Potentiometer

Core Concept Instructor Set

Materials:

myDAQ

Potentiometer

"…from reading a thermostat's requested temperature to measuring the position of an accelerator pedal in an automobile."
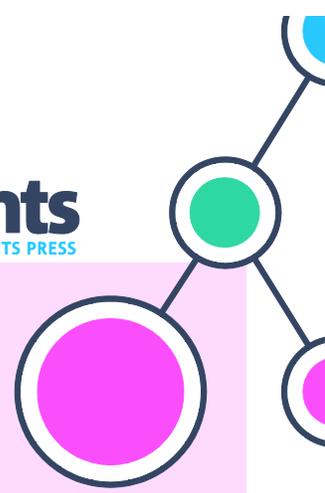
Learn It!

A potentiometer is a variable resistor. Resistors provide electrical impedance to current flow, forcing a voltage drop across their terminals. Most resistors have a fixed resistance value, measured in ohms. A potentiometer functions much like a normal resistor, except that its resistance value can be changed, usually by rotating a knob or pushing a slider on the potentiometer structure. Rotational potentiometers, which use a rotating knob to set the resistance, are commonly used to track the rotational position of objects on a shaft. These measurements can be used in many applications, from reading a thermostat's requested temperature to measuring the position of an accelerator pedal in an automobile.

In this exercise, you will explore the function and potential of a potentiometer, using its properties as a variable resistor. By applying a fixed voltage to a potentiometer, you can read the changing voltage across its variable resistor, and make some deduction about its position.

Build It!

Potentiometer signals are simple analog signals, with a change in voltage corresponding to a change in data. Let's explore how to change this voltage by altering the potentiometer.

Creating an Potentiometer Circuit

Step 1: Connect the potentiometer as indicated in the circuit diagrams. You should supply voltage to one outer leg of the potentiometer, and supply ground to the other. This creates a steady voltage drop across the potentiometer.

Step 2: Download the LabVIEW files from the Resource tab. Open the Potentiometer demo folder and open the VI titled "myDAQ potentiometer.vi". On the front panel should be two numeric indicators. One will display a distinct numerical value, and the other should be a rotating dial indicator. Both indicate the voltage being read at AI0 (Figure 1).
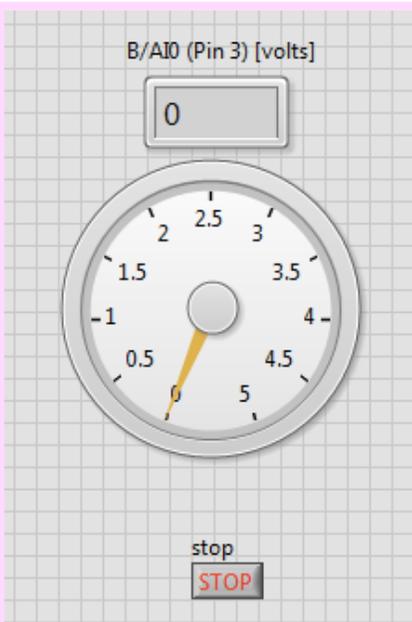
Figure 1: Potentiometer Demo Front Panel

Step 3: Run the VI. The indicators should display a voltage value, which represents the voltage drop across one of the potentiometer's variable resistors. Try rotating the potentiometer's knob to vary this resistance. This should result in a change in the measured voltage.

The net voltage drop across the potentiometer is 5 volts. By rotating the knob we are changing the resistance of both resistors in a series pair of resistors. The voltage drop across one resistor is read by the analog input. As its resistance approaches zero, its voltage drop approaches zero, and the remaining voltage is handled by the remaining resistor.
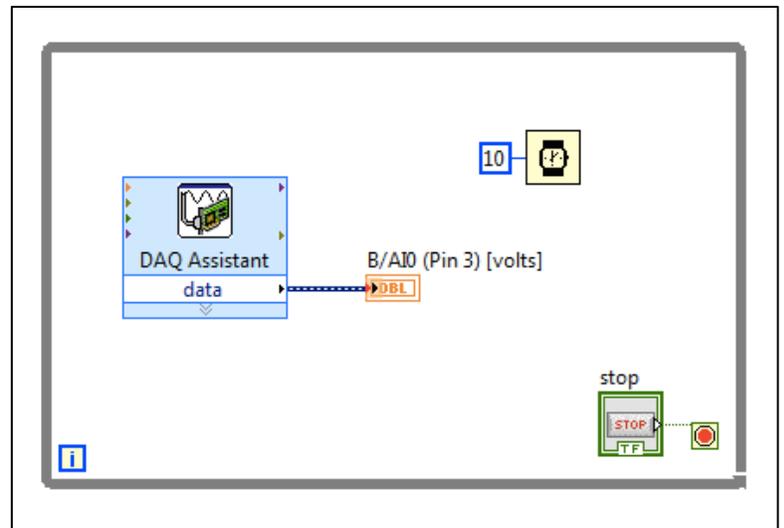
Step 4: Examine the code on the block diagram of the Main VI.

The main structure of this program is a while loop, which allows measurements to repeatedly be taken and displayed on the front panel. Within this while loop is an analog input function, which reads the voltage value input at the analog input zero. This value is generated by the potentiometer's varying position, and is displayed via two numeric indicators (Figure 2).

Figure 2: Potentiometer Demo Block Diagram

Guiding Questions:
- Is there significance to the direction the current flows through the potentiometer? If it were flipped, would the voltage corresponding with each rotational position change?

Expand it!
- Make the front-panel control selectable
- Replace the dial indicator with another type of indicator
- Connect to a DIO input and monitor its state inside a loop; adjust the pot voltage to locate the hysteresis edges of the digital input
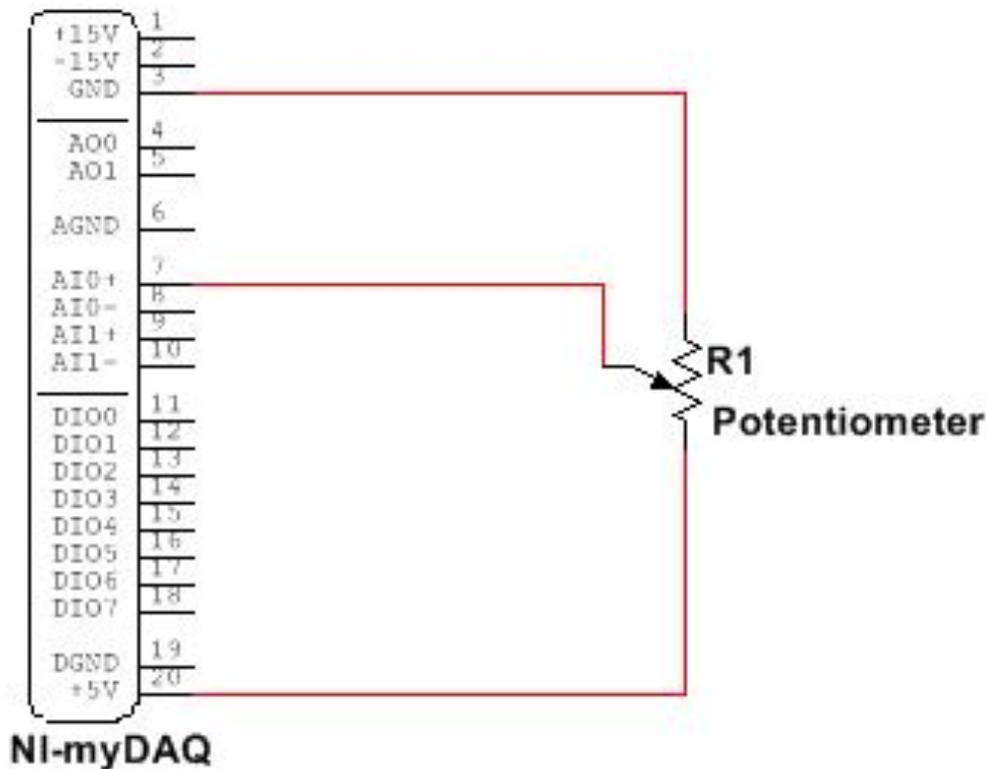- Make a bar-graph indicator of the pot wiper position with onboard LED's

Figure 3: Potentiometer Circuit

Research it!

Study the video Potentiometer Demo Walk-Through (youtu.be/RYeKIuU6DX8, 3:07) to learn the design principles of Potentiometer demo

Study the video Analog Input Express VI (youtu.be/N6Mi-VjBlmc, 2:00) to learn how to use Analog Input Express VI to measure the voltage divider output voltage.

Study the video Potentiometer Characteristics (youtu.be/3gwwF9rF_zU, 7:51) to learn about the potentiometer as a variable voltage source, and also to learn about proper sizing of the potentiometer to minimize power required and also to minimize loading effects that could distort the measurement.

Potentiometer Specs:
http://www.supertech.com.tw/electronic/resistors/potentiometers/PDF/rotary3/23/R0904N.pdf

Potentiometer by Resistor guides describes a variety of potentiometer types and characteristics:
http://www.resistorguide.com/potentiometer