Theory Overview

A series circuit is defined by a single loop in which all components are arranged in daisy-chain fashion. The current is the same at all points in the loop and may be found by dividing the total voltage source by the total resistance. The voltage drops across any resistor may then be found by multiplying that current by the resistor value. Consequently, the voltage drops in a series circuit are directly proportional to the resistance. An alternate technique to find the voltage is the voltage divider rule. This states that the voltage across any resistor (or combination of resistors) is equal to the total voltage source times the ratio of the resistance of interest to the total resistance.

Schematics

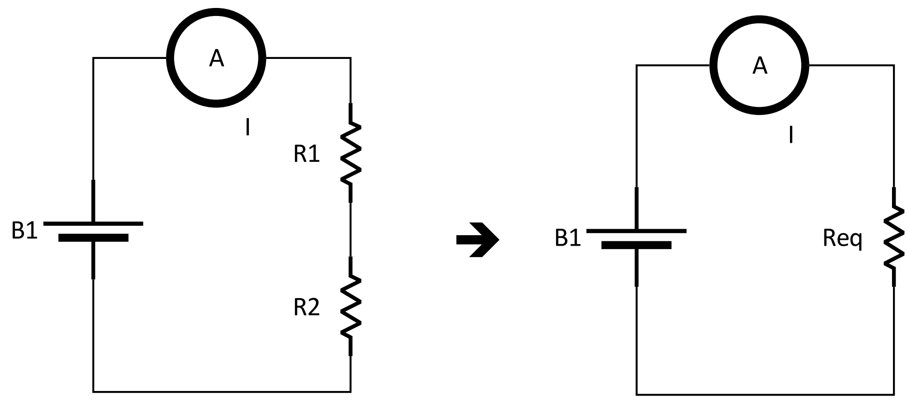

Figure 1 - Series Network Circuit and its Equivalance

Procedure

A. Given the circuit shown in Figure 1, determine the equivalent resistance of the circuit for $R_1$and R_2values given in Table 1 below. (Note that for the cases where R_2 is either the photoresistor or thermistor, you will need to measure the resistance under the conditions given in the table.)
B. Given the equivalent resistance, using Ohm's law ($I = \frac{V}{R}$) and V_{B1} = 9V, determine the theoretical current in the circuit and record it in Table 1 below.
C. Given the calculated current in step B and using Ohm's law ($V = IR$), determine the voltage across R1 and R2. Record the values in Table 1.
D. Construct the resistor network on a breadboard. **Do not connect the battery at this point! Before** connecting the battery, measure the value of each resistor and the equivalent resistance. Record the equivalent resistance value in Table 1 and compare it to the theoretical value determined in step A.
E. Connect the battery and multimeter to measure current. Record the value in Table 1 and compare it to the theoretical value determined in step B.

F. With another multimeter measure the voltage across only R1 and then across only R2. Record the values in Table 1 and compare them to the theoretical values determined in step C.

Table 1 - Calculated and Measured Circuit Values

		Calculated				**Measured**		
R1 (Ω)	**R2 (Ω)**	**Req (Ω) = R1 + R2**	**I (A) = V_{B1} / Req**	**V_{R1} (V) = I x R1**	**V_{R2} (V) = I x R2**	**I (A)**	**V_{R1} (V)**	**V_{R2} (V)**
1K 1%	5.1K 5%							
1K 1%	Photoresistor No Light							
1K 1%	Photoresistor Ambient Light							
1K 1%	Photoresistor Direct Light							
1K 1%	Thermistor Ambient Temp							
1K 1%	Thermistor Iced							

G. For extra credit, determine an equation for V_{R2} based on V_{B1}, R1 and R2.

$$\left.\begin{array}{l} \left.\begin{array}{l} I = \frac{V_{B1}}{R_{eq}} \\ \\ R_{eq} = R_1 + R_2 \end{array}\right\} \xrightarrow{yields} I = \frac{V_{B1}}{(\quad + \quad)} \\ \\ V_{R2} = IR_2 \end{array}\right\} \xrightarrow{yields} V_{R2} = \frac{V_{B1}}{(\quad + \quad)} R_2$$

or

$$V_{R2} = V_{B1} \frac{R_2}{(\quad + \quad)}$$

H. Repeat G for V_{R1}.