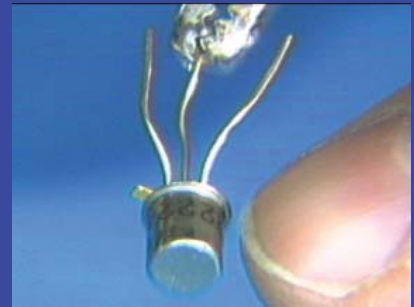
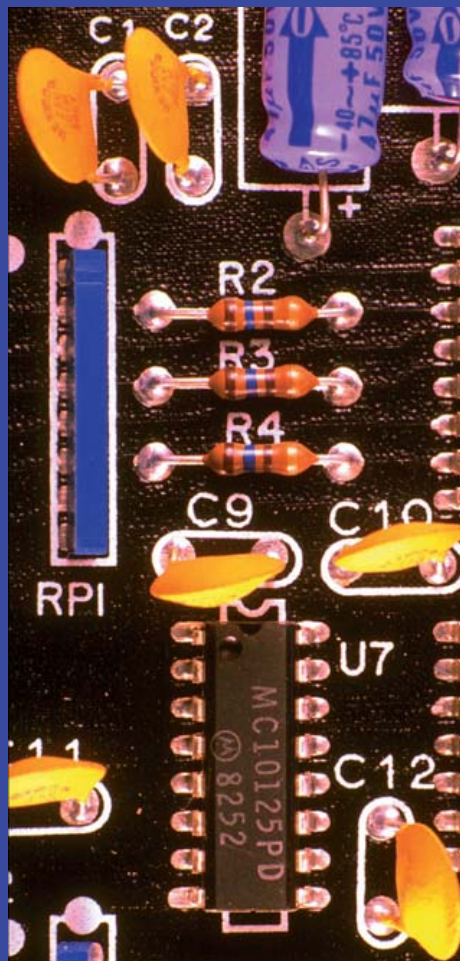
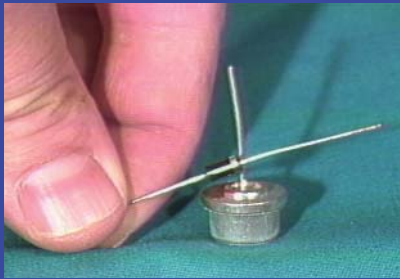


Electrical Troubleshooting



Introduction

Electrical Troubleshooting summarizes and explains the basic procedures used to troubleshoot electrical circuits and components utilized in the home and industry. Students will learn how to diagnose and repair common electrical problems. The program also describes how to use certain electrical testing equipment. Electrical troubleshooting skills are needed in a variety of professions. These professions include auto mechanics, appliance repair, residential wiring, manufacturing technology, and many more. This program provides students with the essential information needed to grasp the concepts of electrical troubleshooting and repair. However, it does not cover the safety rules that should be followed when working around electricity. Make sure students learn and follow these particular safety rules.

The program is organized into major sections or topics. Each section covers one major segment of the subject. Graphic breaks are given between each section so that you can stop the video for class discussion, demonstrations, to answer questions, or to ask questions. This allows you to watch only a portion of the program each day, or to present it in its entirety.

This program is part of the ten-part series *Electricity and Electronics*, which includes the following titles:

- Electrical Principles
- Electrical Circuits: Ohm's Law
- Electrical Components Part I: Resistors, Batteries, and Switches
- Electrical Components Part II: Capacitors, Fuses, Flashers, and Coils
- Electrical Components Part III: Transformers, Relays, and Motors
- Electronic Components Part I: Semiconductors, Transistors, and Diodes
- Electronic Components Part II: Operation—Transistors and Diodes
- Electronic Components Part III: Thyristors, Piezo Crystals, Solar Cells, and Fiber Optics
- Electrical Troubleshooting
- Electronic Circuit Repair

To order additional titles please see **Additional Resources** at www.filmsmediagroup.com at the end of this guide.

Student Objectives

After viewing this program, the student will be able to:

- List the three basic types of electrical circuit problems.
- Describe the purpose of a jumper wire.
- Explain how to use a test light to check a circuit for power.
- Describe the different functions of a multimeter.
- Explain how an inductive ammeter operates.
- List the basic techniques for troubleshooting an electrical circuit.
- Explain the importance of a service manual when troubleshooting an electrical circuit.

- Detect wiring problems in a circuit.
- Test the operation of fuses, circuit breakers, resistors, relays, switches, capacitors, and other components in a circuit.

Discussion Topics

1. Name some of the professions that utilize electrical troubleshooting skills.
2. What type of electrical problems can occur in the home?
3. Name some of the causes of an electrical short.
4. Why are high and low resistances sometimes difficult to detect in an electrical circuit?
5. List some of the instruments that are used for circuit testing.
6. Describe the basic procedures used to troubleshoot an electrical circuit.
7. How is a wiring diagram used to diagnose electrical problems in a circuit?
8. Describe the procedures normally used to test a capacitor.

Short Answers

Briefly answer the following questions in your own words:

1. Why is it important to know and follow all safety rules when working around electricity?
2. List the three basic types of electrical circuit problems.
3. What are the three instruments that make up a multimeter?
4. What troubleshooting procedures should be followed if an electric heater has no power?
5. How do you normally check for wiring problems in an electrical circuit?
6. Explain the purpose of a circuit breaker.
7. Name some of the causes of a blown fuse.
8. How does a variable resistor operate?
9. Name some of the causes of a faulty relay.
10. Describe how to properly solder a wire to an electrical component.

Technical Terms

Write definitions for the following terms. Use a textbook or review the video if needed.

electrical circuit	opens	shorts	electrical resistance
circuit conductor	electric motor	switches	resistors
coils	ohmmeter	circuit breaker	jumper wire
test light	multimeter	solenoid	relay
ammeter	voltmeter	magnetic field	electrical values
wiring diagrams	ohms	capacitor	electrical troubleshooting chart
wire color codes	voltage drop test	inductive ammeter	variable resistor
soldering gun	motor brushes	motor armature	electric motor bearings
motor windings	crimp connectors	rosin core solder	acid core solder

Quiz

1. A(n) _____ will normally increase total circuit _____ and reduce total circuit current.
a. fuse; voltage
b. open; resistance
c. short; resistance
d. none of the above
2. A(n) _____ causes more _____ and less resistance.
a. open; current
b. open; voltage
c. short; current
d. all of the above
3. Which of the following is the most difficult to diagnose in a faulty circuit? _____
a. High or low resistance
b. A short
c. An open
d. A bad fuse
4. Which of the following electrical components can be tested with a jumper wire? _____
a. Switch
b. Relay
c. Solenoid
d. All of the above
5. A(n) _____ is a fast method of checking a _____ for power.
a. test light; circuit
b. digital thermometer; resistor
c. inductive ammeter; resistor
d. none of the above
6. A multimeter's _____ setting is used to measure the amount of electrical pressure or _____ in a circuit.
a. ohmmeter; amps
b. ammeter; resistance
c. voltmeter; volts
d. ohmmeter; current
7. A multimeter's _____ setting measures the amount of _____ or electrical flow in a circuit.
a. ohmmeter; voltage
b. ammeter; resistance
c. voltmeter; amperage
d. ammeter; current
8. A(n) _____ uses the magnetic field around the wire to measure current.
a. inductive ammeter
b. test light
c. inductive ohmmeter
d. all of the above
9. An ohmmeter will measure the amount of _____ or _____ in a circuit.
a. current; amperage
b. resistance; ohms
c. pressure; voltage
d. resistance; amperage
10. Which of the following procedures is used to troubleshoot an electrical circuit? _____
a. Using all of your senses
b. Verifying your repair
c. Observing the symptoms
d. All of the above
11. A _____ will detail common problems, symptoms, and corrections for the electrical unit being repaired.
a. troubleshooting chart
b. wiring diagram
c. circuit manual
d. none of the above

12. _____ use _____ to represent the components in a circuit.
- a. Troubleshooting charts; numbers
 - b. Wiring diagrams; symbols
 - c. Circuit charts; colors
 - d. Service manuals; numbers
13. When tracing for a loss of power in a circuit, you should first check for _____ .
- a. faulty capacitors
 - b. shorted resistors
 - c. wiring problems
 - d. shorted relays
14. When replacing fuses, circuit breakers, and fusible links, always use a replacement of the same _____ .
- a. resistance rating
 - b. voltage rating
 - c. capacitance rating
 - d. amp rating
15. Which of the following instruments is normally used to test the operation of a capacitor?
- _____
- a. Jumper wire
 - b. Ohmmeter
 - c. Test light
 - d. None of the above

Answer Key

Use your own judgment to evaluate the Discussion Topics, Short Answers, and Technical Terms.

Quiz Answer Key:

1. b 2. c 3. a 4. d 5. a

6. c 7. d 8. a 9. b 10. d

11. a 12. b 13. c 14. d 15. b

Useful Web Sites

IEEE Virtual Museum—The History of Electricity, Electronics, and Computers

www.ieee-virtual-museum.org

Community Learning Network

Click on "Technology Education" for educational resources in *Electronics and Electricity*

http://www.cln.org/subject_index.html

Greatest Engineering Achievements of the 20th Century

Click on "Electrification," "Electronics," and more

<http://www.greatachievements.org>

Superconductor Information for Beginners

<http://superconductors.org>

Additional Resources at www.filmsmediagroup.com

Available from Films Media Group • www.filmsmediagroup.com • 1-800-257-5126

Electricity and Electronics

- VHS/DVD
- Preview clip online
- Viewable/printable teacher's guide online
- Item # 34798

The program you have just viewed is part of the ten-part series *Electricity and Electronics*. The series provides a comprehensive guide to the study of electronics, ranging from the fundamental laws and principles of electricity at the atomic level to troubleshooting and repair of electronic components. Lively computer animation and hands-on demonstrations make these videos an ideal resource for the classroom. A Shopware Production. (18-24 minutes each)

The series includes: *Electrical Principles*; *Electrical Circuits: Ohm's Law*; *Electrical Components Part I: Resistors, Batteries, and Switches*; *Electrical Components Part II: Capacitors, Fuses, Flashers, and Coils*; *Electrical Components Part III: Transformers, Relays,*

and Motors; Electronic Components Part I: Semiconductors, Transistors, and Diodes; Electronic Components Part II: Operation—Transistors and Diodes; Electronic Components Part III: Thyristors, Piezo Crystals, Solar Cells, and Fiber Optics; Electrical Troubleshooting; Electronic Circuit Repair

Electric Power on the Move

- VHS/DVD-R
- Viewable/printable teacher's guide online
- Produced in association with the Accreditation Board for Engineering and Technology and the Junior Engineering Technical Society
- Item # 34288

This *Science Screen Report* looks at the production, transportation, and consumption of electricity. Using the Hoover Dam as an example of efficient hydroelectric power generation, the video illustrates how transformers raise or lower voltage and how electricity is channeled to illuminate buildings, power devices, and propel vehicles. The difference between alternating and direct current is discussed, as well as advantages of neon over filament bulbs. Animated segments help students with vital electrical concepts, including ohms, volts, and amperes. © 2004. (18 minutes)

Residential Electrical Wiring

- VHS/DVD
- Preview clip online
- Viewable/printable teacher's guide online
- Correlates to the National Center for Construction Education and Research standards.
- Item # 32070

This eight-part series is filled with information on installing, upgrading, and updating residential electrical service, walking students through all the major processes they'll need to know. A Shopware Production. © 2004. (16-21 minutes each)

The series includes: *The Service Entrance; Panelboards; Wiring Methods; Grounding; GFCIs and AFCIs; Receptacles and Switches; Wiring Light Fixtures; Wiring for Appliances*

Electricity

- VHS/DVD-R
- Viewable/printable teacher's guide online
- Item # 3548

This six-part series covers many of the fundamental concepts in the study of electricity. It explores the mystery of electricity's causes and effects, and enable students to visualize—and thereby understand—abstract and sometimes difficult concepts in physics. (10 minutes each)

The series includes: *Conductors and Insulators; Charging and Discharging; Charging by Induction; Current Electricity; Potential Difference; Resistance*

Electricity and Magnetism

- CD-ROM (Windows/Macintosh)
- Activity sheets
- Preview clip online
- Correlates to the National Science Education Standards developed by the National Academies of Science and Project 2061 Benchmarks for Science Literacy from the American Association for the Advancement of Science.
- Item # 10267

This program examines the principles of electricity and magnetism and gives students insight into this fascinating topic, covering such subjects as: static electricity; attraction/repulsion; current electricity and electrical circuits; measuring electricity—current, voltage, meters; electrical calculations; magnetism—materials, fields, rules, Earth's field; field around a current-carrying wire; the link between electricity and magnetism—induction. A Cambridge Educational Production.

The Generation of Electricity

- VHS/DVD-R
- Recommended by *Science Books & Films*
- Item # 2621

The basic principle of electromagnetic generation of electric current is demonstrated in the laboratory; the principles behind the rather complicated construction of AC and DC generators is elucidated by means of a single coil; the use of slip rings and commutators is demonstrated; and a demonstration shows the relationship between the amounts of mechanical energy input in a generator and the electrical energy output. Sequences at a 2,000-megawatt coal-fired generator demonstrate that the same basic principles are operative, but the processes in a large industrial electricity generator are far more complex. Part of the series *Physics in Action*. (19 minutes)

Understanding Electricity

- VHS/DVD-R
- Preview clip online
- Item # 11937

From the lighting of homes to the beating of a heart, electricity is an integral and fundamental force in human life. In this program, a variety of experts discuss the study and wide-ranging uses of this pervasive phenomenon, from the physics of motors and neon lights to the output of the Hoover Dam. Engaging computer graphics are used to explain voltage, amps, and watts. Dr. Martin Uman of the University of Florida Lightning Research Lab conducts modern versions of the experiment Ben Franklin made famous. Dr. Hugh Calkins, Director of Electrophysiology at Johns Hopkins Hospital, discusses innovations in defibrillators that can now be installed in the patient. A Discovery Channel Production. © 1997. (53 minutes)



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