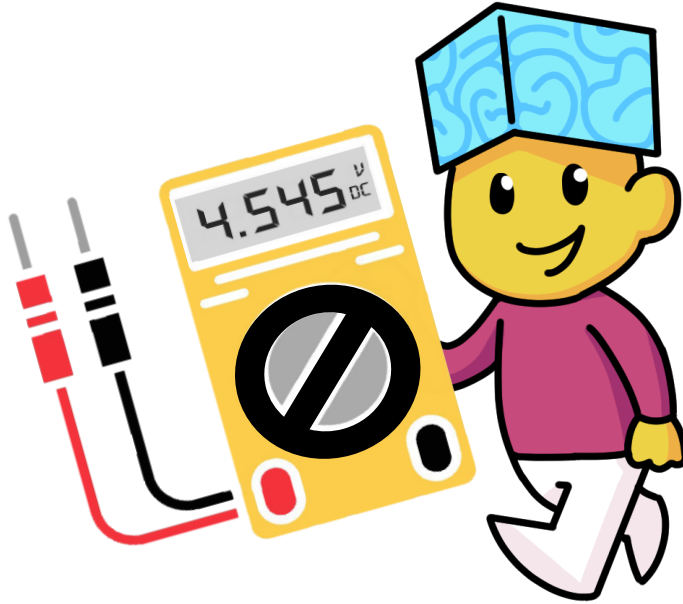


Parts of a Multimeter



What is a Multimeter?

A multimeter is a tool used to measure electrical values in a circuit.

This lesson will identify the parts of a multimeter and the electrical properties that it measures.



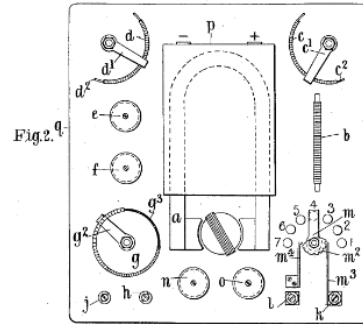
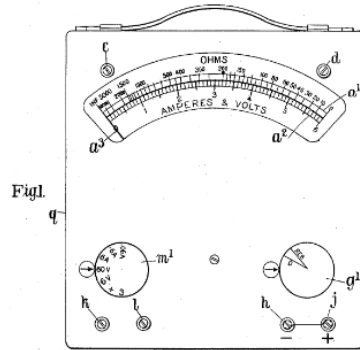
Who Invented the Multimeter?



Donald Macadie
1871-1956

The multimeter was first invented in 1923 by a British Post Office engineer named Donald Macadie.

It was called the *AVOmeter* because it measured Amperes, Voltages, and Ohms.



**An early version of
the AVOmeter**



Many Types of Multimeters

Not all multimeters look the same, but they share similar parts and functionalities.



Analog Multimeters

Use a needle pointer to indicate values measured

Digital Multimeters

Show values measured in a digital LCD display



Parts of the Multimeter

Our digital multimeter (DMM) consists of five main parts.



Face

Probes



Display / LCD

Selection Dial

Ports

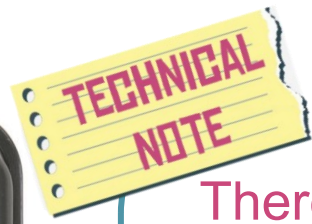


Multimeter- Display / LCD



The display or LCD shows the numeric value for the electric property being measured.





There are two types of multimeters, analog and digital!

What is the easiest way to tell the difference?

The analog display uses a needle to show the measured values and the digital uses numbers.



Analog Multimeter



Digital Multimeter



Multimeter- Ports

The ports are where the **red** and **black** probes are plugged into the multimeter.



VΩmA is where the **red probe** is plugged into the multimeter if you are testing for voltage, resistance, low current and everything else! *(This port is used most of the time)*

COM stands for common and is where the **black probe** is plugged into the multimeter for all testing situations.



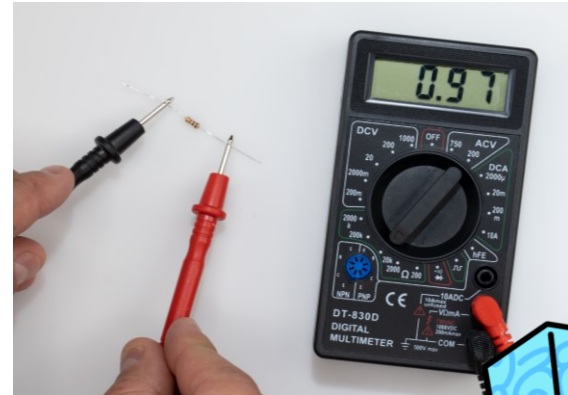
* **10ADC** is where the **red probe** is plugged into. This is only used to measure high current (>200mA).



Multimeter Probes



The plugs are inserted into the multimeter ports. The leads or needle probes are used to take measurements from components or circuits.



Negative
Lead (-)

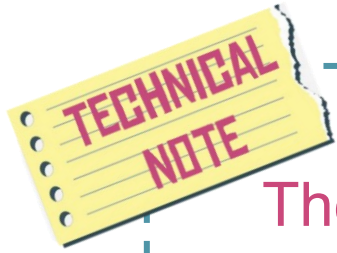
Positive
Lead (+)

Plugs

TECHNICAL
NOTE

There is no difference
between the red and black
probe wires other than color!
To be consistent, we will
always connect the red and
black as shown!





There are several types of probe leads. The type of leads used depends on preference, need, and what comes with your multimeter. Below are two of the most common lead types!



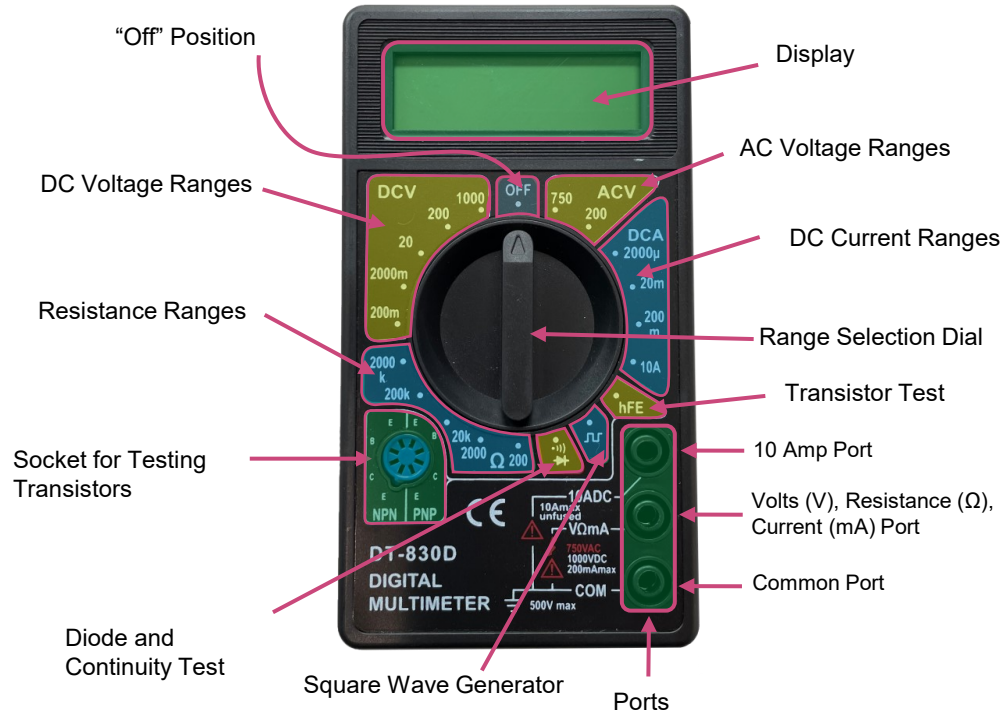
Alligator clips allow you to grab onto devices or components making a secure connection that won't come off easily and frees your hands.



The most common probe leads are **metal needles**. These are great to use with breadboards and circuit boards as they make it easy to touch any wire or point.



The Multimeter- Face



The Face of the multimeter is printed with information explaining the various functions and ports of the multimeter.



Parts of the Multimeter- Function Selection Dial



The dial is located in the middle of the Face of the multimeter.

The dial can be turned to various positions on the Face of the multimeter allowing for the testing of different electrical properties.



Multimeter Dial Positions

TURNING THE MULTIMETER OFF

Off Position



When the multimeter is not in use, turn the dial here to the **OFF** position.

Turn the multimeter **ON** by moving the dial to any other position.

Make sure to do this when you are done using the multimeter or your battery will run out of power.



How to Change the Battery If the Power Runs Out



Before attempting to open the multimeter, make sure that the probes have been disconnected and the multimeter is in the “off” position.

Take out the two screws in the back of the multimeter using a Philip’s screwdriver.

Remove the back of the multimeter.

Replace the battery and close the case. Tighten the screws completely before using the multimeter.



Multimeter Dial Positions

MEASURING DIRECT CURRENT VOLTAGE (DCV)

DC Voltage Range



When the pointer on the dial is in the *DCV* area, *Direct Current Voltage* will be measured.

There are five ranges in this section:

- 200m – Measures up to 0.2 Volts
- 2000m – Measures up to 2 Volts
- 20V – Measures up to 20 Volts
- 200V – Measures up to 200 Volts
- 1000V – Measures up to 1000 Volts



**TECHNICAL
NOTE**

If you exceed the voltage range, the multimeter will look like this image.



TECHNICAL NOTE

Some multimeters will “auto-range” which means that they automatically display the most accurate value, regardless of the voltage/resistance/current being measured.

However, most multimeters will have various positions on the dial to best show the most accurate reading on the display. The number by the position indicates the highest value that the multimeter can display in that setting.

In the setting highlighted on the right image, the multimeter will measure “*up to 20 volts*”.

To measure a 50 volts power supply, move the dial to the “200” position in the DVC section. A good rule of thumb is to start from the highest values and work down the dial.



Multimeter Dial Positions

MEASURING ALTERNATING CURRENT VOLTAGE (ACV)

AC Voltage Range

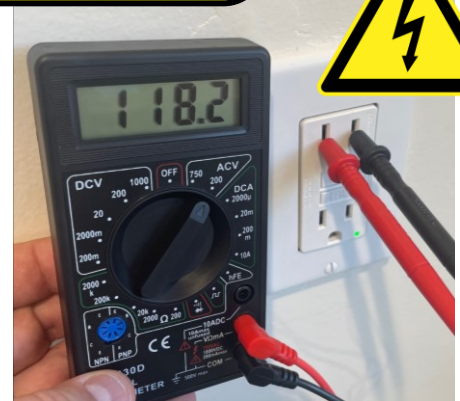


When the pointer on the dial is in the ACV area
Alternating Current (AC)
Voltage is measured.

There are two ranges in the AC Voltage (ACV) section:

- 750V – Measures up to 750VAC
- 200V – Measures up to 200VAC

NEVER touch the
metal part of
probes as wall
voltage can be
dangerous!



Multimeter Dial Positions

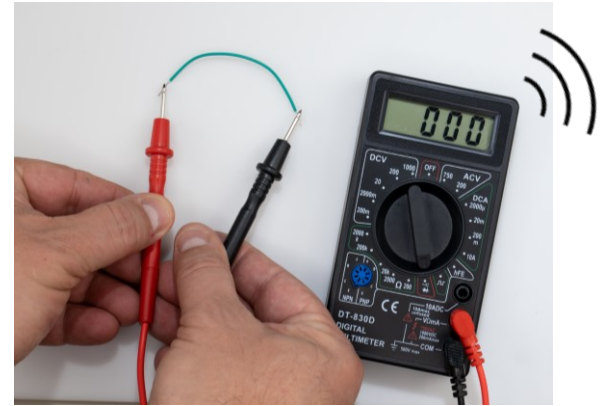
MEASURING CONTINUITY



Continuity

When the pointer on the dial is in this position *Continuity* can be measured. When you touch the leads together it should beep to let you know that the continuity function is working.

This dial position is also used to check if a diode is functional.



Multimeter Dial Positions

MEASURING DIRECT CURRENT AMPERAGE (DCA)



DC Current Range (Amps)

When the pointer on the dial is in this area, *Direct Current Amperage* can be measured. The multimeter needs to complete the circuit to measure the current.

Don't forget to change the port connection of the **red probe** to 10ADC when measuring more than 200mA!



Multimeter Dial Positions

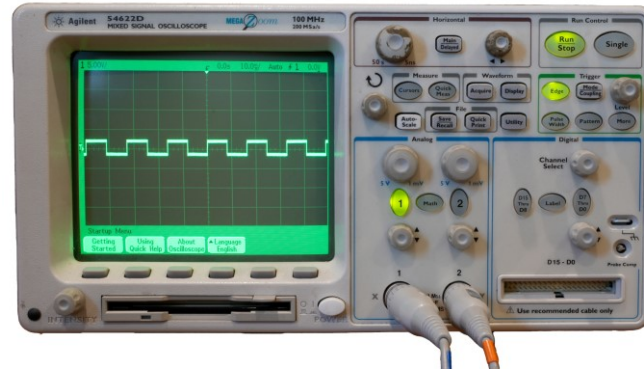
CREATE A SIGNAL OUTPUT

When the pointer on the dial is in this position, a 1V peak to peak square wave signal at 60 hertz is generated by the multimeter.



Signal Output

This oscilloscope shows the square wave generated by the multimeter.



Multimeter Dial Positions

MEASURING RESISTANCE



Resistance Range (Ohms)



When the pointer on the dial is in this area *Resistance* (Ω) can be measured. Start measuring at the 2000K position if you don't know the resistance you are measuring.



Multimeter Dial Positions

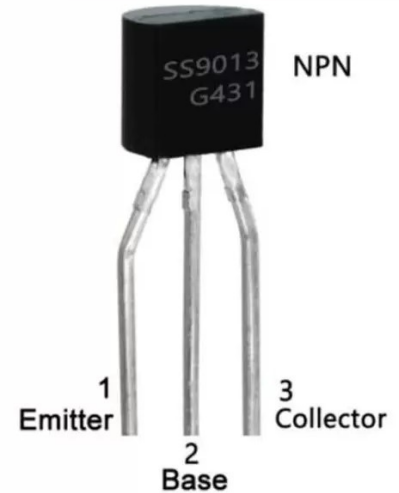
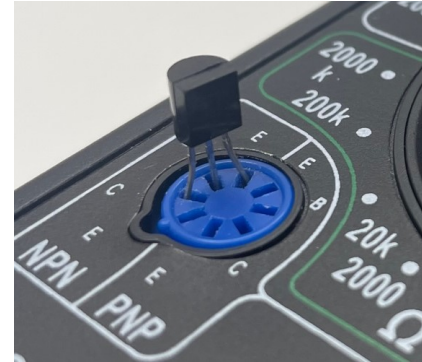
MEASURING TRANSISTOR GAIN

When the pointer on the dial is in this area and a Transistor is inserted in the test socket, *Transistor Gain* can be measured.



Transistor Gain

Socket for testing Transistors
NPN or PNP



SQUARE BRAIN

Parts of the Multimeter

