INSTRUMENTATION WORKSHOP LUNABOTICS 2026

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SOFTWARE TEAM LEADER

INTER BAYAMÓN

AGENDA

- Circuit terminology
- Multimeters & measurements
- Wiring loads
- Bench PSU basics
- Hands on deliverable

CIRCUIT TERMINOLOGY

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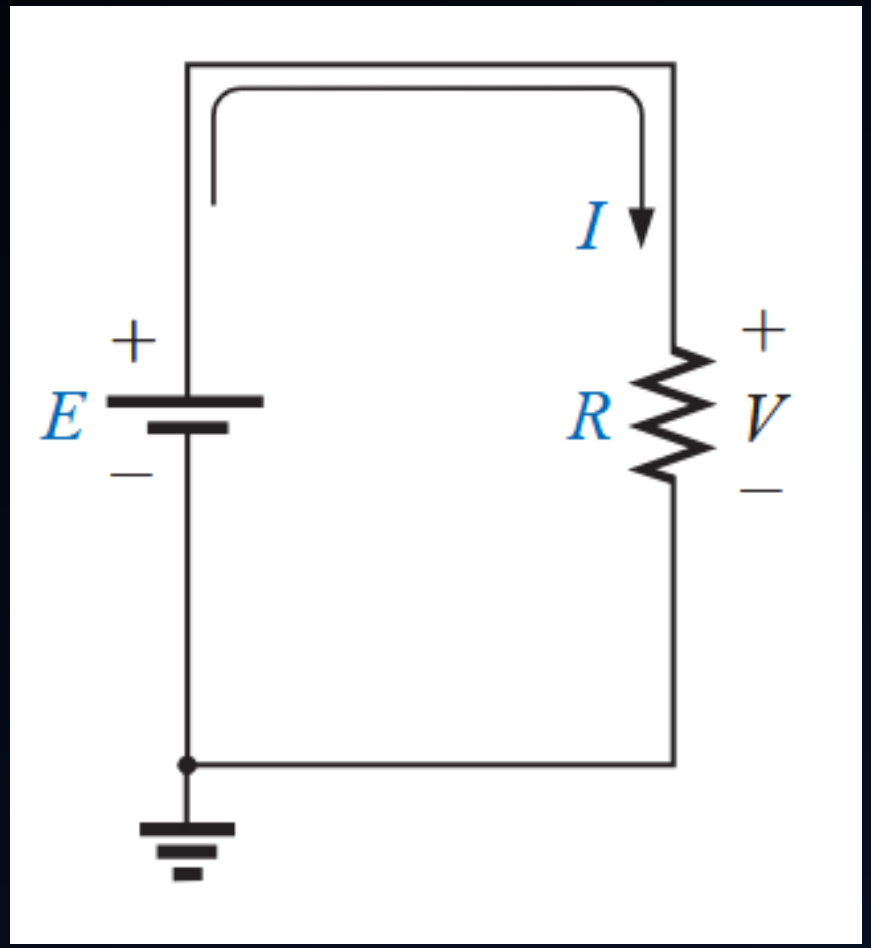


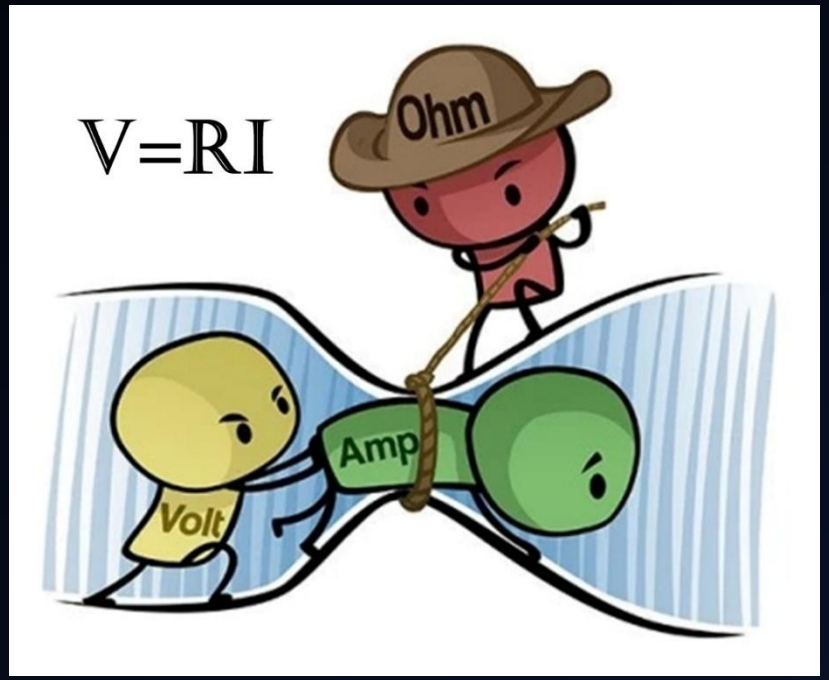
A circuit is a closed path were current can flow; it is essential to be familiar with schematic symbols and terminology to advance in our project

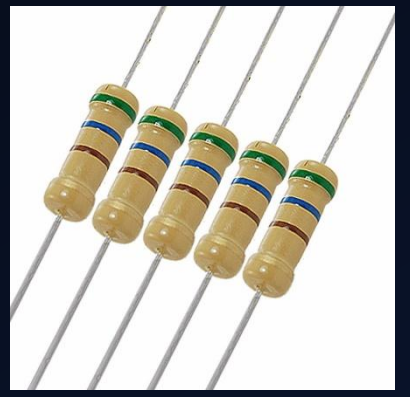
OHMS LAW

V = Voltage (volts)

R = Resistance (ohms)

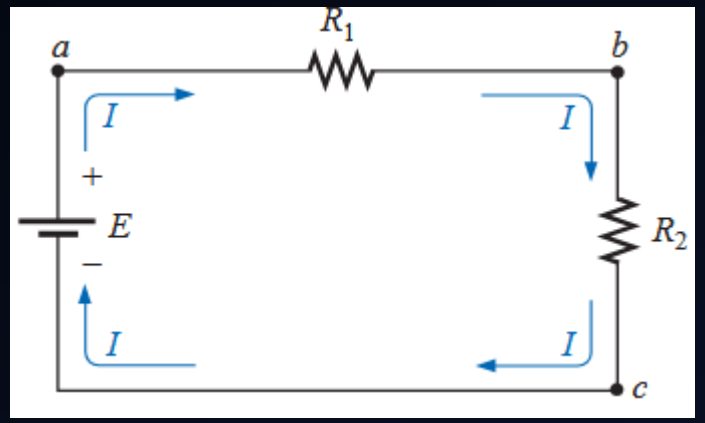
I = Current (Amperes)



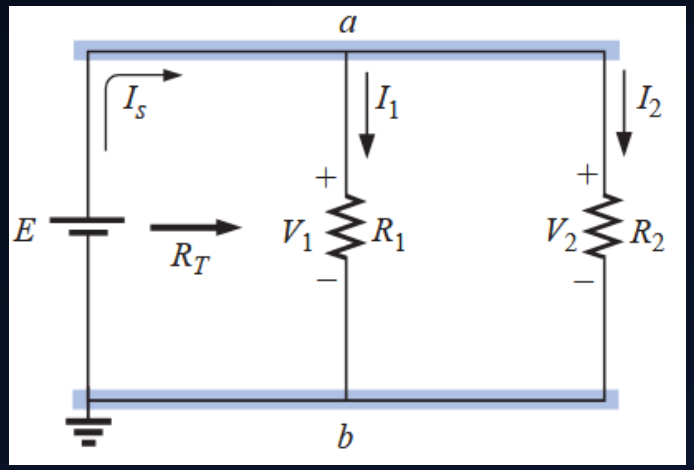


SERIES & PARALLEL CIRCUITS

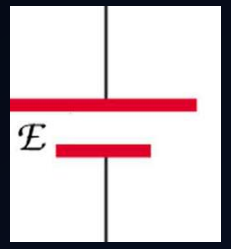
- In a series circuit, the current is the same across all elements but voltage drops across elements

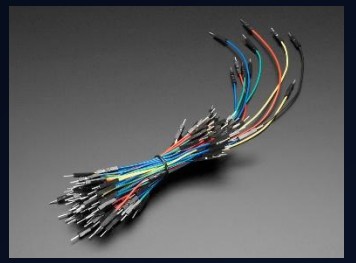


- Parallel circuits all elements have the same voltage but the current divides between them



A FAMILIAR IMAGE…

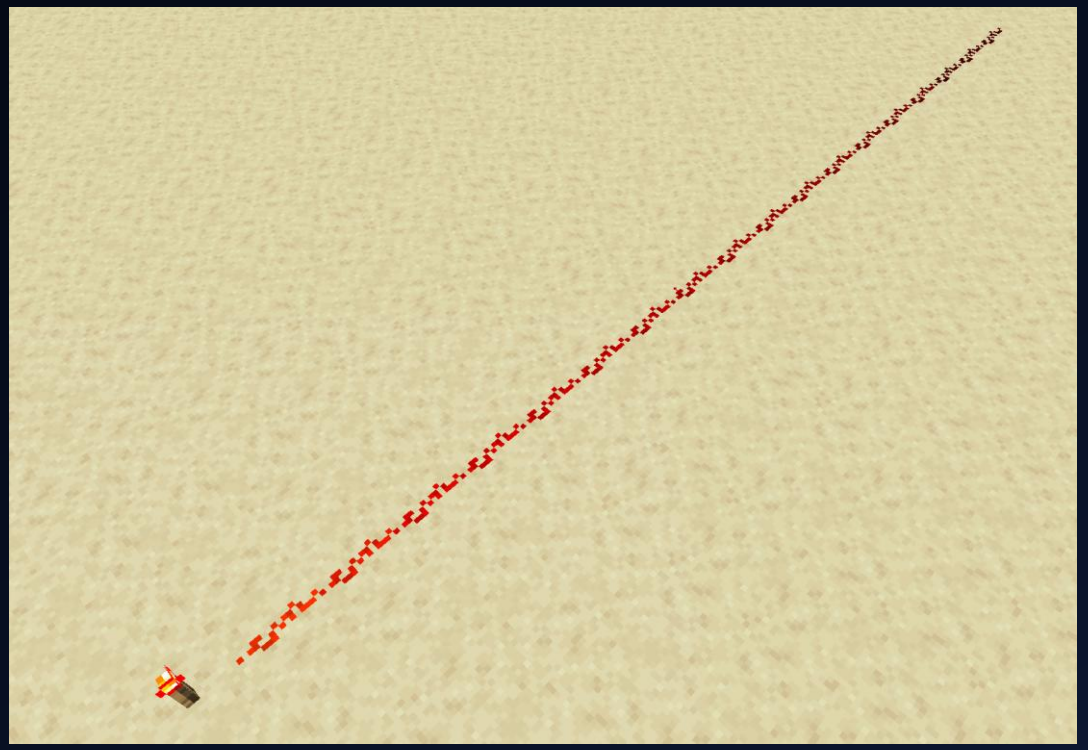




A FAMILIAR IMAGE…

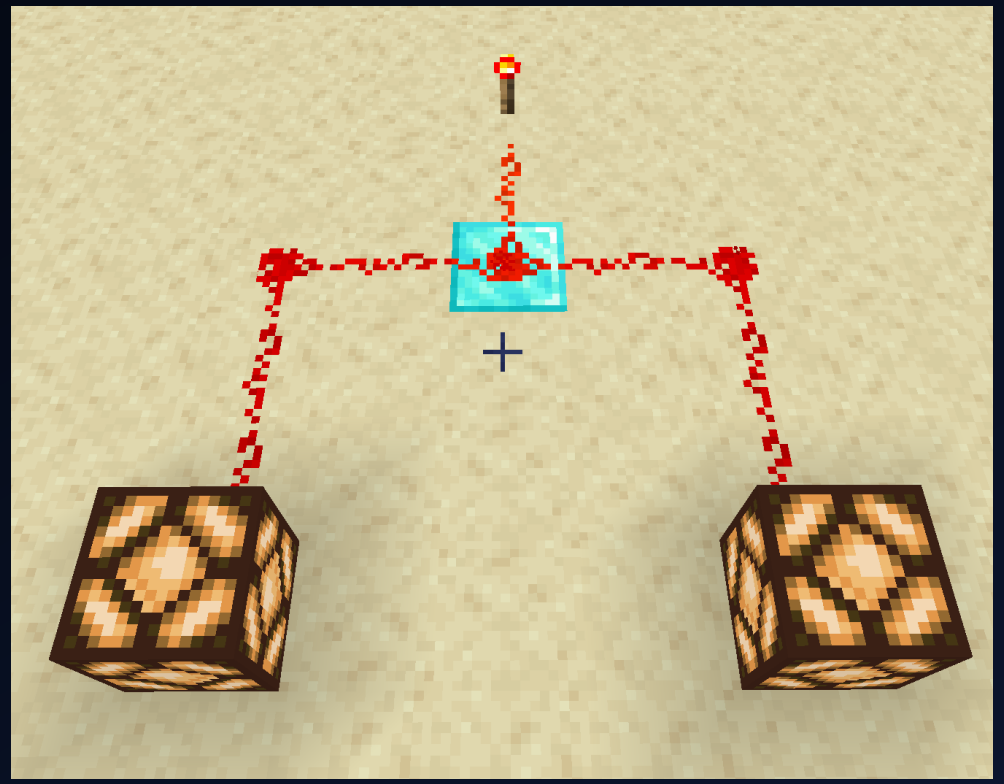
Series circuits have the same current, but voltage drops across loads

- Voltage diminishes as more loads are added in series
- Same current through all loads



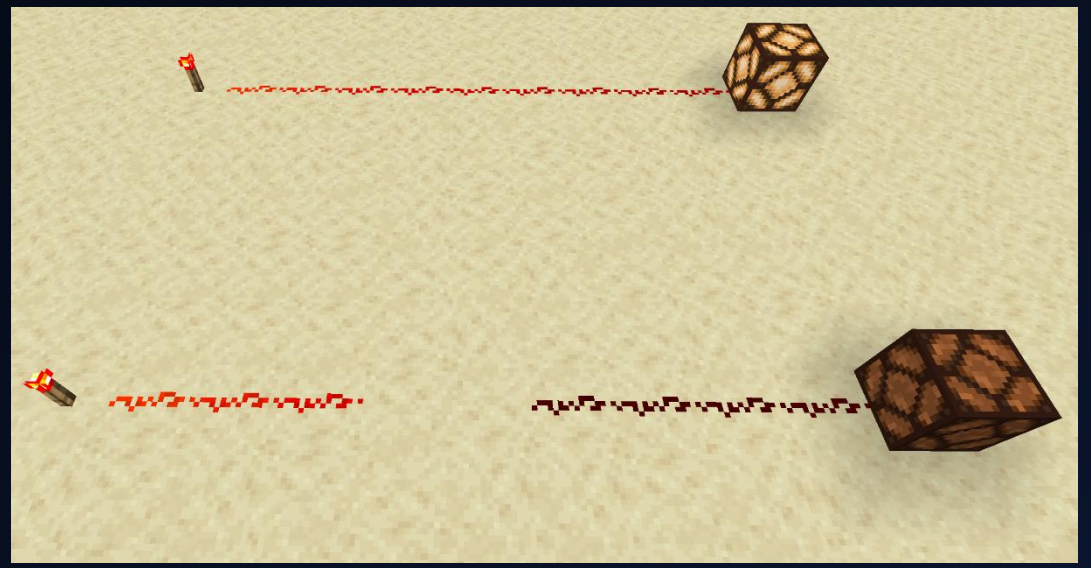
A FAMILIAR IMAGE…

- Parallel circuits have the same voltage for all loads sharing a node
- At the node  the current divides between the lamps



OPEN & CLOSED CIRCUITS

- In a closed circuit, current passes uninterrupted
- In an open circuit, no current can pass

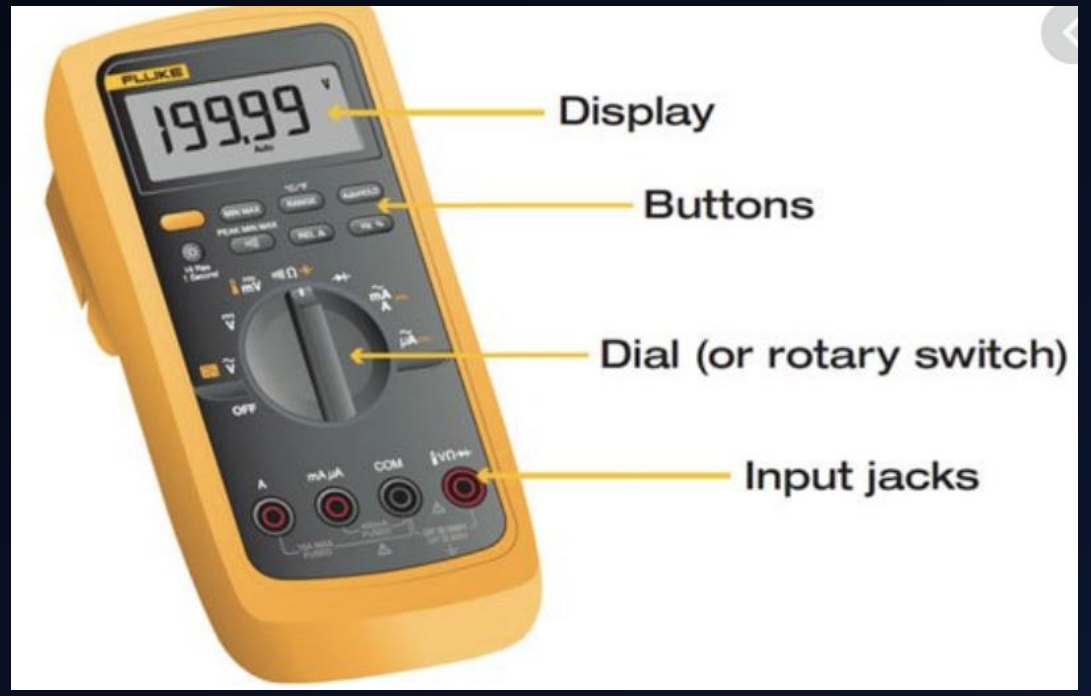


DIGITAL MULTIMETER (DMM)

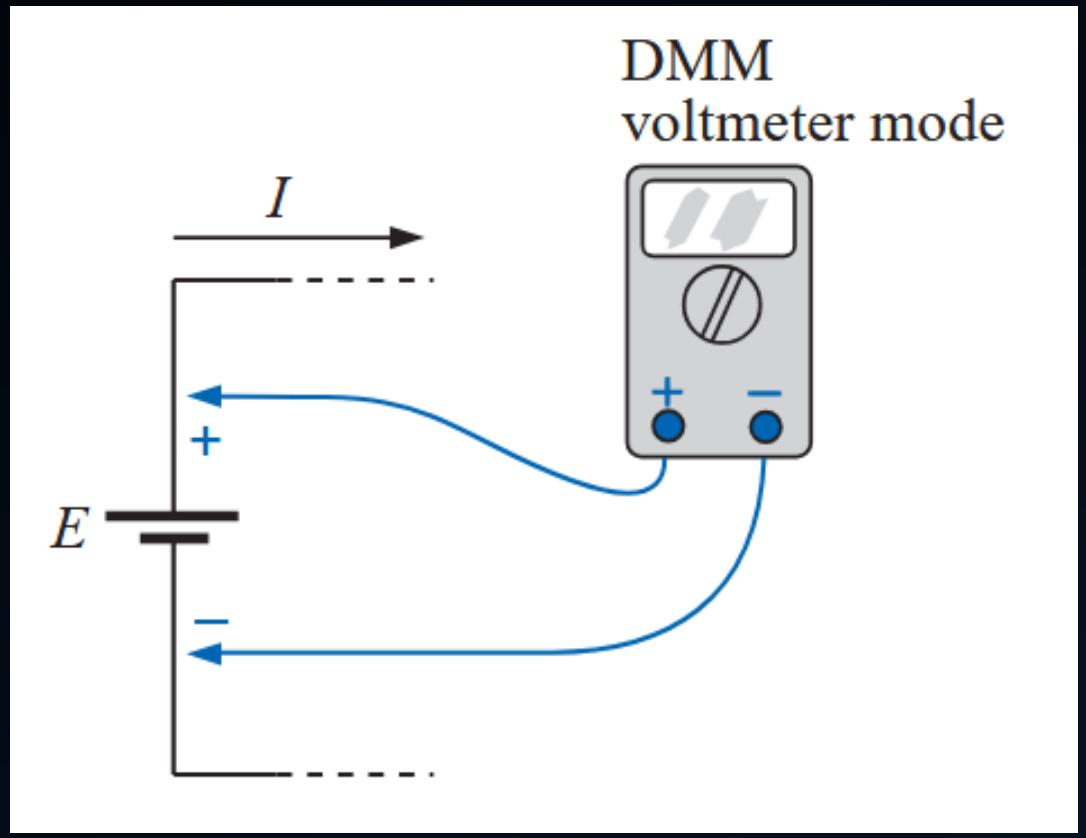
WHY USE A DMM?

"Measure twice, cut once."

- As engineers, it is good practice to always measure
- In our case electronic components are measured with the DMM



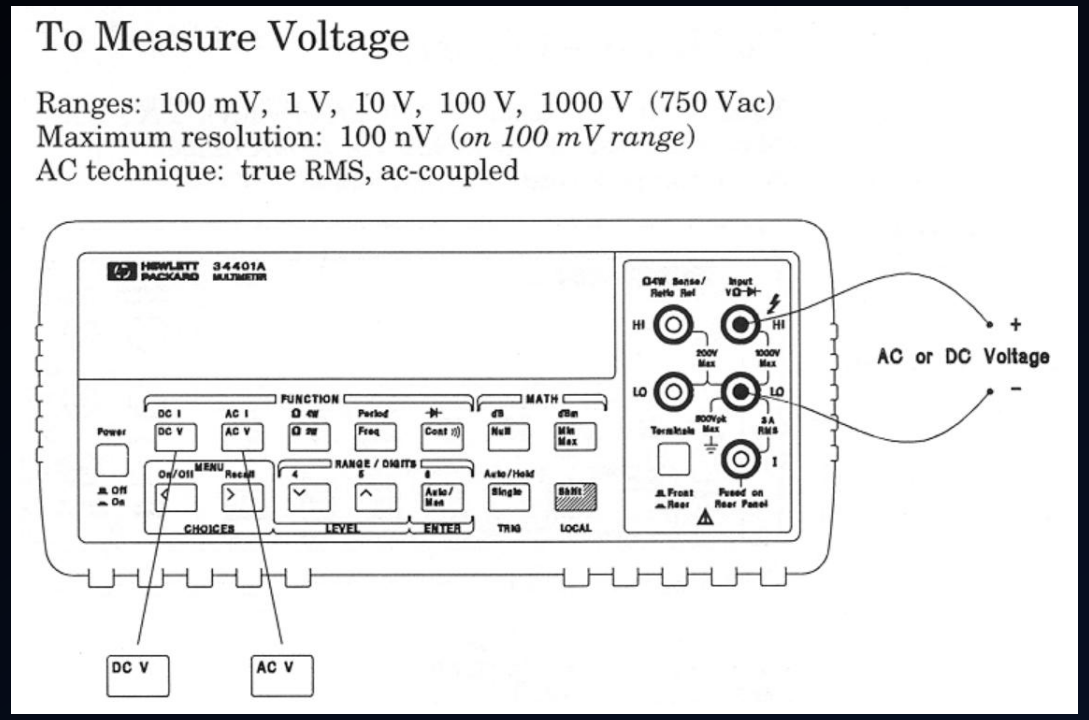
HOW TO USE A DMM?: VOLTAGE MEASSUREMENTS



To measure the potential difference across two points, place the leads in parallel to that element

- Note: A negative sign appears in front of the measurement just means the wires are backwards (this is not an issue)

HOW TO USE A DMM?: VOLTAGE MEASSUREMENTS



Place the black wire in the LO pin, and red wire in the V input pin

- Select DC V for direct current measurements
- If using the front side terminals, make sure the Terminals button is nor pressed down

HOW TO USE A DMM?: CONTINUITY

To verify if two points are connected, put the DMM in continuity mode and probe the two desired points

- A ‘beep’ sound indicates continuity (closed circuit)
- No beep indicates no continuity (open circuit)

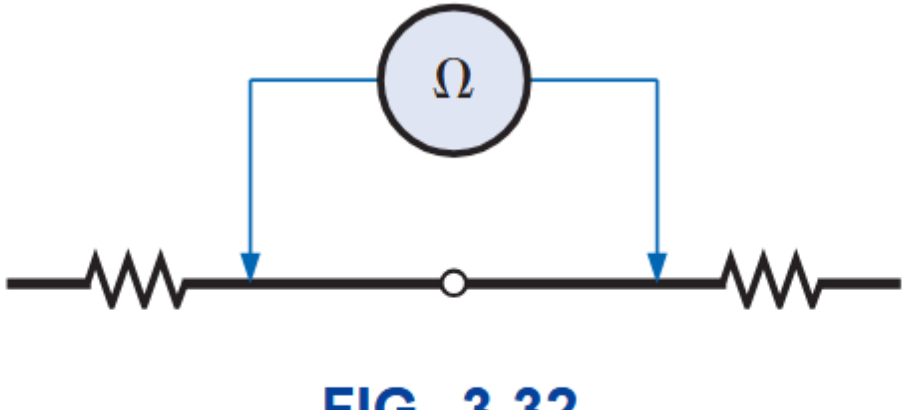


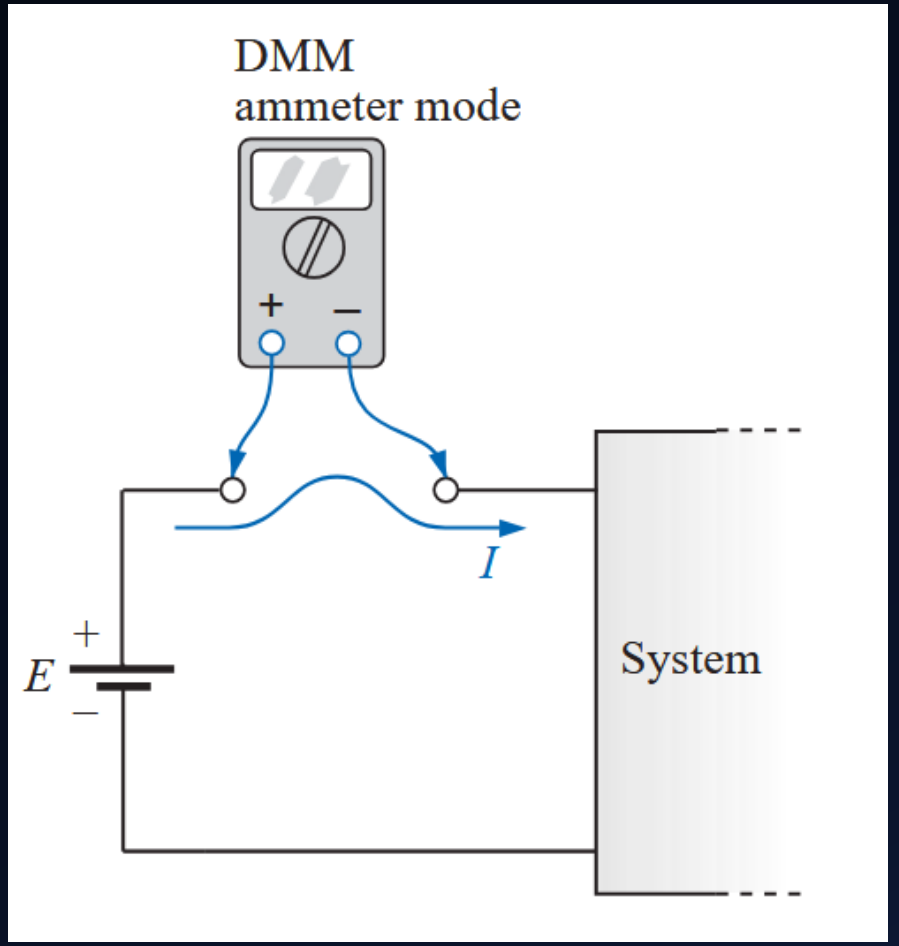
FIG. 3.32

Checking the continuity of a connection.

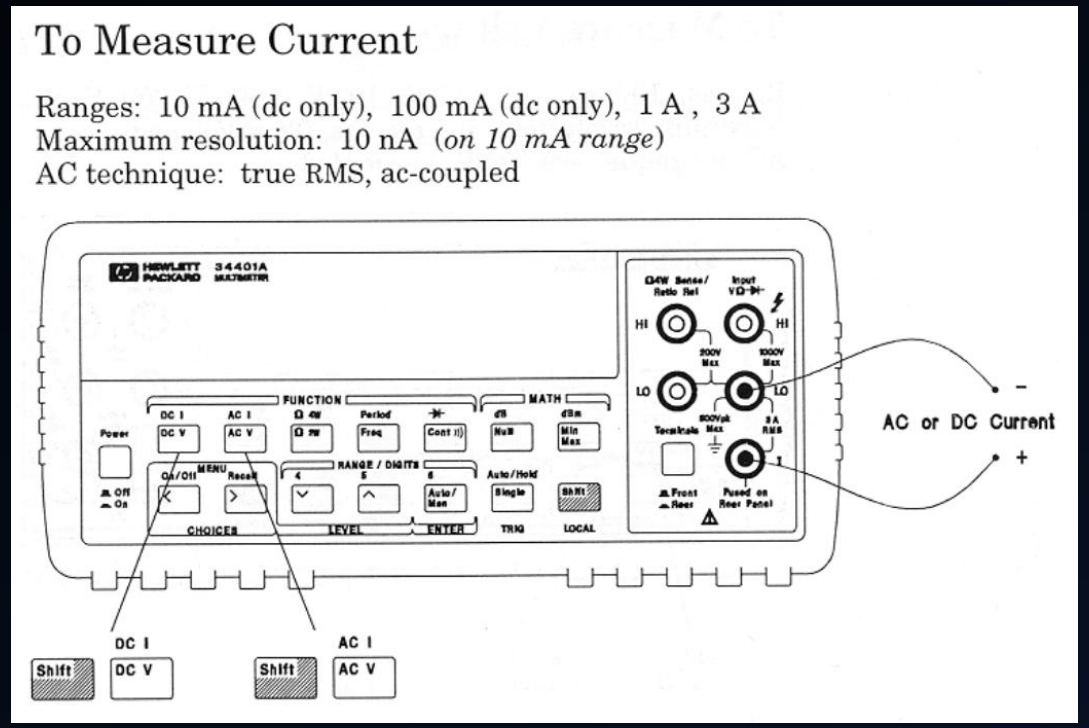
HOW TO USE A DMM?: CURRENT MEASSUREMENTS

Current is always measured in series

- The low resistance in the Ammeter mode of the DMM completes the circuit without causing disturbance



HOW TO USE A DMM?: CURRENT MEASSUREMENTS



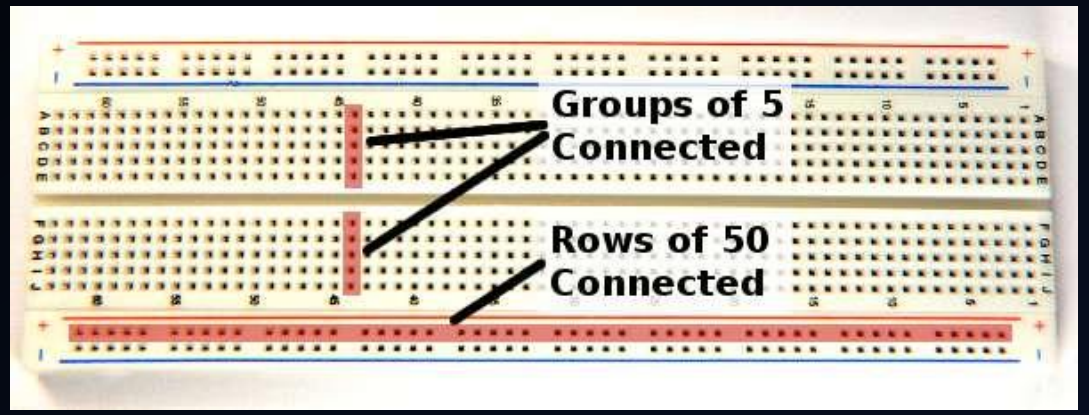
- Press the shift key, then DC V
- Place the black lead on the LO terminal, and the red lead on the “Fused on Rear Panel” terminal marked by a capital I

DO NOT MEASSURE CURRENT IN PARALLEL, DOING SO MAY DAMAGE THE DMM

SO WHAT IF CURRENT IS MEASSURED IN PARALLEL?....

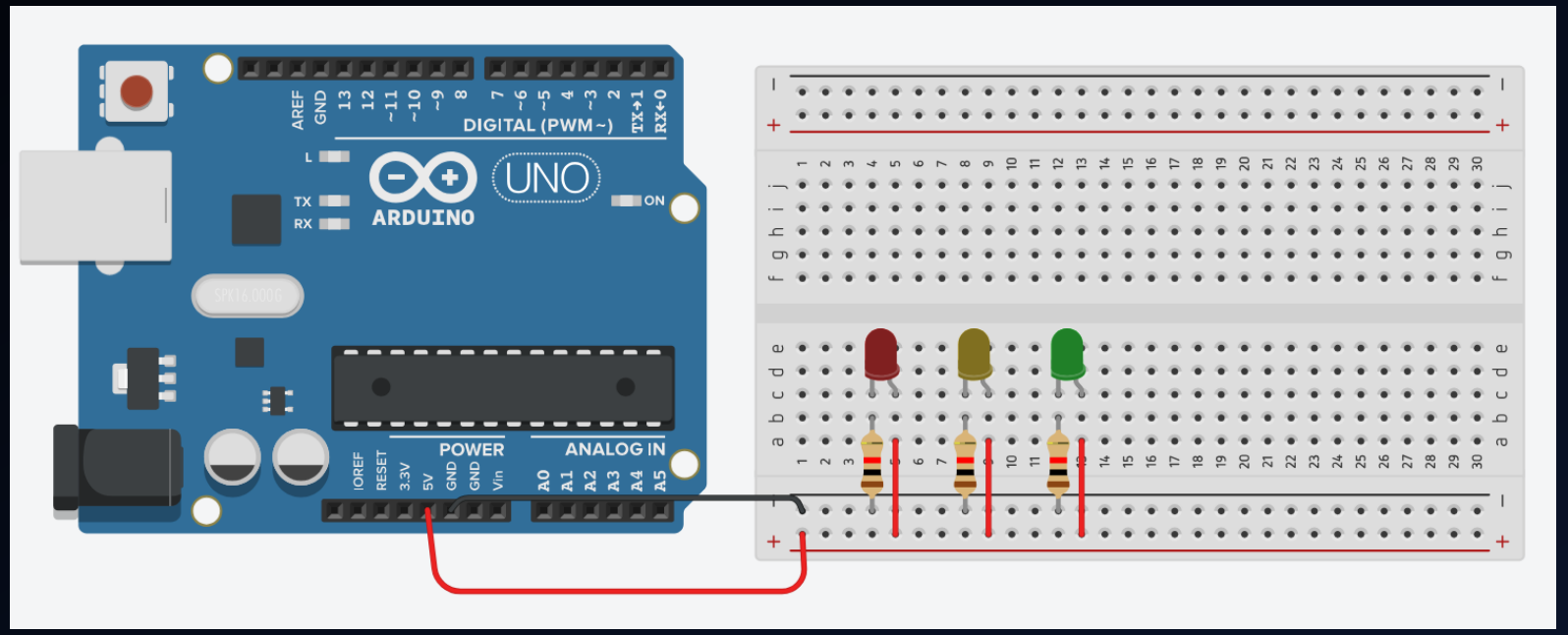
WIRING LOADS

HOW TO USE A BREADBOARD

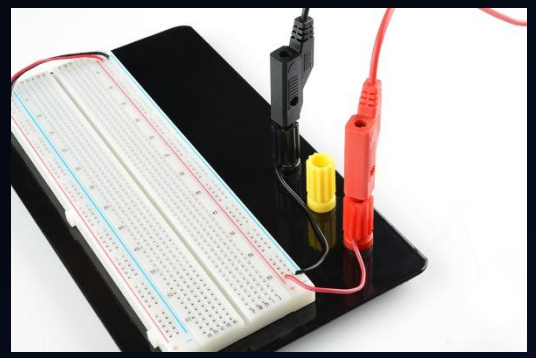


- Numbered rows are connected internally
- + & - Rows serve as a bus, placing one positive and ground wire respectively will power the rails

AN EXAMPLE…


AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM~)
L
TX
RX
ARDUINO
UNO
ON
POWER
ANALOG IN
IOREF
RESET
3.3V
5V
GND
GND
Vin
A0
A1
A2
A3
A4
A5

BANANA WIRES



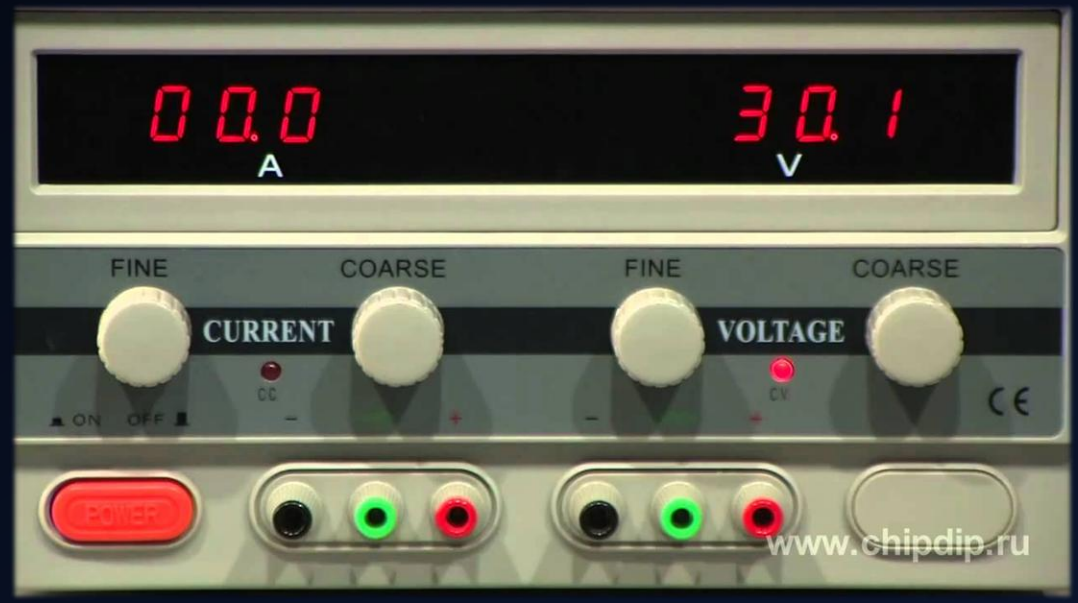
- These wires will com from the PSU into the breadboard
- From the breadboard terminal, jumpers can be added

BENCH PSU & SAFETY

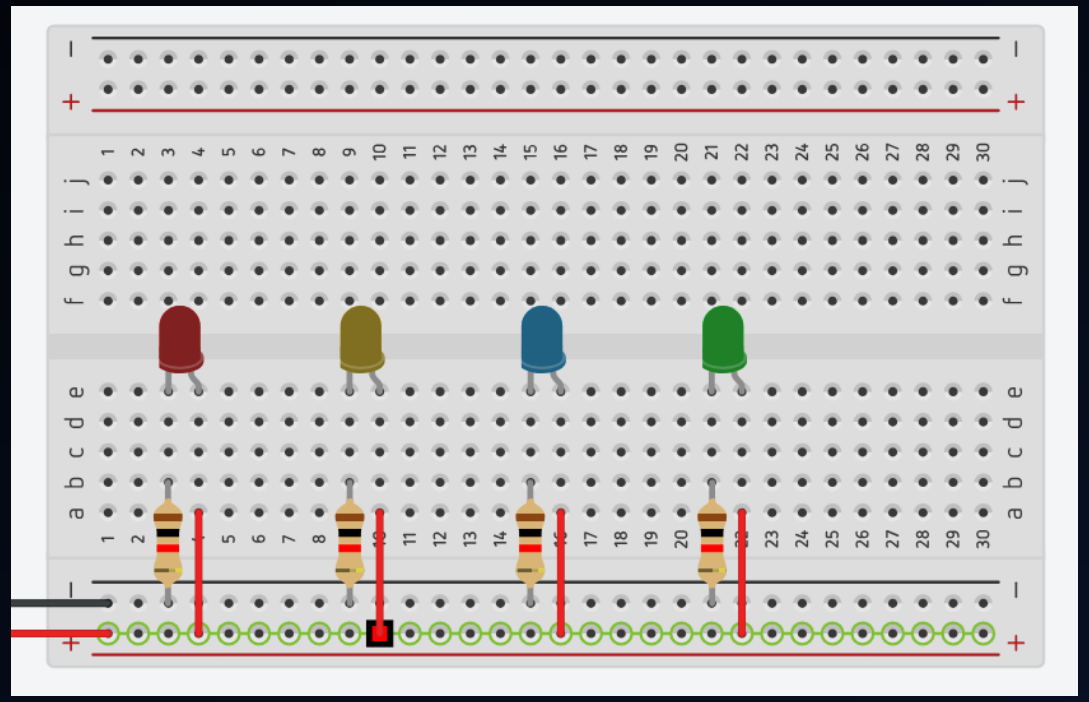
BENCH PSU BASICS

The PSU found at the CUNAR Lab is a current limiting PSU

- (+) - Positive terminal
- (-) – Negative terminal



Hands on activity #1: Voltage measurement

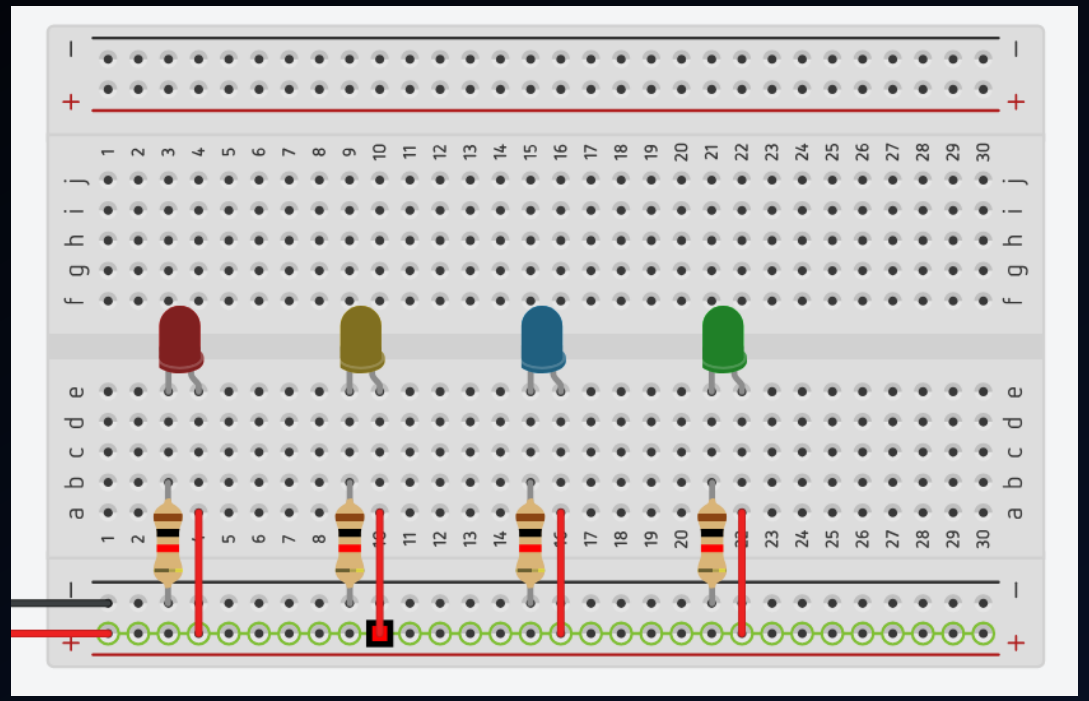


- Power on the LEDs with the breadboard using four 220Ω resistors in the arrangement seen in the picture

a) Measure the source voltage

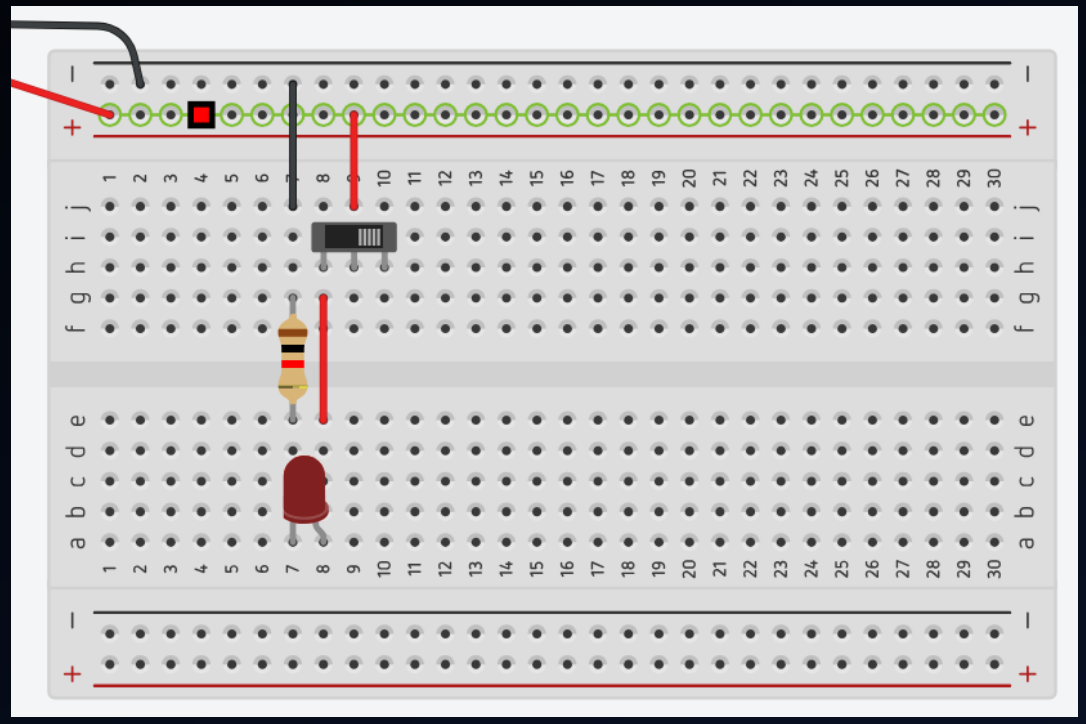
b) Measure the voltage across each LED

Hands on activity #2: Resistance measurement



- Turn off the power supply before measuring
- Measure the voltage drop across each resistor

Hands on activity #3: Current measurement



Lift the jumper wire and measure the current going throught the resistor and LED

KEY TAKEAWAYS

- Electricity isn’t dangerous, arrogance is
- Set PSU voltage and current knob all the way to the left before powering on (0v and 0A)
- Always assume circuits are energized
- Disconnect/Turn off any voltage source when touching the circuit
- If unsure, do not power the circuit. It is good practice to ask your “elders” (no one will nor are supposed to judge you)
- When leaving the lab, turn off equipment and multiplug on the wall
- DO NOT MEASSURE CURRENT IN PARALLEL!!!