

Galvanometer, Ammeter, & Voltmeter

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What is the definition of "galvanometer"?

A basic device for measuring a small electric current by means of a mechanical motion derived from electromagnetic forces produced by the current.

Principle Of Galvano Meter:

- *Galvanometer works on the principle of conversion of electrical energy into mechanical energy. When a current flows in a magnetic field it experiences a magnetic torque. If it is free to rotate under a controlling torque, it rotates through an angle proportional to the current flowing through it.*

What is the principle of ballistic galvanometer?

- when current passes through a coil of b.g then it rotates in a magnetic field and measures the quantity of charge rather than current .

ESSENTIAL PARTS OF GALVANOMETER

- There are five essential parts of a Galvanometer.
 1. A U-shaped permanent magnet with concave poles.
 2. Flat rectangular coil of thin enameled insulated wire 'C'.
 3. A soft iron cylinder 'B'.
 4. A pointer or needle.
 5. A scale.

CONSTRUCTION

- The flat rectangular coil of thin enameled insulated wire of suitable number of turns wound on a light nonmetallic or aluminum frame is suspended between the cylindrically concave poles of magnet by a thin phosphor bronze strip. One end of the wire of the coil is soldered to strip. The other end of the strip fixed to the frame of the galvanometer and connected to an external terminal. It serves as one lead current lead through which the current enters or leaves the coil. The other end of the wire of the coil is soldered to a loose and soft spiral of wire connected to another external terminal. The soft spiral of a wire serves as the other current lead. A soft-iron cylinder, coaxial with the pole pieces, is placed within the frame of the coil and is fixed to the body of the galvanometer. In the space between it and the pole pieces, where the coil moves freely, the soft iron cylinder makes the magnetic field stronger and radial such that into whatever position the coil rotates, the magnetic field is always parallel to its plane.

WORKING :

- When a current passes through the galvanometer coil, it experiences a magnetic deflecting torque, which tends to rotate it from its rest position. As the coil rotates it produces a twist in the suspension strip. The twist in the strip produces an electric restoring torque. The coil rotates until the elastic restoring torque due to the strip does not equal and cancels the deflecting magnetic torque, then it attains equilibrium and stops rotating any furthers.

Applications:

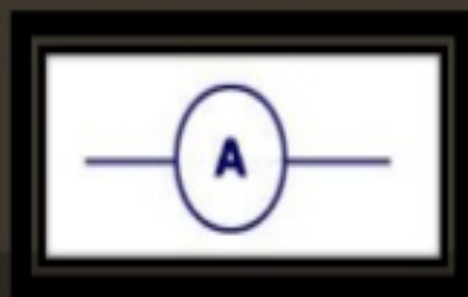
- A galvanometer is a type of ammeter: an instrument for detecting and measuring electric current. It is an analog electromechanical transducer that produces a rotary deflection of some type of pointer in response to electric current flowing through its coil. The term has expanded to include uses of the same mechanism in recording, positioning, and servomechanism equipment

Uses :

- Laser Scanning.
its used to detect and measure electric current Answer It's an ammeter. It's used to detect and measure electric current. To measure small amounts of current in a circuit, it is utilized with the motor effect.

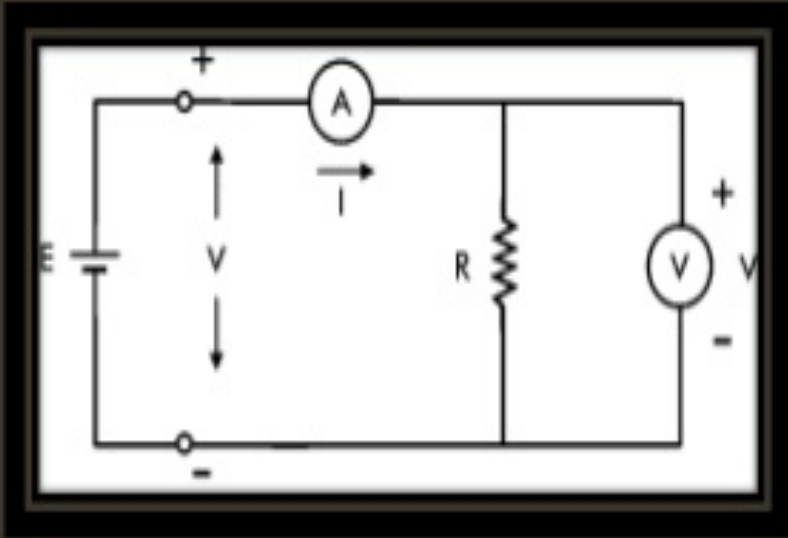
Ammeter

- ❖ Ammeter is a low resistance galvanometer
- ❖ It is used to measure the current in a circuit in amperes
- ❖ Galvanometer can be converted into an ammeter by **using a low resistance wire in parallel with the galvanometer**
- ❖ the resistance of the wire depends upon the range of the ammeter
- ❖ As shunt resistance is small the combined resistance of the galvanometer & the shunt is very low hence the **ammeter has much lower resistance than galvanometer**
- ❖ An ideal ammeter has zero resistance



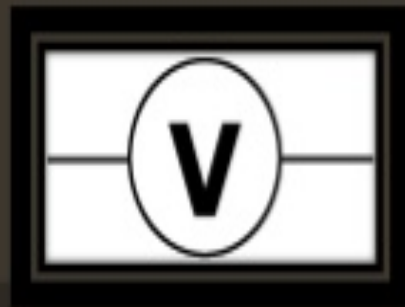
Information :

- ❖ An ammeter (the name is a contraction of 'ampere-meter') is a device for measuring the electric current through a wire or a circuit element. An ammeter is always connected in series with the element in question:
- ❖ Note: the voltage drop across the ammeter itself disturbs the circuit into which it is plugged in, and such disturbance may change the very current the ammeter is used to measure. To minimize the disturbance, the voltage across the ammeter should be as small as possible, which requires that the electric resistance of the ammeter should be as small as possible.



WHAT IS A VOLTMETER?

- ❖ It is the most common instrument used to measure voltage
- ❖ It measure either AC or DC voltage
- ❖ It is a measure of the voltage between two points of an electrical current



Information :

- ❖ A voltmeter is a device for measuring potential difference (the voltage) between two wires, usually across a circuit element or a group of elements. A voltmeter is always connected in parallel with the element(s) in question:
- ❖ Note: the current flowing through the voltmeter itself disturbs the circuit into which it is plugged in, and such disturbance may change the very voltage the voltmeter is used to measure. To minimize the disturbance, the current through the voltmeter should be as small as possible, which requires that the electric resistance of the voltmeter should be as large as possible.



TYPES OF VOLTMETER INSTRUMENT

❖ **Analog**

The readings are shown on a scale

❖ **Digital**

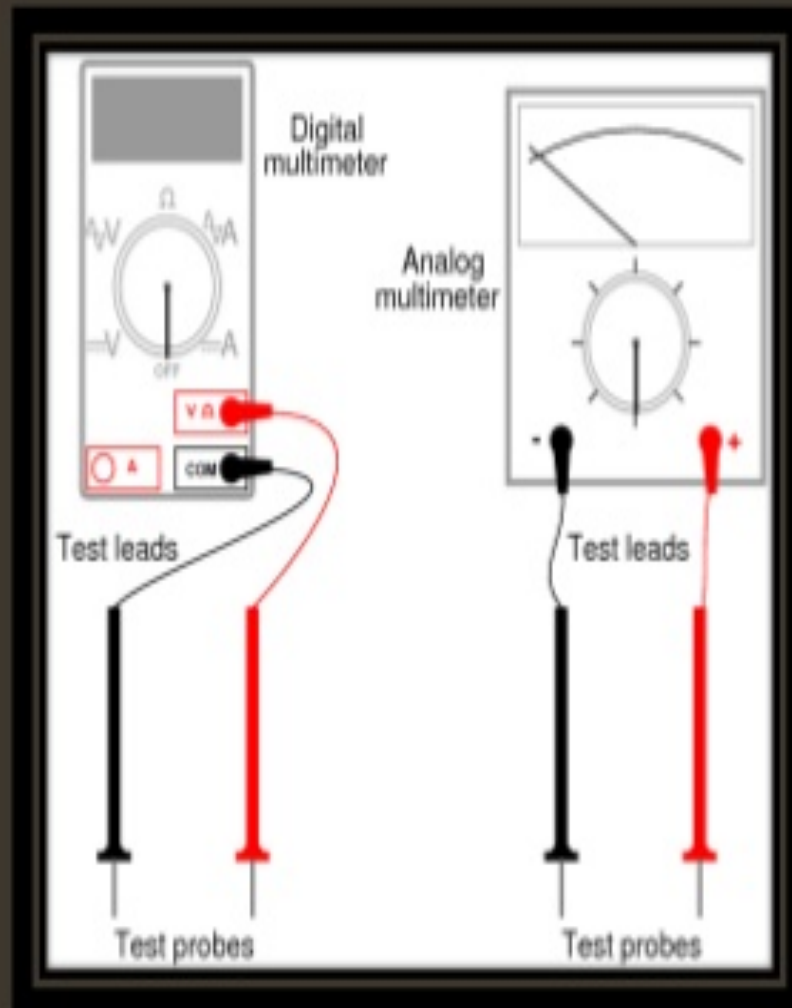
The readings are displayed on a LCD or LED display panel

❖ **Work on the principle of Ohm's Law**

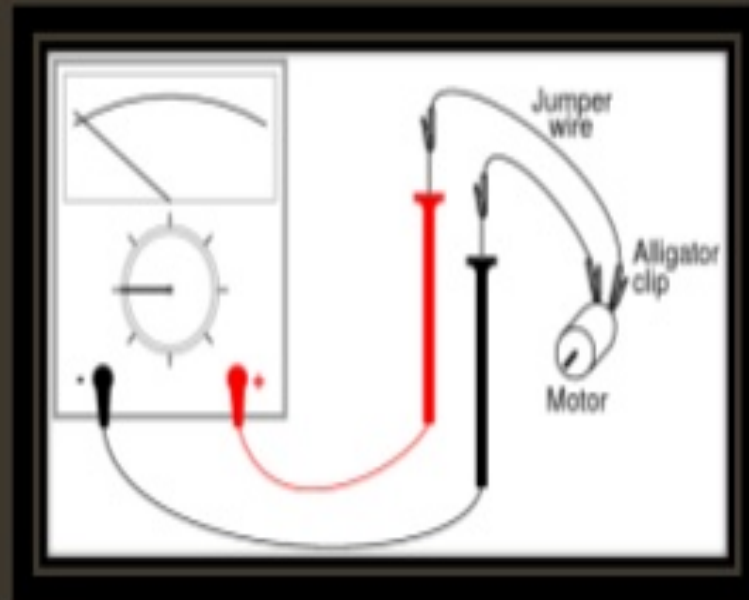
Potential Difference = Current \times Resistance

(Volts) = (Amperes) \times (Ohms)

Voltmeter



MEASURING THE VOLTS OF THE MOTOR



- ❖ The voltmeter indicates polarity by direction by needle movement with an analog instrument.
- ❖ For a digital instrument polarity is indicated by the *sign* of the numerical value

- ❖ When measuring a voltage difference there are always two leads coming from the instrument that will have to be connected to the two points in your circuit across which the voltage appears.
- ❖ **Voltage might be any of the following:**
- ❖ Across an element embedded in a circuit.
- ❖ The output of a transducer measuring some physical variable like temperature, pH, etc.
- ❖ Digital Voltmeter is an instrument which use to measured the voltage & display the measured voltage using LCDs or LEDs to display the result in a floating point format. They are an instrument of choice for voltage measurements in all kinds of situations.
- ❖ Digital voltmeters usually have scales that are 0-0.3v, 0-3v, 0-30v, 0-300v.

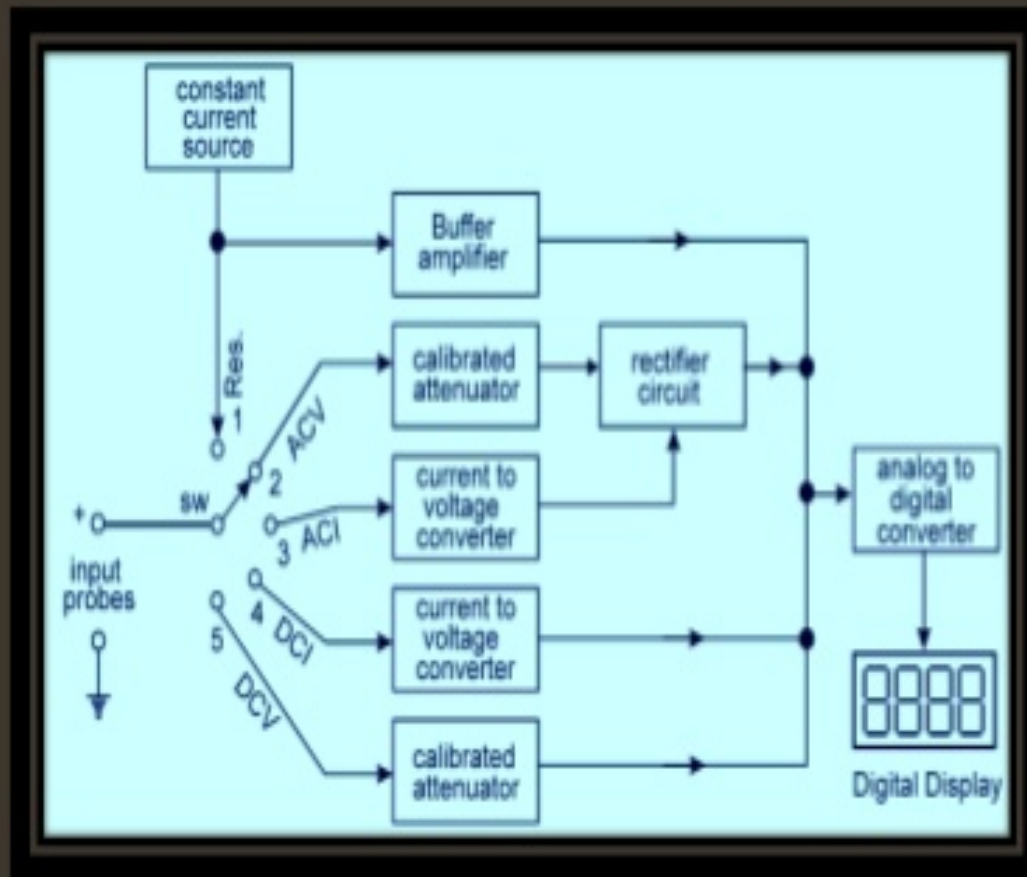
WORKING

- ⦿ INTEGRATOR:-The integrator stabilizes the voltage as a first step in measuring it. It takes a brief time sample, integrates it and outputs a proportional voltage. Integrating a time sample makes the voltmeter more immune to noise in the signal.
- ⦿ ANALOG/DIGITAL CONVERTOR:-The analog/digital converter or ADC, is the heart of the voltmeter. It is a clocked circuit that takes an input voltage sample and outputs a number representing the voltage value. Since it's clocked, you get a steady stream of numbers that change when the input voltage changes.
- ⦿ ZEROING&SAMPLING:-A digital voltmeter needs to know where zero is in order to give a true reading. This is done with a precision zero reference voltage provided either internal to the ADC chip or externally.

For a general-purpose voltmeter, scaling is important. Scale can be switched automatically by detecting overflow in the display.

- ❖ **DISPLAY:** Usually, four or more digits of accuracy, a minus sign, and a floating decimal point are provided. Other indicators for battery status and range may also be included. A well-designed integrator and ADC will keep the display from jittering between values; otherwise usability suffers. For example, if the voltage is 5.21 volts, without some stabilizing, the display might waver between 5.21 and 5.22.
- ❖ The digit display needs driver circuitry to handle the drive current. The same ADC chip frequently also has the display drivers also. Connecting the chip directly to the display simplifies the design and adds reliability.

BLOCK DIAGRAM OF DIGITAL VOLTMETER





Thank – You.

