LABFACILITY
TEMPERATURE & PROCESS TECHNOLOGY

CONNECTING THERMOCOUPLE SENSORS TO INSTRUMENTATION

Connecting the thermocouple sensor to instrumentation must be done carefully to optimize accuracy and minimize cost. The resultant temperature measurement is only as accurate as the sensor and its interface.

The thermocouple produces only a small thermo-electric e.m.f (typically 40μV/^{o}C) and it is necessary to eliminate or minimize spurious thermal emf signals and Ohmic effects which would otherwise result in incorrect readings.

The length of cable used between the sensor and the instrument is an important consideration because the line resistance has to be taken into account (although the instrument input is effectively high impedance, the input usually incorporates special circuitry to result in an 'upscale' reading in the event of sensor failure). Most instruments specify a maximum of 100 Ohm loop cable resistance without accuracy being compromised; this, for example corresponds to only 22m of type K, 7/0.2mm core extension cable (or 44m of equivalent compensating cable).

Extension cable uses true thermocouple wire and is designated X (e.g. KX for type K); compensating cable has a C designation (e.g. KC for Vx, type K) and consists of Vx and U types. Extension cable has a temperature/ e.m.f relationship to an appropriate standard over the complete temperature range.

Compensating cable is of different composition to extension cable (it uses alternative, cheaper alloys) but has a similar temperature vs e.m.f. relationship over a limited range and should only be used for joining thermocouples to their measuring instruments**.** It can only be used in limited ambient temperature, generally not higher than 80^{o}C.

With long cable runs, the cable may need to be screened and earthed at one end (at the instrument) to minimize noise pick-up (interference) on the measuring circuit. Alternative types of screened cable construction are available, and these include the use of copper or mylar screening.

Direct Connection is made using an appropriate type of cable; this is indicated by colour coding according to IEC 584-3 on the insulation. The type of insulation specified would ideally be suited to the working environment (e.g. PVC, PTE, Glassfibre etc). Correct polarity and mechanically sound connection is vital.

Connection using connectors to facilitate interchangeability of probes or the addition of extended cabling requires the use of special plugs and sockets which utilize thermocouple alloys rather than alternative metals. Such connectors are colour coded in a similar way to cable insulations to indicate the relevant thermocouple type and should comply with IEC & CENELEC specifications. Connectors are available as “standard” size (round pins) or miniature size (flat pins); the pins are polarized to ensure correct orientation and cross-connection is impossible.

A temperature transmitter can be used to convert the small thermocouple signal into an amplified current for transmission to the associated instrumentation.
Low cost copper wire is used between the device and the instrumentation (2 wire interface) and
Long cable runs are possible. The required 24V d.c. excitation is applied via the 4-20mA loop, additional wires are not required.

It is important to note that input to output isolation is not incorporated in all transmitters, only the more expensive types, it is therefore essential to use electrically insulated sensors with non-isolated devices.

Tel: +44 (0) 1243 871280

sales@labfacility.com
www.labfacility.com