



## Instruments to Industry Ltd

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**D I R E C T**

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### **What is a Thermocouple?**

A thermocouple is a sensor used to measure temperature in a number of processes. Thermocouples consist of two wire legs made from dissimilar metals which are fixed together at one end, creating a junction. When this junction experiences a change in temperature a voltage is created, this voltage can then be measured and referenced back to the temperature. We supply many types of Thermocouples for various applications, to discuss which would best suit your application contact us on [sales@itidirect.co.uk](mailto:sales@itidirect.co.uk).

### **I need a new Thermocouple, but don't know what type, can you help?**

The simplest way to identify a thermocouple is by the colour of the wire, for more complex sensors please send a couple of photos to [sales@itidirect.co.uk](mailto:sales@itidirect.co.uk) along with any additional information and we will get back to you within 24 hours.

### **What is mineral insulated thermocouple cable and its benefits?**

Mineral insulated thermocouple cable consists of an outer metal sheath that houses the thermocouple conductors; the sheath is then filled with a highly compacted magnesium oxide powder to prevent the conductors contacting at any point other than the fixed junction. This construction allows the sheaths to be easily bent or formed to shape as required by the user, but remain rigid during use. The whole assembly is hermetically sealed giving the conductors full protection from the operating environment.

Mineral Insulated thermocouples have a wide temperature range are robust, flexible and can be made in long lengths and with a broad range of diameters. They also have a very fast response time, and generally more resistant to chemicals due to the sheath and insulating power protecting them meaning they have a longer life than normal sensors.

## What is the difference between a Thermocouple and an RTD?

We have a detailed case study giving practical advice and comparison on the difference between thermocouples and RTD sensors in our technical section.

## What is a type K Thermocouple?

A K Type Thermocouple is the most popular thermocouple available and is used for a wide range of applications. It has a good mV per Deg C output and a wide temperature range of use (typically to – 200 to + 1200 C). It is made from two conductors, the positive leg is 90% nickel, 10% chromium and negative leg is 95% nickel, 2% aluminium, 2% manganese and 1% silicon.

## Which leg of Type K is magnetic?-

K type thermocouple has two legs (Alumel & Chromel). The Alumel leg is magnetic, where the Chromel leg is non-magnetic. This helps to identify the thermocouple when there is no colour coding or the colour coding is not one that you recognise.

## How far should my Thermocouple be immersed in the application?

Thermocouple sensors are 'tip' sensing devices which make them ideal for both surface and immersion applications (Depending on the sensor style). Immersion thermocouples must be used carefully to avoid stem conduction errors, this is when heat flows to or from the sheath and in or away from the process which can result in error in the reading. As a rule of thumb the sensor should be immersed a minimum of 4 times the outside diameter of the sheath (E.g if the diameter is 3mm the minimum immersion depth would be 12mm)



### **How accurate are Thermocouples?**

There are many types of thermocouple (K,T,J,E,N,R,S & B). Each type has its own accuracies as governed by the IEC. There are typically 3 accuracy tolerances for each type of thermocouple, with Class 1 being the most accurate. For K type thermocouple sensor class 1 accuracy is 1.5°C or 0.4% of reading (whichever is the greater figure).

### **What is the difference between Thermocouple grade cable and Extension grade cable?**

Thermocouple grade cable is used internally in sensors to create a sensing point, extension cable is used to connect a sensor to the measuring instrument. It is actually the same as Thermocouple grade cable which means the chance of error is significantly reduced. From past experience we recommend using no more than 80 - 100 metres as this will start to cause errors in the reading, it is also recommended that shielded cable is used for longer runs of cable.

### **What is Thermocouple compensating cable?**

Compensating cable is an economical alternative to extension cable; this is due to it using cheaper alloys, the alloys of which are different from those of the thermocouple grade but have the same output over a limited temperature range. Thermocouple and extension cable are interchangeable but compensating cable must ONLY be used for its intended purpose (i.e. compensating cable could not be used to create a junction inside a sensor).