

CHARACTERISTICS OF THERMOCOUPLES

Type	+ Leg	- Leg	Range, °C	Limits of Error	Environment	Comments
E	Chromel (Ni-10Cr)	Constantan	-200 - 900	Above 0°C: ±0.5% or ±1.7°C Below 0°C: ±1.0% or ±1.7°C	Oxidizing or inert, limited use in vacuum or reducing	Highest EMF change per degree.
J	Iron	Constantan	0 - 750	±0.75% or ±2.2 °C	Reducing, vacuum, or inert, limited use in oxidizing	Not recommended for low temperatures.
K	Chromel (Ni-10Cr)	Alumel Ni-5(Al, Si)	-200 - 1250	Above 0°C: ±0.75% or ±2.2 °C Below 0°C: ±2.0% or ±2.2°C	Clean oxidizing or inert, limited use in vacuum or reducing	Wide temperature range, most popular calibration
R	Platinum-13% Rhodium	Platinum	0 - 1450	±0.25% or ±1.5 °C	Inert or oxidizing. Do not use metal protection tubes. Beware of contamination	High temperature
S	Platinum-10% Rhodium	Platinum	0 - 1450	±0.25% or ±1.5 °C	Inert or oxidizing. Do not use metal protection tubes. Beware of contamination	High temperature
T	Copper	Constantan	-200 - 350	Above 0°C: ±0.75% or ±1.0°C Below 0°C: ±1.5% or ±1.0°C	Mild oxidizing, reducing vacuum or inert. Good where moisture is present.	Low temperature and cryogenic applications

Reference: Omega Engineering's *Temperature Handbook*.

NIST Polynomial Coefficients

Type	E	J	K	R	S	T
Range	-100°C - 1000°C	0°C - 760°C	0°C - 1370°C	0°C - 1000°C	0°C - 1750°C	-160°C - 400°C
Error	±0.5°C	±0.7°C	±0.7°C	±0.5°C	±1.0°C	±0.5°C
a ₀	0.104967248	-0.048868252	0.226584602	0.263632917	0.927763167	0.100860910
a ₁	17189.45282	19873.14503	24152.10900	179075.491	169526.5150	25727.94369
a ₂	-282639.0850	-218614.5353	67233.4248	-48840341.37	-31568363.94	-767345.8295
a ₃	12695339.5	11569199.78	2210340.682	1.90002x10 ¹⁰	8990730663	78025595.81
a ₄	-448703048.6	-264917531.4	-860963914.9	-4.82704x10 ¹²	-1.63565x10 ¹²	-9247486589
a ₅	1.10822x10 ¹⁰	2018441314	4.83506x10 ¹⁰	7.62091x10 ¹⁴	1.88027x10 ¹⁴	6.97688x10 ¹¹
a ₆	-1.76807x10 ¹¹		-1.18452x10 ¹²	-7.20026x10 ¹⁶	-1.37241x10 ¹⁶	-2.66192x10 ¹³
a ₇	1.7842x10 ¹²		1.38690x10 ¹³	3.71496x10 ¹⁸	6.17501x10 ¹⁷	3.94078x10 ¹⁴
a ₈	-9.12978x10 ¹²		-6.33708x10 ¹³	-8.03104x10 ¹⁹	-1.56105x10 ¹⁹	
a ₉	2.06132x10 ¹³				1.69535x10 ²⁰	

Reference: Hewlett-Packard's application note 290, *Practical Temperature Measurements*, page 8.

Standard Polynomial Form

$$T = a_0 + a_1x + a_2x^2 + a_3x^3 \dots a_nx^n$$

Nested Polynomial Form

$$T = a_0 + x(a_1 + x(a_2 + x(a_3 + x(a_4 + xa_5)))) \quad (5^{th} \text{ order})$$

