MAGNETIC FIELD SENSOR ML51M

USER'S GUIDE

CENTRE FOR MICROCOMPUTER APPLICATIONS

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Short description

The Magnetic Field sensor ML51m measures magnetic field strength in the range of -1000 to 3000 Gauss (-100 .. 300 mT). The sensor uses a Hall-element as its sensing element. This element is mounted at the tip of the stainless steel tube.
The face of Hall element is directed perpendicular to the direction of the stainless steel tube and the sensor is most sensitive when the tube is positioned parallel to magnetic field lines. The sensor is therefore very suitable for measuring magnetic field inside coils or near permanent magnets.
The Magnetic Field sensor is an I2C digital sensor, which gives calibrated values of the measured quantity. This sensor can only be connected to special interfaces that support I2C digital sensors like the CMA MoLab interface. The sensor cable needed to connect the sensor to an interface is not supplied with the sensor (sensor cables are supplied with interfaces).

Note:
The values obtained by the sensor will be sensitive to the position in magnetic field and the orientation of the sensor to the field direction. A false low value could be achieved if the direction of magnetic field is not parallel to the direction of the sensor tube.

Sensor specifications

The Magnetic Field sensor ML51m is a digital sensor that converts the measured magnetic field strength value to a digital value via 14-bit analog-to-digital conversion. The resolution of the senor is 0.244 gauss. The maximal sampling frequency of the sensor is 1000 Hz.

Collecting data

This Magnetic Field sensor works only with specific interfaces. The sensor will be automatically detected when connected to such an interface.
For detailed information about measurements with sensors consult the User Manuals of the interface and the Coach 6 software.

Calibration

The Magnetic Field sensor is supplied with a factory calibration in gauss (G). The Coach 6 program allows shifting the pre-defined calibration or creating a new two-point linear calibration if needed. Use the *Set to zero* option in Coach 6 to adjust the zero point of the sensor. The user calibration is stored in non-volatile user sensor memory.

Suggested experiments

This Magnetic Field sensor can be used for:

- Measurements of the magnetic field near a (strong) permanent magnet.
- Measurements of the magnetic field near a current-carrying wire.
- Measurements of the magnetic field near or inside a coil or solenoid.
- The variation of the field in Helmholtz coils.

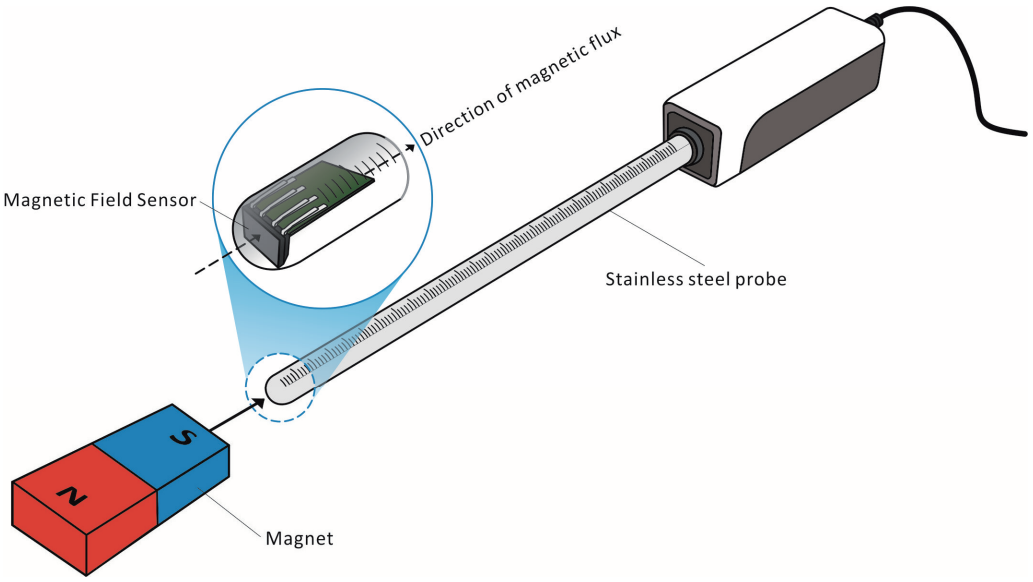

Figure 1. Measuring the magnetic field near a permanent magnet.

Magnetic field strength measurement

Magnetic field strength (also known as the *magnetic flux density*) is a measure of the force the magnetic field will exert on an electric current or another magnet.

In S.I. units magnetic field strength is expressed in teslas (T). In cgs units magnetic field strength is expressed in gauss (G).

$$1\ G = 1 \times 10^{-4}\ T = 0.1\ mT$$

Below are given magnetic field strength values of exemplary magnetic sources.

Magnetic field strength in gauss	Magnetic field source
$10^{-9} – 10^{-8}$	The human brain magnetic field
0.31 - 0.58	The Earth's magnetic field on its surface
25	The Earth's magnetic field in its core
50	A typical refrigerator magnet
100	A small iron magnet
2000	A small neodymium-iron-boron (NIB) magnet
15,000 - 30,000	A medical magnetic resonance imaging electromagnet

Technical Specifications

Sensor kind	Digital: on-sensor analog to digital conversion (14-bits resolution, communication via I2C)
Measuring range	- 1000 .. 3000 gauss
Resolution	Typical 0.244 gauss
Uncertainty	Radiometry sensitivity error: Typical ± 1.5% at full range and temperature of 25°C Linearity sensitivity error: Typical ±3.5% Accuracy: Typical ± 5.0%
Current requirement	Typical 27mA at 25°C
Maximum sampling	1000 Hz
Sensor dimensions	Housing: 70 x 21 x 70 mm (W x D x H) Stainless Steel Probe: Length: 130mm Diameter: 7mm
Connection	5-pins mini jack plug

Warranty:

The Magnetic Field sensor ML51m is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: *This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.*

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