

Resistance and Ohm's Law

A Practical Exercise

Name: _____

Section: _____

I. Purpose.

1. Review an understanding of the Lab Bench equipment and how to set the Dual DC Power Supply outputs.
2. Introduce how to use the DMM to correctly measure DC Voltages.
3. Introduce how to use the DMM to correctly measure DC Currents.
4. Introduce how to use the DMM to correctly measure resistance.
5. Introduce how to determine the value of a fixed resistor using color codes.
5. Introduce Ohm's Law in a Direct Current series circuit.

II. Equipment.

Agilent 34401A Digital Multimeter (DMM)
Agilent E3620A Dual DC Power Supply
 Quad Board and Test Leads
 680 Ohm resistor
 560 Ohm resistor

III. Preparation.

Review procedures for measuring resistance, voltage, and current.

IV. Lab Procedure.

You must **read** and complete each step.

Step One: Measure the resistance of an "OPEN" and a "SHORT".

For this part we will measure the resistance across two unconnected nodes, an "OPEN". Then we will connect these nodes with a RED lead and measure the resistance across two connected nodes, a "SHORT".

- Turn on the DMM.
- Connect a RED lead from the DMM "Input HI" to a node on your QUAD board.
- Connect a BLACK lead from the DMM "Input LO" to a different unconnected node on your QUAD board.
- Select " Ω 2W" function on your DMM.
- Record DMM reading:** _____

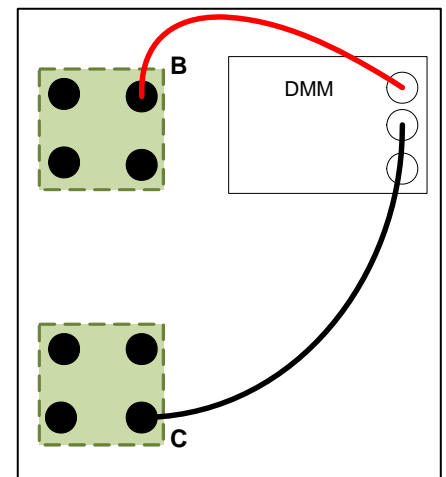


Figure 1

What is the unit of measure for resistance? _____

Does an "OPEN" have extremely high resistance or virtually no resistance? _____

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- Connect the two nodes with a RED lead (Figure 2).
- Record DMM reading:** _____

If the RED lead was a thinner and longer aluminum wire, would the resistance be higher or lower?

Why? _____

Step Two: Measure the resistance of fixed resistors.

- Using Table 3-5 from your text determine the value of the fixed resistors. Enter these values into the tables below.

Resistor #1 Value _____ Tolerance _____

	Band 1	Band 2	Band 3	Band 4
Color				

Resistor #2 Value _____ Tolerance _____

	Band 1	Band 2	Band 3	Band 4
Color				

- Measure and record the individual values of the 560Ω resistor (Resistor #1) and the 680Ω resistor (Resistor #2), using the layout shown in Figure 3 (this isolates the resistor being measured from other components).

	Measured Value	Within Tolerance?
Resistor #1		Yes or No
Resistor #2		Yes or No

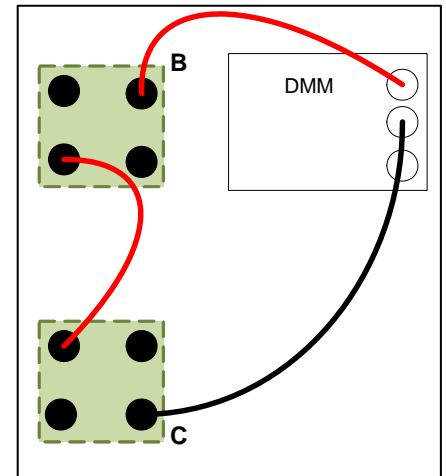


Figure 2

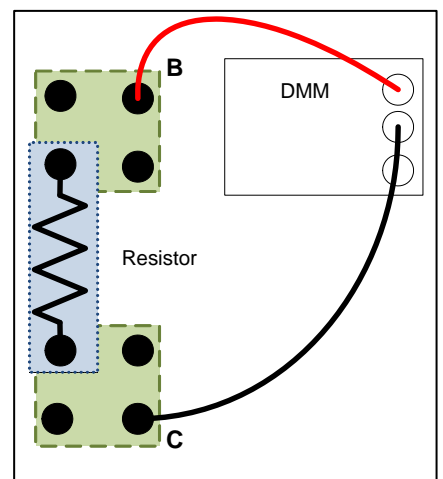


Figure 3

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Step Three: Measurement of a DC current.

For this part we will: (1) Construct a DC series circuit on your QUAD board; (2) Measure the DC current going through this circuit. Remember the current that you wish to measure must pass through the DMM. To measure this current, you will “open” the circuit and insert the DMM. You cannot measure current by placing the DMM “across” components in the circuit.

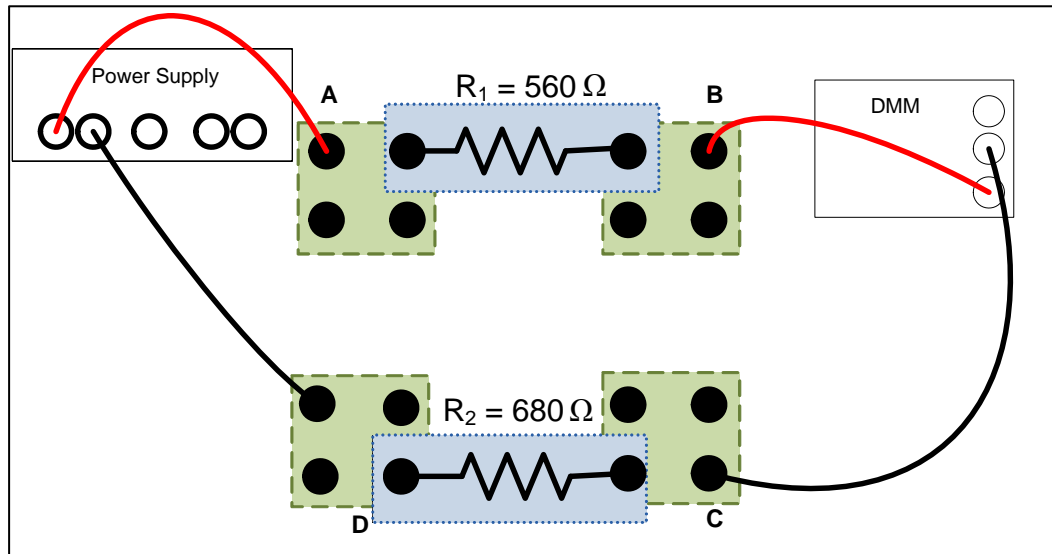


Figure 4

- Construct the circuit (Figure 4) on your QUAD by completing the following steps.
 - Connect a RED lead from “+” side of the DC voltage supply for V1 (right side) to “Node A” on the QUAD board.
 - Plug #1 resistor into “Node A” and “Node B” on the QUAD board.
 - Connect a RED lead from “Node B” on the QUAD board to the “Input I” on the DMM (**note that this is a DIFFERENT jack on the DMM then we used to measure resistance**).
 - Connect a BLACK lead from the “Input LO” on the DMM to “Node C” on the QUAD board.
 - Select “DC I” function on the DMM by depressing “SHIFT” then the button directly below “DC I”.
 - Plug #2 resistor into “Node C” and “Node D” on the QUAD board.
 - Connect a BLACK lead from “Node D” on the QUAD board to the “-” side of the DC voltage supply for V1.
 - Turn on the Dual DC Power Supply and set V1 to 10 volts.
 - Record DMM reading:** _____

What is the unit of measurement for current? _____

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- Turn off the Dual DC Power Supply.
- Swap the RED and BLACK leads from the DMM, so that the BLACK lead connects "Node B" to the Input LO on the DMM and the RED lead connects "DC I" on the DMM to "Node C".
- Turn on the Dual DC Power Supply.
- Record DMM reading:** _____

Why does the DMM display indicate a negative value? _____

Step Four: Measurement of a DC voltage.

For this part we will: (1) Modify the circuit on your QUAD board; (2) Measure the DC voltage across #1 resistor and #2 resistor. We must modify our circuit to ensure that our DC current has a complete "closed" loop to travel. Remember, to measure voltage we place the DMM leads across the component(s) whose voltage you wish to measure

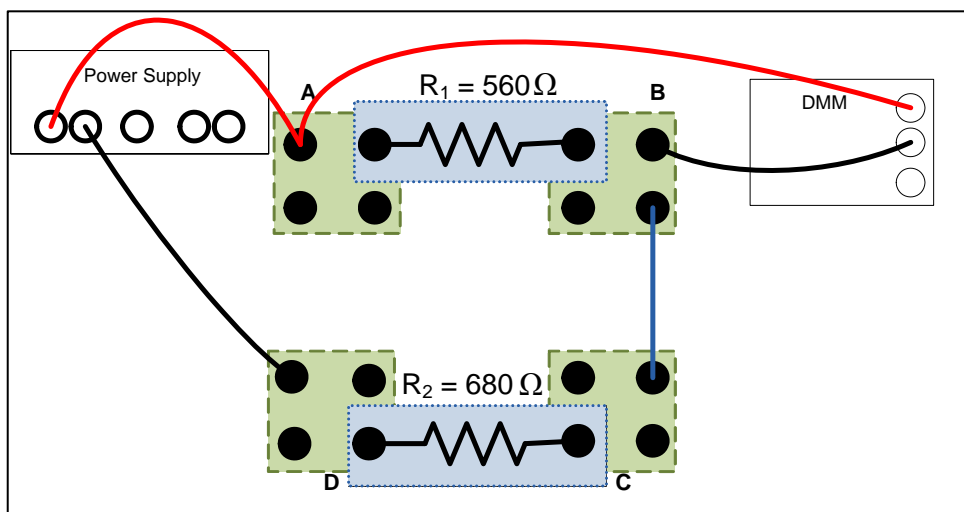


Figure 5

- Turn off your Dual DC Power Supply.
- Modify your circuit (Figure 5) on your QUAD by completing the following steps:
 - Remove the RED and BLACK leads from the DMM to nodes "B" and "C".
 - Connect a blue lead or a "SHORTING BAR" from "Node B" to "Node C".
 - Connect a RED lead from "Node A" to "Input HI" input on the DMM (**note that this is a different jack then was used to measure current**).
 - Connect a BLACK lead from "Node B" to "Input LO" input on the DMM.
- Select "DC V" function on your DMM.
- Turn on your Dual DC Power Supply.
- Record DMM reading:** _____

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What is the unit of measurement for voltage? _____

What component are we measuring the DC voltage across? _____

- Modify the way your DMM is connected (Figure 6) to allow you to measure the voltage across Resistor #2:
 - Turn off the Dual DC Power Supply.
 - Move the RED lead connected to the DMM "Input HI" from "Node A" to "Node C"
 - Move the Black lead connected to the DMM "Input LO" from "Node B" to "Node D"
 - Turn on the Dual DC Power Supply.

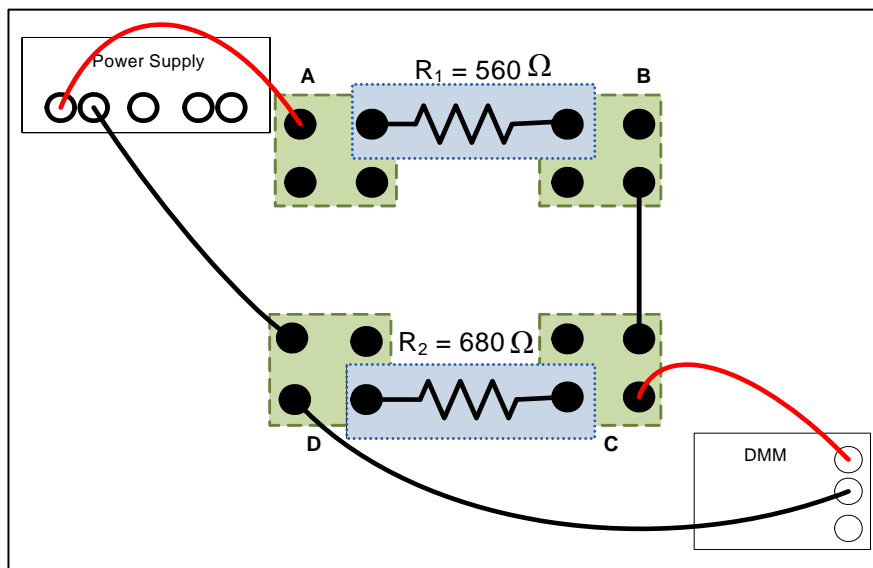


Figure 6

- Record DMM reading:** _____
- Turn off the Dual DC Power Supply.
- Swap the RED and BLACK leads from the DMM, so that the BLACK lead connects "Node C" to "Input LO" on the DMM and the RED lead connects "Node D" to "Input HI" on the DMM.
- Turn on the Dual DC Power Supply.
- Record DMM reading:** _____

Why does the DMM display indicate a negative value? _____

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Step Five: Verify Ohm's Law ($V = IR$).

Complete the following table using **measured values** to determined predicted values.

	Measured Resistive Values	Measured Current	Predicted Voltage Across	Measured Voltage Across
#1 Resistor				
#2 Resistor				

Do these results verify what Ohm determined to be the relationship between resistance, voltage, and current? _____

If you would increase the voltage settings of the Dual DC Power Supply which in turn will increase the current, would the voltage across the resistors increase or decrease? _____