

Becker Müller

Electricity now!

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Vorwort

Inhalte

Das Buch „Electricity now!“ ist ein englisches Lehrwerk für Elektroberufe. In 32 übersichtlichen Kapiteln wird jeweils ein beruflich relevanter Themenbereich der Elektrotechnik behandelt. Texte, Hörbeispiele und zahlreiche Abbildungen wecken in Verbindung mit abwechslungsreichen Aktivitäten Interesse am Erschließen des jeweiligen Themas. Durch die Verwendung von authentischen Materialien und Original-Herstellerunterlagen wird ein lebhafter Bezug zur Arbeitswelt der Lernenden hergestellt. Vokabellisten auf den jeweiligen Seiten erleichtern den Zugang zu den Texten und Materialien.

Für die Arbeit mit „Electricity now!“ werden Englischkenntnisse vorausgesetzt. Statt englischer Grammatik werden praxisrelevante Kenntnisse für den Unterricht an beruflichen Schulen, für bilinguale Unterrichtsmodule oder für die Fort- und Weiterbildung in elektrotechnischen Bildungsgängen vermittelt.

Zielgruppe

Autoren und Verlag empfehlen „Electricity now!“ als Fachbuch für Auszubildende im Elektrohandwerk und in der Elektroindustrie. Auch in der Berufsfachschule Elektrotechnik und in der Weiterbildung ist „Electricity now!“ eine wertvolle Ergänzung. Das Lehrbuch motiviert darüber hinaus Lernende aller verwandten Bildungsgänge, sich in der Fremdsprache mit elektrotechnischen Inhalten vertraut zu machen – daher ist es auch für Mechatroniker, Versorger oder Informationstechniker als Ergänzung geeignet. Durch die einzelnen, thematisch abgegrenzten Kapitel kann für jede Zielgruppe das relevante Thema ausgewählt und modulartig bearbeitet werden. Es werden Aktivitäten auf den Niveaustufen A2–B2 angeboten. Laborversuche in englischer Sprache unterstützen die bilinguale praktische Arbeit.

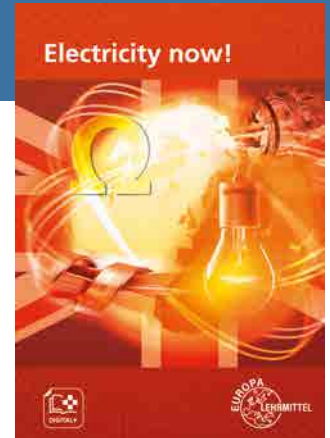
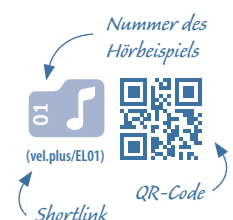
Die Autoren

Beide Autoren unterrichten seit vielen Jahren die Fächer Elektrotechnik und Englisch an Berufskollegs. Ihre jahrelange Erfahrung fließt in dieses Lehrwerk ein und führt zu einem praxisnahen Buch, das erprobte Übungen mit relevanten Materialien verbindet.

Medienpaket

Im Preis von „Electricity now!“ ist gratis ein Medienpaket bestehend aus Abbildungen und Hörbeispielen enthalten. Wie Sie Zugang zu diesem Medienpaket erhalten, erfahren Sie auf der Umschlaginnenseite. Um anschließend die Bilder und Audiodateien zu verwenden, müssen Sie in der EUROPATHEK eingeloggt sein.

Zu den Hörbeispielen gelangen Sie in der Online-Version der EUROPATHEK bequem per QR-Code. Scannen Sie einfach den Code mit der Kamera Ihres Smartphones und die entsprechende Webseite wird im Browser geöffnet. Alternativ können Sie auch direkt im Browser Ihres Rechners, Tablets oder Smartphones den Shortlink eingeben. Wenn Sie mit der Offline-Version arbeiten, öffnen Sie das Medienpaket in Ihrer EUROPATHEK-App und wählen die entsprechende Nummer des Hörbeispiels.



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1 My Company

Your boss tells you that from next week a new electrician from Ireland will be working with you. As you want to welcome him properly and introduce him to your company on his first day, you decide to prepare by reading company profiles of electrical companies on the internet. Here is one that might be quite useful:

A screenshot of a web browser displaying the Jack Miller Electric website. The browser's address bar shows 'www.jack-miller-electric.net'. The website has a yellow header with the company logo, which consists of a yellow lightning bolt and the text 'Jack Miller ELECTRIC'. The main content area is white and features a 'COMPANY PROFILE' section. This section includes a paragraph about the company's size and services, a paragraph about Jack Miller's background, a 'Mission' section with a quote, and a 'Services' section with a bulleted list. To the right of the 'Mission' section is a photograph of a male electrician in a blue uniform and cap, holding a white toolbox and a roll of material, standing next to a white van.

COMPANY PROFILE

Jack Miller Electric is a medium-sized family business offering a variety of electrical services. We employ 15 skilled electricians, 3 master craftsmen, 5 apprentices and 3 unskilled workers. In our offices, two secretaries organise schedules and look after all the paperwork.

Jack Miller has run the company for 5 years now. Before, he worked with a big contractor in the area. When his father John Miller decided to retire, Jack took over and is now continuing to meet the needs and expectations of all the company's customers: private households as well as small and medium-sized businesses. Supported by a fantastic, reliable team Jack Miller is able to provide fast and professional work, including an emergency customer service 24/7 whenever immediate help is needed.

Mission

This is what Jack says himself: "It has always been our mission to achieve customer satisfaction and provide excellent workmanship from start to completion of a project. In order to understand the needs and expectations of our customers, we take great care to work and communicate with every customer in a professional manner. Our excellent reputation is based on service, safety and quality, regardless of how large or small the job."

Services

- Wiring of new buildings
- Rewiring of older buildings
- Repair of circuits and household appliances
- Installation and maintenance of alarm systems
- Smart home applications
- Renewable energy solutions

Activity 1 Text comprehension

Lesen Sie die Website in Abbildung 1 auf Seite 8 sorgfältig durch. Bearbeiten Sie dann die Aufgaben unten in deutscher Sprache.

- Führen Sie auf, wie viele Personen im technischen Bereich der Firma *Jack Miller Electric* arbeiten. Welche Ausbildung haben sie jeweils?
- Beschreiben Sie die Aufgaben der Büromitarbeiter der Firma.
- Fassen Sie zusammen, was Sie über den Lebenslauf des Inhabers Jack Miller und über dessen Vater John erfahren.
- Welche Dienstleistungen und Arbeiten bietet die Firma ihren Kunden?
- Übersetzen Sie die „Mission“, also die Firmenphilosophie, ins Deutsche.

medium-sized business	mittelständisches Unternehmen
skilled worker	Geselle
master craftsman	Meister
apprentice	Auszubildender
contractor	Unternehmer
needs and expectations	Bedürfnisse und Erwartungen
24/7	24 Stunden an 7 Tagen die Woche
to achieve	erreichen
reputation	Ruf, Ansehen
to wire	verdrahten, verkabeln
circuit	Stromkreis, Schaltung
maintenance	Wartung, Instandhaltung
solution	Lösung



Activity 2 Listening

After having learned a lot of words to describe your company you also want to be ready to introduce yourself to the new work mate. On the internet you find a podcast that helps you to find the right words.

Listen to Jimmy's introduction and translate the following German words and expressions:

- | | | |
|--------------------|--------------------------------|-------------------|
| ■ Berufsausbildung | ■ einen Vertrag unterschreiben | ■ Berufsschule |
| ■ Beruf | ■ Angestellter / Mitarbeiter | ■ Handwerkskammer |
| ■ ausbilden | ■ Gehalt | ■ Gesellenprüfung |

Activity 3 Dialogue writing

Together with a partner write a dialogue in which you introduce yourself and your company to Peter from Ireland. Your new colleague also asks questions that you answer.

Translate the parts below into English and fill in the missing parts with information about the company you work for:

- A:** Hallo, guten Morgen!
- B:** Guten Morgen! Du musst Peter aus Irland sein, schön Dich kennenzulernen.
- A:** Ja, ich bin Peter. Ich werde jetzt bei euch arbeiten.
- B:** Herzlich willkommen, ich bin Auszubildender und ich möchte Dir unsere Firma vorstellen. Hier arbeiten ... Personen. [Bitte erklären Sie, wie viele Personen mit welcher Ausbildung in Ihrem Betrieb arbeiten.]



- A:** Was macht die Firma hauptsächlich?
- B:** Wir bieten viele Arbeiten an, hauptsächlich ... *[Beschreiben Sie ausführlich, was Ihre Firma hauptsächlich macht. Nennen Sie ein Beispiel.]*
- A:** Das ist ja interessant. In Irland lernt man den Beruf in der Berufsschule, das dauert ein Jahr. Danach arbeitet man dann in einem Betrieb. Während der Ausbildung an der Schule sind wir nicht in einem Betrieb.
- B:** *[Erklären Sie, wann und wie oft Sie in die Berufsschule gehen.]*
- A:** Heißt das, dass Du während der Ausbildung schon Geld verdienst?
- B:** *[Erzählen Sie Peter, wie viel Sie in welchem Ausbildungsjahr verdienen.]*
- A:** Das ist ja cool! Oh, ist das euer Chef?
- B:** Ja, das ist ... *[Ergänzen Sie den Namen Ihres Chefs.]*. Komm, ich stelle euch vor!

Activity 4 Online support

Your company offers a 24/7 emergency service. As you have already learned a lot, you were asked to be on standby this weekend. Different customers send you emails, asking for help. It is your task to give advice.

Write an answer to each of the following requests. Explain to the customers what they can do to solve their problems. Use the wordbox for some helpful vocabulary.

Sender: Ms Elenor Smith

Dear electrician!

I have a big problem. This morning, I was in a hurry to catch a train. Thus, I quickly started the washing machine and the dishwasher and left the house. When I came home, the electricity had gone and I could not even switch on the lights anymore. What can I do?

Sender: Mrs Jane Fisher

Hello emergency team!

I am sending this from my mobile phone as I have a power problem with my PC. I really need to do some work this weekend and now, the PC doesn't start. There's nothing, not even a blinking LED!! What do you advise me to do? This is really urgent, thank you so much for a fast reply.

Kind regards, J. Fisher

fuse	Sicherung
loose connection	Wackelkontakt
to replace	auswechseln
to switch on/off	ein/aussschalten
to pull the plug	den Stecker ziehen
flat battery	leere Batterie
Mr	Herr (Anrede männlich)
Mrs	Frau (Anrede weiblich, verheiratet)
Ms	Frau (Anrede weiblich, neutral)
Kind regards	Mit freundlichen Grüßen
Dear ...	Liebe/r ..., Sehr geehrte/r ...

Sender: Mr David Baxter

Dear Service Team,

I hope you can help me. I need to drill a couple of holes into the wall. When I first started drilling everything went ok. But then somehow the drilling was interrupted. It went on and off all the time. Do you have any idea what the problem might be?

Activity 5 Presentation

There are often international groups of students at your vocational college. They are usually interested in the different professions that are taught there. Your class was asked to prepare presentations on:

- the German apprenticeship system in general,
- the jobs and tasks of an electrician,
- individual companies.

- a** Split up in groups of a maximum of three people and decide in each group which of the tasks you want to work on.
- b** Before you start, discuss and agree on rules for "the perfect presentation".
- c** Discuss your findings with the rest of the class and agree on rules that are valid for all students.
- d** Prepare a presentation in which each member of your group has his or her part. Make sure you explain everything you show, so that your target group (students from the US) can understand what you are talking about.
- e** Practice your presentation.
- f** Deliver your presentation in front of the group.

The following words and phrases will help you to sound professional and friendly:

Hello everyone, my name is ...	Hallo zusammen, mein Name ist ...
These are my colleagues/class mates ...	Dies sind meine Kollegen/Mitschüler ...
I would like to introduce to you ...	Ich möchte Euch/Ihnen ... vorstellen.
Here, you can see ...	Hier sieht man ...
If you have any questions feel free to ask any time.	Bei Fragen könnt Ihr/können Sie jederzeit unterbrechen.
On this slide we can see ...	Auf dieser Folie sehen wir ...
This table/graph/diagram shows ...	Diese Tabelle/dieses Diagramm zeigt ...
In this picture you see ...	Auf diesem Bild sieht man ...
Thank you for your attention!	Vielen Dank für Eure/Ihre Aufmerksamkeit!



1 Giving a presentation

2 The Basic Electric Circuit

In your first week as an electrician apprentice, there are so many new things to learn that you are getting a bit confused. But you realise that it is really important to understand fully how an electric circuit works. Also, the terms current, voltage and resistance seem to be extremely important. You find a short text on the topic:



In an electric circuit, there is always a source, a conductor and a load. Very often there is also a control. The source provides the power for the circuit. This might be a battery, for example. The conductor allows the current to flow through it. Conductors, for example cables and wires, are often made from copper or other metals. This is because metals are materials that easily conduct electrons. A load can be a lamp, resistor, motor or any other component. The control, e.g. a switch, is used to open and close the circuit.

The flow of electrons through an electric circuit is called electric current. Current can only flow if the circuit is closed and if there is a voltage that forces the electrons through the conductor.

Activity 1 Text comprehension

Bearbeiten Sie die folgenden Aufgaben auf Deutsch.
Lesen Sie dazu den Text noch einmal durch.

- Führen Sie die Bestandteile auf, aus denen jeder elektrische Stromkreis besteht.
- Welche Bedingungen müssen erfüllt sein, damit in einem Stromkreis auch tatsächlich Strom fließen kann?
- Erklären Sie, welche Materialien sich gut als Leiter eignen und warum.
- Erklären Sie, was Strom (physikalisch gesehen) ist.

electric circuit	elektrischer Stromkreis
current	Strom
voltage	Spannung
resistance	Widerstandswert
source	Quelle
conductor	(elektrischer) Leiter
load	Verbraucher
control	Steuerung
copper	Kupfer
to measure	messen

Activity 2 Vocabulary

There are some words in electronics which have a different meaning in real life.

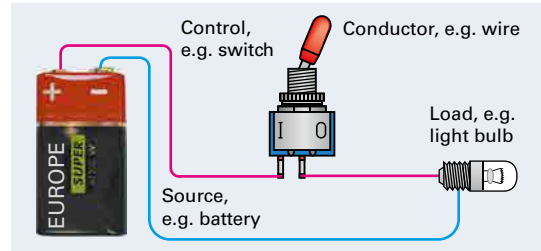
Using a dictionary or the internet, find out other German meanings for the following words:

- current
- conductor
- resistance
- load

Tip: Whenever you look up a word in a dictionary, make sure you use the meaning that fits into the context!

Activity 3 Draw a sketch

- Study the electric circuit in figure 1 and the circuit symbols in table 2. Then draw a technical sketch of the same circuit.
- In the given circuit all components are connected in series. Now draw a second circuit in which a lamp, two resistors and the power source are connected in parallel.
- In both sketches, add the arrows that show the direction of current and voltage.



1 Diagram of an electric circuit

Activity 4 The direction of current

Your apprentice colleague who only speaks English asks you why the electric current always flows from plus to minus. As current is a flow of negatively charged electrons, should they not flow from minus to plus? As you are not sure yourself you look the information up and find the following German text:

Technische und physikalische Stromrichtung

Als Wissenschaftler den Strom entdeckten, nahmen sie an, dass der Strom vom Pluspol zum Minuspol fließt. Erst später merkte man, dass dies physikalisch falsch ist. Richtig ist, dass Elektronen, weil sie negativ geladen sind, vom Pluspol angezogen werden und daher zu diesem hin fließen. Deshalb ist die korrekte, die physikalische, Stromrichtung von minus nach plus. Man hat sich jedoch darauf geeinigt die ursprüngliche Stromrichtung weiterhin zu verwenden und diese als technische Stromrichtung zu bezeichnen. In Schaltplänen der Elektrotechnik verwendet man im Normalfall die technische Stromrichtung: von plus nach minus.

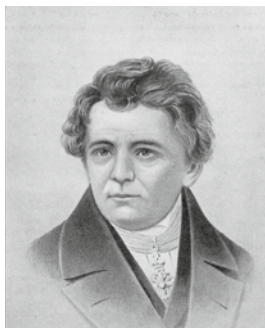
Now, you are ready to answer all your colleague's questions. Please write down the answers in full sentences:

- Is it true to say that current is a flow of electrons through a conductor?
- Electrons are particles of atoms, but are they negative or positive particles?
- Negative particles are attracted by plus poles, aren't they?
- Why does the current arrow in a diagram always point from plus to minus?

Description	Illustration	Circuit symbol
Conductor		
Conductor crossing (non-conductive)		
Conductor branching single		form 1 form 2
Conductor branching double		form 1 form
Battery (generator)		
Incandescent lamp		
Resistor		
Switch		

2 Circuit symbols

Activity 5 Ohm's law



1 Georg Simon Ohm

Translate the following text into German.

Georg Simon Ohm was born in 1789 in Erlangen and died in 1854 in Munich. He was a German physicist who found out that in every electric circuit, voltage, current and resistance depend on each other. This means that if you know two of the three values, you can calculate the third. The law that describes this relationship mathematically is called Ohm's law. Because this was such an important finding, the unit of resistance, the Ohm (Ω), was also named after Georg Simon Ohm.

Ohm's law works for all resistors that do not change with the amount of current that flows through them.

Activity 6 Calculations

Use the following formulas to calculate the missing value, if you know the other two values:

$$V = I \cdot R \quad I = \frac{V}{R} \quad R = \frac{V}{I}$$

Use one of the following formulas to calculate the power (P):

$$P = V \cdot I \quad P = R \cdot I^2 \quad P = \frac{V^2}{R}$$

Now, calculate the missing values using the given formulas. Write down your workings and prepare to read them out loud. Don't forget the units of measurement.

a $R = 100 \, \Omega, \quad V = 10 \, \text{V}, \quad I = ?$

b $I = 250 \, \text{mA}, \quad R = 96 \, \Omega, \quad V = ?$

c $V = 12 \, \text{V}, \quad I = 50 \, \text{mA}, \quad R = ?$

d $V = 4.5 \, \text{V}, \quad R = 2.5 \, \Omega, \quad I = ?$

e $R = 1 \, \text{k}\Omega, \quad I = 4 \, \text{A}, \quad V = ?$

f $I = 150 \, \text{mA}, \quad V = 9.3 \, \text{V}, \quad R = ?$

g $V = 12 \, \text{V}, \quad I = 400 \, \text{mA}, \quad P = ?$

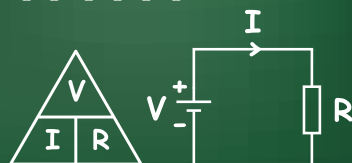
h $P = 9 \, \text{kW}, \quad V = 400 \, \text{V}, \quad I = ?$

Ohm's law

$$V = I \cdot R \quad [V] = [A] \cdot [\Omega]$$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$



2 Ohm's law: formulas and units

Please note that the formula symbol for voltage is V in English whereas in German it's U ! This can be confusing as in English the symbol and the unit for voltage are the same, e.g.: $100 \, \text{mA} \cdot 50 \, \Omega = ?$

The answer is: $V = 5 \, \text{V}$

Mathematical workings

$5 \cdot 2 = 10$ 5 times 2 equals 10
5 multiplied by 2 is equal to 10

$\frac{10}{2} = 5$ 10 over 2 equals 5
10 divided by 2 is equal to 5

V^2 V squared
V to the power of 2

Activity 7 Chain exercise

Think of an easy calculation that includes one or two of the basic mathematical functions **plus, minus, multiplied by, divided by or squared**. One student starts and confronts his neighbour with his or her problem. He or she works out the result and continues by setting the next student his or her task. Go around the class until everybody has had a turn.

Activity 8 Listening



These three men are really famous as they are namesakes for electrical units.



1 English inventor



2 Italian inventor



3 French inventor

Listen to the three texts on these famous inventors.

Copy the table below into your own documents and write down the missing information for each of the people.

- What's his name?
- When and where was the person born?
- When and where did he die?
- What was the person's profession?
- What did he invent?
- Which unit of measurement is named after the person?

	Name	Date and place of birth	Date and place of death	Profession	Inventions	Unit
1						
2						

3 Resistor and Resistance

While repairing an electrical device you realise that the reason for the malfunction is a defective resistor. To select the right replacement, you need the information on the types and classifications of resistors given in the following text.

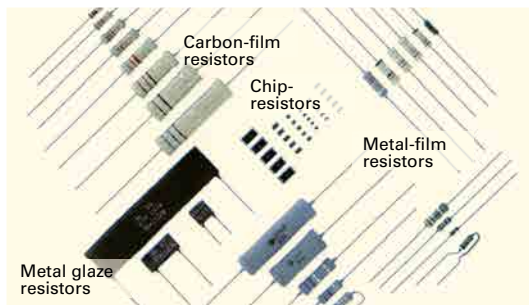
Types and properties of resistors

The material property that hinders the current flow is called resistance. Resistors are electric components that have a specified value of resistance. They are usually used as current control devices. Resistors can be fixed or variable. Variable resistors are often called potentiometers or trimmers.

Two very common types of fixed value resistors are the metal film resistor and the carbon film resistor. They have a thin layer of carbon or metal applied on a ceramic plate. The shape and length of the layer determines the resistance of the component.

In order to select the right resistor you must consider two other aspects in addition to resistance: the power rating (also called rated power) and the tolerance.

The power rating depends on the resistor's maximum heat dissipation. For a high power rating the resistor most often requires large dimensions. Metal film resistors often have higher power ratings than the carbon type. The tolerance indicates the maximum possible spread of resistance due to imperfection of the manufacturing process. The lower the value of the tolerance, the higher are the quality and the costs of the component.



1 Types and sizes of resistors

Activity 1 Text comprehension

Lesen Sie den Text und beantworten Sie folgende Fragen auf Deutsch:

- a Was bedeuten die Begriffe *resistor* und *resistance*?
- b Wie ist ein Widerstand aufgebaut?
- c Was können Sie über die Nennleistung von Widerständen aussagen?

power rating, rated power	Nennleistung
conductor	Leiter
layer	Schicht
metal-film resistor	Metallschichtwiderstand
carbon-film resistor	Kohleschichtwiderstand
properties	Eigenschaften
heat dissipation	Wärmeableitung
to apply	auftragen, anwenden
spread	Streubereich

Activity 2 True or false

Check whether the following statements are true or false. If a statement is false, write down the correct sentence.

- a The material property that opposes the current flow is called resistance.
- b The higher the tolerance of a component, the lower are the costs.
- c The characteristic properties of resistors are resistance, current-rating and tolerance.
- d The maximum heat dissipation of the resistor limits the power rating.
- e Carbon film resistors have a higher tolerance than metal film resistors.
- f Variable resistors are called potentiometers.
- g Resistors are often used as power control devices.

Activity 3 Study the picture

Describe what you can see in figure 1 on page 16 and explain the differences between the components.

Activity 4 Find the words

A computer virus mixed up the letters of several words in the following text.

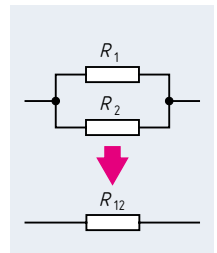
Write down the correct words in your own documents. A look at figure 1 (on this page) might help you!

Equivalent resistance

It might happen that in your workshop you do not have the *otrseir*¹ you need. Then you can *necobim*² two or more resistors to obtain the right *siretsnaec*³.

Simply connect two *icalentdi*⁴ resistors in series and their total resistance will add up to the *uledob*⁵ value. In contrast the total resistance in a parallel circuit is always *sels*⁶ than any of the single resistances. Adding more parallel resistances will cause the total resistance in the circuit to *earsdece*⁷ even more.

When you *ctennco*⁸ for example two resistors of one hundred ohms in parallel, the equivalent resistance will be *iytff*⁹ ohms. When you add *thranoe*¹⁰ identical resistor, the total resistance will be little more than *itythr*¹¹ ohms.



1 Equivalent resistance

Activity 5 Colour codes

Resistors are marked with four colour bands.

An example is shown on the right hand side (table 2). A yellow and a violet colour band stand for the number 47. This number has to be multiplied by the factor indicated by the brown colour band. The last colour band stands for the tolerance.

a Find the resistance of the following resistors using the colour codes given in table 2.

- 1 blue | grey | yellow | gold
- 2 orange | green | red | brown
- 3 yellow | violet | orange | gold
- 4 brown | blue | black | silver
- 5 white | brown | brown | silver
- 6 orange | orange | blue | green

b Find the colour codes for the following resistors.

- 1 $460\ \Omega \pm 10\ \%$ 2 $4,7\ \text{M}\Omega \pm 5\ \%$
- 3 $680\ \Omega \pm 1\ \%$ 4 $330\ \text{k}\Omega \pm 5\ \%$
- 5 $1,2\ \text{k}\Omega \pm 0,5\ \%$ 6 $560\ \Omega \pm 2\ \%$

Colour code According to IEC 757	1. digit	2. digit	Multi- plier	Tolerance in %
	Resistance value in Ω			
black (bk)	—	0	1	—
brown (bn)	1	1	10	± 1
red (rd)	2	2	10^2	± 2
orange (og)	3	3	10^3	—
yellow (ye)	4	4	10^4	—
green (gn)	5	5	10^5	± 0.5
blue (bu)	6	6	10^6	± 0.25
violet (vt)	7	7	10^7	± 0.1
grey (gy)	8	8	10^8	—
white (wh)	9	9	10^9	—
gold (gd)	—	—	0,1	± 5
silver (sr)	—	—	0,01	± 10
no colour	—	—	—	± 20

4 7 • 10 $\pm 5\ \%$ $\Rightarrow 470\ \Omega \pm 5\ \%$

2 Colour codes

Activity 6 Comprehension

Conductors and insulators



1 Metal conductors

Materials that conduct electricity are called conductors. The best electrical conductor is silver and not gold as you may expect. Gold is only the third best conductive material but it is sometimes used as contact material in the field of electronics because unlike silver it does not tarnish. Tarnish is the name for the oxide layer that builds up when silver is exposed to air. Similar to rust on steel or iron tarnish is non-conductive.

The second best conductor is copper. This material is widely used because it is much cheaper than silver and gold. Another good conductor is aluminum which has the advantage that it weighs very little.

Insulators are materials that do not conduct electricity. Rubber, porcelain and oil are examples of insulators. Even water can insulate well but only in its pure state. Dirty water conducts weakly and salt water in contrast is a good conductor.

Whether a material is a conductor or an insulator depends on how easily electrons can move through it. The measure of how well a material conducts an electric current is called the conductivity. The electric conductivity is represented by the Greek letters γ (gamma) or κ (kappa). It is measured in Siemens per meter (S/m). A good conductor has a high conductivity.

Material	Silver	Copper	Gold	Aluminium	Salt water	Rubber
Conductivity (S/m)	$6.30 \cdot 10^7$	$5.96 \cdot 10^7$	$4.10 \cdot 10^7$	$3.5 \cdot 10^7$	4.8	10^{-14}

2 Conductivity γ at 20 °C

Read the text and answer the following questions in your own words:

- Explain the advantages and disadvantages of the four metal conductors mentioned in the text.
- What is said about the properties of water?
- Please explain the term *conductivity*.

Activity 7 Translation

Translate the following sentences into English.

- Ein Widerstand verringert die Stromstärke.
- Die Toleranz beschreibt die Abweichung vom Nennwert.
- Die Nennleistung eines Widerstandes darf nicht überschritten werden.
- Die zugeführte elektrische Leistung wird im Widerstand in Wärme umgesetzt.
- Ein Potentiometer ist ein veränderbarer Widerstand.
- Kupfer hat eine höhere Leitfähigkeit als Gold.
- Silber hat den Nachteil, dass es eine nichtleitende Oxidschicht bildet.
- Der Widerstand einer Leitung hängt von der Länge der Leitung ab.

Activity 8 Comprehension

Sie möchten einen Widerstand im Internet bestellen und stoßen auf das Datenblatt eines Lieferanten (Abbildung 1).

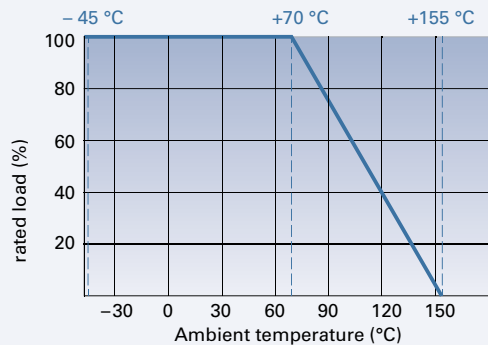
Beantworten Sie die folgenden Fragen mithilfe des gegebenen Datenblattauszuges auf Deutsch:

- Um welche Art von Widerstand handelt es sich?
- Geben Sie die Nennspannung und die maximale Leistung des Widerstandes an.
- Für welche Temperatur gelten die Nennwerte?
- Welche Widerstandswerte sind lieferbar?
- Mit welcher Abweichung vom Nennwert ist zu rechnen?
- Welche maximale Leistung ist bei einer Temperatur von 120 °C zulässig?
- Bei welcher Umgebungstemperatur darf der Widerstand mit voller Nennleistung betrieben werden?

Datasheet carbon film resistor series CFR 500

Type	CFR 500
Rated Power	1.5W at 70 °C
Max. Working Voltage	250 V
Max. Overload Voltage	500 V
Dielectric Withstanding Voltage	500 V
Rated Ambient Temp.	70 °C
Operating Temp. Range.	-45 °C ~ +155 °C
Resistance Tolerance	± 5 %
Resistance Range	1 Ω ~ 10 MΩ E-24 series

CFR series derating curve



1 Datasheet resistor

Activity 9 Listening comprehension



You hear Steven Solid and George Brannon talking on the radio show TecNews about superconductors.

Please answer the following questions:

- What is the normal relationship between conductance and temperature?
- What is the major advantage of superconductivity?
- When was superconductivity first discovered?
- What temperature is necessary to obtain high temperature superconductivity?
- Where are superconductors used today?
- What are the promising future applications of superconductors?

4 Measuring Basics

One of the tasks every electrician has to carry out is measuring. A very common measuring instrument is the multimeter which can be used to measure many different values. It is very important to know how to operate a multimeter to find out the correct values but also to protect the meter itself.

The most common type of multimeter is a digital multimeter. It has a digital display to show the measured values. But there are also analogue multimeters which have scales and a pointer that indicate the result. With the latter it is a bit harder to identify the measured value because reading errors are more likely to occur.

Both types of multimeters have an on/off button, a range switch and sockets for the test leads to be plugged in. You can usually replace the battery and the fuse by opening the battery compartment at the back of the device.

Depending on what you want to measure the multimeter should be connected in different ways. For example, to measure the voltage across a component you have to connect the multimeter in parallel. Before switching on the meter, turn the range switch to volts (AC or DC) and choose the appropriate range for the expected value (if in doubt, make sure you start with the bigger range to protect the measuring device).

If you want to measure the current in an electric circuit, the multimeter must be connected in series with the other components. The current you want to measure has to flow through the meter. Again, choose the appropriate range by turning the range switch and read the result from the display or from the scale.

Voltage and current are the values that are measured most frequently. Often, you can also measure resistance, frequency, and capacity. Some devices also allow you to test your diodes and transistors or even to save the measured values.



1 Electrician carrying out measurements with a multimeter

scale	Skala
pointer	Zeiger
to indicate	anzeigen
to occur	passieren, auftreten
range switch	Messbereichsschalter
socket	Buchse, Steckdose
test lead	Messleitung
test probe	Messspitze
in parallel	parallel
in series	in Reihe
frequency	Frequenz
capacity	Kapazität (vom Kondensator)

Activity 1 True or false?

Find out if, according to the text, the following statements are true or false. For each statement that is false write a correct English sentence.

- a With an analogue multimeter more operating errors occur.
- b Digital multimeters indicate the measured value with a pointer over a scale.
- c With a multimeter you can measure AC as well as DC values.
- d You cannot replace the fuse of a multimeter.
- e You can replace the battery of a multimeter.
- f Most multimeters can measure voltage, current, resistance and frequency.
- g If you want to measure the voltage across a load, the meter has to be connected in series with the load.
- h If you want to measure the electrical current through a component, the meter and the component must be connected in series.