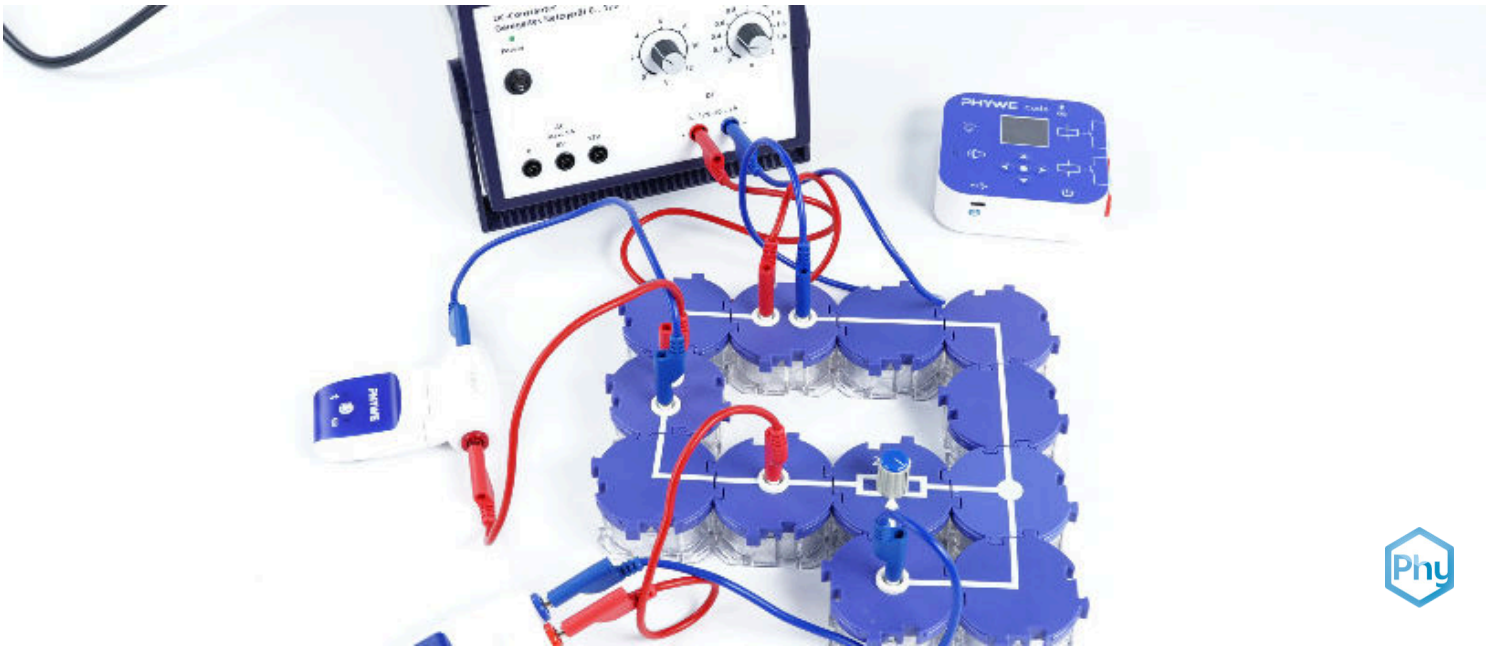
The potentiometer with Cobra SMARTsense



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

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	20 minutes

This content can also be found online at:

https://www.curriculab.de/c/6855542f6dfc920002ef5373

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

PHYWE

Teacher information

Application

PHYWE

Experimental setup

Potentiometers are electrical resistance components whose resistance values can be changed mechanically (by turning or shifting). It has at least three connections (two fixed contacts and a wiper) and is mainly used as a continuously adjustable voltage divider. A variable resistance can be tapped via the wiper. Potentiometers are often used to control electronic devices, such as for setting an amplifier, e.g. the volume setting of a sound amplifier.

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)

PHYWE

Prior knowledge

Students should be familiar with Ohm's law and know how a potentiometer works.

Principle

The potentiometer is used to set a variable resistance, which is measured by measuring the current in series and the voltage in parallel to the potentiometer. The Cobra SMARTsense Code should then be programmed in such a way, that it reacts to a certain resistance.

Other teacher information (2/2)

PHYWE

Learning objective

Students should become confident in working with potentiometers and programming the Cobra SMARTsense Code. Ohm's law is illustrated with the help of the calculated resistance as a channel.

Tasks

The students set up the experiment according to the experiment description. They use the calculated channel to determine the resistance. They measure resistance, voltage and current with varying resistance. Before starting the measurements, they program the Cobra SMARTsense Code.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Safety instructions

PHYWE

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

Student information

PHYWE

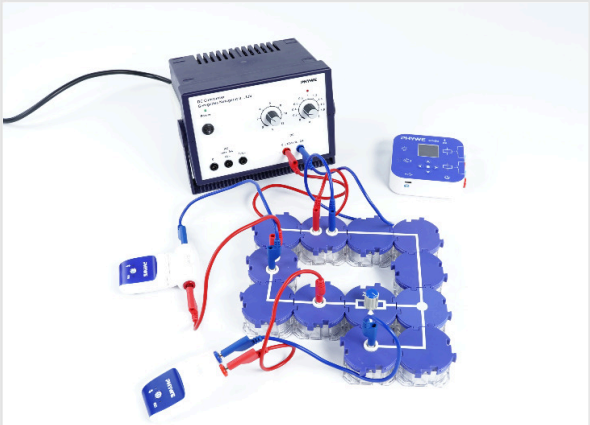
Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Motivation

PHYWE



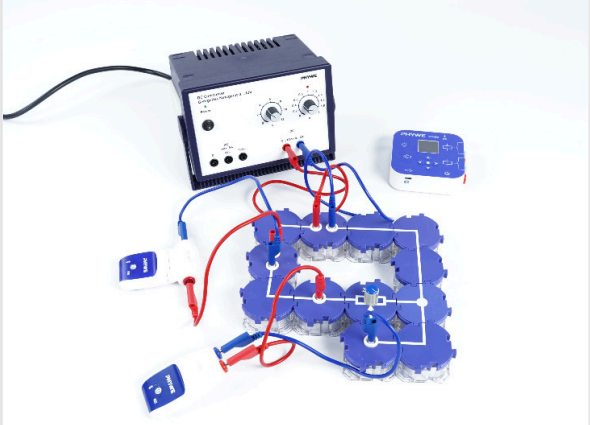
Experimental setup

We encounter potentiometers in many everyday devices - for example, when we adjust the volume on an amplifier. By simply turning or sliding them, you can change electrical resistances and thus control specific voltages.

In this experiment, you will learn how a potentiometer works, how it is constructed and why it is so important as an adjustable voltage divider for controlling electronic devices. You will gain a better understanding of the technology you use every day - and try out for yourself how you can influence it.

Tasks

PHYWE



Experimental setup

1. Set up the experiment according to the experiment description.
2. Set the resistance as a calculated channel.
3. Measure the resistance, voltage and current with varying resistance.
4. Programme the Cobra SMARTsense Code.

PHYWE

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	Cobra SMARTsense Code - Output device for switching relays, LEDs, display	12953-00	1
2	Cobra SMARTsense Voltage - Sensor for measuring electrical voltage ± 30 V (Bluetooth + USB)	12901-02	1
3	Cobra SMARTsense Current - Sensor for measuring electrical current ± 1 A (Bluetooth + USB)	12902-02	1
4	Straight connector module, SB	05601-01	2
5	Angled connector module, SB	05601-02	4
6	T-shaped connector module, SB	05601-03	1
7	Interrupted connector module with sockets, SB	05601-04	2
8	Straight connector module with socket, SB	05601-11	1
9	Angled connector module with socket, SB	05601-12	1
10	Potentiometer module 250 Ohm, SB	05623-25	1
11	Connecting cord, 32 A, 250 mm, red	07360-01	1
12	Connecting cord, 32 A, 250 mm, blue	07360-04	1
13	Connecting cord, 32 A, 500 mm, red	07361-01	2
14	Connecting cord, 32 A, 500 mm, blue	07361-04	2
15	PHYWE Power supply, 230 V,DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
16	measureAPP - the free measurement software for all devices and operating systems	14581-61	1

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Setup (1/4)

PHYWE

For measurement with the **Cobra SMARTsense sensors** the **PHYWE measureAPP** required. The app can be downloaded free of charge from the relevant app store (see below for QR codes). Before starting the app, please check whether your device (smartphone, tablet, desktop PC) is running **Bluetooth activated** is.

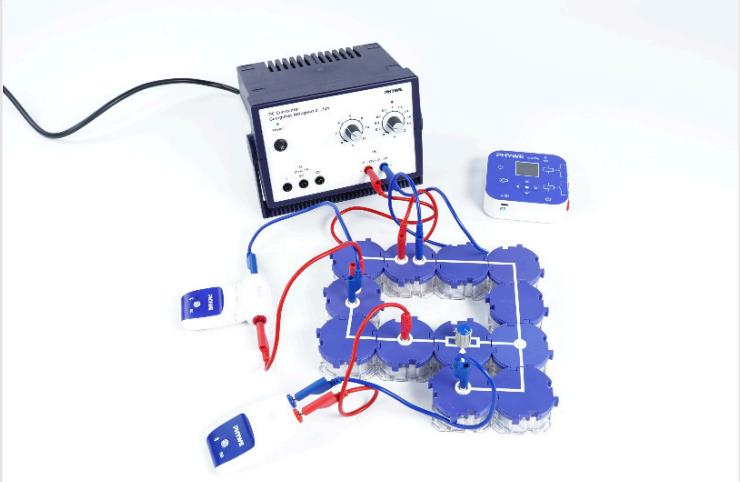
iOS

Android

Windows

Setup (2/4)

PHYWE



Experimental setup

- Set up the experiment as shown in the photos on the left. If you click on the small blue button, the picture will appear without the measuring devices connected.
- Set up the power supply unit $6\ \mathrm{V}$ and $0.8\ \mathrm{A}$.

PHYWE

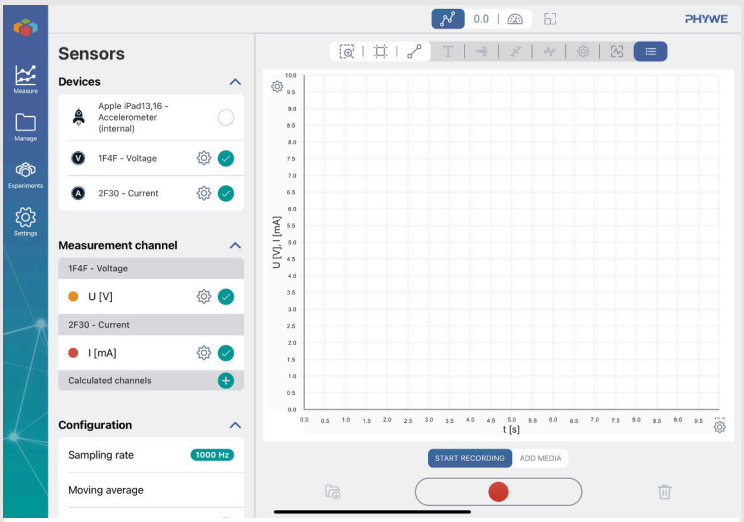
Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Setup (3/4)

PHYWE

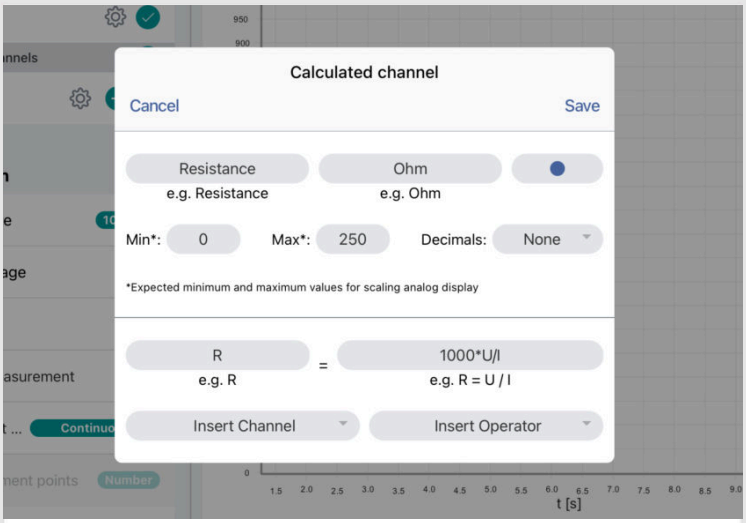


First setting of the measureAPP

- Then open the measureAPP and connect to the Cobra SMARTsense Voltage and Cobra SMARTsense Current.
- Set the measuring frequency to $1000\ \mathrm{Hz}$
- The unit of current should be milliamperes (mA).

Setup (4/4)

PHYWE



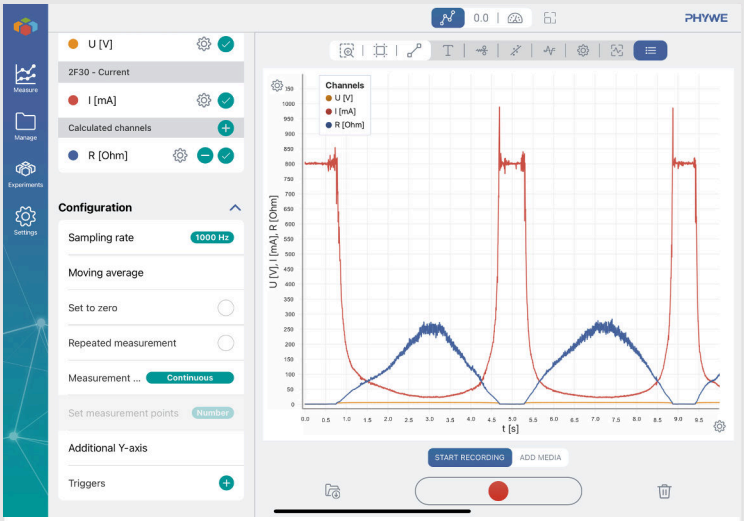
Creating a calculated channel

- Now have the resistance calculated automatically by adding a calculated channel. To do this, click on the plus sign next to "Calculated channels" below the measured channels. In the window that appears, enter the data as shown in the photo on the left. If you want, you can change the colour as you wish.
- Note that in the calculation of the resistance, the factor 1000 must appear. This is because the current is measured in milliamperes instead of amperes.
- Then click on Save.

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Procedure (1/6)

PHYWE

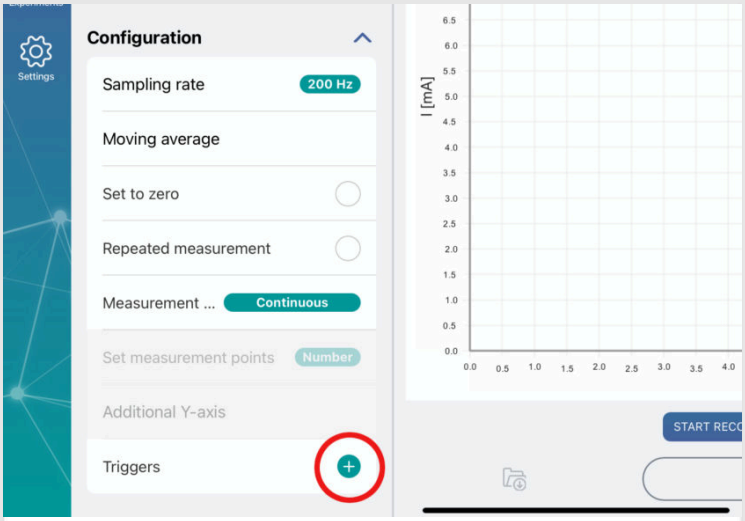


Example measurement

- Now start the measurement and change the resistance on the potentiometer by hand. Stop the measurement and observe the change in voltage and current as a function of the resistance: How are they related? What are the maximum values of current and voltage? Make a note of your observations.
- Now note the current value that is measured when the potentiometer is at approximately half of the maximum resistance.

Procedure (2/6)

PHYWE



Adding a trigger

- Now programme the Cobra SMARTsense Code.
- To do this, add a trigger for the SMARTsense Code by pressing the plus button provided.
- If you set a trigger, this means that the Cobra SMARTsense Code triggers a specific action as soon as a measured value fulfils a condition that you define.

PHYWE

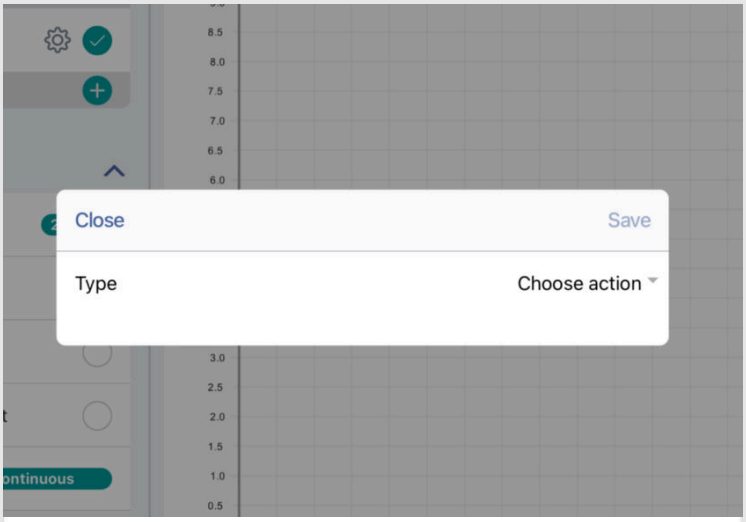
Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Procedure (3/6)

PHYWE

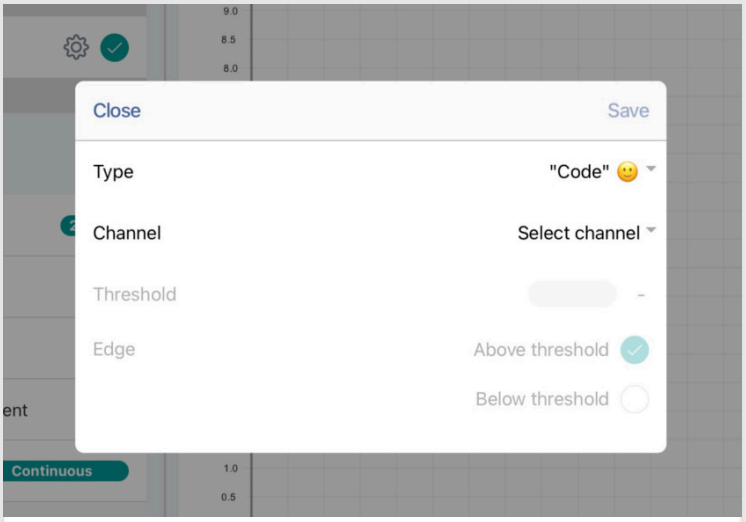


Adding an action

- A window will now appear in which you can select an action that you would like to trigger. For our first trigger, we want the SMARTsense Code to display a happy smiley face. Therefore, select this action by clicking on "Select action".

Procedure (4/6)

PHYWE



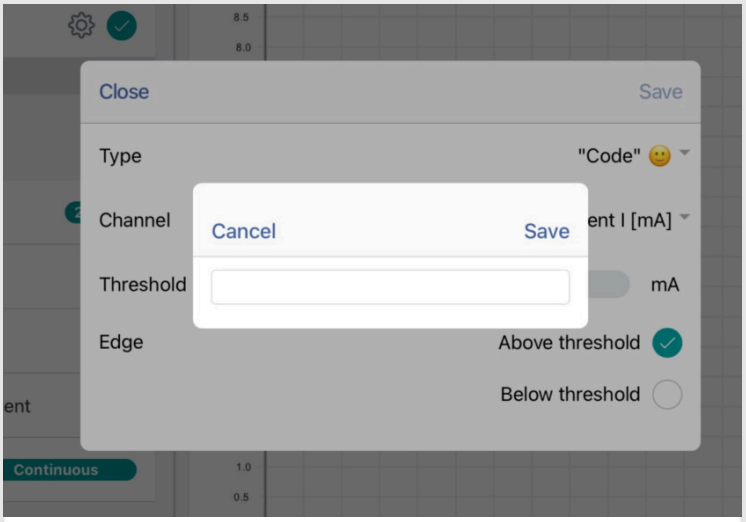
Adding a measurement channel

- Now you have to set which measurement should be taken into account. This will later be the measured variable that should fulfil a certain condition. In our case, this is the current. Therefore, select the corresponding measurement channel.

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Procedure (5/6)

PHYWE

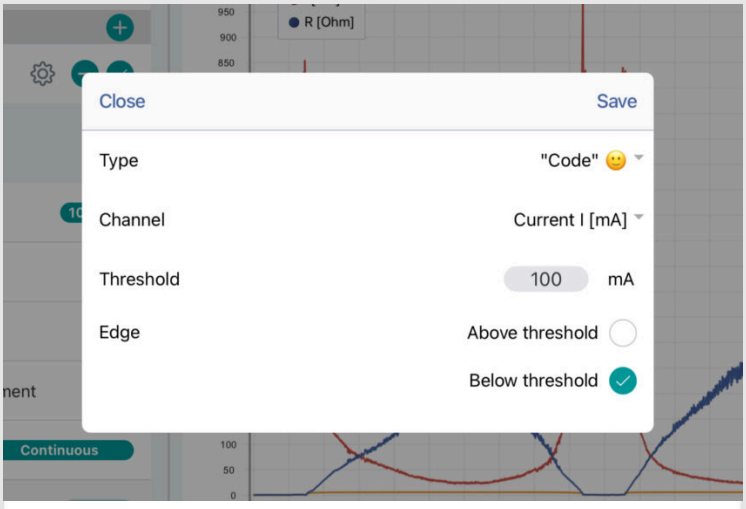


Adding a threshold value

- There are two options for when the action is triggered: Either it is triggered as soon as the threshold value is exceeded or when it falls below it. In the next step, you select which of the two cases applies to this trigger. Now you must first define exactly how high the threshold value is by clicking on the corresponding text field.
- Use half of the maximum current value measured.

Procedure (6/6)

PHYWE

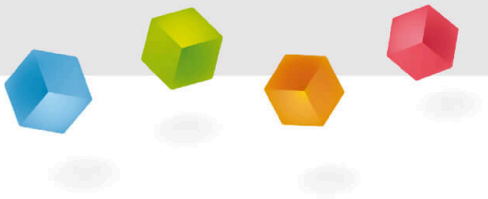


Example of a set trigger for the Cobra SMARTsense Code

- Select, whether the action should be executed when the threshold value is exceeded or fallen below.
- First create a trigger that is triggered when the value falls below the threshold. What this can look like, you will see on the left-hand side. Then click on save.
- Now add another trigger for when the threshold value is exceeded.
- Now, test the functioning of the Cobra SMARTsense Code. Experiment with the setup and let the Code device show all of his features.

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

PHYWE



Report

Task 1

PHYWE

Fill in the blanks correctly.

The potentiometer can be used to adjust the _____ variably. The potentiometer has three inputs: two fixed contacts and a _____. The resistance is measured via the wiper. If the _____ is now measured in series with the potentiometer, it decreases with increasing resistance due to _____. The resistance itself is the _____ of voltage and current.

Not used (alphabetical): _____, _____, _____

wiper
quotient
current
product
voltage
resistance
Ohm's law
difference

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Task 2

PHYWE

Which of the following formula is correct for the current according to Ohm's law?

- ○ $I = \frac{R}{U}$
- ○ $I = U \cdot R$
- ○ $I = \frac{U}{R}$

Check

Slide	Score / Total
Slide 21: The potentiometer	0/8
Slide 22: Ohm's law	0/1

Total amount 0 / 9

Solutions Repeat

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de