6 LAB SESSION 6

To use thermocouples as temperature sensor elements inside the oven

6.1 Learning Objective:

At the end of this study, the student will be able to:

- To use different parts of Oven Test Module including thermocouple, differential amplifier.

6.2 Apparatus

In order to complete the demonstration, we need a number of pieces of equipment.

- Main module
- 5V dc power supply
- DC Amplifier
- 10K potentiometer
- Differential Amplifier
- Thermocouples
- Heating Resistance
- Voltmeter.

6.3 Main Parts of Oven Test Module

1. Oven
2. Thermocouple
3. RTD
4. Thermistor
5. Heating Resistance
6. Fan

6.4 Related theory

A thermocouple is an electrical device consisting of two dissimilar conductors forming electrical junctions at differing temperatures. A thermocouple produces a temperature dependent voltage as a result of the thermoelectric effect, and this voltage can be interpreted to measure temperature. Thermocouples are a widely used type of temperature sensor.

Commercial thermocouples are inexpensive, interchangeable, are supplied with standard connectors, and can measure a wide range of temperatures. In contrast to most other methods of temperature measurement, thermocouples are self powered and require no external form of excitation. The main limitation with thermocouples is accuracy; system errors of less than one degree Celsius (°C) can be difficult to achieve.

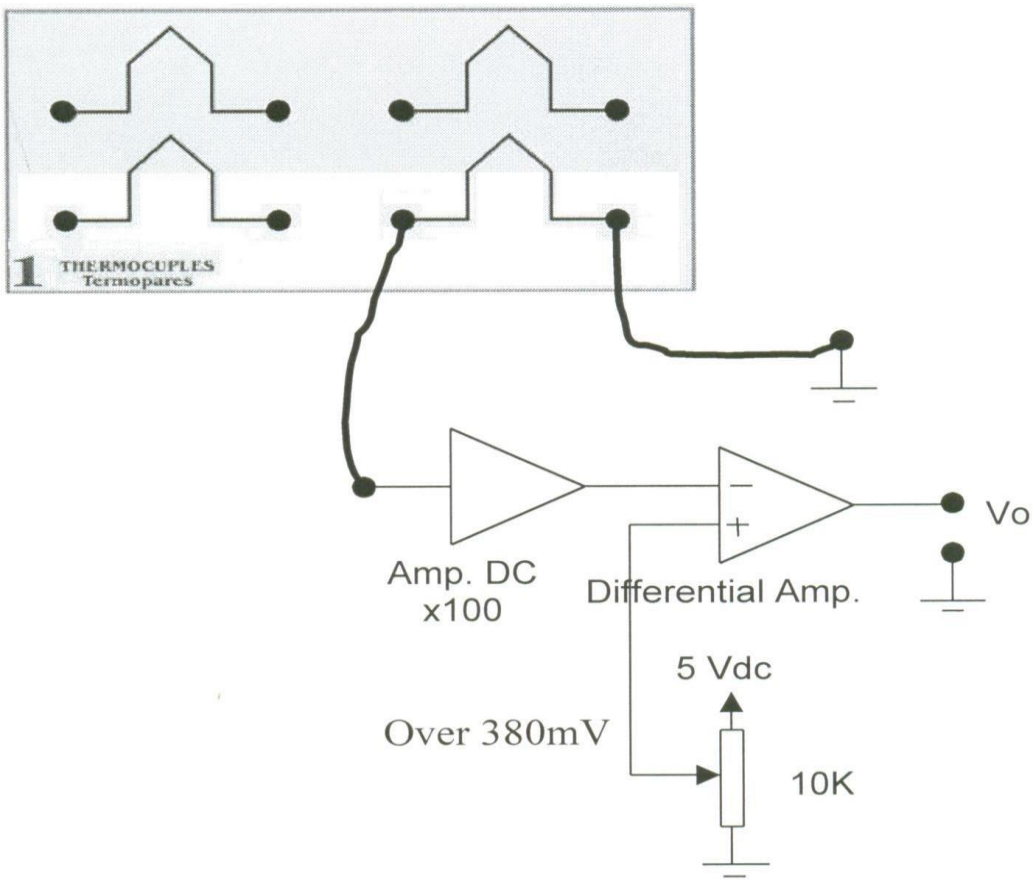

Figure 6-1 Thermocouple Circuit

6.5 Experimental procedure:

1) Set up the equipment and identify its components.

2) During this experiment we will use a group of thermocouples as temperature sensor elements.

3) So that it is possible to make the corresponding measurements with this element it is necessary to make the above connections between the oven test module and the main module.

4) In the central part of the oven there are 4 thermocouples placed at different heights.

5) Studying the above shown figure, symbol 1 of the BS-5 front board, we can see that the thermocouple placed at the right bottom comer is the tallest one and the one place at the left bottom comer is the smallest one.

6) The above shown circuit can be used by all thermocouples if the output signal is adjusted to a value amplified in voltage that tallies the measured temperature values.

7) With these thermocouples it is possible to measure any time the BS-5 oven internal temperature.

6.6 Observations & Calculations

Table 6.1: Calculation of Temperature and Output voltage

Obs. n	Temperature (In terms of ON time of heater)	Output (mV)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

6.7 Graph

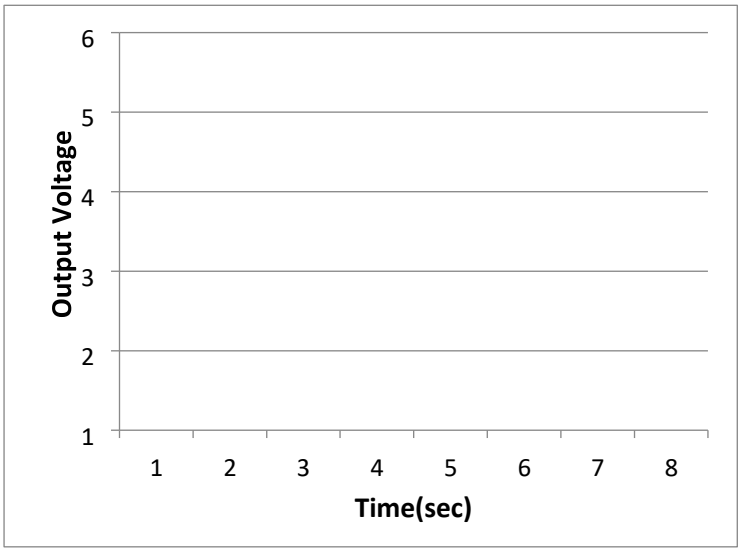

Figure 6-2 Characteristics of Thermocouple.

6.7 Specimen Calculation

N.A

6.8 Statistical Analysis

N.A

6.9 Conclusion: