

I'm not a robot!

potentiometer is a device used for measuring the emf of a cell or potential difference between two points in a circuit. It works on the principle of comparison i.e., comparing the unknown voltage with the known voltage and makes use of balanced condition. DC Crompton's Potentiometer : DC Crompton's potentiometer is the laboratory-type potentiometer that is used to measure unknown emf effectively with a great degree of precision. DC Crompton's potentiometer works on the principle of a slide wire potentiometer. In other words, the DC Crompton potentiometer is a modified version of a slide-wire potentiometer. It basically consists of a small slide wire which is circular in shape and a dial switch with calibrated resistors, as shown in the figure below. In the figure shown, B = Battery/Rh = Rheostat/G = Galvanometer/R = Protective resistance which is of order of 10 k $\Omega$ s = Double throw switch/C = Standard cell and DC Crompton's potentiometer, the dial switch is divided into fifteen steps with each step having a resistance of 10 $\Omega$ . Hence, the total resistance of dial switch is equal to 150 $\Omega$  ( $15 \times 10 = 150$ ). The slide wire is in the form of a circular coil and has a resistance of 10 $\Omega$ , with a single turn. A double-throw switch is provided for standardization and for measuring the unknown emf, one after the other. A protective resistance is connected in series with the galvanometer in order to protect the galvanometer and is shortened when the galvanometer reaches the balanced condition. As the working current provided by the battery is 10 mA, the voltage drop across each step is 0.1 V and hence there is a total range of 1.5 V ( $1.5 \times 10 = 15$  V). If circular slide wire has 200 divisions, then each division in slide wire has a resolution of 0.0005 V ( $0.1/200 = 0.0005$ ). Hence, it is possible to measure the readings up to 0.0001 V with great precision and accuracy by taking readings up to 1/5th division of the scale. First, the potentiometer is to be standardized to the standard cell voltage (1.0186 V) by keeping the dial switch at 1.0 V and slide wire at 0.0186. After making these adjustments, switch is separated from the standard cell and key K is closed and the rheostat is adjusted such that the galvanometer shows null deflection. With this, the potentiometer is standardized to the voltage of standard cell and is connected between the terminals 'a' and 'b'. Now, the switch is thrown into the operating mode for measuring the unknown emf connected between terminals 2 and 2'. The value of unknown emf can be measured directly from the dial switch and circular slide wire after changing the positions of the potentiometer switch such that the null deflection is obtained. In this way, unknown emf can be measured with great precision using DC Crompton's potentiometer. Standardization of DC Crompton's Potentiometer : DC Crompton potentiometer is a laboratory-type potentiometer, with high precision. Here, the long slide wire is replaced with extension coils having the resistance same as that of the slide wire. Standardization is defined as the process of adjusting the working current of the potentiometer such that the voltage drop across the section of slide wire is equal to the standard reference voltage. The following are the steps involved in the standardization of DC Crompton's potentiometer. Settings are made such that, the sum of the voltage across the dial resistors and the slide wire is equal to the standard cell voltage. The switch is closed to calibrate the positions and the rheostat is set for null deflection. The galvanometer key is tapped and the resistance is kept in the circuit to protect the galvanometer. As soon as zero deflection is obtained, the protective resistance is replaced by a short-circuit, and then final settings are done for null deflection using a rheostat. How to Obtain True Zero in Crompton's Potentiometer : The major disadvantage with Crompton's potentiometer is that the true zero cannot be obtained, since the points P1 and P2 can never coincide. To overcome this difficulty, certain modifications have been done to Crompton's potentiometer as shown in the figure below. In this, a shunt resistor Rsh is connected across the slide wire AB. The shunt resistor is tapped at point T. This point T is made as zero of the main dial. When the contact P1 is at a point such that, the ratios  $(r_1 : r_3)$  and  $(r_2 : r_4)$  are equal, then there is no potential difference between the zero stud and the contact P1. At this point, the slide wire has a true zero. The slider can move towards its left giving negative readings and towards its right giving positive readings. The typical range of values of slide wire varies from -0.05 to 0.105 V. Modern Potentiometers : In modern DC potentiometers, a separate standard cell dial circuit is provided as shown in the figure below. By this, the speed of measurement increases. Also, convenience is obtained as it is not required to disturb the settings of potentiometer while the balance point of the standard cell is verified at any time throughout the span of measurement. The standard cell dial circuit consists of a standard cell, standard resistor R, and dial 1. The meter is calibrated by throwing the position of Double Pole Double Throw (DPDT) switch to ab. Now, the measurement of unknown emf Vx is carried out by throwing the DPDT switch to position a1 b1 and by adjusting the resistance of dial 2 (in steps) and dial 3 the balance is obtained. At any time during the span of measurement, the balance of standard cell can be checked by simply switching the DPDT switch to position ab without altering the measuring circuit dials. Whereas, in the case of olden day potentiometers, where no separate dial circuit was provided for standard cell, if the operator wants to check the standard cell balance during the measurement the slide wire (which is common to both standard cell and unknown emf) position has to be adjusted. This was a time consuming process and is avoided in modern dc potentiometers. Applications of DC Crompton's Potentiometer : The various applications of DC Crompton's potentiometer are as follows. Measurement of resistance. Measurement of power. Calibration of wattmeter. Calibration of voltmeter. Calibration of ammeter. Full PDF PackageDownload Full PDF PackageThis PaperA short summary of this paper16 Full PDFs related to this paperDownloadPDF Pack You're Reading a Free Preview Page 9 is not shown in this preview. You're Reading a Free Preview Pages 13 to 24 are not shown in this preview. You're Reading a Free Preview Pages 28 to 30 are not shown in this preview. You're Reading a Free Preview Pages 34 to 45 are not shown in this preview. You're Reading a Free Preview Pages 49 to 52 are not shown in this preview. Dc Crompton Potentiometer Driver Cell OrThe most common form of the potentiometer is the single turn rotary potentiometer. These potentiometers are used in huge quantities in the manufacture of electronics equipment that provides a way of adjusting so that the correct outputs are obtained. Notes: It has been my experience that students require much practice with circuit analysis to become proficient. D C POTENTIOMETERS INTRODUCTION A potentiometer is an instrument designed to measure an unknown voltage by comparing it with a known voltage. The known voltage may be supplied by a standard cell or any other known voltage reference source. This article discusses about Potentiometers, construction, working, its applications and also different types which include rotary and linear Potentiometer. Potentiometers: DC Potentiometer, Crompton potentiometer, construction, standardization, application. Although their most obvious use must be for volume controls on radios and other electronic equipment used for audio. Potentiometer Why is Potentiometer chosen over Voltmeter to measure the potential (EMF) of a cell? When we use Voltmeter, current flows through the circuit and because of the internal resistance of the cell, always terminal potential will be less than the actual cell potential. In this circuit, when the potential difference is balanced (using a Galvanometer null detection), no current flows in the circuit, so the terminal potential will be equal to the actual cell potential. So we can understand that the Voltmeter measures the terminal potential of a cell, but this measures actual cell potential. Schematic Symbols of a Potentiometer Construction and Working Principle The potentiometer consists of a long resistive wire L made up of magnum or with constantan and a battery of known EMF V. Connect the two ends of the resistive wire L to the battery terminals as shown below; let us assume this is a primary circuit arrangement. Construction of Potentiometer The basic working principle of this is based on the fact that the fall of the potential across any portion of the wire is directly proportional to the length of the wire, provided wire has uniform cross-sectional area and the constant current flowing through it. When there is no potential difference between any two nodes there is electric current will flow. Now the potentiometer wire is actually a wire with high resistivity () with uniform cross-sectional area. Dc Crompton Potentiometer Driver Cell OrNow this potentiometer terminal connected to the cell of high EMF V (neglecting its internal resistance) called driver cell or the voltage source. Let the current through the potentiometer is I and R is the total resistance of the potentiometer. Say it has EMF E. Now in the potentiometer wire say at length x the potentiometer has become E.E L x A K x. When this cell is put in the circuit as shown above figure with a jockey connected to the corresponding length (x), there will be no flow of current through the galvanometer because when the potential difference is equal to zero, no current will flow through it. E.L x A K x Secondly, EMF of two cells may also be compared, let the first cell of EMF E1 given a null point at a length L1 and the second cell of EMF E2 show a null point at length L2 Then E1E2 L1L2 Types of Potentiometers A potentiometer is also commonly known as pot. One terminal connected to a sliding contact called wiper and the other two terminals are connected to a fixed resistance track. The wiper can be moved along the resistive track either by use of a linear sliding control or a rotary wiper contact. Both rotary and linear controls have the same basic operation. read more 1 Follower Comments



l  
u  
i  
o