

Thermocouple Calibration

12 five-meter Type T thermocouples (TC) are available for testing fluid or surface temperatures. For the accuracy of the data obtained, all thermocouples need to be calibrated.

Equipment needed for calibration: DT80 data logger, 12 thermocouples, PT-100 temperature sensor and PT-104 data logger, 3-4 thermal baths at different temperatures along the temperature interval you will be measuring (an ice-water bucket could be one of your temperature point reference).

Theory:

All thermocouples will measure the temperatures of the same bucket of water. The average data from the thermocouples are then compared with the average data of a reference thermoresistor PT-100 measuring the same temperature at the same time, which has a higher accuracy (0.02 °C in this case, 1/10 DIN). To calibrate the thermocouples over their operation range (-20°C to 80°C), they will be tested under three different temperatures, i.e. 0°C, 30°C and 60°C. Under each temperature, every thermocouple will take at least 20 measurements when data are stable (the thermocouples has reached an equilibrium with the fluid surrounding it, i.e. the measurement is jumping up and down along one temperature measurement instead of increasing/decreasing). Then a graph similar to Fig.1 will be plotted and the gradient (k1) and intercept (ko) of each thermocouple will be recorded and put into data logger for calibration.

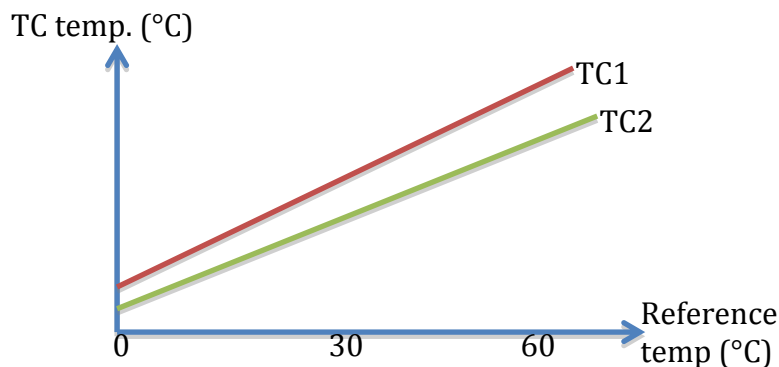


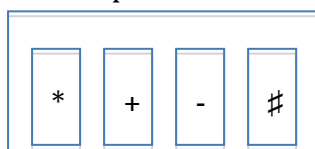
Fig.1

Testing:

1. TCs connection:

The thermocouple is a thin long wire made of two metals, copper and constantan for TT thermocouple. The red metal covered with blue film is copper and the grey metal covered with red film is constantan. After identifying the two metals, the thermocouple will be connected to the datalogger DT80. There are five channels on the data logger and each channel has four sockets and can accommodate three thermocouples.

For example: Channel 1



The copper end of TC1 is connected to * and the constantan end is connected to #. The copper end of TC2 is connected to + and the constantan end is connected to #. The copper end of TC3 is connected to - and the constantan end is connected to #.

Please note that when testing three TCs in one channel, make sure that none of the uncovered metal part of wire is touching each other, otherwise the electrical connection will prevent any accurate measurement.

After connecting TCs to the data logger, the other end of TCs will measure temperatures. If you want to measure the temperature of an electrical conductive fluid, cover the metal end with a rubber protector and tape it securely, in order to avoid any electrical connection with the other thermocouples through the fluid. If you want to measure surface temperature, stick the end to the surface with a tape of the same colour as the surface, or with an highly reflective tape (aluminium) if in outdoor environment, in order to shield it from the sun.

Then, the data logger is connected to the laptop with a USB wire. The software will be installed automatically.

2. Reference temperature:

Connect the PT-100 temperature sensor to one of the four channels on PT-104 data logger. Connect the PT-104 to laptop using a blue USB cable and install the software 'PicoLog' from the CD attached or online:

<http://www.picotech.com/data-logging-software.html>. Open the software and click 'Normal'. Open a new file and start recording data.