Magnetic Field Sensor ±2000 mT 1009941

Instruction Sheet

04/12 Hh

1. Description

Sensor box with attached sensor probe, 140 mm long, 7 mm wide and 1.9 mm thick, for measuring magnetic flux density *B* of a magnetic field acting outside the box in a tangential plane, primarily for use with the basic Hall-effect apparatus (1009934).

At the tip of the probe there is a Hall sensor with an active area of about 0.044 mm², which produces a steady output signal that is ratiometric (i.e., proportional to the operating voltage).

The Hall sensor has an extended temperature range of -20°C to +180°C for measuring the flux density of heated germanium semiconductor crystals (probes).

There are two latching range buttons for 0.2 T and 2 T plus an additional Tare button for calibration. The current setting of the measurement range is shown visually by a light-emitting diode on the left of the relevant button.

The stand clamping rod can be adjusted to hold the sensor in the desired position and orientation in the magnetic field that is being measured.

The box is also suitable for use with the connector box (115 V, 50/60 Hz) (1009954) or connector box (230 V, 50/60 Hz) (1009955). See the relevant technical data.

2. Safety instructions

The magnetic field sensor is not suitable for applications where safety is essential.

- Only use the magnetic field sensor for educational purposes!

3. Equipment supplied

1 sensor box with permanently attached probe
1 miniDIN 8-pin connecting cable, 60 cm
1 clamping rod, length 120 mm
1 instruction sheet

4. Technical data

Measurement ranges:	200 mT, 2000 T
Configuration:	Tangential
Sensor type:	Linear Hall-effect sensor
Position of Hall sensor:	135 mm, with reference to the front of the sensor box casing
Tare range:	
200 mT range:	+/- 100 mT
2 T range:	+/- 1 T
Non-linearity:	Max. ±1,5 % of the total measurement range

Temperature dependence:

$$B(T) = B(300\,K)\cdot\left[1 - 0{,}00088\cdot\left(\frac{T}{K} - 300\right)\right]$$

When used with a connector box

200 mT range:	Conversion factor: 125 mT/V, 1.60 V at 200 mT
2 T range:	Conversion factor: 1250 mT/V, 1.60 V at 2000 mT

5. Operation

Note:

- To avoid permanent damage to the Hall sensor in the sensor probe tip, do not subject it to any mechanical pressure!
- Do not bend the sensor probe tip!

- Hold the sensor box by hand in the magnetic field to be measured, or use the clamping rod to position it as required in the experimental setup.
- Set the tangential orientation of the sensor element as required and measure the magnetic field.
- Insert the sensor probe vertically through the positioning hole marked "MFS" on the top of the basic Hall-effect apparatus till it comes to rest. The centre of the active surface on the sensor will then be within the uniform magnetic field of the electromagnet and right next to the semiconductor crystal.
- Read off the value of the magnetic flux density from the 3B NET*log*™ display.

The sensor box is automatically detected by the 3B NET*log*™ unit.

Any change in the measuring range is automatically transmitted to the 3B NET*log*™ unit.

5.1 Zero calibration for the sensor box

- When a measuring range has been selected, hold down the Tare button for about 1 s. Zero calibration is carried out automatically.

The zero display follows on the 3B NET*log*™ display row corresponding to the selected sensor input.

- Under certain circumstances it may be necessary to carry out zero calibration again between measurements.
- Zero calibration should not be carried out inside the pole pieces of a transformer. The poles may possess some remanence which would need to be taken into account.

6. Experimental applications

Magnetic fields of permanent magnets and coils
Hysteresis of transformers
Remanence
Saturation effects in ferrite cores

7. Sample experiment

Experiment to measure magnetic flux density involving the Hall effect in semiconductors

Equipment needed:

1 3B NET*log*™ (115 V, 50/60 Hz)	1000539
1 Transformer with Rectifier (115 V, 50/60 Hz)	1003315
1 DC Power Supply 20 V, 5 A (115 V, 50/60 Hz)	1003311
or	
1 3B NET*log*™ (230 V, 50/60 Hz)	1000540
1 Transformer with Rectifier (230 V, 50/60 Hz)	1003316
1 DC Power Supply 20 V, 5 A (230 V, 50/60 Hz)	1003312
1 Hall Effect Basic Apparatus	1009934
1 P-Doped Ge on Circuit Board	1009810
or	
1 N-Doped Ge. on Circuit Board	1009760
1 Magnetic Field Sensor ±2000 mT	1009941
1 U Core	1000979
2 Coils D with 600 Taps	1000988
1 Pair of Pole Shoes	1009935
1 Set of 15 Safety Experiment Leads	1002843

- Set up the experiment as in Fig. 1.
- Switch the transformer and rectifier to the 12-V setting to supply the basic Hall-effect apparatus with 12 V AC.

- Select the 2-T range on the magnetic field sensor and press the Tare button.
- Insert the magnetic field sensor into the positioning hole marked "MFS".
- Set the DC power supply to constant-current mode, i.e. turn the current-setting potentiometer all the way to the left (0 A) and the voltage-setting potentiometer all the way to the right (20 V).
- Increase the current in the series circuit including the transformer coils from 0 A to 2 A in steps of 0.1 A.
- You may also measure the current in the coils using the current measurement input of the 3B NET*log*™ unit (measuring range 2 A DC) and include those measurements in your evaluation of the experiment.

Example results:

For a pole-piece separation of 8 mm and values of 10.6 V and 1.74 A the flux density will be 300 mT.

. Care and maintenance

- Before cleaning the equipment, disconnect it from its power supply.
- Use a soft, damp cloth to clean it.

9. Disposal

- The packaging should be disposed of at local recycling points.
- Should you need to dispose of the equipment itself, never throw it away in normal domestic waste. Local regulations for the disposal of electrical equipment will apply.

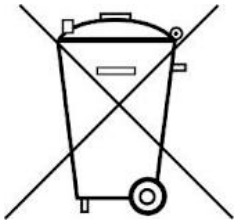

Fig. 1 Measurement of flux density in the air gap between pole pieces of an electro-magnet in an experiment set-up using the basic Hall-effect apparatus