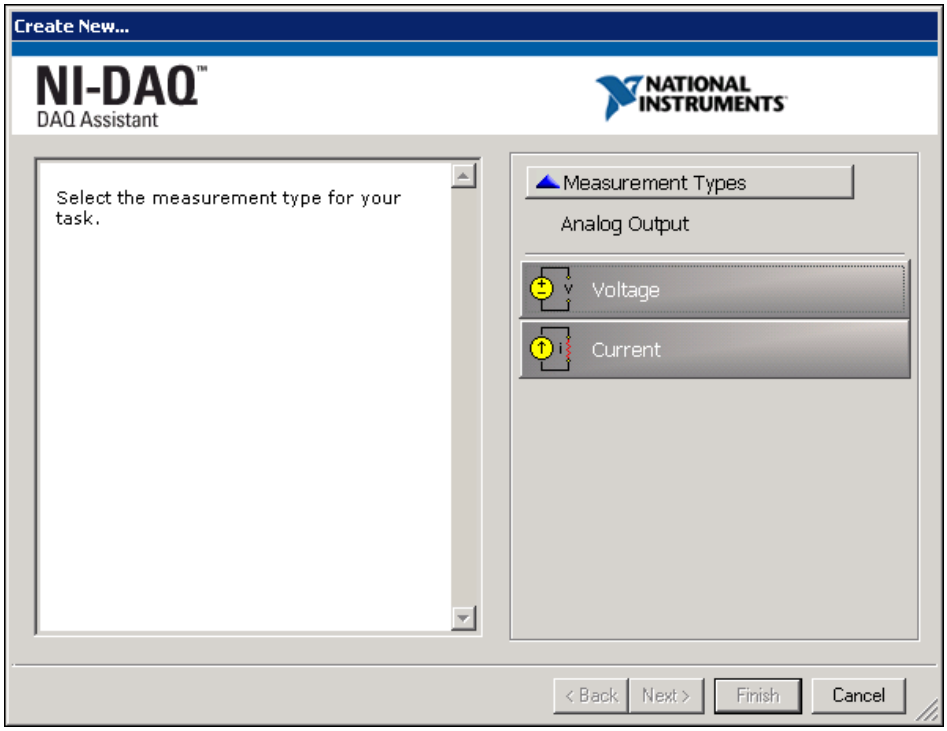
E. Analog Output

Use analog output to perform digital-to-analog (D/A) conversions. The available analog output types for a task are voltage and current.



To perform a voltage or current task, a compatible device must be installed that can generate that form of signal.

Task Timing

When performing analog output, the task can be timed to Generate 1 Sample, Generate *n* Samples, or Generate Continuously.

Generate 1 Sample

Use single updates if the signal level is more important than the generation rate. For example, generate one sample at a time if you need to generate a constant, or DC, signal. You can use software timing to control when the device generates a signal.

This operation does not require any buffering or hardware timing. For example, if you need to generate a known voltage to stimulate a device, a single update would be an appropriate task.

Generate *n* Samples

One way to generate multiple samples for one or more channels is to generate single samples in a repetitive manner. However, generating a single data sample on one or more channels over and over is inefficient and time consuming. Moreover, you do not have accurate control over the time between each sample or channel. Instead, you can use hardware timing, which uses a buffer in computer memory to generate samples more efficiently.

You can use software timing or hardware timing to control when a signal is generated. With software timing, the rate at which the samples are generated is determined by the software and operating system instead of by the measurement device. With hardware timing, a TTL signal, such as a clock on the device, controls the rate of generation. A hardware clock can run much faster than a software loop. A hardware clock is also more accurate than a software loop.

Note Some devices do not support hardware timing. Consult the device documentation if you are unsure if the device supports hardware timing.

Programmatically, you need to include the timing function, specifying the **sample rate** and the **sample mode (finite)**. As with other functions, you can generate multiple samples for a single channel or multiple channels.

Use Generate *n* Samples if you want to generate a finite time-varying signal, such as an AC sine wave.

Generate Continuously

Continuous generation is similar to Generate *n* Samples, except that an event must occur to stop the generation. If you want to continuously generate signals, such as generating a non-finite AC sine wave, set the timing mode to **continuous**.

Task Triggering

When a device controlled by NI-DAQmx does something, it performs an action. Two very common actions are producing a sample and starting a generation. Every NI-DAQmx action needs a stimulus or cause. When the stimulus occurs, the action is performed. Causes for actions are called triggers. The start trigger starts the generation. The reference trigger is not supported for analog output tasks.

Exercise 9-5 Voltage Output VI

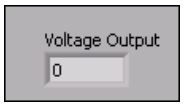
Objective: To output an analog voltage using a DAQ device.

Complete the following steps to finish a VI that outputs voltage from 0 to 9.5 V in 0.5 V steps.

1. Connect Analog Out CH0 to Analog In CH1 on the DAQ Signal Accessory.

Front Panel

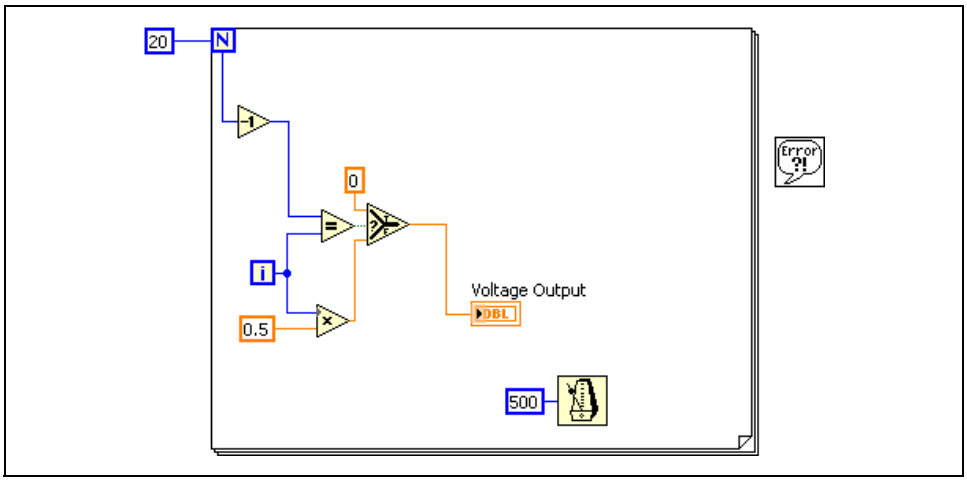
2. Open the Voltage Output VI located in the `C:\Exercises\LabVIEW Basics I` directory. The following front panel is already built.



Voltage Output displays the current voltage output.

Block Diagram

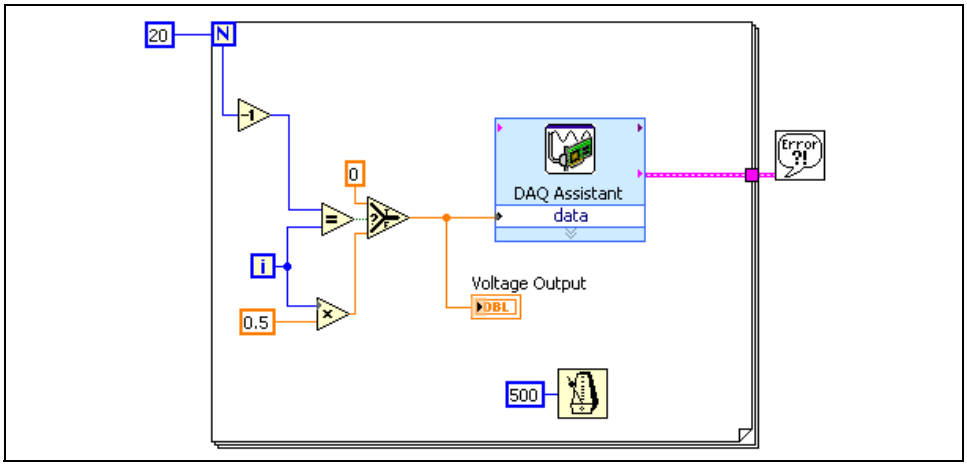
3. Display and examine the block diagram.



The Wait Until Next ms Multiple function located on the **Functions» All Functions»Time & Dialog** palette causes the For Loop to execute every 500 ms.

The Select VI located on the **Functions»Arithmetic & Comparison» Express Comparison** palette checks if the loop is in its last iteration. If the loop is in its last iteration, then the DAQ device outputs 0 volts. This is a good technique to reset the output voltage to a known level. It is always a good idea to reset the output voltage to something that will not damage a device that is connected to the DAQ device.

4. Modify the block diagram as shown in the following figure.



Place the DAQ Assistant Express VI, located on the **Functions»Output** palette, in the For Loop. Complete the following steps to configure this Express VI to generate an analog output voltage.

a. Select **Analog Output»Voltage** for the measurement to make.

b. Select **Dev1»ao0** for the physical channel and click the **Finish** button.

c. In the **Analog Output Voltage Task Configuration** dialog box that appears, configure the **Task Timing** to **Generate 1 Sample**. Change the output range minimum to `0` and maximum to `10`.

d. Click the **OK** button to close the **Analog Output Voltage Task Configuration** dialog box. This saves the settings specified for the task in the DAQ Assistant Express VI.

5. Save the VI.

6. Close the block diagram but leave the front panel open.

Front Panel

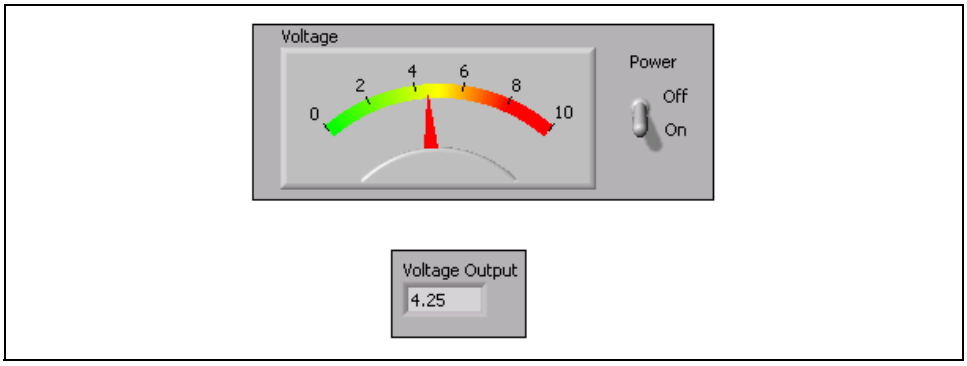
7. Open the Voltmeter VI that you completed in Exercise 9-2.

8. Configure the meter scale minimum to `0.0` and maximum to `10.0`.

Block Diagram

9. Display the block diagram for the Voltmeter VI and double-click the DAQ Assistant Express VI to open the **Analog Input Voltage Task Configuration** dialog box.
10. Right-click **Voltage** in the **Channel List** section and select **Change Physical Channel**. Select **ai1** for the channel because you wired the DAQ signal accessory to output a voltage on Analog Out CH0 and acquire the voltage from Analog In CH1.
11. Select **No Scale** from the **Custom Scaling** pull-down menu.
12. Change the voltage range to `0` to `10`.
13. Click the **OK** button to close the dialog box.
14. Display the front panel and run the Voltmeter VI.
15. To acquire and display the voltage output, run the Voltage Output VI.

    The Voltage Output VI outputs the voltage in 0.5 V increments from 0 to 9.5 V. When the For Loop executes its last iteration, the VI outputs 0 V to reset the analog output channel.



16. Close both VIs.

End of Exercise 9-5