

# Electronics

Name \_\_\_\_\_ ID \_\_\_\_\_ TA \_\_\_\_\_

Partners \_\_\_\_\_

Date \_\_\_\_\_ Section \_\_\_\_\_

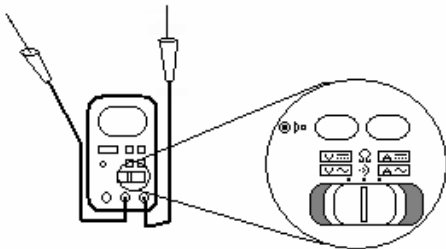
**Please turn off power of to the Circuit Design Trainer each time you put on and take off any wires to avoid damage to the device.**

- Variable Resistors:** Record the resistance values measured between the various connector strips for the control positions indicated. (For each trial, please check the units, **k $\Omega$**  or  **$\Omega$** , carefully. 'k' means one thousand.)

- Conceptual Discussions**

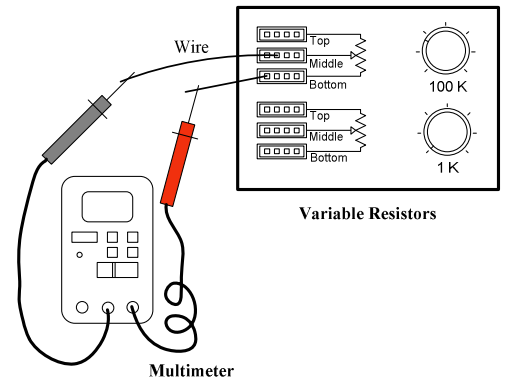
What can a multimeter do?

- Procedure**



⇐ Choose the mode as shown.

Connect wires and put the probes as follows. ⇒

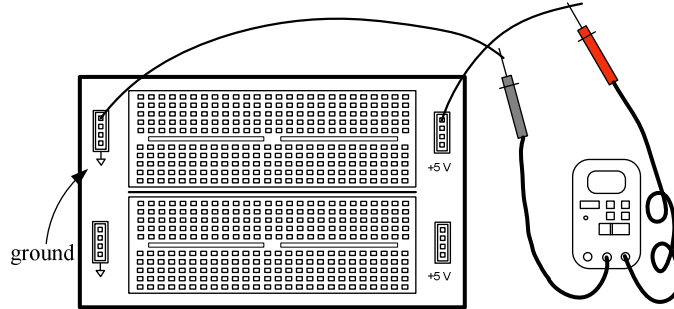


	top-to-middle	middle-to-bottom
100k, full CCW	_____ ↑	_____ ↓
100k, 12 o'clock	_____ ↑	_____ ↓
100k, full CW	_____ ↑	_____ ↓
1k, full CCW	_____ ↑	_____ ↓
1k, 12 o'clock	_____ ↑	_____ ↓
1k, full CW	_____ ↑	_____ ↓

◇ Quick question:

For the top-to-middle and middle-to-bottom positions, does the resistance increase toward the direction of the arrow? Does it make sense to you? Discuss it with your partner.

**2. DC Voltages:** Report your measured voltages between Ground and the strips labeled:



- **Connect the wires to ground and +5V, and turn on the power; then measure the voltage with a multimeter.**

The black wire of multimeter should be connected to Ground (the arrow represents ground in this section); otherwise, you will have negative voltages.

+5V \_\_\_\_\_

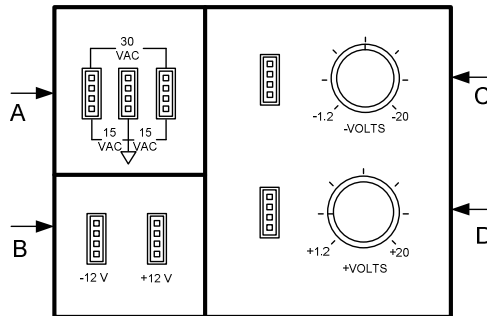
- **Connect the wires to ground and +12V or -12V, and turn on the power; then measure the voltage with the multimeter.**

Use section “B” in the following figure.

-12V \_\_\_\_\_ +12V \_\_\_\_\_

- **Connect the wires to ground and the variable DC voltage sources ( $\pm$ ), and turn on the power; then measure the voltage with multimeter.**

Use the “C “ and “D” in the following figure. This will be similar procedure to the first part of this lab (measuring variable resistors).



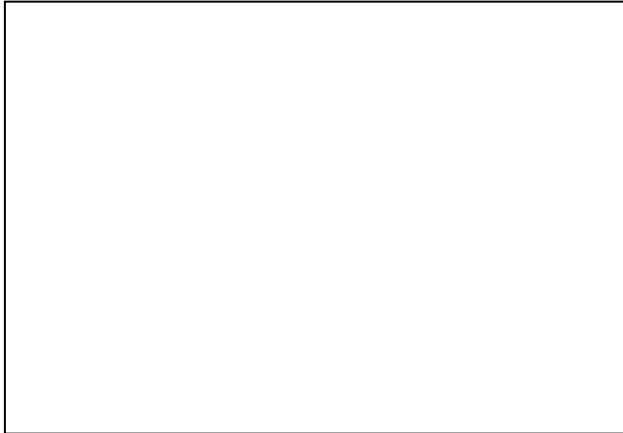
-VOLTS: full CCW \_\_\_\_\_ 12 o'clock \_\_\_\_\_ full CW \_\_\_\_\_

+VOLTS: full CCW \_\_\_\_\_ 12 o'clock \_\_\_\_\_ full CW \_\_\_\_\_

### 3. AC Voltages:

➤ **Oscilloscope observations:** Be sure to connect the center strip to Ground always.

- **Find the AC voltage source (Section “A” in the above figure). Using oscilloscope, sketch the voltage changing with respect to time on the display.**



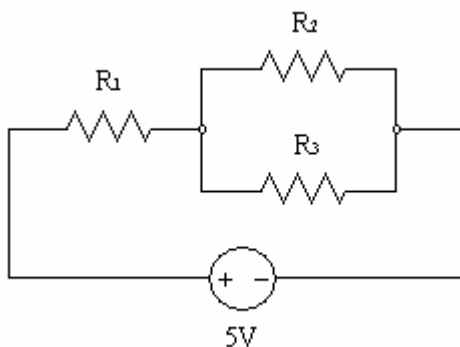
◇ Quick question:

What does the display explain to you?

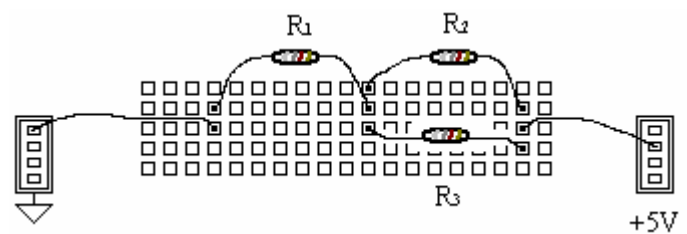
### 4. Implementing circuits; measuring voltage and current

- **First, look at the example on the data sheet.**  
Each column has 5 holes. In the same column, those 5 holes are connected. However, different columns are disconnected from each other.
- **Then, implement the next circuit.**  
Draw the actual connections as the example shows.

- Example:  
*Circuit diagram*



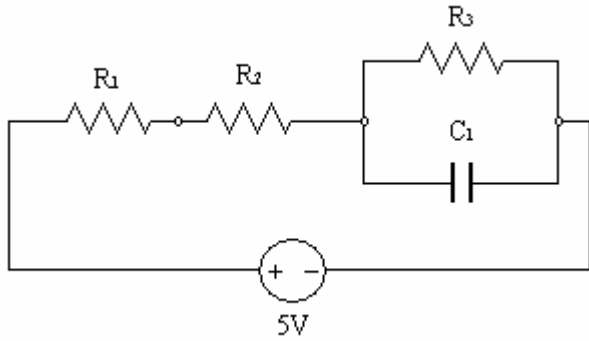
*Actual connections*



- Make the following circuit. (Draw the connections.)

Circuit diagram

Actual connections



- Measure the voltage and current. (Note: **Please follow the manual!**)

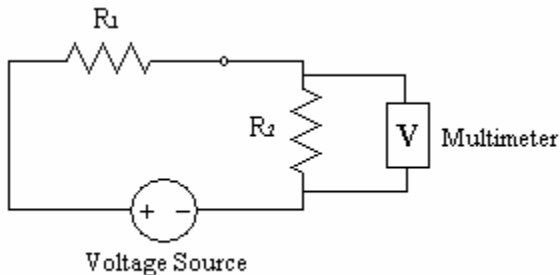
Voltage on the second resistor,  $R_2$  \_\_\_\_\_ (V)

Current flow of this circuit,  $I$  \_\_\_\_\_ (A)

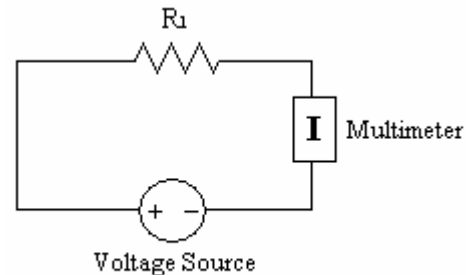
Did you succeed in measuring the voltage and current without burning the fuse in multimeter?

## The manual of how to measure voltage and current

According to the electronics properties, one has to use a multimeter for measuring voltage and current with different alignments. Schematically, the following figures explain the alignments respectively.



**Fig 1**



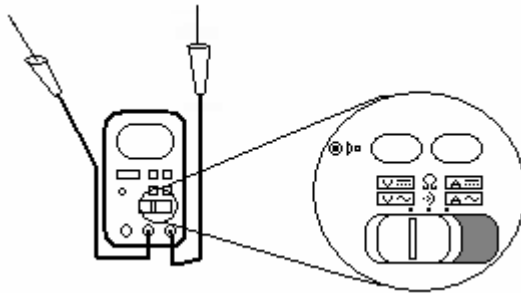
**Fig 2**

In figure 1, the voltage in resistor,  $R_2$ , is being measured. In figure 2, the current flow in the whole circuit is being measured. As you notice, when measuring voltage, you have to align the multimeter parallel with a specific circuit element (in this case, it is resistor,  $R_2$ ); and when measuring current, you have to connect the multimeter in series with respect to the circuit.

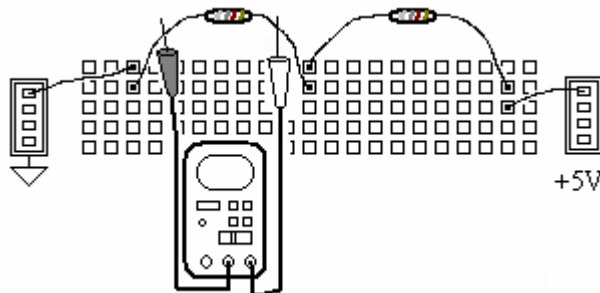
Now, following is the actual measurement of voltages and current flows with the circuits on the breadboard.

- **When measuring voltage, you will take the following steps.**

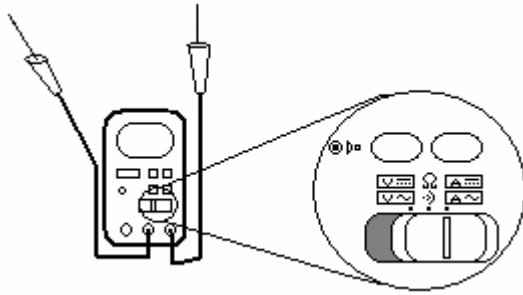
### 1. Select the mode first.



### 2. Measure the voltage (parallel).



- When measuring a current, you will take the following steps.
  1. Change the modes.



2. Measure the current (series).

