Experiment 2: RTD Sensor
(tbc 1/14/2012, 1/21/2017)

Main Task:

Build an RTD circuit to measure temperature (to within ± 2°C).

Name: ________________________________ Date ________________

Sub-tasks:

1. RTD circuit ________________________________
2. Labview data acquisition program ____________________
3. Temperature Calibration Curve _____________________
4. Temperature test _______________________________
1. The RTD Circuit.

![Voltage divider circuit to obtain voltage across RTD.](image)

Figure 1. Voltage divider circuit to obtain voltage across RTD.

a. The 5 volts source can be obtained from the DIGITAL side of the USB-6008 device.

b. Use $R = 100 \, \Omega$ and connect only different colored wires of the RTD in the circuit. (Use a circuit breadboard to implement the circuit.)

2. The Labview program.

a. Include [Express]→[Execution Control]→[While loop]. (Include everything below into the [while loop] window.)

b. Import [Express]→[Input]→[DAQ Assistant] block. Choose [analog input]→[voltage]→[ai0]

- **Max** = 3 volts
- **Min** = 0 volts
- **acquisition mode** = continuous
- **samples to read** = 10
- **rate** = 100 Hz

c. Import [Express]→[Signal Analysis]→[Filter] block.

- **Infinite Impulse Filter** = selected
- **Type** = Lowpass
- **Topology** = Butterworth
- **Order** = 3
- **Cutoff Frequency (Hz)** = 1
d. Import [Express]→[Signal Manipulation]→[from Dynamic Data] block. Choose the “single scalar”.

e. Import [Express]→[Signal Manipulation]→[to Dynamic Data] block. Choose “single scalar”.

f. Import [Express]→[Arithmetic & Comparison]→[Formula].

- Input X1, label = v
- Formula = v

g. Include the following control blocks: [Waveform Chart], [Indicator].

h. Match the wiring as shown in Figure 1.

Figure 1. Labview program.
3. Temperature Calibration Curve.

a. Using a digital thermocouple, record the voltage readings corresponding to temperature readings at approximately 10°C intervals. (see Table 2 as example)

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Voltage (volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

b. Obtain a curve fit (2\textsuperscript{nd} order polynomial fit) of temperature as a function of voltage using Excel.

Formula:

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c. Modify the entry in the “Formula” block using the conversion formula obtained in step 2.

d. Test the obtained \textbf{RTD VI}.