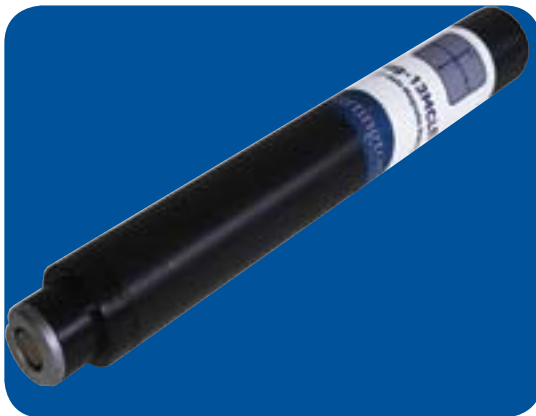


Applications of Three-axis Fluxgate Magnetometers

Medical physics

Magnetic Resonance Imaging (MRI) equipment requires the generation of stable magnetic fields, and the resolution of the measurements may be limited by interference from external magnetic fields and vibration. Interference may result from radio frequency signals, lower frequency interference from electrically operated equipment, such as lifts within the same building, or electric trains even at a considerable distance. It is standard practice to survey an area prior to installation of this sensitive equipment and record the variations in the magnetic field and levels of vibration to determine the suitability of the site and any magnetic shielding and anti-vibration measures required. Radio frequency interference is more easily reduced by shielding but lower frequencies may require active shielding.

The Spectramag-6 unit is specifically designed for pre-installation surveys for MRI equipment, electron microscopes and other sensitive instruments. The Spectramag-6 together with a Mag-03 sensor and accelerometers will record the magnetic field and vibration in three-axes from d.c. to 2.5kHz. The results can be easily incorporated into a site survey report.



Magnetic shielding

In many applications, for instance bioelectromagnetics, the magnetic field must be reduced to a very low level. A single or multi-layer metallic magnetic shield can be easily manufactured for small volumes. This is known as passive shielding.

For larger volumes, for example around MRI machines, electron microscopes and photo electron spectrometers, pairs of Helmholtz Coils are often used to oppose the vertical and horizontal components of the environmental field. In many applications a reduction to 10% of the Earth's field is sufficient, and this can be achieved by applying constant currents to the coils. The Mag-03 sensor, in conjunction with a Mag-03PSU and a digital voltmeter, can be used to monitor each of the three components of the field in turn while the appropriate coil currents are adjusted to achieve zero field. This technique is known as active shielding with open loop control.

The Earth's magnetic field is subject to considerable variations during the course of a day and further variations will occur within a building, due to its structure and to activities both inside and out. In order to achieve a very low or constant field it is necessary to apply a servo system to monitor the field continuously and vary the currents in the coils to counteract these field changes. This provides active shielding with closed loop control. A sensor from the Mag-03 range is suitable for the feedback sensor in this application as it provides simultaneous three-axis monitoring with a good frequency response.

ELF measurements

The flat frequency response of the Mag-03 sensors over the range from d.c. to 3kHz allows measurements of the environmental ELF (10Hz to 3kHz) magnetic field to be made in three axes. Sources of magnetic fields which may be investigated include devices operating at power frequencies, which generate fields at the power frequency and its harmonics, and others which produce fields that are independent of the power frequency. Examples of the latter category include VDU terminals, electric trains (16.7Hz and 25Hz), mass transportation systems (0Hz to 3kHz depending on the characteristics of the variable speed drive), commercial aircraft (400Hz), induction heaters (50Hz to 3kHz) and electric vehicles. The Spectramag-6 data acquisition system is particularly suitable for spectral analysis.

Non-destructive testing

The low noise versions of the Mag-03IE sensors have been used for the detection of deep-lying defects in conducting samples using eddy current testing.

Power distribution

The Mag-03 range is used for the measurement of phase imbalances in transmission systems and earth leakage currents around power generation and distribution facilities.

Physics

The Mag-03 range of sensors have been used in such diverse applications as the magneto-optic sensitivity measurements of diamagnetic glasses and ferrimagnetic bulk, and the thermoelectric detection of spherical tin inclusions in copper.

Defence

The Mag-03 range of sensors, together with Spectramag-6 or the Mag-03SCU signal conditioning unit can be used in magnetic ranges to measure the magnetic signature of vessels or vehicles.

Earth's field measurements and magnetic surveys

A Mag-03 sensor combined with the Spectramag-6 or Mag-03DAM provides a high resolution system to measure the Earth's magnetic field. It can be used in a base station during magnetic surveys, as a secondary system to monitor the performance of a magnetic observatory system, or as a long baseline gradiometer for magnetotelluric measurements. The Mag-03MS is also used as a sensor for the airframe compensation system during airborne magnetic surveys.