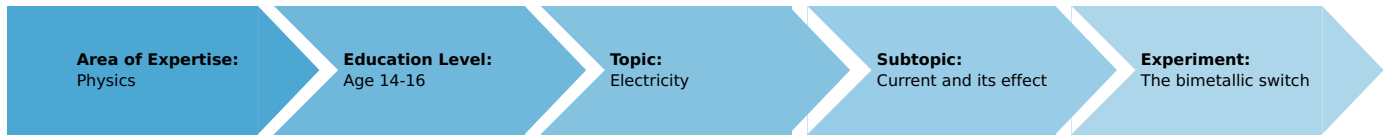


The bimetallic switch (Item No.: P1380800)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

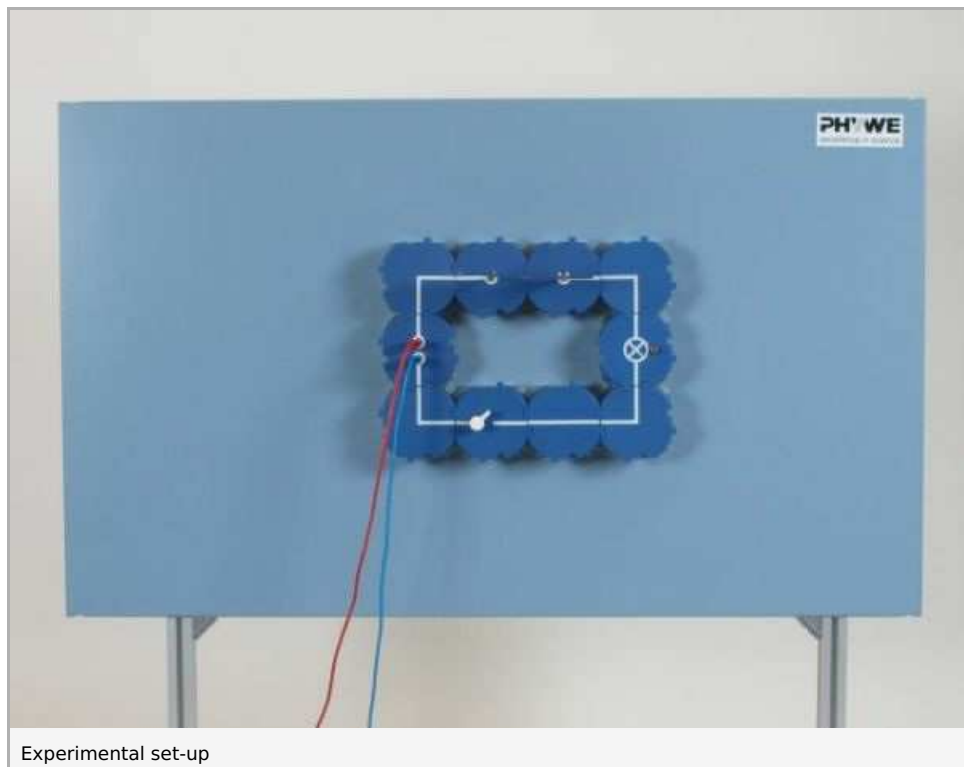
Experiment Variations:

Keywords:

Principle and equipment

Principle

The way in which a bimetallic strip can be used to open or close a circuit is to be demonstrated.



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	Switch on/off, module DB	09402-01	1
4	Socket for incandescent lamp E10 ,module DB	09404-00	1
5	Connector interrupted, module DB	09401-04	1
6	Junction, module DB	09401-10	2
7	Electr.symbols f.demo-board,12pcs	02154-03	1
8	Connector, straight, module DB	09401-01	1
9	Connector, angled, module DB	09401-02	4
10	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
11	Connecting plug, 2 pcs.	07278-05	1
12	Bimetal strip	05913-00	1
13	Connecting cord, 32 A, 1000 mm, red	07363-01	1
14	Connecting cord, 32 A, 1000 mm, blue	07363-04	1
15	Alligator clips, bare, 10 pcs	07274-03	1

Set-up and procedure

- Connect up the circuit as shown in Fig. 1; use the connecting plugs to fit the crocodile clips to the junction module sockets; clamp the bimetallic strip tightly with the right-hand crocodile clip, with the patterned side of the strip facing down; switch on the power supply and adjust it to 12 V rated voltage.
- With the switch open, turn the right-hand crocodile clip so that the bimetallic strip touches the left-hand clip from above.
- Close the switch and use a flame to carefully heat the bimetallic strip in the vicinity of the clamped end, then allow it to cool. Observe the bimetallic strip and the lamp (1).
- If necessary, repeat this procedure.
- Open the switch; re-position the bimetallic strip, so that the free end of it is about 1 cm below the left-hand crocodile clip (patterned side down, as before).
- Close the switch and carry out the heating procedure as in the first part of the experiment (2).

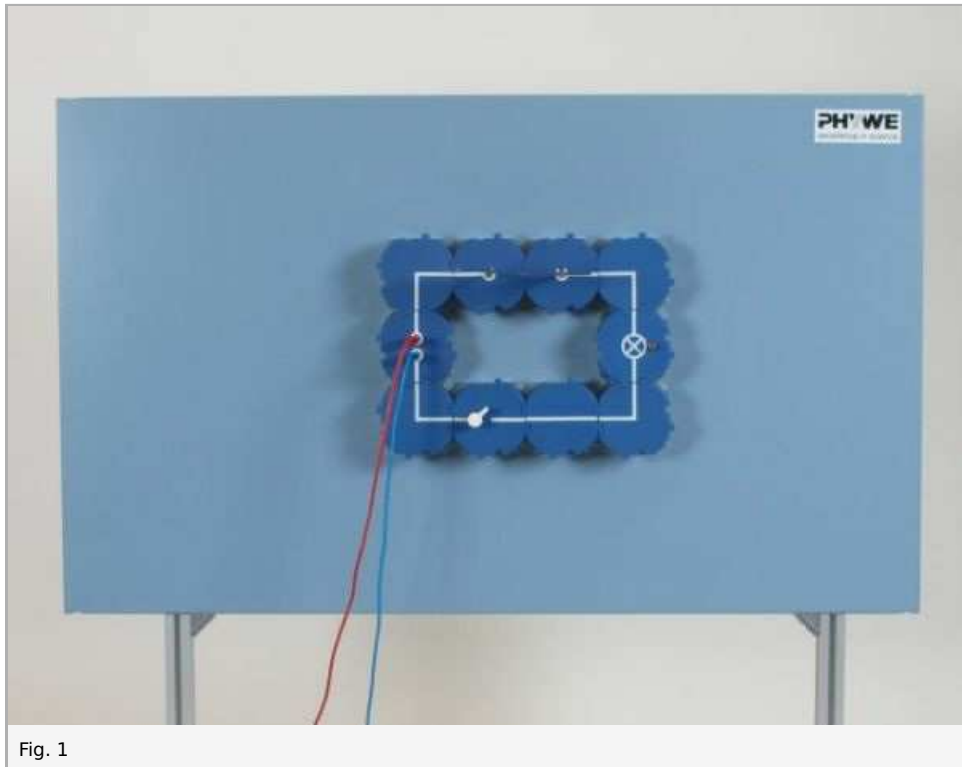


Fig. 1

Observation and procedure

Observation

1. When the bimetallic strip is moderately heated, it bends away from the left-hand crocodile clip, so that the circuit opens and the lamp goes out. When the bimetallic strip cools, it straightens out again, closes the circuit and the lamp lights up again.
2. When the position of the bimetallic strip is reversed and it is then moderately heated, it bends towards the crocodile clip, closes the circuit and the lamp lights up. When the bimetallic strip cools, it straightens out, opens the circuit and the lamp goes out.

Evaluation

A bimetallic strip consists of two flat metal strips fixed together on each other, whereby the two metals have different thermal expansion coefficients. When the strip is heated, it bends in the direction of the metal which has the lower thermal expansion coefficient. The bimetallic strip is therefore suitable for opening electric circuits (e.g. in cut-outs, or as overheating safety switch in electric irons or power supply equipment), or for closing them (e.g. in alarm systems) when the temperature of the surrounding air exceeds a maximum permissible value.

Remarks

The bimetallic strips provided are so sensitive that only gentle heating is sufficient in each of the two parts of the experiment. The recommendation, that care should be taken to only heat moderately, is aimed at ensuring that, despite the repeated carrying out of the demonstration of the switching effect, not too much teaching time is lost in waiting until the bimetallic strip has again straightened out.

The bimetallic switch is a temperature dependent switch. It is still nowadays extensively used, although temperature dependent semi-conductor sensors have taken over its function in many pieces of equipment and systems.