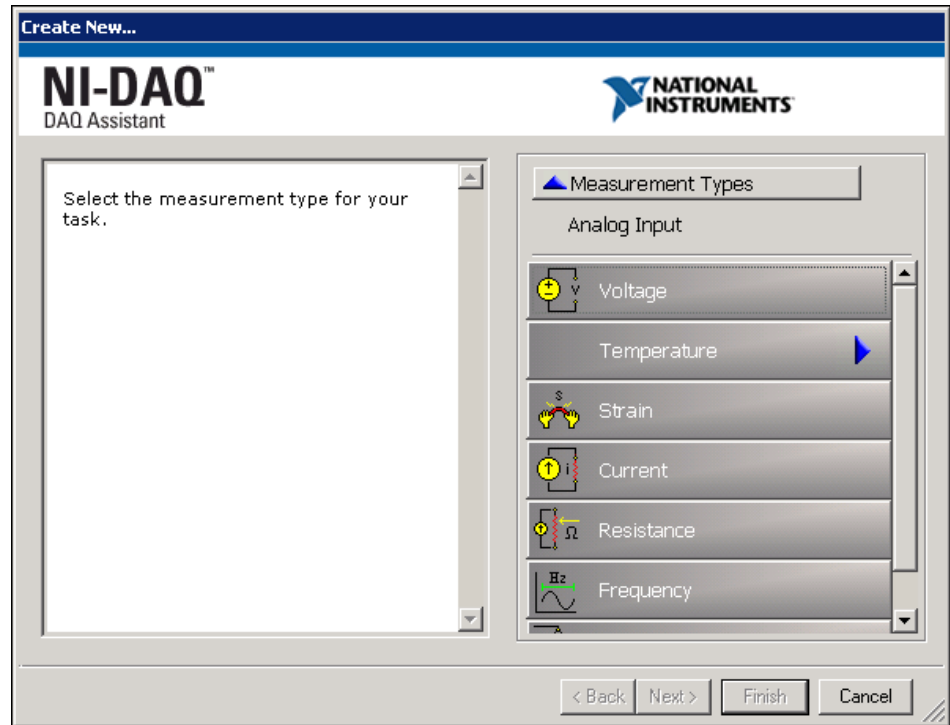


C. Analog Input

Use analog input to perform analog-to-digital (A/D) conversions.

The available analog input measurement types for a task are voltage, temperature, strain, current, resistance, or frequency.



Each measurement type has its own characteristics, such as resistor values for current measurements or strain gauge parameters for strain measurements.

Task Timing

When performing analog input, the task can be timed to Acquire 1 Sample, Acquire n Samples, or Acquire Continuously.

Acquire 1 Sample

Acquiring a single sample is an on-demand operation. In other words, NI-DAQmx acquires one value from an input channel and immediately returns the value. This operation does not require any buffering or hardware timing. For example, if you periodically monitor the fluid level in a tank, you would acquire single data points. You can connect the transducer that produces a voltage representing the fluid level to a single channel on the measurement device and initiate a single-channel, single-point acquisition when you want to know the fluid level.

Acquire n Samples

One way to acquire multiple samples for one or more channels is to acquire single samples in a repetitive manner. However, acquiring 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 acquire data more efficiently. Programmatically, you need to include the timing function and specify the **sample rate** and the **sample mode (finite)**. As with other functions, you can acquire multiple samples for a single channel or multiple channels.

With NI-DAQmx, you also can gather data from multiple channels. For instance, you might want to monitor both the fluid level in the tank and the temperature. In such a case, you need two transducers connected to two channels on the device.

Acquire Continuously

If you want to view, process, or log a subset of the samples as they are acquired, you need to continually acquire samples. For these types of applications, set the sample 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 waveform acquisition. 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 acquisition. The reference trigger establishes the reference point in a set of input samples. Data acquired up to the reference point is pretrigger data. Data acquired after the reference point is posttrigger data.

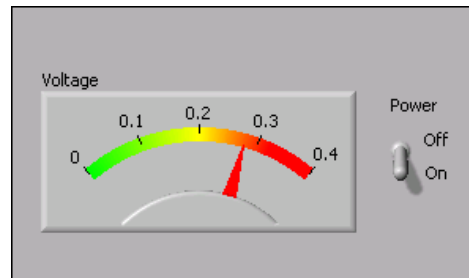
Exercise 9-2 Voltmeter VI

Objective: To acquire an analog signal using a DAQ device.

Complete the following steps to build a VI that measures the voltage that the temperature sensor on the DAQ Signal Accessory outputs. The temperature sensor outputs a voltage proportional to the temperature. The sensor is hard-wired to channel 0 of the DAQ device.

Front Panel

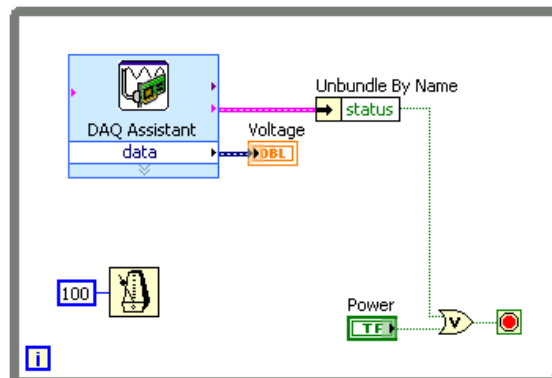
1. Open a blank VI and build the following front panel.



- a. Place the Meter, located on the **Controls»Numeric Indicators** palette, on the front panel. Configure the meter scale for 0.0 to 0.4. Use the Labeling tool to double-click 10.0 and type 0.4. You might need to enlarge the meter to display the scale as shown in the example.
- b. Place a Vertical Toggle Switch, located on the **Controls»Buttons & Switches** palette, on the front panel. Configure the toggle switch to a default value of False and a mechanical action of **Latch When Pressed**.
- c. Create two free labels, **Off** and **On**, using the Labeling tool.

Block Diagram

2. Build the following block diagram.





- a. Place the DAQ Assistant Express VI located on the **Functions»Input** palette, on the block diagram. Configure this VI to read an analog input channel and return the voltage.
 - Select **Analog Input»Voltage** for the measurement to make.
 - Select **Dev1»ai0** for the physical channel.
 - Click the **Finish** button.
 - The **Analog Input Voltage Task** dialog box appears. Configure the **Task Timing** to **Acquire 1 Sample**.
 - Click the **OK** button to close the **Analog Input Voltage Task Configuration** dialog box. This saves the settings specified for the task in the DAQ Assistant Express VI.



- b. Place the Wait Until Next ms Multiple function, located on the **Functions»All Functions»Time & Dialog** palette, on the block diagram. Right-click the input and select **Create Constant** from the shortcut menu. Type 100 in the constant to cause the loop to execute every 100 ms.



- c. Place the Unbundle by Name function, located on the **Functions»All Functions»Cluster** palette, on the block diagram. Use this function to access the **status** from the error cluster.



- d. Place the Or function, located on the **Functions»Arithmetic & Comparison»Express Boolean** palette, on the block diagram. This function stops the loop if an error occurs or the user clicks the power switch on the front panel.

3. Save the VI as `Voltmeter.vi` in the `C:\Exercises\LabVIEW Basics I` directory. You will use this VI later in the course.
4. Display the front panel and run the VI.
The meter displays the voltage the temperature sensor outputs. Place your finger on the temperature sensor and notice that the voltage increases.
5. Stop the VI by clicking the power switch.

Scales

The temperature sensor on the DAQ Signal Accessory outputs the voltage in degrees Celsius, scaled by 100. In order to convert the voltage into degrees Celsius, it is necessary to multiply the voltage by 100. You could multiply the output of the DAQ Assistant Express VI by 100, or configure the DAQ Assistant Express VI to automatically scale the voltage. Using the capabilities that exist within the VI reduces block diagram clutter.

6. Double-click the DAQ Assistant to display the **Analog Input Voltage Task Configuration** dialog box.
7. Select **Create New** in the **Custom Scaling** pull-down menu.

8. Select **Linear** and name the scale temperature. Click the **Finish** button.
9. A dialog box appears where you can scale the data by a multiplier and an offset.
 - a. Set the slope to 100 and the **Scaled Units** to Celsius.
 - b. Click the **OK** button to close the dialog box.
10. In the **Analog Input Voltage Task Configuration** dialog box, set the minimum input range to 0, set the maximum input range to 100, and click the **OK** button to return to the block diagram.
11. Run the VI. The temperature displays in the meter. The temperature values are 100 times greater than the voltage values. Change the meter scale to see the correct values.
12. Stop the VI. Save the VI but do not close it. You will use the VI in Exercise 9-3.

End of Exercise 9-2