## Exercise 3.1 – Analysis

Create a VI that produces a sine wave with a specified frequency and displays the data on a waveform chart until stopped by the user.

1. Open a blank VI from the Getting Started screen.

2. Place a chart on the front panel. Right-click to open the **Controls** palette and select **Controls»Modern»Graph»Waveform Chart**.

3. Place a dial control on the front panel. From the **Controls** palette, select **Controls»Modern»Numeric»Dial**. Notice that when you first place the control on the front panel, the label text is highlighted. While this text is highlighted, type Frequency In to give a name to this control.

4. Go to the block diagram (<Ctrl-E>) and put down a While Loop. Right-click to open the **Functions** palette and select **Express»Execution Control»While Loop**. Click and drag on the block diagram to make the While Loop the correct size. Select the waveform chart and dial and drag them inside the While Loop if they are not already. Notice that a **Stop** button is already connected to the conditional terminal of the While Loop.
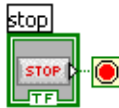
1. Place the Simulate Signal Express VI on the block diagram. From the **Functions** palette, select **Express»Signal Analysis»Simulate Signal** and place it on the block diagram inside the While Loop. In the configuration window under Timing, choose "Simulate acquisition timing." Click **OK**.

6. Place a Tone Measurements Express VI on the block diagram (**Express»Signal Analysis**»**Tone).** In the configuration window, choose **Amplitude** and **Frequency** measurements in the Single Tone Measurements section. Click **OK**.
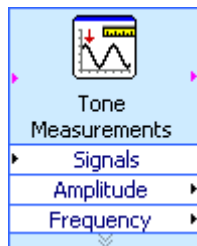
7. Make the following connections on the block diagram by hovering your mouse over the terminal so that it becomes the wiring tool and clicking once on each of the terminals you wish to connect:

    a. Connect the "Sine" output terminal of the Simulate Signal VI to the "Signals" input of the Tone Measurements VI.

    b. Connect the "Sine" output to the waveform chart.

    c. Create indicators for the amplitude and frequency measurements by right-clicking on each of the terminals of the Tone Measurements Express VI and selecting **Create**»**Numeric Indicator**.

    d. Connect the "Frequency In" control to the "Frequency" terminal of the Simulate Signal VI.

8. Return to the front panel and run the VI. Move the "Frequency In" dial and observe the frequency of the signal. Click the Stop button once you are finished.

9. Save the VI as `Exercise 3.1 - Simulated.vi`.

10. Close the VI.

Notes

*   When you bring up the **Functions** palette, press the small pushpin in the upper left-hand corner of the palette. This tacks down the palette so that it doesn't disappear. This step is omitted in the following exercises, but you should repeat it.

*   The solution to this exercise is printed in the back of this manual.

End of Exercise 3.1

Exercise 3.2 – Analysis

Create a VI that measures the frequency of a filtered signal from your USB-6009 DAQ device and displays the acquired signal on a waveform chart. The instructions are similar to Exercise 3.1, but you use DAQ Assistant in place of the Simulate Signal VI and you use Filter Express VI. Try to do this without following the instructions.

1. Open a blank VI.

2. Place a waveform chart on the front panel. Right-click to open the **Controls** palette and select **Controls»Modern»Graph»Waveform Chart**.

3. Place a numeric meter on the front panel. The meter is found in **Controls»Modern» Numeric»Meter**.

4. Right-click the y-axis on the waveform chart and deselect AutoScale Y.

5. Change the scale on the y-axis to –0.15 to 0.15 V by double-clicking the maximum and minimum axis values and typing the new value. Change the scale of the meter to 100 to 2000.

6. Go to the block diagram and place a While Loop around the chart and the meter (**Express»Execution Control**»**While Loop**).

7. Place the DAQ Assistant on the block diagram (**Express»Input**»**DAQ Assistant**). Choose analog input on channel ai0 of your device and click **Finish**. On the Task Timing tab, choose "Continuous" for the acquisition mode. If you are using the USB-6009, change the Input Range to – 2 to 2, the number of Samples to Read to 1000, and the Rate (Hz) to 44100.

8. Place the Filter Express VI to the right of the DAQ Assistant on the block diagram. From the **Functions** palette, select **Express»Signal Analysis**»**Filter** and place it on the block diagram inside the While Loop. In the configuration window under Filtering Type, choose "Highpass." Under Cutoff Frequency, use a value of 300 Hz. Click **OK**.

9. Connect the "Data" output terminal of the DAQ Assistant to the "Signal" input of the Filter VI.

10. Connect the waveform chart to the "Filtered Signal" output.

11. Place a Tone Measurements Express VI on the block diagram (**Express»Signal Analysis**»**Tone**). Select "Frequency" under Single Tone Measurements**.**

12. Connect the output of the Filter VI to the "Signals" input of the Tone Measurements Express VI. Also, connect the "Frequency" output to the meter.

13. Return to the front panel and run the VI. Observe your acquired signal and its frequency and amplitude. Hum or whistle into the microphone and observe the frequency that you are producing.

14. Save the VI as Exercise 3.2 - Data.vi.

15. Close the VI.

Note: The solution to this exercise is printed in the back of this manual.

End of Exercise 3.2

Exercise 3.3 – Decision Making and Saving Data

Create a VI that you can use to save your data to file if the frequency of your data goes below a user-controlled limit.

1. Open Exercise 3.2 – Data.vi.

2. Go to **File**»**Save As…** and save it as `Exercise 3.3 – Decision Making and Saving Data`. In the Save As dialog box, make sure **substitute copy for original** is selected and click **Continue…**

3. Add a case structure to the block diagram inside the While Loop (**Functions» Programming»Structures»Case Structure**).

4. Inside the "true" case of the case structure, add a Write to Measurement File Express VI (**Functions»Programming»File I/O»Write to Measurement File**).
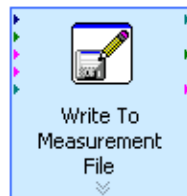
   a. In the configuration window that opens, choose "Save to series of files (multiple files)." Note the default location your file will be saved to and change it if you wish.

   b. Click **Settings…** and choose "Use next available file name" under the **Existing Files** heading.

   c. Under **File Termination,** choose to start a new file after 10 segments. Click **OK** twice.

5. Add code so that if the frequency computed from the Tone Measurements Express VI goes below a user-controlled limit, the data will be saved to file. **Hint**: Go to **Functions»Programming»Comparison»Less?**

6. Remember to connect your data from the Filter Express VI to the "Signals" input of the Write to Measurement File VI. If you need help, refer to the solution of this exercise.

7. Go to the front panel and run your VI. Vary your frequency limit and then stop the VI.

8. Navigate to **My Documents**»**LabVIEW Data** (or the location you specified) and open one of the files that was saved there. Examine the file structure and check to verify that 10 segments are in the file.

9. Save your VI and close it.

Note: The solution to this exercise is printed in the back of this manual.

End of Exercise 3.3