Experiment: 7

Describe the Construction and Characteristics of an NTC Thermistor.

EQUIPMENTS

- Temperature Transducer Trainer IT-5929.
- Stopwatch (not supplied).
- Digital Multimeter.
- 2mm Connecting Leads.

THEORY

The NTC (Negative Temperature Coefficient) Thermistor:

The thermistor (thermally sensitive resistor) is manufactured with the intention that its value will change with temperature. Unlike a normal resistor, a large coefficient of resistance (change of resistance with temperature) is desirable. Some are made with resistance which increases with temperature (positive temperature coefficient, p.t.c) or decreases (negative temperature coefficient, n.t.c). They are made in rod, disc or bread form.

The construction of the NTC. thermistor is shown in Figure 7.1, consisting basically of an element made from sintered oxides of metals such as nickel, manganese and cobalt and with contacts made to each side of the element.

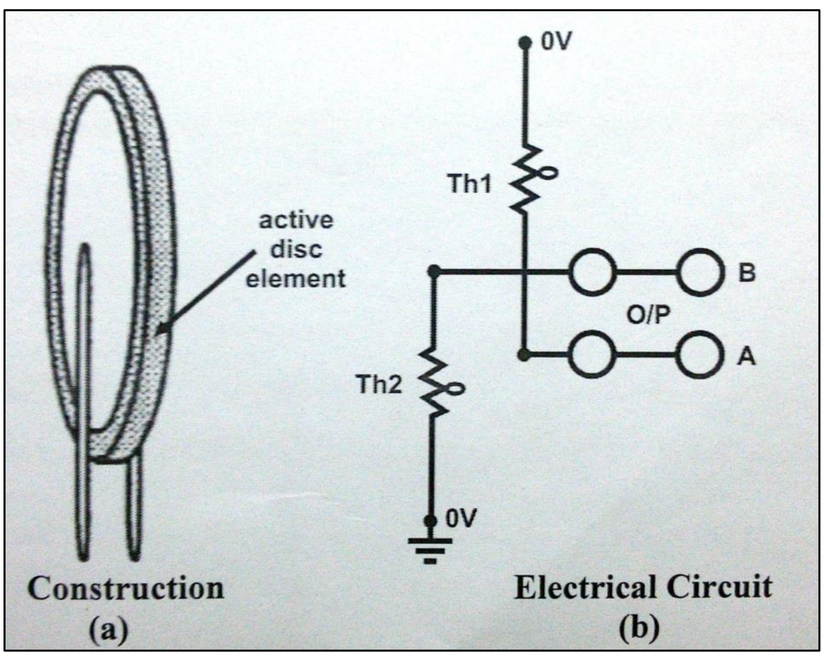


Figure 7.1 (NTC Thermistor)

As the temperature of the element increase, the resistance falls, the resistance/temperature characteristic being non-linear. The resistance of the thermistors provided with the IT-5929 trainer is of the order of 5 kΩ at an ambient temperature of 20 °C (293 °K).

Two similar units are provided, one being mounted inside the heated enclosure, this being connected to the +5 V supply and designated A. The other is mounted outside the heated enclosure, is connected to the 0 V connection and is designated B. The circuit arrangement is shown in Figure above.

EXPERIMENT

The resistance of the NTC thermistor varies over the range 5 kΩ to 1.5 kΩ approximately for the temperature range available within the heated enclosure. For this large range we cannot use the method we used in previous labs to measure the resistance. If readings are to be taken at regular intervals of 1 minute, the readings of resistance must be obtained with the minimum of time. The method used connects the thermistor in series with a calibrated resistor to the +5 V supply.

For each reading, the variable resistor is adjusted until the voltage at the junction of the thermistor and the resistor is half the supply value. For this setting, there will be the same voltage drop across the thermistor and the resistor and their resistances will be equal. Figures 7.2 shows the circuit arrangement in the current trainer.

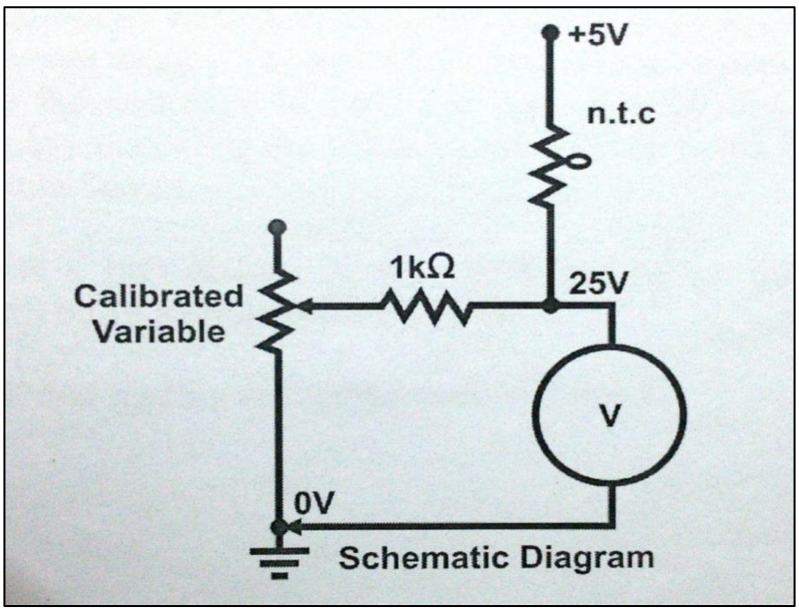


Figure 7.2 (Schematic Diagram NTC Thermistor)

PROCEDURE

Figure 7.3 refers to the connection arrangement for this lab.

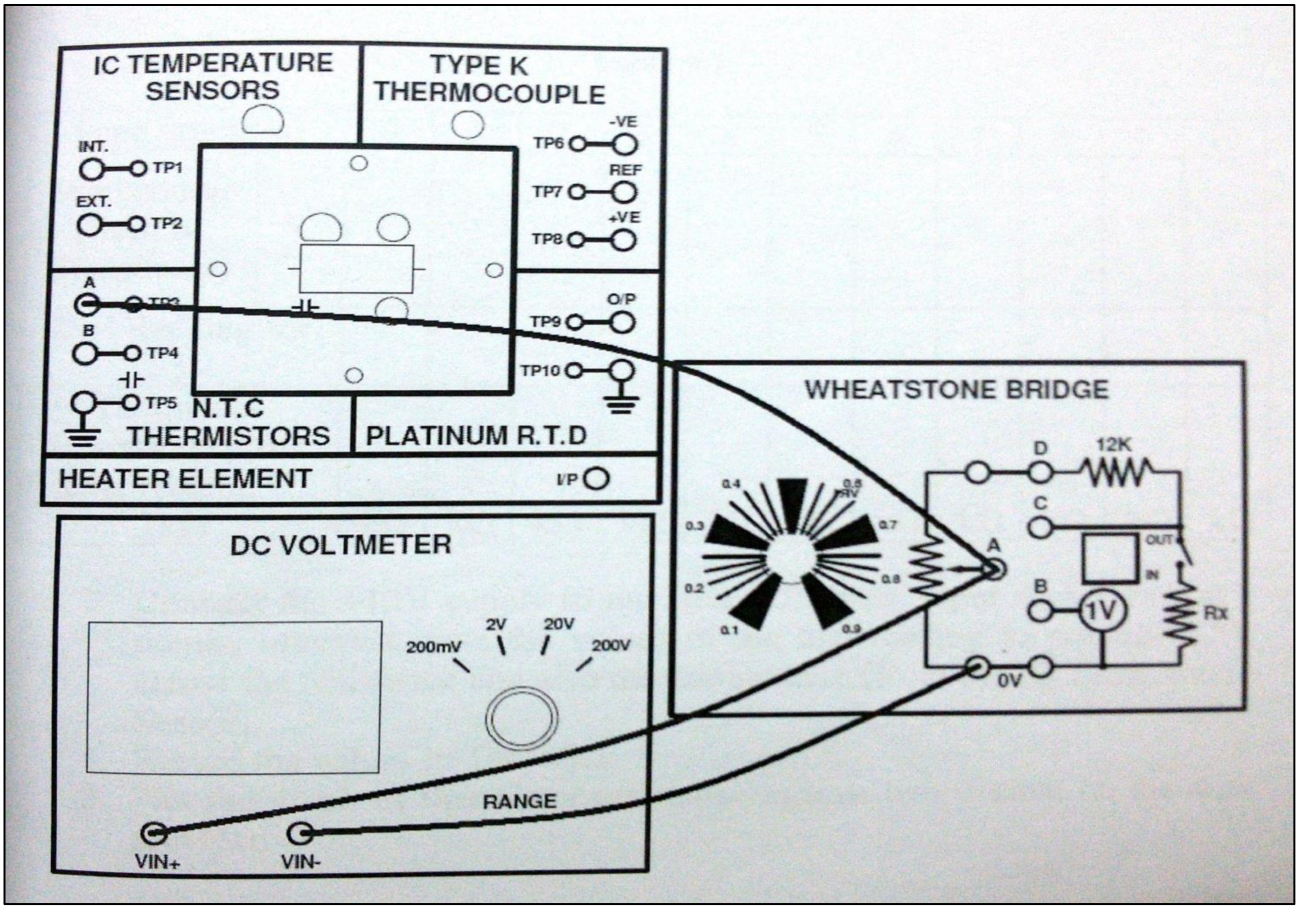


Figure 7.3 (Experimental Setup)

- Connect the circuit as shown in Figure 7.3, set the switch on the Wheatstone bridge circuit to OUT to disconnect the 12 kΩ and Rx resistors from the circuit and set the resistor dial reading to 0.5 approximately.
- Switch the power supply ON, adjust the resistor control until the voltage indicated by the voltmeter is 2.5 V and then note the dial reading and the temperature, by connecting the voltmeter temporarily to the "Int" socket of the I.C. temperature transducer.

Note: Since there is a 1 kΩ resistor in the output lead of the resistance, the total resistance in the resistance circuit will be of value (10 × Dial reading + 1 kΩ).

- Enter the values of dial reading and temperature in Table 7.1.
- Now connect the 12 V supply to the heater input socket and, at 1-minute intervals, note the values of the dial reading to produce 2.5 V across the resistance and also the temperature.
- Enter the values in Table 7.1.
- Switch off the apparatus.

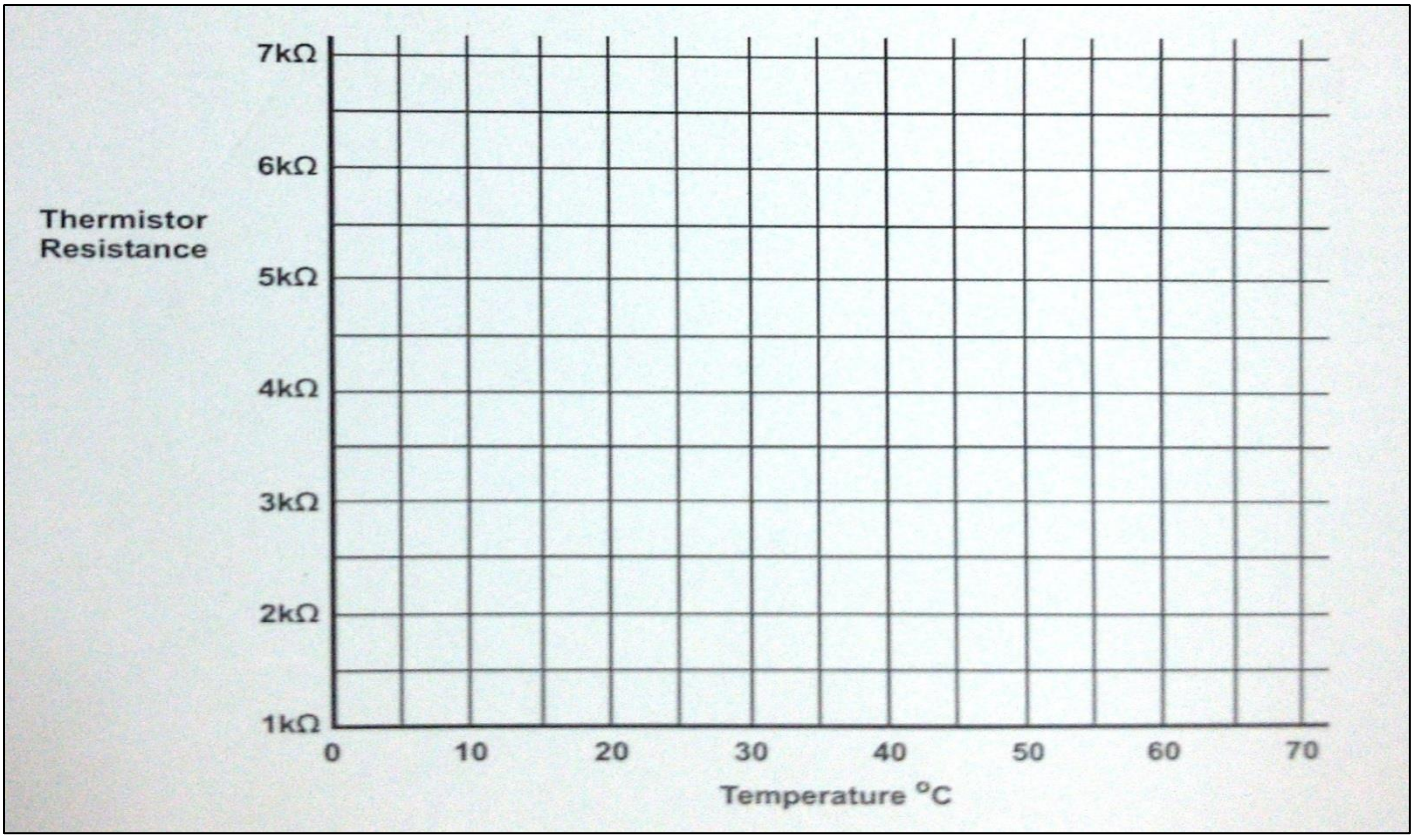
RESULTS

Record values in the table 7.1:

Time (Minutes)	0	1	2	3	4	5	6	7	8	9	10
Temperature(From IC Transducer) (°C)											
Dial Reading for 2.5V											
Thermistor Resistance (10 x Dial reading + 1kΩ)											

Table 7.1 (Observations NTC Thermistor)

Plot the graph of thermistor resistance against temperature on the axes provided in graph 7.1.



Graph 7.1 (Thermistor Resistance Vs Temperature)

The unit is not suitable for applications where an accurate indication of temperature is required but is more suitable for applications in protection and alarm circuits where an indication of temperature exceeding a certain safe value is required.

CONCLUSION

Instructor Signature: ______________________________ **Date: _______________**