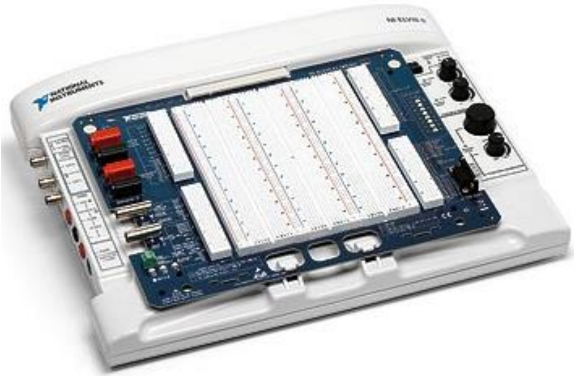
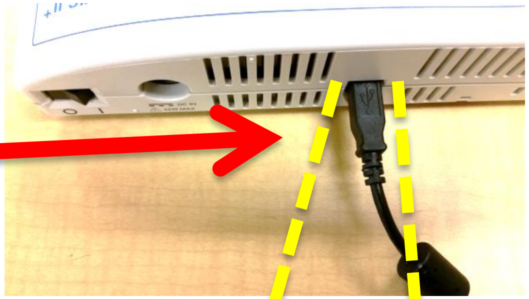
ELVIS II Orientation



- **ELVIS II Prototype Board**
  - Software access & location
  - Connections and power up / power down procedures
  - Grid layout, features we will use, and Run/Stop functions
    - **DMM** = Digital Multi-Meter (Modes = Volts, Amps, Ohms)
    - **VPS** = Variable Power Supply (**Stacked, Dual-Output**)
    - **Function Generator** and **Oscilloscope** discussed in Testing ELVIS
  - Nulling the DMM
  - Measurement procedures for the DMM

Power-Up Procedure



1. Connect one end of the USB cable to the back of the board, and the other end to the PC workstation.

- ***ATTENTION!!!***
- Make sure the USB symbol on the connector is ***facing up***! Inserting the connector the wrong way **WILL** damage the board!

USB

2. Connect the AC power supply to the NI ELVIS II Series Workstation. Connect the power supply into a wall outlet..

Power-Up Procedure (cont'd)

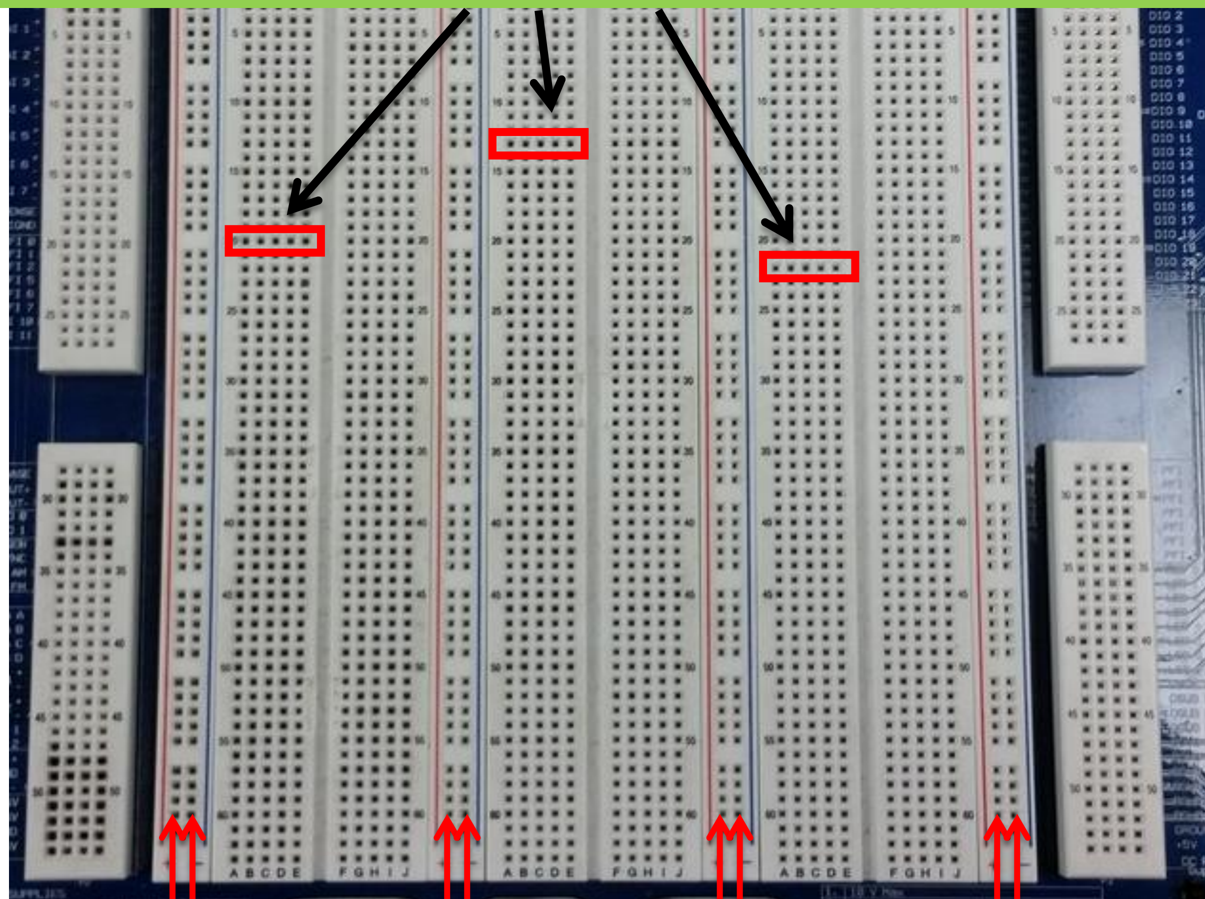
3. Turn on the power switch on the back side of the board.

4. Wait until the "Ready" LED light turns on. That should not take longer than several seconds. If the "Ready" LED remains off, do not proceed further and inform the TA.

5. Turn on the prototyping board switch on top of the board (upper right-hand corner). This enables DMM, VPS, FGEN Oscilloscope, +/-15V, etc.

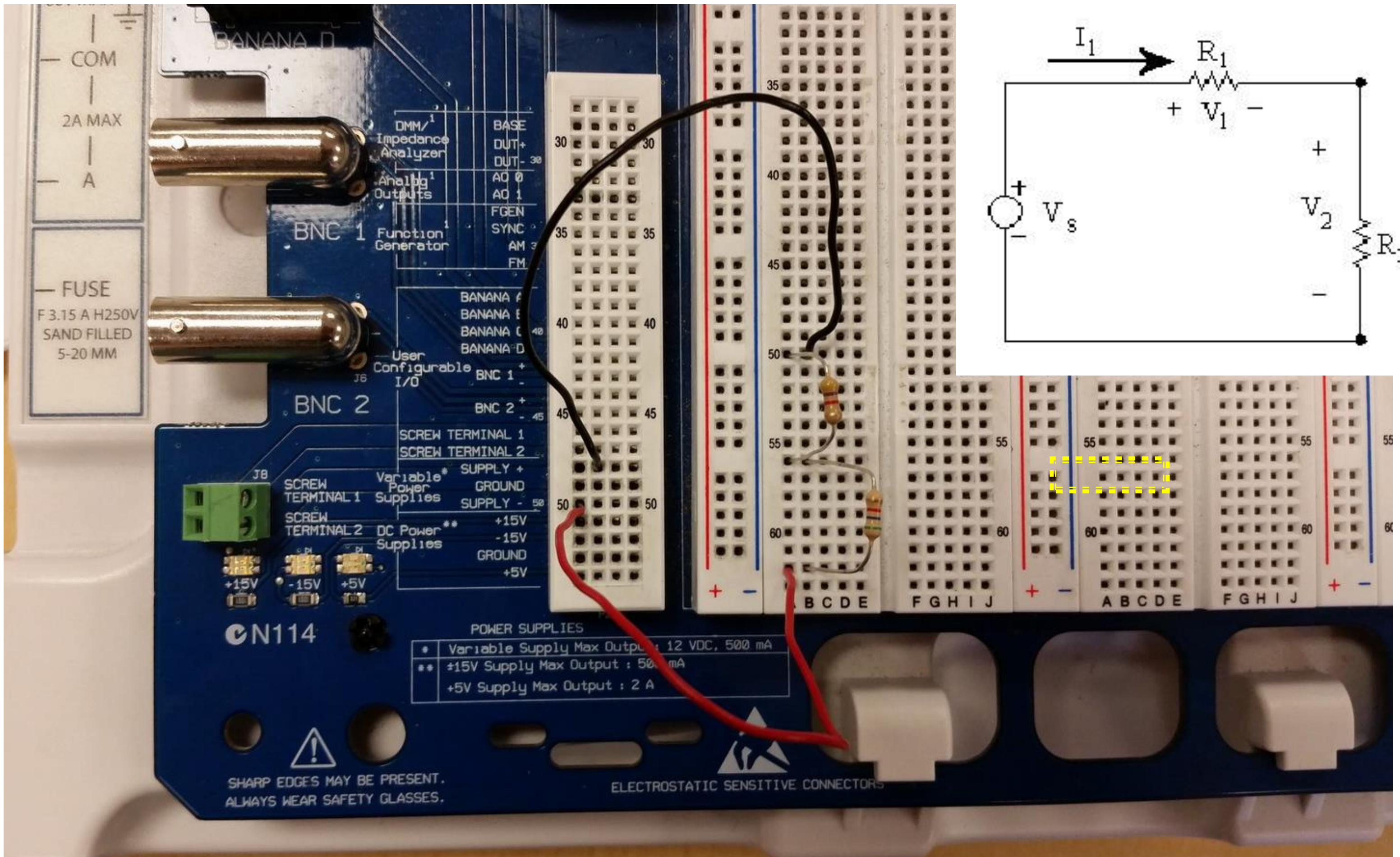
6. Start the ***NI ELVIS Instrument Launcher*** from the Windows Start menu
   - The easiest way to find it is by searching for "Elvis" in the start menu.
   - For easy access in the future create a shortcut on the desktop

Each **horizontal set of five** contacts are internally tied together.
A set of five contacts is not connected to anything else on the board.

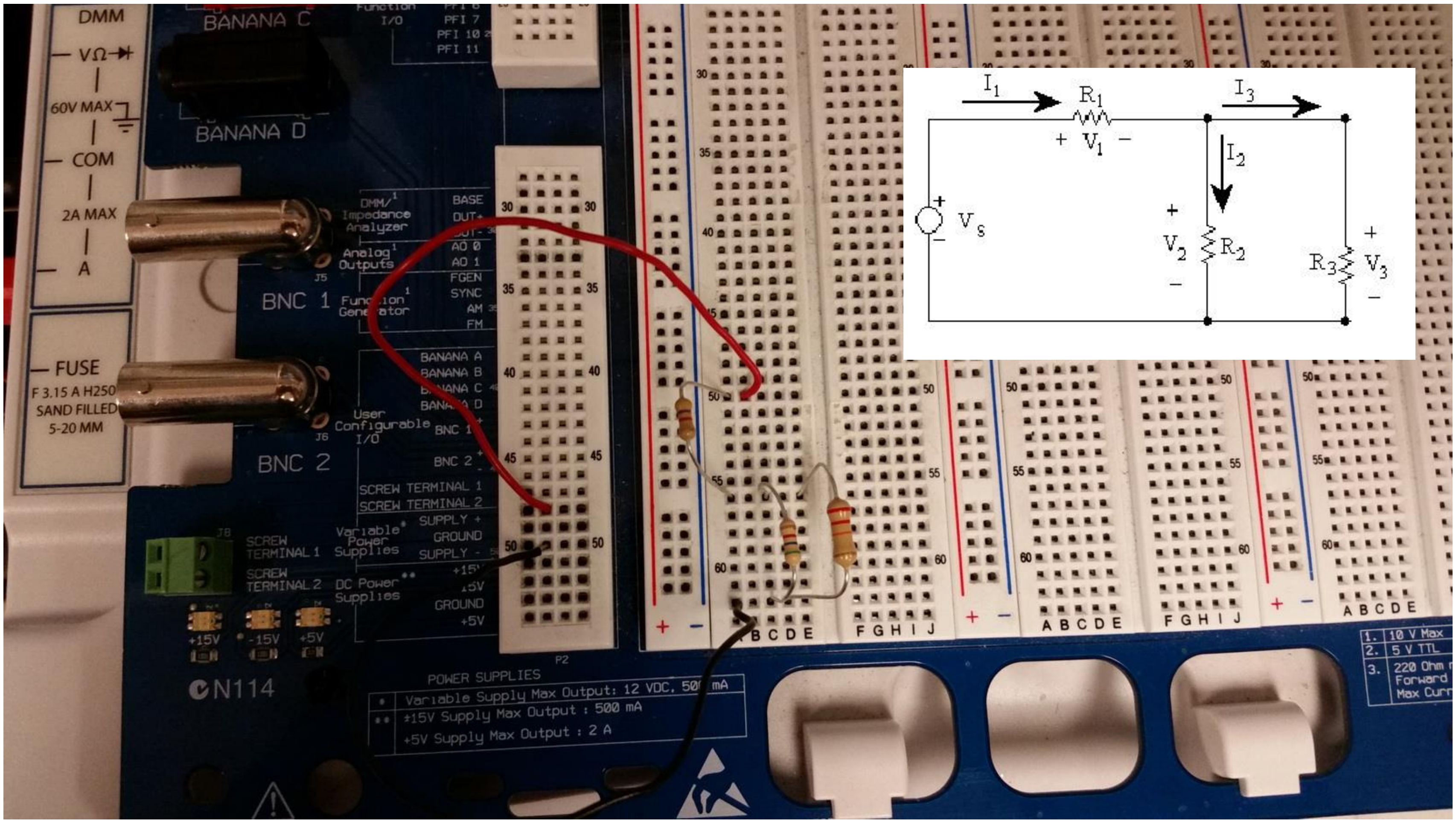


All pins on each of these columns are connected together.
So the user can use "+" for DC power supply and "-" for ground

Voltage Divider



Voltage Divider with a Current Divider



Before taking measurements:

- Null the voltage / current meters before taking measurements.
- Measure all component values and record them. That includes resistors, capacitors, inductors, etc.
- Measure all source voltages with the DMM. That includes the VPS, +/-15 DC sources, etc.

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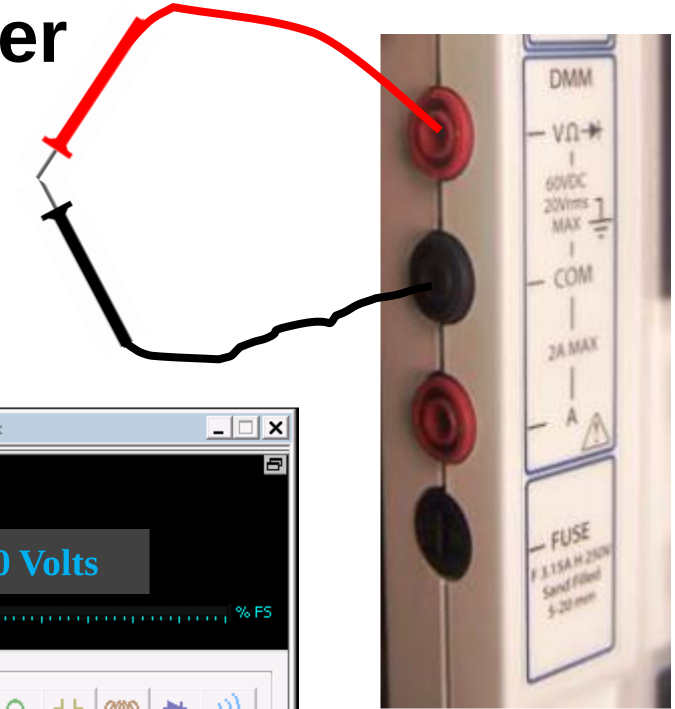
Nulling the voltage meter

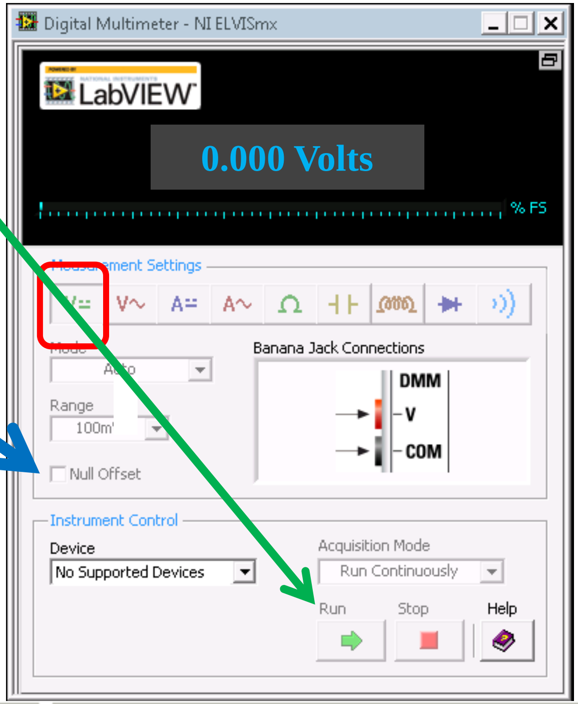
1. Short the two probes



2. Open the DC voltmeter and ***run*** it.

3. Check "Null Offset" and leave it checked!

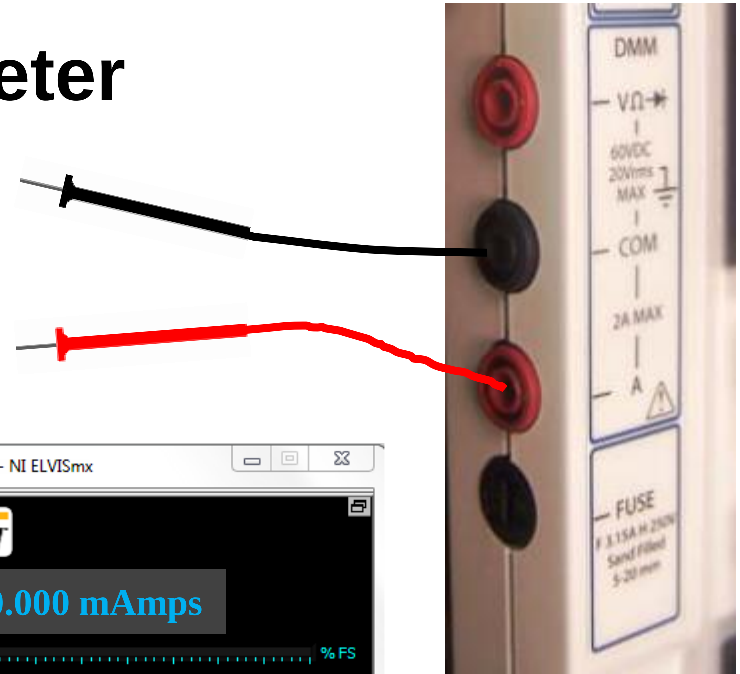
The meter should now read exactly zero volts.



4. You are now ready to measure voltage!

Nulling the current meter

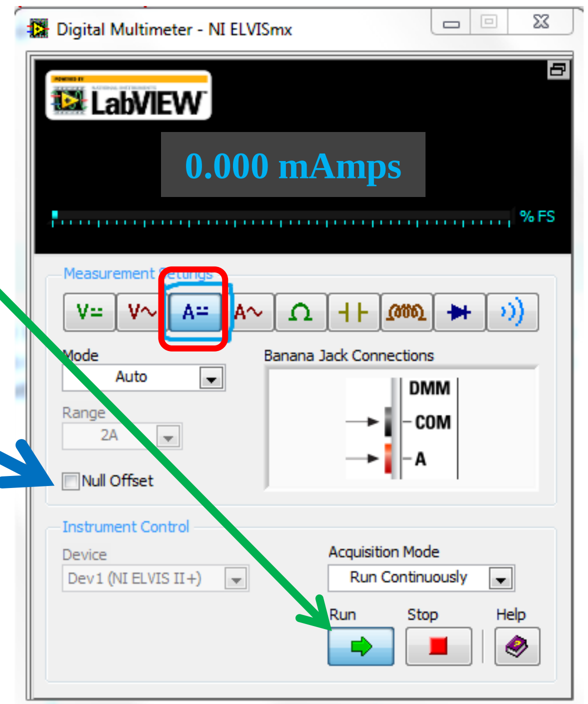
1. Disconnect the two probes (open ckt)



2. Open the DC ammeter and ***run*** it.

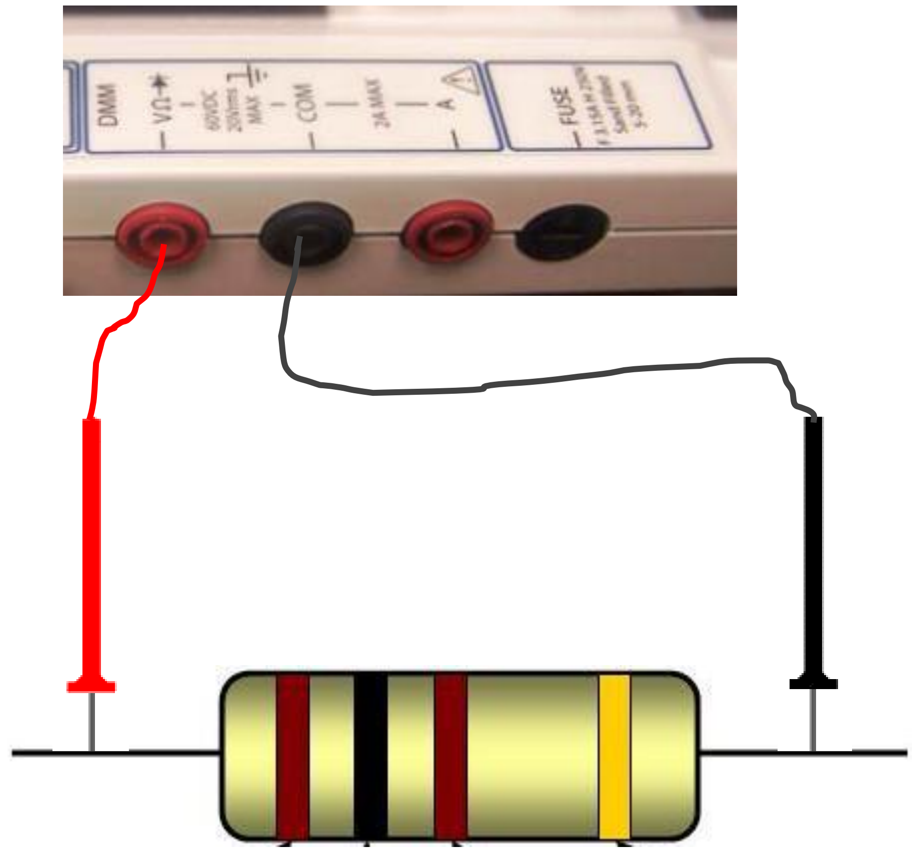
3. Check "Null Offset" and leave it checked!

The meter should now read exactly zero Amps.

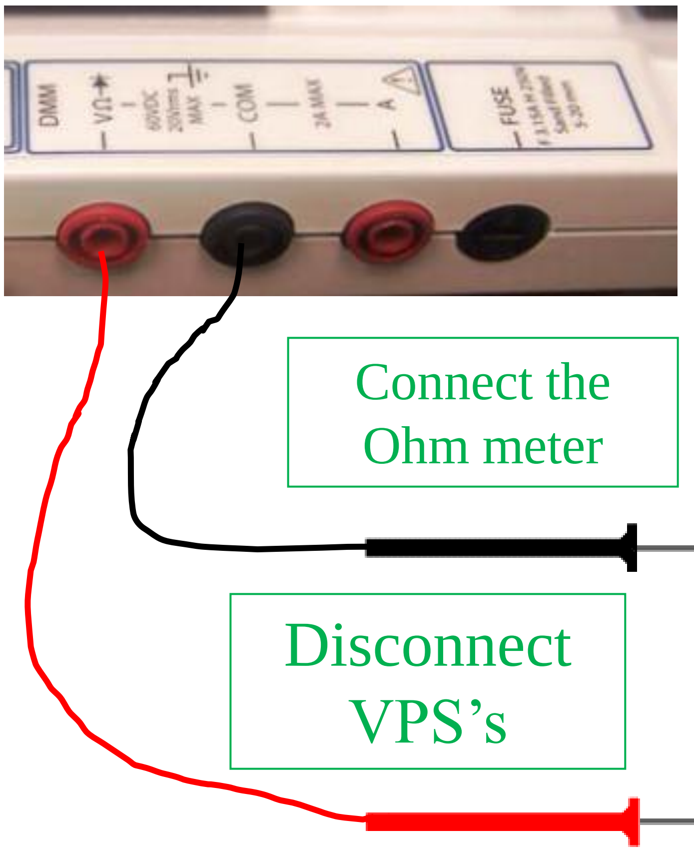


4. You are now ready to measure current!

DMM Measurements (Ohms)

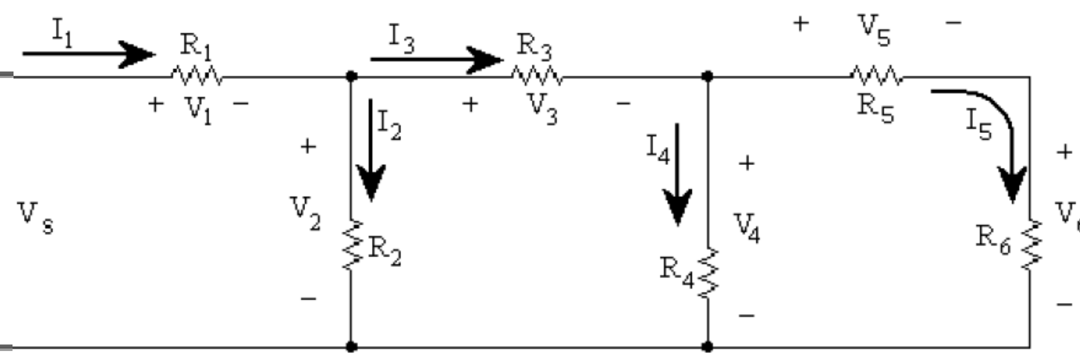


Measuring R_{TH}

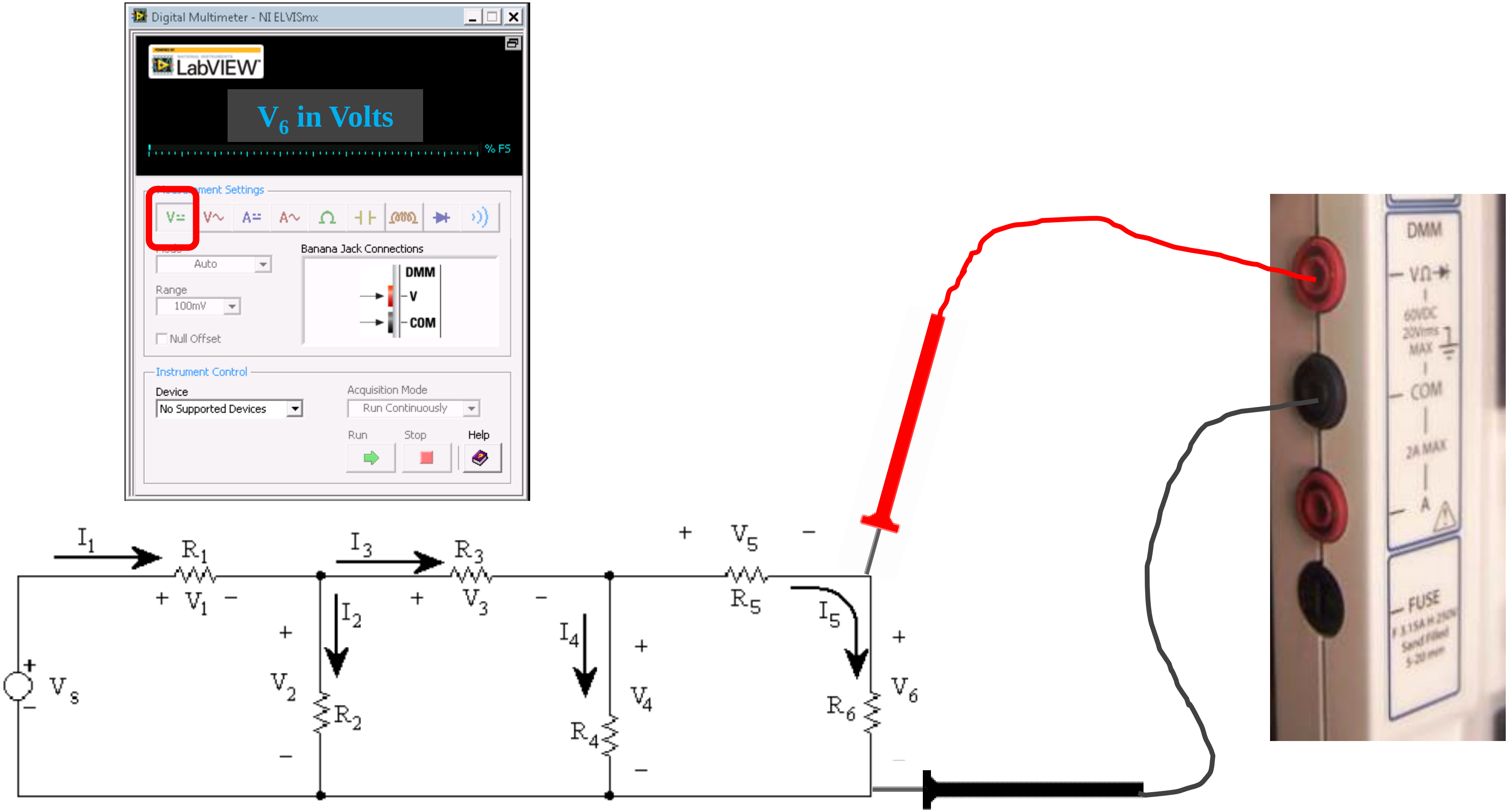


Connect the Ohm meter

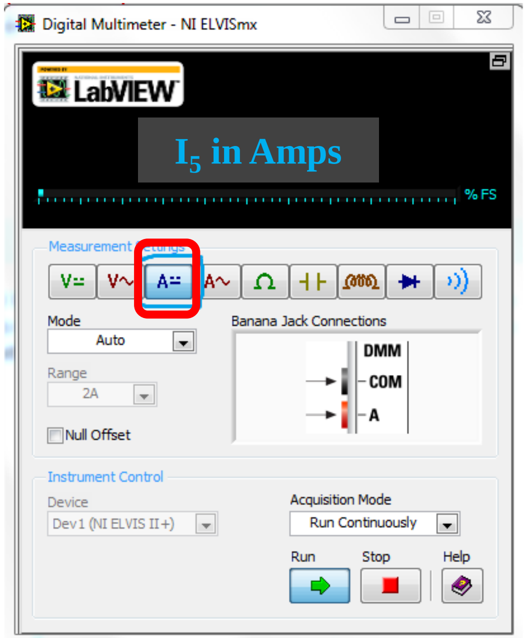
Disconnect VPS's



DMM Measurements (Volts)

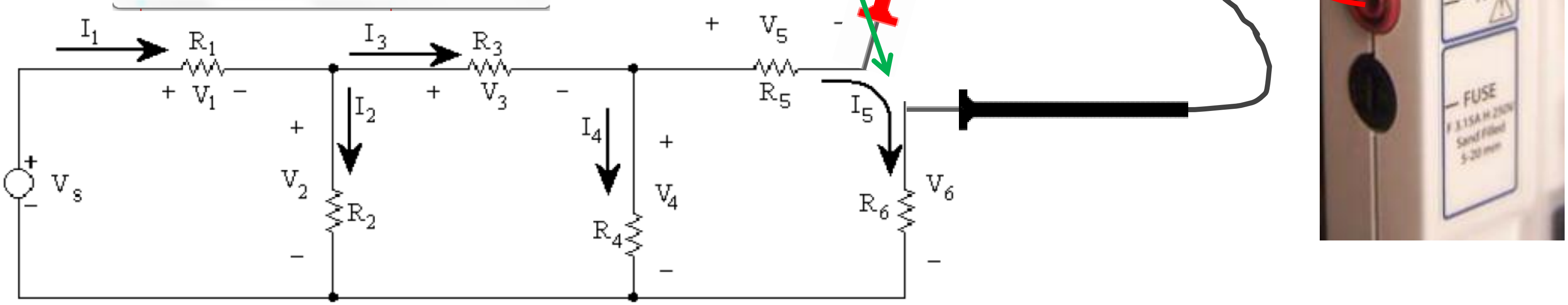


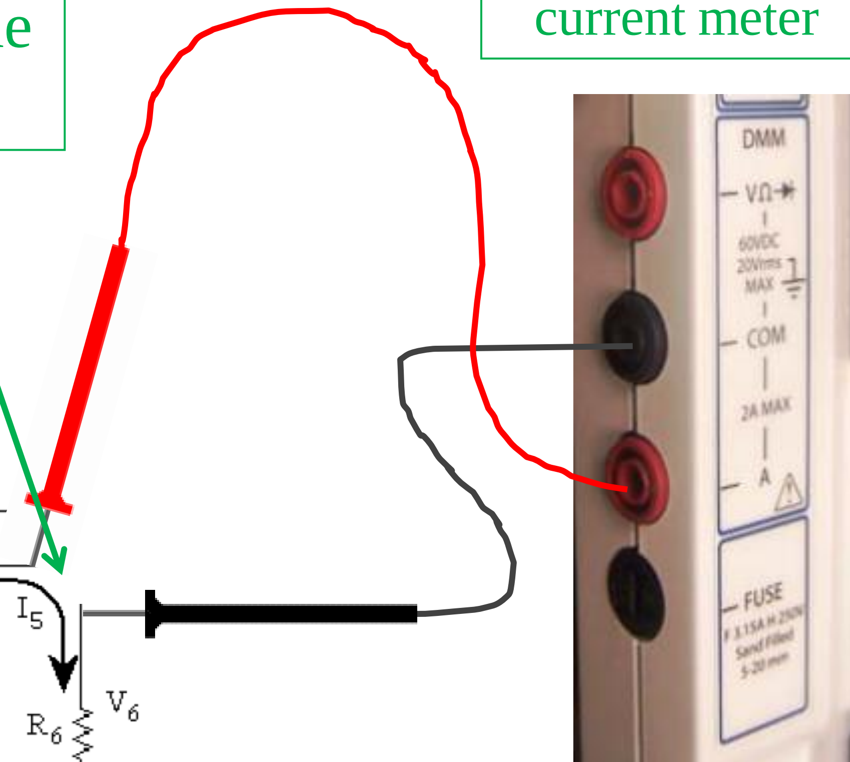
DMM Measurements (Amps)



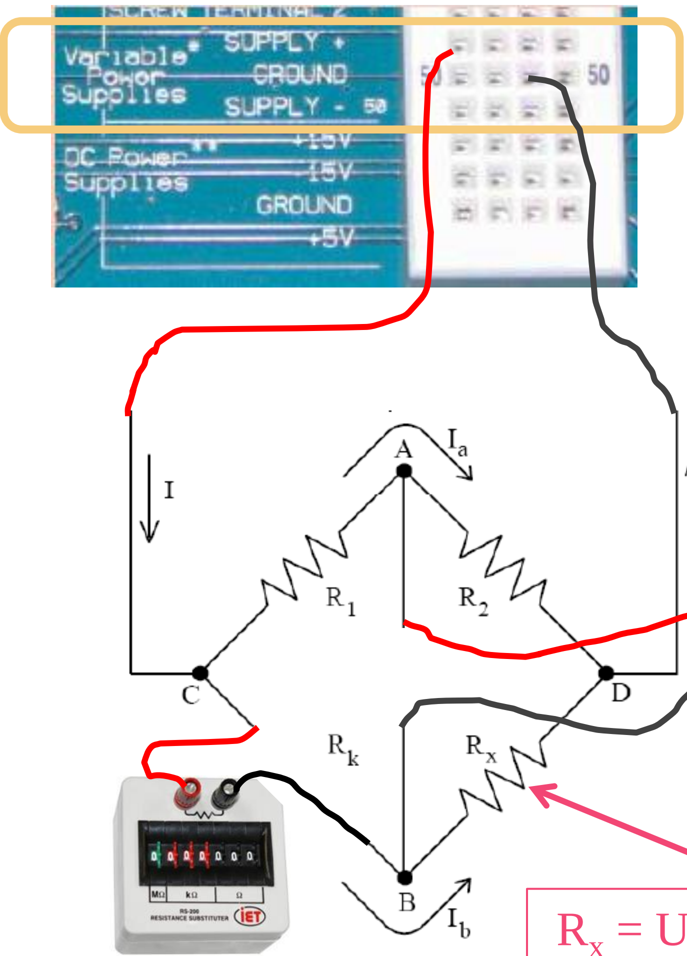
Open the circuit

Complete the circuit with the current meter

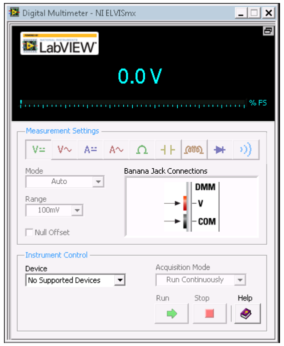


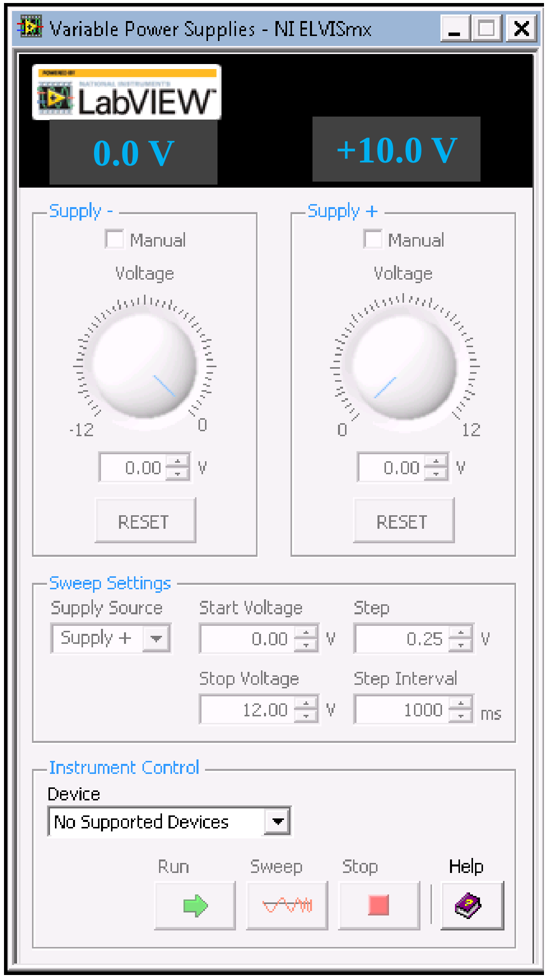


VPS => Single-Ended Configuration



Turn on the Prototyping Board Power Switch to enable VPS's

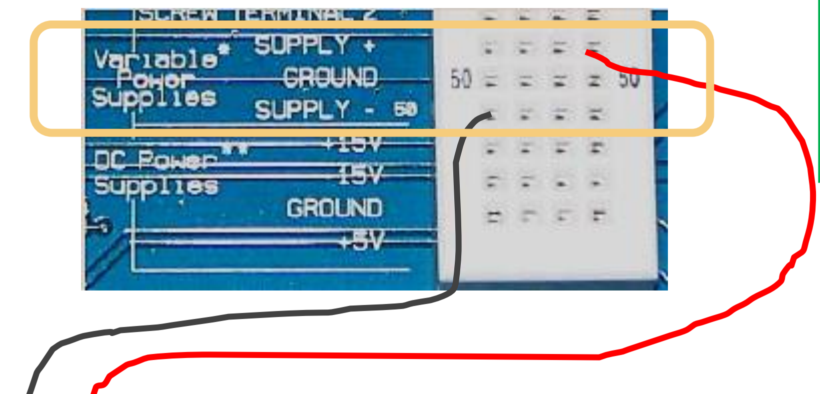


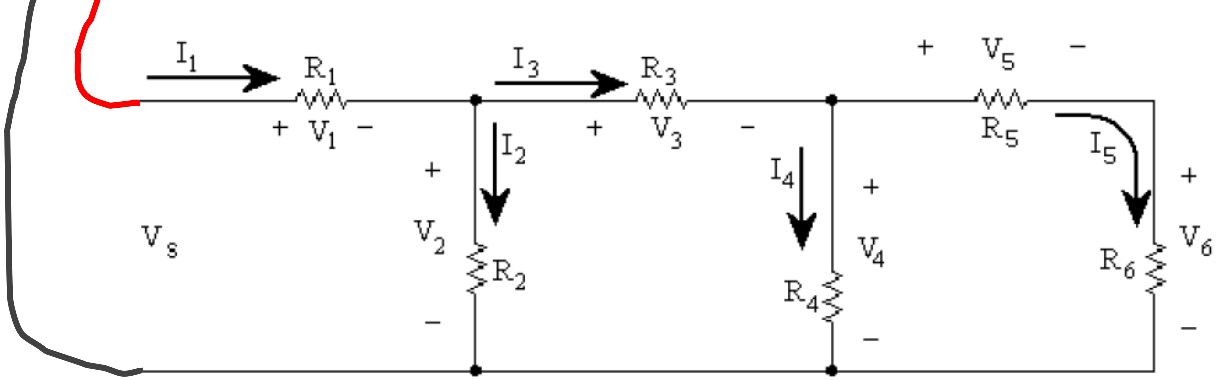


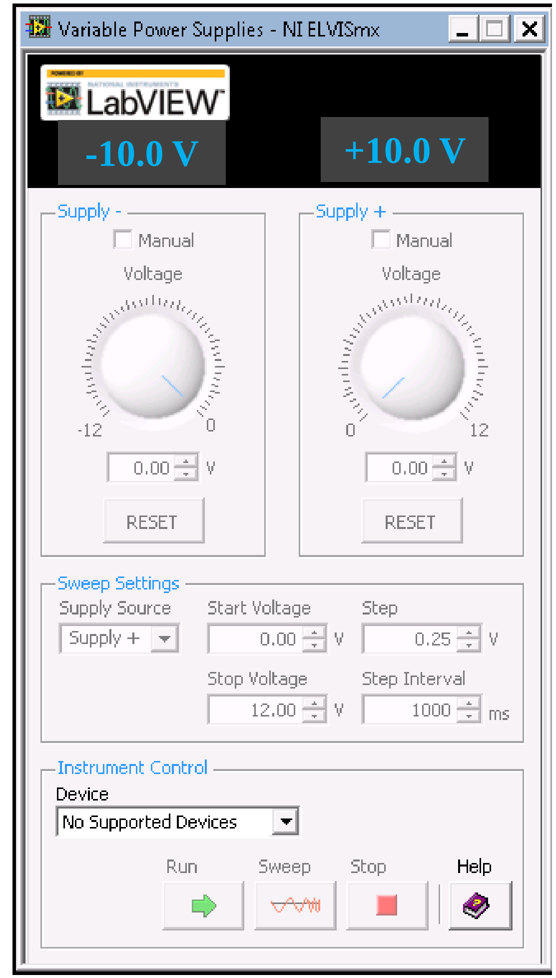
R_x = Unknown resistor

VPS => Dual Configuration

Turn on the Prototyping Board Power Switch to enable VPS's







% Difference = Relative change * 100

- Reference link
  http://en.wikipedia.org/wiki/Relative_change_and_difference

The absolute difference between two values is not always a good way to compare the numbers. For instance, the absolute difference of 1 between 6 and 5 is more significant than the same absolute difference between 100,000,001 and 100,000,000. We can adjust the comparison to take into account the "size" of the quantities involved, by defining, for positive values of $x_{reference}$:

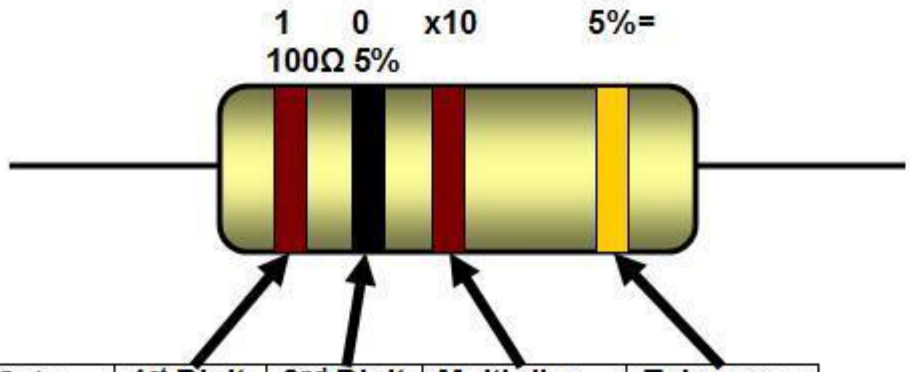
$$\text{Relative change}(x, x_{reference}) = \frac{\text{Actual change}}{x_{reference}} = \frac{\Delta}{x_{reference}} = \frac{x - x_{reference}}{x_{reference}}.$$

The relative change is not defined if the reference value ($x_{reference}$) is zero.

For values greater than the reference value, the relative change should be a positive number and for values that are smaller, the relative change should be negative. The formula given above behaves in this way only if $x_{reference}$ is positive, and reverses this behavior if $x_{reference}$ is negative. For example, if we are calibrating a thermometer which reads -6° C when it should read -10° C, this formula for relative change (which would be called *relative error* in this application) gives ((-6) - (-10)) / (-10) = 4/-10 = -0.4, yet the reading is too high. To fix this problem we alter the definition of relative change so that it works correctly for all nonzero values of $x_{reference}$:

$$\text{Relative change}(x, x_{reference}) = \frac{\text{Actual change}}{|x_{reference}|} = \frac{\Delta}{|x_{reference}|} = \frac{x - x_{reference}}{|x_{reference}|}.$$

4 Band Resistor Color Chart



Color	1st Digit	2nd Digit	Multiplier	Tolerance
Black	0	0	X1	
Brown	1	1	X10	1%
Red	2	2	X100	2%
Orange	3	3	X1000	
Yellow	4	4	X10000	
Green	5	5	X100000	
Blue	6	6	X1000000	
Violet	7	7		
Grey	8	8	Gold **X0.1**	Gold **5%**
White	9	9	Silver **X0.01**	Silver **10%**

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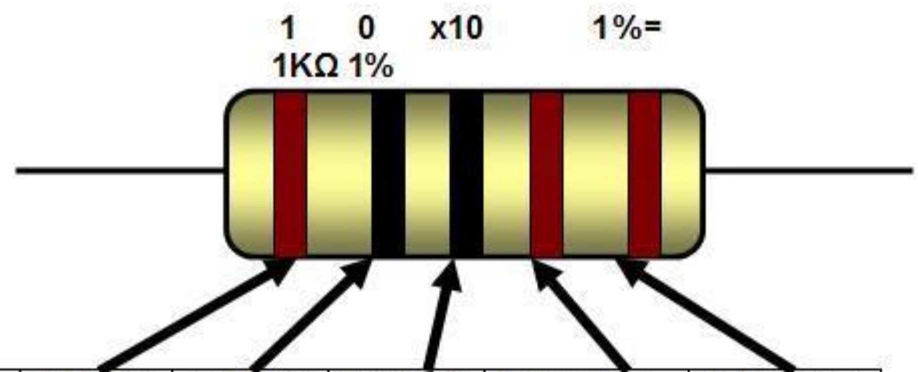
Source: http://electronicszone.net46.net/articles/how-read-resistors

5 Band Resistor Color Chart



Color	1st Digit	2nd Digit	3rd Digit	Multiplier	Tolerance
Black	0	0	0	X1	
Brown	1	1	1	X10	1%
Red	2	2	2	X100	2%
Orange	3	3	3	X1000	
Yellow	4	4	4	X10000	
Green	5	5	5	X100000	
Blue	6	6	6	X1000000	
Violet	7	7	7		
Grey	8	8	8	Gold **X0.1**	Gold **5%**
White	9	9	9	Silver **X0.01**	Silver **10%**

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Source: http://electronicszone.net46.net/articles/how-read-resistors