

Name: \_\_\_\_\_ Lab Section: \_\_\_\_\_ Date: \_\_\_\_\_  
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**OVERVIEW:**

This laboratory introduces the characteristics of series dc circuits. You will need a dc power supply, a Fluke 189 Digital MultiMeter (DMM), and four resistors. Your instructor will also instruct you with the proper operation of each.

In this exercise you will measure and record voltages and currents in a series dc circuit. With these measurements you will verify Kirchhoff's Voltage Law. Using Ohm's Law you will verify that the current is the same through each element of a series circuit.

**CAUTIONS:**

- Record all data in ink. Do not erase. Make corrections by drawing a line through the incorrect data and write the correct data next to the deleted data.
- Do not energize a circuit until your instructor or lab assistant checks it.
- Remove all power from a circuit before attempting to measure resistance in the circuit with an ohmmeter. Remember to disconnect the resistance from the circuit.
- Remove all power before making changes in a circuit.

**PROCEDURE:**

Your ability to measure and record your data in a neat and organized manner is important. Start a habit of being professional by using a lab notebook and generating tables.

1. Prepare the dc power supply for use by setting the current limit to 25 mA.

2. Measure and record the resistance of the following four resistors. Compare these measurements to the nominal values including their relative difference.

Resistor	Measured Value (K $\Omega$ )	Nominal Value (K $\Omega$ )	Relative Difference (%)
R <sub>1</sub>			
R <sub>2</sub>			
R <sub>3</sub>			
R <sub>4</sub>			

3. Connect the circuit in Figure 1.

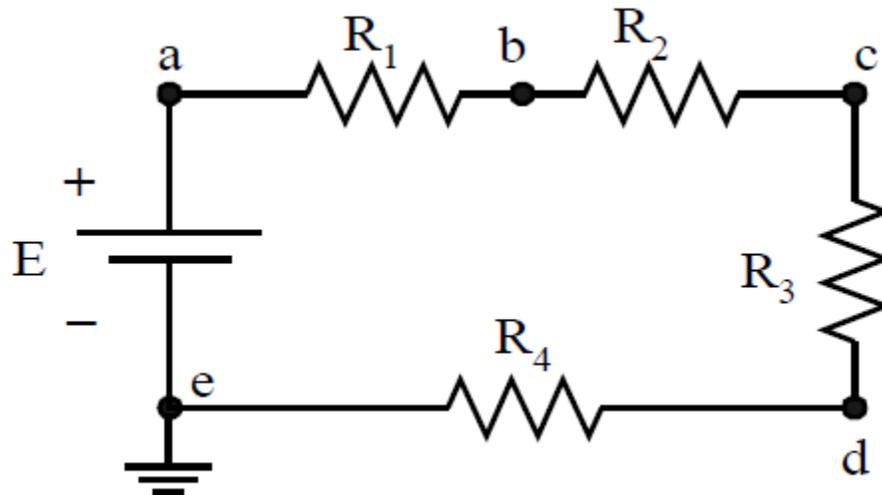


Figure 1. Series dc Circuit

4. Without the power supply connected measure the equivalent resistance of the circuit,  $R_{ae}$ . Compare this measurement to a calculated value. Show your calculation.

Resistor	Measured Value (K $\Omega$ )	Calculated Value (K $\Omega$ )	Relative Difference (%)
$R_{ae}$			

- Connect the power supply to the circuit. Set your power supply to 25 V after the circuit is connected. Remember to verify this voltage with the Fluke DMM.
- Measure and record the following voltages:  $E$ ,  $V_{ab}$ ,  $V_{bc}$ ,  $V_{cd}$ , and  $V_{de}$ . Show your calculations.

Voltage	Measured Value (V)	Calculated Value (V)	Relative Difference (%)
E		25	
$V_{ab}$			
$V_{bc}$			
$V_{cd}$			
$V_{de}$			

- Do your measured voltages verify Kirchoff's Voltage Law? Explain why.

- Measure and record the current at points a, b, c, d, and e. Compare all five of these currents to a calculated value. **Make certain to do this in series with the Fluke in Ammeter mode!**

Current	Measured Value (mA)	Calculated Value (mA)	Relative Difference (%)
$I_a$			
$I_b$			
$I_c$			
$I_d$			
$I_e$			

9. Measure the voltage  $V_{bd}$ . Compare this measured value to a calculated value (use the Voltage Divider Rule).

Voltage	Measured Value (V)	Calculated Value (V)	Relative Difference (%)
$V_{bd}$			

10. Remove the resistors  $R_2$  and  $R_3$  from the circuit. Leave the circuit open between points “b” and “d”. Measure and record the current at node “e”. Measure and record the following voltages:  $V_{bd}$ ,  $V_{ab}$ , and  $V_{de}$ .

	Measured Value (include units)	Calculated Value (include units)	Relative Difference (%)
$I_e$			
$V_{bd}$			
$V_{ab}$			
$V_{de}$			

11. Are your measured values what you expected? Explain.

12. Replace  $R_2$  and  $R_3$  in their appropriate places. Connect a single wire from node “b” to “d”. Measure and record  $V_{bd}$ . Measure and record the current at node “a”, and in the wire from nodes “b” to “d”. Measure and record the current in  $R_3$ . Verify all your measurements in this step to calculated values.

	Measured Value (include units)	Calculated Value (include units)	Relative Difference (%)
$V_{bd}$			
$I_a$			
$I_{bd}$			
$I_{R3}$			

13. How do you explain the current through  $R_3$ ? How do you explain the measured voltage level of  $V_{bd}$ ?

**REPORTING:**

Once you have completed your measurements, have your lab instructor check and sign off on your work. Clean up your bench, turn off and unplug all equipment at your bench, return all equipment to its proper location, clean all trash and debris off your bench and deposit it in the trash receptacle.

Turn in your completed lab worksheets.

Approved by: \_\_\_\_\_ Date: \_\_\_\_\_