



Let It Flow

Student Instruction Sheet

Challenge

Establish the difference between series and parallel in a circuit. Then, investigate the relationship between the current in a circuit and the number of light bulbs that are connected in series or in parallel in the circuit.

Equipment and Materials

<ul style="list-style-type: none"> • Computer with USB Port • PASPORT USB interface • PASPORT Voltage/Current Sensor • DataStudio software • (3) Light Bulb and Stands 	<ul style="list-style-type: none"> • Alligator Clip Leads • (2) D Cell Battery • Battery Holder (D-size) • <i>Student Instruction Sheet</i> • <i>Student Response Sheet</i>
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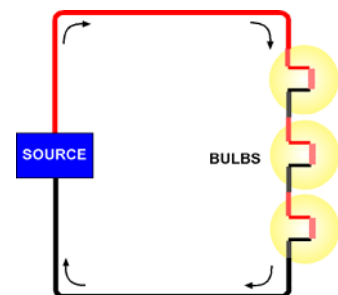


Safety Precautions

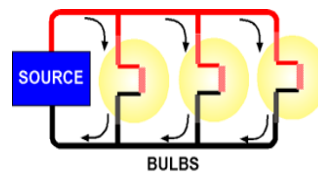
Remember, follow the directions for using the equipment.

Background

Light bulbs in a series circuit are connected in end-to-end. If light bulbs are connected in series to a voltage source, what happens to the brightness of the individual bulbs as more and more bulbs are added to the "chain"? What will happen to the voltage across each individual bulb as more and more bulbs are added to the circuit? If one bulb in a series circuit is removed, what happens to the rest of the bulbs?



Light bulbs in a parallel circuit are connected side-by-side. If light bulbs are connected in parallel to a voltage source, what happens to the brightness of the individual bulbs as more and more bulbs are added? What will happen to the voltage across each individual bulb as more and more bulbs are added to the circuit? If one bulb in a parallel circuit is removed, what happens to the rest of the bulbs?



Predict

Before beginning the eLab, complete the prediction portion of the *Student Response Sheet*.

Explore

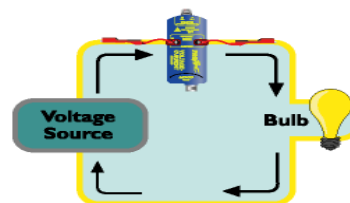
Computer Setup

1. Plug the PASPORT USB interface into the computer's USB port.



2. Plug the Voltage/Current Sensor into the USB interface. This will automatically launch the PASPortal window.

The current portion of the sensor is connected in series in order to measure current through a device.



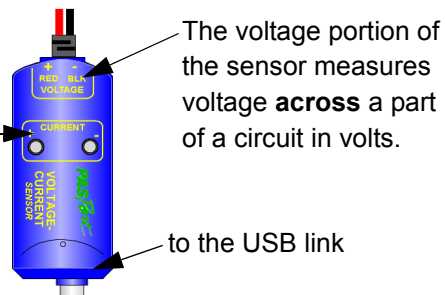
3. Choose the appropriate DataStudio configuration file entitled

15 What is Current CF.ds

Note: Configuration files automatically launch the appropriate display(s), sampling rate(s), etc.

The Voltage/Current Sensor is a multi-sensor. As it measures two distinctly different quantities, you may find it challenging to use the sensor properly. Use the information at right to guide you in the use of the Voltage/Current Sensor.

The current portion of the sensor measures current **through** the circuit in amps.



Record Data

Record Data Part 1: Light Bulbs in Series

1. Set up the equipment as shown in Figure 1. Start with one light bulb.

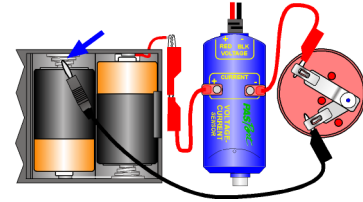


Figure 1

2. In DataStudio on the **Experiment** menu, click **Monitor Data**. (You can continue monitoring data for the rest of the experiment.) Measure the current through the circuit when there is one light bulb connected to the voltage source. Record the value in Data Table Part 1 on the *Student Response Sheet*.

3. Place another light bulb in series with the first. See Figure 2.

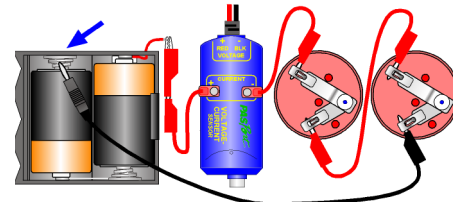


Figure 2

4. Measure the current through the circuit with two light bulbs in series. Record the current in Data Table Part 1 on the *Student Response Sheet*.

5. Place another light bulb in series with the other two light bulbs. See Figure 3.

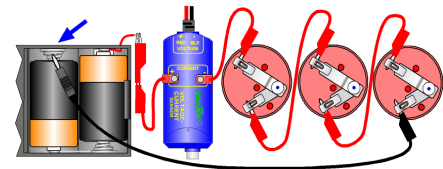


Figure 3

6. Measure the current through the circuit with three bulbs in series. Record the current in Data Table Part 1 on the *Student Response Sheet*.

Remove the light bulb from the middle socket. What happened? Answer the question on the *Student Response Sheet*.

Replace the light bulb once you have answered the question.

Record Data Part 2: Light Bulbs in Parallel

1. Set up the equipment as shown in Figure 4. Start with one light bulb.
2. Measure the current in the circuit with one light bulb connected. Record the current in Data Table Part 2 on the *Student Response Sheet*.

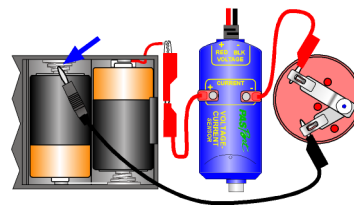


Figure 4

Note: The sensor should still be monitoring the current.

3. Place another light bulb in parallel with the first. See Figure 5.
4. Measure the current through the circuit with two light bulbs in parallel and record the value Data Table Part 2 on the *Student Response Sheet*.

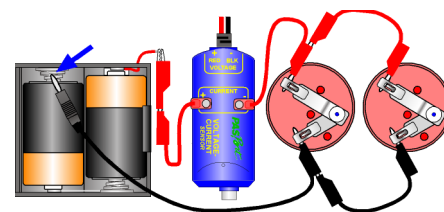


Figure 5

5. Place another light bulb in parallel with the other two light bulbs. See Figure 6.
6. Measure the current through the circuit with three light bulbs and record the value Data Table Part 2 on the *Student Response Sheet*.

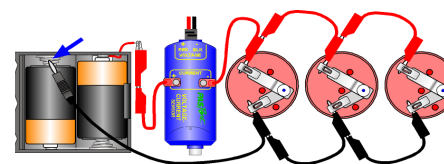


Figure 6

Click the **Stop** () button to end data monitoring.

Remove the light bulb from the middle socket. What happened to the other two bulbs? Answer the question on the *Student Response Sheet*.

Replace the light bulb once you have answered the question.

Analyze

1. Answer the questions and define the vocabulary words on the *Student Response Sheet*.
2. Follow your teacher's instructions regarding cleaning up your work space.

Student Response Sheet

Name: _____

Date: _____

Let It Flow



Vocabulary

Use available resources to find the definition of the following term:

current: _____

Predict

1. What do you think will happen to the current in a series circuit as more light bulbs are added to the circuit?

2. What do you think will happen to the current in a parallel circuit as more light bulbs are added to the circuit?

Data

Data Table Part 1 (Series Circuit)

Current, One Light Bulb:	
Current, Two Light Bulbs:	
Current, Three Light Bulbs:	

What happened to the other two light bulbs, in the series circuit, when you removed the middle bulb from the socket? Why do you think this happened?

Data Table Part 2 (Parallel Circuit)

Current, One Light Bulb:	
Current, Two Light Bulbs:	
Current, Three Light Bulbs:	

What happened to the other two light bulbs, in the parallel circuit, when you removed the middle bulb from the socket? Why do you think this happened?

Analyze

Use your data to answer the questions.

1. How did the current for one light bulb in series compare to the current for two light bulbs in series?

2. How did the current for all three light bulbs in series compare to the current for two light bulbs and the current for one light bulb?

3. What did you notice about the brightness of each bulb in series as the second and third light bulbs were added to the circuit?

4. What is the relationship between current in a series circuit and the number of light bulbs in that circuit?

5. How did the current for one bulb by itself compare to the current for two light bulbs in parallel?

6. How did the current for all three light bulbs in parallel compare to the current for two light bulbs and the current for one light bulb?

7. What did you notice about the brightness of each bulb in parallel as the second and third light bulbs were added to the circuit?

8. What is the relationship between current in a parallel circuit and the number of light bulbs in the circuit?

Synthesize

1. How does the current in a series circuit compare to the current in a parallel circuit?

2. Do your results support your predictions?
