

### Introduction

When a current-carrying conductor is placed in a magnetic field perpendicular to the current direction, a voltage develops transverse to the current. This voltage was first observed in 1879 by Edwin Hall and the effect is called Hall Effect.

The Hall effect has since led to a deeper understanding of the details of the conduction process. It can yield the density of the charge carriers as well as their sign.

### Theory

As you are undoubtedly aware, a static magnetic field has no effect on charges unless they are in motion. When the charges move, a magnetic field directed perpendicular to the direction of motion produces a mutually perpendicular force on the charges. When this happens, electrons and holes will be separated by opposite forces. They will in turn produce an electric field (E) which depends on the cross product of the magnetic intensity, H, and the current density, J.

$$\vec{E}_y = R \vec{J} \times \vec{H}$$

Where R is called the Hall Coefficient

Now, let us consider a bar of semiconductor, having dimension, x, y and z. Let J is directed along X and H along Z then E will be along Y.

Then we could write

$$R = \frac{V_y / y}{JH} = \frac{V_z}{IH}$$

Where V<sub>h</sub> is the Hall voltage appearing between the two surfaces perpendicular to y and I = Jy

### Hall Effect experiment consists of the following:

1. (a) Hall Probe (Ge Crystal) n & p-type  
(b) Hall Probe Mount (for 10x10mm & 5x5mm sample)
2. Constant Current Source
3. Digital Microvoltmeter
4. Electromagnet
5. Constant Current Power Supply
6. Digital Gaussmeter

### Hall Probes

#### (a) Hall Probe (Ge Crystal)

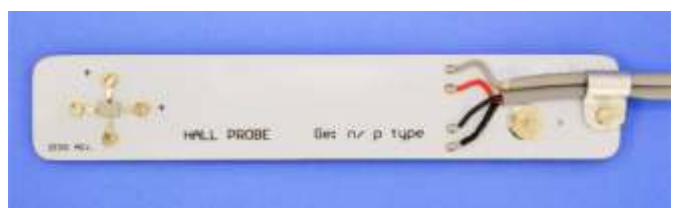
Ge single crystal with four spring-type pressure contacts is mounted on a sunmica-decorated bakelite strip. Four leads are provided for connections with measuring devices.

#### Technical details

Material	: Ge single crystal n or p-type as desired
Resistivity	: 8-10W.cm
Contacts	: Spring type (solid silver)
Zero- field potential	: <1mV (adjustable)
Hall Voltage	: 25-35mV/10mA/KG

It is designed to give a clear idea to the students about Hall Probe and is recommended for class room experiment. A minor drawback of this probe is that it may require zero adjustment.

Further Hall Probe mount for 10x10mm samples and 5x5mm samples is given to enable the user to mount their own samples.



Note: Specifications are subject to change.

### Tesca Technologies Pvt. Ltd.

IT-2013, Ramchandrapura Industrial Area, Sitapura Extension,  
Near Bombay Hospital, Vidhani Circle, Jaipur-302022, Rajasthan, India,  
Tel: +91-141-2771791 / 2771792; Email: info@tesca.in, tesca.technologies@gmail.com  
Website: www.tescaglobal.com

**Current Source  
Constant Current Source**



It is an IC regulated current generator to provide a constant current to the outer probes irrespective of the changing resistance of the sample due to change in temperatures. The basic scheme is to use the feedback principal to limit the load current of the supply to preset maximum value. Variations in the current are achieved by a potentiometer included for that purpose. The supply is a highly regulated and practically ripples free d.c source. The constant current source is suitable for the resistivity measurement of thin films of metals/alloys and semiconductors like germanium.

**Specifications**

Range	: 0-20mA, 0-200mA
Resolution	: 10 <sup>-6</sup> A
Accuracy	: ±0.25% of reading ±1 digit
Display	: 3½ digit, 7 segment LED with autopolarity and decimal indication

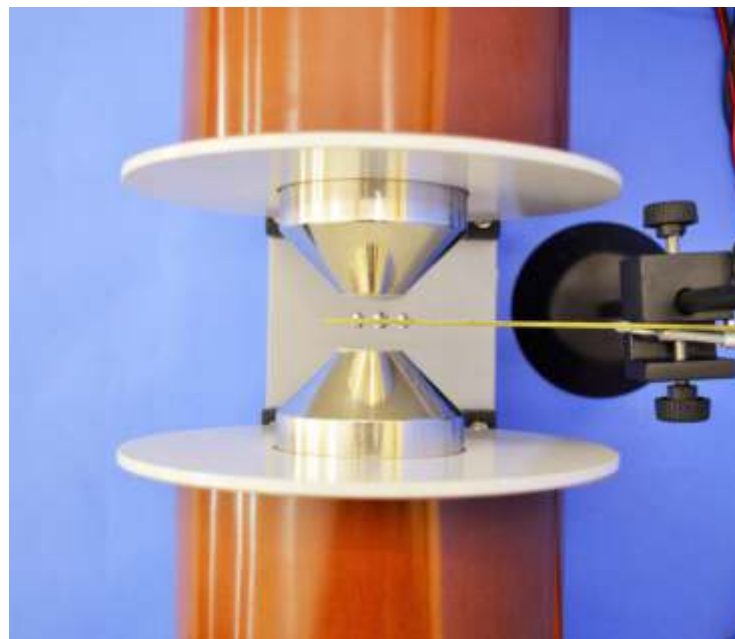
**Voltage Source  
Digital Microvoltmeter**



It is a very versatile multipurpose instrument for the measurement of low dc voltage. It has 5 decade ranges from 1mV to 10mV with 100% over-ranging. For better accuracy and convenience, readings are directly obtained on 3½ digit DPM (Digital Panel Meter).

**Specifications**

Range	: 1mV, 10mV, 100mV, 1V & 10V with 100% over-ranging.
Resolution	: 1μV
Accuracy	: ±0.2% ±1 digit
Stability	: Within ±1 digit
Input Impedance	: >1000MW (10MW on 10V range)
Display	: 3½ digit, 7 segment LED with autopolarity and decimal indication



Note: Specifications are subject to change.

**Tesca Technologies Pvt. Ltd.**

IT-2013, Ramchandrapura Industrial Area, Sitapura Extension,  
Near Bombay Hospital, Vidhani Circle, Jaipur-302022, Rajasthan, India,  
Tel: +91-141-2771791 / 2771792; Email: info@tesca.in, tesca.technologies@gmail.com  
Website: www.tescaglobal.com