

# Measuring DC Voltages and Currents

Lab Manual pages 7-8  
Textbook pages 14-18

## EE330L Lab 1 Supplement

**Introduction:** Two types of instruments are commonly used for electrical tests; one only measures the magnitude of the parameter, while the other provides a visual display of the parameter (usually voltage) as a function of time. The first of these instruments is the digital multimeter (DMM) and the second is the oscilloscope ("scope").

The choice between using a DMM or a scope involves waveshapes, frequency response, accuracy and cost. If the waveshape is unknown or a detailed knowledge of it is required, the scope is mandatory. The frequency response choice between the two is dependent on the specifications of the individual instruments. When it comes to numeric accuracy and cost a multimeter is usually the best choice.

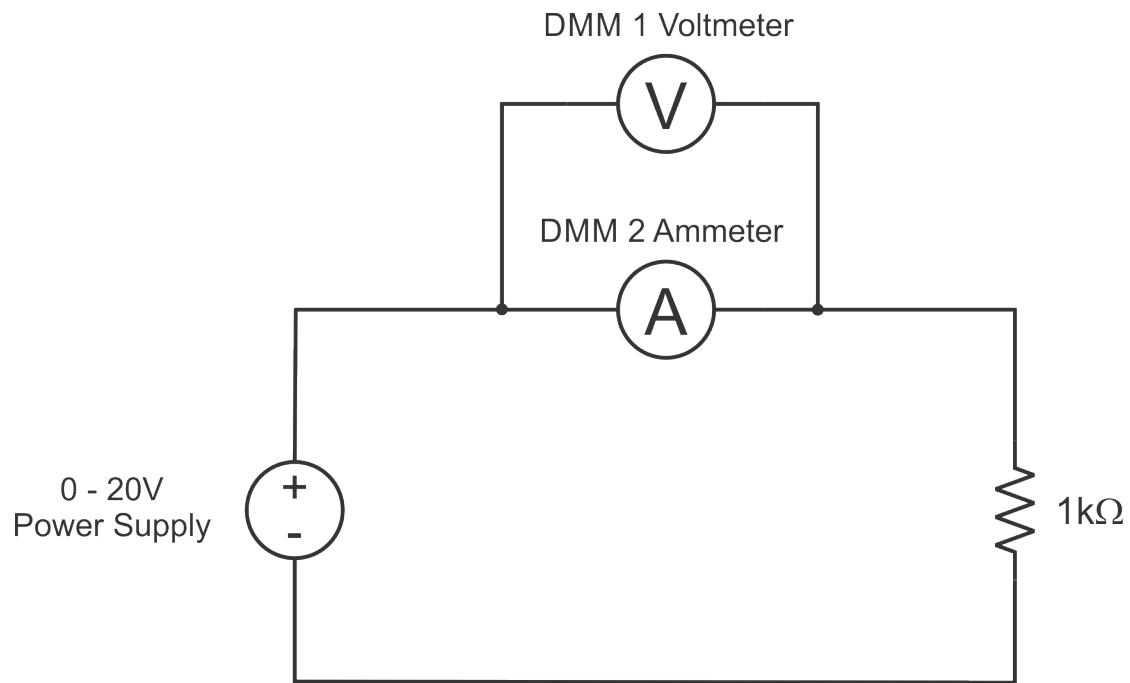
DMMs work by sampling the (analog) voltage across a resistance and using an analog-to-digital converter (ADC) to obtain the digitally displayed value. The sampling resistance used for current measurements must be small to prevent the meter from disturbing the circuit under test. The small voltage drop created by inserting an ammeter into a circuit is called the burden voltage.

In this lab you will use the DMM to measure DC Voltages, DC Currents and Resistance values. You will setup a basic circuit to measure the burden voltage of the Keysight 34460A DMM and compare the results with the manufacturers specifications.

### **Lab Manual Addendum:**

- Steps 1-2: Test the 3 different outputs on the E3630 power supply and record the minimum and maximum open circuit voltage for each. It is not required that you connect the common (-) terminal (black binding post) of the power supply to the chassis ground (green binding post).
- Steps 4-7: You will be given a momentary single pole single throw (SPST) tactile switch. Use the switch to connect your circuit as shown in Fig. 1 of the text. Do not turn the power supply on and off as indicated in the lab manual. First analyze the switch using the continuity feature on the DMM to make sure you understand the connections.
- Steps 9: Build the circuit shown on the back of this page and measure the burden voltage of the 34460A DMM when measuring 100 $\mu$ A, 1mA and 10mA. Compute an estimate for the value of the shunt resistor for each for each current. Compare your results with the specifications for the multimeter and discuss the findings in your lab report.

**Burden voltage test circuit:**



***Additional Content for Lab Report:***

1. What is the minimum and maximum voltages available on each output of the E3630 triple output power supply?
2. Draw a diagram showing the pinout of the four leads on the SPST tactile switch.
3. Explain what the term burden voltage means and why it is a necessary evil.