NIELIT, Gorakhpur

Course Name: A-level (1st Sem.) Subject:IoT

Topic: Thermistor Interfacing with Arduino Date: 25.03.2020

Introduction

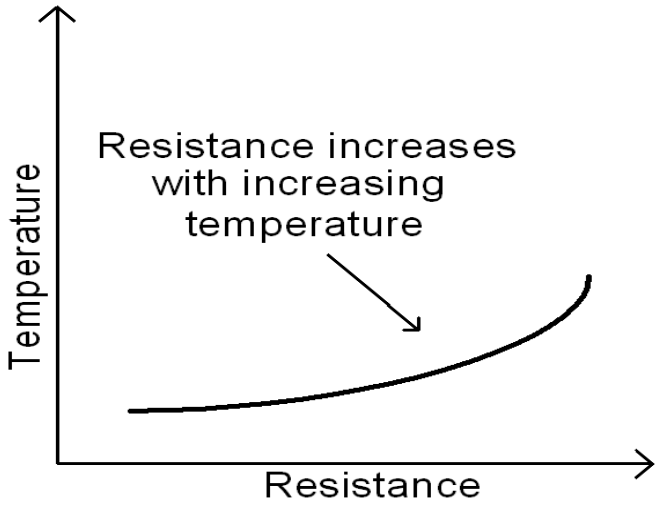
- Thermistor is short form of thermal resistor, whose resistance changes with change in temperature.
- Thermistors are inexpensive, rugged, reliable and responds quickly. Because of these qualities thermistors are used for simple low temperature measurements, but not for high temperatures.
- Thermistors are mostly used in digital thermometers and home appliances such as refrigerator, ovens, and so on.
- Thermistors are available in different shapes like rod, disc, bead, washer, etc.
- Thermistor differs from RTD. In Thermistor, semiconductor materials are used while RTD has pure metals.

Also, RTD are useful for large temperature range whereas Thermistor are useful over small temperature range typically -100 °C to 300 °C.

Types of Thermistor

1. **PTC (Positive temperature coefficient) Type Thermistor**

- In positive temperature coefficient thermistor, resistance of thermistor increases with increase in temperature.



PTC Thermistor Resistance vs.Temperature

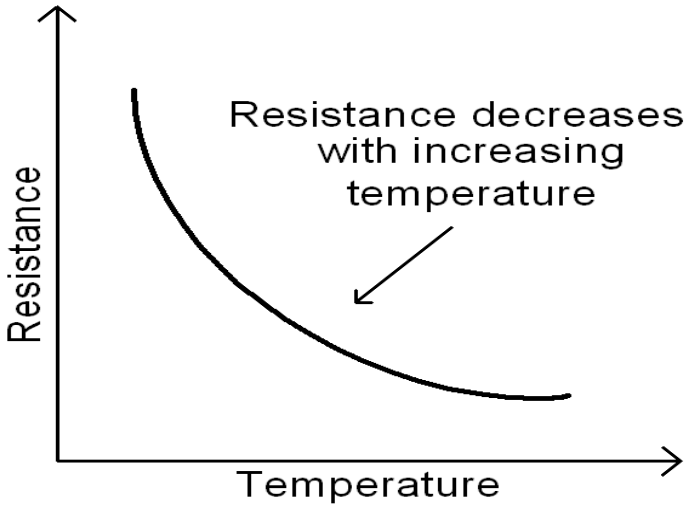
- PTC thermistor are divided into two groups based on
  1. Material used

2. Their structure and manufacturing process

- In first group, thermistor comprises of silistors, which use silicon as the semiconductive material. They are used as PTC temperature sensors for their linear characteristic.
- The second group is the switching type PTC thermistor. This type of PTC thermistor is widely used in PTC heaters, sensors etc.
- PTC thermistors are mostly used as self-regulating heaters, for overcurrent protection, etc.

2. **NTC (Negative temperature coefficient) type thermistor:**

- In negative temperature coefficient thermistor, resistance decreases with increase in temperature.



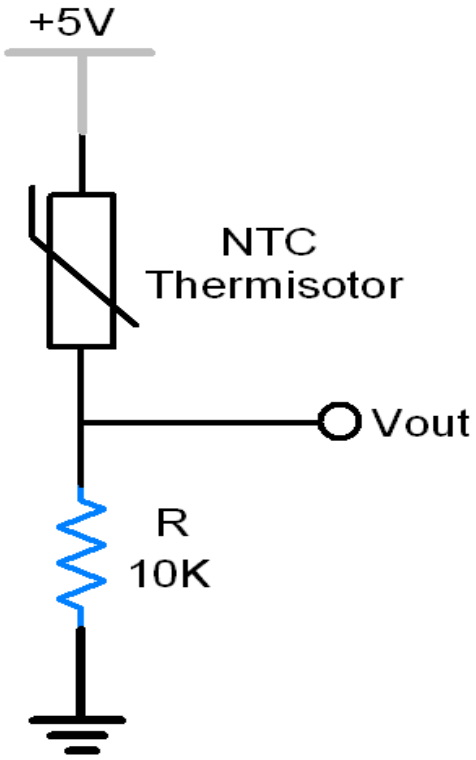
NTC Thermistor Resistance vs. Temperature

- NTC thermistor are made from semiconductor material (such as metal oxide and ceramic)
- Most NTC thermistor sensors are typically suitable for temperature range between -55°C to +150°C
- Generally, NTC thermistors are used for temperature measurement.

How to Use NTC Thermistor for Temperature Measurement

- **Voltage Divider Network**

The output of thermistor is change in resistance. This change in resistance can be measured using voltage divider network by adding one series resistance with thermistor shown below.



Now, measure analog output voltage which is a function of change in resistance with change in temperature.

1. Convert analog voltage to Thermistor resistance

How to calculate Resistance value of thermistor?

$$\text{Rth} = \left(\frac{1023*\text{Series Resistor}}{\text{ADC Output}}\right) - \text{Series Resistor}$$

Where,

ADC Output – Digital value of Vout(from 0 to 1023).

Series Resistor – In circuit diagram shown above, we used 10K ohm series resistor.

Exercise:

Write a program to display value of temperature sensor on LCD