

ENGR 326 - Lab #1

The general goal of this lab is to review basic circuit theory and review operation of the test equipment used in lab this quarter including voltmeters, oscilloscope, signal generator, power supply, and the WWU bread boards.

Objectives

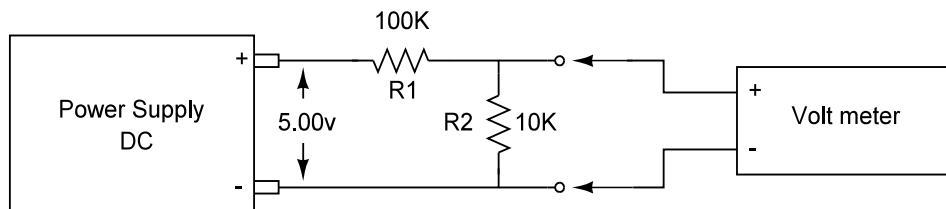
- Refresh knowledge of circuits
- Review operation and use of basic electronic test equipment
(Power supply, voltmeter, oscilloscope, signal generator, & bread board)
- Observe and quantify loading effects
- Observe discrepancy between meters when doing AC measurements of non-sine waves

Note that when recording voltage measurements you must state the units and type of voltage and use the number of significant digits appropriate to the accuracy of the measurement. For direct current use $xx.xx$ Vdc. For AC (alternating current), $xx.xx$ Vpp (voltage peak-to-peak) or Vpeak (peak voltage) or Vrms (voltage rms).

Part 1 - DC voltage measurement, voltage divider operation, and loading effect.

Construct the voltage divider circuit shown below on a breadboard, but measure each resistor before placing them in the circuit. Use a Fluke 45 meter to measure resistance and also to set the power supply to 5.00 volts DC as close as possible.

0) Measure and record resistor values



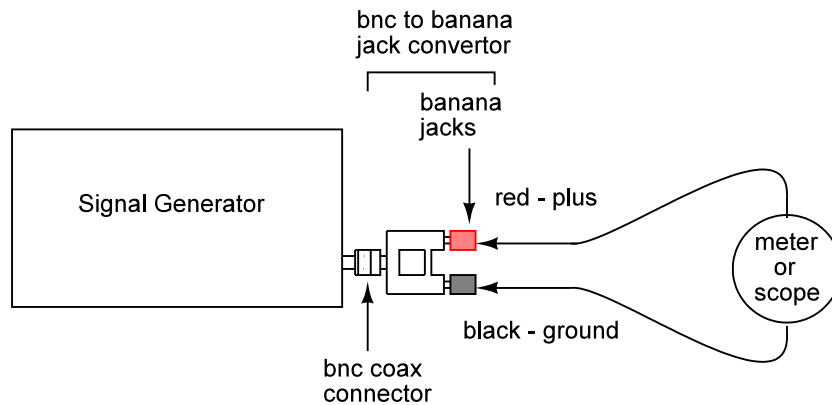
- 1a) Use measured resistances and circuit theory to calculate the expected voltage across R2.
- b) Measure the DC voltage across R2 using a Wavetek AM8 meter using its most sensitive range. Document the range you use.
- c) Measure the DC voltage across R2 with a Fluke 45 meter.
- d) Measure the current flowing from the power supply through this circuit (recall that to measure current the meter must be placed in series with the circuit).
- e) How accurate are the resistance measurements made with the Fluke 45 meter?
- f) How accurate are the DC voltage measurements that you made with the Fluke 45 meter?
(See the Fluke 45 specifications posted on the class web page)

Questions to answer:

- g) Does the DC voltage measured with the Fluke 45 agree with theory?
- h) If the Wavetek AM8 and Fluke 45 meters don't agree, why? Is the difference more than just a difference in calibration?

Part 2 - AC sinusoidal voltage measurement

Set a Wavetek 19 signal generator for sine wave output and zero offset voltage. Use an oscilloscope and adjust signal generator output to 2.0 volts peak-peak amplitude. The offset voltage should be zero. Set the frequency to 100hz



2a) Measure AC voltage with a Fluke 45 meter

b) Measure AC voltage with a HP-3438 (or HP-3435A) meter

c) Determine a calibration factor for the HP meter you use. Multiplying the value measured with the HP meter by the calibration factor should give the value measured with the Fluke 45.

Part 3 - Non-sinusoidal voltage measurement

Use the same equipment and hook-up as defined in Part 2 above but change the signal generator waveform type to Square Wave. Continue using 2.0 volt peak-peak voltage with zero offset.

3a) Measure AC voltage with a Fluke 45 meter

b) Measure AC voltage with a HP-3438 (or HP-3435A) meter. Apply the calibration factor from part 2c above to get the best value that the HP meter can produce.

c) Measure AC voltage with an oscilloscope by reading the value visually from the displayed waveform and the grid scale on the scope face.

Figure out an answer to this question:

d) If the Fluke and HP meters don't agree, why? (hint: Recall that AC voltage magnitude is most commonly reported in RMS units. How is RMS determined?)

Part 4 - Waveform measurements

Use the same equipment and hook-up as that in Part 3, keep the generator set to square wave, but change frequency to 10 KHz. Continue using 2.0 volt peak-peak voltage with zero offset voltage.

4a) Visually measure the waveform period with an oscilloscope.

b) Visually measure waveform rise time and fall time with an oscilloscope. Sketch the edge shapes and annotate with measured values.

c) Repeat the measurement in 4a but use scope measurement features

d) Repeat measurements in 4b but use scope measurement features.