

# MAGNETOMETER.



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Magnetometers: A magnetometer is a device that measures magnetism, the direction, strength, or relative change of a magnetic field at a particular location.

Magnetometers are used to measure the strength of the magnetic field. A sensor that is attached to this device measures the flux density of the surrounding magnetic field around it.

Since the magnetic field flux density is proportional to the magnetic field strength so that output directly gives the intensity or strength of the magnetic lines.

## Types of magnetometers:

There are two types of magnetometers

i) Scalar magnetometer.

ii) Vector magnetometer.

The scalar magnetometer measures the scalar value of the magnetic flux intensity with very high accuracy.

Further, it is divided into proton precession overhaused effect and polarized gas magnetometer.


A vector magnetometer measures the magnitude and the direction of magnetic field. Further, it is divided into various types as rotating coil, Hall effect, magnetoresistive, flux gate, search coil, ~~and~~ and SRR magnetometers.

SQUID

## Type of scalar magnetometry.



• proton precession magnetometry: - It uses nuclear magnetic resonance (NMR) to measure the resonance frequency of the protons in magnetic field.

A polarizing DC current is passed through a solenoid that creates high magnetic flux around the hydrogen-rich fuel like kerosene. Some of these protons are aligned with this flux. When the polarizing flux is released, the frequency of precession of the protons to normal realignment  is used to measure the magnetic field.

• Overhauser Effect magnetometry: - It also works on the principle of proton precession type but in place of the solenoid a low power radio frequency signal is used to align the protons. When an electron-rich liquid combines with hydrogen and when it is subjected to RF frequency signal. Then by overhaused effect protons are coupled to nuclei of the liquid.

The precession frequency is linear with magnetic flux density that can be used to measure the field strength. It requires low power consumption and faster sampling rates.

## Ionized gas magnetometry.

It is more accurate than proton precession magnetometry. This consists of proton emitting light and vapour (gaseous) chamber filled with the vapour like cesium, helium and rubidium.

When the atom of the cesium ~~emits~~



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encounters the photon of the lamp, then the energy levels of the electrons are varied at the frequency corresponds to the external field and this frequency variation measures the intensity of the magnetic field.

### Vector Magnetometers

1) Flux gate magnetometers. It is used for high sensitivity applications. A fluxgate sensor device has an alternating current core that runs a permeable core material. It consists of a magnetically susceptible core wound by two coils of wire.

One coil is excited by the AC supply that produces constantly changing field that induces the current in the second coil. This current is based on the field; with out of current. The extent to which this is the case will depend on the strength of the background magnetic field.

SCQUID magnetometers. It consists of two superconductors separated by thin insulating layers to form two parallel junctions. These are very sensitive for low range intensity fields and most commonly used to measure the magnetic field by the brain or heart in medical applications. These are based on the principle of Faraday's law of induction.



It comprises of copper coils that are wrapped around a magnetic core. The core gets magnetised by the magnetic field lines produced inside the coils. If there is any fluctuation in the magnetic field due to the flow of electrical currents and hence change in voltage is measured and recorded by the magnetometer.

Rotating coil magnetometers.

Magneto resistive magnetometer.

Applications of magnetometers:

There are following applications of magnetometer

i) Archaeology - To detect the archaeological sites, buried and submerged objects.

ii) Coal explorations. Used to locate the silts and other obstacles which result in an explosion.

iii) Military application:- Used for defense and navy to perform the submarine activities.

iv) Defense and aerospace: Used on land, in the air, and in space.

v) Drilling sensors: Used to detect the direction of path for the drilling process.

vi) plasma flows: Used while studying about the solar wind and planetary body.