CompactDAQ Getting Started Tutorial

This hands-on session is an introduction to basic concepts and methods of configuring an NI CompactDAQ system, using test panels and programming NI LabVIEW to take analog input measurements.

Hands-On Summary

- Use Measurement & Automation Explorer (MAX) to test your CompactDAQ system
- Program the DAQ Assistant in LabVIEW to take measurements with CompactDAQ

For more information on NI CompactDAQ, visit the following page:

www.ni.com/compactdaq

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Recommended Hardware and Software

Software

- LabVIEW 8 Developer Suite Core

Hardware

- NI cDAQ-9172 CompactDAQ chassis
- NI 9215 4-Channel, 100 kS/s, 16-bit, ±10 V Simultaneous Sampling Analog Input Module (Slot 1)
- NI 9263 4-Channel, 100 kS/s, 16-bit, ±10 V, Analog Output Module (Slot 2)
- NI 9233 4-Channel, ±5 V, 50 kS/s per Channel, 24-Bit IEPE (Slot 3)
- NI 9237 4-Channel, ±25 mV, 24-Bit Simultaneous Bridge Module (Slot 7)
- NI 9211 4-Channel, 14 S/s, 24-Bit, ±80 mV Thermocouple Input Module (Slot 8)

Using the Target Control Application to Turn on Power to the System

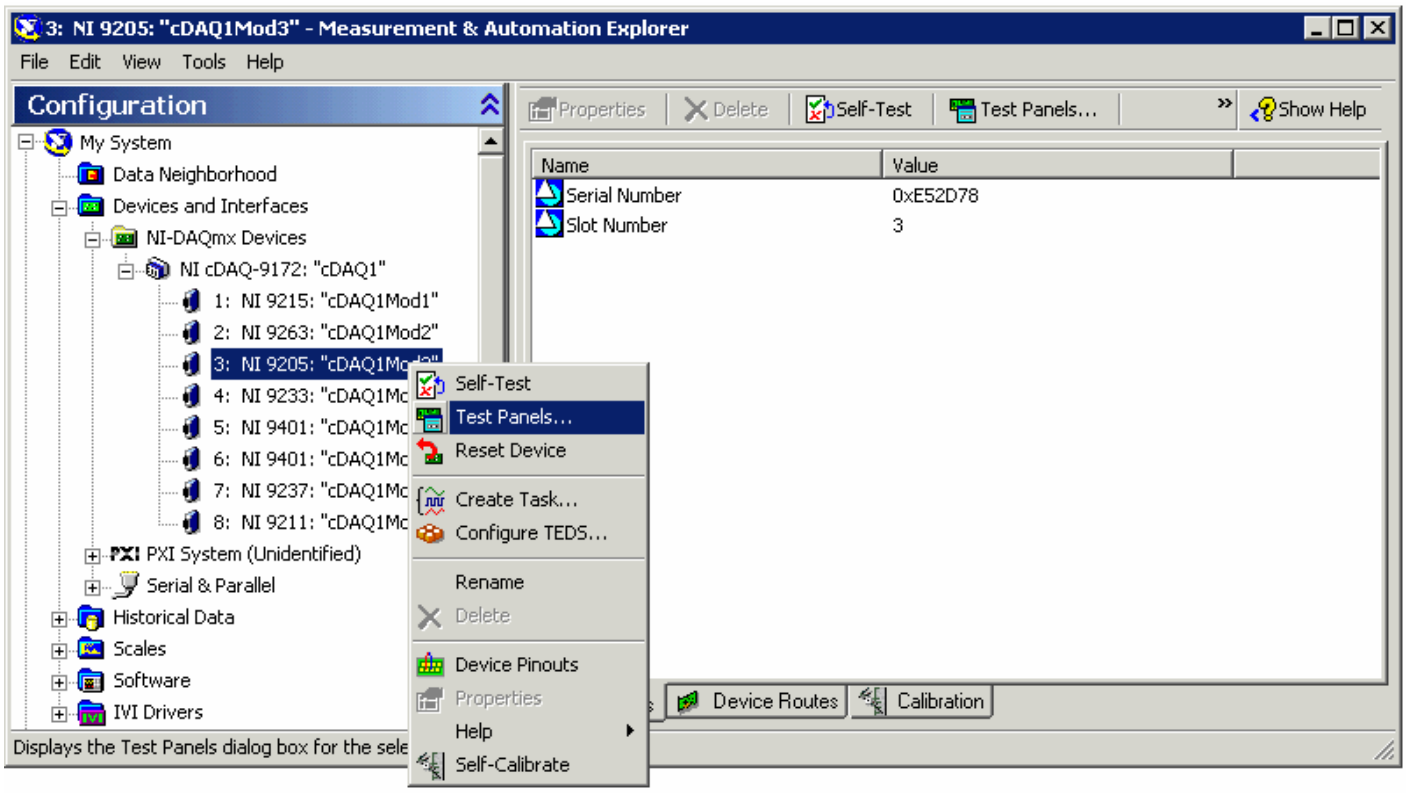
Before beginning the exercise, follow the instructions below to make sure your National Instruments CompactDAQ system is powered up.

1. Double click the **Target Control** icon ( ) on the desktop. To verify that system power is turned on, confirm that the green light is on. If the light is not on, click on the **Power Control** button.

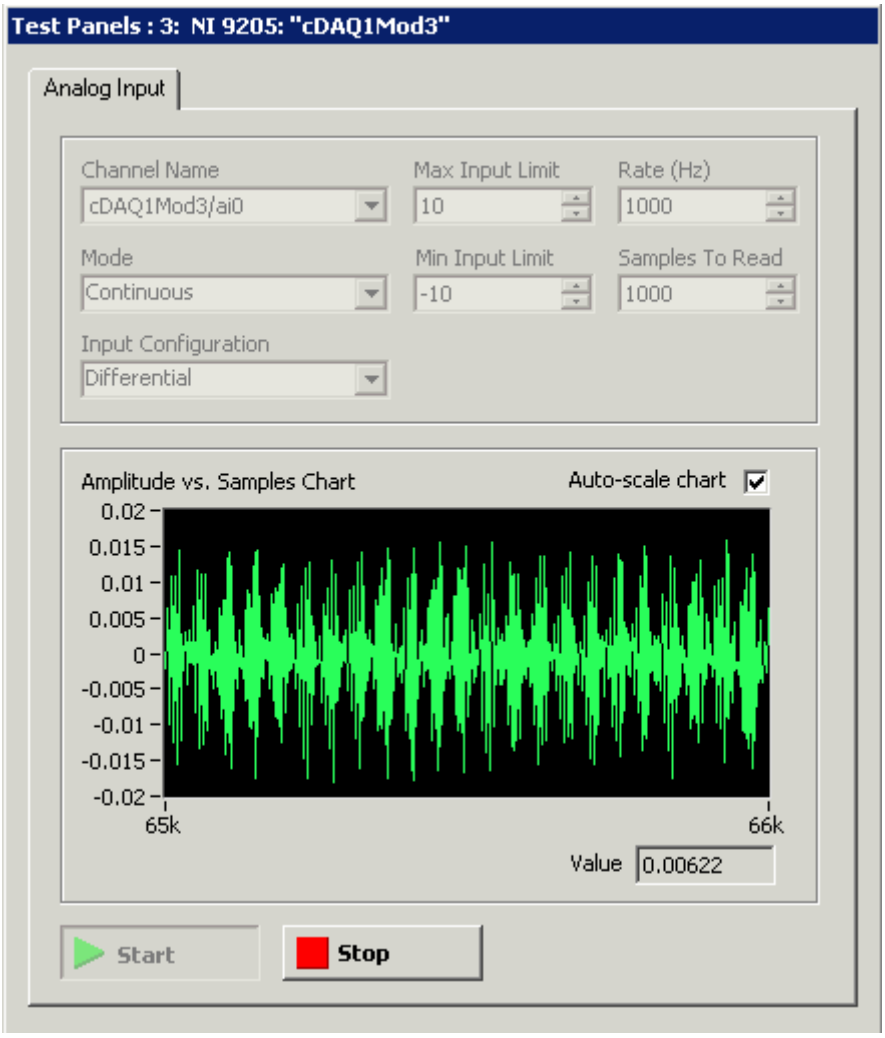
Configuring your CompactDAQ System in Measurement & Automation Explorer (MAX)

This task will introduce you to the NI hardware configuration utility, Measurement & Automation Explorer (MAX), and walk you through using test panels to take an instant measurement with NI CompactDAQ hardware

1.) Open **Measurement & Automation Explorer (MAX)** by double-clicking on the desktop icon or navigating to **Start>>All Programs>>National Instruments>>Measurement & Automation**.
2.) Expand **Devices and Interfaces>>NI-DAQmx Devices>> NI cDAQ-9172: "cDAQ1"** to show the install modules, which are automatically detected.



3.) Now you will open a test panel for the NI 9205 32-channel ±10 V analog input module. Right-click on the **NI 9205** module in slot 3, and then select **Test Panels**. When the test panel opens, change the **Mode** to **Continuous** and then click **Start**.



4.) When you are finished testing the module, click the **Stop** button. Then close the test panel.

5.) If desired, experiment with test panels on other modules. When you are finished, close the **Measurement & Automation Explorer (MAX)**.

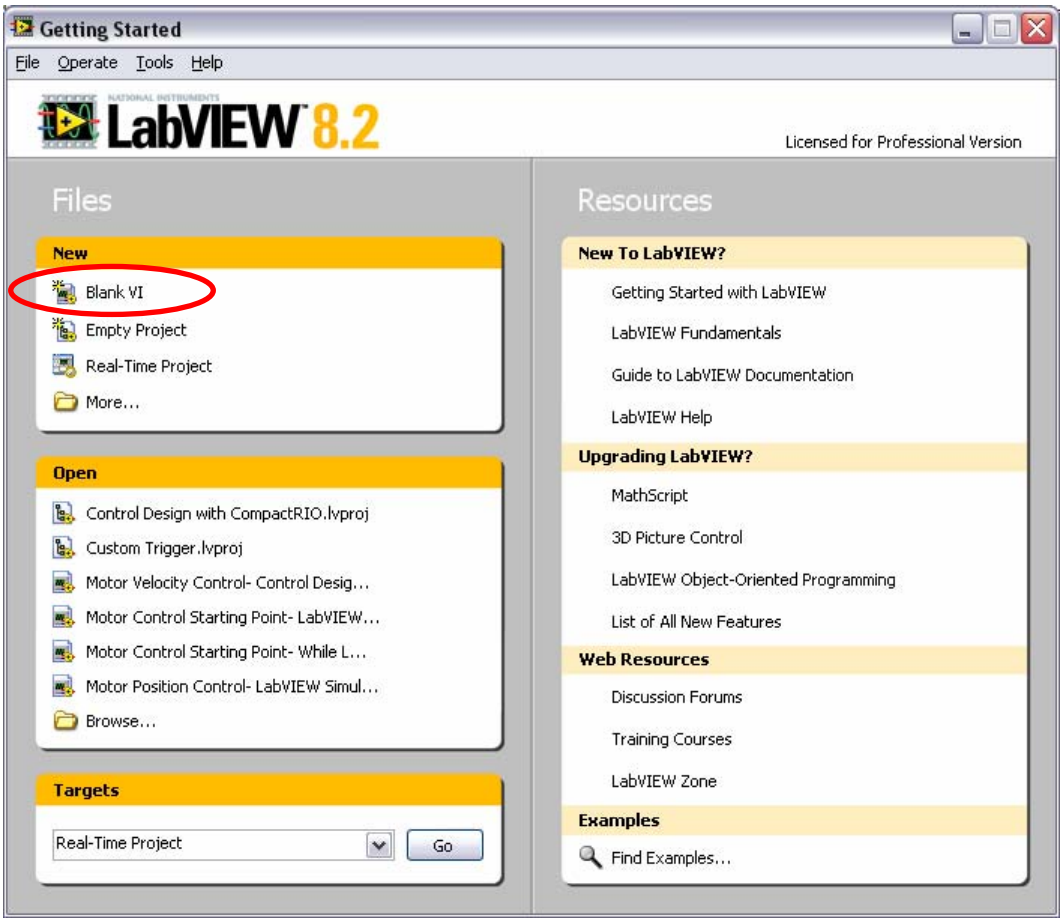
Measuring a Thermocouple with NI CompactDAQ and LabVIEW

This demo shows how to get started with taking measurements using the National Instruments CompactDAQ USB Data Acquisition System and NI LabVIEW. You will be using graphical programming to create an application that acquires temperature data and displays it on a graph in real time.

LabVIEW is a graphical programming language. The development environment consists of two windows: the "front panel" for user interface controls and indicators, and the "block diagram" for placing programming, calculation, and hardware I/O nodes. These programs are known as "Virtual Instruments" or "VIs".

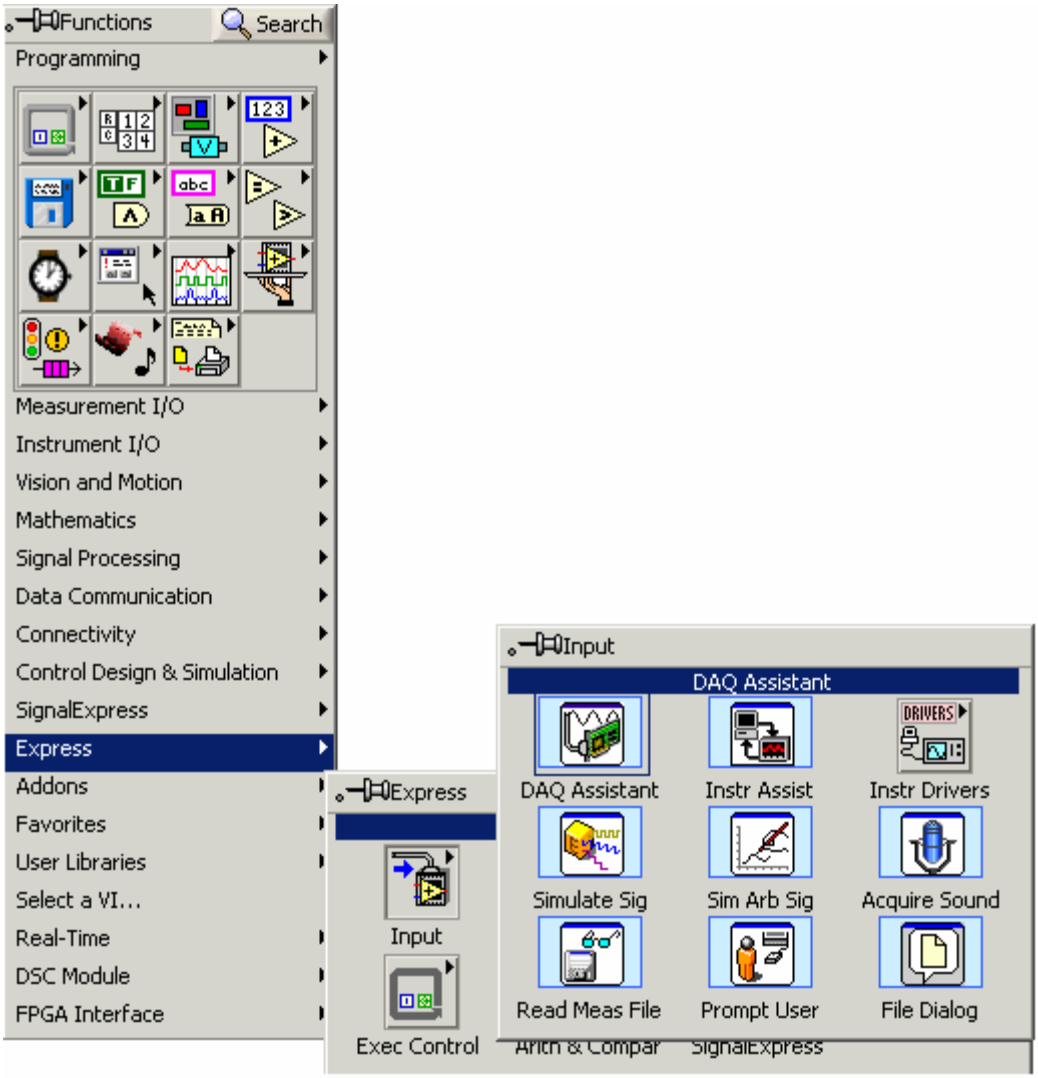
1.) Open LabVIEW by double-clicking the **NI LabVIEW** link on the desktop or navigating to **Start>>All Programs>>National Instruments>>LabVIEW 8.0>>LabVIEW**.

2.) Click on **Blank VI** to open a new application.



3.) Adjust the windows by navigating to **Window>>Tile Left and Right** or by pressing **Ctrl+T**.

4.) On a blank area of the white block diagram window to the right, right-click to bring up the **Functions Palette**.

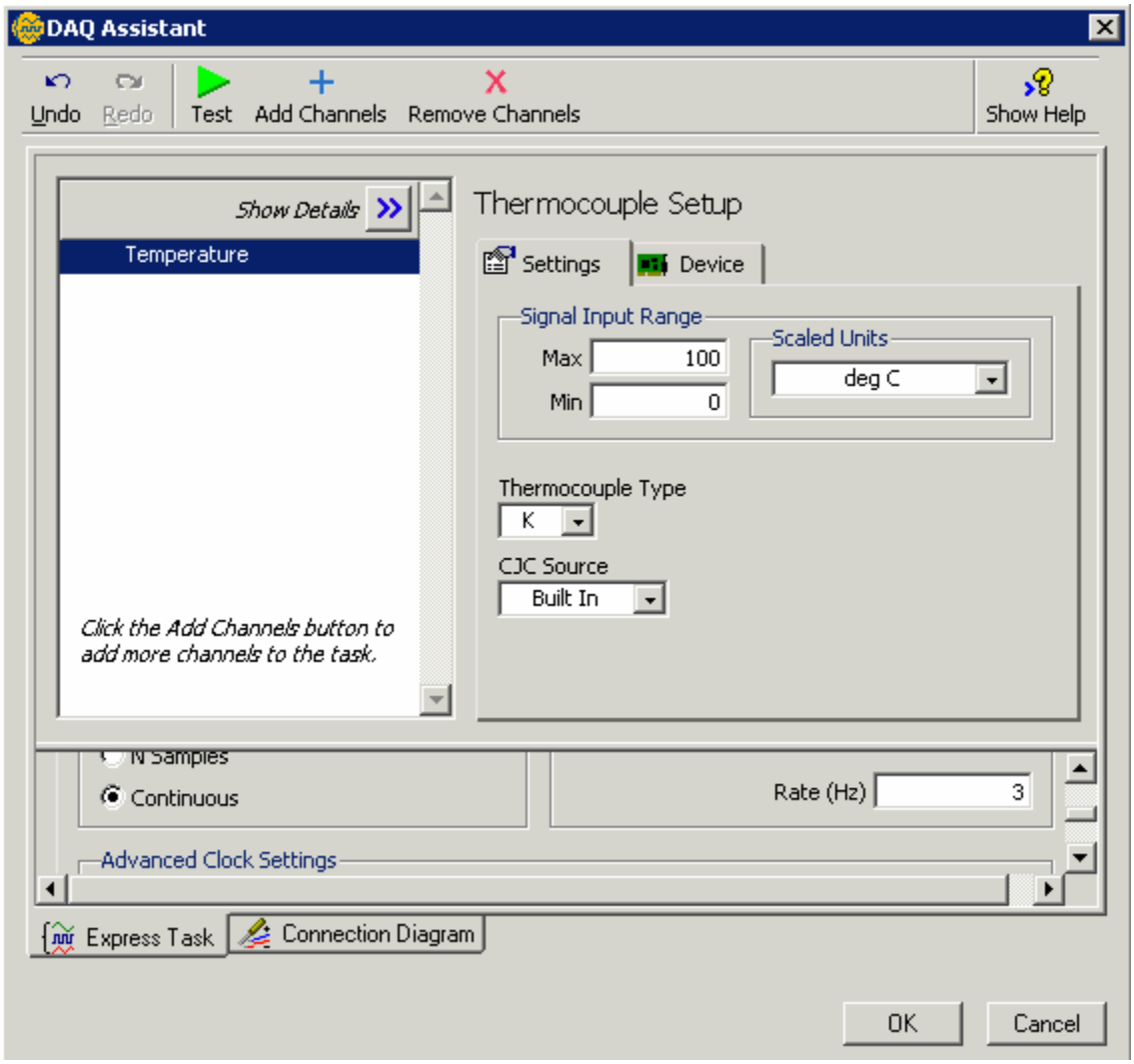


*The **Functions Palette** is navigated much like a series of folders on a disk drive. Functions are organized into palettes and sub-palettes. LabVIEW includes extensive intellectual property (IP) block libraries for scientific and engineering tasks.*

5.) Click on **Express** and then navigate to the **Input** palette. Then click on the **DAQ Assistant** function to select it. Move your mouse over a white area of the block diagram and left-click again to place down the function.

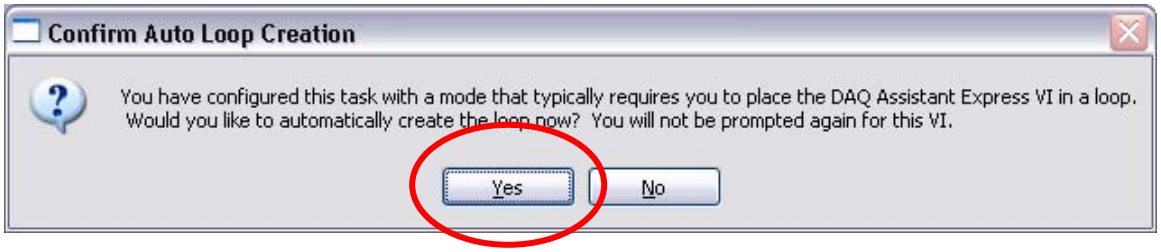
6.) A **DAQ Assistant** configuration window should automatically open. First select **Analog Input>>Temperature>>Thermocouple**. Then expand **cDAQ1Mod8 (NI 9211)** and select channel **ai0** from the list and click **Finish**.

7.) In the **DAQ Assistant** configuration window, change the **Thermocouple Type** to **K**, change the **CJC Source** to **Built In**. Then scroll down in the lower window and change the **Acquisition Mode** to **Continuous**.

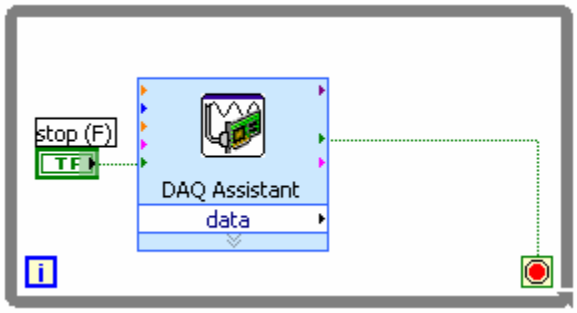


8.) Click **OK** to finish the configuration.

9.) When prompted, click **Yes** to confirm the automatic creation of a loop around your **DAQ Assistant** function.

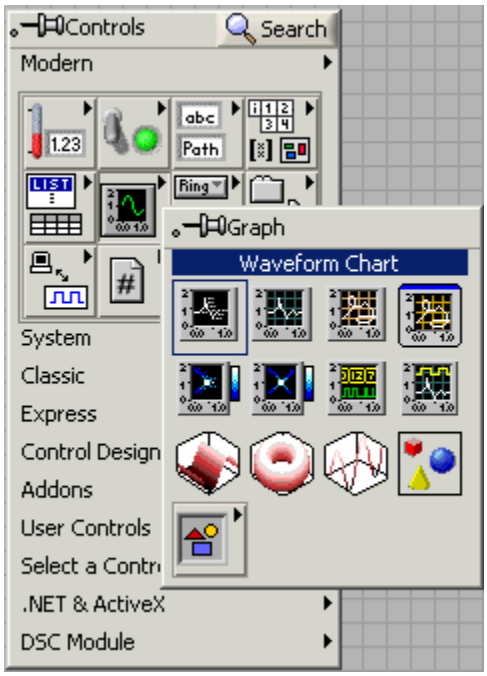


10.) You should now have a **DAQ Assistant** function surrounded by a loop on your block diagram.

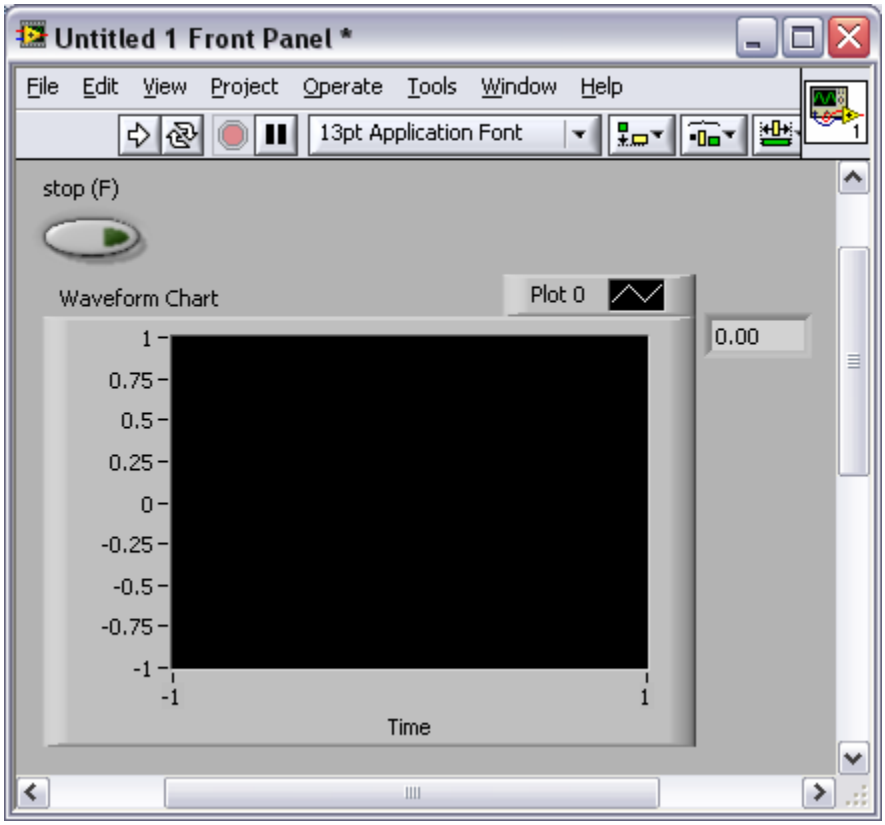


11.) Navigate to the front panel and right click on the grey area. This opens the Controls Palette, which is used to create the user interface for your application.

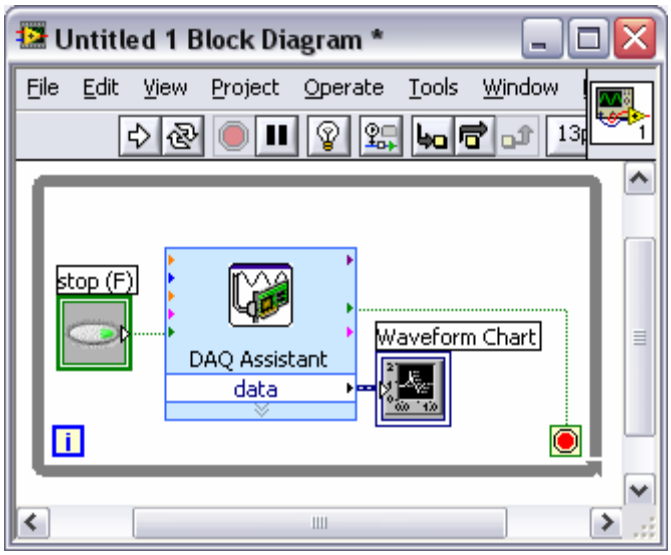
12.) On the **Control Palette**, navigate to **Graph** and select the **Waveform Chart**. Then left-click to place the chart on your front panel.



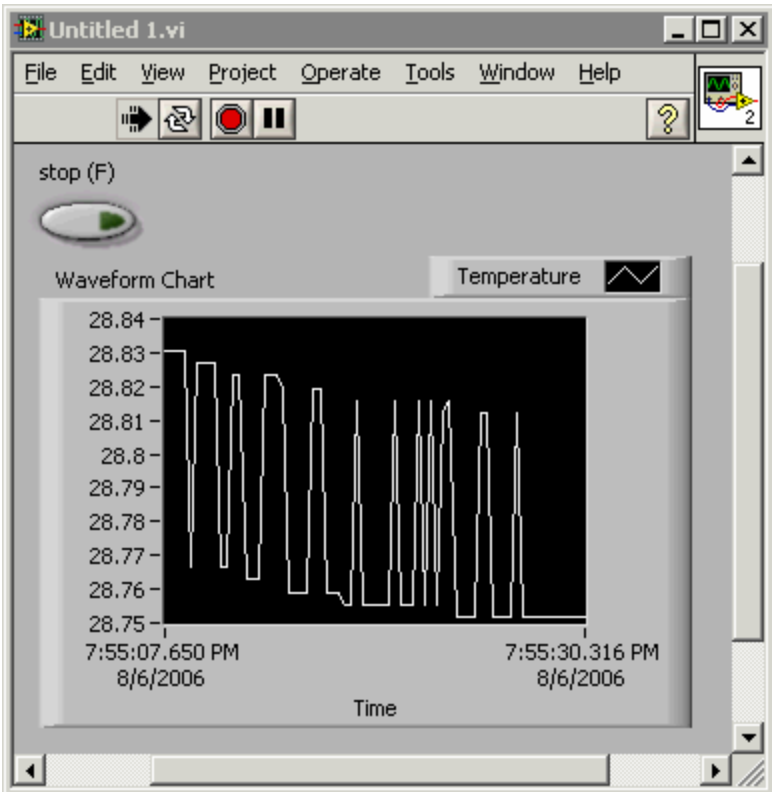
13.) Right-click the **Amplitude** scale label on the chart and select **Visible Scale Label** to remove the scale label from the chart. Right-click on the **Time** label and select **Autoscale X** to enable autoscaling on the time axis. Right-click on the upper right corner of the chart and select **Visible Items>>Digital Display**. Finally, right-click on the chart again and select **Chart History Length**. Set the **Chart History Length** to **25**.



14.) Next you will wire the data from the **DAQ Assistant** function to the chart indicator. Navigate to the block diagram and drag the **Waveform Chart** indicator to the right of the **data** node on the **DAQ Assistant**. Then move your mouse over the triangle () on the right of the **data** node of the **DAQ Assistant** and left-click while the cursor is blinking. Move your mouse over the **Waveform Chart** and left-click again to connect the signal to the chart.



15.) Click the Run button () to start the application. Observe the temperature measurements recorded on the **Waveform Chart**.



16.) While the application is running, navigate to the block diagram and left-click on the blue dynamic data wire going from the **DAQ Assistant** function to the **Waveform Chart** to insert a debugging **Probe**. You can observe the temperature values, timing information and other attributes displayed on the **Probe** window.

17.) When you are finished, close the **Probe** window and click the **stop (F)** button.

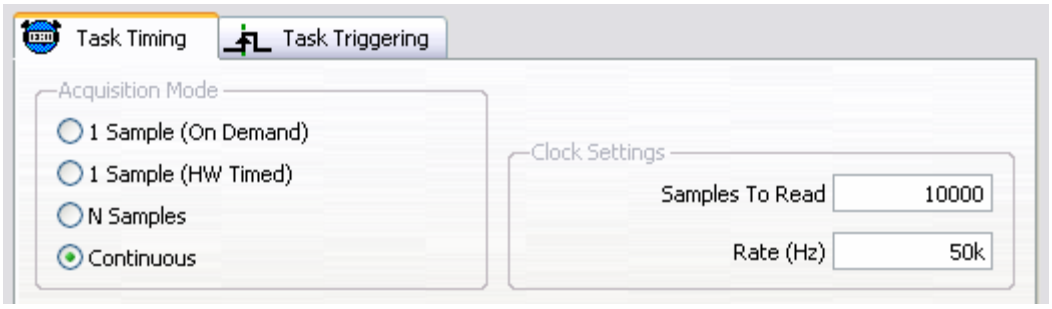
18.) To save the application you have created, navigate to **File>>Save**. Then browse to the **H:\VirtuaLab\CompactDAQ Getting Started Tutorial\Exercises** directory and save the file as **CompactDAQ Analog Input.vi**.

Adding Voltage, Acceleration and Strain Measurements to the Application

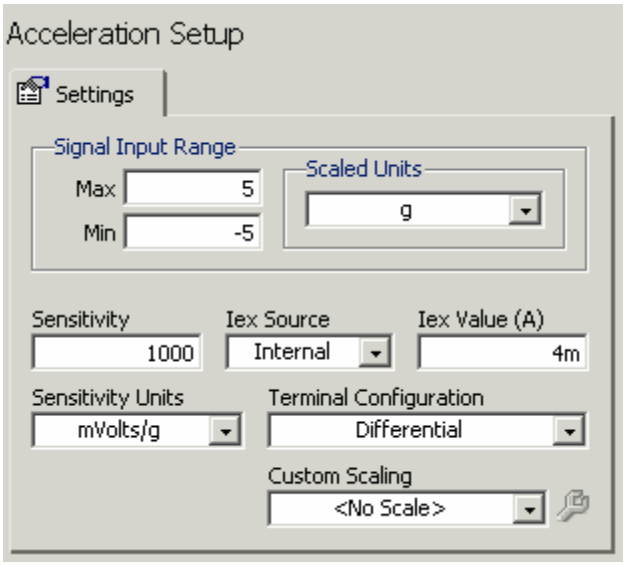
In this exercise, you will add analog voltage input and output channels to your NI CompactDAQ application.

1.) If the **CompactDAQ Analog Input.vi** application is running, click the **stop (F)** button to stop it. On the block diagram, double-click the **DAQ Assistant** function to re-open the configuration panel. Then click the **Add Channels** button and select **Voltage** from the list.

2.) Expand the **cDAQ1Mod1 (NI 9215)** module and select the **ai1** channel. Then click **OK**. Scroll down in the lower window and change **Samples to Read** to **10000** and **Rate (Hz)** to **50000**.

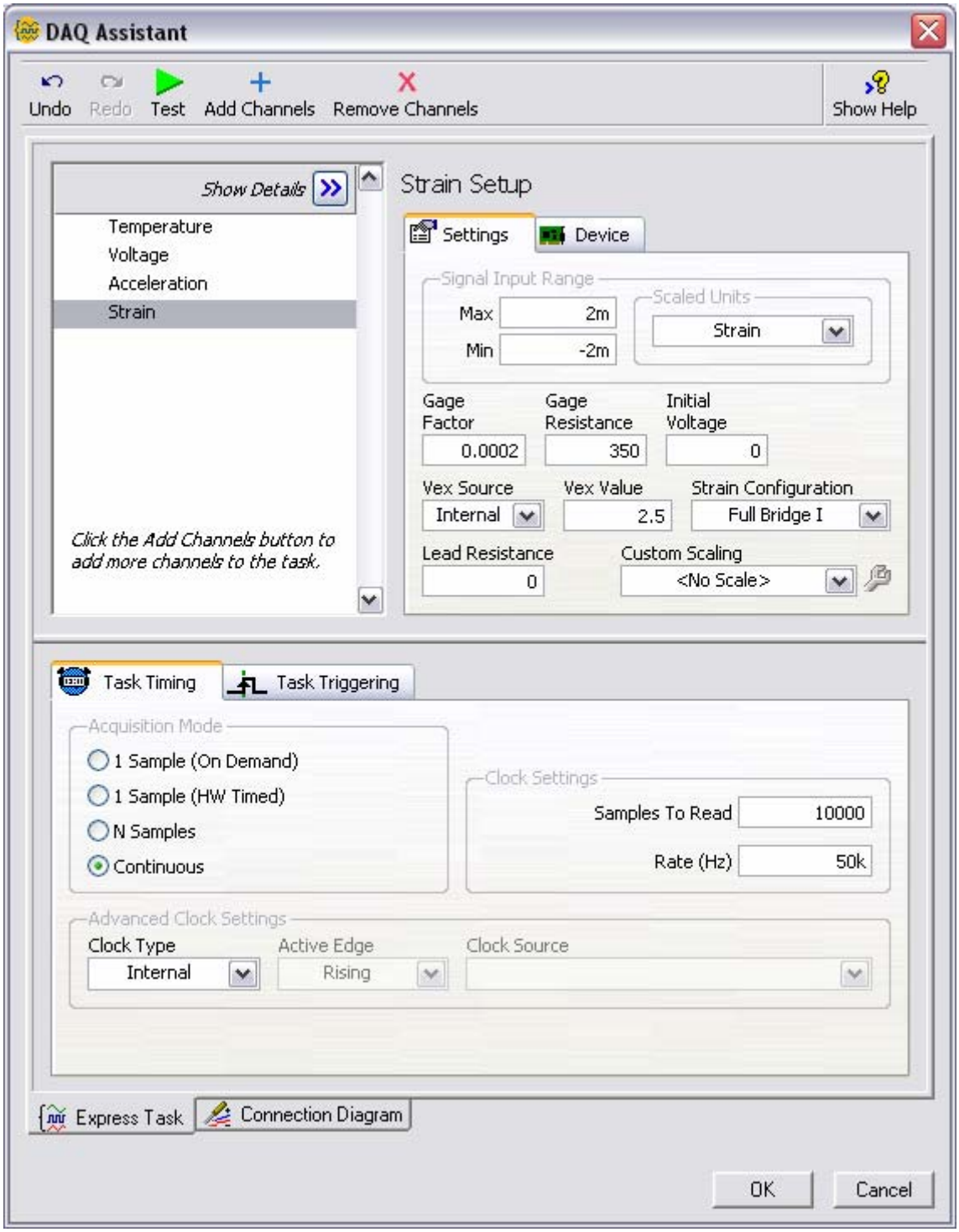


3.) Click the **Add Channels** button again and select **Acceleration** from the list. Expand the **cDAQ1Mod4 (NI 9233)** module and select the **ai0** channel. Then click **OK**. The default settings are correct for this PCB Piezotronics ±5 g accelerometer, so no changes are necessary.



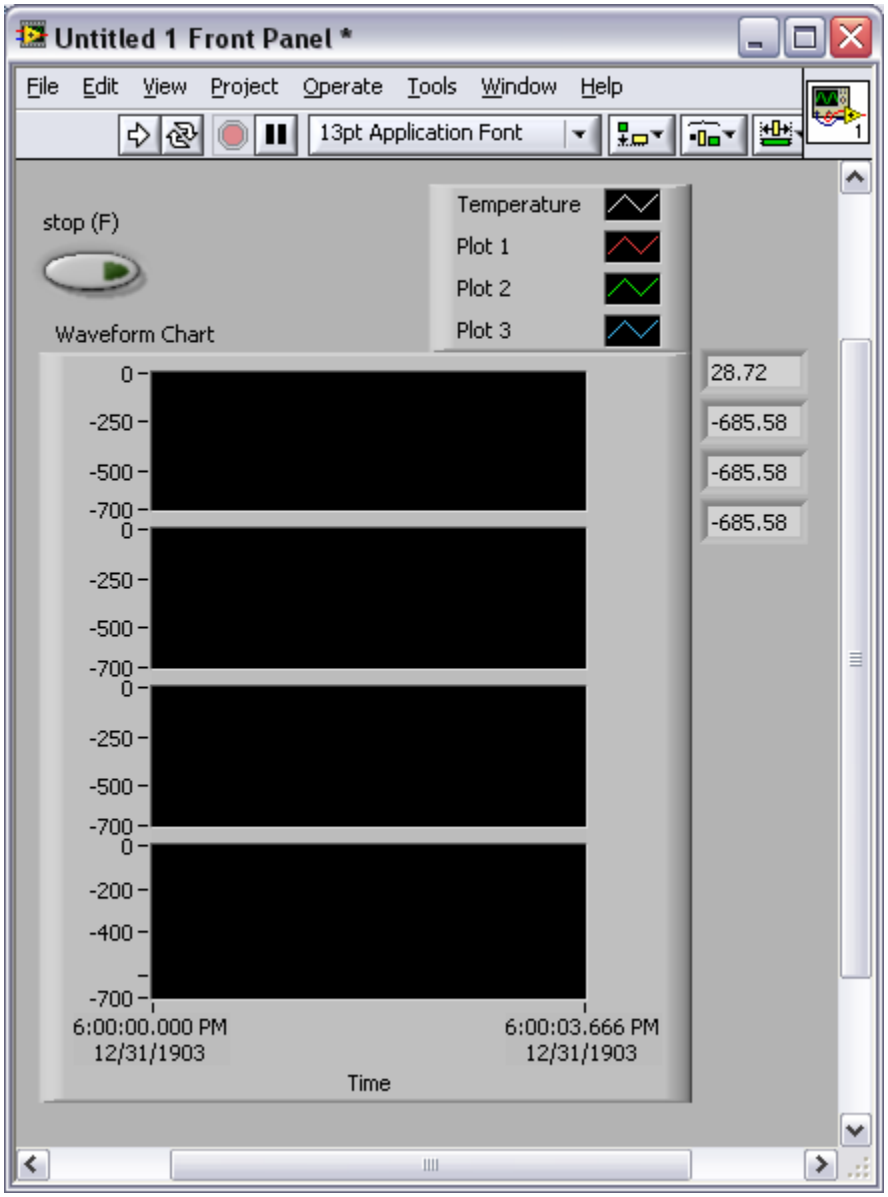
4.) Click the **Add Channels** button one more time and select **Strain** from the list. Expand the **cDAQ1Mod7 (NI 9237)** module and select the **ai0** channel. Then click **OK**.

5.) In the Signal Input Range box, change the **Max** value to **2m** and the **Min** value to **-2m**. Then set the **Gage Factor** to **0.0002**. These settings will scale the strain reading for the FUTEK LSB200 ±5 lb (22.2 N) load cell, which is mounted under a MicroMo Electronics 3242 brushed DC motor rig.

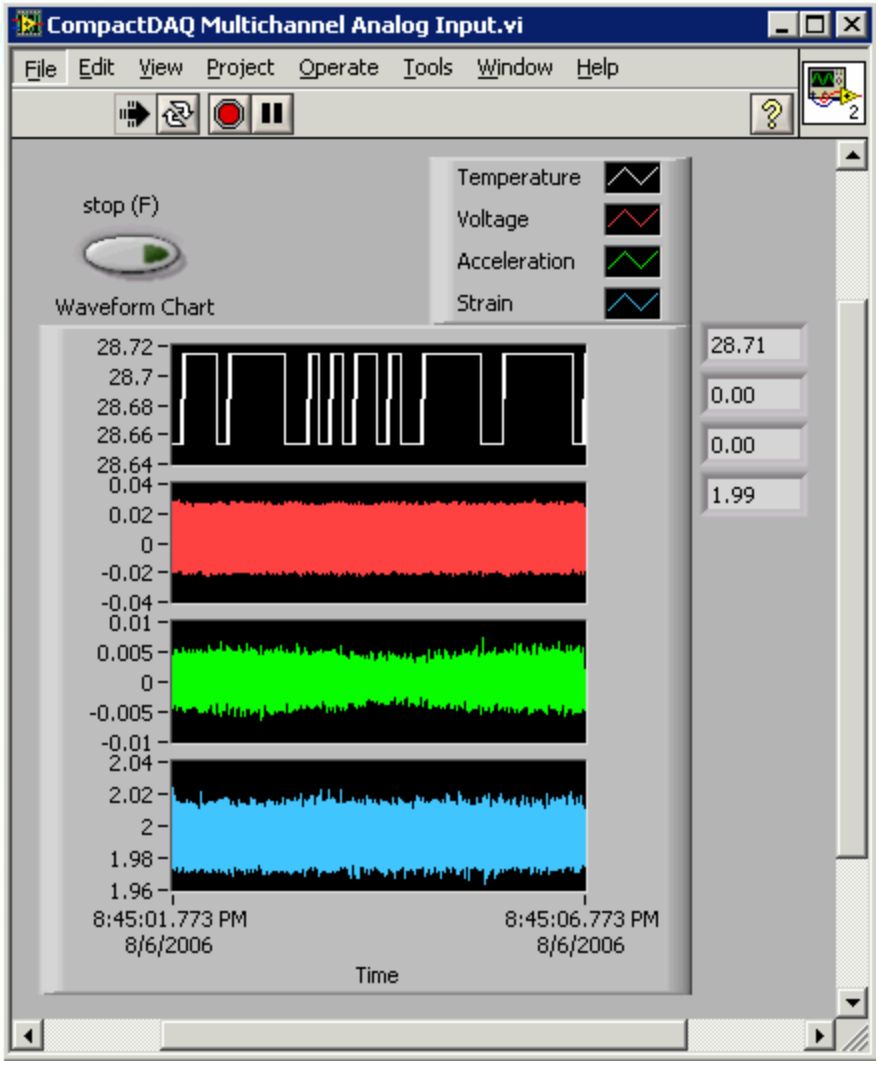


6.) Click **OK** to close the **DAQ Assistant** configuration window.

7.) On the front panel **Waveform Chart** display, move your mouse over the upper border of the **Temperature** label box and click to drag it upwards until labels for three additional plots are displayed. Right-click in the middle of the plot and select **Stack Plots**. Then click the bottom border of the **Waveform Chart** and drag it down to make the chart bigger.

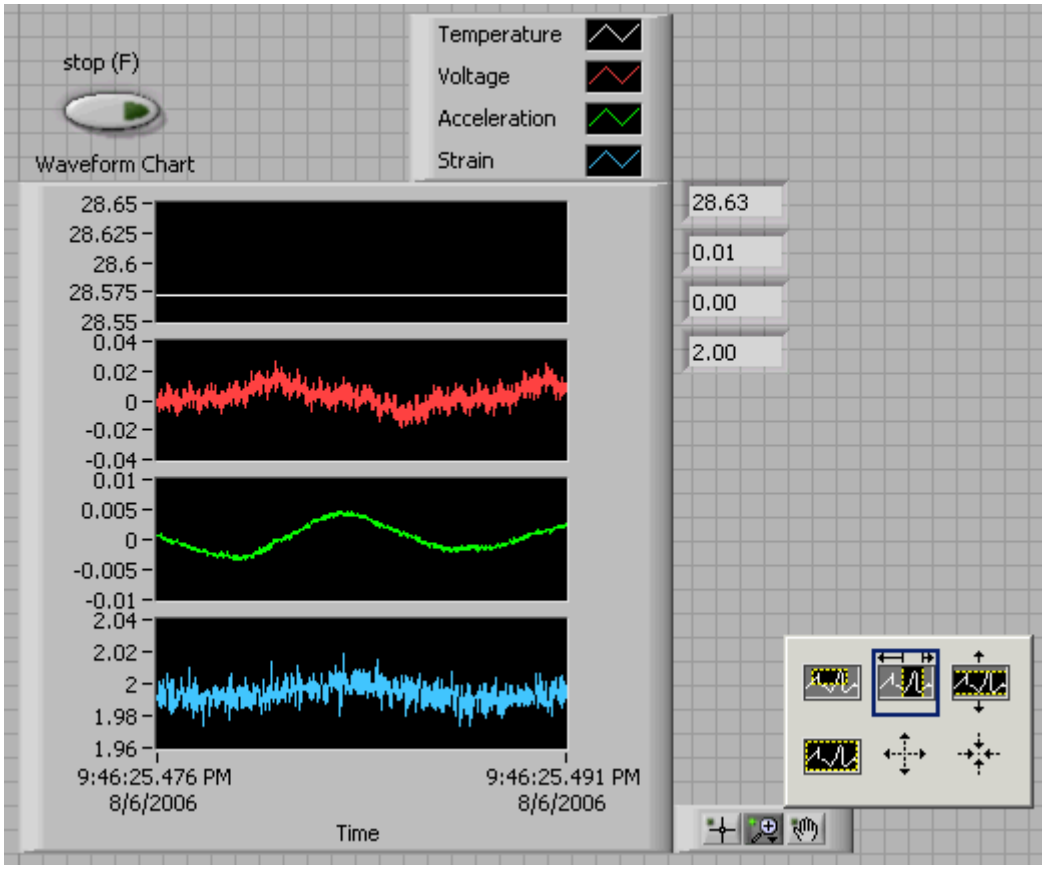


8.) Click the **Run** button () to start the application. The voltage, acceleration and strain gage measurements are all being acquired simultaneously by the NI CompactDAQ USB system.



9.) When you are finished, click the **stop (F)** button.

10.) Right-click on the Waveform Chart and select **Visible Items>>Graph Palette**. Click on the magnifying glass icon and select the time zoom function () as shown below.



11.) Move your mouse over the chart window and click and hold to zoom in on the region of interest. To zoom back out, use the zoom out ( ) function.

12.) When you are finished, navigate to **File>>Save As** and select **Continue**. Name the application **CompactDAQ Multichannel Analog Input.vi** and then click **OK** to save the file.

Summary

As you've seen in these exercises, NI CompactDAQ hardware provides the plug-and-play simplicity of USB to sensor and electrical measurements on the benchtop, in the field, and on the production line. By combining the ease of use and low cost of a data logger with the performance and flexibility of modular instrumentation, NI CompactDAQ delivers fast and accurate measurements in a small, simple, and affordable system.