POTENTIOMETER - CALIBRATION OF HIGH RANGE VOLTMETER

Aim

To study the correctness of the given high range voltmeter using a potentiometer.

Apparatus

The high range voltmeter, potentiometer, accumulators, a Daniel cell, rheostats, six way key, plug keys, resistance boxes and a galvanometer

Theory

Using the Daniel cell, standardize the potentiometer. If L is the balancing length corresponding to the 1.08 V of the Daniel cell. Thus we have

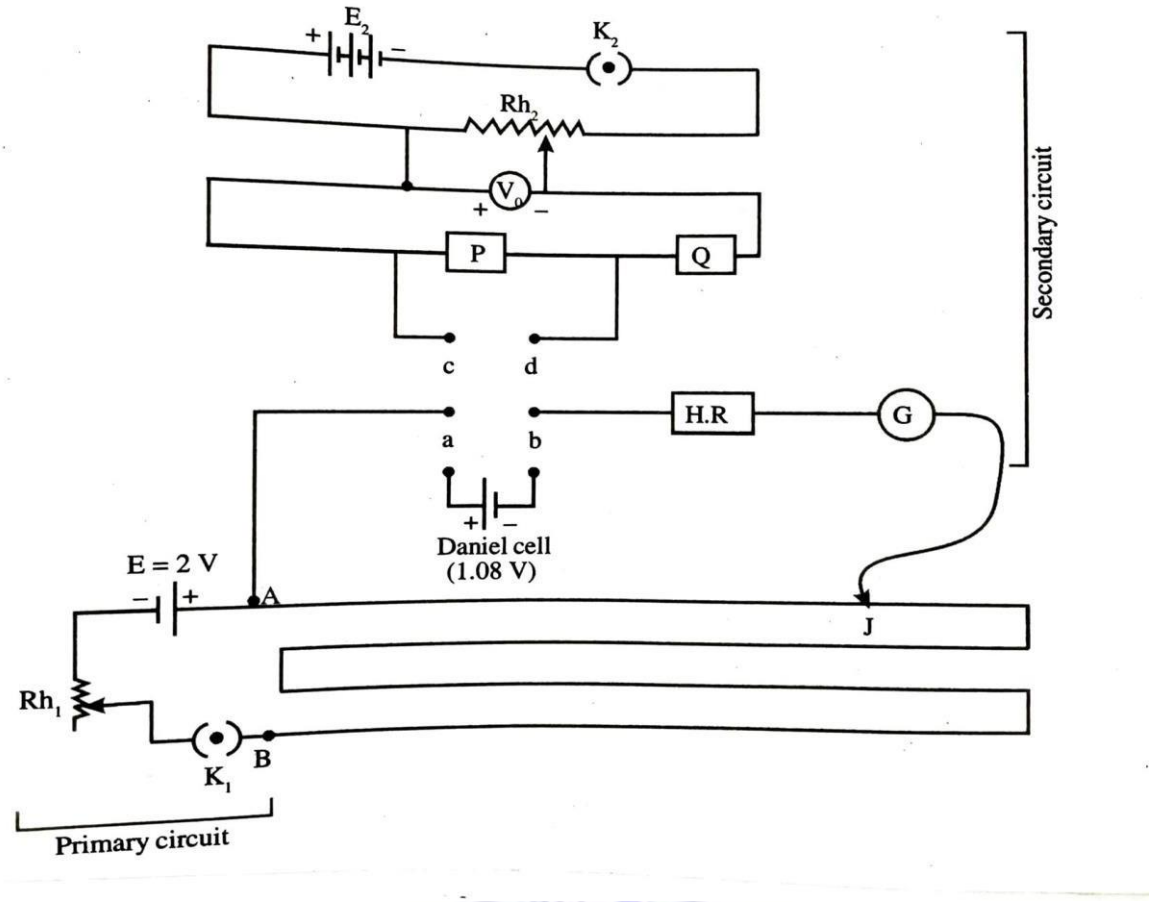
1.08 a L

The potential gradient ($\frac{1.08}{L}$) of the potentiometer is very low, this cannot be used to measure high voltages. So to calibrate a high range voltmeter which is measuring high voltage cannot be directly fed to the potentiometer. To overcome this the high range voltmeter to be calibrated is connected to an external circuit. The potential difference across the voltmeter is then taken and fed to a series combination of resistance P and Q. The potential difference across P is then fed to the potentiometer . If V is the actual voltage across the voltmeter, then the potential difference across P will be($\frac{VP}{P+Q}$). If I is the balance of the potentiometer corresponding to this volt, then,

$$(\frac{VP}{P+Q}) \text{ a } l \text{.....(2)}$$

$$(\frac{Eqn\ (2)}{Eqn\ (1)}) \text{ gives } V = \frac{1.08(P+Q)}{P}\ \frac{l}{L} \text{.....(3)}$$

If V_0 is the voltage as recorded by the voltmeter then difference between V and V_0 gives the correction for the voltmeter.



Procedure

Make the connections as shown in figure. The rheostats Rh_1, and Rh_2, are then adjusted so that we get the balancing point in both cases (opposite deflection) on the potential wire.

Using the rheostat Rh, as a potential divider, the potential of the cell is divided and this potential is measured by the voltmeter. This measured value is applied to the circuit having resistances P and Q connected in series.

To start the experiment the gap a and b are closed. The balancing length L of the Daniel cell is found. Open the gaps a and b then close the gaps c and d. Measure the balancing length as 1. The experiment is repeated by changing the voltage in the voltmeter by adjusting the rheostat in steps of 1 volt. In each case I found out. The voltage is calculated in each time using equation (3)

Finally a graph is drawn with voltmeter reading (V_0) along the X-axis and correction ($V-V_0$) along the Y-axis. This is called as the calibration graph.

Observations and tabulations

Emf of Daniel cell = 1.08V

Balancing length for Daniel cell

i) At start of experiment, L_1 = …….
ii) At end of experiment, L_2 =…….

Mean balancing length, L = $\frac{L1+L2}{2}$

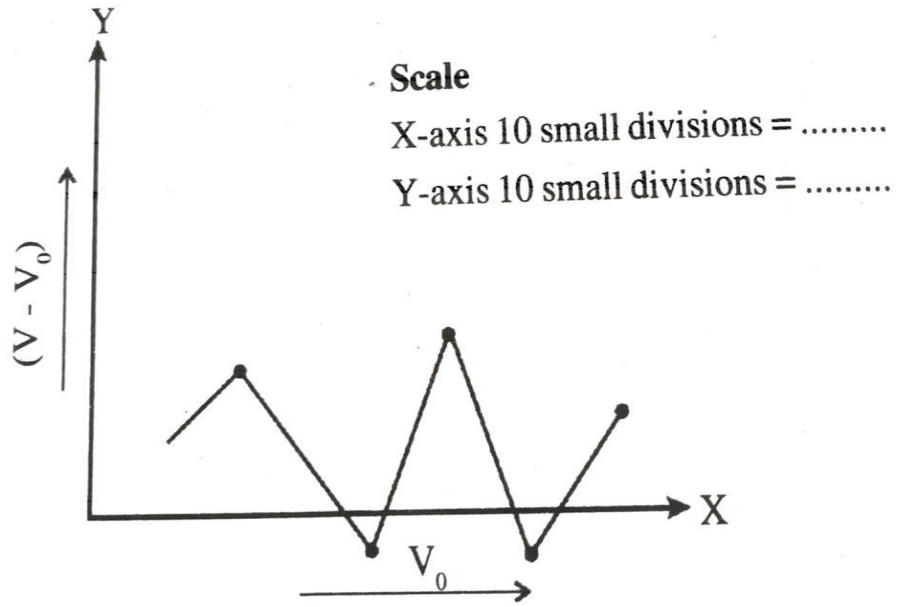
P+Q =

Calculated value of potential difference V= $1.08\frac{(P+Q)}{P}\frac{l}{L}$

Serial No.	Voltmeter reading V_0 (involts)	Resistance (in ohm)		Balancing length l (in m)	Calculated value of p.d. V	Correction $V - V_0$ (involts)
		P	Q			
	1					
	2					
	3					
	4					
	5					

Voltmeter calibration graph

Result



The given high range voltmeter is callibrated and callibration graph is drawn.

References

Experimental Physics – II, For Fifth & Sixth Semester, BSc Degree Programme, Dr.P. Sethumadhavan, Prof. K.C. Abraham, Prof. Meppayil Narayanan, Prof. Philipson C Philip, **Manjusha Publications**

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