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ABB MEASUREMENT & ANALYTICS | DATA SHEET

# SensyTemp TSH200

## Straight thermocouples



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## Measurement made easy

Cost-effective Modular Design  
Supports Numerous Applications

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**For high-temperature applications up to 1800 °C (3272 °F)**

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### Modular design system

- Thermocouple, thermowell, gas-tight inner tube, holding tube, connection head, transmitter

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### Interchangeable thermocouple

- Sensor element can be exchanged during operation

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### Approvals

- Manufacturer's declaration for use in intrinsically safe circuits

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### Transmitter in connection head

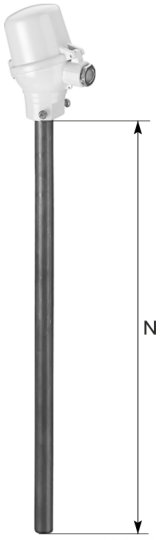
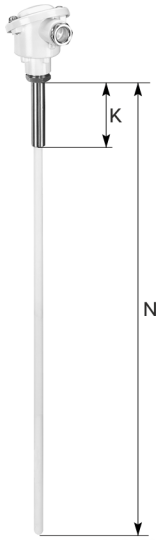
- Reduced wiring, high measuring accuracy, high interference resistance, interface to all state-of-the-art distributed control systems

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### Areas of application

- Industrial furnaces, garbage and hazardous waste incineration, reheating and tempering furnaces, cement and brick production, porcelain and ceramics industry, glass industry, smelting operations, blast furnaces, air-circulation furnaces

## Overview of temperature sensors

Type	TSH210	TSH220
	 <p>N Nominal length</p>	 <p>N Nominal length K Holding tube length</p>
Versions	In accordance with EN 50446: AM, AMK, BM, BMK	In accordance with EN 50446: AK, AKK, BK
Thermowell properties	Metal thermowell	Ceramic thermowell
max. operating temperature	1300 °C (2372 °F)	1800 °C (3272 °F)
components	Thermocouple, thermowell, inner tube, process connection, connection head, transmitter	Thermocouple, thermowell, inner tube, support tube, process connection, connection head, transmitter
Standard process connection	Stop flange with counterflange, threaded socket, welded standard flange	
Thermowell Ø mm (in)	15 (0.59), 22 (0.87), 26 (1.02), 26.7 (1.05), 32 (1.26)	8 (0.31), 10 (0.39), 15 (0.59), 16 (0.63), 24 (0.94), 26 (1.02)
Standard thermowell materials	1.4571, 1.4749, 1.4841, Kanthal® AF, Inconel® 601	Ceramic C530, Ceramic C610, Ceramic C799
Standard inner tube materials	Ceramic C610	Ceramic C799
Standard holding tube materials	Without support tube (one-piece metal thermowell)	Stainless steel 1.4571 (AISI 316 Ti)
Connection heads	A, AUS, AUZ, AUZH, B, BUS, BUZ, BUZH	A, AUS, AUZ, AUZH, B, BUS, BUZ, BUZH
Output signals	Thermal voltage, 4 to 20 mA, HART®, PROFIBUS PA®, FOUNDATION Fieldbus®	
Thermocouples (EN 60584)	Type K, J, N, R, S, B single/dual	Type K, J, N, R, S, B single/dual
Explosion protection class	Installation in non-Ex zone, with manufacturer's declaration for connection to intrinsically safe circuits	
Application	Reheating and hardening furnaces, smelting operations, blast furnaces, waste incineration, flue-gas desulfurization	Cement and brick manufacturing, porcelain and ceramics industry, garbage and hazardous waste incineration, glass industry, steel industry
Process pressure	Depressurized	Depressurized
Weight for standard designs	1.0 to 7.0 kg (2.20 to 15.43 lb)	0.5 to 5.0 kg (1.10 to 11.02 lb)

## ... Overview of temperature sensors

### Versions

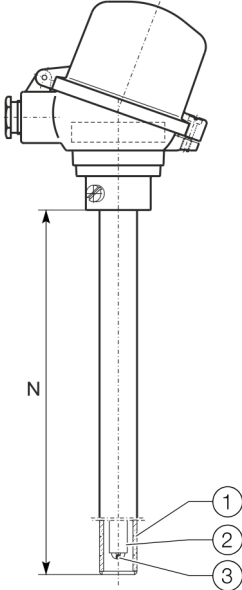
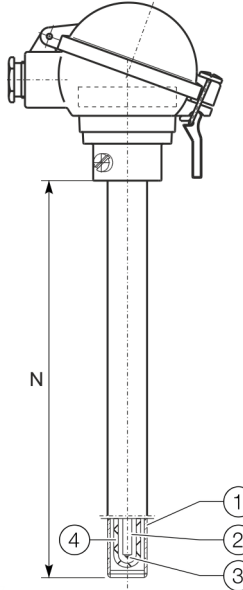
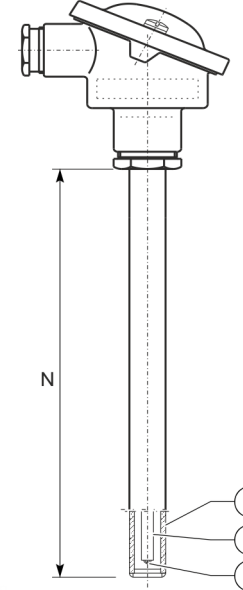
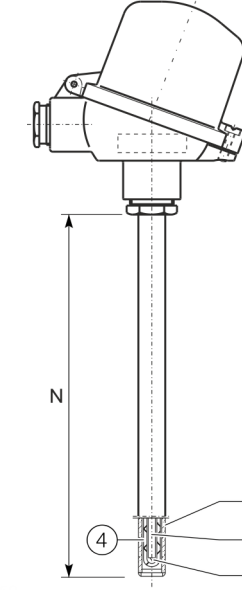
In EN 50446, versions are divided into the following types, according to the shape of the connection head and material of the thermowell:

AM, AMK, BM, BMK, AK, AKK, BK, BKK

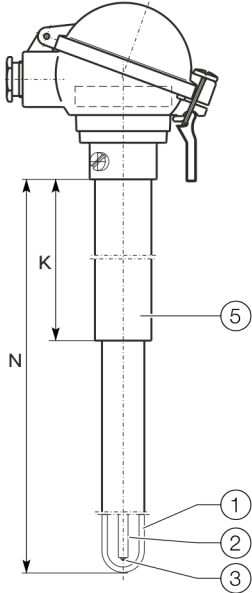
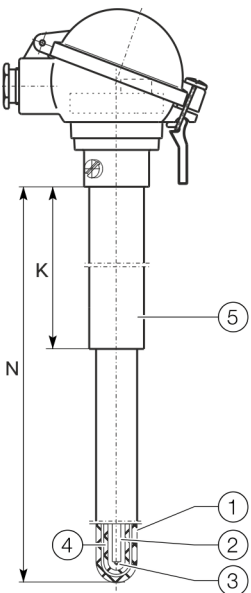
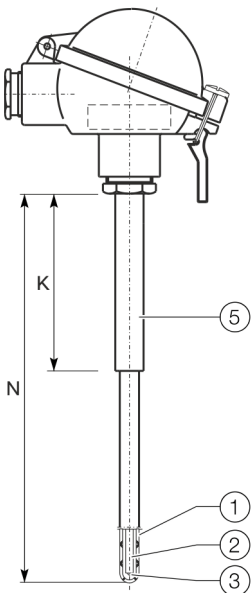
The three letters stand for the following designs:

1. position:	A	Connection head, form A
	B	Connection head, form B
2. position:	M	Metal thermowell
	K	Ceramic thermowell
3. position:	K	Ceramic inner tube
	n.a.	Without inner tube

### SensyTemp TSH210 temperature sensor

Type	AM	AMK	BM	BMK
				
	① Metal thermowell ② Insulating rod ③ Thermocouple	④ Ceramic inner tube	④ Ceramic inner tube	
			N Nominal length	
Connection heads	A, AUS, AUZ, AUZH	A, AUS, AUZ, AUZH	B, BUS, BUZ, BUZH	B, BUS, BUZ, BUZH
Thermowell	Metal thermowell	Metal thermowell	Metal thermowell	Metal thermowell
Inner tube	without	Ceramic inner tube	without	Ceramic inner tube
Standard nominal length mm (in)	500 (19.69); 710 (27.95); 1000 (39.37); 1400 (55.12); 2000 (78.74)		355 (13.98), 500 (19.69), 710 (27.95), 1000 (39.37), 1400 (55.12)	355 (13.98), 500 (19.69), 710 (27.95), 1000 (39.37)
Nominal length	100 / 5000	100 / 2000	100 / 2000	100 / 1400
min. / max. mm (in)	(3.94 / 196.85)	(3.94 / 78.74)	(3.94 / 78.74)	(3.94 / 55.12)

### SensyTemp TSH200 temperature sensor

Type	AK	AKK	BK
			
	<ul style="list-style-type: none"> <li>① Ceramic thermowell</li> <li>② Insulating rod</li> <li>③ Thermocouple</li> <li>④ Ceramic inner tube</li> </ul>	<ul style="list-style-type: none"> <li>⑤ Holding tube</li> </ul>	<ul style="list-style-type: none"> <li>N Nominal length</li> <li>K Holding tube length</li> </ul>
Connection heads	A, AUS, AUZ, AUZH	A, AUS, AUZ, AUZH	B, BUS, BUZ, BUZH
Thermowell	Ceramic thermowell	Ceramic thermowell	Ceramic thermowell
Inner tube	without	Ceramic inner tube	without
Standard nominal length mm (in)	500 (19.69), 710 (27.95), 1000 (39.37), 1400 (55.12), 2000 (78.74)	500 (19.69), 710 (27.95), 1000 (39.37), 1400 (55.12)	355 (13.98), 500 (19.69), 710 (27.95), 1000 (39.37)
Nominal length min. / max. mm (in)	K + 100 (3.94) / 2000 (78.74)	K + 100 (3.94) / 2000 (78.74)*	100 (3.94) / 1400 (55.12)

\* For thermowell C799,  $\varnothing 15 \times 2.5$  mm and thermowell C610,  $\varnothing 16 \times 2$ :  $N_{max} = 1400$  mm  
 (For thermowell C799,  $\varnothing 0.59 \times 0.10$  in and thermowell C610,  $\varnothing 0.63 \times 0.08$  in:  $N_{max} = 55.12$  in)

## Installation instructions

### Mounting position

For high process temperatures, we recommend a vertical mounting position of the temperature sensor to protect against bending and prevent mechanical damage to the thermowell.

If the temperature sensor can only be mounted in a horizontal mounting position, the thermowell should be supported.

### Mounting in installations at operating temperature

Ceramic thermowells are characterized by a high level of hardness and brittleness. If ceramic thermowells are exposed to temperature shock, they can crack due to internal stress in their grain structure.

For this reason, temperature sensors with ceramic thermowells may only be introduced gradually into the process:

Process temperature	Slide-in rate
$\leq 1600\text{ }^{\circ}\text{C}$ ( $\leq 2912\text{ }^{\circ}\text{F}$ )	1 to 2 cm/min (0.4 to 0.8 in/min)
$\leq 1200\text{ }^{\circ}\text{C}$ ( $\leq 2192\text{ }^{\circ}\text{F}$ )	10 to 20 cm/min (3.9 to 7.8 in/min)

### Gas tightness

Gas-tight ceramic materials are typically only resistant to temperature changes on a limited basis. To reduce the risk of temperature shock and prevent the thermowell from subsequently bursting, temperature sensors with gas-tight ceramic thermowells must be heated before installation.

High temperature sensors are generally designed for use in pressureless processes.

When fastening the temperature sensor using limit stop flanges and counterflanges, a pressure of up to approx. 1 bar (14.50 psi) of gas tightness can be assumed with proper installation. Refer to EN 50446 in this regard.

### SensyTemp TSH210 sample installation

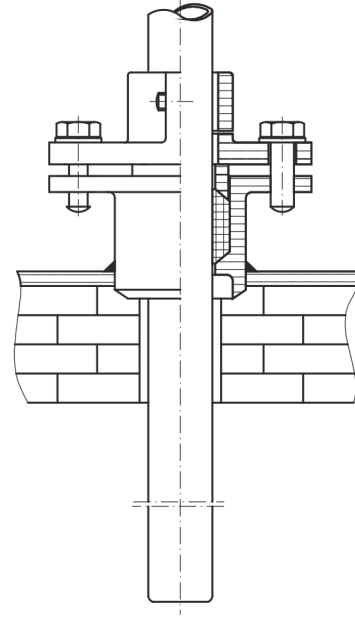


Figure 1: SensyTemp TSH210 sample installation

Gas-tightness up to 1 bar (14.50 psi) can be achieved with a threaded socket or a combination of limit stop flange / counterflange.

- The threaded socket is fastened and simultaneously gasketed by clamping the packed gland to the metal thermowell.
- When using the limit stop flange / counterflange combination, the unit is fastened by clamping it between the limit stop flange and the metal thermowell. A gland seal between counter flange and metal thermowell provides the seal.

The installation length is customizable for both models.

### SensyTemp TSH220 sample installation

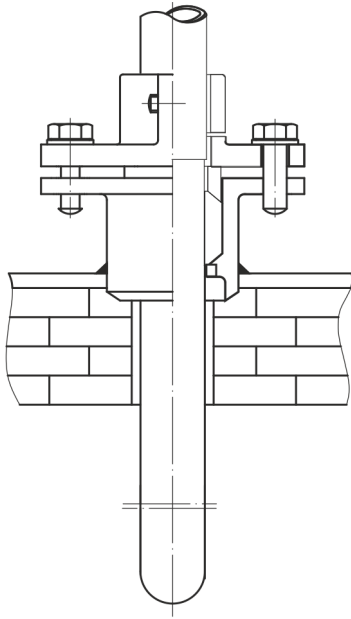


Figure 2: SensyTemp TSH220 sample installation

Gas-tightness up to 1 bar (14.50 psi) can be achieved only with a combination of limit stop flange / counterflange.

- When using the limit stop flange / counterflange combination, the unit is fastened by clamping it between the limit stop flange and the metal holding tube. A gland seal between counter flange and ceramic thermowell provides the seal.

The installation length can be modified only minimally. This must be taken into consideration when ordering.

#### Note

When installing this temperature sensor using a threaded socket, the gland seal is clamped to the metal support tube to simultaneously mount and seal the unit. Since the ceramic thermowell is transitioned to the holding tube in process, a gas-tightness of 1 bar (14.50 psi) cannot be guaranteed.

## Specification

The permissible load for a temperature sensor depends on several factors:

Medium-specific factors	Installation-specific factors
<ul style="list-style-type: none"> <li>• Medium</li> <li>• Viscosity</li> <li>• Medium velocity</li> <li>• Pressure</li> <li>• Temperature</li> </ul>	<ul style="list-style-type: none"> <li>• Thermowell material</li> <li>• Thermowell form</li> <li>• Installation length</li> <li>• Sealable pressure of process connection</li> <li>• Vibration</li> </ul>

Considering the wide range of configuration options, it is not possible to provide generally applicable information. The following information provides recommended values. For conditions that vary significantly from those described herein, contact your ABB partner.

#### Ambient temperature at connection head

Type	Ambient temperature
Connection head without transmitter and with suited cable gland	-40 to 120 °C (-40 to 248 °F)
Connection head with transmitter	-40 to 85 °C (-40 to 185 °F)

In specific applications, high temperature sensors are frequently subjected to higher temperatures at the connection head.

In temperature sensors with cable glands, the supplied cable gland (thread M20 × 1.5) is fitted with a silicon thrust collar instead of a rubber thrust collar.

## ... Specification

### Process temperature

The maximum process temperature depends on the thermocouple and thermowell material.

The long-term stability is considerably better for thermocouples with thicker wires than for wires with small diameters. For this reason, whenever possible ABB provides the base metal thermocouples with 2.5 mm (0.10 in) wire diameters instead of 1.38 mm (0.05 in).

For precious metal thermocouples, ABB provides wire diameters of 0.5 mm (0.02 in) as standard.

Precious metal thermocouples with wire diameters of 0.35 mm (0.01 in) are also available upon request.

Recommended max. operating temperature depending on wire diameter:

Thermocouple	Wire Ø mm (in)	Max. temperature
J	1.38 (0.05)	600 °C (1112 °F)
	2.5 (0.10)	700 °C (1292 °F)
K	1.38 (0.05)	1000 °C (1832 °F)
	2.5 (0.10)	1200 °C (2192 °F)
N	1.38 (0.05)	1000 °C (1832 °F)
	2.5 (0.10)	1200 °C (2192 °F)
R	0.35 (0.01)	1300 °C (2372 °F)
	0.5 (0.02)	1600 °C (2912 °F)
S	0.35 (0.01)	1300 °C (2372 °F)
	0.5 (0.02)	1600 °C (2912 °F)
B	0.35 (0.01)	1400 °C (2552 °F)
	0.5 (0.02)	1800 °C (3272 °F)

### Note

For type K thermocouples, there is a risk of selective chromic oxidation on the NiCr side (also called green rot) between 800 °C (1472 °F) and 1000 °C (1832 °F) under oxygen-deficient, neutral or reducing atmospheres combined with moisture. The measurement errors resulting from green rot can amount to 100 K. If the operating temperature is consistently in this range, we recommend that you use type N thermocouples, which demonstrate considerably higher stability and oxidation resistance at high temperatures as a result of their silicon alloy. As an alternative, a measuring inset with mineral insulated cable (SensyTemp TSA101) with 8 mm (0.31 in) diameter and type K thermocouple can be used upon request.

For temperatures above 1200 °C (2192 °F), only a precious metal thermocouple can be used. With precious metal thermocouples, however, there is a risk of contamination by foreign substances from the environment, e.g., from the ceramic thermowell or inner tube as well as the insulation rod. This risk increases with the temperature.

Typical platinum poisons are silicon and phosphor, which are diffused more rapidly at temperatures above 1000 °C (1832 °F).

To prevent this use only high purity aluminum oxide (Al<sub>2</sub>O<sub>3</sub>) with minimal traces of silicon for the thermowell and inner tube material.

ABB uses high purity ceramic C799 as standard material for the insulation rod in precious metal thermocouples. We recommend that you select this material, at least, for the inner tube and, if possible, for the thermowell as well.

### Process pressure

High temperature sensors are generally designed for use in pressureless processes.

When fastening the temperature sensor using limit stop flanges and counterflanges, a pressure of up to approx. 1 bar (14.5 psi) of gas tightness can be assumed with proper installation.



## Measuring accuracy of thermocouples

The measuring accuracies of the ABB standard thermocouples are in accordance with the IEC 60584 international standard. Tolerance data is listed in the 'Tolerance classes' table.

Tolerance classes in accordance with IEC 60584 for base metal thermocouples				
TE Type	Class	Temperature range	Maximum deviation	Color recognition for compensating cable
K (NiCr-Ni)	2	-40 to 333 °C (-40 to 631 °F)	± 2.5 °C (± 4.5 °F)	- white
		333 to 1200 °C (631 to 2192 °F)	± 0.0075 °C × [t] (± 0.0135 °F × [t])	+ green
	1	-40 to 375 °C (-40 to 707 °F)	± 1.5 °C (± 2.7 °F)	Sheathing green
		375 to 1000 °C (707 to 1832 °F)	± 0.0040 °C × [t] (± 0.0072 °F × [t])	
J (Fe-CuNi)	2	-40 to 333 °C (-40 to 631 °F)	± 2.5 °C (± 4.5 °F)	- white
		333 to 750 °C (631 to 1382 °F)	± 0.0075 °C × [t] (± 0.0135 °F × [t])	+ black
	1	-40 to 375 °C (-40 to 707 °F)	± 1.5 °C (± 2.7 °F)	Sheathing black
		375 to 750 °C (707 to 1382 °F)	± 0.0040 °C × [t] (± 0.0072 °F × [t])	
N (NiCrSi-NiSi)	2	-40 to 333 °C (-40 to 631 °F)	± 2.5 °C (± 4.5 °F)	- white
		333 to 1200 °C (631 to 2192 °F)	± 0.0075 °C × [t] (± 0.0135 °F × [t])	+ pink
	1	-40 to 375 °C (-40 to 707 °F)	± 1.5 °C (± 2.7 °F)	Sheathing pink
		375 to 1000 °C (707 to 1832 °F)	± 0.0040 °C × [t] (± 0.0072 °F × [t])	

Tolerance classes in accordance with IEC 60584 for precious metal thermocouples				
TE Type	Class	Temperature range	Maximum deviation	Color recognition for compensating cable
S (Pt10Rh-Pt)	2	0 to 600 °C (32 to 1112 °F)	± 1.5 °C (± 2.7 °F)	- white
		600 to 1600 °C (1112 to 2912 °F)	± 0.0025 °C × [t] (± 0.0045 °F × [t])	+ orange
	1	0 to 1100 °C (32 to 2012 °F)	± 1.0 °C (± 1.8 °F)	Sheathing orange
		1100 to 1600 °C (2012 to 2912 °F)	± (1 + 0.003 °C × ([t] - 1100)) (± (1 + 0.0054 °F × [t] - 2012))	
R (Pt13Rh-Pt)	2	0 to 600 °C (32 to 1112 °F)	± 1.5 °C (± 2.7 °F)	- white
		600 to 1600 °C (1112 to 2912 °F)	± 0.0025 °C × [t] (± 0.0045 °F × [t])	+ orange
	1	0 to 1100 °C (32 to 2012 °F)	± 1.0 °C (± 1.8 °F)	Sheathing orange
		1100 to 1600 °C (2012 to 2912 °F)	± (1 + 0.003 °C × ([t] - 1100)) (± (1 + 0.0054 °F × [t] - 2012))	
B (Pt30Rh-Pt6Rh)	3	600 to 800 °C (1112 to 1472 °F)	± 4.0 °C (± 7.2 °F)	- white
S (Pt10Rh-Pt)		800 to 1700 °C (1472 to 3092 °F)	± 0.005 °C × [t] (± 0.0090 °F × [t])	+ gray
	2	600 to 1700 °C (1112 to 3092 °F)	± 0.0025 °C × [t] (± 0.0045 °F × [t])	Sheathing gray

### Measuring accuracy of mounted transmitter

For information on transmitter accuracy, refer to the documentation on transmitters.

### Self-heating

For thermocouples no self-heating occurs.

### Response time

For thermocouples in high temperature applications, the response time is not typically relevant, since the temperature fluctuations normally occur over an extended period of time.

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## Thermowells

### Thermowell functions

- Protect the thermocouple from contamination by aggressive media
- Replace or recalibrate the sensor element without interrupting the process

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

The thermowells are divided into two categories:

- Thermowells made of metal (SensyTemp TSH210)
- Thermowells made of ceramics (SensyTemp TSH220)

### Functions of the inner tube

- Additional protection for the thermocouple from contamination by aggressive media, especially with precious metal thermocouples
- Additional protection of thermocouples at high temperatures
- Support thermowell at high temperatures

For inner tubes, gas-tight ceramic tubes are used:

- Ceramic C610: as standard inner tube for base metal thermocouples
- Ceramic C799 made of high purity aluminum oxide. We recommend generally using inner tubes made of C799 with precious metal thermocouples to prevent contamination of thermocouples.

### Note

- When selecting the installation and nominal lengths, ABB recommends referring to standard lengths. This ensures cost benefits and short delivery times based on proper parts inventory. Ceramic thermowells or inner tubes are available maximal lengths of 1000 mm (39.37 in) to 2000 mm (78.74 in), depending on the diameter.
- When selecting the installation length, additionally take into consideration potential temperature increases at the connection head (see **Holding tubes** on page 16)

### SensyTemp TSH210 temperature sensor

Dimensions in mm (in)

Type	Thermowell material	Thermowell Ø	Ceramic inner tube	Inner tube Ø	Base metal thermocouples		Precious metal thermocouples	
					Insulation rod Ø	Thermocouple wire Ø	Insulation rod Ø	Thermocouple wire Ø
AM	1.4571	22 x 2 (0.87 x 0.08)						
	1.4749	22 x 2 (0.87 x 0.08)						
		26 x 4 (1.02 x 0.16)			10.5 (0.41)	2.5 (0.10)		
	1.4841	22 x 2 (0.87 x 0.08)	—	—	6.5 (0.26)	1.38 (0.05)		
		32 x 2 (1.26 x 0.08)						
	Kanthal® AF	22 x 2 (0.87 x 0.08)						
	Inconel® 601	26.7 x 2.9 (1.05 x 0.11)						
AMK	1.4571	22 x 2 (0.87 x 0.08)	C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
			C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
	1.4749	22 x 2 (0.87 x 0.08)	C799	15 x 2.5 (0.59 x 0.10)	6.5 (0.26)	1.38 (0.05)		
			C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
		26 x 4 (1.02 x 0.16)	C799	15 x 2.5 (0.59 x 0.10)	6.5 (0.26)	1.38 (0.05)		
			C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
	1.4841	22 x 2 (0.87 x 0.08)	C799	15 x 2.5 (0.59 x 0.10)	6.5 (0.26)	1.38 (0.05)	8.5 (0.33)	0.5 (0.02)
			C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
		32 x 2 (1.26 x 0.08)	C799	15 x 2.5 (0.59 x 0.10)	6.5 (0.26)	1.38 (0.05)		
			C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
	Kanthal® AF	22 x 2 (0.87 x 0.08)	C799	15 x 2.5 (0.59 x 0.10)	6.5 (0.26)	1.38 (0.05)		
			C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
	Inconel® 601	26.7 x 2.9 (1.05 x 0.11)	C610	16 x 2 (0.63 x 0.08)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)		
			C799	15 x 2.5 (0.59 x 0.10)	6.5 (0.26)	1.38 (0.05)		
			C799	15 x 2.5 (0.59 x 0.10)	6.5 (0.26)	1.38 (0.05)		

Continued on next page.

## ... Thermowells

Dimensions in mm (in)

SensyTemp TSH210 continued			Base metal thermocouples			Precious metal thermocouples		
Type	Thermowell material	Thermowell $\emptyset$	Ceramic inner tube	Inner tube $\emptyset$	Insulation rod $\emptyset$	Thermocouple wire $\emptyset$	Insulation rod $\emptyset$	Thermocouple wire $\emptyset$
BM	1.4571	15 x 2 (0.59 x 0.08)	—	—	10.5 (0.41)	2.5 (0.10)	—	—
	1.4749				6.5 (0.26)	1.38 (0.05)		
	1.4841							
BMK	1.4571	15 x 2 (0.59 x 0.08)	C610	10 x 1.5 (0.39 x 0.06)	6.5 (0.26)	1.38 (0.05)	—	—
			C610	10 x 1.5 (0.39 x 0.06)	6.5 (0.26)	1.38 (0.05)		
	1.4749	15 x 2 (0.59 x 0.08)	C799	10 x 2 (0.39 x 0.06)	—	—	5.5 (0.22)	0.5 (0.02)
			C610	10 x 1.5 (0.39 x 0.06)	6.5 (0.26)	1.38 (0.05)		
	1.4841	15 x 2 (0.59 x 0.08)	C799	10 x 2 (0.39 x 0.06)	—	—		

## SensyTemp TSH200 temperature sensor

Dimensions in mm (in)

Type	Thermowell	Thermowell Ø	Ceramic inner tube	Inner tube Ø	Holding tube Ø / Standard length K	Base metal thermocouples		Precious metal thermocouples		
						Insulation rod Ø	Thermocouple wire Ø	Insulation rod Ø	Thermocouple wire Ø	
AK	C530	26 x 4 (1.02 x 0.16)	—	—	32 x 2 / 200 (1.26 x 0.08 / 7.87)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)	—	—	
		C610	16 x 2 (0.63 x 0.08)	—	—	22 x 2 / 150 (0.87 x 0.08 / 5.91)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)	8.5 (0.33)	0.5 (0.02)
	24 x 2.5 (0.94 x 0.10)		—	—	32 x 2 / 200 (1.26 x 0.08 / 7.87)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)			
	C799	15 x 2.5 (0.59 x 0.10)	—	—	22 x 2 / 150 (0.87 x 0.08 / 5.91)	6.5 (0.26)	1.38 (0.05)	8.5 (0.33)	0.5 (0.02)	
		24 x 3 (0.94 x 0.12)	—	—	32 x 2 / 200 (1.26 x 0.08 / 7.87)	10.5 (0.41)	2.5 (0.10)			
	AKK	C530	26 x 4 (1.02 x 0.16)	C610	16 x 2 (0.63 x 0.08)	32 x 2 / 200 (1.26 x 0.08 / 7.87)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)	8.5 (0.33)	0.5 (0.02)
C799				15 x 2.5 (0.59 x 0.10)	32 x 2 / 200 (1.26 x 0.08 / 7.87)	6.5 (0.26)	1.38 (0.05)			
C610		16 x 2 (0.63 x 0.08)	C610	10 x 1.5 (0.39 x 0.06)	22 x 2 / 150 (0.87 x 0.08 / 5.91)	6.5 (0.26)	1.38 (0.05)	5.5 (0.22)	0.5 (0.02)	
			C799	10 x 2 (0.39 x 0.08)	22 x 2 / 150 (0.87 x 0.08 / 5.91)	—	—			
C610		24 x 2.5 (0.94 x 0.10)	C610	16 x 2 (0.63 x 0.08)	32 x 2 / 200 (1.26 x 0.08 / 7.87)	10.5 (0.41) 6.5 (0.26)	2.5 (0.10) 1.38 (0.05)	8.5 (0.33)	0.5 (0.02)	
			C799	15 x 2.5 (0.59 x 0.10)	32 x 2 / 200 (1.26 x 0.08 / 7.87)	6.5 (0.26)	1.38 (0.05)			
C799		15 x 2.5 (0.59 x 0.10)	C799	8 x 1.5 (0.31 x 0.06)	22 x 2 / 150 (0.87 x 0.08 / 5.91)	—	—	4.0 (0.16)	0.5 (0.02)	
				15 x 2.5 (0.59 x 0.10)	32 x 2 / 200 (1.26 x 0.08 / 7.87)	6.5 (0.26)	1.38 (0.05)			8.5 (0.33)
BK		C610	10 x 1.5 (0.39 x 0.06)	—	—	15 x 2 / 80 (0.59 x 0.08 / 3.15)	6.5 (0.26)	1.38 (0.05)	5.5 (0.22)	0.5 (0.02)
				—	—	15 x 2 / 80 (0.59 x 0.08 / 3.15)	—	—		
		C799	8 x 1.5 (0.31 x 0.06)	—	—	15 x 2 / 80 (0.59 x 0.08 / 3.15)	—	—	4.0 (0.16)	0.5 (0.02)
C799		10 x 2 (0.39 x 0.08)	—	—	—	15 x 2 / 80 (0.59 x 0.08 / 3.15)	—	—	5.5 (0.22)	0.5 (0.02)
	15 x 2 / 80 (0.59 x 0.08 / 3.15)					—	—			

## ... Thermowells

### Thermowell materials

The following table provides an overview of the main thermowell materials as well as their properties and application areas. All information is not binding and does not represent guaranteed properties. Even minor variations in process parameters can considerably influence the resistance. They therefore must be checked closely for each application. We recommend that for special applications you contact your ABB partner.

	Material	Max. temperature depressurized in air		Strengths	Weaknesses	Areas of application
		°C	°F			
TSH210 / metal thermowells	1.0305 (St 35.8)	550	1022	Average resistance to nitrogenous and oxygen-deficient gases	Low resistance to sulfurous gases	Tempering furnaces, zinc smelting 480 °C (896 °F)
	1.4571 (AISI 316 Ti / X6CrNiMoTi17-12-2)	800	1472	Average resistance to nitrogenous and oxygen-deficient gases	Low resistance to sulfurous gases	Tempering furnaces, chemically aggressive steams, with the exception of hydrochloric acid and sulfur dioxide steams
	1.4762 (AISI 446 / X10CrAl24)	1150	2102	Very high resistance to sulfurous gases	Low resistance to nitrogenous gases, tubes with longitudinal seam weld -> Danger of cracks resulting from embrittlement	Reheating and hardening furnaces with sulfurous and carboniferous gases, exhaust gas channels, zinc smelting 480 °C (896 °F)
	1.4749 (~AISI 446 / X18CrN28)	1150	2102	Very high resistance to sulfurous gases	Low resistance to nitrogenous gases	Reheating and hardening furnaces with sulfurous and carboniferous gases, exhaust gas channels, zinc smelting 480 °C (896 °F)
	1.4841 (AISI 314 / X15CrNiSi25-20)	1150	2102	High resistance to nitrogenous and oxygen-deficient gases	Low resistance to sulfurous gases	Industrial furnaces, combustion chambers, air-circulation furnaces, petrochemicals, cyan baths, aluminum smelting 700 °C (1292 °F), lead smelting 700 °C (1292 °F), copper-zinc alloys 900 °C (1952 °F)

Continued on next page

	Material	Max. temperature depressurized in air		Strengths	Weaknesses	Areas of application
		°C	°F			
TSH210 / metal thermowells	Inconel® 600 (2.4816 / NiCr15Fe)	1150	2102	Good oxidation resistance at temperatures up to 1050 °C (1922 °F) and excellent resistance to stress corrosion cracking based on high nickel content.	Very low resistance to sulfurous gases	Industrial furnaces
	Inconel® 601 (2.4851 / NiCr23Fe)	1200	2192	Good resistance to aggressive gases and high temperatures in oxidizing atmospheres up to 1150 °C (2102 °F).	Low resistance to sulfurous gases	Industrial furnaces
	Kanthal® AF (1.4767)	1350	2462	High resistance to sulfurous gases, high resistance to wear and tear, high thermal resistance	Low resistance to nitrogenous gases	Industrial furnaces, waste incineration, glass industry, ceramics and cement industry
TSH220 / Ceramic thermowells	Ceramic C530 (Al <sub>2</sub> O <sub>3</sub> > 70 %)	1500	2732	Very good resistance to temperature fluctuations	Fine porous, not gas-tight, impact sensitive	Industrial furnaces, use of thermowell with gas-tight inner tube
	Ceramic C610 (Al <sub>2</sub> O <sub>3</sub> > 60 %)	1600	2912	gas-tight, high fire resistance, average resistance to temperature fluctuations	Low Al <sub>2</sub> O <sub>3</sub> purity, non-resistant to alkali steams, impact sensitive	Gas-tight furnaces, diffusion furnaces, industrial furnaces, use as gas-tight inner tube
	Ceramic C799 (Al <sub>2</sub> O <sub>3</sub> > 99.7 %)	1800	3272	Very gas-tight, high fire resistance, resistant to acids and alkali, resistant to superheated steam, high bending strength	Low resistance to temperature fluctuations, impact sensitive	Industrial furnaces, furnaces with shielding gas, glass tank furnaces, flue-gas desulfurization systems, cement industry, use as gas-tight inner tube
	Ceramic AL23 (Al <sub>2</sub> O <sub>3</sub> > 99.7 %)	1950	3542	More fine-grained than C799, highest Al <sub>2</sub> O <sub>3</sub> purity, strength and gas-tightness at high temperatures, resistant to hydrofluoric acids and alkali metal oxide steams	Average resistance to temperature fluctuations, impact sensitive	Industrial furnaces, furnaces with shielding gas, glass tank furnaces, flue-gas desulfurization systems, cement industry, use as gas-tight inner tube
	SSIC (depressurized sintered silicon carbide)	1600	2912	Very gas-tight, very good resistance to temperature fluctuations, very good oxidation resistance, very good resistance to acids and alkali,	Impact sensitive	Garbage and residuals incineration

## Holding tubes

The metal support tube is the component between the ceramic thermowell and connection head.

The non-mechanical load carrying ceramic thermowell is cemented into the support tube with a fire-resistant ceramic compound.

### Functions of the holding tube

- Provide a robust mechanical process connection between temperature sensor and ceramic thermowell.
- Bridge existing insulation
- Cooling section between the connection head and medium that protects the connecting point and possible built-in electronics against high temperatures.

### Note

ABB uses stainless steel material 1.4571 (AISI 316 Ti) for the holding tube as standard instead of the usual unalloyed steel 1.0305 (St 35.8). As a result, the holding tube can be used in areas with significantly higher temperatures.

If the holding tube is protruding directly into the combustion chamber, heat-resistant steel 1.4841 (AISI 314) can be used as an alternative.

The diameter of the holding tube and standard lengths depend on the diameter of the ceramic thermowell. ABB uses standard dimensions from DIN EN 50446.

In order to prevent the connection head or built-in transmitter from heating up improperly, a longer support tube may be necessary. Measurements are needed for this, if applicable.

The operator is responsible for ensuring that the max. temperature in the connection head is maintained. This applies, in particular, to explosion risk areas.



## Process connections

The unit is mounted primarily via releasable, sliding fasteners that are sealed using a gland seal:

- Threaded socket for screw-in connection
- Limit stop flange with counterflange for weld-on connection

A gas-tightness of up to approx. 1 bar (14.50 psi) can be achieved for these elements with proper installation. Another option is to mount the unit using limit stop flanges without counter flanges. This installation version is not gas-tight.

As an alternative, the unit can be shipped with welded standard flanges. For temperature sensors with ceramic thermowell (SensyTemp TSH220), the installation length includes the flange that must be welded to the holding tube. As a result, these designs are also not gas-tight.

### Threaded socket

Threaded socket	Thermowell Ø / Holding tube Ø d mm (in)	Thread size D	L1 mm (in)	Hex.
	15 (0,59)	G ½	18 (0,71)	36
		G ¾	18 (0,71)	41
		G 1	25 (0,98)	45
	22 (0,87)	G 1	25 (0,98)	45
	26 (1,02)	G 1¼	30 (1,18)	55
	26,7 (1,05)	G 1¼	30 (1,18)	55
	15 (0,59)	½ NPT	19 (0,75)	36
		¾ NPT	20 (0,79)	41
		1 NPT	25 (0,98)	45
	22 (0,87)	1 NPT	25 (0,98)	45
	26 (1,02)	1¼ NPT	26 (1,02)	55
	26,7 (1,05)	1¼ NPT	26 (1,02)	55
	32 (1,26)	1¼ NPT	26 (1,02)	55

## ... Process connections

### Limit stop flange with counterflange

Dimensions in mm (in)

#### Metal thermowells (TSH210)

	Thermowell Ø d	C
	15 (0.59)	55 (2.17)
	22 (0.87)	70 (2.76)
	26 (1.02)	70 (2.76)
	26.7 (1.05)	70 (2.76)
	32 (1.26)	70 (2.76)

### Limit stop flange

Dimensions in mm (in)

	Thermowell Ø d	C
	15 (0.59)	55 (2.17)
	22 (0.87)	70 (2.76)
	26 (1.02)	70 (2.76)
	26.7 (1.05)	70 (2.76)
	32 (1.26)	70 (2.76)

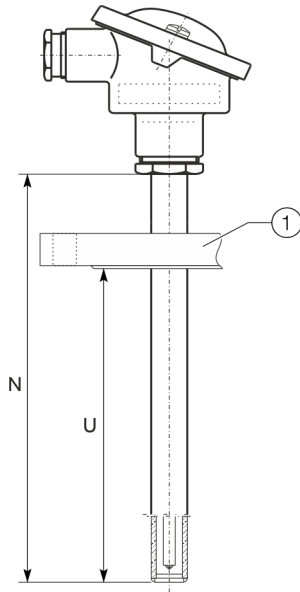
#### Ceramic thermowells (TSH220)

	Thermowell Ø d	Holding tube	C
	15 (0.59)	22 (0.87)	70 (2.76)
	16 (0.63)	22 (0.87)	70 (2.76)
	24 (0.94)	32 (1.26)	70 (2.76)
	26 (1.02)	32 (1.26)	70 (2.76)

## Welded standard flanges

When selecting a welded flange, keep in mind that the installation length must be listed in the order and cannot be changed.

There are dependencies between installation length **U**, nominal length **N** and holding tube length **K**:



U Installation length      N Nominal length

① Flange

Figure 3: Installation length

With the SensyTemp TSH210 temperature sensor, the flange can be welded onto any position on the thermowell. The following applies for installation length **U**:

- $U_{min.} = 100 \text{ mm}$ ,  $U_{max.} = N - 50 \text{ mm}$
- $U_{min.} = 3.94 \text{ in}$ ,  $U_{max.} = N - 1.97 \text{ in}$

For the SensyTemp TSH220 temperature sensor, the flange is welded on the holding tube, which limits installation length:

- $U_{min.} = N - K$ ,  $U_{max.} = N - 50 \text{ mm}$
- $U_{min.} = N - K$ ,  $U_{max.} = N - 1.97 \text{ in}$

## Connection heads

### Functions of the connection head

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

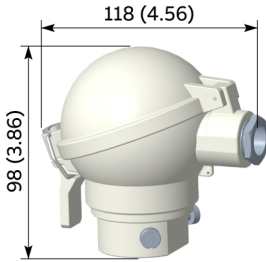
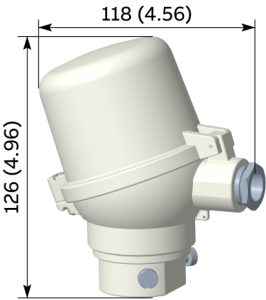
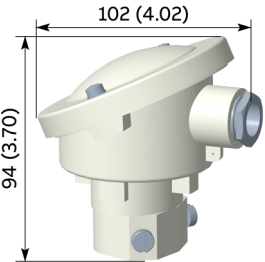
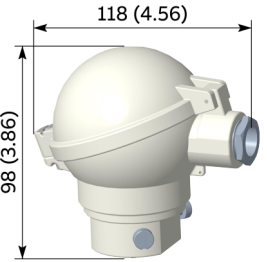
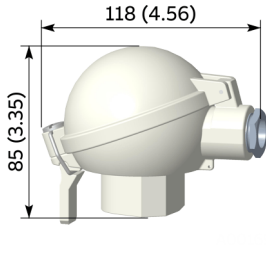
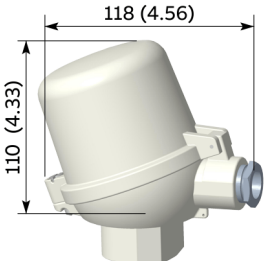
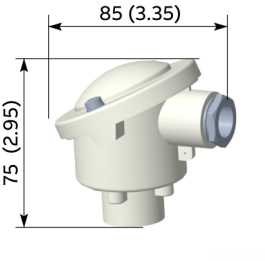
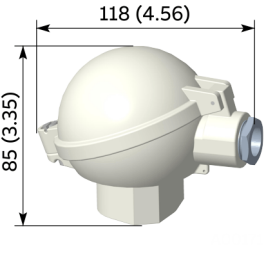
The ABB connection heads in forms A, AUS, AUZ, and AUZH guarantee a minimum IP rating of IP 54 in combination with an ABB thermowell or holding tube and the standard cable entry M20 × 1.5.

Thermocouple versions with these connection heads can also be produced in IP rating IP 65 upon request. With this option the thermocouples are no longer interchangeable.

The ABB connection heads in forms B, BUS, BUZ and BUZH guarantee a minimum IP rating of IP 65 in combination with an ABB thermowell or holding tube and the standard cable entry M20 × 1.5.

The following connection head types are available for the SensyTemp TSH200 temperature sensor series:

Dimensions in mm (in)

Head form	OFF	AUZH	A	AUZ
				
Material	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated
Cover locking system	Hinged cover with quick couplings	Upper hinged cover	Screw-on cap	Hinged cover
Transmitter installable	No	Yes	No	No
Standard IP rating	IP 54, optional IP 65			
Thermocouple versions	AM, AMK, AK, AKK			
Head form	BUS	BUZH	B	BUZ
				
Material	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated	Aluminum, epoxy-coated
Cover locking system	Hinged cover with quick couplings	Upper hinged cover	Screw-on cap	Hinged cover
Transmitter installable	No	Yes	No	No
Standard IP rating	IP 65			
Thermocouple versions	BM, BMK, BK			

## 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).
- 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:

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### Transmitter type

#### TTH200 HART®

4 to 20 mA, HART®




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#### TTH300 HART®

4 to 20 mA, HART®




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#### TTH300 PA

PROFIBUS PA®




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#### TTH300 FF

FOUNDATION Fieldbus® H1




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### Note

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

## Approvals and certifications

### Explosion protection approvals

SensyTemp TSH200 series temperature sensors are used applications above 600 °C (1112 °F).

For temperatures above 450°C (842°F), an Ex zone may not be present.

SensyTemp TSH200 series temperature sensors are therefore not designed for use in potentially explosive atmospheres.

SensyTemp TSH200 series temperature sensors may only be used in safe areas.

To connect temperature sensors to intrinsically safe devices (e.g. head-mounted transmitters), ABB provides a manufacturer's declaration that certifies the SensyTemp TSH200 series temperature sensors for use in intrinsically safe circuits.

### Note

Special solutions for use in potentially explosive atmospheres are available upon request for specific applications. This requires special designs, which can significantly affect price and delivery time. Please contact your ABB partner as needed.

## ... Approvals and certifications

### Tests and certificates

To increase the safety and accuracy of your processes, ABB provides a number of mechanical and electrical tests. The results of these tests are certified in accordance with EN 10204.

The following certificates in accordance with EN 10204 are provided for SensyTemp TSH200 series temperature sensors:

- Declaration of compliance 2.1 for order conformity,
- Inspection certificate 3.1 for the following tests:
  - Visual, dimensional and function checks of the temperature sensor
  - Reference measurement at the thermocouple
  - Material confirmation for thermowell material available upon request
  - Flameproof at thermowell

### DAkKS Calibration

For measurements requiring extremely high accuracy, ABB offers a calibration of the temperature sensor in its in-house DAkKS calibration laboratory.

With a DAkKS calibration, a separate calibration certificate is provided for each temperature sensor.

Reference measurements and DAkKS calibrations are conducted on the thermocouple with a transmitter if necessary.

To obtain accurate measurement results, a minimum length of the thermocouple should be observed:

- at temperatures over 450 °C (842 °F):  
450 to 500 mm (17.7 to 19.7 in)

These are guide values. If you are in any doubt, your ABB partner is available for on-site assistance.

For reference measurements and DAkKS calibration, the individual characteristic of the temperature sensor can also be calculated and a suited transmitter can be programmed based on a freestyle characteristic.

The measuring accuracy of the temperature sensor can be considerably improved by adjusting the transmitter to the sensor characteristics. When doing so, perform measurements at a minimum of three different temperatures.

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## 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.

[www.abb.com/temperature](http://www.abb.com/temperature)

### Precious metal costs

Precious metals are subject to considerable fluctuations in terms of market price. As a result, the price for the precious metal part is regularly adjusted based on the current price.

The net price of the precious metal is included as a separate item. It is subject to confirmation and in case of a contract may differ from the offer price.

## ... Ordering Information

### SensyTemp TSH210

Base model	TSH210	XX	XX	XXX	XX	XX	XXX	XX	XX	XX	XX
Straight Thermocouple, with metal type thermowell, for high temperature applications up to 1300 °C (2372 °F)											
<b>Explosion Protection / Approvals</b>											
Without											
Manufacturer's declaration for use in safe areas with connection to intrinsically safe electronic (e.g. transmitter)											
Without											
Manufacturer's declaration for use in safe areas with connection to intrinsically safe electronic (e.g. transmitter)											
<b>Thermocouple Design</b>											
With metal thermowell (Form AM acc. EN 50446)											
With metal thermowell and ceramic inner tube (Form AMK acc. EN 50446)											
With metal thermowell (Form BM acc. EN 50446)											
With metal thermowell and ceramic inner tube (Form BMK acc. EN 50446)											
<b>Material Thermowell / Inner Tube</b>											
AISI 446 SST (1.4749) / Without inner tube											
AISI 446 SST (1.4749) / Ceramic C-610											
AISI 446 SST (1.4749) / Ceramic C-799											
AISI 446 SST (1.4762) / Without inner tube											
AISI 446 SST (1.4762) / Ceramic C-610											
AISI 446 SST (1.4762) / Ceramic C-799											
AISI 314 SST (1.4841) / Without inner tube											
AISI 314 SST (1.4841) / Ceramic C-610											
AISI 314 SST (1.4841) / Ceramic C-799											
AISI 316Ti SST (1.4571) / Without inner tube											
AISI 316Ti SST (1.4571) / Ceramic C-610											
Kanthal AF / Without inner tube											
Kanthal AF / Ceramic C-610											
Kanthal AF / Ceramic C-799											
Inconel 601 / Without inner tube											
Inconel 601 / Ceramic C-610											
Inconel 601 / Ceramic C-799											
Incoloy 800 (1.4876) / Without inner tube											
Incoloy 800 (1.4876) / Ceramic C-610											
Incoloy 800 (1.4876) / Ceramic C-799											
<b>Thermowell Diameter</b>											
15 × 2 mm (0.59 × 0.08 in)											
22 × 2 mm (0.87 × 0.08 in)											
26 × 4 mm (1.02 × 0.16 in)											
21.3 × 2.77 mm (0.84 × 0.11 in)											
26.7 × 2.9 mm (1.05 × 0.114 in)											
22 × 1.3 mm (0.87 × 0.05 in)											
32 × 2 mm (1.26 × 0.08 in)											
33.7 × 3.25 mm (1.33 × 0.13 in)											
33.4 × 3.4 mm (1.31 × 0.134 in)											

Continuation see next page



Base model	TSH210	XX	XX	XXX	XX	XX	XXX	XX	XX	XX	XX
Straight Thermocouple, with metal type thermowell, for high temperature applications up to 1300 °C (2372 °F)											
<b>Nominal Length</b>											
N = 355 mm (13,98 in)								N1			
N = 500 mm (19,69 in)								N2			
N = 710 mm (28 in)								N3			
N = 1000 mm (39,4 in)								N4			
N = 1400 mm (55,12 in)								N5			
N = 2000 mm (78,74 in)								N6			
Acc. customer specification								Z9			
<b>Process Connection</b>											
No fitting									Y00		
Adjustable stop flange, cast steel									A08		
Adjustable stop flange and counter flange, cast steel									A09		
Adjustable threaded fitting G ½ A, carbon steel									A11		
Adjustable threaded fitting G ¾ A, carbon steel									A12		
Adjustable threaded fitting G 1 A, carbon steel									A13		
Adjustable threaded fitting G 1¼ A, carbon steel									A14		
Adjustable threaded fitting ½ in NPT, carbon steel									A16		
Adjustable threaded fitting ¾ in NPT, carbon steel									A17		
Adjustable threaded fitting 1 in NPT, carbon steel									A18		
Adjustable threaded fitting 1¼ NPT, carbon steel									A19		
Welded flange DN 32 PN 6, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)									F51*		
Welded flange DN 25 PN 10 to PN 40, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)									F52*		
Welded flange DN 40 PN 10 to PN 40, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)									F53*		
Welded flange DN 50 PN 25 to PN 40, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)									F54*		
Welded flange 1 in 150 lbs, form RF acc. ANSI / ASME B16.5, AISI 316Ti SST (1.4571)									F55*		
Welded flange 1½ in 150 lbs, form RF acc. ANSI / ASME B16.5, AISI 316Ti SST (1.4571)									F56*		
Welded flange 2 in 150 lbs, form RF acc. ANSI / ASME B16.5, AISI 316Ti SST (1.4571)									F57*		
<b>Thermocouple Type / Diameter</b>											
Without thermocouple									Y0		
1 × Type K / Wire diameter 2.5 mm (0.10 in)									K1		
2 × Type K / Wire diameter 2.5 mm (0.10 in)									K2		
1 × Type N / Wire diameter 2.5 mm (0.10 in)									N1		
2 × Type N / Wire diameter 2.5 mm (0.10 in)									N2		
1 × Type J / Wire diameter 2.5 mm (0.10 in)									J1		
2 × Type J / Wire diameter 2.5 mm (0.10 in)									J2		
1 × Type K / Wire diameter 1.38 mm (0.05 in)									K5		
2 × Type K / Wire diameter 1.38 mm (0.05 in)									K6		
1 × Type N / Wire diameter 1.38 mm (0.05 in)									N5		
2 × Type N / Wire diameter 1.38 mm (0.05 in)									N6		
1 × Type J / Wire diameter 1.38 mm (0.05 in)									J5		
2 × Type J / Wire diameter 1.38 mm (0.05 in)									J6		

\* Please specify insertion length

Continuation see next page

## ... Ordering Information

Base model	TSH210	XX	XX	XXX	XX	XX	XXX	XX	XX	XX	XX
Straight Thermocouple, with metal type thermowell, for high temperature applications up to 1300 °C (2372 °F)											
<b>Thermocouple Type / Diameter</b> (Continuation)											
1 × Type K / Sheath diameter 8 mm (0.31 in)										M1	
2 × Type K / Sheath diameter 8 mm (0.31 in)										M2	
1 × Type N / Sheath diameter 8 mm (0.31 in)										M3	
2 × Type N / Sheath diameter 8 mm (0.31 in)										M4	
1 × Type S / Wire diameter 0.5 mm (0.02 in)										S1	
2 × Type S / Wire diameter 0.5 mm (0.02 in)										S2	
1 × Type R / Wire diameter 0.5 mm (0.02 in)										R1	
2 × Type R / Wire diameter 0.5 mm (0.02 in)										R2	
1 × Type B / Wire diameter 0.5 mm (0.02 in)										B1	
2 × Type B / Wire diameter 0.5 mm (0.02 in)										B2	
<b>Sensor Accuracy</b>											
Accuracy Class 2 acc. IEC 60584										T2	
Accuracy Class 3 acc. IEC 60584										T6	
Accuracy Class 1 acc. IEC 60584										T1	
Without thermocouple										Y0	
<b>Connection Head Type / Material</b>											
A / Aluminium											A6
AUZ / Aluminium, hinged cover											A1
AUZH / Aluminium, hinged high cover											A2
AUS / Aluminium, hinged cover, with snap lock											A4
AUSH / Aluminium, hinged high cover, with snap lock											A5
AUG / Cast iron, hinged cover											G2
B / Aluminium											B6
BUZ / Aluminium, hinged cover											B1
BUZH / Aluminium, hinged high cover											B2
BUS / Aluminium, hinged cover with snap lock											B4
BUSH / Aluminium, hinged high cover, with snap lock											B5
BUG / Cast iron, hinged cover											G1
<b>Transmitter</b>											
Without transmitter, sensor with ceramic terminal block											Y1
TTH300-HART, programmable, output signal 4 to 20 mA, dual input											H4
TTH300-PA, programmable, output PROFIBUS PA, dual input											P6
TTH300-FF, programmable, output FOUNDATION fieldbus H1, dual input											F6
TTH200-HART, programmable, output signal 4 to 20 mA											H6

Continuation see next page

**Additional ordering information – TSH210**

	XX	XX	XXX	XX	XX	XX	XX	XX	XX	XX	XX
<b>Transmitter Measuring Range</b>											
Standard measuring range (0 to 100°C, 32 to 212°F)	A5										
Customer-specific measuring range	AZ										
<b>Declarations and Certificates</b>											
Declaration of compliance with the order 2.1 acc. EN 10204				C4							
Inspection certificate 3.1 acc. EN 10204 of visual, dimensional and functional test				C6							
Inspection certificate 3.1 acc. EN 10204 of sensor tolerance				CC							
Inspection certificate 3.1 acc. EN 10204 of sensor calibration, single thermocouple				CF							
Inspection certificate 3.1 acc. EN 10204 of sensor calibration, double thermocouple				CG							
DAkkS sensor calibration, single thermocouple, calibration certificate per thermometer				CK							
DAkkS sensor calibration, double thermocouple, calibration certificate per thermometer				CL							
Inspection certificate 3.1 acc. EN 10204 of welded flanges				CM							
<b>Handling of Certificates</b>											
Send via e-mail				GHE							
Send via mail				GHP							
Send via mail express				GHD							
Send with instrument				GHA							
Only archived				GHS							
<b>Number of Calibration Test Points</b>											
1 point										P1	
2 points										P2	
3 points										P3	
4 points										P4	
5 points										P5	
<b>Temperatures for Sensor Calibration</b>											
400 °C (752 °F)										GA	
700 °C (1292 °F)										GB	
1000 °C (1832 °F)										GC	
400 and 700 °C (752 and 1292 °F)										GD	
400 and 1000 °C (752 and 1832 °F)										GE	
700 and 1000 °C (1292 and 1832 °F)										GF	
400, 700 and 1000 °C (752, 1292 and 1832 °F)										GG	
Customer-specific temperatures										G9	
<b>Thermocouple Options</b>											
Insulating rod ceramic AL23, with 4 mm (0.16 in) hole for calibration element										JA	
Insulating rod ceramic AL23										JB	
<b>Housing Options</b>											
Ingress Protection IP 65											HA

Continuation see next page

## ... Ordering Information

Additional ordering information – TSH210 (Continuation)	XX	XX	XX	XX
<b>Cable Entry Options</b>				
1 × ½ in NPT, without cable gland	U2			
1 × M20 × 1.5, with plastic cable gland, cable diameter 5 to 12 mm (0.20 to 0.47 in)	U6			
Harting Han 7D plug and socket connection	UG			
Harting Han 8D (8U) plug and socket connection	UH			
<b>Other Options</b>				
Earth screw external		PG		
<b>Documentation Language</b>				
German				M1
English				M5
<b>TAG Plate</b>				
Stainless steel				I1

## SensyTemp TSH220

Base model	TSH220	XX	XX	XXX	XX	XX	XX	XX	XXX	XX	XX	XX	XX
Straight Thermocouple, with ceramic type thermowell, for high temperature applications up to 1800 °C (3272 °F)													
<b>Explosion Protection / Approvals</b>													
Without		Y0											
Manufacturer's declaration for use in safe areas with connection to intrinsically safe electronic (e.g. transmitter)		K2											
<b>Thermocouple Design</b>													
With ceramic thermowell (Form AK acc. EN 50446)		A3											
With ceramic thermowell and ceramic inner tube (Form AKK acc. EN 50446)		A4											
With ceramic thermowell (Form BK acc. EN 50446)		B3											
<b>Material Thermowell / Inner Tube</b>													
Ceramic C-530 / Without inner tube													C50
Ceramic C-530 / Ceramic C-610													C51
Ceramic C-530 / Ceramic C-799													C52
Ceramic C-610 / Without inner tube													C60
Ceramic C-610 / Ceramic C-610													C61
Ceramic C-610 / Ceramic C-799													C62
Ceramic C-799 / Without inner tube													C70
Ceramic C-799 / Ceramic C-799													C72
Ceramic AL23 / Without inner tube													A23
Ceramic AL23 / AL23													A25
Sintered Silicon Carbide SSiC / Without inner tube													K10
Sintered Silicon Carbide SSiC / Ceramic C-610													K11
Sintered Silicon Carbide SSiC / Ceramic C-799													K12
<b>Thermowell Diameter</b>													
8 × 1.5 mm (0.31 × 0.06 in)													C1
10 × 1.5 mm (0.39 × 0.06 in)													C2
10 × 2 mm (0.39 × 0.08 in)													C3
15 × 2.5 mm (0.59 × 0.10 in)													C4
16 × 2 mm (0.63 × 0.08 in)													C5
24 × 2.5 mm (0.94 × 0.10 in)													C6
24 × 3 mm (0.94 × 0.12 in)													C7
26 × 4 mm (1.02 × 0.16 in)													C8
16 × 3 mm (0.63 × 0.12 in)													K1
25 × 5 mm (0.98 × 0.20 in)													K6

Continuation see next page

## ... Ordering Information

Base model	TSH220	XX	XX	XXX	XX	XX	XX	XX	XXX	XX	XX	XX	XX
Straight Thermocouple, with ceramic type thermowell, for high temperature applications up to 1800 °C (3272 °F)													
<b>Nominal Length</b>													
N = 355 mm (13.98 in)													N1
N = 500 mm (19.69 in)													N2
N = 710 mm (28 in)													N3
N = 1000 mm (39.4 in)													N4
N = 1400 mm (55.12 in)													N5
N = 2000 mm (78.74 in)													N6
Acc. customer specification													Z9
<b>Support Tube Material</b>													
Stainless steel													S2
Heat resistant steel AISI 314 / AISI 310 SST (1.4841)													H3
<b>Support Tube Length</b>													
K = 80 mm (3.15 in)													K2
K = 150 mm (5.91 in)													K4
K = 200 mm (7.87 in)													K5
Acc. customer specification													Z9
<b>Process Connection</b>													
No fitting													Y00
Adjustable stop flange, cast steel													A08
Adjustable stop flange and counter flange, cast steel													A09
Adjustable threaded fitting G ½ A, carbon steel													A11
Adjustable threaded fitting G ¾ A, carbon steel													A12
Adjustable threaded fitting G 1 A, carbon steel													A13
Adjustable threaded fitting G 1¼A, carbon steel													A14
Adjustable threaded fitting ½ in NPT, carbon steel													A16
Adjustable threaded fitting ¾ in NPT, carbon steel													A17
Adjustable threaded fitting 1 in NPT, carbon steel													A18
Adjustable threaded fitting 1¼ NPT, carbon steel													A19
Welded flange DN 32 PN 6, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)													F51*
Welded flange DN 25 PN 10 to PN 40, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)													F52*
Welded flange DN 40 PN 10 to PN 40, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)													F53*
Welded flange DN 50 PN 25 to PN 40, Form B1 acc. EN 1092-1, AISI 316Ti SST (1.4571)													F54*
Welded flange 1 in 150 lbs, form RF acc. ANSI / ASME B16.5, AISI 316Ti SST (1.4571)													F55*
Welded flange 1-½ in 150 lbs, form RF acc. ANSI / ASME B16.5, AISI 316Ti SST (1.4571)													F56*
Welded flange 2 in 150 lbs, form RF acc. ANSI / ASME B16.5, AISI 316Ti SST (1.4571)													F57*

\* Please specify insertion length

Continuation see next page

Base model	TSH220	XX	XX	XXX	XX	XX	XX	XX	XXX	XX	XX	XX	XX
Straight Thermocouple, with ceramic type thermowell, for high temperature applications up to 1800 °C (3272 °F)													
<b>Thermocouple Type / Diameter</b>													
Without thermocouple												Y0	
1 × Type K / Wire diameter 2.5 mm (0.10 in)												K1	
2 × Type K / Wire diameter 2.5 mm (0.10 in)												K2	
1 × Type J / Wire diameter 2.5 mm (0.10 in)												J1	
2 × Type J / Wire diameter 2.5 mm (0.10 in)												J2	
1 × Type N / Wire diameter 2.5 mm (0.10 in)												N1	
2 × Type N / Wire diameter 2.5 mm (0.10 in)												N2	
1 × Type K / Sheath diameter 8 mm (0.31 in)												M1	
2 × Type K / Sheath diameter 8 mm (0.31 in)												M2	
1 × Type K / Wire diameter 1.38 mm (0.05 in)												K5	
2 × Type K / Wire diameter 1.38 mm (0.05 in)												K6	
1 × Type J / Wire diameter 1.38 mm (0.05 in)												J5	
2 × Type J / Wire diameter 1.38 mm (0.05 in)												J6	
1 × Type N / Wire diameter 1.38 mm (0.05 in)												N5	
2 × Type N / Wire diameter 1.38 mm (0.05 in)												N6	
1 × Type S / Wire diameter 0.5 mm (0.02 in)												S1	
2 × Type S / Wire diameter 0.5 mm (0.02 in)												S2	
1 × Type R / Wire diameter 0.5 mm (0.02 in)												R1	
2 × Type R / Wire diameter 0.5 mm (0.02 in)												R2	
1 × Type B / Wire diameter 0.5 mm (0.02 in)												B1	
2 × Type B / Wire diameter 0.5 mm (0.02 in)												B2	
<b>Sensor Accuracy</b>													
Accuracy Class 2 acc. IEC 60584													T2
Accuracy Class 3 acc. IEC 60584													T6
Accuracy Class 1 acc. IEC 60584													T1
Without thermocouple													Y0
<b>Connection Head Type / Material</b>													
A / Aluminium													A6
AUZ / Aluminium, hinged cover													A1
AUZH / Aluminium, hinged high cover													A2
AUS / Aluminium, hinged cover, with snap lock													A4
AUSH / Aluminium, hinged high cover, with snap lock													A5
AUG / Cast iron, hinged cover													G2
B / Aluminium													B6
BUZ / Aluminium, hinged cover													B1
BUZH / Aluminium, hinged high cover													B2
BUS / Aluminium, hinged cover with snap lock													B4
BUSH / Aluminium, hinged high cover, with snap lock													B5
BUG / Cast iron, hinged cover													G1

Continuation see next page





Additional ordering information – TSH220	XX	XX	XXX	XX	XX	XX	XX	XX	XX	XX	XX
<b>Prüftemperaturen</b>											
400 °C (752 °F)					GA						
700 °C (1292 °F)					GB						
1000 °C (1832 °F)					GC						
400 and 700 °C (752 and 1292 °F)					GD						
400 and 1000 °C (752 and 1832 °F)					GE						
700 and 1000 °C (1292 and 1832 °F)					GF						
400, 700 and 1000 °C (752, 1292 and 1832 °F)					GG						
Customer-specific temperatures					G9						
<b>Thermocouple Options</b>											
Insulating rod ceramic AL23, with 4 mm (0.16 in) hole for calibration element									JA		
Insulating rod ceramic AL23									JB		
<b>Housing Options</b>											
Ingress Protection IP 65									HA		
<b>Cable Entry Options</b>											
1 × ½ in NPT, without cable gland										U2	
1 × M20 × 1.5, with plastic cable gland, cable diameter 5 to 12 mm (0.20 to 0.47 in)										U6	
Harting Han 7D plug and socket connection										UG	
Harting Han 8D (8U) plug and socket connection										UH	
<b>Other Options</b>											
Earth screw external										PG	
<b>Documentation Language</b>											
German											M1
English											M5
<b>TAG Plate</b>											
Stainless steel											

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