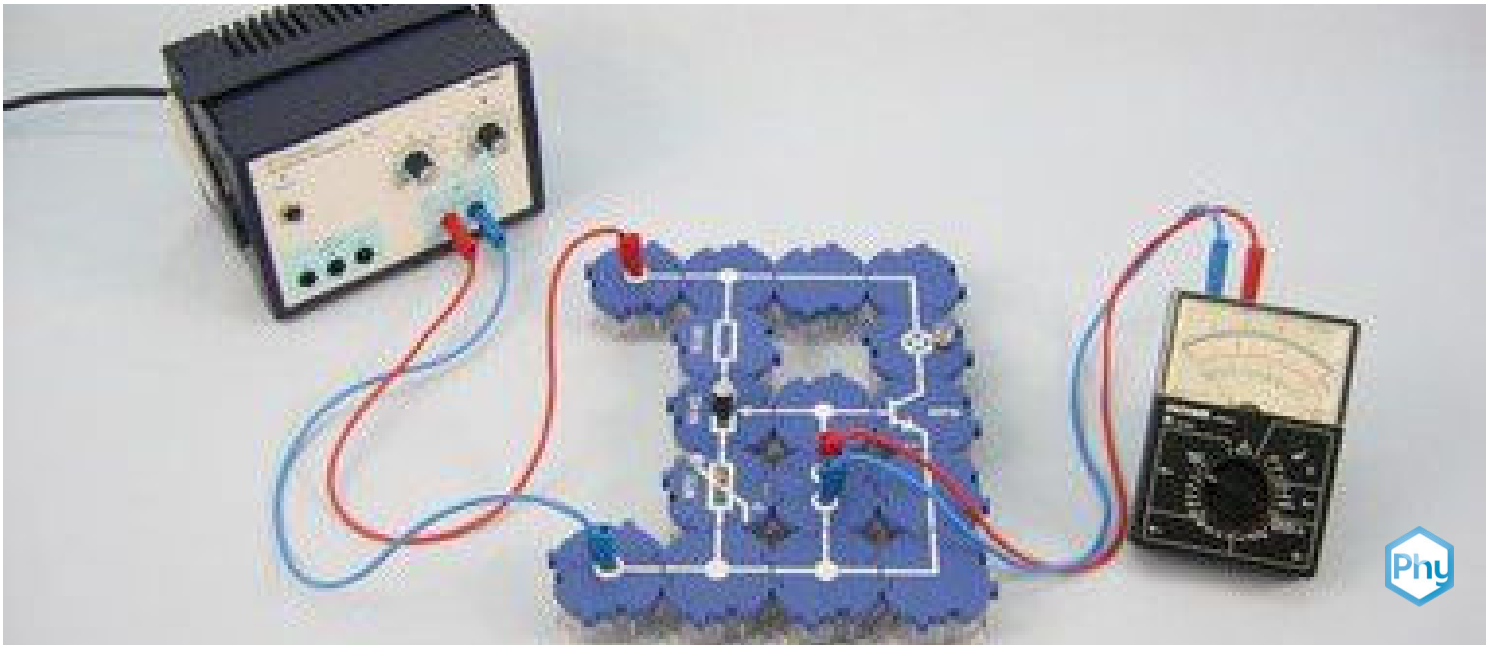
Temperature control of a transistor



The students should learn from the experiment how a transistor can be controlled by temperature.

Physics > Electricity & Magnetism > Electronics

Difficulty level	Group size	Preparation time	Execution time
medium	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/631a2b0cbce9830003710426

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Teacher information

Application

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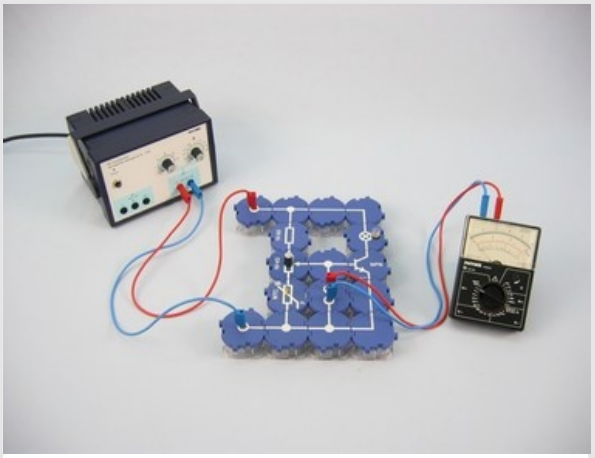

Experimental setup

The resistance value of an NTC resistor depends on the temperature.

In this experiment, a circuit is examined in which a transistor is controlled by an NTC resistor and switches an incandescent lamp on and off.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (1/2)

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Prior knowledge

Students should be familiar with how a transistor works.

Principle

NTC resistor, potentiometer and 10 kΩ resistor form a temperature-dependent voltage divider at which the control voltage of a transistor is tapped. In order to be able to realise both a light and a dark circuit without a relay, the NTC resistor is used at different points of the voltage divider.

Other teacher information (2/2)

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Learning objective

The students should learn from the experiment how a transistor can be controlled by temperature.

Tasks

Investigate how a temperature-dependent resistor can be used to control a transistor and thus switch a lamp.

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Safety instructions

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- The general instructions for safe experimentation in science lessons apply to this experiment.

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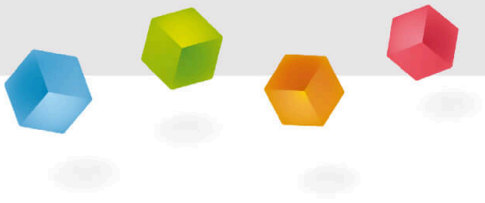

Student information

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Motivation

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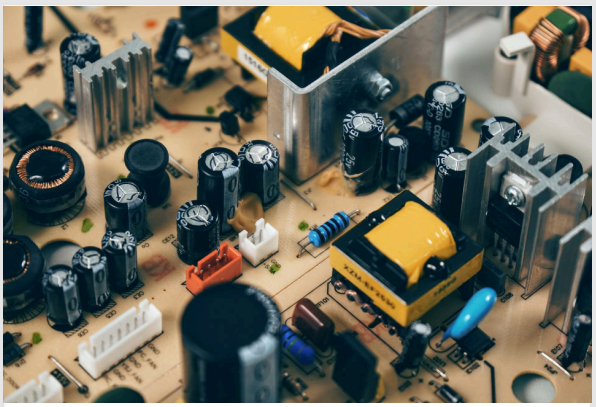
The resistance value of an NTC resistor depends on the temperature. In order to be able to realise both light and dark switching without a relay, the NTC resistor is used at different points of the voltage divider.

In this experiment, a circuit is examined in which a transistor is controlled by an NTC resistor and switches an incandescent lamp on and off.



Power circuit system

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Equipment

Position	Material	Item No.	Quantity
1	Straight connector module, SB	05601-01	2
2	Angled connector module, SB	05601-02	2
3	T-shaped connector module, SB	05601-03	4
4	Interrupted connector module with sockets, SB	05601-04	1
5	Junction module, SB	05601-10	2
6	Socket module for incandescent lamp E10, SB	05604-00	1
7	Battery holder module (C type), SB	05605-00	1
8	Resistor module 1 kOhm, SB	05614-10	1
9	Resistor module 10 kOhm, SB	05615-10	1
10	Potentiometer module 10 kOhm, SB	05625-10	1
11	NTC-resistor module, SB	05630-01	1
12	NPN transistor module BC337, SB	05656-00	1
13	Connecting cord, 32 A, 500 mm, red	07361-01	2
14	Connecting cord, 32 A, 500 mm, blue	07361-04	2
15	Filament lamps 4V/0.04A, E10, 10	06154-03	1
16	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
17	PHYWE Analog multimeter, 600V AC/DC, 10A AC/DC, 2 MΩ, overload protection	07021-11	1
18	Flashlight, w/o battery,medium	08164-00	1
19	Battery Type C 1.5 V - Pack of 2 pieces	07400-00	1
20	Hot/cold air blower, 1800 W	04030-93	1

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Robert-Bosch-Breite 10
37079 Göttingen

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Set-up

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- Set up the experiment according to Fig. 1 and Fig. 2.
- First connect the voltmeter to the power supply unit. Select the measuring range 10 V.

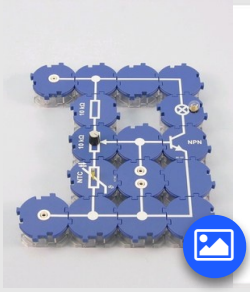

Fig. 1

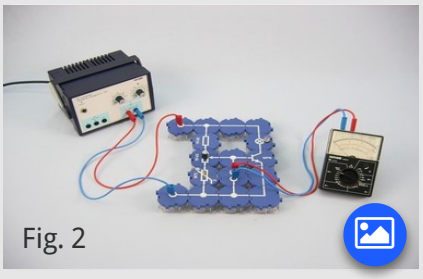

Fig. 2

Procedure (1/2)

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- Switch on the power supply and set a voltage of 4 V.
- Connect the voltmeter in parallel to the NTC resistor. Select the measuring range 1 V.
- **Task 1:** Change the potentiometer. Observe the voltage at the NTC resistor and the lamp. Write down your observations in the report.
- Adjust the potentiometer so that the lamp just shines brightly.
- Heat the NTC resistor by hand.
- **Task 2:** Observe lamp and voltage. Note down your observation.
- **Task 3:** Heat the NTC resistor with a hot hair dryer from a distance of about 5 cm. Write down your observations and measurements in the report.

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Procedure (2/2)

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- Switch off the power supply unit.
- Set up the experiment according to Fig. 3 and Fig. 4. Switch on the power supply again.
- **Task 4:** Change the potentiometer. Observe the voltage across the NTC resistor and the lamp. Write down your observations.
- **Task 5:** Adjust the potentiometer so that the lamp just shines brightly. Repeat the rest of the experiment according to tasks 2 and 3. Write down the observations and measurements in the report.

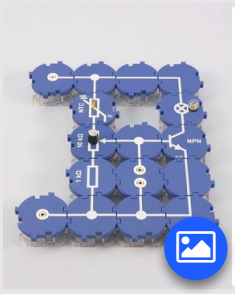

Fig. 3

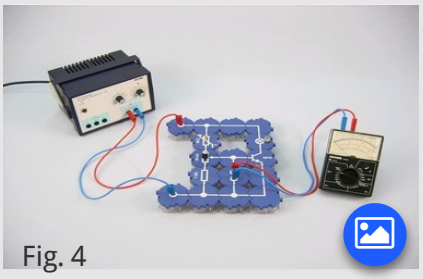

Fig. 4

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Report

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Observation (1/5)

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Make a note of your observations on the first task.

Observation (2/5)

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Make a note of your observations on the 2nd task.

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Observation (3/5)

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Make a note of your observations on the 3rd task.

Observation (4/5)

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Make a note of your observations on the 4th task.

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
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Observation (5/5)

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Make a note of your observations on the 5th task.

Task (1/2)

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How does the resistance value change when the temperature of an NTC resistor changes?

- The resistance rises.
- The resistance decreases.
- The resistance remains constant.

Why does the lamp no longer light up when the NTC resistor is in the lower part of the voltage divider (fig. 1) and is heated up?

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task (2/2)

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Why does the lamp light up when the NTC resistor is in the upper part of the voltage divider (fig. 3) and is heated?

Slide	Score / Total
Slide 18: Temperature dependence	0/1

Total score 0 / 1

Show solutions | Repeat | Export text

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Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de