Ammeter

Definition: The meter uses for measuring the current is known as the ammeter. The current is the flow of electrons whose unit is ampere. Hence the instrument which measures the flows of current in ampere is known as ampere meter or ammeter.

The **ideal ammeter has zero internal resistance**. But practically the ammeter has small internal resistance. The measuring range of the ammeter depends on the value of resistance. The **ammeter is connected in series with the circuit** so that the whole current that has to be measured passes through the ammeter. The **ammeter circuit has low resistance** so that the small voltage drop occurs in the circuit.

Galvanometer

A galvanometer is a low resistance instrument and as such it cannot be used to measure current in a circuit. It is because, even when a small current is passed through the galvanometer, it produces full scale deflection. If a large current oos passed the galvanometer may get damaged due to following reasons;

1. The large current will cause the coil of the galvanometer to deflect through a large angle and the pointer of the galvanometer, in an attempt to go out of the scale, may break.
2. The large current on its passage through the coil of the galvanometer will produce a large amount of heat. The excessive heating may also damage the galvanometer.

However when a galvanometer is converted into ammeter, it can measure currents without causing any damage to it.

Galvanometer to ammeter

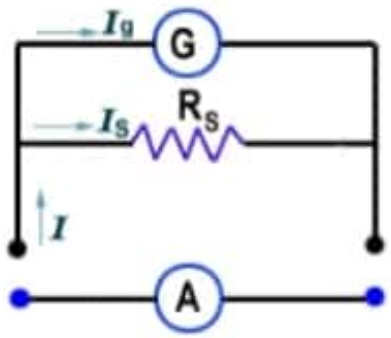
In order to convert a Galvanometer into an Ammeter, a very low resistance known as "shunt" resistance is connected in parallel to Galvanometer. Value of shunt is so adjusted that most of the current passes through the shunt. In this way a Galvanometer is converted into Ammeter and can measure heavy currents without fully deflected.

Value of shunt

Let resistance of galvanometer = Rg and it gives full-scale deflection when current Ig is passed through it. Then,

$V_g = I_g R_g$ -------(i)

Let a shunt of resistance (Rs) is connected in parallel to galvanometer. If total current through the circuit is I.



Then current through shunt:

$$Is= (I-Ig)$$

potential difference across the shunt:

$$Vs= IsRs$$

or

$$Vs = (I - Ig)Rs \text{ -------(ii)}$$

But

$$Vs =Vg$$

$$(I - Ig)Rs = IgRg$$

$$R_s = \frac{I_g}{I - I_g} R_g$$

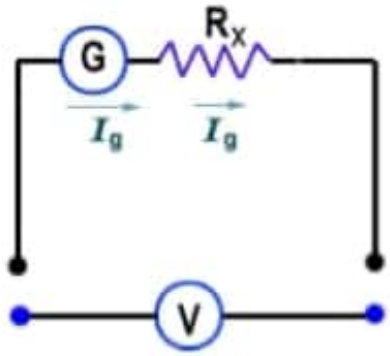
Galvanometer to voltmeter

Voltmeter is an electrical measuring device, which is used to measure potential difference between two points in a circuit. It is always connected parallel to the circuit.

Since Galvanometer is a very sensitive instrument, therefore it can not measure high potential difference. In order to convert a Galvanometer into voltmeter, a very high resistance known as "series resistance" is connected in series with the galvanometer.

VALUE OF SERIES RESISTANCE

Let resistance of galvanometer = Rg and resistance Rx (high) is connected in series to it. Then combined resistance = (Rg + Rx).



If potential between the points to be measured = V and if galvanometer gives full-scale deflection, when current "Ig" passes through it. Then,

$$V = Ig\,(Rg + Rx)$$

$$V = IgRg + IgRx$$

$$V - IgRg = IgRx$$

$$Rx = (V - IgRg)/Ig$$

$$R_X = \frac{V}{I_g} - R_g$$

Thus Rx can be found.