Introduction to Fundamentals

Using NI Multisim and the NI myDAQ

Measuring DC Voltage and Current

**Learning Objectives**

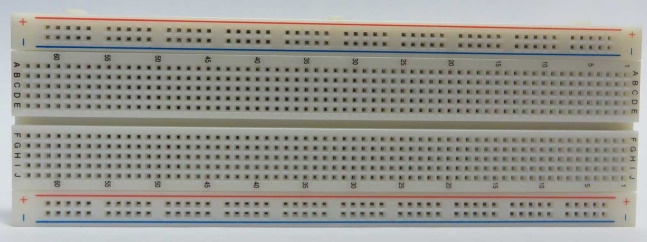
* Use NI Multisim to simulate measurements of voltage and current.
* Use the NI myDAQ to measure the voltage and current in simple circuits.

**What You Need**

**myDaq**

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**Breadboard**

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**Resistor**

560 Ω

**Red Light Emitting Diode**

## **1: Using NI Multisim to Simulate DC Voltage and Current Measurements**

**Purpose**

In this exercise you will simulate a simple circuit and measure the voltage across a virtual lamp and the current flowing through the circuit.

1. In **Multisim** open a new **NI myDAQ design**

Graphical user interface, application

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Use the guidelines below to create the following simple circuit:

Diagram

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Click the **Place Source** icon in the top left corner and place the DC\_POWER and GROUND parts in your workspace.

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The properties menu for the part can be opened by double clicking on the DC\_POWER part. Here you can change the voltage to 15V.

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Click on the **Place Basic** icon, select and place the SPST (Single Pole Single Throw) switch part on the worksheet.

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Another way to find parts is to select the **Place** menu and then select **Component…**

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Under **Group** select **ALL <All groups>** and under **Component**: start typing the part you are interested in (in this case a lamp). Select and place the Virtual Lamp on your worksheet.

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By right clicking on the part, you bring up a menu which will allow you to rotate the part.

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Double click on the lamp and change its voltage to 15V.

Wire all the components together by clicking on the terminals of each part and joining them together.

Diagram

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Run the simulation and note that the lamp should light up when the switch is closed, and turn off when the current is stopped by opening the switch.

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Connect the myDAQ in your simulation to measure the voltage across the lamp. (Remember when measuring voltage we measure across the device).

Diagram, schematic

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Double click on the myDAQ DMM to activate it

Diagram, schematic

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Run the simulation and measure the voltage across the lamp with the switch open and closed. You should get results similar to below:

**Switch Open**

Graphical user interface

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**Switch Closed**

**Graphical user interface, application

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Connect the myDAQ to measure the current flowing through the lamp. Remember in order to measure the current *through* the circuit, the meter must be inserted into the circuit. (Break open the circuit and connect the meter).

Diagram, schematic

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Set the DMM to measure DC current. Run the simulation and record the current with the switch open and closed.

**Switch Open**

**Graphical user interface

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**Switch Closed**

**Graphical user interface

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Delete the **V1 15V** source and connect the circuit to the **+15V** source and **AGND** (analog ground) on the myDAQ. Run the simulation and verify that the voltage and current are the same.

**Note: This won’t work in reality. The myDAQ is current limited at approximately 30mA.**

Diagram, schematic

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## **2: Using the NI myDAQ to measure DC Voltage and Current**

**Purpose**

In this exercise you will measure the voltage and current through a real circuit using the myDAQ and compare those measurements to a simulation.

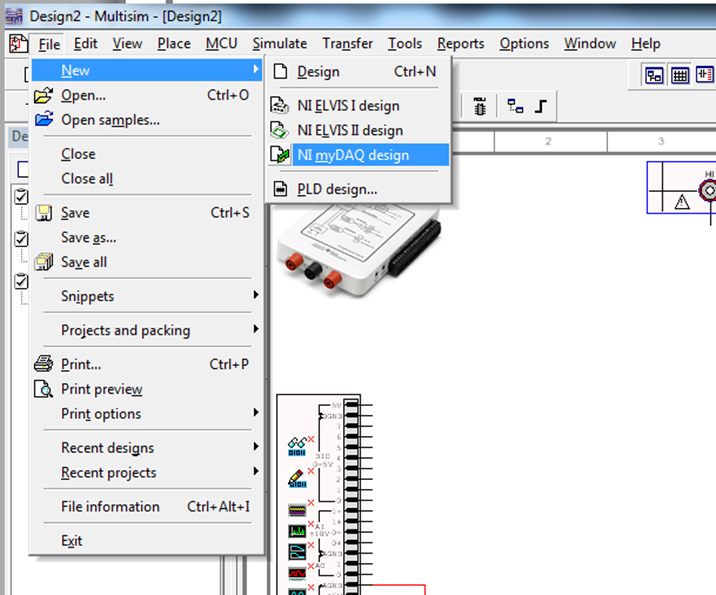
Warning: In this lab the resistor will dissipate about 300mW. Your resistors are designed for 500mW. They are going to get hot! Don’t run the circuit for long periods of time and give the resistor a chance to cool before touching it.

Parts Required:

1 - 560Ω resistor

1 – Red LED

1. In **Multisim** open a new **NI myDAQ design**



1. Create the following circuit using the myDAQ +15V source as the supply voltage:

**Schematic Diagram**

Diagram

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**Multisim Layout**

Diagram, schematic

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1. You will take the following measurements:

Simulated Results

|  |  |  |  |
| --- | --- | --- | --- |
|  | Across Source  (from +15V to AGND) | Across R1 | Across LED1 |
| Voltage |  |  |  |

|  |  |
| --- | --- |
| Current in Circuit |  |

1. Connect the myDAQ DMM (in simulation mode) across each component in turn and measure/record the voltage across each device listed in the table. Then insert the DMM into the circuit and measure the current through the circuit (record your result).

**Note: Screenshots of the measurements are shown at the conclusion of the lab if you run into difficulty taking your measurements.**

Your results should be similar to the following:

Simulated Results

|  |  |  |  |
| --- | --- | --- | --- |
|  | Across Source  (from +15V to AGND) | Across R1 | Across LED1 |
| Voltage | 15.00 V | 13.17 V | 1.83V |

|  |  |
| --- | --- |
| Current in Circuit | 23.51 mA |

1. Try reversing the lead connection to the DMM. You’ll notice that all your measurements will now appear as negative. This is why it is important for a schematic to provide a proper reference system so that you know how all the measurements should be referenced.

Most of our examples are fairly simple with the **HI** lead on the myDAQ connected to the most positive point and the **COM** lead to the most negative (or closest to common) being measured.

1. Construct the circuit on your breadboard and connect the **+15V** and **AGND** connections to the real myDAQ. (This circuit is built exactly the same as the circuit from last week with a different resistor and LED).

Typically the short lead of the LED is the cathode lead and should be connected towards the most negative potential (In this case connect it directly to **AGND**).

The **+15V** connection should be made to the side of the resistor not connected to the LED (just like in our schematic and simulation).

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Connect your myDAQ to the computer via the USB cable and then **select myDAQ1 (NI myDAQ)** under **Device** in the **Instrument Control** of the myDAQ multimeter.

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1. You will take the following measurements:

Measured Values of circuit with myDAQ

|  |  |  |  |
| --- | --- | --- | --- |
|  | Across Source  (from +15V to AGND) | Across R1 | Across LED1 |
| Voltage |  |  |  |

|  |  |
| --- | --- |
| Current in Circuit |  |

1. Select Run on the myDAQ multimeter and measure/record all the values in the table above (measuring the values in the real circuit).
2. Compare your results to the simulated values. As a result of the myDAQ’s low current capacity, the myDAQ’s output voltage may “sag”, resulting in a source voltage closer to 14V.

If the LED does not light, it is possible that you have inserted it backwards. Try reversing it.

**Suggestions on taking your measurements:**

Voltage Across Source

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Voltage Across R1

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Voltage Across LED

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Current Through Circuit

(Note: Since there is only one path for current flow, the current can be measured at any point in the circuit)

Graphical user interface, application

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