Ohm's Law

Objective:

Firstly, to determine the mathematical relationship between current, potential difference, and resistance. After this, a comparison will be made of the potential vs current behavior of a resistor and a light bulb..

Apparatus:

1	Lab Pro Device
1	Ti Graphing Calculator with DATAMATE program installed
1	Adjustable DC power supply
1	Vernier Circuit Board
1	Current and Charge Voltage system
1	Voltimeter
1	Wire

Method:

The fundamental relationship among the three important electrical quantities *current*, *voltage*, and *resistance* was discovered by Georg Simon Ohm. The relationship and the unit of electrical resistance were both named for him to commemorate this contribution to physics. One statement of Ohm's law is that the current through a resistor is proportional to the potential difference across the resistor. Ohm's Law is commonly stated mathematically as $V=I*R$. In this experiment you will test the correctness of this law in several different circuits using a Current Probe and a Voltage Probe.

These electrical quantities can be difficult to understand, because they cannot be observed directly. To clarify these terms, some people make the comparison between electrical circuits and water flowing in pipes.

Here is a chart of the three electrical units we will study in this experiment.

Electrical Quantity	Description	Unit	Water Analogy
Voltage or Potential Difference	A measure of the Energy difference per unit charge between two points in a circuit.	Volt (V)	Water Pressure
Current	A measure of the flow of charge in a circuit.	Ampere (A)	Amount of water flowing
Resistance	A measure of how difficult it is for current to flow in a circuit.	Ohm (Ω)	A measure of how difficult it is for water to flow through a pipe.

Resistors are labeled with a rated resistance and a percentage tolerance, which specifies how much the value of resistance may vary from the rated value. The rated resistance value is usually indicated with a color code. Most ordinary carbon-composition resistors are labeled with four color bands, as shown below in Figure 1.

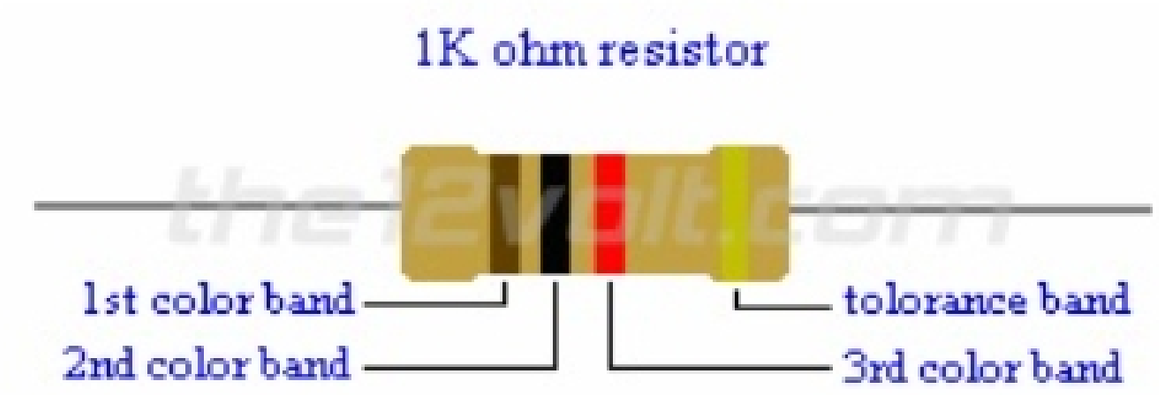

Figure 1: Image taken from the12volt.com website

The color codes used for carbon resistors are listed in Table 1 on the next page. The first two bands are read as a two-digit number. The third is read as a power-of-ten multiplier of that number. The fourth is the tolerance rating. Tolerance is a percent rating, showing how much the actual resistance could vary from the labeled value The resistance value of a resistor can be calculated according to **Eqn. 1** below:

$$\text{Resistance value} = (\text{2-digit \# from first 2 bands}) * 10^{(\text{3rd band digit})} \qquad \textbf{Eqn. (1)}$$

Table 1:

Color	Number for band 1-3	Band #4 Tolerance Rating
Black	0	---
Brown	1	± 1%
Red	2	± 2%
Orange	3	---
Yellow	4	---
Green	5	± 0.5%
Blue	6	± 0.25%
Violet	7	± 0.1%
Gray	8	± 0.05%
White	9	---
Gold	0.1	±5%
Silver	0.01	±10%

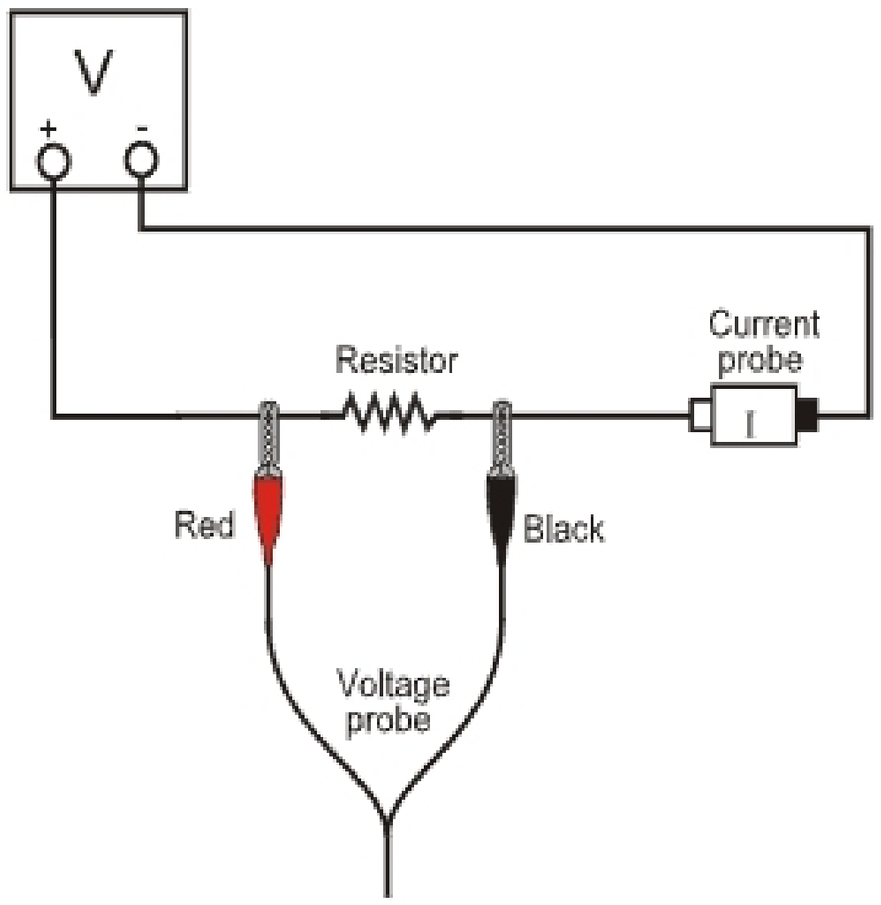

Figure 2

Setup:

1. Connect the Current & Voltage Probe System to the LabPro interface:

   a. Connect DIN 1 on the Dual Channel Amplifier to Channel 1 of the LabPro or CBL 2 interface.

   b. Connect DIN 2 to Channel 2. Then connect a Current Probe to PROBE 1 on the Dual Channel Amplifier and a Voltage Probe to PROBE 2.

2. Use the black link cable to connect the LabPro interface to the TI Graphing Calculator. Firmly press in the cable ends.

3. Turn on the calculator and start the DATAMATE program.