# Transistors as voltage amplifiers (Item No.: P1401500)

## Curricular Relevance

**Area of Expertise:** Physics
**Education Level:** Age 16-19
**Topic:** Electricity
**Subtopic:** Electronics
**Experiment:** Transistors as voltage amplifiers

| Difficulty | Preparation Time | Execution Time | Recommended Group Size |
|---|---|---|---|
| Intermediate | 10 Minutes | 10 Minutes | 2 Students |

**Additional Requirements:**

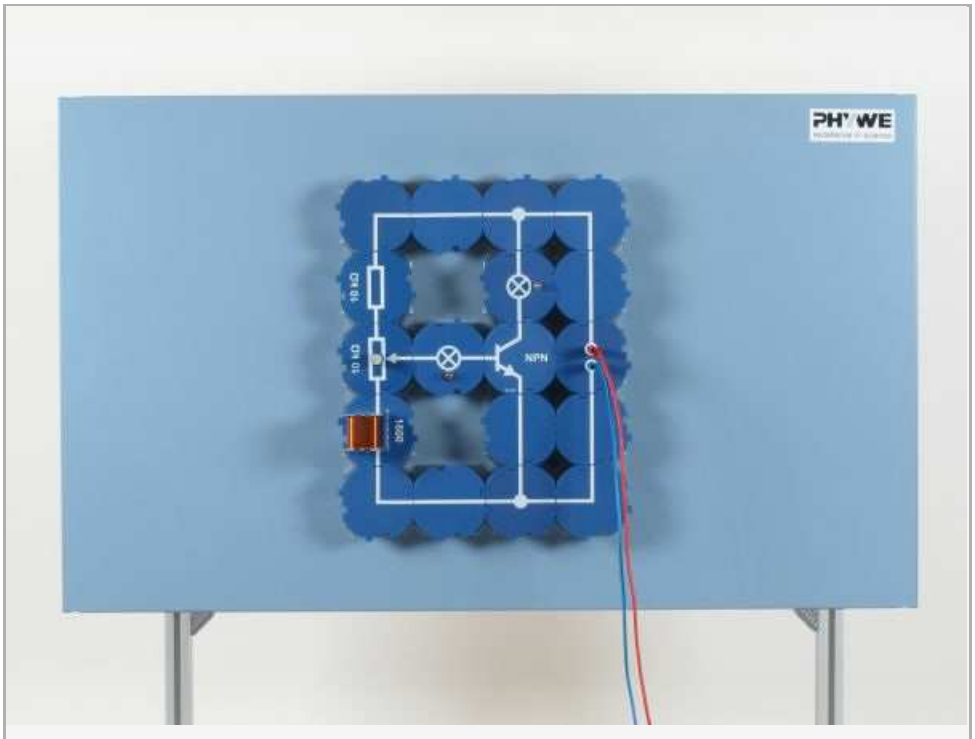
**Experiment Variations:**

**Keywords:**

## Principle and equipment

### Principle

An alternating voltage induced in a coil by a magnet is to be so amplified by transistor that it can be detected by a filament lamp.




Experimental set-up

## Equipment

| Position No. | Material | Order No. | Quantity |
|---|---|---|---|
| 1 | PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A | 13500-93 | 1 |
| 2 | Demo Physics board with stand | 02150-00 | 1 |
| 3 | Coil 1600 turns, module DB | 09472-02 | 1 |
| 4 | Potentiometer 10 kOhm,module DB | 09425-10 | 1 |
| 5 | Transistor BC337,module DB | 09456-00 | 1 |
| 6 | Socket for incandescent lamp E10 ,module DB | 09404-00 | 2 |
| 7 | Connector interrupted, module DB | 09401-04 | 1 |
| 8 | Resistor 10 kOhm,module DB | 09415-10 | 1 |
| 9 | Electr.symbols f.demo-board,12pcs | 02154-03 | 1 |
| 10 | Connector, straight, module DB | 09401-01 | 5 |
| 11 | Connector, angled, module DB | 09401-02 | 4 |
| 12 | Connector, T-shaped, module DB | 09401-03 | 2 |
| 13 | Magnet, bar-shaped, d = 18 mm, l = 70mm | 06318-00 | 1 |
| 14 | Filament lamps 4V/0.04A, E10, 10 | 06154-03 | 1 |
| 15 | Connecting cord, 32 A, 1000 mm, red | 07363-01 | 1 |
| 16 | Connecting cord, 32 A, 1000 mm, blue | 07363-04 | 1 |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## Set-up and procedure

- Set up the experiment as shown in Fig. 1; set the power supply to a direct voltage of 5 V and switch it on
- Adjust the potentiometer so that the filament lamp in the collector circuit weakly lights up
- Move the magnet in front of the opening of the coil and observe both filament lamps; pay particular attention to the relationship between the direction of movement and the change in brightness
- Reverse the magnet and move it with reversed polarity in front of the opening of the coil; pay attention to the change in behaviour of the filament lamp

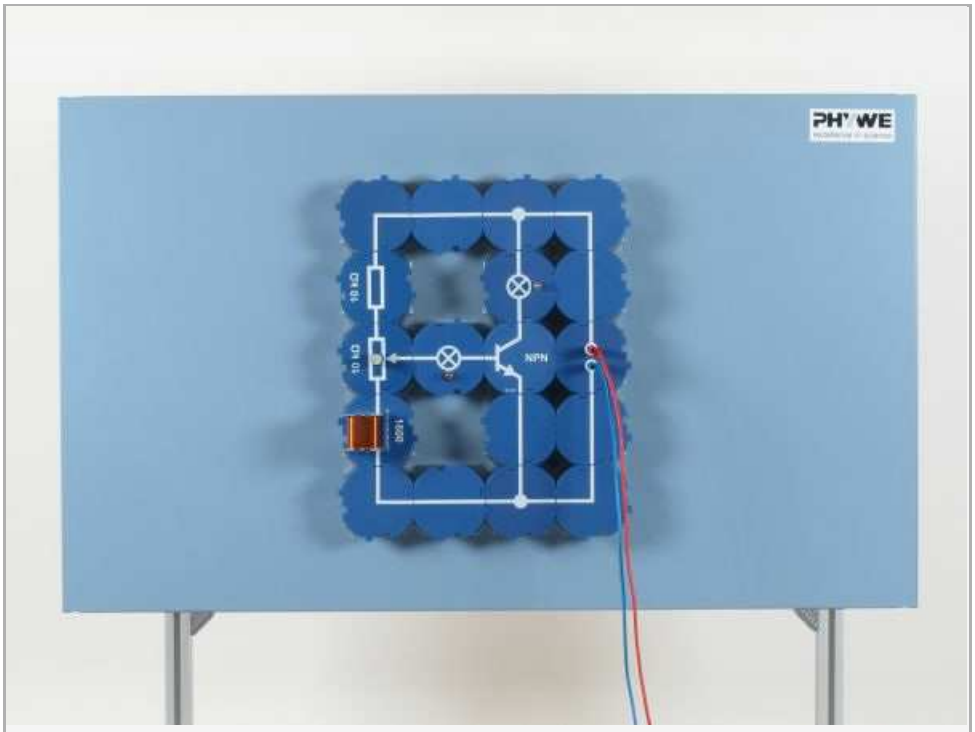


Fig. 1

# Observation and evaluation

## Observation

On moving the magnet in front of the opening of the coil, the filament lamp in the base circuit remains unlit. The filament lamp in the collector circuit changes its brightness rhythmically with the movement of the magnet. When the magnet is moved in front of the coil with polarity reversed, the direction of the change of brightness of the filament lamp also reverses.

## Evaluation

The induction voltage generated in the coil by the movements of the magnet is not sufficiently high to cause the filament lamp in the base circuit to light up. The transistor so amplifies the induction voltage, that it can be detected in the collector circuit. A transistor can amplify small alternating voltages. The direction of the current change in the collector circuit depends both on the direction of movement of the magnet and also on the direction of the magnetic field.


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