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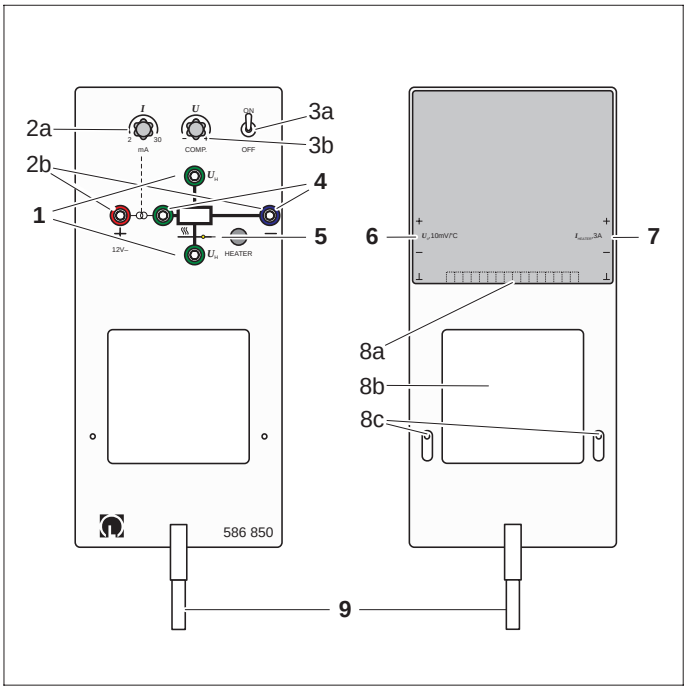



# Instruction Sheet 586 850

## Base Unit for Hall Effect (586 850)

1 **Output for Hall voltage**

2 **Current source**
cross-current adjuster (2a)
input for supply voltage (2b)

3 **Compensation**
on/off switch (3a), compensation knob (3b)

4 **Output for voltage drop at Ge crystal**

5 **HEATER key**, with LED

6 **Temperature measuring output**

7 **Power input for heating and electronics**

8 **Mounting for plug-in boards**
DIN socket (8a), window (8b), holes (8c)

9 **Rod**, with stop

## 1 Description

The base unit for Hall effect is used to investigate the Hall effect and the electrical conductance of Ge crystals on plug-in boards (586 851-853) as a function of temperature. It provides an adjustable current source for the cross-current $I$ through the Ge crystal. The device measures the Hall voltage $U_H$ resp. the voltage drop $U$ at the Ge crystal.

For the Hall effect, the devices is arranged between the pole pieces of the demountable transformer (562 11 ff). You can measure the magnetic field in the immediate vicinity of the crystal using the tangential B-probe (516 60).

An electronic compensation circuit can be activated to adjust the zero point of the Hall voltage at room temperature for a selected cross-current.

The wave-form filaments used to heat the Ge crystals on the plug-in boards are supplied by the base unit for Hall effect. At the same time, the device outputs a voltage $U_\vartheta$ proportional to the crystal temperature $\vartheta$. To protect the sensitive Ge crystals, the heating automatically cuts out at 165 °C.

**Safety notes** *Electrostatic discharge (ESD) protection measures:*

The sensitive electronics of the base unit for Hall effect can be damaged or even destroyed by static electricity discharge.

- Select your working environment so that no electrostatic charging of the user and/or the experiment equipment can occur (no carpeting or similar, implement electropotential bonding, ground experimenter).

When the base unit for Hall effect is used in expanded experiment setups in which connecting leads act as antennas, strong electromagnetic fields can interfere with the function of the device to the extent that it is temporarily unable to function adequately (e.g. incorrect Hall voltage).

- Keep all connecting leads as short as possible.
- Make sure that no RF sources which are not part of the experiment setup (e.g. cellular telephones) are in operation in the vicinity.

## 2 Technical data

**Mounting for plug-in boards:**

| | |
|---|---|
| Connection: | DIN socket |

**Outputs:**

| | |
|---|---|
| Hall voltage: | 2 safety sockets, 4 mm |
| Voltage drop across Ge crystal | 2 safety sockets, 4 mm |

**Adjustable current source and $U_H$ compensation:**

| | |
|---|---|
| Power supply | 12 V, 50 mA DC |
| Connection for power supply: | 2 safety sockets, 4 mm |
| Current range: | 2 mA to approx. 32 mA |
| Compensation voltage: | approx. ±35 mV (at $I$ = 32 mA) |

**Heating and temperature measurement:**

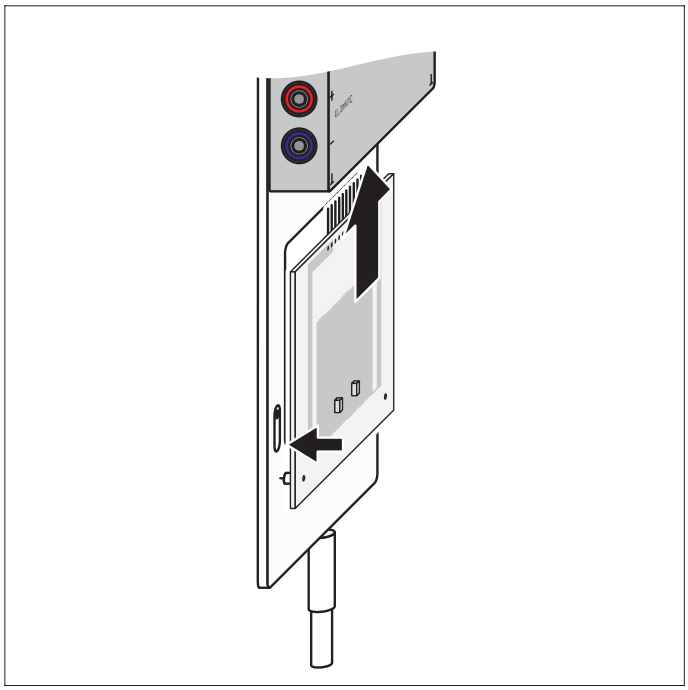
| | |
|---|---|
| Power supply | 15 V, 3 A DC, current stabilized or 12 V, 3 A DC |
| Connection for power supply: | 2 safety sockets, 4mm |
| Temperature measuring output: | 2 safety sockets, 4 mm |
| Temperature calibration: | $\vartheta = 100^0\text{C} \cdot \frac{U}{\text{V}}$ |

**General data:**

| | |
|---|---|
| Dimensions (without rod): | 275 mm × 125 mm × 50 mm |
| Rod: | 50 mm × 10 mm dia. |
| Weight: | 0.8 kg |

## 3 Operation

### 3.1 Mounting the plug-in boards 586 851-3

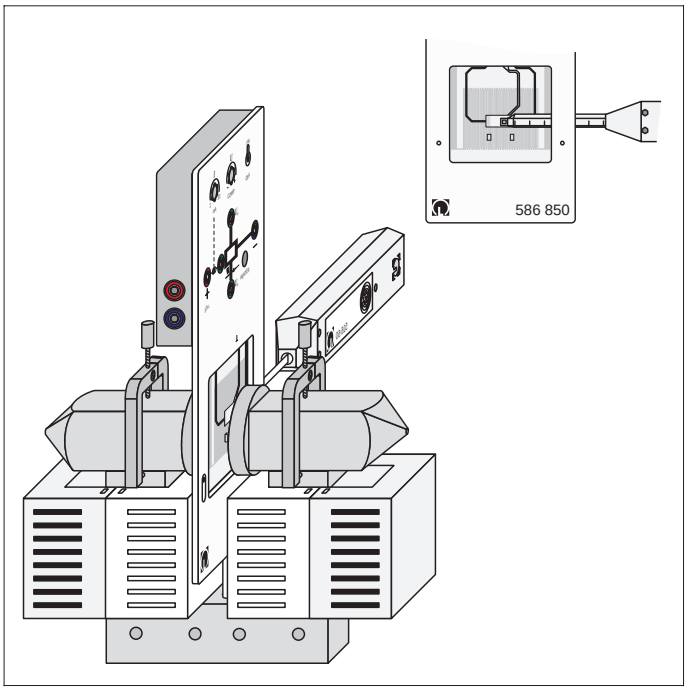


additionally required:

| | |
|---|---|
| 1 Ge undoped on plug-in board | 586 851 |
| or | |
| 1 p-Ge on plug-in board | 586 852 |
| or | |
| 1 n-Ge on plug-in board | 586 853 |

– Turn the plug-in board so that the side with the crystal faces the front of the base unit.
– Insert the plug-in board with DIN plug into the DIN socket on the base unit until the pins latch into the holes.

### 3.2 Arrangement in a homogeneous magnetic field




additionally required:

| | |
|---|---|
| 1 U-core with yoke | 562 11 |
| 1 Pair of bored pole pieces | 560 31 |
| 2 Coils, 250 turns | 562 13 |

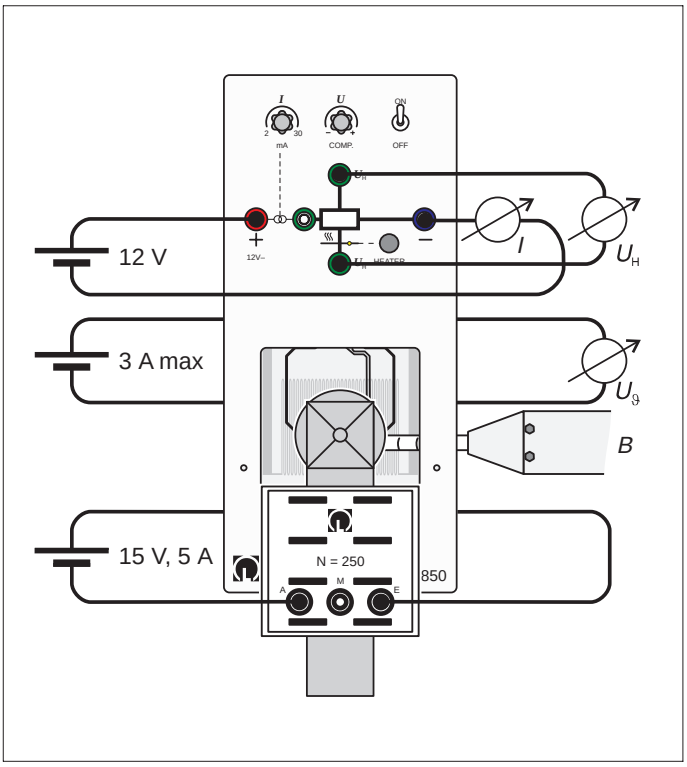
– Insert the base unit with rod into the hole of the U-core all the way to the stop; make sure that the plug-in board is seated parallel to the U-core.
– Attach the pair of bored pole pieces with additional pole piece, and slide the additional pole piece as far as the spacers of the plug-in boards (make sure that the plug-in board is not bent).

*additionally recommended for measuring the magnetic field:*

| | |
|---|---|
| 1 Tangential B-probe | 516 60 |

## 4 Carrying out the experiment

### 4.1 Measuring the Hall voltage as a function of the magnetic flux density, the temperature or the cross-current (only for p- or n-doped Ge crystal)




Experiment examples:

− Set the cross-current *I* to the maximum value (see Instruction Sheet for Ge crystal), switch compensation on and zero the Hall voltage using the compensation knob.

*a) Vary the cross-current I:*

− Set the magnetic flux density *B* resp. the current through the magnet coils, vary the cross-current *I* and measure the corresponding Hall voltage $U_H$.

*b) Varying the magnetic flux density B:*

− Vary the magnetic flux density *B* resp. the current through the magnet coils and measure the corresponding Hall voltage $U_H$.

*c) Varying the temperature ϑ:*

− Set the magnetic flux density *B* resp. the current through the magnet coils.
− Press the HEATER key and record the Hall voltage $U_H$ as a function of voltage $U_ϑ$ at the temperature measuring output using CASSY or an XY-recorder.

*additionally required:*

| | |
|---|---|
| 1 p-Ge on plug-in board | 586 852 |
| or | |
| 1 n-Ge on plug-in board | 586 853 |

*a) Coil power supply:*

| | |
|---|---|
| 1 Power supply, 20 V, 5 A DC, e.g. | 521 50 |

optionally 1 ammeter, $I \leq 5$ A for coil current

*b) Heating and electronics power supply:*

| | |
|---|---|
| 1 Power supply, 15 V, 3 A DC, current regulated, e.g. | 521 50 |
| or | |
| 1 Power supply 12 V, 3A DC | |

optionally 1 ammeter, $I \leq 3$ A

*c) Supplying the controllable voltage source:*

| | |
|---|---|
| 1 Power supply, 12 V, 50 mA DC, e.g. | 521 54 |

optionally 1 ammeter, $I \leq 50$ mA for cross-current through Ge-crystal

*d) Temperature measuring output:*

1 Voltmeter, U ≤ 1.65 V

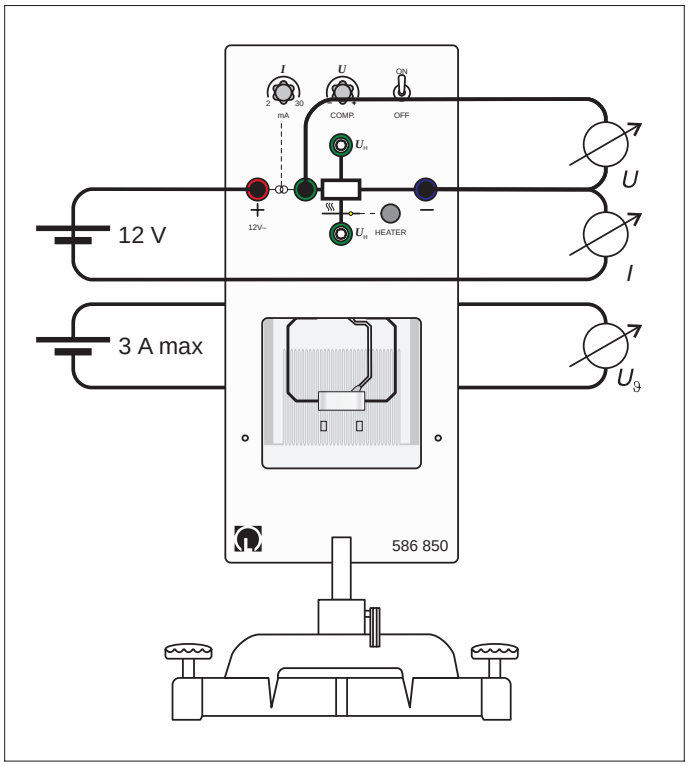
*e) Measuring the Hall voltage:*

1 Voltmeter, U≤ 100 V

*f) Measuring the magnetic field:*

| | |
|---|---|
| 1 Tangential B-probe | 516 60 |
| 1 B-box | 524 038 |
| or | |
| 1 Teslameter | 516 62 |

### 4.2 Measuring conductivity as a function of temperature




*Experiment examples:*

a) *Variation of the cross-current I:*

− Vary the cross-current *I* (see Instruction Sheet for Ge crystal) and measure the voltage drop *U*.

*c) Varying the temperature $\vartheta$:*

− Set the cross-current *I* (see Instruction Sheet for Ge crystal), press the HEATER key and measure the voltage drop *U* as a function of the voltage $U_\vartheta$ at the temperature output using CASSY or an XY-recorder.

*additionally required:*

| | |
|---|---|
| 1 Ge undoped on plug-in board | 586 351 |
| or | |
| 1 p-Ge on plug-in board | 586 852 |
| or | |
| 1 n-Ge on plug-in board | 586 853 |

*a) Heating and electronics power supply:*

| | |
|---|---|
| 1 Power supply, 15 V, 3 A DC, current regulated, e.g. | 521 50 |
| or | |
| 1 Power supply 12 V, 3A DC | |
| optionally 1 ammeter, I ≤ 3 A | |

*b) Supplying the controllable voltage source:*

| | |
|---|---|
| 1 Power supply, 12 V, 50 mA DC, e.g. | 521 54 |
| optionally 1 ammeter, I ≤ 50 mA for cross-current through Ge-crystal | |

*c) Temperature measuring output:*

1 Voltmeter, U ≤ 1.65 V

*d) Measuring the voltage drop at the Ge crystal:*

1 Voltmeter, U ≤ 3 V