DEPARTMENT OF PHYSICS
MAR THOMA COLLEGE FOR WOMEN, PERUMBAVOOR

POTENTIOMETER -CALIBRATION OF AMMETER

A potentiometer is a type of variable resistor that is commonly used for calibrating an ammeter. The calibration process involves adjusting the potentiometer to match the readings of the ammeter with known reference values. This ensures that the ammeter provides accurate measurements

Aim

To calibrate (check the correctness of) the given ammeter.

Apparatus

The given ammeter, a potentiometer, two accumulators, a Daniel cell, a standard resistance, two rheostats, two keys and a galvanometer.

Theory

To calibrate the given ammeter we measure the p.d across a standard resistance R connected in series with the given ammeter by using Potentiometer. By measuring pd (IR) across R, the current through the resistance R which is the same as the current through the ammeter can be calculated. This calculated value of current I can be compared with the current (1) shown by the ammeter. In this way we can check the correctness of the given ammeter.

To find the p.d (IR) across R, firstly we have to standardise the potentiometer using a Daniel cell. Let the balancing for the Daniel cell on the potentiometer wire be L. According to the theory of potentiometer, we have

$$1.08\ \alpha\ L \ \ldots\ldots\ldots\ldots(1)$$

Now if I be the current through the resistance R connected in series with the ammeter in a circuit. Balance the p.d (IR) across the potentiometer. If l is the balancing length obtained then we can write.

$$IR\ \alpha\ l \ldots\ldots\ldots\ldots\ (2)$$

$$\frac{Eq\ (2)}{Eq\ (1)} \text{ gives } \frac{IR}{1.08} = \frac{1}{L}$$

$$\text{Or } I = \frac{1.08l}{RL}$$

Knowing L, I and R, the current through the ammeter can be evaluated. Note the ammeter reading as L. The difference between I and I, gives the correction to be made.

Observations and tabulations

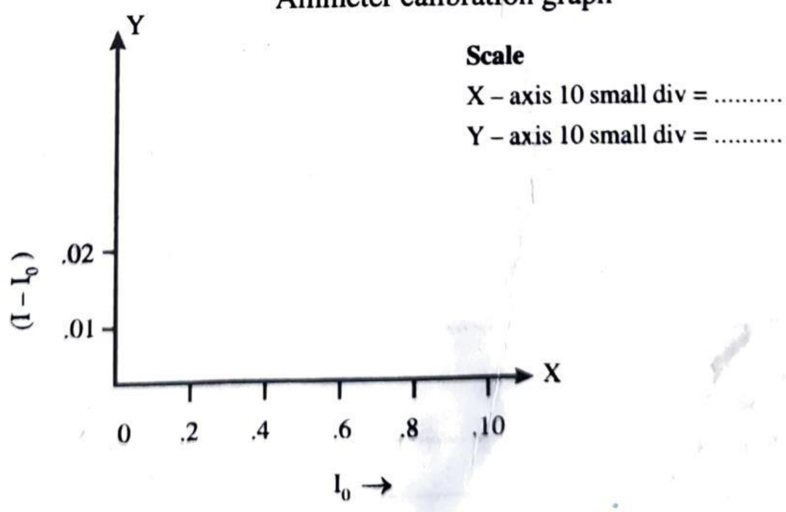
E.M.F of the Daniel cell, E= 1.08V

Balancing length for Daniel cell, L =.......... m

Value of standard resistance, R =...... Ω

S. No.	Ammeter reading I_0 in ampere	Balancing length for p.d across R l in m	Calculated value of current $I = \frac{1.08l}{RL}$	Correction $(I - I_0)$
1	0 . 1			
2	0 . 2			
3	0 . 3			
4	0 . 4			
5	0 . 5			
6	0 . 6			
7	0 . 7			
8	0 . 8			

Ammeter calibration graph



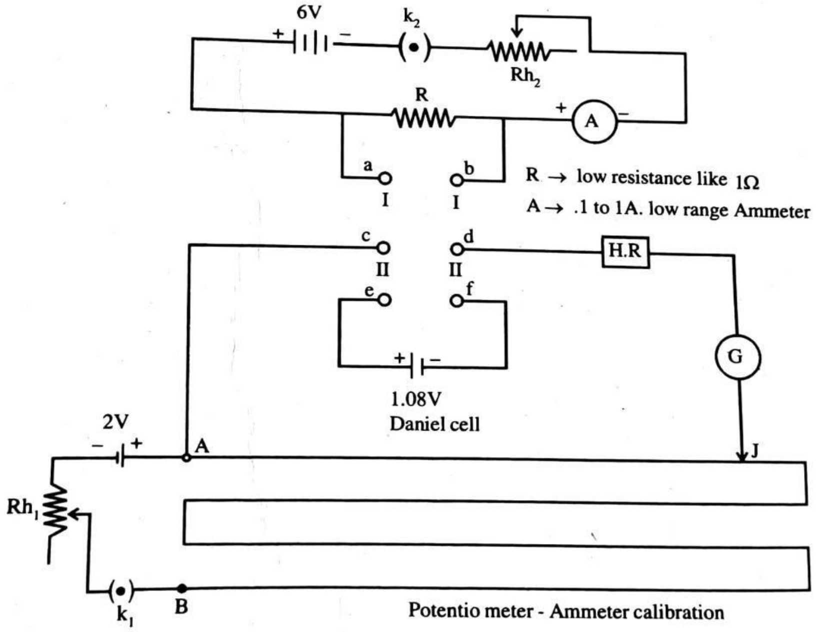
Note : Calibration graph can be of any shape.

Procedure

Make the connections as shown in figure. The potentiometer AB, rheostat Rh_1 , key K_1 and a cell E connected in series. This is called the primary circuit. An accumulator E_1 a key K_2, rheostat Rh_2 an ammeter (A) and a standard resistance R(say 1Ω) connected in series separately constituting the secondary circuit. The Daniel cell of emf 1.08V then connected across the terminals 1 and 2 of the six way key. The ends of the standard resistance R is connected to the terminals 5 and 6 of the six way key. The terminal 3 of the six way key is connected to the positive end A of the potentiometer while the terminal 4 is connected through a galvanometer to the Jockey J.

To start with, the Daniel is included in the potentiometer circuit by closing the gaps I and I of the six way key. Close the key K_1 and press the Jockey near the point A then near the points B of the potentiometer wire AB. If the deflections in the galvanometer are opposite this part of the circuit is okay. If not adjust the rheostat Rh_1 to get opposite deflections. (For better sensitiveness it is desired to adjust the balancing length in the last metre wire of the potentiometer.)

Now remove the keys from the gaps I and II and close the gaps II and II of the six way key. Close the key K_2 and adjust the rheostat Rh_2, and pass a suitable current. Now the p.d across R is fed to the potentiometer wire. Press the Jockey near the point. A and then near the point B. If the deflections in the galvanometer are opposite this part of the circuit is also okay. If not adjust the rheostat Rh, to get opposite deflections. If Rh, is adjusted check the opposite deflections again for the Daniel cell i.e. For the same position of Rh, opposite deflections must be obtained for both Daniel cell and the p.d. across R separately.



Potentio meter - Ammeter calibration

After having done this Daniel cell is introduced in the circuit by closing the gaps I and I. (Do not close the gaps II and II) Find out the balancing length as L. Danial cell is now removed from the circuit.

Remove the keys from the gaps I and I and close the gaps II and II on the six way key. Make the current through the ammeter as say 0.1A. It is noted as I. Then find out the balancing length as l. Knowing L, I and the value of standard resistance; the current (1) through the ammeter can be evaluated by using the formula.

$I = \frac{1.08l}{RL}$

The difference between I_0, and I gives the correction to be made. Repeat the experiment for different values of current I_0, by adjusting the rheostat at Rh_2. Each time calculate I. Finally draw a graph between ammeter reading on the X-axis and the correction $I - I_0$, along the Y-axis. It is called the calibration graph.

Results

The given ammeter is calibrated and calibration graph is drawn.

Reference

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**