

Experiment 17 Multiloop Circuits: Kirchhoff's Rules

Exp 17 Procedures

Pairing the Devices

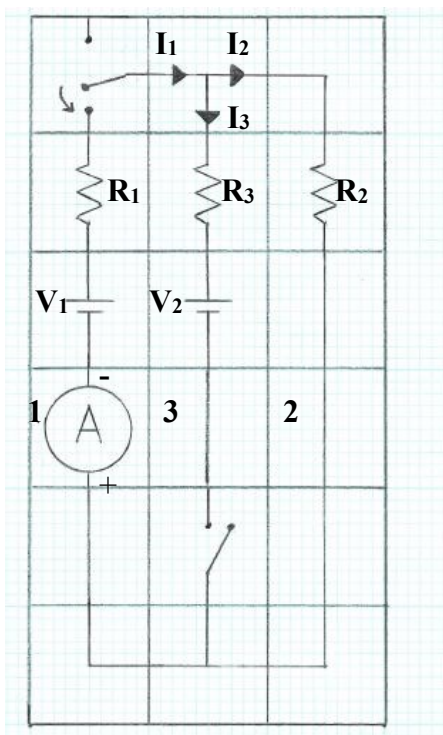
1. Turn on the Voltage Sensor (voltmeter) and Ammeter by pushing the small black buttons on the top of each device until the light near the Bluetooth symbol on the device is blinking.
2. If the batteries are dead on the Voltage Sensor or the Ammeter, plug them into the charging apparatus at your table.
3. Under choose a path, select Sensor Data.
4. The Voltage Sensor and the Ammeter should appear on the left screen (Open the left screen if it is not in view.). Match the number on each device with the number on the screen.
5. Select your Voltage Sensor and Ammeter. Be careful that the numbers on your screen correspond to the number on the device, as many devices will be active around you. (Each device should pair to only one phone.)
6. Once the above is completed, go to the right screen, and under "Templates", select "Digits".
7. At the bottom center of the screen select start. The voltage and current should be displayed on the screen.

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A. Experimental Procedure

1. Construct the circuit as shown in the figure below. Note the placement and orientation of the two-way (SPDT) switch at the top corner of the left loop. **I_1 , I_2 , and I_3 shown in the figure are the assumed directions of currents.**



2. Be sure to leave both switches open until you are ready to take readings, and open them after you have completed taking readings. This will help save the batteries. Check to see that the polarity on the ammeter matches the polarity shown in the figure. If we have correctly predicted the direction of current, I_1 , on the figure, then we should expect to get a positive reading for the current in procedure 3 below.
3. Close both switches and use the voltmeter to measure the “operating” value (terminal voltage) of each battery (V_1 and V_2). Record these values in Data Table 1. Read and record the current in the left branch (I_1) in Data Table 1. **Open both switches.**
4. Move the ammeter to position 2, this time insuring that the positive side of the meter is up so that it is facing the assumed direction of current I_2 . Close both switches and read and record I_2 in Data Table 1. **Open both switches.**

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5. Finally, move the ammeter to position 3, again insuring that the positive side of the meter is up so that it is facing the assumed direction of current I_3 . Close both switches and read and record I_3 in Data Table 1. **Open both switches.**
6. **Do not take your circuit apart until you have completed your calculations** in case you need to check your data in the event of discrepancies. With your measured battery values of V_1 and V_2 , and the three resistance values, use Kirchhoff's rules to calculate the theoretical values of I_1 , I_2 and I_3 . Do this by applying the junction rule to either junction to obtain a current equation. Then, get your two loop equations: designate the left loop as loop 1; the right loop as loop 2; and go clockwise around each loop to find your loop equations.
7. Solve your three equations showing all your calculations clearly. Use a separate sheet of paper for your solution. Record the three currents, with calculated signs, in Data Table 1 as the theoretical values.
8. Compare your theoretical values found in procedure 7 with the measured values of the currents by finding the percent error for each of the three currents. Show at least one sample calculation of percent error in the calculations section of your report.

B. Questions.

9. Answer questions 1 and 2 at the end of the data sheet. Attach your calculation sheet to the lab report before submitting the report.

Turn off the voltmeter and ammeter. Plug voltmeter and ammeter into the charging station. Put all other components neatly back in the plastic bin.