

# Activity 6: Voltage versus Resistance

Equipment	Quantity
Xplorer GLX	1
Voltage Probe	1
Resistors, 1000 $\Omega$	5
Battery and Battery Holder ("AA," "C," "D," or similar)	1
Short Alligator Clip Leads	6

## Background

In this experiment, you will construct the circuit pictured to the right and measure the voltage (relative to the negative terminal of the battery) at points A through F. For each point in the circuit, the GLX will record the measured voltage ( $V$ ) and the total resistance across which the voltage was measured ( $r$ ).

Sketch a prediction of the graph of  $V$  versus  $r$ . Explain your prediction in terms of what you know about

- how current flows through the circuit;
- the relationship between voltage, current, and resistance; and
- the total resistance of two or more resistors in series.

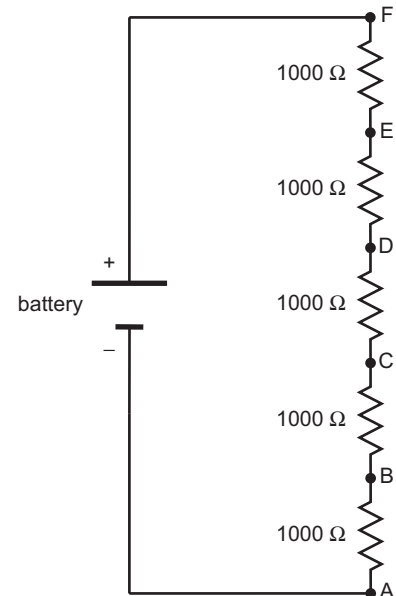
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## Before You Begin

Start a new experiment on the GLX.

1. Press  $\text{Home}$  to go to the Home Screen.
2. Use the arrow keys to highlight the Data Files icon and press  $\text{Enter}$  to open the Data Files screen.
3. Press  $F4$  to open the Files menu and press  $\text{1page}$  to select New File.

4. When the GLX asks if you would like to save the previous file, press **F1** to save or **F2** not to save.

## Procedure

### Equipment Set-Up

- Using the battery, battery holder, resistors, and alligator clip leads, construct the circuit pictured on the previous page.
- Lay out the circuit on a piece of paper so you can label the parts of the circuit. Label points A through F and the positive and negative terminals of the battery.

### GLX Set-Up

#### 1. Connect the voltage probe to the GLX.

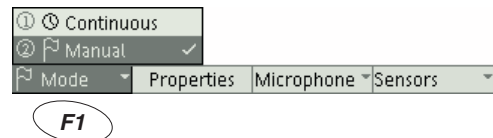
- Connect the voltage probe to the voltage port on the left side of the GLX.
- If there are other sensors connected to the GLX, remove them.

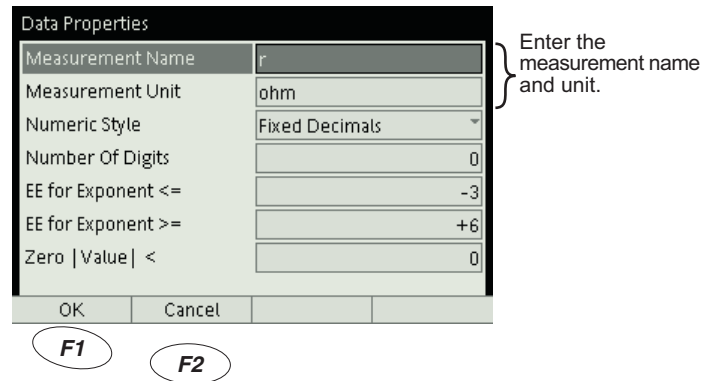
#### 2. Configure the GLX for manual sampling.

- Press **⏠** to return to the Home Screen; press **F4** to open the Sensors screen.
- Press **F1** to open the Mode menu; press **2<sub>uv</sub>** to select Manual.

The Data Properties dialog box for the manually entered resistance data will open.

- With Measurement Name highlighted, press **✓**; type “r” and press **✓**.
- Press the down arrow key to highlight Measurement Unit. Press **✓**, type “ohm”, and press **✓**.





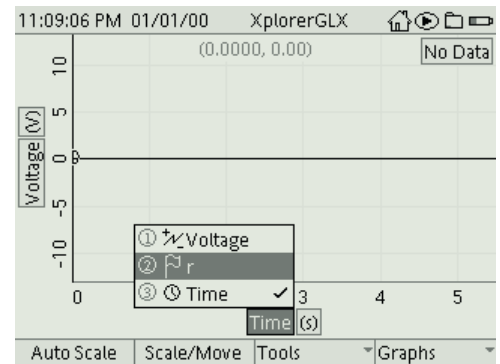
- e) Press **F1** to approve these data properties and close the Data Properties window.

### 3. Prepare the Graph to plot voltage versus resistance.

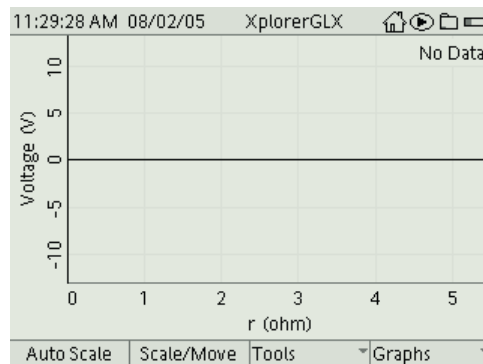
- a) Press **Home** to return to the Home Screen; press **F1** to open the Graph.

The Graph will be automatically set up for voltage versus time. In the next step, you will select resistance (instead of time) for the horizontal axis.

- b) Press **Checkmark** to turn on the highlight; press the down arrow key to highlight "Time."
- c) Press **Checkmark** to open the data source menu.
- d) In the data source menu, use the arrow keys to highlight "r" and press **Checkmark**.



Select resistance for the horizontal axis

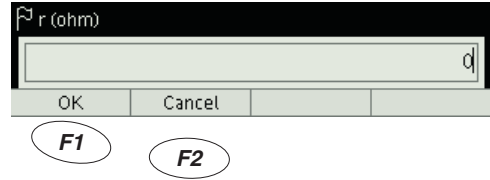


Graph prepared to plot  $V$  vs.  $r$

## Data Collection

1. Press **Play**. The GLX is now measuring voltage, but it is not recording data.

2. Connect the black lead of the voltage probe to the negative terminal of the battery.
3. Place the red lead of the probe in contact with the circuit at point A.
4. Press  $\text{F1}$  to record a single voltage measurement.
5. The GLX will prompt you to enter  $r$ , the total resistance across which the voltage is measured. (For point A,  $r = 0$ .) Type the value of  $r$  and press  $\text{F1}$ .
6. Repeat steps 3, 4, and 5 for points A through F.
7. When you are finished recording data, press  $\text{F2}$ .



### Analysis

1. Press  $\text{F1}$  to automatically scale the Graph.
2. Does your data appear to agree with your prediction?  


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3. Apply a linear fit to the graph and find the slope.

- a) Press  $\text{F3}$  to open the Tools menu; press  $\text{5}$  to select Linear Fit.
- b) What is the slope (including units) of the best-fit line?  
 slope = \_\_\_\_\_
- c) What physical quantity does the slope represent?

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