**APPLIED PHYSICS LAB**

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**Topic: Conversion of Galvanometer Into Ammeter**

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# ***Task # 9***

* **Apparatus**

1. Galvanometer
2. Shunt Resistor wire
3. Connecting Wires
4. Power Supply
5. Keys
6. Ammeter
7. Low Resistance box
8. High resistance box

* **Objective**

The objective of this experiment is to convert a galvanometer into an ammeter by adding a suitable shunt resistor and calibrating it to accurately measure current in a given range. This transformation will enable the galvanometer to measure current values without overloading, providing a valuable tool for current measurement in various electrical circuits.

* **Procedure**

1. Find the resistance of galvanometer (Rg) by half deflection
2. method.
3. Calculate the maximum current through a galvanometer *Ig* by
4. taking full deflection in the galvanometer.
5. Current through the shunt resistance**=I- Ig**
6. Calculate Shunt resistance By **Rs=IgRg /(I-Ig)**
7. Connect this shunt resistance in parallel with galvanometer.
8. Verify the conversion by using the circuit shown in the figure 2.

**(I-Ig)S=IgG**

* **Results**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| High Resistannce **R**  (Ohms) | Full Division | Half Deflection  / 2 | Low Resistance **S** (Ohms) | Resistance of Galvanometer | Figure of Merit **K**  **(** x 10-6 **)** |
| 9000 | 30° | 15° | 90 | 90.9 | 4.40 |
| 9400 | 28° | 14° | 100 | 101.07 | 4.51 |
| 9900 | 26° | 13° | 10 | 101.02 | 4.61 |
| 10000 | 22° | 11° | 90 | 98.9 | 5.40 |

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* **Discussion**

**Galvanometer**

A **galvanometer** is a highly sensitive instrument designed to measure small currents. However, due to its sensitivity, it cannot measure large currents directly, as this would damage its coil or move the pointer beyond its scale. To extend the range of the galvanometer for higher currents, a shunt resistor​ is used.

The shunt resistor allows most of the current to bypass the galvanometer, ensuring that only a small fraction of the total current passes through the galvanometer coil. Mathematically, It can be founded using the formula

**Rs=Ig.G /(I-Ig)**

The relationship ensures that the galvanometer can be used safely while the ammeter, as a whole, measures the total current.

**Ammeter**

An **ammeter** is an electrical instrument used to measure the magnitude of current flowing through a circuit. It is connected in **series** with the circuit so that all the current passes through it.

**Key Features of an Ammeter:**

1. **Low Resistance**: An ammeter must have very low internal resistance to minimize the voltage drop across it and avoid affecting the circuit's performance.
2. **Types**:
   * Analog Ammeters: Use a needle and scale to display current.
   * Digital Ammeters: Display current in numerical form.

**Shunt Resistance:**

A **shunt resistance** is a low-resistance component connected in **parallel** with a galvanometer or an ammeter. Its primary function is to bypass the majority of the current, allowing the instrument to measure large currents without being damaged.

**Purpose of Shunt Resistance:**

1. **Current Division**: A shunt diverts most of the current away from the sensitive component (e.g., galvanometer), protecting it from damage.
2. **Conversion**: It enables the conversion of a galvanometer into an ammeter by allowing it to measure larger currents.

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* **Precautions**
* Ensure that the surfaces of the refracting material (e.g., glass slab or prism) are clean and free from dust or fingerprints to avoid scattering or distortion of the light.
* Place the light source and the medium correctly so that the light ray strikes the surface at the intended angle of incidence.
* Draw the normal (perpendicular line) precisely at the point of incidence to measure angles accurately.
* Conduct the experiment in a dimly lit environment to avoid interference from external light sources, which may affect the visibility of refracted rays.
* Mark the light rays and angles with a fine-tipped pencil or marker for better accuracy during measurements.
* **Conclusion**

The experiment demonstrated how a galvanometer, initially limited to measuring small currents, could be converted into an ammeter by using a parallel shunt resistor. This conversion not only highlighted the principles of current division but also showed the importance of calibration and precision in electrical measurements. By carefully calculating the shunt resistance, we successfully extended the utility of the galvanometer while protecting it from damage due to excessive current.

* **Visual Representation**

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Conversion of Galvanometer into Ammeter

Ammeter

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* **References**

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