# What is potentiometer?

Potentiometer working can be explained when the potentiometer is understood. It is defined as a three-terminal resistor having either sliding or rotating contact that forms an adjustable voltage divider. In order to use the potentiometer as a rheostat or variable resistor, it should have only two terminals with one end and the wiper.

Following are the terms used to describe types of potentiometers:

- Slider pot or slide pot: This can be adjusted by sliding the wiper right or left with a finger or thumb.
- Thumbwheel pot or thumb pot: This can be adjusted infrequently with the help of small thumbwheel which is a small rotating potentiometer.
- Trimmer pot or trimpot: This can be adjusted once for fine tuning of an electric signal.

Potentiometer working principle

The potentiometer consists of L which is a long resistive wire and a battery of known EMF V whose voltage is known as driver cell voltage. Assume a primary circuit arrangement by connecting the two ends of L to the battery terminals. One end of the primary circuit is connected to the cell whose EMF E is to be measured and the other end is connected to galvanometer G.This circuit is assumed to be a secondary circuit.
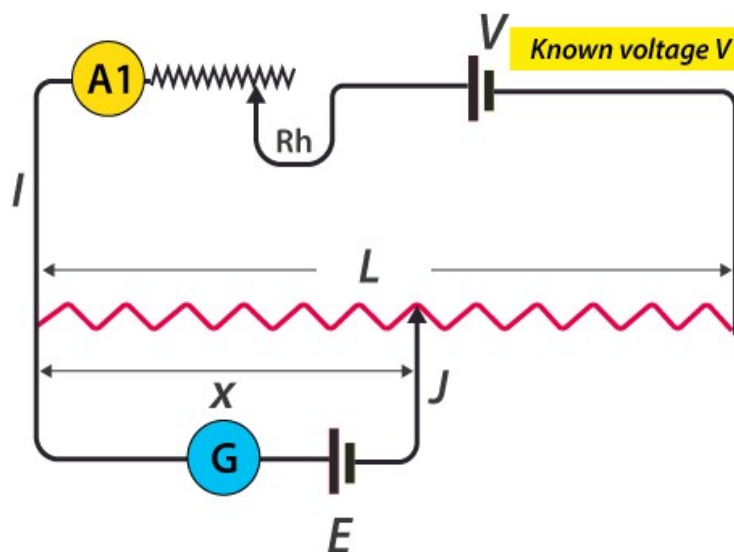
The working principle depends on the potential across any portion of the wire which is directly proportional to the length of the wire that has a uniform cross-sectional area and current flow is constant. Following is the derivation of used to explain the potentiometer working principle:

$V=IR$ (Ohm's law)
Where,

I: current

R: total resistance

V: voltage

$$R = \rho LA$$
$$V = I\rho LA$$
Where,

ρ: resistivity

A: cross-sectional area

With ρ and A constant, I is constant too for a rheostat.

$$L\rho A = K$$
$$V = KL$$
$$E = L\rho xA = Kx$$
Where,

x: length of potentiometer wire

E: cell with Lower EMF

K: constant

The galvanometer G has null detection as the potential difference is equal to zero and there is no flow of current. So, x is the length of the null point. Unknown EMF can be found by knowing x and K.

$$E = L\rho xA = Kx$$
Since the EMF has two cells, let L1 be the null point length of the first cell with EMF E1 and L2 be the null point length of the second cell with EMF E2.

$$E1E2 = L1L2$$

Types of potentiometer

There are basically two types of potentiometers that can be further divided depending on the movement of the wiper. Following is the table when the wiper is moving in a circular path which is known as rotary potentiometers

Type	Description	Applications
Concentric pot	Two potentiometers are adjusted individually with the help of concentric shafts	Found in old car radios that were used to control volume and tone
Single-turn pot	Approximate rotation is 270 degrees in a single rotation	Used where a single turn is enough to control the resolution
Servo pot	Used to adjust a servo motor automatically	Used in remote-controls to control the volume of an audio equipment

Following is the table when the wiper is moving along a linear path which is known as linear potentiometers

Type	Description	Applications

Multi-turn slide	A spindle is used for the construction of this kind of potentiometer	Used where high precision and resolutions are required
Slide pot	High-quality faders are constructed using conductive plastic	Used for the measurement of distance
Dual-slide pot	This is used to control dual slide and single slider potentiometers that are parallel	Used where dual parallel channels are to be controlled

Application of potentiometer

- Audio control: Both linear, as well as rotary potentiometers, are used to control audio equipment for changing the loudness and other audio related signals.
- Television: They are used to control the picture brightness, color response and contrast.
- Motion control: In order to create a closed-loop control, potentiometers are used as position feedback devices known as a servomechanism.
- Transducers: As these give large output signals, they find applications in designing of displacement transducers.