

Thermocouples are widely used to measure temperature. This works on the thermoelectric effect, whereby a metal will generate a voltage when heated. By taking the differential voltage generated when two different metals in the same circuit are heated it is possible to measure changes in temperature as a change in the voltage. In order to get an accurate measurement, expensive metals are commonly used within the temperature probe itself. For long cable runs, the cost of these metals becomes prohibitive and for that reason Habia Cable manufacture a range of Extension and Compensation cables.

Extension cables exhibit the same voltage / temperature characteristics as the Thermocouple over a limited range. By using similar metals to the Thermocouple, they have the advantage of minimising any miss-match in the circuit.

Compensation cables also exhibit similar voltage / temperature characteristics as the Thermocouple over a limited range and they offer a cost saving over both the Thermocouple and the Extension cables. As they use dissimilar metals they are less precise.

As a custom design manufacturer, Habia Cable are able to use any of our wide range of materials as Thermocouple type cables. The common types are:

| Thermocouple types: | | | |
|---------------------|--------------|---------------------------|----------------------------|
| Name | Type | Positive conductor | Negative conductor |
| EX | Extension | Nickel-Chromium (Chromel) | Copper-Nickel (Constantan) |
| JX | Extension | Iron | Copper-Nickel (Constantan) |
| KX | Extension | Nickel-Chromium (Chromel) | Nickel-Aluminium (Alumel) |
| NX | Extension | Nicrosil | Nisil |
| TX | Extension | Copper | Copper-Nickel (Constantan) |
| KCB | Compensation | Copper | Copper-Nickel (Constantan) |
| RCA/SCA | Compensation | Copper | Copper-Nickel (Constantan) |

With all temperature measurement, the essential factor is accuracy. Therefore there are two different tolerance classes for the conductors with Class 1 cables able to measure over a tighter temperature range than Class 2 conductors.

| Thermocouple types: | | | | | |
|---------------------|--------------------|--------------------|------------------------------|--------|---------|
| Name | Tolerance Class 1 | Tolerance Class 2 | Operating range (continuous) | | |
| EX | ± 120 µV (± 1,5°C) | ± 200 µV (± 2,5°C) | -25°C | +200°C | +500°C |
| JX | ± 85 µV (± 1,5°C) | ± 140 µV (± 2,5°C) | -25°C | +200°C | +500°C |
| KX | ± 60 µV (± 1,5°C) | ± 100 µV (± 2,5°C) | -25°C | +200°C | +900°C |
| NX | ± 60 µV (± 1,5°C) | ± 100 µV (± 2,5°C) | -25°C | +200°C | +900°C |
| TX | ± 30 µV (± 0,5°C) | ± 60 µV (± 1,0°C) | -25°C | +100°C | +300°C |
| KCB | - | ± 100 µV (± 2,5°C) | 0°C | +100°C | +900°C |
| RCA/SCA | - | ± 30 µV (± 2,5°C) | 0°C | +100°C | +1000°C |

Although there are many combinations of cores, screens and jackets that can be produced, the typical Extension or Compensation cable will be produced as twin core (positive and negative) cable with stranded conductors. Habia will endeavour to propose a design that lines up with an existing standard (e.g. NEMA-HP4 for FEP wires) however it is also possible for custom thicknesses to be used. With this in mind, Habia have developed a simple to use part numbering system to simply identify the materials and basic construction of a custom cable:

| Thermocouple part numbering system: | |
|-------------------------------------|---|
| IEC KX-1 STKK-K 2 X 0,5 | |
| _____ | CSA or AWG |
| _____ | Number of cores |
| _____ | Highly stranded (K), Few strands (R) or Solid (U) |
| _____ | Jacket material (e.g. K = FEP) |
| _____ | Insulation material (e.g. K = FEP) |
| _____ | Twisted (T) or Flat/Parallel (F) |
| _____ | Screened (S) or Un-screened (U) |
| _____ | Tolerance class (1 or 2) |
| _____ | Thermocouple type (e.g. KX = Chromel, Alumel) |
| _____ | Standard (e.g. IEC 60584.3) |

There are also many standards that cover Extension cables and Compensation cables. Habia Cable will recommend the use of the International standard: IEC 60584.3: 1989, however the company also recognizes: BS4937: Part 30 1993, BS 1843, ANSI MC96.1, DIN 43710-4 and JISC 1601 and these can be produced at no extra cost.