Electricity with the Modular System

Basic Electric Circuits

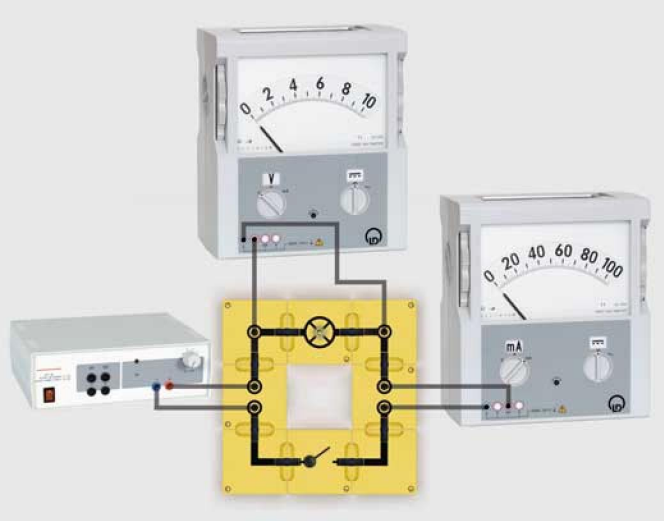
Electrical resistance

Resistance characteristics of an incandescent lamp

Objective of the experiment

1. To investigate the relationship between current and voltage in an incandescent lamp.
2. To determine the resistance characteristics of an incandescent lamp.

Setup



Apparatus

1	539 024	Lamp socket, E10, BST
1	505 15	Incandescent lamp 6 V / 0.05 A, E10
1	539 025	Toggle switch, BST
2	539 003	Connector blocks BST, straight, 2 sockets
2	539 004	Connector blocks BST, 90° angle
2	539 005	Connector blocks BST, 90° angle with socket
8	539 000	Bridging plug, BST
2	531 905	Demo multimeter, passive
1	521 49	Power supply, 12 V DC, 230 V
6	500 644	Safety connection lead, 100 cm
1	301 300	Demonstration experiment frame
1	301 301	Adhesive magnetic board

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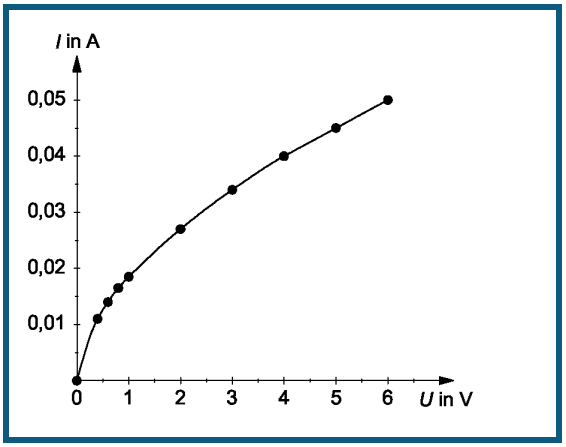
Carrying out the experiment

- Set up the circuit.
- Switch on the power supply and gradually increase the voltage *U* between 0.4 V and 6 V. Read the current *I* in each case.
- Calculate the resistance of the incandescent lamp and enter it into the table.

Measuring example

Voltage *U* / V	Current *I* / A	Resistance *R* / &
0.4	0.011	36
0.6	0.013	46
0.8	0.016	50
1	0.018	55
2	0.027	74
3	0.034	88
4	0.040	100
5	0.045	111
6	0.050	120

Evaluation



With an incandescent lamp, Ohm's Law does not apply because the current *I* doesn't change proportionally to the voltage *U*.

This is due to the temperature increase of the filament with the increasing current *I*.

The temperature increase leads to violent vibrations of the metal ions in the filament lattice. As a result, the movement of electrons (current) is strongly hindered. The resistance *R* of the filament increases.

Note:
In an incandescent lamp, we can distinguish between the cold resistance R_0 and the operating resistance R_B (glowing filament). The following holds true: $R_B >> R_0$