System Level Laboratory

Measurement and Instrumentation Fundamentals

Objective: The objective of experiment is to learn the basics of data acquisition supported by Lab VIEW: How to configure/test the data acquisition hardware using Measurement & Automation Explorer (MAX); Get familiar with the data acquisition VIs provided in Lab VIEW; and design analog input applications using Lab VIEW and MAX**.**

Exercise 1: Measurement and Automation Explorer (MAX)

A. Use Measurement and Automation Explorer (MAX) to test NI PCI-MIO-16E-1 DAQ device.

Steps:

1) Launch MAX
2) Expand the **NI-DAQmx Devices** section in the **Devices and Interfaces** section to view the installed hardware that is compatible with NI-DAQmx. The device number appears in quotes following the device name. You will use this device number to refer to this device for DAQ operation in your data acquisition VIs (You will see your hardware listed as NI PCI-MIO-16E-1: "Dev1".)
3) Perform a self-test on the device by right-clicking it in the configuration tree and choosing **Self-Test** or clicking **Self-Test** along the top of the window. This tests the system resources assigned to the device. The device should pass the test as it is configured.
4) Check the pin out for your device. Right-click the device in the configuration tree and select **Device Pin outs** or click **Device Pin outs** along the top of the center window.
5) Explore the test panels to test different functions of the device. Right-click the device in the configuration tree and select **Test Panels** or click **Test Panels** along the top of the center window. The test panels allow you to test the available functionality of your device, analog input/output, digital input/output, and counter input/output without doing any programming.
6) Connect an analog output pin (**pin 22**) to an analog input pin (**pin 68**). Connect the corresponding **AOGND to pin 34**.
7) On the **Analog Output** tab, set the right channel correspond to the hardware connection, the right Mode and Configuration. Change the value you want to output and click Update. On the **Analog Input** tab of the test panels, change Mode to **Continuous**. And set the input configuration to **Differential**. Click **Start** to observe the signal that is plotted. Click **Finish** when you are done.
8) On the **Digital I/O** tab notice that initially the port is configured to be all input. Observe under Select State the LEDs that represent the state of the input lines. Click the **All Output**

button under Select Direction. Notice that you now have switches under Select State to specify the output state of the different lines. Toggle line 0 and watch the port state. Click **Close** to close the test panels.

B. Use Measurement and Automation Explorer (MAX) to configure a simulated DAQ device.

1) Launch MAX.
2) Expand the Devices and Interfaces section to view the installed National Instruments devices.
3) **Create a simulated DAQ device.** Simulated devices are a powerful tool for development without having hardware physically installed in your computer. Right-click Devices and Interfaces and select create new…»NI-DAQmx Simulated Device. Click "Finish".
4) **Expand the M Series DAQ section.** Select PCI-6220 or any other PCI device of your choice. Click "OK".
5) The NI-DAQmx Devices folder includes a new entry for PCI-6220: "Dev2". You have now created a simulated device!
6) **Perform a self-test** on the device. This tests the system resources assigned to the device. The device should pass the test as it is configured.
7) **Check the pin out for your device**. Right-click the device in the configuration tree and select Device Pin outs or click "Device Pin outs" along the top of the center window.
8) **Explore the test panels to test different functions of the virtual device.** The test panels allow you to test the available functionality of your device, analog input/output, digital input/output, and counter input/output without doing any programming.

Exercise 2: Now it's your turn! (Demonstrate the following to the instructor)

    A. Acquiring an analog signal
    B. Simulate a signal and display its amplitude and frequency
    C. Acquire a signal and display its amplitude and frequency
    D. Manual analysis

Exercise 3: Set up and operate a single analog input application

1) Start Lab VIEW and construct a Front Panel which contains the following object: A waveform.

2) Make the Block Diagram screen active.

a. From the Functions Palette select Express and then input and drag the icon labeled DAQ assistant, into the window.

b. Double click the DAQ assistant to configure the analog input channel, and then select "voltage", configuration (RSE), mode (continuous), and rate.

c. Wire the waveform icon to the data of DAQ assistant. This means that the signal on the specified channel will be captured by DAQ assistant and input to your VI from "data" terminal. Then, the signal will be displayed on the waveform you wired.

3) Physical connections

a. Identify the Analog input channel (0) pin and its ground and connect to a signal generator.

b. Set the generator to a very low frequency triangular wave with amplitude of 0 to 5V and a DC offset of 5V. Thus the triangular wave goes from 0 to 5V.

4) Go the Front Panel

a. Run the program. Notice how the signal varies from 0 to 5V as driven by the signal generator.

b. Vary the amplitude and frequency of the signal generator and note the changes of the waveform on the front panel.

Exercise 4. Simulate the acquisition, processing and display the sensor data.

See Prelab for background and the detail. Demonstrate how your program works to the instructor.
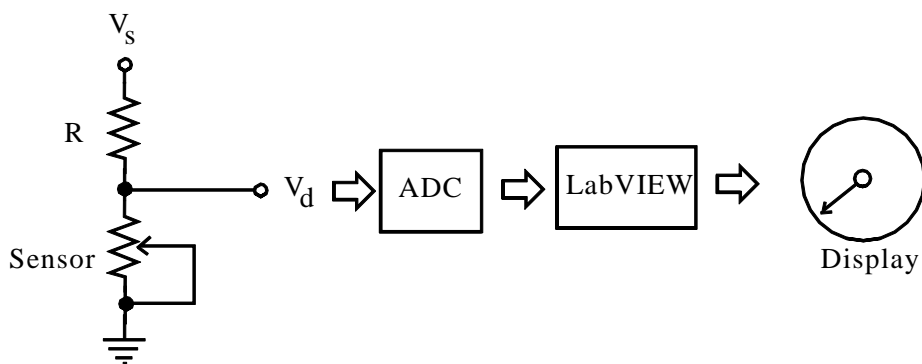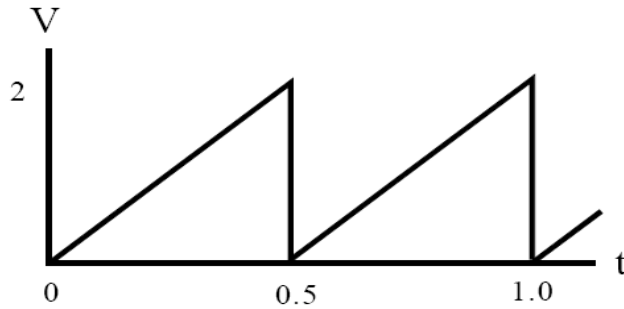

Figure 1 Simulate Pressure Sensor Acquisition and Display

Exercise 5: Set up and operate simple voltage output using DAQ assistant.

Use Lab VIEW to produce a triangular wave with a 500 ms period and 2 volt amplitude, as shown below. Use a While loop that is terminated by a switch on the Front Panel. Demonstrate your result on an oscilloscope.

A. Start up a new blank VI.

B. Make the Block Diagram screen active.

C. From the Functions Palette select Express and then output and drag the icon labeled DAQ assistant, into the window. Select "Analog Output"-> "Voltage".

D. Double click the DAQ assistant to configure the analog output channel (0), voltage range, and mode (continuous). This means the signal will be output to the DAQ board DAC channel 0.

E. From the Functions Palette select Express and then input and drag the icon labeled Simulated Sig in the while loop. This is the signal source of the output. Configure the signal source to saw tooth.

F. Wire the signal source to the "data" terminal of the DAQ assistant.

G. Physical connections:

a. Identify the Analog output channel (0) pin and its ground and connect to an oscilloscope.

b. See the output signal display. Vary the signal source (frequency and amplitude) to see how the waveform changes.

Post lab Question:

1) What are the three methods that DAQ devices can be grounded?

2) Describe three uses of Measurement & Automation Explorer.