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Application Note PE001

Principles of Measurement

Hall Effect probe

About general Principle of Measurement

A majority of the probes of the Teslameter system FM 205 acts by means of the Hall Effect principle. At the tip of the probe, a magnetic-field-sensitive semiconductor element is located, which converts the captured magnetic flux density into a voltage. Magnetic field dependence is nonlinear. Therefore, values detected by the probe will be corrected by electronics, and converted into a directly readable numerical value (µT, mT, T) in basic equipment. In addition, the corrected value is available as an analog voltage (at the jack, located at the head of FM 205 basic equipment).

Hall Effect sensor: Principle of Operation

If a magnetic field acts on moving charge carriers, their courses will be changed. If semiconductor material will be used, esp. indium antimonide or indium arsenide, a particularly large, exploitable effect will be received. If the device is exposed by a magnetic field, the Hall Effect sensor (four-pole connection, see fig. 1) establishes a voltage between the two edges of the device, which run in parallel to the field lines of electrical current. k is the material-dependent sensitivity coefficient.

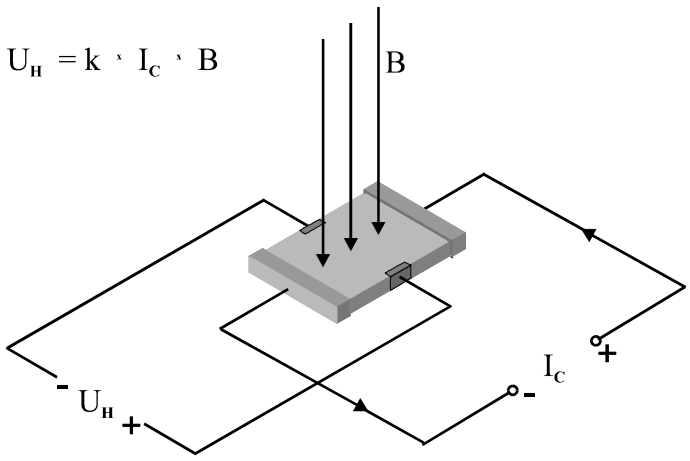

Fig. 1: Hall Effect sensor

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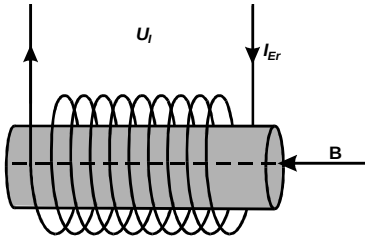
Fluxgate magnetometer

Principle of Operation

The flux gate principle is used for flux density sensors of high sensitivity. It is suitable for measurement of direct and alternating magnetic fields. The sensor consists of a ferromagnetic core and a field coil, which is used for detecting the magnetic flux density too. A generator with 17 kHz magnetizes the sensor core into the saturation over the field coil. Without an external magnetic flux density, in the coil a symmetrical voltage will be generated. By action of an external magnetic flux density, an asymmetry will be generated, which affects coil voltage. This asymmetry is measured, processed and converted in the basic equipment into a readable numerical value (µT). In addition the processed value is available as an analog voltage.



U_i = voltage induced

I_{Er} = exciting current

B = external magnetic flux density

Fig. 2: Fluxgate sensor

Interference of measurement accuracy

Due to principle of measurement, in proximity of probe, metallic matters can cause a falsification of measured value. For instance, measurements in an aluminum pipe (18 mm inner diameter, 1 mm wall thickness) of a flux density of 0 T results in a display of -0,05 µT, and a flux density of +190,0 µT results in a deviation of -0,3 µT.