

## ELT 101: Basic Electricity: AC/DC

### LAB 4-1: Measuring voltage and current

Two of the most common measurements a digital multimeter is used for is to measure voltage and current. In this lab, we'll learn how to safely measure each of these.



#### Objectives

- 1) Safely measure DC voltage
- 2) Safely measure DC current
- 3) Identify the relationship between voltage and current

#### Equipment and materials

- 1) Fluke 179 DMM
- 2) Test leads (located inside the DMM carrying case)
- 3) Electrical lab trainer
- 4) Jumper leads

#### Safety issues

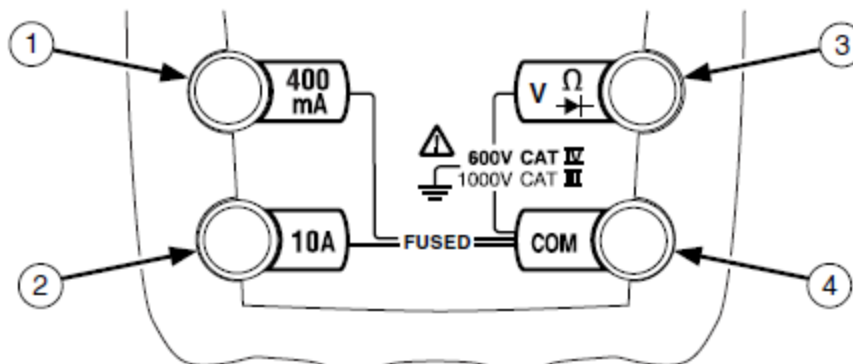
- Follow all lab safety rules: wearing safety glasses at all times in the lab.
- Always turn OFF power before hooking up a meter for measurement.
- Check your meter fuses and check your meter leads.
- Check with your instructor if you're unsure about how to do something

#### Procedure 1: Safely measure voltage

- 1) Check your DMM fuses and test leads.
- 2) Plug in the electrical trainer and turn on the main power; leave the 5V/12V power switch off at this time.
- 3) Connect the test leads to your meter as follows:

Black lead into the COM jack (#4 in the illustration below).

Red lead into the volts/ohm jack (#3 in the illustration below).





- 4) Turn the rotary switch to measure DC volts. This is the function that looks like a V with a bar over it (as shown at right).
- 5) Connect the test leads coming out of the meter to the 5-way binding posts labeled 5V as follows:
  - Red lead to red 5V binding post.
  - Black lead to the black 5V binding post.
- 6) Turn on the 5V/12V power switch.
- 7) Your meter should display approximately 5V.
- 8) Record what your meter displayed: \_\_\_\_\_
- 9) Turn off the 5V/12V power switch.
- 10) Move your meter leads to the 12V 5-way binding posts as follows:
  - Red lead to red 12V binding post.
  - Black lead to the black 12V binding post.
- 11) Turn on the 5V/12V power switch.
- 12) Your meter should display approximately 12V.
- 13) Record what your meter displayed: \_\_\_\_\_
- 14) Turn off the 5V/12V power switch.

### **Procedure 2: Safely measure current**

**CAUTION:** If you're going to blow a meter fuse, this is where it's probably going to happen. New students frequently blow fuses because:

- ✓ They forget to set the Fluke 179 selector knob to measure current (amps).
- ✓ They forget to move the volt/ohms meter lead to one of the two current jacks (400mA and 11A, yes?).
- ✓ They hook the meter up in parallel instead of in **series** with the circuit.

Remember: In order for a meter to measure current, **ALL** of the current must pass *through the meter*. This means you need to break the circuit and insert the meter at the break. In effect, the meter will bridge the gap you've created.

- 1) Turn the 5V/12V power OFF.
- 2) Connect a simple circuit as follows:
  - Connect the red 5V binding post to the bottom (220 ohm) resistor with a jumper lead.
  - Connect the other end of the 220 ohm resistor to the black 5V binding post with a jumper lead.
- 3) Calculate how much current should be flowing by dividing the applied voltage (5V) by the amount of resistance (220 ohms).
- 4)  $5V/220 \text{ ohms} = 0.0227 \text{ amps}$  or 22.7mA.
- 5) Set the Fluke 179 selector knob to measure DC current. **Note: You must push the yellow button to switch from AC current to DC current!**
- 6) Disconnect the jumper wire that connects the 5V binding post to the 220 ohm resistor and replace this with the leads from your meter as follows:
  - Black meter lead to the resistor
  - Red meter lead (connected to the mA terminal – #1 in the illustration on page 1) to the red 5V binding post
- 7) What you've effectively done here is to insert your meter into the circuit so that all the current will also flow through the meter.
- 8) Remove your hands from the circuit and turn the 5V/12V power switch on.
- 8) The meter display should read approximately 22mA.
- 9) What current does your Fluke 179 meter display? \_\_\_\_\_
- 10) Turn off the 5V/12V power and move your meter leads to the 12V binding posts.
- 11) Calculate how much current should be flowing.
- 12)  $12V/220 \text{ ohms} = 0.0545 \text{ amps}$  or 54.5mA, yes?
- 13) Turn on the 5V/12V power switch.
- 14) Your meter should display approximately 54.5mA.
- 15) What current does your Fluke 179 meter display? \_\_\_\_\_
- 16) Turn off all power and disconnect your meter and circuit.
- 17) Stow the meter and leads in the case.
- 18) Stow the trainers and jumper leads as directed by your instructor.

## Questions

1) When you increased the voltage from 5V to 12V when measuring current, what happened to the current?

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2) What does this suggest about the relationship between current and voltage?

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3) If you doubled the voltage in a circuit, what do you think would happen to the current?

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3) If you halved the voltage in a circuit, what do you think would happen to the current?

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