CD-ROM UPGRADES FOR YOUR PC

48784

Popular Electronics®

FEBRUARY 1994

DESIGN YOUR OWN LOUDSPEAKERS

Use your PC and our programs to design enclosures and simple crossover networks

BUILD A LOW-COST MOTORCYCLE ALARM

Get top-shelf security without going broke with our easy-to-build alarm system

BUILD A 125-MHz LOGIC PROBE

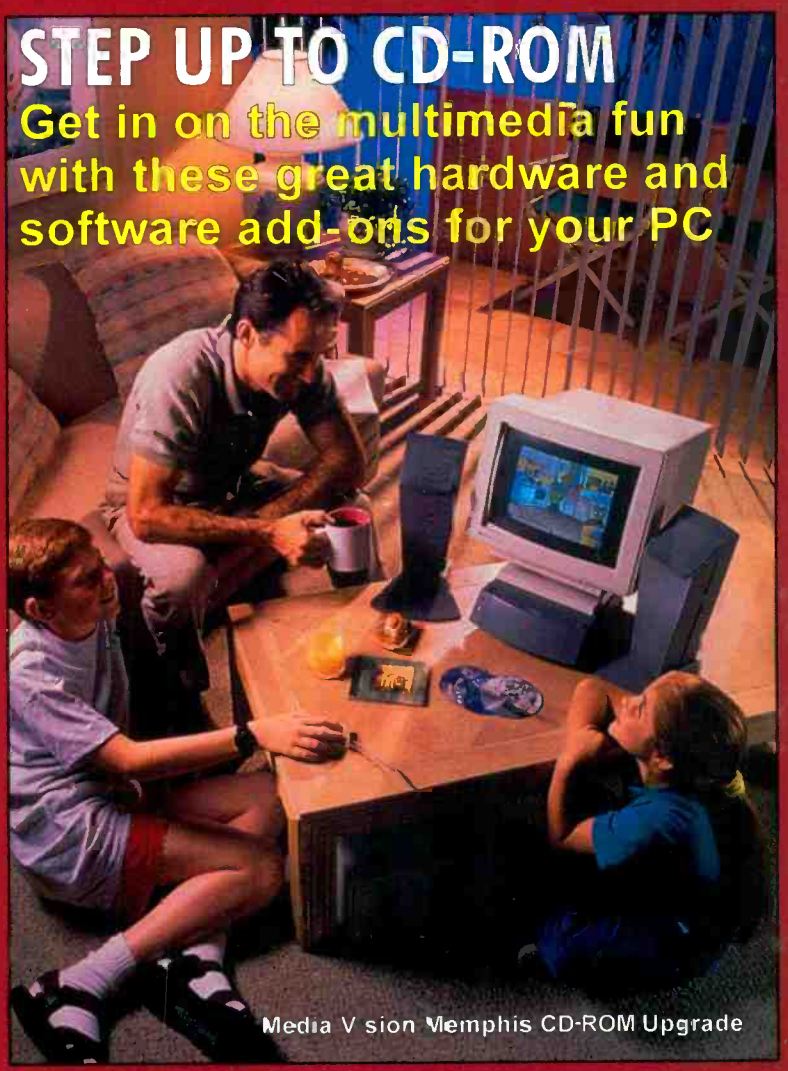
An inexpensive, wide-band circuit that's ideal for today's high-speed digital signals

AUDIO ACCESSORIES FOR HAMS AND SWL'S

Welcome additions to any radio shack

STEP UP TO CD-ROM

Get in on the multimedia fun with these great hardware and software add-ons for your PC



Media V sion Memphis CD-ROM Upgrade

A GERNSBACK PUBLICATION

#BXBDCCH****** 5-DIGIT 60506
#60506DHM997G9006# FEB94 P91

ROBERT DAHM RESP 099

997 GRAND AVE

AURORA IL 60506-2513

www.americanradiohistory.com

What Do These Prestigious Companies Have In Common?

Aerovox
DC Film and RFI Suppression Capacitors, AC Oil Capacitors, EMI Filters

AMP
Electrical/Electronic Connectors, IC Sockets, PCB Switches

AVX CORPORATION
A KYOCERA GROUP COMPANY
MLC, Tantalum and Thin Film Capacitors, Resistors, Networks, Trimmers, Oscillators, Resonators, Filters and Piezo Devices

BERG ELECTRONICS
High Density and Industry Standard Connectors/Subsystems

BURNDY
an FCI Company
Electronic Connectors

CAROL
CAROL CABLE COMPANY INC
Electronic and Electrical Wire and Cable and Power Supply Cords

COLE FLEX
Tubing, Conduits, Hose, Sleevings, Splices, Insulation and Cable Harness Products

CII™ Communications Instruments, Inc.
Relays and Solenoid Relays

COOPER Belden
Multi Conductor, Paired, Coaxial, Flat, Fiber Optic, Instrumentation/Process Control, LAN, Special Application Cables, Power Supply Cords & Molded Cable Assemblies

COOPER Bussmann
Fuses, Fuseholders, Fuse Blocks, and Fuse Accessories

CORNELL DUBILIER
Capacitors-Aluminum Electrolytics, Mica, AC Oil, Film, MICA Paper and Relays

A COMPANY OF VISHAY
DALE
Dale Electronics, Inc.
Resistors, Networks, Oscillators, Displays, Inductors & Thermistors

DI DANTONA INDUSTRIES, INC.
BATTERIES: Computer, Cordless Phone, Scanner & R/C.
ANTENNAS: Cordless Phone (metal & rubber), Scanner Bumpers, Grommets and Stik-On Feet

DEARBORN WIRE AND CABLE L.P.

EATON
Eaton Corporation, Commercial & Military Controls Operation
Switches, Relays, Displays and Keyboards

A **GERNSBACK** PUBLICATION
Popular Electronics
Electronics Now Magazine

KOA SPEER ELECTRONICS, INC.
Resistors, SMT Tantalum Capacitors Inductors, Resistor Networks, SMT Thermistors

MALLORY
North American Capacitor Company
Tantalums, Aluminums, Sonalerts®
Ceramics, Films and AC's

M-tron
Quartz Crystal Clock Oscillators and Special Hybrid Products

murata ERIE
MURATA ERIE NORTH AMERICA
Monolithics, Discs, Variable Capacitors, Oscillators, Potentiometers, RFI/EMI Filters, Microwave, Surface Mount Capacitors

NTE
NTE ELECTRONICS, INC.
A WORLDWIDE REPUTATION FOR QUALITY, SERVICE AND VALUE
Semiconductors, Resistors, Capacitors, Relays

Philips ECG
A North American Philips Company
Semiconductors, Test Equipment, Relays, A/V Parts and Chemicals

Quam
Loudspeakers and Commercial Sound Products

ROHM
Rohm Electronics Division
Resistors, Ceramic Capacitors, Transistors/Diodes, Opto Components and IC's

SELECTA
Electrical Electronic Products
Switches, Relays, Terminals, Indicator/Pilot Lights, LED Indicators, Test Clips, Test Leads, Cable Ties and Heat Shrinkable Tubing

A COMPANY OF VISHAY
SPRAGUE
Tantalum Capacitors, Wet & Foil Capacitors, Resistor Networks, Resistor Capacitors Networks, Filters

Switchcraft
A **Raytheon** Company
Switches, Connectors, Jacks, Plugs, Jackfields & Audio Accessories

TECH SPRAY
Non-CFC Cleaners/Degreasers, UV Cured Compounds, Swabs, Wipes, Brushes, Wick, Cleanroom Supplies, and Static Control Products.

They sell through distributors. They belong to the E.I.A. They belong on your vendor list.

Leadership in electronics is not just a matter of designing products better and manufacturing them better, but also of marketing them better. And the sponsors of this message understand that better service to customers *requires* effectively involving distributors as part of their marketing teams.

Distributor involvement means lower prices, quicker deliveries, better service over-all. The Buyer wins. . .the Seller wins.

Distributors help achieve marketing leadership. So does the manufacturer's involvement in the Components Group of the Electronic Industries Association. EIA fosters better industry relations, coherent industry standards, and the sharing of ideas, which helps one another *and* serves customers better.

In choosing your component supplier, look for the marks of leadership —

- availability through distribution
- membership in the E.I.A.

ELECTRONIC INDUSTRIES ASSOCIATION
EIA
EST. 1924

Electronic Industries Association/Components Group
2001 Pennsylvania Avenue, N.W. 11th Floor
Washington, D.C. 20006
Phone: (202) 457-4930 Fax: (202) 457-4985

Committed to the competitiveness of the American electronics producer

www.americanradiohistory.com

FEBRUARY 1994, VOLUME 11, NO. 2

Popular Electronics®

THE MAGAZINE FOR THE ELECTRONICS ACTIVIST!

CONSTRUCTION ARTICLES

BUILD A LOW-COST MOTORCYCLE ALARM ..... *Dean Kasper* 37
Give your favorite set of wheels top-shelf security at a rock-bottom price

BUILD A 125-MHz LOGIC PROBE ..... *Paul Yost* 57
An inexpensive, wide-band test device that's perfect for today's high-speed circuits

FEATURE ARTICLES

STEP UP TO CD-ROM ..... *Marc Spiwak* 31
Get in on the multimedia fun with these great add-ons for your PC

DESIGN YOUR OWN LOUDSPEAKERS ..... *William R. Hoffman* 40
Use your PC and our programs to design enclosures and simple crossovers

CAN YOU PASS THIS FCC EXAM 63
Check your technical knowledge using the actual questions used by the FCC

AUDIO ACCESSORIES FOR THE RADIO LISTENING ..... *Karl T. Thurber, Jr.* 68
Welcome additions to any modern ham or shortwave listening post

PRODUCT REVIEWS

GIZMO 45
Including: Nikon Slide Scanner, Bose Acoustic Wave Receiver/Alarm Clock, Onkyo A/V Receiver, and lots more

HANDS-ON REPORT 18
Elenco Soldering-Practice Kit

PRODUCT TEST REPORT ..... *Len Feldman* 20
Kodak Photo-CD Player

COLUMNS

THINK TANK ..... *John Yacono* 24
Displays and discrepancies

ANTIQUE RADIO ..... *Marc Ellis* 73
A trip to Mecca

COMPUTER BITS ..... *Jeff Holtzman* 75
Crosstalk for Windows

CIRCUIT CIRCUS ..... *Charles D. Rakes* 80
Plenty of oscillators

DX LISTENING ..... *Don Jensen* 82
Viennese DX

HAM RADIO ..... *Joseph J. Carr* 84
Radio and the solar eclipse

SCANNER SCENE ..... *Marc Saxon* 86
Underground chatter

DEPARTMENTS

EDITORIAL ..... *Carl Laron* 2
LETTERS 4
ELECTRONIC LIBRARY 6
NEW PRODUCTS 10
ELECTRONICS MARKET PLACE 77
ADVERTISER'S INDEX 94
POPULAR ELECTRONICS MARKET CENTER 95
FREE INFORMATION CARD 131

Popular Electronics (ISSN 1042-170X) Published monthly by Gernsback Publications, Inc., 500-B Bi-County Boulevard, Farmingdale, NY 11735. Second-Class postage paid at Farmingdale, NY and at additional mailing offices. One-year, twelve issues, subscription rate U.S. and possessions $21.95, Canada $28.84 (includes G.S.T. Canadian Goods and Services Tax Registration No. R125166280), all other countries $29.45. Subscription orders payable in U.S. funds only, International Postal Money Order, or check drawn on a U.S. bank. U.S. single copy price $3.50. © 1993 by Gernsback Publications, Inc. All rights reserved. **Hands-on Electronics** and **Gizmo** trademarks are registered in U.S. and Canada by Gernsback Publications, Inc. **Popular Electronics** trademark is registered in U.S. and Canada by Electronics Technology Today, Inc. and is licensed to Gernsback Publications, Inc. Printed in U.S.A.

Postmaster: Please send address changes to **Popular Electronics**, Subscription Dept., P.O. Box 338, Mount Morris, IL 61054-9832.

A stamped self-addressed envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.

As a service to readers, **Popular Electronics** publishes available plans or information relating to newsworthy products, techniques, and scientific and technological developments. Because of possible variances in the quality and condition of materials and workmanship used by readers, **Popular Electronics** disclaims any responsibility for the safe and proper functioning of reader-built projects based upon or from plans or information published in this magazine.

www.americanradiohistory.com

Popular Electronics®

Larry Steckler
EHF, CET
Editor-In-Chief and Publisher

EDITORIAL DEPARTMENT
Carl Laron
Editor
Robert A. Young
Associate Editor
John J. Yacono
Associate Editor
Byron G. Wels, K2AVB
Associate Editor
Teri Scaduto
Assistant Editor
Evelyn Rose
Editorial Assistant
Marc Spiwak
Editorial Associate
Joseph J. Carr, K4IPV
Marc Ellis
Len Feldman
Jeffrey K. Holtzman
Don Jensen
Charles D. Rakes
Marc Saxon
Contributing Editors

PRODUCTION DEPARTMENT
Ruby M. Yee
Production Director
Karen S. Brown
Production Manager
Kathy Campbell
Production Assistant
Lisa Rachowitz
Editorial Production

ART DEPARTMENT
Andre Duzant
Art Director
Injae Lee
Illustrator
Russell C. Truelson
Illustrator

Jacqueline P. Cheeseboro
Circulation Director

Michele Torrillo
PE Bookstore

BUSINESS AND EDITORIAL OFFICES
Gernsback Publications, Inc.
500-B Bi-County Blvd.
Farmingdale, NY 11735
1-516-293-3000
Fax: 1-516-293-3115
President: Larry Steckler

Subscription
Customer Service/Order Entry
1-800-827-0383
7:30 AM – 8:30 PM EST

Advertising Sales offices listed on page 94

Composition by
Mates Graphics

ABC AUDITED

Since some of the equipment and circuitry described in POPULAR ELECTRONICS may relate to or be covered by U.S. patents, POPULAR ELECTRONICS disclaims any liability for the infringement of such patents by the making, using, or selling of any such equipment or circuitry, and suggests that anyone interested in such projects consult a patent attorney.

EDITORIAL

THE AGE OF INFORMATION

In the 1800's, the face of this nation was changed forever by the start of the Industrial Revolution. Today, another revolution, the "Information Revolution," has begun and like every revolution, there will be winners and losers.

Information is power. Those with the most information, and the ability to access and use it effectively, will inevitably rise to the top of society. Unfortunately, it is also inevitable that the Information Revolution will have many casualties. The coming years may be difficult ones for those used to the "old ways" of doing things. To avoid becoming "obsolete," individuals will need not only to accept, but embrace the emerging information technologies.

One of the key elements of the information revolution is the so-called "Digital Highway." It will be here soon, and, in fact, parts of it are already in place. In the meantime, many computer users are getting a jump on the rest of society. Dial-up databases such as CompuServe, smaller corporate and university databases that are interconnected via the Internet (which will likely make up part of the digital highway), and the like already give computer users nearly instant access to vast amounts of information.

Now there's CD-ROM. That technology is revolutionizing the way students and professionals can assemble and access information. As an example, in New York, attorneys can obtain CD-ROM's containing the complete N.Y. State statutes, case law, etc. This means the research that once could have taken days to complete can now be done in hours, and perhaps even in minutes. That's what we mean by power.

For those who want to learn more, this month **Popular Electronics** presents "Step Up to CD-ROM." It's a feature story that examines what to look for when adding a CD-ROM to your PC. It also samples some of the hardware and software products that are available today. The story begins on page 31.

Carl Laron
Editor

www.americanradiohistory.com

Introducing a New Era In Technical Training.

World College, an affiliate of the Cleveland Institute of Electronics, was created to provide a four year, independent study, technical degree program to individuals seeking a higher education. The Bachelor of Electronics Engineering Technology Degree, offered by World College, prepares students for high-paying careers in electronics, telecommunications, electrical power, computer and control systems. World College's curriculum is taught in an effective, time-proven, independent study environment. With World College's flexible study schedule, students have the opportunity to work or spend time with their family without having to worry about rigid scheduling residential colleges offer.

A Quality Education with a Flexible Schedule.

In a world heavily dependent on electronic equipment, people who understand electronics will have no problem putting their knowledge to work... in high-paying careers. The staff and faculty of World College have invested over ten years developing, what we believe to be, the finest independent-study, baccalaureate degree program available. World College's mission is to instill in each student the knowledge, *education, and training* that employers are seeking for the many technical positions available today. It's a program created to provide the best education and training possible with a flexible schedule to match your busy lifestyle.

World College is currently seeking approval to confer the Bachelor Degree from the Virginia Council of Higher Education.

Earn A Bachelor of Electronic Engineering Technology Degree from

WORLD COLLEGE

Bringing Technology Home!

Lake Shores Plaza
5193 Shore Drive, Suite 113
Virginia Beach, VA 23455-2500

Send For Your Free Course Catalog.

Take the first step towards a new start in life. Send for World College's Free Independent Course Catalog today and discover how easy and affordable it is to get started on your Bachelor Degree.

World College is affiliated with

ICIE

Complete the Entire Degree Program Under One Roof. Yours!

Only World College offers an independent study, four year technical degree which can be completed through one school. All lab equipment*, parts, and software are included in your tuition and the program's 300-plus laboratory experiments can be completed in your own home.

You Pay Only For Time Actually Used.

World College not only provides a means to earn a Bachelor Degree while fulfilling current obligations, but there are no restrictions on how fast you can complete the program. At World College, you pay tuition only for the actual upper-level semesters it takes to graduate. The quicker you complete the program, the less you pay in tuition. It's an effective way to keep you motivated in order to complete the course and move on to a better paying position as quickly as possible.

Currently not available in Ohio.
* Student must have access to a personal computer system.

☐ **YES!** Please send me World College's Free Course Catalog detailing the full curriculum.

Name: _____

Address: _____

Apt: _____

City: _____

State: _____ Zip: _____

Phone: (_____) _____

Age: _____

Return to: WAH05
World College
Lake Shores Plaza
5193 Shore Drive, Suite 113
Virginia Beach, VA 23455-2500

www.americanradiohistory.com

LETTERS

THANKS, AND A TIP

I have comments about two articles that appeared in the November issue of **Popular Electronics**.

First, thanks for "Where to Find Electronics Parts," which listed many sources for parts and services. I seldom see advertising by most of the companies listed, and have not been aware of most of them. The list will be valuable to me. I have business for one of them already.

My second comment is about the telephone-line tester that appeared in *Circuit Circus*. It certainly can be of great financial benefit to any capable person to do some testing before calling in the phone company. Besides testing for line voltage and seeing it drop under off-hook conditions, it is valuable to have a known working telephone set with a standard plug that can be connected to the line at the protector box where the cable meets up with the house. Here, at least, the telephone company provides a test jack in that box for such test purposes. You can listen for noise and verify that you get a dial tone when going off-hook.

However, the article repeats a common error (almost a universal error), in saying that there should be about 48 volts between tip and ring conductors in the idle condition. It is true that in the trade that voltage is called 48 volts, but in reality it almost never is. To the best of my knowledge, you will almost always find it to be within half a volt of 52 volts. If you build the circuit in the article and calibrate the meter for 50 volts full scale, the needle will go off scale high under normal circumstances. This might be a minor point, but a lot of people might wonder if something is wrong when they see a reading that is four volts higher than the article says they should see.

K.E.S.
Cherryvale, KS

RELOCATED SUPPLIER

*Star-Tronics was mentioned in the article "Where to Find Electronics Parts" (***Popular Electronics**, November 1993). We have just moved to Las Vegas, and the address shown in the article is no longer applicable.

Please note that we are still providing fine parts at low prices, as we have for the past 20 years. Our new mailing address is Star-Tronics, P. O. Box 98102, Las Vegas, NV 89193. Our physical address is 4640 South Valley View Blvd., Suite E, Las Vegas, NV 89103. Our new phone number is 702-795-7151.

BRUCE STELLER, OWNER
Star-Tronics
Las Vegas, NV

HAVES & NEEDS

I have a set of red, green, and blue guns for an A-1 ceiling or wall projection TV monitor. Each gun is 5½ inches in diameter. They have been tested and are in working order.

I will ship the set to anyone who might be interested, for the price of shipping and handling.

KENNETH SOMERS
5717 SE Riverside Drive
Vancouver, WA 98661

I am looking for an owner's manual as well as a service manual for a Hitachi model V-1050F oscilloscope. I will gladly pay for copying or postage costs. Thank you.

PHIL DENNING
865 Globe Ave.
Fort Worth, TX 76131

I'm looking for a used, or unwanted, low-cost home electronics training course. I'm hoping that a fellow **Popular Electronics** reader might be able to help me out. I'll gladly pay for any postage costs.

CLAYTON CAMPBELL
31b Argyle Road
St. Pauls
Bristol BS2 8UY
Avon, United Kingdom

I've seen other readers get lucky, and now I'm hoping it's my turn. I'm trying to locate an audio amplifier chip that was used in the old Cobra and President radios that used the 858 PLL. any of the following will work: UPC 156 H, SK 3484, or NTE/ECG 1194. I have checked all my sources and was told that it is discontinued and can't be found. But I'd hate to trash a good radio.

TOM WILSON
71 Woodland Ave.
Mantua, NJ 08051

I am searching for a frequency-synthesis IC, part #15-3015689-1, for a 12-year-old Sylvania TV, chassis #E51-06. The IC is no longer available from Sylvania. I will accept a used or a new IC. Thank you!

JAMES P. KOCH
3867 Kelley Circle South
Memphis, TN 38111

I have a working H.H. Scott LK-30 stereo amplifier, which is, I believe, about 30 years old. I would very much like to find an instruction book for it.

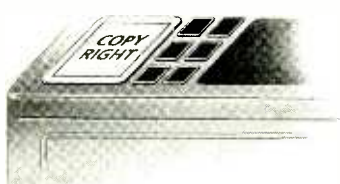
If anyone has any suggestions, I would love to hear them. Many thanks.

THOMAS BLALOCK
113 East Housatonic Street
Pittsfield, MA 01201

WRITE ON

Do you have a question, compliment, complaint, or comment about **Popular Electronics**, *or the electronics world in general? Drop us a line at:*

Letters
Popular Electronics
500-b Bi-County Blvd.
Farmingdale, NY 11735 ■



THE MOST
AN IMPORTANT PART OF YOUR PHOTOCOPIER ISN'T PART OF YOUR PHOTOCOPIER

Having a machine may not permit you to photocopy books, journals, newsletters and magazines. The Copyright Clearance Center CAN. Contact us to find out how you too can COPY RIGHT!℠

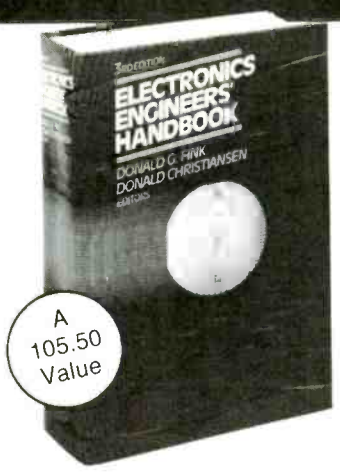
COPYRIGHT CLEARANCE CENTER
222 Rosewood Drive, Danvers, MA 01923 ☐ Tel. (508) 744-3350 ☐ Fax (508) 741-2318
© 1993 Copyright Clearance Center

www.americanradiohistory.com

Your choice for only $9.95

when you join the Electronics Engineers' Book Club®

Your source for . . .



A 105.50 Value

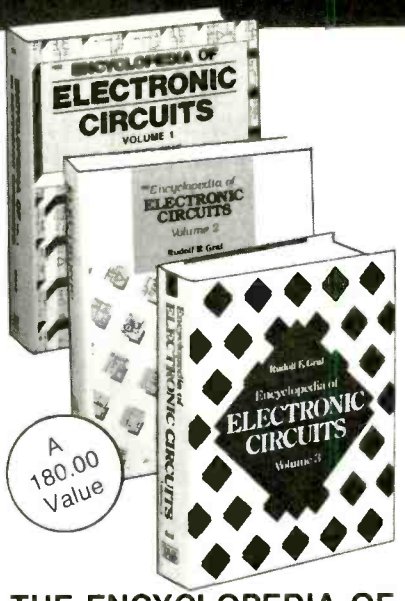
ELECTRONICS ENGINEERS' HANDBOOK, 3rd Ed.

by Donald G. Fink and Donald Christiansen

This fully revised and updated edition of the standard desktop reference shows you how to use the latest design and cost-cutting solutions at work in the industry today. You'll find a wealth of new material on electronic systems design, computer systems and digital recording, telecommunications, process control, laser technology, and CAD of electronic circuits.

2,258 pp., 1,800 illus.

Order #9255H



A 180.00 Value

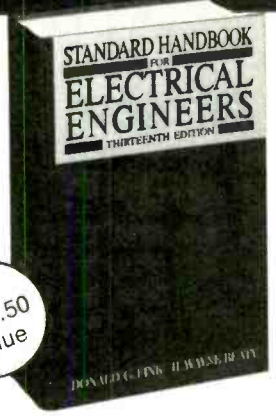
THE ENCYCLOPEDIA OF ELECTRONIC CIRCUITS —Volumes 1, 2 & 3

by R.F. Graf

Turn to this comprehensive circuit library for hundreds of project ideas . . . valuable troubleshooting and repair tips . . . and concise pinout diagrams and schematics. Each volume contains more than 700 electronic and integrated circuits and covers 100 + circuit categories.

2,344 pp., 3,490 illus.

Order #5489C



A $110.50 Value

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS, 13th Ed.

Edited by Donald G. Fink and H. Wayne Beaty

- the essential on-the-job reference for Electrical Engineers
- latest information on rapidly changing areas such as nuclear power and high-voltage transmission systems
- all the essentials including circuits, telecommunications, power distribution and electrical standards
- Written and compiled by 115 recognized experts

2,208 pp., 1,421 illus.

Order #020984H

As a member of the Electronics Engineers' Book Club . . .

. . . you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off of regular publishers' prices. If you want the Main Selection do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. And you'll be eligible for *FREE* BOOKS through the Bonus Book Program. Your only obligation is to purchase 3 more books during the next 2 years, after which you may cancel your membership at any time.

A shipping/handling charge and sales tax will be added to all orders. All books are hardcover. (Publishers' Prices Shown) © 1994 EEBC

If coupon is missing, write to:
Electronics Engineers' Book Club, Blue Ridge Summit, PA 17294-0860

ELECTRONICS ENGINEERS' BOOK CLUB®

Blue Ridge Summit, PA 17294-0860

YES! Please rush me the book(s) indicated below for just $9.95 plus shipping/handling & tax. Enroll me as a member according to the terms in this ad. If not satisfied, I may return the book(s) within ten days without obligation. A shipping/handling charge and sales tax will be added to all orders.

- ☐ Electronics Engineers' Handbook, 3rd Ed. **#9255H**
- ☐ Encyclopedia of Electronic Circuits, Volumes 1, 2 & 3 **#5489C**
- ☐ Standard Handbook for Electrical Engineers, 13th Ed. **#020984H**

Name _____

Address _____

City/State _____

Zip _____ Phone _____

Valid for new members only, subject to acceptance by EEBC. Canada *must* remit in U.S. funds drawn on U.S. banks. Applicants outside the U.S. and Canada will receive special ordering instructions.

PPIF294

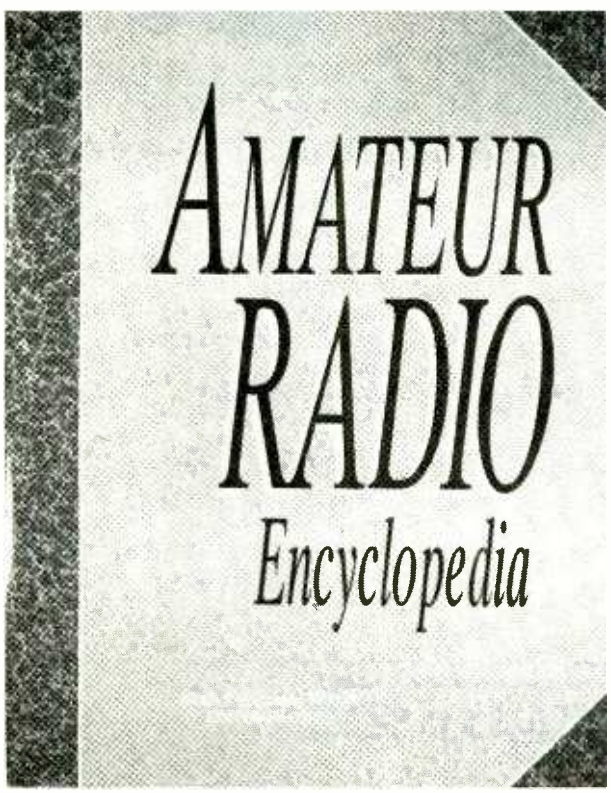
www.americanradiohistory.com

ELECTRONICS LIBRARY

Amateur Radio Encyclopedia

edited by Stan Gibilisco, W1GV

From "absorption wavemeter" to "Zurich sunspot number," this fully-illustrated encyclopedia provides a practical overview of every topic related to amateur radio. Aimed at ham-radio operators, shortwave listeners, CB'ers, and electronics enthusiasts, the one-volume reference



presents detailed information in a format that is easily accessible even to beginners and would-be hobbyists. The book's 600 pages of alphabetically arranged, cross-referenced articles cover more than 1000 topics. Included are comprehensive listings on packet radio, antennas and wave propagation, modulation and repeaters, amateur satellite communications, radioteletype, amateur television, Military Affiliated Radio Service (MARS), power supplies and test equipment, and hundreds of other amateur-radio-related subjects.

Amateur Radio Encyclopedia costs $29.95 and is published by Tab Books Inc., Blue Ridge Summit, PA 17294-0850; Tel. 800-233-1128.

CIRCLE 98 ON FREE INFORMATION CARD

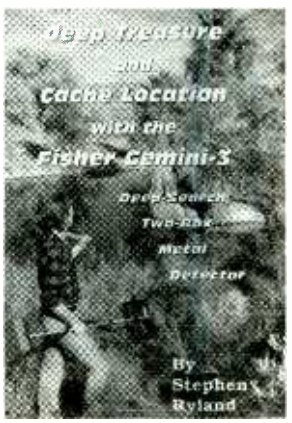
DEEP TREASURE AND CACHE LOCATION WITH THE FISHER GEMINI-3

by Stephen Ryland

Buried treasure isn't found only in old pirate movies—there are plenty of valuables hidden underground just waiting to be found. For those who are interested in taking up the search, this book explains how to put the Fisher Gemini-3 two-box, deep-search metal detector to work. The 60-page, illustrated book provides valuable tips for anyone with an interest in deep-cache treasure hunting, from generating treasure leads to recovering buried treasure.

The book explains everything you'll need to pack up and take off on the trail of hidden treasure. It teaches the difference between cache and treasure, and how to generate leads for both. It covers planning the hunt, developing a search strategy, and searching for gold. Also included are a history of deep-cache treasure hunting, and chapter full of recent case histories. The book also contains a detailed discussion of the Gemini-3 metal detector, with separate chapters devoted to theory of operation and in-depth operating instructions.

Deep Treasure and Cache Location with the Fisher Gemini-3 costs $8 plus $2 shipping and handling (California residents must ad 7.25% sales tax) from Fisher Research Laboratory, Department PE, 200 West Willmott Road, Los Banos, CA 93635.



CIRCLE 85 ON FREE INFORMATION CARD

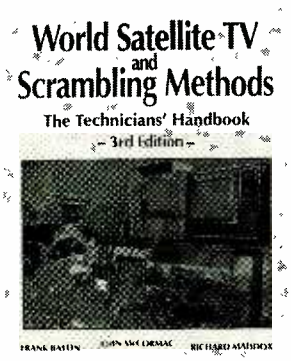
WORLD SATELLITE TV AND SCRAMBLING METHODS
The Technician's Handbook: Third Edition

by Frank Baylin, John McCormac, and Richard Maddox

Containing a wealth of practical information for technicians, satellite professionals, and curious do-it-yourselfers, this book covers all components of home satellite systems with an emphasis on their design, operation, and repair. The book contains chapters on troubleshooting and setting up a test bench, as well as a chapter on specialized electronic components. Expert guidance on testing, servicing, and tuning is complemented by detailed illustrations. Circuit and block diagrams of most components are presented and clearly explained throughout the book.

Almost a third of the book is

www.americanradiohistory.com



devoted to an in-depth study of broadcast formats including NTSC, PAL, SECAM, and MAC; digital-audio techniques; and basic scrambling and encryption methods. Complete circuit descriptions of the Chaparral Cheyenne, The General Instrument 2400R, the Maspro 90R, and the Sakura receivers are included. That material serves as a backdrop to a discussion of all American and European scrambling technologies.

The third edition has been revised and updated to include expanded information on LNB design and construction, flat-plate antennas, feedhorns, and smart cards. It also contains updates to case studies of several current encryption methods.

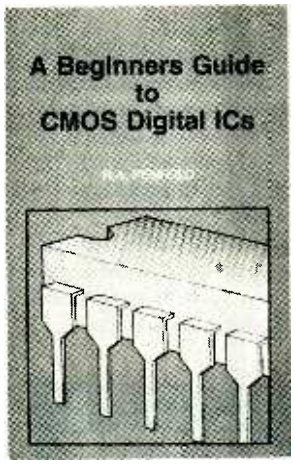
World Satellite TV and Scrambling Methods: The Technician's Handbook, Third Edition is available for $40 plus $4 shipping and handling from Baylin Publications, 1905 Mariposa, Boulder, CO 80302.

CIRCLE 86 ON FREE INFORMATION CARD

A BEGINNERS GUIDE TO CMOS DIGITAL ICS

by R.A. Penfold

Because many of the basic concepts of logic circuits seem rather abstract and remote from obviously useful applications, beginners often have trouble getting started. This book covers the fundamental theory of digital electronics and the use of CMOS integrated circuits, but it never loses sight of the fact that digital electronics has many real-world applications. The book discusses the basic concepts of logic circuits and explains the functions of gates, inverters, and other logic build-



ing blocks. It describes CMOS logic IC characteristics and the advantages of using CMOS logic IC's in practical circuit design. The book also covers oscillators and monostables, flip-flops, binary dividers and binary counters, decade counters, and display drivers. Several circuits that demonstrate the use of CMOS logic IC's in practical applications are also included.

A Beginners Guide to CMOS Digital ICs (order number BP333) is available for $6.25 plus $2.50 shipping and handling from Electronics Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240.

CIRCLE 97 ON FREE INFORMATION CARD

POWER SUPPLIES, SWITCHING REGULATORS, INVERTERS, AND CONVERTERS: Second Edition

by Irving M. Gottlieb

Although regulated power supplies are an indispensable part of every electronic system, they remain a mystery even to many professionals. This book provides all the technical data and hands-on guidance that professional and amateur circuit designers need to build power supplies for demanding applications, from TV sets and radio transmitters to computers. State-of-the-art theory and practice are covered in detail, with a bare minimum of math. Hundreds of helpful schematics and diagrams are included. The book covers transistor and thy-

Earn Your B.S. Degree in ELECTRONICS or COMPUTERS

By Studying at Home

Grantham College of Engineering, now in our 43rd year, is highly experienced in "distance education"—teaching by correspondence—through printed materials, computer materials, fax, and phone.

No commuting to class. Study at your own pace, while continuing on your present job. Learn from easy-to-understand but complete and thorough lesson materials, with additional help from our instructors.

Our Computer B.S. Degree Program includes courses in BASIC, PASCAL and C languages — as well as Assembly Language, MS DOS, CADD, Robotics, and much more.

Our Electronics B.S. Degree Program includes courses in Solid-State Circuit Analysis and Design, Control Systems, Analog/Digital Communications, Microwave Engr, and much more.

An important part of being prepared to *move up* is holding the right college degree, and the absolutely necessary part is knowing your field. Grantham can help you both ways—to learn more and to earn your degree in the process.

Write or phone for our free catalog. Toll free, 1-800-955-2527, or see mailing address below.

•

Accredited by the Accrediting Commission of the National Home Study Council

•

GRANTHAM College of Engineering

Grantham College Road
Slidell, LA 70460

www.americanradiohistory.com

ristor inverter and converter applications, switching-type power-supply applications, high-performance regulated power supplies, low-power and low-voltage regulated power supplies. The second edition has been updated to present the latest developments in regulated power supplies, including new IC technology, low-voltage logic devices, and one-watt power supplies for ISDN equipment. Solid-state devices, including transistors, controllers, MOSFET's, thyristors, and the SIDAC, also are covered.

Power Supplies, Switching Regulators, Inverters, and Converters, Second Edition, costs $21.95 and is published by Tab Books Inc., Blue Ridge Summit, PA 17294-0850; Tel. 800-233-1128.

CIRCLE 98 ON FREE INFORMATION CARD

DOS FOR BEGINNERS: "No Experience Required!"

by Udo Bretschneider

Written for the newcomer who needs to know DOS basics right away, this book anticipates the reader's questions and presents the answers in an easy-to-understand style. The book opens with thorough explorations of the keyboard, the computer, the display, hard- and floppy-disk drives, and what to expect from MS-DOS. It goes on to explain how to create directories, work with files, using diskettes, set the computer's calendar and clock, create and use macros, back up your data, use the MS-DOS Shell and the MS-DOS Editor, change the AUTOEXEC.BAT and CONFIG.SYS files, install new software, and deal

with error messages. The book also points out things that the beginner shouldn't mess with, such as formatting the hard drive, and things that are unwise for anyone to do—removing a diskette while the drive is still working, switching off the computer while programs are still running, working directly from a diskette, and the like. Finally, the book provides a command reference, two glossaries, and a companion diskette. The disk contains two programs: an icon-oriented, Windows-like graphical user interface called Desktop that gives the user simple, intuitive control of the system and programs; and Cannonade, a futuristic game of skill and strategy.

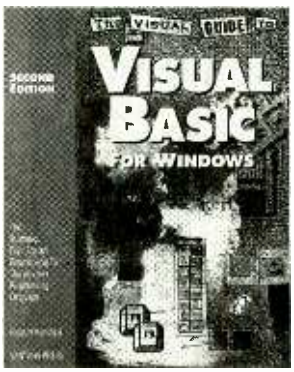
DOS for Beginners costs $22.95, including diskette, and is published by Abacus, 5370 52nd Street SE, Grand Rapids, MI 49512.

CIRCLE 87 ON FREE INFORMATION CARD

THE VISUAL GUIDE TO VISUAL BASIC FOR WINDOWS: For Version 3, Second Edition

by Richard Mansfield

Visual BASIC for Windows takes a visual approach to Windows programming, and this book takes the same approach to explaining the popular Windows programming tool. The language's more than 400 commands, tools, and techniques are arranged in easy-to-use, alphabetic listings, accompanied by more than 600 illustrations. The book reveals how to create customized Windows applications to meet specific needs, design animated controls, make Windows programs communicate with each other, and build powerful database managers with the new Data Control. It shows readers how to tap into the 600-plus powerful commands that are built into Windows itself, and uncovers techniques used by the experts to make their programs visually exciting and easy to use.



The Visual Guide to Visual BASIC for Windows Version 3 costs $29.95 and is published by Ventana Press, P. O. Box 2468, Chapel Hill, NC 27515; Tel. 919-942-0220; Fax: 919-942-1140.

CIRCLE 88 ON FREE INFORMATION CARD

TURBOCHARGE YOUR MAC! Make any Mac Faster & Smarter

by Carla Rose

Regardless of the type of Mac you use—whether it's a Plus, the Quadra 900, or anything in between—this book-and-diskette package shows you how to make it work faster and more efficiently. Mac users of all skill levels will find in its pages information and advice, illustrated by helpful screen shots, diagrams, and car-related icons that highlight important do's and don'ts. Lively automotive analogies appear throughout this guide for would-be Macintosh power users. The diskette contains powerful productivity tools.

The book explains how to speed up operations with RAM disks, cache utilities, coprocessors, clock cards, and disk optimizers. Also covered are removable drives, optical drives, floptical drives, SCSI, and virtual memory. The book presents a variety of software-based speed- and efficiency-boosters, including command keys and macros, shareware utilities, network monitors, print spoolers, OCR scanners, and DiskTop. Readers also learn how to secure data with commercial anti-virus and file-recovery programs, fail-proof power supplies, surge protectors, tape-backup systems, and anti-theft devices.

Turbocharge Your Mac! Make Any Mac Faster & Smarter costs $32.96, including diskette, and is published by Windcrest/McGraw-Hill, Blue Ridge Summit, PA 17294-0850; Tel. 800-233-1128; Fax: 717-794-2103.

CIRCLE 96 ON FREE INFORMATION CARD

BUILD YOUR OWN LOW-COST PC AND SAVE A BUNDLE

by Aubrey Pilgrim

For anyone who's looking for a inexpensive but full-featured computer that runs today's most popular software products, this book shows how easy, satisfying, and fun it can be to build your own PC. Newly upgraded to include the latest information on hardware sources, components, and prices, the book provides all the guidance needed to assemble an AT-compatible 286 or 386SX for a fraction of the market cost. Featuring step-by-step instructions, close-up photographs, and a lay-flat binding, the book is intended as a hands-on tool. It tells readers what to look for

www.americanradiohistory.com

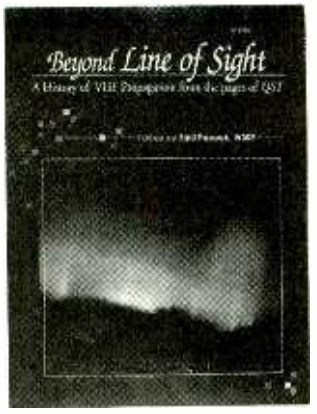
and what to avoid in today's disk drives, display monitors, keyboards, mice, plug-in boards, printers, modems, and on-line services. The book explains how the components work once they're connected, and describes a variety of word-processing, database, spreadsheet, and disk-management programs, including the latest versions of DOS and Windows.

Build Your Own Low-Cost PC and Save a Bundle costs $18.95 and is published by TAB Books, Division of McGraw-Hill Inc., Blue Ridge Summit, PA 17294-0850; Tel. 800-822-8138.

CIRCLE 98 ON FREE INFORMATION CARD

BEYOND LINE OF SIGHT: A History of VHF Propagation from the pages of QST

The belief that radio waves could never travel beyond the line of sight led DX'ers to coin the phrase "What you see is what you work." Today, however, it's common knowledge that VHF radio waves can travel thousands of miles in various propagation modes. That knowledge came about largely through the efforts of early amateur radio experimenters, beginning back in the 1930's. This book relates the story of



the exciting developments in VHF propagation, as told in the pages of *QST* magazine. The chapters, arranged chronologically in the approximate order in which amateurs became aware of each propagation mode, each contain several technical articles from that magazine. The articles were chosen either because they represent important turning points in propagation history or because they impart information vital to the understanding of the field. In addition to the articles, excerpts from "The World Above 50 MHz" and other station reports are reprinted, providing a first-hand taste of some exciting sessions.

Beyond Line of Sight: A History of VHF Propagation from the pages of QST costs $12.00 and is published by The American Radio Relay League, 225 Main Street, Newington, CT 06111.

CIRCLE 89 ON FREE INFORMATION CARD

MAINTAINING AND REPAIRING VCRS: Third Edition

by Robert L. Goodman

If you've ever comparison-shopped for VCR repairs, you know that the diagnosis and the price of the repair varies dramatically from shop to shop. In fact, many common VCR troubles can easily be avoided by proper maintenance, or remedied at home. This book provides all the professional guidance you need to service and repair VCR's. Completely upgraded and expanded to include state-of-the-art VCR technology and troubleshooting techniques, the book is packed with hundreds of helpful pinout diagrams and exploded-view photographs that illustrate how to locate and fix any malfunction. The book provides in-depth coverage of every mechanical system and electronic circuit used in Betamax and VHS VCR's, including servo and control systems. It explains the use of test equipment, including Sencore's VC93 all-format VCR analyzer and SC61 waveform analyzer. Camcorders and special VCR circuits, including high-quality (HQ) video and stereo-audio circuitry, also are covered.

Maintaining and Repairing VCRs: Third Edition costs $19.95 and is published by TAB Books, Division of McGraw-Hill Inc., Blue Ridge Summit, PA 17294-0850; Tel: 800-822-8138.

CIRCLE 98 ON FREE INFORMATION CARD ■

SUPER 12 HOUR RECORDER
CALL TOLL FREE

Modified Panasonic Slimline. 6 hrs per side.
120 TDK tape furnished.
AC/DC Operation.
Quality Playback.
Digital Counter.
Durable Lightweight Plastic.
$119.00*

PHONE RECORDING ADAPTER
Starts & Stops Recorder Automatically When Hand Set is Used.
Solid State!
FCC APPROVED
$28.50*

VOX VOICE ACTIVATED CONTROL
Solidstate Adjustable Sensitivity. Voices & Sounds Activate Recorder. Adjustable Sensitivity. Provisions for Remote Mike.
$28.50*

*Add for ship. & handling. Phone Adapter & Vox $2.00 each, Recorders $5.00 each, Colo. Res. add tax. Mail Order, VISA, M/C, COD's OK. Money Back Guar. Qty. Disc. available. Dealer inquiries invited. Free data on other products.

ALL MAIL TO: Box 20100, Boulder, CO 80308
AMC SALES INC., 193 Vaquero Dr., Boulder, CO 80303
Phones (303) 499-5405 • 1-800-926-2488
FAX (303) 494-4924 • Mon-Fri 8-5 MTN. TIME

CIRCLE 151 ON FREE INFORMATION CARD

Be an FCC LICENSED ELECTRONIC TECHNICIAN!

No costly school. No commuting to class. The Original Home-Study course prepares you for the "FCC Commercial Radiotelephone License." This valuable license is your professional "ticket" to thousands of exciting jobs in Communications, Radio-TV, Microwave, Maritime, Radar, Avionics and more...even start your own business! You don't need a college degree to qualify, but you do need an FCC License.

No Need to Quit Your Job or Go To School
This proven course is easy, fast and low cost! GUARANTEED PASS—You get your FCC License or money refunded. **Send for FREE facts now. MAIL COUPON TODAY!**

COMMAND PRODUCTIONS
FCC LICENSE TRAINING, Dept. 100
P.O. Box 2824, San Francisco, CA 94126
Please rush FREE details immediately!
NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

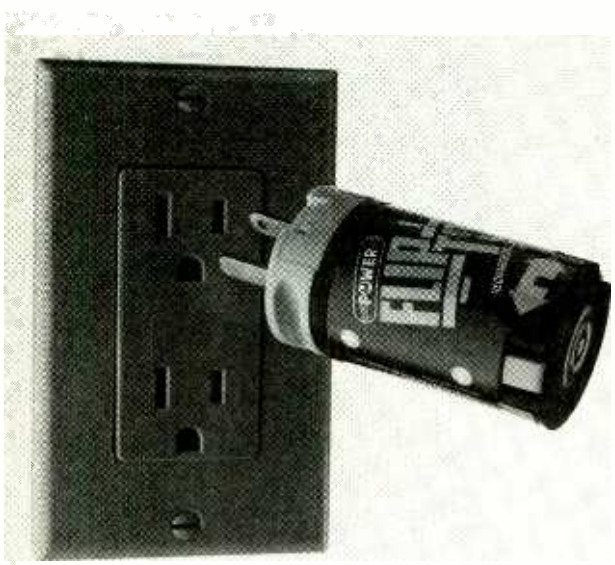
www.americanradiohistory.com

NEW PRODUCTS

Flip-Top Rechargeable Battery

There's no question that using rechargeable batteries instead of disposable ones makes economical and ecological sense. Yet there is still consumer resistance to rechargeables, due primarily to the cost and inconvenience of component systems that require separate charging devices. The *Power FlipTop*, a D-size, 1.25-volt, 1600-mA, nickel-cadmium battery from *Power Battery Holdings Corporation* addresses both those complaints. It plugs directly into a wall socket for recharging, allowing recharging anywhere there is an AC socket.

The device's patented FlipTop feature allows a pair of AC blades to be housed within the battery casing. For recharging, the user pulls up the top to



expose the blades, and then plugs the cell into any standard AC wall socket. When charging is complete, the top flips back down, concealing the blades, and the FlipTop is ready for use in any D-cell-powered appliance. It is said to work best in high-drain devices such as portable audio equipment and electric toys.

Guaranteed for a minimum of 500 recharges, the FlipTop replaces approximately 200 disposable batteries, saving the consumer approximately $400 and eliminating some 52 pounds of solid waste that would otherwise go into landfills. The company is currently developing C- and AA-sized versions, as well as portable-appliance applications.

A pair of Power FlipTop D cells costs $12.99. For more information, contact Power Battery Holdings Corporation, 16301 N.E. 8th St., Suite 250, Bellevue, WA 98008; Tel. 206-641-7155; Fax: 206-643-4216.

CIRCLE 100 ON FREE INFORMATION CARD

HANDHELD DIGITAL MULTIMETERS

Three rugged, general-purpose, handheld digital multimeters from *Tektronix* are designed and manufactured to comply with safety standards established by UL and IEC and to conform to Mil-T028800, Class-2 standard for shock and vibration. The *DM255* features a 3½-digit display, 0.7% accuracy, autoranging or manual selection, data-hold, and current measurements. Where current measurements are not needed, the *DM256* offers testing of voltage, capacitance, resistance, and diodes, with 0.5% accuracy, a fast continuity beeper, and memory offset. The *DM257* offers current and capacitance measurements with 0.5% accuracy, autoranging and manual selection, and a low-battery indicator.

The *DM255*, *DM256*, and *DM257* handheld DMM's cost $65, $75, and $85, respectively. For additional information, contact Tektronix Electronic Service Tools, Tektronix, Inc., P. O. Box 1520, Pittsfield, MA 01202; Tel. 1-800-426-2200, extension 183.

CIRCLE 101 ON FREE INFORMATION CARD

AFFORDABLE 486

The *Tandy 2100* 486-based personal computer provides the power and performance of a business-level PC at the price you'd expect to pay for a home system. The 25-MHz PC-compatible system is flexible and expandable, with 4 MB of standard memory (expandable to 32 MB), a 130 MB hard drive, four open expansion slots, and three

open device bays. The system includes a 101-key enhanced keyboard, a two-button mouse, Super VGA graphics, one game port, one parallel port, and two serial ports.

The Tandy 2100 comes with Microsoft Windows 3.1, Microsoft Works for Windows, and America Online software preinstalled. The software provides word processing, including a 120,000-word spell checker and a thesaurus; custom-designed business or personal databases; spreadsheets, forms, and financial statements; standard or scientific calculations; graphs and charts, including 31 chart templates; and the ability to combine draw and chart files with word processed documents to design letterheads, maps, or

www.americanradiohistory.com

flyers. America Online allows the user to access on-line entertainment, business, and educational information; monitor stock quotes, news, weather, and sports; and send and receive electronic mail.

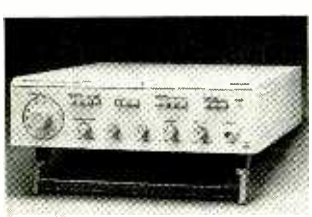
The Tandy 2100 is available at a suggested retail price of $1099 at Radio Shack stores nationwide. For more information, contact Radio Shack, 700 One Tandy Center, Fort Worth, TX 76102.

CIRCLE 102 ON FREE INFORMATION CARD

FUNCTION GENERATOR

With its clean, logical front-panel design, easily adjustable settings, and versatile sweep functions, the *Fluke PM 5135* function generator is well suited for a variety of general-purpose applications, including education and training, audio and electronics service, production testing, and development. The unit's output is completely protected against short circuits, ensuring constant reliable service even under difficult operating conditions.

During setup, frequency is selected using pushbuttons in four decade ranges along with a large logarithmic dial and a Vernier control with a range of ±20% of the dial setting. Pushbuttons are also used to easily select the standard sine, triangle, and square waveforms. Duty cycle is a standard 50%. DC offset, if needed, can be added with a ±10V range. Offset DC voltage can also be produced without any AC component.



Sweeps can be single or continuous, with a logarithmic characteristic and a continuously variable sweep ratio from 1 to 2000. There is a sweep range of 3.5 decades, and the sweep period is continuously adjustable over a range of 10 to 50 seconds. Triggering can occur manually, with a pushbutton, or through an external source.

The attenuation range can also be selected using pushbuttons, covering a 0–60-dB range in 10-dB increments, or it can be continuously varied over a 0–20-dB range.

The PM 5135 function generator costs $795. For more information, contact Fluke Corporation, P. O. Box 9090, Everett, WA 98206; Tel. 800-44-FLUKE; Fax: 206-356-5116.

CIRCLE 103 ON FREE INFORMATION CARD

PORTABLE MINIDISC PLAYER

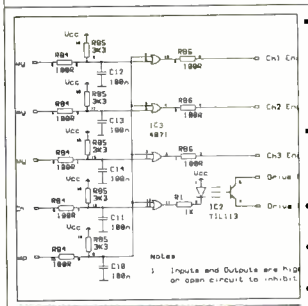
Aiwa's latest entry in the portable digital-audio marketplace is the *AMD-50* portable MiniDisc player, an extremely compact unit that will play back prerecorded optical MiniDiscs. Just larger than a deck of playing cards, and weighing only 10.6 ounces, the AMD-50 provides the clear, distortion-free sound, and the convenience, of the optical disc-based format. It offers nearly instant random access to any selection on a disc, as well as repeat play and

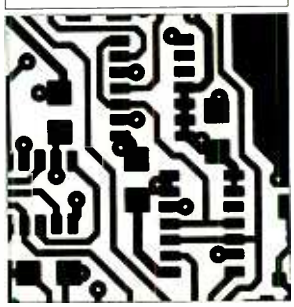
random play. A full-function wired remote control module, located on the headphone cord, includes an LCD panel that displays the track, play mode, and the chosen DSL (Dynamic Super Linear Bass) and PLSS (Private Listening Sound System) settings. PLSS headphones minimize sound leakage that might disturb others nearby.

For uninterrupted portable playback, the AMD-50 features a shock-resistant memory circuit that prevents skipping by storing audio information for three seconds in a RAM chip before it's passed along to the listener. That delay allows the player to find its place in the

PCB and SCHEMATIC C.A.D.

EASY-PC $195





- Runs on PC/XT/AT/386/486 with Hercules, CGA, EGA or VGA display and many DOS emulations.
- Design Single sided, Double sided and Multilayer boards.
- Provides Surface Mount support.
- Exceptionally fast operation.
- Standard output includes Dot Matrix / Laser / Inkjet Printers, Pen Plotters, Photo-plotter and N.C. Drill.
- Award winning EASY-PC is in use in over 17,000 installations in 70 Countries World-wide.
- Very easy to learn and use.
- Not Copy Protected.

Options - 500 Piece Surface Mount Library $112
1000 Piece library $75.00 Gerber Import facility $195.00

For full details write, call, fax or use Inquiry #

Number One Systems

REF:- PEUS, 1795 Granger Avenue, Los Altos CA 94024

Telephone
USA: (415) 968 9306
Intnl: +44 480 461778
FAX: 011 44 480 494042

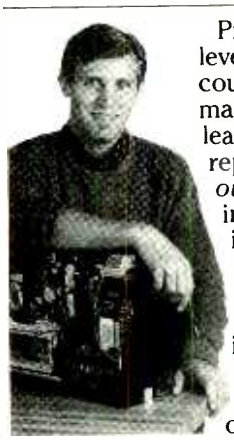
BRITISH DESIGN AWARD 1989

AMERICAN EXPRESS, MASTERCARD and VISA WELCOME.

CIRCLE 13 ON FREE INFORMATION CARD

Learn VCR repair at home!

MAKE *GOOD* MONEY IN YOUR OWN FULL- OR PART-TIME JOB



Professional-level home study course. You will master easy-to-learn, high-profit repairs *without* investing in high-tech instruments or a costly workshop. Want more independence and higher income? Send or call today!

Free career literature:

800-223-4542

Name _____ Age ____
Address _____ Phone (___) _____
City _____ State ____ Zip _____

The School of VCR Repair
6065 Roswell Road
Dept. VB341, Atlanta, Georgia 30328

CIRCLE 14 ON FREE INFORMATION CARD

www.americanradiohistory.com

event of a mistrack, and resume play before the three seconds have elapsed.

The AMD-50 MiniDisc player has a suggested retail price of $550. For further information, contact Aiwa America, 800 Corporate Drive, Mahwah, NJ 07430; Tel. 201-512-3600.

CIRCLE 104 ON FREE INFORMATION CARD

TINY SINGLE-BOARD COMPUTER

Intended for embedded applications such as industrial control, data acquisition, and interfacing, the *BASIC Stamp* from *Parallax, Inc.* is a single-board computer that measures just 1 × 2 inches. Programs for the Stamp can be developed on a PC with the Stamp editor. At the press of a key, the user's program is converted into tokens, downloaded to the stamp through a 3-pin cable, and executed. The easy-to-learn PBASIC language includes instructions for high-speed digital, analog, and serial I/O, as well as power control, sound, debugging, table look-up, and on-board EEPROM access. The maximum program size is about 80 PBASIC instructions.

The Stamp consists of an 18-pin RISC microcontroller, which interprets PBASIC and manages the I/O lines, and an 8-pin EEPROM, which stores the PBASIC tokens. A small prototyping area is available for adding circuitry to the Stamp's eight general-purpose I/O lines. The Stamp is powered by a clip-on 9-volt battery or externally supplied 5–12 VDC. Using a single line and ground, multiple Stamps can be connected together, and large tasks can be subdivided across several Stamps.

The Stamp development kit, including one BASIC Stamp, a 3-pin downloading cable, the editor software, and a manual, costs $129. Each BASIC Stamp is priced at $39. PBASIC interpreter chips, for use in custom circuits, are available for $6 each, with a 25-piece minimum. For more information, contact Parallax, Inc., 3805 Atherton Road, #102, Rocklin, CA 95765; Tel. 916-624-8333; Fax: 916-624-8003; BBS: 916-624-7107.

CIRCLE 105 ON FREE INFORMATION CARD

SOLDERING STATION

The built-in temperature sensor in *Extech's* soldering station ensures that the iron tip is always within 10° of the setpoint temperature, eliminating the problems of cold solder joints or burned flux. The tip temperature can be changed from 300 to 790°F without changing the iron

tip. The soldering station is available in Fahrenheit (320–900°F), as *Model 385030*, and in Centigrade (160–480°), as *Model 385031*. The front panel features a bright, three-digit LED display and a switch that allows the user to display either the setpoint or the actual tip temperature. Both models are powered from 110 VAC and come complete with a 1/32-inch copper tip, a heat-resistant cable, a tip grounding terminal, a cleaning sponge, an iron holder, and a 1-amp fuse. Optional tips are available.

The temperature-controlled soldering stations each cost $149; replacement tips, available in 1/32-, 1/64-, and 1/16-inch sizes, cost $4 each. For additional information, contact Extech Instruments Corp., 335 Bear Hill Road, Waltham, MA 02154; Phone: 617-890-7740; Fax: 617-890-7864.

CIRCLE 106 ON FREE INFORMATION CARD

FULL-MOTION VIDEO PC CARD

Based on the MPEG (Motion Picture Experts Group) compression standard, *Sigma Designs' ReelMagic* multimedia playback controller card allows CD-ROM-equipped PC's to play back full-screen, full-motion, full-color video and CD-quality digital stereo sound. The card is compatible with MPEG-based multimedia software, and its MPEG capabilities will allow

standard PC's to take advantage of the upcoming VideoCD standard. VideoCD, which will allow movies, TV shows, and other videos to be played from a standard CD-ROM, is a multiplatform standard backed by companies including Philips, Sony, JVC, Matsushita, Goldstar, Samsung, and 3DO. Twelve entertainment and multimedia titles will be introduced by the end of 1993, and the first VideoCD titles are expected to be out by the 1993 Christmas season. The card supports Windows multimedia applications and is DOS Game compatible.

ReelMagic plays 32K color video at resolutions up to 1024 × 768 at 30 frames per second. Its VGA feature connector allows all 32,768 colors to be seen even on a standard 16-color VGA card. ReelMagic also contains a 16-bit sound card that allows fully orchestrated soundtracks to run simultaneously with full-motion video.

The ReelMagic MPEG playback card, complete with installation program, a full array of drivers and system software, utilities, and Activision's "Return to Zork" MPEG game, costs $449. For more information, contact Sigma Designs, Inc., 47900 Bayside Parkway, Fremont, CA 94538; Tel. 510-770-0100; Fax: 510-770-2640.

CIRCLE 107 ON FREE INFORMATION CARD

VIDEO TITLER

The *ColorWriter Magic* video titler from *Sima* offers amateur and intermediate videomakers color titles and 14 special effects. Titles are created beforehand, stored in a 12-page memory bank, and inserted onto the video in a variety of exciting ways as the videotape is copied. Users can select one or more of eight colors, including black and white, and can present titles on a colored background or overlay them on their actual video. Other options include a colored border around letters, and a boxing-in of letters or words with a contrasting color. A touch of the reverse button yields a solid background with the video playing through the letters of the title. Users can

move entire titles across the screen, converge alternate title lines, crawl titles onto the screen line by line, or have titles pop up typewriter style (letter by letter). The ColorWriter Magic titler also allows users to zoom in or out, fade titles in or out, scroll at any one of four speeds, and combine a stationary headline with scrolling. The unit features a full-size keyboard that includes international characters and symbols. Function keys are arranged in logical groups, making it fun, not frus-

(Continued on page 16)

www.americanradiohistory.com

Just like these Fully Trained Electronics Professionals

"Thanks to CIE I have tripled my previous salary, and I am now in a challenging and rewarding new field where only the sky is the limit."
Daniel Wade Reynolds
Industrial Electrician
Ore-Ida Foods

"CIE was recommended to me by my boss. It was appealing since I could study at my own pace at home and during business travel."
Dan Parks
Marketing Manager/Consumer Products
Analog Devices, Inc.

"I loved the flexibility CIE offered. It was the only way I could continue both school and my demanding job."
Britt A. Hanks
Director of Engineering
Petroleum Helicopters, Inc.

"I liked the way the school was set up with laboratory assignments to enforce conceptual learning. The thing which impressed me the most about CIE's curriculum is the way they show application for all the theory that is presented."
Daniel N. Parkman
Missile Electro-Mechanical Technician
U.S. Air Force

"Completing the course gave me the ability to efficiently troubleshoot modern microprocessor based audio and video systems and enjoy a sense of job security."
Tony Reynolds
Service Manager/Technician
Threshold Audio & Video

Graduate with an Associate Degree from CIE!

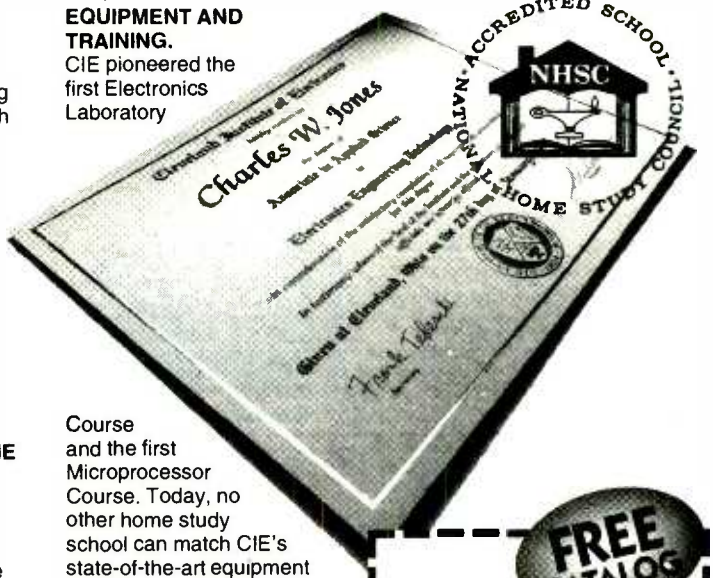
CIE is the best educational value you can receive if you want to learn about electronics, and earn a good income with that knowledge. CIE's reputation as the world leader in home study electronics is based solely on the success of our graduates. And we've earned our reputation with an unconditional commitment to provide our students with the very best electronics training.

Just ask any of the 150,000-plus graduates of the Cleveland Institute of Electronics who are working in high-paying positions with aerospace, computer, medical, automotive and communications firms throughout the world. They'll tell you success didn't come easy...but it did come...thanks to their CIE training. And today, a career in electronics offers more rewards than ever before.

CIE'S COMMITTED TO BEING THE BEST...IN ONE AREA...ELECTRONICS.
CIE isn't another be-everything-to-everyone school. CIE teaches only one subject and we believe we're the best at what we do. Also, CIE is accredited by the National Home Study Council. And with more than 1,000 graduates each year, we're the largest home study school specializing exclusively in electronics. CIE has been training career-minded students for nearly sixty years and we're the best at our subject...
ELECTRONICS...
IT'S THE ONLY SUBJECT WE TEACH!

CIE PROVIDES A LEARNING METHOD SO GOOD IT'S PATENTED.
CIE's AUTO-PRO-GRAMMED® lessons are a proven learning method for building valuable electronics career skills. Each lesson is designed to take you step-by-step and principle-by-principle. And while all of CIE's lessons are designed for independent study, CIE's instructors are personally available to assist you with just a toll free call. The result is practical training... the kind of experience you can put to work in today's marketplace.

LEARN BY DOING...WITH STATE-OF-THE-ART EQUIPMENT AND TRAINING.
CIE pioneered the first Electronics Laboratory Course and the first Microprocessor Course. Today, no other home study school can match CIE's state-of-the-art equipment and training. And all your laboratory equipment, books and lessons are included in your tuition. It's all yours to use while you study and for on-the-job after you graduate.



PERSONALIZED TRAINING....TO MATCH YOUR BACKGROUND.
While some of our students have a working knowledge of electronics others are just starting out. That's why CIE has developed twelve career courses and an A.A.S. Degree program to choose from. So, even if you're not sure which electronics career is best for you, CIE can get you started with core lessons applicable to all areas in electronics. And every CIE Course earns credit towards the completion of your Associate in Applied Science Degree. So you can work toward your degree in stages or as fast as you wish. In fact, CIE is the only school that actually rewards you for fast study, which can save you money.

Send for CIE's FREE Course Catalog and See How We Can Help Your Career Too!

FREE CATALOG

YES! I want to get started. Send me my CIE course catalog including details about the Associate Degree Program. (For your convenience, CIE will have a representative contact you - there is no obligation.)

Please Print Clearly **AH49**

Name _____

Address _____

City _____

State ____ Zip _____ Age ____

Phone No. _____

Check box for G.I. Bill Benefits.
☐ Veteran
☐ Active Duty

Cleveland Institute of Electronics, Inc.
1776 East 17th Street
Cleveland, OH 44114

A School of Thousands.
A Class of One. Since 1934.

www.americanradiohistory.com

NEW PRODUCTS

(Continued from page 12)

trating, to create, correct, and rearrange titles.

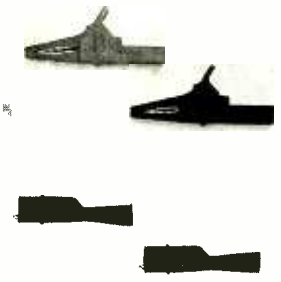
The ColorWriter Magic video titler has a suggested retail price of less than $300. For more information, contact Sima Products Corporation, 8707 North Skokie Boulevard, Skokie, IL 60077; Tel: 708-679-7462; Fax: 312-286-7227.

CIRCLE 108 ON FREE INFORMATION CARD

ALLIGATOR CLIP DMM ACCESSORIES

Two alligator clips for *Fluke* digital multimeters, the *AC85A* and *AC70A* offer improved features including a 600-volt rating for the AC85A and new probe-tip receptacles for secure probe connections in the AC70A.

The AC85A is a pair of fully insulated alligator clips with a ¾-inch jaw opening. Extra strong teeth and a spring design provide superior grip. Connection is made via a standard banana jack. Rated for use at 600 volts,



the clips are suitable for use in marine, aviation, electrical, and HVAC applications. The AC85A clips are recommended for use with the Fluke TL24 flexible test leads, and are also compatible with all test leads that have standard, 4mm-diameter banana plugs.

The beryllium-copper springs of the AC70A alligator clips offer a secure grip, and work with digital multimeters from a wide variety of manufacturers. The probe-tip receptacles are gold-plated. The clips are rated for voltage to 1000 volts and current to 10 amps. The jaw opening of the clip is a standard 0.313-inch, and its sharp, well-aligned teeth make it suitable for use in virtually all electronics applications.

The AC85A and AC70A alligator clip pairs cost $9 and $7, respectively. For further information, contact John Fluke Mfg. Co., Inc., P. O. Box 9090, Everett, WA 98206; Tel. 800-87-FLUKE.

CIRCLE 109 ON FREE INFORMATION CARD

COMMERCIAL TELEPHONE DECODER

The *Digit Snatcher II* from *International MicroPower* is a handheld tester that can be used for decoding scanners and amateur radios as well as telephone lines. It also features Caller I.D. capture. An Intel microprocessor allows the unit to store thousands of digits, offer self-help messages on the LCD screen, and send and receive

data via an RS-232 serial port. The Digit Snatcher II features a built-in microphone with electronic automatic level control and noise filter that allows users to acoustically capture DTMF (touch-tone) dialing as well as Caller I.D., with no electrical connection between the source and the decoder. If you can hear DTMF on the radio or TV, Digit Snatcher II will decode and store the digits as you hear them. A built-in day/date/time stamp can be used to mark each series of digits with the current date and time. Stored information will be retained for up to 5 years, even while the unit is turned off, so the device can be taken in the field and later connected to a PC for data retrieval.

The Digit Snatcher II with 1000-digit storage capacity costs $179; the 2000-digit version with Caller I.D. and serial port costs $289. For further information, contact International MicroPower Corporation, 65 Palm Drive, Camarillo, CA 93010; Tel: 805-482-2870.

CIRCLE 110 ON FREE INFORMATION CARD

NO-INSTALLATION CAR ALARM

AMCAMEX's CarGuard car-security system requires no installation. The unit simply slips into a car-stereo cassette slot. To arm it, the driver turns the key and then removes it. A solid-steel deadbolt locks the CarGuard securely in place. The unit beeps and flashes during a 30-second exit delay to allow the driver time to get out of the car. (No beeping indicates

that a new 9-volt battery is required.) Upon returning to the car, the driver has ten seconds to turn the key in the ignition, which disarms the alarm. If the key isn't turned within ten seconds, a 130-dB alarm sounds and continues as long as motion is detected. The siren stops 20 seconds after the movement ceases. That setup offers a significant improvement over those car alarms that continue to wail away for long periods of time, disturbing the entire neighborhood. The CarGuard's piercing siren sounds inside the car, where it will scare the thief without annoying the neighbors. The unit automatically rearms itself after 20 seconds.

The CarGuard comes in "wide load" and "long load" versions. Each comes with two warning decals for the car windows and costs $59.95. For further information, contact AMCAMEX Electronics Corp., P. O. Box 50775, Amarillo, TX 79159-0775; Tel. 806-354-2690; Fax: 806-354-8800.

CIRCLE 111 ON FREE INFORMATION CARD

900-MHZ SPREAD-SPECTRUM PHONE

Frequency-hopping spread-spectrum technology, first used by the military to ensure communications security, is put to use by *Cincinnati Microwave* in their *Escort 9000* 900-MHz digital cordless telephone. By using spread-spectrum technology with digital transmission in a 900-MHz phone, the Escort 9000 achieves up to four times

the range of conventional, 46–49-MHz cordless phones and has the added advantages of clarity and security. Conversations are digitized and encoded between the base and the handset; the phone features more than 100,000 digital security codes. In addition, the voice data "hops" over 100 channels Other features include a concealed handset antenna, 3 ways to mount the handset in the base (upright, horizontal, or wall mount), user-replaceable battery, and handset-speaker volume control.

The Escort 9000 costs $399. For additional information, contact Cincinnati Microwave, Inc., 5200 Fields-Ertel Road, Cincinnati, OH 45249; Tel: 800-433-3487. ■

CIRCLE 112 ON FREE INFORMATION CARD

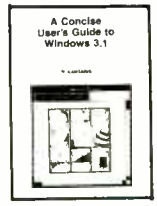
One match can burn 3,000,000 trees.

A Public Service of This Magazine & The Advertising Council

www.americanradiohistory.com

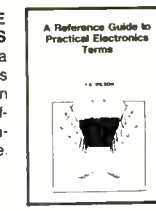
Electronic Paperbacks at Special Prices

☐ **BP325—A CONCISE USER'S GUIDE TO WINDOWS 3.1 . . . . $7.95.** Come to grips with Windows 3.1 in the shortest and most effective way. Learn how to manipulate Windows screens and DOS by Windows graphics interface. Master its word processor, Paintbrush and data base along with Notepad, Macro Recorder, PIF Editor, and Calculator.



☐ **BP311—AN INTRODUCTION TO SCANNERS AND SCANNING . . . . $7.95.** Radio scanners have opened a realm of exciting radio listening. Understand radio wave propagation, types of transmissions, antennas, band assignments—the straight dope on what to hear and where to hear it! Comes complete with index, glossary of important terminology.

☐ **BP287—A REFERENCE GUIDE TO PRACTICAL ELECTRONICS TERMS . . . . $8.95.** More than just a dictionary of practical electronics terms, the book goes a step further in getting down to fundamentals. A reference volume that can be read casually by a reader seeking knowledge.



☐ **BP248—TEST EQUIPMENT CONSTRUCTION ..... $5.95.** Details construction of simple, inexpensive, but extremely useful test equipment. AF Gen, Test Bench Ampl, Audio Millivoltmeter, Transistor Tester and six more.

☐ **BP267—HOW TO USE OSCILLOSCOPES AND OTHER TEST EQUIPMENT ..... $6.95.** Mastering the oscilloscope is not really too difficult. This book explains all the standard controls and functions. Other equipment is also described.

☐ **BP265—MORE ADVANCED USES OF THE MULTIMETER . . . . $5.95.** Use these techniques to test and analyze the performance of a variety of components. Also see how to build add-ons to extend multi-meter capabilities.

☐ **BP256—INTRO TO LOUDSPEAKERS AND ENCLOSURE DESIGN ..... $5.95.** We explore the variety of enclosure and speaker designs in use today so the reader can understand the principles involved.

☐ **BP298—A CONCISE INTRODUCTION TO THE MACINTOSH SYSTEM AND FINDER. . . $6.25.** If you have one of the popular Macintosh range of computers, this book is designed to help you get the most from it. Although the Mac's WIMP user interface is designed to be easy to use, much of it only becomes clear when it is explained in simple terms. All Macintosh computers are covered including the new "Classic" range.

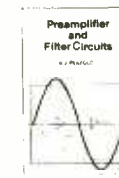
☐ **BP299—PRACTICAL ELECTRONIC FILTERS ..... $6.95.** Presents a dozen filter-based practical projects with applications in and around the home or in the constructor's workshop. Complete construction details are included.

☐ **BP249—MORE ADVANCED TEST EQUIPMENT CONSTRUCTION . . . . $6.95.** Eleven more test equipment construction projects. They include a digital voltmeter, capacitance meter, current tracer, etc.

☐ **BP245—DIGITAL AUDIO PROJECTS ..... $5.95.** Practical circuits to build and experiment with. Includes A/D converter, input amplifier, digital delay line, compander, echo effect and more.

☐ **BP247—MORE ADVANCED MIDI PROJECTS ..... $5.95.** Circuits included are a MIDI indicator, THRU box, merge unit, code generator, pedal, programmer, channelizer, and analyzer.

☐ **BP257—INTRO TO AMATEUR RADIO . . . . $6.95.** Amateur Radio is a unique and fascinating hobby. This book gives the newcomer a comprehensive and easy to understand guide to the subject.



☐ **BP309—PREAMPLIFIER AND FILTER CIRCUITS ..... $6.95.** Provides circuits and background info for a range of preamplifiers, plus tone controls, filters, mixers and more. All are high-performance circuits that can be built at a reasonable cost.

☐ **BP303—UNDERSTANDING PC SOFTWARE ..... $6.95.** This book will help you understand the basics of various types of business software in common use. Types of software covered include word processors, spelling checkers, graphics programs, desktop publishing, databases, spreadsheets and utilities.

☐ **BP251—COMPUTER HOBBYISTS HANDBOOK . . . . $8.95.** A wrapup of everything the computer hobbyist needs to know in one easy to use volume. Provides a range of useful reference material in a single source.

☐ **PCP115—ELECTRONIC PROJECTS FOR HOME SECURITY . . . . $10.00.** 25 projects ranging from a single-door protection circuit that can be completed in an hour or two, to a sophisticated multi-channel security system. Each project is described in detail with circuit diagrams, explanations of how it works, instructions for building and testing, and how to adapt circuits to meet special requirements.

☐ **BP190—ADVANCED ELECTRONIC SECURITY PROJECTS.....$5.95.** Includes a passive infra-red detector, a fiber-optic loop alarm, computer-based alarms and an unusual form of ultrasonic intruder detector.

☐ **BP235—POWER SELECTOR GUIDE . . . . $10.00** Complete guide to semiconductor power devices. More than 1000 power handling devices are included. They are tabulated in alpha-numeric sequence, by technical specs Includes power diodes, Thyristors, Triacs, Power Transistors and FET's.

☐ **BP234—TRANSISTOR SELECTOR GUIDE.....$10.00.** Companion volume to BP235. Book covers more than 1400 JEDEC, JIS, and brand-specific devices. Also contains listing by case type, and electronic parameters. Includes Darlington transistors, high-voltage devices, high-current devices, high power devices.

☐ **BP117—PRACTICAL ELECTRONIC BUILDING BLOCKS—Book 1.....$5.75.** Oscillators, Timers, Noise Generators, Rectifiers, Comparators, Triggers and more.

☐ **BP195—INTRODUCTION TO SATELLITE TV..... $9.95.** A definitive introduction to the subject written for the professional engineer, electronics enthusiast, or others who want to know more before they buy. 8 × 10 in.

☐ **BP179—ELECTRONIC CIRCUITS FOR THE COMPUTER CONTROL OF ROBOTS ..... $7.50.** Data and circuits for interfacing the computer to the robot's motors and sensors.

☐ **BP239—GETTING THE MOST FROM YOUR MULTIMETER..... $5.95.** Covers basics of analog and digital meters. Methods of component testing includes transistors, thyristors, resistors, capacitors and other active and passive devices.

☐ **BP97—IC PROJECTS FOR BEGINNERS.....$5.50.** Power supplies, radio and audio circuits, oscillators, timers, switches, and more. If you can use a soldering iron you can build these devices.

☐ **RADIO—100 RADIO HOOKUPS.....$3.00.** Reprint of 1924 booklet presents radio circuits of the era including regenerative, neutrodyne, reflex & more.

☐ **BP42—SIMPLE LED CIRCUITS..... $5.50.** A large selection of simple applications for this simple electronic component.

☐ **BP122—AUDIO AMPLIFIER CONSTRUCTION . . . . $5.75.** Construction details for preamps and power amplifiers up through a 100-watt DC-coupled FET amplifier.

☐ **BP92—CRYSTAL SET CONSTRUCTION..... $5.50.** Everything you need to know about building crystal radio receivers.

☐ **BP255—INTERNATIONAL RADIO STATIONS GUIDE . . . . $7.95.** Provides the casual listened, amateur radio DXer and the professional radio monitor with an essential reference work designed to guide him or her around the more than ever complex radio bands

CHECK OFF THE BOOKS YOU WANT

ELECTRONIC TECHNOLOGY TODAY INC.
P.O. Box 240, Massapequa Park, NY 11762-0240

Name _____

Address _____

City _____ State _____ Zip _____

PE294

SHIPPING CHARGES IN USA AND CANADA

$0.01 to $5.00	$1.50
$5.01 to $10.00	$2.50
$10.01 to 20.00	$3.50
$20.01 to 30.00	$4.50
$30.01 to 40.00	$5.50
$40.01 to 50.00	$6.50
$50.01 and above	$8.00

SORRY No orders accepted outside of USA & Canada

Number of books ordered ☐

Total price of merchandise . . . . $ _____
Shipping (see chart at left) . . . . $ _____
Subtotal . . . . . $ _____
Sales Tax (NY State only) . . . . . $ _____
Total Enclosed . . . . . $ _____

All payments must be in U.S. funds

www.americanradiohistory.com

A Hands-on Electronics® REPORT

ELENCO SP-1 SOLDERING PRACTICE KIT

CIRCLE 119 ON FREE INFORMATION CARD

Learn to how solder the right way with the Elenco Electronics SP-1 Soldering Kit.

The key to successfully completing any electronics project is good soldering skills. Sloppy soldering will most likely cause some kind of circuit failure, whether it be upon initial power up of the device or after it has been functioning for awhile. Surprisingly, beginners in electronics aren't the only people who have trouble soldering, or just have no experience doing it. There are people who have studied lots of electronic theory, but have seldom had their hands on a soldering iron.

That's not a good thing, because soldering is not just for technicians. Certainly any good hobbyist or engineer should be able to put a circuit together or repair one without causing damage. Besides, soldering is an acquired skill that must be mastered if one is to fully enjoy the world of electronics.

If you're one of those people who really need to brush up on your soldering skills, or if you know someone who would like to get into electronics, then the Practical Soldering Project Kit Model SP-1 from Elenco Electronics, Inc. (150 W. Carpenter Ave., Wheeling, IL 60090; Tel. 708-541-3800) is worth taking a look at. It's a simple project that exposes the builder to various soldering techniques. While the project's warbling alarm and flashing LED's might not be something everybody needs, it might be the perfect first-time electronic project for any soon-to-be enthusiast. Especially at the low price of $8.25.

Shorts, Bleeps, and Blunders. We know from years of experience that most circuit failures are caused by bad soldering. Certainly that's the culprit a lot more often than a defective component. When a project doesn't work, the first thing to look for is poor solder connections; next, wiring mistakes; and then defective components. So what exactly are bad solder joints?

The most common soldering error is a short. Solder just loves to "jump" over to other solder or nearby foils. Sometimes those shorts are very noticeable "blobs," and other times they are hairline shorts that are very difficult to find and hard to see with the naked eye. That's why good soldering can save you hours of troubleshooting.

You've probably read at one time or other in this magazine to check for "cold-solder joints." A cold-solder joint is just what it sounds like: the solder wasn't hot enough when applied to properly adhere to and bond with any surfaces. The joint will usually appear to be dull. Quite often a joint like that will function for awhile and then fail, which is more of a pain in the neck than an immediate failure. Avoiding cold solder joints will help prevent premature breakdown.

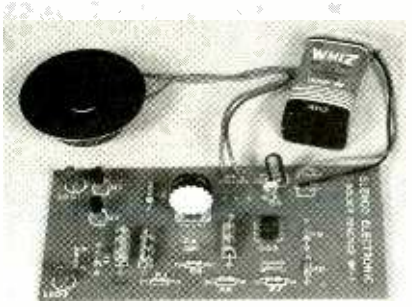
Too much heat when soldering causes other problems. For example you can overheat a pad right off a PC board. Then you can botch things up further in an attempt to repair the damage. A pad on a printed-circuit board can usually be reheated many times over, but only for brief periods. It's just one of those things where practice makes perfect.

The SP-1. So, sometimes solder is too hot, sometimes too cold, and other times it's just right. Let's see what the SP-1 Soldering Practice Kit has to offer to help you heat your solder just right every time.

As mentioned, the SP-1 circuit is a warble alarm with flashing LED's. The kit is like any other, except that the manual places more emphasis on soldering technique than it does on the circuit itself. More than two thirds of the manual are devoted to explaining the steps involved in proper soldering.

Practice pads are provided on an unpopulated area of the PC board. They allow the builder to try out the soldering hints before beginning construction on the actual circuit. Large and small test pads are included, as

www.americanradiohistory.com



The assembled unit will warble and flash to let you know you've done everthing just right. It's a great incentive for kids to complete the project.

well as tack-soldering pads. The larger pads give the builder a feel for the amount of heat required for soldering large areas, while the small, closely spaced pads provide practice for avoiding shorts.

The rest of the PC board—the functional part—is also well-designed for soldering practice. Most of the traces and pads are spaced to provide plenty of room. The only exception is the area for a 555 timer IC, which has standard 0.1-inch spacing.

Not only does the SP-1 provide soldering practice, it also teaches the builder all other aspects of kit building. The first thing a builder must do is identify the parts, and the kit does have a handful of parts that have to be identified by their appearance, color codes, or other markings. Some information has to be obtained from the parts list, which teaches the builder to consult that valuable source of documentation. Finally, some of the components (such as the IC) have to be installed with a certain polarity, which helps familiarize the builder with such components.

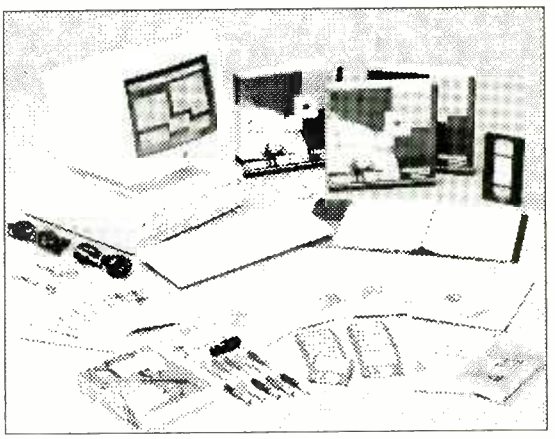
You Can't Lose. In all, the SP-1 provides a good introduction to kit-building for the beginner, but it doesn't introduce the pressure of getting some fancy gadget to work. Once completed, should there be any problems in getting the circuit to work, a brief troubleshooting section is included. For anyone who would someday like to build very complicated projects or repair intricate circuitry, the Elenco SP-1 is a good place to start. If you think so too, or just want more information, contact Elenco directly, or circle No. 119 on the Free Information Card. ■

Heathkit Heathkit Heathkit Heathkit Heathkit

PC Servicing

Now, a Quality, Affordable, and Value-Packed Course

A Heathkit Exclusive. We deliver a true multi-media learning adventure. Not only do you get a better computer, but you get the only Computer-Aided Instruction software available as part of a self-study course.



What You'll Learn:

- PC Upgrading and Maintenance
- Preventive Maintanence Procedures
- How to Identify and Repair Problems
- Installing Memory, Drives, Expansion Boards, Microprocessor Upgrades
- How to Configure for Performance
- MS/DOS® & Windows®

And Learn About Computers at the Electronics Level:

- DC Electronics
- AC Electronics
- Semiconductor Devices
- Electronic Circuits
- Digital Techniques
- Microprocessor Programming

Compare this course with any others. You'll find that Heathkit offers you 2 -3 times the value and quality of education. Many additional courses are available for TV, VCR, Camcorder Servicing, Electronics, etc.

•Heathkit Educational Systems •455 Riverview Drive •Benton Harbor, MI 49023-1288

For a Full-Line Catalog of Electronics Courses, call 1-800-44-HEATH
When calling, please mention this code: 107-021

CIRCLE 155 ON FREE INFORMATION CARD

Whether you wish to save money, boldly go where no guitarist has gone before or simply have fun building electronic gadgets designed for your musical pleasure, then read

Electronic Projects for GUITAR

$12.95

Some of the add-on guitar gadgets you can build are:

Preamplifier • Headphone Amplifier • Soft Distortion Effects Unit • Compressor • Auto-waa • Waa-waa Pedal • Phaser • Dual Tracking Effects • Distortion Unit • Expander • Dynamic Treble Booster • Direct Injection Box • Dynamic Tremelo • Thin Distortion Unit • and Guitar Tuner.

Anyone with some previous electronic project building experience should have no problem assembling the projects.

ELECTRONICS TECHNOLOGY TODAY INC.
P.O. Box 240, Massapequa Park, NY 11762-0240

Yes, send my copy of ELECTRONIC PROJECTS FOR GUITAR by RA Penfold to the address at right. I am enclosing $12.95 plus $2.95 for shipping charges in USA and Canada. All payments must be made in US funds. Sorry, no orders accepted outside of USA and Canada. New York State residents add local sales tax. Allow 6-8 weeks for delivery.
☐ Check enclosed.

Please charge my ☐ Visa ☐ MasterCard
Signature _____
Account No. _____ *Expir. Date* _____
Name _____
Address _____
City _____ *State* _____ *ZIP* _____

www.americanradiohistory.com

PRODUCT TEST REPORTS

By Len Feldman

Kodak Model PCD 5870 Photo-CD Player

When Sony and Philips introduced compact discs more than a decade ago, they made it clear that the storage capacity of these optical discs could be used for many other purposes besides musical recording and playback. Since then, we have seen the emergence of CD-ROM (for use with computers) CD-I (or CD Interactive), CD-V (short video clips plus audio-only music), and CD-G (CD plus graphics), to name but a few formats.

Perhaps one of the most novel uses to which CD's have been put is for storaging ordinary photo prints or slides. Kodak, the originators of this technology, call such discs "Photo CD's." This month, we will take a look at one of Kodak's line of Photo-CD players, the model PCD 5870.

CIRCLE 120 ON FREE INFORMATION CARD

The Kodak PCD 5870 Photo CD player plays both Photo CD's and conventional audio CD's.

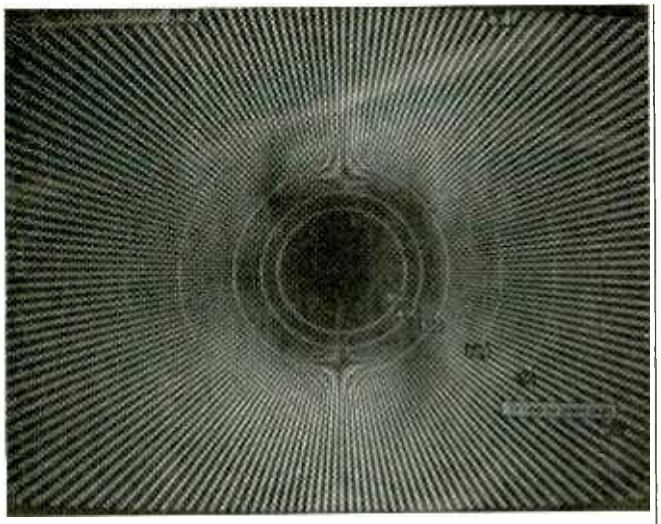
The Kodak PCD 5870 is a "carousel" player that will accommodate five audio or photo CD's at once. Photo CD's and audio-only CD's can be intermixed and the player is able to identify which is which, but that's only the beginning. The features associated with this photo-CD player are incredible. You can frame a portion of a viewed picture and then enlarge it. You can pan from left to right or up and down on a given picture or show the entire picture on screen, surrounded by a black border. Pictures can be changed automatically at 2-, 4- or 8-second intervals, or you can change them manually at your own pace. You can teach the machine to insert certain pictures in an out-of-numerical-order sequence, and every time that disc is played, the machine will display the pictures in the sequence you've requested. You can rotate pictures on screen, clockwise or counterclockwise—a handy feature for those photos that were taken with the camera rotated 90 degrees. You can have the machine skip certain photos on a disc (e.g. shots that were out of focus or poorly lighted) and have the machine skip those same shots every time that the disc is played. Once you've done all these things to a disc, your selections are memorized in the machine in what's called an FPS (favorite picture selection) program, and the machine will play those pictures in the order selected, as edited or cropped, and so forth. (Of course, since the FPS list is stored in the player, if the same disc is played in another machine, the picture display will revert to normal.) An on-screen display can be brought up to show you the status of a given disc and, when you first load one or more discs into the player, your connected TV set shows which "slots" are empty, which contain photo CD's, and which contain audio-only CD's.

CONTROLS

Pushbuttons on both the player and the supplied remote control are of three types: those used in the photo-CD mode only, those used in the audio mode only, and those that are used either in photo-CD or audio modes. A power on/off switch is found at the lower left of the front panel. Above it are an open/close button for the disc tray, a play button, previous and next (track or photo) buttons, a pause button, and a stop button.

A display area is centered near the top of the front panel. It shows the current and next photo numbers (or, in the case of audio CD's, track number and time elapsed), disc-tray status (how many discs are loaded into the five available slots), and other useful audio or picture-status information, depending upon which type of disc is currently being played or shown.

www.americanradiohistory.com



The horizontal video resolution measured 330 lines, which is the maximum one can expect from broadcast TV under ideal conditions.

To the right of the display area are the FPS button, an autoplay button (used only with photo CD's), a shuffle-play button (used only with audio CD's to randomize track selection), scan and repeat buttons (that work for both types of discs), fast-search buttons (used with audio discs), a reverse button (for showing pictures in reverse order), and a pair of disc-selection buttons. A stereo phone jack at the lower right corner completes the front panel layout.

The rear panel of the Kodak PCD-5870 is equipped with video and left and right audio-output jacks, as well as with an S-video connector for use

TEST RESULTS—KODAK PCD 5870 PHOTO-CD PLAYER

Specification	Manufacturer's Claim	PE Measured
Video Section		
Horizontal resolution	325 lines	330 lines
Video signal-to-noise		
Red field chroma AM/PM	N/A	72.5/58.8 dB
Luminance (re: 100 IRE)	N/A	62.9 dB
Audio Compact-Disc Section		
Output level	2.0 volts	2.142 volts
Signal-to-noise ratio	95 dB	95.2 dB
Max. deemphasis error	N/A	–0.19 dB
Harmonic Distortion		
1 kHz/10 kHz/16 kHz	0.008% (1 kHz)	0.0048/0.0122/0.22%
Linearity error to –50 dB	N/A	–0.01 dB to +0.03 dB
Frequency response		
20 Hz to 20 kHz	± 0.15 dB	+0.09 dB to –0.2 dB
Additional Data		
Power requirements	15 watts	15.5 watts
Random access time		
Track 1 to 21	N/A	1.66 seconds
Track 20 to 21	N/A	0.72 seconds
Scan time		
Track 1 to 21	N/A	1.26 seconds
Track 21 to 1	N/A	3.32 seconds
Dimensions		
(H × W × D, inches)	4.7 × 17.1 × 15.0	Confirmed
Weight	N/A	14.75 lbs.
Suggested retail price	$549.00	

Be a computer repair expert!

CAREER-LEVEL HOME STUDY

Learn PC repairs, troubleshooting, servicing, upgrading, installation. Increase your value as an employee or open your own business. No expensive instruments, no high-tech electronics. Over 90% of PC repairs and service involve easy mechanical procedures or parts replacements. **Send or call for free literature.**

800-223-4542

Name _____ Age_____

Address _____ Phone (___)_____

City_____ State_____ Zip_____

The School of PC Repair

6065 Roswell Road

Dept. JB341 , Atlanta, Georgia 30328

CIRCLE 159 ON FREE INFORMATION CARD

Earn $1000

A Week While You Learn High Paying VCR Repair.

Earn While You Learn . . .

Secrets Revealed . . .

Train at Home

If you are able to work with small hand tools and possess average mechanical ability, you could earn top dollar part time or full time. Our learn by doing method teaches you how to work on VCR's without boring unnecessary electronic basics.

For Free Information Package Send Coupon to:

Foley-Belsaw Institute, 6301 Equitable Road, Kansas City, MO 64120

Check VCR or another High Paying Career Field

FOLEY BELSAW *Since 1926*

(Check One Box Only)

☐ VCR Repair, Dept. **62119**

☐ Computer Repair, Dept. **64029**

☐ Advance VCR Repair, Dept **65016**

☐ Camcorder Repair, Dept. **66026**

☐ Fax Repair, Dept. **67026**

☐ Printer Repair, Dept. **68026**

☐ Digital Electronics, Dept. **69026**

Name _____

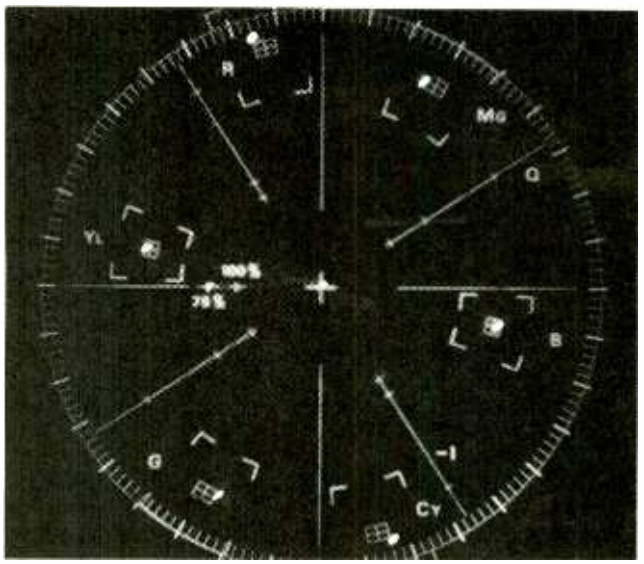
Address _____

City _____

State _____ Zip _____

CIRCLE 154 ON FREE INFORMATION CARD

www.americanradiohistory.com



As this vectorscope photo shows, the color purity was as close to perfect as we have seen on any consumer product.

with TV sets or TV monitors so equipped. For those who own TV sets that do not have composite video and audio inputs of any kind, RF antenna-in and -out connectors are provided. Associated with the RF connectors is a small Channel-3/4 switch that allows you to choose an unused channel in your area.

In addition to duplicating most of the controls on the front panel (with the exception of the open/close button and the power switch), the remote control that comes with this player is used to access some of the special features referred to earlier. For example, there are four pan buttons, a button that permits you to change the interval between photos during autoplay, buttons associated with the various viewing modes, buttons for rotating pictures, and buttons for skipping pictures and for "keeping" the order and viewing mode of the pictures on a given disc. Also included are numeric buttons for direct access to tracks on an audio CD or to picture numbers on a photo CD.

For audio CD's, fast-search buttons are provided as well programming, favorite-track selection, and an A-B button used to select a specific segment of audio to be repeated over and over again. An On Screen Display (OSD) button on the remote activates on-screen messages that provide information about the disc in the player. Finally, a time-edit button allows you to select a length of time to record sound from a disc to tape. shTEST RESULTS The lab measurements made by APEL on this unit involved both video and audio performance. Special test discs supplied by Kodak were used for many of the tests. The horizontal video resolution measured 330 lines, which, coincidentally, is the maximum one can expect from broadcast TV under ideal conditions. The color purity was as close to perfect as we have seen on any consumer product. The AM and PM chroma (color) signal-to-noise ratios measured 72.5 dB and 58.8 dB respectively, or far better than we usually measure for the very best VCR's or videodisc players. The

(Continued on page 91)

FAX DIRECTORY LISTING

COMPANY	FAX NUMBER
Alfa Electronics, Inc.	(609) 275-9536
All Electronics Corporation	(818) 781-2653
Alltronics	(408) 943-9776
A.M.C. Sales, Inc.	(303) 494-4924
Communications Specialists, Inc.	(714) 974-3420
C&S Sales, Inc.	(708) 520-0085
Contact East	(508) 688-7829
Extech Instruments	(617) 890-7864
Howard W. Sams & Company	(317) 298-5604
Interactive Image Technologies Ltd.	(416) 368-5799
Jameco	(800) 237-6948
Kepro Circuit Systems, Inc.	(314) 343-0668
Lake Sylvan Sales, Inc.	(612) 895-9454
M.D. Electronics	(402) 392-0991
Midwest Laser Products	(708) 430-9280
Moody Tools, Inc.	(401) 885-4565
Mouser Electronics	(817) 483-0931
M.M. Newman Corporation	(617) 631-8887
North Country Radio	(914) 576-6051
People's College of Independent Studies	(407) 847-8793
Skyvision, Inc.	(218) 739-4879
Somerset Electronics, Inc.	(407) 773-8097
T.K.A. Electronics	(402) 697-0799
Weka Publishing, Inc.	(203) 622-4187

www.americanradiohistory.com

Popular Electronics® FAX FORM

DIRECT READER/MFR CONTACT

Need data in a hurry?

Don't worry!

Just clip this form carefully along the dotted lines, fill it out (PLEASE PRINT) and fax it to the company of your choice today!

For fastest response, please send directly to manufacturers.

Fax numbers are on the page to the left.

If you need more than one form, please make copies of this original.

Popular Electronics provides this fax form as a service to its readers. A quick response from you indicates your company's willingness to do business with the sender.

Popular Electronics *FAX RESPONSE*

TO: _____
Company Name Fax Number

I urgently need more information about your _____ products.

I saw your products on Page _____ in the _____ issue of **PE**;
(Month/Year)

ADDITIONAL NOTE:

_____

_____

_____

_____

FROM: _____
Sender's Name Title

Company Name: _____

Street _____

City Country _____

Phone Fax _____

We are a(n) ☐ manufacturer ☐ service center ☐ engineering company
☐ R&D center/laboratory ☐ other ( )

Popular Electronics®

500-B Bi-County Boulevard, Farmingdale, NY 11735 Tel: 1-516-293-3000 Fax: 1-516-293-3115

www.americanradiohistory.com

THINK TANK

By John J. Yacono

Displays and Discrepancies

Like last time, this month's letters will present projects that have displays of one sort or other. But before we'll get to them, let's continue discussing some of the little know aspects of the 7400 series.

MIXED OUTPUTS AND INPUTS

Last time out, I mentioned the variety of special inputs and outputs that a logic chip may have. However, what I didn't reveal is that while two chips may have the same designation, they can have different input or output styles. The most common examples are listed in Table 1. Take the 7401, for example. It can come with ordinary open-collector (OC) outputs, 15-volt OC outputs, or low-leakage outputs (see *Think Tank*, January 1994 if you've forgotten the meanings of those terms). With such a chip, the only safe way to determine its output style is to check the chip manufacturer's specifications.

Basically then, what Table 1 shows is that the 7401 comes in 3 output "flavors," the 7402 in 2, the 7403 in 3, the 7405 in 3, and the 7409 in 2. (Frustrating, isn't it?) The 7400 and the 7404 both have totem-pole outputs, but can be purchased with plain or 15-volt inputs (again check the manufacturer's specifications). Furthermore, the confusion doesn't stop there; next month I'll present a whole bunch of 7400-series chips with alternate pinouts. That's enough controversy for one day, let's get to the letters.

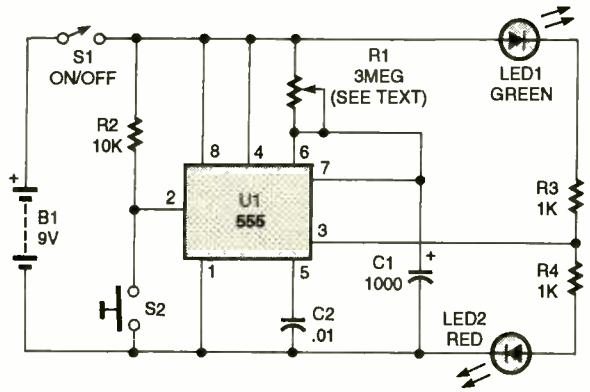


Fig. 1. Smokers trying to quit might find this device useful, provided they're more willing to listen to it than there own conscience.

ELECTRONIC WILLPOWER

Do you know any smokers that are trying to cut down or quit? Here's a simple circuit, essentially a monostable 555-timer circuit that may help (see Fig. 1). In use, the green LED indicates "go ahead and have one," but the red LED means "don't even think about it." When the indication changes from red to green, just push the momentary switch to start the timing cycle over again. The circuit gives a certain finality to the "smoke/don't smoke" decision process; electrons, after all, have immense willpower!

Potentiometer R1 is used to adjust the time period. When R1 is set at maximum resistance (1 megohm), the time is about 25 minutes. If R1 is set at 2 megohms, the time is 55 minutes. If R1 is set at 3 megohms, the period is 90 minutes. I used a 3-megohm potentiometer for R1 to make the timing adjustable. Since the 555's output can sink or source current, both LED's are controlled by the chip's output. With a little creativity, a single dual-color LED can be used too! Other uses for the circuit include timing for slowpoke chess tournaments, and hardboiling ostrich eggs.

—Nick Cinquino, Schaumburg, IL

What a coincidence, I was in the middle of boiling an ostrich egg when I got your letter! Seriously, I like the circuit, and I'm sure it has many uses.

Those wishing to use a dual-color, two-lead LED should short the connections for LED1 and LED2, and insert the new LED between pin 3 and the junction of R3 and R4.

LED FLASHER

This circuit (see Fig. 2) provides a low-cost way to

TABLE 1—MORE THAN ONE INPUT OR OUTPUT STYLE

Chip	Totem Pole Outputs	Plain OC Outputs	6.5V OC Outputs	15V OC Outputs	Low Leakage OC Outputs	15V Inputs
7400	•					•
7401		•		•	•	
7402	•		•			
7403		•		•	•	
7404	•					•
7405		•		•	•	
7409		•		•		

www.americanradiohistory.com

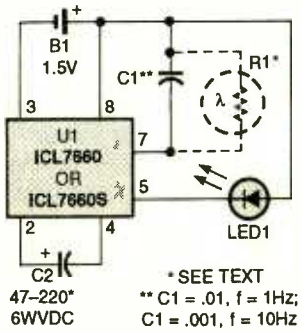


Fig. 2. Need a flashy LED display? This one is inexpensive, very portable, and sparing on batteries.

flash an LED from a single 1.5-volt source. Based on the ICL7660 DC-to-DC voltage converter, the circuit makes use of an external capacitance (C1) on the oscillator rate-control pin to decrease the charge/dump time to the desired flash rate. A DC resistance (R1) on the same pin can also be used to disable the oscillator and extend the power-cell's life. That optional DC resistance (in the form of a photoconductive cell) will shut off the oscillator in daylight.

The component values are not critical. Timing capacitor C1 determines the flash rate. Capacitor C2 determines the charge transferred to the LED and thus determines the flash brightness and duration. Photocell R1 should have a dark resistance in excess of 15 megohms. That can be facilitated by painting the photocell window with dark paint. A series resistor (2 to 10 megohms) can be used with the photocell to implement light-sensitive flash-rate modulation. For best results, use a high-brightness LED and keep the value of C2 to less than 220 µF.

—Brian McKean, San Diego, CA

I can think of two good uses for the circuit right away. One, if placed at strategic points around the home, a set of them could make excellent light beacons for late night trips to the kitchen or bathroom. Second, one would make an eye-catching fake car alarm to scare would-be theives.

nine and counts down to zero with each clock pulse. When the counter hits zero, the output from the 74193 goes low, turning off the relay and the light. The light can be turned back on by pressing the reset button again.

The binary output from the 74193 can be seen on an LED 7-segment display when it is connected to the input of a 7447 seven-segment decoder/driver and the output of the 7447 is connected to the display.

Before starting the timed

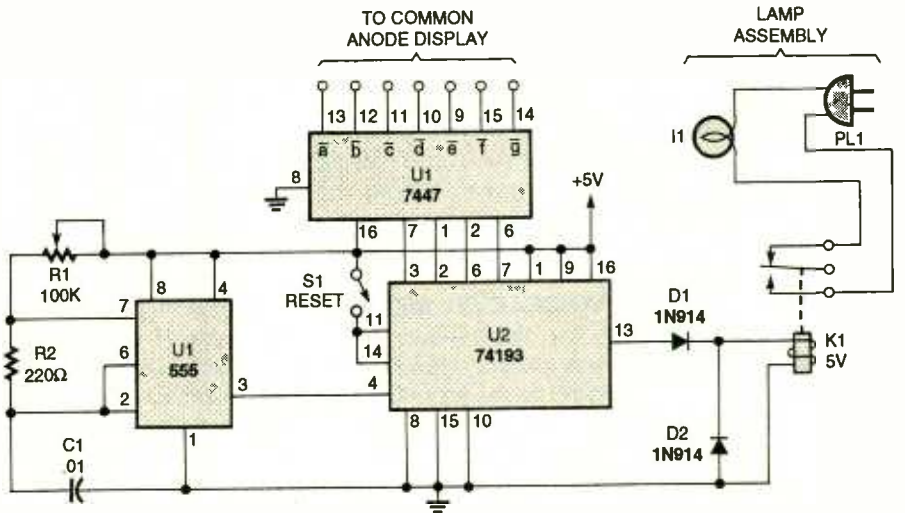


Fig. 3. I'll be using this count-down to lights-out timer in my own workshop. It certainly can be modified for wide versatility in a number of other applications.

LIGHT TIMMER

Have you ever awakened in the middle of the night to find that your roommate has fallen asleep with a book on his chest, and the light is still on? Well, I have; and during one of the many trips to the other side of the room, I realized that a simple timed switch would be a great way to keep from having to shut the light off for my roommate.

The timed switch (see Fig. 3) uses a 555 oscillator/timer wired to operate in the astable mode. The timer supplies a positive pulse to the clock input of a 74193 4-bit binary up/down count every five minutes. Since the 74193 is set to operate in the count-down mode, the output of the 555 is connected to the count-down input of the 74193.

As the binary counter is reset, it starts counting at

43,216
ELECTRONIC COMPONENTS
Whether you order 1 part or all 43,216...MOUSER stocks and...*ships same day!!*
CALL...
(800) 992-9943
for your FREE CATALOG
2401 Hwy. 287 N.
Mansfield, TX 76063
MOUSER®
ELECTRONICS
Sales & Stocking Locations Nationwide
CIRCLE 163 ON FREE INFORMATION CARD

www.americanradiohistory.com

switch, the 555 should be adjusted, via R1, to emit a pulse every five minutes from its output at pin 3. As the circuit is set up, the switch will be on for 45 minutes (five times nine) when the 555 has an interval of five minutes between each pulse. To set different total times, adjust the 555 to any time, measure how much time it takes to go through one cycle, and multiply the time by nine.

Extra digits can be added by using the same 74193/7447 configuration and tying the borrow output from the first 74193 to the count-down input of the second 74193. The output to the relay would come from the output of the second 74193. Remember that the first 74193/7447 configuration will be the ones digit and the second will be tens digit.

Since the timed switch has only a few parts, it can be placed into a small enclosure and fastened directly onto most small bed lamps.

—David Markun, Jociet, IL

This circuit is going into my workshop. When I transport parts out of my attached garage so I can work indoors at night, I almost always forget to shut the light after the last trip. This timer would do that for me and give me an indication of how many more trips I could make for those last-minute items as my work progresses.

VOICE-LEVEL METER

The circuit shown in Fig. 4 was specially designed to indicate the sound level of a student speaking in a classroom in order to help an English teacher obtain the same volume from each student. It consists mainly of a 10-LED VU meter, a microphone, and a preamp to improve its sensitivity. It is very, very easy to build.

When switch S1 is closed, it supplies power to the circuit, and LED1 (if used) will indicate that the power is on. Transistor Q1 and Zener diode D3 make up a 5-volt regulator from which an electret microphone and 10 LED's derive their power.

The microphone picks up sound and produces an audio signal that is fed to the non-inverting input (pin 3) of U1-a, the first half of a dual low-noise operational amplifier (type TL072), through a 0.022-µF ceramic capacitor. The output signal of U1-a is passed to 10k linear potentiometer R17, the level control. Now, the audio signal is coupled through R8 and C6 to the input (pin 5) of U1-b, the other half of the amplifier IC. Using the actual values shown in the circuit, the voltage gain of the first stage will be about 69, and the second stage will be approximately 213, making a total voltage gain that is very high indeed.

The audio signal at pin 7 of U1-b is rectified by D1 and D2, and the resulting DC voltage is filtered by C9 and then applied to pin 5 of U2, an LM3915 bargraph VU-display driver. The cathode leads of the 10 LED's are connected directly to pins 1 and 10–18 of the LM3915, while their anodes are all connected to +5 volts. The pulsating DC voltage on pin 5 of U2 varies from 200–1500 mV, and is proportional to the level of the sound picked up by the electret microphone. So, the 10-LED bargraph driven by the outputs of U2 will give the user a reasonably exact idea of the sound variation. For a more informative display of the voice level, you should use green LED's for LED2–LED6, yellow LED's for LED7–LED9, and red LED's for LED10 and LED11.

To set the unit for the correct sensitivity, the teacher should ask a student to read some text at a normal voice level, and then adjust R17 so that the indication ranges from the first to the third yellow LED. Once the correct setting is found, there's no need for further adjustment; the unit is ready for use.

—Evandro Luiz Duarte Madeira, Contagem, Brazil

Wow, that's some design work.

Well, those are the letters for this month. Remember to write to *Think Tank*, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735, if you want your circuits to appear here and to receive a *Think Tank II* book. ■

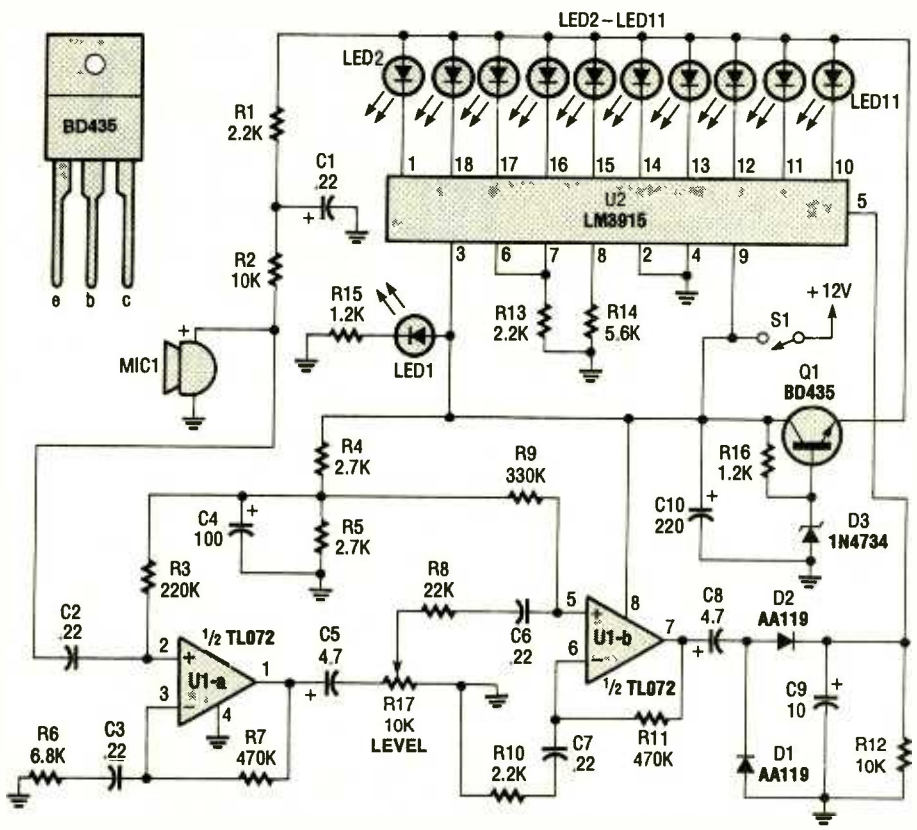


Fig. 4. This volume meter can be handy anywhere you need to measure the relative sound level in a room. It is readily adjustable to increase its usefulness.

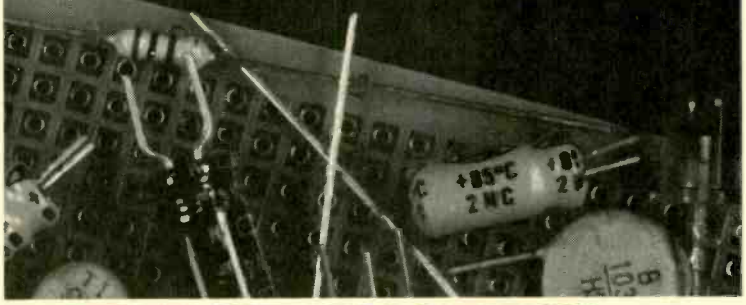
www.americanradiohistory.com

Select any 5 books for only $4.95

(values to $175.70)

plus 1 BOOK FREE upon prepayment

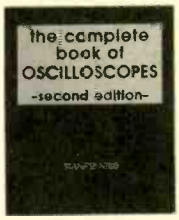
when you join the Electronics Book Club®



1367P $29.95
Softcover

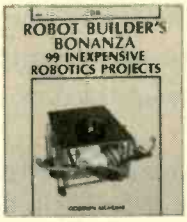
3671P $18.95
Softcover

2790P $15.95
Softcover

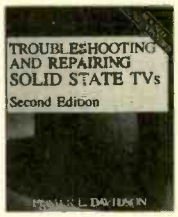


3825P $17.95
Softcover

2613P $18.95
Softcover



2800P $17.95
Softcover

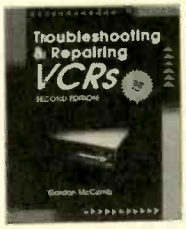


3700H-XX $36.95
Counts as 2

3765P $18.95
Softcover

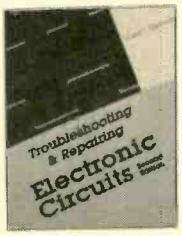
3374P $16.95
Softcover

4269H $29.95

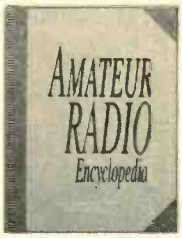


3777H-XX $32.95
Counts as 2

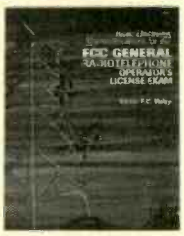
3485H $27.95



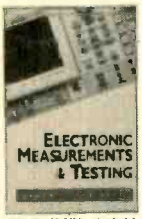
3258P $19.95
Softcover



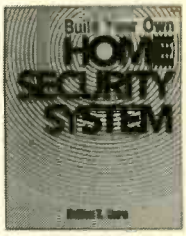
4213H-XX $50.00
Counts as 2



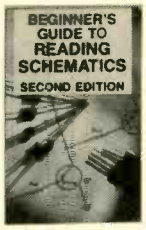
4055H-XX $34.95
Counts as 2



003951H-XX $40.00
Counts as 2

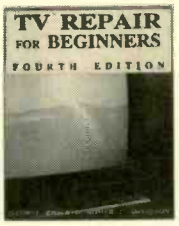


4139P $14.95
Softcover

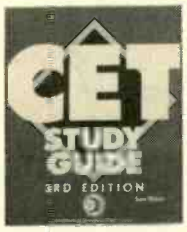


3612P $10.95

4231H $19.95

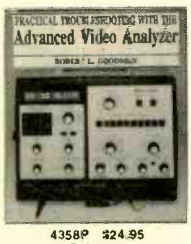


3627P $19.95
Softcover



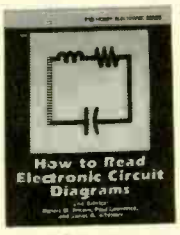
4076H $27.95

3975H $29.95



4358P $24.95
Softcover

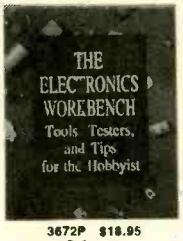
3279P-XX $24.95
Counts as 2/Softcover



2880P $15.95
Softcover

4111H $27.95

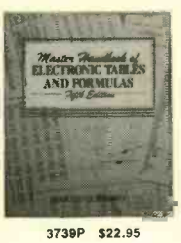
4270H $29.95



3672P $18.95
Softcover

4227H $24.95

3795P $19.95
Softcover



3739P $22.95

As a member of the Electronics Book Club . . .

. . . you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off of regular publishers' prices. If you want the Main Selection do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. And you'll be eligible for *FREE* Books through the Bonus Book Program. Your only obligation is to purchase 3 more books during the next 12 months, after which you may cancel your membership at any time.

A shipping/handling charge and sales tax will be added to all orders. All books are hardcover unless otherwise noted. (Publishers' prices shown) If you select a book that counts as 2 choices, write the book number in one box and XX in the next.

©1994 Electronics Book Club PE294

If card is missing, write to: Electronics Book Club, Blue Ridge Summit, PA 17294-0810

Your most complete and comprehensive source for the finest electronics books.

www.americanradiohistory.com

ATTENTION

PUBLIC SAFETY ANNOUNCEMENT

Tampering with Motorola's Communication Technology is Nothing Short of a Crime.

Motorola has been at the forefront of communications technology for more than 60 years. Today, we offer a greater array of communications products than ever before. We are proud of our products and the vital services they bring to our customers which are of unparalleled public importance.

Theft of communications services and so-called High-Tech piracy threaten the entire communication industry's reputation for reliability. This conduct not only damages the reputation of Motorola, Inc. and the communications industry, but undermines the very integrity of America's public and private communications services.

Motorola intends to combat this conduct by aggressively maintaining and enforcing its proprietary rights to its hardware and software technology. Anyone who has knowledge of illegal activities or has questions concerning such activities is urged to contact Motorola Inc. immediately at 1-800-325-4036. Contacts will be kept confidential and may be made anonymously.

MOTOROLA

Ⓜ and Motorola are trademarks of Motorola, Inc., © 1993 Motorola, Inc.

www.americanradiohistory.com

Step Up to CD-ROM

Catch a CD-ROM drive—coming to a PC near you!

BY MARC SPIWAK

If you're the proud owner of a fire-breathing (read that powerful) PC, but you haven't yet installed a CD-ROM (Compact Disc Read-Only Memory) drive in it, then it's time to consider getting one. Even if the thousands of reference and multimedia applications don't interest you, the fact that many future multi-megabyte software packages will be available only on CD-ROM might force you to get a drive. In addition, many software packages are already available on both floppy disk and CD-ROM. The CD-ROM versions are generally preferable, because bulky items (such as clip art and help files) can be left off your hard disk, saving you many valuable megabytes.

CD-ROM is going to catch up to all of us, and soon. The reasons for that are numerous, but the main one—and one that's not by choice—is that software keeps on growing and Growing and GROWING in size. Many software packages now require ten or more distribution diskettes, and those disks cost money. Depending on the number of copies produced, and the size of the package, it can actually be cheaper to distribute software on CD-ROM, which can cost less than $2.00 apiece to manufacture in bulk. In addition, many individual software packages can be bundled on one disk. That will surely lead to some interesting marketing tactics, and better values for consumers. Also, disk errors are much less likely to occur on one CD-ROM than on several floppies.

There are many other reasons for CD-ROM's growing popularity. For the manufacturer, there's less bulk, which means lower packaging and shipping costs. There's also better copy protection, because you can't simply copy a CD-ROM for a friend—not yet anyway. CD-ROM also benefits the user by eliminating the need for disk swapping when installing software. Last, but certainly not least, CD-ROM drives are getting cheaper and faster, with entry-level drives available for about $200. The cheaper the drives get, the more drives end up in user's hands, and the more discs will be sold. The more discs sold, the cheaper they will get, and so on, until CD-ROM drives are as popular as floppy drives. It's just a matter of time before every new PC, or workstation if you prefer, comes with a CD-ROM drive.

Mass Storage. A CD-ROM's storage capacity of 680 megabytes makes it the perfect choice for distributing tons of data. Entire encyclopedia and dictionary volumes fit on one disc. Telephone books are available on CD-ROM, and one set of discs contains every phone number in the country. That uses up much less space, paper, or (more important) trees than the equivalent number of paper phone books.

Although the capacity of a CD-ROM may be impressive, the real beauty of using a CD-ROM lies in the computer's swift searching capabilities. With an encyclopedia on CD-ROM, you could have your computer search for every occurrence of the word "shoe," for example—or anything else you want to look up. You'll have the information at your fingertips in a matter of seconds. Imagine how long it would take to search visually through several encyclopedia volumes for the word "shoe."

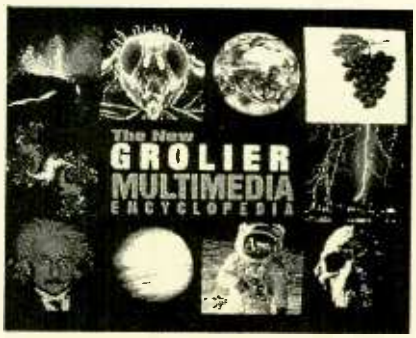
Depending on the disc, CD-ROM's can cost tens or hundreds of dollars. However, when you consider that their paper-bound counterparts can cost thousands of dollars (sets of encyclopedias and dictionaries do cost that much), they can be a bargain.

While resource discs are the librarian's "knights in shining armor," some of the most impressive CD-ROM discs are the multimedia titles. Such discs combine audio, video, and graphics to create new kinds of computing experiences. While nearly any computer can be used as a search engine for a reference CD-ROM, you'll need at least a 386 SX (for level 1 compatibility; more on that later)—but more realistically a 486—and one of the newer, faster CD-ROM drives to squeeze the most out of the multimedia titles. You'll also need some kind of sound card if you don't want to be confined to a pair of headphones.

Formats. There is a lot of confusion as to which type of CD-ROM can be read in which drive, and which drive is suitable for so-called "MPC" applications, and so on. Let's try to cut through the confusion and explain what the different formats are.

To begin with, there are "book" specifications for CD's. These specifi-

www.americanradiohistory.com



The New Grolier Multimedia Encyclopedia *CD-ROM contains 33,000 articles. It has 3000 color and black and white images, audio clips, maps, timelines, and so on. Also included are various animations and video clips.*

cations lay down the basic rules of how information is stored and laid out on a CD. For example, all CD-ROM drives can play plain audio CD's; they are of the Red Book format.

The basic standard for all CD-ROM's is the ISO 9660 or the Yellow Book specification. Any CD-ROM drive can read an ISO 9660-spec disc, of which there are thousands of titles in circulation.

Philips' effort to interleave text, sound, and video on a CD led to the Green Book specification, or CD-I (which stands for CD interactive). The only way to be completely compatible with all CD-I discs is to buy one of Philips' home CD-I players. However, CD-I compatibility should not be a concern when buying a CD-ROM drive (at least not for the moment).

The CD-ROM XA (for Extended Architecture) spec, while not very popular yet, is basically CD-I with audio compression and interleaved text, audio, and video. The audio compression allows storage of 16 hours of audio, versus about the 72 minutes of a Red Book CD. Even though CD-ROM XA is based on CD-I, an XA drive may not be able to read CD-I discs. But, as we said, CD-I compatibility should not be a concern yet.

Because the information on an XA disc must be decoded differently than on a regular CD-ROM, a drive must be specifically stated as being XA-compatible in order to read an XA disc. There are many CD-ROM XA drives on the market, and XA-compatibility is rapidly becoming important.

The Orange Book spec applies to CD-R, or recordable CD's. Yes, there are several CD recorders now on the market that let you make your own CD's but the blank discs can cost $40 apiece. Many of these CD-R systems can be had for under $10,000. While that price might be out of your reach, companies that continually have to store vast amounts of data might be able to justify it. Software companies wanting to make beta copies of new CD-ROM's also find such prices reasonable. Like everything else in the computer business, the prices are sure to come down to more affordable levels in the future.

Which brings us to the concept of single- and multi-session discs. When a CD-ROM is manufactured, only one directory is written to the disk, making it a "single session" disc. However, if you were to record, say, 100 megabytes onto a CD-R disc in one session, and another 100 megabytes in another, there would be two directories written on the disc, and it would then be called a "multisession" disc. To then read such a disc, you would need a multisession CD-ROM drive.

One good reason to look for multisession capability is Kodak's new Photo CD system. You can now take your exposed rolls of film to a developer and have them put your pictures onto a Photo CD. You then view the pictures on your TV using Kodak's Photo CD player. You can store several rolls of film on one Photo CD, and you can bring a disc back to the developer to add new rolls to it until it's full. Each time you have the disc updated, a new session is added, resulting in a multisession disc. Photo CD's could become a desktop-publisher's dream, because they allow inexpensive storage of high-resolution color photos, which are known to gobble-up hard-disk space. Note that many Photo-CD compatible CD-ROM drives do *not* have multisession capability; they can only read single-session discs. So read the ads carefully!

MPC—Ready or not? In discussing all of the various formats and specifications, we haven't yet mentioned what it means for a piece of hardware to be MPC-compliant. The Multimedia PC (MPC) Marketing Council used to specify that a CD-ROM drive must have an average seek time of less than 1 second and be able to sustain a data-transfer rate of 150 kilobytes per second, all while using less than 40 percent of the CPU's resources. However, those specifications are already somewhat outdated, as most current CD-ROM drives have seek times under half a second. Even so, that half a second can be unbearable when you're used to hard-disk access times of less than 15 milliseconds.

In response to the changes in technology, a second set of recommended specs (called "level 2") has been issued by the MPC Council. They call for a double-speed (300-kilobyte-per-second data-transfer rate) with

Double-speed drives like that provided with the Fusion 16 upgrade package (shown here) are fast enough to meet the new level-2 MPC standards.

www.americanradiohistory.com

XA and multisession compliance. As their name implies, these drives spin the disc at double speed when accessing data, and at normal speed for CD audio. That yields access times under 300 milliseconds and transfer rates of 300 kilobytes per second.

Still though, for the drive to be part of an MPC system, the computer should only need to devote less than 40 percent of its resources to operating the multimedia system. That's why slow PC's have a tough time with multimedia, even with a fast drive installed; multimedia over-taxes their resources. A true MPC system can play audio and video without being choppy, and look up information from vast resources without putting you to sleep.

If you were to try to run a multimedia CD-ROM on a non MPC-compliant system, you might possibly see just video stills and hear only sound snippets instead of the smooth animation and audio that's possible on a faster system. It's always to your advantage to have the fastest possible equipment—if not for today, then certainly for tomorrow.

In light of that, the MPC level-2 standard calls for a 486 microprocessor, at least 4MB of system memory, a 160-MB hard disk, and 64k color at 640 × 480 resolution. Contrast that with the old level-1 standard which called for a 386SX microprocessor, 2MB of system memory, a 30-MB Hard disk, and VGA color. Note that while most software currently available will run acceptably on a level-1 system, that is certain to change in the near future.

Sound Advice. PC's have never been blessed with much of a sound system, just that internal speaker that's capable of reproducing beeps and crude sounds. So, if you want to play with multimedia software, you're going to need a sound card and speakers. The Ad Lib card was the first such device to provide PC users with good sound to go along with great games. Soon the Soundblaster came along, which was compatible with the Ad Lib card, had a built-in synthesizer, and allowed digital audio recording and playback. The problem was that they were 8-bit, "mono" cards, and the sampling rate was limited to 22 kHz. That provided a very unimpressive frequency response—in other words, rather dull, or flat sound.

Meeting the Level-2 sound requirements means purchasing a 16-bit sound card like this one. With built-in word recognition and a MIDI interface, you'll probably use it for more than just hearing CD ROM's.

Today, 16-bit sound cards (which are required in the level-2 standard; 8-bit cards are level-1 compliant) are available, in stereo, with sampling rates up to 44 kHz. That gives you CD-quality sampled sound, which is what any audio enthusiast wants. To record sound with any sound card, you do, of course, need a microphone, which usually comes bundled with a complete multimedia package, or upgrade.

Most sound cards require that you add an amplifier and speakers, or just amplified speakers. There are many different models of amplified speakers on the market intended for use with a PC. In some cases they are specially shielded to protect your computer monitor from magnetic interference. While the smallest amplified speakers are adequate, you'll want plenty of power once you hear how good your PC can sound.

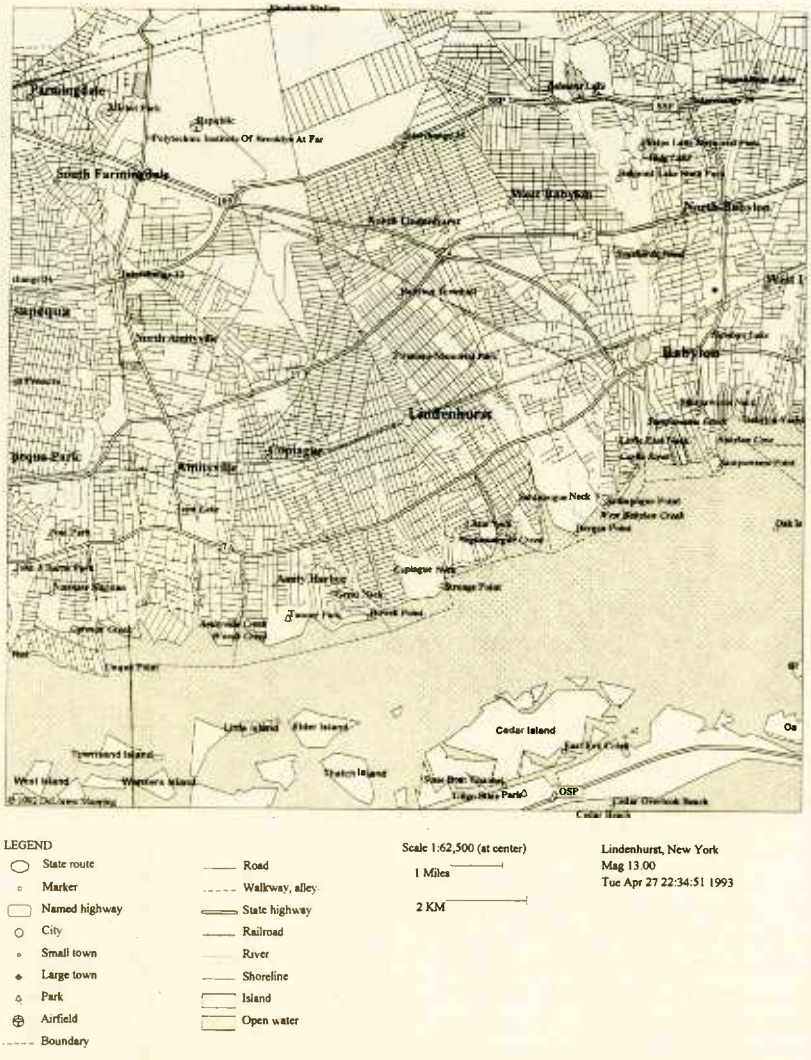
Get a Bundle. Because of the confusion surrounding CD-ROM drives and which one works with which controller, and which controller works with which sound card, it's probably best if you purchase everything you need all at once in one multimedia-upgrade package. They contain a CD-ROM drive, a controller card, a sound card, usually a few CD-ROM discs to get you started, and sometimes speakers and a microphone. The CD-ROM drive controller is often built into the sound card, which saves you some bucks and a slot in your computer.

Included with any multimedia upgrade, you'll also receive the necessary Windows and DOS software drivers for the CD-ROM drive and sound card. Software-installation disks make installing multimedia upgrades a breeze, compared to the tedious job of getting mix-and-match components to work peacefully with one another in a system. Buying a multimedia upgrade is also one way of ensuring that all of the components will form an MPC-compliant system. Look for the MPC logo on any multimedia upgrade you buy, and check to see whether its the level-1 or level-2 logo (they look different).

There are multimedia upgrades to fit every budget. If you're on a tight budget, you can buy an upgrade that has stereo sound and a single-speed CD-ROM drive for less than $500—and even less if you want to settle for mono sound. To get a double-speed drive in your upgrade you'll have to spend more. But, as they say, if you want to play you gotta pay. A company called Media Vision puts together some very nice MPC-compliant upgrade packages to fit every budget, and they include hardware of all levels from many different manufacturers.

Because we're seeing such a rapid

www.americanradiohistory.com



Map Expert with Street Atlas USA *is a map maker's dream come true. The disc contains the entire Street Atlas USA and color and black-and-white map-printing capabilities.*

evolution of multimedia hardware, we can't recommend any single piece of equipment or package, as there's bound to be a better, cheaper one out "next week." The best advice we can give you is take your time and shop around. Research the upgrade packages that are within your price range and find out exactly what components are included in each. Then research the individual components so you know exactly what you're getting. Taking your time when buying multimedia equipment can save you literally hundreds of dollars. That's because new equipment rolls out almost every week and last week's equipment drops in price accordingly.

CD-ROM Software. We'll have to assume that if you're still with us at this point then you must be interested in CD-ROM drives. And if you're interested in CD-ROM drives, then you must be at least curious as to what sort of stuff you can get on CD-ROM. We were, so we contacted several software companies to see what we could come up with. Here is a small sample of what we found:

Encyclopedias and Atlases. Encyclopedias and atlases are good applications for CD-ROM's and the amount of data they can hold. Applied Optical Media Corporation's *Multimedia Animal Encyclopedia* contains color illustrations and photos; descriptions of range, habitat, physiology, behavior, and conservation status; pronunciation of common and scientific names; and classification of nearly 2000 different animals. You can also hear the sounds that many of the animals make—we liked listening to the different bird calls. Any piece of information is easy to search for. The disc retails for $79.95.

Two other discs from Applied Optical Media, *American Vista* and *World Vista*, are multimedia atlases containing all kinds of information including maps, pictures, and audio. The discs are like talking social-studies books on American and world culture, and with them you can travel all around the globe without leaving your PC. The discs retail for $79.95 each.

The New Grolier Multimedia Encyclopedia can be a valuable tool for any computer owner. The CD-ROM contains 33,000 articles on subjects from A to Z and can provide the user with information on nearly any topic in a matter of seconds.

The disc contains over 3000 color and black-and-white images to peruse through, audio clips, maps, timelines, and so on. Also included are various animations and video clips. We were reminded of how far the PC has come as we watched Neil Armstrong taking his one small step and listened to his famous quote. For research purposes, it's hard to beat the New Grolier Multimedia Encyclopedia. That plus hours of entertainment make this $395 disc a good investment.

When you think of beautiful color images of animal, vegetable, mineral, or whatever, the National Geographic Society might come to mind. While they're best known for their magazines and TV programs, they haven't overlooked CD-ROM's potential either. *Mammals: A Multimedia Encyclopedia*, contains an interactive look at over 200 mammals. The disc contains 45 film clips from TV documentaries, 700 pictures, and 155 sounds that animals make. Mammals sells for $99.00.

Not to be left out of the encyclopedia business, Microsoft offers *Encarta*, a great multimedia resource containing pictures, sounds, music, readings, animations, and more. With the complete text of the 29-volume *1992 Funk and Wagnall's New Encyclopedia*, as well as over 1000 articles exclusive to Encarta on CD, information on any topic is available in seconds. Encarta will cost you $395.

www.americanradiohistory.com

Sources

Applied Optical Media Corporation
1450 Boot Road, Bldg. 400
West Chester, PA 19380
215-429-3701

Aris Entertainment, Inc.
4444 Via Marina, Suite 811
Marina Del Rey, CA 90292
310-821-0234

DeLorme Mapping
Lower Main Street, PO Box 298
Freeport, ME 04032
207-865-1234

Dr. T's Music Software
124 Crescent Road
Needham MA 02194
617-455-1454

Ebook, Inc.
32970 Alvarado-Niles Road, Suite 704
Union City, CA 94587
510-429-1331

Electronic Arts
1450 Fashion Island Blvd.
San Mateo, CA 94404
415-571-7171

Grolier Electronic Publishing, Inc.
Sherman Turnpike
Danbury, CT 06816
800-356-5590

HyperGlot Software Company, Inc.
PO Box 10746
Knoxville, TN 37939-0746
615-558-8270

InterOptica Publishing Ltd.
300 Montgomery Street
Suite 201, 2nd Floor
San Francisco, CA 94104
415-788-8788

Interplay Productions
3710 S. Susan, Suite 100
Santa Ana, CA 92704
714-549-2411

LucasArts Games
PO Box 10307
San Rafael, CA 94912
415-721-3342

Media Vision
3185 Laurelview Court
Fremont, CA 94538
510-770-8600

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
206-882-8080

National Geographic Society
Educational Media Division
1145 17th Street, NW
Washington, DC 20036-4688
800-368-2728

Virtual Reality Laboratories, Inc.
2341 Ganador Court
San Luis Obispo, CA 93401
805-545-8515

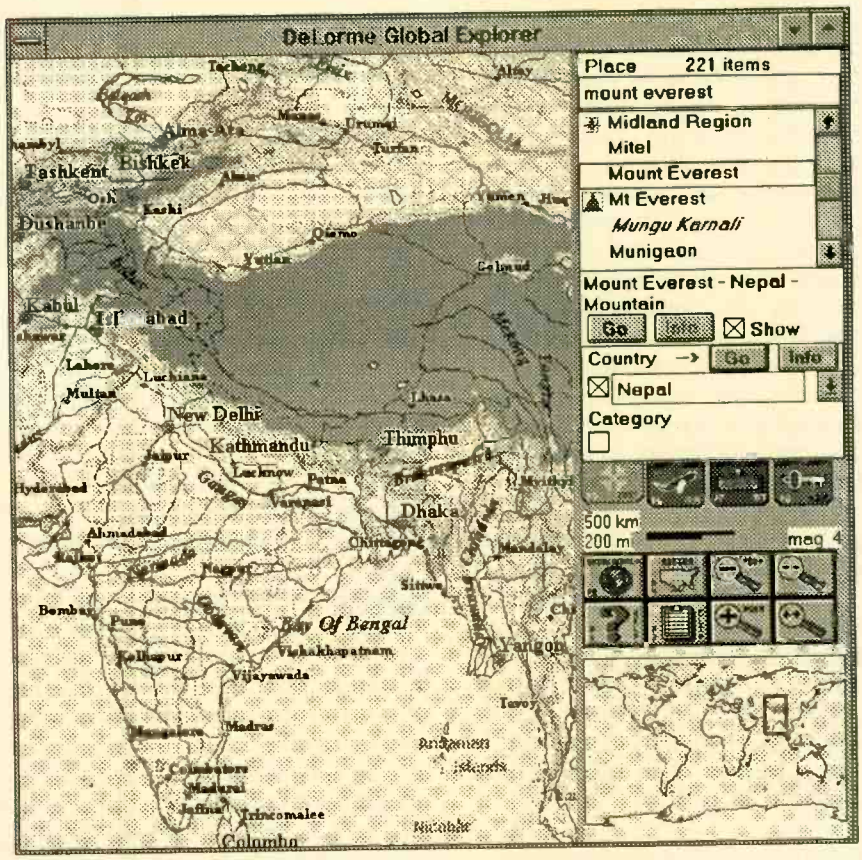
Sights and Sounds. Since a CD-ROM can hold lots of megabytes, it's the perfect place for things like clip art that would otherwise soak-up precious hard-disk space. Aris Entertainment has a series of multimedia clip-art discs under the titles of *Business Backgrounds; Full Bloom; Island Designs; Jets and Props; Majestic Places; Money, Money, Money; Wild Places;* and *World View*. Each title includes 100 photos and 100 sounds. The professional-quality images and sound clips can be used royalty-free and are perfect for sprucing up any presentation—business or otherwise. The discs sell for $39.95 each.

Another disc from Aris, *MPC Wizard*, contains 50 sample images and audio tracks, and also contains diagnostic utilities to test and fine-tune MPC systems. The MPC Wizard lets you measure the data-transfer rate of your CD-ROM drive, perform a 256-color test on your video system, and test and troubleshoot sound cards. The disc also includes over 80 megabytes of Windows sound and video drivers, and helps you install them in your system. At $14.95, this disc is a good investment for any multimedia-PC owner.

Music-related software is a logical application for CD-ROM, and *Composer Quest* from Dr. T's Music Software is a good example. The program lets you browse through music history using a time-line screen that displays all of the major musical periods. You can jump into any period and learn about different composers, the work they did, and the times they lived in. And, of course, you can listen to over 60 musical performances. Anyone with an interest in music from the year 1600 on will find this $99 disc both amusing and educational.

Microsoft has all bases loaded with CD-ROM's covering a wide variety of topics. One of them, *Multimedia Beethoven: The Ninth Symphony*, contains a fully digital, stereo-audio track of the four movements of Beethoven's Ninth Symphony. Also included is a measure-by-measure commentary on what is being heard, as well as a pop-up window that displays the score as the music plays. This disc is $79.95.

Another musical disc from Microsoft



Global Explorer *contains the major roadways of the entire world. With it, you can search for anything you like (not just streets) anywhere in the world.*

www.americanradiohistory.com

is entitled *Musical Instruments*, and it's a multimedia catalog of musical instruments from A to Z. Photos and diagrams of all instruments are included in addition to audio samples of how the instruments sound alone and in an ensemble. This disc is also $79.95.

Super Maps. One truly fascinating disc we looked at is *Street Atlas USA*, from DeLorme Mapping. When you start this program you see a map of North America with all 50 of the States labeled. From there you can zoom down to street level anywhere in the country and see all the street labels. You can actually see the block you live on! Not only that, but extensive searching capabilities let you locate cities, towns, and streets by name, zip code, and telephone-area and exchange codes. Because this is a Windows program, you can easily copy a map to the clipboard for use in other programs. This program has a retail price of $169.

While any PC user will find Street Atlas USA both interesting and quite useful, another disc from DeLorme called *Map Expert with Street Atlas USA* is without a doubt a map maker's dream come true. Not only does this disc contain the entire Street Atlas USA material, it also contains extensive color and black and white map-printing capabilities. Using a common laser printer, you're able to print out stunning maps of wherever, and you can add your own custom labels to it as well. A Muralmaker function lets you produce wall maps. This $495 package is the perfect gift for anyone who's always planning road trips.

Another disc from DeLorme, *Global Explorer*, is similar to Street Atlas in its operation, However, it contains the roadways of the entire world—not all of them, though. While Street Atlas lets you zoom in and see the smallest of streets, Global Explorer can zoom in only to the point where you can see major roadways. Of course you can search for anything you like (not just streets) anywhere in the world. We went on a trip to Mount Everest and studied the surrounding geography! Global Explorer is a $169 travel ticket around the world.

Books. As you might be able to guess, Ebook publishes books on CD-ROM. Not only can you read a book on your screen or from a printout, you can also listen to a narrator tell the story as you look at the pictures. It's a whole new way of listening to *A Christmas Carol* during the holiday season, which is just one of Ebook's "books." And the power of CD-ROM lets you search the Ebooks for specific words, chapters, phrases, and so on.

The game Putt Putt Joins the Parade *lets kids explore many different locations and activate hundreds of sounds and animations. There's enough fun here to keep young kids busy for hours.*

Some of Ebook's other titles include *Twelve Roads to Gettysburg, Renaissance Masters I, Don Quixote, Aesop's Fables, Goferwinkel's Adventures, The White Horse Child*, and there are many more. The Ebooks we've mentioned range in price from $24.95 to $79.95.

We looked at two discs from InterOptica Publishing Ltd.: *Great Wonders of the World Vol. 1*, and *Great Cities of the World Vol. 1*. Both contain collections of history, photos, video, facts, maps, and so on. A timeline helps you to pinpoint moments in history and see the events surrounding them.

One thing we found on the InterOptica discs that we very much liked is a guided tour of the features. We found that to be very helpful in getting off to a quick start, and it makes it easier to get the most out of each disc. The InterOptica discs list for $49.95 each.

Games. From Electronic Arts we looked at two game CD-ROM's. For kids ages 3–7 there's a cute game called *Putt Putt Joins the Parade*. Putt Putt is a car who lives in the interactive, animated world of Cartown. The game lets kids explore many different locations and activate hundreds of sounds and animations. There's enough fun here to keep young kids busy for hours—not to mention giving them a familiarity with computers from a very young age.

For older kids and adults as well, there's *Sherlock Holmes, Consulting Detective Volume II*. This game lets you solve three different cases as you walk through the interactive streets of London. If solving mysteries is your bag of tricks, then this is $69.95 well spent.

If you like to play Chess, then you'll surely like to see *Battle Chess* in action with over 30 megabytes of animation and graphics in a 3-D Chess game. An unusual, animated 25-minute tutorial is educational for the beginner at Chess, yet still entertaining for the aficionado.

For the graphics to run as fast as possible, it's recommended that you install Battle Chess on your hard drive, although you can play it solely, albeit slowly, from the CD-ROM. While 30 megabytes is a large chunk of anybody's hard drive, it's also 30 megabytes worth of floppy disks that don't have to be shuffled during installation. Battle Chess costs $79.95.

It seems as though adventure games with long twisty plots have benefited quite a bit from CD-ROM, as the subtitles and still images are finally gone; all words are spoken and real-time animation takes place, in addition to everything being point-and-click. We looked at two games of this type from LucasArts: *Loom* and *The Secret of Monkey Island*. In *Loom*, the player follows the hero Bobbin Threadbare as he battles good versus evil in the Age of the Great Guilds. *The Secret of Monkey Island* involves Guybrush Threepwood and his quest for pirate treasure. An added bonus of CD-ROM is that Monkey Island can be played in five different languages.

LucasArts' *Secret Weapons of the Luftwaffe* on CD-ROM is an exciting flight-simulator game with very realistic graphics and endless numbers of flight options, including being able to take the wheel of many of the Luftwaffe's secret weapons. There's hours of entertainment on this disc.

More from Microsoft. Down another road of entertainment is Microsoft's *Cinemania*, an interactive movie guide. This disc will hold anyone's interest, as it is hard to find someone who does not like movies. Not only is it easy, but it's also very tempting

(Continued on page 92)

www.americanradiohistory.com

Build a Low-Cost Motorcycle Alarm

Build and install a professional quality motorcycle alarm system, and sleep easier knowing that you wheels are well protected

BY DEAN KASPER

No matter how concerned you are on the street, if you have more than one cycle in your household, the of installing an alarm system in each vehicle can be cost prohibitive. Commercial units can go for between $60 and $400. But, with the *Motorcycle Alarm System* described in this article (which can be built for about $20.00), price need no longer be a stumbling block.

The Motorcycle Alarm has all the standard features of the commercial units on the market, such as delayed arming, it's affordable, simple, reliable, and small in size. Alarm triggering is accomplished through a built-in motion sensor. The alarm system can be selected to drive the cycle horn or an external siren.

To Toot or Scream? The Motorcycle Alarm has provision for either of two sounders: the cycle's own horn or a piezoelectric siren. The motorcycle's own horn is the most common sounder used in alarm systems, and provides the loudest multi-directional alert. In using the vehicle's own horn, the only space required is for the system's printed-circuit board. However, there is a drawback to using the vehicle's horn; the current drain on the battery is quite heavy when the alarm is activated. The average cycle horn will draw between 1 and 2 amps. On the plus side, our design reduces the drain by cycling the horn on and off through the alarm duration, thereby reducing the average current drain.

Using a piezoelectric siren is beneficial; the siren draws less power when the alarm is activated. However, there is a down side: you must find a convenient location for the siren. The size of your motorcycle and thus its battery size will determine which sounder best suits your situation.

Operation. Figure 1 is a schematic diagram of the Motorcycle Alarm. Power for the circuit is supplied through D2, which is used to protect the circuit in the event that power is applied to the circuit backwards during testing or installation. Capacitor C6 is used to decouple the power supply to circuit ground.

The sensor (SENS1) is comprised of alternate rows of ground- and sense-line traces etched onto the circuit's printed-circuit board. When the protected vehicle is disturbed, a stainless-steel ball bearing rolls across the alternate traces, shorting and opening the connections between the traces. A pull-up resistor (R5) pulls the trigger input high whenever the traces are not shorted by the bearing. The pulse created by the shorting and opening action triggers the alarm-circuit input. The size of the steel bearing can be varied for different degrees of sensitivity; a 3/16 or 1/4-inch diameter bearing was used in the author's prototype. A stainless-steel bearing must be used to ensure good electrical contact and avoid corrosion.

The heart of the alarm circuit is an LM556 dual oscillator/timer, U1. The trigger pulse is applied through C1 to U1-a (the first half of U1), which (configured as a one shot) controls the duration of the alarm output once triggered. The duration, about 52 seconds, is given by:

$$T_{ON} = (1.1 \times R2 \times C3)$$

The first timer circuit is held off momentarily by Q2, a 2N7000 N-channel enhancement FET, when the ignition is switched off. That gives the rider time to dismount before the alarm is armed. When the ignition switch is turned on, the ignition voltage forward biases D1. With D1 forward biased, Q2 turns on, disabling the alarm until the ignition is switched off.

Resistor R6 is used to limit the charge current applied to C8, and is necessary if a tantalum capacitor is used for C8 to produce longer hold-off times. When the ignition is turned off, power is removed from the anode of D1. Diode D1 blocks the current from C8, causing it to discharge through R7. During the time it takes for C8 to discharge, the timer is disabled. That hold-off time (about 20–30 seconds), is given by:

$$T_{OFF} = (3 \times R7 \times C8)$$

The second timer, U1-b (which is wired as a non-symmetrical squarewave generator) is enabled by the output U1-a. The squarewave generator controls the on/off time of

www.americanradiohistory.com

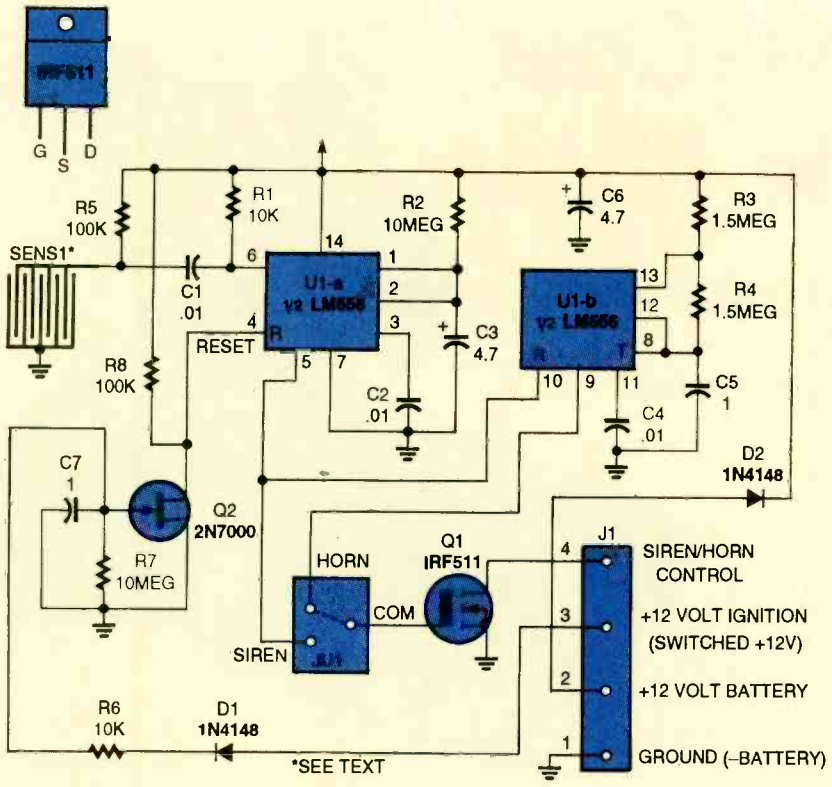


Fig. 1. At the heart of the Motorcycle Alarm is a LM556 dual oscillator/timer, a pair of FET's, and a rather unusual sensing unit (SENS1)—which is comprised of adjacent circuit board traces and a small stainless-steel ball bearing.

the horn driver. Cycling the horn on and off during alarm activation reduces battery drain when the cycle horn is used as the sounder. A typical cycle horn draws 1 to 2 amps. That on/off time (about 2-seconds on to about 1-second off) is given by:

$$T_{ON} = [0.693 \times (R3 + R4) \times C5]$$
$$T_{OFF} = (0.693 \times R4 \times C5)$$

The siren/horn driver circuit (built around Q1) functions as a switch, pulling the sound's negative lead to ground when enabled. A jumper connection (denoted JU1 in Fig. 1) is used to select either the vehicle horn or piezoelectric siren as a sounder.

Construction. The Motor Cycle Alarm was assembled on a small double-sided, printed-circuit board, measuring about 2 by 1 11/16 inches. Templates for both sides of that printed-circuit board are shown in Fig. 2 (A is the component side and B is the solder side). If you choose not to etch your own board, a pre-tinned, double-sided (without plate-through holes), printed-circuit board can be ordered from the supplier given in the Parts List.

When etching your own board, care must be taken to prevent shorting between the closely spaced senor (SENS1) traces. Once the board has been etched, it is recommended that an ohmmeter be used to verified that there are no shorts in the sensor traces before installing the parts. If there is a shorting problem, an Exacto knife can be run between adjacent traces to remove unwanted copper. The sensor area of the circuit board must also be very smooth. To avoid corrosion and to maintain consistency, it is recommended that the traces be tinned.

After etching but before installing the parts, you must decide on the type of sounder that will be connected to the circuit. That is done by either leaving or severing the a trace at JU1. If the vehicle's horn is to be used as the sounder, you need not do anything; the board is already set-up for that. But if you intend to use a siren, the small trace between the board's COM and HORN donut pads must be severed, and a jumper connection placed between the SIREN and COM donut pads.

Figure 3 gives the proper locations and orientation of the various parts that comprise the Motorcycle Alarm. When assembling the board, watch out for the polarities of C3 and C6. Note that the circuit is non-critical and component substitutions can be made freely.

When assembling the unit, be sure to solder all components on both the top (component side) and bottom (solder side) of the board; particularly R2, R3, R5, R6, R8, C1, C5, C6, Q1, D1, J1, and pin 5 and pin 10 of U1.

The ball bearing, which is used in the sensor portion of the circuit, can be purchased at most local hardware stores. You'll also need a 5/8 to 1 1/16-inch plastic pipe cap to house the ball bearing on the printed-circuit board. The cap can be secured to the board

PARTS LIST FOR THE MOTORCYCLE ALARM

SEMICONDUCTORS

U1—LM556 dual oscillator/timer, integrated circuit
Q1—IRF511 N-channel, enhancement power MOSFET
Q2—2N7000 N-channel, enhancement FET (Motorola)
D1, D2—1N4148 general-purpose silicon diode

RESISTORS

(All fixed resistors are ¼-watt, 5% units.)
R1, R6—10,000-ohm
R2, R7—10-megohm
R3, R4—1.5-megohm
R5, R8—100,000-ohm

CAPACITORS

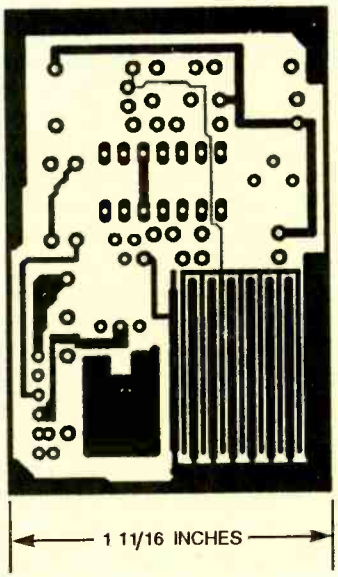
C1, C2, C4—0.01-µF, ceramic-disc
C3, C6—4.7-µF, 50-WVDC, tantalum
C5, C7—1-µF, ceramic-disc

ADDITIONAL PARTS AND MATERIALS

SENS1—See text
J1—4-pin right-angle friction-lock connector
Printed-circuit materials, enclosure (see text), plastic pipe cap, stainless steel ball bearing, wire, solder, hardware, etc.

Note: A pre-tinned double-sided printed-circuit board without plate-through holes, part MC-Alrm-002, is available for $9.50 from Kasper Electronics, 400 West Hollow Lane, Fort Collins, CO 80524. Colorado residents please add appropriate sales tax.

www.americanradiohistory.com



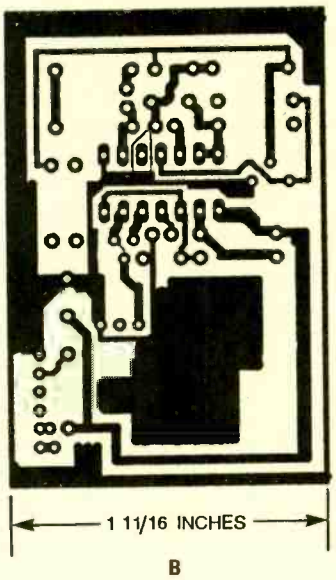


Fig. 2. The Motorcycle Alarm was assembled on a small double-sided, printed-circuit board, measuring about 2 by 1 1/16 inches: A is the template for the component side, and B is the solder side. The board can be ordered from the supplier given in the Parts List.

over the sensor traces (with the bearing in place) using hot glue.

Testing. Once the circuit has been completely assembled and checked for imperfections, it should be tested to ensure that it is working properly. Figure 4 shows a simple way to test the alarm circuit. Wire the circuit as shown. In that set-up, a 12-volt lamp is used in place of the horn, and single-pole single-throw switch is used to simulate the ignition switch. Connect a 12-volt power source to the circuit and power it up. When power is first turned on, the alarm triggers until the ignition switch (S1) is turned on and off for the first time. After to toggling S1 off and on, the alarm should go silent. Once silenced, tilt the circuit so the bearing breaks and makes the on-board circuit trace connection. At that point, the alarm (in this case, the light) should come on.

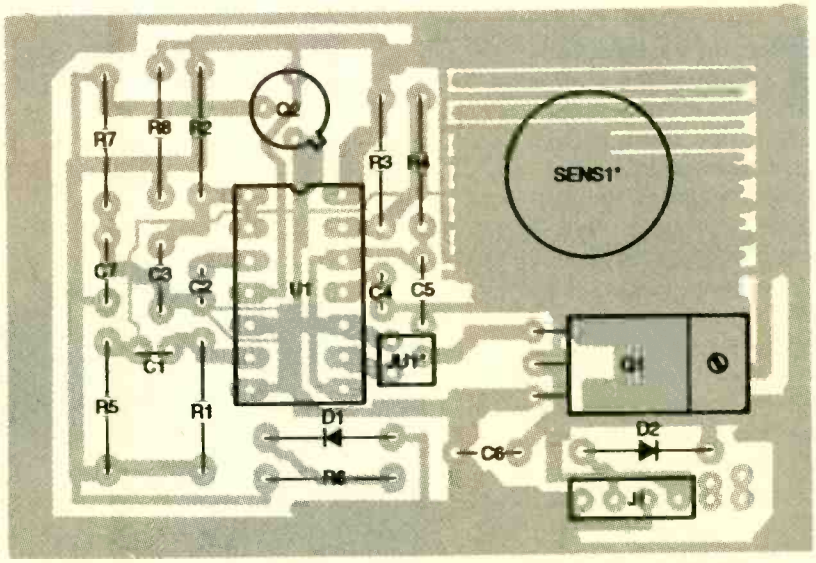


Fig. 3. Here are the proper locations and orientation of the various parts that comprise the Motorcycle Alarm. When assembling the board, watch out for the polarities of C3 and C6.

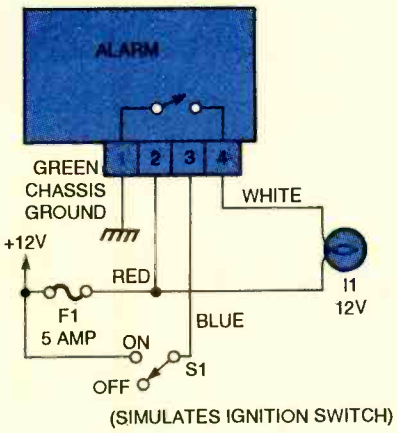


Fig. 4. In this simple test set-up, a 12-volt lamp is used in place of the horn.

Housing. Once the board's operation has been verified, the circuit can either simply be wrapped in plastic electrical tape, mounted in a project box, or potted in a non-conductive material. The author chose to pot the assembled board in hot glue. That is easily done by making a "form" around the board using wax paper or

(Continued on page 88)

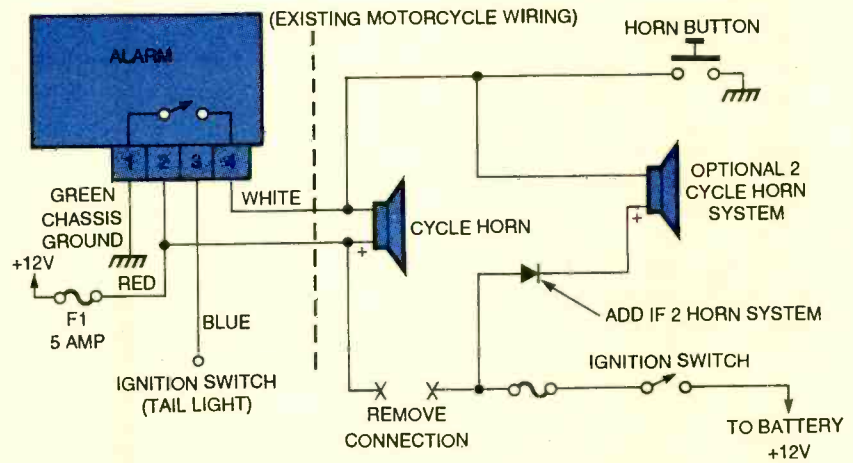
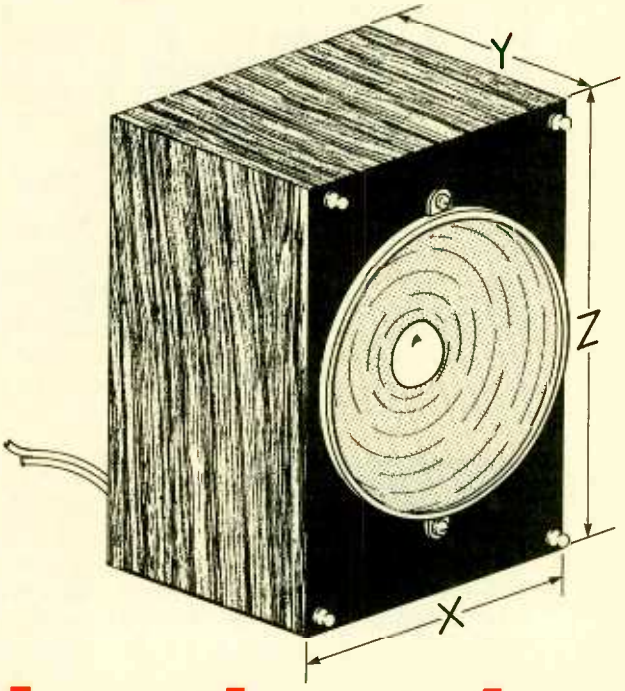


Fig. 5. While this illustration shows how to connect the circuit in a dual-horn arrangement, the same connection scheme is applicable to a single-horn setup.

www.americanradiohistory.com

Design your own Loudspeakers



Three simple programs that will help you design your own speakers the right way.

BY WILLIAM R. HOFFMAN

To many **Popular Electronics** readers, loudspeaker design may seem more than a bit mysterious, what with all the talk of "Thiele/Small parameters," resonance, and various, more arcane terms. Indeed, for many, building a speaker simply means buying some "raw drivers" and putting them in any old cabinet they might have around, and hoping for the best. Too often, such haphazard work is a big disappointment.

In contrast, when a hardy soul goes hunting for some more substantial design theory, all they might find are some very specialized physics texts. All in all, it is a discouraging situation, to say the least.

However, all is not lost. Thanks to the work of two insightful engineers—A. N. Thiele and R. H. Small—the number of parameters you'll need to chose between to produce a good loudspeaker design has been reduced from hundreds to just three. Further, the three programs presented in this article will let your PC do the number crunching for you. Specifically they'll tell you the volume and dimensions of the enclosure, and design a crossover network for you.

To simplify this approach further, most driver manufacturers provide you with some of the necessary parameters to help you decide on a driver. Many even publish them right in their catalogs and brochures. That will allow you to do some useful trial-and-error work with your computer, instead of wasting many hours of hard work and dollars worth of wood and drivers.

The Cabinet. First we'll look at cabinet design. At this point you might be wondering if a cabinet is at all necessary. There are two reasons why you need a cabinet (more properly called an "enclosure"). The first is to prevent the sound radiated from the rear of the driver (which is in opposite phase to that from the front) from meeting and canceling the driver's forward output. Second, an enclosure serves to flatten and extend the driver's bass output. (Anyone who has ever propped up a driver without a cabinet and played some music through it knows what happens to the bass.)

Specifically, we'll discuss the design of a sealed acoustic-suspension cabinet. Of course, there are other types of enclosures—bass-reflex, ducted-port, passive-radiator, horn, and more. All of them could serve the same purpose, but are much harder to design and build. So we will only deal with a simple, acoustic-suspension system here.

The Basics. There are a couple of preliminary concepts of speaker design that we must first introduce. Let's start by defining the three parameters that Thiele and Small have given us. They are commonly abbreviated f_o, Q_{ts} (also referred to as Q_t or the "Q"), and V_{as}. As mentioned earlier, those parameters are commonly supplied by a driver's manufacturer.

Let's start with f_o, or the frequency of oscillation. That refers to the natural bass-resonance frequency of a loudspeaker driver without a cabinet. It will be used to determine how low in frequency our completed system (with a cabinet) will efficiently go, or f_{cab}.

Second, Q_t is the degree of peaking that occurs in the driver's response, again without a cabinet, at the bass-resonance frequency. That is related to the Q within a cabinet, which we'll call Q_{cab}. The parameter Q_{cab} can be decided more or less by the designer.

Last, V_{as} is the volume of air contained within a closed space that would have the same compliance or "springiness" as the suspension of the driver's moving part (the cone).

With the three manufacturer-supplied parameters (f_o, Q_{ts}, and V_{as}), a carefully chosen cabinet Q (Q_{cab}), and the help of our first design program, we can exactly specify the volume of a sealed acoustic-suspension cabinet. The enclosure will work with the chosen driver to give the best bass response possible.

Now that you know the parameters, there are a two things we need to mention about using them to design a loudspeaker. First, there's more than one possible enclosure for any given driver. The difference between the designs is a trade-off between how low we want the frequency response to extend (f_{cab}) and how sharply we want the response to fall off below that bass cut-off point (Q_{cab}).

www.americanradiohistory.com

Second, we must understand that once we have selected our driver, we can only set one of those two parameters (bass frequency response or bass fall-off). Although it can be either one, once we decide the value of one parameter, the remaining parameter will be fixed by the laws of physics.

Realistic Bass Cutoff. It is important to recognize that a given size driver has a fairly well defined lower frequency limit (f_o). That is because the movement of the cone of a driver must quadruple (yes, quadruple) for every halving of frequency to maintain the same acoustic output. There comes a point at which the driver will simply run out of cone excursion (the distance the cone can move) and its sound output will fall off sharply.

There are many advertisements that claim miraculous bass reproduction from tiny speakers, but Table 1 gives us some practical values to shoot for in our design work. Attempting to push a driver much below those recommended frequency limits will usually result in weak or distorted output, or even driver damage.

The table also indirectly gives us a guide to our lower limit for the value of f_{cab}, your speaker's bass-output capability. That's because the driver in a cabinet can't produce bass response lower than it can in free air—a natural consequence of the loading effect of the volume of air trapped in the sealed cabinet behind the driver. It therefore sets a lower practical limit on one of our "designer-determined" parameters.

TABLE 1—LOWEST FREQUENCIES

Driver Size (inches)	Low Limit (H2)
4	90 – 95
5	85 – 90
6	65 – 70
8	40 – 45
10	30 – 35
12	25 – 30
15	20 – 25

The Q. Now, we must consider the "Q" of the system (Q_{cab}), the other parameter we can set ourselves. There are some things we need to know about Q. To begin with, the higher the Q, the stronger the bass output will be. You might be tempted to make the Q as high as possible, but

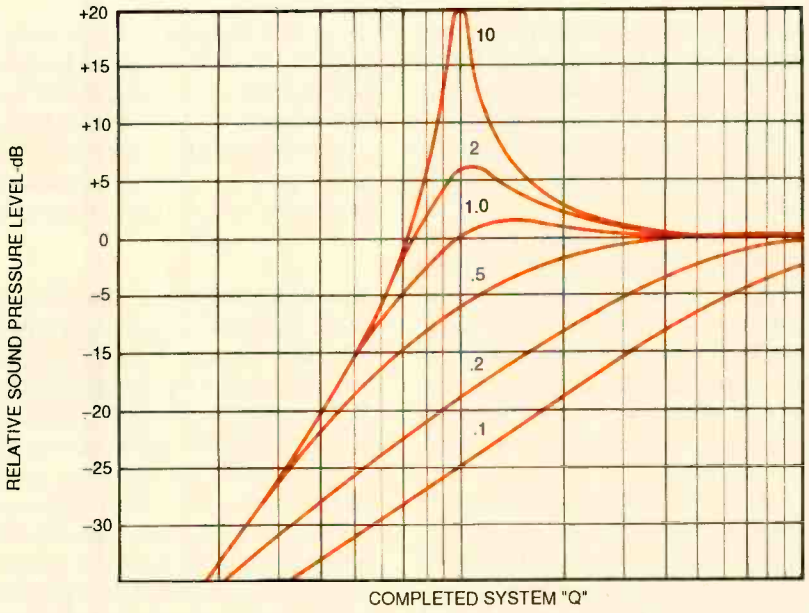


Fig. 1. If the Q is too high, there will be an undesirable peak in the frequency response. Thus the speaker will sound to boomy.

LISTING 1

```
9 PRINT:PRINT:PRINT:PRINT:PRINT
10 PRINT "          LOW FREQUENCY ACOUSTIC SUSPENSION LOUDSPEAKER"
11 PRINT:PRINT
12 PRINT "                                DESIGN PROGRAM"
13 PRINT:PRINT:PRINT
14 PRINT "                                By William R. Hoffman"
15 PRINT:PRINT:PRINT
17 PRINT "                                Copyrite 1993"
18 PRINT:PRINT:PRINT
20 INPUT "                                Proceed? (1=yes 2=no) and Enter ";P
22 PRINT:PRINT:PRINT:PRINT:
25 ON P GOTO 30, 990
30 INPUT "                                Free air resonance of driver (Hz) =";B
35 PRINT
40 PRINT "                                Air volume compliance equivalent of"
45 INPUT "                                driver (Vas) in cu. ft. =";C
46 PRINT
50 PRINT "                                Free air total Q of driver at"
55 INPUT "                                bass resonance (Qts) =";D
60 PRINT
65 PRINT "                                What is desired completed system  Q "
70 INPUT "                                at bass resonance (Qcab) =";E
75 PRINT:PRINT:
100 LET Z=(E/D)^2*(1.05)-1
110 LET Y=B*E/D
120 LET X=C/Z
130 PRINT"                                For an in cabinet bass driver Q of"E
135 PRINT
140 PRINT"                                The cabinet volume is ="X"cu. ft."
145 PRINT
150 PRINT"                                And the driver bass resonance frequency
155 PRINT"                                will be ="Y"Hz"
160 PRINT
165 PRINT"                                If you wish to print this information,"
170 PRINT"                                use <prn scr> key at this time."
172 PRINT
175 PRINT"                                Would you like to try another driver?"
180 INPUT"                                (1=yes 2=no) and Enter ";F
182 PRINT
185 ON F GOTO 30, 990
187 PRINT
990 PRINT"                                Good listening!"
999 END
```


www.americanradiohistory.com

remember, the higher the Q the faster the speaker output will fall off below f_{cab}. Also, just as in an electrical circuit, too high a Q can cause ringing and oscillation, which means highly distorted (typically muddy or boomy) bass.

So then, what would be a good value? Figure 1 shows some Q curves possible with our completed speaker system. Notice, that for values much over 1, a large peak in the output occurs, growing with increasing Q. The peak is what you must avoid if you want good sound from the completed system.

For some guidelines, look at Table 2 where a range of Q values are suggested for various bass-driver sizes. The values are based on many factors, including the size of the driver itself. Notice that very small drivers should have rather high Q values, while larger ones have lower Q's. The reasons for those suggestions are very practical. A tiny 4–5-inch driver has so small a cone, and consequently such weak bass output, that the slight peak due to a high Q value actually makes the sound fuller and more satisfying. A very large driver, on the other hand, can produce so much bass output that a lower Q is required to control and smooth-out its response. So now, armed with some knowledge about f_{cab} and Q_{cab}, we are ready to begin some practical design work.

TABLE 2—POSSIBLE Q's

Driver Size (inches)	Q Value Range
4 – 5	0.9 – 1.2
6	0.8 – 1.0
8	0.7 – 0.9
10	0.6 – 0.9
12 – 15	0.5 – 0.8

Our First Program. To begin with, you need to enter the speaker-design program (see Listing 1) in a directory along with GWBASIC or BASICA, at least one of which you must have to run the program. We called our program LFSPKR-1.BAS. It's job is to calculate the volume of the enclosure and the bass resonance frequency of the system.

Be sure to carefully enter it as it is shown, including all punctuation and spaces. They are very important to the program. All the blank spaces found in the "input" and "print" statements bring the displayed lines in the program to a nicely centered place on the working screen, so be sure to include them. If anyone needs help, or has never entered or run a BASIC program, just find a friend or ask someone about how it is done: the process is very easy. Really!

Running LFSPKR-1. Once the program has been typed in and entered as LFSPKR-1.BAS, from the DOS prompt we can start it by typing GWBASIC LFSPKR-1.BAS if you are using GWBASIC, or BASICA LFSPKR-1.BAS if you are using BASICA. When the opening screen appears, the title, "Low Frequency Acoustic Suspension Loudspeaker Design Program" appears. The program then asks you, if you wish to proceed. After answering "1" (or yes), you will be asked for the values of f_o, V_{as}, and Q_{ts}, in that order. Then, you will be prompted for a value for Q_{cab}, the completed system Q at bass resonance. That value must always be higher than Q_{ts}.

Since we are only making trial-and-error calculations, we can search for a bass driver/f_{cab}/Q_{cab} combination that gives you the system a bass cutoff frequency/Q combination that you want based on the guidelines already given. Once you've entered the driver-based parameters, choose a Q value (Q_{cab}), from Table 2. Once that is entered, the program will automatically calculate the interior volume of a cabinet that will yield the Q_{cab} we specified.

Typically it's good to line an enclosure with at least a single 1–2-inch thick layer of material. Typically Fiberglas, which usually comes in a roll or in pillow form, is cut into batts that cover the size of each of the interior surfaces, and fastened to the walls using a staple gun. Applying it that way means you can probably expect to gain about 5% of the effective enclosure volume, something you can usually ignore. Don't add more material than that, or apply the material in any other fashion.

LISTING 2

```
10 PRINT:PRINT:PRINT:PRINT:PRINT
15 PRINT "                    SPEAKER ENCLOSURE DIMENSIONS"
16 PRINT:PRINT
17 PRINT "                    DESIGN PROGRAM"
18 PRINT:PRINT:PRINT
19 PRINT "                    By William R. Hoffman"
20 PRINT:PRINT:PRINT
21 PRINT "                    Copyrite 1993"
22 PRINT:PRINT:PRINT
23 PRINT "This is a program designed to calculate optimum"
24 PRINT "dimensions for a loudspeaker enclosure when only"
25 PRINT "the desired volume is known."
26 PRINT:PRINT:PRINT:PRINT
27 INPUT "Proceed? (1=yes 2=no) and Enter";P
28 PRINT:PRINT:PRINT:PRINT
30 ON P GOTO 40, 990
35 PRINT:PRINT:PRINT:PRINT
40 PRINT "The desired enclosure internal"
41 INPUT "  volume is (cu. ft.) =" ;A
43 PRINT:PRINT:PRINT:
45 ON A GOTO 50
50 LET X=A^(1/3)*(12)
55 LET Y=X*.62
60 LET Z=X*1.62
70 PRINT "The following are the INSIDE dimensions of a box"
71 PRINT "of"A"cubic feet that are optimized to provide the"
72 PRINT "least number of standing waves (or resonances)."
75 PRINT:PRINT:PRINT
80 PRINT "                    HEIGHT = "Z
85 PRINT "                    WIDTH  = "X
90 PRINT "                    DEPTH  = "Y
95 PRINT:PRINT
100 PRINT"Do you wish to try another volume?"
110 INPUT"(1=yes 2=no) and Enter";B
120 ON B GOTO 35, 990
990 PRINT:PRINT:
995 PRINT"                    Good listening!"
999 END
```


www.americanradiohistory.com

The Second Program. Our second program is a simple one. It asks for the volume of enclosed empty air space we are looking for. In return, it gives us a set of inside (not outside) dimensions that offer the least opportunity for resonances or standing waves to develop within the enclosure. Also, it gives us a nice rectangular shape that is pleasing to the eye.

To use the program, ENCDES-1.BAS, first enter it as shown in Listing 2. Like the first program, be sure and enter it exactly as shown. Once this is done, you may access it along with your copy of BASIC by entering either GWBASIC ENCDES-1.BAS (if you are using GWBASIC), or BASICA ENCDES-1.BAS (if you are using BASICA) at the drive prompt.

Once the opening screen appears, respond to the prompt with a "1," and ENTER. Following that, another prompt will ask for the enclosure volume. Enter the value in cubic feet, but remember that the box volume must include an allowance for the driver(s), acoustic material, bracing, and crossover, if any. Once that is done, the program will calculate and display a set of values for the three inside dimensions, in inches. With these, then, we are ready to start building our new speaker system.

Now we need to talk about crossover networks and the last of the three programs to be presented. The program calculates the exact values of inductors and capacitors that you will need to complete your loudspeaker system.

Now the Questions. Looking at our calculated values, we can ask ourselves: is the frequency of f_{cab} low enough to ensure good bass response, but still within the limits suggested by Table 1? If it is somewhere near the limit shown in the table, then we will be getting all that we probably can from it. Then we can ask: is the size of the suggested enclosure too big or smaller than we want?

If the values are unsatisfactory, then you can simply try again. At the prompt, respond (1=yes), and then enter another value of Q_{cab} for the particular driver you are working with, or instead try the specifications of another driver that you might want to use. Because this is a computer program, you can easily try as many times as you want until you find the right set of specifications for your needs. If you wish, you can even have a printer (almost any printer will work) print out the entire screen with all the prompts and information contained. Simply use the PRNT SCR key on the keyboard.

What Volume? Now, the next logical step is to use the calculated volume and another small program to get the actual internal cabinet dimensions (height, width, and depth.) as indicated in Fig. 2. But before we introduce the next program, let's discuss a few points first.

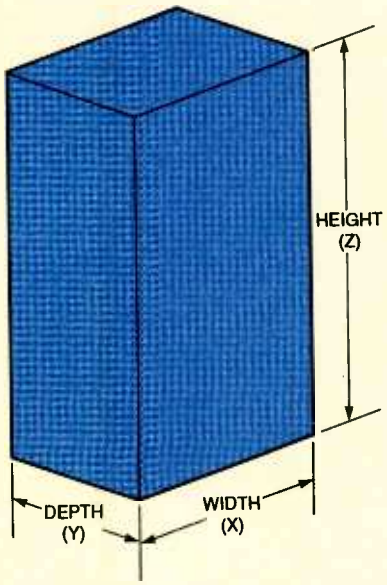


Fig. 2. The second program uses the three variables shown here to indicate the cabinet dimensions.

For one, the enclosure volume calculated in our first program (LFSPKR-1.BAS) was the *empty* cabinet volume. That is, no allowance was made for the space that would be occupied by the driver (or drivers), any extra bracing you might want to use, or the crossover network. If possible eliminate or reduce the volume they will occupy in the cabinet.

Alternatively, you can counter the volume change with acoustic damping material (Fiberglas, wool, or foam). Adding it will make the cabinet seem larger than it really is. (Yes, I said larger!) When the acoustic waves from the rear of the driver pass through these soft, absorptive materials, they are actually slowed down by a small amount—typically by about 20%—and are also partially absorbed. The result is that the enclosure seems "acoustically bigger" than it really is. For a typical material like Fiberglas, up to 40% larger. So, if you were to lightly "fluff" fill a box of 1 cubic foot in volume, it would acoustically look like about 1.4 cubic feet to the driver.

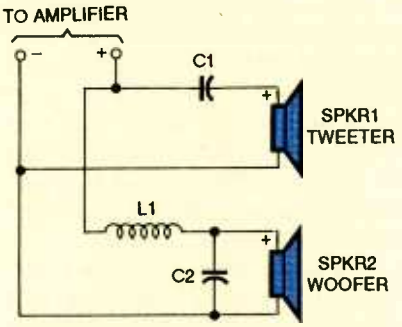


Fig. 3. A crossover network divides the frequency spectrum up so only the necessary sonic components are reproduced by each driver.

What is a Crossover? Most speakers have more than one driver. The reason for having multiple drivers is simple: a big driver will reproduce bass frequencies very well, but is very poor on the highs because its cone is too big and heavy to move very quickly. While on the other hand, a little driver can make its light little cone move very rapidly and reproduce the highs very well, but it cannot move enough air to reproduce deep bass in any quantity. Obviously, then, we must have at least two different types of drivers (one large and one small) to really be able to make a good, wide-range speaker with low distortion.

There are also speaker systems made with even more drivers. There are some with three or even four, each one covering only a very narrow and specific range of frequencies (for which it is optimized.) In such a system each driver is physically smaller than the last as we move up from the bass, through the midrange, and on to the highs. However, here we'll limit our scope to a two-driver, or two-way system.

To prevent large drivers (called "woofers") from distorting while trying to reproduce highs, and small drivers (the smallest of which are called "tweeters") from blowing out from lows, a crossover network is used. A

www.americanradiohistory.com

crossover separates the sonic frequency spectrum into the ranges needed by each driver in a multi-way loudspeaker. More specifically, it is a combination of inductors and capacitors that form an electronic filter network.

The Crossover Components. Let's look at an example circuit to see just what a crossover does. The simple crossover circuit in Fig. 3 is applied to a speaker system that has a woofer and tweeter. Notice that there is an inductor wired in series with the woofer, and a capacitor wired in series with the tweeter. Those two elements divide the sound spectrum between the drivers.

The inductor when connected as in Fig. 3, forms a low-pass filter. That is, it allows the low frequencies to pass through it, but will block all high frequencies. The result is that only the bass is passed, which is fine since the woofer can only mechanically reproduce bass any way, and therefore it avoids wasting power from the amplifier uselessly. The action of the low-pass filter on frequency is shown graphically in Fig. 4A.

The capacitor, when it is connected to a tweeter as shown back in Fig. 3, performs a function that is the compliment to the inductor: It forms a high-pass filter. It will only allow high frequencies to pass, keeping the strong bass power out of the small high-frequency driver. That prevents possible distortion and damage. The effect the high-pass filter has is shown in Fig. 4B.

In addition, another capacitor is connected directly across the terminals of the woofer to perform another necessary function: compensation. The voice coil of the woofer is just that, a coil, so it has a substantial inductance just like the inductor we are using for the low-pass filter. If we didn't use C2, the voice-coil inductance would defeat the crossover inductor, and no crossover action would take place. The compensation capacitor nullifies the effects of the woofer's voice-coil inductance and allows the inductor to create the low-pass function we require.

The Crossover Program. Listing 3 shows the BASIC program, called XDES-1.BAS, which we will use to calculate the values of inductance and capacitance we need for our crossover network. As with the previous programs, carefully enter it in with your copy of GWBASIC or BASICA, being sure to get all spaces and punctuations correct. Once that is done, we can access the program like the others by typing GWBASIC XDES-1.BAS or BASICA XDES-1.BAS.

Once the opening screen appears, answer the prompt, and you will be prompted for the frequency (in Hz) that you want the crossover function to take place at. Then you will be asked for the impedance of the bass driver at the crossover frequency you have just selected. You can usually find that value from an impedance curve supplied by the driver manufacturer. If not, use an impedance bridge that you or someone you know might have to measure the driver's impedance. If neither of these sources of information are available, then use the nominal impedance of the driver (usually 8 ohms). This should get you fairly close, since our filter slope is quite shallow (as Fig. 4 shows, it's only 6 dB/octave.)

(Continued on page 88)

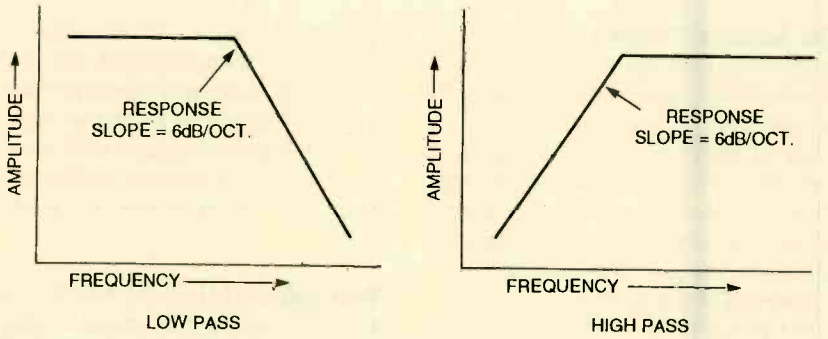


Fig. 4. The action of the woofer and tweeter outputs of the two-way crossover are shown here in A and B respectively.

LISTING 3

```
5 PRINT:PRINT:PRINT:PRINT:PRINT
10 PRINT "                    DESIGNING A LOUDSPEAKER "
11 PRINT:PRINT
12 PRINT "                    CROSSOVER NETWORK"
14 PRINT:PRINT:PRINT
15 PRINT "                    By William R. Hoffman"
16 PRINT:PRINT:PRINT
17 PRINT "                    Copyrite 1993"
18 PRINT:PRINT:PRINT
20 INPUT "                    Proceed? (1=yes 2=no) and Enter";P
22 PRINT:PRINT:PRINT
25 ON P GOTO 30, 990
27 PRINT:PRINT:PRINT
30 INPUT "                    Crossover frequency is (Hz) =";A
35 PRINT:PRINT
40 PRINT "                    Impedance of low frequency driver at"
45 INPUT "                    the crossover frequency is (ohms) =";B
46 PRINT:PRINT
50 PRINT "                    Impedance of high frequency driver at"
55 INPUT "                    the crossover frequency is (ohms) =";C
60 LET X=((B)/(6.28*A))*1000
65 LET Y=((1)/(C*6.28*A))*10^6
66 LET Z=((1)/(B*6.28*A))*10^6
70 PRINT:PRINT:PRINT
75 PRINT "                    L = "X"mHy"
80 PRINT:PRINT
85 PRINT "                    C1 = "Y"uF"
86 PRINT:PRINT
87 PRINT "                    C2 = "Z"uF"
90 PRINT:PRINT:PRINT
95 PRINT "                    Would you like to try another set of"
96 INPUT "                    values ? (1=yes 2=no) and Enter";Q
97 ON Q GOTO 27, 990
990 PRINT:PRINT
995 PRINT"                    Good listening!"
999 END
```


www.americanradiohistory.com

GIZMO®

A CHRONICLE OF CONSUMER ELECTRONICS

Slip Slidin' Away

COOLSCAN 35-mm SLIDE SCANNER. Manufactured by Nikon Electronic Imaging, 1300 Walt Whitman Road, Melville, NY 11747-3064. Phone: 800-52-NIKON or 516-547-4355. Price: $2495 (external), $2195 (internal).

The distinctions between traditional and desktop publishing are becoming more blurred with each passing year. It was easy even a couple of years ago to spot desktop-published material. It generally looked something like a patch-work ransom note because of the many different fonts used; poor-quality "clip-art" images were the rule. To make matters worse, it often was printed on a dot-matrix printer.

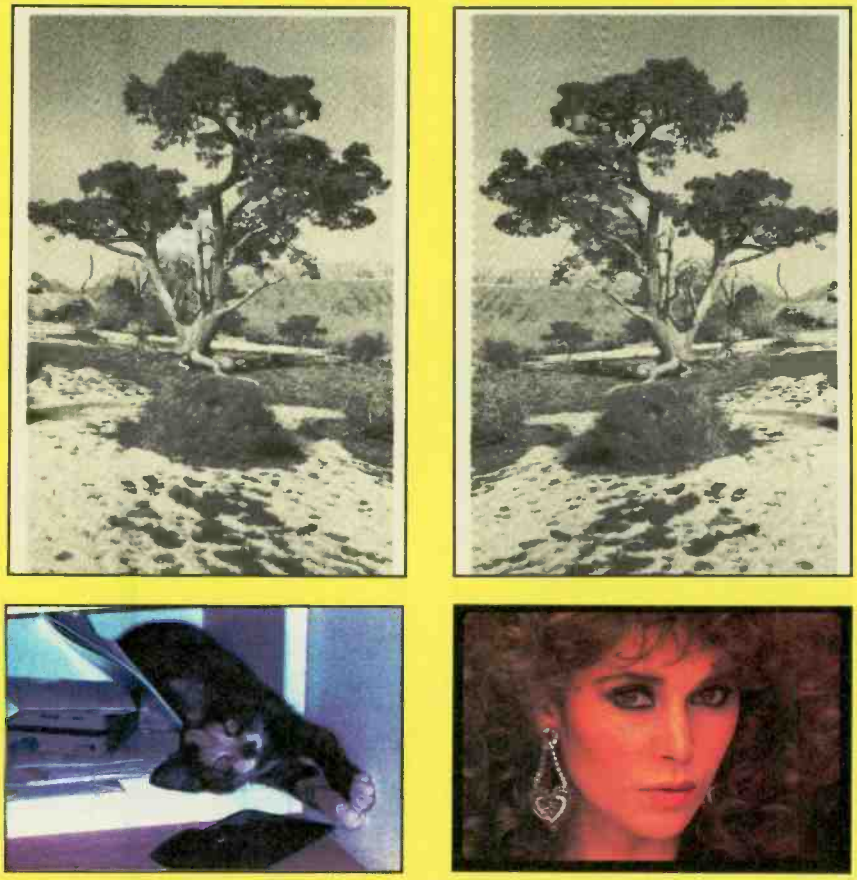
There is no shortage of poorly designed published material today. What's different is the availability of affordable hardware that now allows even the worst designs to be output at a professional level of quality—on the desktop, with a PC. Desktop-published documents can now be virtually indistinguishable from professionally printed material.

One of the latest innovations to help the desktop publisher is the *Coolscan 35-mm Film Scanner* from *Nikon Electronic Imaging*. The Coolscan can capture images from both color or black-and-white, positive or negative slides and film. The images can be imported into desktop-published documents. The scanned images can even find themselves in the pages of **Popular Electronics**. In fact, all of the images on this page were scanned by the Nikon Coolscan.

The Coolscan is a small device, measuring about 6 × 8 × 1¾ inches. Its small size and low price is made possible because it uses red, green, and blue LED's as a light source. It runs as cool as its name indicates.

We installed the Coolscan on our IBM-standard PC without a hint of trouble—it took us about two minutes to install the

CIRCLE 50 ON FREE INFORMATION CARD



These five photographs were scanned by the Coolscan from color and black-and-white negative film, and color slides. The tree on the left had a file size of about 260 kilobytes. The tree on the right was scanned at maximum resolution for a file size of 10 megabytes.

www.americanradiohistory.com

hardware, including opening our computer's case. All that was required was to set the SCSI ID of the interface card, insert it into our PC, and then to connect the Coolscan to the card with the supplied cable. An internal version, which mounts in a drive bay, is also available for IBM-standard PC's. The Coolscan is also compatible with Apple Macintosh computers.

The minimum system requirements suggested by Nikon are a PC running Microsoft Windows 3.0 or later with 8 megabytes of RAM, an 80 megabyte hard drive, and VGA graphics. For better performance, Nikon recommends Windows 3.1, 16–32 megabytes of RAM, a 300-megabyte hard drive, and a 24-bit true-color display.

Installing the supplied software, which runs under Microsoft Windows, was as simple as installing the hardware. The Coolscan comes with "plug-in" software that can be controlled by such graphics software as Adobe Photoshop or Aldus PhotoStyler. We chose to use only the included Coolscan Control software (which also makes use of the plug-in software) to control the scanner for our tests. A separate utility for ejecting slides from the Coolscan is also supplied.

The hardware and software installation went so smoothly that we were ready to try our first scan less than a half our after we opened the Coolscan shipping box. We didn't even have to search for a slide to scan. Nikon ships one with the scanner, and refers to it in the first chapter (Getting Started) of the excellent user's guide that accompanies the Coolscan.

A slide is inserted into the scanner in much the same way that a floppy disk is inserted into a disk drive. For proper orientation, the slide is inserted with one of its thin (24-mm) sides first. The emulsion side of the film must be facing up for the sharpest results. (The emulsion side is the side of the film that contains the dyes. The other side is called the base.)

A supplied film holder allows unmounted film to be scanned. In general, film strips can be up to five frames long.

After the slide or film is inserted into the scanner and the control program is launched, the next step is to tell the software what type of film you are scanning (black-and-white or color, positive or negative) and the orientation of the image (landscape or portrait). Then you are ready for a preview scan.

The preview scan is a fast, low-resolution scan of the entire frame of the film. When the preview image is on the screen, the parameters for the final scan can be set. The resolution, size, and cropping area can be adjusted, as can the contrast, brightness, and color balance.

The final resolution of the scan is selected once the other parameters are chosen. Selecting the best final resolution can be a tricky job, because it depends on the size of the enlargement and how the final output will be printed. The resolution determines how big the image file will be, and how long the final scan will take.

According to Nikon, the ideal final scanning resolution for printing in **Gizmo** is 266 pixels per inch, twice the line screen (133 lines per inch) used for our printing.

We scanned a black-and-white image of a tree in two resolutions. In the first, we ended up with a resolution of 266 dots per inch, and ended up with a file size of about 263 kilobytes. Then we scanned the same image at the maximum resolution of the scanner, which produced a file larger than 10 megabytes! Can you see a difference between the two? Well, we won't see the actual printed page until you do, but we are willing to bet that we wasted our time scanning at the higher resolution—our printing process limits the maximum resolution that can be shown on the page.

Some of the other images that we wanted to use could not be scanned for a final resolution of 266 dots per inch because the images were on a small portion of the frame, and had to be enlarged. The maximum resolution with which a frame of film can be scanned is 2700 dots per inch. Such a high-resolution scan can take about six or seven minutes.

All of the scanned images printed here were made with the Coolscan in its automatic mode. All exposure, color-balance, and focusing decisions were made by the scanner. There is, however, a rather sophisticated set of controls for manually adjusting all aspects of the scan. The controls unquestionably could have allowed us to make better scans. But they also could have allowed us to completely mess up all of the images. We experimented with the controls, but let Nikon take the blame for the images shown here.

Color-balance controls allow the scanner's red, green, and blue exposure times to be varied in a range from 25 to 100. Adjusting the controls can be tricky if an uncalibrated monitor is being used. One thing to keep in mind is that if one color is decreased, its inverse color is increased.

For more precise control, the scanner's gamma curves can be adjusted. Gamma is a measure of contrast in a photographic image. The gamma editor allows the master gamma curve, as well as the gamma curves for each of the colors, to be adjusted. (Black-and-white images have a master and monochrome gamma curves associated with them.) Custom curves can be saved.

The gamma curve can be thought of as an input/output transfer function. It represents how input color values are output in the final scan. It can be used, for example, to strengthen the color values in shadows, and reduce those in the highlighted areas of the image to create what is essentially a negative.

Viewing a histogram of the preview image is helpful in making intelligent gamma-editing decisions. It provides a graphical view of the brightness of an image, which is often easier to interpret than the on-screen preview image.

The black point and white point of the images can be adjusted to vary the tonal range in the image.

The Coolscan is ideal for low-volume scanning of images that will be printed at small sizes. High-resolution scans require about 5–7 minutes, which would not be acceptable at high volumes. The maximum size that a scanned image could be printed in this magazine at acceptable resolution is about 4 × 5 inches.

Most of the competitive products in the Coolscan's price class are slide adapters for flatbed desktop color scanners. However, the low resolution they produce, typically up to 600 dpi, makes them unacceptable for serious users.

The Coolscan is very convenient—especially when compared to sending an image to a service bureau to be scanned, or putting an image onto Photo CD. (Photo CD, however, provides better results and higher resolution, and for high-volume applications, probably a speed advantage.) For small-scale desktop publishing, for quick emergency scans in high-end publishing, and for desktop presentations, the Nikon Coolscan is one hot product. ■

"If you must know, my wife set off our security system... I was blinded by the strobe light and ran into a post."

Senior Writers: Chris F. O'Brian, Teri Scaduto. ©Gernsback Publications, Inc, 1993. Gizmo is a registered trademark. All rights reserved.

The Wave of the Future

BOSE ACOUSTIC WAVE RECEIVER/ ALARM CLOCK. Manufactured by Bose Corporation, The Mountain, Framingham, MA 01701-9168; Phone: 800-444-BOSE. Price: $349.

If you're like most adult Americans, the last thing you see before falling asleep at night, and the first thing to greet you each morning, is something you hate. If that description immediately calls to mind your spouse, you'd probably be better off reading Ann Landers, or seeking the aid of a marriage counselor or divorce attorney. Remember, this is *Gizmo*. We are, of course, referring to your clock radio.

No one enjoys being roused from peaceful slumber by a blaring alarm, especially if its main job is to make sure you get to work on time. It doesn't matter if the clock chimes, chirps, rings, buzzes, or plays tinny music,—you just want it to let you sleep a little longer. ("Aw, c'mon, just another five minutes...")

Bose makes it a little easier to get up in the morning with the *Wave Radio* stereo receiver/alarm clock. Not your typical clock radio by a long shot, the Wave is first and foremost a radio receiver that is suitable for real listening, and not just catching the morning traffic and weather reports. It also happens to have just about every feature you might want in an alarm clock, and is small enough to fit on your nightstand.

The Wave Radio is both unobtrusive—measuring just 4.5 inches high, 14 inches wide, and 8 inches deep—and attractive. Its gently curved, clutter-free front panel contains only the display, which is centered between two plastic speaker grilles. The control panel is conveniently located on top of the radio, so that you can reach out and slap down that snooze button. A credit-card-sized remote control duplicates most of the top-panel controls and adds a MUTE key. At the bottom of the unit is a compartment that holds three "AAA" batteries, which will maintain the time and station settings for as long as a week in the event of a power failure. An FM wire antenna and an AM loop antenna are also included.

The Wave Radio can stand alone as a radio or clock/radio or serve as the center of a stereo system. RCA-type phone jacks on the back of the unit allow a CD player, tape deck, or TV to be connected. We hooked up a portable CD player for which we've never had much use. (It turned out to be impractical while exercising, and we've since installed CD players in our home, office, and car.) The CD player now rests inconspicuously on top of the radio, and we're able to listen to our favorite discs in the bedroom. If our small bedroom TV set had audio outputs, we could imagine using the Wave Radio to improve the audio instead. Because audio outputs are provided on the Wave Radio, it's also possible to use Bose Acoustimass-3 or -5 powered speakers, or your own favorite stereo amplifier and speakers.

That's really not necessary in most applications, however. The Wave's built-in speakers use Bose's Acoustic Wave technology to provide deep, full bass from a small package. It features one 2.5-inch long-throw, full-range transducer and one 2.5-inch, long-throw, "wide-range" transducer in an Acoustic Wave enclosure. That enclosure is the key to the impressive audio that the radio delivers. A 34-inch single-ended waveguide is molded in a folded arrangement inside the unit behind the left speaker. The waveguide output is at the right-hand edge of the front panel. Remove the waveguide, and you have a clock radio that sounds like a clock radio.

Because only the left speaker feeds the waveguide, Bose feeds the low-frequency signals from both channels to that speaker. Low-frequency signals are non-directional, so stereo imaging isn't affected—not that we would expect good imaging from such closely spaced speakers. Although you might expect a waveguide to be resonant at only a single frequency, Bose engineered the transducer and waveguide to interact to extend the frequency response. The result is deep, full-bodied sound at any volume.

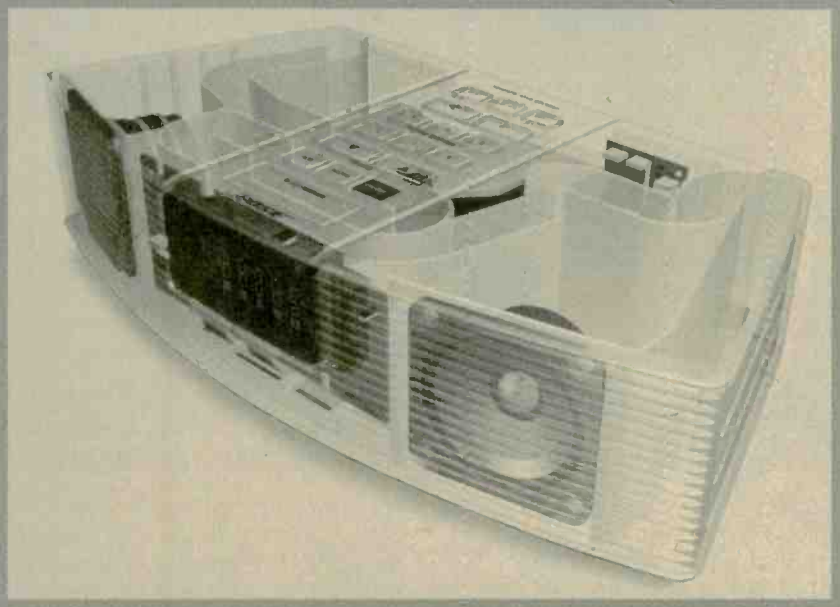
To our ears, Bose was not as successful with the Wave Radio as it has been with the Acoustic Wave in other products. The bass often struck us as being ill-defined and muddy, with a hint of being boomy. Nevertheless, the Wave Radio is the best-sounding small-package radio we've ever heard.

When it's put to work as a clock radio, the Wave Radio is truly in its element, providing almost as many sleep/wake options as you could possibly desire. Do you like to fall asleep to the radio (or a CD or tape), and wake to an alarm? Okay. Would you prefer waking up to a different radio station, or the same one at a different volume? No problem there! Do you and your spouse wake at different times? Two separate alarms can be set, and each of you can wake up to a different station.

Do you like your clock display to double as a night light, or do you prefer to sleep in a darkened room? It's easy to adjust the brightness of the Wave's display. Could you sleep through an earthquake, or do you wake if the next-door neighbor sneezes? You can adjust the volume accordingly. Whatever the volume, whether the Wave is set to the alarm or radio, the volume will gradually increase—no sudden piercing sound breaks the silence. Perhaps you'd like to wake to an alarm, hit the snooze bar for a 10-minute reprieve, and then wake to the radio. Again, that's no problem. In fact, the only falling-asleep/waking-up scenario that the Wave can't handle is waking to an external source, such as a compact disc.

All of the clock radio's functions are set from the top-panel keypad (and can be accessed using the remote control). The top row of the keypad contains the ALARM SET, CLOCK SET, and ALARM MODE(buzzer or music) keys. Just beneath those three are the up and down tuning arrows that are used to change the time when setting the alarm or the clock, and for tuning the radio. Holding down one of the arrow keys tunes up or down through the radio dial; a quick press tunes up or down through the station presets. Pressing both at once displays the current station. Six preset buttons can access six AM and six FM stations. Below the preset buttons are up and down volume keys, which are also used in conjunction with the CLOCK SET button to adjust the display brightness. The next row contains the AUX button, used to select CD or tape; the AM/FM key; and the ON/OFF key. The bottom row contains only the oversized SLEEP/SNOOZE bar, used to grab that extra 10-minute's sleep.

www.americanradiohistory.com



Inside the Wave Radio is a 34-inch folded acoustic waveguide that allows the 2½-inch drivers to produce amazingly deep bass. Note the open end of the waveguide to the right of the right speaker.

None of the functions are difficult to set; in fact, most are quite simple. Clock and alarm times are set by simultaneously holding down the ALARM SET or CLOCK SET key and the tuning up or down arrow. Radio stations are stored as presets by holding down a preset button while the station is playing, until a beep is heard. The alarm mode is set by pressing that button repeatedly while keeping an eye on the icons shown in the display: a blank display for no alarm, an increasing volume icon for buzzer, and a musical note for radio, and both icons for buzzer with radio. To wake to a station other than the last one selected, the new station's preset key is pressed while the ALARM SET key is being held down. To set the second alarm, the ALARM SET and ALARM MODE keys must be held down at the same time until the alarm 2 indicator begins to flash. Two sets of alarm signals are displayed when both alarms are set.

When the alarm rings, you have still more options. You can hit the SLEEP/SNOOZE bar—as many times as you like. If you've selected buzzer with radio, the two will alternate each time you press the bar. Should you finally decide to wake up, you can press the ON/OFF key to stop today's alarm and make sure it wakes you up at the same time tomorrow. Or you can press the ALARM MODE key, in which case you'll have to remember to reset the alarm the next time you need it. The alarm time, however, is retained.

After putting it through its clock-radio paces, we tried moving the Wave Radio into the kitchen, a room with tiled floors and backsplash, bare walls in the dining area, and curtainless windows. Although the manual warned that it might sound bright and shrill in such "hard" surroundings, we found the opposite to be true. The deep bass was quite obvious in that room, where the Wave Radio, backed into a corner, sounded a bit boomy. No tone controls are provided.

We do have a few complaints that don't reflect upon the Wave Radio's audio quality. First, we would have preferred to see (or feel) a larger ON/OFF button, perhaps with a different shape or texture from the other top-panel keys, so that we wouldn't be groping for it in the dark. We'd like to see the buttons backlighted as well. And we found it nearly impossible to keep track of the tiny remote control amidst the clutter of books, magazines, eyeglasses, photographs, etc. on the nightstand on the other side of the bed from the Wave. Granted, we have problems finding even standard-sized remotes, but this one, barely larger than a credit-card, never seemed to be in sight when we needed it. Finally, we can't understand why the radio doesn't support the expanded AM band.

We still don't like waking up in the morning (weekdays, that is!). But the Bose Wave radio makes the most out of the inevitable: It makes waking up pleasing to the ears and, well, almost bearable ■

The Marriage of A and V

ONKYO TX-SV717PRO A/V RECEIVER. From: Onkyo U.S.A. Corporation, 200 Williams Drive, Ramsey, NJ 07446; Phone: 201-825-7950. Price: $949.95.

Audio and video have become inseparable in the last ten years. If you've been shopping for a stereo receiver lately, you might have found that to be literally true. A/V receivers have taken over the stereo receiver market. But not many of them can match the quality of *Onkyo's TX-SV717PRO*.

The major features of the receiver are: a five-mode digital signal processor; full digital Dolby Pro Logic; on-screen displays; 85 watts per channel for front left, right, and center channels; multiple-room capability; four video and six audio inputs; and 40-station preset tuning.

The TX-SV717PRO is rather large (about 18 × 6¾ × 15¼ inches) and heavy (over 30 pounds). That's a natural result of putting five amplifiers, switching circuitry, and AM and FM tuners into a box. Besides, we've never known Onkyo to scrimp on power transformers, heatsinks, and chassis materials.

The amplifier section of the TX-SV717PRO can operate in either a stereo or a surround mode. In stereo mode, it can provide a minimum 110 watts per channel to the front left and right channels. In surround mode, it can provide 85 watts to each of the front channels, and 30 watts to each of the two surround channels.

The receiver supports multi-room operation by way of a set of remote-speaker terminals. A person in the second room can listen to a different source from that playing in the main room. An optional multiple-room remote system allows the receiver to be controlled from an infrared

CIRCLE 52 ON FREE INFORMATION CARD

www.americanradiohistory.com

remote in the second room. However, when the TX-SV717PRO is in its multi-room mode, the surround modes will be turned off, and the power capability is reduced to 85 watts per channel.

The receiver offers four audio-only inputs (PHONO, CD, TAPE 1, and TAPE 2) and three audio/video inputs (VIDEO 1, 2, and 3) on the rear panel. A fourth A/V input (VIDEO 4) is provided on the front panel for the convenient connection of a camcorder. The VIDEO 1 and VIDEO 4 connections provide inputs only. VIDEO 2 and VIDEO 3 provide both inputs and outputs, so they can be used for VCR's or other recorders. The receiver's extensive signal-routing capabilities make recording very convenient. For example, it is possible to record one source while listening to another.

After amplifier power, perhaps the most important thing to consider when shopping for an A/V receiver is how easy it will be to operate—not only for you, but for other, less technically inclined members of your family. Remember, you are likely to have the receiver for many years.

One of the strengths of the TX-SV717PRO, and of other Onkyo A/V receivers we've seen, is the convenience of the user interface, despite the complexity of its switching functions. Most of the receiver's features can be controlled either from the front panel, the remote, or through a series of on-screen menus.

The on-screen menu system is ideal for setting up the receiver for video. The menus are easy to see from the viewing position, and provide positive feedback and pictorial guides. Five buttons on the remote, four cursor keys and an enter/escape key, control all menu functions, so setup is easy even in a darkened home theater. The main menu features four choices: Input Select, Record Output, Surround-Sound Setup, and Graphic Display.

The Input Select menu provides an easy way to choose the video and audio inputs. When the menu is first called up, the picture- and sound-select "buttons" (icons) are "locked together." Pressing the side-to-side cursor keys changes both the video and audio sources as one. Pressing the up or down cursor keys permits the video and audio sources to be adjusted independently, so, for example, you can watch a nationally televised baseball game while listening to the local radio commentary.

If the radio is selected as the audio source, the tuner memory presets can be adjusted from the Input Select menu. The surround mode (but not the surround parameters) can also be adjusted from that menu, and the tape monitor can be turned on or off.

The Record Output menu is used to select the recording source, and to route the outputs accordingly. If "source" is selected, the current source that you are listening to or playing back will be routed to any devices connected to TAPE 1, VIDEO 2, or VIDEO 3. It is possible, however, to select a source for recording other than what is being listened to. For example, you can record a radio broadcast can be while watching a videodisc. The output to TAPE 2 is always the current selected source (the one being listened to) and cannot be changed.

The Screen Setup menu gives a couple of easy choices. The first lets you choose between eight available the background colors, to be displayed on the video screen when no other video source is present. The second choice is whether the "immediate display" is turned on or off. When on, the mode of the receiver is displayed on-screen when the input or surround mode is changed.

The Surround Sound setup menu permits the surround mode and all relevant parameters to be adjusted. Five modes are available: Dolby Pro Logic, Hall, Theater, Studio, and Live. The surround mode can also be turned off.

When Dolby Pro Logic is selected, the center mode (normal, wideband, and phantom), center level, rear level, and delay time (15–30 milliseconds) can be adjusted from the on-screen menu. The test tone—which is useful in setting the levels properly—can also be turned on from the menu, and all settings can be returned to their initial, default values.

The theater menu is similar to that for Pro Logic, but an extra page is added so that the theater size, effect level, reverb level, and reverb time can be set. All settings can also be returned to their default values. The theater size and shape can be adjusted from 0.4 to 1.6, which is the ratio of the theater's width to its length. There's no need to calculate the kind of theater you wish to simulate. On-screen graphics depict the shapes and relative size of the theaters as you make the adjustment.

The effect level, reverb level, and reverb time are adjusted with another set of on-screen graphics that represent the initial sound reflections and reverb time. Each setting can also be set from 0.4 to 1.6. For these effect settings, however, we preferred to use our ears, rather than the graphics or numbers.

The Hall, Live, and Studio DSP modes also provide similar parameters to be set (but not the delay time for the rear speakers). The Hall mode is intended for recordings that already have a substantial amount of reverb—classical music for example. (Listening to speech in this mode can be disconcerting because of all of the echoes it creates.) The Studio mode is intended for studio recordings that contain little reverb, while the Live mode is intended for live recorded music. Of course, how the modes are used is entirely up to the taste of the listener. Just as some people prefer that all music be played with window-rattling bass, we assume that some people like to listen to newscasts that sound as if they are coming from a huge church.

The surround modes can be controlled from the front panel via five buttons. One selects the surround mode, two others are used to scroll through the parameters that can be adjusted (delay time, for example), and two more can be used to scroll through the parameter's possible values.

The remote control permits many of the settings to be accessed directly. For example, one key can be used to switch the surround mode, and other keys, the remote can be used to directly change the delay time and the main, center, and rear levels.

The remote control has sixty small buttons on its front panel. Thanks to the menu system, it's easy to perform most adjustments without too much trouble, even in a darkened home theater. Eighteen of the buttons are for controlling compatible Onkyo tape decks and compact-disc players. Ten additional buttons can be programmed to control a videodisc player and VCR.

The TX-SV717PRO contains a few other features that show how much thought Onkyo put into how the receiver will be used in real life. For example, the 40 tuner-memory presets can be grouped into six classifications, labeled A through F. Both AM and FM stations can be stored in a single classification. Some users might assign one category for each family member. Other users might assign stations by type—classical, jazz, news, etc. The number of stations that can be stored in each category is limited only by the total of forty stations that can be stored.

The only complaint we have about the receiver is a rather minor one. We were a little confused by the preset-station memory programming. Unfortunately, it's not possible to overwrite a memory location. Its contents must be deleted first. It's also difficult to assign a specific memory number to a given station. For example, when a station is stored in classification "A," it is automatically assigned to the lowest available number not already programmed in that category. We like to assign the same number to a station on all of our receivers (home, office, and car).

To sum things up, we can't think of any reason why we wouldn't want Onkyo's TX-SV717PRO in our home theater. It provides adequate power for even the most demanding source material, and its digital Pro Logic decoding provides accurate surround-sound steering and reproduction. The other DSP modes of the receiver, when used "properly," can provide a believable, enjoyable recreation of a wide variety of recordings. And everyone in the family can operate the receiver. ■

www.americanradiohistory.com

CIRCLE 53 ON FREE INFORMATION CARD

A Perfect Match

PS-24 SHIELDED A/V SPEAKERS. Manufactured by Design Acoustics, and Audio-Technica Company, 1225 Commerce Drive, Stow, OH 44224. Phone: 216-686-2600. Price: $189.95 each.

Home theater is the bright spot of the 1990's for audio retailers. Born about 15 years ago, home theater owes its existence in good part to the 1976 release of *Star Wars*, which popularized Dolby Stereo in theaters and created public awareness of the important role played not by actors, but by the soundtrack. The first Dolby Surround decoders for home use followed about five years later.

Between the opening of *Star Wars* and the first consumer Dolby Surround decoders, home theater was quite a bit different from what it is today. The earliest setups used non-Dolby decoders, which extracted an "ambience" channel from the difference between the right and left channels (or the L − R signal). Next came the first Dolby-licensed Surround encoders. Those included a rear-channel delay, which, in effect, moved the rear speakers farther back in the room. Dolby Pro Logic—used in most modern home theaters—was a relative latecomer to the scene.

One of the main benefits of Pro Logic is that it provides a center channel, which draws attention to the screen. It also eliminates the "hole" in the middle of the soundfield that is often heard in setups without a center channel. With a center channel, on-screen action sounds as it is coming from the screen, while off-screen sounds still sound properly placed to the sides or rear of the room.

All Pro Logic equipment provides a "phantom" mode that tries to eliminate the hole in the middle when only two speakers are used. In that mode, the center-channel information is fed to both the left and right speakers. While the phantom mode works to eliminate the hole in the middle, it eliminates the main benefit of Pro Logic—improved imaging.

The gradual evolution of home-theater surround sound over the past 15 years has afforded consumers several different approaches to putting a system together. In the early days, most consumers assembled home theaters by adding a decoder and an extra pair of speakers to their existing audio and video equipment. For example, their existing stereo receiver or amplifier fed their existing front speakers, while the decoder fed the surround channel to the new speakers.

Although most consumers today are moving into surround sound with the help of a Dolby Pro Logic audio/video receiver (such as Onkyo's TX-SV717PRO reviewed elsewhere in this month's Gizmo), even now, they might use some of their existing equipment, especially their stereo speakers. With a Dolby Pro Logic system, they're more than likely to add the center-channel and surround speakers.

For the most part, we've been satisfied with the quality of the surround effect from such setups, particularly when the receiver can provide the same amount of power to the center channel as it does to the right and left channels. (That's something to keep in mind as you shop for an A/V receiver.) Fortunately, most A/V receivers can now do that, even though the center channel doesn't contain sound with frequencies under 100 Hz. (Most also include a "wideband" mode in which the full audio spectrum is fed to the center channel.)

Despite being satisfied with the sound of many home-theater setups, something always bothered us a little. We would never consider using different, mismatched speakers for listening to stereo music. We couldn't help but wonder what we were missing by using mismatched speakers for recreating surround sound.

Of course, in the best of all worlds, all five speakers in a Pro Logic setup should be matched. One good reason to consider using five identical speakers is that your home theater system won't always be used to listen to Dolby Pro Logic material. Most A/V receivers offer various digital signal processing (DSP) modes that feed sounds to the rear speakers in a way that Pro Logic doesn't. And tomorrow's consumer Dolby decoders will handle the multi-channel Dolby SR-D, which has full-range surround channels.

But this is the real, here-and-now world. In less-than-perfect circumstances, if there is one place to compromise, it's in the surround speakers. That's because they need to process signals in the relatively narrow bandwidth between 100 Hz and 7 kHz, and there is far less power contained in the surround channel (which is why most A/V receivers provide far less power to the surround speakers). It's still important, however, for the surround speakers to match the front speakers in the 100-Hz to 7 kHz bandwidth. Otherwise you might notice that sounds change abnormally as they move from the front to the surround channels.

To our ears, however, the effect of mismatched surround speakers is subtle. It's far less disturbing, for example, than an incorrect setting of the surround-channel volume level. Matching the front speakers is far more important because sounds are continually being passed between the right, center, and left speakers.

Don't take our word for it. Even Dolby Laboratories advises, "Three identical

www.americanradiohistory.com

loudspeakers for left, center, and right . . . [give] the best results." We found that out when we set up our home theater with three *Design Acoustics PS-24* shielded A/V speakers.

The PS-24 speakers are a bass-reflex design and have a rated frequency response of 50 Hz–20 kHz, ±3 dB. (We installed them in a home-theater system along with the Design Acoustics PS-SW subwoofer, which was reviewed in the August 1993 issue of *Gizmo*.) The 20 × 5 × 10-inch cabinets house two 4-inch long-throw woofers and a ¾-inch metallized polycarbonate dome tweeter, and a crossover frequency of 10 kHz. The tweeter is ferrofluid-cooled, which maximizes its power-handling capability. It is mounted at the cabinet's center so that the acoustic center of the speaker is the same as the physical center. (That's important for a center-channel speaker, which is mounted to match the center of the screen.) The 6-ohm speakers are rated to handle up to 75 watts and have a sensitivity (1 kHz/1 watt/1 meter) of 89 dB. The PS-24 speakers are packaged in attractive black, composition cabinets with metal grilles.

The speakers are magnetically "shielded," which is essential for home-theater use. That's especially true for a center-channel speaker, which should be located either immediately above or below the center of the screen. If a speaker is not magnetically shielded, the field from its magnet will distort the picture. (This is not a concern with projection sets, however.)

Because of the thin width (5 inches) of the PS-24, and its magnetic shielding, in many entertainment centers the speakers can fit on the left and right of the screen. That's not an ideal placement, especially if the home theater is also used for listening to music, but it's a compromise that's made in many home theaters. Besides, that arrangement is better that than placing the speakers so far from the screen that off-screen sounds become so distracting that they pull attention away from the screen. (The center-channel speaker helps to reduce that by keeping the viewer/listener's attention focused on-screen.)

The result of using three PS-24 speakers in our home-theater setup bordered on being dramatic. During adventure films such as *Batman* and the ever-popular Indiana Jones series, the imaging was so realistic that our conscious thoughts about where the sounds were coming from disappeared. Rather than noticing and thinking about how the sound was panning from left to center to right (as we often do when we listen to surround sound on better, yet mismatched, speakers), we just listened and enjoyed what we were watching. That's just what we do in a good movie theater. And that's exactly what surround sound is all about. ■

CIRCLE 54 ON FREE INFORMATION CARD

Off to See the Wizard

OZ-9600II WIZARD PEN-BASED ELECTRONIC ORGANIZER. From Sharp Electronics Corporation, Sharp Plaza, Mahwah, NJ 07430-2135; Phone: 800-321-8877. Price: $649.

In our vocabulary, "organization" refers to an association or confederation—you know, like the Boy Scouts or the VFW—and "get organized" means to join Greenpeace or or some other protest group. Somehow, we never use either term when discussing our work habits or our record-keeping methods.

We tend to jot down notes on little scraps of paper, then scribble other notes on the backs of those scraps—and then lose the whole thing. There are more papers stacked on top of our file cabinet than stored alphabetically inside the drawers. Jumbled together in those file-top stacks are household bills, memos, press releases, technical papers, birthday cards that never got sent, research notes, magazines, and, of course, lots of those little lost scraps of paper. Each time we flip through our Rolodex, business cards come flying out—and those are just the ones that we remembered to "file" there in the first place! It's no wonder that we spend a good deal of our "work" time trying to get our hands on information that somehow got lost in the shuffle.

Because we're scribblers at heart, we've never had much use for those "electronic personal organizers" that require you to type information on a minuscule keyboard and read it on a tiny display. We've tried them, of course—it would be hard to avoid, in our line of work—but they've always been too awkward, too bulky, and just too much trouble to stick with for long. Furthermore, if you don't stick with them almost religiously, you're soon back to searching for those little scraps of paper again.

Obviously, we're not the only scribblers out there. There are enough of us that *Sharp* has come out with a version of their popular (among better organized folks) Wizard electronic organizer just for us. The *OZ-9600II* allows the user to input information using either the keyboard or "electronic ink." The latter method involves "writing" on the LCD screen using the included stylus or your fingertip. While it doesn't have any handwriting-recognition ability, the pen-based Wizard lets the user jot down notes and transcribe them to text later, or just use them as is. It's also possible to take your hand-written or drawn files and attach them to a text file, perhaps adding a picture to a telephone entry or attaching a hand-drawn map to an appointment.

Of course, the OZ-9600II Wizard is much more than an electronic note pad. Besides its "scrapbook" (electronic-ink) function, the Wizard offers the "notebook" word processor, which provides various fonts, formatting options, and page-layout previews; a "To Do" list that lets you assign due dates and priority levels

to various tasks; daily, weekly, monthly, and six-month calendars; and three telephone directories and three "user" files (business, restaurant, and other) that allow you to keep track of business and personal contacts. The Wizard also offers pop-up calculator and clock features, an "anniversary" function to help you remember birthdays and anniversaries, a scheduler; and its own "file cabinet."

Wait, we're not done. The Wizard comes with 512K of memory, but that can be upgraded by inserting another 512K RAM IC card into the slot on the side of the unit; a RAM card can also be used to back up the data in your Wizard, and cards can be swapped between some other Sharp organizer models for data sharing. (No card is needed to transfer data to another Wizard; that's done via direct infrared transmission.) There are application IC cards available that allow you to add, for instance, a dictionary, thesaurus, or an expense tracker. Sharp also offers optional peripherals including a wireless interface for printing, a data-transfer cable, a 1200-bps pocket modem, a wireless interface for linking to a personal computer, and an AC adaptor.

Measuring just over 7×4×1 inches when closed, and weighing in at 15 ounces, the Wizard can be comfortably carried in a purse or briefcase, and can fit in a large suit pocket. The top of the unit flips open to reveal an LCD screen under the lid and a QWERTY-style keypad surrounded by assorted function keys on the base. The stylus fits into a groove above the keypad.

Let's start at the top, literally and figuratively, with the Wizard's pen-based touch-screen. The 3×4-inch LCD is larger than is standard for personal organizers, and with 320×240 pixels it is fairly easy to read. Its contrast can be adjusted; however, it is not backlit, so some ambient light is required. Arranged just to the left of the display are 15 icons that represent the visible portion of the Wizard's graphical user interface. By touching an icon with the stylus or your fingertip, that function is opened for use.

It's hard to resist tapping the scrapbook icon first, to try writing with electronic ink. You can choose from three different stroke widths—thin, thick, and brush, and three different shades of "ink"—black, gray, or white. (We're not sure why you'd need the latter, but if you use the brush stroke to paint the screen bright, and then write in white, you can get the effect of chalk on a black board, without the squeak!) If you can't draw a straight line, the Wizard will do it for you, with a press of the ruler icon. And if you make a mistake, you can press the eraser icon and rub out what you've drawn, just as if you were using the eraser on the end of a pencil.

There's no question that writing and drawing on the touchscreen is novel and fun—but it is a bit awkward. First, even good handwriting comes out looking a bit shaky because of the low resolution of the "ink." Our everyday scrawl was illegible until we slowed ourselves down enough to write a bit more neatly. Second, because the screen is situated above the keypad, we found ourselves inadvertently pressing keys that affected our artwork or scribbles. Most notably, we kept hitting the ENTER key and storing whatever we were working on in mid-stroke. We experienced the same problem whether the Wizard was flat on a desk, held in one hand, or balanced on a laptop.

With touch-screen, stylus-input technology, Sharp's latest Wizard lets you jot down notes in "electronic ink."

We tried turning the Wizard sideways and holding it as if it were an open paperback book. We were then able to write on the right-hand "page" without touching the keypad. Of course, if we later wanted to copy what we'd written into another Wizard file, it would appear sideways there as well. We wouldn't want to transcribe sideways notes using the keypad.

Actually, we probably wouldn't want to transcribe anything using the keypad. It is larger than those found on most pocket organizers, but still difficult to use for touch-typing. With a bit of practice, we were able to pick up some speed—but continued to have trouble with accuracy, particularly with our right hand. That's because the punctuation keys that normally appear on the far right of the keyboard are abbreviated or missing. That leaves the right pinky finger (which normally rests on the colon/semi-colon key) hanging, and tends to throw the entire right hand off track. To the immediate right of the "L" key is the return key; next to the "M" the comma and apostrophe share one key, and the period, colon, and semi-colon share another. Shifting accesses the apostrophe or colon; the 2ND function key gets you to the semi-colon.

Despite those difficulties, the Wizard's keyboard is much easier to use than those on other pocket organizers that we've tried, and our typing did improve with practice. Of course, you can always switch to the scrapbook and hand write your documents, but you might not want to because the notebook function is a full-fledged word-processing program that allows you to set margins and tabs; define and move, copy, or delete blocks of text; use plain, underlined, italic, or bold type; and display a "dummy" of the page layout before transmitting the document to a printer. It's worth learning to use the keypad to access those features.

To help you get your thoughts organized before you start to write a letter or report, the Wizard offers the outline function. In effect, the outline is the electronic equivalent of that stack of blank index cards that you used to use when researching term papers, but it's a lot more flexible. You can type in a title and as many subtitles as you like, shuffle the topics to put your thoughts in a more logical order, merge two topics, or split one topic into two. You can also create subtopics of subtopics, or "children."

The telephone and user functions are almost identical, but they have different default file and field names to accommodate different types of information. There are three separate telephone files, each providing fields for name, address, and phone number. You might use one for personal numbers, another for service numbers (doctor, hairdresser, car mechanic, repairman, plumber, accountant, and the like), and the third for everyone on your Christmas-card list. The user application provides three separate directories. User File 1 is a business-card file that contains eight fields (company, name, position, extension, department, phone, fax, address, and a picture field for drawings from the scrapbook). User File 2 is a restaurant guide, in which you can list your favorite eateries by cuisine, and then note their names, addresses, phone numbers, prices, the appropriate attire, additional remarks, and add on a map drawn in the scrapbook. User File 3, with five unlabeled text fields, can be used as you see fit, perhaps for a listing of books to read, videos to rent, or travel-related numbers (hotels, airlines, car rentals).

We particularly liked the To Do function, which allows you to make lists. We're big list makers, but we usually lose the list long before we complete all the tasks on it. The To Do list lets you keep all your lists in one place, assign each task a priority level and a due date, cross them off when you're done, and place them in as many as five categories (a total of 32 different categories can be used in the To Do application). For instance, you might have

to call Jane Smith of the ABC company regarding the XYZ project that you're working on. In the description field, you might write "Call Jane Smith." Then you might place the task under the categories of "phone calls," "ABC Company," and "XYZ Project." When you check your phone calls category, you might also find reminders to call your son's teacher, make a dentist appointment, and call your mother to say happy birthday. That comes in handy if you like to set aside some time each day to make all your calls.

When you assign a due date to a task, the task is automatically entered onto your calender on the appropriate day. Similarly, when you enter a birthday, anniversary, or other important annual event into the Anniversary file, it appears on your calendar. To add specific appointments or meetings, the Schedule function can be used.

Obviously, the Wizard provides the functions needed to help you get organized. But once you've entered information in your telephone and user files, made detailed To Do lists, made a note of mom's birthday, outlined a business report, and wrote a few letters, how do you ever find them again?

Don't worry: They won't get lost in the electronic equivalent of that stack of papers atop our file cabinet! You can search for information in the telephone and user functions by scrolling through their alphabetized indexes. Also, by pressing the search icon at the side of the LCD, you can quickly search for a key word in a specific application or in all applications.

Finally, virtually every Wizard function gives you the opportunity to file your work in an electronic file cabinet at the touch of a button (before it gets a chance to pile up with a bunch of unrelated files), without even leaving the application. You can even store a piece of data in more than one file, so that Jane Smith's phone listing could be filed under both "Business Contacts" and "XYZ Project."

Although the Wizard is not without its flaws, its attributes far outweigh them. The small keyboard and screen are can't really be considered flaws, but rather characteristics of pocket organizers as a product category—and the Wizard's are about as good as they get. Despite its extensive applications, the Wizard isn't difficult to use, but getting truly proficient takes some effort. The 300-plus-page manual is intimidating at first glance, but upon closer examination, is only slightly convoluted. Luckily, it opens with a quick-start guide that can help you get started, and on-screen help is available.

The Wizard won't help a completely disorganized person get organized. But its touch-screen writing tablet is sure to lure some of those scribblers who previously shied away from electronic organizers. ■

CIRCLE 55 ON FREE INFORMATION CARD

Kid-Sized Zapper

FOXAPPER TV/CABLE REMOTE CONTROL. Manufactured by Fox Electronics & Technology, Inc., 265 Eisenhower Lane South, Lombard, IL 60148; Phone: 708-261-0661. Price: $15.

Have you begun to wonder if, after you've turned off all your audio/video gear and retired for the night, all your remote controls begin to multiply? We're pretty sure that's the case around here, where remotes currently outnumber viewers by about 4.5:1. After all, there's a certain resemblance among them all: The original remotes, the assorted universal remotes, and even the glow-in-the-dark and the voice-activated remote all are rectangular, black plastic boxes with keypads on the front.

Given what's going on behind our backs, why would we ever purposely add yet another remote to the current menagerie? *Fox Electronics* can name a few reasons to buy its *FoXapper*, an amoeba-shaped, brightly colored TV/cable remote control with a minimal number of buttons. At the top of the list is kid appeal. That's quickly followed by unique design, ease of use, and affordable price.

The FoXapper features a transparent case that is available in three neon colors—purple, orange, and lime—all sporting green buttons. Measuring approximately 4 × 2½ inches, the remote fits comfortably in a child's hand. With only six front-panel buttons, it's easy for even a child to use.

The FoXapper is preset to operate virtually any brand or model of TV and cable box. To set it to control your equipment, according to the back-of-the-package instructions (there is no user's manual other than that), you must enter the "set" mode by using the tip of a pen to press the SET button that is recessed on the back of the remote, and then press the TV button. With the remote aimed at the TV, the volume-up button is pressed repeatedly until the TV turns off. The set mode is then deactivated with your pen point. The process is repeated for your cable box.

Once it's programmed, the FoXapper can be used to control power, volume, and channel tuning. A mute button is also included, though we've yet to see a kid use that one! All the keys are easily reached even by those with small hands.

Upon first sight, we thought the FoXapper was nothing more than a silly gimmick. After playing around with it, though, we've discovered some redeeming qualities. It allows you to control the most-often used functions—volume, power, channel, and mute—so it can stand in for a full-sized remote for everyday viewing. Its bright purple case makes it stand out from the crowd, and from the rug, and from the sofa, so it's usually easy to spot. At a suggested retail price of $15, it's not going to break the family bank. Finally, kids do seem to like it. ■

www.americanradiohistory.com

ELECTRONICS WISH LIST

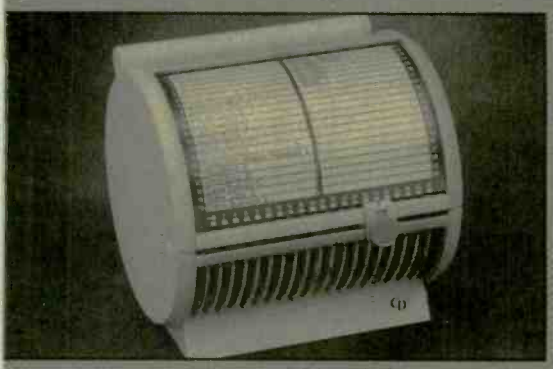
For more information on any product in this section, circle the appropriate number on the Free Information Card.

Bel-Tronics 900-MHz Cordless Phone

Pint-Sized 900-MHz Phone

With a flip-style handset that weighs less than 7.5 ounces—the smallest of its kind, according to *Bel-Tronics Limited* (8100 Sagi Parkway, Covington, GA 30209)—the *Micro 900 System* is one cordless phone that you can slip into your pocket and carry around the house and yard. When it comes time for recharging, you'll have your choice of charging stations. That's because the Micro 900 System consists of two separate units: the main 900M base/handset unit, and the 900MR remote handset/charger unit. When the base of the 900MR is plugged into an electrical outlet, its handset becomes an extra cordless extension. Up to three 900-MHz remote units can be used with one base unit, without the need for additional telephone jacks. The 900M base unit works independently of the remote unit, but the remote unit requires the base unit. The Micro 900 System also features a two-line LCD readout on each handset, 40-channel auto scanning, auto digital security, two-way intercom and paging functions, a 20-number alphanumeric memory, music on hold, programmable call blocking, and eight selectable ring tones. Price: 900M, $449.95; 900MR, $259.95

CIRCLE 56 ON FREE INFORMATION CARD

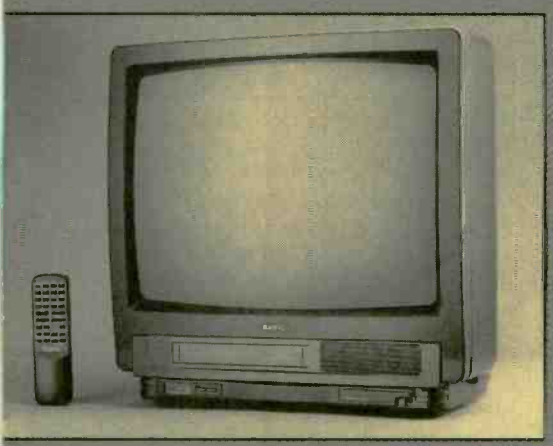


SC&T CD Storage System

CD Cylinder

Up to 40 compact discs can be stored safely and efficiently in the compact, flip-top *CD³* CD storage system from *SC&T International, Inc.* (3837 East LaSalle Street, Phoenix, AZ 85040). On the top of the unit is a title sheet with numbered spaces for the name of each disc. Each disc is assigned a number and placed in the appropriate position in the case, separated by spacers to protect the disc's recording surface. Across the front of the case is a row of numbers and a sliding indicator knob. To select a specific disc, the indicator knob is moved to the appropriate number before the case is opened. When the lid swings up, the desired disc is lifted for easy removal. By placing your finger through the CD's center hole and your thumb along its edge, you need never touch the surface. A convenient carrying handle locks the case shut and makes it easy to carry your CD collection around the house and in your car. Price: $34.95.

CIRCLE 57 ON FREE INFORMATION CARD



Sanyo Video Viewer

Video Viewers

Sanyo's (21350 Lassen Street, Chatsworth, CA 91311-2329) first entries into the combination-TV/VCR market are the 13-inch *TVR-1344* and the 19-inch *TVR-1944*, pictured here. Both sets feature bilingual on-screen programming in English and Spanish, a small footprint for viewing where space is at a premium, automatic TV and VCR power-on with tape insertion, and a special picture-quality selector with two settings: normal and rental. Selecting the rental mode enhances picture quality when viewing grainy, worn-out rental videos. Both TVCR's also feature easy setup, with no wires required between the TV and VCR; simple programming, using either one-touch timer recording or the "today timer," which automatically uses today's date for programming; and memory backup for picture control and TV channel settings, so that the sets can be moved about without losing that data. Prices: TVR-1344, $399.99; TVR-1944, $449.95.

CIRCLE 58 ON FREE INFORMATION CARD

Sherwood Receiver with Digi-Link III

Audio Link

The *RX4030R* audio receiver from *Sherwood Electronics'* (14830 Alondra Blvd., La Mirada, CA 90638) contains the latest version of the company's proprietary Digi-Link interactive data-bus. The receiver automatically switches to the appropriate input whenever a linked program source is activated. The 65-watts-per channel (with less than 0.05% THD) receiver features matrix surround sound, which permits the addition of small rear speakers to create a theater-like surround effect. Reception is enhanced with drift-free, quartz-reference digital tuning, dual-gate MOSFET front ends, and balanced-mixer stages. Other features include A/V integration, motorized volume control, A + B speaker switching, tape monitor, four audio inputs, 30 station presets, sleep timer, and headphone jack. Price: $225.

CIRCLE 59 ON FREE INFORMATION CARD

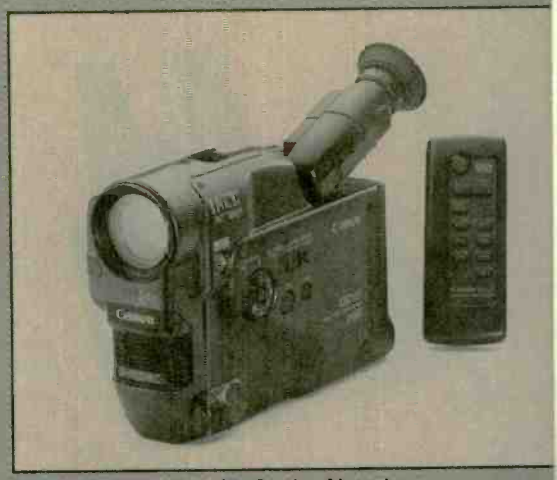
For more information on any product in this section, circle the appropriate number on the Free Information Card.

ELECTRONICS WISH LIST

Rock Steady Camcorder

Canon U.S.A., Inc. (One Canon Plaza, Lake Success, NY 11042), has introduced the *UCS5 with Shake Absorber*, their first Hi-Band 8mm camcorder to feature the optical image-stabilization technology that the company has been using in its full-sized UC Series models to prevent the shaky images caused by inadvertent camcorder movement. The optical stabilization technology causes no degradation of image quality or loss of field of view, common problems with electronic image-stabilization systems. Highly sophisticated sensors detect horizontal or vertical movement, and transmit data to a microprocessor. The microprocessor then sends signals to actuators that adjust the system's specially designed Vari-Angle Prism to the proper angle to refract light and compensate for camera movement. Numerous compensation programs are stored in the system's microprocessor, increasing the camcorder's stabilization performance by allowing it to adapt to a wider range of shooting situations. Other features of the UCS5 include digital signal processing with Hi-band circuitry, a 12× zoom lens and a 24× digital zoom function, autoexposure as well as five selectable exposure modes, stereo sound, wind-noise reduction, a 16:9 widescreen-format function, and a wireless remote control. Price: $1900.

CIRCLE 60 ON FREE INFORMATION CARD

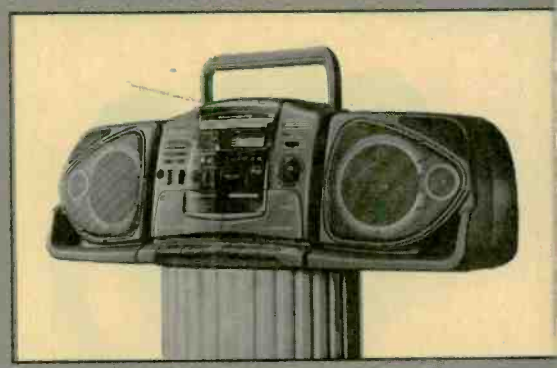


Canon Camcorder with Shake Absorber

Music to Go

Featuring larger speakers and a digital bass-recovery system (DBRS), *Fisher's* (21350 Lassen Street, Chatsworth, CA 91311-2329) *PH-D380* portable audio system puts big sound in a small package. The system contains a CD player, a dual cassette player, a digitally tuned AM/FM stereo radio, and a three-way detachable bass-reflex speaker system with matrix surround sound. DBRS synthesizes a bass signal one octave lower than the original playing octave, and adds that signal to the music to extend the bass signal. The portable music system features an electronic equalization system with the performance of a graphic equalizer and the convenience of one-touch presets. The PH-D380 offers 16-selection programmability, synchronized high-speed CD dubbing, sequential play, 24 station presets, and a 24-key remote control. Price: $349.95.

CIRCLE 61 ON FREE INFORMATION CARD



Fisher Portable Audio System

Clock Radio with Thermometer

How do you keep clutter off your nightstand? *Lloyd's Electronics* (6450 West Cortland, Chicago, IL 60635) would probably answer: with a *Model CR-500* analog clock radio, which can be mounted on the wall next to your bed. The compact, off-white clock radio measures less than ten inches wide and two inches deep, so it wouldn't take up much space if you decided to place it on the night table instead. Slated for use in the kitchen as well as the bedroom, the CR-500 features an easy-to-read, large quartz clock and something that we've never seen on a clock radio before—a built-in thermometer. Other features include wake to radio or alarm, AC or battery power, illuminated clock, oversized tuning and volume dials, and a snooze bar. Price: $39.95.

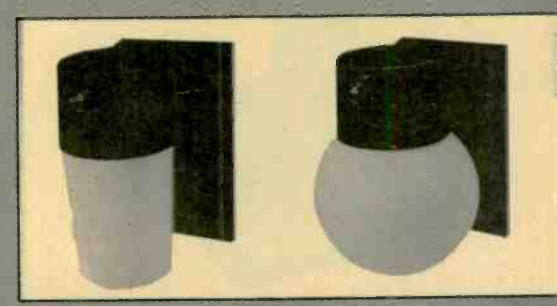
CIRCLE 62 ON FREE INFORMATION CARD

Lloyd's Wall-Mount Clock Radio

Motion-Sensing Entry Lights

Even if you live alone, you can be "greeted" at the front door when you come home at night, if you've installed one of *Heath Zenith's* (Reflex Brand Group, 455 Riverview Drive, Benton Harbor, MI 49022) entryway motion-sensing security lights. *Model SL-5610* has a cylindrical glass fixture, while *Model SL-5615* has a globe fixture. A sensor in the front of each durable, high-impact plastic fixture provides vertical and horizontal adjustments, allowing you to position the fixture to light the desired area. The lights are pre-wired for easy installation. During installation, a selectable test mode allows you to quickly aim and adjust the lights even in daylight. It's possible to adjust the sensitivity to motion, and pulse-count technology helps reduce the likelihood of false triggering by as much as 75%. You can also select the length of time before the lights shut off after motion has stopped. Manual override allows you to turn the light on from a standard wall switch. At daylight, a sensor resets the unit to the automatic motion-sensing mode. Price: $30 each.

CIRCLE 63 ON FREE INFORMATION CARD



Heath Zenith Reflex Motion Sensor Lights

ELECTRONICS WISH LIST

For more information on any product in this section, circle the appropriate number on the Free Information Card.

Samsung Anti-Curl Fax Machine

STD Entertainment GameGear Carrying Case

Toshiba Cordless Phone/Digital TAD

Anti-Curl Fax

By applying heat and pressure, the *FX1505* fax machine is able to dramatically reduce the amount of paper curl, allowing users to read incoming faxes "without having to place paperweights on both ends of the page," according to *Samsung Electronics America, Inc.* (105 Challenger Road, Ridgefield Park, NJ 07660). The fax machine provides automatic switching between fax and voice calls, and has a jack for connecting an answering machine. It has a 10-sheet automatic document feeder, and each page is transmitted in 15 seconds. Convenience features include an automatic paper cutter, 10 one-touch fax numbers, 10 one-touch phone numbers, and 20 additional numbers for two-digit dialing. Measuring just 13⅛ × 3½ × 10⅜ inches, the fax machine should easily find a spot in small businesses and home offices where space is at a premium. Price: $599.95.

CIRCLE 64 ON FREE INFORMATION CARD

GameGear Carrying Case

Handheld video games are great to bring along on car and plane trips, but what if you want to bring your GameGear to the beach? What's to protect it from sand, salt water, and suntan lotion? *STD Entertainment* (110 Lakefront Drive, Hunt Valley, MD 21030) comes to the rescue with the *Handy Gear*, a water-resistant, shock-absorbing case specifically designed for Sega's GameGear system. A plastic outer casing provides an air-tight buffer between your GameGear and the elements (a bonus for those who become so wrapped up in the game that they forget to come in out of the rain, we suppose), yet allows full access to game controls while the unit is being protected. The case also features a magnifying lens that enlarges the screen for better visibility, and an adjustable screen protector that reduces glare from the sun. There's room to store a game cartridge within the case, which comes with a carrying strap for easy travel. Price: $24.95.

CIRCLE 65 ON FREE INFORMATION CARD

High-Tech Puzzler

Puzzle-solving with a twist is on the menu with *The Even More Incredible Machine*, the successor to the award-winning "The Incredible Machine" from *Dynamix, Inc.* (1500 Millrace Drive, Eugene, OR 97403). The game, available for Windows, DOS, and Mac environments, asks players to piece together convoluted, Rube Goldberg-style contraptions whose final movements solve stated puzzle goals. The game offers ascending levels of difficulty, allowing players of all ages to work through its 160 different puzzles by doing strange and outrageous things. To achieve each puzzle goal, players have to build strange trip-lever contraptions by placing an odd assortment of fixed and movable parts on the screen. When the parts are assembled correctly, the machine's final falling/spinning action completes the assigned mission. For example, to win a "puzzle solved!" message, players might have to blow up brick walls with bundles of dynamite, or knock bowling balls onto conveyor belts using spring-loaded boxing gloves. Furthermore, there's no need to feel guilty about playing: Rooted in the laws of gravity and physical science, The Even More Incredible Machine is said to help players develop logic, problem-solving, and spatial-relations skills. Price: $49.95.

CIRCLE 66 ON FREE INFORMATION CARD

Stand-Up and Be Answered

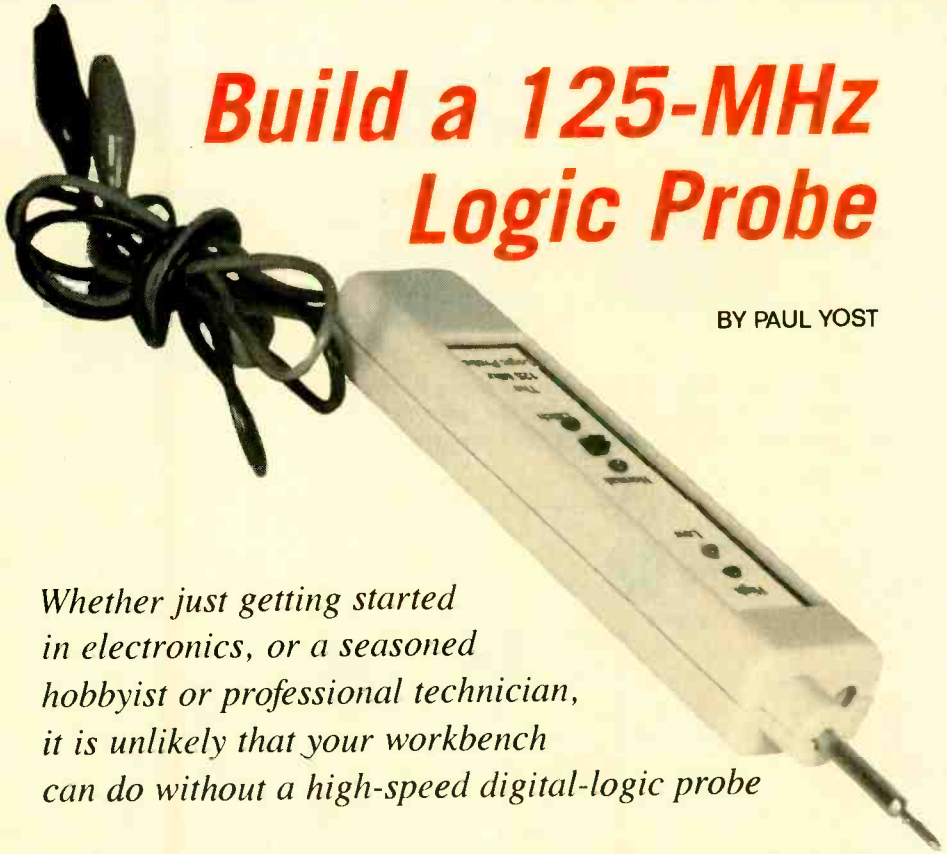
Combining an all-digital answering machine with a stand-up cordless phone, the *Model FT-9003* from *Toshiba America Consumer Products, Inc.* (82 Totowa Road, Wayne, NJ 07470) can record up to 40 incoming messages and boasts a high sampling rate for superior voice quality. Digital conveniences include high-speed playback and instant, random-access message retrieval. A special "silence detection" feature "shrinks" the blank spaces between words to make the most efficient use of the available recording time. The ITAD (integrated telephone answering device) offers a Help voice menu that provides all the information needed to operate the device. All major features can be accessed remotely from the handset. Price: $250.

CIRCLE 67 ON FREE INFORMATION CARD

www.americanradiohistory.com

Build a 125-MHz Logic Probe

BY PAUL YOST



Whether just getting started in electronics, or a seasoned hobbyist or professional technician, it is unlikely that your workbench can do without a high-speed digital-logic probe

As an electronics service professional, it is vital that I keep current with the latest products and changes. However, because electronics is the most dynamic industry of all, that task is often easier said than done. In our field, what's new today can literally be obsolete by tomorrow. Electronic circuits have changed dramatically over the years. System speeds have increased, component sizes have decreased, and digital-logic IC's have become commonplace.

The main focus for any new design today is speed, speed, and more speed. Personal computers and other electronic devices that once operated in the 1- to 5-MHz range now work at speeds from 25 to 66 MHz; and manufacturers promise that future products will operate at 100 MHz and beyond.

Not surprisingly, as the technology advances, the skills and knowledge of the technician must advance as well and so too must the test equipment to service it. It is no longer sufficient to simply have functional test equipment. The test equipment must perform its functions at the very high speeds used by the new products. So as system speeds increase, test equipment that was once adequate no longer makes the grade.

Buying good test equipment doesn't necessarily mean buying expensive test equipment. Fortunately, the same technological advances that created the newer, faster products have also made possible newer and better test equipment, and at the same low prices. The *125-MHz Logic Probe* presented here can be built from readily available and inexpensive parts. It takes less than 30 minutes to assemble, requires no complicated setup or adjustment, and you don't need any complicated equipment or tools to build it.

When finished, the probe will do all the tests that any commercially made probe will do, but it will perform those tests at incredible speeds.

Theory of Operation. At the most basic level, all digital circuits—no matter how complicated—work by processing binary data composed of logic 1's and 0's. To properly troubleshoot such circuitry, the technician must be able to see the logic states and trace their paths. The simplest way to do that is by using a logic probe. A logic probe is a device that allows the technician a fast and convenient way to "look inside" a digital circuit and see exactly which paths are high, which are low, and which are pulsed.

The circuit, as shown in the block diagram of Fig. 1, consists of six sections: a switching transistor, the FAST NOR gates, a latching switch, a logic-low indicator (green LED), a logic-high indicator (red LED), and a beeper.

The schematic diagram of a circuit that encompasses those elements is shown in Fig. 2. The switching transistor (Q1) acts as an interface between the probe tip and the first NOR gate. Recall that for TTL a logic 1 is approximately a +5-volt DC potential and a logic 0 is about a 0-volt DC potential. When the probe tip touches a circuit that is at a logic-1 state, that signal is coupled through the 91k resistor (R4) to the transistor's base.

Since a positive voltage forward biases the base-emitter junction of an NPN transistor, the transistor turns on. When that occurs, the positive voltage at the transistor's collector is switched through to the emitter, which then effectively places a logic-high state on the pin-6 input of the first NOR gate, U1-b.

When a logic 1 is placed on either one or both inputs of a NOR gate, its output toggles to logic 0. In our circuit, the logic-0 output of the first NOR gate is fed along two paths. First, it travels to the green LED (LED2) and, because a logic 0 equals 0-volts DC, LED2 does not light. In the other path, the signal is fed to a second NOR gate (U1-a), which is wired as an inverter. When that gate receives a logic-0 input, it converts it to a logic-1 output, which then causes the red LED (LED1) to light and the beeper (BZ1) to sound. That indicates that the circuit under test is high.

When a logic-0 condition is present at the probe tip, the transistor is not biased on and a logic-low state remains at the input of the first NOR gate. That makes its output go high, which then lights LED2. Of course, that means that a logic high is also placed on the input of U1-a, which then inverts the signal, producing logic-low output, which extinguishes LED1 and turns off BZ1, indicating a logic-low condition.

To basically recap, when a logic 0 is present at the probe tip, LED2 lights and LED1 is off. However, when a logic 1 is present, LED2 is off, LED1 is on, and the beeper sounds.

Sometimes, a circuit has neither a continuous high or low state, but is pulsed. Usually, those pulses are

www.americanradiohistory.com

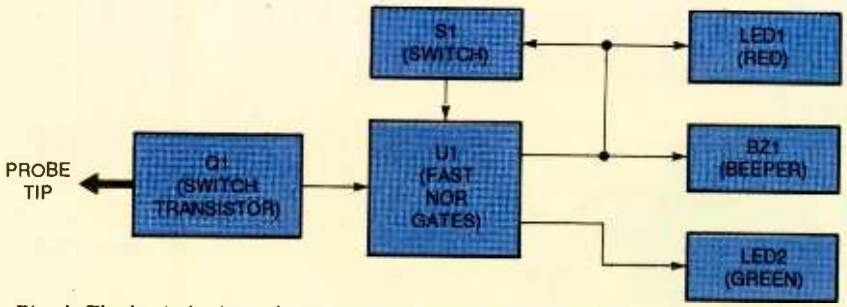


Fig. 1. The basic-logic probe circuit, as shown by this block diagram, consists of six sections: a switching transistor, FAST NOR gates, a latching switch, a logic-low indicator (green LED), a logic-high indicator (red LED), and a beeper.

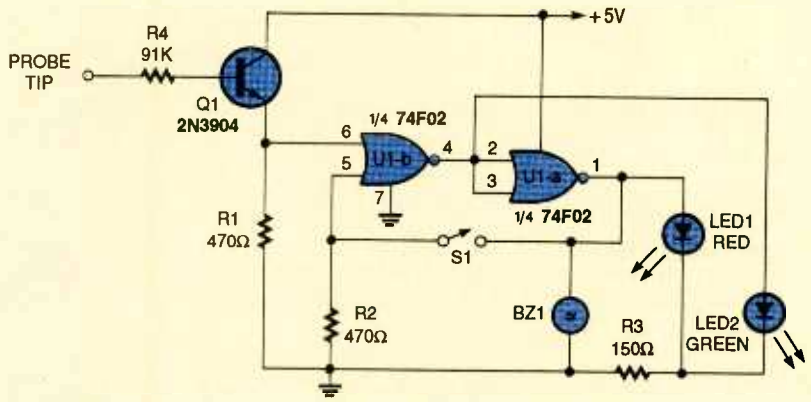


Fig. 2. The schematic diagram shows a circuit that encompasses all of the elements laid out in the block diagram of Fig. 1.

nanoseconds in duration, which is far too short a time for the red LED to light or for the human eye to catch. In such cases, a latch switch is used to perform a simple memory function to detect or "capture" those quick digital pulses.

When the latch switch (S1) is engaged, a logic 1 appearing at the probe input not only lights LED1, but is also coupled back (via the switch) to the second input of the first NOR gate (U1-b). That action, in turn, maintains a constant logic-1 indication on the probe. That means that, in the case of a pulse, the initializing input signal will activate the latch function and maintain a high indication. Even if the pulse is only a few short nanoseconds in duration, it will still be long enough to activate the probe and indicate that a pulse has occurred.

The technician can use that function to check for one shots or other logic-pulse operations. After S1 is engaged and the probe is armed, the technician knows that a pulse has been detected when the LED indication changes from green to red.

A Lesson in Logic. At this point, I'd like to explain how the probe is able to respond to pulse rates in excess of 100 MHz. The first part, the switching transistor, is easy. If you need a circuit to work at very high frequencies, simply select a transistor rated to work in the VHF range. Since the 2N3904 is rated to operate to at least 250 MHz, it fills that need quite well. However, that is but part of the story. What also makes the high speed possible is the type of digital IC used.

While digital chips are made by many manufacturers, they all share a common numbering system. For example, the IC used in this project is a 74F02. The first part, the "74," along with the "F" indicates that the IC is part of the 7400 TTL-series, commercial-grade digital family. The next part, the letter in the middle, designates the type of circuitry ued in the chip's construction, while the remaining two digits on the end represent the specific logic function of the chip.

In this particular case, the "F" stands for FAST a special subfamily of the TTL group. Other letters commonly used are C for CMOS, L for low power, H for high speed, and S for Schottky. Sometimes, the letters are combined in a number. For example, a chip with the number 74LS02 means that the IC uses low-power Schottky circuitry. A 74HC02 would mean a high-speed CMOS chip. Knowing the difference is very important. During a repair, you would not want to replace a high-speed CMOS device with a Schottky type since different power-supply voltages and clock speeds may be in use.

As mentioned, the last part of the number, the end digits, designate the logic function of the chip. In our part number, the "02" indicates a quad NOR -gate construction. Naturally, other numbers would represent other functions. (Check any IC data manual for further information about that or any other part number.)

Oftentimes, you will see other letters as well in part numbers, but those are manufacturer specific. For example, the "F" in an F74S00P would mean that the chip is manufactured by Fairchild,

PARTS LIST FOR THE 125-MHZ LOGIC PROBE

SEMICONDUCTORS

U1—74F02 FAST quad 2-input NOR gate, integrated circuit
Q1—2N3904 general-purpose NPN silicon transistor
LED1—3-mm, red light-emitting diode
LED2—3-mm, green light-emitting diode

RESISTORS

(All resistors are ¼-watt, 5% units.)
R1, R2—470-ohm
R3—150-ohm
R4—91,000-ohm

ADDITIONAL PARTS AND MATERIALS

BZ1—Piezoelectric buzzer (Radio Shack 273-074, or similar)
S1—SPST switch
Printed-circuit materials, enclosure, front-panel decal sticker, red and black alligator clips, 18 inches of red and 18 inches of black wire, solder, hardware, etc.

Note: A complete kit of parts (including the case) is available for $18.95 plus $1.00 shipping and handling from Paul E. Yost, P.O. Box 32291, Louisville, KY 40232. Kentucky residents must add 6% sales tax ($1.14). (No credit card or foreign orders.)

www.americanradiohistory.com

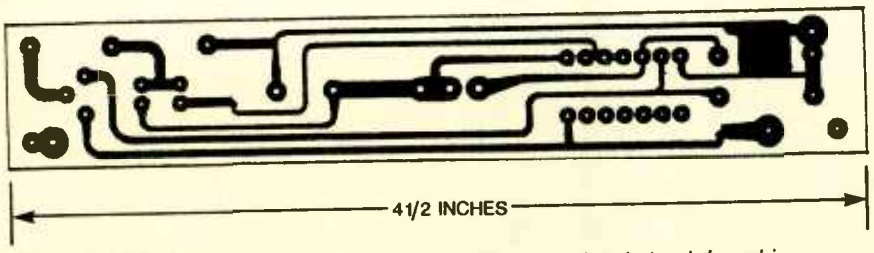


Fig. 3. This full-size template of 125-MHz Logic Probe's printed-circuit board is provided for the avid do-it-yourselfer.

while the "P" is their designation for a plastic DIP package.

The IC used in the 125-MHz Logic Probe is a 74F02. The "F" stands for FAST—shorthand for Fairchild Advanced Schottky TTL, which is a very high-speed, low-power logic family construction. The development of FAST was begun in the late 1970's by Fairchild with certain specific objectives in mind. Their main goal was to create a very high-speed, low-power IC family that would greatly out perform all the current TTL families. Their research led to a special new manufacturing process that produced internal transistors with incredibly high switching speeds and extremely small parasitic capacitances.

Eventually, their research resulted in logic chips with greatly enhanced speeds. Today, FAST logic chips work at clock speeds from 115 to 150 MHz with typical propagation delays of 3 to 4 nanoseconds. Considering that standard gates work from 10 to 20 MHz and other high-speed gates work up to about 40 MHz, that was a major breakthrough. That, then, is how the probe is able to obtain such an impressive frequency response—using a special combination of a VHF switching transistor and an advanced technology.

Other Features. There are two other circuit features that the technician needs to be aware of to properly understand the probe's operation. First, note the two 470-ohm resistors (R1 and R2) connected to the NOR-gate inputs. Theoretically, when a logic gate has no signal input, it "sees" a logic 0. However, in the real world, logic gates don't work that way.

In the real world, if a logic gate input is not specifically connected (or referenced) to either a logic 0 or ground condition, it floats high. That is partly due to all the electrical noise present in every circuit, but it can also be caused by small leakage currents in the high-impedance paths used by digital circuits. Whatever the cause, the net effect is the same.

If a gate input is not referenced properly, it "thinks" that it is high. Because of that, each NOR-gate input is referenced to ground via a 470-ohm resistor. That way, when the probe does not specifically have a logic 1 applied to its tip, the gate inputs are referenced to a logic-low state and the probe operates properly.

The next circuit feature to consider is the switching transistor. At first glance, that transistor may appear unnecessary for circuit operation. That is, why switch a logic 1 and 0 through a transistor when a directly coupled signal from the tip should operate the circuit just as easily? Well, as far as the logic probe is concerned, there is no need. The probe would work just as well without the transistor. However, the circuit under test may not.

Recall that the input to the NOR gate is coupled to ground via a 470-ohm resistor. That is a relatively low resistance. Without the transistor switch, any circuit that the probe touches would also be coupled to ground via the same resistance. In many cases, that would affect the circuit under test by loading it down, thus altering or "throwing off" the test results. By using the transistor switch as an interface, the circuit under test sees a 91k impedance instead of 470 ohms, thereby isolating the two circuits and ensuring the validity of the test results.

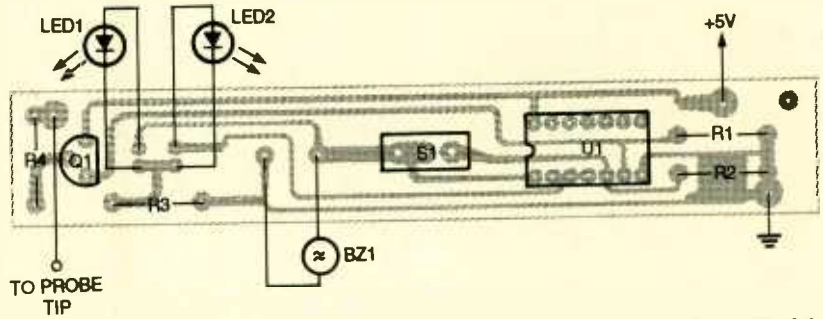


Fig. 4. Whether choose to purchase a kit or "roll your own," once you have all of the parts, you need only install the parts in the positions and with the orientations shown in rhis parts-placement diagram.

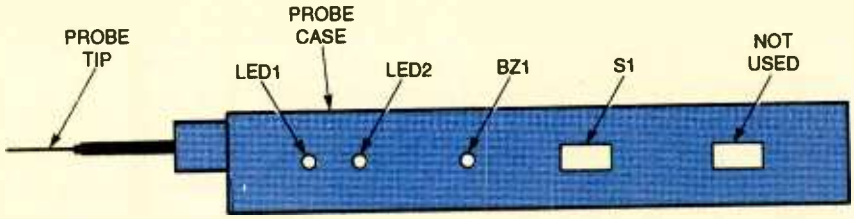
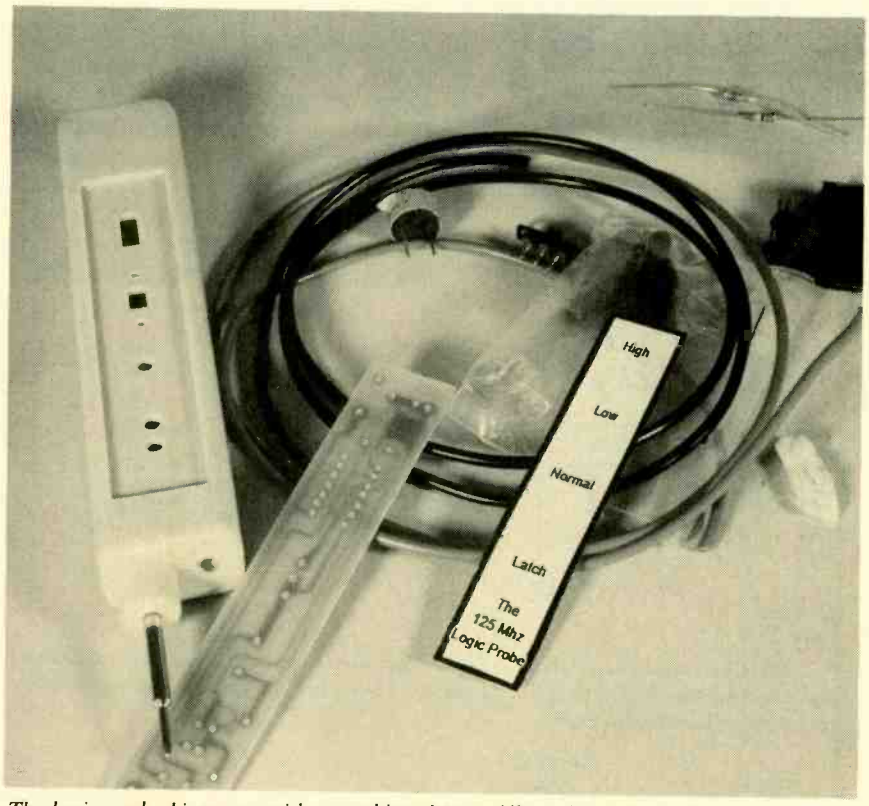


Fig. 5. Here is a graphic representation of enclosure and top-panel layout provided with the kit of parts offered in the Parts List. Even if you choose not to purchase a kit, you might still consider laying out your unit in a similar fashion.

Construction. Despite its incredible frequency range, the circuit is probably the easiest project you have ever built. Even people with little or no electronics experience can easily build it and get it to work. Despite its simplicity, though, it should be built it on a printed-circuit board. Point-to-point wiring works well for low-frequency devices, but the probe is designed to test for pulse rates beyond 100 MHz. At that frequency, interconnections and parasitic capacitances can quickly cause problems.

Figure 3 is a full-size template of the foil pattern for the 125-MHz Logic Probe's printed-circuit board for those who choose to etch their own. But, if you prefer, you can purchase a com-

www.americanradiohistory.com



The logic-probe kit comes with everything that you'll need to put together a professional-looking probe, including the case and front-panel decal.

plete kit of parts (including the enclosure) from the source listed in the Parts List. Note that if you do not choose to purchase the kit, you'll have to come up with an enclosure of your own. One idea to try is a plastic toothbrush holder, which has roughly the same form as a logic probe. For the balance of this discussion, however, we will assume that you are using the enclosure that comes with the kit.

In either event, once you have all of the parts, you need only install the parts in the positions and with the orientations shown in Fig. 4. From an operational viewpoint, exact parts placement and lead lengths aren't critical for a stable operation, but those factors are crucial for a proper fit in the case. The LED leads, in particular, must be cut to the right length and positioned properly to fit through the case holes correctly. Also, the transistor and resistor leads must be cut short enough to fit inside the case as well. (Figure 5 gives the general layout of the case top.)

Referring back to Fig. 4, there are three wires that connect the board to the outside world. The first is the wire that connects the 91k resistor (R4) to the probe tip. That wire is soldered between the board and the tail of the probe tip. The other two wires are the red and black leads, which are used to connect the probe to the +5-volt supply and ground, respectively. To install those wires correctly, be sure to check the parts-placement diagram for their proper locations.

The board is held in place within the case via S1's mounting screws. During construction, you will find it easiest to physically mount the switch to the case top first (using the two mounting screws) then complete the assembly by soldering the now mounted switch to the board. You must save this procedure for the last step, though.

Next, run the red and black leads out the case's end hole and then solder the corresponding alligator clips (red to red and black to black) to the leads. Secure the rear cover in place and place the peel off decal sticker over the case front. Placing the sticker covers the unused case holes and gives the completed assembly a truly professional look.

Testing. Unless you have a defective part or have misplaced or misoriented something on the board, the probe should work as soon as power is applied. When power is applied to the circuit, the green LED should light while the red should not. When you connect the probe tip to a logic 1 potential, the green LED should extinguish, the red should light, and the beeper should sound.

For the next test, disconnect the probe from the logic-1 source and then arm the pulse test function by setting the latch switch. Initially, you should have a logic low indication (the green LED lit), but as soon as the probe tip "sees" a logic 1, it should change to a high indication (the red LED lights and the beeper sounds) and remain in that state until the latch switch is reset.

Troubleshooting Guide. If, at this point, you have any trouble, the following steps should help you to locate the cause and correct it.

1. First check the power supply connections. The incoming +5-volts DC should be on the collector of Q1 and pin 14 of U1. If the voltage is missing at either of those points, you probably have a bad solder connection at either the red clip lead or on the board.

2. Check for proper parts orientation and placement. The most common mistakes are the misorientation of the IC, the LED's, the transistor, and/or the beeper. Since each of those parts is symmetrical, it is quite easy to place any or all of them in backwards.

3. Check the voltage level at pin 6 of U1, with no input to the probe tip; that pin should have a 0-volt reading. With a logic high at the tip, pin 6 should read between 4- and 5-volts DC. If it does not have that response, then Q1 may be defective.

4. You can check the two gates in the IC as you would any NOR gate. That is, when the inputs (pins 5 and 6) are low, the output pin (4) should be high and when 5 and 6 are high, the output is low. (The same troubleshooting steps hold true for pins 3, 2, and 1 of the second gate as well.) Since a high and a low are +5- and 0-volts DC, respectively, you can use a standard voltmeter to make the test. If any of the readings are off, the IC may be defective.

5. If all the tests in the previous steps check out okay, then use a jumper wire to place a +5 volt DC potential directly on pin 4 of the IC. When you

(Continued on page 88)

www.americanradiohistory.com

CAN YOU PASS THIS FCC EXAM?

Test your knowledge with this sample test that uses the actual questions used by the FCC.

Effective September, 1993, several private agencies have been authorized to manage Commercial Operators Examination testing. As a first step in this process, the FCC has issued question pools to be used by these independent agencies. This sample Element-3 test was assembled using the actual questions from that pool.

Passing an Element-3 examination proves that an individual possesses the operational and technical knowledge that is necessary to perform the duties required of a person holding a General Radiotelephone Operator License (GROL). To pass the test, an individual must answer at least 57 out of 76 questions correctly. Passing the Element-3 test is also a partial requirement for the Global Maritime Distress and Safety System Maintainer's License.

A general radiotelephone operation license must be held by any person who adjusts, maintains, or internally repairs a radiotelephone transmitter at a station licensed by the FCC in the aviation, maritime, or international fixed public-radio services. A GROL must also be held by the operator of (1) certain aviation and maritime land-radio stations; (2) compulsory equipped ship radiotelephone stations transmitting with more than 1500 watts of peak-envelope power; and (3) voluntarily equipped ship stations transmitting with more than 1000 watts peak-envelope power.

Each Element 3 examination is administered by a Commercial Operator License Examination Manager (COLE Manager). Just as we've done here, the COLE Manager constructs the examination by randomly selecting a total of 76 questions from the question pool, which consists of 8 subsets, following a specific FCC breakout.

If you are interested in finding out where you can take the FCC Commercial Operators test, see the box entitled "How to Take the FCC Exam" elsewhere in this article.

Now test yourself and see if you could pass the Element-3 exam!

---

1) What is the modern standard scan rate for a facsimile picture transmitted by a radio station?

A. The modern standard is 240 lines per minute
B. The modern standard is 50 lines per minute
C. The modern standard is 150 lines per second
D. The modern standard is 60 lines per second

2) In facsimile, how are variations in picture brightness and darkness converted into voltage variations?

A. With an LED
B. With a Hall-effect transistor
C. With a photodetector
D. With an optoisolator

3) What is the period of a satellite?

A. An orbital arc that extends from 60-degrees west longitude to 145-degrees west longitude
B. The point on an orbit where satellite height is minimum
C. The amount of time it takes for a satellite to complete one orbit
D. The time it takes a satellite to travel from perigee to apogee

4) Which emission modes suffer the most from selective fading?

A. CW and SSB
B. FM and double-sideband AM
C. SSB and image
D. SSTV and CW

5) What happens to a radio wave as it travels in space and collides with other particles?

A. Kinetic energy is given up by the radio wave
B. Kinetic energy is gained by the radio wave
C. An Aurora is created
D. Nothing happens since radio waves have no physical substance

6) The bending of radio waves passing over the top of a mountain range that disperses a weak portion of the signal behind the mountain is:

A. Eddy-current phase effect
B. Knife-edge diffraction
C. Shadowing
D. Mirror refraction effect

7) What is a frequency-marker generator?

A. A device used to produce a highly

How to Take the FCC Exam

One of the COLE Managers authorized by the FCC is the International Society of Certified Electronics Technicians. They have a nationwide network of Test Administrators who can make all the arrangements necessary to enable you to take the FCC exam at a location convenient to you. For information on test locations, fees, or any other details you can contact ISCET at:

International Society of Certified Electronics Technicians
2708 West Berry Street
Fort Worth, TX 76109-2356
Tel 817-921-9101
FAX 817-921-3741

www.americanradiohistory.com

accurate reference frequency
B. A sweep generator
C. A broadband white-noise generator
D. A device used to generate wideband random frequencies

8) What is the most the actual transmit frequency could differ from a reading of 462,100,000-hertz on a frequency counter with a time base accuracy of ±0.1ppm?

A. 46.21 Hz
B. 0.1 MHz
C. 462.1 Hz
D. 0.2 MHz

9) What types of coupling occur between a dip-meter and a tuned circuit being checked?

A. Resistive and inductive
B. Inductive and capacitive
C. Resistive and capacitive
D. Strong field

10) How can the frequency response of an oscilloscope be improved?

A. By using a triggered sweep and a crystal oscillator as the time base
B. By using a crystal oscillator as the time base and increasing the vertical sweep rate
C. By increasing the vertical sweep rate and the horizontal-amplifier frequency response
D. By increasing the horizontal sweep rate and the vertical-amplifier frequency response

11) How can intermodulation interference between two transmitters in close proximity often be reduced or eliminated?

A. By using a Class C final amplifier with high driving power
B. By installing a terminated circulator or ferrite isolator in the feed line to the transmitter and duplexer
C. By installing a band-pass filter in the antenna feed line
D. By installing a low-pass filter in the antenna feed line

12) What is resonance in an electrical circuit?

A. The highest frequency that will pass current
B. The lowest frequency that will pass current
C. The frequency at which capacitive reactance equals inductive reactance
D. The frequency at which power factor is at a minimum

13) What is the approximate magnitude of the impedance of a parallel R-L-C circuit at resonance?

A. Approximately equal to the circuit resistance
B. Approximately equal to XL
C. Low, as compared to the circuit resistance
D. Approximately equal to XC

14) Where does practically all of the RF current flow in a conductor?

A. Along the surface
B. In the center of the conductor
C. In the magnetic field around the conductor
D. In the electromagnetic field in the conductor center

15) What factors determine the capacitance of a capacitor?

A. Area of the plates, voltage on the plates, and distance between the plates
B. Area of the plates, distance between the plates, and the dielectric constant of the material between the plates
C. Area of the plates, voltage on the plates, and the dielectric constant of the material between the plates
D. Area of the plates, amount of charge on the plates, and the dielectric constant of the material between the plates

16) Why would the rate at which electrical energy is used in a circuit be less than the product of the magnitudes of the AC voltage and current?

A. Because there is a phase angle that is greater than zero between the current and voltage
B. Because there are only resistances in the circuit
C. Because there are no reactances in the circuit
D. Because there is a phase angle that is equal to zero between the current and voltage

17) How many watts are being consumed in a circuit having a power factor of 0.6 when the input is 200 VAC and 5 amperes is being drawn?

A. 200 watts
B. 1000 watts
C. 1600 watts
D. 600 watts

18) What is the effective radiated power of a repeater with 100 watts of transmitter power output, a 5-dB feedline loss, 4-dB duplexer and circulator loss, and 10-dB antenna gain?

A. 800 watts, assuming the antenna gain is referenced to a half-wave dipole
B. 126 watts, assuming the antenna gain is referenced to a half-wave dipole
C. 12.5 watts, assuming the antenna gain is referenced to a half-wave dipole
D. 1260 watts, assuming the antenna gain is referenced to a half-wave dipole

19) What is the effective radiated power of a repeater with 150 watts of transmitter power output, a 4-dB feedline loss, 3-dB duplexer and circulator loss, and 7-dB antenna gain?

A. 946 watts, assuming the antenna gain is referenced to a half-wave dipole
B. 37.5 watts, assuming the antenna gain is referenced to a half-wave dipole
C. 600 watts, assuming the antenna gain is referenced to a half-wave dipole
D. 150 watts, assuming the antenna gain is referenced to a half-wave dipole

20) What happens to the resistance of a photoconductive material when light shines on it?

A. It increases
B. It becomes temperature dependent
C. It stays the same
D. It decreases

21) What is the term for the time required for the capacitor in an RC circuit to be charged to 63.2% of the supply voltage?

A. An exponential rate of one
B. One time constant
C. One exponential period
D. A time factor of one

22) After two time constants, the capacitor in an RC circuit is discharged to what percentage of the starting voltage?

www.americanradiohistory.com

A. 86.5%
B. 63.2%
C. 36.8%
D. 13.5%

23) What is the time constant of a circuit having two 100-microfarad capacitors and two 470-kilohm resistors, all in parallel?

A. 470 seconds
B. 47 seconds
C. 4.7 seconds
D. 0.47 seconds

24) How long does it take for an initial charge of 20 VDC to decrease to 7.36 VDC in a 0.01-microfarad capacitor when a 2-megohm resistor is connected across it?

A. 12.64 seconds
B. 0.02 seconds
C. 1 second
D. 7.98 seconds

25) How long does it take for an initial charge of 20 VDC to decrease to 0.37 VDC in a 0.01-microfarad capacitor when a 2-megohm resistor is connected across it?

A. 0.08 seconds
B. 0.6 seconds
C. 0.4 seconds
D. 0.2 seconds

26) How long does it take for an initial charge of 800 VDC to decrease to 14.8 VDC in a 450-microfarad capacitor when a 1-megohm resistor is connected across it?

A. Approximately 900 seconds
B. Approximately 1,350 seconds
C. Approximately 1,804 seconds
D. Approximately 2,000 seconds

27) What is the impedance of a network comprised of a 1.0-millihenry inductor in series with a 200-ohm resistor, at 30 kHz? (Specify your answer in rectangular coordinates.)

A. 200 - j188
B. 200 + j188
C. 188 + j200
D. 188 - j200

28) What special type of diode is capable of both amplification and oscillation?

A. Point-contact diodes
B. Zener diodes
C. Tunnel diodes
D. Junction diodes

29) What is the principal characteristic of a varactor diode?

A. It has a constant voltage under conditions of varying current
B. Its internal capacitance varies with the applied voltage
C. It has a negative resistance region
D. It has a very high PIV

30) What is the meaning of the term beta with regard to bipolar transistors?

A. The change of collector current with respect to base current
B. The change of base current with respect to emitter current
C. The change of collector current with respect to emitter current
D. The change in base current with respect to gate current

31) What is the meaning of the term alpha-cutoff frequency with regard to bipolar transistors?

A. The practical lower frequency limit of a transistor in a common-emitter configuration
B. The practical upper frequency limit of a transistor in a common-base configuration
C. The practical lower frequency limit of a transistor in a common-base configuration
D. The practical upper frequency limit of a transistor in a common-emitter configuration

32) What are the elements of a unijunction transistor?

A. Base 1, base 2, and emitter
B. Gate, cathode, and anode
C. Gate, base 1, and base 2
D. Gate, source, and sink

33) When an SCR is in the triggered or on condition, its electrical characteristics are similar to what other solid-state device (as measured between its cathode and anode)?

A. The junction diode
B. The tunnel diode
C. The hot-carrier diode
D. The varactor diode

34) What technique can be used to construct low-cost, high-performance crystal-lattice filters?

A. Splitting and tumbling
B. Tumbling and grinding
C. Etching and splitting
D. Etching and grinding

35) What is a depletion-mode FET?

A. An FET that has a channel with no gate voltage applied; a current flows with zero gate voltage
B. An FET that has a channel that blocks current when the gate voltage is zero
C. An FET without a channel; no current flows with zero gate voltage
D. An FET without a channel to hinder current through the gate

36) What determines the gain of a closed-loop op-amp circuit?

A. The external feedback network
B. The collector-to-base capacitance of the PNP stage
C. The power supply voltage
D. The PNP collector load

37) What do the initials TTL stand for?

A. Resistor-transistor logic
B. Transistor-transistor logic
C. Diode-transistor logic
D. Emitter-coupled logic

38) A permanent magnetic field that surrounds a traveling-wave tube (TWT) is intended to:

A. provide a means of coupling
B. prevent the electron beam from spreading
C. prevent oscillations
D. prevent spurious oscillations

39) Electromagnetic coils encase a traveling wave tube to:

A. provide a means of coupling energy
B. prevent the electron beam from spreading
C. prevent oscillation
D. prevent spurious oscillation

40) What is one major advantage of CMOS over other devices?

A. Small size
B. Low current consumption
C. Low cost
D. Ease of circuit design

41) What is a linear electronic voltage regulator?

A. A regulator that has a ramp voltage as its output
B. A regulator in which the pass transistor switches from the "off" state to the "on" state
C. A regulator in which the control device is switched on or off, with the duty cycle proportional to the line or load

www.americanradiohistory.com

conditions
D. A regulator in which the conduction of a control element is varied in direct proportion to the line voltage or load current

42) What is a three-terminal regulator?

A. A regulator that supplies three voltages with variable current
B. A regulator that supplies three voltages at a constant current
C. A regulator containing three error amplifiers and sensing transistors
D. A regulator containing a voltage reference, error amplifier, sensing resistors and transistors, and a pass element

43) What is a Class AB amplifier?

A. Output is present for more than 180 degrees but less than 360 degrees of the signal input cycle
B. Output is present for exactly 180 degrees of the input signal cycle
C. Output is present for the entire input signal cycle
D. Output is present for less than 180 degrees of the input signal cycle

44) Which class of amplifier has the highest linearity and least distortion?

A. Class A
B. Class B
C. Class C
D. Class AB

45) What is an L-network?

A. A network consisting entirely of four inductors
B. A network consisting of an inductor and a capacitor
C. A network used to generate a leading phase angle
D. A network used to generate a lagging phase angle

46) Which type of network offers the greater transformation ratio?

A. L-network
B. Pi-network
C. Constant-K
D. Constant-M

47) What are the three general groupings of filters?

A. High-pass, low-pass, and band-pass
B. Inductive, capacitive, and resistive
C. Audio, radio, and capacitive
D. Hartley, Colpitts, and Pierce

48) What are the distinguishing features of a Butterworth filter?

A. A filter whose product of the series- and shunt-element impedances is a constant for all frequencies
B. It only requires capacitors
C. It has a maximally flat response over its passband
D. It requires only inductors

49) How is the positive feedback coupled to the input in a Hartley oscillator?

A. Through a neutralizing capacitor
B. Through a capacitive divider
C. Through link coupling
D. Through a tapped coil

50) What is the major advantage of a Pierce oscillator?

A. It is easy to neutralize
B. It doesn't require an LC tank circuit
C. It can be tuned over a wide range
D. It has a high output power

51) Why is the Colpitts oscillator circuit commonly used in a VFO?

A. The frequency is a linear function of the load impedance
B. It can be used with or without crystal lock-in
C. It is stable
D. It has high output power

52) What is a reactance modulator?

A. A circuit that acts as a variable resistance or capacitance to produce FM signals
B. A circuit that acts as a variable resistance or capacitance to produce AM signals
C. A circuit that acts as a variable inductance or capacitance to produce FM signals
D. A circuit that acts as a variable inductance or capacitance to produce AM signals

53) What is a balanced modulator?

A. An FM modulator that produces a balanced deviation
B. A modulator that produces a double sideband, suppressed-carrier signal
C. A modulator that produces a single sideband, suppressed-carrier signal
D. A modulator that produces a full-carrier signal

54) How is the efficiency of a power amplifier determined?

A. Efficiency = (RF power out/DC power in) × 100%
B. Efficiency = (RF power in/RF power out) × 100%
C. Efficiency = (RF power in/DC power in) × 100%
D. Efficiency = (DC power in/RF power in) × 100%

55) What order of Q is required by a tank-circuit sufficient to reduce harmonics to an acceptable level?

A. Approximately 120
B. Approximately 12
C. Approximately 1200
D. Approximately 1.2

56) What is the principle of detection in a diode detector?

A. Rectification and filtering of RF
B. Breakdown of the Zener voltage
C. Mixing with noise in the transition region of the diode
D. The change of reactance in the diode with respect to frequency

57) What is the mixing process?

A. The elimination of noise in a wide-band receiver by phase comparison
B. The elimination of noise in a wide-band receiver by phase differentiation
C. Distortion caused by auroral propagation
D. The combination of two signals to produce sum and difference frequencies

58) What are the advantages of the frequency-conversion process?

A. Automatic squelching and increased selectivity
B. Increased selectivity and optimal tuned-circuit design
C. Automatic soft limiting and automatic squelching
D. Automatic detection in the RF amplifier and increased selectivity

59) What is the primary purpose of the first IF amplifier stage in a receiver?

A. Noise figure performance
B. Tune out cross-modulation distortion
C. Dynamic response
D. Selectivity

60) What is a bistable multivibrator circuit?

A. An AND gate
B. An OR gate

www.americanradiohistory.com

C. A flip-flop
D. A clock

61) What is a monostable multivibrator?

A. A circuit that can be switched momentarily to the opposite binary state and then returns after a set time to its original state
B. A "clock" circuit that produces a continuous square wave oscillating between 1 and 0
C. A circuit designed to store one bit of data in either the 0 or the 1 configuration
D. A circuit that maintains a constant output voltage, regardless of variations in the input voltage

62) What is a NOT gate?

A. A circuit that produces a logic 0 at its output when the input is logic 1 and vice versa
B. A circuit that does not allow data transmission when its input is high
C. A circuit that allows data transmission only when its input is high
D. A circuit that produces a logic 1 at its output when the input is logic 1 and vice versa

63) What is facsimile?

A. The transmission of tone-modulated telegraphy
B. The transmission of a pattern of printed characters designed to form a picture
C. The transmission of printed pictures by electrical means
D. The transmission of moving pictures by electrical means

64) What type of emission is produced when an amplitude-modulated transmitter is modulated by a television signal?

A. F3F
B. A3F
C. A3C
D. F3C

65) How can an FM-phone signal be produced?

A. By modulating the supply voltage to a class-B amplifier
B. By modulating the supply voltage to a class-C amplifier
C. By using a reactance modulator on an oscillator
D. By using a balanced modulator on an oscillator

66) How can a single-sideband phone signal be produced?

A. By producing a double sideband signal with a balanced modulator and then removing the unwanted sideband by filtering
B. By producing a double sideband signal with a balanced modulator and then removing the unwanted sideband by heterodyning
C. By producing a double sideband signal with a balanced modulator and then removing the unwanted sideband by mixing
D. By producing a double sideband signal with a balanced modulator and then removing the unwanted sideband by neutralization

67) What is meant by the term deviation ratio?

A. The ratio of the audio modulating frequency to the center carrier frequency
B. The ratio of the maximum carrier frequency deviation to the highest audio modulating frequency
C. The ratio of the carrier center frequency to the audio modulating frequency
D. The ratio of the highest audio modulating frequency to the average audio modulating frequency

68) What is meant by the term modulation index?

A. The processor index
B. The ratio between the deviation of a frequency-modulated signal and the modulating frequency
C. The FM signal-to-noise ratio
D. The ratio of the maximum carrier-frequency deviation to the highest audio-modulating frequency

69) What are electromagnetic waves?

A. Alternating currents in the core of an electromagnet
B. A wave consisting of two electric fields at right angles to each other
C. A wave consisting of an electric field and a magnetic field at right angles to each other
D. A wave consisting of two magnetic fields at right angles to each other

70) When the electric field is perpendicular to the surface of the earth, what is the polarization of the electromagnetic wave?

A. Circular
B. Horizontal
C. Vertical
D. Elliptical

71) What is the period of a wave?

A. The time required to complete one cycle
B. The number of degrees in one cycle
C. The number of zero crossings in one cycle
D. The amplitude of the wave

72) What is meant by the term antenna gain?

A. The numerical ratio relating the radiated signal strength of an antenna to that of another antenna
B. The ratio of the signal in the forward direction to the signal in the back direction
C. The ratio of the amount of power produced by the antenna compared to the output power of the transmitter
D. The final amplifier gain minus the transmission line losses (including any phasing lines present)

73) What is the principle of a trap antenna?

A. Beamwidth may be controlled by non-linear impedances
B. The traps form a high impedance to isolate parts of the antenna
C. The effective radiated power can be increased if the space around the antenna "sees" a high impedance
D. The traps increase the antenna gain

74) What is a driven element of an antenna?

A. Always the rearmost element
B. Always the forwardmost element
C. The element fed by the transmission line
D. The element connected to the rotator

75) Why is the physical length of a coaxial cable transmission line shorter than its electrical length?

A. Skin effect is less pronounced in the coaxial cable
B. RF energy moves slower along the coaxial cable
C. The surge impedance is higher in the parallel feed line
D. The characteristic impedance is higher in the parallel feed line

76) What factors determine the receiving antenna gain required at a station in earth operation?

(Continued on page 92)

www.americanradiohistory.com

Accessories For Radio Listening

BY KARL T. THURBER, JR.

Stand by for a high-tech audio tour through the contemporary radio listening post! In this article we'll examine a variety of audio accessories and add-ons including speakers, headphones, tape recorders, automatic recorder controls, active and passive audio filters, "smart" filters and signal decoders, and specialized add-ons for the mobile listening post. In fact, we'll cover just about anything you can hook onto your radio's audio-output jack. If you're a radio amateur, you might also pick up some useful audio-related ideas and tips for your hamshack.

Why Listening Post Accessories? A high-quality station receiver with good selectivity, sensitivity, stability, image and spurious-signal rejection, and accurate readouts forms the heart of any radio installation, whether for the SWL, radio amateur, or scanner buff. However, no radio is perfect, and few, if any, come complete with all the possible bells and whistles to satisfy every listening need. To narrow the gap between needs and reality, and to help enhance and tailor radio performance, there are many receiver audio add-ons that you can buy. These include external speakers, headphones, tape recorders, automatic recorder controls, audio filters, high-tech accouterments like "smart" audio filters and signal decoders, and even specialized accessories for mobile listening posts. Indeed, if you look through the various radio-hobby publications, you'll find many advertisements for such gear. But how does one separate the gold plating from the gold? Which accessories are truly necessary, which are nice to have, and which are frivolous? While you're the final judge, in the pages that follow we'll focus on a wide range of listening-post audio accessories to help make you more knowledgeable of what's out there to really improve and enhance your reception.

External Speakers. Most pieces of contemporary radio equipment are small and contain minimal internal speakers. Typically, the audio quality is poor, which results in overall poor performance from an otherwise excellent transceiver or receiver. Fortunately, most equipment has a provision for an optional external speaker, and I recommend you obtain the matching external speaker when you buy the radio as you may be unable to obtain one later once models change. If you can't obtain the matching speaker, you can use almost any communications speaker with your radio as long as the impedance roughly matches that of your set's output, which is usually 8 ohms or so.

Generally you should use communications-type speakers, as their restricted frequency response is preferred for speech. High-fidelity speakers, though perhaps of superior quality, may unduly accentuate low-frequency hum as well as high-frequency noise and hiss. However, in certain instances—such as listening to very strong, "armchair copy" shortwave-broadcast stations or scanner channels—you might opt for high-fidelity performance. Sometimes, with hi-fi speakers, you can understand previously unintelligible background scanner conversations and enjoy the full fidelity with which shortwave broadcasts usually are transmitted.

In that case, consider routing your radio's audio to your stereo system. One ready-made accessory, the Electron Processing AFBOX-1 hi-fi connection adapter, lets you do just that. Connections to the external speaker jack of the receiver and the hi-fi auxiliary input jacks are made with supplied connectors; an isolation transformer and passive attenuator are included. The AFBOX-1 also can be connected to a VCR for up to 6 hours of audio recording. It sells for $30 from Electron Processing, Inc.

Radio headphones. Using good communications-type headphones has advantages, too. Many DX (distant) signals are too obscured and weak for solid copy on a loudspeaker. Headphones will help to pull such signals "out of the mud." Buy a good pair of communications-type headphones at the start since you probably will use the same pair for your entire listening career.

Switching from speaker to headphones can materially improve the readability of received signals and keep distracting room noise out—weak signals can get lost in the ambient noise that exists between a speaker and your ear. A headset isolates you from your environment, directing your attention to the signal.

By bringing the sound directly to your ear, a headset adds definition. It's easier to separate two Morse-code signals or distinguish voices in a headset than in a speaker. Also, a headset can give you the extra "oomph" needed to hear weak stations because of typically high sensitivity.

Many beginners grab the closest set of stereo phones for their radios, but monaural headphones are usually best. While most stereo phones can be used (because they are designed for hi-fi reproduction) their wide frequency response may elevate internally generated receiver hum and noise to objectionable levels. Also, some lead-switching needs to be done, or an adapter pur-

www.americanradiohistory.com

chased, to convert them for monaural use.

Headphone Requirements. Several manufacturers sell communications-type phones, including JRC, Kenwood, Yaesu, ICOM, and Radio Shack. Such headphones have a narrow frequency response, are sensitive, can be adjusted easily, and have comfortable earmuffs. Several other considerations emerge. The input impedance should roughly match the output impedance of the receiver's audio stage. In most solid-state gear this is in the 4-to-16-ohm range, though some tube sets have a higher output impedance. Most military-surplus headphones, often attractive because of their rugged construction and oversize earmuffs, are 600-ohm units, but they sometimes are found in higher- and lower-impedance versions.

Sitting by your radio for hours at a stretch is fatiguing. Doing it while wearing an uncomfortable set of headphones with a tight headband is torturous. It's important to purchase earphones having good earmuffs; the muffs keep the signal in and distractions out. Thick, but soft and flexible pads are needed. These should fit snugly against the head, though not so tightly as to be uncomfortable. Other desirable features include a coiled cord, individual headset volume controls, easily-replaced earmuffs, and a way to adjust the headband for a comfortable fit.

Tape Recorders. Tape recorders are very useful listening-post adjuncts; many listeners wouldn't be without one. Small cassette recorders have a wide range of applications in the radio listening post. Recorders can be used for such diverse purposes as taping important local and DX signals for later playback, compressing listening sessions (especially sleepy overnight ones), "live" signal reporting, documenting equipment settings, and code practice; indeed, their use is limited only by the user's imagination.

Taping signals for later playback is the most common, obvious use of the recorder. The machine is simply connected to the receiver's output jack, either through a Y-plug across the external speaker output or to an auxiliary jack. The tapes can serve both as documentation for rare finds and as a logging aid. You can record a reference time at the beginning of the tape, or continuously on the second channel of a stereo recorder, to later determine logbook-entry times.

Going hand-in-hand with that use is saving tape, your time, and your sanity by recording a given radio channel or frequency only when there's activity on it. A voice-actuated control switch lets you watch for a particular channel or frequency to become active overnight or when you're not home. That saves tape by automatically activating your recorder only when voice or other sounds are transmitted to the unit by a scanner or radio—more on that later.

Take a guided tour with us as we explore the various speakers, headphones, decoders, and other audio accessories that are an important part of the contemporary hi-tech radio listening post.

Another common use is to provide "live" signal reporting to radio amateurs and shortwave broadcast or utility stations. Most are genuinely surprised to learn how they sound over the air, particularly at a far-distant location. They often view an opportunity to hear their signal as more meaningful than a simple readability-and-strength report. The recognition may help you land a QSL (confirmation) card in exchange.

It's often handy to use a tape recorder to verbally document equipment settings and alterations, antenna tuning or selection, signal-strength readings, and the like. You describe what's happening as you do it, with the recorder doing the "writing." Subsequent playback and written transcription to a notebook or log may be helpful in interpreting and analyzing the results you obtain.

If you're headed toward obtaining your amateur-radio license, you can make code-practice tapes using a straight key or keyer and audio oscillator. Your recorder also can be used to tape the on-the-air code practice sessions broadcast by W1AW, the American Radio Relay League (ARRL) headquarters station at Newington, CT, for later playback and practice. See the ARRL's monthly journal, QST, for information on their over-the-air practice sessions.

Recorder Technical Considerations. True hi-fi sound reproduction isn't a necessity, but a few other requirements do exist. The recorder should be of good quality, feature low distortion, boast low wow and flutter, have an auxiliary audio input for direct receiver connection, and include a recording-level meter and tape counter.

A pause or edit control also is desirable. Other nice-to-have features include a monitoring or auxiliary speaker jack, automatic shutoff or auto reverse, fast forward and rewind. A monophonic unit is fine; there is little advantage in using a stereo unit, although as mentioned earlier, some listeners find it useful to record time or verbal-annotation information on the second channel.

A standard-play cassette recorder is adequate for most uses. However, a long-playing recorder can be very useful. One vendor, AMC Sales, offers a $119 modified Panasonic 12-hour long-playing recorder, the Model 2712, that records 6 hours on each side of a standard C-120 audiocassette. Features include cue and review, pause control, tape counter, one-touch recording, and separate volume control. AMC Sales also offers a customized 3-hour, voice-activated Panasonic microcassette recorder, the Model 180 LP, for $69. It features automatic voice level control, cue and review, LED level indicator, and pause control.

A heavy-duty, 10-hour recorder is offered by Viking International. It's $139 and features a metal chassis, 5 hours of recording time per side with a C-120 tape, AC/DC operation, switch-

www.americanradiohistory.com

able automatic level control (ALC), a digital counter, and internal voice-controlled activation (as a $25 option). Accessories include an automatic telephone-recording adapter that starts and stops the recorder, as well as a dialed-number decoder that plugs into the recorder's earphone jack and displays Touch-Tone telephone numbers from tape.

You may need various patch cords, connectors, switches, and jumpers to use a recorder with your equipment. Use shielded cable, especially with high-impedance audio interconnections, to minimize RF noise, and hum pickup. The radio's output may need to be attenuated to avoid overloading the recorder's audio input. AMC Sales also offers a 6-ft. attenuator cord, the ATC-24. It allows direct connection to the recorder from the receiver or scanner.

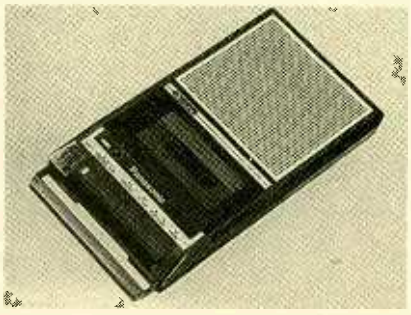
Automatic-Recorder Controls. A few receivers have a feature of special interest to SWL's: a built-in timer used to turn on the radio and accessories for scheduled listening or to control a tape recorder. Lacking such a feature, you may be able to use a simple AC light timer to achieve a similar result. .

Another useful device is a voice-actuated control switch to record overnight as it waits for a particular channel or frequency to become active. Such devices save tape by activating your recorder only when voice or other sounds are transmitted to the unit, either via a VOX (voice-operated transmit) microphone or a direct-wired source, such as a scanner or receiver.

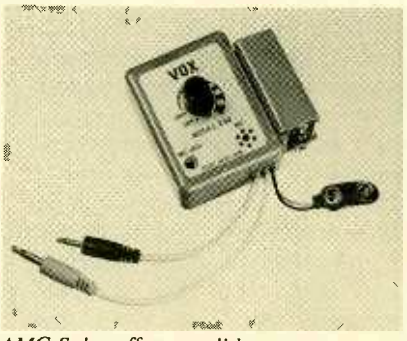
AMC Sales offers a solid-state VOX control switch, the Model 250, for $28.50 that serves that purpose. It features a built-in voice-actuated microphone, a VOX sensitivity-level control, and a delay circuit that shuts off the recorder 2–3-seconds after the last sound is heard by the unit. It's designed to work in concert with AMC's long-play recorder, described previously.

A tape-saving device is also offered by Electron Processing. It saves dead time on overnight scanner tapes, letting you listen to an entire night's scanning in minutes. The TS-1 Tape Saver is connected between the scanner and a cassette recorder. It switches the recorder on when it detects activity and off when the scanner is silent. A built-in speaker lets you listen to scanner activity; you can switch off the speaker for silent recording. Connection is made with plugs that hook to most scanners and recorders. It's $60 from Electron Processing.

The AFBOX-1 connects your radio to a hi-fi system; by doing so, scanner listeners can often understand previously unintelligible conversations and SWL's can enjoy the full fidelity of shortwave broadcasts.



The uses for a tape recorder in the radio listening post are legion. AMC Sales offers a modified Panasonic recorder, the Model 2712, to capture up to 12 hours on tape.



AMC Sales offers a solid-state miniature, voice-actuated switch, the Model 250. It features a built-in VOX-actuated microphone, a VOX sound-level sensitivity control, and a time-delay feature that shuts off the recorder a few seconds after the last sound.

Audio Filters. The congestion on the high-frequency (HF) radio bands has placed a premium on receiver selectivity. Simple fixed-bandwidth intermediate-frequency (IF) crystal filters were good enough in the 1940's and 1950's, but may be inadequate to handle crowded, present-day spectrum conditions. Densely-packed and overlapping AM and SSB stations, closely-spaced CW signals, and RTTY and digital-mode reception through potentially obliterating heterodynes demands complex, sharp-skirt selectivity, IF filters, or other means of achieving high radio selectivity.

It's difficult to beat an external audio filter when it comes to an inexpensive and easily installed means of improving the selectivity of shortwave receivers, especially low-end older radios. Even in sets having adequate IF filtering, an audio filter can significantly enhance performance. The filter cuts down on the noise and hiss generated by the set's IF chain, and it flexibly narrows the receiver's overall response curve, often allowing true single-signal reception. Both characteristics aid reception under heavy interference and weak-signal conditions.

Whether you opt for a simple or complex audio filter, you'll be glad you made the investment. An audio filter is one of the most cost-effective accessory aids you can buy for your radio. There are two main types we're concerned with here: passive and active.

Passive Audio Filters. A fixed-tuned passive (non-amplifying) audio filter, though inherently simple, can markedly improve receiver selectivity, especially one without adequate IF filtering. In some very inexpensive radios, an audio-stage filter is the primary selectivity-determining device. Many listeners have found that surplus "radio range" filters in their headphone leads separate closely-spaced CW signals, though they also found that receiver tuning and stability became critical when using narrow band-pass filters.

Passive filters are brute-force devices, and they are lossy, especially noticeable if the radio drives a speak-

www.americanradiohistory.com

er rather than headphones. Though simple and inexpensive, passive filters rely on cumbersome and hard-to-find inductors. Also, there is no flexibility in setting the center frequency and band-pass curve or changing these characteristics during operation.

While they can't make a poor receiver into a razor-sharp set, passive filters can do much to improve the wide response of lesser radios. Realistically, however, a far more satisfactory and flexible approach to enhancing receiver selectivity lies in the use of active audio filters.

Active Audio Filters. An active audio filter can yield surprising reception results. Assuming the filter is used with a receiver or transceiver with sharp-skirt IF selectivity, weak and interference-plagued signals can appear to jump out of the noise when an active filter is switched in.

The MagicNotch interference filter is an automatic notch filter that requires no tuning or user intervention. When it detects a heterodyne signal, it immediately filters it out using a sharp rejection filter. Audio of other frequencies, such as speech, is passed through without attenuation.

Several firms market these effective interference-reducers, including Autek Research, MFJ Enterprises, Palomar Engineers, and others. Some filters are designed for CW, others for AM and SSB, and some for all modes. Most are self-contained, include their own power supply, and are simply connected to the receiver's audio output. A few include an audio amplifier and speaker.

Most of the filters allow you to vary audio selectivity from just a few hertz for super-sharp CW single-signal work, up to a completely "flat" response for hi-fi broadcast reception. Some also have high-pass and low-pass modes, while others can notch-out an interfering signal or heterodyne while passing the desired signal with little attenuation. Many fancier units allow you to notch and peak signals at the same time.

Using the active filter on AM and SSB is a gratifying experience, especially if used with a modest set. By proper adjustment, you can dramatically improve readability under conditions of QRM (interference), QRN (static), splatter, and the like—reducing operator fatigue and making listening more enjoyable. While radio amateurs are the biggest users of active audio filters, SWL's and CB operators can benifit greatly from them as well.

As usefuls as these devices can be for AM and SSB communication, the real thrill comes when using these filters on CW, where before-and-after comparisons can be dramatic. With the active filter, the desired signal can be peaked with an effective bandwidth measured in tens of hertz, even in the presence of close-by strong signals that sneak through the set's IF stages. It's often possible to tune through the IF passband with the audio filter and discover several copyable CW signals—signals that were unreadable or even barely detectable without the filter.

New-Age "Smart" Audio Filters. Several high-tech take-offs on active-filtering techniques have surfaced lately. These devices are revolutionary and definitely deserve a close look.

A very promising device is the J-Com MagicNotch automatic notch filter that installs between your radio and external speaker or headphones.

Communications Headphone Operating Tips

Here are some headphone operating tips you may find useful:

- Use earplugs under the headphones. Desired signals come through the earplugs well, while noise is suppressed. Using earplugs is particularly effective when working on a noisy band for long periods, or if your listening post is in a noisy area of the house. You'll also find that earplugs reduce fatigue.
- "Ride gain" on your set's RF- and AF-gain controls. Avoid audio blasting, which has the effect of desensitizing your ears. Usually, the best CW and SSB copy is obtained by running with the AF gain wide open and controlling signal level with the RF-gain control, keeping overall levels low to avoid overloading.
- Try reversing audio leads to one headphone. The ear tries to cancel out noise which is presented in-phase. Sometimes headsets produce a substantial readability improvement while letting the signal of interest through with little impediment if the leads to one phone are reversed. Don't be afraid to experiment.
- When receiving CW signals, adjust the set's main tuning or beat-frequency oscillator (BFO) for a pleasant audio tone. But don't opt for a too-low pitch: 750 Hz is usually "about right" for most people, give or take 100 Hz or so.
- Use FM radio cordless headphones for cord-free operation. Such headphones have a built-in FM radio inside the headphone shell; you feed your radio's output to an FM wireless-broadcaster module to create a cordless system. Doing so offers flexibility by doing away with entangling headphones cords. The approach also lets you monitor your radio anyplace in your home or yard by tuning to the rebroadcaster frequency on any FM broadcast receiver.

Ramsey Electronics, Inc. sells several inexpensive FM wireless-microphone and signal-rebroadcaster kits for as little as $5.95. They even offer a $29.95 stereo FM transmitter kit that you can adapt to rebroadcast two monitor receiver calls—one on the right channel and the other on the left. This feature lets you monitor more than one radio at a time.

For the user who prefers a complete cordless system, RCA offers a lightweight, rechargeable, cordless stereo-headphone ensemble at $149; it include a stand that functions as a transmitter and battery recharger. The RCA phones are available from NBO Distributors, Inc. NBO also offers a Sony infrared, wireless, stereo-headphone system for $129, and your local Radio Shack sells a battery-operated monaural wireless headphone system for $59.95.

The Microdec decoders let you decode radio transmissions without a computer. They sport an 8-character LED display with intensity controls, a built-in code-practice oscillator, an internal speaker, and pushbutton operation. An optional display adapter, the VIP50 adapter interface (also shown here), offers an expanded display for use with your TV, computer monitor, or VCR.

www.americanradiohistory.com

The filter requires no tuning or user intervention. When it detects an interfering carrier, it immediately removes it with a very narrow and deep, digitally tuned notch.

When the unit is in the off or bypass positions, audio is fed directly to the speaker. In the on position, the switched-capacitor active filter (SCAF) scans the audio spectrum continually for interference. A control circuit monitors the filter output and stops the scanning when the output drops. The filter phase locks to the interfering signal and tracks any variations in its frequency until it disappears. The filter has a notch depth of 40 dB over a range of 200–4000 Hz. It costs $109.95.

Advanced Digital Signal-Processing (DSP) filter techniques are being increasingly used. DSP makes use of microprocessor technology to simulate analog filter circuits. DSP-filter performance is typically excellent, with filters possessing very good skirt characteristics. The filters are "virtual:" they're of a soft nature and so exist only in a microprocessor. This allows the construction of adaptive filters that vary characteristics to react to changing conditions. Thus, DSP filters provide superior performance in reducing interference on voice, CW, and RTTY.

An impressive DSP-based filter is the JPS Communications NIR-10 (*N*oise and *I*nterference *R*eduction unit), a spin-off of the firm's government and commercial signal-enhancement equipment. The NIR-10 quickly and automatically senses and removes multiple tones from communications, allowing reception of difficult signals and reducing listener fatigue. Unlike conventional audio filters, the $349.95 NIR-10 can remove heterodynes and various types of noise that occur in the presence of speech—without corrupting the speech itself or reducing the audio bandwidth.

The NIR-10 has three main operating modes, the NIR mode, which automatically enhances voice; the NF (Notch Filter) mode, which removes multiple heterodynes; and the BP (Band-Pass) mode, where the unit operates as a digital audio filter with adjustable center frequency and switch-selectable bandwidths, which is especially useful for CW and RTTY. A bypass mode feeds unprocessed audio through to the output.

Names and Numbers

AMC Sales, Inc.
193 Vaquero Drive
Boulder, CO 80303
Tel. 1-800-926-2488.

Autek Research
P.O. Box 302
Odessa, FL 33556
Tel. 1-813-920-5810.

Electron Processing, Inc.
P.O. Box 68
Cedar, MI 49621
Tel. 1-616-228-7020.

Grove Enterprises, Inc.
P.O. Box 98, 140 Dog Branch Road
Brasstown, NC 28902-0098
Tel. 1-800-438-8155.

J-Com
P.O. Box 194Y
Ben Lomond, CA 95005
Tel. 1-408-335-9120.

JPS Communications, Inc.
P.O. Box 97757
Raleigh, NC 27624-7757
Tel. 1-919-790-1011.

MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State, MS 39762;
Tel. 1-800-647-1800.

MoTron Electronics
310 Garfield St., Suite 4
Eugene, OR 97402
Tel. 1-800- 338-9058.

NBO Distributors, Inc.
5631 Palmer Way
Carlsbad, CA 92008
Tel. 1-800-346-6466.

Palomar Engineers
P.O. Box 462222
Escondido, CA 92046
Tel. 1-617-747-3343

Ramsey Electronics, Inc.
793 Canning Parkway
Victor, NY 14564
Tel. 1-716-924-4560.

Somerset Electronics, Inc.
1290 Highway A1A
Satellite Beach, FL 32937
Tel. 1-800-678-7388.

Viking International
150 Executive Park Blvd. #4600
San Francisco, CA 94134
Tel 1-415-468-2066.

A single-mode DSP-based automatic notch filter, the NF-60, is also available for $149.95. Unlike ordinary analog units, the NF-60's filter algorithm automatically provides as many extremely narrow notch filters as there are tones, simultaneously removing them. When no tones are present, the NF-60 has a negligible effect on received audio.

Signal Decoders. There's a lot of high-tech gear that you can hook to your radio's audio output or headphone jack besides speakers, headsets, tape recorders, and filters. We're talking about decoders of various types—let's look at some of them.

You can use decoders with your shortwave radio to decode Morse, RTTY, AMTOR/SITOR, and ASCII transmissions—without a computer. An impressive multimode decoder add-on is the Microdec series of decoders from Somerset Electronics. The Microdecs, offered in three different models with distinct demodulation-mode capabilities, let you decode many Morse, digital, and RTTY transmissions with ease.

The Microdec units sport an 8-character LED display with intensity controls, a built-in code practice oscillator, an internal speaker, and simplified pushbutton operation. An optional display adapter offers an expanded display (32 characters/line × 16 lines) for use with your TV, computer monitor, or VCR. Three models range from $229.95 to $429.95, depending on features.

An interesting scanner add-on is the MoTron TM-16 Tone-Master Touch-Tone decoder display ($229) that not only lets you hear the tones, but also see the numbers. It features a 16-digit LCD readout with an 80-character scrollable memory, a built-in amplifier and speaker, and a high-speed decoder that displays up to 25 digits per second. The TM-16 Plus ($299) includes an RS-232 serial output and software for optional automatic date, time, and number logging using a PC. Besides scanner monitoring, the units are useful for monitoring cordless telephones and testing handheld autodialers.

MoTron also offers the Auto-Kall AK-10 DTMF selective-calling decoder, for people who don't want to constantly monitor a busy frequency or channel but who want to remain available. When placed in the decode position, your radio remains si-

(Continued on page 93)

www.americanradiohistory.com

ANTIQUE RADIO

By Marc Ellis

A Trip to Mecca!

Last month I led you to believe that this column would be devoted to constructional details on a "Quaker Oats Container" crystal set. However, like about 1000 other antique-radio enthusiasts from all over the United States and some foreign countries, I've just returned from a week-long trip to Mecca—otherwise known as the Antique Wireless Association (AWA) annual conference in Rochester, New York.

Prospective buyers pore over some of the wares offered at the three-acre flea market.

For me, the decision to make the pilgrimage was a last-minute one. I'd never attended before, and figured it was high time. But as a result of playing hooky from the immediate concerns of the column, I didn't get enough work done on our crystal set to discuss it on these pages. What I *am* in a position to do is tell you a little bit about the conference, which ought to be just as interesting, if not more so!

THE HIGH SPOTS

How do I get into describing what amounted to five days of total immersion in our fascinating hobby? Maybe the best way would be to hit the high spots first, then go back and fill in some details. The conference was held in and around the Rochester Thruway Marriott, a large motor hotel just outside the Rochester metropolitan area. Officially, the proceedings began on Wednesday, September 22 and concluded on Saturday, September 25. However, many of us who couldn't find the time during the conference proper stayed on an extra day to visit the amazing AWA museum, located a short distance away in Bloomfield, New York.

Among the activities that kept me glued to the Marriott during the four-day period were several major auctions, a host of talks and seminars, the old-equipment contest, the books and magazines show, a flea market encompassing the better part of the Marriott's paved parking area (someone estimated three acres), and last, but certainly not least, the Grand Banquet and associated farewell ceremonies.

Many of the seminars, talks, and activities were related to the Westinghouse Company, which was designated as the central thread of this year's conference. Quoting from the Antique Wireless Association conference literature: "Thinking of major U.S. electrical companies, Westinghouse comes immediately to mind. It touched nearly every field related to communications from the alternator to broadcasting ..."

SEMINARS AND TALKS

The seminars and talks offered to the 1993 conference attendee included: News for SWL's; Key and Telegraph; DX'ing With the Westinghouse RC Receiver; Radio Collector's Slide Show; Entertainment for All (a presentation of "On the Air," a film on Westinghouse's station KDKA); Amateur Radio Seminar, including a film on the laying of the Atlantic Cable; The Life of Frank Conrad; The Early History of Collins Radio; Electrical and Wireless Apparatus, Pre-1910; and The Charles Herrold Story.

Among the more engrossing of the presentations that I attended were those on Conrad (sponsored by the Pittsburgh Antique Radio society) and Herrold. Conrad was a famous Westinghouse inventor and the founder of pioneer broadcasting station KDKA. Herrold was relatively unknown outside his San Jose, California home town, but is a legitimate contender to the title (usually assigned to Conrad) of "Father of Radio Broadcasting." The Herrold story was presented via a rough-cut video by Mike Adams, producer of the award-winning PBS video program *The Radio Collector*. Mike gave us all the opportunity to fill out an evaluation sheet on the video so that he could consider our comments for incorporation into the final version.

I was also thoroughly en-

www.americanradiohistory.com

Auctioneer Ed Gable (right), about to knock down an early battery set, while a classic Philco cathedral waits its turn.

tertained and edified at the Key and Telegraph seminar moderated by key collector Murray Willer, VE3FRX. After a short introductory slide show, the meeting became an exchange of information on such concerns as the non-destructive removal of oxidation and corrosion from brass parts and the cutting of screw threads to obsolete specifications.

As I understand it, this seminar (repeated yearly) is one of the few organized opportunities for key collectors to get together in person. I'm not a key collector myself but, through some networking accomplished during the seminar, I'm well on my way toward identifying an old key-and-sounder combination that happens to be in my possession. I may also be able to figure out how to replace a missing sounder-limit screw having a thus-far-unidentifiable thread.

I had another good time at the pre-1910 electrical apparatus program, which was moderated by the dynamic Bruce Kelley, curator of the Antique Wireless Association Museum and one of AWA's founding fathers. This was essentially a show-and-tell session. Anyone who cared to bring in and talk about a piece of ancient electrical apparatus could enter the friendly competition to determine which piece was the most unique. The winner, as determined by a representative of the Smithsonian institution, was a medical spark coil judged to date from the time of Joseph Henry. If I'm lucky enough to get out to Rochester next year, maybe I'll enter my Tiffany Never-Wind clock!

THE AUCTIONS

When auction time rolls around, most other conference activities slow down or grind to a halt. Exhibit areas are deserted, seminar attendance tapers off, buyers—and even sellers—desert the flea market. The auction room fills to capacity with folks hoping to make the buy of a lifetime, preferably at a once-in-a-lifetime price.

This year's conference was unusual in that there was a special estate auction of communications receivers on Thursday, the day before the main auction. Containing 250 lots, the special auction was almost half the size of the main auction—at which some 600 lots changed hands.

An unusual feature of the communications-receiver auction was the accompanying printed catalog, a feature heretofore unknown in the antique-radio field. I attended with hopes of achieving my fond dream of acquiring a Hammarlund Super Pro—until I got a really good look at one. After seeing how large and heavy it was, discretion ruled and I kept my bidding paddle firmly ensconced in my lap.

The main auction on Friday was divided into three sub-auctions: tubes, paper, and "general." I spent some time at all of these, but (maybe this is heresy) never did buy anything! Prices seemed to run higher than those of similar items in the outdoor flea market, and I prefer not to have to compete for the things I purchase. It's a matter of personal taste, I guess.

Other people definitely were buying, however. The AWA tells me that sales at the four auctions totted up to a hefty $53,000. If you're curious, the highest priced lot was a blue Fada "Bullet" (Model 1000) Catalin—which fetched $2,400. That sale brought a round of applause, in honor of either the buying power of the purchaser or the selling power of the radio—I'm not sure which.

OTHER ATTRACTIONS

The Old Equipment Contest is open to those wishing to submit outstanding examples of equipment in specific categories. One group of categories centered around products of Westinghouse, the conference theme company. Another group, "The Standard Categories," is the showcase for receivers and transmitters of various designs. The final group, "The Craftsmanship Categories," encourages submissions showing restoration of appearance, restoration of operation, and "new for old" (replicas of old equipment or demonstrations of old technology).

Spotted at the Old Equipment Contest was this shortwave receiver newly made from a set of early plans.

The Old Equipment contest is set up as a permanent, conference-long display in one of the Marriott ballrooms. Among the wonders that caught my eye were an unbelievably perfect replica of a large Federal battery set; a newly-built shortwave receiver, constructed following plans in a 1930's shortwave manual; a display of rare, perfectly-restored Aerola Grand receivers; a battery-operated "station in a suitcase" ham

(Continued on page 87)

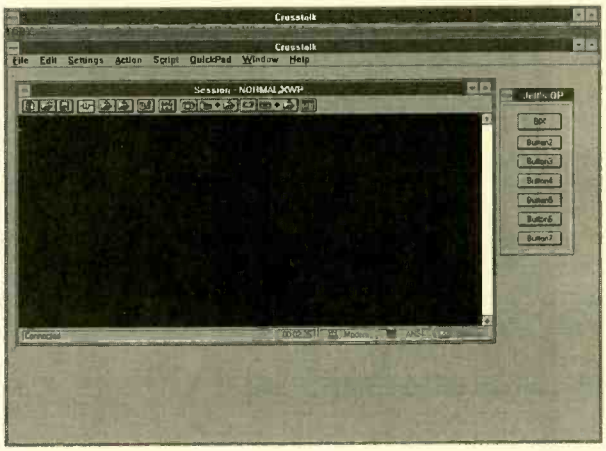
www.americanradiohistory.com

COMPUTER BITS

By Jeff Holtzman

Crosstalk for Windows

Telecommunications is one of the most exciting and useful activities that can be performed using a computer. Other than the computer, all you need are a modem and a telecommunications (telcom) program. What you'll find, once you get connected, is a wild and woolly frontier filled with places to explore, people to meet, and things to do.



Multiple simultaneous communications sessions and network support define the high-end capabilities, but CrossTalk for Windows also offers plenty for everyday BBS and on-line service browsing.

Some services (e.g., Prodigy and America Online) provide their own dedicated telecom programs. Others (CompuServe for one) provide access via both general-purpose and dedicated programs. Yet others, such as electronic bulletin boards (BBS's), depend mostly on general-purpose programs. Thus, to do almost anything, you need a general-purpose program.

There are lots of products in this category, among both commercial and shareware programs; and almost any program will be good enough. I've tried numerous packages over the years, but the one I keep coming back to is CrossTalk, made by Digital Communications Associates (DCA). My favorite is release 2.0 of the Windows version (XTALK2). It is a powerful program that eases many of the repetitive chores involved in telecommunicating, and does so through a user interface that is second to none.

The program is easy to get started with, and it provides plenty of power as your needs increase and your skill grows. It supports just about every modem ever produced, likewise with file-transfer protocols (Xmodem, Ymodem, Zmodem, ASCII, Kermit, and more), terminal emulations, and programming capabilities.

SESSIONS

XTALK2 is built around the concept of a session. Each on-line service or BBS that you call has an associated session file, which contains information like the telephone number, user ID, password, terminal emulation, and so on. Each session may in addition be associated with three things: a keyboard map, a script, and a QuickPad.

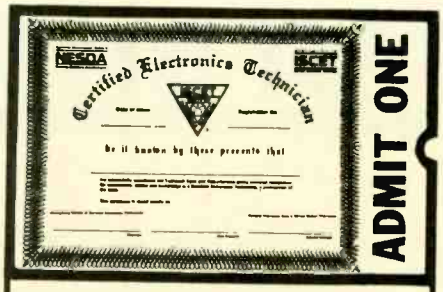
The keyboard map allows you to customize every key on your keyboard on a per-session basis. Thus, you could, for example, set up one hot key to send the correct codes to log you in to your favorite service, another to download all current messages, and a third to get an updated list of downloadable files. The keyboard editor is fully graphical: it displays a representation of your keyboard. To customize a key, you simply double-click on its representation. Then a dialog box comes up in which you can enter a series of keystrokes, a series of script-language commands, or the name of an external script file. Subsequently, whenever you press that key in that session, it sends the corresponding keystrokes or runs the associated script.

The script language is something like BASIC, so it's easy to learn and use. You can create a script file from scratch using the built-in text editor, or you can record it live, during an on-line session, and touch it up later. The script language is extremely powerful, and includes extensive support for Windows' Dynamic Data Exchange (DDE) protocol. DDE allows you to establish a "conversation" between two Windows applications. A sample DDE script establishes a link between CrossTalk and Excel, allowing CrossTalk to supply real-time stock updates to a spreadsheet file.

A QuickPad is a customizable tool box that appears on-screen in front of any other open windows. A graphical editor allows you to place icons, images, and pushbuttons on the QuickPad; as with the keyboard map, each button may be associated with a series of keystrokes, an internal script, or an external script.

I've used those features to increase the convenience and efficiency of my telecommunications

www.americanradiohistory.com



Your Ticket To

SUCCESS

Over 28,000 technicians have gained admittance worldwide as certified professionals. **Let your ticket start opening doors for you.**

ISCET offers Journeyman certification in Consumer Electronics, Industrial, Medical, Communications, Radar, Computer and Video. For more information, contact the **International Society of Certified Electronics Technicians, 2708 West Berry Street. Fort Worth, TX 76109; (817) 921-9101.**

Name_____

Address_____

City_____

State_____ Zip_____

____ Send material about ISCET and becoming certified.

____ Send one "Study Guide for the Associate Level CET Test." Enclosed is $10 (Inc. postage).

"My life without an education would be no job, no life and nobody to love."

Gary Hinton, Jr.
7th grade

America needs more schools that encourage our children to fulfill their promise.

KEEP THE PROMISE.

For information on how you can help change the schools in your community, call 1 800-96-PROMISE.

Ad Council

Education Excellence Partnership

sessions in several ways. I've set up my system so that whenever I start the program, it loads a QuickPad that contains a set of buttons for initiating sessions with my favorite on-line services. Each of those sessions has an associated set of keyboard maps and QuickPads that ease the process of session navigation. For example, I've built one fairly elaborate script that downloads current news items in several categories related to computers and electronics from one on-line service, automatically, at the push of a button. I used to browse those items on-line at tremendous cost. Now I can download half a megabyte of information in fifteen minutes, peruse it at my leisure, plus have the full text available (via a text-indexing program) for future research projects.

Here's another example of a system I'm currently working on for a client. The client uses a custom Windows application to gather applications data from a manufacturing process, but then must re-enter that data by hand into the company's corporate minicomputer. When my system is complete it will allow the company to write data from the source application to a standard ASCII file, and then use CrossTalk's script language to read the data from the file, establish a connection via a built-in terminal emulator, and upload the data semi-automatically after review by manufacturing personnel.

Writing a program like that from scratch would probably have taken months. Buying an off-the-shelf telecommunications program and customizing it allows us to get a better job done in a fraction of the time. The program has a number of rough edges, including inconsistent keyboard support, an incomplete and buggy on-line help system, and some arbitrary limitations in the script language. Despite those problems, I believe XTALK2 still offers a better balance among power and ease of use than its competition. If you would like to learn more about it, use the telephone number or address in the box entitled "Vendor Information" to receive more complete information. ■

VENDOR INFORMATION

CrossTalk for Windows, version 2.0 ($195.00)
Digital Communications Associates
1000 Alderman Drive
Alpharetta, GA 30202-4199
800-348-3221
or 404 442-4930

When someone in your family gets cancer, everyone in your family needs help.

Nobody knows better than we do how much help and understanding is needed. That's why our service and rehabilitation programs emphasize the whole family, not just the cancer patient.

Among our regular services we provide information and guidance to patients and families, transport patients to and from treatment, supply home care items and assist patients in their return to everyday life.

Life is what concerns us.

So you can see we are even more than the research organization we are so well known to be.

No one faces cancer alone.

AMERICAN CANCER SOCIETY

www.americanradiohistory.com

ELECTRONICS MARKET PLACE

FOR SALE

CABLE descramblers and test turn-on kits available for most makes and models. We also carry bullet stoppers. Our prices are insane (owner brain-damaged). Cash paid for cable equipment. No Florida sales. (305) 425-0751.

SECRET cable descramblers! Build your own descrambler for **less** than $12.00 in **seven easy steps! Radio Shack** parts list and **free** descrambling methods that **cost nothing** to try, included. Send $10.00 to: **INFORMATION FACTORY,** Dept. 5, PO Box 669, Seabrook, TX 77586. For COD's (713) 922-3512 any time!

INTERFACES for IBM compatibles. 48 line digital I/O, 16 channel analog input. 8 relay board, 8 opto input board. Control motors, lights, measure temperature, voltage. To get flier, send SASE to **JOHN BELL,** 1381 Saratoga St., Minden, NV 89423.

CABLE test chips. Jerrold, Tocom, S.A., Zenith. Puts cable boxes into full service mode! $29.95 to $59.95. 1 (800) 452-7090, (310) 902-0841.

CLASSIFIED AD ORDER FORM

To run your own classified ad, put one word on each of the lines below and send this form along with your check to:

Popular Electronics Classified Ads, 500-B Bi-County Boulevard, Farmingdale, N.Y. 11735

PLEASE INDICATE in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of **$11.00.**

( ) Plans/Kits ( ) Business Opportunities ( ) For Sale
( ) Education/Instruction ( ) Wanted ( ) Satellite Television
( ) _____

Special Category: $11.00

PLEASE PRINT EACH WORD SEPARATELY, IN BLOCK LETTERS.
(No refunds or credits for typesetting errors can be made unless you clearly print or type your copy.) Rates indicated are for standard style classified ads only. See below for additional charges for special ads. **Minimum: 15 words.**

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15 ($23.25)
16 ($24.80)	17 ($26.35)	18 ($27.90)	19 ($29.45)	20 ($31.00)
21 ($32.55)	22 ($34.10)	23 ($35.65)	24 ($37.20)	25 ($38.75)
26 ($40.30)	27 ($41.85)	28 ($43.40)	29 ($44.95)	30 ($46.50)
31 ($48.05)	32 ($49.60)	33 ($51.15)	34 ($52.70)	35 ($54.25)

We accept MasterCard and Visa for payment of orders. If you wish to use your credit card to pay for your ad fill in the following additional information (Sorry, no telephone orders can be accepted.):

Card Number _____ Expiration Date _____

PRINT NAME _____ / SIGNATURE _____

IF YOU USE A BOX NUMBER YOU MUST INCLUDE YOUR PERMANENT ADDRESS AND PHONE NUMBER FOR OUR FILES. ADS SUBMITTED WITHOUT THIS INFORMATION WILL NOT BE ACCEPTED.

CLASSIFIED COMMERCIAL RATE: (for firms or individuals offering commercial products or services) $1.55 per word prepaid (no charge for ZIP code)...**MINIMUM 15 WORDS.** 5% discount for same ad in 6 issues within one year; 10% discount for 12 issues within one year if prepaid not applicable on credit card orders. **NON-COMMERCIAL RATE:** (for individuals who want to buy or sell a personal item) $1.25 per word, prepaid....no minimum. **ONLY FIRST WORD AND NAME** set in bold caps at no extra charge. Additional bold face (not available as all caps) **30¢ per word additional.** Entire ad in boldface, $1.85 per word. **TINT SCREEN BEHIND ENTIRE AD:** $1.90 per word. **TINT SCREEN BEHIND ENTIRE AD PLUS ALL BOLD FACE AD:** $2.25 per word. **EXPANDED TYPE AD: $2.05 per word prepaid.** Entire ad in boldface, $2.45 per word. **TINT SCREEN BEHIND ENTIRE EXPANDED TYPE AD:** $2.55 per word. **TINT SCREEN BEHIND ENTIRE EXPANDED TYPE AD PLUS ALL BOLD FACE AD:** $2.95 per word. **DISPLAY ADS:** 1" × 2⅛"—$205.00; 2" × 2⅛—$410.00; 3" × 2⅛"—$615.00. **General Information:** Frequency rates and prepayment discounts are available. **ALL COPY SUBJECT TO PUBLISHERS APPROVAL. ADVERTISEMENTS USING P.O. BOX ADDRESS WILL NOT BE ACCEPTED UNTIL ADVERTISER SUPPLIES PUBLISHER WITH PERMANENT ADDRESS AND PHONE NUMBER. Copy to be in our hands on the 18th of the fourth month preceding the date of issue (i.e.; Sept. issue copy must be received by May 18th). When normal closing date falls on Saturday, Sunday or Holiday, issue closes on preceding work day. Send for the classified brochure. Circle Number 49 on the Free Information Card.**

ELECTRIFYING DEALS!!
★ CABLE TV ★
DESCRAMBLERS
CONVERTERS ★ ACCESSORIES
★ Name Brands ★ Great Service ★
★ Immediate Delivery ★ Lowest Prices ★
NOT AVAILABLE IN CALIFORNIA
CALL FOR FREE CATALOG (800) 777-7731
PRIME TIME
ELECTRONICS, INC.

300 Experimenters Circuits — Complete in 6 practical books using diodes, relays, FET's, LED's, IC 555's, and IC CA3130's for building blocks. Only $33.00 plus $5.50 for shipping. USA and Canada only. US funds. **ETT, INC.,** PO Box 240, Massapequa Park, NY 11762-0240.

CABLE descrambler liquidation. Major makes and models available. Industry pricing! (Example: Hamlin Combo's, $44 each... Minimum 10 orders). Call **WEST COAST ELECTRONICS,** 1 (800) 628-9656.

TUBES. (Thousands in stock). Send SASE for list. **FALA ELECTRONICS,** PO Box 1376-2, Milw., WI 53201.

FREE CATALOG
FAMOUS "FIRESTIK" BRAND CB ANTENNAS AND ACCESSORIES. QUALITY PRODUCTS FOR THE SERIOUS CB'er. SINCE 1962
FIRESTIK ANTENNA COMPANY
2614 EAST ADAMS
PHOENIX, ARIZONA 85034

PROTOTYPE service for hobbyists & engineers. Single quantity ss PCB's. $10.00 minimum. No setup fee. We also scan magazine artwork. Get out your back issues! **FIRST PROTO,** (407) 392-8677.

DESCRAMBLING secrets revealed. Free 24 hour hotline reveals secret satellite and cable descrambling information. (718) 390-7130.

CABLE TV descramblers. All major brands. Have make/model used in your area when calling. 1 (800) 327-3407. For a free catalog write **KD VIDEO,** PO Box 29538, Minneapolis, MN 55429.

www.americanradiohistory.com

CB RADIO OWNERS!

We specialize in a wide variety of technical information, parts and services for CB radios. 10-Meter and FM conversion kits, repair books, plans, high-performance accessories. Thousands of satisfied customers since 1976! Catalog $2.

CBC INTERNATIONAL
P.O. BOX 31500PE, PHOENIX, AZ 85046

DESCRAMBLERS for cable and satellite. Kits and assembled units. All types. Guaranteed. From $19.95. Free catalog. (212) 330-8035.

SAVE money! Feel safer! Automate your home. New book. $19.99 **APPROACHING, INC.,** 1 (800) 484-9697 extension 4847.

CABLE TV descramblers. Save money, don't rent! Nobody beats our price! Call us last for the best price! All brands, 24 hour shipping. VCI, 1 (800) 677-0321.

PREVENT descrambler damage — Don't bite the bullet! Snooper Stopper Data Pulse Blocker $34.95 — Data Blocker with dual surge protection $54.95 — Wireless video sender $54.95 — remote control A/B switch $39.95 — **VIDEO CONNECTIONS,** 1 (800) 925-9426.

DIGITAL video stabilizer. Removes all video tape copy protection, caused by copy guard, on pre-recorded tapes $54.95 — **VIDEO CONNECTIONS,** 1 (800) 925-9426.

ANTIQUE RADIO CLASSIFIED

Free Sample!

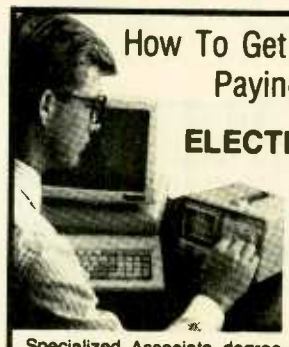
Antique Radio's Largest Circulation Monthly. Articles, Ads & Classifieds.

6-Month Trial: $16.95. 1-Yr: $29.95 ($44.95-1st Class). A.R.C., P.O. Box 802-L10, Carlisle, MA 01741

PRINTED circuit boards from your artwork,. Prototypes and short runs. Reasonable rates. **ATLAS CIRCUITS,** PO Box 892, Lincolnton, NC 28092-0892. (704) 735-3943.

PCB assembly, prototype service. Call or write to **K-TEK,** 923 N. St., Fortuna, CA 95540. (707) 725-1893.

OSCILLOSCOPE for sale. Tektronix, calibrated, with cart, model #7904, 500, 250, 100 mega hertz. Call (619) 674-4445.



How To Get A High-Paying Job In ELECTRONICS

Become more competitive in the job market with EDUCATION

Specialized Associate degree and diploma programs in electronics technology, computer repair, communications, and industrial electronics by

DISTANCE EDUCATION

Call or write for college catalog and booklet "How to Get a High-Paying Job in Electronics."

1-800-765-7247 JJ0294

PEOPLES COLLEGE OF INDEPENDENT STUDIES
233 Academy Drive • P.O. Box 421768
Kissimmee, FL 34742-1768
Member, D.L. Peoples Group • Accredited Member, NHSC

UNDETECTABLE cable descrambler will work on all systems **guaranteed!** Send SASE/info, $94.95/kit, $14.95/plans, **MYSTICAL ELECTRONICS,** PO Box 481, Cooper Station, NY, NY 10276.

PRINTED circuit boards — etched, drilled, tin plated. Single sided $1.25/sq. inch. Free shipping. **CHELCO ELECTRONICS,** 61 Water Street, Mayville, NY 14757. 1 (800) 388-8521.

PLANS & KITS

60 Solderless Breadboard Projects in two easy-to-read pocket books. Complete with circuit descriptions, schematics, parts layouts, component listings, etc. Both books (BP107 & BP113) only $11.90 plus $3.50 for shipping. USA and Canada only. US funds. **ETT, INC.,** PO Box 240, Massapequa Park, NY 11762-0240.

ANNOUNCING OmniAlert! (pat.pend) Designed by F-18 tactical radar engineer. Revolutionary photosensitive alarm safeguards your home, office, car, & valuables. Professionally engineered board & plans, guaranteed foolproof! $11.95. **DRALIN DESIGNS,** PO Box 04, Ellenburg Depot, NY 12935.

FASCINATING kits, useful, fun and educational kits! Lasers, voice changers, message recorders, detectors, talking clocks and more. We supply **all** the parts plus detailed manuals. Send $1.00 (refundable) for catalog: **LNS TECHNOLOGIES,** 20993 Foothill Blvd., Suite 307P, Hayward, CA 94541-1511.

BUGGED? Telephone tapped? Find out fast! **Free** catalog of fantastic counter-surveillance equipment! **1 (800) 732-5000.**

C.B.'S AND SCANNERS

SCANNERS, C.B.'s, radar detectors. Call or write for **free** catalog. (803) 829-3411 **CB DOCTOR,** PO Box 2842, Orangeburg, SC 29116-2842. To place order call 1 (800) 569-1393.

BEST BY MAIL

Rates: Write National, Box 5, Sarasota, FL 34230

OF INTEREST TO ALL

VCR SECRECTS — ONE Tip Saves $50.00-$100.00 In Repairs. Also The Most Common Problems And Solutions. $5.00 To: J.B. Enterprises, PO Box 227, Medway, MA 02053.

LONG-RANGE CORDLESS PHONES. Non-cellular. 60-mile range. Base connected to home line. Morningstar, 307 E. Ash, S47, Columbia, MO 65201.

ALTERNATOR AND STARTER rebuilding manual and video only $19.95. Send to: Gagnon, Box 50851(P), New Bedford, MA 02745.

AMAZING LOTTERY SECRET of "31." Recorded Message (313)927-0187, Extension 4.

CAPS/EMBROIDERY PATCHES Iron-on 100% Markup, Free Wholesale Colored Catalogue: IRWIN, Box 2096-(PE), Baytown, TX 77522. (713-424-7651).

ATTENTION HOMEOWNERS — $100-$4,000 refund due from FHA Insurance if you satisfied, sold or refinanced home with FHA Mortgage. Info and forms $19.95, money back guarantee. E&G Enterprises, Box 4207-A, Grand Central, NY 10163.

ETERNAL SECURITY: TRUE or False? Free Bible Studies. Light, St. Maries, ID 83861.

PLANS

CONFUSE LIDAR! PLANS, parts, sources to construct laser speed gun confuser. Info pack $3.00, plans $20. Send Check/MO to: M. Wallace & Assoc., POB 267-Paul, Morrison, CO 80465.

BUSINESS OPPORTUNITIES

AMAZING PROSPERITY PLAN. Make $20.00, Keep $20.00. Money never stops. Free information. Peeler, Box 632-(PE), Bonham, TX 75418-0632.

GIFT CATALOGS

BEAUTIFUL GIFT CATALOG: $2.00: HAMILTON'S, 2050 E. 5th St., Stockton, Calif. 95206.

FINANCIAL

STOP BILL COLLECTORS COLD!! Extensive Report $29.00 FREE Information: 800-393-1114 Ext. 11.

RECIPES

20 ORIENTAL RECIPES. $4 (SASE) To: Sylvester, Box 528, Scranton, PA 18501.

20 ITALIAN RECIPES. $4.00 (SASE) To: Sylvester, Box 528, Scranton, PA 18501.

20 CHRISTMAS RECIPES. $4.00 (SASE) To: Sylvester, Box 528, Scranton, PA 18501.

EDUCATION/INSTRUCTION

VCR Repairs You Can Do. Save$. Make$. "Bible of Electromechanical repairs." 403-pages. $Back-guarantee. Over 37,800 **sold.** 704 illustrations + tool. Mail $24.95 to **WORTHINGTON PUBLISHING,** Box 16691M, Tampa, FL 33687-6691.

ELECTRONIC engineering. 8 volumes complete. $109.95. No prior knowledge required. Free brochure. **BANNER TECHNICAL BOOKS,** 1203 Grant Avenue, Rockford, IL 61103.

DIGITAL electronics, learn at home or college for digital computers, full color illustrations 360 pages. Send $29.95 to **PJ ENTERPRISES,** 26551 Sparks St., Highland, CA 92346.

PROCESS refunds. Your help is needed immediately to process insurance refunds. Earn up to $250.00 or more per refund processed. No experience needed. Easy and fun to do. Work in the privacy of your own home. Complete step by step instruction book. Rush $22.95 to: **POPLAR PUBLISHING,** PO Box 1766, Dept. PE9, Enid, OK 73702.

BUSINESS OPPORTUNITIES

MAKE $75,000.00 to $250,000.00 **yearly.** Learn IBM monitors repairs (solutions most brands). New home based business program. Software available. Information: **USA-Canada** $3.00 cash (no checks), Dealers wanted worldwide ($35.00) US funds. **RANDALL DISPLAY,** PO Box 2168-H, Van Nuys, CA 91404, USA.

HOME assembly work available! Guaranteed easy money! Free details! SASE. **HOMEWORK-P,** Box 520, Danville, NH 03819.

NEED money? Guaranteed employment! Assemble simple products at home. Easy work! Excellent income! 1 (800) 377-6000, ex7930.

FREELANCE readers needed! $30,000/year income potential. Details: (619) 491-1541 Ext. 73, 24 hrs.

WANTED: Distributors! Top quality mini-satellite systems for RV, home, office and more. 5'9" C/Ku remote demo included. Unlimited profit potential. **STRATAVISION,** (24 hrs.) 1 (800) 960-9656.

GOVERNMENT seized cars, trucks, boats, computers, televisions. Surplus bargains galore! Your area: 1 (800) 601-2212 Ex.SP7930.

EASY work! Excellent pay! Assemble products at home. Call toll free 1 (800) 467-5566 ext. 5730.

SATELLITE TELEVISION

25° LNB $67.95 .7° $89.00. Call for wholesale price list. **SATELLITE WAREHOUSE,** Tuscon, AZ 1 (800) 851-6534.

INVENTIONS

INVENTORS: CONCEPT NETWORK offers professional, inexpensive patenting and marketing services. (New product ideas with prototype or schematics preferred; but they are not required.) Free information packet: Call 1 (800) 835-2246 extension 67.

FREE Invention package: DAVISON & ASSOCIATES offers customized development, patenting, and licensing for new products and ideas. Proven results: 1 (800) 677-6382.

MASTERCARD AND VISA are now accepted for payment of your advertising. Simply complete the Classified Ad order form and we will bill you.

THIS IS AN ALL BOLDFACE AD. If you want your entire ad in boldface, the cost is $1.70 per word.

www.americanradiohistory.com

GET CONTROL!

with

CABLE TV DESCRAMBLERS AND CONVERTERS

Gain complete control of your TV, and save money on monthly rental charges by owning your cable equipment!

TOP BRANDS AVAILABLE

Everquest • Panasonic • Jerrold • Zenith • Pioneer • Scientific Atlanta • Tocom • and many more!

SATISFACTION GUARANTEED!

Quantity Pricing Available

Orders can be placed 24 hours a day 7 days a week!

Same day shipment if order placed before 5 pm EST M-F

Call Toll-Free

1-800-775-0444

MC, Visa and COD.

T.C. ELECTRONICS

Special Note: Decoders and Descramblers must not be used without authorization by your local cable operator. Sorry, no Tennessee sales.

CIRCLE 164 ON FREE INFORMATION CARD

Look to the Future

With Your Own

Cable Converter & Descrambler !

1-800-228-7404

NU-TEK ELECTRONICS

FREE CATALOG!

3250 Hatch Rd.
Suite 1 C
Cedar Park, TX 78613

ALL MAJOR BRANDS

COD

RECEIVING TUBES

OVER 3000 TYPES IN STOCK!

Also hard-to-find transformers, capacitors and parts for tube equipment.

Send $2.00 for our 32 page catalog.

ANTIQUE ELECTRONIC SUPPLY

6221 S. Maple Ave.•Tempe, AZ 85283•602-820-5411

From the Lab to your Living Room!

Does your VCR have a "Head Cold?"

Probably not! However, through constant playing and using of degrading dry or wet cleaners, the output of your video tapes has slowly diminished to an unacceptable level and the VCR plays as if it has a head cold! The culprit is most likely clogged and dirty video and/or audio heads.

The **3M Black Watch™ Head Cleaner Videocassette** uses a patented magnetic tape-based cleaning formation to remove head clogging debris. No foreign substances such as cloth, plastics or messy liquids and no harsh abrasive materials are present. The cleaner's usable life is 400 cleanings or more!

It's easy to use. Place the **3M Black Watch™ Head Cleaner Videocassette** in the VCR and press the Play button. A pre-recorded message appears clearly on your screen and an audible tone is heard, telling you that the cleaning process is now completed. No guess work, you never over clean!

3M Black Watch™ Head Cleaner Videocassette SVHS VHS.....$19.95

Once your VCR's head cold is cured, and the unit plays like new, consider using the finest videocassette you can buy—the **3M Black Watch™ T120 Hi Pro VHS 4410 Videocassette**. The 4410 is the highest performing videocassette available today for use with all standard format VHS recording hardware!

Here's what you hear and see....A sharp, clear picture—brightest colors—freedom from streaks, flashes and snow—outstanding high-fidelity audio reproduction—optimum camcorder performance—maintains recording integrity. **3M Black Watch™** video tape is 100% laser inspected to guarantee surface smoothness and drop-out free performance.

3M Black Watch™ T120 Hi Pro VHS 4410 Videocassette VHS.....$8.00

CLAGGK INC. — ***3M VHS Special Offer***
P.O. Box 4099, Farmingdale, New York 11735

Yes, I like your offer and here is my order for 3M Black Watch™ products!

___ 3M Black Watch™ Head Cleaner Videocassette ($19.95 each) _____$

___ 3M Black Watch™ T120 Hi Pro VHS 4410 Videocassette ($8.00 each) $ _____

Shipping and handling per order $ 4.00

Total Amount in U.S. Funds only $ _____

New York State residents add local sales tax. Canadians add $6.00 per order. No foreign orders. Do not send cash.

Bill my ☐ VISA ☐ MasterCard Expire Date ___/___/___

Card No. _____

Signature _____

Name (Please print) _____

Address _____

City _____ State _____ ZIP _____

www.americanradiohistory.com

CIRCUIT CIRCUS

By Charles D. Rakes

Plenty of Oscillators

This outing, we're going to look over a number of oscillator circuits. Even if you do not anticipate needing an oscillator anytime soon, it is still worthwhile to see how some these often-used electronic building blocks work. Oscillators can be found in electronic watches (which contain crystal oscillators that keep the digital display or analog dial on time), in computers, calculators, portable telephones, stereos, TV's, radios, remote controls, and in just about everything else electronic.

UJT OSCILLATOR

Our first circuit, see Fig. 1, is an unusual 100-kHz oscillator built around a unijunction transistor (UJT). The operating frequency of that circuit is determined by crystal XTAL1. That simple crystal-controlled oscillator can be used as a marker generator to calibrate the analog dial of a communications receiver, or its output can be fed to a divider counter to produce a stable lower-frequency output for use as a clock generator.

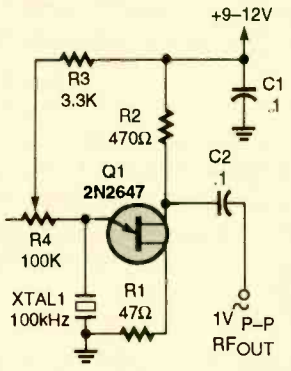


Fig. 1. This unusual 100-kHz oscillator (whose frequency is determined by XTAL1) can be used as a marker generator to calibrate the analog dial of a communication receiver, or its output can be fed to a divider counter to produce a stable lower-frequency output for use as a clock-signal generator.

Most UJT-based oscillators depend an RC timing circuit to set the oscillator's frequency. That method is fine for many applications where frequency stability is not too important. Where frequency stability is important, using a quartz crystal is the simplest and least expensive path to follow.

The output of the Fig. 1 oscillator should be adjusted for a fairly good sinewave. To do so, you'll need an oscilloscope. Simply connect the oscilloscope to the output of the circuit and adjust R4 for the best looking waveform. If an oscilloscope isn't handy, an AM radio can be used with acceptable results. Simply turn the AM radio on and set the dial to pick up a station near the low-frequency end of the dial. Set the radio next to the oscillator and adjust R4 until a heterodyne (beat signal) is heard.

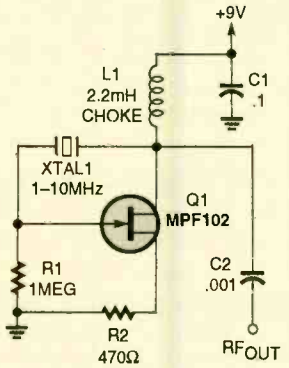


Fig. 2. The unijunction oscillator shown here allows higher frequency operation, and like the previous circuit, uses a quartz crystal (XTAL1) to set its operating frequency.

FET OSCILLATOR

The FET-based oscillator shown in Fig. 2 is every bit as simple as the unijunction oscillator, but this one is capable of higher frequency operation. That circuit is built around an MPF102 N-channel JFET (junction field-effect transistor) Q1. Like the previous one, it uses a quartz crystal (XTAL1) to set the oscillating frequency. The circuit oscillates because of the drain-to-gate feedback path through the quartz crystal.

With the component val-

PARTS LIST FOR THE UJT OSCILLATOR

RESISTORS

(All fixed resistors are ¼-watt, 5% units.)
R1—47-ohm
R2—470-ohm
R3—3300-ohm
R4—100,000-ohm potentiometer

ADDITIONAL PARTS AND MATERIALS

Q1—2N2647 N-channel UJT
C1, C2—0.1-μF, ceramic-disc capacitor
XTAL1—100-kHz quartz crystal
Perfboard materials, 9–12-volt power source, wire, solder, hardware, etc.

www.americanradiohistory.com

ues shown and depending on the crystal selected for XTAL1, the circuit can be made to oscillate from about 1 to 10 MHz. To make the circuit operate at the lower end of its frequency range, use a large value of inductor for L1; for higher frequency operation go to a smaller value. Using a 10- to 22-mH choke allows the circuit to operate down to 100-kHz; with a 100-μH unit, the circuit can operate at frequencies above 10 MHz.

TTL OSCILLATOR

In our next circuit, three inverters (from a 7404 TTL hex inverter) along with crystal XTAL1 are used to form an oscillator that is capable of operating at frequencies of up to 10 MHz. In that circuit (see Fig. 3) two of the inverters (U1-a and U1-b) are used to produce the 180-degree phase shift that is necessary for oscillation. At its series-resonant frequency, XTAL1

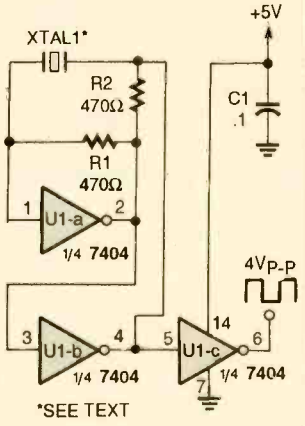


Fig. 3. In this circuit, three inverters along with XTAL1 are used to form an oscillator circuit capable of operating at up to 10 MHz.

provides a low-resistance path between the two inverters to maintain oscillation. The third inverter, U1-c, is used to provide isolation and drive current for any circuit connected to its output.

PARTS LIST FOR THE FET OSCILLATOR

RESISTORS
(All resistors are ¼-watt, 5% units.)
R1—1-megohm
R2—470-ohm

CAPACITORS
C1—0.1-μF, ceramic-disc capacitor
C2—0.001-μF, ceramic-disc capacitor

ADDITIONAL PARTS AND MATERIALS
Q1—MPF102 N-channel JFET
L1—2.2-mH RF choke
XTAL1—1- to 10-MHz crystal
Perfboard materials, enclosure, 9-volt power source, wire, solder, hardware, etc.

PARTS LIST FOR THE TTL OSCILLATOR

U1—7404 hex inverter TTL IC
R1, R2—470-ohm, ¼-watt, 5% resistor
C1—0.1-μF, ceramic-disc capacitor
XTAL1—Quartz crystal, see text.

ADDITIONAL PARTS AND MATERIALS
Perfboard materials, IC socket, 5-volt power source, wire, solder, hardware, etc.

PARTS LIST FOR THE VXO

RESISTORS
(All fixed resistors are ¼-watt, 5% units.)
R1—1-megohm
R2—470-ohm

CAPACITORS
C1, C2—680-pF, mica or NPO ceramic-disc
C3—0.01-μF, ceramic-disc
C4—0.1-μF, ceramic-disc
C5—365-pF tuning variable

ADDITIONAL PARTS AND MATERIALS
L1—10-μH RF choke
L2—22-μH RF choke
Q1—MPF102 N-channel JFET
XTAL1—3.579-MHz crystal
Perfboard materials, 12-volt power source, wire, solder, hardware, etc.

VXO

The oscillator circuit shown in Fig. 4 is known in the ham community as a VXO (variable crystal oscillator). Normally a quartz crystal is selected for its fixed-frequency stability, but in some cases, it is necessary to shift the crystal's frequency slightly to achieve a more precise oscillator frequency. That is accomplished in the Fig. 4 circuit by adding a fixed inductor and a variable capacitor in series with the crystal.

Operating at about 3.5 MHz, the oscillator's frequency may be adjusted by about 1 kHz. The actual frequency shift possible depends mostly on the cut

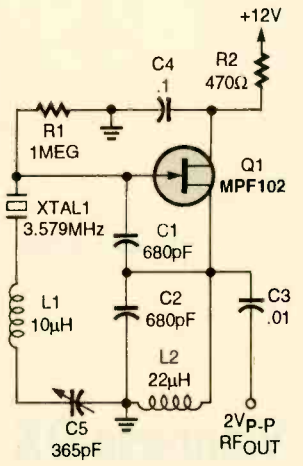


Fig. 4. This FET-based crystal oscillator, known in the ham community as a VXO (variable crystal oscillator), can be made to shift the crystal's frequency slightly to achieve a more exact frequency.

and type of crystal used. Experimenting with different crystals and values of L1 will help determine what combinations work best for a given oscillator.

The oscillator will operate from about 2 MHz to 10 MHz as shown. To operate at higher frequencies, reduce the values of L1, L2, C1, and C2. Increase the values of those components to obtain lower frequencies. Note that as you move the crystal's frequency near its maximum shift, the circuit's stability can suffer, and in some cases the operating frequency goes off into never-never-land. If that happens, re-adjust C5 for stable operation.

DBM OSCILLATOR

Our next oscillator relies on the oscillator section of an NE602 double-balanced mixer for operation. The circuit in Fig. 5, like its predecessors, is also a crystal-controlled oscillator. The output of this circuit is taken at pin 5 of U2. The double-balanced mixer circuit is unbalanced by tying one

(Continued on page 90)

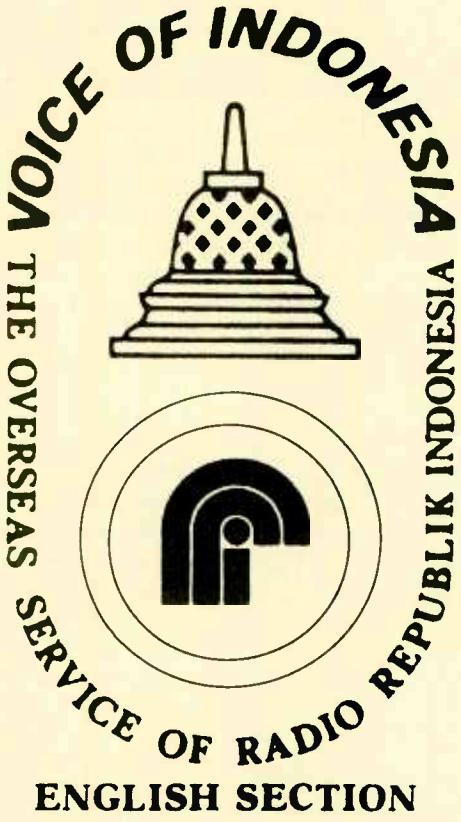
www.americanradiohistory.com

DX LISTENING

By Don Jensen

Viennese DX

Austria is famous for its towering Alpine scenery, its beautiful blue Danube, and its Viennese pastry. It's also the "musical" birthplace of famed composers Mozart, Haydn, and Schubert. But shortwave listeners know it as the home of *Radio Austria International.* It's not the biggest, but it is one of the better international broadcasters in Europe.



The stylized letters RRI, for Radio Republik Indonesia, form part of the identification logo of the station's overseas SW service, the Voice of Indonesia.

While SW transmissions from Vienna were on the air as early as 1929, it wasn't until the 1950's, when Austria was still occupied by the four allied powers (the U.S., Great Britain, France, and the former U.S.S.R) that a modern, domestic, shortwave operation began. An international shortwave service aimed at listeners elsewhere in Europe and overseas arrived in the 1960's, according to Edgar Sterbentz, deputy director of Radio Austria International.

Sterbentz, interviewed by Ian Macfarland on a *Radio Japan* "Media Roundup" DX'ers program, says that Radio Austria International has two 100-kilowatt and two 500-kilowatt transmitters at its Moosbrunn broadcasting site. However, the station is temporarily barred from using both of its high-powered units pending a decision by that nation's highest court in a lawsuit brought by local environmentalists.

Radio Austria International—which has an agreement with *Radio Canada International* to relay its shortwave programming—also has new equipment being added to its Vienna studios, where programs are prepared in six languages: English, German, French, and Spanish, and once a week in Arabic and the "international language," Esperanto.

According to Sterbentz, Radio Austria International has 60 full-time employees, including programmers, studio technicians, and transmitter engineers. In addition, there are another 50 to 60 freelance contributors and part-timers.

Because of the country's centuries of musical tradition, Radio Austria International prides itself on its coverage of that important aspect of Austrian culture. The Vienna Opera Ball and the New Year's Eve concert by the Vienna Philharmonic Orchestra are broadcast to the world on shortwave.

As of this writing, Radio Austria International could be found with English programming at 0130 and 0330 UTC on 9,870 kHz; at 0530 and 0630 UTC on 6,015 kHz; and at 1130 UTC on 13,730 kHz.

Reception reports can be sent to Radio Austria International, A-1136 Vienna, Austria, or, according to the annual "Passport To World Band Radio" reference publication, may be faxed to the station by first dialing the standard international access code, plus the Vienna Austria country-city code, 43-1, then the number 87-878-3630.

REPORT FROM BRAZIL

Reader Delio F.R. Coelho writes from Rio de Janeiro, Brazil to say that although he has been listening to shortwave radio since he was a boy, he thinks that SW is not as popular in his country as it might be. He goes on to say that he is part of a group of listeners working to encourage Brazilians to tune in to shortwave broadcasts. "We are having some success here in Rio de Janeiro," he notes.

Delio (who is 41 and works for an international airline, a job that regularly brings him to the U.S.), says "When I'm in Florida, I carry my Sony ICF-SW1 portable

www.americanradiohistory.com

radio. I listen to Brazilian stations when propagation conditions permit so that I can have news from home. I've been trying to keep a list of those stations and I'm enclosing a copy to help you answer questions from readers with questions about radio stations in South America." Here are some of them:

Radio Brasil—4,875. Evenings.

Radio Gazeta—5,995. 24 hours.

Radio Globo—6,120. 24 hours.

Radio Record—9,505. 24 hours.

Radio Aparecida—9,630. Mornings.

Radio Bandeirantes—9,645. Mornings.

Radio Nacional—11,780. 1300–0100 UTC.

Radio Brasil Central—11,815. 24 hours.

Radio Anhanguera—11,830. 24 hours. Delio notes that the programs are in Portuguese, and offers to provide more information on Brazilian stations if our readers would like.

"They are not widely known by DX listeners, but there are a wide range of SW stations broadcasting music, culture, and sports."

WHOZAT?

"I'm puzzled, Don," writes Dale Smith of Fresno, CA. "The other day on 11,715 kHz, I tuned in to a station that seemed to be programming continuous reading of Bible verses, repeated over and over, as well as some hymns. What station is this?"

It seems that you heard KJES, perhaps the most unusual U.S. shortwave voice on the air. Recently, some information about that religious broadcaster appeared in Fred Waterer's "Listening In" (a column in DX Ontario, the bulletin of the Ontario DX Association). KJES Radio, which broadcasts from The Lord's Ranch in Mesquite, NM, is operated by Our Lady's Youth Center, located in El Paso, TX.

Of the repetitive programing, the Rev. Richard M. Thomas says, "This is the way we pray before evangelizing to prisoners in jail or patients in the mental hospital. Our intent in broadcasting this type of prayer is similar—to penetrate and dissipate the darkness that envelopes the world."

KJES is scheduled to broadcast from 1300 to 1600 UTC on 11,715 kHz and from 1800 to 2100 UTC on 9,510 kHz. Reception reports can be sent to KJES, The Lord's Ranch, Mesquite, NM 88048.

INFORMATION CENTRAL

For those DX'ers who favor the lower so-called "tropical" shortwave bands, one of the best sources of information about stations, frequencies, and schedules is the "Tropical Bands Survey," which is published annually by the Danish Shortwave Club International (Tavleager 31, DK2670, Greve, Denmark). The survey covers SW broadcasting stations between 2,310 and 5,900 kHz and is priced at 7 International Reply Coupons; 9 IRC's if you want it sent airmail. IRC's are available at your post office.

Smaller SW stations do not always reply to reception reports. That's the sad truth. But sometimes, with the "toughies," your odds of getting a QSL reply improve if you can direct your letter to a specific person at the station who is known to have already replied to other SWL's. That's when a list of current verification signers is of use.

QSL signers, compiled by DX'er Al Quaglieri, is the most comprehensive and up to date list of verification signers and station addresses available. It can be ordered for $3.00 postpaid from the NASWA Company Store, 45 Wildflower Road, Levittown, PA 19057.

DOWN THE DIAL

Why not drop me a line. What are you logging? Questions? Comments about SWL'ing? How about a photo of you listening to your favorite SW station? You can write me at *DX Listening*, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735.

Here are some of the stations being reported lately.

EGYPT—9,475 kHz. *Radio Cairo* has been heard at 0207 UTC with Islamic readings from the Koran, translated into English. That is followed by a news broadcast and identification.

INDONESIA—9,675 and 11,755 kHz. The *Voice of Indonesia* is scheduled on those two frequencies at 0030–0400, 0800–1300, and 1730–2100 UTC. English programs are aired at 0100–0200, 0800–0900, and 2000–2100 UTC.

JAPAN—11,865 kHz. *Radio Japan* has been reported at 1910 UTC, in English, with a program on sumo wrestling.

KENYA—4,935 kHz. The *Kenya Broadcasting Corp.* has been noted on this frequency at 0249 UTC with pop music, followed at 0300 by the station ID and the news in English. ■

*Credits: Mark Anderson, MI; Jim Clar, NY; Richard D'Angelo, PA; James Gagliano, NY; Marie Lamb, NY; Kevin Murray, OR; Tony Orr, VA; Dan Unruh, WA; North American SW Association; Ontario DX Association, P.O. Box 161, Station A, Willowdale, Ont. M2N 5S8, Canada.

COMING NEXT MONTH

in the March 1994 Issue of

Popular Electronics®

Shortwave Radio brings the world into your home! Hear history made with your own handcrafted 9-band regenerative radio built from our plans. Plus—Build an Automotive Electrical System Analyzer and an Electronic Casino. The latter offers Blackjack, Craps, and Slots—without financial risk!

On Sale JANUARY 18, 1994

Watch for it!

Pick up *Popular Electronics* at your favorite Newsstand, Bookstore, Convenience Store or Supermarket

www.americanradiohistory.com

Radio and the Solar Eclipse

By Joseph J. Carr, K4IPV

In the December, 1993 column, we introduced you to the idea of using your radio skills in scientific experiments. That type of effort may especially appeal to high school students who need science-fair topics, but it also appeals to "students" of all ages and persuasions. In the December issue (as well as in a note in the January, 1994 issue), the topic was looking for random events such as sudden ionospheric disturbances (SID's).

This month, however, we are going to give you an opportunity to use the radio solar-observation idea on a real and predictable event: the annular solar eclipse coming up on May 10, 1994.

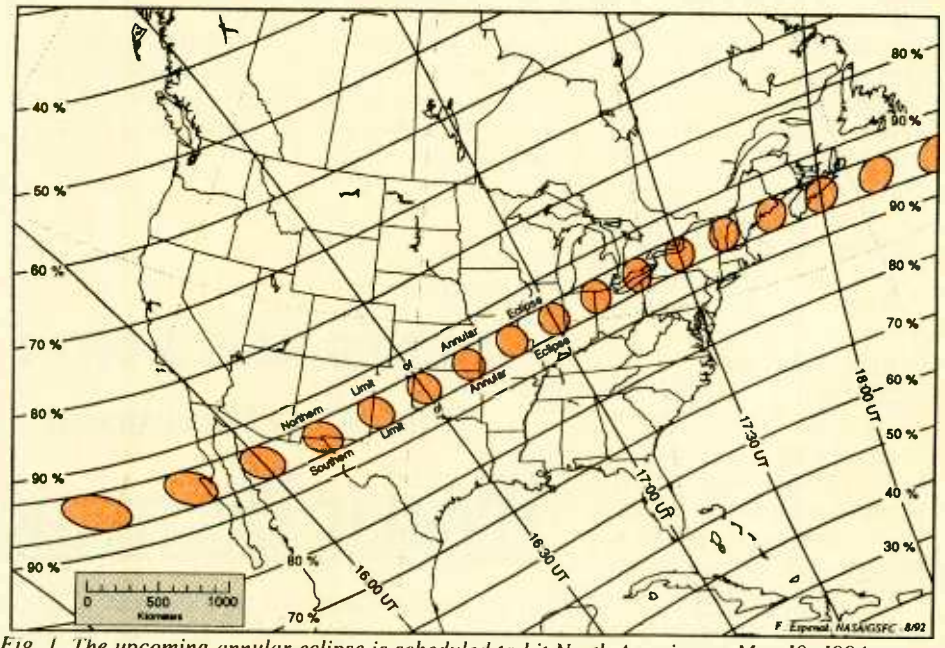


Fig. 1. The upcoming annular eclipse is scheduled to hit North America on May 10, 1994, entering the USA about where Texas, Mexico, and New Mexico share common borders, continue in a northeasterly direction (passing over the Oklahoma panhandle, into Kansas, Missouri, and central Illinois, across Indiana, Ohio, New York, and the New England states), and exit the continent at Nova Scotia.

SOLAR ECLIPSE

A solar eclipse occurs when the Moon passes between the Earth and the Sun during daylight hours, thereby preventing Sun light from reaching the Earth. The solar eclipse of March 7, 1970 passed in totality over Norfolk, Virginia where I was attending Old Dominion University. It was one of the "thrills of a lifetime" to be on Ocean View Beach to watch the event. Because that was a total eclipse, the Sun was totally obscured, except for the brilliant corona.

An annular solar eclipse (like the one that will occur in May), on the other hand, is not the same as the total eclipse that we experienced in 1970 and again two years ago for those in the Baja California area. In an annular eclipse, the perceived size of the lunar disk is smaller than the solar disk, so the Sun appears as a blackened ring of fire in the sky. One source claims that this event will be the last of its type to be seen over so much of the USA and Canada until 2017 AD.

Warning! Direct viewing of a solar eclipse is always dangerous. Looking at the eclipse with the naked eye can cause permanent spotting of the retina (you'll always see that eclipse!) or blindness. Furthermore, attempting to view an eclipse through a telescope without knowing how to project the image onto a blank sheet of paper will result in immediate irreversible blindness!

RADIO PROPAGATION

Radio propagation effects can be seen during solar eclipses. Radio propagation is seriously affected by the presence of the Sun, which accounts for the difference in performance of the HF bands between day and night. During the day, the upper layers of the ionosphere (*F1* and *F2*) are heavily ionized. As a result, during the daytime, the frequencies from 9 or 10 MHz and up "see" the ionosphere as a "radio mirror" that reflects signals back to Earth. That's the origin of "skip" communications, and all that luscious daytime DX. At lower frequencies during the day, the lowest region of the ionosphere is also ionized, but acts somewhat differently: it absorbs low-frequency energy, preventing skip. As a result, during the daytime, D-layer absorption renders the

www.americanradiohistory.com

frequencies below 9 MHz or so either short skip or ground-wave only. Monitor the 160-, 75/80-, and 40-meter bands during the daylight hours and you will hear only "locals" out to several hundred miles.

At night, the Sun's energy is on the other side of the Earth, so the ionization of the ionosphere begins to collapse. Starting in the early evening, first 10-meters, then 15-meters, and 20-meters will become de-ionized, and the *F1* and *F2* layers contract into one zone. The bands above 9–10-MHz begin to drop off until they no longer support any skip at all. At the same time, the lower frequencies come alive with DX (indicating skip). The 40-meter band is especially interesting because it is close to the transition region between the two sorts of behavior.

In all of that activity, the maximum usable frequency (MUF) is generally controlled by the F-layer, while the lowest usable frequency (LUF) is controlled by the D-layer. For a brief period during a partial or total eclipse of the Sun, the energy from the Sun is unavailable to ionize the Earth's atmosphere. During that period, along the path of the eclipse, there is a sudden return to night time conditions. Strange propagation is noted, especially in those bands most affected by D-layer absorption.

The upcoming annular eclipse on May 10 is predicted to hit North America (see the map in Fig. 1) in about the middle of Baja California at about 15:45 hours Universal Time. (UT is GMT—"Zulu" time—*i.e.*, 5 hours ahead of EST.) The "totality" track will enter the USA about where Texas, Mexico, and New Mexico share common borders; continue northeast over the Oklahoma panhandle about 16:30 UT; into the midwestern states of Kansas and Missouri, and into central Illinois by 17:00 UT. It will continue across Indiana, Ohio, New York and the New England states, exiting the continent at Nova Scotia. All of the USA, most of Canada, and nearly all of Mexico will be within at least the 50 percent bands of the eclipse pathway.

SOME EXPERIMENTS FOR HAMS

In the December, 1993 column, I mentioned a high-school science fair student who monitored WWV to study solar activity. Hams can do that trick as well, but there is also another approach: use your transmitters to study the effects. Most such studies in the past have used the 75/80-meter bands because they are most affected, although some experiments can also be run on 40-meters and up. I suspect that the best results can be found on 75/80-meters, where D-layer effects are seen best, and also on the ham band closest to the MUF for that day. With the WARC-79 bands in full operation, hams have opportunities that didn't exist in previous eclipses.

Several different scenarios present themselves. The simplest is to just monitor the bands and log the callsigns and locations of stations (found in Callbook) heard over a narrow (say, 25-kHz) region of the band. Another method is to form a group of friends around the country and to pick a frequency to test. A small number of ham stations spaced at various distances along and across the path of the eclipse, but not more than about 1000 miles between the two most distant, could transmit in rotation for ten seconds at a time (keeping required ID's in mind!), while a dozen or more others monitor the signal strengths on an S-meter.

If you don't like CW, then try using 400-Hz modulated CW on the SSB/AM portions of the band. In that case, an AC multimeter could be used to measure signal strength. The experiment should be done for several consecutive days, not just to test the synchronization between stations transmitting in rotation, but also to establish a baseline of data.

Another method is to select just one station, and set up a schedule. In that type of experiment, try the same 10-second-at-a-time transmissions, back and forth so that you can see bidirectional effects. Again, make the same measurements several days in advance in order to establish averages.

The time of the trials, no matter which method is selected, should cover three or four hours centered on the time when the eclipse passes over, or as close as it will come, to your location. Odd effects are seen as the eclipse approaches or recedes. Also, keep very good time records. A quartz controlled clock set to WWV or WWVH just before the trials begin usually will yield close enough time data.

If you participate in monitoring the eclipse, you'll have the satisfaction of monitoring one of Nature's more spectacular shows. I would appreciate hearing about the results of any experiments that you conduct. Send details to me at PO Box 1099, Falls Church, VA, 22041. ■

From Not-Working to Networking!

Troubleshooting Local-Area Networks!

Now, complete for the first time in one detailed booklet!

ONLY $5.00

Gain a fuller knowledge of network fundamentals and how they developed from the early days of main frames, from XNS to Ethernet technology, the OSI stack for interconnecting different computers, basic and specialized test instruments, etc. Several tough LAN case histories bring from theory to the practical side of troubleshooting.

CLAGGK Inc., Reprint Bookstore
P.O. Box 4099, Farmingdale, NY 11735

Please rush my copy of "From Not-Working to Networking." I enclosed payment of $5.00 which includes shipping charges.

Name _____

Address _____

City _____ State _____ ZIP _____

Sorry, no orders excepted outside of United States and Canada. All Payments must be in U.S. funds. Send check or money order payable to CLAGGK Inc.—do not send cash or stamps. New York State residents add applicable sales tax.

www.americanradiohistory.com

SCANNER SCENE

By Marc Saxon

Underground Chatter

The *Realistic PRO-44* is a new handheld that offers 50 memory channels in the following bands: 30–54 MHz, 108–174 MHz, and 380–512 MHz. It features one-hour memory backup without batteries, a special battery-saver circuit, and scan/search function. There is also an extra memory channel that temporarily saves a frequency that you locate during a search. The unit operates at 16 channels per second in scan and search modes.

Realistic's PRO-44 handheld offers 50 memory channels.

The PRO-44 has IF frequencies of 10.7 and 455 kHz, and uses a crystal and ceramic filter. The selectivity is ±10 kHz at −6 dB; ±20 kHz at −50 dB. The sensitivity is 1.0 μV on all bands except the VHF aeronautic band (108–137 MHz), where it is 2.0 μV. The unit operates from six "AA" batteries or an external 9VDC source.

The Realistic PRO-44 exhibits the modern, rounded-case styling that the company has been using in some of its handhelds. See it at any Radio Shack store.

UNDERGROUND RADIO

Communications enthusiasts who venture into any metropolitan subway system invariably wonder how two-way radios work in such an environment. Think about it: A subway system extends over a wide geographic area, and it is sealed underground in a metal framework that contains electrified tracks.

In this place, two-way communications for various services must be operated, and the need to cover the entire subway system. A single subway system could have separate two-way networks for police operations; train dispatching; and the maintenance of tracks, towers, and yards.

Getting VHF radios to work effectively throughout a system is seldom easy, and may require the use of a large number of remote receive sites to pick up the signals from the portable units used by the employees. The New York City Transit Authority Police use more than 65 miles of special radiating cable strung through the subway tunnels to provide communications in that system's many "dead spots."

Frequencies used by the New York City Transit Authority Police include 160.305, 160.50, 160.695, 160.905, and 160.965 MHz.

TRUNKING TALK

Scanner monitors have observed that some trunked two-way systems have an especially annoying feature. At the end of each transmission, a series of tones that form a musical jingle are played. That wastes about three seconds, hanging up the scanner so it can't go on to search out the channel with the next part of the conversation.

That effect is entirely intentional and is done for the express purpose of thwarting attempts at unauthorized monitoring. The tune played is GE's "it brings good things to life" jingle because that is the distinctive signature of the Ericsson/GE trunked system.

One way to foil that system is with the *Comsec SA 78-E*. This device, when hooked to a scanner, senses when a message has ended, mutes the scanner, then lets it ignore the tones to immediately resume searching for another transmission. It's all automatic, and it ignores signals other than the Ericsson/GE trunked ones. Models are presently available for the Realistic PRO-2005 and

www.americanradiohistory.com

PRO-2006, with others in development.

Installation requires soldering four wires to easily accessible points on top of the radio's upper circuit board. Instructions are provided. For more information, contact Comsec Associates, Inc., 2219 West Olive Avenue, Burbank, CA 91506, or phone 818-502-0000.

ACARS, ANYONE?

Monitoring the portion of the VHF aeronautic bands reserved for airline-company communications (128.825–132.0 MHz), one often hears the term "Acars" used by pilots. Acars refers to a non-voice communications system used to carry operational data between the airline ground stations and airliners. The incoming information comes up on video screens, and it is sent by keyboard.

This data is sent in abbreviated form, and might cover such things as weather information, gate assignments, cargo loading weights, fuel needs, special passenger requirements, and other operational concerns. The data is sent out in quick bursts, and has a sound like a "ping." it seems to go out continuously, day and night.

Acars signals can be picked up on any scanner that will receive the VHF aeronautic band. Listen for Acars transmissions on 131.555 MHz, with 130.025 MHz also used in busy areas. In Canada, 129.125 MHz is used.

Decoding the Acars transmissions requires special equipment fed data by the audio output of a scanner tuned to an Acars frequency. This equipment, most notably, includes the *Universal M-400* or *M-1200* produced by Universal Electronics, 6830 American Parkway, Reynoldsburg, OH 43068.

PHONE HOME

A letter from Ed, who lives somewhere in New Jersey, mentioned that he put an all-band scanner antenna on a mast mounted on the chimney of his two-story home. The top of the antenna is about 30 feet above ground level. Using this antenna with his Realistic scanner, he put some effort into seeing what could be heard on the cordless-telephone channels.

Ed told us that he was amazed to find that he was able to pick up calls from miles away. He knows this because one of the units he can regularly receive is a real-estate agency that has a sales agent who uses a cordless phone, and mentions the company name all the time. Ed reported that this agency and its location are well known, and it's a good five miles from his home.

The bulk of the calls Ed told us he heard by tuning the cordless frequency band were, as he put it, "an earful." He recommends it highly. Specifically, he mentioned the large number of dingbats and troublemakers he was able to monitor. Ed, is that a nice way to speak about your neighbors?

If you haven't yet put an ear there, the band runs form 46.61 to 46.97 MHz. You might find it of interest, as have many other scanner owners.

KEEP IN TOUCH

You are invited to send us your questions, comments, and frequencies. Write to *Scanner Scene*, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735. Your input helps make this column the best that it can be! ■

ANTIQUE RADIO

(Continued from page 74)

rig of 1930's vintage; and a group of sinister-looking Nazi "people's radios" done in gleaming black Bakelite. I have to admit that I don't have good notes on the contest winners, but will try to include that information in the next column.

Another run-of-the-conference feature was the book fair, set up in an alcove next to the registration area. Here, the interested attendee could browse through and purchase most of the books and pamphlets currently available to the antique-radio hobbyist. Antique Radio Supply, Antique Radio Classified, Antique Radio Club of America, and Vestal Press, not to mention the Antique Wireless Association itself, all showcased their publications. In addition, there were a few used-book dealers offering nice selections of early titles relevant to our hobby.

THE FLEA MARKET

I've been to many antique-radio swap meets and hamfest flea markets in my time, but I've never seen any vintage-equipment marketplace as extensive as the bazaar that was spread out over the Marriott parking lot during the AWA conference.

It should be noted right away that this was not the place to steal a nice old wood-cabinet table model or an early three-dialer for a couple of bucks. Both the sellers and the buyers who were competing to purchase their offerings were too sophisticated for that. And, of course, many of the sellers were professional marketers who had trucked their wares for many miles to take advantage of the high concentration of serious collectors. Unlike the private sellers, these folks regularly move their stock from event to event. They weren't about to drop their prices—even at the end of the show.

What the flea market definitely did offer the collector was variety and shopping convenience. Here was the opportunity to find that elusive set needed to fill a special niche. Here, too, could be found a complete selection of such restoration aids as reproduction knobs and grille cloths.

I was most startled at the prices being asked for small table-model sets—even those brown Bakelite jobs we used to be able to pick up for just a few bucks. This reflects, I'm sure, the interests of the new collectors entering our hobby. Many of them seem to be attracted to the smaller pieces that are easier to restore and to display in today's smaller living spaces. It seemed easier to find realistic prices on the larger 1920's battery sets; many were priced at fair, if not modest, levels.

Test equipment was priced better, however. I picked up several items that had been on my want list for some time, including a Sprague capacitor checker, a Rider Chanalyst, and the rare military-surplus BC221-AK heterodyne frequency meter—the only model offering a modulated signal.

Well, it looks like I've run out of space before I could get to the AWA museum. If you will be patient with me for just a little longer, we'll discuss the museum next month! In the meantime, for more information about the Antique Wireless Association, write to Joyce Peckham, Secretary, Box E, Breeseport, NY 14816. ■

www.americanradiohistory.com

MOTORCYCLE ALARM

(Continued from page 39)

cardboard, then applying hot glue to both sides of the board. Care should be taken that hot glue does not get inside the ball-bearing housing. Repair or modification can still be done later by heating up the module in the oven until the hot glue runs off the board.

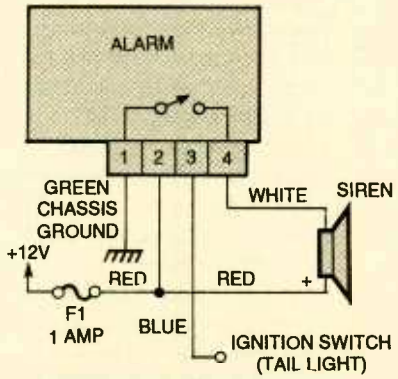


Fig. 6. The Radio Shack #49-489A piezoelectric siren (which draws about 0.2 amps and is very directional) is a prime candidate for use in the Motorcycle Alarm. This arrangement is recommended for use in motorcycles with unusually small batteries.

Installation. The location of the alarm is important. It should be in a secure place. The most common place is under the seat. That placement also has the convenience of being close to the battery and cycle wiring. On most modern motorcycles, whenever the ignition switch is on, the lights are turned on as well. If that is true of your cycle, it maybe easier to locate and use the hot taillight wire in place of the ignition switch.

For best results, the board should be laying slightly off level when the motorcycle is in its parked position. When the cycle is on the kick stand, the alarm will be tilted slightly with the cycle. Adjusting the tilt angle will affect the sensitivity of the alarm; less tilt gives more sensitivity. Adjust the tilt to your liking, keeping in mind that you don't want a small gust of wind to set off the unit.

Figures 5 and 6 illustrate two options for installation. Figure 5 shows an option (a second horn) that is available on some cycles, but that installation scheme also applies to single-horn cycles. It is recommended that only one horn be enabled via the alarm to limit the current drain. That is easily done by adding a diode in the +V line of the second horn. That is necessary to prevent current from flowing through the second horn when the ignition switch is off.

Figure 6 shows the Motorcycle Alarm used with a siren. The Radio Shack #49-489A piezoelectric siren (which draws about 0.2 amps and is very directional) is a prime candidate for this application. The only problem with that configuration is that space will have to be found for the siren. However, it is well worth it if the motorcycle has an unusually small battery, as do some smaller motorcycles that do not have electric starters.

Protecting your favorite set of wheels makes good sense. The project that was presented in this article can provide you with that protection at a reasonable price. Why not build one today! ■

Rain Forest Rescue™

The National Arbor Day Foundation

96,000 acres of irreplaceable rain forest are being burned every day. These once lush forests are being cleared for grazing and farming. But the tragedy is without the forest this delicate land quickly turns barren.

The National Arbor Day Foundation, the world's largest tree-planting environmental organization, has launched Rain Forest Rescue. By joining the Foundation, you will help stop further burning. For the future of our planet, for future generations, support Rain Forest Rescue. Call now.

Call Rain Forest Rescue.
1-800-255-5500

LOUDSPEAKER DESIGN

(Continued from page 44)

Finally, you will be prompted for the tweeter's impedance at the selected crossover frequency. To find that value, use the same strategy mentioned above for the woofer, using the nominal impedance of the driver if necessary.

Once all the above information has been entered, the program will automatically calculate the inductor/capacitor values and display them for you. Copy the values down for future reference.

Now that we have completed this last in our series of loudspeaker design programs, I hope that you all have begun to feel a little more at home with speaker systems, and can start to do a little designing and building for yourselves without undo fear of failure. Admittedly, the speakers you can design using these programs are fairly basic, but they are surprisingly good performers that can give you years of enjoyable listening. ■

125-MHz LOGIC PROBE

(Continued from page 60)

do that, the green LED should light. Next, place a +5 volts on pin 1. Now the red LED should light and the beeper should sound. If neither of those event occur, check the solder connections on the board.

Using the Logic Probe. Basically, there are no special instructions or techniques needed to use the probe. Simply use it as you would any other logic probe. The only difference between it and other probes is its superior frequency response.

I have used my probe for many digital applications and can personally testify to both its accuracy and reliability. For those of you who want to know, yes, I have used it at frequencies up to 100 MHz (the limit of my calibration equipment) and seen it capture pulses consistently every time.

A logic probe is a valuable and time-saving piece of gear. Every serious technician has one. ■

www.americanradiohistory.com

Enter A World Of Excitement with a Subscription to

Popular Electronics®

Get the latest electronic technology and information monthly!

Now you can subscribe to the magazine that plugs you into the exciting world of electronics. With every issue of Popular Electronics you'll find a wide variety of electronics projects you can build and enjoy.

Popular Electronics brings you informative new product and literature listings, feature articles on test equipment and tools—all designed to keep you tuned in to the latest developments in electronics. So if you love to build fascinating electronics, just fill out the subscription form below to subscribe to Popular Electronics... It's a power-house of fun for the electronics enthusiast.

EXCITING MONTHLY FEATURES LIKE:

- ❑ **CONSTRUCTION**—Building projects from crystal sets to electronic roulette
- ❑ **FEATURES**—Educational training on digital electronics, Ohm's Law, Antennas, Communications, Antique Radio, Simplified Theory
- ❑ **HANDS-ON-REPORTS**—User test comments on new and unusual consumer products
- ❑ **SPECIAL COLUMNS**—Think Tank, Circuit Circus, Computer Bits, DX Listening, Antique Radio, Amateur, Scanner Scene

PLUS: ALL OUR GREAT DEPARTMENTS!

You'll get 12 exciting and informative issues of Popular Electronics for only $18.95. That's a savings of $23.05 off the regular single copy price. Subscribe to Popular Electronics today! Just fill out the subscription order form below.

Save 55% Off The Regular NEWSSTAND Rate

FOR FASTER SERVICE CALL TODAY

1-800-827-0383

(7:30AM-8:30PM)
EASTERN STANDARD TIME

APEB4

Popular Electronics SUBSCRIPTION ORDER FORM

P.O. Box 338, Mt. Morris IL. 61054

YES! I want to subscribe to Popular Electronics for 1 Full year (12 Issues) for only $18.95. That's a savings of $23.05 off the newstand price.
(Basic Subscription Rate—1 yr/$21.95)

❑ Payment Enclosed ❑ Bill me later

Please charge my: ❑ Visa ❑ Mastercard

Acct. # _____

Signature Exp. Date

PLEASE PRINT BELOW:

NAME _____

ADDRESS _____

CITY STATE ZIP

Allow 6 to 8 weeks for delivery of first issue. U.S. Funds only.
In Canada add $6.68 Postage (Includes G.S.T.) All Other Foreign add $7.50 Postage.

www.americanradiohistory.com

input (pin 1) to ground. That allows the RF to appear at the mixer's output (pin 4 and 5), isolating the RF output from the oscillator circuit.

The NE602's oscillator is designed to operate at a maximum frequency of 200 MHz. So just about any crystal that you might have should be okay. The values of C1 and C2 are fine for crystal frequencies between 3 and 10 MHz. The values of those two capacitors can be reduced to operate the circuit at frequencies above 10 MHz; increase the value of those capacitors for frequencies below 3 MHz.

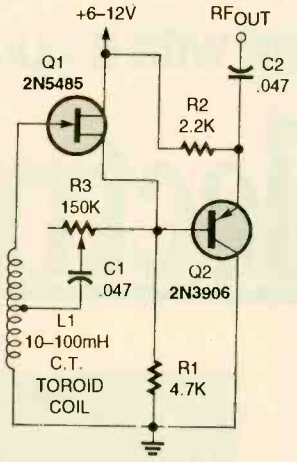


Fig. 6. The VLF oscillator uses a large toroid coil as the frequency-determining component and a 2N5485 FET as the active device.

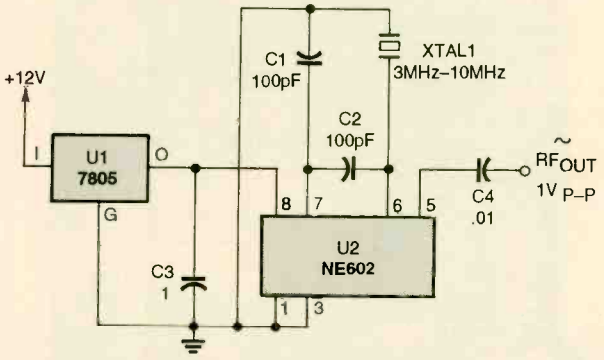


Fig. 5. Built around the oscillator section of an NE602 double-balanced mixer, the operating frequency of this is also crystal controlled.

PARTS LIST FOR THE DBM OSCILLATOR

SEMICONDUCTORS
U1—7805 5-volt, 1.5-amp voltage regulator, integrated circuit
U2—NE602 double-balanced mixer, integrated circuit

CAPACITORS
C1, C2—100-pF mica or NPO ceramic-disc
C3—0.1-μF, ceramic-disc
C4—0.01-μF, ceramic-disc

ADDITIONAL PARTS AND MATERIALS
XTAL1—3- to 10-MHz crystal
Perfboard materials, 12-volt power source, IC socket, wire, solder, hardware, etc.

As long as the NE602's power supply voltage is kept below 8 volts, the 7805 voltage regulator isn't necessary. In fact, the oscillator functions fine from a 4- to 8-volt supply voltage and draws less than 10 mA of current.

VLF OSCILLATOR

The VLF oscillator shown in Fig. 6 uses a large toroid coil as the frequency-setting component and a 2N5485 FET as the active device. Inductor L1 and its distributed capacitance sets the oscillator's frequency to about 50 kHz.

The circuit's feedback control (R3) allows for a very fine adjustment of the circuit's gain. Potentiometer R3 can be adjusted so that the circuit just breaks into oscillation. In that condition, the circuit can be used as a

PARTS LIST FOR THE VLF OSCILLATOR

SEMICONDUCTORS
Q1—2N5485 general-purpose N-channel JFET
Q2—2N3906 general-purpose PNP silicon transistor

RESISTORS
(All fixed resistors are ¼-watt, 5% units.)
R1—4700-ohm
R2—2200-ohm
R3—150,000-ohm potentiometer

ADDITIONAL PARTS AND MATERIALS
C1, C2—0.047-μF, Mylar capacitor
L1—10- to 100-mH toroid coil
Perfboard materials, 6–12-volt power source, wire, solder, hardware, etc.

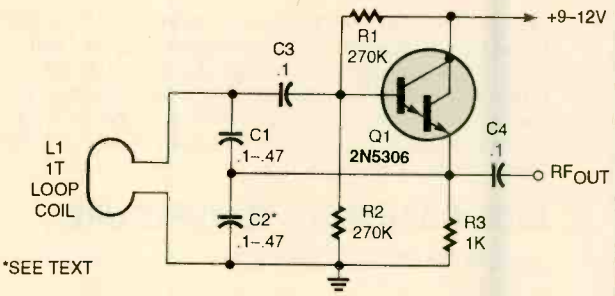


Fig. 7. This Darlington-based oscillator uses a very large capacitance-to-inductance ratio to achieve oscillation.

PARTS LIST FOR THE LC OSCILLATOR

RESISTORS
(All resistors are ¼-watt, 5% units.)
R1, R2—270,000-ohm
R3—1000-ohm

CAPACITORS
C1, C2—0.1- to 0.47-μF, Mylar
C3, C4—0.1-μF, ceramic-disc

ADDITIONAL PARTS AND MATERIALS
Q1—2N5306 NPN Darlington transistor
L1—See text
Perfboard materials, 9–12-volt power source, wire, solder, hardware, etc.

www.americanradiohistory.com

proximity detector. Any capacitive loading of L1 will reduce the oscillator's output, which can be monitored at the output to indicate a near-by object. Transistor Q2 is used as a buffer amplifier to prevent the connected circuit form loading the oscillator.

LC OSCILLATOR

The LC oscillator shown in Fig. 7 uses a very large capacitance-to-inductance ratio to set the circuit's operating frequency. The tuning circuit is comprised of a 12-inch single-turn loop of No. 12 copper wire, and a pair 0.1-μF capacitors. The series-connected capacitors are wired across the loop to resonate the circuit at about 500 kHz.

A high-gain, high input impedance, Darlington transistor is used to match and isolate the tuned circuit from the output. The oscillator can be tuned to a lower or higher frequency by changing the values of C1 and C2. Larger capacitance values lower the oscillator frequency, while smaller values increase the frequency.

A larger or smaller loop can also be used to produce similar results. Larger loops produce lower frequencies and smaller loops generate higher frequencies.

That's all the room we have for this month. Until next time we meet, have fun. ■

When someone in your family gets cancer, everyone in your family needs help.

Among our regular services we provide information and guidance to patients and families, transport patients to and from treatment, supply home care items and assist patients in their return to everyday life.

Life is what concerns us. So you can see we are even more than the research organization we are so well known to be.

No one faces cancer alone.

AMERICAN CANCER SOCIETY

PRODUCT TEST REPORT

(Continued from page 22)

luminance signal-to-noise ratio was also superb, measuring 62.9 dB for a reference level of 100 IRE.

As for the audio performance of this player, it certainly equaled or surpassed that of many audio-only CD players in the same price category. The maximum audio-output level was 2.142 volts. The A-weighted signal-to-noise ratio measured 95.2 dB, while stereo separation between channels measured between 101.1 dB and 104.0 dB for a 1-kHz test signal, depending upon which channel was being measured. The total harmonic distortion at 1 kHz, for a maximum recorded signal, was an insignificant 0.0048%. The frequency response was never off by as much as 0.1 dB over the range from 10 Hz to 20 kHz.

The Kodak PCD 5870 consumed 15.5 watts of power in the play mode. The random-access time from track 1 to 2 was 1.66 seconds, while from track 20 to track 21, random-access time was 0.72 seconds. The scan time from track 1 to 21 was 1.26 seconds, while scan time from track 21 to track 1 measured 3.32 seconds. There is a delay after the first button on the remote is pressed when entering a track number directly; that is to allow for a 2-digit number to be entered. If two buttons are pushed one after another, this delay is defeated. That accounts for the discrepancy between the random-access time and the scan time.

HANDS-ON TESTS

Kodak supplies an excellent "demo" disc with this product and, just by watching this disc, we were able to quickly learn how to use the many special Photo-CD features. The demo disc even allows you to choose among several languages for narration and instruction. If, after viewing the demo disc you still need help, there is, of course, a well written and well illustrated owner's manual that's also written in three languages (English, Spanish, and French). The pictures observed when playing the demo disc, as well as those viewed on other photo CD's, were crisp and had excellent color reproduction. Being able to pan and "crop" photos and to expand the size of a framed portion of a photo was extremely useful and was, of course, something that could not be done with the original prints or slides.

If you are an avid photographer (or even if you shoot a roll of film only when you go on vacation or attend an important family event), and if you have yet to choose a compact disc player, having the "best of both worlds" by selecting a photo CD player such as the Kodak PCD 5870 would seem like a very wise thing to do—especially at its suggested retail price of only $549.00.

For more information on the Kodak PCD 5870 contact the manufacturer (Eastman Kodak Co., 343 State St., Rochester, NY 14650) directly, or circle no. 120 on the Free Information Card. ■

"If it works, I've got an amplifier; if not, I've got lunch."

MEETING TOMORROW'S CHALLENGES TODAY

The men and women in the Navy's Seaman/Airman/Fireman Program are working for America, while learning valuable skills through on-the-job training. They're building solid futures, succeeding in a competitive, high-tech world and advancing as quickly as their abilities and performance allow. Find out more about the Seaman/Airman/Fireman Program, as well as other exciting Navy job opportunities, from your local Navy recruiter. This ad is brought to you as a public service of this newspaper.

Navy. Full Speed Ahead.

www.americanradiohistory.com

FCC EXAM

(Continued from page 67)

A. Height, transmitter power and antennas of satellite
B. Length of transmission line and impedance match between receiver and transmission line
C. Preamplifier location on transmission line and presence or absence of RF-amplifier stages
D. Height of earth antenna and satellite orbit ■

FCC-TEST ANSWERS

1 A	39 A
2 C	40 B
3 C	41 D
4 B	42 D
5 A	43 A
6 B	44 A
7 A	45 B
8 A	46 B
9 B	47 A
10 D	48 C
11 B	49 D
12 C	50 B
13 A	51 C
14 A	52 C
15 B	53 B
16 A	54 A
17 D	55 B
18 B	56 A
19 D	57 D
20 D	58 B
21 B	59 D
22 D	60 C
23 B	61 A
24 B	62 A
25 A	63 C
26 C	64 B
27 B	65 C
28 C	66 A
29 B	67 B
30 A	68 B
31 B	69 C
32 A	70 C
33A	71 A
34 D	72 A
35 A	73 B
36 A	74 C
37 B	75 B
38 B	76 A

SUPPORT RESEARCH.
It Works Wonders.
American Heart Association

STEP UP TO CD-ROM

(Continued from page 36)

to search this disc for information by title, topic, cast, category, and so on. Over 19,000 movies are reviewed on this disc. This $79.95 disc is the perfect way to prepare for your next trip to the video store, in addition to being the perfect companion for any home-video collector.

With all of the unusual applications that can be found on CD-ROM, we still don't want to lose sight of everyday productivity applications. And neither does Microsoft with their *Word for Windows and Bookshelf* combination on CD-ROM. We were already familiar with Word for Windows' powerful word-processing capabilities, so we were eager to see what it's like when packaged with *Bookshelf*, which puts seven popular references right on Word's toolbar. Word is the same familiar program, except that one new button on the toolbar instantly brings up *The Concise Columbia Encyclopedia, The American Heritage Dictionary, Roget's II Electronic Thesaurus, The World Almanac and Book of Facts 1992, Bartlett's Familiar Quotations, and the Hammond Atlas.* The real beauty is that those references remain on the CD-ROM and don't clutter up your hard drive. This $595 package is a great reference tool for any writer.

Education. Another disc from National Geographic, *The Presidents: It All Started With George*, is a multimedia look at the presidency of the United States. More than 1200 photos, motion-picture footage, music, audio clips, and other facts illustrate the lives and times of the presidents. The disc sells for $99.00 to educators and $149.00 retail. The last National Geographic disc we looked at is their *Picture Atlas of the World*. This disc lets you jump from a map of anywhere in the world right into the sights and sounds of the streets and countrysides without calling a travel agent.

If stargazing is something you find interesting, then you'll probably feel the same way about Virtual Reality Laboratories' *Distant Suns* disc, the desktop planetarium for Windows. The program lets you see a display of the night sky from anywhere on earth, any day of any year, from 4173 B.C. to 10,000 A.D.—so you can only use this disc for another 8006 years.

The program can display thousands of stars, as well as galaxies, nebulas, and star clusters, so it's easy to find and identify celestial objects. You can also add custom objects to create your own personal night sky. If you have a printer, you can produce star charts to take with you on your next stargazing outing. If you're fortunate enough to have a laptop PC, you'll be able to bring the water to the horse—or so to speak. Distant Suns has a suggested price of $99.95.

While it's unlikely that CD-ROM's will ever replace *all* paper books, some books are more likely to be replaced than others. Language text books come to mind here. If that's so, the HyperGlot Software Company is onto something with their language software on CD-ROM. After all, what better way is there to learn a foreign language than to hear the words spoken properly. That's something that CD-ROM-based learning material can offer that paper books just can't. HyperGlot offers software-based help in languages ranging from French to Chinese to Russian.

We looked at two CD-ROM sets from HyperGlot, both on Spanish. The first one, *Berlitz Think & Talk Spanish*, contains 8 CD-ROM's, and is intended for a beginner in Spanish. The discs let you hear Spanish used in everyday situations presented via dialog, pictures, and music, all with the user having full interactive control. Fifty lessons are included and there's a 10,000-word on-line bilingual dictionary available at the touch of a button. *Think & Talk Spanish* has a suggested retail price of $199.00. The second set, *Learn to Speak Spanish*, contains 2 discs and 30 context-driven lessons, and a slimmer price of $99.00.

Conclusion. It has been our intention to interest you in CD-ROM. Because the faster the general public accepts and begins to use CD-ROM's in day-to-day tasks, the quicker new applications will come to market, and the cheaper they'll get. We've discussed only a sampling of what's out there, and there's probably hundreds of new applications on the horizon. So it's now up to you to keep-up with technology and take the multimedia plunge. ■

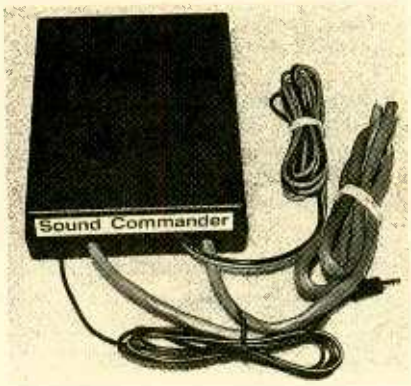
www.americanradiohistory.com

AUDIO ACCESSORIES

(Continued from page 72)

lent until someone sends a personal Touch-Tone code. When the proper code is received, the built-in speaker is turned on, allowing the call to be heard. A front-panel LED also illuminates, letting you know that someone called you while you were away from the radio.

The $99.95 MoTron DTMF (or Touch Tone) device can be used with any FM receiver, transceiver or scanner, including VHF/UHF amateur radio, business-band, marine-VHF, volunteer fire department, and AM CB radios. If the calling station doesn't have a built-in Touch-Tone pad, inexpensive memory tone dialers are available from many sources; you can place the dialer next to the microphone to send the calling code.



The Electron Processing Sound Commander's motto is, "never miss a scanner call again." The device allows mobile-scanner users to effectively monitor their car radio and scanner simultaneously. Connection to the car-radio speaker leads and scanner is simple. It's designed for use with car radios of up to four speakers and not more than 25 watts per channel.

Mobile-Rig Accessories Most mobile receivers, scanners, and transceivers have small internal speakers, and their harsh sound puts a crimp in the quality of reception. Although many radios have their speaker installed on top of the unit so that the user hears it best, many sets aim the speaker downward—the worst way. The set's audio output is directed where it's largely absorbed. Thus, an external speaker can be highly desirable. Extension speakers markedly improve signal intelligibility when positioned properly, and they're probably much more efficient than the sets' internal speakers.

Almost any mobile speaker, even CB types, will yield adequate results. However, you'll find the quality, lightweight units offered by manufacturers such as Kenwood, Yaesu, ICOM, and MFJ Enterprises better than CB style units. Those units can benefit any mobile installation.

In some cases where your radio has inadequate audio output and you're operating under high-noise conditions, consider an amplified speaker, such as the 10-watt SP-10 mobile amplified extension speaker offered by Grove Enterprises for $39.95. Grove also sells a $9.95 clip-on mini speaker for handheld radios that provides solid, concentrated sound when clipped to your lapel or collar.

What has priority, your mobile scanner or your car radio? Switching between communications radios, car radios, and tape players can be confusing. However, not switching, can lead to sensory overload, to say the least. The Electron Processing Sound Commander is a mobile scanner interface that eliminates missed radio calls caused when a car radio is used in conjunction with a mobile scanner. The unit switches the auto speakers to your scanner, muting the car stereo, whenever a call comes in. Connecting it to the car-radio speaker leads and the scanner is simple and provides sensitive VOX operation with any scanner. The 12 VDC unit is for use with car radios with up to four speakers and not more than 25 watts per channel. It's priced at $80.

Conclusion. In this article we've presented an audio tour through the contemporary radio listening post. We also examined a variety of audio accessories and add-ons including speakers; headphones; tape recorders; automatic-recorder controls; active, passive, and smart audio filters; signal decoders; and specialized add-ons for the mobile listening post.

In the final analysis, you must decide which, if any, audio accessories are valuable to you. Hopefully, the suggestions and observations we provided in this article will help make your accessory-related decisions both logical and wise. ■

Popular Electronics®

WE HAVE THE RIGHT ANSWER

Advertisers who want to place their print ads in a quality publication ask the question: "Is your circulation audited?"

We're very proud to answer "Yes."

We are a member of the Audit Bureau of Circulations because we share ABC's belief that circulation audits are an essential assurance of value.

ABC is the premier circulation auditing organization in the world, and has been since 1914. Each year, ABC auditors test and verify that our circulation figures are facts, not claims. An ABC audit is the sign of a sound investment for advertisers.

Not all publications are audited, but they should be. Because when advertisers ask "Is your circulation audited?" there's only one answer.

"Yes."

Audit Bureau of Circulations

www.americanradiohistory.com

FUN WITH ELECTRONICS

◄ ☐ **160—COIL DESIGN & CONSTRUCTION MANUAL .... $5.95.** How to make RF, IF, audio and power coils; chokes and transformers. Practically every possible type is discussed.

☐ **PCP113—THE PC MUSIC HANDBOOK .... $13.95.** Learn the basics of computer music systems. For the professional musician, gifted amateur or just plain curious. ►

◄ ☐ **BP297—LOUDSPEAKERS FOR MUSICIANS .... $6.25.** Loudspeaker design from the musician's point of view! All you need to know, and you should be able to design your own after reading this.

☐ **BP277—HIGH POWER AUDIO AMPLIFIER CONSTRUCTION .... $6.25.** Here's background and practical design information on high power audio amplifiers capable of 300 ± 400 watts r.m.s. You'll find MOSFET and bipolar output transistors in inverting and non-inverting circuits. ►

◄ ☐ **BP302—A CONCISE USER'S GUIDE TO LOTUS 1-2-3 RELEASE 3.1 .... $6.25.** If you are a PC user and want to upgrade to Lotus 1-2-3 release 3.1. this book can teach you how to do that in the shortest and most effective way.

☐ **BP298—A CONCISE INTRODUCTION TO THE MACINTOSH SYSTEM AND FINDER .... $6.25.** This introduction for those new to the Mac, this book also serves as a quick refresher for experienced owners that have not used the machine in some time. ►

MAIL TO: **Electronic Technology Today, Inc.**
P.O. Box 240
Massapequa Park, NY 11762-0240

SHIPPING CHARGES IN USA AND CANADA

$0.01 to $5.00 . . . $1.50	$30.01 to $40.00 . $5.50
$5.01 to $10.00 . . $2.50	$40.01 to $50.00 . $6.50
$10.01 to $20.00 . $3.50	$50.01 and above . $8.00
$20.01 to $30.00 . $4.50	

SORRY, No orders accepted outside of USA and Canada

Total price of merchandise ..... $ _____
Shipping (see chart) ..... $ _____
Subtotal ..... $ _____
Sales Tax (NYS only) ..... $ _____
Total Enclosed ..... $ _____

Name _____
Address _____
City _____ State _____ Zip _____

ADVERTISING INDEX

POPULAR ELECTRONICS magazine does not assume any responsibility for errors that may appear in the index below.

Free Information No.		Page
151	AMC Sales	9
—	Antique Radio Classified	78
—	CBC International	78
—	CIE	15
—	CLAGGK Inc. Video Offer	CV3
—	Command Productions	9
—	Elec. Industry Association	CV2
—	Electronic Tech. Today	17
—	Electronics Book Club	5, 29
—	Firestik II	77
153	Fluke Corporation	CV4
154	Foley-Belsaw Company	21
—	Grantham College	7
155	Heathkit	19
—	ISCET	76
—	Motorola	30
163	Mouser	25
—	NRI Schools	61
—	Nu-Tek	79
13	Number One Systems Ltd.	76
—	People's College	78
—	Prime Time Electronics	77
159	The School Of PC Repair	25
14	The School Of VCR Repair	11
164	U.S. Cable Supply, Inc.	79
—	World College	3

ADVERTISING SALES OFFICE

Gernsback Publications, Inc.
500-B Bi-County Blvd.
Farmingdale, NY 11735
1-(516) 293-3000

Larry Steckler
President

Christina Estrada
Assistant to the President

For Advertising ONLY
516-293-3000
Fax 1-516-293-3115

Larry Steckler
publisher

Arline Fishman
advertising director

Denise Mullen
advertising assistant

Kelly Twist
credit manager

Subscription/
Customer Service/
Order Entry
1-800-827-0383
7:30 AM - 8:30 PM EST

ADVERTISING SALES OFFICES

EAST/SOUTHEAST

Stanley Levitan
Eastern Sales
1 Overlook Ave.
Great Neck, NY 11021
1-516-487-9357, 1-516-293-3000
Fax 1-516-487-8402

MIDWEST/Texas/Arkansas/
Oklahoma, Colorado, Arizona

Ralph Bergen
Midwest Sales
One Northfield Plaza, Suite 300
Northfield, IL 60093-1214
1-708-446-1444
Fax 1-708-559-0562

PACIFIC COAST/Mountain States

Mike Brooks
Pattis/3M
1800 North Highland Avenue
Suite 717 ,
Hollywood, CA 90028
1-213-462-2700
Fax 1-213-463-0544

www.americanradiohistory.com

Supplement to Popular Electronics
February 1994

Popular Electronics Market Center™

Paperback Books

GREAT PAPERBACKS AT SPECIAL PRICES

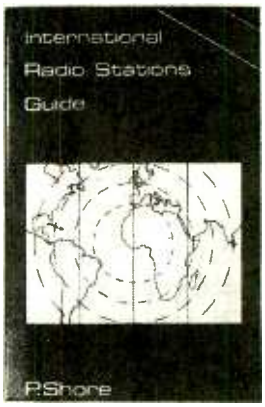
☐ **COMPUTER HOBBYISTS HANDBOOK—BP251—$8.95**

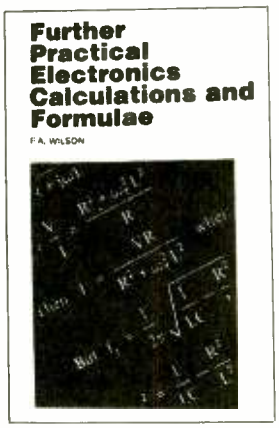
Subjects covered include microprocessors and their register sets; interfacing serial, paralley, monitor, games and MIDI ports; numbering systems, operating systems and computer graphics. While the book is aimed at the computer hobbyist, it should also prove useful to anyone who intends to use a computer to follow their interests.

☐ **INTERNATIONAL RADIO STATIONS GUIDE—BP255—$9.95**

Provides the casual listener, amateur radio DXer and the professional radio monitor with an essential reference work designed as a guide for the complex radio bands.

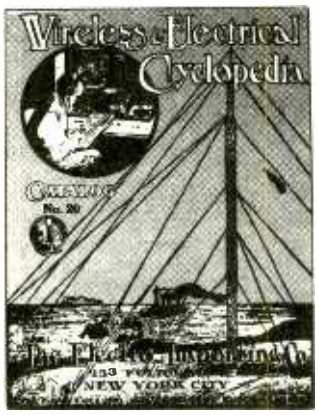
Includes coverage on Listening to Short Wave Radio, ITU Country Codes, Worldwide Radio Stations, European Long Wave and Medium Wave Stations, Broadcasts in English and more.





☐ **FURTHER PRACTICAL ELECTRONICS CALCULATIONS—BP144—$9.00**

450 pages crammed full of all the formulae you are likely to need. Covers Electricity, Electrostatics, Electromagnetism, Complex Numbers, Amplifiers, Signal Generation and Processing, Communications, Statistics, Reliability, Audio, Radio Systems, Transmission Lines, Digital Logic, Power Supplies. Then there's an appendix of Conversion Factors, Mathematical Formulae and more.



☐ **WIRELESS & ELECTRICAL CYCLOPEDIA—ETT1—$5.75**

A slice of history. This early electronics catalog was issued in 1918. It consists of 176 pages that document the early history of electricity, radio and electronics. It was the "bible" of the electrical experimenter of the period. Take a look at history and see how far we have come. And by the way, don't try to order any of the merchandise shown, it's unlikely that it will be available. And if it is, the prices will be many times higher.

ELECTRONIC TECHNOLOGY TODAY INC.
P.O. Box 240, Massapequa Park, NY 11762-0240

Name _____

Address _____

City _____ State _____ Zip _____

PE294

SHIPPING CHARGES IN USA AND CANADA

$0.01 to $5.00	$1.50
$5.01 to $10.00	$2.50
$10.01 to 20.00	$3.50
$20.01 to 30.00	$4.50
$30.01 to 40.00	$5.50
$40.01 to 50.00	$6.50
$50.01 and above	$8.00

SORRY No orders accepted outside of USA & Canada

Number of books ordered ☐

Total price of merchandise .... $ _____
Shipping (see chart) ..... $ _____
Subtotal ..... $ _____
Sales Tax (NYS only) ..... $ _____
Total Enclosed ... $ _____

All payments must be in U.S. funds

www.americanradiohistory.com

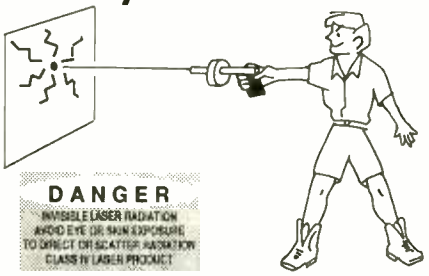
AMAZING Electronic and Scientific Products

Mystery Levitating Device!

Remember War of the World? Objects float in air and move to the touch. Defies gravity, amazing gift, conversation piece, magic trick or great science project.

ANT1K Easy to Assemble Kit / Plans $19.50

Laser Ray Gun



Advanced project produces a burst of light energy capable of burning holes in most materials. Hand-held device uses rechargeable batteries. 500 joules of flash energy excite either a neodynium glass, yag or other suitable 3" laser rod. This is a dangerous CLASS IV project (individual parts/assemblies available).

LAGUN1 Plans $20.00
LAGUN1K Kit / Plans ..... Price on Request

Extended Play Telephone Recording System

READY TO USE! Automatically controls and records on our X-4 extended play recorder, taping both sides of a telephone conversation. Intended for order entry verification. Check your local laws as some states may require an alerting beeper.

TAP20X Ready to Use System $129.50

Shocker Force Field/ Vehicle Electrifier

Neat little device allows you to make hand and shock balls, shock wands and electrify objects, charge capacitors. Great payback for those wise guys who have wronged you!

SHK1KM Easy to Assemble Electronic Kit $24.50

Blaster Pulser

Pocket-sized wand produces 100,000 watts of power for personal defense, field and lab use, etc. BLS3 Plans $10.00
BLS3K Kit / Plans $69.50

Homing / Tracking Transmitter

Beeper device, 3 mile range.

HOD1 Plans .....$10.00 HOD1K Kit / Plans $49.50

Listen Through Walls, Floors

Highly sensitive stethoscope mike.

STETH1 Plans.....$8.00 STETH1K Kit/Plans $44.50

NEW! Telephone Line Grabber / Room Monitor

ALL NEW! The Ultimate In Home or Office Security & Safety! Simple to Use! Call your home or office phone, push a secret tone on your telephone keypad to access either: A. On premises sounds and voices; or B. Existing telephone conversation with break in capability for emergency messages. CAUTION: Before assembly or use, check legalities with your state Attorney General's office as you may require "beepers" or other 3rd party alerts.

TELEGRAB1 Plans Only $10.00
TELEGRAB1K Kit / Plans $99.50

Ultrasonic Blaster

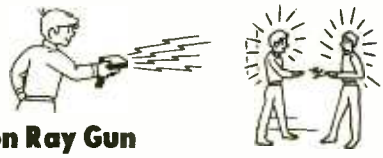
Laboratory source of acoustical shock waves. Blow holes in metal, produce "cold" steam, atomize liquids. Many cleaning uses for PC boards, jewelry, coins, small parts, etc.

ULB1 Plans.....$10.00 ULB1K Kit/Plans.....$69.50

100,000V Intimidator / Shock Wand Module

Build an electrical device that is affective up to 20 feet. May be enclosed for handheld, portable field or laboratory applications.

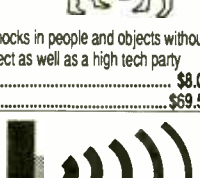
ITM2KM Easy-to-Assemble Electronics Kit $49.50
ITM2 Plans only, credit-able to kit $10.00



Ion Ray Gun

Projects charged ions that induce shocks in people and objects without any connection! Great science project as well as a high tech party prank. IOG3 Plans $8.00
IOG3K Kit/Plans $69.50

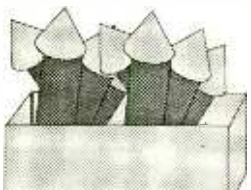
Invisible Pain Field Generator



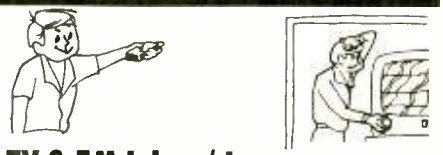
Shirt pocket size electronic device produces time variant complex shock waves of intense directional acoustic energy, capable of warding off aggressive animals, etc.

IPG7 Plans .....$8.00 IPG7K Kit/Plans ...$49.50
IPG70 Assembled $74.50

SUPER GIANT SMOKE ASSORTMENT



SPECIAL INTRODUCTORY OFFER! WOW! Over 500 items - the largest smoke assortment we have! Each super giant assortment contains at least 500 pieces - enough to last you a long time. All this at a special price - less than 12 cents per item. Guaranteed value at least 50 percent more than you pay! SMOKE 25 ..... $59.50



TV & FM Joker / Jammer

Shirt pocket device allows you to totally control and remotely disrupt TV or radio reception. Great gag to play on family or friends. Discretion required. EJK1KM Easy to Assemble Electronic Kit $24.50

Visible Beam Laser

High brightness red HeNe laser visible for miles.

Produce your own light show! Projects a visible beam of red lite clearly visible in most circumstances. Can be used to intimidate by projection of a red dot on target subject. Also may be used to "listen in" using our laser window bounce method #LLIS1 below. *Easy to build module makes A working visible laser!*

LAS1KM Kit w/1mw Laser Tube, Class II. $69.50
LAS3KM Kit w/2.5mw Laser Tube, Class IIIA $99.50

"Laser Bounce" Listener System

Allows you to hear sounds from an area via a lite beam reflected from a window or other similar objects. System uses our ready-to-use LATR1 Laser Terminator gun site as the transmitter. The receiver section is supplied as an easy-to-build kit, including our cushioned HS10 headsets. LLIST2 Plans $20.00
LLIST1K Kit of Both Transmitter and Receiver $199.50
LLIST20 Assemble with Laser Gun Site $299.50

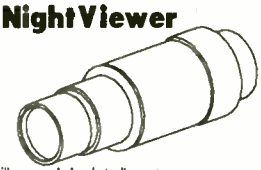
5mw Visible Red Pocket Laser

Utilizes our touch power control!

VRL5KMX Kit / Plans $119.50

Fantastic ALL NEW pinwheel effect for auto, motorcycle, bicycle, etc. Use one per wheel. SIMPLE TO USE! LWMIRLY $9.50

Pocket Sized Night Viewer



Uses Low Level Starlight to See In the Dark!

- Low Cost
- Ultra-Hi Lite Amplification!
- Auto Brightness Control
- Limited Amount Available
- Made in USA • Night surveillance • Animal studies, etc.

Can be used to fly an airplane or drive a car!

PKV7 Plans $15.00
PKV7K Easy to Assemble Kit $1,295.00
PKV70 Ready to Use $1,595.00

3 Mile FM Wireless Microphone

Subminiature! Crystal clear, ultra sensitive pickup transmits voices and sounds to FM radio. Excellent for security, monitoring of children or invalids. Become the neighborhood disk jockey, or go "under cover" using our sunglasses FM radio (see catalog). FMV1 Plans ... $7.00
FMV1K Kit and Plans $39.50
SUGL10 Sunglasses with built in FM Radio $29.50

Telephone Transmitter - 3 Mi

Automatically transmits both sides of a telephone conversation to an FM radio. • Tunable Frequency • Undetectable on Phone • Easy to Build and Use • Up to 3 Mile Range • Only transmits during phone use.

VWPM7 Plans $7.00
VWPM7K Kit/Plans $39.50

Popular Electronics, February 1994

INFORMATION UNLIMITED
Dept PEM14, Box 716, Amherst, NH 03031
Phone: 603-673-4730 FAX 603-672-5406
MC, VISA, COD, Checks accepted Please add $5.00 Shipping & Handling
CATALOG With many more items! Free with Order or send $1 P&H
Order by Mail or by 24 Hour Orders-Only Phone 800-221-1705

www.americanradiohistory.com

CAIG Electronic Chemicals
for Manufacturing, Maintenance & Service!

DON'T JUST CLEAN CONNECTIONS; DEOXIDIZE, SEAL & PROTECT THEM!

Even the finest equipment cannot guarantee noise-free/error-free operation. One "dirty" connection anywhere in the signal path can cause unwanted noise or signal loss.

***ProGold** and **DeoxIT** increase the performance and reliability of electrical components and equipment. They provide long-lasting protection, reducing the expense of repeated cleaning with expensive ozone-depleting solvents.*

ProGold™
Gold Conditioner & Protector

ProGold is specifically formulated to improve conductivity and protect gold, base metals and other precious metal surfaces. Use on gold connectors and contacts for maximum performance and protection. A common problem with gold plated surfaces is that the base metals migrate to the surface due to gold's soft and porous nature (dendrite corrosion). Once exposed, base metals oxidize, adding unwanted resistance that impedes electrical performance. Since gold plated surfaces are thinly coated, they are susceptible to scratching & abrasion, further exposing the base metals.

ProGold is a one-step treatment that conditions gold connectors, contacts and other metal surfaces, enhancing the conductivity characteristics to efficiently transmit electrical signals. **ProGold** coats the entire contact surface and connection, providing superior protection from abrasion (insertion resistance), arcing, RFI, wear and atmospheric contamination.

DeoxIT™ & PreservIT™
Deoxidizes, Seals & Protects Electrical Connections

DeoxIT, *a one-step treatment*, is a fast-acting, deoxidizing solution that cleans, preserves, lubricates & improves conductivity on all metal surfaces. Use as a general treatment for connectors, contacts & other metal surfaces.

PreservIT seals, lubricates and preserves metal surfaces for protection from oxidation and contamination. For use on clean/new surfaces or those pre-cleaned with **DeoxIT**.

Both have excellent migration properties that coat the surfaces and protect them from future oxidation & contamination. These new advanced formulas contain improved deoxidizers, preservatives, conductivity enhancers, anti-tarnishing compounds, arcing & RFI inhibitors and provide extended temperature range.

OpticALL™
Effectively cleans, polishes and eliminates static electricity on optical viewing surfaces. OpticALL is also recommended as a general purpose antistatic cleaner on plastic, glass and metal surfaces.

StaticALL™
Neutralizes static build-up caused by friction & low humidity conditions.

DustALL™
Quickly & safely removes dust, lint & particles from sensitive electronic equipment, computers, lab equip., optical grade surfaces & other mechanisms & equipment.

FreezALL™
Quickly and safely cools circuits to -54°C. Locates intermittent components due to heat failure and hairline cracks on PCBs.

MechanicALL™
High Penetrating Anti-Corrosive Anti-Tarnishing Cleaner & Lubricant. Lubricates & Protects, Displaces Moisture, Stops Squeaks, Migrates & Coats Entire Surface.

ElectricALL™
Rejuvenating Solution For All Electrical Applications. Cleans, Preserves, Improves & Protects Connections, Removes Corrosion & Oxidation, Reduces Wear, Abrasion, Arcing & RFI.

DegreasALL™
For degreasing, cleaning & defluxing equipment and parts. Removes oil, grease, dirt and contaminants including rosin flux from PCBs, components and metal parts. Biodegradable.

CAEON™ 27
For sensitive equipment applications. For removal of oil, grease & dirt from surfaces. (Freon® TF).

CAEON™ 28
Degreaser and cleaning liquid removes organic contaminants including rosin flux from PCBs, components and metal parts. (Freon® TMC).

X-10S Instrument Oil
Contains silicone. Finest quality instrument oil for use on rubber, plastics and metals. Non-gumming, rust inhibiting, long lasting lubrication.

X-10 Instrument Oil
Lubricates precision instruments, fine parts & mechanisms. Use on all metals (gauges, gears, clocks, instruments, etc.). Non-gumming, rust inhibiting, long lasting lubrication.

CAIG Products ... used by those who demand the best!

Boeing	Honeywell	Recoton
Diebold, Inc.	IBM	Switchcraft
Dolby Laboratories	John Fluke Mfg.	Tektronix
E.I. Dupont	McIntosh Labs	Texas Instruments
Federal Express	Motorola	Wayne-Dresser
General Electric	Nakamichi	Xerox Corp.
Hewlett Packard	RCA	. . . and many more

Since 1956
CAIG LABORATORIES, INC.

16744 West Bernardo Drive
San Diego, CA 92127-1904

Phone: (619) 451-1799
FAX: (619) 451-2799

CIRCLE 31 ON FREE INFORMATION CARD

www.americanradiohistory.com

Plans for the world's zaniest plaything—
September 1989

Put together your own Macintosh computer—
September 1991

Build the Tesla Coil that went square!—
August 1989

Take a chance on our Dice-Roulette project—
April 1989

Get the one you missed!

Popular Electronics®

Popular Electronics back issues are available although quantities of some issues are nearly exhausted. Here's an opportunity to complete your collection, or obtain a selected back issue you cannot find elsewhere. This offer is valid only when using the coupon on this page or a photo copy.

Special Back Issue Offer!

Please circle the issue(s) ordered!

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1987	1	2	3	4	5	6	7				11	12
1988	1	**1987-1988 back issues not available**								22	23	24
1989	25	26	27	28	29	30	31	32	33	34	35	36
1990	37	38	39	40	41	42	43	44	45	46	47	48
1991	—	49	—	50	51	52	53	54	55	56	57	58
1992	59	60	61	62	63	64	65	66	67	68	69	70
1993	71	72	73									

Note: Issues prior to November 1988 are "Hands-on Electronics"—the predecessor of Popular Electronics.

How to determine cost!

Quantity	Price per copy United States	Canada	Foreign
1-5	$6.50 US	$6.50 US	*
6-11	5.50	5.75	$8.00 US
12-23	5.00	5.25	7.50
24 and more	4.50	4.75	7.00

Prices include handling and shipping. Prices subject to change. All orders payable in U.S.A. funds only, via international money order, check drawn on a U.S.A. bank, or acceptable credit card (Visa, MasterCard) in U.S.A. funds. Allow 6-8 weeks delivery. Foreign orders may take longer. *Minimum foreign order—6 issues.

☐ Visa ☐ MasterCard ☐ USA Bank Check ☐ US or Int. Money Order

[**Note:** Credit Card minimum order is $15.00.]

Credit Card Number _____ Exp. Date _____/_____

Signature _____

Name _____

Address _____

City _____ State _____ ZIP _____

Send Orders To: CLAGGK, Inc., P.O. Box 4099, Farmingdale, NY 11735. Sorry, no telephone orders.

www.americanradiohistory.com

ACE COMMUNICATIONS

ACE Communications 800-445-7717
10707 East 106th Street Fishers, IN 46038

Get instant tech information FREE from your Fax or Computer!

You can obtain specs, freq. info, software and more from our automated services. For fax facts, call from your stand alone fax machine and follow the voice prompts. Use the BBS from your modem of fax/modem equipped computer. Dial 317-849-8683 for fax back service, or dial 317-579-2045 for our computer bulletin board service

Total Coverage Radios

AOR AR1000XLT
$449.00
AM Broadcast to Microwave
1000 Channels

500KHz to 1300MHz coverage in a programmable hand held. Ten scan banks, ten search banks. Lockout on search and scan. AM plus narrow and broadcast FM. Priority, hold, delay and selectable search increment of 5 to 995 KHz. Permanent memory. 4 AA ni-cads and wall plus cig charger included along with belt clip, case, ant. & earphone. Size: 6 7/8 x 1 3/4 x 2 1/2. Wt 12 oz. Fax fact document # 205

AR2500
$449.00
2016 Channels
1 to 1300MHz
Computer Control

62 Scan Banks, 16 Search Banks, 35 Channels per second. Patented Computer control for logging and spectrum display. AM, NFM, WFM, & BFO for CW/SSB. Priority bank, delay/hold and selectable search increments. Permanent memory. DC or AC with adaptors. Mtng Brkt & Antenna included. Size: 2 1/4H x 5 5/8W x 6 1/2D. Wt. 1lb. Fax fact #305

AR3000
$1195.00
400 Channels
100KHz to 2036MHz

Patented computer control, top rated receiver in its class, offers AM, NFM Wide FM, LSB, USB, CW modes. RS232 control. 4 priority channels. Delay & hold & Freescan. AC/DC pwr cord and whip ant. Size: 3 1/7H x 5 2/5W x 7 7/8D.Wt 2lbs., 10oz. Fax fact document #105

NEW AOR AR1500
$499.00.
Full Coverage with SSB and 1000 Channels.

500KHz to 1300MHz. Ten scan banks, ten search banks. Search lock and store. BFO. 2 Antennas. AM/NFM/WFM. Selectable increments . Tons of features, small size: 5 7/8 x 1 1/2 x 2. Wt 14 oz. Fax fact document # 250

Scanner with Shortwave

Yupiteru 8-1300MHz Mobile or Hand Held Units. $399.00, each.

Top rated receivers from Japan now available in the USA. Tune down to 100KHz. Sensitivity guaranteed from 8MHz up. 200 scan channels. AM/NFM/WFM. No gaps, no cut-outs. Mobile is super slim line. AC/DC. Order MVT8000, includes antenna, mbl mnt. Order MVT7000 for the hand held. Complete with Ni-Cads, Charger, antenna & earphone. Fax fact document #275

Continuous Coverage

Bearcat 2500XLTA hand held.....$369.00
Bearcat 8500XLTC mobile.....$389.00
Bearcat 890XLTB mobile.....$279.00
29-1300MHz, 500 ch. in 8500, 400 in 2500. 890 has 200 ch.& 29-956MHz. All cell locked. Spring delivery. Fax Fact#420

Mobile Scanners

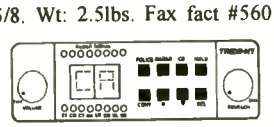
Bearcat 760XLTM
$249.95
100 Channel
800 MHz

Five banks of 20 channels each. Covers 29-54, 118-174, 406-512 and 806-954MHz (with cell lock). Features scan, search, delay, priority, CTCSS option, lockout, service search, & keylock. Includes AC/DC cords, mounting bracket, BNC antenna. Size: 4 3/8 x 6 15/16 x 1 5/8. Weight: 4.5lbs. Fax fact document #550

Bearcat 560XLTZ
$99.95
16 Channel
10 Band

Compact, digital programmable unit covers 29-54, 136-174, and 406-512MHz. Features scan, WX search, delay, priority, memory backup, lockout, review,& auto delay. Includes AC/DC cords, mounting bracket, and antenna. Size: 7 3/8 x 2 1/2 x 15/8. Wt: 2.5lbs. Fax fact #560

Trident TR-33WL
$399.00
Scan/CB. X,K,Ka,Wide & Laser



Scans police pre-programmed by state channel *plus* full radar and laser alerts in one small unit. Weather, CB receive & mobile relay. Size: 5 5/8 x 4 7/8 x 1 3/4. Wt: 1.5lbs. Fax fact #580

Hand Held Scanners

AOR 900 $249.95
100 Channel 800 MHz

Five scan banks 5 search banks. Covers 27-54, 108-174, 406-512 and 830-950 MHz (no cell lock). Features scan, search, delay, priority, permanent memory, lockout, backlite, & keylock. Includes AC/DC adaptor, belt clip, antennas, & Nicad. Size: 5 3/4H x 2W x 1 1/2D. Wt: 12oz.. Fax fact document #650

Bearcat 200XLTN
$229.95 200 Channels 800 MHz

Ten scan banks plus search. Covers 29-54, 118-174, 406-512 and 806 956MHz (with cell lock). Features scan, search, delay, 10 priorities, mem backup, lockout, WX search, & keylock. Includes NiCad & Chrgr. Size: 1 3/8 x 2 11/16 x 7 1/2. Wt. 32 oz. Fax Facts # 450

Bearcat 100XLTN 100Ch H/L/U..... $159.95
Bearcat 70XLTP 20Ch H/L/U..... $139.95
Bearcat 55XLTR 10 Ch H/L/U..... $ 99.95
Coverage of above hand helds is: 29-54, 136-174, 406-512 except 100 which also adds 118-136 Air Band. Fax facts #475

Table Top Scanners

Bearcat 855XLTE 50Ch w/800..... $159.95
Bearcat 142XLM 10Ch H/L/U..... $ 84.95
Bearcat 147XLJ 16 Ch H/L/U..... $ 89.95
Bearcat 172XM 20Ch H/L/U/Air..... $124.95
Bearcat 210 16Ch H/L/U/Air..... $129.95
Coverage of above units is: 29-54, 136-174, 406-512, plus Air in 172 and 210 and air plus 800MHz in the 855. Fax facts #675

Bearcat 800XLX
$219.95

12 bands and 40 channels with 800MHz and nothing cut out. AC or DC. Fax facts #690

Accessories & Etc.

Mag Mount Mobile Ant MA100..... $ 19.95
Base Ant. 25-1000MHz AS300..... $ 59.95
Pre-Amp .1-1500MHz GW2..... $ 89.00
Downconverter 800 to 400 DC89..... $ 89.00
Base Discone Ant DA300..... $ 89.00
External Speaker MS190/opt. amp.... $ 19.95
Old Scanner Repair, all brands..... $ *CALL*
Extended Warranties..... $ *CALL*
Frequency Info FaxFact/Modem..... $ *FREE*
Frequency Books..... $ *CALL*

2 Way Radios

VHF hi band programmable mobiles as low as $299.95. Call for quotes or Fax Fact #775

Toll Free, 24 Hours! ***800-445-7717*** *Fax Orders* ***800-448-1084*** *Fax Facts* ***317-849-8683***
Computer BBS Modem & Fax/Modem, **317-579-2045**. Toll Free Tech Support, Dial **800-874-3468**
International Fax: en *Espanol, en Francais, und auf Deutsch, or just fax in plain English to:* **317-849-8794**

ACE Communications 10707 East 106th Street, Fishers, IN 46038

Service & Support hours: Mon.-Fri. 9AM to 6PM, Sat. 10-4 EST. Mastercard, Visa, Checks, Approved P.O.'s & COD (add $5.50) & AMEX (add 5%). Prices, specifications and availability subject to change. Flat rate ground shipping and handling charge only $5.95 per unit. Express Air only $8.95 , for most units, to most locations. One week trial, no returns accepted two weeks after original receipt without substantial restocking charge. All units carry full factory warranty. Indiana residents add 5 per cent sales tax.

FLY IT! ONLY $8.95

CIRCLE 25 ON FREE INFORMATION CARD

www.americanradiohistory.com

LATEST TECHNOLOGY

- DESCRAMBLERS
- CONVERTERS
- COMBINATION UNITS

WE'LL BEAT ANY PRICE!

LATEST DESCRAMBLER MODELS

Add On Descrambler for all JERROLD Systems (Except Base Band) Guaranteed to Work Anywhere Coast to Coast (Model JD-3)
~~$125~~ **$89** 6-10
$119 1-5

Add On Descrambler For All PIONEER Systems. Guaranteed to Work Anywhere Coast to Coast. (Model PD-3)
~~$125~~ **$89** 6-10
$119 1-5

Add On Descrambler For All SCIENTIFIC ATLANTA Systems (Except 8570, 8590, 8600). Guaranteed to Work Anywhere Coast to Coast. (Model SAD-3)
$89 6-10
$119 1-5

BRAND NEW
1 YEAR WARRANTY

SCIENTIFIC ATLANTA 8580

Features
- Wireless Remote Control
- Favorite Channel Recall
- Parental Lockout

$259 6-10
$289 1-5

BRAND NEW
1 YEAR WARRANTY

ZENITH
Features
- Wireless Remote Control
- 550mHz (99 Channel) capacity
- Volume Control
- Parental Lock-Out
- Programmable Favorite Channel Memory

$259 6-10
$289 1-5

ADD ON DESCRAMBLERS

	1-5	6-10
FTB-3	49.00	39.00
TVT OR TBI	55.00	47.00
SA-3	59.00	49.00
KN12-3	59.00	49.00
MLD1200-3	49.00	39.00

CONVERTERS

	1-5	6-10
PANASONIC 1453G	79.00	69.00
JERROLD DQN7-3	75.00	65.00
STARGATE 2001	75.00	65.00

Call for other models

DPV7 & DBB7
8590 & 8600
Call for availability & prices

JP VIDEO
1470 OLD COUNTRY ROAD,
SUITE 315 - P.E.
PLAINVIEW, NY 11803
NO NY SALES

FREE COLOR CATALOG!
1-800-950-9145

www.americanradiohistory.com

Satellite Television

Order Your FREE Catalog/Buyers Guide Today!

The World Supplier of Satellite T.V. Products. . . "Down To Earth Prices"

New Powerful Satellites = Smaller Dishes
Smaller Dish = Less $$$

KU-BAND SYSTEM

Package INCLUDES all of this:

- 3ft Quality alum dish
- Pansat BR 1100 Receiver
- Polar tracking mount
- Polarity switching feed
- Low Temperature LNB
- 100ft All in one ribbon cable
- Site data coordinate sheet

***Complete System Only $499**

C-BAND SYSTEM

Package INCLUDES all of this:

- 7ft ORBITRON mesh dish
- uniden 4400 IRD
- Polar tracking mount and motorized arm
- Chaparral Polarity switching feed
- 25°Low Temperature LNB
- 100ft All in one ribbon cable
- Optional Decoder module

*All you need to supply is ground pole to mount dish on. (3.5" O.D.)

***Complete System Only $859**

Satellite Analysis and Antenna Aiming Software

An extremely valuable tool for designing and installing TVRO's, tailored for ease of use by professionals and dealers as well as by technically orientated TVRO owners. Demonstrates how changing parameters such as dish size or LNB noise temperature affect picture quality. The program performs both TVRO system analysis and antenna aiming. The analysis subcomponent, is especially useful for predicting performance when viewing signals from a particularly weak satellite. The aiming subcomponent calculates azimuth and elevation angles and range to all satellites within "view" of a TVRO. The names and latitudes of all world-wide C and Ku-band broadcast satellites, presently in service or to be launched by 1995, are listed. The user simply enters TVRO site latitude and longitude.

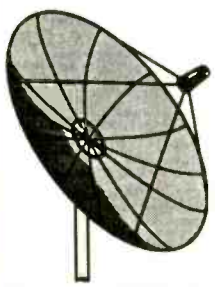
5.25" disk $49.95
3.5" disk $49.95

SATELLITE SYSTEM DO-IT-YOURSELF INSTALLATION VIDEO

"Now You Can Watch It Being Done"

Install or "Tune up" your satellite system in no time flat with this professional video.

VHS or Beta (45 Min.)..... $33.95



MESH DISHES by ORBITRON

Quality Demonstrated by Performance

Orbitron antennas ("size for size") are known the world over for their superior reception and picture quality.

7ft	dish & polar tracking mount		$259
8.5ft	"	"	319
10ft	"	"	369
10ft H.D.	"	"	449
12ft	"	"	649

Pico dish Tuning Meter

Bulz-I-Tuning Meter Now with audio alert

TUNE YOUR DISH TO IT'S MAXIMUM!

Dish tuning meters are a must for the serious dealer or satellite system owner. Saves time, frustration and money. Use when installing a new system, moving your dish, re-alignment of a dish that has been moved by wind, frost heaves etc., gets you right on the satellite belt for the best possible pictures!

Pico meter (meter tuning) $89.95
Bulz-I-IV meter (meter & audio alert)..... 154.95

LNBs

New Lower Temp's

Hemt Technology Commercial Grade

35°	LNB C-band 4GHz		$ 79
25°	LNB	" "	99
1.0db	LNB Ku-band 12GHz		$ 79
0.9db	LNB	" "	99
0.7db	LNB	" "	119
0.6db	LNB	" "	179

All Major Credit Cards Accepted

Skyvision Inc.®

1048 Frontier Drive, Fergus Falls, MN 56537 – Toll Free 800-334-6455

Mail in coupon or call today for the SKYVISION Satellite TV Product Catalog/Buyers Guide Delivered free to your mail box in U.S. and its possessions.

☐ **Send Free Domestic Satellite TV Products Catalog**

☐ **Send International Satellite Catalog** (For International Catalog add $8.00 to cover S&H)

Name _____ Phone (___) _____

Address _____

City _____ State _____ Zip _____

SATISFACTION GUARANTEED

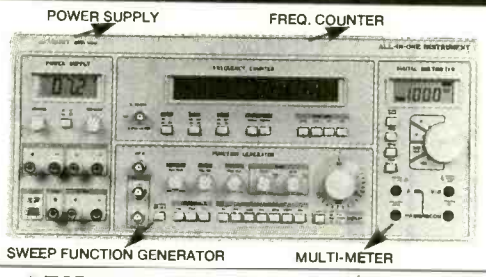
Install A System, Upgrade & Repair Yourself And Save $$$$

Call Toll Free 800-334-6455 International 1-218 -739-5231 Fax 218-739-4879

www.americanradiohistory.com

Unbeatable Discount Prices

1 YEAR WARRANTY
15 DAY MONEY BACK GUARANTEE



Four Instruments in One Instrument

MT-100
Reg. $595.
$399.00

1 Function Generator
- Sine, Square, Triangle, Pulse, Skewed Sine, Ramp, TTL
- 0.02 Hz ~ 2MHz

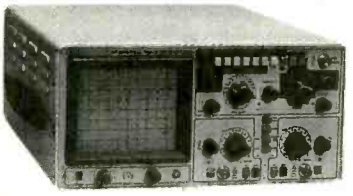
2 Frequency Counter
- 8 Digit LED
- 1 Hz ~ 100MHz
- ± (1 Hz + 1 dgt. + Time Base Error)

3 Power Supply
- 3-1/2 Digit LCD
- Triple output: #1. 0~50V, 0.5A MAX #2, 15V, 1A #3. 5V, 2A

4 Digital Multimeter
- 3-1/2 Digit LCD
- DCV, ACV, Ω, DCA, ACA
- ± (0.5% + 2 dgts)

BEST BUY! O'SCOPES

2 Yr. Parts/Labor Warranty



25 MHz Dual
Reg. $525.
$299.00

25 MHz Dual
w/Component Test
Reg. $595.
$379.00

40 MHz
Dual/Delay
Reg. $695.
$499.00

OS-3304/3324, 25 MHz

- DC to 25 MHz. Dual Channel
- 6" Rectangular CRT with Internal Graticule 10x8cm (Phillips P31)
- Uncalibration LED.
- High Sensitivity 1 mV/div to 20V/div X-Y modes, Z Axis (intensity modulation)
- Rise time 14n Sec. or less.
- Full TV Trigger for TV-V & TV-H
- Acceleration Potential 2kV

OS-3315, 40 MHz Sweep Delay

- DC to 40 MHz. Dual Channel
- Delayed Sweep 100nS to 1 Sec.
- 6" Rectangular CRT with Internal Graticule 10x8cm (Phillips P31)
- Uncalibration LED.
- High Sensitivity 1 mV/div to 20V/div X-Y modes, Z Axis (intensity modulation)
- Rise time 8.5nS or less.
- Full TV Trigger for TV-V & TV-H
- Acceleration Potential 12kV

GoldStar Oscilloscopes

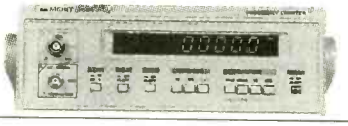
OS-7020A. 20MHz Dual
Reg. $525. **$395.00**
OS-902RB. 20MHz Dual/Read Out
Reg. $795. **$595.00**
OS-9040D. 40MHz Delay
Reg. $695. **$575.00**
OS-904RD. 40MHz Dual/Read Out
Reg. $895. **$695.00**
OS-8100. 100MHz 8 Trace
Reg. $1395. **$1,145.00**
Other Models *Call for Price*

FG-150
Reg. $395. **$229.00**

2MHz Sweep / Function Generator w/Built-in Frequency Counter

- 4 Digit LED Display
- 0.2 Hz ~ 2.0 MHz
- Sine, Square, Triangle, Pulse, Skewed Sine, Ramp, TTL
- Linear or Logarithmic Sweep
- Variable DC Offset Control
- 10 MHz Frequency Counter

Best Buy!
1.0 GHz Counter FC-200
Reg. $395. **$199.00**



High Resolution Frequency Counter

- 1.0 Hz ~ 1.0 GHz
- 8 Digit LED Display
- Auto & Manual Range
- Measured Value Hold
- 4 Selectable Gate Times
- Below 20mV Input Sensitivity
- 1mΩ & 50Ω Input Impedance
- 10:1 Input Switchable Attenuator

Reg. $199. **$119.00**

RF Signal Generator, SG-310 100KHz - 150MHz

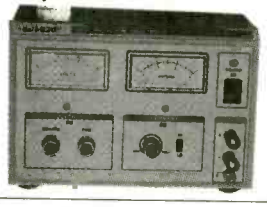
- 100KHz ~ 150MHz, 6 Ranges.
- Accuracy : ± 5%
- RF Output: 100 m Vrms (Up to 35MHz Unloaded)
- Modulation
  Int. 1KHz (AM) 30%
  Ext. 50Hz ~ 20KHz
- Audio Output: 1KHz Min 2 Vrms

Reg. $199. **$119.00**

Audio Generator, AG-350 10Hz ~ 1MHz

- 10Hz ~ 1MHz, 5 Ranges.
- Accuracy : 5% ± 2
- Output Inpedance : 600Ω
- Sine Wave Output
  - Range : 10Hz ~ 1MHz
  - Output Voltage : 8 Vrms
- Square Wave Output
  - Range : 10HZ ~ 100KHz
  - Output Voltage : 15Vp-p

Reg. $249. **$159.00**



DC Power Supply, PS-500 0-30VDC, 0-3A

- 0 ~ 30VDC Continuously Variable
  - Regulation : ≦ 0.01% + 3mV
  - Ripple Voltage : p-p ≦ 2m Vrms; ≦ 1mV
- 0.1A ~ 3A Constant Current
  - Regulation : ≦ 0.2% + 3mA
  - Ripple Current : ≦ 3m Arms
- Short Circuit Overload Protection w/Indicating Lamp

Reg. $399. **$289.00**

DC Power Supply, PS-540 0-16VDC, 0-10A

- 0 ~ 16VDC Continuously Variable
  - Regulation : ≦ 0.01% + 3mV
  - Ripple Voltage : p-p ≦ 2m Vrms; ≦ 1mV
- 0.1A ~ 10A Constant Current
  - Regulation : ≦ 0.2% + 3mA
  - Ripple Current : ≦ 3m Arms
- Short Circuit Overload Protection w/Indicating Lamp

Oscilloscope Probes Switch Selectable X1 / X10

HP-9060, 60MHz
Reg. $29. **$15.00**

HP-9150, 150MHz
Reg. $49. **$22.00**

HP-9250, 250MHz
Reg. $59. **$29.00**

Auto Bargraph w/Holster

DM3200
Reg. $99.
$59.00

- Auto & Manual
- 3-1/2 Digit
- 32 Seg. Bargraph
- Diode Test
- Continuity Beeper
- Data Hold
- Auto Power Off
- Low Battery Mark
- Over Range Mark
- Holster

Multimeter Multi-Function w/Holster

DM3000
Reg. $69.
$44.00

DM3050
Reg. $99.
$54.00

DM3100
Reg. $99.
$54.00

- 3-1/2 Digit
- 1.5" Big LCD
- Heavy Duty, 20A
- Capacitance
- TR-hFE
- Diode
- Low Battery Mark
- Over Range Mark
- Protective Holster
- Tilt Stand

DM3050 Only
- Frequency
- Continuity Beeper

DM3100 Only
- Temperature w/ Optional Probe
  Reg. $15 **$8.00**
- Continuity Beeper

BMC *Your Best Source for High Standard Electronics*
13700 Alton Pkwy., Ste. 154-282
Irvine, CA 92718

Order & Free Catalog
800-532-3221
(714) 586-2310 Fax (714) 586-3399

VISA. MasterCard

CIRCLE 30 ON FREE INFORMATION CARD

www.americanradiohistory.com

LIGHTS OUT!!

OPTOELECTRONICS turn out the lights on LED Counters...

...with the new 10 digit LCD MiniCounter.
More PERFORMANCE
In a SMALLER package

- 1 MHz - 2.8GHz Frequency Range
- Direct Count Range From 1MHz to 250MHz with 1Hz/Sec high resolution display.
- Prescaled Range from 10MHz to 2.8GHz for virtually all two way communications
- Select up to 6 Gate/Measurement Periods
- 10MHz Industry Standard Time Base
- Ultra Compact – true pocket size
- Maximized sensitivity for picking up radio transmissions from the greatest distance
- Display Hold Switch Locks current Measurement

The New Model 3300 MiniCounter breaks the LED counter tradition. From our first Model FC50 (1976) to our latest Model 2300, we have always had quality LED counters. But LEDs are power hungry, failure prone and unreadable in sun light. So the LED counter has now gone the way of the LED wristwatch—replaced by LCD. The LCD advantages include lower power, better reliability, smaller package, more information displayed and better viewing characteristics.

ACTUAL SIZE!
(Actual Size Hand!)

Introductory Price
$129.00
MADE IN THE USA

Model M1 & 3000A Hottest on the Market with:
Digital Filtering for the fastest method to reduce false counts–no loss of sensitivity & **Digital Auto Capture** that auto holds and stores – working even near strong RF fields!

- **3000A-Multifunction HandiCounter®**
  - 15 gate times selectable • 7 hrs. Batt. life
- **M1-Full Range HandiCounter®**
  - 10 Gate times • 6 hrs. Battery life

Both offer:
- OE10 Ultra Fast & Reliable Counter IC
- Standard Backlit 10 digit LCD Display
- 16 Segment Signal Strength Bargraph
- 3 Data Storage Registers
- 1.3% of a second Measurement Rate
- 1Hz Resolution in 1 Sec. up to 250MHz
- 2 Wire Serial Output for Data Logging

3000A .....$329.
M1 .....$229.

OPTOELECTRONICS

TOLL FREE ORDER LINE
1-800-327-5912
305-771-2050 • FAX 305-771-2052
5821 NE 14th Ave, Ft. Laud., FL 33334
5% Ship/Handling (Min $5 & Max $10) U.S. & Canada.
15% outside continental U.S.
Visa, Master Card, C.O.D., Cash or Money Order only.

CIRCLE 43 ON FREE INFORMATION CARD

www.americanradiohistory.com

CALL TOLL FREE
1-800-292-7711
1-800-445-3201 (Can.)

TEST EQUIPMENT AT DISCOUNT PRICES

LOWEST PRICES GUARANTEED

DIGITAL METERS

Dual-Display LCR Meter w/ Stat Functions
B+K 878
$239.95
Auto / Manual Range
Many Features with Q Factor
High Accuracy

Digital Multimeter w/ Inductance & Capacitance
$75.00
LCM-1850
Ten Functions
by Elenco

Digital Capacitance Meter
CM-1550B
$58.95
9 Ranges
.1pf-20,000ufd
.5% basic accy.
Zero control w/ Case
Big 1" Display
by Elenco

Digital Multimeter
DVM-638
$39.95
11 Functions with Case

Fluke Multimeters

Model 12	$84.95
Model 70II	$67.50
Model 77II	$149.00
Model 79II	$169.00
Model 87	$289.00
Model 93	$1,225.00
Model 97	$1,795.00

All Models Available - Call

HIGH QUALITY POWER SUPPLIES

High Current Power Supply
Spectrum by Elenco
2.5 - 15VDC or 13.8VDC
Fully regulated, Short circuit protected
Voltage/Current Analog Meters
SPL-010 0-10A **$139** SPL-020 0-20A **$199**

12A DC Power Supply
B+K 1686
$169.95
3-14V @ 12A
Fully regulated & protected
Separate Volt & Current Meters
Current Limiting, Low Ripple

Quad Power Supply XP-580
$79.95
2-20V @ 2A
12V @ 1A
5V @ 3A
-5V @ .5A
Fully regulated & short circuit protected
Made in USA by Elenco

Triple Power Supply XP-620
Assembled $75
Kit $49.95
2 to 15V @ 1A,
-2 to -15V @ 1A
(or 4 to 30V @ 1A)
and 5V @ 3A
Made in USA by Elenco
All the desired features for doing experiments.
Features short circuit protection, all supplies.

GENERATORS & VIDEO PRODUCTS

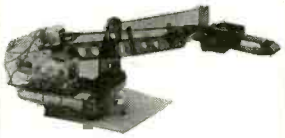
Function Generator
Blox
#9600
by Elenco
$28.95
Provides sine, triangle, square wave from 1Hz to 1MHz
AM or FM capability
Kit $26.95

Color Convergence Generator
Elenco SG-250
$89.95
Kit $69.95
Finest in the industry
10 rock steady patterns
RF & Video output

Wide Band Signal Generators
Elenco
SG-9000
$129
RF Freq 100K-450MHz AM Modulation of 1KHz Variable RF output
SG-9500 w/ Digital Display & 150MHz built-in counter $239

Sweep/Function Generator with Freq. Counter
$239
Elenco GF-8026
Int/Ext Operation,
Sine, Square, Triangle, Pulse, Ramp, .2 to 2MHz, Freq Counter .1-10MHz

EDUCATIONAL KITS - FUN & EASY TO BUILD



Robotic Arm Kit
Model Y-01 **$48.95**
Teaches basics of robotics. Arm grabs & releases, lifts & lowers, & pivots from side to side

AM/FM Transistor Radio Kit
with 52 page Training Course
Elenco AM/FM 108
$27.95
14 Transistors ◆ 5 Diodes
Easy to build because schematic is printed right on the PCB
Makes a great school project
Model AM 550 AM Only $18.95

Learn to Build and Program Computers with this kit
Includes: All Parts, Assembly and Lesson Manual
Elenco
MM-8000
$129.00
Starting from scratch you build a complete system. Our Micro-Master trainer teaches you to write into RAMs, ROMs and run a 8085 microprocessor, which uses similar machine language as IBM PC.

Digital Multimeter Kit
with Training Course
Elenco
M-2665K
$49.95
Fun & Easy to Build
Ideal School Project
Full Function
34 Ranges
Includes
Capacitance, Transistor/Diode Testing
20Amp AC/DC, Extra Large Display
M-2661 (assembled) $54.95

Multi-Function Counter
Elenco
F-1200
1.2GHz
$229
Measures Frequency, Period, Totalizer
8 LED digits, Crysral Oven Oscillator
.5ppm Accuracy

XK-500 Digital / Analog Trainer

A complete mini-lab for building, testing, prototyping analog and digital circuits
Elenco's Digital/Analog Trainer is specially designed for school projects, with 5 built-in power supplies. Includes a function generator with continously variable, sine, triangular, square wave forms. All power supplies are regulated and protected against shorts.

Power Supplies $159.95 Assembled $129.95 Kit
- Variable Power Supply
- +1.25 to 20VDC @ .5 Amp (+1.25 to 15VDC @ 1 Amp)
- -1.25 to -20VDC @ .5 Amp (-1.25 to -15VDC @ 1 Amp)
- +12VDC @ 1 Amp
- -12VDC @ 1 Amp
- +5VDC @ 1 Amp
- 30VAC Center tapped @ 15VAC at 1 Amp

Analog - Section
- Function Generator Sine, Triangular, Square wave forms
- Frequency adjustable in five ranges from 1 to 100KHz
- Fine frequency adjust
- Amplitude adjust
- DC offset
- Modulation FM-AM

Digital - Section
- Eight data swiches
- Two no bounce logic switches
- 8 LED readouts TTL buffered
- Clock frequency 1 to 100KHz
- Clock amplitude 5VPP square wave

Breadboards
- 2 breadboards, each contain: 840 tie points (total 1,680)

ALL PRODUCTS FACTORY NEW
UPS SHIPPING: 48 STATES 5% OTHERS CALL
IL RES add 7.75% TAX
PROBES INCLUDED IN ALL METERS

C&S SALES INC.
1245 ROSEWOOD, DEERFIELD, IL 60015
FAX: 708-520-0085 • (708) 541-0710

VISA MasterCard

15 DAY MONEY BACK GUARANTEE
FULL FACTORY WARRANTY
WRITE FOR FREE CATALOG
PRICES SUBJECT TO CHANGE

CIRCLE 32 ON FREE INFORMATION CARD

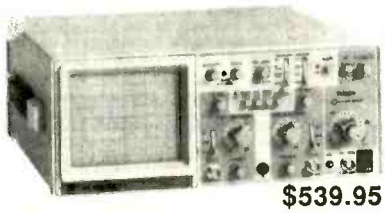
www.americanradiohistory.com

FREE PROBES WITH ALL SCOPES

ELENCO ♦ HITACHI ♦ B&K SCOPES AT GUARANTEED LOWEST PRICES

24 HOUR SHIPPING

B&K 2120



$539.95

20MHz $389 Model 2125
2 Channel Delayed Sweep

40MHz DUAL-TRACE

Model 1541B

$695.95

- 1mV/div sensitivity
- Video sync separators
- Z axis input
- Single sweep
- V mode-displays two signals unrelated in frequency

60MHz DUAL-TRACE

Model 2160

$949.95

- 1mV/div sensitivity
- Sweep to 5 ns/div
- Dual time base
- Signal delay line
- V mode-displays two signals unrelated in frequency
- Component tester

100MHz THREE-TRACE

Model 2190

$1,395.95

- 1mV/division sensitivity
- Sweeps to 2ns/division
- Dual time base
- Calibrated delay time multiplier
- Signal delay line
- 19kV accelerating voltage

20MHz ANALOG WITH DIGITAL STORAGE

Model 2522A

$875

- 20MHz analog bandwidth
- 20MS/s sampling rate
- 2k memory per channel
- 20MHz equivalent time sampling
- Pre-trigger capture

AFFORDABLE - ELENCO OSCILLOSCOPES

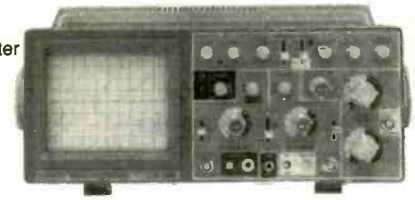
2 YEAR WARRANTY

S-1360 Delayed Sweep $775

60MHz Dual Trace

S-1365 Cursor Readout $849

- Automatic Beam Finder
- Built-in Component Tester
- 1mV Sensitivity
- Dual Time Base
- Illuminated Internal Gradicule
- TV Sync



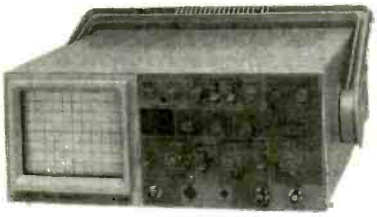
- Voltage, Time, + Frequency differences displayed on CRT thru the use of cursors.
- 1mV Sensitivity
- TV Sync

S-1345 Delayed Sweep $575

40MHz Dual Trace

S-1340 $495

- Automatic Beam Finder
- Built-in Component Tester
- 1mV Sensitivity
- Dual Time Base
- Illuminated Internal Gradicule
- TV Sync



- High luminance 6" CRT
- 1mV Sensitivity
- 12KV Acceleration Voltage
- 9ns Rise Time
- X-Y Operation
- TV Sync

S-1330 Delayed Sweep $449

25MHz Dual Trace

S-1325 $349

- Automatic Beam Finder
- Built-in Component Tester
- 1mV Sensitivity
- Dual Time Base
- Illuminated Internal Gradicule
- TV Sync

- High luminance 6" CRT
- 1mV Sensitivity
- 2KV Acceleration Voltage
- 18ns Rise Time
- X-Y Operation
- TV Sync

SPECIAL BUY HITACHI V-212

20MHz
2 Channel

$399

Hitachi Popular Series

V-525 - 50MHz, Cursors	$995
V-523 - 50MHz, Delayed Sweep	$949
V-522 - 50MHz, DC Offset	$895
V-422 - 40MHz, DC Offset	$795
V-222 - 20MHz, DC Offset	$649

Hitachi Compact Series Scopes

V-660 - 60MHz, Dual Trace	$1,149
V-665A - 60MHz,DT, w/cursor	$1,325
V-1060 - 100MHz, Dual Trace	$1,395
V-1065A - 100MHz, DT, w/cursor	$1,649
V-1085 - 100MHz, QT, w/cursor	$1,995
V-1100A - 100MHz, Quad Trace	$2,495
V-1150 - 150MHz, Quad Trace	$2,895

Elenco DS-203 20MHz, 10MS/s Digital Storage Oscilloscope

$775

- 2K Word Per Channel
- Plotter Output
- 8 Bit Vert. Resolution
- 2048 Pts Hor. Resolution
- Much More

C&S SALES INC.
1245 ROSEWOOD, DEERFIELD, IL 60015
FAX: 708-520-0085 • (708) 541-0710

VISA MasterCard

CALL TOLL FREE 1-800-292-7711
1-800-445-3201 (Canada)
ALL PRODUCTS ARE FACTORY NEW

15 DAY MONEY BACK GUARANTEE
FULL FACTORY WARRANTY
WRITE FOR FREE CATALOG

CIRCLE 32 ON FREE INFORMATION CARD

www.americanradiohistory.com

Electronics made Easy "Learn by Seeing"

Complete Course in Basic Electronics Includes 6 one hour videos and 6 workbooks. Everything you need to learn basic electronics. You will learn about Direct Current, Alternating Current, Semiconductor devices, Power supplies, Amplifiers, and Oscillators. These videos are **100% computer animated,** they make learning electronics easy and fun. Don't waste any more of your valuable time reading and re-reading the same material to try and understand these simple concepts when you can **"see it happen."** These videos will ... teach you more in less time ... allow you to learn at your own pace ... help you remember more of what you learn ... give you years of quality use ... become a valuable source of reference material ... make your understanding of electronics more complete ... and help you build your future today. **Your future is too important to gamble with, so order your course in Basic Electronics Today.**

Call Now ... ask about these and our other popular UCANDO videos. These videos are currently being used by Tech-Schools, CET's, Military branches, Ham Operators, Industries, and are sold in six foreign countries. After you have seen your first UCANDO video you will understand why ... **"UCANDO is Changing The Way The World Learns Electronics".**

Part 1 DC	$49.95
Part 2 AC	$49.95
Part 3 Semiconductors	$49.95
Part 4 Power Supplies	$49.95
Part 5 Amplifiers	$49.95
Part 6 Oscillators	$49.95

SAVE ... buy all six for only $280

Call toll free 1-800-678-6113

CIRCLE 136 ON FREE INFORMATION CARD

TOP SECRET

CONSUMERTRONICS
2011 Crescent Dr., P.O. Drawer 537
Alamogordo, NM 88310
(505) 434-0234, 434-1778
FAX: (505) 434-0234 (if you get answering machine press "#", then "1" any time)
VOICE LINES: 8 AM - 8 PM MST, Mon-Sat
FAX (orders only): 24-hour, 7 days/week

Add $5 total S/H (USA, Canada). All items in stock. VISA, MCard OK. No CODs or "bill me"s. New Catalog is $2 w/ order, $4 w/o (no free catalog). In business since 1971. As seen on TV, etc. John Williams - former Lockheed Senior Engineer, NMSU Professor of Computer Science, NIH Health Physicist. Educational purposes only.

*All software supports all IBM-PC compatible systems (8086 - 80486)

Off-The-Shelf HARDWARE

Van Eck Systems, Automated Tempest Module, KX Radar Emitter, Carjacking Foiler, Personal Body Alarm, Voice Disguiser, Hearing Assistor, Shriek Module, EM Countermeasure, Omnimax TENS, 6th Sense Communicator, many nifty Phone Boxes, Bumper Beeper, Subliminal Mixer/Amp, Super MWO, Rife Device, Neurophone, Hieronymus Machine, MU Magnetometer, Data Card Reader/Writers, Dwelling Security System, Levitator, Vortex Generator, Ultrasonic Jammer & Receiver, Stealth Paint - much more! See our Catalog.

SPECIAL PROJECTS

We design, build, repair, modify, maintain and-or consult on any device, system, process or project - electrical, electronic, computer, phone, mechanical, optical, automotive. Invention prototyping. Confidentiality guaranteed. Describe and include $25 pre-engineering fee (does not obligate you). Time and cost estimates in 7-10 days.

CELLULAR & CORDLESS PHREAKING

How cellphones operate and are reprogrammed. Vulnerabilities to hack attack and countermeasures. Comprehensive info on reprogramming NAMs and ESNs (cloning), control data formats, computing encoded MINs, ESNs, SIDHs, operating system, PROMs and their programming, forcing ACK, Test Mode and resets, scanning, tracking, scanner restorations, freq and channel allocations, roaming, ESN and SIDH tables, parts/equipment sources, Attendant Stations, non-USA bands, health concerns, and the ECPA and critique. Step-by-step descriptions on how to keypad reprogram 100+ popular cellphones. Also includes a complete section on phreaking cordless phones. And more. Comprehensive and invaluable - contains 10 times more info than our competitor's $79 manual! $69.

VOICE MAIL HACKING

How Voice Mail Box (VMB) systems are used and the specific ways they are hacked. Includes ASPEN, MESSAGE CENTER, BIX, GENESIS, EZ, SYDNEY, PHONE MAIL, AUDIX, CINDY, CENTAGRAM, SPERRY LINK, RSVP, etc. Absolutely required for all users and sysops! $29.

PBX HACKING

Thousands of PBXs are hacked to the tune of about $8 Billion/yr! While our "VOICE MAIL HACKING" details how VMSs are hacked for "phun" and profit - including VMS methods for hacking PBXs themselves - "PBX HACKING" addresses ALL issues relating to PBX hacking, including countermeasures! Can your business or agency afford a $90,000 phone fraud loss (the average loss due to hacked PBXs)? As described in Forbes Magazine. $39

PHREAKING CALLER ID & ANI

Details on how they work and dozens of effective ways of defeating Caller ID, ANI, *69, *57, and Call Blocking and *67. Also describes Caller ID, Orange, Beige, Cheese and CF Boxes, ESS, SS7, E-911, various CLASS services, CNA, NON PUB DA, CAMA, DNR, 800-ECR, Diverters, LD Extenders, Centrex - more. $29.

PHONE COLOR BOXES

As designed by Phone Phreaks! 15 phone color boxes described. Dozens of circuits, simulator programs. Plus call-forwarding, conferencing, phreak history, 50 useful and legal phone circuit plans - more. $29.

ROBOFONE AUTODIALER

Powerful, versatile, menu-driven "Wargames" autodialer lets you dial any quantity (up to 10K) or mix of local/long distance numbers in any order, over any length of time, whether busy or answered (your choice) and log the times, commands and results to monitor, printer and-or disk. Quick-dial directory of up to 600 numbers. BUSY redial options. Direct modem command and control. All Result Codes, including VOICE and RINGING. Optional shell to terminal program upon CONNECT. Exit to menu or DOS (for batching). Manual + Disk* $29.

COMPUTER PHREAKING

TROJAN HORSES, VIRUSES, WORMS, etc. and countermeasures. Includes disk with 360K of hacker text files and utilities, and legendary FLUSHOT+ protection system (Ed. Choice, PC Magazine). Dozens of computer crime and abuse methods and countermeasures. How systems are penetrated. BBS advice, password defeats, glossary - much more! Manuals + Disks* $39.

BEYOND VAN ECK PHREAKING

Eavesdropping on VDT and TV video signals using an ordinary TV! Documented in security industry literature. Range up to 1 KM. Plans include both the Consumertronics and the original Top Secret Van Eck designs! $29.

CRYPTANALYSIS TECHNIQUES

Five powerful menu-driven crypto programs (in .COM and their .BAS sources) to analyze, decrypt "secure" ciphertexts. Worked-out examples. Recommended in prestigious "Computers & Security". Manual + Disk* $29.

STOPPING POWER METERS

As reported on CBS "60 MINUTES": How certain devices can slow down - even stop - watthour meters - while loads draw full power! Device simply plugs into one outlet and normal loads into other outlets. Also describes meter creep, overload droop, etc. Plans $29. THE I.G. MANUAL: External magnetic ways (applied to the meter itself) to slow down and stop watthour meters while drawing full loads. Plans. $19. KW-HR METERS: How watthour meters work, calibration, error modes (many), ANSI Standards, etc. Demand and Polyphase Meters. Experimental results to slow and stop meters by others. $19. Any 2, $38. All 3, $59.

AUTOMATIC TELLER MACHINES

ATM crimes, abuses, vulnerabilities and defeats exposed! 100+ methods detailed, include: Physical, Reg. E, cipher, PIN compromise, card counterfeiting, magnetic stripe, false front, TEMPEST, Van Eck, tapping, spoofing, inside job, super-cool, vibration, pulse, high voltage - others. Case histories, law, countermeasures, detailed security checklist, labeled internal photos, figures. ATMs contain up to $250,000 in cash! Recent $350,000 ATM crime spree still unsolved! $39.

CREDIT CARD SCAMS

Cardholders, merchants, banks suffer $ Billions in losses annually because of credit card fraud. Describes every known means of credit card fraud and scams. Protect yourself! $29.

CONS & SCAMS

Cons & scams fleece Americans of $100+ Billion per year! The most comprehensive survival manual on cons & scams of all kinds - from the classic to hi-tech. Details on 100s and their many variations. Protect yourself! $29.

HIGH VOLTAGE DEVICES

HV devices plans: Stun Gun, Taser, Prod, Cane, Flasher, Blaster, Zapper, Audio/RF/Radar Jammer, Jacob's Ladder, Plasma & Van de Graaff Gens., Fence Charger, Geiger Counter, Ozone Gen., Fish Stunner, Plant Stim., Kirlian, more! Shocking! $29.

UNDER ATTACK!

Electromagnetic Interference and Electronic Weapon Attacks cause: Cancer, birth defects, and profound psychological, neurological, cardiovascular and immune system disorders! Destructive to people, animals, plants, equipment! Includes ACTUAL CASES OF EM ATTACKS ON PEOPLE (we investigated)! Includes how to verify and pinpoint EMI and electronic attack sources, and specific countermeasures. $29. EM BRAINBLASTER: Tutorial and plans for powerful ELECTROMAGNETIC WEAPONS and LAB DEVICES. Optimum circuits, freqs, waveforms, duty cycles, intensities. Thorough.. $29. Both $49.

RADIONICS MANUAL

Exciting electrical, electronic and electromagnetic therapeutic, diagnostic and preventive devices (mostly experimental). History, descriptions, plans (dozens), availabilities of Radionics Devices from early to modern. While drugs cost $ Hundreds, electricity costs pennies! $29. HEAL THYSELF: Plans for 3 major electronic therapeutic devices of types approved by FDA. $19. Both $39.

HARD DRIVE MANUAL

Covers all hard drive and controller implementations (emphasis on PCs). How to select, interface, initialize, set up, use, maintain, troubleshoot and repair them. How to protect them from mistakes, sabotage, prying eyes and sticky fingers. How to recover damaged and lost files. How to prevent crashes. Includes software reviews. Loaded with information, advice, tips. $29. DISK SERVICE MANUAL: Maintain, troubleshoot, repair, adjust, align floppies Without special equipment or software. 3.5"/5.25"/8". PC/XT/AT/386/486, Apple, Commodore, etc systems. All floppies need regular upkeep. $29. DISK DRIVE TUTORIAL: Theory, practical facts on floppy drives, disks, including many tips, recommendations, formatting, interfacing, FDC, etc. $24. Any 2, $49. All 3, $69.

SOFTWARE PROTECTION SYSTEM

Unique system that highly discourages costly software piracy while not interfering with legit archival copies. No known way to defeat. No special equipment required. Simple and automatic to install on your distributed software. Compatible with all other copy-prevention systems. Manual + Disk* $59.

STEALTH TECHNOLOGY

Police radar is fascinating! It also has error rates of 10-20%! Every known error mode - stealth method and material used to minimize radar reflections - tactic and strategy to fight unjust radar tickets (that cost you $100s in insurance and risk cancellation) - methods to detect and jam signals - fully described! $29.

SECRET & SURVIVAL RADIO

Optimum survival and security radio equipment, methods, freq allocations and voice/data scrambling/encoding. Includes small receivers/transmitters, telemetry, antenna optimizations, remote monitoring and control, security, surveillance, and ultrasonic, fiber-optic and infrared commo. 70+ circuit plans, tables. $29.

ULTIMATE SUCCESS MANUAL

Underpaid? Harassed or abused? Manipulated? Taken for granted? Stuck in a dead-end job? Can't find a good job? Expect to be laid off, fired or transferred soon? The ultimate no-holds-barred, looking-after-#1 Machiavellian techniques to find, obtain, optimize and keep top jobs, pay and benefits. THE RULES OF THE GAME FOR A GAME WITHOUT RULES! From first resume to CEO. $29.

By an ORDER of the MAGNITUDE

The most comprehensive, hard-hitting, hi-tech survival book ever written! Topics include electronics, computers, energy, weapons, concealment, revenge, alarms, etc to survive today's dangerous world. We all face increasingly financially and physically brutal times! Field-expedient use of technology in various threat and conflict environments and scenarios. $49.

ROCKET'S RED GLARE

How to design and build solid-propellant amateur and survival rockets. Emphasis on formulation, manufacture, installation of propellants, motors, igniters, etc. Includes list of commonly available materials, and the design of launch pads and test beds and their electronics. $29.

www.americanradiohistory.com

B & S SALES

Call(313) 566-7248 • FAX (313) 566-7258 24 hrs.

Hours: Monday through Friday 8 am to 6 pm EST
51756 Van Dyke St. #330, Shelby Township, MI 48316

WE SPECIALIZE IN QUANTITY PRICING 5, 10, 20 LOTS

$ SALE
Y RENT

$ SALE
Y RENT

Make Your Best Deal!

JERROLD	SA	PIONEER	HAMLIN	TOCOM	ZENITH
DRX-3-DIC	8590	BA 6110	CR 6600-3M	5507 VIP	1600
DPBB	8580	BA 5135	CR 6000-3M	5503 VIP	
DPV-5,7	8570				
	8550				

NEW PAN
PIONEER
GREEN E LITE
BA 5000 > SERIES
BA 6000

NEW PAN
SA-8500 SERIES
(BUT ALL BASE BAND)
THE PREMIER

NEW PAN
JERROLD
PINK PAN

MINI TVT:
THE 1/4 POUNDER
LITTLE 4x4
SECOND ONLY TO TVT
GOLD IN POPULARITY

OWN YOUR OWN
SA-3
M-80
SAVE $

NEW REMOTE CONTROL AB SWITCH FOR DUAL SYSTEMS (WITHOUT LEAVING THE COMFORT OF YOUR CHAIR)

PANASONIC TZ — PC 1453G2

By far the best basic converter on the market today. 550 MHz (1 to 99) parental control, sleep timer, remote batteries, contrast and remote control range.

Superior to all other converters

NO MICHIGAN SALES

TVT GOLD ORIGINAL
FOR MOST
JERROLD SYSTEMS,
LEADING SELLER
OF ALL PANS

TNT
MLD
OWN YOUR OWN
SAVE $

FILTERS
POST & NEG
SUBCONTRACTORS
& DEALERS
ONLY QUANTITY

We are now offering a 6-month warranty. In order for warranty to be in effect, this form must be signed and returned.
FOR VCR, SECOND, THIRD, ETC. HOOK-UPS.

☐ Yes, I agree all units are to be used or resold in compliance with Federal and State laws.

Signature _____ Date _____

Name _____ Phone No. ( ) _____

Address _____

City _____ State _____ Zip _____

It is not the intent of B & S Sales to defraud any pay television operator and we will not assist any company or individual in doing the same.

CIRCLE 140 ON FREE INFORMATION CARD

www.americanradiohistory.com

AFFORDABLE
DATA ACQUISITION

MODEL 30 ..... $79.00

- PLUGS INTO PC BUSS
- 24 LINES DIGITAL I/O
- 8 CHANNEL-8 BIT A/D IN
- 12 BIT COUNTER
- UP TO 14K SMP/SEC

MODEL 45 ..... $189

- RS-232 INTERFACE
- 8 DIGITAL I/O
- 8 ANALOG INPUTS
- 2 ANALOG OUTPUTS
- 2 COUNTERS-24 BIT

MODEL 70 ..... $239

- RS-232 INTERFACE
- 18 BIT A/D
- 5.5 DIGIT
- UP TO 60 SMP/SEC

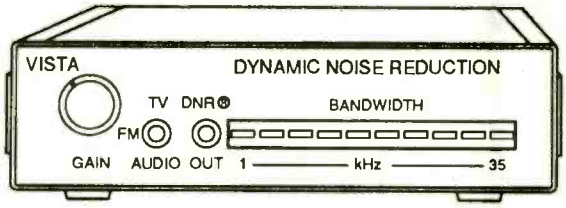
MODEL 150-02 .. $179

- RS-232 INTERFACE
- TRMS, 20 AMPS
- 12 BIT A/D
- OPTO-ISOLATED
- CHANGE RANGES, AC/DC, VIA RS-232

Prairie Digital, Inc.
846 17th Street • Industrial Park • Prairie du Sac, WI 53578
(608) 643-8599 • FAX: (608) 643-6754

CIRCLE 47 ON FREE INFORMATION CARD

* NOISE REDUCTION *



Make your big screen stereo TV sound come alive. **DNR** component reduces the noise of system at least 10dB. Comparable to **Dolby-B** without encoded material, any line level signal - disc, tape, FM, or TV. Employs **National Semiconductor** patented psychoacoustic noise masking and adaptive filter. *Free brochure.* Size 5" x 5" x 1.5". Price $139.00 + 5% shipping in the U.S. (12% in Canada). Add 6.75% sales tax in IL. Chk or money order (UPS COD in contiguous U.S. only).

VISTA, BOX 1425
BOLINGBROOK, IL. 60440
(708)378-5534

NEW!! Laser Radar Detectors $99.95

CABLE CONVERTER SPECIALS

	1	5	10+
Jerrold 400 Converter 60 channel refurbished with new transmitter. Fine tuning HRC/STD selectable. 6 month warranty	59.95	49.95	45.00
Hamlin 5000 Converter 64 channel w/fine tune. New transmitter. Channel O & 1 Compatable.	69.95	59.95	55.00
SA-3 Type Decoders	89.95	65.00	50.00

United Electronic Supply
P.O. Box 1206-NV
Elgin, IL 60121

708-697-0600

No Illinois Sales

Hours: Mon - Fri: 8:30 — 5:00 pm CST

24 Hour Answering Machine for orders

www.americanradiohistory.com

STARTEK INTERNATIONAL INC.
FREQUENCY COUNTERS

Made in USA

FIND FREQUENCIES FAST

With the new, high sensitivity, ultra-fast, Auto Trigger & Hold *STARTEK* frequency counters. Increase readability distance with the new Band Pass Filters. All products made in USA.

AUTO TRIGGER & HOLD

Now, for the first time, available on inexpensive, portable counters with our new *ATH™* Series. This feature is the most significant improvement ever made to the pocket sized counters! It allows "Hands Free" operation to automatically *read & hold* a signal as quick as 80ms or 8% of a second.

New ATH™ Series

Say goodbye to random counting & false readings with the ATH™ Series

WARRANTY
5 YEARS *all parts*
1 YEAR *labor*
ALL MODELS

TA-90 Antenna
(priced separately)

Introducing NEW ATH-50

HP-400
Band Pass Filter

ATH-30
1-2800 MHZ
One-Shot Feature

ATH-50
5 Hz to 2800 MHZ
One-Shot Feature

ATH-15
1-1500 MHZ

Ultra Bright Display

Signal Strength Bar Graph Works on Every Range

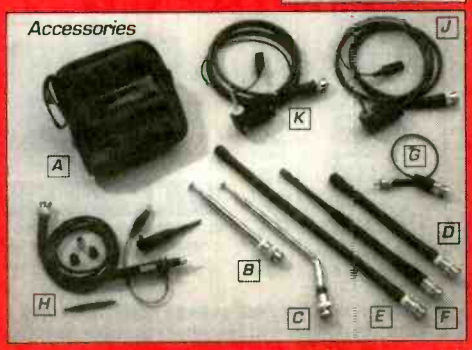
Low Battery Indicator

Size 4"h x 3.5"w x 1"d Aluminum Cabinets

ATH™ SERIES FEATURES:

- **Easy to use – simple controls**
- **Ultra fast response time**
- **Extra BRIGHT LED digits**
- **3-5 hour battery operation**
- **Automatic clean dropout**
- **Maximized sensitivity, <1mV typical**
- **Signal strength Bar Graph**
- **2 ranges – 6 fast gate times**
- **9-12V auto-polarity power jack**
- ***StarCab™* aluminum cabinet**

Ni-Cads and A/C Charger INCLUDED with ALL Models



In Stock... Same Day Shipment!

Ultra High Sensitivity Frequency Counters

ATH-15	1-1500 MHZ, High speed	$199.	~~$225.~~
ATH-30	1-2800 MHZ, High speed, one shot	259.	~~289.~~
ATH-50	5 Hz to 2800 MHZ, one shot	289.	~~325.~~
HST-15	Optional 0.2 PPM TCXO High Accuracy Timebase (installed)	100.	~~125.~~

Economy Frequency Counter

1350	1-1300 MHZ, 10 HZ Res. 3 gate times, Hold switch	$119.	~~139.~~

Band Pass Filters

Increase range or distance from a transmitter with a Band Pass Filter. <1 dB pass band insertion loss.

LP-60	DC-60 MHZ Usage	$69.
HP-400	400-1500 MHZ Usage	69.
HP-800	800-2000 MHZ Usage	69.
BP-3	Above 3 filters *(SAVE $30)*	$177. ~~207.~~

Accessories

A	*CC-90*	Case for all models	12.
B	*TA-90*	Telescope BNC antenna	12.
C	*TA-90-L*	Telescope elbow antenna	16.
D	*RD-150*	150 MHZ rubber duck	16.
E	*RD-2750*	27-50 MHZ rubber duck	28.
F	*RD-800*	800 MHZ rubber duck	29.
G	*M-207-IC*	Interface cable for MFJ-207	10.
H	*P-110*	200 MHZ, 1x, 10x probe	39.
J	*LP-22*	Lo-Pass, audio usage probe	25.
K	*DC-10*	Direct, 50 OHM probe	20.

Factory Direct Order Lines
SAME DAY SHIPMENT
Orders Only 800-638-8050
Orders & Information 305-561-2211
FAX 305-561-9133

DISCOVER MasterCard VISA

STARTEK INTERNATIONAL INC.
398 NE 38th St., Ft. Lauderdale, FL 33334

Terms: Ship/Hand charges for US & Can $10, others add 15%. FL residents add tax. C.O.D. $5. VISA, MC, Discover accepted. Prices and specifications subject to change without notice or obligation.

www.americanradiohistory.com

Still a little FUZZY on Fuzzy Logic?
Neural Nets keep you noodling???
fuzzy???
DON'T BE LEFT OUT...

Soft•Wear Productions
103 Westward Cove
Austin, TX 78733
1-800-783-8161 Code 5884

These important new technologies are in your future. Find out how they work in this Desk Top Video. Get hands on practice with source code of working models. Call or write now with your order.

☐ Fuzzy Logic MSDOS Package Includes:
Video Tape
Source Code in C, BASIC, and WK? Spdsht

☐ Neural Networks MSDOS Package Includes:
Video Tape
Source Code in C for two operating nets

$29.95 ea + $5.00 s&h per order. VISA/MC incl number and exp date

Greenleaf ELECTRONICS

CABLE TV
Converters & Descramblers

Compatible with
Jerrold, Scientific Atlanta, Pioneer, Oak, & Hamlin
Equipment

BRAND NEW!
90-DAY GUARANTEE
LOWEST PRICES
Volume Control & Parental Lockout Available

Greenleaf Electronics
1-800-742-2567
NO ILLINOIS SALES

It is not the intent of Greenleaf Electronics to defraud any pay television operator and we will not assist any company or individual in doing the same.

EASY TO FABRICATE
DESIGNED FOR SMALL LOT PRODUCTION

SHEET METAL BOXES FOR CONSTRUCTION

ALL ITEMS STOCKED FOR QUICK DELIVERY
SHEET METAL BOXES SHIPPED FLAT

PANELS ARE .063" ALUMINUM

RACK CHASSIS

MODEL	DESCRIPTION W x D x H (inches)	PRICE $
1RU5	19 x 5 x 1.75	30.85
1RU7	19 x 7 x 1.75	33.10
1RU10	19 x 10 x 1.75	35.25
2RU5	19 x 5 x 3.5	33.10
2RU7	19 x 7 x 3.5	35.25
2RU10	19 x 10 x 3.5	37.50
3RU5	19 x 5 x 5.25	41.90
3RU7	19 x 7 x 5.25	44.10
3RU10	19 x 10 x 5.25	46.30

PANELS ARE .063" ALUMINUM

METAL CABINETS

MODEL	DESCRIPTION W x D x H (inches)	PRICE $
MC-1A	4 x 3 x 2	16.50
MC-2A	6 x 3 x 2	18.75
MC-3A	8 x 3 x 2	20.95
MC-4A	4 x 4 x 3	18.75
MC-5A	6 x 4 x 3	20.95
MC-6A	8 x 4 x 3	23.18
MC-7A	4 x 7 x 4	20.95
MC-8A	6 x 7 x 4	23.15
MC-9A	8 x 7 x 4	25.75

PANELS ARE .060" ALUMINUM AND ARE FIELD REMOVABLE

HEAVY DUTY RACK CHASSIS

MODEL	DESCRIPTION W x D x H (inches)	PRICE $
3RU7 HD	19 x 7 x 5.25	115.00
3RU10 HD	19 x 10 x 5.25	121.00
3RU14 HD	19 x 14 x 5.25	134.00
4RU7 HD	19 x 7 x 7.0	121.00
4RU10 HD	19 x 10 x 7.0	129.00
4RU14 HD	19 x 14 x 7.0	134.00
5RU7 HD	19 x 7 x 8.75	126.00
5RU10 HD	19 x 10 x 8.75	133.00
5RU14 HD	19 x 14 x 8.75	143.00

DUAL SLOPE METAL CABINETS

MODEL	DESCRIPTION MAJOR DIM. x SECONDARY DIM. W x D x H x S1 x S2 x D1 (in.)	PRICE $
DS-1	4 x 6 x 4 x 1.2 x 1.9 x 2.4 x 1.6	59.00
DS-2	5 x 6 x 4 x 1.2 x 1.9 x 2.4 x 1.6	63.25
DS-3	6 x 6 x 4 x 1.2 x 1.9 x 2.4 x 1.6	67.50
DS-4	10 x 6 x 4 x 1.2 x 1.9 x 2.4 x 1.6	71.50
DS-5	12 x 6 x 4 x 1.2 x 1.9 x 2.4 x 1.6	76.00
DS-6	18 x 6 x 4 x 1.2 x 1.9 x 2.4 x 1.6	81.00
DS-7	4 x 8 x 6 x 2 x 3.1 x 3.5 x 1.9	69.00
DS-8	6 x 6 x 6 x 2 x 3.1 x 3.5 x 1.9	73.00
DS-9	8 x 8 x 6 x 2 x 3.1 x 3.5 x 1.9	78.00
DS-10	10 x 8 x 6 x 2 x 3.1 x 3.5 x 1.9	82.75
DS-11	12 x 8 x 6 x 2 x 3.1 x 3.5 x 1.9	87.75
DS-12	18 x 8 x 6 x 2 x 3.1 x 3.5 x 1.9	100.75

SHEET METAL PUNCHES

MODEL	HOLE SIZE & SHAPE	PRICE $
PUNCH 1	3/8" ROUND	9.95
PUNCH 2	7/16" ROUND	9.95
PUNCH 3	1/2" ROUND	9.95
PUNCH 4	9/16" ROUND	12.95
PUNCH 5	5/8" ROUND	12.95
PUNCH 6	11/16" ROUND	12.95
PUNCH 7	3/4" ROUND	12.95
PUNCH 8	13/16" ROUND	12.95
PUNCH 9	7/8" ROUND	12.95
PUNCH 10	1" ROUND	13.95
PUNCH 11	1-1/16" ROUND	13.95
PUNCH 12	1-1/8" ROUND	13.95
PUNCH 13	1-3/16" ROUND	13.95
PUNCH 14	1-1/4" ROUND	14.95
PUNCH 15	1-3/8" ROUND	14.95
PUNCH 16	1-1/2" ROUND	16.95
PUNCH 17	1-5/8" ROUND	21.95
PUNCH 18	1-3/4" ROUND	24.95
PUNCH 19	2-5/8" ROUND	61.95
PUNCH 20	11/16" SQUARE	32.95
PUNCH 21	3/4" SQUARE	38.95
PUNCH 22	1" SQUARE	46.95
PUNCH 23	21/32" x 15/16" RECT.	46.95
*PUNCH 24	*THURST RACES	10.95

EXTRUDED SERIES

MODEL	DESCRIPTION W x D x H (inches)	PRICE $
ET-1	4.52 x 4.35 x 1.57	10.00
ET-1B	4.52 x 4.35 x 1.57	10.00
ET-2	4.52 x 6.00 x 1.57	24.00
ET-2B	4.52 x 6.00 x 1.57	24.00
CCET	PLASTIC CARRYING CASE	18.00

$610.00 (shipped within 48 states)

BRAKE & SHEAR

CUTS METALS, PLASTIC, ETC. TO .063" THICK AND 7 7/8" WIDE AND BENDS UP TO 90°. GREAT SHOP TOOL.

HAND TOOLS

MODEL	DESCRIPTION	RANGE (mm)	PRICE $
MD-1	MICRO REAMER	1.0-5.5	16.50
MD-2	REGULAR REAMER	3.0-12.0	26.00
MD-3	LARGE REAMER	10.0-25.0	48.00
RT-1	RETHREADER	3.0 x 0.5	10.50
AD-1	DRILL BIT ADAPTER FOR POWER SCREWDRIVER		6.50

NEW FOR 1994
RACKEM 'N' STACKEM™ SERIES
A NEW ½ RACK SYSTEM WITH ITS OWN TABLE-TOP RACK AVAILABLE IN CLEAR, BLACK AND GOLD FOR A GREAT PRESENTATION

ORDERS (800) 634-3457
FAX ORDERS (800) 551-2749
TECH LINE (702) 565-3993 M - Th 8 am TO 4 pm (Pacific Time)
Line will only be answered by our technician; if no answer, please try at another time
OFFICE (702) 565-3400
FAX (702) 565-4828

SESCOM, INC.
2100 WARD DRIVE
HENDERSON, NV 89015 USA

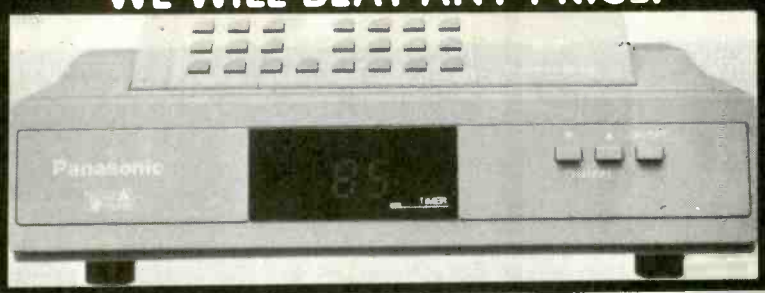
CALL OR WRITE FOR YOUR *FREE* 24 PAGE CONSTRUCTOR'S CATALOG!
PREPAID ORDERS SHIPPED GROUND AT NO CHARGE (48 STATES)

CIRCLE 48 ON FREE INFORMATION CARD

www.americanradiohistory.com

CABLE TV DESCRAMBLERS
Best Prices in the U.S.A.!Guaranteed to Work!

WE WILL BEAT ANY PRICE!



JERROLD PANASONIC SCIENTIFIC ATLANTA PIONEER

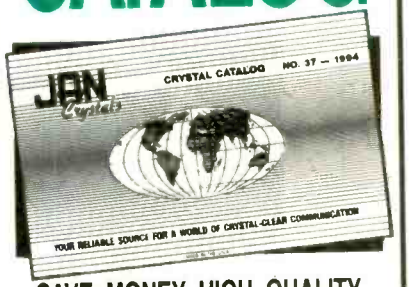
The Newest & the Latest

DMTB-A - all Jerrold Impulse & Starcom series
SA3-DFA - all Sci. Atlantas incl. 8536/+, 8580, Drop-field
PN-3A - all Pioneer systems
ALSO FTB3, SA3, TZPC145G
24 HR. SHIPMENTS FREE CATALOG 30 DAY MONEY BACK GUARANTEE

1-800-772-6244 M-F: 9-6 EST
U.S. Cable TV, Inc. Dept.: KPE024
4100 N. Powerline Rd, Bldg. F-4 Pompano Beach FL 33073
NO FLORIDA SALES!

CIRCLE 55 ON FREE INFORMATION CARD

FREE 1994 CATALOG



SAVE MONEY- HIGH QUALITY, FAST DELIVERY
General Communication • Industry
Marine VHF • Scanners • Amateur Bands
CB Standard • CB Special • Microprocessor

CALL TOLL FREE: 1-800-JAN-XTAL

JAN Crystals

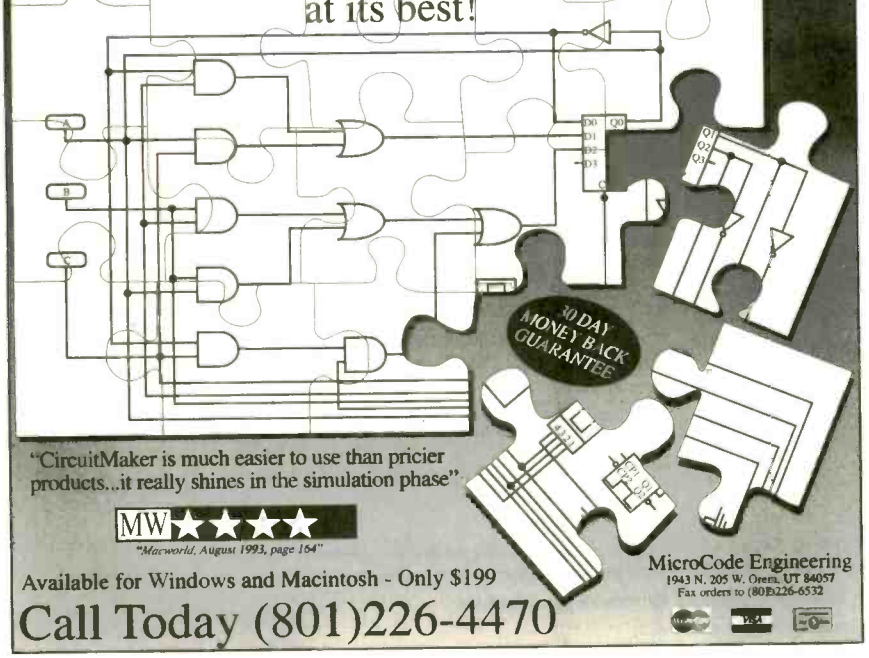
P.O. BOX 06017 • Fort Myers, Florida 33906
(813) 936-2397

CIRCLE 37 ON FREE INFORMATION CARD

Don't let circuit design puzzle you!

CircuitMaker™

Schematic layout and digital simulation at its best!



"CircuitMaker is much easier to use than pricier products...it really shines in the simulation phase"

MW★★★★
"Macworld, August 1993, page 164"

Available for Windows and Macintosh - Only $199

Call Today (801)226-4470

MicroCode Engineering
1943 N. 205 W. Orem, UT 84057
Fax orders to (801)226-6532

Model 1010 Digital Sweep/Function Gen.
$289

Finally, digital frequency and waveform synthesis at a price everyone can afford. Sine, Square, Triangle, Ramp, Pulse AM and FM modulation - All under full digital control with 9 programmable memory setups. 0 to 8 MHz at 50 parts per million frequency accuracy Alphanumeric display 30 Day money back guarantee. One year parts and labor

Model 4010 Digital Function Generator
$189

Model 2010 1 GHz Frequency Counter
$249

Model 3010 2.4 GHZ RF Freq. Gen.
$389

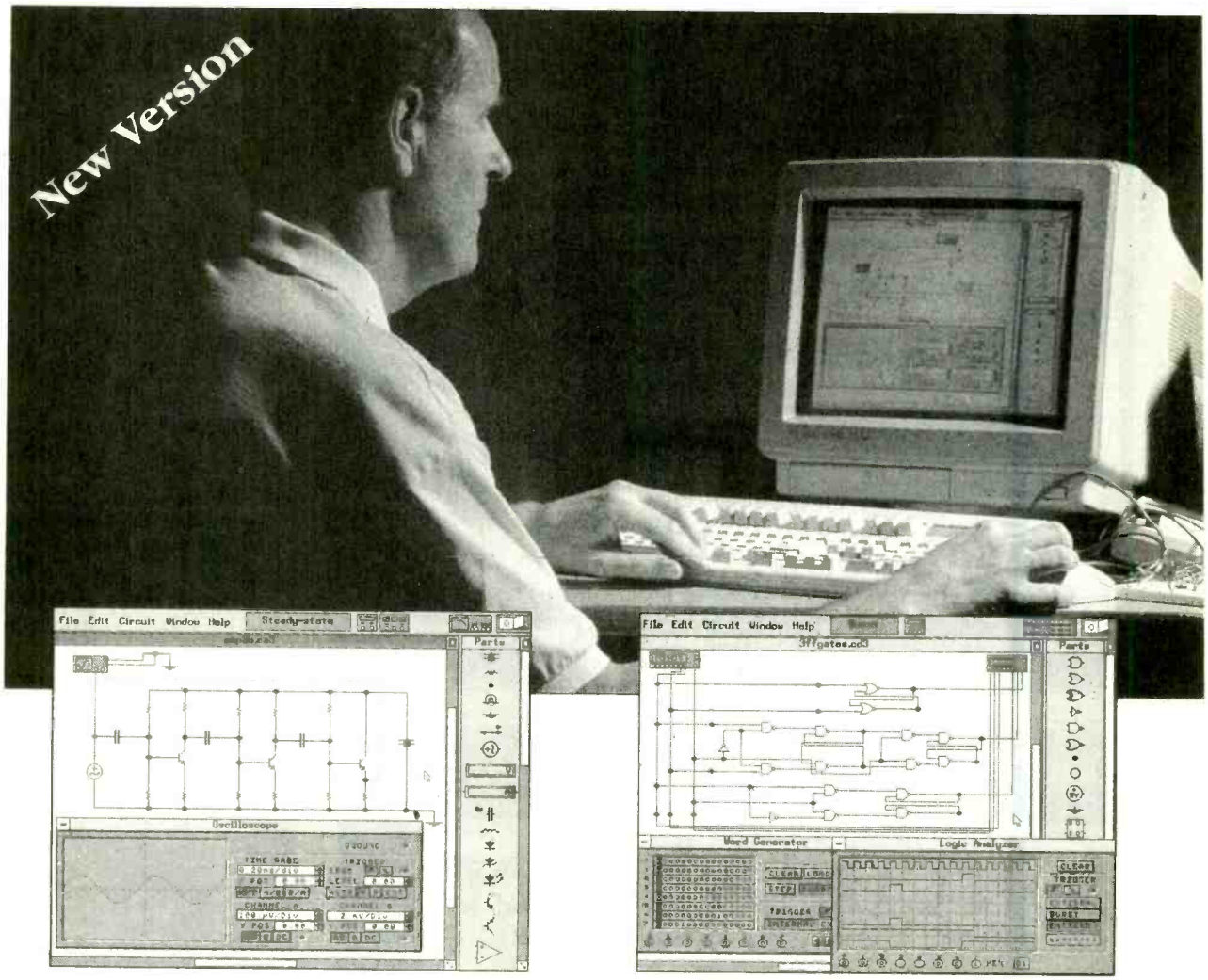
All prices subject to change without notece

Videospectra
P.O. Box 755
Agoura, CA 91301

(800) 835-8335

www.americanradiohistory.com

Design and Verify



Analog Module includes:

- resistors, capacitors, inductors, transformers, relays, diodes, Zener diodes, LEDs, PNP and NPN BJTs, opamps, bulbs, fuses, JFETs, MOSFETs, and manual, time-delay, and voltage- and current-controlled switches
- complete control over all component values
- ideal and real-world models for all active components
- independent and voltage- and current-controlled switches
- function generator (1 Hz to 1 GHz)
- dual-trace oscilloscope
- Bode plotter (1 mHz to 10 GHz)

Digital Module includes:

- fast simulation of ideal components
- AND, OR, XOR, NOT, NAND and NOR gates
- RS, JK and D flip-flops
- LED probes, half-adders, seven-segment displays
- word generator (16 eight-bit words)
- logic analyzer (eight-channel)
- logic converter (converts among gates, truth table and Boolean representations)

Electronics Workbench®

The electronics lab in a computer™

SYSTEM REQUIREMENTS

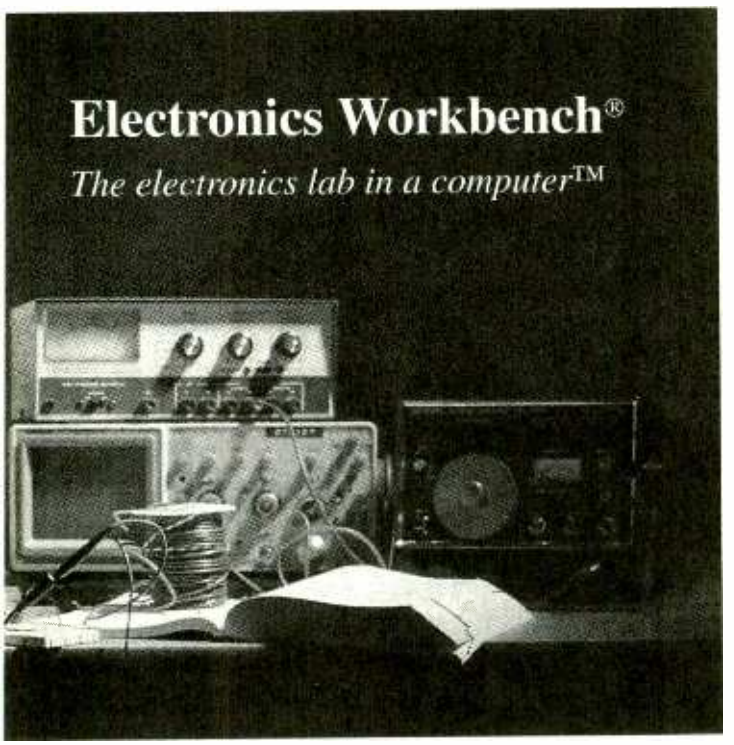
MS-DOS version: Requires IBM AT PS/2 or true compatible with 286 or greater, hard disk, 1 MB RAM, Microsoft-compatible mouse, EGA or VGA display adapter and DOS 3.0 or greater. Supports a math co-processor if available.

Windows version: MS-DOS 5.0 or higher, Microsoft Windows 3.1 with suitable pointing device.

Macintosh version: Macintosh Plus or higher, 2 MB RAM, System 6 or 7.

www.americanradiohistory.com

Circuits. Fast.



Ideal for Every Test Bench

Here's why Electronics Workbench belongs on *your* test bench: Wires route themselves. Connections are always perfect. And the simulated components and test instruments work just like the real thing. The instruments are indestructible and the parts bin holds an unlimited supply of each component. The result: thousands of electronics professionals and hobbyists save precious time and money. Over 90% would recommend it to their friends and colleagues. Electronics Workbench: the ideal, affordable tool to design and verify your circuits.

And now the best is even better — Electronics Workbench Version 3.0 is here. It simulates more and bigger circuits, and sets the standard for ease of use. We guarantee it.*

Just $299!

New Features in Version 3.0

- new components include JFETs, MOSFETs, voltage- and current-controlled sources; and manual, time-delay and voltage- and current-controlled switches
- real-world models for opamps, BJTs, JFETs, MOSFETs and diodes. Over 100 models available.
- MS-DOS version now supports up to 16 MB of RAM for simulation of bigger circuits
- new Microsoft® Windows™ and Macintosh® versions available
- Technical support now available on CompuServe

"Design work is faster and cheaper with Electronics Workbench."
Mark L. Weaver, Production Engineer Technician, Colorado Memory Systems, Milpitas, California

"Building a circuit is simple and intuitive."
Jeff Holtzman, Computer Editor, Electronics Now

"I used Electronics Workbench extensively in the design of a six-meter receiver. I got surprisingly good comparison with actual breadboard and end-unit performance, even at 50 MHz. As an affordable tool for performing design tradeoffs, you can't beat it."
M. A. Chapman, Oceanside, California

"Electronics Workbench saved me hours of calculation time for my design work, and was an excellent check on my circuit calculations."
James G. Mages, Mages Enterprises, Jordan, Minnesota

Call 1-800-263-5552

Yes, I want Electronics Workbench!

Check the version you want:
- ☐ MS DOS
- ☐ Windows
- ☐ Macintosh

Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Tel: _____ Fax: _____
MC/VISA/AMEX # _____
Signature: _____ Exp: _____

Order Information: Check, Purchase Order, MasterCard, Visa and American Express accepted. Call for Canadian prices. All orders add $15 shipping and handling.

INTERACTIVE IMAGE TECHNOLOGIES LTD.
908 Niagara Falls Boulevard, North Tonawanda,
NY 14120-2060
Tel: (416) 361-0333 Fax: (416) 368-5799

☐ VISA ☐ M/C ☐ AMEX

INTERACTIVE

All trademarks are the property of their respective owners.

*30-day money-back guarantee.

CIRCLE 36 ON FREE INFORMATION CARD

www.americanradiohistory.com

MIKE NELSON'S MOVIE VIEW SALES, INC.

WHERE YOU'RE TREATED POLITE AND GIVEN INDIVIDUALIZED ATTENTION!

INFO (708) 250-8690/FAX (708) 250-8755

P.O BOX 26 • WOOD DALE, IL 60191

Call C.S.T. Monday thru Friday 9:00 - 6:00 • Sat. 10:00 - 2:00

Friendly Courteous Service • 12 Yrs. Experience • 6 Mo. Warranty

JERROLD	1-3	4 or more
NEW TRI/BI COMBO (FTB)	130.00	125.00
NEW TRI/BI PAN	75.00	60.00
NEW SB-3 COMBO	115.00	110.00
NEW SB-3 PAN	60.00	55.00
DPV-7212	CALL	MIKE
DPBB-7212	CALL	MIKE
CAMOUFLAGE TRI/MODE	85.00	79.00
NEW FTB-2	75.00	60.00
NEW SB-2	60.00	55.00
HAMLIN	**1-3**	**4 or more**
NEW HAMLIN COMBO(CH 2 OR 3)	110.00	105.00
NEW HAMLIN MLD-1200	50.00	45.00
MLD-1200-2	50.00	45.00

Price effective 1/1/93 (Subject to change without notice)

PIONEER	1-3	4 or more
*NEW SA-PIO-COMBO	155.00	150.00
NEW SA-PIO-PAN W/SWITCH	80.00	75.00
NEW ORIG. BA-6100 PAN	CALL	MIKE
SCIENTIFIC ATLANTA	**1-3**	**4 or more**
*NEW SA-3 COMBO (SA-3B)	130.00	125.00
NEW SA-3 PAN	75.00	60.00
8550:	175.00	165.00
8580:	250.00	CALL
8536:	210.00	205.00
OAK	**1-3**	**4 or more**
NEW OAK N-12 COMBO(Vari Sync)	130.00	125.00
NEW OAK N-12 PAN(Vari Sync)	75.00	60.00
M-35-B	50.00	45.00
PANASONIC-VIEWSTAR	20 LOT	100 LOT
	75.00	CALL
ZENITH: Z-TAK	220.00	CALL
NOTCH FILTERS	16.00	12.00

* All Combos come with new Panasonic or Viewstar converter.

(Parental lockout units: No extra charge.)

Volume control units available

MOST ORDERS SHIPPED SAME DAY!

QTY.	ITEM	PRICE EA.	TOTAL PRICE

SUB TOTAL

SHIPPING Add $4.00 per unit

$4.50 PER COD TAG/CREDIT CARDS Add 5%

TOTAL

(WAIVER) - MUST BE SIGNED FOR OUR RECORD

☐ Yes, I am paying for full service. This is only to be used as a second unit.

DECLARATION OF AUTHORIZED USE - I, the undersigned, do hereby declare, under penalties of perjury, that all products purchased, now and in the future, will only be used on cable TV systems with proper authorization from local officials or cable company officials in accordance with all applicable federal and state laws. FEDERAL AND VARIOUS STATE LAWS PROVIDE FOR SUBSTANTIAL CRIMINAL AND CIVIL PENALTIES FOR UNAUTHORIZED USE.

ABSOLUTELY NO ILLINOIS SALES

SIGNATURE

X_____

VISA-MASTER ☐ C.O.D. ☐

CASHIER'S CHECK ☐ MONEY ORDER ☐

It is not the intent of MOVIE VIEW to defraud any television operator and we will not assist any company or individual in doing the same.

ORDERS ONLY: 1-800 735-5912

Card #_____ Exp. Date_____

Name_____

Address_____

City_____ State_____ Zip_____

Phone ( )_____

If for any reason you are not satisfied with any item purchased, you may return it within 30 days of delivery for a full refund.

FOTRONIC

QUALITY ELECTRONIC TEST EQUIPMENT

Sales • Service

We buy surplus Electronic Equipment FAX your list!!!

- Specialists in - Fluke, Hewlett Packard, Tektronix
- NIST Traceable/Mil Spec 45662A Calibration Available

TECHNICAL SUPPORT

Oscilloscope Specials

Tek 465	100 MHZ	$419.00
Tek 465B	100 MHZ	$539.00
Tek 475	200 MHZ	$619.00
Tek 475A	250 MHZ	$719.00

ALL EQUIPMENT SOLD WITH WARRANTY

For more GREAT VALUES Call, Write, or FAX
P.O. Box 708, Medford, MA 02155

(617) 391-6858 FAX (617) 391-6903

www.americanradiohistory.com

KELVIN ELECTRONICS

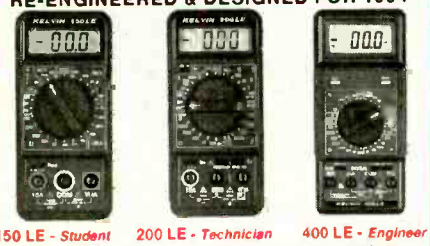
10 HUB DRIVE, MELVILLE, NY 11747

(800) 645-9212
(516) 756-1750
(516) 756-1763/FAX

Established 1945
M/C & VISA *20 Minimum Order

KELVIN CATALOG $3
Stock No. 650412

RE-ENGINEERED & DESIGNED FOR 1994



150 LE - *Student* 200 LE - *Technician* 400 LE - *Engineer*

Standard Features - ●AC & DC VOLTAGES ●DC CURRENT ●RESISTANCE ●TRANSISTOR ●CONTINUITY TEST - Buzzer ●DIODE TEST ●3 1/2 Digit LCD ●10M ohm INPUT IMPEDANCE

150 LE	200 LE	400 LE
BATTERY TEST	FREQ COUNTER up to 20MHz	INDUCTANCE Resolution 1uH
TRANSISTOR	TRANSISTOR	FREQ COUNTER up to 20MHz
DC CURRENT 10 Amp	CAPACITANCE from 1pF to 20uF	CAPACITANCE from 1pF to 200uF
	AC/DC CURRENT 10 Amp	AC/DC CURRENT DUTY % 20 Amp
Stock # 990122	Stock # 990123	Stock # 990124
$29.95	$49.95	$79.95

Designed to meet IEC-348 & UL-1244 safety specifications

2 Year Warranty *(Parts & Labor)*

"Not only does the ***Kelvin*** 94 boast alot of features ... the features go the extra distance."

"If we had to run into a burning building to do some emergency trouble-shooting and could carry in only one piece of equipment, the ***Kelvin*** 94 would be it!"

Popular Electronics
Reviewed - May 1993

KELVIN 94 ***The Ultimate Meter***

LCR Hz dBm True RMS Logic Probe

The only meter with **0.1% Accuarcy** on DC Voltages, built-in **True RMS, Freq Counter to 20MHz** Res: 10 Hz, **LCR-Inductance Tester** Res: 10 uH, **DC/AC Voltages** Res:0.1mV, **Ohm Meter** Res: 0.1 ohms

TRUE RMS PLUS *12 INSTRUMENTS IN ONE* - **AC & DC VOLTMETERS, AC & DC CURRENT, dBm, OHMMETER, DIODE TESTER, AUDIBLE CONTINUITY TEST, 20 MHz FREQ COUNTER, CAPACITANCE METER, INDUCTANCE METER, LOGIC PROBE**

Model 94 #990111
$199.95
*See Standard Features Listed below

ENGINE ANALYZER PLUS ***Standard Features*** plus - TEMP, TACHOMETER & DWELL ANGLE TESTER, DUTY CYCLE, 10M OHM IMPEDANCE, ANALOG BAR GRAPH, K-TYPE TEMP PROBE, ALLIGATOR CLIP TEST LEADS, INDUCTIVE PICKUP CLIP, 6' TEST LEADS & DELUXE CARRYING CASE

Model 95 #990112
$199.95
A Must For Auto Mechanics

*** Standard Features - Models 94 & 95**

- ●DC/AC VOLTMETERS ●AC/DC CURRENT
- ●OHM METER ●DATA HOLD ●RELATIVE MODE
- ●FREQ COUNTER to 4 MHz (Model 95)
- ●AUDIBLE CONTINUITY TEST ●DIODE TEST
- ●MAX/MIN AVERAGE MEMORY RECORD
- ●10A HIGH-ENERGY FUSE PROTECTION
- ●AUTO SLEEP & AUTO POWER OFF

KELVIN 100 Basic

990087
$19.95

- AC & DC VOLTAGES
- DC CURRENT
- RESISTANCE
- CONTINUITY TEST-Buzzer
- 3 1/2 Digit LCD
- LOW BATTERY INDICATOR
- ●DIODE TEST ●BATTERY TEST

CAPACITANCE METER

KELVIN 250 LE
990126
$59.95

- ACCURACY: 0.5%
- **RANGES**:20mF, 2000uF, 200uF, 20uF, 2uF, 200nF, 20nF, 2000pF, 200pF
- Zero Adjust
- Safety Test Leads
- Test Socket for Plug-in Components

AUTO-RANGE METER

KELVIN 300 LE
990125
$49.95
AUTO-RANGE

- ●ACV & DCV
- ●DC CURRENT
- ●RESISTANCE
- ●CONTINUITY TEST
- ●DIODE TEST 3 1/2 Digit LCD
- ●10M ohm INPUT IMPEDANCE

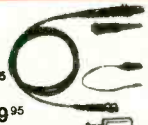
INSTRUMENTS

20 MHz SCOPE
Dual Trace 2 Yr Warranty-Parts & Labor
Stock No. 740085 ..... $385

40 MHz SCOPE 2 Yr Warranty
Dual Trace with Delayed Sweep
Stock No. 740086 ..... $655

TEST ACCESSORIES

SCOPE PROBES
60 MHz, X1 & X10 *SPECIAL*
700072 .... $18.95
150 MHz, X10
700073 ..... $39.95



IC CLIPS
SOLDER TYPE SPRING LOADED

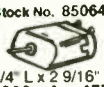
Stock No.	COLOR	COST	25+ Qty
990104	BLACK	$.65 ea.	$.50 ea
990105	RED	$.65 ea.	$.50 ea

DC TOY MOTORS

DC Toy Motor
Stock No. 850647
$.80 ea
$.75 ea / 50+ Qty

6V DC High Speed

Solar Motor Stock No. 850646
$.60 ea 1.5V DC
$.55 ea / 50+ Qty

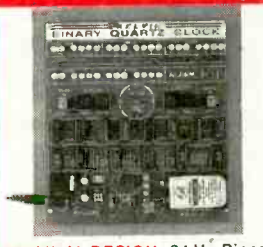


Solar Cells 3 3/4" L x 2 9/16" W
Stock No. 260099 1000mA .45V
$5.95 ea
$5.50 ea / 3+ Qty

DIGITAL TRAINER

Laptop Digital Trainer comes with 100 page instruction manual, power supply, built-in 1 digit true Hexadecimel display, two independent clocks with user adjustable freq & duty cycles, 4 data bit switches and 4 LED displays. *Assembled*
Stock No. 840460 ..... $99.95

BINARY QUARTZ CLOCK w/Alarm

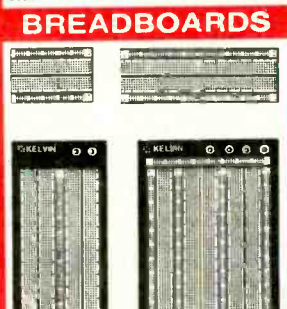


ORIGINAL DESIGN - 24 Hr. Binary Quartz Accurate Clock with 2 color LED's. Built-in **Alarm** and **Alarm Display** in binary code. **DESIGNED FOR LEARNING** *about digital circuitry & binary code.* Built with individual IC components. **Battery Memory Loss Prevention.** *Comes with rechargeable battery, DC wall transformer and* detailed instruction manual. **Advanced Level Kit**
Stock No. 840589 ..... $79.95

Electronic VOICE PAD

An electronic note pad, able to record your message & replay it later. It has a built-in photo cell & as soon as it senses your presence, it will automatically playback the message left for you. The components are PC mounted. The IC can record a message up to 20 seconds & no mechanical parts or tape - only a digital integrated circuit.
Intermediate Level Kit
Stock No. 840606 ..... $49.95

BREADBOARDS



Stock No.	Post	Contacts	YOUR COST
680093	0	500	$ 4.25
680097	0	840	$ 5.95
680098	2	1380	$11.75
680100	4	2390	$22.95

WIRE JUMPER KIT
Pre-cut, Pre-Stripped
330289 140 Piece Set ..... $ 4.95
330290 350 Piece Set ..... $ 8.95

COMPONENTS

WHOLESALE PRICES!

Stock No.	TYPE	(10 Pc. Min.) YOUR COST
600021	555 TIMER	$.29 ea
600029	556 DUAL TIMER	$.40 ea
600039	LM566 PPL FUNCTION GENERATOR	$.60 ea
600018	741C OP-AMP INTERNALLY COMPENSATED	$.30 ea
600026	1458 OP-AMP DUAL 741C OP-AMP	$.35 ea
630041	2N2222	$.20 ea
630383	PN2222	$.08 ea
600023	7805 Voltage Reg	$.36 ea

SILICON CONTROLLED RECTIFIER
(Similar to GE C106C1) 4.0 amp, 100PIV
600014 ..... $.89 ea ..... $.79 ea/10+

THERMISTER - 100 ohm
110097 ..... $1.35 ea ..... $1.00 ea/20+

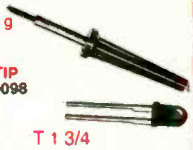
THERMISTER - 10K ohm
110097 ..... $1.35 ea ..... $1.00 ea/20+

PROJECT PARTS

Project Speaker
2", 8 Ohm, .1 Watt
Stock No. 350009
59 ¢

Project BUZZER
3 - 9 Volt DC, 80 db
Stock No. 680089
$1.59 ea
$1.39 ea / 10+ Qty

Soldering IRON
with STAND
LONG LIFE TIP
Stock No. 990098
$3.95 ea



LED T 1 3/4

Stock No.	Color	100+ Qty	1000+ Qty
260020	RED	$.05 ea	$.045 ea
260027	GREEN	$.08 ea	$.07 ea
260026	YELLOW	$.08 ea	$.07 ea
260078	2 COLOR RED/GREEN	$.32 ea	$.29 ea

XENON STROBE TUBE
Stock No. 260050
$3.25 ea
$2.95 ea / 20+ Qty

TRIGGER COIL
for XenonStrobe Tube
Stock No. 320037
$1.25 ea
$ .89 ea / 20+ Qty

INFRARED LED
IR Pair, LED Infrared transmitter and receiver
Stock No. 260061
$1.95 ea

NEON LAMP
NE2, 2" Lead
Stock No. 260003
$.15 ea
$.12 ea / 100+ Qty

PHOTO CELL
Photo Cell - 450 ohm
Stock No. 260017
$.65 ea $.45 ea /20+ Qty
Photo Cell - 1.5K ohm
Stock No. 260018
$.65 ea $.45 ea /20+ Qty

PUSH-BUTTON SWITCH
PUSH-ON, PUSH-OFF
Stock No. 270021
$.55 ea
$.49 ea / 100+ Qty

SUB-MINIATURE MOMENTARY SWITCH
Stock No. 990002
$.35 ea
$.28 ea / 100+ Qty

MINIATURE TOGGLE SWITCH
Stock No. 270034
$.90 ea Type - SPST
$.79 ea / 50+ Qty

CIRCLE 38 ON FREE INFORMATION CARD

www.americanradiohistory.com

EARN MORE MONEY!

Be an FCC LICENSED ELECTRONIC TECHNICIAN!

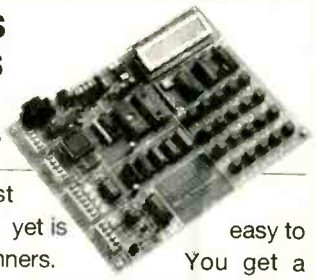
No costly school. No commuting to class. The Original Home-Study course prepares you for the "FCC Commercial Radiotelephone License." This valuable license is your professional "ticket" to thousands of exciting jobs in Communications, Radio-TV, Microwave, Maritime, Radar, Avionics and more...even start your own business! You don't need a college degree to qualify, but you do need an FCC License.

No Need to Quit Your Job or Go To School
This proven course is easy, fast and low cost! GUARANTEED PASS—You get your FCC License or money refunded. **Send for FREE facts now. MAIL COUPON TODAY!**

COMMAND PRODUCTIONS
FCC LICENSE TRAINING, Dept. 210
P.O. Box 2824, San Francisco, CA 94126
Please rush FREE details immediately!

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

Learn COMPUTERS MICROPROCESSORS AND PROGRAMMING with the AES-10 trainer



This microboard has the most advanced features available, yet is easy to use and understand by beginners. You get a learning system that is also a fully functioning embedded industrial controller with 20 key input - 2 line liquid crystal display - Intel 8052 PLCC microprocessor - 64K bytes of memory - digital and analog inputs and outputs - built in logic probe - battery or 9v converter powered - and two RS232 ports. The AES - 10 operates as a stand-alone system, or connect it to your PC for high-level-language programming. Learn by doing. Machine language-Assembly language-Full Basic. Clear texts give details about how the microcontroller/computer works. Shown in easy to follow style; hex and binary numbers, digital and analog electronics, and the three levels of programming. Fully built.

EACH LEARNING SYSTEM INCLUDES:

Microboard, manuals, primer textbook, assembler, PC connector cable, software and examples. Everything you need. $269 Complete. *Free brochure.*

Advanced Educational Systems
1407 N. Batavia St. #220 • Orange, CA 92667
1-800-730-3232

NOW! A QUALITY SATELLITE SCPC AUDIO RECEIVER

AT AN AFFORDABLE PRICE

UNIVERSAL SCPC-100 AUDIO RECEIVER

SPECIFICATIONS

STABLE, MICROPROCESSOR CONTROLLED TUNING. • 50 CHANNEL MEMORY RECALL. • COMPATIBLE WITH 950-1450 BLOCK SYSTEMS. • 3 MINUTE HOOK-UP. • LARGE L.E.D. TUNING SCALE. • RECEIVES C AND KU BAND SCPC. • DOES NOT DISABLE VIDEO WHEN IN USE.

SERVICES ON SCPC

HUNDREDS OF QUALITY SCPC CHANNELS ON SATELLITES - SPORTS - AP - UPI - RADIO NETS - HOME TOWN SPORTS & RADIO - RACING - TALK SHOWS - CLASSICAL, ROCK & JAZZ - RADIO STATIONS - FINANCIAL NEWS AND MORE.

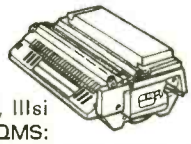
INTRODUCTORY PRICE $439 + S&H
TO ORDER CALL: 1 - 800 - 241-8171

UNIVERSAL ELECTRONICS, INC.
4555 GROVES RD., SUITE 13, COLUMBUS, OH 43232
(614) 866-4605 FAX (614) 866-1201

www.americanradiohistory.com

Toner Cartridge Recharge

Kits—Supplies—Service



Everything you need to recharge toner cartridges used with Canon based laser printers and personal copiers.
Use with HP: LaserJet, II, IID, IIP, III, IIIP, IIIsi
Apple: LaserWriter, LaserWriter IINT,IINTX, QMS:
Kiss, PS-800, PS-810, Canon: LB-P8A1,A2,II, OKI, NEC, Ricoh, etc
With our ***Kits—Supplies—Service*** you can start your own profitable recharge business or just recharge your own cartridges.

Model	Recharge Kits/Supplies	Retail Dealers Please Call
TR-300	Recharge Kit for CX type laser printer engines.	$21.95
TR-302	Recharge Kit for SX type laser printer engines.	$26.30
TR-304	Recharge Kit for HP IIP (LPB-4) laser printer.	$21.95
TR-325	Recharge Kit for PC-10/12/14/20/24/25 copier.	$25.50
TR-370	Recharge Kit for Sharp Z-50/55/70 copier.	$34.95
4080	Replacement Toner Kit for Ricoh 4080 laser.	$35.95ea/5
6000	Replacement Toner Kit for Ricoh 6000 laser.	$14.25ea/10
9710	200 grms of high quality black toner for CX.	$9.95ea/10
9730	250 grms of high quality black toner for SX.	$12.50ea/10
8011-Blue/Br	200 grms of Blue/Brown toner for CX & SX.	$22.95ea/10
8057	150 grms of high quality black toner for PC.	$10.95ea/10
Felt-CX,SX	replacement treated felt for all models.	$0.90ea/10
SS-CX,SX	seal strips for sealing in toner for reshipping	$0.85ea/10
DPP	Drum Padding Powder (pixie dust)	$12.95
EverDrum™	OPC drum life extender agent. 40+ applications	$34.95
C2094	3M Toner Vacuum with attachments.	$199.95

Instructions Available Free to Customers!

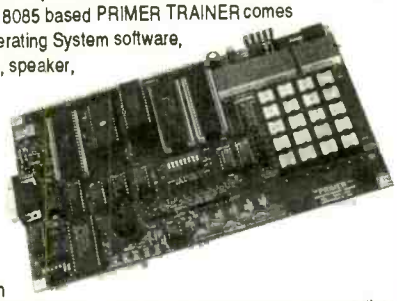
Call 800-221-3516 ask for our catalog.

CP CHENESKO PRODUCTS

Chenesko Products, Inc.
2221 Fifth Ave., Suite 4, Ronkonkoma, NY 11779
Call: 516-467-3205, Fax: 516-467-3223

* THE BEST * 8085 MICROPROCESSOR TRAINING SYSTEM

No other training system we know of comes close to matching the PRIMER's features at this low price. The PRIMER teaches more and is easier to use than other comparably priced trainers. The over 100 page Self Instruction manual takes you from binary number systems, to processing interrupts, to interfacing temperature sensors. The 8085 based PRIMER TRAINER comes complete with Monitor Operating System software, digital I/O, A/D, D/A, timer, speaker, display and keypad.



Learn how to program and interface at the machine level with the PRIMER TRAINER. Start programming with machine language, then move on to Assembler, and then continue on with multi-tasking BASIC or Forth compilers. Ideally suited for beginners as well as advanced high-level programmers and engineers.

THE PRIMER IS $99.95 QUANTITY 10 OR ONLY $119.95 QUANTITY 1 IN KIT FORM. THE PRIMER ASSEMBLED & TESTED BY EMAC IS $169.95. ORDER NOW AND RECEIVE A FREE POWER SUPPLY. PLEASE ADD $5.00 FOR SHIPPING.

EMAC, inc.
618-529-4525 FAX: 618-457-0110
P.O.BOX 2042 CARBONDALE, IL 62902

Build or Upgrade Your PC!

PC-Build specializes in computer kits and components. Our staff of system consultants will work with you to develop the machine you're looking for, at the right price. You can choose one of our standard kits or create your own machine using our custom kit option.

Our kits are 100% compatible PCs that perform as well as (or better than) a comparably configured Compaq or Dell (Based on Norton SI ratings). But you get more than just a fast PC. You go inside the case and learn hardware secrets by doing it yourself. Future upgrades and repairs are a snap -- after all you've built it yourself!

You can't beat our services. We offer:

- A full line of FCC class B approved kits (from 386SX to 486DX)
- 30 day *"You Can Build It"* guarantee
- Our famous step-by-step instruction manual with special sections on Computer Basics and Troubleshooting
- Integrated kit building video
- 1 year warranty on parts
- Top quality components from manufacturers like Seagate, Chinon, and Hewlett Packard
- One of the best technical support hotlines in the business

VESA Local Bus Available NOW!

"What gets lost in today's preconfigured buying is the very essence of the computer kit -- understanding what is inside the case and learning how the components all work together.
If you want to teach someone how a computer works and, more importantly, how to build one from scratch, this is one way to learn and get a real working computer in the bargain. The lesson can be invaluable."

Computer Shopper
March 1993

Call today for more information: **1-800-798-6363**

1993 Discovery Curve, Inc. All brands and product names are trademarks of their respective companies. All rights reserved.

PC-Build
COMPUTER KITS

Discovery Curve, Inc.
85 Franklin Street
Needham, MA 02194
(617) 449-7575 FAX (617) 449-8444

The Leader in "Build It Yourself" Computers

www.americanradiohistory.com

DON'T GET SPIKED BY HIGH CABLE RENTAL FEES!

IT'S TIME TO OWN YOUR CABLE TV DESCRAMBLERS & CONVERTERS

JERROLD, SCIENTIFIC ATLANTA, ZENITH, PIONEER, TOCOM, OAK, HAMLIN, EAGLE

FOR A FREE CATALOG OR QUESTIONS CALL TOLL FREE

1-800-729-1776

30 DAY NO-RISK TRIAL PERIOD

TKA ELECTRONICS

ONE YEAR WARRANTY IN WRITING

7914 WEST DODGE ROAD #334 OMAHA, NE 68137

CIRCLE 129 ON FREE INFORMATION CARD

www.americanradiohistory.com

CABLE TV DESCRAMBLER KITS

Universal Descrambler
Includes all the parts and an etch ed & Drilled PC Board. Not included is AC adaptor or enclosure..... **$69.00**

Tri-Mode Descrambler
Includes all the parts and an etched & drilled PC board & AC adaptor. Not included is the enclosure..... **$49.00**

SB-3 Descrambler
Includes all the parts & an etched & drilled PC board & AC adaptor. Not included is the enclosure..... **$29.00**

Call Toll Free 1-800-258-1134

Visa, MasterCard & COD

M & G Electronics, Inc., 301 Westminister Street
Providence, RI. 02903

It is not the intent of M & G Electronics, Inc. to assist any individual to defraud any pay TV operator or to violate any state or federal laws regarding the use of the descrambler kits. You must understand the kits being purchased for educational and or experimental use only.

CIRCLE 35 ON FREE INFORMATION CARD

The Television Gray Market

by Henry Eisenson

The truth about cable theft!

TV's hidden underground... chips and test devices, bootleg converter boxes, the law, industry countermeasures. Actually identifies hundreds of dealers in products, services, and information. **This book is a MUST! ALA's *Booklist* calls it "Controversial, but of high interest."** ***You bet it is!*** **$23.75**

Scanners & Secret Frequencies

Whether you're an expert or beginner, prefer police calls or listening to private conversations, this new 320-page book will help you a *lot!* Discusses the law, the FCC, aviation, cellular, baby monitors, law enforcement, much more! Here's what the experts say...

"...broad in scope and authoritative..." Bob Grove, Publisher, *Monitoring Times*
"...must reading..." Brian Fenton, *Electronics Now*
"...indispensable tool..." Steve Crum, President, Ace Communications
"...comprehensive, no nonsense..." Bill Cheek, *World Scanner Report*
"Absolutely the best..." Norm Schrein, "Mr. Scanner" **$19.95**

Underground Database

$23.75

This large-format book lists hundreds of *underground* sources for services and products that are legal to make, advertise, sell, buy, and even own, but if you actually *use* them... *look out!*

"Fascinating," *American Survival Guide*

Add $3 U.S., $4 Canada, $8 elsewhere per book for shipping. CA residents add sales tax. U. S. funds only.

Money order or check:
INDEX Publishing Group
3368 Governor Dr, #273F
San Diego, CA 92122

Credit card orders only:
1-800-546-6707

VISA · MasterCard · American Express

FREE VOLUNTEER TAX ASSISTANCE

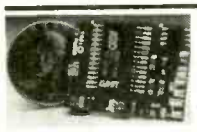
1-800-424-1040

ASK FOR SITE NEAREST YOU.

NEW MICRO TX1000 - SMALLEST 100 MILLIWATT FM VOICE TRANSMITTER

- USE 9-VOLT BATTERY OR ATTACH TO ANY PHONE LINE!
- STABLE TUNE 88-110mhz ON ANY BROADCAST RECEIVER
- ATTACH 3 WIRES AND HEAR A WHISPER UP TO 2 MILES AWAY!
- USES STANDARD 9-VOLT BATTERY

TX 1000 **$59.95**



MICRO 1.1 VOICE RECORDER

- WORLDS SMALLEST - 7-15 V. OPERATION - EXACT SOUND REPRODUCTION
- 60 SECONDS RECORD TIME - 100 YEAR MEMORY WITHOUT POWER
- NOT A KIT! INCLUDES MICROPHONE, SWITCHES & MANUAL

ORDERS ONLY
CALL 1-800-588-4300

MICRO 1.1 **$79.95**

AGRELO ENGINEERING
1145 CATALYN ST., SCHENECTADY, NY 12303

TECH. SUPPORT: (518) 381-1057 TECH. FAX: (518) 381-1058
ORDER BY PHONE OR MAIL IN U.S.A. ADD $3 FOR S&H. C.O.D. CHARGES APPLY. NYS RESIDENTS ADD 7¼ SALES TAX

www.americanradiohistory.com

USE PE MARKET CENTER CLASSIFIEDS

READ BY 87,877 BUYERS OF ELECTRONIC EQUIPMENT ACCESSORIES AND PARTS

INSTRUCTION FOR PLACING YOUR AD!

HOW TO WRITE YOUR AD

TYPE or PRINT your classified ad copy CLEARLY (not in all capitals) using the form below. If you wish to place more than one ad, use a separate sheet for the additional ads (a photocopy of this form works well). Choose a category from the list below and write that category number into the space at the top of the order form. If you do not specify a category, we will place your ad under Miscellaneous or whatever section we deem most appropriate.

We cannot bill for classified ads. Payment in full must accompany your order. We do permit repeat ad or multiple ads in the same issue, but in all cases, full payment must accompany your order.

WHAT WE DO

The first two words of each ad are set in bold caps at no extra charge. No special positioning, centering, dots, extra space, etc. can be accommodated.

RATES

Our classified ad rate is $1.00per word. Minimum charge is $15.00 per ad per insertion (15 words). Any words that you want set in bold or caps are 20¢ each extra. Bold caps are 40¢ each extra. Indicate bold words by underlining. Words normally written in all caps and accepted abbreviations are not charged as all-caps words. State abbreviations must be Post Office 2-letter abbreviations. A phone number is one word.

CONTENT

All classified advertising in the **PE Market Center** is limited to electronics items only. All ads are subject to the publisher's approval. We reserve the right to reject or edit all ads.

DEADLINES

Ads received by our closing date will run in the next issue. For example, ads received by November 15 will appear in the march, 1994 issue that is on sale January 18. The PE Market Center is published monthly. No cancellations permitted after the closing date. No copy changes can be made after we have typeset your ad. NO REFUNDS, advertising credit only. No phone orders.

AD RATES: $1.00 per word, Minimum $15.00.

Send your ads with payment to:
Popular Electronics Market Center, 500-B Bi-County Blvd. Farmingdale, NY 11735

CATEGORIES

100 — Antique Electronics
130 — Audio-Video-Lasers
160 — Business Opportunities
190 — Cable TV
210 — CB-Scanners
240 — Components
270 — Computer Equipment Wanted
300 — Computer Hardware
330 — Computer Software
360 — Education
390 — FAX
420 — Ham Gear For Sale
450 — Ham Gear Wanted
480 — Miscellaneous Electronics For Sale
510 — Miscellaneous Electronics Wanted
540 — Music & Accessories
570 — Plans-Kits-Schematics
600 — Publications
630 — Repairs-Services
660 — Satellite Equipment
690 — Security
710 — Telephone
720 — Test Equipment

CLASSIFIED AD COPY ORDER FORM

Ad No. 1—Place this ad in Category # _____

1 - $15.00	2 - $15.00	3 - $15.00	4 - $15.00
5 - $15.00	6 - $15.00	7 - $15.00	8 - $15.00
9 - $15.00	10 - $15.00	11 - $15.00	12 - $15.00
13 - $15.00	14 - $15.00	15 - $15.00	16 - $16.00
17 - $17.00	18 - $18.00	19 - $19.00	20 - $20.00
21 - $21.00	22 - $22.00	23 - $23.00	24 - $24.00
25 - $25.00	26 - $26.00	27 - $27.00	28 - $28.00
29 - $29.00	30 - $30.00	31 - $31.00	32 - $32.00
33 - $33.00	34 - $34.00	35 - $35.00	36 - $36.00
37 - $37.00	38 - $38.00	39 - $39.00	40 - $40.00

Ad No 1—Total words _____ × $1.00 per word = $ _____

All Caps words _____ × .20 per word = $ _____

Bold words _____ × .20 per word = $ _____

Bold Cap words _____ × .40 per word = $ _____

TOTAL COST OF AD No. 1 $ _____

Total classified ad Payment $ _____ enclosed.

[ ] Check [ ] MasterCharge [ ] Visa ($15.00 minimum credit card order)

Card # _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Expiration Date _ _ / _ _

Signature _____

Name _____ Phone _____

Address _____ City State Zip _____

www.americanradiohistory.com

TONY TALLI'S ORIGINAL
TELEVIEW DISTRIBUTORS

WHERE OUR VALUED CUSTOMERS'

BUSINESS

IS HONESTLY APPRECIATED

ØUR PRICES

1 800 847 3773

Call Us Today

90 DAY + GUARANTEE

SCIENTIFIC ATLANTA

JERROLD PIONEER

OAK HAMLIN

HRS. M - F 9-4 PST NO NV. SALES

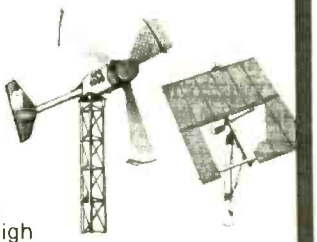
VISA MasterCard FEDERAL UPS

Tap into a World of...

FREE ELECTRICITY

Our 150+ page ***Self-Reliance Catalog***
IS JUST LOADED WITH DC to AC ENERGY INDEPENDENCE ...

We offer:
Solar, Wind & Hydroelectric energy systems. True Sine Wave DC to AC Inverters. Electric Boat & Car kits. Portable power packs. Solar Lighting & Cooling systems. Solar Pool Heaters. Solar Battery chargers. Solar Books & Toys. DC Appliances. Active & Passive Solar Air & Water Heating Systems. Composting Toilets. Hydroponic, Fish-Farming, Solarium & Greenhouse Systems. Water Testing, Treatment, & Pumping Systems. Emergency Food & h2o Kits. High Efficiency AC/DC Refrigeration + More...



A LOT OF INFORMATION FOR ONLY $ 4.75 ...

SEND CHECK or MO TO:

Self-Reliance Company Inc.
P.O. Box 306, Florissant, Mo. 63032

Highest Quality-Unbeatable Prices

AMREL

1-YEAR WARRANTY

470D

WIDE-RANGE LCR METER WITH DISSIPATION FACTOR

- Drop-proof, Heavy Duty
- Inductance: 200uH to 200H
- Capacitance: 200pF to 20mF
- Resistance: 2 ohms to 20M ohms (max. resolution: 1 milliohm)
- Dissipation factor (D=1/Q) measurement
- 120Hz and 1KHz test frequencies
- +/- offset indication
- SMD or Chip component test probes available

Reg. $249.95
Our price $159.95

1-YEAR WARRANTY

700T

TRUE RMS 4-1/2 DIGIT DMM + FREQUENCY COUNTER

- 0.05% DCV accuracy
- True RMS AC measurement
- Frequency counter up to 200KHz
- Data Hold
- AC / DC up to 20A
- Audible continuity check
- Diode check
- Drop proof to 4 feet

Reg. $199.95
Our price $129.95

2-YEAR WARRANTY

Reg. $699.00
Our price $599.00

LPS-305

KEYPAD PROGRAMMABLE & LCD READBACK DC POWER SUPPLY AT ANALOG PRICE

- Output Voltage/Current Programming and Readback via LCD Panel
- Data Entry via Keypad
- Power Off Memory
- Microprocessor Controlled
- Voltage and Current Step Up/Down Function
- Superior Line and Load Regulation
- Output Enable/Disable
- Intelligent Forced-Fan Operation
- Standard RS-232 Interface for Remote Operation

1-YEAR WARRANTY

Reg. $395.00
Our price $345.00

9850UV

THE PERSONAL E/EEPROM PROGRAMMER WITH BUILT-IN UV ERASER

- Stand-Alone and PC Remote with Auto Detection
- Simple Fuction Key Operations
- Full LCD Display Message
- Programs 2716 to 27513 EPROMs and 2804 to 28256 EEPROMs
- Programming Algorithms: STANDARD, INTELLIGENT, INTERACTIVE, and QUICK PULSE
- Data File Formats: INTEL HEX, BINARY, MOTOROLA S. and TEKTRONIX HEX
- Programming Functions: READ, WRITE, AUTO, BLANK CHECK, VERIFY

PRINT Products International
8931 Brookville Rd, Silver Spring MD 20910
Tel: 301-587-7824 • Fax: 800-545-0058
Technical Support: 1-800-654-9838

CALL NOW
800-638-2020

VISA MasterCard CARD

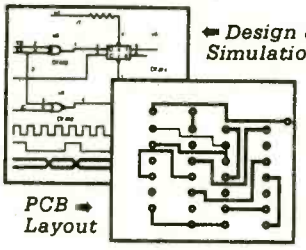
CIRCLE 46 ON FREE INFORMATION CARD

www.americanradiohistory.com

Low Cost CAD Software

for the IBM PC and Compatibles

Now for DOS and Windows™



★ Easy to use schematic entry program (**SuperCAD**) for circuit diagrams, only $99. Includes netlisting, bill of materials, extensive parts libraries, dot matrix printer output. More parts, HPGL plotter and laser printer output available separately or in enhanced CAD package (**SuperCAD+**) for only $199. **New Windows version available.**

★ Powerful, event-driven digital simulator (**SuperSIM**) allows you to check logic circuitry quickly before actually wiring it up. Works directly within the **SuperCAD** editor from a pulldown menu and displays results in "logic analyzer" display window. Starting at $99, this is the lowest cost simulator on the market. Support for PALs, a larger library, and a separate interactive logic viewer are available in full-featured **SuperSIM+** for only $395. Library part models include TTL, CMOS and ECL devices. **New Windows version available.**

★ Circuit board artwork editor and autorouter programs, starting at $99 each. Produce high quality artwork directly on dot matrix or laser printers. Separate plotter driver available for $49. You can do both single or double-layer boards with plated through holes. Includes drill hole listing utility. Autorouter accepts netlists and placement data directly form the **SuperCAD** schematic editor.

★ All software comes with complete documentation and 30-day money-back guarantee.

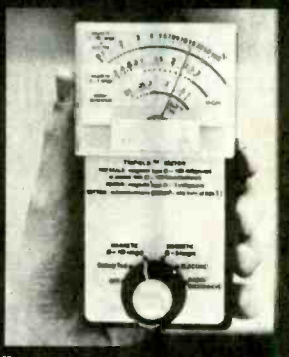
Write or call for further information and free demo disks:

MENTAL AUTOMATION, INC.

Mental Automation, Inc.
5415 - 136th Place S.E.
Bellevue, WA 98006

(206) 641-2141
FAX (206) 649-0767

NOW YOU CAN "SEE" INVISIBLE FIELDS AND AVOID THEM



Most homes and offices have hot spots with strong artificial electro-magnetic fields, where chronic exposure may cause mental or physical problems. Even the EPA names these fields as suspected carcinogens. You can reduce your risk by avoiding these high-field areas.

The ***TriField***™ meter detects *far more* of these fields than any other electro magnetic pollution meter. It's the only one that independently reads AC electric fields, AC magnetic fields, *and* radio/microwaves. It also reads field strengths in *all directions simultaneously*. Every other meter that sells for under $500 reads only magnetic and only in one direction — they can entirely miss a magnetic field unless pointed correctly and are blind to radio/microwaves and electric fields, both of which cause biological effects.

The ***TriField***™ meter reads all three types of fields numerically and with a SAFE/BORDERLINE/HIGH SCALE, weighted proportional to effect on the body. Thresholds are based on epidemiological and laboratory studies (While no *absolute* hazard thresholds have been established reduction of *relative* exposure is prudent.)

The ***TriField***™ meter comes ready-to-use with battery, instructions, and one-year limited warranty. The cost is $144.50 postpaid.

AlphaLab, Inc. / 1280 South Third West / Salt Lake City, UT 84101-3049
For literature and information, call (503) 621-9701

PE MARKET CENTER CLASSIFIEDS

MISCELLANEOUS ELECTRONICS FOR SALE

DESCRAMBLERS FOR cable and satellite. Kits and assembled units. All types. Guaranteed. From $19.95. Free catalog. (212) 330-8035.

DESCRAMBLING SECRETS REVEALED. FREE 24 hour hotline reveals secret satellite and cable descrambling information. (718) 390-7130.

SILENT SAM Turn signal reminder alerts you **IF** you forget to cancel. Unobtrusive. Kits and pre-wired units $15.00 and up. Free literature. 1 (800) 398-5605 Visa/MC. Silent Sam, 1627 Basil Dr., Columbus, OH 43227.

OSCILLOSCOPE, H.P. 338, military, grade, 50 MHz, 2 channels, delayed, sweep, full, featured, 12 VDC &, 110/220 VAC, transportable, 16"X 12"X 9", waterproof, box, $145.00, (619) 722-6649.

POWER INVERTER. Turn your vehicle's cigarette lighter into an AC outlet. $59.95. For information send a SASE to: Marketing By Design, PO Box 84, Port Murray, NJ 07865.

Quality Microwave TV Antennas

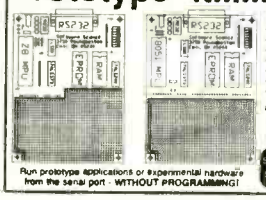
WIRELESS CABLE - IFTS - MMDS - Amateur TV
Ultra High Gain 50db(+) • Tuneable 1.9 to 2.7 Ghz.

- 55-Channel Dish System $199.95
- 36-Channel Dish System $149.95
- 20-Channel Dish System $124.95
- Optional Commercial Grid Antenna (not shown) Add $50.00
- Yagi Antennas, Components, Custom Tuning Available
- Call or write (SASE) for "FREE" Catalog

PHILLIPS-TECH ELECTRONICS
P.O. Box 8533 • Scottsdale, AZ 85252
(602) 947-7700 ($3.00 Credit all phone orders)
MasterCard • Visa • American Express • COD's • Quantity Pricing

Dish System LIFETIME WARRANTY

Prototype it..... *FAST!*



with ProtoQuick 8051 or Z8
- Complete single board computers
- Up to 32K EPROM and 8K RAM
- 12 sq. in. plated-through proto area
- RS232 C serial port w/ DB25 conn.
- Op sys in EPROM w/ source code
- Assembled, ready to run - 5v. only
- MS-DOS crossassembler included

ProtoQuick Z8 and 8051

$99.00 each

Run prototype applications or experimental hardware from the serial port - WITHOUT PROGRAMMING!

Software Science — Software Science, 3792 Roundbottom Road, Cincinnati, OH 45244 USA (513) 561-2060

COMPUTER HARDWARE

MAGAZINE SUPPORTING Z80, CP/M, S100, Kaypro, 8031, 6809 and more. **The Computer Journal.** 10th year of classic computer projects. Hardware, software, forth, assembler. Micro-C Kaypro disks and schematics. 6 issues, $24.00, free sample. 1 (800) 424-8825. TCJ, PO Box 535, Lincoln, CA 95648.

COMPUTER KITS build your own computer and save. 386/sx $499.00, 486/sx $599.00. **FREE CATALOG. ABI SYSTEMS,** 6 Angelcrest Ln., West Seneca, NY 14224.

CABLE TV

"BULLET" BUSTER. Protect your cable box against the infamous cable "bullet." The "Bullet" Buster acts as an electronic shield. Installs in-line in seconds. Don't wait until it's too late! $19.95 + $3.00 S&H. **ELECTROMAN,** Box 24474, New Orleans, LA 70184. (504) 482-3017.

CBTV DOCTOR Stop the Bullet and ID signals in cable lines. Send $20.00 to: R.R. Enterprise, PO Box 3532, Easton, PA 18043.

CABLE UNSCRAMBLED. Everything you wanted to know about cable, but were afraid to ask. $10.00. **Electroman,** Box 24474, New Orleans, LA 70184. (504) 482-3017.

ZENITH Z-TAC repair test kit $34.95 plus shipping includes: two chips (one will decode only non-scrambled channels, other will decode all channels), installation instructions, trouble shooting guide, parts cross reference and function list. Testing only. COD, MC, Visa (805) 382-1854.

Cable Test Aids

Orders only 1-800-452-7090
Information (310)902-0841

Test chips for JERROLD, TOCOM, ZENITH, S.A. & more. Puts cable boxes in full service mode. Easy installation. Zenith only $39.95. Most others under $50ea. FAX: (310)902-0851 Quantity prices available.
No Ca. sales. Not for use in cable co. owned equip. For use as a test aid only.

CABLE DOCTOR: Attention: All you cable box owners. Want to watch one channel & record another? I have what you need, send $74.00 to: R. R. Enterprises, PO Box 3532, Easton, PA 18043.

DIGITAL VIDEO stabilizer. Eliminates all video copyguards during playback of pre-recorded tapes. $29.95. For information send a SASE to: Marketing By Design, PO Box 84, Port Murray, NJ 07865.

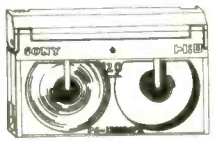
www.americanradiohistory.com

ALL ELECTRONICS CORP.

QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING

(USED) "HI-8" VIDEO CASSETTE

8 mm Video Camcorder Users!

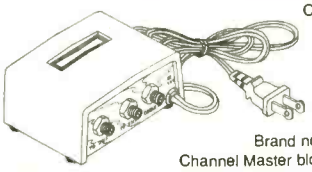


High quality, name brand 8 mm "HI 8" video cassettes at a fraction of the price of new cassettes. These 120 minute, T-120, metal oxide cassettes that were used for a short time, then bulk-erased. Each cassette has its own plastic storage box. Don't miss this great buy on some excellent video tape.

CAT# VCU-8

10 for $28.00 **$3.00 each**

EXPERIMENTER'S DELIGHT VHF TO UHF BLOCK CONVERTER

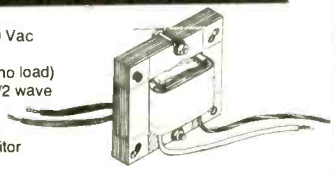


Channel Master # 0746
This is one of those deals that's too good to be true. Brand new, in the box, Channel Master block converters. They used to be quite popular back in the early days of cable television, before there were a lot of cable-ready TVs. Somewhere in the world we know there is still a demand for them--especially at this price. Designed to convert television VHF channels 2 through 13 and A through W to UHF channels 36 through 76. The box alone, is a great project box. The 10 ft. AC power cord, the interior components, F connectors and AC receptacles are well worth the price.

CAT# CM-0746

10 pieces for $18.50 **$2.00 each**

2KV TRANSFORMER



Primary: 120 Vac
Secondary:
1,890 Vac (no load)
2,250 with 1/2 wave rectifier
@ 4 madc &
.22 uf capacitor

Orig1nally designed for laser power supply.
Measures: 3.13" X 3.75" X 2.3"

CAT# HVTX-3 **$15.00 each**

3 Vdc MOTOR

Johnson Motors # MF213G-2050
DC motor operates well at 1.5 Vdc to 4.5 Vdc.
0.72" X 0.94" X 1.38" long.
0.08" (2 MM) diameter shaft is 0.25" long.

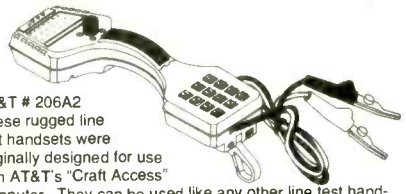
CAT# DCM-42

2 for $1.00

LARGE QUANTITY AVAILABLE!

150 for 40¢ each • 600 for 30¢ each

TELEPHONE LINE TEST HANDSET

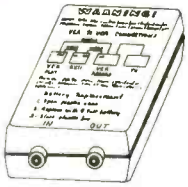


AT&T # 206A2
These rugged line test handsets were originally designed for use with AT&T's "Craft Access" computer. They can be used like any other line test handset, but they have special features which may or may not be useful. In addition to the touch-tone keypad, talk/monitor switch, alligator clip leads, 4 conductor modular jack and tool belt clip, these units have a LCD screen and function button/joystick for use with AT&T's "Craft Access" computer. For the average user, the extra features mainly allow you to adjust the volume and program in phone numbers. The main drawback to these units is that they contain batteries that require recharging, and the test set should be recharged when not in use. The size of the unit is 12.5" long X 4.5" wide. Brand new, in the box. They include 2 ni-cad battery packs, a charger and instructions.

CAT # PTS-206

$60.00 per set

DIGITAL VIDEO STABILIZER

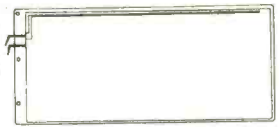


Eliminate color shifting screen flashing, jagged edges and unwanted lines copyguarding can cause. Ellminates copy guards and cleans up movies as you view them. Simply hook-up; just install 9 Vdc battery (not included) and watch crystal clear video without need for adjustment.

WARNING: This product is intended for personal use only. Not intended for pre-recorded material that might constitute copyright infringement.

CAT# RX-11 **$29.95 each**

ELECTROLUMINESCENT "Glow Strip"



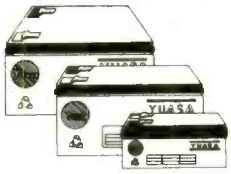
4.75" X 10.25" electrolumines cent glow strip operates on 80-120 Vac.

Emits a soft pink/white glow when energized. Great for backlighting control panels and special effects. Thin and flexible, can be used on curved surfaces. 0.04" thick. 2 wire connection.

CAT# GS-510

$6.00 each

RECHARGEABLE GEL CELL BATTERIES



Maintenance free, rechargeable batteries ideal for alarm back-up or portable power of any kind. Useable in any position.

6 Volts @ 4 A/h CAT# GC-64
Panasonic # LCR6V4P or equiv.
2.75" X 1.87" X 4" high
$12.00 each

12 Volts @ 1.2 A/h CAT# GC-1212
Yuasa # NP1.2-12 or equiv.
3.8" X 1.81" X 2" high.
$ 7.50 each

12 Volts @ 7 A/h CAT# GC-127
Yuasa # NP7-12 or equiv.
5.95" X 2.53" X 3.71" high
$ 25.00 each

12 Volts @ 12 A/h CAT# GC-12
Yuasa # NP12-12 or equiv.
5.93" X 3.83" X 3.69" high
$ 35.00 each

4 (USED) AA RECHARGEABLE BATTERIES

Battery pack with 4 AA nickel-cad batteries in series to make a 4.8 volt pack. Batteries have solder tabs and can be separated and reconfigured.

CAT# NCB-41AAU

$2.00 per pack

CALL, WRITE or FAX For A Free 64 Page Catalog
Outside the U.S.A. send $2.00 postage.

ORDER TOLL FREE 1-800-826-5432

MAIL ORDERS TO:
ALL ELECTRONICS CORP
P.O. Box 567
Van Nuys, CA 91408

FAX (818) 781-2653
INFO (818) 904-0524

DISCOVER VISA MasterCard

Minimum Order $10.00 • All Orders Can Be Charged To Visa, Mastercard Or Discover Card • Checks and Money Orders Accepted By Mail • California. Add Sales Tax • No C.O.D. • Shipping And Handling $4.00 for the 48 Continental United States • All Others Including Alaska, Hawaii, P.R. And Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

CIRCLE 28 ON FREE INFORMATION CARD

www.americanradiohistory.com

Radiotelephone - Radiotelegraph

FCC Commercial License

Why Take Chances?

Discover how easy it is to pass the exams. Study with the most current materials available. Our **Homestudy** Guides, Audio, Video or PC "Q&A" pools make it so fast, easy and inexpensive. No college or experience needed. The new commercial FCC exams have been revised, covering updated Aviation, Marine, Radar, Microwave, New Rules & Regs, Digital Circuitry & more. We feature the Popular "Complete Electronic Career Guide" 1000's of satisfied customers **Guarantee** to pass or money back. Send for **FREE DETAILS** or call

1-800-800-7588

WPT Publications
7015 N.E. 61st Ave Dept. 10
Vancouver, WA 98661

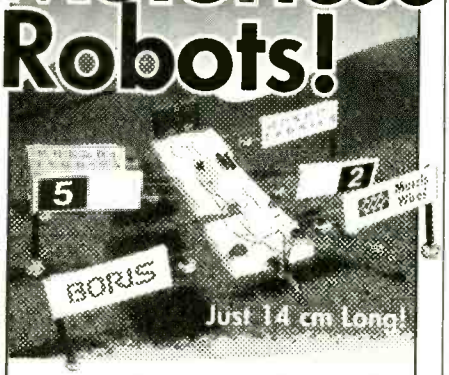
Name_____

Address_____

City_____St._____Zip_____

1-800-800-7588

Motorless Robots!



Create direct linear action with Muscle Wires®– they *actually contract* up to 5% when powered! Use them in robots, planes, railroads – anywhere you need small, strong all-electric motion.

Q&A

What are Muscle Wires?

Muscle Wires are highly processed strands of a nickel–titanium alloy called *nitinol*. At room temperature they are easily stretched by up to 5% of their length. When conducting an electric current they return to their original "unstretched" shape with a force thousands of times their weight.

How strong are Muscle Wires?

The force a wire pulls with varies with size, from 35 to 930 grams. For more strength, use several wires in parallel.

How fast can Muscle Wires activate?

They contract as fast as they are heated – as quickly as 1/1000 of a second. To relax, the wire must cool again. Rates of many cycles per second are possible with active cooling.

Flexinol Muscle Wire Specifications

Wire Diameter (μm)	50	100	150	250
Resistance (Ω/m)	510	150	50	20
Contract Force (grams)	35	150	330	930
Typical Current (mA)	50	180	400	1000

How much power do Muscle Wires need?

Power varies with wire diameter, length, and surrounding conditions. Once the wire has fully shortened, power should be reduced to prevent overheating.

What are the advantages of Muscle Wires?

Small size, light weight, low power, very high strength-to-weight ratio, precise control, AC or DC activation, long life and direct linear action and much more!

Get our all new 128 page Book and Deluxe Sample Kit with full plans for Boris and 14 other *motorless motion* projects. Includes one meter each of 50, 100 and 150 μm diameter Muscle Wire – everything you need to get moving today!

Ask for our FREE Muscle Wires Technical Brochure

TOLL FREE 24 Hour Order Line

800-374-5764

VISA MasterCard

Mondo-tronics

524 San Anselmo Ave. #107-22
San Anselmo, CA 94960

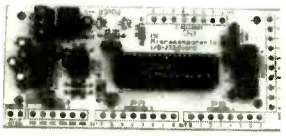
Questions: 415-455-9330
Fax: 415-455-9333
Internet: mondo@holonet.net

New Book & Deluxe Kit only **$59.95** Plus $5.00 P&H CA orders add tax

International Orders Welcome! First Class P&H: $11.00

FINALLY !

UP TO 115 KBAUD SERIAL INTERFACE TO CONTROL YOUR PROJECT FROM AN RS-232 COMPUTER PORT



- Uses ASCII mnemonics from user's program or Procomm, MAC240, etc
- Bin, Hex or Dec formats
- 24 bit programmable I/O lines
- 10 X 8 bits Analog/ Digital channels
- 10–10,000 Hz Pulse Width Modulation
- High & Low interrupts
- 3 EASY to use logic interfaces for stepper motors
- Measures relative resistance/capacitance and much, much more!

- **I/O 232 KIT*: ONLY $65**
- **ASSEMBLED*: ONLY $75**

Some connectors not incl

- **ASSEMBLED*** (all conn. incl.): **ONLY $87**
- **Manuals(ref): ONLY $10**

ITC MICROCOMPONENTS INC.

Tel. 1 (403) 486 2377.
Canada & Overseas:
18440-57 Ave Edmonton,
Alberta T6M 1Y2.

Tax not incl. All prices in US$. *Add $5 for S&H.

All your tapes can look as Clear as Day!

Before After

(Video Simulation)

$59.95 plus S & H

Copy Any Tape!

with INTELESTAR

- **Connects easily to any VCR**
- **Durable metal casing**
- **Gold-plated cables**
- **2-Year Long-lasting Battery**
- **Copy Any Tape**

800-829-7746

Vista International, Inc
1971 E. 5th St., #101 • Tempe, AZ 85281
(602) 829-8110

Want to buy a new PC?

386? 486? or Pentium?

200MB? 300MB? 500MB? 1GB?
14"? 17"? 20"? 2,4,8,16,32 MB?

What about the budget? We have the best price and we build to your order! First, let us send to you, free of charge, a BTO software that allows you to configure and budget a PC system yourself before you place any order! Write to:

Softfact BTO Center
1195 Eureka Av.
Los Altos, CA94024

for free BTO (build-to-order) software!

(sample system: 486/33+128Kc, 4M/120MB,SVGA etc. $1045, VESA486DX2/66,8M/500MB $1989)

www.americanradiohistory.com

B. G. MICRO

P. O. Box 280298 Dallas, Texas 75228
(214) 271-5546
FAX (214) 271-2462

VISA MasterCard

NEW ITEMS! NEW PRICES! NEW ITEMS! NEW PRICES!

LCD DISPLAYS

OPTREX 2x16-DMC 16207H-8 Bit ASCII Input Dim. 3 1/8x1 3/4x3/8 Char. Height .19" **$5.99**

OPTREX 2x20-DMC 20261-8 Bit ASCII Input Dim. 4 9/16x1 7/8x3/8 Char. Height .19" **$7.99**

OPTREX 1x16 "Backlit"-DMC 16187-8 Bit ASCII Input Dim. 3 1/8x1 3/8x9/16 Char. Height .11" **$9.95**

OPTREX 1x20-DMC 20171-8 Bit ASCII Input Dim. 7 3/16x1 5/16x1/2 Char. Height .42" **$9.95**

OPTREX 2x40-DMC 40218-8 Bit ASCII Input Dim. 7 3/16x1 5/16x1 3/32 Char. Height .19" **$9.95**

VERY EASY TO INTERFACE TO ALMOST ANY MICROPROCESSOR!!!!!!

LTP 1157 AE

1.2' 5x7 Matrix Displays
5x7 Array with x.y select. This Red Orange Matrix Can Be Stacked Horizontally. Matrix Orientation - Cathode Column, Anode Row.
Great For "Moving Message" Signs.

WITH DATA **$1.19 Ea., 8/$6.95, 100/$75.00**

DTMF

SSI-202 Decoder	2.25
8870 Decoder	2.25
5087 Generator	2.00
5089 Generator	1.25

UART

NS16450	6.50
16550	10.95
TR1602B (COM 2017)	1.75
IM6402 +5v High speed	
AY5-1013 pin out	2.45
INS 8250	2.95

FANS

SANYO—BRUSHLESS
12 Volt DC at .07 Amps—
7 Blades
60 MM—2 3/8"x2 3/8"x1"
$5.95

TECHIDYNE—Brushless
12 Volt DC at .12 Amps—
7 Blades
80MM—3 1/8"x3 1/8"x1"
This size commonly used in Computer Power Supplies
$5.90

PANAFLO—Brushless—12 Volt DC at .2 Amps 5 Blades—
119MM—4 11/16"x4 11/16"x1 1/2"
$5.99

8000/80000

8001	5.20	8237	1.90	8088-2	3.25	8257	1.50
8002	$2.50	8237-5	2.80	8155	2.25	8259A	1.85
8010	4.95	8243	1.75	8156	2.25	8259C-5	2.10
8031	2.95	8250	2.95	8202A	8.00	8275	10.95
8032	3.95	(16450)	6.50	8212	1.25	8279	2.25
8035	1.00	(16550)	10.95	8214	2.00	8284	1.49
8036	4.95	8251	1.10	8216	1.25	8286	3.50
8039	1.00	8253-5	1.75	8224	1.25	8287	2.49
8085	1.55	8254	1.80	8228	1.75	8288	3.50
8086	1.55	8255	1.50			8530	3.00
8088	2.20	8255-5	1.75				

STATIC RAM

2016-2KK8 200 n.s.	1.00
2101-1 - 256X4 500 n.s.	.75
21L02-1 350 n.s.	.65
2102AL-4 L.P. 450 n.s.	.49
2111-1 256X4 500 n.s.	1.00
2112A-2	2.50
2114L-3 1KK4 300 n.s.	.45
2125A-2 1KK1 70 n.s.	1.00
2147 4KX1	1.00
2148	1.00
6116P-4	1.00
6117	1.20
6264	1.40
62256 32KX8	5.00
128KX8	15.00

DYNAMIC RAM

2108-4 8KX1	1.50
2118-4 16KX1-5Volt	.70
4027-4KX1-260 n.s.	.80
4116-16KX1-250 n.s.	.40
4116-16KX1-200 n.s.	.75
4116-16KX1-150 n.s.	.90
4128 Piggyback	2.00
4164-150 n.s.	.49or9/3.50
4164-120 n.s.	1.10
4164-100 n.s.	1.40
TMS4416-16KX4-15- n.s.	2.75
4464-150 n.s.	1.40
4464-120 n.s.	1.45
4464-100 n.s.	1.45
4464-80 n.s.	1.45
41256-150 n.s.	1.25 or 9/9.95
41256-120 n.s.	1.30 or 9/10.99
41256-100 n.s.	1.30 or 9/10.99
41256-80 n.s.	1.30 or 9/10.99
41256-60 n.s.	1.85
1 Meg - 100 n.s.	4.40
1 Meg - 80 n.s.	4.40
414256-80 n.s. 256 x 4	4.60

SIPPS, SIMMS, & CACHE AVAILABLE

EPROM SPECIAL

We bought a large quantity of 2708s, 2716s, 2532s, 2732s, 2764s, 27128s, 27256s and 27512s from a computer manufacturer who re-designed their boards. We removed them from sockets, erased and verified them, and now we offer the savings to you. Complete satisfaction guaranteed.

	Your Choice	
2708	1/20	10/8.00
2716	1.75	10/15.00
2532	2.00	10/17.50
2732	2.00	10/17.50
2764	2.00	10/17.50
27128	2.50	10/20.00
27256	3.00	10/25.00
27152	4.75	10/40.00
1 Meg	8.50	10/77.50

EPROM

8741	7.00
8742	7.00
8748	7.00
8749	7.00
8751H	12.95
8755	7.00

PROMS

82S123	1.49
82S126	1.49
82S153	1.75

LOCAL AREA NETWORK

NETWORK

Little Big LAN

- Peer to Peer LAN, to 250 nodes
- $75 total software cost! No matter how many nodes!
- Use ARCnet, serial, parallel or Ethernet to link your computers.
- Mixed mode routing Any combination of above connections is possible on any given node.
- RAM needed approx. 35-45K
- Uses DOS versions 2 and above, 3.1 and above preferred.
- Print spooling
- Record locking via Dos SHARE
- Open network, API provided
- Runs ok with Windows 3.0
- Drive A-Z can be redirected to reference any drive on any computer. LPT1-LPT3 can print to any printer.
- "Start small, grow as you grow"

$75.00

CUSTOM CABLES

Cables Also available for Little Big Lan
Serial (5 Wire Null Modem) - $10.00 for First 6 ft. 25¢ a foot after 6 feet (Custom Cables Non-Refundable)

Parallel - Adapter $10.50
Adapt Most 25 pin to 25 pin cables to meet the Parallel interface requirements.

Arcnet - 50¢ a ft (Twisted Pair Only)
Ethernet - 50¢ a ft (ThinNet RG 58)

LAN CABLE

Another B.G. Micro Exclusive ... 25 feet of Etjernet RG 58A/U Coax with a BNC connector, a BNC "T", and a BNC terminator on each end.
No one can beat this price. - $7.95
Additional "T" - $.99

NETWORK CARDS

- 16TB Model - Complies with IEEE 802.3
- Standards for 10Base-T and 10Base2.
- Works with most popular network softwares including Netware, TCP/IP, Windows for
- Workgroups, LANtastic, and etc..
- On-board 16K RAM for Multi-packet Buffers.
- Four LEDs to indicate link, transmit/ receive, polarity/Jabber, and collision status.
- Automatic polarity detection and correction of writing errors.
- Jabber function (Watchdog timer).
- Novell Approved NE 2000 Compliant

$67.99

* NE 1000 Available (Call)
* Arcnet Available (Call)

NEW PRICES! NEW ITEMS! NEW PRICES! NEW ITEMS!

TERMS: (Unless specified elsewhere) Add $3.25 postage, we pay balance. Orders over $50.00 add 85¢ for Insurance. No. C.O.D. Texas Res. add 8 1/4% Tax. 90 Day Money Back Guarantee all items. All items subject to prior sale. Prices subject to change without notice. Foreign order - US funds only. We cannot ship to Mexico or Puerto Rico. Canada, add $7.50 minimum shipping and handling. Countries other than Canada, add $15.00 minimum shipping and handling.

CIRCLE 56 ON FREE INFORMATION CARD

www.americanradiohistory.com

$129* Laser Light Show

This kit displays animation, text, drawings, & music! Includes 2 Galvos, VCO, Computer Interface, Manual & Software listing. Works from parallel printer port.

Computerized Motors $39*

Includes: 2 Stepper or 4 DC servo motors, Computer interface kit, 32 page training manual & Software listing. Works from parallel printer port.

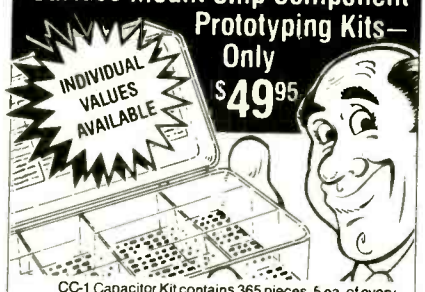
* Add $5 for shipping. Computer and Laser not included.

Call for **FREE** Flyer

SVS Light & Motion in kit form

1273 Industrial Pky. W#460
P O Box 55125
Hayward CA 94545-0125
510-582-6602

Surface Mount Chip Component Prototyping Kits— Only $49.95



CC-1 Capacitor Kit contains 365 pieces, 5 ea. of every 10% value from 1pf to .33μf. CR-1 Resistor Kit contains 1540 pieces; 10 ea. of every 5% value from 10Ω to 10 megΩ. Sizes are 0805 and 1206. Each kit is ONLY $49.95 and available for Immediate One Day Delivery!

Order by toll-free phone, FAX, or mail. We accept VISA, MC, COD, or Pre-paid orders. Company PO's accepted with approved credit. Call for free detailed brochure.

COMMUNICATIONS SPECIALISTS, INC.
426 West Taft Ave. • Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420
Entire USA 1-800-854-0547

Statement of Ownership, Management and Circulation
(Required by 39 U.S.C. 3685)

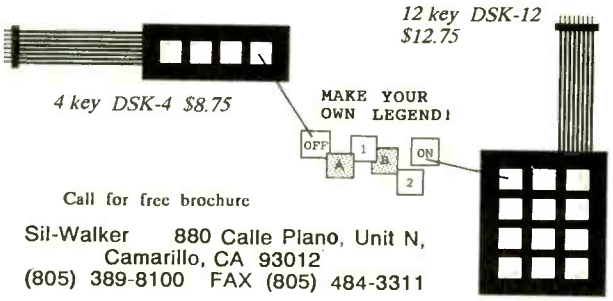
1a. Title of Publication: POPULAR ELECTRONICS	1b. Publication No.: 0 7 7 1 9 8 5	1c. Date of Filing: 10/14/93	
2. Frequency of Issue: MONTHLY	2a. No. of Issues Published Annually: 12	2b. Annual Subscription Price: $21.95	
3. Complete Mailing Address of Known Office of Publication (Not printer): 500-B BI-COUNTY BLVD. FARMINGDALE, NY 11735			
4. Complete Mailing Address of the Headquarters or General Business Offices of the Publisher (Not printer): 500-B BI-COUNTY BLVD. FARMINGDALE, NY 11735			
5. Full Names and Complete Mailing Address of Publisher, Editor, and Managing Editor (This item MUST NOT be blank): Publisher (Name and Complete Mailing Address): LARRY STECKLER 500-B BI-COUNTY BLVD. FARMINGDALE, NY 11735			
Editor (Name and Complete Mailing Address): CARL LARON 500-B BI-COUNTY BLVD. FARMINGDALE, NY 11735			
Managing Editor (Name and Complete Mailing Address):			
6. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) (Item must be completed.)			
Full Name: GERNSBACK PUBLICATIONS, INC.	Complete Mailing Address: 500-B BI-COUNTY BLVD. FARMINGDALE, NY 11735		
LARRY STECKLER	500-B BI-COUNTY BLVD. FARMINGDALE, NY 11735		
7. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages or Other Securities. (If there are none, so state.)			
Full Name: NONE	Complete Mailing Address:		
8. For Completion by Nonprofit Organizations Authorized To Mail at Special Rates (DMM Section 424.12 only): The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes: (Check one) ☐ Has Not Changed During Preceding 12 Months ☐ Has Changed During Preceding 12 Months (If changed, publisher must submit explanation of change with this statement.)			
10.	Extent and Nature of Circulation (See instructions on reverse side)	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies (Net Press Run)		161,155	163,497
B. Paid and/or Requested Circulation 1. Sales through dealers and carriers, street vendors and counter sales		38,208	44,876
2. Mail Subscription (Paid and/or Requested)		49,704	50,884
C. Total Paid and/or Requested Circulation (Sum of 10B1 and 10B2)		87,912	95,760
D. Free Distribution by Mail (Samples, Complimentary, and Other Free Copies)		4,126	4,015
E. Total Distribution (Sum of C and D)		92,038	99,775
F. Copies Not Distributed 1. Office use, left over, unaccounted, spoiled after printing		10,705	10,654
2. Return from News Agents		58,412	53,068
G. TOTAL (Sum of E, F1 and 2—should equal net press run shown in A)		161,155	163,497

11. I certify that the statements made by me above are correct and complete. Signature and Title of Editor, Publisher, Business Manager, or Owner: Editor

PS Form 3526, January 1991 (See instructions on reverse)

MEMBRANE SWITCH KITS!

These highly durable water resistant flat-panel keypads can be assembled in minutes with YOUR legend! Available in 4, 12, 16, 24 & 40 Key models. Steel "clickdomes" optional. Connector and bezel included.



Call for free brochure

Sil-Walker 880 Calle Plano, Unit N, Camarillo, CA 93012
(805) 389-8100 FAX (805) 484-3311

Learn **Windows**® from Video tapes!

Only 12.95 per tape, any two for $22.95! (each tape is 1 hour, learn at your own pace and leisure, no PC needed)

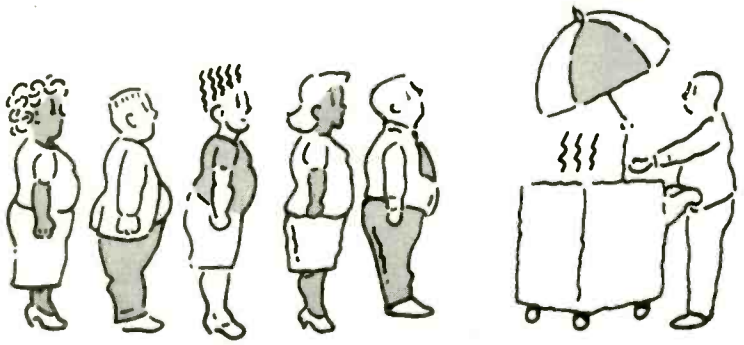
1. Introduction to **Microsoft Windows** 3.1
2. More about Windows
3. Introduction to **Microsoft Excel** 4.0
4. More about Excel
5. Intro. to Microsoft **Word** 2.0 for Windows
6. More about Microsoft Word
7. Intro. to **Microsoft Access** 1.1
8. More about Microsoft Access database

and more advanced courses also! Cheaper than any book, yet it is more fun, insightful, inspirational, and relaxed learning without toil! Write to or send check, cash, or money order (+3.95 shipping per order) to:

Softfact, 1195 Eureka Av, Los Altos, CA 94024

BUY BONDS

IT'S NOT WORTH THE WEIGHT.



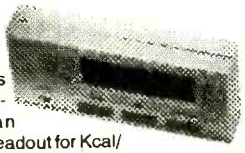
For better health and fitness, exercise.

American Heart Association

© 1992, American Heart Association

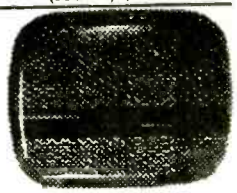
www.americanradiohistory.com

TREADMILL DISPLAY



LCD display offers speed, time, distance and scan modes as well as readout for Kcal/min. Operates on 5VDC. Uses +5V pulses to operate readout. Many applications.
(93U013) **$5.95 each**

BRIGHT RED STROBE



Intended to clip on the rear of a bicyclist's waistband as a safety device, it can be seen for blocks at night. Alternative uses may be as a signaling device, to attract bulls or as a simulated UFO encounter. Runs on two AA cells (not included).
(93L008) **$14.95**

AMBER LENS

16-pin DIP package; 8 LEDs 0.375" x 0.75"; I_{MAX}=25 mA/LED; diffuse white cover. HLMP 2785.
(93L010) **10 FOR $7.95**

FAMOUS BRAND SOLDER

Solid core, 0.25" diameter, 29T/70L. 5 lb. spool.
(92Z012) **$9.95**

SON OF A CHEAP SLIDE SWITCH!

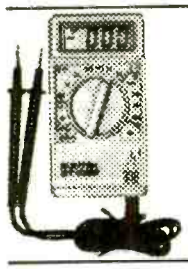
DPDT, 12A rated. (93B004)
6 for $1.00
100 for $9.95

TVRO MOTHERBOARD

These defective units contain many useful parts including a 950-1450 MHz tuner, two NEC 5150 gain blocks, filters. etc. (92V002) **$24.95**

HELPING MAGNIFIER

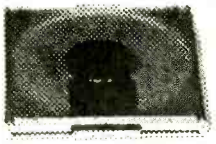
Six ball joints for all angles. Nickel-plated fittings. Heavy cast-iron base. 2X 2.5" magnifying glass. Alligator spring clips. Locks at any angle.
(93U002) **$5.95 each**



3.5 DIGIT MULTIMETER

Six functions, 14 ranges, AC/DC voltages up to 500V, diode and battery tests. Suntek ST1000.
(93Z023) **$19.95 each**

CD ROM CADDY



Fits Sony, Chinon, Toshiba, etc. Brand new. (93C018)
$4.50 each
SPECIAL! *Buy ten caddies before 2/28/94 and get a free case!* (93C018A)

BRAND "X" LENS

Eyepiece-type magnifier. Focal length = 50mm, f:3.2. Approx. dimensions: dia. = 38mm, length = 43mm. Excellent hand magnifier at approx. two power, or telescope eyepiece.. (93L009)
$9.95

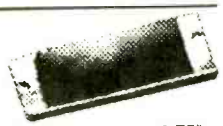
EMERGENCY LAMP

Just add water! Send up attached to a balloon as a "UFO." Practical uses include hurricanes, earthquakes, tornadoes, camping, hunting, electrical outages, etc. Over one hour of light. Can also be used as a hand warmer. Battery type BA-292/AM, used by the military. Comes packed ten in a sealed can. (93E013) **$14.95/can**

6V DC GEARMOTOR

Autotrol model 200. Shaft 1/8" dia., 1" long. 6-2/3 RPM. Quality cast metal gearbox. (93M009)
$6.95 each

DOMINO SIZED SUPER MAGNET

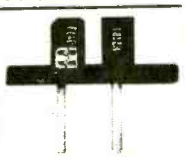


Approx. 500 Gauss. Measures approx 0.75" x 1.75" x 0.625". Very strong for its size!
(93M011) **3 for $9.95**

BRIDGE RECTIFIER

300V @ 1A. DIP package. (93S029)
45¢ each - 25 for $9.95
Large quantities available.

OPTICAL INTERRUPTOR



IR LED emitter/detector pair. Harris #017J-H21B1.
(93B005) **$1.49 each**

POWER MOSFET

BUZ-80 (93S014) **$1.49 each**

EPROM BLOWOUT!

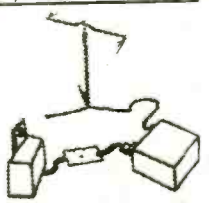
Erase and save $$$!

2708	$ .25	27128	$1.29
2716	$ .75	27256	$1.49
2732	$ .99	27C256	$1.69
2764	$1.09	27C010	$3.99

IR REMOTE CONTROL/ RECEIVER KIT

Your imagination is the only limitation for the uses of this device. The controller is new and fully assembled. It has thirty function buttons, each of which causes the transmitter to emit a unique infra-red pulse train. Originally, the receiver was mounted in a satellite receiver; the satellite receivers are all gone but we have reproduced the IR receiver and are offering it here in kit form. The IR RECEIVER KIT can be assembled in less than an hour. We also furnish the IC which served as the IR decoder and controller. A decoder can be breadboarded around this chip. To make life easier, we have all the schematic diagrams, including the diagram of the satellite receiver. (93V010) **All For $19.95**

ION DRIVE MOTOR

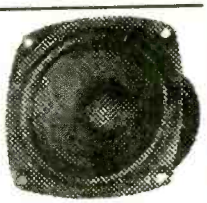


Rapidly rotating micropower ion drive motor is ideal for demonstrations of the theory of interstellar flight or simply as a decorative piece defying common sense. Guaranteed to arouse and challenge the mind for a long time. Not intended for young children. (92M034) **$19.95 each**

PLUG-IN WALL TRANSFORMER ASSORTMENT

Various output voltages and currents. (92E035)
Seven for $9.95

4" Speaker



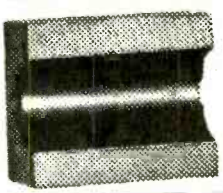
4 Ohm, 50W max., 5W nom. (93V011)
$7.95 each

2-20 KHz Speaker

4 Ohm, 30W max., 10W nom., 2.5" x 4". (93V012)
$7.95 each

Package Deal!

Two pair of the above (93V011 & 93V012) with crossover data. (93V013) **$25.00**



SPLIT CORES

Fair Rite P/N 2643164151. No. 43 material. Tape over cable up to 0.5" diameter. (93N010)
$5.95 pair

Also Visit:
Alltronics of Las Vegas
6283 Industrial Avenue
Las Vegas, NV 89118
(702) 897-7237

ALLTRONICS

Visa, MC, AmEx cards accepted. • Minimum order $15.00.
CA & OH residents add local sales tax. • Shipping additional on all orders.ONICS
2300 Zanker Road • San Jose, CA 95131
Phone (408) 943-9773 • Fax (408) 943-9776

Also Visit:
Alltronics of Salt Lake City
2880 S. Main Street
Salt Lake City, UT 84115
(801) 485-5117

020294

CIRCLE 27 ON FREE INFORMATION CARD

www.americanradiohistory.com

MARYMAC®
The New Realistic®
PRO-43 Scanner
Radio Shack®
PHONES
Our 17th year of DISCOUNTS
Toll Free 800-231-3680
PRO-43 List $349.95
Our Delivered Price $290.00
We discount everything in the RS catalog
22511 Katy Fwy.
Katy (Houston), TX 77450
1-713-392-0747 FAX 713-574-4567

The Pocket Programmer
The portable Eprom programmer that uses the printer port of your PC instead of an internal card. The software has 24 easy to use functions and programs 27/25/28/68764 & Cmos from 16K (2K × 8)—2M (256K × 8) Eproms (32 pin socket, UpGradeable to 8Meg). Adapters available for MCU's, 40-Pin Eproms, 5-Gang and Eprom Emulator to 32K × 8.
INTRONICS, INC.
Box 13723
Edwardsville, KS 66113
(913) 422-2094
$129.95
Add $3.00 for shipping
Add $3.75 for COD
Visa/MasterCharge

Satellite-TV
SAVE 40% - 60%
800-334-6455
218-739-5231 Int'l
218-739-4879 Fax
FREE Catalog
Skyvision Inc.®
1048 FRONTIER DRIVE • FERGUS FALLS, MN 56537
See full page ad in The Market Center

CABLE TV EQUIPMENT CHANNELS GUARANTEED
The nationwide source for cable TV equipment.
FREE 30 DAY TRIAL
"BUY WHERE THE DEALERS BUY."
FREE TV Cable Descramblers and Converterters Catalog. Open Every Day!
MEGA ELECTRONICS
VISA • MC C.O.D.
1-800-676-6342
SAVE 1000's
21 South Main Street, Winter Garden, FL 34787

PE MARKET CENTER CLASSIFIEDS

!!! BROADCAST FARTHER !!!
PLANS ARE SOLD FOR EDUCATIONAL PURPOSES ONLY
The model 1525 is an RF amplifier that connects to mono or stereo FM transmitters and produces a *powerful* 15-25 watt signal which could broadcast up to 5 miles or more! Requires 75-250 mW drive. Step by step plans complete with part source information and broadcast antenna designs. – ONLY $16
Progressive Concepts 1313 N. GRAND AVENUE, SUITE 291 WALNUT, CALIFORNIA 91789 (909) 626-4969

PLANS-KITS-SCHEMATICS

BUILD — FIVE-digit, ohms, capacitance, frequency, pulse, multimeter. Board and instructions $9.95. Bagnall Electronics, 179 May, Fairfield, CT 06430.

FM STEREO TRANSMITTER kit broadcasts any audio signal to FM stereo radios throughout your home. Uses unique BA1404 IC. Complete kit: PC board/components — $24.00. Visa/MC. **TENTRONIX,** 3605 Broken Arrow, Coeur d'Alene, ID 83814. (208) 664-2312.

ALL-IN-ONE catalog. AM/FM/ham/spy, transmitters/amplifiers, voice disguisers, descramblers, audio/TV/science projects. Start your own licensed/unlicensed radio station, books/plans/kits for import and export. 60 mouth-watering pages for $1.00. **PAN-COM INTERNATIONAL,** PO Box 130-H2, Paradise, CA 95967.

Z80 CONTROLLER boards with schematic, parts list, and info. 32K Eprom, 32K RAM, battery backup, 32 lines I/O, 4 counter/timers, expansion port. Bare boards — $27.95. Kit with all components — $69.00. Henry Smith, 16801 Gaines Rd., Broad Run, VA 22014.

BUGGED??
EAVESDROPPING is unbelievably widespread! Electronic Devices with amazing capabilities can be monitoring your telephone and room conversations RIGHT NOW! Are you sure you're safe? FREE CATALOG tells you fast! Includes Free Bonus details on fantastic opportunities now open in Counter-Surveillance field. Exciting, immensely interesting and EXTREMELY profitable (up to $250 hr) full/part-time income. Call Now!
1-800-732-5000

STUCK INDOORS? Bored beyond belief? Check out our intriguing line of kits and plans. Free catalog. **Electroman,** Box 24474, New Orleans, LA 70184. (504) 482-3017.

RADIATION ALERT!! Geiger counter utilizes one of the most sensitive Geiger tubes available and no nonsense circuitry. Schematic, operating info and parts availability $11.95 to: **Electronic Safety Instruments,** Box 156, 2927 West Liberty Ave., Pittsburgh, PA 15216.

HIGH SECURITY alarm system diagram. Formerly secret circuit is virtually undefeatable. Uses commonly available parts. 1 remote sensor is included with plans, parts and acc. list. $12.95 ppd. Armstrong Mfg., Box 94328, OKC, OK 73143.

QUANTUM KITS! Super FM Transmitter — tuneable, long range $25.00! Bug Detector — detect and monitor transmitters to 10 GHz. $40.00! IC Tester — test any integrated circuit $25.00! Radar Detector — audible, bargraph microwave warning $20.00! Vocal Truth Detector — determines voice stress levels $40.00! Free catalog with order or $4.00 (refundable). **QUANTUM RESEARCH,** 17919 — 77th Ave., Edmonton, Alberta, Canada T5T 2S1.

CABLE DESCRAMBLERS, build your own, SSAVI, Gated Sync, Sinewave. $14.95. Cabletronics, Box 30502PE, Bethesda, MD 20824.

COMPUTER SOFTWARE

AMAZING TALKING SOFTWARE! makes your XT-AT computer talk! Great for programmers! Send $25.00 cash/MO: Max Tomek, 42 Leonard, Canton, MA 02021-3244.

COMPONENTS

ELECTRONIC FASTENERS. Stainless steel. Kits available. Free catalog. "RUSTY BOLT", Box 708X, North Attleboro, MA 02761.

FREE PLANS/ catalog. Shocker, bug, T.V. jammer. Hobby catalog lowest prices components, parts, tools, more! Gallimore Electronics, Box 70150-C, San Diego, CA 92167.

AUDIO-VIDEO-LASERS

FREE LASER CATALOG. Argon, He-Ne, and visible diode lasers, holography, lightshows, pointers. Write: Midwest Laser Products, PO Box 2187, Bridgeview, IL 60455. Or call (708) 460-9595.

SURROUND SOUND decoder ready to connect to rear amp. Low noise FET circuitry. $34.95 ppd. Armstrong Mfg., Box 94328, OKC, OK 73143.

SURVEILLANCE
& COUNTERSURVEILLANCE Electronic Devices
Bugging/Phone Tapping Detectors • Caller IDs • Covert Video • Phone Scramblers • Voice Changers • Shotgun Mics Vehicle Tracking • Transmitter Kits • Locksmithing • AND MORE!
NEW! Telephone Recording Systems Disguise Video Cameras
EDE FOR CATALOG SEND $5.00 TO... P.O. Box 337, Buffalo, NY 14226 (716) 691-3476

SATELLITE EQUIPMENT

VIDEOCIPHER II descrambling manual. Schematics, video and audio, $18.95. Videocipher II 032, $15.00. Videocipher II plus, $20.00. Software, $25.00. Cabletronics, Box 30502PE, Bethesda, MD 20824.

VC-2 RS MODULE 399 with programming 25° LNB $85.00. Uniden 4400-S 459, no module, best prices, call for phone quote. All major brands sold. Satellite TV, 120 West Centennial, Muncie, IN 47303. (317) 288-0074. 11-5.

EDUCATION

LEARN SKILLS electrical and electronic. Most courses **$49.50.** Catalog $2.00. A&A Products, Rt1 Box 482-L, Rockdale, TX 76567.

IMPULSE BASEBAND DPBB-73XX $225.00, DPV5-ch:3 $150.00, Pioneer BA6110 $250.00 — Testaids: Star6: $15.00 Star7: $15.00. SA all: $25.00, Pioneer all: $25.00 — min. 10 pc. Please call (212) 978-3535. No N.Y. sales.

LEARN TO EARN: Electronics, robot, radio, others. Free catalog. A&A Products, Rt1 Box 482-L, Rockdale, TX 76567.

BUSINESS OPPORTUNITIES

EASY WORK! Excellent pay! Assemble products at home. Call toll free 1 (800) 467-5566 ext. 5192.

www.americanradiohistory.com

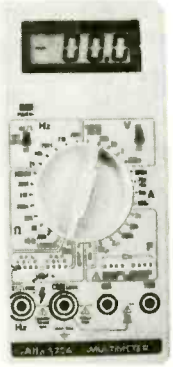
ALFA ELECTRONICS

HIGH-QUALITY TEST EQUIPMENT
BEST PRICE

DMM 2360 $119.95

DMM + LCR Meter
Most Versatile DMM

Inductance: 1μH-40H
Capacitance: 1pF-40μF
Frequency: 1Hz - 4MHz
Temperature: -40 - 302 °F
TTL Logic Test: 20MHz
Diode, Continuity
Volt, Amp, Ohm
3999 count display
Peak Hold
Auto power off
Ruggerdized case.
Rubber Holster $8.00



DMM 175A $67.95

DMM with 20 MHz Frequency Counter
Most Popular DMM

Freq. Counter 1Hz-20MHz
DCV 0.1mV-1000V
ACV 0.1 mV-750V
ACA/DCA 0.1μA-10A
Resistance 0.1Ω-2000MΩ
Capacitance 1pF-20μF
TTL Logic test 20 MHz
Transistor HFE test
Diode test ,LED test
3 1/2 digit display
10 MΩ impedance
Soft case$3.00, deluxe case $5.00

Fluke Multimeter

Fluke 12	$79.95
Holster C-10	$10
Fluke 70 II	$65
Fluke 73 II	$90
Fluke 75 II	$127
Holster C-70	$15
Fluke 77 II	$147
Fluke 79 II	$167
Fluke 29 II	$167
Fluke 83	$225
Fluke 85	$259
Fluke 87 True RMS	$285
Fluke 97 Scope Meter	$1750

LCR Meter 814 $199.95

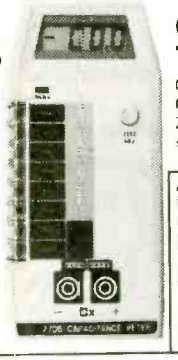
The Best Handheld LCR

Inductance: 0.1μH-200H
Capacitance: 0.1pF-20,000μF
Resistance: 1mΩ-20MΩ
1% basic accuracy
Dissipation factor indicates leakage in capacitor and Q factor in inductor
Zero adjustment to reduce parasitics from test fixture
Best for high frequency RF and surface mount components.
SMD and chip component test probe $25.00, Deluxe carrying case $5.00

LCR Meter 195 $119.95

Very Popular LCR

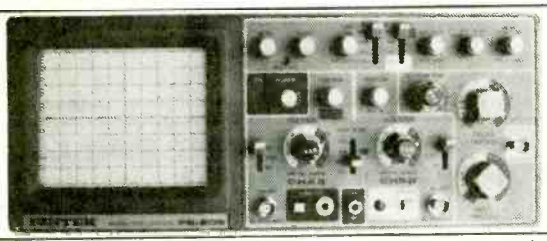
Inductance: 1μH-200H
Capacitance:0.1pF-200 μF
Resistance:0.01Ω-20MΩ
Basic accuracy:R:1%, C:2%, L:3%
Test frequency 1 kHz
Soft carrying case $3.00
Deluxe case $5.00



Capacitance Meter 7705 $57.95

0.1 pF-20,000μF in 9 ranges
0.5% basic accuracy
Zero adjustment ± 20pF to compensate parasitics from test fixture

Also Available:
Heavy duty DMM, AC/DC clamp meter, Thermometer, Light meter pH meter,, High voltage probe Digital caliper, Anemometer Elctronic scale, Force guage Tachometer, Humidity & EMF adapter, Sound level meter Frequency counter, SWR/field strength/power meter, Dip meter



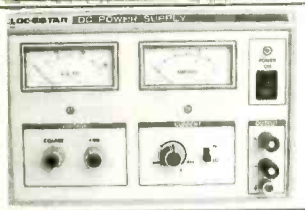
20 MHz Oscilloscope with Delay Sweep PS-205 $429.95

Dual Trace, Component test, 6" CRT, X-Y Operation, TV Sync, Z Modulation, CH2 Output, Graticule Illum, 2 probes each has x1,x10 switch. Best price with delay sweep.

PS-200 20 MHz DUAL TRACE	$339.95
PS-400 40 MHz DUAL TRACE	$494.95
PS-405 40 MHz DELAY SWEEP	$589.95
PS-605 60 MHz DELAY SWEEP	$789.95

20 MHz Digital Storage Oscilloscope DS-203 $729.95

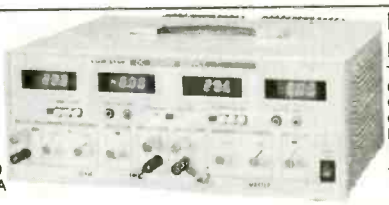
Switchable between digital and analog modes
2 K word per channel storage
Sampling rate: 10 M sample /sec
8 bit vertical resolution (25 Lerel/div)
Expanded Timebase 10ms/div - 0.5 s/div
Refresh, Roll, Save all , Save CH2, Pre-Trig
Plotter Control



DC Power Supply PS-303 $159.00

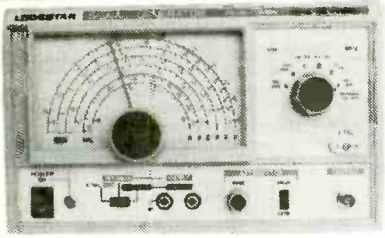
0-30 VDC , 0-3A output

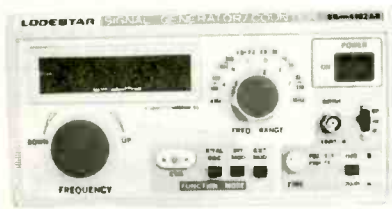
0.02% + 2mV line regulation
0.02% + 3mV load regulation
1 mVrms noise and ripple
Short circuit and overload protected
PS-8200 with digital voltmeter $179.00
Also available: 30V/5A, 60V/3A, 60V/5A 16V/10A, 30V/10A



DC Power Supply Triple Output PS-8202 $499.95

Two 0-30 VDC , 0-3A outputs
One fixed 5VDC, 3A output
Capable of independent or tracking operation
Constant voltage and constant current mode
Four digital meters for volt and current display
Excellent regulation and low ripple
Short circuit and overload protected
Also available: 30V/5A triple output $549.95
60V/5A dual tracking $749.95





RF SIGNAL GENERATOR SG-4160B $119.00

100 kHz-150MHz sinewave in 6 ranges
RF Output 100mVrms to 35 MHz
Internal 1kHz, External 50Hz-20kHz AM modulation
Audio output 1 kHz, 1 Vrms

RF SIGNAL GEN./COUNTER SG-4162 AD $229.95

Generates RF signal same as SG-4160B
Frequency counter 1Hz - 150 MHz for internal and external source
Sensitivity <50mV

AUDIO GENERATOR AG-2601A $119.00

10Hz - 1MHz in 5 ranges
Output: 0-8Vrms sinewave
0-10Vp-p squarewave
Synchronization: ±3% of oscillation frequency per Vrms
Output distortion:
0.05%-500Hz - 50kHz
0.5 % 50Hz - 500kHz
Output impedance: 600 ohm

AUDIO GEN./COUNTER AG-2603AD $229.95

Generates audio signal same as AG-2601A
Frequency counter 1Hz-150MHz for internal and external sources
Sensitivity <50mV

FUNCTION GENERATOR FG-2100A $169.95

0.2 Hz -2 MHz in 7 ranges
Sine, square, triangle, pulse and ramp
Output: 5mV-20Vp-p
1% distortion, DC offset ± 10V
VCF: 0-10V control frequency to 1000:1

FUNCTION GEN/COUNTER FG-2102AD $229.95

Generates signal same as FG-2100A
Frequency counter 4 digits
Feature TTL and CMOS output

SWEEP FUNCTION GEN./COUNTER $329.95

0.5Hz to 5 MHz in 7 ranges
Sweep: Linear 10:1/Log 10:1 20ms to 2s
AM Modulation
Gated Burst, Voltage Control Generator
Generator Control Voltage & 6 digit counter
1Hz-10MHz for internal & external sources

ALFA ELECTRONICS
741 Alexander Rd., Princeton, NJ 08540
(800) 526-2532/(609) 520-2002
FAX:(609) 520-2007

15 DAY MONEY BACK GUARANTEE. 1 YEAR WARRANTY
CALL OR WRITE FOR FREE CATALOG AND BEST OFFER.
Visa, Master Card, American Express, COD, Purchase Order Welcome

CIRCLE 26 ON FREE INFORMATION CARD

www.americanradiohistory.com

ADVERTISING INDEX

POPULAR ELECTRONICS magazine does not assume any responsibility for errors that may appear in the index below.

Free Information No.		Page
25	Ace Communications	99
26	Alfa Electronics	29
28	All Electronics	123
—	Allen Engineering	116
27	Alltronics	127
—	AlphaLab Inc.	122
140	B&S Sales	107
30	Bel Merit	102
56	BG Micro	125
—	C&C Specialties	122
32	C&S Sales	104
31	Caig Labs	97
—	Chenesko	117
5	Command Productions	116
—	Communication Specialists	126
—	Consumertronics	106
—	EDE	128
—	EMAC	117
—	Fotronics	114
—	Great Southern Security	128
—	Greenleaf Electronics Inc.	110
35	Index Publishing	119
—	Information Unlimited	96
36	Interactive Image Technologies	112
—	Intronics	128
—	ITC Microcomponents Inc.	111
37	Jan Crystals	111
—	JP Video	100
38	Kelvin Electronics	115
—	M&G Electronics	119
—	Marymac Industries Inc.	128
—	Mega Electronics	128
—	Mental Automation	122
—	MicroCode Engineering	111
—	Mondo-tronics	124
—	Movie View Sales	114
—	MWK Industries	114
43	Optoelectronics	103
—	PC Build Computer Kits	117
—	Phillips Tech	122
47	Prairie Digital Inc.	108
46	Print	121
—	Progressive Concepts	128
—	Self-Reliance Co. Inc.	121
48	Sescom Inc.	110
—	Sil Walker	126
—	Silicon Valley Surplus	126
—	Skyvision (Small)	128
—	Skyvision Inc.	101
—	Soft Fact	126
—	Soft Fact	124
—	Soft-Wear Productions	110
—	Software Science	122
—	Startek International	109
—	Tele View Distributors	121
129	TKA Electronics Inc.	118
136	UCANDO Videos	106
—	United Electronic Supply	108
—	Universal Electronics Inc.	116
55	US Cable (Zentek)	111
—	Video Spectra	111
—	Vista	108
—	Vista International	124
—	WPT Publications	124
134	Xandi Electronics	130

Serving the public since 1981

XANDI Electronics

201 E Southern #111, Tempe AZ 85282

SATISFACTION GUARANTEED!

BUY WITH CONFIDENCE FROM XANDI
- **30-DAY REFUND POLICY**
- **NEW TELEPHONE TECH SUPPORT NUMBER**

(602-894-0992)

- Smallest FM transmitter anywhere!
- Tunes 88-108 MHz.
- Powerful 2 stage audio amplifier.
- Sensitive, picks up sounds at the level of a whisper.
- Up to 1 mile range.

XST500 SUPER-MINIATURE FM TRANSMITTER

Worlds smallest FM voice transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip (SMT) parts are pre-assembled to the circuit board.

XST500(E-Z) Kit $44.95

- Smallest Phone transmitter anywhere!
- Tunes 88-108 MHz.
- No batteries required, powered by phone line.
- Up to 3/4 mile range.
- Attach to phone line anywhere in house, even inside phone.

XSP250 SUPER-MINIATURE PHONE TRANSMITTER

Worlds smallest FM phone transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip (SMT) parts are pre-assembled to the circuit board.

XSP250(E-Z) Kit $34.95

- Digital voice changing: male to female, female to male, adult to child, child to adult.
- 16 levels of voice masking.
- Button for normal operation.
- Complete anonymity on all calls

TRANSITION 2000 VOICE CHANGING TELEPHONE

STOP THOSE ANNOYING PHONE CALLS! Sound older and tougher when you want to. Not a kit, fully assembled. Single line phone operation only.

TRANSITION 2000 ..... $89.95

- Digital voice changing: male to female, female to male, adult to child, child to adult.
- Use with any modular phone.
- Connects between handset and phone.
- 16 levels of voice masking.

TRANSITION 2001 VOICE CHANGING Accessory

STOP THOSE ANNOYING PHONE CALLS! Sound older and tougher when you want to. Use with single or multi-line phones. Not a kit, full assembled.

TRANSITION 2001 ..... $59.95

- Transmits both sides of phone conversation.
- Adjustable from 88-108MHz.
- Works with any FM broadcast receiver.
- Up to 1 mile range.
- Turns off when phone is not in use to extend battery life.

XTT100 LONG RANGE PHONE TRANSMITTER

Similar to our very popular XSP500, the XTT100 is battery powered for maximum range. It plugs into any phone jack and transmits all calls on that line.

XTT100(C) Kit $32.95

- Super sensitive, hear every sound in a house!
- Powerful 2 stage audio amp.
- Use with any FM broadcast receiver.
- Up to 1 mile range.
- Powered by 9V battery.

XFM100 MINIATURE FM TRANSMITTER

The XFM100 has a super sensitive microphone and is capable of picking up sounds at the level of a whisper and transmitting them to any FM broadcast receiver.

XFM100(C) Kit $32.95

- Transmits a continuous beeping tone.
- Adjustable from 88-108 MHz.
- Up to 1 mile range.
- Works with any FM broadcast receiver.
- Operates at battery voltages of 3 to 18 volts.

XTR100 TRACKING TRANSMITTER

Measuring .7 by 2.4 inches, the XTR100 is ideal for use in locating lost model rockets, bicycles, automobiles, games of hide-and-seek, and contests.

XTR100(C) Kit $43.95

- Uses sensitive microwave transistor amplifier.
- Covers 1 to 2000 MHz.
- Compact hand held unit.
- Uses Miniature loudspeaker (not included) for audio indication of detected signals.

XBD200 SUPER SENSITIVE BUG DETECTOR

When the XBD200 intercepts a signal in the 1 to 2000 MHz range, it emits a growl that increases to a high pitched squeal as the signal strength increases.

XBD200(C) Kit $49.95

XLC900 800-950 MHz SCANNER CONVERTER KIT

If your scanner can receive 400-550 MHz, just add the XLC900 for uninterrupted 800-950 MHz coverage. It converts all 800-950 MHz signals down to 400-550 MHz so your scanner can receive them! Add our custom case and knob kit for that "professional" look.

XLC900 Kit $49.95

XLC-Case Kit $13.95

XLA1000 AMPLIFIER KIT

Designed to help scanners with poor sensitivity pull in those weak signals. Includes off/pass switch for returning to normal operation and front panel gain control. Add our custom case and knob kit for that "professional" look.

XLA1000 Kit $24.95

XLA-Case Kit $13.95

WE ACCEPT VISA, MC, MO, COD
ASK FOR FREE CATALOG OF ALL OF OUR PRODUCTS

TOLL FREE ORDER LINE

1-800-336-7389

SEND MAIL ORDERS TO: XANDI ELECTRONICS
BOX 25647
TEMPE, AZ 85285-5647

CIRCLE 134 ON FREE INFORMATION CARD

www.americanradiohistory.com

Countersurveillance

Never before has so much professional information on the art of detecting and eliminating electronic snooping devices—and how to defend against experienced information thieves—been placed in one VHS video. If you are a Fortune 500 CEO, an executive in any hi-tech industry, or a novice seeking entry into an honorable, rewarding field of work in countersurveillance, you must view this video presentation again and again.

Wake up! You may be the victim of stolen words—precious ideas that would have made you very wealthy! Yes, professionals, even rank amateurs, may be listening to your most private conversations.

Wake up! If you are not the victim, then you are surrounded by countless victims who need your help if you know how to discover telephone taps, locate bugs, or "sweep" a room clean.

There is a thriving professional service steeped in high-tech techniques that you can become a part of! But first, you must know and understand Countersurveillance Technology. Your very first insight into this highly rewarding field is made possible by a video VHS presentation that you cannot view on broadcast television, satellite, or cable. It presents an informative program prepared by professionals in the field who know their industry, its techniques, kinks and loopholes. Men who can tell you more in 45 minutes in a straightforward, exclusive talk than was ever attempted before.

Foiling Information Thieves

Discover the targets professional snoopers seek out! The prey are stock brokers, arbitrage firms, manufacturers, high-tech companies, any competitive industry, or even small businesses in the same community. The valuable information they filch may be marketing strategies, customer lists, product formulas, manufacturing techniques, even advertising plans. Information thieves eavesdrop on court decisions, bidding information, financial data. The list is unlimited in the mind of man—especially if he is a thief!

You know that the Russians secretly installed countless microphones in the concrete work of the American Embassy building in Moscow. They converted

CALL NOW!

1-516-293-3751

HAVE YOUR VISA or MC CARD AVAILABLE

what was to be an embassy and private residence into the most sophisticated recording studio the world had ever known. The building had to be torn down in order to remove all the bugs.

Stolen Information

The open taps from where the information pours out may be from FAX's, computer communications, telephone calls, and everyday business meetings and lunchtime encounters. Businessmen need counselling on how to eliminate this information drain. Basic telephone use coupled with the user's understanding that someone may be listening or recording vital data and information greatly reduces the opportunity for others to purloin meaningful information.

CLAGGK INC. PE
P.O. Box 4099 • Farmingdale, NY 11735

Please rush my copy of the Countersurveillance Techniques Video VHS Cassette for a total cost of $53.95 each (which includes $4.00 postage and handling).

No. of Cassettes ordered _____.
Amount of payment $_____
Sales tax (N.Y.S. only) _____.
Total enclosed _____.
Bill my ☐ VISA ☐ MasterCard
Card No. _____
Expire Date ____ / ____

Signature _____
Name _____
Address _____
City _____ State _____ ZIP _____

All payments in U.S.A. funds. Canadians add $4.00 per VHS cassette. No foreign orders.

The professional discussions seen on the TV screen in your home reveals how to detect and disable wiretaps, midget radio-frequency transmitters, and other bugs, plus when to use disinformation to confuse the unwanted listener, and the technique of voice scrambling telephone communications. In fact, do you know how to look for a bug, where to look for a bug, and what to do when you find it?

Bugs of a very small size are easy to build and they can be placed quickly in a matter of seconds, in any object or room. Today you may have used a telephone handset that was bugged. It probably contained three bugs. One was a phony bug to fool you into believing you found a bug and secured the telephone. The second bug placates the investigator when he finds the real thing! And the third bug is found only by the professional, who continued to search just in case there were more bugs.

The professional is not without his tools. Special equipment has been designed so that the professional can sweep a room so that he can detect voice-activated (VOX) and remote-activated bugs. Some of this equipment can be operated by novices, others require a trained countersurveillance professional.

The professionals viewed on your television screen reveal information on the latest technological advances like laser-beam snoopers that are installed hundreds of feet away from the room they snoop on. The professionals disclose that computers yield information too easily.

This advertisement was not written by a countersurveillance professional, but by a beginner whose only experience came from viewing the video tape in the privacy of his home. After you review the video carefully and understand its contents, you have taken the first important step in either acquiring professional help with your surveillance problems, or you may very well consider a career as a countersurveillance professional.

The Dollars You Save

To obtain the information contained in the video VHS cassette, you would attend a professional seminar costing $350-750 and possibly pay hundreds of dollars more if you had to travel to a distant city to attend. Now, for only $49.95 (plus $4.00 P&H) you can view ***Countersurveillance Techniques*** at home and take refresher views often. To obtain your copy, complete the coupon or call.

www.americanradiohistory.com

There are copies and then there are originals. Only Fluke meters – the original and most copied DMMs in the world – deliver the safety, quality and value they promise. They're built tough enough to achieve C.S.A. and U.L. listings, not to mention the considerable on-the-job punishment they endure. Each meter is loaded with features, of course. But those features are also designed to work together intelligently, so your job is easier. Faster. And safer.

If you're going to spend your hard-earned money on a multimeter, why buy an inferior copy when you can own an original? See Fluke's full line of handheld meters and accessories at your local distributor; or call 1-800-87 FLUKE for the name and number.

O R I G I N A L S

FLUKE®

© Copyright 1993 John Fluke Mfg. Co., Inc. P.O. Box 9090 M/S 250E Everett, WA 98206 U.S.: 206-356-5400
Canada: 416-890-7600 Other Countries: 206-356-5500 All rights reserved. Ad no. 00381

CIRCLE 153 ON FREE INFORMATION CARD

www.americanradiohistory.com