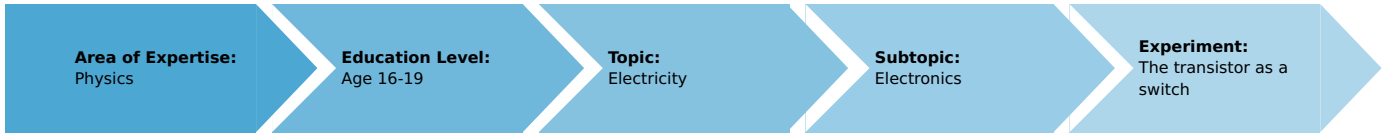


# The transistor as a switch (Item No.: P1383400)

## Curricular Relevance



**Difficulty**



Intermediate

**Preparation Time**



10 Minutes

**Execution Time**



10 Minutes

**Recommended Group Size**



2 Students

**Additional Requirements:**

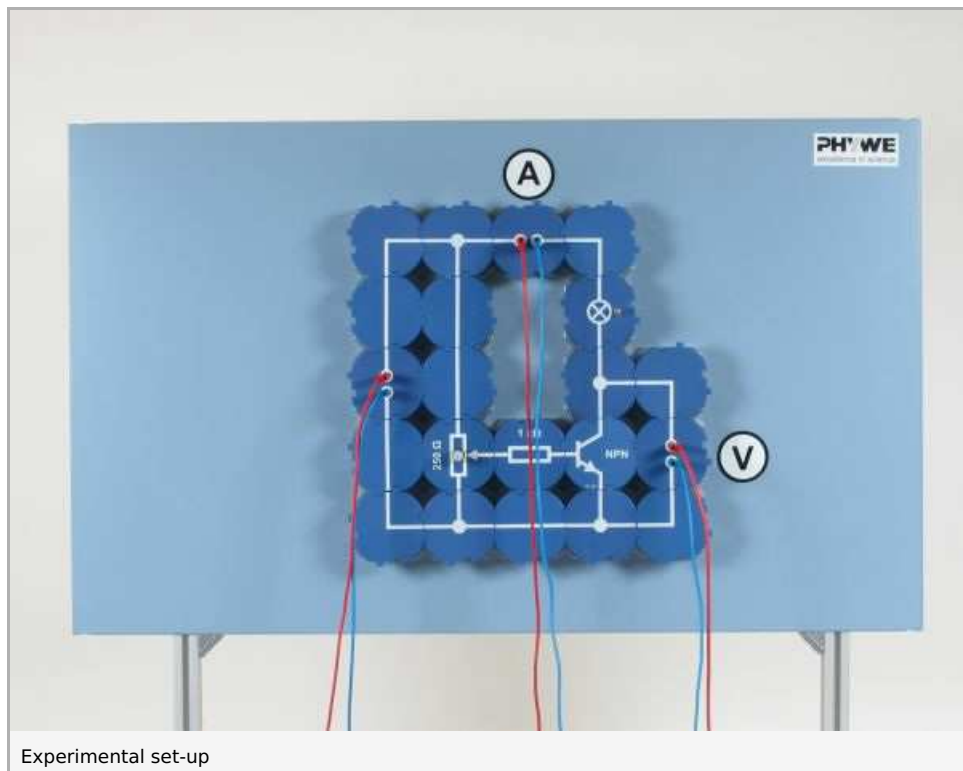
**Experiment Variations:**

**Keywords:**

## Principle and equipment

### Principle

It is to be demonstrated that a transistor can be used as a contactfree switch.



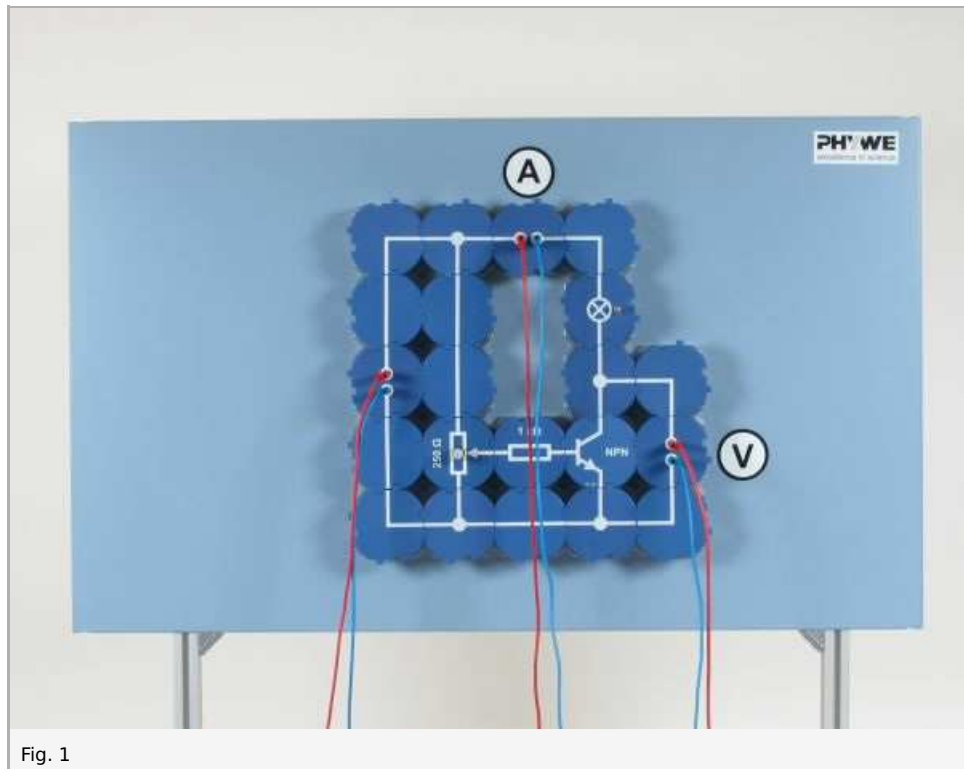
Experimental set-up

## Equipment

Position No.	Material	Order No.	Quantity
1	Multimeter ADM2, demo., analogue	13820-01	2
2	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
3	Demo Physics board with stand	02150-00	1
4	Potentiometer 250 Ohm, module DB	09423-25	1
5	Transistor BC337,module DB	09456-00	1
6	Socket for incandescent lamp E10 ,module DB	09404-00	1
7	Connector interrupted, module DB	09401-04	3
8	Resistor 1 kOhm,module DB	09414-10	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	5
12	Connector, T-shaped, module DB	09401-03	4
13	Filament lamps 4V/0.04A, E10, 10	06154-03	1
14	Connecting cord, 32 A, 1000 mm, red	07363-01	3
15	Connecting cord, 32 A, 1000 mm, blue	07363-04	3

## Set-up and procedure

- Connect up the circuit as shown in Fig. 1, switch on the power supply; set the voltage to 4 V.
- First observe the experiment qualitatively by observing the lamp and the measuring instrument while turning the potentiometer from the left stop to the right stop and back again.
- Turn the potentiometer to the left stop, measure the collector current  $I_C$  and the collector-emitter voltage  $U_{CE}$  and enter the values in Table 1.
- Turn the potentiometer so far that the filament lamp begins to light up, again measure  $I_C$  and  $U_{CE}$  and enter the values in Table 1.
- Turn the potentiometer to the right stop and record the measured values.
- Turn the potentiometer back to the left stop. Switch off the power supply.



## Observation and evaluation

### Observation

Table 1

Filament lamp	$\frac{U_{CE}}{V}$	$\frac{I_C}{mA}$
Does not light	4.0	0.06
Lights up weakly	0.65	38
Lights up brightly	0.04	42

The qualitative observation shows that the moment the lamp goes on or off,  $U_{CE}$  and  $I_C$  change very quickly. When the measured values are read at this moment, they can vary greatly, according to which point on the steep slope has just been reached.  $U_{CE}$  and  $I_C$  are both constant at the start and at the end of the switching process.

### Evaluation

The collector-emitter path of a transistor acts like a contactfree switch. The switch is closed when a positive base-emitter voltage is applied. There is then only a small voltage drop at the transistor, and the current takes on a maximum value which is dependent on the applied voltage and the resistance of the filament lamp.

The transistor acts like an opened switch when there is no base-emitter voltage or a negative one. No current flows and the total voltage lies on the transistor.

The transistor is an electronic switch, because the switching procedure is carried out contactfree and is triggered by a voltage.

Electronic switches are very frequently used in engineering, because they can switch very quickly and are not subject to wear, and in addition the switching power required at the base of the transistor for switching is exceptionally low, even when a high switching power is necessary.