2 × Type L (Fe-CuNi)		L2			
1 × Type N (NiCrSi-NiSi)		N1			
2 × Type N (NiCrSi-NiSi)		N2			
1 × Type T (Cu-CuNi)		T1			
2 × Type T (Cu-CuNi)		T2			
1 × Type E (NiCr-CuNi)		E1			
2 × Type E (NiCr-CuNi)		E2			
1 × Type S (Pt10Rh-Pt)		S1			
2 × Type S (Pt10Rh-Pt)		S2			
Others		Z9			

Continued see next page

Base model	TSP121	XX	XX	XX
Sensor Accuracy it				
Without measuring inset		Y0		
Accuracy Class B, IEC 60751		B2		
Wire Wound, Double, Accuracy Class A, IEC 60751, Range 0 to 250 °C (32 to 482 °F)		D2		
Wire Wound, Accuracy Class A, IEC 60751, Range -100 to 450 °C (-148 to 842 °F)		D1		
Thin Film, Accuracy Class A, IEC 60751, Range -30 to 300 °C (-22 to 572 °F)		S1		
Thin Film, Accuracy Class AA, IEC 60751, Range 0 to 100 °C (32 to 212 °F)		S3		
Thermocouple, Accuracy Class 2, IEC 60584		T2		
Thermocouple, Accuracy Class 1, IEC 60584		T1		
Thermocouple, Standard Accuracy ANSI MC96.1		T4		
Thermocouple, Special Accuracy ANSI MC96.1		T3		
Thermocouple, Accuracy according to DIN 43710		T5		
Others		Z9		
Connection Head Type / Material				
BUZ / Aluminum, flat cover, hinged			B1	
BUZH / Aluminum, high cover, hinged			B2	
BUZHD / Aluminium, high cover with display, hinged			B3	
BUKH / Polyamide, high cover, hinged			K1	
BEG / Stainless steel, screwed cover			E1	
BUS / Aluminium, hinged cover with snap lock			B4	
BUSH / Aluminium, high cover, hinged with snap lock			B5	
BBK / Polyamid, screwed cover			K2	
B / Aluminum, cover held on with screws			B6	
BH / Aluminium, high cover			B7	
BUG / Cast iron, hinged cover			G1	
Others			Z9	
Transmitter				
Without transmitter, sensor with ceramic terminal block - spring loaded				Y1
Without transmitter, sensor with flying leads and metal plate - spring loaded				Y2
TTH300-HART, programmable, output signal 4 to 20 mA, dual input				H4
TTH300-HART, Ex version, programmable, output signal 4 to 20 mA, dual input				H5
TTH300-PA, programmable, output PROFIBUS PA, dual input				P6
TTH300-PA, Ex version, programmable, output PROFIBUS PA, dual input				P7
TTH300-FF, programmable, output FOUNDATION Fieldbus H1, dual input				F6
TTH300-FF, Ex version, programmable, output FOUNDATION Fieldbus H1, dual input				F7
TTH200-HART, programmable, output signal 4 to 20 mA				H6
TTH200-HART, Ex version, programmable, output signal 4 to 20 mA				H7

... Ordering Information

Additional ordering information SensyTemp TSP121

	XX	XX	XX
Transmitter Measuring Range			
Standard measuring range	A0		
Customer-specific measuring range	AZ		
Declarations and certificates			
Declaration of compliance according EN 10204-2.1, with the order			C4
Test report according EN 10204-2.2, material monitoring for wetted parts			C1
Test report according EN 10204-2.2 for batch values, MIC-TC			C5
Test report according EN 10204-2.2 for measuring of insulaionsresistance at ambient temperature			CN
Inspection certificate according EN 10204-3.1, material monitoring for wetted parts			C2
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test			C6
Inspection certificate according EN 10204-3.1, helium leakage test			C7
Inspection certificate according EN 10204-3.1, dye penetration test			C9
Inspection certificate according EN 10204-3.1, pressure test on thermowell			CB
Inspection certificate according EN 10204-3.1, sensor tolerance			CC
SIL2 declaration of conformity in accordance with IEC 61508 for sensor with integrated transmitter, HART			CS
Inspection certificate according EN 10204-3.1, sensor calibration, single RTD			CD
Inspection certificate according EN 10204-3.1, sensor calibration, double RTD			CE
Inspection certificate according EN 10204-3.1, sensor calibration, single thermocouple			CF
Inspection certificate according EN 10204-3.1, sensor calibration, double thermocouple			CG
DAkKS sensor calibration, single RTD, calibration certificate per thermometer			CH
DAkKS sensor calibration, double RTD, calibration certificate per thermometer			CJ
DAkKS sensor calibration, single thermocouple, calibration certificate per thermometer			CK
DAkKS sensor calibration, double thermocouple, calibration certificate per thermometer			CL
Inspection certificate according EN 10204-3.1, x-ray- test for weldings			CU
Wetted parts according to EC 1935			CX
Others			CZ
Number of Calibration Test Points			
1 point			P1
2 points			P2
3 points			P3
4 points			P4
5 points			P5

Additional ordering information SensyTemp TSP121 (Continuation)	XX	XX	XX
Temperatures for Sensor Calibration			
Standard calibration: 0 °C (32 °F)	V1		
Standard calibration: 100 °C (212 °F)	V2		
Standard calibration: 400 °C (752 °F)	V3		
Standard calibration: 0 °C and 100 °C (32 °F and 212 °F)	V4		
Standard calibration: 0 °C and 400 °C (32 °F and 752 °F)	V5		
Standard calibration: 0 °C, 100 °C and 200 °C (32 °F, 212 °F and 392 °F)	V7		
Standard calibration: 0 °C, 200 °C and 400 °C (32 °F, 392 °F and 752 °F)	V8		
Standard calibration: Customer specific temperatures	V6		
DAkKS calibration: 0 °C (32 °F)	D1		
DAkKS calibration: 100 °C (212 °F)	D2		
DAkKS calibration: 400 °C (752 °F)	D3		
DAkKS calibration: 0 °C and 100 °C (32 °F and 212 °F)	D4		
DAkKS calibration: 0 °C and 400 °C (32 °F and 752 °F)	D5		
DAkKS calibration: 0 °C, 100 °C and 200 °C (32 °F, 212 °F and 392 °F)	D7		
DAkKS calibration: 0 °C, 200 °C and 400 °C (32 °F, 392 °F and 752 °F)	D8		
DAkKS calibration: Customer specific temperatures	D6		
Thermowell Options			
With additional tantalum sleeve, tantalum sleeve is brazed to the flange in two points		S1	
Thermowell coated with 0.5 mm (0.02 in) E-CTFE / Halar, wetted parts incl. flange surface		S2	
Thermowell coated with 0.5 mm (0.02 in) PFA, wetted parts incl. flange surface		S3	
Thermowell coated with 1 mm (0.04 in) NiCrB / META 43		S4*	
Thermowell coated with 0.5 mm (0.02 in) NiZrO2 / PL1312		S5*	
Thermowell incl. tests and certificates AD-2000 standard for austenitic steel		S6	
Thermowell incl. tests and certificates AD-2000 standard for high temperature steel		S7	
Thermowell clean for oxygen service		S9	
Thermowell stress calculation according Dittrich / Kohler		SD	
Others		SZ	
Flange Connection Options			
Flange raised face form RF, ASME B16.5			F6
Flange raised face form B1 acc. EN 1092-1			F7
Flange raised face form B2 acc. EN 1092-1			F8
Flange facing with tongue form C EN 1092-1			F1
Flange facing with groove form D acc. EN 1092-1			F2
Flange facing with RTJ surface acc. ASME B16.5			F3
Others			FZ

* Specify length from thermowell tip in mm.

... Ordering Information

Additional ordering information SensyTemp TSP121 (Continuation)	XX	XX	XX	XX	XX	XX
Extension Tube Options						
Mounting bracket	N5					
Measuring Inset: Option						
Hot junction grounded		J1				
2 insets paired from 0 to 100 °C (32 to 212 °F), max. deviation 0.1 K		J3				
Improvement Sensor Accuracy to 0.5 Cl. A, 0 to 100°C, U>100 mm		J8				
Improvement Sensor Accuracy to 0.5 Cl. A, 0 to 400°C, U>250 mm		J9				
Measuring Inset: Transmitter Mounted						
Transmitter mounted on inset, without ceramic block			J2			
Measuring Inset: Other Options						
Others				JZ		
Connection Head Options						
Second transmitter mounted in connection head (same type as first one)					H1	
Connection head seawater-resistant, painted grey-white					H3	
Others					HZ	
Cable Entry Options						
1 × M20 × 1.5, without cable gland						U1
1 × ½ in NPT, without cable gland						U2
1 × ¾ in NPT, without cable gland						U3
2 × M20 × 1.5, without cable gland						U4
2 × M20 × 1.5, with cable gland skintop, temperature range -40 bis +70 °C (-40 bis +158 °F), cable diameter 4 to 13 mm (0.16 to 0.51 in)						U7
Harting Han 7D plug and socket connection						UG
Harting Han 8D (8U) plug and socket connection						UH
M12 plug for PROFIBUS PA						UJ
¾ in plug for FOUNDATION Fieldbus						UK
Others						UZ

Additional ordering information SensyTemp TSP121	XX	XX	XX	XX	XX
Display Type					
LCD indicator type AS	L1				
Configurable LCD Indicator type A	L2				
Other Options					
Thermometer silicone-free		PS			
Earth screw external		PG			
Each Thermometer single packed - Polyethylen		PN			
Documentation Language					
German			M1		
English			M5		
Language package Western Europe / Scandinavia (Languages: DA, ES, FR, IT, NL, PT, FI, SV)			MW		
Language package Eastern Europe (Languages: EL, CS, ET, LV, LT, HU, HR, PL, SK, SL, RO, BG)			ME		
Additional TAG Plate					
Stainless steel plate with TAG no.				T1	
Additional Identification Plate					
Stainless steel plate with customer specific text					T2
Adhesive label					T3

... Ordering Information

SensyTemp TSP131

Base model	TSP131	XX	XX	XX	XXX	XX									
Explosion Protection / Approvals															
Without		Y0													
Intrinsic Safety ATEX II 1 G Ex ia IIC T6...T1 Ga or II 2 G Ex ib IIC T6...T1 Gb or II 1/2 G Ex ib IIC T6...T1 Ga/Gb		A1													
Non-sparking and increased safety as well as dust explosion protection ATEX II 3 G Ex nA IIC T6...T1 Gc, ATEX II 3 G Ex ec IIC T6...T1 Gc und ATEX II 3 D Ex tc IIIB T133°C Dc		B1*													
Intrinsic safety IECEx ia IIC T6...T1 Ga		H1													
Intrinsic Safety IECEx ib IIC T6...T1 Gb or IECEx ib IIC T6...T1 Ga/Gb		H2													
Intrinsic Safety acc. NAMUR NE 24 and ATEX II 1 G Ex ia IIC T6...T1 Ga		N1													
GOST Russia - metrological approval		G1													
GOST Russia - metrological approval and EAC-Ex, Ex i - Zone 0		P2													
GOST Kazakhstan - metrological approval		G3													
GOST Kazakhstan - metrological approval and EAC-Ex, Ex i - Zone 0		T2													
GOST Belarus - metrological approval		M5													
GOST Belarus - metrological approval and EAC-Ex, Ex i - Zone 0		U2													
NEPSI Intrinsic Safety type of protection: Ex ia IIC T6 Ga		S1													

* According to EN 60079-0 and EN 60079-31, the application in hybrid mixtures (concomitance of potentially explosive dust and gas) is currently not allowed

Continued see next page

Base model	TSP131	XX	XX	XXX	XX									
Wetted Thermowell Material														
Stainless steel ASTM 316L (1.4404)		S1												
Stainless steel ASTM 316Ti (1.4571)		S2												
Heat-resistant stainless steel ASTM A182 F12 (1.7335)		W1												
Heat-resistant stainless steel ASTM A182 F22 (1.7380)		W2												
Heat-resistant stainless steel ASTM A182 F1 (1.5415)		W3												
Highly heat-resistant stainless steel ASTM A347 H (1.4961)		W4												
Highly heat-resistant stainless steel ASTM A446-1 (1.4749)		H1												
Heat resistant steel ASTM A446 (1.4762)		H2												
Heat resistant steel ASTM A314 (CrNi, 1.4841)		H3												
Duplex stainless steel (CrNi, 1.4462)		S9												
Stainless steel ASTM 904L (CrNi, 1.4539); (Uranus B6)		S4												
Ni-Alloy Hastelloy C-276 (2.4819)		N1												
Ni-Alloy Hastelloy C-4 (2.4610)		N2												
NiCu-Alloy Monel 400 (2.4360)		N4												
Ni-Alloy Incoloy 800 (1.4876)		H4												
2.4816 / Inconel 600		N5												
Highly heat-resistant stainless steel ASTM A182 F91 (1.4903)		W5												
Stainless steel ASTM 304 (CrNi, 1.4301)		S5												
Stainless steel ASTM 321 (CrNi, 1.4541)		S6												
Carbon steel ASTM A105 (1.0460)		C1												
Others		Z9												
Thermowell Type														
Weld-in thermowell from bar stock material, diameter F2 = 24 mm (0.95 in), (DIN 43772, Form 4)			D1											
Weld-in thermowell from bar stock material, diameter F2 = 18 mm (0.71 in), (DIN 43772, Form 4)			D2											
Flanged thermowell from bar stock material, diameter F2 = 24 mm (0.95 in), (DIN 43772, Form 4F)			D3											
Flanged thermowell from bar stock material, diameter F2 = 18 mm (0.71 in), (ABB-Form 4FS)			D4											
Weld-in thermowell from bar stock material, diameter F2 = 26 mm (1.02 in), (DIN 43772, Form 4)			D5											
Flanged thermowell from bar stock material, diameter F2 = 26 mm (1.02 in), (DIN 43772, Form 4F)			D6											
Weld-in thermowell from bar stock material, (ABB, Form DR)			R1											
Flanged thermowell from bar stock material, (ABB, Form DRF)			R2											
Weld-in thermowell from bar stock material, (ABB, Form RD)			R3											
Flanged thermowell from bar stock material, (ABB, Form RDF)			R4											
Weld-in thermowell from bar stock material, (ABB, Form PW)			P1											
Flanged thermowell from bar stock material, (ABB, Form PF)			P2											
Screwed thermowell from bar stock material, tapered tip, (ABB, Form PS)			P3											
Screwed tubular thermowell from bar stock material, straight shaft (DIN 43772, Form 6)			S1											
Others			Z9											

Continued see next page

... Ordering Information

Base model	TSP131	XXX	XX								
Process Connection											
Without process connection		Y00									
Flange DN 25 PN 10 to PN 40, EN 1092-1		F03									
Flange DN 25 PN 63 to PN100, EN 1092-1		F29									
Flange DN 32 PN 16 to PN 40, EN 1092-1		F30									
Flange DN 40 PN 10 to PN 40, EN 1092-1		F04									
Flange DN 40 PN 63 to PN 100, EN 1092-1		F37									
Flange DN 50 PN 6, EN 1092-1		F06									
Flange DN 50 PN 25 to PN 40, EN 1092-1		F05									
Flange DN 50 PN 63, EN 1092-1		F33									
Flange DN 50 PN 100, EN 1092-1		F34									
Flange DN 80 PN 16, EN 1092-1		F35									
Flange DN 100 PN 40, EN 1092-1		F36									
Flange 1 in 150 lbs, ASME B16.5		F07									
Flange 1 in 300 lbs, ASME B16.5		F08									
Flange 1 in 600 lbs, ASME B16.5		F09									
Flange 1-½ in 150 lbs, ASME B16.5		F11									
Flange 1-½ in 300 lbs, ASME B16.5		F12									
Flange 1-½ in 600 lbs, ASME B16.5		F13									
Flange 1-½ in 900 / 1500 lbs, ASME B16.5		F14									
Flange 2 in 150 lbs, ASME B16.5		F15									
Flange 2 in 300 lbs, ASME B16.5		F16									
Flange 2 in 600 lbs, ASME B16.5		F17									
Flange 2 in 900 / 1500 lbs, ASME B16.5		F18									
Conical thread ½ in NPT		S04									
Conical thread ¾ in NPT		S05									
Conical thread 1 in NPT		S06									
Others		Z99									

Continued see next page

Base model	TSP131	XX								
Extension Tube Length										
K = 150 mm (6 in)		K1								
Customer specific length		Z9								
Thermowell Connection										
Extension tube with Cylindrical thread G 1/2 A				G1						
Extension tube with Cylindrical thread G 3/4 A				G2						
Extension tube with Cylindrical thread G 3/8 A				G3						
Extension tube with Cylindrical thread M14 × 1,5				M1						
Extension tube with Cylindrical thread M18 × 1,5				M2						
Extension tube with Cylindrical thread M20 × 1,5				M3						
Extension tube with Cylindrical thread M24 × 1,5				M4						
Extension tube with conygal thread ½ in NPT				N1						
Nipple / ½ in NPT / ½ in NPT				N2						
Nipple-Union / ½ in NPT / Union ½ in NPT				N3						
Nipple - Union - Nipple / ½ in NPT / ½ in NPT				N4						
Extension with Male nut, thread G ½ in				U6						
Others				Z9						
Immersion Length										
Without fixed immersion length					Y0					
U = 130 mm (5.2 in)					D1					
U = 190 mm (7.5 in)					D2					
U = 340 mm (13.4 in)					D3					
U = 100 mm (4 in)					P1					
U = 150 mm (6 in)					P2					
U = 200 mm (8 in)					P3					
U = 250 mm (10 in)					P4					
U = 300 mm (12 in)					P5					
U = 350 mm (14 in)					P6					
Customer specific length					Z9					

Continued see next page

... Ordering Information

Base model	TSP131	XX	XX	XX	XX	XX	XX
Thermowell Length							
L = 110 mm (4.4 in), C = 65 mm (2.5 in)		D1					
L = 115 mm (4.6 in), C = 40 mm (1.5 in)		D2					
L = 140 mm (5.6 in), C = 65 mm (2.5 in)		D3					
L = 200 mm (8 in), C = 65 mm (2.5 in)		D4					
L = 200 mm (8 in), C = 125 mm (5 in)		D5					
L = 260 mm (10.3 in), C = 125 mm (5 in)		D6					
L = 410 mm (16.2 in), C = 275 mm (10.9 in)		D7					
L = 146 mm (5.8 in)		R1					
L = 175 mm (6.9 in)		R2					
L = 265 mm (10.5 in)		R3					
L = 415 mm (16.4 in)		R4					
L = U + 65 mm (2.5 in) - ABB-standard		P1					
Acc. customer specification		D9					
Customer specific length		Z9					
Measuring Inset Type							
Without measuring inset			Y0				
RTD, TF, Basic application, measuring range -50 to 400 °C (-58 to 752 °F), 10 g			S1				
RTD, TF, Extended vibration resistance, measuring range -50 to 400 °C (-58 to 752 °F), 60 g			S2				
RTD, WW, Extended measuring range -196 to 600 °C (-321 to 1112 °F), 10 g			D1				
RTD, WW, Extended vibration resistance, extendend measuring range -196 to 600 °C (-321 to 1112 °F), 60 g			D3				
RTD, adjustable to German calibration regulations, sign of app. 000/308 - without calibration			E1				
RTD, custody preliminary, adjustable to German calibration regulations, sign of app. 000/308 - with calibration -10 °C and +50 °C			E2				
Thermocouple			T1				
Others			Z9				

Continued see next page

Base model	TSP131	XX	XX	XX	XX
Sensor Type and Wiring					
Without measuring inset		Y0			
1 × Pt100, 2-wire		P1			
1 × Pt100, 3-wire		P2			
1 × Pt100, 4-wire		P3			
2 × Pt100, 2-wire		P4			
2 × Pt100, 3-wire		P5			
2 × Pt100, 4-wire (with integrated transmitter only one Pt100 is connected)		P6			
1 × Pt1000, 2-wire		P8			
1 × Pt1000, 3-wire		P7			
1 × Pt1000, 4-wire		P9			
1 × Type K (NiCr-NiAl)		K1			
2 × Type K (NiCr-NiAl)		K2			
3 × Type K (NiCr-NiAl)		K3			
1 × Type J (Fe-CuNi)		J1			
2 × Type J (Fe-CuNi)		J2			
1 × Type L (Fe-CuNi)		L1			
2 × Type L (Fe-CuNi)		L2			
1 × Type N (NiCrSi-NiSi)		N1			
2 × Type N (NiCrSi-NiSi)		N2			
1 × Type T (Cu-CuNi)		T1			
2 × Type T (Cu-CuNi)		T2			
1 × Type E (NiCr-CuNi)		E1			
2 × Type E (NiCr-CuNi)		E2			
1 × Type S (Pt10Rh-Pt)		S1			
2 × Type S (Pt10Rh-Pt)		S2			
Others		Z9			
Sensor Accuracy					
Without measuring inset		Y0			
Accuracy Class B, IEC 60751		B2			
Wire Wound, Double, Accuracy Class A, IEC 60751, Range 0 to 250 °C (32 to 482 °F)		D2			
Wire Wound, Accuracy Class A, IEC 60751, Range -100 to 450 °C (-148 to 842 °F)		D1			
Thin Film, Accuracy Class A, IEC 60751, Range -30 to 300 °C (-22 to 572 °F)		S1			
Thin Film, Accuracy Class AA, IEC 60751, Range 0 to 100 °C (32 to 212 °F)		S3			
Thermocouple, Accuracy Class 2, IEC 60584		T2			
Thermocouple, Accuracy Class 1, IEC 60584		T1			
Thermocouple, Standard Accuracy ANSI MC96.1		T4			
Thermocouple, Special Accuracy ANSI MC96.1		T3			
Thermocouple, Accuracy according to DIN 43710		T5			
Others		Z9			

Continued see next page

... Ordering Information

Base model	TSP131	XX	XX
Connection Head Type / Material			
BUZ / Aluminum, flat cover, hinged		B1	
BUZH / Aluminum, high cover, hinged		B2	
BUZHD / Aluminium, high cover with display, hinged		B3	
BUKH / Polyamide, high cover, hinged		K1	
BEG / Stainless steel, screwed cover		E1	
BUS / Aluminium, hinged cover with snap lock		B4	
BUSH / Aluminium, high cover, hinged with snap lock		B5	
BBK / Polyamid, screwed cover		K2	
B / Aluminum, cover held on with screws		B6	
BH / Aluminium, high cover		B7	
BUG / Cast iron, hinged cover		G1	
Others		Z9	
Transmitter			
Without transmitter, sensor with ceramic terminal block - spring loaded			Y1
Without transmitter, sensor with flying leads and metal plate - spring loaded			Y2
TTH300-HART, programmable, output signal 4 to 20 mA, dual input			H4
TTH300-HART, Ex version, programmable, output signal 4 to 20 mA, dual input			H5
TTH300-PA, programmable, output PROFIBUS PA, dual input			P6
TTH300-PA, Ex version, programmable, output PROFIBUS PA, dual input			P7
TTH300-FF, programmable, output FOUNDATION Fieldbus H1, dual input			F6
TTH300-FF, Ex version, programmable, output FOUNDATION Fieldbus H1, dual input			F7
TTH200-HART, programmable, output signal 4 to 20 mA			H6
TTH200-HART, Ex version, programmable, output signal 4 to 20 mA			H7

Additional ordering information SensyTemp TSP131

	XX	XX	XX
Transmitter Measuring Range			
Standard measuring range	A0		
Customer-specific measuring range	AZ		
Declarations and certificates			
Declaration of compliance according EN 10204-2.1, with the order			C4
Test report according EN 10204-2.2, material monitoring for wetted parts			C1
Test report according EN 10204-2.2 for batch values, MIC-TC			C5
Test report according EN 10204-2.2 for measuring of insulaionsresistance at ambient temperature			CN
Inspection certificate according EN 10204-3.1, material monitoring for wetted parts			C2
Inspection certificate according EN 10204-3.2, material monitoring for wetted parts			C3
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test			C6
Inspection certificate according EN 10204-3.1, helium leakage test			C7
Inspection certificate according EN 10204-3.1, dye penetration test			C9
Inspection certificate according EN 10204-3.1, Positive Material Identification (PMI)			CA
Inspection certificate according EN 10204-3.1, pressure test on thermowell			CB
Inspection certificate according EN 10204-3.1, sensor tolerance			CC
SIL2 declaration of conformity in accordance with IEC 61508 for sensor with integrated transmitter, HART			CS
Inspection certificate according EN 10204-3.1, sensor calibration, single RTD			CD
Inspection certificate according EN 10204-3.1, sensor calibration, double RTD			CE
Inspection certificate according EN 10204-3.1, sensor calibration, single thermocouple			CF
Inspection certificate according EN 10204-3.1, sensor calibration, double thermocouple			CG
DAkks sensor calibration, single RTD, calibration certificate per thermometer			CH
DAkks sensor calibration, double RTD, calibration certificate per thermometer			CJ
DAkks sensor calibration, single thermocouple, calibration certificate per thermometer			CK
DAkks sensor calibration, double thermocouple, calibration certificate per thermometer			CL
Inspection certificate according EN 10204-3.1, x-ray- test for weldings			CU
Inspection certificate according EN 10204-3.1, x-ray- test for bore concentricity			CV
Inspection certificate according EN 10204-3.1, ultrasonic- test for bore concentricity			CW
Wetted parts according to EC 1935			CX
Others			CZ
Number of Calibration Test Points			
1 point			P1
2 points			P2
3 points			P3
4 points			P4
5 points			P5

... Ordering Information

Additional ordering information SensyTemp TSP131 (Continuation)	XX	XX	XX
Temperatures for Sensor Calibration			
Standard calibration: 0 °C (32 °F)	V1		
Standard calibration: 100 °C (212 °F)	V2		
Standard calibration: 400 °C (752 °F)	V3		
Standard calibration: 0 °C and 100 °C (32 °F and 212 °F)	V4		
Standard calibration: 0 °C and 400 °C (32 °F and 752 °F)	V5		
Standard calibration: 0 °C, 100 °C and 200 °C (32 °F, 212 °F and 392 °F)	V7		
Standard calibration: 0 °C, 200 °C and 400 °C (32 °F, 392 °F and 752 °F)	V8		
Standard calibration: Customer specific temperatures	V6		
DAkKS calibration: 0 °C (32 °F)	D1		
DAkKS calibration: 100 °C (212 °F)	D2		
DAkKS calibration: 400 °C (752 °F)	D3		
DAkKS calibration: 0 °C and 100 °C (32 °F and 212 °F)	D4		
DAkKS calibration: 0 °C and 400 °C (32 °F and 752 °F)	D5		
DAkKS calibration: 0 °C, 100 °C and 200 °C (32 °F, 212 °F and 392 °F)	D7		
DAkKS calibration: 0 °C, 200 °C and 400 °C (32 °F, 392 °F and 752 °F)	D8		
DAkKS calibration: Customer specific temperatures	D6		
Thermowell Options			
With additional tantalum sleeve, tantalum sleeve is brazed to the flange in two points		S1	
Thermowell coated with 0.5 mm (0.02 in) E-CTFE / Halar, wetted parts incl. flange surface		S2	
Thermowell coated with 0.5 mm (0.02 in) PFA, wetted parts incl. flange surface		S3	
Thermowell coated with 1 mm (0.04 in) NiCrB / META 43		S4*	
Thermowell coated with 0.5 mm (0.02 in) NiZrO ₂ / PL1312		S5*	
Thermowell incl. tests and certificates AD-2000 standard for austenitic steel		S6	
Thermowell incl. tests and certificates AD-2000 standard for high temperature steel		S7	
Thermowell incl. tests and certificates NACE MR 01-75		S8	
Thermowell clean for oxygen service		S9	
Thermowell stress calculation according ASME 19.3-TW 2010 (Murdock)		SM	
Thermowell with plug, gasket and chain		SP	
Thermowell with plug and gasket		SR	
Others		SZ	
Flange Connection Options			
Flange raised face form RF, ASME B16.5			F6
Flange raised face form B1 acc. EN 1092-1			F7
Flange raised face form B2 acc. EN 1092-1			F8
Flange facing with tongue form C EN 1092-1			F1
Flange facing with groove form D EN 1092-1			F2
Flange facing with RTJ surface ASME B16.5			F3
Flange full penetration welded			F4
Others			FZ

* Specify length from thermowell tip in mm

Additional ordering information SensyTemp TSP131 (Continuation)	XX						
Extension Tube Diameter Options							
Extension Diameter 14,0 × 2,5 mm	N1						
Extension Diameter 11,0 mm	N2						
Extension Tube Options							
Extension tube welded with measuring inset, gas tight		N3					
Measuring Inset: Option							
Hot junction grounded				J1			
2 insets paired from 0 to 100 °C (32 to 212 °F), max. deviation 0.1 K				J3			
Improvement Sensor Accuracy to 0.5 Cl. A, 0 to 100°C, U>100 mm				J8			
Improvement Sensor Accuracy to 0.5 Cl. A, 0 to 400°C, U>250 mm				J9			
Measuring Inset: Transmitter Mounted							
Transmitter mounted on inset, without ceramic block					J2		
Measuring Inset: Other Options							
Others						JZ	
Connection Head Options							
Second transmitter mounted in connection head (same type as first one)							H1
Connection head seawater-resistant, painted grey-white							H3
Others							HZ
Cable Entry Options							
1 × M20 × 1.5, without cable gland							U1
1 × ½ in NPT, without cable gland							U2
1 × ¾ in NPT, without cable gland							U3
2 × M20 × 1.5, without cable gland							U4
2 × M20 × 1.5, with cable gland skintop, temperature range -40 bis +70 °C (-40 bis +158 °F), cable diameter 4 to 13 mm (0,16 to 0,51 in)							U7
Harting Han 7D plug and socket connection							UG
Harting Han 8D (8U) plug and socket connection							UH
M12 plug for PROFIBUS PA							UJ
¾ in plug for FOUNDATION Fieldbus							UK
Others							UZ

... Ordering Information

Additional ordering information SensyTemp TSP131	XX	XX	XX	XX	XX
Display Type					
LCD indicator type AS	L1				
Configurable LCD Indicator type A	L2				
Other Options					
Thermometer silicone-free		PS			
Earth screw external		PG			
Each Thermometer single packed - Polyethylen		PN			
Documentation Language					
German			M1		
English			M5		
Language package Western Europe / Scandinavia (Languages: DA, ES, FR, IT, NL, PT, FI, SV)			MW		
Language package Eastern Europe (Languages: EL, CS, ET, LV, LT, HU, HR, PL, SK, SL, RO, BG)			ME		
Additional TAG Plate					
Stainless steel plate with TAG no.					T1
Additional Identification Plate					
Stainless steel plate with customer specific text					T2
Adhesive label					T3

Accessories	Ordering number
TSP commissioning instruction, German	3KXT161001R4403
TSP commissioning instruction, English	3KXT161001R4401
TSP commissioning instruction, language package Western Europe / Scandinavia	3KXT161001R4493
TSP commissioning instruction, language package Eastern Europe	3KXT161001R4494

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