Temperature control of a transistor (Item No.: P1401800)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 16-19
Topic: Electricity
Subtopic: Electronics
Experiment: Temperature control of a transistor

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

Additional Requirements:

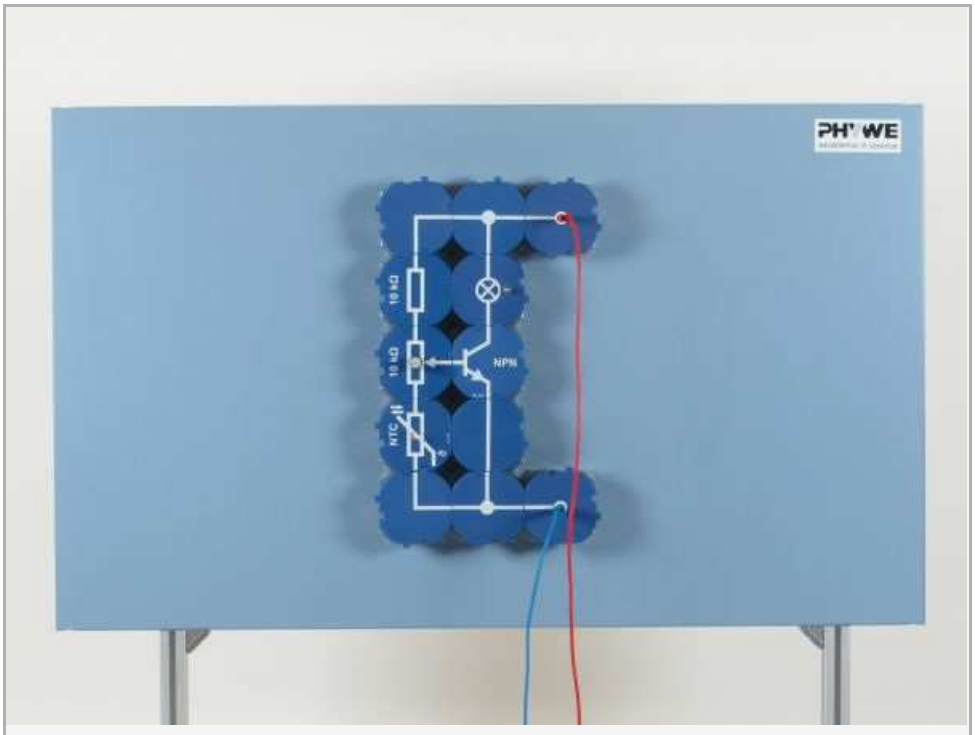
Experiment Variations:

Keywords:

Principle and equipment

Principle

A demonstration is to be made of how the collector current of a transistor can be controlled by an NTC resistor.



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	Potentiometer 10 kOhm,module DB	09425-10	1
4	Hot/cold air blower, 1800 W	04030-93	1
5	Transistor BC337,module DB	09456-00	1
6	Socket for incandescent lamp E10 ,module DB	09404-00	1
7	Junction, module DB	09401-10	2
8	Resistor 10 kOhm,module DB	09415-10	1
9	NTC-resistor,module DB	09430-00	1
10	Connector, straight, module DB	09401-01	1
11	Connector, angled, module DB	09401-02	2
12	Connector, T-shaped, module DB	09401-03	2
13	Filament lamps 4V/0.04A, E10, 10	06154-03	1
14	Connecting cord, 32 A, 1000 mm, red	07363-01	1
15	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 4 V direct voltage and switch it on
- Adjust the potentiometer so that the lamp is just caused to light up at full brightness
- Heat the NTC resistor with a fan or other source of heat while observing the lamp; stop heating and continue to observe the lamp

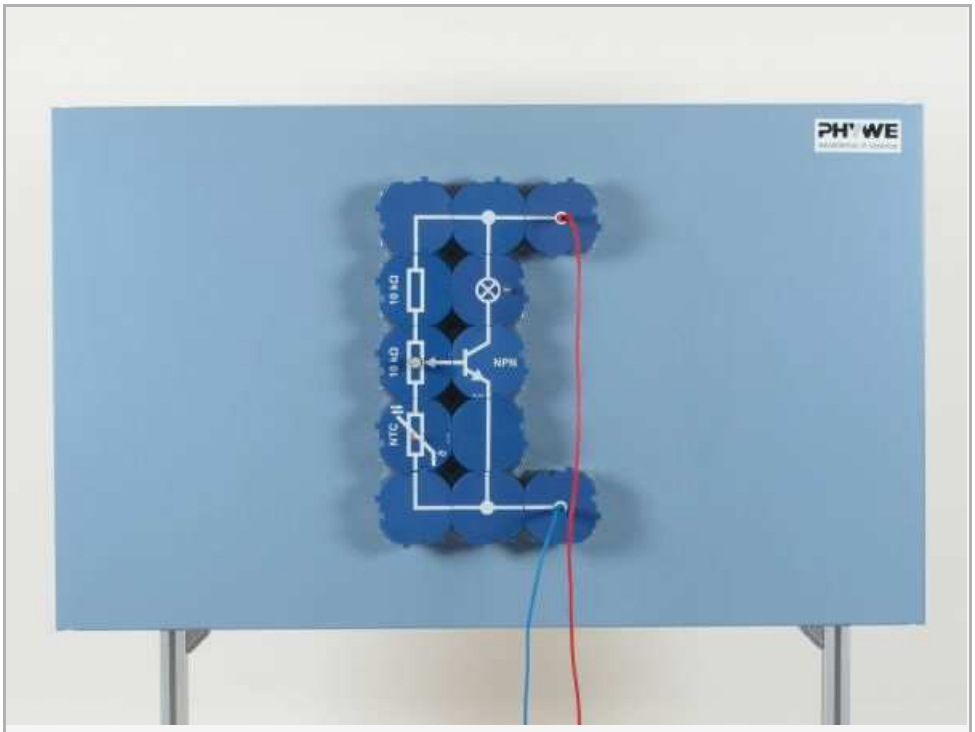

Fig. 1

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Observation and evaluation

Observation

When the NTC resistor is heated, the brightness of the lamp decreases until it finally goes out. When the NTC resistor has cooled, the lamp has regained its original brightness.

Evaluation

Together with the potentiometer and the 10 kQ resistor, the NTC resistor forms a temperature dependent voltage divider. The voltage drop at the NTC resistor forms the base-emitter voltage of the transistor. When the NTC resistor is heated, its resistance value decreases, and so also the base-emitter voltage and the collector current. The extinguishing of the lamp signals the temperature increase.

Remarks

This simple circuit is suitable to indicate temperature. The transistor does not carry out a switching function here, but works as a direct current amplifier. For the realisation of temperature threshhold value switches, such as those in fire alarms, temperature regulators in heating apparatus, in refrigerators or other electrical appliances, flip-flops with two transistors are used.

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