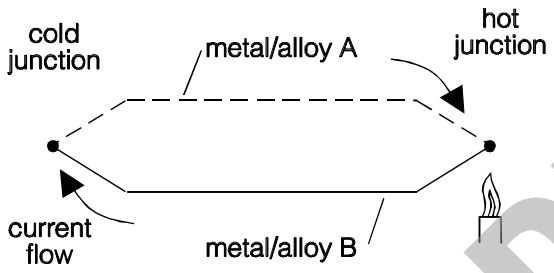
Thermocouples

Modex thermocouples are manufactured in-house to our customers' individual specifications. To place an initial order, please provide a dimensional drawing with details of sensor type and special requirements. Each thermocouple specification is allocated a number (fitted to each thermocouple in the form of a tag) which may be quoted when re-ordering to the same specification.

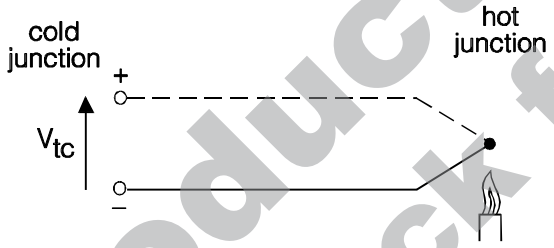
Principles of Operation

Thermocouple temperature probes are a useful product of the 'thermocouple effect', a property that is peculiar to certain combinations of different metals and alloys.

If two wires made of these different materials are connected at each end, and heat is applied to one of the connections (the 'hot junction'), the temperature difference between the two junctions causes a current to flow around the circuit:–



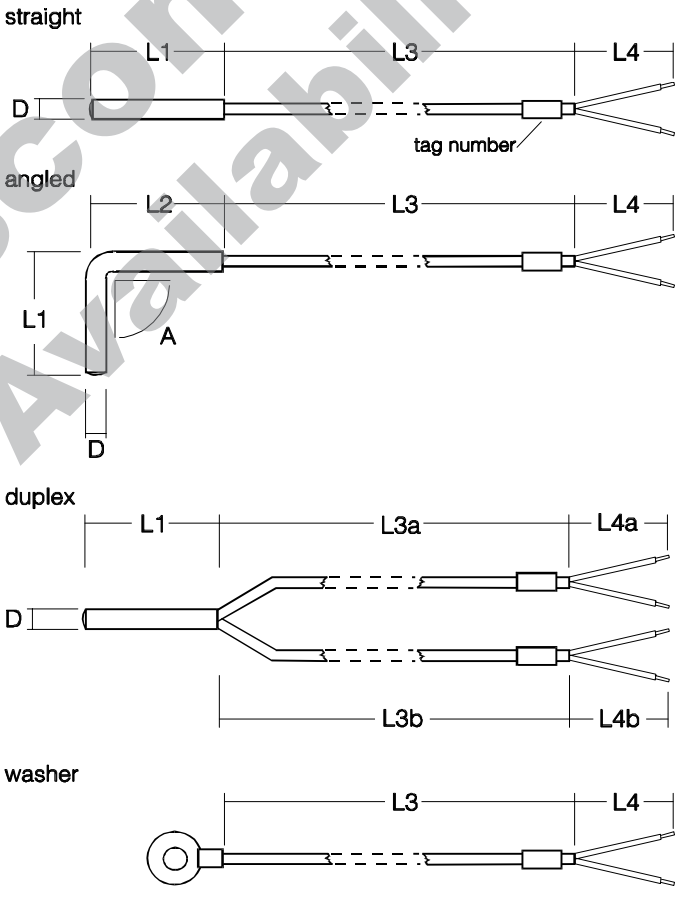
If the 'cold' junction is disconnected, this potential for current flow can be measured as a milli-voltage (V_{tc}) between the two disconnected wires:–



For particular metal and alloy combinations, over certain temperature ranges, this voltage increases linearly and predictably with an increasing temperature difference. This linear signal makes for relatively easy measurement, and hence control, of process temperature by electronic equipment.

Approximately 10 combinations of metals and alloys have been adopted by international standards organisations as being useful in temperature measurement and control applications. Each combination (or 'type') has it's own internationally recognised letter (e.g. 'K' type) and nationally recognised colour coding for the wire insulation. For each thermocouple type, tables are available which give the voltage generated for any given temperature difference.

Thermocouple types:–



washer	standard bolt sizes: 2BA, 4BA, 1/4"
D	standard diameters: 1/8",3/16",1/4", 4mm, 5mm, 6mm, 7mm, 8mm
L1/L2:	stainless steel body with silver solder tip, optional welded tip, optional anti-corrosion sleeving
L3:	fibreglass insulated thermocouple cable, with or without stainless steel armour braiding
L4:	stripped tails: standard lengths 38mm or 75mm

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TEMPERATURE SENSORS

In the UK., the most commonly used types are:–

J type Iron/Constantan (Fe/Con or I/C).
Useful over the range +20 to +700°C.

K type Chromel/Alumel (NiCr/NiAl, Cr/Al, or C/A).
Useful over the range 0 to +1100°C.

Construction and Installation of thermocouples

Each thermocouple therefore consists of two wires. At one end, the 'hot junction' is usually fitted for protection inside a metal probe, and mounted in a position which gives the most accurate measurement of the process temperature. Correct location is important: mounting the probe too close or too far from the source of heat can result in the incorrect measurement of the true process temperature, in turn leading to inaccurate temperature control.

The lead out from each probe is sheathed in glass fibre for good electrical insulation and heat resistance, and is usually supplied with an outer stainless steel braid for protection and electrical screening. At the end of the lead out, +ve and –ve colour coded wires are supplied ready stripped for connection to the controlling device. The UK. colour coding (to BS1843) for J and K type thermocouples is:–

	Inner insulation		Outer insulation
	+ ve	– ve	
J type	yellow	blue	black
K type	brown	blue	red

To ensure the accuracy and stability of the thermocouple output voltage, any additional interconnection or panel wiring between thermocouple and temperature controller should be of a compatible type of 'compensating cable' (see 'accessories', right).

Note that the output voltage of a thermocouple is proportional to the *difference* between hot and cold junctions, but that most applications require the control of a process to a fixed, absolute temperature. Each monitoring or controlling device must therefore incorporate a circuit which compensates for variations in the cold junction (i.e. ambient) temperature. All Modex temperature controllers are fitted with an automatic 'cold junction compensation' circuit as standard.

Ordering:

To order a new specification thermocouple, please specify:–

a) Thermocouple type (J or K)
b) Physical type and dimensions
(e.g. as per sample drawings overleaf)
c) Special options, if required (see section right)

Special Options and Accessories

All welded stainless steel construction Standard Modex thermocouples employ a silver solder tip, suitable for working temperatures of up to 500°C. Temperatures above this level require the tip to be of an 'all welded' construction.

Anti-corrosion/ chemically resistant sleeving Atum® (to +80°C) or Viton® (to +200°C) probe sleevings – please contact Modex for full specifications.

Compensating cable: For use as thermocouple extension wiring in panels or cable runs.

Available as either:–

a) Fibreglass insulated, stainless steel braided cable (as used in thermocouples). Available by the meter, or

b) PVC insulated tinned copper braided compensating cable (more flexible than fibreglass). Available in 100m reels only.

Compensating connectors: Electrical connectors made of the appropriate metal/alloy for interconnection between thermocouples and compensating cable without loss of accuracy.

Mounting accessories: Bayonet fittings, compression glands, anti-kink springs, etc.. Please contact Modex with your requirements.

To re-order, simply quote the individual tag number fitted to the tail end of each thermocouple.