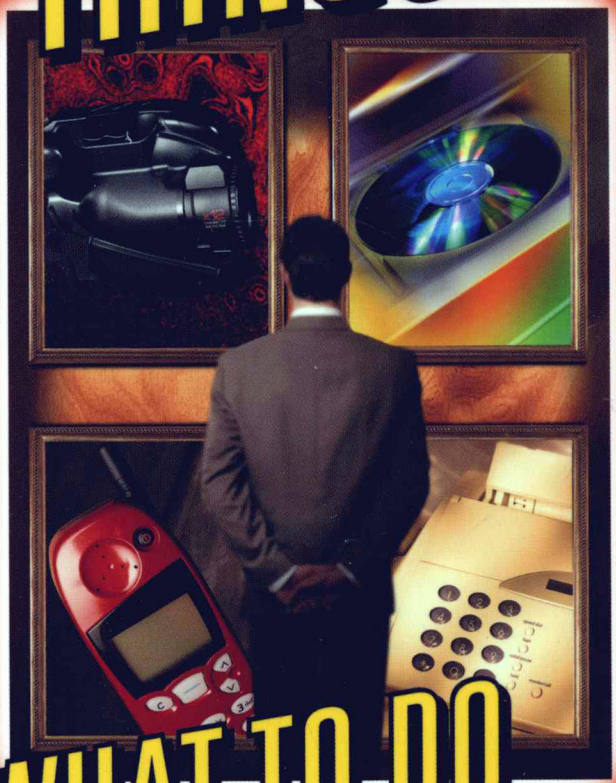
SECOND EDITION

HOW ELECTRONIC THINGS WORK...



AND WHAT TO DO WHEN THEY DON'T

BOB GOODMAN

TAB ELECTRONICS

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

ROBERT L. GOODMAN

Second Edition

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DETAILED CONTENTS

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 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

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INTRODUCTION TO VERY BASIC ELECTRONICS "101"

CONTENTS AT A GLANCE

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 ¼-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.

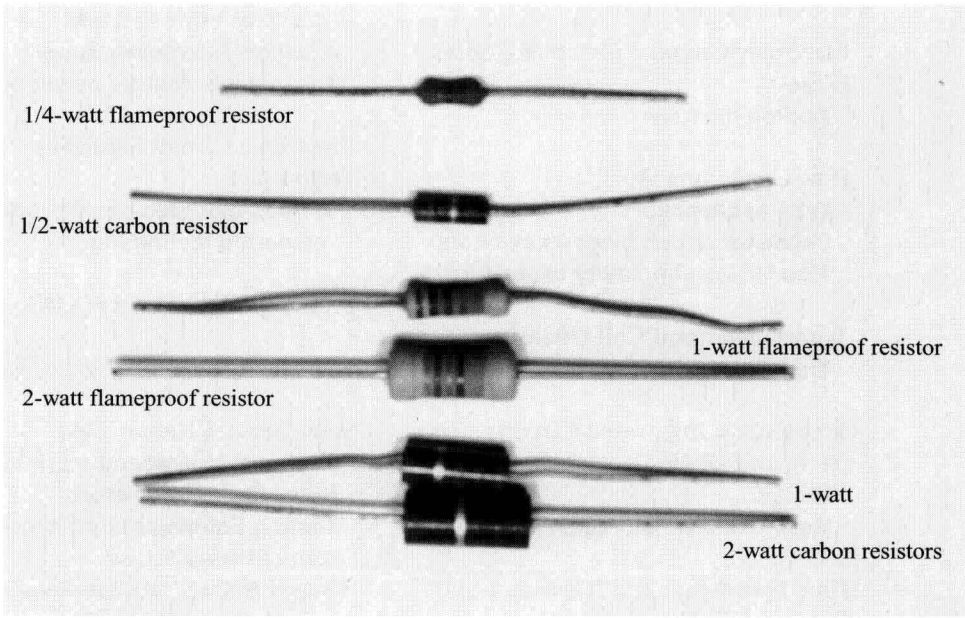
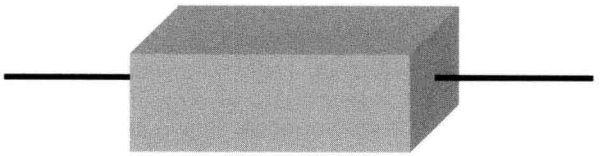


FIGURE 1-1 **Various types and wattages of resistors.**

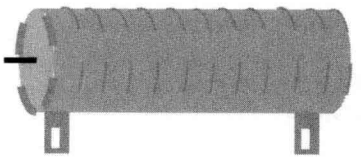
Carbon Resistor

1-watt 2600 ohms

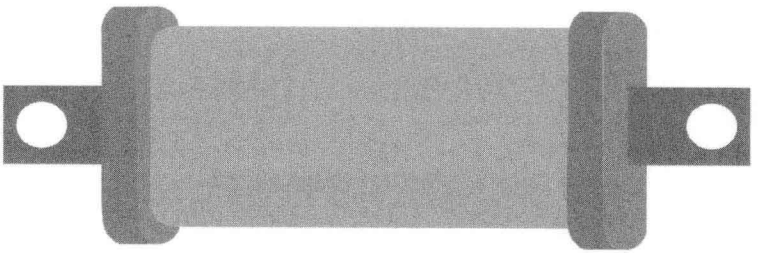
FIGURE 1-2 **A schematic symbol of a fixed resistor.**



.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 kΩ) 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.

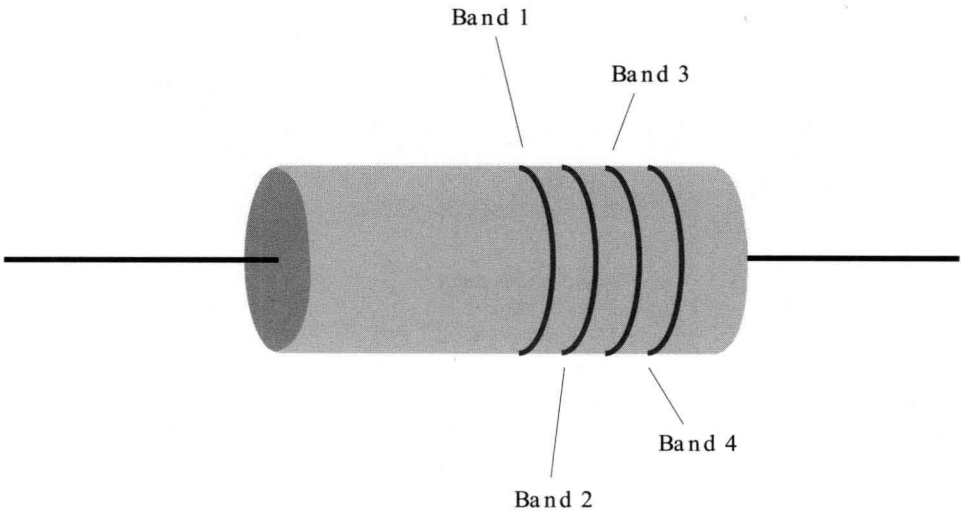


FIGURE 1-4 **Resistor color-code position bands.**