

# Thermocouple - Junction Styles

## Grounded Junction

The wires in the thermocouples are welded into the tip of the sheath material making it a junction. This junction has faster response than an ungrounded junction. It is recommended for the measurement of static or flowing gas and liquid temperatures and for high pressure applications. It is the most commonly supplied junction type.

## Ungrounded Junction

In this type of thermocouple, the wires are insulated from the sheath with magnesium oxide powder (soft). This type of junction should be used where the thermocouple may come in contact with electrical lines or where the control system requires an ungrounded input. Applications are the same as for the grounded type, but response time is slower than the grounded junction.

## Exposed Junction

The thermocouple wires are completely exposed for fastest response time. The wires are completely exposed to the environment so that this type of junction should only be used in suitable environments. The sheath insulation is sealed at the factory, where the wires emerge, to prevent moisture or gas penetration of the magnesium oxide insulation. It is recommended for the measurement of static or flowing non-corrosive gas temperatures where fast response time is required.

## Thermocouple Application Guide And Error Charts

Limits Of Error					
Thermocouple	Temperature Range		Standard	Special	Application Information
	°C	°F	°C (whichever is greater)	°C (whichever is greater)	
T	0 to 350	32 to 700	±1 or ±0.75%	±0.5 or 0.4%	Useable in oxidizing, reducing, or inert atmospheres as well as vacuum. Not subject to corrosion in most atmospheres. Limits of error published for sub-zero temperature ranges.
J	0 to 750	32 to 1400	±2.2 or ±0.75%	±1.1 or 0.4%	Suitable for vacuum, reducing, or inert atmospheres, oxidizing atmosphere with reduced life. Iron oxidizes rapidly above 1000°F (538°C) so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 1000°F (585°C).
K	0 to 1250	32 to 2300	±2.2 or ±0.75%	±1.1 or 0.4%	Recommended for continuous oxidizing or neutral atmospheres. Mostly used above 1000°F (538°C). Subject to failure if exposed to sulphur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes "green rot" and large negative calibration drifts most serious in the 1500–1900°F range (816–1038°C). Ventilation of inert-sealing of the protection tube can prevent this.
R or S	0 to 1450	32 to 2700	±1.5 or ±0.25%	±0.6 or 0.1%	Recommended for high temperature. Must be protected with non-metallic protection tube and ceramic insulators. Continued high temperature usages causes grain growth which can lead to mechanical failure. Negative calibration drift caused by rhodium diffusion to pure leg as well as from rhodium volatilization. Type R is used in industry; type S in the laboratory.

## Thermocouple Temperature Limits

Calibration	1/25"		1/16"		1/8"		3/16"		1/4"		5/16"		7/16"	
J	482°C	900°F	538°C	1000°F	538°C	1000°F	649°C	1200°F	649°C	1200°F	649°C	1200°F	649°C	1200°F
T	149°C	300°F	204°C	400°F	204°C	400°F	371°C	700°F	371°C	700°F	371°C	700°F	371°C	700°F
K	760°C	1400°F	982°C	1800°F	982°C	1800°F	1093°C	2000°F	1093°C	2000°F	1093°C	2000°F	1149°C	2100°F
E	427°C	800°F	538°C	1000°F	538°C	1000°F	538°C	1000°F	593°C	1100°F	649°C	1200°F	704°C	1300°F