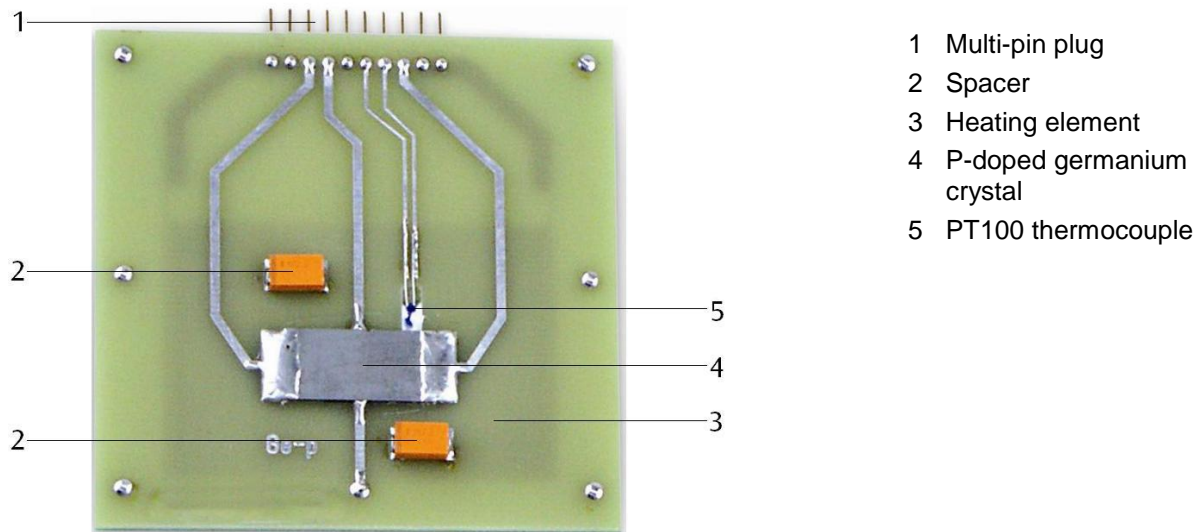


P-doped germanium on circuit board 1009810

Instruction manual

10/15 ALF



1. Safety instructions

The germanium crystal is highly breakable:

- Handle the board carefully and do not put any mechanical stress on it.

The sample circuit board can get very hot when in operation (170°C) and there is a risk of burns.

- Before dismantling the board from the apparatus, allow it sufficient time to cool.

Because of its high resistivity, the germanium crystal will start to heat up as soon as a sample current is put through it.

- Do not exceed the maximum sample current $I = \pm 33$ mA.
- Turn the trimmer for setting the sample current to a position in the centre.

2. Description

The circuit board is intended for use with the Hall effect basic apparatus (1009934) in order to measure the conductivity and Hall voltage of p-doped germanium as a function of temperature. In addition, it is also possible to study how the Hall voltage depends on an external magnetic field and the sample current through the crystal.

The circuit board has a multi-pin plug with contacts for a sample current, the resistive heating element and the temperature sensor underneath the crystal.

3. Contents

- 1 Circuit board with germanium crystal
- 1 Test record
- 1 Instruction manual

4. Technical data

Maximum sample current: ± 33 mA
Dimensions of crystal: 20x10x1 mm approx.
Dimensions: 70x70x10 mm approx.
Weight: 30 g approx.

5. Pin assignment

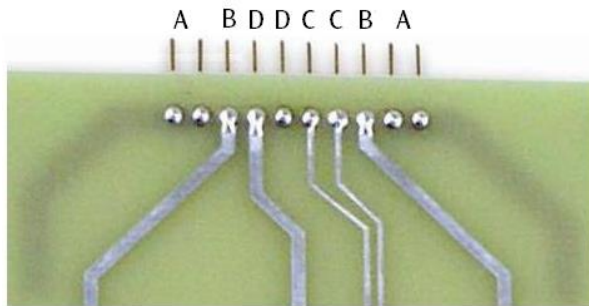


Fig.1 A Heating element, B Sample current through germanium crystal, C PT100 thermocouple, D Hall voltage

6. Operation

Installation of the circuit board in the Hall effect console and the circuit diagram for the experiment are included in the instruction manual for the Hall effect equipment itself.

7. Measurement values

Hall voltage U_H (basic apparatus)
Sample voltage U (basic apparatus)
Sample current I (basic apparatus)
Sample temperature T_P (basic apparatus)
Magnetic flux B (with magnetic field sensor)

Derived values:

$$\text{Conductivity: } \sigma = \frac{I}{U} \cdot \frac{20\text{mm}}{10\text{mm} \cdot 1\text{mm}}$$

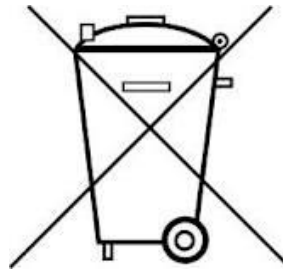
$$\text{Absolute temperature in Kelvin: } T = T_P + 273,15\text{K}$$

8. Care and maintenance

- Use a soft brush to clean the board. Do not touch the crystal with your fingers if possible.
- Keep in the original box after the equipment has been used and has cooled down.

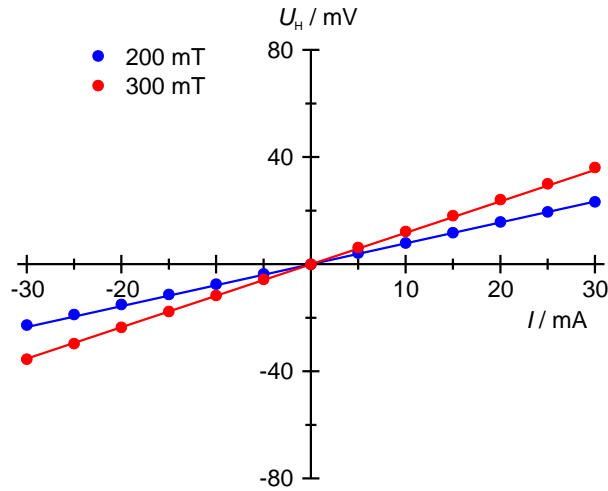
9. Disposal

- If you need to dispose of the circuit board, never throw it away in normal domestic waste. Local regulations for the disposal of electrical equipment will apply.
The packaging is made of environmentally-friendly materials and can be recycled.
- You can dispose of it at local recycling points.

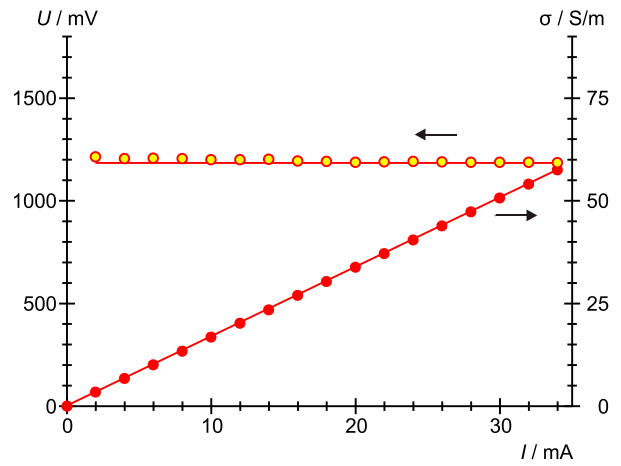


10. Experiments

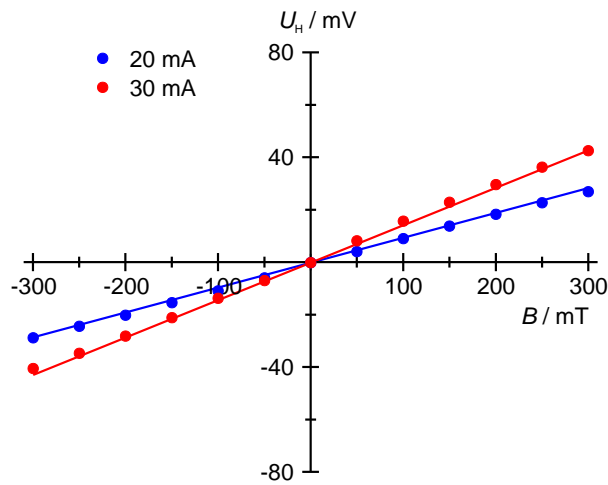
10.1 U_H as a function of I



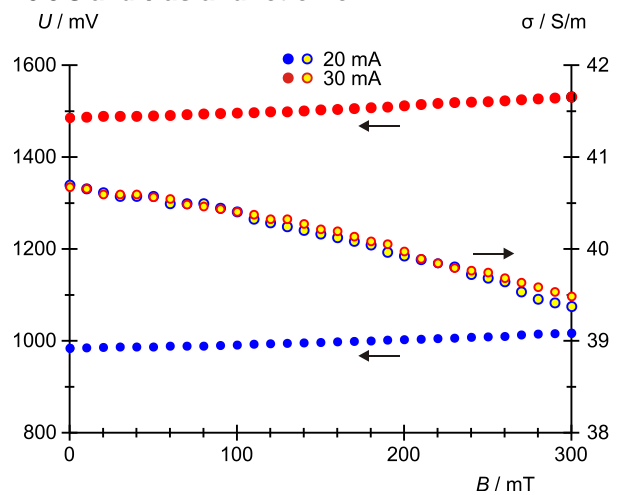
10.4 U and σ as a function of I



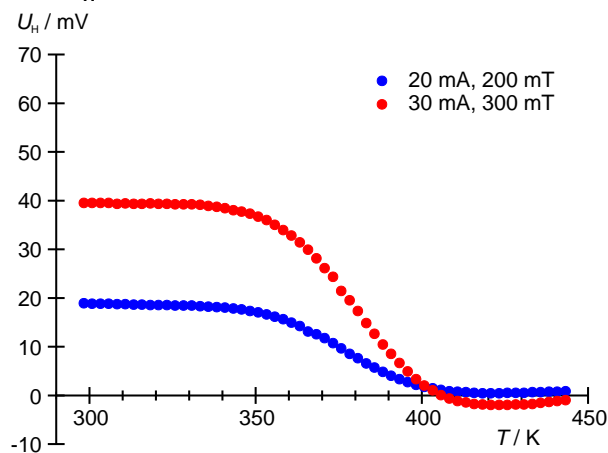
10.2 U_H as a function of B



10.5 U and σ as a function of B



10.3 U_H as a function of T



10.6 U and σ as a function of T

