Measurement of temperature using Thermistor temperature sensor and perform its data logging using NI USB DAQ and LabVIEW.

Objective:

Measurement of temperature using Thermistor temperature sensor and perform its data logging using NI USB 6008 and LabVIEW. Design the front panel as shown in fig.
NOTE: This lab is mainly written for USB 6008. It is up to the students to find the correct pinout in case other DAQs are used.

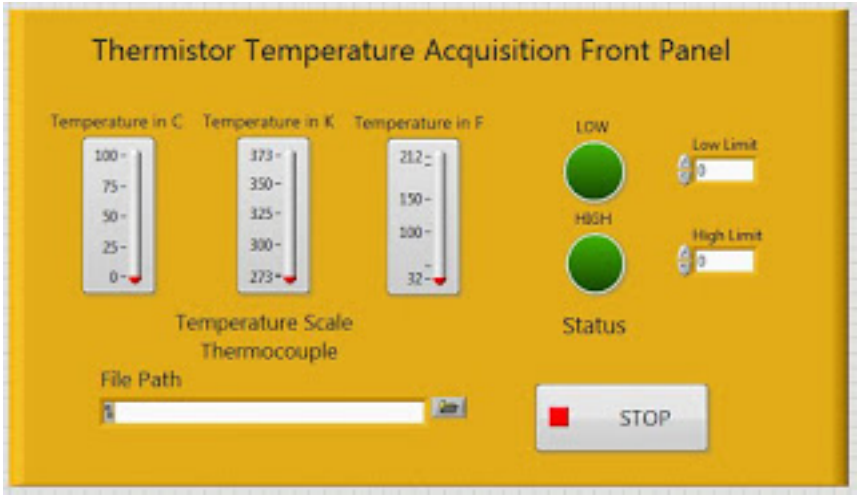


Figure 1. Front panel.

Apparatus Required:

- 10K Thermistor temperature sensor (https://www.sparkfun.com/products/250)
- Breadboard
- Jumper wires
- NI USB 6008 multifunction DAQ
- 1K resistor
- Data sheet (https://www.sparkfun.com/products/250)

Theory:

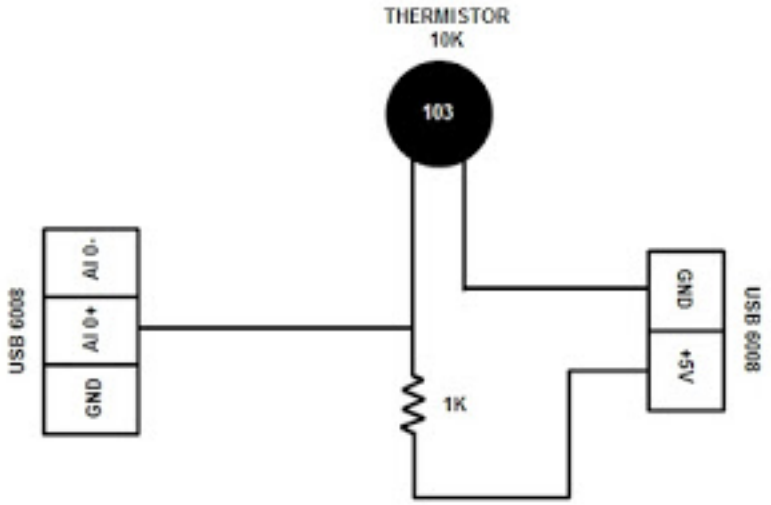
Thermistor: It is a resistive temperature sensor. It has Negative Temperature Coefficient (NTC) of resistance, means the resistance of thermistor increases as the temperature

decreases and vice versa. It is very highly sensitive temperature sensor and the relation between temperature and resistance is non-linear.

NI USB 6008: It is a multi-function DAQ, because it has both Analog and Digital I/O lines with 5V power supply. It is connected through a USB cable to the PC. It has

- 8 analog inputs (12 bits, 10Ks/sec)
- 2 analog outputs (12 bits)
- 12 digital I/O lines.

Procedure:



- Connect the sensor with the DAQ as per the diagram shown above.
- Connect the USB cable of DAQ to one of the USB ports of the PC.
- Open the LabVIEW software and create a new VI. Bring the DAQ Asst function into the block diagram by right clicking over it go to Express------>Inputs-------->DAQ Asst.
- Select the proper channel of the DAQ as Acquire Signals------->Analog Input------->Voltage------>AI 0 then click on finish.
- A configuration window will be opened and change some parameters in the configuration window such as:

- Voltage range (max=5, min=0)
- Terminal configuration (RSE)
- Acquisition Mode (Sample on Demand), then click on OK.

- Now the LabVIEW will configure the DAQ and Build all the parameters you have changed.
- A ‘DAQ Asst’ function block will appear on the block diagram and it has an output variable named ‘Data’. It has an outward arrow (input for the VI) means the data acquired by the DAQ is ready for further processing in the VI.

- The value of the variable 'Data' is the real time data in Voltage.
- **Remember: Your front panel should look like the figure shown above (Figure 1)**
- Now find the resistance of the thermistor (R_t) at temperature 't' using this formula:

$$R_t = \frac{V R_S}{V_{CC} - V}$$

Where
V = voltage obtained from the DAQ
R_S = Series Resistance = 1K
V_{CC} = Supply Voltage = 5V

Now from R_t, find the temperature (T) using the following formula:

$$T = \Delta + [1/T0 + 1/B * \ln(R_t/R_0)]^{-1}$$

Where
T_0 = Ambient temperature in Kelvin (equivalent to 25° C) = 298.15
T = Temperature in Kelvin
B = 3380
R_0 = Resistance at 25°C = 10K ohms
Δ = Error; can be +/- value
R_t = Resistance of the thermistor (R_t) at temperature 't'

Remember C = K - 273.15.

Note that this a simplified version of the Steinhart-Hart equation, it still provides good results over a narrower temperature range. Refer to the **datasheet** for the example Steinhart-Hart equation. Therefore, you may want to do some adjustment to your code to find the Δ.

Results:

Part 1: Assuming Vs = 5V, V measured from the DAQ is 2.5V calculate the temperature in C.

Part 2: After you complete your code make sure you measurements are accurate. Verify your measurements using 10 different measurements:

Measured	Measured [1]

[1] Use a different measurement device to ensure that your measurement is accurate. This table should assist you to find Δ.

Part 3: Convert the temperature from Kelvin to Celsius and make the file system to log the data in the following format (you must have a minimum of 10 measurements with in 10 min:

Date/Time	Low Limit	High Limit	Thermistor voltage	Thermistor Resistance	Temp. Measured	Status

Note: For the status give a high and low threshold limit of the temperature, within that limit the temperature is 'NORMAL' otherwise 'ABNORMAL'

References:

[1] Thermistors/Temperature Measurement with NTC Thermistors
https://www.jameco.com/Jameco/workshop/TechTip/temperature-measurement-ntc-thermistors.html