

Remote Lab Workshop

Exercise 1 – Temperature measurement

Purpose: The purpose of this simulation is to gain an understanding of the basic principles of a thermocouple.

The thermocouple effect is the name given to a phenomenon where a tiny current flows when a junction between two different metals is heated up.

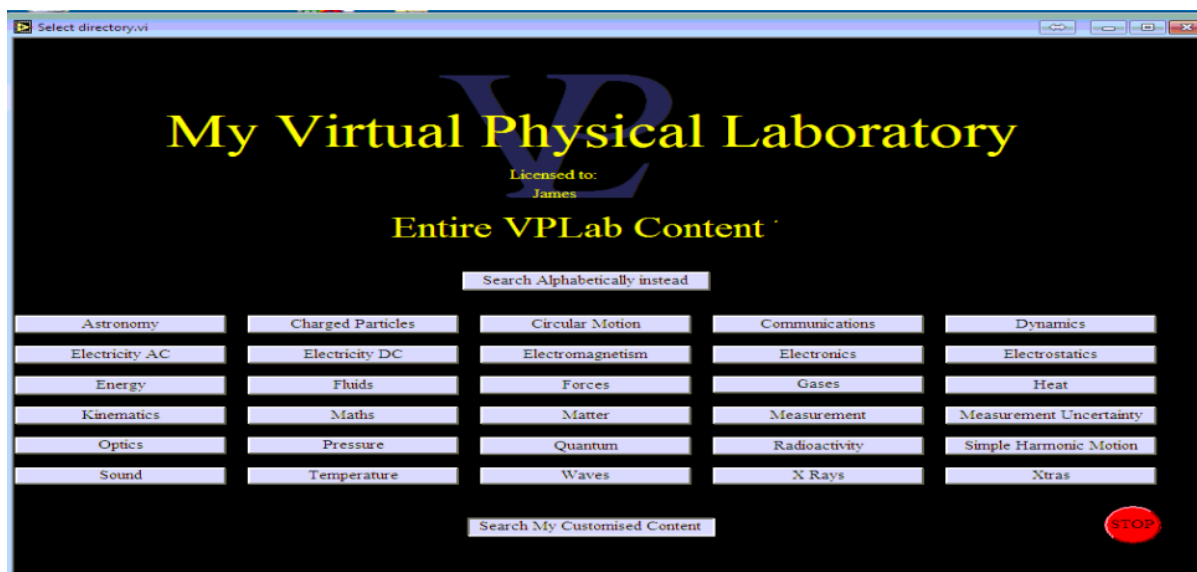
The thermocouple is a device that makes use of this effect to measure temperature. If one junction is kept at 0° C and the other is heated up, the small voltage produced can be used as a measure of the temperature difference.

Note: the potentiometer wire which has a resistance of just 1 ohm, shares the 10V with a 99.999 ohm resistor. In this way the potential difference across its entire length is only 10/100,000 (=100 μ V). Each cm represents 1 μ V.

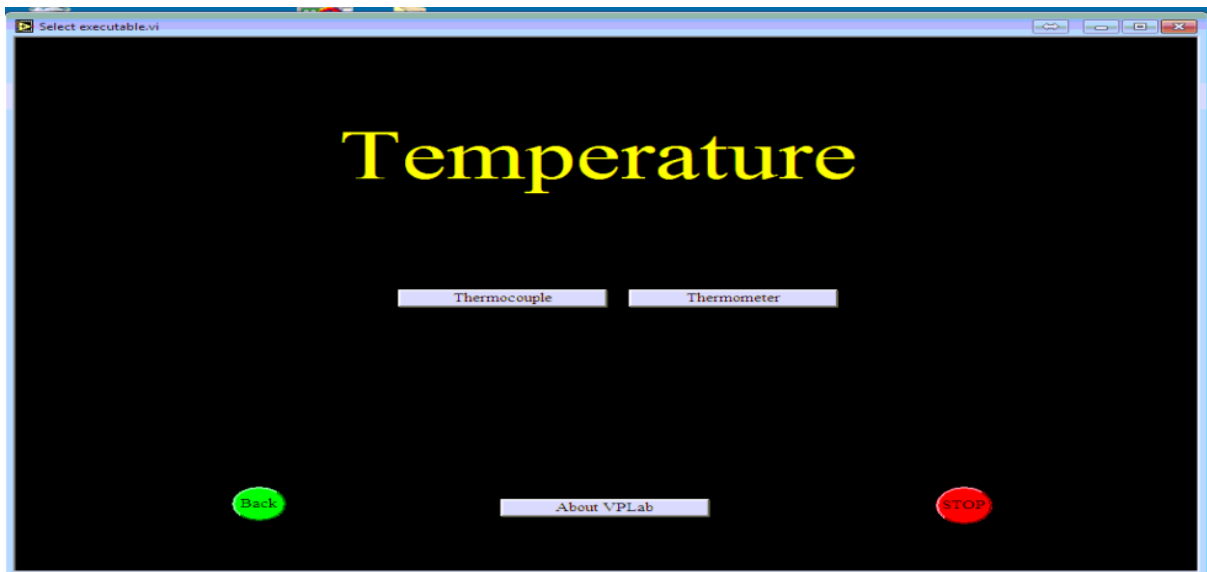
Thermocouples are cheap and are normally connected to electronic circuits which display the temperature directly. Thermocouples can be used at temperatures as high as 1200° C inside ovens and industrial furnaces here it is only used up to 100° C.

Experimental Procedure

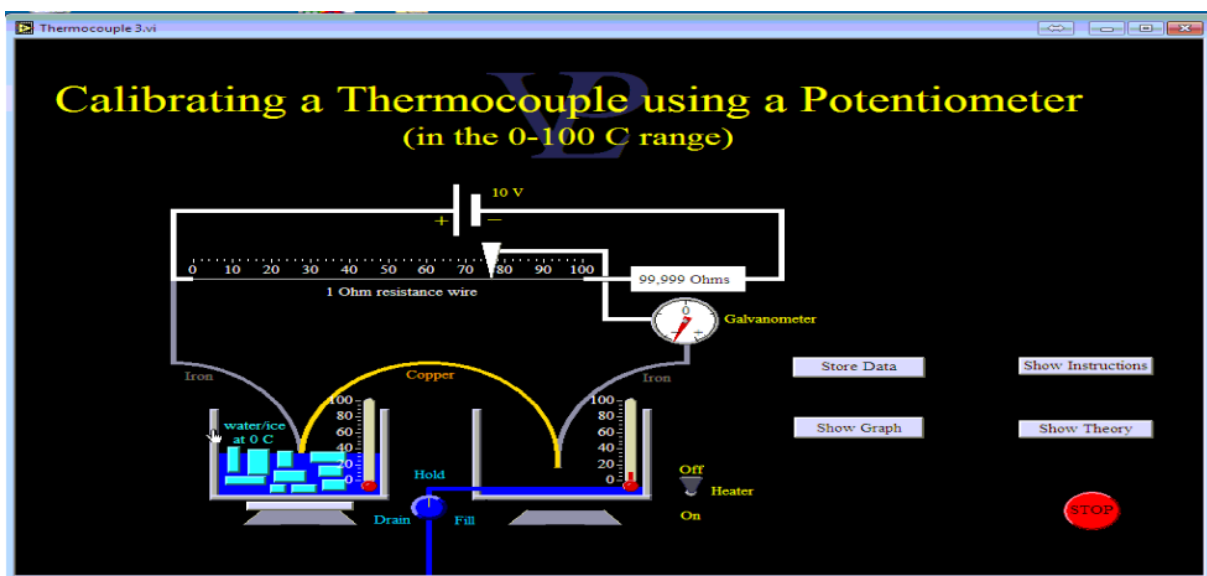
- Follow the VPLabs Access Instructions.pdf for instructions, but select Temperature instead of Electricity AC, however, the procedure for using the software remains the same.



3. Click on the icon titled **‘Temperature’**



4. Now click on the icon titled 'Thermocouple'. This will commence the simulation for the exercises.



5. Once the simulation is running,

13. Fill the right hand beaker with water then turn the heater on. As the water warms up, a small electromotive force (emf) is produced and the balancing point of the potentiometer will move.

6. Switch the heater off at about 40°C, and find the balancing point on the potentiometer (Galvanometer at 0) using the (Ohm) slider.

7. Press "store data" to save the present temperature and emf produced by the thermocouple at the exact balancing point.

8. Turn the heater back on and repeat the two steps above for several other temperatures (60, 80) until you reach a temperature above 90-95° C

9. When you have enough data (3x Store Data) press "show graph" and see the relationship between the thermocouple emf and the temperature.

NOTE: Take a screen shot of the graph and submit it as evidence of the exercise.

10. Notice that the graph is not linear. This is one of the drawbacks. However, thermocouples are cheap and can be used to measure temperatures up to hundreds of degrees.