SCS3101 –Electronics Lectures

Measuring Equipments in Electronics

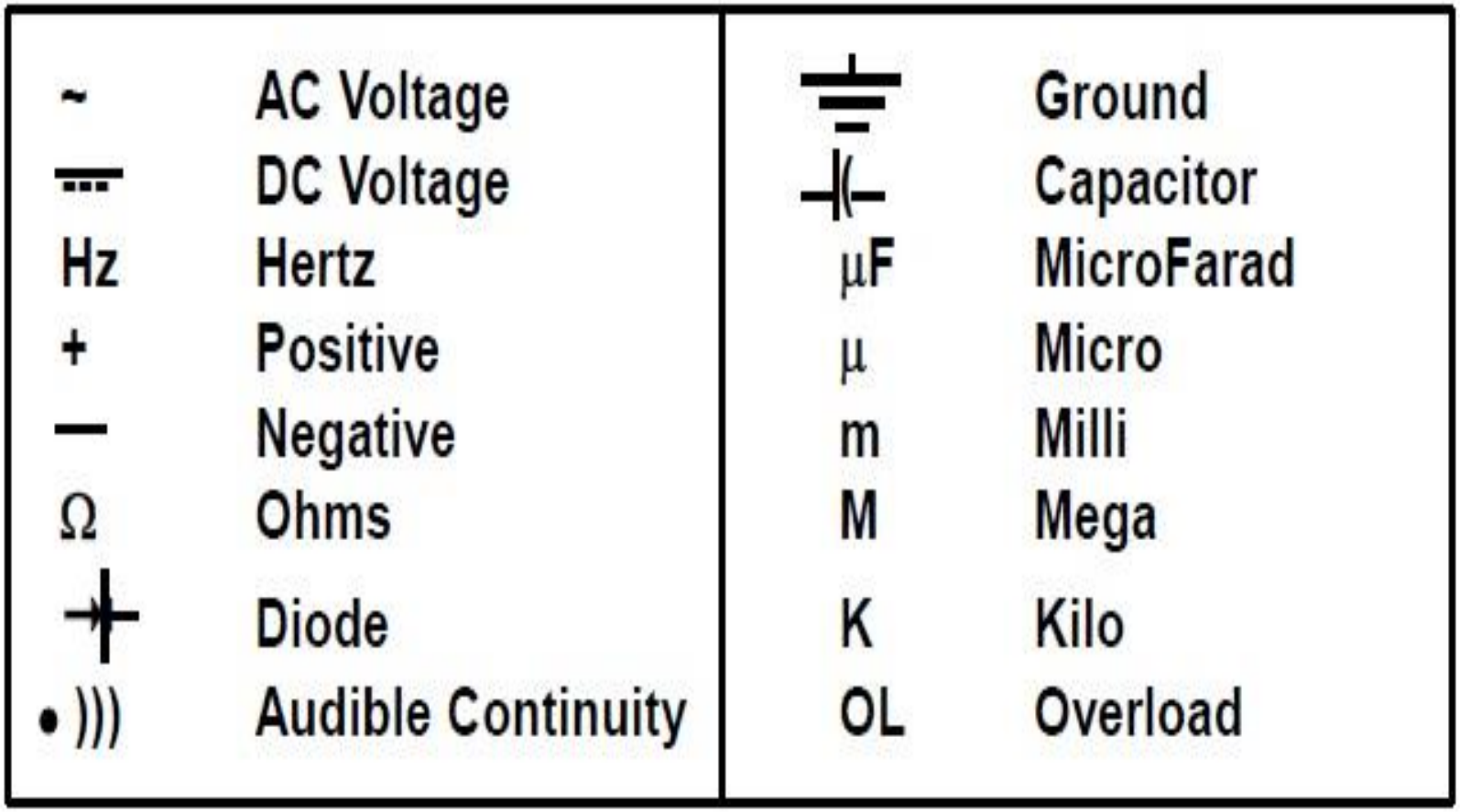
Multimeter

Basics for measuring voltage, current, resistance and continuity…….

Digital Multimeter

Analog Multimeter

Common Digital Multimeter Symbols



Parts of Multimeter

Ports of Multimeter

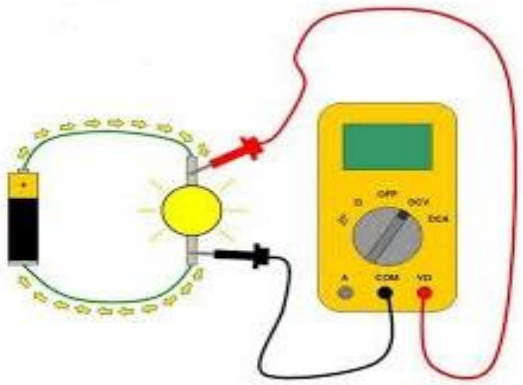
- COM- negative or ground
- Voltage Point or mAVΩ-usually connect the red lead
- 10A-special port
- Use best quality test leads such as Si leads

Measure Voltage using the Multimeter

- Multimeter act as a pressure gage
- Two types of voltages AC and DC
- select the appropriate range then LCD display will show the selection
- better to start with the larger reading first
- Overload or out-of-range in non auto range multimeters
- In auto range multimeters, fluctuations of the measurement are shown by the bar graph
- Sometimes measurement will indicate as a negative since DC voltage has the polarity

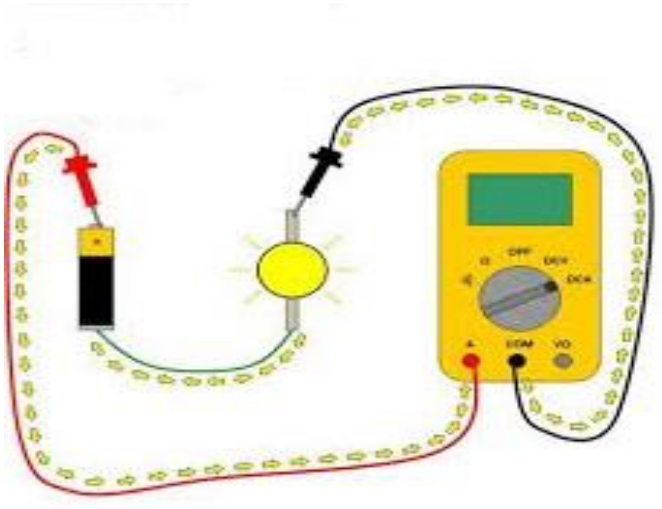
Measure Voltage using the Multimeter cont…

- To measure the voltage, connect the multimeter parallel with the item.
- Al the current of the circuit does not goes through the circuit since the parallel connection
- Beware of AC and use AC tester



Measure Current using the Multimeter

- Current is the flow rate of the electricity
- Measuring current is tricky since it will blow the fuse
- All the current of the circuit goes through multimeter
- Overloading the current can result in a blown fuse



Measure Current using the Multimeter cont…

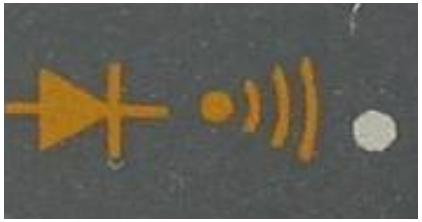
- Usually black lead goes to the common plug and red lead goes to the Amp plug.
- In some multimeters there are two separate plugs: A and mA. So it is safe to connect the lead to A plug first and get the readings and base on the reading can change the plug.

Measure the Resistance

- Resistance is measured in Ohm's
- Disconnect power source before testing the resistance
- Remove item from system before testing
- Turn the meter to the resistor sign
- If reads **0.00** or nearly zero, then lower the mode to **2kΩ** or **200Ω**

Measure the Continuity

- Continuity-act of testing the resistance between two points
- Check if there is a continuous path from one end to another
- power should be disconnected
- Have to change the meter to continuity symbol
- toching leads emit beep sound if the circuit is connected



Function Generator


KENWOOD


TG2000 20MHz DDS FUNCTION GENERATOR
WAVE:sine
FREQ:45.0000kHz CONT
AMPL:+3.50Vpp
DC:+7.70Vdc (+7.70V)
MAN TRIG

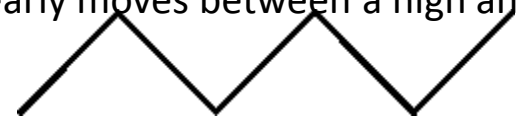
- Generate different types of electrical waveforms over a wide range of frequencies
- Function generators are used in the development, test and repair of electronic equipment
- Straightforward signal generators mostly focus on producing a good sine waves
- addition to producing sine waves,square, triangular and sawtooth shape waves can be generated
- These waveforms can be either repetitive or single-shot (which requires an internal or external trigger source)

Wave forms produce by Function Generator

•***Sine wave:*** This is the standard waveform that oscillates between two levels with a standard sinusoidal shape.

Square wave: A square wave is consists of a signal moving directly between high and low levels.

Triangular wave: This forms linearly moves between a high and low point.



Sawtooth wave: same as triangular waveform, but with the rise edge of the waveform faster or slower than the fall.

Controls of the Function Generator

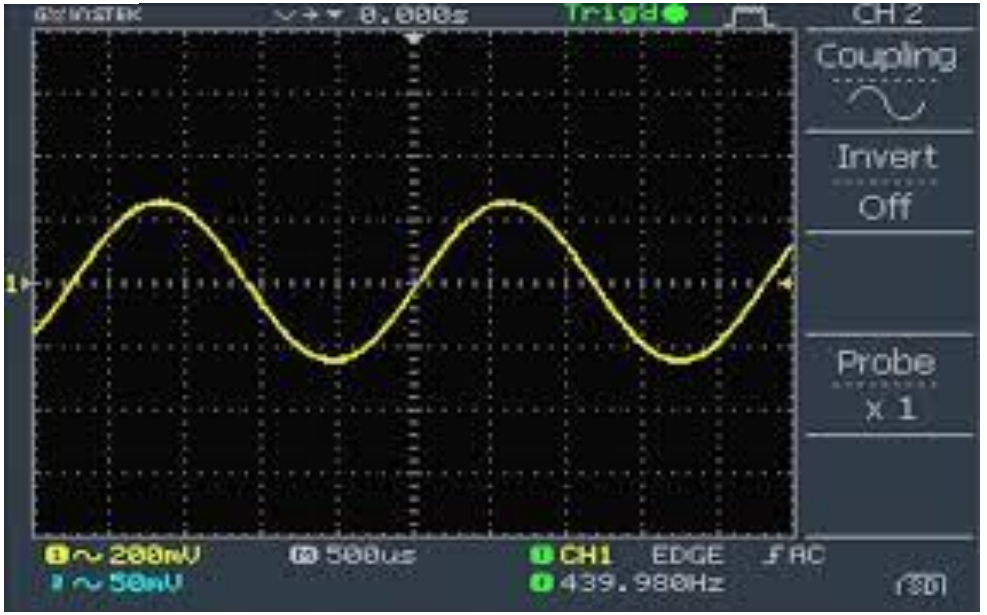
- Frequency
- Waveform type
- DC offset: alters the average voltage of a signal relative to 0V or ground
- Duty cycle: changes the ratio of high voltage to low voltage time in a square wave signal

Oscilloscope

measure electrical signals over time…

Introduction to oscilloscope

- scopes produce a two-dimensional graph with time on the x-axis and voltage on the y-axis.
- Time machine
- Can measure frequency, amplitude, and other waveform characteristics
- Oscilloscope can measure both time-based and voltage-based characteristics


0.000s
Trig'd
CH 2
Coupling
Invert
Off
Probe
x 1
200mV
50mV
500us
CH1
EDGE
AC
439.980Hz

Oscilloscope Display

- voltage on the vertical or Y-axis, and time on the horizontal or X-axis
- Manually select time scale or the oscilloscope do it to suit for the signal
  - On X axis 5ms will be displayed in 10 divisions where each division will represent 500 microseconds
  - Y axis represent the signal level , most of the times it is voltage
  - On Y axis 10 V will be displayed in 10 divisions where each division will represent 1V
- Controls of the oscilloscope allow to change the vertical or horizontal scales of the *V*/*t* graph

- Middle line going across the oscilloscope represent the reference line for signals
- Signal can be moved up or down with respect to that frame of reference
- This base line is important to understand the amplitude and the polarity of the signal
- reference line is not always necessary since the measurements can be taken by counting the no of squares in y axis
- Two channels called channel1 and channel 2
- Two signals can be inputted once via two channels or can input only one signal

Common Characteristics measure using Oscilloscope

- **Timing characteristics**:
  - **Frequency** – repeated numer of waveforms per second
  - **Period** – reciprocal of frequency
  - **Duty cycle** – The percentage of a period that a wave is either positive or negative
  - **Rise and fall time** –The duration of a wave going from a low point to a high.
- **Voltage characteristics**:
  - **Amplitude** – Amplitude is a measure of the magnitude of a signal.
  - **Maximum and minimum voltages** –high and low end of the signal voltage
  - **Mean and average voltages**

Basic adjustments of the oscilloscope

1. **Vertical position(each channel)**

- Can change the vertical position of each channel.

2. **Voltage scale/volts per division(each channels)**

- Adjust volts per division
- Can change the voltage scale and by zoom in and zoom out

Basic adjustments of the oscilloscope cont..

3. **Horizontal position (all channels)**

- Can move all the signals along the time axis,
- If the signal is not symmetrically viewing we can adjust it

4. **Time base/seconds per division(all channels)**

- Can change the time per division
- control the time scale to adjust number of waveforms that can be seen on the screen

Basic adjustments of the oscilloscope cont..

5. **Trigger position/level-volts(all channels)**

- Adjust the view to more stable and focus
- It is hard to measure the characteristics of a signal iff the signal is sweaping across the display
- Trigger can be adjusted to keep the display **static** and unflinching

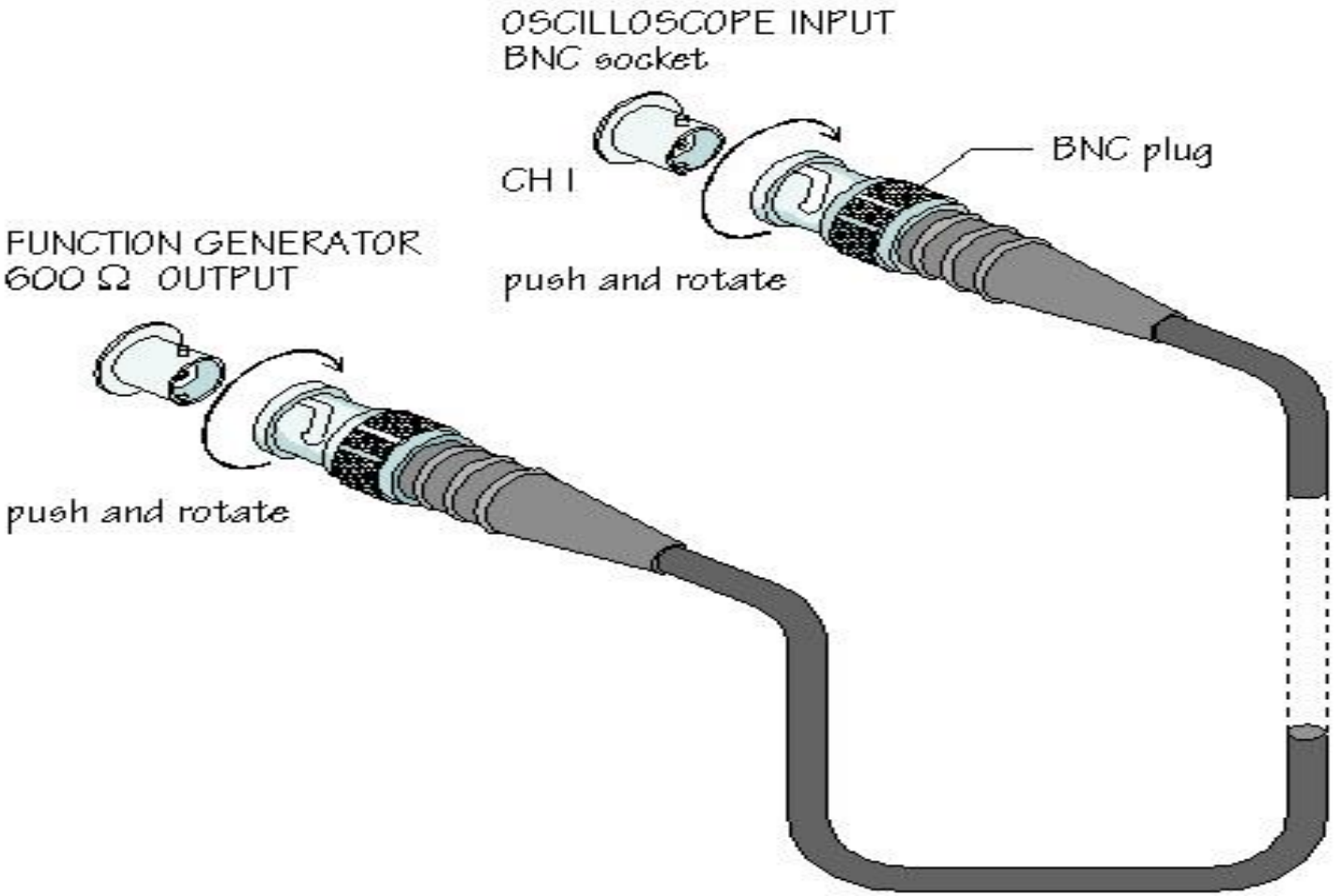
Probes

- Probes use to direct a signal from circuit to the oscilloscope.
- They have a sharp **tip** which consists of hooks, tweezers or clips to make latching onto a circuit. Every probe also includes a **ground clip**, to a common ground point on the circuit under test.

Connect the Probes and function Generator

- select a probe: the simple passive probe will work better.
- before connecting set the attenuation on the selected probe. 10X – the most common attenuation factor
- Connect your probe to the first channel (channel 1) on oscilloscope, and turn it on.
- Turn channel 1 on and channel 2 off.
- Set channel 1 to DC coupling.
- Set the trigger source to channel
- Set the trigger type to rising edge, and the trigger mode to auto
- Make sure the scope probe attenuation on your scope matches the setting on your probe (e.g.10X).

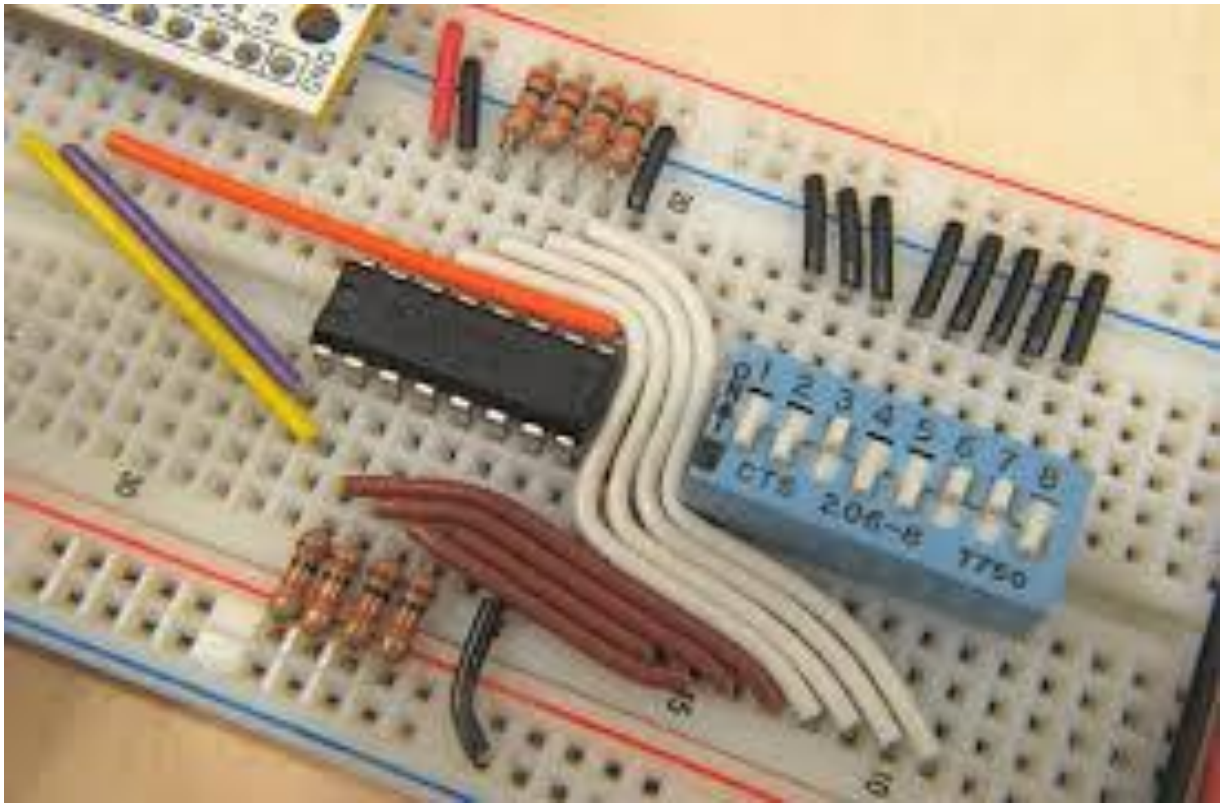
Connect the Probes and function Generator cont..



Connect the Probes and function Generator cont..

- Connect that channel to a signal coming from frequency.
- The frequency generator output has two separate conductors – one for the signal and one for ground. Connect probe's ground clip to the ground, and the probe tip to the signal output.
- Make the necessary changes using horizontal and vertical system and if required by trigger position knob.

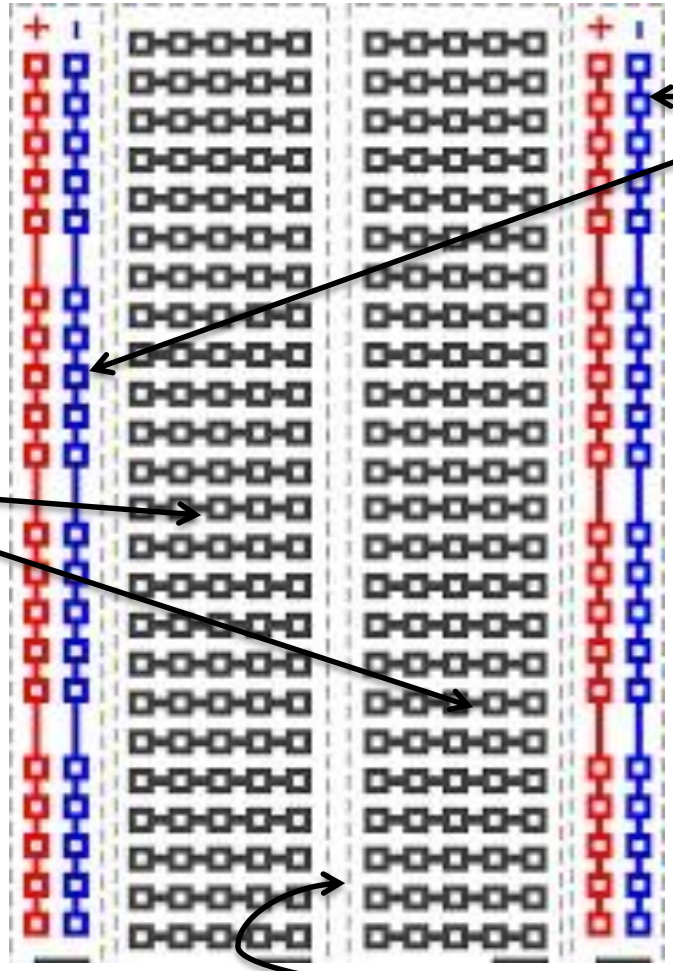
Construct Electronic Circuits Using Breadboard



Introduction to breadboard

- Temporary circuit board for testing and prototyping circuits
- Solder less electronic circuit building
- House both the simplest circuit as well as very complex circuits

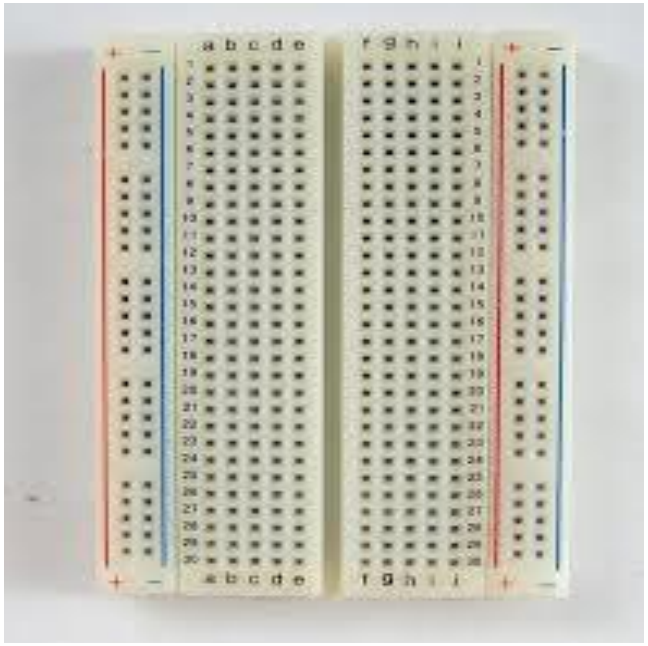
Layout of strips



Bus Strips/Power rails

Socket strips/Terminal strips

Gutter

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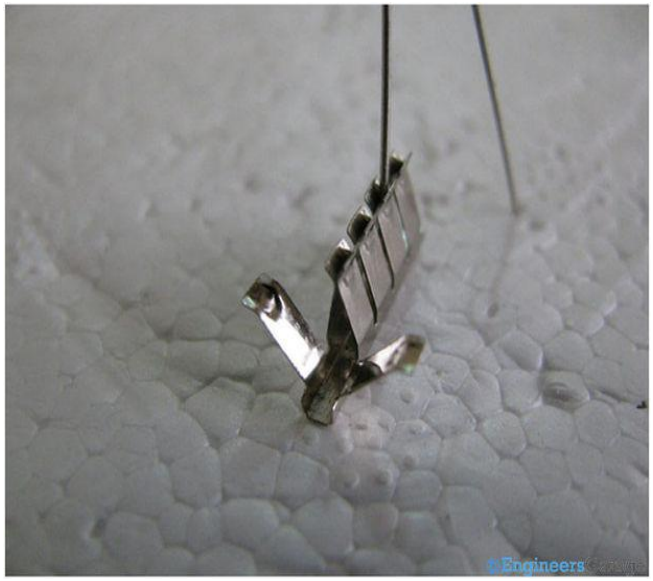
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- Inside the board metal trips are plated and rust proof
- breadboards have **numbers** and **letters** marked on various rows and columns
- bread board layout consists of two types of region also called strips
- Bus strips(vertical) – provide power supply and ground to the circuit
  - label with a '+' and a '-' and red and blue or black stripe , to indicate the positive and negative side
  - right and left power rails are isolated
- Socket strips(horizontal) -hold most of the components in a circuit
  - Every column is electrically connected from inside
  - there are only five clips on this strip and only five components can be connected
- Gutter/ravine
  - IC chip on board it should hurdle the center divider