## Multimeter

#### Measuring the Voltage Across the Resistor...Using the Multimeter



### What is a Multimeter?

- A tool capable of measuring a variety of different quantities.
  - Possible Measurements
    - Current (Amperes) Resistance (Ohms) Voltage (Volts)



#### How is the Multimeter different than the Oscilloscope? Multimeter Oscilloscope

- Numerical Output Displayed
- Represents a complete signal with a single value.
- Measures voltage, current and resistance.

- Graphical Output DisplayedShows how a signal changes over time
- Many only display voltage





## **Explanation of Controls**

Setting up the multimeter for various measurements.

#### Taking measurements with the Multimeter First, we connect our wires.

- One wire is always connected to the black terminal. This is called the common terminal.
- The red terminal is used when measuring voltage, resistance and small currents.
- The white terminal is used when measuring large currents.



TO DO: Using another set of banana to mini-grabber cables, connect the **banana** end to the red & black terminals

## Taking measurements with the Multimeter

- Next, we turn it on and select the item to measure.
- Choose from:
  - Current Resistance Voltage

**TO DO:** Since we want to measure the voltage across our 1K ohm resistor, press the **Voltage** button



# Taking measurements with the Multimeter

- Now, we select our scale.
- Either select a scale appropriate for your measurement or choose AUTO and let the multimeter select the appropriate scale for you.
- Measuring the voltage from across the 1K resistor (~3V), you wouldn't want to choose 200mV (much too small) or 200V (much too large). Instead, the 2V selection is more suitable.



## Taking measurements with the

### Multimeter

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ON -

- While your circuit is attached to the power supply...
- Attach the minigrabber end around the 1K resistor
- Press the "POWER" button on the multimeter and take a reading!!



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#### Building & Verifying Series Circuit #2

**R2 = 1K**Ω

 $R1 = 1K\Omega$ 

3V

 Resistors connected by only 1 terminal, back-to-back, are considered to be in 'series'

• Ohm's Law States:

> V(R1) = 1.5mA x 1K  $\Omega$  = 1.5V

 $V(R2) = 1.5 mA \times 1K \Omega = 1.5 V$ 

 We are now going to build the circuit, and verify the voltage drops...

## Setting up the breadboard

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- Turn off the 3V supply and disconnect the cables
- Disconnect the cables to the minigrabbers to the multimeter
- Obtain a 2<sup>nd</sup> 1K resistor
- Plug one end of the resistor into a hole in the same row as the end of the other resistor
- Plug the other end into a hole in another row

## Taking measurements with the Multimeter

- Set the Power Supply to 3V
- Attach the power supply leads as follows
- Measure the voltage across each resistor with the multimeter





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#### **Resistors in Parallel**



- Resistors connected at 2 terminals, sharing the same node on each side, are considered to be in 'parallel'
- The voltage is the same on both branches of the circuit

 It is now up to you to build this circuit and verify the voltages

#### Including a Diode In the Circuit



• We'll use LEDs (Light Emitting Diodes) for our circuits.

• Unlike resisters, the two diode leads (wires) must be connected in the correct way.

The longer lead (anode) should be connect so that current flows through it and to the shorter lead (cathode).

• Note: In some diodes, a stripe is used to indicate the cathode lead. Round diodes often have a flat side, indicating the cathode.