TEMPERATURE MEASURING

WITH TERMO SENSOR

www.aramakco.com

Introductions

Aramak temperature measurement are available for light duty applications, high pressures, high temperatures ; as well as meeting many general service industry needs.

Selected on the basis of pressure, temperature, flow, vibration and corrosion parameters. The “K” and “RTD” (PT100) type is generally the costly and most versatile. Also available are custom temperature measurement for unique applications. Proper temperature measurement selection is critical to most applications. To configure an ARAMAK temperature measurement part number follow the Selection Part

Sensor Selection

Higher temperatures are measured with thermocouples. Different thermocouples can be used depending on the requirements. Available types are L, J, K, N, S, and B. The respective voltage series and limiting deviations are standardized according to DIN EN 60584 and DIN 43710. Compensating cables or thermal cables must be used for the connection. The different lines (sheath and stranded wire) are color coded according to the type. Applications above 800 °C require the use of protection fittings made of heat-resistant steel or ceramic. See below table for selec
tion and EMF. In many industrial applications, temperature is measured with RTD temperature. Platinum is widely used as the resistance material because it guarantees high measuring accuracy and long-term stability. The temperature-dependent electrical resistance, which increases with rising temperature, functions as the measured value here.
This is referred to as a positive temperature coefficient (PTC). The most widely used nominal values are Pt100, Pt500, and Pt1000. The various nominal values, temperature-dependent output characteristic, and tolerances are specified in DIN EN 60751.
If extended transmission paths need to be covered, a transmitter in the terminal head with an
output of 4 to 20 mA is generally recommended.

Specification

Resistance thermometer

The use of a mineral insulated cable and special sensors, including the installation, makes the vibration resistance of all industrial thermo meters very high.

The peak-to-peak acceleration values of 30 m/sec2 (3 g) for frequencies between 10 and 500 Hz (already defined in accordance with standard IEC 60751 for increased requirements) are exceeded by all industrial thermo sensor. The optimally suitable combination of measuring range, diameter, accuracy, and vibration resistance can be taken from the following table.

Accuracy classes of measurement resistors in accordance with IEC 60751

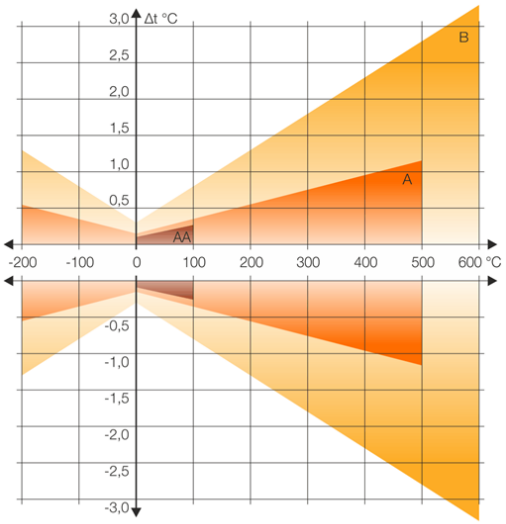
Both thin film resistors and wire wound resistors in accordance with IEC 60751 can be used across the entire range of application (also with increased accuracy class AA or class A). Subsequently, only the accuracy class of the temperature range used can remain valid.

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

Thin film resistor (TF) – Base design

	Meas. range	Vibration resistance
Class B	−50 to 400 °C (−58 to 752 °F)	100 m/sec² (10 g) at 10
Class A	−30 to 300 °C (−22 to 572 °F)	to 500 Hz
Class AA	0 to 100 °C (32 to 212 °F)	

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



Specification

Thermocouples

The Accuracy class of the thermocouple are in accordance with in the IEC60584 international Standards.

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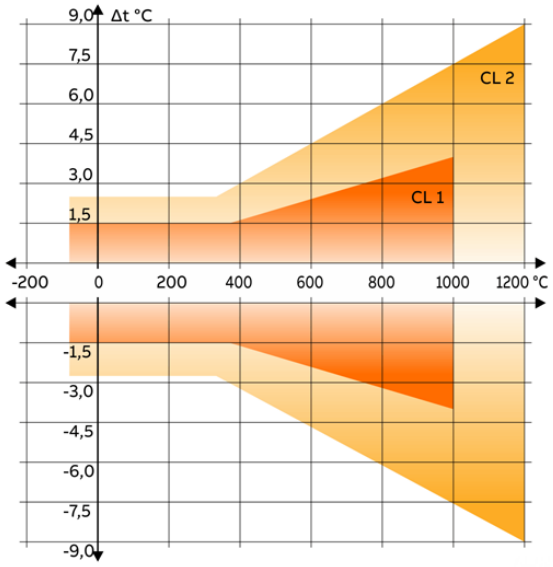
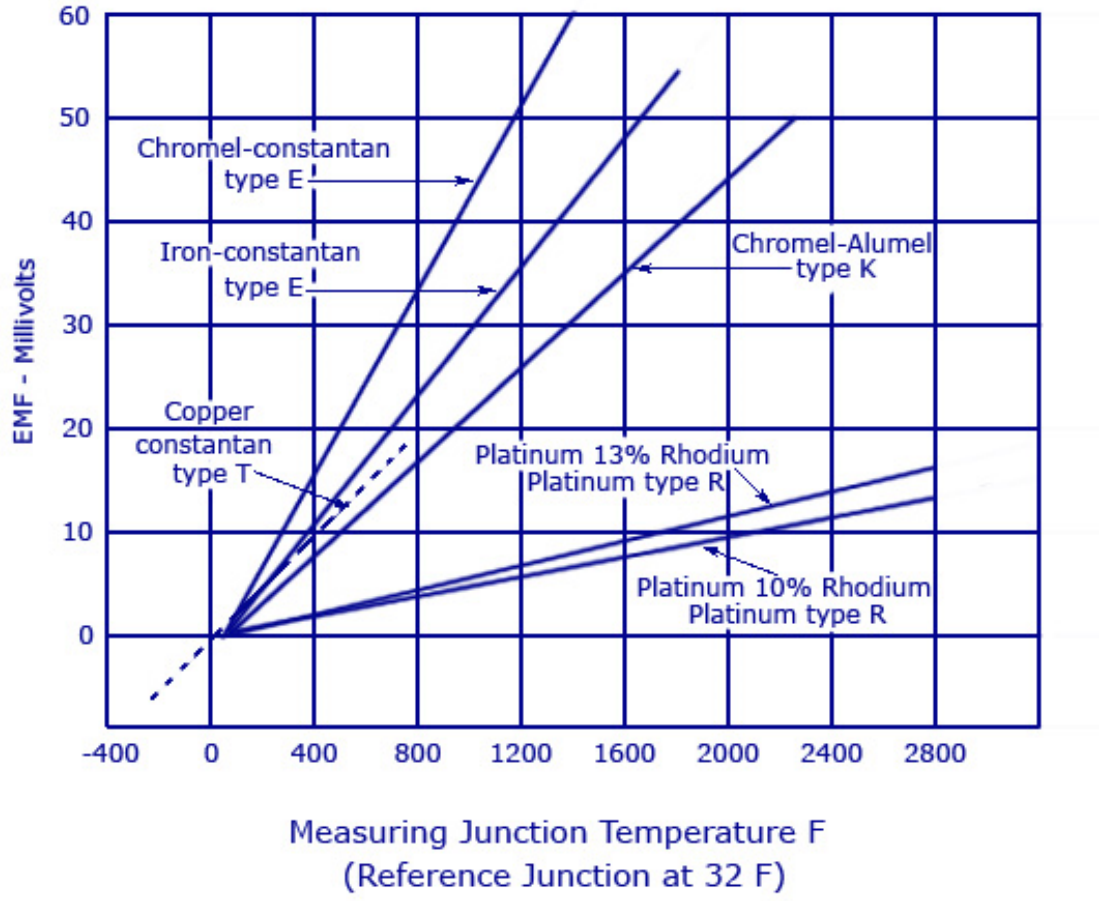
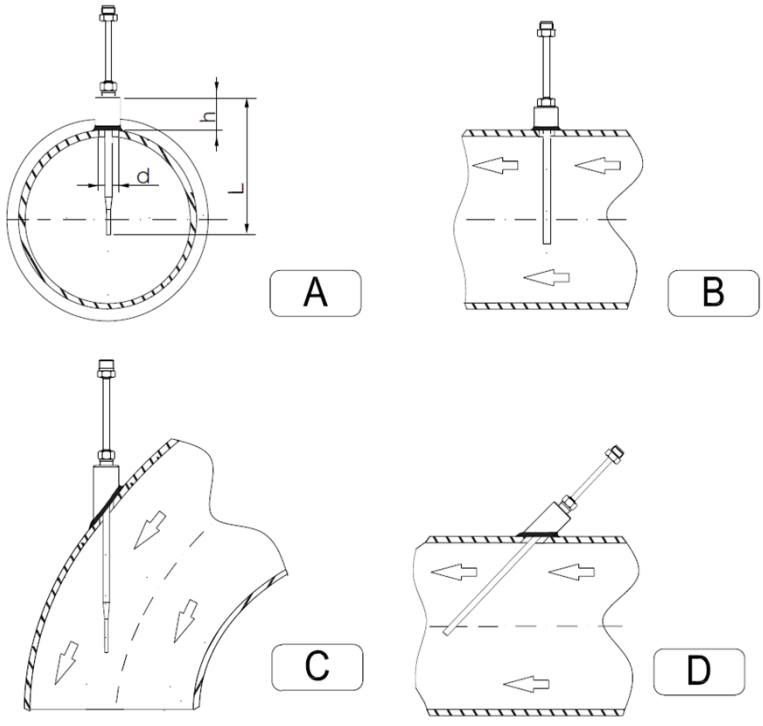




Installation

The Thermometer shall assembles on Thermowell can mounted on the wall of pipes or vessels or other plant parts that may require them.
The interface components for the process connection and the related gaskets are not normally provided with the sensors and must be purchased by the customer.
Immersion length may influence the accuracy of the measurement. If the immersion length is too low, an error may be generated in the temperature recorded due to the lower temperature of the process fluid near to the walls and heat transfer, which takes place through the sensor stem. The incidence of such an error can be relevant if there is a large difference between the process temperature and ambient temperature. In order to avoid this source of inaccuracy, the thermowell should have a small diameter and the immersion length (L) should be, if possible, at least 80÷100 mm.
For pipes with a small section, it is necessary to make sure that the tip of the probe reaches or slightly exceeds, if possible, the axis line of the duct (see fig. A-B). Insulation of the outer part of the sensor reduces the effect produced by a low immersion length. Another solution may be a tilted installation (see fig. C-D). For use in the food industry, it is best to follow the rule h <= d/2.
With regard to corrosion, the base material of the wetted parts (SS 316L/1.4404, SS 316Ti/1.4571, Hastelloy C) can tolerate the common corrosive media right up to even the highest temperatures.
For further information on specific applications, please contact the ARAMAK Customer Service.

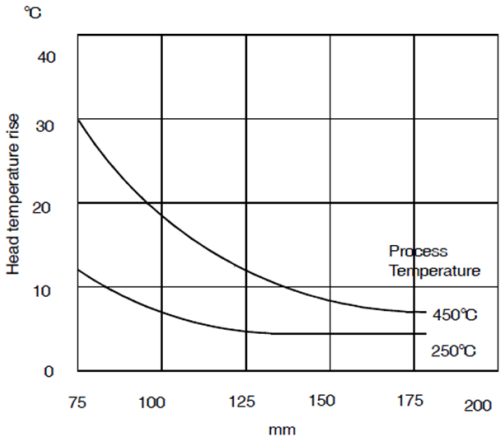


Terminals Head

A thermometer terminal head is recommended to protect the connection between the thermocouple and the extension wire. In alternative a 2-wire transmitter can be mounted in the head. The head also permits easy replacement of the thermometer. The most widely used connection heads are constructed in light metal, usually aluminum, according DIN 43729 type B.

All terminal heads are provided for connection to the Thermowell and have a cable gland with gasket. The maximum ambient temperature for heads is 80°C up to 130°C with appropriate gaskets.

The curves in figure are used to get an indication how big is the rise of temperature in the head, given the process temperature above local ambient temperature.



Cable Entry

All terminal heads are provided for connection to the sensor and have a cable gland with gasket. The maximum ambient temperature for heads is 80°C up to 130°C with appropriate gaskets.

The cable entry with gasket type show in below.

Standard | Plastic | Brass, nickel-plated | Stainless steel | Junction box, M12 x 1 (4-pin)

Thermocouple Protection

CERAMIC PROTECTION SHEATHS

Temperature Controls have available from stock a large range of ceramic sheaths. ceramics are the most economical impervious ceramic material for use as a protection sheath for thermocouples. They are gas tight and suitable for use to 1400 Deg C. Alumina ceramics have an Alumina content of 99.7% and are best suited for use with noble metal thermocouples. Rubalit sheaths offer a high working temperature to 1700 Deg C and resist chemical attack. Sizes available from stock in 1000 & 1500 mm Lengths .

6mm OD	4mm ID	Sheath COE
8mm OD	5mm ID	Sheath COE
10mm OD	7mm ID	Sheath COE
12mm OD	8mm ID	Sheath COE
15mm OD	10mm ID	Sheath COE
17mm OD	13mm ID	Sheath COE
20mm OD	15mm ID	Sheath COE
25mm OD	18mm ID	Sheath COE

HEXOLOY PROTECTION SHEATHS

Hexoloy is a sintered silicon carbide sheath and is ideal as a high performance thermowell or thermocouple protection sheath. Hexoloy is the hardest commercially available material and provides a wide range of superior properties.

- High Temperature Strength to 1900 °C
- Excellent Thermal Shock Resistance
- Universal Corrosion resistance
- High thermal conductivity equal to stainless steel and 5 times that of alumina
- Exceptional Wear Resistance—50 % Harder than Tungsten Carbide

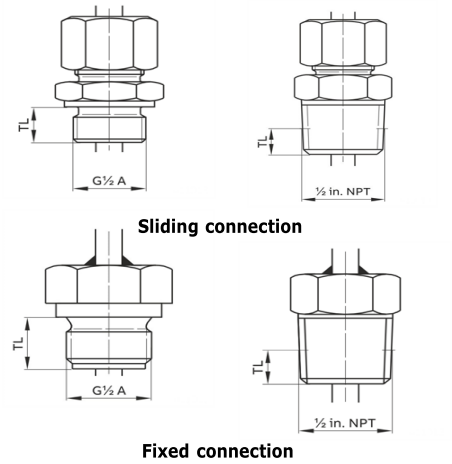
SIALON PROTECTION SHEATHS

Sialon Thermocouple protection sheaths are a silicon nitride based high quality ceramic offering superior performance in molten aluminum with direct temperature sensing in the metal. Sialon offers

- Non wetting to Aluminum and it's alloys
- Excellent thermal shock resistance
- Low maintenance
- Constant temperature monitoring

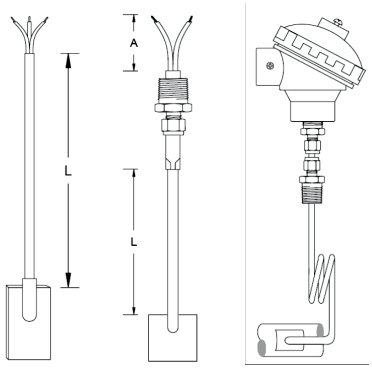
Sensor Type & Connection

Process Connection

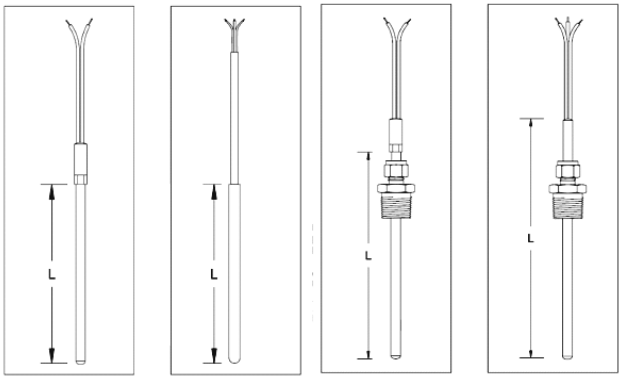


Design	Material	Thread Mineral insulated
Fixed connection	Stainless steel	M8 x 1
		G¼ A
		G½ A
		¼ in NPT
		½ in NPT
Sliding connection	Stainless steel	M8 x 1
		G¼ A
		G½ A
		¼ in NPT
		½ in NPT

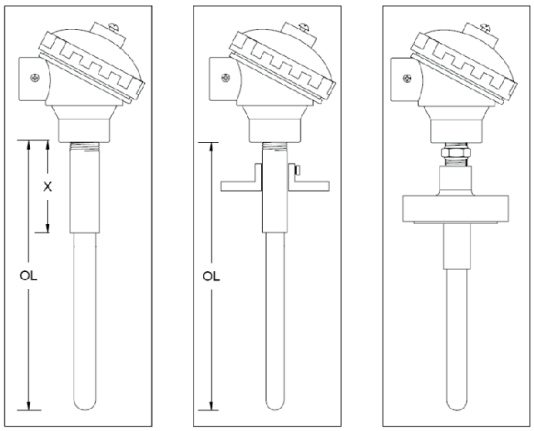
Skin Type Sensor



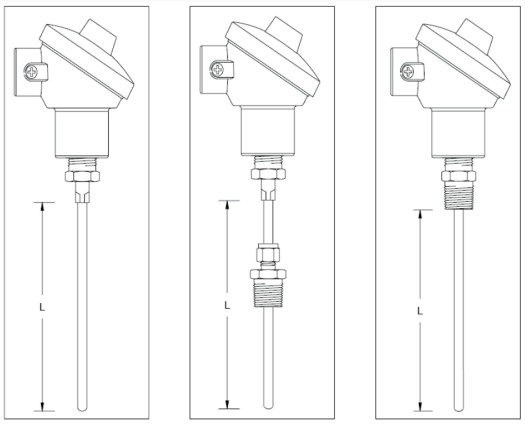
Wired RTD & TC Sensor



Furnace & high Temperature



Complete RTD & TC



Ordering Information

TSM	XXX	XXXX	XXXX	XX	XXX	XX	XX	XX	XX
Sensor Design									
Wired TC with spring	WT1								
Wired TC with Compress Fitting	WT2								
Wired TC with Aluminum Head	WT3								
Complete TC with Compress Fitting	WT4								
Complete TC with fixed sensor	WT5								
Complete TC with Nipple	WT6								
Complete TC with Union	WT7								
Wired RTD with spring	RT1								
Wired RTD with Compress Fitting	RT2								
Wired RTD with Aluminum Head	RT3								
Complete RTD with Compress Fitting	RT4								
Complete RTD with fixed sensor	RT5								
Complete RTD with Nipple	RT6								
Complete RTD with Union	RT7								
TC for Furnace	TF1								
Skin wire	SW1								
Skin with Compress fitting	SW2								
Skin with head mount & compress fitting	SW3								
Skin wire , weld on pad	SW4								
Skin with Compress fitting, weld on pad	SW5								
Other	OTH								
Sensor length (U)									
… mm (100 to 9999 mm)/ …. Mm(100 to …)		XXXX							
Wire length									
… mm (100 to 9999 mm)			XXXX						
Sensor Type									
1 x Pt100, three-wire circuit				P1					
1 x Pt100, four-wire circuit				P2					
2 x Pt100, three-wire circuit				P3					
2 x Pt100, four-wire circuit				P4					
1 x Type K (NiCr-NiAl)				K1					
2 x Type K (NiCr-NiAl)				K2					
3 x Type K (NiCr-NiAl)				K3					
1 x Type N (Fe-CuNi)				N1					
2 x Type N (Fe-CuNi)				N2					
1 x Type R (Fe-CuNi)				R					
2 x Type R (Fe-CuNi)				R2					
1 x Type S (Fe-CuNi)				S1					
2 x Type S (Fe-CuNi)				S2					
1 x Type B (Fe-CuNi)				B1					
2 x Type B (Fe-CuNi)				B2					
Others				O1					

Ordering Information

Sensor Diameter					
3 mm	S1				
4.5 mm	S2				
6 mm	S3				
9 mm	S4				
Others	H7				
Sensor Material					
Stainless steel 316		S1			
Stainless steel 304		S2			
Stainless steel 321		S3			
Stainless steel 310		S4			
Inconel 600		S5			
Inconel 800 (for R, S, B type)		H1			
Alumina 95%		H2			
Alumina 99%		H3			
Others		H7			
Process connection type					
Without			F0		
Parallel thread M8 x 1			F1		
Parallel thread M20 x 1.5			F3		
Parallel thread G ¼ A			F4		
Parallel thread G ½ A			F5		
Tapered thread ¼ in. NPT			F6		
Tapered thread ½ in. NPT			F7		
Other			F8		
Electrical Connection					
Aluminum Head, M20 Gland				E1	
Ceramic Terminal				E2	
Thermocouple-plug				E3	
Open wires, length 100 mm				E4	
Aluminum Head,4~20mA Transmitter				E5	
Aluminum Head,4~20mA Transmitter , Display				E6	
Others				E7	
Additional Options					
Material Certificate					N1
NACE Certificate					N2
Dimension Report					D1
Drawing Document					D2
Plug & chain					D3
Calibration					U1
Tag No.					U2
Pressure test internal (water)					U3
Radiograph process connection					W1
Weld location report					W2
Weld qualification report					W3

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