



When you need to detect a temperature in your system, not only must you weigh various tradeoffs between temperature sensors, you must also be sure you have the right cable for data handling and to ensure accurate measurements. SAB North America has expertise in thermocouples, resistance thermometers and the cabling you need to build an optimal assembly. We're well-positioned to answer cabling questions that pertain to your temperature measurement needs. Here is a sample of some of the questions we often answer:

 **Should I use a resistance thermometer or a thermocouple to measure the temperature in my system?**

A: Both devices have advantages. To find the ideal solution, you should match your system's requirements with the benefits of each type of sensor. This table can help you compare each sensor:

Characteristics	Resistance Thermometer	Thermocouples
Dimensions	larger sensor surface	small sensor surface possible
Response Time	relatively long	short
Connection Cables	copper cables	thermocompensating cable
Accuracy	very good	good
Consistency	very good	satisfactory
Surface Temperature Measurement	not possible	possible
Hot Junction	over the whole length of the RTD	punctual
Robustness	good	very good
Spontaneous Heating	has to be considered	does not occur
Temperature Range	up to +600°C	higher temperature possible
Cold Junction	not necessary	necessary
Circuit Supply	yes	no
Vibration Resistance	relatively sensitive	very rugged

 **I need a measurement system with a very fast response time?**

A: Jacket construction has the largest effect on response time. For example, you can speed up your response time by choosing the right metal jacket, heat transfer compounds and measurement point position. You can also talk to SAB North America's experts to determine an ideal solution for your assembly.

 **I have a large distance between the measurement point and the temperature display unit. How can I reliably transfer my data?**

A: Away from the hottest spot of measurement, the temperature will decrease rapidly. At this point, a temperature-resistant metal sheath is no longer necessary and it is possible to switch to an extension cable to transfer the measured value. Depending on the remaining distance, SAB North America can offer suitable cable with the right cross-section.



What type of connection cable should I choose for my thermocouple?

A: **Thermocouple cables** consist of the same element material as the thermocouple and are tested for the same temperatures. **Extension cables** are made of conductors with a nominal structure that's identical to the corresponding thermocouple and are normally tested within a temperature range of 0° up to +200°C. **Compensating cables** are made of substitute insulating material and have thermoelectric characteristics in the allowed temperature range (usually 0° up to +200°C) as the corresponding thermocouple.



I use my measurement system in a hazardous environment. How can I protect the sensor?

A: The metal sheath is an important part of a temperature sensor assembly, and it should be chosen carefully. There are several metallic alloys to resist acids, combustible gases and rust, as well as maximum temperature. SAB North America can provide an overview of various steel types to address your application's harsh environment.

Unalloyed High Temperature Steel			
Max. Application Temperature	Material No.	Material Characteristics	Application Range
400°C	1.305 (ASTM 105)	Unalloyed steel	weld-in and screw-in protecting tubes in steam lines
500°C	1.5415 (AISI A204 Gr. A)	Low Alloy and high temperature steel with molybdenum addition	weld-in and screw-in protecting tubes
540°C	1.7335 (AIAI A182 F11)	Low-alloy and high temperature steel with chromium and molybdenum addition	weld-in and screw-in protecting tubes
570°C	1.7380 (AISI A182 F11)	Low-alloy and high temperature steel with chromium and molybdenum addition	weld-in and screw-in protecting tubes
650°C	1.4961	High temperature austenitic chromium nickel steel (Niobium stablized)	weld-in and screw-in protecting tubes
Rust and Acid Resistant Steel			
550°C	1.4301 (AISI 304)	Good resistance against organic acids with medium temperatures, saline solutions p.e. sulphates, sulphides, alkaline solvents with medium temperature	food, luxury market, medical, apparatus engineering
550°C	1.4404 (AISI 316 L)	With the addition of molybdenum it is more corrosion-proof in oxidizing acids, p.e. acid of vinegar, acidity of wine, phosphoric acid, sulphuric acid and others. There is an elevated resistance against intercrystalline corrosion by a reduced carbon content	chemical, pulp, nuclear, textile, pharmaceutical, dairies and breweries
550°C	1.4435 (AISI 316 L)	elevated resistance against corrosion compared with 1.4404, smaller delta ferrite portion	pharmaceutical
550°C	1.4541 (AISI 321)	good intercrystalline corrosion resistance, good resistance against heavy products, vapor, and combustion gases. Good resistance against oxidation	chemical industry, nuclear power plants, textile
550°C	1.4571 (AISI 316 TI)	elevated corrosion resistance compared to certain acids due to the addition of molybdenum. Resistant against crevice corrosion, salt water and aggressive industrial influences	pharmaceutical, dairies, and breweries



There are many different types of thermocouples. How can I find the right one?

A: The main differences among the various types are the temperature range in combination with the accuracy of the classes. The experts at SAB North America can walk you through the different types of thermocouples or customize a thermocouple to fit your needs.

Type	Standard	Material	class 1		class 2		class 3	
			Temp Range	(2) Limit deviation	Temp Range	(2) Limit deviation	Temp Range	(2) Limit deviation
T	DIN EN 60584	Cu-CuNi	-40°C to +350°C	0.5°C or 0.40%	-40°C to +350°C	1.0°C or 0.75%	-200°C to +40°C	1.0°C or 1.5%
(1) U	DIN 43710	Cu-CuNi	-	-	0°C to +600°C	± 3°C / ±0.75%	-	-
J	DIN EN 60584	Fe-CuNi	-40°C to +750°C	1.5°C or 0.40%	-40°C to +750°C	2.5°C or 0.75%	-	-
(1) L	DIN 43710	Fe-CuNi	-	-	0°C to +900°C	±3°C / ±0.75%	-	-
K	DIN EN 60584	NiCr-Ni	-40°C to +1000°C	1.5°C or 0.40%	-40°C to +1200°C	2.5°C or 0.75%	-200°C to +40°C	2.5°C or 1.5%
E	DIN EN 60584	NiCr-CuNi	-40°C to +800°C	1.5°C or 0.40%	-40°C to +900°C	2.5°C or 0.75%	-200°C to +40°C	2.5°C or 1.5%
N	DIN EN 60584	NiCrSi-NiSi	-40°C to +1000°C	1.5°C or 0.40%	-40°C to +1200°C	2.5°C or 0.75%	-200°C to +40°C	2.5°C or 1.5%
S	DIN EN 60584	PtRh 10-Pt	0°C to +1600°C	1.0°C or (3)	0°C to +1600°C	1.5°C or 0.25%	-	-
R	DIN EN 60584	PtRh-13-Pt	0°C to +1600°C	1.0°C or (3)	0°C to +1600°C	1.5°C or 0.25%	-	-
B	DIN EN 60584	PtRh30-PtRh6	-	-	600°C to +1700°C	1.5°C or 0.50%	+600°C to +1700°C	4.0°C or 1.0%

- Classes 1, 2, and 3 are valid for thermocouples.
 (1) Since April 1994 the standard DIN 43710 is no longer valid.
 (2) For the limit deviation, the higher value is valid
 (3) 1°C or $[1+(t-1100) \times 0.003]^{\circ}\text{C}$

Get Temperature Sensors Tailor-Made To Your Requirements

A: As a leading manufacturer of electric thermometers for many different applications, SAB North America can help you select the right thermocouple or create a custom solution for your application. And, we can provide the right thermocouple cable with the quality and reliability your system demands. Be sure to talk to SAB North America to get all your temperature measurement questions answered.

