

Thermocouple

Codes/Conductor combinations
Characteristics
National & International standards
Extension & compensating
cable colours

CODE	CONDUCTOR COMBINATIONS		Approximate generated EMF change per degree Celsius Change with reference junction at 0°C.			Approximate working temperature range of measuring junction. NB Not related to wire and conductor insulating materials.		National standards for outputs of thermocouple conductors	National colour coding for insulation of thermocouple and extension cable (and compensating cable where noted as such)					NOTES	
	+ leg	- leg	µV/°C at			°C			Those standards noted in this column all conform with each other and are based upon IPTS 1968 & IEC 584.1: 1977	BRITISH to BS 1943	AMERICAN to ANSI/MC96.1	GERMAN to DIN 43714	FRENCH to NF C 42-323		JAPANESE to JIS C 1610-1981
			100°C	500°C	1000°C	Continuous	Short Term								
K	NICKEL-CHROMIUM Also known as: *Chromel, *Thermokanthal KP, Ni-Cr, *T1, *Topfel	NICKEL-ALUMINIUM (magnetic) Also known as: Ni-Al, *Alumel, *Thermokanthal KN, *T2, *Nial	42	43	39*	0 to +1100	-180 to +1350	BS4937 part 4 ANSI/MC96.1 type K DIN 43710 NF C 42-321 JISC 1602						Wide range and most commonly used. BS 4937 part 4 replaced BS 1827. ANSI/MC96.1 type K replaced circular 561	
V	COPPER	COPPER-NICKEL Also known as: Constantan, *Advance, Nickel	Used for interconnecting Type 'K' thermocouples and instrumentation as an alternative to Type 'K' material. Only used where the interconnection temperature is in the range 0°C to +80°C.											Colour coded for used as a compensating cable for Type 'K' thermocouple. In fact Type 'T' conductors are incorporated and therefore excepting that the colour coding will be incorrect this compensating cable also be used for extending Type 'T' thermocouples.	
T	COPPER	COPPER-NICKEL Also known as: Nickel, *Cupron, *Advance, Constantan	46	—	—	-185 to +300	-250 to +400	BS4937 part 5 ANSI/MC96.1 type T NF C 42-321 JISC 1602						Many low temperature and cryogenic applications. Suitable for used in a mildly oxidising or reducing atmosphere as an unprotected thermocouple sensor. BS 4937 part 5 replaced BS 1828. ANSI/MC96.1 type T replaced circular 561	
J	IRON (magnetic) Also known as: Fe	COPPER-NICKEL Also known as: Constantan, *Advance, *Cupron	46	56	59	+20 to +700	-180 to +750	BS4937 part 3 ANSI/MC96.1 type J NF C 42-321 JISC 1602						Commonly used in the plastics moulding industry. Used in reducing atmospheres as an unprotected thermocouple sensor. NB Iron rusts at low and oxidises at high temperatures. BS 4937 part 3 replaced 1829. ANSI/MC96.1 type J replaced circular 561	
E	NICKEL-CHROMIUM Also known as: *Chromel, *Topfel, Chromium, Nickel	COPPER-NICKEL Also known as: Nickel, Copper, Constantan, *Advance, *Cupron	68	81	—	0 to +800	—	BS4937 part 6 ANSI/MC96.1 type E DIN 43710 NF C 42-321 JISC 1602						Highest thermal EMF output change/°C. Suitable for used in a vacuum or mildly oxidising or reducing atmosphere as an unprotected thermocouple sensor. ANSI/MC96.1 type E replaced circular 561	
N	NICKEL-CHROMIUM-SILICON Also known as: Nicrosil	NICKEL-SILICON-MAGNESIUM Also known as: Nail	30	38	39	0 to +1100	-270 to +1300							This combination shows good promise as an alternative to Type 'K'. Appears to be more stable and longer lived. It is proposed that the code N and the thermal EMF outputs for type N thermocouples (generally as NBS monograph 161) be adopted under BS 4937 Part 8.	
R	PLATINIUM-13% RHODIUM	PLATINIUM	8	10	13	0 to +1600	-50 to +1700	BS4937 part 2 ANSI/MC96.1 type R DIN 43710 NF C 42-321 JISC 1602						Used for high temperature application. Used in the UK in preference to Type 'S' for historical reasons. Has high resistance to oxidation and corrosion. Easily contaminated and normally requires protection. BS 4937 part 2 replaced BS 1826. ANSI/MC96.1 type R replaced circular 561	
S	PLATINIUM-10% RHODIUM	PLATINIUM	8	9	11	0 to +1550	-50 to +1700	BS4937 part 1 ANSI/MC96.1 type S DIN 43710 NF C 42-321 JISC 1602						See Type 'R' above. BS 4937 part 1 replaced BS 1826. ANSI/MC96.1 type S replaced circular 561	
B	PLATINIUM-30% RHODIUM	PLATINIUM-6% RHODIUM	1	5	9	+100 to +1600	+50 to +1750	BS4937 part 7 ANSI/MC96.1 type B DIN IEC 88 NF C 42-321 JISC 1602						See type 'R' above. Commonly used in glass industry. Copper VS copper compensating cable can be used for normal ambient interconnection temperature up to 100°C. ANSI/MC96.1 type B replaced circular 561	
U	COPPER	COPPER-LOW VALUE NICKEL Also known as: Nickel, *Advance, *Cupronic	Used for interconnecting Type 'R' and 'S' thermocouples and instrumentation. Only used where the interconnection temperature is in the range 0°C to +50°C.											This is a compensating cable only and is used with Types 'R' and 'S' measuring thermocouple sensors.	
W	TUNGSTEN	TUNGSTEN-26% RHENIUM	5	16	21	+20 to +2300	0 to +2600							Tungsten Rhenium alloy combinations offer reasonably high and relatively linear EMF outputs for high temperature measurement up to 2600°C and good chemical stability at high temperatures in hydrogen, inert gas and vacuum atmospheres. They are not really practicable for use below 400°C. Not recommended for use in oxidising conditions. Suggested compensating cable below.	
W5	TUNGSTEN 5% RHENIUM	TUNGSTEN 26% RHENIUM	15	18	18	+20 to +2300	0 to +2600								
W3	TUNGSTEN 3% RHENIUM	TUNGSTEN 25% RHENIUM	13	20	20	+20 to +2000	0 to +2100								

Thermocouple Combination	Compensating Cable Combination	
	+ leg	- leg
W	ALLOY 220*	ALLOY 226*
W5	ALLOY 405*	ALLOY 426*
W3	ALLOY 203*	ALLOY 225*

NB Thermocouple tolerances
At the time of publishing this data the IEC 584.2:1982 (BS 4937 Part 20:1983) specification has been introduced but the BSI has not yet officially superseded that Part of BS 1041 Part 4:1966, which relates to this subject. We understand that this will occur in due course.
*Trade name

* These codes have not been adopted Nationally or internationally.

* With reference to ANSI/MC96.1 colour coding, it is noted that a brown overall sheath colour, replacing that shown, denotes the incorporation of thermocouple grade conductors where relevant. However, cables available from us incorporate thermocouple grade conductors as standard within the colour coding illustrated where relevant.

* These colour codes normally related only to the compensating cable for use with the appropriate thermocouple conductor combination type code.