

Radio Electronics®

JANUARY 1991

TECHNOLOGY - VIDEO - STEREO - COMPUTERS - SERVICE

BUILD YOUR OWN MACINTOSH-COMPATIBLE COMPUTER!

And save a bundle of money
in the process

BUILD R-E's E-Z SHORTWAVE RADIO

Tune in to a new world
of programming

WHICH BATTERY IS RIGHT FOR YOU?

How to choose and
use the right battery

GET THE MOST OUT OF YOUR DIGITAL SCOPE

By understanding
how it works

BUILD A NEGATIVE-ION GENERATOR

Experiment with high-voltage electronics
and the effects of negative ions



A
GERNSBACK
PUBLICATION

\$2.95 U.S.
\$3.75 CAN

XXXXXXXX CAR-RT SORT ** CR24
390736DHMO997G093 01 07
JAN 92
MR ROBERT DAHM RB
997 GRAND AV
AURORA, IL 60506

FLUKE



PHILIPS



Great Choice.

More professionals in more industries make Fluke their first choice in multimeters.

Fluke DMMs. Reliable. Accurate. Powerful. Tough. Versatile. Easy to use and simple to operate. Backed by the longest, most comprehensive warranty in the business. **Made in the U.S.A.** In short, Fluke makes meters you can bet your reputation on.

More choice. No matter what the job, there's a Fluke to handle it.

There's the new 80 Series—the most powerful, most complete test and measurement system available in a handheld package.

The popular 70 Series—simply put, the most requested DMM in the world, with nearly 2 million units in service since 1984. And the Fluke 21 and 23—70 Series simplicity in high-visibility yellow.

The Fluke 25 and 27—the most rugged meters ever built, totally sealed against water, dust and other contaminants.

And the precise 8060 Series—with the versatility of a test lab, the accuracy of a bench instrument, and the convenience of a handheld.

Smart choice. Compare Fluke DMMs with any other handheld. No one else gives you as much meter for your money. And no other meter costs less to own.

Your choice. For the name of your nearest Fluke distributor, call toll-free **1-800-44-FLUKE, ext. 33.** And make a great choice.

John Fluke Mfg. Co., Inc. P.O. Box C9090 M/S 250C Everett, WA 98206. U.S.: (206) 356-5400. Canada: (416) 890-7600. Other Countries: (206) 356-5504. © 1989 John Fluke Mfg. Co., Inc. All rights reserved. Ad No. 0491-F70

FROM THE WORLD LEADER
IN DIGITAL MULTIMETERS

FLUKE

CIRCLE 121 ON FREE INFORMATION CARD

NEW!! FAX US YOUR FREE INFORMATION CARDS FOR EVEN FASTER SERVICE!

Now you can send your requests for Free Information by **FAX** or mail. It's simple, it's easy—just follow these three steps:

- 1 Print your name, address and Zip Code on one of the attached postage-paid cards.
- 2 Circle the number (or numbers) on the card that matches the number at the bottom of each ad or editorial item that you want information on. Advertisers' free information numbers also appear in the ad index.
- 3 FAX the complete card to us at 413-637-4343 or if you prefer, drop the card in the mail—it's still postage paid!

NOTE: Submit all Free Information requests by either **FAX** or mail, **NOT BOTH!** **DUPLICATE REQUESTS WILL BE DISCARDED.** Use the **FAX** telephone number and the postcard address for Free Information only. Address all editorial inquiries to Editor, Radio-Electronics®, 500-B Bi-County Blvd., Farmingdale, NY 11735

BUSINESS PROFESSIONAL FREE INFO CARD

**Radio
Electronics®**

4-191

Name _____ Title _____
 Company _____
 Dept./MS. _____
 Daytime Business Phone _____
 Company Address _____
 City _____ State _____ Zip + 4 _____

Unclear or incomplete mailing info will prevent our processing this request.

2 Please send me 12 issues of RADIO-ELECTRONICS® for \$17.97 and bill me. (Canada \$23.97 - US Funds only)

4 Please send me 12 issues (1 year) of POPULAR ELECTRONICS® for \$18.95 and bill me. (Canada \$23.95 - US Funds only)

22 43 64 85 106 127 148 169 190 211 232 253 274 295 316 337 358
 23 44 65 86 107 128 149 170 191 212 233 254 275 296 317 338 359
 24 45 66 87 108 129 150 171 192 213 234 255 276 297 318 339 360
 25 46 67 88 109 130 151 172 193 214 235 256 277 298 319 340 361
 26 47 68 89 110 131 152 173 194 215 236 257 278 299 320 341 362
 27 48 69 90 111 132 153 174 195 216 237 258 279 300 321 342 363
 28 49 70 91 112 133 154 175 196 217 238 259 280 301 322 343 364
 29 50 71 92 113 134 155 176 197 218 239 260 281 302 323 344 365
 9 30 51 72 93 114 135 156 177 198 219 240 261 282 303 324 345 366
 10 31 52 73 94 115 136 157 178 199 220 241 262 283 304 325 346 367
 11 32 53 74 95 116 137 158 179 200 221 242 263 284 305 326 347 368
 12 33 54 75 96 117 138 159 180 201 222 243 264 285 306 327 348 369
 13 34 55 76 97 118 139 160 181 202 223 244 265 286 307 328 349 370
 14 35 56 77 98 119 140 161 182 203 224 245 266 287 308 329 350 371
 15 36 57 78 99 120 141 162 183 204 225 246 267 288 309 330 351 372
 16 37 58 79 100 121 142 163 184 205 226 247 268 289 310 331 352 373
 17 38 59 80 101 122 143 164 185 206 227 248 269 290 311 332 353 374
 18 39 60 81 102 123 144 165 186 207 228 249 270 291 312 333 354 375
 19 40 61 82 103 124 145 166 187 208 229 250 271 292 313 334 355 376
 20 41 82 83 104 125 146 167 188 209 230 251 272 293 314 335 356 377
 21 42 63 84 105 126 147 168 189 210 231 252 273 294 315 336 357 378

VOID after MARCH 31, 1991.

Allow 6-8 weeks for delivery of first issue

FREE INFORMATION CARD

BUSINESS PROFESSIONAL FREE INFO CARD

**Radio
Electronics®**

3-191

Name _____ Title _____
 Company _____
 Dept./MS. _____
 Daytime Business Phone _____
 Company Address _____
 City _____ State _____ Zip + 4 _____

Unclear or incomplete mailing info will prevent our processing this request.

2 Please send me 12 issues of RADIO-ELECTRONICS® for \$17.97 and bill me. (Canada \$23.97 - US Funds only)

4 Please send me 12 issues (1 year) of POPULAR ELECTRONICS® for \$18.95 and bill me. (Canada \$23.95 - US Funds only)

22 43 64 85 106 127 148 169 190 211 232 253 274 295 316 337 358
 23 44 65 86 107 128 149 170 191 212 233 254 275 296 317 338 359
 24 45 66 87 108 129 150 171 192 213 234 255 276 297 318 339 360
 25 46 67 88 109 130 151 172 193 214 235 256 277 298 319 340 361
 26 47 68 89 110 131 152 173 194 215 236 257 278 299 320 341 362
 27 48 69 90 111 132 153 174 195 216 237 258 279 300 321 342 363
 28 49 70 91 112 133 154 175 196 217 238 259 280 301 322 343 364
 29 50 71 92 113 134 155 176 197 218 239 260 281 302 323 344 365
 9 30 51 72 93 114 135 156 177 198 219 240 261 282 303 324 345 366
 10 31 52 73 94 115 136 157 178 199 220 241 262 283 304 325 346 367
 11 32 53 74 95 116 137 158 179 200 221 242 263 284 305 326 347 368
 12 33 54 75 96 117 138 159 180 201 222 243 264 285 306 327 348 369
 13 34 55 76 97 118 139 160 181 202 223 244 265 286 307 328 349 370
 14 35 56 77 98 119 140 161 182 203 224 245 266 287 308 329 350 371
 15 36 57 78 99 120 141 162 183 204 225 246 267 288 309 330 351 372
 16 37 58 79 100 121 142 163 184 205 226 247 268 289 310 331 352 373
 17 38 59 80 101 122 143 164 185 206 227 248 269 290 311 332 353 374
 18 39 60 81 102 123 144 165 186 207 228 249 270 291 312 333 354 375
 19 40 61 82 103 124 145 166 187 208 229 250 271 292 313 334 355 376
 20 41 82 83 104 125 146 167 188 209 230 251 272 293 314 335 356 377
 21 42 63 84 105 126 147 168 189 210 231 252 273 294 315 336 357 378

VOID after MARCH 31, 1991.

Allow 6-8 weeks for delivery of first issue

FREE INFORMATION CARD

BUSINESS REPLY MAIL
 FIRST CLASS MAIL PERMIT NO. 597 BOULDER, CO

POSTAGE WILL BE PAID BY ADDRESSEE

**Radio
Electronics®**

SUBSCRIPTION SERVICE
 P.O. Box 51866
 BOULDER, COLORADO 80321-1866

NO POSTAGE
 NECESSARY
 IF MAILED
 IN THE
 UNITED STATES





BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 132 PITTSFIELD, MA

POSTAGE WILL BE PAID BY ADDRESSEE

**Radio
Electronics®**

READER SERVICE MANAGEMENT DEPT.
P.O. BOX 5192
PITTSFIELD, MA 01203-9989

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



**Radio
Electronics®**

4SA19

Subscribe today to the magazine that keeps you up-to-date with the newest ideas and innovations in electronics. (If you already are a subscriber, do a friend a favor and pass this subscription card along to him.)

check offer preferred

- 1 year—12 issues **ONLY \$17.97**
(You save \$17.43 off single copy price)
Basic Subscription Rate
- 2 Years (SAVE MORE)—24 issues \$34.97
(You save \$35.83 off single copy price)
Basic Subscription Rate
- Canada—12 issues \$23.97
- Canada—24 issues \$46.97

ALL SUBSCRIPTIONS PAYABLE IN U.S. FUNDS ONLY

- Payment enclosed
- Bill Me
- Check here if you are extending or renewing your subscription

Name (Please print) _____

Company Name (if applicable) _____

Address _____

City _____ State _____ Zip _____

Allow 6-8 weeks for delivery of first issue.



BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 132 PITTSFIELD, MA

POSTAGE WILL BE PAID BY ADDRESSEE

**Radio
Electronics®**

READER SERVICE MANAGEMENT DEPT.
P.O. BOX 5192
PITTSFIELD, MA 01203-9989

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



For New Ideas In Electronics read Radio- Electronics® every month.

Radio-Electronics will carry timely articles on:

- audio
- video
- personal computers
- VCR servicing
- test equipment
- interactive video
- robotics
- experimenter circuits
- TV scrambling and descrambling
- solid-state technology
- exceptional construction projects



Radio-Electronics offers a unique combination of articles on electronics technology, service, audio, video, computers. Keep up-to-date! Subscribe Today!

USE THE ORDER CARD ON YOUR LEFT

Popular Electronics

Delivers projects for the beginning and advanced builder, articles that help you get the most from your hobby, news and reviews on the hottest new consumer and hobby gear, monthly columns on computers, ham radio, shortwave listening, antique radio, and more!



SUBSCRIBE TODAY!

BUILD THIS

31 MAC COMPATIBLE

Use an Apple motherboard to build a low-cost Macintosh clone.
Charles Colby

41 NEGATIVE ION GENERATOR

Experiment with high-voltage electronics and the effects of negative ions.

Anthony J. Caristi

56 R-E's E-Z SHORTWAVE RADIO

Build a shortwave receiver that you can modify to pick up any frequency that you're interested in!

Rodney A. Kreuter, WA3ENK



PAGE 41

TECHNOLOGY

45 BATTERY TECHNOLOGY

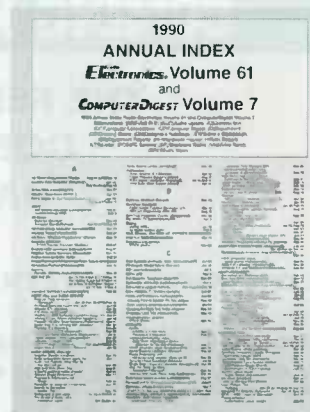
Learn the answers to commonly asked battery questions.

Mark Dewey

50 PUTTING A NEW SCOPE TO WORK

A look at key operating and measurement concepts of today's digital scopes.

Robert W. Ramirez



PAGE 61

COMPUTERS

84 COMPUTER CONNECTIONS

Software reviews, and more.

Jeff Holtzman

DEPARTMENTS

8 VIDEO NEWS

What's new in this fast-changing field.

David Lachenbruch

12 EQUIPMENT REPORTS

Global Specialties' Protolab.

61 1990 ANNUAL INDEX

Find the story you want with this handy listing of articles and departments.

68 HARDWARE HACKER

Cold-fusion update, and more.

Don Lancaster

80 AUDIO UPDATE

The Boston sound.

Larry Klein

AND MORE

98 Advertising and Sales Offices

98 Advertising Index

49 Free Information Card

9 Letters

87 Market Center

28 New Lit

18 New Products

4 What's News

ON THE COVER



If you're looking for a computer that ranks high on customer loyalty, the Mac's the one. Satisfied Mac users are quick to defend their computers against the pro-IBM faction. Unfortunately, the high cost of owning a Macintosh has kept many potential users in the IBM ranks. If that describes you, check out our cover story to find out how you can invest about \$400 and the cost of any 128K through SE-30 Mac logic board—and several hours work, of course—to build your own Macintosh computer. The finished product includes the case, power supply, 800K floppy-disk drive, a power/video board, and the video driver module. And with our version, it's easier to install or remove a board or a drive. Turn to page 31 for more details.

COMING NEXT MONTH

THE FEBRUARY ISSUE GOES ON SALE JANUARY 3.

BUILD A UNIVERSAL COUNTER/TIMER BOARD FOR YOUR PC

It offers a 10-Hz to 2.4-GHz measurement range, runs under Windows, and can control a communications receiver.

BUILD AN AUDIO SWEEP/MARKER GENERATOR

Use it with a scope to display the frequency response of audio systems.

STANDARDS

What's a volt? An ohm? Standards keep our measurements meaningful.

SEMICONDUCTOR MEMORIES

A look at different technologies, including the pluses and minuses of CMOS, TTL, and EEPROM's.

As a service to readers, RADIO-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, RADIO-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.

Since some of the equipment and circuitry described in RADIO-ELECTRONICS may relate to or be covered by U.S. patents, RADIO-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.

RADIO-ELECTRONICS, (ISSN 0033-7862) January 1991. Published monthly by Gernsback Publications, Inc., 500-B Bi-County Boulevard, Farmingdale, NY 11735 Second-Class Postage paid at Farmingdale, NY and additional mailing offices. Second-Class mail registration No. 9242 authorized at Toronto, Canada. One-year subscription rate U.S.A. and possessions \$17.97, Canada \$23.97, all other countries \$26.97. All subscription orders payable in U.S.A. funds only, via international postal money order or check drawn on a U.S.A. bank. Single copies \$2.95. © 1990 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

POSTMASTER: Please send address changes to RADIO-ELECTRONICS, Subscription Dept., Box 55115, Boulder, CO 80321-5115.

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.

Radio Electronics®

Hugo Gernsback (1884-1967) founder

Larry Steckler, EHF, CET,
editor-in-chief and publisher

EDITORIAL DEPARTMENT

Brian C. Fenton, editor
Marc Spiwak, associate editor
Daniel Goodman, technical editor
Kim Dunleavy,
assistant technical editor
Teri Scaduto, assistant editor
Jeffrey K. Holtzman
computer editor
Robert Grossblatt, circuits editor
Larry Klein, audio editor
David Lachenbruch
contributing editor
Don Lancaster
contributing editor
Richard D. Fitch
contributing editor
Kathy Terenzi, editorial assistant

ART DEPARTMENT

Andre Duzant, art director
Injae Lee, illustrator
Russell C. Truelson, illustrator

PRODUCTION DEPARTMENT

Ruby M. Yee, production director
Janice Box,
editorial production
Karen S. Tucker
advertising production
Marcella Amoroso
production assistant

CIRCULATION DEPARTMENT

Jacqueline P. Cheeseboro
circulation director
Wendy Alanko
circulation analyst
Theresa Lombardo
circulation assistant
Michele Torrillo, reprint bookstore

Typography by Mates Graphics
Cover photo by Diversified Photo
Services

Radio-Electronics is indexed in
Applied Science & Technology Index
and *Readers Guide to Periodical Literature*.

Microfilm & Microfiche editions are
available. Contact circulation depart-
ment for details.

Advertising Sales Offices listed on page 98.

Radio-Electronics Executive and
Administrative Offices
1-516-293-3000.

Subscriber Customer Service:
1-800-288-0652.

Order Entry for New Subscribers:
1-800-999-7139.

The
Audit
Bureau
of Circulation



\$59.95 INCLUDES 10 GOOD REASONS WHY THIS MULTIMETER IS FOR YOU.



- 1** AUTO RANGING
- 2** FULL OVERLOAD PROTECTION
- 3** DIODE CHECK
- 4** CONTINUITY CHECK WITH ALARM
- 5** 'HANDS-FREE' MEASUREMENT
- 6** CURRENT UP TO 10 AMPS
- 7** MEMORY MODE FOR DEVIATION MEASUREMENT
- 8** 0.5% ACCURACY
- 9** COMPACT RUGGED CONSTRUCTION
- 10** 3 1/2 DIGIT LCD DISPLAY

Global's Model 735 Digital Multimeter provides a superb combination of high performance, low cost and extremely easy operation. Featuring a full compliment of Autoranging measurement functions including DC Voltage, AC Voltage, DC Current, AC Current, Resistance, Diode Check, and Continuity check.

Advanced features such as Memory Mode and Data Hold are provided giving the Model 735 performance normally associated with meters costing twice the price. Don't let the

low price and compact size fool you, the Model 735 packs performance and value found in all Global instruments. Clearly, the Model 735 is the best value available in it's price category, and is suitable for school, hobbyist and professional users.

Order yours today!!

\$59.95!

A024



Call toll-free for details
1-800-572-1028


**GLOBAL[®]
SPECIALTIES**

CIRCLE 182 ON FREE INFORMATION CARD

Global Specialties
70 Fulton Terrace, New Haven, CT 06512
Telephone: (203) 624-3103. ©Interplex Electronics, 1990.

WHAT'S NEWS

A review of the latest happenings in electronics.

Building robots with "survival instincts."

By studying the instincts and reflexes of living creatures, researchers at the Georgia Institute of Technology have demonstrated feasibility for a robot capable of making "instinctive" survival decisions such as seeking shade to cool down internal systems or changing travel plans to save fuel. A model of the hormonal systems that control "fight-or-flight" decisions in mammals could provide the blueprint for a generation of robots that could possibly navigate hazardous waste sites, coal mines, or even distant planets—without remote-control assistance.

The goal of Dr. Ronald Arkin is a robot that, when confronted by unmapped terrain, is capable of reacting instinctively, without the need for reprogramming or remote direction. By studying the endocrine system of mammals and other biological models, Dr. Arkin hopes to discover precisely what cognitive events or visual



DR. RONALD ARKIN ADJUSTS the vision system that "George," Georgia Tech's specially modified materials-handling robot, uses to navigate to its objective.

signals trigger and modulate particular movements in animals. Ultimately, he hopes to outfit Georgia Tech's mobile materials-handling robot, George, with sensors capable of transmitting information about a variety of internal scenarios or "schema," such as dwindling fuel reserves or dangerous temperature levels. Solution options could then be programmed into "receptor schema" that would be linked to a subsystem that makes routing decisions.

PARTS ORDERS

ORDER STATUS: W	CREATED: 07/05/90
MANUF CONTROL NO.:	TRANSMITTED: / /
BACK ORDER QTY: 0	CONFIRMED: / /
CANCELLED QTY:	RECEIVED: / /
COMMENT: THIS PART GENED.FOR TEST ONLY	BACK ORDER DUE: / /

P O NUM	PART NUM	ORDER QTY	SUPPL	EMERG	FILL CODE	SHIP METHOD
22	99999999999999999999	2	PANAS	X		
55	11111111111111111111	1	IBM	X		
55	11111111111111111111	1	IBM	X		
56	22222222222222222222	1	MICTK	X		
56	22222222222222222222	2	MICTK	X		
56	22222222222222222222	1	MICTK			
57	55555555555555555555	1	PANAS			
57	55555555555555555555	1	PANAS			

PART ORDER LIST SORT
 ORDER NUMBER
 PART NUMBER
 SUPPLIER

F1=HELP F2=SEARCH F7=SORT LIST ENTER=TO ADJUST ORDER
 ESC=TO RETURN TO MAIN MENU

A PARTS ORDERING SCREEN FROM IBM'S Electronic Service Management System/2, which provides independent service centers with direct, on-line communications with manufacturers.

How many transistors?

The 1968 Transistor Rule, deemed "obsolete but innocuous" by Commissioner Andrew J. Strenio Jr., has been repealed. The Federal Trade Commission ruling prohibited manufacturers from stating that a radio or walkie-talkie contained a specific number of transistors when some of those transistors did not actually detect, amplify, or receive radio signals. The "truth-in-advertising" rule was drafted to put an end to the deceptive promotional use of transistor count. So few transistors are used in modern radios and transceivers that the rule, in effect, already had been rendered meaningless. Strenio expressed hope that sometime in the future the FTC would have sufficient resources to undertake systematic "pruning projects" to remove other outdated and obsolete regulations under Federal law.

On-line service-center management.

Introduced at last summer's National Professional Electronics Convention in Las Vegas, NV, IBM's

Electronic Service Management System/2 (ESMS/2) is a comprehensive, on-line solution that allows small- and medium-sized independent consumer-electronics servicers to electronically process warranty claims and order spare parts. With ESMS/2, service centers can communicate directly with the manufacturers for faster reimbursements on warranty claims and quicker turnarounds on parts orders. On-line pricing updates and service and technical bulletins from the manufacturers will also be available.

The software runs on the IBM PS/2 or IBM PC's, and a modem is required to access the IBM Information Network. ESMS/2 is available as software only, or in a package with a PS/2. Besides the communications capabilities, ESMS/2 provides other service-management functions, including work-order processing, parts inventory, and technician evaluations. It can also be used to generate receipts and invoices, custom and form letters, mailing lists, and reports. A LAN version is available for multiple users.

R-E

Discover Your Career Potential In The Fast Growing Field Of High-Tech Electronics!

CIE Gives You The Training You Need to *Succeed...*
At Your Own Pace...& In Your Own Home!

If you're anxious to get ahead...and build a *real* career...you owe it to yourself to find out about the Cleveland Institute of Electronics!

CIE can help you discover your career potential in the fast growing field of high-tech electronics. A career that will challenge and excite you every day...reward you with a powerful feeling of personal accomplishment...and deliver a level of financial security you may have only dreamed of before!

As the leading school in home-study electronics, CIE has helped over 150,000 students in the U.S.A. and over 70 foreign countries get started in this exciting field. To find out how CIE could be helping you...read on...then send for a CIE catalog TODAY!

A Growing Need For Trained Professionals!

The career opportunities shown here are only a few of the challenging, high-paying careers you could enjoy as an electronics technician.

You could be the "brains" behind the scenes of an exciting TV broadcast...trouble-shoot life-saving medical equipment...design exotic new aeronautics systems...CIE's job-oriented programs offer you the quickest possible path to the career of your dreams! And CIE also features military and union re-training, to build on what you already know.

Dozens Of Fascinating Careers To Choose From!

Even if you aren't sure which career is best for you, CIE can get you started with core lessons applicable to *all* areas of electronics. As you advance, CIE makes job opportunities available to you through the bimonthly school paper, *The Electron*.



Data Communications



Automotive Electronics



Avionics



Computer-Assisted Manufacturing



Consumer Electronics



Military Electronics

Personal Training From A Renowned Faculty.

Unlike the impersonal approach of large classroom study, CIE offers you one-on-one instructional help 6 days a week, toll-free. Each CIE lesson is authored by an independent specialist, backed by CIE instructors who work directly with you to answer your questions and provide technical assistance when you need it.

Practical Training... At Your Own Pace.

Through CIE, you can train for your new career while you keep your present job. Each course allows a generous completion time, and there are no limitations on how fast you can study. Should you already have some electronics experience, CIE offers several courses which start at the intermediate level.

"State-Of-The-Art" Facilities & Equipment.

In 1969, CIE pioneered the first electronics laboratory course, and in 1984, the first Microprocessor Laboratory. Today, no other home study school can match CIE's state-of-the-art equipment. And all your laboratory equipment is included in your tuition cost. There is no extra charge—it's yours to use while you study at home and on the job after you complete your course!

Earn Your Degree To Become A Professional In Electronics!

Every CIE course you take earns you credit towards the completion of your Associate in Applied Science Degree, so you can work towards your degree in

stages. And CIE is the only school that awards you for fast study, which can save you thousands of dollars in obtaining the same electronics education found in four-year Bachelor's Degree programs! Write for details today!

Send For Your Catalog Today!



CIE World Headquarters

Cleveland Institute of Electronics, Inc.
1776 East 17th St., Cleveland, Ohio 44114

YES! Please send me your independent study catalog (For your convenience, CIE will have a representative contact you—there is no obligation.)

Print Name _____

Address _____ Apt # _____

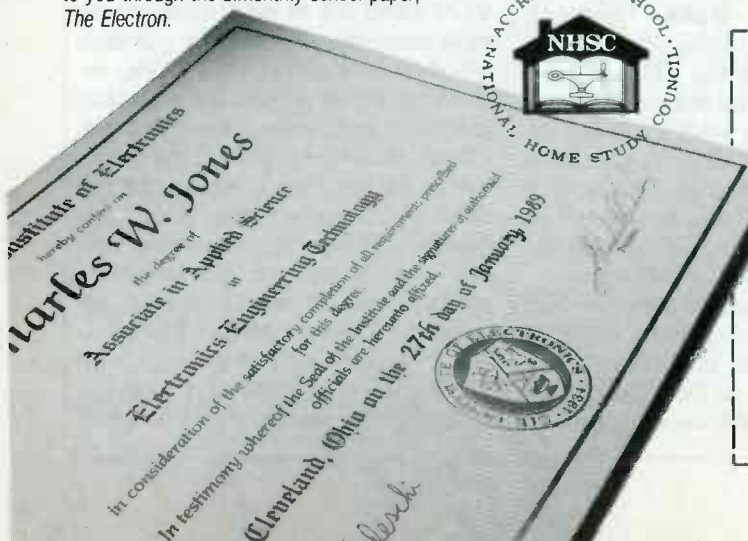
City/State/Zip _____

Age _____ Area Code/Phone No. _____

Check box for G.I. Bill bulletin on educational benefits: Veteran Active Duty

Mail This Coupon Today!

AE01



VIDEO NEWS

What's new in the fast-changing video industry.

DAVID LACHENBRUCH

• **Photo CD.** An electronic photo album combining the best features of film and video photography has been developed by Eastman Kodak and Philips and is promised for worldwide introduction in mid-1992. Photo CD is a system for storing home still color snapshots digitally on a standard five-inch compact disc for playback on any television set or for printing with full-film definition at any time. Under Kodak's plan, amateur photographers will take their negatives to their neighborhood processor, who will transfer them to a disc. One disc will hold up to 100 exposures. A basic disc with 24 pictures will cost less than \$20, according to Kodak, and that disc may be returned to add more pictures—up to 100. Storage of the pictures on the disc is basically a write-once CD-ROM process. Each disc will be packaged in a standard "jewelbox" container with an "index print" on the front cover—a page divided into 24 miniature color pictures showing the contents of the disc.

The player, which can also play audio CD's, is expected to sell for less than \$500. Unlike videotapes and laser videodiscs, the Photo CD is standards independent. Because the signals on the disc are digital, it can be played on any TV anywhere in the world. The system is claimed to have four times the resolution of the best high-definition TV proposed to date, or about 16 times the detail of today's TV systems. Philips says it will produce several models of Photo CD players, and Kodak says it hopes to license other manufacturers.

• **Closed Captions for All.** A bill passed by both the House and the Senate and awaiting President Bush's signature at our press time will add a new feature to most television sets made or imported after July 1, 1993. Although decoders have been available for many years to display the closed captions available on an increasing number of programs, all future TV sets with screens 13 inches and larger will have them built in. The

captions are on line 21 of the vertical blanking interval (VBI) between pictures, and are designed as an aid to the hearing impaired. They're also being hailed as a way to help foreign-speaking viewers learn English. The addition of the new feature is expected to add a few dollars to the cost of the set. The first manufacturer to introduce a wide range of closed-captioned sets is expected to be Zenith, which had planned to add the feature before the legislation was passed. Zenith, the only American manufacturer offering sets with built-in teletext, is expected to add the caption sets in 1991.

• **Program Chips.** Manufacturers of home video equipment must sit up many a night trying to figure out new products and features. The latest is a camcorder with ready-to-use programs. Canon's newest high-band 8mm (Hi8) camcorder is designed to accommodate both audio and video "program chips," which fit into slots on the side of the camcorder body. The graphic chips contain titles and simple automation—"Happy Birthday," "The End," and so forth. One chip, for example, includes an animated helicopter flying across the screen, pulling a banner on which the user may insert the title of his or her epic. The music chips contain electronically-generated ditties, which can be used as background accompaniment in three volume settings.

• **First HDTV Sets.** Thomson Consumer Electronics, the French firm that markets the RCA and GE brands in the United States, is scheduled to introduce what may well be the world's first mass-produced widescreen HDTV sets in Europe this month (January). The new sets will be ready for almost any TV system expected to be available in Europe.

The sets have a tube measuring 36 inches in overall diagonal in the 16:9 proportion, closer to Cinemascope dimensions than to the 4:3 of standard TV. They will be equipped to

display standard European PAL and SECAM broadcast transmissions in two ways—either in the standard proportions taking up only part of the screen, or "blown up" to fill the full screen (but sacrificing part of the top and bottom of the picture). They are equipped with built-in satellite receivers and can also display both standard and enhanced-definition (MAC) pictures to be transmitted from some European satellites, as well as "Wide MAC," a widescreen version of the enhanced-definition pictures. And when the new HD-MAC widescreen transmissions with 1,250 scanning lines are available, they will display them in full definition.

The sets are equipped with two tuners, and have a "picture-outside-picture" (POP) feature that displays three smaller pictures vertically to the right of a standard 4:3 picture on the wide tube. Those pictures can be a quick table of contents of channels available, or a sequence of snapshots from any program. In addition, the set is designed to enhance any standard European transmission by doubling the number of lines to 1,250, resulting in an IDTV (improved-definition) picture. The price for all this? The equivalent of about \$7,000 U.S., installed, including a 13-inch dish antenna for the upcoming high-powered European satellite transmissions.

• **Widescreen VCR.** A suitable companion to the Thomson widescreen TV set will be a widescreen VCR—and it's in sight. Standards have been developed for a compatible dual-dimension VHS video recorder that will record and play both standard and widescreen pictures. When recording widescreen pictures, the system compresses the data horizontally, expanding it on playback. Playback is automatic, with the recorder sensing the dimension of the picture on the tape and adjusting itself. The widescreen VCR system, developed by JVC and Thomson, is expected to be announced this year by JVC. **R-E**

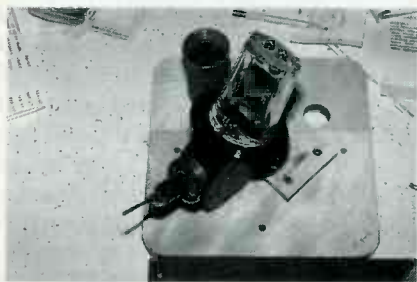
LETTERS

Write to Letters, Radio-Electronics,
500-B Bi-County Blvd., Farmingdale, NY 11735

MYSTERY MICROWAVE TUBE

I read with great interest about early attempts at microwave generation in Joseph Carr's article "Introduction to Microwave Electronics" (**Radio-Electronics**, June 1990). I acquired a strange tube, pictured here, that appears to be an old wartime military microwave tube. (Note the markings on the unit, and the fancy oak packing.) It doesn't seem to have enough external connections to be a klystron, and it has no magnets like a magnetron would. Is it from some early, secret radar unit, or from something much less glamorous, like a diathermy machine?

TOM SHERWOOD
Xenia, OH



The device pictured is a Type-2J22 magnetron, and was used in pulsed oscillators for radar units operating in the 10-cm microwave band (3.267 to 3.333 GHz). It was discussed at length in Volume 6 of the M.I.T. Radiation Laboratory Series on microwave and radar technology. Illustrations in the book depict the tube with the magnet and without it, as in your picture, and a schematic view. The 2J22 pictured here is complete except for the magnet, which indicates to me that it was a replacement part (the magnet remained with the equipment).—Joe Carr

CAD-PROGRAM KUDOS

Several months ago, **Radio-Electronics** had a short review of a computer-aided drafting program for electronic schematics, called Autoskem, from BSOFT Software. After reading the article, I bought a copy of the program and was pleasantly sur-

prised to find that my fifty dollars bought a full-featured CAD program fine-tuned for optimum use in making schematic designs. It comes with an extensive symbols library and allows you to edit symbols, create new ones, and create entire new symbol libraries. In addition, whole schematics or a section (text and all) can be saved as an object, to be called into other schematics as desired. The program is Microsoft-mouse compatible, and can save schematics to Hewlett-Packard Graphics Language (HPGL) format plotter files. It even includes a utility that allows you to print the HPGL files on a 24-pin dot-matrix printer. I highly recommend Autoskem to any IBM-PC-compatible user who needs an inexpensive, powerful schematics CAD program.

BRUCE O. YOUNG
Minot, ND

TESTING TAPE SPEED

I was very interested in Geoff Sale's letter concerning tape-deck speed calibration (**Letters, Radio-Electronics**, June 1990). My method is similar, and might interest other readers.

Not having a frequency meter, I built the frequency-to-voltage converter depicted in Fig. 1. Using a function generator set to about 1 kHz, I recorded a good-quality cassette on a very good cassette deck, monitoring the input frequency on the converter. At 1 kHz I got a reading of 6 volts. I then played the cassette back through the same machine, and got exactly 6 volts back. If it had not given the correct frequency I would have adjusted the motor speed accordingly—a high reading indicates too fast a tape speed, a low reading means too slow. The motor speed can be adjusted using either a built-in trimming potentiometer or an external one mounted on the PC board.

Record, play back, and adjust the motor speed until the playback voltage is exactly that of the function generator. Then record the whole tape; that will be your calibration tape.

It's no fluke.



Made in the U.S.A.

Building the best DMM for the money is no accident. The new RMS225 was carefully designed to give you what you wanted at a price you could afford. Visit your local distributor today and you'll agree the choice is obvious.

Fluke Model 77	Beckman Industrial RMS225
3-1/2 Digits	4 Digits
3,200 Counts	10,000 Counts
0.3% Accuracy	0.25% Accuracy
Touch Hold®	Probe Hold™
31 Segment Analog Bar Graph	41 Segment Analog Bar Graph
2,000 Hour Battery Life	1,000 Hour Battery Life
10A Range (Fused)	10A Range (Unfused)
Protective Holster	Protective Holster
3 Yr. Warranty	3 Yr. Warranty
—	True RMS
—	Auto Min Max™
—	Relative Mode
—	Self-Resetting Fuse (40mA Input)
\$159*	\$149

® Touch Hold is a registered trademark of the John Fluke Mfg. Co., Inc. *1990 Fluke and Philips Catalog

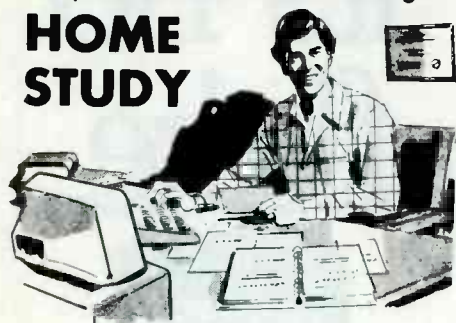
Beckman Industrial™
An Affiliate of Emerson Electric Co.

Instrumentation Products Division
3883 Ruffin Road, San Diego, CA 92123-1898
(619) 495-3200 • FAX (619) 268-0172 • TLX 249031
Outside California 1-800-854-2708 Within California 1-800-227-9781
© 1990 Beckman Industrial Corporation. Specifications subject to change without notice. Fluke is a registered trademark of John Fluke Mfg. Co., Inc.

JN190-01-091

CIRCLE 98 ON FREE INFORMATION CARD

Put Professional Knowledge and a
COLLEGE DEGREE
 in your Technical Career through
HOME STUDY



Add prestige and earning power to your technical career by earning your Associate or Bachelor degree through directed home study.

Grantham College of Engineering awards accredited degrees in **electronics and computers.**

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.

Grantham offers two degree programs—one with major emphasis in **electronics**, the other with major emphasis in **computers**. Associate and bachelor degrees are awarded in each program, and both programs are available completely by correspondence.

No commuting to class. Study at your own pace, while continuing on your present job. Learn from easy-to-understand lessons, with help from your Grantham instructors when you need it.

Write for our free catalog (see address below), or phone us at toll-free 1-800-955-2527 (for catalog requests only) and ask for our "degree catalog."

Accredited by
 the Accrediting Commission of the
 National Home Study Council

GRANTHAM
 College of Engineering
 Grantham College Road
 Slidell, LA 70460

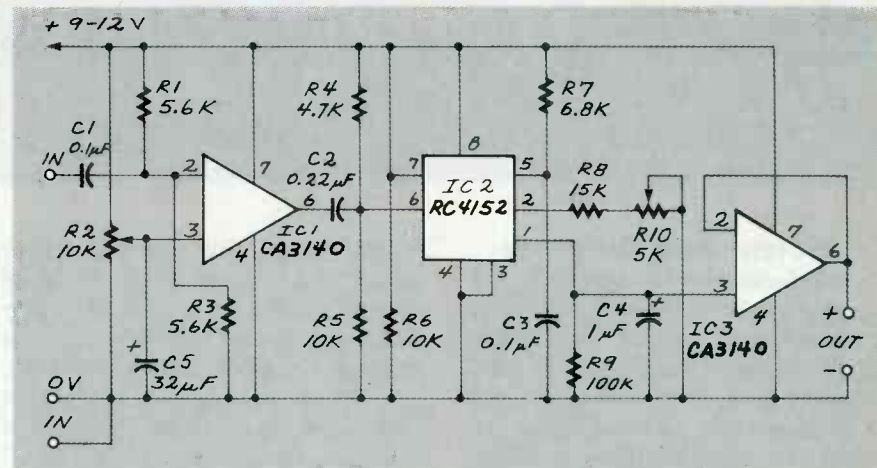


FIG. 1—CASSETTE MOTOR-SPEED CALIBRATOR. Set potentiometer R2 so that the potential at pin 2 of IC1 (the CA3140) is equal to that on pin 3. Careful adjustment will result in a sensitivity of 100 mV. Feed a frequency of ± 1000 Hz to the input ("IN") and use a DVM to measure the reading at the output ("OUT"). Set R10 to give a convenient reading.

The frequency-to-voltage converter can easily drive an analog instrument, which clearly indicates small variations in speed. The needle of the meter should be rock steady for a good drive mechanism.

I test a number of cassettes in the course of my work, and in the several years that I've used this frequency-to-voltage converter, I'd say that it is definitely better than a frequency counter.

By the way, I've been reading **Radio-Electronics** since the **Radio-Craft** days of the 1930's, and I think it's the best. Keep it up!

JOHNNY BRUYNS

Port Shepstone, South Africa

CLEANING VCR HEADS

After reading Larry Klein's response to Jo Anne Abbot's letter in the October 1990 issue of **Radio-Electronics**, I felt compelled to add to her statement whatever weight I could. As a Regional Support Representative for IBM for 30 years, I had many occasions to experience low-quality magnetic media (usually cheap diskettes). As advised by engineering and proved by countless field incidents, passing a *high-quality* media over the heads (i.e., formatting a couple of times, write/record for a few minutes) will clean them.

Ms. Abbot is correct in that high-quality tape or diskette manufacturers *do* put lubricant in the magnetic formulation that cheap media do not have. But it is the slightly abrasive quality of a *new* tape or diskette that cleans the head(s), and not the chemicals. After a few passes, the media

surface will polish down and lose most of its cleaning ability. The lubricants in the formulation are there to reduce head wear, nothing else.

Cheap media will plug the head gap as a result of low-quality binder in the oxide mix. With a cheap binder, the oxide particles easily break away from the media surface and get down into the gap. Remember that, as small as the gap is, the particles are much smaller yet, and easily fill the gap and coat the head. While Larry Klein might not have heard of Ms. Abbot's cleaning method, I can assure him that it does work—with high-quality, *new* tape or diskette media—and eliminates the need for treacherous cleaner tapes or diskettes.

JAMES W. BIGGER
 San Diego, CA

DESOLDERING IC's

Several letters relating to desoldering IC's have recently appeared here, and I'd like to present my technique. Use a "solder sucker" or desoldering braid. If the solder remaining has a frosty, lumpy appearance, put a little rosin flux on it and try again. After that, each contact will be over against one side of the circuit-board hole and bonded to the hole with a thin film of solder. Next, take a small screwdriver and push the stuck contact from one side of the hole to the other. The movement is small and hard to see, but you should feel and hear a slight "pop" when the film breaks. Do this to all contacts and pull the IC off; it works.

PAUL S. MCKIBBEN
 Lake Elizabeth, CA

R-E

ELENCO & HITACHI PRODUCTS AT DISCOUNT PRICES

NEW! RSOs (Real-Time & Storage Oscilloscopes) From HITACHI **NEW!**
The RSO - its the new solution
View, Acquire, Test, Transfer and Document Your Waveform Data

4-Channel, 100MS/s Model **Introductory Price**
100MS/s (25MS/s on 4 channels simultaneously), 100MHz, 4kw x 1ch., 2kw x 2ch., 1kw x 4ch. VC-6145 \$4,695.00

Compact, Full Feature Models
40MS/s, 100MHz, 4kw x 1ch., 2kw x 2ch. VC-6045 \$3,049.00
20MS/s, 50MHz, 2kw x 2ch. VC-6025 \$2,295.00

Low Cost/High Value Models
20MS/s, 50MHz, 2kw x 2ch. VC-6024 \$2,049.00
20MS/s, 20MHz, 2kw x 2ch. VC-6023 \$1,749.00

RSOs from Hitachi feature such functions as roll mode, averaging, save memory, smoothing, interpolation, pretriggering, cursor measurements, plotter interface, and RS-232C Interface. With the comfort of analog and the power of digital.



V-212
\$435
DC to 20MHz
Dual Channel
Hitachi Portable Scopes
DC to 50MHz, 2-Channel, DC offset
function, Alternate magnifier function
V-525 CRT Readout, Cursor Meas. \$1,025
V-523 Delayed Sweep \$995
V-522 Basic Model \$895

V-422 40MHz Dual Trace \$795

20MHz Elenco Oscilloscope



\$375
MO-1251
• Dual Trace
• Component Tester
• 6" CRT
• X-Y Operation
• TV Sync
• 2 p-1 Probes

FREE DMM
with purchase of
ANY SCOPE

SCOPE PROBES

P-1 65MHz, 1x, 10x \$19.95
P-2 100MHz, 1x, 10x \$23.95

Compact Series Scopes



Delayed Sweep
Lightweight (13lbs)
2mV Sens
3 Yr Warranty

Model V-1065
Shown

This series provides many new functions such as CRT Readout, Cursor measurements (V-1085/1065/665), Frequency Ctr (V-1085), Sweeptime Autoranging and Trigger Lock using a 6-inch CRT. You don't feel the compactness in terms of performance and operation.

V-660 60MHz Dual Trace \$1,195
V-665 60MHz Dual Trace w/Cursor \$1,345
V-1060 100MHz Dual Trace \$1,425
V-1065 100MHz Dual Trace w/Cursor \$1,695
V-1085 100MHz Quad Trace w/Cursor \$2,045
V-1100A 100MHz Quad Trace w/Cursor \$2,295
V-1150 150MHz Quad Trace w/Cursor \$2,775

Elenco 35MHz Dual Trace Good to 50MHz



\$495
MO-1252

- High Luminance 6" CRT
- 1mV Sensitivity
- 6KV Acceleration Voltage
- 10ns Rise Time
- X-Y Operation - Z Axis
- Delayed Triggering Sweep
- Includes 2 P-1 Probes

All scopes include probes, schematics, operators manual, and 3 year (2 yrs for Elenco scopes) world wide warranty on parts & labor. Many accessories available for all Hitachi scopes. Call or write for complete specifications on these and many other fine oscilloscopes.

WE NOW CARRY COMPLETE LINE OF FLUKE MULTIMETERS Models

- 21F 83
- 23F 85
- 25F 87
- 27F 8050A
- 73 8060A
- 75 8062A
- 77F + More

CALL FOR SPECIAL PRICING

True RMS 4 1/2 Digit Multimeter M-7000
\$135
.05% DC Accuracy
.1% Resistance
with Freq. Counter and deluxe case

10 Function Multimeter CM-365
\$65
AC + DC Voltage & Amps
Resistance to 2000MΩ
Diode, Logic, & Trans test
Capacitance to 200uF

Digital Capacitance Meter CM-1550
\$58.95
9 Ranges
.1pf-20,000uF
.5% basic acy
Zero control
with case

Digital LCR Meter LC-1801
\$125
Measures:
Coils 1uH-200H
Caps .1pf-200uF
Res. .01-20M

Function Generator Blox #9600
\$28.95

Provides sine, triangle, square wave from 1Hz to 1MHz AM or FM capability

Triple Power Supply XP-620
Assembled \$65
Kit \$45
2 to 15V at 1A,
-2 to -15V at 1A
(or 4 to 30V at 1A)
and 5V at 3A

Contains all the desired features for doing experiments. Features short circuit protection, all supplies.

Wide Band Signal Generators SG-9000
\$129

RF Freq 100K-450MHz
AM Modulation of 1KHz
Variable RF output
SG-9500 w Digital Display and 150MHz built-in Counter \$249

AC Current Meter ST-1010
\$69.95
1000 Amps
Data & Peak hold
8 Functions
Deluxe Case

Decade Blox #9610 or #9620
\$18.95
#9610 Resistor Blox
47 ohm to 1M & 100K pot
#9620 Capacitor Blox
47pf to 10MFD

Quad Power Supply XP-580
\$59.95
2-20V at 2A
12V at 1A
5V at 3A
-5V at .5A
Fully regulated and short circuit protected
XP-575 without meters \$39.95

LEARN TO BUILD AND PROGRAM COMPUTERS WITH THIS KIT!
INCLUDES: All Parts, Assembly and Lesson Manual
Model 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. You will write the Initial Instructions to tell the 8085 processor to get started and store these instructions in permanent memory in a 2816 EPROM. Teaches you all about input and output ports, computer timers. Build your own keyboard and learn how to scan keyboard and display. No previous computer knowledge required. Simple easy to understand instruction teaches you to write in machine language.
ROBOTICS KIT FOR ABOVE (MM-8010) \$71.95

Digital Triple Power Supply XP-765
\$249
0-20V at 1A
0-20V at 1A
5V at 5A
Fully regulated, Short circuit protected with 2 limit control, 3 separate supplies
XP-660 with Analog Meters \$175

GF-8016 Function Generator with Freq. Counter
\$249
Sine, Square, Triangle
Pulse, Ramp, 2 to 2MHz
Freq Counter .1 - 10MHz
GF-8015 without Freq. Meter \$179

WE WILL NOT BE UNDERSOLD!
UPS Shipping: 48 States 5%
(\$10 Max) IL Res., 7% Tax

C & S SALES INC.
1245 Rosewood, Deerfield, IL 60015
(800) 292-7711 (708) 541-0710

15 Day Money Back Guarantee
2 Year Warranty Prices subject to change
WRITE FOR FREE CATALOG

CIRCLE 109 ON FREE INFORMATION CARD

EQUIPMENT REPORTS

Global Specialties Protolab

Electronics can be a very rewarding career. Of course, it takes some work to get there—anything worthwhile does. But while we have nothing against the hard work and studying that is required to earn a degree, anything that makes the work more efficient is a godsend.

We recently found such a godsend: *Protolab* from Global Specialties (70 Fulton Terrace, New Haven, CT 06512). *Protolab* is an DC/AC Circuit Analysis Program that turns your PC into a computer-simulated electronics laboratory. With *Protolab*, you can build circuits and examine their behavior with test equipment. It gives you the advantage of having unlimited parts and all the test equipment you'll need—without the worry that you'll blow up your lab.

Protolab requires an IBM PC (or compatible computer) with at least 384K of RAM, a mouse, and a CGA display. (Unfortunately, the Hercules graphics adapter is not supported.) A separate version supports Macintosh computers.

Students who are studying circuit

Turn your computer into a DC and AC circuit simulation tool



CIRCLE 10 ON FREE INFORMATION CARD

analysis should find the *Protolab* to be an ideal supplement to their classroom and laboratory instruction. (We'd also expect many schools to use the program as part of their course work, since it can eliminate the need for buying some test equip-

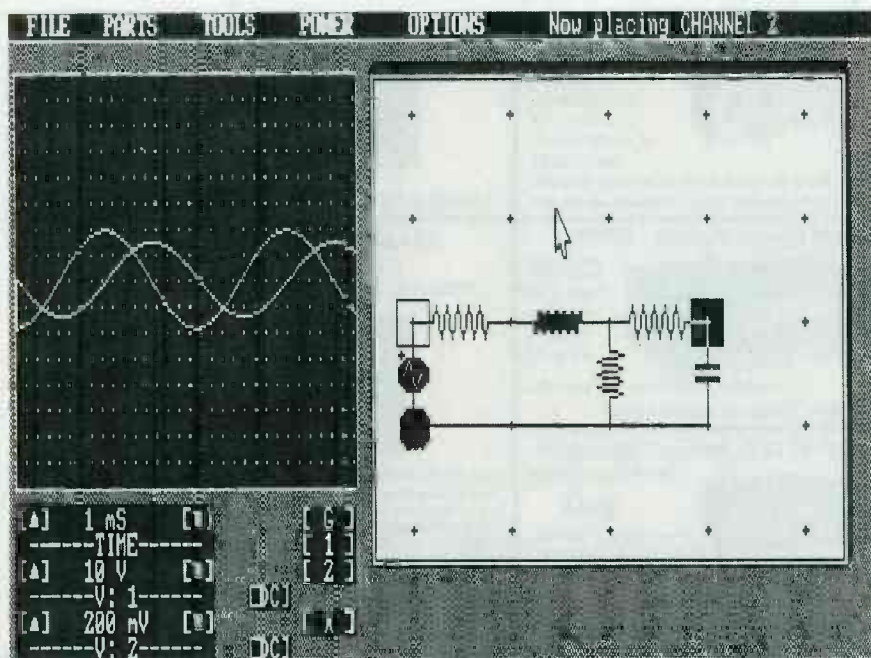
ment.) Topics that are covered in the laboratory manual include DC series and parallel circuits, voltage dividers, temperature effects, superposition, polyphase systems, Delta-Wye conversion, phasor mathematics, resonance in tuned circuits, and other topics typically covered in the sophomore year of an electrical engineering or technology program.

The *Protolab* screen is broken into two main sections: the circuit construction board and the test-equipment window. Most interaction with the program is done with the mouse, except for numerical component values which are entered by using the keyboard.

For example, to build a circuit, you would click the mouse on the mouse-command line over the word PARTS. A pull-down menu lets you select the part you want to place—resistors, capacitors, inductors, impedances, wires, and AC/DC voltage and current sources are available.

To place the component or source, you simply move to the appropriate place, and click the mouse. You're then asked for the part's parameters, for example, a coil's inductance and

continued on page 82



THIS EXAMPLE SHOWS THE OSCILLOSCOPE making measurements of the RLC circuit on the right.

OFF THE BENCH AND RUNNING

When OPTOELECTRONICS took frequency counters off the bench we created a whole new dimension - Frequency Finding.

Our Handi-Counters™ make Frequency Finding a reality by allowing you to pick-up radio transmitters at the maximum possible distance.

Monitoring Enthusiast, Security Specialists, Broadcast and Design Engineers, Two Way and Amateur Radio Operators and Service Technicians have all made the move. *Shouldn't you?*



3000
Top of the Line Universal
Handi-Counter™.
\$375.



2600
Super Sensitive RF
Frequency Finder.
\$325.



2210A
Full Range
Pocket
Size LED.
\$239.



8030
Bench Portable (Fits in an attache
case) with ALL the Handi-Counter™
Features plus More. \$579.



1300H/A
Low Cost Ultra
Sensitive (HF,
UHF, VHF).
\$179.

Model	Range Low High	Display 8 Digit LED	Display 10 Digit .CD	Signal Strength Bargraph	Universal Counter	TCXO Option
8030	10Hz 2.4GHz		•	•	•	± .1ppm add \$125.
3000	10Hz 2.4GHz		•	•	•	± 2ppm add \$ 80.
2600	1MHz 2.4GHz		•	•	•	± 2ppm add \$ 80.
2210A	10Hz 2.4GHz	•				± 5ppm add \$ 75.
1300H/A	1MHz 3GHz	•				± 5ppm add \$ 75.

Sensitivity: < 1 to <10mV typical. NiCads & AC Charger/Adapter included. Carry Case, Antennas and Probes extra. One year parts & labor warranty on all products.

OPTOELECTRONICS

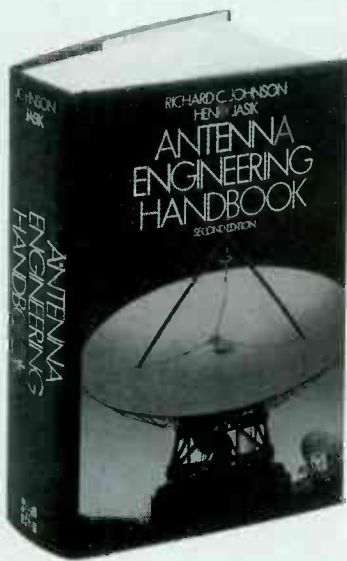
**Toll Free Order Line:
1-800-327-5912**

**In Florida call (305)771-2050
FAX (305)771-2052**

5821 NE 14th Avenue • Ft. Lauderdale, FL 33334
Visa, MC, COD, Cash, M.O. accepted. Personal
Check allow 3 weeks. 5% Shipping, Handling,
(Maximum \$10) U.S. & Canada. 15% outside
continental U.S.A.

Take any one of these HANDBOOKS ELECTRONICS and CONTROL

- your one source for engineering books from over 100 different publishers
- the latest and best information in your field
- discounts of up to 40% off publishers' list prices



322/910

Publisher's Price \$119.50

ANTENNA ENGINEERING HANDBOOK, Second Edition

Edited by R. C. Johnson and H. Jasik

- 1,408 pages, 946 illustrations
- covers all types of antennas currently in use with a separate chapter devoted to each
- provides detailed data on physical fundamentals, operating principles, design techniques, and performance data
- up-to-the-minute information on antenna applications
- a must for those involved in any phase of antenna engineering

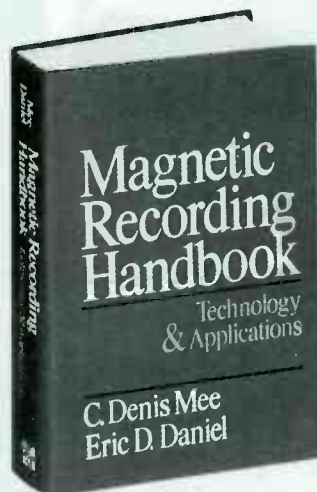
Publisher's Price \$94.50

MAGNETIC RECORDING HANDBOOK

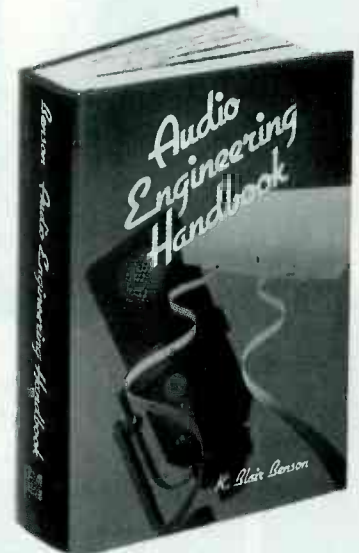
Technology and Applications

Edited by C.D. Mee and E.D. Daniel

- 1,100 pages, 400 illustrations
- the most comprehensive reference available on all aspects of magnetic recording technology
- features contributions from 25 international experts
- includes coverage of error correction coding and magneto-optical recording



412/74X



047/774

Publisher's Price \$86.95

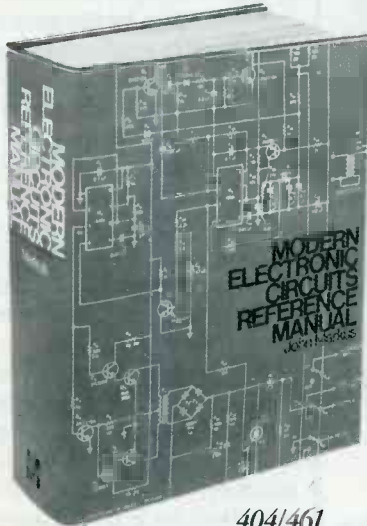
AUDIO ENGINEERING HANDBOOK

Edited by K.B. Benson

- 1,056 pages, 722 illustrations
- the ideal on-the-job reference for all designers, operators, and servicers of professional and consumer audio equipment
- a one-volume source of fundamentals and how-to information encompassing all aspects of audio engineering
- coverage includes DSP, CDs, DAT, and noise reduction developments
- contributors include Ray Dolby, R.C. Cabot, and many more

for only \$14.95 — when you join the ENGINEERS' BOOK CLUB

values up to \$119.50



404/461

Publisher's Price \$94.95

MODERN ELECTRONIC CIRCUITS REFERENCE MANUAL

By J. T. Markus

- 1,264 pages, 3,666 circuit diagrams
- a handy, desktop reference with 103 chapters organized by "family" grouping
- filled with predesigned and use-tested circuits to save you production time and money
- includes concise summaries of all the recent applications notes, journal articles, and reports on each circuit, efficiently organized and indexed for the practicing engineer

4 reasons to join today!



1. Best and newest books from ALL publishers! Books are selected from a wide range of publishers by expert editors and consultants to give you continuing access to the best and latest books in your field.

2. Big savings! Build your library and save money, too! Savings range up to 40% off publishers' list prices.

3. Bonus books! You will automatically be eligible to participate in our Bonus Book Plan that allows you savings up to 70% off the publishers' prices of many professional and general interest books!

4. Convenience! 14-16 times a year (about once every 3-4 weeks) you receive the Club Bulletin FREE. It fully describes the Main Selection and alternate selections. A dated Reply Card is included. If you want the Main Selection, you simply do nothing — it will be shipped automatically. If you want an alternate selection — or no book at all — you simply indicate it on the Reply Card and return it by the date specified. You will have at least 10 days to decide. If, because of late delivery of the Bulletin you receive a Main Selection you do not want, you may return it for credit at the Club's expense.

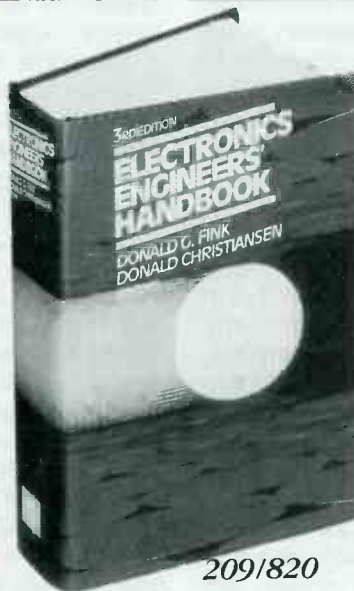
As a Club member you agree only to the purchase of two additional books during your first year of membership. Membership may be discontinued by either you or the Club at any time after you have purchased the two additional books.

Publisher's Price \$89.95

ELECTRONICS ENGINEERS' HANDBOOK, Third Edition

Edited by D. G. Fink and D. Christiansen

- 2,496 pages, 1,600 illustrations
- the definitive reference to electronics engineering
- fully updated to cover all recent advances and developments
- ranges from essential principles and data to the latest design solutions and practical applications — with an all-new chapter on standards
- written and compiled by more than 170 contributors — all experts in their fields



209/820

McGraw-Hill Book Clubs
Electronics and Control Engineers' Book Club®
 P.O. Box 582
 Hightstown, NJ 08520-9959

Please enroll me as a member of the Electronics and Control Engineers' Book Club® and send me the book I have chosen for only \$14.95 plus local tax, postage and handling. I agree to purchase a minimum of two additional books during my first year as outlined under the Club plan described in this ad. Membership in the club is cancellable by me or McGraw-Hill any time after the two book purchase requirement has been fulfilled. A shipping and handling charge is added to all shipments.

I wish to order the following book:

- ANTENNA ENGINEERING HANDBOOK (322/910)
- MODERN ELECTRONIC CIRCUITS REFERENCE MANUAL (404/461)
- ELECTRONICS ENGINEERS' HANDBOOK, 3/e (209/820)
- AUDIO ENGINEERING HANDBOOK (047/774)
- MAGNETIC RECORDING HANDBOOK (412/74X)

Signature _____

Name _____

Address/Apt. # _____

City/State/Zip _____

This order subject to acceptance by McGraw-Hill. Offer good only to new members. Foreign member acceptance subject to special conditions.

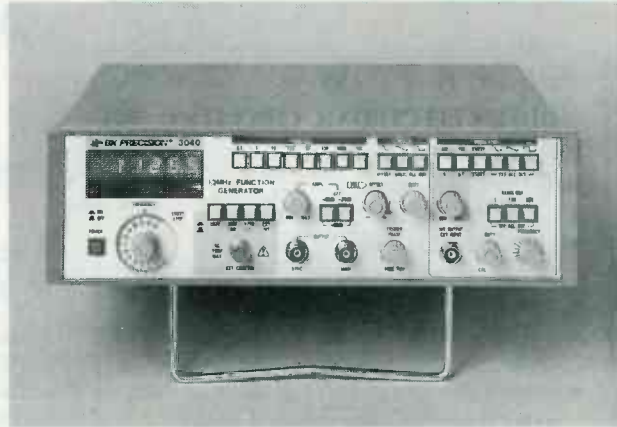
ECGA-043

NEW PRODUCTS

Use the Free Information Card for more details on these products.

UNIVERSAL FUNCTION GENERATOR.

Providing the higher frequencies and greater versatility required to evaluate high-speed electronic systems, *B&K-Precision's* model 3040 13-MHz universal function generator with frequency counter is designed for use in R&D, production testing, service and repairs, and education. It offers a 0.1-Hz to 13-MHz main generator range with a digital frequency display and provides sine, square, triangle, ramp, and pulse waves; TTL outputs; and AM and FM modulated signals. The second generator range, from 0.1 Hz to 10 kHz, can be used as a modulation source, sweep source, gating source, or independently. The second generator provides sine, square,



CIRCLE 30 ON FREE INFORMATION CARD

triangle, ramp, and pulse signals. An internal/external 6-digit frequency counter measures signals to 30 MHz. The model 3040 has internal/external AM and FM modulation and sweep generator capabilities. It provides triggered and

gated, single or multiple operations and two simultaneous outputs.

The model 3040 13-MHz function generator costs \$1,195.00—**B&K-Precision**, 6470 West Cortland Street, Chicago, IL 60635; Tel: 312-889-1448.

POCKET INFO PAC. The battery-powered *Pocket Info Pac*, which measures 1¾ x 4 x 8¾ inches and weighs just over one pound, lets users access images and scroll through electronic pages, much like reading a book, by simply pressing a series of three or four buttons on a touch pad, or through menu options. Using the innovative *Private Eye* ultra-miniature

virtual display from *Reflection Technology (Radio-Electronics, February, 1990)* as its display, *Colby Systems' Pocket Info Pac* gives users instant access to any one of thousands of images. The high-capacity, handheld information-storage and -retrieval system lets users download, access, and control text and graphics using a built-in touch pad.

The *Private Eye*, although it weighs only 2.26 ounces and fits in the palm of a hand, allows users to view high-resolution images as a full 12-inch, 720 x 280-pixel image. The data is downloaded via a serial port from a Macintosh or MS-DOS-compatible computer and can be

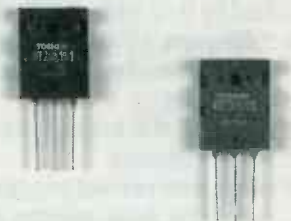
updated or changed according to the user's needs. The device can be configured with 1MB of standard memory or up to 16MB of optional memory, and is available with EPROM, STATIC RAM, or PSEUDO-STATIC RAM internal add-on memory. Also available are the plug-in *Colby Magic Memory Module* and *COLBYCARD* memory units.

The *Pocket Info Pac* costs between \$899.00 and \$2999.00, depending on the type of memory.—**Colby Systems Corporation**, 2991 Alexis Drive, Palo Alto, CA 94304; Tel: 415-941-9090.

AUDIO POWER TRANSISTORS. Three lines of audio power transistors

from *Toshiba*, targeted at the U.S. power-amplifier market, are engineered with good noise linearity for low THD and low intermodulated distortion. Three audio product types—IGBT, MOSFET, and bipolar—are represented to provide performance and price options; all three meet class A and class AB power-amplifier standards.

The IGBT power transistors (pictured) include the 250-volt, 20-amp *GT20D101* and the complementary *GT20D201* that feature high forward transfer admittance, low saturation voltage, high input impedance, and an enhancement mode. The complementary P-channel/N-channel MOSFET pairs



CIRCLE 12 ON FREE INFORMATION CARD

feature high forward transfer admittance, low ON impedance, and high-frequency operation. They provide optimal low switching distortion for the highest frequency response in high-end power amplifiers. The MOSFET pairs include the 18-volt, 10-amp *2SK1529* and *2SJ200*; the 200-volt, 12-amp *2SK1530* and *2SJ201*. The bipolar audio power transistors are high-voltage, high-current complementary NPN/PNP devices optimized for low-power dissipation and

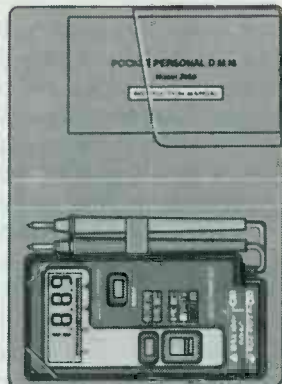


CIRCLE 11 ON FREE INFORMATION CARD

lower cost per watt of output power in audio power-amplifier applications. The bipolar 2SA1553/2SC4029 pairs are fabricated in TO-3P(L) packages, as are the IGBT transistors. The MOSFET's are packaged in TO-3P(N) packages.

In quantities of 500, the IGBT power transistors range in price from \$5.30 to \$5.70 each, the MOSFET's range from \$3.50 to \$4.00 each, and the bipolar transistors from \$1.70 to \$2.10.—**Toshiba America Electronic Components Inc.**, 9775 Toledo Way, Irvine, CA 92718.

POCKET PERSONAL DMM. About the size of a slim pocket calculator (2 x 4 x 3/8 inches), *Techni-Tool's Personal DMM Meter (#393TE060)* offers easy one-hand operation. The compact unit features



CIRCLE 13 ON FREE INFORMATION CARD

a high-speed auto-ranging and sample rate for bargraph display and an operating range from 0°C to 40°C, with maximum 80% RH. An automatic power-off function increases battery life to 250 hours. The DMM comes in a protective folding case, and weighs only 100 grams including the meter case and batteries.

The *Personal DMM Meter* has a suggested

price of \$49.95.—**Techni-Tool, Inc.**, 5 Apollo Road, P.O. Box 368, Plymouth Meeting, PA 92462; Tel: 215-825-4990; Fax: 215-828-5623.

BENCH/PORTABLE COUNTER/TIMER. For portable as well as bench-top use, *Optoelectronics' model UTC 8030* is both a full-featured, 3-GHz bench-top counter and a self-contained portable frequency finder that can be outfitted with its own batteries, antenna pack, and backlit readout for field work.



CIRCLE 14 ON FREE INFORMATION CARD

As a counter-timer, the instrument makes direct and prescaled frequency, period, and time-interval measurements and calculates and displays frequency ratios. The *UTC 8030* provides 1-mV sensitivity, 1-PPM accuracy, 1-Hz resolution, and a 1-Hz to 3-GHz range. A display-hold feature makes it easy to record 10-place frequency readings. An external reference jack is provided for more accurate lab reference clocks. The unit offers signal-conditioning controls. A variable trigger control eliminates jitter and a 6-dB/octave low-pass filter and a switchable 20-dB attenuator allow the user to filter out noise.

As a portable frequency finder, the *UTC 8030* has a 10-Hz to 2400-MHz dynamic operating range, and 1-mV sensitivity up to 500-MHz. It features a 16-segment signal-strength bar

Train at Home to be an Electronics Technician!

Professional training and equipment can help you qualify for a dynamic, high-paying career in your spare time.

As the demand for computers and microprocessors in business and manufacturing continues to grow, so does the need for qualified technicians. It's not unusual for experienced technicians to earn from \$35,000 to more than \$40,000 a year.* Now there's a way you can train for this exciting field without interrupting your job or home life.

Choose From These Programs of Study

- Electronics & Microprocessor Technology
- Industrial Electronics & Microprocessor Technology
- Computer Servicing & Electronics Technology
- Specialized Associate Degree In Electronics Technology

You Get Professional Equipment For Professional Training

Depending on the program you select, you'll perfect your skills using this advanced equipment, included in the price of tuition:

- IBM-Compatible Personal Computer
- Digital Multimeter
- Digital Logic Probe
- Elenco Oscilloscope

Exclusive Extras That Enhance Your Training

Peoples College introduces some training firsts to make your learning experience more complete:

- Accelerated Learning System — a scientifically proven study system that lets you learn faster and easier than ever before.
- Optional One-Week Seminar — available with our advanced programs. Conducted on our campus near Orlando, Fla. Not required for graduation, but a valuable opportunity to fine tune your skills with personal guidance.
- Video Tutor Training Tapes — give you a permanent, visual record of informative lectures and close-up demonstrations.
- Experience Labs — professionally designed experiments that give you hands-on "bench" experience.
- Industry Certification Training Guide — provided with three of our programs. Gives you first-hand insight into the examination you may take for your professional license.



For COLOR CATALOG Mail Coupon or Call TOLL FREE

1-800-765-7247

Programs offered only in United States, Canada, Puerto Rico and Virgin Islands. No Obligation. No sales person will call.

Our programs are accredited by the Accrediting Commission of the National Home Study Council

YES! I would like to know more about your training programs. Send a catalog to:

Name _____
Address _____
City _____
State _____ Zip _____

PEOPLES COLLEGE
OF INDEPENDENT STUDIES
233 Academy Drive • P.O. Box 421768
Kissimmee, FL 34742-1768
Member, D.I., Peoples Group R0191

(* Source: U.S. Bureau of Labor Statistics)

graph, augmented by an audio annunciator that beeps faster as signal strength increases.

The UTC 8030 universal counter/timer costs \$579.00. Options include a ± 0.1 PPM time base (\$125), a Ni-Cd battery pack (\$75), and an LCD backlight (\$40).—**Optoelectronics, Inc.**, 5821 NE 14th Avenue, Ft. Lauderdale, FL 33334; Tel: 800-327-5912 or 305-771-2050; Fax: 305-771-2025.

UPS-BATTERY TESTER. For testing lead-acid batteries—including the maintenance-free types such as sealed, recombination, and gel cells that are commonly used with standby, uninterruptible, and back-up power supplies—*Performance Technological Products* has introduced the model 1200 universal 12-volt battery tester. The bat-



CIRCLE 15 ON FREE INFORMATION CARD

teries can be tested when series-connected with each other, and even while they are actively being charged. The device allows the user to log gradual changes in battery condition as they occur, providing a useful history for preventative maintenance. By subjecting the battery to an 80-amp electronic load for 10 seconds, the device can indicate whether the battery is "good," "weak," or "bad." Test results are easy to in-

terpret; by simply clipping the tester to a battery, the LCD indicators display the status. Pin jacks on the model 1200 accommodate an auxiliary voltmeter, which allows precise measurements during testing.

The model 1200 battery tester, with 12-inch leads and copper-plated, color-coded steel clips, costs \$194.70.—**Performance Technological Products**, P.O. Box 947, Roswell, GA 30077.

COAX ADAPTER-CONNECTOR KIT. Containing 24 connectors and six universal interfaces, *Test Probes, Inc.'s TPI 3000A Kit* lets users quickly and easily create any adapter by screwing any combination of two connectors to one of the interfaces. Because no soldering or crimping is required, the connectors can be used repeatedly. Included are two male and



CIRCLE 16 ON FREE INFORMATION CARD

female connectors of the BNC, N, UHF, and TNC adapters; one male and female of the SMA, mini-UHF, F, and RCA adapters; and six universal interfaces. The male and female connectors have gold-plated contacts, Teflon insulation, and machined-brass silver-plated connector bodies. Universal adapter cables are available separately, as are spare individual pieces. The kit comes in a soft-leather case that organizes the collection.

CABLE - TV

SIGNAL REMOVERS

- FOR ELIMINATION OF SEVERE INTERFERENCE
- FOR 'CENSORING' OF ADULT BROADCASTS



FOR FULL DESCRIPTION OF USES ask for our free brochure

- ATTENUATION - 45 dB TYPICAL
- BANDWIDTH - 4 MHz AT 5 dB POINTS
- INSERTION LOSS - 2 dB

MODEL	TUNING RANGE	FOR CHANNELS	PASSBAND	PRICE	SHIPPING
23H	50-66 MHz	2,3 (or 6 meter ham)	50-300 MHz	\$30	NO SHIPPING or C.O.D. CHARGES
46FM	66-108 MHz	4,5,6 (or any FM)	50-300 MHz	\$30	
1417	120-144 MHz	*4(A) 15(B) 16 (C) 17 (D)	50-400 MHz	\$30	
1822	144-174 MHz	18(E) 19(F) 20(G) 21(H) 22 (I)	50-400 MHz	\$30	
713	174-216 MHz	7,8,9,10,11,12,13	50-400 MHz	\$30	

3 for \$75 - 10 for \$200 - mix or match

CALL TOLL FREE FOR C.O.D. OR SEND CHECK TO ORDER
FAST DELIVERY
30 DAY MONEY BACK GUARANTEE (3 FILTER LIMIT)

Star Circuits
P. O. Box 94917
Las Vegas, NV 89193-4917
1-800-433-6319

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. 90
P.O. Box 2824, San Francisco, CA 94126
Please rush FREE details immediately!

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

Try the

Radio Electronics

bulletin board system

(RE-BBS)
516-293-2283

The more you use it the more useful it becomes.

We support 300 and 1200 baud operation.

Parameters: 8N1 (8 data bits, no parity, 1 stop bit) or 7E1 (7 data bits, even parity, 1 stop bit).

Add yourself to our user files to increase your access.

Communicate with other R-E readers.

Leave your comments on R-E with the SYSOP.

RE-BBS
516-293-2283

A Shocking Offer!

Now for the first time in CIE's 56 year history you do not have to be enrolled at CIE to receive our introductory Electronic and Electricity Lesson Modules. Available for a limited time to non-students for the shockingly low price of only \$99.50.

With CIE's patented AUTO-PROGRAMMED method of learning you'll quickly learn and then master the basics of electronics and electricity and then move on to... DC/AC circuit theories, fundamentals of bi-polar junction transistors (BJT), field effect transistors (FET), wiring, diagram and schematic readings, component identification, soldering techniques... and much, much, more.

Your commitment to CIE ends with your payment, but CIE's commitment to your success just begins when you receive your

39 lessons, exams, binders and equipment. This special introductory price includes all the benefits and assistance CIE normally extends to its students and graduates. You'll be entitled to unlimited access to CIE's faculty and staff to assist you in your studies via a toll free 800 number six days a week, 24-hour turnaround on grading your submitted exams, CIE Bookstore privileges, a patented learning method, reference library, a student, faculty

and alumni electronic bulletin board and a free issue of CIE's school newspaper The Electron. All this knowledge and support will put you on the road to understanding digital electronics, microprocessing principles, computer systems, telecommunications, and much, much, more.



**All This and Much More
For ONLY!**

\$99.50

- Free Issue of The Electron
- Build your personal burglar alarm
- Instructors available 6 days a week
- 20 lesson books containing 39 theory and hands-on training lessons and exams.

- Bookstore Privileges
- Patented Learning Method
- Electronic Bulletin Board
- 24-Hour Grading

Yes, send me CIE's 39 Introductory Electronic and Electricity Lessons and Equipment.

Name: _____

Address: _____

City: _____ Apt. #: _____

State: _____ Zip: _____

Age: _____ Phone (_____) _____

Total Merchandise: \$99.50

Ohio Residents add 7% Sales Tax: _____

California Residents add 6-1/2% Sales Tax: _____

Total this order: _____

Method of Payment: Amount Enclosed . . . \$ _____

Personal Check or Money Order

Master Card Visa

□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

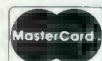
Card Expiration Date: _____

Signature _____



BOOKSTORE
1776 East 17th Street
Cleveland, Ohio 44114
(216) 781-9400

BK03



CHARGE BY PHONE!



9 AM to 4:30 PM Eastern Time; from Ohio 1-800-523-9109
from all other states 1-800-321-2155

The *TPI 3000A* coaxial adapter/connector kit costs \$150.00.—**Test Probes, Inc.**, 9178 Brown Deer Road, San Diego, CA 92121; Tel: 800-368-5719.

PORTABLE RESISTIVITY METER. For static control, *ACL's #475* meter is designed to provide fast, repeatable, comparative measurements of surface resistivity. The easy-to-use instrument has no cables or probes to adjust, and offers automatic ranging from 10^4 to 10^{14} ohms per square. Accurate to $\pm 1/2$ decade, the meter conve-



CIRCLE 17 ON FREE INFORMATION CARD

niently checks resistivity specifications for static-control products such as anti-static bags, static-dissipative mats, and conductive work surfaces. The rugged, portable meter comes with a leather carrying case and a rechargeable battery with a 115-VAC adapter/charger that provides 4–8 hours of steady operating time.

The #475 portable surface resistivity meter has a suggested price of \$825.00.—**ACL Incorporated**, 1960 East Devon Avenue, Elk Grove Village, IL 60007; Tel: 708-981-9212.

FREQUENCY-LOGGING/-ANALYSIS SYSTEM. Designed for stand-alone, unattended frequency monitoring and logging in Wide FM, Narrow FM,

AM, or single-sideband frequencies, a complete package from *ACE Communications* consists of a receiver that covers 100 kHz to 2036 MHz, plus control software and serial-interface hardware. The computer-driven system offers two basic types of



CIRCLE 18 ON FREE INFORMATION CARD

analysis and logging functions. In one, a spectrum-analyzer-type display shows "spikes" of received frequencies vertically ranked by signal strength, with the horizontal axis representing the radio frequencies being received.

The display can either be viewed on a screen or output to a dot-matrix or laser printer. The other, tabular, method lists active calls by frequency, signal strength, date, and time. It even keys the call to a tape recording of the audio portion of the radio transmission. Tabular data also can be printed or stored to disk. The RS232C serial interface allows remote operation and provides future expansion capabilities. A 4800-baud transfer rate is supported.

The frequency-logging and -analysis system has a suggested retail price of \$1,290.00.—**Ace Communications**, Monitor Division, 10707 East 106th Street, Indianapolis, IN 46256; Tel: 800-445-7717; Fax: 800-448-1084.

PULSE GENERATORS. Built-in CRT displays enhance the flexibility and ease-of-use offered by *Tektronix's PG2010* family

of pulse generators. The displays provide instant access to pulse-parameter information and show the timing relationships between the two channels and the pulse edges—without the user having to deal with an array of knobs and buttons. Each of the pulse generators provide menu-driven set up and built-in calibration, selectable from the Utility Menu, for enhanced accuracy. The 50-MHz pulse generators provide 250-ps transitions and programmability in portable packages that can be used with benchtop oscilloscopes or logic analyzers.

The instruments cover applications from general-purpose analog design



CIRCLE 19 ON FREE INFORMATION CARD

through high-speed digital applications, and all pulse parameters can be controlled over wide ranges. Pulse period is adjustable from 20 ns to 10 seconds ($\pm 1\%$ of setting ± 1 ns) with 100-ps resolution. Delay and width are also adjustable with 100-ps resolution over ranges of 0.0 ns to 9.89990 seconds and 10 ns to 9.9 seconds, respectively. Each pulse generator also has a double-pulse mode and DC-50-MHz external trigger and gate input capabilities, as well as a counted-burst capability for 2–999,999 cycles per burst.

The *PG 2010* family provides a mix of available output levels and pulse-transition times. The *PG 2010* provides an adjustable output level to 2.5 volts p-p into 50 ohms within a

± 2.5 -volt window, and selectable transition times of 250 ps, 700 ps, and 1.8 ns. The *PG 2011* provides an adjustable output level to 10 volts p-p into 50 ohms within a ± 10 -volt window and transition times adjustable from 5.5 ns to 10 ms. The *PG 2011's* rise and fall transitions can be set together or independently. The *PG 2012* contains two pulse channels; one is equivalent to a *PG 2010* and the other is equivalent to a *PG 2011*.

Prices for the *PG 2010*, *PG 2011*, and *PG 2012* pulse generators range in price, depending on model and options ordered, from \$6,950 to \$12,900.—**Tektronix, Inc.**, P.O. Box 19638, Portland, OR 97219-0638, Attention: 65W; Tel: 800-426-2200.

PROGRAMMABLE ATTENUATOR. *Pasternack Enterprises' model PE7011-3A* is a 50-ohm programmable coaxial attenuator with an attenuation range of 0–60-dB steps, designed for DC to 1,000 MHz. The unit has a $1/2$ -watt average power handling capability, with 50



CIRCLE 20 ON FREE INFORMATION CARD

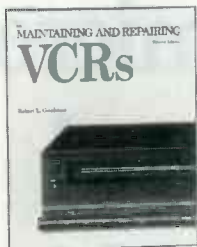
watts peak. Its switching time is 15 milliseconds, and its operating voltage is +12 VDC at 45 mA per step maximum. Connectors are SMA female.

In 100-piece quantities, the *PE7011-3A* programmable attenuator costs \$168.00 each.—**Pasternack Enterprises**, P.O. Box 16759, Irvine, CA 92713-6759; Tel: 714-261-1920. **R-E**

12 NEW YEAR'S RESOLUTIONS FROM **TAB**

Maintaining and Repairing VCRs—2nd Ed.

by Robert L. Goodman



This money-saving guide shows you how to maintain and repair VHS HQ machines, 8mm, and camcorders. Includes full coverage of mechanical systems, electronic circuits, and illustrated service data. 352 pp., 370 illus. #3103H \$27.95

Practical Antenna Handbook

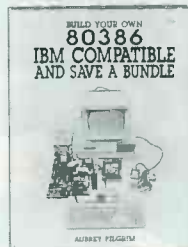
by Joseph J. Carr



Build and design antennas for any application, including radio and TV antennas... antennas for short-wave listeners... mobile antennas... and others. You get valuable information on propagation, waveguides, grounding techniques, and more. 416 pp., 354 illus. #3270H \$32.95

Build Your Own 80386 IBM® Compatible and Save a Bundle

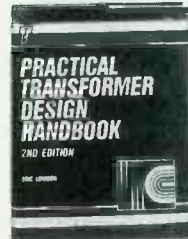
by Aubrey Pilgrim



Get the power of a PS/2 Model 80 at a fraction of the cost. Includes easy-to-follow instructions for assembling an 80386 computer, explanations of memory functions and operation, and sources for components and parts. 232 pp., 84 illus. #3131H \$26.95

Practical Transformer Design Handbook—2nd Ed.

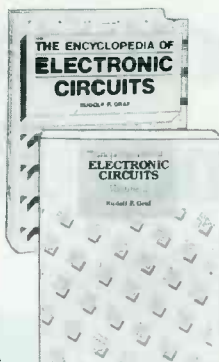
by Eric Lowdon



This practical handbook on the design, construction, and application of small iron-core transformers shows you how to build power transformers and current transformers to suit your equipment and project needs. 400 pp., 288 illus. #3212H \$34.95

Encyclopedia of Electronic Circuits—Vols. 1 and 2

by Rudolf F. Graf



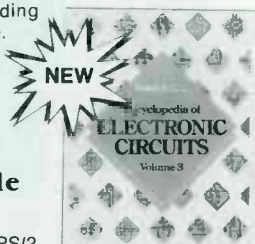
Volume 1 puts over 1,200 of the most useful circuit designs in the industry at your fingertips. Features everything from A—alarm circuits—to Z—zero crossing detector circuits. 768 pp., 1,762 illus.

Volume 2 features a wealth of electronic and integrated circuit ideas, including laser and fiberoptic circuits, sensors, thermal reactors, and more. 744 pp., 728 illus.

Both books for only \$49.95, #5376C

Encyclopedia of Electronic Circuits—Vol. 3

by Rudolf F. Graf



The latest entry in Rudolf Graf's bestselling series of giant sourcebooks! This third volume covers every conceivable electronic and integrated circuit category. You get schematics for the latest available alarm and security circuits, detectors, and much more. 768 pp., 1,000 illus. #3348P \$29.95

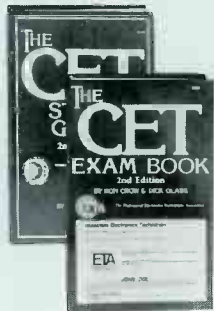
Save Money! Order all three volumes for only \$75.90! Order #5460C

The CET Study Guide—2nd Ed.

by Sam Wilson

The CET Exam Book—2nd Ed.

by Dick Glass and Ron Crow



These study guides will help you prepare and pass the Associate and Journeyman exams with flying colors! They cover the latest technical information on everything from antennas and digital circuits to test equipment and troubleshooting. #5447C \$24.90

International Encyclopedia of Integrated Circuits

by Stan Gibilisco



This reference is packed with the latest ICs used in communications, microcomputers, power supplies, data-conversion, logic, and more. Compare specifications and pinouts... locate replacement information... generate design concepts... and more. 1,088 pp., 4,000 illus. #3100H \$44.95 (regularly \$75.00)

Old Time Radios! Restoration and Repair

by Joseph J. Carr



Repair or restore classic vacuum tube and transistor radios easily and inexpensively. Carr presents the history, theory, and practical operation of old-time radio sets. Detailed instructions and schematics are provided. 256 pp., 247 illus. #3342H \$25.95

Mastering Electronics—3rd Ed.

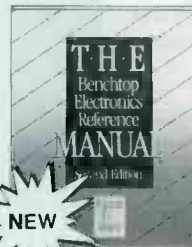
by John Watson



Master the principles of electronics beginning with resistors, capacitors, units of electricity, transformers, and linear electronics. Advanced topics include audio amplifiers, optoelectronics, digital logic, timers, and radio and TV. 449 pp., 200 illus. #9351H \$34.95

The Benchtop Electronics Reference Manual—2nd Ed.

By Victor F.C. Veley



This is the most comprehensive reference available on the subject. It covers the topics of AC, DC, solid-state and tube circuits, microwaves, communications, digital principles, and electronic mathematics. 784 pp., 389 illus. #3414H \$39.95

To Order Call Toll Free 1-800-822-8158

(in PA, AK, and Canada call 1-717-794-2191) or fax your order: 717-794-2080

or mail coupon to: **TAB BOOKS, Blue Ridge Summit, PA 17294-0840**

Please add applicable state and local sales tax (in Canada add \$5.00 shipping and handling).

Check or money order enclosed made payable to TAB BOOKS.

Charge my VISA MasterCard American Express

Acct. No. _____ Exp. _____

Signature _____

Please send me the book(s) below:

Book # _____ Price _____ Book # _____ Price _____

Book # _____ Price _____ Book # _____ Price _____

Name _____

Address _____

City _____

State/Zip _____

Satisfaction Guaranteed—If you are not completely satisfied, return the book(s) for a complete refund. Order(s) subject to credit approval. Prices subject to change. RE11

Learn to troubleshoot and service today's computer systems as you build a fully AT-compatible micro, complete with 1 meg RAM, and powerful 20 meg hard drive

Train the NRI Way— and Earn Good Money Servicing Any Brand of Computer

Jobs for computer service technicians will almost double in the next 10 years according to Department of Labor statistics, making computer service one of the top 10 growth fields in the nation.

Now you can cash in on this exciting opportunity— either as a full-time industry technician or in a computer service business of your own—once you've mastered electronics and computers the NRI way.

NRI's practical combination of "reason-why" theory and hands-on building skills starts you with the fundamentals of electronics, then guides you through more sophisticated circuitry all the way up to the latest advances in computer technology.

Train With a Powerful AT-Compatible—Now with 20 Meg Hard Drive and 1 Meg RAM!

To give you hands-on training with the absolute in state-of-the-art computer technology, NRI includes the powerful West Coast 1010 ES computer as the centerpiece of your training. As you assemble this fully IBM AT-compatible micro from the keyboard on up, you actually see for yourself how every section of your computer works.



You build this powerful West Coast 1010 ES computer, all the while gaining a true mastery of computer electronics. Best of all, it's yours to keep for all your professional and personal computing needs.

You assemble and test your computer's "intelligent" keyboard, install the power supply and 5¼" disk drive, then interface the high-resolution monitor. But that's not all.

Your hands-on training continues as you install a powerful 20 megabyte hard disk drive—today's most-wanted computer peripheral—now included in your course to dramatically increase the data storage capacity of your computer while giving you lightning-quick data access. Plus you work with exclusive word processing, database, and spreadsheet software, yours to use for your own professional and personal applications.

As you build your computer, performing key demonstrations and experiments at each stage of assembly, you get the confidence-building, real-

Your NRI computer training includes all this: • NRI's unique Discovery Lab® for circuit design and diagnosis • NRI's hand-held digital multimeter featuring "talk-you-through" instructions on audio cassette • A digital logic probe that lets you visually examine computer circuits • The new AT-compatible West Coast 1010 ES computer with high-speed 80286 CPU, 101-key "intelligent" keyboard, 1.2 meg high-density floppy disk drive, 1 meg RAM (expandable to 4 meg), 64K ROM • 20 megabyte hard disk drive • MS-DOS, GW-BASIC, word processing, spreadsheet, and database software • Reference manuals with programming guidelines and schematics

NOW!
AT-compatible
computer and 20
meg hard drive!

prepared to take advantage of today's opportunities in computer service. You learn at your own convenience in your own home.

No classroom pressures, no night school, no need to quit your present job until you're ready to make your move. And all throughout your training, you've got the full support of your personal NRI instructor and the NRI technical staff, always ready to answer your questions and help you whenever you need it.

FREE 100-Page Catalog Tells More

Send today for NRI's big, 100-page catalog that describes every aspect of NRI's innovative computer training, as well as hands-on training in other growing high-tech career fields. If the coupon is missing, write to: NRI School of Electronics, McGraw-Hill Continuing Education Center, 4401 Connecticut Avenue, NW, Washington, DC 20008.

NRI School of Electronics

McGraw-Hill Continuing Education Center
 4401 Connecticut Avenue, NW
 Washington, DC 20008

IBM and AT are registered trademarks of International Business Machines Corporation



world experience you need to work with, troubleshoot, and service today's most widely used computer systems.

New! Explore the Latest Advances in Voice Synthesis

Now NRI also includes innovative hands-on training in voice synthesis, one of today's most exciting and widely applied new developments in computer technology.

You now train with and keep a full-featured 8-bit D/A converter that attaches in-line with your computer's parallel printer port. Working with the exclusive text-to-speech software also included with your course, you explore the fascinating technology behind both digitized and synthesized computer speech.

NRI's new hands-on training in voice synthesis is just one more way you get the confidence-building experience you need to feel at home with the latest advances in computer technology.

No Experience Needed, NRI Builds It In

This is the kind of practical, hands-on experience that makes you uniquely

SEND TODAY FOR FREE CATALOG!



McGraw-Hill Continuing Education Center
 4401 Connecticut Avenue, NW, Washington, DC 20008

For Career courses approved under GI Bill

check for details.

CHECK ONE FREE CATALOG ONLY

- Computer Electronics
- TV/Video/Audio Servicing
- Robotics
- Electronic Music Technology
- Security Electronics
- Digital Electronics Servicing

- Telecommunications
- Industrial Electronics
- Electronic Circuit Design
- Basic Electronics
- Bookkeeping & Accounting
- Building Construction
- Automotive Servicing

- Air Conditioning, Heating, & Refrigeration
- Small Engine Repair
- Electrician
- Locksmithing
- Travel Careers
- Writing
- Paralegal
- Computer Programming

Name (Please print) _____

Age _____

Street _____

City/State/Zip _____

We'll give you tomorrow.

Accredited Member National Home Study Council

3-011

NEW LIT

Use The Free Information Card for fast response.

GUIDE TO HIGH PERFORMANCE DMMs; from John Fluke Mfg. Co., Inc., P.O. Box 9090, Everett, WA 98206-9090; Tel: 800-44-FLUKE; free.

To introduce buyers and regular users of digital multimeters to the high-performance functions and capabilities of today's instruments, Fluke has created



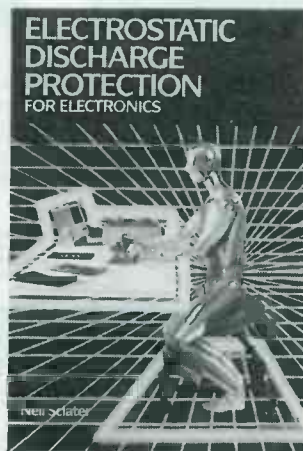
CIRCLE 21 ON FREE INFORMATION CARD

this application note. It provides useful selection criteria for buyers, and information to help current users get the most from their instruments. It opens with a detailed description of a high-performance DMM, and includes sections on extended measurement capabilities, recording modes, special features, and accessories. One chapter is devoted to matching the technician and application with the right meter.

ELECTROSTATIC DISCHARGE PROTECTION FOR ELECTRONICS; by Neil Sclater. TPR, Division of TAB Books Inc., Blue Ridge Summit, PA

17294-0850; Tel: 1-800-233-1128; hardcover; \$29.95.

As the power, speed, and compactness of electronic devices is improved, those devices are becoming more vulnerable to over-stress from electrostatic discharge (ESD). For those who are involved in the production, packaging, distribution, or repair of electronic components and assemblies, this book provides a practical introduction to ESD protection. It explains the origins and effects of ESD and what can be done to prevent dangerous static levels in the workplace. The book offers practical advice on how to design and build static-free workstations; measure and monitor static levels; select static-control equipment and test instruments; choose static-free flooring; and regulate humidity and ionization in the



CIRCLE 22 ON FREE INFORMATION CARD

workplace. It explains how to design ESD-protective packages, materials, and containers; handle and store electronic components; simulate elec-

trostatic discharges; and train employees in static-control techniques, including the use of protecting ground straps and clothing. The book also provides a glossary of ESD-related terms and phrases and a listing of static-control product vendors.

ELECTRONIC INTERCONNECTION SYSTEMS: PRODUCT ORDERING GUIDE; from 3M Electronic Products Division Catalog, P.O. Box 3064, Cedar Rapids, IA, 42406-3064; free.

In its 576 pages, this catalog presents information

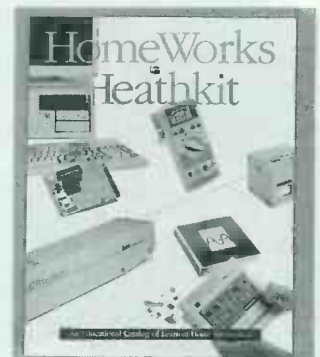


CIRCLE 23 ON FREE INFORMATION CARD

on IC socket, board-mount and wire-mount socket, "MIX," plug, DIN, PCB, DIP, card-edge, D-sub, and D-ribbon connectors; headers; breadboard systems; cables; and assembly equipment. Extensive cross-reference charts help readers to quickly locate products, as well as mating cable, accessories, and assembly equipment. Three complete indexes—arranged by grid spacing, part number, and product type—are included in the guide. The description for each item includes full physical, electrical, and en-

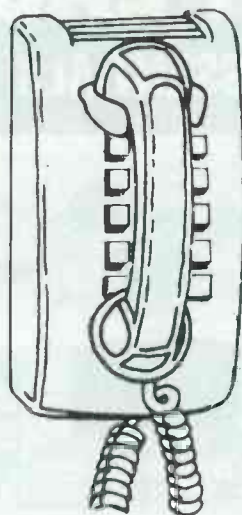
vironmental specifications. Ordering information includes dimensions, part numbers, accessories, and mating connectors.

FALL 1990 HOMEWORKS BY HEATHKIT; from Heath Company, Department 350-052, Benton Harbor, MI 49022; Tel: 800-44-HEATH; free.



CIRCLE 24 ON FREE INFORMATION CARD

Featuring Heathkit's full line of learn-at-home electronics courses for consumers who want to keep up with today's technological advances and innovations, this 32-page catalog includes courses in basic and advanced electronics, laser technology, digital techniques, micro-processing, fiber optics, and amateur-radio operation. Also offered, in both kit and preassembled form, are a variety of Heathkit trainers and accessories for use in performing the course experiments. Several of the courses have optional videotapes that supplement the texts, or could be used alone as an overview. The kits come in varying degrees of difficulty, for beginning and advanced builders. **R-E**

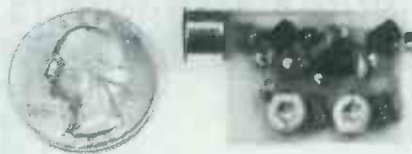


CALL NOW AND RESERVE YOUR SPACE

- 6 x rate \$940.00 per each insertion.
- Fast reader service cycle.
- Short lead time for the placement of ads.
- We typeset and layout the ad at no additional charge.

Call 516-293-3000 to reserve space. Ask for Arline Fishman. Limited number of pages available. Mail materials to: mini-ADS, RADIO-ELECTRONICS, 500-B Bi-County Blvd., Farmingdale, NY 11735.

FAX: 516-293-3315



SIMPLY SNAP THE WAT-50 MINIATURE FM TRANSMITTER on top of a 9v battery and hear every sound in an entire house up to 1 mile away! Adjustable from 70-130 MHZ. Use with any FM radio. Complete kit **\$29.95 + \$1.50 S + H**. Free shipping on 2 or more! COD add \$4. Call or send VISA, MC, MO. **DECO INDUSTRIES, Box 607, Bedford Hills, NY 10507. (914) 232-3878.**

CIRCLE 127 ON FREE INFORMATION CARD



FREE CATALOG! ELECTRONIC TOOLS & TEST EQUIPMENT. Jensen's new Master Catalog, available free, presents major brand name electronics tools, tool kits, and test instruments, plus unique, hard-to-find products for assembly and repair and custom field service kits available only from Jensen. All fully described and illustrated. Enjoy free technical support and rapid, post-paid delivery anywhere in the Continental USA. **JENSEN TOOLS INC., 7815 S. 46th St., Phoenix, AZ 85044. Phone: 602-968-6231; FAX: 1-800-366-9662.**

CIRCLE 115 ON FREE INFORMATION CARD



CABLE TV CONVERTERS AND DE-SCRAMBLERS SB-3 \$79.00 TRI-BI \$95.00 MLD-\$79.00 M35B \$69.00 DRZ-DIC \$149.00. Special combos available. We ship COD. Quantity discounts. Call for pricing on other products. Dealers wanted. **FREE CATALOG.** We stand behind our products where others fail. One year warranty. **ACE PRODUCTS, P.O. Box 582, Saco, ME 04072 1 (800) 234-0726.**

CIRCLE 75 ON FREE INFORMATION CARD



THE MODEL WTT-20 IS ONLY THE SIZE OF A DIME, yet transmits both sides of a telephone conversation to any FM radio with crystal clarity. Telephone line powered - never needs a battery! Up to 1/4 mile range. Adjustable from 70-130 MHZ. Complete kit **\$29.95 + \$1.50 S + H**. Free Shipping on 2 or more! COD add \$4. Call or send VISA, MC, MO. **DECO INDUSTRIES, Box 607, Bedford Hills, NY 10507. (914) 232-3878.**

CIRCLE 127 ON FREE INFORMATION CARD



ELEVEN-PIECE RACHET TOOL KIT Includes reversible ratchet handle, extension bar, six bits, two precision screwdrivers, and a cutter. Comes in fitted case. Get one for your shop, another for your car, another for your tool kit. To order send **\$11.75 USA shipping only.** **ELECTRONIC TECHNOLOGY TODAY INC., PO Box 240, Massapequa Park, NY 11762-0240.**



NEW XST500 SUPER-MINIATURE FM transmitter uses Surface Mount Technology (SMT)! Own the smallest high performance FM transmitter available. Transmits whispers to any FM receiver up to a mile away. Uses 9V battery. Complete, easy to assemble kit, with SMT components already assembled to circuit board. **\$39.95 Cash, VISA, MC. COD add \$5.** **XANDI ELECTRONICS, 201 E. Southern Ave., Suite 114, Tempe, AZ 85282. 1-602-829-8152, (1-800-336-7389 orders only).**

CIRCLE 179 ON FREE INFORMATION CARD



APPLIANCE REPAIR HANDBOOKS—13 volumes by service experts; easy-to-understand diagrams, illustrations. For major appliances (air conditioners, refrigerators, washers, dryers, microwaves, etc.), elec. housewares, personal-care appliances. Basics of solid state, setting up shop, test instruments. **\$2.65 to \$7.90 each.** Free brochure. **APPLIANCE SERVICE, P.O. Box 789, Lombard, IL 60148. (312) 932-9550.**

CIRCLE 84 ON FREE INFORMATION CARD

RADIO SHACK PARTS PLACE

SM

YOUR SOURCE FOR PROJECT AND REPAIR ESSENTIALS

PARTS HOTLINE

Your nearby Radio Shack store has a huge selection of popular electronic components. Plus, we can special-order 10,000 items from our warehouse—ICs, tubes, semiconductors, phono cartridges and styli, even SAMS® manuals. Service is fast and there's no minimum order or postage charge.



BATTERY HOTLINE

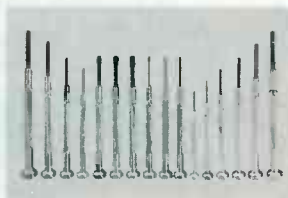
In addition to our large in-store stock, Radio Shack can now supply almost any currently manufactured consumer-type battery—for cordless phones, computer memory, camcorders, transceivers, pagers and more. Service is fast. No postage or handling charges!



Studfinder. Ends guessing, easy to use! Senses changes in wall density to find wooden studs fast—also wires, conduit, pipes. Battery extra. #64-2825 19.95



Super Calculator! The EC-4035 makes electronics math a snap. Displays and computes with electrical units—V, A, mA, mW. 110 functions. #65-983 39.95



16-Piece Precision Tool Kit. Top-quality jewelers'-type philips, blade and nutdrivers plus hex keys and a torque bar. Fitted molded case. #64-1961 10.95



100-Watt Soldering Gun. Pull the trigger for full temperature in seconds. Built-in light. The comfort-molded handle stays cool. UL listed AC. #64-2193 10.95



Semiconductor "Sub" Book. Our 1991 edition lists over 95,000 types and the Radio Shack replacements. #276-4014 3.99

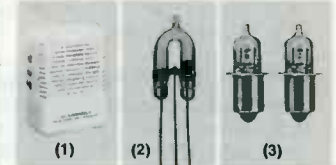
Getting Started in Electronics. By Forrest Mims III. The perfect introduction to project building. 128 pages. #276-5003 2.49

THE PLACE TO SHOP FOR VALUE!



Engineer's Mini-Notebook Series. By Forrest Mims III. Practical project ideas and useful data in Mims' famous, friendly style—big diagrams, handlettered text. With tips and suggestions for further experiments.

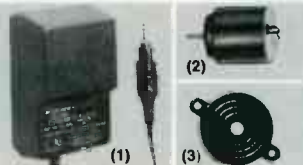
- NEW! Science Projects. #276-5018 ... 1.49
- Timer ICs. 555/556 ICs. #276-5010 ... 99¢
- Op Amp ICs. #276-5011 1.49
- Optoelectronics. #276-5012 1.49
- Basic Circuits. #276-5013 1.49
- Digital Logic Circuits. #276-5014 1.49
- Communications Projects. #276-5015, 1.49
- Formulas and Tables. #276-5016 1.49
- Schematic Symbols. #276-5017 1.49



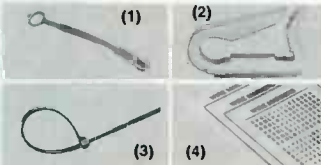
- (1) Mini Audio Amp/Speaker. Ideal testbench amp, also great for computer voice/music synthesis. Battery extra. #277-1008 11.95
- (2) Long-Life Xenon Strobe Tube. With data. #272-1145 3.29
- (3) Halogen Flashlight and Lantern Bulbs. HPR50. 6-volt. #272-1189. HPR52. 3V. #272-1190 .. Each 3.95



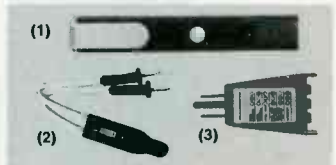
Pocket-Size Digital Multimeter With Autoranging. Really handy for anyone working with electronics. This tester folds, with its probes, to fit a shirt pocket. Features easy-to-read LCD display, continuity sounder. Measures to 400 volts AC/DC, 2 megohms resistance. 4 1/4 x 2 1/8 x 5/16". #22-171 39.95



- (1) Universal AC Adapter. 3, 4, 5, 6, 7.5 or 9VDC output. With 6-piece Adaptaplug® set. #273-1650 12.95
- (2) 1 1/2-3VDC Motor. About 1 1/2" long. #273-223 99¢
- (3) DC Pulsing Buzzer. Extra loud! #273-066 4.29



- (1) Reusable Cable Ties. Hang-up loop. #278-1622 . Pkg. of 10/4.99
- (2) "Universal" Cable Clips. #278-1647 Pkg. 10/2.79
- (3) Indoor/Outdoor Wire Ties. #278-1652 Pkg. of 30/2.99
- (4) Markers. 630 stick-on letters. #278-1650 Set/1.79



- (1) AC Sensor. Indicates the presence of 70 to 440VAC without direct electrical connection. Safety first! #22-103 9.95
- (2) Neon Circuit Tester. 90-300V AC/DC. #22-102 1.99
- (3) AC Outlet Fault-Finder. 3-prong for grounded outlets. #22-101 .. 5.95

Since 1921 Radio Shack has been the place to obtain up-to-date electronic parts as well as quality tools, test equipment and accessories at low prices. Over 7000 locations to serve you—NOBODY COMPARES

Prices apply at participating Radio Shack stores and dealers. Radio Shack is a division of Tandy Corporation

Radio Shack
AMERICA'S TECHNOLOGY STORE™

CIRCLE 78 ON FREE INFORMATION CARD.

BUILD A MACINTOSH-COMPATIBLE COMPUTER

CHARLES COLBY*

At last, a Mac-compatible computer for people on a budget—and it can be cheaper and more powerful than the new Classic Mac from Apple!

HAS THE HIGH COST OF OFF-THE-SHELF MACS kept you restricted to the confined world of MS-DOS computers? Well, you can stop feeling confined because, for about \$400.00 and a few hours work, plus the cost of any 128K through SE-30 Mac logic board, you can build your own Mac! And that price includes the case, power supply, 800K floppy drive, special power/video board, video driver module, and a 14-inch Mac-compatible monitor.

The unit is 100% compatible with all Mac software, since it uses the real Apple Macintosh main logic board or motherboard.

Even the earliest motherboards can be the start of a powerful machine. For example, with third party add-ons, you can increase the RAM of a Mac 128K through Mac SE to 1, 2.5, or 4 megabytes; you can increase the RAM on an SE-30 to 4, 8, 16, or 32 megabytes! There are accelerators avail-

able to let the unit run with a clock speed as high as 50 MHz even with a Mac 128K. With add-on boards, you can use a 19- or 21-inch 1024 × 768 pixel high-resolution monitor.

If you don't already have a Mac, any version of our Macintosh "clone" is a good starter

machine. If you already have a Mac, you can put together a good second or third machine. If you are in any Mac-related service business, you'll especially appreciate how much easier it is to install or swap an internal component. That's because the case we use makes it easier to install or remove a board or drive as compared to a standard Mac case.



*Charles Colby is the president of Colby Systems Corporation, a company specializing in portable computers, terminals, Macintosh-compatible computers, and accessories.

Technical description

As shown in the block diagram of Fig. 1, the desktop Mac contains a real Apple Macintosh motherboard. The Mac motherboard is a very cleverly designed self-contained computer—it contains all of the essential components. The CPU in the Mac 128K, 512K, 512KE, Mac Plus, and Mac SE is a Motorola 68000 16-bit processor running at 8 MHz; a 16-MHz Motorola 68030 32-bit processor is found in the Mac SE-30. The motherboard also contains bios ROM's, RAM, various glue-logic chips, a keyboard- and mouse-input processing IC, and a custom Sony sound processor. There are two serial output ports: one for a modem and one for a printer—there are no parallel printer output ports. A small computer system interface (SCSI) port is found on a Mac Plus, SE, and SE-30, although SCSI adapters are available for other versions.

Also on the motherboard are the video chips that generate the Mac's 512 × 342 pixel, 22.5-kHz horizontal rate video. There are many third-party accelerators and big-screen video boards available for Macs; the Mac SE and SE-30 have expansion ports on the motherboard to accommodate them, and there are special expansion devices available that clip over the 68000 chip in the 128K, 512K, 512KE and Mac Plus boards eliminating the need for the expansion ports.

The motherboard is the most important part of this or any other Mac-compatible project. They can cost anywhere from 50 to 1500 dollars, depending on which model you want.

All that is needed to make the motherboard operate is a power supply, a video/sync adapter to drive an external monitor, a Mac-compatible floppy drive, an SCSI hard drive (optional), and a case in which to put them. The power supply is an IBM-PC clone type, so it is low in cost.

We'll show you where to get everything you need, and how to put it all together. We'll even show you how to build the interface that makes this project possible.

There are some external accessories required to make a complete operating computer, and one of them is a mouse or

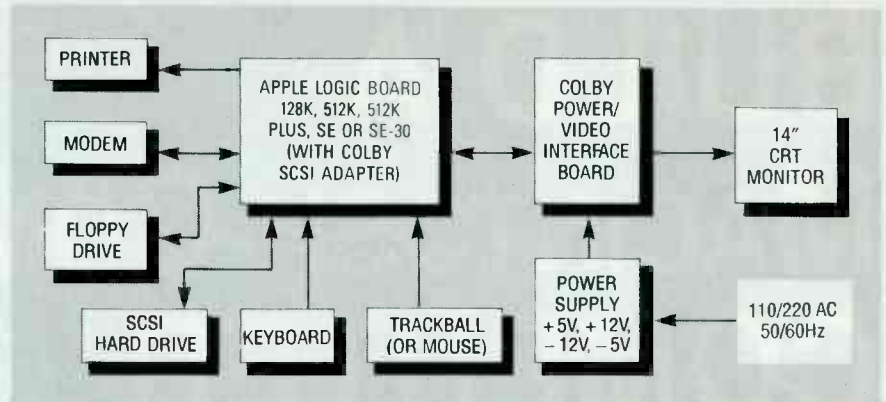


FIG. 1—YOU CAN SEE FROM THE BLOCK DIAGRAM, that the Colby Mac contains a real Apple motherboard.

trackball. There are two basic types of Mac mice and trackballs. The original type is for the Mac 128K, 512K, 512KE, and the Mac Plus. Those all have a male 9-pin "D" connector. The newer type used with the SE and the SE-30 has a 4-pin male mini-DIN connector. They are known as ADB-type, which stands for Apple Desktop Bus which uses a proprietary Apple serial protocol. An IBM-PC type mouse or trackball will not work on a Mac.

A keyboard is also required. The original keyboard for the Mac 128K, 512K, and Mac Plus uses a 4-pin modular jack like the one on the handset of a telephone. However, the wiring in a telephone cable is different than a Mac keyboard cable.

Our desktop Mac uses a special 14-inch monitor. With a horizontal frequency of 22.5 kHz, it will not work with an IBM-PC or clone. It is available in either amber or paper-white phosphor versions. The monitor will work with all Macintosh computers with a proper Colby interface.

The one thing that sets our Mac apart from true Apple Macs is the power/video interface board that allows an IBM-PC style power supply, the monitor, and an Apple motherboard (logic board) to be connected together in one system. The interface board can either be built or purchased fully assembled. If you wish to build the board, PC foil patterns are provided, or you can buy a ready-made bare board.

Where to buy parts

Before building the interface board, let's discuss all of the other necessary components,

where you can get them, and how much they cost. As mentioned earlier, you need an Apple 128K, 512K, 512KE, Plus, SE or SE/30 motherboard (\$50.00 to \$1400.00), a modified IBM-PC clone case (\$89.00), a power supply (\$69.00), a keyboard (\$89.00–\$129.00), a mouse or trackball (\$49.00–\$79.00), a monitor (\$189.00), a floppy drive (\$189.00), and perhaps an optional 40-MB hard drive (\$299.00–\$399.00). You'll also need the interface adapter board described in this article; it'll run you \$59.00 in the assembled form (not including a \$30 video/sync processor module), or you can build it yourself.

The most difficult part to find is the Apple motherboard. The

PARTS LIST—128K THROUGH MAC PLUS

1. Any Apple motherboard, 128K, 512K, 512KE or Mac Plus
2. PC case (Gettys Electronics)
3. 200-watt power supply (must fit in Gettys case)
4. 800K Mac-compatible internal floppy drive (must fit in Gettys case)
5. Modular-plug type Mac keyboard
6. 9-pin D-type trackball or
7. 9-pin D-type mouse
8. 14-inch Mac-compatible monitor (optional adapter for regular Mac)
9. Power/video adapter board
10. 20-pin floppy cable
11. 10-conductor power cable
12. 9-conductor video output cable
13. Internal modular keyboard cable w/bracket
13. Cermagraph 740S video/sync processing module
14. 3.6V lithium battery for CPU real-time clock

added, as well as provisions for the Mac reset function. The case comes with a bag of all the screws and standoffs you will need to mount the Mac motherboard, power supply, and floppy drives. It also comes with the cables required to connect the power supply to the adapter board, hook up the key switch, connect the green power LED, the reset button, the hard-drive access LED, and the Mac programmer's switch (mis-labeled "turbo" on the front panel of the case). All of that adds up to a big savings in assembly time.

Not included with the case are the logic-board-to-power-adapter cable, video-output cable, hard-drive cable, and the mounting brackets for 3½-inch hard drives. (A 5¼-inch hard drive will mount easily without adapter brackets.) The power supply for the case, which provides +5, -5, +12, and -12 volts is rated at 200 watts; quite a bit higher than is required, so the system will always run cool.

There are some cables that are required inside the case, but not included, to connect the major components. One of them is the power signal cable from the interface board to the Mac motherboard, and there are two types. Type 1, a 10-conductor cable, is for use with 128K, 512K, 512KE and Mac Plus motherboards. Type 2, a 12-conductor cable, is for use with the SE and SE-30 motherboards. The required motherboard-to-floppy-drive cable provides both power and signals in one 20-pin flat cable. The video/sync output cable goes from the power/video interface board to the rear panel of the unit. It is a 10-pin-to-9-pin cable. The optional 50-to-50 pin SCSI hard-drive signal cable goes from the Mac motherboard to the hard drive. All cables must be built or purchased from one of the sources mentioned.

Add-on video boards

Most add-on boards for the Mac 128K through Mac SE will work in the Colby Desktop Mac. Although Apple has never manufactured big-screen boards for the early Macs, many aftermarket companies do. One problem with some add-on video boards is that they are designed to plug into Apple SE-30 mother-

MAC VS IBM-PC

The Apple Macintosh was introduced January 1, 1984 with the now-famous TV commercial shown during the Superbowl football game where the girl in jogging shorts throws a sledgehammer into a movie screen amid an audience of "followers" with shaved heads, all dressed alike, bowing to a uniformed "leader." The "leader" was intended to be representative of IBM. Apple's message was 1984 won't be like 1984. Did it work?

Apple's challenge to the IBM dominance of the personal-computer market has produced sales of five or six million computers, vs IBM and clones of 40 to 50 million units. Who won? Both did, and are continuing to win, as the need for small computer systems accelerates worldwide. The clear advantage of the Mac's easy-to-learn, easy-to-use graphical interface and operating system makes it possible to do productive work on a Mac in one tenth to one fiftieth of the time required to become proficient at some MS-DOS based programs on an IBM-PC or clone.

Time will tell what effect Windows™ 3.0 will have in the race between the IBM world and the Mac world. Many people think the Mac will triumph. Yet the absence of true Mac clones (Apple will not let it happen) has kept the cost of the Macs very high in relationship to the relatively low prices found in the IBM-PC and clone arena.

The Mac 128K was a true major innovation in its day, and innovations continue. For example, system 7.0, due out anytime now, promises to add many new features.

The Mac paved the way to desktop publishing by providing the first small computer with bit-mapped graphics, WYSIWYG text, and an innovative easy-to-use operating system that changed the face of personal computing. Even six years later, the 128K Mac is still a useful machine and can do simple word processing and drawing functions almost as well as the latest \$11,000.00 Mac FX.

Apple isn't known for low prices, but it is one of the few companies ever to go from two guys building computers in a garage to a multi-billion dollar yearly sales organization with six or seven thousand employees and a billion dollars in the bank...all in a span of 12 years. R-E

boards at a right angle. These boards will not work with the case we described because they are too high. We do know that boards from E-Machines, Inc., Lapis Technology, Sigma Designs, Nutmeg, Moniterm, and Colby Systems will work in the Colby Mac. Of course, if you use a bigger case, you can use whatever size boards you like.

Colby Systems Corporation manufactures 640 × 480 monochrome, gray scale, 8- or 24-bit

color, and 1024 × 768 monochrome boards for 19- and or 21-inch monitors that mount parallel with the motherboard. Colby also makes right-angle adapter board (SE-30 RAB, \$49.99) that adapts most SE-30 boards to work with the case we used.

Accelerator boards

Two of the best companies, in terms of technical support, price, variety of products, and state-of-the-art offering, that make add-on accelerator boards for Macs are Dove Computer and Total Systems Incorporated (TSI). You can purchase their products through dealers, mail-order, and Colby Systems, as well.

Dove Computer has a line of medium- to high-end accelerators that enable you to add a 33-MHz 68030 processor to a Mac 128K! They also have a low-cost (\$500.00) 68030 accelerator for a Mac SE-30 that doubles the speed to 33 MHz.

TSI has two lines called Gemini and Gemini II. The lower-cost Gemini series consists of 16- and 20-MHz 68020 and 68030 accelerators with versions available for Mac 128K through Mac SE-30. The Gemini II series is available in speeds from 33 to 50 MHz. The big advantage of accelerators is that the older motherboards may be brought up to speeds comparable with the latest Macs.

One problem that plagued early Macs was the power supply, which could deliver only about 35 watts—barely enough to run the standard motherboard, a 9-inch CRT, a floppy drive, and a keyboard. Once you started adding accelerators and hard drives, many power supplies went up in smoke. Apple has since re-designed the power supply in the Mac SE and SE-30 to output 60 watts. But because of the early problems, most reputable accelerator manufacturers have a separate 110 VAC-to-5 VDC power supply available to run the accelerator to prevent overloading the Mac's power supply. If you use a hefty enough power supply, you can save some money when you buy an accelerator. For example, all Dove and TSI accelerators are available without the additional power supply at a correspondingly lower price.

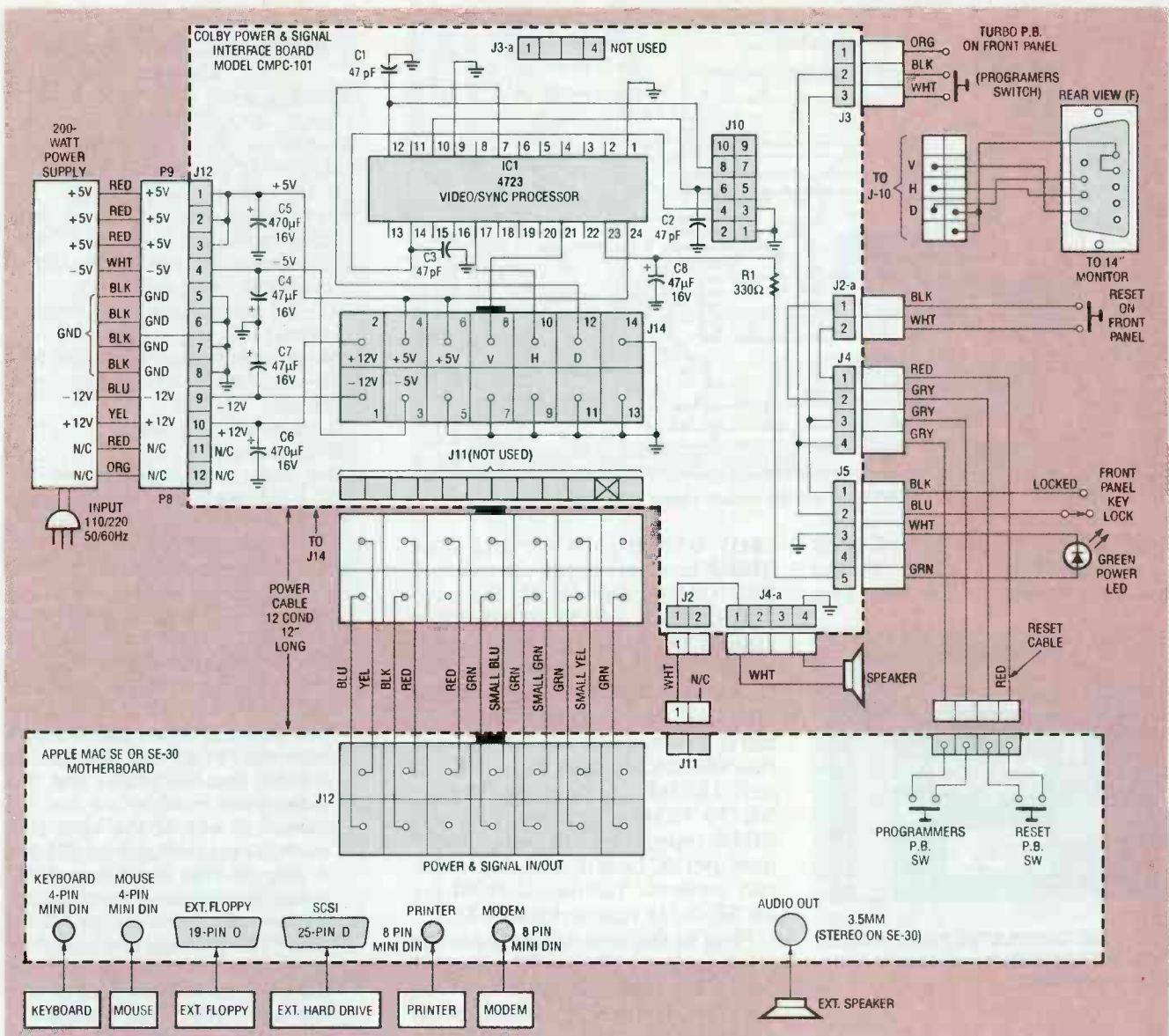


FIG. 3—SCHEMATIC FOR THE Mac SE and SE-30.

Building the Mac

Let's go over, step-by-step, the procedures necessary to get your Macintosh-compatible computer up and running. A wiring schematic for the 128K, 512K, 512KE, and Mac Plus versions is shown in Fig. 2, and one for the Mac SE and SE-30 is shown in Fig. 3. Regardless of which version you're going to build, you will need the power/video interface board. Should you decide to build the board yourself, a parts-placement diagram is shown in Fig. 4. A photograph of the completed board is shown in Fig. 5.

The first step is to make sure that the motherboard will fit in your case. There is a vertical metal tab, 2-inches high by 1-inch wide, near the two PC-mounted pushbuttons at the rear of all Mac

PARTS LIST FOR MAC SE & SE-30

1. Apple SE or SE-30 motherboard
2. FC case (Gettys Electronics)
3. 200-watt power supply (must fit in Gettys case)
4. 800K Mac-compatible internal floppy drive (must fit in Gettys case) Colby FDD-800K
5. ADB-type Mac keyboard
6. ADB-type trackball or mouse
7. 14-inch Mac-compatible monitor
8. Power/video adapter
9. 20-pin floppy cable
10. 14-conductor power cable
11. 9-conductor video output cable
12. Cermagraph 4723N video/sync processing module

motherboards. You will probably have to bend the metal tab parallel with the motherboard to clear

the new case. The tab on the opposite side of the board must also be bent down, but not as low as the other tab.

The only difference between a Mac 512K and a 512KE motherboard is that the 512KE has enhanced 128K ROM's (versus the older 64K ROM's). The later ROM's are available as upgrades. Do not attempt to copy Apple ROM's, as doing so would be a copyright infringement, and Apple has prosecuted many people who have copied their ROM's. If you obtain a motherboard without ROM's, they are installed in two 28-pin sockets on the motherboard, one marked ROM LO and one marked ROM HI.

The Apple ROM marked 342-0342-A, B, or C goes in the ROM LO socket and the ROM

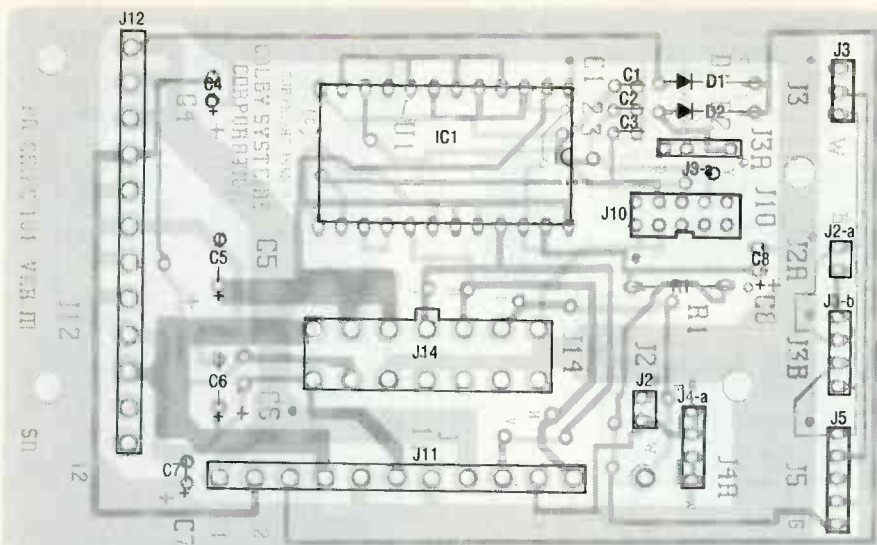


FIG. 4—PARTS-PLACEMENT DIAGRAM for the power/video interface board.

marked 342-0341-A, B, or C goes in the ROM HI socket. Those numbers are for 128K ROM's. The

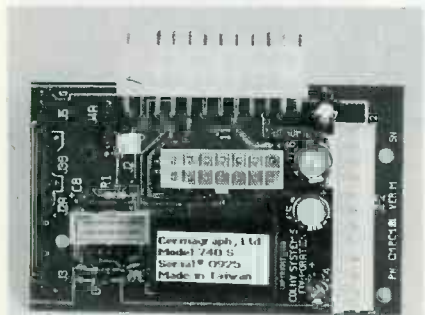


FIG. 5—THE COMPLETED POWER/VIDEO INTERFACE BOARD. It is the key to building your own Mac.

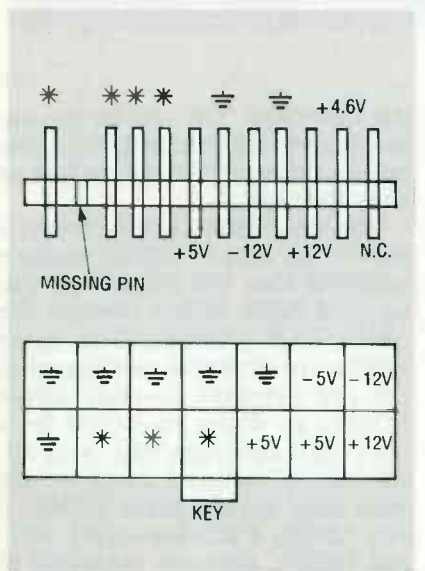


FIG. 6—MEASURE THESE VOLTAGES on the two connectors on the power/video interface board. The pins that are marked with an asterisk should have no more than 2 volts on them when not connected to the motherboard.

early 64K ROM's for pre-Mac 512KE motherboards are marked 342-022-A for ROM LO and 342-0220-A for ROM HI; they should be used only with 128K and 512K motherboards running very early Mac software, 400K single-sided floppies, and no hard drive. Mac SE ROM's are marked 342-0353A for ROM LO and 342-0352A for ROM HI. Mac SE-30 ROM's are on a single SIMM-type (single inline memory module) PC board, and not in 28-pin sockets. The latest ROM for an SE-30 is marked 638-4339.

Plug in the two cables from the power supply, P8 and P9, into J12 on the power/video interface board. Measure the voltages on J11 and J14, on the power/video interface board as shown in Fig. 6. An 8-ohm, 20-watt resistor must be used as a dummy load on the +5-volt line to obtain proper readings. In a Mac 128K through Mac Plus, plug in the 10-conductor cable from J11 on the power/video interface board to J7 on the Apple motherboard. Plug in the 1-conductor cable from J11 on the Apple motherboard to J2 on the power/video interface board. Plug in the 2-conductor cable from the speaker to J4-a on the power/video interface board.

In a Mac SE or SE-30, plug in the 14-conductor cable from J14 on the power/video adapter board to J12 on the Apple motherboard. Plug in the 1-conductor cable from J11 on the Apple motherboard to J2 on the power/video interface board. Plug in the 2-conductor cable from the speaker to J4-a on the power/video inter-

PARTS LIST—POWER/VIDEO ADAPTER

- R1—330 ohms, 1/4-watt
- C5, C6—470 μ F, 16 volts, electrolytic
- C1—C3—47 pF, ceramic disc
- C4, C7—47 μ F, 16 volts, electrolytic
- D1, D2—1N4001 rectifier diode
- IC1—Cermagraph video/sync processing module (740S or 4723N)
- J11—12-position right-angle Molex connector with key
- J12—12-position Molex connector without key
- J14—14-position connector with key
- J10—10-position video & sync connector
- J2, J2-a—2-pin header
- J3—3-pin header
- J3-a, J3-b, J4-a—4-pin headers
- J5—5-pin header

Miscellaneous: PC board, 24-pin IC socket, solder, etc..

Note: The following items for the power/video interface are available from Maus Electronics: A bare PC board (#CMP-101), \$19.99; a PC board and all parts except the video/sync module (#CKP-128), \$36.99; an assembled and tested power/video interface (#CAT-128), \$59.99. BE AWARE that the cables and the video/sync module are not included in any of the kits. The modules are available for \$29.99. A step-by-step build-it-yourself video is available from Colby Systems Corporation for \$19.99 plus \$3.99 postage and handling (#PS-800K). A new book, "Building your own Colby Mac Desktop and Colby Mac Portable," will also be available from Colby Systems. Call, write, or fax for more information.

face board. The inside of a medium-cost SE version is shown in Fig. 7 and the inside of an SE-30 is shown in Fig. 8. The extra boards you see inside the SE-30 are for the Colby voice navigator (\$499), which allows you to perform certain tasks using voice commands rather than a mouse or trackball. The voice navigator is shown in Fig. 9.

Turn on the power and, within 2 seconds, you should hear the familiar Mac "boing" sound on Macs 128K through SE and the multi-note 0.5-second chime on the SE-30. Those sounds indicate that the Mac motherboard has run through and successfully completed its on-board self-diagnosis routines. If you do

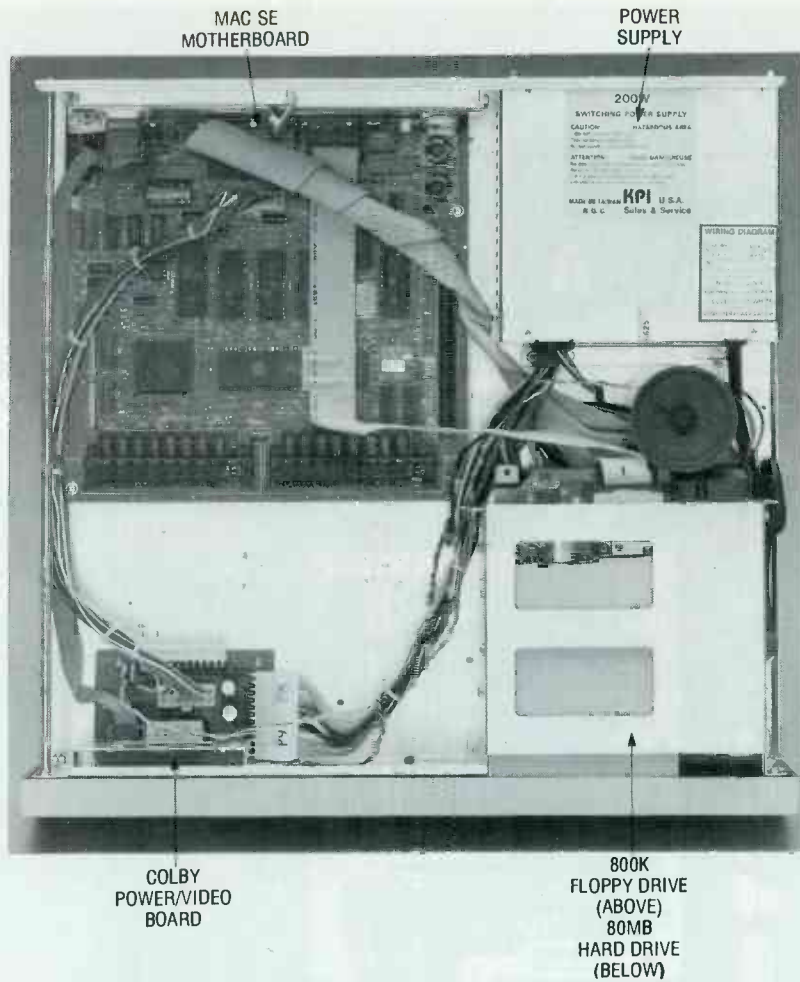
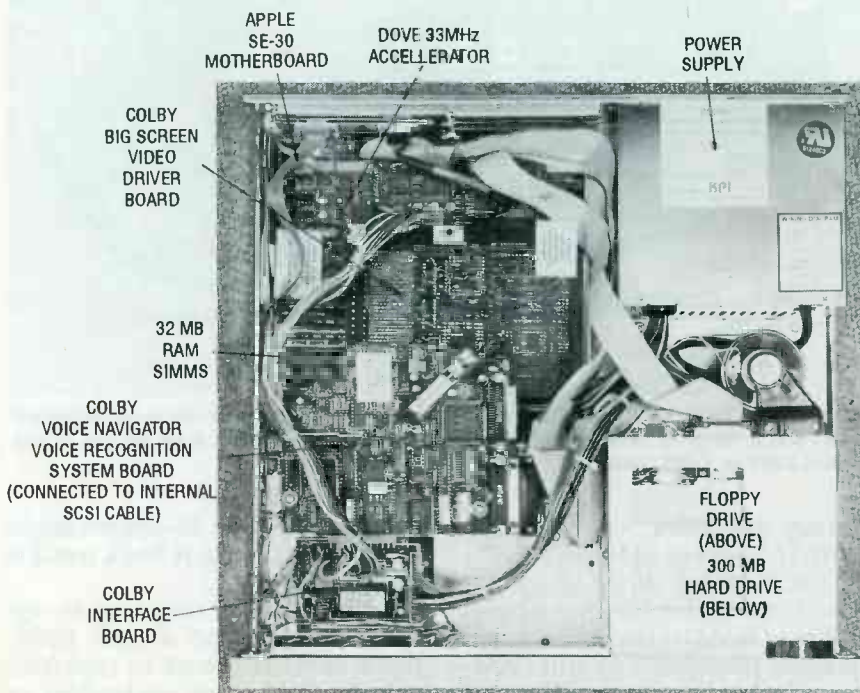


FIG. 7—THE INSIDE OF THE MEDIUM-COST SE VERSION.



8—THE INSIDE OF THE SE-30 VERSION. The extra boards you see are for the Colby voice navigator and big-screen driver board.

not get either of those sounds, or you get a brash sound or none at all on a Mac 128K through Mac Plus, or a multi-note chime that lasts for about 1½ seconds, then there is a problem on the motherboard. If that's the case, recheck the voltages at J7 or J12 on the motherboard. Recheck the ROM's to be sure they are in the correct sockets, that they are seated correctly, and that there are no pins folded under. Recheck the RAM; be sure it is seated correctly and that R8 and the jumpers are set correctly. If you have access to a Mac that you know is working properly, you can test the RAM SIMM's in that unit to verify that they are good.

Plug in the following cables one by one, and turn on the power after plugging each cable in to verify that you hear the correct boing or chime each time. By doing so, if there is a shorted or misplaced cable, you will know which cable is the suspect as you plug it in. All J numbers referred to are on the power/video interface board. Plug the 10-position video-output cable into J10. Plug the 9-pin "D" cable and verify that you have a raster on the CRT. There should be about a 1-inch black area between the edge of all sides of the raster and the plastic case bezel.

Plug one end of the 4-conductor reset cable into J4; the other end with the 1 × ½-inch PC board adapter plugs onto the 4 contacts on the top of the two black plastic pushbutton switches on the left rear of the Apple motherboard. Bend the pushbutton contacts so they are vertical and plug the adapter PCB on so the 4-conductor wire comes off toward the center of the motherboard.

Plug the 5-connector cable from the power-on LED and key-lock switch into J5. With the key-lock switch in the "on" (unlocked) position, verify the boot boing or chime. Then turn the key lock switch to the locked position and make sure you don't get the boing or chime. That essentially shorts the contacts on the programmer's switch and keeps the motherboard from booting.

Plug the connector with the orange, black, and white wires from the "turbo" pushbutton onto J3. Test the switch by turn-

ing on the power, waiting for the Mac raster to appear; then press the switch and a dialogue box should appear in the center of the screen. Note that it is not actually a turbo switch; it is used for activating the Mac function known as "programmer's switch" (see an Apple manual for a complete explanation). Also, the pushbutton switch is not exactly the right type for a programmer's switch; it is a push-push alternate action type where it actually should be a momentary pushbutton.

If you like, you can unsolder the switch from the PCB next to the key lock and replace it with the correct type of switch, or just remember to push it twice if you use it. Unless you plan to do any programming, you will not need to use it. The switch can also function as a simple "lock" for your computer. If you press it once and lock the button in, the computer will not boot.

Now plug in the 2-conductor black and white cable that goes to the front panel "reset" pushbutton. Test it by turning on the power and waiting for the boing or chime. When you press the button, the computer should reset; that is, it should boing or chime after each press.

Plug in the 20-conductor ribbon cable from J6 on 128K through Mac Plus boards or J8 on SE or SE-30 boards to the floppy drive. The cable is keyed so it cannot be inserted incorrectly. It also has several internally cut wires to make it work correctly with the Mac motherboards.

Plug in a mouse (or trackball) and a keyboard at the rear of the motherboard. Add an internal or external hard drive as desired. Insert an Apple system disk in the floppy and boot the computer so you get the Mac desktop. Table 1 shows the various combinations of system versions that work with different Mac motherboards. Note that motherboards with 64K ROM's use System 4.1, up to 6.0. Mac Plus motherboards (128K ROM's) use System 6.1 to 6.04. System 6.04 is the most bug-free, but is too large for use without a hard drive. If there is no hard drive, system 6.03 is recommended. System 6.05 is not recommended for the Plus or SE series; use it on the Mac FX IIci, etc..

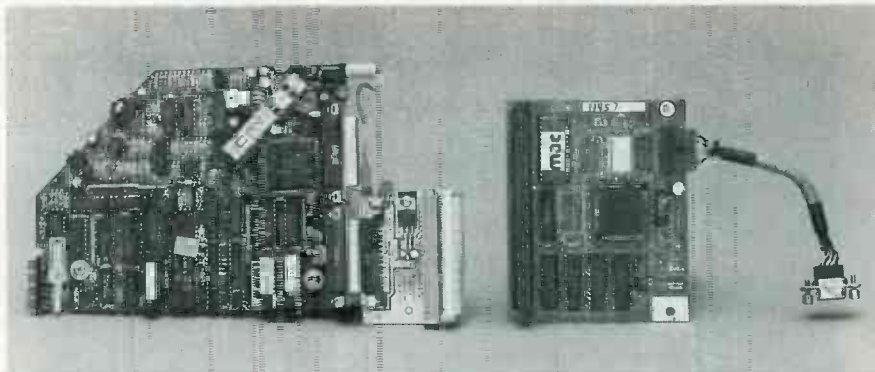


FIG. 9—THE VOICE NAVIGATOR allows you to perform certain tasks using voice commands rather than using a mouse or trackball.

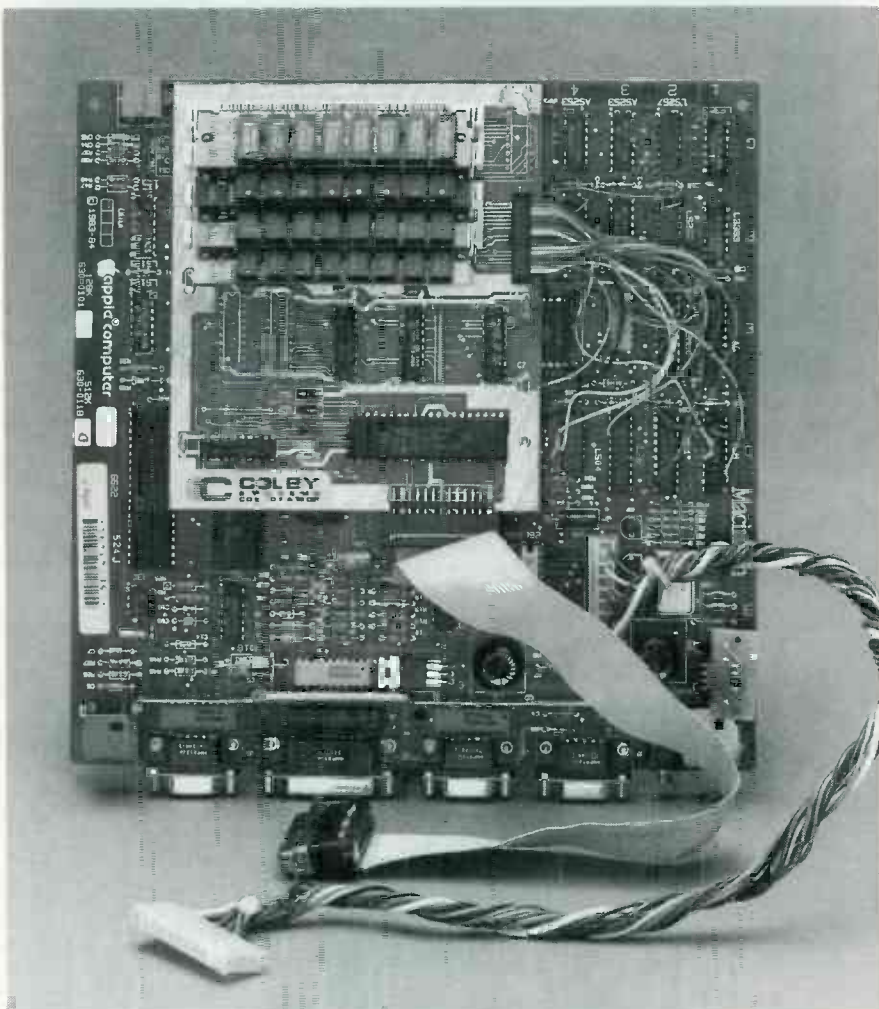


FIG. 10—THE COLBY SIMM ADAPTER BOARD requires that 2 DIP's be removed and about 22 wires and a daughter board to be soldered onto the motherboard. It allows you to use standard 256K or 1-MB SIMM's.

Memory upgrades

With the advent of Hypercard™ and many other later applications that require one megabyte or more of RAM, it becomes more and more important to add RAM to run the latest software. Simply install each SIMM module with chips to the right of the SIMM by pressing the SIMM module firmly

in the socket at a 45-degree angle and gently rolling it back until it snaps into place.

Originally, the only way to upgrade memory on a Mac 128K, 512K or 512KE was to unsolder the old RAM chips and solder in newer, higher-capacity chips. More often than not, that resulted in damaging the fine

SOURCES OF MAC PARTS

MEMORY AND ROM UPGRADES

- Colby Systems Corp.
- Dove Computer
- Total Systems Inc.

MAC MOTHERBOARDS

- Your local computer or Apple dealer
- Mac Heaven
- Pre-Owned Electronics, Inc.
- Shreve Systems

MAC-COMPATIBLE KEYBOARDS AND MOUSE OR TRACKBALL

- Abaton Technology
- Any Apple dealer
- DataDesk Int'l.
- Colby Systems Corp.

SPECIAL CASE AND POWER SUPPLY

- Gettys Electronics

HARD DRIVES (20 to 300 MB)

- Any Apple dealer
- Colby Systems Corp.
- SuperMac Technology

HARD DRIVE BRACKETS, CABLES, AND FORMATTING SOFTWARE

- Maus Electronics
- Colby Systems Corp.

MAC-COMPATIBLE INTERNAL FLOPPY DRIVES

(you must use the Colby FDD-800K in the case we used)

- Colby Systems Corp.

MAC-COMPATIBLE EXTERNAL FLOPPY DRIVES

- Any Apple dealer
- Colby Systems Corp.
- Applied Engineering

POWER & VIDEO CABLES AND VIDEO PROCESSOR MODULE

- Maus Electronics

MAC II COMPATIBLE 14" MONITOR

- Colby Systems Corp.
- Nuvotech

APPLE MACINTOSH OPERATING SYSTEM SOFTWARE

- Any Apple dealer

ADDRESSES

- Abaton Technology
48431 Milmont Dr.

Fremont, CA 94538
Phone: 415-683-2226

- Applied Engineering
PO Box 5100
Carrollton, TX 75011
Phone: 214-241-6060

- Colby Systems Corp.
2991 Alexis Drive
Palo Alto, CA 94304
Phone: 415-941-9090
Fax: 415-949-1019

- DataDesk Int'l.
7651 Haskell Ave.
Van Nuys, CA 91406
Phone: 800-826-5398
(in CA: 800-592-9602)

- Dove Computer
Phone: 919-763-7918
- Gettys Electronics
22018 Frontier Rd.
Clovis, CA 93618
Phone: 209-299-7828

- Mac Heaven
14101 Park Long Court
Chantilly, VA 22021
Phone: 703-263-2567

- Maus Innovations
121 S. Corona
Denver, Co 80209
Phone: 303-744-9512

- Nuvotech
2015 Bridgeway Ste 204
Sausalito, CA 94965
Phone 415-331-7815

- Pre-Owned Electronics, Inc.
30 Clematis Ave
Waltham, MA 02154
Phone: 617-891-6851
Fax: 617-891-3556

- Shreve Systems
2421 Malcom St.
Shreveport, LA 71108
Phone: 318-635-1121
Fax: 318-865-2006

- SuperMac Technology
485 Potrero Ave.
Sunnyvale, CA 94086
Phone: 408-245-2202
- Total Systems Inc.
Phone: 503-345-7395

traces of the motherboard. Also, the fact that the board is a four- or six-layer board makes desoldering very difficult. There is now an easier way to upgrade 128K and 512K motherboards without desoldering all the old

RAM chips one-by-one.

The Colby SIMM adapter board requires only 2 DIP's to be removed and about 22 wires and a daughter board to be soldered onto the motherboard, as shown in Fig. 10. That will save you about 3-4 hours of work, is much less likely to damage your motherboard, and allows you to use standard 256K or 1-MB SIMM's instead of discrete RAM chips. It also has a built-in SCSI port to enable you to operate a hard drive on a Mac 128K or 512K (128K ROM's are required).

The Mac Plus motherboard was the first Mac to use SIMM RAM. Unlike IBM-PC clones, the

Mac uses only eight chips per SIMM instead of nine, because there is no provision for parity checking. There are two types of SIMM's that will work on this unit; 256K and 1-MB types. In general, they can be identified by inspecting the individual RAM IC's. The 256K chips have leads on all four sides, whereas the 1-MB chips have leads on only two sides.

The Mac Plus can be configured with 1 MB consisting of four 256K SIMM's, 2 MB consisting of two 1-MB SIMM's, 2.5 MB consisting of two 256K SIMM's and two 1-MB SIMM's, or 4 MB consisting of four 1-MB SIMM's.

One megabyte of memory (four 256K SIMM's) is normally present in the Mac Plus. It is located on four SIMM's at an angle of about 45 degrees to the main board in front of the 68000 processor. Remove all four of the SIMM's currently installed in your Mac Plus. Use your fingernail or small screwdriver to gently bend the plastic locking tabs out to the left and right to release the SIMM. CAUTION: The plastic retaining tabs will break very easily if you are not careful. Push them only enough so they clear the edge of the SIMM.

Locate resistor R8 in the corner of the motherboard nearest the printer port; clip it on one end and bend it aside to prevent contact. Do not remove it, so that if you want to reconfigure your Mac Plus back to one megabyte, you can do so easily.

Starting with the SIMM slot in the rear nearest the 68000 processor (row 1), install a 1-MB SIMM module in the rear socket on the Mac Plus motherboard by pressing it firmly into the socket at a 45-degree angle and gently rolling it back until the locking tabs snap into place. For 2.5 MB, two of the original Mac Plus 256K SIMM's go in the third and fourth sockets and two 1-MB SIMM's go in the first and second. For 4 MB, all four sockets must be filled with 1-MB SIMM's.

Replace the keyboard, mouse, and other attachments and power-up your Mac Plus. To test the memory installation, pull down "About the Finder" under the Apple DA menu for the registered amount of RAM. Note that with memory configurations

TABLE 1

Version	System	Finder
Mac 128K	4.1	5.5
Mac 512K	4.1	5.5
Mac 512KE	6.0 to 6.04	6.1-6.1.4
Mac Plus	6.0 to 6.04	6.1-6.1.4
Mac SE	6.0 to 6.04	6.1-6.1.4
Mac SE-30	6.0 to 6.04	6.1-6.1.4

larger than 1 MB, the Macintosh will take an extra 15–30 seconds to boot up.

Like the Mac Plus, the Mac SE motherboard has 4 SIMM sockets and can be configured with 1 MB, 2 MB, 2.5 MB, or 4 MB of RAM. There are two versions of the SE motherboard and the placement of the SIMM's and jumper differs, so you must determine your logic board type. Type 1 has resistors and no jumper, and type 2 has a jumper on the header. Adhere to the instructions pertaining to your particular motherboard.

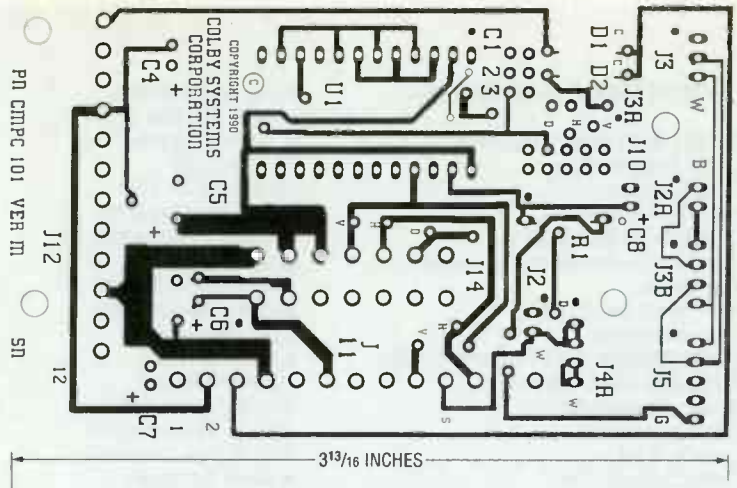
One megabyte of memory is typically installed in most SE motherboards with four 256K SIMM's filling the four memory SIMM slots. Remove all four original SIMM's, working from the front to the rear on both sides. If your SE has a resistor, clip the R35 resistor on one end and bend it aside to prevent contact. Do not remove it, as you may want to reconfigure to 1 MB later on.

The SE memory requirements with resistor R35 are as follows: For 2 MB, install two 1-MB SIMM's in SIMM sockets 1 and 2 (second row). For 2.5 MB, install two 1-MB SIMM's in position 1 and 2 (first row). Place two of the Apple 256K SIMM modules in positions 3 & 4 (second row), and completely remove the jumper. For 4 MB, install four 1-MB SIMM's in all four positions and completely remove the jumper.

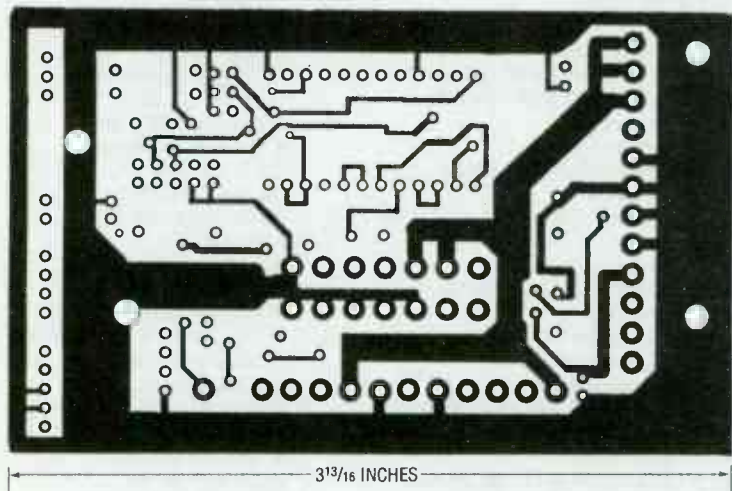
The three-pin jumper tells the SE what type of SIMM's are in use. The standard configuration is 1 MB of memory consisting of four 256K SIMM's installed in both rows. The jumper will be installed on the jumper block terminals labeled "1M."

The memory requirements for the SE version with a jumper are as follows: For 2 MB, install two 1-MB SIMM's in sockets 3 and 4 (second row). Move the jumper to the jumper block terminals labeled "2/4 MB." For 2.5 MB, put two of the Apple 256K SIMM modules in positions 1 and 2 (first row). Install two 1-MB SIMM's in positions 3 and 4 (second row), and completely remove the jumper. For 4 MB, install four 1-MB SIMM's in all four positions and completely remove the jumper.

Replace the keyboard, mouse,



THE COMPONENT SIDE of the power/video interface board.



THE SOLDER SIDE of the power/video interface board.

and other attachments and power-up your Mac Plus. To test your memory installation, pull down "About the Finder" under the Apple DA menu for the registered amount of RAM. The Mac SE-30 can be configured as follows: 1 MB with four 256K SIMM's in bank A, 2 MB with four 256K SIMM's in bank A and four 256K SIMM's in bank B, 4 MB with four 1-MB SIMM's in bank A, 5 MB with four 1-MB SIMM's in bank A and four 256K SIMM's in bank B, 8 MB with four 1-MB SIMM's in bank A and four 1 MB SIMM's in bank B, 16 MB with four 4-MB SIMM's in bank A, and 32 MB with four 4-MB SIMM's in bank A and four 4-MB SIMM's in bank B. Note: Since the Mac SE-30 runs at 16 MHz, it is recommended that 80 ns RAM be used (denoted by a -8 or -80 suffix on the part number on the individual chips on the SIMM).

You must remove the original SIMM's found on your SE-30 motherboard if you are installing 1-MB SIMM modules. Note: This step is not necessary if you are installing 2 MB. Gently bend the plastic locking tabs out to the right and left to release the SIMM module. Rotate the SIMM forward to clear the locking tabs and remove all four SIMM's. Place the SIMM's on a non-static surface, such as the anti-static bags and pink foam supplied with your new SIMM's. Repeat this same procedure until all of the original SIMM's are removed.

Install each SIMM module with chips to the right of the SIMM by pressing the module firmly in the socket at a 45-degree angle and gently rolling it back until it snaps into place. 256K SIMM's are about \$24.99, 1-MB SIMM's are about \$49.99, and 4-MB SIMM's are about \$299.99. R-E

BUILD A NEGATIVE ION GENERATOR

IF YOU'VE SEEN ADVERTISEMENTS for negative ion generators in mail-order catalogs and wondered how they work, this project is for you. The simple version described here provides insight into their theory and applications, and is both informative and entertaining. Some of the demonstrations you can do with it will amaze you and your friends.

Many claims have been made for the beneficial attributes of negative atmospheric ions on human and plant life, especially by a Dr. Albert Krueger of the University of California. Studies have shown that negative ions promote physical and mental alertness and well-being, while positive atmospheric ions (such as in polluted air) cause discomfort and lassitude.

Certain negative ion properties can be demonstrated. For example, the surrounding air after a thunderstorm smells clean and fresh, due to generation of negative ions from lightning. The negative ions attach to smoke, dust, and pollen particles, bringing them to the ground to discharge, leaving fresh, clean air. That's why a cool room with a breeze is invigorating, compared with one that's stiflingly heated. Cool air is generally negatively ionized, whereas heated air is generally positively ionized.

Negative ions are air molecules with one or more excess electrons, produced in this case by a low-power, 9 to 14-kilovolt DC supply. The positive terminal is grounded, and the other (the emitter) is a needle exposed to air. (To generate positive ions, the polarities would be reversed.) Extra electrons on the emitter's surface produce a high local electric field owing to its pointed shape. The electrons exit the emitter needle's

Build this negative ion generator and put some charge in your life.

ANTHONY J. CARISTI



WARNING!! This article deals with and involves subject matter and the use of materials and substances that may be hazardous to health and life. Do not attempt to implement or use the information contained herein, unless you are experienced and skilled with respect to such subject matter, materials, and substances. Neither the publisher nor the author make any representation as for the completeness or the accuracy of the information contained herein, and disclaim any liability for damages or injuries, whether caused by or arising from the lack of completeness, inaccuracies of the information, misinterpretations of the directions, misapplication of the information, or otherwise.

surface due to the polarization of surrounding air molecules between the emitter needle and ground. The electrons collide with the air molecules and produce negative ions.

A common misconception regarding high-voltage corona or arcing is that electrons are "overcrowded" on the tip, and forced off by mutual repulsion. What actually causes corona is the high electric field at the tip, which is directly proportional to the voltage, and is enhanced by sharpening an electrode tip to a fine point.

The high electric field strains the air molecules, polarizing them by a phenomenon called dipole polarization. If the electrode is positive, electrons are literally ripped off, creating positive ions, or if the electrode is negative, they're forced to accept electrons, creating negative ions.

High-voltage supplies like those in TV's need careful design, so no undesired discontinuities like sharp points or edges cause arcing. However, for the negative ion generator discussed here, the goal is to generate corona, not to avoid it, and the high electric field in the vicinity of a discontinuity more readily polarizes and ionizes air molecules.

The reason for the high electric field at the tip of a needle is due to its small localized radius of curvature. A sphere has a much more uniform electric field at its surface, due to its constant and much larger radius. The audible hiss caused by a high-voltage discharge is called "corona wind," and is often heard in older large-screen color TV's, especially on humid days, when the breakdown potential of the surrounding air is reduced, making the flyback transformer arc. You can often also feel it, if the corona is strong enough.

The negative ion generator de-

scribed here is low-cost, easy to build, and uses a high-voltage flyback transformer from an old black-and-white TV. It generates high voltage, but at very low current. However, the safety precautions taken for any high-voltage device should be observed here.

The circuit

The schematic of the negative ion generator appears in Fig. 1; T2 is a TV flyback transformer with an open ferrite core partially enclosed in an aluminum bracket. The only original connections used are one low-voltage tap as ground, and the lead connecting to the flyback transformer output winding (at right).

The other low-voltage taps aren't used, and the new feedback and bifilar primary windings are wound on the ferrite core. The bifilar primary winding goes to the collectors of an astable multivibrator made up of Q1 and Q2, with the center tap driven by the +3–5 volts DC from IC1. The astable energy-storage elements are the inductances of the new feedback and bifilar primary windings.

The term bifilar means a pair of transformer windings optimally coupled by having been wound in the same direction, either adjacent to or, preferably, superposed on top of one another. The feedback winding goes to the bases of Q1 and Q2 for positive feedback, with the center tap driven by the +3–5 volts DC from IC1 through R3. The transistors are then forward-biased by the opposite ends of each half of the feedback winding.

When power is applied, the current through Q1 and Q2 is unequal, due to differences in doping, layer thickness, and base-emitter (B-E) turn-on voltage. That's what causes oscillation; if all the astable parts were perfectly balanced (nearly impossible), it might not oscillate at all. Whichever transistor carries higher current saturates due to positive base feedback, and the other cuts off.

When the sharp increase in transistor current in half the bifilar primary winding is maximized, the induced voltage reverses, so the second transistor conducts and the first one cuts off. The collector waveform

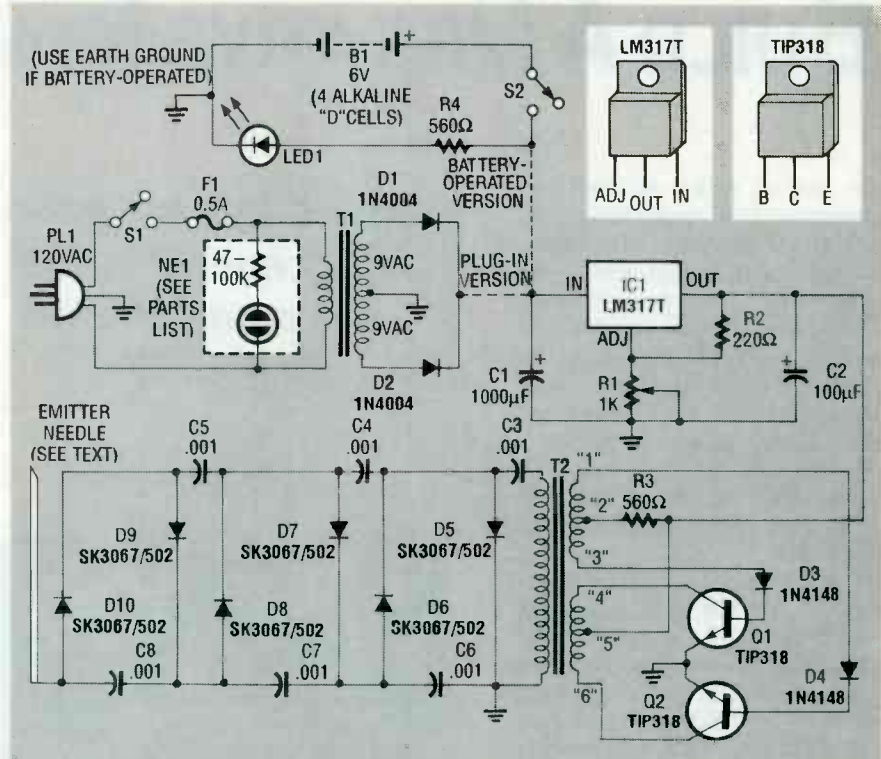


FIG. 1—THE SCHEMATIC OF THE NEGATIVE ion generator. T2 is a TV flyback transformer; only its output winding is used, and new feedback and bifilar primary windings are wound on the ferrite core. The bifilar primary winding goes to the collectors of astable Q1-Q2. Its square wave induces high voltage into the flyback transformer output winding, boosted followed by a ladder voltage-tripler – 9 to – 14 kilovolts.

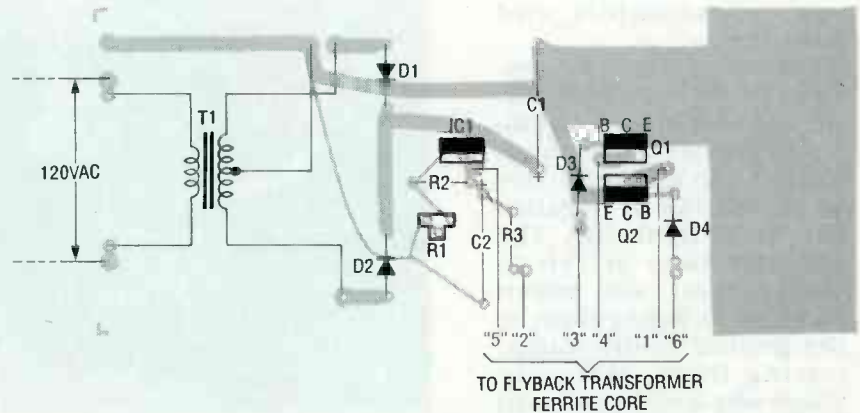


FIG. 2—THE PARTS-PLACEMENT DIAGRAM for the main PC board; Q1, Q2, and IC1 have U-shaped 1×1-inch copper heatsinks, with silicone grease for heat transfer; each goes on the main PC board without insulators. In the prototype, S1, S2, F1, and NE1 were omitted, and T2 was salvaged from a small-screen TV; note the new feedback and bifilar primary windings. Pin 7 had the highest resistance relative to the flyback transformer output lead, so it becomes ground.

fundamental frequency was 23.26 kHz, although higher harmonics greatly extend the total bandwidth. Also, the peak-to-peak bifilar primary winding voltage is four times that of the supply.

The astable square wave induces voltage into the flyback transformer output winding, proportional to the transformer turns ratio. A flyback transformer bifilar primary winding is

normally quite small, while the flyback transformer output winding normally has about 2000–2500 turns, inducing – 3 to – 4 kilovolts.

Since the negative ion generator needs to produce – 9 to – 14 kilovolts DC, a ladder voltage-tripler with six diode-capacitor rungs is used to half-wave rectify and multiply the flyback transformer output voltage. Its operation is best understood in

PARTS LIST

All resistors are 1/4-watt, 5%, unless otherwise noted.

- R1—1000 ohms, PC-board mounted potentiometer
 R2—220 ohms
 R3, R4—560 ohms (the former for the astable-flyback transformer combination, the latter optional for the battery-operated version)
 R5-R6—200- and 40-megohm series high-voltage focus divider, RCA SK3868/DIV-1, used for an optional high-voltage range extender for a conventional high-impedance (10-megohm) voltmeter (see text)
 R7—2.7 megohms

Capacitors

- C1—1000 μ F, 25 volts, electrolytic
 C2—100 μ F, 16 volts, electrolytic
 C3-C8—0.001 μ F, 10 kilovolts, ceramic disc
 C9—0.001 μ F, 500 volts, ceramic disc, optional for aluminum can/neon bulb experiment (see text)

Semiconductors

- D1, D2—1N4004 silicon diode
 D3, D4—1N4148 silicon diode
 D5-D10—RCA SK3067/502 high-voltage diode, 12 kilovolts PIV
 LED1—light-emitting diode for the battery-operated version
 Q1, Q2—TIP31B NPN transistor
 IC1—LM317T adjustable voltage regulator

Other components

- F1—0.5-amp slow-blow fuse with holder
 NE1—120-volt AC neon-bulb assembly with 47-100K built-in series resistor for the plug-in version (Radio Shack 272-712)
 NE2—neon bulb, type NE2 (not the part number), optional for experiment (see text)
 S1—SPST toggle switch
 S2—SPST toggle switch
 T1—18-volt center-tapped transformer (Radio Shack 273-1515)
 T2—standard TV flyback transformer (see text)

Miscellaneous: Plastic case (7.5 x 4.25 x 2.25-inches, Radio Shack 270-224), enamel magnet wire, three-wire line cord, emitter needle (made from either straight pin or sewing needle), RTV silicon rubber, heat sinks, four alkaline "D" cells (optional for battery operation), 2-liter plastic soda bottle, and a sewing needle.

NOTE: The following are available from Anthony J. Caristi, 69 White Pond Road, Waldwick, NJ 07463: Two etched and drilled PC boards (one each for the main and voltage-tripler sections) for \$15.95, IC1 for \$3.25, Q1 and Q2 for \$2.75 each. Please add \$2.00 for postage and handling with each order; NJ residents please add 7% sales tax.

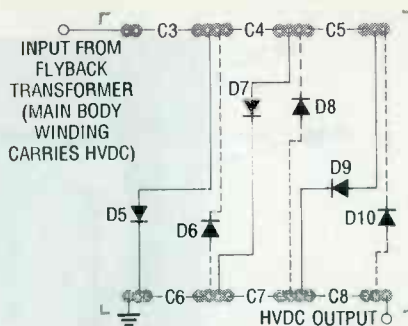


FIG. 3—THE PARTS-PLACEMENT diagram for the high-voltage PC board. The parts shown include high-voltage ceramic disc capacitors C3-C8, and selenium rectifiers D5-D10. D5, D7, and D9 go on the component side (solid lines), while D6, D8, and D10 go on the foil side (dashed lines).

segments. The AC waveform from the transformer is coupled to D5 and D6 via C3, charged through D5 acting as a clamp.

The peak-to-peak magnitude of the AC waveform at the anode of D5 equals that of the flyback transformer output winding, with a negative DC component of half the peak-to-peak value. The

AC output waveform from the flyback transformer is coupled to the anode of D7 via C3 and C4, where D7 charges C4. The action is repeated again via D9, which charges C5. The DC potentials on C3-C5 add, tripling the voltage from the flyback transformer winding. The anode of D10 is the output of the negative ion generator, and should be at -9 to -14 kilovolts DC.

Power is supplied by either a standard full-wave rectifier followed by variable voltage regulator IC1, or four series "D" cells producing 6 volts DC. Although S1, S2, F1, and NE1 are shown in Fig. 1, they were omitted in the prototype. IC1 controls the DC voltage fed to the oscillator via R1. Since the negative ion generator output must be -9 to -14 kilovolts, and the exact flyback transformer turns ratio is normally unknown, adjusting R1 is mandatory. Once R1 is set, the negative ion generator output voltage will be stable.

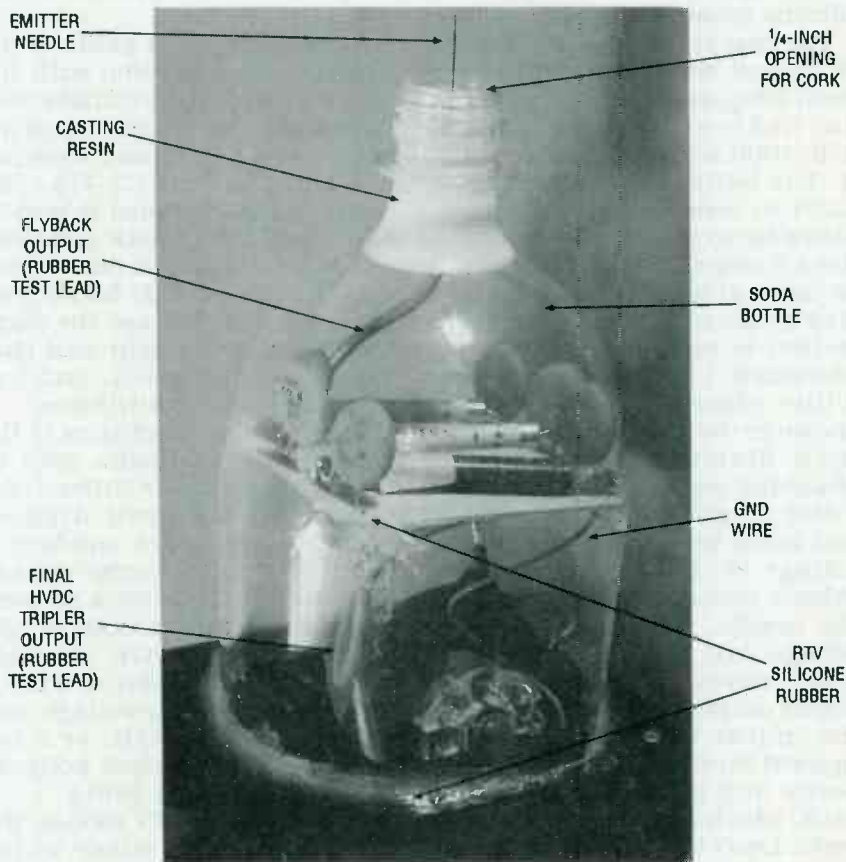


FIG. 4—THE NEGATIVE ION GENERATOR, showing the case, T2, plastic soda bottle, and the top of the high-voltage PC board, with D5, D7, D9, and C3-C8. Both the plastic soda bottle and high-voltage PC board are held in place with RTV. The neck is sealed with casting resin to within 1/4-inch of the top; cover the needle with a cork when unused.

Construction

Next, we'll discuss construction, focusing on the main and voltage-tripler PC boards, the plastic cover for the voltage-tripler PC board made from the top third of a 2-liter plastic soda bottle, the emitter needle, and the cutout in the lid of the plastic case for the flyback transformer. Figure 2 shows the parts-placement diagram for the main PC board, and Fig. 3 the ladder voltage-tripler section. Remember to add S1, S2, F1, and NE1 off the main PC board, as shown in Fig. 1, if you want them.

The main section includes the regulated supply, oscillator, and flyback transformer, and goes on the single-sided PC board mentioned in the parts list, with the foil pattern shown here. The high-voltage PC board contains the ladder voltage tripler, connected to the main PC board by two leads, and the emitter needle is above the high-voltage PC board. In Fig. 2, Q1, Q2, and IC1 need heatsinks; you can buy them, or make them from 1×1-inch copper bent in a "U," with silicone grease for heat transfer.

The heat sinks go on top of the PC board without insulators. Neon lamp assembly NE1 acts as an indicator, and has a 47K–100K resistor in series with it. For battery operation, use LED1 in series with R4; use alkaline batteries, not carbon-zinc. Use a 3-wire cord with ground, or an earth ground in battery-operated versions. The voltage-tripler section is built to avoid arcing and shock. Cut the top third off a 2-liter plastic soda bottle, as shown in the lead photo, or use 4-inch diameter plastic PVC plumbing pipe.

Use 18-gauge rubber-coated test leads to connect the high-voltage PC board to both the flyback transformer output and the needle, to withstand high voltage, but not until indicated (more below). The heavy voltage-tripler output lead is soldered to the emitter needle, which goes upward through the plastic soda bottle and projects out of the neck, which is filled with casting resin. Don't fill the neck with resin all the way to the top; leave ¼ inch of the neck open, so you can cap the needle with a wine bottle cork when not in use.

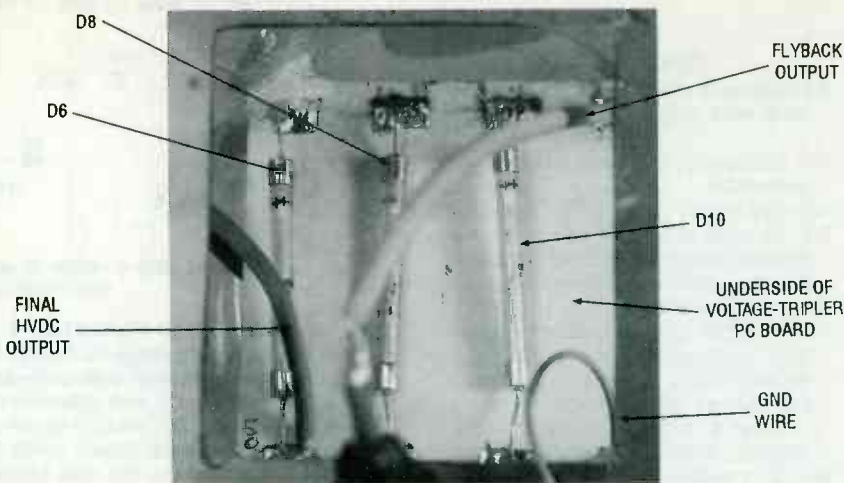


FIG. 5—THE BOTTOM OF THE HIGH-VOLTAGE PC board, showing D6, D8, and D10, and the attachment points of the ground lead and both high-voltage leads.

The voltage tripler shown in Fig. 3 consists of ceramic disc capacitors C3–C8, and high-voltage selenium rectifiers D5–D10. Note that D5, D7, and D9 go on the component side of the PC board, while D6, D8, and D10 go on the foil side. They're common to most TV's, so most TV repair shops should stock them; see the parts list.

Figure 4 shows a photo of the negative ion generator, with the closed case, flyback transformer, plastic soda bottle, and top of the high-voltage PC board showing D5, D7, D9, and C3–C8. The high-voltage PC board is held in place inside the plastic soda bottle top using RTV silicone rubber, and the plastic soda bottle goes on the top of the case the same way, for a water-tight seal that avoids condensation, and has good high-voltage attributes.

The markings and sizes of the high-voltage TV diodes used in the voltage tripler differ from those on standard diodes. They're much larger, and have a very high peak-inverse voltage (PIV) rating. Also, on a conventional diode, the cathode is normally marked with a band, whether a white band on a black body for such low-voltage rectifiers as the 1N4001, or a red band on a clear glass body, as with the 1N4148 or 1N914.

In high-voltage TV diodes, the body is generally either white, black, or see-through. In Fig. 4, D5 and D7 are white with a band of black "+" signs on the right end, while D9 is black with a

dashed band of white "-" signs on the right end. The ends with the bands are the cathodes, for both diode body types; the reason for the "+" signs on D3 and D5 is that circuit power is normally considered as being extracted from the cathode ends in TV, and is called B+. In Fig. 5, D6, D8, and D10 all have bands of "+" signs on the cathodes.

A 3×3-inch hole was made in the case top for the flyback transformer; adjust yours as needed. Don't connect the voltage-tripler PC board to the main PC board until the final checkout below; put it aside and let the RTV dry overnight. The soda bottle and the high-voltage PC board are held in place using RTV. The rubber-coated test leads connect the flyback-transformer output to the voltage tripler and the voltage tripler to the emitter needle; the thin wire is the ground.

A flyback transformer is also called a tuned transformer, and consists of a ferrite core surrounded by a metal bracket, with a large coil of windings coated in plastic or ceramic with an extremely high dielectric breakdown voltage. Often, as with the flyback transformer used in the prototype, there are additional low-voltage output winding taps (seven, in that case) placed around a plastic ring on one side of the transformer coil, that have equally high-voltage breakdown characteristics.

That's all we have room for. Next month we'll finish up this project.

R-E

BATTERIES ARE BECOMING A BIGGER part of all our lives, and many innovative new products coming to market either use or contain them. Battery-powered products are no longer limited to just toys and handheld vacuums. Serious products—like handheld transceivers, portable scopes, or laptop computers—are often battery-operated. However, while batteries provide mobility, they're also often the culprits when a product fails.

Many of us still consider batteries to be the ultimate black boxes: mysterious devices that work only when they feel like it. However, they're really not that difficult to understand and use effectively. Here are some questions and answers to help you create better designs using them.

• I know there are many kinds of batteries. What's the best type for my application?

Choosing a battery type means knowing something about both

batteries and how they'll be used in your equipment. Batteries are commonly classed as either primary or secondary. Primary cells include the disposable varieties such as carbon-zinc, alkaline, and lithium cells that can't be recharged.

Secondary cells include the varieties based on either nickel-cadmium (Ni-Cd) or lead-acid cell chemistries, that are rechargeable several times without degradation. So first, consider your equipment. Specific questions include: What is the drain rate? How often will the equipment be used? And, finally, is recharging feasible?

Low current drain, short duty cycles, and remote operation favor the use of primary batteries for watches, hearing aids, garage door openers, and retrofit smoke detectors. Obviously, the application parameters for secondary batteries are basically the opposite of those for primary cells. In applications involving high

current drain or extended usage, the cost of replacement of disposable batteries may be prohibitive. Such applications are logical for rechargeable secondary batteries as long as recharging power can be provided.

• Based on drain rate and duty cycle, my application could go either way. What are the performance differences among various battery types?

Table 1 provides a comparison of various common battery types, both primary and secondary. The first point of interest is the nominal cell voltage; more sophisticated concepts like energy density will be covered later. Also, all batteries have one or more cells, operating at voltages fixed by the electrochemistry of a given cell. Note that the operating voltages are shown as decreasing in Table 1; the initial value refers to the fully charged state, while the final value refers to the end of runtime, or useful life.

BATTERY TECHNOLOGY

Here are some important Q&A's about batteries to enable you to use them more effectively.

MARK DEWEY

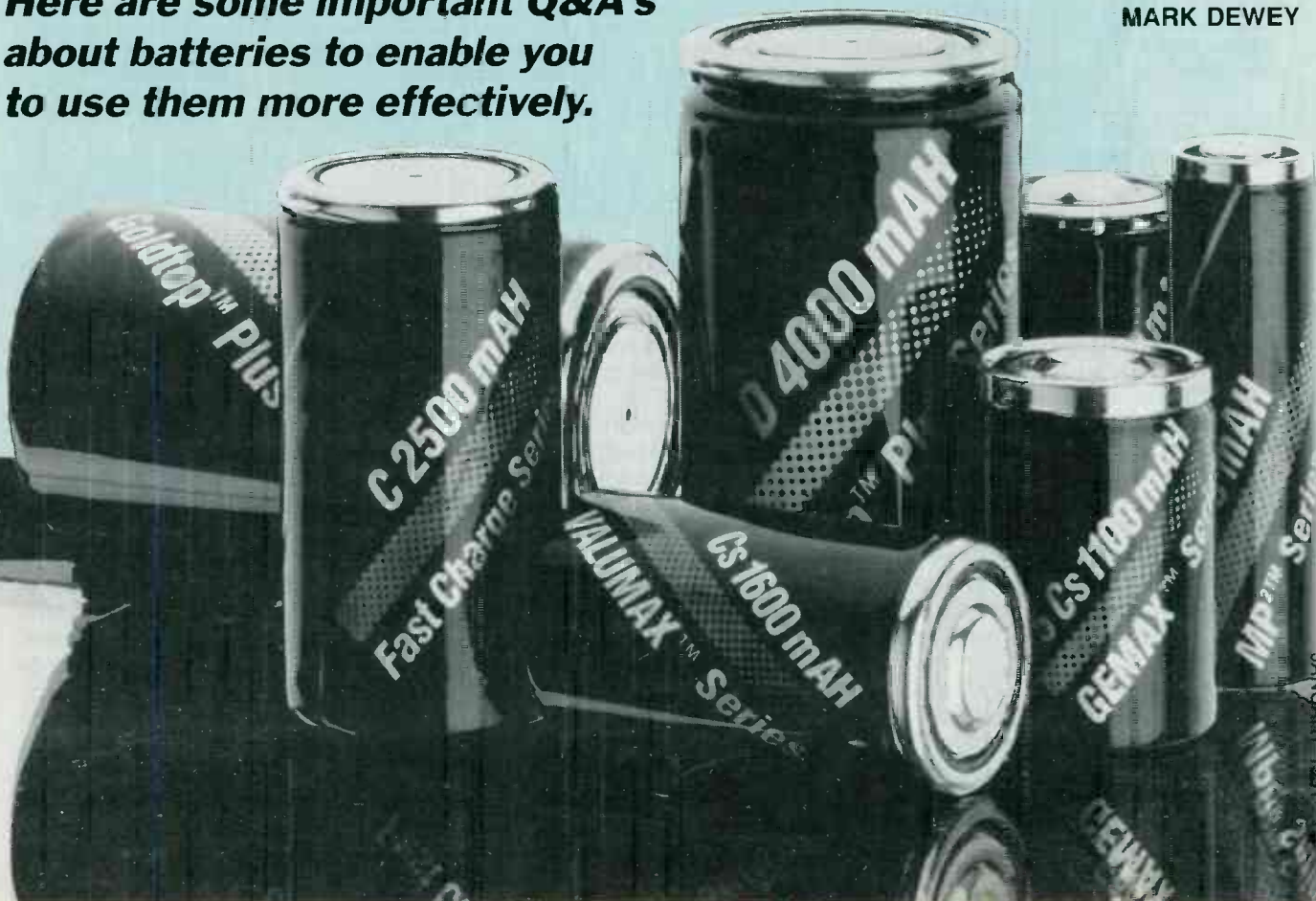


TABLE 1—CHARACTERISTICS OF COMMON BATTERY TYPES

Characteristic	Primary Cells		Secondary Cells	
	Carbon-Zinc (LeClanche)	Alkaline	Lead-acid (sealed (SLA), wound, gel.)	Ni-Cd (sealed, wound)
Chemistry:				
Anode	Zn	Zn	Pb	Cd
Cathode	MnO ₂	MnO ₂	PbO ₂	NiOOH
Electrolyte (all aqueous solutions)	NH ₄ Cl and ZnCl ₂	KOH	H ₂ SO ₄	KOH
Cell voltage:				
Nominal	1.5	1.5	2.0	1.2
Open-circuit	1.5–1.75	1.5	2.1	1.25
**Operating	1.25–1.15	1.25–1.15	2.0–1.5	1.25–1.00
End	0.8	0.9	1.75	0.9
Operating temperature (°C)	–5–45	–20–55	–40–55	–40–70
Energy density (20°C) for cylindrical cells				
*Wh/kg	85	85	35	30
*Wh/liter	100	220	70	80
Advantages	Lowest cost; good for non-critical use under moderate conditions; variety of shapes and sizes; readily available	High capacity compared with zinc-carbon; good low temperature	Low cost; readily available; good high-rate, high- and low-temperature operation	Sealed, no maintenance; good low temperature and high-rate performance, long cycle life
Limitations	Low energy density; poor low temp., high-rate performance	Moderate cost	Relatively low cycle life; limited energy density; poor charge retention; hydrogen evolution	Higher initial cost than lead-acid
Major types available	Cylindrical bobbin cells to 30 Ah; flat cells	Button and cylindrical cells to 20 Ah	Prismatic, cylindrical, wound cells, 200-400 Ah	Button cells to 0.5 Ah; cylindrical cells to 10 Ah

*Wh: Watt-hour.

**Values are deliberately decreasing

The nominal voltages of all cells are fixed by their electrochemistry (more below). The two major primary cells, carbon-zinc and alkaline, both produce 1.5 volts, while lithium versions produce 3.0 volts. The carbon-zinc cell is referred to in Table 1 as a "Leclanche" cell, named after the French chemist George Leclanche, who discovered it in 1866. Under the Ni-Cd cell listings, one of the the cathode material has the unusual formula of NiOOH, which is nickel oxy-hydroxide.

Of the major secondary cells, Ni-Cd cells produce 1.2 volts/cell, and lead-acid cells 2.0 volts/cell. Higher voltages, up to 240 volts, are commercially available from

series cells. In 12-volt car batteries, all cells are connected internally. However, certain cell potentials, like 4 volts, may be possible from one cell type, but not from others.

Cell chemistry also causes voltage "droop" during discharge, which may affect a given application. While flashlights merely dim as their battery voltage decreases, many electronic circuits are highly sensitive to even slight drops in input voltage. Figure 1 compares the performance of primary carbon-zinc and alkaline "D" cells with secondary Ni-Cd and sealed-lead cells, for a discharge current of 800 milliamps.

The carbon-zinc voltage profile falls rapidly with discharge, with

a runtime under four hours. The voltage of an alkaline cell also falls off steadily, but its runtime is roughly quadruple that of a carbon-zinc cell. The Ni-Cd cell has a voltage profile that's nearly flat for most of its life, but only half the terminal potential of an alkaline cell. The Ni-Cd cell has a first recharge life that roughly equals the total life of an alkaline cell.

The stability of Ni-Cd cells at high current drains is why they're used in portable items: drills can draw up to 30 amps under load. The internal resistance of a Ni-Cd cell is 5–15 milliohms due to its construction, making such high current drains possible. A spiral nylon separator

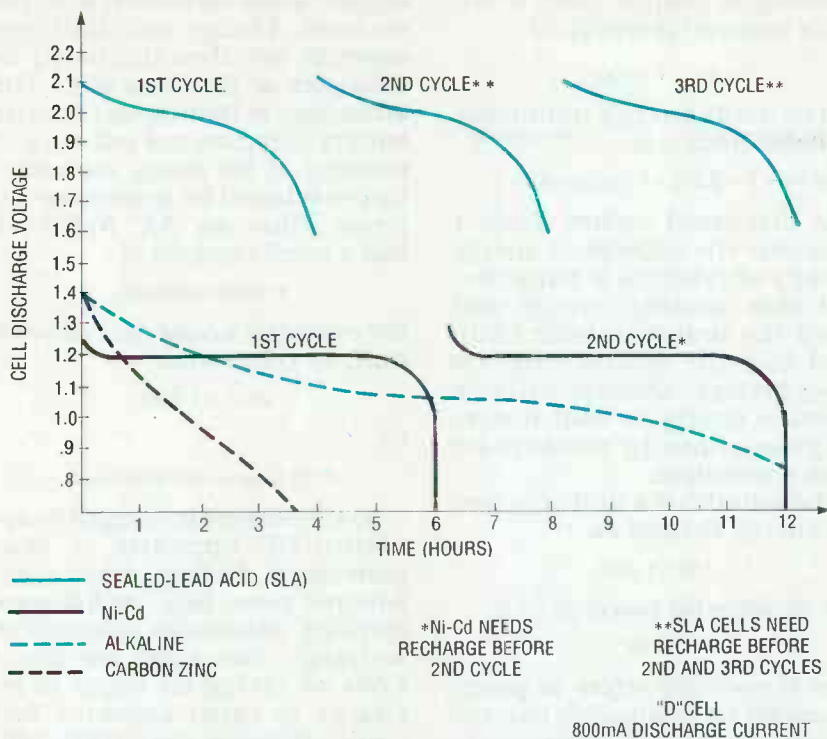


FIG. 1—THE VOLTAGE PROFILES OF PRIMARY and secondary D-cells are compared for a discharge current of 800 milliamps. The carbon-zinc voltage profile falls rapidly with discharge, with a runtime under four hours. Alkaline performance falls off steadily, but runtime is quadruple that of carbon-zinc.

isolating the electrodes goes in a steel can used as the negative terminal, and is filled with electrolyte that transmits mobile charge. The steel it's sealed in is used as the positive terminal, as shown in Fig. 2.

Whereas Ni-Cd cells have a large anode-nylon-cathode surface area due to their spiral design, alkaline cells have an annular (or doughnut-shaped) cross section. Powdered anode material fills an inner ring, and compressed cathode material fills an outer ring. They're isolated by a porous fiber separator as shown in Fig. 3, giving a higher internal resistance, and limiting the available current drain.

Note that in Fig. 3, the top positive electrode is the cathode, while the bottom negative electrode is the anode. At first glance, that might seem odd, since most of us are normally accustomed to the reverse usage encountered with diodes. However, since a battery is an electrolytic (or electrochemical) cell, the labels for the terminals of a battery follow chemical, not electrical usage.

Earlier, there was a reference to how the electrochemistry of a battery fixes its terminal poten-

tial; let's now examine that aspect in more depth. The chemical process in a battery is an oxidation-reduction, also called a "re-

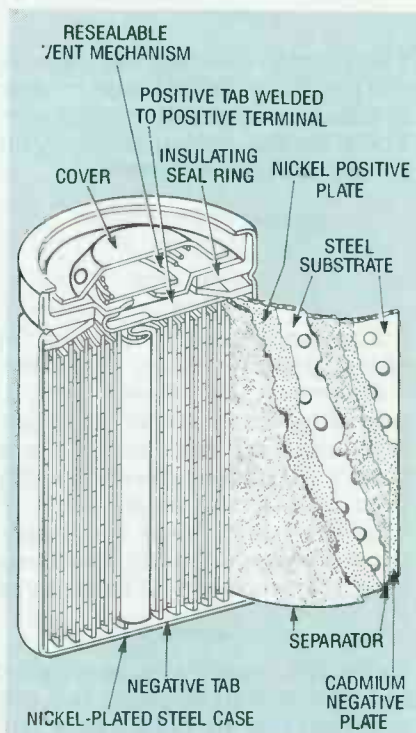


FIG. 2—NI-Cd CELLS EXHIBIT an internal resistance of 5–15 milliohms due to their construction, making stable current drain possible.

dox" reaction.

The anode is the terminal where material is oxidized, or where electrons are removed from or given up, and is usually called negative or minus ("−"), or where mobile electrons exit into a wire. The cathode is the terminal where material is reduced, or where electrons are accepted, and is usually called positive, plus ("+"), or the terminal where mobile electrons enter from a wire.

An electrolyte is the wet (or at least damp) ionic medium, through which mobile free electrons released by oxidation at the cathode travel to the anode, to propagate the electrolytic reaction of a battery. Table 1 lists the materials used for all three parts of the most common batteries.

The term "electrolytic" has the same meaning here that it has for capacitors, with certain variations. An electrolytic capacitor is polarized like a battery, and may well explode if its DC working voltage (WVDC) is exceeded (especially for reverse polarity), just as many primary nonrechargeable batteries will if recharged.

A battery, by contrast, is basically a fuel cell, maintaining terminal potential by electrochemical means until its fuel is exhausted. That is, the very selection of electrode metals and electrolyte is what determines the terminal potential of a battery, and a battery thus supplies charge *without* having to be charged initially.

All an electrolytic capacitor can do is store a charge fed into it, and dissipate the charge by generating an exponential current into a resistance. It stores charge (whereas a battery generates it spontaneously), and its potential decays exponentially, just as with any other capacitor. However, the electrolytic medium used allows the packaging of larger capacitance values than would otherwise be possible for a given volume. Nonetheless, batteries and electrolytic capacitors are at least second (or maybe even first) cousins.

● What are cell capacity ratings based on?

Battery manufacturers rate cell capacities in amp-hours (Ah), a unit of charge, not energy. A 1-

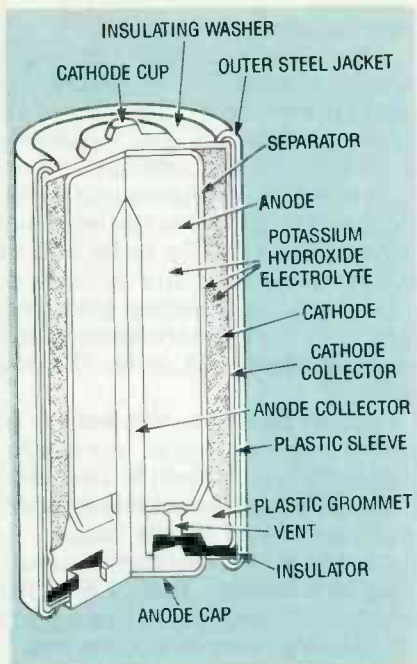


FIG. 3—THIS IS A CROSS section of an alkaline cell showing its annular construction.

amp current corresponds to the motion of 1 coulomb (C) of charge past a given point in 1 second (s), or

$$1 \text{ amp} = 1 \text{ C/s,}$$

where,

$$1 \text{ C} = 6.25 \times 10^{18} \text{ electrons/s.}$$

The individual electron is often denoted by the variable e^- , so the above relation would appear as

$$1 \text{ C} = 6.25 \times 10^{18} e^-.$$

The metric unit of charge is the coulomb, while that of energy is the joule (J). The potential energy (or potential work) W contained in a battery is related to its total available charge q and terminal voltage V by

$$W = q \times V.$$

The variable W is used for energy to avoid confusion with E and V , normally reserved for voltage, although many texts use E for total energy (kinetic and potential) and V for potential energy as well, so you should know the context to avoid confusion. Thus, an "AA" Ni-Cd cell that can maintain a 0.6-amp load for one hour is said to contain

$$\begin{aligned} q &= 0.6 \text{ Ah,} \\ &= (0.6) \times \\ &\left(\frac{6.25 \times 10^{18} e^-}{\text{C}} \right) \left(\frac{1 \text{ C}}{\text{s}} \right) \left(\frac{3600 \text{ s}}{\text{hr}} \right) (1 \text{ hr}) \\ &= 1.35 \times 10^{22} e^-, \\ &= 2160 \text{ C} \end{aligned}$$

of available charge. Such a cell has a terminal potential of

$$V = 1.2 \text{ volts,}$$

so the total energy nominally available from it is

$$W = q \times V = 0.6 \text{ C} \times 1.2 \text{ volts} = 0.72 \text{ J.}$$

As discussed earlier, Table 1 mentions the concept of energy density of cylindrical batteries, and uses another energy unit called the unit watt-hour (Wh), used with the electric meter on most houses. Electric utilities measure energy in watt-hours, not joules, since the numbers are more convenient.

The watt (W) is a unit of power, not energy, defined as

$$1 \text{ W} = 1 \text{ J/s.}$$

The variable for power is P ; if

$$P > 0 \text{ W,}$$

then P normally refers to power expended or dissipated, like the loss from a resistor. Whereas, if

$$P < 0 \text{ W,}$$

the reverse is normally true, that power is being supplied, rather than expended. Thus, a watt-hour is equivalent to

$$\begin{aligned} 1 \text{ Wh} &= \left(\frac{1 \text{ J}}{\text{s}} \right) \left(\frac{3600 \text{ s}}{\text{hr}} \right) (1 \text{ hr}) \\ &= 3600 \text{ J,} \end{aligned}$$

There are two energy density values per cell in Table 1, one relative to mass, and the other to volume. Thus, for the carbon-zinc cell, for the value relative to mass

$$\begin{aligned} \frac{65 \text{ Wh}}{\text{kg}} &= \left(\frac{65 \text{ Wh}}{\text{kg}} \right) \left(\frac{3600 \text{ J}}{\text{Wh}} \right) \\ &= \frac{2.34 \times 10^5 \text{ J}}{\text{kg}} \end{aligned}$$

A similar argument follows for energy density relative to volume.

However, the same cell, if providing less current, can provide more useful energy, since there's then less internal battery heat loss. If the same "AA" cell were discharged over five hours, it could sustain a 130-milliamp load, for an observed capacity of

$$q = 650 \text{ milli-Ah.}$$

Cells are generally marketed using five-hour ratings, but any comparison of cells from different manufacturers should use equivalent ratings.

Battery manufacturers define C as rated capacity; the italics are

used to avoid confusion with the coulomb. Charge and discharge currents are then discussed as multiples or fractions of C . The advantage is that we can discuss battery currents, not cell sizes or ratings; C for many manufacturers is based on a one-hour interval. Thus, an "AA" Ni-Cd cell has a rated capacity of

$$C = 600 \text{ milli-Ah.}$$

For example, under that convention, we could write

$$2 \times C = 1.2 \text{ Ah,}$$

or,

$$C/10 \text{ hours} = 60 \text{ milliamps.}$$

Ni-Cd cells are recharged by applying DC opposite to that generated during discharge, whether pure, half-, or full-wave rectified. Minimum commercial recharge rates used are about $C/20$, or taking 20 hours to recharge to rated capacity. But since charging isn't 100% efficient, especially when it's so slow, some 36–48 hours would realistically be needed.

• **Is there a danger of overcharging a Ni-Cd battery?**

Recharging efficiency decreases as it nears completion. The final few percent is returned as the cell approaches "overcharge," where Ni-Cd cells generate gaseous oxygen (O_2). At low recharge currents, continuous overcharge isn't damaging, since the cell electrochemically recombines the total oxygen volume, letting Ni-Cd cells be totally sealed.

For safety, venting is designed into the cell cover. If overcharged at current above a recommended limit, the oxygen is expelled via such a vent, which then reseals. Repeated venting does dry out water from the electrolyte, causing damage manifested as decreased lifetime for a given load.

Also distinguishing primary cells from Ni-Cd cells is the property of charge retention. Alkaline cells can maintain full charge in ambient environments for up to four years, especially if they're refrigerated, whereas most Ni-Cd cells will lose some 1–2% of their rated capacity per day. That's why many commercial Ni-Cd cell applications use trickle charging (as low $0.02C$) when the battery reaches an overcharge condition.

• I've heard a great deal about charge rates, especially "quick" and "fast" charging. What's the distinction?

Battery manufacturers have met market demands for cells with faster recharge rates. "Standard" charging is at a rate of 0.1 C, or 16–20 hours. "Quick" charging is at a rate of 0.33C, or 4–5 hours. Cells are available that can sustain continuous overcharge, with 100% oxygen recombination, at up to 0.33C, eliminating the need for trickle charging. "Fast" charging has become the industry standard, being a rate of 1.0C or higher, up to 2C–4C; recharge shutoff is done to prevent oxygen venting, even though it does no damage.

• Explain how cells are configured to make batteries. Don't I need certain additional knowledge about performance?

Assembling cells into batteries can appear, at least superficially, to be a rather trite exercise. However, knowing correct cell performance doesn't necessarily guarantee uniform, successful battery performance. Experienced product designers and hobbyists alike are aware that battery assembly can involve some important concerns, not the least of which is cell reversal. Ni-Cd cells are typically series-connected for higher voltage, and capacity is achieved using cells of adequate size.

Ni-Cd cells are typically connected in series for batteries. Runtime, or capacity, is met by using cells of sufficient size to meet the requirement. Cells of even the same size and manufacture lot can exhibit actual capacities that vary up to 8% of a mean. In multicell batteries, such variances can cause some cells to give up the last of their usable capacity, while others are still viable. If the extent of discharge is deep enough to bring one or more cells to zero voltage, cell reversal can occur.

• Explain cell reversal.

The voltage of a cell is the stored potential or electromotive force (EMF) capable of driving current through a circuit. When a cell is reversed, its energy is expended to the point where any further current drain is into the

cell, such that the circuit drives the cell, instead of the reverse, as shown in Fig. 4. During reversal, cell voltage can go as low as -1.4 volts, generating gaseous hydrogen (H_2), which doesn't recombine and has to be vented.

The solution to cell reversal is to understand and design for applications where cells have the potential for repeated reversal. Product designers can choose to use a cutoff circuit to terminate discharge based on battery voltage, to prevent cell reversal. Motorized products draw high current, so when their performance decays before the onset of reversal, they should be shut off. Modern Ni-Cd cells are more tolerant of cell reversal. Modern Ni-Cd cells repeatedly tested to 40% reversal at 10C have suffered no degradation.

Finally, if all Ni-Cd cells in a battery pack are overcharged, reversal is less likely since they all begin to discharge from the same

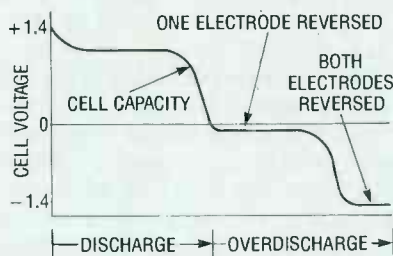


FIG. 4—IN CELL REVERSAL, the stored energy of a cell is expended to the point where the circuit drives the cell, instead of the reverse.

point. Building batteries from cells of equal capacities reduces the effect of individual cell variation at the end of discharge, and minimizes the chance of reversal.

• Memory continues to be a much-discussed problem in Ni-Cd batteries. How is memory avoided?

No discussion of Ni-Cd cells would be complete without mentioning the "memory" effect. The term memory was coined in the early 1960's during early NASA satellite flights. Satellite batteries have strict discharge/recharge regimes and receive very little overcharge. Such precise regimes were the result of NASA computer-controlled energy management, and are seldom duplicated commercially.

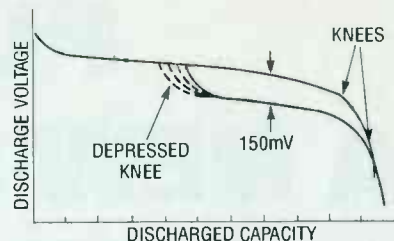


FIG. 5—IN NI-CD "MEMORY," cells repeatedly discharged only partially to the same extent, and then recharged soon won't discharge beyond the "memorized" level.

If Ni-Cd cells are repeatedly discharged only partially to the same extent (or thereabouts) and then fully recharged, they reach a point where they won't discharge further than the "memorized" location in their discharge profile. Today, the term "memory" is a misnomer, since it's now applied to a much wider range of similar problems.

Voltage depression and poor capacity are two common examples, often mistaken for memory, manifested as shortened runtime, as shown in Fig. 5. Devices frequently won't operate at voltages below a specific design value, or will exhibit reduced performance, at best. Causes include low recharging, excess recharge current, excess battery heat during recharge, improper recharge termination voltage, or wearout.

During standard or quick recharging, Ni-Cd cells need some overcharging, since recharging isn't 100% efficient. If they're not fully recharged, they can't deliver their rated capacity. Excessive overcharge currents can cause overheating in Ni-Cd battery packs. In overcharge, the energy provided to the battery is predominantly converted to heat, since the chemical conversions are complete, or nearly so. Such overcharging accelerates wearout or causes voltage depression or poor capacity, although improved Ni-Cd cell designs have lower sensitivity. Such improvements, along with careful application, insure long life.

• Does the electrolyte in a Ni-Cd cell ever leak?

Ni-Cd cells can undergo storage leakage, especially in radio applications, if left on. However, even if turned off, solid-state power supplies often allow leak-

continued on page 83

PUTTING A NEW SCOPE TO WORK

To get the most out of a new digital scope, you have to understand how it works, from the inside out.

ROBERT W. RAMIREZ

IF YOU'RE THINKING ABOUT BUYING A new oscilloscope, or your boss is putting a new one on your bench, you may be in for a surprise. Many of today's new scopes are vastly different from those of only a few years ago. That applies not just to exotic, state-of-the-art scopes, but also to low-cost, basic scope types. Becoming familiar with some key concepts behind

the new scopes will give you a head start into understanding how these useful testing devices work.

Oscilloscopes of today typically have far more features, yet cost about the same as—or even less than—yesterday's scopes. While they may have the same basic controls, and appear similar, they handle signals differently,

and measurement techniques have changed dramatically. In some cases, a new scope can even be a PC board that plugs into a personal computer or a logic analyzer. Yesterday's exotic features have become today's norm. Let's start off by looking at some of the changes that have occurred in traditional analog scopes.

Scopes going digital

It's rare today to find a garden-variety analog scope that doesn't use some form of digital circuitry. Some things are easier and less expensive to implement digitally. In fact, most control functions in any scope are more effectively accomplished digitally. The only analog devices in some traditional scopes may be the actual test probes, amplifiers, and CRT.

The usual front-panel controls and buttons still are present in newer scopes, and operate in much the same way as in older scopes. The main difference is that they're digitally implemented, with a microprocessor or two keeping track of things.

Some newer scopes have banks of push buttons for selecting vertical (volts per division) and horizontal (seconds per division) scaling of waveform displays. Others may still use the traditional knob approach, but with a new twist—no numbers or mark-



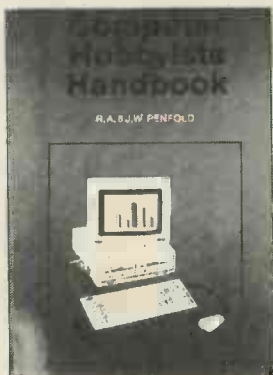
SHOPPER

Paperback Books

GREAT PAPERBACKS AT SPECIAL PRICES

COMPUTER HOBBYISTS HANDBOOK—BP251—\$8.95

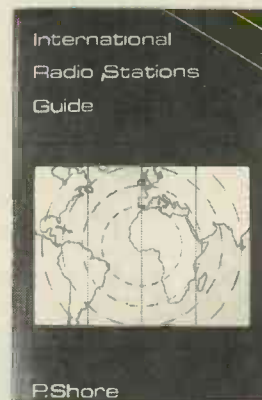
Subjects covered include microprocessors and their register sets; interfacing serial, parallel, monitor, games and MIDI ports; numbering systems, operating systems and computer graphics. While the book is aimed at the computer hobbyist, it should also prove useful to anyone who intends to use a computer to follow their interests.



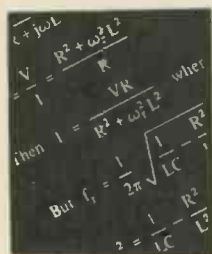
INTERNATIONAL RADIO STATIONS GUIDE—BP255—\$9.95

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.

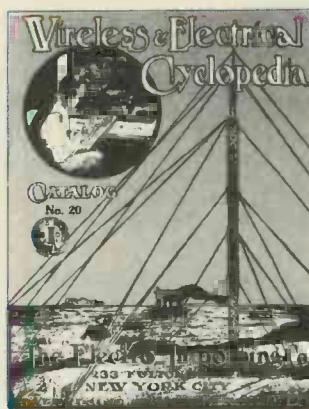


Further Practical Electronics Calculations and Formulae
F.A. WILSON



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

SHIPPING CHARGES IN USA AND CANADA

SORRY No orders accepted outside of USA & Canada

Number of books ordered

Name _____
Address _____
City _____ State _____ Zip _____

\$0.01 to \$5.00	....	\$1.25
\$5.01 to \$10.00	....	\$2.00
\$10.01 to \$20.00	....	\$3.00
\$20.01 to \$30.00	....	\$4.00
\$30.01 to \$40.00	....	\$5.00
\$40.01 to \$50.00	....	\$6.00
\$50.01 and above	....	\$7.50

Total price of merchandise \$ _____
Sales Tax (New York State Residents only) \$ _____
Shipping (see chart) \$ _____

Total Enclosed \$ _____

All payments must be in U.S. funds

RES

LEARN TO CLEAN/MAINTAIN/REPAIR FAX MACHINES

HUGE NEW UNTAPPED MARKET!



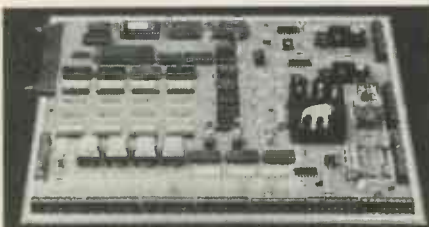
Over 8 million Fax machines in homes/offices - predictions are for over 25 million by 1992!

- Work from your home/van
- Home study program gets you started servicing fax machines in 2 weeks!
- No special tools/equipment needed
- Earn additional profits selling fax supplies!
- Fax machines are not cheap - therefore, you can get good \$\$ for the repair.
- Average Fax machine requires professional service every 18 months.
- Home study training program includes full instructions on EVERY ASPECT of Fax maintenance/repair. FULL COVERAGE of how to set up your home-based service business.

FREE DETAILS
CALL 1-800-537-0589

Or write to: Viejo Publications, Inc.
5329 Fountain Avenue
Dept RES Los Angeles, CA 90029

CIRCLE 288 ON FREE INFORMATION CARD



Knight Patrol™ Talking Home Alarm Kit

A high end alarm system at an affordable price!
Features include:

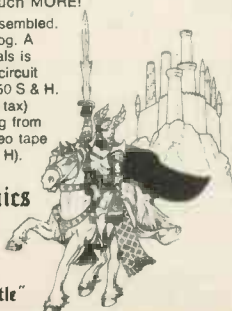
- ◆ State of the art PCF 8200 Speech Synthesizer
- ◆ 21 Sensor Zones, 2 Arming Circuits
- ◆ 2 Five Watt Audio Amplifiers
- ◆ Auxiliary Alarm
- ◆ Real Time 24 Hr. Clock
- ◆ A 10A & 3A Relay Circuit for Sirens, etc.
- ◆ Alert/Sleep Monitoring Modes (verbal status)
- ◆ Trigger Memory (verbal status)
- ◆ Self Diagnostics & Performance Monitoring
- ◆ Microprocessor Controlled
- ◆ Pleasant Female Voice
- ◆ Expandibility & so much MORE!

Available as a kit or pre-assembled.
Send \$3 for full-line catalog. A complete line of peripherals is also available. Complete circuit board kit \$220.00 + \$10.50 S & H. (CA residents add 6.75% tax)
Complete systems starting from \$440.00. Instructional video tape (VHS \$9.95 + \$2.50 S & H).

Paladin Electronics

19425-B Saledad Cyn Rd
Suite 333, Dept. RES
Canyon Country, CA 91351

"We protect your castle"



CIRCLE 287 ON FREE INFORMATION CARD

ADVERTISERS INDEX

RS #	Page	RS #	Page
—	Advance Computers	50	267
—	AIS Satellite, Inc.	62	260
275	Alfa Electronics	10	—
264	All Electronics	24	—
258	Alltronics	49	294
293	Alpha Products	65	281
—	Altek Products	27	—
—	AndraTech	61	—
271	Battery Tech	16	265
284	Becktron	56	268
263	B.G. Micro	23	280
266	The Book Source	29	—
—	Cable Plus	22	—
—	Calco International	60	—
283	Cheneko Products, Inc.	32	273
—	CNC Concepts, Inc.	62	—
277	Command Productions	15	—
286	Computer Business Mart	64	250
—	Computer Disk Service	28	—
—	Computer Music Group	66	251
270	Consumertronics	8	—
298	Contact East	17	276
269	Crestwood Products, Inc.	6	—
259	d b Computer Products	53	—
255	D & C Electronics	41	—
—	D & D Electronics, Inc.	63	—
—	Dalbani	57	—
—	DataCraft International	56	—
—	Davilyn	9	—
—	Delphi	35	—
—	DemoSource	61	—
—	D 1 International, Inc.	54	—
—	Electrified Discounter	12,13	—
—	Electronic Goldmine	33	—
—	Electronic 1-2-3	6	—
—	Electronic Parts Outlet	30	—
—	Electronic Rainbow, Inc.	55	—
—	Electronic Technology Today	1,42	—
—	Electronic Technology Today	48,66	—
—	E.T. Tech, Inc.	20	—
—	Fordham	4	—
—	Gems Computers, Inc.	43	—
—	Gott Electronics	36	—
—	The Grapevine Group, Inc.	66	—
—	Haltek	70,71	—
—	Information Unlimited	31	—
—	Jerrold	26	—
—	Kelvin Electronics	67	—
—	L-Com, Inc.	30	—
—	Lesko	69	—
253	Mendelson Electronics, Inc.	18	—
292	Micro Mart	30	—
296	Midwest Laser Products	60	—
—	Mondotronics	56	—
295	MWK Industries	14	—
279	Needham's Electronics	26	—
261	Ocean State Electronics	11	—
297	Omnitron	59	—
—	OWI	20	—
—	Pacific Rim	28	—
274	Pak Rat Electronic Parts	22	—
287	Paladin Electronics	2	—
262	Parts Express	44	—
—	P.C. Boards	54	—
282	PMC Electronics	32	—
—	Prelco	39	—
272	R & D Electronics	16	—
291	Ramsey Electronics	3	—
—	RSL Software	26	—
—	SeaSide Software	60	—
278	Sescom, Inc.	28	—
254	Skyvision, Inc.	72	—
—	Smith Design	66	—
—	Somerset Electronics, Inc.	56	—
—	Startek	7	—
—	Surplus Sales of Nebraska	64	—
257	Surplus Traders	21	—
—	Tanner Electronics	32	—
—	TechServ Corp.	58	—
—	TransWorld Cable Co.	54	—
285	Ucando Videos	58	—
256	United Electronics Supply	47	—
288	Viejo	2	—
299,289	VRS Electronics	8,10	—

Radio Electronics SHOPPER

Executive Offices

Larry Steckler,
EHF, CET, Publisher
Arline Fishman,
Advertising Director
500-B Bi-County Blvd.
Farmingdale, NY 11735

1-516-293-3000
FAX 1-516-293-3115

NATIONAL REPRESENTATIVE

Joe Shere
P.O. Box 169
Idyllwild, CA 92349
1-714-659-9743
FAX 1-714-659-2469

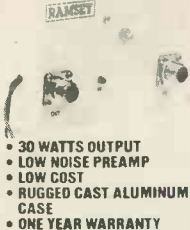


★ ALL NEW KITS ★

2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output allowing you to hit the repeaters full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 mtr amp kits but now, we offer completely wired and tested 2 mtr as well 220 MHz units. Both have all the features of the high priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested \$79.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested \$79.95



- 30 WATTS OUTPUT
- LOW NOISE PREAMP
- LOW COST
- RUGGED CAST ALUMINUM CASE
- ONE YEAR WARRANTY

PERSONAL SPEED RADAR

Complete kit, SG-7
\$89.95

New low cost microwave doppler radar kit "clocks" cars, planes, boats, horses, baseballs, models, runners or virtually anything that moves. Operates at 2.6 GHz with over 1/4 mile range. LED digital readout displays speeds in miles per hour, kilometers per hour or feet per second! Earphone output permits listening to actual doppler shift. Uses two 1 lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripboard. Kit includes deluxe ABS plastic case with speed graphics for a professional look. A very useful and full-of-fun kit!

RADIOS

20, 40 & 80 METERS HAM RECEIVERS

Sensitive all mode, AM, CW, SSB receivers for 3.5-4 or 70-75 MHz. Direct conversion design using NE602 ICs as featured in QST and ARRL handbooks. Less than 1 µV sensitivity, varactor diode tuned, 250 mw audio output. Runs on 9VDC, has HF gain control. This kit is very easy to build, lots of fun and educational—ideal for the beginner or the old pro. The optional matching case kit features a rugged ABS plastic case with screened graphics. Included are machined aluminum knobs for a well-finished professional look.

20 MTR receiver kit HR-2	40 MTR receiver kit HR-4	80 MTR receiver kit HR-8	Receiver case CHR
\$24.95	\$24.95	\$24.95	\$12.95

QRP TRANSMITTER KITS, 20, 40 & 80 METERS

Operate a mini ham shack. These little CW rigs are ideal mates to our 40 and 80 meter receivers. Features include smooth variable tuning, one watt output and excellent keying characteristics. Runs on 12 VDC and is VSWR protected. See how far you can stretch your signal with one of these mini rigs. Optional ABS cases are available.

20 MTR QRP kit QRP-20	40 MTR QRP kit QRP-40	80 MTR QRP kit QRP-80	Case CORP
\$29.95	\$29.95	\$29.95	\$12.95

AIRCRAFT RECEIVER KIT

Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110-135 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 250 mw audio output. 1 µV sensitivity. Optional matching ABS plastic case lets you take it anywhere. Features screened graphics and machined aluminum knobs for the air professional look. Compact—great for airshows or for just plain hanging around the airport.

Complete kit, AR-1	Receiver case, CR-1
\$24.95	\$12.95

SHORTWAVE RECEIVER KIT

A fantastic receiver that captures the world with just a 12' antenna. Receives 4-11 MHz in 2 MHz bands, varactor tuned, superhet design with AGC, RF gain control, and 250 mw audio output. Uses new Signetics micro chip for less than a microvolt sensitivity, runs on 9V battery. This is a fascinating scout, school or club project, and will provide hours of fun even to the most serious DX'er. Add the optional case kit and you have a real nice looking shortwave set.

Complete kit, SR-1	Receiver case kit, CSR-1
\$24.95	\$12.95

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Oligocom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation.

Complete kit, PC-1
\$49.95

FM COMMUNICATIONS/ 2 MTR, 10 MTR & 220 RECEIVERS

Sensitive superhet FM receiver tunes any 5 MHz segment of band. Listen to ham operations, high band police calls, weather or mobile phone calls! Easy to build receiver features varactor tuning, IC mixer stage, ceramic IF filters and dual conversion design with adjustable squelch. Less than 1 µV sensitivity, runs on 9 V battery, with 50 mw audio output. Optional ABS case with screened graphics and machined aluminum knobs provide a nice professional look.

2 MTR kit FR-7	10 MTR kit FR-10	220 MHz kit FR-20	Receiver case kit CFR-7
\$29.95	\$29.95	\$29.95	\$12.95

NEW MINIKITS—NEW MINIKITS

<h4>BROADBAND PREAMP</h4> <p>A sensitive all purpose preamp, ideal for scanners, TV sets, VHF, UHF rigs, counters, etc. Features low noise, 4 db NF, 20 db gain, 100 KHz—1 GHz operation. Runs on 9—12 VDC, 50 ohms input.</p> <p>Complete kit, SA-7 \$14.95</p>	<h4>LIGHT BEAM COMMUNICATORS</h4> <p>Transmits modulated infrared light up to 30 feet without lenses, up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru window, ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.</p> <p>Transmitter kit, LB-6 \$8.95</p> <p>Receiver kit, LB-5 \$9.95</p>	<h4>HIGH POWER FM WIRELESS MIKE</h4> <p>A high power unit that will transmit up to 1/2 mile to any FM broadcast radio. Sensitive input accepts any type of mike, will pick up normal voices 10 feet away using the available mini-electric mike cartridge. Operates on 9—12 VDC.</p> <p>FM-4 kit \$12.95</p> <p>Sensitive microphone cartridge \$2.95</p>
---	---	---

RAMSEY ELECTRONICS

Quality Test Gear & Electronic Kits for Professionals and Hobbyists

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp • 3 db NF

\$49.95
Wired includes AC adapter PR-2 kit \$39.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiples up in frequency • great for PL tone measurements • multiples by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

\$69.95
Wired PS-2 kit \$49.95

PS-10B 1.5 GHz PRESCALER

Extends the range of your present counter to 1.5 GHz • 2 stage preamp • divide by 100 circuitry • super sensitive (50 mV typical) • BNC connectors • 1.5 GHz in, 1.5 MHz out • drives any counter.

\$89.95
Wired includes AC adapter

COM-3

\$279.50 THE COMMUNICATIONS SERVICE MONITOR THAT WORKS HARDER FOR LESS.

Introducing COM-3... the new service monitor designed by service technicians for service technicians. It works harder for less... giving you advanced testing capabilities at a very affordable price.

FEATURES • Direct entry keyboard with programmable memory • Audio & transmitter frequency counter • LED bar graph frequency/error deviation display • 0.1-10,000 µV output levels • High receive sensitivity, less than 5 µV • 100 KHz to 999.9995 MHz Continuous frequency coverage • Transmit protection, up to 100 watts • CTS tone encoder, 1 KHz and external modulation

MINI KITS—EASY TO ASSEMBLE—FUN TO USE

<h4>TONE DECODER</h4> <p>A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.</p> <p>Complete kit, TQ-1 \$5.95</p>	<h4>COLOR ORGAN</h4> <p>See music come alive! 3 different lights flicker with music. One light each for high, mid-range, and lows. Each individually adjustable and drives up to 300 W runs on 110VAC.</p> <p>ML-1 kit \$8.95</p>	<h4>VIDEO MODULATOR</h4> <p>Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit, JM-7 \$12.95</p>	<h4>FM WIRELESS MIKE</h4> <p>Transmits up to 300' to any FM broadcast radio, uses 100' of wire of mike. Runs on 3 to 9V Type FM-2 has added sensitive mike preamp stage.</p> <p>FM-1 kit \$5.95</p> <p>FM-2 kit \$7.95</p>
<h4>40 WATT 2 mtr PWRAMP</h4> <p>Simple Class C power amp features 8 times power gain 1 W in for 8 out, 2 W in for 15 out, 5 W in for 40 W out. Max output of 50 W, incredible value, complete with all parts, case and T-R relay.</p> <p>PA-1, 40 W pwr amp kit \$27.95</p> <p>TR-1, RF sensed T-R relay kit 6.95</p>	<h4>VOICE ACTIVATED SWITCH</h4> <p>Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED or even a tape recorder motor. Runs on 9VDC.</p> <p>VS-1 kit \$6.95</p>	<h4>LED BLINKY KIT</h4> <p>Alternately flashes 2 jumbo LEDs. Uses 4 name badges, buttons, warning panel lights. Runs on 3 to 15 volts.</p> <p>BL-1 kit \$3.95</p>	<h4>MAD BLASTER</h4> <p>Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.</p> <p>MB-1 kit \$4.95</p>
<h4>UNIVERSAL TIMER</h4> <p>Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.</p> <p>UT-5 kit \$5.95</p>	<h4>WHISPER LIGHT</h4> <p>An interesting kit, small mike picks up sounds and converts them to pre-light. The louder the sound, the brighter the light, includes mike, controls up to 300 W, runs on 110 VAC.</p> <p>WL-1 kit \$6.95</p>	<h4>SIREN</h4> <p>Produces upward and downward wail, 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.</p> <p>Complete kit, SW-3 \$3.95</p>	

<h4>SUPER SLEUTH</h4> <p>A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.</p> <p>BN-9 kit \$5.95</p>	<h4>TELEPHONE TRANSMITTER</h4> <p>Low cost with professional performance. Features include: self phone line powered, tunable from 76 to 100 KHz, polarity insensitive, compact size (7" x 1 1/2"), easily installs anywhere on the phone line or inside the instrument itself.</p> <p>PB-1 kit \$14.95</p>	<h4>FM RECEIVER</h4> <p>For built-in applications or hobby experimentation. Full fledged super-hetrodyne receiver, microvolt sensitivity, 10.7 MHz IF. Integrated Circuit detector, 50 mw audio amplifier, 9V external power source, operation on standard FM broadcast band as well as large portions on each side, compact (6" square), for bug detection or reception.</p> <p>FR-1 kit \$14.95</p>	<h4>FM MINI MIKE</h4> <p>A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available!</p> <p>FM-3 kit \$16.95</p> <p>FM-3 wired and tested 19.95</p>	<h4>MICROWAVE INTRUSION ALARM</h4> <p>A real microwave doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz and is not affected by heat, light or vibrations. Drives up to 100 ma output, normally open or closed, runs on 12 VDC.</p> <p>Complete kit, MD-3 \$16.95</p>	<h4>SPEECH SCRAMBLER</h4> <p>Communicate in total privacy over your telephone or radio. This scrambler kit features full duplex operation using frequency inversion. Runs on a 9 volt battery. Both mike and line or speaker output/inputs. Easy to connect to any radio—telephone use requires no direct connection! Easy to build, uses IC, OEM circuitry, can also be used to build your own com scramblers.</p> <p>Complete kit, SS-7 \$29.95</p> <p>Case kit, CSS-7 12.95</p>
--	---	--	---	--	--

FREQUENCY COUNTERS

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one year warranty on parts and labor. We take great pride in being the largest manufacturer of low cost counters in the entire USA. Compare specifications. Our counters are fully featured, from audio to UHF, with FEET high impedance input, proper wave shaping circuitry and durable high quality epoxy glass, plated-through PCB board construction. All units are 100% manufactured in the USA.

ACCESSORIES FOR COUNTERS

Telescopic whip antenna—BNC plug	\$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt ball for CT-70, 90, 125	3.95
Nick pack for CT-70, 90 & 125	19.95

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mV to 150 MHz	1 PPM	7	1 Hz, 10 Hz, 100 Hz	139.95
CT-90	10 Hz-600 MHz	< 10mV to 150 MHz < 150mV to 600 MHz	1 PPM	9	0.1 Hz, 10 Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1 Hz, 10 Hz	169.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1 Hz, 1 Hz, 10 Hz	169.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mV to 150 MHz < 150mV to 600 MHz	0.1 PPM	9	0.1 Hz, 1 Hz, 10 Hz	229.90

TERMS: • satisfaction guaranteed • examine for 10 days. If not pleased, return in original form for refund • add 6% for shipping and insurance for a maximum of \$10.00 • foreign add 15% for surface mail • CDD add \$4.00 • 000 in USA only • orders under \$20.00 add \$3.00 • NY residents add 7% sales tax • 90 days parts warranty on all kits • 1 year parts & labor warranty on all wired units.

PHONE ORDERS CALL 716-924-4560

FAX 716-924-4555

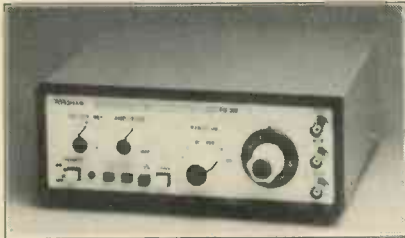
RAMSEY ELECTRONICS, INC. 793 Canning Parkway, Victor, NY 14564

Fordham

SATISFACTION GUARANTEED

FORDHAM

SIGNAL/AUDIO GENERATORS and COUNTERS



FUNCTION GENERATOR

It's versatile and compact - capable of generating high quality sine, triangle, and square waveforms of high stability and accuracy. The sine and triangle waveforms can be amplitude and frequency modulated by applying external voltages at the VCA (Voltage Controlled Amplitude) and the VCF (Voltage Controlled Frequency) inputs. With these two inputs, the unit can easily produce amplitude modulated, frequency, sweep, ASK (Amplitude Shift Keying) or FSK (Frequency-Shift Keying) signal. **Frequency Range: 0.5Hz to 500KHz (6 ranges).**

MODEL FG-202
Our Price
\$149.90



AUDIO GENERATOR

- High frequency stability: within ± 2 Hz
- Output voltage floating: within ± 1 dB
- Sine square wave output: > 8 Vrms.

Description: A portable Audio Generator with 600 Ω input impedance, all band voltage floating \pm dB, low distortion output wave from 0.05%, high output voltage, stable oscillation circuit loop and minimum frequency floating. The oscillation frequency range of the AG-260 is usually between voice and super voice frequency bands. Its main function is to measure the characteristics of an audio circuit. **Frequency Range: 10Hz-1MHz 5 decade bands.**

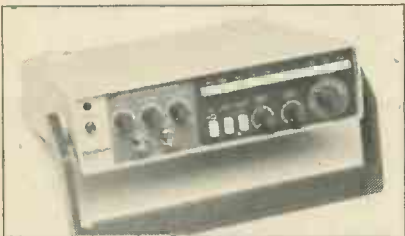
MODEL AG-260
Our Price
\$134.95



100KHz-150MHz SIGNAL GEN./ COUNTER

OSCILLATOR SECTION: Frequency Range: A 100KHz-320KHz, B 300KHz-1100KHz, C 1MHz-33MHz, D 3.0MHz-11MHz, E 10MHz-35 MHz, F 32MHz-150MHz, (up to 450MHz on 3rd harmonics). **Frequency Accuracy:** by counter section accuracy. **COUNTER SECTION: Frequency Range:** 10Hz-150MHz HF 10Hz-10MHz VHF 10MHz-150MHz. Accuracy: ± 1 Count, \pm Reference time Accuracy.

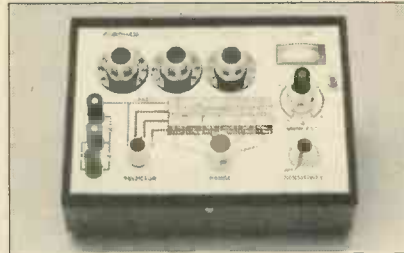
MODEL SG-498
Our Price
\$275.00



SWEEP FUNCTION GENERATOR

Output: Square wave, triangle wave, or sine wave (selectable). Also TTL pulse, sweep output. **Input:** Voltage controlled frequency (VCF). **Frequency Range:** 0.2Hz to 2MHz (7 ranges). **Frequency Accuracy:** $\pm 5\%$ of length scale. **Frequency Multiplier:** 0.2 to 2.0. **VCF Range:** 100: min. for 0 to +10V input. **Sweep Characteristics:** Internal: Linear. **Sweep Rate:** 0.5Hz (2 SEC period) to 50Hz (20mSEC period), continuously variable.

MODEL FG-801
Our Price
\$219.95



LCR BRIDGE METER

A fully transistorized AC bridge meter, which allows for accurate measurement of resistances, capacities, inductances and the turns ratio of transformers. This unit is battery operated, small and handy, and has high mechanical and electrical stability. Besides the actual bridge circuit a 1KHz generator and a three-stage test-amplifier is inserted.

MODEL LC-340
Our Price
\$149.95



10Hz-1MHz/AUDIO GEN./ COUNTER

OSCILLATOR SECTION: Frequency Range: 10Hz-1MHz 5 decade bands. **Accuracy:** with Counter Section Accuracy. **Output Impedance:** 600 Ω , unbalance. **Output Control:** 0dB/-20dB/-40dB and Fine adjuster. **Sine Wave Output: Range:** 10Hz-20KHz. **Output Voltage:** 8 Vrms, max. **COUNTER SECTION: Frequency Range:** 10Hz-150MHz HF 10Hz-10MHz VHF 10MHz-150MHz. Accuracy: ± 1 Count, \pm Reference time Accuracy.

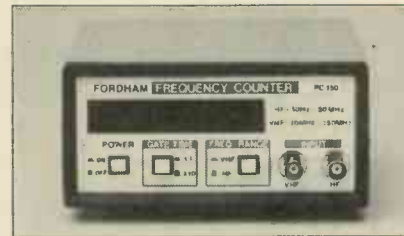
MODEL AG-298
Our Price
\$275.00



RF SIGNAL GENERATOR

- Wide frequency range: 100KHz-150MHz
- Portable, high stability • With 1KHz oscillator in inner part for the purpose of modulation. **Description:** Here is a compact solid state RF signal generator for checking and aligning the IF circuit and tuners in AM, FM and TV sets.

MODEL SG-490
Our Price
\$134.95



FREQUENCY COUNTER

Frequency Range: 10Hz-150MHz. **Gate Time:** 1 Sec., 5 Sec. **Accuracy:** ± 1 Count. **Max. Input:** 20 V p-p. **Voltage Sensitivity:** 25mV-100mV, 10Hz-30MHz; 100mV-300mV, 10MHz-150MHz. **Multiplication:** HF and VHF. **Input Impedance:** HF-1M Ω , VHF-50 Ω . **Max. Input Voltage:** < 3 V effective. **Reference Time Frequency:** 2,500MHz.

MODEL FC-150
Our Price
\$139.90



GLOBAL SPECIALTIES FREQUENCY COUNTER

Description: Can measure any frequency from subsonic through the 1.3GHz ham band. • 8 digit LED display • 5Hz-1300MHz response • Dual gate times • Tilt stand included.

MODEL MAX-1300
Our Price
\$249.95

Service and Shipping Charge Schedule For Continental U.S.A. ONLY

\$ 0 - \$ 25 - \$4.50	\$201 - \$ 300 - \$10.00	\$ 750 - \$1000 - \$18.00
\$ 26 - \$ 50 - \$6.00	\$301 - \$ 400 - \$12.00	\$1001 - \$1250 - \$20.00
\$ 51 - \$100 - \$7.50	\$401 - \$ 500 - \$14.00	\$1251 - \$1500 - \$22.00
\$101 - \$200 - \$9.00	\$501 - \$ 750 - \$16.00	\$1501 - \$2000 - \$27.50
All prices are subject to change without notice. Not responsible for typographical errors.		\$2001 & up - \$35.00

Ask for
FREE CATALOG
of over
10,000 items.

MONEY ORDERS OR CHECKS ACCEPTED.

C.O.D.'s require
25% deposit
with order.



QUANTITY DISCOUNTS AVAILABLE!

World's Largest Discount Test Equipment Distributor.

FORDHAM POWER SUPPLIES



REGULATED TRIPLE POWER SUPPLY

Assembled and tested... and it's short circuit proof!
Description: Benchtop power supply. Includes fixed 5 V at 1 amp, 5 V to 15 V at 0.5 amp, and -5 V to -15 V at 0.5 amp. All supplies regulated, short proof. Each supply has a power on indicator LED. Complete and ready for use in a durable (8 x 6 x 3 1/2") metal case.

MODEL FM-6
 Our Price

\$139.95

Reg. \$179.95



SINGLE OUTPUT/DUAL ANALOG METERS

DC Output: 0-30 volts, 0-3 amps. Ripple: 0.5mVrms. Over load and short circuit protection. Current can be limited from 0-3A.

MODEL PS-398
 Our Price

\$199.95

SCOPE DIGITAL MULTI-METERS 3 1/2 DIGIT LCD METER

MINI METER with MAXI SPEC's

- 0.5% accuracy • DC Voltage • AC Voltage • DC Current
- Resistance • Diode Test • Battery Test • Battery Life 300 hours
- Test Leads Included • Overload Protection: DC 500V, AC 350V, Ohms 250V DC/AC. Ranges: DC Voltage: 200mV to 100V. Resistance: 200 Ω to 2M Ω . DC Current: 200mA to 2A. AC Voltage: 200V & 750V.

MODEL DVM-630
 Our Price **\$32.50**

Model CC-30
 Deluxe zippered carrying case \$4.50



HAND HELD 3 1/2 DIGIT LCR METER

This lightweight, portable meter is for measuring, capacitance, resistance and inductance of components. Ideally suited for field service applications. Also used in development and research applications. Overload Protected. Comes with test leads, test clip, battery, spare fuse. Display: 3 1/2 Digit LCD.

CAPACITANCE Range: 200pF, 2nF, 20nF, 200nF, 2 μ F, 20 μ F, 200 μ F. Accuracy: $\geq 0.5\mu$ F $\pm 2\%$ ± 1 digit > 0.5 μ F $\pm 3\%$ ± 1 digit.

RESISTANCE Range: 20 Ω , 200 Ω , 2K Ω , 20K Ω , 200K Ω , 2M Ω , 20M Ω . Accuracy: ≥ 1 M, $\pm 1\%$, ± 1 digit. > 1M, $\pm 5\%$, ± 1 digit.

INDUCTANCE Range: 2mH, 20mH, 200mH, 2H, 20H, 200H. Accuracy: 2mH-2H, $\pm 3\%$, 2H-200H, $\pm 5\%$. Power Requirements: one 9V battery. Size: 6.9"H x 3.5"W x 1.6"D. Weight: 13.8 oz.

MODEL LCR-680
 Our Price

\$129.95

HAND HELD DIGITAL MULTIMETERS

8 function, 37 ranges incl.: transistor & capacitance measurements.

MODEL DVM-636
 Our Price **\$59.95**

11 function, 38 ranges incl.: logic level detector, audible visual continuity, capacitance & conductance measurements • 10M input impedance • Overload Protection • Auto decimal LCD readout • Polarity Indication • 300 hr. battery life with 9V transistor battery • Low battery indication.

MODEL DVM-638
 Our Price **\$69.95**

Model CA-92
 Deluxe Padded Case for DVM meters... \$9.95

Model TL-216
 Transistor and Capacitance Test Leads. \$9.90



Special!
BEST VALUE FOR YOUR DOLLAR!

HITACHI 35 mHz DUAL TRACE OSCILLOSCOPE

Effective Area 8 x 10 div (1 div = 1 cm). Acceleration Potential: 12kV. Focus Adjustment automatic.

External Intensity Modulation— Effective Bandwidth: DC to 2 MHz. Input Impedance: 47 Ω (typ). Max. Input Voltage: 30V (DC + AC peak). Voltage: 5V p-p or more. Vertical Deflection Sensitivity: 5mV/div to 5V/div $\pm 3\%$, 10 calibrated steps, 1mV/div to 1V/div, $\pm 5\%$ (when using x5 amplifier) Uncalibrated continuous control between steps 1: > 2.5 (provided with lock positioning). Uncal Lamp: Front panel lamp indicates the uncalibrated condition. Frequency Bandwidth: DC to 35 MHz, -3dB (at 8 div) DC to 7 MHz, -3dB (at 8 div) (when using x5 amplifier). Rise time: 88 ns (50 ns for x5 magnification). Signal Delay Line: Permits viewing leading edge of displayed waveform. Max. Input voltage: 500V p-p or 300V p-p (DC + AC peak at 1 kHz) Input Coupling: AC, GND, DC (lever switch). Input Impedance: Direct 1M Ω approx. 30 pF. Operating Modes: CH1, CH2, ALT, CHOP, ADD. Polarity Switching: CH2 only. XY Operation: CH1: X-axis, CH2: Y-axis. Sensitivity: 5 mV/div to 5 V/div (when using x5 magnifier: 1 mV/div to 1V/div). Phase Difference: DC to 50 kHz within 3°. X-axis Bandwidth: DC to 500 kHz, -3 dB. Dynamic Range: 8 div or more. CH1 Output: Provided to enable frequency measurement using an external frequency counter. Output voltage: 20 mV/div or more. Frequency Bandwidth: 50 Hz to 5 MHz, 13 dB. Output Impedance: Approx. 50 Ω . Horizontal Deflection Trigger Modes: AUTO, NORM, TV-V, TV-H. Trigger Source: INT (CH1, CH2, V-MODE), LINE, EXT. Trigger Coupling: AC TV Sync Internal: 1 div or more (vertical sync signal). External: 1 VP-p or more (vertical sync signal). Trigger Sensitivity Frequency: 5 to 35 MHz. Internal: 1.5. External: 800mV. Auto Low Bandwidth: 25 Hz. Trigger Slope: \pm . External Trigger Input— Input Impedance: Approx. 1M. Approx. 30pF. Max. Input Voltage: 300 V (DC + AC peak at 1 kHz). Sweep Time: 0.2 us/div to 0.2s/div $\pm 3\%$, 19 calibrated steps, Uncalibrated continuous control between steps 1: > 2.5 (provided with lock-positioning). Uncal Lamp: Front panel lamp indicates the uncalibrated condition. Sweep Time Magnifier: 10 times ($\pm 5\%$). Max. Sweep Time: 20 ns/div. Calibrator Waveform: Approx. 1 kHz squarewave (duty cycle: 48:52 or more). Voltage: 0.5 V $\pm 3\%$. Power: AC 100 / 120 / 220 / 240 $\pm 10\%$ connector selectable, 50 / 60 Hz Approx. 45W. Size: 12.2"W x 5.1"H x 14.6"D. Weight: 14.3 lbs. Accessories: 2-AF-10AK, 15 probes 10:1 1:1, 1-Power Cable, Instruction Manual.



FREE DVM-630
 with purchase of the V-355

DESCRIPTION: The model V-355 provides an unbeatable combination of lightweight scope and high performance. Its thin, light, compact design features a large 6 inch rectangular, internal graticular CRT, with percent calibrations, autofocus, condition lumination and photographic bezel.

MODEL V-355
 Our Price **\$598.00**
 (PROBES INCLUDED)

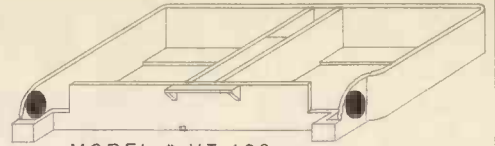
ORDER BY MAIL: Fordham, 260 Motor Parkway, Hauppauge, NY 11788 • ORDER BY FAX: (516) 435-8079 or 435-2883

ORDER BY PHONE: **Toll Free 800-695-4848**

CRESTWOOD PRODUCTS INC.

MANUFACTURER, DISTRIBUTOR AND *ORIGINATOR* OF THE
VU-THRU VCR DIAGNOSTIC TOOL

297 S. RIVER ROAD
DES PLAINES IL. 60016 **1-800-544-8583**



MODEL * VT 102

NEW UPDATED 1991 VERSION

outdates all others
Works on ALL VCR's with VHS & SUPER VHS formats. Front loaders, top loaders, side loaders, slimlines uprights, & camcorders

Many VCR problems are simply due to dirty heads, slipping belts or wheels or minor adjustments. With the diagnostic tool & instructions you can quickly isolate simple problems without special tools or equipment

\$ 9.95 each

\$ 2.55 S&H

\$12.50 total

Order two for

\$ 19.90

\$ 2.55 S&H

\$ 22.45 total

We send * 3 Free

COD
VISA

MASTERCARD
Canadian orders
add \$10.00 US

GREAT FOR BEGINNERS

Dig out that old VCR & get it going again.

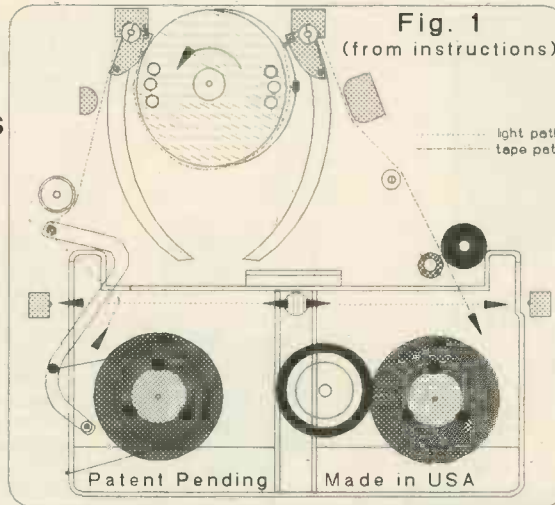
EIGHT PAGES OF FULLY ILLUSTRATED INSTRUCTIONS SHOW HOW TO:

- * CLEAN HEADS
- * LUBRICATE
- * MAKE ADJUSTMENTS
- * CHANGE IDLER TIRES
- * SIMPLE TROUBLE SHOOTING HINTS
- * PLUS MUCH MORE

Allows for inspection, adjustment & cleaning of video, audio, control track, erase heads, idler tires, drive belts, tension band, pressure roller, loading posts & capstan

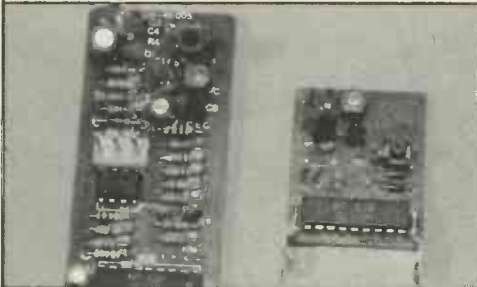
WHILE VCR IS RUNNING

Typical VHS mechanism



CIRCLE 269 ON FREE INFORMATION CARD

REMOTE CONTROL MODULE



TX-88 \$9.95

- * Tiny size, only 1" X 1.5", powered by 12VDC.
- * 4096 possible codes. 100-200' line-of-sight distance

RE-01 \$19.95

- * Small size, 1.25" X 2.75", powered by 5VDC.
- * Single channel RF receiver.

RE-99 \$19.95

- * Same as RE-01, except it's a multi-channel RF receiver.
- * 8 bit address codes, 4 bit data codes.

RC-01 Combination of TX-88 & RE-01 **\$29.95**

RC-99 Combination of TX-88 & RE-99 **\$29.95**

(Above items are board-level products only)

INSTANT EPROM ERASER

Erase EPROM in only 5 seconds

SALE IEE-9088 **\$149.95**
was \$249.99

- * Now boot from SRAM (RDC512 only).
- * The best way to prevent "Computer Virus".
- * Put DOS & app. files in EPROM or SRAM
- * Vibration, dust and humidity proof.

DIGITAL VOICE RECORDER



DVR-120M \$149.95

- * 4 Mb DRAM, up to 2 minutes recording time.
- * 16 variable-length messages each w/ direct trigger terminal.
- * Very low standby current, only **8 mA!**
- * VOX on/off switch. REPEAT mode available.
- * Built-in back-up system to prevent memory loss.
- * "ENDLESS" feature for continuous recording.
- * Completed product w/ dynamic MIC & AC adapter

TALKING ALARM TIMED MESSAGE DEVICE
VERBAL NOTEPAD GUIDANCE SYSTEM
HAM OPERATION TALKING COMPASS
TELEPHONE MUSIC-ON-HOLD TALKING
BIRD TRAINER VOICE WARNING SYSTEM

REMOTE CONTROL SYSTEM

BEST SELLING

ZEMCO SA-432
Only \$49.95

ELECTRONICS

1 2 3

A DIVISION OF MING E&P, INC.

1. Exclusive items at good prices.
2. Unique items at better prices.
3. Popular items at the best prices.

1-800-669-4406

(ORDER DESK ONLY)

1. Prices are subject to change without notice.
2. VISA, MASTER CARD and COD (add \$3) accepted.
3. Freight charge adds \$5 UPS Ground, \$8 UPS Blue, \$15 UPS Red.

977 S. Meridian Ave.
Alhambra, CA 91803
TEL: (818) 281-4065
FAX: (818) 576-8748

ROM/SRAM DISK CARD

RDC-512 (0 KB) \$179.95

RDC-1024 (0 KB) \$199.95

NEW UPDATED VERSION

CIRCLE 268 ON FREE INFORMATION CARD



STARTEK

INTERNATIONAL, INC.

MODEL 1500A

NEW

FREQUENCY COUNTER 1-1500 MHZ

\$99⁹⁵

- 8 RED LED DIGITS
- 2 GATE TIMES 1PPM TCXO
- ANODIZED ALUMINUM CABINET
- INTERNAL NI-CAD BATTERY OPTION
- FULL YEAR LIMITED WARRANTY

The 1500A FREQUENCY COUNTER is a quality built, LSI circuit design instrument that actually outperforms many counters costing much more. The 1500A can be powered by 9-12 VDC, AC adaptor or internal Ni-Cad batteries. The excellent UHF/VHF sensitivity makes it ideal to use with the telescoping antenna for easy and accurate measurements of transmit frequencies from handheld, fixed or mobile radios such as: police, ham, car telephone, marine, aircraft, etc. The 1500A can also be used with a probe to measure computer clocks, oscillators, etc.



- #1500A 1-1500 MHZ FREQUENCY COUNTER \$99.95
- #BP-15 RECHARGEABLE NI-CAD BATTERIES (INSTALLED) \$20.00
- #AC-15 110VAC ADAPTOR/BATTERY CHARGER \$ 9.00
- #TA-90 TELESCOPING BNC ANTENNA \$12.00

MADE IN USA

IMPROVE RANGE AND SENSITIVITY OF YOUR LOW FREQUENCY COUNTER WITH OUR

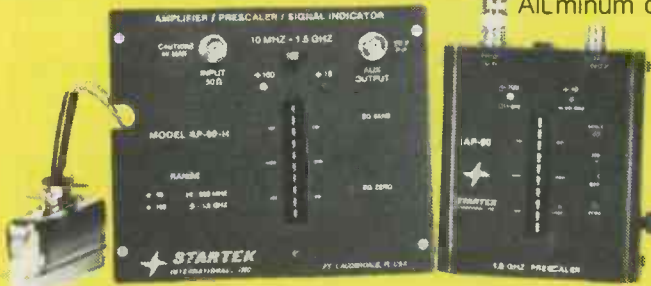
AMPLIFIER — 1.6 GHZ PRESCALER — SS BAR GRAPH

MODEL AP-90-H

Same features as AP-90 but custom configured as a plug-in accessory for Hewlett Packard counters #5245L/M, 5246L or 5248L/M.

MODEL AP-90

Extend the range of any counter capable of counting 16 MHz or higher to 1600 MHz with super sensitivity of 1-5 mV RMS typical over the entire range. A 10 segment LED bar graph displays signal strength of the input signal. ± 10 , 10-500 MHz; ± 100 , 300-1600 MHz. 1-2 V P-P output. Alluminum cabinet, 110VAC adaptor included.



- #AP-90 (AC adaptor included) \$159.95
- #AP-90-H (for HP counters) \$179.95
- #TA-90 TELESCOPING BNC ANT. . . \$ 12.00

ORDER FACTORY DIRECT

800-638-8050

STARTEK INTERNATIONAL, INC.

398 NE 38TH ST., FORT LAUDERDALE, FL 33334

PHONE: (305) 561-2211

FAX: (305) 561-9133

ORDERS TO US & CANADA

ADD 5% S/H (\$4 Min, \$10 Max)

FL RES ADD SALES TAX, COD \$3.50

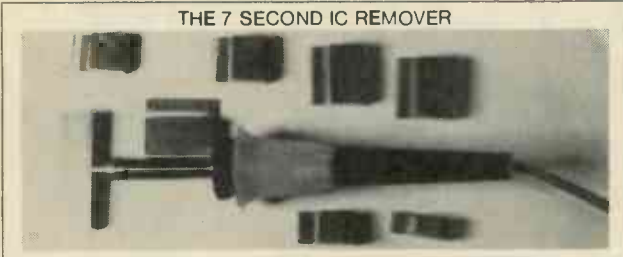


WE GUARANTEE IT!

REMOVE IC'S FASTER

(AND OTHER COMPONENTS)

THE 7 SECOND IC REMOVER



with this simple invention than any other method, including \$6,000 vacuum desoldering stations. Speed up your repairs and salvage hundreds of good IC's per hour from junk boards. Won't damage IC's or circuit board. Remove 6 thru 64 pin IC's. This is a money making, labor saving tool. Fits Radio Shack or Ungar soldering irons - soldering iron not included.

Complete set of 10 desoldering bits your satisfaction guaranteed or your money back
Not Available Through Stores Yet

\$114.95

Quickly removes IC's, ribbon connectors, SIP's, DIP's, transistors, wirewrap pins, square pin connectors, PFQP's, and transformers. Easily removes a wide variety of other hard to remove devices from printed circuit boards.

EASY TO USE — HERE'S HOW:

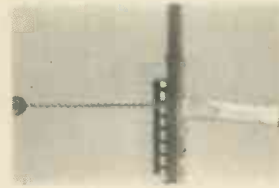
Step 1. Heat IC from top or bottom side. Remove one side of IC at a time, like you would open a book.



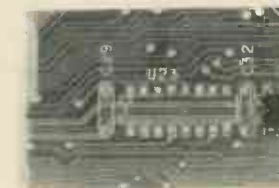
Step 2. Heat other side of IC and remove.

Step 3. Mop up excess solder on PC board with your favorite brand of desoldering braid, Solder Wick, or Archer, etc. Remove solder from a row of pins at a time with a strip of wick and the desoldering bit you just used to pull the IC with.

Step 4. Remove solder from plate through holes rapidly and cleanly by heating the holes and ramming a cold straight pin or safety pin of the appropriate diameter through the hole. This will give you a smooth clean hole to put the new IC or socket back into.



Step 5. Brush away solder flues left by pin and insert IC or socket. IC is not damaged by removal process and can be reused if it is not found to be the problem. Note what a nice job it does and no damage to the board. For simple anti-static operation for CMOS IC removal, a bare wire can be wrapped around the iron and clipped to your anti-static work station.



Order now. We pay shipping on prepaid orders.
— TRY IT AT OUR EXPENSE —
Your satisfaction guaranteed or your money back.

VRS ELECTRONICS

P. O. BOX 813 - RE
SELMER, TENNESSEE 38375
TELEPHONE (601) 287-1594

CIRCLE 299 ON FREE INFORMATION CARD



CONSUMERTRONICS
2011 CRESCENT DR., P.O. DRAWER 537
ALAMOGORDO, NM 88310
1-505-434-0234
FAX 1-505-434-0234 (Orders Only)
Add \$4 ship. (USA, Canada) All items are in stock. COD (UPS cash only), VISA and MasterCard OK 100% More Computer and Electronic Offers!! **FREE CATALOG** with order, else \$2. In business since 1971. As seen on TV.

PHONE COLOR BOXES

Designed by Phone Phreaks! 15 Phone Color Boxes described. Dozens circuits, programs. Plus Call Forwarding, Conferencing, Phreak History, Plus 50 useful, simple and legal phone circuit plans. More! **2 Manuals \$29.**

HIGH VOLTAGE DEVICES

HV Devices - Stun Gun, Laser, Prod. Cane, Umbrella; Zapper, RF/Radar/Audio Jammer, Flasher, Blaster; Jacob's Ladder, Plasma and Van de Graaf Gens.; Fence Charger, Geiger Counter, Ozone Gen.; Fish Stunner, Pest Killer, Plant Stimulator; Kirlian; Magnetizer, etc. Devices. **SHOCKING! \$29.**

E. M. BRAINBLASTER

Plans for powerful **ELECTROMAGNETIC WEAPONS** and **LAB DEVICES**. Optimum circuits, freqs, waveforms, intensities. Mind Boggling! **\$29. EM LAB DEVICE \$29.95.**

RADIONICS MANUAL

Exciting electromagnetic therapies - some FDA-Approved! History, descriptions, plans (dozens circuits), availabilities of **RADIONICS DEVICES** from early tube-type to modern IC. **\$29. Radionics Catalog \$2.**

SECRET & SURVIVAL RADIO

Optimum survival and security radio equipment, methods; frequency allocations, voice/data scrambling/encoding; includes small receivers and transmitters; telemetry, antenna optimizations; remote monitoring, control; security, surveillance; and ultrasonic, fiberoptic, infrared commo 70+ Circuits. **\$29.**

DECODERS/CONVERTERS

Plans for several TV Decoders and Converters. Plus Satellite TV component purchase, use tips. Tutorial. **\$14.**

PHONE RECORD. INTERFACES

Plans for undetectable (ultra-hi input impedance), undetectable **TELEORDER** to record phone conversations. Also monitors for bugs, taps. Plus simple FM Xmitter plans. Plus ear-piercing **SHRIEK CIRCUIT** plans. **\$14. Module \$195. SHRIEK MODULE \$95.**

STEALTH TECHNOLOGY

Police radar is fascinating! It also has error rates of 10%-20%! Every known. Error mode - Method and material to minimize radar reflection - Strategy and tactic to fight unjust radar tickets (that cost you a fortune in insurance) - Method to detect and jam signals - described! **\$19.**

KW-HR METERS

How electric energy meters work, calibration; many error modes, ANSI Standards Demand Meters, Pole Meters, Polyphase Meters, meter creep, overload droop. **\$19.**

POOR MAN'S SUPER LASER

Ruby Rod Laser Plans. Used in intrusion systems, weapons targeting, precise optical alignments, seismography; signaling and commo. strobes, holography, science projects, etc. Includes a list of dozens of sources for ruby rods and other parts. **\$14.**

STOPPING POWER METERS

AS REPORTED ON CBS "60 MINUTES" How certain electrical loads can slow down Power Meters - even stop them - while drawing full load! Also describes Pole Meters, Meter Creep and Overload Droop. **\$19.**

THE I.G. MANUAL

Magnetic ways to slow down and stop Power Meters. **\$19.**

GAS FO' ALL!

Every known vulnerability of gasoline and diesel fuel pumps and dispensers. **\$19.**

VOICE MAIL BOX HACKING

What Voice Mail Box (VMB) systems are, how they are used and the ways they are hacked. Includes ASPEN, MESSAGE CENTER, BIX, EZ, SYDNEY, PHONE MAIL, AUDIX, etc. Fascinating! **\$29.**

LIBERATE GAS & WATER

How gas and water meters can be reversed using simple household equipment. **\$19.**

SURVIVAL GUNS & AMMO

THE ULTIMATE SURVIVAL MANUAL! Describes optimum weapons and ammo to pick, conversions of commonly available semiautos to assault weapons, silencers, explosive devices, improvised, End Times scenarios, retreats, etc. **\$19.**

VOICE DISGUISER

Plans for real devices to change voice frequencies. Effective against snogs using voice analyzers; to conceal gender for women living alone; for electronic games; for anti-intrusion systems; for musical accompaniment, for seances; as a gag; as a doorbell substitute, etc. **\$19. VOICE DISGUISER MODULE \$95.**

VORTEX GENERATOR

Heat/cool with simple, amazing 3-Port Device. Uses no moving parts, electricity, fossil fuel, liquid or iron. Guaranteed Scientifically Sound. Plans. **\$14.**

ROCKET'S RED GLARE

How to design and build solid-fuel rockets beyond model rocketry. Special emphasis on the formulation, manufacture and installation of propellants, motors and igniters. And the design of launch pads and electronics. **\$19.**

THE "SILKWOOD"

Small, simple (2-IC), effective Radiation Detector. No high voltage, heavy/special batteries, or special tubes. Radiation is everywhere! Protect your health! Plans. **\$14.**

THE "GOLDFINGER"

Metal detector finds **GOLD, SILVER, PLATINUM, COPPER, ALUMINUM**. Rejects all ferromagnetic objects. Simple circuit. Plans. **\$14.**

SOLED FOR EDUCATIONAL PURPOSES ONLY.

ROBOFONE AUTODIALER

Powerful, versatile menu-driven program allows you to dial any number (up to 10,000) or mix of local and long distance phone 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). Ideal as a "Wargames" dialer, phone call logger and telemarketing dialer. **Disk* + Manual \$29.** With **LABELS** and **LETTERS** programs \$49. Optional **TELEMARKETING INTERFACE \$29.**

HARD DRIVE MANUAL

Relates local Hard Drive and Controller implementations (emphasis on PC/XT/AT/386). How to select, interface, initialize, set up, use them. How to maintain, troubleshoot, repair them. How to protect them from mistakes, sabotage, prying eyes, sticky fingers. How to recover damaged and lost files. Includes software reviews. Much info found nowhere else! **\$29. SAVE \$\$\$!**

DISK SERVICE MANUAL

Maintain, troubleshoot, repair, adjust, align Floppy Drives without special equipment or software - 5.25"/3.5"/8". **PC/XT/AT/386, Apple, Commodore, Kaypro, Tandy, Epson, Atari, TI, HP, DEC, etc.** systems. **\$29. SAVE \$\$\$!**

DISK DRIVE TUTORIAL

Theory, practical facts on Floppy Drives, Disks, FDCs, Formatting, Software Protection for the systems described above. Invaluable advice and tips on how to best select, interface and use Drives and Disks. **\$19.**

COMPUTER PHREAKING

TROJAN HORSES, VIRUSES, WORMS, etc. and CounterMeasures - includes **Disk*** with 250K+ of phreaking text files and disk-protection programs, and the great **FLUSHOUT*** Disk* (Editor's Special PC MAGAZINE). Doctors of Computer Crime and Abuse Methods, and CounterMeasures. How systems are penetrated. **BBS** Advice, Password Defeats; 200 Phreak-Term Glossary; much more. **2 Manuals + 2 Disks* \$39.**

BRAIN VIRUS ANTIDOTE

THE PAKISTANI BRAIN VIRUS plagued dozens of universities and businesses. The mildly destructive original version is hacked into highly virulent strains! **BRAIN VIRUS ANTIDOTE** consists of the antidote, source code and write-up. **Disk* (NOT Infected) \$19.**

BEYOND VAN ECK PHREAKING

Eavesdropping on VDI video signals using an ordinary TV! Ranges up to 1 KM! Plans, countermeasures. Includes legal Van Eck uses. Now includes original **Top Secret VAN ECK DESIGN!!! \$29. VAN ECK SYSTEM \$1.495.**

ATMS

ATM Crimes, Abuses, Security, Vulnerabilities 100+ methods described - from Reg. E to ciphers. Case Histories, Law, Countermeasures, detailed Security Checklist, Internal Photos! Recently, a crook stole \$237,000 from one bank's ATMs (still unsolved!) **2 Manuals \$39.**

ABSOLUTE SECURITY

Dozens of simple, versatile, secure Computer Security methods, tips. Plus our invulnerable Cipher Program (in .COM and its .BAS Source). Plus **\$1,000 CIPHER CONTEST** rules with Ciphertext Manual + **Disk* \$29.**

CRYPTANALYSIS TECH.

5 Powerful Menu-Driven Crypto Programs (in .COM and its .BAS Source) to Analyze, Decrypt! "Secure" Ciphertexts. Examples. Recommended in the prestigious **COMPUTERS & SECURITY**. Manual + **Disk* \$29.**

STOCKPRO

Unique, Powerful, Shrewd, Unconventional Common Stock Investment Strategy. Created for NMSU. Basis of expensive consulting system. Manual + **Disk* \$29.**

PRINTER/PLOTTER MANUAL

Types, Descriptions, Specs, and 100+ Interfaces (Parallel, Serial). Detailed Plans of X-Switchers, Buffers, and Serial-To-Parallel and Parallel-To-Serial Devices. Many service, repair, buy, use tips. **\$19.**

SUPER RE-INKING METHOD

Re-ink Cloth Ribbons for about 50 cents and 10 minutes each. Plans for El Cheapo Motor-Driven Re-inker. Commonly used ink (5 colors) and carrier described. **\$14.**

SOFTWARE PROTECTION

Unique system that highly discourages costly software piracy while not interfering with legal archival copies. No known method of defeat. No special equipment required. Easy, automatic to install. Can be used with any other protection system. **Disk* + Manual \$59. (was \$95).**

SPECIAL PROJECTS

We Design, Build, Repair, Modify, Maintain and Consult on any Device, System or Project. Computer, Electronic, Electrical, Mechanical, Optical - many invention prototypes. Confidentiality guaranteed. Describe and include \$25 fee. We then provide you cost, time estimates.

TECH. RESEARCH SERVICES

Unique \$1K electronic, computer design articles in database accessed by title, subject, Digital, uP, uC, analog, hybrid, nomograph, software. Provide us keys, we return listing. \$25 search fee (1-20 keywords/ phrases; unrelated topics OK). Saves you **R&D \$\$\$!**
*Software supports PC/DOS, MSDOS, PS/2; Mono, Herc., CGA, EGA, VGA; 5.25", 3.5". Hard (specify your floppy drive size).

CIRCLE 270 ON FREE INFORMATION CARD

Davileys

CORP.

**13406 Saticoy Street
North Hollywood, CA 91605-3475**



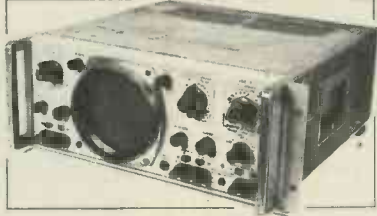
(Call for free catalog.)



**A.C. POWER SUPPLY
STACO MODEL E1010VA**

This unit has been designed and constructed for rigorous industrial, classroom or laboratory applications. These power supplies are brand new. Current list price \$750.00. Specifications: Input: 120 VAC 50/60 HZ. Output: 0-120 VAC 10 amps. Includes manual with schematics. Features: Ammeter, voltmeter, convenience outlet, power indicator and circuit breaker. Dimension: 10" x 15" x 6". Weight: 22 lbs.

Price: \$165



MODEL 130C

High Sensitivity X-Y Oscilloscope: Sensitivity of 200 uV to 20V per cm, frequency response to DC to 500 KHz, 1 usec to 5 sec timebase, 5" CRT.

Price: \$150.00



HP 331A DISTORTION ANALYZER

Covers 5 Hz to 600 kHz range and measures total distortion down to 0.1% full scale. Harmonics are indicated up to 3 MHz. Measures noise as low as 25µV, and voltages over a wide range, 300 µV to 300 V RMS full scale. Frequency calibration accuracy is > ±5% from 5Hz to 300 kHz; > ±10% from 300 to 500 kHz. Basic voltmeter accuracy is ±2%.

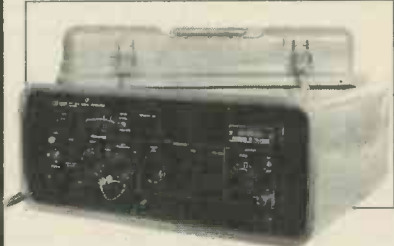
Price: \$400.00



**HEWLETT PACKARD
MODEL 606A SIGNAL GENERATOR**

Signal Generator: Freq. 50kHz to 65 MHz in 6 bands ± 1%, freq. call 100kHz and 1 MHz, RF output 0.1 uV to 3.0V at 50 ohms ± 1dB over freq. range, output VVXR—30 DBC leverage 0.10V, modulation 0 to 100% +0.5DB over freq. range. Internal: 400 Hz/1000Hz ± 5%; External: DC to KHz. Power 1½20V, 50 to 1000 Hz, 135 watts. Size: 20¾" (W) x 12½" (H) x 14¾" (L). Wt. 46 lbs.

Price: \$250.00



**HEWLETT PACKARD 8640B-OPT 323
SOLID STATE SIGNAL GENERATOR**

(w/o synchronizer) Frequency range: 450 KHz to 512 MHz, to 1100 Mhz with external frequency doubler option (not supplied). Ten Frequency bands in octave increments from 500 KHz; band 11 for doubler use. Accuracy: 6 digit LED read out. Stability: < 1000 ppm. Output power: -145 dBm to +10 dBm (0.013 V to 2 V) into 50 Ω. Level flatness is < +0.5 dB from 0.5 to 512 MHz. Impedance is 50 Ω, VSWR < 2.0 on 2 V and 1 V range < 1.3 on other ranges >. Spectral Purity: Harmonics at 1 V output > 35 dB below fundamental of 0.5 to 128 MHz; > 30 dB below fundamental of 128 to 512 MHz. Modulation: Internal AM, FM and PM, external AM, FM, and PM. Pulse frequency: 0.05 to 5 KHz. General: Power Requirements: 100, 120, 220, 240 V, 48 Hz to 420 Hz, 2 amps. Note: OPT 323 built to military specifications. Ruggedized performance for better operation under severe environment. Size: 6" (H) x 19" (W) x 13¾" (D). Wt. 60 lbs. Includes ruggedized case and manual.

Price: \$1850.00

Current Hewlett Packard Price \$12,050.00



OS-8/U PORTABLE OSCILLOSCOPE

Oscilloscope OS-8/U having a 3 inch cathode ray tube, is a portable device used in the visual analysis of wave forms of varying electrical potential. Specifications: Power Requirements: 60W, 105 to 125V, 50 to 1000 cy. 1Ph, AC Frequency Range: Horizontal Amplifiers: 0 to 2 mc-Sweep Circuit Oscillator; 3 cy to 50 kc - Input Impedance; 1.5 mcshunted by 25 uuf (AC); 2 meg (DC); 9 meg shunted by 11 uuf - Deflection Sensitivity; Horizontal; .075 rms V/in (map 1), 17 rms X/in (direct) - Accuracy: ± dB Price: \$50.00



**L.R.
TANK
PERISCOPE**

Type M-24. Rugged military construction. Contains two independent infrared image converter tubes plus correction lenses, prisms, and eyepieces. The binocular viewing system is directly connected to a prism-type periscope. The image tubes have dynamic focus provided by a built-in adjustable voltage divider. This unit requires 10 to 15 KV at low current for operation. Unable to supply power supply. (Dimensions: 18" high x 9" wide x 4½" thick. Weight 17 lbs.) Stock #OP 9001 Price: \$200.00

(818) 787-3334

(800) 235-6222

FAX (818) 787-4732

OUTSIDE CALIF.

LEARN THE SECRETS OF HOW TO FIX ELECTRONIC EQUIPMENT FASTER ON OUR REPAIR TECHNIQUES ON VIDEOTAPE

YOUR SATISFACTION GUARANTEED

Learn our techniques and make more money repairing electronic equipment. These tapes are packed with much practical information that will save enough of your valuable time to quickly pay for the tapes.

Learn from an expert what fails, why it fails, how to find it faster, and how to fix it faster.

Much of this information is available nowhere else.

These tapes start at the beginning for beginners, but cover each subject so thoroughly that even old-pros will learn valuable new techniques and skills.

The material in these video tapes is the same material that we have presented in classes that have been taught for the local college, businesses, and industrial maintenance departments. You will find very little of the information presented on most of these tapes in textbooks or in any courses that you have taken elsewhere. Most of the material is original. We show what fails, all of the ways that the various components fail, how to recognize the failures, and how to test and locate the failures. We also show how to repair and make improvements where appropriate to give a reliable repair.

Send payment with order and we will pay shipping. Order any five tapes or more and get 5% discount, order any 10 or more tapes and get a 10% discount, order any 15 tapes or more and get a 15% discount. **ORDER NOW!**

How to use a Voltmeter (1 hr. 51 min.).....	\$39.95
How to use a logic probe and logic pulser	\$39.95
All about resistors and their failure modes (1 hr.).....	\$39.95
All about capacitors and their failure modes (1 hr. 28 min.)	\$39.95
All about inductors and their failure modes, Part I. Includes inductors, transformers, flybacks, pinball coils, solenoids.....	\$39.95
All about inductors and their failure modes, Part II. Includes magnetic clutches, relays of all types, other devices (58 min.)	\$39.95
All about diodes and their failure modes. Includes rectifiers, SCR's, Zeners, triacs, LED's (55 min.)	\$39.95
All about transistor failure modes (56 min.).....	\$39.95
How to solder like a pro — with lots of time saving circuit board repair techniques, including some of the fastest ways to change IC's you ever saw (1 hr. 30 min.)	\$39.95
All about electrical contacts, connectors, connections and their failure modes, common and uncommon problems, symptoms, good cures	\$39.95
How to use the oscilloscope (to track down digital failures)	\$39.95
How to read schematics and use them for troubleshooting, Part I. Covers monitors, how to find monitor problems with wiring diagrams, gives symptoms, where to look, covers both raster scan and X-Y monitors (56 min.)	\$39.95
How to troubleshoot digital integrated circuits — includes micro-processors, what goes wrong and how to find it, how to use the best literature on IC's and where to get it (1 hr. 45 min.)	\$39.95
How to select and hire the best electronic technician. It takes one to know one, and believe us, they are not all created equally excellent. This tape will save management and you a lot of grief if it keeps them from hiring a dud	\$39.95
The best money making Ideas I know. (For anyone contemplating getting into the amusement or arcade business — Shows how to do it right the first time.) (56 min.).....	\$39.95
Videogame Repairs (for arcade games). (36 min.)	\$39.95
Pinball Repairs (for arcade games). (44 min.)	\$39.95
Videogame monitor repairs and adjustments (for arcade games). (31 min.)	\$39.95

OUR NEWEST TAPES

Job opportunities and money making opportunities in electronics. (45 min.)	\$39.95
Pinball Theory (for arcade games). (1 hr. 29 min.)	\$39.95
Videogame Theory (for arcade games). (1 hr. 12 min.).....	\$39.95
Troubleshooting and locating component failures. (1 hr. 10 min.).....	\$39.95
Power Supplies — Linear and Switching. (42 min.).....	\$39.95

VIDEO REPAIR SCHOOL

P. O. BOX 813 - RE
SELMER, TN 38375

(601) 287-1594

CIRCLE 289 ON FREE INFORMATION CARD

DIGITAL METERS

NEW

DMM 2360 \$129.95

**DMM + LCR Meter
Most Versatile DMM**

- Inductance: 1 μ H - 40H
 - Capacitance: 1pF - 40 μ F
 - Temperature: -40 - 302°F
 - Frequency: 1Hz - 4MHz
 - Logic test: 20MHz
 - Diode test
 - Continuity beeper
 - Volt, current, ohm
 - 3999 count display
 - Peak hold
 - Auto power off
- DMM specifically designed for HAM, checks coil, capacitor frequency, temperature and a lot more.*

DMM 135 \$69.95

MEASURE TEMPERATURE

- 0°-1400° F, -20°-750°C, .1°, 1° resolution
 - Capacitance: 1pF - 20 μ F
 - Resistance: .1 Ω - 2000M Ω
 - Volt, current, continuity
 - Diode, hFE tests
 - Type K thermocouple included
- DMM measures temperature using type-K chromel-alumel thermocouple. Very fast response with 0.1° or 1° resolution.*

**CAPACITANCE
METER \$57.95**

- 3 1/2 digits, 0.5% basic accuracy
- 0.1pF - 20,000 μ F
- 9 ranges
- Zero adjustment \pm 20 pF
- Protected from charged capacitor

This meter covers very broad range capacitance from 0.1 pF to 20,000 μ F. Zero adjustment of \pm 20 pF can be used to compensate parasitic from the test leads.



**INDUSTRIAL QUALITY & RELIABILITY
15 DAY MONEY BACK GUARANTEE
ONE YEAR REPLACEMENT WARRANTY
PROMPT DELIVERY & SERVICE**

QUANTITY & EDUCATION DISCOUNTS AVAILABLE

ALFA ELECTRONICS

P.O. BOX 8089, PRINCETON, NJ 08543

1-609-275-0220/(800) 526-ALFA

FAX: (609) 275-9536

Visa, MasterCard, C.O.D., Purchase Order Welcome

CIRCLE 275 ON FREE INFORMATION CARD

OCEAN STATE ELECTRONICS

PROFESSIONAL, AMATEUR, OR COMMERCIAL — WE'RE YOUR ONE STOP ELECTRONIC SOURCE
CALL OR WRITE FOR YOUR FREE CATALOG 1-800-866-6626



6146B POWER TUBE

Most Popular Power Tube
Used In HF Transmitters.
\$13.50 Each SAVE!
Buy 2 or more \$11.50 Each
CALL US FOR ALL YOUR TUBE NEEDS



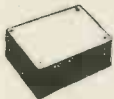
VERNIER DIALS

1/1/2" Diameter 0-10 Marking \$7.25
1 1/2" Diameter 0-100 Marking \$8.25
2" Diameter 0-100 Marking \$9.25

RESISTOR KITS

GREAT FOR THE EXPERIMENTER
OR PROFESSIONAL LAB!
1/4W 5% CARBON FILM

100 Each 177 Different Values
17,700 Pieces \$169.95
100 Each 70 Most Popular Values
7000 Pieces \$63.95
10 Each 70 Most Popular Values
700 Pieces \$15.95
All Resistors Individually Bagged and Labeled



HANDY BOXES WITH ALUMINUM PANEL

Made of sturdy plastic. Removable aluminum cover. Perfect for housing test equipment, experimental projects. Ideal for hobbyists, etc.

#784 3 1/4" x 2 1/8" x 2 1/8" \$3.15
#785 4" x 2 1/8" x 1 5/8" \$3.35
#786 6 1/4" x 3 3/4" x 2 1/8" \$6.30

STANDARD PANAVISE

The 301 Standard PanaVise is the all-purpose work holding unit. It tilts, turns, and rotates. This combination consists of the 300 Standard Base and the 303 Standard Head with 343 Nylon Jaws. Just one convenient control knob locks the work firmly in any position.



MOD 301
..... \$34.99

WE STOCK A COMPLETE LINE OF PANAVISE.
CALL US FIRST, WE CAN'T BE BEAT!

VOLTAGE REGULATORS

7805 5V AT 1A \$4.9
7808 8V AT 1A \$4.9
7809 9V AT 1A \$4.9
7812 12V AT 1A \$4.9
7815 15V AT 1A \$4.9
7818 18V AT 1A \$4.9
7824 24V AT 1A \$4.9
LM317T Adj 2-37V \$9.9

CALL US FOR ALL YOUR LINEAR IC'S,
WE'VE GOT 'EM.



DELUX CODE KEY

Adjustable, heavy duty brass base with ball bearing pivots. Designed for hard usage. 3/16" plated contacts.
\$9.90

BUZZER

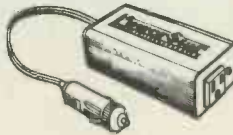
Produces steady high frequency signal. Excellent for code practice. Screw control for adjusting pitch. Uses standard 1 1/2V battery.



\$2.25

200 WATT INVERTER

Plugs into your lighter and runs:



- Ham Equipment
- Lights
- Soldering Iron
- Computer
- Power Tools
- Shaver
- Battery Charger
- MUCH MORE

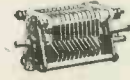
Model: POW 200
Input: 10 to 15 volts DC
Output: 115 volts AC true RMS
Power: 400 Watts peak
200 Watts for 2 minutes
140 Watts continuously
5" x 2.6" x 1.7"
Weight: 15 ounces
Warranty: 1 year

Regularly \$149.95
FALL SPECIAL \$139.95

DEALER INQUIRIES INVITED

HIGH VOLTAGE VARIABLE CAPACITOR

Ideal for Antenna Tuners
Johnson/Cardwell # 154-10-1
25-247PF 3000 Volts
Air Gap .075"
Plates 51
Depth 6 7/8"
Quantities are Limited
Brand New \$29.00 each



WE STOCK THOUSANDS OF VARIABLE CAPACITORS BY HAMMARLUND; JOHNSON, MILLEN, NATIONAL, ETC.

REGULATED POWER SUPPLIES 13.8VDC

Quality 13.8VDC power supplies. Perfect for car stereo's, CB equipment, Ham equipment and other 13.8VDC items. Binding post outputs.



MOD 384 4 amp continuous 6 amp surge \$21.95 (REG. \$29.98)
MOD 737B 6 amp continuous 8 amp surge \$41.95

TO ORDER

Call 1-800-866-6626
8 a.m. - 9 p.m. EST
Monday through Saturday



OR WRITE TO:
Ocean State Electronics,
P.O. Box 1458, Westerly, R.I. 02891

OR FAX TO:
(401) 596-3590

LOCAL CALLS
PLEASE USE 596-3080

If paying by CREDIT CARD include Card No. and Exp. Date
Mail in orders please include \$4.00 shipping
Minimum order \$5.00
R. I. Residents add 7% Sales Tax



RFI PROBLEMS? Try this pot core

Wrap a couple of turns of your phone line, coax, AC line, etc. around the core, secure with a cable tie, and this should help significantly.
1" O.D. \$1.00

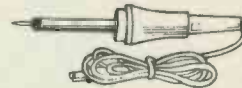
TRANSISTORS

2N918	T0-72, VHF OSC/AMP	.25
PN2222	T0-92, GP AMP/SW	.09
2N3055	T0-3, GP PWR AMP/SW	.69
2N3771	T0-3, PWR AMPSW	1.99
2N3866	T0-39, VHF/UHF OSC	.90
2N3904	T0-92, GP AMP	.09
2N3906	T0-92, GP AMP	.09
2N4401	T0-92, GP AMP	.15

WE CAN SUPPLY NEARLY ANY TRANSISTOR, INCLUDING RF POWER, JAPANESE AND MANY OBSOLETE NO'S.

WELLER PROFESSIONAL SOLDERING IRONS

25 Watt Iron #SP23 \$10.95
40 Watt Iron #SP40 \$13.95
80 Watt Iron #SP80 \$18.95



REPLACEMENT TIPS FOR ABOVE

SP23 Iron Tip #MT1 \$3.79
SP40 Iron Tip #MT10 \$5.25
SP80 Iron Tip #MT201 \$5.25



WELLER ALL PURPOSE SOLDERING GUN MODEL 8200

Built in prefocused spotlight.
Choice of 100 or 140 watts with pull of the trigger switch. Balanced pistol grip design, replaceable tip.
YOUR COST \$24.25 Each

COPPER REPLACEMENT TIP FOR 8200 GUN \$3.07

Tips priced 2/Pkg. except MT201

PRODUCTS & MANUFACTURERS

Variable/ Capacitors	Antennas	Baluns
Keyboards	QST KIts	Magnet Wire
Roller Inductors	Hardware	Potentiometers
Shaft Couplers	Vernier Dials	Speakers
AC Line Cords	Heatsinks	Switches
AC/DC Adapters	IC's (any type)	Toroids
Breadboards	Jacks	Tools
Capacitors	Knobs	Transistors
Chokes/Coils	Meters	Transformers
Connectors	Pots	Wire
Crystals	Resistors	Relays
Panavise	Diodes	Enclosures
Test Equipment	Spacers	Soldering Equip.
Chemicals	B&W	ASJ
LED's	Oscilloscopes	Plastic Bags
Hammond	Philmore	Heat Sink
C Sockets	Cable TV Acces.	Compound
Batteries	PC Board Kits	JW Miller
Insulators	ARCO	Coilforms
Tubes	Panasonic	Coax Switches
Elenco	Telephone Acces.	DATAK
Thermistors	Little Fuse	Ribbon Cable
C&K	GC Electronics	KEYSTONE
	Computers	SIPS
	Dummy Loads	Power Supplies

HARD TO FIND COMPONENTS AND MUCH MORE!

\$\$SAVES\$

\$\$SAVES\$

\$\$SAVES\$

\$\$SAVES\$

ANY ORDERS PLACED FROM THIS AD WILL RECEIVE
A DISCOUNT COUPON WORTH 10% OFF YOUR FIRST CATALOG ORDER!

Electrified

COMPUTER

AMAZING ONLY \$1899
GOLDSTAR — 386/20MHz
 40MB System & Goldstar
 VGA - Color Monitor



COUNTRY

UNBELIEVABLE ONLY \$1899
GOLDSTAR — 386/20MHz
 40MB System & Goldstar
 VGA - Color Monitor

IMPOSSIBLE!!!

System Includes:
 80286 Color Computer
 1MB High Speed RAM expands to 10MB
 Memory Upgrades Available
 40MB Seagate Hard Drive - 28MS
 (1 year Drive Warranty)
 1.44M Floppy Drive
 VGA Monitor Card - 18 Bit

14" VGA Color Monitor Model 1425 Plus
 with Tilt & Swivel Upgrades Available
 101 Style Keyboard
 DOS 3.3 with Basic
 8-Slots (1.52 Bt, 8-16 bit, 2.8 bit)
 Parallel/Serial/Cache Controller
 200 Watt Power Supply - 80287 Retail
 Hard Carded

WARRANTY

1-Year Parts & Warranty
LIMITED TIME
120 Day On-Site Service
 Additional On-Site Service Available

GOLDSTAR TOLL FREE CUSTOMER SUPPORT LINE
 Goldstar XT/Turbo and 286/16Mghz Systems are Available - CALL

FREE
 ALPHAWORKS - SOFTWARE
 Wordprocessor, Spreadsheet,
 Data Base Manager, Spellchecker
 and Thesaurus, Communication
 Software and Tutorials

SUPER SOFTWARE SET
 For IBM or IBM Compatibles - 3 Outstanding Packages at One Amazing Price
DAC - EASY ACCOUNTING
 Includes: GA, A/R, A/P, Purchase Order, Billing, Inventory & Forecasting
PRACTWORD - WORD PROCESSOR
 Easy to use Word Processor - with Multi-Level Help System
PRACTBASE - DATA BASE MANAGER
 A Powerful Relational Database Manager
List Price \$269.95
DAC EASY ACCOUNTING TUTOR
AVAILABLE - Call for Pricing **\$39.95**

PRINTER POWER

SAVE 80% IBM 5182
COLOR PRINTER
BRAND NEW - Heavy Duty List \$1,995
 • Wide Carriage (132 Column)
 • 200 CPS Draft - 110 CPS Correspondence
 35CPS NLO - Prints Black, 4 Colors, and 8 Colors
 • Bi-Directional Dot Matrix - 9 Wire-Parallel Interface
 • Tractor Included
FRONT - BOTTOM - REAR PAPER FEED -
Paper Rack Available - Stacks Printed Paper ONLY \$12.95
 Easy Change Cartridge Ribbons - Available
90 Day Warranty **QUANTITY PRICING - CALL!!!**

\$399

SUPER SYSTEM
NOW 10MHz
8088-1-TURBO
COMPUTER SYSTEM
1-Drive IBM Compatible System
 with 256K Memory!!!
 • 1-Half Height, 360K, 5 1/4" Drive INSTALLED -
 Dual Speed - 4.77 MHz and 10MHz - TURBO -
 256K Installed - 8 slots - 8087 Socket - 150 Watt
 Power Supply - Deluxe Keyboard - Full Size Case
 for 4 1/2 Ht. Drives - 1 Year Parts & Labor
 Warranty on Base Unit - Produced by Trinity
IMPOSSIBLE
PRICE!!!
 Quantity Pricing
 Available **\$299**

AWESOME
80286 - TURBO
10/16 MHz
Fully IBM Compatible
Zero Wait State!!
 512K Installed - Full Size Case • 200 Watt Power
 Supply Award BIOS - 101 Keyboard - Up to 4MB
 on Motherboard - 8 I/O Slots - 80287 Socket
 Reset and Turbo Button - Keyboard and 3 LEDS -
 Clock/Calendar - 1 YEAR WARRANTY
 Produced by Trinity
\$399 **NOW**
16MHz

386SX — 16MHz
BY-TRINITY
 512K Installed - Baby AT Case - 200 Watt
 Power Supply - AMI BIOS - ZERO WAIT STATE
 - 80387SX - Socket - Up to 4MB
 on the Motherboard - 101 Deluxe Keyboard
 8-Slots - Reset and Turbo Buttons - Keyboard
 3 (12HT, 5 1/4") and 2 (12HT, 3 1/2")
 Drive Bays - Clock/Calendar
 1-Year Warranty
\$599

TOSHIBA P-321SL
SAVE 72% PACKAGE BRAND NEW
24-PIN-216CPS-72NLO-Narrow Carriage
 Parallel and Serial Interface-32K Buffer-Tractor
 Full Manufacturer's War. - 1 Year Parts and Labor
Package Includes: P-321SL Printer - Cut Sheet Feeder
and 3 font cartridges
Package Price List \$1,285 **\$349**
 (Toshiba P-321SL Printer only — \$299)

CITIZEN MSP - 50
BRAND NEW! - Color Optional!
 300 CPS 50 NLO - Narrow Carriage, 9-Wire - Epson/IBM Compatible
 Push or Pull Tractor - Zero Tear Off
MSP-50 Options
 Color Kit (7 Colors) \$50
 Serial Interface \$49
 Font Card Sand/Sark/Oxide \$59
 Parallel Interface \$59
 Black or Color Ribbons Available - Call
Quantity Price: 3/3 \$249, 6/6 \$245, 12/6 \$239, 24/6 \$229
Only \$269

RITEMAN BY C-TOH **BRAND NEW**
120CPS-60CPS Expanded
 Narrow Carriage-Parallel Interface **\$149**
 90 Day Warranty - Quantity Pricing Available

COMPUTER PRODUCTS

Computers
 • Acer • Altos • Apple • Compaq • Goldstar • Quadrant
 • Mitsubishi • NEC • Toshiba • Trinity • Unisys • WYSE
Monitors
 • Amdek • Apple • AT&T • Goldstar • Hitachi • IBM
 • Magnavox • Mitsubishi • NEC • Panasonic
 • Princeton Graphics • Samsung • Sony • Zenith
Printers
 ALPS • Apple • Brother • Canon • Citizen • C-TOH • Diablo
 • Epson • Fujitsu • Genicom • Hewlett Packard • IBM
 • Mannesmann Tally • NEC • Okidata • Panasonic
 • Printronics • Televideo • Texas Instruments • Toshiba
Call for Pricing!!!

The Best Color Monitor & Card Deal
In The USA

AT&T 318H with AT&T Color Card

Works on All IBM AT/XT's & Compatibles
12" - Super Hi-Res — CGA — Color Monitor
600x400 — 31 Dot Pitch — Anti-Glare Screen
Tilt & Swivel - 90 Day Warranty
Comes with the AT&T VDC-400 Color Card
Better Than EGA Resolution - Brand New Condition
Factory Rebuilt
The Best CGA Resolution You Can Buy List \$849
 Quantity Pricing: 3-\$269, 6-\$259,
 12-\$249, 24-\$239 Over 24- Call **ONLY \$279**

HARD DRIVE DEALS

MINISCRIBE 3675-62MB-RL-5 1/4"-NEW \$299
 MINISCRIBE 8450-40MB-RL-3 1/2"-NEW \$199
 SEAGATE-ST-138R-32MB-RL-3 1/2" \$199
 MINISCRIBE-8438F-30MB-RL-3 1/2"-NEW \$179
 SEAGATE-ST-238-30MB-RL-5 1/4"-1/2HT \$179
 TANDON-TM-262-20MB-MFM-3 1/2" \$149
 WESTERN DIGITAL-MFM-XT Cont. w/Cables \$49
 RLL Controllers for XT and AT's Available
 MINISCRIBE Warranty-6 Months-NEW DRIVES
 Seagate & Tandon Warranty-90 Days-OEM Pulls
QUANTITY PRICING AVAILABLE
CALL FOR DETAILS!

SYSTEM OPTIONS

SUPER SYSTEM OPTIONS
 Add a 2nd 360K 5 1/4" Drive \$70
 Add a 10MB Drive - Ind. Controller \$119
 Add a 20MB Drive - Ind. Controller \$159
 Add a 30MB Drive - Ind. Controller \$249
 Add a 40MB Drive - Ind. Controller \$299
 Clock Calendar Card \$20
 Parallel/Serial Game Card \$40
 Memory Upgrade to 512K \$80
 Memory Upgrade to 640K \$90

386SX/286 SYSTEM OPTIONS
 512K Upgrade for 386SX/286 (1 Full Meg) \$90
 MEM DRV Upgrade Avail for 386SX/286 CALL \$199
 Controller - Dual HD-FD \$70
 1.2MB - 5 1/4" Drive \$70
 360K - 5 1/4" Drive \$70
 720K - 3 1/2" Drive \$70
 1.44MB - 3 1/2" Drive - requires DOS 3.3 \$119
 20MB - Hard Drive \$159

386SX or 286 or SUPER SYSTEM OPTIONS
 DOS 3.1, 3.2, 3.3, 4.01 \$394/599/79
 Parallel or Serial Card \$19
 VGA Monitor and VGA Card \$39
 AT&T 12" Color Monitor and AT&T Card \$249
 RCL Color Monitor \$199
 Color Graphics w/Printer Part \$39

NCR 15" GREEN with NCR CARD \$299
 AT&T 12" Black & White TTL and AT&T Card \$59
 12" Monochrome Hi-Res - TTL \$90
 Monochrome Graphics Card with Printer Part \$10
DRIVE WARRANTIES VARY -
CALL FOR DETAILS

MONITOR MANIA

PRINCETON GRAPHICS
Ultra Sync 14 Color Monitor
 14" Multisync - Ultra Hi-Res .28 Dot Pitch
 - 800x600 - Mint Condition - Refurbished
 Full 90 Day Warranty from Princeton.
Monitor Cards List \$899 **\$399**
on Special

IBM — VGA COLOR
 13" Viewing Area - 640x480 - 31 Dot Pitch
 IBM Model #7544/S01
BRAND NEW
 High Performance Graphics
 90 Day Warranty **\$399**
UNBELIEVABLE VALUE

MONITOR MANIA

AMDEK 600T — Color
 14" - RGB-Color-600x200, List \$550
 Green/Amber Switch, Tilt & Swivel
BRAND NEW ONLY \$199

AT&T CRT-327 - 12" TTL-Black & White Monitor & AT&T 1024HP Card
 Hi-Resolution-800x480-Tilt & Swivel
Works On All IBM AT/XT's & Compatibles
90 Day Warranty List \$1390
 Quantity Pricing: **ONLY \$119**
 6-\$115, 12-\$109, 24-\$105, Over 24-Call

.28 Dot Pitch
AMSTRAD COLOR VGA
 Ultra-Hi-Res-12" VGA-PC-Model 12HR
 Tilt & Swivel - 720 x 480 -
 Anti-Glare Screen Only **\$299**
1 YEAR WARRANTY - BRAND NEW

BRAND NEW **BRAND NEW**
NCR - 15" - Green - TTL
 with NCR - Monitor Card 640x400
1 YEAR WARRANTY
 Save Over 75% List \$438 **\$99**

★ ★ Electrified Discounters ★ ★
HOURS: Mon-Thurs 9AM - 7PM **ORDERS**
Fri-Sat 10AM - 6PM **Fri-Sat 10AM - 6PM**
 1066 Sherman Avenue
 Hamden, CT 06514
 FAX 203-248-8580
FAX ORDERS AND BIDS ACCEPTED!

(800) 678-8585
Customer Service & Technical Support
(203) 287-1976

30-DAY MONEY BACK GUARANTEE!
 Full Refund of HARDWARE
 Price on All Advertised Products
 Catalog Sent with All Orders

Dealer Inquiries Invited
 All Prices listed are Cash Discounted. Add 2
 1/2% for MasterCard, Visa, or AMEX. Not
 responsible for typographical errors. Prices
 are subject to change without notice. Conn.
 residents add 6% sales tax. NY State Add NY
 Tax. Quantities are limited! Prices do not
 include freight. Allow 3 weeks for
 personal/company check clearance. 20%
 restocking fee minimum on all returns.
 Compatibility is not guaranteed. Some system
 options may be refurbished. IBM is a
 registered trademark of International
 Business Machines, Inc.

MasterCard VISA AMERICAN EXPRESS

LOWEST PRICES
QUICK DELIVERY

Electrified

WE WILL TRY TO BEAT ANY PRICE ON ANYTHING FROM ANYWHERE!!!
A TRULY PROFESSIONAL STAFF WITH A COMMITMENT TO SERVICE!!!

LIST \$595

DAC-EASY — BREAKTHRU 286

LIST \$595

MAKE YOUR 8088 COMPUTER A 80286 COMPUTER!!

12MHz SPEED-UP BOARD

FOR YOUR 8088 - COMPUTER
(IBM PC/XT or Compatible)

BRAND
NEW!!!

BRAND
NEW!!!

SAVE 75%

1000% FASTER THAN A REGULAR PC

SAVE 75%

REPLACE YOUR OLD CPU WITH AN INTEL 80286 MICROPROCESSOR

Includes a 80287 Math Co-Processor Slot With 16K Cache Memory and Zero-Wait-Access

EASILY INSTALLED IN 5 MINUTES

Software Compatibility is Virtually UNLIMITED. Full Manufacturer Warranty and Technical Support.

FREE

**DAC-EASY
LIGHTNING**

**LIST - \$69.96
A DISK CACHING
PROGRAM**

AMAZING ONLY

\$149

**SUBSTANTIAL QUANTITY
DISCOUNTS AVAILABLE!!**

What The Critics Say:

"The Breakthru 286 performed flawlessly with every application we headed it, including copy-protected programs and nine memory-resident utilities at once."

Stephen Manes, PC Magazine

"... the Breakthru 286 was the card of choice."

PC Business Softwareview (Rated #1)

The 12 MHz Breakthru 286-12 speedup board is the fastest of those tested, but not the most expensive. On a dollar per-horsepower basis, it could be called the cheapest boost available for an XT."

Mark Welch, InfoWorld (Rated #1)

LIST \$1190

BRAND
NEW!!!



AT&T FULL-PAGE SCANNER

BRAND
NEW!!!

MODEL SC-60 - SHEET FEED SERIES

INCLUDES - IBM Compatible Interface Card

**INCLUDES - AT&T PAGE POWER SOFTWARE
(Draw, Scan and Fax Package)**

**INCLUDES - Microsoft - Runtime Windows
Resolution-200 DPI-Full Page/400 DPI-Half Page
Half-Tone Feature for Photographs**

SAVE OVER 75%

1 YEAR WARRANTY FROM AT&T

AMAZING ONLY - \$269 Quantity Discounts Available!!

FREE

**Microsoft Windows 3.0 Upgrade
Call For Details!!!**

★★ **Electrified Discounters** ★★

**30-Day Money
Back Guarantee**

DEALER INQUIRIES INVITED

1066 SHERMAN AVENUE
HAMDEN, CT 06514
FAX 203-248-8680
FAX ORDERS and BIDS ACCEPTED!

HOURS:
Mon-Thurs 9am-7pm
Fri-Sat 10am-6pm

Orders Only — (800) 678-8585

Customer Service and
Technical Support — (203) 287-1976

FULL REFUND OF HARDWARE PRICE
CATALOG SENT WITH ALL ORDERS



All Prices are Cash Discounted. Add 21% for MasterCard, Visa or AMEX. Not responsible for typographical errors. Prices are subject to change without notice. Conn. residents add 8% sales tax. NY Sales-Add NY Tax. Quantities are limited! Prices do not include freight. Allow 3 weeks for personal company check clearance. 20% restocking fee minimum on all returns. Compatibility is not guaranteed. Some system options may be refurbished. IBM is a registered trademark of International Business Machines, Inc.

MWK Industries

1269 W. Pomona Road #110
Corona, California 91720

For Technical Questions Call 714 278-0563

To Order Only-Call Toll Free 1 800 356-7714

9 am to 5 pm PST

FAX # 714 278-4887

Educational & Corporate P.O.'s Welcome

WE ACCEPT VISA, MASTERCARD

SATISFACTION GUARANTEED

If for any reason you're unsatisfied... return
the laser within 30 days for a refund or credit

Call us for your MWK Industries catalog for all our laser products at the lowest prices anywhere.

LASERS is our only business. If you have any questions on which laser best suits your needs give us a call.

2-3 mW SIEMENS LASER-TUBE

Great for light shows, holography communications or just plain fun! The units are surplus, but have never been used and are as good as new! Buy several at this great price. **Now only \$40.00 Each!** (Tube needs a power-supply to operate.)



Siemens Laser-Tube

.5 mW LASER-TUBE

These tubes were made by a major laser manufacturer and are only 4" long and 1" in diameter! They make great pointers, small light-shows, weapon-sights, or can be used for educational or experimental applications. **Now only \$20.00 Each!**



.5mW Laser-Tube

NEW ITEM! OUR LATEST LASER-LIGHT-SHOW

Comes complete with a 1mW laser power-supply and electronics all in one small package. Runs from AC adaptor (included). Makes hundreds of pattern variations from built-in oscillators or external audio source. Great for parties and personal entertainment.

Our Introductory price is only **\$295.00**



Laser Light Show

BASIC LIGHT SHOW

This unit can be used with any laser up to 1 Watt of power without problems. It comes complete with a control box, scanner box, AC power adaptor and 6' of connecting cable. The built-in oscillator/amplifier circuitry produces an infinitely variable selection of lissajous patterns. Two RCA jacks permit the use of an external audio source such as a stereo system to pulsate the patterns to the music. An external laser of your choice is required for use with the light show (laser not included). Great for mobile DJ's, small bars, night-clubs or home entertainment.

Our Price.....\$295.00

COMPLETE WORKING SUPERMARKET BAR-CODE SCANNER

Pull one apart and get a 2-3 working mW laser tube, laser power-supply, polygon-mirror motor, several front-surface mirrors and much, much more! A bonanza of parts for the electronics experimenter.

Our Low-Low Price **\$75.00** (plus shipping and handling charges)



Open Circuit Board



Bar Code Scanner

OUR "OPEN-CIRCUIT-BOARD" LASER POWER SUPPLY

Is ideal for the budding laser enthusiast on a tight-budget! This supply was originally destined for use in video-disc players, but are now available for your use on any He-Ne tube up to 4 mW. They measure 4" by 12" by 2" with an external transformer, and are now selling for only **\$24.00 Each!**



Laser Pointer

LASER POINTER

Fits in the palm of your hand! Includes 670 nm Toshiba 7 VDC battery operated. New. 5 1/2" by 3/4". 12 month warranty.

Lowest priced pointer that we know of. Our Price.....\$190.00

LASER DIODES

5 mW 670 nm Toshiba 9211 with glass LR collimator, Heat sink & 4.5 to 12 VDC P.S. All contained in 1 1/4" by 1/2" package "New". Projects up to 200 feet. Our Price.....\$210.00



**WE BUY,
SELL & BROKER
NEW & USED
LASER EQUIPMENT**

ALL LASER PARTS ARE SOLD AS COMPONENTS ONLY

WARNING: DO NOT BUY THESE PRODUCTS IF YOU DO NOT KNOW THE DANGERS OF LASER ENERGY. WE TAKE NO RESPONSIBILITY FOR YOUR ACTIONS! WHEN ASSEMBLED THIS LASER MUST INCORPORATE THE SAFETY REQUIREMENTS OF THE CENTER FOR DEVICES AND RADIOLOGICAL HEALTH OF THE FOOD AND DRUG ADMINISTRATION.

**Learn at home
in your spare time**



**Earn up to
\$30 an hour
and more!**

You can earn more money if you get an FCC License

Not satisfied with your present income? Add prestige and earning power to your electronics career by getting your FCC Government License.

No costly school. No commuting to class. The Original Home-Study course prepares you for the "FCC Commercial Radio-telephone License".

This valuable license is your professional "ticket" to thousands of exciting jobs in Communications, Broadcast, 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 a Commercial FCC License.

No Previous Experience Necessary

Our proven course is designed so even beginners can start fast. Step-by-step, you start with the very basics—and continue lesson by lesson at your own pace...in your own home.

The course is written in everyday language, complete with photos, diagrams and audio cassette tapes that make it simple and easy to understand.

No need to quit your job or go to school. This proven FCC training "Self-Study" system is easy, fast and low cost!

Get Started Immediately!

Thousands of high-paying jobs are waiting for ambitious people who have an FCC License. So, mail us the coupon and we'll rush you complete information FREE by return mail.

Be an FCC LICENSED ELECTRONIC TECHNICIAN!

GUARANTEED PASS...

Here's our famous warranty that you **will** get your FCC License or your money will be refunded.

Read What Others Are Saying

"Yes, I got my FCC license. I also got a pay increase and am now studying for the Radar Endorsement."

— JC, Hope, AK

"I studied for only one weekend with your course and didn't miss any questions on the test."

— HS, Tampa, FL

"When given my exam and I began, I could barely believe my eyes, it was just like sitting at home studying your course."

— TB, Hines, OR

"I got my license which changed my life immediately. I am now in Communications servicing FM 2-way equipment. This was accomplished only because of your material."

— MK, Glenn Falls, NY

"Your study tapes and manuals were wonderful. I've passed my test today and I owe it all to your books and tapes. Thank you so very much."

— TB, Bloomington, IN

COMMAND PRODUCTIONS

D-93

FCC LICENSE TRAINING
Custom House POB 2824
San Francisco, CA 94126-2824

YES! Please rush FREE details immediately on how I can study at home for my FCC License.

Name _____

Address _____

City _____

State _____ Zip _____

Mail This Coupon Today!

BATTERIES

REPLACEMENT BATTERIES

(ALL NEW - MADE IN USA)

<p>ICOM</p> <p>7S 13.2v 1200 mah \$59.00 8S 9.6v 1200 mah \$59.00 BP7 13.2v 600 mah \$59.00 BP8 8.4v 1000 mah \$59.00 SA/SAT BP82, BP83 BP83A 7.2v 750 mah BP84 7.2v 1000 mah BP85A 9.6v 600 mah BP85B 12v 600 mah</p> 	<p>KENWOOD</p> <p>PB1 12v 1000 mah \$59.00 KNB4 7.2v 2200 mah \$59.00 PB6 7.2v 750 mah \$46.00 PB7 7.2v 1500 mah \$55.00 PB8 12v 750 mah \$55.00</p> 	<p>MOTOROLA</p> <p>HT300 7.2v 1600 mah \$45.00 HT90 12v 600 mah \$34.00 HT440 12v 600 mah \$39.00 MT500 15v 500 mah \$39.00</p> <p>RADIUS</p> <p>P-10 500 mah \$28.00</p> <p>SABER</p> <p>7.2v 1100 mah \$59.00</p>	<p>CAMCORDER</p> <p>JVC PANASONIC PVBP80/88 12v 2.3 amps RCA/HITACHI Full size VHS-C SONY NP22 NP55/77 ALL BRANDS AVAILABLE</p>
<p>YAESU</p> <p>FNB-2 v 500 mah \$21.00 FNB-2 v 600 mah \$23.00 FNB-4A FNB-10 FNB-10S 7.2v 1000 mah \$43.00 FNB-12 FNB-12S 12v 600 mah \$45.00</p> 	<p>SPECIALS</p> <p>ICOM-SA/SAT</p> <p>BP-84 7.2v 1000 mah \$49.00 BP-85B 12.600 mah \$69.00</p> 	<p>INSERTS</p> <p>KENWOOD</p> <p>PB-21 \$13.00, PB-25, 26- \$20.00</p>  <p>ICOM</p> <p>BP-3 \$17.00, BP-5 \$22.00 BP-7, BP-8</p>	<p>CELLULAR</p> <p>MITSUBISHI \$60.00 NEC \$45.00 NOVATEL \$45.00 PANASONIC \$45.00 Bag Phone Kits \$55.00 MOTOROLA "FLIP" \$60.00</p> 

* ALL BATTERY PACKS - GUARANTEED TO HAVE THE ADVERTISED CAPACITY

SEND FOR
 FREE CATALOG
 DEALER INQUIRIES
 WELCOME

BATTERY-TECH, INC.

28-25 215 PLACE, BAYSIDE, N.Y. 11360 • FAX 718-461-1978
 800-442-4275 - N.Y.S. 718-631-4275



VISA



MASTER CARD

CIRCLE 271 ON FREE INFORMATION CARD

R&D ELECTRONICS

SEND FOR OUR
 FREE CATALOG

DISCOUNT
 SURPLUS PRICES!

Compact 9-12 VDC Coil RELAY 30 Amp, N.O Contact

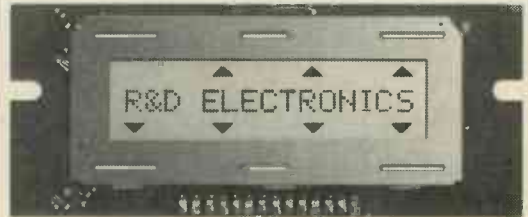


\$1.99*

Order #1095
 AZ #2100-1A-9DE

- Compact sealed unit
1.05"x1.05"x1.25"
- Contact:
Normally Open
30 Amps at 30 VDC
30 Amps at 120 VAC
inductive or resistive
12 Amps at 277 VAC
inductive or resistive
- Coil:
9 - 12 VDC 95 ohms
Dissipation 500 mW

15 CHARACTER LCD MODULE



- Intelligent Display
LSI HD44780 & HD44100 chips
Full ASCII character set
Interfaces to 4 & 8 bit mpu's
- Ideal for battery operated devices
Instructions & applications included
(Also see June & July RE article:
"Add a Display to Your Project")
- Brand new - still in the box!

\$9.95* Order #1099

5 VDC , 2 ma, 3.85" x 1.75" x .25"

* Minimum order 10.00 plus shipping

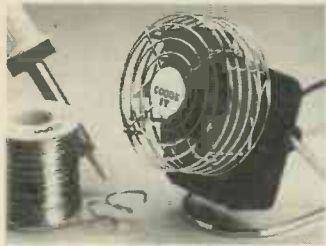
R&D ELECTRONICS 1224 PROSPECT AVE. CLEVELAND, OH 44115

CALL (216) 621-1121

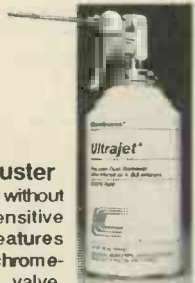
R & D Electronics is the mail order branch of ELECTRONIC SURPLUS of Cleveland, Ohio

CIRCLE 272 ON FREE INFORMATION CARD

BIG SAVINGS ON QUALITY BRAND-NAME PRODUCTS



Miniature Bench Fan
Whisper-quiet fan blows away irritating solder and glue fumes. 50 CFM. 120 VAC. 4-1/2"H.
ZCF-1 Reg. \$25.00 **SPECIAL \$19.00**



Precision Duster
Removes dust without scratching sensitive surfaces. Features a precise chrome-plated brass valve. Replaceable canister contains an EPA approved, ozone safe gas.
ZCK1200 Reg. \$26.25 **SPECIAL \$23.50**



Weller
35 Watt Soldering Iron
Low cost, quality iron excellent for electronic soldering. Screwdriver tip included. 3-wire cord.
Cat. No. Description Reg. **SPECIAL**
ZWP40P-3 35 Watt Iron \$35.65 **\$28.00**
ZPH60 Iron Stand 18.25 **13.00**



Lamp with Built-in Magnifier
Great bench lamp has rectangular lens (4-1/2" x 2-3/4") and magnifies objects 175%. Spring-balanced arm reaches up to 38". Complete with a 60W bulb and desk mounting clamp. Black.
Cat. No. Reg. **SPECIAL**
Z16272 \$50.75 **\$39.90**



Weller
Professional Temperature Controlled Soldering System
Widely used in industry. It maintains a constant tip temperature of 700°F. Grounded tip protects components from voltage spikes. Comes with power unit, iron, stand, sponge & 700°F tip.
ZWTCP5 Reg. \$128.65 **SPECIAL \$99.00**

Flux Core Solder
Highest quality electronic-grade solder. 1 lb. spool, 63/37 alloy, type RA rosin flux core.
Cat. No. Description **ONLY**
ZA63-20-SC2 .020 **\$11.35**
ZA63-32-SC2 .032 **8.55**



Moody
100-Piece Precision Tool Set
Contains 33 chuck-type knurled handles, 2 each of 33 different miniature screwdriver, hexdriver, nutdriver and wrench blades plus one 3" handle extender in a wooden case.
Z730199 Reg. \$143.95 **SPECIAL \$99.00**



Desk and Bench Lamp
Translucent shade allows soft light to filter through. Spring-balanced arm and clamp-on base. 75 watt, UL listed. White.
Cat. No. Reg. **SPECIAL**
Z15003 \$39.95 **\$29.00**



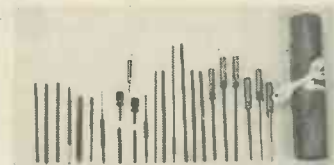
SPECIAL \$59.95
Reg. \$80.00
Model REIM5



The Professional's Tool Case

- Case top has built-in document holder
- Case bottom is partitioned into 3 areas
- Two removable pallets hold over 60 tools

A handsome black case to organize and transport your valuable tools and instruments. This is the same quality case used by literally thousands of professional field engineers. Case is made of high impact polypropylene, and has snap-action key locks and a padded handle. Size: 17-1/2" x 12-1/2" x 5". Tools are not included.



25-Piece Alignment Tool Kit
A complete set of adjustment tools used on all communication gear.
Z8283 Reg. \$34.30 **SPECIAL \$29.00**



1/4" Hex Insert Bit Set
A 33 piece set with a full assortment of 1" slotted, phillips, square recess and clutch bits (4 each) plus 7 hex (5/64"-3/16") & 9 torx bits (T8-T40) in a case with one 2" extension bit.
Z15693 Reg. \$36.95 **SPECIAL \$29.95**



Compact Zipper Tool Case
Great way to organize and protect tools in the car, boat or home. Black durable Cordura® case is designed to carry 20 tools plus a pocket size DMM. Built-in pouch holds small parts. 11" x 8" x 2-1/2". Tools not included.
ZPZ1 Reg. \$28.00 **SPECIAL \$24.00**



Xcelite
10-Piece Nutdriver Set
Full hollow-shaft nutdrivers have color-coded handles in sizes 3/16" -9/16".
Z1896-18 Reg. \$48.40 **SPECIAL \$38.00**



DREMEL
32-Pc. Power Rotary Tool Kit
The perfect tool for precise grinding, cutting, carving, sharpening, drilling or polishing. Lightweight, handheld, high-speed (28,000 and 15,000 RPM) tool comes with case and 30 accessories.
Z2850 Reg. \$84.90 **SPECIAL \$78.00**

Money Back Guarantee! Offer Expires January 31, 1991

Terms: Visa, MC, Amex, P.O.'s from qualified firms. Add \$5.50 for packing & delivery.

Contact East, Inc. • 325 Willow Street • North Andover, MA 01845-5095

TO ORDER CALL: 1-800-225-5370
In MA: (508) 682-2000

Mendelson Electronics Inc.

1-800-422-3525

GRAPHICS TABLET

- Kurta Series - One
- 8 1/2" X 11" Writing Area
- Serial RS 232C Interface
- Factory Refurbished
- Includes Drawing Pen



\$119 ea.

Part No. 220-3500
Shipping & Handling \$6.50 ea.

COLOR GRAPHICS PLOTTER

- Factory Refurbished
- Houston Instrument DMP - 29
- 8 Pen Positions (Pens not included)
- RS 232C Interface
- DM/PL IV Protocol
- Maximum Plotting Area 10" X 15"



\$300 ea.

Shipping & Handling \$18.00 ea.

Part No. 220-3700

5 1/4" QUAD DENSITY FLOPPY DISK DRIVE

\$50 ea.

- 720KB Double Sided/Quad Density
- 80 Track 96 TPI
- AT&T KS-23114
- Fujitsu M2552A
- 1/2" Height
- Dark Brown Face Plate



Part No. 220-3401

Shipping & Handling \$4.50 ea.

IBM PC/2 CARRY CASE

- Genuine IBM Product
- Designed for PS/2 Model 25
- Also works great with Macintosh +, SE
- Removable casters & feet
- Heavy duty padded nylon construction
- Completely unzips for easy storage
- Size 15" x 14" x 16"



\$1995 ea.

Part No. 220-6422 Shipping & Handling \$6.50 ea.

3 1/2" FLOPPY DISK DRIVE

\$84 ea.

- Mounted in 5 1/4" Bracket
- 1.44 MB
- Tan Face Plate
- Sony MD-F73W-32D



Part No. 220-3404

Shipping & Handling \$3.75 ea.

84 AT KEYBOARD

\$39 ea.

- Standard 84-Key PC/AT Layout
- Large L-Shaped Return
- Num, Caps, Scroll Lock LED In Keys
- IBM PC/AT Plug Compatible (non-Switching)



Shipping & Handling \$6.00 ea.

Part No. 220-3203

IRWIN TAPE BACK-UP DRIVE

- For use in AT/Class 286 or 386 Machines only
- Connects to FD-HD Controller only.
- 20 MB Storage
- Use DC 1000 Tape (not included)
- Model 125
- Fits 5 1/4" slots
- Beige front panel
- Includes Software



\$149 ea.

Shipping & Handling \$6.00 ea.

Part No. 220-3408

Protect Your PC From Data Theft!

STOPLOCK IV

\$195 ea.

Part No. 220-3104



w/Encryption

\$250 ea.

Part No. 220-3105
Shipping & Handling \$4.00 ea.

The STOPLOCK IV is an add-on card specifically designed for use with IBM PC/XT/AT and all 100% compatibles with DOS 2.1 or higher. The addition of this card will provide the user with protection from unauthorized use, data theft, software modification, and piracy.

This easy to use computer and information security system is totally menu driven and can support up to 32 different passwords or users. As well as limiting access to the computer it also limits access to hard drives, printers, comm ports, and up to 9 disk drives. Authorized users can have limited access based on the day of the week and the time of day.

File access can be broken down into four different levels: 1) No access 2) Execute only 3) Read only 4) Write only
Directory access can be broken down into four different levels: 1) No access 2) Execute only 3) Read only 4) Write only

Optional file encryption is available using three different methods, Electronic Code Book (ECB), Cipher Feed Back (CFB) and Chain Block Cipher (CBC). This is very useful for protecting data that must be transferred between PCs either by diskette or by serial communication.

Perhaps the most useful of all features is the audit trail of access that permits detection and after the fact investigation of security violations. Only the Security System Administrator has access to the audit trail utility.

Note: This card cannot be used with MICRO-CHANNEL architecture.

IBM PC/AT CASE

- Genuine IBM Case
- Slide-Off Top

- 8 Slot Frame
- Made in U.S.A.
- Full Size AT Case

Part No. 220-2759

ACCEPTS
MINI OR
FULL-SIZE
MOTHERBOARDS



\$49 ea.

Shipping & Handling \$12.50 ea.



GENICOM PRINTER

- Genicom 3184
- Dot Matrix 9PN Wide Carriage
- 200 CPS
- Built-In Tractor Feed
- Serial Interface
- Factory Refurbished
- Industrial Quality



\$295 ea.

Part No. 220-3701 Shipping & Handling \$20.00 ea.

PC/XT KEYBOARD 5150

- Caps Lock, Num lock LED in Keys
- 84-key design with large return (extra return key in number pad)
- IBM PC/XT compatible only
- Zenith Part No. 100 - 1861
- Manufactured by ALPS



\$39 ea.

Part No. 220-3200
Shipping & Handling \$6.50 ea.

PC COMMUNICATIONS BOARD

- 3780 Bisyne
- PC/XT, AT Compatible
- Synchronous Port
- Complete Software & Documentation
- Emulates IBM 2770, 2780, 3471, 3780
- Requires Synchronous External Modem



\$99 ea.

Part No. 220-3100
Shipping & Handling \$4.50 ea.

101 ENHANCED KEYBOARD

- IBM XT/AT Switchable
- 12 Function Keys
- Caps Lock, Num Lock, Scroll Lock LEDES.
- Separate Cursor & Home Keys
- Uses "New" 6-Pin Mini Din Connector for New "Micro-Channel" type Computers
- Require Special Adaptor for use with Standard 5-Pin Din Connector (not included)



\$49 ea.

Shipping & Handling \$6.50 ea.

Part No. 220-3202

95 KEY ENHANCED KEYBOARD

- PC/XT & PC/AT Plug Compatible
- Switch for XT/AT
- 10 Function Keys
- Separate Cursor & Home Keys
- NumLock, Cap Lock, Scroll lock Lights
- K-155

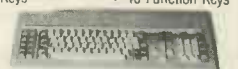


\$55 ea.

Part No. 220-3201 Shipping & Handling \$6.50 ea.

PC/XT ENHANCED KEYBOARD

- IBM PC/XT Compatible
- Separate cursor & home keys
- Num Lock, Caps Lock LEDES in Keys
- Designed for PC 41 & PC-6
- 95 Key
- PC/XT only
- Made by Cherry
- 10 Function Keys



\$49 ea.

Part No. 220-204
Shipping & Handling \$6.50 ea.

S O F T W A R E R E I O T

MS DOS 3.1

- Xerox MS DOX 3.1
- Complete Software
- Includes all manuals
- Screenmate
- GW Basic
- Hardware Utilities
- 5 1/4" Diskettes



\$1995 ea.

Part No. 220-3900
Shipping & Handling \$6.50 ea.

PROFESSIONAL PIXEL

A software tutorial that teaches the use of Graphics, Sound & Animation using "Basic"

\$10 ea.

Part No. 229-3904 Shipping & Handling \$3.50 ea.

VP-PLANNER

- Has everything 1-2-3® has with more features and more functions
- Spreadsheet Software
- Compatible with 1-2-3® Release 1A
- U.S. Government version
- PC/XT, AT IBM Compatible
- 5 1/4" Diskettes



\$1995 ea.

Part No. 220-3902
Shipping & Handling \$4.00 ea.

PROFESSIONAL DOS

A Software Tutorial on How to Use DOS & all its Commands

\$10 ea.

Part No. 229-3905
Shipping & Handling \$3.50 ea.

Mendelson Electronics Co., Inc.

340 E. First Street • Dayton, Ohio 45402
800-422-3525 • FAX 513-461-3391 • 513-461-3525



STORE HOURS: 8:30-5:00 (Eastern Time) Monday thru Saturday
IBM PC/XT is a registered trademark of IBM Corp
Xerox is a registered trademark of Xerox Corp
1-2-3 is a registered trademark of Lotus Corp
TERMS: MasterCard/VISA/Discover Card, Check, or Money Order
(Checks allow two weeks for clearance) C.O.D. add additional \$4.00
Ohio residents add 5% State Tax
Above shipping/handling are rates for UPS ground in Continental U.S. only

20% Restocking Fee on Non-Defective Returns

CIRCLE 253 ON FREE INFORMATION CARD

Mendelson Electronics Inc.

1-800-422-3525

THE COMPLETE ANSWERING MACHINE



Sophisticated PC Voice Messaging System. Acts as an Answering Machine, Sends messages to a list of people. Gives messages & Transfers calls. Supports up to 999 Voice-mailboxes. IBM PC/XT, AT COMPATIBLE

Part No. 220-3106-R
Shipping & Handling \$5 ea.

\$175 ea.

IBM PCjr. EXTERNAL POWER SUPPLY

Genuine IBM part #8600006. PCjr. Power Supply. Sidecar Expansion Attachment. Allows for three additional expansion attachments.



Part No. 500-0013-R
Shipping & Handling \$6 ea.

\$19⁹⁵ ea.

IBM PS/2 BUS CARD W/ BATTERY

Genuine IBM part # 61X8910. Includes 3V lithium battery.



Part No. 220-0016-R
Shipping & Handling \$3⁵⁰ ea.

\$25 ea.

IBM PCjr JOYSTICK

Genuine IBM part. Self centering lever.



Part No. 220-3501-R
Shipping & Handling \$3⁵⁰ ea.

\$9⁹⁵ ea.

OUTDOOR COLUMN SPEAKER

All weather. Designed for use w/ PA Mixer/Receiver kit. Large area coverage in small package.

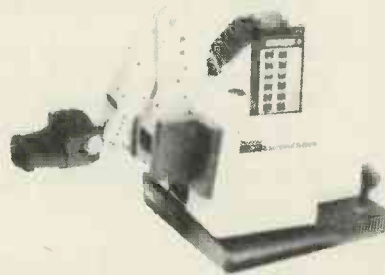


Part No. 180-0003-R
Shipping & Handling \$10 ea.

\$79⁹⁵ ea.

HERO 2000 ROBOT ARM & BASE

Assembled base unit controls the robot arm using a Z-80 main processor and six slave processors. The unit features a teaching pendant with 17 key membrane pad and 16 character LCD readout which is used to control the arm directly. Built-in diagnostic routines help you get the system up and running quickly. Internal Basic interpreter software eliminates the need for an external computer, or use the RS-232 port to control it remotely via terminal or PC. Also provided is an 8-ch bi-directional status port and a partial control mode for operation with a custom gripper. The arm kit comes with detailed step-by-step assembly instructions. The patented gripper is capable of lifting 1 lb. and of exerting specific amounts of force up to 3.75 lbs. The closed-loop DC servomotor design provides excellent overall accuracy and repeatability. Assembly required.



Part No. 370-0007-R

Shipping & Handling \$25 ea.

\$399⁹⁵ ea.

HERO 2000 ROBOT ARM KIT

Robot arm kit without controller and base unit. Assembly required.

Part No. 370-0003-R

Shipping & Handling \$8 ea.

\$179⁹⁵ ea.

HERO 2000 "B" KIT

The "B" kit contains 3 cu. ft. of structural parts, bearings, wheels, DC servomotors and misc hardware. The parts included are only half of a complete HERO 2000 mobile unit. No instructions or electronics are included. This kit is an ideal starting point for "hackers" who want to build a custom robot.



Part No. 370-0005-R

Shipping & Handling \$24 ea.

\$49⁹⁵ ea.

ROBOTIC EDUCATIONAL KIT

A comprehensive introductory course on intelligent machines which encompasses robotics, AI, computers and sensor systems. The course has five units of text, a sixth with experiments and a final exam kit. Also included are a wide range of objects needed to perform the experiments.



Part No. 370-0006-R

Shipping & Handling \$6 ea.

\$9⁹⁵ ea.

PA Mixer/Receiver Kit

35-watt monaural background music and paging system. Five outputs are provided to allow connection of auxiliary microphone, phonograph, CD, or cassette. An isolated phone line connector is also provided for paging from existing telephone equipment. The unit also features preamp and power amp input jacks, bargraph output monitor, and output short-circuit protection. Assembly required.



Part No. 120-0001-R

Shipping & Handling \$15 ea.

\$129⁹⁵ ea.

Mendelson Electronics Co., Inc.

340 E. First Street • Dayton, Ohio 45402
800 422-3525 • FAX 513 461-3391 • 513 461-3525



STORE HOURS: 8:30-5:00 (Eastern Time) Monday thru Saturday
*IBM PC/XT is a registered trademark of IBM Corp.
Xerox is a registered trademark of Xerox Corp.
1-2-3 is a registered trademark of Lotus Corp.
TERMS: MasterCard/VISA/Discover Card, Check, or Money Order.
(Checks allow two weeks for clearance.) C.O.D. add additional \$4.00.
Ohio residents add 6.5% State Tax.
Above shipping/handling rates for UPS ground in Continental U.S. only.

20% Restocking Fee on Non-Defective Returns

CIRCLE 253 ON FREE INFORMATION CARD

RE-SHOPPER 19

OWIKITS

ELECTRONIC ROULETTE

- Numbers 1 thru 36, plus 0 and 00 (38 LED's).
- Game board for "betting" included.
- Automatic shut-off.
- As much fun to assemble as it is to play.
- Easy-to-follow instructions.
- A hands-on introduction to high technology.

BT-805

A game of chance, just like at all the casinos. No ball to lose, no wheels to spin. At the push of a button electronic sounds and flashing lights go off... and where they stop nobody knows.



GRAND PIANO

BT-802

A kit that teaches you the basics of electronics, and a miniature piano to play once you're done. Instructions as simple to follow as do-re-mi.



- A 47-note memory allows you to replay your tunes over and over.
- 15 notes spanning 3 octaves.
- Play your own originals.
- Or, set up to play your choice of 15 pre-programmed melodies.
- A hands-on introduction to high technology.



OWI Incorporated
 1160 Mahalo Place
 Compton, CA 90220
 213.638.4732
 FAX: 213.638.8347

NEW AFFORDABLE - PRECISION TEST EQUIPMENT

E.T. Tech., Inc. - Division of Empire Telecommunication Inc.

SIGNAL SYNTHESIZERS



SG-100
\$685

.1000000 Hz. -
 99.9999 KHz.

SG-100

Six Digit resolution, .005% accuracy low distortion sine wave, output and adjustable to 20 Vp-p with 50 ohm output impedance and TTL. GPIB Option.

SG-102 - \$955 - Dual signal independent output or phase locked to one of 16 phases.

SYNTHESIZER PULSE GENERATOR



PGS-33
\$1355

.100000 Hz. -
 33 MHz.

PGS-33

Provides digital pulse train synthesis with six digit resolution. Control of single and dual pulse delay and duration. Multi-modes including burst pulse train and variable duty cycle. Output to 20 Vp-p with 50 ohm impedance. D.C. offset with TTL.

DUAL SIGNAL & PHASE SYNTHESIS

SG-112 \$1350 .100000 Hz. -
 99.9999 KHz.

Dual signal low distortion digital synthesis. Independent or locked signals. Locked signal phase resolution to .01 degrees.

PM-100 \$855

Measures test signal phase to .01 degrees as compared to reference from 10 Hz. to 2 MHz.

SYNTHESIZER FUNCTION GENERATOR



SFG-33
\$1275

.100000 Hz. -
 32.9999 MHz.

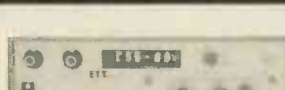
SFG-33

SFG-330

Waveforms are provided with six digit resolution, .005% crystal accuracy. Waveforms are sine, triangle, square, and rising and falling ramps, with dc offset and 20 Vp-p 50 ohm output over 80 dB range and TTL.

SFG-330 - \$1789 - Keyboard and GPIB entry dBv and recall features. Options: 66 MHz. and dual Quad output.

CLOCK SIGNAL SYNTHESIZER



CSS-33
\$1095

.100000 Hz. -
 65.9999 MHz.

CSS-33

Clock signals have six digit frequency resolution, crystal stability and .005% accuracy. Squarewave output .002 to 20.0 Vp-p with 50 ohm output impedance and TTL.

SIGNAL DIGITIZER & SCOPE MEMORY WAVEFORM GENERATOR

SD-200 \$795

Signal digitizer captures signal transient for scope display. Adjustable sampling with 200 nsec. maximum, stores 8 Kilo-byte with .5% amplitude resolution. Pretrigger display enables analog scope to operate as a storage scope.

SD-240 \$1395

Waveform Generator captures signals and allows for signal data entry with a light pen.

To order or for more information call or write:

E.T. Tech., Inc.

15 South Van Brunt Street, Englewood, N.J. 07631
 Phone 201 569-3339 Fax 201 569-5838

SURPLUS SALE

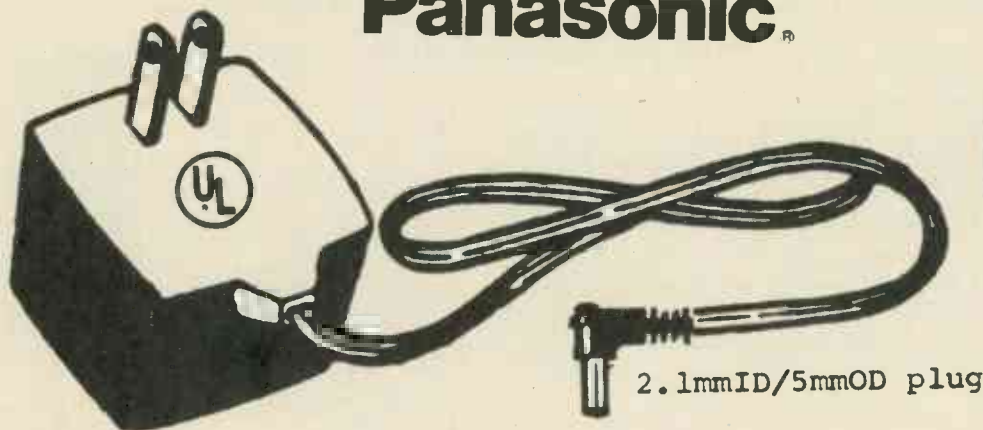
WE HAVE AVAILABLE OVER 125,000 SURPLUS PLUG-IN WALL ADAPTERS. THESE ARE ALL BRAND NEW IN A WIDE RANGE OF VOLTAGES AND CURRENTS IN BOTH AC AND DC OUTPUTS. WE ALSO HAVE 220/240VAC ADAPTERS AND DUAL OUTPUT VOLTAGE POWER SUPPLIES. PHONE OR FAX US FOR OUR LATEST ADAPTER CATALOG OR CALL FOR AVAILABILITY AND PRICE QUOTE ON YOUR NEEDS. WE ARE ALSO INTERESTED IN PURCHASING YOUR EXCESS ADAPTER INVENTORY. CONTACT US TODAY!

SPECIAL PURCHASE!

12VDC/100ma WALL ADAPTERS

12,000 IN STOCK
AT PRESS TIME!!

Panasonic[®]



NOW
ONLY
99¢

EA/5000

\$1.10 EA/1000

\$1.20 EA/ 100

\$1.35 EA/ 50

2.1mmID/5mmOD plug

SURPLUS TRADERS specializes in the distribution of surplus parts and equipment to the electronic, computer and hi-tech industry. We publish a wholesale surplus catalog which is available to the trade at no charge. Please make your request on your company letterhead or accompanied by your business card. If you indicate your areas of interest or specialization - we will key our computer to target special offers in your field of interest. Hobbyists and those not in the trade may obtain our catalog for a handling charge of \$2.

SURPLUS TRADERS

P.O. Box 276

Winters Lane

Alburg, Vermont 05440

514-739-9328

(Fax 514-345-8303)

CABLE TV EQUIPMENT

Converters, Descramblers, Remote Controls

	<u>1</u>	<u>10</u>
OAK M35B	39.95	34.95
JERROLD (compatible) SB-3	69.00	50.00
JERROLD (compatible) Tri-bi (Fast Tri-bi)	89.00	60.00
JERROLD 400-DRX-3DIC (with a Built in SB-3 and with remote)	139.00	99.00
SCIENTIFIC ATLANTA SA-3	89.00	60.00
HAMLIN MLD-1200	79.00	55.00
HAMLIN CR-6600 (with a Built in Descrambler and with remote)	149.00	119.00
TOCOM Add On (Descrambler)	139.00	99.00
TOCOM 5503 Vip (with a Built in TOCOM Descrambler and with remote)	299.00	249.00

Same Day Shipment On Most Items

CALL NOW 800-822-9955

Call For Larger Quantity Pricing.

No CA Sales

CABLE PLUS

Dealers Wanted

14417 Chase St., Suite 481, Panaorama City, CA 91402



TAKE
THE
XT
PLUNGE!

399.00!!!

COMPLETE 12-MEG SYSTEM
WITH 101 KEYBOARD, 640K MEM,
CASE, POWER SUPPLY, MULTI-
ID CARD WITH/SER/PAR/GAME/CL,
12 IN AMBER MONITOR, 1 FLOPPY
DISK DRIVE (5.25 OR 3.5 IN.)
ADD 259.00 FOR 20-MEG HARD DR

LINEAR

LM324--39	7805CT--49	WE HAVE
LM339--39	7812CT--49	MORE TYPES
LM331--39	7910CT--45	IN STOCK!
LM393--39	7806CT--45	
LM351--39	7912CT--49	
LM3914-1.99	7810SA--39	
LM307J-.39	LM7815CK--99	
LM317T-.49	LM7818CT--49	

LEDS 10/1.50 1N4005 20/1.00

8088 CONTROL BOARD

- 16 LATCHED OUTPUTS
 - 16 BUFFERED INPUTS
 - 7 ADDRESSABLE INPUTS
 - 7 HI-CURRENT OUTPUTS
 - 8 CHANNEL ANALOG IN
 - ON BOARD EPROM PROGRAMMER EASILY
 - TRANSFERS YOUR PROGRAM TO EPROM
- 8088 BOARD WITH PROGRAMMER-179.00
POWER SUPP V 21V FOR EPROM- 59.00



PAK RAT ELECTRONIC PARTS

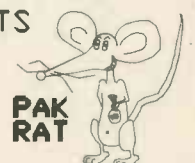
P.O. BOX 690073

HOUSTON, TEXAS

ZIP 77269

713-893-0313

ASK FOR A FREE CATALOG



FAX • 713-583-1446

HOURS: NOON TO 6:00 MON-FRI 9:00-1:00 SAT.

AUTO ALARM MODULE

COMES WITH HOOD
AND TRUNK PIN SW
AND HOOKUP INST.

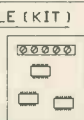
7.50 EA!!!



HOME ALARM MODULE (KIT)

2-ZONE CONTROL
USE BATT. CHARGE
TO CHARGE B/U
BATTERY.

27.50 EA!!!



R-F SPECTRUM ANALYZER (KIT)

0-500 MEG 199.00
420-900 MEG BASIC KIT



PROG CHARGE CONTROLLER

USE THIS TO CONTROL YOUR
CHARGE CURRENT FROM A
SOLAR PANEL ARRAY OR ANY
OTHER CURRENT SOURCE.
AUTOMATIC LOAD MONITORING

26.50 KIT/34.50 ASSEMBLED

SIMPLEX VOICE REPEATER

USES DIGITAL STORAGE MOD-
ULE TO STORE VOICE AND
RE-TRANSMITS VOICE.
NO NEED FOR EXPENSIVE DUP-
LEXERS. CONNECTS TO YOUR
2-WAY RADIO. 199.00

CURRENT LIMITER/BATT. CHARGER

GREAT FOR BATTERY
CHARGING OR WHEREVER
CURRENT-LIMITING IS
NEEDED.

12.50 EA!!!



1/2 INCH PROTO-BOARD
JUMPERS.



3.00 PER THOUSAND

FEEDTHROUGHS.
ELIMINATES UNWANTED R-F



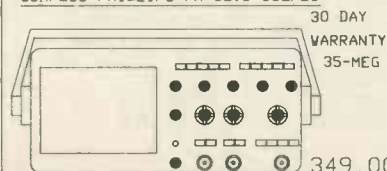
2.00 PER HUNDRED

TELEPHONE LINE ANSWERING
DEVICE

ANSWERS PHONE AUTOMATICALLY
HAS PROGRAMMABLE TIME OUT
AND HOLDING.

19.50 EA! (KIT)

SURPLUS PHILLIPS PM-3216 SCOPES



349.00

- 43-WATT SOLAR PANEL 299.00!!
- 51-WATT SOLAR PANEL 339.00!!
- PR-5 300-WATT WIND GENERATOR 850.00
- PR-6 400-WATT WIND GENERATOR 950.00
- PR-7 10A CHARGE CONTROLLER
- PR-8 TRACE 2000-WATT INVERTER-1090.00
- PR-9 80-AMP HYDROELECTRIC SYSTEM-1310.00



GIANT
SOLAR
PANEL
3/4 AMP
14.4V
12x36 IN.
48.00 EA!

CIRCLE 274 ON FREE INFORMATION CARD

B. G. MICRO

P. O. Box 280298 Dallas, Texas 75228
 (214) 271-5546
 FAX (214) 271-2462



B. G. SPECIALS

2016 P-15

2K x 8 N-MOS
 Trimmed Leads,
 But will Fit In Sockets.
 Super Buy

10/2.95 105/22.00

2N4401

Super 2N3904 NPN
 Switching Transistor
 40V-TO-92
 P.C. Leads

15/1.00 1000/20.00

RGP-15D

(NTE580-ECG580)
 1.5 AMP 200 V
 Fast Recovery Diode
 Taped & Reeled

Box of 1500/14.95

1/4" BLACK HEAT SHRINK TUBING

4 Foot Length

99¢

74LS

LS00	.14	LS122	.35	LS241	.60
LS02	.14	LS123	.45	LS242	.65
LS03	.14	LS125	.30	LS243	.50
LS04	.14	LS126	.35	LS244	.55
LS05	.14	LS132	.35	LS245	.55
LS08	.14	LS133	.25	LS251	.45
LS09	.14	LS138	.35	LS253	.40
LS10	.14	LS139	.35	LS257	.35
LS11	.14	LS145	.75	LS258	.45
LS12	.20	LS148	.35	LS259	1.00
LS13	.25	LS151	.35	LS260	.40
LS14	.30	LS153	.35	LS266	.30
LS15	.20	LS154	.85	LS273	.75
LS20	.14	LS155	.50	LS279	.30
LS21	.16	LS156	.42	LS280	.80
LS26	.14	LS157	.30	LS283	.35
LS27	.20	LS158	.25	LS290	.70
LS28	.15	LS160	.25	LS298	.65
LS30	.14	LS161	.35	LS323	2.25
LS32	.16	LS162	.45	LS353	1.00
LS33	.25	LS163	.36	LS357	.80
LS37	.24	LS164	.45	LS363	.75
LS38	.24	LS165	.60	LS365	.30
LS42	.35	LS166	.75	LS367	.35
LS51	.15	LS169	.90	LS368	.30
LS54	.20	LS173	.60	LS373	.50
LS55	.20	LS174	.35	LS374	.45
LS74	.22	LS175	.35	LS375	.35
LS75	.25	LS181	1.25	LS377	.75
LS83	.30	LS191	.45	LS378	.80
LS85	.45	LS192	.65	LS390	.80
LS86	.20	LS193	.65	LS393	.75
LS90	.35	LS194	.40	LS399	1.00
LS92	.30	LS195	.52	LS541	1.20
LS95	.30	LS196	.55	LS645	.75
LS107	.28	LS197	.75	LS646	.75
LS109	.20	LS221	.50	LS670	.80
LS112	.25	LS240	.50		
LS113	.25	26LS32	.75		
LS114	.25	25LS2569	1.50		

THE S25 NETWORK

Try The 1st Truly Low Cost LAN

- Connect 2 or 3 PCs, XTs, ATs
- Uses serial ports and 5 wire cable
- Runs at 115 K baud
- Runs in background, totally transparent
- Share any device, any file, any time
- Needs only 14K of ram

Skeptical: We make believers!

LOTUS 1-2-3 VALUE PACK

For 2.0 and 2.01

This software package includes:

- PostScript Device Support
- Enhanced EGA and VGA Display Support
- Lotus Speedup
- Lotus Learn
- Lotus Prompt Hotline: Free Premium Telephone Support
- Copy Protection Removal

Complete Manual and 5-1/4 Inch, 360K Disk

Brand New in Sealed Packages

ONLY \$3.95

+50¢ Postage & Handling WHILE SUPPLY LASTS!

CLOCK CIRCUITS

SAF3019	2.50
58321	2.50
146818	3.50

SOCKETS

Low Profile SOLDER TAIL	
6 Pin	14/1.00
8 Pin	13/1.00
14 Pin	13/1.00
16 Pin	13/1.00
18 Pin	13/1.00
20 Pin	13/1.00
22 Pin	13/1.00
24 Pin	8/1.00
28 Pin	7/1.00
40 Pin	7/1.00

BUY \$10

GET \$1.00 - FREE CHOICE

6500/6800

6502	2.00	6821	1.00
6520	1.25	6845P	2.20
6522	2.70	6845S	2.20
6530	3.00	6850	1.75
6532	4.25	6852	3.50
6545	2.10	6860	3.95
6551	2.40	68681	3.00
6800	1.40	68A09EP	1.29
6802	2.50	68A40	4.00
6803	3.00	68A54	3.00
6805	2.95	68B09	4.00
6809EP	2.75	68B10	2.00
6809P	2.50	68B45	4.95
6810	1.25	68B54	4.00

TEXT TO SPEECH BOARD

PC/XT COMPATIBLE. MAKE YOUR COMPUTER TALK!

PRICE CUT \$69⁹⁵

ASSEMBLED & TESTED
 ADD \$3.50 SHIPPING & HANDLING



A VERY POWERFUL AND AMAZING SPEECH CARD. USES THE NEW GENERAL INSTRUMENTS SPO256-AL2 SPEECH CHIP AND THE CTS256A-AL2 TEXT TO SPEECH CONVERTER.

THIS BOARD USES ONE SLOT ON THE MOTHERBOARD AND REQUIRES A COM SERIAL PORT. BOARD MAY ALSO BE USED IN A STAND ALONE ENVIRONMENT (EXTERNAL POWER SUPPLY) WITH ALMOST ANY COMPUTER THAT HAS A RS232 SERIAL PORT. TO USE THE BOARD IT IS ONLY NECESSARY TO SEND ENGLISH TEXT TO THE RS232 INPUT ON THE BOARD. THE BOARD INCLUDES A 1500 BYTE TEXT BUFFER AND HANDSHAKE LINE TO ALLOW YOU TO SEND DATA TO THE BOARD; THE SAME AS YOU WOULD SEND DATA TO AN RS232 SERIAL PRINTER. YOU CAN SET UP BATCH FILES THAT WILL MAKE YOUR COMPUTER GREET YOU WITH "GOOD MORNING MASTER," ETC. EVERY TIME YOU TURN IT ON. DEMONSTRATION SOFTWARE AND A LIBRARY BUILDING PROGRAM ARE INCLUDED ON A 5 1/4 INCH PC/XT DISKETTE. FULL DOCUMENTATION AND SCHEMATICS ARE ALSO INCLUDED.

FOR INFORMATION ON A LOW COST SPEECH SYNTHESIZER SYSTEM FOR THE VISUALLY IMPAIRED, PLEASE SEND FOR FREE PACKET T.M.1.

STAND ALONE POWER SUPPLY FOR ABOVE
 ADD \$2.50 SHIPPING & HANDLING

\$19⁹⁹

STATIC RAM

2016-2KX8 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 1KX4 300 n.s.	.45
2125A-2 1KX1 70 n.s.	1.70
2147 4KX1	1.95
6116P-4	1.20
6117	1.20
6264-15	1.40
62256 32KX8	6.50

EPROM SPECIAL

We bought a large quantity of 2708s, 2716s, 2532s, 2732s, 2764s, 27128s, 27512s and 27256s from a computer manufacturer who redesigned 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	2.25 10/20.00
27128	3.20 10/27.50
27256	3.85 10/32.50
27512	5.50 10/48.50

DYNAMIC RAM

2108-4 8KX1	1.50
2118-4 16KX1-5Volt	.70
4027-4KX1-250 n.s.	.80
4116-16KX1-250 n.s.	.40
4116-16KX1-200 n.s.	.75
4116-16KX1-150 n.s.	.90
4164-64K 200 n.s.	.90
4164-150 n.s.	1.25
4164-120 n.s.	1.50
4164-100 n.s.	1.75
4464-150 n.s.	1.90
4464-120 n.s.	2.20
4464-100 n.s.	2.55
4464-80 n.s.	2.70
41256-150 n.s.	1.75
41256-120 n.s.	1.85
41256-100 n.s.	1.92
41256-80 n.s.	2.05
41256-60 n.s.	3.00
1 Meg - 100 n.s.	5.75
1 Meg - 80 n.s.	5.90
44256-80 n.s. 256 x 4	6.30

SIPPS & SIMMS AVAILABLE

THREE CHIP SET

16450, 1488, 1489

B.G. SPECIAL

\$6.95

8000/80000

8031	2.95	8251	1.10
8035	1.00	8253-5	1.75
8039	1.00	8254	1.80
8085	1.55	8255	1.50
8086	1.55	8255-5	1.75
8087	87.80	8257	1.50
8087-1	167.50	8259A	1.85
8087-2	127.50	8259C-5	2.10
8088	2.70	8275	10.95
80C98	.40	8279	2.25
8155	2.25	8284	1.49
8156	2.25	8286	3.50
8202A	8.00	8287	2.49
8212	1.25	8288	3.50
8214	2.00	8530	3.00
8216	1.25	8741	7.00
8224	1.25	8742	7.00
8228	1.75	8748	7.00
8237-5	2.80	8749	7.00
8243	1.75	8755	7.00
8250	2.95	80286-8 PLCC	8.50
(16450)	6.50	80287-8	191.50
(16550)	12.00	80287-10	227.50
		V-20-10MHZ	6.50

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 1/2% Tax. 90 Day Money Back Guarantee on all items. All items subject to prior sale. Prices subject to change without notice. Foreign order - US funds only. We cannot ship to Mexico. Countries other than Canada, add \$4.50 shipping and handling.

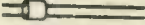
SEND FOR FREE CATALOG!

SEND FOR FREE CATALOG!

QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING

ALL ELECTRONICS CORP.

OPTO-ISOLATORS

Clairex# CLM-6000 
LED-photoconductor
isolator. Off resistance: 500 ohms. On resistance: 500K ohms. 2000 volt isolation. Forward voltage: 2 Vdc. **CAT# CLM-6000**
\$2.50 each • 10 for \$22.00

Sigma# 301T1-12B1.
Signal applied to the input is coupled by means of light to isolated photo conductive cell. High reliability switching. 12 Vdc.

CAT # OP-301 \$1.50 each

WATER PUMP



Design your own water cannon! 3-6 volt DC, piston driven, self-priming pump. Will project a stream of water or any non-corrosive liquid up to 25 feet. Motor, gears and piston in plastic housing 5.5" long X 1.03" square. Complete with 1/8" diameter input and output tubing. Squirt nozzle on output tube.

CAT# WP-1 \$3.95 each

OPTO SENSORS

Honeywell # HOA 0866-N55
U-shaped opto sensor.

1/8" gap. 4 pc leads.

CAT# OSU-8 75¢ each

TRW# OPB-818

U-shaped opto switch.

0.2" gap between sensor

and emitter. **CAT# OSU-9 75¢ each**

TRW# OPB 822SD

Reflective scanner

module. U-shaped

device with 4 leads each side (8 total) 0.09"

gap. 0.75" mounting centers.

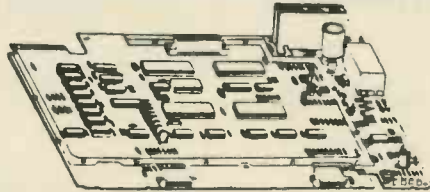
CAT# OSU-10 75¢ each

TRW# OPB-708

Wedge-shaped reflective

opto sensor. **CAT# OSR-5 75¢ each**

EXPERIMENTER'S DELIGHT



These Atari 5200 video game controllers were returned to the dealer because of various defects. None of them work properly, but they have lots of great parts which could be used in other projects. They include a RF video modulator, eight 16K dynamic RAMs in sockets, microprocessors and D-A converters in sockets, two voltage regulators on a heavy-duty heat-sink and lots of other ICs, capacitors, resistors, connectors and other components all in the original chassis. Does not include the power transformer or controls (joysticks). The video modulator or the RAMs alone are worth the price. **SOLD AS-IS. No returns accepted.**

CAT# A-5200 \$7.50 each • 2 for \$13.50

SPA THERMOMETER



Originally designed for hot tub use, 50 to 120 degree thermometer is connected to brass probe via 10 ft of teflon covered thermocouple wire. Thermometer snap-mounts into 1.6" hole in panel. Logo on thermometer says "Safe max 104 degrees F." Useful wherever remote temperature sensing is desired. Brass probe is 0.375" diameter X 2.97" long.

CAT# THM-1 \$3.50 each

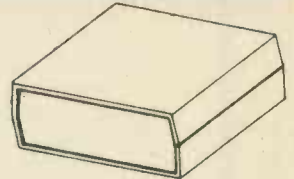
64K DYNAMIC RAM HOUSE MARKED

New 4164 150 nanosecond 64K dynamic RAMs. 16 pin DIP package. Originally intended as add-on memory for a consumer product, these Motorola chips have been housemarked (70C18) and individually packaged in anti-static foam inside a plastic bag. Though they don't have 4164 written on them, we guarantee that they are new, functioning 4164s.

SPECIAL! CAT# HN-4164 \$1.25 each

ABS INSTRUMENT ENCLOSURES

Molded ABS Instrument enclosures are available in ivory, beige, grey, blue, and black.



Front and rear panels in matching .090" thick ABS plastic or, as an option, anodized satin finish aluminum. Integral P.C. board mounting standoffs and two sets of vertical mounting slots for front and rear subpanel P.C. boards. Includes 6-32 pan head screws and anti-skid rubber feet. All enclosures are 6" wide X 6.25" deep. Front and rear panels available in 2.25", 2.625", and 3" heights.

color	panel ht.	cat #	1-9	10-99	100+
ivory	2 1/4"	MB 1A	\$7.50	6.50	6.00
beige	"	MB-2A	"	"	"
grey	"	MB-3A	"	"	"
blue	"	MB-4A	"	"	"
black	"	MB-5A	"	"	"
ivory	2 5/8"	MB-1B	\$7.75	6.75	6.25
beige	"	MB-2B	"	"	"
blue	"	MB-4B	"	"	"
black	"	MB-5B	"	"	"
ivory	3"	MB-1C	\$8.00	7.00	6.50
beige	"	MB-2C	"	"	"
blue	"	MB-4C	"	"	"
black	"	MB-5C	"	"	"

Satin finish aluminum front or rear panels.

panel ht.	cat #	1-9	10-99	100+
2 1/4"	PNL-1	\$1.00	.85	.70
2 5/8"	PNL-2	\$1.20	1.10	1.00
3"	PNL-3	\$1.40	1.25	1.10

SPECIAL 12 VOLT DC COOLING FAN

Rotron # NC12E3

These are the same

fans we have in our

catalog for \$9.00 each.

We just received another

load of them and want to move quantities at a

special price. Rated: 12Vdc, 0.18 amp, 2.2

watts. 4.69" square plastic housing X 1.25"

thick. 5 blade fan. Two 9" pigtail leads.

CAT# CF-122 10 for \$65.00

100 for \$500.00



CALL OR WRITE FOR OUR
FREE 60 PAGE CATALOG
WITH OVER 4000 PARTS!
OUTSIDE THE U.S.A. PLEASE SEND
\$2.00 POSTAGE FOR A CATALOG

**TOLL FREE
PHONE ORDERS
1-800-826-5432**

MAIL ORDERS TO:
**ALL ELECTRONICS
P.O. BOX 567
VAN NUYS, CA 91408**

QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING

ALL ELECTRONICS CORP.

MOTORS

6 Vdc MOTOR

Sanko# TE-325
1 1/2" dia. X 1" long. 1/16" dia shaft.
CAT# MQT-6 \$2.50 each



12 Vdc MOTOR WITH TACH

Probably used on disc drives.
Buehler# 13.65
Rated 6,800 RPM 12 Vdc.
Torque 3.9 in/oz.
Can be used from 6 - 24 Vdc. Built in tach winding (1.8 V/1,000 RPM). 2 3/16" X 1 3/16".
Shaft 3/8" X 3/32" dia with attached pulley.
CAT# MOTS-A \$4.50 each



MINIATURE GEAR MOTORS

Buehler series 61.13
Miniature DC gearhead motors. Reversible.
Motor and gearhead enclosed in rugged die-cast housing. 1.55" X 1.122" X 1.475".
Long-life bronze bearings. 0.115" diameter flat-ted shaft. Two types available:



18 volts dc (nominal) @ 50 ma.
10 rpm @ 14 Vdc (no load)
17 rpm @ 24 Vdc (no load)
CAT# MOTG-18 \$5.50 each

38 volts dc (nominal) @ 70 ma.
274 rpm @ 24 Vdc (no load)
451 rpm @ 38 Vdc (no load)
CAT# MOTG-38 \$5.50 each

STEPPING MOTORS

Airpax# A82743-M4
12 Vdc 35 ohm dual coil, permanent magnet stepper motor. 7.5 degrees per step. 2.25" dia. X .91" thick. 0.25" dia. shaft is 0.6" long. Two hole mounting flange, 2.625" centers. 6 wire leads. CAT# SMT-5 \$10.00 each

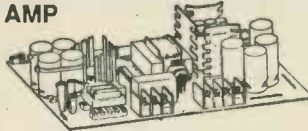


Airpax# C82711-M1 17 Vdc 23.25 ohm dual coil, permanent magnet stepper motor. 7.5 degrees per step. 2.25" dia. X .91" thick. 0.25" dia. shaft is 0.6" long. Two hole mounting flange, 2.625" centers. 6 wire leads.
CAT# SMT-6 \$6.00 each • 10 for \$50.00

Airpax# C 82710 12 Vdc, 36 ohm dual coil permanent magnet stepper motor. 7.5 degrees per step. 2.25" dia. body X 0.93" high. Mounts on 2.675" centers. 6 wire leads.
CAT# SMT-7 \$7.00 each • 10 for \$65.00

POWER SUPPLIES

5 VDC 10 AMP



Computer Products# 80011-01-002
Open frame switching power supply. Operates on 115-230 Vac. Output: 5 Vdc @ 10 amps.
Screw terminal inputs and outputs.
Measures 8.375" X 5.12" X 2.2".
CAT# PS-35 \$15.00 each

12 VDC 2.1 AMP

Lambda# LUS-9A-12
Fully enclosed switching power supply with screw terminal connections.
Input: 120 Vac 60 Hz.
Output: 12 Vdc ± 5% @ 2.1A overvoltage and overcurrent protection. Compact ventilated case measures 5.24" X 3.81" X 1.38" overall.
Includes instruction sheet.
CAT# PS-122 \$23.50 each



SWITCHING POWER SUPPLY

Compact, well-regulated switching power supply designed to power Texas Instrument computer equipment.
T.I.# 1053201-0002
INPUT: 14 - 25.2 Vac @ 1 amp.
OUTPUT: +12 Vdc @ 350 ma., +5 Vdc @ 1.2 amp., -5 Vdc @ 200 ma.
SIZE: 4 3/4" X 4 1/4" X 1 1/4"
CAT# PS-30 \$3.50 each • 10 for \$30.00



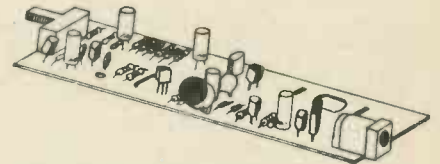
CRYSTAL SPECIAL

HU-18/U Style

6 mhz CAT# CRY-618S
10 mhz CAT# CRY-1018S
MINIMUM ORDER 100 PIECES
100 of one VALUE \$75.00
500 of one VALUE \$300.00
1000 of one VALUE \$500.00



SOUND ACTIVATED SWITCH



PC board with electret mike responds to sounds in immediate vicinity. Originally part of sound activated light organ. Output slots in board fit our motor CAT# DCM-24. Originally, when the unit was placed near speakers the motor turned, spinning some optic fibers over colored lights. Could easily be used without motor for any similar application where sound activation is desired. Shuts off when sound is not present. Operates on 6 Vdc. On-off switch and co-ax power jack (center positive).
4" X 1.4" pc board.
Includes hook-up diagram.
CAT# SAB-2 \$2.50 each

SOLID STATE INPUT/OUTPUT MODULES

Microprocessor interface switches designed for industrial control applications. For electrically clean, photo-isolated, noise-free interfacing between logic level programmable controllers and power level loads. Input modules accept power level signals and convert them to logic level signals. Output modules accept logic level signals to switch AC or DC loads to 3.5 amps. All modules fit standard I/O mounting boards and have captive hold down screws.



part#	brand	description	CAT#	Price
ODC5	Opto 22	5 Vdc Output	ODC-5	\$5.00
OAC24	Opto 22	24 Vac Output	OAC-24	\$5.00
ODC24	Opto 22	24 Vdc Output	ODC-24	\$5.00
IAC5	Crydon	5 Vac Input	IAC-5	\$4.50
IAC24	Opto 22	24 Vac Input	IAC-24	\$5.00
IDC24	Opto 22	24 Vdc Input	IDC-24	\$5.00

TOLL FREE ORDER LINES 1-800-826-5432

FAX (818) 781-2653 • INFORMATION (818) 904-0524

Minimum Order \$10.00 • All Orders Can Be Charged To Visa, Mastercard Or Discovercard • Quantities Limited • California, Add Sales Tax • Shipping And Handling \$3.50 For the 48 Continental United States - All Others Including Alaska, Hawaii, P.R. And Canada Must Pay Full Shipping • No C.O.D. • Prices Subject to change without notice.



Top Rated IBM-PC shareware & public domain software



\$3.50 a disk (1-9 disks) - \$3.00 a disk (10 or more) - for 3.5" disks, add \$1.00 for each disk

20 - **SimCGA** - run CGA-Only programs on Hercules monitors

48,49 - **Imageprint** (2 disks) - top notch printer fonts for IBM/Epson printers. Many styles and sizes.

51 - **AutoMenu** - set up your PC for quick access to programs on your hard drive.

60 - **Xtree** - top hard drive management & access.

110 - **Newspace** - compresses your hard drive data 'on the fly', allowing you more space. Transparent to your programs.

116 - **Anti Virus Utilities** - a collection of programs that scan for, detect and remove viruses.

121-123 **PC-Write** (3 disks) - the tops in shareware word processing! Includes spell check, mail merge and much more (hard drive req'd).

147 - **PRO-CR** - optical character recognition for desktop scanners and some hand scanners.

170,171 - **Procomm** (2 disks) - one of the popular telecommunications programs for phone modems.

190-192 - **PC-File 5.0** (3 disks) - the leader in shareware database management programs. Create your own database systems quickly and easily. Has mail merge, reporting, label making and much more (hard drive req'd).

211 - **As Easy As** - the best Lotus 1-2-3 compatible spreadsheet program available. Fully functional.

278 - **PC-Key Draw** - combination paintbrush & CAD system. Complex but easy to use. (CGA/EGA req'd)

279-288 - **PC DOGS CAD** (10 disk set) - a powerful and complex computer aided design system

that rivals AutoCAD. Many functions. (requires HPGLplotter).

340 - **Printmaster Clipart** - a collection of 500+ pictures for use with Printmaster and Printshop.

392 - **FormGen** - whip up forms for business and personal use quickly and easily.

580 - **Fractals 1** - discover the colorful, chaotic world of fractals. Includes Julia and Mandelbrot sets. (EGA req'd)

Call or write for our free software catalog

683,684 - **C Tutorial** (2 disks) - learn how to program in the popular computer language ever.

726 - **Personal C Compiler** - a great compiler that helps you to make professional programs in C. A great companion to the C Tutorial.

733 - **PC-Tutor** - top interactive tutorial for those learning DOS.

734 - **Help DOS** - TSR quick reference for DOS. Allows you to always have command syntax available

830 - **Psion Chess** - a great 2/3-D chess game - several levels of play.

1092 - **PC-Track** - great EGA satellite tracking program. Tracks real or elapsed time. (EGA req'd).

1096 - **Radio Mods** - a nice collection of modifications for scanners, HT's, VHF rigs and some HF rigs

1097 - **SSTV** - receive SSTV signals on your PC (req's CGA & game port)

1101 - **CW Decoders** - a collection of programs

that allow your PC to copy CW.

1102 - **FCC Exams** - Novice, Tech & General preparation on a disk! Contains entire question pool. Keeps track of what you missed.

1121 - **ARL** - Top notch (and fast) logbook. Great for those who make a lot of QSO's (hard drive req'd).

1149 - **GeoClock** - like DX Edge. Shows light/dark areas of the Earth and moves real time (for Herc/CGA/MCGA/ATT) - (note: for EGA or VGA, order 1150 Geoclock EGA)

1156 - **Skyglobe** - the greatest in skyviewing programs. Shows constellations, stars and galaxies as they appear from anywhere on the Earth! Top notch - you have to see it to believe it! (CGA req'd).

1201 - **STORM** - The tops in Hurricane tracking! Map views of the Gulf or Atlantic (needs CGA or better).

1249 - **World 29!** - nice map viewing system. View the world from any point and 'zoom' in. (CGA req'd)

1311-1317 - **Online Bible** (7 disks) - KJV version of both Old and New Testament. Online browse and search facility.

1320 - **PC Board Layout** - a nice system for design of printed circuit boards. Has AutoCAD output.

1321 - **Motorola Database** - good cross reference database program for Motorola semiconductors.

1322 - **CoreDBMS** - A full database for ferrite and toroid iron cores. Great for the RF related builder or experimenter.

1330 - **ACIRAN Circuit Analysis** - AC Linear circuit analysis on a PC.

To order, call 1-800-525-7235 (orders only) - US/Canada include \$4 shipping per order, others please include \$8 shipping. Visa/MC/Check/MO accepted

renaissance software & development

killen plaza - box 640 - killen - al - 35645

(205)757-5928 - (205)757-8388



EPROM PROGRAMMERS

Stand-Alone Gang Programmer

\$750.00



8 ZIF Sockets for Fast Gang Programming and Easy Splitting

- Completely stand-alone or PC driven Programs E(EP)ROMs
- 1 Megabit of DRAM
- User upgradable to 32 Megabit
- .3/.6" ZIF socket, RS-232, Parallel In and Out
- 32K Internal Flash EEPROM for easy firmware upgrades
- Quick Pulse Algorithm (27256 in 5 sec, 1 Megabit in 17 sec.)
- 2 year warranty
- Made in U.S.A.
- Technical support by phone
- Complete manual and schematic
- Single Socket Programmer also available. \$550.00
- Split and Shuffle 16 & 32 bit
- 100 User Definable Macros, 10 User Definable Configurations
- Intelligent Identifier
- Binary, Intel Hex, and Motorola S

20 Key Tactile Keypad (not membrane)

20 x 4 Line LCD Display

Internal Programmer for PC

\$139.95

New Intelligent Averaging Algorithm. Programs 64A in 10 sec., 256 in 1 min., 1 Meg (27010, 011) in 2 min. 45 sec., 2 Meg (27C2001) in 5 min. Internal card with external 40 pin ZIF.

- Reads, verifies, and programs 2716, 32, 32A, 64, 64A, 128, 128A, 256, 512, 513, 010, 011, 301, 27C2001, MCM 68764, 2532
- Automatically sets programming voltage
- Load and save buffer to disk
- Binary, Intel Hex, and Motorola S formats
- Upgradable to 32 Meg EPROMs
- No personality modules required
- 1 year warranty • 10 day money back guarantee
- Adapters available for 8748, 49, 51, 751, 52, 55, TMS 7742, 27210, 57C1024, and memory cards
- Made in U.S.A.

2 ft. Cable 40 pin ZIF



NEEDHAM'S ELECTRONICS

4539 Orange Grove Ave. • Sacramento, CA 95841
Mon. - Fri. 8am - 5pm PST

C.O.D.  

Call for more information

(916) 924-8037

FAX (916) 972-9960

CIRCLE 279 ON FREE INFORMATION CARD

YOU'VE SHOPPED THE REST, NOW BUY FROM THE BEST!!



**JERROLD 400
DRX-3-105**
\$40 20+
SINGLE \$55



PANASONIC
• 550 MHZ
• PARENTAL LOCK
• LAST CHANNEL RECALL
• TIMER

\$69 20+ **\$95** EA.

MODEL	QUANTITY			CALL: ZENITH, OAK, MORE
	1	10+	20+	
SB-3	\$60	\$50	\$45	
TB-3	\$95	\$75	\$69	
DRX-DIC	\$125	\$95	\$85	

JERROLD EQUIPMENT SALES, INC.

7094 MIRAMAR ROAD, BOX 118 • SAN DIEGO, CA 92121

SALES OFFICE 1-800-676-7966

Technical Assistance or FAX: 619-693-7966

CIRCLE 276 ON FREE INFORMATION CARD

Alltek Computer

COMPUTERS • PRINTERS • COMPONENTS

SYSTEM SPECIALS

AT 386

25 MHz
80 Meg HD
VGA Monitor

\$2150

AT 386SX

16 MHz
40 Meg HD
Mono Monitor

\$1250

AT 286

12 MHz
40 Meg HD
Mono Monitor

\$895

EACH SYSTEM INCLUDES

1 Megabyte RAM
AT Case w/Power Supply
KEYTRONICS 101 Keyboard
1:1 Hard Floppy Controller

TEAC 1.2 and 1.4 Floppy Drive
Monitor (14" S VGA/12" Mono)
Video Controller (512K RAM on VGA)
2 Serial/1 Parallel Card

HARD DRIVES

NEC 3142 44/66MB 24MS **\$315**
WD 44MB 28MS (IDE) **\$290**
Quantum 80MB 19MS (IDE) **\$510**
Conners 100MB 24MS (IDE) **\$550**

VIDEO CARDS

Paradise OEM 512K **\$140**
Genoa 6400 512K **\$160**
Tseng Lab OEM 512K **\$140**
Orchid Pro Designer II 512K **\$290**

MOTHERBOARDS

386/33 MHZ 64K Cache **\$950**
386/33 MHZ 64K Cache **\$850**
386SX/16 MHZ **\$390**
286/12 MHZ **\$135**

MONITORS

MITSUBISHI
14" 1381 Diamond Scan **\$499**
POWER II
14" S VGA 1024x768 .28DP **\$389**
14" VGA 640x480 .28DP **\$350**
SAMSUNG
12" Amber Mono Monitor **\$79**
14" VGA Monitor **\$365**

MISCELLANEOUS

1.2 TEAC Floppy **\$80**
1.44 TEAC Floppy **\$80**
360K TEAC Floppy **\$63**
AT I/O 2s/1p/1g **\$30**
2400 Baud Modem **\$79**

Other items available.
Call for pricing information.

Local Area Networks Repairs & Installations
XT to AT Upgrades Full One Year Warranty

*Limited
Quantities*

AC 359 W. El Camino Real
Mt. View, CA 94040

M-F 10-7:00
Sat. 10-4:00



Call Jim Meredith
or Tim Gillies
1-800-745-8984

GRAY MATTER COMPUTING

XT SYSTEM: 8088-10 with 640K, 360K Floppy, 2 parallel, 2 serial, 1 game port, 101 keyboard, clock/calendar, monographic card & monitor. **\$399.00**

AT SYSTEM: 286-12, 2MB RAM, 1.2 Floppy, 2 ser, 2 par, 1 game, 101 keyboard, 1:1 hd/fd Controller, monographic video card & monitor. **\$699.00**

386-25/64K Cache system includes 2MB RAM, 1.2 Floppy, 1:1 hd/fd Controller, 2 ser, 1 par, 1 game port, 101 keyboard, 16 bit VGA Card & monitor. **\$2085.00**

We will happily configure a system to fit your needs.

1:1 AT MFM HD/FD Controller \$75.00
 1:1 AT RLL Combo Controller \$99.00
 XT MFM & RLL Controllers \$51, \$59
 360K & 1.2MB Floppy Drives \$60, \$75
 720K & 1.44MB Floppy Drives \$65, \$75
 CMS Jumbo Tape Backup \$275.00

CALL TODAY

40MB MR535 MFM 28ms RLL cert \$325.00
 72MB Maxtor XT1085 FH 28ms \$625.00
 100MB CP3104 IDE (AT) with kit \$655.00
 200MB CP3204 IDE (AT) with kit \$995.00
 XT 4.77/10MHz Motherboard 0K \$ 60.00
 286 VLSI Motherboard 12MHz 0K \$110.00

WHY US

Customer satisfaction is our primary goal. We know that you need knowledgeable support as well as prompt service. Here at Gray Matter, we take pride in providing these and more at a competitive price. And we enjoy it. That's why.

4357 Mt. Hukee Avenue

619-278-8211

San Diego, CA 92117

ALUMINUM RACK AND CHASSIS BOXES

FEATURES:

DESIGNED FOR SMALL LOT PRODUCTION
 EASY TO FABRICATE (DRILL OR PUNCH HOLES)
 SHIPPED UNASSEMBLED (FLAT)
 ALL MAIN PANELS ARE FLAT FOR EASY FABRICATION
 FRONT AND REAR PANELS ARE CLEAR BRUSH ANODIZED
 TOP AND BOTTOM PANELS ARE BLACK BRUSH ANODIZED
 END PANELS ARE BLACK ANODIZED

CHASSIS BOXES

MODEL#	WIDTH	DEPTH	HEIGHT	PRICE
MC-1A	4"	3"	2"	\$ 15.00
MC-2A	6"	3"	2"	17.00
MC-3A	8"	3"	2"	19.00
MC-4A	4"	5"	3"	17.00
MC-5A	6"	5"	3"	19.00
MC-6A	8"	5"	3"	21.00
MC-7A	4"	7"	4"	19.00
MC-8A	6"	7"	4"	21.00
MC-9A	8"	7"	4"	23.00

RACK BOXES

MODEL	RU	DEPTH	PRICE
1RU5	1.75"	5"	\$ 29.40
1RU7	1.75"	7"	31.50
1RU10	1.75"	10"	33.60
2RU5	3.50"	5"	31.50
2RU7	3.50"	7"	33.60
2RU10	3.50"	10"	35.70
3RU5	5.25"	5"	39.90
3RU7	5.25"	7"	42.00
3RU10	5.25"	10"	44.10

ORDER DIRECT FROM THE FACTORY.
 ON PREPAID ORDERS SHIPPED UPS
 GROUND, SECOND DAY AIR \$10.00
 NEXT DAY AIR \$20.00



CALL FOR COMPLETE CATALOG AND ENGINEERING DIMENSIONS.
 WE ALSO STOCK CHASSIS PUNCHES AND INSTANT LETTERING. CALL FOR CATALOG.
 SESCOM, INC. - 2100 WARD DR. HENDERSON NV. 89015 U.S.A.
 800-634-3457 (ORDERS ONLY) - 702-565-3400 (TECHNICAL HELP) - FAX 702-565-4828

CIRCLE 278 ON FREE INFORMATION CARD



COMPUTER DISK SERVICE

SPECIALIZED DRIVE REPAIR

REPAIR
\$75⁰⁰

SEAGATE 5 1/4"
 ST 238, ST 225
 MINISCRIBE 5 1/4"
 3425, 3435, 3438
 MINISCRIBE 3 1/2"
 8425, 8438

\$120⁰⁰
 SEAGATE ST 251
 MINISCRIBE 3650

Special
Low Prices!

FOR SALE
NEW!!

380mb Sesi 16ms
 MINISCRIBE 9380S
INTERNAL
\$950.00

EXTERNAL KIT
CALL FOR PRICE
1 YEAR WARRANTY

- Class 100 clean room
- Servowriting capabilities (Call for prices)
- Volume discount
- 6 month warranty on all repairs
- 7-10 day turn around time
- 24 hour turn around - ADD 30%
- Ask about our data recovery (Call for quote)

COMPUTER DISK SERVICE
 3537 OLD CONEJO ROAD, SUITE #115
 NEWBURY PARK, CA 91320-2157

PH (805) 499-6355
 FAX (805) 499-0346

Amazing Pocket Reference!

480 pages of tables, formulas, & conversions and it fits in your shirt pocket!

(Size 3.2" x 5.4" x 0.6")

The Greatest pocket reference of all time!

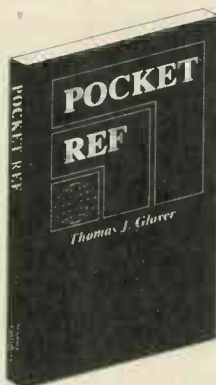
NEW RELEASE!

» Every engineer, geologist, manager, foreman, contractor, purchasing agent, maintenance person, and craftsman needs this book!

» A must for every student!

» The handyman's dream!

**100% MONEY BACK GUARANTEE
IF NOT COMPLETELY SATISFIED!**



* Plus shipping and handling and Colorado residents sales tax. See order form below.

A UNIQUE PRESENT

- **Air**
Properties of Air
Density of Moist Air
General Gas Laws
Air Tool CFM vs PSI
Air Hose Friction
- **Automotive**
Antifreeze Table
Spark plug Torques
Battery Charging
Oil Viscosity vs Temp
Tire Size vs Load Rate
Tire Manufacturer Codes
- **Carpentry and Construction**
Lumber Sizes & Grades
Hardwood Grades
Wood Characteristics
Plywood & Panel Grades
Floor Joist Span Limits
Insulation R Values
Concrete & Mortar
- **Chemistry & Physics**
Element Tables
Periodic Table
pH of Acids & Bases
Elementary Particles
Radioisotopes
- **Computers and Printers**
Computer ASCII Codes
IBM® PC Error Codes
IBM® Interrupts-IO Map
IBM® Memory Map
80286 Hard Disk Types
Printer Control Codes
Cable Wiring
Modem Commands
- **Electrical**
Electric Wire Size vs Load
Copper Wire Resistance
Electric Motor Specs
Wire Classes & Insulation
Wire Color Codes
NEMA Motor Frames
Wire & Sheet Gauges
Electric HP vs Torque
Resistor Color Codes
Resistor Standard Values
Capacitor Color Codes
Pilot Lamp Specs
Fuse & Battery Specs
RF Coil Winding Data
Wire Size vs Turns/Inch
Wire Size vs Voltage Drop
Ampacity vs Temperature
Decibel Tables
Electric/Electronic Formulas
- **General Information**
US & State Holidays
Signs of the Zodiac
Flowers of the Months
Anniversary Names
Radio Alphabet
Morse & TEN Radio Codes
Paper Sizes (Intl)
Military Rank & Grade
State Information
Climate Data of the US
Time Zones of the US
Time Zones of the World
Telephone Area Codes
World Airport Elevations
Lost Credit Card Phone #'s
Airline 1-800 Phone #'s
Temperature Conversion
Sound Intensities
Body Weight vs Height
Wind Strength Scale
Wind Chill Factors
Firewood Comparisons
Frequency Spectrum
Sun & Planet Data
- **Geology**
Mineral Tables
Crystal Systems
Mohs Hardness Scale
Earthquake Scales
Geologic Time Scale
- **Glues, Solvents, Paints and Finishes**
- **Hardware**
Bolt Torque Tables
Wood Screw Specs
Sheet Metal Screws Specs
Nail Sizes and Weights
Wire Rope Cable Clamps
- **Math**
Inch-Foot-MM-Drill Number
Math Formulas & Tables
Roman Numerals
Numeric Prefixes
Triangle Formulas
Plane Geometry Formula
Solid Geometry Formula
- **Mining & Milling**
Sieve Sizes & Met Tables
Stock Pile Volume & Weight
Dumping Angles
Mining Equipment Specs
- **Money & Currency**
Currency Exchange Rates
Interest & NPV Tables
- **Plumbing & Pipe**
- **Rope, Cable, & Chain**
- **Steel & Metals**
- **Survey & Mapping**
Percent Grade to Degrees
Mapping Scales & Areas
Stadia/Apparent Dip Tables
Magnetic Declination
- **Tools**
Tap-Die-Drill Sizes
Drill & Cut Lubricants
Fire Extinguishers
Sand Paper & Abrasives
Saw Blades
- **Water**
Water Friction Losses
Water Discharge Tables
Weld Electrode & Solder
Water Pollution & Hardness
- **Weights of Materials**
- **Welding**
- **3200 Conversion Factors**

And MUCH, MUCH more, this isn't even 1/2 of the contents of Pocket Ref!

Please send me _____ copies of Pocket Ref

1 to 9 books = \$9.95 each) Plus
10 to 24 books = \$9.00 each) Shipping =>
25 to 54 books = \$8.50 each)

Total Shipping & Handling per Order

1 book = \$2.00	6 books = \$6.00	11 books = \$8.50
2 books = \$4.00	7 books = \$6.50	12 books = \$9.00
3 books = \$4.50	8 books = \$7.00	13 books = \$9.50
4 books = \$5.00	9 books = \$7.50	> 14 books = \$10.00
5 books = \$5.50	10 books = \$8.00	

Name: _____

Company: _____

Address: _____

City/State/Zip: _____

Phone: (____) _____

Payment enclosed (mark one): Check Money Order Visa MasterCard

Card #: _____

Exp. Date: _____ Signature: _____

Colorado Residents
add 4.7% sales tax
on the book + ship-
ping total.

**The Book Source, Dept 956, P.O. Box 620820, Littleton, CO 80162
TOLL FREE ORDER LINE !!! • (800) 873-7157**

LINEAR IC'S

1 EACH DIP LM324, LM339, LM380, NE555, LM723, 741, MC1310, LM1800. 8 PIECE ASS'T - \$2.00

TRANSISTORS

ASSORTMENT INCLUDES 2N2222, 2N3055, 2N3904, 2N3906, 2N4401 PLUS MUCH MORE TO-92, TO-5 AND TO-220 STYLE. 25 PIECE ASSORTMENT - \$2

LYTICS

ASSORTMENT CONTAINS 1uf, 4.7uf, 10uf, 22uf, 47uf, 100uf, 220uf, 470uf, 1000uf, 2200uf AND MORE. FULL LEADS/VOLTAGES VARY. 25 PCS/\$2

TANTALUMS

ASSORTMENT OF DIPS, SOLIDS, RAD/AX. VALUES INCLUDE 1uf, 3.3uf, 4.7uf, 10uf, 15uf, 22uf, 47uf AND MORE. 40 PIECE ASSORTMENT - \$4

SOCKETS

LOW PROFILE - ASSORTMENT INCLUDES 2 EACH 8, 14, 16, 18, 24 AND 40 PIN. 12 PCS/\$1

WIRE WRAP - ASSORTMENT INCLUDES 1 EACH 8, 18, 20, 22, 24, 28 AND 40 PIN. 7 PIECES/\$4

DIODES

100 PIECE ASSORTMENT INCLUDES SOME EACH 1N4004, 1N4148, 1N4735, 1N4749 AND MORE.

SOME ZENERS HOUSE NUMBERED. 100/\$2

DIGITAL IC'S

25 PIECE ASSORTMENT OF 7400, 74LSXX, 4000 CMOS, 74SXX SERIES IC'S INCLUDING POPULAR DEVICES 7447, 74LS373, CD4013, 74S374, AND MUCH MORE. 25 PIECE ASSORTMENT - \$3.95.

RESISTORS

1,000 PIECE RESISTOR ASS'T - MINIMUM OF 50 DIFFERENT TYPES. MOSTLY 1/4 AND 1/2 WATT.

SOME 1/8 AND A FEW 1 AND 2 WATT. GUARANTEED TO CONTAIN 1K, 10K, 100K, AND MANY, MANY MORE POPULAR AND USEFUL VALUES INCLUDING PRECISIONS. COMPETITION BASHING PRICE \$6.95

REGULATORS

ONE PIECE EACH LM309K, MC337T, 7805, 78L08, 7812, 7905, 7912, 7915. 8 PIECE ASSORTMENT \$2

RELAYS - 10 PC ASS'T. \$2.50

WE'RE LOOKING FOR A FEW GOOD CUSTOMERS!!!!!!

ATTENTION SCHOOLS: MICRO-MART

WILL EXPERTLY PACKAGE LAB KITS FOR YOU.

CATALOG/MAIL - SEND AN ORDER AND

WE WILL INCLUDE SPECIAL OFFER LIST. IF

THERE IS NOTHING IN THIS AD FOR YOU, YOU

DON'T NEED US! NO CATALOG COLLECTORS PLEASE.

SWITCHES

ASSORTMENT INCLUDES SLIDES, TOGGLES, ROCKERS, AND PUSH BUTTONS. 15 PIECE ASS'T - \$1

TRIMPOTS

ASSORTMENT INCLUDES WIDE RANGE OF STYLES/VALUES. 25 PIECE ASSORTMENT - \$2

DISCS

ASSORTMENT FROM 1.5pf TO .33uf. MINIMUM 15 DIFFERENT VALUES. 50 PIECES FOR \$1

MYLARS

ASSORTED DIP, METALIZED AND FOIL MYLAR CAPS. VALUES UP TO .33uf. 35 PIECES FOR \$2

SLIDE POTS

10 PIECES ASSORTED - \$1

LED'S

ASSORTMENT OF STANDARD AND NON STANDARD STYLES. 50/\$4

TRIMCAPS

10 VARIABLES ASSORTED - \$2



DMM
WITH FREQUENCY, CAP, WFE FUNCTIONS. COMES COMPLETE WITH PROTECTIVE CARRYING CASE, SPARE FUSE, TEST PROBES, BATTERY. EXTERNAL CAP AND TRANSISTOR PROBES OPTIONAL AND \$4.95 EACH EXTRA
MODEL #905
\$68.95

MICRO-MART (TEL: 201 654 6008) TERMS - CHECK, MONEY ORDER, VISA/MC. \$10 MIN. ORDER. COD REGULAR CUSTOMERS WESTFIELD, NJ 07090 ONLY. SHIPPING - U.S. \$3, CANADA \$4. NJ RESIDENTS ADD 7%.

CIRCLE 292 ON FREE INFORMATION CARD

TECHNICAL SCHOOL CLOSED!

Selling hundreds of HEATH Co. test and training equipment at up to 50% off their catalog prices. Use Heath catalog for description. Condition: new to slightly used, many without manuals. All professionally wired & tested, or in kit form if noted. First come, first served. Check or major credit cards. Sorry, no COD or open accounts. Add \$4.50 Mailing & Handling.

HEATH TEST EQUIPMENT		HEATH LEARNING COURSES	
1MS217	Battery Operated V.O.M., Wired	29.50	Note: The small kits of component parts usually supplied with manuals are not available and prices reflect this omission. All courses are new, and with exam.
1MS228	Vacuum Tube Voltmeter, Wired	79.50	EE101 Operational Amplifiers 26.50
1T2250	Auto Range Capacitor Test, Wired	89.50	EE102 Active Filters Course 19.50
1T3120	Semiconductor Checker, Wired	59.50	EE103 I.C. Timers Course 22.50
PKW105	Deluxe 10:1 Combo Probe Kit	19.50	EE104 Phase Locked Loops Course 29.50
SK101	12 VDC-3A Power Supply	39.50	EE105 Opto Electronics Course 29.50
1271	Function Generator	69.50	EE110 Laser Technologies Course 39.50
1274	2MHz Sweep/Pulse Generator	135.00	EE1001 Passive Circuit Design Course 28.50
1277	Pulse Generator	147.00	EE1002 Transistor Circuit Design, 2 vol. 49.50
2320K	Handheld 3.5 Digit DMM Kit	49.50	EE1003 Analog Circuit Design 49.50
2320W	Handheld 3.5 Digit DMM Wired	59.50	EE1004 Digital Circuit Design, 2 vol. 49.45
2420	Deluxe Universal Counter	255.00	EE3140 Concepts of Electronics, 2 vol. 39.50
2717A	Reg. H.V. Power Supply	165.00	EE3201A Digital Techniques Course, 2 vol. 44.50
2760	8-15V Battery Eliminator	129.50	EE4201 Fiber Optics Learning Course 39.50
2760K	8-15V Battery Eliminator Kit	89.50	EE6201 Lab Experiments Digital Tech w/Guide 18.50
4200A	Laser Trainer, Wired	225.00	EE8088 Adv'd Microprocessors Course, 2 vol. 59.50
4200K	Laser Trainer, Kit	195.00	EE8090 Data Com. & Network, 2 vol. 59.50
4225	Dual Trace 25 MHz Oscilloscope	375.00	EH702 TTL/CMOS Circuits 29.50
4226	Dual Trace 25 MHz Oscilloscope	385.00	
HEATH EDUCATIONAL SYSTEMS		EDUCATIONAL BOOKS	
ET100	Microcomputer Trainer	395.00	These books are brand new & represent a saving over publishers list prices. All hard bound except as noted.
ETB3300	Bread Board Experiment Module	39.50	Easy Course Programming H-P11C & 15C 15.00
ETB6201	Dig. Experiment Circuit Brd Module	69.50	TTL Cook Book, Lancaster (soft), Sams 5.95
ETW1000	Analog/Digital Ckt Trainer	185.00	Assembly Language Program (soft), Intel 6.95
ETW3100	Electronic Design Experimenter	69.50	Electricity 1-7, Mifflin, Hayden 19.50
ETW3200	Digital Design Experimenter	69.50	Decision Making Under Uncertainty, Hull, P-Hall 9.50
ETW3300	Bread Board Trainer, Wired	59.50	Fundamentals of Digital Electronics, P-Hall 19.50
ETW3567	Trainer Accessory Bk/Pack	79.50	Concise Intro to Engineering Economics 12.50
ETW3600	Analog Educational Trainer, Wired	88.50	BOOKS BY MC GRAY HILL
ETW3700	Digital Techniques Trainer, Wired	88.50	Garb Basic Electronics, 5th Ed. 10.50
EWD100	Dual 5.25" Disk Drive	158.00	Software Reliability, Musa lamino 10.50
ZVM133	Terminal for ET100 Above	245.00	Intro to Uni Systems, Byers, 5th Ed. (soft) 9.50
MISCELLANEOUS		DIGITAL ELECTRONICS	
HP-15C	H-P Scientific Calculator & Hand Book	49.50	Digital Electronics, Takham 2nd Ed. (soft) 6.95
U93	Ok-Da Microline Printer	95.00	A Reference Guide to Practical Electronics (soft) 3.75
545A	Hewlett Packard Logic Probe	89.00	Digital Electronics thru Experiments 9.95
546A	Hewlett Packard Logic Pulser	149.00	BOOKS BY MERRILL
547A	Hewlett Packard Current Tracer	245.00	Experiments in Electronic Devices, 2nd Ed. 9.50
548A	Hewlett Packard Logic Clip	125.00	Electronic Devices, Floyd, 2nd Ed. 24.50
700	T-1 Sent 700 Portable Data Terminal	89.50	Digital Experiments-Trouble shoot, Cox (soft) 8.95
5022A	Set of 4 H-P Testers in Carry Case	595.00	Experiments Electronic Circuits, Stanley, 2nd 9.95
		14.50	Principles of Electronic Circuits, Floyd, 2nd Ed. 12.95
		16.50	Principles of Electronic Circuits, Floyd, 3rd Ed. 19.50
			Digital Fundamentals, Floyd, 3rd Ed. 12.50

Lcom Tech 1755 Osgood St., North Andover, MA 01845
CALL: 508/682-6936 FAX: 508/689-9484
ORDER TOLL FREE: 800/343-1455

NUDE! ♥ NUDE! ♥ NUDE!

"NAKED" WORKSTATION CASE & POWER SUPPLY

At the scandalously low price of **only \$59.95 for both!**

It's brand new...it just isn't wearing a plastic front panel, bezel, key switch or LEDs.

Featuring:

- 230 watt 110/120 power supply (AT style, back switch)!
- Eight (8) 1/2-height slots for drives (6 front, 2 back)
- Accepts eight (8)-slot mother board (full or baby)
- Extra 12-volt cooling fan
- Speaker for mother board
- Six (6) rail sets included

...With all this, it's worth twice the price!

And more bargains...

SWITCHING POWER SUPPLY

Only \$9.95!

- Fully enclosed with switch and D.I.N. power connector.
- 5v at 4.5 amps
 - -12v at 3 amps
 - 12v at 1.4 amps
 - +12v at 1.2 amps

Electronic Parts Outlet • 2815 Fondren • Houston, TX. 77063
(713) 784-0140 • FAX: (713) 784-9740

Three locations in Texas....Come visit our retail stores!

CIRCLE 280 ON FREE INFORMATION CARD

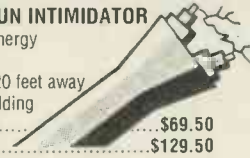
AMAZING ELECTRONIC PRODUCTS and KITS

100,000 VOLT STUN GUN INTIMIDATOR

Construct your own high energy personal protection unit.

- Intimidating effect up to 20 feet away
- Research into muscle building

ST62K Kit & Plans\$69.50
ST620 Assembled tested\$129.50



Miniature FM WIRELESS MIKE (3 Mi)

Construct a device that transmits sound to your FM radio, over considerable distances (up to 3 miles)

- Be a neighborhood disc jockey
- Monitor children/invalids
- Build a security system

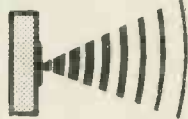
FMV1 Plans\$6.00
FMV1K Kit & Plans\$39.50



Invisible PAIN FIELD GENERATOR

Shirt pocket sized electronic device produces *time variant* complex shock waves of intense directional acoustic energy capable of warding off aggressive animals, etc.

IP67 Plans\$8.00
IP67K Kit & Plans\$49.50
IP670 Assembled tested\$74.50



SEE IN THE DARK VIEWING

Device uses invisible infra red illumination for seeing in total darkness. Excellent application of night vision, along with observing lasers and other IR sources. Functional unit. Has many useful applications.

- Excellent science fair project
- Featured front cover "Radio Electronics" August 1985

SD5 Plans\$10.00
SD5K Kit & Plans\$299.50

TELEPHONE TRANSMITTER (3 MI)

Automatically transmits both sides of a telephone conversation to an FM radio.

- Tunable frequency
- Easy to build & use
- Undetectable on phone
- Up to 3 mile range
- Only transmits when phone is used

VWPM7 Plans\$6.00
VWPM7K Kit & Plans\$39.50

AUTOMATIC TELEPHONE RECORDER DEVICE

Automatically records both sides of a telephone conversation onto a tape recorder.

- Requires no power
- Easy to use
- Sub miniature
- Extends normal tape time

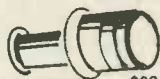
TAT3K Kit & Plans\$14.50
TAT30 Assembled\$24.50

ELECTRIC MAN/ION RAY GUN

Become an electric man! Construct a novel device that transforms your body into a walking power source.

- Energize lights, objects and "other people."
- Demonstrate feats of magic and mystery.
- Enhances "apparent" telekinetic motion.

EMA1K Kit & Plans\$69.50
IO63K Kit & Plans (Gun Configuration)\$69.50



SEE IN THE DARK IMAGE CONVERTER TUBES

Full Spec RCA 6032A

6032A & System Plans\$89.50

LASER LISTENER

Hi-tech space age listening device that allows you to hear sounds from a source requiring no access. Data shows how to use our LLIS1 Laser Lite Detector and VRL2 Laser Lite Gun described on this sheet. **CAUTION** - this data is for educational science projects only. Check local and state laws before implementing. **Advanced science project.**

LLIS1K Kit & Plans includes LLRI/VRL2\$199.50

GIANT SOLAR CELL

Demonstrates free energy from the sun. Shows how to make a solar battery capable of doing actual useful work.

• Includes Plans to a Solar Battery
SOL1 Giant Solar Cells 4" 2 amps\$7.50



5mw VISIBLE RED LASER DIODE SYSTEM

All new up to 5mw Highly Visible Red Laser utilizes some of our unique circuit tricks that allows switchless operation and non contact charging of the internal nicad batteries. Shirt pocket sized system provides up to 5mw output and includes collimating lens. Circuitry is being featured on front cover of Radio Electronics magazine November 1990. This laser is a real performer.

VRL2 Plans\$10.00
VRL2K Kit & Plans (3mw diode)\$158.50
VRL20 Assembled (3mw diode)\$249.50

TABLETOP TESLA COIL

- Spectacular and Fascinating
- A real attention getter!
- Energy passes through windows!
- Great for science projects, displays, stores advertising.
- Featured in Spring '84 Special Projects by Radio Electronics

Highly spectacular device produces visible audible bolts of lightning appearing to flash into the air. Cause certain materials to burn from within and glow, lights bulbs without wires, produces induction fields, St. Elmo fire corona. Clearly demonstrates high frequency, high voltages yet terminal may be touched by user during operation with a metal object. 115VAC operation only.

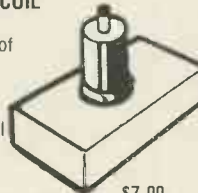
BTC3 Plans\$10.00
BTC3K Kit & Plans\$249.50
BTC30 Assembled\$349.50



WORLDS SMALLEST TESLA COIL

Produces 50 to 75,000 volts of lightning-like discharges capable of generating "plasma in a jar", St. Elmo's Fire, Corona or being just an excellent conversation piece. Unit contains power control and discharge terminal. Excellent lab or science project.

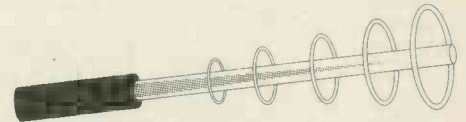
BTC1 Plans\$7.00
BTC1K Kit & Plans\$49.50
BTC10 Assembled & tested 115 VAC powered unit, requires caution\$69.50



ELECTRO MAGNETIC LAUNCHER

This device clearly demonstrates the magnetic and mechanical reaction produced by the "Lorentz" force. This is the basis of present research being done on rail and coil guns, weapons, or vehicle launching. Great research and controlled science fair project. Propels object to considerable distance using a discharge of 160 joules. Caution required, unit operates on 115VAC.

EML1K Kit & Plans\$69.50
EML10 Assembled\$99.50



PLASMA FIRE SABER

Produces the spectacular effect that captured the fantasy of millions of movie fans. Visible plasma field is controlled by grip pressure & adjusts saber length. Active energy field produces weird & bizarre effects. Excellent for special effects. Available in photon blue/neon red/phosor green/starfire purple

PFS2 Plans\$8.00
PFS2K Kit & Plans\$49.50
PFS20 Assembled\$69.50

DECOR HI LITE NEON

26" display length. Available in choice of fire red, phosor green, photon blue. Operates from 12VDC or 115VAC. Produces a bizarre strobing effect when light is in motion.

DNE1 Plans\$6.00
DNE10 Assembled\$49.50

MUSICAL NEON DANCING PLASMA FIRE-RHAPSODY IN LITE

Highly visible plasma length varies with the volume of sounds and music.

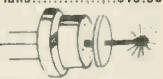
- Supplement to home stereo
 - Amusement for bars & entertainment areas
 - Attention getting for point of sales
 - Available in fire red, photon blue or phosor green
- DPL1 Plans\$8.00
DPL1K Kit & Plans\$59.50
DPL10 Assembled\$79.50

- HARD TO FIND PARTS -

VG20 - High Voltage 20KV Avalanche Diode\$3.50
VG4 - High Voltage Sub Mlni 4 KV Avalance Diode\$79.50
.001/15V - High Voltage .001 AT 15KV Capacitor\$79.50
TU01 - Special Tunnel Diode & Plans for the Famous Martini Olive Voice Transmitter\$29.50
10K/25 - High Voltage 10KV 25MA 60HZ 115 AC Transformer\$69.50
CO25B - High Voltage 50KV Mini Pulse Transformer\$16.50
T08 - High Voltage 8" High Toroidal Terminal\$69.50
Fans - Muffin Fans 115 VAC Excellent Condition\$6.50
XL0660 - 15 WATT Laser Diode with Plans\$19.50

VISIBLE RED LASER DIODES

670NM Toshiba all new full spec
VRD1 3 MW Laser Diode & Plans to Build a Complete System\$74.50




INFORMATION UNLIMITED

DEPT RES10, BOX 716, AMHERST, N.H. 03031

WE ACCEPT MC, VISA, COD, CHK, PLEASE AD \$5.00 SHIPPING & HANDLING

ORDERS: MAIL YOUR ORDER, OR
CALL TOLL FREE, 24 HRS. A DAY 1-800-221-1705
OR FAX 24 HRS A DAY 1-603-672-5406

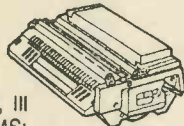
FREE CATALOG OF MANY MORE ITEMS AVAILABLE ON REQUEST.

"AT" CMOS SETUP RAM. MC146818 (CDP6818) \$2.49 ea. This device also includes the clock calendar and alarm functions.		CMOS TIMERS TLC555.....\$0.69 TLC556.....\$0.99	AUDIO AMPS: TDA2002 (8W).....\$0.99 (TO-220 CASE) TDA2030 (14W).....\$1.49
ALPHA-NUMERIC LED ARRAY  7x5 LED Matrix. For Moving Message Signs, Etc. By IEE. # 2057 - c/c rows. Your Choice: # 2058 - c/a rows. \$2.95 ea. With Hook-Up (SIZE: 2 X 1.5 in) (8 For \$17.95) RARE SURPLUS FIND! NEW!	CRYSTALS \$1.25 1.843 4.000 14.318 2.000 4.915 20.000 2.457 5.068 ALL IN MHZ 3.120 8.000 CALL FOR 3.579 10.000 OTHER 3.680 11.059 FREQUENCIES	STEPPER MOTOR \$3.95 IBM Surplus. 8 wire. 4 windings. 7V @ 350 mA 1.8° (200 steps per rev.) DC. res. 20 ohm ea. 25 oz. in. torque. Works great on 5vdc. W/Data FOR ROBOTICS	TRIAC: BT139-500 12 AMP 500 PRV. TO-220 \$0.99 TRIAC DRIVERS MOC3010 MOC3040 MOC3011 MOC3041 \$0.99 LINEARS OP07 (DIP).....\$1.49 TL062 (house #).....\$0.49 TL072 (DIP).....\$0.59 LM324 (DIP).....\$0.49 LM358 (DIP).....\$0.49 LM348 (DIP).....\$0.59 MC4741 (DIP).....\$0.59 LM318 (DIP).....\$0.99 LF356 (can).....\$0.89 5532 (DIP).....\$0.99 5534 (DIP).....\$0.99 MC3403 (DIP).....\$0.49 TL084 (DIP).....\$0.99 RC4558 (DIP).....\$0.49 4136 (DIP).....\$0.69 LM339 (DIP).....\$0.49 75491 (DIP).....\$0.49 75492 (DIP).....\$0.49 ULN2003 (DIP).....\$0.69 LM3900 (DIP).....\$0.59 LM2900 (DIP).....\$0.79 XR2240 (DIP).....\$0.99
12 VDC POWER RELAYS #1 by OMRON. DPDT 10 A. cont. 150 ohm coil 1x1.5x.75 inch. \$2.95 ea #2 by P&B. SPST-N.O. 30 A. cont. 160 ohm coil 1.5x1x.75 inch. \$1.99 ea	SIEMENS SMART LED ARRAY I 5x7 Red. Built in logic I #DLO-7135 Requires only a chip select and an ASCII input. Operates on 5 VDC. 1 inch tall. With Data. New Units. Displays entire 128 char. set I \$3.95 each or 8 for \$24.95	CMOS 8032 MICROPROCESSOR 80C32 By Matra. 40 pin DIP 12 MHZ. Very low power. \$3.95 PLASTIC TRANSISTORS: 6 FOR \$1 2N3904 PN2222 2N4124 2N3415 6116LP-15.....\$1.95 2N3906 PN2907 2N5401 2N3417 6264P-15.....\$2.95 2N4401 2N3565 2N5172 2N5089 62256LP-10.....\$6.95 2N4403 2N5086 2N6517 2N3392 2114.....\$0.89 2N4125 2N5551 MPSA06 MPSA56 7198-S45P.....\$1.99	
CAPS FOR HAMS I High Voltage I Very Dangerous. 110 MFD 450V AXIAL.....\$1.99 800 MFD 450V CAN.....\$4.95 5100 MFD 350V CAN.....\$6.95 ALL NEW. NAME BRANDS I HARD TO FIND.	6 V. 4 A.H. BATTERY Gell Cell style. Brand New fresh units. 4x3x2 inch. Tabs on top. \$6.95 ea CMOS EPROMS 27C32HQ (house #).....\$1.49 27C64-2 (Intel).....\$2.99 27C256 (TI).....\$3.50 27C512 (TI).....\$4.95	VOLT. REG. ICs 7805.....\$0.49 7812.....\$0.49 7815.....\$0.49 7824.....\$0.49 7905.....\$0.49 7912.....\$0.49 7915.....\$0.49 7924.....\$0.49	LM350T.....\$2.95 LM317T.....\$0.69 LM337T.....\$0.69 78H12.....\$4.95 78H05.....\$3.95 723.....\$0.49 TL494.....\$1.19 TL495.....\$1.19 TL497.....\$1.49 LM338K.....\$4.95 SG3524.....\$1.25 SG3526.....\$1.25 LAS6350.....\$1.49 LM309K.....\$0.99 LM350K.....\$3.95
CAPS FOR POWER SUPPLIES 8200 MFD 50V...RADIAL.....\$0.99 12,000 MFD 75V...CAN.....\$3.95 21,500 MFD 40V...CAN.....\$2.95 41,000 MFD 35V...CAN.....\$3.95 47,000 MFD 25V...CAN.....\$2.95 105,000 MFD 25V...CAN.....\$2.95	TO-3 POWER TRANSISTORS 2N4398.....\$1.49 2N3773.....\$1.49 2N6547.....\$2.49 2N3055.....\$0.89 2N6056.....\$1.49 2N6254.....\$1.49 2N3771.....\$1.95 2N5038.....\$1.95 2N5881.....\$0.99 2N3772.....\$1.95 2N6308.....\$2.49 2N5879.....\$0.99	FULL WAVE BRIDGES 1.5A 400V.....\$0.49 2A 200V.....\$0.49 10A 400V.....\$0.99 35A 600V.....\$2.95	XEROX LENS 4-element, coated. F:5.7 10in. F.L. \$5.95 fixed aperture of 1.75 in. NEW
TANNER ELECTRONICS 214-242-8702 FAX: 214-709-5041 1301 W. Bellline Rd. #105 Carrollton, Tx 75006 (Store prices vary)	TERMS: Send check, or use, Visa, MC. NO COD. USA, Canada Only. Add \$3.85 min. for UPS. Texas add sales tax. 90 Day limited warranty on all items. \$15 min.		

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, LaserJet Series II, IID, III
Apple: LaserWriter, LaserWriter IINT, IINTX, QMS:
Kiss, PS-800, PS-810, Canon: LB-P8A1, A2, II, Cordata: LP-300X, etc.
With our **Kits—Supplies—Service** you can start your own profitable recharge business or just recharge your own cartridges.



Model	Recharge Kits/Supplies	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.	\$49.95ea/6
6000	Replacement Toner Kit for Ricoh 6000 laser.	\$16.25ea/6
8011	200 grms of high quality black toner for CX.	\$9.95ea/12
8056	250 grms of high quality black toner for SX.	\$12.50ea/12
8011-Blue/Br	200 grms of Blue/Brown toner for CX & SX.	\$22.95ea/12
8057	150 grms of high quality black toner for PC.	\$10.95ea/12
Felt-CX, SX	replacement treated felt for all models.	\$0.90ea/12
SS-CX, SX	seal strips for sealing in toner for reshipping	\$0.85ea/12
DPP	Drum Padding Powder (pixie dust)	\$12.95
EverDrum™	OPC drum life extender agent. 40+ applications	\$41.95
C2093	Hoover Toner Vacuum with attachments.	\$149.95

Instructions Available Free to Customers!
Call 800-221-3516 ask for our catalog.



Cheneko Products, Inc.
62 N. Coleman Rd., Centereach, NY 11720
Call: 516-736-7977, Fax: 516-732-4650

CIRCLE 283 ON FREE INFORMATION CARD

Phonvu Videophone in a Chip

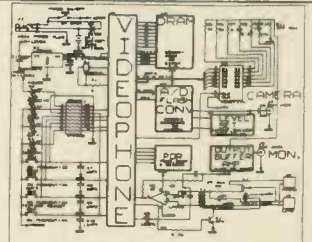
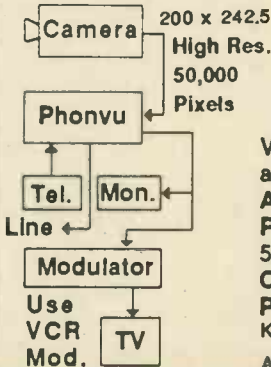
STILL FRAME TV PICTURE TELEPHONE TRANCEIVER KIT

Sends Slow Scan TV pictures over the phone line in Twelve Seconds
Captures any TV Camera, Camcorder VCR, NTSC Video output and holds the display and sends on command

Auto Mode allows hands free send and receive. Displays on any TV

IC Chip Replaces 150 SSI Dips

50 Levels of Grey Scale Serves as: TV FAX



Videophone Chip 48P DIP and Schematic \$59.95
A/D, DRAM, D-Reg. \$35.00
PC Board (BARE) \$18.95
50 Res. Cap. Diode \$28.75
Cabinet (uncut) \$12.75
Power Pack \$8.75
KIT PRICE: \$184.15
ASSEMBLED TOTAL: \$235.00

PHONE and FAX Order (213) 827-1852
PMC Electronics Box 1148
Marina Del Rey, CA 90292

CIRCLE 282 ON FREE INFORMATION CARD



**KITS
DESIGNED
AND MADE
IN U.S.A.**

THE ELECTRONIC GOLDMINE

MINIMUM ORDER: \$10.00 plus \$3.00 Shipping and Handling
We accept MasterCard, Visa and Money Orders
Call or send for our free catalog!

P.O. BOX 5408, Scottsdale, AZ 85261
PHONE ORDERS: (602) 451-7454

★ SPECIALS ★

**PIEZOELECTRIC FAN
G756 \$7.95**



Compare
at \$17!

New

One of the neatest new scientific breakthroughs! It is a fan that operates on 110V/60Hz AC and uses a fraction of the energy that standard rotary types use. It is compact and has no rotating parts to wear out! Delivers about 7 cubic Ft/minute air flow. Use for cooling computers, equipment, etc. Features two 1-7/8" x 3/4" blades. Connect through 10K resistor (supplied) to any source of 110V or 120VAC.

Line Cord to use with above Fan
G761 49¢ each.

**12VDC IC FAN
G757 \$9.00**



Compare
at \$18!

New

This tiny fan made by SHICOH has no brushes to wear out. Features whisper quite smooth running and only .15A current drain. This is absolutely the smallest 12VDC fan we have seen - only 1-9/16" square x 13/16" thick. Use for cooling computers, equipment, etc. Will even work on a 9V transistor battery. Hurry, we have only a limited supply of these beauties!

G758



\$15.95

T2103V MODEM

The T2103V contains a Bell System 103 modem that operates at 300 baud full duplex or 1200 baud half-duplex. It has error checking and is an intelligent modem, which conforms to EIA standards for data communications and interface signal characteristics. Has standard RS232C connector and modular phone jacks. These appear to be new and come with wall adapter and manual. Mfg. by TENERON. Use with almost any communications software program.

**COMPUTER
CONNECTOR/
ADAPTORS**

New



G759 \$1.98

TYPE 1 - is a 3 way adapter that has 3 DB25 female connectors connected together.

TYPE 2 - is a male DB25 to 36 pin female centronics.



G760 \$2.25

ELECTRONIC PROJECT KITS

**MINI GEIGER
COUNTER KIT**

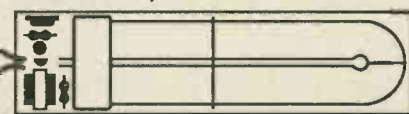
- ★ Detects All Types of Radiation
- ★ Uses Sensitive Alpha Window Tube
- ★ Operates from 9V Battery (not incl.)
- ★ Comes w/PC Board, Parts, Tube, Instr.
- ★ Size of PC Board: 3" x 1.9"

C6430 \$59.95



Remember, all of
our kits contain all
parts, PC board
and instructions!

C6356 \$13.95

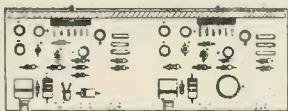


**BATTERY OPERATED
BLACK LIGHT KIT**

- ★ Detects invisible Fluorescent Inks, Minerals, etc.
- ★ Uses Large Unfiltered U Shaped Black Light Tube

- ★ Operates from any 6V Battery Source (not incl.)

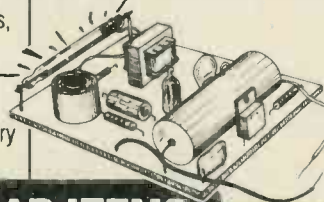
20W+20W STEREO AMP KIT



C6442 \$19.95

- ★ Boost Car Stereos, Tape Players, Portable Radios, etc.
- ★ Features 2 Separate 20W RMS Amps w/Level Controls
- ★ Operates on Std. 12V Car Battery
- ★ Skill Level 2

3V XENON WARNING FLASHER KIT



- ★ Bright white flashes of light
- ★ Requires only 2AA or C cells
- ★ Skill level 2

C3207 \$10.00

POPULAR ITEMS

**HUMDINGER SONIC
MOSQUITO REPELLER**



New

These high output Ultrasonic Mosquito Repellers have a 1-1/2" diameter ultrasonic speaker and a two IC circuit to produce a high intensity penetrating ultrasonic sound. We have not tried them, but at this price there is not much to lose! The on/off switch has a test position, which allows you to hear what the mosquitos hear (and it is obnoxious). The case is bright red with a key chain attached. Operates from 9V battery (not incl.). Size: 3-3/8" tall x 1-3/4" diameter.

Retail Card w/10 Humdingers
\$16.00

**G763
\$2.00 each**

CDS CELL ASST.

Great for hundreds of projects and experiments. These change their resistance with light. 5 different types.

G764 5/\$2.00

FIBER OPTICS

Sale

3 Ft. Long
Pcs

Small diameter unjacketed fiber optic strand. Perfect for 1000's of applications. Fun to use and experiment with. **G755**

5pcs for \$1.00

4KV TRIGGER COIL

Use with any strobe tube that needs a 4KV trigger.

3 Lead N1700
1.25 Each, 100 for \$80

4 Lead N1701
1.45 Each, 100 for \$80

**INVERTER
TRANSFORMER**

Small 4 lead transformer for use with 555 IC to convert 12VDC to 250V for strobe/fluorescent tubes with schematic.

**N1703 \$2.00 Each
1,000 for \$1,500**

FAST SERVICE - FAIR PRICES!

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



1-800-522-6260

**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.

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 below or call toll free.

RADIO-ELECTRONICS VIDEO OFFER	RES
500-B Bi-County Blvd. Farmingdale, NY 11735	
Please rush my copy of the Countersurveillance Techniques Video VHS Cassette for \$49.95 plus \$4.00 for postage and handling.	
No. of Cassettes ordered _____	
Amount of payment \$ _____	
Bill my <input type="checkbox"/> VISA <input type="checkbox"/> 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. New York State residents add applicable sales tax.	

A HARD DRIVE IS A TERRIBLE THING TO WASTE.

So don't. For only \$6 per hour, you can download to your hard disk from DELPHI's library of over 10,000 programs. That's right, just \$6 per hour including evening and weekend local phone number access at modem speeds up to 2400 bps.

Join DELPHI now for \$9.95 and your first hour is free. There's no risk— if you're not completely satisfied, we'll refund the \$9.95.

Save even more by choosing the 20/20 Advantage Plan. At 20 hours for \$20, it's the best deal in downloading.

Of course, you may eventually fill up your hard disk. Then you can enjoy exploring DELPHI's other services such as electronic mail, conference, multi-player games, news, encyclopedia, stock quotes, and travel.

SIGN UP WITH YOUR COMPUTER AND MODEM

- Dial 1-800-365-4636
- At *Username*: type JOINDELPHI
- At *Password*: type ELECTRONICS

DELPHI

POPULATING HARD DRIVES SINCE 1982

General Videotex Corporation • Three Blackstone Street • Cambridge MA 02139
800-544-4005 • 617-491-3393

CIRCLE 294 ON FREE INFORMATION CARD

RE-SHOPPER 35

GOTT ELECTRONICS

- COMBO PLUS by AST RESEARCH INC. \$29.95**
Memory Expansion & I/O Board for IBM PC, XT & Compatibles, real-time Clock-Calendar with battery backup, RS-232C Serial port, parallel printer port, SuperPak™, SuperSpool™, clock software, and the RAMCLEAR memory initialization utility program (available with 64, 128, 192, or 256 kilobytes of RAM memory \$9.00 per 64K increments).
- SIX PACK PLUS \$39.95**
Same as Combo Plus but expands to 384 KB of memory
- SONY BATTERY PACK NP-11 \$39.95**
(9.6V, 1000MA) for laptop computers and camcorders, nickel-cadmium battery
- ASYNCLUSTER ADAPTER by AST RESEARCH INC. \$199.00**
Multichannel Board providing four individually addressable RS-232 Serial Ports on IBM PC/XT/AT and compatibles (uses AST-FourPort/XNTM Enhanced Xenix™ Communications Version #2.0) (ASYNCLUSTER ADAPTER Cable additional \$15.00).
- 1/4" STREAMING TAPE CONTROLLER by ADAPTEC, \$33.95**
SCSI to QIC-36, Model ACB-3530A (Manual \$5.00)
- FLOPPY DISK CONTROLLER BOARD \$19.95**
Dual 360K or 720K switch selectable
- BEZEL \$2.00**
For full height hard drive, black with rectangular LED lower lefthand corner, double-sided tape for mounting, 3-3/8"x5-7/8"
- LASER PLATFORM ARRAY \$499.00**
10 MW HeNe Laser, power supply, 2 beam splitters, 5 front surface mirrors, AO modulator, AO driver, polygon scanner, photo detectors, 3 special lenses, polarizer, over \$5,000 worth of optical components plus documentation. Sold many of these to Fortune 500 companies, universities, and research labs. Applications include research, design and engineering. An experimenter's dream.
- NEW! NEC 10 Mil HeNe LASER Plus Power Supply \$200.00**
- LASER POWER SUPPLY \$39.95**
Semi-kit. Units removed from laser video disk players, comprised of power cable, transformer and circuit board. Will power 1 to 10 MW HeNe laser. Excellent bargain.
- SHARP LASER DIODE \$8.95**
LT022MC, 5mW at 780nm, single transverse mode.
- MIRRORS, PRECISION FRONT SURFACE**
For use with lasers.
13-7/8"x1-3/16" **\$7.00** 19-1/2"x1-5/8" **\$10.00**
- GREEN FLUORESCENT TUBE for scanners \$2.00**
- STAGE/STUDIO QUARTZLINE LAMP \$9.95**
FEL(Q1000/4CL) 1000W, 120V 3200°
- INTEL 27128A-2 EPROM (New) \$4.00**
- INTEL 2732A-3 EPROM (New) \$2.00**
- INTEL P-8031 \$3.00**
- TRIAC: Hitachi FSM16F4 400 volts 16 AMPS \$2.50**
- DIODES 6A 200V Motorola Part No. MR752 30 for \$10.00**
- RF CONNECTOR APPLIED ENGINEERING PRODUCTS \$2.50**
Model 2005-1551-003
- GOLD WIRE WRAP SOCKETS**
14 pin-10 pcs/\$5 16 pin-10 pcs/\$6
- SOLID STATE RELAY, CRYDON D1240 \$19.95**
input 3-32 VDC, output 120 VAC 40A
- BIPOLAR LEDS 10 PCS/\$6**
- MOTOR, AIRPAX \$9.95**
120VAC 60Hz 2-12:1 gear train, toothed pinion
- COMPUMOTOR:MOTOR-DRIVE SYSTEMS \$1.50**
Model M57-83 \$ 773 8 MHz, 13333 MHz,
Model M57-102 \$ 942 14.864 MHz, 15 MHz, 25 MHz
Model M106-178 \$1695 36.037 MHz, 49.7664 MHz
50 MHz, 51.04 MHz, 75.6 MHz
- VGA RT. ANGLE PC BOARD MOUNT CONNECTOR \$10.00**
Hi Density DB 15 10 pcs/\$10.00
- COMPUTER POWER CABLES BY BELDEN \$2**
10 AMP, 18/3, 6"
- TOSHIBA T3100 EXPANSION INTERFACE PA7313E \$99.00**
EXPANSION BOX PA7310U \$299.00
Interfaces Toshiba laptops to IBM BUS to use IBM add-on boards.
- LCD DISPLAY (MODEL LM585) BY HITACHI \$199**
640 x 200 Graphic and Alphanumeric
- LCD DISPLAY (MODEL EA-Y40025AT) BY EPSON \$35**
40 characters X 2 lines
- POWER SUPPLY 9.95**
For computer related equipment, Input 120V AC, 60Hz, 30W; Output =5V DC, 1000MA, +/- 12V DC, 200MA
- CCD DOCUMENT SCANNER \$39.95**
Uses a 4096-element line imaging chip. Can use for robotics, astronomy, machine vision, high resolution slow scan TV, etc. Supplied with documentation.
- STEPPER MOTOR \$29.95**
By Oriental Motor, Model #PH566-A-Q5, high precision, 500 steps per revolution, 0.72° per step.
- HITACHI LCD DOT MATRIX LM215B \$29.00**
Graphic and Alphanumeric, 480 Dot(W) x 128 Dot(H) High quality device easily interfaced with microprocessor. Bit map graphics and text. Other applications possible. Driving voltages available at microprocessor port, CMOS/TTL compatible signal level, built-in RAM for display data storage, built-in CMOS LCD driver and controller, supports full ASCII and extended character set, character size 5x7 or 7x9, dimensions 10.6" L x 4.3" W x 4/100" D
- HITACHI DIGITIZING TABLET HICOMSCAN HDG-111**
Input device through which graphic data is input to a computer.
11" x 10" Dimension **\$199.00**
4-Button CURSOR for Digitizing Tablet **\$29.95**
Manual **\$5.00**
- EDGE CARD CONNECTORS**
22/44 Connector, .156 spacing **10pcs/\$7.50**
25/50 Connector, for Apple **10pcs/\$10.00**
- COAX CONNECTOR Part #CP-N1 \$1.50**
- MONITOR BOARD WITH POWER SUPPLY/HI VOLTAGE \$7.95**
Video, brightness, focus, vertical, and horizontal with flyback transformer and high voltage parts, Model 99-0493-001 rev D
- Replacement CABLES for IBM-like keyboards \$2.99**
- APPLE MANUAL (LaserWriter and LaserWriter Plus) \$5.00**
- WATERTIGHT ALARM BELL \$19.95**
By Henschel Corp., Type IC/BID3, size 3", 24V DC.
- 5 LB. SOLDER \$25.00**
Wire, Rosin Core, Tin/Lead 60/40, Flux 2.2%, Dia. .036 (20Ga)
- HARD DRIVE CONTROLLERS:**
Western Digital ST-506 (10-200 Mb)
XT-WD1002A-WX1 **\$29** AT-WD1003WAH **\$39**
- HP NUMERIC DISPLAY 5082-7300 \$4.95**
- DATA LINK CONNECTOR \$7.75**
(AMP Part #501107-2) Fiber optic field mountable connector used with 125 NM fiber clad OD. This connector mates with AT&T 40 MB/s and 1 MB/s data link products. AT&T F. Eq. Ref. No. 1005B.
- AMP OPTIMATE FIBER OPTIC CABLE ASSEMBLY \$49**
with Biconic Connectors (AMP Part #501450-2) 5 meters long.
- SYMBOL LASERSCAN 2000 \$899**
VISIBLE LASER DIODE SCANNER \$899
Hand-held point-of-sale bar code scanner manufactured by Symbol Technologies, Inc.
- ORIGINAL IBM MODEL 1130700 \$19.95**
COMPUTER PC POWER SUPPLY 63W 115VAC.
- ORIGINAL IBM MODEL 154001438 \$29.95**
COMPUTER PC-XT POWER SUPPLY 130W 115VAC.

GOTT ELECTRONICS

LASERS

Laser Platform Array Kit Price \$499

Can be used for research, design, and engineering in the medical, industrial, and educational sectors. An experimenter's dream in the fields of holography, interferometry, graphic arts, light shows, and projection. The Laser Deck Consists of:

- A 10 milliwatt (maximum output) Helium-Neon laser tube (NEC Part #GLG 5261) which emits a red beam. The tube is hard seal and 15.5" long by 1.75" in diameter. It is mounted by two transverse mounting fixtures.
- The laser power supply (NEC Part #GLS5281A) powers the laser tube and has an input voltage of 115 to 120 VAC. Output sustaining voltage is 2800 to 3300 VDC.
- This unit sits on an 18.5 lb precision cast aluminum plate.
- The acoustic-optic modulator (NEC Part #OD8813A) is a 140 Mhz broad band amplifier and will take TTL and video signals. The A-O driver is on the deck also and requires 24 volts to operate.
- The polygon motor unit (Mfr: Japan Electronics) is a ten-sided first surface mirror mounted on an electric motor that spins at approx. 26,000 rpm. The driver for the polygon unit is on the deck and requires 24 volts to operate.
- In addition to the main items above, there are (5) special surface mirrors, (2) beam splitters and (3) special lenses all attached by optical mounts which guide the laser beam to various sensors and places to give the desired result, a reproduced copy of information.
- We have available an excellent 24 volt LAMBDA™ power supply at 49.95 that will power both the Acoustic-optic modulator and driver and polygon motor unit and driver.

Laser Beam Modulator \$398 MC14016 tube of 25 \$5.00
(Acoustic-Optic Modulator and Driver) Tri-state switch, CMOS

Argon-Ion Laser (Air Cooled) \$2995

These lasers emit visible blue and green lines. Power output is 110mW. They are re-built with brand new tubes and power supplies. Manufactured by a major laser company, they are excellent for laser shows and holography. These lasers are guaranteed for one year.

- NINTENDO GAME CONNECTOR \$9.95**
The black connector inside game unit that game cartridge fits into. Often needs replacing when cartridge makes intermittent contact. Almost impossible to get.
- POWER SUPPLY \$9.95**
Bikor Corp. LBA 5-6, Input 115/230VAC, 47-440Hz, Output 5V DC at 6.0 AMPS.
- HALOGEN LAMP \$2.85**
Toshiba JH115V930WK1A, 17" long, 120V.
- HP 10-ELEMENT BAR GRAPH ARRAY \$2.00**
HDSP-4820 (red)
- HITACHI DIGITIZER \$99.00**
Comscan HDG-111, grid board/mother board, no plastic case, you build the case. Standard serial interface (15" X 15-1/2"), works on a PC.
- IC SOCKETS \$1.00**
40 pin, Robinson-Nugent, tube of 10
- MICRO-CONTROLLER-8048 \$1.50**
ROM is already programmed--you find a use, we've got 40K of these!
- HITACHI DIGITIZER \$199.00**
HDG-1515BN-C, grid board/mother board, no plastic case, you build the case. Standard serial interface. Runs all versions of autocad. Cannot be used with mouse emulation.

Gott Electronics carries thousands of parts, i.e., lasers, optics, electro-mechanical, electro-optic, power supplies, computer related materials and general electronic supplies far too numerous to list. In order to better serve you, watch for our highly innovative bulletin board catalog ordering system.

Coming soon...contests with prizes and giveaways.

Have excess inventories to sell? Call us or FAX us your lists. Need special parts? Let us know.

COMPUTER POWER SUPPLY

130W 115 VAC IBM-XT Model 1501438

(+5V, +12V, -5V, 12V)

These are brand new supplies. They make an excellent workbench power supply for experimenting. They can also be used in XT computers and other electronic equipment.

Priced to move

1 \$29.95
2-9 \$25.00
10-25 \$20.00

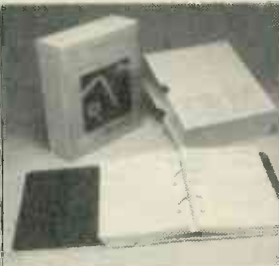


CABLE NAILS by the box WOW!

Black or White

Each box, 100 nails. #814W-AB 13 mm for dual RG-59 cable. Manufactured by ABERDEEN. Used to tack when running cable. They have a hardened nail and tough plastic construction.

1 \$2.00
2-9 \$1.50
10-25 \$1.25



The REAL THING HARD TO FIND

The complete IBM DOS 3.3 manual in Spanish. Excellent for the bilingual schools and trade schools. We had a hard time finding these, so let's just blow them out to you.

1-9 \$17.95
10-49 \$15.00
50-99 \$12.95
100-up \$11.95

EL DOS de IBM es la base para miles de programas de aplicacion. Muchas facilidades en el manejo de datos estan a su disposicion. Y usted puede desarrollar nuevas aplicaciones en una amplia gama de lenguajes de programacion soportados.

COMPUTER SWITCHING POWER SUPPLY

63W 115VAC IBM-PC

Model 1130700

(+5V, +12V, -5V, 12V)

Brand New Supplies. Good for the workbench. Can be used for external drive. Full of good parts, 12VDC fan, caps, transistors, etc. We have over 1,000 of these units. Priced to move.

1 \$19.95
2-9 \$16.95
10-25 \$14.95

POWER CABLE

15'7" Long, 115V 20A

14/3 grounded 3-wire. Male plug one end, other end 3 wires. Black. Can be used on power tools, air conditioning, electrical appliances, and wherever. These are real beauties, difficult to find. We have over 4,000.

1-9 \$5.00
10-49 \$4.50
50-99 \$4.00
1K \$3.00

ORDERS : COD, Cashier's Check or Money Order

Technical Support: (213) 316-0916

FAX: (213) 316-9189

24-HOUR ORDER LINE: 800-544-9244

\$15.00 minimum order. CA residents add 6.75%

GOTT ELECTRONICS

2227 DuFour Avenue, Redondo Beach, CA 90278

GET THE LATEST ADVANCES IN ELECTRONICS

WITH A SUBSCRIPTION TO

Radio Electronics®



ENJOY THE WORLD OF ELECTRONICS EACH MONTH!

Now you can subscribe to the best electronics magazine. The only one that brings you articles on—electronics projects, technology, circuit design, communications, new products and much more.

Radio-Electronics looks to the future and shows you what new video, audio and computer products are on the horizon. What's more you'll find helpful, monthly departments such as Video News, Equipment Reports, Hardware Hacker, Audio Update, Drawing Board, Communications Corner. All designed to give you instruction, tips, and fun.

Radio-Electronics gives you exciting articles like:

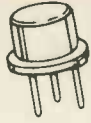
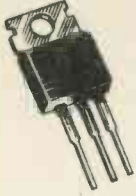
- ISDN: The Telephone Network of Tomorrow
- The Facts on FAX
- A Digital Phone Lock
- How To Design Switching Circuits
- EIA-232 A real standard for serial interfacing?
- Build a synergy card for your PC
- '386 Power at a '286 price
- Build a biofeedback monitor
- More on Multiplexing



FOR FASTER SERVICE CALL TODAY
1-800-999-7139

DON'T DELAY SUBSCRIBE TODAY!

Just fill out the order card in this magazine and mail it in today.

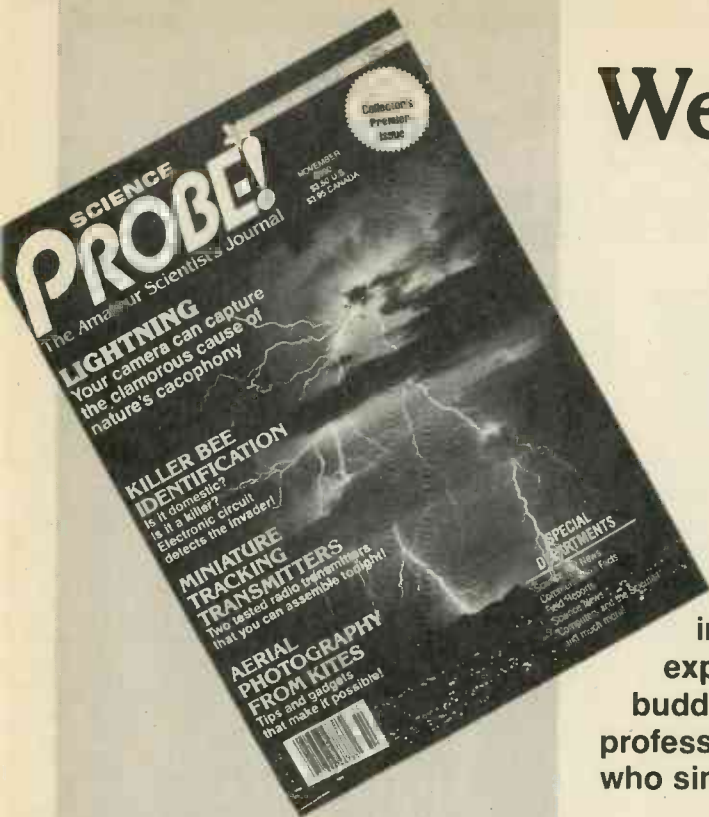


PRELCO

605 Chestnut St • Union, N.J. 07083
TEL: 201-851-8600 FAX: 201-686-4656



JAPANESE IC'S		KIA7217P		M5278L56		STK5372		TCP4621		UPC1182H		NAP SEMI'S			
AN214	2.50	BA3406L	1.75	KIA7222	1.75	M51102L	2.50	STK5471	5.10	TD6710AN	3.20	UPC1186H	1.45	15-35059	1.25
AN217	1.80	BA3708F	1.40	L5630	1.55	M51172P	1.50	STK5476	5.10	TD62105P	1.80	UPC1187V	1.85	15-37701	2.95
AN236	2.65	BA3812L	1.25	LA1111	1.25	M51307BSP	8.25	STR380	4.75	TD62504P	2.85	UPC1188H	1.45	15-37702	1.85
AN239	6.50	BA3828F	2.45	LA1140	1.50	M51512L	1.50	STR381A	4.75	TD62506P	2.55	UPC1191V	.95	15-37704	1.75
AN240P	1.40	BA4210	1.75	LA1180	1.65	M51533L	1.50	STR451	6.25	TD62553S	2.85	UPC1197C	2.45	15-39207	4.95
AN245	4.25	BA4232AL	1.95	LA1185	1.50	M51544AL	2.75	STR2013	3.50	TD62555S	2.20	UPC1228H	1.10	15-39208	2.25
AN262	1.75	BA4234L	1.95	LA1201	.95	M51903L	1.80	STR3115	4.75	TDA1057	1.55	UPC1252H	1.95	15-39209	2.50
AN277	2.45	BA4402	1.00	LA1210	1.65	M54514AP	1.90	STR3125	4.75	TDA1170	2.40	UPC1253H	1.95	15-41627	2.20
AN302	3.50	BA4403	1.25	LA1222	1.65	M54516P	1.80	STR3135	4.75	TDA1190Z	2.10	UPC1263C	1.25	15-41764	4.10
AN305	3.50	BA4558	.90	LA1231	1.55	M58473P	1.50	STR30123	4.75	TDA1220A	2.45	UPC1350C	1.35	15-43098	4.40
AN318	3.75	BA5101	1.85	LA1245	1.75	M58626P	2.65	STR30130	4.75	TDA1220B	2.45	UPC1352C	2.40	15-43703	1.35
AN335F	1.85	BA5102	1.85	LA1260	1.60	M58846	2.35	T74LS164	1.25	TDA1578A	.95	UPC1363C	2.65	15-45300	1.30
AN360	1.00	BA5115	2.75	LA1265	.95	MAB8461P	4.10	TA2003	1.25	TDA2002V	.65	UPC1371C	2.90	610471-1	.55
AN362	1.85	BA6104	2.95	LA1365	1.65	MC378HC04	1.65	TA7054P	.65	TDA2003V	1.25	UPC1373H	2.00	610551-1	.95
AN366	2.00	BA6144	1.75	LA3115	1.35	MB3712	1.40	TA7060P	1.60	TDA2030H	1.55	UPC1378H	1.40	612042-2	2.75
AN608P	1.65	BA6146	1.70	LA3155	1.25	MB3713	1.75	TA7061AP	1.10	TDA2540	1.80	UPC1379C	1.60	612044-1	1.50
AN3313	3.50	BA6209	1.50	LA3160	.80	MB8726	2.45	TA7092P	2.40	TDA2577A	2.65	UPC1470	1.10	612069-1	2.35
AN3821K	6.25	BA6238A	2.50	LA3161	.85	MB88303	3.75	TA7115P	1.50	TDA2820M	1.50	UPC1474H	4.50	612070-1	1.80
AN5015K	1.50	BA6993	1.60	LA3220	.90	MC78HC04	7.75	TA7117P	2.70	TDA3222M	1.55	UPC1513	1.35	612072-1	1.75
AN5020	1.75	CA1391E	1.45	LA3301	1.45	MC78M05CT	20	TA7142P	2.45	TDA3190	2.00	UPC1514	1.60	612076-4	2.85
AN5111	3.75	CA1394E	1.45	LA3310	.85	MC78M06CT	20	TA7154P	9.95	TDA3564N	6.10	UPD261	2.95	612076-7	2.85
AN5151	3.75	CA3070E	1.75	LA3350	1.75	MC78M12CT	20	TA7157P	1.80	TDA3570	4.20	UPD262	2.95	612094	2.15
AN5265	3.50	CA3072E	1.75	LA3360	1.75	MC78M18CT	20	TA7204P	2.25	TDA3653	3.85	UPD547LC	1.50	612120-1	3.80
AN5310	4.75	CA3088E	1.50	LA4031	2.50	MC1309P	1.25	TA7205AP	1.65	TDA3654	2.65	UPD865C	1.75	612298-1	3.90
AN5312	2.75	CA3126E	1.70	LA4182	2.75	MC1310P	1.25	TA7217P	1.50	TDA4433	3.75	UPD946	5.50	612305-1	1.30
AN5512	1.50	CA3126Q	1.60	LA4261	1.90	MC1351P	2.95	TA7226P	2.10	TDA4505A	8.75	UPD1200	6.95	612331-2	5.50
AN5515	1.65	CA3151E	3.10	LA4420	1.65	MC1357P	1.45	TA7230P	1.75	TDA47211	2.50	UPD1203C	2.00	612337-3	4.70
AN5700	1.75	CA3166E	4.50	LA4422	1.65	MC1394P	1.40	TA7267P	2.25	TDB2033	1.50	UPD1709	5.50	612338-3	5.10
AN5720	1.50	CA3177E	1.95	LA4430	1.65	MC3001	1.10	TA7310P	1.10	TLO81CB	1.50	UPD1913	2.75	612347-2	1.95
AN5730	1.90	CA3195E	1.95	LA4440	1.95	MC3357P	1.75	TA7312P	1.95	TL431CP	.95	UPD1937C	2.10	612405-1	2.25
AN5750	1.50	CA3202E	2.30	LA4500	2.95	MC7809CT	5.50	TA7313AP	2.05	TL783C	1.35	UPD1986C	1.65	ZENITH IC'S	
AN5760	1.60	CA3217E	3.45	LA5512	1.25	MC7813CT	.30	TA7317P	1.50	TMC1073	3.40	UPD1987C	1.65	221-43	2.35
AN6291	3.50	CA3218E	1.75	LA5521D	1.25	MC7902CT	.30	TA7325P	1.50	TMS1071	4.40	UPD6104C	2.10	221-45-01	2.60
AN6306	3.95	CA3224E	2.45	LA6358	1.10	MC7905CT	.30	TA7330P	2.55	TMS1751	2.45	UPD6111	6.45	221-46	1.75
AN6307	3.95	CA3234E	5.95	LA6358S	1.10	MC7905 2CT	.30	TA7331P	1.60	TMS1944N	2.90	UPD7538C	4.95	221-69	1.95
AN6326	2.95	CA3236E	5.95	LA7032	5.20	MC7908CT	.30	TA7335P	.90	TMS3450	2.90	UPD8039H	2.85	221-77	3.20
AN6327	2.10	CA3237E	1.75	LA7507	1.50	MC7912CT	.30	TA7341P	1.85	TMS3451	2.45	UPD75106	5.45	221-78	2.85
AN6328	3.25	CA3238E	1.75	LA7520	2.75	MC14011B	.15	TA7342F	1.25	TMS3452	2.45	XO137CEZ	3.95	221-79-01	1.75
AN6337	2.85	CA7607E	1.65	LA7530	2.75	MC14023B	.45	TA7342P	1.25	TMS3459	2.45	TRANSISTORS		221-87-01	2.15
AN6341	2.95	CA7611E	1.65	LA7655	5.25	MC14024B	.40	TA7343P	1.85	TRC2073D	1.50	2SA564	.25	221-92	.95
AN6342	2.10	CD4013B	.15	LA7800	2.25	MC14025B	.40	TA7353P	1.40	TX7809CT	.25	2TA1015	.25	221-97	1.75
AN6343	2.90	CD4069B	.15	LA7830	2.05	MC14049B	.15	TA7358P	1.25	U416B	3.10	2SC454	.20	221-97-01	1.75
AN6346	3.85	CD22402E	8.95	LA7910	1.10	MC14069B	.15	TA7373F	1.55	U417B	2.30	2SC708	.85	221-97-02	1.75
AN6350	6.25	CX7770	3.75	LB1252	2.40	MC14073B	.65	TA7378P	1.50	U420B	2.70	2SC710	.20	221-102-01	2.65
AN6359	3.90	CXA1019	4.90	LB1403	1.10	MCM2114	1.50	TA7504S	1.15	ULN2110	1.45	2SC711	.20	221-103	1.95
AN6360	3.95	CXD1135	3.85	LB1405	1.35	MM5368	3.00	TA7611P	1.65	ULN2212	2.45	2SC828	.20	221-104	1.95
AN6361	3.95	CXK5816M	4.90	LB1409	2.10	MM5387AA	2.00	TA7613P	2.30	ULN2228	1.50	2SC829	.20	221-105	2.10
AN6362	4.50	HA1137W	1.50	LB1416	.95	MM5456N	1.60	TA7614P	2.55	ULN2229	1.85	2SC945	.15	221-106	2.20
AN6366NK	5.25	HA1156	1.40	LB1450	1.70	MM7317BN	1.50	TA7628P	1.75	ULN2261	2.10	2SC1055	1.65	221-111-01	.75
AN6387	5.10	HA1197	1.80	LC7131	1.25	MM1280R	2.45	TA7630P	1.75	ULN2269	1.90	2SC1306	1.55	221-140	3.75
AN6650	3.10	HA1199	2.95	LC7269	2.95	MM4052B	.20	TA7640P	1.50	ULN2280	1.50	2SC1387	1.40	221-157-02	1.65
AN7025	1.60	HA1203	1.65	LF347N	1.55	MM4081B	.20	TA7644P	5.75	ULN3810A	1.65	2SC1816	1.60	221-158-03	1.65
AN7110	1.50	HA1306W	2.65	LI2006	1.50	MM6163	3.95	TA7658P	1.75	ULN3859	1.45	2SC1829	1.45	221-160-01	2.15
AN7111	1.50	HA1338	5.90	LM3017T	.75	MM6168	3.75	TA7668P	1.50	UPA53C	1.80	2SC1940	.50	221-164	2.75
AN7115	1.50	HA1406	1.75	LM337MT	.60	MM15823	3.75	TA7670P	5.75	UPA80C	1.50	2SC1941	.65	221-171	.75
AN7142	1.75	HA11221	2.75	LM340T-5	.30	NIS7264B	2.65	TA7678P	4.10	UPB553AC	1.45	2SC1964	1.75	221-175	5.95
AN7143	2.75	HA11226	3.50	LM340T-6	.30	MP1908	3.40	TA7680P	4.75	UPC16C	1.50	2SC1973	1.50	221-178	1.60
AN7205	1.50	HA11227	1.85	LM340T-8	.30	MPC574J	1.55	TA7687P	2.60	UPC27C	2.25	2SC1975	1.95	221-179	5.95
AN7213	.85	HA11423	2.25	LM340T-12	.30	MPL2906	1.60	TA7705F	1.60	UPC358C	1.25	2SC2166	1.75	221-190	5.95
AN7222	1.50	HA11747	7.50	LM340T-18	.30	MSL9372	3.75	TA7709F	1.50	UPC393C	1.60	2SC2230	.50	221-192	1.25
AN7224	1.75	HA12003	1.25	LM350T	1.75	NIS7264B	3.95	TA7719P	1.50	UPC554C	1.90	2SC2271	.50	221-193	2.10
AN7310	1.10	HA12413	2.25	LM379S	3.95	NJM2063A	1.50	TA7757F	.95	UPC555H	1.50	2SC3038	1.25	221-213	.90
AN7320	1.25	HCF4011B	.15	LM380N	1.25	NJM2068S	1.50	TA7766AF	2.40	UPC556H	1.50	2SC3298A	1.10	221-250	1.75
AN7410	1.50	IR2E01	1.50	LM384N	1.55	NJM4558S	7.50	TA7777N	8.75	UPC571H	1.50	2SD77	.75	221-261	4.25
AN7420	1.30	IR2E02	1.50	LM1011N	1.75	NJM78L08	.25	TA7784P	1.25	UPC574	.65	2SD91	2.05	221-267	9.95
AY-385-00	2.45	IR2E05	1.50	LM1818N	2.50	OEC0001B	5.80	TA7792F	1.85	UPC575C	1.75	2SD200	1.60	221-285-02	5.50
AY-385-01	2.45	IR2E19	1.50	LM1822N	5.95	OEC1002	5.80	TA8102P	1.75	UPC577H	1.60	2SD870	1.85	221-285-03	5.50
BA235	1.60	IR2403	1.80	LM1823N	5.95	OEC2003	5.80	TA8105N	1.75	UPC585	4.45	2SD951	1.65	221-303	3.30
BA301	1.50	IR2406G	1.80	LM1868N	2.40	OEC3006	6.								



Welcome to. . .

SCIENCE PROBE!®

The Amateur Scientist's Journal

Embark on an irresistible new journey into the realm of mystery, challenge, and exploration! The perfect magazine for the budding scientist, the serious amateur, the professional who would like to relax, and those who simply want to gaze at the stars.

SCIENCE PROBE! — the *only* magazine devoted entirely to Amateur Scientists! If you are fascinated by science in all its many forms . . . if you can't stay away from a microscope, telescope, calipers, or test tube — we invite you to share the wonders in every issue of **SCIENCE PROBE!** You will join a community of Amateur and Student Scientists who enthusiastically seek scientific knowledge or follow scientific pursuits for their own sakes and not merely as a profession.

Obtain your personal *premier* edition of **SCIENCE PROBE!** by visiting a quality Newsstand, Convenience Store, or Supermarket this Fall or by reserving your personal copy through the mail by completing the coupon below.

From the very first issue of **SCIENCE PROBE!** you will be involved in a world of scientific facts, experiments, and studies pursued by amateur scientists who are university students, inventors, academicians, engineers, or office workers, salesmen, farmers—whose *quest* is to probe into the mysteries of science and reveal them to all.

Plan to become a **SCIENCE PROBE!** reader!

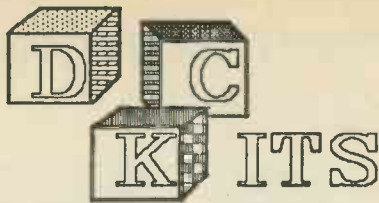
Articles to appear in early issues of **SCIENCE PROBE!** are:

- LIGHTNING—CAPTURE IT ON FILM**
- MONITORING ULTRAVIOLET FROM THE SUN**
- MOBILE-MOUNT EXPERIMENTAL WIND TUNNEL**
- CHECKING OUT ACID RAIN**
- AERIAL PHOTOGRAPHY FROM KITES AND BALLOONS**
- MINIATURE TRACKING TRANSMITTER**
- KILLER BEE IDENTIFICATION**
- HOW TO OBTAIN ANIMAL EYESHINE PHOTOGRAPHS**

If you're fascinated by science in all its many forms, if you are compelled to experiment and explore, then **SCIENCE PROBE!** is your kind of magazine!

SCIENCE PROBE!	RES
500-B Bi-County Boulevard Farmingdale, NY 11735	
Please forward my Premier Edition of SCIENCE PROBE! as soon as it comes off the press. I am enclosing \$3.50-U.S.A. (\$3.95-Canada) plus \$1.00 for shipping and handling. Better still, please enroll me as a charter-member subscriber and send the next four (4) quarterly issues of Science Probe. I am enclosing \$9.95-U.S.A. (Canada: \$14.95 U.S.A. Funds)	
<input type="checkbox"/> Premier Edition only <input type="checkbox"/> First Four Issues (1 Year)	
Offers valid in the U.S.A. and Canada only. No foreign orders.	
Name _____	
Address _____	
City _____ State _____ ZIP _____	
All Orders payable in U.S.A. Funds only.	

ON SALE AT QUALITY NEWSSTANDS, CONVENIENCE STORES AND SUPERMARKETS
STARTING SEPTEMBER 13, 1990 — \$3.50-U.S.A. — \$3.95-Canada



**TOLL FREE ORDER
HOT LINE
1-800-423-0070**

KIT CORNER

WIRELESS FM STEREO BROADCASTER KIT

CAT. NO. SFM-II \$19.95

DC'S all new FM Stereo Transmitter Kit is based upon the unique BA1404 Stereo Broadcaster Integrated Circuit that includes all the complex circuitry to generate the stereo signal. The kit includes the new special IC, a 38 KHZ crystal, circuit board, and all the small components. This fascinating project will provide many hours of enjoyment as you re-broadcast your CD/VCR/Cassette or stereo broadcasts from your satellite system thru your high-quality FM home or auto stereo system.



PC BOARD HACKERS CORNER

**MAKE CIRCUIT BOARDS
THE NEW, EASY WAY**



**WITH TEC-200 FILM
JUST 3 EASY STEPS**

1. Copy circuit pattern on TEC-200 film using any plain paper copier.
 2. Iron film onto copper clad board.
 3. Peel off film and etch.
- ORDER TEC-200-10 FOR TEN

PC BOARD SUPPLIES

Copper clad boards for use with TEC-200

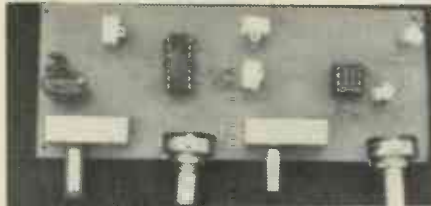
22-250	3 X 6	\$1.62
P1-36	3 X 6	2.03
22-260	4 X 6	2.27
22-261	6 X 6	2.88
22-263	6 X 9	4.08

POSITIVE PRESEN-SITIZED PC BOARDS

22-330	2 X 4	\$3.83
22-332	3 X 4	4.40
22-334	4 X 6	5.78
22-336	6 X 6	7.60
22-338	6 X 9	9.63

FUNCTION GENERATOR KIT ORDER FG2 KIT

\$19.95



A great project to enhance your bench. This handy little function generator has a built-in buffer amplifier, a 3-decade range selector switch that covers 15 hZ to 25 kHz, output level control and function switch to select sine, square, or triangle.

DC'S PARTS WAREHOUSE

UNIVERSAL DECODER (RE MAY 1990) ICs

CD22402E	7.95	CA3126E	1.95	NE564	2.29
LM733	.99	74C00N	.29	CD4053	.50
LM7805	.50	LM7812	.50	LM7905	.50
18 Uh CHOKE	.39	3.58 MHz	1.00		

ORDER ABOVE ITEMS DIRECT FROM THIS PAGE

**ICL7106 EV KIT LCD DIGITAL
PANEL METER NOW \$24.95**

The ICL7106 EV Kit is based upon a 3-1/2 digit A/D converter that includes all the circuitry to build a digital panel meter. Operates from a 9-v battery. Includes LCD, 7106 IC, circuit board and small parts. Builder must add resistors to expand to multi-meter

**POWER SUPPLY KIT
PS-1 \$16.99**

Output of this power supply is continuously adjustable from 1.2 to 25V DC. The LM317T voltage regulator provides excellent regulation and ripple rejection. Includes a 1 A transformer, PC board, LM317T, 2 binding posts, and all small parts.

MORE KITS

- 3 DIGIT LED DVM ONLY 3" X 3" READS 0 TO 100 V DC ORDER DVM3 \$19.95
- FM WIRELESS BROADCASTER FMI \$ 9.95
- 8038 FUNCTION GEN. KIT FGI \$ 9.50
- SEQUENCER PROJECT SEKIT \$ 9.50

CHRISTMAS TREE PROJECT

Build this unique seasonal project and have an unusual conversation piece. Powered by two D cells, 17 LEDs flash in a seemingly random fashion. Kit includes everything except batteries. ORDER XMASKIT \$16.95

**70-WATT STEREO POWER AMP
35 WATTS PER CHANNEL**

Now you can boost your low power car stereo with the new PM-35 module kit. Each module can provide up to 35 watts per channel while operating from the vehicle's battery into a 4 ohm speaker system. New hi-tech power op-amps are used in a unique circuit to increase voltage swings, thus more power. Additional modules can be used to increase power to 100 or 200 watts/channel.

ORDER PM-35 KIT \$19.95

UNIQUE IC's

NE602	\$2.00
UGN3013	.98
ULN2429	1.75
ZN414	2.00
XR2206CP	4.75
XR2212CP	4.75
MAX232	5.40
ULN3330	1.50
ICL8038	3.85
ICM7226BIPL	23.50

DC ELECTRONICS

TO ORDER FROM THIS PAGE CALL: 1-800-423-0070
SEND MAIL ORDERS TO:
PO BOX 3203 SCOTTSDALE, AZ 85271

Electronics Paperback Books

GREAT PAPERBACKS AT SPECIAL PRICES

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 multimeter 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.

BP263—A CONCISE INTRO TO dBASE \$6.95. The dBASE series of programs are probably the best known database programs for microcomputers. This book is designed to help you get started working with them.



BP260—CONCISE INTRO TO OS/2 \$5.95. If you are a multitasking PC user and want to get the most out of your computer, then you must learn its OS/2 operating system. This book shows you just how to do that, quickly and easily.



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



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.

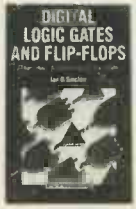
BP247—MORE ADVANCED MIDI PROJECTS \$5.95. Circuits included are a MIDI indicator, THRU box, merge unit, code generator, pedal, programmer, channelizer, and analyzer.



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



PCP102—INTRODUCING DIGITAL AUDIO \$9.95. Covers all kinds of digital recording methods—CD, DAT and Sampling. Bridges the gap between the technician and the enthusiast. Principles and methods are explained.



PCP107—DIGITAL LOGIC GATES AND FLIP FLOPS \$10.00. Thorough treatment of gates and flip-flops for enthusiasts, student and technicians. Only a basic knowledge of electronics is needed.

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.



PCP108—COMPUTERS AND MUSIC \$9.95. Explains the basics of computers and music with no previous knowledge of computers needed. Covers types of music software and explains how to set up your own computer music studio.

- 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 x 10 in.
- 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 FETs.
- 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.
- BP99—MINI-MATRIX BOARD PROJECTS**.....\$5.50. Here are 20 useful circuits that can be built on a mini-matrix board that is just 24 holes by ten copper-foil strips.
- BP82—ELECTRONIC PROJECTS USING SOLAR CELLS**.....\$5.50. Circuits with applications around the home that are powered by the energy of the sun. Everything from radio receivers, to a bicycle speedometer, to timers, audio projects and more.
- BP117—PRACTICAL ELECTRONIC BUILDING BLOCKS—Book 1**.....\$5.75. Oscillators, Timers, Noise Generators, Rectifiers, Comparators, Triggers and more.
- BP184—INTRO TO 68000 ASSEMBLY LANGUAGE**.....\$6.95. The 68000 is a great new breed of microprocessor. Programming in assembly language increases the running speed of your programs. Here's what you need to know.
- 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.
- BP37—50 PROJECTS USING RELAYS, SCR'S & TRIACS**.....\$5.50. Build priority indicators, light modulators, warning devices, light dimmers and more.
- 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.
- BP127—HOW TO DESIGN ELECTRONIC PROJECTS**.....\$5.75. Helps the reader to put projects together from standard circuit blocks with a minimum of trial and error.
- BP122—AUDIO AMPLIFIER CONSTRUCTION**.....\$5.75. Construction details for preamps and power amplifiers up through a 100-watt DC-coupled FED amplifier.
- BP92—CRYSTAL SET CONSTRUCTION**.....\$5.50. Everything you need to know about building crystal radio receivers.
- BP45—PROJECTS IN OPTOELECTRONICS**..... \$5.50. Includes infra-red detectors, transmitters, modulated light transmission and photographic applications.
- BP185—ELECTRONIC SYNTHESIZER CONSTRUCTION** \$5.95. Use this book to learn how to build a reasonably low cost, yet worthwhile monophonic synthesizer and learn a lot about electronic music synthesis in the process.

CHECK OFF THE BOOKS YOU WANT

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

SHIPPING CHARGES IN USA AND CANADA

\$0.01 to \$5.00	... \$1.25
\$5.01 to 10.00	... \$2.00
\$10.01 to \$20.00	... \$3.00
\$20.01 to \$30.00	... \$4.00
\$30.01 to \$40.00	... \$5.00
\$40.01 to \$50.00	... \$6.00
\$50.01 and above	... \$7.50

SORRY No orders accepted outside of USA & Canada

Number of books ordered

Name _____
Address _____
City _____ State _____ Zip _____

Total price of merchandise \$ _____
Sales Tax (New York State Residents only) \$ _____
Shipping (see chart) \$ _____

All payments must be in U.S. funds
Total Enclosed \$ _____

RES

Call for Outstanding Pricing on Tailored Computer Systems

ALWAYS AT A DISCOUNT

Quality & Service to the Smart Mail Order Shopper for over 4 Years

MOTHERBOARDS • XT • 286 • 386 • 486	
XT, 8mhz Turbo, 0.640 Max, 3 Slots, w/BIOS & CPU	62
XT, 10mhz Turbo, 0.640k Max, 8 slots, w/BIOS & CPU	74

OUR BEST SELLING VLSI 12MHz MOTHERBOARD	
12mhz 286, 0.640, 4mb, 8 slots, AMI BIOS, Baby size	139

CONTROLLERS	
AT, 286-12, Baby Sz, 0.640, NEAT CHIP, EEMS, Shad	239
AT, 286-12, Baby Sz, 0.640, NEAT CHIP, EEMS, Shad	245
AT, 386-1.65x, Baby Sz, 0.640, NEAT CHIP, EEMS, Shad	365
AT, 386-25/33, 32k Cache, Baby Sz, 0.640, 16mb, 8 Slots, AMI BIOS.1139/1375	

SUPER FDC, Control 4 Internal Drives, XT/AT	
All Drive Types	39

CDMPACTICARD II, 4 Drives, 360K/720K/1.2mb/1.44mb	
CDMPACTICARD II, Co-Exist, Ctrls 2 Or, All Types	75
CDMPACTICARD IV, 4 Dr, All Types, Co-Exist or Stand Alone Boot From Any Drive, Easy Installation	112

WESTERN DIGITAL XT-GEN, Ctrls 2 H/D, MFM, XT	
WESTERN DIGITAL 27X, Ctrls 2 H/O, RLL, XT	53
WESTERN DIGITAL 1003-MM2, 2FD/2HD, 2:1, MFM, AT	102
WESTERN DIGITAL 1006-MM2, 2FD/2HD, 1:1, MFM, AT	116
WESTERN DIGITAL 1003-SR2, 2FD/2HD, 2:1, RLL, AT	129
WESTERN DIGITAL 1006-SR2, 2FD/2HD, 1:1, RLL, AT	142
LONGSHINE 6220, 2FC/2HD, XT Only	53
LONGSHINE 6622, 2FD/2HD, 1:1, MFM, AT	79
WA-3, 2FD/2HD, 2:1, MFM, AT	75
WA-6VR, 2FD/2HD, 1:1, RLL, AT	85
WA-6, 2FD/2HD, 1:1, MFM, AT	77
OTC 7280, 2FD/2HD, 1:1, MFM, AT	99
OTC 7287, 2FD/2HD, 1:1, RLL, AT	131

POWER SUPPLIES	
150w XT, Standard Size for PC/XT Systems	38
150w XT, UL Approved	45
200w XT, Standard Physical Size for PC/XT	48
200w XT, UL Approved	52
220w AT, Standard Physical Size for IBM AT	54
220w AT, UL Approved	62

FLOPPY DISK DRIVES	
TEAC 360K, 5-1/4, FD55BR, Black/Biege, (Best)	66/68
TEAC 1.2mb, 5-1/4, FD55GR, Biege/Black, (Best)	78/80
TEAC 720K, 3-1/2, FD235F, with 5-1/4 Kit, Biege Only	66
TEAC 1.44mb, 3-1/2, FD235HF, with 5-1/4 Kit Biege	78
FUJITSU 360K, 5-1/4, M2551A, Black/Biege	63/65
FUJITSU 1.2mb, 5-1/4, M2553K, Biege	73
TOSHIBA 720K, 3-1/2, N03525, w/Kit, Black/Biege	69
TOSHIBA 1.44mb, 3-1/2, N03565, w/Kit, Black/Biege	80
MINI MICRO 1.2mb, 5-1/4, MFRF-560K, Biege, Mfg Samsung	74

HARD DISK DRIVES	
40mb, RLL, Mini-Micro—Mfg. by Samsung, 3.25 HH w/5.25 kit, 35ms	239
40/60mb, MFM-RLL, MITSUBISHI MRS35, 5.25 HH, less than 28ms Shockmounted, Vol Coil, Surface Mounted Technology.	347

SEAGATE	
20mb, MFM, ST-225, 5.25 HH, 65ms * Dr. Only/ w/crtl	205/259
20mb, MFM, ST-125, 3.25 HH w/5.25 kit, 40ms/28ms	235/280
20mb, RLL, ST-225R, 5.25 HH, 70ms * Dr. Only/ w/crtl	193/249
30mb, RLL, ST-238R, 5.25 HH, 65ms * Dr. Only/ w/crtl	219/282
30mb, MFM, ST-138R, 3.25 HH w/5.25 kit, 40/28ms	288/299
30mb, MFM, ST-138, 3.25 HH w/5.25 kit, 40ms/28ms	294/312
40mb, RLL, ST-250R, 5.25 HH, 70ms w/ controller (XT)	312
40mb, MFM, ST-251, 5.25 HH, 40ms/28ms	315
40mb, MFM, ST-151, 3.25 HH w/5.25 kit, 24ms	394
60mb, RLL, ST-277R-1, 5.25 HH, 28ms (65mb)	388
80mb, MFM, ST-4097, 5.25 HH, 28ms	585

VIDEO DISPLAY CARDS	
MONOCHROME GRAPHICS Card, w/Par. Port, LPT1	29
MONOCHROME GRAPHICS Card, Parallel Port, LPT1-2 or 3	29
DUAL VIDEO Card Allows 2 Monitors to Run on a Single Card	73
DUAL MONO/COLOR Graphics Card, 2 In one Card	25
CGA Color Graphics Adapter, No Printer Port	34
EVEREX ENHANCER, 640x350, No Printer Port	112
SUPER EGA DEM, 800x600, Auto Switching	75
VGA GRAPHICS 800x600 SUPER VGA 1024x768 16BIT	179
V P AT1, 800x560, 8BIT, 256	112
ATI, OEM, 1024x768, 16BIT, 256K, (VIEW PERFECT)	205
ATI VGA, OEM, 1024x768, 16BIT, 256K, w/Mouse, (VP)	230
VGA 800x600 (Oak), 16BIT	89

MONITORS

ALL OEM MONITORS MANUFACTURED BY SAMSUNG MONOCHROME

12" yundal 1200, 720x348, Amb T/S	76
12" MII OEM 1252, 720x350, AMB., Tilt & Swivel	79
14" MII OEM 1457, 720x350, AMB., Whi, Flat Scr, T/S	112
14" VOLTRON GM-1489, 720x350, AMB./WHI, F/S, T/S	110
14" EVERVISION, 720x350, Amb., Flat Screen, T/S	130
14" MIM OEM MM1464K, 640x200, 52 Dot, T/S	229
14" MM OEM MIM1464W, 640x200, 41 Dot, T/S	244
14" MM OEM 1453M, 640x200, 31 Dot, Tilt & Swivel	349
14" RELYSIS RE-5154, 640x350, 31 Dot, (Best Value)	379
14" NEG 3D, 1024x768, 28 Dot, Analog/TTL, T/S	649
14" VIEW PERFECT VP3, 1024x768, 29 Dot, SONY tube, Sharp	539
14" RELYSIS RE-5155, 800x600, 31 Dot, A/TTL, T/S	495
14" VIEW PERFECT VP-2, 640x480, 29 Analog, T/S	349
14" RELYSIS RE-9513, 720x480, 31 Dot, Analog, T/S	379
14" MM OEM 14681, 720x400, 31 Dot, Analog, T/S	379
14" NEG 2A, 800x600, 31 Dot, Analog, Tilt & Swivel	545

INPUT/OUTPUT - MULTIFUNCTION CARDS	
SERIAL Card, 2 Parts, 2nd Port Opt., COM 1 & 2(For XT)	13
SERIAL Card, 2 Parts, 2nd Port Opt., COM 1-4 (XT)	18/21
SERIAL Card, 4 Parts, 3rd & 4th Port Opt, COM 1-8 (XT/AT)	59/95
2nd SERIAL Port Opt.—Cable & Chip Set—Pin Connector Config. required	
w/Digital Display	10/15
PARALLEL PRINTER Card, LPT1 Only/LPT 1-2-3 (XT/AT)	9/15
GAME CARD, 2 Parts, Allows Attachment of 2 Joysticks	11
CLOCK Card, Calendar & Clock Only, Fits Into a Slot (primarily XT)	12
AT I/O #1, 1 Ser, 1 Par, 1 Game, COM 1-4, LPT 1-2	22
AT I/O #3, 2 Ser, 1 Par, 1 Game, COM 1-4, LPT1-2	27
AT I/O #4 2 Serial, 2 Parallel, COM 1-2, LPT1-3	35
I/O PLUS, Clock, Calendar, Parallel, Serial, Game (for XT)	37
384K MULTI I/O, Q, To 384K, Cal, Clk, Ser, Par, Game (XT)	69
MULTI I/O, w/Floppy Ctrl, Cal, Ser, Par, Game (XT)	33
SUPER MULTI I/O, w/Floppy Ctrl—Controls, 360/720K, 1-2 and 1.44mb FDD, Cal, Clk, Ser, Par, Game Parts (XT)	59

BARE BONES	
XT	
10mhz Desktop Barebone Sys., XT/AT Like Case, 101 K/B, 150W P/S, Floppy Ctrl, 360 Floppy Drive, 256K Memory	279
AT 286	
12mhz 286 Desktop Barebone System, 0 to 4mb M/B, 0 Full Size AT Case, 220w P/S, 101 Enhanced Keyboard, Floppy/Hard Drive Controller, 1.2mb Floppy Disk Drive	499

MODEMS	
1200 GVC, Internal, with PC TALK III Software	45
1200 EVEREX, Internal, with BITCOM Software	74
1200 GVC, External, with PC TALK III Software	59
1200 GVC, External Pocket Modem	74
2400 OEM ZOOM, Internal with PC TALK III Software	98
2400 EVEREX, Internal with BITCOM Software	138
2400 OEM ZOOM, External with PROCOMM Software	105
2400 GVC, External, with PC TALK III Software	109
2400 GVC, External, with PC TALK III MNP Class 5	185
2400 EVEREX, External, with BITCOM Software	199

SOFTWARE	
MS DOS 3.3 W/GW Basic, OEM Version	59
MS DOS 3.3, Actual MICROSOFT	84
MS DOS 4.01 W/GW Basic, OEM Ver Sliim—No Basic Manual	68
MS DOS 4.01 W/Actual MICROSOFT Sliim—No Basic Manual	82
MOUSE - TRACKBALL - SCANNERS	
QMOUSE X-30M Stream Line 2 Button Serial	24
QMOUSE X-30M Stream Line 2 But Serial Deluxe w/DR Halo	31
QMOUSE X-30S Stream Line 3 Button Serial	25
QMOUSE X-30S Stream Line 3 But Serial Deluxe w/DR Halo	38
GENIUS GM-600, DR Halo III, 2/3 But Operation, 350-1050 Res., 9-25 Pin Adp	33
75 GENIUS GM-6X, DR, Halo	25
LOGITECH X-9, Pop-Up DSS S/W, 50-19,000 Res, Ser/Bus	75/85
MIGHTY TRACKBALL, QTRONIX, DR Halo S/W, 9-25 Part Adaptor	49
LOGITECH TRACKMAN, 50-15,000 plus DPI, 3 Button, Software, Ser/Bus	95
75 Mouse Pocket, Store Your Mouse When Not in Use	3.00
Mouse Pad, Soft or Hard	3.00
Mouse Stage, Padded Stage Placed over K/B for Mouse	9.50
PS/2 Mouse Adaptor	4.00
Joystick Magic 909 IBM & Compatible/Magic 909A IBM/Apple	15/17

KEYBOARDS	
MAXI-SWITCH 84 Key (The Best)	42
MAXI-SWITCH 101 Key (The Best)	50
KEYTRONICS 101 Key (Excellent)	48

NTC SPECIAL 101 KEYBOARD Tacticle/Click 12 Function Keys on Left Side, Other Suppliers Ad Price \$99 Keyboards Our Price	
	\$65

84 KEY KEYBOARD, Non-click	29
84 KEY CHICONY, Tacticle/Click	45
101 KEY Non-Click Capacitive Tacticle 12 Function Keys	40
101 KEY KEYBOARD Tacticle/Click, 12 Function Keys	43

KT-30 101/102 Key with Microsoft Compat. (Serial or Bus) Trackball Mouse, 20 DPI-6400 Variable Resolution	
	95


SPECIAL—QMNKEY/PLUS KEYBOARD from NORTHGATE—Too many features to list, call or write for feature listing	
	99

CASES	
DESKTOP CASES	
XT SLIDE, Standard PC/XT, 4 Exposed Drive Bays	29
XT/AT Like, 2 Exp. Dr, 2 Int. Dr, LED/Reset/Key/Turbo	33
XT/AT Like, Flip-Top Case (Same as Above)	44
BABY AT, 3 Exp. Dr, 2 Int. Dr, LED/RESET/KEY/Turbo, XT sz. P/S	50
w/Digital Display	58
AT STD Desktop, 3 Exp/2Int Dr, LED/Reset/Key/Turbo	52
AT DELUXE DT, Same as Above, Heavier Duty, Better Qual	54
w/Digital Display	62
MINI AT DT, Attractive, w/200w P/S, 3x5-1/4 & 1x3-1/2 Exp Dr	109
Bays plus 1 Int 3-1/2 Hd Dr Bay, Fits AT & XT Sz M/B	109
w/Digital Display (Less Int 3-1/2 Hd Bay)	119

FLOOR STAND VERTICAL CASES	
VERT, w/220w P/S, 6x5-1/4 Exp Drives, Non Digital	210
w/260w UL Approved Power Supply	239
VERT, w/200w P/S, 2x5-1/4, 2x3-1/2 Exp Dr, 2x5-1/4 Int H/D Bays, Dig. Disp.199	199
VERT, w/220w P/S, 3x5-1/4 Exp Dr, 4x5-1/4 1/2 Ht Dr, Digital Display	215
w/285w P/S	259
MID Size VERT, w/200w P/S, 3x5-1/2 & 2x3-1/2 Exp Dr, 2x3-1/2 Int Bay, Fits XT&AT Size Motherboard, Digital	149
MINI VERT, w/200w P/S, 2x5-1/4x1x3-1/2 Exp Dr, 2x3-1/2 Int, Fits XT M/B Only 125	149

CABLES - MISC - ACCESSORIES	
XT Hard Drive Cable Set, 1 34 Pin & 1 20 Pin Cable	3.95
XT Hard Drive Daisy Chain Cable, For 2HD Connections	4.95
XT Hard Drive Data Cable, 20Pin Data Cable Only	3.00
XT Floppy Drive Cable, For 2 Floppy Drive Connections	3.95
AT Cable Set, 3 Cables, 1 for FDD, 2 for Hard Drive	5.95
Parallel Printer Cable 6	3.95
Parallel Printer Cable 6; Molded	4.95
Parallel Printer Cable 10; Molded	5.95
Parallel Printer Cable, Centronic to Centronic, 6	5.95
Serial Modem Cable, 6; Male to Female	4.95
Serial Modem Cable, 10; Male to Female	6.95
AC PDWER CORD, For Power Supply to AC Outlet	3.00
Y Cable, Adaptor to Expand No. of Power Outputs of P/S	3.00
Keyboard Extension Cable, 6/10	2.95/3.95
Monitor Expansion Cable 6/10	3.95/6.95
Serial Port Adaptor, 9 Pin Female to 25 Pin Male	5.00
Gender Changer, Female to Female	3.50
Gender Changer, Male to Male	5.00
6B VGA Cables, 9 Pin to 15 Pin to 25 Pin	10.00
VGA Expansion Cable, Universal for Sony, NEC	9.00
Surge Protector, 6 Outlet Power Strip, UL Approved	6.95
Power Center with Surge Protection, Sits Under Monitor	18
Battery Pack For AT Computer, Hold 4 AA Size Batteries	3.00
Speaker, 2-1/2	3.00
Speaker Holder	2.00
AC Power Cord, Connects Between P/S and AC Outlet	3.00
AT Rattism For Mounting Floppy/Hard Drives, Set of 2	3.00
XT Face Plates (Black), Covers Empty Drive Bay	2.00
AB Switch Box, Specify Type of Connection	14.00
Disk Drive Cleaning Kit for 3-1/2 Drives	6.00
Disk Drive Cleaning Kit for 3-1/2 Drives	6.50
Printer, Keyboard, Mouse, Cleaning Kit	6.50
Printer Stand, Universal, Fits All Printers	6.00
Printer Stand With Paper Tray, Heavy Duty Wire Const.	11.00
Printer Stand With Enclosed Paper Tray	17.00
CPU Adp., Stand, Set Desktop Sys on Floor In Vert Posl	9.00

FMBS MOBILE BABY SITTER
Portable Wireless Monitoring System



A 2 station, RF frequency monitoring system. Transmitter unit plugs into any AC outlet, monitors easily, receiver extremely lightweight and compact. Comes complete with belt clip and magnet for kitchen use... 300 ft. max operating distance. Uses 2 AA batteries. FCC approved. **39.95***

ALL-PURPOSE DUST CLEANER
with 5 SLIP-ON ADAPTOR TOOLS
BLOWS AWAY DUST PARTICLES FROM: VCR'S - COMPUTERS - CAMERAS



No. ER5

With a push of the button, blow away dust, oxide particles and simple dirt from hard to reach areas. Attach appropriate adaptor from tools furnished and Blow Master cleans VCR heads, computer keyboards, terminals, disk drives, camera optics and dozens of other delicate devices. Includes a brush attachment. 2 AA batt. (not included). **7.95***

Racing Battery
This 7.2V 1200mAh battery is a first grade battery from the matched, twin stick cells, to the heavy duty high temp. silicone wire leads. First line racing parts built to high standards. **19.80***



DELUXE MEGAPHONE
WITH SIREN, WHISTLE & LIGHT



Powerful solid state amplifier. Features include built-in switch-selectable alarm siren, whistle, light, pistol grip press to talk switch, vol control, and shoulder strap. 8C cell batteries (not supplied). **129.95***

Length 14-1/8"
Bell Dia. 9-1/8"
Wgt. 3 1/2 lbs. w/o Batt
Voltage 20W Max.
Effect. Range 1200 Ft

XT™ AT™ & IBM™ Are Registered Trademarks of International Business Machines. Prices are subject to change without notice.
\$1 Rebate per \$100 on all phone orders (ex., \$5.00 rebate for \$500 order)

GEMS
computers inc

408-432-7380

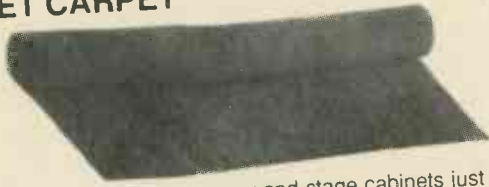
TECH SUPPORT 408-432-7557 FAX 408-432-8622

2115 Old Oakland Road
San Jose, CA 95131

Call or write for shipping details. A \$3.00 handling charge is applied to all orders plus a minimum of \$4.00 freight. GEMS will ship UPS, FED EX, or any other recognized freight service. 15% restocking fee applied to good returned merchandise for refund.
In Business Since 1985 • A member of the Chamber of Commerce

FANTASTIC BUYS !!

CABINET CARPET



Now you can cover your custom car and stage cabinets just like the pros. Carpet-like covering is easily cut and glued to plywood, particle board, etc. Provides protection and good looks. 54" wide. Sold by the linear yard.

#RN-260-765 (Black)
#RN-260-767 (Charcoal gray)

\$7⁹⁵
Yard

15" SANYO WOOFER



Original Sanyo 15" woofer with paper cone, vented dust cap and treated cloth surround. 12 oz. magnet. 60 watts RMS. 8 ohm. Response: 25-2,500 Hz. Sanyo part #S38F12. Net weight: 6 lbs.

#RN-291-155

\$19⁹⁵

HI POWER SPEAKER WIRE

Extra large 12 gauge speaker wire for use with very high power stereo systems or for extremely long cable runs. Rope lay construction consists of over 250 strands of 36 ga. wire. Please order in multiples of 5 feet.



39c
Foot

#RN-100-151

PIN CONNECTOR



Gold plated pin connector for use with 12 gauge speaker wire. Sold in color coded pairs.

#RN-090-225

\$3⁹⁵
Pair

POLYDAX TWEETER

This 1/2" ultra-light polymer dome tweeter is active horn loaded. Features a ferro fluid cooled, formerless voice coil. This tweeter exhibits a wide dispersion angle and excellent transient response. 8 ohm. SPL: 91.3 dB. 40 watts nominal power handling. 2" square.



\$6⁹⁵

#RN-270-110

PIONEER TWEETER

Mylar dome, 2.93 oz. barium ferrite magnet. 8 ohm. Frequency response: 1,800-20,000 Hz. 35 watts RMS. Pioneer #AH E60-51F. Net weight: 1 lb.



\$5⁹⁵

#RN-270-050

CABINET CORNERS

High quality, zinc plated P.A. cabinet corners. Made of heavy .047" steel. Made in U.S.A.



58c

#RN-260-710

12" SUBWOOFER

Dual voice coil subwoofer. 30 oz. magnet, 2" voice coils. 100 watts RMS, 145 watt max. 25 Hz resonant frequency. 6 ohm impedance (4 and 8 ohm compatible). Sensitivity: 89dB. Response: 25-700 Hz. Pioneer #A30GU30-55D. Net weight: 6 lbs.



\$39⁸⁰

#RN-290-145

PIONEER MIDRANGE

Tuned cup midrange. 9.3 oz. ferrite magnet. 50 watts RMS, 70 watts max. Frequency response: 320-6,000 Hz. 8 ohm. SPL: 94 dB. Pioneer #B11EC80-02F. Net weight: 3-1/2 lbs.



\$9⁹⁵

#RN-280-020

3-WAY 200W CROSSOVER

Excellent crossover for high power speakers. Woofer section rolls-off at 800 Hz. with a 6 dB slope, while the tweeter section utilizes a 12 dB per octave roll-off at 4,500 Hz. For the midrange frequencies this crossover uses a true band pass filter with a response of 750-5,000 Hz. All crossover frequencies are rated into a 8 ohm load.



\$27⁵⁰

#RN-260-230

SPEAKER BUILDING BOOK

Completely revised and updated to reflect the latest trends in audio technology, this new edition of David B. Weems' bestseller (more than 35,000 copies in print) will guide do-it-yourselfers through the building and testing of low-cost speaker systems that rival the most expensive units on the market. 224 pages.



\$16⁹⁵

#RN-500-021

PARTS EXPRESS
340 EAST FIRST ST.
DAYTON, OHIO 45402
LOCAL: 513-222-0173
FAX: 513-222-4644

CALL TOLL FREE
1-800-338-0531

Special prices expire 1/31/91



SPEAKER TERMINAL



#RN-260-300

39c

10" PASSIVE RADIATOR

Passive radiators can be used in conjunction with smaller woofers to produce improved bottom end without the added expense of large low frequency drivers.



#RN-260-405

\$5⁹⁰

6" X 9" BRIDGELESS SPEAKERS



Polypropylene woofer with 20 oz. magnet. Bridgeless design for better bass punch. 3" midrange and 1-1/4" tweeter. Power handling capability: 60 watts RMS. 4 ohm impedance. Sold in pairs. Net weight: 7 lbs. per pair.

#RN-265-240

\$39⁸⁰

8" THRUSTER



Heavy duty ribbed paper cone with poly foam surround. 20 oz. magnet. 6 ohm. 50 watts RMS. 1-1/2", 4 layer voice coil. fs = 26.5 Hz. Frequency response: 22-2,700 Hz. Net weight: 5 lbs.

#RN-290-053

\$22⁵⁰

CARPETED TRUCK BOX PAIR

These quality, carpeted truck boxes are made of high density acoustical grade particle board. Each box is cut to accept an 8" woofer and port. Speaker terminals and handles are included. Dimensions: 19" x 13" x 5" (tapered front). Sold in pairs. Net weight: 22 lbs. per pair.



#RN-260-455

\$39⁹⁵

18" EMINENCE WOOFER

Ribbed paper cone with treated cloth accordion surround. Giant 100 oz magnet. 250 watts RMS, 350 watts max. 3", 2 layer voice coil. 8 ohm. fs = 30 Hz. Frequency response: 27-3,500 Hz. Net weight: 26 lbs.



#RN-290-200

\$99⁸⁰

100 WATT "L" PAD

Allows you to adjust the relative volume of individual drivers in a speaker system while maintaining a constant 8 ohms impedance. Complete with faceplate, knob, and instructions.



#RN-260-265

\$5⁹⁰

2-WAY 100 WATT CROSSOVER

This crossover features a crossover point of 3,000 Hz with a 12 dB per octave roll-off for the low pass and a 6 dB roll-off for the high pass. 8 ohm. 100 watts RMS. 6" x 4" x 1".



#RN-260-195

\$6⁵⁰

6" X 9" BOXES



High density particle board cabinets for 6" x 9" speakers. Unfinished so that you may paint or cover to your liking. Deep enough for large magnet speakers. Net weight: 9 lbs. per pair.

#RN-260-450

\$12⁵⁰

STANTON HEADPHONES

Soft vinyl covered foam earpads make these headphones comfortable to wear, and they sound fantastic. 7-1/2 ft. cord is the perfect length for use with home stereo systems. 1/4" to 3.5mm adaptor is included for use with your portable stereo as well. 1 year warranty.



#RN-241-020

\$9⁹⁵

PIONEER 12" WOOFER



Ribbed paper cone with foam surround. 20 oz. ferrite magnet. 1-1/2" voice coil. 60 watts RMS, 90 watts max. 8 ohm. 30-2,500 Hz frequency response. SPL: 92 dB. Net weight: 5 lbs.

#RN-290-105

\$19⁹⁵

PARTS EXPRESS
340 EAST FIRST ST.
DAYTON, OHIO 45402
LOCAL: 513-222-0173
FAX: 513-222-4644

ORDERING INFORMATION

• 15 day money back guarantee • \$15.00 minimum order • We accept Mastercard, Visa, Discover, and C. O. D. orders. • 24 hour shipping • Shipping charge = UPS chart rate + \$1.00(\$3.00 minimum charge) • Hours 8:30 am - 7:00 pm EST, Monday - Friday, 9:00 am - 2:00 pm EST. Saturday • Mail order customers, please call for shipping estimate on orders exceeding 5 lbs. • Foreign customers please send \$5.00 U.S. funds for postage when requesting a catalog •

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 \$16.45 off the regular single copy price. Subscribe to Popular Electronics today! Just fill out the subscription order form below.

THE BEST ELECTRONICS PRODUCTS OF 1990 L 48784

Popular Electronics

200,000-VOLT VAN DE GRAAFF GENERATOR
Have hours of high-voltage fun with this static-electricity generator

LIVING WITH LIGHTNING
The truth about lightning, and the best ways to protect yourself, and your gear, from it

BUILD AN AUTOMATIC CAR-RADIO SILENCER
Turns down the volume on command from your radar detector, cellular phone, or CB

TUNE IN THE RADIO PIRATES
These illegal broadcasters offer a refreshing change from standard radio fare

BUILD AN IR-CONTROLLED SOUND-EFFECTS GENERATOR
It's perfect for your Halloween haunted house, or for dozens of other applications

THE AUTOMATED HOME
Computers and electronics team up man in command of his castle

PRODUCT REVIEWS

- Sony "Discman" Portable CD Player
- Heathkit Active Antenna

Save 46% Off The Regular NEWSSTAND Rate

THE HADGETEER'S GIZMO BUYER'S GUIDE

3 NEW FootCards IN THIS ISSUE!

\$2.50 U.S. \$2.95 CANADA

FOR FASTER SERVICE CALL TODAY
1-800-435-0715
(7:30AM-8:30PM)
EASTERN STANDARD TIME

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 \$16.45 off the newsstand price.

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 \$5.00 Postage. All Other Foreign add \$7.50 Postage.

ASPA1

SPECIALS

LIMITED QUANTITIES

CABLE CONVERTERS

SIGMA

SIGMA 550—86 CHANNEL \$99.95 EACH

TOP CHANNEL ROLLOVER,
LAST CHANNEL MEMORY,
PARENTAL LOCKOUT,
FAVORITE CHANNEL, SURGE
PROTECTION, 4 db AMP,
DECODER COMPATIBLE,
1 YEAR WARRANTY.

\$79.95 EACH 5 LOT

\$75.00 EACH 10 LOT

\$67.50 EACH 20 LOT

\$65.00 EACH 50 LOT

VIEWSTAR IS HERE

MXC-2520-525 MHZ remote volume
remote volume control

Audio/video Baseband **\$129.95** ea.

Output, decoder loop **\$109.00** 5 lot

Parental Lockout **\$100.00** 10 lot

Favorite channel **\$95.00** ea. 20 lot

Remote Fine tuning

NEW "North Coast"

'Excel' 66 channel remote **\$109.95** ea.

Fine tune remote,
60 min. Sleep timer **\$89.95** 5 lot

Display dimmer.
Favorite channel **\$79.95** 10 lot

Parental Lockout,
HRC/STD Remote **\$75.00** 20 lot

Selectable Twinline A/B Select

UNITED ELECTRONIC SUPPLY

P.O. BOX 1206, ELGIN, IL 60121

(708) 697-0600

NEW PRODUCTS

SPECIAL FROM ETT

□ **PCP101—PRACTICAL DIGITAL ELECTRONICS HANDBOOK ... \$9.95.** Introduces digital circuits, logic gates, bistables and timers, as well as micro-processors, memory and input/output devices. Special section on digital test gear projects.



□ **PCP102—INTRODUCING DIGITAL AUDIO ... \$9.95** Shows what is involved in the digital part of audio signals, particularly in the newest devices such as CD, DAT and sampling. Bridges the gap of understanding for the technician and enthusiast.

□ **PCP103—PRACTICAL MIDI HANDBOOK ... \$9.95.** Covers all MIDI based equipment you can use—keyboards, drum machines, sequencers, effects units, mixers, drum pads and guitars. Also a section on computer music that covers software and more.

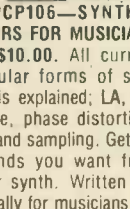


□ **PCP104—ELECTRONICS BUILD & LEARN, Second Edition ... \$9.95.** You start by assembling a circuit demonstrator that is then used to build and investigate a variety of useful circuits including oscillators, multi-vibrators, bistables and logic circuits.

□ **PCP105—MAKE MONEY FROM HOME RECORDING ... \$10.00.** Now that you've spent all that money on all that recording gear, wouldn't it be nice to get some of it back? Well here's the book that can show you how.



□ **PCP106—SYNTHESIZERS FOR MUSICIANS ... \$10.00.** All current popular forms of synthesis explained; LA, additive, phase distortion, FM and sampling. Get the sounds you want from your synth. Written especially for musicians.



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	\$1.25	\$30.01 to \$40.00	\$5.00
\$5.01 to 10.00	\$2.00	\$40.01 to \$50.00	\$6.00
\$10.01 to \$20.00	\$3.00	\$50.01 and above	\$7.50
\$20.01 to \$30.00	\$4.00		

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 _____

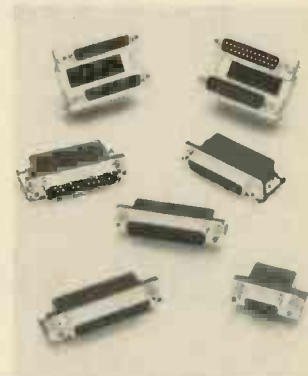
RES

RIGHT-ANGLE D-SUB CONNECTORS.

3M's line of right-angle D-sub connectors increases printed-circuit board design options with a wide range of styles for computer and peripheral board-mount applications. The connectors are available in four product families: 0.318-inch-footprint sockets and plugs in 9, 15, 25, and 37 positions, 10- and 30-microinch gold plated; 0.590-inch-footprint sockets and plugs in 9, 15, 25, and 37 positions, 10- and 30-microinch gold plated; high-density socket only, 15 positions in 9-position size; and stacked, with two 9, 15, or 25 positions, or 9 over 25 positions, socket/plug, socket/socket, plug/plug, or plug/socket.

To ensure reliable electrical contact, all have sealed backs to protect against solder and flux entrapment. Each connector has a tin-plated metal shell for high-quality shielding. In addition, friction dimples on the male connector's metal face provide ground continuity with the mating connector for effective EMI shielding. The dual-wipe, clover-leaf contact design assures a good connection, and rigid tin-plated solder tails eliminate bending and aid in alignment with PC board hole patterns. Optional features include inside or outside ground straps, board locks to hold the connector securely in place during wave soldering, and 4-40 inserts to offer still more design options.

The 25-position right-angle female connector with



CIRCLE 25 ON FREE INFORMATION CARD

metal face and 10-micro-inch gold plating costs \$1.80 each in quantities of 5,000. (Contact 3M for pricing details on other styles and quantities.)—**3M Electronic Products Division, P.O. Box 2963, Austin, TX 78769-2963; Tel: 800-225-5375.**

WAVEFORM RECORDER SYSTEM.

For use in laser physics, high-voltage switching, material testing, NDT testing, ultrasonics, telecommunications, and speech analysis, *Rapid System's R1222* waveform recorder system has a 2-MHz sample rate at 12-bit



CIRCLE 26 ON FREE INFORMATION CARD

resolution. The system has a large data buffer (up to 1 MEG words) and easy-to-use, Windows-based software. Dual timebases allow users to digitize fast and slow events at the same time. The *R1222* is modular from 4 to 32 inputs. The recorder system offers sig-



Atari 5200 Trak-Ball Controller

Use with your 5200 game or build your own computer mouse. Unit comes with heavy snooker ball running on five precision bearings. Two opto-isolators translate the rotary motion into x,y coordinates. IC's are: LM339, CD4011, CD4013, CD4030, CD4538. Unit also has two twelve-button keypads in addition to a bank of two buttons below each keypad. New, in original carton, with instructions.

\$12.95 each

50-LB. CARE PACKAGE

Surplus goodies from Silicon Valley. Electronic and mechanical subassemblies from robots to rockets. This is not junk, just material we've acquired in quantities too small to catalog — IC's caps, diodes, resistors, transistors, connectors, springs, etc. Most items are unused.

50 Lbs. for \$49.95

★ SILICON VALLEY GOLD ★

Over 50 pounds of printed circuit boards from computers, monitors, modems, test, RF and microwave equipment, all stuffed with goodies such as toroids, IC's, switches, sockets, connectors, oscillators, crystals, transistors, diodes, varactors, varistors, etc. A gold mine of usable parts.

50 Lbs. for \$49.95

IBM-Compatible 84-Key Keyboard

For XT's with dual cursor control/numeric keypad.

\$24.95 each



Protect Your Computer . . .

Fax . . . Copier . . . From Power Surges
SOLA 250 Watt Micro/Mini Autotransformer / Line Conditioner. 85-135 VAC in and 110 VAC out, +/- 5%. Used, good condition.

\$44.95 each

Morse Code Trainer/Keyer Kit

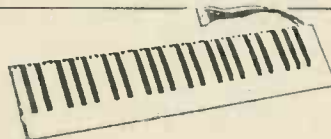
Learn Morse Code faster and easier with this easy-to-build kit. The 8049 micro-processor will send Morse Code at any speed you are comfortable receiving. Attach your Iambic Paddle and practice your sending. Connect it to your transceiver and use it as a Digital Keyer. Comes with instructions and 73 and CQ article reprints. *Reduced prices . . .*

Starter Kit — PC board, micro-processor, documentation **\$12.95**

All Parts, except power supply, enclosure **\$27.95**

Power Supply, +5V @ 1.2A, +12V @ 0.4 A **\$ 9.95**

EVERYTHING, except enclosure **\$34.95**



Build Your Own Music Synthesizer

Matsushita keyboards, four octaves, full-sized keys, as used in Sequential Circuits and other synthesizers. Comes with technical and operating manuals.

\$24.95 each



250 Watt Transistor

Complementary pair MJ15024 and MJ15025, 250 Volt, 16 Amp transistors used for Hi-Power Audio and other Linear Applications. Application notes included.

2 Pair for \$9.95

Ultrasonic Transducer Experimenter's Kit

Includes a transducer and over 80 pages of application notes.

\$29.95

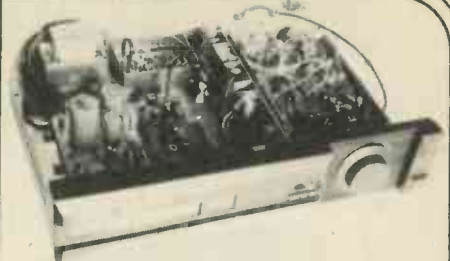


BOOM MIKE



Electret condenser type. Easy to hook up to your handie-talkie, PA system, telephone, etc. New, with diagrams.

\$4.95 each



GOBS OF GOODIES !!!

Studioline Stereotrak II Cable TV Adaptor

Separates stereo signals from the cable TV input, feeds TV signals to TV/VCR/tuner and stereo signals to FM (either RF or fixed/variable level audio). Inside are hundreds of useful parts which may be removed for audio/RF projects. Controller board has CPU and socketed EPROM as well as Mitsumi varactor tuner. Cable/FM separator board. Regulated power supply sub-assembly. Channel select board. Stereo separation output board. Black metal case, 14" x 10" x 3".

Only \$19.95

PAY RADIO ???

CODART Pay Radio Decoder, part of a system that broadcast pre-paid stereo programming. These units would activate one of two tape recorders when a coded tone was received. When one cassette stopped, the second unit would be enabled to complete the recording. Contains a Z-80, 4K EPROM, 2K battery-backed RAM, 18-key keyboard, 8-digit display and relays for the recorders. Reprogram it to control stereo, TV usage, timing, and appliance control. New units with manual and schematic.

Two for \$19.95



Power Factor Controller

POWER PINCHER can save you up to \$20 each per month. When used with refrigerators, washing machines, furnace and attic blowers and motor-driven tools, this NASA licensed device can reduce the energy required by the appliances and tools by up to 60%. Maximum power load 750 Watts.

\$19.95 each

ALLTRONICS

2300 ZANKER ROAD • SAN JOSE, CA 95131

Terms: Orders shipped U.P.S. C.O.D. plus shipping unless other arrangements have been made.
VISA/MC/AM EX cards accepted. Minimum order \$12.00. California residents add 7 1/4% sales tax.

Phone (408) 943-9773 • FAX (408) 943-9776

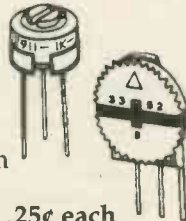
CIRCLE 258 ON FREE INFORMATION CARD

COMPONENTS TO COMPUTERS



IEE Flip™
Vacuum Fluorescent Display Module.
 Features microprocessor controlled 8 bit TTL-ASCII data base accessing 2 line by 20 character 5X7 dot matrix display with lower case with blinking and underline.
 Regular Price \$299. **ACP Only \$99**

Bourns Trim Pots

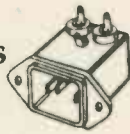


3/8" single turn
 Cermet pot.
 3352T-1-205 25¢ each
 1/4" round single turn
 3329P-1-503 35¢ each

Special Grabbag!

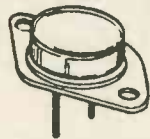
25 pcs (mix) all types potentiometers/trimmers
 Only \$4⁹⁹

Corcom RFI Filters



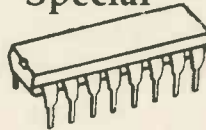
We have with straight tab terminals or Right angle. rated 3A/250V
 3EF1 \$2.50
 3EF2(rt angle) \$2.95
Call for more types and styles. We have over 100 models in stock

Motorola 2N6051

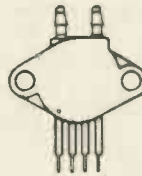


Darlington Power Transistor. ACP Special Price
Only \$2.25
Qty 10 \$1.95

Resistor Network Special



8 Isolated Resistors 16pin DIP
4116R-1-512 (5.1K) 19¢
 15 Bussed Resistors 16pin DIP
4116R-2-223 (22k) 19¢
 Call for all your resistor networks!
 We have over 500,000 in stock.



Motorola Pressure Sensor

Model MPX50DP
 Noncompensated piezoresistive.
 50kPa(max) range.
 Differential measurement with ported elements.
 60mv full scale span
 35mv offset
 1.2mv/kPa sensitivity
 Mot List \$22.86
ACP Only \$14.95

Fujitsu 128K Bytes Bubble Memory



P/N N16B-8416-001/02
 Model # FBC 501M4E
 Bubble memory module on card is P/N FBM54DB.
 We also have a few motherboards with modular power supply that accepts card shown above.
 22 pin edge connector 128K Bytes
Card Only \$99
Motherboard .. \$49
Manual add \$5

Motorola

Bridge Rectifier

MDA 990-2
 35A at 200V
 tab leads.



ACP Only \$2.25
Qty 10 \$1.75

AC Connector



Flange mount female connector. Tab terminals rated 6 amps/250v.
6ESRF-3 69¢

Rayovac

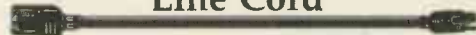
Lithium Batteries

Popular replacement for most PC add-in cards.

All factory fresh
 BR2325-T2 \$1.25
 BR2325(no leads) \$1.35
 844 PC replacement \$9.95



Line Cord



3 Conductor shielded PVC Jacketed Power Cord
 8' length
ACP Only \$2.50
 6' length (w/o receptacle)
ACP Only \$1.50

ACP since 1976 has in stock the largest and broadest selection of components and computers in Southern California. We are both wholesale and retail. Our retail facility is 14,000 sq. ft., located near the Orange County Airport. If you don't see the part you need, please give us a call. If you are a reseller or dealer we suggest you call our wholesale division at 714-558-8822. Thank you for considering ACP. Prices subject to change without notice. Quantities limited to stock on hand. Minimum order is \$10.00. All items new unless indicated. Product may be returned within 10 days from ship date with prior authorization from ACP. Returns must have RMA# and returned with copy of original packing slip and complete with original packaging, manuals, diskettes, etc.. Shipping charges added. Yes we accept VISA, Mastercharge, and AMEX.

Advanced Computer Products

SINCE 1976 • 1310 E. EDINGER • SANTA ANA CA 92705 • 800-FONE-ACP • 714-558-8813 • FAX 714-558-1603

Its Fun To Shop At ACP

Switchcraft "Q-G" Audio Connector



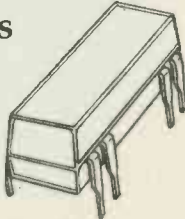
Stainless Finish, 3 contacts,
female P/N A3F and QGP-3-22
Compare at \$5.95 reg price
ACP price Only \$2.75 each
Stock Up! Buy 10 \$1.95 each

Aromat Relay



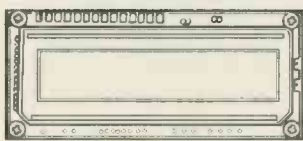
Normally open
3A 250 volts DCSV
#AE822908 (5leads)
ACP Only \$2.99 each

Gordos Dip Relay



Standard Dip Relay
P/N F81-1359-2
ACP Only 1.99 each
Qty 10 Only 1.79 each

Hitachi



Laptop LCD Display
8 lines x 40 characters
4 1/2" x 10 3/4"L
Same as used
in the Gavilan laptop.
ACP Only \$10



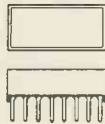
RG 59 Cable

Male to Male 20ft
ACP Only \$2.95



Infrared Emitting Diode

T-1 3/4 Infrared LED
ACP Only 29¢ each
Qty 10 Only 19¢ each



LED Bar Graph

8 segment. Popular
Hewlett Packardtype
HP P/N HLMP-2785
Bar (Yellow) 69¢
Buy 25 pieces 49¢



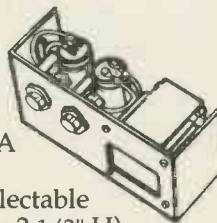
Right Angle LED's

T-1 3/4 LED. Available in
single on a bank or 4.
Single (Red) 69¢
Bank of 4 (Red) \$1.79

Power One

Series
Power
Supply

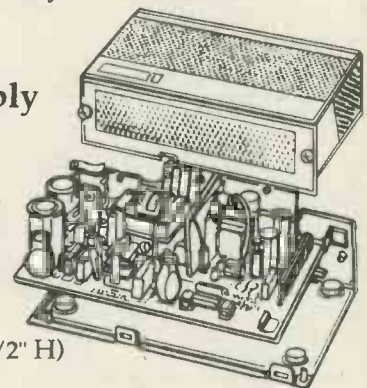
5V @ 4A
12V @ 2.5A
110/220
jumper selectable
(5 x 8 1/4 x 2 1/2" H)
ACP Only \$16



ASTEC

Switching Power Supply

115 V@ 2.2A
230V @ 1.2A
50/60 Hz
Output 1 128W Output 2 86W
+5V @ 10A +5V @ 10A
+12V @ 2.5A +12V @ 1.0A
+12V @ 3.5 +12V @ 1.5
-12V @ 0.5A -12V @ 0.5A
(10 1/2 x 5 x 2 1/2" H)
ACP Only \$29



Slotted Optical Switch

Transistor
Outputs
1.7 V @ 20 mA
standard style
SPX1879-15



ACP Only .. 69¢ each
Qty 25 Only 49¢ each

MASS STORAGE

Hard Disk Specials All New!



Seagate
20Mb ST225 \$189
30Mb ST238R \$215
40Mb ST251-1 \$259
80Mb ST4096 \$549
40MB IDE ST157A \$279
100Mb IDE ST1144A Call
Imprimis 330Mb, CDC/Wren
150Mb, Toshiba 150Mb in stock
at special price Call ACP
10Mb Hard Drive Blow-out!
Densi 10Mb FH 5.25" \$69

Western Digital

Hard Disk Controller WAH 1003.

2/3rd size card. New!
Reg price \$99.00
ACP Only \$24.95



Advanced Computer Products

SINCE 1976 • 1310 E. EDINGER • SANTA ANA CA 92705 • 800-FONE-ACP • 714-558-8813 • FAX 714-558-1603

- | | |
|--|---|
| <input type="checkbox"/> 126 Radio-Electronics Annual 1986 \$6.00 | <input type="checkbox"/> SP8 Special Projects #8 \$6.00 |
| <input type="checkbox"/> 125 Radio-Electronics Annual 1985 \$6.00 | <input type="checkbox"/> SP6 Special Projects #6 \$6.00 |
| <input type="checkbox"/> 210 Radio-Electronics (1990 back issues) .. \$3.50 | <input type="checkbox"/> SP5 Special Projects #5 \$6.00 |
| <input type="checkbox"/> 109 Radio-Electronics (1989 back issues) .. \$3.75
(April not available)
Write in issues desired _____ | <input type="checkbox"/> SP4 Special Projects #4 \$6.00 |
| <input type="checkbox"/> 108 Radio-Electronics (1988 back issues) .. \$4.00
Write in issues desired _____ | <input type="checkbox"/> SP1 Special Projects #1 \$7.00 |
| <input type="checkbox"/> 107 Radio-Electronics (1987 back issues) .. \$4.50
(January, February not available)
Write in issues desired _____ | <input type="checkbox"/> EH90 Experimenters Handbook (1990) .. \$4.00 |
| <input type="checkbox"/> 106 Radio-Electronics (1986 back issues) .. \$5.00
Write in issues desired _____ | <input type="checkbox"/> EH87 Experimenters Handbook (1987) .. \$5.00 |
| <input type="checkbox"/> 105 Radio-Electronics (1985 back issues) .. \$5.50
(January, February not available)
Write in issues desired _____ | <input type="checkbox"/> HH89 Popular Electronics Hobbyist
Handbook \$4.50 |
| <input type="checkbox"/> 104 Radio-Electronics (1984 back issues) .. \$5.75
(December, February not available)
Write in issues desired _____ | <input type="checkbox"/> EH88 Experimenters Handbook (1988-89) \$4.50 |
| <input type="checkbox"/> 220 Popular Electronics (1990 back issues) \$3.50 | |
| <input type="checkbox"/> 119 Popular Electronics (1989 back issues) \$3.75
Write in issues desired _____ | |
| <input type="checkbox"/> 118 Hands-On Electronics (1988 back issues) \$4.00
Write in issues desired _____ | |
| <input type="checkbox"/> 117 Hands-On Electronics (1987 back issues) \$4.50
Write in issues desired _____ | |
| <input type="checkbox"/> 116 Hands-On Electronics (1986 back issues) \$5.00
Write in issues desired _____ | |
| <input type="checkbox"/> 115A Hands-On Electronics #6 \$5.50 | |
| <input type="checkbox"/> 115 Hands-On Electronics #5 \$5.50 | |
| <input type="checkbox"/> 114 Hands-On Electronics #4 \$5.50 | |
| <input type="checkbox"/> 113 Hands-On Electronics #3 \$5.50 | |
| <input type="checkbox"/> 112 Hands-On Electronics #2 \$5.50 | |
| <input type="checkbox"/> 111 Hands-On Electronics #1 \$6.00 | |
| <input type="checkbox"/> SP10 Special Projects #10 \$6.00 | |

REPRINTS REPRINTS

- | | |
|--|---|
| <input type="checkbox"/> 169 Think Tank (133 Circuits) \$3.50 | <input type="checkbox"/> 169A Think Tank Vol. 2 \$3.00 |
| <input type="checkbox"/> 168 Fact Cards (#34-66) \$4.00 | <input type="checkbox"/> 168C Fact Cards (#67-99) \$3.50 |
| <input type="checkbox"/> 168D Fact Cards (#100-132) \$3.50 | <input type="checkbox"/> 167 Designing With IC's \$4.00 |
| <input type="checkbox"/> 166 Collected Works of Mohammed Ullyses Fips
(62 pages, April Fools Collection) \$7.50 | <input type="checkbox"/> 165 How to Repair CD Disc Players \$5.00 |
| <input type="checkbox"/> 165 How to Repair CD Disc Players \$5.00 | <input type="checkbox"/> 164 Modern Electrics (April 1908) \$3.00 |
| <input type="checkbox"/> 164 Modern Electrics (April 1908) \$3.00 | <input type="checkbox"/> 163 Receiving Satellite TV \$5.00 |
| <input type="checkbox"/> 163 Receiving Satellite TV \$5.00 | <input type="checkbox"/> 162 Build Your Own Satellite TV Receiver \$5.00 |
| <input type="checkbox"/> 162 Build Your Own Satellite TV Receiver \$5.00 | <input type="checkbox"/> 161 Descrambling (Feb., 1984) \$3.00 |
| <input type="checkbox"/> 161 Descrambling (Feb., 1984) \$3.00 | <input type="checkbox"/> 160 New Ideas - 42 Circuits \$3.50 |
| <input type="checkbox"/> 160 New Ideas - 42 Circuits \$3.50 | <input type="checkbox"/> 159 Low Frequency Receiving Techniques
Building and using VLF Antennas \$5.00 |
| <input type="checkbox"/> 159 Low Frequency Receiving Techniques
Building and using VLF Antennas \$5.00 | <input type="checkbox"/> 158 Electro Importing Co. Catalog
(Circa 1918) \$5.95 |
| <input type="checkbox"/> 158 Electro Importing Co. Catalog
(Circa 1918) \$5.95 | <input type="checkbox"/> 157 All About Kits \$2.00 |
| <input type="checkbox"/> 157 All About Kits \$2.00 | <input type="checkbox"/> 156 How To Make PC Boards \$2.00 |
| <input type="checkbox"/> 156 How To Make PC Boards \$2.00 | <input type="checkbox"/> 155 IBM Typewriter To Computer \$2.00 |
| <input type="checkbox"/> 155 IBM Typewriter To Computer \$2.00 | <input type="checkbox"/> 154 How To Repair VCR's \$3.50 |
| <input type="checkbox"/> 154 How To Repair VCR's \$3.50 | <input type="checkbox"/> 150 Pay TV Decoder (1981) \$3.00 |
| <input type="checkbox"/> 150 Pay TV Decoder (1981) \$3.00 | |

To order any of the items indicated above, check off the ones you want. Complete the order form below, include your payment, check or money order (DO NOT SEND CASH), and mail to Radio-Electronics, Reprint Department, P.O. Box 4079, Farmingdale, NY 11735. Please allow 4-6 weeks for delivery.

If you need a copy of an article that is in an issue we indicate is unavailable you can order it directly from us. We charge 50¢ per page. Indicate the issue (month & year), pages and article desired. Include payment in full, plus shipping and handling charge. Make checks payable to Gernsback Publications, Inc.

ARTICLE _____

PAGES _____ MONTH _____ YEAR _____

TOTAL PAGES _____ @50¢ each TOTAL PRICE _____

MAIL TO: Radio-Electronics
Reprint Bookstore, P.O. Box 4079, Farmingdale NY 11735

All payments must be in U.S. funds

SHIPPING CHARGES IN USA & CANADA

\$0.01 to \$5.00 \$1.25	\$30.01 to 40.00 \$5.00
\$5.01 to \$10.00 \$2.00	\$40.01 to 50.00 \$6.00
\$10.01 to 20.00 \$3.00	\$50.01 and above \$7.50
\$20.01 to 30.00 \$4.00	

SORRY — We only ship to USA & Canada

Total price of merchandise \$ _____
Sales Tax (New York State Residents only) \$ _____
Shipping Charge (see chart) \$ _____

Name _____ Total Enclosed \$ _____

Address _____

City _____ State _____ Zip _____

RES

nal averaging, five programmable input ranges, and extensive triggering including pre/post, pattern, edge, state, and external.

The R1222 waveform recorder system costs \$4995.00.—**Rapid Systems Inc.**, 433 North 34th Street, Seattle, WA 98103; Tel: 206-547-8311; Fax: 206-548-0322.

TOOL KIT. The computer-designed *Tec-Tuff Kit* contains a practical assortment of top-quality tools in a rugged and durable case. The case features a valance design and has a heavily padded handle, a



CIRCLE 27 ON FREE INFORMATION CARD

three-tumbler combination lock, and recessed locks that will open when the case is right side up. The *Tec-Tuff* case is 18½ inches long and 13½ inches wide, and is available in 6-, 8-, and 10-inch depths.

Prices for the *Tec-Tuff* tool kits range from \$135.00 to \$150.00.—**Techni-Tool Inc.**, 5 Apollo Road, P.O. Box 368, Plymouth Meeting, PA 19462.

REPAIRABLE 300-MHz OSCILLOSCOPE PROBES. Designed to fit all scopes having 1-megohm input, *Test Probes Inc.'s (TPI)* thin-cable 300-MHz oscilloscope probes are constructed to allow inexpensive replacement of failed parts. The modular probes screw together



Computers, Components, Tools And Supplies

Computer Products

3931 Edwards Road
Cincinnati, OH 45209

1 (800) 423-4499

Free Mouse !!!!!

Microsoft Windows 3 bundled with Z-NIX serial mouse

Buy Microsoft Windows 3 for 1/3 off the retail price and get a **FREE Z-NIX Super Mouse II** - This special package deal includes Microsoft Windows version 3.0 and a Z-NIX 2 Button serial mouse with cable and driver..

Limited Quantity.....\$99.99

Heathkit Deals...

Genuine Heathkit Kits - original packaging with all parts and documentation - Heathkit catalog close-out...

Data Line Protector Kit SK202 - Skill Level 1 - Easy beginners kit to help protect your RS232 C lines from voltage spikes and static charge build-ups.

1/3 off!\$9.99

Baud Rate Analyzer Kit SK205 - Skill Level 1 - Displays baud rates between 300 and 38.4K - Combination M/F DB25 connector with selectable pin 2 or 3 configuration

60% off!\$19.99

Ribbon Blowout...

We bought out the stock of a local distributor and we're selling these ribbons out at ridiculous prices - All new ribbons in the original sealed packages - no returns

IBM Proprinter XL Ribbons - black, wide carriage
OKIDATA Microline 292 Ribbons - black nylon, narrow
T.I. 810 Rainbow Pack 2 blk, 1 brn, 1 blu, 1 grn, 1 red
Diablo Hytype II - black multistrike

6 ribbons per box, each box
Your choice.....\$9.99

Super Cable Deals..

6' IBM ptr cable.....\$8.88
10' IBM ptr cable.....\$12.88
25' IBM ptr cable.....\$24.88

Custom cables....

Serial or Parallel\$16.00 + 1.00/foot
Any length - Any pinout

Software Deals...

All brand name - brand new software - factory fresh with unbroken seals and registration cards

EasyLan 2 - Low cost, easy to install networks using the PC's serial port. Two PC system with cables and software - PC magazine says "Cast Iron Reliable"

1/2 price.....\$99.99

EasyPrint - Multiple computers, shared printers, background printing on PC, XT, AT or PS/2 or compatible systems - PC magazine says "Best Bargain"

Now Only.....\$49.99

Reference File - The first really serious pop-up database management system - perfect companion to 1-2-3, Dbase or almost any other program.

Give away price!\$9.99

Twin Advanced - Spreadsheet, Graphics, Data Management - File and macro compatible with 1-2-3 1A and Release 2 - much better graphics than 1-2-3 - over 150,000 sold!!

Unbelievable!.....\$9.99

SQZ Plus - The best file utility for 1-2-3 - Shrinks Lotus files by up to 95% - Backup and recover your spreadsheets easily and quickly.

Incredible!.....\$9.99

Weller Solder Station

WTCPR Professional Soldering Station - Low voltage, temperature controlled tip - Uses standard Weller tips

Under Cost.....\$79.99

286 Motherboard...

The manufacturer made a one-time deal with us on a great AT motherboard with the latest DFI chipset

12.5 MHz PC-AT compatible system board - 80286 chip running at 12.5 or 8 MHz, hardware or software selectable - 8 MHz bus speed - up to 4 MB of memory can be installed - supports EMS 4.0 driver - baby AT size - coprocessor socket - 3 XT slots, 4 AT slots - AMI BIOS

Lowest price!.....\$129.99

3-in-1 Meter DC Volts, Amps, Watts Measured Simultaneously!



**One low
cost meter
saves panel
space.**

The APM70W Series, 3-in-1 analog meter uses two isolated meter movements that measure DC Volts and Amps. Where the Volt and Amp meter pointers intersect, DC Watts are read from a calibrated scale on the same meter face. Custom meter faces can be supplied. Only one panel cutout required to mount meter.

DC Voltage Range: 0-30VDC. (All models)
DC Current Range: 0-5, 0-15 or 0-30 Amps
DC Wattage Range: 80, 250 or 500 Watts.

**ASK ABOUT
OUR FULL
LINE OF
LOW COST
METERS.**



Challenger
Series



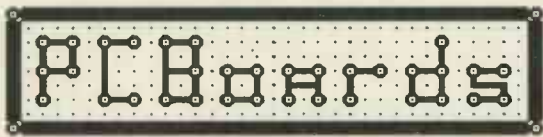
Master
Series



Champion
Series

D1 International, Inc.

95 E. Main St., Huntington, NY 11743
Phone: (516) 673-6866 • FAX: (516) 673-6893



P-C-B ARTWORK MADE EASY !
Create Printed Circuit Artwork on your
IBM or Compatible

- * MENU DRIVEN
- * HELP SCREENS
- * ADVANCED FEATURES
- * EXTREMELY USER FRIENDLY
- * AUTO GROUND PLANES
- * 1X and 2X PRINTER ARTWORK
- * 1X HP LaserJet ARTWORK

* HP and HI PLOTTER DRIVER optional 49.00

REQUIREMENTS: IBM PC or Compatible, 384 K RAM
DOS 3.0 or later. IBM compatible printers.

PCBoards - layout program 99.00
PCRoute - auto-router 99.00
SuperCAD - schematic pgm. 99.00
DEMO PKG. - 10.00

Call or write for more information
PCBoards

2110 14th Ave. South, Birmingham, AL 35205
(205) 933-1122



**CIRCLE 28 ON FREE
INFORMATION CARD**

without soldering for on-site repairs and provide a more secure contact than snap-together probes. A distinctive, sawtooth-shaped center conductor eliminates microphonics. That design offers superior resistance to breakage from pulling and bending. The cable that is used is thinner and more flexible than those with straight conductors.

The 300-MHz probe assures precise measurements with less than 3% overshoot and 1.2-nanose-

cond risetime. Some models have an activator pin for readouts and automatic scale factoring that can be used on scopes having that feature.

List prices for the 30-MHz TPI probes begin at \$74.00.—**Test Probes Inc.**, 9178 Brown Deer Road, San Diego, CA 92121; Tel: 619-535-9292.

TOROID TRANSFORMER TESTER.

Atlantic Magnetics' model 3500A toroid transformer tester can be used for in-process testing and incoming inspection of transformers and inductors wound on donut-shaped toroid cores. The tester can handle just about every available size toroid, ranging from small-signal, 0.060-inch core-inside diameter transformers for communications, up to large, 8-inch core-inside diameter trans-

CABLE TV "BOXES"

**Converters—Descramblers
Remote Controls
Accessories**

- ★ **Guaranteed Best Prices** ★
- ★ **1 Year Warranty—C.O.D.'s** ★
- ★ **Immediate Shipping** ★
- ★ **FREE CATALOG** ★

Call or Write

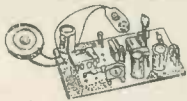
TRANS-WORLD CABLE CO.

12062 Southwest 117th Court Suite 126
Miami, Florida 33186

1-800-442-9333



RAINBOW KITS



RADAR SIGNAL DETECTOR

If you think that a sensitive radar detector is a complicated piece of equipment, take a look at this new kit. This simple, yet effective, detector circuit can be built in less than an hour and can be tuned to respond to signals between 50MHz to 500GHz. It's a fun kit to build and play with. A cigarette lighter plug is included. Size 1"x3/4" operates on 9 to 15v DC.

KIT RSD-1 \$12.95

STROBE LIGHT

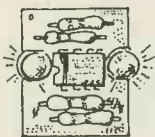
If you need an attention getter, or warning light, you need the strobe light kit. Use it for emergency light for autos, for model planes or radio towers. Even use it on your bicycle. Operates on 6 or 12v DC and has a variable strobe rate.

KIT ST-1 \$8.95

DIGITAL THERMOMETER

Have you ever wanted to tell temperature changes fast & accurately? The DT-1 kit will turn your digital volt meter into an accurate digital thermometer with .1 degree resolution. It gives you a 250 degree window with a range from -40F to 300F degrees. It has a remote sensor .25" sq. that can be mounted many feet from the meter if need be.

KIT DT-1 \$8.95



BLINKY LIGHTS

Want to attract attention? These kits are perfect for decorating name tags, lighting up your hat, or flashing lights for your model trains. Some people use them to simulate a burglar alarm for autos. Put it in a box, set it on your dash and it looks like the real thing. Each kit contains two LEDs that alternates flashing. Operates on a 9v battery. Size 5"x5"

KIT RB-2 \$3.45

CAPACITANCE METER

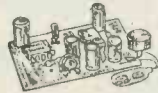
This easy to build kit will turn your digital volt meter into a CAPACITOR METER. Turn that junk box of unmarked capacitors into a fortune. Measures capacitors from (2pF to 2.2uF. Operates on a 9v battery. Size 1.75"x2"

KIT CA-2 \$12.95

WIRELESS FM MIKE

Small but mighty .8"x1" PCB, will really stomp out a signal well over 400 yds. This is a buffered wireless mike that operates on 80 to 120 MHz FM. Comes complete with a microphone, and 9V battery connector. Operates on 6 to 12v DC.

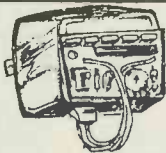
KIT WM-1 \$12.95



SUPER SNOOPER-BIG EAR

Use this BIG EAR amplifier to listen through walls, hear conversations across the room. Beef up the sensitivity with a parabolic reflector and hear blocks away. Due to the size, the BIG EAR can be hidden about anywhere. Use the earphones from a pocket transistor radio to listen. Makes an ultra-sensitive intercom. Can also be used as a general purpose 1.5W amp. We supply a mini-microphone in the kit. You can also use any 8 to 45 ohm speaker. Operates on 6 to 12v DC. Size 1"x1.75"

KIT AA-1 \$10.95



AC LINE MONITOR

This is something every computer user, photographer, or anyone that must maintain a safe usable AC line voltage should have handy. Monitor the voltage of your motor home's 110v AC generator inside the motor home. Every technician's bench needs this item. The AC line monitor will indicate, with multi-color LEDs, what voltage is being distributed to your equipment at that particular outlet.

KIT LM-110 \$10.95



12V BATTERY MONITOR

Have you ever been in your car, boat, or camper — you try to start your motor but the battery is dead? The BATTERY MONITOR kit uses the cigarette lighter plug outlet to monitor the true battery voltage. Multi-color LEDs indicate the voltage in 1v steps from 11v to 15v, green means great, yellow is good, and red — call the tow truck or get out the oars. Size 1.2"x1.75"

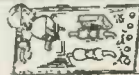
KIT LM-12 \$5.95



PHONE TRANSMITTER

Small but mighty, so small it fits anywhere. Telephone line powered, never needs batteries. Transmits both sides of a phone conversation loud and clear, wireless, to any FM radio at great distances away. Variable tunes 70MHz to 130MHz. It can also be used to make any phone a speaker phone. Size .55"x1"

KIT TEL-B1 \$10.95



PHONE RECORDING SWITCH

This telephone line powered switch is small enough to install anywhere only .9"x.6". Every time someone picks up the phone the tape recorder will record both sides of the conversation automatically. Use it in your office to record all phone conversations so you don't lose that important address you wrote on the back of an envelope.

KIT TEL-SW 1 \$10.95

BUSY PHONE LIGHT

Add this little kit to any or all of your phones. When any extensions are in use the LED will light. Uses a 9v battery. P.C. Board 1"x1/2". Complete with etched & drilled PCB, all parts and schematics.

KIT TEL-LIT-1 \$9.95



VOICE ACTIVATED SWITCH

This vox can be used to operate a tape recorder, ham radio, CB radio. Use it to turn on an alarm. The output can operate a load up to 100ma. It will operate a relay, lights, motor, or LEDs. What could you do with a sound activated switch? Size 1.5"x1.25"

KIT VOX-1 \$6.95

LIE DETECTOR

This kit can be great fun at parties. Lie and an audible tone will change, the more you lie the more the tone changes. When you lie your palms & forehead sweat. This kit allows you to measure these changes. Only a very slight amount of change will cause the tone to increase in frequency. Operates on 6 to 12v DC. Size

KIT LD-1 \$9.95

THE STRIPPER

X XXXX RATED

- X WE HAVE THE BEST UNIT YOU CAN BUY AT ANY PRICE
- X ALL AUTOMATIC • NO CONTROLS
- X 1 CABLE IN — 1 CABLE OUT
- X USE ON ANY VCR
- X THE ONLY UNIT WITH THE ENHANCING SWITCH
- X 100% MONEY BACK GUARANTEE



VIDEO STABILIZER

If you rent movies you need THE STRIPPER

When watching rental movies you will notice annoying picture flashing from dark to light, color shifts, unwanted lines, & picture jitters. This is caused by the copy protection installed in the video tape by the manufacturer. THE STRIPPER completely eliminates all copy protection and gives you crystal clear copies.

WE HAVE THE ENHANCING SWITCH

SOME NEW COPYGUARD SCHEMES REQUIRE ADDITIONAL CIRCUITRY TO CLEAR THE PICTURE COMPLETELY OF UNWANTED LINES AND PICTURE INTERRUPTION. THIS IS THE PURPOSE OF THE ENHANCING SWITCH. NO OTHER UNIT ON THE MARKET HAS THIS FEATURE!

THE STRIPPER's intended use is to stabilize and restore crystal clear pictures to prerecorded video tapes for your personal viewing enjoyment. Electronic Rainbow doesn't recommend using The Stripper to duplicate perfect copies from rental tapes in your own home for your personal use.

COMPLETELY
BUILT \$49.95

WARNING: Use of this device to duplicate copyright material may be against certain federal & state laws.



THIS MANUAL CONTAINS ALL SCHEMATICS, PARTS & P.C. BOARD LAYOUTS FOR ALL OF THE RAINBOW KITS. USE YOUR OWN PARTS TO CONSTRUCT ANY OF OUR KITS.

KIT BOOK \$14.95

\$5.00 OFF IF YOU BUY ANY KIT.



TV NOTCH FILTERS

OUR TV FILTERS ELIMINATE UNWANTED TV CHANNELS OR ANY INTERFERENCE THAT ALTERS BOTH THE SOUND AND VIDEO.

Channels available 2 thru 6 & 14 thru 22
Specify a specific channel when ordering

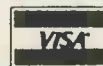
CHOICE
14.95
EACH

NOTE: All TV Filter Kits are sold for educational purposes only. You must obtain permission from your local cable company before using these filters on your cable system.



Please add sufficient postage

We will accept telephone orders for Visa & Mastercard



To Order Call
317-291-7262



ELECTRONIC RAINBOW

6254 LaPas Trail • Indianapolis, IN 46268

Add New Enjoyment To Your SW Receiver with the *MICRODEC™ Decoder

MODE
Selects, CW, RTTY, ASCII

**POWER/
VOLUME
CONTROL**

**ALPHANUMERIC 5X7 DOT MATRIX
8 SEGMENT LED DISPLAY**

**SIGNAL STRENGTH
INDICATOR LED**

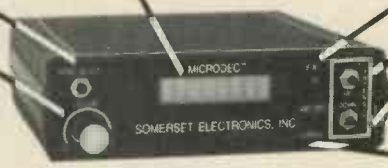
**DISPLAY
INTENSITY
CONTROLS**

**SEVEN LEVELS
OF INTENSITY**

**BATTERY CHARGE
LED**

\$199

LIST PRICE \$229.95



MICRODEC™ decodes MORSE, RTTY, and ASCII to ALPHANUMERIC CHARACTERS

- Automatically tracks MORSE code speeds from 5 to 70 WPM
- Decodes 60,67,75,100 wpm RTTY and 110, 330 BAUD ASCII.
- Standard ASCII port to interface with your computer.
- Internal practice code oscillator.
- Standard cockpit green display. (red & yellow optional)
- Power switch/Volume control/Internal speaker
- Completely portable with optional NICAD rechargeable batteries mounted internally. — \$29.95 (List \$49.95)
- Ultra compact and lightweight (1.5H X 5.08W x 5.25L)
- Optional display color: \$15.00 (List \$30.00) (red or yellow)
- Operates on DC voltages between 9 VDC and 15 VDC (AC/DC adapter provided at no cost).

SHIPPING AND HANDLING: Continental United States add \$8.50 for UPS ground. Florida residents add 6% sales tax. Other types of Express shipments and foreign destinations will be quoted on request.

METHODS OF PAYMENT: MasterCard, VISA, Money Orders, Certified Checks, and Personal Checks. (Please allow two weeks for personal checks to clear.) QUANTITY DISCOUNT FOR HAM/SWL CLUBS. Dealer Inquiries Welcome.

SOMERSET ELECTRONICS, INC.

1290 HIGHWAY A1A, SATELLITE BEACH, FL 32937 • ORDER & FAX: (407) 773-8097

**ORDER YOUR
CLASSIFIED SPACE
FOR MARCH 1991
NOW—SEE ORDER
FORM PAGE 68**

DataCraft
INTERNATIONAL



Looking for

Bargain\$?



DRAM

1MX1-70	\$5.99
1MX1-80	\$5.59
1MX1-100	\$5.49
41256-70	\$1.89
41256-80	\$1.79
41256-100	\$1.69
44256-80	\$5.89
4164-100	\$1.59
4464-100	\$1.99

SIMM/SIPP

1MX9-80	\$55.00
1MX9-100	\$54.50
256Kx9-80	\$16.50
256Kx9-100	\$16.00
1Mx8-80	\$54.00
4Mx9-80	\$339

Prototype Cards

for IBM/PC/XT/AT/PS2
Universal plug-in
from 4"x4" **\$12.5**

Eprom Programmer 8031, Z80, 6809

PC-based Programmer
• Programs 27xx and 27xxx up to 27010.
• Supports various Formats and voltages. w/software

\$115 Up to 27512

Single Board Computer

8031: 8155+2764+RS232
Z-80: 2x8255+2764+6264
6809: 2x8255+2764+6264

Bare board with schematics **\$18.5**

486-25, 100MB, SVGA sys	\$3190
386-33C, 100MB, SVGA sys	\$2350
386-25C, 40MB, SVGA sys	\$1850
386-SX, 40MB, SVGA sys	\$1390
286-16, 40MB, SVGA sys	\$1150

All systems include: 1Mb memory, 5.25" 1.2M Floppy Drive or 3.5" 1.44M Floppy Drive with controller, 101 Enhanced Keyboard, AT Desktop case with Power supply, 2 Serial, 1 Parallel, 1 Game port, High quality Gold Star SVGA 1024x768 14" Color Monitor.

Order Call (800) 873-3709

• All prices are cash only, Quantity pricing CALL.
• Add \$3.5 minimum S&H, and add \$3.5 for COD.
• Add 7.25% Sales Tax on CA residents.
• Money Order, Personal Check, PO accepted.
2828 lone Drive, San Jose, CA 95132 (408) 259-4866

Motorless Motion!

Robotics! Engines! Inventions!
Thin Shape Memory Alloy wires contract like living muscle when electrically activated.

Space Wings - Sleek silver wings flap silently using only 5 cm of SMA wire. Assemble this futuristic kit in under an hour. Stands 15 cm high. Perches on your PC or desk lamp. Annoys cats. With printed circuit board, parts, info on SMAs, and complete instructions. Runs on two AA batteries (not included).

3-001 Space Wings Kit \$19.95



Send a business size Self-Addressed Stamped Envelope for latest catalog.

Order Today - Send check or money order (sorry no credit cards). CA orders add 7.25% tax. All orders add \$4 P&H (\$8 to Canada).

**Mondo•tronics • 2476 Verna Ct.
San Leandro, CA 94577 • USA**

9/90

REVOLUTIONARY LOGIC PROBE

BECKTRON's TD-4, THE ONLY FOUR CHANNEL LOGIC PROBE



BECKTRON's TD-4

Dealers Inquiries Welcome

THE TD-4 IS LIKE FOUR LOGIC PROBE IN ONE EACH CAN BE USED INDEPENDENTLY OR SYNCHRONOUSLY THE TD-4 IS A FOUR BIT TRIGGER SOURCE FOR YOUR OSCILLOSCOPE

THE TD-4 FEATURES: "TECHNOLOGICALLY ADVANCED SIMPLISTY" 4 CHANNEL OF QUALIFIERS; RE-OCCURRING DATA CAPTURE; ONE TIME EVENT DATA CAPTURE UP TO 15 NANO-SECONDS; PROPAGATION DELAY COMPENSATION; TTL AND C-MOS COMPATIBLE; SHIRTPOCKET PORTABLE; AFFORDABLE; 4 CHANNEL EVENT RELATIONSHIP, FOUR BIT TRIGGERING EXTERNAL SOURCE FOR YOUR OSCILLOSCOPE AND MORE;

TD-4 PRICE \$229.00

BECKTRON
Honing The Technical Edge





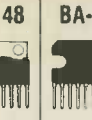


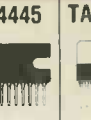

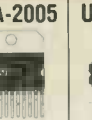
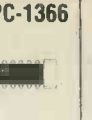














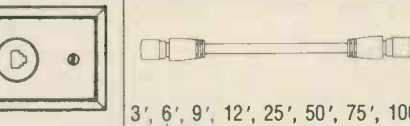




1-800-592-4141

Full line catalog available
Terms: Visa / MC / COD

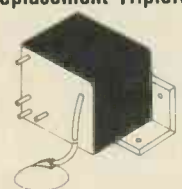
MADE IN
USA

CIRCLE 284 ON FREE INFORMATION CARD

 as low as .17	 as low as 1.10	 as low as 1.15	 as low as 1.10	 as low as .81	 as low as .96	 as low as .95	 as low as 1.20	 as low as .99	 as low as .90	 as low as 8.60
 as low as .03	 as low as .05	 as low as .07	 as low as .21	 as low as .36	 as low as 1.49	 as low as 1.25	 as low as 1.90	 as low as .20	 as low as .20	 as low as 19.50
 as low as 1.99	 as low as .50	 as low as .51	 3', 6', 9', 12', 25', 50', 75', 100'				 Large Selection of Rubber Belts		 as low as 8.75	

FOR MORE INFORMATION ABOUT OUR PRODUCTS AND PRICING PLEASE CALL FOR A FREE CATALOG

Replacement Triplers



Order#	Replaces	1-9	10+
61-500	500A	8.57	7.34
61-521	521	9.22	7.90
61-522	522	10.29	8.82
61-523	523	8.70	7.45
61-526	526A	8.71	7.47
61-528	528	8.79	7.53
61-529	529	8.79	7.53
61-530	530	8.80	7.54
61-531	531	10.11	8.67
61-532	532	9.33	8.20
61-533	533	9.34	8.02
61-534	534	9.81	8.42
61-535	535	9.81	8.42
61-537	537	9.93	8.99
61-538	538	8.62	7.38
61-539	539	8.73	7.48
61-549	549	11.22	9.61
61-550	550	11.76	10.08
61-556	556	10.85	9.30
61-557	557	9.70	8.31
61-559	559	10.38	8.90
61-561	561	10.57	9.06
61-564	564	9.28	7.98

FLYBACK REPLACEMENTS

EMERSON			KAWASHO			SAMSUNG			SHARP		
REPLACES MFR#	ORDER#	1-4	REPLACES MFR#	ORDER#	1-4	REPLACES MFR#	ORDER#	1-4	REPLACES MFR#	ORDER#	1-4
0432140021	62-810	18.47	101-214-004-03	62-170	17.33	FBC-1215AL	62-650	12.24	RTRNF 0003PEZZ	63-810	22.50
0432140071	62-825	22.16	101-214-005-03	62-180	17.34	FCM-2015BL	62-680	18.47	RTRNF 0009PEZZ	63-820	22.86
0432140081	62-830	18.60	101-214-009-03	62-190	17.34	FMD-1235BL	62-760	12.24	RTRNF 0014	63-840	20.50
0432200111	63-0122	31.72	101-220-002-03	62-200	23.16	SANYO REPLACES MFR# | ORDER# | 1-4 4-2751-48500 | 63-105 | 8.00 4-2751-48600 | 63-110 | 8.00 4-2751-60108 | 63-115 | 7.59 FO-192A | 63-135 | 15.70 FO-239 | 63-150 | 15.71 FO-240 | 63-155 | 17.10 FO-241 | 63-160 | 15.57 FO-243 | 63-170 | 19.86 FO-260 | 63-180 | 15.94 F-1108 | 63-220 | 15.74 F-1117 | 63-225 | 25.86 F-1119 | 63-240 | 17.15 F-1123 | 63-250 | 15.55 F-1125 | 63-252 | 15.91 F-1129 | 63-255 | 25.85 F-1133 | 63-260 | 21.51 F-1148 | 63-270 | 20.88 F-1177 | 63-280 | 19.45			RTRNF 0015	63-840	20.50
GOLDSTAR REPLACES MFR# | ORDER# | 1-4 154-040 | 63-409 | 17.59 154-040A | 63-410 | 17.30 154-040B | 63-412 | 19.99 154-041A | 63-411 | 17.55 154-056A | 63-415 | 17.14 154-074A | 63-450 | 15.00 154-074E | 63-451 | 18.51 154-074N | 63-0102 | 18.52 154-122E | 63-460 | 15.30			PANASONIC REPLACES MFR# | ORDER# | 1-4 TLF-6041F | 62-485 | 28.28 TLF-69965 | 62-510 | 26.97 TLF-14401F | 62-570 | 20.78 TLF-14503F | 62-580 | 22.16 TLF-14617F | 62-490 | 27.27 TLF-14706 | 62-601 | 27.16 TLF-69983 | 62-520 | 26.97 TLF-70012 | 62-740 | 18.60 TLF-80082-1 | 62-530 | 9.42 TLF-80843-1 | 62-540 | 9.42						RTRNF 0016	63-850	20.50
HITACHI REPLACES MFR# | ORDER# | 1-4 2432471 | 63-0104 | 23.15 2432811 | 63-0105 | 23.15 2432944 | 62-840 | 35.24 2433171 | 63-0118 | 30.94 2434391 | 62-850 | 18.47 2434401 | 62-860 | 18.60 2434651 | 63-0103 | 20.37 7334021 | 63-0101 | 28.40			SAMPO REPLACES MFR# | ORDER# | 1-4 8FT-024D | 63-680 | 8.06 8FT-043B | 63-900 | 9.01 8FT-046 | 63-870 | 8.06 8FT-063A | 63-890 | 8.06 FB-1053 | 63-210 | 18.27 FB-1061A | 63-0109 | 19.42 FB-3005 | 63-0110 | 21.62 FB-01166 | 63-0121 | 29.76			RTRNF 0059	63-860	20.50			
A.O.C. REPLACES MFR# | ORDER# | 1-4 79A 302-1 | 63-0107 | 22.68			R.C.A. REPLACES MFR# | ORDER# | 1-4 164581 | 63-0108 | 20.88			RTRNF 1335CE	63-1335	34.22			
						RTRNF 1431CEZZ	63-910	24.93			
						RTRNF 1452CEZZ	63-920	24.93			
						RTRNF 1477CEZZ	63-930	24.93			
						RTRNF 1588C	63-0108	25.00			
						TANTUNG REPLACES MFR# | ORDER# | 1-4 FTB-174 | 63-0117 | 21.62					

FOR FIVE OR MORE PIECES. PLEASE CALL OUR TOLL FREE NUMBER

What you see here is not only what you get.

WE STOCK...

over 13,000 different items, act now, start the saving. Call us or FAX us, for your free large catalog, we will mail it to you right away.
Or Fax us your inquiry. (213) 727-6032 OR (213) 888-6032

SEMI-CONDUCTORS					
74	3SK	BUX	LB	MPS	TD
74HC	AC	BUY	LC	MPSA	TBA
74LS	AD	CA	LD	NE	TOA
1N	AN	CX	LM	SN	TDA
2N	BA	DM	M	STA	TIP
2SA	BC	GL	MB	STK	UA
2SB	BD	HA	MC	STR	ULN
2SC	BF	HD	MJ	SN	UPA
2SD	BU	KA	MJE	TA	UPC
2SK	BUW	LA	MN	TC	UPD

SERVICE:

It took us decades in this business to have 16,000 customers. Aggressiveness to serve you the customer. We do all we can to help you save and grow.

PRICES:

Our competitive prices have moved us to the front of the line in this industry. We have low, low prices because we are convinced to mark up every item we have the lowest % we can afford.

SHIPPING:

We ship anywhere in the world within 24 hours from the date of your confirmation. We can use:
 • Airmail
 • DHL
 • Airlines
 • or other means of transport

QUALITY:

We sell premium high quality merchandise, if it was not that good we would not buy it ourselves, and we offer satisfaction guaranteed.

A SUMMARY OF WHAT WE HANDLE

- Genuine made semi-conductor
- I.C. sockets
- Fuses & lamps
- Connectors audio/video
- Cable assemblies audio/video
- Magnetic tape heads
- DC motor 6, 9, 12 volts
- Rubber belts audio/video
- Pinch rollers audio/video
- Video idler assemblies, wheels & tires
- Video heads & belt kits
- CATV/MATV accessories
- Ties & clips
- Indoor TV antenna
- Video R.F. modulator
- High voltage triplers

Min. Order \$49.00

All prices, terms, and conditions subject to change without any notice

1-800-325-2264

DALBANI CORPORATION OF AMERICA

Address: 2733 CARRIER AVENUE
 LOS ANGELES, CALIFORNIA 90040
 UNITED STATES OF AMERICA

Tel: (213) 727-0054
 Fax: (213) 727-6032
 (213) 888-6032

ALL SALES IN U.S. DOLLARS



WE ACCEPT VISA | M.C.I. | Am.Ex.

CIRCLE 260 ON FREE INFORMATION CARD

Double your income! Computer maintenance/service - a \$10 billion industry.

If you are presently servicing TVs, VCRs, camcorders or any other electronic equipment, computer repair can **double your income**.

National research results indicate that computer technicians bill out at double the hourly rate of electronic equipment technicians.

Tech-Serv can put you into computer repair quickly, economically and efficiently and with a complete support program including a **proven marketing plan**.

We provide:

RECOGNITION

Nationally recognized trademarks and logos give you immediate recognition as a professional computer repair specialist by being a Tech-Serv Authorized Computer Repair Center in your market area.

DOCUMENTATION

We provide manuals, schematics, documentation and advanced diagnostic software.

NEW HARDWARE

CPU's: IBM, Apple, Compaq, and others.
Printers: Okidata, Epson, HP Lasers and others at huge discounts.

PARTS & BOARD REPAIR

Single source for parts and board repair.
24-hour express turnaround.

TRAINING

Hands on training: IBM, Compaq, Apple, and compatibles at 3 separate levels:

Level 1: 8086-8088 Based Machines
DOS System Configuration
and upgrades

Level 2: 80286/80386 Machines, Letter
Quality and Laser Printers

Level 3: System Networks Configuration,
Installation and Repair

FINANCING

Available for qualified businesses.

OVER 165 DEALERS WORLDWIDE

Find out why more and more electronic professionals are adding computer repair to their businesses or starting their own computer repair businesses.

Call Tech-Serv at (212)967-1865 now.

techserv AUTHORIZED DEALER
SERVICING THE WORLD OF MICROS

253 West 28th Street, New York, NY 10001

© 1989 Tech-Serv Corp.



CIRCLE 29 ON FREE
INFORMATION CARD

formers for power conversion and transmission applications.

The instrument accurately determines and displays the turns-count of toroid transformer core windings, even if they are overlaid with hundreds of turns wrapped with finishing tape. By eliminating the need for benchtop setups of signal generators, oscilloscopes, and voltmeters, use of the 3500A reduces the chance for human error and level of skill required to do that type of testing.

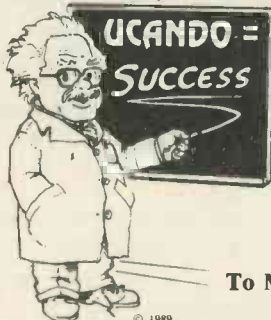
Toroids are placed over the instrument's conical mounting hub and, at the touch of a button, a rotating contact arm swings into position to complete the low-voltage primary connection. In 100 ms or less, the test is performed and the results are displayed; total test time is just 15 seconds. A low-permeability mode, in which the unit is used to compare toroids under test to known turns-count reference transformers, solves the testing problems caused by low-permeability core materials. A wide selection of reference toroids for testing purposes are available separately.

The model 3500A toroid-transformer tester costs \$1995.00; reference toroids cost \$50.00 each.—**Atlantic Magnetics, Inc.**, 1441 SW 30th Avenue, Pompano Beach, FL 33069; Tel: 305-979-7920; Fax: 305-977-5128.

R-E

LEARN ELECTRONICS FROM VHS VIDEO TAPES!

At
Ucando
your Success
is our
Business!



Our Video Tapes
Are Designed
To Make Learning Electronics
Fun and Easy!

© 1989

- PART 1-DC, 53 min.....\$32.95
Electronics and You—VT-201
- PART 2-AC, 71 min.....\$32.95
Electronics and You—VT-202
- PART 3-SEMICONDUCTORS,
47 min.....\$32.95
Electronics and You—VT-205
- PART 4-POWER SUPPLY
55 min.....\$32.95
Electronics and You—VT-206

- PART 5-AMPLIFIERS
52 min.....\$32.95
Electronics and You—VT-207
- PART 6-OSCILLATORS
54 min.....\$32.95
Electronics and You—VT-208
- VCR MAINTENANCE & REPAIR
VT-203—54 min.....\$32.95
- INTRODUCTION TO VCR REPAIR
VT-204—110 Min.....\$59.95

CALL TOLL FREE AT

1-800-678-6113

or

mail check or money order to:

UCANDO VIDEOS

P.O. BOX 928 • GREENVILLE, OH 45331

**ORDER
NOW!**

**VISA
AND
MASTERCARD
ACCEPTED**

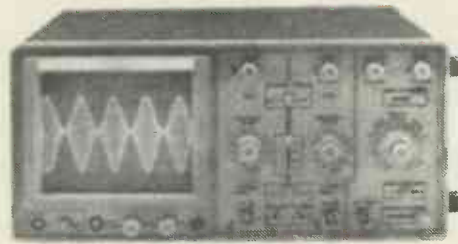
CIRCLE 285 ON FREE INFORMATION CARD

PROTEK TEST INSTRUMENTS

OSCILLOSCOPES

MODEL P-2020
20 MHz DUAL
TRACE
WITH COMPONENT
TESTER.

\$339



CURSOR READOUT

P-2620 20 MHz, DUAL TRACE \$699.95
P-2640 40 MHz, DUAL TRACE \$839.95

DIGITAL STORAGE SCOPES

P-2820 20MHz, 20 MS/s \$1299.95
P-2840 40 MHz, 20 MS/s \$1499.95

*All Scopes Come Complete With Probes.
Spec Sheets - Upon Request.

OTHER MODELS

P-2520 20 MHz, DUAL TRACE, DELAYED TRIGGER \$439.95	P-2035 35 MHz-50 MHz, DUAL TRACE, DELAYED TRIGGER \$449.95
P-2540 40 MHz, DUAL TRACE, DUAL TIME BASE \$689.00	P-2015 15 MHz, BATTERY PORTABLE, MINI-SCOPE \$499.95
P-2560 60 MHz, 3 CHANNEL, 8 TRACE \$899.95	P-2510 100 MHz, 3 CHANNEL, 8 TRACE \$1250.00

Auto-Ranging "Probe" and "Shirt Pocket" DMMs

- Model D-935 includes 2 probe tips (short & long; 2-LR-44 button battery), carrying case, ground lead & alligator clip.
- Size / Wt.: 1-1/8" H x 7/8" W x 6-1/3" D; 2.1 oz.
- Has audible continuity beeper data hold. Input 10M Ω
- DCV: 0.1 mV to 1000V $\pm 0.7%$ ($\pm 1%$ D-930) 5 ranges.
- ACV: 1 mV to 500V $\pm 1%$ 4 ranges.
- Resistance: 0.1 Ω to 20M Ω $\pm 0.7%$ ($\pm 2%$ D-930) 6 ranges.
- Model D-930 has diode test and includes batteries, probes, carrying case.
- Model D-930
Size / Wt.: 2" W x 4-1/3" H x 2/5" D; 3-1/4 oz.

MODEL D-935 \$29.95



MODEL D-930 \$19.95

Bar-Graph DMM

- Auto-ranging for easy accurate readings with manual over-ride.
- Range and data hold, plus Hi-low power ohms.
- Memory set, for making relative meas.
- Transistor test for NPN / PNP plus diode test.
- Analog bar-graph ideal for null-peak and trend observation.
- Extended resolution of 1:3000 in manual mode.
- Visual plus audible over range indication for voltage and current.



MODEL D-990 \$69.95

200 kHz AUDIO OSCILLATOR and DIGITAL FREQUENCY COUNTER

B-820
\$225



SWEEP FUNCTION GENERATORS

B-801 (2MHz)
\$230
B-810 (10 MHz)
\$895



FOUR FUNCTION FREQUENCY COUNTERS

Frequency, Period, Totalize, Self Check w/ High Stabilized Crystal Oven Oscillator, 8 digit LED display.

B-818 (1.2 GHz)
\$199.95
B-808 (120 MHz)
\$175



DIGITAL MULTIMETER

19 Ranges
DCV-1000
ACV-750
DCA-10A
Res-2M Ω
Diode check

D-906
\$24.95



DIGITAL LCR METER

Measures:

Coils
1uH-200H
Caps
.1pf-200uf
Res
.01-20M

ZM-108D
\$99.95



2KV and 20KV MULTIMETERS

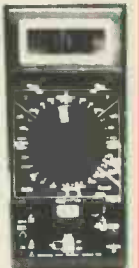
A-402Z
(20KV)
\$17.95

A-413
(2KV)
\$6.95
(MIN. 10 PCS.)



10 FUNCTION DMM WITH TEMPERATURE PROBE

- 10 Functions
- Temp. with "K" type thermo. probe - 20°C to 1200°C.
- Frequency: 10 Hz to 200 kHz, 2 ranges.
- Capacitance: 1 pf to 20 uF, 3 ranges.
- Transistors: hFE, NPN/PNP
- Diode and continuity test, data hold
- 20 ampere AC/DC
- D-910**
\$99.50



OMNITRON

ELECTRONICS

280 No. Midland Ave. (Bldg. Z-2A)
Saddle Brook, NJ 07662

201-703-9800
Fax: 201-703-9804

96 PAGE CATALOG
(FREE WITH ORDER)
\$3.00 Value

UPS Shipping. Continental USA 5%
Money Orders, Certified Checks
School Purchase Orders — Net 30
Sorry...No COD's.
Add 5% For Credit Cards
Visa - Mastercard

LAB-ON-A-CARD™

(For your IBM PC or compatible)

Imagine having all of the following instruments for one low price:

4 CHANNEL DIGITAL STORAGE SCOPE

400K samples/sec (adjustable)
flexible trigger modes:
pre, post, voltage, time
multi (like logic analyzer!)

3 CHANNEL UNIVERSAL COUNTER/TIMER

time nanoseconds to days
frequency to 1 MHz

PULSE GENERATOR

nanoseconds to days
mono or astable

DIGITAL VOLTMETER

use alone or add PK, PK-PK,
or ?? to your scope display

24 CHANNEL DIGITAL I/O

Use as trigger inputs for
instruments or general
purpose TTL I/O

Manual shows you how to
modify the instrument software
(SOURCE CODE included) or
write your own routines in any
language. Examples include:
LOGIC ANALYZER, how to
add cursors to your scope,
make a CHART RECORDER
and MORE!
Most instruments operate
concurrently.

Introductory specials:

KIT: \$295.00
Assembled \$349.00

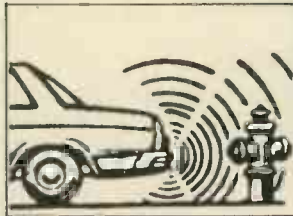
SeaSide Software
312 W. Sixth St. #108 R1
Corona, CA 91720
(714) 278-3780

VISA / MasterCard

CA residents add 6.75% tax

BACK-UP ALARM

- Prevents possible backing accidents
- Detects unseen objects behind a vehicle
- Gives out a warning signal to the driver
- Eliminates the guesswork when parking in reverse
- Never again will heavy rain, snow, or fog be a problem



- Easy installation on to the bumper
- Available in black, silver, chrome, red, ivory to match the color of your bumper
- 30 day satisfaction guarantee: Full refund if not satisfied

\$49.99

+ \$2.50 shipping & Handling

Send check or money order to:

Calco International

18040 Sherman Way Suite 511
Reseda, CA 91335

Tel: (818) 708-2334

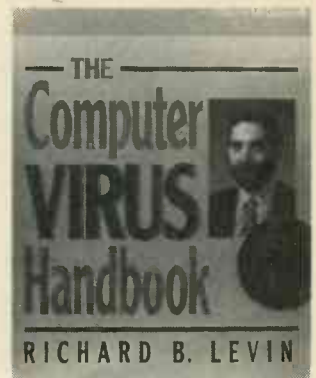
Fax: (818) 708-2362

NEW LIT

THE COMPUTER VIRUS HANDBOOK; by Richard B. Levin. Osborne McGraw-Hill, 2600 Tenth Street, Berkeley, CA 94710; softcover, \$24.95.

How can you protect your company computer data from viruses? Cutting through the hype, rumors, and false claims about computer viruses that plague the marketplace, this book is a practical and useful guide to minimizing the risk of corrupted or lost data.

The author presents an overview of how viruses and other types of "rogue" software operate, and then presents tips on preventing the spread of computer viruses. Complete coverage of antiviral policies for the workplace includes advice on evaluating and using antivirus software, identifying and eradicating viral infections, implementing viral defense mechanisms, hard-disk management techniques, and personnel policies.



CIRCLE 30 ON FREE INFORMATION CARD

Eight file-protection utility programs are discussed, and complete step-by-step instructions are provided, for FATSO (File Allocation Table Security Option); PARK (hard-disk head parker); Virscan (command-line virus scanner); Protect (software write-protect tab); Lockup (automated hard-disk lock and key); FLU SHOT+ (memory-resident virus protection); Clean-up (virus-eradication utility); and CHECKUP (the au-

Solid-State Laser



1mW Solid-State Laser. Uses Toshiba 9200 laser diode. Produces about a 0.6" spot at 40 feet. Requires only 3.9 to 4.5 VDC (3 pen-light batteries works great.) Wavelength: 670nm (red) Size: Only 1.6" long by 0.625" in diameter!

\$130.00 each!!!

Laser Diodes

Toshiba TOLD9200
Wavelength: 670nm
Optical Power: 3mW
Operating Current: 85mA
\$65.00 each

Toshiba TOLD9211
Wavelength: 670nm
Optical Power: 5mW
Operating Current: 60mA
\$110.00 each

Laser Diode Collimator

Fits all Toshiba laser diodes. Used to maintain a tight beam at long distances. High Quality Optic. \$18.00 each

Midwest Laser Products

P.O. Box 2187
Bridgeview, IL 60455
(708) 403-6984

Call or write for free catalog.

Low Power He-Ne's
Holography
Lightshows
Optics



Shipping & Handling	
Under \$50.00	= \$5.00
\$50.00 to \$100	= \$7.00
over \$100	= \$10.00

MS-DOS EPROM PROGRAMMING SYSTEM NEEDS NO INTERNAL CARD

EPROMS

2708 (3 supply)
2758, 2716
27C16, 2516
2532*, 2564*
68764*, 68766*
2732, 2732A
27C32, 2764
2764A, 27C64
27128, 27128A
27C128, 27256
27C256, 27512
27C512, 27C010*
27010*, 27C1001*



EEPROMS

2804, 2816A
2864A, 28256*

MicroControllers

8741A*, 8742*
8748*, 8748H*
8749*, 8749H*
8751*, 87C51*
8752*, 8744H*

*Socket Adapter Required
(Diagrams Included)

CONNECTS TO YOUR SYSTEM'S

PARALLEL PRINTER INTERFACE

- A FULL FEATURED, EASY-TO-USE SYSTEM WORKS WITH ANY DESKTOP OR LAPTOP MACHINE
- ADAPTIVE, HIGH-SPEED ALGORITHM MINIMIZES PROGRAMMING TIME AND INSURES VALID DATA
- SYSTEM PROGRAMS ALL STANDARD DEVICES OR EQUIVALENTS FROM ANY MANUFACTURER
- ALL SYSTEM COMPONENTS FIT NEATLY INTO CASE FOR TRAVEL OR STORAGE

SYSTEM SOFTWARE COMMANDS

- PROGRAM EPROM(S) FROM DISK FILE
- READ EPROM(S) INTO BUFFER
- SAVE EPROM(S) OR BUFFER TO DISK
- PROGRAM EPROM(S) FROM BUFFER
- COMPARE EPROM(S) WITH BUFFER
- COPY EPROM(S) VERIFIED EPROM ERASED
- BUFFER EDITOR
- SELECT DEVICE TYPE
- DEVICE CHECKSUM

BUFFER EDITOR HAS 18 BYTE LEVEL COMMANDS FOR DETAILED OPERATIONS

SYSTEM INCLUDES: PROGRAMMING UNIT, POWER PACK, CONNECTING CABLE, OPERATION MANUAL & SOFTWARE **\$239**

SOFTWARE AVAILABLE ON 3 1/2" OR 5 1/4" DISK

TO ORDER SEND CHECK, MONEY ORDER, WRITE OR CALL:

ANDRATECH
P.O. BOX 222
MILFORD, OHIO 45150
(513) 831-9708

VISA

MASTER CARD

CALL OR WRITE FOR MORE INFO. - ADD \$5.00 FOR SHIPPING - \$4.00 COD

VOICE MAIL MONEY-MAKER

Generate hundreds of dollars monthly in your spare time by installing a *BigMouth* voice mail card and our menu-driven software package in your own IBM-clone computer.

Use it to rent voice mailboxes and pocket pagers, advertise mail order products, or operate a pay-per-call service using credit cards, passwords, or a nationwide 900 number.

Add the optional Goldmine module and your *BigMouth* will automatically generate outbound telephone calls to friends, existing clients, or new prospects for sales and telemarketing purposes.

Your *BigMouth* arrives complete with all software, external speaker, third-party peripherals directory, a detailed installation manual and entrepreneurs guide.

ID# 1840 Bigmouth \$299.⁹⁹ • ID# 1841 Goldmine \$99.⁰⁰
Entrepreneurs Toolkit \$25.⁰⁰ (credited on future purchases)

24-Hr Info & Order Hotline
1-800-283-4759

8646 Corbin Avenue • Northridge, CA 91324

TradeMark registered to their respective companies
Check state regulations before using Goldmine

DemoSource

RESELLER INQUIRIES INVITED
CIRCLE 281 ON FREE INFORMATION CARD

R-E SHOPPER CLASSIFIED

MISCELLANEOUS ELECTRONICS FOR SALE

INTERESTED IN a better screwdriving bit? Phillips, Torx, Slotted, Tri-Wing, Square Tip, Allen and more? Then use Apex! An industrial bit that is precision machined from special shock-resistant steel, then heat treated for toughness and durability. The bit that sets the standard for "quality" in American industry. A bit that is inexpensive without being cheap. Sound great? Then send today for your complimentary catalog. Pick from 101 sizes and styles in lengths up to 6 inches. You'll get low prices, speedy delivery and courteous service. Shipping is free, and no order is ever too small. Made in the USA. **DON SHOCKEY COMPANY**, P.O. Box 24042-RE, Dayton, OH 45424. (513) 236-2983.

TUBES RECEIVING INDUSTRIAL ANTIQUE 6L6GC 6LQ6 20LF6 12AX7 ETC. SYLVANIA DISTRIBUTOR EXTENSIVE INVENTORY ARLEN SUPPLY CO., 7409 WEST CHESTER PIKE, UPPER DARBY, PA 19082. 1 (800) 458-1301. FAX (215) 352-9388.

3-1/2" HD 1-44MB formatted disks. USA made. 10 minimum. \$1.00 each postpaid! 100% certified or huge catalog of over 3,000 surplus items on 720K disk \$2.00 free with order! **BEACH RADIO**, PO Box 548, Boston, MA 02112-0548.

CABINETS/ENCLOSURES. Rigid 1/16 aluminum shell, hardwood trim, contemporary styling. Several sizes and styles available. \$9.99 - \$23.99, free brochures. **PYRAMID ELECTRONIC PRODUCTS**, 15020 LaGrange Road, Suite 2100, Orland Park, IL 60462.

TUBES \$2.49, 1000 typés. Also surplus components. SASE brings lists. **DNF**, 6690 7.Mile Road, South Lyon, MI 48178.

COMPUTER HARDWARE

FREE CATALOG. Huge discounts on IBM compatible hardware. **A&D PRODUCTS**, 250E S. Lyon, Suite 322, Hemet, CA 92343.

COMPUTER SOFTWARE

PC BOARD and schematic design software for the IBM PC/compatible. Create professional PCB layouts (requires EGA) and electronics schematics (CGA) with these inexpensive shareware programs. Both for \$7.00. **DEL-PHONE INDUSTRIES**, PO Box 5835A, Spring Hill, FL 34606.

FREE GAME or utility program for IBM on 360K disk! You choose category, we choose program. We will also send you our lists of rental and shareware programs and surplus electronics (over 3000 items) on more disks! Monthly specials too! Just send \$2.00 (refundable) for shipping. Add \$.50 for 720K disks. **BEACH RADIO**, PO Box 548, Boston, MA 02112-0548.

RELAY BOARD for PC/XT 32 inputs 16 DPDT relay outputs. Software matrix selects any input to any output. Board, cables, terminators, and software \$299.00. **MBF ASSOC.**, Box 6775, Torrance, CA 90504.

RENT COMMERCIAL software, as low as \$2.00 per disk. **SOLUTIONS**: Box 5143, Old Bridge, NJ 08857.

PLANS-KITS-SCHEMATICS

INFRARED REMOTE control tester. Build your own with easy to find parts. No more hard to see test cards, anyone can build it. Send \$5.00 for plans or

large SASE for more information. **CHECKMATE COMM.**, PO Box 11-0808, Brooklyn, NY 11211.

DIGITAL COMPASS Sensor. Build your own state-of-the-art electronic compass with LED output. Sensor & plans \$16.00. **DEL-PHONE INDUSTRIES**, Box 5835A, Spring Hill, FL 34606.

FM STEREO TRANSMITTER kit including PC board and components. Transmitter is tuneable from 88 - 108 MHz to transmit audio from your disc player, VCR, TV or any line level source to any FM radio throughout your home, yard, or car. Send \$24.00 to **WJD ELECTRONICS**, RD#2, Box 80A, Middleburg, PA 17842-9571.

HAM RADIO kits & assemblies for various QST & 73 construction articles. We also offer books and electronic components. For catalog, send legal size SASE w/45 cents postage or \$1.00 to **A&A Engineering**, 2521 W. LaPalma, #K, Anaheim, CA 92801.

PLANS, KITS: Bugs, micro devices, animal repellent, infrared viewers, shockers, shotgun microphones, scramblers, alarms. Great deals! \$3.00 to **GWM RESEARCH**, 2025 Reuter road, Timonium, MD 21093.

COLOR TV repairs made easy. Fastest color TV repairs anyone can do. 125 priceless secrets. \$2.00 brings sample or send large SASE for more information. **CHECKMATE COMMUNICATIONS**, PO Box 11-0808, Brooklyn, NY 11211.

CB-SCANNERS

SECRET SCANNER FREQUENCIES! Directories list federal agencies, police, surveillance, bugging, codes, channels, etc. Big free catalog! **CRB**, Box 56-RE, Commack, NY 11725.

CABLE TV DESCRAMBLERS



NEW LOW PRICES!!!

OURS WORK GREAT

NEW LOW PRICES!!!

WHERE OTHERS HAVE FAILED

FREE CATALOG CALL NOW!!!

TOLL FREE 1-800-535-1843

(8-5 CST) 24 HOUR ANSWERING MACHINE AFTER HOURS

QUANTITY	1	5	10	20
DECODERS				
FTB-3	109	89	69	64
SA-3	99	89	79	75
TB-3	109	89	69	64
SB-3	88	78	56	47
NON-ADDRESSABLE CONVERTERS				
STARGATE	88	79	75	72
JERROLD 550	95	79	74	67
JERROLD 400	82	72	67	CALL
COMBINATION CONVERTER DESCRAMBLERS (BUILT IN SB-3)				
JERROLD DRX	CALL	CALL	CALL	CALL
JERROLD DRZ	CALL	CALL	CALL	CALL

ALSO AVAILABLE: SACRAMENTO SPECIALS, OAK, EAGLE, HAMLIN, TEXSCAN, REMOTE CONTROLS
EXTENDED WARRANTY AVAILABLE

CNC CONCEPTS INC.

P.O. BOX 34503 - MPLS., MN 55434
90 DAY GUARANTEE SORRY, NO MINNESOTA SALES

DISCLAIMER: It is not the intent of CNC Concept to defraud any cable television operator. Federal and State laws provide substantial penalties for the theft of cable television services.

POLICE RADAR

SPEED MEASURING EQUIPMENT



KUSTOM TR6 X-Band RADAR

Professional models, some originally selling for \$2000+. Portable 2-piece unit can be mounted on dashboard & connects to a 12 volt power source. Numerous uses: car, boat & snowmobile racing, baseball, speedometer calibration, traffic surveys, etc. A wide selection of used and reconditioned X-band and K-band models with 90-day warranty start at only \$199. Lower priced as-is units for experimental use. Limited quantities. Call for free catalog and list.



DECATUR MV-724 K-Band RADAR

BOOKLET

"How RADAR Works"
ONLY \$4.95 ppd.

UHF EQUIPMENT CLOSEOUTS

Zenith SSAVI STV-2 - \$75 for 1, \$49 ea. for 12.
Blonder Tongue - \$21 for 1, \$14 ea. for 12.
(UHF units untested, as removed from service.)
Bargains on UHF antennas, RG-11/U cable, etc.



AIS Satellite, Inc.
106 N. 7th Street
Perkasie, PA 18944

Technical information: Orders and catalog requests:
(215) 453-1400 1-800-AIS-2001
Please call weekdays 10 A.M. to 6 P.M. Eastern time.

R-E SHOPPER CLASSIFIED

CB DX 1990'S. Get more out of your radio. CBR, Box 212 Rochelle Park, NJ 07662. Catalog.

ORDER YOUR CLASSIFIED SPACE FOR MARCH 1991 NOW—SEE ORDER FORM PAGE 68

CABLE TV

DESCRAMBLERS, ELECTRONIC, test and computer equipment. Catalog \$3.00. Refundable. **B&R ENTERPRISE**, PO Box 662, Portage, MI 49081.

DESCRAMBLER SPECIALS. All brands. Examples: Combo Jerrold 400 and SB3 \$165.00. Complete cable descrambler kit \$39.00. Complete satellite descrambler kit \$45.00. Free catalog. **MJMRS INDUSTRY**, Box 531, Bronx, NY 10461-0208.

STARCOM 6 turn on. Boards \$99.00. Tocom test chips 5503A or VIP \$39.95 guaranteed. Fully functional units Starcom 6 \$275.00, Tocom 5501 \$115.00, 5503 VIP \$275.00, 5507 \$350.00. **BOND ENGINEERING**, 3567B Grand #130, Gurnee, IL 60031.

IF YOU want some of the prices on converters, descramblers, remotes call **B&S SALES** (313) 365-0908. Example — Jerrold DRX-3-DIC SB built in for one — \$110.00 delivered. Quantity prices available.

TEST EQUIPMENT

LOWEST PRICES. Test equipment and parts. Free catalog. **EF ELECTRONICS**, Box 326, Aurora, IL 60507.

TEST EQUIPMENT by HP, TEK, etc., parts, tubes, accessories. Catalog \$2.00 refunded with 1st order. **R&D ASSOCIATES**, 514 West Avenue, N. Augusta, SC 29841. (803) 278-0744.

DISTORTION METER LDM-171 Leader \$550.00. **WOW/FLUTTER** meter LFM-3610 Leader \$450.00. Never used. Box 588, Woodacre, CA 94973.

BUSINESS OPPORTUNITIES

EARN \$\$\$\$ WITH YOUR COMPUTER AT HOME Exciting new part-time opportunities working with an established software marketing company. Will teach. For info send \$1.00 to: **COMPUTER**, PO Box 1442-RE, Orange Park, FL 32067.

Cable TV

Descrambler Article Parts

We stock the exact Parts for several articles published in Radio-Electronics magazine on building your own Cable TV Descrambler.

February 1984 SB-3 Type

701 Parts Pkg.....\$19.00
Includes all original parts.

702 PC Board.....7.95
Original 3X4 etched, drilled and Silk-Screen pc board.

704 AC Adaptor.....7.95
12 to 18 Volt DC @ 200ma.

701, 702 & 704.....29.00
All three for special saving.

February 1987 Tri-Mode

301 Parts Pkg.....29.00
Includes all original parts.

302 PC Board.....7.95
Original 5X8 etched, drilled and Silk-Screen pc board.

304 AC Adaptor.....7.95
12 to 18 Volt DC @ 200ma.

301, 302 & 304.....39.00
All three for special savings.

Tri-Mode Tutorial..7.95
26 pages of in-depth info.

May 1990 Universal

901 Parts Pkg.....\$49.00
Includes all

902 PC Board.....9.95
Improved 4X7 etched, drilled and Silk-Screened pc board.

904 AC Adaptor.....8.95
12 to 18 Volts AC @ 350ma.

901, 902 & 904.....59.00
All three for special savings.

Snooper Stopper...\$39.00

Prevent Descrambler detection with snooper stopper/data blocker and protect your privacy. Includes free article on Cable Snooping.

Macrovision Kit...\$29.00

Macrovision.....now you see it, now you don't with our macro-scrubber kit. Originally Published in Radio-Electronics .

Signal Eliminator (tunable notch filters).....\$29.95

*Model number & channel; #23 (channel 2 & 3) #46FM (channel 4 to 6 & FM)
#713 (channel 7 to 13) #1417 (channel 14 to 17) #1822 (channel 18 to 22)*

1 remote replaces 3...

The MAC 20 wireless remotes replaces any three combinations; TV, VCR, Cable Converter, Stereo, CD or other entertainment system.

MAC 20.....\$59.95

A VCR in every room..

with the first FCC approved wireless home broadcast system. 120 ft. range.

VC2000.....\$99.95

70 Channel Cable TV Converter.....\$89.95

- * 6 Function Infra-Red remote.
- * Fine Tuning.
- * Memory & Recall.
- * Compatible with all External Descramblers.
- * Channel 3 or 4 switchable output.
- * STD, HRC & IRC compatible.

CALL TOLL FREE 1-800-332-3557

Outside USA Call 1-508-699-6935

Visa, MasterCard and COD.

Add \$4.00 S&H, \$6.50 Outside USA.

D & D Electronics, Inc. PO Box 3310, N. Attleboro, Ma. 02761

VISA

MC

ALL PURPOSE TERMINALS



MANUFACTURED BY
RCA

\$85

RCA's APT is a high quality, self-contained computer, a smart terminal, loaded with many features. Originally selling for about \$500, this terminal is a super value for anyone needing a computer to access bulletin boards, word process or simply free up a larger PC.

- Built-in dual speed telephone modem with RJ-11 port for easy hookup.
- Composite video or RF (channels 3&4) allow use of either a monochrome or TV type monitor.
- Parallel printer port for connection of a Centronics type printer.
- Serial (DB-25) RS-232 port allows connection of TNC, hard drive, modem or other peripheral.
- Keyboard selectable 40 or 80 column display.
- Built in word processor with word wrap feature.
- All terminal parameters are fully adjustable allowing emulation of many terminal systems.
- Also includes acoustical coupler input, auto log-on, 8 customizable function keys plus more!

Our APT's are very clean units removed from service. Instruction manual, wall cube power supply and TV/ APT selector switch included. Optional 6' Centronics printer cable—\$25. Add \$5 for UPS.

IRON POWDER TOROID CORES

CORE	O. D.	L ₁ μH / 100 turns	1-10	11-99	CORE	O. D.	L ₁ μH / 100 turns	1-10	11-99	CORE	O. D.	L ₁ μH / 100 turns	1-10	11-99
T5-6	.050"	10.	35	25	T44-2	.440"	52	.70	.60	T157-6	1.57"	115	3.25	2.75
T12-2	.125"	48	35	30	T44-6	.440"	42	.70	.60	T200-2	2.00"	120	4.00	3.60
T12-4	.125"	17	35	30	T50-2	.500"	49	.80	.68	T200-6	2.00"	100	4.75	4.25
T12-17	.125"	7.5	40	35	T50-6	.500"	40	.80	.68	T200-52	2.00"	900	3.00	2.40
T16-52	.160"	150	35	30	T50-17	.500"	18	.90	.78	T225-28	2.25"	215	6.00	5.40
T25-2	.255"	34	40	35	T50-268	.500"	420	.90	.78	T225-6	2.25"	100	6.00	5.40
T25-6	.255"	27	40	35	T50-52	.500"	350	.80	.68	T300-2	3.04"	114	6.00	5.40
T25-17	.255"	12	40	35	T68-2	.690"	57	.80	.68	T300-20	3.04"	228	13.00	12.
T30-2	.307"	43	40	35	T68-6	.690"	47	.80	.68	T300-52	3.04"	850	8.00	7.20
T30-6	.307"	36	40	35	T68-52	.690"	420	.80	.68	T400-2	4.00"	180	13.00	12.
T30-17	.307"	16	40	35	T80-2	.795"	55	.95	.82	T400-20	4.00"	340	22.00	20.
T30-52	.307"	73	40	35	T80-6	.795"	45	.95	.82	T400-52	4.00"	1400	12.00	11.
T37-2	.375"	40	60	50	T80-52	.795"	500	.85	.72	T520-2	5.20"	200	22.00	20.
T37-6	.375"	30	60	50	T130-0	1.30"	15	3.00	2.40					
T37-17	.375"	15	60	50	T157-2	1.57"	140	3.25	2.75					

Toroid cores are used in most radio frequency projects because of their relative small size. EMI/RFI filters are made with a core in the interference's frequency range. The suffix of each core (eg. -2 or -6) indicates the mix.

- 2 mix - Maximum Q range: 25-10 MHz. Permeability (μ_o)=10. Rf transformer below 160meters.
- 6 mix - Maximum Q range: 2-30 MHz. Permeability (μ_o)=8.5. Rf transformer to 10 meters.
- 17 mix - Maximum Q range: 20-200 MHz. Permeability (μ_o)=4.0. Rf transformer HF - VHF.
- 26 mix - Maximum Q range: DC - 8 MHz. Permeability (μ_o)=7.5. DC, 60 Hz and EMI/RFI filtering.
- 52 mix - Maximum Q range: DC - 1 MHz. Permeability (μ_o)=7.5. DC, 60 Hz and EMI/RFI filtering.

* Note: Toroids operate at 4 to 100 times the stated frequency range with reduced Q and efficiency.

"Where the hard to find parts are found..... and on hand"

Catalog 6 included with your order (\$3 a'la carte). 200 pages, over 10,000 electronic PARTS including almost any capacitor (transmitting to monolithic), resistor, inductor, wire or cable, toroid & ferrite, Collins replacement part, antenna, connector (rf, computer, IC, electrical), shaft, coupling, knob, motor, transistor, diode, IC, switch, relay (solid state to contactors), project box, rubber feet, hardware (stainless, brass, etc.), tubing, fan or blower, tube (receiving to transmitting) or tube socket. Please add adequate shipping (\$3 min). We accept Visa, MC, Amexco, checks, COD add \$3.

1315 Jones St. • Omaha, Nebraska 68102 • 402-346-4750 • fax: 346-2939

Surplus Sales of Nebraska

ZENITH TERMINAL-\$50

FEATURES:

MODEL ZTX-1-UZ AND ZTX-11-Z:

- *Full size keyboard with help and function keys
- *New and complete in original box with user's manual
- *Built-in 300 baud auto answer modem
- *Two phone jacks: in from line, out to phone
- *Parallel centronics printer port
- *Composite video output
- *Switch for use with single or multi line phones
- *CMOS RAM stores phone #'s and configuration info
- *Stores 26 phone numbers and names for voice, data, and auto logon dialing sequences
- *User changeable security access code
- *DEC VT52 and ASCII terminal emulation
- *Intel 8031 CPU
- *TTL serial port access through power connector

MODEL ZTX-11-Z ALSO HAS:

- *RS-232 port for access to external modems
- *Technical manual with schematic circuit board x-ray views, semiconductor identifications

USES:

- *Multiuser computer system terminal
- *Packet radio transmitter/receiver
- *Remote database access
- *Dedicated auto receive terminal

MODEL ZTX-11-Z (WITH RS-232) \$75

MODEL ZTX-1-UZ (W/O RS-232) \$50

800 441-1491

COMPUTER BUSINESS MART

6450 Lusk Blvd. Suite E-102, San Diego, Ca 92121

(619) 453-8445 FAX (619) 558-3088

CIRCLE 286 ON FREE INFORMATION CARD

R-E SHOPPER CLASSIFIED

SECURITY

SURVEILLANCE COUNTERSURVEILLANCE electronic equipment catalog transmitters, bug detectors, phone and fax scramblers, radar jamming equipment, spy books, \$10.00, EDE, PO Box 337, Buffalo, NY 14226.

TELEPHONE

CALLER ID unit displays phone number of person calling, also stores numbers, date and time of persons that phoned you while you were away. \$89.95 EDE, POB 337, Buffalo, NY 14226. (716) 691-3476.

REPAIRS-SERVICES

ATTENTION ELECTRONIC COMPANIES! If you are looking for homeworkers to do the ASSEM-

BLING/SOLDERING of circuit boards for you, please send us details about your soldering needs. KASPERSKI, POB 385, APO, NY 09098.

COMPONENTS

FREE PARTS and free disk! We've got electronic parts coming out of our ears and want to ship them to your pockets. One dozen assorted electronic parts plus list of 5000+ inventory on 720K disk free! Just send \$3.00 (refundable) for shipping. **BEACH RADIO** PO Box 548, Boston, MA 02112-0548.

ANTIQUA ELECTRONICS

SUBLIMINAL SUGGESTION audio tapes. Make your own and save \$\$\$! For simple complete instructions send \$11.50 money order to **ANDREW COUP**, 359 9th Avenue, Lot #12, Tiffin, OH 44883.

AUDIO-VIDEO-LASERS

AFFORDABLE LASERS, we carry up to 3mw he-ne's, laser diodes, light show units, and holography kits. We offer the lowest prices. Free catalog. **MIDWEST LASER PRODUCTS**, PO Box 2187, Bridgeview, IL 60115. Phone: (708) 403-6984.

PUBLICATIONS

TECHNO JUNKIES join your colleagues! A new generation information exchange newsletter. Shortcuts, covert, classified, more! Subscribe now! One year only \$6.95 money back guarantee, or write for more info. **MST**, 6A Grove Street, PO Box 9105, #289, Norwell, MA 02061.

BUY BONDS

A-BUS™ NEWS

New Products

Alpha Products proudly announces two new product lines: **C-Net** serial communications devices, and **Alpha Box** interfaces. These new products are not merely A-Bus accessories, but complete sets of products for all of your interfacing needs.

All the products are used to connect different types of devices to your computer. Our communications devices help you connect devices that have computer interfaces already built in. **C-Net** provides the option of connecting many different RS-232 devices to a single serial port on your computer. We also carry converters to other standards, including RS-422, RS-485 and IEEE-488.

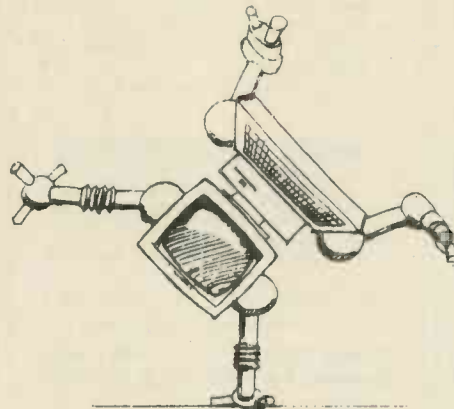
- * **C-Net Adapter**, Connects the master control computer to C-Net. \$74
- * **Quad C-Net Module**: Connect 4 RS-232 serial devices to C-Net. Each device is configurable (baud rate, parity, etc.) and has 4.8K byte input and output buffers. \$695
- * **C-Net Device Module**: Connect any RS-232 Device to C-Net for data collection or communication, with handshaking. \$195

Alpha Boxes and A-Bus cards both provide ways to interface other types of devices to your computer. **Alpha Boxes** sense, measure, switch and govern. They feature:

- * Each box is an attractively packaged self contained module that connects directly to the computer and includes power supply.
- * The input boxes offer the option of logging data "off-line" and downloading it rapidly to the computer.
- * Built-in intelligence provides a simple and consistent interface to your software.

A Sampling of Alpha Box Products:

- * **Digital Input**: 64 TTL/CMOS/0.5V input channels. \$495
- * **Digital Output**: 64 TTL/CMOS/0.5V level outputs. \$495. 120VAC control available.
- * **Digital I/O**: 32 TTL Level (0.5V) Inputs and 32 Outputs. \$495
- * **Analog Input**: 16 channels. 0-5.1V, 20mV steps (8 bit). 2000 readings/sec. \$495.
- Expansion Option**: 16 more channels. \$100
- * **12 Bit Analog Input**: 16 channels, programmable gain. 10000 inputs/sec. max. \$995. Option: 16 more Inputs. \$200
- * **Analog Output**: 4 channel, 12 bit D/A. $\pm 5.1V$ outputs. \$495. Expander Option: 12 more outputs. \$200
- * **Counter**: 16 inputs, 24 bit. \$595



"We can make your PC do things you wouldn't believe."

C³ From Your PC

- **Command**
- **Control**
- **Communications**

Bring new dimensions to your computer with A-Bus, C-Net and Alpha Boxes. No longer is your computer limited to number crunching or word processing. Now you can connect to all types of equipment, sensors or machines. This offers unprecedented power from production lines to experiments to home control.

Each product is designed to fit your needs: They're **affordable**. Compare our prices; the cost of a solution is surprisingly low. They're **simple** and easy to connect to your computer and your application, and carefully designed to adapt to your software easily. They're **versatile**. An infinite number of combinations is possible; one of them is right for you. Easily expanded or changed for future projects. They're **proven** by customers around the world, including Fortune 100 companies, universities, governments and individuals.

Call for a Catalog (800) 221-0916

Overseas distributors

Asia: Batam DA, Singapore
Tel: 473-4518 Fax: 479-6496

Japan: Japan Crescent
Tel: 03-824-7449 Fax: 03-818-8914

Scandinavia: A/S Con-Trade Norway
Tel: (04) 41 83 51 Fax: (04) 41 94 72

UK: Pinna Electronics, Scotland
Tel: (0294) 605296 Fax: (0294) 68286

Low Cost Data Acquisition and Control

A-Bus Sensing & Measuring:

Read switch status. Detect or measure voltage. Read pressure, temperature, weight and other sensors. For example:

- * **High-Speed 12-bit A/D converter**: 8 10µs analog inputs. 1 mV resolution \$179
- * **8 Bit A/D**: 8 inputs. 0-5.1V in 20mV steps. 7500 conversions/sec. \$142
- * **12 Bit A/D**: $\pm 4V$ in 1mV steps. 130mS conversion time. 1 input, expandable \$153
- * **Temperature Sensor**: 0-200°F 1° Accuracy. 10mV/°F. \$12
- * **Digital Input**: 8 opto-isolated. Read voltage presence, switch closure. \$65
- * **Latched Input**: Each individually latched to catch switch closures or alarm loops. \$85
- * **Touch Tone Decoder**: \$87
- * **Counter/Timer**: 3 16-bit counters. Generate or count pulses. Time events. \$132
- * **Clock with Alarm**: real time clock with calendar and battery backup. \$98

A-Bus Switching & Governing:

Switch any type of electrical device. Adjust level or position. A sampling:

- * **Relay Card**: 8 individually controlled industrial relays. 3A at 120VAC, SPST. \$142
- * **Digital Output Driver**: 8 outputs: 250mA at 12V. For relays, solenoids... \$78
- * **Reed Relay Card**: 8 individually controlled relays. 20mA @ 60VDC, SPST. \$109
- * **Multiplexer**: Switch up to 32 channels to a single common. \$83
- * **Smart Stepper Motor Control**: Microprocessor controls 4 motors. English commands for position, speed, units, limits, etc. \$299
- * **Telephone Control Card**: On/off hook, generate and decode touch tones, call progress detection. \$159
- * **X-10 Controller**: Control and sense standard wall outlet power modules. \$149
- * **Voice Synthesizer**: Unlimited vocabulary, text to speech software built in. \$159
- * **D/A**: Four 8 Bit Outputs. Adjustable full scale. \$149
- * **24 line TTL I/O**: Connect 24 signal, TTL 0/5V levels or switches. (8255A) \$72

A-Bus Adapters and Software:

Adapters connect A-Bus cards to your particular computer.

- * **Plug-in adapters** for IBM PC/XT/AT/386 and compatibles (\$69), Micro-Channel (\$93), Apple II, Commodore, TRS-80.
- * **Serial adapters** for Mac, PC, etc.
- * **Odin PC compatible software**. Control relays from analog inputs or time schedules. Logging. Runs in background. \$129

ALPHA Products

242-RE West Ave, Darien, CT 06820 USA (203) 656-1806 Fax 203 656 0756

CIRCLE 293 ON FREE INFORMATION CARD

RE-SHOPPER 65

AMIGA-Commodore Chips...Parts...Upgrades

6526	\$12.25
6567	\$14.95
6581	\$11.25
PLA (82S100)	\$12.95
All 901 Roms	\$10.95
1 x 4 MEG/80 NS (ZIP)	\$57.95
A501-512K Ram	\$99.50
8362 Denise	\$39.95
8364 Paula	\$49.94
8520A	\$17.95
1.3 Kickstart Rom	\$27.95
256 x 4/100	\$9.50
1 MEG x 1/120	\$9.40

Commodore Diagnostician #6

Now fix your own computers with this fantastic diagnostic tool. Save time and money by promptly locating faulty chips on all Commodore 64 Computers and 1571 drives. Utilizes sophisticated cross reference methods. Over 15,000 sold. Received fantastic review in many magazines including full page in "Computer Shopper" \$6.95 includes postage.

NEW, POWERFUL

REPAIRABLE C-64 POWER SUPPLY

- 13-month warranty • Complete schematic included • External fuse—runs cool • UL Approved • Heavy duty—perfect for "packet radio"
- Conservatively rated @ 1.8 amps • Made by Commodore sub-contractor

\$24.95
PLUS
UPS

Amiga Upgrade..New 1 Megabyte "Fatter AGNUS" Chip 8372 \$99.50 with simple step step 10 min. Instructions and chip puller.

SEND FOR CATALOG ON EXCLUSIVE NEW PRODUCTS

THE GRAPEVINE GROUP, INC.

3 Chestnut St., Suffern, N.Y. 10901

1-800-292-7445 • (914) 354-4448

FAX (914) 354-6696

Dealer Prices Available

Prices Subject To Change



- 60dB display dynamic range
- 40dB spurious rejection
- 60 uv sensit, ±2dB flatness
- 1 KVDC, 1v @ 100 MHz max input as isolated by 10pF
- ±7%hor frequency linearity

107 SPECTRUM PROBE™

converts your scope into a 100MHz spectrum analyzer

\$249 dealers wanted

30 Day refund VISA/MC
Specifications & app. ideas

Smith Design 1324 Harris
Dresher, PA 19025 (215) 643-6340

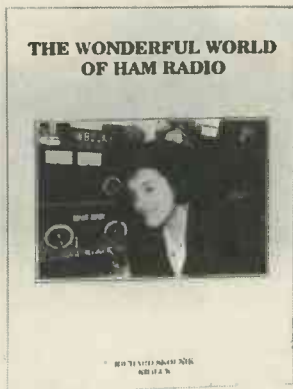
JOIN COMPUTER MUSICIAN COALITION JOIN

the Nation's Computer/Music
Enthusiast's Users Group
1024 W. Willcox Av.
Peoria, IL 61604

thor's own virus-detection system). Money-saving coupons for all eight programs are included in the book.

THE WONDERFUL WORLD OF HAM RADIO: AN INTRODUCTION FOR YOUNG PEOPLE; by Richard Skolnik, KB4LCS. MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; 601-323-5869; for orders, 800-647-1800; fax: 601-323-6441; paper-back; \$7.95.

If you're considering buying a youngster a ham radio this Christmas, consider including a copy of this fun-to-read book that describes what ham radio is all about and why it can be a valuable part of his or her life. The book explains how hams can use radio communications to learn about computers, electronics, geography, and more. It



CIRCLE 31 ON FREE INFORMATION CARD

illustrates how hams provide valuable communications services during emergencies, and even includes an actual emergency QSO. Finally, it explains how to get a ham license at set up a station to talk to other hams around the world. The book is filled with photos of radios, ham stations, Field Day setups, and students learning about and using ham radios. **R-E**

Try the

Radio Electronics.

bulletin board system

(RE-BBS)
516-293-2283

The more you use it the more useful it becomes.

We support 300 and 1200 baud operation.

Parameters: 8N1 (8 data bits, no parity, 1 stop bit) or 7E1 (7 data bits, even parity, 1 stop bit).

Add yourself to our user files to increase your access.

Communicate with other R-E readers.

Leave your comments on R-E with the SYSOP.

RE-BBS
516-293-2283

SPECIAL FROM ETT

PCP107—DIGITAL LOGIC GATES AND FLIP-FLOPS ... \$10.00. Establishes a firm foundation for the user who wants to design and troubleshoot digital circuitry and wants to know more than a few rules of thumb. No background beyond a basic knowledge of electronics is assumed.



PCP108—COMPUTERS AND MUSIC ... \$9.95. Helps you learn the basics of computing, running applications programs, wiring a MIDI system and using the system to good effect. In fact, just about everything you need to know about hardware and programs.

PCP109—EVERYDAY ELECTRONICS DATA BOOK ... \$10.00. Presents the essential theory of electronic circuits and also deals with a wide range of practical electronic applications. Info is presented in the form of a basic electronics recipe book.



PCP110—ELECTRONIC POWER SUPPLY HANDBOOK ... \$10.00. All types of power supplies are covered, starting with cells and batteries, on to rectified supplies and linear stabilizers, to modern switch-mode systems, IC switch-mode regulators, DC-DC converters and inverters.

BP285—BEGINNERS GUIDE TO MODERN ELECTRONIC COMPONENTS ... \$6.50. Basic functions of resistors, capacitors, inductors, diodes (including Zeners and Varicaps), transistors, Thyristors, optoelectronic devices, op-amps, logic IC's, speakers and microphones, and meters are all described. Sort of a beginners bible of electronics.



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	... \$1.25	\$30.01 to \$40.00	\$5.00
\$5.01 to 10.00	... \$2.00	\$40.01 to \$50.00	\$6.00
\$10.01 to \$20.00	\$3.00	\$50.01 and above	\$7.50
\$20.01 to \$30.00	\$4.00		

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 _____

RES

SUPER

KELVIN Electronics

INDUSTRIAL QUALITY AT DISCOUNT PRICES

BREADBOARDS FOR LESS!

DURABLE - MADE OF THE HIGHEST QUALITY PLASTIC - DESIGNED TO WITHSTAND THOUSANDS OF INSERTION CYCLES



Fig.	Stock No.	Contact Points	YOUR COST
A	680093	500	\$ 4.25 ea
B	680097	840	\$ 5.95 ea
C	680098	1380	\$11.75 ea
D	680099	1580	\$15.75 ea

WIRE JUMPER KIT

Use with Quick test sockets and bus strips.

Stock No.	Description Points	YOUR COST
330290	350 Piece Set	\$ 7.75 ea

PRO 400 The Professionals' Choice

with 20MHz FREQUENCY COUNTER excellent for COMPUTER, TV, VCR REPAIR and ENGINEERING.

YOU CAN'T GO WRONG!

MONEY BACK GUARANTEE!

- LOGIC TEST
- DIODE CHECK
- CONTINUITY TESTER
- 5 FREQUENCY RANGES
- TRANSISTOR hFE TEST
- 5 CAPACITANCE RANGES
- LED TEST VERIFY
- 20 MHz FREQ COUNTER
- AC/DC VOLTAGE RANGES
- AC/DC CURRENT RANGES

CASE - Yellow, Durable, Back Stand **\$69.95**

Stock No. 990092

PROTECTIVE CARRY CASE Stock No. 990094 \$9.95 ea



30 DAY MONEY BACK GUARANTEE!

KELVIN 100

Stock No. 990087 **\$23.95**

- AC/DC VOLTAGE
- DC CURRENT
- RESISTANCE
- DIODE TEST
- BATTERY TEST
- LOW BATTERY Warning
- ACCURACY +/- 0.5%

KELVIN T50

Stock No. 990090 **\$29.95**

- AC/DC VOLTAGE
- DC CURRENT
- RESISTANCE
- DIODE & BATTERY TEST
- LOW BATTERY Warning
- ACCURACY +/- 0.5%
- CONTINUITY TEST/BUZZER
- TRANSISTOR CHECK

KELVIN 200

Stock No. 990091 **\$39.95**

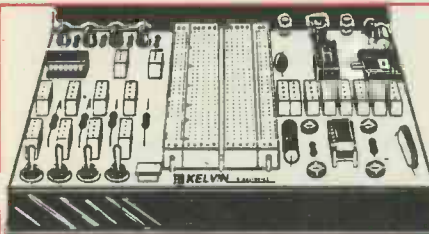
- AC/DC VOLTAGE
- AC/DC CURRENT
- RESISTANCE
- DIODE TEST
- LOW BATTERY Warning
- ACCURACY +/- 0.5%
- CONTINUITY TEST/BUZZER
- TRANSISTOR CHECKER
- CAPACITANCE CHECKER

INDUSTRIAL QUALITY



30 DAY MONEY BACK GUARANTEE!

CARRYING CASE Stock No. 990093 \$4.95 ea



- FEATURES**
- ONE DIGIT TRUE HEXADECIMAL DISPLAY WITH BUILT IN LOGIC (MEMORY, DECODER, DRIVERS) FULL ALPHA CHARACTERS
 - TWO INDEPENDENT CLOCKS USER ADJUSTABLE FREQUENCY & DUTY CYCLES
 - BREADBOARD 500 PT PROTO-TYPE AREA W/TWO POWER DISTRIBUTION BUSES (GND, VCC)
 - 4 DATA BIT SWITCHES
 - MOMENTARY PUSH BUTTON SWITCH (SPDT)
 - 4 LED DISPLAYS w/IC DRIVERS
 - POWER SUPPLY: WALL PLUG-IN TYPE UL LISTED
 - VOLTAGE REG: +5 VOLTS, SHORT CIR. OVERLOAD PROTECT
 - HOOK-UP WIRES
 - COMPACT CARRYING CASE
 - INSTRUCTION MANUAL FOR BEGINNER TO ADVANCED USERS
 - MADE WITH PRIDE IN THE USA

THE **KELVIN LDT™** Laptop Digital Trainer

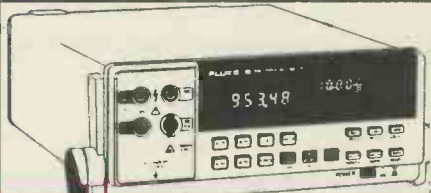
\$99.95

Stock No. 840460

FREE COMPREHENSIVE TEACHER/STUDENT LAB MANUAL

- NAND GATE
- INVERTER
- AND
- OR GATE
- NOR GATE
- EX - OR GATE
- DOUBLE INVERTERS
- NAND GATE AS INVERTER
- NOR GATE AS INVERTER
- CREATING NAND FUNCTION, USING AND GATE & TWO INVERTERS
- CREATING AND FUNCTION, USING NAND GATES
- CREATING OR FUNCTION, USING NOR GATES
- CREATING OR FUNCTION USING NOR GATES
- CONSTRUCTING A FREE RUNNING OSCILLATOR, USING A RESISTOR, CAPACITOR & INVERTER
- CONSTRUCTION OF A GATED OSCILLATOR
- R - S FLIP-FLOP
- R' - S' FLIP-FLOP
- D FLIP-FLOP
- J - K FLIP-FLOP
- T FLIP-FLOP, USING J - K FLIP FLOP
- USING THE HEXADECIMAL DISPLAY WITH THE BUILT-IN LATCH DECODER & DRIVER
- COMPARING THE DECIMAL, HEXADECIMAL, BINARY & BINARY CODED DECIMAL NUMBERS
- 4 BIT COUNTER
- BINARY ADDITION
- EXPERIMENT WITH BUILT-IN CLOCK GENERATORS: ADJUSTING THE FREQUENCY & DUTY CYCLE
- ... AND MUCH, MUCH MORE!

Trainer Manual gives detailed instructions on the topics listed. An excellent tool covering topics for High School (Beginner - Advanced), Trade School (Beginner - Intermediate) & College. A PERFECT FIT WITHIN ANY DIGITAL CURRICULUM & YOUR CLASSROOM TEXTBOOK



FLUKE 45 DUAL DISPLAY

- 5 Digit Multifunction Dual Display
- Selectable Reading Rates & Resolutions
- True RMS AC Voltage, AC Current
- .02% Basic DC Voltage Accuracy
- DC Current to 10A
- RS-232 Interface
- Touch Hold, Relative & Min/Max

Stock No.	Model	YOUR COST
710035	45	SPECIAL \$579. PRICE

TIMER - LM555

Stock No. 600021 **20¢** ea. (in 100+ Qty)



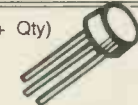
L.E.D. RED (in 100+ Qty)

Stock No. 260020 **6¢** ea.



Transistors (in 100+ Qty)

2N2222 **18¢** ea.
PN2222 **.08¢** ea.



Project BUZZER

6-9V DC, 80 dB
Stock No. 680069
\$1.59 ea **\$1.39/10+** ea.



9V Battery Snap & Holder

Snap **.15** ea. **.10**ea/100+
Holder **.20** ea. **.10**ea/100+



LAPEL MICROPHONE

Stock No. 850306
YOUR COST \$2.95 ea



CADMIUM SELENIDE PHOTO CELL

450 ohms @ 2 ft., C minimum dark resistance 225 ohms
Max voltage 170V peak. Peaks at 6900 angstroms.
No. 260017 YOUR COST **\$.99** ea



SULPHIDE PHOTO CELL

1.5K ohms @ 2 ft., C minimum dark resistance 75 ohms.
Max voltage 170V peak. Peaks at 5500 angstroms.
No. 260018 YOUR COST **\$.99** ea



SUB-MINIATURE MOMENTARY PUSH SWITCH

Silent action red push button molded housing.
Requires 1/4" panel hole. Overall length including solder lugs is 1".
Rated 115 VAC, 1 AMP.
Stock No. Color YOUR COST 100+
990002 Red **\$.35** ea **\$.28** ea



DC MOTOR

1.5 to 6VDC
Stock No. YOUR COST 20+
852211 **\$.50** ea **\$.45** ea



SOLDERING EQUIPMENT

WELLER MARKSMAN SOLDERING GUN



Model SP23
Featherweight 1-3/4 oz., 25 watts for PC work. Ideal for reaching into those hard to get spots. Replaceable tip.
Stock No. YOUR COST 6+
810002 \$8.55 ea \$7.95 ea

SOLDERING IRON HOLDER



Model PH60
Soldering stand with base, sponge, and receptacle.
For W60P, WP25P, WP40P, and irons with barrel diameters up to 15/32".
Stock No. Description YOUR COST 6+
810041 PH60 Stand \$13.78 ea \$13.09 ea
810042 Replacement Sponge \$1.89 ea \$1.80 ea

KESTER SOLDER

RESIN CORE SOLDERS 1 LB. ROLL
Non-Corrosive Flux Resin Core

Stock No.	Inch	Dia.	GA.	Type	YOUR COST
580010	1/64"	.025	23	63/37	\$11.95 ea
580005	1/32"	.031	21	60/40	\$9.95 ea
580001	1/16"	.062	16	60/40	\$8.95 ea
580011	3/32"	.093	13	60/50	\$11.75 ea

KELVIN Electronics

7 Fairchild Ave. Plainview, NY 11803

Call: 1 (800) 645-9212

1 (516) 349-7620

FAX: 1 (516) 349-7830

FREE CATALOG CIRCLE RESPONSE CARD

USE R-E SHOPPER CLASSIFIEDS

READ BY MORE THAN 100,000 ELECTRONICS BUYERS AND SELLERS AND TRADERS

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 40¢ per word. Minimum charge is \$6.00

per ad per insertion (15 words). Any words that you want set in bold or caps are 10¢ each extra. Bold caps are 20¢ 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 **R-E Shopper** 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 April 10 will appear in the July, 1991 issue that is on sale June 4. Shopper ads will appear Jan., Mar., May etc. 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: 40¢ per word, Minimum \$6.00.

Send your ads with payment to:

Radio-Electronics SHOPPER, 500-B Bi-County Blvd. Farmingdale, NY 11735

CATEGORIES

- | | | | |
|------------------------------|---------------------------------|--|---------------------------|
| 100 — Antique Electronics | 270 — Computer Equipment Wanted | 450 — Ham Gear Wanted | 630 — Repairs-Services |
| 130 — Audio-Video-Lasers | 300 — Computer Hardware | 480 — Miscellaneous Electronics For Sale | 660 — Satellite Equipment |
| 160 — Business Opportunities | 330 — Computer Software | 510 — Miscellaneous Electronics Wanted | 690 — Security |
| 190 — Cable TV | 360 — Education | 540 — Music & Accessories | 710 — Telephone |
| 210 — CB-Scanners | 390 — FAX | 570 — Plans-Kits-Schematics | 720 — Test Equipment |
| 240 — Components | 420 — Ham Gear For Sale | 600 — Publications | |

CLASSIFIED AD COPY ORDER FORM

Ad No. 1—Place this ad in Category # _____

1 - \$6.00	2 - \$6.00	3 - \$6.00	4 - \$6.00
5 - \$6.00	6 - \$6.00	7 - \$6.00	8 - \$6.00
9 - \$6.00	10 - \$6.00	11 - \$6.00	12 - \$6.00
13 - \$6.00	14 - \$6.00	15 - \$6.00	16 - \$6.40
17 - \$6.80	18 - \$7.20	19 - \$7.60	20 - \$8.00
21 - \$8.40	22 - \$8.80	23 - \$9.20	24 - \$9.60
25 - \$10.00	26 - \$10.40	27 - \$10.80	28 - \$11.20

29 - \$11.60	30 - \$12.00	31 - \$12.40	32 - \$12.80
33 - \$12.80	34 - \$13.60	35 - \$14.00	36 - \$14.40
37 - \$14.80	38 - \$15.20	39 - \$15.60	40 - \$16.00

Ad No 1—Total words _____ x .40 per word = \$ _____
 All Caps words _____ x .10 per word = \$ _____
 Bold words _____ x .10 per word = \$ _____
 Bold Cap words _____ x .20 per word = \$ _____

TOTAL COST OF AD No. 1 \$ _____

Card # _____

Expiration Date ____ / ____

Signature _____

Total classified ad Payment \$ _____ enclosed.

Check MasterCharge Visa (\$15.00 minimum credit card order)

Name _____ Phone _____

Address _____ City State Zip _____

! NOVEMBER SPECIALS !

EVER-TEK 286-12 MEG MB,G2 CHIP SET,AMI BIOS,0K.....	\$ 115.95
EVER-TEK AT I/O Card,2 Ser,Parrallel,Game.....	\$ 19.95
EVER-TEK Mono Graphic Monitor Card w/LPT1.....	\$ 19.95
PTI 48 MEG HD,RLL,3 1/2" w/WD-RA2 HD/FL Controller.\$	259.95
PTI 65 MEG HD,RLL,3 1/2" w/WD-RA2 HD/FL Controller.\$	329.95
PTI 40 MEG HD,MFM,3 1/2", Drive Only.35Ms.....	\$ 249.95
PTI 48 MEG HD,RLL,3 1/2", Drive Only.35Ms.....	\$ 239.95
PTI 65 MEG HD,RLL,3 1/2", Drive Only.35Ms.....	\$ 309.95
XT-RLL HARD DRIVE CONTROLLER w/cables.....	\$ 64.95
XT-MFM HARD DRIVE CONTROLLER w/cables.....	\$ 59.95
SPEEDLINK 2400I MODEM,w/software,cable,2YR WARRANTY.\$	69.00
6 OUTLET SURGE PROTECTOR STRIP.....	\$ 8.95
6 OUTLET SURGE PROTECTOR w/MODEM PROTECTION.....	\$ 21.95
JOYSTICK,ADJUSTABLE CENTERING,w/FIRE BUTTON.....	\$ 19.95
FOCUS 2001 KEYBOARD,101 Keys,AT/XT,w/Flip Cover....	\$ 59.95
360K/1.2MEG FLOPPY DRIVES.....	\$ 64.95/74.95
1.44 MEG Floppy w/5 1/4 mounting kit.....	\$ 78.00
XT-FLOPPY CONTROLLER, 360,1.2,720,1.44 Drives.....	\$ 49.95
TDCOMM 5503VIP-5507 TEST CHIPS (NO WI. SALES).....	\$ 29.95
SUNSHINE EW904B EPROM PROGRAMMER 4 GANG w/software..	\$ 129.95
ALL HARD DRIVES COME WITH 5 1/4" MOUNT AND 1 YEAR WARRANTY	

PHONE DIALER

- The single Line Telephone System-with 100 NO. memory up to 40 digits in length.
- THE SPEED DIALING SYSTEM/with a dozen more features.
- Automatic and manual delays may be stored.
- 6 Telephone and Systems restrictions.
- Last number redial-hold features-
- LOCK OUT UNWANTED 900 NUMBERS.

Requires no other parts when used with a single phone. Comes with battery backup and single adaptor.

PRICE ONLY \$15.95

COMPUTER PARTS

84 Key XT Keyboard	\$22.50
Multi I/O XT s/p/c/g/FD cont.	35.95
Multi I/O AT s/p/g	35.95
6' Printer Cable	8.95
Monitor Ext. Cable 6'	6.95
Keyboard Ext. Cable 6'	5.95
Monitor Adaptor Cord 6'	4.50
Apple II & IIE RGB Color Card	15.95
Replacement keyboard cable w/connector	4.00
CALL FOR OTHER ITEMS	

MISC. PARTS

Musical Phone Ringer	\$ 10.95
SAW Filter CTI-80-134 70 mhz	1.95
Wavetek Filter 45 mhz	2.50
24 Pin Machine Sockets Gold	.65
Other IC Sockets in Stock	CALL
Oscillating Ceramic Heaters	43.95
1 1/2" Black Duct Tape 100'	2.50
3/4" Black Duct Tape 100'	1.50
Loran Amplifier	8.95
DC to DC Power converter	10.95
22 Volt DC power supply	9.95
A/B Switch 70 ohm	2.50
Mitsumi RF Modulator	5.00
Toshiba RF Modulator	5.00



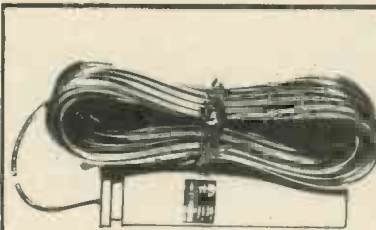
MITSUMI RF MODULATOR

Crystal controlled, "RCA" phono style output connector. Used by Birdview for their Satellite receivers. Super for projects!
ONLY \$ 5.00



GENIUS GM-6X MOUSE

Including Dr. Halo III Graphics Software.
ONLY \$32.95 !



LORAN ANTENNA MOUNT

This is a Loran antenna mount with builtin amplifier used to receive the Loran Navigational signals used on ships & boats to locate their position. The antenna mounts can be converted for "Ham or CB use. The built in amp is low freq. usable in the 40-400khz range. Comes with approx. 35 ft of cable.
A STEAL AT ONLY ! \$ 15.95

IC'S - EPROMS

TMS 4464-120 (np)	\$ 3.00
TMS 4464-150 (np)	2.80
27128 Eprom (pe)	2.75
27256 Eprom (pe)	3.25
27512 Eprom (pe)	5.00
2708-2716-2732-2764	CALL
Eprom Eraser w/timer 25 Piece	124.95



\$585

UNIVERSAL PROGRAMMER

- PROGRAMS
 - EPROMs upto 4MBits & 16Bit wide
 - PALs from AMD, MMI, TI, NS, TYPRESS etc
 - 22V10 from AMD, ATMEL, TI, SAMSUNG & GAT
 - RESS
 - EPLDs from ALTERA, INTEL
 - GALs from LATTICE, SGS & NV
 - FPLDs from SIGNETICS
 - PEELs from ICT, HYUNDAI & GOLD
 - BIPOLAR PROMs
 - SINGLE CHIPS (8748, 8751 & 87C51 series)

- SUPPORTS
 - 32Bit WORDSPLIT with 4 GANG adaptor
 - PALASM2, CUPL, ABEL, TANGO, OCAD, JEDEC files
 - PAL VERIFICATION using TEST VECTOR
 - GAL electronic signature recognition
 - 87C451, 63701, X, Y, V & 63705V with adaptor (option)
 - Tests ICs: TTL, CMOS & D-S Memories ICs with user definable test patterns

- Package includes software, programming module, signal speed interface, lead and cable

- OPTIONS
 - ICs
 - 4 Socket adaptor for PLCC, LCC, CMOS and PLAI ICs
 - 4 Socket adaptor for EPROMs
 - Socket adaptors for micro computers



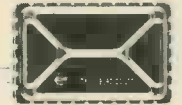
TRACKER II & III REMOTE CONTROL UPGRADE KIT

These units will upgrade your Houston Tracker II & III Satellite Dish Controller. Control your dish from your armchair!! These units are ICHP controlled and can be used for any projects, robots, airplanes, cars, or anything you want. Great for experimentors!!

PRICE ONLY \$15.00



4 WAY SPLITTER DC Passive
WOW ! ONLY \$5.00



MITSUMI TUNER UHF p/n UES-A55F
These are standard uhf tuners with a 70 mhz output. These are used in many TV's and VCR's
Price is **ONLY \$5.00**

DON'T SEE WHAT YOU NEED? CALL!!! Computer, Satellite Electronics and More!!! FREE CATALOG!!



Send Orders To: Lesko's
6614-7th Street
Kenosha, WI 53144
Phone Orders:(414) 553-9440
Fax Orders:(414) 859-2928
Hours: Mon-Fri 9-5 Central Time
Closed Sat-Sun

Minimum orders: \$10.00. Minimum shipping & handling \$5.00. MC, VISA, M.O. and CODs. Wisconsin residents add 5% sales tax. Not responsible for typographical errors. All merchandise subject to prior sale. 20% restocking fee for returned orders. Returned orders require R/A Number. Sorry No Personal Checks.

WE BUY SURPLUS & OVERSTOCK ELECTRONICS
Send us a fax with discription/price and quantity.

A COMPLETE ELECTRONICS SUPERMARKET!

- Visible Laser Diode.....\$45.00
630nm * NEC * documentation available * pulls *
- 5 Volt Power Supply
70 Amps Lambda #LYS-K-5-OV * New w/manual.....\$195.00
120 Amps Lambda #LYS-D-5-OV * New w/manual.....\$250.00
- Helium Neon Laser Tube.....\$19.95
Approx. 1mW * Tested Good * without power supply *
- Rechargeable Batteries.....\$4.95
6VDC @ 3Amp Hour * 5.5"x1.5"x2.5" * 2 Piece Minimum *
- AA Alkaline Battery Pack (New * 89/90 date code * Bussed for voltage)
4 x AA 6 volt.....per pack \$0.95
8 x AA 6 volt (higher current).....per pack \$1.49
- Lens/Mirror Unit.....\$4.95
From copy machine * by Fujii Optical* 2 1/4" Plano/Convex Lens *
- Super Magnet.....10 for \$9.95
Rare earth * approx 1/2" x 1/2" x 1/32" * Incredibly strong *
- Low Noise Converter.....\$9.95
3.7-4.2 GHz in * 70 MHz IF * 120 Degree *
- Carbide Drill Bits.....box of 50 \$4.95
For PC boards * .024" *
- S.C.S.I. Cable.....\$9.95
DB25 male to 50 pin Blue Ribbon male * 3' * NEW! *
- Sun Micro Systems Hi-Res Color Monitors.....\$495.00
14" * Sony CRT * Mod #360-1033-01 * MAC II HI-Res Compatible *
- Battery Charger.....\$19.95
Deluxe for ni-cads * D,C,AA,9V * UL listed *
- 1 GHZ Band Pass Filter.....\$19.95
SMA in & out * NEW! *
- Hyundai Monochrome Monitors
12" Amber * IBM/Hercules Compat. (order #HMM 1200A).....\$39.00
12" Flat Screen Amber * IBM/Hercules Compat. (order #HMM 1201A).....\$45.00
14" Flat Screen Amber * IBM/Hercules Compat. (order #HMM 1401A).....\$59.00
- 286 Laptop Computer (order #R/Laptop).....\$1495.00
20 MB Hard Disk * 1.44 Floppy * Modem * Carry Case * 1 MB RAM
* 80C286 * 10 MHz * SIO/PIO *

Haltek Electronics is a 15,000 sq.ft. retail store in the heart of silicon valley. We offer one of the most diversified selections of high-tech goods from the oldest to state of the art. We are exceptionally strong with computer products, IC's passive components, electro mechanical, optics, wire & cable and probably one of the biggest inventories of Lambda power supplies around. We do not have a catalog or a product listing, due to the ever changing supply.

So give us a call and we will be happy to check stock for any and all your electronics needs.

HALTEK

ELECTRONICS



1062 LINDA VISTA AVENUE • MOUNTAIN VIEW, CA 94043 • 408-744-1333 / 415-969-0510

A COMPLETE ELECTRONICS SUPERMARKET!

- XT Mother Boards (order #R/Turbo).....\$49.95
8088 * 8 MHz * 640K opt. *
- 286 Mother Boards (order #R/286-12).....\$99.95
AT Compatible * 12 MHz * Baby *
- 20 MHz Oscilloscope (order #R/Model-2000).....\$295.00
Dual Trace * TV Sync. Filter * 2 each x1, Ref., x10 Probes *
- 35 MHz Oscilloscope (order #R/Model-3500).....\$389.00
Dual Trace * Delayed & Single Sweep Modes * 10n.s. Rise Time
* 2 Axis Intensity Mod * 2 ea. x1, Ref., x10 Probes *
- EPROM Programmers * w/Software * IBM Compatible * 2716 to 27512 *
One Gang (order #R/EPROM).....\$59.95
Ten Gang (order # R/EPROM-10).....**SALE!**.....\$149.95
- 150 Watt Power Supply * XT Compatible *.....\$39.95
- 200 Watt Power Supply * AT Compatible *.....\$49.95
- VGA Color Monitor (order # R/VGA Monitor).....\$295.00
14" * Tilt & Swivel Base * Relisys Mod #RE9513 *
- CGA Adaptor (order #R/CG).....\$19.95
IBM Compatible * Great for video games!
- Hard Disk Controller for XT Compatible (order #R/HDC).....\$29.95
supports 10 Drive Types * w/Cables and Documentation *
- RLL Hard Disk Controller for XT Compatible (order #R/RLL).....\$49.95
50% faster data transfer * Rom Resident Pre-Format * RLL Drives Only!
- Hard Disk Drives Factory Refurbished * 1 Yr Exchange by Haltek
- 20 MB Hard Disk * Seagate ST-225.....\$179.00
- 30 MB Hard Disk * Seagate ST-238R.....**SALE!**.....\$135.00
- 40 MB Hard Disk * Seagate ST-251-1 * 28 ms *.....\$249.00
- 80 MB Hard Disk * Seagate ST-4096.....\$299.00
- 340 MB S.C.S.I. Package Deal (R/1578-PKG).....\$995.00
18ms * w/W.D.'s S.C.S.I. Controller & Cables * 1 Yr Warranty *
- 340 MB E.S.D.I. Package Deal (R/1558-PKG).....\$995.00
18ms * w/W.D.'s E.S.D.I. Controller & Cables * 1 Yr Warranty *
- 49 MB Hard Disk.....**SALE!**.....\$179.00
Seagate ST-157R * RLL * 3.5" * New * 1 Yr Exchange *

*** ABOUT OUR REFURBS ***

Our refurbished inventory contains items that fall into one or more of the following categories: 1) failed primary testing, 2) was sold and returned as failed, 3) cosmetically imperfect. In any case, the item was returned to the O.E.M. (original equipment manufacturer) and was reconditioned or fixed to original manufacturers specifications. HALTEK guarantees all refurbished products for 90 days from the date of purchase. Any item may be exchanged within that period. The management of Haltek Electronics requires that any returns be in the original packaging and be complete, including any and all manuals, cables, software, etc. and must be accompanied by the original sales receipt. Prices subject to change without notice * Quantities limited to stock on hand * All items are refurbished unless indicated as "new"

BBS# (415) 969-6321

HALTEK

ELECTRONICS



1062 LINDA VISTA AVENUE • MOUNTAIN VIEW, CA 94043 • 408-744-1333 / 415-969-0510

*FREE CATALOG

Loaded With Satellite TV Products At Discount Prices

- Complete Systems
 - Upgrades
 - 2ft to 24ft Dishes
- Parts
 - Accessories
 - Major Brands
- Factory Fresh
 - USA Warranty
 - Fast Delivery



Satellite TV Anywhere

World Satellite TV
Scrambling Methods
The Technicians' Handbook



WORLD SATELLITE TV AND SCRAMBLING METHODS

"The Technicians' Handbook"

This thorough text is a must-buy for technicians, satellite professionals and curious do-it-yourselfers. The design, operation and repair of satellite antennas, feeds, LNBs, receivers and modulators are examined in detail. An in-depth study of scrambling methods and broadcast formats including the VideoCipher II, Oak Orion, FilmNet, Sky Channel, EuroCypher, D2 MAC, BSB and Teleclub Payview III. Circuit and block diagrams of all components are presented and clearly examined throughout the handbook. This information is a prelude to the chapters on troubleshooting and setting up a test bench. This expert guidance on testing, servicing and tuning is complimented by a wealth of detailed illustrations.

340 pages, 8 1/2 x 10 3/8 over 200 photos, diagrams, wiring schematics and 16 tables / appendices / index
Order 0020013S&H \$4 (U.S.)\$39.95



THE SKYVISION DO-IT-YOURSELF INSTALLATION VIDEO

"Now You Can Watch It Being Done"

Installing or "Tuning up" your satellite system made simple. From start to finish, the Skyvision Do-It-Yourself Installation Video is a step-by-step video that will help you set-up your systems in no time flat. It's like having our trained technicians right at your site helping you with every step.

Order 0020010 VHSS&H \$3 (U.S.) \$33.95

Order 0020014 BetaS&H \$3 (U.S.)\$33.95



IRDs / RECEIVERS / SYSTEMS

"Save \$\$\$ on Packages"

System package Includes: ORBITRON 10 foot mesh dish, 50degree LNB, 18" Jack Arm, Feedhorn and Receiver/IRD of your choice, plus a FREE detailed installation Video.

TUNE YOUR DISH TO ITS MAXIMUM!

"With The Pico Signal Meter"

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! The PP-1450 Pico Peaker is a super sensitive signal meter used for antenna aiming, focusing, peaking and polarity alignment. The multi-purpose Peaker can be used on any receiver system with block down-converted frequencies between 70 and 1500 MHz. (Does not work with older single conversion receivers - Ask for Bulz-I-Meter) The Peaker comes in an attractive case with neck strap.

Order 0025003S&H \$5 (U.S.).....\$89.95

Optional jump cable kit. Connects Peaker to LNB (Kit includes 2ea. 12' coax cables w/ splicer).

Order 0025007S&H \$3\$7.95

	IRD/Receiver	System
UNIDEN UST2200	(Receiver)	\$219
UNIDEN UST9000	(Receiver)	\$459 \$999
UNIDEN UST7700	(IRD)	\$909 \$1449
UNIDEN UST9900	(IRD)	\$997 \$1529
UNIDEN UST4400	(IRD)	\$939 \$1477
UNIDEN UST4800	(IRD)	\$1599 \$2139
HTS V	(IRD)	\$1025 \$1569
HTS VIII Plus	(IRD)	\$1177 \$1719
HTS X	(IRD)	\$1328 \$1869
DRAKE ESR324b	(Receiver)	\$239
DRAKE ESR924i	(Receiver)	\$599 \$1149
DRAKE ESR1024	(IRD)	\$909 \$1459
DRAKE ESR1224	(IRD)	\$1039 \$1577
DRAKE ESR1424	(IRD)	\$1229 \$1769
ECHOSTAR 4000	(IRD)	\$859 \$1399
TOSHIBA TRX 120	(IRD)	\$1179 \$1717
TOSHIBA TRX 2000	(IRD)	\$1585 \$2119

Just a partial listing of hundreds of products listed in the Skyvision catalog. Ask for your's today!

Skyvision, Inc.®

2048 College Way Fergus Falls, MN 56537 - Toll Free 800-334-6455

Mail in coupon or call Toll FREE today for the SKYVISION Satellite TV Product Catalog.

Delivered free to your mail box in U.S. and its holdings.

* International requests add \$8.00 to cover shipping and handling.

Send Skyvision Satellite TV Products Catalog

Name _____ Phone () _____

Address _____

City _____ State _____ Zip _____



install A System, Upgrade or Repair Yourself And Save \$\$\$\$

ings are on the knob. For example, the knob setting of 5 volts per division appears as a readout directly on the CRT near the waveform display. You just turn the knob a little one way or the other to scroll up or down through the settings. The screen readout tells you where you are.

In the most advanced scopes, there may only be one or two knobs on the front-panel. That's it. You determine what a "soft" knob do by making selections from a screen menu, as shown in Fig. 1. If you want to adjust the vertical sensitivity, simply select VERT from the screen menu, then adjust the knob for vertical scaling. Select HORIZ, then POS, and the knob becomes a horizontal position control. There are two big advantages of displaying scope setup and control readouts directly on the CRT—the user can make quick measurements, without taking his or her eyes off the screen, and it helps with screen photographs, where all of the pertinent information about the measurement is displayed on the CRT.

The automatic setup feature makes setting up the scope easy and efficient. With an automatic setup button, the scope automatically senses key setup parameters from the waveform at the probe tip and sets itself up for a

standard display of that waveform. The usual scope controls are also available to change settings or to set up special functions, such as delayed sweep or single-shot triggering. Single-button setup of initial displays is a definite advantage, and a convenience that's quite easy to get used to.

In addition to automatic setup features, many scopes also have front-panel controls that allow you to store and recall setup configurations. Such advanced features allow you to set the scope up one way for a waveform measurement and store the settings in a memory location. You'll then be able to set the scope up in a completely different way for another measurement, and store those settings in a different memory location. Switching between the measurements then becomes a piece of cake!

Automatic memory recall is particularly useful if you're tracing a waveform through various circuit stages and need to repeat several scope setups at each stage to check waveform parameters such as rise time, pulse width, and repetition rate. Simply push a few buttons for the setup you want.

The number of front-panel settings that are stored in a scope depends on the amount of memo-

ry provided for that purpose. Also, if the memory is non-volatile, the settings will still be there for recall the next time you turn the scope on.

Screen cursors and push-button measurements are still other features that are appearing more on analog scopes. Screen cursors are a set of lines or other markers that can be moved to any place on the screen (see Fig. 1). The screen location of the cursor, in terms of amplitude or time, appears numerically on a screen readout. By properly positioning two cursors on a waveform display, it's easy to measure peak-to-peak voltages or rise times.

The features discussed so far have been enhancements to the traditional analog scope; the waveform being probed, displayed, and measured has not been digitally altered in any way. Because an analog waveform is displayed in real time on an analog display, it must be repetitive in order to remain on the display long enough to be measured by counting divisions, placing cursors, or using push-button measurements.

Digital scopes offer many advantages and conveniences over typical analog versions. Let's find out why some prefer to use digital scopes over their analog counterparts.



Digitizing scopes

Some key elements of a digital scope are shown in the block diagram of Fig. 2. The analog waveform is sampled and digitized after the input signal is conditioned. The digitized waveform is stored in digital memory, from which it can be recalled at any time for processing, display, and measurement. All of that occurs automatically, and is set up using the same basic controls as a traditional scope. Additional controls are used to select memory locations for waveform storage, and any processing or analysis that occurs during or after waveform acquisition.

Waveform digitizing offers significant advantages to the traditional approach of waveform viewing and measurement. In terms of scope design and manufacture, a wideband-signal path to the CRT display no longer has to be provided. Also, the CRT speed requirements are reduced since waveforms can be reconstructed from digital memory. Some digitizing scopes even use LCD displays, which eliminate bulky CRT's and their associated power supplies.

Some primary advantages of waveform digitization are:

- Waveforms that would appear as a brief flash (single-shot or low-repetition pulses) or a slowly moving dot (low-frequency signals) on a traditional analog scope, can be frozen on the screen for observation and analysis later on.
- Waveforms can be captured at different times and places and displayed together for purposes of comparison.
- Various amounts of waveform prior to the trigger point (see Fig. 3) can be included in capture and display, allowing complete and detailed analysis of rise times and any waveform preshoot.
- Signal averaging, enveloping, peak detection, and other types of processing can be used to enhance or emphasize certain aspects of waveforms.
- A wide range of analysis procedures can be applied to compute waveform parameters either as built-in scope features or by transferring digitized waveforms to a computer for software based waveform processing.

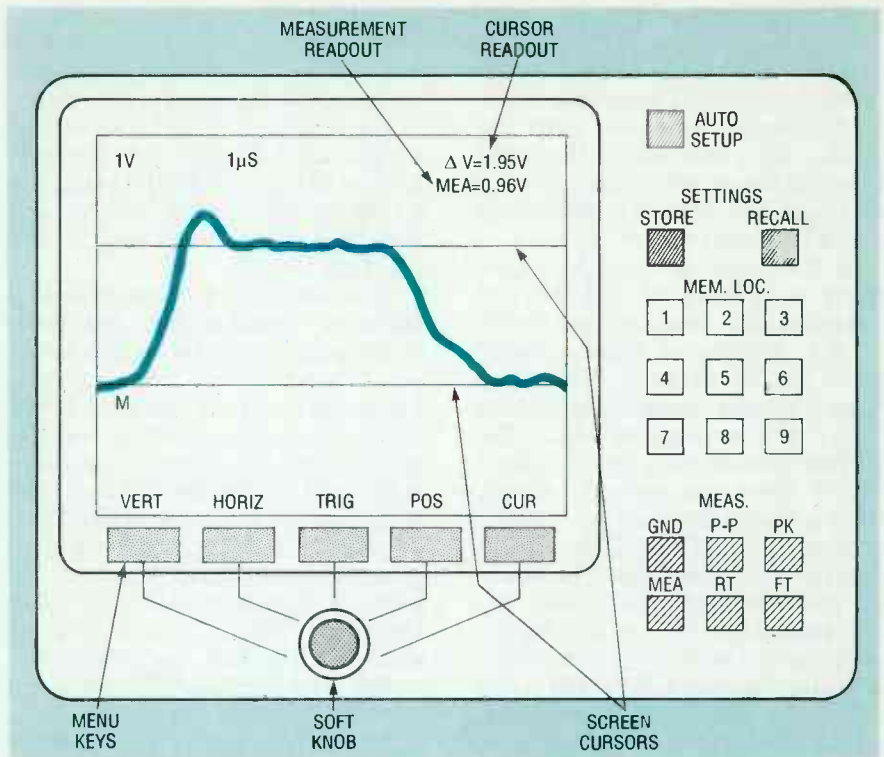


FIG. 1—SOME OF THE MANY features that are changing the face of traditional analog scopes, as well as digital scopes are screen menus, soft knobs, automatic setup, cursors, and front-panel settings with storage and recall.

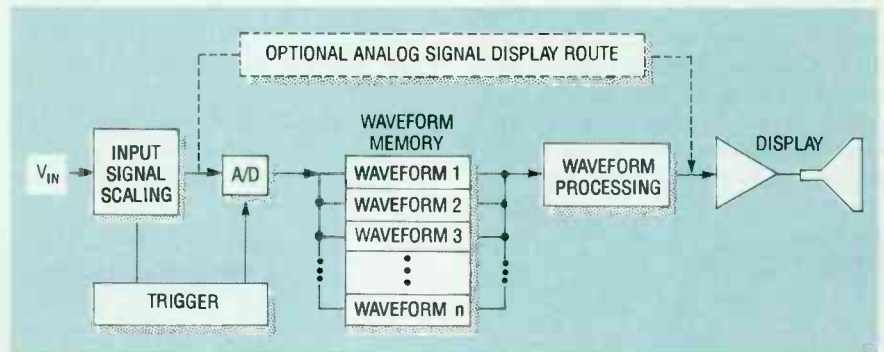


FIG. 2—THIS IS A BLOCK DIAGRAM of a digital scope showing analog-to-digital (A/D) conversion taking place immediately following input-signal conditioning. Some digital scopes may also have an optional nondigitizing mode for use in initial scope setup.

The items mentioned above are just some of the many advantages provided by digital scopes. There can also be disadvantages which can be minimized through a better understanding of basic waveform digitizing.

Waveform digitizing up close

Waveform digitizing involves three processes—sampling, analog-to-digital (A/D) conversion, and storage of the digitized samples. Depending on the means of implementation, sampling and digitizing may be done in the same step, or separately. The end

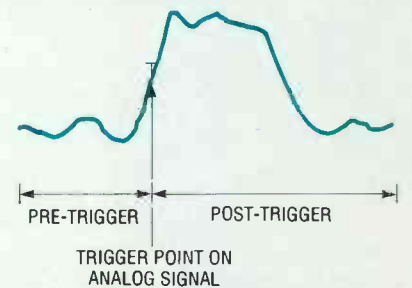


FIG. 3—TRADITIONAL ANALOG scopes display only the signal following the trigger point (post-trigger). Many digital scopes, however, can capture and display signal information prior to the trigger point (pre-trigger) as well as post-trigger information. Some digital scopes also indicate the trigger point with a "T" on the waveform display.

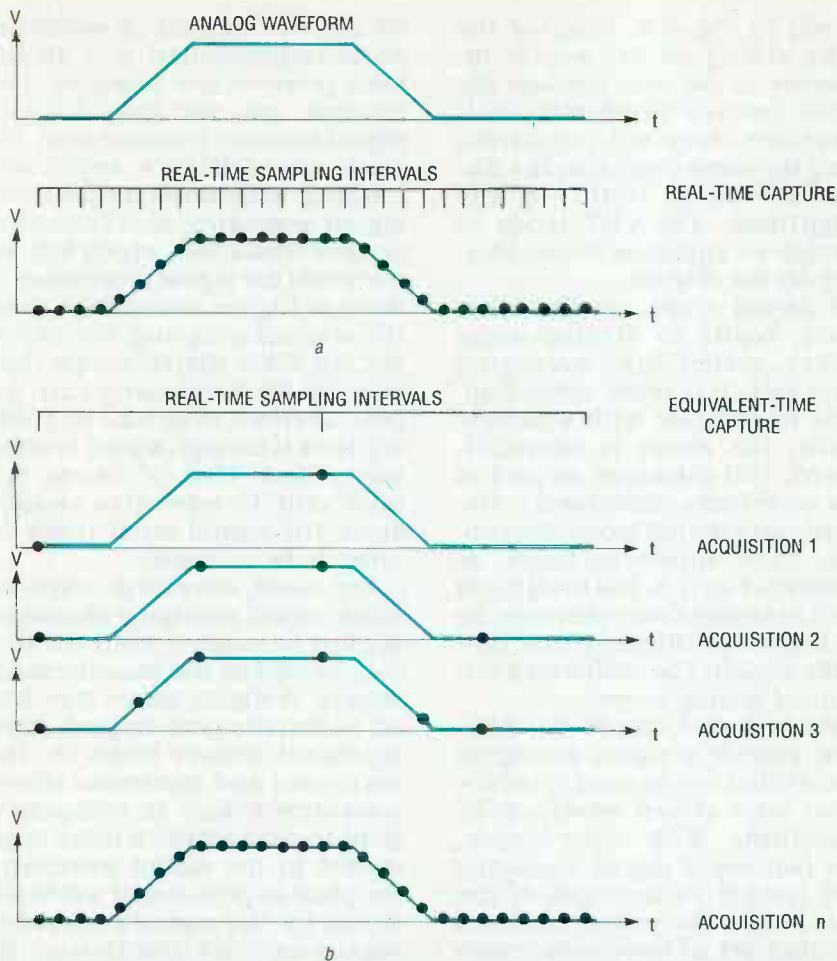


FIG. 4—REAL-TIME SAMPLING CAPTURES all waveform samples sequentially as the waveform occurs in real-time (a), equivalent-time sampling achieves the same apparent results as long as the waveform is repetitively triggered for sample build up over multiple acquisitions (b).

result, however, is a set of digitized amplitude samples representing the analog waveform.

The rate at which sampling is done determines the sample interval of the waveform and, therefore, the time resolution of the waveform representation. Depending on your needs, that can be looked at in terms of resolving rise times, or number of samples per cycle for overall waveform definition. For example, a 100-megasamples per second (MS/s) sampling equates to a sample interval of 10 nanoseconds (1/100 MS/s). That sampling rate is quite adequate for defining rise times of 500, down to 50 nanoseconds, but inadequate for rise times of 20 nanoseconds or less. In simple terms, a 100-MS/s sampling provides 100 samples per cycle for a 1-MHz sine wave, a 10-MHz sine wave is sampled 10 times per cycle, and a 50-MHz sine wave is sampled only 2 times per cycle.

Most digital scopes provide more than adequate sampling rates on all sweep-speed settings (seconds/division), as long as you are dealing with repetitively triggered waveforms. Just set the sweep speed, and the appropriate sampling rate is automatically set by the scope. That may not be the case, however, if you use single-sweep triggering for waveform capture.

With a single-triggered sweep, all samples must be taken sequentially in real-time, as the waveform occurs. The limit of effectiveness is determined by the digital scope's real-time sampling rate. Some digital scopes have very high real-time sampling rates, some as high as 500 MS/s or even higher. Others opt for the economy of a low real-time sample rate, 10 MHz for example, and use equivalent-time sampling to cover the higher sweep speeds. The real-time sample rate, however, determines the

resolution limit for single-sweep waveform captures.

The differences between real-time and equivalent-time sampling are shown in Fig. 4. In Figure 4-a, real-time sampling takes all samples in sequence. The waveform is fully sampled in a single triggered acquisition. In Fig. 4-b, equivalent-time sampling builds up a full set of samples by combining samples from multiple-triggered acquisitions of the waveform. Because of the multiple acquisition requirement, equivalent-time sampling can be used only on repetitive waveforms.

Even if you only need to capture repetitive waveforms, the scope's real-time sample rate is still important. With a low real-time rate, it takes more triggered acquisitions to obtain a full equivalent-time set of samples. As a result, it takes longer to fully update the displayed waveform after any waveform change. The delayed waveform display can cause an annoying time lag between tuning a circuit under test or making a scope adjustment and seeing the waveform change completed on the screen. High-speed, real-time sampling and fast display update rates eliminate such display lag problems. Another approach used by some digital scopes is to provide an alternate analog signal path (non-digitizing mode) for real-time, nonstored displays in the traditional scope manner (see Fig. 2).

Regardless of the sampling method or speed, each amplitude sample must be digitized before it can be stored in the digital scope's memory. The number of bits used in digitizing determines the amplitude resolution used in representing the waveforms. For example, 6-bit sampling provides 64 digital levels (2^6) for describing a waveform captured at any selected vertical scale factor (volts/division). By contrast, 8-bit sampling provides 256 levels (2^8) of vertical resolution, which is an improvement of four times the resolution. Figure 5 graphically shows how 8-bit sampling more accurately represents the waveform amplitude than 6-bit sampling does.

With the resolution advantage of 8-bit versus 6-bit sampling,

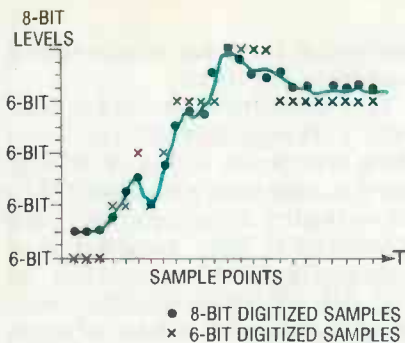


FIG. 5—RESOLUTION IS FOUR times better with 8-bit sampling (256 levels) than with 6-bit sampling (64 levels). The result is a closer representation of waveform amplitude details.

you might ask yourself why anyone would offer a 6-bit digitizing scope? For that matter, why settle for 8-bits? Why not go for 10-bit digitizing with 1024 resolution levels?

The answer simply boils down to speed and cost. It's easier and less expensive to get high real-time sampling rates with lower resolution. Thus, some scope manufacturers use 6-bit sampling, and emphasize price and sample-rate advantages in their product specifications. The truth is, high sample rates and time resolutions have little advantage without adequate vertical resolution. For example, to make rise-time measurements, you must first determine the 10% and 90% pulse amplitude levels before you can measure transition time, which is best achieved with 8-bit or higher resolution.

Waveform processing and measurements

When a waveform is displayed on both a traditional analog scope and a digital scope, it can appear to have distinctly different details. That is often due to ambient noise riding on the waveform and the differences in how it is captured and displayed along with the waveform.

A low-level repetitive waveform with noise presents a somewhat fuzzy trace on an analog scope display. The bright central portion of the trace represents the actual waveform on average, without the noise. The less bright, fuzzy edges of the trace are the result of trace blooming (edge glow or spreading) as well as some low-level noise elements, as

shown in Fig. 6-a. Much of the noise riding on the waveform, however, is not seen because the noise occurs randomly and, therefore, does not repeatedly trace the same course on the display screen to build up any brightness. The CRT tends to average or suppress noise, blurring on the display.

A digital scope, on the other hand, tends to display noise spikes, rather than averaging them out. If a noise spike happens to coincide with a sample point, the noise is sampled, stored, and displayed as part of the waveform. Waveforms displayed on a digital scope often appear to be sprouting hairs, as shown in Fig. 6-b. You need to get used to seeing noise elements on digital scope displays that normally wouldn't be visible on a traditional analog scope.

Many digital scopes do, however, provide a signal averaging feature that can be used to reduce noise on a stored waveform by smoothing. With some scopes, you can select signal averaging and specify 16 averages of the waveform. The scope captures the first set of waveform points and stores it in memory. The second set of points is then captured and added to the first set in memory. That process goes on until 16 sets of captures have been summed in memory. The sum of the captures is then point-by-point divided by 16 to get the averaged waveform.

The advantage of averaging is that it reduces random noise. The amount of noise reduction increases with the number of averages selected, which correspondingly improves the signal-to-noise ratio of the waveform.

Ideally, the amount of signal-to-noise improvement is 3 dB for each power-of-two averages. For example, you will have 3 dB of signal-to-noise improvement for 2 averages, 6 dB for 4, and so on.

Along with noise reduction, signal averaging also improves vertical resolution, which will occur when the signal processing is done at higher resolutions than the original sampling. For example, an 8-bit digital scope that uses 16-bit processing can appear, in effect, to be a 10- or 11-bit digitizer if enough signal averaging is done. That, of course, applies only to repetitive signals in order to be averaged.

For most waveform acquisitions, signal averaging should be applied to improve both the display as well as the measurement results. A digital scope that has an automatic peak-to-peak measurement feature looks for the maximum and minimum stored waveform values to compute a peak-to-peak result. If noise is included in the stored waveform, the peak-to-peak result will be affected by the signal-plus-noise maximum and minimum. By averaging the signal first, you reduce the noise, and achieve a more accurate measurement of the signal peaks.

In other cases, signal averaging may defeat the purpose of the measurements, which would be the case in checking digital signal noise and timing margins. With that type of measurement, you want to see and measure the noise and jitter extremes: so don't use averaging.

Traditional analog and digital scopes display waveform jitter in different ways. An analog scope

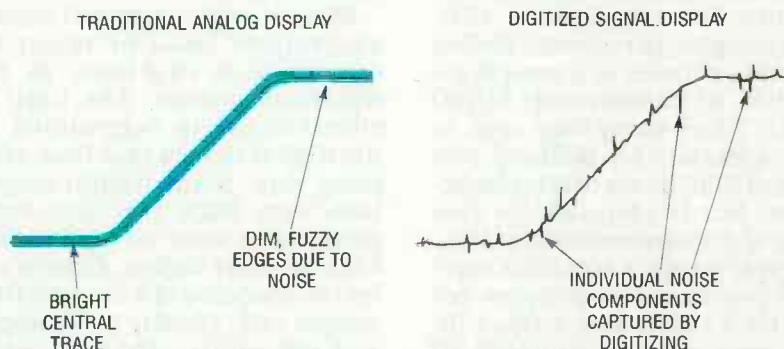


FIG. 6—A NOISY SIGNAL APPEARS on an analog display as a bright central trace with dimmer, fuzzy edges (a), whereas a digitized signal clearly shows all captured noise elements as part of the stored signal samples (b).

display shows most of the waveform jitter, but may miss the extremes because they are too infrequent to cause a visible trace. Figure 7-a shows a jittered-pulse edge display on an analog scope of moderate speed. That display has multiple vertical values for each point in time.

As far as digital scopes go, they can't give you a true representation of timing jitter because they normally capture and display only one vertical point for each sample point in time, as shown in Fig. 7-b. A digital scope can, however, show the full extremes of waveform noise and jitter variations by using the envelope mode. Figure 7-c shows how the displayed extremes are captured by enveloping multiple waveform acquisitions, which are actually two stored waveforms—one consists of maximum values of the overall acquisition points, the other consists of the minimum values.

Thinking literally

What you should remember about digital scopes is that they tend to be much more literal in how they capture and display waveforms than an analog scope. Getting used to that requires some thought about what you expect, or need to see in a waveform capture. If you want to see a "cleaned up" version of the waveform for measurements such as peak, rise time, and fall time, use signal averaging. If you're troubleshooting a noise or timing problem, you'll want to see the actual waveform, so don't use averaging. Or you may just want to see the extremes represented by the envelope of point-by-point maximum and minimum values of a waveform.

Thinking literally also applies to many automatic measurement features. As an example, you wouldn't expect to find a DC component in a sine wave that's been passed through a coupling capacitor. The sine wave's mean value over time should be zero, however, the mean value of a sine wave on a digital scope probably won't be zero. Is the digitizing scope in error?

Not really when you stop and think about the waveform and how it's captured and processed. A pure sine wave has a zero mean

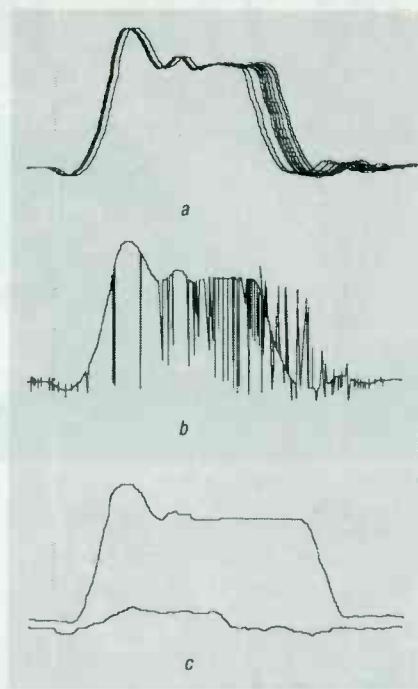


FIG. 7—WAVEFORM JITTER IS displayed differently, depending on the type of scope and capture mode being used; (a) is a display of waveform jitter on an analog scope of moderate speed, (b) is a display on a digital scope using equivalent-time sampling, and (c) shows clear representation of jitter and noise extremes obtained by long-term signal capture using a digital scope in a continuous-enveloping mode.

value only when considering entire cycles. If you consider 1.5 cycles, the mean value includes the additional fractional cycle. You're rarely able to precisely display a sine wave on a scope so that you see only entire cycles, with absolutely no fractional cycle, except if you adjust the time/division control in the uncalibrated mode. So, if you're feeding it 1.5 cycles of a sine wave, that's just what it's going to compute the mean value of. It does exactly what it's told to do, from exactly what's given. Nothing more, nothing less.

The scope's display is correct, it's just not what you expected because you were thinking in terms of the mean value over many cycles of the sine wave. If you apply about 20 or so cycles to the scope, a better result will be achieved because the computed mean over many full cycles will predominate, and minimize the error contribution from an extra fractional cycle.

If the digital scope's answer is still far from the expected zero mean, maybe you should take a

closer look at the waveform you're examining. Maybe there really is a DC component, or a bias component from the circuit. Maybe the waveform really isn't a sine wave. Is it exactly symmetrical above and below the zero reference level? And speaking of zero reference levels, did you capture a zero reference level just before you captured the waveform? If you didn't, the scope will use some previously established zero reference or a default zero reference that may not be correct for the current waveform and front-panel settings.

There's a lot to keep in mind when you're using a new scope to capture waveforms and compute their parameters. By understanding how the new scopes work, you'll be able to get precise answers for your specific testing needs, and no longer have to glance at a waveform display and say, "that looks just about right."

R-E

Try the

**Radio
Electronics®**

bulletin board
system

(RE-BBS)
516-293-2283

The more you use it the more
useful it becomes.

We support 300 and 1200 baud
operation.

Parameters: 8N1 (8 data bits, no
parity, 1 stop bit) or 7E1 (7 data
bits, even parity, 1 stop bit).

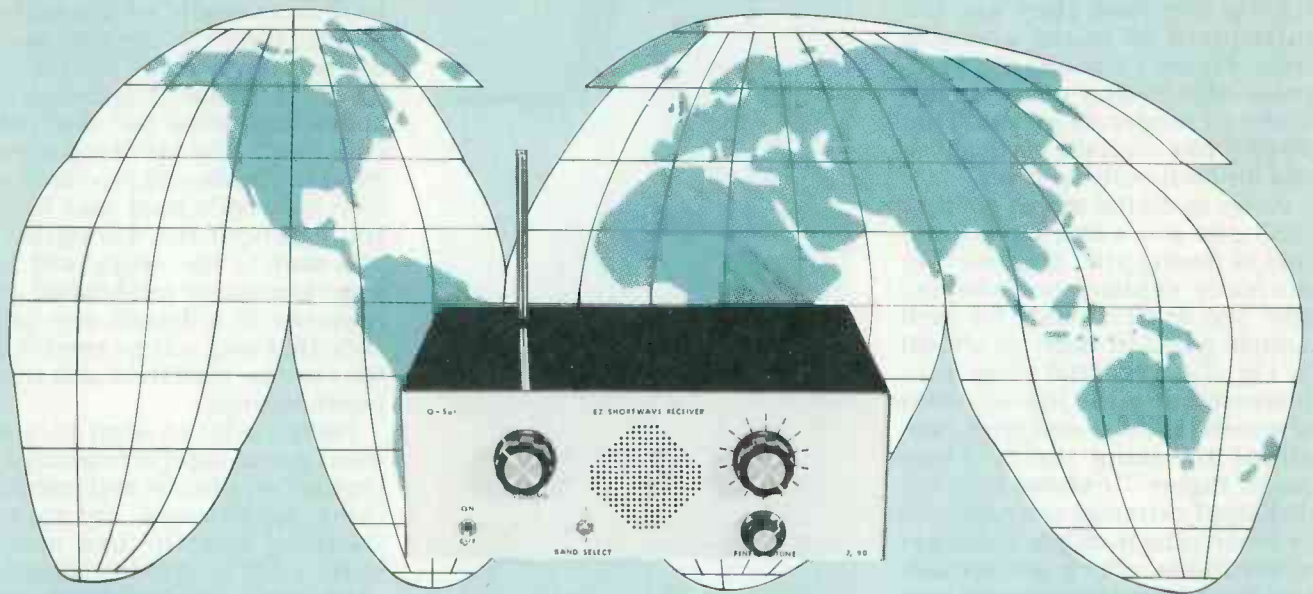
Add yourself to our user files to
increase your access.

Communicate with other R-E
readers.

Leave your comments on R-E with
the SYSOP.

RE-BBS
516-293-2283

TUNE IN THE WORLD



With R-E's EZ Shortwave Receiver

If you're looking for a fun project that won't break the budget, here's a shortwave receiver that's not short on performance.

RODNEY A. KREUTER WA3ENK

IF YOU'VE ALWAYS WONDERED WHAT you might hear on shortwave radio but didn't have the time or the money to get involved with it, then our simple, inexpensive shortwave receiver is the perfect project for you. It will have you tuning in on shortwave in no time—as a matter of fact, the first evening after the prototype was completed, stations from Germany, England, Cuba, Canada and France were easily copied.

The shortwave receiver is a no-crystal set with an audio amplifier. It's a true superheterodyne that tunes 8.5 to 11 MHz in two bands and includes a 455-kHz IF filter, automatic gain control (AGC), tracking RF tuning, and a very sensitive detector. It's sensitivity of under a microvolt puts it in a class with some high-performance receivers.

Theory of operation

The shortwave receiver takes a very straightforward approach to the classic superheterodyne receiver. The basic block diagram of our "superhet" is shown in Fig. 1, and the schematic is shown in Fig. 2.

The RF input tank, unlike many simple designs, provides "tracking," in that the input tuned circuit changes frequency when the oscillator is tuned. RF tuning is performed by D1, and oscillator tuning by D5. Both diodes are Motorola MV209 varactors, which act as voltage-variable capacitors. RF energy is coupled into pins 1 and 2 of IC1, the Signetics NE602 double-balanced mixer.

The mixer combines the incoming RF signal with the local oscillator and produces an intermediate frequency or IF of 455 kHz. Both mixer and oscillator functions are provided by IC1. Table 1 shows its specifications.

To simplify construction and enhance performance, a ceramic IF filter, FL1, is used instead of a more common tunable IF transformer. That results in a very clean IF that never needs tuning. The filters are available with bandwidths from 4 to 12 kHz to suit individual needs. The shortwave receiver will accept filters with input and output impedances of 2000 ohms.

Turning to the detector circuit,

D2 and D3 provide a 1.2-volt bias for diode D4 and Q3. The bias keeps both D4 and Q3 slightly on, so only a small signal is necessary for detection, reducing the gain needed before the detector and improving sensitivity.

The signal at the base of Q3 contains two components. The AC component is the demodulated audio, and the DC component is proportional to the strength of the incoming signal. The DC component is filtered by R20 and C17 and is used to provide an AGC signal to Q2 via AGC amplifier Q4. That helps to reduce fading that is so common on the shortwave bands.

The audio output stage, IC2, is a Motorola MC34119 audio amplifier. It provides about ¼-watt of audio into speakers of 8 to 64 ohms. No large output-coupling capacitors are needed, but a large power-supply decoupling capacitor provides excellent stability.

The prototype operates on a 9-volt battery and, if you listen at moderate volumes, they give you reasonable service. For longer service, use a pack of 6 or 8 "AA" cells, or an AC supply.

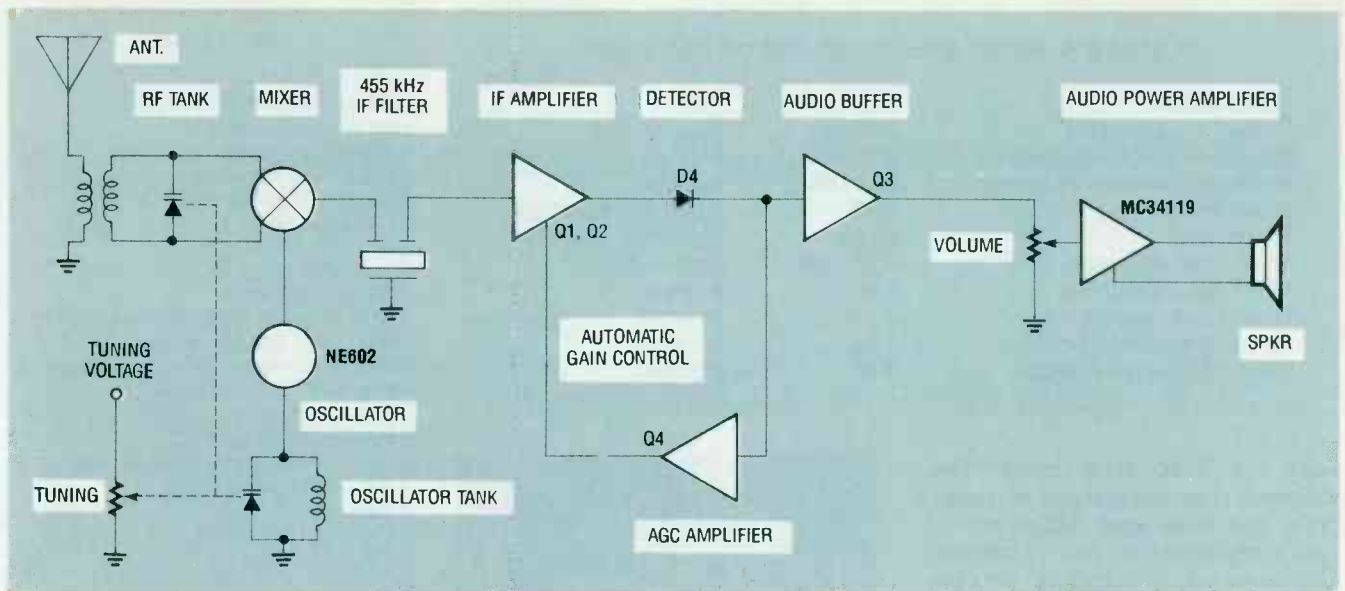


FIG. 1—BASIC BLOCK DIAGRAM of our superhet shortwave receiver. It's a true superheterodyne designed to tune 8.5 to 11 MHz in two bands.

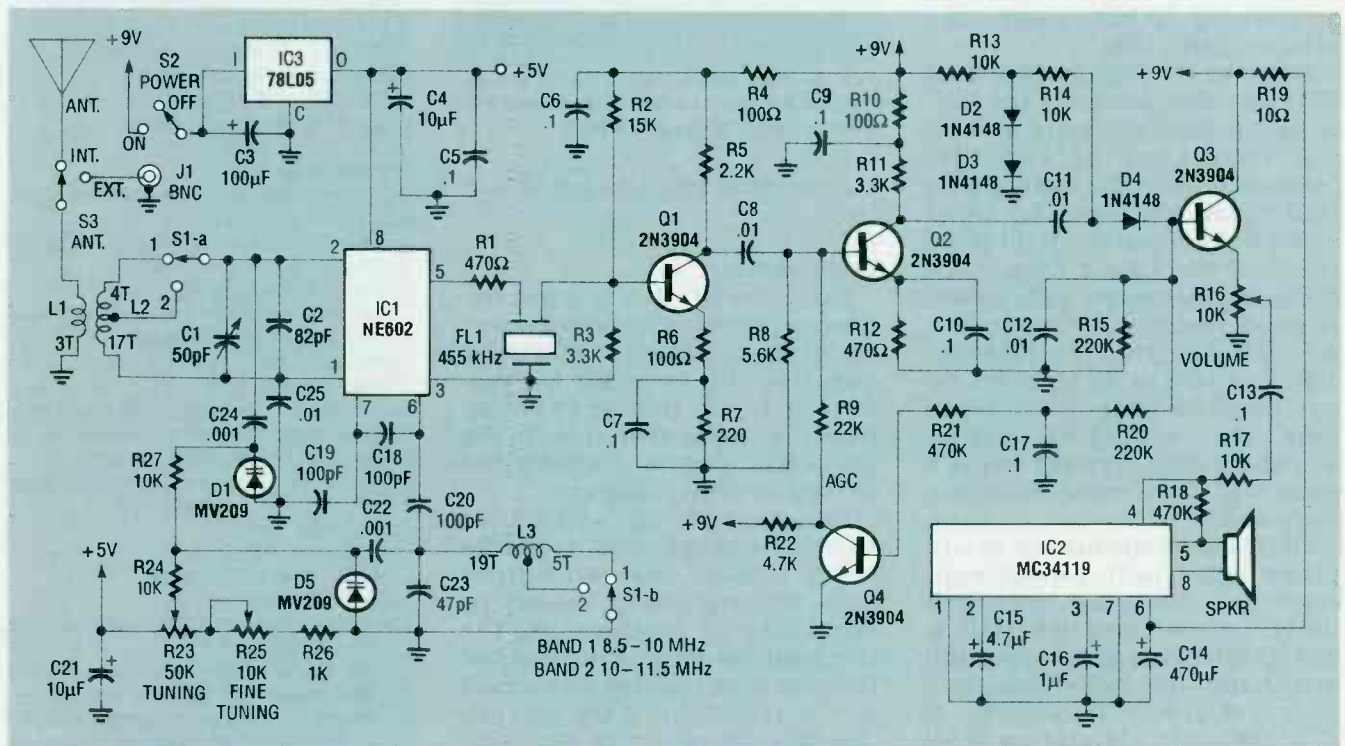


FIG. 2—SCHEMATIC FOR THE SHORTWAVE RECEIVER. The unit is powered from a 9-volt battery, making it very portable. It's sensitivity of under a microvolt puts it in a class with some very high-performance receivers.

Modifications and compromises

Every engineer learns early on that to design is to compromise. Usually performance is traded off for reduced cost. This design is no exception. The basic design philosophy was to produce a reasonable receiver at a reasonable price. In that regard we're very happy with the outcome. We did, however, omit some features, as a result.

Most modern shortwave receivers include a beat-frequency oscillator or BFO. The purpose of the BFO is exactly as its name implies, to beat a local oscillator (LO) signal against the incoming RF to produce a heterodyne frequency in order to copy code (CW) or single side band (SSB). That can be done at either the RF frequency or the IF, although IF BFO's are much more common.

The shortwave receiver's input coupling network provides tuning and impedance matching from the 50-ohm antenna input to the 1500-ohm input of the NE602. A really good receiver would use double or even triple tuning here, for better image rejection and overload performance.

Images, which are produced in the mixing of two signals, are

TABLE 1—BASIC SPECIFICATIONS OF THE NE602

Power supply	4.5V-8V	
Current consumption	2.4 ma.	(typical)
Maximum mixer frequency	500 MHz	(typical)
Maximum oscillator Frequency	200 MHz	(typical)
Noise figure	5 dB	(typical at 45 MHz)
Mixer gain	15 dB	(typical at 45 MHz)
Third order intercept	-17 dBm	(maximum)
Mixer input resistance	1.5k	(typical)
Mixer input capacitance	3 pF	(typical)
Mixer output resistance	1.5K	(typical)
Mixer output capacitance	3 pF	(typical)

very hard to eliminate. Remember that the output of a mixer is the sum and difference of two frequencies. For example, suppose we wanted to receive WWV on 10 MHz using an IF of 455 kHz. Using low oscillator injection, we would generate a local oscillator of 10 MHz minus 455 kHz, or 9.545 MHz.

However, if a frequency of 9.09 MHz was also present at the mixer input, we'd also have an output frequency of 455 kHz because 9.545 MHz minus 9.09 MHz equals 455 kHz. That other undesired frequency (9.09 MHz) is called the image frequency. Some sophisticated techniques, such as image-reject mixers or up-converting receivers are available, but almost all receivers reject the 9.09 MHz at the input tank. The tracking RF tank on our shortwave receiver helps a great deal, but doesn't eliminate the problem.

Overload performance is another important aspect concerning a shortwave receiver. If the RF tank is tuned to 10 MHz, it will let 10-MHz signals pass and attenuate—but not eliminate—signals of all other frequencies. If a 50,000-watt AM station is located close to the tank, some of the signal will get through. If enough of it does, you'll hear the AM station as well as the shortwave.

Tests on our active antenna (*Radio-Electronics*, February 1989) proved that an AM-reject filter was necessary to "clean up" our own local 50-kilowatt station. A high-pass filter that will attenuate AM stations by 40 dB is shown in Fig. 3; its low-frequency cutoff is about 2.2 MHz. The filter can be constructed on a piece of perforated construction

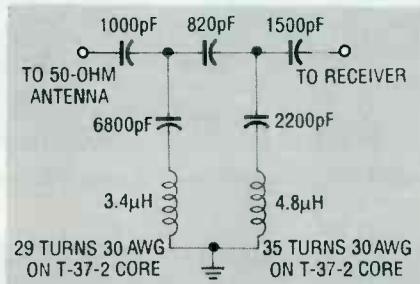


FIG. 3—THIS HIGH-PASS FILTER will attenuate AM stations by 40 dB. Its low-frequency cutoff is about 2.2 MHz.

board using point-to-point wiring.

Construction

Even though this is a low-frequency project, a PC board is recommended; you can make your own from the provided foil pattern or buy a finished version from the source mentioned in the parts list. Figure 4 shows the parts-placement diagram.

Inductors L1, L2, and L3 are wound on toroid cores, so they're much smaller than air-wound coils, and can still be "tuned" by stretching or compressing the turns on the toroids. Remember that a turn is counted on a toroid every time the wire passes through the center of the core. After you tune the coils, the wire can be held in place with epoxy.

Any speaker from 8 to 64 ohms will work with the MC34119. Expect slightly less audio output with higher-impedance speakers. The speaker leads should be twisted tightly and kept short.

If you use stereo headphones, don't connect the ground. Just feed the speaker output through resistors (you'll need to experiment with the value) to the left and right channels. Note that the MC34119 does not ground reference the speaker.

PARTS LIST

All resistors are 1/4-watt, 5%.

- R1, R12—470 ohms
- R2—15,000 ohms
- R3, R11—3300 ohms
- R4, R6, R10—100 ohms
- R5—2200 ohms
- R7—220 ohms
- R8—5600 ohms
- R9—22,000 ohms
- R13, R14, R17, R24, R27—10,000 ohms
- R15, R20—220,000 ohms
- R16, R25—10,000 ohms, potentiometer
- R18, R21—470,000 ohms
- R19—10 ohms
- R22—4700 ohms
- R23—50,000 ohms, potentiometer
- R26—1000 ohms

Capacitors

- C1—9-60 pF trimmer
- C2—82 pF, ceramic
- C3—100 µF, 16 volts, electrolytic
- C4, C21—10 µF, 16 volts, electrolytic
- C5-C7, C9, C10, C13, C17—0.1 µF (poly-ester or ceramic)
- C8, C11, C12, C25—0.01 µF, ceramic
- C14—470 µF, 16 volts, electrolytic
- C15—4.7 µF, 16 volts, electrolytic
- C1—1 µF, 16 volts, electrolytic
- C18-C20—100 pF, NPO
- C22, C24—0.001 µF, ceramic
- C23—47 pF, NPO

Semiconductors

- D1, D5—Motorola MV209 varactor
- D2-D4—1N4148 diode
- FL1—455-kHz ceramic filter (8-kHz bandwidth Toko HCFM2-455C)
- IC1—Signetics NE602N mixer
- IC2—Motorola MC34119 audio amplifier
- IC3—78L05 5-volt regulator
- Q1-Q4—2N3904 NPN transistor

Other components

- L1—3 turns #30 wire on L2's toroid core
- L2—21 turns #30 wire tapped at 17 turns on T-37-2 Micro Metals toroid
- L3—24 turns #30 wire tapped at 19 turns on T-37-2 Micro Metals toroid
- S1—DPDT switch
- S2, S3—SPST switch
- SPKR—8-64 ohm speaker
- J1—BNC connector
- Miscellaneous: PC board, metal cabinet, wire, solder, etc.

Note: The following items are available from Q-Sat, P.O. Box 110, Boalsburg, PA 16827. A PC board only (# EZSW-PCB) is \$7 plus \$1 shipping; a partial kit that includes a PC board (does not include potentiometers, switches, connectors, speaker, or case # EZSW-KIT) is \$27 plus \$2 shipping; a kit for the AM reject filter (# AMREJ-KIT) is \$3 plus \$1 shipping; a kit for the active antenna (# ACTANT-KIT, see text) is \$15 plus \$2 shipping. Pennsylvania residents must add 6% sales tax. Allow 3-5 weeks for delivery.

All receivers need a good antenna: this one is no exception. Although the first field trials were conducted in a state park with 30

feet of wire thrown over a tree limb, a good antenna will greatly improve reception. A dipole will give good results, but if you're cramped for space, try an active antenna (see **Radio-Electronics**, February 1989). A good ground also helps.

The receiver should be installed in a metal cabinet to reduce the effects of hand capacitance and provide some shielding from strong local AM stations. Figure 5 shows the prototype receiver. Note that the active antenna and the 2.2-MHz high-pass filter are used in the prototype, although they are not mandatory. The holes for the speaker were made using a neat trick: Draw the outline on a piece of perforated construction board, and tape the board to the cabinet. Then use the board as a drill guide.

Table 2 is a guide to let you modify the receiver for frequency ranges other than 8.5 to 11.5 MHz (actually 8.5–10 MHz for band 1 and 10–11.5 MHz for band 2) used in the prototype. Don't think of L2 and L3 as tapped coils, but rather as "selectable" coils. For example, L3 is specified as a 24-turn coil with a tap at 19 turns. What that really means is that a coil of either 19 turns or 24 turns is switch-selectable. You could even wind a 45-turn coil with taps at 14, 15, 17, 19, 24, 29, and 34 turns for L3. With the right switch (good luck finding one), you could tune 5 to 16 MHz in 8 bands. Remember that it has to switch the capacitors, as well.

Since the coils must be hand-wound, there will be some variation. Wire size was calculated for no. 30 wire. Other wire sizes may be used but you will find it hard to get as many as 45 turns on a T-37-2 core with larger wire. The spacing of the wire on the core will also change the tuning frequency. The values are given as reasonable starting points. If you wish to build the receiver for some frequency other than the prototype, follow these steps:

- 1) Build the unit completely except for the two coils.
- 2) Using Table 2, wind the oscillator coil. Tack the coil into the circuit from ground to the junction of C20, C22, and C23. (That way you won't need the band switch.)

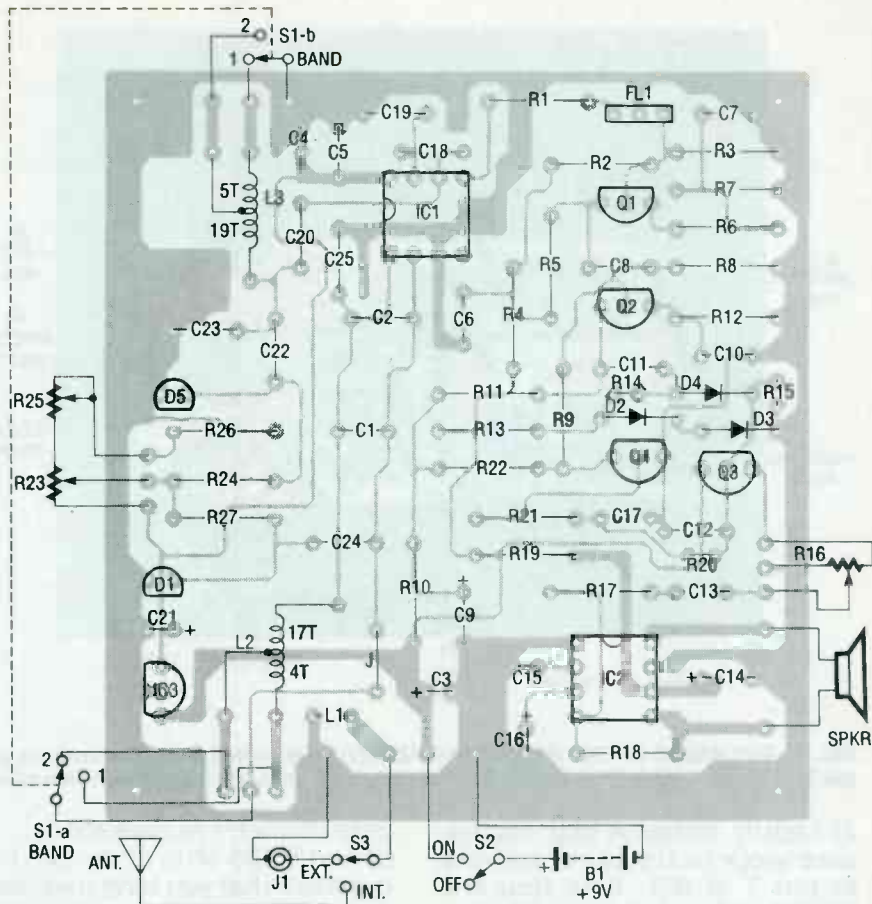


FIG. 4—PARTS-PLACEMENT DIAGRAM. Be sure to install the circuit in a metal project case to help reduce interference.

TABLE 2

Frequency (MHz)	C2 (pF)	C18, C19 (pF)	C23 (pF)	L1, L2 (Ant) (# of turns on T-37-2 core)	L3 (Osc)
5	100	120	68	5, 41	45
6	100	120	68	4, 30	34
7	82	100	47	4, 26	29
8	82	100	47	3, 22	24
10	82	100	47	3, 17	19
12	82	100	47	2, 15	17
14	68	82	33	2, 14	15
15	68	82	33	2, 13	14

TABLE 3

	NE602	MC34119		
Pin 1	1.27 V	0V		
Pin 2	1.27 V	4.15 V		
Pin 3	0V	4.11 V		
Pin 4	3.64 V	3.97 V		
Pin 5	3.59 V	4.14 V		
Pin 6	4.99 V	9.09 V		
Pin 7	4.33 V	0V		
Pin 8	5.05 V	4.20 V		
	Q1	Q2	Q3	Q4
Emitter	0.95 V	0.80 V	0.27 V	0V
Base	1.61 V	1.45 V	0.82 V	0.58 V
Collector	2.56 V	3.30 V	9.17 V	7.41 V

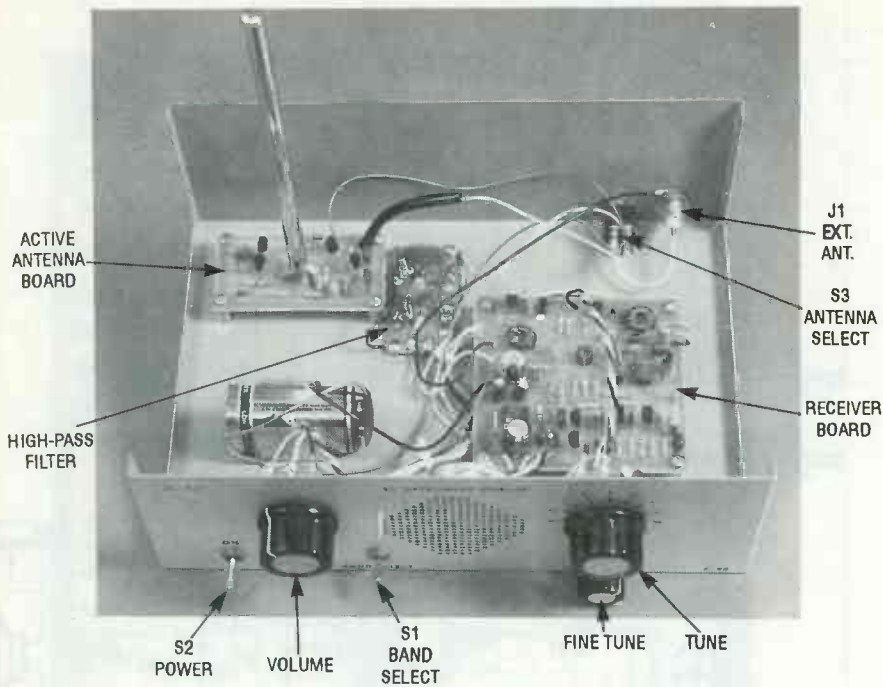


FIG. 5—THE INSIDE OF THE PROTOTYPE RECEIVER. Note that the active antenna and the 2.2-MHz high-pass filter are used in the prototype, although they are not mandatory.

3) Lightly couple a high-impedance scope or frequency counter to pin 7 of IC1; note that the NE602 will not drive a 50-ohm input without a buffer. A 10-pF series capacitor is therefore recommended.

4) Turn the tuning and fine tuning, if you are using one, completely counterclockwise and measure the frequency. Now turn the tuning and fine tuning all the way clockwise and measure the new frequency. If it's lower than the first frequency, you've got the

potentiometer in backwards.

5) Add 0.455 MHz to the two frequencies that you have just measured. This is your tuning range.

If you are building the unit for a higher frequency range, say on the order of 14 or 15 MHz, you will find that the tuning range is 2 or 3 MHz. On the other hand, units built for 3 or 4 MHz will tune only about 0.5 MHz. That is caused by the rather small capacitance change of the MV209. Typically, capacitance vs. (reverse) voltage of the MV209 is 40 pF at 1 volt, 26 pF at 5 volts, 14 pF at 10 volts, and 9 pF at 20 volts.

Low-frequency tuned circuits require more capacitance than high-frequency tuned circuits. Since the change in capacitance of the MV209 is fixed, it becomes a smaller percentage change with low-frequency tanks than with high-frequency tanks. And you can forget about a series or parallel combination of MV209's. The percentage works out the same as a single one. If you require more tuning range, the best method is to

provide a separate, stable tuning voltage of up to 20 volts. Since the current drawn by the diodes is in the microamp range, a separate 9-volt battery may be used. Just remember that as the battery ages, the tuning range will change.

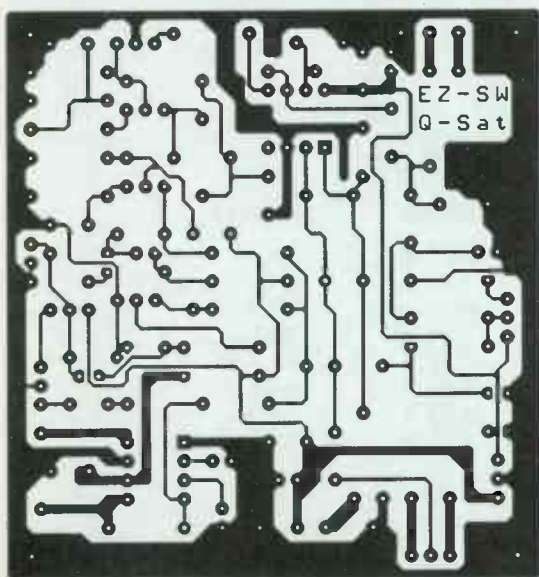
6) If you are satisfied with the tuning range, wind the antenna coil with a turn or two less than the oscillator coil. This is necessary because the input tuned circuit operates at 0.455 MHz higher in frequency than that of the oscillator.

The varactors used in this receiver only need to vary by about 15 pF to cover 8.5 to 10.0 MHz or 10.0 MHz to 11.5 MHz. That can be from 25 to 40 pF, or 0 to 15 pF, or any combination that gives a change of about 15 pF. When the bias voltage is changed from 1 to 5 volts, the capacitance really changes from about 40 pF to 26 pF. If a well-regulated supply of higher than 5 volts but less than 20 volts is available, it may be used to increase the tuning range. Since we're running it on a 9-volt battery, we decided to regulate down to 5 volts. If you decide to operate the varactor on a higher voltage, remember that the NE602 is rated at a maximum of 8 volts. The high side of the tuning potentiometer can be connected to a higher voltage as long as the connection from the PC board to the high side of the potentiometer is left disconnected.

Tuning 1500 kHz with a single-turn potentiometer can be tricky. A "poor mans ten turn" can be made by putting a 10K potentiometer in series with the normal 50K potentiometer for fine tuning. Be careful with the leads going to the potentiometers; any AC signal will "modulate" the oscillator with disastrous results. Since the tuning of a varactor isn't linear with voltage, you may want to experiment with different potentiometers, such as linear, log, or audio.

Troubleshooting

If you have any problems, the DC voltages shown in Table 3 should help. All voltages were taken with a new 9-volt alkaline battery powering the receiver. The volume control is about 1/3 with no signal input. Total current is 22 milliamps. R-E



THE FOIL PATTERN for the single-sided board.

1990

ANNUAL INDEX

Radio **Electronics®** Volume 61

and

COMPUTERDIGEST Volume 7

1990 Annual Index Radio-Electronics Volume 61 and ComputerDigest Volume 7

Abbreviations: (ARE)Ask R-E; (AUD)Audio Update; (C)Construction;
(CC)Computer Connections; (CD)Computer Digest; (D)Department;
(DB)Drawing Board; (DN)Designer's Notebook; (EW)Editor's Workbench;
(ER)Equipment Reports; (HH)Hardware Hacker; (KR)Kit Report;
(LTR)Letter; (PCS)PC Service; (SR)Shortwave Radio; (VN)Video News;
(WN)What's News

A

AC Power Measurement (Trietley)	Aug 51,(LTR)Nov 16
Acoustic Field Generator (Templin)(C)	Jan 35, Feb 39,(PCS)Feb 59
Active filters (Lancaster)(HH)	Oct 77
Adapter, Capacitance (Kohl)(C)	Apr 43
Add a Display to Your Project (Avrich)(C)	Jun 59, Jul 50,(LTR)Oct 14
Alarm	
and security resources (Lancaster)(HH)	Feb 67
-system backup (ARE)	Dec 8
All About	
Batteries (Bernard)	Mar 43
Surround Sound (Bernard)	Jun 51,(LTR)Sep 12
Alternate-energy resources (Lancaster)(HH)	Apr 59
Allimeter, Rocket (Fleischer)(C)	Oct 37
AM Radio, Whatever Happened to? (Dexter)	Sep 71
Amplifier/prescaler	
1.6-GHz Counter Prescaler (Hufft)(C)	Oct 47
Amateur radio astronomy (Lancaster)(HH)	Aug 67
Amplifier Transfer Functions (Klein)(AUD)	Dec 76
Analog noise generator (ARE)	Oct 12
Analx Powercard PC-Controlled Power Supply (ER)	Oct 20
Annabooks PromKit (Holtzman)(EW)	Mar 71
Antenna	
Portable 146-MHz Quad (Robertson)(C)	Nov 41
ASK R-E (D)	Jan 12, Feb 8, Mar 8,(LTR)May 14 Apr 12, May 8, Jun 8,(LTR)Oct 14 Jul 8, Aug 12,(LTR)Nov 16, Sep 7 Oct 12, Nov 14, Dec 8
Asymetrix ToolBook 1.0 (Holtzman)(CC)	Sep 88
AUDIO (See also AUDIO UPDATE)	
Acoustic Field Generator (Templin)(C)	Jan 35, Feb 39,(PCS)Feb 59
All About Surround Sound (Bernard)	Jun 31
Amplifier IC's (Marston)	Apr 53
F/X, Forle (Holtzman)(CC)	Oct 86
Heath's AD-2550 Surround-Sound Processor (KR)	Jun 57
-Muting Circuit, Phone-Activated (Vaught)(C)	Jan 43
Portable 146-MHz Quad Antenna (Robertson)(C)	Nov 41
Power Amp IC's, Working With (Marston)	Mar 52
Pre-Amp IC's (Marston)	Feb 54
R-E's Vocal Stripper (Weeder)(C)	Sep 33
Super-Directional Microphone (Blackwell)(C)	Jul 41
-visual switcher circuit (Lancaster)(HH)	Dec 67
vollmeter (Lancaster)(HH)	Sep 75
Volume Limiter (Johnson)(C)	Mar 39,(PCS)Mar 57
What's New in CD Players (Bernard)	Jan 45
AUDIO UPDATE (Klein)(D)	
Amplifier Transfer Functions	Dec 76
Audio Answerman strikes again, the	Jan 71
Audio Test Reports: What they do	
and don't tell you	Nov 85
High-End Hi-Fi Show, The	Aug 61
Is sound quality a matter of taste?	Apr 64
National Sound Preference?	Mar 77
Progress in hi-fi hearing-aid	
design	Feb 24
Receivers vs. separate components	Jun 72
Search for the perfect	
tweeter, The	May 76
Taking care of your tapes	Jul 69,(LTR)Oct 14
The Sound of Audio: AES	
conference report	Sep 81, Oct 84

Audio Volume Limiter (Johnson)(C)	Mar 39
Automotive	
Audio Amplifier IC's (Marston)	Apr 53
Digital Pressure Gauge (Caristi)(C)	Aug 41
R-E's Digital Dashboard (Ortman)(C)	Jul 31, Sep 61
Solid-State Wiper Control (Heil)(C)	Apr 46

B

Batteries, All About (Bernard)	Mar 43
Beckman Industrial	
FG2A Sweep Function Generator (ER)	Mar 18
RMS225 Professional DMM (ER)	Aug 16
Benchtop Frequency Counter (Bergquist)(C)	Dec 33
Big-screen TV (Lachenbruch)(VN)	Apr 6
Binary	
coding (ARE)	Jan 12
-to-digital readout (ARE)	Feb 8
Book Reviews (See NEW LIT, EDITOR'S WORKBENCH)	
Boot from ROM (Holtzman)(EW)	Mar 71
Breadboarding software	
SPICE (Byers)	Nov 63

C

CAD Systems Unlimited's Slick! (Grossblatt)(EW)	Jan 81
CD Players, What's New in (Bernard)	Jan 45
CD-1 (Lachenbruch)(VN)	Jul 6
CDTV (VN)	Sep 4
Call Screener, Telephone (Koller)(C)	Dec 52
Camcorder, still/motion (Lachenbruch)(VN)	Dec 6
Capacitance Adapter (Kohl)(C)	Apr 43,(LTR)Oct 14
Case Histories, TV Service (Zymaris)	Oct 67
Cases and Enclosures (Lancaster)(HH)	Jun 63
Changing Face of Satellite TV, The (Angus)	Nov 58
Chaos science resources (Lancaster)(HH)	Jan 61
Choosing the Right Test Probe (Hansen)	Dec 63
Christmas Card, The (Holzwarth)(C)	Dec 40
Circuit-simulation program	
SPICE (Byers)	Nov 63
CIRCUITS	
Audio	
Amplifier IC's (Marston)	Apr 53
Pre-Amp IC's (Marston)	Feb 54
Component-selection disks	
Data Disks: High-Speed Device	
Selection for the 90's (Prestwood)	Sep 47
DTMF generator circuit (Grossblatt)(DB)	Dec 78
Home-Security Cookbook (Marston)	May 61
Power Processing and	
not-so-dynamic memory (Mullin)(ICS)	Dec 66
Security-Circuit Cookbook (Marston)	Jul 56
Single-Chip Frequency Converter (Covington)(C)	Apr 49
Why Are There So Many	
Transistors? (Bernard)	May 53
Working With Audio Power Amp IC's (Marston)	Mar 52
Cold-working papers and kits (Lancaster)(HH)	Feb 67
CompatiCard IV, Microsystems (Holtzman)(EW)	Jan 81
Common Cathode Drivers (ARE)	Sep 7
COMPUTER (See also COMPUTERDIGEST, COMPUTER CONNECTION, EDITOR'S WORKBENCH, HARDWARE REVIEWS, SOFTWARE REVIEWS)	
Coordinated Time Link, CTS10	

Computer Time Standard (ER)	Nov 24
Crystal-controlled video timing	
generator, A (Grossblatt)(DB)	Feb 72
Data Disks: High-Speed Device	
Selection for the 90's (Prestwood)	Sep 47
Digital Keyless Entry System (Avrich)(C)	Mar 71
DTMF generator circuit (Grossblatt)(DB)	Dec 78
Experimenters' I/O Card (Hanslip)(C)	Jun 73
Low-cost Logic Analyzer (Holtzman)(EW)	Aug 73
Monitor	
NTSC—RGB Converter (Harrigle)(C)	Oct 59
Morse RTTY Detector (Ashworth)(C)	Apr 33
Port-A-Matic (Grossblatt)(C)	Jan 81, Feb 75
R-E's Video Frame Grabber (Toner)(C)	Aug 31
Time Standard,	
Coordinated Time Link (ER)	Nov 24
Secure your Hard Disk with PC	
Access (Renton)(C)	Apr 69
Solid-State Disk Drive (Hatten)(C)	Jul 75, Aug 73
SPICE (Byers)	Nov 63
SUSIE (Byers)	Dec 57
-System course, Elenco's Micro-Master (ER)	Jan 22
Talking PC, The (Holtzman)(EW)	May 81
Waveform Processing with your PC (Ramirez)	May 81
COMPUTER CONNECTIONS (Holtzman)(D)	Sep 88
Electronics Lab Simulation Program (Holtzman)(CC)	Oct 86, Nov 86, Dec 86
MIDI-compatible stereo	
music scores (Holtzman)(CC)	Oct 86
SCSI/ESDI shootout (Holtzman)(CC)	Nov 86
Windows 3.0, and ToolBook (Holtzman)(CC)	Sep 88
COMPUTERDIGEST	
Announcement (Holtzman)(EW)	Feb 75
Boot from ROM (Holtzman)(EW)	Mar 71
Digital Keyless Entry System (Avrich)(C)	Mar 71
Electronics Lab Simulation Program (Holtzman)(CC)	
Experimenters' I/O Card (Hanslip)(C)	Dec 86
Floppy Heaven (Holtzman)(EW)	Jun 73
Low-cost Logic Analyzer (Holtzman)(EW)	Aug 81
MIDI-compatible stereo	
music scores (Holtzman)(CC)	Oct 86
Personal computers and the	
future (Holtzman)(EW)	Apr 69
Port-A-Matic (Grossblatt)(C)	Jan 81, Feb 75
Readers' Letters (Holtzman)(EW)	Jul 75
SCSI/ESDI shootout (Holtzman)(CC)	Nov 86
Talking PC, The (Holtzman)(EW)	May 81
Windows 3.0, and ToolBook (Holtzman)(CC)	Sep 88
CONSTRUCTION	
1.6-GHz Counter Prescaler (Hufft)	Oct 47
100-MHz Frequency Probe (Lashansky)	Feb 31
Acoustic Field Generator (Templin)	Jan 35, Feb 39
Add a Display to Your Project (Avrich)	Jun 59, Jul 50
Audio Volume Limiter (Johnson)	Mar 39
Benchtop Frequency Counter (Bergquist)	Dec 33
Capacitance Adapter (Kohl)	Apr 43
Christmas Card, The (Holzwarth)(C)	Dec 40
Digital Keyless Entry System (Avrich)	Mar 71
Digital Pressure Gauge (Caristi)	Aug 41
Experimenters' I/O Card (Hanslip)	Jun 73
Generic Linear Power	
Supply Board (Wannamaker)	Jun 41
Ion Meter (Lovelock)	Mar 35
LaserJet Memory Card (Green)	Oct 55
Lawn Ranger, The	
(Rafaels)	Jun 31, Jul 45, Aug 45, Sep 53
Morse/RTTY Detector (Ashworth)	Apr 33, May 49
NTSC—RGB Converter (Harrigle)	Oct 59
Phone-Activated	
Audio-Muting Circuit (Vaught)	Jan 43

Port-A-Matic (Grossblatt) Jan 81, Feb 75
 Portable 146-MHz Quad Antenna (Robertson) Nov 41
 Programmable Crystal-Controlled Pulse Generator (Lovelock) Jun 47
R-E's
 Digital Dashboard (Ortman) Jul 31, Sep 61
 Telephone-Line Controller (Saad) Sep 37
 Video Frame Grabber (Toner) Aug 31
 Vocal Stripper (Weeder) Sep 33
 Radar Detector Tester (Ayer) Feb 37
 Rocket Altimeter (Fleischer) Oct 37
 Secure your Hard Disk with PC Access (Renton) Apr 69
 Semiconductor Laser System (Iannini) Nov 34
 Single-Chip Frequency Converter (Covington) Apr 49
Solid-State
 Disk Drive (Hatten) Jul 75, Aug 73
 Wiper Control (Heil) Apr 46
 Super-Directional Microphone (Blackwell) Jul 41
 Telephone Call Screener (Koller) Nov 49, Dec 52
 Three-Chip Logic Analyzer (Robinson) Jan 41
 Universal Descrambler (Graf & Sheets) May 37
 Universal Laboratory Power Supply (Metz) Mar 31
 VCR Head Amp Tester (Bathgate) Feb 51
 Control circuitry (Grossblatt)(DB) Sep 83
 Counter Prescaler, 1.6-GHz (Huff)(C) Oct 47
 Crystal-controlled video timing generator, A (Grossblatt)(DB) Feb 72
 Cycolor printing secrets (Lancaster)(HH) May 70

D

DMM and Dwell/Tach Meter, Jameco (ER) May 22
 Dashboard, R-E's Digital (Ortman)(C) Jul 31
 Data Compression (Lancaster)(HH) Aug 67
 Data Disks: High-Speed Video Selection the 90's for (Prestwood) Sep 47
 Decoder, Morse/RTTY Detector (Ashworth)(C) Apr 33, May 49
 Descrambler, Universal (Graf & Sheets)(C) May 37
 Derive, Soft Warehouse (Holtzman)(EW) Jul 75
 Detector, Morse/RTTY (Ashworth)(C) Apr 33, May 49
 Digi-Compass (Nov'89) (LTR) Jan 16, Feb 14
DIGITAL
 amplification (ARE) Sep 7
 circuit simulation
 SUSIE (Byers) Dec 57
 Dashboard, R-E's (Ortman)(C) Sep 61
 Oscilloscopes, Inside (Stover) May 44
 Keypress Entry System (Avritch)(C) Mar 71
Multimeter
 and Dwell/Tach Meter, Jameco (ER) May 22
 Beckman Industrial RMS225 (ER) Aug 16
 Fluke 85 (ER) Apr 18
 Micronta (ER) Dec 24
 Pressure Gauge (Caristi)(C) Aug 41, (PCS) Aug 65
 thermometer (Lancaster)(HH) Oct 77
 Discrete cosine transforms, and more (Lancaster)(HH) Dec 67
 Disk Drive, Solid-State (Hatten)(C) Jul 75, Aug 73
Display
 Add to Your Project (Avritch)(C) Jun 59, Jul 50
 of the Future? (Fenton) Feb 43
 Today's graphics coprocessors (Mullin)(ICS) Nov 81
 DOS on a motherboard (ARE) Feb 8
DRAWING BOARD (Grossblatt)(DB) Jan 79, Feb 72,
 Apr 66, May 78, Jun 70, Jul 72,
 (LTR) Dec 16, Aug 18, Sep 83, Nov 83, Dec 78
 Control circuitry Sep 83
 Crystal-controlled video timing generator, A Feb 72
 DTMF controller Nov 83
 DTMF generator circuit Dec 78
 Finally, a video signal! Jun 70
 Let's plunge deeper into video Apr 66
 Scrambling and Macrovision Jul 72, (LTR) Dec 16
 Video-scrambling techniques Aug 18
 Video-sync generator May 78
 World of video, the Jan 79
 DTG System's Sleuth 2.0 (Holtzman)(EW) Jun 73
DTMF
 controller (Grossblatt)(DB) Nov 83
 controller (ARE) Aug 12
 generator circuit (Grossblatt)(DB) Dec 78
 Dual-deck VCR (Lachenbruch)(VN) Oct 10

E

EDTV (Lachenbruch)(VN) Jan 6
 EGA to CGA Conversion (ARE) Oct 12
 Echo PC +, Street Electronics Corp.'s (Holtzman)(EW) May 81
EDITOR'S WORKBENCH (Holtzman)(D) Jan 81,
 Feb 75, Mar 71, May 81, Jun 73, Jul 75,
 Aug 73, (LTR) Dec 16,
 Jun 73
 68000 News Feb 75
 Announcement Mar 71
 Boot from ROM Mar 71
 Floppy Heaven Jan 81
 Low-cost Logic Analyzer Aug 73
 Personal computers and the future Apr 69
 Readers' Letters Jul 75
 Talking PC, The May 81
 8mm camcorders

(Lachenbruch)(VN) Aug 6, Sep 4
 vs. VHS-C (Lachenbruch)(VN) Nov 6
ELECTRONIC
 Christmas Card, The (Holzwarth)(C) Dec 40
 dice (Lancaster)(HH) Nov 69
 melody chips (Lancaster)(HH) Jul 62
 controllers (Grossblatt)(DB) Sep 83
 levels (Lancaster)(HH) Jun 63
 Workbench, Interactive Image Technologies Lab Simulation Program (Holtzman)(CC) Dec 86
 Electrostatic Discharge (Hollander) Jan 54
 Elenco's Micro-Master 8000 Computer-System Course (ER) Jan 22
 Engineering simulator
 SUSIE (Byers) Dec 57
EQUIPMENT REPORTS (D) Jan 22, Feb 17, Mar 18
 Apr 18, May 22, Jun 18, Jul 18
 Aug 15, Sep 16, Oct 20, Nov 24, Dec 24
 Analyx Powercard PC-Controlled Power Supply Oct 20
Beckman Industrial
 FG2A Sweep Function Generator Mar 18
 RMS225 Professional DMM Aug 16
 Computer-system course,
 Elenco's Micro-Master, Jan 22
 Coordinated Time Links, CTS10
 Computer Time Standard Nov 24
Digital multimeter
 and Dwell/Tach Meter, Jameco
 Fluke 85 DMM May 22
 Micronta DMM Dec 24
 Elenco's Micro-Master 8000
 Computer-System Course Jan 22
 Fluke 85 Digital Multimeter Apr 18
 Hameg HM8028 Spectrum Analyzer Jan 22
 Handi-Counter UTC3000, Optoelectronics' Oct 20
 Hewlett-Packard 48SX Scientific Calculator Sep 16
 Huntron DC Line Sentry Jun 18
 Integrity Electronics' IER-109
 60-Hz Magnetic Field Meter May 22
 Jameco
 Melex M-3900 DMM and Dwell/Tach Meter May 22
 Wishmaker II Prototype Design Station Mar 18
 Logic Analyzer, PC-based, NCI's Jun 18
 Field Meter, Integrity May 22
 Micronta's Voice Meter DMM Jun 18
 NCI's PA480 PC-Based Logic Analyzer Jun 18
 Optoelectronics' UTC3000 Handi-Counter Oct 20
 Oscilloscope, 2214 D A, Tektronix Jul 18
 Portasol Butane-Gas-Powered Soldering Tool Kit Apr 18
 Power Supply, Analyx Powercard Oct 20
 Prototype design station,
 Jameco's Wishmaker II Mar 18
 Scientific calculator, HP 48SX Sep 16
 Soldering tool kit, Portasol Apr 18
 Sony CRF-V21 Visual World-Band Receiver Feb 17
 Spectrum analyzer module, Hameg HM8028 Jan 22
 Sweep Function Generator,
 Beckman Industrial FG2A Mar 18
 Tektronix 2214 Digital/Analog Oscilloscope Jul 18
 Time Standard, Computer Nov 24
 Voice Meter, Micronta Dec 24
 Wishmaker II, Jameco Mar 18
 World-Band receiver, visual,
 Sony CRF-V21 Feb 17
 Etching tank (Dec'89) (LTR) Apr 16
 Experimenter's I/O Card
 (Hanslip)(C) Jun 73, (LTR) Sep 12

F

Fault-indicator alarms (Marston) Jul 56
 Fax-Mate (Oct'89) (LTR) Jan 16
 Field Generator, Acoustic (Templin)(C) Jan 34, Feb 39
 Finally, a video signal! (Grossblatt)(DB) Jun 70
 Five-band equalizer circuit (Lancaster)(HH) Apr 59
 Floppy Heaven (Holtzman)(EW) Jan 81
 Fluke 85 Digital Multimeter (ER) Apr 18
 Forte's Audio F/X MIDI-compatible stereo music scores (Holtzman)(CC) Oct 86
 Fractals (Lancaster)(HH) Jan 61
Frequency
 Converter, Single-Chip (Covington)(C) Apr 49
 Counter, Benchtop (Bergquist)(C) Dec 33
 Counter Prescaler, 1.6-GHz (Huff)(c) Oct 47
 Probe, 100-MHz (Lashansky)(C) Feb 31
 Fuel-level gauge
 R-E's Digital Dashboard (Ortman)(C) Jul 31, Sep 61
 Future of shortwave broadcasting, The (Leinwoll)(SWR) Jan 73
G
 Gauge, Digital Pressure (Caristi)(C) Aug 41
Generator
 Video-sync (Grossblatt)(DB) May 78
 Pulse
 Programmable Crystal-Controlled (Lovelock)(C) Jun 47
 Generic Linear Power Supply
 Board (Wannamaker)(C) Jun 41, (PCS) Jun 69,
 (LTR) Aug 14
 Glitches in the Power Line (Migliore) Apr 39
 Graph-in-the-Box, New England Software (Holtzman)(EW) May 81
 Graphics coprocessors, Today's (Mullin)(ICS) Nov 81

H

HDTV (Lachenbruch)(VN) Mar 6, May 6
 Hall-effect resources (Lancaster)(HH) May 70
 Hameg HM8028 Spectrum Analyzer Module(ER) Jan 22
 Handi-Counter UTC3000, Optoelectronics(ER) Oct 20
 Hard disks (ARE) Apr 12
 Hard-disk controller (ARE) Dec 8
HARDWARE HACKER (Lancaster)(D) Jan 61,
 (LTR) May 14, Feb 67, Mar 58, Apr 59,
 May 70, Jun 63, Jul 62, Aug 67,
 Sep 75, Oct 77, Nov 69, Dec 67
 Alternate-energy resources Apr 59
 Chaos science resources Jan 61
 Cold-fusion papers and more Feb 70
 Cycolor printing secrets May 70
 Data Compression Aug 67
 Discrete cosine transforms Dec 67
 Low-cost memory Jun 63
 Perpetual motion, and the magnetocaloric effect Sep 75
 Power-control fundamentals Jul 62
 Synchronous demodulation Mar 58
 Various filters and a digital thermometer Oct 77
 Walking-ring counters and more Nov 69
HARDWARE REVIEWS
 Audio F/X, Forte's (Holtzman)(CC) Oct 86
 CompatiCard IV, Jan 81
 Microsolutions (Holtzman)(EW)
 Echo PC +, Street Electronics
 Corp.'s (Holtzman)(EW) May 81
 (E)EPROM programmer, JDR's (Holtzman)(EW) Feb 75
 Forte's Audio F/X MIDI-compatible package (Holtzman)(CC) Oct 86
 JDR Microdevices' (E)EPROM
 Modular IC-programming system (Holtzman)(EW) Feb 75
 LA1 Logic Analyzer,
 Photonics' (Holtzman)(EW) Aug 73
 Microsolutions' Jan 81
 Compacard IV (Holtzman)(EW)
 Photonics' LA1 Logic Analyzer (Holtzman)(EW) Aug 73
 Sealevel Systems' Universal
 Memory Card (Holtzman)(EW) Mar 71
 Street Electronics Corp.'s
 Echo PC + (Holtzman)(EW) May 81
 Texas Instruments' RS-232 line
 driver and receiver (Holtzman)(EW) Feb 75
 Universal Memory Card,
 Sealevel Systems' (Holtzman)(EW) Mar 71
 Hazardous-material disposal Apr 59
 Hearing-aid design,
 progress in hr-lr (Klein)(AUD) Feb 24
 Heath's AD-2550 Surround-Sound Processor (ER) Jun 57
 Hewlett-Packard 48SX Scientific Calculator(ER) Sep 16
 High-End Hi-Fi Show, The (Klein)(AUD) Aug 81
 Home-Security Cookbook (Marston) May 61
 Huffman codes (Lancaster) (HH) Aug 67
 Huntron DC Line Sentry Voltage Monitor(ER) Jun 18

I

IC SPOTLIGHT (Mullin)(D)
 Power Processing and not-so-dynamic memory Dec 66
 Today's graphics coprocessors Nov 81
IC's
 Audio
 Amplifier (Marston) Apr 53
 Power Amp.
 Working With (Marston) Mar 52
 Pre-Amp (Marston) Feb 54
 Intel's i860 (Mullin)(ICS) Nov 81
 Removal of (ARE) Mar 8
 I/O Card, Experimenter's (Hanslip)(C) Jun 73
 IR Remote Extender (May'89) (LTR) Jan 16
 Impedance measurements
 Test Methods (Rogalski) Mar 21
 Inside Digital Oscilloscopes (Stover) May 44, (LTR) Aug 14
 Intel's i860 (Mullin)(ICS) Nov 81
 Integrity Electronics IER-109
 60-Hz Magnetic Field Meter (ER) May 22
Interactive
 Image Technologies' Electronics
 Workbench Program (Holtzman)(CC) Dec 86
 Laserdiscs (Lachenbruch)(VN) Dec 6
 Video (Lachenbruch)(VN) Mar 6, Jul 6
 Introduction to Microwave
 Technology (Carr) Aug 60, Sep 68, Oct 71
 Ion Meter (Lovelock)(C) Mar 35, (PCS) Mar 57,
 (LTR) Jun 12, (LTR) Nov 16
 Is sound quality a matter
 of taste? (Klein)(AUD) Apr 64
J
 JDR Microdevices' (E)EPROM
 Programmer system (Holtzman)(EW) Feb 75
Jameco Electronics'
 Melex M-3900 DMM and Dwell/Tach meter (ER) May 22
 Wishmaker II Prototype Design Station (ER) Mar 18



Plug a Friend into Radio-Electronics this Christmas ... and Save \$19.43!

This Christmas give an electrifying gift ... plug a friend into Radio-Electronics and brighten his whole new year! Whether electronics is his livelihood or his hobby, your gift will sharpen his focus and illuminate the whole spectrum of electronics throughout the coming year.

Radio-Electronics will keep him informed and up-to-date with new ideas and innovations in all areas of electronic technology ... computers, video, radio, stereo, solid state technology, satellite TV, industrial and medical electronics, communications, robotics, and much, much more.

He'll get great plans and printed circuit patterns for great electronic projects. In just the last year, Radio-Electronics has presented voice scramblers, video switchers, frequency standards, wireless audio links, radiation monitors, function generators, and much more.

In coming issues, Radio-Electronics will present practical, educational, and money-saving projects like: a helium-neon laser ... a lighting controller ... a video timebase corrector ... a video noise processor ... a light-beam communicator ... an antenna amplifier ... and many others!

PLUS ... equipment troubleshooting techniques ... circuit design ... reports on new technology and new products ... equipment test reports ... in-depth coverage on computers, video, audio, shortwave radio ... and lots more exciting features and articles.

SAVE \$19.43*...OR EVEN \$38.86*...For each gift of Radio-Electronics you give this Christmas, you save a full \$19.43* off the newsstand price. And as an R-E gift donor, you're entitled to start or extend your own subscription at the same Special Holiday Gift Rate—you save an additional \$19.43*!

No need to send money ... if you prefer, we'll hold the bill till January, 1991. But you must rush the attached Gift Certificate to us to allow time to process your order and send a handsome gift announcement card, signed with your name, in time for Christmas.

So do it now ... take just a moment to fill in the names of a friend or two and mail the Gift Certificate to us in its attached, postage-paid reply envelope. That's all it takes to plug your friends into a whole year of exciting projects and new ideas in Radio-Electronics!



*Basic sub rate—1 yr/\$17.97 2 yr/\$34.97

K

K-Talk Communications' MathEdit (Holtzman)(EW) Apr 69
 Keyless Entry System, Digital (Avrlich)(C) Mar 71
KIT REPORT
 Heath's AD-2550
 Surround-Sound Processor (KR) Jun 57

L

LA1 Logic Analyzer, Photonics (Holtzman)(EW) Aug 73
LCD
 projectors (Lachenbruch)(VN) Mar 6
 screens (Lachenbruch)(VN) Jan 6
Laserdiscs
 (Lachenbruch)(VN) Jun 6, Sep 6
 Interactive (Lachenbruch)(VN) Dec 6
 Laser System, Semiconductor (Iannini)(C) Nov 34
 LaserJet Memory Card (Green)(C) Oct 55
 LaserWriter technical information (Lancaster)(HH) Jun 63
 Lawn Ranger, The (Rafaela)(C) Jun 31, Jul 45, Aug 45, Sep 53
 Leading Edge's PC-compatible computer (ARE) Apr 12
 Let's plunge deeper into video (Grossblatt)(DB) Apr 66
LETTERS (D) Jan 16, Feb 14, Mar 14, Apr 16
 May 14, Jun 12, Jul 14, Aug 14
 Sep 12, Oct 14, Nov 16, Dec 16
 Linear Power Supply Board, Generic (Wannamaker)(C) Jun 41
 Linear voltage differential (Lancaster)(HH) Mar 58
 Lines of resolution (ARE) Jun 8
 Listening tests (Klein)(AUD) Nov 85
Logic Analyzer
 low-cost (Holtzman)(EW) Aug 73
 PC-based, NCI (ER) Jun 18
 3-Chip (Robinson)(C) Jan 41
Low-cost
 Logic Analyzer (Holtzman)(EW) Aug 73
 memory (Lancaster)(HH) Jun 63
 Low-noise amplifiers (Lancaster)(HH) May 70
 Low-temperature alloys (Lancaster)(HH) Apr 59

M

Macrovision, Scrambling and (Grossblatt)(DB) Jul 72
Magnetic
 Field Meter, Integrity Electronics' (ER) May 22
 refrigeration (Lancaster)(HH) Sep 75, Nov 69
 Magnetron tubes
 Introduction to Microwave Technology (Carr) Oct 71
 Make Your Own Etching Tank (Dec '89) (LTR) Mar 14
 Manifest, Quarterdeck Office Systems' (Holtzman)(EW) Jun 73
 MathCAD, MathSoft (Holtzman)(EW) May 81
 MathEdit, K-Talk Communications (Holtzman)(EW) Apr 69
 Matter, new form of (Lancaster)(HH) Jun 63
 Measurement, AC Power (Trietley) Aug 51
 Mechanical devices, Unusual (Lancaster)(HH) May 70
 Memory expansion board
 LaserJet Memory Card (Green)(C) Oct 55
 Microphone, Super-Directional (Blackwell)(C) Jul 41
 Micropolis Corp. 1654-7 ESDI PC-Pak (Holtzman)(CC) Oct 71, (LTR) Nov 16
Microsoft
 Windows 3.0 (Holtzman)(CC) Sep 88
 Word (Holtzman)(EW) May 81
 Microsolutions Complicard IV (Holtzman)(EW) Jan 81
 Microwave Technology, Introduction to (Carr) Aug 60, Sep 68
 Oct 71, (LTR) Nov 16
 MIDI-compatible stereo music
 scores (Holtzman)(CC) Oct 86
 Model rocketry
 Rocket Altimeter (Fleischer)(C) Oct 37
 Modular IC-programming system (Holtzman)(EW) Feb 75
 Morse RTTY Detector (Ashworth)(C) Apr 33
 (C) May 49, (PCS) May 66
 Micronta's Voice Meter DMM (ER) Dec 24

N

NCI PA480 PC-Based Logic Analyzer(ER) Jun 18
NTSC
 -PAL VCR conversion (LTR) Jan 16
 -RGB Converter (Harrigfeld)(C) Oct 59
 standard (ARE) Jun 8
 National Semiconductor LM38X
 Audio Pre-Amp IC's (Marston) Feb 54
 National Sound Preference? (Klein)(AUD) Mar 77
NEW LIT (D) Feb 23, Mar 26, Apr 30, May 33
 Jul 25, Aug 24, Sep 26, Oct 30
 Nov 26, Dec 30
NEW PRODUCTS (D) Jan 26, Feb 20, Mar 22, Apr 22
 May 24, Jun 22, Jul 21, Aug 20
 Sep 22, Oct 22, Nov 26, Dec 26
 Nintendo car adapter (ARE) Mar 8

O

Oil-pressure gauge
 R-E's Digital Dashboard (Ortman)(C) Jul 31, Sep 61
 1.6-GHz Counter Prescaler (Huff)(C) Oct 47
 100-MHz Frequency
 Probe (Lashansky)(C) Feb 31, (PCS) Feb 59
 Optoelectronics UTC3000 Handi-Counter (ER) Oct 20
 Organic vapor detectors (Lancaster)(HH) Apr 59
 Oscilloscope, Tektronix 2214 D/A (ER) Jul 18
 Oscilloscopes, Inside Digital (Stover) May 44

P

Passive filters (Lancaster)(HH) Oct 77
 PC Access, Secure Your Hard Disk
 with (Renton)(C) Apr 69
 PC boards
 making (Lancaster)(HH) Feb 67
 (LTR) Feb 14, Mar 14
 supplies (LTR) Mar 14
 washing (ARE) Nov 14
 PC-compatible computer,
 Leading Edge (ARE) Apr 12
 PC vision system
 R-E's Video Frame Grabber (Toner)(C) Aug 31
PC SERVICE (D) Feb 59, Mar 57,
 May 57, Jun 69
 Peripheral Technology's
 PT-68K2 (Holtzman)(EW) Jun 73
 Perpetual motion,
 and the magnetocaloric effect (Lancaster)(HH) Sep 75
 Personal computers and the future (Holtzman)(EW) Apr 69
 Personics UltraVision 2.0 (Holtzman)(CC) Oct 86
 Phone-Activated Audio-Muting Circuit (Vaught)(C) Jan 43
 Photonics LA1 Logic Analyzer (Holtzman)(EW) Aug 73
 Port-A-Matic (Grossblatt)(C) Jan 81, Feb 75, (PCS) Feb 81
 Portable 146-MHz Quad Antenna (Robertson)(C) Nov 41
 Portasol Butane-Gas-Powered
 Soldering Tool Kit (ER) Apr 18
 PostScript direct toner kits (Lancaster)(HH) Feb 67
 Power Line, Glitches in (Migliore) Apr 39
Power Supply,
 Analyx Powercard (ER) Oct 20
 Generic Linear Power Supply (Wannamaker)(C) Jun 41
 Universal Laboratory (Metz)(C) Mar 31
 Power Processing and
 not-so-dynamic memory (Mullin)(ICS) Dec 66
 Power-control fundamentals (Lancaster)(HH) Jul 62
 Pressure Gauge, Digital (Caristi)(C) Aug 41
 Printed-circuit standard (Lancaster)(HH) Jul 62
 Printing resources (Lancaster)(HH) Mar 58
 Private Eye, Reflection Technology's
 Display of the Future? (Fenton) Feb 43
 Probe, 100-MHz Frequency (Lashansky)(C) Feb 31
Program
 SPICE (Byers) Nov 63
 SUSIE (Byers) Dec 57
Programmable
 analog inverter (Lancaster)(HH) Mar 58
 Crystal-Controlled Pulse
 Generator (Lovelock)(C) Jun 47, (PCS) Jun 69
 Progress in hi-fi hearing-aid
 design (Klein)(AUD) Feb 24
 PromKit, Annabooks (Holtzman)(EW) Mar 71
 Prototype design station,
 Jameco's Wishmaker II (ER) Mar 18
 Pulse Generator, Programmable
 Crystal-Controlled (Lovelock)(C) Jun 47, (PCS) Jun 69

Q

Quad Antenna, Portable 146-MHz (Robertson)(C) Nov 41
 Quarterdeck Office Systems'
 Manifest (Holtzman)(EW) Jun 73

R

RAM disk, battery-backed
 Solid-State Disk Drive (Hatten)(C) Jul 75, Aug 73
R-E's
 Digital Dashboard (Ortman)(C) Jul 31, Sep 61
 Telephone-Line Controller (Saad)(C) Sep 37
 Video Frame Grabber (Toner)(C) Aug 31
 Vocal Stripper (Wieder)(C) Sep 33
 Radar Detector Tester (Ayer)(C) Feb 37, (PCS) Feb 59
RADIO
 Future of shortwave broadcasting,
 The (Leinwoll)(SWR) Jan 73
 Morse-RTTY Detector (Ashworth)(C) May 49
 Rock, Religion, and Rhetoric (Dexter) Jul 53
 Sony CRF-V21 Visual World-Band Receiver
 Whatever Happened to AM Radio? (Dexter) Feb 17
 Sep 71
 Radioteletype
 Morse-RTTY Detector (Ashworth)(C) Apr 33, May 49
READER-HELP-READER (D) Apr 21, Jun 89
 Readers' Letters (Holtzman)(EW) Jul 75
 Receivers vs. separate

components (Klein)(AUD) Jun 72
 Recording balance (Klein)(AUD) Jan 71
 Reflected speaker sound (Klein)(AUD) Jan 71
 Reflection Technology's Private Eye
 Display of the Future? (Fenton) Feb 43
 Research, Independent (Lancaster)(HH) Sep 75
 Resistance standard (LTR) Dec 16
 Robotics
 Lawn Ranger, The (Rafaela)(C) Jun 31, Jul 45
 Aug 45, Sep 53
 Rock, Religion, and Rhetoric (Dexter) Jul 53
 Rocket Altimeter (Fleischer)(C) Oct 37
 Run-length encoding (Lancaster)(HH) Aug 67

S

SAP Second Audio Program (Lachenbruch)(VN) Feb 6
 SCR's (ARE) Jul 8
 SCSI/ESDI shootout (Holtzman)(CC) Nov 86
 Santa Claus machine (Lancaster)(HH) Dec 67
 Satellite TV,
 The Changing Face of (Angus) Nov 58
 Scientific calculator,
 HP 48SX (ER) Sep 16
 Scrambling and Macrovision (Grossblatt)(DB) Jul 72
 Sealevel Systems Universal
 Memory Card (Holtzman)(EW) Mar 71
 Search for the perfect tweeter. The (Klein)(AUD) May 76
 Secure your Hard Disk with PC Access (Renton)(C) Apr 69
Security
 -Circuit Cookbook (Marston) Jul 56
 Digital Keyless Entry System (Avrlich)(C) Mar 71
 Home-Security Cookbook (Marston) May 61
 Semiconductor Laser System (Iannini)(C) Nov 34
 Servicing
 TV Service Case Histories (Zymlars) Oct 67
Shortwave Radio
 Future of (Leinwoll)(SWR) Jan 73
 Rock, Religion, and Rhetoric (Dexter) Jul 53
 Single-Chip Frequency Converter (Covington)(C) Apr 49
 68000 News (Holtzman)(EW) Jun 73
 Sky Cable (Lachenbruch)(VN) Jun 6
 Slick! drawing management
 system (Grossblatt)(EW) Jan 81
 Soldering tool kit, Portasol (ER) Apr 18
 Soft Warehouse's Derive (Holtzman)(EW) Jul 75
Software
 Data Disks: High-Speed Device
 Selection for the 90's (Prestwood) Sep 47
 Floppy Heaven (Holtzman)(EW) Jan 81
SOFTWARE REVIEWS
 Asymetrix ToolBook 1.0 (Holtzman)(CC) Sep 88
 Audio F/X, Forte's (Holtzman)(CC) Oct 86
 Annabooks' PromKit (Holtzman)(EW) Mar 71
 CAD Systems Unlimited's Slick! (Holtzman)(EW) Jan 81
 Derive, Soft Warehouse's (Holtzman)(EW) Jul 75
 Electronic Workbench, Interactive Image
 Technologies' (Holtzman)(CC) Dec 86
 Forte's Audio F/X MIDI-compatible
 package (Holtzman)(CC) Oct 86
 Graph-in-the-Box, New England
 Software's (Holtzman)(EW) May 81
 K-Talk Communications
 MathEdit (Holtzman)(EW) Apr 69
 MathCAD, MathSoft's (Holtzman)(EW) May 81
 Micropolis Corp.'s 1654-7
 ESDI PC-Pak (Holtzman)(CC) Nov 86
Microsoft
 Windows 3.0 (Holtzman)(CC) Sep 88
 Word (Holtzman)(EW) May 81
 Personics UltraVision 2.0 (Holtzman)(CC) Oct 86
 PromKit, Annabooks (Holtzman)(EW) Mar 71
 Slick! drawing management
 system (Holtzman)(EW) Jan 81
 Soft Warehouse's Derive (Holtzman)(EW) Jul 75
 Sport serial port set-up, Western
 Hydraulic Systems' (Holtzman)(EW) Aug 73
 ToolBook, Asymetrix's (Holtzman)(CC) Sep 88
 UltraVision 2.0, Personics (Holtzman)(CC) Oct 86
 Western Hydrologic Systems'
 sPORTt serial port setup (Holtzman)(EW) Aug 73
 Windows 3.0, Microsoft (Holtzman)(CC) Sep 88
 Word, Microsoft (Holtzman)(EW) May 81
Solid-State
 Disk Drive (Hatten)(C) Jul 75, Aug 73, (PCS) Aug 65
 Wiper Control (Heil)(C) Apr 46, (LTR) May 14
 Sony CRF-V21 Visual World-Band
 Receiver (ER) Feb 17
 Sound of Audio. The:
 AES conference report (Klein)(AUD) Sep 81, Oct 84
Speakers
 Search for the perfect tweeter (Klein)(AUD) May 76
 Spectrum analyzer module,
 Hameg HM8028 (ER) Jan 22
 SPICE (Byers) Nov 63
 Split battery supply (ARE) Nov 14
 sPORTt, Western Hydrologic
 Systems' (Holtzman)(EW) Aug 73
Stereo
 Silencer
 Phone-Activated Audio-Muting
 Circuit (Vaught)(C) Jan 43
 -system imbalance (Klein)(AUD) Feb 24
 -TV (Lachenbruch)(VN) Jun 6

Street Electronics Corp's Echo PC + (Holtzman)(EW)	May 81
Super-Directional Microphone (Blackwell)(C)	Jul 41
Surround Sound	
All About (Bernard) decoder	Jun 51
Acoustic Field Generator (Templin)(C) processor, Heath's AD-2550 (KR)	Jan 35
VCR Ask R-E (ARE)	Jun 57
SUSIE (Byers)	Oct 12
Sweep/Function Generator Beckman Industrial FG2A (ER)	Dec 57
Sync regenerator	Mar 18
Universal Descrambler (Graf & Sheets)(C)	May 37
Synchronous demodulation (Lancaster)(HH)	Mar 58
System Sleuth 2.0, DTG's (Holtzman)(EW)	Jun 73

T

Taking care of your tapes (Klein)(AUD)	Jul 69
Talking PC, The (Holtzman)(EW)	May 81
Technical literature (See NEW LIT, HARDWARE HACKER)	
Tektronix 2214 Digital/Analog Oscilloscope (ER)	Jul 18
Telephone	
-Activated Audio-Muting Circuit (Vaught)(C)	Jan 43,(LTR)Jul 14
Call Screener (Koller)(C)	Nov 49,Dec 52
-Line Controller (Saad)(C) ringer (ARE)	Sep 37,(LTR)Oct 14
Television (See also TV, Video)	
Changing Face of Satellite TV, The (Angus)	video Nov 58
Ten-speed blender control (Lancaster)(HH)	Jul 62
Test Equipment (See also EQUIPMENT REPORTS)	
Benchtop Frequency Counter (Bergquist)(C)	Dec 33
Capacitance Adapter (Kohl)(C)	Apr 43
Choosing the Right Test Probe (Hansen)	Dec 63
Inside Digital Oscilloscopes (Stover)	May 44
1.6-GHz Counter Prescaler (Huff)(C)	Oct 47
100-MHz Frequency Probe (Lashansky)(C)	Feb 31
Programmable Crystal-Controlled Pulse Generator (Loveclock)(C)	Jun 47
Radar Detector Tester (Ayer)(C)	Feb 37
Three-Chip Logic Analyzer (Robinson)(C)	Jan 41
Test Methods (Rogalski)	Mar 21,(LTR)May 14
Test Probe, Choosing the Right (Hansen)	Dec 63
Tester	
Radar Detector (Ayer)(C)	Feb 37
VCR Head Amp (Bathgate)(C)	Feb 51
Waveform Processing with your PC (Ramirez)	May 81
Test Methods (Rogalski)	Mar 21,(LTR)May 14
Test Probe, Choosing the Right (Hansen)	Dec 63
Texas Instruments	
RS-232 driver and receiver(Holtzman)(EW)	Feb 75
TMS340XX/TMS320XX (Mullin)(ICS)	Nov 81
Thermoelectric coolers (Lancaster)(HH)	Jan 61

Three-Chip Logic Analyzer (Robinson)(C)	Jan 41
Time Standard, computer (ER)	Nov 24
Today's graphics coprocessors (Mullin)(ICS)	Nov 81
ToolBook, Asymetrix's (Holtzman)(CC)	Sep 88
Touch-tone decoder (ARE)	Jul 8
Transistors, Why Are There So Many? (Bernard)	May 53
Trade journals (Lancaster)(HH)	Nov 69
Transputers, second-generation (Mullin)(ICS)	Dec 66
Triacs, Telling SCR's from (ARE)	Jul 8
Troubleshooting Potentiometers Test Methods (Rogalski)	Mar 21
Tweeter, The search for the perfect (Klein)(AUD)	May 76
2N2222 AND gate (ARE)Jan 12	
TV (See also Television, Video)	
screen captions (Lachenbruch)(VN)	Nov 6
Service Case Histories (Zyranis)	Oct 67
-VCR combos (Lachenbruch)(VN)	Apr 6
TVRO (VN)	Sep 4

U

Ultra-violet flame detector (Lancaster)(HH)	Apr 59
UltraVision 2.0, Personics (Holtzman)(CC)	Oct 86
Universal	
Descrambler (Graf & Sheets)(C)	May 37
Laboratory Power Supply (Metz)(C) Mar 31,(PCS)Mar 57	
Memory Card, Sealevel Systems (Holtzman)(EW)	Mar 71

V

Vacuum gauge	
R-E's Digital Dashboard (Ortman)(C)	Jul 31, Sep 61
Various filters and a digital thermometer (Lancaster)(HH)	Oct 77
VCR	
Head Amp Tester (Bathgate)(C)	Feb 51
programming aides (Lachenbruch)(VN)	Oct 10
VGA to CGA displays (ARE)	Jul 8
VHS-C (Lachenbruch)(VN)	Feb 6
Video (See also Television, TV, VIDEO NEWS)	
compression (Lancaster)(HH)	Dec 67
DTMF controller (Grossblatt)(DB)	Nov 83
Finally, a video signal! (Grossblatt)(DB)	Jun 70
Frame Grabber, R-E's (Toner)(C)	Aug 31
Let's plunge deeper into video (Grossblatt)(DB)	Apr 66
line drivers (Lancaster)(HH)	Aug 67
Scrambling and Macrovision (Grossblatt)(DB)	Jul 72
-scrambling techniques (Grossblatt)(DB)	Aug 18
-sync generator (Grossblatt)(DB)	May 78
Tapes, Taking care of your (Klein)(AUD)	Jul 69
The world of (Grossblatt)(DB)	Jan 79
timing generator,	

a crystal-controlled (Grossblatt)(DB)	Feb 72
Universal Descrambler (Graf & Sheets)(C)	May 81
May 37,(PCS)May 66,(LTR)Jun 12	May 8
Upgrade (ARE)	
VCR Head Amp Tester (Bathgate)(C)	Feb 51,(PCS)Feb 59
VIDEO NEWS (D)	
Jan 6, Feb 6, Mar 6, Apr 6	
May 6, Jun 6, Jul 6, Aug 6	
Sep 6, Oct 10, Nov 6, Dec 6	
Visible-light laser diodes	
Semiconductor Laser System (Iannini)(C)	Nov 34
Vocal Stripper, R-E's (Weeder)(C)	Sep 33
Voice Meter, Micronta (ER)	Dec 24
Voltage	
converter (ARE)	Dec 8
gauge	
R-E's Digital Dashboard (Ortman)(C)	Jul 31, Sep 61
Monitor, Huntrol DC Line Sentry (ER)	Jun 18
readout (ARE)	May 8
VOR Generator (ARE)	Aug 12
Vortex coolers (Lancaster)(HH)	Nov 69

W

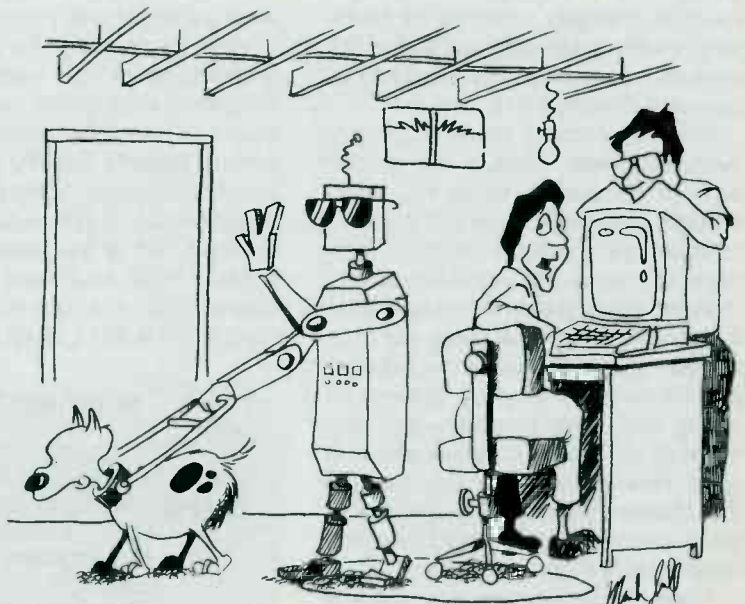
Walking-ring counters and more (Lancaster)(HH)	Nov 69
Water	
-pressure gauge	
R-E's Digital Dashboard (Ortman)(C)	Sep 61
-temperature gauge	
R-E's Digital Dashboard (Ortman)(C)	Jul 31
Waveform Processing with your PC (Ramirez)	May 81
Western Hydrologic Systems' sPORT1 (Holtzman)(EW)	Aug 73
Whatever Happened to AM Radio? (Dexter)	Sep 71,(LTR)Dec 16
What's New in CD Players (Bernard)	Jan 45
WHAT'S NEWS (WN)	
Jan 4, Feb 4, Mar 4, Apr 4	
May 4, Jun 4, Jul 4, Aug 4	
Sep 4, Oct 8, Nov 4, Dec 4	
Why Are There So Many Transistors? (Bernard)	May 53
Windows 3.0, Microsoft (Holtzman)(CC)	Sep 88
Wiper Control, Solid-State (Heil)(C)	Apr 46
Wireless video (Lachenbruch)(VN)	Aug 6
Wishmaker II, Jameco (ER)Mar 18	
Working With Audio	
Power Amp IC's (Marston)	Mar 52
World of video, The (Grossblatt)(DB)	Jan 79
World-Band receiver, Sony CRF-V21 (ER)	Feb 17

X

XT	
-to-AT Upgrade (ARE)	Sep 7
upgrade (ARE)	Nov 14



Where did you think robotic arms came from?



I haven't got the eyesight figured out yet

HARDWARE HACKER

A cold-fusion update, some alternatives to patenting, understanding decibels, wholesale surplus sources, and audio-level meters.

DON LANCASTER

As most of you already know, we now provide a no-charge *Hardware Hacker* helpline for you as shown in the box below. Here I can try to show you all the products, resources, publications, and consultant services that might be helpful to you. But every third day or so I get a call which starts off with "I can't tell you what I'm now working on or what it does..." and then goes on to request something totally absurd.

For instance (and no way could I have made these up), a phase detector with a 143-decibel dynamic range, a fishtank full of hot mercury, a microwave traveling-wave tube made from a fluorescent lamp, or a matched quad of high-power Zener diodes. Even a slow-blow fuse to get around a circuit that had an obvious short in it. To me, paranoid secrecy on any new idea is both asinine and monumentally stupid.

Paranoid secrecy obviously diverts time and energy from improving your product, besides being the inherently evil opposite of what shared hardware hacking is supposed to be all about in the first place. Paranoid secrecy also largely prevents the multi-step, multi-person process that is the essential core of useful product design and development.

Paranoid secrecy tends to grossly overvalue ideas. Back in the golden age of hardware hacking, well-thought-out ideas were once worth as much as a dime a dozen. These days, of course, ideas are worth less than ten cents a bale in ten-bale lots. It is only when those ideas are converted into actual final products being put to work or play by dozens of happy end-users that they gain any value at all. It ain't creative unless it sells. Paranoid secrecy discourages the thorough third-party testing of your working models and ongoing beta development prototypes.

Finally, paranoid secrecy virtually eliminates any possibility of selling your product. One of the hardest

lessons for Hardware Hackers to learn is that *others must come to you* for your product to be successful. You can't sell to them; they *must* come to you. Always.

So, by all means, give me a helpline call *if* you are willing to tell me what you are doing and are willing to share it with others. On the other hand, if you want to attempt to lay a paranoid-secrecy fantasy on me, I'd suggest you try one of those 900-number kinky sex lines instead. They would be in a better position to help you out.

Patents again

As we've seen a number of times in past columns, any Hardware Hacker involvement with patents in any way, shape, or form, is *absolutely certain* to cause you a net loss of time, energy, money, and sanity.

I recently received yet another sad case for my overflowing patent-victim files. But this one's so appallingly bad that it forms a near-perfect example of everything *not* to do. This new patentee was wondering why Fortune-500 companies weren't beating his door down, and why he couldn't even get anyone to promote his idea.

Well, for openers, his patent clearly should never have been issued. On the patent side, it obviously violated a dozen or more fundamental optical-control patents held by a major corporation. On the non-patent side, it describes an obsolete concept totally blown out of the water by a well-known 1952 technical paper, and thoroughly discussed (and dismissed) in a 1973 student textbook.

NEED HELP?

Phone or write your **Hardware Hacker** questions directly to:
Don Lancaster
Synergetics
Box 809
Thatcher, AZ 85552
(602) 428-4073

While the idea purports to be a micropower one, it requires the continuous application of very precisely regulated high energy levels. While it is supposed to be microminiature, a complex mechanism is involved. And multiplication is introduced at crucial points in the circuit where outstanding linearity is an absolute must.

Despite it being something that any of you could easily beat out on the kitchen table, it is obvious that the idea was never tested in a final-use application. Nor could any possible end-user or builder of this product ever have been so much as contacted, let alone consulted.

I sorely wish this was an isolated example, but it is now one of hundreds in my victim files that collectively have cost all you hardware hackers many millions of dollars. *Not once* have I ever seen *any* example of anyone who has profited in *any* way from *any* patent involvement from within a small-scale hardware hacking environment.

So what are the alternatives? Figure 1 shows you some patent-avoidance guidelines that may help you.

We've plowed some of this ground pretty well in the past. But one thing I'd like to emphasize here is that you can *never* develop and market an idea as an outsider. To develop and sell something that's useful, you *must* be thoroughly familiar with that field's technical literature; its history; its marketing realities; the mainstream tools and techniques; and, above all, the insider trade journals involved.

For instance, there is absolutely no way you should be writing forest-fire simulation software if you have never sharpened a Pulaski. Working with active filters is pointless if you have never met Sallen and Key. And developing unfocused solar collectors without Winston is unthinkable.

I once had a long talk with a retired patent examiner who carefully went back over his thirty years of experience and tried to find out just how

1. Do not ever call yourself an inventor or behave like one. To do sets you up for interminable scams. Instead, you will want to become a product development engineer or a prototyping house.
2. Totally avoid any and all contact with anything even remotely patent related. In any way, shape or form. Do so religiously.
3. Don't bother creating anything in any field in which you are not eventually *certain* to become an expert. An expert who is thoroughly familiar with the technical literature, the history of the field, the marketing realities, the insider trade journals, and the mainstream tools and techniques in use.
4. Publish all your key secrets and ideas in a major magazine, leaving out no detail, and omitting no insider secrets. This immediately can generate positive cash flow for you and safely tucks all your ideas away in the public domain, preventing most others from attempting to patent them. This also exposes your new ideas to the widest possible audience.
5. Try to set up some royalty arrangement with a small to medium firm in some position to market and distribute your invention. The tricky part: *They must come to you, and never vice versa.* That is why it is super important to publish your ideas and creations and expose them as widely as possible.
6. Your main defense against getting ripped off in any royalty setup is the expectation that you will be delivering newer and better stuff in the future.
7. Use the shotgun technique. There is no way that one single idea or product will hack it. To survive in this game, you'll need hundreds or even thousands of new ideas and concepts working for you on a total lifetime and total lifestyle basis.
8. Expect to be ripped off. That way, it will be far less of a rude surprise when this inevitably happens to you. And far less of a stress trip.
9. Be realistic. You don't create things to get filthy rich. You create things because you like to create things and have some compelling desire or need to do so. As long as there are enough nickels to keep going, that is all that should really matter.

FIG. 1—SOME THOROUGHLY TESTED and hacker-friendly alternatives to the patenting process.

many individuals *acting alone* were successful with a strategy of "patent an undeveloped and unproven idea as an outsider and then try to sell it somewhere." The answer: *Not one ever!*

For more on patents and patenting, see *The Case Against Patents* in the December 1990 *Midnight Engineering* (now in GENIE PSRT library as #162), or read my *Incredible Secret Money Machine* book.

An audio-level meter

As we've seen a time or two in the past, the new three-volume *Linear IC Databook* set from *Samsung* has been crammed to the rafters with top-notch hacker integrated circuits. For this month, I thought we might take a look at some of their audio-level indicator chips.

But first, let's go over some fundamentals. You will often find two popular ways of dealing with any electronic

or physical quantity, *linear* and *log*, short for logarithmic.

The linear scale has equal steps everywhere in it. Obvious examples include a ruler where the distance between 1 and 2 is exactly the same as the distance from 8 to 9. The channels on the AM-radio dial are also linearly spaced with frequency, each being 10 kilohertz above or below its nearest neighbor.

Now a linear scale sounds great, and it is the *only* way to go if you want to prevent any interaction, multiplication, or distortion when two or more quantities of something are present at once. But, if you attempted to go too far with a linear scale, one end or the other ends up far too cramped or way too spread out. Put another way, the *dynamic range* of a linear scale or system is often limited.

The log system instead works with *constant percentage* scales. Equal anythings are close together on the

"low" end and farther apart on the "high" end. For instance, the notes on a musical instrument are usually a tad under six percent above or below one another. Or, more precisely, we are dealing with the twelfth root of two, or 1.059545, since the frequency of your notes doubles as you go up a twelve-note octave, or a ratio of 2:1 in frequency.

Log systems will often have a much higher dynamic range than the linear ones. And there's lots of places where "equal change" is more important than "equal steps." For instance, rank beginners are often mystified why standard resistors do not simply go 1.0, 2.0, 3.0, 4.0..., instead of 1, 2.2, 3.3, 4.7, 6.8...

Obviously, we are dealing with a log scale here. First because you'll normally want to cause a constant percentage change when you alter a resistor in an electronic circuit. And second, because stocking resistors in one-ohm increments in the meg-ohm range would get out of hand.

Some physical systems are inherently logarithmic. In fact, anything linear over a wide range in the real world is usually the exception rather than the rule.

NEW FROM DON LANCASTER

HANDS-ON BOOKS

Hardware Hacker Reprints II	24.50
Ask The Guru Reprints I or II	24.50
CMOS Cookbook	18.50
TTL Cookbook	16.50
Active Filter Cookbook	15.50
Micro Cookbook vol I or II	16.50
Lancaster Classics Library	99.50
Enhancing your Apple I or II	17.50
AppleWriter Cookbook	19.50
Apple Assembly Cookbook	21.50
Incredible Secret Money Machine	10.50
LaserWriter Reference (Apple)	19.50
PostScript Cookbook (Adobe)	16.50
PostScript Ref. Man. (Adobe)	22.50
PostScript Prog. Design (Adobe)	22.50
Type I Font Format (Adobe)	15.50
Real World Postscript (Roth)	22.50

UNLOCKED SOFTWARE

LaserWriter Secrets (Ile/Mac/PC)	29.50
PostScript Show & Tell	39.50
Intro to PostScript VHS Video	39.50
PostScript Beginner Stuff	39.50
PostScript BBS Stuff	19.50
The Whole Works (all PostScript)	249.50
Absolute Reset Ile & Iic	19.50
Enhance I or II Companion Disk	19.50
AppleWriter CB or Assy CB Disk	24.50

FREE VOICE HELPLINE

VISA/MC

SYNERGETICS

Box 809-RE
Thatcher, AZ 85552
(602) 428-4073



**386-25 COMPUTER with
80MB HARD DRIVE and
64K CACHE MEMORY**



80 MB Hard Drive!

Rev up to the power and speed you get from this KLH 386-25 Computer with 80MB hard drive. The 386 processor running at a fast 25MHz zooms through tough applications with ease. And the incredible 64K cache memory speeds up your data access time like never before!

- 80386-25 MHz, full 32 bit processor.
- 80MB hard drive/28 millisecond access time.
- 1MB RAM expandable to 8MB on motherboard.
- One 3-1/2" 1.44MB floppy disk drive.
- One 5-1/4" 1.2MB floppy disk drive.
- 64K disk cache memory expandable to 128K.
- 16-bit VGA card: 800x600 with 256K memory.
- Expansion slots: six 16-bit (four available), one 8-bit, one 32-bit slot.
- 2 serial ports, 1 parallel port, 1 game port.
- Five 5.25" drive bays exposed (three available).
- 80387 math co-processor socket.
- MS-DOS 4.01 included.
- 101 AT-styled keyboard.
- Includes instructional video tape for set-up.
- One Year Mfr. Warranty!
- **Factory New!**

VGA Color Monitor: Mfr. Sugg. Retail: **\$5,194.00**

- 14" high resolution monitor.
- 31 dot pitch.
- IBM compatible.
- Resolution: 640 x 480.
- Analog input signal.
- Tilt swivel base.

DAMARK PRICE:
\$1999⁹⁹

Item No. B-2500-160159
Insured Ship/Hand.: \$49.00

**FOR FASTEST SERVICE
CALL TOLL FREE**

1-800-729-9000



DAMARK INTERNATIONAL, INC.
7101 Winnetka Ave. N., Minneapolis, MN 55428-1619
Customer Service 612-531-0082

Please rush me: KLH 386-25 computer(s)
@ \$1999.99 each, plus \$49.00 s/h each.
Item No. B-2500-160159
MN res. add 6% sales tax.

Name _____
Address _____
City, State, Zip _____
 Check/MO VISA Master Card Discover
Card No. _____
Exp. Date _____ Ph. # () _____
Signature _____
Copyright 1990 DAMARK International, Inc. All rights reserved.

DELIVERY TO 48 U.S. STATES ONLY

NAMES AND NUMBERS

Bourns, Inc.
1200 Columbia Avenue
Riverside, CA 92507
(714) 781-5500
CIRCLE 301 ON FREE INFORMATION CARD

Journal of Electroanalytical Chem.
Box 564, 1001 Lausanne 1
Switzerland
(021) 20 73 81
CIRCLE 307 ON FREE INFORMATION CARD

Electronic Buyers News
600 Community Drive
Manhasset, NY 11030
(516) 562-5000
CIRCLE 302 ON FREE INFORMATION CARD

Model Railroader
Box 1612
Waukesha, WI 53187
(414) 796-8776
CIRCLE 308 ON FREE INFORMATION CARD

Electronic News
Box 1051
Southeastern, PA 19398
(215) 630-0951
CIRCLE 303 ON FREE INFORMATION CARD

Radio Control Modeler
Box 487
Sierra Madre, CA 91024
(800) 523-1736
CIRCLE 309 ON FREE INFORMATION CARD

ELTEC Instruments Inc.
Box 9610
Daytona Beach, FL 32020
(800) 874-7780
CIRCLE 304 ON FREE INFORMATION CARD

Samsung
3725 North First Street
San Jose, CA 95134
(408) 434-5400
CIRCLE 310 ON FREE INFORMATION CARD

GEnie
401 North Washington Street
Rockville, MD 20850
(800) 638-9636
CIRCLE 305 ON FREE INFORMATION CARD

Synergetics
Box 809
Thatcher, AZ 85552
(602) 428-4073
CIRCLE 311 ON FREE INFORMATION CARD

International CMOS Technology
2125 Lundy Avenue
San Jose, CA 95131
(408) 434-0678
CIRCLE 306 ON FREE INFORMATION CARD

Texas Instruments
PO Box 809066
Dallas, TX 75380
(800) 232-3200
CIRCLE 312 ON FREE INFORMATION CARD

The ear is logarithmic, allowing it to deal with everything from a whisper to a shout over an incredible dynamic range. And since radio began with audio, it is convenient to employ log systems to describe the differences between powerful transmitted signals and weak received ones.

All of which leads us around to *decibels*. Decibels are simply one convenient way of measuring things on a log scale with a potentially wide dynamic range. Since you'll usually measure voltage rather than power, most hackers typically use voltage decibels rather than the much rarer power ones.

A reading of so many decibels tells you the *relative* strength between two quantities. For instance, a one-decibel change is about a ten-percent change in amplitude. It is also roughly the smallest amplitude change you can usually pick up with your ear.

A two-decibel change is around twenty percent, and a three-decibel change is around thirty percent. More specifically, when one signal is at a -3-decibel level from another (or "three dB down"), you will be at 0.707 relative amplitude.

Now, since power is related to the square of your circuit voltage, and since 0.707 squared is 0.5, being three decibels down is also at *half* power from whatever your 0-decibel level happened to be.

Hi-fi components normally have their frequency responses specified between their upper and lower -3-dB points. Put another way, this is the range over which the available power remains over half of what you would get in the "middle" of whatever frequency range you're measuring.

Moving right along, a ten-decibel change is roughly a 3:1 amplitude ratio, twelve decibels is one quarter,

- 60 Decibels is a 1000:1 amplitude gain.
- 40 Decibels is a 100:1 amplitude gain.
- 20 Decibels is a 10:1 amplitude gain.
- 18 Decibels is an 8:1 amplitude gain.
- 12 Decibels is an 4:1 amplitude gain.
- 10 Decibels is roughly a 3:1 gain.
- 6 Decibels is a 2:1 gain.
- 3 Decibels is about a 30 percent gain and the double power point.
- 2 Decibels is a 20 percent amplitude gain
- 1 Decibels is a 10 percent amplitude gain.
- 0 Decibels is a unity amplitude ratio of 1:1.
- 1 Decibels is a 10 percent drop.
- 2 Decibels is a 20 percent drop.
- 3 Decibels is about a 30 percent drop and the half power point.
- 6 Decibels is half amplitude.
- 10 Decibels is around one-third amplitude.
- 12 Decibels is quarter amplitude.
- 18 Decibels is eighth amplitude.
- 20 Decibels is a 10:1 attenuation.
- 40 Decibels is a 100:1 attenuation.
- 60 Decibels is a 1000:1 attenuation.

FIG. 2—SOME SIMPLE RULES that make learning how to use decibels much easier.

eighteen decibels is one eighth, and twenty decibels equals one tenth. One hundredth is forty decibels, and one thousandth is sixty decibels. The 143-decibel phase detector asked for above is the ratio between one microvolt and fourteen volts, an almost impossible dynamic range to deal with gracefully at reasonable cost in the real world. I've gathered some of these "rule of thumb" decibel ratios in Fig. 2 for your reference.

Once again, almost all your decibel

measurements are *relative* and will always refer to two different levels in two points in your circuit. Decibels usually answer the question "How strong is the present signal or response compared to another one?"

How strong is a six-decibel signal? Somewhere between a femtowatt and a gigawatt, at least sometimes. Maybe. It all depends. All we know for sure is that this particular signal is twice as strong in amplitude as some other one at some other time or

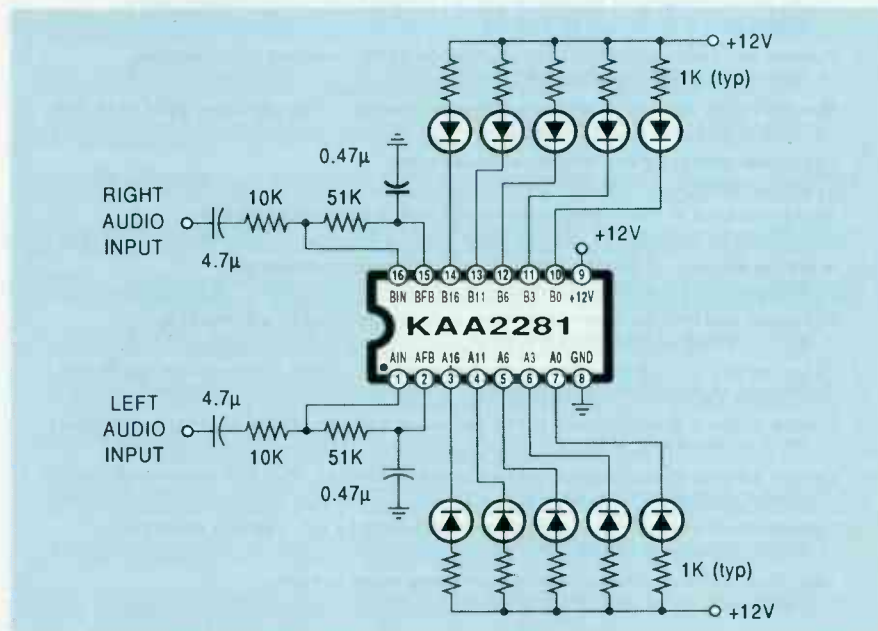


FIG. 3—A STEREO AUDIO-LEVEL METER using the Samsung KAA2281. Levels displayed are -16, -11, -6, -3, and 0 decibels. Input sensitivity is one millivolt.

DISCOVER EXPERIMENT LEARN ADVANCE ELECTRONICS LASERS CAD-CAM HOME STUDY HEATHKIT HOMEWORKS!

Now you can learn beginning to advanced electronics at home, with the same courses used today in the world's top colleges and tech schools, and pay a lot less! You'll learn just what you want, when you want, at your own pace. The complete story is in our free catalog, *Homeworks by Heathkit*. Order yours today, call toll-free:

1-800-44-HEATH
(1-800-444-3284)



YES! Please send me a FREE copy of the *HomeWorks by Heathkit* Catalog.

Send to: Heath Company, Dept. 020-014
Benton Harbor, Michigan 49022

Name

Address

City

State Zip

ED 240

Bull Data Systems, Inc.

CIRCLE 86 ON FREE INFORMATION CARD

DIGITAL VIDEO STABILIZER ELIMINATES ALL VIDEO COPY PROTECTIONS



While watching rental movies, you will notice annoying periodic color darkening, color shift, unwanted lines, flashing or jagged edges. This is caused by the copy protection jamming signals embedded in the video tape, such as Macrovision copy protection. Digital Video Stabilizer: RXII completely eliminates all copy protections and jamming signals and brings you crystal clear pictures.

WARNING :
SCO Electronics and RXII dealers do not encourage people to use the Digital Video Stabilizer to duplicate rental movies or copyrighted video tapes. RXII is intended to stabilize and restore crystal clear picture quality for private home use only.

FEATURES:

- Easy to use and a snap to install
- State-of-the-art integrated circuit technology
- 100% automatic - no need for any troublesome adjustments
- Compatible to all types of VCRs and TVs
- The best and most exciting Video Stabilizer in the market
- Light weight (8 ounces) and Compact (1x3.5x5")
- Beautiful deluxe gift box
- Uses a standard 9 Volt battery which will last 1-2 years.

(Dealers Welcome)

To Order: \$49.95 ea + \$4 for FAST UPS SHIPPING

1-800-445-9285 or 516-568-9850

Visa, M/C, COD M-F: 9-6 (battery not included)

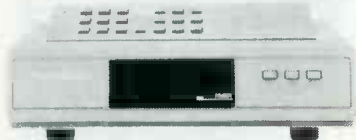
SCO ELECTRONICS INC.

Dept. CRE01 581 W. Merrick Rd. Valley Stream NY 11580
Unconditional 30 days Money Back Guarantee

CIRCLE 190 ON FREE INFORMATION CARD

CABLE TV DESCRAMBLER

How You Can Save Money
on Cable Rental Fees



1 Unit 10 Lot
Jerrold SB w/Trimode...\$99...\$70
Super Tri-Mode...\$109...\$75
Oak KN12 (w/VIS)...\$109...\$65
Scientific Atlanta...\$109...\$75
SA (Combo)...\$250...\$195
Pioneer...\$109...\$79
Hamin MLD 1200...\$89...\$59
Tocom...\$169...\$129
Sargate converter...\$95...\$75
Panasonic converter...\$99...\$79

**US Cable will
Beat Anyone's
Price
Advertised in
this Magazine!**

30 Days Money Back Guarantee

Free 16 page Catalog

Visa, M/C, COD or send money order to:

US Cable TV Inc. Dept. KRE01

4100 N. Powerline Rd., Suite F-4
Pompano Beach, FL 33073

1-800-445-9285

For Our Record

I, the undersigned, do hereby declare under penalty 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.

Date: _____

Signed: _____

No Florida Sales!

CIRCLE 191 ON FREE INFORMATION CARD

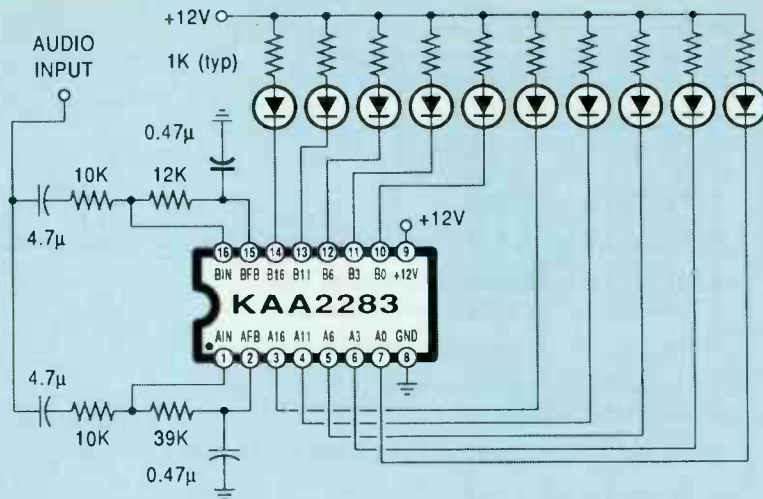


FIG. 4—A MONO AUDIO-LEVEL METER can be built by using both halves of the Samsung KAA2283. Levels displayed are -18, -16, -14, -12, -10, -8, -6, -4, -2 and 0 decibels. Sensitivity is from 0.1 to 0.9 millivolts.

Electrochemically induced nuclear fusion of deturium.

Fleishmann, Pons, Hawkins, vol 261 pp 301-308.

Examination of nuclear measurements in cold fusion experiments.

Abriola, et.al, vol 265 pp 355-360.

Observations of the surface composition of palladium cathodes after electrolysis.

Mebrahtu, et.al, vol 267 pp 351-357.

Electrochemical incorporation of lithium into palladium into aprotic electrolytes.

Dalard, et.al, vol 270 pp 445-450.

Production of tritium from electrolysis at a palladium cathode.

Packham, et.al, vol 270 pp 451-458.

A long-term calorimetric study of electrolysis using palladium cube cathodes.

Armstrong, et.al, vol 272 pp 293-297.

Tritium production during the cathodic discharge of deuterium on palladium.

Chene, et.al, vol 280 pp 199-205.

Electrochemical fusion: a mechanism speculation.

Lin, et.al, vol 280 pp 207-211.

Tritium separation during heavy water electrolysis: implications for cold fusion.

Corrigan, et.al, vol 281 pp 305-310.

Experimental investigations of electrolysis using palladium cathodes.

Zahm, et.al, vol 281 pp 313-319.

In-situ measurements of deuterium uptake in palladium using diffractometry.

Bennington, et.al, vol 281 pp 323-328.

Surface and electrochemical characterization of Pd cathodes after charging.

Ulmann, et.al, vol 286 pp 257-263.

Morphological difference between hydrogen-loaded and deuterium-loaded palladium.

Rolison, et.al, vol 287 pp 375-384.

Local heat effects by electrolysis of heavy water.

Ratkje, et.al, vol 273 pp 269-273.

Energy balance in the electrolysis of water with a palladium cathode.

Rock, et.al, in press.

A critical analysis of electrochemical nuclear fusion experiments.

Kreysa, et.al, vol 266 pp 437-450.

Hydrogen and oxygen recombination in calorimetry of water electrolysis.

Cunnane, et.al vol 269 pp 163-174.

Experimental investigation of thermal and radiation effects by deuterium discharge.

Chemla, et.al, vol 277, pp 93-103.

Energy balance of electrolysis with a palladium cathode, Part I, Theoretical relations.

Balej, et.al, vol 278 pp 85-98.

Energy balance of electrolysis with a palladium cathode, Part II, Experimental results.

Divisek, et.al, vol 278 pp 99-117.

Absorption of electrolytic hydrogen and deuterium by Pd: cyanide adsorption.

McBreen, et.al, vol 287 pp 279-291.

Calorimetry of the palladium-deuterium-heavy water system.

Fleischmann, et.al, vol 287 pp 293-348.

FIG. 5—SOME KEY PAPERS ON COLD FUSION that have recently appeared in the Journal of Electroanalytical Chemistry.

R-E Engineering Admart

Rates: Ads are 2 1/4" x 2 7/8". One insertion \$995 each. Six insertions \$950 each. Twelve insertions \$925 each. Closing date same as regular rate card. Send order with remittance to Engineering Admart, Radio-Electronics Magazine, 500-B Bi-County Blvd., Farmingdale, NY 11735. Direct telephone inquiries to Arline Fishman, area code-1-516-293-3000. FAX 1-516-293-3115. Only 100% Engineering ads are accepted for this Admart.

INCREASE YOUR EARNING POWER!

LEARN TO DESIGN WITH SINGLE CHIP MICROCOMPUTERS

SINGLE CHIP MICROCOMPUTER PRIMER FOR MOTOROLA 6805

Includes:

- * Professional Quality MS-DOS Software
- Editor
- Assembler
- Simulator/Debugger
- * Schematics for Sample Project
- * Single Chip Microcomputer Primer Lesson Book

Price \$195

MCPM-1 Programmer for Motorola MC68705P3, P5, U3, U5, R3, R5
 Parts kit w/driver program \$190
 Fully assembled w/driver program \$325
 Fully assembled w/driver, assembler, simulator/debugger \$449

MCPM-3 Programmer for Motorola MC68HC705C6, 805C4
 Parts kit w/driver program \$176
 Fully assembled w/driver program \$360
 Fully assembled w/driver, assembler, simulator/debugger \$495



The Engineers Collaborative Inc.
 Rt. #3 Box 8C Barton, VT 05860 USA
 TEL: (802) 525-3465 FAX: (802) 525-3451
 Toll Free (800) 338-8321

CIRCLE 185 ON FREE INFORMATION CARD

Power within your range-the Huntron DC Line Sentry.



Sags, surges and glitches in DC voltages can cause logic and systems to do funny things. This "go/no go" in-range indicator is a cost effective tool for isolating problems to either the power supply or the system under power. Find out more. Call toll free:



1-800-426-9265.

HUNTRON

CIRCLE 187 ON FREE INFORMATION CARD

FCC LICENSE PREPARATION

The FCC has revised and updated the commercial license exam. The NEW EXAM covers updated marine and aviation rules and regulations, transistor and digital circuitry. THE GENERAL RADIOTELEPHONE OPERATOR LICENSE - STUDY GUIDE contains vital information. VIDEO SEMINAR KITS ARE NOW AVAILABLE.

WPT PUBLICATIONS
 979 Young Street, Suite E
 Woodburn, Oregon 97071
 Phone (503) 981-5159 Dept. 50

CIRCLE 178 ON FREE INFORMATION CARD

place. For an amplifier with a 20-decibel gain, we know that the output will be ten times as strong as the input amplitude, at least over whatever the intended working levels of your circuit are.

Audio engineers will sometimes refer decibels to a very specific voltage level over a specified impedance. They will then use the term dBm to specify such an absolute level. One milliwatt into a 600-ohm line is one possible absolute dBm level. In this case you are comparing the ratio of your signal against the standard reference, rather than comparing it to another signal.

But the stereo, hi-fi, and home-recording people have long since bastardized the meaning of the term dBm. Today, unless you are certain you are dealing with the professional studio audio standards, an apparent 0 dBm is just the maximum allowable voltage level at some point in some circuit above which the distortion levels are no longer acceptable.

Thus, while the VU (or volume-unit) display on your receiver or recorder does in fact measure some absolute voltage level, the chances are that your particular VU units have nothing to do with anyone else's. The VU display only indicates a reference level above which distortion will start to become unacceptable.

Samsung has a bunch of level-meter driver chips that are simple and easy to use. Note that the driver chips all differ from a "bargraph" driver in that the bargraph works in linear steps and the level meter driver works in log steps.

Figure 3 shows you the KA2281 which offers internal trip levels of -16, -11, -6, -3, and 0 decibels and gives you two stereo channels that can power five lamps each.

Note that some commercial units will cheat and assign a pair of light-emitting diodes to each output, giving you the illusion of ten steps when you really only have five.

Figure 4 shows you the similar KA2283 which uses levels of -8, -6, -4, -2, and 0 decibels instead. This time, I've shown you how to attenuate one side to make a single-channel ten-lamp display. You might want to make your lower level LED's green, a middle one yellow, and use reds for the upper ones for an additional effect.

In this particular circuit, less than 100 millivolts of input lights nothing and more than 900 millivolts lights everything. You can easily change the input attenuators to pick up other operating ranges. Note that the bottom half of the circuit has to attenuate ten decibels more than the upper one to keep all of the steps equal.

Cold fusion update

What ever happened to cold fusion? Well, Uh, Um, Er...Two years have gone by and cold fusion remains what it started out as...a largely unduplicatable lab anomaly in which some apparently excess unexplainable heat sometimes appears to get erratically generated. Since there seems to be an ongoing glut in the lab anomaly market, most interest in cold fusion has, to say the least, waned.

However, there remain bunches of dedicated true believers continuing to do high-quality research in the cold-fusion area. The leading source for professional papers on cold fusion is that *Journal of Electroanalytical Chemistry*, a Swiss publication. A few of the more important cold-fusion papers are listed for you in Fig. 5.

This month's contest

One thing I like to do every now and then is pick up a magazine on some hobby or industry that I'm not the least bit into. More often than not, you can find unusual ads, ideas, techniques, or mindsets that end up surprisingly relevant to your own trip.

For instance, we've seen in the past how *Model Railroader* is one outstanding source of unusual tools and techniques. I think that MR has by far the finest technical writing of any publication anywhere ever on any

Cable TV

Descrambler Article Parts

We stock the exact Parts, PC Board and Adaptor for several articles published in Radio-Electronics magazine on building your own Cable TV Descrambler.

February 1984 SB-3 Type

701 Parts Pkg.....\$19.00
Includes all original parts.

702 PC Board.....7.95
Original 3X4 etched, drilled
and Silk-Screen pc board.

704 AC Adaptor.....7.95
12 to 18 Volt DC @ 200ma.

701, 702 & 704.....29.00
All three for special saving.

February 1987 Tri-Mode

301 Parts Pkg.....29.00
Includes all original parts.

302 PC Board.....7.95
Original 5X8 etched, drilled
and Silk-Screen pc board.

304 AC Adaptor.....7.95
12 to 18 Volt DC @ 200ma.

301, 302 & 304.....39.00
All three for special savings.

Tri-Mode Tutorial..7.95
26 pages of In-depth info.

May 1990 Universal

901 Parts Pkg.....\$49.00
Includes all parts.

902 PC Board.....9.95
Improved 4X7 etched, drilled
and Silk-Screened pc board.

904 AC Adaptor.....8.95
12 Volts AC @ 350ma.

901, 902 & 904.....59.00
All three for special savings.

Snooper Stopper...\$39.00

Prevent Descrambler detection with snooper
stopper/data blocker and protect your privacy.
Includes free article on Cable Snooping.

Macrovision Kit...\$29.00

Macrovision.....now you see it, now you
don't with our macro-scrubber kit.
Originally Published in Radio-Electronics .

70 Channel Cable TV Converter.....\$89.95

- * 6 Function Infra-Red remote.
- * Fine Tuning.
- * Memory & Recall.
- * Compatible with all External Descrambler.
- * Channel 3 & 4 switchable output.
- * STD, HRC & IRC compatible.

CALL TOLL FREE 1-800-332-3557

Outside USA Call 1-508-699-6935

Visa, MasterCard and COD.

Add \$4.00 S&H, \$6.50 Outside USA.

D & D Electronics, Inc. PO Box 3310, N. Attleboro, Ma. 02761

VISA

MC

CIRCLE 181 ON FREE INFORMATION CARD

A HARD DRIVE IS A TERRIBLE THING TO WASTE.

So don't. For only \$6 per hour, you can download to your hard disk from DELPHI's library of over 10,000 programs. That's right, just \$6 per hour including evening and weekend local access at modem speeds up to 2400 bps.

Join DELPHI now for \$9.95 and your first hour is free. There's no risk—if you're not completely satisfied, we'll refund the \$9.95.

Of course, you may eventually fill up your hard disk. Then you can enjoy exploring DELPHI's other services such as electronic mail, conference, multi-player games, news, stock quotes, encyclopedia, and travel.

SIGN UP WITH YOUR COMPUTER AND MODEM

- Dial 1-800-365-4636
- At Username: type JOINDELPHI
- At Password: type RADIO

DELPHI

POPULATING HARD DRIVES SINCE 1982

General Videotex Corporation • Three Blackstone Street • Cambridge MA 02139
800-544-4005 • 617-491-3393

CIRCLE 186 ON FREE INFORMATION CARD

level, and should be mandatory reading for any tech writer. Some day, I hope to eventually be able to write that good. Maybe with some more experience....

Another magazine which recently caught my eye was *Radio Control Modeler*. Again, lots of unusual tools and techniques. I'm wondering what happens when you use what these folks call a *heat-sealing iron* for *Kroy Color* or for circuit board dry-resist laminating. The R/C people are also into amateur-television stuff.

But what I noticed the most (and this is probably ancient history to an R/C buff), is that these hobbyists now are building models at *one quarter scale*. No, not quarter inch scale, but quarter scale.

Now, any quarter-size aircraft can hoist a respectable payload and carry it an acceptable distance. At costs that are ridiculously lower and far less regulated than "real" aviation.

Uses? For video obviously. But less obvious would be such things as cave hunting, either by the regular stereo photography for sinkhole searches in difficult terrain.

So for this month's contest, tell me what you would do with an aerial platform that can handle a respectable payload. Let's go well beyond chopping holes in the *Goodyear* blimp (as was recently done), the nudist colony jokes, and drug deliveries. Limit all your responses to largely legal and purportedly more noble endeavors.

There'll be all the usual *Incredible Secret Money Machine* book prizes for the top dozen entries, along with an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two going to the very best. Be sure to send all your written entries directly to me at *Synergetics*, and not to **Radio-Electronics**.

Wholesale surplus sources

Have you ever wondered where the surplus houses go to buy their stuff? Few hackers realize there is a lean and mean collection of small outfits out there collectively known as *wholesale surplus dealers*.

All of the good news here is that outstanding prices are the norm. Two-cent integrated circuit sockets, three-cent LED's, quarter motors, and fifty-cent EPROM's are routine. The bad news is that you can only buy using stiff lot, line, or total-order miniums. There is also no technical sup-

WHOLESALE SURPLUS SOURCES

Ace Electronics

3210 Antoine
Houston, TX 77092
(713) 688-8114

CIRCLE 313 ON FREE INFORMATION CARD

ACP Components

1317 East Edinger
Santa Ana, CA 92705
(714) 558-8822

CIRCLE 314 ON FREE INFORMATION CARD

All Components

5999 Summerside Place #208
Dallas, TX 75252
(800) 367-7312

CIRCLE 315 ON FREE INFORMATION CARD

American Design Components

Box 220
Fairview, NJ 07022
(800) 776-3800

CIRCLE 316 ON FREE INFORMATION CARD

Braniff Industries

91 South Ottawa
Dixon, IL 61021
(815) 288-4500

CIRCLE 317 ON FREE INFORMATION CARD

Calcera

PO Box 489
Belmont, CA 94002
(800) 257-5549

CIRCLE 318 ON FREE INFORMATION CARD

Dorf Electronics

1 Biehn Street
New Rochelle, NY 10801
(800) 431-2912

CIRCLE 319 ON FREE INFORMATION CARD

H&R Enterprises

21521 Blythe Street
Canoga Park, CA 91304
(818) 703-8892

CIRCLE 320 ON FREE INFORMATION CARD

Japan Electronics

15138 Valley Blvd
City of Industry, CA 91744
(818) 369-5000

CIRCLE 321 ON FREE INFORMATION CARD

J&C Electronics

Box 630
Salem, MA 01970
(800) 447-7014

CIRCLE 322 ON FREE INFORMATION CARD

Jerome Industries

8737 Shirley Avenue
Northridge, CA 91324
(818) 993-1393

CIRCLE 323 ON FREE INFORMATION CARD

Leo Electronics

22353 S. Western Avenue #201
Torrance, CA 90501
(213) 212-6133

CIRCLE 324 ON FREE INFORMATION CARD

Micro-C

11085 Sorrento Valley Court
San Diego, CA 92121
(619) 552-1213

CIRCLE 325 ON FREE INFORMATION CARD

Microprocessors Unlimited

24000 South Peoria Avenue
Beggs, OK 74421
(918) 267-4962

CIRCLE 326 ON FREE INFORMATION CARD

New England Circuit Sales

292 Cabot Street
Beverly, MA 01915
(800) 922-NECS

CIRCLE 327 ON FREE INFORMATION CARD

Oracle Electronics

1355 Adams Court
Menlo Park, CA 94025
(415) 326-2660

CIRCLE 328 ON FREE INFORMATION CARD

Search Electronics

228 East Atara
Monrovia, CA 91016
(818) 359-3350

CIRCLE 329 ON FREE INFORMATION CARD

Southwest Memory

3939 Beltline Road #775
Dallas, TX 75244
(214) 484-1595

CIRCLE 330 ON FREE INFORMATION CARD

Surplus Traders

Winters Lane Box 276
Alburt, VT 05440
(514) 739-9328

CIRCLE 331 ON FREE INFORMATION CARD

World Wide

18 Stern Avenue
Springfield, NJ 07081
(800) 222-6268

CIRCLE 332 ON FREE INFORMATION CARD

port or hand holding whatsoever.

Our resource sidebar for this month shows you several of the better-known wholesale surplus sources. These and others often advertise in the classified sections of *Electronic News* and the *Electronic Buyer's News* magazines. Except for *Surplus Traders*, virtually none of them have catalogs. Some provide fax current availability lists, while others prefer to bid on your needs.

The foremost rule in dealing with these folks is *no messing around*. The preferred contact means is by fax, and most quotations are good only for twelve minutes or so. Quick cash sales are the norm.

New tech literature

Some ancient hacker construction projects on those solid-state vortex coolers we recently looked at include the November 1947 issue of *Popular Science*, and chapter 4 of the *Scientific American Amateur Scientist* reprint volume from the early 1960's.

Two interesting application notes are the *Introduction to Infrared Pyroelectric Detectors* from *ELTEC* on the subject of human-motion detection, and the *Best of the Trimmer Primers* from *Bourns* on the use of precision trimmer potentiometers.

Free samples this month include 1K serial EEPROM's from *International CMOS Technology*, and SCOPE octal drivers from *Texas Instruments*. TI also has a new three-volume set on *Digital Signal Processing Using the TMS320* available.

Turning to my own stuff, for the fundamentals of digital integrated circuits, check into my classic CMOS and TTL Cookbooks. I do have autographed copies on hand for you here at *Synergetics*.

Also, a reminder that I have this new PostScript PSRT roundtable and library up on *GENIE*. You'll also find lots of *Hardware Hacker* and all the *Midnight Engineering* reprints and other resources here.

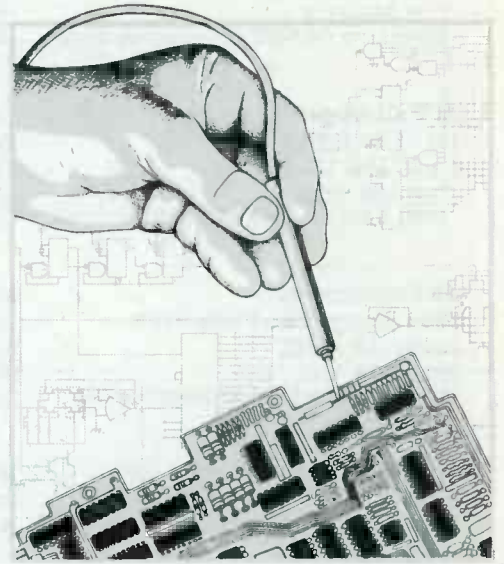
Finally, I do have a new and free mailer for you which includes dozens of insider hardware hacking secret resources. Write or call for info.

As always, this is your column and you can get technical help and off-the-wall networking per that *Need Help?* box. The best calling times are weekdays 8-5 in *Mountain Standard Time*. Let's hear from you.

R-E

SELECT 5 BOOKS for only \$4⁹⁵

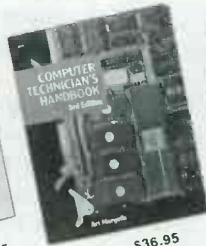
(values to \$129.70)
and get a FREE Gift!



2707 \$26.95
Counts as 2



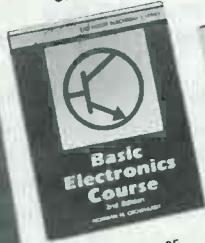
2883P \$17.95



3279 \$36.95
Counts as 2



3360 \$29.95
Counts as 2



2613P \$17.95



3307 \$26.95
Counts as 2



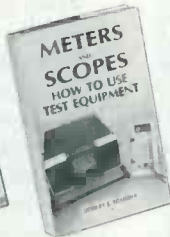
2980P \$19.95



1625P \$22.95



3358 \$28.95
Counts as 2



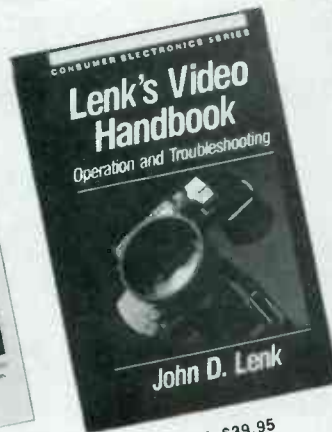
2826P \$16.95



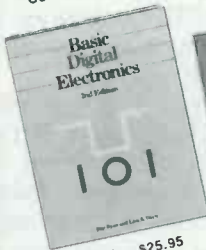
3455 \$25.95
Counts as 2



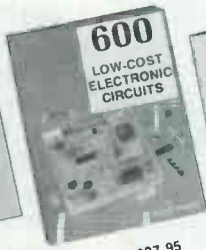
3321 \$24.95



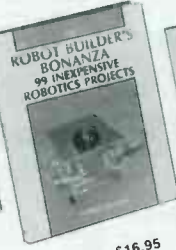
10018 \$39.95
Counts as 2



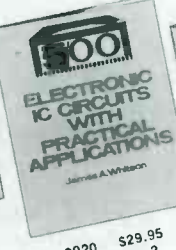
3370 \$25.95
Counts as 2



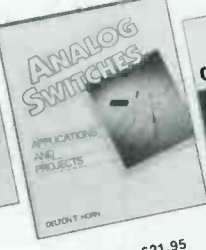
3219 \$27.95
Counts as 2



2800P \$16.95



2920 \$29.95
Counts as 2



3445 \$21.95



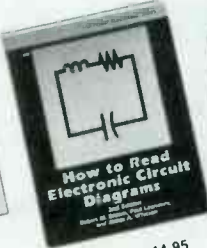
3337 \$35.95
Counts as 2



1599P \$17.95



3355 \$26.95
Counts as 2



2880P \$14.95



3165 \$17.95



3270 \$32.95
Counts as 2



1897P \$14.95

For over 25 years, your most complete source for electronics books.

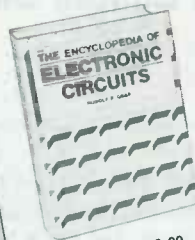
An Absolutely No-Risk Guarantee.



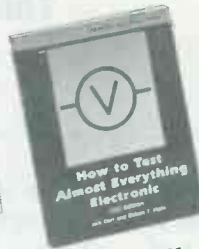
3329 \$29.95
Counts as 2



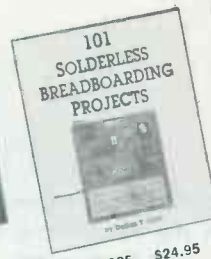
2867P \$18.95



1938 \$60.00
Counts as 3



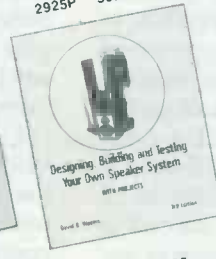
2925P \$9.95



2985 \$24.95



3275 \$22.95



3374 \$24.95



2926 \$25.95



3241P \$16.95



3031P \$17.95



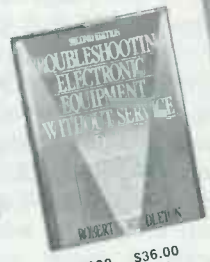
2996P \$13.95



3260 \$22.95



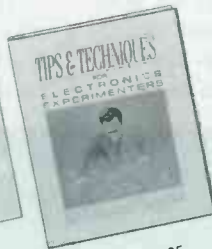
2898P \$15.95



9290 \$36.00
Counts as 2



3258 \$27.95
Counts as 2



3145 \$19.95

FREE when you join!

15 Easy Electronic Projects From Delton T. Horn

Projects you can build—some unique, some old favorites—from the author's vast treasury of electronics know-how.

\$7.95 Value!

Delton T. Horn's All-Time Favorite Electronic Projects



ELECTRONICS BOOK CLUBSM

Blue Ridge Summit, PA 17294-0810

YES! Please accept my membership in the Electronics Book Club and send the 5 volumes listed below, plus my FREE copy of Delton T. Horn's All-Time Favorite Electronic Projects (3105P), billing me \$4.95. If not satisfied, I may return the books within ten days without obligation and have my membership cancelled. I agree to purchase at least 3 books at regular Club prices during the next 12 months and may resign any time thereafter. A shipping/handling charge and sales tax will be added to all orders.

--	--	--	--

Name _____

Address _____

City _____

State _____ Zip _____ Phone _____

Signature _____

Valid for new members only. Foreign applicants will receive special ordering instructions. Canada must remit in U.S. currency. This order subject to acceptance by the Electronics Book Club.

RE191

Membership Benefits • Big Savings. In addition to this introductory offer, you keep saving substantially with members' prices of up to 50% off the publishers' prices. • **Bonus Books.** Starting immediately, you will be eligible for our Bonus Book Plan, with savings of up to 80% off publishers' prices. • **Club News Bulletins.** 15 times per year you will receive the Book Club News, describing all the current selections—mains, alternates, extras—plus bonus offers and special sales, with scores of titles to choose from. • **Automatic Order.** If you want the Main Selection, do nothing and it will be sent to you automatically. If you prefer another selection, or no book at all, simply indicate your choice on the reply form provided. You will have at least 10 days to decide. As a member, you agree to purchase at least 3 books within the next 12 months and may resign at any time thereafter. • **Ironclad No-Risk Guarantee.** If not satisfied with your books, return them within 10 days without obligation! • **Exceptional Quality.** All books are quality publishers' editions especially selected by our Editorial Board. (Publishers' Prices Shown)

All books are hardcover unless number is followed by a "P" for paperback.

©1991 ELECTRONICS BOOK CLUB, Blue Ridge Summit, PA 17294-0810

**Or Call Toll-Free
1-800-233-1128 To Join Today!**

The Boston Sound

LARRY KLEIN

Followers of this column may remember my recounting of a mid-70's visit from a group of touring Japanese audio journalists. In our conversations, they seemed strangely interested in the relative popularities among U.S. audiophiles of speakers with "East Coast Sound" vs. "West Coast Sound." Years later I learned that almost all Japanese audio journalists are on the payroll (as consultants) of one or another of the major Japanese audio companies. At that point I realized that their questions were probably not simply prompted by editorial curiosity, but rather were part of a commercial fact-finding expedition. In any case, Altec and JBL speakers with their boosted mid-bass and strong upper-midrange were highly respected in Japan, and many Japanese products resembled them sonically and—in some cases—physically.

Meanwhile, back in the U.S.A., a small core group of New England-based academics and amateur and professional engineers were busily producing "bookshelf" speaker systems that, in contrast with those from the major West Coast manufacturers, had a smooth, flat, wide-range frequency response and exceptionally low bass distortion.

I think it's safe to say that "East Coast Sound" began with the work of Edgar Villchur, the developer of the acoustic-suspension speaker system. (I say developer, rather than inventor, in the same sense that Edison developed rather than invented the light bulb. In both cases, the idea was not new—but applied talent and knowhow made it work.)

The Source of the sound

In the mid-1950's, Villchur founded Acoustic Research in Cambridge to manufacture and market his acoustic-suspension designs. In the next five years, AR managed to take over at least a third of the speaker-system

market with their various models—a feat that has not been equalled before or since. From this point on the story begins to resemble the Biblical "begats" with regard to who worked with what company and then went on to found their own.

Early on, Henry Kloss, who co-founded AR along with Villchur, left to become the "K" in KLH. Kloss manufactured acoustic-suspension speakers under license from AR, but differed somewhat with Villchur on the question of system frequency balance. Roy Allison, now of Allison Acoustics, became plant manager for Acoustic Research, and Andy Petite, presently president of Boston Acoustics, went to work for KLH. Petite subsequently left KLH to join Kloss in the newly formed Advent Corporation, where he ultimately became the chief designer of a series of successful Advent speaker systems. Advent ran into difficulties in the late Seventies, and Petite left to co-found

Boston Acoustics, now one of the leading U.S. speaker companies. (Their products consistently get top ratings from Consumers Reports.)

A visit to Boston Acoustics

Last Fall, while in Boston, I called to say hello to my old friend Andy Petite. Andy invited me to visit the new Boston Acoustics speaker-manufacturing facility located in an industrial park about 20 minutes outside of Boston, and I jumped at the chance. Five years ago, during a previous visit to BA, I was struck by the extensive use of alignment jigs and other specialized tools. These allowed the production-line workers to apply the cements in carefully measured quantities to assemble the tight-tolerance voice-coil and cone assemblies to the basket and magnetic structure.

The first things that impressed me about the new plant were its size, and the high degree of automation on the driver assembly line. Most of the crit-

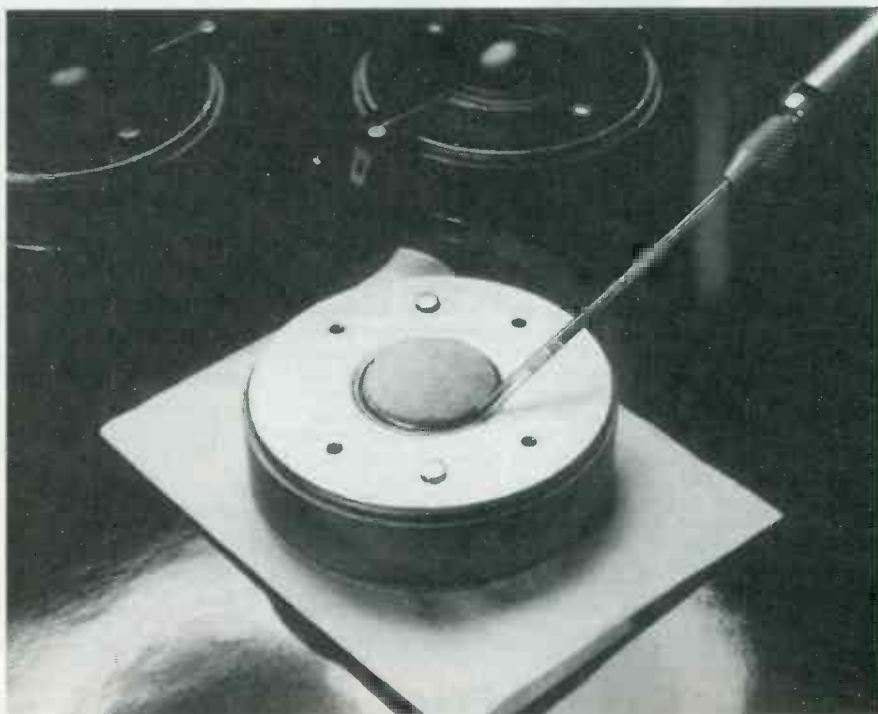


FIG. 1—IN ONE OF BOSTON ACOUSTICS' manufacturing procedures, a precise amount of ferrofluid is added to each tweeter magnet assembly.

ical assembly processes, formerly done by hand, were being performed by sophisticated specialized machines that were not only faster, but provided greater consistency in the finished product. That was reflected both in a lower reject rate and tighter performance specs.

Andy told me an interesting story in that connection. When they first started to produce woofers on the new line, the first batch had to be rejected for excessive efficiency. It seems that new automatic mechanisms were injecting precisely the amount of cement needed, which was less than what was applied with hand construction. The lowered mass produced a woofer that was more efficient than the crossover and enclosure had been designed for. Anyone who still believes that electronic equipment wired and assembled by hand is necessarily better made or more reliable than components made on an automatic line, simply doesn't appreciate the benefits of modern manufacturing technology.

Speaker facts

I've always felt that, at best, I was a "second-hand" hi-fi expert in that most of what I knew I had learned from those who were the real experts—those who were up to their elbows in the day-to-day design and manufacturing process. The engineers who most impressed me were those whose products were a cut above the average both in performance and cost effectiveness. For that reason, I've especially valued my relationships with people like Andy Petite who are willing to share information and opinions based on real-world experiences.

For most of the day, Andy and I talked about loudspeaker design and manufacturing. Below, extracted and paraphrased, are some of Andy's more interesting facts and opinions about loudspeakers in general, and Boston Acoustics loudspeakers, in particular:

- It's a lot more difficult to design a good \$200 speaker than a \$2,000 one. Any designer who knows his business should be able to put together a relatively good-sounding expensive system. One of my goals as a designer is to get the best possible sound at each price level using the

most cost-effective approach. This frequently involves rethinking both the design and manufacturing and production process.

- We've found that it's important to make our own drivers for three reasons: quality, reliability, and price. When we were buying tweeters from outside vendors we always had to contend with inconsistencies in performance. Rejects had to be shipped back—an expensive and time-consuming task. And failures in the customer's home, due to manufacturing flaws, were even more problematic. We knew what the problems were, but our suppliers weren't willing or able to solve them.

For example, we could improve reliability using high-temperature voice coils. However, our supplier wasn't willing to use the new voice coils because his manufacturing procedure involved burning off the voice-coil lead insulation in a solder bath. High-temp insulation won't burn off—which would mean that his manufacturing procedure would have to be redesigned.

When you manufacture your own drivers and rejects occur, you can determine the source of the problem and, frequently, stop the assembly line and fix it then and there. Reject problems can be solved in hours, rather than weeks.

- We've found it worthwhile to individually test the performance of every driver after it comes off the line before it is installed in a system. This is feasible, because we have designed a separate computer test program for each driver and system we produce. Every test station has a carefully calibrated miniature anechoic chamber with a test microphone installed. The computer provides a test signal to the driver, instantly displays the curve and other data, and then assigns a pass/fail rating. Each driver must match the reference standard within ± 1 dB. The complete test is done in less time than it takes to describe it. Of course, every completed system undergoes equivalent testing.

We've run out of space for this month; in my next column I'll continue my conversation with Andy Petite discussing crossover design, the virtues of acoustic-suspension woofers, and other practical loudspeaker manufacturing and design matters. **R-E**

SUPER LONG PLAY TAPE RECORDERS

12 Hour Model —
USES 120 TAPE
\$119.00*

Modified Panasonic Slimline, high quality AC-DC provide 6 continuous hours of quality recording & playback on each side of cassette for 12 hours total. Includes • Voice level control • Digital counter, etc. TDK — 120 Cassette Furnished.



PHONE RECORDING ADAPTER

Records calls automatically. All Solid state connects to your telephone jack and tape recorder. Starts recording when phone is lifted. Stops when you hang up. **\$28.50***



VOX VOICE ACTIVATED CONTROL SWITCH

Solid state. Self contained. Adjustable sensitivity. Voices or other sounds automatically activate and control recorder. Uses either recorder or remote mike. **\$28.50***



*Add for ship & hdg. Phone Adapter & Vox \$1.50 ea. Recorders \$4.00 ea. Cal. Res. add tax. Mail order, VISA, M/C, COD's OK. Money Back Guarantee. Qty. disc. avail., Dealer inquiries invited, Free data.

AMC SALES INC. Dept. A 9335 Lubec St.
Box 928, Downey, CA. 90241
Phone (213) 869-8519
FAX (213) 923-1478

CIRCLE 108 ON FREE INFORMATION CARD

WE STOCK

America

with over 24,000 industrial electronic components and will

ship your order today !!

Call or Write

(800) 992-9943

2401 Hwy 287 N.
Mansfield, TX 76063

for your
FREE

CATALOG

Subscription



MOUSER ELECTRONICS

Stocking Locations Across America

CIRCLE 117 ON FREE INFORMATION CARD

ATTENTION! ELECTRONICS TECHNICIANS

EARN YOUR
**B.S.E.E.
DEGREE**

THROUGH HOME STUDY

Our New and Highly Effective Advanced-Placement Program for experienced Electronic Technicians grants credit for previous Schooling and Professional Experience, and can greatly reduce the time required to complete Program and reach graduation. No residence schooling required for qualified Electronic Technicians. Through this Special Program you can pull all of the loose ends of your electronics background together and earn your B.S.E.E. Degree. Upgrade your status and pay to the Engineering Level. Advance Rapidly! Many finish in 12 months or less. Students and graduates in all 50 States and throughout the World. Established Over 40 Years! Write for free Descriptive Literature.

**COOK'S INSTITUTE
OF ELECTRONICS ENGINEERING**



4251 CYPRESS DRIVE
JACKSON, MISSISSIPPI 39212

CIRCLE 58 ON FREE INFORMATION CARD

EQUIPMENT REPORT

continued from page 12

DC resistance.

When you have your circuit built, you can turn on the power and get out the test equipment to see how it works. The *Protolab* is equipped with a voltmeter, ammeter, ohmmeter, wattmeter, dual-trace oscilloscope, and sweep generator.

Since the *Protolab* is primarily a teaching tool, the manual is one of its most important components. Sixteen experiments guide the user through important AC/DC circuit-analysis concepts, and each experiment offers an "Observation and Implications" section that emphasizes the lessons that should be noted, along with the pages in popular textbooks where additional information can be found.

We wish we'd had the *Protolab* back in our college days. It would have made some of the important concepts easier to get a handle on thanks to the instant gratification it offers. *Protolab* does, of course, have

some limitations, such as the inability to show parts values on the schematic, and the inability to support Hercules graphics. However, at \$99.95 for the PC version and \$129.95 for the Mac version—about the price of two or three college texts—it's certainly a good investment. We hope to see future versions that support active components and other more advanced topics. **R-E**



When we think of trees, we usually think of what we can see and hear. They shade and cool our homes, bring song birds close by, and mark the changing seasons.

But trees also clean the air we breathe and help keep the atmosphere in balance, which makes life possible.

You can make life better for your children and for the future. Join me and plant a tree today for all the world to share.

For your free brochure, write: Trees for America, The National Arbor Day Foundation, Nebraska City, NE 68410.

"Plant a tree
today for
all the world
to share"



John Denver for



**The National
Arbor Day Foundation**

BATTERY TECHNOLOGY

continued from page 49

age current. In other words, the battery is not completely disconnected from the load circuit even when the power is turned off. Over a period of time, ranging from one week to two months, leading to minor battery leakage. Even if designed to prevent such an occurrence, a minor short may occur, insufficient to affect performance even when turned on, but resulting in what's known as "creep" leakage.

In the above cases, "creep" usually manifests itself as white fuzz around the top seal of a cell. To avoid it, turn power switches off when equipment isn't in use. In radios unused for extended periods, remove the batteries, and replace them when needed. Even if creep does occur, a Ni-Cd cell can be recharged, with proper care.

• **Ni-Cd cells have been around a long time, and yet the application of that technology is growing and changing. What technology improvements, if any, have occurred that we should be aware of, and is there anything better available on the horizon?**

Ni-Cd manufacturers are continuously seeking to improve product capabilities and quality.

Increased capacity means longer run times; for many years, makers have boosted capacity by over 10% a year, itself driving research into new electrochemical couples. Rechargeable lithium and Ni-metal hydride cells are prominent contenders, with significant increases in energy density over Ni-Cd cells, but their availability is still limited.

Safety continues to impede broad acceptance of lithium cells. Metal-hydride is progressing steadily, and is also equivalent in voltage to that of Ni-Cd cells. Broad acceptance of metal-hydride depends on its ability to be successfully used in several environments. Ni-Cd cells offer such flexibility today, at reasonable prices. Also, the prices of newer technologies will further impede broad acceptance. In our next article, we'll spotlight some recent ingenious and innovative applications of batteries. R-E

Try the

Radio Electronics®

bulletin board system

(RE-BBS)
516-293-2283

The more you use it the more useful it becomes.

We support 300 and 1200 baud operation.

Parameters: 8N1 (8 data bits, no parity, 1 stop bit) or 7E1 (7 data bits, even parity, 1 stop bit).

Add yourself to our user files to increase your access.

Communicate with other R-E readers.

Leave your comments on R-E with the SYSOP.

RE-BBS
516-293-2283

LEARN VCR CLEANING/MAINTENANCE/REPAIR

EARN UP TO \$1000 A WEEK, WORKING
PART TIME FROM YOUR OWN HOME!



Secrets
Revealed!

NO Special
Tools or
Equipment
Needed.

EARN UP TO \$60
AN HOUR AND
MORE!

THE MONEY MAKING OPPORTUNITY OF THE 1990'S

IF you are able to work with common small hand tools, and are familiar with basic electronics (i.e. able to use voltmeter, understand DC electronics) . . .

IF you possess average mechanical ability, and have a VCR on which to practice and learn . . . then we can teach YOU VCR maintenance and repair!

FACT: up to 90% of ALL VCR malfunctions are due to simple MECHANICAL or ELECTRO-MECHANICAL breakdowns!

FACT: over 77 million VCRs in use today nationwide! Average VCR needs service or repair every 12 to 18 months!

Viejo's 400 PAGE TRAINING MANUAL (over 500 photos and illustrations) and AWARD-WINNING VIDEO TRAINING TAPE reveals the SECRETS of VCR maintenance and repair—"real world" information that is NOT available elsewhere!

Also includes all the info you'll need regarding the BUSINESS-SIDE of running a successful service operation!

FREE INFORMATION
CALL TOLL-FREE 1-800-537-0589

Or write to: Viejo Publications Inc.
5329 Fountain Ave.
Los Angeles, CA 90029 Dept. RE

CIRCLE 177 ON FREE INFORMATION CARD



CHEMICAL SOLUTIONS

FREE CHEMTRONICS CATALOG!

Comprehensive new source for over 200 products used in electronic manufacturing and field service. E-Series products are CO₂ propelled for ozone safety. Precision cleaning agents, flux removers, bulk solvents, circuit refrigerants, precision dusters, non-residual wipers, premoistened pads/swabs, antistatic compounds, conformal coatings, lubricants, adhesives, desoldering braids and soldering products. Complete with technical specifications and application guide.



Chemtronics Inc.
8125 Cobb Centre Drive
Kennesaw, GA 30144
1-800-645-5244
in GA 404-424-4888

CIRCLE 54 ON FREE INFORMATION CARD

Get A Complete Course In

ELECTRONIC ENGINEERING

8 volumes, over 2000 pages, including all necessary math and physics. 29 examinations to help you gauge your personal progress. A truly great learning experience.

Prepare now to take advantage of the growing demand for people able to work at the engineering level.

Ask for our brochure giving complete details of content. Use your free information card number, or write us directly. \$99.95, Postage Included. Satisfaction guaranteed or money refunded.



Banner
Technical
Books, Inc.

1203 Grant Ave.
Rockford, IL 61103

CIRCLE 67 ON FREE INFORMATION CARD

COMPUTER CONNECTIONS

Some predictions for the PC's to come during the next decade.

JEFF HOLTZMAN

This marks the first issue of 1991, so I thought I would take a look at where things in the PC industry are going. Much of the PC future revolves around a single product. Even though that product has been on the market for only a few months so far, it's fair to say that already it has permanently altered the course of the PC industry. You've probably guessed that that product is Windows 3.0.

Windows' success apparently exceeds even the most optimistic sales projections, and it has forced a complete redefinition of the relationship between IBM and Microsoft, along with a redefinition of the boundaries between OS/2 and Windows. For example, Microsoft has indicated that OS/2 2.0 will include a compatibility layer that will allow Windows applications to run with a slight performance penalty, and that OS/2 3.0 will run Windows applications directly, without a loss in performance. (Microsoft has already privately shown Windows programs running under the as-yet unreleased OS/2 2.0, the long-awaited 386-specific version.) In addition, it now seems that some of OS/2's most advanced features will migrate down (over?) to the Windows environment. So in a sense it seems that the two products are in the process of merging.

However, after months of rumors about troubles between IBM and Microsoft, the two companies recently announced that the two product lines will be developed separately. IBM will develop for OS/2 and Microsoft for Windows (and DOS). The two companies will cross-license each other's products, and Microsoft will also take responsibility for developing a "portable" OS/2, that presumably will run on non-80xxx family CPU's, including perhaps the 68K family used in the Macintosh line and many workstations, or some RISC family. If the latter occurs, a prime candidate would

be IBM's RS6000 workstations, which were released last year, and which finally brought IBM some much-needed credibility in that market.

Although the companies' respective roles have crystallized, product differences still remain murky; most likely the product for which the best software is written first will win out in the end. And considering the difficulty of developing for both environments, Windows' head start may give it a clear long-term advantage. In the meantime, what about Windows 3.0 as it currently exists?

Beauty and brains

Some would call Windows 3.0 the most-hyped PC product to hit the market in years. Others, while acknowledging the hype, insist that there really are some brains behind the pretty face. I've been using Windows for several months now in a variety of modes, with a variety of display adapters, CPU types, and

memory capacities, and with a variety of software, including regular DOS applications, the built-in Windows apps, and numerous large and small Windows apps. My overall conclusion? The hype is real, but the product is substantial. Windows is imperfect, but with the right hardware, it is both powerful and pleasurable to use.

Should you switch to Windows? No, if you don't have at least a 10-MHz 286. No, if you find learning new software (which really amounts to learning a new metaphor of the world) a pain in the you-know-what. No, if you still insist that your CP/M machine with 160K floppies does everything you need it to. (Yes, there really are people who still believe that.) No, if you're not willing to put up with some bugs. No, if you enjoy the idea of dropping anchor and watching the rest of the world sail on by.

But if you've got a sense of adventure, or if you would simply like to try a new way of doing things, or if you

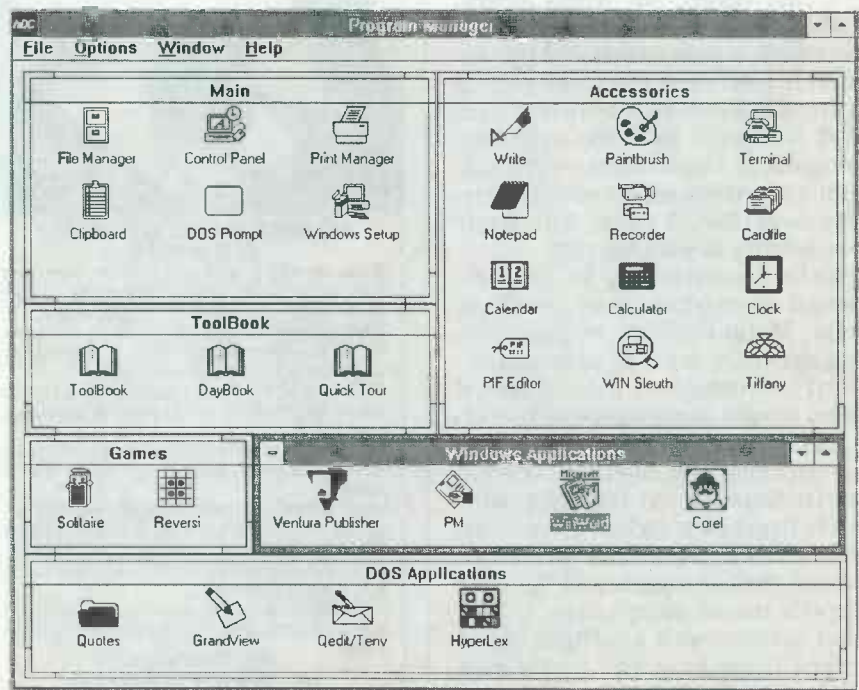


FIG. 1—AN EXAMPLE OF WINDOWS' ICONS.

R-E Computer Admart

Rates: Ads are 2 1/4" x 2 7/8". One insertion \$995 each. Six insertions \$950 each. Twelve insertions \$925 each. Closing date same as regular rate card. Send order with remittance to Computer Admart, Radio-Electronics Magazine, 500-B Bi-County Blvd., Farmingdale, NY 11735. Direct telephone inquiries to Arline Fishman, area code-1-516-293-3000. FAX 1-516-293-3115. Only 100% Computer ads are accepted for this Admart.

GETTING THE MOST FROM YOUR PRINTER

Getting The Most From Your Printer



BP181—It is probable that 80% of dot-matrix printer users only ever use 20% of the features offered by their printers. This book will help you unlock the special features and capabilities that you probably don't even know exist. To order your copy send **\$6.95 plus \$1.50 for shipping** in the U.S. to **Electronic Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240.**

PT68K4 68000-16MHZ

EGA/VGA

HIGH DENSITY DRIVES

- 4 MB of onboard DRAM
- 4 RS232 + 2 Parallel Ports
- Floppy Disk Controller
- 7 XT Expansion Slots

12 MHZ Kits from \$220

Assembled Boards from \$579

Professional OS9/68000 \$299

Peripheral Technology

1480 Terrell Mill Rd. Suite 870

Marietta, GA 30067

404/984-0742

CIRCLE 189 ON FREE INFORMATION CARD

PROMPT DELIVERY!!!
SAME DAY SHIPPING (USUALLY)
QUANTITY ONE PRICES SHOWN for OCT. 28, 1990

OUTSIDE OKLAHOMA: NO SALES TAX

DYNAMIC RAM		
4M Board for hp LJ's w/2MB		\$170.00
SIMM 2M IBM PS-2 Model 70		175.00
SIMM 1M AST Prem386/33Mhz		125.00
SIMM 1Mx9	80 ns	53.00
SIMM 256Kx9	100 ns	20.00
1Mbit	1Mx1 60 ns	10.95
1Mbit	1Mx1 80 ns	5.95
41256	256Kx1 80 ns	2.85
41256	256Kx1 100 ns	2.05
41256	256Kx1 120 ns	1.85
4464	64Kx4 100 ns	2.00
41264*	64Kx4 100 ns	5.95
EPROM		
27C1000	128Kx8 200 ns	\$15.00
27C512	64Kx8 120 ns	5.25
27256	32Kx8 150 ns	6.75
27128	16Kx8 250 ns	3.75
STATIC RAM		
62256P-10	32Kx8 100 ns	\$6.50
6264P-12	8Kx8 120 ns	4.25

OPEN 6 DAYS, 7:30 AM-10 PM; SHIP VIA FED-EX ON SAT.

SAT DEL ON FED-EX ORDERS RECEIVED BY: 24 000 S. Phoenix Ave. BEGGS OK 74421 (918) 267-4961

MasterCard VISA or UPS CASH COD

MICROPROCESSORS UNLIMITED, INC.

No minimum order. Please note prices subject to change! Shipping insurance extra, up to \$1 for packing materials.

CIRCLE 61 ON FREE INFORMATION CARD

require a new way of doing things, Windows is your ticket to the future. Just as surely as DOS replaced CP/M, a graphical environment is going to replace DOS. And although Windows is the first step into the future, it certainly won't be the last.

Even on optimal hardware, Windows has several problems, including its user interface, its lack of serious multitasking, and font management. The user interface problem is that Windows does nothing to simplify the MS-DOS file system metaphor. Although you can associate icons with programs, you cannot associate icons with files or directories. Thus, file management under Windows requires an abstract understanding of the hierarchical file system.

On the other hand, if icons were smarter and we could associate them with other types of objects, the icons could represent real-world objects. For example, you might have a project icon that would provide a way of organizing several different sorts of files (CASE diagrams, a desktop-published business presentation, CAD schematics, etc.). To work on one item in the project, you would "open" the project icon, click on, for example, the CAD icon, and up would come your circuit diagram. You can achieve that type of effect in a limited way with Windows now (see Fig. 1), but the product really needs a com-

plete metaphor built on the way we work, not computers.

As for multitasking, Windows currently has what is called non-preemptive multitasking, which means that all programs must cooperate—i.e., give up use of the CPU periodically. In a preemptive multitasking system (UNIX or OS/2), the operating system itself periodically interrupts each task, so no task can hog resources. The effect of the latter system is much smoother coordination among programs.

A related issue is that of "threads". In a full multitasking system, a task can spawn subtasks, or threads, which perform processing independently of the main task. Threads are the only way to perform simultaneous background operations efficiently.

Who needs background operation? Maybe you don't, but your software does. Here are a few examples. A spreadsheet could recalculate while you enter data. A desktop publishing program could repaginate while you spruce up other pages. You could plot a PC board layout from your CAD program while transferring the parts data to a word processor. Your system could back itself up in the background with no intervention by you. Your system could perform automatic daily downloads of Email from your favorite on-line service, again without intervention.

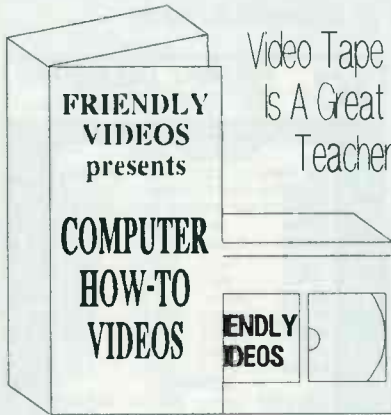
Those things may sound fanciful, but some of them are available already, albeit in limited form. By the end of the decade, we will take those types of activities for granted.

Hardware issues

Some people say that Windows will never achieve really widespread popularity because it requires a 386 to run most efficiently. I believe that the converse is true. I think that people with less-powerful machines will try Windows, like it, want better performance, and thereby be persuaded to upgrade. Again, an analogy with CP/M is appropriate. In 1981, when the PC was introduced, 64K of memory and no hard disk were standard. Five or six years later, ten times the amount of memory and 20-MB hard disks were standard. Now, 1 MB of memory and 40-MB hard disks are minimum standards; I see more and more offices with 4 MB of RAM and 100-MB hard disks.

Of course video and printer technologies have evolved drastically in that time period, as well. For example, in 1980 I bought a Qume daisy-wheel printer for about \$1000 more than what I paid for an HP LaserJet with 1.5 MB of memory, a font cartridge, and numerous soft fonts, in 1988. The trend will continue. You will be able to buy a laser printer, sooner than you think, without mortgaging

The **LOW COST, EASY** Way
To Learn About Computers



Video Tape
Is A Great
Teacher

- *HOW TO BUILD YOUR OWN IBM 286/386 CLONE*
\$39.95 + SHIPPING AND SALES TAX
- *SHAKE HANDS WITH YOUR IBM PC/XT/AT COMPUTER*
\$29.95 + SHIPPING AND SALES TAX
- *UPGRADE YOUR PC TO A 286-AT FOR UNDER \$150*
\$24.95 + SHIPPING AND SALES TAX
- *HOW LASER PRINTERS WORK*
\$39.95 + SHIPPING AND SALES TAX

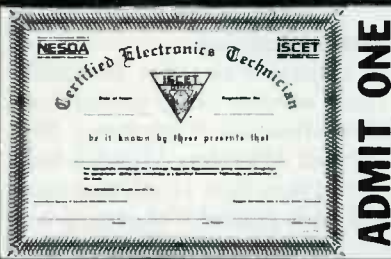
ORDER NOW!



Friendly Videos
PO Box 5684



Garden Grove, CA 92645
(714) 898-4055



Your Ticket To
SUCCESS

Over 25,000 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, MATV, Radar, Computer, and Video. For more information, contact the International Society of Certified Electronics Technicians, 2708 West Berry St., 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).

RADIO-ELECTRONICS

your grandmother.

Hardware capabilities will continue to evolve because people's needs are nowhere near being met. Presenting a respectable metaphor to the average user requires lots of CPU power, lots of video resolution, and lots of hard-disk space. I believe that by mid-decade, the average machine will be a 33-MHz 386 with 16 MB of memory, a 300-MB hard disk, video with resolution of about 1000 pixels in both directions, built-in sound/video compression and processing, modem/fax, and a 300-DPI hardcopy output device based on PostScript or some derivative thereof.

Many people will have some sort of optical storage capability. CD-ROM is a candidate, but its 550-megabyte capacity may turn out to be a limitation as the use of bit-mapped graphics, sound, and video data become more widespread. The video system will be NTSC-compatible, HDTV-compatible (if U.S. manufacturers ever get their act together), and will have a standard rasterizing mechanism, which again will probably be PostScript or a derivative. All I/O subsystems will be based on coprocessors controlled by a multitasking/multiprocessing derivative of Windows, OS/2, or both.

What will we be doing with all that hardware? Nearly everyone will be using a graphical operating environment (which will nonetheless maintain an optional command-line mode for power users). The operating system will provide a much more intuitive way of managing files. The concept of files will fade, to be replaced by compound documents that include all sorts of media. Multimedia technology will just be coming of age, now that a significant number of users have the requisite hardware.

Multimedia will be used extensively for educational purposes; computer-based training and on-line tutorials will have sound, video, and will be fully interactive so that the direction a course follows will depend on user responses. The emergence

of serious PC-based multimedia will finally spur the educational market to embrace PC technology in a big way. Looking for an opportunity? Multimedia presentations of all traditional subject matters—language, history, math, and science—are going to be hot sellers, both to schools and to forward-looking parents.

Conclusion

Ignoring Windows' influence for the moment, it's impossible not to notice the inexorable trend toward technological improvement. Disk drives are getting bigger and faster. Video systems are getting bigger and faster—and smarter. CPU's are getting bigger and faster. The improvements in hardware are not part of Microsoft's plan to insinuate Windows into every nook and cranny of the computer-literate world. Hardware improvements are happening because real-world data requires it. Real-world data includes graphics, sound, and video, not just 80 x 25 screens of text. Windows may be the environment that helps erase the distinction between the computer and what we do with it—or it may not. Regardless, Windows, or something like it, will become a standard. Hardware is getting bigger, faster, and smarter—not to make money for the hardware manufacturers but because the real world is large and complex. The personal computer can do much more now than it could ten years ago, but the next ten years will see even more fantastic growth in capability. It's also going to be a lot of fun getting there.

Next time the discussion will be more practical, with hints about how to get the most out of Windows 3.0, along with discussions of particular programs. **R-E**

ITEMS DISCUSSED

- Windows 3.0 (\$149), Microsoft Corp., 17011 NE 36th Way, Box 97017, Redmond, WA 98073-9717. (206) 882-8080.

CIRCLE 41 ON FREE INFORMATION CARD



"He said take two aspirins and bring it to his shop first thing in the morning!"

MARKET CENTER

FOR SALE

DESCRAMBLERS. All brands. Special: Combo Jerrold 400 and SB3 \$165.00. Complete cable descrambler kit \$39.00. Complete satellite descrambler kit \$45.00. Free catalog. **MJM INDUSTRY**, Box 531, Bronx, NY 10461-0208.

TUBES: "oldest," "latest." Parts, schematics. SASE for lists. **STEINMETZ**, 7519 Maplewood Ave., RE Hammond, IN 46324.

ENGINEERING software, PC/MSDOS. Hobbyists — students — engineers. Circuit design and drawing, PCB layout, Logic simulation, FFT analysis, Mathematics, Circuit analysis. Call or write for free catalog. 1 (800) 728-3805, **BSOFT SOFTWARE**, 444 Colton Rd., Columbus, OH 43207.

RESTRICTED technical information: Electronic surveillance, schematics, locksmithing, covert sciences, hacking, etc. **Huge selection. Free brochures.** **MENTOR-Z**, Drawer 1549, Asbury Park, NJ 07712.

CABLE TV DESCRAMBLERS! BARGAIN HEADQUARTERS!



•JERROLD™ •TOCOM •HAMLIN
•OAK •ZENITH
•SCIENTIFIC ATLANTA

PHOTOFACT folders under #1400 \$4.00. Others \$6.00. Postpaid. **LOEB**, 414 Chestnut Lane, East Meadow, NY 11554.

TOCOM VIP converters w/remote from \$279.00. Tocom super chips turn on everything, \$69.00 each. Phone (219) 935-4128.

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:

Radio-Electronics Classified Ads, 500-B Bi-County Boulevard, Farmingdale, NY 11735

PLEASE INDICATE in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of \$25.00.

() Plans/Kits () Business Opportunities () For Sale
() Education/Instruction () Wanted () Satellite Television
() _____

Special Category: \$25.00

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 (\$46.50)
16 (\$49.60)	17 (\$52.70)	18 (\$55.80)	19 (\$58.90)	20 (\$62.00)
21 (\$65.10)	22 (\$68.20)	23 (\$71.30)	24 (\$74.40)	25 (\$77.50)
26 (\$80.60)	27 (\$83.70)	28 (\$86.80)	29 (\$89.90)	30 (\$93.00)
31 (\$96.10)	32 (\$99.20)	33 (\$102.30)	34 (\$105.40)	35 (\$108.50)

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

Business Print Name

Signature

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) \$4.70 per word prepaid (no charge for zip code)...**MINIMUM 15 WORDS.** 5% discount for same ad in 6 issues; 10% discount for same ad in 12 issues within one year; if prepaid. **NON-COMMERCIAL RATE:** (for individuals who want to buy or sell a personal item) \$2.50 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) 55¢ per word additional. Entire ad in boldface, \$3.70 per word. **TINT SCREEN BEHIND ENTIRE AD: \$3.85 per line.** **TINT SCREEN BEHIND ENTIRE AD PLUS ALL BOLD FACE AD: \$4.50 per word.** **EXPANDED ENTIRE AD: \$4.70 per word prepaid.** Entire ad in boldface, \$5.60 per word. **TINT SCREEN BEHIND ENTIRE AD AND NAME TYPE AD: \$5.90 per word.** **TINT SCREEN BEHIND ENTIRE EXPANDED TYPE AD PLUS ALL BOLD FACE AD: \$6.80 per word.** **DISPLAY ADS:** 1" x 2 1/4"—\$410.00; 2" x 2 1/4"—\$820.00; 3" x 2 1/4"—\$1230.00. **General Information:** Frequency rates and prepayment discounts are available. **ALL ADS 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 10th of the third month preceding the date of the issue (i.e., Aug. issue copy must be received by May 10th). When normal closing date falls on Saturday, Sunday or Holiday, issue closes on preceding working day. Send for the classified brochure. Circle Number on the Free Information Card.

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 31500RE, PHOENIX, AZ 85046

FM 2-way, CB/amateur, scanners, radar detectors, auto alarms, catalog \$1.00, RAYS, PO Box 14862, Fort Worth, TX 76117.

CABLE converters, all major brands. Info + orders 1 (800) 782-0552. **FREEWAY, INC.**, SMP PO # 5036, Burnsville, MN 55337.

CALLER ID displays phone number of person calling you after first ring. \$89.95 PPD, **EDE**, PO Box 337, Buffalo, NY 14226.

BLACK market, hacking, phreaking, weapons, electronic surveillance, communications, more. Hardware, software, plans, kits, books. \$1.00 catalog: **OMEGATECH**, PO Box 8789C, Woodlands, TX 77387.

RADIO tubes, parts. Extensive listings. \$1.00 (refundable). **DIERS**, 4276-E6 North 50th Street, Milwaukee, WI 53216-1313.

FREE catalog: Save hundreds on sought after electronic, electro mechanical, and computer related hardware and components — including hard-to-find items. Call toll free: 1 (800) 776-3700. **AMERICAN DESIGN COMPONENTS/Dept.** 119-011, 815 Fairview Avenue, Fairview, NJ 07022.

CABLE DESCRAMBLERS, wholesale prices, Tocoms, Oaks, Jerrolds, Hamlins, S.A., Tri-Bis, examples — Oak RTC-56 \$150.00, Tocom 5503-A \$250.00, COD orders OK, **MOUNT HOOD ELECTRONICS** (503) 253-0459.

T.V. notch filters, surveillance equipment, brochure \$1.00. **D.K. VIDEO**, Box 63/6025, Margate, FL 33063. (305) 752-9202.

CABLE descramblers (Jerrold) from \$40.00. Tocom VIP test chip. Fully activates unit. Also Zenith test board. Fully activates Z-Tacs. \$50.00. Call (213) 867-0081.

PROTOQUICK Z8, single board computer with prototype area, \$69.00. **SOFTWARE SCIENCE**, 3750 Roundbottom Road, Cincinnati, OH 45244. (513) 561-2060.

GREAT buys, surplus prices, DC motors, PS-13VDC-20A, light chasers, fiber optics, transformers, scope probes, vacuum pumps, LSASE, **FERTIK'S**, 5400 Ella, Phila., PA 19120.

LOST control of your home entertainment center? Send for a free brochure of innovative, remote controlled switching products to: **INFRACON**, Dept. RE, Box 1205, Richardson, TX 75085-1205. (214) 437-3366.



Quality Microwave TV Antennas

WIRELESS CABLE - IFTS - MMDS - Amateur TV
Ultra High Gain 50db(+) • Tuneable 1.9 to 2.7 Ghz.

- 36-Channel System Complete \$149.95
- 12-Channel System Complete \$114.95
- 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 • COD's • Quantity Pricing

KITS, MC68701 programmer \$135.00, Morse code keyboard \$75.00, ten meter FM conversion \$25.00. **SINGLE CHIP SOLUTIONS**, Box 680, New Hartford, CT 06057-0680.

SURVEILLANCE Countersurveillance electronic equipment catalog, transmitters, radar jamming, books, \$10.00, **EDE**, PO Box 337, Buffalo, NY 14226.

HELP! If you buy cable units, interference filters, computer equipment, electronic components, integrated circuits, capacitors, resistors, power supplies. Stop! Call our toll-free number 1 (800) 762-9730 for free catalog.

AC/DC VOLTAGE **PRO 400**
AC/DC CURRENT
DIODE TEST Stock No. \$69.95
LOGIC TEST 990092
LED TEST GOOD/BAD
5 FREQ RANGES
5 CAPACITANCE RANGES
LOW BATTERY Warning
CONTINUITY TEST/BEZEL
TRANSISTOR CHECKER
20 MHZ FREQ COUNTER VISA
KELVIN Electronics M/C
7 Fairchild Ave., Plainview, NY 11803
(516) 349-7620 1(800) 645-9212
FAX (516) 349-7830

DESCRAMBLERS, Tocoms — Tocoms — and more Tocoms Oak RTC-56 \$150.00, Jerrold 400 \$125.00, Hamlin 6600-3M \$125.00, super Tri-Bi \$79.00, SA-3-B \$79.00, Same low prices on all lines of equipment. COD orders OK. S.A.C. Orders only 1-800 622-3799. Info (647) 647-3799.

ARTWORK created for use in printed circuit board production from your engineering schematics. Professional quality hardcopy, Gerberfile, or Photoplotter outputs. Reasonable rates. Send for details to: **JTD ENGINEERING**, 10628 Grandview Place, Alta Loma, CA 91701.

CABLE TV brokers and distributors high volume of descramblers Jerrold SB-3 refurbished or as is, converters Jerrold models DRX-400, JRX and hand remote control (no Canada sales for descramblers). Affitech, ask **DANIEL PERREAULT** (514) 656-9150.

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

IF you want some of the prices on converters, descramblers, remotes, call **B&S SALES** (313) 365-0908. Example — Jerrold DRX-3-DIC SB built in, for one — \$110.00 delivered. Quantity prices available.

SERVICERS: Save time & money! The DTS125 automatically tracks service time & charges for your repair jobs. Call or write for brochure. **JOHNSON ELECTRONIC TECHNOLOGIES**, 5 Kane Industrial Drive, Hudson, MA 01749. (508) 562-1157.

WIRELESS CABLE RECEIVERS 1.9 TO 2.7 GHz

30 CH PARABOLIC DISH SYSTEM \$173.90
30 CH ROD ANTENNA SYSTEM \$193.90
30 CH CRYSTAL CONTROLLED SYSTEM \$294.95
SUN MICROWAVE INT'L. INC. SEND \$1.00 FOR P.D. BOX #34522 CATALOG ON THESE PHOENIX, AZ, 85067 AND OTHER FINE (602) 230-0540 VIDEO PRODUCTS QUANTITY DISCOUNTS
VISA/MC/AMEX MEMBER OF THE BETTER BUSINESS BUREAU

COMMUNICATIONS SECURITY ASSOCIATION — Electronic surveillance, countersurveillance, communications security topics — membership information — POB 7069, Gaithersburg, MD 20898. (301) 309-3731.

NEW devices: proximity switch, static snooper, personal defender, laser supplies, bug snooper, PC interfaces and more. Catalogue \$2.00. **BAUER**, 35 Soucy, Delson, Quebec, J0L 1G0.

FREE catalogue. Computers. Electronic parts and kits. Filters, amplifiers, power supplies. Radio Shack Dealer. **MCDOWELL ELECTRONICS**, Box 1206, Brewton, AL 36427. (205) 867-8805.

STUN GUNS — 65KV \$35.00 120KV \$55.00. Free catalog. **MOEBIUS UNLIMITED**, POB 2562, Lilburn, GA 30226.

DESCRAMBLERS — Cable TV converters — lowest prices, best quality, guaranteed, **CNC CONCEPTS INC.**, Box 34503, Minneapolis, MN 55434. 1 (800) 535-1843.

TUBES Sylvania 6LQ6, 6L6GC, 20LF6 etc. Huge discounts. **ARLEN SUPPLY**, 7409 West Chester Pike, Upper Darby, PA 19082. 1 (800) 458-1301.

CABLE TV

TB-3 (Tri-Bi) or SA-3

Quantity Prices

10

20

\$48.

Each

\$43.

Each

50

100

\$39.

Each

\$35.

Each

Hours open 10:00 am to 4:00 pm Eastern time
Minimum order 5 units 55.00 ea.
Dealers wanted. We ship COD.

King Wholesale
1-800-729-0036
Fax number 6173400053

"No one beats the King's prices!"

DESCRAMBLERS

Try the

Radio Electronics

bulletin board system

(RE-BBS)
516-293-2283

The more you use it the more useful it becomes.

We support 300 and 1200 baud operation.

Parameters: 8N1 (8 data bits, no parity, 1 stop bit) or 7E1 (7 data bits, even parity, 1 stop bit).

Add yourself to our user files to increase your access.

Communicate with other R-E readers.

Leave your comments on R-E with the SYSOP.

RE-BBS
516-293-2283

JERROLD 450 turn-on boards, plug-in, no modifications. \$40.00 for kit, \$50.00 assembled, quantity discounts available. Send check or money order to **DIVERSIFIED WHOLESALE**, 7014 E. Golflinks, Suite 141, Tucson, AZ 85730.

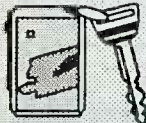
PLANS AND KITS

MINIATURE FM transmitters! Tracking transmitters! Voice disguisers! Bug detectors! Phone Devices! More! Available in kits or assembled! Catalog \$2.00: **XANDI ELECTRONICS**, Box 25647, Dept. 60M, Tempe, AZ 85285-5647.

CATALOG: hobby/broadcasting/HAM/CB: Cable TV, transmitters, amplifiers, surveillance devices, computers, more! **PANAXIS**, Box 130-F6, Paradise, CA 95967.

SURVEILLANCE transmitter kits! Four models of each; telephone, room, combination telephone/room transmitters tune from 65 to 305 MHz. Catalog with **Popular Communications** and **Popular Electronics** book reviews of "Electronic Eavesdropping Equipment Design," \$1.00. **SHEFFIELD ELECTRONICS**, 7223 Stony Island Ave., Chicago, IL 60649-2806.

REMOTE CONTROL KEYCHAIN



Complete w/mini-transmitter and +5 vdc RF receiver Fully assembled including plans to build your own auto alarm. Quantity discounts available.

\$24.95 Check, Visa or M/C Add \$ 3 shipping

VISITECT INC. BOX 5442, SO. SAN FRAN. CA. 94080 (415) 872-0128 Fax (415) 872-2635

CB Tricks II book. Power amplifier design and theory. UHF CB tune ups. Send \$19.95 **MEDICINE MAN CB**, PO Box 37, Clarksville, AR 72830.

COMPUTER KITS

General Technics
Quality Computer Systems
Post Office Box 2676
Lake Ronkonkoma, NY 11779
(516) 981-9473



General Technics Computer Kits include a complete line of 8088, 286, and 386 models. They are designed to offer the highest degree of quality and reliability available today. They're also fun, easy to build, educational, fully IBM compatible, very powerful, and at wholesale prices. All kits are pre-tested and include a free step by step assembly manual, software, one year warranty and our 24 hour support/order phone line. Assembly is available.

ask for your free catalog

INVESTIGATORS, experimenters — Quality new plans. Micro and restricted devices. Free catalog. Self addressed stamped envelope required **KELLEY SECURITY INC.**, Suite 90, 2531 Sawtelle Blvd., Los Angeles, CA 90064.

BUILD: Infrared motion detector, ultrasonic distance meter, long-range FM infrared transceiver. Complete plans. \$4.00 each. **K. KEMP**, 13772 Goldenwest St., #549, Westminster, CA 92683.

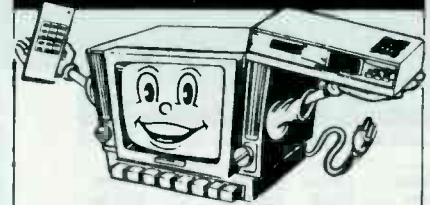
METAL project boxes — 50% off! Huge selection. Plus storage capacitors, amplifier kits, electronic parts. Free catalog. **SCC**, Box 551RE, Dublin, OH 43017.

PCB and schematic CAD software. Easy multilayer rubberband zoom pan and more. CGA EGA IBM compatibles. \$195.00. **NUMBER ONE SYSTEMS**, 10565 Bluebird Street, Coon Rapids, MN 55433.

KITS — alarms, games, and test equipment. Send \$1.00 for catalog. **RAKJAB**, PO Box 1875, Apopka, FL 32704.

CABLE T.V. CONVERTERS

WHY PAY A HIGH MONTHLY FEE?



All Jerrold, Oak, Hamlin, Zenith, Scientific Atlanta, Magnavox and all specialized cable equipment available for shipment within 24 hours. For fast service MC / VISA or C.O.D. telephone orders accepted (800) 648-3030 60 Day Guarantee (Quantity Discounts) 8 A.M. to 5 P.M. C.S.T. **CLOSED WEEK-ENDS**. Send self-addressed Stamped envelope (60¢ postage) for Catalog.

MIDWEST ELECTRONICS INC.
P.O. Box 5000
Suite 311 (R)
Carpentersville, IL 60110

No Illinois Orders Accepted.

POWERFUL single-chip FM room transmitter, size of a postage stamp, transmits to any FM radio up to one mile away. Complete kit \$19.95 postpaid. **HERTZ MICRODEVICES**, Box 41771, LA, CA 90041-41771.

PROJECTION TV. Convert your TV to project 7 foot picture... Easy... Results comparable to \$2,500 projectors... Plans and 8" lens \$27.95... Professional systems available... Illustrated catalog free... **MACROCOMA**, 15GE Main Street, Washington Crossing, PA 18977. Creditcard orders 24 hours. (215) 736-3979.

THERE IS AN ANSWER IN SIGHT!

MCM ELECTRONICS

Been in the dark about where to go to find high-quality parts and components? This is your lucky day! Our **GIANT** new catalog contains more than 16,000 items, including over 3,000 RCA/GE parts plus the largest selection of Japanese semiconductors in the Country. And our **HUGE INVENTORY** lets us ship 98% of all orders within 24 hours! Now, feel "enlightened"?

For your **FREE** subscription to the MCM ELECTRONICS Catalogs, call **TOLL-FREE 1-800-543-4330**.



MCM ELECTRONICS
650 CONGRESS PARK DR.
CENTERVILLE, OH 45459-4072
A PREMIER Company



SHEDS LIGHT ON PARTS PROBLEMS.

SOURCE NO. RE-68

CIRCLE 87 ON FREE INFORMATION CARD

Cable Descramblers

New Auto Tri-Bi guaranteed no flashing \$165.00

SB-3.....	\$99.00	ZENITH SUPER	
TRIMODE.....	\$109.00	SAAVI.....	\$199.00
HAMLIN.....	\$99.00	TOCOM.....	\$319.00
SCIENTIFIC.....	EAGLE.....		\$119.00
ATLANTA.....	\$119.00	COPY GUARD.....	\$59.95
OAK M35B.....	\$99.00	STARGATE 2000.....	\$88.00
ZENITH.....	\$175.00		

M.D. Electronics will match or beat any advertised wholesale or retail price.

Your best buys and warranties for cable converters and descramblers start with a FREE catalog from MD

For Information Call

402-554-0417

To order or request a free catalog

1-800-624-1150



M.D. ELECTRONICS

875 SO. 72nd St.
Omaha, NE 68114

BY ORDERING CABLE TV EQUIPMENT FROM M.D. ELECTRONICS THE PURCHASER AGREES TO COMPLY WITH ALL STATE AND FEDERAL LAWS REGARDING PRIVATE OWNERSHIP OF CABLE TV EQUIPMENT. IF YOU ARE UNSURE OF THESE LAWS CHECK WITH YOUR LOCAL OFFICIALS.

CIRCLE 53 ON FREE INFORMATION CARD

EXCELLERATOR™ Series CABLE CONVERTERS WHEN QUALITY COUNTS



New Dynatrack™ fine tuning provides unmatched picture quality
550 Mhz tuner provides 83 channel capacity
Sleep timer for automatic shut off within 15-90 minutes
2/3 switchable HRC / IRC / Standard Switchable
2 Year warranty, Last channel recall, Favorite channel select, Scan
Double vented high efficiency transformer for cool performance
Stargate-2001 \$99.00
Stargate-550XL \$119.00 With Volume Control

Don't settle for anything less.



C.O.D.

K.D. VIDEO

FOR ALL YOUR CABLE TV NEEDS

WE SPECIALIZE IN DEALER PRICING

QTY	1	10	20
Jerrold (Type) SB-3	89.00	56.00	48.00
Jerrold (Type) Tri-Bi	119.00	69.00	65.00
Scientific Atlanta SA-3	129.00	80.00	75.00
Hamlin MLD-1200	99.00	59.00	45.00
Oak N-12 Vari-Sync	99.00	59.00	58.00
Jerrold 550 Converter	99.00	75.00	68.00
Jerrold 400 DRX-3DIC (With Built in SB-3)	169.00	109.00	100.00

1-800-327-3407

Call us for prices on large quantities

K.D. Video PO Box 29538, Mpls., MN 55429

FREE catalog — Lowest prices worldwide, save 40 — 60%. Systems, upgrades, parts, all major brands factory fresh and warranted. SKYVISION, 2009 Collegeway, Fergus Falls, MN 56537. 1 (800) 334-6455.

CABLE TV secrets — the outlaw publication the cable companies tried to ban. HBO, Movie Channel, Showtime, descramblers, converters, etc. Suppliers list included. \$9.95. CABLE FACTS, Box 711-R, Pataskala, OH 43062.

PAY TV AND SATELLITE DESCRAMBLING
ALL NEW... 1991 EDITION... ALL NEW

All new current information. Build a scrambler/descrambler combo. More turn-ons, bypasses for wireless, cable and satellite. Data readers, BAG's. Technical updates on VCI+ and B-MAC. Lots more. Our best yet. \$14.95. Vol 1, Vol. 89 \$14.95 each. Wireless Cable Handbook \$9.95. Build Satellite Systems under \$600. \$12.95. Any \$38/29 or \$5/42. Scrambling News Monthly \$19.95/yr Sample \$3. New catalog \$1.

Scrambling News, 1552 Hertel Ave., Buffalo, NY, 14216.
COD's are OK 716-874-2088

LASER lighting entertainment systems. Create your own 3-dimensional laser light shows with these professional secrets! Detailed mechanical and electrical schematics, designs for any budget! \$20.00. MILLENNIUM, 229 McAfee, Thousand Oaks, CA 91360.

DAZER II personal protection device! Plans \$8.00. Lasers! Transmitters! Detectors! More! Kits or assembled! Catalog \$2.00. QUANTUM RESEARCH, 16645-113 Avenue, Edmonton, Alberta T5M 2X2.

PEN transmitter: Sensitive micro FM transmitter, housed inside standard size pen. Latest surface mount technology. Complete kit and instruction \$44.95. MICRONIC-INT., Box 5726, Sherman Oaks, CA 91413.

TRANSMIT VCR to any set in house. Inexpensive. No construction. Complete instructions. \$4.00. VENTURA, Box 377, Beverly, MA 01915.

EEPROM Programmer for the Commodore 64 PC. \$8.00 for plans and autostart software. WILKINSON ELECTRONICS, Box 58261, Renton, WA 98058.

DESIGN your own custom circuits with our user friendly electronic engineering software. IBM and compatibles, Commodore 64, and 128. Free information. Write or call today! WEASELGRAPHICS, PO Box 51697, Riverside, CA 92517-2697. Phone 1 (800) 356-8113 Visa/Mastercard.

BIG screen 48" rear projection TV kit, priced 85% below commercial sets, easily assembled, factory parts, no electronic experience necessary, information \$5.00. M. HOWE ENTERTAINMENT SYSTEMS, PO Box 121-R, Swisshome, OR 97480.

ANTIQUE RADIO CLASSIFIED

Free Sample!

Antique Radio's

Largest Circulation Monthly.
Articles, Ads & Classifieds.

6-Month Trial: \$13. 1-Yr: \$24 (\$36-1st Class).
A.R.C., P.O. Box 802-L6, Carlisle, MA 01741

SURVEILLANCE — Audio/video/infra-red/laser equipment. Industrial or private. 500 item catalog \$7.00. SECURITY SYSTEMS, 3017G Hudson, New Orleans, LA 70131.

PRO-2004/2005/2006 Owners! Restore cellular telephone, add-on S-meter, add 6,400 channels, increase scanning speed, auto tape record, etc! Manual includes 10 modifications with detailed instructions and schematics. Only \$8.95 from the ENGINEERING WORKSHOP, PO Box 4176, Fullerton, CA 92634-4176.

SURVEILLANCE electronics, plans, kits, assembled. Catalog \$4.00. S&S ELECTRONICS, PO Box 36505-123, San Jose, CA 95158.

BEST BY MAIL

Rates: Box 5, Sarasota, FL 34230

OF INTEREST TO ALL

JOURNALIST REVEALS SECRET to publishing books. \$19.95. Barrett, Box 11341 (RE), Clayton, MO 63105.

EARN EXTRA CASH. Send \$3.00 to: P.O. Box 72087, C.C., TX 78472-2087.

THE CREATOR HAS A Name! Few people know it, Yet wonder why prayers aren't answered! Free information, Write: NAME, Box 2442, Abilene, TX 79604.

SATELLITE TV

VIDEOCIPHER II manuals. Volume 1 — Hardware, Volume 2 — Software — either \$34.95. Volume 3 — Projects/Software, Volume 5 — Documentation or Volume 6 — Experimentation \$44.95 each. Volume 4 — Repair \$99.95. Cable Hacker's Bible — \$34.95. Clone Hacker's Bible — \$34.95. Catalog — \$3.00. COD's (602) 782-2316. TELECODE, PO Box 6426-RE, Yuma, AZ 85366-6426.

BUSINESS OPPORTUNITIES

MAKE \$50/hr working evenings or weekends in your own electronics business. Send for free facts. INDUSTRY, Box 531, Bronx, NY 10461-0208.

YOUR own radio station! AM, FM, TV, cable. Licensed/unlicensed. BROADCASTING, Box 130-F8, Paradise, CA 95967.

INVENTORS: We submit ideas to industry. Find out what we can do for you. 1 (800) 288-IDEA.

LET the government finance your small business. Grants/loans to \$500,000. Free recorded message: (707) 449-8600. (KS1).

CABLE DESCRAMBLERS OAK M35B COMBO \$39.95

Jerrold, Zenith, Hamlin, Sci. Atlanta, Pioneer & MORE! OUR PRICES ARE BELOW WHOLESALER!

CABLE+PLUS

14417 Chase St. #481-A Panorama City, CA 91402
1-800-822-9955 • Other Info. 1-818-785-4500
NO CALIF. SALES — DEALERS WANTED

MAKE \$75,000 to \$250,000 yearly or more fixing IBM color monitors (and most brands). No investment. Start doing it from your home. (A telephone required.) Information, USA, Canada \$1.00 cash. US funds. other countries \$8.00 RANDALL DISPLAY, Box 2168-R, Van Nuys, CA 91404 USA.

LOW power radio broadcasting. Your own business. Unlicensed — licensed — legal! Complete details! SOUTHEASTERN TECHNICAL SERVICES, Box 8, Stonewall, OK 74871.

PROJECTION TV... Make \$\$\$'s assembling projectors. Easy!... Results comparable to \$2,500 projectors... Plans, 8" lens & dealers information \$25.50... Professional systems available... Illustrated catalog free. MACROCOMA, 15GEX Main Street, Washington Crossing, PA 18977... Credit-card orders 24 hrs. (215) 736-2880.

LEARN to clean/repair fax machines. Huge new market! Earn \$85/hour. No experience necessary. Free details call 1 (800) 537-0589 or write to: VIEJO PUBLICATIONS 5329 Fountain Ave., Dept. FX200, Los Angeles, CA 90029.

LEARN IBM PC assembly language. 80 programs. Disk \$5.00. Book \$18.00. ZIPFAST, Box 12238, Lexington, KY 40581-2238.

CONSUMER advocate. Help sources, any problem. SASE for description. HELP, Box 132, Indian Rocks, FL 34635.

EDUCATION & INSTRUCTION

MAGIC! Four illustrated lessons plus inside information shows you how. We provide almost 50 tricks including equipment for four professional effects. You get a binder to keep the materials in, and a one-year membership in the International Performing Magicians with a plastic membership card that has your name gold-embossed. You get a one-year subscription to our quarterly newsletter "IT'S MAGIC!" Order now! \$29.95 for each course + \$3.50 postage and handling. (New York residents add applicable state and local sales tax.) **THE MAGIC COURSE**, 500-B BiCounty Boulevard, Farmingdale, NY 11735.

F.C.C. Commercial General Radiotelephone license. Electronics home study. Fast, inexpensive! "Free" details. **COMMAND**, D-176, Box 2824, San Francisco, CA 94126.

MOVIE VIEW SALES

Cable T.V. Converters
Descramblers / Low Prices

PO Box 26 • Wood Dale, IL 60191
(708) 766-5222/Fax (708) 766-5269
Call CST Mon.-Fri. - 9-5 / Sat.-10-2

**JERROLD - SCIENTIFIC ATLANTA
OAK • ZENITH • HAMLIN • PIONEER**

Converter Only • Hand Helds
Ch. 3 Filters • 3 Ft. Jumper Cable

☐ VISA/Mastercard ☐ C.O.D.

☐ Friendly Knowledgeable Service

☐ 10 Yrs. Experience

☐ 6 Mos. Warranty

(NO ILLINOIS SALES)

LEARNING electronics troubleshooting? Basic electronics simulations and problems program can help. PC/MSDOS \$32.95 EES-RE1, POB 1391, Lubbock, TX 79408.

WANTED

INVENTORS! Confused? Need help? Call IMPAC for free information package. US/Canada: 1 (800) 225-5300.

INVENTIONS! new products/ideas wanted: call TLCI for free information 1(800) 468-7200 24 hours/day - USA/Canada.

CABLE TV EQUIPMENT

Converters, Remote Controls,
Descramblers, CD Players.



**JERROLD-OAK-SCIENTIFIC ATLANTA-HAMLIN
ZENITH MANY MORE CALL TODAY!**

✓ Only quality products sold ✓ Easy to use
✓ Satisfaction guaranteed ✓ Knowledgeable sales staff

✓ Most orders shipped within 24 hours

CALL FOR YOUR FREE CATALOG

MC 1-800-228-7404 VISA

MAKE THE CONNECTION

WITH

NU-TEK ELECTRONICS

5114 Balcones Wood Dr.#307 Dept.298
Austin, TX. 78759



TUBES - 2000 TYPES DISCOUNT PRICES!

Early, hard-to-find, and modern tubes. Also transformers, capacitors and parts for tube equipment. Send \$2.00 for 28 page wholesale catalog.

ANTIQUE ELECTRONIC SUPPLY

6221 S. Maple St. • Tempe, AZ 85238 • 602/820-5411

ENTER THE WORLD OF PROFESSIONAL VIDEO! Pro's tell techniques and secrets of U-matic VCR's 32 pg. Illus. Send \$12.95 to **ANIBAL NEGRON**, 64 Mason Blvd., S.I., NY 10309.

CABLE TV DESCRAMBLER LIQUIDATION!

FREE CATALOG!

Hamlin Combos \$44, Oak M35B \$60 (min. 5), etc.

WEST COAST ELECTRONICS

For Information: 818-709-1758

Catalogs & Orders: 800-628-9656

MARK V ELECTRONICS, INC.

Competitive Pricing * Fast Shipping

Since 1985

ORDER IN CALIFORNIA 800-521-MARK

ORDER OUTSIDE CA 800-423-3483

FREE CATALOG & INFORMATION (213)888-8988

FAX (213) 888-6868

▲ indicates the level of difficulty in the assembling of our Products. ▲ Beginner ▲▲ Intermediate ▲▲▲ Advanced ★ Fully Assembled

TA-120 MK2

TA-3600

TA-802

TA-477

TR-355A/B

SM-328

SM-666 metal cabinet

SM-49

SM-333

SM-100

TY-43

AMPLIFIERS

KIT ASSEMB.

MODEL	DESCRIPTION		
TA-28MK2	Digital Voice Memo ▲▲	\$30.00	
TA-50A / B	Multi-Purpose Melody Generator ▲	12.84	17.20
TA-50C	Multi-Purpose Melody Generator ▲	13.65	18.71
TA-120MK2	35W Class "A" Main Power Mono Amp. ▲▲	31.50	42.80
TA-300	30W Multi-Purpose Single Channel Amp. ▲	20.00	29.00
SM-302	60W + 60W Stereo Power Amplifier (with Mic. Input)▲▲	59.95	75.00
TA-323A	30W X 2 Stereo Pre-main Amp. ▲	31.50	42.80
TA-377A	Hi-Quality FET Stereo Pre-Amp. ▲▲▲	28.00	34.93
TA-400	40W Solid State Mono Amp. ▲	68.00	85.00
TA-477	120W Mostel Power Mono Amp. ▲▲	63.92	
TA-800MK2	120W + 120W Low Tim Pre-Main Stereo Power Amp. ▲▲	45.94	59.72
TA-802	80W + 80W DC Stereo Main Power Amp. ▲▲	40.39	49.37
TA-820A	100W Dynamic Class "A" Main Power Mono Amp.▲▲	59.69	80.58
TA-1000A	100W X 2 Class "A" DC Stereo Pre-Main Amp.▲▲▲	73.70	95.81
TA-1500	Fet Super Class "A" DC Pre-Amp. ▲▲	47.70	58.24
TA-2200	Electronic Echo & Reverberation Amp. ★		96.00
TA-2400A	Hi-Fi Pre-Amp. w/10 band graphic equalizer ★		68.80
TA-2500	Hi-FET IC Pre-Amp. w/3 way tone control ▲		63.57
TA-2800	Stereo Simulator (For Mono TV or Any Mono Source) ▲▲	48.90	63.57
TA-3000	300W HQ Hi-Fi Power Mono Amp ▲▲▲	27.00	38.50
TA-3600	300W HQ Hi-Fi Power Mono Amp ▲▲▲	85.00	110.00

POWER SUPPLIES

KIT ASSEMB.

MODEL	DESCRIPTION		
TR-100A	0-15V 2A Regulated DC Power Supply (w/Case)★	\$	\$ 69.50
TR-355A	0-15V 5A Regulated DC Power Supply ▲	15.65	21.76
TR-355B	0-30V 3A Regulated DC Power Supply ▲	15.65	21.76
TR-503	0-50V 3A Regulated DC Power Supply ▲▲	16.75	23.65

INSTRUMENTS

KIT ASSEMB.

MODEL	DESCRIPTION		
SM-43	3½ Multi-Functional Led D.P.M. (w/ABS plastic case)▲▲	\$ 34.50	\$ 43.00
SM-48	4½ Hi-Precision D.P.M. ▲▲▲	38.00	48.00
SM-48A	4½ Hi-Precision D.P.M. (w/ABS plastic case)▲▲▲	41.20	52.00
SM-49	3½ Multi-Functional LCD D.M.P. (w/Hold Function)▲▲	36.00	44.50
SM-100	150MC Digital Frequency Counter ▲▲	79.00	90.00
FC-1000A	1 GHz Frequency Counter ★		179.00

MISCELLANEOUS

KIT ASSEMB.

MODEL	DESCRIPTION		
TY-23B	3 Channel Color Light Controller ★	\$	\$ 65.00
TY-25	Stereo Loudspeaker Protector ▲	14.85	20.85
TY-35	FM Wireless Microphone ▲	11.25	
TY-36	AC/DC Quartz Digital Clock ▲	19.00	26.20
TY-38	Sound / Touch Control Switch ▲	12.00	
TY-41MK V	Infrared Remote Control Unit (w/Case) ▲▲▲	22.00	35.00
TY-42	Bar / Dot Level Meter ▲	24.15	33.81
TY-43	3½ Digital Panel Meter ▲	29.00	38.00
TY-45	20 Steps Bar / Dot Audio Level Display ▲▲	38.45	46.14
TY-47	Superior Electronic Roulette ▲▲	19.46	27.24
SM-222	7 Band Hi-Fi Graphic Equalizer ▲▲▲	26.80	36.80
SM-328	4 Channel Professional Color Light Controller★		145.00
SM-333	Audio/Video Surround Sound Processor ▲▲▲	65.00	75.00
SM-666	Dynamic Noise Reduction ▲	26.00	34.00
SM-888	Universal Audio/Video KARAOKE Mixer, Pre-Amp. ★		225.00
10.000uF	80 V Capacitor (Suggested for TA-3600, TA-477, TA-1000A & TA-802)		23.00

METAL CABINETS WITH ALUMINUM PANEL

MODEL	H" x W" x D"	MATCHING	PRICE
LG-1273	3" 12" 7"	TA-2800, TA-377A, TA-2200	\$ 22.85
LG-1684	4" 16" 8"	TA-323A, TA-377A, TA-2200	27.50
LG-1924	4" 19" 11½"	TA-802, TA-820A, TA-1500, TA120MK2, TA-800, TA-1000A	32.80
LG-1925	5" 19" 11½"	TA-477, TA-800, TA-1500, TA-1000A, TA-3600	35.80
LG-1983	2¾" 19" 8"	TA-377A, TA-2800, TA-2200, TA-120MK2	29.25

POWER TRANSFORMERS

MODEL	DESCRIPTION	MATCHING	PRICE
001	28V x 2 6A to 30V x 2 6A	TA-800, TA-802, TA-820A, TA-1000A, TA-1500	\$ 27.00
002	36V x 2 3A	TR-503, TA-323A, TA-400, TA-300	22.00
003	40V x 2 6A	TA-477	28.00
004	24V x 2 6A	TA-120 MK 2	22.00
005	26V x 2 3A	TR-355B	16.00
006	18V x 2 5A	TR-355A	15.50
007	53V x 2 8A	TA-3600	43.00

We accept major Credit Cards. Money Orders. Check and C.O.D. Orders. C.O.D. fee is \$5.00. Minimum order is \$20.00. * We ship by UPS ground inside US (min. \$3.00) and ship by US mail Business & Showroom hours: (Pacific Time) outside US. Please call our sales department for orders over 2 lbs. or foreign orders. All assemblies units have a 30 days warranty. Quality or Volume discount available upon request. Residents Mon. thru Fri. 9:30 am to 5:00 pm of CA please add sales tax 6.75%. All merchandise are subject to prior sale. Prices are subject to change without prior notice. We are not responsible for typographical errors. Sat. 10:00 am to 5:00 pm

MARK V ELECTRONICS, INC. - 8019 E. Slauson Ave, Montebello, CA 90640



CIRCLE 93 ON FREE INFORMATION CARD

AMAZING SCIENTIFIC & ELECTRONIC PRODUCTS

GRA1 — ANTI GRAVITY GENERATOR	\$10.00
LC7 — 40 WATT BURNING CUTTING LASER	\$20.00
RUB4 — HI POWER PULSED DRILLING LASER	\$20.00
BTC5 — 1 MILLION VOLT TESLA COIL	\$20.00
MC1 — HI VELOCITY COIL GUN	\$15.00
LLS1 — LASER LIGHT SHOW 3 METHODS	\$20.00
EH1 — ELECTRONIC HYPNOTISM TECHNIQUES	\$8.00
EML1 — LOWER POWERED COIL GUN LAUNCHER	\$8.00
JL3 — JACOB LADDER 3 MODELS	\$10.00
SD5 — SEE IN THE DARK	\$10.00
LEV1 — LEVITATION DEVICE	\$10.00

FV1K — 3 MILE FM VOICE TRANSMITTER	\$34.50
PFS1K — HAND CONTROLLED PLASMA FIRE SABER	\$49.50
NI7K — HI FLUX NEGATIVE ION GENERATOR	\$34.50
PG5K — PLASMA LIGHTNING GLOBE	\$49.50
LHC2K — VISIBLE SIMULATED 3 COLOR LASER	\$44.50
HOD1K — HOMING/TRACKING BEEPER TRANSMITTER	\$44.50
LGU6K — 2.5 MW HAND-HELD VISIBLE LASER GUN	\$249.50
BTC3K — 250,000 VOLT TABLE TOP TESLA COIL	\$249.50
IOG2K — ION RAY GUN, project energy without wires	\$129.95
TKE1K — TELEKINETIC ENHANCER/ELECTRIC MAN	\$79.50
VWPM7K — 3 MILE AUTO TELEPHONE TRANSMITTER	\$49.50

LIST10 — INFINITY XMTR Listen in via phone lines	\$199.50
IPG70 — INVISIBLE PAIN FIELD BLAST WAVE GENERATOR	\$74.50
ITM10 — 100,000 VOLT INTIMIDATOR UP TO 20'	\$99.50
TAT30 — AUTOMATIC TELEPHONE RECORDING DEVICE	\$24.50
PSP40 — PHASOR SONIC BLAST WAVE PISTOL	\$89.50
DNE10 — ALL NEW 26" VIVID COLORED NEON STICK	\$74.50
LGU20 — 5 TO 1MW VISIBLE RED HeNe LASER GUN	\$199.50
BL510 — 100,000 WATT BLASTER DEFENSE WAND	\$89.50

EASY ORDERING PROCEDURE - TOLL FREE 1-800-221-1705
or 24 HRS ON 1-603-673-4730 or FAX IT TO 1-603-672-5406
VISA, MC, CHECK, MD IN US FUNDS. INCLUDE 10% SHIPPING. ORDERS
\$100.00 & UP ONLY ADD \$10.00. CATALOG \$1.00 OR FREE WITH ORDER.

INFORMATION UNLIMITED
P.O. BOX 716, DEPT. R2, AMHERST, NH 03031

CABLE TV "BOXES"

Converters — Descramblers
Remote Controls — Accessories

★ Guaranteed Best Prices ★
★ 1 Year Warranty — C.O.D.'s ★
★ Immediate Shipping ★
★ FREE CATALOG ★

Call or Write
TRANS-WORLD CABLE CO.
12062 Southwest 117th Court, Suite 126
Miami, Florida 33186
1-800-442-9333



FLUKE SUPER SALE

Model 73 ... \$79	Model 83 ... \$199	VISA
75 ... \$119	85 ... \$229	MC
77 ... \$149	87 ... \$269	

▲ NEW! Model 45 ... \$79 ▼

KELVIN Electronics
7 Fairchild Ave., Plainville, NY 11803
(516) 349-7620 (1800) 645-9212



ZENITHS & TOCOMS

SUPER Zenith (Z-TAC) converters (flashing)... \$169.00. Zenith "turn-on" module... \$49.00.
Tocom 5503(A) & 5504 converters... \$139.00.
Tocom (add-on) descramblers... \$79.00. Tocom (5503-VIP & 5507) "turn-on" chips... \$49.00. CIN-EPLEX VIDEO GROUP. 1 (800) 726-4627.

COMPUTER BOOKS

DISCOUNT computer books! Thousands of titles available. Including recent releases. Please call or write for our latest free catalog. **BOOKWARE**, 344 Watertown Road, Thomaston, CT 06787. 1 (800) 288-5662, (203) 283-6973.

THE JOY OF PROGRAMMING!

Algorithm

THE PERSONAL PROGRAMMING NEWSLETTER

► features how-to projects for beginners and experts: fractals, moiré patterns, ecological simulations, black holes, sand-piles, wallpaper for the mind and much more!

► Write today for a free sample issue to:
Algorithm - Special Order Department
P.O. Box 29237, Westmont Postal Outlet
785 Wonderland Road South
London, Ontario, CANADA N6K 1M6

CABLE BOX REPAIR

JERROLD 400 opportunity CATV repair manual. DRX-3DIC-105 cable converter. CAD drawings, circuit schematics, microprocessor pinout, parts list, parts available \$14.95 + \$2.00 P&H. Rush US PO money order, cash or check to **BONDED CABLE T.V. CO.** PO Box 20340 Dept. RM * Fax (313) 548-0053. Ferndale, MI 48220-9998 U.S.A. * No COD.

RADIO-ELECTRONICS



2-1/2" SANYO TWEETER

Paper cone with gold tone dust cap. 8 oz. magnet. 8 ohm. 1/2" ferro fluid voice coil. Power handling: 50W RMS, 70W max. Frequency response: 3K-20KHz.

#RB-271-020 \$1⁹⁵ \$1⁷⁵ 95c
(1-9) (10-59) (80-up)

SUPER HORN TWEETER

Original piezo tweeter made by Motorola. SPL=94 dB 2.83V/1M. Response: 4KHz-27KHz. Handles approximately 50 watts.

#RB-270-010 \$5³⁰ \$4⁵⁰ \$3⁹⁵
(1-9) (10-79) (80-up)

2" DOME MIDRANGE

Textile dome midrange made by Philips. 8 ohm. SPL=90 dB 1W/1M. 30W RMS, 40W max. Response: 550-5KHz.

#RB-280-210 \$27³⁰ \$25⁷⁰
(1-3) (4-up)

15" SUBWOOFER



10" POLY WOOFER

Medium duty. 60W RMS, 80W max. 14 oz. magnet. Response: 25-2.5KHz. fs=28Hz.

#RB-290-096 \$18⁵⁰ \$16⁹⁰
(1-3) (4-up)

TITANIUM COMPOSITE TWEETER

The advantages of both hard and soft dome technologies. 8 ohm. Ferro fluid cooled voice coil. SPL=90 dB 1W/1M 50W RMS, 70W max. 4" round. Polydax #DTW100T125.

#RB-270-047 \$27⁵⁰ \$24⁸⁰
(1-9) (10-up)

SUBWOOFER XOVER

200W RMS crossover designed specifically for use with dual voice coil subwoofers. 12 dB per octave roll-off at 150Hz.

#RB-260-220 \$28⁸⁰ \$24⁴⁰

12" CAST FRAME WOOFER



12" woofer made in the USA by Eminence. Paper cone and dust cap with treated cloth surround. 80 oz. magnet. 2-1/2" vented voice coil. 8 ohm. 170W RMS, 235W max. 40-4.5KHz response.

#RB-290-147 \$72⁹⁰ \$69⁹⁰
(1-3) (4-up)

SPEAKER BUILDING BOOK

Revised edition of David Weems' best selling book. Learn to build low cost speakers that rival the high priced models.

#RB-500-021 \$16⁹⁵



FREE CATALOG

Parts Express
340 E. First St., Dayton, Ohio 45402
Local: 1-513-222-0173
FAX: 513-222-4644

• 15 day money back guarantee • \$15.00 minimum order • We accept Mastercard, Visa, Discover, and C.O.D. orders. • 24 hour shipping • Shipping charge = UPS chart rate + \$1.00(\$3.00 minimum charge) • Hours 8:30 am - 7:00 pm EST, Monday - Friday • Mail order customers, please call for shipping estimate on orders exceeding 5 lbs. Foreign customers please send \$5.00 U.S. funds for catalog postage.

CALL TOLL FREE
1-800-338-0531

FREE CATALOG!

1-800-648-7938

For all information 1-702-362-9026

JERROLD HAMLIN OAK ETC.

CABLE TV DESCRAMBLERS

- Compare our low Low Retail Prices!
- Guaranteed Prices & Warranties!
- Orders Shipped Immediately!

REPUBLIC CABLE PRODUCTS INC.

4080 Paradise Rd. #15 Dept. RE-90
Las Vegas, NV 89109



***** PRESENTING ***** CABLE TV DESCRAMBLERS

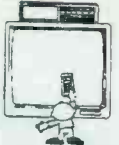
***** STARRING *****
JERROLD, HAMLIN, OAK
AND OTHER FAMOUS MANUFACTURERS

- FINEST WARRANTY PROGRAM AVAILABLE
- LOWEST RETAIL/WHOLESALE PRICES IN U.S.
- ORDERS SHIPPED FROM STOCK WITHIN 24 HRS.
- ALL MAJOR CREDIT CARDS ACCEPTED

FOR FREE CATALOG ONLY 1-800-345-8927
FOR ALL INFORMATION 1-818-709-9937

PACIFIC CABLE CO., INC.
7325 1/2 Reseda Blvd., Dept. 1000
Reseda, CA 91335

Cable TV Descramblers



If you find a better deal,
we'll better our deal.

*Jerrold *Tocom *Hamlin *Oak

*Scientific Atlanta *Zenith

Ask about our extended warranty
program.

COD, Visa, M/C welcome.

Free Call - Free Catalog.

Video Tech **800-562-6884**

3702 S. Virginia St., Ste. 160-304
Reno, NV 89502.

INVENTORS

INVENTORS! Can you patent and profit from your idea? Call **AMERICAN INVENTORS CORPORATION** for free information. Over a decade of service 1 (800) 338-5656. In Canada call (413) 568-3753.

MASTERCARD AND VISA are now accepted for payment of your advertising. Simply complete the form on the first page of the Market Center and we will bill.

BUY BONDS

VOLUME I - TEST EQUIPMENT

CONSOLIDATED ELECTRONICS

Get two of the most valuable electronic catalogs ever! These 2 catalogs contain over 16,000 hard to find electronic parts & equipment. VOL. I - features 112 pages of high quality test equipment. VOL. II - features 144 pages of electronic parts, tools & cross references. Send \$5 check or money order, or call today & use your VISA or MasterCard.

1-800-543-3568

VOLUME II - PARTS & ACCESSORIES

CONSOLIDATED ELECTRONICS, INCORPORATED 705 WATERVLUIT AVENUE DAYTON, OHIO 45420-2599
FAX: 1-(513)-252-4066 / TEL: 1-(513)-252-5662 / TELEX: 288-229 / COMPUSERVE: 76057, 3347 / EASYLINK: 62850013

CIRCLE 70 ON FREE INFORMATION CARD

UNICORN - YOUR I.C. SOURCE!

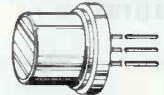
COLLIMATOR PEN (INFRA-RED)



- Output: 2.5 mW (max.)
- Current: 90-150 mA
- Operating Voltage: 2.2-2.5V
- Wavelength: 820nm
- Collimation: .18mrad (typ.)
- Size: 11mm diameter

STOCK # **SB1052** PRICE **\$39.99**

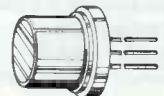
LASER DIODE (INFRA-RED)



- Output: 10 mW (max.)
- Current: 90-150 mA
- Operating Voltage: 2.2-2.5V
- Wavelength: 820nm

STOCK # **SB1053** PRICE **\$9.99**

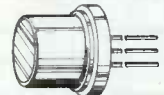
LASER DIODE (VISIBLE-RED)



- Output: 5 mW (max.)
- Current: 65-100 mA
- Operating Voltage: 1.75-2.2V
- Wavelength: 780nm

STOCK # **LS022** PRICE **\$19.99**

LASER DIODE (VISIBLE-RED)



- Output: 4 mW (max.)
- Current: 20 mA
- Operating Voltage: 2.2-3.0V
- Wavelength: 665nm

STOCK # **LS3200** PRICE **\$129.99**

POWER SUPPLY



- Input: 115/230v
- Size 7" L x 5 1/4" W x 2 1/2" H
- Output: +5 volts @ 3.75 amps
- Output: +12 volts @ 1.5 amps
- Output: -12 volts @ .4 amps

STOCK # **PS1002** PRICE **\$19.99**

EPROMS

STOCK #	PINS	DESCRIPTION	1-24	25-99	100+
1702	24	256 x 4 1us	3.99	3.79	3.41
2708	24	1024 x 8 45ns	6.49	6.17	5.55
2716	24	2048 x 8 450ns (25v)	3.29	3.13	2.82
2716-1	24	2048 x 8 350ns (25v)	3.79	3.60	3.24
TMS2716	24	2048 x 8 450ns	6.29	5.98	5.38
27C16	24	2048 x 8 450ns (25v-CMOS)	3.99	3.79	3.41
2732	24	4096 x 8 450ns (25v)	3.79	3.60	3.24
2732A-2	24	4096 x 8 200ns (21v)	3.79	3.60	3.24
2732A	24	4096 x 8 250ns (21v)	3.69	3.51	3.16
2732A-4	24	4096 x 8 450ns (21v)	3.19	3.03	2.73
TMS2532	24	4096 x 8 450ns (25v)	5.79	5.50	4.95
TMS2532P	24	4096 x 8 450ns (25v-One Time Programmable)	1.99	1.89	1.70
27C32	24	4096 x 8 450ns (25v-CMOS)	4.19	3.98	3.58
2764-20	28	8192 x 8 200ns (21v)	3.99	3.79	3.41
2764	28	8192 x 8 250ns (21v)	3.79	3.60	3.24
2764A-20	28	8192 x 8 200ns (12.5v)	3.99	3.79	3.41
2764A	28	8192 x 8 250ns (12.5v)	3.29	3.13	2.82
TMS2564	28	8192 x 8 250ns (25v)	6.79	6.45	5.81
27C64	28	8192 x 8 250ns (21v-CMOS)	4.19	3.98	3.58
27128-20	28	16,384 x 8 200ns (21v)	5.79	5.50	4.95
27128	28	16,384 x 8 250ns (21v)	5.09	4.84	4.35
27128A	28	16,384 x 8 250ns (21v)	5.79	5.50	4.95
27C128	28	16,384 x 8 250ns (21v)	5.79	5.50	4.95
27256-20	28	32,768 x 8 200ns (12.5v)	5.29	5.03	4.53
27256	28	32,768 x 8 250ns (12.5v)	4.79	4.55	4.09
27C256	28	32,768 x 8 250ns (12.5v)	5.29	5.03	4.53
27512-20	28	65,536 x 8 200ns (12.5v)	7.49	7.12	6.41
27512	28	65,536 x 8 250ns (12.5v)	6.99	6.64	5.98
27C512	28	65,536 x 8 250ns (12.5v-CMOS)	6.99	6.64	5.98
27C1024	32	131,072 x 8 200ns (12.5v-CMOS)	17.99	17.09	15.38
68764	24	8192 x 8 450ns	13.99	13.29	11.96
68766	24	8192 x 8 450ns	14.99	14.24	12.82



ORDER BY PHONE!

10011 Canoga Ave., Unit B-8 • Chatsworth, CA 91311

OUTSIDE CALIFORNIA: (800) 824-3432 (Orders Only)

IN CALIFORNIA: (818) 341-8833

ORDER BY FAX: (818) 998-7975

Minimum Order \$15.00

CIRCLE 188 ON FREE INFORMATION CARD



Welcome to . . .

SCIENCE PROBE!®

The Amateur Scientist's Journal

Embark on an irresistible new journey into the realm of mystery, challenge, and exploration! The perfect magazine for the budding scientist, the serious amateur, the professional who would like to relax, and those who simply want to gaze at the stars.

SCIENCE PROBE! — the *only* magazine devoted entirely to Amateur Scientists! If you are fascinated by science in all its many forms . . . if you can't stay away from a microscope, telescope, calipers, or test tube — we invite you to share the wonders in every issue of **SCIENCE PROBE!** You will join a community of Amateur and Student Scientists who enthusiastically seek scientific knowledge or fellow scientific pursuits for their own sakes and not merely as a profession.

Obtain your personal *premier* edition of **SCIENCE PROBE!** by visiting a quality Newsstand, Convenience Store, or Supermarket this Fall or by reserving your personal copy through the mail by completing the coupon below.

From the very first issue of **SCIENCE PROBE!** you will be involved in a world of scientific facts, experiments, and studies pursued by amateur scientists who are university students, inventors, academicians, engineers, or office workers, salesmen, farmers—whose *quest* is to probe into the mysteries of science and reveal them to all.

Plan to become a **SCIENCE PROBE!** reader!

Articles to appear in early issues of **SCIENCE PROBE!** are:

LIGHTNING—CAPTURE IT ON FILM
MONITORING ULTRAVIOLET FROM THE SUN
MOBILE-MOUNT EXPERIMENTAL WIND TUNNEL
CHECKING OUT ACID RAIN
AERIAL PHOTOGRAPHY FROM KITES AND BALLOONS
MINIATURE TRACKING TRANSMITTER
KILLER BEE IDENTIFICATION
HOW TO OBTAIN ANIMAL EYESHINE PHOTOGRAPHS





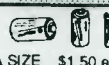



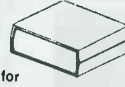



If you're fascinated by science in all its many forms, if you are compelled to experiment and explore, then **SCIENCE PROBE!** is your kind of magazine!

SCIENCE PROBE!	7RA11
500-B Bi-County Boulevard Farmingdale, NY 11735	
Please forward my Premier Edition of SCIENCE PROBE! as soon as it comes off the press. I am enclosing \$3.50-U.S.A. (\$3.95-Canada) plus \$1.00 for shipping and handling. Better still, please enroll me as a charter-member subscriber and send the next four (4) quarterly issues of Science Probe. I am enclosing \$9.95-U.S.A. (Canada: \$14.95 U.S.A. Funds)	
<input type="checkbox"/> Premier Edition only <input type="checkbox"/> First Four Issues (1 Year)	
Offers valid in the U.S.A. and Canada only. No foreign orders.	
Name _____	
Address _____	
City _____ State _____ ZIP _____	
All Orders payable in U.S.A. Funds only.	

ON SALE AT QUALITY NEWSSTANDS, CONVENIENCE STORES AND SUPERMARKETS
 STARTING SEPTEMBER 13, 1990 — \$3.50-U.S.A. — \$3.95-Canada

QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING

ALL ELECTRONICS CORP.

<p>DIGITAL CLOCK AND APPLIANCE TIMER</p>  <p>Digital clock and appliance timer removed from automatic electric coffee makers due to design changes. Operates on 120 Vac and is capable of turning on appliances drawing up to 10 amps. Because of the application they were designed for they automatically turn off after two hours. Some have surface blemishes. 4.2" X 2.45" X 1.1" deep. Beige or ivory with brown trim. CAT# MCT \$6.50 each</p>	<p>CIRCUIT BOARD PEN</p>  <p>Circuit Works # 2200 Make and fix circuit board lines instantly. Valved pen with a specially formulated silver bearing thermoplastic polymer allows you to draw conductive silver traces. Can be soldered after 15 or 20 minutes with 350 degree iron. Each pen contains enough silver conductor for 100 feet of shielding, traces and connections. Traces are as narrow as 1/16" in width. CAT# CW-2200 \$10.95 each</p>	<p>150 MICROAMP METERS</p>  <p>150 microamp full scale. 2.165" X 1.875" X 0.96" deep Face is 1.965" X 1.1". White background with black and red scale. Two types. One is marked "Modulation" and has a 0 - 100 scale. The other has two scales, "RF" and "SWR". Otherwise meter are identical. *Modulation* meter CAT# MET-21 \$3.50 RF/SWR meter CAT# MET-22 \$3.50</p>	<p>ONE MINUTE TIMER</p>  <p>This white box with a blue button will drive you crazy. Box measures 3 1/4" square X 2" high. When the button is pressed 4 LEDs light and a beeper pulses. Every 15 seconds one led goes out and the speed of the beeping increases. At the end of 60 seconds the unit gives off a long beep followed by a low squelch, all LEDs shut off and the unit stops. Unit requires a 9 volt transistor battery (not included) to operate. CAT# TMR-1 \$2.25 each - 10 for \$20.00</p>	
<p>SWITCHES</p> <p>SPDT PUSHBUTTON Marquardt# 1843 Rated 6 amps @ 125/250 Vac. Black plastic pushbutton. Switch body. .92" X .84" X .65". CAT# PB-18 \$1.65 ea. - 10 for \$15.00</p> <p>PUSHBUTTON SWITCH GC/Thornsen# 35-420 S.P.S.T. normally open momentary pushbutton switch. Red plastic actuator 0.57" diameter. Chrome bezel 0.68" diameter. Threaded bushing mounts in .50" diameter hole. Rated 3 amp @ 250Vac. Solder loop terminals. CAT# PB-20 \$1.00 each</p> <p>THUMBWHEEL SWITCH 1 pole 10 position decimal encoded switches which interlock to make up desired number or digits. Terminates to 11 pc pins (1 common and 10 poles). Each section measures .31" wide X .20" high X .78" deep. End plates can be added to form a .94" wide bezel. CAT# SWH-9 \$1.25 each - 10 for \$10.00</p> <p>2 END PLATES - CAT# SW-9EC \$1.00/2set</p> <p>MINIATURE TOGGLE SWITCH Rated: 3 amps @ 120 Vac S.P.S.T. (ON-ON) solder lugs CAT# MTS-4 \$1.35 each</p> <p>S.P.S.T. (ON-ON) P.C. mount CAT# MTS-4PC \$1.00 each</p>	<p>NICKEL-CAD BATTERIES (RECHARGEABLE)</p>  <p>AAA SIZE \$1.50 each 1.2 volts 180 mAh CAT# NCB-AAA</p> <p>AA SIZE \$2.00 each 1.25 volts 200 mAh CAT# NCB-AA</p> <p>AA SIZE \$2.20 each WITH SOLDER TABS CAT# NCB-SAA</p> <p>C SIZE \$4.25 each 1.2 volts 1200 mAh CAT# NCB-C</p> <p>D SIZE \$4.50 each 1.2 volts 1200 mAh CAT# NCB-D</p>	<p>0 - 6 HOUR AUTO SHUT-OFF TIMER</p> <p>M.H. Rhodes, Inc. Mark-Time# 90007 Timer fits standard 3" deep wallbox. Rated 20 amps @ 125 Vac. Turn knob to desired time. Includes hardware, beige wallplate, and knob, UL and CSA listed, CAT# TMC-6 \$5.75 each - 10 for \$50.00</p> <p>Special: New Reduced Price PHOTOFLASH CAPACITOR</p> <p>Rubicon CE photoflash capacitor. 0.79" dia. X 1.1" high. These are new capacitors that have been prepped with 1.4" black and red wire leads soldered to the terminals. 210 Mfd 330 Volt CAT# PPC-210 \$1.25 each - 10 for \$11.00 - 100 for \$100.00</p>	<p>LED'S</p> <p>STANDARD JUMBO DIFFUSED T 1-3/4 size (5 mm)</p> <p>RED CAT# LED-1 10 for \$1.50 - 100 for \$13.00</p> <p>GREEN CAT# LED-2 10 for \$2.00 - 100 for \$17.00</p> <p>YELLOW CAT# LED-3 10 for \$2.00 - 100 for \$17.00</p> <p>FLASHING LED with built in flashing circuit 5 volt operation. T 1-3/4 (5mm)</p> <p>RED \$1.00 each CAT# LED-4 10 for \$9.50</p> <p>GREEN \$1.00 each CAT# LED-4G 10 for \$9.50</p> <p>YELLOW \$1.00 each CAT# LED-4Y 10 for \$9.50</p> <p>LED HOLDER Two piece holder. CAT# MLED 10 for 65¢</p>	<p>L.E.D. FLASHER KIT</p>  <p>Two L.E.D.'s flash in unison when a 9 volt battery is attached. This kit includes a p.c. board, all the parts and instructions to make a simple flasher circuit. A quick and easy project for anyone with basic soldering skills. CAT# LEDKIT \$1.75 per kit</p> <p>LED CHASER KIT</p>  <p>Build this variable speed led chaser. 10 leds flash sequentially at whatever speed you set them for. Easy to build kit includes pc board, parts and instructions. Ideal for special lighting effects, costumes, etc. Operates on 3 to 9 volts. PC board is 5" X 2.25". A great one hour project CAT# AEC \$6.50 each</p>
<p>WALL TRANSFORMERS</p>  <p>ALL PLUG DIRECTLY INTO 120 VAC OUTLET</p>	<p>HEAVY DUTY "C" CELL</p> <p>YUASA 1800C Rechargeable "C" cell 1.2 volt, 1800 mah Price reduced on 10 or more. CAT# HDNCB-C 10 for \$42.50/100 for \$375.00</p> <p>RELAYS</p> <p>6 VOLT D.C. - S.P.D.T. Aromat # RSD-6V Super small relay. Rated: 1 amp @ 30 Vdc, TTL direct drive possible. Operates on 4.3 to 14 Vdc. Coil. 220 ohms. 1 3/16" X 13/32" X 7/16". CAT# RSD-6V \$1.50 each - 10 for \$13.50</p> <p>12 VOLT D.C. D.P.D.T.</p>	<p>STEPPER MOTOR</p> <p>Alpax P/N C82711-M1 17 Vdc dual coil, permanent magnet stepper. 23.25 ohm coil. 7.5 degrees per step. CAT# SMT-6 \$6.00 each - 10 for \$50.00</p> <p>INSTRUMENT ENCLOSURES</p>  <p>High quality molded ABS instrument enclosures. Integrated PC board standoffs and two sets of vertical mounting slots for front and rear sub panels. All enclosures are 6" wide X 6 1/4" deep. Choice of three hts. Includes non-skid rubber feet and hardware. beige, ivory, black, and blue. 4 1/2" # MB-A \$7.50 each - 10 for \$65.00 # MB-B \$7.75 each - 10 for \$67.50 # MB-C \$8.00 each - 10 for \$70.00 Please specify color.</p>	<p>PHOTO RESISTOR</p> <p>100 ohms bright light 18K ohms dark. 0.182" dia. X .08" high. 0.18" long leads. CAT# PRE-7 2 for \$1.00 - 100 for \$45.00 - 1000 for \$400.00</p> <p>OPTO SENSOR</p> <p>Standard U-shaped gnotted optical switch with 1/8" gap between sides. 0.75" mounting centers. CAT# OSU-7 2 for \$1.00</p> <p>REFLECTIVE OPTO SENSORS</p> <p>These units have an IR emitter and sensor pair pointing in the same direction. Light from emitter bounces off object to be detected by sensor. Effective range approx. 0.15". Three types available. TRW/Optron # OPB5447-2 Rectangular w/ 28" wire leads CAT# OSR-4 2 for \$1.00</p> <p>TRW/Optron # OPB703A Wedge shape with PC pins. CAT# OSR-3 75¢ each</p> <p>TRW/Optron # OPB711 Rectangular with PC pins. CAT# OSR-2 75¢ each</p>	<p>STEPPING MOTOR CONTROLLER KIT</p>  <p>Learn about stepping motors while building this simple circuit. Includes circuit board, stepping motor and all parts except 12 Vdc power supply. CAT# SMTK \$18.00 each</p> <p>12 VDC GEARHEAD MOTOR</p>  <p>Soho# GBL 35-DH-21080-10Y Powerful little gearhead motor. 40 RPM @ 12 Vdc. 0.5 amps (no load). 32 RPM with load. Operates at lower voltages with reduced speed and torque. 6.3 pound inches torque. Stall: 27 pound inches. 3.1" long X 1.375" diameter. Shaft: 0.187" dia. X 0.75" long. CAT# MOTG-14 \$11.50 each - 10 for \$100.00</p> <p>XENON TUBE</p>  <p>1" long flashtube with 3 1/2" red and black leads. Ideal for flash or strobe projects. CAT# FLT-3 2 for \$1.00</p>

Does your career need a boost?

Call for help!

1-800-321-2155

1-800-523-9109 (in Ohio)



See our ad in this issue.

REE 1-800-826-5432

• INFORMATION (818) 904-0524

Order \$10.00 • All Orders Can Be Charged To Visa, Mastercard, Discover, American Express • California, Add Sales Tax • Shipping And Handling \$3.50

48 Continental United States - All Others Including Alaska, Hawaii, Canada Must Pay Full Shipping • Quantities Limited • No C.O.D. • Prices Subject to change without notice.

ALL ELECTRONICS CORP. • P.O. BOX 567 • VAN NUYS, CA 91408

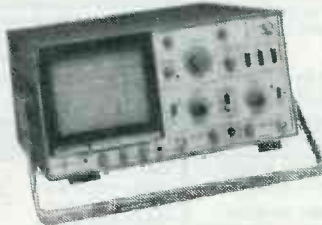
DISCOVER
 VISA
 MasterCard

FOR FREE INFORMATION CARD

Freedom of Choice.

Test / Measurement and Prototype Equipment

GoldStar 20MHz Oscilloscope



Features:

- 6" rectangular CRT display, internal grid & scale
- Phase difference measurements between two forms under two methods: x-y scope and Dual Trace
- Two different scale probes: x1 and x10
- Bandwidth from DC to 20MHz
- Includes: Two 40MHz probes, two fuses, power cord, operation manual, schematics and block and wiring diagram
- High sensitivity: 1mV/div
- Two-Year Warranty

GS7020.....\$499.95

24 Hour
Order Hotline
(415) 592-8097

Jameco Universal IC Programmer

Memory Devices: EPROMs, EEPROMs and PROMs
Logic Devices: PALs, GALs, RALs, EPLDs, EEPLDs and FPLDs



- Stand alone or computer controlled mode via RS232C port
- The JE680 uses the JEDEC standard for logic devices. Accepts input from virtually all major software packages including: PALASM, PLAN, CPUL, ABEL, and AMAZE

JE680 Universal IC Programmer.....\$1799.95
JE680-40P 40-pin MPU Adapter Module (8741, 8742, 8748, 8749, 8751).....\$149.95

Jameco Logic Pulser



- Compatible with TTL, DTL, RTL, HTL, HNIL, MOS and CMOS ICs. • 1MΩ Sync input impedance • Pulser mode output current: 10mA • Square wave current output: 5mA • Audible tone

LP540.....\$16.95

Jameco Logic Probe



- Max Frequency 80MHz • Minimum detectable pulse: 10ns • 120KΩ input impedance • Max. supply voltage: ±25V • TTL threshold: (Lo) 0.8V ±0.1V (Hi) +2.3v ±0.2V • CMOS threshold: (Lo) 30% VCC ±10% (Hi) 70%VCC ±10%

MS104.....\$24.95

A.R.T. EPROM Programmer



- Programs all current EPROMs in the 2716 to 27512 range plus the X2864 EEPROM
- RS232 port • Software included

EPP.....\$199.95

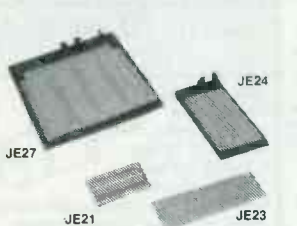
UVP EPROM Eraser



- Erases all EPROM's • Erases 1 chip in 15 minutes and 8 chips in 21 min
- UV intensity: 6800 UW/CM²

DE4.....\$79.95

PROTOTYPING PRODUCTS Jameco Solderless Breadboards



Part No.	Dim. L" x W"	Contact Points	Binding Posis	Price
JE21	3.25 x 2.125	400	0	\$4.95
JE23	6.5 x 2.125	830	0	\$6.95
JE24	6.5 x 3.125	1,360	2	\$12.95
JE25	6.5 x 4.25	1,660	3	\$17.95
JE26	6.875 x 5.75	2,390	4	\$22.95
JE27	7.25 x 7.5	3,220	4	\$32.95

Metex Digital Multimeters

General Specs:

- Handheld, high accuracy • AC/DC voltage, AC/DC current, resistance, diodes, continuity, transistor hFE
- Manual ranging w/ overload protection



- M3650 & M4650 only: • Also measure frequency and capacitance

M4650 only: • Data hold switch • 4.5 digit

M3610 3.5 Digit Multimeter.....\$59.95
M3650 3.5 Digit Multimeter w/Frequency & Capacitance.....\$74.95
M4650 4.5 Digit w/Frequency, Capacitance and Data Hold Switch.....\$99.95

Handheld Multimeter



- 3.5 digit LCD with automatic polarity indication • AC/DC voltage measurement up to 500 volts • AC/DC current measurement up to 200mA • Resistance measurement up to 20MΩ • Continuity checker with audible tone • Diode and logic tester • Auto/manual range and data hold functions • All range protection and function indications

DMM905.....\$49.95

EPROMs - for your programming needs

Part No.	Price	Part No.	Price	Part No.	Price
TMS2516	4.95	2764-20	4.95	27256-15	5.95
TMS2532	6.95	2764-25	4.75	27256-20	5.75
TMS2532-35	7.49	2764-45	4.49	27256-25	5.25
TMS2532A	7.95	2764A-20	4.25	27C256-15	6.95
TMS2564	5.95	2764A-25	3.95	27C256-20	4.95
TMS2716	5.95	27C64-15	4.49	27C256-25	4.49
1702A	4.89	27C64-25	3.49	27512OTP	5.95
2708	6.95	27128OTP	4.95	27512-20	7.95
2716	3.49	27128-20	6.95	27512-25	6.95
2716-1	3.95	27128-25	6.25	27C512-15	8.95
27C16	4.25	27128A-15	6.95	27C512-20	6.95
2732	4.95	27128A-20	5.95	27C512-25	6.49
2732A-20	3.95	27128A-25	4.95	27C010-15	14.95
2732A-25	3.75	27C128-15	5.95	27C010-20	13.95
2732A-45	3.49	27C128-25	5.75	68764	14.95
27C32	3.95	27256OTP	4.95	68766-35	12.95

Soldering and Desoldering Stations

60 Watt Analog Display Soldering Station • Electronic temperature control from 200° to 878°F • Cartridge heating element for a longer life of the soldering tip

XY1683.....\$69.95

30 Watt Electronic Temperature Controlled Desoldering Station • Electronic temperature control from 212° to 842°F • Self contained high rotary vacuum pump

XY999.....\$299.95



XY999

JAMECO

24 Hour Order Hotline
(415) 592-8097

FAX's: (415) 592-2503
or (415) 595-2664

• Partial Listing • Over 4000 Electronic and Computer Components in Stock!

CIRCLE 114 ON FREE INFORMATION CARD

24 Hours a Day.

Computer Products and Electronic Components

Assemble Your own Computer Kit!

Jameco 16MHz 80386SX Desktop Computer Kit

- Building your own computer provides you with a better understanding of components and their functions
- In-depth assembly instructions included
- Have your new computer assembled and running in an evening, using common tools
- Software included
- Purchase computer kits configured by Jameco or design your own

Jameco 16MHz 80386SX Desktop Computer Kit

- Includes:
- 80386SX Motherboard with 2MB RAM (expandable to 8MB)
 - 101-key enhanced keyboard
 - Multi I/O Card
 - Toshiba 1.44MB, 3.5" DSHD floppy disk drive
 - Baby sized desktop case
 - 200 Watt power supply
 - DR DOS (Version 5.0) by Digital Research and Diagsoft's QAPLUS diagnostic software



\$1199.95
JE3816 monitor extra

Hard Drives



Conner (16-bit IDE)

CP3044	40MB 3.5" Low Profile.....	\$469.95
CP3184	80MB 3.5"HH.....	\$699.95
CP3104	100MB 3.5"HH.....	\$799.95
ADP20	Host Adapter.....	\$29.95

Relisys 14" VGA Color Monitor



- Max resolution: 720 x 480
- Bandwidth: 30MHz
- Tilt/Swivel base

RE9513.....\$449.95

Jameco 16-bit VGA Card



- Supports VGA, EGA, CGA, MDA and Hercules modes • Comes with 256KB video RAM upgradable to 512KB (eight 41464-80) • Capable of 640 x 480 with 256 colors, 800 x 600 with 16 colors

VG2000.....\$149.95

JAMECO

24 Hour Order Hotline
(415) 592-8097

FAX's: (415) 592-2503
or (415) 595-2664

1355 Shoreway Road
Belmont, CA 94002

Look to Jameco.....

- Wide selection of integrated circuits and components
- Quality prototype and test equipment
- Computer kits and accessories

Additional items that Jameco offers:

- Motherboards
- Memory
- Math Coprocessors
- Computer Accessories
- Tools
- Cables
- Connectors
- Data Books
- Power Protection Equipment
- Much, much more!

Let us show you what we have to offer; call or write for the latest Jameco catalog!

\$50.00 Minimum Order

Data Sheets - 50¢ each

For a FREE 90-Page catalog send \$2.00 to cover first Class Postage and Handling
© 1991 Jameco Electronics 1/91

CA Residents Add

6.25%, 6.75% or 7.25% Sales Tax
Shipping - Add 5% plus \$1.50 Insurance
(May vary according to weight and shipping method)
Terms: Prices subject to change without notice. Items subject to availability and prior sale.
Complete list of terms/warranties is available upon request.
IBM is a registered trademark of International Business Machines



Please refer to Mail Key 2 when ordering

Integrated Circuits

Part No.	1-9	10+	Part No.	1-9	10+
74LS00	.25	.15	74LS154	1.29	1.19
74LS02	.25	.15	74LS155	.49	.39
74LS03	.25	.15	74LS156	.49	.39
74LS04	.25	.15	74LS157	.45	.35
74LS05	.28	.18	74LS158	.39	.29
74LS06	.59	.49	74LS166	.79	.69
74LS07	.59	.49	74LS169	.99	.89
74LS08	.28	.18	74LS173	.49	.39
74LS10	.25	.15	74LS175	.39	.29
74LS11	.29	.19	74LS181	1.39	1.29
74LS13	.35	.25	74LS189	3.95	3.85
74LS14	.49	.39	74LS190	.59	.49
74LS20	.28	.18	74LS191	.59	.49
74LS21	.29	.19	74LS193	.69	.59
74LS27	.35	.25	74LS194	.69	.59
74LS30	.28	.18	74LS221	.69	.59
74LS32	.28	.18	74LS240	.59	.49
74LS38	.35	.25	74LS241	.59	.49
74LS42	.49	.39	74LS323	2.49	2.25
74LS47	.85	.75	74LS541	1.09	.99
74LS48	.85	.75	74LS590	5.95	5.75
74LS112	.39	.29	74LS670	.89	.79
74LS122	.55	.45	74LS688	2.19	1.95
74LS123	.49	.39	81LS95	.99	.89
74LS125	.49	.39	81LS97	.99	.89

Miscellaneous Components

Potentiometers

Values available (insert ohms into space marked "XX"):
500Ω, 1K, 5K, 10K, 20K, 50K, 100K, 1MEG

43PXX	3/4 Watt, 15 Turn.....	.99
63PXX	1/2 Watt, 1 Turn.....	.89

Transistors And Diodes

PN2222.....	.12	1N4735.....	.25	2N4401.....	.15
PN2907.....	.12	2N3904.....	.12	1N4148.....	.07
1N4004.....	.10	1N751.....	.15	2N3055.....	.69
2N2222A.....	.25	C106B1.....	.49	1N270.....	.25

Switches

JMT123	SPDT, On-On (Toggle).....	1.25
206-8	SPST, 16-pin (DIP).....	1.09
MPC121	SPDT, On-Off-On (Toggle).....	1.19
MS102	SPST, Momentary (Push-Button).....	.39

D-Sub Connectors and Hoods

DB25P	Male, 25-pin.....	.65	DB25H	Hood.....	.39
DB25S	Female, 25-pin.....	.75			

LEDs

XC209R T1, (Red).....	.14	XC556R T1 3/4, (Red).....	.12
XC556G T1 3/4, (Green) ...	.16	XC556Y T1 3/4, (Yellow) ...	.16

IC Sockets

Low Profile	Wire Wrap (Gold) Level #2		
8LP.....	.11	8WW.....	.49
14LP.....	.12	14WW.....	.65
16LP.....	.13	16WW.....	.69
24LP.....	.19	24WW.....	1.05
28LP.....	.22	28WW.....	1.29
40LP.....	.28	40WW.....	1.79

Soldertail Standard & Header Plug Sockets Also Available

• Customer Service • Technical Assistance • Credit Department • All Other Inquiries • (415) 592-8097 • 7AM - 4PM P.S.T.

CIRCLE 114 ON FREE INFORMATION CARD

3 FOR 1 SPECIAL

ON SUB-MINIATURE VOICE FM TRANSMITTERS. KITS CONTAIN PC BOARDS



***FMX-1 LONG RANGE (3 MI) ULTRA SENSITIVE FM VOICE XMTR** with fine tune, range control plus.....\$34.50



***TELX-1 TELEPHONE FM XMTR (3 MI)** automatically operates when phone is used. Crystal clear clarity with fine tune and range control. Non detectable.....\$34.50



***ATR-1 AUTOMATIC TELEPHONE RECORDING DEVICE** tapes telephone conversation all automatically.....\$19.50

ALL THREE OF ABOVE FOR.....\$69.50

CALL OR SEND VISA, MASTER CHARGE, MONEY ORDER, ETC. TO **AMAZING CONCEPTS**, BOX 716, AMHERST, NH 03031. (603) 673-4730.

THE ELECTRONIC GOLDMINE



The Electronic Goldmine has one of the greatest selections of unique electronic kits available in the world. We have over 130 kits and over 1,400 unique, bargain priced, components in our catalog.

FREE CATALOG
With **OVER 1400 DIFFERENT ITEMS INCLUDING 135 KITS!** REQUEST YOUR COPY TODAY!

Special Item

MINI GEIGER COUNTER KIT

- ★ Detects ALL Types of Radiation
- ★ Uses Sensitive Alpha Window Tube
- ★ Operates from 9V Battery (not incl.)
- ★ Comes with PC Board, Parts, Tube and Instructions
- ★ Size of PC Board: 3" x 1.9"



C6430 \$59.95

4KV TRIGGER COIL

Use with any strobe tube that needs a 3 lead 4KV trigger.

N1700 \$1.25 EA
100 for \$80.00

INVERTER TRANSFORMER

Small 4 lead transformer for use with 555 IC to convert 12VDC to 250V for strobe/fluorescent tubes with solenoid.

N1703 \$2.00 EA
1,000 for \$1,500

CDS CELL ASSORTMENT

Great for hundreds of projects and experiments. These change their resistance with light. 5 different types.

G764
5 for \$2.00

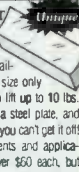
GIANT HORSESHOE XENON STROBE TUBE

Largest Horseshoe Tube we have ever seen! Make a behemoth strobe to frighten everyone on Halloween, or use it in a whopper of a disco strobe! Size: 2" tall x 1-1/8" wide, glass tubing dia. 5/16". Operates on 300VDC and can be used with our 4KV trigger transformer. (stock # N1700 to left).

G762 \$7.00 EACH

RARE EARTH MAGNET

Many times stronger than other magnets, these are among the world's strongest commercially available magnets for this size. Small size only about 1.63" x .56" x .44" yet can lift up to 10 lbs. Try to remove this magnet from a steel plate, and you'll find that unless you slide it, you can't get it off! Great for thousands of experiments and applications. Normally these sell for over \$60 each, but these are surplus and have a few chips (does not affect performance). **G765 \$9.00**



ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

Free Information Number	Page
108 AMC Sales	81
75 Ace Products	29
107 All Electronics	95
— Amazing Concepts	92
84 Appliance Service	29
67 Banner Technical Books	83
98 Beckman Industrial	9
109 C&S Sales	11
70 CEI	93
— CIE	7,21
54 Chemtronics	83
— Command Productions	20
180 CompuServe	CV4
58 Cook's Institute	82
181 D&D Electronics	74
186 DELPHI	74
— Damark International	70
127 Deco Industries	29
176 Electronic Goldmine	98
— Electronics Book Club	76
121 Fluke Manufacturing	CV2
— Friendly Videos	86
182 Global Specialties	3
— Grantham College	10
86 Heathkit	71
187 Huntron Instruments	73
— Information Unlimited	98
— ISCET	86
114 Jameco	96,97
115 Jensen Tools	29
— King Wholesale	88
87 MCM Electronics	89
53 MD Electronics	90
93 Mark V. Electronics	91
— McGraw Hill Book Club	14
61 Microprocessors Unltd	85
117 Mouser	81
— NRI Schools	24
183 Optoelectronics	13
56 Parts Express	92
184 People's College of Indep. Study	19
189 Peripheral Technology	85
78 Radio Shack	30
190 SCO Electronics	72
— Star Circuits	20
— TAB Books	23
185 TECI	73
188 Unicorn	93
191 U.S. Cable	72
177 Viejo Publications	83
178 WPT Publications	73
179 Xandi Electronics	29

ADVERTISING SALES OFFICE

Gernsback Publications, Inc.
500-B Bi-County Blvd.
Farmingdale, NY 11735
1-(516) 293-3000
President: **Larry Steckler**
Vice President: **Cathy Steckler**

For Advertising ONLY
516-293-3000
Fax 1-516-293-3115

Larry Steckler
publisher
Arline Fishman
advertising director
Denise Haven
advertising assistant
Christina Estrada
advertising associate
Kelly McQuade
credit manager

Subscriber Customer Service
1-800-288-0652
Order Entry for New Subscribers
1-800-999-7139
7:00 AM - 6:00 PM M-F MST

SALES OFFICES

EAST/SOUTHEAST
Stanley Levitan, Eastern Sales Manager
Radio-Electronics
259-23 57th Avenue
Little Neck, NY 11362
1-718-428-6037, 1-516-293-3000
Fax 1-718-225-8594

MIDWEST/Texas/Arkansas/Okla.
Ralph Bergen, Midwest Sales Manager
Radio-Electronics
540 Frontage Road—Suite 339
Northfield, IL 60093
1-708-446-1444
Fax 1-708-446-8451

PACIFIC COAST/ Mountain States
Marvin Green, Pacific Sales Manager
Radio-Electronics
5430 Van Nuys Blvd. Suite 316
Van Nuys, CA 91401
1-818-986-2001
Fax 1-818-986-2009

Charter Subscriber's Special Offer

FOR FASTER SERVICE CALL TODAY!
1-800-777-5489

4RA14

POWER PACKED TRIO

#1 Premier Edition for Charter Members!

SCIENCE PROBE! is published for the recreational, observational, and experimental amateur Scientist. Discover what's happening in Astronomy, Photography, Medicine, Mechanics, and other interesting fields.

#2 First Time ever offered!

Who-holds barred Video tape reveals the pros and cons on the science of debugging. Learn how to protect yourself and your business. Consider a whole new profession!

#3 Modern Short Stories

...a magazine packed with the imagination of becoming authors who will parade their imagination and creativity as you savour every word of fantasy and fiction.

Gain new insights to the sciences! Enjoy hours of pleasurable reading. View and learn how thieves steal your very words! At most of all, increase your knowledge and improve your mind.

SCIENCE PROBE!—the only magazine devoted entirely to Amateur Scientists! If you are fascinated by science in all its many forms. . . if you can't stay away from a microscope, telescope or test tube. . . if you like to tinker with gadgets, test equipment, and high-tech consumer gear—we invite you to share the wonders in every issue of **SCIENCE PROBE!**

Order your one-year subscription of **SCIENCE PROBE!** now, and save \$4.05 off the cover price—pay only \$9.95 for 4 quarterly issues. Order now! Become a Charter Subscriber and the Premier Edition of **SCIENCE PROBE!** will be yours!

Name _____
Address _____
City _____ State _____ Zip _____

All payments must be made in U.S.A. funds. Add extra for postage: Canada \$5.00; Foreign \$7.50. Single copies may be purchased at quality newsstands, convenience stores and supermarkets for \$3.50 U.S.A., \$3.95 Canada. Allow 6-8 weeks for delivery.



Wake up!

Discover your future in Countersurveillance Technology The Science of De-bugging

View it on your TV

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, provided you know how to discover telephone taps, locate bugs, "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 program that you can view at home, and nowhere else! It presents an informative program prepared by professionals in the field who know their industry, its techniques, kinks and loopholes. Discover more in 45 minutes in a straightforward, exclusive personal seminar that was never attempted before.

(See other side of Card)

IS SOMEONE SNOOPING ON YOUR PRIVATE DISCUSSIONS? YOU CAN STOP THAT!

Discover the Human Imagination!

FOR FASTER SERVICE CALL TODAY
1-800-435-0715
(7:30 AM-8:30 PM) EST

BREA1

Modern Short Stories uncovers the mysterious workings of the human mind and heart within the magic of its easy-to-read stories. Encounter a parade of fascinating people. Become involved with their lives, their failures and triumphs. Human vignettes that move you to laughter and tears, excite your sense of wonder, and engage your sense of outrage!

Six (6) issues now for **only \$7.95—save \$5.55** off the cover price.

Twelve (12) issues now for **only \$14.95—save \$12.05** off the cover price.

Name _____
Address _____
City _____ State _____ Zip _____

All payments must be made in U.S.A. Funds. Add extra for postage: Canada; \$3.00; Foreign \$4.50. Single copies may be purchased at quality newsstands, convenience stores and supermarkets for \$2.25 U.S.A., \$2.75 Canada. Allow 6-8 weeks for delivery.





NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 1164 BOULDER, COLORADO

POSTAGE WILL BE PAID BY ADDRESSEE

SCIENCE PROBE!

P.O. BOX 54098
BOULDER, COLORADO 80321-4098



**Don't
pass by
these
ACTION
CARDS!**

**Bring some
excitement to
your life.
Some Tips:**

Print your name, address and ZIP code on the cards you select.

Credit card users: Be sure to copy accurately your card's number and expire date. Don't forget to place your signature on the card when required.

When payment is sent with order, be sure to use U.S. funds only. Send check or money order. Do not send cash or stamps.

These offers make excellent gifts for family and friends. Surprise someone who is near and dear to you.

Foiling Information Thieves

ALL IN ONE VIDEO

Discover the targets professional snoopers seek out! The prey may be stock brokers, manufacturers, high-tech companies, any competitive industry, or even small businesses in your community. The valuable information they fish 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!

To obtain the information contained in the video VHS cassette, you must 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 as often as you like. To obtain your copy, complete the coupon below. For faster service call today 1-800-522-6260

RE
RADIO-ELECTRONICS VIDEO OFFER
500-B Bi-County Blvd.
Farmingdale, NY 11735

Please rush my copy of the *Countersurveillance Techniques* Video VHS Cassette for \$49.95 plus \$4.00 for postage and handling.

No. of Cassettes ordered _____ Amount of payment \$ _____
Bill my VISA MasterCard
Card No. _____ Expire Date _____
Signature _____
Name _____
Address _____
City _____ State _____ Zip _____
Canadian orders: All payments in U.S. funds. No foreign orders. NY State residents add applicable sales tax.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 144 MT. MORRIS, IL

POSTAGE WILL BE PAID BY ADDRESSEE

MODERN SHORT STORIES

P.O. Box 473
Mt. Morris, IL 61054-8026



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.

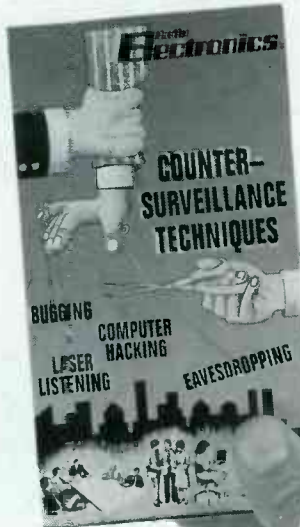
Wake up! If you are not the victim, then you are surrounded by countless victims who need your help if you know how to discover telephone taps, locate bugs, or “sweep” a room clean.

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
TODAY
TOLL
FREE

1-800-522-6260

**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.

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.

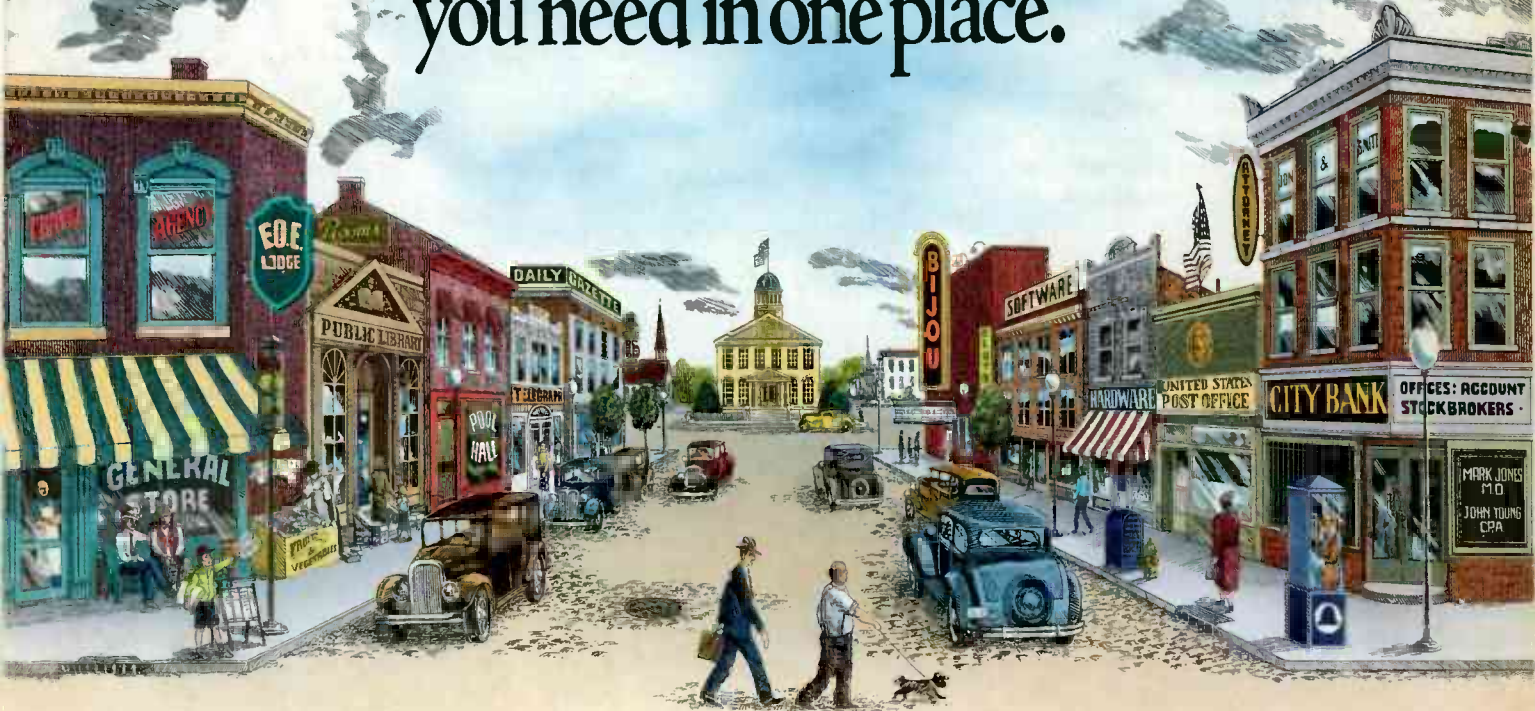
This advertisement was not written by a countersurveillance professional, but by a beginner whose only experience came from viewing the video tape in the privacy of his home. After you review the video carefully and understand its contents, you have taken the first important step in either acquiring 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 below or call toll free.

RADIO-ELECTRONICS VIDEO OFFER	RE
500-B Bi-County Blvd. Farmingdale, NY 11735	
Please rush my copy of the Countersurveillance Techniques Video VHS Cassette for \$49.95 plus \$4.00 for postage and handling.	
No. of Cassettes ordered _____	
Amount of payment \$ _____	
Bill my <input type="checkbox"/> VISA <input type="checkbox"/> 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. New York State residents add applicable sales tax.	

There's nothing new about having everything you need in one place.

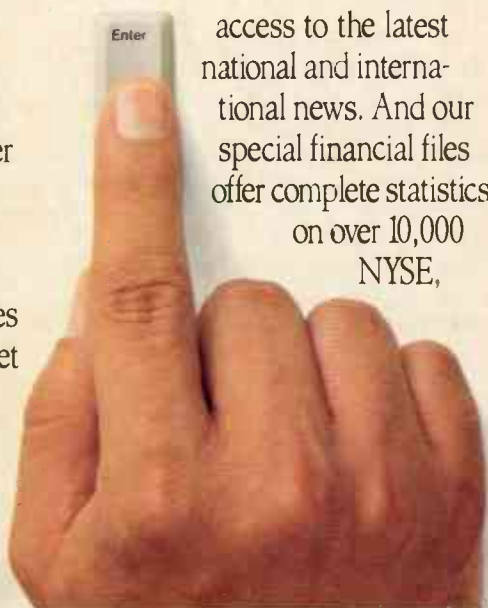


With CompuServe, it's all at your fingertips.

When you become a member of CompuServe, you join a vital, active community of over 500,000 friends and neighbors from all over the world.

Small-town friendly. We keep in touch with electronic mail and faxes, and by posting messages on our bulletin boards. We even meet in forums to discuss everything from science fiction to sharing software, and to get invaluable personal computer software and hardware support. And that's one of the best things about small towns: people helping people.

Big-city opportunities. But we can also shop coast-to-coast at hundreds of nationally known stores, and take advantage of a world-class library. We have



access to the latest national and international news. And our special financial files offer complete statistics on over 10,000 NYSE,

AMEX, and OTC securities.

We can even trade online with our local discount brokers.

And, just for fun . . . We've also got games — everything from trivia to TV-style game shows with

live entertainment to interactive space and fantasy adventures.

We've got airline schedules, so you can check out the bargains and book your own flights online. We even have listings from over 35,000 hotels.

It's not hard to get here. To get to CompuServe, all you need is a computer and a modem. We'll send you everything else, including a \$25.00 Usage Credit. In most places you'll be able to go online with a local phone call.

To buy a CompuServe Membership Kit, see your nearest computer dealer. To receive our informative brochure or to order direct, call 800 848-8199.

CompuServe

CIRCLE 180 ON FREE INFORMATION CARD