

Unit 4

ELECTRICAL MEASURING DEVICES

In this unit you will

- ▶ learn the names of some common measurement and testing devices
- ▶ learn and practice vocabulary related to devices and measurements
- ▶ learn vocabulary and practices related to safety in working with electricity



Part 1 Electrical Aspects and Measuring Devices 1a Class Discussion

- ▶ What kind of electrical measurements have you made?
- ▶ What kind of instruments have you used?
- ▶ What's the difference between the two meters in the picture?



1b Match

Read through the following text and match the following Turkish words and phrases with their highlighted English equivalents in the text.

ölçüm birimi

akımın geçişi

mevcut

direnç

çok fonksiyonlu

süreklilik

doğru çalışmak

kurulum

voltaj

akım

uygun monte edilmiş

devre

Electrical measuring instruments are devices used for measuring various electrical aspects such as **current**, **voltage**, **resistance** and **continuity**. Measuring these aspects is important to determine if an electrical system is **installed appropriately**.

Some of the electrical measuring instruments are listed below.

Ammeters

Ammeters are electrical instruments used to measure current in a **circuit**. The evaluation it does is read in 'amps' as the unit.

Voltmeters

Voltmeters are electrical devices that measure the voltage or potential difference between two points in a circuit. The **unit of measurement** of voltmeters are 'volts'.

Ohmmeters

Ohmmeters, which use 'ohm' as unit of measurement, are devices that measure the electrical resistance through a circuit. These equipments are important in **installations** that require correct resistance in order to **function properly** such as speakers. Ohmmeters also check the **flow of current** to make sure that it has continuity.

Multimeters

Multimeters are a popular type of electrical measuring instrument because they are **multi-functional**. A multimeter works like an ammeter, ohmmeter and voltmeter as it can measure different aspects. Similar to other electrical measuring instruments, multimeters are **available** in analog and digital types.



ohmmeter



digital multimeter

Adapted from <<http://www.thegreenbook.com/electrical-measuring-instruments.htm>>

1c Check your understanding



Answer the following questions according to the information in the text.

1. Why should electricians measure electrical aspects?
2. What is the unit of measurement for 'current'?
3. What can you use an ohmmeter for when installing a surround sound system?
4. What measuring device do you need to check if a current is cut?
5. What is the unit of measurement for electrical resistance?
6. If you are an electrician, do you need to buy all the meters mentioned in the text? Why/Why not?
7. Which of these devices are analog and which are digital?
8. What makes a multimeter multi-functional?

1d Check the meaning

Below are screen clippings of two testing tools from the website <http://www.test-meter.co.uk/>

Use your glossary to check the meanings of the following phrases.

automatic switching; three phase rotation testing; audible indication; visual indication; voltage detection

Device 1



DiLOG Combivolt 1 - DL6780 Voltage And Continuity Tester

Be the first to review this product

Official distributor for:

Di-LOG

- > Test AC and DC voltages from 12V to 690V.
- > Automatic switching between voltage and continuity.
- > Can perform three phase rotation testing.

£34.00

£40.80 (Inc. VAT)

FFP £47.99

Choose Your Free Gift

ADD TO BASKET

QTY

1



Device 2



Megger VF1 Voltage Detector Stick

Be the first to review this product

Official distributor for:

Megger.

- > Non-contact voltage detection from 100V to 600V AC.
- > Tip glows red when voltage is detected.
- > Ideal for identifying AC voltages in socket outlets, fuses and cables.

£13.95

£16.74 (Inc. VAT)

FFP £15.99

ADD TO BASKET

QTY

1



1e Compare



Work with your partner and answer the following questions according to the specifications of the two devices:

1. What electrical aspects can Device 1 test or measure?
2. How is Device 1 different from a multi-meter?
3. Which device offers a wider range of voltage detection?
4. How do you know there is voltage in a socket when you test it with Device 2?
5. Can the second device measure voltage of a battery? Explain your answer.
6. Which of the two devices would you buy? Explain your answer.

Part 2 Your Digital Multimeter

2a Class Discussion

- ▶ Who has a multimeter? / Who has used one?
- ▶ Where can you use a multimeter?



2b Find the meaning

Skim through the following two texts and use your glossary to check the meanings of **highlighted words**.

What can multimeters measure?

Almost all multimeters can measure voltage, current, and resistance.

▶ **Voltage** is how hard electricity is being "pushed" through a circuit. A higher voltage means the electricity is being pushed harder. Voltage is measured in volts. The symbol for volts is V. V- sign on a multimeter is the setting for DC (direct current) and V~ for AC (alternating current).

▶ **Current** is how much electricity is flowing through the circuit. A higher current means more electricity is flowing. Current is measured in amperes. The symbol for amperes is A.

▶ **Resistance** is how difficult it is for electricity to flow through something. A higher resistance means it is more difficult for electricity to flow. Resistance is measured in ohms. The symbol for ohms is Ω (the capital Greek letter omega).

Continuity check: Some multimeters have a continuity check, resulting in a loud beep if two things are electrically connected and will not make any noise if there is no **conductive path**. This is helpful if, for instance, you are building a circuit and connecting wires or **soldering**; the beep indicates everything is connected and nothing has come **loose**. You can also use it to make sure two things are not connected, to help **prevent short circuits**. The setting for this on a multimeter looks like a soundwave symbol.



2e Check your understanding

1. Label the leads, pin jacks and probe tips in the picture.
2. How do you decide which probe end goes where when testing AC voltage?
3. How do you place the probes when testing an AA size battery?
4. How do you decide where to plug in the jacks on your multimeter?

2c Label

Label the settings for voltage (AC and DC), current, resistance and continuity on the following multimeter dial.



2d True or False

- ___ 1. How much electricity there is in a cable is its voltage.
- ___ 2. There are separate settings for AC and DV voltage.
- ___ 3. On a multimeter A shows the setting for current.
- ___ 4. The Greek letter omega shows the setting for continuity.
- ___ 5. A lower resistance reading on a multimeter indicates that electricity is flowing easily.
- ___ 6. If a light bulb is tested for continuity and the multimeter makes a loud beep, it means that the bulb is dead.

red and black wires?

Your multimeter probably came with red and black wires that look something like the ones in the picture. These wires are called **leads**. One end of the lead is called a **banana jack**; this end plugs into your multimeter (Note: some multimeters have **pin jacks**, which are smaller than banana jacks. The other end is called the **probe tip**; this is the end you use to test your circuit. The red probe is used for positive, and the black probe is used for negative. This is important when measuring DC. DC has polarity (+ and -) but AC does not.

Where do I plug in the wires?

Although they come with two probes, many multimeters have more than two places in which to plug the probes. Exactly where you plug the probes in will **depend on** what you want to measure (voltage, current, resistance, continuity test, or diode test) and the type of multimeter you have.

2f Check the meaning

Skim through the text and find the meanings of the highlighted words.

Equus 3300 Hands-free Digital Multimeter

With the Equus 3300 **Hands-free** Digital Multimeter, you can safely and **accurately troubleshoot** most of the automotive and electrical problems that you may have at home. It can be used to measure the voltage, current and resistance of nearly any electrical item in your home **with ease**. The specialized circuitry in this electronic multimeter helps **prevent damage** to sensitive electronics. It can also help you to **identify** computer parts and small appliances that have **failed** due to **electrical wiring**. It can be used to troubleshoot automotive circuits, fuses, wiring and batteries, making it an **ideal choice** for any home mechanic. It's also a great way to find a dead fuse.

- ▶ Electronic multimeter uses 10 MegOhm circuitry
- ▶ Includes test lead holders for **hands-free** testing
- ▶ Safe and high quality
- ▶ Includes **easy-to-read instructions** in English, French and Spanish

Where can you use this multimeter?

- ▶ **Household uses** include: outlets, fuses, wiring, general-purpose batteries, electronic hobbies and more
- ▶ **Automotive uses** include: automotive circuits, fuses, wiring, vehicle battery and charging systems, electrical components and more

<<http://www.walmart.com/ip/Innova-3300-Equus-3300-Hands-free-Digital-Multimeter/14644665#Specifications>>



2g True or False

Decide if the following statements are True (T) or False according to the text:

1. The device is easy to use.
2. You should be very careful because it can cause damage to electronics.
3. You can troubleshoot a failing computer with this multimeter.
4. You can check continuity with this meter.
5. You cannot use it to detect a dead fuse in a plug.
6. You can use this device without holding the meter.
7. This meter cannot determine if your batteries are charged.
8. You can use it to troubleshoot a circuit board.
9. Users manual includes Turkish instructions.
10. You can use the device to test your power outlets.
11. A mechanic can use this meter to test a car battery.

2h Group work



1. Work in small groups and:

- ▶ make a list of the 5 best qualities of this multimeter.
- ▶ make a list of different things your team members can use this multimeter for in their own homes

5 Best qualities

We can use it ...

Part 3 Clamp Meters

3a Class Discussion

- ▶ Who has seen or used a clamp meter before?
- ▶ Which part of the tool is the 'clamp'?
- ▶ How is it different from a multimeter?
- ▶ What are they called in Turkish?



How to measure electricity with a clamp meter

A clamp meter is an electrical tester with a basic digital multimeter and a current sensor in one. Clamps measure current. Probes measure others. You can simply clamp the tool around wires, cables and other conductors at any point in the electrical system and measure its current, without disconnecting it.

What do clamp meters measure?

AC current, AC and DC voltage, resistance and continuity; some models also measure DC current, temperature, frequency and more



flexible current probes are used when conductors are too large for a clamp

What are they used on?

- ▶ Industrial equipment
- ▶ Industrial controls
- ▶ Electrical systems
- ▶ Commercial/industrial ventilation

Why use a clamp meter?

Technicians sometimes need to measure different things at the same time during troubleshooting. Because of this, they carry two meters: one to measure electrical current and one to measure voltage. For electricians, a clamp meter is a quick tool to determine why an electrical system or a piece of equipment is not operating

Who uses them?

- ▶ Industrial maintenance technicians
- ▶ Control technicians
- ▶ Electricians
- ▶ Building maintenance and ventilation technicians
- ▶ Service organizations

What do they use them for?

- ▶ **Service:** Repairing existing systems
- ▶ **Installation:** Troubleshooting installation problems and performing final circuit tests
- ▶ **Maintenance:** Performing regular maintenance on electro-mechanical systems.

3b Match

Find the English equivalents of the following Turkish phrases in the text. Use your glossary if necessary.

1. kurulum sorunlarını giderme
2. endüstriyel bakım teknisyenleri
3. bina bakımı
4. servis kurumları
5. mevcut sistemleri tamir etme
6. endüstriyel kontrol
7. akım sensörü
8. düzenli bakım yapma
9. bağlantıyı kesmeden
10. son devre testi
11. ticari/endüstriyel havalandırma
12. elektro-mekanik sistemler
13. kontrol teknisyenleri
14. elektrik akımını ölçmek
15. havalandırma teknisyenleri
16. teçhizatın doğru çalışmaması
17. endüstriyel teçhizat

3c Check your comprehension

Answer the following questions according to the information in the passage.

1. How is a clamp meter different from a multimeter?
2. What makes a clamp meter very practical when measuring current?
3. What can you do when the cable you want to test is too large for the clamp?
4. Are clamp meters used in troubleshooting computers?
5. List three purposes for use of clamp meters.
6. What is the use of clamp meters in industry?
7. What is the main advantage of a clamp meter for technicians and electricians?

Part 4 Safety comes first!

4a Class Discussion

What's the difference between the two men in the pictures?



Picture 1



Picture 2

4b Check the meaning

Use your glossary to check the meanings of the **highlighted words**.

Safety is everyone's **responsibility** and it is in your hands. No tool by itself can guarantee your safety when working with electricity. It's the combination of the right tools and **safe work practices** that gives you maximum **protection**. Here are a few **tips** to help you in your work:



A. Make sure you always **comply with (local) regulations**.

B. Work on **de-energized circuits** whenever possible. Use proper **lock-out/tag-out procedures**. If these procedures are **not in place**, assume that the circuit is live.

C. Use **protective gear** when working on **live circuits**:

- ▶ Use **insulated tools**
- ▶ Wear safety glasses or a face shield
- ▶ Wear insulated gloves, remove watches or jewelry
- ▶ Stand on an insulated mat
- ▶ Wear **flame resistant** clothing, not ordinary work clothes

D. Select the right testing device

E. **Inspect** and test your device



Picture 3

4c Label

1. Label the protective gear the electrician is using in Picture 3.
2. Find the phrases in the text that match Picture 4, Picture 5, and Picture 6.



Picture 4



Picture 6



Picture 5

4d Check your understanding

Answer the following questions according to the information in the text.

1. What are the two things that can give you maximum protection while working with electricity?
2. What should you do if you are not sure that a circuit is de-energized?
3. What should you do when you are working on a live circuit?
4. What are the two important things you should pay attention to about tools?

Part 5 Revision

5a Match

Match the following captions with the pictures:

- A. using a multi-meter for repair and diagnostic of an electronic circuit board
- B. using probes of a clamp meter to test thermostat voltage
- C. testing AC voltage in an electrical socket with a multimeter
- D. multimeter set to continuity mode
- E. technician working on a PC board with a multi-meter
- F. auto mechanic using a multi-meter to check voltage level in a car battery
- G. electrician checking current with a clamp meter
- H. testing continuity in a car tail light circuit:
- I. electrician checking fuse box with a multi-meter
- J. measuring electrical installation with a clamp meter
- K. voltage detection in a socket with a voltage tester pen



Picture 1



Picture 2



Picture 3



Picture 4



Picture 5



Picture 6



Picture 7



Picture 8



Picture 9



Picture 10



Picture 11