EXPERIMENT -No 14

CALIBRATIONOF THERMISTORFOR TEMERATURE MEASUREMENT

Aim: To calibrate the given Thermistor by using Thermometer

Apparatus:
Temperature sensor (Thermistor), Heating coil to heat water in water bath , Digital temperature indicator and Thermometer

Theory: A Thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. Thermistors are semiconductors of certain materials that are extremely sensitive to temperature. The material is made by sintering oxides of such materials as Manganese, Nickel, Cobalt, Copper, Iron etc. Physical forms may be beads, discs, washers and rods. The temperature co-efficient of resistivity of metallic oxide semiconductors is –ve. The resistance of a thermistor decreases as the temperature increases. Moreover, the temperature resistance relationships of thermistors are exponential. Most important point in favor of thermistor is their extremely high sensitivity to temperature changes. The highest temperature up to which thermistors can be used is limited up to 200^0 C

Principle: The temperature-resistance function for thermistor is given by $R = Ro\ e^k$

$K = \beta (1/T - 1/To) Ro$

R = the resistance at any temperature T in ^{0} K

Ro = the resistance at ref. temp

To$in\ ^0 K$ E = the base of

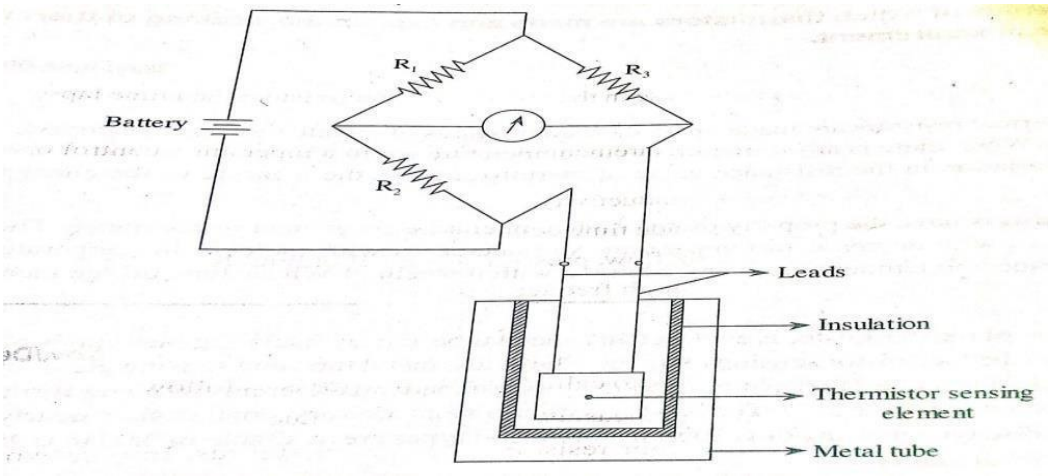
Naperian logarithms. ,

β = a constant

The constant β generally has a value between 3400 and 3900 depending on thermistor formulation.

Thermistor can be classified in to two types, depending on the sign of k. If k is positive, the resistance increases with increasing temperature ,and the device is called a positive temperature co-efficient (PTC) Thermistor .If k is negative, the resistance decreases with increasing temperature, and the device is called a negative temperature co-efficient(NTC)thermistor.Resistorsthatarenotthermistoraredesigned to have a ‘k’ as close to zero as possible, so that the resistance remains nearly constant over a wide temperature range.

Sl..no.	Temp. of Water by Thermometera °C	Temp. of Water by Thermistor, Tm °C	Error = (Tm -Ta) oC	Correction= (Ta–Tm) oC	Absolute %Error= [(Tm -Ta)/Tm]*100
1					-T)/ T
2	75	76	1	-1 3	1.31 %
2			1		
3					
4					
5					



Procedure:

1.Check connection made and Switch 'ON' the instrument by rocker switch at the front panel. The display glows to indicate the instrument is ON.

2.Allow the instrument in ON Position for 10 minutes for initial warm-up.

3.Pour around 3/4th full of water to the kettle and place sensors and thermometer inside the kettle. Note down the initial water temperature from the thermometer.

4.Select the sensor on which the experiment to be conducted through selection switch on the front panel. Adjust the Initial set Potentiometer in the front panel till the display reads initial water temperature.

5.Switch on the kept and wait till the water boils note down the reading inn the thermometer and set final set potentiometer till the display reads boiling water temperature.

6.Remove the sensor from the boiling water immerse it the cold water. Set the cold water temperature using initial set potentiometer.

7. Repeat the process till the display reads exact boiling water and cold water temperature. Change the water in the kettle with and re heat the water. Now the display starts showing exact temperature raise in the kettle.

8. Experiment can be repeated for all the three sensors. Temperature in the thermometer and the indicator readings in steps of 10^0 C can be tabulated.

Considering the second observation, the specimen calculations are as follows.

Temp. of water by Thermometer,Ta = 75 ^{o}C

Temp. of water by Thermist Tm = 76 ^{o}C

Error = (Tm -Ta) = 76 – 75 = 1.0oC

Correction = - error = (Ta–Tm) = 75 – 76 = - 1

Absolute %Error = |[(Tm -Ta)/Tm]*100| = |[(76 – 75)/ 76]*100| = 1.31 %

Graphs:

Draw the following graphs:

- Tmv/s Ta
- Tmv/s Correction
- Tmv/s Absolute % Error