# CONVERSION OF GALVANOMETER TO VOLTMETER

## 1 OBJECTIVES

To convert a galvanometer to voltmeter.

## 2 REQUIREMENTS

Galvanometer, power supply(DC), plug keys, resistance boxes($0-1000\Omega$ and $0-10000\Omega$)

## 3 INTRODUCTION

A voltmeter is an instrument of high resistance so that when it is connected across an element for measurement, the voltmeter draws a negligble current through it. Suppose we want to convert a galvanometer of resistance G into a voltmeter of range $0-V$ where $V > I_g G$ where $I_g$is the current through the galvanometer. Then the series resistance R to be connected is given by;

$$\frac{V}{R+G} = I_g$$

$$\Rightarrow R = \frac{V}{I_g} - G \tag{1}$$

## 4 PROCEDURE

### 4.1 *To find the resistance G of the galvanometer.*

1. Set up the circuit as shown in the circuit diagram.
2. Introduce suitable resistance R such that with $K_2$ open and $K_1$ closed the galvanometer gives a full scale deflection of any n division.
3. Now introduce some resistance in S such that the deflection is reduced to half the initial value.
4. Then if R is very large compared to G, the resistance introduced in S is equal o resistance of the galvanometer.

### 4.2 *To determine K, the figure of merit of galvanometer.*

1. Figure of merit of galvanometer is defined as the current required to produce unit deflection in the galvanometer. Connect the circuit as shown in the diagram.
2. A resistance R is introduced in the circuit and the deflection $\theta$ produced in the galvanometer is noted down.
3. The current I through the galvanometer is given by

   $$I = \frac{E}{R+G}$$

   where E is the emf of the cell. The figure of merit of galvanometer is defined by

$$K = \frac{I}{\theta} = \frac{E}{\theta(R+G)} \approx E \times \text{slope}$$

4. The experiment is repeated for various values of R and the mean value of K is noted using a plot of $\frac{I}{\theta}$ versus R.

### 4.3 *To determine the resistance $R_s$, required to be added in series*

1. If N divisions correspond to full scale deflection of the galvanometer, the current $I_g$ required to produce full scale deflection is

   $$I_g = KN$$

   Calculate the value of R to be added to the galvanometer using the relation

   $$R = \frac{V}{I_g} - G$$

2. Connect the resistance to the galvanometer in series. Now the galvanometer (V is the range of the voltmeter) can be used as a voltmeter with terminals at A and B. It is used to measure DC voltages in the particular range.

## 5 OBSERVATIONS

### 5.1 *Part 1:*

| Sl. No | R ($\Omega$) | S ($\Omega$) | G ($\Omega$) | Average ($\Omega$) |
|---|---|---|---|---|
| | | | | |

### 5.2 *Part 2:*

| R($\Omega$) | $\theta$ | $\frac{1}{\theta}$ |
|---|---|---|
| | | |

### 5.3 *Part 3:*

| $V$(V) | $V'$(V) | $V - V'$(V) |
|---|---|---|
| | | |

## 6 CALCULATIONS

### 6.1 *Figure of merit of galvanometer.*

$$K = \frac{I}{\theta} = \frac{E}{\theta(R+G)} \approx \frac{E}{R\theta}$$

$E =$ _____$V$

From the graph,

$$\frac{1}{\theta} = \text{slope} = \_\_\_\_\_$$

$$K = E \times \frac{1}{R\theta} = \_\_\_\_\_$$

### 6.2 *To determine the resistance $R_s$, required to be added in series*

$$I_g = KN = \_\_\_\_\_$$

Value of R to be added to galvanometer

$$R = \frac{V}{I_g} - G = \_\_\_\_\_$$

## 7 RESULT

1. The figure of merit of galvanometer, K is _____
2. The resistanc eof the galvanometer is _____
3. The resistance in series to be added for conversion into a voltmeter is _____

## 8 PRECAUTIONS

Insert a high resistance in the circuit before switching the circuit ON, inorder to protect the galvanometer from damage due to heavy current.