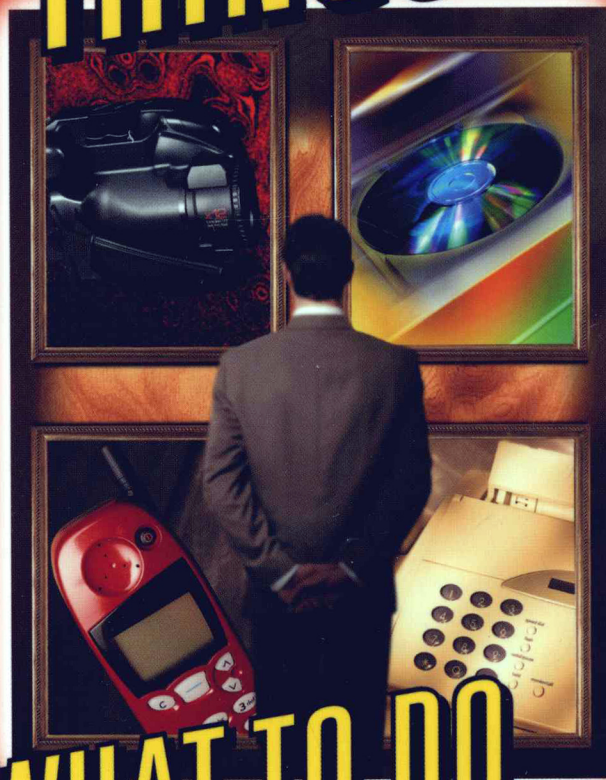


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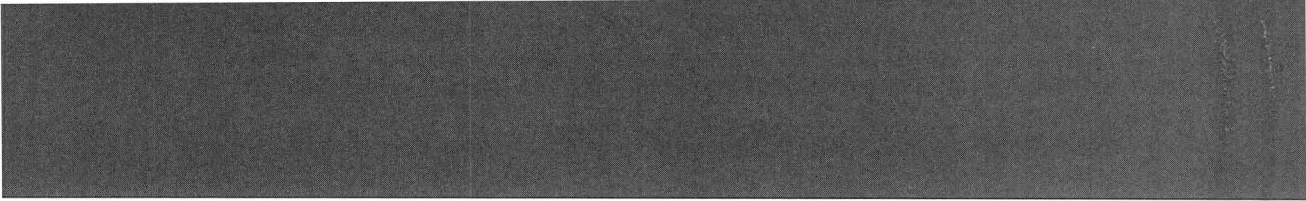
HOW ELECTRONIC THINGS WORK...



AND WHAT TO DO WHEN THEY DON'T

BOB GOODMAN





HOW ELECTRONIC THINGS WORK . . . AND WHAT TO DO WHEN THEY DON'T

ROBERT L. GOODMAN

Second Edition

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DETAILED CONTENTS

Chapter 1 Introduction to very basic electronics “101”

How resistors work • Reading resistor color codes • Resistor problems • Electronic circuit-protection devices (fuses) • How capacitors work • Tips for locating faulty capacitors • Transformer and coil operations • Transformer troubles and checks • Transistors, ICs, and diodes • How transistors and solid-state devices work • Solid-state scope sweep checker • Electronic power supplies • Electronic circuit soldering techniques • Surface-mounted devices and their soldering techniques • Electronic test meters (VOMs) • Tools for electronic circuit repairs • Some electronic service repair tips • Intermittent temperature problems • Noisy ICs or transistors • Testing equipment that intermittently blows fuses • Power supply trouble repair tips • Digital circuit power supplies

Chapter 2 Radio/audio/stereo/speakers/music systems and cassette player operations

Broadcast radio transmitter operation • FM/AM radio receiver operation • Radio circuit operation • IF amplifiers • Ratio detector operation • Composite amplifier function • Biphase detector operation • Dolby recording technique • Audio recording • How a Dolby recording is produced • Tips for making your audio sound better • Stereo speaker placement • FM radio antennas • Receiver trouble checks and tips • Intermittent receiver problems • Some receiver service don'ts • Loudspeaker concepts and precautions • How tuned-port speaker systems work • Bose Acoustic Wave speaker system • Bose series III music system • Bose Lifestyle 901 system • Bose home theater system • Cassette player operation and maintenance • Cassette tape recorder circuit operation • Tape player electronics • Cassette belt and rubber pulley drive systems • Fast forward not working • Tape will not rewind properly • Demagnetize the tape heads • Tape head cleaning and maintenance • Operation of the Trackmate cleaning cassette • Audio cassette problems, solutions, and corrections • No tape movement or sound • Sluggish tape rewind • No fast forward action • Auto shut-off not working • Checking the belt drives • Notes on cassette switch problems • Unit will not load cassette cartridge • Cassette recorder blows fuses • Deck shuts down after a few seconds • A smoking cassette unit • Noise problems • Rewind and fast-forward problems • Erratic tape speed • Poor recordings • Cassette tape recorder problems

Chapter 3 Audio/video and CD player operation

How CD and laserdisc players work • Skip, search, and scan operation • How the laserdisc is made • Signal (pit) detection scheme • Optical pickup and detection via the pit signal • The laserdisc pits • Types of CDs • How the pickup carriage functions • How the mechanical subchassis works • Mechanical tray operations • Pickup carriage operation • Tray operation • Notes on spindle operation • Pickup

lens cleaning of the laserdisc player • DVD discs • DVD technology • Laser light and laser diode information • Typical CD player • Power supply • Optical deck • Electronics PC board • Disc motor • Spindle platform table • Sled mechanism • Pickup motor • Disc clasper • Optical pickup unit • CD player problems and solutions • Dead CD player • Command operation failure • Drawer will not open or close • Unpredictable drawer operation • Drawer will not close properly • Various intermittent operation modes • Problems develop after unit heats up • CD player audio problems • A review of common CD player problems • Checking and cleaning the laser player • CD player will not operate (start-up) • The CD sequence start-up routine • Notes on CD readout failures • CD skipping problems • CD noise problems • Optical-pickup sled comments

Chapter 4 How color TVs, digital HDTV receivers, and PC monitors work

The color TV signal • Color TV signal standards • Color TV receiver operation • The tuner section • IF and video stages • Video detector • Video amplifiers • Luma delay line • Chroma processing circuits • Chroma and luminance stages • Color-killer circuit operation • Sandcastle circuit operation • Functions of the sync circuits • Vertical sweep deflection operation • Horizontal sweep deflection operation • Sound converter stage operation • Sound IF amplifier operation • Audio detector • Audio amplifier stage • TV power-supply operation • Sweep circuits and picture tube operations • Loss of the vertical raster • Troubleshooting horizontal sync troubles • Deflection yoke problems • Key voltage readings • Inoperative computer monitor problem • Testing sweep high-voltage transformers • More monitor problems • Checking out the high-voltage diode multipliers • High voltage problems • Horizontal oscillator, driver, and output stage problems • TV start-up problem • Measuring the TV set high voltage • Blurred, out-of-focus picture symptom • Switching transformer checks • Vertical sweep section operation • How the vertical drive signal is developed • Vertical picture-tube scanning • How the color picture (CRT) works • CRT electron gun operation • In-line CRT gun assembly • Large-screen projection TV operation • Light path of a projection TV set • Liquid-cooled projection tubes • Optical CRT coupling • Self-convergence design • Picture brightness and the projection screen • A list of TV receiver problems and solutions • Digital/HDTV operation and review • HDTV picture quality • Set-Top converter box • Digital video formats • Digital TV signal • Digital TV compatibility • Introduction to DTV delivery systems • The status of NTSC TV broadcasts • Standard-definition and high-definition basics • Digital television questions and answers

Chapter 5 Flat panel monitor/large screen projection set and HDTV digital TV system operation

Introduction to flat screen HDTV and monitor displays • Current plasma panel technology • Plasma panel programming • Plasma monitor adjustments • HDTV digital video processing • Tips for plasma panel installation • Plasma HDTV maintenance tips • Flat panel LCDs displays • Digital chip TV projection system • Basic TV projection system • The optical light path • Projection TV lens system • Liquid-cooled projection CRTs • Special projection screen details • Projection set digital convergence • Simplified digital convergence • Digital television (HDTV) system overview • HDTV picture improvement • Analog/digital set-top conversion

box • HDTV video formats • Over-the-air television signals • The compatibility question • Receiving the digital signal • Various HDTV formats • Future NTSC TV reception • HDTV and NTSC transmission basics • Simplified HDTV transmitter operation • The HDTV basic audio system • Digital audio signal processing • Digital audio processing • The sampling process • Quantized binary sampling • Audio signal coding • Using audio compression • Recovering digital audio • Some HDTV questions and answers • Recap of the digital DTV and HDTV systems

Chapter 6 Direct broadcast satellite (DBS) system operation

Introduction to satellite TV • Keeping the satellite on track • Powering the satellites • DBS satellite overview • How the satellite system works • Operation of the RCA DBS system • Ground station uplink • MPEG2 video compression • Data encryption • Digital data packets • The DirecTV satellites • Dish operation • Low-noise block (LNB) • DBS receiver circuit operation • The receiver modem • Diagnostic test menus • Customer-controlled diagnostics • Controlled diagnostics for troubleshooting • Service test • Using the front-panel control buttons • Pointing the dish • A world view of the DSS system • Front-panel receiver controls • Connecting the satellite receiver for operation • Readjusting and fine tuning the dish position • Video display dish alignment • Aligning the dish with the video display • Aligning the dish with an audio tone • Some possible DBS system problems and solutions • DBS Glossary

Chapter 7 How video cameras and camcorders work

Camcorder features and selections • Digital video images • Sharp model VL-DC1U digital camcorder • Video camera/camcorder basics • What is a camcorder? • Determining which camcorder section is faulty • Performance check out • Video camera functional blocks • Lens/iris/motors • Sync generator circuitry • Camera pick-up devices • Developing the video signal • How the color signal is developed • Repairing and cleaning your camcorder • Taking your camcorder apart for cleaning and repairs • Cleaning the camcorder heads • Tape will not move and no viewfinder picture • Camera auto-focus operation • Slide switches and control buttons • Cassette not loading properly • Intermittent or erratic operation • Camcorder motors • Sony Handycam servicing • Camcorder troubles and solutions • Camcorder care tips

Chapter 8 Wired telephones, cordless phones, answering machines, and cellular phone systems

Telephone system overview • Tip and ring connections • Telephone ringer (bell) • The hook switch • Telephone handset and touch-tone pad • Conventional telephone block diagram • Conventional telephone troubles and solutions • Static and phone noise checks • Low sound or distortion • DTMF touchpad problems • Electronic telephone operation • Electronic telephone troubles and repair tips • Noisy phone operation • No phone operation (dead) • Touch-tone pad problems • How a phone answering machine works • Conventional tape machine operation • Play/record operation • Cassette tape operation overview • Cleaning the tape mechanical system • Digitized tapeless answering machines • Various answering machine troubles and solutions • Cordless telephone overview • Some cordless phone considerations • Cordless phone problems and answers • Some new and different phone technologies • Security codes now

being used • Cordless phone sound quality • Deluxe cordless phone features • Cordless phone buying tips • Basic cordless phone operation • Cordless phone base unit circuitry • Portable handset unit • Cordless phone troubles and correction hints • Removing the phone case • Cordless phone trouble checklist • Handset and base unit will not communicate (two beeps) • Phone will not operate (dead) • Noise or static problems • Phone will not ring • Phone will not work (dead) • No dial tone • Phone interference review • Cordless phone antenna replacement • Phone surge protection • Mobile radio telephone communications • Two-way radio trunking system • 800-MHz trunking system overview • Trunking telephone interconnect • The cellular telephone radio system • How the cell phones operate • Transmit/receive section • CPU and memory logic • Some cell phone tips for poor, noisy, or intermittent reception • Battery talk • Drop-out and dead reception areas • Personal communications service (PCS) • Browsing the Internet • PocketNet portables • EarthLink wireless service system • Cell phones that “glow” in the dark • Dual cell phones

Chapter 9 How remote-control systems work

How remote-control systems operate • The ultrasonic remote transmitter • The infrared (IR) remote-control transmitter • What to do when the remote control will not work • Universal remote-control device • How to program the universal remote • Remote-control care and maintenance • Remote-control extenders • Transmitter and receiver extender installation • What to do if you have trouble with the extender • Intelligent remote-control system • Operations of Philips Pronto remote • Sony's RM-AV2100 universal learning remote • Programming the learning remote • Tips on MACRO programming • Designing user-friendly macros • Programming the Sony universal learning remote • Viewing cable TV programs • Viewing DVD programs • Viewing VCR tapes • Scrolling commands for the Sony RM-AV2100 learning remote unit • Building your own secret commands • Radio Shack VCR programmer

Chapter 10 Printers, copiers, and fax machine operations

Daisywheel printer operations and tips • Datadisks • Keyboards • Printwheel • Platen cleaning • Monitor screen • Check list for PWP machines • How the ink-jet (bubble) printer works • Print cartridge and nozzles operation • Ink-jet head problems • Ink-jet printer problems • Paper-handling problems and checks • Print-head carriage assembly problems • Multi-pass troubleshooting tips • Printout is wrong • Print job vanishes • Bubble-jet print jobs disappear under windows • Characters on screen do not match printed characters • Printout does not match paper size • The machine will not print anything • Cannot print from the file menu in a windows application • Printout is too light • Disconnecting the printer port • Uninstalling the multipass desktop manager • Uninstalling program for Windows 95 • Diagnosing software and hardware problems • Multipass diagnostics for Windows 95 • Plain-paper-fax-machine operation • Fax modem operation • Some fax modem problems • Fax machine operational panel • Some fax problems and solutions • Unable to send documents • Images sent are dirty or spotted • Cannot receive documents automatically • Cannot receive documents manually • Nothing appears on the printed page • You cannot make copies • Fax machine will not work (dead) • Fax machine paper is jammed • Paper jammed in printer area • Dot-matrix printer operation • Dot-matrix printer block diagram • Print-head operation • Overall system overview • Printers/print head troubles and tips •

How laser printers work • Laser printer block diagram operation explanation • Photosensitive drum operation and care • Looking inside the laser printer • The laser printer control circuits • Controlling the printer with the microprocessor • How images are transferred onto paper • Notes on cartridge usage • Color printer overview • Color laser printer operation • Laser printer problems and tips • Printer will not turn on (dead) • Paper is jammed or has tears • Prints have splashes and specks • Scanner operation • Three types of scanners • The flatbed scanner • Top-of-the-line scanners • Connecting the scanner to the computer port • Scanner review

Chapter 11 Digital video disc (DVD) system operation

The DVD player • Sound channels • Parental lock • DVD player operation • Signal processing • Servo and optical pick-up electronics • RF signal processor • DVD digital signal processor • MPEG technology • Encoding and decoding • Laser injection diodes • Caution when working around lasers • Construction and operation of the DVD disc • DVD disc operation review • DVD troubleshooting trouble symptoms and corrections • Personal video recorder (PVR)

Chapter 12 General electronics service and maintenance information

Tips on locating, repairing, and adjusting common problems that “crop up” in consumer electronics products in the home and office

PREFACE

I think you will find this book unique in its simple explanations and its many easy-to-understand illustrated drawings and photos of how electronic equipment works in the home or office.

The brain storm for this type of book was started many years ago when my brother wanted to know how a picture was formed on a color TV. The planning, development, and portions of the drawings and writing for the first edition were in progress for eight years. The actual writing and production of the many photos and drawings took over two years.

The mission of the second edition remains to take the mystery out of how electronic consumer products work, for persons with little or no electronic background. Not only does this book give you simplified electronic equipment operations, but hints and tips about what to check when the device does not work properly or does not work at all. There's also information about how and what to clean, plus preventive maintenance that can be done to extend the life of these very expensive products. The book includes tips on how to protect products from voltage surges and lightning spike damage.

This is a basic "how electronics works" book for the consumer who buys and uses the many wondrous electronic product devices now found in most homes and offices. You now have in your hand a book with over 50 years of my electronic troubleshooting experience and information culled from over 60 of my published electronics books. Thus, this is a book that just about everyone needs to keep on their home or office bookshelf or desk.

The simplified technical electronics information and service tips you obtain from this book can help you in dealing with electronics technicians or service companies when you need professional service for the repair of your equipment. This might save you repair costs because service personnel will not be able to "pull the wool over your eyes," so to speak, since you will be better technically informed. Thus, service repair estimates and costs may swing in your favor. Also, the knowledge gained from this book might help to determine if you should repair a faulty device or purchase a new one.

Finally, this is a valuable book for the hobbyist, electronic experimenter, or any person interested in entering the wonderful world of electronics as a career.

*Bob Goodman, CET
Hot Springs Village, AR*

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Many thanks to the following electronics companies for furnishing some of the technical circuit information, drawings, and photos: Zenith Electronics Corp., Thomson Multimedia Corp., Sencore Electronics, Inc., and Bose Acoustic Wave Music Systems.

Many thanks to the electronics instructors and electronics service technicians that I have had the pleasure of meeting during the seminars that I have given for many years in all parts of the nation.

INTRODUCTION

This new edition is designed for anyone who wants simple explanations of how electronic equipment in the home and office works. Following is a chapter-by-chapter description of the wealth of information in this book that will take the mystery out of electronic consumer products.

Chapter 1 gives you a basic introduction to electronics—"Very Basic Electronics 101." The chapter contains photos and drawings of the components found in your electronic devices with explanations of what they do, how they are constructed, and how to test them. You'll be shown how to use a volt-ohm meter (or multimeter) to check the voltage and resistance found in electronic circuits. You'll learn how to build a simple circuit tester in order to check solid state devices such as transistors, diodes, and ICs.

Chapter 2 is an overview of how FM radio signals are developed and received on a stereo radio. You'll get tips on radio repair and a look at the Dolby audio system. You find out how loudspeakers work and how the advanced Bose Acoustics radio and speaker systems operate. The chapter concludes with an explanation of how cassette recorder/player machines work, audio cassette trouble symptoms, corrective action, and care and cleaning of these units.

Chapter 3 introduces you to the operation of audio and video laser disc players and compact discs (CDs) and how to clean them and perform minor repairs. You'll get hints on keeping your CD operating smoothly and a list of common CD problems and their solutions.

Chapter 4 contains an overview of color TV signal makeup, the components within the signal, and some of the various worldwide color TV standards. The stages that make up color TV set operation are explained via a block diagram that helps walk you through the circuit operations. You'll delve into horizontal and vertical sweep circuit operations, color picture tube operation, and how a color picture is developed on the screen. A preview of large-screen projection receiver operations follows. The chapter concludes with a list of typical color TV and PC computer monitor trouble symptoms and their solutions.

In Chapter 5 you'll learn about flat screen plasma TV/monitor devices, large screen projection sets, and the new digital HDTV system operations. You'll see how the plasma flat screen develops a TV picture and learn how to make adjustments. The chapter concludes with a series of HDTV questions and answers.

Chapter 6 has information on the new and exciting Digital TV DirecTV Satellite (DSS) transmission system and its operation, including an overview of the uplink earth station, the satellite that receives and retransmits the signals, and the dish/receiver that picks up the downlink signals. Detailed drawings will help you connect the DSS receiver to your TV receiver and VCR recorder.

In Chapter 7 you'll get a look at past and present video cameras and camcorders and review various features of this equipment, such as older models with

vidicon pickup tubes and modern CCD solid-state image pickup chips and digital video cameras. You'll learn how camcorders work and how to perform minor repairs and clean recording heads.

Chapter 8 explains the telephone landline system and home phone operation and describes how the electronic phone works. You'll find out how to determine whether your phone or the phone company line to your residence is at fault. You'll learn how answering machines and cordless telephones work. All types of phone problems and their solutions are covered.

Chapter 9 covers the various remote control units used for operating TV receivers, CD players, DVD players, set-top boxes, cable control boxes, VCRs, and DSS satellite dish receivers.

Chapter 10 reviews basic printer, copier, and fax machine operation. You'll find out how the "Daisywheel," ink-jet, dot-matrix, laser, and color laser printers operate and how to troubleshoot them. The chapter concludes with information on the operation of copiers, scanners, and fax machines.

Chapter 11 gives you an inside look at DVD video player operation, DVD disc construction, and how the laser beam reads disc information.

Chapter 12 contains general electronic service and maintenance information that you will find useful for keeping your electronic devices in good working order.

CONTENTS

AT A GLANCE

Detailed Contents	<i>ix</i>
Preface	<i>xv</i>
Acknowledgments	<i>xvii</i>
Introduction	<i>xix</i>
1 Introduction to very basic electronics “101”	1
2 Radio/audio/stereo/speakers/music systems and cassette player operations	49
3 Audio/video and CD player operation	91
4 How color TVs, digital HDTV receivers, and PC monitors work	115
5 Flat panel monitor/large screen projection set and HDTV digital TV system operation	161
6 Direct broadcast satellite (DBS) system operation	195
7 How video cameras and camcorders work	227
8 Wired telephones, cordless phones, answering machines, and cellular phone systems	259
9 How remote-control systems work	311
10 Printers, copiers, and fax machine operations	329
11 Digital video disc (DVD) system operation	363
12 General electronics and and maintenance information	381
Glossary	391
Index	415

INTRODUCTION TO VERY BASIC ELECTRONICS “101”

CONTENTS AT A GLANCE

How Resistors Work

- Resistor types
- Reading resistor color codes
- Resistor problems

Electronic Circuit-Protection Devices (Fuses)

- Testing the fuse

How Capacitors Work

- Type of capacitors
- Capacitor circuit diagram symbols
- Tips for locating faulty capacitors

Transformer and Coil Operations

- Transformer troubles and checks

Transistors, Integrated Circuits (ICs), and Diodes

- Diodes
- Metal-oxide varistor (MOV) operation

How Transistors and ICs (Solid-State Devices) Work

- The integrated circuit (IC)

Solid-State Scope Sweep Checker

Electronic Power Supplies

- Half-wave power supply
- Full-wave power supply
- A bridge-type power supply
- The voltage-doubler power supply

Electronic Circuit Soldering Techniques

- Surface-mounted devices and their soldering techniques

Electronic Test Meters (VOMs)

Tools for Electronic Circuit Repairs

Some Service Repair Tips

- Intermittent temperature problems
- Noisy ICs or transistors
- Testing Equipment that Intermittently Blows Fuses
- Power Supply Trouble Repair Tips
- Digital Circuit Power Suppliers

How Resistors Work

Resistors are made in various shapes, sizes, resistance values (in ohms) and wattage ratings. Resistors are the most common electronic circuits. In fact, ICs have many resistors inside them. Resistors are used as current-limiting devices and an electronic circuit will not work without them. You might think of a resistor as a control device that limits current flow to the circuit load. A circuit load provides the work; it can be a light bulb, motor, loud speaker, transistor, or IC. Resistor values are in ohms and are made of carbon or coils of resistance wire. Resistor values can be fixed or adjustable (as with a rheostat or like a variable volume control used on a radio or TV). The value in ohms of a resistor is what will determine the electron current. A low resistance will cause a large current to flow, and a high resistance will cause a small current flow.

RESISTOR TYPES

Many types, values, and sizes of resistors are used in electronic products. The photo in (Fig. 1-1) shows various wattage sizes of carbon and flameproof resistors from $\frac{1}{4}$ -watt to 2-watt ratings. These fixed resistors are made to a specific resistance value and cannot be changed. The resistance value is indicated by color-coded bands or stamped numbers on the side of the resistors body. The symbol for a fixed resistor is shown in Fig. 1-2. The larger, 10- to 300-watt, power resistors are shown in Fig. 1-3.

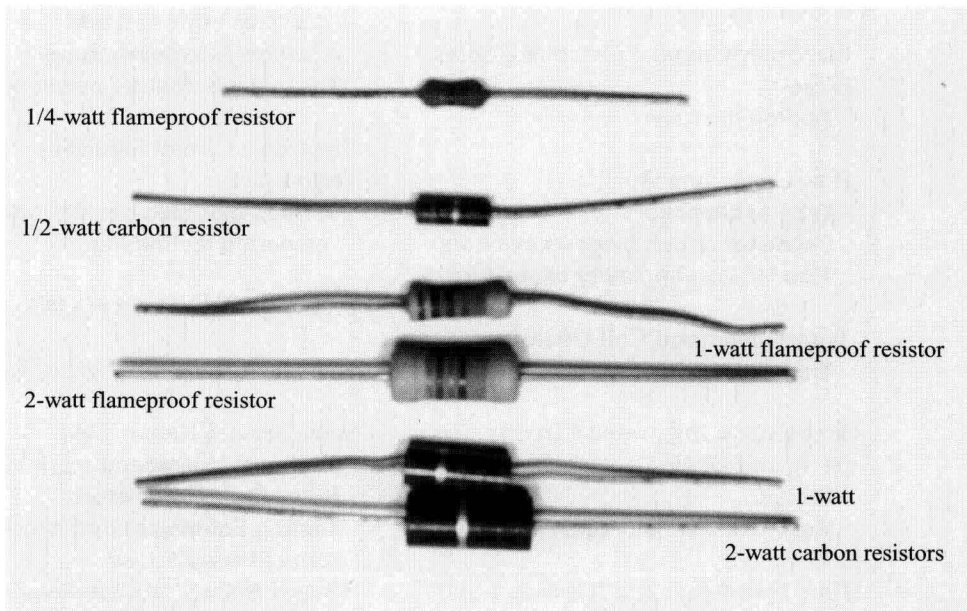
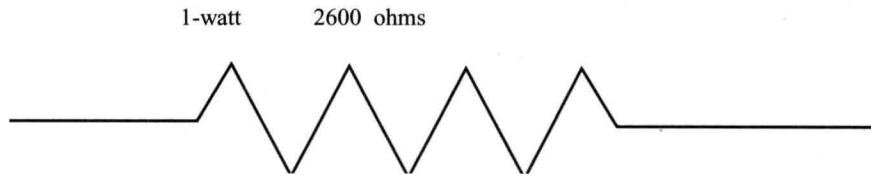
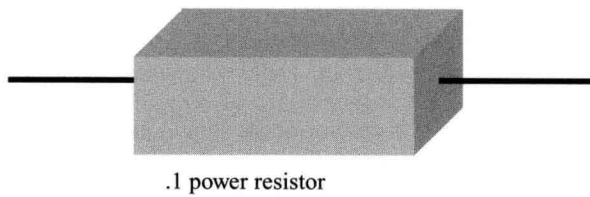
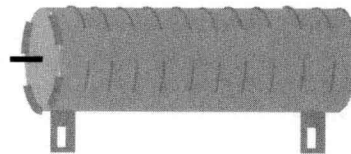


FIGURE 1-1 Various types and wattages of resistors.

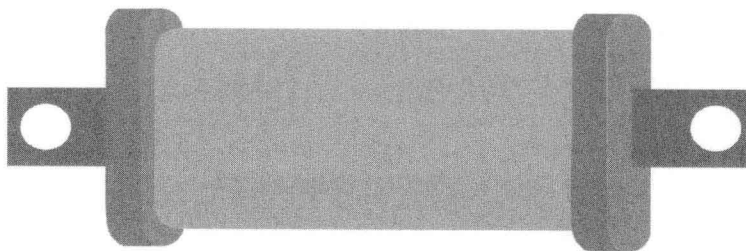
Carbon Resistor

**FIGURE 1-2** A schematic symbol of a fixed resistor.

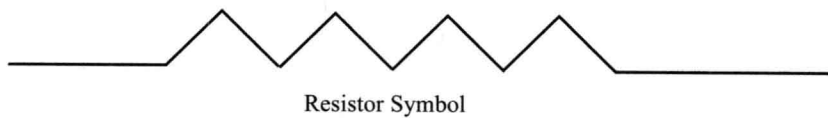
.1 power resistor



1.6-ohm 300-watt resistor



50-ohm power resistor



Resistor Symbol

FIGURE 1-3 Drawings of high-wattage resistors.

READING RESISTOR COLOR CODES

If you need to replace a resistor, you will need to be able to read the color code bands to determine its value because you might not have a schematic or the value might not be given on the circuit diagram. The standard resistor color code is:

Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Most fixed carbon resistors use the color band layout (as shown in Fig. 1-4) to indicate their value and tolerance. The first band color is for the first number of the resistor value. Band 2 indicates the second number. Band 3 is a multiplier to show how many zeros follow the first two color-band numbers. As an example, a 25,000 ohm (25 k Ω) resistor would have these band colors:

- Band #1: Red or 2
- Band #2: Green or 5
- Band #3: Orange or 3 for 3 zeros 000.

And the resistor would read as 25,000 ohms.

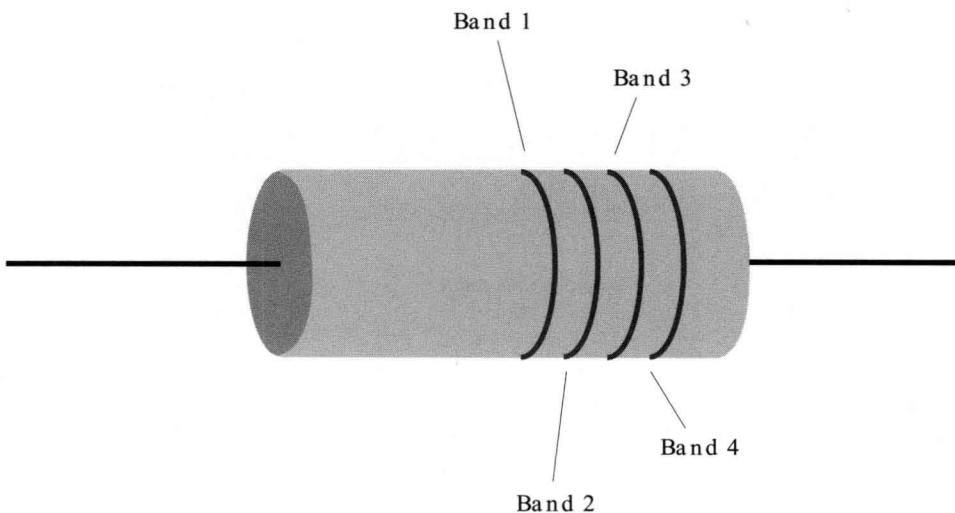


FIGURE 1-4 Resistor color-code position bands.