Accelerometer

Core Concept Instructor Set

Materials:

myRIO

Accelerometer

"Accelerometers have a wide range of applications from motor vehicle control systems to smartphone user interfaces"

Learn It!

Accelerometers measure both static acceleration for leveling, tilt, and drop sensor applications as well as dynamic acceleration for shock and vibration data acquisition.

Accelerometers have a wide range of applications from motor vehicle control systems to Smartphone user interfaces.

In this exercise you will implement an accelerometer with a myRIO that measures X,Y, and Z acceleration.

Build It!

Creating the accelerometer circuit

Step 1: Connect the accelerometer as indicated in the circuit diagram shown in figure 3.

Step 2: Open the Accelerometer demo folder and project (Accelerometer demo.lvproj). Open the VI titled "Main.vi". The front panel of the VI should look like the picture shown in figure 1
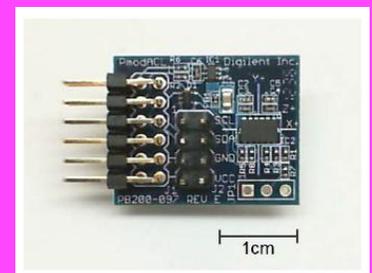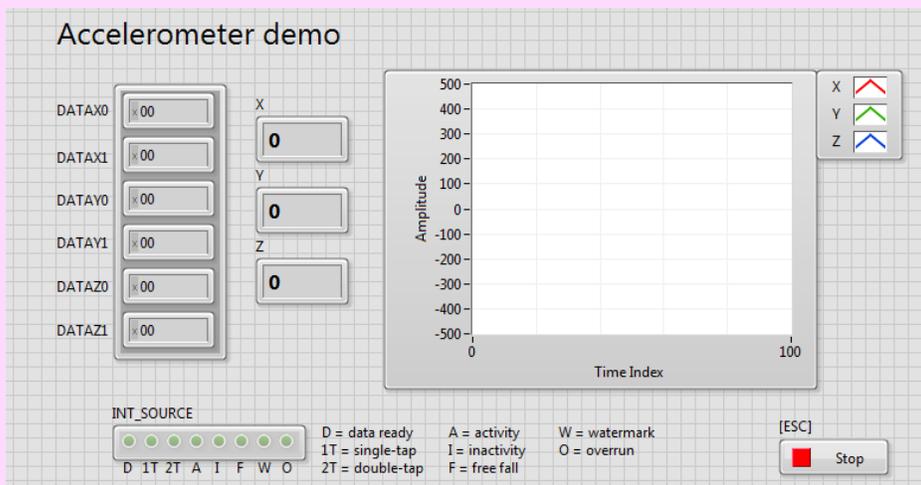
Figure 1: Accelerometer Demo Front Panel

Guiding Questions:
- How many different ways does the front panel display the accelerometer values?

Step 4: Examine the code on the block diagram of the Main VI.

The main VI can be separated into two different sections: configuration and reading. Figure 3 shows the configuration portion of the block diagram which opens DIO channels and I2C channels to initialize the accelerometer. The DIO channels are opened for the interrupts of the accelerometer and I2C channel is used to read the accelerometer values. Figure 2 shows the VI reading the I2C channel to obtain the accelerometer values for the X, Y, and Z axes. For a more detailed explanation of how the main VI works watch the video: youtu.be/-_GWEsrfxU4.

Guiding Questions:
- How many bytes are the accelerometer values at the first reading? At the second reading?

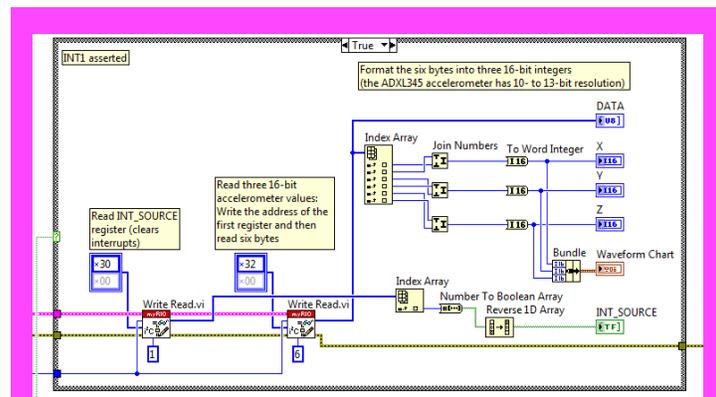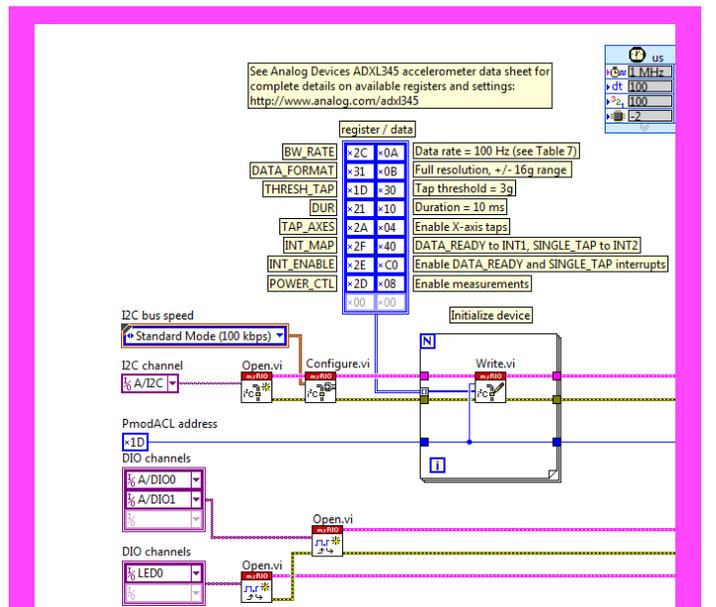*Step 3:* Run the VI and observe the front-panel display as you shake the accelerometer. Try shaking the accelerometer along a particular axis and then correlate this motion with what you see on the front panel. Try tapping the edge of the board on the table or tap the edge with your finger. The NI myRIO onboard LED0 will flash to indicate that a single-tap event was detected by the accelerometer. Single-tap detection is only enabled along the X-axis. Try tapping on the three different axes as you observe the LED.

Figure 2: Reading the Accelerometer

Figure 3: Configuring the Accelerometer
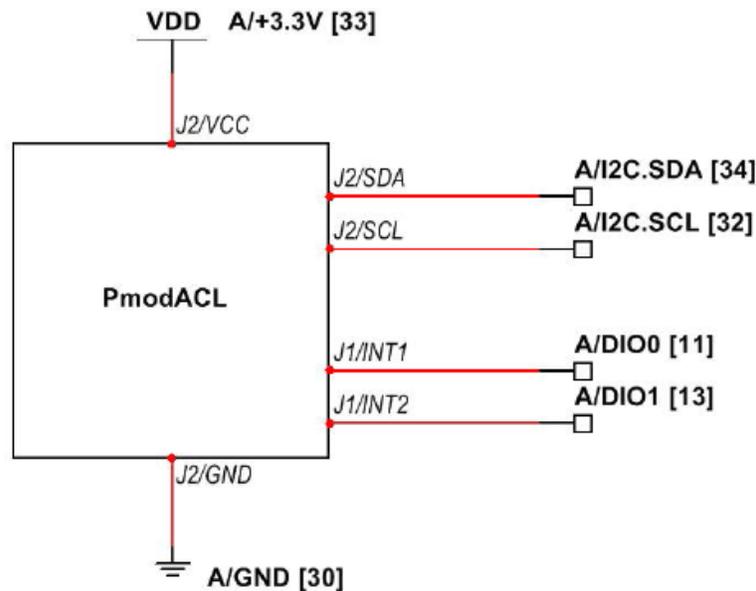
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Figure 4: Accelerometer Circuit Diagram

Expand it!

- Change the device address to some other value. What LabVIEW error message do you see?
- Add the necessary computation to display the acceleration in "g" units.
- Add code to read the ADXL345 device ID register (address 0x00) and to generate an error condition if the ID does not match the expected value; in this way your VI can detect that the correct I2C-bus device is attached to the NI myRIO I2C terminals. Study the ADXL345 datasheet register map (Table 19) to determine the expected value. Select one of the pop-up dialog box Vis from the Programming | Dialog & User Interface subpalette to display your error message.

Research It!

Study the video Accelerometer Interfacing Theory (youtu.be/uj76-JtT_xk, 15:55) to learn about accelerometer principle of operation, applications, Analog Devices ADXL345 features, and Digilent PmodACL connections and sensor axis orientation. Continue studying the video to learn the necessary details to configure the ADXL345 registers and read accelerometer data.

Study Serial Communication: I2C (youtu.be/7CgNF78pYQM, 8:47) to better understand the signaling waveforms between I2C-bus transmitters and receivers.

Study the video Accelerometer Demo Walk-Through (youtu.be/-_GWEsrfxU4, 8:37) to learn the design principles of Accelerometer demo.

Accelerometer (PmodACL) datasheet, http://digilentinc.com/Data/Products/PMOD-ACL/PmodACL_rm.pdf

PmodACL Reference Manual by Digilent's Reference manual for the accelerometer: http://digilentinc.com/Data/Products/PMOD-ACL/PmodACL_rm.pdf