ABB MEASUREMENT & ANALYTICS | DATA SHEET

SensyTemp TSP300-W WirelessHART

Temperature sensor with Energy Harvester



Measurement made easy

Autonomous wireless temperature measurement

Powered by process temperature

Backup via standard lithium battery with long service life

Fast and easy commissioning

No battery replacement necessary with optimum operation

Intuitive and intelligent operating concept

Configuration on the temperature sensor itself
Without external power supply

Heavy duty model for harsh process operation

WirelessHART (IEC 62591)

Approvals
- ATEX
- IECEx

Introduction

Autonomous temperature measurement

In the past, temperature measurement devices always required cables to supply power and transmit signals.
The cabling was often very laborious, taking up a lot of time and incurring high costs, particularly if larger distances had to be covered, disturbances circumvented, and safety aspects considered.
The costs for the cabling often exceeded the costs of the measuring device itself, which ultimately led to temperatures not being measured at all. This meant accepting compromises in terms of optimum process control.
The introduction of wireless signal transmission brought about a reduction in the costs of cabling. Nevertheless, a cable connection was still required to supply power to the measuring device.
Battery operation is a possible alternative. However, maintenance intervals for battery replacement must be strictly observed to guarantee fully functioning measurement.

The SensyTemp TSP300-W temperature sensors enable completely independent temperature measurement. There is no longer any need for cabling or battery replacement, and installation and maintenance costs are drastically reduced or even eliminated completely. No additional external energy is needed, and ensuring compliance with safety requirements is much easier. The result is an increase in system performance, improved effectiveness, and increased safety.



Figure 1: SensyTemp TSP300-W Temperature sensor

System structure

TSP temperature sensors are contact thermometers which, through contact with the measuring medium, are brought to the temperature of the medium.
The sensor is made up of modular components. The centerpiece is the measuring inset, which houses the actual sensor element for temperature measurement in its tip.
The thermowell surrounds the measuring inset and establishes the contact to the measuring medium. It ensures that the measuring inset can be replaced in a self-contained process and protects the inset against mechanical and corrosive influences of the process. The material and geometry of the thermowell must meet the process requirements (e.g. medium composition, measuring temperature, pressure).

The process connection is the mechanical interface between the process and the temperature sensor. The extension tube mounted on this interface creates the required distance to the connection head to protect it against overheating. The temperature gradient between the process temperature and the ambient temperature in the extension tube is converted into electrical energy by an Energy Harvester. An integrated micro-thermal generator (micro TEG) supplies the power for this. The electrical energy required is generated from the temperature difference between the process pipe and the ambient temperature by applying the Peltier effect. The micro TEG is therefore the ideal solution for using wireless WirelessHART temperature sensors as completely autonomous units in most processes.- Many processes involve sufficient process heat to enable a "complete power supply" by the micro TEG. A built-in high-performance battery buffers potential process-driven power failures of the micro TEG.
The adjustable connection head houses the transmitter electronics that convert the small output signal from the sensor elements into a WirelessHART signal.

… Introduction

Operating principle

Resistance thermometers and thermocouples are used as sensor elements.
Platinum has established itself as the resistance material in resistance thermometers due to its excellent chemical resistance and its characteristic curve quality.
Pt100 is used in most cases; a platinum resistance with 100 Ω at 0° C. The temperature coefficient α is 0.003851/K.
Measuring ranges and accuracy classes are defined in IEC 60751.

There are two different Pt100 sensor element designs.
Wire wound resistors (WW) consist of a bifilar wound platinum wire embedded in a ceramic capillary in ceramic powder. As the platinum wire is embedded flexibly in this design, there is almost no mechanical tension to restrict the measuring range. Measurements of −196 to 600 °C (−320.8 to 1112 °F) are possible, although this design is relatively sensitive to external mechanical influences.

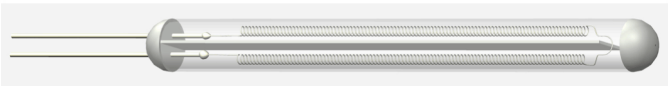


Figure 2: Wire wound resistor (WW)

In thin film resistors (TF), a ceramic substrate is sputtered with platinum. The resistance wire is then sealed with a glass coating. As the platinum layer is permanently bonded with the substrate here, the measuring range for the most common types is −50 to 400 °C (−58 to 752 °F) due to material tensions. Thin film sensors are very small and light. They are particularly resistant to external mechanical influences and can be installed in very short temperature-sensitive lengths.



Figure 3: Thin film resistor (TF)

Thermocouples use the Seebeck effect. This creates thermal voltages dependent on two different, conductive alloys at different temperatures.
The level of the thermal voltage depends on the alloy combination and the temperature difference of the connection points.
Various types of thermocouples cover a measuring range of 0 to 1100 °C (32 to 2012 °F) for industrial thermocouples.
IEC 60584 describes both the characteristic curves and the accuracy classes of the most common types. In the USA, ANSI MC96.1, which is very similar, is used.
Thermocouples are extremely stable from a mechanical perspective and in an optimized design, have very short response times. However, resistance sensors provide greater accuracy.



Figure 4: Thermocouple

General information

As contact thermometers have to be brought to the temperature of the measuring medium, correct installation is particularly important for the quality of the measurement. The best results with regard to accuracy and response time are achieved when the sensor element is located at the point of the greatest medium velocity, i.e. the center of the pipe. To eliminate heat conduction errors to the greatest extent possible, the immersion depth must be 10 to 15 times the thermowell diameter.- Heat conduction errors arise when the ambient temperature reaches the sensor element via the thermowell.

The sensor built in to the tip of the thermowell should be as evenly bathed in medium as possible.

Installation positions 2 and 3: The thermowells are therefore usually installed at a 90° angle.- The thermowell tip, i.e. the sensor, should be in the middle of the pipe.

Installation positions 1 and 5: To meet the requirement for central installation of the sensor, thermowells can also be installed in elbow pipes vertically or at an obtuse angle to the flow direction.

Installation position 4: Indirect measurement of the medium temperature via the pipe surface is a further option in addition to immersion measurement. Indirect measurement is somewhat less accurate than measurement in the pipe. Pipe wall thickness, pipe material and other parameters can influence the measuring result.

For surface measurement, ensure optimum contact between the sensor element and the surface and that the sensor element is insulated against the ambient temperature by means of suitable insulating material.
In conjunction with an Energy Harvester, the temperature sensor is completely location-independent within its range in this measuring method as neither wiring nor difficult to install welded spuds are required.

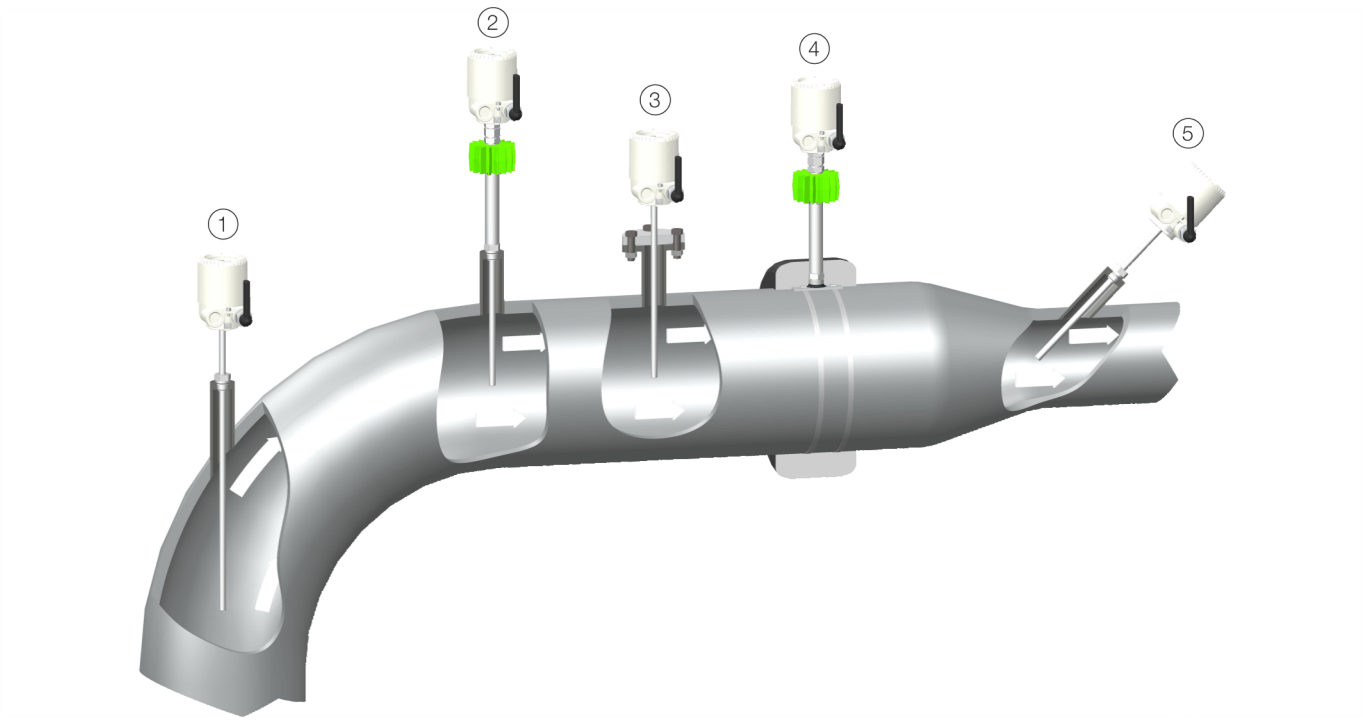
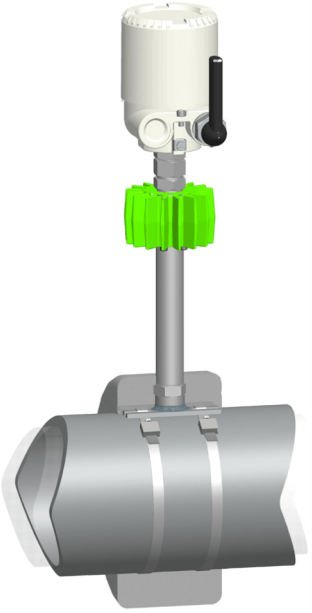


Figure 5: Installation positions

Types of temperature sensor – overview

Type	TSP311-W	TSP321-W	TSP331-W	TSP341-W
				
Energy Harvester	●	—	●	●
LCD indicator	●	●	●	●
Design	Measuring inset, thermowell, extension tube with thermowell connection, process connection, connection head, WirelessHART electronics-			
Process connection	For installation in an existing thermowell	Screw-in thread, flange, weld-in socket, compression fitting	Screw-in thread, flange, weld-in socket	Surface mounting
Thermowell	without	Welded	Drilled	without

Built-in sensors – specifications

Temperature ranges and pressure limits

Designs, materials, ranges, limit values		
Storage / transportation temperature	−50 bis 85 °C (−58 bis 185 °F)	
Process	In the process, the values specified generally deviate significantly downwards due to the influence of viscosity, medium velocity, pressure and temperature.	
Resistance thermometer Pt100	Thin film resistor (TF)	−50 to 400 °C (−58 to 752 °F)
	Wire wound resistor (WW)	−196 to 600 °C (−320.8 to 1112 °F)
Thermocouples	Type K	−40 to 1200 °C (−40 to 2192 °F)
	Type N	−40 to 1200 °C (−40 to 2192 °F)
	Type J	−40 to 750 °C (−40 to 1382 °F)
	Type E	−40 to 950 °C (−40 to 1742 °F)
Thermowell materials	1.4404 / 316L	−196 to 600 °C (−320.8 to 1112 °F)
	1.4571 / 316Ti	−196 to 800 °C (−320.8 to 1472 °F)
	2.4819 / Hastelloy C 276	0 to 1100 °C (32 to 2012 °F)
	2.4816 / Inconel 600	0 to 1100 °C (32 to 2012 °F)
	2.4360 / Monel 400	0 to 550 °C (32 to 1022 °F)
	1.0460 / C22.8	0 to 1100 °C (32 to 2012 °F)
	1.4876 / Incoloy 800	0 to 1100 °C (32 to 2012 °F)
	1.4539	0 to 1100 °C (32 to 2012 °F)
	1.7335	0 to 540 °C (32 to 1004 °F)
	1.7380	0 to 570 °C (32 to 1058 °F)
	1.5415	0 to 500 °C (32 to 932 °F)
for stainless steel thermowells with coating	ECTFE coating	0 to 120 °C (32 to 248 °F)
	Tantalum coating	0 to 200 °C (32 to 392 °F)
Designation of gas connections	Tubular thermowells	40 bar (4 MPa) (580 psi)
	Drilled thermowells	700 bar (70 MPa) (10152 psi) or in accordance with calculation by ABB*

* ABB performs thermowell calculations in accordance with ASME PTC 19.3 / TW 2010 or in accordance with the calculation method (Dittrich / Kohler) often required in central Europe. This requires the specification of the maximum flow velocity of the measuring medium (m/s), the density (kg/m3), the process temperature (°C), and the process pressure (bar). The thermowell dimensions (mm) required are the installation length, tip diameter, bore diameter and the desired material.

… Built-in sensors – specifications

Measuring inset

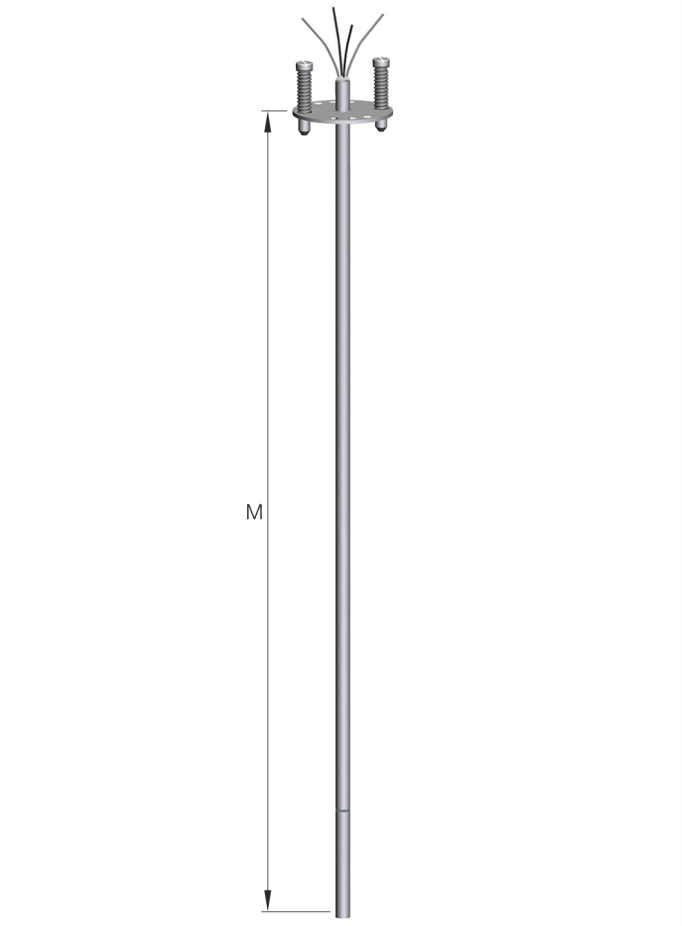


Figure 6: Measuring inset

Design	
Dimensions***	for type 311-W: M = U + K + 25 mm (0.984 in)* for type 321-W: M = N + 25 mm (0.984 in) for type 331-W: M = L + K + 25 mm (0.984 in)*
Outer diameter	3 mm, 6 mm**
Design	Open connection wires; Single or double sensor
Mineral-insulated cable	Bendable and vibration-resistant ABB mineral insulated cable. Sheath material for resistance thermometers made from stainless steel 1.4571 / 316Ti or highly heat-resistant steel 2.4816 / Inconel 600 for thermocouples.-

* With Energy Harvester: K = 241 mm (9.488 in)

** Not with the Energy Harvester

*** The dimensions K, L, N and U are described on the following pages (thermowells, extension tubes)

Response times

The thermowell used in each application and the thermal contact between the thermowell and measuring inset have an impact on the response times of TSP temperature sensors. In the case of TSP321-W and TSP331-W 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 types TSP321-W and TSP331-W measured in accordance with IEC 60751 in water at 0.4 m/s and temperature increase from 25 °C (77 °F) to 35 °C (95 °F).

Sensor element	**Exterior Ø [mm]**	**$t_{0,5}$ [s]**	**$t_{0,9}$ [s]**
Single Pt100 / 4 L resistance thermometer--	6	4	10
Double type K thermocouple-	3	0.8	2.1

Sensor element – resistance thermometer

Specifications and designs

Measuring insets with resistance thermometers					Single Pt100						Double Pt100			
Sensor	Maximum vibration sensitivity	TSL	nBL	Class	2-W		3-W		4-W		2-W		3-W	
					Ø 3	Ø 6	Ø 3	Ø 6	Ø 3	Ø 6	Ø 3	Ø 6	Ø 3	Ø 6
TF	100 m/sec² (10 g)	7 (0.276)	30 (1.181)	B	•	•	•	•	•	•		•		•
				A			•	•	•	•				•
				AA				•		•				•
	600 m/sec² (60 g)	10 (0.394)	40 (1.575)	B		•		•		•		•		•
				A				•		•				•
WW	30 m/sec² (3 g)	50 (1.968)	60 (2.362)	B	•	•	•	•	•	•	•	•	•	•
				A			•	•	•	•				
	100 m/sec² (10 g)			B	•	•	•	•	•	•	•	•	•	•
				A			•	•	•	•				

TSL = temperature-sensitive length in mm (in)
nBL = non-bendable length in mm (in)
Ø 3 / Ø 6 = measuring inset diameter in mm (in)
TF = thin film resistor
WW = wire wound resistor
2-W / 3-W / 4-W = two-, three-, or four-wire circuit

Accuracy classes in accordance with IEC 60751

Resistance thermometer		Class	Measuring range	Calculation of the measuring error
In accordance with IEC 60751	Thin film resistor (TF)	B	−50 to 400 °C (−58 to 752 °F)	Δt = ± (0.30 + 0.0050|t|)
		A	−30 to 300 °C (−22 to 572 °F)	Δt = ± (0.15 + 0.0020|t|)
		AA	0 to 100 °C (32 to 212 °F)	Δt = ± (0.10 + 0.0017|t|)
	Wire wound resistor (WW)	B	−196 to 600 °C (−320.8 to 1112 °F)	Δt = ± (0.30 + 0.0050|t|)
		A	−196 to 500 °C (−320.8 to 932 °F)	Δt = ± (0.15 + 0.0020|t|)

|t| = insert required temperature value as an amount

Thermocouples

Specifications and designs

Measuring insets with thermocouples					Single thermocouple						Double thermocouple					
Standard	Maximum vibration sensitivity	TSL	nBL	Class	K		J		N		K		J		N	
					Ø 3	Ø 6	Ø 3	Ø 6	Ø 3	Ø 6	Ø 3	Ø 6	Ø 3	Ø 6	Ø 3	Ø 6
IEC 60584	600 m/sec² (60 g)	7 (0,276)	30 (1,181)	2	•	•	•	•		•	•	•	•	•		•
				1	•	•	•	•		•	•	•	•	•		•
ANSI MC 96.1				Standard	•	•	•	•		•	•	•	•	•		•
				Special	•	•	•	•		•	•	•	•	•		•

TSL = temperature-sensitive length in mm (in)
nBL = non-bendable length in mm (in)
Ø 3 (0.118) / Ø 6 (0.236) = measuring inset diameter in mm (in)

… Built-in sensors – specifications

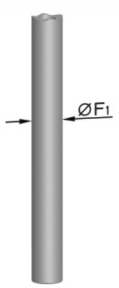
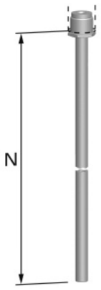
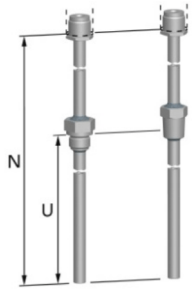
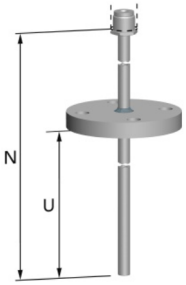
Accuracy classes in accordance with IEC 60584 and ANSI MC 96.1

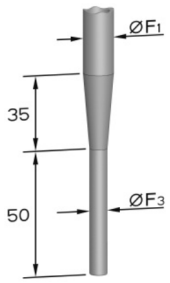
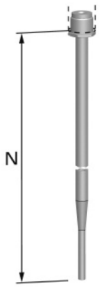
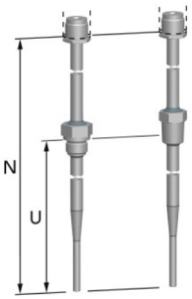
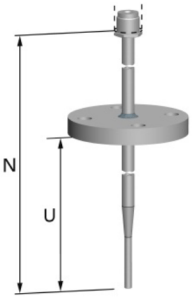
Thermocouple		Class	Measuring range	Calculation of the measuring error
In accordance with IEC 60584	Type K (NiCr–Ni)	2	–40 to 333 °C (–40 to 631.4 °F)	±2.5 °C (77 °F)
			333 to 1200 °C (–631.4 to 2192 °F)	±0.0075 x |t|
		1	–40 to 375 °C (–40 to 707 °F)	±1.5 °C
			375 to 1000 °C (–707 to 1832 °F)	±0.0040 x |t|
	Type J (Fe–CuNi)	2	–40 to 333 °C (–40 to 631.4 °F)	±2.5 °C
			333 to 700 °C (–631.4 to 1292 °F)	±0.0075 x |t|
		1	–40 to 375 °C (–40 to 707 °F)	±1.5 °C
			375 to 750 °C (–707 to 1382 °F)	±0.0040 x |t|
	Type N (NiCrSi–NiSi)	2	–40 to 333 °C (–40 to 631.4 °F)	±2.5 °C
			333 to 1200 °C (631.4 to 2192 °F)	±0.0075 x |t|
		1	–40 to 375 °C (–40 to 707 °F)	±1.5 °C
			375 to 1200 °C (–707 to 2192 °F)	±0.0040 x |t|
	Type E (NiCr–CuNi)	2	–40 to 333 °C (–40 to 631.4 °F)	±2.5 °C
			333 to 900 °C (631.4 to 1652 °F)	±0.0075 x |t|
		1	–40 to 375 °C (–40 to 707 °F)	±1.5 °C
			375 to 800 °C (–707 to 1472 °F)	±0.0040 x |t|
In accordance with ANSI MC 96.1	Type K (NiCr–Ni)	Standard	0 to 293 °C (32 to 559.4 °F)	±2.2 °C
			293 to 1250 °C (559.4 to 2282 °F)	±0.0075 x |t|
		Special	0 to 275 °C (32 to 527 °F)	±1.1 °C
			275 to 1250 °C (527 to 2282 °F)	±0.0040 x |t|
	Type J (Fe–CuNi)	Standard	0 to 293 °C (32 to 559.4 °F)	±2.2 °C
			293 to 750 °C (559.4 to 1382 °F)	±0.0075 x |t|
		Special	0 to 275 °C (32 to 527 °F)	±1.1 °C
			275 to 750 °C (527 to 1382 °F)	±0.0040 x |t|
	Type N (NiCrSi–NiSi)	Standard	0 to 293 °C (32 to 559.4 °F)	±2.2 °C
			293 to 1250 °C (559.4 to 2282 °F)	±0.0075 x |t|
		Special	0 to 275 °C (32 to 527 °F)	±1.1 °C
			275 to 1250 °C (527 to 2282 °F)	±0.0040 x |t|
	Type E (NiCr–CuNi)	Standard	0 to 293 °C (32 to 559.4 °F)	±2.2 °C
			293 to 900 °C (559.4 to 1652 °F)	±0.0075 x |t|
		Special	0 to 275 °C (32 to 527 °F)	±1.1 °C
			275 to 800 °C (527 to 1472 °F)	±0.0040 x |t|

|t| = insert required temperature value as a value

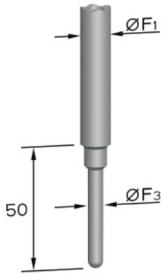
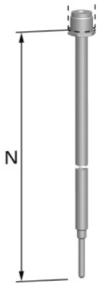
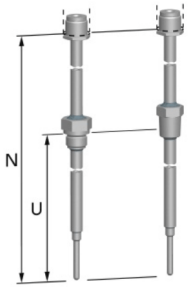
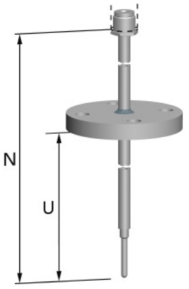
Thermowells

Type TSP321-W welded thermowells

Straight shaft	**DIN 43772 – form 2**	**DIN 43772 – form 2G**	**DIN 43772 – form 2F**
			M24 x 1.5 head connection
			
1.4571/316Ti	F1 = 12, 14 mm	F1 = 12, 14 mm	F1 = 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, tip 8	Ø 6 mm, tip 8	Ø 6 mm, tip 8

Tapered tip*	**DIN 43772 – form 3**	**DIN 43772 – form 3G**	**DIN 43772 – form 3F**
			M24 x 1.5 head connection
			
1.4571/316Ti	F1/F3 = 12/9 mm	F1/F3 = 12/9 mm	F1/F3 = 12/9 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

… Built-in sensors – specifications

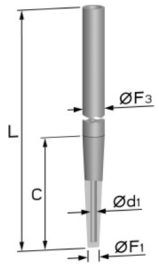
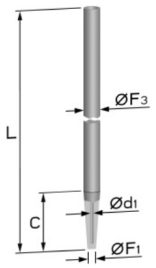
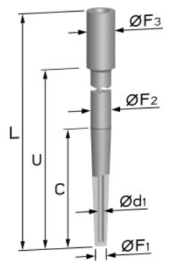
Stepped tip	**ABB – form 2S**	**ABB – form 2GS**	**ABB – form 2FS**
			M24 x 1.5 head connection
			
1.4571/316Ti	F1/F3 = 14/6 mm	F1/F3 = 14/6 mm	F1/F3 = 14/6 mm
1.4404/316L	F1/F3 = 12/6 mm	F1/F3 = 12/6 mm	F1/F3 = 12/6 mm
2.4819/C-276	–	F1/F3 = 13.7/6 mm*	F1/F3 = 13.7/6 mm**
Measuring inset	Ø 3 mm	Ø 3 mm	Ø 3 mm

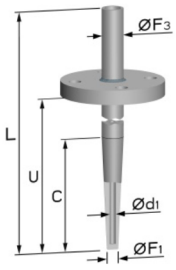
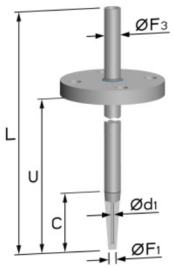
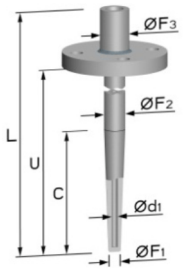
* Only with G½ in A, ½ in NPT thread

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

Other diameters and materials available on request.

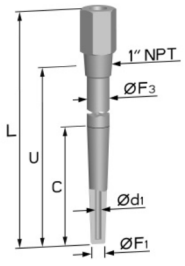
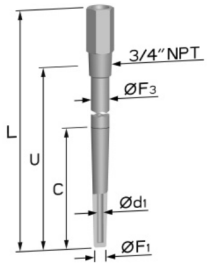
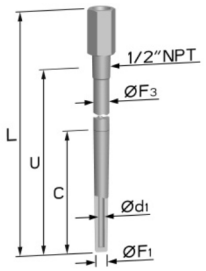
Type TSP321-W drilled thermowells

Weld-in thermowell		**DIN 43772 – form 4**		**DIN 43772 – form 4**		**ABB – form PW**	
Extension tube connection		M18 x 1.5		M14 x 1.5		½ in NPT	
							
Material		1.4404/316L; 1.4571/316Ti; 1.7335/13CrMo4-5; 1.5415/15Mo3				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**	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 x 1.5		M14 x 1.5		½ in NPT	
							
Material		1.4404/316L; 1.4571/316Ti		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

… Built-in sensors – specifications

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)

Special installation conditions for thermowells

For aggressive media, a flange thermowell made from stainless steel can be provided with an effective coating, for example ECTFE 0.5 mm.--

For highly corrosive measuring media, additional protection can also be provided in the form of a tantalum coating for flange thermowells Form 2F or 3F, outside diameter 12 mm, material 1.4571/316Ti or 1.4404/316L.

If required, contact your ABB partner.

Process connections

For welded and drilled thermowells

Design	**Sliding connection**	
TSP321-W, plug-in thermowells, welded	G½ in A, ½ in NPT	
DIN 43772 – form 2, straight shaft		
DIN 43772 – form 3, tapered tip		
ABB – form 2S, stepped tip		
Design	**Fixed connection**	
TSP321-W, screw-in thermowells, welded	G½ in A, G¾ in A, G1 in A, ½ in NPT, ¾ in NPT, 1 in NPT	
DIN 43772 – form 2G, straight shaft	M20 × 1,5, M27 × 1,5	
DIN 43772 – form 3G, tapered tip		
ABB – form 2GS, stepped tip		
TSP331-W, screw-in thermowells, drilled	½ in NPT, ¾ in NPT, 1 in NPT	
ABB – form PS		
Design	**Flange in accordance with EN 1092-1**	**Flange in accordance with ASME B16.5 TW**
TSP321-W, flange thermowells, welded	Form B1 sealing surface,	Form RF sealing surface,
DIN 43772 – form 2F, straight shaft	Form C or D optional	Form RTJ optional
DIN 43772 – form 3F, tapered tip	DN 15, DN 20, DN 25, DN 40, DN 50	Nominal diameter 1 in, 1 ½ in, 2 in
ABB – form 2FS, stepped tip	each PN 10 to PN 40	Nominal pressure 150 #, 300 #, 600 #
TSP331-W, flange thermowells, drilled		
DIN 43772 – form 4F, F3 = 24 mm and 18 mm		
ABB – form PF		

… Built-in sensors – specifications

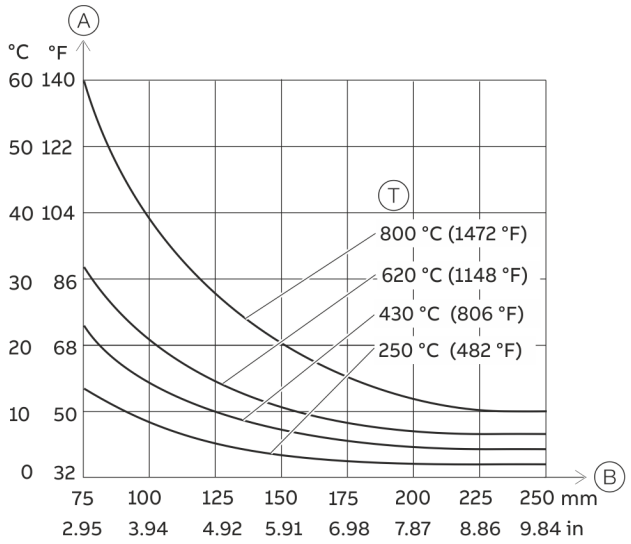
Extension tubes

For types TSP311, TSP331

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 in the connection head and the actual process. Extension tubes for thermometers without a harvester have a standard length K of 150 mm (5.906 in). For extension tubes with an Energy Harvester, the extension tube length K = 241 mm (9.488 in).

Extension tube spacer

Extension tube spacers (maximum 4 spacers, 25 mm in length) enable the device to be used at higher process temperatures. The spacers reduce the overtemperature of the connection head and the temperature at the micro TEG (see also the specifications for the Energy Harvester).



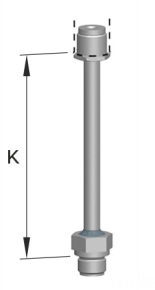
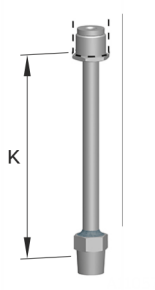
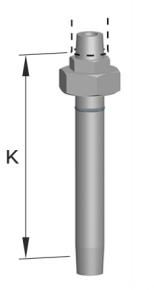
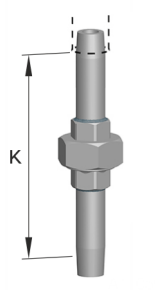
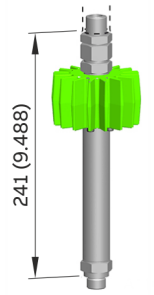
(A) Overtemperature at the connection head compared to the ambient temperature

(B) Extension tube length

(T) Flange temperature

Figure 7: Flange temperature

Specifications

	Cylindrical screw-in thread	Conical screw-in thread	½ in NPT – ½ in NPT separable (nipple-union)	½ in NPT – ½ in NPT separable (nipple-union-nipple)	Energy Harvester
Head connection	M24 × 1.5	M24 × 1.5	½ in NPT	½ in NPT	M24 × 1.5
					
Thermowell connection	M14 × 1.5; M18 × 1.5; M20 × 1.5; G1/2	½ in NPT	½ in NPT	½ in NPT	½ in NPT; M18 × 1.5
Material				1.4571/316Ti	1.4404/316L 1.4571/316Ti

Surface sensors

TSP341-W type design

Sensor mounting 90° to the piping
Design for simple surface mounting. A retaining board is mounted on the process side of the extension tube. The SensyTemp TSP341-W can be fastened to the surface using two tension clips.

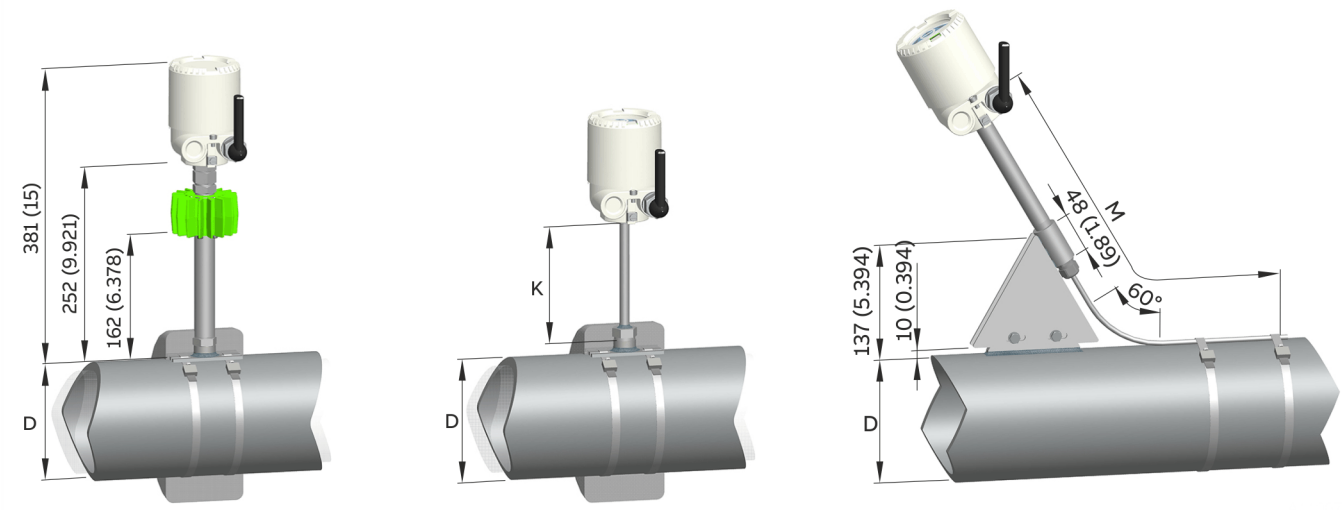
With Energy Harvester
Adapters for fastening between the extension tube and retaining board can be selected to enable the Energy Harvester to be used at high surface temperatures.
Minimum temperature difference of +35 K between the temperature at the process pipe and the environment.

Specification
Thermal insulation of the sensor at the tube surface is mandatory.
Stainless steel clamp collars for DN 150 to DN 500 (6 to 20 in)
Measuring range: −196 to 600 °C (−320 to 1112 °F)
Limited temperature range if the Energy Harvester is used (see also the Energy Harvester specifications).
Sensor elements: see Built-in temperature sensors

Sensor mounting alongside the piping
Design for surface mounting with adjustable and vibration-resistant fastening. A retaining board is welded to the surface of the pipe or tank conveying the medium. The attachment is screwed on using a 60° angle plate fixed to the thermometer. This tilts the temperature sensor by 30°. The tip of the measuring inset with the sensor is fastened to the process pipe using two clamp collars.

Specification
Thermal insulation of the sensor at the tube surface is mandatory.
Stainless steel clamp collars for DN 150 to DN 500 (6 to 20 in)
Measuring range: −196 to 600 °C (−320 to 1112 °F)
Limited temperature range if the Energy Harvester is used (see also the Energy Harvester specifications).
Sensor elements: see Built-in temperature sensors
Measuring inset length M: 400 mm (15.748 in)
Retaining board material: 1.4571/316Ti, 1.4404/316L or process-specific material

Dimensions mm (in)



With Energy Harvester

Without Energy Harvester

Figure 8: Sensor fastening 90° to piping / alongside piping

Connection head

The connection head holds and protects the measurement and sender electronics and the battery required for these electronics. An LCD indicator can be installed as an option. The antenna and head can be rotated. This enables optimum transmission characteristics to be set.

Specification

- Ambient temperature −40 to 85 °C (−40 to 185 °F)
- optional −50 to 85 °C (−58 to 185 °F)
  (restricted range during operation with LCD indicator or with explosion-proof design)

Electrical connections
- Spring cage terminals
- Connection leads up to max. 1.5 mm^2 (AWG 16)

Material
- Aluminum, epoxy-coated
- Stainless steel

Color
- gray RAL 9002

IP rating
- IP 66 / IP 67

Dimensions

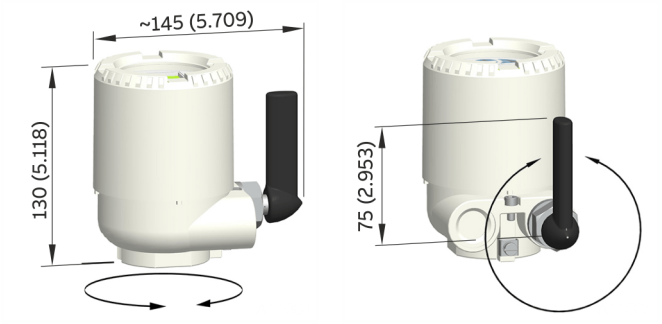
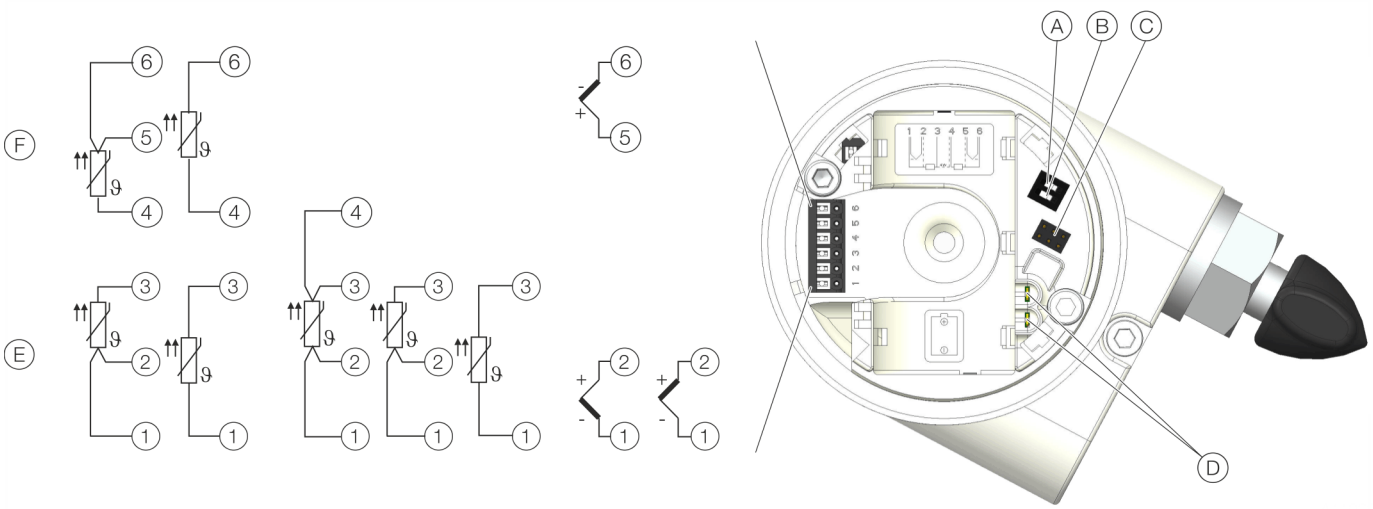


Figure 9: Dimensions mm (in)

Electrical connections



① - ⑥ Sensor connection (of the measuring inset)
Ⓐ DIP switch, hardware write protection
Ⓑ DIP switch standby mode
Ⓒ LCD indicator connection
Ⓓ HART Maintenance Port (handheld terminal)
Ⓔ Sensor 1
Ⓕ Sensor 2

Figure 10: Electrical connections (opened connection head)

Transmitter

Specification

Electromagnetic compatibility
Interference immunity in accordance with IEC/EN 61326-1 (industrial environment, influence < 1%)

Vibration resistance in accordance with IEC 60068-2-6
10 to 60 Hz 0.21 mm / 60 to 2000 Hz 3g

Humidity in accordance with IEC 60068-2-30
95 %

With integrated adjustable omnidirectional antenna
Coverage:
up to 300 m (328 yds)

Wireless refresh rate
- Standard 16 seconds
- Can be configured between 4 seconds and 60 minutes

Transmission protocol
WirelessHART® Version 7 (IEEE 802.15.4-2006)

Frequency band
2.4 GHz (ISM-band, license-free)
Transmission power: max. 10 mW (10 dBm) EIRP

Minimum distance between antenna and persons
0.2 m (8 in)

User-defined configuration of Network ID & Join Key through LCD indicator with button operation or through EDD or DTM.

Resistance thermometer input

Resistance thermometer
- Pt100 in accordance with IEC 60751

Sensor connection type
- Two-wire, three-wire, and four-wire circuits

Connection lead
- Maximum sensor line resistance of 50 Ω per line in accordance with NE 89
- Three-wire circuit:
  Symmetrical sensor line resistances
- Two-wire circuit:
  Compensation up to 100 Ω total lead resistance

Measurement current
< 300 µA

Sensor short circuit
< 5 Ω (for resistance thermometer)

Sensor wire break
- Measuring range: 0 to 500 Ω > 0.6 to 10 kΩ

Corrosion detection in accordance with NE 89
- Three-wire resistance measurement > 50 Ω
- Four-wire resistance measurement > 50 Ω

Sensor error signaling
- Resistance thermometer: short-circuit and wire break

Thermocouple input

Types
K, J, N, E in accordance with IEC 60584, ANSI MC 96.1

Connection lead
- Maximum sensor line resistance
  1.5 kΩ per lead

Sensor wire break monitoring in accordance with NE 89
- Pulsed with 1 µA outside measurement interval
- Thermocouple measurement 5.3 to 10 kΩ

Input resistance
> 10 MΩ

Internal reference junction Pt1000, IEC 60751 Class B

Sensor error signaling
- Thermocouple:
  Wire break

Freestyle characteristic / 32-points-sampling point table
- Resistance measurement up to a maximum of 5 kΩ
- Voltages up to maximum 1.1 V

Sensor error adjustment
- Through Callendar-Van Dusen coefficients
- Through value table, 32 support points
- Through single-point adjustment (offset adjustment)
- Through two-point adjustment

Input functionality
- 1 Sensor
- 2 Sensors:
  mean measurement,
  differential measurement,
  sensor redundancy,
  Sensor drift monitoring

… Transmitter

Measuring accuracy

includes linearity error, repeatability / hysteresis at 23 °C (73.4 °F) ±5 K ambient temperature.
Information on measuring accuracy corresponds to 3 σ (Gaussian distribution).

Sensor element	Measuring range limit	Minimum span	Digital measuring accuracy (24 bit AD conversion)
Resistance thermometer			
Pt100 (a=0.003850)	−196 to 600 °C (−320 to 1112 °F)	10 °C (18 °F)	±0.08 °C (±0.14 °F)
Thermocouples			
Type K (Ni10Cr-Ni5)	−270 to 1372 °C (−454 to 2502 °F)	50 °C (90 °F)	±0.35 °C (±0.63 °F)
Type J (Fe-Cu45Ni)	−210 to 1200 °C (−346 to 2192 °F)		
Type N (Ni14CrSi-NiSi)	−270 to 1300 °C (−454 to 2372 °F)		
Type E (Ni10Cr-Cu45Ni)	−270 to 1000 °C (−454 to 1832 °F)		

Operating influence

Sensor element	Ambient temperature effect*
Pt100 (all connection types)	±0.004 °C (±0.007 °F)
Thermocouple (all defined types)	±[(0.001 % × (ME[mV] / MS[mv]) + (100 % × (0.009 °C / MS [°C]))]**, ***

* Per 1 °C (1.8 °F) deviation to 23 °C (73.4 °F) based on the digital measured value

** The percentages refer to the already set measuring span

*** ME = voltage value of the sensor at the upper range value in accordance with the standard
MA = voltage value of the sensor at lower range value in accordance with the standard
MS = voltage value of the thermocouple over the measuring span in accordance with the standard. MS = (ME - MA)

LCD indicator

In the connection head
For displaying measurement and status information
For on-site configuration
Automatic shutdown after 1 minute without activating the buttons (can be configured)
Manual reactivation via push buttons



Figure 11: LCD indicator

Communication

Configuration parameters

- Sensor type, activation type
- Error signaling
- Measuring range
- General information, e.g. TAG number
- Damping
- Warning and alarm thresholds
- Output signal simulation
- Burst refresh rate
- Burst commands
- Network ID
- Join key
- Software write protection

Diagnostic information in accordance with NE 107

Standard:

- Sensor error signalling (wire break or short circuit)
- Device error
- Limit value up-scale / down-scale
- Measuring range up-scale / down-scale
- Simulation active

Advanced:

- Sensor redundancy / sensor backup active (sensor failure)
- Drift monitoring
- Sensor / Sensor connection lead corrosion
- Drag indicator for Sensor 1, Sensor 2 and ambient temperature
- Ambient temperature up-scaled
- Ambient temperature down-scaled
- Operating hours counter
- Wireless interface error
- Connection status
- Battery status

WirelessHART

The device is listed with the FieldComm Group.

Manufacturer-ID	0x1A
Device-ID	0x9B
Profile	HART® 7.5
Network ID	0xABB (2747 dec.)
Join Key	0x57495245
	0x4c455353
	0x4649454c
	0x444b4559
Configuration	On device using LCD indicator
	DTM
	EDD

0x = hexadecimal

NOTICE

For data security reasons, we highly recommend that you change parameters Network ID and Join Key during commissioning.

Standard Burst Configuration	
Burst message 1	
HART® command	9 ‘device variables with status’
	PV, SV, TV, QV, battery life (days)
Update rate	16 seconds
Burst message 2	
HART® command	48 ‘extended device status’
Update rate	32 seconds

Power supply

Energy Harvester

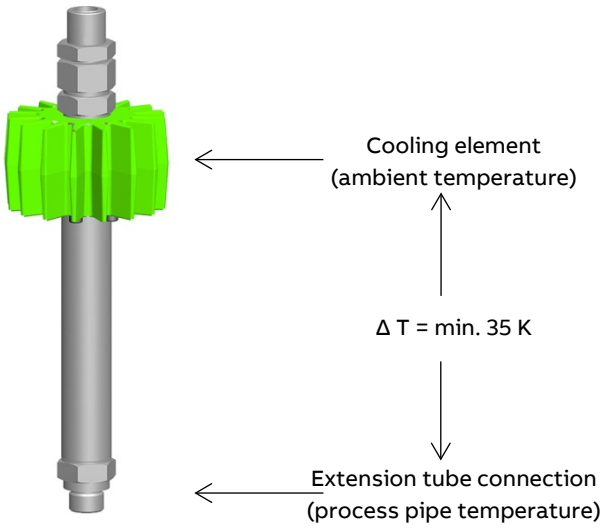
Specification
The Energy Harvester is based on the thermoelectrical effect (Seebeck effect) and requires a temperature difference of 35 K between the process pipe surface and the ambient temperature in order to provide all the energy required for the transmitter and sender electronics.

However, an integrated power management system provides energy
if the temperature difference is less than 35 K. Only the remaining energy needed is taken from the integrated battery, thereby increasing its availability. The energy withdrawal is provided as a
percentage value.

Operating temperature at the process connection
- −40 to 150 °C (−40 to 302 °F)
  Adapters for fastening between the extension tube and thermowell can be selected to enable the Energy Harvester to be used at high process temperatures.

Threaded connection to the process
- M18 × 1.5 or ½ in NPT

Material
- 1.4404/316L



Battery
Standard lithium battery (lithium content 5 g)
Service life 5 years (without Energy Harvester) under the following
reference conditions:
25 °C (77 °F) ambient temperature
Update rate 16 s
3 additional network participants
LCD off

Wireless operation approvals

Telecommunications directive
Any device used for wireless applications must be certified in accordance with the telecommunications directives applicable for the operating location. This certification is country-specific. Before commissioning, you must make sure that local restrictions are complied with.

European directives
Radio Equipment Directive 2014/53/EU

Within Europe, use of the 2400 - 2483.5 MHz frequency band is not harmonized. Country-specific regulations must therefore be observed.

Restrictions for Norway
Operation not permitted within a radius of 20 km around Ny-Alesund in Svalbard. For more information, see www.npt.no, the Norway Posts and Telecommunications website.

USA / Canada directives
FCC Part 15.247:2009 (USA)
IC RSS-210 and ICES-003 (Canada)

Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Note

- Further information on the approval of devices for use in potentially explosive atmospheres can be found in the explosion protection test certificates (at www.abb.com/wirelessmeasurement).
- Depending on the design, a specific marking in accordance with ATEX or IECEx applies.

Ex marking

Transmitter

Model TSP3x1-W-A6..., TSP3x1-W-H6... **(Temperature sensor with transmitter in zone 0, 1 or 2)**	
ATEX	**IECEx**
II 1 G Ex ia IIC T4...T1 Ga	Ex ia IIC T4...T1 Ga
Certificate no.:	Certificate no.:
PTB 14 ATEX 2010X	PTB 15.0009X

- The transmitter and the connected temperature sensor may be used fully in zone 0, zone 1 or zone 2.
- The temperature range corresponds to the information in **Temperature data**

LCD indicator

The device is supplied with or without an LCD indicator (order option "Housing / Indicators").
The LCD indicator has the following certificates:

ATEX	**IECEx**
Certificate no.:	Certificate no.:
PTB 05 ATEX 2079X	IECEx PTB 12.0028X

Temperature data

For all TSP3x1-W versions there are two relevant parts of the Sensor with different temperature ranges:

1. The permissible temperature range on the housing of the transmitter is −40 to 70 °C (−40 to 158 °F).
2. The process temperature at the measuring point could be different, but the influence of the self-heating from the sensor, the temperature rise in the electronic and the temperature class/zone has to be taken into account.

Model TSP341-W-A6 / H6-Y22 and Y23

Models TSP341-W xx Y22 and Y23 (….) are designed for ambient temperatures of −40 to 70 °C (−40 to 158 °F) on the transmitter housing. The maximum process temperature must be specified for the respective temperature class and the respective design with consideration of a maximum temperature of 70 °C (158 °F) for the electronics and self-heating of the temperature sensor components mentioned above.

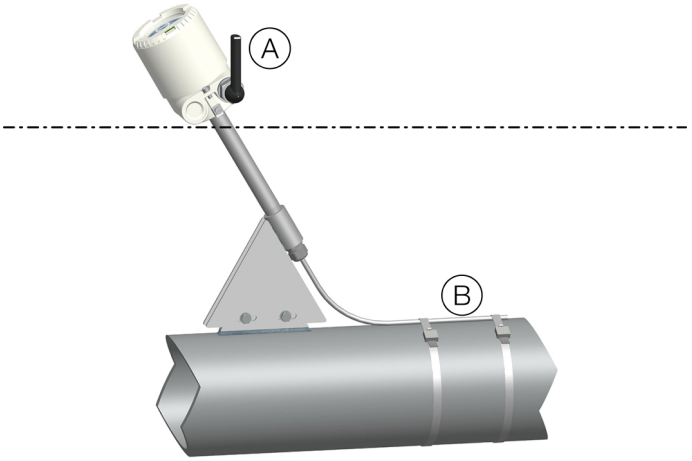


Figure 12: Temperature sensor fastening alongside the piping

Number	Temperature
Ⓐ	$T_{ambient}$: −40 to 70 °C (−40 to 158 °F)
Ⓑ	Surfacetemperature: Temperature class reduced by selfheating of the Sensor

… Use in potentially explosive atmospheres in accordance with ATEX and IECEx

TSP3x1-W (X=1-3) and TSP341-W-Y11 with Energy Harvester

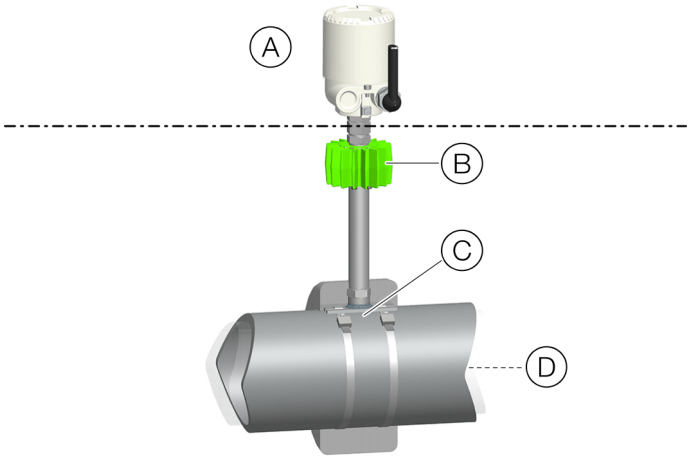
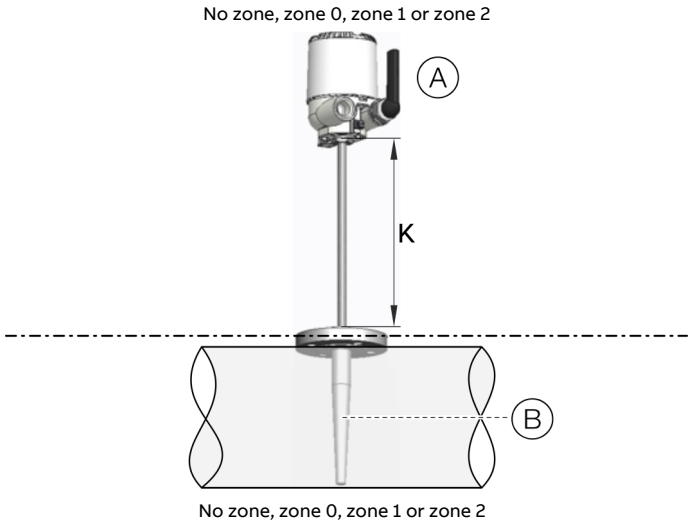


Figure 13: Temperature sensor fastening 90° to the piping with Energy Harvester

Number	Temperature
A	$T_{ambient}$: −40 C to 70 °C (−40 to 158 °F)
B	• The Energy Harvester is designed for a temperature range from −40 to 150 °C (−40 to 302°F). • To guarantee intrinsic safety, a maximum temperature difference of 150 K is allowed at the Energy Harvester
C	TEG unit used: Maximum surface temperature 150 °C (302 °F)
D	$T_{process}$: −40 °C to 150 °C (−40 to 302°F)

TSP3x1-W (X=1-3) and TSP341-W-Y11 without Energy Harvester



K Extension tube length

Figure 14: Temperature sensor with extension tube

Number	Temperature
A	Temperature region for the electronic: −40 °C to 70 °C (−40 to 158 °F) Maximum $T_{ambient}$: 70 °C (158 °F) – heating due the process temperature
B	Maximum $T_{process}$: Temperature class reduced by selfheating of the Sensor

For TSP3x1-W (X=1-3) and TSP341-W-Y11 without Energy Harvester the use for the different temperature classes depends on the process temperature and the zone definition. The transmitter housing may not heat up to more than 70 °C (158 °F). The transmitter housing heats up depending on the extension tube length 'K' and the process temperature. Therefore, the ambient temperature must be appropriately reduced in such cases.
The following table shows the maximum ambient temperature $T_{ambient}$ for the TSP3x1-W at different process temperatures. A protection against radiation heat has to be realized. (For example: isolation with 25mm thickness around the process enclosure.)

$T_{process}$	$T_{ambient}$ for extension tube length K = 150 mm (5.9 in)	$T_{ambient}$ for extension tube length K = 250 mm (9.8 in)
100 °C	max. 65 °C (149 °F)	max. 70 °C (158 °F)
200 °C	max. 60 °C (140 °F)	max. 70 °C (158 °F)
300 °C	max. 60 °C (140 °F)	max. 70 °C (158 °F)
400 °C	max. 55 °C (131 °F)	max. 65 °C (149 °F)

Self heating of the temperature sensor

The self heating of the sensor is generally defined.
The corresponding values are considered in the following tables. For each configuration of the TSP3x1-W, the maximum process temperature for the various temperature classes is provided.

Ex-Zone	T4 135 °C (-5K)	T3 200 °C (-5 K)	T2 300 °C (-10K)	T1 400 °C (-10K)
Zone 1	123 °C	188 °C	283 °C	383 °C
Zone 0	96 °C	148 °C	223 °C	303 °C

Zone 0 in conformity with EN1127-1.

Electrical data

HART Maintenance Port

	HART Maintenance Port on TTF300-W	Maximum external connection values
Maximum voltage	U_o = 5,4 V	U_i = 2,6 V
Short-circuit current	I_o = 25 mA	I_i = 18 mA
Maximum power	P_o = 34 mW	—
Inductance	L_i = 0 mH	L_o = 1 mH (IIC)
Capacitance	C_i =1,2 µF	C_o = 0,4 µF (IIC)

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.

Main ordering information SensyTemp TSP311-W

Base model **TSP311-W**	**XX**	**XX**	XX	XX	XX	XX	XX	XX	XX	XX
SensyTemp TSP311-W Temperature Sensor, without thermowell, WirelessHART										
Explosion Protection / Approvals										
Without	Y0									
Intrinsic Safety: ATEX II 1 G Ex ia IIC T4	A6									
Intrinsic Safety: IECEx ia IIC T4	H6									
Extension Tube Length										
Without Extension Tube		Y0								
K = 242 mm (9.5 in), free length up to cooling element = 152 mm (6 in), Harvester		H1								
K = 267 mm (10.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 25 mm (1 in)		H2								
K = 292 mm (11.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 50 mm (2 in)		H3								
K = 317 mm (12.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 75 mm (3 in)		H4								
K = 342 mm (13.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 100 mm (4 in)		H5								
K = 150 mm (6 in)		K1								
Customer specific length < 150 mm (< 5.9 in)		W1								
Customer specific length 150 to < 300 mm (5.9 to < 11.8 in)		W2								
Customer specific length 300 to < 400 mm (11.8 to < 15.7 in)		W4								
Customer specific length 400 to < 500 mm (15.7 to < 19.7 in)		W5								
Customer specific length 500 to < 600 mm (19.7 to < 23.6 in)		W6								
Customer specific length 600 to < 750 mm (23.6 to < 29.5 in)		W7								
Customer specific length 750 to < 1000 mm (29.5 to < 39.4 in)		W8								
Customer specific length 1000 to < 1500 mm (39.4 to < 59 in)		Y1								
Customer specific length 1500 to < 2000 mm (59 to < 78.7 in)		Y3								

Continued see next page

Main ordering information SensyTemp TSP311-W	**XX**	**XX**	XX	XX	XX	XX	XX	XX
Thermowell Connection								
No extension / Connection head with thread M24 × 1,5	W1							
No extension / Connection head with thread ½ in NPT	W2							
No extension / Connection head with lock nut M24 × 1.5	W3							
Double nipple / G ½ A / G ½ A	W4							
Double nipple / ½ in NPT / 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 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 conycal thread ½ in NPT	N1							
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							
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							
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 < 150 mm (< 5.9 in)		W1						
Customer specific length 150 to < 300 mm (5.9 to < 11.8 in)		W2						
Customer specific length 300 to < 400 mm (11.8 to < 15.7 in)		W4						
Customer specific length 400 to < 500 mm (15.7 to < 19.7 in)		W5						
Customer specific length 500 to < 600 mm (19.7 to < 23.6 in)		W6						
Customer specific length 600 to < 750 mm (23.6 to < 29.5 in)		W7						
Customer specific length 750 to < 1000 mm (29.5 to < 39.4 in)		W8						
Customer specific length 1000 to < 1500 mm (39.4 to < 59 in)		Y1						
Customer specific length 1500 to < 2000 mm (59 to < 78.7 in)		Y3						
Customer specific length 2000 to < 3000 mm (78.7 to < 118 in)		Y5						
Customer specific length 3000 to < 5000 mm (118 to < 196.8 in)		Y7						
Customer specific length 5000 to < 10000 mm (196.8 to < 393.7 in)		Z1						
Customer specific length 10000 to < 15000 mm (393.7 to < 590.5 in)		Z3						
Customer specific length 15000 to < 20000 mm (590.5 to < 787.4 in)		Z4						

Continued see next page

… Ordering Information

Main ordering information SensyTemp TSP311-W	**XX**	**XX**	**XX**	**XX**	XX	XX
Measuring Inset Type					Continued	
RTD, Basic application, TF, measuring range −50 to 400 °C (−58 to 752 °F), 10 g	S1				see next	
RTD, Extended vibration resistance, TF, measuring range −50 to 400 °C (−58 to 752 °F), 60 g	S2				page	
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 10 g	D1					
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 3 g	D2					
Thermocouple	T1					
Others	Z9					
Measuring Inset Diameter						
3 mm (0,12 in)		D3				
6 mm (0,24 in)		D6				
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			
1 × Type K (NiCr-NiAl)			K1			
2 × Type K (NiCr-NiAl)			K2			
1 × Type J (Fe-CoNi)			J1			
2 × Type J (Fe-CoNi)			J2			
1 × Type N (NiCrSi-NiSi)			N1			
2 × Type N (NiCrSi-NiSi)			N2			
1 × Type T (Co-CoNi)			T1			
2 × Type T (Co-CoNi)			T2			
1 × Type E (NiCr-CoNi)			E1			
2 × Type E (NiCr-CoNi)			E2			
Sensor Accuracy						
RTD, Accuracy Class B, IEC 60751				B2		
Thin Film, Accuracy Class A, IEC 60751, Range −30 to 350 °C (−22 to 662 °F)				S1		
Wire Wound, Accuracy Class A, IEC 60751, Range −196 to 500 °C (−321 to 932 °F)				D1		
Wire Wound, Double, Accuracy Class A, IEC 60751, Range 0 to 250 °C (32 to 482 °F)				D2		
TC, Accuracy Class 2, IEC 60584				T2		
TC, Accuracy Class 1, IEC 60584				T1		
TF, Accuracy Class AA, IEC 60751, Range 0 to 100 °C (32 to 212 °F)				S3		
TC, Standard Accuracy ANSI MC96.1				T4		
TC, Special Accuracy ANSI MC96.1				T3		
Others				Z9		

Main ordering information SensyTemp TSP311-W	**XX**	**XX**
Connection Head Type / Material		
AGLH / Aluminium, high cover, screwed	L2	
AGLD / Aluminium, screwed cover with LCD indicator	L4	
AGSH / Stainless steel, high cover, screwed	S2	
AGSD / Stainless steel, screwed cover with LCD indicator	S4	
Others	Z9	
Transmitter		
WirelessHART		W1
WirelessHART + Harvester		W3

Additional ordering information SensyTemp TSP311-W

	XX	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Declaration of Compliance: 2.1							
Declaration of compliance according EN 10204-2.1, with the order	C4						
Test report: 2.2, Batch Values							
Test report according EN 10204-2.2 for batch values, MIC-TC		C5					
Inspection Certificate: 3.1, Visual, Dimensional and Functional Test							
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test			C6				
Inspection Certificate: 3.1, Sensor Tolerance							
Inspection certificate according EN 10204-3.1, sensor tolerance				CC			
Certificate: Sensor Calibration							
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		
Certificate: Other							
Other						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 TSP311-W	**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		
Documentation Language			
German		M1	
English		M5	
Name Plate			
Stainless steel plate with TAG no.			T1

Main ordering information SensyTemp TSP321-W

Base model	**TSP321-W**	**XX**	**XX**	**XX**	XX	XX	XX	XX	XX	XX	XX	XX	XX
SensyTemp TSP321-W Temperature Sensor, with tubular thermowell, WirelessHART													
Explosion Protection / Approvals													
Without		Y0											
Intrinsic Safety: ATEX II 1 G Ex ia IIC T4		A6											
Intrinsic Safety: IECEx ia IIC T4		H6											
Wetted Thermowell Material													
Stainless Steel ASTM 316L (1.4404)			S1										
Stainless Steel ASTM 316Ti (1.4571)			S2										
Heat Resistent Steel 1.4762			H2										
Stainless Steel AISI 314 (1.4841)			H3										
Stainless Steel ASTM 904L (1.4539)			S4										
Ni-Alloy Hastelloy C-276 (2.4819)			N1										
Ni-Alloy Hastelloy C-4 (2.4610)			N2										
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, 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									

Continued see next page

… Ordering Information

Main ordering information SensyTemp TSP321-W	**XXX**	**XX**	XX	XX	XX	XX	XX	XX	XX
Process Connection									
Without process connection (weld-in type)	Y00								
Adjustable compression fitting G ½, stainless steel	A01								
Adjustable compression fitting ½ in NPT, stainless steel	A02								
Cylindrical thread G ½ A	S01								
Cylindrical thread G ¾ A	S02								
Cylindrical thread G 1 A	S03								
Conical thread ½ in NPT	S04								
Conical thread ¾ in NPT	S05								
Conical thread 1 in NPT	S06								
Cylindrical thread M20 × 1.5	S07								
Cylindrical thread M27 × 2	S08								
Conical thread ½ in BSPT	S09								
Conical thread ¾ in BSPT	S10								
Conical thread 1 in BSPT	S11								
Flange DN 15 PN 10 to PN 40, B1, EN 1092-1	F01								
Flange DN 20 PN 10 to PN 40, B1, EN 1092-1	F02								
Flange DN 25 PN 10 to PN 40, B1, EN 1092-1	F03								
Flange DN 40 PN 10 to PN 40, B1, EN 1092-1	F04								
Flange DN 50 PN 10 to PN 40, B1, EN 1092-1	F05								
Flange DN 50 PN 6, B1, EN 1092-1	F06								
Flange 1 in 150 lbs, RF, ASME B16.5	F07								
Flange 1 in 300 lbs, RF, ASME B16.5	F08								
Flange 1-½ in 150 lbs, RF, ASME B16.5	F11								
Flange 1-½ in 300 lbs, RF, ASME B16.5	F12								
Flange 1-½ in 600 lbs, RF, ASME B16.5	F13								
Flange 1-½ in 900 / 1500 lbs, RF, ASME B16.5	F14								
Flange 2 in 150 lbs, RF, ASME B16.5	F15								
Flange 2 in 300 lbs, RF, ASME B16.5	F16								
Flange 2 in 600 lbs, RF, ASME B16.5	F17								
Flange 2 in 900 / 1500 lbs, RF, ASME B16.5	F18								
Others	Z99								
Thermowell Diameter									
9 mm (0.36 in)		A1							
11 mm (0.44 in)		A2							
12 mm (0.48 in)		A3							
14 mm (0.56 in)		A4							
13.7 mm (0.54 in)		B2							
10 mm (0.4 in)		A6							
Others		Z9							

Continued see next page

Main ordering information SensyTemp TSP321-W	**XX**	**XX**	**XX**	XX	XX	XX	XX
Immersion Length				Continued see next page			
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 < 150 mm (< 5.9 in)	W1						
Customer specific length 150 to < 300 mm (5.9 to < 11.8 in)	W2						
Customer specific length 300 to < 400 mm (11.8 to < 15.7 in)	W4						
Customer specific length 400 to < 500 mm (15.7 to < 19.7 in)	W5						
Customer specific length 500 to < 600 mm (19.7 to < 23.6 in)	W6						
Customer specific length 600 to < 750 mm (23.6 to < 29.5 in)	W7						
Customer specific length 750 to < 1000 mm (29.5 to < 39.4 in)	W8						
Customer specific length 1000 to < 1500 mm (39.4 to < 59 in)	Y1						
Customer specific length 1500 to < 2000 mm (59 to < 78.7 in)	Y3						
Customer specific length 2000 to < 3000 mm (78.7 to < 118 in)	Y5						
Customer specific length 3000 to < 5000 mm (118 to < 196.8 in)	Y7						
Customer specific length 5000 to < 10000 mm (196.8 to < 393.7 in)	Z1						
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 < 150 mm (< 5.9 in)		W1					
Customer specific length 150 to < 300 mm (5.9 to < 11.8 in)		W2					
Customer specific length 300 to < 400 mm (11.8 to < 15.7 in)		W4					
Customer specific length 400 to < 500 mm (15.7 to < 19.7 in)		W5					
Customer specific length 500 to < 600 mm (19.7 to < 23.6 in)		W6					
Customer specific length 600 to < 750 mm (23.6 to < 29.5 in)		W7					
Customer specific length 750 to < 1000 mm (29.5 to < 39.4 in)		W8					
Customer specific length 1000 to < 1500 mm (39.4 to < 59 in)		Y1					
Customer specific length 1500 to < 2000 mm (59 to < 78.7 in)		Y3					
Customer specific length 2000 to < 3000 mm (78.7 to < 118 in)		Y5					
Customer specific length 3000 to < 5000 mm (118 to < 196.8 in)		Y7					
Measuring Inset Type							
Without measuring inset			Y0				
RTD, Basic application, measuring range −50 to 400 °C (−58 to 752 °F), 10 g			S1				
RTD, Extended vibration resistance, measuring range −50 to 400 °C (−58 to 752 °F), 60 g			S2				
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 10 g			D1				
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 3 g			D2				
RTD, adjustable to German calibration regulations, sign of app. 000/308 - without calibration			E1				
Thermocouple			T1				
Others			Z9				

… Ordering Information

Main ordering information SensyTemp TSP321-W	**XX**	**XX**	**XX**	**XX**
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			
1 × Type K (NiCr-NiAl)	K1			
2 × Type K (NiCr-NiAl)	K2			
1 × Type J (Fe-CoNi)	J1			
2 × Type J (Fe-CoNi)	J2			
1 × Type N (NiCrSi-NiSi)	N1			
2 × Type N (NiCrSi-NiSi)	N2			
1 × Type T (Co-CoNi)	T1			
2 × Type T (Co-CoNi)	T2			
1 × Type E (NiCr-CoNi)	E1			
2 × Type E (NiCr-CoNi)	E2			
Sensor Accuracy				
RTD, Accuracy Class B, IEC 60751		B2		
Thin Film, Accuracy Class A, IEC 60751, Range −30 to 350 °C (−22 to 662 °F)		S1		
Wire Wound, Accuracy Class A, IEC 60751, Range −196 to 500 °C (−321 to 932 °F)		D1		
Wire Wound, Double, Accuracy Class A, IEC 60751, Range 0 to 250 °C (32 to 482 °F)		D2		
TC, Accuracy Class 2, IEC 60584		T2		
TC, Accuracy Class 1, IEC 60584		T1		
TF, Accuracy Class AA, IEC 60751, Range 0 to 100 °C (0 to 212 °F)		S3		
TC, Standard Accuracy ANSI MC96.1		T4		
TC, Special Accuracy ANSI MC96.1		T3		
Others		Z9		
Connection Head Type / Material				
AGLH / Aluminium, high cover, screwed			L2	
AGLD / Aluminium, screwed cover with LCD indicator			L4	
AGSH / Stainless steel, high cover, screwed			S2	
AGSD / Stainless steel, screwed cover with LCD indicator			S4	
Others			Z9	
Transmitter				
WirelessHART				W1

Additional ordering information SensyTemp TSP321-W

	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
Declaration of Compliance: 2.1										
Declaration of compliance according EN 10204-2.1, with the order	C4									
Test report: 2.2, Material Monitoring for Wetted Parts										
Test report according EN 10204-2.2, material monitoring for wetted parts		C1								
Test report: 2.2, Batch Values										
Test report according EN 10204-2.2 for batch values, MIC-TC			C5							
Inspection Certificate: 3.1, 3.2, Material Monitoring for Wetted Parts										
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: 3.1, Visual, Dimensional and Functional Test										
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test					C6					
Inspection Certificate: 3.1, Helium Leakage Test										
Inspection certificate according EN 10204-3.1, helium leakage test						C7				
Inspection Certificate: 3.1, Dye Penetration Test										
Inspection certificate according EN 10204-3.1, dye penetration test							C9			
Inspection Certificate: 3.1, PMI Test										
Inspection certificate according EN 10204-3.1, Positive Material Identification (PMI)								CA		
Inspection Certificate: 3.1, Pressure Test										
Inspection certificate according EN 10204-3.1, pressure test on thermowell									CB	
Inspection Certificate: 3.1, Sensor Tolerance										
Inspection certificate according EN 10204-3.1, sensor tolerance										CC

… Ordering Information

Additional ordering information SensyTemp TSP321-W	**XX**	**XX**	**XX**	**XX**
Certificate: Sensor Calibration				
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			
Certificate: Other				
Other		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

Additional ordering information SensyTemp TSP321-W	**XX**	**XX**	**XX**	**XX**	**XX**
Thermowell Options					
Thermowell stainless steel with additional tantalum sleeve	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 (specify length from thermowell tip in mm)	S4				
Thermowell coated with 0.5 mm (0.02 in) NiZrO2 / PL1312 (specify length from thermowell tip in mm)	S5				
Thermowell clean for oxygen service	S9				
Others	SZ				
Flange Connection Options					
Flange facing with groove form C EN 1092-1		F1			
Flange facing with tongue form D EN 1092-1		F2			
Flange facing with RTJ surface ASME B16.5		F3			
Others		FZ			
Thermometer single packed					
Each Thermometer single packed - Polyethylen			PN		
Documentation Language					
German				M1	
English				M5	
Name Plate					
Stainless steel plate with TAG no.					T1

… Ordering Information

Main ordering information SensyTemp TSP331-W

Base model	**TSP331-W**	**XX**	**XX**	XX	XXX	XX	XX	XX	XX	XX	XX	XX	XX	XX
SensyTemp TSP331-W Temperature Sensor, with drilled thermowell, WirelessHART														
Explosion Protection / Approvals														Continued see next page
Without		Y0												
Intrinsic Safety: ATEX II 1 G Ex ia IIC T4		A6												
Intrinsic Safety: IECEx ia IIC T4		H6												
Wetted Thermowell Material														
Stainless Steel ASTM 316L (1.4404)			S1											
Stainless Steel ASTM 316Ti (1.4571)			S2											
High temperature Steel 13CrMo4-5 (1.7335)			W1											
High temperature Steel 10CrMo9-10 (1.7380)			W2											
High temperature Steel 16Mo3, formerly 15Mo3 (1.5415)			W3											
Stainless steel (1.4961)			W4											
Heat Resistent Steel AISI 446 (1.4749)			H1											
Heat Resistent Steel 1.4762			H2											
Stainless Steel AISI 314 (1.4841)			H3											
Stainless Steel ASTM 904L (1.4539)			S4											
Ni-Alloy Hastelloy C-276 (2.4819)			N1											
Ni-Alloy Hastelloy C-4 (2.4610)			N2											
Ni-Alloy Hastelloy B-2 (2.4617)			N3											
NiCo-Alloy Monel 400 (2.4360)			N4											
Ni-Alloy Incoloy 800 (1.4876)			H4											
Ni-Alloy Inconel 600 (2.4816)			N5											
Stainless Steel ASTM 304 (1.4301)			S5											
Stainless Steel ASTM 321 (1.4541)			S6											
Others			Z9											

Main ordering information SensyTemp TSP331-W	**XX**	**XXX**	XX	XX	XX	XX	XX	XX	XX	XX	XX
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), (DIN 43772, Form 4F)	D4										
Weld-in thermowell from bar stock material, diameter F2 = 32 mm (1.26 in), (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										
Others	Z9										
Process Connection											
Without process connection (weld-in type)		Y00									
Conical thread ½ in NPT		S04									
Conical thread ¾ in NPT		S05									
Conical thread 1 in NPT		S06									
Flange DN 25 PN 10 to PN 40, B1, EN 1092-1		F03									
Flange DN 40 PN 10 to PN 40, B1, EN 1092-1		F04									
Flange DN 50 PN 10 to PN 40, B1, EN 1092-1		F05									
Flange DN 50 PN 6, B1, EN 1092-1		F06									
Flange 1 in 150 lbs, RF, ASME B16.5		F07									
Flange 1 in 300 lbs, RF, ASME B16.5		F08									
Flange 1-½ in 150 lbs, RF, ASME B16.5		F11									
Flange 1-½ in 300 lbs, RF, ASME B16.5		F12									
Flange 1-½ in 600 lbs, RF, ASME B16.5		F13									
Flange 1-½ in 900 / 1500 lbs, RF, ASME B16.5		F14									
Flange 2 in 150 lbs, RF, ASME B16.5		F15									
Flange 2 in 300 lbs, RF, ASME B16.5		F16									
Flange 2 in 600 lbs, RF, ASME B16.5		F17									
Flange 2 in 900 / 1500 lbs, RF, ASME B16.5		F18									
Others		Z99									

Continued see next page

… Ordering Information

Main ordering information SensyTemp TSP331-W	**XX**	**XX**	**XX**	XX	XX	XX	XX	XX	XX
Extension Tube Length									
K = 242 mm (9.5 in), free length up to cooling element = 152 mm (6 in), Harvester	H1								
K = 267 mm (10.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 25 mm (1 in)	H2								
K = 292 mm (11.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 50 mm (2 in)	H3								
K = 317 mm (12.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 75 mm (3 in)	H4								
K = 342 mm (13.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 100 mm (4 in)	H5								
K = 150 mm (6 in)	K1								
Customer specific length < 150 mm (< 5.9 in)	W1								
Customer specific length 150 to < 300 mm (5.9 to < 11.8 in)	W2								
Customer specific length 300 to < 400 mm (11.8 to < 15.7 in)	W4								
Customer specific length 400 to < 500 mm (15.7 to < 19.7 in)	W5								
Customer specific length 500 to < 600 mm (19.7 to < 23.6 in)	W6								
Customer specific length 600 to < 750 mm (23.6 to < 29.5 in)	W7								
Customer specific length 750 to < 1000 mm (29.5 to < 39.4 in)	W8								
Customer specific length 1000 to < 1500 mm (39.4 to < 59 in)	Y1								
Customer specific length 1500 to < 2000 mm (59 to < 78.7 in)	Y3								
Thermowell Connection									
Extension tube with Cylindrical thread M14 × 1,5		M1							
Extension tube with Cylindrical thread M18 × 1,5		M2							
Extension tube with conycal thread ½ in NPT		N1							
Extension with Male nut, thread G ½ in		U6							
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							
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 < 150 mm (< 5.9 in)			W1						
Customer specific length 150 to < 300 mm (5.9 to < 11.8 in)			W2						
Customer specific length 300 to < 400 mm (11.8 to < 15.7 in)			W4						
Customer specific length 400 to < 500 mm (15.7 to < 19.7 in)			W5						
Customer specific length 500 to < 600 mm (19.7 to < 23.6 in)			W6						
Customer specific length 600 to < 750 mm (23.6 to < 29.5 in)			W7						
Customer specific length 750 to < 1000 mm (29.5 to < 39.4 in)			W8						
Customer specific length 1000 to < 1500 mm (39.4 to < 59 in)			Y1						

Continued see next page

Main ordering information SensyTemp TSP331-W	**XX**	**XX**	**XX**	XX	XX	XX
Thermowell Length						Continued see
L = 110 mm (4.4 in), C = 65 mm (2.5 in)	D1					next page
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) - European standard	P1					
Custom specification	D9					
Others	Z9					
Measuring Inset Type						
Without measuring inset		Y0				
RTD, Basic application, measuring range −50 to 400 °C (−58 to 752 °F), 10 g		S1				
RTD, Extended vibration resistance, measuring range −50 to 400 °C (−58 to 752 °F), 60 g		S2				
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 10 g		D1				
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 3 g		D2				
RTD, adjustable to German calibration regulations, sign of app. 000/308 - without calibration		E1				
Thermocouple		T1				
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			
1 × Type K (NiCr-NiAl)			K1			
2 × Type K (NiCr-NiAl)			K2			
1 × Type J (Fe-CoNi)			J1			
2 × Type J (Fe-CoNi)			J2			
1 × Type N (NiCrSi-NiSi)			N1			
2 × Type N (NiCrSi-NiSi)			N2			
1 × Type T (Co-CoNi)			T1			
2 × Type T (Co-CoNi)			T2			
1 × Type E (NiCr-CoNi)			E1			
2 × Type E (NiCr-CoNi)			E2			

… Ordering Information

Main ordering information SensyTemp TSP331-W	**XX**	**XX**	**XX**
Sensor Accuracy			
RTD, Accuracy Class B, IEC 60751	B2		
Thin Film, Accuracy Class A, IEC 60751, Range −30 to 350 °C (−22 to 662 °F)	S1		
Wire Wound, Accuracy Class A, IEC 60751, Range −196 to 500 °C (−321 to 932 °F)	D1		
Wire Wound, Double, Accuracy Class A, IEC 60751, Range 0 to 250 °C (32 to 482 °F)	D2		
TC, Accuracy Class 2, IEC 60584	T2		
TC, Accuracy Class 1, IEC 60584	T1		
TF, Accuracy Class AA, IEC 60751, Range 0 to 100 °C (0 to 212 °F)	S3		
TC, Standard Accuracy ANSI MC96.1	T4		
TC, Special Accuracy ANSI MC96.1	T3		
Others	Z9		
Connection Head Type / Material			
AGLH / Aluminium, high cover, screwed		L2	
AGLD / Aluminium, screwed cover with LCD indicator		L4	
AGSH / Stainless steel, high cover, screwed		S2	
AGSD / Stainless steel, screwed cover with LCD indicator		S4	
Transmitter			
WirelessHART			W1
WirelessHART + Harvester			W3

Additional ordering information SensyTemp TSP331-W

	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
Declaration of Compliance: 2.1										
Declaration of compliance according EN 10204-2.1, with the order	C4									
Test report: 2.2, Material Monitoring for Wetted Parts										
Test report according EN 10204-2.2, material monitoring for wetted parts		C1								
Test report: 2.2, Batch Values										
Test report according EN 10204-2.2 for batch values, MIC-TC			C5							
Inspection Certificate: 3.1, 3.2, Material Monitoring for Wetted Parts										
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: 3.1, Visual, Dimensional and Functional Test										
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test					C6					
Inspection Certificate: 3.1, Helium Leakage Test										
Inspection certificate according EN 10204-3.1, helium leakage test						C7				
Inspection Certificate: 3.1, Dye Penetration Test										
Inspection certificate according EN 10204-3.1, dye penetration test							C9			
Inspection Certificate: 3.1, PMI Test										
Inspection certificate according EN 10204-3.1, Positive Material Identification (PMI)								CA		
Inspection Certificate: 3.1, Pressure Test										
Inspection certificate according EN 10204-3.1, pressure test on thermowell									CB	
Inspection Certificate: 3.1, Sensor Tolerance										
Inspection certificate according EN 10204-3.1, sensor tolerance										CC

… Ordering Information

Additional ordering information SensyTemp TSP331-W	**XX**	**XX**	**XX**	**XX**
Certificate: Sensor Calibration				
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			
Certificate: Other				
Other		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

Additional ordering information SensyTemp TSP331-W	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Thermowell Options						
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 (specify length from thermowell tip in mm)	S4					
Thermowell coated with 0.5 mm (0.02 in) NiZrO2 / PL1312 (specify length from thermowell tip in mm)	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					
Others	SZ					
Thermowell Stress Calculations						
Thermowell stress calculation according Dittrich / Kohler		SD				
Thermowell stress calculation according Murdock		SM				
Flange Connection Options						
Flange facing with groove form C EN 1092-1			F1			
Flange facing with tongue form D EN 1092-1			F2			
Flange facing with RTJ surface ASME B16.5			F3			
Flange full penetration welded			F4			
Others			FZ			
Thermometer single packed						
Each Thermometer single packed - Polyethylen				PN		
Documentation Language						
German					M1	
English					M5	
Name Plate						
Stainless steel plate with TAG no.						T1

… Ordering Information

Main ordering information SensyTemp TSP341-W

Base model	**TSP341-W**	**XX**	**XXX**	**XX**	**XX**	**XX**	XX	XX	XX	XX
SensyTemp TSP341-W Temperature Sensor, Clamp-on, WirelessHART										
Explosion Protection / Approvals										Continued see next page
Without		Y0								
Intrinsic Safety: ATEX II 1 G Ex ia IIC T4		A6								
Intrinsic Safety: IECEx ia IIC T4		H6								
Sensor Mounting										
Clamp-on, sensor in 90° angle to pipe			Y11							
Clamp-on, sensor attached alongside to pipe 1.4571			Y22							
Clamp-on, sensor attached alongside to pipe 1.4404			Y23							
Pipe Diameter										
DN150				C1						
DN200				C2						
DN300				C3						
DN400				C4						
DN500				C5						
Others				Z9						
Extension Tube Length										
K = 242 mm (9.5 in), free length up to cooling element = 152 mm (6 in), Harvester					H1					
K = 267 mm (10.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 25 mm (1 in)					H2					
K = 292 mm (11.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 50 mm (2 in)					H3					
K = 317 mm (12.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 75 mm (3 in)					H4					
K = 342 mm (13.5 in), free length up to cooling element = 152 mm (6 in), Harvester, adapter 100 mm (4 in)					H5					
K = 150 mm (6 in)					K1					
Customer specific length 150 to < 300 mm (5.9 to < 11.8 in)					W2					
Customer specific length 300 to < 400 mm (11.8 to < 15.7 in)					W4					
Customer specific length 400 to < 500 mm (15.7 to < 19.7 in)					W5					
Measuring Inset Type										
RTD, Basic application, measuring range −50 to 400 °C (−58 to 752 °F), 10 g						S1				
RTD, Extended vibration resistance, measuring range −50 to 400 °C (−58 to 752 °F), 60 g						S2				
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 10 g						D1				
RTD, Extended measuring range, WW, measuring range −196 to 600 °C (−321 to 1112 °F), 3 g						D2				
Thermocouple						T1				

Main ordering information SensyTemp TSP341-W	**XX**	**XX**	**XX**	**XX**
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			
1 × Type K (NiCr-NiAl)	K1			
2 × Type K (NiCr-NiAl)	K2			
1 × Type J (Fe-CoNi)	J1			
2 × Type J (Fe-CoNi)	J2			
1 × Type N (NiCrSi-NiSi)	N1			
2 × Type N (NiCrSi-NiSi)	N2			
1 × Type T (Co-CoNi)	T1			
2 × Type T (Co-CoNi)	T2			
1 × Type E (NiCr-CoNi)	E1			
2 × Type E (NiCr-CoNi)	E2			
Sensor Accuracy				
RTD, Accuracy Class B, IEC 60751		B2		
Thin Film, Accuracy Class A, IEC 60751, Range −30 to 350 °C (−22 to 662 °F)		S1		
Wire Wound, Accuracy Class A, IEC 60751, Range −196 to 500 °C (−321 to 932 °F)		D1		
Wire Wound, Double, Accuracy Class A, IEC 60751, Range 0 to 250 °C (32 to 482 °F)		T2		
TC, Accuracy Class 2, IEC 60584		T1		
TC, Accuracy Class 1, IEC 60584		T4		
TC, Standard Accuracy ANSI MC96.1		T3		
Connection Head Type / Material				
AGLH / Aluminium, high cover, screwed			L2	
AGLD / Aluminium, screwed cover with LCD indicator			L4	
AGSH / Stainless steel, high cover, screwed			S2	
AGSD / Stainless steel, screwed cover with LCD indicator			S4	
Transmitter				
WirelessHART				W1
WirelessHART + Harvester				W3

… Ordering Information

Additional ordering information SensyTemp TSP341-W

	XX	XX	XX	XX	XX	XX	XX
Declaration of Compliance: 2.1							
Declaration of compliance according EN 10204-2.1, with the order	C4						
Test report: 2.2, Batch Values							
Test report according EN 10204-2.2 for batch values, MIC-TC		C5					
Inspection Certificate: 3.1, Visual, Dimensional and Functional Test							
Inspection certificate according EN 10204-3.1, visual, dimensional and functional test			C6				
Inspection Certificate: 3.1, Sensor Tolerance							
Inspection certificate according EN 10204-3.1, sensor tolerance				CC			
Certificate: Sensor Calibration							
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		
Certificate: Other							
Other						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 TSP341-W	**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		
Documentation Language			
German		M1	
English		M5	
Name Plate			
Stainless steel plate with TAG no.			T1

Accessories	**Order code**
Lithium battery	3KXT000029U0000
TSP300-W Commissioning Instruction, German	3KXT161300R4403
TSP300-W Commissioning Instruction, English	3KXT161300R4401
TSP300-W Commissioning Instruction, Language package Western Europe / Scandinavia	3KXT161300R4493
TSP300-W Commissioning Instruction, Language package Eastern Europe	3KXT161300R4494
TSP300-W Documentation CD-ROM	3KXT161300R0800

Order form configuration

Configuration		**Selection**
Measurement type		☐ Sensor redundancy / sensor backup
(for 2-sensor selection only)		☐ Sensor drift monitoring ____°C / K sensor drift difference ____s time limit for drift overshoot
		☐ Difference measurement
		☐ Average measurement
Software write protection		☐ Off (standard) ☐ On
TAG number		☐ _____
Long TAG number		☐ _____
Network ID		☐ Hexadecimal value ABB standard or _____
Join key		☐ Hexadecimal value ABB standard or _____
		☐ Hexadecimal value ABB standard or _____
		☐ Hexadecimal value ABB standard or _____
		☐ Hexadecimal value ABB standard or _____
Burst message 1	HART command	☐ 3 'Dynamic HART variables'
		☐ 9 'Device variables with status' (ABB-Standard)
	Update rate	☐ 4 seconds
		☐ 8 seconds
		☐ 16 seconds
		☐ 32 seconds
		☐ 60 to 3600 seconds _____

Trademarks

WirelessHART is a registered trademark of FieldComm Group, Austin, Texas, USA

Castel Maggiore (BO) 40013
Via Lirone 60/i

e-mail: info@eurotecsrl.com
Tel: +39 051/6321595
Website: www.eurotecsrl.com

C.F.: 04103780377
P.I.: 01596581205

ABB Limited
Measurement & Analytics
Howard Road, St. Neots
Cambridgeshire, PE19 8EU
UK
Tel: +44 (0)870 600 6122
Fax: +44 (0)1480 213 339
Email: enquiries.mp.uk@gb.abb.com

ABB Inc.
Measurement & Analytics
125 E. County Line Road
Warminster, PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

ABB Automation Products GmbH
Measurement & Analytics
Schillerstr. 72
32425 Minden
Germany
Tel: +49 571 830-0
Fax: +49 571 830-1806

abb.com/wirelessmeasurement

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail.
ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB.

© ABB 2019

3KXT161300R1001

DS/TSP300-W-EN Rev. C 08.2019