



# LAB INTRODUCTION & INSTRUCTIONS

EE-100 Electric Circuits Laboratory

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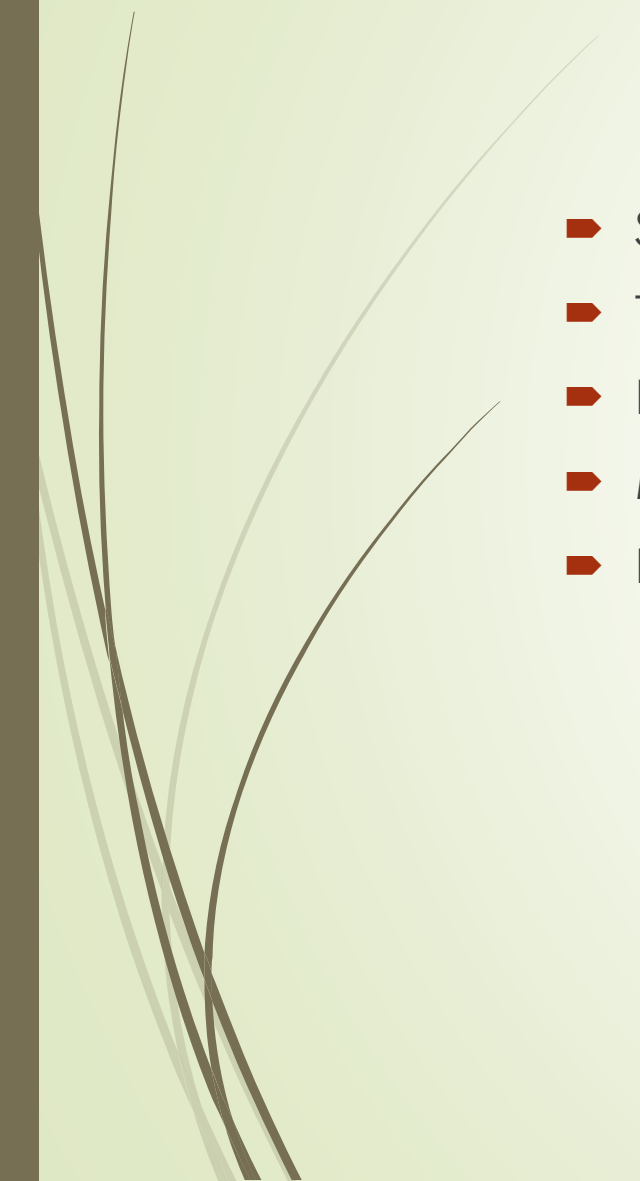
# EE-100 Electric Circuits Lab



- Introduction to lab equipment: Digital multimeter (DMM), function generator, oscilloscope, breadboard, power supply, probes etc.
- Equivalent resistance measurement
- Series and parallel resistance combinations
- Voltage and current division rules
- Kirchhoff's laws
- Internal resistance of a voltage source
- Nodal and mesh analysis



# EE-100 Electric Circuits Lab

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- Superposition theorem
  - Thevenin theorem
  - Norton theorem
  - Maximum power transfer theorem
  - Equivalent capacitances and inductances

# Learning Outcomes

CLOs	Description Students will be able to	PLOs
CLO1	Evaluate and analyze the operation of electric circuits.	PLO 01 Engineering Knowledge
CLO2	Apply the lab practices to form mini projects.	PLO 02 Problem Analysis

## PEC PLO/Graduate attributes

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of solutions
4. Investigation
5. Modern tool Usage
6. The Engineering and society
7. Environmental and sustainability
8. Ethics
9. Individual and team work
10. Communication
11. Project management
12. Lifelong Learning

# Marks, Letter Grades & Corresponding Grade Points

Marks	90 or above	85-89	80-84	75-79	70-74	65-69	60-64	55-59	50-54	45-49	44 or below
Letter Grades	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Grade Points	4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	1.0	-

# Marks Distribution\*

	Performance	Manual	Mid Assessment	Final Assessment	Total
Marks	26	39	15	20	100

\*may subject to vary





# Regarding Lab Performance

- Your behavior and attitude will be observed throughout the lab.

Includes

- talking during the instructions
  - non-serious attitude
  - strolling in the lab needlessly
  - using cell phones
  - staying outside the lab without any reason
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- You do not need my permission to go outside for a while.

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- In case of having a problem, ask the lab supervisor.
  - Take care of the lab timings. Attendance of late comers will not be marked.
  - Zero performance mark will be awarded if any student is found using mobile phone.
  - The teamwork and the approach with which each group is conducting the experiment will be evaluated. Includes minimal guidance too.



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- ▶ Engage actively and cooperate with other group members in an effective manner.



Divide your task and shuffle on regular basis

- ▶ performing the calculations
- ▶ implementing the circuit hardware
- ▶ collection of readings/data



# Regarding the Experiment

- After the lab instructions, each group take a seat on the tables and only one student from each group issues the apparatus from the lab supervisor.
- While issuing the lab apparatus, submit your student ID card to the lab supervisor and collect it when you return the apparatus back to him.
- Once you issue the apparatus, check the apparatus first by using the digital multimeter/LC meter i.e. measure the resistance, capacitance, inductance, checking the functionality of the diode, transistor, op-amp, probes etc.

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- ▶ Every student will be required to show the readings/observations after the lab.
  - ▶ Handling of the apparatus, precision/accuracy of the results will be assessed.
  - ▶ Make sure that each group return the apparatus back to the lab supervisor before leaving the lab.
  - ▶ You might be asked some questions after the lab is done.



# Regarding Lab Manuals

- On a weekly basis, submit your manual to the lab supervisor before the start of the lab. No need to put a file cover. Staple it.
- Attach graph paper or A4 pages for the derivations / calculations / graphs / results / observations / conclusion / summary.
- Keep the marked reports intact. In the end you will be asked to bind the whole lab manual.
- Copied manuals will **not** be marked.



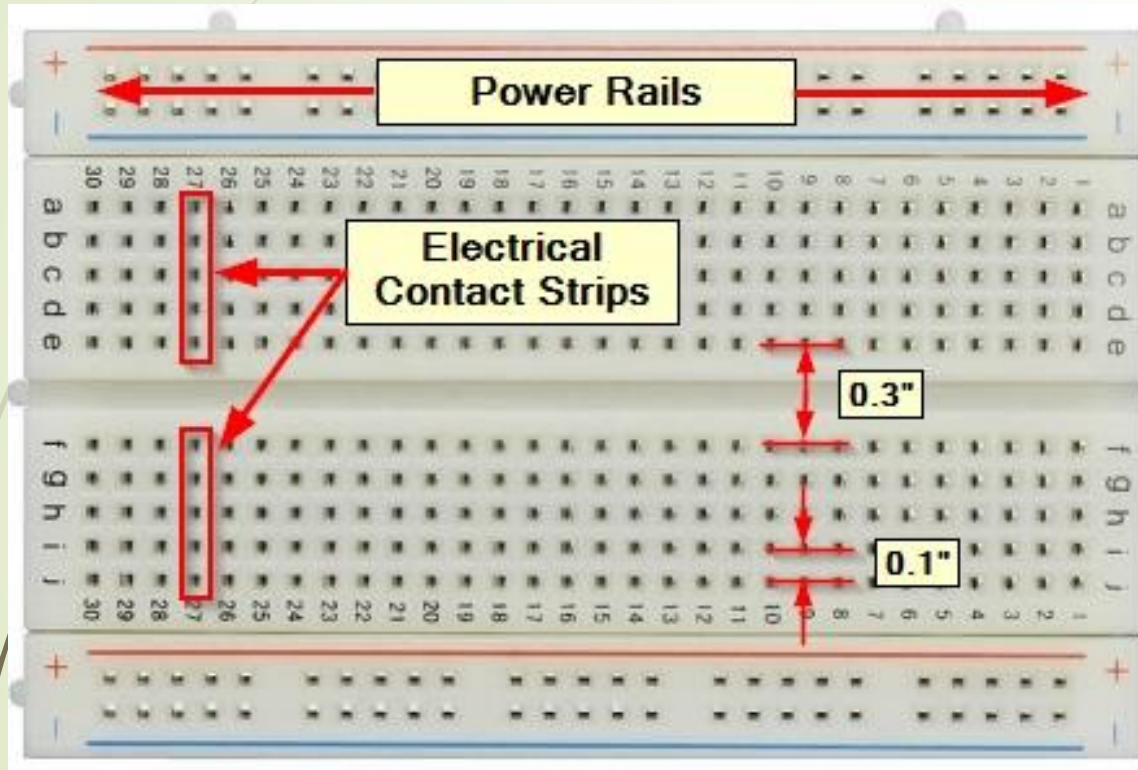
# Lab Equipment

Usually you will come across with the following lab equipment

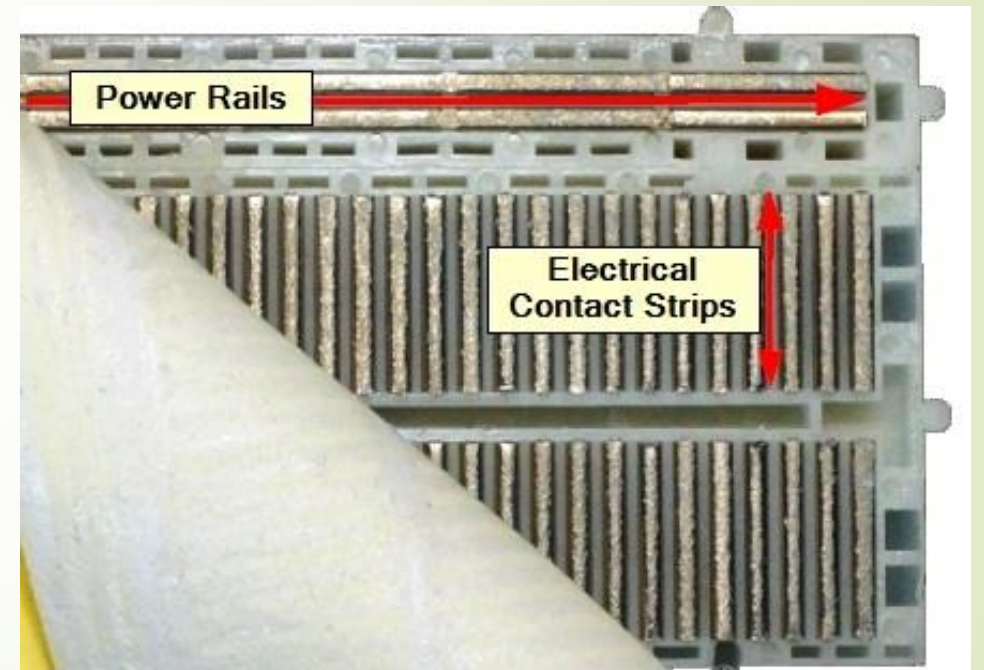
- Breadboard
- Power supply
- Digital multimeter
- Function generator
- Oscilloscope



# Breadboard configuration



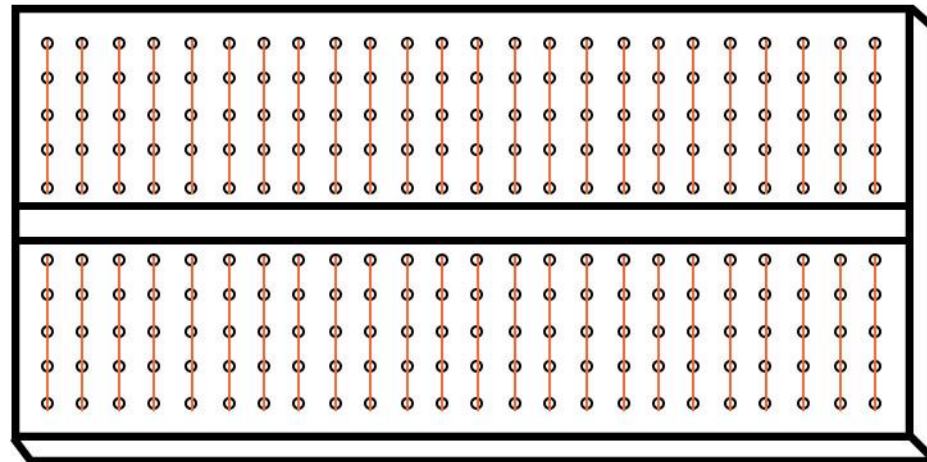
Features



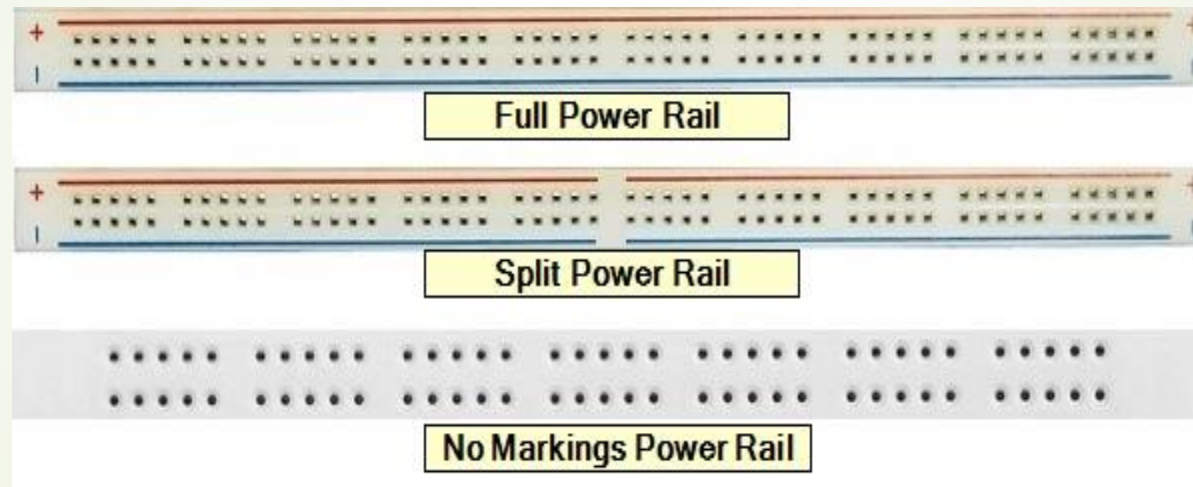
Inside view

# Breadboard configuration

Lines show common connections underneath board between holes



# Breadboard configuration



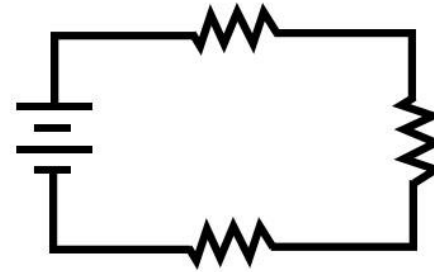
Power rail types



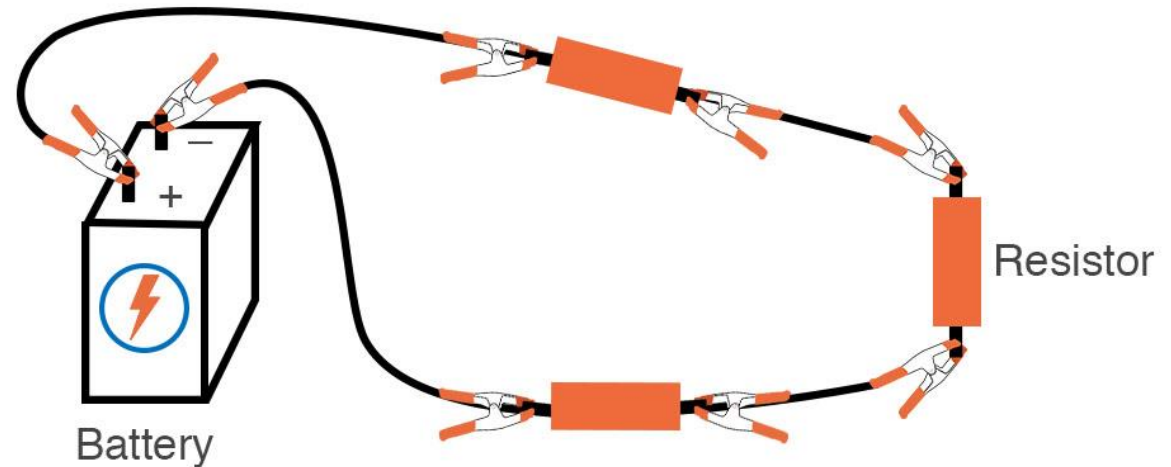
# Interpretation of a circuit diagram

- Current always flows through a closed loop path.
- No current will flow if there is an open circuit.
- Open circuit corresponds to infinite resistance.
- Short circuit corresponds to zero resistance.

Schematic diagram

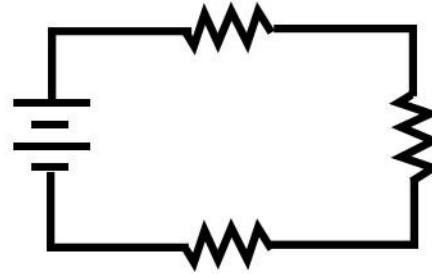


Real circuit using jumper wires

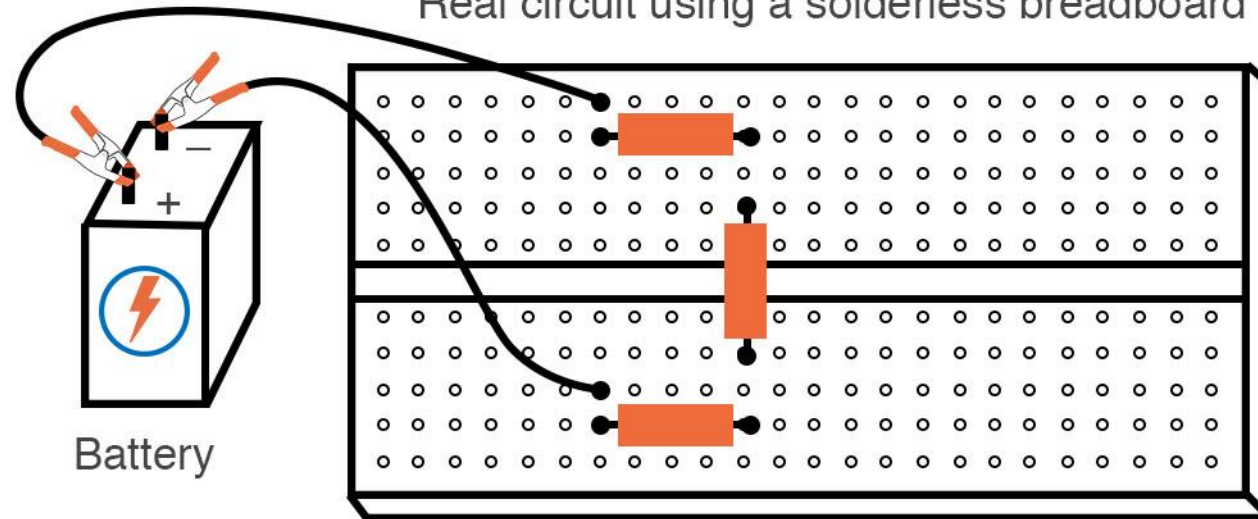


# Series connection (1<sup>st</sup> approach)

Schematic diagram

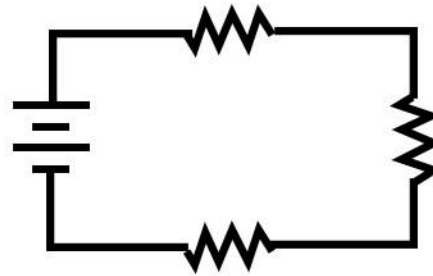


Real circuit using a solderless breadboard

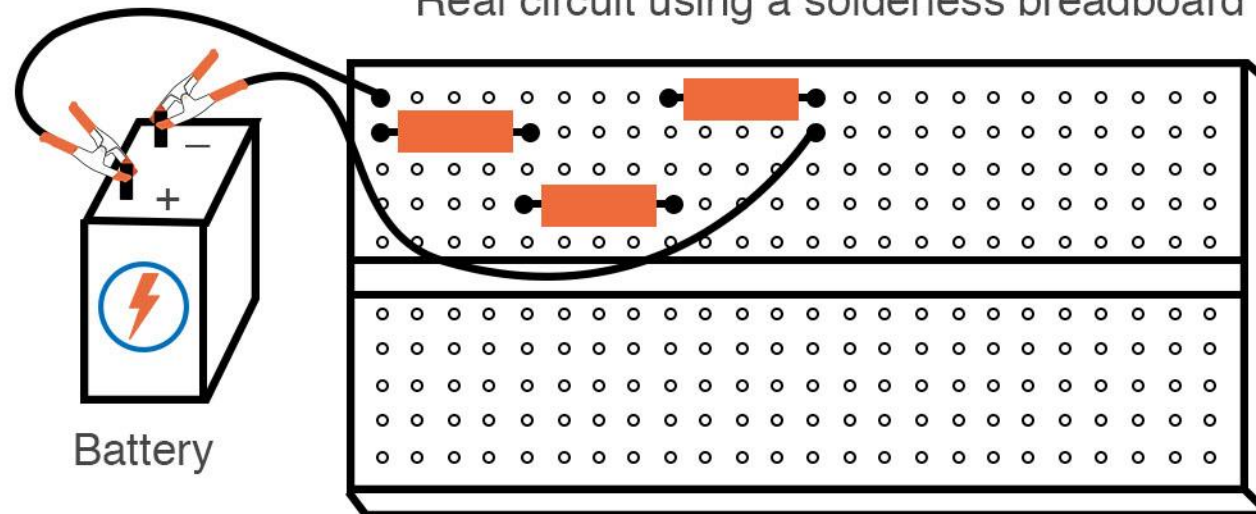


# Series connection (2<sup>nd</sup> approach)

Schematic diagram

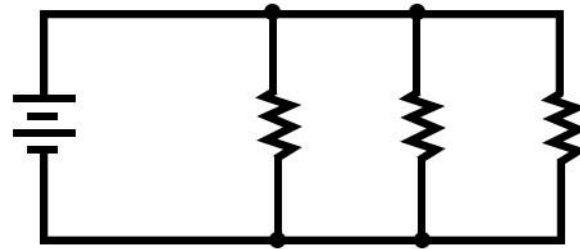


Real circuit using a solderless breadboard

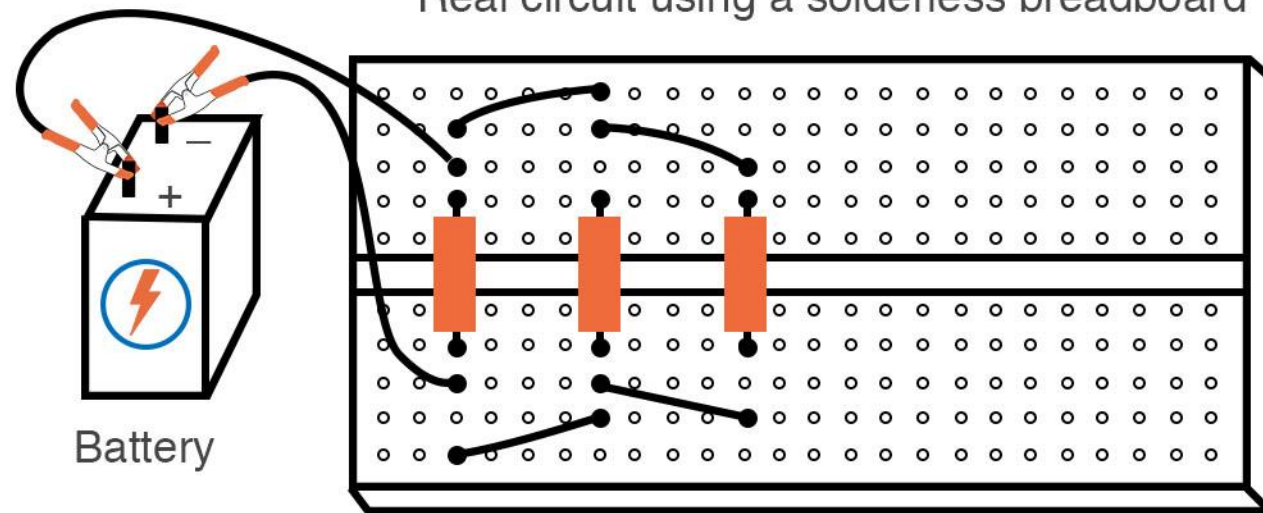


# Parallel connection

Schematic diagram

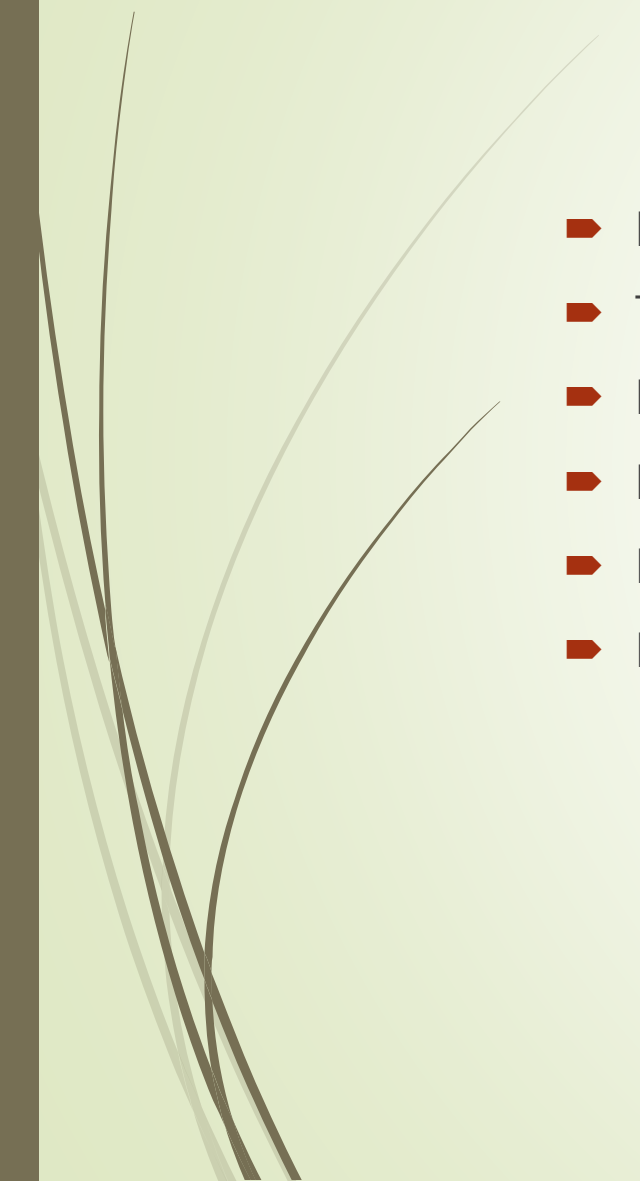


Real circuit using a solderless breadboard





# Terminologies

- Frequency
  - Time period
  - Peak value or maximum value
  - Peak to peak value
  - Root mean square value
  - Relation among them
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# DC power supply

- DC Power Supply is used to generate either a constant voltage or a constant current.
- That is, it may be used as either a DC voltage source or a DC current source.
- You will primarily use it as a voltage source.
- Knobs: **Coarse** & **Fine**





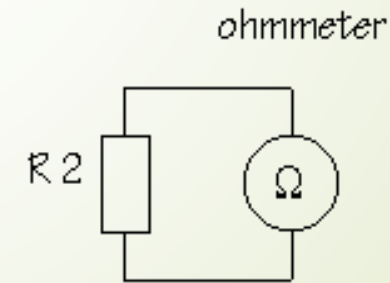
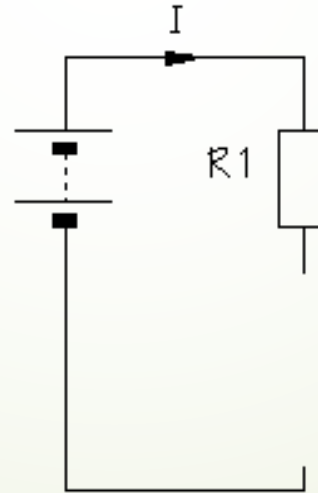
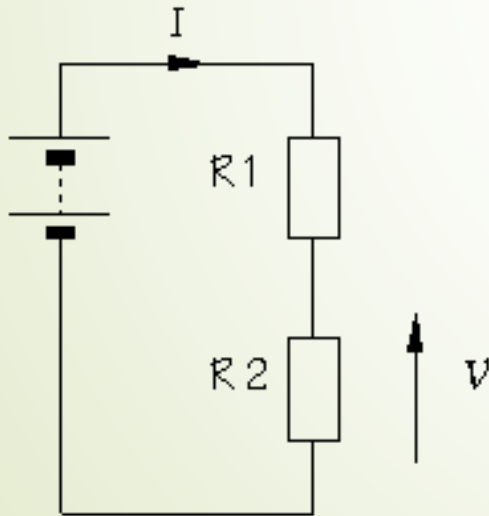
# Digital Multimeter (DMM)

- Can be used for different purposes,
- As an ammeter, voltmeter, ohmmeter, to measure the capacitance, dc current gain of a transistor etc.
- Take care of the probes connection when using it for a particular purpose.
- When connected to ac supply, it gives the readings in rms value.



# Digital Multimeter as an ohmmeter

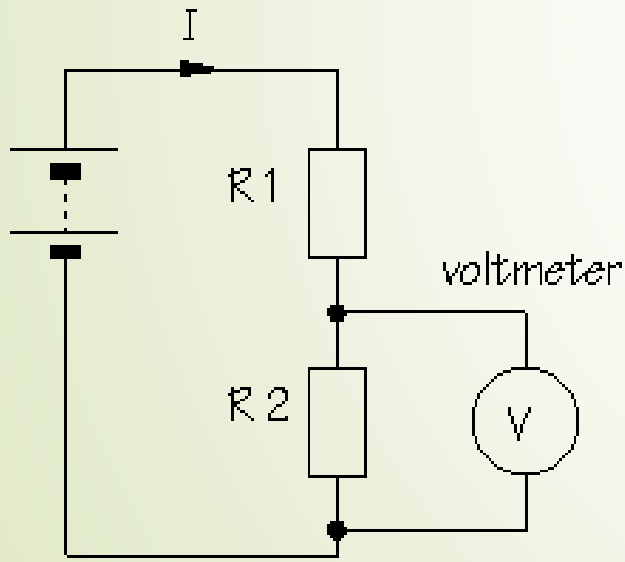
- An ohmmeter does not function with a circuit connected to a power supply.
- If you try this with the component connected into a circuit with a power supply, the most likely result is that the meter will be damaged.
- Most multimeters have a fuse to help protect against misuse.
- Ohmmeters work by passing a current through the component being tested and measuring the voltage produced.



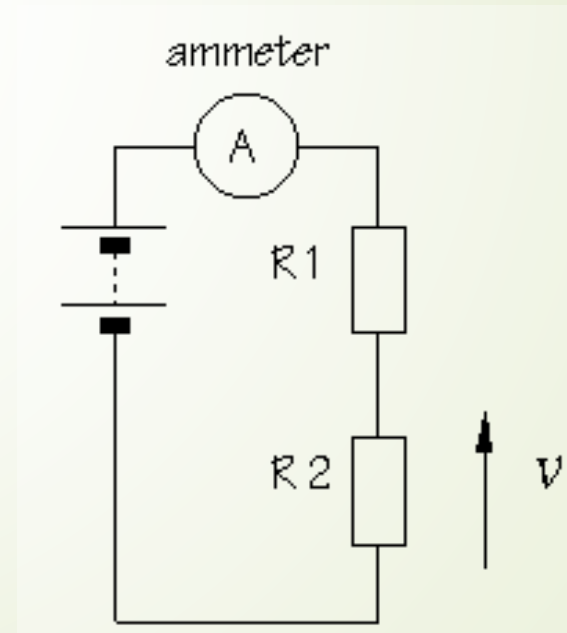


# Digital Multimeter as a voltmeter and an ammeter

- When using as a **voltmeter**, always connect it in a parallel fashion.
- You do **NOT** need to break the circuit.



- When using as an **ammeter**, always connect it in series.
- You **need** to break the circuit.
- Fuse will blow off if connected in parallel.



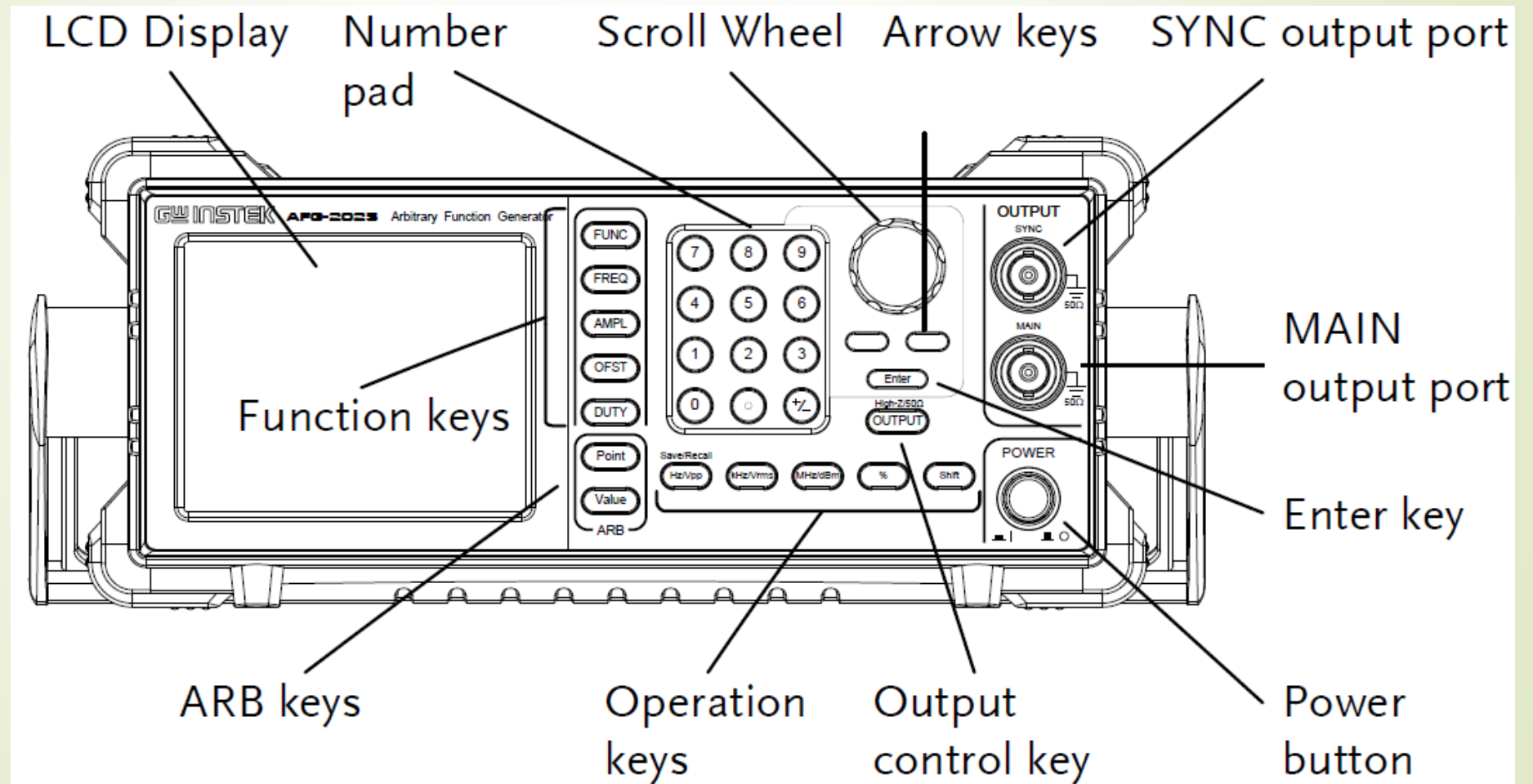


# Function Generator



- A device that can produce various patterns of voltage at different frequencies and amplitudes.
- Most function generators allow the user to choose the shape of the output from a small number of options.
- Square wave, Sine wave, Triangle wave, Noise
- Waveform parameter setting through 1) Numeric Keypad Entry & 2) Knob Selection
- Duty cycle (square & triangular wave)
- Offset voltage

# Front panel of a function generator



Detailed description can be studied from the user manual

# Setting frequency on a function generator

## Setting the Frequency

Panel Operation

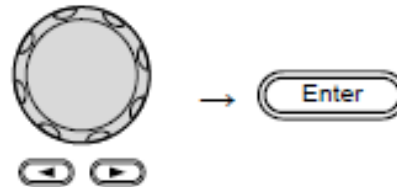
1. Press the **FREQ** key.



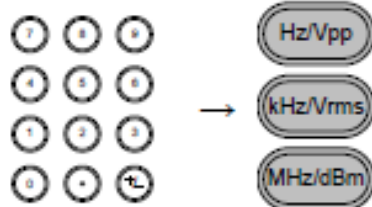
2. The **FREQ** icon will flash in the frequency display area.



3. Use the arrow keys, scroll wheel and Enter key to edit the frequency.

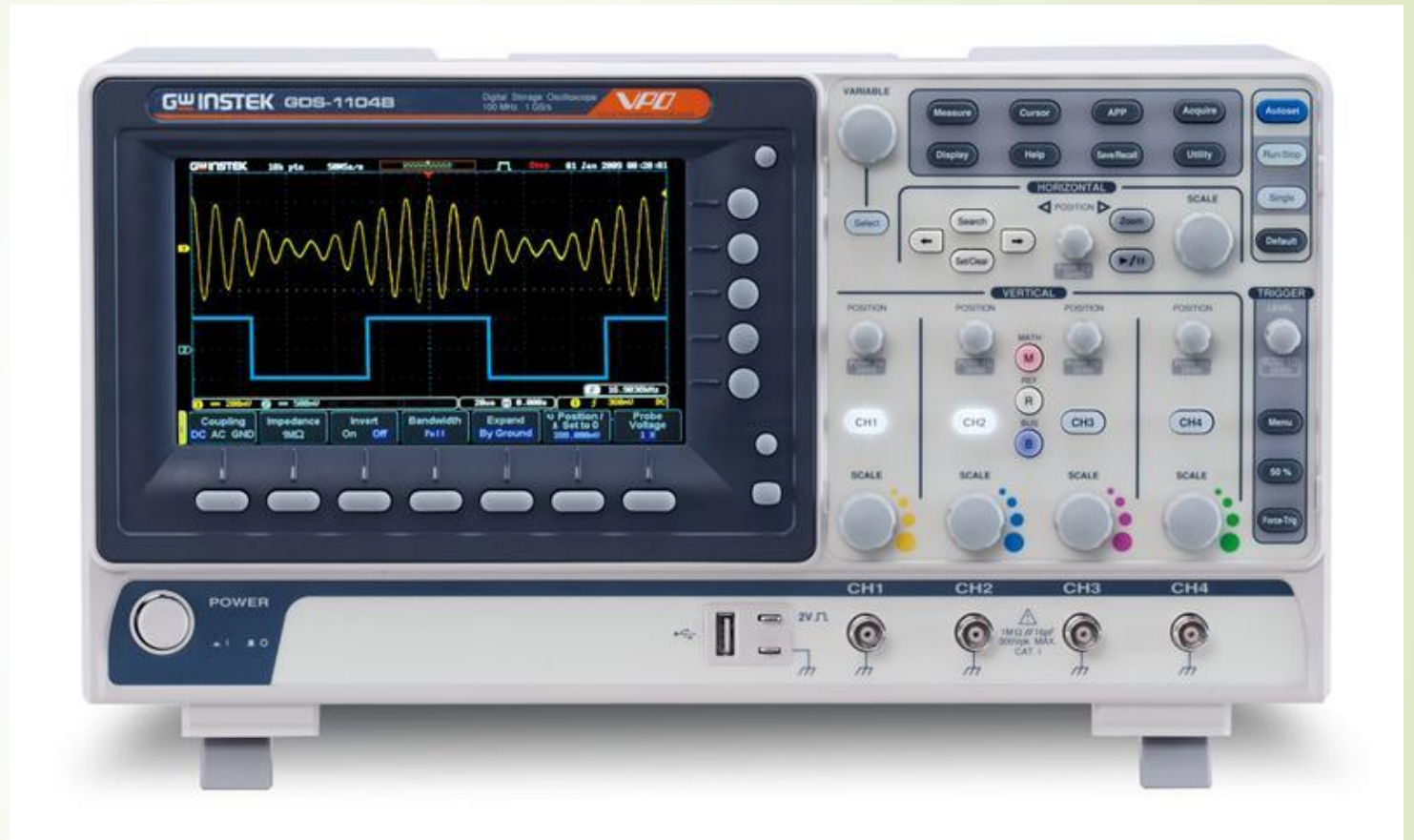


Use the keypad and the relevant unit key to enter a new frequency.



# Oscilloscope

- A device that shows the input/output waveforms.
- Has different channels.
- It provides horizontal control such as varying time axis scale/position.
- Also provides vertical control such as varying voltage axis scale/position.
- You may save the waveforms in USBs.



Detailed description can be studied from the user manual





# Google classroom (Section A)

- You will get all the announcements and information.
- Visit <https://classroom.google.com/> and then go to “Join class”.
- You may download this app from Play Store in your cell phones to get timely notifications.
- Add the following code

**ntvofc3**



# Google classroom (Section B)

- You will get all the announcements and information.
- Visit <https://classroom.google.com/> and then go to “Join class”.
- You may download this app from Play Store in your cell phones to get timely notifications.
- Add the following code

**ks2jsfy**