Ohm's law with Cobra SMARTsense

Physics | Electricity & Magnetism | Simple circuits, resistors & capacitors

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

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Teacher information

Application

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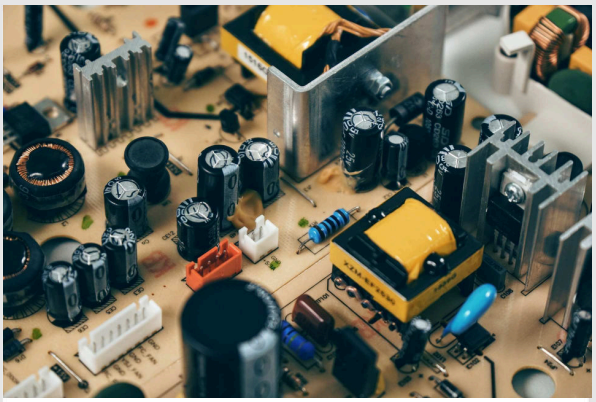

Electrical resistors on a circuit board

Electrical resistors are needed to create certain conditions for certain consumers, such as diodes. Without a resistor, the diode might be damaged by too much voltage and current flowing through it. The resistor lowers the voltage and thus the current and emits heat. How exactly it can be determined how to use resistors will be learned in this experiment.

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Other teacher information (1/2)

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Prior knowledge

The relationship between an applied electrical voltage and the resulting current is measured at various test resistors. The quotient of voltage and current is recognized as a constant value that characterizes the component.

Learning objective

The students should first use the measured values they have obtained to explain Ohm's law $I \sim U$recognize.

Other teacher information (2/2)

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Tasks

1. What are the most important parameters of a circuit and how are they related?
2. How does the current change when the voltage is changed?
3. How is this related to the resistance of the circuit?

Scientific principle

The context$I \sim \frac{1}{R}$ for U = konstantcan be verified by entering line by line the values for $I$and Rin Table 1.

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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

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Motivation

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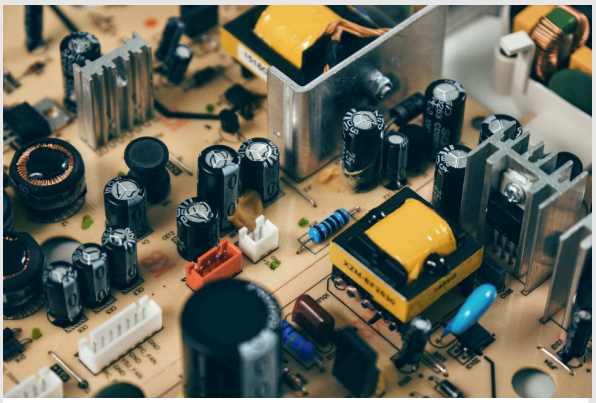
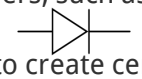


Electrical resistors on a circuit board

Electrical resistors are needed to provide for certain consumers, such as



diodes to create certain conditions.

Without A resistor, the diode would possibly be flowed through by a too high voltage of too much current and break down.

The resistor lowers the voltage and thus also the current and emits heat. How exactly it can be determined how to use resistors is learned in this experiment, among other things.

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Equipment

Position	Material	Item No.	Quantity
1	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
2	Cobra SMARTsense - Voltage, ± 30 V (Bluetooth + USB)	12901-01	1
3	Cobra SMARTsense - Current, ± 1 A (Bluetooth + USB)	12902-01	1
4	Angled connector module, SB	05601-02	2
5	Interrupted connector module with sockets, SB	05601-04	2
6	Angled connector module with socket, SB	05601-12	2
7	On-off switch module, SB	05602-01	1
8	Socket module for incandescent lamp E10, SB	05604-00	1
9	Resistor module 50 Ohm, SB	05612-50	1
10	Resistor module 100 Ohm, SB	05613-10	1
11	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
12	Connecting cord, 32 A, 250 mm, red	07360-01	1
13	Connecting cord, 32 A, 250 mm, blue	07360-04	1
14	Connecting cord, 32 A, 500 mm, red	07361-01	2
15	Connecting cord, 32 A, 500 mm, blue	07361-04	2
16	measureAPP - the free measurement software for all devices and operating systems	14581-61	1

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Set-up

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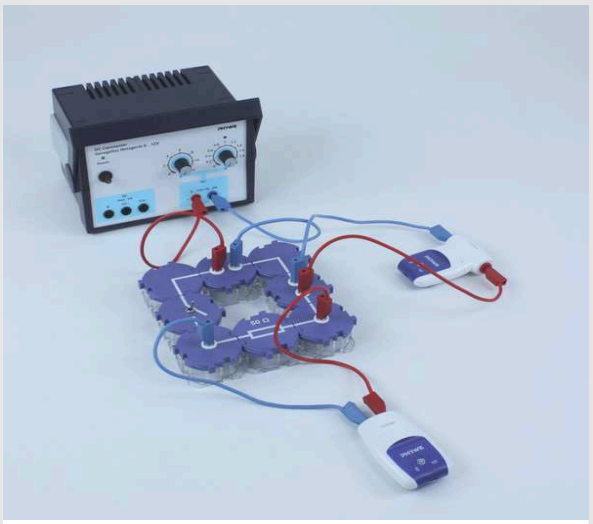
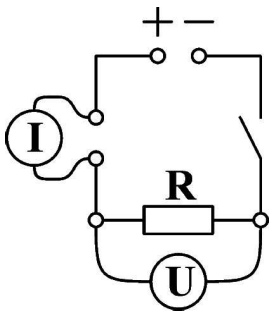


Experiment set-up



- Set up the experiment according to the overview photo and the circuit diagram.
- First the device with nominal resistance $R = 50\Omega$ into the circuit.

Procedure (1/4)

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Cobra SMART scythe

- Turn on both SMARTsense sensors and make sure the tablet can connect to Bluetooth devices.
- Open the PHYWE measure App and select the sensors "Current" and "Voltage".
- Select the sampling rate of your choice. The higher the sampling rate the more accurate the measurement.

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Procedure (2/4)

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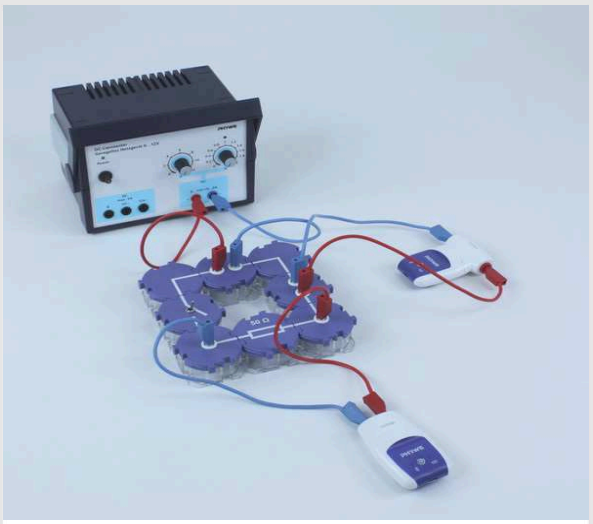

Experiment set-up

- Documents for the first measurement the y-axis with the voltage U and the x-axis with time t.
- Close the switch and slowly and evenly increase the DC voltage at the power supply unit by hand from 0 V to 12 V and then regulate it back to 0 V. While the measurement continues, first the 100-ohm and then the 500-ohm resistor are inserted into the circuit and the voltage ramp is repeated.
- Then save the measurement. For further analysis, the measurement can be reopened at any time under "My measurements".

Procedure (3/4)

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Example of a measurement

- Evidence for the second measurement the y-axis with the current I. Now carry out the experiment as in the first measurement.
- Then save the measurement. For further analysis, the measurement can be reopened at any time under "My measurements".

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Procedure (4/4)

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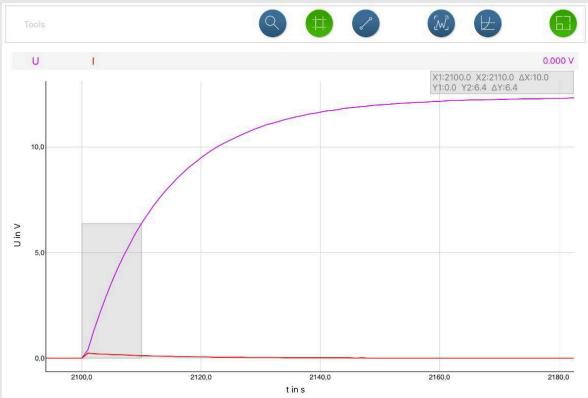

Example of a measurement

- For the third measurement carry the voltage U against the current I on. Close the switch and slowly and evenly regulate by hand the DC voltage at the power supply unit from 0 V to 12 V and back to 0 V. While the measurement continues, first the 100 Ohm and then the glow ramp are inserted into the circuit and the voltage ramp is repeated. Also observe the brightness of the filament lamp.
- Then save the measurement. For further analysis, the measurement can be reopened at any time under "My measurements".

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Report

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Task 1

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Ohm's law is:

- $U = R^2 \cdot I$
- $U = R/I$
- $U = R \cdot I$

For the second measurement, the current to the two resistors should be $12V$ can be determined (see figure). Stretcher I_{max} and U/I into the table.

$R[\Omega]$	$U[V]$	$I[A]$	$R/I[V/A]$
5012			
10012			

Task 2

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Drag the right words into the gaps!

The series of measured values and graphs show that for both components there is obviously a _____ relationship between the _____ and the current I exists. This connection is called _____.

In the incandescent lamp, resistance increases as the current increases, which causes a _____. Apparently, the resistance of the incandescent lamp is _____. This is a further insight: Ohm's law applies only to components whose resistance is _____. R=constant is the _____ for the ohmic law

- voltage U
- linear
- validity condition
- dependent on temperature
- ohms law
- temperature rise
- constant

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Slide	Score / Total
Slide 15: Ohm's law	0/4
Slide 16: Ohm's law and resistance	0/7

Total amount 0 / 11

Solutions | Repeat | Exporting text

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