

Name: _____ Lab Section: _____ Date: _____

OVERVIEW:

This laboratory introduces analog and digital multi-meters used to measure voltage. The focus will be on dc power supply configuration and voltage measurement.

INTRODUCTION:

For this exercise you will be using a dc power supply, a Volt-Ohm-Milliampere meter (VOM), and two Digital MultiMeters (DMM).

Remember when asked to calculate relative difference to compare A (measured) with B (nominal) the ECET method is: $RD = (A - B) / B$, expressed in percent.

PROCEDURE:

1. Turn on your dc power supply and turn both the voltage and current knobs counter clockwise all the way. Push in the CC Set button and turn the current knob so it displays 20 mA. This “current limits” your supply such that the maximum current available from the terminals is 20 mA. The current maximum is achieved by automatically lowering the output voltage magnitude if the load tries to draw more than 20 mA. Current-limiting the supply provides a level of safety to the circuit connected to the supply.
2. Your power supply has 3 terminals: positive, negative, and ground.



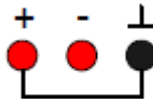
The variable voltage is only available between the positive and negative terminals. The ground terminal is used to provide a zero-volt reference.

For example, if the supply is set to 15 V, the positive terminal will have a voltage potential that is 15 volts higher than that of the negative terminal. This does not specify the exact voltage of either terminal, just the voltage difference. The ground terminal is used to provide an exact output voltage by setting one of the terminal voltages to zero. In this manner, the supply can provide either a positive or negative voltage.

A “positive voltage supply” is achieved by grounding the negative terminal as shown below. The negative ground sets the negative terminal voltage to zero. If the supply is set to a magnitude of V_{AB} , the positive terminal will have a node voltage of $+V_{AB}$ (compared to ground) since the positive terminal has a voltage potential V_{AB} greater than that of the negative terminal, which in this case is set to zero.



A “negative voltage supply” is achieved by grounding the positive terminal as shown below. With this configuration, the negative terminal will have a node voltage of $-V_{AB}$ (compared to ground) since the negative terminal has a voltage potential V_{AB} less than that of the positive terminal, which is now set to zero.



In either case, the voltage rise from the negative terminal to the positive terminal is V_{AB} .

- Configure your dc power supply for a negative ground. Using both DMMs and the VOM, complete Table 1. First set the supply voltage V_{AB} to the exact value shown in the table. Next use the VOM to verify your setting. Record the value shown on the meter. Do not let the settings or any previous meter readings influence your reading. Then, use the DMMs to record the supply voltage.

To measure voltage with the VOM, you must select either DC+ or DC-, depending on the measured voltage's polarity. The VOM has two terminals, "+" and COM. The meter measures the voltage at the "+" terminal with reference to the COM terminal. V_{AB} is read as: Voltage at A with respect to B. The second subscript is the reference or common point. In the absence of a second subscript, ground is implied. Thus, V_B is read as: Voltage at B with respect to ground. When using the VOM, always start with a highest scale, moving to the lowest possible scale that provides a measurable reading, and finally reading and recording the value.

Table 1

V_{AB} (V) (A)	VOM (V) (B)	DMM ₁ (V) (C)	DMM ₂ (V) (D)
0.1			
0.2			
0.5			
1.0			
2.5			
5.0			
10.0			
25.0			
50.0			
100.0			

4. The remainder of this lab is analysis. We will be calculating relative differences between indicated and measured voltages for each of the three meters. Complete Table 2 using MS Excel to compare the internal meter used to set the power supply output voltage to the second DMM. When you want to set your power supply voltage accurately, which would you use, the DMM or the power supply reading?

Table 2

V_{AB} (V) (A)	DMM ₂ (V) (D)	RD (A-D)/D * 100.00%
0.1		
0.2		
0.5		
1.0		
2.5		
5.0		
10.0		
25.0		
50.0		
100.0		

5. Complete Table 3 to compare the VOM to set the power supply output voltage to the second DMM. Again, use MS Excel for your calculations. When you want to set your power supply voltage accurately, which would you use, the DMM or the VOM?

Table 3

VOM (V) (B)	DMM ₂ (V) (D)	RD (B-D)/D * 100.00%

6. Complete Table 4 to compare the first DMM to the second DMM. Again, use MS Excel for your calculations. When you want to set your power supply voltage accurately, which would you use, the first or second DMM?

Table 4

DMM₁ (V) (C)	DMM₂ (V) (D)	RD (C-D)/D * 100.00%

REPORTING:

Once you have completed your measurements, have your Lab Instructor check, sign off, and retain your worksheets. Upload your MS Excel workbook to the Dropbox for this laboratory. Clean up your bench, turn off and unplug all equipment at your bench, return all equipment to its proper location, clean all trash and debris off your bench and deposit it in the trash receptacle.

Approved by: _____ **Date:** _____