TECH 3821
Lab #4
Ver 2.53

Adapted from Gerald Recktenwald

Thermistor Calibration Lab

http://web.cecs.pdx.edu/~eas199/b/howto/thermistorcalibration/thermistorresistancecalibration.pdf
http://web.cecs.pdx.edu/~gerry/class/EAS199B/howto/thermistorProbe/

Objective:

To obtain calibration curves for a thermistor and LM35 Temperature Sensor.

Procedure:

1. ~~With a lab partner create two temperature probes (Thermistor and LM35) by following the instructions at http://web.cecs.pdx.edu/~gerry/class/EAS199B/howto/thermistorProbe/ (modifying it as needed for the 3 lead LM35 sensor). Make sure to color code the leads of the LM35 (red for the +Vcc, black for ground and green for signal)~~

2. Now, create a Labview VI that will read two voltages (analog inputs) and display them on the frontpannel in both a waveform chart and numerical display. To do this:

   Open LabVIEW and do a FILE | NEW VI.

    TWO windows should open, a "Front Panel" and a "Block Diagram". The block diagram is the program and the front panel is the user interface.

    We will start in the Block Diagram Window.

    First we need to turn on the Functions Pallet by doing a VIEW | Functions Pallet. Now find the Measurement I/O menu and select it, then select NI-DAQmx.
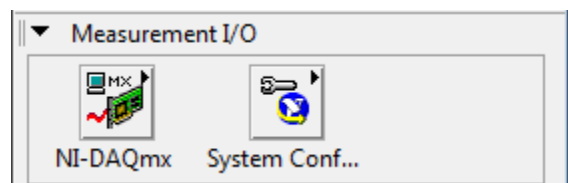
   This will open up all the functions associated with the Data Acq Card. It should look like this:
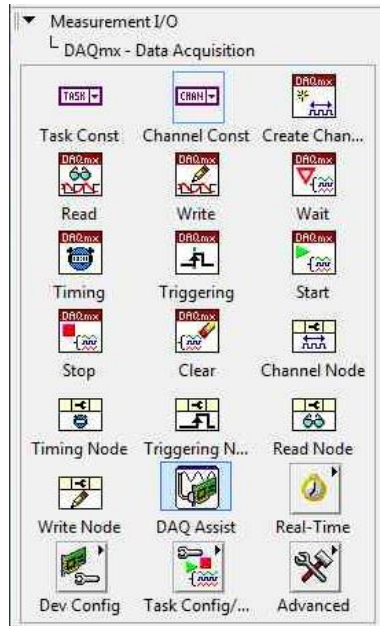
Find the Read Icon. Click the left mouse button AND hold it down and drag over to your Block Diagram Window and Release. This places that FUNCTION into your program. Under the icon is a pull down menu. Click on the ˅ and do the following selections:
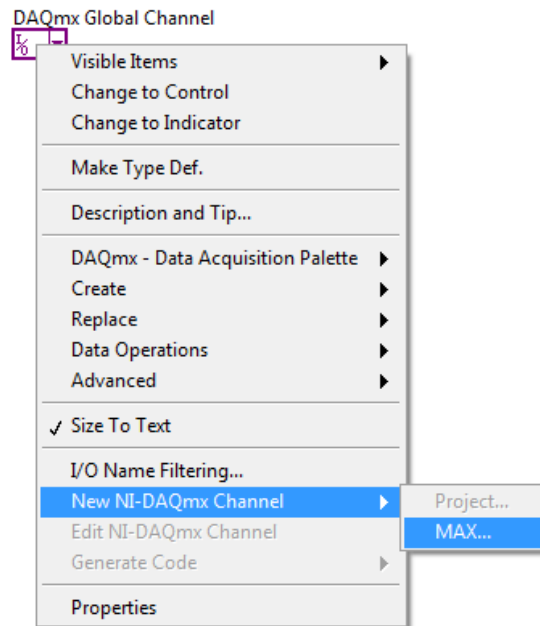

[Analog| Multiple Channel | Single Sample | 1D DBL]

This sets up multiple analog input pins. Now we need to define the input channels we will use. To do that go back to the NI-DAQmx functions and select "Task Const"
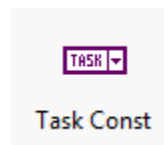

And drag and drop this onto your block diagram to the left of the write block.

Right click on this new block and select the following:

This will take you through a series screens. Since we want analog inputs we will select:
Acquire Signals | Analog Input | Voltage

Then we will select the analog input channels we will use. Note you must hold down the <Ctrl> or <Shift> keys to select multiple channels (in the example analog input ai0 and ai1):
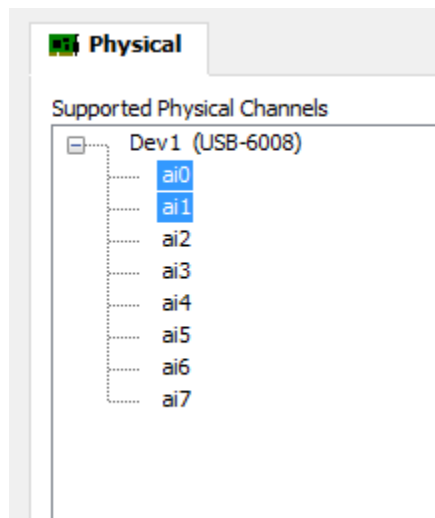
It will ask you to "Enter a Name" you can just leave the default and hit finish.

Configure each input (make sure you do BOTH) with the following options:

- For "Terminal Configuration" set it to "RSE"
- For "Acquisition Mode" set it to "1 sample on demand"
- For max 5v and min 0v.
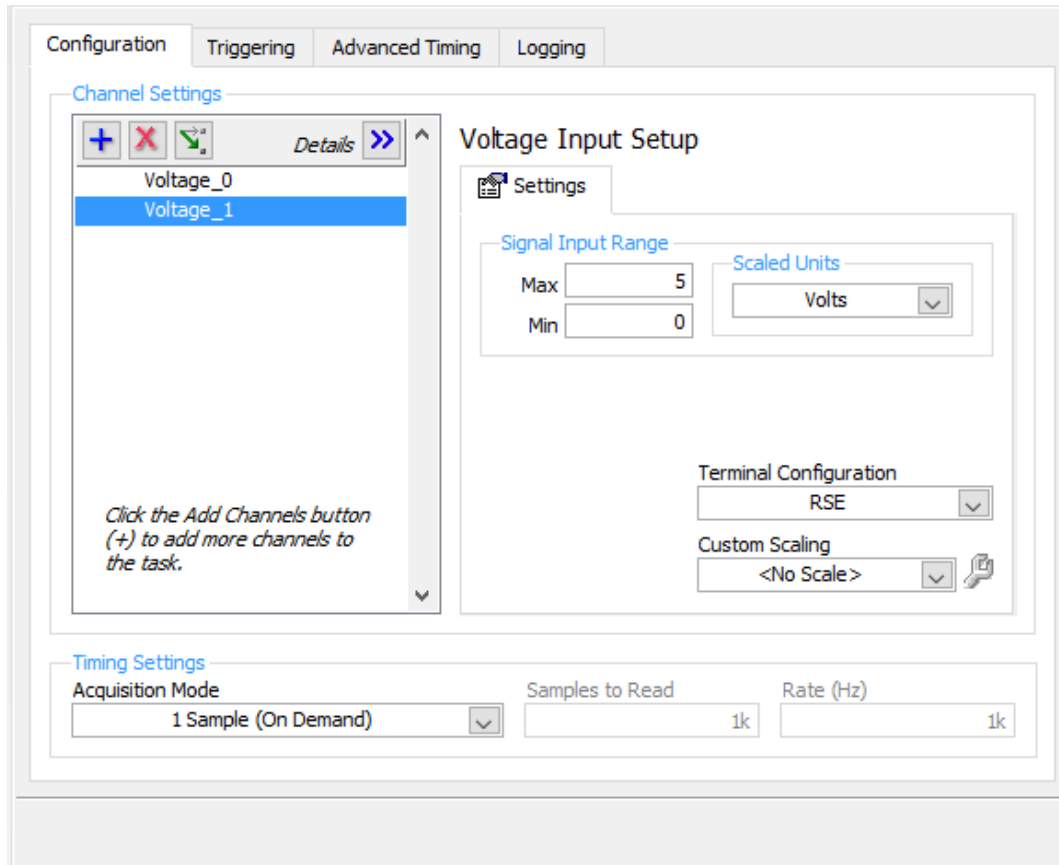
You can then click on RUN ICON to test the configuration before moving on:

Make sure the values (either in chart or table form) change when the corresponding input voltage changes.

Once you are done testing, click on OK at the bottom of the window.

Now you should be back on the Block Diagram. Draw a line between the DAQmx name and the DAQmx Write block as follows:
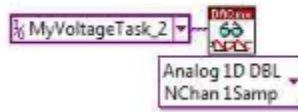
Since we are bringing in multiple analog signals at the same time, we need to separate them into individual signals to display the values. To do this first we need to add an ARRAY to CLUSTER block (as seen below). It can be found in the Programming | Cluster, Class & Variant Menu.
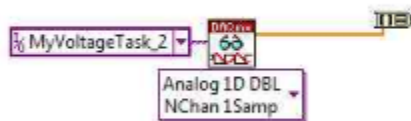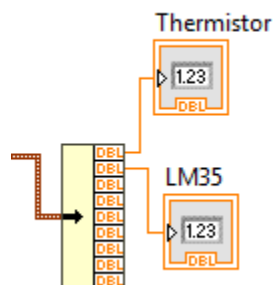

Now we need to add an Unbundle block (from the same menu as before:
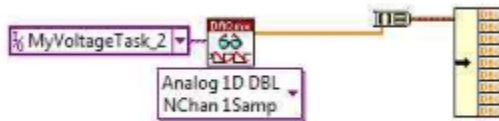
Although it shows 8 output from the block, only the first two have values (since we only are only reading 2 analog inputs.

Now add indicators to the two analog values by right clicking on an output dot and selecting Create | Indicator. Repeat for the second value and label as follows:

Now click on the front panel and add a graph by right clicking on the workspace, select Graph from the menu and selecting Waveform chart and place it on the front panel as shown:
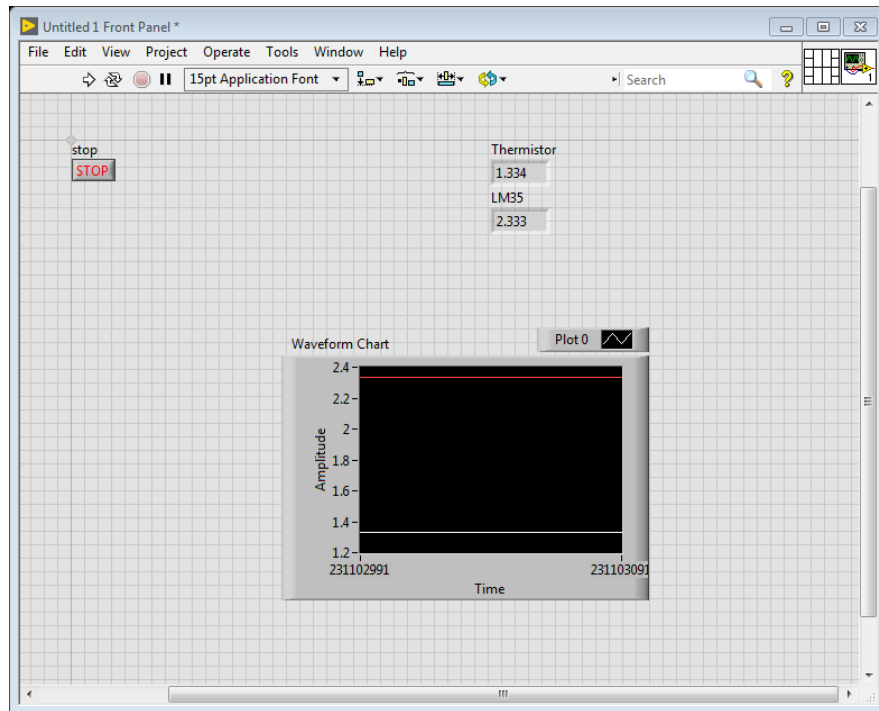
Now go back to the block diagram. There should now be a waveform block in the diagram. Connect it as shown below:
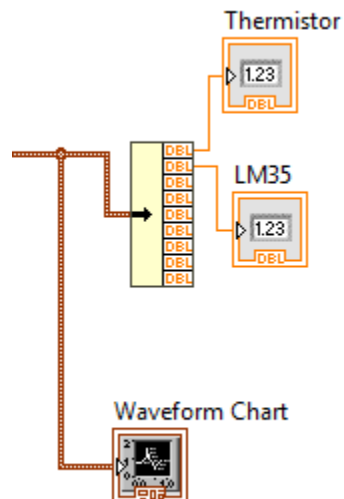
Now create a while loop that encases all but the DAQmx name. Add a ½ second wait into the while loop. The end product should look like this:

Note, if you only see one signal on the graph, stop the VI and left click on the graph and select PROPERTIES. In the appearance tab, change the number of PLOTS SHOWN from 1 to 2.

3. Connect the LM35 to a 5v power supply and ground and connect the signal out to one of the A/D inputs.

Red Wire: +Vs is +5v

Black Wire: Gnd is ground

Green or Blue wire: Vout connect to one of the $V_{in}(+)$

Note: 10mV/C°

Connect the Thermistor as follows:
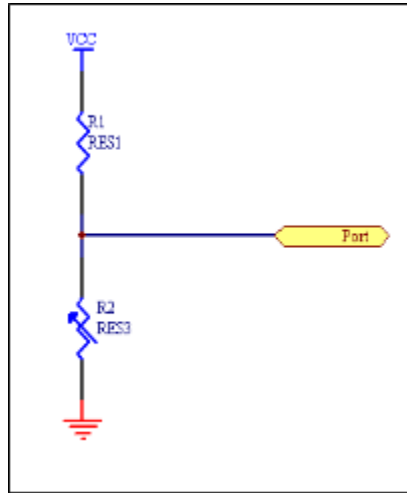
Where:

R1 is the 4.7K resistor
R2 is the thermistor

Vcc = +5v

Port connects to the 2nd A/D Input

USB-6008

GND	P0.0
AI 0 (AI 0+)	P0.1
AI 4 (AI 0−)	P0.2
GND	P0.3
AI 1 (AI 1+)	P0.4
AI 5 (AI 1−)	P0.5
GND	P0.6
AI 2 (AI 2+)	P0.7
AI 6 (AI 2−)	P1.0
GND	P1.1
AI 3 (AI 3+)	P1.2
AI 7 (AI 3−)	P1.3
GND	PFI 0
AO 0	+2.5 V
AO 1	+5 V
GND	GND
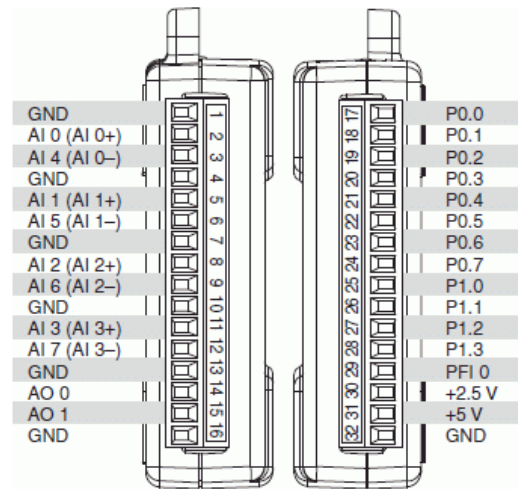
4. Now set up the following apparatus:

Insulated Coffee mug

Thermistor probe

Reference Thermometer
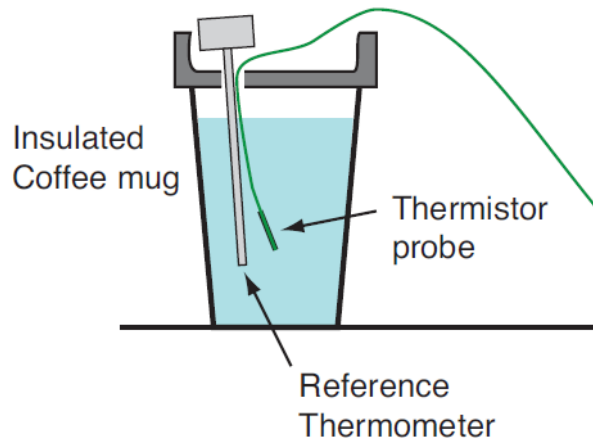
5. Fill the mug with hot water, and start the labview vi. Wait until the voltage readings stabilize. Take a reading of the Temperature and the voltage values from the two sensors and put into an excel spreadsheet.

6. Add a little cold water to the coffee cup and repeat step 5+6 so you get at least 15 readings (Hot as possible, to close to room temperature)

7. In excel plot a graph (Temp vs Voltage with V on the x axis) for the two sensors.

8. Using the appropriate trend line, come up with an equation for each sensor that will approximate the temperature, based on the input voltage.

9. Add the calculations to your existing LabVIEW VI for both sensors and add indicators for both temperatures so they appear next to the existing voltages on the front panel.

   You can use the Express VI off the function pallet EXPRESS | Arithmetic and Comparison | | Formula. To accomplish this.

10. Verify the temperatures displayed are correct.

11. Demo to the instructor your final VI.

12. Submit the final VI, docx file (done in the same way as last lab) and the Excel Spreadsheet (suitably formatted). Make sure to include your names and make it so the excel prints nicely in landscape (showing the data collected and the 2 graphs with trend lines and trend line equations). Only one submission for each team is required (please include both names when submitting).