

# WHATEVER HAPPENED TO AM RADIO?

# Radio Electronics

SEPTEMBER 1990

TECHNOLOGY - VIDEO - STEREO - COMPUTERS - SERVICE

## BUILD THIS LEAD-VOCAL ZAPPER



Remove the vocal tracks  
from stereo recordings

## BUILD R-E's DIGITAL DASHBOARD

Add a high-tech look to any car

## DATA DISKS



Speed up your device selection  
in the 90's—often for free!

## BUILD THE LAWN RANGER

Let a robot take the work  
out of cutting your lawn!

## TAKE CONTROL OF YOUR PHONE!



Our Telephone Line Controller  
lets you restrict incoming and  
outgoing calls, and lots more!

## MICROWAVE TECHNOLOGY

Early attempts at  
microwave generation



\$2.50 U.S.  
\$2.95 CAN

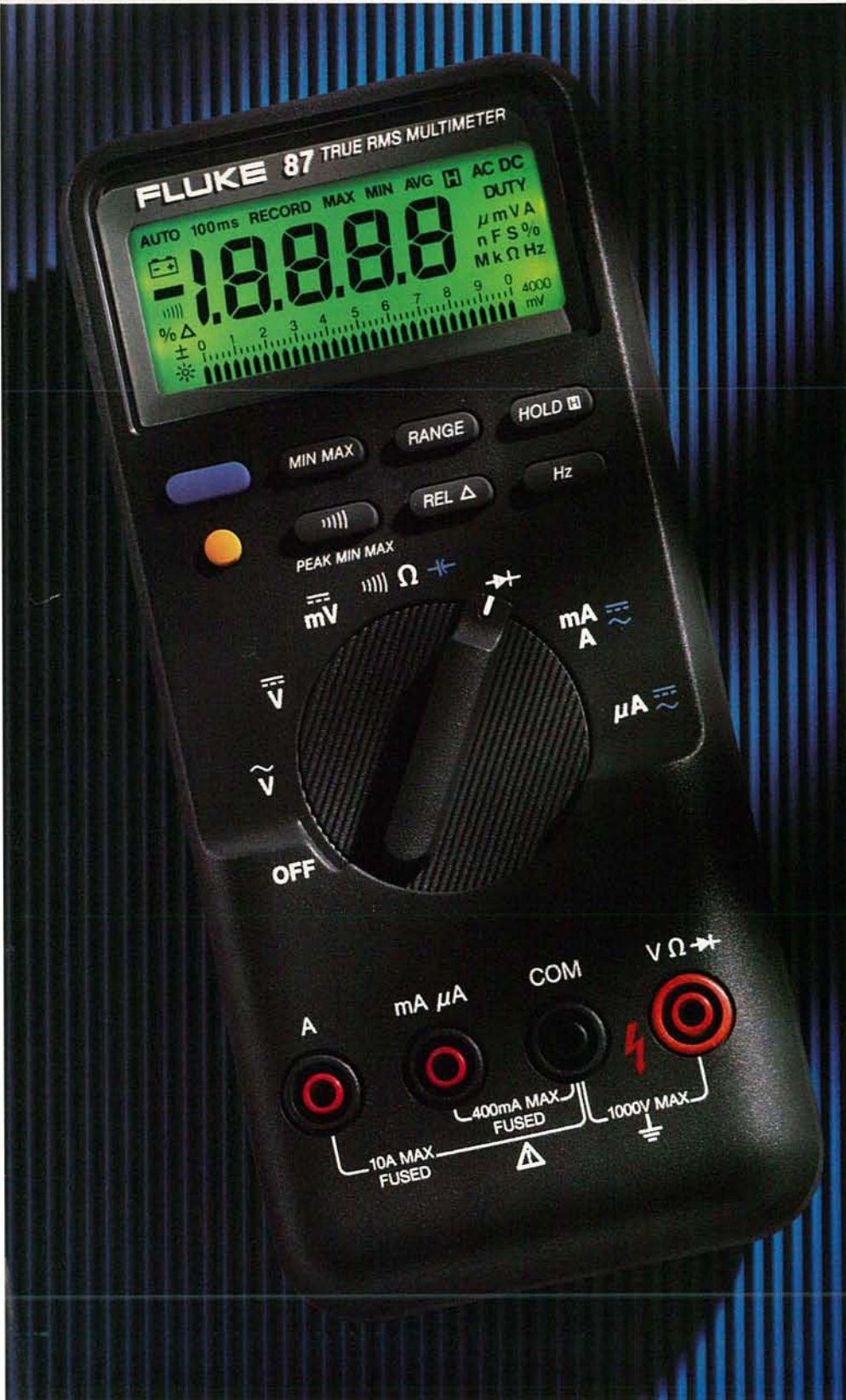
A  
**GERNSBACK**  
PUBLICATION

\*\*\*\*\* CAR-RT SORT \*\* CR03  
750456HRR5165M093 09 34  
SEP 91  
RE

**FLUKE**



**PHILIPS**



The new 80 Series is a digital meter, an analog meter, a frequency counter, a recorder, a capacitance tester, and a lot more.

It's the first multimeter that can truly be called "multi" ... not only standard features, but special functions usually limited to dedicated instruments.

Plus, innovations only Fluke can bring you. Like duty cycle measurements. Or recording the minimum, maximum and average value of a signal. Or the audible MIN MAX Alert™ that beeps for new highs or lows.

There's even Fluke's exclusive Input Alert™, that warns you of incorrect input connections. And a unique Flex-Stand™ and protective holster, so you can use the 80 Series almost anywhere.

Make sure your next multimeter is truly multi. Call today at **1-800-44-FLUKE, ext 33.**

FROM THE WORLD LEADER IN DIGITAL MULTIMETERS.



**FLUKE 83      FLUKE 85      FLUKE 87**

Volts, ohms, amps, diode test, audible continuity, frequency and duty cycle, capacitance, Touch Hold®, Relative, protective holster with Flex Stand™.

\$199*	\$239*	\$289*
0.3% basic dc accuracy	0.1% basic dc accuracy	0.1% basic dc accuracy
5 kHz acV	20 kHz acV	20 kHz acV
Analog bargraph & zoom	Analog bargraph & zoom	High resolution analog pointer
Three year warranty	Three year warranty	True rms ac
		1 ms PEAK MIN MAX
		4 1/2 digit mode
		Back lit display
		Three year warranty

\*Suggested U.S. list price

The new Fluke 80 Series shown actual size

John Fluke Mfg. Co., Inc., P.O. Box 9090 M/S 250C, Everett, WA 98206  
 U.S. - 206-356-5400 CANADA - 416-890-7600 OTHER COUNTRIES: 206-356-5500  
 © Copyright 1990 John Fluke Mfg. Co., Inc. All rights reserved. Ad No 1191-F80

CIRCLE 121 ON FREE INFORMATION CARD

**FLUKE**



## ON THE COVER



If there's a common thread that runs through the three seemingly disparate stories highlighted on this month's cover, it would have to be the notion of control—whether at home, at work, or at play. Our Telephone Line Controller (see page 37) is an obvious example, allowing you to block out any calls, either incoming or outgoing, that you deem undesirable. If your work (or your hobby) involves electronic design, the article on data disks that replace bulky, inconvenient cross-reference books will show you how to take better control of your valuable time. Turn to page 47 to find out how to speed up the device-selection process. And, just for fun, our Lead-Vocal Zapper (see page 33) gives you some control over your stereo records, by letting you replace the lead vocal with your own voice.

## COMING NEXT MONTH

### THE OCTOBER ISSUE GOES ON SALE SEPTEMBER 4.

#### BUILD A ROCKET ALTIMETER

Get a second-by-second playback of the flight of model rockets.

#### LASER-JET MEMORY CARD

Add memory to HP's LaserJet printer, for a fraction of HP's price.

#### SOME TV SETS CROSS THE BENCH

Case histories in TV service have some lessons to teach.

#### MICROWAVES: PART III

A look at magnetron tubes.

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) September 1990. 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 \$2.50. © 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  
M. Harvey Gernsback,  
editor-in-chief, emeritus

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 Campbell, 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 department  
for details.

#### Advertising Sales Offices listed on page 96.

Radio-Electronics Executive and  
Administrative Offices:

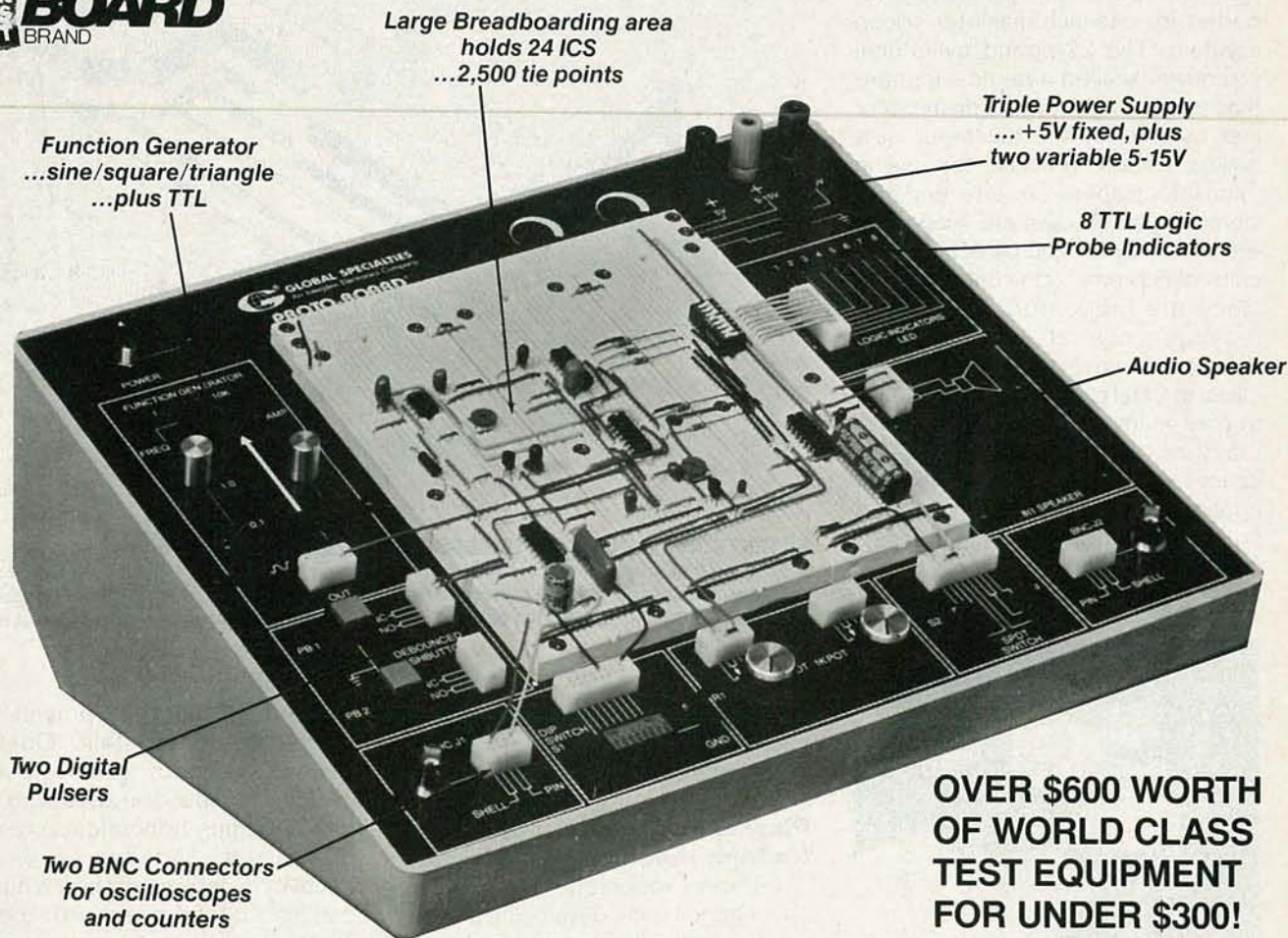
1-516-293-3000.  
Subscriber Customer Service:  
1-800-288-0652.  
Order Entry for New Subscribers:  
1-800-999-7139.



The  
Audit  
Bureau  
of Circulation



# AT \$299.95, NO OTHER DESIGN WORKSTATION GIVES YOU SO MUCH FOR SO LITTLE.



Large Breadboarding area  
holds 24 ICS  
...2,500 tie points

Function Generator  
...sine/square/triangle  
...plus TTL

Triple Power Supply  
... +5V fixed, plus  
two variable 5-15V

8 TTL Logic  
Probe Indicators

Audio Speaker

Two Digital  
Pulsers

Two BNC Connectors  
for oscilloscopes  
and counters

**OVER \$600 WORTH  
OF WORLD CLASS  
TEST EQUIPMENT  
FOR UNDER \$300!**

Here's PB-503, the total design workstation. It has everything! **Instrumentation**, including a function generator with continuously variable sine/square/triangle wave forms—plus TTL pulses. **Breadboards** with 8 logic probe circuits.

And a **Triple Power Supply** with fixed 5VDC, plus two variable outputs (+5 to 15VDC and -5 to 15VDC). Throw-in 8 TTL compatible LED indicators, switches, pulsers,

potentiometers, audio experimentation speaker...plus a lifetime guarantee on all breadboarding sockets! You have everything you need right there in front of you! PB-503—one super test station for under \$300! Order yours today!!



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

  
**GLOBAL<sup>®</sup>  
SPECIALTIES**

CIRCLE 189 ON FREE INFORMATION CARD

Global Specialties,  
70 Fulton Terrace, New Haven, CT 06512.  
Telephone: (203) 624-3103. © Interplex Electronics, 1990.  
All Global Specialties breadboarding products made in USA.  
ProtoBoard is a registered trademark of Global Specialties.

A016

an  
**Interplex  
Industries**  
company

SEPTEMBER 1990

# WHAT'S NEWS

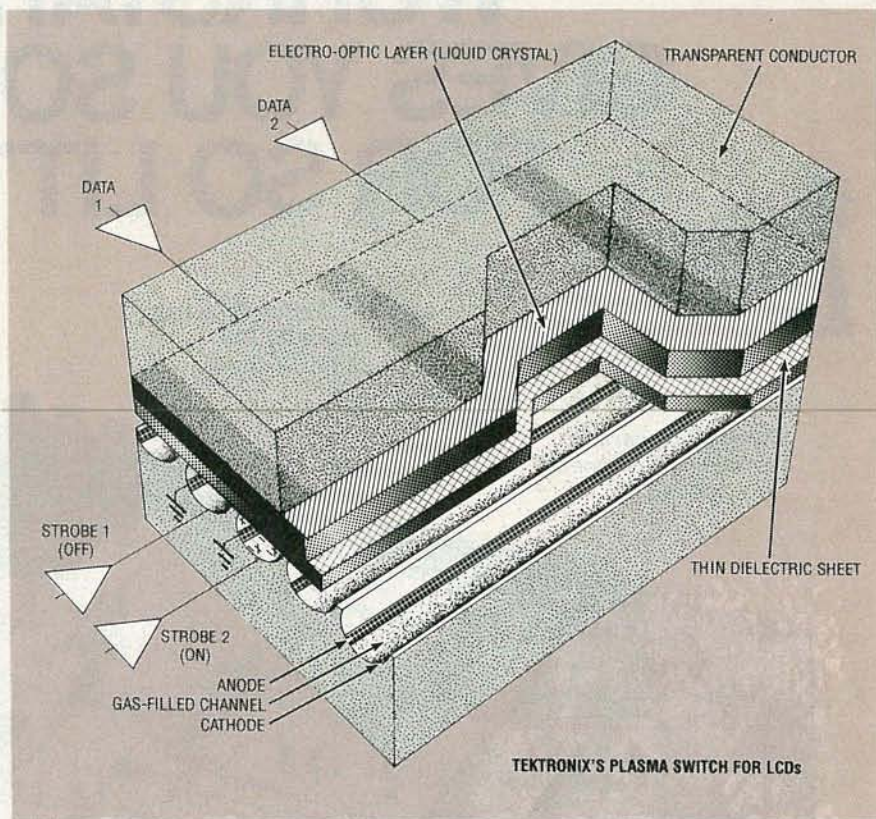
*A review of the latest happenings in electronics.*

## Ultra-pure silicon crystal

Scientists at the Westinghouse Science & Technology Center (Pittsburgh, PA) have produced a silicon crystal that is four times purer and significantly larger than any previously reported silicon material. Impurities comprise only a few parts in 100 trillion, compared to more than 10 parts in 100 trillion previously reported for one-inch diameter silicon crystals. The 22-pound cylindrical structure—called a boule—is more than a yard long and has a diameter of just over 3 inches. Its larger size makes it more practical for use in microelectronics circuits and devices. Crystal boules are sliced into wafers on which microelectronic circuits and power semiconductor devices are fabricated. The Westinghouse crystal, which its developers believe to be the purest silicon crystal ever made, is expected to play an important role in the manufacture of infrared detectors for space, defense, and environmental applications. The ultrapure silicon crystal was grown in Westinghouse's float-zone crystal-growth facility, the largest float-zone furnace in the U.S.,



**WESTINGHOUSE TECHNICIAN Don Nebel** holds a single-crystal boule of silicon, believed to be the purest and largest ever produced.



**IN TEKTRONIX'S PLASMA-ADDRESSING PROCESS**, the liquid-crystal material and a protective dielectric layer are sandwiched between two sheets of glass; the upper sheet contains the data electrodes patterned from the transparent indium-tin-oxide conductors and the bottom sheet provides channels that contain the plasma gas with two electrodes per channel.

which can be adapted to produce boules up to four feet long and five inches in diameter.

## Plasma-addressing approach for high-resolution LCD's

Tektronix researchers in Beaverton, Oregon, are developing a new plasma technique using a plasma switch to address the active matrix of a liquid-crystal display. Intended as an alternative to silicon thin-film transistors (TFT's), which are successful in small, full-color displays but are difficult to manufacture in a large array to address more than a million elements, the new technique could significantly reduce the number of row drivers and make the displays easier to manufacture.

The plasma technique uses gas-filled channels to address a variety of

twisted-nematic and polymer-dispersed liquid crystals. Confined ionized gas acts as an electrical switch: It conducts in an ionized state and becomes nonconductive when de-ionized. The degree of conductivity is determined by the number and mobility of the carriers in the gas. Tektronix says that the conductivity range of the gas (between conducting and nonconducting states) can be ten orders of magnitude. They have developed a plasma switch to take advantage of that property.

The plasma switch is a three-terminal structure that uses a probe electrode on one terminal to alter the conductivity between the other two. A single switch can replace a whole row of silicon-based TFT's.

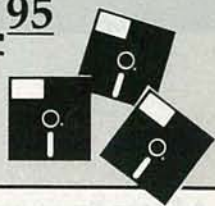
Results of the initial demonstrations have been promising. **R-E**



# Select 5 Books for only \$4<sup>95</sup>

when you join **The Computer Book Club**<sup>SM</sup>

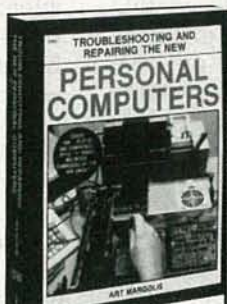
(Values to \$139.75)



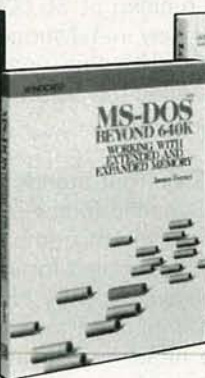
3570P \$22.95  
Counts as 2



3417P \$24.95



2809 \$29.95  
Counts as 2



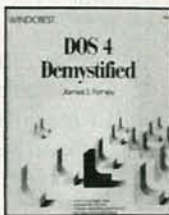
3239 \$29.95



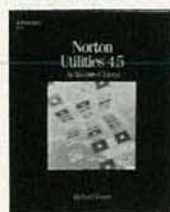
3440P \$17.95



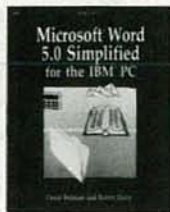
3382P \$29.95



3563P \$22.95  
Counts as 2



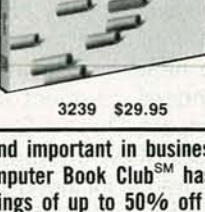
3359P \$16.95



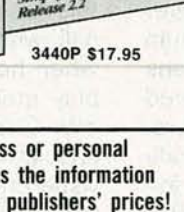
3318P \$19.95  
Counts as 2



9309P \$28.95  
Counts as 2



3578P \$16.95



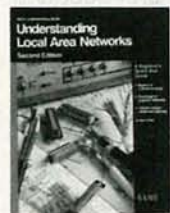
9262 \$39.95  
Counts as 2



3341 \$16.95



3280 \$31.95  
Counts as 2



9335P \$19.95  
Counts as 2



3616 \$27.95



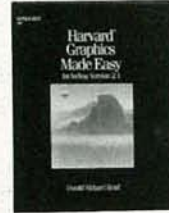
9309P \$28.95  
Counts as 2



3578P \$16.95



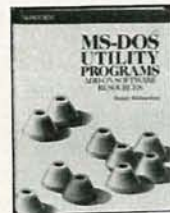
9262 \$39.95  
Counts as 2



3401P \$17.95



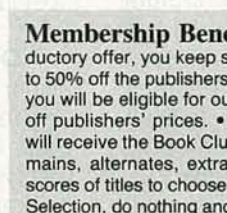
9250P \$19.95



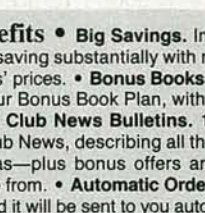
3278 \$34.95  
Counts as 2



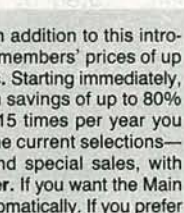
3176P \$16.95



9309P \$28.95  
Counts as 2



3578P \$16.95



9262 \$39.95  
Counts as 2



3204P \$21.95



3146P \$17.95



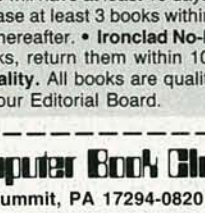
3131 \$26.95



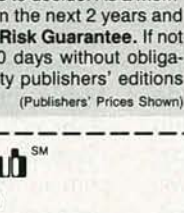
2879P \$22.95  
Counts as 2



9309P \$28.95  
Counts as 2



3578P \$16.95



9262 \$39.95  
Counts as 2



2959 \$29.95  
Counts as 2



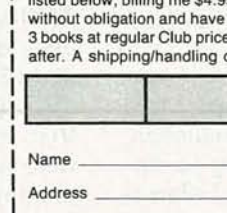
3101P \$19.95



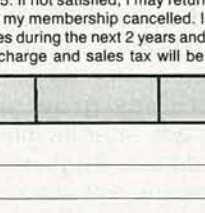
3006P \$29.95  
Counts as 2



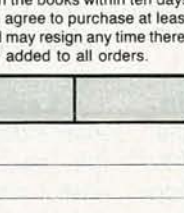
2870P \$16.95



9309P \$28.95  
Counts as 2



3578P \$16.95



9262 \$39.95  
Counts as 2



2812P \$14.95



3049 \$37.95  
Counts as 2

When it's new and important in business or personal computing, The Computer Book Club<sup>SM</sup> has the information you need . . . at savings of up to 50% off publishers' prices!

**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 2 years 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)

**The Computer Book Club<sup>SM</sup>**  
Blue Ridge Summit, PA 17294-0820

Please accept my membership in The Computer Book Club and send the 5 volumes listed below, 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 2 years 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 Computer Book Club. RPIC990

All books are hardcover unless number is followed by a "P" for paperback.

© 1990 THE COMPUTER BOOK CLUB  
Blue Ridge Summit, PA 17294-0820

# VIDEO NEWS

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

**DAVID LACHENBRUCH**

• **More 8mm converts.** The 8-millimeter camcorder format is gaining adherents in the United States at the expense of the full-size VHS and VHS-C (for compact) versions. Last month I reported the addition of an 8mm camcorder to Zenith's line (**Radio-Electronics**, August 1990). The latest brands to add 8mm are even more significant. RCA, owned by France's Thomson Consumer Electronics, has added four 8mm camcorders to its line, and—perhaps even more telling—Hitachi entered the 8mm field with three camcorders. Hitachi's entry is particularly significant since it is a member of the original Japanese VHS group and the first to break ranks and market an 8mm product under its own name. In addition to fielding 8mm camcorders under its own brand name, Hitachi is manufacturing the camcorders for RCA's line.

The VHS-C camp is replying with significant artillery. JVC has introduced several VHS-C recorders that rival 8mm in compactness and light weight with excellent picture quality. Panasonic, Quasar, and Magnavox have added tiny, palm-size VHS-C models built by Matsushita. The VHS-C group says it will mount a major promotion campaign for the VHS-C format.

Neither Zenith, Hitachi, nor Thomson is abandoning VHS-C. All three will also have the compact semi-compatible format as well. Zenith introduced several VHS-C models made by JVC, while Hitachi added a fold-up VHS-C camcorder for easy storage, and Thomson said its GE brand will have a model similar to Panasonic's Palmcorder. Although VHS-C is fighting back, 8mm is definitely gaining ground in the camcorder wars.

• **TVRO's climbing again.** After a major setback when signal scrambling started, home satellite dishes are on the upswing, according to the Satellite Broadcasting & Communications Association (SCBA). It puts the home-dish population at 3,000,000 and estimates that sales

are now running at 30,000 monthly, with total new installations expected to hit 400,000 this year, up from 240,000 when the scrambling-induced slump began.

• **CDTV.** That stands for "Commodore Dynamic Total Vision," a new interactive system combining audio and video scheduled for introduction this fall. Developed by Nolan Bushnell, who originated the video game when he headed Atari, CDTV can play standard compact discs, the new Compact Discs + Graphics, or special CD-ROM interactive audiovisual programs. Included in the initial 100 programs, to be sold for \$30 to \$100, will be a world atlas, a cookbook, encyclopedias, and games for both adults and children. The system uses the basic chips of the Commodore Amiga computer—in fact, it's convertible to a computer with the addition of a keyboard.

The basic system, to be priced at "less than \$1,000" initially, is operated by a wireless remote control, which lets users pan, zoom, and control a cursor, among other things. It permits full motion on half the screen, or 15 frames per second for full-screen scenes, but Commodore says it is an "open architecture" system that can be converted to a full-screen, full-motion medium when a standard is approved by the International Standards Organization.

Philips and American Interactive Media previously announced that they will market their full-screen Compact Disc-Interactive (CD-I) system in 1991. A Philips official expressed disappointment that the CDTV system was introduced before a standard was set. Consumer confusion could be the result.

• **Laserdiscs grow up.** More than a decade after its introduction, the laserdisc is beginning to approach mass-market status. Sales of discs exceeded 3,500,000 last year, and by midyear at least 16 brands were offering combination CD-laserdisc players or had announced their

intentions to do so. Players are now, or will soon be, available under these brands: Denon, Fisher, Funai, Kenwood, Magnavox, Marantz, Mitsubishi, NEC, Panasonic, Philips, Pioneer, Quasar, RCA, Sharp, Sony, and Yamaha.

• **Video vignettes.** After lagging for three years, sales of projection-TV receivers in the first quarter of 1990 were up 25% from the same period in 1989, and there were forecasts that 1990 would be the first record year for projection TV since 1986.

The picture-tube shortage that plagued the TV industry for the last few years seems to have ended, and an overcapacity of 3,000,000 to 4,000,000 tubes is being forecast for 1992. Companies that have expanded, built, or announced new color-tube plants in the United States since 1988 include Hitachi, Matsushita (Panasonic), Philips, Sony, Thomson (RCA and GE), and Toshiba.

• **Digital VHS audio.** JVC, the leader of Japan's VHS group, has developed a compatible digital soundtrack for VHS recordings. Although the system is at least a year from the market, the company has released specifications, presumably to encourage other VHS manufacturers to go along. The system uses "depth multiplex" recording, which permits video and audio signals to be recorded on different layers of the tape's magnetic coating.

The recorded digital signal doesn't disturb the other soundtracks on the VHS tape—longitudinal mono and AFM stereo. The PCM audio signal uses a 48-kHz sampling frequency and 16-bit quantization, according to JVC. It will be used only on Super VHS recordings; if the technique were used on standard VHS it would overlap the luminance signal and cause interference, said JVC. The signal may be split into four channels for multilingual recording or other purposes.

**R-E**



## ASK R-E

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

### XT TO AT UPGRADE

**I recently upgraded my computer from an XT to an AT clone, and there seems to be some sort of problem with the disk drives. Whenever I try to read a disk from the AT on my XT, I get one of two kinds of errors. The most common one is that lots of read errors show up, but occasionally I can't read the disk at all. I can't even get a directory to show up on the screen. What's going on?—F. Scher, Amsterdam, NJ**

You haven't given me all the particulars of your computers, but I can make a good guess as to the source of the problem. The chances are that you got your AT with a 1.2-MB 5¼ inch drive and your XT has a 360K drive. The two drives look very much alike on the outside, but there's a big difference internally. In order to understand what's causing your first problem, let's talk a bit about the basic difference between the drives.

The original 360K floppies have two sides with 40 tracks each, and each track has nine sectors. The 1.2-MB disks were organized a bit differently to get the increased amount of storage. The high-density disks have 80 tracks on two sides, and each track is divided into 15 sectors. Since you've got twice as many tracks and 60% more sectors, you can store more data on the disk. If you do the arithmetic, you'll see that the numbers work out correctly.

It makes sense that something had to be done to the original drives to allow them to hold so much more information. And it's what was done to the drives that's causing both of your problems.

Disk drives are essentially the same as tape recorders. They have a read/write head, and they record information on magnetic media (the disk surface). When the number of tracks was doubled, the distance between tracks was halved (makes sense), and doing that increased the chances of crosstalk between the tracks.

The problem was solved by reducing the write current on high-density drives. Since the signal was much lower, the unwanted noise from nearby tracks was reduced. In order to read the desired tracks, however, the read gain was also increased. The system worked well (and still does), but it was necessary to change the composition of the recording medium in order to make the system reliable. There's a real, physical difference between 360K and 1.2-MB disks, and each can only be used for its intended purpose.

If you want to use a 1.2-MB drive to write to a 360K disk, you have to use a disk made for 360K operation. Both the number of tracks and the number of sectors can be changed in software. When you issue the command `FORMAT A:/4`, you're telling the software to make the head put forty tracks and nine sectors on the disk—you'll be formatting a 360K floppy disk.

What's causing your problem is that while the software can force the drive to do the correct number of tracks and sectors, it can't do anything about the write current—that's an internal adjustment on the drive and the software can't do a thing about it.

When you write a 360K disk on a high-density drive, the information is going to be correctly organized on the disk but the recorded level will be very low. Since the 360K drive has its read gain set for a higher recorded level, the drive often has trouble reading the disk and that's the first problem you're having.

The second problem you're having—not being able to read the disk at all—is probably because you're trying to read a 1.2-MB floppy in the 360K drive. That can't be done at all.

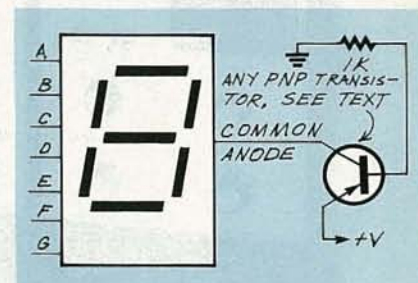
The solution to your problems is through hardware, and the cheapest way to do it is to add a 360K drive to the AT. Adding a 1.2-MB to your XT will undoubtedly mean you'd need a new disk controller as well, and there's no reason to spend the extra cash.

### COMMON-CATHODE DRIVERS

**I'm building a circuit that uses a 4511 to drive a seven-segment LED display. Everything is fine but the chip is designed to drive only common-cathode displays and I have a box of common-anode displays. Is there any way I can use these instead of having to go out and buy a bunch of common-cathode displays? I asked the person in the store about this and he said there was no way it could be done. You're my last hope.—N. Rofe, New Brunswick, NJ**

Although you're not *supposed* to do it, there's *always* a way to do that kind of thing. The person in the store who told you that it was impossible has, in kind words, a very limited imagination.

The 4511 is designed to directly drive a common-cathode display, but using it to drive a common-anode display means that you'll have to add a transistor as shown in Fig. 1. The transistor is working as a simple inverter, and just about any small signal PNP transistor should be able to handle the amount of current you'll need. Re-



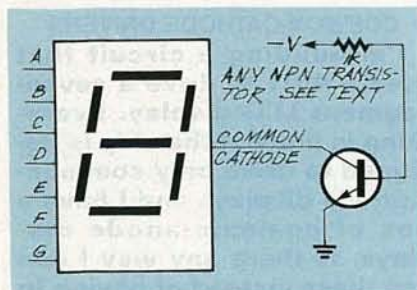
**FIG. 1—THE 4511 IS DESIGNED to directly drive a common-cathode display but, by adding a transistor as shown here, you can use it to drive a common-anode display.**

member the rule: Better to underrate parts than to overrate them.

You may find the schematic shown in Fig. 2 to be useful as well. Even though the 4511 can directly drive a common-cathode display, it has (as do all display drivers) a maximum current that it can deliver at the outputs.

That causes a problem when you try to drive really big displays or even incandescent bulbs.

Putting a transistor at the output switches the burden of powering the display from the chip to the transistor. If you need more current just add a



**FIG. 2—EVEN THOUGH THE 4511 can directly drive a common-cathode display, you may have to add a transistor to the output. That allows you to drive really big displays or even incandescent bulbs.**

chunkier transistor. The solution is really that simple.

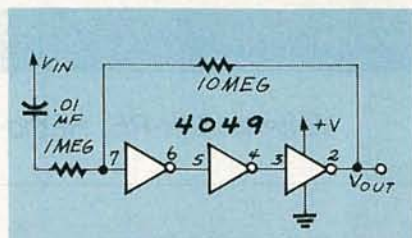
Of course you have to keep in mind that the 4511 is a CMOS part and it can't be expected to deliver enough current to trigger heavy-duty transistors. If you ever want to do something like that, you'll have to build an

intermediate transistor stage to bring the output of the 4511 up to the level of the output transistor. But, for driving standard common-anode displays that typically want a maximum of about 20 mA per segment, that circuit should solve the problem without any difficulty.

**DIGITAL AMPLIFICATION**  
**I've built a circuit to accept data from a temperature sensor but the input signal is a bit too low to go through my A-to-D converter. I don't want to have to add analog circuitry to the design so is there any easy way to amplify the incoming signal with digital IC's?—A. Dolan, Belmar, NJ**

Once upon a time there was no way to do that, but your problem can be solved with the addition of a couple of CMOS inverters. You may have to add an IC to the board but, if you've got three spare inverters around, you can use them.

The 4049 is a good choice for this application since it can handle higher power levels and is perfect to use if you've got to do any sort of voltage



**FIG. 3—The 4049 CAN HANDLE high power levels and is perfect for any sort of voltage translation. The amplifier will give you a gain of 10 with an input impedance of over a megohm.**

translation. As shown in Fig. 3, the amplifier will give you a gain of 10 with an input impedance of over a megohm. It doesn't require any kind of special layouts and should work without a problem. If you add a 4049 remember to do something with the unused inverter inputs.

Although you can easily build the circuit, and it will do the job, I don't understand why you don't build a small single-transistor amp to do the same job. I don't know what the characteristics of your input signal are but I'm sure you could easily design a simple transistor amp to provide the gain you need. **R-E**



**Cut Your Video Servicing Time by 54%\***



**\$3,495 Patented**

**With The Market Proven VA62A Universal Video Analyzer™**

Are you finding it tough to service today's hi-tech VCR and TV circuits? Successful video servicers have told us that, to them, the new technology meant lost profit and troubleshooting grief until they tried the VA62A's time tested, functional analyzing methods. *"The VA62A cuts servicing time and increases profits..."*

\*Based on a nationwide survey of users who reported an average time savings of 54% compared to their previous test equipment.

You can prove it to yourself, in your shop, absolutely risk free—and share in the profits successful video servicing can bring. Call **1-800-SENCORE (736-2673)** and ask about our exclusive VA62A instrument evaluation program. Tech-Tape Video Preview and FREE full line color catalog are also available.

**SENCORE®**  
**3200 Sencore Drive, Sioux Falls, SD 57107**  
**100% American Made**

CIRCLE 180 ON FREE INFORMATION CARD

# 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

ARE-174

**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 # \_\_\_\_\_

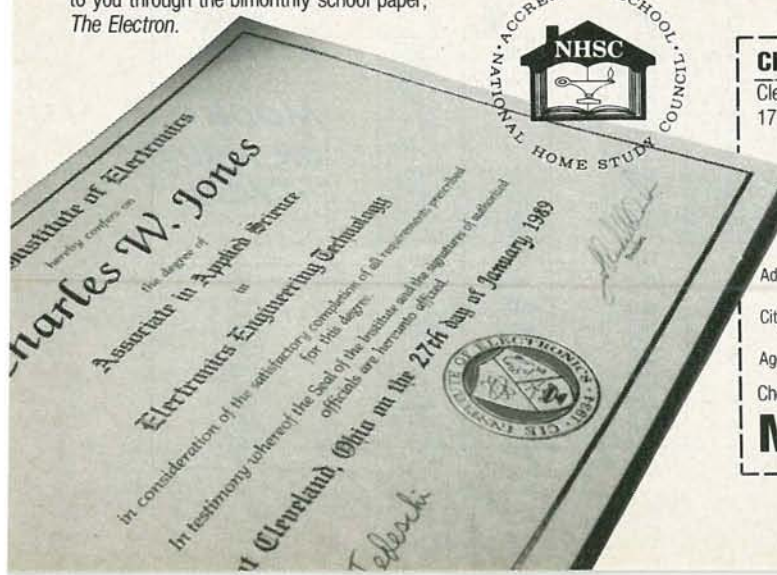
City/State/Zip \_\_\_\_\_

Age \_\_\_\_\_ Area Code/Phone No. \_\_\_\_\_

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

## Mail This Coupon Today!

ARE-174



SEPTEMBER 1990

# LETTERS

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

## DESOLDERING DEVICES

I'm writing in response to Mr. Perdue's letter that appeared in the May 1990 issue of **Radio-Electronics**. (He was responding to a previously published letter that concerned IC removal.) I take extreme exception to his general statement that the use of desoldering braid is "the only one approved by government organizations." I work for a government organization that regards the use of desoldering braid as a last resort! As a matter of fact, the U.S. government approves several methods of both soldering and desoldering components on printed-circuit boards.

One of the approved methods of desoldering IC's is to use a motorized vacuum device, such as a "Pace Kit." Of course, that method requires specialized training, and the cost of such a device would be prohibitive to the average home technician. Next on the list is the mechanical vacuum device, commonly known as the "solder sucker." That item is available at most electronics parts stores. To use it, simply cock it and then heat the joint to be desoldered with a low-wattage iron. As soon as the solder begins to flow, place the tip of the solder-sucker vacuum over, and in physical contact with, the joint, and press the trigger button. When the solder sucker has tripped, remove both the iron and the vacuum immediately. Check the joint to make sure that all the solder was removed. If not, simply repeat the procedure.

A few words of caution: First, use a low-wattage (10-25 watts) soldering iron at all times, to prevent overheating the IC and causing internal damage. A temperature-controlled iron is even better. Next, when working with IC's—particularly CMOS types—always use a ground strap (a metal wrist strap with a detachable ground wire) and connect its wire to ground. That will prevent the dreaded static discharge from destroying your IC or other components on the circuit board. If you don't have a ground strap, discharge yourself on a cold-water pipe or some other type of

ground before starting work. Finally, use a small-diameter pointed or wedge tip on your soldering iron. That helps to heat only the area intended to be heated, and will prevent circuit-board runs from being lifted.

As a last resort, Mr. Perdue's desoldering braid method, as described in his letter, will work. Using either the solder-sucker or the solder-wick method will take some practice, and I, too, would recommend that the novice practice on a junk circuit board to get a feel for either method. That lessens the chance of accidentally destroying a good circuit board or its components.

STEVEN E. SWENTON  
Glen Burnie, MD

## I/O CARD INPUT

I was intrigued by Mark Hanslip's article, "Build This Experimenter's I/O Card" (**Radio-Electronics**, June 1990). I find it amazing that the 8255 PPI, an LSI IC introduced about a decade and a half ago for 8080

systems, is still being used in new designs.

I disagree with the author's statement about Port B when Port A is initialized for mode 2 operation: "Port B is not used at all." Although Port B cannot be initialized for mode 2 operation, it is far from useless. Port B, independent of Port A's mode of operation, can still be used in either mode 0 or 1.

One last thing: The pins of Port C that are not commandeered for use by Ports A and B (when operating in modes 1 and/or 2 for handshaking) are available for use as input or output lines.

JAMES KOVAR  
Lincoln, NE

Fig. 1 goes here

Mr. Kovar has a point. The chart that he provided (Fig. 1) leaves a blank where Port B would be located in relation to mode 2. As I have never needed to use mode 2, the situation has never come up. Thanks, Mr. Kovar, for clearing up that anomaly.

Mode Definition Summary

	MODE 0		MODE 1		MODE 2
	IN	OUT	IN	OUT	GROUP A ONLY
PA <sub>0</sub>	IN	OUT	IN	OUT	↔
PA <sub>1</sub>	IN	OUT	IN	OUT	↔
PA <sub>2</sub>	IN	OUT	IN	OUT	↔
PA <sub>3</sub>	IN	OUT	IN	OUT	↔
PA <sub>4</sub>	IN	OUT	IN	OUT	↔
PA <sub>5</sub>	IN	OUT	IN	OUT	↔
PA <sub>6</sub>	IN	OUT	IN	OUT	↔
PA <sub>7</sub>	IN	OUT	IN	OUT	↔
PB <sub>0</sub>	IN	OUT	IN	OUT	—
PB <sub>1</sub>	IN	OUT	IN	OUT	MODE 0 OR MODE 1 ONLY
PB <sub>2</sub>	IN	OUT	IN	OUT	
PB <sub>3</sub>	IN	OUT	IN	OUT	
PB <sub>4</sub>	IN	OUT	IN	OUT	
PB <sub>5</sub>	IN	OUT	IN	OUT	
PB <sub>6</sub>	IN	OUT	IN	OUT	
PB <sub>7</sub>	IN	OUT	IN	OUT	
PC <sub>0</sub>	IN	OUT	INTR <sub>B</sub>	INTR <sub>B</sub>	I/O
PC <sub>1</sub>	IN	OUT	IBF <sub>B</sub>	OBF <sub>B</sub>	I/O
PC <sub>2</sub>	IN	OUT	STB <sub>B</sub>	ACK <sub>B</sub>	I/O
PC <sub>3</sub>	IN	OUT	INTR <sub>A</sub>	INTR <sub>A</sub> <sup>P</sup>	INTR <sub>A</sub>
PC <sub>4</sub>	IN	OUT	STB <sub>A</sub>	I/O	STB <sub>A</sub>
PC <sub>5</sub>	IN	OUT	IBF <sub>A</sub>	I/O	IBF <sub>A</sub>
PC <sub>6</sub>	IN	OUT	I/O	ACK <sub>A</sub>	ACK <sub>A</sub>
PC <sub>7</sub>	IN	OUT	I/O	OBF <sub>A</sub>	OBF <sub>A</sub>

CAN ALSO BE USED WHEN PA IS MODE 2

OR

The 8255 is truly a great device. It allows for software-configurable hardware. In the past, I have designed interfaces using the 8255 for Apple, Radio Shack, Timex, Decision Mate V, and S-100 computers.  
MARK HANSLIP

### TUBE TALK

While browsing through some old issues of **Radio-Electronics** I came across several letters in the December 1988 issue that dealt with tubes from Russia being imported into this country, and it brought to mind an experience I once had.

At a government auction (where I purchased a couple of pallets of test gear), a well-dressed fellow was bidding on items that I considered to be just so much junk. (After all, they were all full of tubes.) He was picking the stuff up by the ton, while hardly anyone else there showed any interest in it.

When I asked him about his purchases, he told me that he and two other ex-Air-Force pilots had formed their own business. He went around the country to all the government auctions and routed his purchases to a port, where they were loaded onto a ship and sent to Taiwan. One of his partners headed a group there that dismantled all the gear, "even salvaging the pan-head screws." The tubes, considered "choice" items, were re-routed to Europe where they commanded a very high price. (The third ex-pilot handled the European end.)

When I saw those letters about Russian tubes, I couldn't help but wonder: "Does it seem likely that a lot of our own tubes are coming back at us—re-labeled?"

RUSSELL RIESBERG  
Weimar, CA

### ALL ABOUT THX SOUND

In Josef Bernard's June 1990 article, "All About Surround Sound," he gives the mistaken impression that "THX" is "... just quality control for movie sound ..." The THX Sound System was developed by Tom Holman for the main sound-mixing theater at Lucasfilm. It consisted of particular speakers mounted in a special construction behind the screen along with a crossover designed with those elements in mind. Its sound was amazing. Since the vast majority of sound systems in cinemas were outdated, and few could

## 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.  
3540 Wilshire BL. STE. 310  
Los Angeles, CA 90010 Dept. RE

CIRCLE 178 ON FREE INFORMATION CARD

## SUPER LONG PLAY TAPE RECORDERS

12 Hour Model —  
USES D-120 TAPE  
\$119.00\*

Modified Panasonic Stimline, high quality AC-DC provide 6 continuous hours of quality recording & playback for 12 hours total. Includes • Voice level control • Digital counter, etc. TDK D-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\*  
FCC APPROVED

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. Records \$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

# 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 Phillips 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.

CIRCLE 98 ON FREE INFORMATION CARD

SEPTEMBER 1990

13



er it to be quite "awake" in many respects. It clearly has a personality of sorts. It expects my interaction with it to follow certain behavior patterns and complains if I deviate from them. It has a strong instinct toward self-preservation. It stops and asks me if I'm sure before it allows me to reformat its disk memory. Other computers, those that do real-world control applications, are aware of at least some of their surroundings and are able to interact with them. That all suggests a form of awareness that has obviously escaped Mr. Rolph. While he waits for his network to wake up and assault him, Heinlein style, he is sleeping through a revolution in computers.

I applaud Don Lancaster for his imaginative thinking; I have been a follower since the days of the "TV Typewriter." I also applaud **Radio-Electronics**, for providing a forum for him and other innovative thinkers.

PETER A. BARNES  
Cincinnati, OH

### SHARING FREWARE

I have thoroughly enjoyed each of the articles in **Radio-Electronics**; it is one of the few publications that I actually read cover-to-cover. It is also one of the few magazines in my field that contains something I can share with everyone on at work, at any level of expertise. I'm not saying that I agree with everything in its pages, but that it promotes discussion on the art of electronics.

One thing I'd like to share with other **Radio-Electronics** readers is that Linear Technology Corporation is supplying—for free—an improved freeware PSPICE version from Microsim. It provides 28 op-amp models, which model benched data. I don't like to keep lots of inventory in my lab at work or my home workshop. This excellent simulator lets me be certain a circuit does what it should, and if a circuit doesn't work (i.e., an amp oscillates), I can quickly work out the bugs. Impedance matching, feedback, and other work becomes play, because parts values can be swept to cover a range. The freeware simulates a digital storage scope and a digital signal processor.

ROBERT KESSERLING  
Plano, TX

R-E

## 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

**CI E** 4251 CYPRESS DRIVE  
JACKSON, MISSISSIPPI 39212

CIRCLE 58 ON FREE INFORMATION CARD

## New AOR Scanner

**1000 Channels.**  
8-600MHz,  
805-1300  
MHz



### AR1000

Total Price, Freight Prepaid  
(Express Shipping Optional)

**\$499**

- Continuous coverage (except UHF TV 600-805)
- AM, FM and wide band FM tuning modes
- 10 Scan Banks, 10 Search Banks
- Selectable Priority Channel
- Selectable Search Increments, 5-955KHz
- Permanent memory backup
- 25 Day Satisfaction Guarantee. Full refund if not Satisfied
- No Frequencies cut out
- All normal accessories included.
- Size: 6 7/8"H x 1 3/4"D x 2 1/2"W. Wt. 12 oz.

**ACE**  
COMMUNICATIONS

10701 E. 106th St. Indpls., IN 46256  
Toll Free 800-445-7717



Visa and MasterCard  
(COD slightly higher)



FAX (317) 849-8794

CIRCLE 182 ON FREE INFORMATION CARD

# DMM Test Leads That Will Last. At Last.



On the bench or out in the field you're left to your own devices. That's why Pomona has developed 12 different DMM Test Lead Kits. You can reliably attach different probes or clips to the same lead because Pomona's "Pop Jack" coupler holds tight, just like a chinese finger puzzle until you "unlock" it. Silicone insulated wire feels great, won't be burned by the bump of a soldering iron, and stays flexible in cold temperatures.

### Choice Quality, Choice Selection.

These, and a host of other features like field repairability, low-cost slide-on tips, extendable and replaceable probe tips, and a rugged pouch or case to fit in pocket or toolbox, make them the best choice. Someone's finally making test leads that will last. See your nearest Authorized Pomona Distributor or contact

POMONA ELECTRONICS  
1500 E. Ninth St.,  
P.O. Box 2767  
Pomona, CA 91769  
(714) 623-3463  
FAX (714) 629-3317



### FREE 1990 CATALOG!

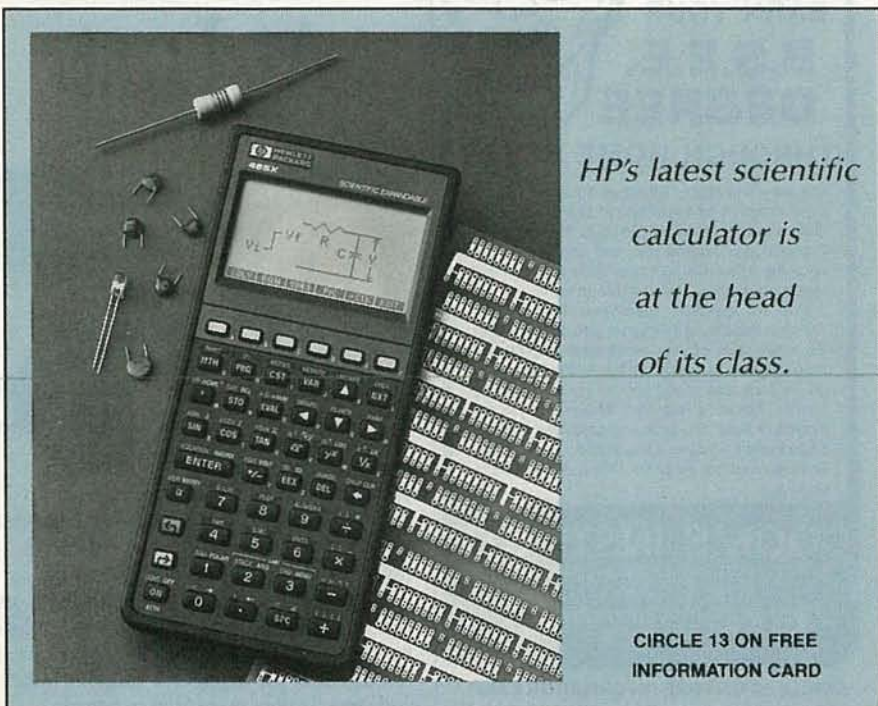
Thousands of test accessories  
and solutions in 138 pages.  
Call or write for your FREE  
copy today!

**ITT Pomona**  
AN ITT EMC WORLDWIDE COMPANY  
*Discover our strengths.*

CIRCLE 101 ON FREE INFORMATION CARD

# EQUIPMENT REPORTS

## Hewlett-Packard 48SX Scientific Expandable Calculator



*HP's latest scientific calculator is at the head of its class.*

CIRCLE 13 ON FREE INFORMATION CARD

September is back-to-school time for many of tomorrow's engineers. It's the time that many students—along with those of us who haven't been students for some time—start looking for the perfect scientific calculator. We may have found that perfect calculator, the HP 48SX from Hewlett Packard (Inquiries manager, Hewlett-Packard Company, 1000 N.E. Circle Blvd., Corvallis, OR 97330).

The calculator, introduced earlier this year, boasts more than 2100 functions. It allows equations to be entered the same way they would be written, and an impressive array of graphics functions lets you plot the equations. An RS-232 interface is available as an option, and an infrared interface is also offered. The standard built-in memory consists of 256K of ROM and 32K of RAM, but plug-in cards allow you to expand memory to 512K of ROM and 288K of RAM.

### Using the 48SX

Without question, the 48SX is the most powerful and advanced hand-

held calculator available. Getting access to all of that power is not always easy because some functions don't work the way you would intuitively expect. Also, the larger than 800-page (!) manual, while excellent on specifics and details, does not give a good overview of what the calculator has to offer. (We would recommend stopping by an HP dealer, who should have a demo disk or RAM card that *does* provide a good overview.)

The HP 48SX offers several impressive and important features. Its *EquationWriter* application allows equations to be entered as you would write them. Its graphics capabilities integrate calculus and graphics functions to find roots, minima and maxima, slopes, area under a curve, etc. A unique *automatic unit management* feature converts unlike units of measurements (148 different units in 16 categories such as force and energy) automatically. An equation-solver function allows you to find the numerical solution to an equation without isolating the dependent variable. For example, if Ohm's law was entered as an equation, you could enter the nu-

merical values of the known variables, and the calculator would solve for the missing one.

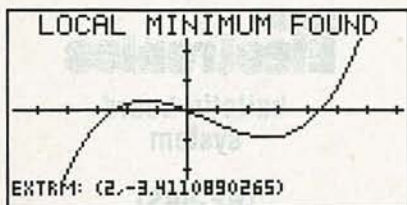
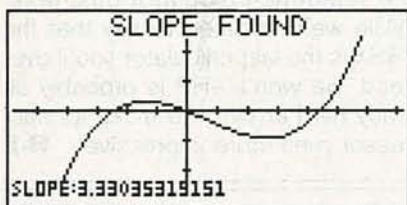
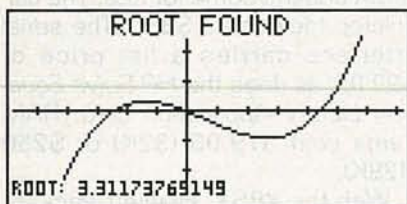
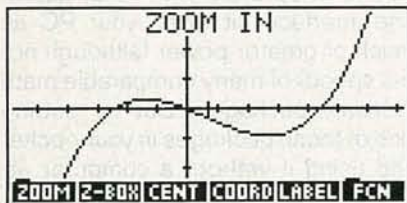
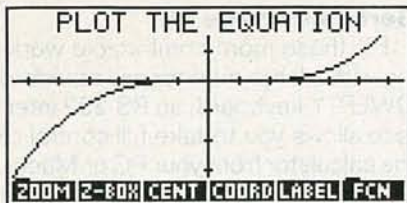
The calculator's keyboard contains 49 keys, most of which perform three or four different functions. Each key's primary function is on the keyface, while its secondary functions are shown in orange, blue, and white legends around the key, and are accessed by using the appropriate shift key. Some secondary functions (lower-case letters, Greek letters, and special characters), which are not shown on the calculator's face, are also available. The top row of keys are "soft" keys—they take on the function shown on the bottom, menu line of the display.

Most mathematical operations are performed by entering arguments on to the *stack* (which is a last-in, first-out sequence of storage locations) and then executing commands to manipulate the stack contents. Although the display can show the contents of up to four stack locations, the actual stack size can be much larger, and is



A SERIAL INTERFACE KIT is available as an option to allow you to link the calculator to a PC or Macintosh so you can take advantage of the computer's storage, printing, and display capabilities.





THE HP 48SX INTEGRATES GRAPHICS AND CALCULUS functions to automatically find roots, intersections, minima and maxima, derivatives, and the like.

limited only by available RAM.

As you might guess, the calculator uses *reverse Polish notation* to solve equations. For example, to find the sum of  $2+2$ , you would enter both addends on the stack, and then perform the addition. The keystrokes would be: "2 <enter> 2 <enter> +." The number 4 would appear at the top of the stack.

Understanding the stack is the key to understanding how to use the calculator. Even when you enter an equation "as you would write it," you cannot solve it, plot it, or do anything else with it until you put it on the stack. Unfortunately, when you do

move the equation onto the stack, it loses its "textbook appearance" and takes on a form more common to computers. That can be disconcerting and confusing until you get used to it—and the learning curve can be a steep one if you've never had any similar experience.

You can name an equation that is stored on the stack. That's helpful because the name can be used to identify an equation that might otherwise be very difficult to recognize once it's moved to the stack—especially if the equation contains integrals.

While the 48SX's built-in functions are impressive, it's important to remember that the calculator can be custom programmed through its built-in programming language. And we've barely mentioned the calculator's built-in functions! The 48SX can handle all sorts of operations with arrays and matrices, statistics, algebra, calculus, logical operations, vectors, complex numbers, and more. It can also produce eight different types of plots from function plots to histograms, and from scatter plots to polar and parametric plots.

## Be an FCC LICENSED ELECTRONIC TECHNICIAN!



Learn at home in spare time. No previous experience needed!

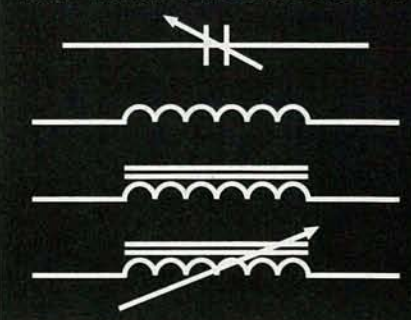
No costly School. No commuting to class. The Original Home-Study course prepares you for the "FCC Commercial Radiotelephone License". This valuable license is your "ticket" to thousands of exciting jobs in Communications, Radio-TV, Microwave, Computers, Radar, Avionics and more! You don't need a college 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 \_\_\_\_\_

## Which symbol represents a variable inductor?



What is the principle disadvantage of neon lights?

What are out-of-phase signals?

## Heath Video Courses speed your learning curve!

Learn basic electronics at home at your own pace with four, 60-minute video tapes. Know the variable inductor symbol. Recognize a PN junction. Understand oscillator fundamentals. Clearly SEE what most basic electronic books can only describe.

**DC ELECTRONICS.** Covers electron movement to troubleshooting and repairing a simple electronic circuit. **EV-3101-A.**

**AC ELECTRONICS.** Follow-up to DC Electronics. Covers the principles of AC, voltage and electrical measurement. Includes motors, generators and test instrument meter movements. **EV-3102-A.**

**SEMICONDUCTORS.** Complete the DC/AC videos and you're ready to learn how semiconductor devices are made, plus the principles of discrete devices, integrated circuits & optoelectronic devices. **EV-3103-A.**

**ELECTRONIC CIRCUITS.** Complete the basic course with amplifier configurations, biasing, coupling, audio amplifiers, closed-loop vs. open-loop operation and more. **EV-3104-A.**

An activity-filled workbook and explanation of how to solve each problem comes with each tape so you learn three ways — video, workbook and hands-on!

**Order today!**  
**Call Toll free,**  
**24-hours a day.**  
**1-800-253-0570.**

We accept VISA, MasterCard, American Express and Heath Revolving Charge card. Use Order Code 601-018.

VIDEO TAPES  
**\$39.95 EACH**

# Heath®

Benton Harbor, MI

Call for a FREE catalog 1-800-44HEATH.

\*Price does not include shipping and handling, or applicable sales tax. ©1990, Heath Company, Subsidiary of 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.

- 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.

**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.**

(Dealers Welcome)

To Order: \$49.95 ea. + \$4 for FAST UPS SHIPPING

**1-800-445-9285 or 516-694-1240**

Visa, M/C, COD M-F: 9-6 (battery not included)  
SCO ELECTRONICS INC.

Dept. CBY9 581 W. Merrick Rd. Valley Stream NY 11580  
Unconditional 30 days Money Back Guarantee

CIRCLE 190 ON FREE INFORMATION CARD

## CABLE TV DESCRAMBLER



	1 Unit	10 +
Jerrold S.B. ....	\$74	.....\$55
Jerrold SB w/Trimode.....	\$90	.....\$70
Oak N-12 (w/VS).....	\$89	.....\$65
Scientific Atlanta.....	\$109	.....\$75
Pioneer.....	\$109	.....\$75
Panasonic converter.....	\$98	.....\$79
73 channel converter.....	\$79	.....\$59

**We Beat Anyone's Price!**

**30 Days Money Back Quaranty**

**Free Catalog**

Visa, M/C, COD or send money order to:

**US Cable TV Inc.** Dept. KCT9

4100 N.Powerline Rd., Suite F-4

Pompano Beach, Fl 33073

**1-800-445-9285**

Please have make and model number of the equipment used in your area ready.

**No Florida Sales!**

It's not the intent of US Cable TV Inc. to defraud any pay TV operator and we will not assist any company or individual in doing so.

CIRCLE 191 ON FREE INFORMATION CARD

## Equation Library

Hewlett-Packard calls the 48SX an expandable calculator. One way it can be expanded is with plug-in cards, such as the *HP Solve Equation Library Applications Card*, which contains more than 300 science and engineering equations. The library's main menu contains such entries as ELECTRICITY, FLUIDS, HEAT TRANSFER, OPTICS, OSCILLATIONS, and SOLID STATE DEVICES. Each main entry contains sub-entries and equations, and in some cases, pictorial representations.

The equation library also contains a library of constants. Avogadro's number, Planck's constant, and the rest mass of an electron are among the 40 physical constants in the library (in both SI and English units).

A periodic table is available, as are various financial applications. And of course, things wouldn't be complete without a game of some sort. *Minehunt* should provide a pleasant diversion for both the bored and the frazzled engineer.

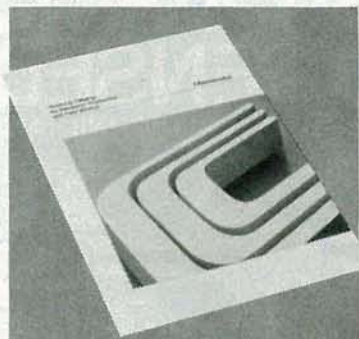
Although the equation library is the only currently available ROM card, HP does plan to introduce special cards to customize the HP 48SX for specialized applications.

## Serial interface kit

For those more comfortable working with a large monitor and standard QWERTY keyboard, an RS-232 interface allows you to take full control of the calculator from your PC or Macintosh. Programs, plots, and data can be stored on disks—a convenient way to swap them with other users. The interface kit gives your PC as much or greater power (although not the speed) of many comparable math software packages. But try putting one of those packages in your pocket and using it without a computer attached!

Of course, the power of the HP 48SX doesn't come for free. The calculator itself costs \$350. The serial interface carries a list price of \$99.95, as does the *HP Solve Equation Library Application card*. RAM cards cost \$79.95 (32K) or \$250 (128K).

With the 48SX, Hewlett-Packard maintains its leadership position in the scientific-calculator business. While we're inclined to say that the 48SX is the last calculator you'll ever need, we won't—HP is probably already hard at work to make its successor even more impressive. **R-E**



## CHEMICAL SOLUTIONS

**FREE CHEMTRONICS CATALOG!**

Comprehensive new source for over 200 products used in electronic manufacturing and field service. E-Series products are CO<sub>2</sub> 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

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.

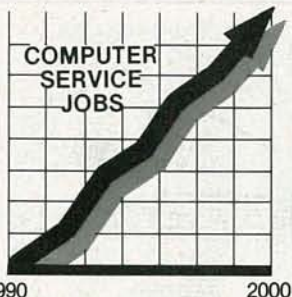
Leave your comments on R-E with the SYSOP.

**RE-BBS  
516-293-2283**

# 5 sure steps to a fast start as a high-paid computer service technician

## 1. Choose training that's right for today's good jobs

Jobs for computer service technicians will almost double in the next 10 years, according to the latest Department of Labor projections. For you, that means unlimited opportunities for advancement, a new career, or even a computer service business of your own.



But to succeed in computer service today, you need training—complete, practical training that gives you the confidence to service any brand of computer. You need NRI training.

Only NRI—the leader in career-building, at-home electronics training for more than 75 years—gives you practical knowledge, hands-on skill, and real-world experience with a powerful AT-compatible computer you keep. Only NRI starts you with the basics, then builds your knowledge step by step until you have everything you need for a fast start as a high-paid computer service technician.



## 2. Go beyond "book learning" to get true hands-on experience

NRI knows you learn better by doing. So NRI training works overtime to give you that invaluable practical experience.

You first read about the subject, studying diagrams, schematics, and photos that make the subject even clearer. Then you do. You build, examine, remove, test, repair, replace. You discover for yourself the feel of the real thing, the confidence gained only with experience.

## 3. Get inside a powerful computer system

If you really want to get ahead in computer service, you have to get inside a state-of-the-art computer system. That's why NRI includes the powerful new West Coast 1010 ES computer as the centerpiece of your hands-on training.

As you build this fully IBM AT-compatible micro from the keyboard up, performing key tests and demonstrations at each stage of assembly, you actually see for yourself how every section of your computer works.

You assemble and test your computer's 101-key "intelligent" keyboard, install the power supply and 1.2 meg 5¼" floppy disk drive, then interface the high-resolution monitor. But that's not all.

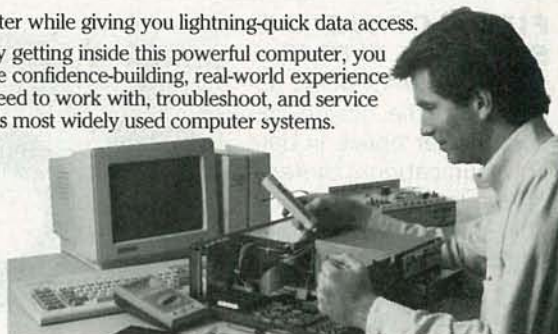
You go on to install a powerful 20 megabyte hard disk drive—today's most-wanted computer peripheral—included in your training to dramatically increase the data storage capacity of your



Now—  
AT Compatible!

computer while giving you lightning-quick data access.

By getting inside this powerful computer, you get the confidence-building, real-world experience you need to work with, troubleshoot, and service today's most widely used computer systems.



## 4. Make sure you've always got someone to turn to for help



Throughout your NRI training, you've got the full support of your personal NRI instructor and the entire NRI technical staff. Always ready to answer your questions and help you if you should hit a snag, your instructors will make you feel as if you're in a classroom of one, giving you as much time and personal attention as you need.

## 5. Step into a bright new future in computer service—start by sending for your FREE catalog today!

Discover for yourself how easy NRI makes it to succeed in computer service. Send today for NRI's big, 100-page, full-color catalog describing every aspect of NRI's one-of-a-kind computer training, as well as training in robotics, TV/video/audio servicing, electronic music technology, security electronics, and 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. AT & IBM are registered trademarks of International Business Machines Corp.



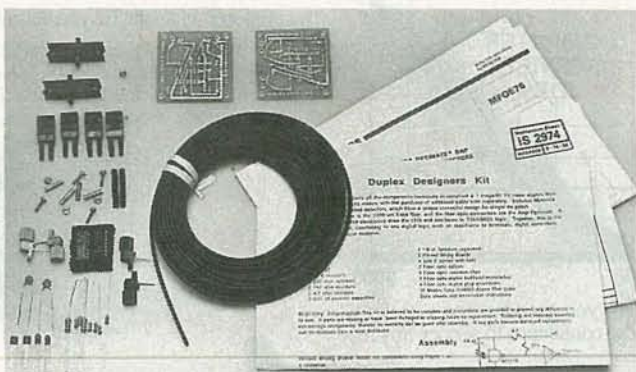
<b>NRI</b> School of Electronics McGraw-Hill Continuing Education Center 4401 Connecticut Avenue, NW, Washington, DC 20008	For career courses approved under GI Bill <input type="checkbox"/> check for details.
	<input type="checkbox"/> CHECK ONE CATALOG ONLY <input type="checkbox"/> Computers and Microprocessors <input type="checkbox"/> Robotics <input type="checkbox"/> TV/Video/Audio Servicing <input type="checkbox"/> Telecommunications
Name _____ Address _____ City _____ State _____ Zip _____	
Accredited Member, National Home Study Council	

# NEW PRODUCTS

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

## FIBER-OPTIC DESIGNER'S KITS.

Providing a learn-by-doing approach to the design and use of fiber optics in data communications, *Sintec's Fiber-Optic Kits* are available in both simplex and duplex versions, for single or bi-directional links. No previous training or experience is needed to complete these hands-on courses. Each contains all the components required to construct a 10-meter data link, which can be extended to 60 meters with optional extension packages. The link operates off a single +5-volt power supply and interfaces to all TTL/CMOS logic devices. Each kit contains fiber-optic emitter(s), detector(s), printed wiring board(s), all necessary electronic components, and 10 meters of



CIRCLE 15 ON FREE INFORMATION CARD

either simplex or duplex cable. The fiber-optic connections for interfacing to the emitter, the detector, and two bulkheads are also included, along with a fiber-optic splice. The connections are made from a dry, non-polished interface that is easy to handle and requires no special tools. The parts are packaged in an impact-resistant plastic

box, which also contains assembly and fiber-termination instructions.

Prices for the fiber-optics designer's kits range from \$59.95 to \$89.95, depending on the version and the length.—**Sintec Company**, 28 8th Street, P.O. Box 410, Frenchtown, NJ 08825; Tel. 201-996-4095; Fax 201-996-3891.

## DIGITAL/ANALOG MULTIMETER.

Sporting both 3¼-digit and linear bar-graph readouts for measurement display to 4,000 counts, *B&K-Precision's* model 2919 handheld digital/analog multimeter is designed for situations where the accuracy of a digital readout and the responsiveness of an ana-

log display are needed. The 41-segment bar graph, which is updated 20 times per second to follow changing values, simplifies peaking or level adjustments. "Data hold" immediately freezes the displayed digital reading, and "peak hold" holds the highest digital value obtained during a measurement, while "min/max" memory stores the lowest and highest reading observed.

The model 2912 also offers selectable auto- or manual ranging; measurement of voltage, current, and resistance; diode check; and an audible continuity check. Additional functions include capacitance measurement up to 40 mF and frequency to 400 kHz. The meter is

rated at 0.3% accuracy on DC volts, and spans 40 ranges, including the frequency counter and capacitance functions. It is well-protected against reverse polarity and overloads, and features high-energy fusing to protect the  $\mu\text{A}/\text{mA}$  current ranges.

The 2912 handheld analog/digital multimeter costs \$149.00.—**B&K-Precision**, Division of Maxtec International Corporation, 6470 West Cortland Street, Chicago, IL 60635; Tel. 312-89-9087.

## COAXIAL ADAPTER KIT.

*Pomona's* Model 5698 *Universal Adapter Kit* allows lab workers, field-service/installation technicians, and designers to quickly "mix and match" al-

most any combination of coaxial end termination styles, including banana plugs. The specially assembled kit allows users to make their own adapter combinations, such as SMA to BNC, or BNC to double banana plugs for connecting coax to instruments. The kit includes two male and two female of each the following: BNC, TNC, SMA, and "N" adapters. Four intermediate coupling nuts, one double banana plug, and one double banana jack/binding post round out the assortment.

Each of the double-banana jack/plug adapters are fitted with an integral coupler to accept any threaded coaxial connector. Individual connectors can be joined with a coupling nut to any other



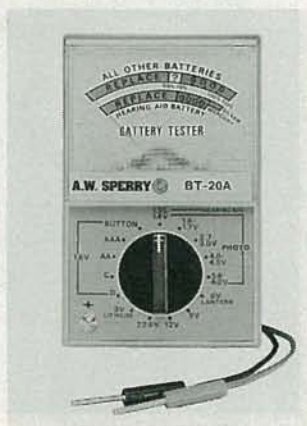
CIRCLE 17 ON FREE INFORMATION CARD

to make the required coaxial assembly. The high-quality adapters, which come equipped with gold-plated center pins and silver-plated bodies, are packaged in a convenient reusable plastic case.

The model 5698 *Universal Adapter Kit* costs \$99.00.—**ITT Pomona Electronics**, 1500 East Ninth Street, P.O. Box 2767, Pomona, CA 91769; Tel. 714-623-3463, Fax 714-629-3317.



CIRCLE 16 ON FREE INFORMATION CARD



CIRCLE 18 ON FREE INFORMATION CARD

**BATTERY TESTER.** A quick, inexpensive means to determine the condition of a wide variety of batteries is provided by the *BT-20A Battery Tester* from *A.W. Sperry*. The compact, handheld instrument can be used to test all popular batteries from 1.25- to 22.5-volts DC—including hearing-aid batteries; "AAA," "AA," "C,"

and "D" cells; 6-volt lanterns; 3-volt lithium batteries; and 5.6- to 6-volt photo cells. The rugged tester is reliable and easy to use, and comes with a one-year warranty.

The model *BT-20A* battery tester costs \$15.95.—**A.W. Sperry Instruments Inc.**, 245 Marcus Boulevard, Hauppauge, NY 11788; Tel. 516-231-7050.

**HANDHELD LOGIC ANALYZER.** Intended as an affordable alternative to multiple logic probes, *Global Specialties'* model *LM-8* TTL logic analyzer has trigger word recognition that allows to it be used in place of more complex logic analyzers for troubleshooting 8-, 16-, and 32-bit microprocessor circuits. The *LM-8* has eight input channels, an external clock input, and an oscilloscope trigger out-

put. The number of channels can be expanded to as many as 32 by linking four pods together and triggering from a 32-bit trigger word. The captured data can be displayed by the built-in LED's or on an oscilloscope. Each channel's trigger can be set to 0, 1, or "don't care." The logic status of each channel is continuously displayed on the LED's. Pulse stretching allows high-frequency or short-duration pulses to be viewed. The maximum

clock frequency is 25 MHz, with pulses as narrow as 10-ns wide being captured and displayed.

The *LM-8* provides two operating modes: *RUN* and *TRIGGERED*. In the *RUN* mode, the data is continuously updated every time the trigger word is recognized. In the *TRIGGER* mode, the data is captured and displayed until the trigger word is recognized, at which time the analyzer is halted and the last data held.

The *LM-8* handheld logic analyzer, complete with grabber leads for each data channel, costs \$249.95.—**Global Specialties**, 70 Fulton Terrace, New Haven, CT 06512; Tel. 1-800-572-1028.



CIRCLE 19 ON FREE INFORMATION CARD

**MULTIMETER LEADS.** Silicon-rubber multimeter leads from *Test Probes, Inc.* remain soft and flexible even under conditions of

## OEI OPTOELECTRONICS

The only name in HANDI-COUNTERS



Model	UTC3000	2600H	2210A	1300HA
Function	Freq. Period Ratio, Interval, Avg. Prescale	Frequency	Frequency	Frequency
Range	10Hz-2.4GHz	10MHz-2.4GHz	10Hz-2.4GHz	1MHz-1.3GHz
Display	10 Digit LCD w/Function Annunciators	10 Digit LCD	8 Digit LED	8Digit LED
RF Signal Strength Indicator	16 Segment Adjustable Bargraph	16 Segment Adjustable Bargraph	•	•
Price	\$375.	\$325.	\$239.	\$179.

Sensitivity: <1 to <10mV typical. Time Base: ± 1ppm., ± 5ppm. add \$75. LED Models: ± .2ppm add \$80. - LCD Models. Nicads & AC charger adapter included. Carry Case, Antennas and Probes extra. One year parts & labor warranty on all products.



### Check These Incredible Features On The All New UTC3000

- **10Hz to 2.4GHz Range.**  
Simply amazing!
- **10 Digit LCD Display.**  
1Hz resolution to over 150 MHz direct. Readable in bright sunlight.
- **RF Signal Strength Bargraph.**  
16 Segment, Zero, & Full Scale adjustment. SEE the input signal!
- **Super Sensitivity.** <1mV 10-200MHz, <5mV to 2GHz for efficient antenna pickup.
- **6 Functions.** Frequency, Period, Ratio Time Interval, Average, & Prescale.
- **Hold Button.**  
"Locks in" your exact Measurement FAST!
- **Extruded Aluminum Enclosure.**  
Designed to fit every hand.
- **Priced Right! Only \$375.**  
Includes Nicads, AC Charger/Adapter. Or Select Our Most Popular **HANDI-COUNTER**, the model **2210A** that set the standard in handheld frequency counter technology! **Value Priced at only \$239.**

Professionals and Hobbyists all over the world have chosen OEI for 16 years! **Shouldn't YOU?**

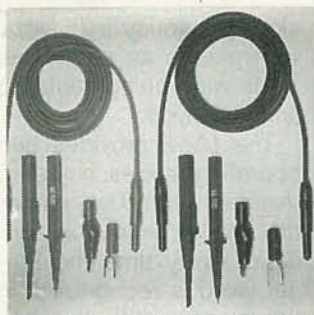
**HANDI-COUNTERS!** ...Only from OEI! Choose the model that fits your needs... and your budget! **CALL NOW!**

**Toll Free Order Line: 1-800-327-5912** FL(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.  
In FL add 6% sales tax. Full-line Product and Accessory Catalog available on request.



CIRCLE 184 ON FREE INFORMATION CARD

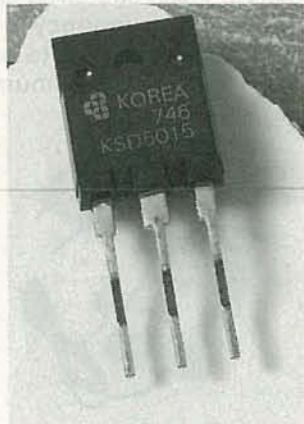


CIRCLE 20 ON FREE INFORMATION CARD

extreme cold. The *TLS2000* owes its flexibility to the fine silicon wires in the cable. It fits all makes of analog and digital multimeters that are equipped with standard 4-mm input jacks. Offered in straight or right-angle plug versions, with an array of interchangeable accessories available, the leads are suitable for a wide variety of measurement applications. Their low contact resistance facilitates accurate measurements of low voltages and resistances.

The *TLS2000* multimeter leads cost \$30.00.—**Test Probes, Inc.**, 9178 Brown Deer Road, San Diego, CA 92121; Tel. 619-535-9292.

**PRE-ISOLATED POWER TRANSISTORS** For use in color monitors, power supplies, and high-voltage switching applications, *Samsung* is offering pre-



CIRCLE 21 ON FREE INFORMATION CARD

isolated bipolar power transistors in TO-3PF packages that simplify mounting procedures. The isolated packages offer better EMI control for ungrounded heat sinks, require less mounting hardware, and are cost effective. The power transistors can handle 1500-volt collector-base voltage. The devices have a 5,000-volt isolation rating, eliminate bushings and isolation pads, and have no exposed metal surfaces other than the leads.

The pre-isolated power transistors have excellent thermal characteristics when mounted to a heat sink and an industry-standard footprint. The devices are built with special oversized lead frames for good heat-spreading performance. A thin, tightly controlled thermal epoxy over a back-mounting surface further improves their heat-spreading capabilities.

Eight devices—*KSD5010-KSD5017*—are available. When ordered in quantities between 100 and 999, the prices range from \$1.55 to \$2.10 each.—**Samsung Semiconductor**, 3725 North First Street, San Jose, CA 95134-1708; Tel. 408-434-5400.

**DIGITAL CLAMP METER.** Four advanced digital clamp meters introduced by *C.G. Instruments* have 3¾-digit displays and offer up to 4,000 counts. All four meters are UL listed and have rugged, drop-proof enclosures. They feature large clamping jaw openings to allow easy measurements of cables and bus bars up to 2.95 inches in diameter.

The *Soar 632 AC Clamp Meter* (shown in photo) has a basic accuracy of ±1%, provides 3200 counts, and has an analog bar-graph indicator. Its features include auto and man-



CIRCLE 22 ON FREE INFORMATION CARD

ual range select, data-hold function, audible continuity test, and low power consumption. The *632* measures AC current to 1000 amps in two ranges, AC volts to 630 volts in two ranges, AC/DC volts up to 630 volts, and ohms to 3.2 Kohms in two ranges. The *Soar 641* and *Soar 642* each provide 4000 counts and feature an analog bar-graph indicator, data hold, peak hold, max hold, averaging functions, and diode-audible continuity test capabilities.

The meters measure AC to 1000 amps in three ranges, AC/DC volts to 630 volts in three ranges, ohms to 4 Kohm in two ranges, frequency from 20 Hz to 999.9 Hz with 0.1 Hz resolution, and temperature from -50° to +130°C. The model *641* has an average-type sensing mode; the *642* offers true RMS. The fourth instrument in the group is the *Soar 643*, a true RMS, multifunction, AC/DC current clamp meter with 4000 count that measures AC/DC current to 1000 amps as well as all the features of the models *641* and *642*.

List prices for the digital clamp meters start at \$124.95.—**C.G. Instruments Corp.**, 434 Windsor Park Drive, Dayton, OH 45459; Tel. 513-434-6952; Fax 513-434-7643. R-E

## LEARN TO BUILD & PROGRAM COMPUTERS WITH THIS KIT!

INCLUDES ALL PARTS, ASSEMBLY & LESSON MANUAL



MODEL  
MM-8000  
\$129.00

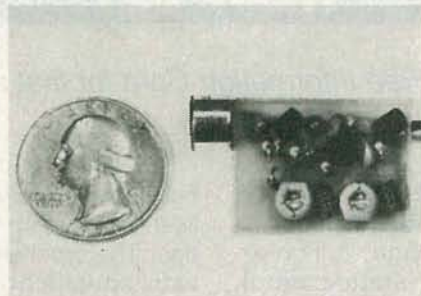
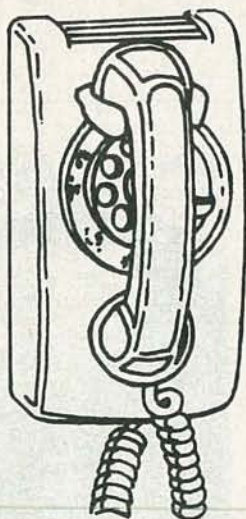


Starting from scratch you build a complete computer system. Our Micro-Master® trainer teaches you to write into RAMs, ROMs and run a 8085 microprocessor, which uses the same machine language as IBM PC. You will write the initial instructions to tell the 8085 processor to get started and store these instructions in permanent memory in a 2816 E² PROM. 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. ADD 5% For Shipping.

**C&S SALES INC.** (800) 292-7711  
1245 Rosewood, Deerfield, IL 60015 (312) 541-0710  
15 Day Money Back Guarantee Write For Free Catalog

CIRCLE 109 ON FREE INFORMATION CARD

# Radio-Electronics mini-ADS



**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



**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

## 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.

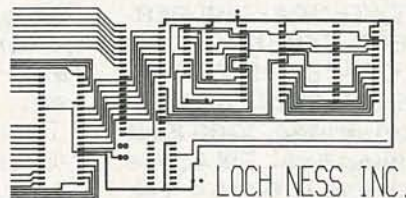
FAX: 516-293-3115



**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

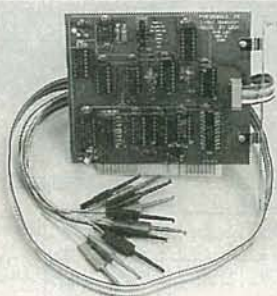
## ONE HOUR PROTOTYPING



LOCH NESS INC.

**1 HOUR PROTOTYPING!!** Develop Multi-layered Printed Circuit Boards in Less than 1 Hour with the New Loch Ness Quick-circuit Kit! Process is Patent Pending. No dangerous UV lights! No hole drilling! No mistakes! Kit comes with everything to make 216 sq. inches of PCB. Money back guarantee. Send **\$65.00** to **LOCH NESS, INC., 3700 Colfax Avenue South, Minneapolis, MN 55409. 1-800-323-8623.**

CIRCLE 193 ON FREE INFORMATION CARD



**LOW COST PC LOGIC ANALYZER.** Designed for students and hobbyists working with 5V TTI/CMOS signals in the Khz range. 36" data cable—eight channels, external clock, ground. Selectable trigger & clock edge, internal clock (1Hz-100Khz). Full-featured software, state table graphics, file/print utilities, etc. Over 100,000 samples/sec on 12 Mhz AT. LA1—**\$99.95**. **PHOTRONICS, INC. 109 Camille St., Amite, LA 70422 (504) 222-4146.**

CIRCLE 199 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 ¼ 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

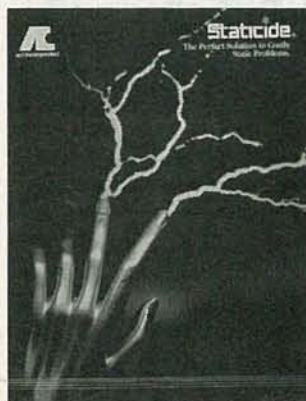


**GET YOUR RECHARGE CATALOG FREE...EARN BIG \$\$ IN YOUR SPARE TIME**—All supplies and Do-It-Yourself kits with complete instructions available. Supplies cost from **\$9.95** in qty and you can sell recharged toner cartridges for **\$40.00 to \$55.00** each. Printers include HP LaserJet and Series II, Apple LaserWriter, QMS, etc. Canon PC-25 Copier also. **CHENESKO PRODUCTS, 62 N Coleman Rd., Centereach, NY 11720, 516-736-7977, 800-221-3516, Fax: 516-732-4650**

CIRCLE 183 ON FREE INFORMATION CARD

# NEW LIT

Use the Free Information Card for fast response.



CIRCLE 23 ON FREE INFORMATION CARD

**STATICIDE: THE PERFECT SOLUTION TO COSTLY STATIC PROBLEMS. ACL Incorporated, 1960 East Devon Ave., Elk Grove Village, IL 60007; Tel.**

**708-981-9212; fax 708-981-9278; free.**

This 8-page, full-color catalog of static-control products features *Staticide* liquids, wipes, floor finish, electrostatic locators, work-surface cleaners, and surface-resistivity meters. New products include lint-free wipes, dual-tipped foam swabs, and the *Tech Essentials* cleaning kit line.

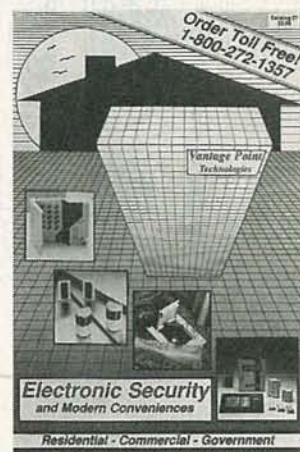
**CORDLESS TELEPHONE BATTERIES. Power Pak, Inc., 6216 Oakton Street, Morton Grove, IL 60053; Tel. 1-800-637-2212; free.**

This guide to replacement batteries for cordless telephones is written to

help the user make an intelligent, well-informed selection. The brochure is filled with specifications and complete cross-reference material, along with other information about replacement batteries.



CIRCLE 24 ON FREE INFORMATION CARD



CIRCLE 25 ON FREE INFORMATION CARD

**ELECTRONIC SECURITY AND MODERN CONVENIENCES. Vantage Point Technologies, 630 Nordahl Road, Suite P9, San**

## CRAMOLIN® DeOxidizer

DEOXIDIZES • CLEANS • PRESERVES • LUBRICATES • IMPROVES CONDUCTIVITY

For All Metals, Including Gold!

CRAMOLIN® DeOxidizer... is a fast-acting deoxidizing solution that cleans, preserves, and lubricates all metal surfaces including gold.

When applied to metal contacts, connectors and other metal surfaces, CRAMOLIN® DeOxidizer removes resistive oxides and forms a protective molecular layer that adheres to metal surfaces, preventing future oxidation. CRAMOLIN® DeOxidizer maintains maximum electrical conductivity, reduces wear, and has excellent migration properties.

### IDEAL FOR:

- Switches & Relays • Connecting Cables & Adaptors
- Edge Connectors • Terminal Strips • Plugs & Sockets
- Gold Plated Connectors • Potentiometers • Battery Contacts

### USED BY THOSE WHO DEMAND THE BEST:

- Bell & Howell • Capitol Records • Dolby Laboratories
- Hewlett Packard • John Fluke Mfg. • McIntosh Labs
- MCI (Sony) • Motorola • NASA • Nakamichi
- RCA • Switchcraft



P. O. Box J • Escondido, CA 92025-0051  
(619) 743-7143 • FAX: (619) 743-2460



- Economical/ Long Lasting
- Ozone Safe Propellants
- Operates in Any Position
- Contents Completely Dispensed
- Uniform Spray Pattern

## 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	14(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**



**Marcos, CA 92069;**  
**Tel. 800-272-1375 or**  
**619-565-1863; free.**

Electronic security systems and accessories designed for do-it-yourself installations are described in a clear, easy-to-understand style in this 32-page catalog. The brochure covers a broad range of high-tech systems for residential, commercial, and government needs—ranging from no-wire home alarms to state-of-the-art computer-based building-management system. Some of the products described include burglar-alarm systems, motion detectors, glass protection, switches, fire detectors, sirens, vehicle alarms, notification systems, CCTV, and building-access systems, along with special tools and books. Helpful installation and product tips are provided throughout the catalog. R-E

## 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 original parts.

902 PC Board.....9.95  
Original 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.

CD22402E.....12.95  
Video sync IC (IC-9)

**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.

**58 Channel  
Cable TV Converter** with infra-red remote .....\$69.95  
Re-Manufactured Jerrold 400 with new remote. Channel 3 output.  
Compatible with all External Descramblers.

**CALL TOLL FREE 1-800-332-3557**

Outside USA Call 1-508-699-6935

Visa, MasterCard and COD. Free Catalog.  
Add \$4.00 S&H, \$6.50 Outside USA.  
D & D Electronics, Inc. PO Box 3310, N. Attleboro, Ma. 02761

VISA

MC

CIRCLE 194 ON FREE INFORMATION CARD

# VALUE PRICING ON B&K PRECISION **SAVE!**

### 20 MHz DUAL-TRACE OSCILLOSCOPE

1 mV/div sensitivity • 20MHz response at a true -3dB • AUTO/NORM triggered sweep operation with AC, TVH, TVV and Line coupling • Calibrated 18-step timebase with x10 magnifier • X-Y operation • Built-in calibration source • Bright, sharp CRT with P31 phosphor • Tilt stand and soft handle. Includes Probes. Model 2120

Reg. \$549  
**\$397<sup>50</sup>**

### 20 MHz DUAL-TRACE DELAYED SWEEP SCOPE

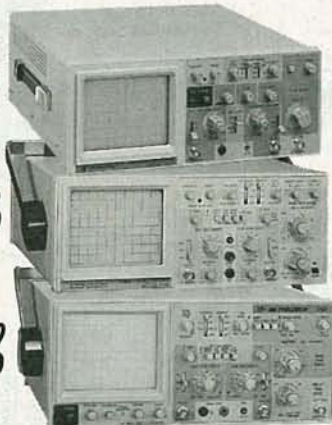
1 mV/div sensitivity • Delayed sweep in 18 ranges • Built-in component tester for capacitors, inductors, diodes, transistors, zener diodes • 20MHz response at a true -3dB • AUTO/NORM triggered sweep operation with AC, TVH, TVV and Line coupling • Calibrated-20 step timebase with x10 magnifier • X-Y operation • Built-in calibration source • Bright, sharp CRT with P31 phosphor • Tilt stand; soft handle. Probes incl. Model 2125

Reg. \$646  
**\$525<sup>00</sup>**

### 60 MHz DUAL-TRACE DUAL TIME BASE SCOPE

1 mV/div sensitivity • sweep to 5 ns/div • 22 calibrated ranges — main time base • 19 calibrated ranges — delayed time base • 12kV accelerating voltage • Signal delay line • Beam finder • V mode • Component tester • Channel 1 output, Z axis input • X-Y operation • Single sweep. Probes included. Model 2160

Reg. \$1099  
**\$888<sup>00</sup>**



**FULL 3-YEAR  
WARRANTY ON  
ALL B&K SCOPES**  
from  
**JOSEPH ELECTRONICS**

**BONUS VALUE!**  
EXTRA UNIVERSAL SWITCHABLE  
SCOPE PROBE **\$19<sup>00</sup>**

Only with B&K Scope purchases. Limit 2 per scope.

3-position — 1x, ref, 10x •  
Risettime less than 1.5 nsec •  
Excludes interference even on  
most sensitive ranges • Rugged;  
withstands heat, humidity •  
Universal for all scopes.



**\$39 Value**

### HAND-HELD 3 1/2 DIGIT LCD 'TEST BENCH' MULTIMETER

41 voltage ranges • Measures AC & DCV with 0.5% DCV accuracy • DC & AC currents: 200  $\mu$ A to 20A • Resistance 0.1  $\Omega$  to 2000 M $\Omega$  • Frequency 20 kHz to 200 kHz • Capacitance up to 20pF • Logic Level (TTL) • Transistor gain • Diode junction test • Drop-resistant case • Tilt stand. Model 388-HD

**OUR BEST  
PRICE EVER** Reg. \$129  
**\$108<sup>50</sup>**

### DUAL TRACE DIGITAL/ANALOG STORAGE SCOPE

20 MHz analog bandwidth • 10MS/s sampling rate • 2k memory per channel • 20MHz equivalent time sampling • Pre-trigger capture. Probes included.

Reg. \$995  
Model 2522  
**\$848<sup>00</sup>**

### 100 MHZ 3-TRACE DELAYED SWEEP SCOPE

1 mV/div sensitivity • Sweeps to 2ns/div • 23 calibrated ranges; 20 on delayed time base • Calibrated delay time multiplier • Signal delay line • 19kV accelerating voltage • V mode triggering • Channel 1 output. Probes included.

Reg. \$1645  
Model 2190  
**\$1325<sup>00</sup>**

### 0-30V DC 0-3A POWER SUPPLY

Low ripple • Regulated constant volt or current outputs • 2 current ranges • Isolated output — float, ground either polarity • Overload, reverse polarity protection • Parallel, series capability. 1-year warranty.

Reg. \$489  
Model 1630  
**\$248<sup>00</sup>**

### 0-16V DC 0-10A POWER SUPPLY

Continuously variable voltage & current • Constant-voltage & constant-current modes • Voltage & current analog meters • 2A and 10A current range limits. 1-year warranty.

Reg. \$489  
Model 1646  
**\$398<sup>00</sup>**

### 0-150V AC 2A POWER SUPPLY

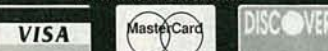
Variable isolated 0-150 VAC, 2 amp continuous output • Voltage or current display • Isolation transformer eliminates shock hazard. 1-year warranty.

Reg. \$239  
Model 1653  
**\$188<sup>00</sup>**

CALL TOLL-FREE - SAME-DAY SHIPPING

Add \$7.50 Shipping and Handling for each unit ordered. IL Residents add 7% Sales Tax

**Joseph ELECTRONICS** 1.800.323.5925  
8830 N. Milwaukee Av. Niles, IL 60648 • 708-297-4200 FAX 708-297-6923



Call or write for our 528 pg. Catalog. Only \$4.95 — FREE with order.

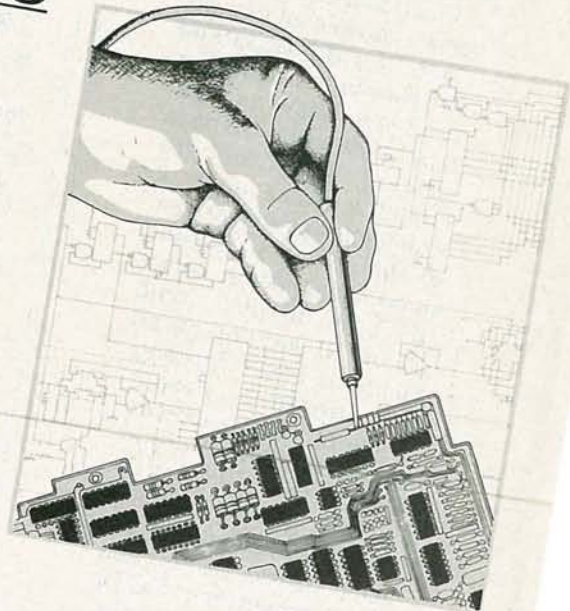
CIRCLE 192 ON FREE INFORMATION CARD

SEPTEMBER 1990

27

# SELECT 5 BOOKS for only \$4<sup>95</sup>

(values to \$130.70)  
and get a **FREE Gift!**



2707 \$26.95  
Counts as 2



2883P \$17.95



3195 \$28.95  
Counts as 2



3157 \$25.95  
Counts as 2



2613P \$17.95



3205 \$24.95



2980P \$19.95



1625P \$22.95



1367P \$24.95



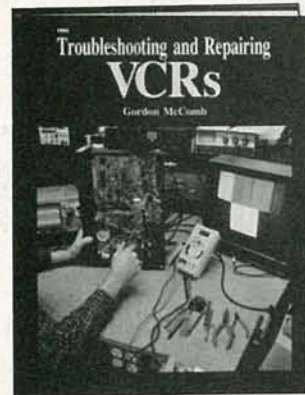
2826P \$16.95



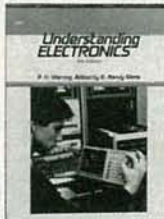
3234P \$15.95



9244P \$18.95



2960 \$27.95  
Counts as 2



3044P \$11.95



3219 \$27.95  
Counts as 2



2898 \$23.95



3285 \$25.95  
Counts as 2



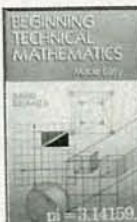
3445 \$21.95



3312 \$23.95



2800P \$16.95



3383 \$14.95



3226 \$22.95



3265 \$22.95



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.

3260 \$22.95

2867P \$18.95

1938 \$60.00  
Counts as 3

2925P \$9.95

2724P \$16.95

2809 \$29.95  
Counts as 2

3374 \$24.95

2831P \$15.95

3241P \$16.95

804P \$21.95  
Counts as 2

2880P \$14.95

1599P \$17.95

9243P \$12.95

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.

A \$7.95 Value!

Delton T. Horn's  
**All-Time Favorite Electronic Projects**

**ELECTRONICS BOOK CLUB<sup>SM</sup>**

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. RE990

**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.

All books are hardcover unless number is followed by a "P" for paperback. (Publishers' Prices Shown)  
©1990 ELECTRONICS BOOK CLUB, Blue Ridge Summit, PA 17294-0810

**Call Toll-Free  
1-800-233-1128 to join Now!**

SEPTEMBER 1990

# Radio Shack Parts Place <sup>SM</sup>

**YOUR SOURCE FOR PROJECT AND REPAIR ELECTRONICS**  
**Try Our Special-Order "Hotline"**



## ICs, Crystals, Tubes, Much More

Your Radio Shack store manager can special-order a wide variety of parts and accessories from our main warehouse. Over 200,000 items are available including vacuum tubes, ICs, microprocessors, phono cartridges and styli, crystals for scanners and computers, even SAMS Photofacts® manuals. Best of all, there are no handling charges or minimum order requirements. Your order is sent directly to the Radio Shack near you and we notify you when it arrives. Delivery time for most items is about a week.

## Battery Special-Order Service



### Hundreds of Types Available

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, walkie-talkies, pagers and more. Batteries are sent from our main warehouse to the Radio Shack near you. We notify you when they arrive and there's no postage or handling charge.

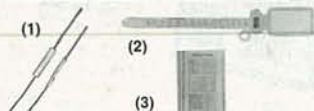
### Infrared Module

#### Complete, Easy-to-Use IR Detector



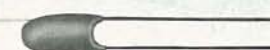
Heart of a remote-control project! Combines detector, limiter, band-pass, demod, integrator and comparator in a compact 3-lead module. #276-137 ..... 3.49

### Neater Wiring



- (1) Heat-Shrink Tubing. 1/16 to 1/2" sizes. #278-1627 ..... Pkg. of 7/1.79
- (2) Cable Tie/Markers. For cables up to 5/8" dia. #278-1648 ..... Pkg. of 10/2.49
- (3) Wire Markers. 630 "peel and stick" characters. #278-1650 ..... Set/1.79

### Tantalum Caps



High capacitance in a tiny size.

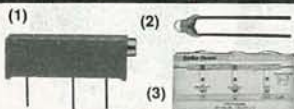
µF	VWDC	Cat. No.	Each
0.1	35	272-1432	.59
0.47	35	272-1433	.59
1.0	35	272-1434	.59
2.2	35	272-1435	.69
10	16	272-1436	.79
22	16	272-1437	1.19

### "Snap" RFI Choke



Snap-Together Toroid Cores. Effective "roadblock" to radio-frequency interference. Just wind on AC, phone, computer, coax or audio cable, then snap choke together. #273-104 ..... Set of 2/7.95

### Resistance Items



- (1) 15-Turn Trimmers. 1k, #271-342, 10k, #271-343, 20k, #271-340, Each 1.49
- (2) Precision Thermistor. Resistance changes in proportion to temperature. -50 to +110° C. #271-110 ..... 1.99
- (3) Color-Code Decoder. #271-1210 ..... 79¢

### Shielded D-Sub Hoods

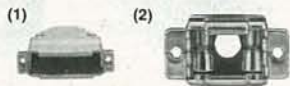


Fig.	Description	Cat. No.	Each
1	9-Position Metal	276-1508	2.19
...	25-Position Metal	276-1510	2.79
2	9-Pos. Metalized	276-1513	1.49
...	25-Pos. Metalized	276-1536	1.99

### "Ding-Dong" Chime

#### Great Entry Alerter



This IC and mini-speaker combo has a pleasant chime output and it's ideal for a customer-entry alert, doorbell or event indicator. Operates from 6 to 18 VDC. Produces 80 dB sound pressure at 12 VDC. 5" leads. #273-071 ..... 8.99

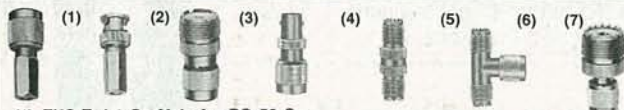
### Rod Antennas



For projects or replacing damaged antennas on cordless handsets and bases, walkie-talkies and radios. We have over a dozen styles in stock. For example:

Sections	Extended	Cat. No.	Each
5	13"	270-1407	2.79
6	17 3/4"	270-1409	2.59
4	34 3/4"	270-1402	3.79

### TNC and Mini-UHF Connectors



- (1) TNC Twist-On Male for RG-58 Cable. #278-140 ..... 1.99
- (2) TNC Double-Female. #278-142, 1.99
- (3) PL-259 Female. #278-118, 3.49
- (4) BNC Male. #278-145, 4.99
- (5) Mini-UHF Double-Female. Joins two male mini-UHFs. #278-172 ..... 2.49
- (6) Mini-UHF T Adapter. Female-male-female power divider. #278-173 ..... 3.99
- (7) UHF Adapter. Accepts PL-259. Fits female Mini-UHF. #278-174 ..... 3.99

### Solderless IDC-Type Connectors

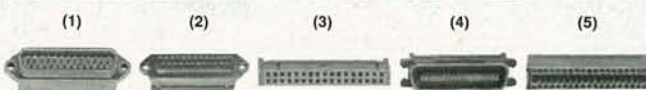


Fig.	Description	Cat. No.	Each
1	25-Position D-Sub Male	276-1559	3.99
2	25-Position D-Sub Female	276-1565	3.99
3	34-Position Header	276-1525	2.49
4	36-Position Male Printer Connector	276-1533	4.99
5	34-Position Card-Edge Connector	276-1564	1.99



### Electronic Counter Module

Prewired! Great for a traffic or event counter. Counts up to 99,999. Advanced (or reset) by external switch closure or digital circuit. Accepts count rate up to 7 Hz. Has 1/2" liquid crystal display. Requires "AA" battery. With data. #277-302 ..... 16.95

### Foldup Autoranging DVM



Select the function and this precision Micronta® meter sets the range. Has automatic power-off when shut, detented hinge for best viewing angle. Measures to 1000 VDC, 500 VAC, 10A AC/DC, 2 megohms resistance. Requires 2 "AA" batteries. #22-193 ..... 69.95

### Dual-Power Soldering Iron



Go from 15 to 30 watts with the flick of a switch. Has replaceable tip. 8 1/4" long. UL listed AC. #64-2055 ..... 9.49  
 Replacement Tip. #64-2065 ..... 1.19  
 Chisel Tip. #64-2056 ..... 1.19

Since 1921 Radio Shack has been the place to obtain up-to-date electronic parts as well as quality tools, test equipment and accessories. Today, with our big in-store selection and convenient special-order service, Radio Shack continues its tradition of supplying high-tech products at competitive prices. We're America's Technology Store with over 7000 locations—NOBODY COMPARES

**Radio Shack**  
**AMERICA'S**  
**TECHNOLOGY**  
**STORE** <sup>SM</sup>

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

CIRCLE 78 ON FREE INFORMATION CARD

# BUILD R-E's VOCAL STRIPPER



**Build this lead  
vocal filter  
and test  
your singing  
ability.**

TERRY J. WEEDER

ALMOST EVERYONE ENJOYS LISTENING TO music, and just about as many people enjoy singing along to their favorite songs. If you're one of the many people who loves to sing, you may be interested in a clever audio device that filters out lead vocals from a stereo recording, leaving just the background music. For under \$50.00, you can build this unique audio filtering device. Impress your friends with this *Karaoke*-like audio system and enjoy hours of singing pleasure.

Filtering out the vocal tracks from a recording is not as simple as merely eliminating the mid-range frequencies. Along with

the vocals, the midrange frequencies contain a large portion of the music. Vocal filtering is quite easy, however, if you take advantage of the way stereo recordings are mixed.

### Stereo mixing

When mixing is done in a studio, each instrument or voice is assigned a position relative to left (L) and right (R) channels. Some instruments are recorded at higher levels on the right channel so that their sounds seem to come from the right side of the stage. Others are recorded on the left channel for the opposite effect. Lead vocals and instru-

ments such as the bass drum and bass guitar are usually recorded at the same level on both channels so they seem to come from center stage. That is what makes lead vocal filtering possible.

Vocal signals, which consist primarily of mid-high range frequencies, can be filtered out by a series of filtering stages shown in Fig. 1. Bass instruments, corresponding to a lower frequency range, can be diverted to a final mixing stage so that the music is not filtered out along with the vocals.

A signal from one channel is inverted and subtracted from the

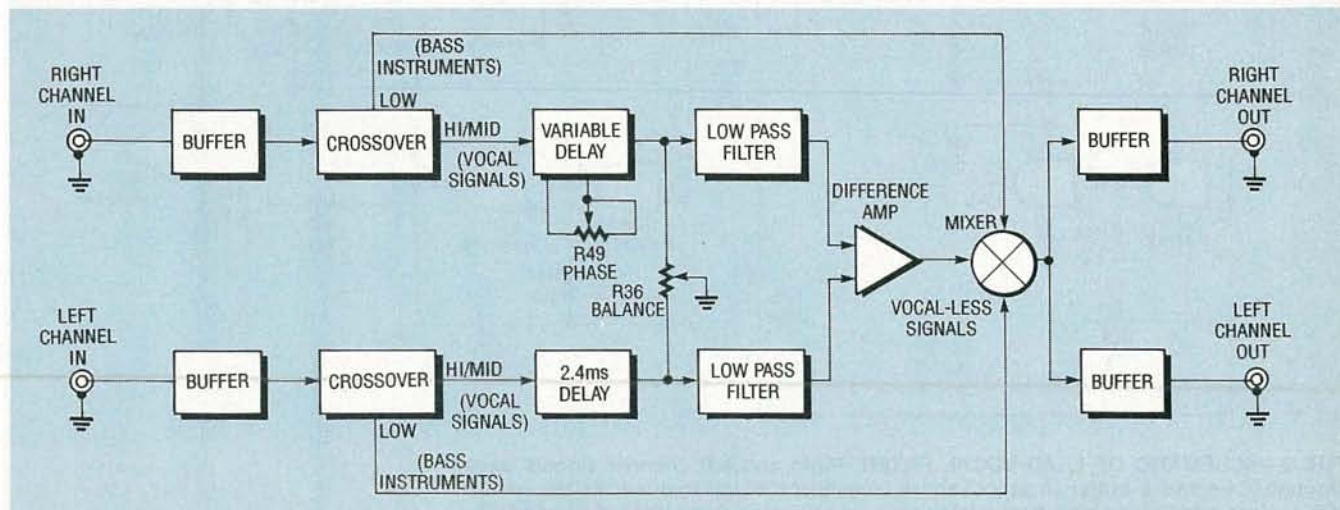


FIG 1—BLOCK DIAGRAM OF FILTER NETWORK. Right channel signal is inverted and subtracted from the left channel, cancelling the lead vocals. Low frequencies are bypassed by an active crossover and remixed with the difference signal, without the vocals.

other (L-R), which causes the lead vocals that are common to both channels to cancel out. The music common to the left and right channel remains unchanged. Unfortunately, along with the lead vocals, all low frequencies are common to both channels and must bypass the cancellation circuit. A simple active crossover removes the low frequencies so that they can be remixed with the vocal-less signal at a later stage.

From the active crossover stage, all midrange and high fre-

quencies pass through a variable delay stage, which is used to align the left and right channel signals so that they are exactly 180° out of phase with each other. Proper signal cancellation is achieved only when both signals are 180° out of phase. The low-pass filter stage filters out unwanted high frequencies from the variable delay stage. The output of the low-pass filter enters a difference amp, where the lead vocal signals cancel, and is then remixed with the low frequencies at the final mixing stage.

### Here's how it works

The schematic of the lead vocal filter is shown in Fig. 2. The left and right channel signals are coupled through C1 and C2 to buffer amps IC4-a and IC4-b. From the buffer amps, the left and right channel signals pass through active crossovers IC5-a and IC5-b, sending all low frequencies to a final mixer IC6-c, and all middle and high frequencies to analog delay lines IC1 and IC2, RD5106 256-sample bucket-brigades. Integrated circuit IC2 delays the left channel signal by

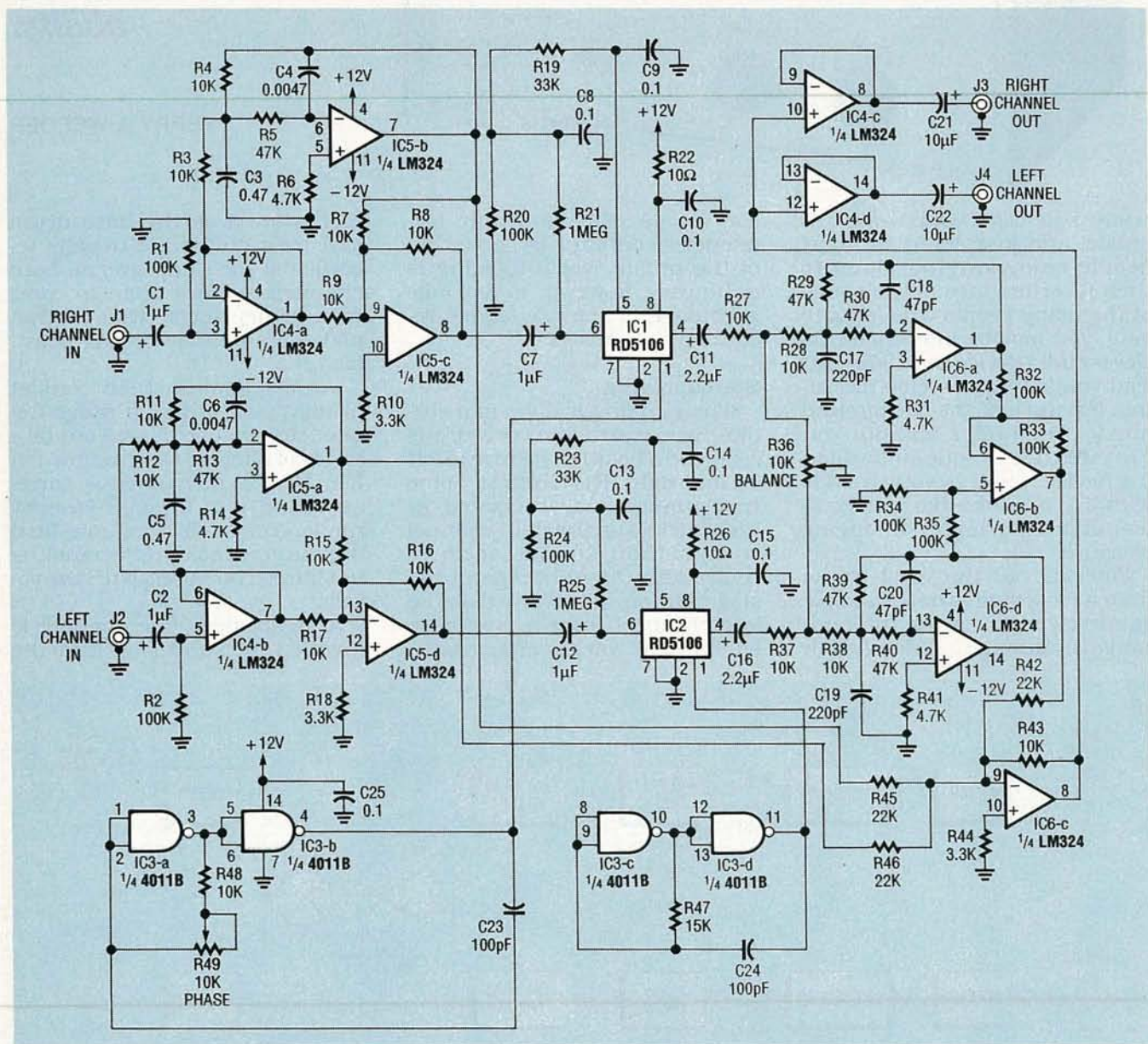


FIG. 2—SCHEMATIC OF LEAD VOCAL FILTER. Right and left channel signals pass through IC4-a and -b buffer amps into active crossover IC5; low frequencies are sent to IC6-c mixer, middle and high frequencies are sent to analog delay lines of IC1 and IC2. That output passes through IC6-a and -d to filter high frequency sample steps. IC6-b signals are remixed with low frequencies by IC6-c and are sent to final output via IC4-c and -d buffers.

2.4 ms, set by the fixed-frequency clock generated by  $\frac{1}{2}$ -IC3, R47, and C24. The right channel signal is delayed by IC1 with a variable-frequency clock generated by  $\frac{1}{2}$ -IC3, R48, R49, and C23. Potentiometer R49 is used for phase adjustment.

The output of each delay line

**All resistors are  $\frac{1}{4}$ -watt, 5%, unless otherwise indicated.**

- R1, R2, R20, R24, R32, R33-R35—100,000 ohms
- R3, R4, R7-R9, R11, R12, R15, R16, R17, R27, R28, R37, R38, R43, R48—10,000 ohms
- R5, R13, R29, R30, R39, R40—47,000 ohms
- R6, R14, R31, R41—4700 ohms
- R10, R18, R44—3300 ohms
- R19, R23—33,000 ohms
- R21, R25—1 megohm
- R22, R26—10 ohms
- R36, R49—10,000 ohms, potentiometer
- R42, R45, R46—22,000 ohms
- R47—15,000 ohms

**Capacitors**

- C1, C2, C7, C12—1  $\mu$ F tantalum
- C3, C5—0.47  $\mu$ F tantalum
- C4, C6—0.0047  $\mu$ F Mylar
- C8, C9, C10, C13, C14, C15, C25—0.1  $\mu$ F Mylar
- C11, C16—2.2  $\mu$ F tantalum
- C17, C19—220 pF ceramic disc
- C18, C20—47 pF ceramic disc
- C21, C22—10  $\mu$ F electrolytic
- C23, C24—100 pF ceramic disc

**Semiconductors**

- IC1, IC2—RD5106 256-sample bucket-brigade analog delay line, EG & G-Reticon
  - IC3—4011 quad two-input NAND gate
  - IC4-IC6—LM324 quad op-amp
- Miscellaneous:** Perforated circuit board, standoffs, mounting hardware, hookup wire, shielded cable, 18-AWG power supply cord, strain relief, and four RCA jacks for J1-J4.

**Power supply parts**

- F1—0.5 amp fuse and fuseholder
- T1—24 VAC center-tapped transformer
- BR1—1.5-amp bridge rectifier, 100 PIV
- C1, C2—1000  $\mu$ F, 25 volts, electrolytic
- C3, C4—10  $\mu$ F, 16 volts, electrolytic
- C5, C6—0.1  $\mu$ F, ceramic disc
- D1, D2—12-volt Zener diode
- R1, R2—220 ohms
- R3—1000 ohms
- S1—SPST switch, 1 amp
- LED1—light emitting diode, any color

**Note: The following are available from Weeder Technologies, 14773 Lindsey Rd., Mt. Orab, Ohio 45154: An etched, drilled, and plated PC board, \$15.00; a basic parts kit including all resistors, capacitors and semiconductors (not including power-supply components), \$29.00. Please include \$2.00 for shipping and handling in the U.S., \$3.00 in Canada. Ohio residents add 5.5% sales tax. Allow 4 to 6 weeks for delivery.**

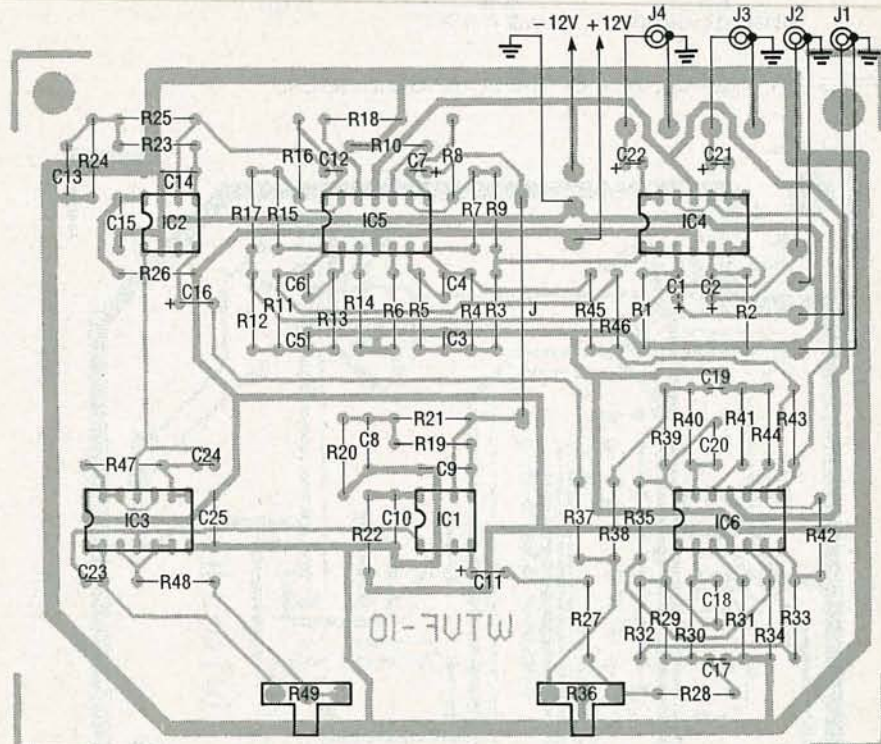
from IC1 and IC2 passes through low-pass-filters IC6-a and -d, and their associated parts, to filter out high-frequency sample-steps produced by IC1 and IC2. Balance control R36 is adjusted for equal amplitude of the left and right channels. IC6-b is a difference amplifier which cancels all lead vocals that are common to both channels. The resulting signal from IC6-b is remixed with low frequencies by IC6-c and is then sent to the output via buffers IC4-c and IC4-d.

**Construction**

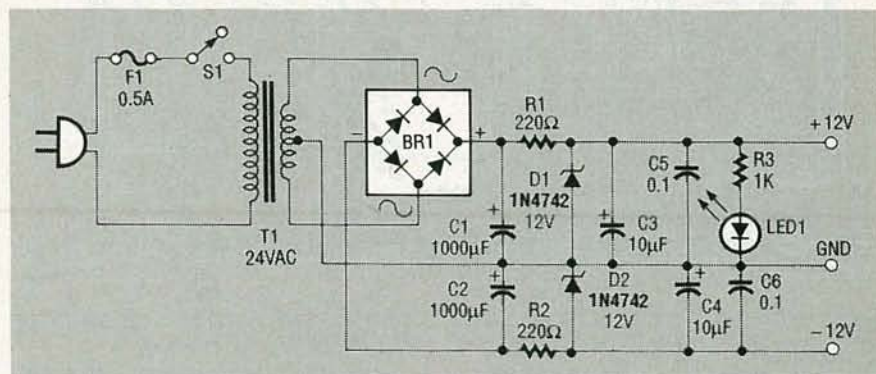
The easiest way to go about constructing the vocal filter circuit is to use a PC board. An

etched and drilled PC board is available from the source in the Parts List or you can make your own from the foil pattern provided here. Mount the vocal filter components as shown in the parts placement diagram, Fig. 3. Use shielded wire to connect the RCA jacks, and ground them properly, either by mounting them to a grounded chassis or by soldering ground wires to their cases. The DC power supply leads from the power-supply board should be twisted to reduce noise transmission.

If you don't use PC mounted potentiometers for R49 and R36, be sure to keep their connecting leads short and twist them to re-



**FIG. 3—PARTS PLACEMENT DIAGRAM.** Remember to connect the jumper lead, use shielded cables for the RCA jacks and twist the supply leads before soldering to the LED and main PC board.



**FIG. 4—POWER SUPPLY SCHEMATIC** for the lead vocal filter circuit.

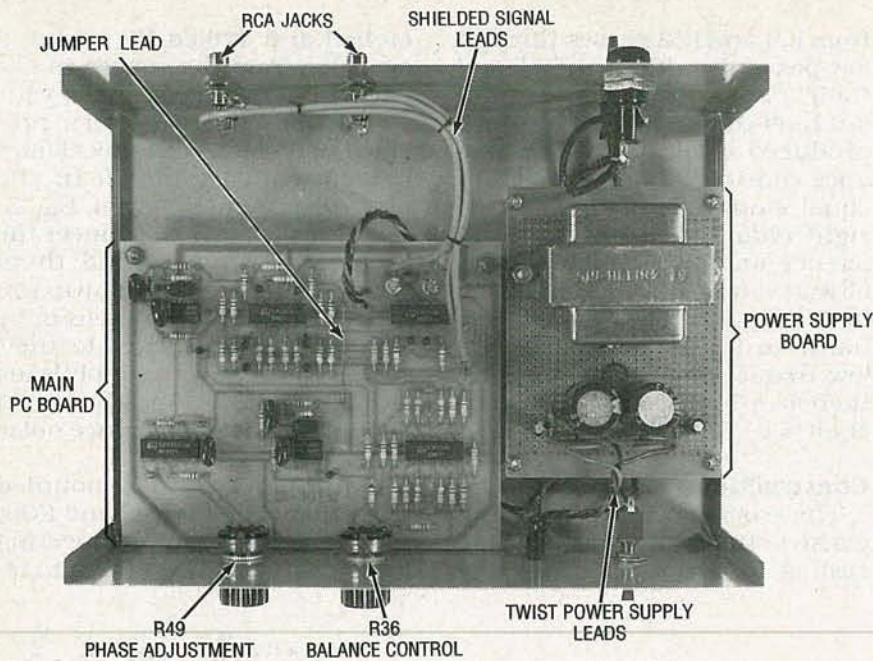
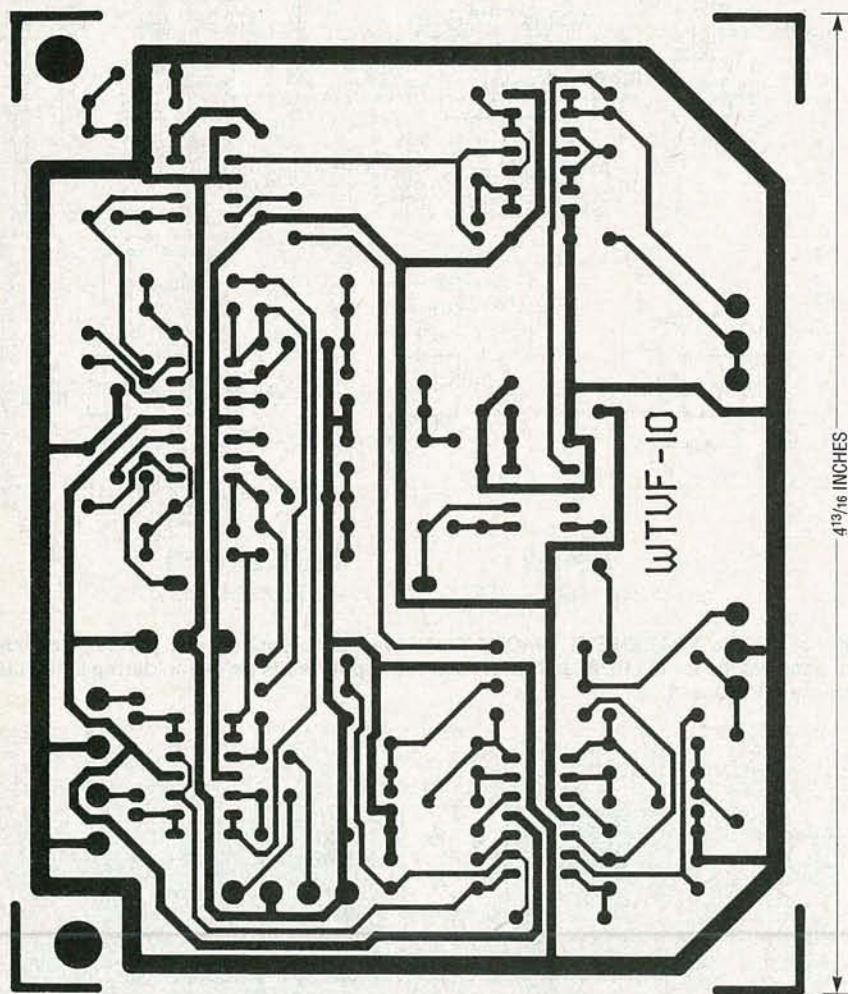


FIG. 5—AN INTERNAL VIEW OF THE LEAD VOCAL FILTER.



duce noise and hum pickup. It is preferable, though, to use shielded leads for these connections. These potentiometers

should be grounded by mounting to a grounded chassis.

A simple power supply, like the one shown in Fig. 4, may be used

for this device. The power supply can be mounted on a perforated circuit board, as long as you closely follow the component connections shown on the schematic. Although optimum performance is obtained with a  $\pm 12$  volt supply, the vocal filter gives good results using two 9-volt batteries connected in series.

The power supply and main PC board should be adequately enclosed before operating the vocal filter. A metal enclosure is recommended, as a 120-volt line potential is exposed in the power supply circuit (see Fig. 5).

### Hook up and operation

The vocal filter should be connected into the tape loop of your stereo system. Use shielded cables with phono connectors to connect inputs J1 and J2 to the "record" tape monitor jacks on your stereo, and outputs J3 and J4 to the "play" side. To use the vocal filter with a tape deck that normally uses tape monitor jacks, plug the output "play" jacks of the tape deck into J1 and J2 of the vocal filter. Plug J3 and J4 into the input or "play" jacks of the stereo. Make sure you apply power to the vocal filter before turning on the stereo; sensitive components in the vocal filter may be damaged if a signal is applied before power is turned on.

Set R36 to its middle position, play a stereo sound track or tune in an FM stereo broadcast, and switch in the tape monitor. Adjust R49 for minimum lead vocals, then adjust R36. Repeat that process until the lead vocals are suppressed.

If you think the vocal filter is not working, tune in to a mono FM broadcast. If you can't find one, tune to a stereo station, and adjust the tuning knob either way, just enough so the stereo light goes off. If the vocal filter operates properly, you should be able to adjust R36 and R49 to filter out all music except low frequencies.

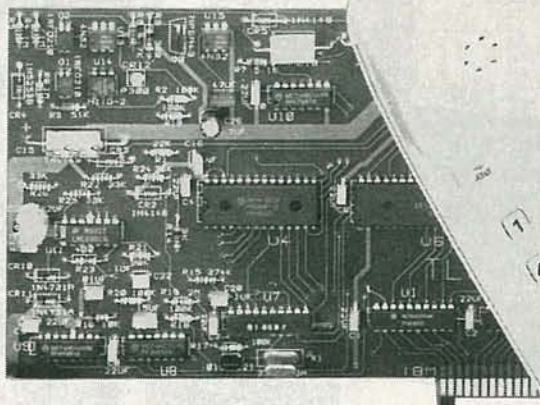
With a little help from **Radio Electronics**, you now have the know-how to build a fairly simple audio filtering device in just a few short evenings. Once completed, you can use this system to practice singing alone, or be creative and have all your friends over for a *Karaoke* party!

R-E



# Build R-E's

# TELEPHONE-LINE CONTROLLER



WITH THE EVER INCREASING VARIETY of pay telephone services such as Dial-A-Sex, Dial-A-Party, and Dial-A-Friend, the telephone abuses at home and in the office are reaching alarming proportions. For many years, only large corporations were able to afford PBX (private branch extension) systems with facilities to restrict the use of certain numbers. However, now you can build an inexpensive, microprocessor-controlled, integrated telephone line controller that can selectively restrict outgoing calls, selectively restrict incoming calls, selectively dial an array of numbers for promotions, and record all activities on the telephone line, including the time, date, and duration of each call.

The controller uses an IBM PC or clone as a host. However, the card is almost a stand-alone device. It includes its own microprocessor and runs its own operating program. The computer is needed to load the operating program into the controller's static RAM, to initialize operations, and to let the user interact with the controller. The host computer may access the SRAM for reloading firmware, sending and retrieving data, and alternating modes and functions. An internal power supply allows the line controller to operate even when the host computer is turned off.

The line controller does not have to be installed on the phone line at the point of entry to restrict outgoing calls and screen unwanted incoming calls. The card can be plugged into a modu-

lar telephone outlet at any point along the indoor phone line, without any modification of the existing installation (see Fig. 1).

## How it works

The controller is fully programmable and can perform a wide variety of functions. Using the software provided on the RE BBS, the controller can prevent a number from being dialed if the prefix matches a number on your "list to restrict" (see Fig. 2). If, for example, the list contains the number 9311, then dialing 931-1882 (or 931-1xxx) will be prevented. A list containing 0-9 will prevent all outside calls, and a list containing 0, 1, 20, 21, 30, 31, 40, 41...90, 91 will prevent the use of all area codes, operator, and international. The list can consist of up to 128 prefixes, up to 6 digits each.

The user may choose to have the controller automatically list all outgoing calls made on the computer screen. The list will consist of the destination telephone number, date, time, and duration of each call.

The user can screen incoming calls and limit them to as many as 32 relatives and friends. In that case, the card would have to be used in conjunction with a telephone answering machine. The answering machine would prompt the caller to enter his own number. Then, only the numbers that match one on the list will be allowed to go through. Any

**Take full control of  
incoming and  
outgoing  
telephone  
calls.**

MORDECHAI SAAD

matching number, along with time and date, will be stored in memory for later use. The user can then make a list of the incoming calls appear on the screen.

The card can be used to automatically dial a number from the keyboard, a number selected from a menu, or a pre-selected range of numbers. The redial function is not limited to the last dialed number, as the user may select a number from a list of previously dialed numbers.

## Circuitry

The line controller contains a microprocessor, memory to hold the software and data, interface circuitry for the host computer, a telephone line interface, and a wall transformer to maintain power when the host computer is off.

A schematic of the circuit is shown in Fig. 3. In the center of the diagram is the microprocessor (IC6, a 65SC02), which is an 8-bit CMOS version of the 6502 used in Apple, Atari, Commodor, and other computers. The static memory, IC4, is an 8K x 8 SRAM. The host computer is used to write the program to IC4. The bi-directional tri-state buffer (IC5) is enabled by the pro-

# Join the Electronics and Control Engineers' Book Club®

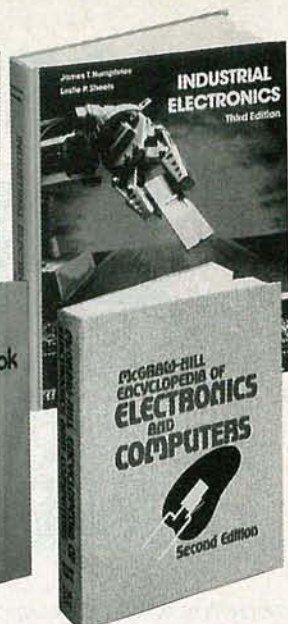
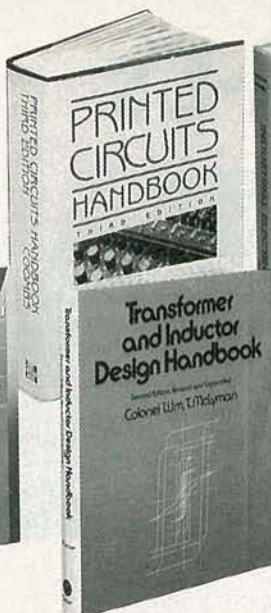
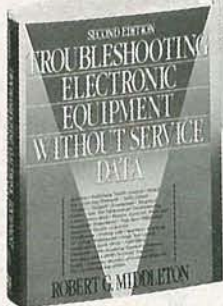
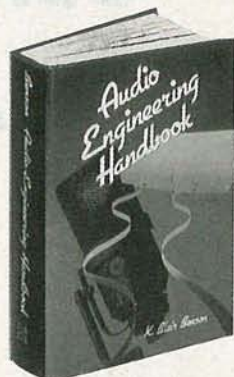
**TROUBLESHOOTING ELECTRONIC EQUIPMENT WITHOUT SERVICE DATA, Second Edition.** By R.G. Middleton. 320 pp., illus. This indispensable new edition features all the information that made the first edition so successful, plus the latest developments in digital testing, phase checks, IC troubleshooting, and repair of VCRs, stereos, TVs, tape recorders, and much, much more.  
585092-3 Pub. Pr., \$30.00 Club Pr., \$22.50

**PRINTED CIRCUITS HANDBOOK, Third Edition.** By C.F. Coombs, Jr. 960 pp., 556 illus. Here in one handy volume is all the information you need to design, manufacture, test, and repair printed wiring boards and assemblies. This new edition features ten all-new chapters, including three on SMT.  
126/097 Pub. Pr., \$64.95 Club Pr., \$45.50

**SOUND SYSTEM ENGINEERING, Second Edition.** By D. Davis and C. Davis. 665 pp., illus. The definitive source for all professionals responsible for audio system design, covering everything from concert halls to virtually every oscillator in use today. Packed with proven strategies for solving design and engineering problems and cutting your clients' costs.  
584657-8 Pub. Pr., \$39.95 Club Pr., \$31.50

**MCGRAW-HILL ENCYCLOPEDIA OF ELECTRONICS AND COMPUTERS, Second Edition.** S. Parker, Editor-in-Chief. 1,047 pp., 1,250 illus. Featuring 160 new and revised articles, this new edition treats the entire spectrum of applications, devices, systems, and theory in areas ranging from the flow of electricity to hardware, software, robotics, and IC fabrication.  
454/99X Pub. Pr., \$79.50 Club Pr., \$54.95

**COMMUNICATIONS RECEIVERS: Principles and Design.** By Ulrich L. Rohde and T.T.N. Bucher. 608 pp., 402 illus. Everything you need to know if you design or work with communications receivers, from theory to practical design approaches. Coverage includes all types of receivers: shortwave, broadcast, radar, military, marine, aeronautical, and more.  
535/701 Pub. Pr., \$64.95 Club Pr., \$44.50



- 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

New Members!  
Take any one of these great professional books **\$289** for only as a premium with your first selection!

Spectacular values up to **\$204.95**

**HANDBOOK OF TRANSDUCERS.** By H.N. Norton. 554 pp., illus. Get fast answers to all of your questions about commercially available transducers. This up-to-date reference explains how they operate, how to select the right transducer for a given measurement, and the characteristics and relative merits of each category of transducer.  
585142-3 Pub. Pr., \$44.00 Club Pr., \$34.50

**DESIGNING WITH FIELD-EFFECT TRANSISTORS, Second Ed.** By Siliconix Inc., Revised by E. Oxner. 320 pp., illus. This on-the-job guide provides page after page of practical data, tables, examples, and design and specification strategies to help you capitalize on recent breakthroughs in MOSFET design. Coverage includes FET operating principles and procedures . . . step-by-step fabrication methods . . . how to bias FETs for desired performance . . . and much more.  
575/371 Pub. Pr., \$39.95 Club Pr., \$29.95

**CIARCIA'S CIRCUIT CELLAR, Volume VII.** By S. Ciarcia. 256 pp., 100 illus., softcover. More do-it-yourself circuits from the master—Steve Ciarcia. Step-by-step guidance on projects ranging from a gray-scale video digitizer and the Circuit Cellar AT Computer to parallel interfacing and the Neighborhood Strategic Defense Initiative.  
109/699 Pub. Pr., \$19.95 Club Pr., \$15.95

**THE COMPACT DISC: A Handbook of Theory and Use.** By K. C. Pohlmann. 288 pp., illus. softcover. The most readable and comprehensive guide to CD technology offers clear descriptions of disc design and manufacturing . . . player circuitry . . . and comparisons of different types of players—all without complicated theoretical or mathematical discussions.  
585096-6 Pub. Pr., \$29.95 Club Pr. \$22.50

**MOBILE CELLULAR TELECOMMUNICATIONS SYSTEMS.** By W.C.Y. Lee. 442 pp., 215 illus. A to Z coverage of state-of-the-art cellular systems, from design to implementation and troubleshooting. Clearly explains spectrum efficiency, propagation models and prediction, interference treatment, and more.  
370/303 Pub. Pr., \$62.95 Club Pr., \$44.50

**TRANSFORMER AND INDUCTOR DESIGN HANDBOOK, Second Edition.** By Col. W.T. McLyman. 440 pp., illus. All the information you need to design today's lighter, smaller transformers and inductors, without relying on out-moded approximation methods. In ready-reference tabular format, this new edition covers the latest equations in transformer and gapped design applications.  
584646-2 Pub. Pr., \$55.00 Club Pr., \$38.50

**ENCYCLOPEDIA OF TELECOMMUNICATIONS.** Edited by R. Meyers. 575 pp., illus. The expertise of 40 recognized leaders in the field is captured in this A to Z reference. Areas covered range from fiber optics, intelligent systems, and networking, to signal processing, mathematical relationships, and theory.  
584897-X Pub. Pr. \$49.95 Club Pr., \$37.50

**PROGRAMMABLE LOGIC DESIGNER'S GUIDE.** By R.C. Alford. 304 pp., illus., softcover. This practical guidebook shows you how to design devices that provide all the logic functions a circuit requires and avoid the compromises inherent in conventional methods. Covers design philosophy, PLD families, hardware, software, and programming languages.  
585141-5 Pub. Pr., \$29.95 Club Pr., \$22.95

**SURFACE-MOUNT TECHNOLOGY FOR PC BOARD DESIGN.** By J.K. Holmoman, Jr. 504 pp., illus., softcover. Get a real working understanding of SMT. This up-to-date guide provides a proven, step-by-step approach to SMT design as it thoroughly covers components, methods, and techniques for maximizing quality, reliability, and profitability.  
585235-7 Pub. Pr., \$49.95 Club Pr., \$36.50

PORTABLE ELECTRONICS DATA BOOK

360 pp., 6 x 9, illus., softcover 585390-6

A-to-Z coverage of all the essential facts, figures, and formulas you need, in a format that's easy to use and easy to carry. John Douglas-Young has filled this handy on-the-job companion with equations, algorithms, calculus formulas, and BASIC programs in areas ranging from alternating current and amplifiers to transducers and waveguides . . . and they're all yours ABSOLUTELY FREE!

A \$33.00 Value—Yours ABSOLUTELY FREE when you join!

**INDUSTRIAL ELECTRONICS, Third Ed.** By J.T. Humphries and L.P. Sheets. 651 pp., illus. A clear, convenient guide to the components and systems used in modern industry. Included is an extensive collection of manufacturers' data sheets, along with many quick-access tables and charts.

585226-8 Pub. Pr., \$41.95 Club Pr., \$31.95

**BUILD YOUR OWN UNIVERSAL COMPUTER INTERFACE.** By B. Chubb. 309 pp., illus., softcover. Guiding you from theory to step-by-step assembly instructions, this lively manual shows you how to construct a computer interface and hook it up to virtually any IBM or IBM compatible personal computer, including the XT, XT-286, AT, and System/2 Model 30.

585080-X Pub. Pr., \$19.95 Club Pr., \$15.95

**DIGITAL FILTERS AND SIGNAL PROCESSING, Second Ed.** By L.B. Jackson. 410 pp., illus. An acclaimed guide to signal processing theory, design methods, and implementation strategies. Using an intuitive approach, the author covers state-space representation, A/D and D/A conversion, the DFT, FFT, and much more.

585269-1 Pub. Pr., \$52.50 Club Pr. \$39.50

**SWITCHGEAR AND CONTROL HANDBOOK, Second Ed.** Edited by R. W. Smeaton. 1,056 pp., 789 illus. The only handbook that treats all aspects of switchgear control, including design, applications, safety, and maintenance. Updated to reflect the changes brought about by the use of computers, solid-state devices, and programmable controls.

584/494 Pub. Pr., \$85.00 Club Pr., \$59.95

**ANTENNA APPLICATIONS REFERENCE GUIDE.** Edited by R. C. Johnson and H. Jaski. 496 pp., 368 illus. and tables. Covers the major applications of antenna technology in all areas of communications and their design methods. Emphasizes important new applications such as earth station, satellite, seeker, aircraft, and microwave-relay antennas.

322/848 Pub. Pr., \$59.95 Club Pr., \$42.50

**RADIO HANDBOOK, Twenty-Third Ed.** Edited by W. I. Orr. 667 pp., 1,073 illus. and tables. The latest edition of the most complete, current resource on radio technology and its applications. Expert contributors show you how to select, design, build, test and operate all kinds of equipment.

584638-1 Pub. Pr., \$29.95 Club Pr., \$23.95

**AUDIO ENGINEERING HANDBOOK.** Edited by K. B. Benson. 1056 pp., 722 illus. The ideal on-the-job reference for professionals who design, operate, and service audio equipment. It's a one-volume source of fundamental audio acoustics engineering information and practical how-to source book covering generation, transmission, storage, and reproduction of the audio signal.

047/774 Pub. Pr., \$86.95 Club Pr., \$59.95

**Be sure to consider these important titles as well!**

**BUCHSBAUM'S COMPLETE HANDBOOK OF PRACTICAL ELECTRONIC REFERENCE DATA, Third Ed.** By W.H. Buchsbaum. 583880-X Pub. Pr., \$34.95 Club Pr., \$26.50

**ON-LINE ELECTRICAL TROUBLESHOOTING.** By L. Lundquist. 391/105 Pub. Pr., \$34.50 Club Pr., \$26.50

**ESSENTIAL CIRCUITS REFERENCE GUIDE.** By J. Markus & C. Weston. 404/623 Pub. Pr., \$59.95 Club Pr., \$47.50

**INTRODUCING PC-DOS AND MS-DOS, Second Ed.** By T. Sheldon. 565/651 Pub. Pr., \$29.95 Club Pr., \$19.95

**ENGINEERING FUNDAMENTALS FOR THE PROFESSIONAL ENGINEERS' EXAM, Third Ed.** By L.M. Polentz. 503/931 Pub. Pr., \$39.50 Club Pr., \$27.95

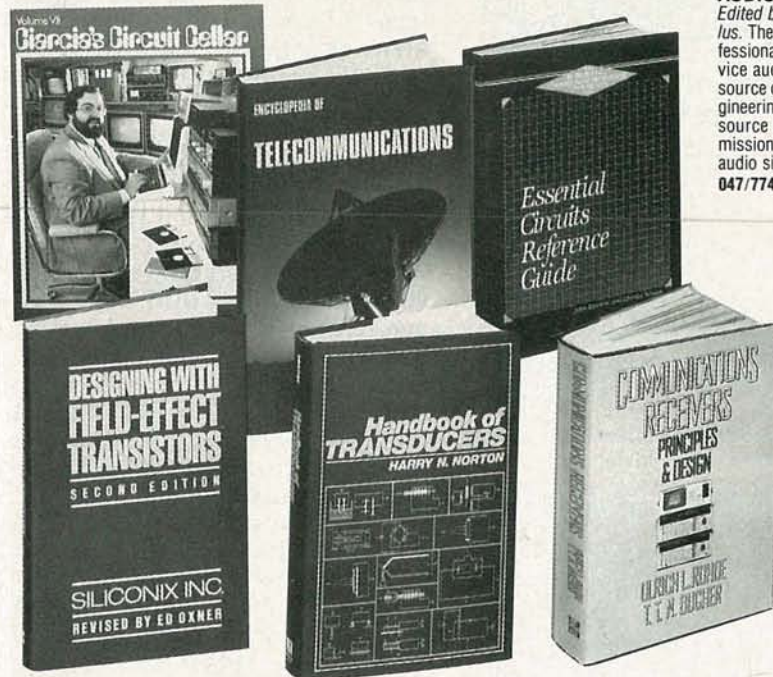
**INTRODUCTION TO DIGITAL SIGNAL PROCESSING.** By J. G. Proakis and D. G. Manolakis. 584954-2 Pub. Pr., \$50.00 Club Pr., \$37.50

**AUTOMATIC CONTROL SYSTEMS, Fifth Ed.** By B. C. Kuo. 583706-4 Pub. Pr., \$57.40 Club Pr., \$43.50

**MICROCOMPUTER TROUBLESHOOTING AND REPAIR.** By J.G. Stephenson and B. Cahill. 585106-7 Pub. Pr., \$24.95 Club Pr., \$18.95

**DIGITAL AND MICROPROCESSOR TECHNOLOGY, Second Ed.** By P. J. O'Connor. 585184-9 Pub. Pr., \$42.00 Club Pr., \$33.50

**MICROELECTRONICS, Second Ed.** By J. Millman and A. Grabel. 423/30X Pub. Pr., \$56.95 Club Pr., \$41.50



## Here's how the Club works to serve YOU:

### ■ IMPORTANT INFORMATION ... WE MAKE IT EASY TO GET!

In our rapidly changing world, those who perform best are those who are best informed. Designed exclusively for the practicing engineer, the Electronics and Control Engineers' Book Club provides you with information that is relevant, reliable, and specific enough to meet your needs. Each Club bulletin comes your way 14-16 times a year and offers you more than 30 books to choose from — the best and newest books from all publishers!

### ■ DEPENDABLE SERVICE ... WE'RE HERE TO HELP!

Whether you want information about a book or have a question about your membership, our qualified staff is here to help. Just call us toll-free or write to our Customer Service. We also make sure you get only the books you want. All you do is simply tell us your choice on the Reply Card and return it to us by the specified date. If you want the Main Selection, do nothing — it will be sent to you automatically. (A small shipping and handling charge is added to each shipment.)

### ■ CLUB CONVENIENCE ... WE DO THE WORK!

Beyond the benefit of timely information, Club membership offers many other benefits. For example, you get a wide choice of books that cannot be matched by any bookstore — anywhere. And all your books are conveniently delivered right to your door. You also get the luxury of 10 full days to decide whether you want the Main Selection. If you should ever receive a Main Selection you don't want because the Club bulletin came late, just return it for credit at our expense.

### ■ SUBSTANTIAL SAVINGS ... AND A BONUS PROGRAM TOO!

In keeping with our goal to provide you with the best information at the greatest possible savings, you will enjoy substantial discounts — up to 40%! — on every book you buy. Plus, you're automatically eligible for our Bonus Book Plan which allows you savings up to 70% on a wide selection of books.

### ■ EASY MEMBERSHIP TERMS ... IT'S WORTHWHILE TO BELONG!

Your only obligation is to purchase one more book — at a handsome discount — during the next 12 months, after which you enjoy the benefits of membership with no further obligation. Either you or the Club may cancel membership anytime thereafter.

**FOR FASTER SERVICE IN ENROLLING CALL TOLL-FREE 1-800-2-MCGRAW**

**MAIL THIS COUPON TODAY**

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

Please enroll me as a member and send me the two books indicated, plus the PORTABLE ELECTRONICS DATA BOOK. I am to receive one book for just \$2.89, the other at the discounted member's price, plus local tax, shipping and handling charges. I agree to purchase a minimum of one additional book during my first year of membership as outlined under the Club plan described in this ad. I understand that a shipping and handling charge is added to all shipments.

Your FREE Data Book	
585390-6	
Write Code No. of the \$2.89 selection here	Write Code No. for the First selection here
<input type="text"/>	<input type="text"/>

Signature \_\_\_\_\_

Name \_\_\_\_\_

Address/Apt. # \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

This order subject to acceptance by McGraw-Hill. All prices subject to change without notice. Offer good only to new members. Foreign member acceptance subject to special conditions.

ECGA-041

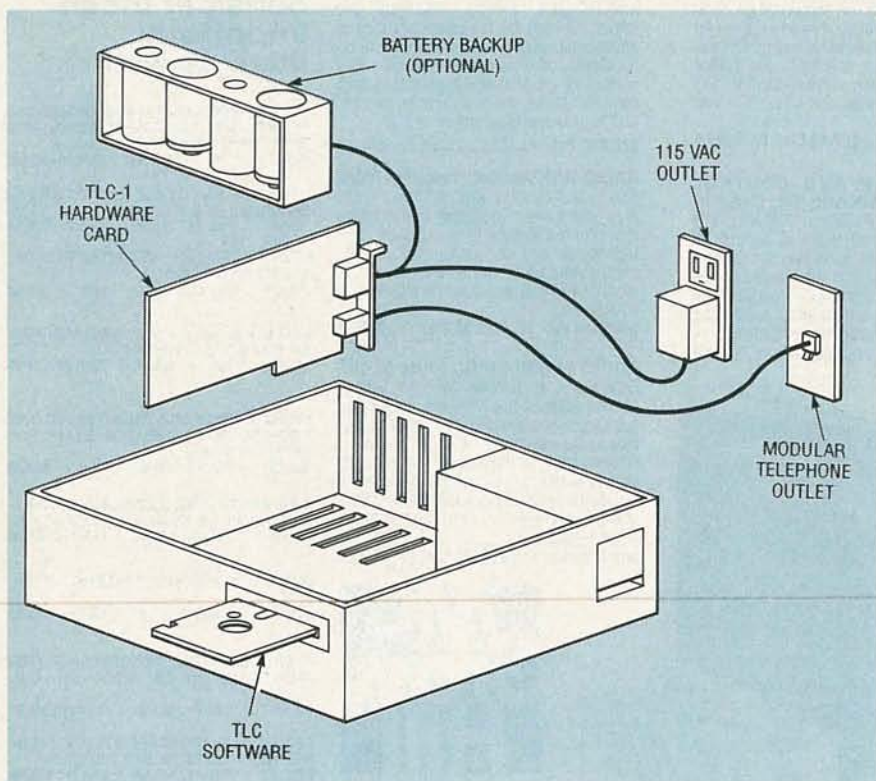


FIG. 1—THE ADD-ON-CARD can be plugged into a modular telephone outlet at any point along the indoor phone line, without any modification to the existing installation.

1/ 25 Records	Tel. No.	Description
1.	0	Operator
2.	1	Long Distance
3.	20	Long Distance
4.	21	Long Distance
5.	30	Long Distance
6.	31	Long Distance
7.	40	Long Distance
8.	41	Long Distance
9.	50	Long Distance
10.	51	Long Distance
11.	540	General Information
12.	550	Group Talk Line

ADDRESS: 00000000

Home PgUp ↑ ↓ PgDn End Ins Del Esc F9=More F10=Help

FIG. 2—THE CONTROLLER CAN PREVENT a number from being dialed if the prefix matches a number on your "list to restrict."

processor on pin 1 (the direction pin) according to whether the host computer wants to read from or write to the SRAM. Components C16, R1, and D3 provide the processor with a power-on reset.

The peripheral interface adapter (PIA) IC3 is responsible for synchronizing the control of the

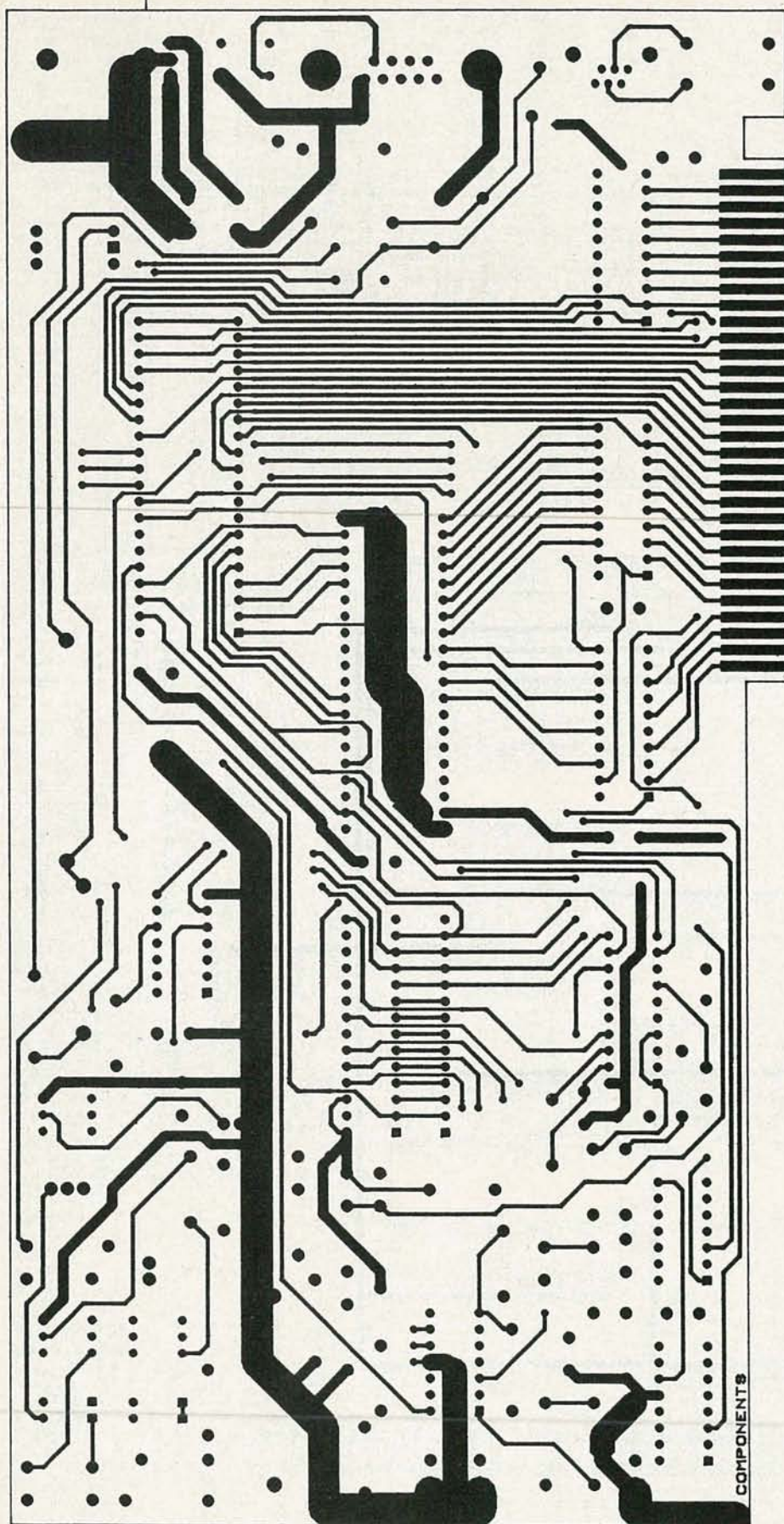
buses between the host processor (80xx) and the controller's 6502. The DTMF (dual-tone multi-frequency) transceiver, IC7, is constantly monitoring the telephone line for DTMF activities, as well as for incoming calls. When dialing, the transceiver generates DTMF signals.

Resistors R17 and R18 set the gain of IC7 to 1, C24 provides AC coupling for the incoming signals, and D10 and D11 are 4.3 volt-Zener diodes; when connected back to back they limit the voltage swing on the secondary of T1 to 5 volts (4.3+0.7), thereby protecting IC7 and IC11 from voltage transients. The transmitter output of the DTMF transceiver is buffered by IC11-b to drive the 600-ohm line transformer T1. IC11-b is configured as an inverting amplifier with a gain of 1. By connecting the non-inverting input to a reference voltage of 2.5 volts, the output swing can extend to both rails, centered around 2.5 volts.

The other side of T1's secondary is connected to the output of IC11-a which is configured as a voltage follower to buffer the voltage reference of IC7, and is also used as a return for the line transformer T1. The on-chip clock oscillator of IC7 uses a 3.58-MHz crystal, and the output is coupled to the input of 4-bit binary counter IC8-a via C21. The first-stage output of the counter is the source of the 1.79-MHz clock for the processor. The fourth bit of IC8-a outputs 224 kHz, which IC8-b divides down to 14 kHz. The 14-state counter, IC9, divides the 14 kHz by 1024 down to 13.65 Hz, which is the real-time clock. The 13.65-Hz clock signal is used to tag events such as outgoing calls, incoming calls, and duration of calls, with a relative time and date. The host computer converts it to absolute time and date.

Varistors R27-R29 are used as surge suppressors, preventing the tip and ring terminals from exceeding a differential potential of 150 volts with respect to chassis ground and to each other. Bridge-rectifier BR2 is used to correctly polarize the telephone line on its way to the line-status and -control circuitry. The ring-detector circuitry is connected directly to tip and ring. It detects an AC signal greater than 100 volts p-p. Capacitor C18 blocks the 48-volts DC from opto-coupler IC15's LED, and R11 limits the LED's current.

When a ring signal is present, the opto-coupler's output transistor is on, which causes C26 to



YOU CAN MAKE YOUR OWN PC BOARD for the telephone line controller. This pattern is for the component side of the board.

9 1/4 INCHES

discharge, pulling the input of IC10-d to ground. The processor reads the output of IC10-d (high when ringing) into data line DO by enabling IC1. Resistor R10 charges C26 at a rate where the brief pauses between rings will not reach the threshold of IC10-d, thereby maintaining IC10-d's output high.

Schmitt trigger IC10-e and IC14 allow the controller to "pick-up," or get on line. The processor sets the input of IC10-e. The output of IC10-e then drives the LED part of opto-coupler IC14 to ground via R7. The transistor part of IC14 then turns on, driving Q3. At this point, the following components are conducting the loop current in a clockwise order: R13, 1/4 of BR2, Q3, LED1, R9, 1/4 of BR2, and R12. LED1 is there only to indicate that the controller has "picked-up."

A circuit made up of transistors Q1 and Q2, IC13, and IC10-c continually monitors the telephone line. When any telephone on the line is picked up, the voltage between the tip and ring drops from 48- to 7-volts DC and, as a result, Q2 turns off. Transistor Q1 then turns on, turning on the transistor in the opto-coupler IC13, causing the output of IC10-c to go high. That tells the processor that somebody is on the line. The processor reads that signal on data line D1 via IC1. IC10-a and -b provide the internal microprocessor with a reset pulse on power up, and on bus-transfer command.

The card can get its power from the host computer via D2, at least while the host computer is in operation, and the external wall transformer is not connected. The existence of external power



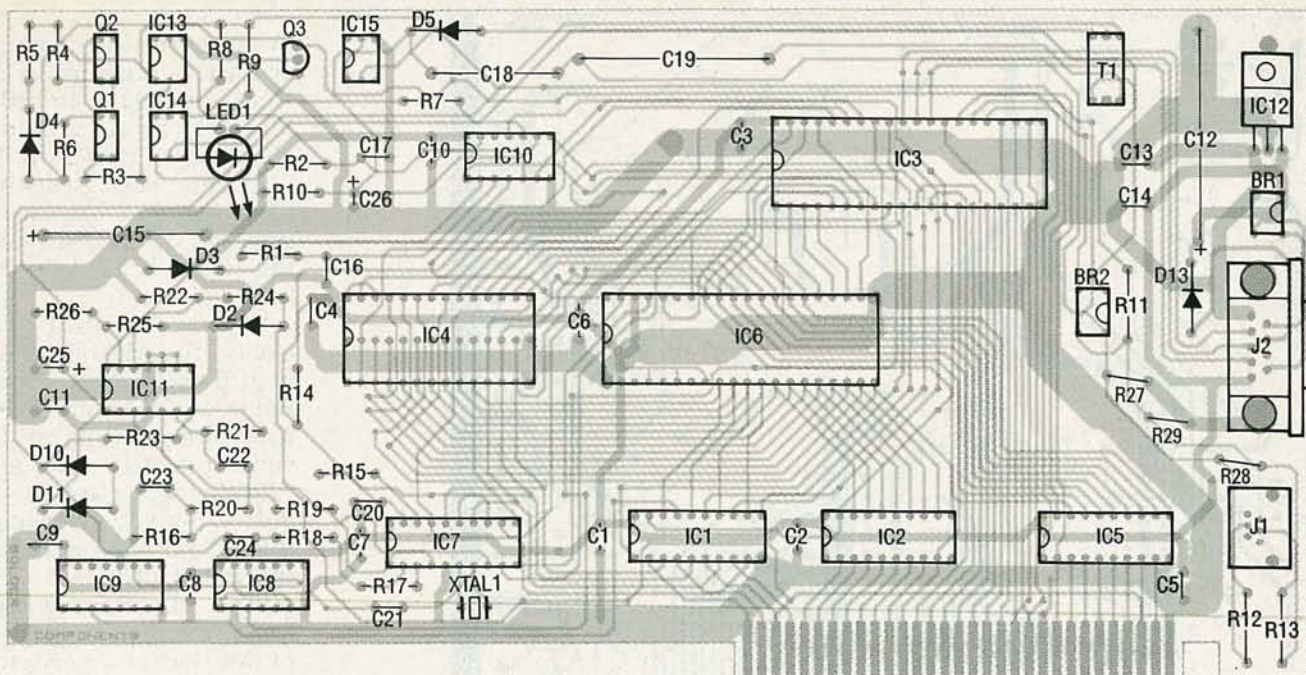


FIG. 4—PARTS-PLACEMENT DIAGRAM. The card is assembled on a double-sided PC board that fits in an expansion slot on your motherboard.

#### PARTS LIST

All resistors are 1/8-watt, 2%, unless otherwise indicated.

R1, R2, R10, R17, R18—100,000 ohms  
 R3—51,000 ohms  
 R4—R6—1 megohm  
 R7—5100 ohms  
 R8—4700 ohms  
 R9—300 ohms, 1/2-watt  
 R11—2200 ohms  
 R12, R13—5100 ohms  
 R14—3000 ohms  
 R15, R24—36,000 ohms  
 R16, R20—10,000 ohms  
 R19—2 megohms  
 R21, R22, R25, R26—33,000 ohms  
 R23—390 ohms  
 R27—R29—P7056 125-volt surge suppressor

#### Capacitors

C1—C11, C13, C14, C25—0.22  $\mu$ F, 50 volts, ceramic  
 C12—470  $\mu$ F, 25 volts, electrolytic  
 C15—220  $\mu$ F, 10 volts, electrolytic  
 C16—1000 pF, 100 volts, ceramic  
 C17—0.47  $\mu$ F, 50 volts, ceramic  
 C18—0.22  $\mu$ F, 250 volts  
 C19—1  $\mu$ F, 250 volts  
 C20, C21—0.01  $\mu$ F, 100 volts, ceramic  
 C22, C23—0.1  $\mu$ F, 50 volts, ceramic  
 C24—0.015  $\mu$ F, 100 volts, ceramic  
 C26—4.7  $\mu$ F, 25 volts, electrolytic

#### Semiconductors

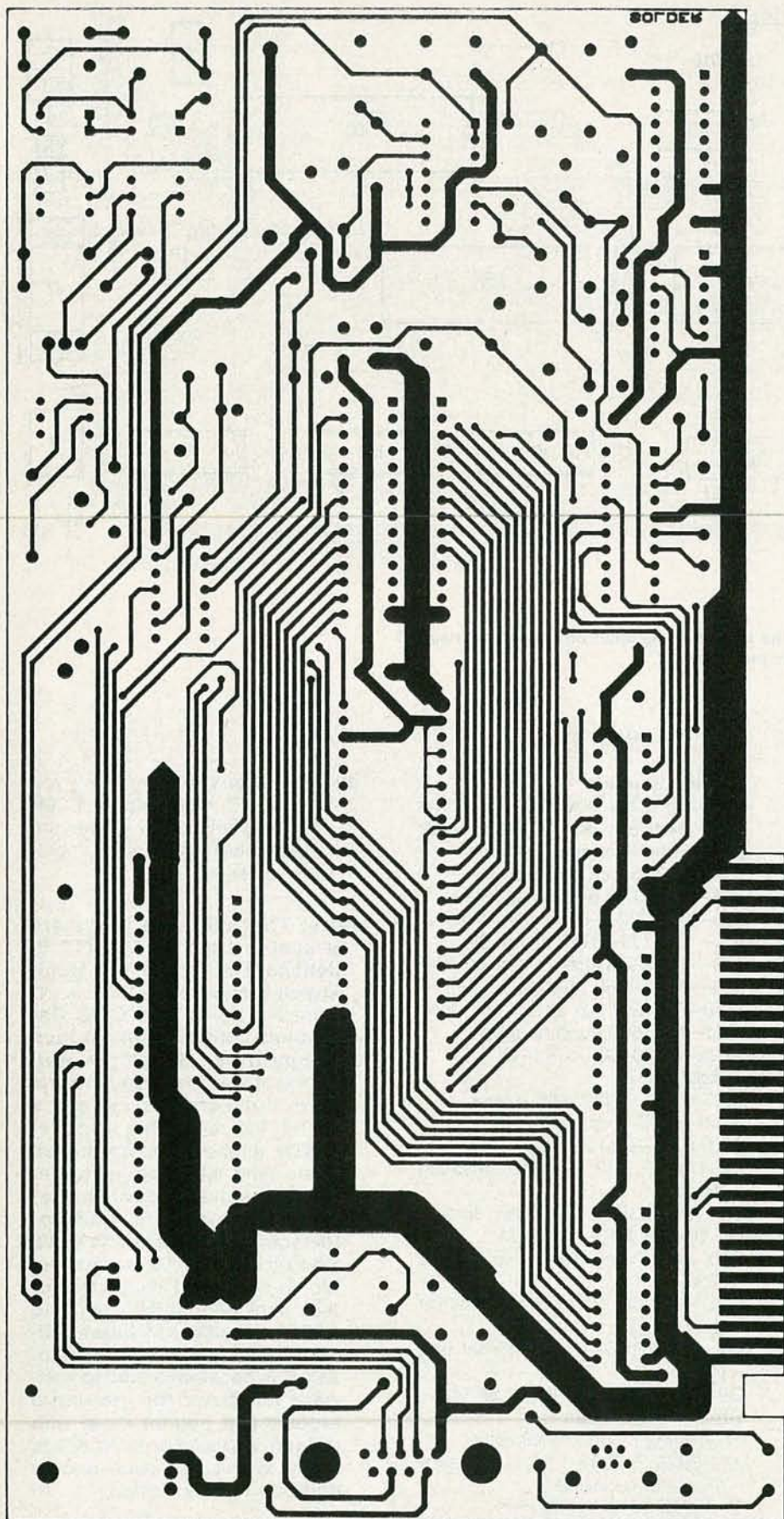
IC1—74HC244 octal tri-state buffer  
 IC2—74HC541 octal tri-state buffer  
 IC3—S26C41 interface adapter  
 IC4—V62C64 8K  $\times$  8 SRAM  
 IC5—74HC245 octal transceiver  
 IC6—65SC02 8-bit microprocessor  
 IC7—S18C62 DTMF processor  
 IC8—74HC393 dual 4-stage counter  
 IC9—74HC4060 14-state counter  
 IC10—74HC14 hex Schmitt trigger  
 IC11—LMC660 quad op-amp  
 IC12—LM2940CT-5 +5-volt regulator  
 IC13, IC15—4N32 optoisolator  
 IC14—H11D-2 optoisolator  
 BR1, BR2—DB103 bridge rectifier  
 D2, D3, D5, D13—1N4148 switching diode  
 D4—1N5253B 25-volt Zener diode  
 D1, D6—D9, D12—not used  
 D10, D11—1N4731A 4.3-volt Zener diode  
 LED1—P300 light-emitting diode (any color)  
 Q1, Q2—IRFD210 N-channel hex DIP  
 Q3—MPSA43 H.V. NPN transistor

#### Other components

J1—H9032 modular connector  
 J2—8926 747844-1 female D-subminiature connector  
 T1—42HL016 600/600-ohm transformer  
 XTAL1—3.579545-MHz crystal

**Miscellaneous:** PC board, 9-volt 200-mA AC wall adapter, E09P male D-subminiature connector, battery holder, PC bracket, hardware, solder, etc.

**Note:** The following items are available from AC&C, 717 E. Jericho Tpk., Suite 101, Huntington Station, N.Y. 11746: A PC board (TLC-1) and OGC Restrainer software (on 5 1/4-inch floppy disk), \$55.00; A wall transformer, modular phone cord, three connectors, and a metal PC mounting bracket \$36.00; all the above mentioned items, and all components including semiconductors, resistors, capacitors, and optoelectronics devices; \$198.00. Be sure to add \$5.50 to any order for shipping and handling. For technical information, write to AC&C, and please include a self-addressed stamped envelope. AC&C is constantly adding software functions for the entire product line, and for those with unique applications, AC&C is ready to work on your custom software requirements.



9 1/4 INCHES

(AC line transformer, and or battery backup) is detected by IC11-d, in order to alert the user before shutting off power on the host computer. Resistors R24 and R22 are set to provide the non-inverting input of IC11-d with 2.39 volts.

When external power exists, the cathode of D2 is at 5 volts. When external power does not exist, the voltage drops to 4.3 volts; resistors R25 and R26 divide the voltage by 2, to 2.5 and 2.15 respectively, to drive the inverting input of IC11-d. The output, therefore, will go high when the external power does not exist and vice-versa. The 5-volt regulator IC12 provides the circuits with power as long as it is supplied with at least 6.5-volts DC or 7 volts AC RMS.

A provision has been made for future interface with external hardware on a three-line serial communication; see pins 2-4 of connector J2. Also, ground and  $V_{CC}$  is brought to pins 1 and 5 respectively. The connection of a battery to pin 7 is optional; when used, it ensures proper operation during power interruptions.

#### Construction

Construction of the card is straightforward. Figure 4 shows a parts-placement diagram. The PC board can be made from the foil patterns provided, or you can purchase one from the source mentioned in the parts list. When building the board, just be sure to install the IC's last, as they are more susceptible to damage than the other components. The only other thing that needs explaining is the bracket that holds the card down in the computer. You must take a "blank" IBM-  
(Continued on page 82)



# DATA DISKS: HIGH SPEED DEVICE SELECTION FOR THE 90'S



ED PRESTWOOD\*

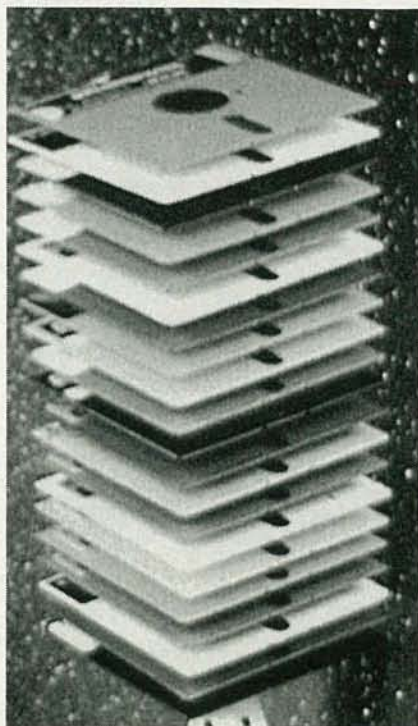
TRADITIONALLY, DEVICE SELECTION involved paging through hard copy selection guides and data books until a suitable device was located. Now, with the revolution in electronic data processing, the technical community is quickly moving toward high-speed computer-assisted software for selecting semiconductors and other electrical components. The process is not only faster and simpler, it also results in better device selections.

What began as a simple foray into PC-assisted device selection is rapidly becoming the preferred method of device selection by today's engineers. For one thing, data disks routinely save users hours in the device-selection process. Second, and perhaps even more important, there's a tremendous cost advantage for engineers to design in components that not only perform well, but are cost-effective as well. Selecting the ideal device at the best price often results in the savings of thousands of dollars for companies that take the time to optimize their designs. Some companies are even using data disks to find better, less expensive replacements for components in existing designs.

## What are data disks?

Data disks are selection guides on floppy disks. Manufacturers are now providing data disk's to

\*Ed Prestwood is president of Cybersoft, Inc., a Tempe, AZ company specializing in the production of data disks.



customers as a supplement to conventional literature to speed up and simplify the device selection process. Data disks are not intended or designed to replace data sheets; instead, they are computer-assisted selection guides that recommend several suitable devices for the user's application. They run on popular PC's and help users select the ideal device or product for their application in seconds rather than minutes or even hours. Some data disks integrate cross reference support for as many as 27,000 competitive devices.

***Finding the right component for a particular application is easier than ever, with the help of today's data disks.***

After the data disk recommends several suitable candidates, it's up to the user to obtain the appropriate data sheet to make a final intelligent selection. To make it easier to order the proper literature, some disks even contain listings of technical literature for the devices on the disk. The Motorola data disk, for instance, lists every application note, article reprint, engineering bulletin, training course, data sheet, and data book available for over 13,000 integrated circuits and discrete semiconductors.

## What do data disks do?

One of the simplest functions provided by these electronic selection guides is the part number search. Users enter the device number they are interested in, press the Enter key, and the program conducts the search. When the part is found, all information concerning it is displayed. The more sophisticated disks automatically search every product category on the disk for a spec-

ified part number. A useful variation of the part number search is the partial part number search. In a partial device number search (also called a substring search), the user enters a portion of a device number—"6800," for instance. The program then locates every device that contains "6800" somewhere in its part number and displays the list in a tabular format on the screen. One similar feature is called the complementary device number search. This option will locate the electrical complement for any discrete device specified by the user.

A few of the currently available data disks provide a useful cross-referencing feature. If the specified part number isn't on the disk, the program automatically looks for it in a special cross-reference file. If it's listed, the software automatically looks up the manufacturer's equivalent device and displays the information for that device. Some data disks tell users if the cross-reference device is a "similar replacement" or a "direct replacement." The Harris Op Amps data disk even tells users about the pin-to-pin compatibility and the degree of electrical equivalency. The Harris disk also provides comments regarding the suitability of the device as a substitute for the requested device number.

For most users, the most valuable capability of data disks is the parametric search function. After this function is selected, the program displays a menu of parameters for the devices in the selected product category. Users then select the parameters for their application from a menu and enter minimum or maximum values appropriate for their application. Some data search disks provide pop-up menus that list choices for parameters such as package, temperature range, Zener voltage, etc. After entering the values, pressing a single key will display all the devices that meet or exceed the specified requirements.

Like any good spreadsheet, the better data disks allow users to conduct "what if?" sessions. High-end data disks, such as those developed by CyberSoft, actually remember the previous parametric search and permit users to conduct the search over

and over, "tweaking" just one or two parameters with each pass. That permits users to make whatever compromises are necessary to optimize the cost-performance tradeoffs.

Data disks also provide a host of other features, such as the ability to limit searches to military components, surface mount components, or military surface mount components. Many data disks include a printable "Information Request Form" so that users can order technical literature and sample devices. Most data disks also contain sales office and/or distributor contact lists. Help files, screen-color utilities, and printer utilities (including network and spooler

support) are also available on some disks. The Burr-Brown data disk even has a provision for displaying new product information that users can download from the Burr-Brown BBS in Tucson, Arizona. Thoughtful manufacturers also include a phone number for users to call to obtain the latest versions of their data disks. Many offer free subscription services.

#### Are all disks created equal?

By no means. Several of the data disks available today are highly polished, professional software packages. A few, however, carry the mark of the novice. The differences matter little, however, when a manufacturer

### SOME AVAILABLE DATA DISKS

#### Analog Devices

Two Technology Way  
Norwood, MA 02062  
Bill Schweber (617) 329-4700  
CIRCLE 225 ON FREE INFORMATION CARD

#### Best Power Technology

P.O. Box 280  
Necedah, WI 54646  
Literature Center (800) 356-5794  
CIRCLE 226 ON FREE INFORMATION CARD

#### Bourns

1200 Columbia Avenue  
Riverside, CA 92507  
Customer Service (714) 781-5500  
CIRCLE 227 ON FREE INFORMATION CARD

#### Burr-Brown

P.O. Box 11400  
Tucson, AZ 85734  
Customer Support (800) 548-6132  
CIRCLE 228 ON FREE INFORMATION CARD

#### Cuttler-Hammer

Dept H293  
4201 N. 27th Street  
Milwaukee WI 53216  
Diane Nuesslein (800) 833-3927  
CIRCLE 229 ON FREE INFORMATION CARD

#### Equipto

351 Woodlawn Avenue  
Aurora IL 60506  
Customer Service (708) 897-4691  
CIRCLE 230 ON FREE INFORMATION CARD

#### Harris Semiconductors

P.O. Box 883, M/S CB-1-25  
Melbourne, FL 32901  
Literature Center (407) 724-3739  
CIRCLE 231 ON FREE INFORMATION CARD

#### Lambda

515 Broad Hollow Road  
Melville, NY 11747  
Customer Service (800) 526-2324  
CIRCLE 232 ON FREE INFORMATION CARD

#### Motorola

P.O. Box 20924  
Phoenix, AZ 85036  
Literature Center (800) 521-6274  
CIRCLE 233 ON FREE INFORMATION CARD

#### Newport

P.O. Box 8020  
Fountain Valley, CA 92728  
Technical Hotline (714) 965-5406  
CIRCLE 234 ON FREE INFORMATION CARD

#### Philips Components

George Washington Hwy.  
Smithfield, RI 02917  
Cindy Taylor (401) 232-0500  
CIRCLE 235 ON FREE INFORMATION CARD

#### Precision Monolithics

1500 Space Park Drive  
Santa Clara, CA 95052  
Literature Center (800) 843-1515  
CIRCLE 236 ON FREE INFORMATION CARD

#### Titan Severe Environments

20151 Nordhoff Street  
Cathsworth, CA 91311  
John Van Putten (818) 709-7117  
CIRCLE 237 ON FREE INFORMATION CARD

#### Western Digital

17900 Von Karman Ave.  
Irvine, CA 92714  
Literature Center (800) 832-4778  
CIRCLE 238 ON FREE INFORMATION CARD

#### Xentek

P.O. Box 1987  
Vista, CA 92083  
Larry Merchell (619) 727-0940  
CIRCLE 239 ON FREE INFORMATION CARD

has the only data disk for their given product line. But with new disks becoming available every few weeks, the competition to provide the most convenient and powerful user interface is intensifying. All the manufacturers mentioned here have improved their disks with each new revision. It may seem ironic, but today and throughout the 90's, the battle for share-of-mind will be fought and won on the basis of

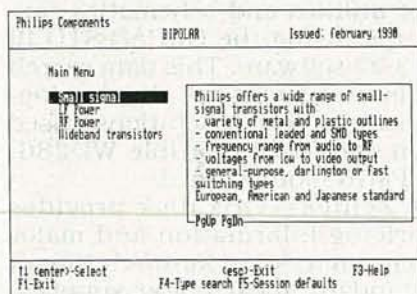


FIG. 1—THE MAIN MENU from Philips Components' Discrete Semiconductors Transistors data disk.

the ease of selection rather than solely on the reputation of the manufacturer.

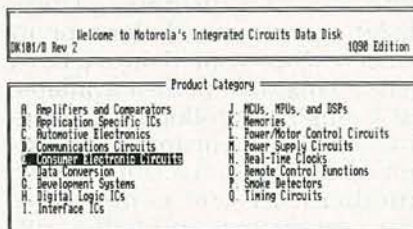
A few of the data disks available today provide automatic multi-level sort capability, which is a definite advantage in today's competitive market. CyberSoft, Inc. introduced the multi-level sort feature when it developed the first Motorola data disk in 1987. The multi-level sorting algorithm sorts each and every column selected by the user. It sorts on the first selected parameter, the second parameter, the third, and so on across all the parameters selected by the user. The procedure takes place in milliseconds and assures users that the absolute best device in the database for the specified application is always listed first, and so on.

The automatic multi-level sort is arguably the very best way to display data. A less useful compromise to the automatic multi-level sort is the manual column-by-column sort that users can conduct after the search has been completed.

One feature users should be aware of is called the "early-abort" search algorithm. Some data disks search their databases and abort the search after a specified number of devices are located (10 and 15 are common

numbers). That's an awful approach to searching a database, since the 16th device—or the 2,016th, for that matter—may be the ideal device for the specified application. Look for disks that search the entire database for parameters selected by the user, then report back the total number of "hits." The best way for the software to "know" how many devices meet the user's requirements is by searching the entire database.

Another very useful feature that separates the men from the boys is called parameter queuing. That is, the program automatically displays the parameters in the same sequence that the user selected them in. If a user selects  $r_{DS(on)}$  as his or her



• Press the letter of the desired category. Press **ENTER** for highlighted option.  
• Press **ESC** to print screen. Press **DEL** for Colors.  
• Press **ESC** for previous screen. **ESC** for Exit Screen. **ESC** for Main Menu.

FIG. 2—MOTOROLA'S IC data disk gives access to a wide variety of product categories.

most important parameter, it is displayed in the first column. Likewise, if the user specifies breakdown voltage as the second most important parameter, it will be displayed in the second column. Automatic parameter queuing, coupled with automatic multi-level sorting, provide users with the most useful and convenient display sequence possible. Burr-Brown, Harris, and Motorola support both of these important features in their data disks.

Data disks also vary greatly in the amount of data they store. The number of devices is not a reliable indicator of the amount of information contained on the disk because there may be only five or six columns of information available for each device. CyberSoft, who developed the Burr-Brown, Harris, Motorola, Titan, and Western Digital data disks, supports up to 64 columns of data for every device, which can add up to a lot of data. A final

consideration when gauging the amount of information on a disk is the number of cross references supported. Motorola's data search disk contains well over 25,000 cross-references, which can be a great convenience for designers and technicians alike.

Some data disks include pricing information. Most engineers insist on seeing price information, even if it's only "ball park" pricing. Relative pricing greatly simplifies designing to a budget. If two devices will work in a specified application and one costs half as much as the other, it generally pays to take a good look at the less expensive component. Some disks, like the Titan Data disk, provide users with volume pricing based on the quantities ordered.

One other feature that appears only on high-end data disks is footnote support. All too often, a device that looks ideal may be inappropriate because of some subtle characteristic that isn't obvious by looking at the tabular



**ESC** = Main Menu; **ESC** = Print; **ESC** = Help; **ESC** = Exit Screen; **ESC** = Exit.

FIG. 3—A SAMPLE DEVICE INFORMATION screen from Western Digital's data disk.

data itself. All data disks developed by CyberSoft provide extensive footnoting capabilities.

Another important thing to look for in a data disk is good customer support. Some companies, like Burr-Brown, Motorola, and Western Digital, are placing their data disks onto corporate Bulletin Boards so users can download their latest data disk (and/or new product updates) in minutes. Others, like Equipto, provide a dedicated customer service number that users can call. Within minutes, Equipto sends FAX information on any component covered in their data disk to their customers. Equipto's disk, coupled with their dedicated support line, has not only dramat-

ically increased sales leads, it's also propelled them into a record sales year.

### Who's offering data disks?

Over the past four years, a number of companies have provided data disks to their customers. Disks are distributed at trade shows, technical colleges and universities, and through "shareware" catalogs. More and more of the 6,000+ bulletin board services across the United States have data disks waiting to be downloaded at no charge. The following list shows a sampling of the data disks that are free for the asking.

- Analog Devices—This disk provides pricing information and covers Analog Devices' line of op amps and data conversion circuits. Disks containing SPICE emulation models for Analog Devices op amps are under development and will soon be available.
- Best Power Technology—This disk, available in English, French, German, or Spanish, is a "brochure-on-a-floppy" for their broad line of computer-grade uninterruptible power supplies.
- Bourns—Bourns "Selectrim" data disk provides coverage for Bourns' complete line of trimmer potentiometers.
- Burr-Brown—This data disk covers Burr-Brown's entire line of op amps, instrumentation amplifiers, isolation amplifiers, analog circuit functions, D/A and A/D converters, analog circuit multiplexers, sample/hold amplifiers, voltage-to-frequency converters, and data-acquisition components.
- Cuttler-Hammer—Billed by the company as an "Expert System" program, this data search disk leads specifiers through a series of pertinent questions that results ultimately in the recommendation of the appropriate photoelectric or proximity transducer for a given specified application.
- Equipto—The Equipto disk incorporates more graphics than most data disks. It helps users specify the optimal modular enclosure (including vertical racks and slope front consoles) for electronic equipment. Also includes computer furniture, instrument cabinets, and EMI/RFI shielded enclosures.

- Harris—Harris' first entry in the data disk arena covers their broad line of operational amplifiers, including devices from the recent merger of GE, RCA, and Intersil. Look for additional Harris product lines to be added soon. A disk containing SPICE macro models for several Harris op amps is also available.

- Lambda—Lambda offers a disk covering their broad line of AC-DC switching and linear power supplies, DC-DC power supplies and converters, supplies for laboratory and test equipment, power semiconductors and power systems. It also includes pricing information.

- Motorola—Motorola offers two IBM disks containing all the selection guide information for both IC's and discretes. These disks operate stand-alone or in concert when copied onto a hard drive. This disk is also available on a single microfloppy for Macintosh PC's. It features 124 product categories, 13,000 device numbers, 27,000 competitive cross references, and half a million parameters. Motorola also offers SPICE models for their power MOSFET's and scatter parameters for selected small signal RF devices.

- Newport—The Newport Optics Catalog on a floppy features their line of optical lenses. Includes over 2,100 cross reference products for several of Newport's major competitors products.

- Philips Components—This company is offering four data disks, covering diodes, FET's, hybrid amplifiers, optocouplers, power MOSFET's, small-signal transistors, and trigger devices. Competitive cross references and pricing are supported.

- Precision Monolithics—The "Precision Decisions" data disk provides data for PMI's IC product line, including op amps, data conversion circuits, and sample and hold circuits. Includes prices and industry cross references. A disk containing SPICE emulation models is also available.

- Titan Severe Environment Systems—The Titan disk features the company's full line of SECS militarized and ruggedized board-level and system products, including microcomputers, memory, parallel and serial interface, bus interface,

analog, and peripheral controller modules. The data disk also includes product overviews and general pricing information.

- Western Digital (WD)—Provides extensive coverage for WD's line of VLSI chip set solutions for XT, AT, 386 and 486 PC architectures, including their Microchannel products. Prints product overviews and provides a useful "Related Solutions" section. WD also offers a two-disk set of utilities and schematics captured using the ORCAD/STD III v3.22 software. This data search disk set facilitates the development of design solutions based on the AT-compatible WD286-LPM16 motherboard.

- Xentek—This disk provides pricing information and major parameters for Xentek's line of standard linear power supplies. Extreme isolation transformers and switching power supplies will be added in the near future.

### Gimmick or trend?

Data disks have come a long way from the first ones that appeared in the mid 1980's. What may have begun as a marketing gimmick is now evolving into a useful engineering trend. Today's data disks cover virtually every discrete and IC product category. New disks are also covering power supplies, sensors, resistors, VLSI chip sets, plastics, and even optics and lasers.

The major force driving the data disk market is that companies are motivated to make it as easy as possible for customers to select and purchase their products. The thrust and cut of competition has helped create a healthy win-win situation: manufacturers view their data disks as marketing tools; users view data disks as time-saving engineering tools. Since introducing their first data disk, Equipto reports an increase in sales leads from 12,000 per year to approximately 75,000 better qualified sales leads per year! That kind of result, coupled with increasing customer demand for faster, easier, and better device-selection tools will continue to assure the proliferation of data disks. For more information, contact CyberSoft, Inc., at 1820 W. Drake Drive, Suite 108, Tempe, AZ 85283, (602)491-0022. R-E

LAST MONTH WE FINISHED BUILDING THE MOTHERBOARD AND THE motor-controller board. Then we covered the operating theory of the power board. So, now let's get to building whatever we haven't covered yet, including the control panel, power board, and mechanical assembly.

### Construction

Fabricate an aluminum sheet-metal enclosure to house the control-panel electronics; we showed you how to wire everything last month.

As for the manual controller, drill holes in a plastic box to accommodate the components; we showed you a schematic of the controller last month. Feed the ribbon cable through a hole on the side of the plastic box and put a knot on the inside of the box so that the wire can't be pulled through. Fasten the top cover to the box and attach the knob to the potentiometer (P1).

### Power-board construction

Following Fig. 1, mount the following components on the solder side (back side) of the PC board: R42, R52, R54, D7-D9, D20-D29, and all E-terminals (they are basically solder posts that allow you to solder heavy-gauge wire to the PC board). Those components are mounted on the solder side in order to create more space for the other components. It is probably a good idea to add a 1/8-inch piece of sleeving insulation to the leads of those components before assembly (with the exception of the E-terminals). That will prevent any accidental shorting of the exposed component leads. After they are installed, trim the component leads. Now install the remaining parts on the component side with the exception of the power MOSFETs.

The MOSFETs require the installation of heat sinks and insulators before assembly. For each MOSFET, place an insulator on the PC board and then cover with a heat sink. Carefully clip off the center lead (drain) of the MOSFET as close to the device body as possible. The lead is not used because the drain connection is also provided by the metal tab on the MOSFET. Bend the MOSFET leads at a 90° angle and insert into the PC board so the device lies flush with the heat sink. Secure the device and heat sink to the PC board with 4-40 hardware.

The high-current jumpers should now be installed on the solder side of the PC board; solder them to the E-terminals. The jumpers are required because the etched traces on the PC board can not handle 15-30 amperes. The jumpers should be made of solid insulated 18-gauge wire. Figure 2 illustrates the three types of jumpers. Install the jumpers on the solder side

**Let's mow the lawn already—  
rather, let's watch the lawn get  
mowed!**

# Build the Lawn Ranger



**RAYMOND RAFAELS**

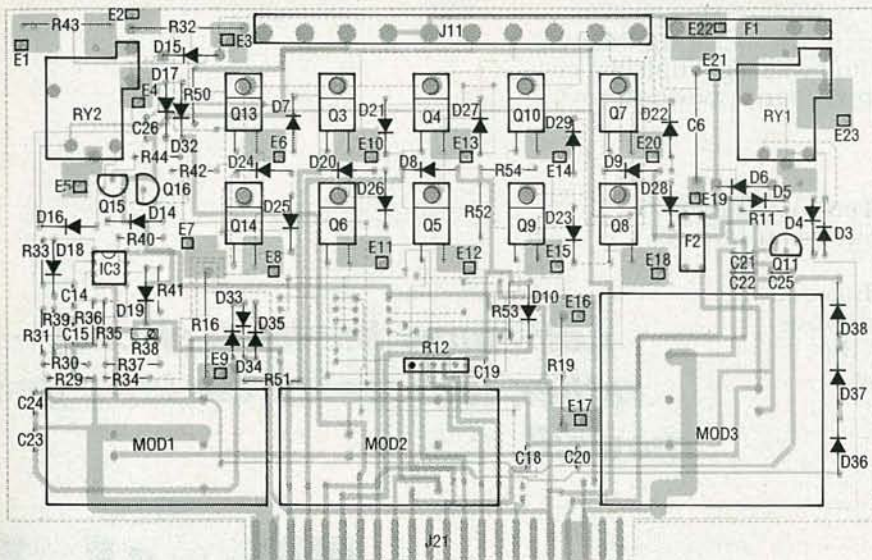


FIG. 1—PARTS PLACEMENT DIAGRAM for the power board. Remember that several components must be mounted on the solder side of the board to leave room for the other components (see text).

of the board as follows:

#### TYPE-A JUMPERS

- E-23 to drain of Q8
- E-18 to drain of Q9
- E-20 to drain of Q10
- E-13 to drain of Q5
- E-10 to drain of Q6

#### TYPE-B JUMPERS

- Drain of Q4 to Drain of Q7
- Drain of Q3 to Drain of Q4
- Drain of Q8 to Drain of Q14
- Drain of Q7 to Drain of Q18 (mount on component side)
- Drain of Q13 to Drain of Q14 (mount on component side)

#### TYPE-C JUMPERS

- E-23 to E-21
- E-18 to J11-10
- E-19 to J11-8
- E-20 to J11-9
- E-17 to J11-8
- E-14 to E-15
- E-15 to E-16
- E-13 to J11-7
- E-10 to J11-6
- E-12 to E-11
- E-11 to E-7
- J21-23 to J11-3
- E-6 to E-8
- E-2 to E-6
- E-5 to J11-2
- E-1 to E-17
- E-1 to E-9
- E-3 to E-4
- E-22 to J11-4
- E-22 to J11-5

#### Grass-sensor assembly

Build the mechanical portion

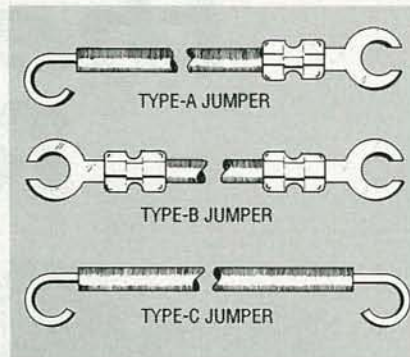


FIG. 2—HERE ARE THE THREE TYPES OF JUMPERS. They are used to handle the high currents that exist on the power board.

of the sensor assembly as shown in Fig. 3, and wire the grass sensors themselves as shown in Fig. 4. The length of the ribbon cable that connects the sensor assembly to J1 on the motor-controller board should be approximately 3½ feet long. Crimp J1 onto the end of the ribbon cable using an IDC crimping tool or vise.

#### Power-board testing

Inspect all solder joints and jumper connections to ensure that everything is properly assembled. Place the power board on a flat surface (not plugged into the motherboard) and temporarily jumper J11-3, J11-8, and J21-44 with clip leads. Now connect the +24-volt input to the PC board through J11-4 (+) and J11-3 (ground). You should hear the relay "click" on. Measure the DC voltages at J21-32, J21-18,

J21-30, J21-31, and J21-19. The voltage readings should match the values listed on the schematic diagram that we showed you last month. If all the voltages read correctly, the DC/DC converters are working properly. Remove the test clip leads from the PC board.

#### Mechanical assembly

Figure 3 shows the mechanical assembly of the Lawn Ranger. Although it does not include all of the details, detailed mechanical drawings can be purchased from Technical Solutions. However, the chances are that you won't follow the original plans exactly—just as long as you follow the general layout. Also, make sure that the cutting section is safely constructed, and that the blade shield protects the cutting deck a full 360 degrees. **WARNING**—The cutting blades should not be connected until it has been proven that the Lawn Ranger has been properly constructed, is fully functional, and safe.

Many of the mechanical parts are available from various manufacturers listed in Table 1. The rest of the mechanical components shown in Fig. 3 are not available from TSI; you must either fabricate them yourself or have a local machine shop make them for you.

#### WHAT'S BEEN COVERED

This series on the Lawn Ranger began in the June issue. In that issue, we covered the general operation of the unit, the software, and we discussed and built the CPU board.

In the July issue, we went over the electronic control system, the motor controller board, D/A converter circuitry, grass-sensor circuitry, motherboard, and velocity-feedback loops. We gave you the parts lists for the motor-controller board and the motherboard, although we didn't get to build them that month.

In August, we began with the construction of the motherboard and the motor-controller board. Then we covered the operation of the power board, drive motors, cutting motors, hand-held controller, and the Lawn Ranger's electronic control panel.

In this issue we have finished up the series. We hope you have found it to be an interesting and worthwhile project.

R-E

# 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

### CLOSING DATES:

Issue	Reservations in N.Y.	Final Film in N.Y.
Sept. 1990	June 11, 1990	June 18, 1990
Nov.	Aug. 13	Aug. 20
Jan. 1991	Oct. 15	Oct. 22
Mar.	Dec. 13	Dec. 20
May	Feb. 13, 1991	Feb. 20, 1991



## ADVERTISERS INDEX

Alfa Electronics .....	28	Information Unlimited .....	37
All Electronic .....	8	Jensen Tools, Inc. ....	36
AndraTech .....	32	Kelvin Electronics .....	29
B.G. Micro .....	35	L-Com, Inc. ....	28
Battery Tech. ....	32	Mondo-Tronics, Inc. ....	36
Becktron .....	16	Needham's Electronics. ....	26
The Book Source .....	6	O W I. ....	20
Calco International .....	16	Omnitron. ....	27
Command Productions. ....	21	P.C. Boards .....	22
Computer Disk Service .....	30	PMC Electronics .....	20
Consumertronics .....	24	Paladin Electronics .....	34
d b Computer Products. ....	14	Periphex, Inc. ....	30
D & D. ....	17	Prelco .....	25
Dalbani Corporation .....	13	Ramsey. ....	3
Davilyn .....	7	Sescom .....	20
E.T. Tech, Inc. ....	26	Sky Vision .....	40
Electric Rainbow .....	23	Surplus Sales of Nebraska .....	16
Electrified Discounters .....	11	Surplus Traders .....	12
Electronic Goldmine .....	19	Tanner Electronics. ....	10
Electronics Parts Outlet .....	26	Tech Services .....	34
Electronics Clearing House. ....	30	Top Sales Co. ....	18
Electronics 1 2 3 .....	18	TransWorld .....	32
Gems Computers, Inc. ....	33	Ucando .....	34
J.F. Glaser .....	10	United Electronic Supply .....	31
Gott Electric .....	4	Universal View. ....	39
The Grapevine Group. ....	36	Video Repair .....	24
Gray Maher .....	22	Viejo .....	34
IQ Systems. ....	2	Walling Co. ....	36

**BREAK THE SYSTEM  
WIN - \$25,000**

**THE TymCard®  
\$25,000 CHALLENGE**

***IQ, Inc.*, in an attempt to improve the security of its product,  
offers this challenge:**

***IQ, Inc.***, is about to release an anti-fraud "smart card" called ***TymCard***, to be used by long distance telephone companies to help eliminate calling card fraud. We believe our product to be unbeatable. To detect any possible flaws in our system. ***IQ, Inc.***, is offering a prize of \$25,000 to the first person who can demonstrate that he or she has been able to access the system, at any time, by being able to generate a valid code at will. Accessing the system DOES NOT mean "breaking" one or more existing TymCards as that only allows temporary and insignificant access to the system.

**EXAMPLE:** If you knew the numbers of one or more TELCO calling cards, you would be able to make long distance calls that would be charged to that card - until you were discovered - and that number was deactivated. If, however, you had a "Blue Box", you would be able to make calls at any time. You were able to "break the system" without need for any calling card numbers. The only permanent solution, as far as TELCO was concerned, was to change the system which, in effect, "deactivated" the Blue Box.

A condition of this challenge is that you supply to ***IQ, Inc.***, the details on how you were able to "crack the system" and assist ***IQ, Inc.***, to correct the flaw.

Each respondent to this challenge will be invited to a meeting with members of our staff. At this meeting you will be given much more technical information about TymCard as well as a description of the service.

Please note that there is absolutely and positively no charge to you to accept this challenge. If you desire to "borrow" an ACTIVE ***TymCard*** that will allow you to test the system at any time, we ask for a \$50.00 cash deposit. This deposit will be returned to you, in full, upon the ***TymCard*** being returned to ***IQ, Inc.***, as agreed.

**If you are interested, please call (818) 592-0423 for information as to the  
time and location of the next meeting.**

**NOTE:** If you are not located in the Los Angeles area please call the number to arrange for complete information to be sent to you by mail.



# ★ 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, bikes, 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 stripline. Kit includes deluxe ABS plastic case with speedy 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 3.5-4.0 or 70-75 MHz. Direct conversion design using NE602 IC as featured in QST and ARRL handbooks. Less than 1 µV sensitivity, varactor diode tuned, 250 mw audio output. Runs on 9VDC, has RF 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 **\$24.95**
- 40 MTR receiver kit HR-4 **\$24.95**
- 80 MTR receiver kit HR-8 **\$24.95**
- Receiver case CHR **\$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 **\$29.95**
- 40 MTR QRP Kit QRP-40 **\$29.95**
- 80 MTR QRP Kit QRP-80 **\$29.95**
- Case kit CORP **\$12.95**

### AIRCRAFT RECEIVER KIT

Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110-136 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 which you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

- Complete kit, AR-1 **\$24.95**
- Receiver case kit, CAR-1 **\$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 mixer 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 **\$24.95**
- Receiver case kit, CSR-1 **\$12.95**

### PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom 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 **\$29.95**
- 10 MTR kit FR-10 **\$29.95**
- 220 MHz kit FR-20 **\$29.95**
- Receiver case kit CFR-7 **\$12.95**

## NEW MINIKITS—NEW MINIKITS

### BROADBAND PREAMP

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.

Complete kit, SA-7 **\$14.95**

### LIGHT BEAM COMMUNICATORS

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 windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operate on 9-12 VDC.

- Transmitter kit, LB-6 **\$8.95**
- Receiver kit, LB-5 **\$9.95**

### HIGH POWER FM WIRELESS MIKE

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-circuit microphone cartridge. Operates on 9-12 VDC.

- FM-4 kit **\$12.95**
- Sensitive microphone cartridge **\$2.95**

# 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 **\$38.95**



### PS-2 AUDIO MULTIPLIER

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

**\$69.95**

Wired PS-2 kit **\$48.95**



### PS-10B 1.5 GHz PRESCALER

Extends the range of your present counter to 1.5 GHz • 2 stage preamp • divide by 1000 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



**\$2795.00** 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



### TONE DECODER

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.

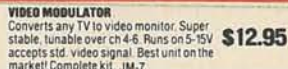
Complete kit, TD-1 **\$5.95**



### COLOR ORGAN

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.

ML-1 Kit **\$8.95**



### VIDEO MODULATOR

Converts any TV to video monitor. Super stable, tunable over ch 4-8. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit, JM-7

**\$12.95**

### LED BLINKY KIT

Alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights. Runs on 3 to 15 volts.

BL-1 Kit **\$3.95**

### MAD BLASTER

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.

MB-1 Kit **\$4.95**

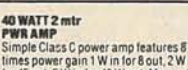


### FM WIRELESS MIKE

Transmits up to 300' to any FM broadcast radio. Uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-2 Kit **\$5.95**

FM-2 Kit **\$7.95**

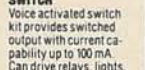


### 40 WATT 2 MTR PWR AMP

Simple Class G 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, less case and T-R relay.

PA-1, 40 W pwr amp kit **\$27.95**

TR-1, RF sensed T-R relay kit **6.95**



### VOICE ACTIVATED SWITCH

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 9 VDC.

YS-1 KIT **\$6.95**



### UNIVERSAL TIMER

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.

UT-5 Kit **\$5.95**



### WHISPER LIGHT

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, condenser up to 300 W, runs on 110 VAC.

WL-1 Kit **\$6.95**



### SIREN

Produces upward and downward wail. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.

Complete kit, SM-3 **\$3.95**



### SUPER SLEUTH

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.

BN-9 Kit **\$5.95**



### TELEPHONE TRANSMITTER

Low cost with professional performance. Features include: self phone line powered, tunable from 78 to 100 MHz, polarity antisensitive, compact size (3" x 1 1/4"), easily installs anywhere on the phone line or inside the instrument itself.

PB-1 KIT **\$14.95**



### FM MINI MIKE

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.

FM-3 Kit **\$16.95**

FM-3 Wired and Tested **19.95**



### MICROWAVE INTRUSION ALARM

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 light, light or vibrations. Drives up to 100 ma output, normally open or closed, runs on 12 VDC.

Complete kit, MD-3 **\$16.95**



### SPEECH SCRAMBLER

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 ODM circuitry. Can also be used to descramble most com. scramblers.

Complete kit, SS-7 **\$29.95**

Case kit, CSS-7 **12.95**

### CT-70 7 DIGIT 525 MHz



**\$139.95** WIRED, INCLUDES AC ADAPTER

### CT-90 9 DIGIT 600 MHz



**\$169.95** WIRED, INCLUDES AC ADAPTER

### CT-50 8 DIGIT 600 MHz



**\$189.95** WIRED, INCLUDES AC ADAPTER

### CT-125 9 DIGIT 1.2 GHz



**\$189.95** WIRED, INCLUDES AC ADAPTER

## 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-thru PC 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 bail for CT-70, 90 & 125..... **3.95**
- Nicad pack for CT-70, 90 & 125..... **8.95**

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mv to 150 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	<b>139.95</b>
CT-90	10 Hz-600 MHz	< 10mv to 150 MHz < 100mv to 600 MHz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	<b>169.95</b>
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	<b>189.95</b>
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	<b>189.95</b>
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv to 150 MHz < 150mv to 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	<b>229.90</b>



TERMS: • satisfaction guaranteed • examine for 10 days, if not pleased, return in original form for refund • add 8% for shipping and insurance for a maximum of \$10.00 • foreign add 15% for surface mail • CDD add \$4.00 (CDD 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

# GOTT ELECTRONICS

<b>COMBO PLUS by AST RESEARCH INC.</b>	<b>\$29.95</b>	<b>COMPUTER POWER CABLES BY BELDEN</b>	<b>\$2</b>
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.		10 AMP, 18/3, 6"	
<b>SIX PACK PLUS</b>	<b>\$39.95</b>	<b>TOSHIBA T3100 EXPANSION INTERFACE PA7313E</b>	<b>\$99.00</b>
Same as Combo Plus but expands to 384 KB of memory		<b>EXPANSION BOX PA7310U</b>	<b>\$299.00</b>
<b>SONY BATTERY PACK NP-11</b>	<b>\$39.95</b>	Interfaces Toshiba laptops to IBM BUS to use IBM add-on boards.	
(9.6V, 1000MA) for laptop computers and camcorders, nickel-cadmium battery		<b>LCD DISPLAY (MODEL LM585) BY HITACHI</b>	<b>\$199</b>
<b>ASYNCH CLUSTER ADAPTER by AST RESEARCH INC.</b>	<b>\$199.00</b>	640 x 200 Graphic and Alphanumeric	
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) (ASYNCH CLUSTER ADAPTER Cable additional \$15.00).		<b>LCD DISPLAY (MODEL EA-Y40025AT) BY EPSON</b>	<b>\$35</b>
<b>1/4" STREAMING TAPE CONTROLLER by ADAPTEC,</b>	<b>\$33.95</b>	40 characters X 2 lines	
<b>SCSI to QIC-36,</b> Model ACB-3530A (Manual \$5.00)		<b>POWER SUPPLY</b>	<b>9.95</b>
<b>FLOPPY DISK CONTROLLER BOARD</b>	<b>\$19.95</b>	For computer related equipment, Input 120V AC, 60Hz, 30W; Output =5V DC, 1000MA, +/- 12V DC, 200MA	
Dual 360K or 720K switch selectable		<b>CCD DOCUMENT SCANNER</b>	<b>\$39.95</b>
<b>BEZEL</b>	<b>\$2.00</b>	Uses a 4096-element line imaging chip. Can use for robotics, astronomy, machine vision, high resolution slow scan TV, etc. Supplied with documentation.	
For full height hard drive, black with rectangular LED lower lefthand corner, double-sided tape for mounting, 3-3/8"x5-7/8"		<b>STEPPER MOTOR</b>	<b>\$29.95</b>
<b>LASER PLATFORM ARRAY</b>	<b>\$499.00</b>	By Oriental Motor, Model #PH566-A-Q5, high precision, 500 steps per revolution, 0.72° per step.	
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.		<b>HITACHI LCD DOT MATRIX LM215B</b>	<b>\$29.00</b>
<b>NEW! NEC 10 Mil HeNe LASER Plus Power Supply</b>	<b>\$200.00</b>	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	
<b>LASER POWER SUPPLY</b>	<b>\$39.95</b>	<b>HITACHI DIGITIZING TABLET HICOMSCAN HDG-111</b>	
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.		Input device through which graphic data is input to a computer.	
<b>SHARP LASER DIODE</b>	<b>\$8.95</b>	11" x 10" Dimension	<b>\$199.00</b>
LT022MC, 5mW at 780nm, single transverse mode.		4-Button CURSOR for Digitizing Tablet	<b>\$29.95</b>
<b>MIRRORS, PRECISION FRONT SURFACE</b>		Manual	<b>\$5.00</b>
For use with lasers.		<b>EDGE CARD CONNECTORS</b>	
13-7/8"x1-3/16" <b>\$7.00</b>	19-1/2"x1-5/8" <b>\$10.00</b>	22/44 Connector, .156 spacing	<b>10pcs/\$7.50</b>
<b>GREEN FLUORESCENT TUBE</b> for scanners	<b>\$2.00</b>	25/50 Connector, for Apple	<b>10pcs/\$10.00</b>
<b>STAGE/STUDIO QUARTZLINE LAMP</b>		<b>COAX CONNECTOR</b> Part #CP-N1	<b>\$1.50</b>
FEL(Q1000/4CL) 1000W, 120V 3200°	<b>\$9.95</b>	<b>MONITOR BOARD WITH POWER SUPPLY/HI VOLTAGE</b>	<b>\$7.95</b>
<b>INTEL 27128A-20 EPROM (New)</b>	<b>\$4.00</b>	Video, brightness, focus, vertical, and horizontal with flyback transformer and high voltage parts, Model 99-0493-001 rev D	
<b>INTEL 2732A-3 EPROM (New)</b>	<b>\$2.00</b>	<b>Replacement CABLES for IBM-like keyboards</b>	<b>\$2.99</b>
<b>INTEL P-8031</b>	<b>\$3.00</b>	<b>APPLE MANUAL</b> (LaserWriter and LaserWriter Plus)	<b>\$5.00</b>
<b>TRIAC: Hitachi FSM16F4</b> 400 volts 16 AMPS	<b>\$2.50</b>	<b>WATERTIGHT ALARM BELL</b>	<b>\$19.95</b>
<b>DIODES 6A 200V</b> Motorola Part No. MR752 <b>30 for \$10.00</b>		By Henschel Corp., Type IC/BID3, size 3", 24V DC	
<b>RF CONNECTOR APPLIED ENGINEERING PRODUCTS</b>	<b>\$2.50</b>	<b>5 LB. SOLDER</b>	<b>\$25.00</b>
Model 2005-1551-003		Wire, Rosin Core, Tin/Lead 60/40, Flux 2.2%, Dia. .036 (20Ga)	
<b>GOLD WIRE WRAP SOCKETS</b>		<b>HARD DRIVE CONTROLLERS:</b>	
14 pin-10 pcs/\$5	16 pin-10 pcs/\$6	<b>Western Digital ST-506 (10-200 Mb)</b>	
<b>SOLID STATE RELAY, CRYDON D1240</b>	<b>\$19.95</b>	XT-WD1002A-WX1 <b>\$29</b>	AT-WD1003WAH <b>\$39</b>
input 3-32 VDC, output 120 VAC 40A		<b>HP NUMERIC DISPLAY 5082-7300</b>	<b>\$4.95</b>
<b>BIPOLAR LEADS</b>	<b>10 PCS/\$6</b>	<b>DATA LINK CONNECTOR</b>	<b>\$7.75</b>
<b>MOTOR, AIRPAX</b>	<b>\$9.95</b>	(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.	
120VAC 60Hz 2-12:1 gear train, toothed pinion		<b>AMP OPTIMATE FIBER OPTIC CABLE ASSEMBLY</b>	<b>\$49</b>
<b>COMPUTER:MOTOR-DRIVE SYSTEMS</b>		with Biconic Connectors (AMP Part #501450-2) 5 meters long.	
Model M57-83 <b>\$ 773</b>	<b>CRYSTAL OSCILLATORS</b>	<b>SYMBOL LASERSCAN 2000</b>	
Model M57-102 <b>\$ 942</b>	<b>\$1.50</b>	<b>VISIBLE LASER DIODE SCANNER</b>	<b>\$899</b>
Model M106-178 <b>\$1695</b>	8 MHz, 13.333 MHz, 14.864 MHz, 15 MHz, 25 MHz 36.037 MHz, 49.7664 MHz 50 MHz, 51.04 MHz, 75.6 MHz	Hand-held point-of-sale bar code scanner manufactured by Symbol Technologies, Inc.	
<b>VGA RT. ANGLE PC BOARD MOUNT CONNECTOR</b>		<b>ORIGINAL IBM MODEL 1130700</b>	
Hi Density DB 15	<b>10 pcs/\$10.00</b>	<b>COMPUTER PC POWER SUPPLY</b>	<b>\$19.95</b>
		63W 115VAC.	
		<b>ORIGINAL IBM MODEL 154001438</b>	
		<b>COMPUTER PC-XT POWER SUPPLY</b>	<b>\$29.95</b>
		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 aplicación. Muchas facilidades en el manejo de datos están a su disposición. Y usted puede desarrollar nuevas aplicaciones en una amplia gama de lenguajes de programación 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

# 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!*

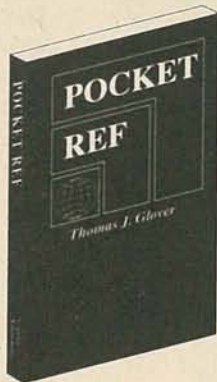
## NEW RELEASE!

» 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 954, P.O.Box 620820, Littleton, CO 80162  
TOLL FREE ORDER LINE !!! • (800) 873-7157**

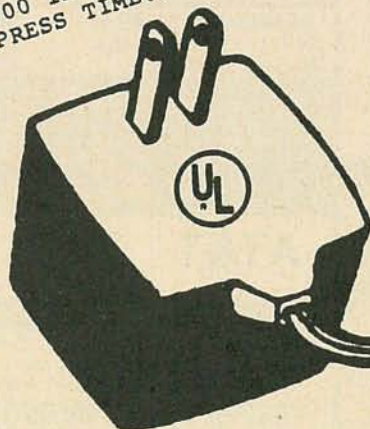
# SURPLUS SALE

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!

### 9VDC/500ma WALL ADAPTERS

23,000 IN STOCK  
AT PRESS TIME!!



\$1.95EA/1000  
\$2.25EA/500  
\$2.95EA/100  
\$3.25EA/50

2.1mmID/5mmOD plug

VG610

CR610....CSA APPROVED VERSION...P.O.R.

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)

# Electrified

WE WILL TRY TO BEAT ANY PRICE ON ANYTHING FROM ANYWHERE !!!  
A TRULY PROFESSIONAL STAFF WITH A COMMITMENT TO SERVICE !!!

★ **COMPUTER COUNTRY** ★

## AWESOME 80286 TURBO - 10/16MHz

Fully IBM Compatible - Zero Wait State!

- 512K Installed - Full Size Case
- 200 Watt Power Supply
- Award BIOS - 101 Keyboard
- Up to 4 MB on Motherboard
- 8 I/O Slots - 80287 Socket
- Reset and Turbo Button
- Keypad and 3 LEDs
- Clock/Calendar -
- 1 YEAR WARRANTY

Now  
16MHz

**\$399**

Now  
16MHz

System Options	
512K Upgrade for 286 (1.75 Meg)	\$ 99
MEMORY Upgrade AVAILABLE For	
256K	Call
Controller 1 to 1 for 386	99
Controller - Dual HD/D	79
1.2 MB - 5 1/4 Drive	79
360K - 5 1/4 Drive	79
120K - 5 1/4 Drive	79
1.44MB - 3 1/2 Drive Red DOS 3.1	119
20MB - Hard Drive	189
30MB - Hard Drive	199
40MB - Hard Drive	249
With 20MB 1 year Back up system for AT Model 125 981 Drive DOS 3.1	199
Large Hard Drives Available	Call
VGA Monitor and VGA Card	489
AT&T Color Monitor & AT&T Card	349
AT&T 12" Black & White Mono 77"	249
& AT&T Card	99
12" Monochrome Hi-Res TTL Monitor	59
Mini Graphics Card w/Printer Port	39
DOS 3.1/3.2/3.3	39/49/69
DOS 3.1/3.2/3.3/4.0	29/49/69/79
Parallel Card or Serial Card	19
AT-Printer/Game/Car Card	29
Drive Warranties Vary - Call for Details	

## 80386

### 20 Mhz Power

- 1MB - Installed - Expands to 8 MB on Board - Zero Wait State - Norton Landmark - 28 7-Slots - 1 - 32 Bit, 5 - 16 Bit, 1 - 8 Bit
- Mini Tower Case - 200 Watt Power Supply - 4 - Drive Bays
- 2 - 5 1/4" - 1/2 Ht & 2 - 3 1/2"
- 80387 Socket - Clock Calendar
- 101 - Keyboard - 1 Year Warranty
- Fully IBM Compatible.

**\$995** Add \$400 for 386/25 MHz

**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

**PRACTIWORD - WORD PROCESSOR**  
Easy to use Word Processor - with Multi-Level Help System

**PRACTIBASE - 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
- 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 - NEAR PAPER FEED - Paper Rack Available - Stacks Printed Paper ONLY \$12.95
- Easy Change Cartridge Ribbons - Available
- 30 Day Warranty
- QUANTITY PRICING - CALL!!!

List \$1,995  
**\$399**

## TOSHIBA P-321SL

AMAZING PACKAGE BRAND NEW

- 24-PIN-216CPS-72NLO-Narrow Carriage
- Parallel and Serial Interface-32K Buffer-Tractor
- Full Manufacturer's Warranty - 1 Year Parts and Labor
- Package Includes: P-321SL Printer - Cut Sheet Feeder
- 12 Black Multistrike Ribbons - 3 Font Cartridges

SAVE 72% Package List Price \$1,435 **\$399**

THE BEST PRINTER VALUE IN THE USA!!

### MPI - PRINTMATE - 350

- 300 CPS - 60NLO - Wide Carriage
- 18 - Wire Technology - IBM/Epson Codes - Variable Width Tractor - Up to 6-Part Form - Front Key Pad with Over 50 Functions - 90-Day Warranty - Parallel Interface (Serial Optional)
- Quantity Pricing Available
- CALL! BRAND NEW List \$425 Only **\$289**

### CITIZEN MSP - 50

- BRAND NEW! - Color Optional!
- 50 NLO - Narrow Carriage, 9-Wire - Epson/IBM Compatible
- Push or Pull Tractor - Zero Tear Off
- MSP-50 Options
- Color Kit (7 Colors) \$59
- Top or Bottom Feed, Automatic Paper Loading
- Serial Interface \$49
- 8K Buffer - 18 Month Manufacturer's Warranty
- Font Card save Set/Driver \$59
- Parallel Interface
- Black or Color Ribbons Available - Call
- Quantity Price: \$3-\$249, \$4-\$299, 10-\$329, 24-\$379
- Only **\$269**

### SEIKOSHA SL-80AI

- 24 Pin - 135CPS - 54NLO
- Below Dealer Cost **\$259**

### RITEMAN BY C-ITOH

- 120CPS-60CPS Expanded
- Narrow Carriage-Parallel Interface
- 90 Day Warranty - Quantity Pricing Available
- BRAND NEW **\$149**

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 List \$849

The Best CGA Resolution You Can Buy  
Quantity Pricing: 3-\$269, 6-\$259,  
12-\$249, 24-\$239 Over 24- Call **\$279**

## THE SUPER SYSTEM

### 8088-1-10Mghz TURBO COMPUTER SYSTEM

#### 1-Drive IBM Compatible System with 256K Memory

- System Includes: 256K INSTALLED 8088-1 Processor • 1-Half Height, 360K, 5 1/4 Drive
- INSTALLED • Dual Speed - 4.77 Mghz and 10Mghz - TURBO • 8 slots • 8087 Socket
- 150 Watt Power Supply • Deluxe Keyboard • Full Size Case for 4-1/2 Ht. Drives
- 1 Year Parts and Labor Warranty on Base Unit (Drive Warranties Vary)

NOW 10 Mhz

**\$299**

System Options:	
Add a 2nd 360K 5 1/4 Drive	\$79
All Hard Drives Include Controllers	
Add a 10MB Drive	149
Add a 20MB Drive	199
Add a 30MB Drive	249
Add a 40MB Drive	299
AT&T Color Monitor & AT&T Card	249
12" Monochrome Hi-Res TTL Monitor	59
AT&T 12" Black & White Mono-	
TTL & AT&T Card	99
Mono Graphics Card w/Printer Port	39
Serial Card or Parallel Card	19
DOS 3.1/3.2/3.3	39/49/69
Clock Calendar Card	29
Memory Upgrade to 512K	69
Par/Ser/Clk/Game Card	49
Memory Upgrade to 640K	99

Quantity Pricing Available

## HARD DRIVE DEALS

### MINISCRIBE 8450 XT 40MB Hard Drive Kits 40MB - 1/2HT - 5 1/4" Frame 3 1/2" Drive-45MS Access Speed

8-Bit RLL Controller INCLUDED

Limited Quantities  
1 Year Warranty  
from Miniscribe

**\$279**

MINISCRIBE-3085-85MB-MFM-5 1/4"-1/2HT	\$499
MINISCRIBE 3675-62MB-RLL-5 1/4"-NEW	\$299
MINISCRIBE-8450-40MB-RLL-3 1/2"-NEW	\$239
SEAGATE-ST-138R-32MB-RLL-3 1/2"	\$199
MINISCRIBE-8438F-30MB-RLL-3 1/2"-NEW	\$179
SEAGATE-ST-238-30MB-RLL-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	CALL!

MINISCRIBE Warranty-6 Months-NEW DRIVES  
Seagate & Tandon Warranty-90 Days-OEM Pulls  
QUANTITY PRICING AVAILABLE  
CALL FOR DETAILS!

## MONITOR MANIA

### PRINCETON GRAPHICS

- Ultra Sync 14 Color Monitor
- 14" Multisync - Ultra Hi-Res 31 Dot Pitch
- 800x600 Rel refurbished
- Mint Condition - Full 1-Year Warranty From Princeton
- Monitor Cards Only **\$449**
- On Special List \$899

### IBM - VGA COLOR

- 13" Viewing Area - 640x480 - 31 Dot Pitch
- IBM Model #7544/S01
- High Performance Graphics
- 90 Day Warranty
- List \$1,605
- UNBELIEVABLE VALUE
- BRAND NEW ONLY **\$399**

### AMDEK 600T - Color

- 14" - RGB-Color-600x200, Green/Amber Switch, Tilt & Swivel
- BRAND NEW List \$550 ONLY **\$209**

### .28 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

- NCR - 15" - GREEN - TTL with NCR
- Monitor Card - 640x400 LIST \$438 ONLY
- BRAND NEW 90 Day Warranty **\$149**

- 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: **\$119**
- 6-\$115, 12-\$109, 24-\$105, Over 24-Call

## ★ ★ Electrified Discounters ★ ★

HOURS: Mon-Thurs 9AM - 7PM  
Fri-Sat 10AM - 6PM

ORDERS ONLY (800) 678-8585

1066 Sherman Avenue  
Hamden, CT 06514  
FAX 203-248-8660

Customer Service & Technical Support  
(203) 287-1976

30-DAY MONEY  
BACK GUARANTEE!  
Full Refund on HARDWARE  
Price on all Advertised Products  
Catalog Sent with A-Orders

Dealer Inquiries Invited  
All prices listed are Cash Discounts. Add 2.1% for MasterCard and 3% for VISA. Not responsible for typographical errors. Prices are subject to change without notice. Cash returns and 90-day warranty on all items. Tax: Quantity discounts. Prices do not include freight. We warrant that the goods are as described. We do not warrant the minimum of 90 days. Refunds are not guaranteed. Some items may be returned. IBM is a registered trademark of International Business Machines Corp.




If you mail to the computer marketplace . . .

## MAILING LISTS TO TARGET YOUR KEY PROSPECTS

- 1) **HEATHKIT** Over 97,000 electronic hobbyists who purchase ham radios, home computers, educational courses.
- 2) **NUTS & VOLTS** 83,000 Subscribers/buyers of parts and accessories for ham radios, computer hardware and software, CB gear, cable TV.
- 3) **KENSINGTON MICROWARE** An active file of 273,000 buyers and inquirers of micro computer peripherals. Select IBM-PC, Macintosh, Apple users.
- 4) **JDR MICRODEVICES** NEW! A large list of micro computer users.

For details, call or FAX:

**J.F. Glaser Inc.**  
 999 Main Street / Suite 103  
 Glen Ellyn, IL 60137  
 708-469-2075  
 FAX: 708-790-5244

<b>AUDIO POWER DRIVER ICs:</b> NE540H.....\$1.49 LM391N-80.....\$1.29		<b>CMOS TIMERS</b> TLC555.....\$0.69 TLC556.....\$0.99	<b>AUDIO AMPS:</b> TDA2002 (8W).....\$0.99 TDA2030 (14W).....\$1.49
<b>ALPHA-NUMERIC LED ARRAY</b>  7x5 LED Matrix. For Moving Message Signs, Etc. By IEE. # 2057 - c/c rows. Your Choice: 2.457 5.068 # 2058 - c/a rows. \$2.95 ea. 3.120 8.000 With Hook-Up (SIZE: 2 X 1.5 in) 3.579 10.000 (8 For \$17.95) RARE SURPLUS FIND! NEW! 3.680 11.059		<b>CRYSTALS \$1.25</b> 1.843 4.000 14.318 2.000 4.915 20.000 2.457 5.068 3.120 8.000 ALL 3.579 10.000 IN 3.680 11.059 MHZ	<b>STEPPER MOTOR \$3.95</b> 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
<b>RS232 DRIVERS</b> 1488.....\$0.49 1489.....\$0.49 MAX232.....\$2.49		<b>CMOS 8032 MICROPROCESSOR</b> 80C32 By Matra. 40 pin DIP 12 MHZ. Very low power. \$3.95	
<b>J FETS FOR HAMS!</b> MPF102 or 2N5486 \$0.49 Your Choice		<b>CMOS EPROMS</b> 27C32HQ (house #).....\$1.49 27C64-2 (Intel).....\$2.99 27C256 (TI).....\$3.50 27C512 (TI).....\$5.50	
<b>CAPS FOR HAMS I</b> High Voltage ! Very Dangerous. 110 MFD 450V AXIAL.....\$1.99 800 MFD 450V CAN.....\$3.95 5100 MFD 350V CAN.....\$6.95 ALL NEW. NAME BRANDS I HARD TO FIND.		<b>BY PASS CAPS</b> .1 MFD 50V RADIAL 7805.....\$0.49 LM317T.....\$0.69 SG3524.....\$1.25 (.10 in. spacing) 10/\$1 7812.....\$0.49 LM337T.....\$0.69 SG3526.....\$1.25 (.30 in. spacing) DIP 8/\$1 7815.....\$0.49 78H12.....\$4.95 LAS6350.....\$1.49 7824.....\$0.49 78H05.....\$3.95 LM309K.....\$0.99 7905.....\$0.49 723.....\$0.49 LM350K.....\$3.95 7912.....\$0.49 TL494.....\$1.19 7915.....\$0.49 TL495.....\$1.19 7924.....\$0.49 TL497.....\$1.49	
<b>CAPS FOR POWER SUPPLIES</b> 8200 MFD 50V.....RADIAL.....\$0.99 12,000 MFD 75V.....CAN.....\$2.95 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		<b>TO-3 POWER TRANSISTORS</b> 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	
<b>TANNER ELECTRONICS</b> 214-242-8702 FAX: 214-709-5041 1301 W.Beltline Rd. #105 Carrollton, Tx 75006 (Store prices vary)		<b>TERMS:</b> Send check, or use, Visa, MC. NO COD. USA, Canada Only. Add \$3.85 for UPS. Texas add 8% sales tax. 90 Day limited warranty on all items. \$15 min.	

QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING

# ALL ELECTRONICS CORP.

## LED'S

Special purchase on two types of rectangular LEDs. Both styles have a face which is 5 mm X 2.1 mm.



Red LED 10 mm long and 4 mm wide at the base.

CAT# RLED-5 10 for \$1.00  
200 for \$15.00 • 1000 for \$50.00

Green LED 8 mm long and 2.1 mm wide throughout.

CAT# RLED-6 10 for \$1.00  
200 for \$15.00 • 1000 for \$50.00

## T 3/4 (3 mm dia.) RED LEDS

Axial leads

CAT# LED-9 10 for \$1.00  
200 for \$15.00 • 1000 for \$50.00

Cut and bent radial leads

CAT# LED-10 10 for \$1.00  
200 for \$15.00 • 1000 for \$50.00

## 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

## REFLECTIVE OPTO SENSOR

IR emitter and sensor pair pointing in the same direction. Light from emitter bounces off object to be detected by sensor. TRW/Optron# OPB5447-2

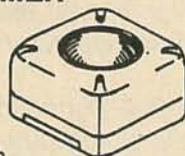
Rectangular package with 28" color coded leads.

CAT# OSR-4 2 for \$1.00



## ONE MINUTE TIMER

Originally used as a game timer 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. If at any time during the cycle you want the unit to stop, press the blue button and the beeping stops and in ten seconds the unit shuts off. Unit requires a 9 volt transistor battery (not included) to operate.

CAT# TMR-1 \$2.25 each • 10 for \$20.00

9 volt Alkaline battery

CAT# BAT-9 \$1.70 each

## RELAYS

### 6 VOLT D.C. - D.P.D.T.

Sigma# 70 HE22-6DC.

2 amp contacts.

52 ohm coil.

Polycarbonate cover.

1 1/8" high X 9/10" X 3/4"

CAT# RLY-62PC \$2.50 each



### 24 Vdc - D.P.D.T. - PC MOUNT

Fujitsu# FRL-264 D024/02CK

10 amp contacts.

685 ohm coil.

1.354" X .858" X 1.110".

Clear plastic case.

CAT# RLY-229 \$2.50 each



### 24 Vdc - D.P.D.T. - PC MOUNT

Omron# MX2P-OE-UZ-006004

492 ohm coil.

Contacts rated

3 amps @ 120 Vac

or 5 amps at 30 Vdc.

Clear polycarbonate dustcover 1.03" X 0.875" X 0.69". UL and CSA listed.

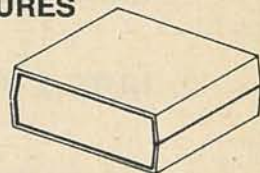
CAT# RLY-230 \$1.75 each



## 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	"	"	"
grey	"	MB-3C	"	"	"
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

## NEON INDICATOR 120 VOLT



Good looking neon indicator RATED: 120 volts @ 1/3 watt. Mounts in 5/16" hole. Red lens with chrome ring.

CAT# IND-100 75¢ each  
10 for \$7.00 • 100 for \$65.00

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

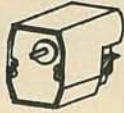


QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING

# ALL ELECTRONICS CORP.

## 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  
flatted shaft. Two types available:

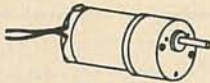


**18 volts dc** (nominal) @ 50 ma.  
10 rpm @ 14 Vdc (no load)  
17 rpm @ 24 Vdc (no load)  
**CAT# MOTG-18** \$5.50 each

**38 volts dc** (nominal) @ 70 ma.  
274 rpm @ 24 Vdc (no load)  
451 rpm @ 38 Vdc (no load)  
**CAT# MOTG-38** \$5.50 each

## 12 VDC GEARHEAD MOTOR

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



## STEPPING MOTORS

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

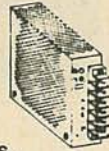


Airpax# C 82710  
12 Vdc, 36 ohm dual coil permanent mag-  
net stepper motor. 7.5 degrees per step.  
2.25" dia. body X 0.93" high. Mounts on  
2.675" centers. 6 wire leads.  
**CAT# SMT-7** \$7.00 each • 10 for \$65.00

## POWER SUPPLIES

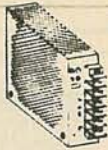
### 5 VOLT, 5 AMP

Lambda# LUS-9A-5  
Switching power supply.  
Input: 85-132 Vac 47-440Hz  
or 110-165 Vdc 37 watts  
Output: 5 Vdc  $\pm$  5% @ 5 amps.  
Overvoltage and overcurrent protection.  
120 mV ripple. 5.2" X 3.8" X 1.375". Grey,  
vented metal case. UL and CSA listed.  
**CAT# PS-55** \$14.00 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  $\pm$  5% @ 2.1A overvoltage  
and overcurrent protection. Compact venti-  
lated case measures 5.24" X 3.81" X 1.38"  
overall. Includes instruction sheet.  
**CAT# PS-122** \$23.50 each



### 24 VOLT DC - 2.4 AMP

Power-One Inc.# HC24-2.4  
Input: 115/230 Vac  
(wired for 115Vac)  
Output: 24 Vdc @ 2.4 amp. Brand new  
open frame power supply with line and  
load regulation, remote sensing, overload  
and short circuit protection. 5.62" X 4.87"  
X 2.50". CSA rated.  
**CAT# PS-2424** \$30.00 each



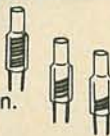
## 6 or 10 mhz HU-18/U STYLE CRYSTALS - SPECIAL PRICE

6 mhz **CAT# CRY-618S**  
10 mhz **CAT# CRY-1018S**  
**MINIMUM ORDER**  
**100 PIECES**  
100 of either VALUE \$75.00  
500 of either VALUE \$300.00  
1000 of either VALUE \$500.00

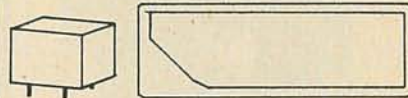


## CHOKE GRAB BAG

8 pieces, 2 each of  
4 different tunable  
chokes. Actual values unknown.  
**CAT# GRCK** \$1.00 each



## ELECTROLUMINESCENT STRIP(GLOW STRIP) AND INVERTER



Electroluminescent strips used for back-  
lighting control panels or as decorative or  
emergency prime lighting source. They are  
thin, tough and flexible and operate on low  
current. They operate on AC voltage, and  
the preferred power source is a miniature  
DC to AC inverter. We received a supply  
of glow strips that have a bit of an odd  
shape. The strips are 2.15" wide X 5.88"  
long and are 0.035" thick. The luminescent  
area is 5.3" long X 1.72" wide and has  
one corner cut off, leaving a useful area  
of fairly good proportions. We are selling  
the strips and inverters as a package.

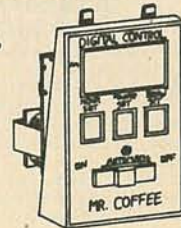
Inverter operates on 6 Vdc.  
Glow strip, inverter and hook-up diagram  
**CAT# GS-500** \$5.00 per set

### EXTRA INVERTERS

Input: 6 Vdc Output: 225 Vac  
**CAT# INV-1** \$2.00 each

## DIGITAL CLOCK AND APPLIANCE TIMER

Turn on lights, radio,  
VCR automatically.  
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. Guaranteed to work  
but some have surface blemishes. 4.2" X  
2.45" X 1.1" deep. Beige or ivory with  
brown trim. **CAT# MCT** \$6.50 each

# 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.

# Davileyn CORP.

13406 Saticoy Street  
North Hollywood, CA 91605-3475



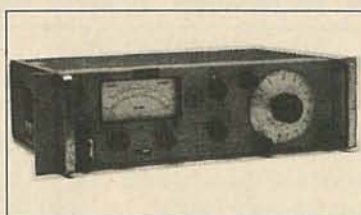
(Call for free catalog.)



### A.C. POWER SUPPLY STACO MODEL E1010A

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.

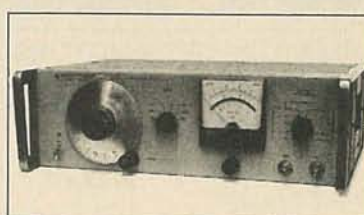
Price: \$165



### HP 333A DISTORTION ANALYZER

Covers 5 Hz to 600 kHz range. Measures down to 0.1% fullscale distortion. Includes auto nulling feature to speed up time consuming portion of measurements. Also includes switchable high-pass filter to attenuate frequencies below components.

Price: \$695.00



### HP 651A TEST OSCILLATOR

Frequency range is 10 Hz to 10 MHz in six bands. Dial calibration, 1 to 10. Dial accuracy is  $\pm 2\%$ , 100 Hz to 1 MHz,  $\pm 3\%$ , 10 Hz to 10 MHz. Output of 200 mW (3.16 V input 50  $\Omega$ ); 16 mW (3.16 V input 600  $\Omega$ ); 6.32 V open circuit. Output monitor voltmeter monitors level at input of attenuator in volts or dB; accuracy is  $\pm 2\%$  at full scale; frequency response is flat within  $\pm 2\%$ , 100 Hz to 1 MHz;  $\pm 3\%$ , 10 Hz to 100 Hz;  $\pm 4\%$ , 4 MHz to 10 MHz. Attenuation range is 90 dB in 10 dB steps; overall accuracy is  $\pm 0.1$  dB.

Price: \$295.00



### HEWLETT PACKARD MODEL 606A SIGNAL GENERATOR

Signal Generator: Freq. 50kHz to 65 MHz in 6 bands  $\pm 1\%$ , freq. call 100kHz and 1 MHz, RF output 0.1  $\mu$ V to 3.0V at 50 ohms  $\pm 1$ dB over freq. range, output VVXR-30 DBC leverage 0.10V, modulation 0 to 100%  $\pm 0.5$ dB over freq. range. Internal: 400 Hz/1000Hz  $\pm 5\%$ ; External: DC to KHz. Power  $15\pm 3$ W, 50 to 1000 Hz, 135 watts. Size: 20 3/4" (W) x 12 1/2" (H) x 14 1/4" (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  $\Omega$ . Level flatness is  $< +0.5$  dB from 0.5 to 512 MHz. Impedance is 50  $\Omega$ , 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 13 1/4" (D). Wt. 60 lbs. Includes ruggedized case and manual.

Price: \$1850.00

Current Hewlett Packard Price \$12,050.00



### TEKTRONIX MODEL 453 OSCILLOSCOPE

Vertical, 2 Channels. Bandwidth and risetime: 10 mV/div to 20 mV/div; DC to 50 MHz, 7 ns. 10 mV/div; DC to 45 MHz, 7.8 ns. 5 mV/div; DC to 40 MHz, 8.75 ns. Calibrated Deflection: 5 mV to 10 V/div in 11 calibrated steps (1-2-5 sequence). Input RC: 1 megohm  $\pm 2\%$ , 20 pf  $\pm 3\%$ . Modes: Channel 1, Channel 2 (normal or inverted), added alternate and chopped. Has vertical delay line. Horizontal: Time Base A: 0.1 us/div to 55/div in 24 steps. Length continuously variable from 4 div to 11.0  $\pm 0.5$  div. Time Base B: 0.1 us/div to 0.5 sec/div in 21 calibrated steps (1-2-5 sequence). X 10 Magnifier: Increases sweep rate to 10 n sec/div. Triggers after delay time or starts after delay. Time Base A Trigger Modes: DC internal/external; AC, ACLF reject, AC HF reject. X-Y operation Ch 1 horizontal, Ch 2 vertical, 5 mV/div to 10 V/div in 11 calibrated steps. B.W. is DC to  $\geq 5$  MHz ( $-3$ dB). Horizontal Amplifier (ext in) 270 mV/div or 2.75 V/div in external  $\pm 10$  position. Calibrated sweep delay: 0.2 us to 50 sec. General: Power Requirements: 90 to 272 V @ 48 to 440 Hz. Size: 7 1/4" (H) x 12 1/2" (W) x 20 1/2" (D)  $\geq$  Wt. 27 3/4 lbs. Includes manual.

Price: \$400.00



### 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 4 1/2" thick. Weight 17 lbs.) Stock #OP 9001

Price: \$200.00

(818) 787-3334

(800) 235-6222

FAX (818) 787-4732

OUTSIDE CALIF.

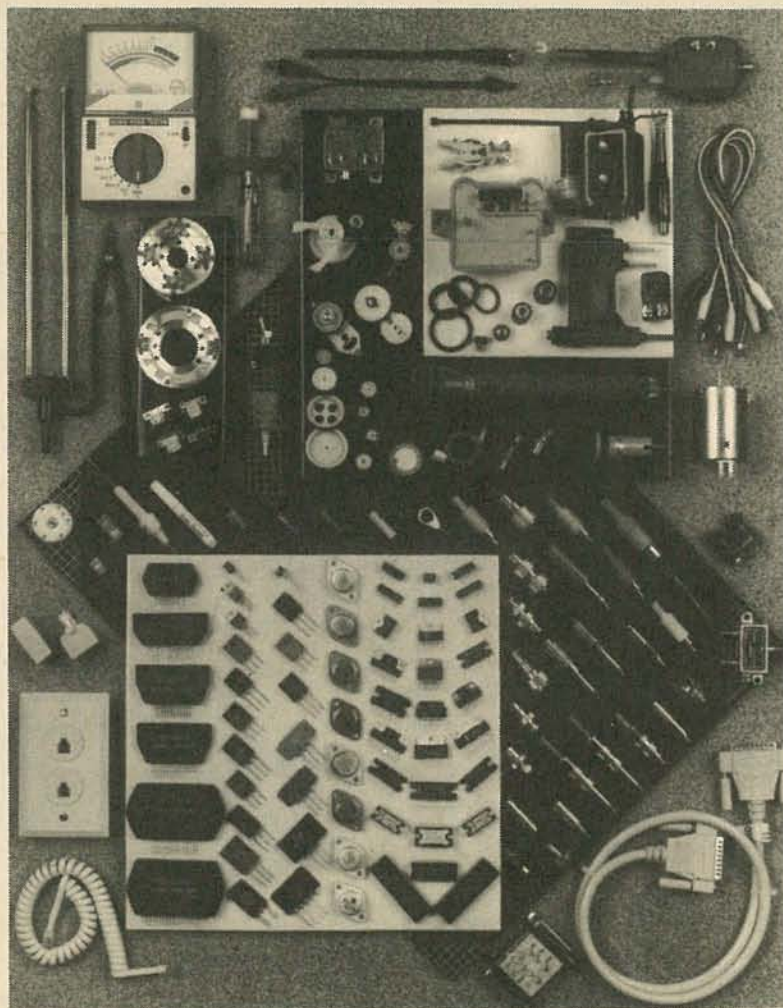


### PRICES

Our competitive prices have placed us at the top. We have low, low prices because we mark down each item the lowest % we can afford.

### SERVICE

For decades, our 23,000 customers have been satisfied because we are aggressive in making sure we do all we can to help customers save and grow.



### QUALITY

We sell high quality merchandise. If it wasn't good, we wouldn't buy it ourselves. Your satisfaction is guaranteed.

### SHIPPING

We ship anywhere in the world within 24 hours from the date of your confirmation. We can use:

- \*Airmail
- \*Airlines
- \*DHL
- \*UPS
- \*other means of transport

**CALL FOR A FREE CATALOG:**

**1-800-325-2264**

Computers, Components, Tools And Supplies

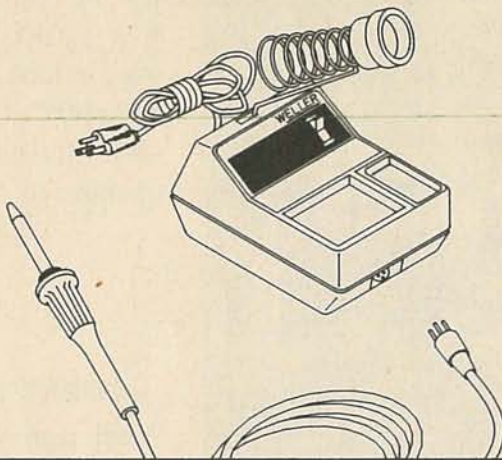
# db

# Computer Products

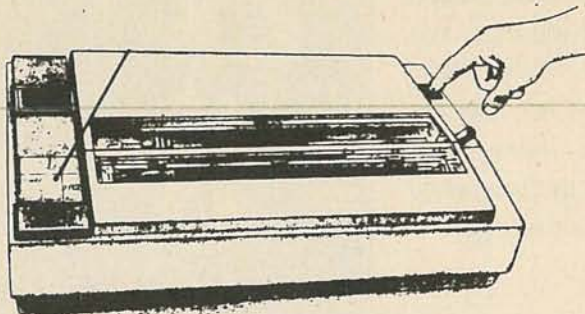
4025 Edwards Road  
Cincinnati, OH 45209

## 1 (800) 423-4499

**Weller WTCPR Professional Soldering Station.....\$99.99**



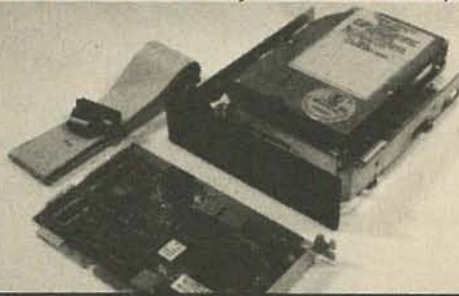
**Facit B3350 Wide Carriage Printer 18 pin, includes cable.....\$329.99**



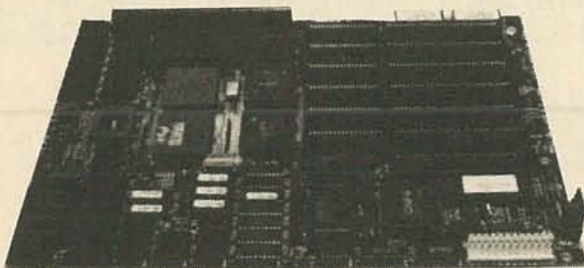
**Cyrix Fasmath coprocessor Fully compatible with Intel but much faster.....**

- 80387-16.....\$299.99
- 80387-20.....\$349.99
- 80387-25.....\$429.99
- 80387-33.....\$529.99

**MiniScribe M8450 Hard Drive Kit 42.6 megabytes - 46 ms access with 16 bit card, cables....\$249.99**



**db is one of the midwest's largest suppliers of electronic and computer parts!!! ICs, resistors, capacitors. Call or write for our free catalog.**



**db Kit Systems - All the top quality parts necessary to assemble your own custom PC, AT, 386 or 486 system.**



**386-33 cache main board  
0K memory..... \$1,399.99**

MicroSoft Bus Mouse  
The real thing.....\$39.99

# Microsoft Mouse

EasyLan PC to PC Network Special  
Full resource sharing network  
with hardware, software, cables



The whole works.....\$179.99

EasyPrint shares printers  
for 2 PCs.....\$79.99



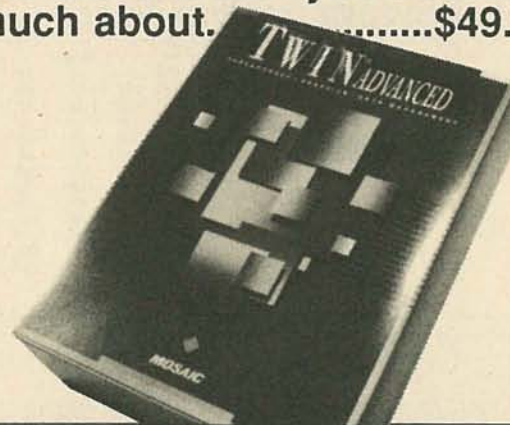
Reference File, The first really  
serious pop-up database  
management system.....\$49.99



SQZ Plus from Symantec  
The best spreadsheet file  
utility for Lotus.....\$49.99



Twin Advanced, Spreadsheet -  
Graphics - Data Management -  
This is the one that you've heard  
so much about. ....\$49.99

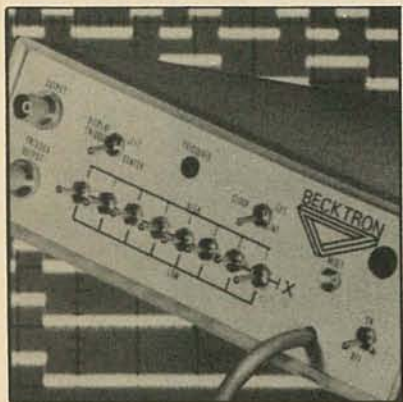


**db Computer Products**

prices and availability subject to change without notice  
cash mail order prices - shipping and handling extra

4025 Edwards Road, Cincinnati, OH 45209 (800) 423-4499

# NOW YOU CAN AFFORD A LOGIC ANALYZER



The A-96 will convert any oscilloscope into an eight channel logic analyzer with;

- \* 2K MEMORY PER CHANNEL
- \* PRE-TRIGGER AND POST TRIGGER DATA CAPTURE
- \* INTERNAL AND EXTERNAL CLOCKING
- \* STORING UP TO SIXTEEN THOUSAND LOGIC EVENTS

The A-96 is so technologically advanced that its simple to use and at \$389.00 its affordable For full information call BECKTRON at 1-800-592-4141 and request the "A-96 INFO PACKAGE

BECKTRON's A-96 Master card, Visa and C.O.D orders excepted

## 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, μH / 100 turns	1-10	11-99	CORE	O. D.	L, μH / 100 turns	1-10	11-99	CORE	O. D.	L, μH / 100 turns	1-10	11-99
T5-4	.850"	10	35	25	144-4	.440"	52	70	.60	T157-4	1.57"	115	3.25	2.75
T12-2	.125"	48	35	30	144-4	.440"	42	70	.60	T200-2	2.00"	120	4.00	3.60
T12-4	.125"	17	35	30	150-2	.500"	49	80	.68	T200-4	2.00"	100	4.75	4.25
T12-17	.125"	7.5	40	35	150-4	.500"	40	80	.68	T200-52	2.00"	900	3.00	2.40
T16-52	.160"	150	35	30	150-17	.500"	18	90	.78	T225-28	2.25"	215	6.00	5.40
T25-2	.255"	34	40	35	150-268	.500"	420	90	.78	T225-4	2.25"	100	6.00	5.40
T25-4	.255"	27	40	35	150-52	.500"	350	80	.68	T300-2	3.04"	114	6.00	5.40
T25-17	.255"	12	40	35	168-2	.690"	57	80	.68	T300-20	3.04"	228	13.00	12
T30-2	.307"	43	40	35	168-4	.690"	47	80	.68	T300-52	3.04"	850	8.00	7.20
T30-4	.307"	36	40	35	168-52	.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"	360	22.00	20
T30-52	.307"	73	40	35	T80-4	.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
T37-4	.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) = 10. RF transformer below 160 meters.
- 6 mix - Maximum Q range: 2-30 MHz. Permeability (μ) = 8.5. RF transformer to 10 meters.
- 17 mix - Maximum Q range: 20-200 MHz. Permeability (μ) = 4.0. RF transformer HF - VHF.
- 26 mix - Maximum Q range: DC-8 MHz. Permeability (μ) = 7.5. DC, 60 Hz and EMI/RFI filtering.
- 52 mix - Maximum Q range: DC-1 MHz. Permeability (μ) = 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"

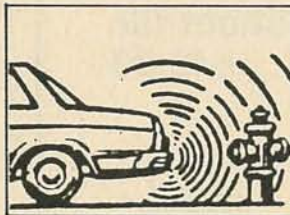
Catalog 6 included with your order (\$3 a la carte). 200 pages, over 10,000 electronic PARTS including almost any capacitor (transmitting to monolithic), resistor, inductor, wire or cable, toroid & ferrite, Collins replacement part, antenna, connector (rf, computer, IC, electrical), shaft, coupling, 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

## 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

## PENCIL-TYPE DMM/ LOGIC TESTER.

The Voltmaster 90S from Bel Merit Corporation provides a full range of digital-multi-meter and logic-test functions in an easily portable package. It has a 3½-digit LCD with function annunciators and automatic polarity indication. It offers automatic and manual range selection and data hold. Its functions include logic test, diode test, audible continuity check by buzzer, AC/DC current measurement to 200 mA, AC/DC voltage measurement to 500 volts, and ohm measurement to 20 megohms. All ranges are protected. The Voltmaster 90S comes with an operating manual, two 1.5V batteries, power leads for logic tests, and test leads.



CIRCLE 320 ON FREE INFORMATION CARD

The Voltmaster 90S pencil-style DMM and logic tester costs \$49.95.—Bel Merit Corporation, 14775 Carmenita Road, Norwalk, CA 90650; Tel. 213-802-3666.

# 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 original parts.*

**902 PC Board.....9.95**  
*Original 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.*

**CD22402E.....12.95**  
*Video sync IC (IC-9)*

### 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 filter).....\$29.95

*ELIMINATE a channel that you find unsuitable or CLEAR UP a channel that contains severe interference by eliminating it. NOTE: If picture and sound are effected, this is interference and CAN BE removed. If only the picture is effected, this usually IS NOT interference and CANNOT be removed. Works on Cable or Broadcast TV.*

# 23H Tunes 50-66 Mhz & 6 Meter Ham , For channels 2 or 3..

# 46FM Tunes 66-108 Mhz; or any FM station. For channels 4, 5 or 6.

# 713 Tunes 174-216 Mhz For channels 7, 8, 9, 10, 11, 12 or 13.

# 1417 Tunes 120-144 Mhz For channels 14 (A), 15 (B), 16 (C) or 17 (D).

# 1822 Tunes 144-174 Mhz For channels 18 (E), 19 (F), 20 (G), 21 (H), 22 (I).

### 58 Channel

### Cable TV Converter with infra-red remote .....\$69.95

*Re-Manufactured Jerrold 400 with new remote. Channel 3 output. Compatible with all External Descramblers.*

## CALL TOLL FREE 1-800-332-3557

Outside USA Call 1-508-699-6935

Visa, MasterCard and COD. Free Catalog.

Add \$4.00 S&H, \$6.50 Outside USA.

D & D Electronics, Inc. PO Box 3310, N. Attleboro, Ma. 02761

VISA

MC

## 5 SECOND EPROM ERASER

- \* A REVOLUTIONARY PRODUCT.
- \* INCREDIBLE SPEED, ONLY 5 SECONDS.
- \* ONCE YOU USE IT, YOU'LL LOVE IT.
- \* SAVE YOUR TIME & MONEY.
- \* A MUST ITEM FOR THOSE PEOPLE HAVE EVERYTHING.
- \* DIMENSION: 7" X 4" X 3".
- \* ONE YEAR WARRANTY (EXCEPT UV TUBE)

IEE-9088 \$249.99

## ELECTRONICS

1 2 3

A DIVISION OF MING E&P, INC.

1. Exclusive Items at good price.
2. Unique Items at better price.
3. Popular Items at the best price.

1-800-669-4406

ORDER DESK ONLY

## DIGITAL VOICE RECORDER

- \* ADM RECORDING SYSTEM.
- \* INSTANT RECORD & PLAY BACK.
- \* 4 MEGA BIT DRAM, PROVIDE YOU 2 MINUTES OF HIGH QUALITY VOICE.
- \* 16 SELECTABLE PHRASE CHANNELS.
- \* PLASTIC HOUSING W/ MIC & AC ADAPTER
- \* BUILT-IN 500MW AUDIO AMP & SPEAKER.
- \* FULLY ASSEMBLED & TESTED.

DVR-120 \$189.99



### RF REMOTE CONTROL SYSTEM

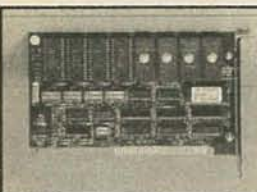
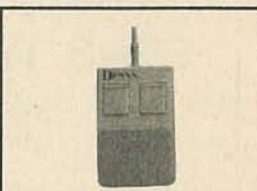
- 19683 digital coding
- 2 tiny transmitters
- ON/OFF confirming signal
- Dry contact relay output
- FCC approved

SA-432 \$49.99

### DEXXA MOUSE

- Superior tactile feedback switch
- 50-750 adjustable dpi
- Opto-mechanical design
- Microsoft mouse compatible
- UL and FCC approved

DLX-MOUSE \$39.99



### ROM/SRAM DISK CARD

- For diskless PC station
- Load DOS & files instantly
- Battery back-up for SRAM
- watch-dog timer rebooting

RDC-512 (512 KB, 0KB) \$179.99

RDC-1024 (1024 KB, 0KB) \$199.99

### PIR DETECTOR

- Very small size (2.5"X1.7"X1.4")
- Advanced SMT design
- Extra high RFI immunity
- Adjustable pulse count feature
- Security industry quality

RK-3000 \$49.99



### BARGAIN SALE

- SYNTAX Proto-typing PCB COMBO-1 \$9.99
- SYNTAX Proto-typing PCB COMBO-2 \$11.99
- SYNTAX Proto-typing PCB COMBO-3 \$39.99
- SYNTAX Proto-typing PCB COMBO-4 \$11.99
- SYNTAX Proto-typing PCB SUPER COMBO \$69.99

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

977 S. Meridian Ave., Alhambra, CA 91803

TEL: (818) 281-4065 FAX: (818) 576-8748

Unlock the mysteries of the Universe.  
For information call:  
**(508) 832-6567**

**KEY CIRCUITS**

X-61  
MASTER ELECTRONICS

## SA 10<sup>®</sup> ASSAULT DESCRAMBLER

FROM  
**MASTER ELECTRONICS**  
(THE S. A. SPECIALISTS)  
**(508) 832-6567**

SA10      \* and SA20

**BRIEF:** The SA10 and SA20 are the most sophisticated and reliable stand alone descramblers ever made for S. A. equipment. They are highly integrated premium descramblers designed to "S. A. Specifications" for superior performance.

They have no "jitters", no video level problems, no alignment or quality control problems, and no sensitivity or basic design problems associated with the simple video and clock circuits of the SA-3. (THIS IS NOT AN SA-3 CLONE OF ANY KIND!)

The SA10 and SA20 have a great looking cabinet enclosure, the quality of which would fit in beautifully with a component home stereo/entertainment system. Also the power supply is built into the enclosure.

The SA10 and SA20 are available from **MASTER ELECTRONICS (THE S. A. SPECIALISTS)** who sell only S. A. related equipment and only the best at that. **MASTER ELECTRONICS** is dedicated to customer satisfaction and is ready to offer their services at competitive prices. **MASTER ELECTRONICS** and the SA10/SA20 ASSAULT DESCRAMBLERS are ready to blow away the competition.

- \* Superior Performance
- \* Conforms to S. A. Specs.
- \* Drop Field Capable (SA20)
- \* Auto Scramble Detect
- \* False Firing Switch

- \* High Quality Control
- \* Handsome Enclosure
- \* Built In Power Supply
- \* Power On L.E.D.
- \* Competitive Pricing





**KITS  
DESIGNED  
AND MADE  
IN U.S.A.**

# THE ELECTRONIC GOLDMINE

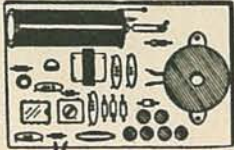
MINIMUM ORDER: \$10.00 plus \$3.00 Shipping and Handling  
We accept MasterCard, Visa and Money Orders  
Call or send for our free catalog!

P.O. BOX 5408, Scottsdale, AZ 85261  
PHONE ORDERS: (602) 451-7454

## ELECTRONIC PROJECT KITS

### 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 Instr.
- ★ Size of PC Board: 3" x 1.9"
- ★ Skill Level 2



**C6430 \$59.95**

### 120VAC XENON STROBE KIT

- ★ Complete Variable Rate
- ★ Comes with PC Board, Parts and Instructions
- ★ Skill Level 2

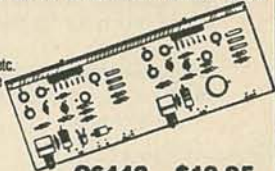
Remember, all of our kits contain all parts, PC board and instructions!



**C3071 \$13.70**

### 20W+20W STEREO AMP KIT

- ★ Boost Car Stereos, Tape Players, Portable Radios, etc.
- ★ Features 2 Separate 20W RMS Amps w/Level Controls
- ★ Operates from Std. 12V Car Battery
- ★ Skill Level 2



**C6442 \$19.95**

### ELECTRONIC WHEEL OF FORTUNE KIT

- ★ 10 LEDs spin as speaker clicks
- ★ Operates from 9V battery (not incl.)
- ★ Skill level 3



**C3806 \$14.98**

### LED FLASHER KIT

- ★ One red and one green LED alternately flash
- ★ Operates on 9V battery (not incl.)
- ★ Skill level 1

**C3287 \$3.00**

### 3V XENON WARNING FLASHER KIT

- ★ Bright white flashes of light
- ★ Requires only 2AA or C cells
- ★ Skill level 2

**C3207 \$10.00**

### 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.)

**C6356 \$13.95**

### INFRARED DETECTOR KIT

- ★ Detects ALL Types of Infrared (TV/VCR Remotes, LEDs)
- ★ Produces Sound and Bright Red LED Output
- ★ Operates from 9V Battery (not incl.)

**C6441 \$5.95**

**FREE CATALOG**  
with OVER 1400 DIFFERENT ITEMS INCLUDING 135 KITS!  
REQUEST YOUR COPY TODAY!

## ★ SPECIALS ★

### \$1 BLOWOUT SALE

Tremendous bargains on prime components only \$1.00 per pack

- 50 1% Precision Resistors\*..... **G705**
- 20 Plastic Transistor PC Leads ..... **G706**
- 30 Capacitors-Disc & Electrolytic\*..... **G707**
- 2 CDS Cells ..... **G708**
- 2 Solar Sensors ..... **G709**
- 40 Tiny 1/8W Resistors\*..... **G710**
- 10 1N4004 Diodes ..... **G711**
- 12 LEDs-Different Colors, Sizes\*..... **G712**
- 4 Circuit Board with Bubble Readout .. **G713**
- 20 Surface Mtg. Chip Capacitors\*..... **G714**
- 20 Surface Mtg. Chip Resistors\*..... **G715**
- 20 Silver Mica Capacitors\*..... **G716**
- 20 Micro Red LEDs on Strip ..... **G717**
- 10 Tantalum Capacitor\*..... **G718**
- 20 9V Mini Zeners ..... **G719**
- 10 3MM Ultrabright Green LEDs ..... **G720**
- 10 Small Single Turn Trim Resistors\*... **G721**

Items marked with \* are assortments and will contain several different values.

**\$1.00 Each**

### FIBER OPTICS

Small diameter unjacketed fiber optic strand. Perfect for 1000's of applications. Fun to use and experiment with.

**G722**

**5Ft piece for 49¢ Each**

### BLUE BUTTON TIMER

Unique game timer features 4 LEDs that extinguish one at a time over a ONE minute period as the unit increases its beeping. Great timer for games. Operates from 9V battery (not incl.).

**G723 \$2.95**

### ZIPPER CLOSE BAGS

HIGH QUALITY!  
2 mil bags with white block to write on. Sold in packages of 100 only.

- 2 x 3 ----- G663 ----- 100/\$3.30
- 3 x 4 ----- G664 ----- 100/\$3.75
- 3 x 5 ----- G665 ----- 100/\$4.00
- 4 x 6 ----- G666 ----- 100/\$5.50

### 9VDC ADAPTER

**Great Bargain!**

Perfect for almost all 9V battery powered items. Has 9V snap, filtered output. For 120VAC.

**G724 \$1.69**

## POPULAR ITEMS

### COLOR BURST CRYSTAL

Miniature Case. 3.579545MHz  
**G615 \$1.00 Each**  
10 for \$9.00

### BAG OF HEAT SHRINK

Handy assortment of 25pcs of various sizes/colors 1" to 3" and .06" to 5" Dia.  
**G179 \$1.00**

### COPPER CLAD PC BOARD

Thin flexible PC material can be cut with scissors. Double sided 4" x 6".  
**G591 75¢**

### ELECTREC MICROPHONE

Sensitive type. 1ft cable  
**G703 69¢**

### #65 DRILL BITS

Tungsten carbide. Most popular size for PC boards.  
**G725 3 for \$2.00**

### MAGIC SOUND SWITCH

Triggers with clap of hand. Turn on low voltage lamps, motors. With Schematic. Operates on 3VDC.  
**G658 \$1.00**

### PENCIL 30W SOLDER IRON

Perfect for building our kits. Operates from 120VAC.  
**H1200 \$2.95**

### SPECIAL PC SOLDER

Perfect solder for our kits. Low melting, excellent conductivity, micro thin solder, SNGO .031 Dia. made by Kester.  
H1201 --- 6Ft Coil --- **\$1.50**  
H1203 --- 1Lb Roll --- **\$12.00**

### STROBE TUBE & TRIGGER COIL

Great combo of mini straight xenon tube & trigger coil  
**A1039 \$1.75**

### MICRO TOGGLE SWITCH

SPDT type with mounting hardware.  
**L1806 \$1.00**

### 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

### 4KV TRIGGER COIL

For strobe tube  
3 Lead N1700 **1.25 Each**  
4 Lead N1701 **1.45 Each**  
1,000 for \$650  
1,000 for \$700

### HORSESHOE STROBE TUBE

Standard 1-1/4" tall  
**A1034 \$3.75**

### LASER LIKE LED

300MCD Ultrabright clear jumbo case red LEDs  
**A1012 3 for \$1.00**  
1,000 for \$220

### FLASHING RED LED

Flashes when 5VDC is applied. Red diffused case.  
**G301 79¢**

# 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

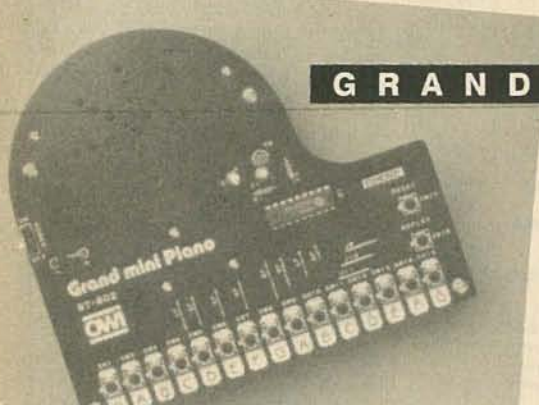
A game of chance, just like at all the casinos. No ball to lose, no wheels to spin. At the push of a button electronic sounds and flashing lights go off... and where they stop nobody knows.



## 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

## 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

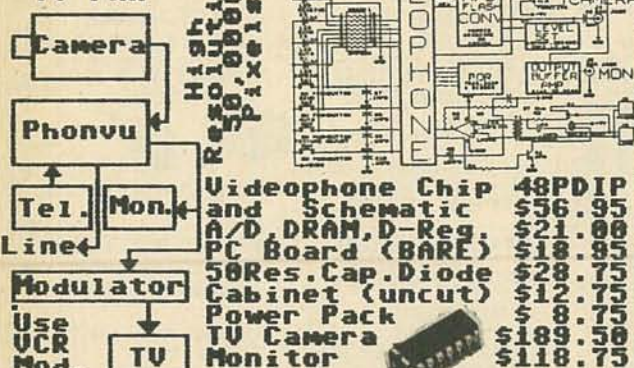
Auto Mode allows hands free send and receive. Displays on any TV

IC Chip Replaces 150 SSI Dips

15 to 50 Levels of Grey Scale

Serves as:

TU FAX



- Videophone Chip 48PDIP \$56.95
- and Schematic \$21.00
- A/D, DRAM, D-Reg. \$18.95
- PC Board (BARE) \$28.75
- 50Res. Cap. Diode \$12.75
- Cabinet (uncut) \$ 8.75
- Power Pack \$189.50
- TV Camera \$118.75
- Monitor

Use VCR Mod. TV

Visa and FAX Order (213)827-1852  
PMC Electronics #295, Box 8901  
Marina Del Rey, Ca. 90295

## 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
MC-1A	4"	3"	2"
MC-2A	6"	3"	2"
MC-3A	8"	3"	2"
MC-4A	4"	5"	3"
MC-5A	6"	5"	3"
MC-6A	8"	5"	3"
MC-7A	4"	7"	4"
MC-8A	6"	7"	4"
MC-9A	8"	7"	4"

### 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

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!

# 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, 1MB 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	\$119.00
1:1 AT RLL Combo Controller	\$130.00
XT MFM & RLL Controllers	\$51, \$59
360K & 1.2MB Floppy Drives	\$60, \$76
720K & 1.44MB Floppy Drives	\$65, \$78
CMS Jumbo Tape Backup	\$295.00

**CALL TODAY**

<b>Hard Drives:</b>	
40MB MR535 MFM 28ms RLL cert	\$350.00
72MB Maxtor XT1085 FH 28ms	\$625.00
80MB HH1090 MFM 28ms	\$625.00
100MB CP3104 IDE (AT) with kit	\$695.00
200MB CP3204 IDE (AT) with kit	\$1070.00

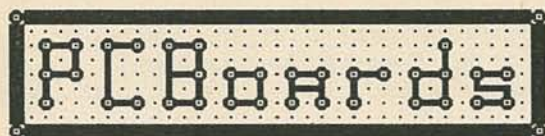
## WHY US

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



## 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, 384K 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

## PORTABLE DATA LOGGERS.

A line of full-featured, rugged, data-gathering products that tie directly to thermocouples or voltage- or current-output devices has been introduced by *MetraByte*. The *DDL-400 Series* data loggers, and the variety of available hardware and software accessories, allow the user to configure a system to meet specific application requirements in the lab, factory, or field. The IBM-compatible, programmable, menu-driven data loggers offer 16 analog input channels, four digital inputs, and 16 alarm outputs. A sealed-membrane keyboard on the front panel controls functions such as data-logging interval, Hi/Lo alarm limits, channel select/skip, and time/date settings. The LCD readout shows channel data, alarm limits and status, time, and date.

Each data logger requires a *TCV-16* I/O panel,

a slide-in module that has 16 single-ended inputs for thermocouple, voltage, or current signals as well as 16 logic-level alarm outputs and four digital input channels for contact closures or logic levels. Each channel is independently configured by a 10-position range switch. Optional *Applications Software* allows remote control of one or more data loggers.



CIRCLE 321 ON FREE INFORMATION CARD

Every alarm in the system is independently and continuously checked at full speed at least every four seconds. Limit values are stored in non-volatile memory.

*continued on page 28*

# 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

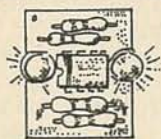
If you need an attention getter, or warning light, you need the strobe light kit. Use it for emergency light for autos, for model planes or radio towers. Even use it on your bicycle. Operates on 6 or 12v DC and has a variable strobe rate.

**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 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 BUG

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.8". 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-SW1 \$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

XXXXX 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

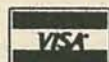
14.95 EACH

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



## CONSUMERTRONICS

2011 CRESCENT DR., P.O. DRAWER 537  
ALAMOGORDO, NM 88310  
1-505-434-0234

Add \$3 ship. (USA, Canada). All items are in stock. COD (UPS cash only), VISA and MasterCard OK. 100+ More Computer and Electronic Offers! FREE Tech. 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; Taser; Prod. Can; Umbrella; Zapper; RF/Radar/Audio Jammer; Flasher; Blaster; Jacob's Ladder; Plasma and Van de Graaff 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.

### 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 xmitters; 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), indestructible TELECODER 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 \$35.

### 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 loads! Also describes Pole Meters, Meter Creep and Overload Droop. \$19.

### THE I.G. MANUAL

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

### 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 neat devices to change voice frequencies. Effective against snoops 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. Module \$35.

### VORTEX GENERATOR

Heat/cool with simple, amazing 3-Port Device. Uses no moving parts, electricity, fossil fuel, liquid or freon. 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.

GOOD 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 OOS (for batching). Ideal as a "Wargames" dialer, phone call logger and telemarketing dialer. Disk\* + Manual \$29. With LABELS and LETTERS programs \$49. Optional TeleMark. Interface \$295.

### HARD DRIVE MANUAL

Relates to all Hard Drive and Controller implementations (emphasis on PC/XT/AT/386). How to select, interface, initialize, set up, use them. How to maintain, trouble-shoot, 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, FDs, 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 FLUSHOT+ Disk\*! (Editor's Choice, PC MAGAZINE!) Dozens of Computer Crime and Abuse Methods, and CounterMeasures. How systems are penetrated. BBS Advice, Password Deleters, 200 Phreak-Term Glossary, much more. 2 Manuals + 2 Disks\* \$29.

### 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 VDT video signals using an ordinary TV! Ranges up to 1 KM! Plans, countermeasures. Includes legal Van Eck uses. Now includes original VAN ECK DESIGN!!! \$29.

### 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 (all unsolved)! 2 Manuals \$39.

### ABSOLUTE SECURITY

Dozens of simple, versatile, secure Computer Security methods, tips. Plus our Invaluable Cipher Program (in COM and its BAS Source). Plus \$1,000 CIPHER CHALLENGE 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 legit 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

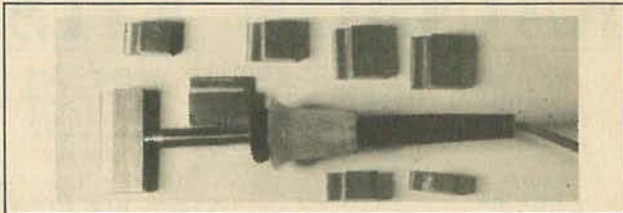
We Design, Build, Repair, Modify, Maintain and Consult on any Device, System or Project - Computerized, Electronic, Electrical, Mechanical, Optical - many invention prototypes. Confidentiality guaranteed. Describe and include \$25 non-refundable fee. We then provide you cost, time estimates.

### TECH. RESEARCH SERVICES

Unique 42K electronic, computer design articles in database accessed by title, subject, Digital, uP, uC, analog, hybrid, nomograph, software. Provide us keys, we return listing. \$25 non-refundable search fee (1-20 keywords/ phrases). Saves you R&D \$\$\$!

\*Software supports: PCDOES, MSDOS, PS;2; Mono, Herc, CGA, EGA, VGA; 5.25"; 3.5"; hard (specify your floppy drive size).

## REMOVE IC'S FASTER



with this simple invention than any other method, including \$6,000 vacuum desoldering stations. Salvages hundreds of good IC's per hour from junk boards, and also speeds up repairs. Won't damage IC's or circuit board. Removes 6 thru 40 pin IC's. This is a money making labor saving tool. Order now. We pay shipping on prepaid orders.

**\$89.95**

Complete set of 8 desoldering bits

## LEARN THE SECRETS OF HOW TO FIX ELECTRONIC EQUIPMENT FASTER ON OUR

## REPAIR TECHNIQUES ON VIDEOTAPE

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.

Send payment with order and we will pay shipping. Order all 14 tapes and send payment with order and get a 10% discount. (Send \$503.37 for all 14 tapes.) 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 1. Includes inductors, transformers, flybacks, pinball coils, solenoids	\$39.95
All about inductors and their failure modes, Part 2. 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 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 1. 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 microprocessors, what goes wrong & 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

## VIDEO REPAIR SCHOOL

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



# PRELCO

605 Chestnut St • Union, N.J. 07083  
TEL: 201-851-8600 FAX: 201-686-4656



2N5308	0.29	AN6291	3.50	CA3217E	3.45	LA5512	1.25	MM5368N	3.00	TC9145P	2.20	UPC1382C	1.70	221-192	1.25
2N5635	6.90	AN6308	3.95	CA3218E	1.75	LA5521D	1.25	MM5387	1.99	TCAB30	1.50	UPC1391	1.40	221-193	2.10
2N5636	6.50	AN6307	3.95	CA3224E	2.45	LA6358	1.10	MM5402N	0.45	TCAB30SM	1.50	UPC1470	1.10	221-213	0.90
2N6045	0.79	AN6326	2.95	CA3234E	5.95	LA7031	1.90	MM5456N	1.50	TCA4500	1.75	UPC1473	1.10	221-261	6.10
2N6497	0.69	AN6327	3.10	CA3236E	5.95	LA7032	5.20	MM7317BN	1.50	TCP4621	2.75	UPC1513	1.35	221-267	9.95
2N6558	0.49	AN6328	3.25	CA3237E	1.75	LA7090	2.00	MN1280R	2.45	TD62105P	1.80	UPC1514	1.80	221-285-02	5.50
2SA643	1.95	AN6337	2.85	CA3238E	1.75	LA7210	2.55	MN6183A	3.95	TDA1067	1.55	UPC1520C	2.75	221-285-03	5.50
2SB171	0.35	AN6341	2.95	CA7807E	1.85	LA7507	1.60	MN6188	3.75	TDA1083	2.30	UPD261	2.95	221-291	1.95
2SB173	0.35	AN6342	2.10	CA7811E	1.85	LA7520	2.75	MN6178	2.40	TDA1170	2.40	UPD282	2.95	221-303	3.40
2SB178	0.40	AN6343	3.90	CD22402E	8.95	LA7530	2.75	MN15823	3.75	TDA1190Z	2.10	UPD940C	3.95	221-304	1.90
2SB179	0.45	AN6346	3.85	CX770	3.75	LA7620	3.75	MP1908	3.40	TDA1220A	2.45	UPD946	5.55	221-343	0.75
2SB186	0.50	AN6350	6.25	CX20017	6.10	LA7800	2.25	MPC874J	1.55	TDA1578A	0.95	UPD1200	6.95	221-347	2.80
2SB187	0.55	AN6359	3.90	CX23035	3.95	LA7830	2.05	MPSA13	0.35	TDA2003V	1.25	UPD1203C	2.00	221-418	6.95
2SB189	0.60	AN6360	3.95	CXA1019	4.90	LA7910	1.10	MPSU10	0.55	TDA2008V	1.55	UPD1704C	2.25	221-419	1.80
2SB459	0.40	AN6361	3.95	DN8838	1.75	LB1403	1.10	MRF4421C	13.95	TDA2030H	1.55	UPD1709	5.50	221-493	4.40
2SB512	0.40	AN6362	4.50	DTA114	0.56	LB1405	1.35	MRF4818C	6.90	TDA2577	2.65	UPD1937C	2.10	221-516	6.75
2SB546	0.65	AN6366	5.25	DTA124ES	0.80	LB1409	2.10	MRF641	12.75	TDA2820M	1.50	UPD1943G	2.50	221-528	2.60
2SB562	0.55	AN6387	5.10	DTC114ES	0.45	LC4081B	0.45	MRF644	7.95	TDA2822M	1.55	UPD1988C	1.85	221-545	2.75
2SB710	0.40	AN7025	1.60	DTC114F	0.45	LM317T	0.75	MRF901	1.10	TDA3190	2.00	UPD1987C	1.85	442-58	2.35
2SB834	0.50	AN7110	1.50	DTC124ES	0.58	LM324N	0.95	MRF911	1.25	TDA3564N	6.10	UPD4027	0.45	442-62	1.05
2SC535	0.25	AN7111	1.50	DTC144	0.56	LM337MT	0.80	MSL2318	2.75	TDA3570	4.20	UPD4066B	0.35	442-74	1.98
2SC708	0.85	AN7115	1.50	DTC144ES	0.56	LM340T-5	0.30	MSL9372	3.75	TDA3653CQU	3.85	UPD4081	0.45	56D3-1	1.15
2SC900	0.20	AN7142	1.75	GH3F	1.95	LM340T-6	0.30	MSM5525	2.75	TDA4505A	8.75	UPD4556B	0.50	56D6-1	1.50
2SC929	0.30	AN7143	2.75	HA1138	2.99	LM340T-8	0.30	MUR3005	1.72	TL783C	1.35	UPD6104C	2.10	56D23-1	1.10
2SC930	0.30	AN7145	2.95	HA1156	1.39	LM340T-12	0.30	MUR3015	1.72	TLP560G	1.50	UPD6111	6.45	56D24-1	1.50
2SC945	0.15	AN7148	1.80	HA1197	1.80	LM340T-18	0.30	PH902	0.90	TMC1073	3.40	UPD7538C	4.95	56D25	1.05
2SC1000	0.25	AN7205	1.50	HA1338	5.90	LM350T	1.75	RC556N	0.15	TMS1025	4.95	UPD75106	5.45	57B316-10	1.95
2SC1023	0.35	AN7213	0.85	HA1389	2.70	LM357N	2.80	SAB3036	3.75	TMS1045	5.60	X0137	3.95	610142-4	0.25
2SC1096	0.55	AN7222	1.50	HA1389R	2.70	LM380N	1.25	SAB3037	2.95	TMS1071	4.50	121-868	0.45	610419-2	0.25
2SC1359	0.20	AN7224	1.75	HA11227	1.50	LM384N	1.55	SAF1039P	1.60	TMS1751	2.45	121-1014	0.80	610442-1	0.80
2SC1449	0.55	AN7310	1.10	HA11423	2.25	LM556CN	0.55	SN29764	0.75	TMS1944	2.90	121-1028	0.70	610456-2	0.25
2SC1674	0.30	AN7320	1.25	HA11714	5.50	LM1310N	1.35	STA401A	2.50	TMS1952	2.90	121-1035	0.70	610457-2	0.80
2SC1815	0.15	AN7410	1.50	HA11747	7.50	LM1818N	2.50	STK011	4.45	TMS3450	2.90	121-1037	0.75	610471-1	0.70
2SC1923	0.20	AN7420	1.30	HA12003	1.25	LM1822N	5.95	STK433	5.20	TMS3451	2.45	14DN158	5.60	610551-1	0.75
2SC1941	0.65	AN7812F	0.85	HA12413	1.50	LM1823N	5.95	STK4192II	11.50	TMS3452	2.45	14DN197	6.90	612024-1	2.20
2SC1959	0.15	AN7815F	0.85	HA17458	0.90	LM1888N	2.40	STK5372	5.30	TMS3495	2.45	14DN209	6.75	612042-2	2.75
2SC1975	1.95	AN7818	0.65	HD36290	5.70	LM1877N9	2.65	STK5471	5.10	TRC2073D	1.50	14DN233	5.10	612044-1	1.50
2SC2058	0.25	AN78M05	0.45	HD38941	3.75	LM1880J	2.95	STK5476	5.10	UA168	3.10	15-35059	1.25	612069-1	2.35
2SC2120	0.20	AN78M05F	0.65	HD614042	7.90	LM1895N	2.75	STR380	4.75	UA17B	2.30	15-37701	2.95	612070-1	1.80
2SC2230	0.75	AY-385-00	2.45	IR2403	1.80	LM2877P	1.80	STR381A	4.75	UA208	2.75	15-37702	1.85	612072-1	1.95
2SC2271	0.75	AY-385-01	2.45	IR2410	1.50	LM2901N	1.75	STR451	8.25	UA767	1.75	15-37704	1.75	612076-4	2.85
2SC2482	0.75	BA235	1.60	IR2E01	1.50	LM8361	3.10	STR2013	5.80	ULN2110A	1.45	15-39207	4.95	612076-7	2.85
2SC3038	1.25	BA390	1.50	IR2E02	1.50	LM8560	3.10	STR3115	4.75	ULN2212	2.45	15-39208	2.25	612094	2.15
2SC3298A	1.10	BA328	1.00	IRCS	0.95	LU11627B	3.00	STR3125	4.75	ULN2216	1.00	15-39209	2.50	612105	5.10
2SD77	0.75	BA521	1.25	KA33V	1.55	M5218P	0.90	STR3135	4.75	ULN2224	1.95	15-41627	2.20	612120-1	3.80
2SD91	2.05	BA526	1.50	KA1222	1.50	M5278L56	0.50	STR30123	4.75	ULN2228	1.50	15-41784	4.10	612298-1	3.10
2SD187	0.50	BA532	1.25	KA2101	0.55	MA7020	2.45	STR30130	4.75	ULN2229	1.85	15-43098	4.40	612305-1	1.30
2SD200	2.85	BA612	0.90	KA2102A	1.80	M51307BSP	8.25	TA7117P	2.70	ULN2261A	2.10	15-43703	1.35	612331-2	5.50
2SD261	1.50	BA718	0.65	KA2130A	1.45	M54516P	1.80	TA7137P	1.10	ULN2280B	1.50	15-45300	1.30	612337-3	4.70
2SD400	0.50	BA728	1.25	KAZ206	1.75	M58618P	2.95	TA7142P	2.45	ULN3810A	1.65	221-42	1.70	612337-5	4.70
2SD880	0.80	BA1310	1.75	KA2261	1.45	M58626P	2.65	TA7157P	1.80	ULN3859	1.45	221-43	2.35	612338-3	5.10
2SD1159	0.75	BA1320	1.45	KA2263	1.85	M58659P	2.45	TA7159P	2.10	UPA53C	1.80	221-45-01	2.60	612347-2	1.95
2SD1227M	1.10	BA3308	1.25	KAZ2281	1.20	MA89461P	4.10	TA7223P	1.45	UPA80C	1.50	221-46	1.75	612351-1	1.10
2SD1265	0.85	BA3612L	1.25	KA2912	2.50	MB3106	1.35	TA7230P	1.75	UPC27C	2.25	221-69	1.95	612405-1	2.25
2SD1286	0.90	BA4210	1.75	KA3213	0.85	MB8726	2.45	TA7267P	2.25	UPC358C	1.85	221-77	3.20	612442-1	4.95
2SD1384	0.70	BA4232AL	1.95	KIA7137	1.10	MB88303	8.75	TA7325P	1.25	UPC393C	1.60	221-78	2.85	612445-1	2.65
2SD1397	1.85	BA4234L	1.95	KIA7640	2.75	MBR3035	2.15	TA7330P	2.55	UPC554C	1.80	221-79-01	1.75	612479-3	0.75
2SD1427	1.75	BA4402	1.00	L5630	1.55	MBR3045	2.15	TA7331P	1.60	UPC571H	1.20	221-87-01	2.15	612480-1	1.55
AN217	1.80	BA4403	1.25	LA1180	1.80	MC1309P	1.25	TA7335P	0.90	UPC574	1.80	221-82	0.95	DM32	1.10
AN236	2.65	BA4558	0.90	LA1185	1.50	MC1351P	2.95	TA7342P	1.25	UPC575C	1.25	221-97	1.75	DM50	1.20
AN240P	1.40	BA5101	1.85	LA1201	0.95	MC1357P	1.45	TA7343P	1.85	UPC585	4.45	221-97-01	1.75	DM82	0.75
AN262	1.75	BA5102	1.85	LA1210	1.65	MC1394P	1.40	TA7353P	1.40	UPC587C	1.25	221-97-02	1.75	DM106	0.18
AN277	2.45	BA5115	2.75	LA1222	1.65	MC3357P	1.75	TA7358P	1.25	UPC592H	4.10	221-102-01	2.85	DM112	0.75
AN278	1.50	BA6104	2.95	LA1231	1.55	MC7805CT	0.30	TA7378P	1.50	UPC1018C	2.75	221-104	1.95	DM163	0.75
AN302	3.50	BA6209	1.90	LA1245	1.75	MC7819CT	0.30	TA7607P	1.65	UPC1028	1.25	221-105	2.10	DS102	0.19
AN305	3.50	BA6238A	2.50	LA1260	1.80	MC78L15CG	0.25	TA7611P	1.65	UPC1032H	1.75	221-106	2.20	IC-13	2.35
AN318	3.75	BA6993	1.60	LA1365	0.85	MC78L18CG	0.25	TA7613P	2.30	UPC1197C	1.45	221-111-01	0.75	IC-27	2.10
AN360	1.00	BFW92A	1.25	LA3115	1.35	MC78M05CT	0.20	TA7614P	2.55	UPC1204C	1.55	221-140	3.75	IC-32	2.40
AN362	1.85	BN5111	3.75	LA3155	1.25	MC78M06CT	0.20	TA7628P	1.75	UPC1213C	2.50	221-157-02	1.85	PC000049	5.90
AN366	2.00	CA1384E	1.45	LA3160	0.80	MC78M12CT	0.20	TA7630P	1.75	UPC1263C	1.25	221-158-03	1.85	PC000050	6.20
AN3313	8.25	CA3085E	0.85	LA3201	0.95	MC78M15CT	0.20	TA7640P	1.50	UPC1350C	1.35	221-160-01	2.15	PC000051	6.20
AN3821K	3.50	CA3070E	1.75	LA3220	0.90	MC78M18CT	0.20	TA7644P	5.75	UPC1352C	2.40	221-164	2.75	PC000065	5.85
AN5015K	1.50	CA3071E	2.35	LA3301	1.45	MC7902CT	0.30	TA7658P	1.75	UPC1363C	2.65	221-175	5.95	PC000083	5.50
AN5111	3.75	CA3072E	1.75	LA3310	0.85	MC7905.2CT	0.35	TA7668AP	1.50	UPC1371C	2.90	221-177			

# NEW AFFORDABLE - PRECISION TEST EQUIPMENT

E.T. Tech., Inc. - Division of Empire Telecommunication Inc.

## SIGNAL SYNTHESIZERS



**SG-100**  
**\$685**

.100000 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. -  
99.999 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.

125 South Van Brunt Street, Englewood, N.J. 07631  
Phone 201 569-3339 Fax 201 569-5838

## 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(E)PROMs
- 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

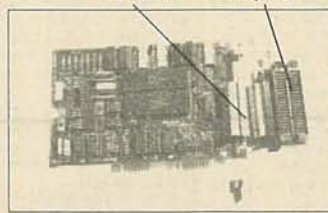
Internal Programmer for PC

**\$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

Call for more information

(916) 924-8037

FAX (916) 972-9960

C.O.D.

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!**

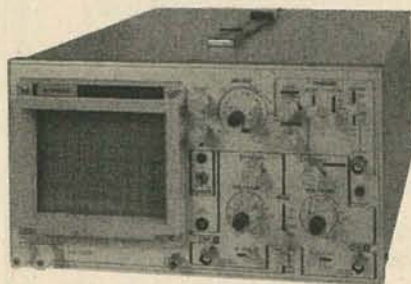
Fully enclosed with switch and D.I.N. power connector.

- 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!



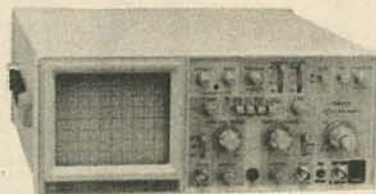
**BK PRECISION****OSCILLOSCOPES****ELENCO**

**Model MO-1251**  
**20MHz Dual Trace**  
 Component Tester

**\$355**

MO-1252 - 35-50MHz, Dual Trace,  
 Delayed Trigger **\$475**

P-1 Scope Probe - 65MHz, X1 X10 **\$18.95**  
 P-2 Scope Probe - 100MHz, X1 X10 **\$22.95**

**B+K PRECISION**

**Model 2120**  
**20MHz Dual Trace**

**\$389**

2125 - 20MHz, DT, Delayed Sweep, Component Tester **\$479**  
 1541 - 40MHz, DT **\$650**  
 2160 - 60MHz, DT, Delayed Sweep **\$899**

**HITACHI**

**Model V-212**  
**20MHz Dual Trace**

**\$399****Other Models**

V-522 - 50MHz, DT **\$845**  
 V-523 - 50MHz, DT, Delayed Sweep **\$930**  
 V-525 - 50MHz, DT **\$975**  
 V-660 - 60Hz, DT **\$1,050**  
 V-665 - 60MHz, DT, w/cursor **\$1,290**  
 V-1060 - 100MHz, DT **\$1,370**  
 V-1065 - 100MHz, DT, w/cursor **\$1,650**  
 V-1085 - 100MHz, QT, w/cursor **\$1,950**  
 V-1100A - 100MHz, QT **\$2,200**  
 V-1150 - 150MHz, QT **\$2,675**

**Digital Storage Scopes**

VC-6023 - 20MHz, 20MS/s **\$1,695**  
 VC-6024 - 50MHz, 20MS/s **\$1,950**  
 VC-6025 - 50MHz, 20MS/s **\$2,195**  
 VC-6045 - 100MHz, 40MS/s **\$2,885**  
 VC-6145 - 100MHz, 100MS/s **\$4,595**

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

**ELENCO TEST EQUIPMENT****Digital Triple Power Supply****XP-765**

**\$245**  
 0-20V @ 1A  
 0-20V @ 1A  
 5V @ 5A

Fully regulated, Short circuit protected with  
 2 current limit controls, 3 separate supplies  
**XP-660 with Analog Meters \$175**

**GF-8016 Function Generator with Freq. Counter****\$245**

Sine, Square, Triangle  
 Pulse, Ramp, .2 to 2MHz  
 Freq Counter .1 - 10MHz

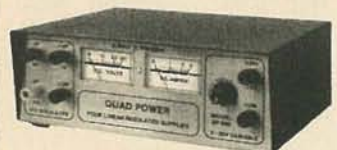
GF-8015 without Freq. Meter **\$179**

**Multimeter with Capacitance and Transistor Tester****\$49 CM-1500A**

Reads Volts, Ohms  
 Current, Capacitors,  
 Transistors and  
 Diodes / with case

**Digital Capacitance Meter****CM-1550****\$55**

9 Ranges  
 .1pf-20,000ufd  
 .5% basic acy  
 Zero ctr w/ case

**Quad Power Supply****\$55**

2-20V @ 2A  
 12V @ 1A  
 5V @ 3A  
 -5V @ .5A

Fully regulated and short circuit protected

**Wide Band Signal Generators****SG-9000 \$125**

RF Freq 100K-450MHz  
 AM Modulation of 1KHz  
 Variable RF output

SG-9500 with Digital Display  
 and 150MHz built-in Freq Ctr **\$245**

**Digital LCR Meter****LC-1801****\$120**

Measures:  
 Coils 1uH-200H  
 Caps .1pf-200uf  
 Res .01-20M

**Digital Multimeter****M-1000****\$24.95**

19 Ranges  
 DCV-1000  
 ACV-750  
 DCA-10A  
 Res-2M Ω  
 Diode check

**Triple Power Supply****XP-620**

Assembled **\$60**  
 Kit **\$40**  
 2 to 15V @ 1A,  
 -2 to -15V @ 1A  
 (or 4 to 30V @ 1A)  
 and 5V @ 3A

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

**Four-Function Frequency Counters****F-100 120MH****\$175****F-1000 1.2GH****\$255**

Frequency, Period, Totalize,  
 Self Check with High Stabilized Crystal Oven  
 Oscillator, 8 digit LED display

**10 Function Multimeter****CM-365****\$59.95**

AC + DC Voltage & Amps  
 Resistance to 2000MΩ  
 Diode, Logic, & Trans test  
 Capacitance to 200uF  
 Frequency Counter

**AM/FM Radio Kit****AM/FM 108 \$24.95**

Manual teaches AM & FM  
 Theory in easy to  
 understand language  
 Many more kits available

**OMNITRON****ELECTRONICS**

280 N. Midland Ave. BLDG. 2-2A  
 Saddle Brook, NJ 07662

UPS Shipping: Continental USA 5% (MAX FRT \$20)

Money Order, Checks Accepted

School Purchase Orders - NET 30

Sorry no CODs

Add 5% for credit card

100 Page Catalog \$3 (FREE with order)

**201-703-9800****201-703-9804 (FAX)**

# DIGITAL METERS

**NEW**



**DMM 2360 129.95**

**DMM + LCR Meter  
Most Versatile DMM**

- Inductance: 1 $\mu$ H - 40H
- Capacitance: 1pF - 40  $\mu$ F
- Temperature: -40 - 302 $^{\circ}$ F
- Frequency: 1Hz - 4MHz
- Logic test: 20MHz
- Diode test
- Continuity beeper
- Volt, current, ohm
- 3999 count display
- Peak hold
- Auto power off

**DMM 135 \$79.95**

**MEASURE TEMPERATURE**



- 0 $^{\circ}$  - 1400 $^{\circ}$ F
- -20 $^{\circ}$  - 750 $^{\circ}$ C
- .1 $^{\circ}$ , 1 $^{\circ}$  resolution
- C: 1pF - 20 $\mu$ F
- .1 $\Omega$  - 2000M $\Omega$
- Volt, current, continuity
- Diode, hFE tests
- Type K thermocouple included

**DMM 175A \$94.95**

**DMM MEASURES 20 MHz**



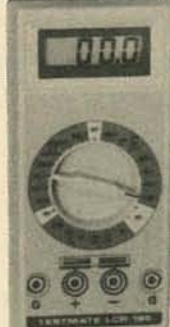
- Frequency 1 Hz - 20 MHz
- Logic test 20 MHz
- C: 1pF - 20 $\mu$ F
- .1 $\Omega$  - 2000 M $\Omega$
- Volt, current, continuity
- LED, diode, hFE tests

**DMM 5365 \$79.95**



- Frequency 1 Hz - 200 KHz
- Logic test 20 MHz
- C: 1pF - 20 $\mu$ F
- .1 $\Omega$  - 2000 M $\Omega$
- Volt, current, continuity
- Diode, hFE tests
- Compact size

**LCR Meter**



- \$119.95**
- Inductance: 1 $\mu$ H - 200H
  - Capacitance: .1pF - 200 $\mu$ F
  - Resistance: .01 $\Omega$  - 20 M $\Omega$

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

**ALFA ELECTRONICS**  
P.O. BOX 8089, PRINCETON, NJ 08543  
**(800) 526-ALFA**  
**FAX: (609) 275-9536**

## TECHNICAL SCHOOL CLOSED!

Selling hundreds of HEATH Co. test and training equipment at up to 60% off their catalog prices. Use Heath catalog for description. Condition: new to slightly used, unfortunately many without manuals. All professionally wired & tested, or in original kit form as noted. First come, first served. Check or major credit cards. Sorry, no COD or open accounts. Add \$4.50 for Mailing and Handling.

### HEATH TEST EQUIPMENT

SK101	12 VDC-3A Power Supply	39.50
1271	Function Generator	69.50
1274	2MHz Sweep/Pulse Generator	135.00
1277	Pulse Generator	147.00
2250	Digital Capacitance Meter	115.00
2320K	Handheld 3.5 Digit DMM Kit	49.50
2320W	Handheld 3.5 Digit DMM Wired	59.50
2420	Deluxe Universal Counter	255.00
2717A	Reg. H.V. Power Supply	165.00
2718	Triple Output DC Supply	129.50
2760	8-15V Battery Eliminator	135.00
3117	Decade Resistance Box	49.50
3120	Semiconductor Checker	69.50
4200A	Laser Trainer, Wired	225.00
4200K	Laser Trainer, Kit	195.00
4225	Dual Trace 25 MHz Oscilloscope	375.00
4226	Dual Trace 25 MHz Oscilloscope	395.00
5217	Battery Operated V.O.M.	39.50
5226	Vacuum Tube Voltmeter	89.50
HCA3000	Deluxe Coax Connector Adaptor Kit	89.50
PKW105	Deluxe 10:1 Combo Probe Kit	22.50

### HEATH EDUCATIONAL SYSTEMS

1000	Analog/Digital Ckt Trainer	215.00
3300	Plug-in Bread Board Trainer	85.00
3400	Microprocessor Trainer	185.00
3400C	Portable Carry Case for M.T.	18.50
3567	Trainer Accessory Back Pack	95.00
3600	Analog Educational Trainer	88.50
3700	Digital Techniques Trainer	79.50
6201	Digital Experiment Module	77.50
ET100	Microcomputer Trainer	395.00
ZVM133	Terminal for Above	245.00
EWD100	Dual 5.25" Disk Drive	158.00

### MISCELLANEOUS

700	T-1 Portable Data Terminal	99.50
HP-15C	H-P Scientific Calculator/Manual	68.50
545A	Hewlett Packard Logic Probe	156.00
546A	Hewlett Packard Logic Pulser	210.00
547A	Hewlett Packard Current Tracer	378.00
548A	Hewlett Packard Logic Clip	192.00
5022A	All 4 in Carry Case	918.00
SP100	Serial-Parallel Converter, 110VAC	58.00

### HEATH LEARNING COURSES

Note: The small kits of component parts usually supplied with manuals are not available and prices reflect this omission. All courses are new and unused.

3140A	Concepts of Electronics Course	28.50
E4201	Fiber Optics Learning Course	56.50
EC1001	Passive Circuit Design Course	28.50
EE1004	Digital Circuit Design Course 2 vol.	59.50
ED6201	Lab Experiments Digital Techniques	19.50
EE101	Operational Amplifiers	29.50
EE102	Active Filters Course	19.50
EE103	I.C. Timers Course	22.50
EE104	Phase Locked Loops Course	29.50
EE105	Opto Electronics Course	36.50
EE110	Laser Technologies Course	59.50
EE3201A	Digital Techniques Course, 2 vol.	49.50
EE8088	Adv/4 Microprocessors Course, 2 vol.	59.50

### EDUCATIONAL BOOKS

These books are brand new & represent a saving over publishers list prices. All hard bound except as noted.

Lab Experiments Digital Tech (soft)	PUR
TTL Cook Book, Lancaster (soft), Sams	8.85
Assembly Language Program (soft), Intel	PUR
Electricity 1-7, Mileaf, Hayden	PUR
Decision Making Under Uncertainty, Hull, P-Hall	PUR
Fundamentals of Digital Electronics, P-Hall	PUR
Concise Intro to Engineering Economics	12.50
Industrial Ventilation, Edward Bros.	16.50

### BOOKS BY MC GRAW HILL

Gorb Basic Electronics, 5th Ed.	10.50
Software Reliability, Musa Iamino	10.50
Intro to Uni Systems, Byers, 5th Ed. (soft)	9.50
Digital Electronics, Tolvaim 2nd Ed. (soft)	9.85
A Reference Guide to Practical Electronics (soft)	3.75
Digital Electronics thru Experiments	5.95

### BOOKS BY MERRILL

Experiments in Electronic Devices, 2nd Ed.	9.50
Electronic Devices, Floyd, 2nd Ed.	24.50
Digital Experiments-Trouble shoot, Cox (soft)	10.50
Experiments Electronic Circuits, Stanley, 2nd	11.50
Principles of Electronic Circuits, Floyd, 2nd Ed.	16.50
Principles of Electronic Circuits, Floyd, 3rd Ed.	23.50
Digital Fundamentals, Floyd, 3rd Ed.	14.50

## Com Tech

1755 Osgood St., North Andover, MA 01845  
CALL: 508/682-6936 FAX: 508/689-9484  
ORDER TOLL FREE: 800/343-1455

## NEW PRODUCTS

*continued from page 22*

Expansion from stand-alone data logger to complete data-logging system is simple and easy. As many as five data loggers (for a total of 80 channels) can be networked together using the RS-422 ports at the rear of each unit. By wiring a network into a PC, up to 800 channels can be monitored.

No programming experience is required for set up. Once data is taken it can be sent to a printer, logged to a PC, or sent to one of the DB-2000 Series data buffers. Suggested applications are in temperature monitoring and control, field-environment experiments, benchtop data gathering, industrial-equipment monitoring, and remote data gathering.

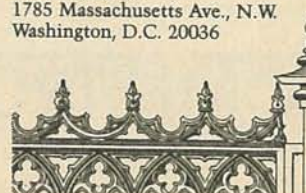
Prices for the expansion data logger range from \$995.00 to \$1295.00; the DDL SW applications soft-

ware and LTN-03 Labtech Notebook software cost \$495.00 and \$995.00, respectively; and the TCX-16 I/O module costs \$345.00. A complete line of accessories, including cables, adapters, data buffers, battery-backup systems, rack-mount kits, and driver relays, is also available. — **MetaByte Corp.**, 440 Myles Standish Blvd., Taunton, MA 02780; Tel. 508-880-3000.

## PRESERVATION PLAN ON IT

Write:

**National Trust for Historic Preservation**  
Department PA  
1785 Massachusetts Ave., N.W.  
Washington, D.C. 20036



**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

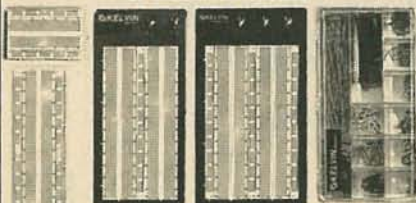


Fig.	Stock No.	Contact Points	YOUR COST
A	680093	500	\$ 4.25 ea
B	680097	840	\$ 5.95 ea
C	680098	1380	\$11.75 ea
D	680099	1580	\$15.75 ea

**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 GOOD/BAD
- 20 MHz FREQ COUNTER
- AC / DC VOLTAGE RANGES
- AC / DC CURRENT RANGES

CASE - Yellow, Durable, Back Stand



**\$ 69.95**

Stock No. 990092

PROTECTIVE CARRYING CASE  
Stock No. 990094 \$9.95 ea

**30 DAY MONEY BACK GUARANTEE!**

**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. For W002, 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

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

**K.I.S. SYSTEMS KELVIN INTERFACE SYSTEMS**

NEW HARDWARE  
NEW SOFTWARE

USER FRIENDLY

**\$ 199**

EDUCATIONAL ACTIVITY

GET 5 COMPLETE CLASSROOM SETUPS FOR UNDER \$1000

**ROBOTIC CONTROL SYSTEM**

AVAILABLE for IBM or APPLE

SYSTEM INCLUDES:

- Robotic Arm
- 2 Joysticks
- Power Supply
- Software
- K.I.S. Interface Module
- Demonstration Video

UPGRADABLE - ADDS THE ABILITY TO CONTROL AN ADDITIONAL 4 DC MOTORS UP TO 1 AMP EACH FOR PROBLEM SOLVING ACTIVITIES SUCH AS CONVEYORS, ELEVATORS, PLOTTERS & ROBOTIC CARS.

**KELVIN 100**

Stock No. 990087 **\$ 23.95**

- AC/DC VOLTAGE
- DC CURRENT
- RESISTANCE
- DIODE TEST
- BATTERY TEST
- LOW BATTERY Warning
- ACCURACY +/- 0.5%

**KELVIN 150**

Stock No. 990090 **\$ 29.95**

- AC/DC VOLTAGE
- DC CURRENT
- RESISTANCE
- DIODE & BATTERY TEST
- LOW BATTERY Warning
- ACCURACY +/- 0.5%
- CONTINUITY TEST
- 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**



**YOU CAN'T GO WRONG!**

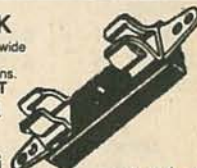
**30 DAY MONEY BACK GUARANTEE!**

CARRYING CASE  
Stock No. 990093  
**\$4.95 ea**

**WE STOCK A COMPLETE LINE OF FUSES FAST ACTING - SLO-BLO TYPE - PIGTAIL**

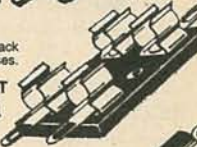
**3AG FUSE BLOCK**

Black laminated phenolic. 1/2" wide 1 7/8" long. For 1/4" x 1 1/4" long fuses. Solder lug connections.  
Stock No. YOUR COST  
380030 \$ .45 ea



**FUSE MOUNTING BLOCK**

Dual fuse block 2 1/4" x 1" long. Black bakelite base. For 1/4" x 1 1/4" fuses. Mounting centers 5/8" (15.8mm).  
Stock No. YOUR COST  
380010 \$ .62 ea



**FUSE POST TYPE HKP**

Bayonet type. 2 3/16" L for 1/4" x 1 1/4" fuses. 15 Ampere 250V. Panel hole size 1/2" (12.7mm). Complete with mounting nut.  
Stock No. YOUR COST  
380001 \$ .90 ea



**TIMER - LM555**

Stock No. 600021

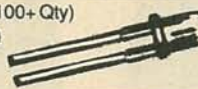
**20 ¢ ea.** (in 100+ Qty)



**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. 680089

**\$1.59 ea \$1.39/10+ ea.**



**9V Battery Snap & Holder**

Snap .15 ea. .10ea/100+

Holder .20 ea. .10ea/100+



**LAPL MICROPHONE**

Stock No. 850306

YOUR COST \$2.95 ea



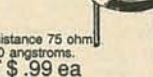
**CADMIUM SELENIDE PHOTO CELL**

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



**KELVIN BRAND HI-SPEED, HI-QUALITY PRINTED CIRCUIT ETCHANT**

Ready-to-use solution of ferric chloride printed circuit etchant in plastic container.  
Stock No. SPECIAL BUY  
440017 **\$ 6.25 per gallon**



**KELVIN BRAND HI-SPEED DRY PRINTED CIRCUIT ETCHANT**

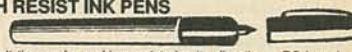
Clean, safe, economical, indefinite shelf life. 4 lbs. will make 2 gallons of recommended 20% etching solution.  
Stock No. YOUR COST NEW PRICE  
440026 \$8.40 ea \$ 7.00/ 4lb bag

**KELVIN BRAND COPPER CLAD BOARD**

NEMA grade FR-2 1/16" thick, unpunched clad on one side.  
Stock No. Size YOUR COST  
440002 4 1/2" x 6" \$1.55 ea  
440003 5" x 7" \$2.40 ea  
440015 8 1/2" x 12 1/2" \$4.90 ea

**ETCH RESIST INK PENS**

Black felt tip pen for making resist circuits directly on PC boards. Dries instantly for neat, easy application. Can be removed with PC Board Stripping Solution.  
Stock No. Model Description YOUR COST  
440115 22-220 Draws 1/32" wide \$1.48 ea  
440116 22-222 Draws 1/64" wide \$1.85 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

RE-SHOPPER



# ELECTRONIC CLEARING HOUSE, INC.

P.O. BOX 2006 • OLDSMAR, FLORIDA 34677  
813-855-4740 • FAX 813-855-6326

## WEATHERPROOF 8 OHM SPEAKER

Size 3"x3"x2" can be mounted  
Hardware included  
4.5' Cord 3.5mm Plug



#SPK305 **\$9.95**

## NEW ITEM - VOLT PEN

Determines presence of AC voltage through insulated wires. Contact with bare wire not required. Locates live wires in junction boxes, blown fuses, breaks in insulated wire & cable, defective circuit breakers, defective in-line circuits, etc.



#TKS10 1 - 4 **\$17.95**  
5 + **\$15.95**

## IC'S MEMORY CHIP/D-RAM SOCKET PULLS

#IC64 **\$1.75**

256K X 1 — 150 NS

#IC25 **\$2.50**

## AXIAL ELECTROLYTIC KIT 50 PIECES

5 each of the following values:

1UF 150V	8UF 150V
3UF 150V	10UF 100V
2UF 350V	20UF 100V
2.2UF 250V	150UF 150V
3.3UF 250V	220UF 100V

#AE50 **\$9.50**

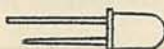
## ZENER DIODE KIT 100 PIECES

5 each of the following values  
3.6V 8.8V 18V 36V  
3.9V 8.2V 20V 39V  
4.7V 9.1V 27V 43V  
5.6V 12V 30V 47V  
6.2V 16V 33V 56V

ALL 1 WATT  
#WZD20 **\$15.00**

## LED'S

T 1 3/4 Clear Lens; Light as Red



#LED25 Bag of 25 **\$2.50**

## ZENER DIODE KIT

150 PIECES

5 each of the following values

2.4V	5.6V	8.7V	16V	25V
2.7V	6.0V	9.1V	17V	27V
3.0V	6.2V	10V	18V	28V
3.3V	6.8V	12V	19V	30V
3.9V	7.5V	13V	20V	33V
4.7V	8.2V	15V	22V	56V

ALL 500 MW

#MZD30 **\$22.50**

## MONOLYTHIC KIT

100 PIECES

5 each of the following values

10PF	470PF	.0047UF	0.47UF
33PF	680PF	.0068UF	.1UF
68PF	1000PF	.01UF	.22UF
100PF	.0022UF	.015UF	.33UF
220PF	.0033UF	.022UF	.47UF

ALL MINIMUM 50V  
RANGES 5-10-20%

#MK20 **\$10.00**

## 3 AMP RECTIFIER KIT

24 PIECES

3 each of the following values:

5400	5401	5402	5403
5404	5405	5406	5407

#RRK24 **\$2.50**

## CERAMIC DISC KIT

105 PIECES

15 each of the following most popular values:

(All 1 KV) (Some Short Leads)

5PF	25PF	350PF	910PF
.0015PF	.0039PF	.01PF	

#CD105 **\$5.00**

## RESISTOR KIT

200 PIECES

1 & 2 WATT 5 & 10%  
10 each of 20 assorted values

#REK200 **\$2.00**

## CAPACITOR KIT

100 PIECES

Radial Mylar — All 100V 10%

10 each of the following values:

.0015	.0056	.033	.068	.15
.0022	.01	.047	.1	.47

#CPK15 **\$12.00**

## TRANSISTOR KIT

PNP NPN

5 each of the following values:

2N4400	2N4401
2N4403	2N5401

#TRK20 **\$2.50**

# CAMCORDER REPLACEMENT BATTERIES FROM THE BATTERY STORE

- Low Cost Allows Extra Spare Batteries
- Buy Direct From The Battery Manufacturer
- Eliminate "Memory" Problem
- Extended Run Time Models Available
- 6 Month Warranty
- Other Battery Types Available
- Overnight Shipment by UPS

8mm	NP-22 Sony	.....	\$27.00
	NP-55/77 Sony	.....	\$31.00
	E-77K Canon	.....	\$46.00
	VP-BP81 Olympus/Nikon	.....	\$41.00
VHS	BP80 Panasonic	.....	\$34.00
	CB-120 RCA/Hitachi	.....	\$49.00
	NP-009 RCA/Pentax	.....	\$49.00
	BP-96FL RCA/Hitachi	.....	\$49.00
VHS-C	BN-V6GU JVC/Zenith	.....	\$31.00
	VMP-51 RCA/Hitachi	.....	\$49.00

\*Add \$4.00 shipping & handling per battery

Batteries are our only business. The true value of any battery system is determined by service, performance and dependability. Make your choice Periphex. Nobody has a better battery or offers a better value.

## PERIPHEx inc.

149 Palmer Road • Southbury, CT 06488  
(800) 634-8132 • In CT (203) 284-3985  
FAX: (203) 282-6943



## COMPUTER DISK SERVICE

### SPECIALIZED DRIVE REPAIR

**Special  
Low Prices!**

**\$75.00**  
SEAGATE 5 1/4"  
ST 238, ST 225  
MINISCRIBE 5 1/4"  
3425, 3435, 3438  
MINISCRIBE 3 1/2"  
8425, 8438  
**\$120.00**  
SEAGATE ST 251  
MINISCRIBE 3650

**FOR SALE  
NEW!!**  
380mb Scsi 16ms  
MINISCRIBE 9380S  
INTERNAL  
\$ 1,000.00  
EXTERNAL - KIT  
CALL FOR PRICE  
1 YEAR WARRANTY

- Class 100 clean room
- Servowriting capabilities (Call for prices)
- Volume discount
- 120 day 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

PH (805) 499-6355  
FAX (805) 499-0346

DEALER INQUIRIES WELCOME.  
CALL OR WRITE FOR A COPY OF OUR FREE FLYER.  
PRICES DO NOT INCLUDE SHIPPING.  
FLORIDA RESIDENTS ADD 6% SALES TAX.  
MINIMUM ORDER \$10.00 — COD (CASH ONLY)  
SHIPPING AND HANDLING ADD \$3.75

## 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

**COMING SOON 'NORTH COAST' CONVERTERS**  
TOP OF THE LINE

**SAN JOSE SPECIAL!**

**SCIENTIFIC ATLANTA 6700 A/B \$99.95 EACH**

**\$79.95** EACH 5 LOT

**\$75.00** EACH 10 LOT

**\$69.95** EACH 20 LOT

**\$65.00** EACH 50 LOT

54 CHANNEL A/B TWINLINE,  
10 CHANNEL RECALL,  
CHANNEL 3 OUTPUT,  
ZENITH COMPATIBLE

**UNITED ELECTRONIC SUPPLY**

P.O. BOX 1206, ELGIN, IL 60121

**(708) 697-0600**

# BATTERIES

Replacements (All New — Made in the U.S.A.)

CAMCORDER (batteries)	COMMUNICATIONS (complete battery packs and inserts)	SPECIALS!!!	CORDLESS PHONE (batteries)
<b>JVC</b> GR-C series ..... \$35.95  <b>PANASONIC</b> PVBP80 (12V @ 2.3amps) ..... \$35.95 LCS2012-VBNC ..... \$35.95 LCS2012-BVBN ..... \$36.95  <b>RCA/HITACHI</b> Full size VHS ..... \$39.95 VHS-C ..... \$39.95  <b>SONY</b> NP22 ..... \$32.95 NP55 ..... \$32.95	<b>ICOM</b> PB-2 (500mah @ 7.2V) ..... \$33.00 PB-5 (500mah @ 7.2V) ..... \$44.28 *7(S) (1200mah @ 13.2V) ..... \$63.00 *8(S) (1200mah @ 9.6V) ..... \$59.00 *base charge only, one inch longer  <b>KENWOOD</b> KNB-1 (500mah @ 10.8V) ..... \$39.00 KNB-4 (2200mah @ 7.2V) ..... \$65.00 PB-1 (1100mah @ 12V) ..... \$64.00  <b>YAESU</b> FNB-2 (500mah @ 11V) ..... \$20.00 **FNB-10 (600mah @ 7.2V) ..... \$30.00 **FNB-10(S) (1000mah @ 7.2V) ..... \$45.95 FNB-12 (500mah @ 12V) ..... \$44.00 **FNB-12(S) (600mah @ 12V) ..... \$49.00 **same size case as FNB-12	<b>CELLULAR BATTERIES AND ELIMINATORS</b> MOTOROLA PANASONIC MITSUBISHI OKI \$55.00 NEC NOVATEL NOKIA-MOBIRA DIAMONDTEL TECHNOPHONE  <b>MOTOROLA-FLIP PHONE SERIES</b> AUDIOVOX \$75.00	<b>ATT</b> 4110, 4310, 5210, 5310 ..... \$ 9.00 Freedom 400 ..... \$ 8.00 Nomad 200, 250, 400 ..... \$ 8.00  <b>COBRA</b> CP-100, 200, 300, 400, series ..... \$ 8.00 CP-464S to CP-475S series ..... \$ 9.00  <b>PANASONIC</b> KX-T3805, PQP-25F301A ..... \$11.00 KX-series most models ..... \$ 8.00  <b>SONY</b> SSP-80 ..... \$ 9.00  <b>UNIDEN</b> EX-series most models ..... \$ 8.00 XE-series ..... \$ 9.00

MasterCard and Visa cards accepted. NYS residents add 8 1/4% sales tax. Add \$3.50 for postage/handling.



Prices subject to change without notice.

DEALERS WANTED (QUANTITY DISCOUNTS)



- If you don't see it ask for it
- Custom battery packs
- High capacity packs
- Nickel Cadmium cells
- Alkaline
- Lithium
- Gel Cells (Lead Acid)

## BATTERY-TECH INC.

28-25 215th PLACE, BAYSIDE, NEW YORK 11360

(800) 442-4275

IN NEW YORK (718) 631-4275

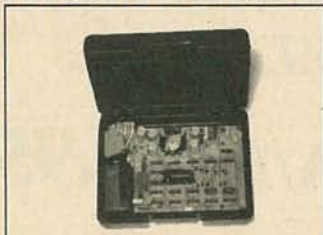
FAX: (718) 461-1978

TELEX: 51060 16795

CIRCLE 347 ON FREE INFORMATION CARD

## 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\*



**EPROMS**  
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 DISK FILE INTO BUFFER
- 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)
- VERIFY 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:

VISA

ANDRATECH  
P.O. BOX 222  
MILFORD, OHIO 45150  
(513) 831-9708

MASTER CARD

CALL OR WRITE FOR MORE INFO. -- ADD \$5.00 FOR SHIPPING - \$4.00 COD

# 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

VISA





## 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!

- 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

## 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

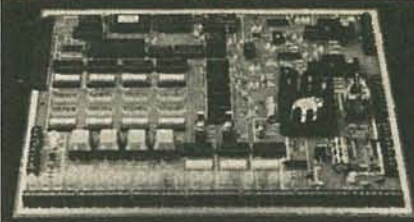
Find out why more and more electronic professionals are adding computer repair to their businesses or starting their own computer repair businesses.

Call Tech-Serv at (212)967-1865 now.

**techserv** AUTHORIZED DEALER  
SM  
SERVICING THE WORLD OF MICROS

253 West 28th Street, New York, NY 10001

©1989 Tech-Serv Corp.



### 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
- ♦ Expandability & so much MORE!

Available as a kit or pre-assembled. Send for our FREE catalog! A complete line of peripherals is also available. Complete Circuit Board kit \$220 plus \$10.50 S&H. (Ca. residents add 6.75% tax).

### Paladin Electronics

19425-B Soledad Cyn. Rd.  
Suite 333, Dept. PE  
Canyon Country, CA 91351

"We protect your castle"



CIRCLE 343 ON FREE INFORMATION CARD

## LEARN TO CLEAN/MAINTAIN/REPAIR FAX MACHINES

HUGE NEW UNTAPPED MARKET!



EARN  
\$65/HRI

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 — no need for a background in electronics!
- 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.  
3540 Wilshire Bl. #310  
Dept RES Los Angeles, CA 90010

CIRCLE 349 ON FREE INFORMATION CARD



# B. G. MICRO

P. O. Box 280298 Dallas, Texas 75228

(214) 271-5546

FAX (214) 271-2462



## 7400

7400	.17	7474	.30	74162	.50
7401	.17	7475	.35	74163	.50
7402	.17	7482	.30	74164	.70
7403	.17	7483	.45	74165	.70
7404	.17	7484	.30	74166	.90
7405	.17	7485	.55	74173	.75
7406	.23	7486	.30	74174	.70
7407	.23	7488	.30	74175	.80
7408	.22	7490	.37	74176	.50
7409	.17	7492	.30	74177	.50
7410	.17	7493	.30	74180	.50
7413	.33	7496	.30	74191	.35
7414	.25	7497	.30	74193	.80
7416	.20	74102	.35	74194	.25
7417	.20	74107	.20	74195	.80
7420	.17	74111	.35	74197	.25
7425	.25	74120	.30	74199	1.00
7426	.17	74125	.40	74221	.60
7427	.25	74126	.19	74251	.25
7428	.25	74128	.19	74259	.70
7430	.15	74136	.19	74265	.50
7432	.27	74144	.20	74273	1.75
7433	.25	74145	.40	74276	.50
7437	.17	74148	.90	74279	.50
7438	.22	74150	.25	74283	.50
7440	.19	74151	.50	74365	.60
7442	.35	74153	.35	74366	.60
7450	.17	74154	1.19	74367	.50
7451	.18	74156	.30	74368	.30
7453	.22	74157	.30	74376	.30
7454	.22	74160	.80	74390	1.40
7473	.28	74161	.50		

## 74LS

LS00	.14	LS122	.35	LS241	.80
LS02	.14	LS123	.45	LS242	.85
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	.85
LS30	.14	LS161	.35	LS323	2.25
LS32	.16	LS162	.45	LS363	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	.85	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	29LS2569	1.50		

## NETWORK

\$25.00

(LAN) NETWORK  
THAT REALLY WORKS!

CALL OR WRITE  
FOR DETAILS.

## WE ALSO CARRY

**POWER SUPPLIES**  
74S  
74ALS  
74F  
74HC  
74HCT  
CMOS  
LINEAR  
UART  
Z80  
PROMS  
CRYSTALS  
DIP SWITCHES  
OSCILLATORS  
DRIVES  
VOLTAGE REGULATORS  
F.D. CONTROLLERS  
CLOCK CIRCUITS  
DRIVERS  
RECEIVERS  
CRT CONTROLLERS

**MUCH, MUCH MORE!  
CALL OR WRITE FOR  
FREE CATALOG.**

## 6500

6502	2.00
6520	1.25
6522	2.70
6530	3.00
6532	4.25
6545	2.10
6551	2.40

## 6800

6800	1.40	6852	3.50
6802	2.50	6860	3.95
6803	3.00	6868	3.00
6805	2.95	68A09EP	1.29
6809EP	2.75	68A40	4.00
6809P	2.50	68A54	3.00
6810	1.25	68B09	4.00
6845P	2.20	68B10	2.00
6845S	2.20	68B45	4.95
6850	1.75	68B54	4.00

## THREE CHIP SET

1488, 1489, 16450

B.G. SPECIAL

\$6.50

## VOLTAGE REGULATORS

LM317K	1.40	7815K	.60
LM317T	.50	7818K	.60
LM337T	.50	7824T	.35
7805T	.35	7875T	.30
7805T	.25	7905K	.75
7806T	.28	7905T	.40
7808T	.50	79M05T	.25
7810T	.28	7912T	.35
7812T	.40	7912K	.50
7812CK	1.00	7915K	.30
78M12T	.25	LM350K	3.35
7815T	.30	78H05K	3.75

## 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	1.75
TMS4416-16KX4-150 n.s.	2.75
4464-150	2.25
4464-120	2.55
4464-100	3.05
41256 150 n.s.	1.75
41256 120 n.s.	2.05
41256 100 n.s.	2.35
41256-80	2.90
41256-60	4.00
1 Meg - 100 n.s.	8.00
1 Meg - 80 n.s.	8.35
414256-80 n.s. 256 x 4	9.00

SIPPS & SIMMS AVAILABLE

## 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, 27128 and 27256 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

We Also Have New EPROMS

## 8000/80000

8031	2.95	(16450)	6.50
8035	1.00	(16550)	12.00
8039	1.00	8251	1.10
8085	1.55	8253-5	1.75
8086	1.55	8254	1.80
8087	87.50	8255	1.50
8087-1	167.50	8255-5	1.75
8087-2	127.50	8257	1.50
8088	2.70	8259A	1.85
80C98	.40	8259C-5	2.10
8155	2.25	8275	10.95
8156	2.25	8279	2.25
8202A	8.00	8284	1.49
8212	1.25	8286	3.50
8214	2.00	8287	2.49
8216	1.25	8288	3.50
8224	1.25	8530	3.00
8228	1.75	8741	7.00
8237-5	2.80	8748	7.00
8243	1.75	8749	7.00
8250	2.95	8755	7.00

80286-8 PLCC	8.50
80287-8	191.50
80287-10	227.50
V-20-10MHZ	6.50

## TEXT TO SPEECH BOARD

PC/XT COMPATIBLE.  
MAKE YOUR COMPUTER TALK!

PRICE  
CUT



ASSEMBLED & TESTED  
ADD \$3.50 SHIPPING  
& HANDLING

**\$69<sup>95</sup>**

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

**\$19<sup>99</sup>**

## IBM PC, XT COMPATIBLE KEYBOARD

IBM, PC, XT COMPATIBLE KEYBOARD

**CHEAP PRICE  
EXCELLENT QUALITY**

COMPUTER MANUFACTURERS EXCESS.  
BRAND NEW UNITS MANUFACTURED BY HONEYWELL.

COILED CONNECTING CABLE.  
HAS SAME MAKE AND BREAK CODES AS STANDARD PC,  
XT KEYBOARD.  
WORKS FINE WITH CLONES AND COMPATIBLES.

ADJUSTABLE REAR ELEVATION CONTROL (3 LEVEL).  
ORIGINAL COST IN EXCESS OF \$65.00 EACH.

**\$19<sup>95</sup> or 3/\$47<sup>50</sup>**  
Add \$3.00 each for shipping

## 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

## BAUD RATE GENERATOR

NS16450	6.50
16550	12.00
BR1941	2.00
1945(WD8136M-00)	2.00
COM8116	2.00
INS8250	2.95
MC 14411	5.95

TERMS: (Unless specified elsewhere) Add \$2.50 postage, we pay balance. Orders over \$50.00 add 85c 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.

## AMIGA-Commodore Chips...Parts...Upgrades

6526.....	\$12.25
6567.....	\$14.95
6581.....	\$11.25
PLA (82S100).....	\$12.95
All 901 Roms.....	\$10.95
41256/120.....	\$2.95
A501-512K Ram.....	\$99.50
*Fatter/Super Agnus.....	\$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

\*Includes Chip Puller (many others in stock)

**Commodore Diagnostician \$6.95 prepaid**

### ● 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

**\$23.95  
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.

35 Charlotte Drive, Wesley Hills, N.Y. 10977

1-800-292-7445 • (914) 354-4448

FAX (914) 354-6698



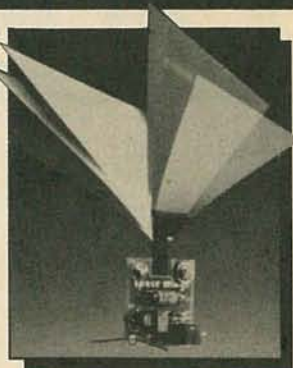
Dealer Prices Available

Prices Subject To Change

## 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**

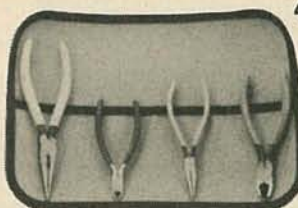


Send a business size Self-Addressed Stamped Envelope for latest catalog.

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**

CIRCLE 337 ON FREE INFORMATION CARD



### 4-Piece Electronics Pliers Kit

★ U.S. Made ★ Lifetime Guarantee  
Finest quality alloy steel pliers with color-coded cushion grip handles. Includes 4-1/2" miniature diagonal cutter, 5-1/2" diagonal cutter, 6-3/4" chain nose with cutter, 4-3/4" miniature chain nose and vinyl roll pouch. Charge Visa, MasterCard, American Express or send check or money order.  
**RES-82 Pliers Kit . . . \$39.00**

We pay the shipping charges.

**JENSEN TOOLS INC.**

7815 S. 46th St. Phoenix, AZ 85044 • Phone (602) 968-6231 • FAX (602) 438-1690

CIRCLE 338 ON FREE INFORMATION CARD

# Give.

American Heart  
Association



## THE ULTIMATE PERSONAL UV ERASER

D][ AC  
**39<sup>95</sup>**

Add 3<sup>95</sup>  
Shipping & Handling

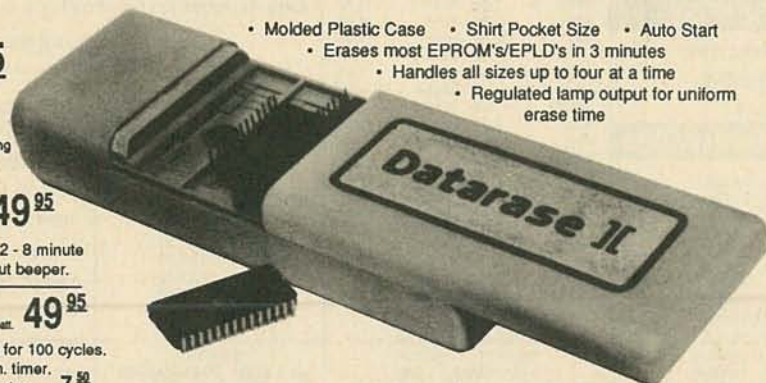
Also Available

D][ ACT **49<sup>95</sup>**

AC with internal 2 - 8 minute timer and time out beeper.

D][ B with AAA batt. **49<sup>95</sup>**

Battery powered for 100 cycles.  
Internal 2 - 8 min. timer.  
Optional AC adaptor. **7<sup>95</sup>**



- Molded Plastic Case
- Shirt Pocket Size
- Auto Start
- Erases most EPROM's/EPLD's in 3 minutes
- Handles all sizes up to four at a time
- Regulated lamp output for uniform erase time

**WALLING CO.**

4401 S. Juniper • Tempe, AZ 85282

Dealer inquiries welcome.  
6 month unconditional guarantee.  
Order direct or call for dealer near you.  
(602) 838-1277 1-800-338-9813

## Are you in DEFAULT On a Student Loan?

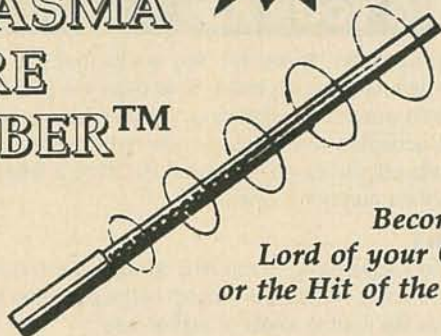
If you're in default on a guaranteed student loan (FISL, GSL, Stafford, SLS, or PLUS loan), you may be eligible for a special program that lets you pay it back without penalty or collection charges.

You must pay your loan in full by August 31, 1990 to take advantage of this special program. For information, call the guarantee agency that holds your loan, or call the U.S. Department of Education's toll-free number:

**(800) 333-INFO**

# ALL NEW! NEON PRODUCTS

## PLASMA FIRE SABER™



*Become the Lord of your Galaxy or the Hit of the Party!*

Length of visible plasma fire field is controlled by your touch. Creates a bizarre and spectacular effect. Available in Star Fire Red, Photon Blue, Nova Purple, and Phasor Green. Please specify color.

PFS20 FIRE SABRE (battery not included) ..... \$89.50  
 PFS2K EASY TO BUILD KIT - Excellent Science Project! ..... \$59.50

Quantity	10-24	25-99	100+	1,000+
Discounts	\$45.00	\$40.00	\$35.00	Price on Req

## MUSICAL NEON & DANCING PLASMA FIRE™



Brightly lit columns of colorful plasma move up and down with the intensity of sounds and music picked up by the built-in microphone.

- Mounts Anywhere
- 26 Inches Long!
- 12VDC/115VAC Operation
- Adjustable Sensitivity
- Available in Star Fire Red, Photon Blue, Nova Purple and Phasor Green (please specify)

DPL20 DANCING PLASMA ..... \$99.50  
 DPL2K EASY TO BUILD KIT ..... \$69.50

Quantity	10-24	25-99	100+	1,000+
Discounts	\$52.00	\$47.00	\$40.00	Price on Req

## Outdoor Neon Lighting for Garden, Walkways PLASMA STIK LITES™

Experience the mystifying beauty of PLASMA STIK LIGHTING™

Highly Efficient Cold Cathode design uses UL 10 volt adapter.

- Safe, Easy to Install - simply push into ground
- Weatherproof, durable construction
- Economical to operate - less than 2 watts

Basic system includes one STIK LITE and a power adapter capable of driving up to 3 extra "AD-ON's". Buy extra STIK LITE as needed. Specify color(s).

STIK Basic System, 1 Stik Lite with power adapter for 3 AD-ON's ..... \$49.50  
 EXTRA STIK LITE AD-ON's, Each ..... \$29.50



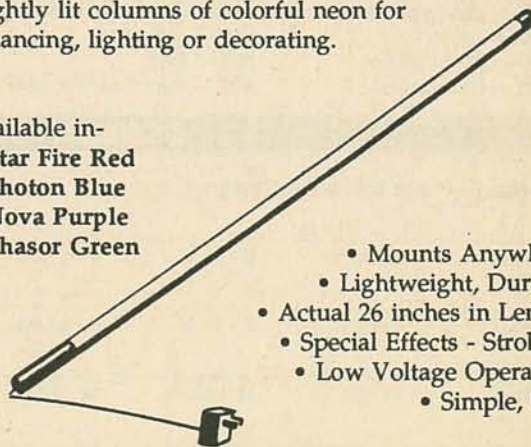
STIK LITES Available in:

- Garden Green
- Pool Blue
- Walkway White
- Warning Red

## Decor HI LITE NEON™

Brightly lit columns of colorful neon for enhancing, lighting or decorating.

- Available in-
- Star Fire Red
  - Photon Blue
  - Nova Purple
  - Phasor Green



- Mounts Anywhere
- Lightweight, Durable
- Actual 26 inches in Length
- Special Effects - Strobing
- Low Voltage Operation
- Simple, Safe

DNE10 DECOR NEON ..... \$79.50  
 DNE1K EASY TO BUILD KIT ..... \$59.50

Quantity	10-24	25-99	100+	1,000+
Discounts	\$39.00	\$35.00	\$30.00	Price on Req

Most products on this sheet are made possible through a recently obtained patent for single ended energizing of neon display signs and lighting systems. Ref U.S. Patent #4,742,278. All requests for quantity or dealer discounts are welcome. You may fax us at 603-672-5406. Phone orders 800-221-1705 or 603-673-4730 for 24 hour service. Call 603-673-6493 for information.

**FAX ORDERS: 1-603-672-5406**

**PHONE ORDERS: 1-800-221-1705**

INFORMATION UNLIMITED

P.O. Box 716

Amherst, New Hampshire 03031

603-673-4730

ORDERS: 800-221-1705

RE-SHOPPER

# 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 June 11 will appear in the September, 1990 issue that is mailed on July 10. 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: 40c 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	29 - \$11.60	30 - \$12.00	31 - \$12.40	32 - \$12.80
5 - \$6.00	6 - \$6.00	7 - \$6.00	8 - \$6.00	33 - \$12.80	34 - \$13.60	35 - \$14.00	36 - \$14.40
9 - \$6.00	10 - \$6.00	11 - \$6.00	12 - \$6.00	37 - \$14.80	38 - \$15.20	39 - \$15.60	40 - \$16.00
13 - \$6.00	14 - \$6.00	15 - \$6.00	16 - \$6.40	Ad No 1—Total words _____ × .40 per word = \$ _____			
17 - \$6.80	18 - \$7.20	19 - \$7.60	20 - \$8.00	All Caps words _____ × .10 per word = \$ _____			
21 - \$8.40	22 - \$8.80	23 - \$9.20	24 - \$9.60	Bold words _____ × .10 per word = \$ _____			
25 - \$10.00	26 - \$10.40	27 - \$10.80	28 - \$11.20	Bold Cap words _____ × .20 per word = \$ _____			
				<b>TOTAL COST OF AD No. 1 \$ _____</b>			

Total classified ad Payment \$ \_\_\_\_\_ enclosed.

Check  MasterCard  Visa (\$15.00 minimum credit card order)

Name \_\_\_\_\_ Card # \_\_\_\_\_

Address \_\_\_\_\_ Expiration Date \_\_\_\_ / \_\_\_\_ / \_\_\_\_

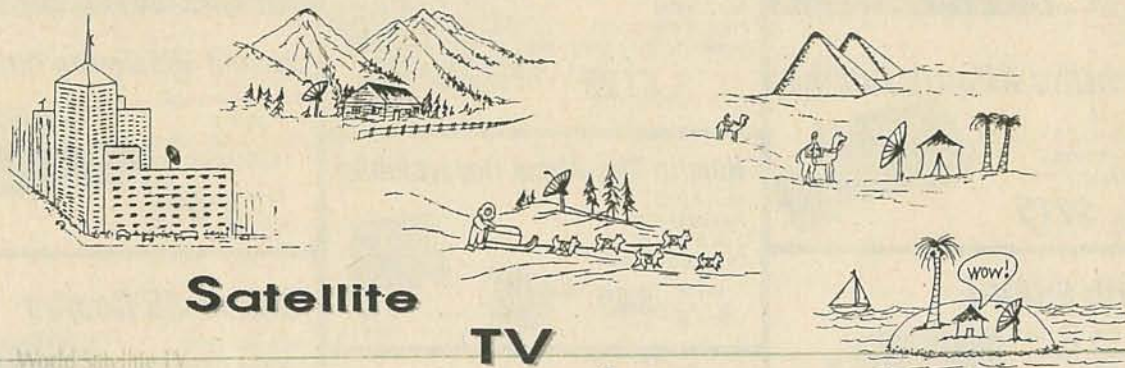
City State Zip \_\_\_\_\_ Signature \_\_\_\_\_



# \*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

WorldSatellite  
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 #21T .....S&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 #SK10 VHS .....S&H \$3 (U.S.) .....\$33.95  
Order #SK11 Beta .....S&H \$3 (U.S.) .....\$33.95



### 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 #PP-1450 .....S&H \$5 (U.S.) .....\$89.95  
Optional jump cable kit. Connects Peaker to LNB (Kit includes 2ea. 12' coax cables w/ splicer).  
Order #C212 .....S&H \$3 .....\$7.95



### IRDs / RECEIVERS / SYSTEMS

#### "Save \$\$\$ on Packages"

System package Includes: ORBITRON 10 foot mesh dish, 50degree LNB, 18" Jack Arm, Feed-horn and Receiver/IRD of your choice, plus a FREE detailed installation Video.

	IRD/Receiver	System
UNIDEN UST2200	(Receiver) \$219	
UNIDEN UST9000	(Receiver) \$449	\$999
UNIDEN UST7700	(IRD) \$899	\$1449
UNIDEN UST9900	(IRD) \$1019	\$1569
UNIDEN UST4200	(slave recv.) \$679	
UNIDEN UST4400	(IRD) \$909	\$1459
UNIDEN UST4800	(IRD) \$1539	\$2089
HTS V	(IRD) \$1049	\$1599
HTS VIII Plus	(IRD) \$1229	\$1779
HTS X	(IRD) \$1419	\$1969
DRAKE ESR324b	(Receiver) \$239	
DRAKE ESR924i	(Receiver) \$599	\$1149
DRAKE ESR1024	(IRD) \$909	\$1459
DRAKE ESR1224	(IRD) \$1039	\$1589
DRAKE ESR1424	(IRD) \$1209	\$1759
EHOSTAR 3000	(Slave recv.) \$729	
EHOSTAR 4000	(IRD) \$849	\$1399

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

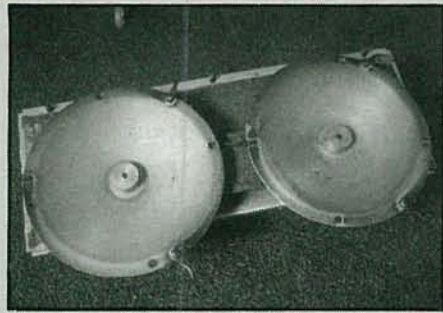
Name \_\_\_\_\_ Phone ( ) \_\_\_\_\_

Address \_\_\_\_\_

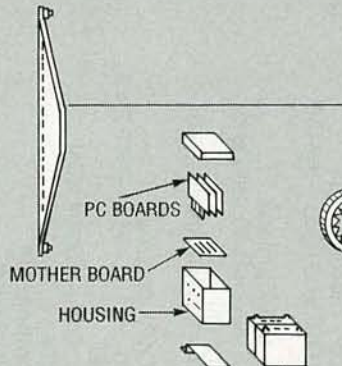
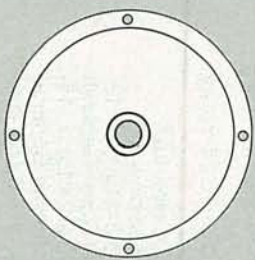
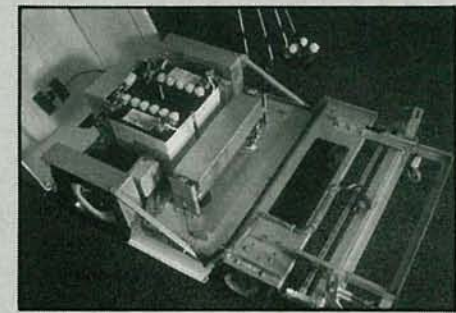
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



Install A System, Upgrade or Repair Yourself And Save \$\$\$\$



CUTTING ASSEMBLY

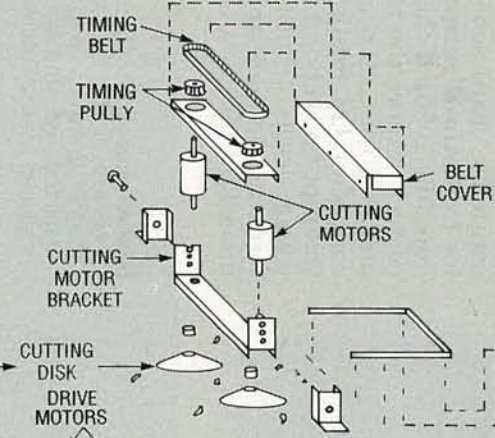


TWO 12-VOLT BATTERIES

MAIN CHASSIS

SHAFT  
SOCKET  
DRIVE WHEEL

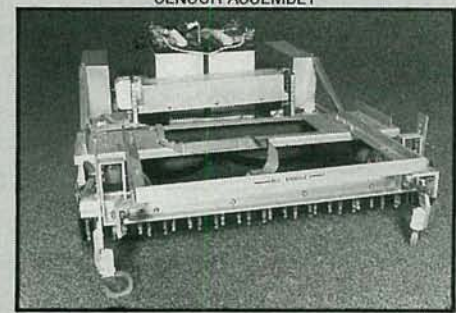
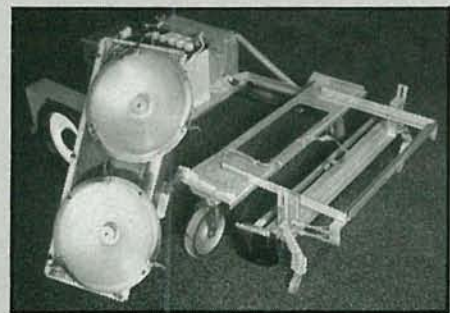
TACHOMETER SHUTTER



CUT HEIGHT ADJUST

SENSOR BRACKET

CASTOR WHEEL



SENSOR ASSEMBLY

FIG. 3—THE MECHANICAL ASSEMBLY of the Lawn Ranger.

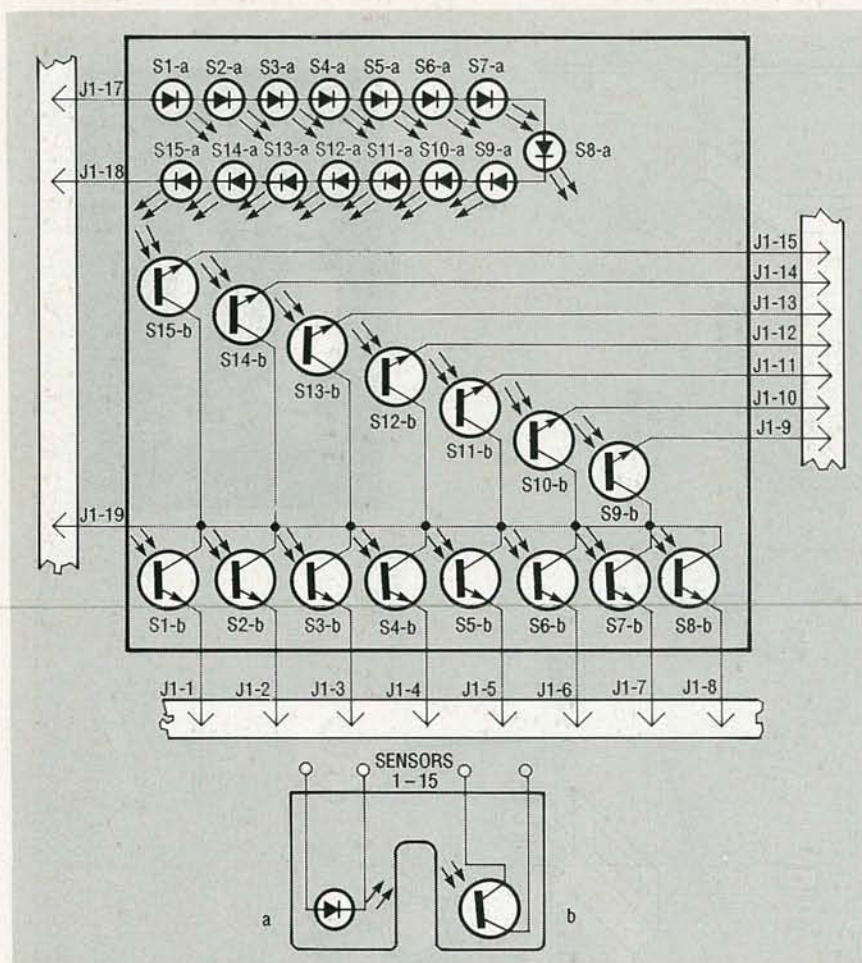


FIG. 4—WIRE THE GRASS SENSORS as shown here.

### Chassis wiring

Wire the chassis as shown in Fig. 5. Use 18-gauge stranded wire for the high-current cutting- and drive-motor connections. Secure the cable harness with tie wraps and secure the cable harness to the Lawn Ranger's chassis. Make sure all external cables from the motors, electronic control panel, bumper switch, and grass sensors are connected properly.

### Control-system test

Remove all input power and insert the power board into J21 on the motherboard. Repeat the test procedure that was just described, except measure the DC supply voltages at edge connector J23 and J22 on the motherboard. The supply voltages should agree with the values indicated on the CPU and motor-controller board schematics (refer to **Radio-Electronics**, June and July 1990). If the values are correct, remove the input power and plug the CPU board in edge-connector J23. Reapply the +24-volt input power and recheck the voltage levels. If all is well, perform the digital-board check-out procedure outlined in the June

### PARTS LIST—POWER BOARD

All resistors are 1/8-watt, 5%, unless otherwise indicated.

R1-R10, R13-R15, R17, R18, R20-R28, R45-R49—not used  
 R11, R44, R50—3300 ohms  
 R12—680,000 ohms, 6-pin, 1/4-watt, SIP resistor network  
 R16, R19, R32, R43—0.01 ohm, 5 watts  
 R29—150,000 ohms  
 R30, R31, R34, R35—270,000 ohms  
 R33, R36—1 megohm  
 R37—147,000 ohms, 1/4-watt, 1%  
 R38—10,000 ohms, potentiometer  
 R39—82,000 ohms  
 R40—100,000 ohms  
 R41—27,000 ohms  
 R42—22,000 ohms  
 R51-R54—560,000 ohms

### Capacitors

C1-C5, C7-C13, C16, C17—not used  
 C6—1000  $\mu$ F, 35 volts, axial electrolytic  
 C14, C15, C23-C26—0.1  $\mu$ F, 50 volts  
 C18, C21—100  $\mu$ F, 50 volts, radial electrolytic  
 C19, C20—100  $\mu$ F, 16 volts, radial electrolytic  
 C22—220  $\mu$ F, 16 volts, radial electrolytic

### Semiconductors

IC1, IC2—not used  
 IC3—LF412N op amp  
 D1, D2, D11-D13, D30, D31—not used  
 D3, D4, D16, D17, D20-D24, D33-D38—1N4001 diode  
 D5, D14, D18, D19, D32—1N4148 diode  
 D6, D15—1N5402 diode  
 D7-D10—1N5256B 30-volt Zener diode  
 D25-D29—1N4740 10-volt Zener diode  
 Q1, Q2, Q12—not used  
 Q3-Q10, Q13, Q14—IRFZ42 MOSFET  
 Q11, Q15, Q16—293904 NPN transistor

### Other components

J11—terminal strip  
 RY1—T90N1D12-24 relay (Potter Brumfield)  
 RY2—68P-111P-US-DC24 relay (Omron)  
 F1—3AG 30-amp fast-blow fuse  
 F2—2AG 0.5-amp fast-blow fuse  
 MOD1—Model DC2-2-24/12,  $\pm$  12-volt DC converter (Power General)  
 MOD2—Model DC2-2-24/15,  $\pm$  15-volt DC converter (Power General)  
 MOD1—Model 710, 5-volt DC converter (Power General)

Miscellaneous: 3AG fuse holder, 2AG fuse holder, solder posts for the "E" terminals, 18-gauge solid insulated wire, 18-gauge stranded insulated wire, solder, etc.

Note: The following equipment can be purchased from Technical Solutions, Inc., P.O. Box 284, Damascus, MD 20872 (301-253-4933): etched and drilled PC boards for CPU Board, Motor Controller Board, Power Board, and Motherboard, \$39 each; programmed EPROM, \$39; grass sensors, \$8.99 each; hand-held manual controller kit, \$39; full kit for CPU Board, \$129 (PC board, EPROM, all parts); full kit for Motor Controller Board, \$169 (PC board and all parts); full kit for Motherboard, \$69 (PC board and all parts); Power Board kit (PC board, and all parts except DC/DC converters), \$149; Detailed drawing package, \$79; Lawn Ranger demo videotape and information package, \$19; complete electronic kit with everything mentioned above, \$777. Please add \$8.00 for S/H for all orders. Maryland residents add sales tax.



issue while the boards are plugged into the motherboard.

Now plug the motor-controller board into J22 on the motherboard. Also, plug the grass-sensor connector (J1) into the motor-controller board. Reapply the +24-volt input power to the power board.

If you have an oscilloscope, verify that a 5-volt 10-kHz square wave is found at the following points: J22-34, J1-1 through J1-15, and J22-2 through J22-16. The square wave is a gating pulse created by the CPU board which is used to turn the grass sensors on and off. The gating technique is used in order to conserve battery power and extend the life of the grass sensors. If you don't have a scope, Use an AC voltmeter to read the voltage levels at those points. The square wave should create a reading of approximately 4.5-volts AC. If the square wave is not there, you should read 0 volts on the AC voltmeter.

Now it is time to check the Pulse Width Modulator (PWM) circuitry. Plug the hand-held controller into J4 on the motor-controller board. Temporarily jumper J22-40 to ground. Turn the steering control knob (the potentiometer on the hand-held controller) counterclockwise until you see a 30-volt square wave at J22-26 (L. REV), J11-7 (L. MOTOR -), J22-27 (R. FOR), and J11-9 (R. MOTOR +). If you don't have a scope, an AC voltmeter should give you a reading of 0 to 35.5 volts AC, depending upon the knob setting. Test points J22-25 (L. FOR) and J22-28 (R. REV) should read 0 volts.

The "left wheel reverse" (L. REV) and "right wheel forward" (R. FOR) signals become active since the Lawn Ranger has been commanded to turn to the left. If the steering knob is turned clockwise, the robot circuitry will be commanded to turn to the right. That causes J22-25, J11-6, J22-28, and J11-10 to become active with the 30-volt PWM square wave, and J22-26 and J22-27 to read 0-volts DC. If the steering knob is centered, J22-25, J11-6, J22-27, and J11-9 will be enabled and a voltmeter placed at J22-28 and J22-26 will read 0 volts since the robot has been commanded to steer straight.

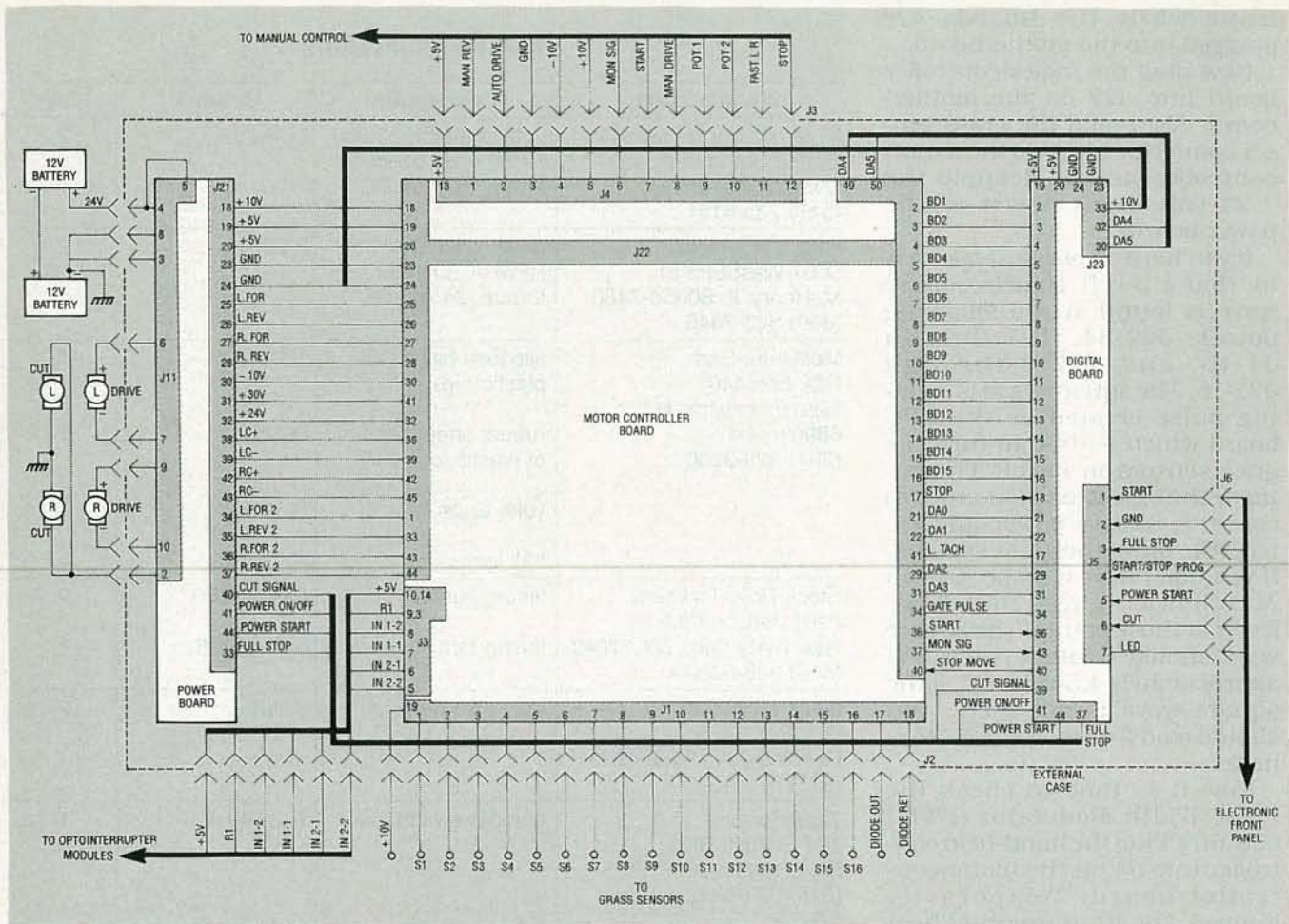
TABLE 1—SUPPLIERS

Manufacturer	Description	Model #	Qty
Motor Products Owosso 201 S. Delany Rd. Owosso, MI 48867 (517) 725-5151	cutting motors, 3,000 RPM @ 80 oz-in torque, 24 volt DC	LES-25A	2
RAE Corporation 5801 West Elm St. McHenry, IL 60050-7480 (800) 323-7049	drive motors, 187 RPM @ 30 in-lb torque, 24 volt DC	P-20705	2
McMaster-Carr P.O. Box 440 New Brunswick, NJ 08903-0440 (201) 329-3200	slip joint hinge (for plastic top)	1606A41	1
	rubber sheet (for front of plastic top) 1/16"	8635K11	1
	yoke ends	6071K12	4
	ball joints	6072K35	4
Stock Drive Products 2101 Jericho Pike New Hyde Park, NY 11040 (516) 328-0200	timing pulley	6A4-14DF0	2
	timing belt	6R4-08005	1
General Battery P.O. Box 1425 Reading, PA 19612-4205 (215) 378-0500	lead-acid battery	22NF	2
Tape Switch 100 Schmitt Blvd. Farmingdale, NY 11735 (516) 694-6312	bumper switch, 8 oz	102-BPH	1
Agri-Fab 303 W. Raymond Sullivan, IL 61951 (217) 728-4334	drive wheels	3108-148	2
	drive gear	2692-006	2
Colson 3700 Airport Rd. Jonesboro, AR 72401 (800) 643-5515	Caster Wheels	2-6056-45	2
Power General P.O. Box 189 Canton, MA 02021 (617) 828-6216	+ 5 volt DC	710	1
	+ 30 volt DC	DC2-2-24/	1
	± 12 volt DC	DC2-2-24/	1
Pioneer 9100 Gaither Rd. Gaithersburg, MD 20877 (301) 921-0660	E-terminals	160-2085-02-01	30
Techni-edge 389 Liberty St. Ferry, NJ 07643-1008 (201) 641-7776	hook blade	TE-28	6

#### Control panel test

Disconnect J11-2, J11-6, J11-7, J11-9, and J11-10 on the terminal block. Ensure that the cable from the electronic control panel is connected to J5 on the CPU board and that the batteries are connected to J11-4 and J11-5 on the power board. Turn the igni-

tion key; the red power-on LED should begin to flash. This indicates that power has been switched on to all circuits. Push the STOP button. The Lawn Ranger should turn off. Check that the cutting-motor connection J11-2 is still disconnected. Turn the ignition key again and



**FIG. 5—WIRING DIAGRAM FOR THE CHASSIS.** Use 18-gauge stranded wire for any high-current connections.

then push the CUT button. The voltage at J11-2 should now read +30-volts DC. Press the bumper switch and the Lawn Ranger should turn itself off. Turn the unit on again and push the RUN button. J23-40 (STOP MOVE) should now read +10-volts DC. Reconnect the motor wires to

J11-6, J11-7, J11-9, and J11-10 on the terminal block.

#### Drive-motor test

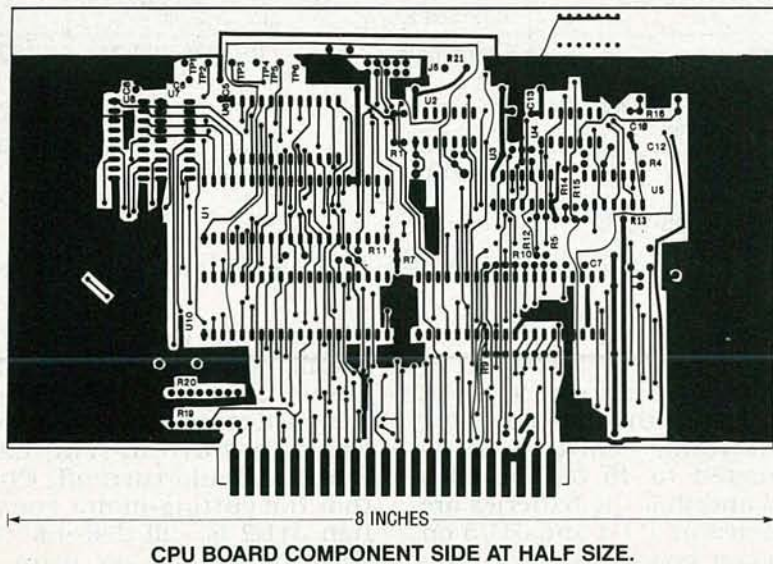
Make sure that the hand-held controller is connected to J4 on the motor-controller board, and that everything is connected on the terminal block J11 except for

J11-2 (cutting motors). Turn the ignition key (the power LED should be flashing), and turn the steering knob to its centered position. Squeeze the hand switch on the manual controller. Both rear drive motors and wheels should be spinning forward. Push the REVERSE button. The wheels should slowly stop and then turn in reverse. Turn the steering knob and observe the drive wheels as they change speed for steering. Release the hand switch and the Lawn Ranger will turn itself off.

#### Cutting-motor test

WITHOUT THE CUTTING BLADES ATTACHED TO THE CUTTING DISKS, reconnect the cutting motor wire to J11-2. Put the Lawn Ranger on a flat level hard surface, and keep the cutting deck area free of obstructions. With your hands away from the cutting deck area, push the CUT button; the cutting disks will begin to spin. Push the STOP button; the cutting disks should stop within three seconds. If the

*continued on page 70*



**CPU BOARD COMPONENT SIDE AT HALF SIZE.**

# BUILD R-E's DIGITAL DASHBOARD

Update your dashboard  
with six accurate,  
good-looking  
gauges.

ROSS ORTMAN

OUR DIGITAL GAUGE STORY BEGAN IN the July issue; this month we will build all of them. Note that in all of the parts lists, except for the displays, the part number for the A/D converter (IC2) was listed incorrectly. It should be a CA3162E, as shown in the schematics—speaking of which, the captions for Figs. 4 and 6 should be reversed.

## Construction

Each digital gauge is built using two different PC boards. The display board contains the seven-segment displays along with the driver components, as well as the annunciator light bar. The main board contains the A/D converter, all input circuitry, and the 5-volt regulator.

The boards are mounted one on top of another, separated by standoffs. A typical gauge is shown in Fig. 8. With the display board facing toward you, the main board is mounted directly behind it, with its components also facing toward you. Electrical connections from board to board are made using short pieces of bare wire between matching pads on both boards. A piece of 9-conductor ribbon cable can be used instead. Once assembled, the boards can be folded apart to allow for easy testing, troubleshooting, or calibrating.

Each gauge uses either a two- or three-digit display board. Table 1 shows which boards are to be used with each gauge. When stuffing the three digit display board, begin with R1 and R2 as shown in Fig. 9, and install R3 only if the board is to be used with the voltage gauge, as R3 supplies power to the decimal point. Install DISP1-DISP3 and

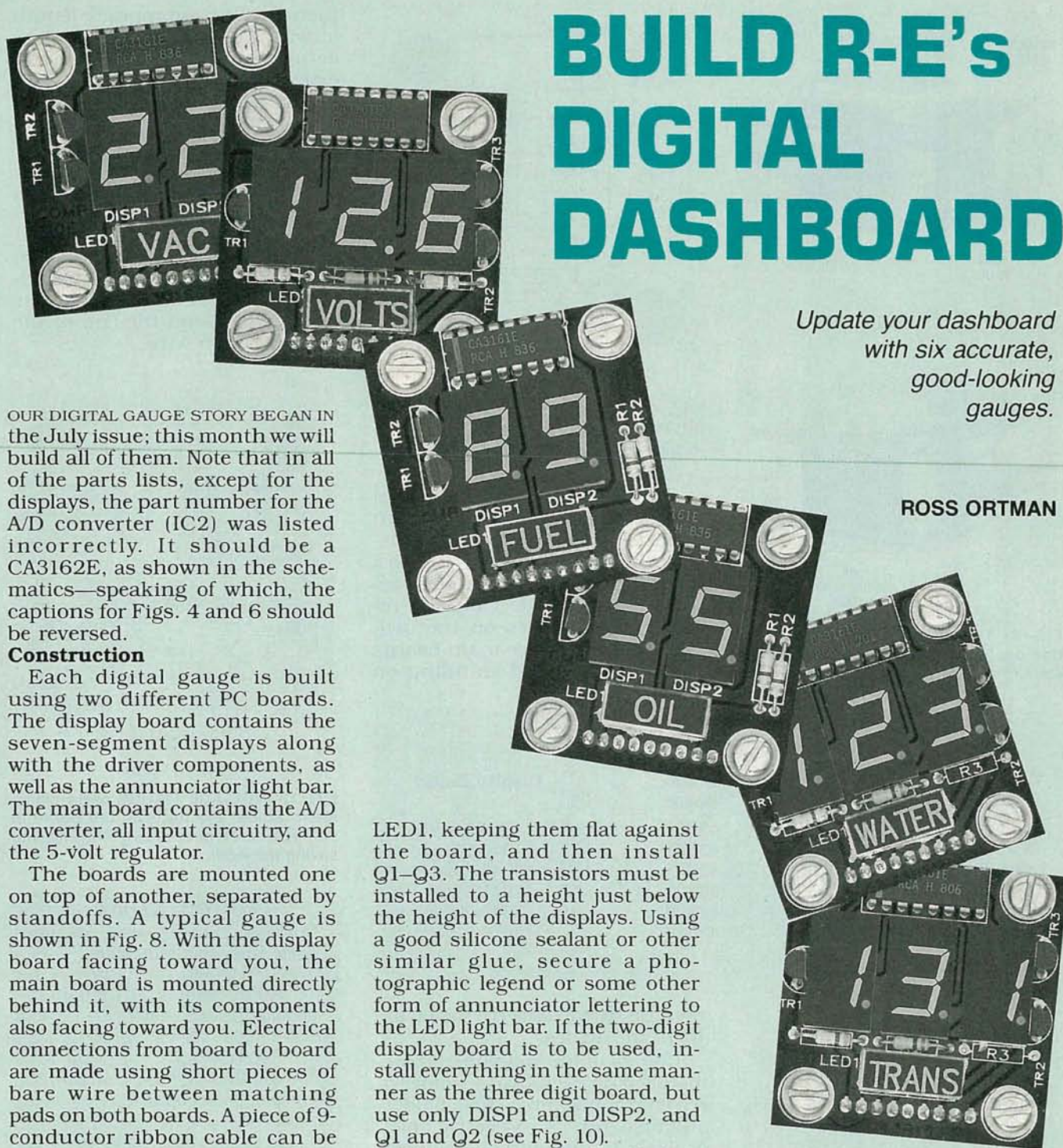
LED1, keeping them flat against the board, and then install Q1-Q3. The transistors must be installed to a height just below the height of the displays. Using a good silicone sealant or other similar glue, secure a photographic legend or some other form of annunciator lettering to the LED light bar. If the two-digit display board is to be used, install everything in the same manner as the three digit board, but use only DISP1 and DISP2, and Q1 and Q2 (see Fig. 10).

Although the use of sockets is normally recommended, IC1 must be kept below the height of the seven-segment displays. Therefore, IC1 must be soldered directly to the board. Be careful when soldering the IC.

Referring to Table 1, note that the same main board is used for the voltage, oil-pressure, water-temperature, and miscellaneous temperature gauges. However, the actual components soldered to the board are different for each gauge, and not all PC pads are

used on all boards. Install only the components specified in each parts-placement diagram.

Figure 11 shows the component placement for the voltage gauge. Solder the parts to the board in smallest-to-largest order, clipping and saving the leads. The parts-placement diagram for the oil-pressure gauge is shown in Fig. 12, the water-temperature gauge in Fig. 13, and the miscellaneous temperature gauge in Fig. 14.



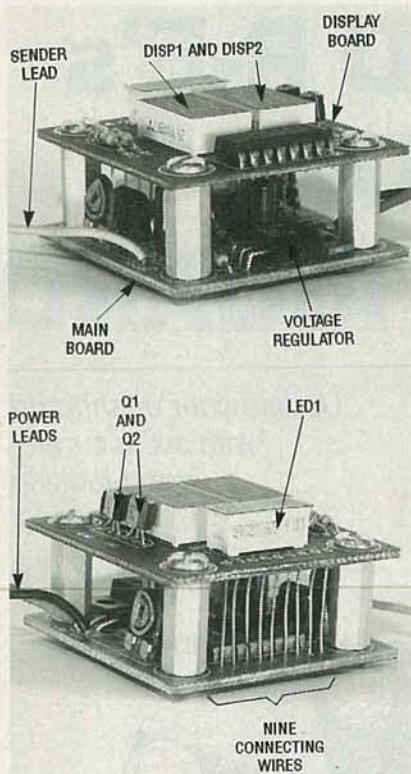


FIG. 8—THE BOARDS ARE MOUNTED one on top of another, separated with standoffs. A typical gauge is shown here.

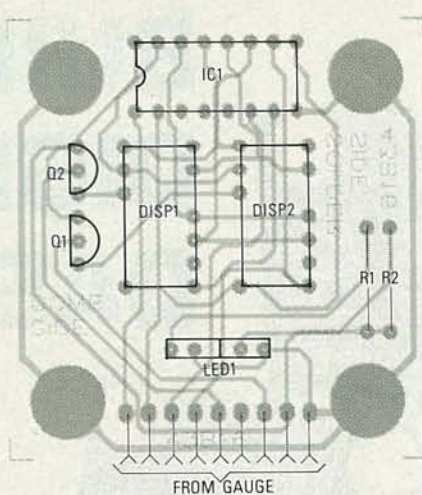


FIG. 10—THE TWO-DIGIT DISPLAY BOARD is the same as the three-digit board, but uses only DISP1 and DISP2.

The fuel gauge and vacuum gauge each has its own main board. Figure 15 shows the parts-placement diagram for the fuel gauge, and Fig. 16 for the vacuum gauge. Note that the resistors and diodes on the fuel- and vacuum-gauge main boards must be installed standing on

then need an appropriate length of wire that will run out to the actual sender, and you should crimp on a 1/4-inch male solderless terminal to one end, and set it aside for now.

The miscellaneous temperature gauge will need both a sender wire and a ground return wire. Install the sender wire as previously described, and cut a 4" piece of black wire to be soldered into the hole just above the sender wire. A 1/4-inch male solderless terminal goes on the end of the ground return wire.

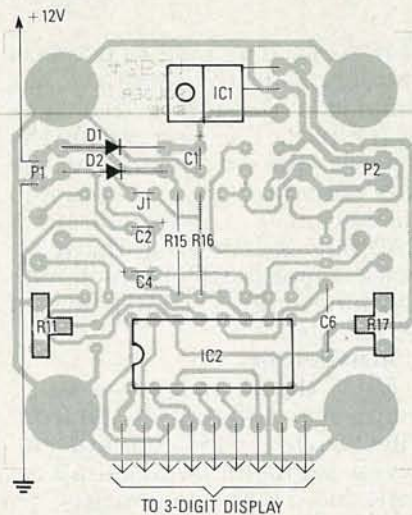


FIG. 11—VOLTAGE GAUGE parts placement. Solder the parts to the board in smallest-to-largest order, clipping and saving the leads.

TABLE 1

Digital Gauge	Main Board	Display Board
Voltmeter	43B21	43B15 3-digit
Oil Pressure	43B21	43B16 2-digit
Water Temp	43B21	43B15 3-digit
Misc Temp	43B21	43B15 3-digit
Fuel	43B20	43B16 2-digit
Vacuum	43B17	43B16 2-digit

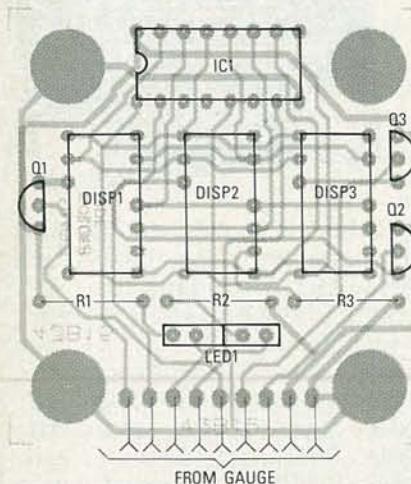


FIG. 9—WHEN STUFFING THE THREE-digit display board, install R3 only if the board is to be used with the voltage gauge. Otherwise it is not used.

end. Be sure to observe the polarity of the diodes.

After all of the components are installed on each board, solder a red wire containing a fuse holder and fuse into its respective hole. A black ground wire is soldered into the hole next to the power wire.

The oil-pressure, water-temperature, and fuel gauges all need one sender wire attached to the main board. Cut a 4-inch piece of wire and solder one end to the main-board location marked P2, "sender," and be sure to put it in the hole that is farthest from the upper-right-hand corner of the board. Next, crimp on a 1/4-inch female solderless terminal to the other end of the wire. You will

#### VOLTAGE GAUGE

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

- R1-R10, R12-R14—not used
- R11—10,000 ohms, PC-mounted trimmer potentiometer
- R15—100,000 ohms
- R16—1000 ohms
- R17—50,000 ohms, PC-mounted trimmer potentiometer

#### Capacitors

- C1—47  $\mu$ F, 25 volts, electrolytic
- C2, C5—10  $\mu$ F, 35 volts, electrolytic
- C3, C4—not used
- C6—0.33  $\mu$ F, 50 volts, stacked film

#### Semiconductors

- IC1—LM340T-5, 5-volt regulator
- IC2—CA3162E, A/D converter
- D1, D2—1N4002 diode

**Miscellaneous:** 43B21 main PC board, 3-digit display board, in-line fuse holder, 1-amp fuse, four 6-32  $\times$  0.625" standoffs, eight 5/16-inch #6 screws, bronze or red plexiglass, mounting hardware, hookup wire

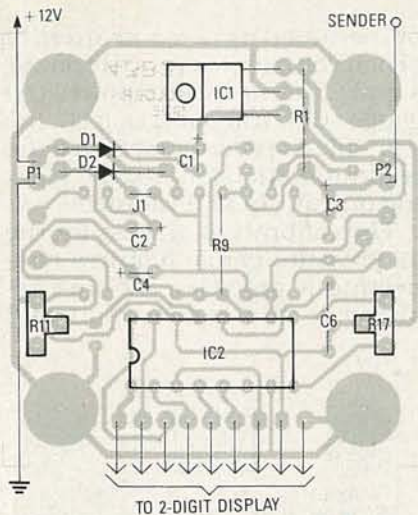


FIG. 12—OIL-PRESSURE GAUGE parts placement.

### OIL-PRESSURE GAUGE

All resistors are ¼-watt, 5%, unless otherwise indicated.

- R1—470 ohms
- R2—R8, R10, R12—R16—not used
- R9—100,000 ohms
- R11—10,000 ohms, PC-mounted trimmer potentiometer
- R17—50,000 ohms, PC-mounted trimmer potentiometer

#### Capacitors

- C1—47  $\mu$ F, 25 volts, electrolytic
- C2, C3, C4—10  $\mu$ F, 35 volts, electrolytic
- C5—not used
- C6—0.33  $\mu$ F, 50 volts, stacked film

#### Semiconductors

- IC1—LM340T-5, 5-volt regulator
- IC2—CA3136E, A/D converter
- D1, D2—1N4002 diode

**Miscellaneous:** 43B21 main PC board, 15G5 oil-pressure sender, 2-digit display board, in-line fuse holder, 1-amp fuse, four 6-32  $\times$  0.625" standoffs, eight 5/16-inch #6 screws, bronze or red plexiglass, mounting hardware, hookup wire

The main boards are now ready to be connected to the display boards. The first step is to place the four standoffs between the boards and secure them with eight 5/16-inch #6 screws. Assemble the boards with the foil side of the display board facing the component side of the main board. The holes for the board-to-board connecting wire should line up on the same edge. After the two boards are secured to each other, lay the assembly face down and begin inserting pieces of bare wire or scraps of component

leads through the holes in the main board and down into the respective holes in the display board. After a few wires have been inserted, solder the connections. Continue until all nine wires have been installed.

The temperature probe for the miscellaneous temperature gauge is constructed from the 1N4148 diode, a 10-foot length of coax cable, and a male and female crimp-on connector. On one end

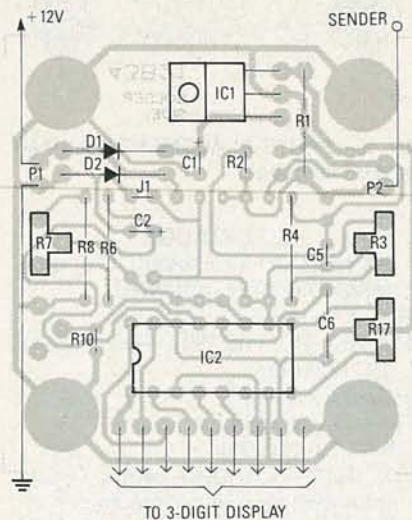


FIG. 13—WATER-TEMPERATURE gauge parts placement.

### WATER-TEMPERATURE GAUGE

All resistors are ¼-watt, 5%, unless otherwise indicated.

- R1—100 ohms, ½-watt
- R2—430,000 ohms
- R3, R7—10,000 ohms, PC-mounted trimmer potentiometer
- R4, R8—22,000 ohms
- R5, R9, R11—R16—not used
- R6—470,000 ohms
- R10—2200 ohms
- R17—50,000 ohms, PC-mounted trimmer potentiometer

#### Capacitors

- C1—47  $\mu$ F, 25 volts, electrolytic
- C2, C5—10  $\mu$ F, 35 volts, electrolytic
- C3, C4—not used
- C6—0.33  $\mu$ F, 50 volts, stacked film

#### Semiconductors

- D1, D2—1N4002 diode
- IC1—LM340T-5, 5-volt regulator
- IC2—CA3136E, A/D converter

**Miscellaneous:** 43B21 main PC board, 14G11 water-temperature sender, 3-digit display board, in-line fuse holder, 1-amp fuse, four 6-32  $\times$  0.625" standoffs, eight 5/16-inch #6 screws, bronze or red plexiglass, mounting hardware, hookup wire.

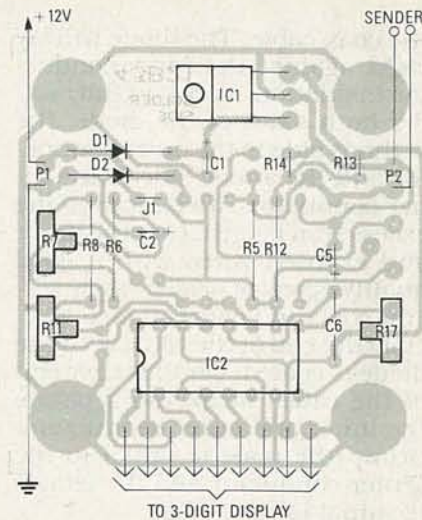


FIG. 14—MISCELLANEOUS temperature gauge parts placement.

### MISCELLANEOUS TEMPERATURE GAUGE

All resistors are ¼-watt, 5%, unless otherwise indicated.

- R1—R4, R9, R10, R15, R16—not used
- R5—2200 ohms
- R6—6800 ohms
- R7—1000 ohms, PC-mounted trimmer potentiometer
- R8—470 ohms
- R11—10,000 ohms, PC-mounted trimmer potentiometer
- R12—10,000 ohms
- R13—1000 ohms
- R14—220 ohms
- R17—50,000 ohms, PC-mounted trimmer potentiometer

#### Capacitors

- C1—47  $\mu$ F, 25 volts, electrolytic
- C2, C5—10  $\mu$ F, 35 volts, electrolytic
- C3, C4—not used
- C6—0.33  $\mu$ F, 50 volts, stacked film

#### Semiconductors

- IC1—LM340T-5, 5-volt regulator
- IC2—CA3162E, A/D converter
- D1, D2—1N4002 diode

**Miscellaneous:** 43B21 main PC board, 1N4148 diode for temperature probe, 3-digit display board, coax cable, in-line fuse holder, 1-amp fuse, four 6-32  $\times$  0.625" standoffs, eight 5/16-inch #6 screws, bronze or red plexiglass, mounting hardware, hookup wire.

of the coax cable, strip off about 3/4-inch of the outer insulation, unbraided the outer conductor, and twist toward one side. Next, strip about 1/4-inch of the cable's inner insulation.

Position the 1N4148 diode so that the band, or cathode, is touching the outer conductor of

the coax cable. The diode will lay right against the inner-conductor insulation. Very carefully solder the cathode side to the outer conductor and the anode side to the inner conductor. After clipping the excess lead length, coat the diode and exposed wires with a good quality epoxy or sealer. Apply several coats to ensure a good seal. Only the end of the cable with the diode is coated. On the other end of the cable, strip and separate the inner and outer conductors. Crimp the male terminal to the center conductor and the female terminal to the shield.

The solid-state vacuum sensor is mounted to the vacuum gauge by first removing the two screws near IC3 that hold the main board to the standoffs. Place the sensor bracket on the back side of the main board and align the holes on the two tabs with the board mounting holes and reinsert the two screws (see Fig. 17). Next, insert the sensor leads into the main board with the lettering on the sensor body facing away from the bracket. Insert the remaining hardware and tighten the sensor to the bracket. Do not overtighten the mounting screws as you damage the sensor. It is a good idea to only hand tighten the screws and apply a small drop of glue to keep them from coming loose. Very carefully solder the leads of the sensor to the board, working from the back side of the board. Be careful not to melt the case of the sensor with the soldering iron.

### Calibration

After the gauges are completely assembled, turn all the calibration potentiometers to the center of their rotation. Next, connect each gauge to a 12-volt DC power supply or battery. At this point, all the display digits should light as should the LED light bar.

The calibration process for all of the digital gauges begins with zeroing the A/D converter. To do that, pins 10 and 11 of the CA3162E A/D converter must be shorted together. Use a small screwdriver or jumper wire. Once connected, the display should now read zero or very close to it. Adjust the zero calibration potentiometer (see each schematic for

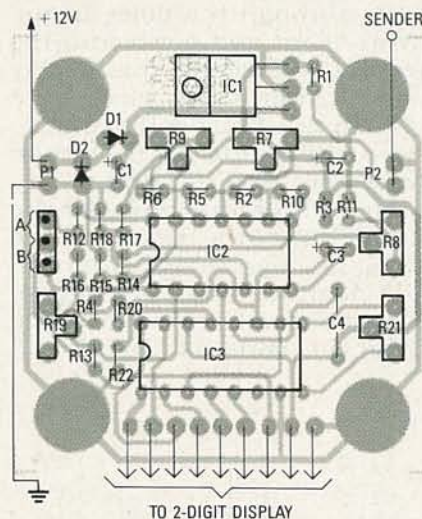


FIG. 15—PARTS-PLACEMENT DIAGRAM for the fuel gauge.

### FUEL GAUGE

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

- R1—470 ohms
- R2, R5, R10, R12, R14, R15, R16—100,000 ohms
- R3—33,000 ohms
- R4—47,000 ohms
- R6—1.8 megohms
- R7, R19—100,000 ohms, PC-mounted trimmer potentiometer
- R8—10,000 ohms, PC-mounted trimmer potentiometer
- R9—200,000 ohms, PC-mounted trimmer potentiometer
- R11—2700 ohms
- R13—8200 ohms
- R17—22,000 ohms
- R18—1000 ohms
- R20—470,000 ohms
- R21—50,000 ohms, PC-mounted trimmer potentiometer
- R22—2200 ohms

### Capacitors

- C1—47  $\mu$ F, 25 volts, electrolytic
- C2, C3—10  $\mu$ F, 35 volts, electrolytic
- C4—0.33  $\mu$ F, 50 volts, stacked film

### Semiconductors

- IC1—LM340T-5, 5-volt regulator
- IC2—LM324, quad op-amp
- IC3—CA3162E, A/D converter
- D1, D2—1N4002 diode

**Miscellaneous:** 43B20 main PC board, 2-digit display board, 0.1" 3-conductor header, 2-conductor jumper, in-line fuse holder, 1-amp fuse, four 6-32  $\times$  0.625" standoffs, eight 5/16-inch #6 screws, bronze or red plexiglass, mounting hardware, hookup wire.

exact potentiometer number) so that the display reads "000" or "00." Then remove the jumper.

The voltage gauge is calibrated

by connecting a good quality bench voltmeter across the power supply that is used to power the gauge. Carefully adjust R11, the gain adjust potentiometer, so the reading is the same as the reading on your bench voltmeter.

The calibration process for the oil-pressure gauge requires connecting a precision 47-ohm resistor to the sensor lead and

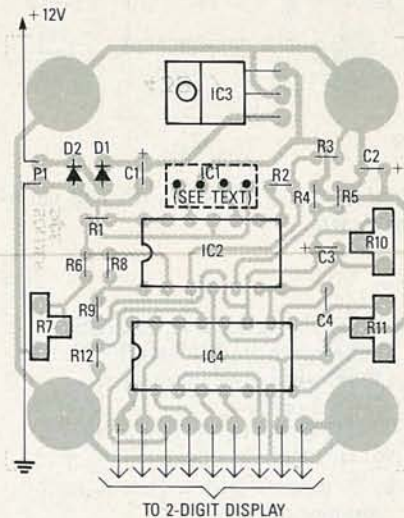


FIG. 16—PARTS-PLACEMENT DIAGRAM FOR THE vacuum gauge.

### VACUUM GAUGE

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

- R1, R2—10,000 ohms
- R3, R8—100,000 ohms
- R4—22,000 ohms
- R5—1000 ohms
- R6—680,000 ohms
- R7, R10—200,000 ohms PC mounted trimmer potentiometer
- R9—82,000 ohms
- R11—50,000 ohms PC mounted trimmer potentiometer
- R12—2200 ohms

### Capacitors

- C1—47  $\mu$ F, 25 volts, electrolytic
- C2, C3—10  $\mu$ F, 35 volts, electrolytic
- C4—0.33  $\mu$ F, 50 volts, stacked film

### Semiconductors

- IC1—Sensym SX30DN vacuum sensor (Dakota Digital #69G18 includes mounting bracket)
- IC2—LM324, quad op-amp
- IC3—LM340T-5, 5-volt regulator
- IC4—CA3162E, A/D converter
- D1, D2—1N4002 diode

**Miscellaneous:** 43B17 main PC board, 2-digit display board, in-line fuse holder, 1-amp fuse, four 6-32  $\times$  0.625" standoffs, eight 5/16-inch #6 screws, bronze or red plexiglass, mounting hardware, hookup wire.

carefully adjusting R11 so the reading is at "47." Actually, any resistor between 33 and 91 ohms can be used to calibrate the unit. Just set the display to coincide with the value of the resistor.

The water-temperature gauge is calibrated by connecting the sending unit and adjusting for freezing and boiling temperatures. First, prepare a bowl of water with several ice cubes in it, and a pot of boiling water. Place the sending unit in the boiling water with its base submerged in the water and the terminal above the water line. After waiting about a minute for the sending unit to stabilize, adjust the "high adjust" potentiometer (R7) for a reading of "212" on the display. Next, place the sending unit in the ice water using the same precautions not to let the center terminal come in contact with the water. Wait a minute for the sending unit to stabilize and adjust the "low adjust" potentiometer (R3) for a reading of "032" on the display. Repeat the high- and low-adjustment procedures until a good balance has been reached.

To calibrate the fuel gauge, you must determine the empty and full resistance of your vehicle's sender. For most Fords, it's 73 ohms empty to 10 ohms full. GM vehicles run from 0 ohms empty to 90 ohms full, and AMC, marine, and most aftermarket senders use the scale of 244 ohms full to 33 ohms empty. The calibration range of our fuel gauge will easily accept the input from virtually any brand of sending unit.

Obtain two resistor values that are very close to the empty and full resistances of the sending unit that will be used. If your system requires you to use the "A" circuit, you will begin calibrating the fuel gauge by first turning R9 fully counterclockwise. Be sure the jumper is in the "A" position. With the "empty" resistance connected to the lead wire, adjust R7 for a reading between "00" and "05." Because the gauge has a large RC circuit for averaging, allow plenty of time for the reading to settle. Next, connect the "full" resistance and adjust R9 for a reading between "95" and "99." It is usually better to have some headroom to avoid over-range and under-range conditions due to sending-unit tolerance. After

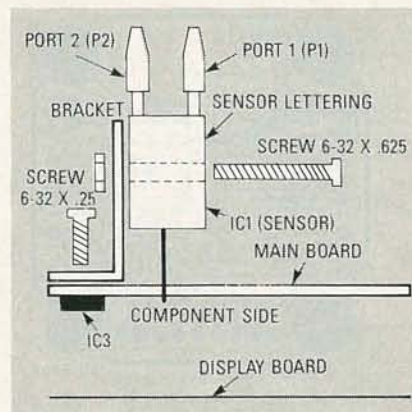


FIG. 17—PLACE THE SENSOR BRACKET on the back side of the main board and align the holes on the two tabs with the board mounting holes.

the empty and full settings are adjusted, repeat the two steps until a good balance has been reached.

If the "B" circuit is being used, begin the procedure by turning R19 fully clockwise. Connect the "empty" resistance and adjust R8 for a reading of "00" to "05" on the display. Reconnect to the "full" resistance and adjust R19 for a reading between "95" and "99." Repeat the two steps until a good balance has been obtained.

The calibration procedures for the miscellaneous temperature gauge are almost identical to the water-temperature gauge. Prepare a bowl of water with several ice cubes and a pot of boiling water. Place the temperature probe in the boiling water, wait 30 seconds for it to stabilize, and adjust R11 for a reading of "212" on the display. Next, place the sending unit in the ice water. Wait another 30 seconds for the sending unit to stabilize, and adjust the "low adjust" potentiometer (R7) for a reading of "032" on the display. Repeat the high- and low-adjustment procedures until a good balance has been reached.

The calibration process for the vacuum gauge begins by turning R10 fully clockwise and adjusting R7 for a reading of "00" on the display. That zeros the offset of the pressure/vacuum sending unit. Next, connect a piece of 7/64-inch vacuum line to P2 (port 2) on the sending unit. The other end must go to an accurate vacuum source that you will use as a standard for full-scale calibration of the vacuum gauge. The vacuum source can be a hand-held

### 3-DIGIT DISPLAY BOARD

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

R1, R2—220 ohms

R3—220 ohms (voltmeter only)

#### Semiconductors

IC1—CA3161E, Display driver

DISP1—DISP3—0.43" 7-segment C.A. LED display (Panasonic LN514RA)

Q1—Q3—2N3906 PNP transistor

LED1—5- × 15-mm LED, (Panasonic LN0202RP)

### 2-DIGIT DISPLAY BOARD

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

R1, R2—220 ohms

#### Semiconductors

IC1—CA3161E, display driver

DISP1, DISP2—0.43" 7-segment C.A. LED display (Panasonic LN514RA)

Q1, Q2—2N3906 PNP transistor

LED1—5- × 15-mm LED, (Panasonic LN0202RP)

**Note:** The following items are available from Dakota Digital, 11301 Kuhle Drive, Sioux Falls, SD 57107 (605) 332-6513: a PC-board set for each gauge (includes main PC board and display board) is \$6.95. A parts kit for each gauge (includes PC boards, components, and manual) is \$29.95. Each gauge assembled and tested is \$39.95. Stock numbers are as follows: voltage-gauge kit #2005-KIT, assembled and tested #3005-UNIT; oil-pressure gauge kit #2006-KIT, assembled and tested #3006-UNIT (order oil-pressure sender separately); water-temperature gauge kit #2007-KIT, assembled and tested #3007-UNIT (order water-temperature sender separately); miscellaneous temperature gauge kit #2008-KIT, assembled and tested #3008-UNIT; fuel-gauge kit #2009-KIT, assembled and tested #3009-UNIT; vacuum-gauge kit #2010-KIT, assembled and tested #3010-UNIT (order vacuum sensor separately). Oil-pressure sender (#15G5), \$15.50; water-temperature sender (#14G11), \$5.50; vacuum sensor (#69G18), \$19.95; RCA CA3161E driver (#69G16), \$1.95; RCA CA3162 A/D converter (#69G15), \$7.95. All orders add 4% shipping and handling (\$1.50 minimum), Visa and Mastercard accepted.

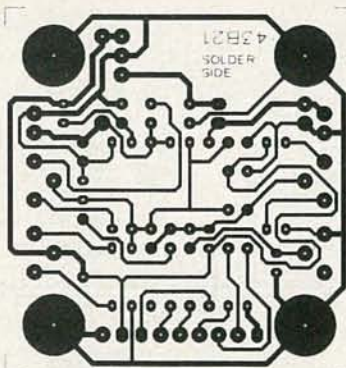
vacuum pump that has an accurate dial gauge, or you can connect the vacuum gauge and an automotive tune-up vacuum gauge to a running engine and use its reading as your standard. Once a known amount of vacuum is connected to the vacuum gauge, adjust R10 for a full-scale reading.

### Installation

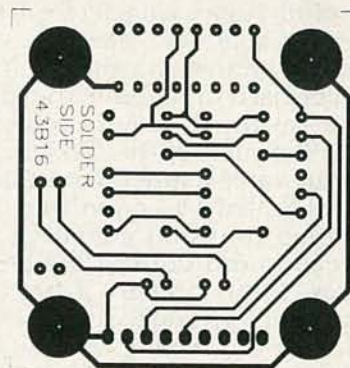
A good enclosure will protect the units from shock, dirt, and shorting. The enclosure must also have a front panel that will enhance the viewing of the displays. That is especially important for bright days, where bare LED displays can be very difficult to read.

The digital gauges can be mounted by the same bolts that hold the two boards together. That allows the point of mounting to be from the front or back of the unit. For rear mounting, the screws that hold the main board to the spacers are removed. From here, additional spacers are used to mount the unit to a panel located behind the digital gauge. The length of the spacers will depend on how far the mounting panel is from the front panel. The unit can also be mounted directly to the front panel by removing the screws holding the display board to the spacers. Here again, additional spacers will be used to keep the unit away from the front panel and provide a secure mounting. If mounted from the front panel, use an attractive screw that will enhance the look of the front panel. Hex-head screws, Allen screws, or Torx screws can be used. As with any type of enclosure, you will also need to drill or cut vent holes to allow heat to escape.

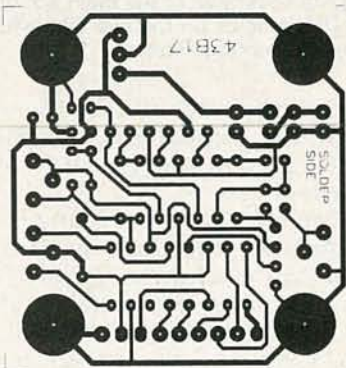
For the front panel, bronze or smoked plexiglass is recommended. That material is not only durable, but it will also keep outside light from shining into the display area and allow the LED's to shine through, thus creating a more visible and readable display. Red filter plexiglass will also work well as long as only red LED's are used. The front panel should be masked to allow only the LED's and annunciator to show, thus hiding the rest of the display board. Masking can be done by taping over the area



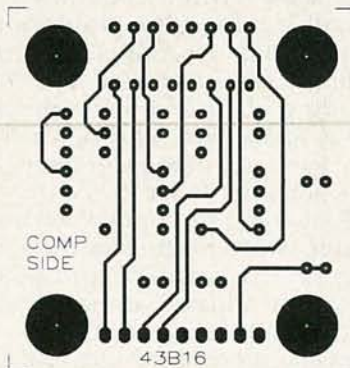
1 13/16 INCHES  
VOLTS, OIL, WATER, AND MISC. TEMP.



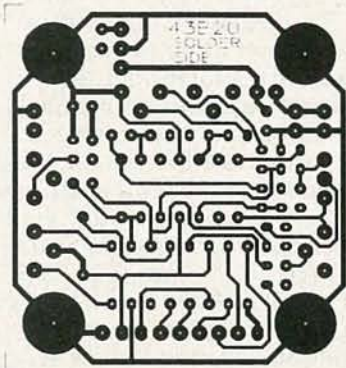
1 13/16 INCHES  
2-DIGIT DISPLAY SOLDER SIDE.



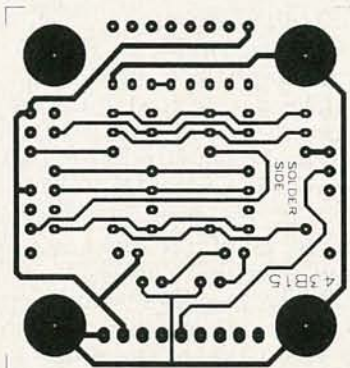
1 13/16 INCHES  
VACUUM GAUGE FOIL PATTERN.



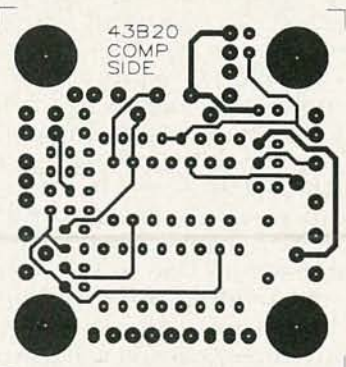
1 13/16 INCHES  
2-DIGIT DISPLAY COMPONENT SIDE.



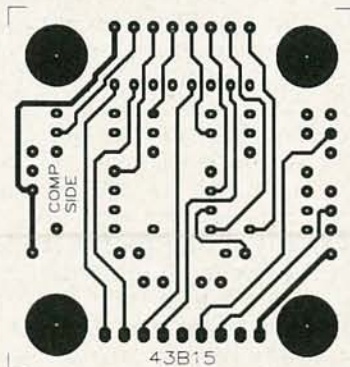
1 13/16 INCHES  
SOLDER SIDE OF THE FUEL GAUGE.



1 13/16 INCHES  
3-DIGIT DISPLAY SOLDER SIDE.



1 13/16 INCHES  
COMPONENT SIDE OF THE FUEL GAUGE.



1 13/16 INCHES  
3-DIGIT DISPLAY COMPONENT SIDE.



where the displays will be located and painting the uncovered area black on the back side.

Both the oil-pressure gauge and the water-temperature gauge require sending units to be mounted to the engine. The oil-pressure sending unit mounts directly to the block of the engine. Its 1/8-inch pipe thread fits GM motors directly while Ford motors, along with some other manufacturers using 1/4-inch thread, will require a 1/4- to 1/8-inch adapter. The water-temperature sending unit is made to mount directly to the block or water pump of a Ford motor using standard 3/8-inch pipe thread. GM motors will require a 1/2- to 3/8-inch adapter. Should your application be somewhat different, adapters and fittings can be obtained from your local hardware or automotive store.

You may also wish to keep your original gauge or idiot light that came factory with your car. That can be done in one of two ways. A "T" fitting can be used to mount both the original sender and the new sender. Otherwise you have to find another location that is occupied by a plug that can be replaced with the sending unit. That lets you keep the factory dashboard functions intact.

When connecting the fuel gauge to the fuel sender, the easiest method is to find the factory wiring harness connection that runs back to the fuel tank. A second option is to run a new wire. The original fuel gauge cannot be connected to the same sender that the new digital fuel gauge is using. The two will interfere with each others readings.

When connecting any of the gauges to the motor or fuel tank, be sure that the sender has a good connection to chassis ground. Failure to properly ground the gauge or the sender will result in erratic or incorrect readings.

The temperature probe for the miscellaneous temperature gauge can be mounted in one of several ways. When monitoring air temperature, inside or out, the probe should be placed in an area where a good average temperature exists. Inside, that may be under the dash, away from any heating or cooling vents and

out of any sunlight. Outside, under the front grill area of the car will provide the most accurate point as it is out of the sun and not affected too much by engine heat.

If the goal is to measure the temperature of the transmission fluid, engine oil, differential, or coolant, mount the sensor in a manner that maintains good thermal contact to the outer plate of the item being monitored. Heat sink compound should also be used to ensure good thermal contact. For example, when monitoring oil temperature, mount the sensor to the bottom, back side of the oil pan, where there will be very little air movement to cool the sensor.

Remove one of the oil pan bolts and manufacture a bracket that will hold the probe to the oil pan. This can be a simple piece of aluminum or thin steel cut in such a way so when the oil pan bolt is inserted through the bracket and into the block, the sensor will be lightly compressed between the bracket and the oil pan. Do not make it too tight, as excessive pressure on the 1N4148 diode will break its glass housing. You may want to hold the sensor by the cable near the diode to be safe. Apply heat sink compound to the sensor and the oil pan where contact is to be made. Be sure the oil pan is free of dirt. Then route the coax cable up through the firewall to the location of the gauge.

The vacuum gauge is connected to the intake manifold via 7/64-inch vacuum hose. Run the hose through a location in the firewall and to the intake manifold, or vacuum "T" usually located near the rear of the engine compartment. Connect the vacuum hose to P2 (port 2) on the sending unit.

Once a suitable panel or enclosure has been constructed, and the gauges mounted to it, install the assembly into the vehicle and connect the power to a source that is on only when the ignition key is in the "on" position. Be sure to secure any hook-up wires so they will not present a hazard to you or your vehicle. Your new digital gauge system is now ready to display important vehicle information and keep you up to date on its condition. **R-E**

## SAME DAY SHIPPING

### 3-1/2 Digit Pocket DMM

- Reading to 450V or 32MΩ
- Auto/manual ranging
- 32-segment bar graph
- Auto power-off
- Low battery indicator
- Continuity beeper
- Diode test
- Includes test leads, batteries and case

HMC PRICED!

**\$45**



RE-3060

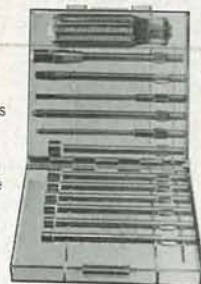
SOAR corporation

### Xcelite Compact Tool Set

- Interchangeable blades
- 4 screwdriver sizes
- 7 nutdriver sizes
- Handle and extension
- Snap-shut plastic case

HMC PRICED!

**\$35**



RE-99PS50

### 6-Outlet Surge Suppressor

- Protects against spikes, surges, and line noise
- 15-amp circuit breaker
- Lighted power switch
- "Protected" LED indicator
- 6-foot power cord

HMC PRICED!

**\$39**



RE-TR6

### Refillable Butane Iron

- Cordless, flameless
- Flint igniter in cap
- Temperature adjustable
- 90-minutes of continuous use
- Tip included



RE-PBI

**\$26**

HMC PRICED!



Send for your...

**FREE CATALOG!**

Products to Design, Assemble, Test and Repair "Electronics"



TO ORDER, CALL  
**1 800 482-4440**

in MA (617) 821-1870

Prices good until October 31, 1990.

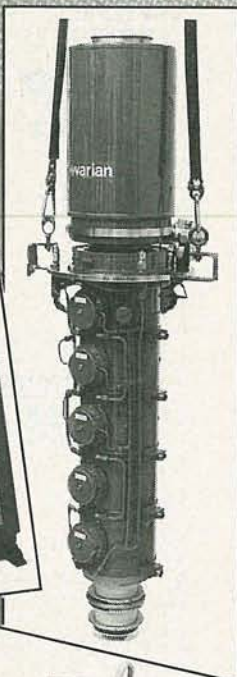
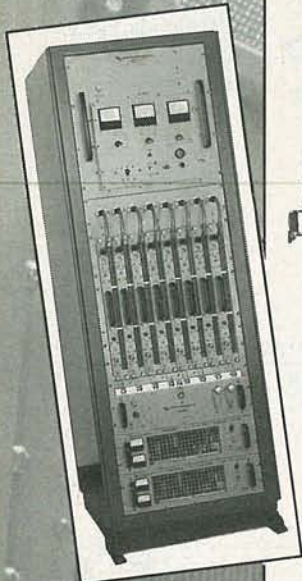
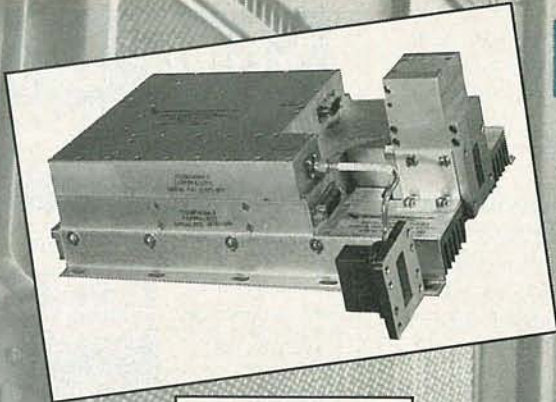
# HMC

HUB Material Company

33 Springdale Avenue Canton, MA 02021

CIRCLE 188 ON FREE INFORMATION CARD

# INTRODUCTION TO MICROWAVE TECHNOLOGY



LAST MONTH, WE EXAMINED SOME basic concepts of the electromagnetic spectrum, some basic parameters of electromagnetic waves (such as amplitude, frequency, period, and wavelength), and some early methods of RF generation, including the spark-gap generator, and the Barkhausen-Kurz Oscillator or BKO. This month, we'll examine some early microwave RF sources in greater depth, to try and appreciate the problems faced by early designers.

In the early days of radio, the term "microwave" meant anything above about 100 MHz. The region above modern CB was usually called "UHF," which an early textbook referred to jokingly as "unbelievably high frequen-

cies." Many recent European receivers mark the FM band (88–108 MHz) with a "U," after the German "ultra kurz welle" (ultra-short waves). Such early designations were indicative of the problems of generating RF power at such frequencies because of device limitations.

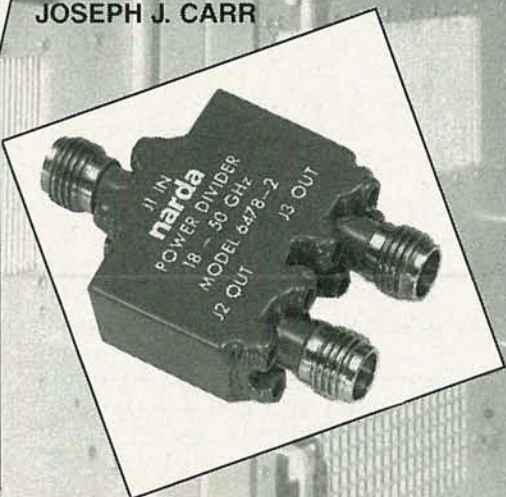
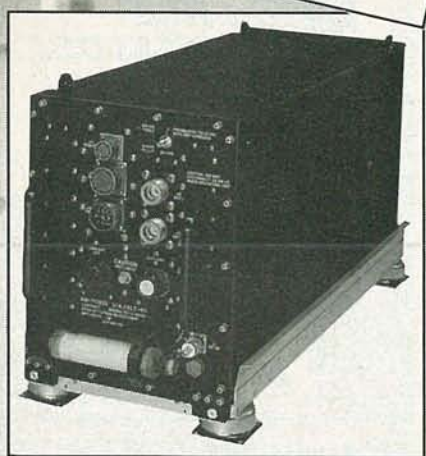
One of the earliest problems inhibiting full use of the RF spectrum was the inability to generate enough RF power at frequencies of value. For many years generating RF signals at useful power levels was limited to the Medium-Frequency (MF) band. Various problems limited devices then in common use. But from 1920–45, advantage was taken of inherent limitations of vacuum tubes to enable the generation of RF power at higher frequencies.

The definition of what constitutes high frequencies has varied according to the difficulty of generating RF power at those ranges. Until the early-1920's, when hams opened the HF shortwave region (3–30 MHz), commercial radio used the MF range with:  $\lambda < 200$  m/cyc, or:  $f < 1.5$  MHz. The technology of that period worked well at MF, but its effectiveness dropped rapidly with increased frequency.

Even in the early days of radio, higher frequencies were examined. Early radio pioneer Heinrich Hertz, in 1887-88, used 31.3 MHz–1.25 GHz for short range investigations across his lab, and 1.25 GHz is a microwave frequency even now! Guglielmo Marconi used 500 MHz for short-range experiments, but switched to MF when he found that lower frequencies yielded propagation over greater distances.

*Learn about early RF oscillators in our continuing series on microwave circuits*

JOSEPH J. CARR



Besides the fact that RF was easier to generate in this region, the detectors of that period ("Branly coherers," after Prof. Edouard Branly) were far more sensitive in the MF range. In addition, experimenters of the period also ran into some realities of electromagnetic propagation. On December 12, 1901 Marconi and his coworkers achieved the first confirmed transatlantic transmission, of 313 kHz from Poldhu, Great Britain, to Marconi's receiver at St. Johns, Newfoundland, Canada. A transmitter power of 10 kW was used to achieve that feat.

Vacuum tubes made possible operation on yet higher frequencies. Commercial, military and amateur radio moved to the HF shortwave region in the mid-1920's. Difficulties with devices above 25 MHz caused the region above modern CB to be called "ultra-high frequencies" (UHF). Today, "UHF" designates 300-900 MHz. Advances in vacuum tubes during World War II allowed practical use of up to 450 MHz, so the UHF definition was changed.

The three traditional methods for generating RF energy were spark gaps, Alexanderson alternators, and vacuum tubes.

### Spark gap generators

An electric arc produces tremendous energy at both harmonic and non-harmonic spurious frequencies. For example, any AM receiver will pick up noise from lightning. Similarly, arcs from motors or ignition systems also produce large amounts of wide-bandwidth RF noise. Figure 1 shows a simple spark-gap RF power generator. Until 1938, when they were declared illegal, circuits like these were used to make crude radio transmitters. Some early experimenters stole

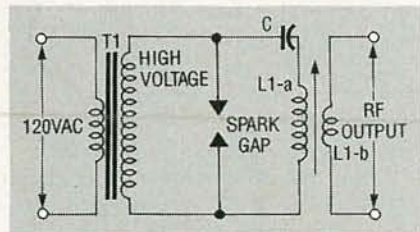


FIG. 1—A SIMPLE SPARK-GAP RF POWER GENERATOR used as a crude transmitter; they were declared illegal in 1938.

Ford Model-A ignition coils from their family car to make spark-gap transmitters. Today, spark-gap RF generators are used for medical electrocautery.

The power for a spark-gap generator comes from a high-voltage AC power transformer, T1. The secondary voltage is high enough to ionize the air between the spark gap electrodes. A series-resonant LC tank (L1-a-C1) picks off the RF energy. Unfortunately, a spark gap is very wideband; an 800-kHz spark-gap generator actually produces significant power levels from 10-3000 kHz, and weak harmonics up to the microwave range. A secondary is wound onto L1-a for RF output.

Figure 2 shows a method used in 1930 to generate microwave RF up to 75 GHz. A spark gap goes inside a cavity acting as a resonant tank. A coupling loop picks off the RF output, and delivers it to the load. Unfortunately, spark gaps are very inefficient. Since their RF power has wide bandwidth, only a small amount is available over any narrow band approximating a single

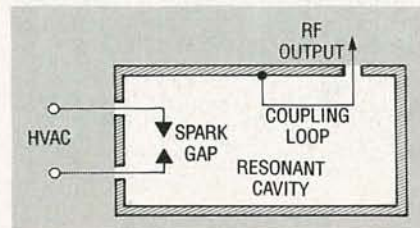


FIG. 2—A SPARK-GAP TRANSMITTER USED IN THE 1930's. The spark gap and cavity are a resonant tank, and the coupling loop picks off the RF. However, bandwidth is very wide, with only a small amount of power per frequency; efficiency is under 1% at 75 GHz.

frequency. Also, as frequency increases, the power drops dramatically. At 75 GHz, the efficiency is far below 1%, since the majority of the RF power is outside the microwave range.

### Alexanderson alternators

The two main problems with spark-gap transmitters are limited efficiency and spectral purity. The Alexanderson alternator attempted to overcome those problems; it was identical, except for the use of rectifiers, to the alternator on modern cars. A magnet would rotate inside a coil. The frequency of the AC generated by

the stator is related to the number of poles on the magnet, the number of coil pairs in the stator, and the speed of rotation. If a magnet were spun at 1 rev/s inside a two-pole stator, a 1-Hz signal would be generated. By increasing the number of magnets, the number of stator poles, and the rotation speed, frequencies up to 1 MHz could be generated, although most alternators produced 30-200 kHz.

The alternators in communications use an electromagnet to generate RF. Telegraphy was possible, by interrupting the coil current with a telegraph key. In 1916, engineers from the Naval Research Lab (NRL), Washington, D.C., used the U.S. Navy radio station at Arlington, VA (call sign NAA), to produce the world's first voice transmission over radio. NAA, also known as Radio Arlington, had a 100-kW, 113-kHz alternator, and dominated voice radio before World War I. NAA engineers varied the electromagnet current using a voice signal, to create AM. Because of its low operating frequency, the Alexanderson alternator was of limited microwave value.

### Vacuum-tube oscillators

Although this series is about microwave devices, we must take a brief look at vacuum tubes, in order to understand the limitations and problems of microwave oscillators. In 1885, Thomas A. Edison noted the Edison effect, that a positively charged electrode inside an evacuated glass bulb drew current. In 1905, Alexander Fleming of Great Britain used that effect to make the diode rectifier, using a heated cathode to emit electrons, and an anode to collect them. In 1907, Lee DeForest of the U.S. inserted a grid to modulate the anode current, to make the triode.

Figure 3 shows the basic triode, with cathode, grid, and anode. In some models, the cathode is a direct heater, while here it's a hollow tube with indirect filament. In either case, the object is to heat the cathode until electrons boil off into the surrounding volume; a process called thermionic emission. This electron cloud is called space charge. A positive anode or plate

placed nearby attracts these electrons, creating anode current.

The porous grid is between cathode and anode. If the grid is negatively biased, it can control anode current. If negative enough, the anode current goes to zero. When  $V_i$  is superposed on  $V_G$ , the total grid voltage is  $V_i + V_G$ . If  $V_i$  is negative, the total bias increases, so the anode current decreases. Conversely, when  $V_i$  is positive the total bias decreases, so the anode current increases. Thus,  $V_i$  modulates the anode current.

Early vacuum tubes were quite limited in bandwidth; devices that operated above 15 MHz were rare. The primary problems were lead inductance, interelectrode

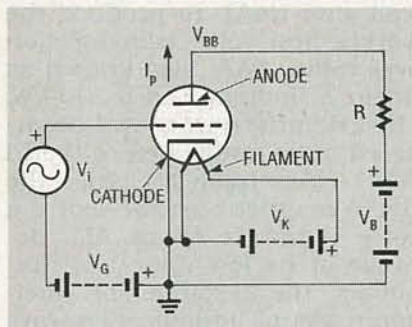


FIG. 3—THE TRIODE, WITH CATHODE, GRID, AND ANODE. The cathode thermionically emits space charge electrons, attracted to the anode as current. Total grid voltage is  $V_i + V_G$ , and  $V_i$  modulates anode current. If  $V_i$  is negative, bias increases and anode current decreases, and vice-versa.

capacitance, Gain-Bandwidth Product (GBP), transit time/angle, and interelectrode spacing. Making the electrodes smaller decreases capacitance, but severely limits operating power, and was deemed useless. Moving the elements further apart also decreases capacitance, but increases transit time. Transit time/angle problems occur when the time required for electrons to pass from cathode to anode approximates the signal period.

### The Barkhausen-Kurz Oscillators

An early solution to the bandwidth problem in vacuum tubes was to exploit transit time, as in the Barkhausen-Kurz Oscillator or BKO. The BKO in Fig. 4-a used a triode with reversed anode bias. The BKO had a cylindrical anode, since flat or rectangular

anodes wouldn't work in BKO mode. Both anode and cathode were negative, while the grid was positive.

Figure 4-b shows BKO operation. Cathode electrons were attracted by the positive grid toward the anode, but its negative bias repelled them. Since the cathode was negative, a similar effect occurred there. Electrons traveled circularly about the grid, with the operating frequency set by the rotation rate. Output power was taken from the grid, a principal limitation of the BKO. The small grid size limited RF power, so it normally ran white hot.

### Other approaches

Later devices used magnetic fields to control current, instead of the electric field of the BKO. These included the magnetron, an "M-type" crossed-field device invented by Hull in 1921, the par-

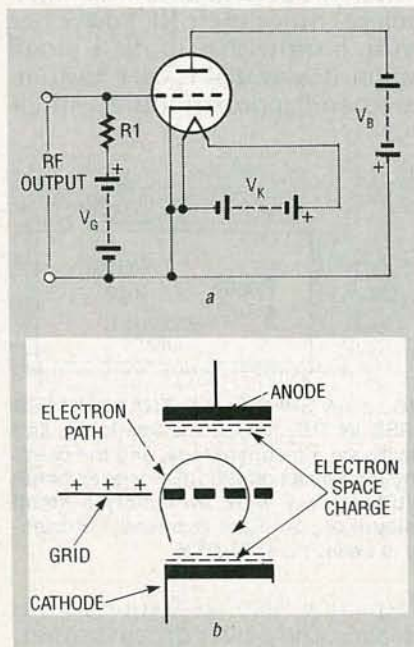


FIG. 4—THE BARKHAUSEN-KURZ OSCILLATOR (BKO) used transit time to increase bandwidth. In (a), both cathode and anode are negative; the grid is positive. In (b), cathode electrons are alternately attracted toward and repelled from the anode, traveling circularly about the grid with rotation rate setting operating frequency. The small grid produced only limited RF output power, so it ran white hot.

allel-field "O-type" device invented by both the Heil's in 1935, and the Varian brothers in 1939. Next month, we'll examine the magnetron in depth. R-E

## LAWN RANGER

*continued from page 58*

cutting disks take too long to come up to speed, adjust R38 on the power board. If they take too long to stop, check relay RY2 and resistor R43. Disconnect J11-2.

### Automatic guidance test

By blocking grass sensors with your fingers or electrical tape, you can simulate a grass border that the Lawn Ranger can follow. As you block different grass sensors, you can verify that the motor controller is working properly by observing the drive wheels as they change in both speed and direction.

Before turning the Lawn Ranger on, ensure that the cutting blades and disks are disconnected. Place the rear end of the unit up on blocks so the wheels do not touch the ground. Ensure that the grass sensors are not blocked by grass or other objects and that the manual controller is disconnected. Turn the ignition key clockwise and push the START button. The right wheel should spin clockwise and the left wheel should spin counter clockwise. The Lawn Ranger will initiate a left turn because it cannot detect tall grass. If it were allowed to move on the ground, you would see it steer to the left in a counter-clockwise circle. It would continue to move in a circle searching for tall grass for approximately 6 seconds and then turn itself off.

Now it is time to test the full range of the steering. Block sensors 1-8 with electrical tape. Adjust potentiometer R203 as described in the July issue. Now, Adjust R201 and R202 until both wheels spin at the same rate. You can calculate wheel speed by counting the number of revolutions that each wheel performs within one minute (rpm's). This test validates that the Lawn Ranger steers straight ahead when the grass border is in the center of the grass-sensor assembly (between sensors 8 and 9).

Clear all the grass sensors so they are free of obstructions; the Lawn Ranger should return to its left turn mode. Now, block sensor 1, then 2, then 3, and so on, until

*continued on page 79*

NO HOLD THE LINE  
HELP PEOPLE  
TO CHECK RADIO 10?

GERRY L. DEXTER

## AM radio is seeing hard times.

MOLLY WOULD CRY OUT, "NO, NO, McGee—not the front closet!" But Fibber McGee would open the door anyway, and there'd follow several seconds of crashes, bangs, thumps, and thuds as Fibber's famous overstuffed closet emptied out. The radio audience loved that, as well as the show and its characters.

Fibber McGee and Molly were part of the "Golden Age" of radio in the 1930's, 1940's, and early 1950's, when amplitude modulation (AM) was king, and Jack Armstrong, Gangbusters, Gabreal Heater, the Lux Radio Theater, Edward R. Murrow, and hundreds of other shows and personalities ruled the airways. It was even bigger than TV is now, because there was really no competition except movies and newspapers. Now, those days are gone and AM is seeing hard times. The present AM is a far cry from a decade ago.

### The trouble with AM

Surprisingly, AM's problems are only partially due to TV. When

TV skyrocketed in the 1950's, AM radio actually prospered, despite a period when it took some blows. Once the Top 40 arose, with repetitive song cycles, energetic disc jockeys, time, temperature, and contests, AM found its fortunes again. Actually, most of AM's troubles come from frequency modulation (FM) competition. AM and FM may both be radio, but there are some important differences in the way information is transmitted.

Both AM and FM transmitters radiate "carrier" wave RF, modulated to contain transmitted information. In AM, the carrier wave amplitude is proportional to the audio amplitude, but the carrier frequency is constant. Figure 1 shows the components of an amplitude modulated waveform: (a) is the carrier RF signal, (b) is the audio-modulation signal and (c) shows the amplitude-modulated carrier signal. In FM, the carrier amplitude is constant, while the carrier frequency varies in proportion to the audio signal rate. Figure 2-a shows an

FM audio signal, and Fig. 2-b is the frequency-modulated carrier.

The AM band is much lower in the RF spectrum than FM; AM spans 535–1605 kHz, while FM spans 88–108 MHz. AM channels are 10 kHz wide and FM channels are 200 kHz wide, so you would be able to squeeze only about 5.5 FM channels onto the entire AM band. There are 107 AM channels presently available, and 100 on FM.

FM signals normally don't propagate beyond 75 miles, which is considered the line-of-sight limit and is within the Very-High Frequency (VHF) range. The VHF range used by broadcasters is subject to signal scattering from obstructions such as building edges or hills and is prone to fading in and out under certain conditions. In contrast, AM signals often travel very great distances. The difference between AM and FM signal propagation is due to the great difference in their carrier frequencies, not their modulation differences.

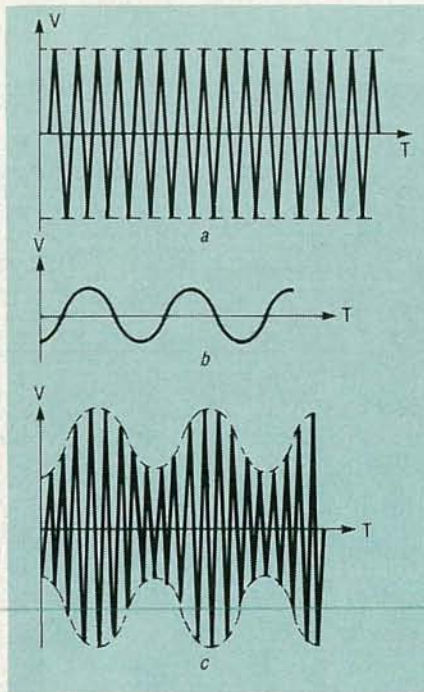


FIG. 1—AM SIGNAL COMPONENTS; (a) is the carrier signal, (b) is the modulating signal, and (c) is the amplitude modulated signal at a constant frequency.

Two characteristics of FM operation are responsible for its high fidelity response: wide bandwidth transmission and constant carrier amplitude. The wide bandwidth allows a wider range of audio frequencies to be processed, up to 15 kHz for FM, compared to only 5 kHz for AM. The source of most noise in AM transmission and reception is from atmospheric or static noise resulting from lightning, fluorescent device radiation, and electronic machinery, especially during hot weather. AM transmission is, therefore, amplitude-sensitive. By maintaining a constant carrier amplitude in FM, static noise can virtually be eliminated. FM was originally used for stereo because of its high fidelity.

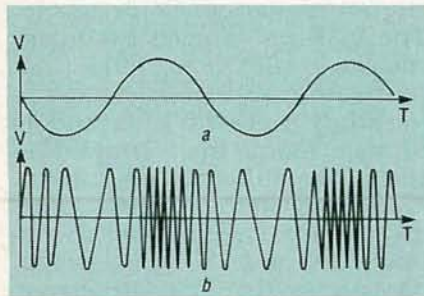


FIG. 2—HERE IS AN FM SIGNAL; (a) is the audio modulating signal and (b) is the frequency modulated carrier signal at a constant amplitude.

### FM popularity

After World War II, AM stations began adding FM. There weren't many FM stations back then, so FM programming consisted primarily of classical music to take advantage of the high fidelity; otherwise they just duplicated AM programming. FM grew slowly, because consumer-electronics manufacturers and the public were mesmerized by TV. Some AM stations gave up on FM, relinquishing their FCC FM station licenses. They regretted it later, when FM became prominent but, by then, most FM frequency allocations were gone.

Several factors contributed to the prominence of FM. Stereo arrived in the early 1960's, becoming the foundation of further success. The availability of FM stereo receivers, component systems, AM/FM portables, and AM/FM car stereos followed. The FCC eventually ruled that most combined AM/FM stations had to program AM and FM broadcasts separately, forcing broadcasters to create competitive FM programming. There then arose a couple of generations of listeners who used radio mainly for music, not comedy, drama, or news.

The growth of FM over AM in the last 16 years has been dramatic. In 1972, AM had 75% of the radio audience; that was reversed by 1988. FM is considered *the* stereo music medium, which is what most listeners want. However, not all AM is in trouble; large markets capable of developing major audience shares command sale prices of tens of millions of dollars. However, the average AM station is far less glamorous.

### AM's battle against FM

Most mid-size markets have a couple of AM stations at the bottom of the ratings. The top two or three in a market get by on community service, creative programming, good management, and poor competition. Most AM stations that are considered to be on shaky-grounds are those that broadcast daytime-only stations, especially those that have no FM companion station, and aren't part of a broadcasting group under one owner. They sink or swim on their own and most drown; about 65% lose money.

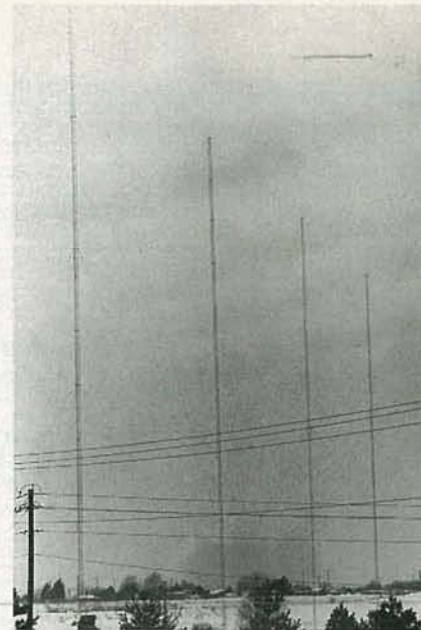


FIG. 3—AM RADIO TRANSMITTING TOWERS aren't the beacons of comedy and drama they were in the good old days.

The FCC helped by giving most daytime stations post-sunset broadcast authorizations, but the rules often dictate transmitter powers as low as 1–50 watts! Even for a small-town station, that's not enough power to provide the needed coverage, especially if there's competition. AM's crowded frequencies are another problem, especially for night listening when signals propagate farther. Interference obviously turns listeners away. Many AM channels are a jumble of noise at night, with half a dozen stations fighting to be heard and none succeeding.

In the 1960's and most of the 1970's, AM rode high, and many broadcasters and investors wanted part of the market. Hundreds of new stations began during that period, crowding the AM dial. Many towns of 20,000 people have two or three AM stations competing for large FM audiences. The economic downturn of the late 1970's and early 80's hurt many AM stations, especially those in rust and farm belts, which suffered most from the sluggish economy.

AM radio generally gets a small slice of local advertising, with the larger chunk going to FM. TV, cable, newspaper, shopping, and billboard competition is very heavy. Falling revenues mean less money for promotional or inno-

vative program changes, or high-quality air personalities that might hold an audience. In 1988, AM and FM each had about 5,000 commercial stations; AM stations did \$1.7–\$1.9 billion of business, while FM stations did \$4.8–\$5 billion. FM's early lack of commercial success helped draw listeners because of fewer commercials. And, while FM stations do air more commercials today, they still air about half as many as AM stations—they just charge more.

### AM solutions

AM station managers know the problems, and try to find solutions. They know audiences don't see AM as a music medium. A National Association of Broadcasters survey on public attitudes toward AM found that 75% of respondents want good programming with good technical sound. The survey showed both a strong preference for news-talk-information on AM, and an older audience. Some stations try drastic cures. "Narrowcasting" or "niche programming" describes programming aimed at very specific audiences:

- In New York, WFAN (once WNBC, flagship station of the NBC network) runs an all-sports format; play-by-play, sports talk, and news.

- In Los Angeles, with 100 competing stations, KMNY devotes itself to money, and how to have more of it, syndicating some programs to other stations.

- All-kiddie radio by KPAL, Little Rock, Arkansas, includes children's music, stories, and school news reported by children.

- In Florida, WWNN broadcasts self-help and positive-thinking radio programs.

- Several stations now use single-theme approaches to music. There are all-Elvis stations, and at least one playing only Beatles music.

Whether these formats will last is yet to be seen. For example, all-weather and traffic formats have been tried and abandoned in Los Angeles and Minneapolis. AM stations can also inexpensively subscribe to satellite program services. Services with a "big city" feel have proven successful for smaller stations, especially when such services can mean

## BETTER RECEIVERS FOR BETTER SOUND

One of the main reasons why AM has taken a back seat to FM is because of AM's inherently poor fidelity. The National Association of Broadcasters (NAB) is trying to do something about that. Specifically, the NAB is trying to convince electronic manufacturers to incorporate three design improvements into their AM receivers. Those improvements, which are in accordance with the National Radio Systems Committee (NRSC) suggested guidelines are: the ability to receive frequencies within the expanded band, AM stereo compatibility and, de-emphasis circuitry.

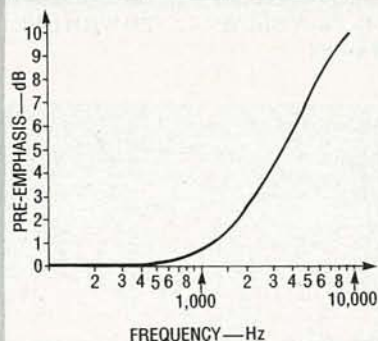
Manufacturers will be able to make units that receive transmitted signals in the expanded bandwidth fairly easily and inexpensively. However, they are much more reluctant to jump into mass production of AM stereo receivers—adapting current product designs to incorporate stereo reception can be an expensive proposition.

Another stumbling block that manufacturers face is that there are two mutually incompatible systems on the market. Motorola's C-Quam and Kahn Communications are two AM stereo systems that are currently in use by broadcasters today. C-Quam is used by approximately 500 broadcasters, while only about 100 broadcasters use the Kahn System. The only commercially available AM stereo receivers on the market are compatible with Motorola's C-Quam transmitter design. Sony, Sanyo and Sansui previously made IC stereo detectors that were compatible with both the C-Quam and Kahn transmission systems, and about 20 such receiver models were once produced by those companies. However, those chips and receivers are no longer in production because of various legal battles between Kahn and Motorola. We may again see some Kahn-compatible receivers after the legal dispute is over.

There are still many varied opinions in the broadcasting field about which system is better. Broadcast engineers profess the advantages of each system, and may choose one system over another because of their specific transmission needs, or personal preferences. When AM stereo was first introduced years ago, FCC's "let the marketplace decide" attitude sealed the fate of AM stereo by causing a relentless battle between various competing systems. Now, more than eight years after the introduction of AM stereo, the two survivors, Kahn and Motorola, are still battling it out. The FCC's lack of direction during the early stages has hindered the acceptance of AM stereo, and has hurt not only electronic manufacturers, but consumers, too.

savings through staff cutbacks, or when staff can be freed to develop more local and major news programming. It's easy to insert local news, sports, weather, and other features.

Frequency boosting, or pre-emphasis is a design modification that the NRSC is recommending to reduce noise transmission for higher fidelity. Within the time interval that an AM signal carrier is transmitted and received, the carrier signal may be affected by noise. The greatest impact that noise has on the carrier is changing the amplitude. FM is much less subject to that type of noise distortion because it is transmitted at a constant amplitude. The sound volume of an AM detector is proportional to deviation of the carrier amplitude. If the audio signals cause a much larger amplitude change than the unwanted noise amplitude deviations, during transmission and reception, then the noise will not be very noticeable. That relationship is called the signal-to-noise ratio—the higher the value, the better the sound quality.



**PRE-EMPHASIS CHARACTERISTIC suggested by the NRSC for AM transmission.**

In a pre-emphasis circuit, a portion of the transmitted signal is boosted, or pre-emphasized, causing a larger carrier amplitude deviation. The receiver conversely de-emphasizes, or attenuates that signal. The overall effect is to increase the signal-to-noise-ratio. The accompanying figure shows the 75  $\mu$ s pre-emphasis characteristic suggested for use.

The NAB is working closely with the electronic industry to develop a certification for improved AM receiver designs which follow NRSC guidelines. One idea is to authorize the use of a quality mark that will identify receivers that comply with NRSC standards. Broadcasters are also receptive to the idea of promoting the new design standards in AM receivers. Clearly, AM stereo compatibility and the efforts to improve AM sound quality are complicated issues which are still being worked out. Perhaps with the cooperation of the electronic industry, broadcasters, and the FCC, AM will continue as a viable communications medium.

Not long ago, AM operators thought the answer was AM stereo, but it's been a disappointing panacea. Most broadcast experts feel that the FCC ruined things by refusing to pick a specific AM



FIG. 4—TALK SHOWS, OFTEN WITH LIVE GUESTS, are a programming staple of stations of all sizes.



FIG. 5—WELL-RUN SMALL-TOWN STATIONS with a solid history are likely to continue a successful tradition.

stereo approach from the half-dozen stations competing for FCC approval. Instead, the FCC let the market decide, and so far it hasn't. In the last seven years, AM stereo has barely affected the minds of broadcasters or the public.

Two AM stereo systems are still competing: Motorola's C-Quam, and the system developed by Kahn Communications. Broadcasters haven't reached a consensus on which should be standard. Only 10% of AM stations now have stereo. The audience percentage that use AM stereo gear is still low, and there's

no real impetus to switch, which can cost up to \$100,000—half a year's income or more for some small stations.

#### AM's expanded band

An important change affecting AM broadcasters as well as radio receiver manufacturers is that of AM frequency band expansion, or "AM improvement." In 1988, the World Administrative Radio Conference agreed to expand the AM radio upper bound from 1600 kHz to 1700 kHz, effective July 1, 1990. Ten additional channel slots will be available as a result of the expansion. With 20 to 30

stations per channel, a total of approximately 200 to 300 new AM stations in the U.S. could conceivably occupy the expanded band.

The primary objective of the FCC in authorizing transmission in the upper range is to unclutter the existing band and reduce the overall levels of broadcast interference. Stations who are considered as causing the most interference will be given highest priority by the FCC for transmission in the upper band. Some night-time broadcasters are considered to be the "worst offenders," and the FCC is hoping that most of those stations will voluntarily migrate into the upper band. The advantage of changing into the upper band is that the adjacent stations will experience less interference, and the listener will receive a much clearer broadcast.

After a transition period, the FCC will make new AM stations available for new licensees, so that broadcasters can make full use of the entire expanded band. Stations who are licensed to broadcast within the new upper range will be able to transmit full-time, with power restrictions of minimum 1 kilowatts after sunset and 10 kilowatts during daylight hours.

Many problems, however, still need to be solved. Existing services, such as the Traveler's Information Stations (TIS) will need to move or—because the TIS are considered by the FCC to be secondary broadcasters—may have to relinquish their transmitting rights.

So, can we see the future of AM? Clearly, it'll hardly vanish from your dial. Most stations will likely solve problems by new programming, promotion, management, and technology. Some may not have their prior success, having to live with less. But those with bleak futures may die out due to survival of the fittest. That sort of periodic adjustment befalls most industries, when change creates a new operating climate, killing off and weeding out the weak, leaving what's left leaner and meaner. Meanwhile, those who live and work in the world of AM radio today can only echo Molly's long ago words: "Taint funny McGee!" **R-E**



# HARDWARE HACKER

**Perpetual motion, independent research, the magnetocaloric effect, and audio voltmeters.**

**DON LANCASTER**

It's not at all obvious to me why we need all of the foot dragging, infighting, and squabbling going on today over HDTV high-quality video-display standards. It seems that several government agencies are now battling each other to win the coveted role of chief obstructionist.

To me, it is entirely obvious that HDTV will use square pixels, will not have interlace, will use fully programmable, rather than hard-wired (single standard) receivers and displays, will be totally digital, will use a real-time JPEG compression, and will follow Japanese set standards.

It is also totally obvious to me that terrestrial broadcasting will serve a negligible to totally vanishing role in HDTV, while the computing, satellite, VCR, and cable uses will overwhelmingly dominate. And any intermediate or interim "transition" steps will prove to be a monumental waste of time and money, done by the wrong people for the wrong reasons.

So, let's just ban the networks and the feds from any HDTV input whatsoever, and then get on with it. They are the enemy, not Japan. Our topics this month seem to range from the ridiculous to the sublime...

## Perpetual motion

It may be the New Age nineties, or just a sunspot cycle peak, but a surprisingly large number of all you hardware hackers are busy at work building your own perpetual motion machines. I simply cannot believe the number of helpline calls and visitor drop-ins I am getting on this.

Since perpetual motion is definitely real as far as its history and its ongoing activities are concerned, maybe we should take a brief look here.

I guess I was in the seventh grade when I built my first perpetual motion machine. Figure 1 shows the details. I took a gyroscope and hung several magnets on it so that like poles faced each other. The magnets were at an angle so that the repulsion would

have a tangential component. As the poles repelled each other, the gyroscope would accelerate.

Or so I thought at the time. Very strangely, the gyroscope locked up instead of spinning. Seems it latched itself into a minimum reluctance field position and just sat there.

These days, I guess I don't really understand why perpetual motion is desirable. Since unlimited free energy would hasten the entropic heat death of the planet, perpetual motion is both environmentally unconscionable and socially reprehensible. The first thing we should do to a successful perpetual motion machine designer is to just stake him to an anthill, and then leave him out there until the next meeting of the steering committee.

Nonetheless, perpetual motion is a fascinating topic. Some very good books on this subject are available from *Lindsay Publications*, while a few of the more opportune ongoing perpetual-motion scams are available to you through *H&A Industries* or the *Tesla Book Company*.

After working with a bunch of them, the perpetual-motion buildees these days all appear to share several common traits. None of them have ever attended an introductory college physics course, or else they seem to have slept through it.

While all of them claim they "just can't find anything at all" on their idea, they studiously go out of their way to avoid doing any real or honest library research. As we've found out

several times in the past, any hardware hacker anywhere can instantly get the very latest scoop on anything by way of the *Dialog Information Service*. More on this shortly.

A disproportionate number of the perpetual-motion buildees seem to belong to one particular religion that happens to be very big on faith and on self-reliance.

There's often a very heavy dose of paranoia, usually aimed at the patent office, a local university, those oil companies, Detroit (who could not possibly suppress anything except quality or profits), an ex-boss, or else "them" in general.

Almost always, the buildees think *linearly* instead of *cyclically*. Thus, while a power stroke of the repelling magnets or their freezing milk bottle makes a lot of sense to them, they usually ignore the inevitable repetitive and cyclic energy supplying steps as needed to get to that stage.

There's also the *Cosmic cupcake* syndrome, the *Few chips shy of a full board* affliction, and the *Boy a whole flock of them flew over that time* concept. But we need not get into any of these here.

Finally, there is the *magic bullet*. Their idea almost but not quite works. So, all we need to fix it is better gears, stronger magnets, a larger milk bottle, or a different rear axle ratio. Or more bucks for research.

Several of us folks around here at **Radio-Electronics** editorial have now somehow gotten some silly ideas into our collective heads. For some unbeknownst reason, many of us presently feel that:

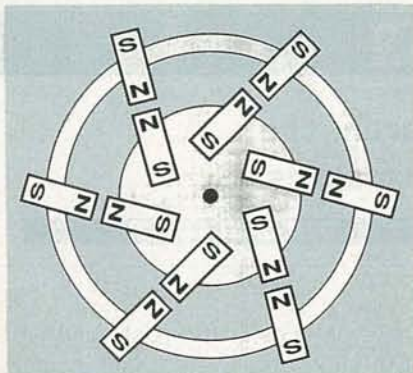
(A) Neither matter nor energy can be created or destroyed, except by an atomic process.

(B) Available energy always seems to convert itself from higher quality forms into lower and less useful ones. Not once have the dishes ever washed themselves. Nor have those pool balls ever re-racked themselves.

(C) Nearly all physical and elec-

## NEED HELP?

Phone or write your **Hardware Hacker** questions directly to:  
Don Lancaster  
**Synergetics**  
Box 809  
Thatcher, AZ 85552  
(602) 428-4073



**FIG. 1—MY VERY FIRST PERPETUAL MOTION MACHINE.** As the like poles of the magnets repel each other, they accelerate the rotor on a gyroscope. Sadly, it latched, rather than speeding up. But maybe if I used stronger magnets...

tronic processes end up producing unrecoverable low-grade heat energy, usually through friction or electrical resistance.

(D) Despite a House-Senate compromise committee, Congress is not expected to repeal the three laws of thermodynamics this session. Para-

phrased, these three laws are (1) You can't win; (2) You can't break even; and (3) Yes, the dice are crooked, but it's the only game in town.

I guess one of the reasons some of us around here feel this way is that not once in the entire history of hardware hacking has even one reproducible counter example to these silly ideas of ours ever been successfully and unarguably demonstrated.

Naturally, you are free to agree or disagree with us as you wish. But if you disagree, we do make only one simple request: Provide us with an experiment that can be *independently* duplicated by *disinterested* outsiders which causes your effect to show up at least reasonably well. Then we will all believe.

### Doing serious research

So, what is the best way to research any topic? I don't know how many calls and letters I have gotten from people who live in such a "remote" area and will claim that "absolutely nothing" is available locally. Believe it or not, one of these letters was from Cambridge, MA and yet another was from Palo Alto, CA.

Well, I've been sitting right here watching Gila Monsters on this sand dune smack dab in the middle of the Upper Sonoran desert for nearly two decades now. While almost everything I do is local (and much of it done underground or in mountaintop wilderness areas), I've had no problems whatsoever handling top-quality research on all kinds of very rewarding and well-paying topics.

So don't give me any "remote" bull. Admittedly, my tiny and isolated town of 2400 does have its own symphony orchestra, but that's another story.

Figure 2 lists a few of my key secrets to doing independent hacker research. The overwhelming reason you cannot find something is because you are not looking. You are instead going through some inept motions and keeping yourself busy, rather than by taking obvious steps and handling all of them in a logical manner.

Research is not an activity that you turn on or off. Instead, you put yourself in a *continuous* research mode in which you gather and collect *everything*, needed or not, or expected or not. Never mind the topic. The subject does not matter in the

least, since chance favors the prepared mind. Thus, your own personal resource file is far and away the most important place to look, should any specific need come up.

Set a minimum goal of eight cubic yards for your personal resource files. At least for a bare bones start-up. Then let it grow from there.

Your foremost outside resource should be all of the trade journals. I subscribe to over 400 of them. As we have seen in the past, any and all fields have all their own private technical magazines which are intended for a select group of insiders. Most of these are free, provided you tell them what they want to hear on their qualification cards. Many do include bingo cards, annual directories, and tech info.

Naturally, you'll circle everything even remotely usable on the bingo cards. If in doubt, circle it. If you do not personally rent the largest box in your local post office, you've missed the point here completely.

Electronic trade journal examples include *E.E. Times*, *Electronics*, *EDN*, *Electronic Products*, *Electronic De-*

### RARE EARTH RESOURCES

#### Aesar

Box 8247 Ward Hill  
Haverhill, MA 01835  
(800) 343-1990

CIRCLE 259 ON FREE INFORMATION CARD

#### Alfa Products

PO Box 8247  
Ward Hill, MA 01835  
(800) 343-0660

CIRCLE 260 ON FREE INFORMATION CARD

#### Cerac

PO Box 1178  
Milwaukee, WI 53201  
(414) 289-9800

CIRCLE 261 ON FREE INFORMATION CARD

#### ESPI

5310 Derry  
Agoura, CA 91301  
(800) 638-2581

CIRCLE 262 ON FREE INFORMATION CARD

#### Fisher Scientific

711 Forbes Avenue  
Pittsburgh, PA 15219  
(412) 562-8300

CIRCLE 263 ON FREE INFORMATION CARD

#### Goodfellow

301 Lindenwood Drive Ste 1  
Malvern, PA 19355  
(800) 821-2870

CIRCLE 264 ON FREE INFORMATION CARD

## 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
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 Perspective Draw	39.50
PostScript Technical Illustrations	39.50
PostScript BBS stuff	19.50
Absolute Reset Ile & Iic	19.50
AppleWriter/Laserwriter Utilities	49.50
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

CIRCLE 83 ON FREE INFORMATION CARD

- (1) - If you can't find it, you ain't lookin'.
- (2) - Research is a continuous activity done on a total lifestyle basis. You cannot turn it on and off at will.
- (3) - Anticipate what you are going to research in the future and get started on it long ahead of any actual or possible need.
- (4) - Your own personal resource file should be your first and foremost starting place. Your beginning file should fill at least eight cubic yards, and should expand from there.
- (5) - The free trade journals are far and away your most important external resource. A complete listing appears in *Uhlricht's Periodicals Dictionary*. Use those bingo cards!
- (6) - The *Dialog Information Service* at your local library can instantly find anything for you from anywhere at anytime.
- (7) - Other important library resources are the *Science Citations Index*, the *Thomas Registry of Manufacturers*, Interlibrary loan, the *UMI* reprint service, and the *Encyclopedia of Associations*.
- (8) - Form an extensive network of contacts outside of your circle of family, friends, or work associates. Clubs, helplines, and BBS systems are ideal for this sort of thing.
- (9) - Let your subconscious be your guide, starting from fundamental principles and guidelines. Go with the vibes.
- (10) - Quest *tinajas*.

FIG. 2—SEVERAL OF MY INSIDER secrets on independent research.

sign, and dozens more. We'll look at these names and numbers in some future sidebar.

For now, you go to the library and view the Hacker's Holy Grail, that is otherwise known as the *Uhlricht's Periodicals Dictionary*. This one hardware hacking resource is far and away more important than all of the rest put together. Use and enjoy.

The second most important outside Hardware Hacking research resource is the *Dialog Information Service*. It's also at your local library. For a small fee, *Dialog* will instantly research anything, anywhere, anytime. As an example, we'll shortly be looking at magnetic refrigeration. To get from knowing virtually nothing on the topic to having eighteen of the most recent worldwide key abstracts in hand took me a total of seven minutes and cost me a total of \$27.57.

There's lots of other goodies in the library, should you snoop around in enough nooks and crannies. In general, the *least* valuable things in any library are its takeout books. There's that free *Interlibrary Loan Service* which lets you get anything from anywhere, and the faster *UMI* service which can get you any reprint of anything provided you know the exact title, journal, and pages. For much less than *Dialog*, as long as you don't mind waiting a few days.

There's also a *Thomas Registry of Manufacturers* that lists who makes everything, but I've found this to be of limited utility. Also, check into the *Encyclopedia of Associations*, and, if you can't locate *Uhlricht's*, then the *International Standard Periodicals Dictionary* is almost as good.

Another library favorite of mine is the virtually unknown *Science Citations Index*. Unlike all the others, this one lets you move *forward* through time, rather than back into older and older material. It works by listing who put whom into their bibliographies.

For instance, any competent new technical paper on active filters *must* reference *Sallen and Key*. Anything new on cold fusion absolutely *must* list *Pons and Fleischman*. Anything new on unfocused solar collectors simply *must* cite *Winston*, and so on. If they don't, then they aren't worth reading anyhow.

Simply shove any of these names through the index, and you'll generate all of the newer papers in the field. After a while, new author names will start cropping up and repeating. You then use the *avalanche effect* to find the latest and the best, just by starting with one or two ancient authors.

And do not ignore the library's kiddie, young adult, or popular press books. Excellent, understandable, and readable backgrounds are easily

picked up in the *Doubleday Science Series*, or the *Life Science Library*.

Beyond the library, you'll want to collect the specialty direct-mail books catalogs. We've covered this resource in depth in a previous column and contest. More details appear in my *Hardware Hacker II* reprints.

Let's see. What else is there? You'll definitely want to set up some sort of extensive personal network that involves people strictly *outside* of any friends, family, or work associates. Obviously, my help line works like a champ here. Electronic bulletin board systems are another great route to networking. So are clubs.

Your own personal experiments can very much clarify any topic, as can teaching a class on it. The purpose of research is to get the effect you are after to show up reasonably well in as simple and as cheap a way as possible.

But stay in school forever. While there's lots of possibilities here, the best I've found are local community college courses, and that self-study material from *Heath*.

Finally, simply let things gel. Take Bowseretta up the mountain. Quest a tinaja. Map that terminal crawlway. Any field has an order and a flow to it. Often in directions that "they" don't care to admit. Start with a few fundamentals, think about it for a while, and a pretty fair picture of the rest may fall in place without much in the way of conscious intervention.

Remember that sincerity is everything. Once you've got that faked, all else follows.

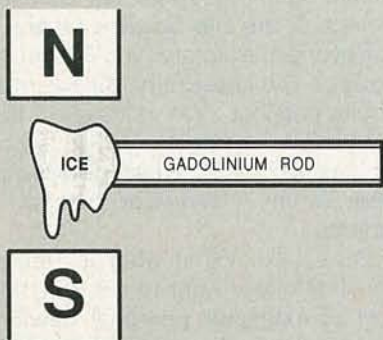
### This month's contest

Tellyawhat. I am about to reveal here for the first time a stunning new technological breakthrough, one that is eminently hackable, besides being a sure fire winner for a research topic, school paper, or science-fair entry.

Only instead of me doing all the work, let's try doing it together. See how much you can improve your research skills along the way.

Just show me an easily done and **Radio-Electronics**-compatible method to demo the magnetocaloric effect described below, at room or lower temperatures. Or else add in any way (patents, papers, articles, data sheets, etc.) to our ongoing magnetic refrigeration dialog below.

There'll be all the usual *Incredible*



**FIG. 3—THE MAGNETOCALORIC EFFECT**, very greatly oversimplified. Gadolinium and other rare earth alloys can absorb heat energy in the presence of a magnetic field and release it otherwise. The efficiency can be as much as 40:1 better than mechanical cooling. Magnetic refrigeration is usable over an absolute zero to above room temperature range. Important first uses will be in cryogenics, superconductivity, liquefied gases, and hydrogen fuels.

*Secret Money Machine* book prizes, along with an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* going to the very best of all. As usual, send your written entries directly to me here at *Synergetics*, rather than directly over to **Radio-Electronics** editorial.

### Magnetic refrigeration

There's apparently a brand new way to cool things that is just turning the corner from laboratory to preliminary product development. If what has happened so far is to be believed, it should completely blow away many traditional cooling schemes, particularly at very low temperatures.

This genuine breakthrough is called the *magnetocaloric effect*, and I have grossly oversimplified it in Fig. 3. The latest key papers appear in the listings of Fig. 4.

Basically, if you take critical rare earth elements or their alloys, they will absorb heat when magnetized and release heat otherwise, acting as a heat pump. At least over certain temperature ranges and over specified magnetic field strengths. Gadolinium is one popular material.

Heat transfer operations take place in and around the *Curie Point*. Most magnetic materials lose many of their properties when they exceed their Curie Point temperature.

The magnetocaloric effect can be tuned over a range of absolute zero to above room temperature. Efficiencies as much as 40:1 better than me-

#### Magnetocaloric Effect in Strong Magnetic Fields

A.M. Tishin, *Cryogenics (UK)*, February 1990, v30 #2, pp 127-136.

#### Magnetocaloric Effects in Rare Earth Magnetic Materials

A.S. Andreevko, et. al., *Soviet Physics (USA)*, August 1989, v32 #8, pp 649-664.

#### Magnetocaloric Effect in Thulium

C.B. Zimm, et. al., *Cryogenics (UK)*, September 1989, v29 #9, pp 937-938.

#### Magnetic Refrigeration

*Superconductivity Industries*, Spring 1989, v2 #1, pp 32-41.

#### Magnetocaloric Effect and Refrigerant Capacity of Tb-Dy Alloys

S.A. Nitkin, et. al., *Physics Status Solidi (East Germany)*, May 1989, pp 117-121.

#### Magnetic Refrigerator for Superconducting Magnets at 1.8K

V.A. Altov, et. al., *ICEC 12 (UK)*, 1988, pp 635-640.

#### Magneto-thermal Properties of Sintered Gadolinium

E. Gmelin, et. al., *ICEC 12 (UK)*, 1988, pp 432-436.

#### Determination of the Cooling Capacity of Magnetic Refrigerants

S. Nikitin, et. al., *Soviet Technical Physics Letters*, April 1988, v14 #4, pp 327-328.

#### Magnetic Refrigerator

T. Hashimoto, *Refrigeration (Japan)*, 1988, v63 #733, pp 1189-1201.

#### Magnetic Field Changes in the Entropy of Europium Sulphide

P. Bredy, et. al., *Cryogenic (UK)*, Sept 88, v28 #9, pp 605-606.

#### Magneto-thermal Conductivity of Er-Al for Cryogenic Applications

C.B. Zimm, et. al., *Journal of Applied Physics*, 15 April 1985, v57 #8, p4294-4296.

#### Adiabatic Temperature Changes in Ferromagnetic Intermetallic Compounds

C.B. Zimm, et. al., *Journal of Applied Physics*, 15 April 1985, v57 #8, p3829.

#### Magnetic Refrigeration

T. Hashimoto, et. al., *Solid State Physics (Japan)*, March 1985, v20 #3, p161-175.

#### Characteristics of Magnetocaloric Refrigerants below 20K

T. Hashimoto, et. al., *ICEC 9 (Japan)*, May 1989, pp 26-29.

#### A Composite Material for Magnetic Refrigeration Using Internal Heat Transfer.

B. Daudin, et. al., *Cryogenics (Great Britain)*, September 1982, v22 #9, pp 439-440.

#### Magnetic Refrigeration from 10K to Room Temperature

T. Hashimoto, et. al., *Cryogenics (Great Britain)*, November 1981, v21 #11, pp 647-653.

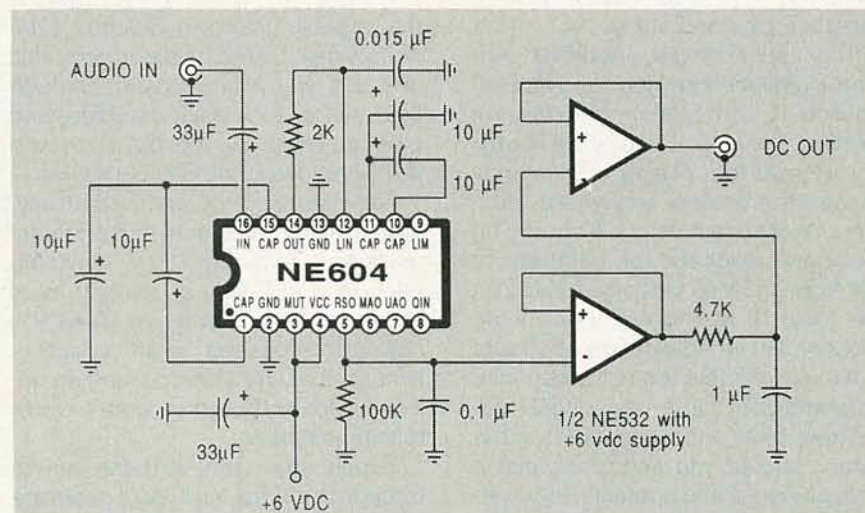
#### T-S Diagram for Gadolinium Near the Curie Temperature

S. Benford, et. al., *Journal of Applied Physics*, March 1981, v52 #3, pp 2110-2112.

#### The Magnetocaloric Effect in Dysprosium

S. Benford, et. al., *Journal of Applied Physics*, March 1979, v50 #3, pp 1868-1870.

**FIG. 4—A FEW OF THE RECENT PAPERS** on magnetic refrigeration and the new magnetocaloric effect.



**FIG. 5—AN AUDIO VOLTMETER** having a range of 0 to -80 dBm. Use this one to calibrate microphones and speakers, or as a receiver "S" meter. Output is 0.5 volts at -80 dBm and 5 volts at 0 dBm. Sensitivity is 10 microvolts.

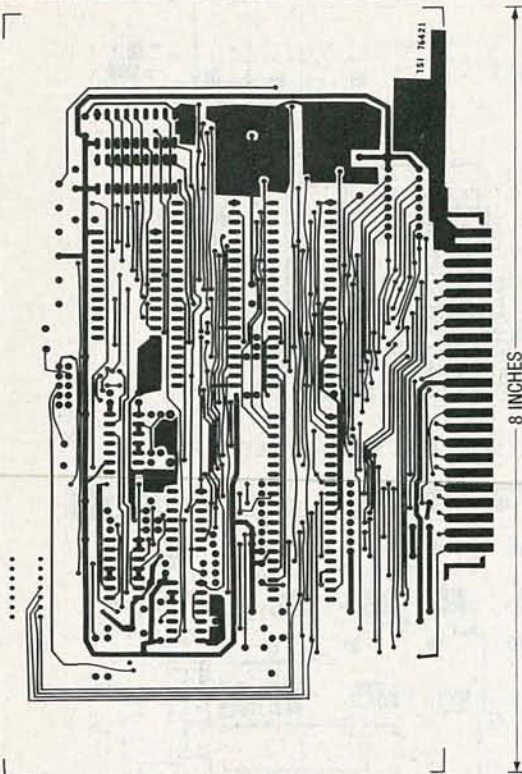
chanical refrigeration have been bandied about. Yes, the effect can be done using no moving parts.

Obvious applications for magnetic refrigeration include cryogenics and superconductivity, the production of

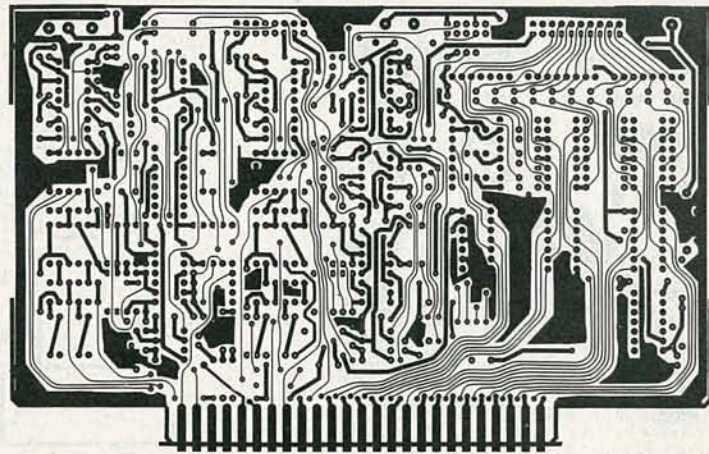
liquid gases (especially hydrogen as a fuel), and as Freon replacements for traditional room air conditioners. A few sources of gadolinium and its related rare earths are shown in our *continued on page 90*

# LAWN RANGER

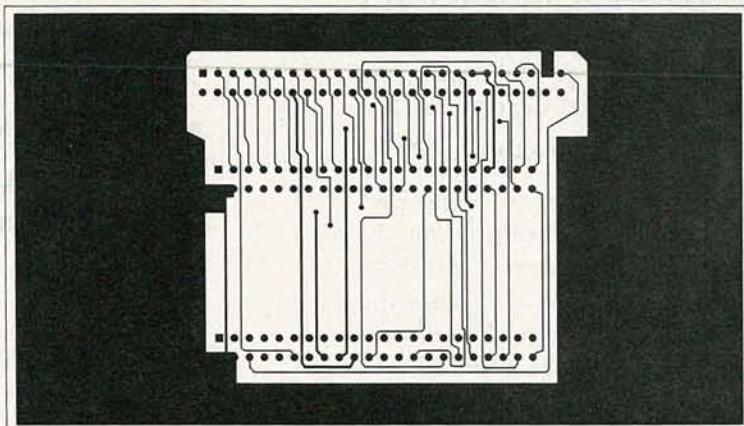
continued from page 70



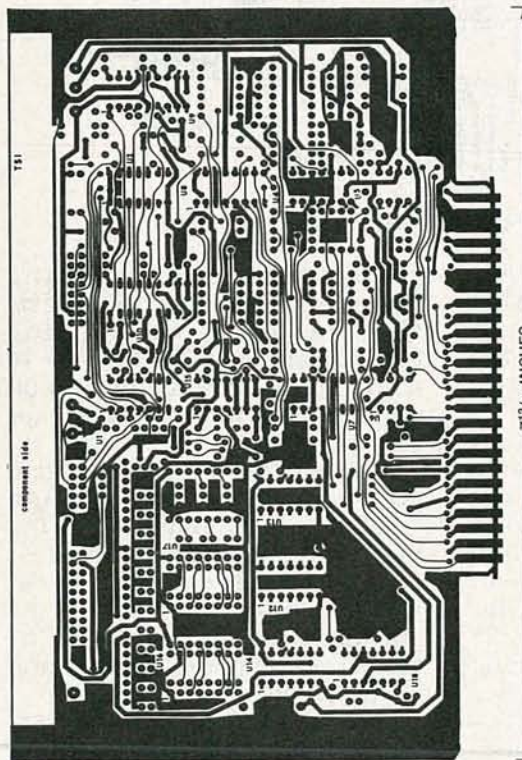
CPU BOARD SOLDER SIDE AT HALF SIZE.



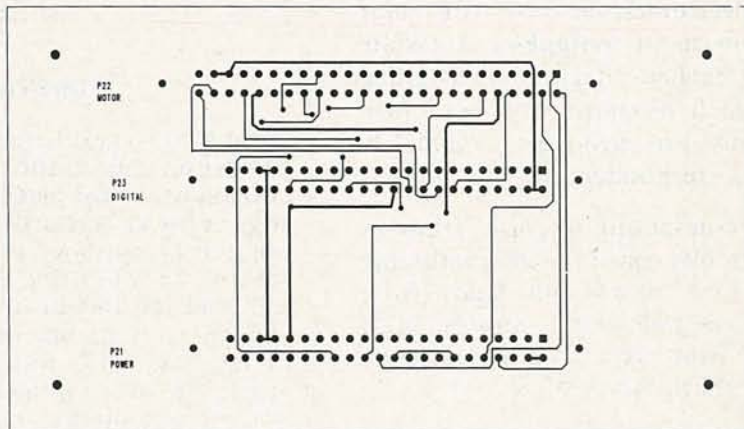
MOTOR CONTROLLER BOARD SOLDER SIDE AT HALF SIZE.



MOTHERBOARD SOLDER SIDE AT HALF SIZE.



MOTOR CONTROLLER BOARD COMPONENT SIDE AT HALF SIZE.



MOTHERBOARD COMPONENT SIDE AT HALF SIZE.

all the sensors are blocked. You should notice that the left wheel will slowly change from a counter-clockwise to a clockwise direction and the right wheel will change from a clockwise to a counter-clockwise rotation. If the

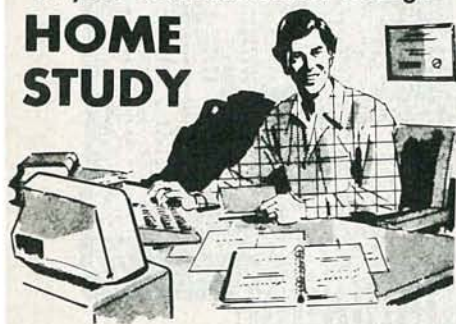
Lawn Ranger has passed all tests so far, it is ready for outdoor testing.

If it did not pass one or more of the tests, double check the operation of the CPU board as described in the June issue.

## Outdoor guidance testing

Now it is time to have some real fun! Make sure your neighbors or friends are out because they will love to see the capabilities of your new creation. Cut a six-foot thick square border around a small grassy test area with a conventional lawn mower (don't use the Lawn Ranger yet). Connect the manual controller, squeeze the

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.

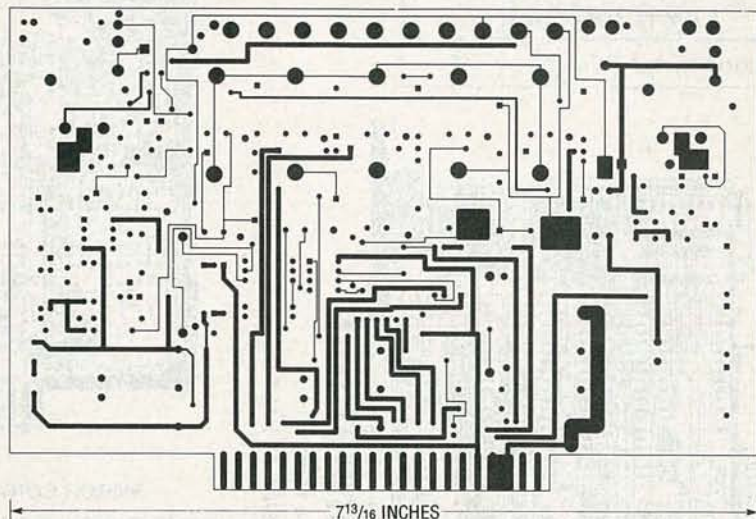
Grantham offers two degree programs—one with major emphasis in **electronics**, the other with major emphasis in **computers**. Associate and bachelor degrees are awarded in each program, and both programs are available completely by correspondence.

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.

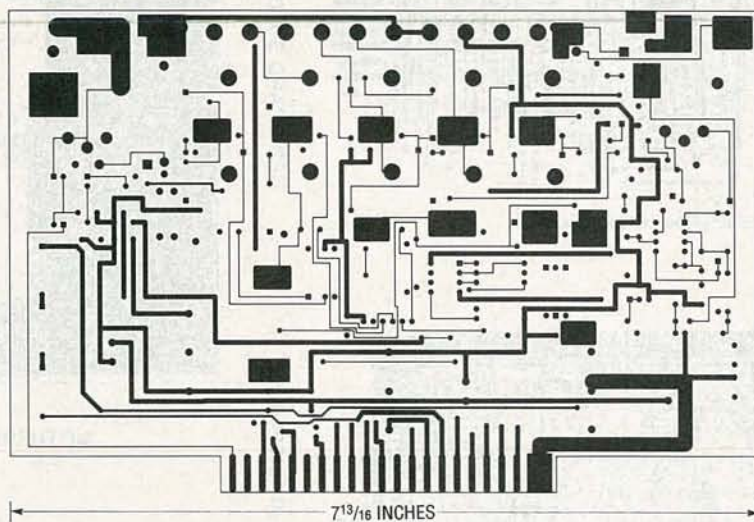
Write for our free catalog (see address below), or phone us at toll-free 1-800-955-2527 (for catalog requests only) and ask for our "degree catalog."

Accredited by  
 the Accrediting Commission of the  
 National Home Study Council

**GRANTHAM**  
 College of Engineering  
 250 Frontage Road  
 Slidell, LA 70460



POWER BOARD COMPONENT SIDE AT HALF SIZE.



POWER BOARD SOLDER SIDE AT HALF SIZE.

hand switch and turn the Lawn Ranger on. "Walk" the unit to the cutting area and place it on the edge of the grass border with the tall grass positioned to the left—see Fig. 1 of the June issue.

Adjust the height of the grass sensors so their tips lie approximately one inch above the cut grass. The uncut grass should be around two inches higher than the cut grass for your first test. Remove the manual controller and push the RUN button. The mower will begin to track along the border you previously cut. It should continue tracking this border until you stop it. If it passes this test, you are ready to connect the cutting blades and really show off.

**Final test**

Now you are ready to connect the blades as shown in Fig. 3 (make sure the batteries are dis-

connected before attaching blades). Double check the shields that surround the cutting blades; they should be able to withstand a force as high as 60 pounds upon impact to allow for safe operation.

After the blades are attached, grab yourself a cold drink and "walk" the Lawn Ranger with the manual controller to the test area. Set up the mower as described above and connect the cutting-motor wire to J11-2. Remove the manual controller and turn the Lawn Ranger on.

Push the CUT and RUN button. Now, watch in amazement as the mower automatically cuts the grass contained within the test area. You will love the way it "turns on a dime" when it reaches the end of a row. When it is finished with the job, it will steer in a tight circle searching for tall grass and then turn off. R-E

# AUDIO UPDATE

## The Sound of Audio: An AES conference report

LARRY KLEIN

Last month I wrote about an audiophile High End Hi-Fi Show. This column is about an altogether different kind of "show" sponsored by the Audio Engineering Society (AES). Properly billed as a conference, rather than a show, "The Sound of Audio" was a wide-ranging exploration of the latest findings on the perception, measurement, recording, and reproduction of sound. A variety of papers were presented along with a special session on the reviewing of audio products featuring reviewers from both "slick" and "underground" publications. Given my 20 years in charge of product reviewing for *Stereo Review*, I heard nothing new—although the session gave me a chance to say hello to a lot of old friends. However, the pertinent and intelligent questions from the audience led me to make a mental note to discuss the somewhat controversial topic of equipment reviews in a future *Audio Update* column. Now, on with the conference.

### Psychoacoustics

Because of my ongoing interest in psychoacoustics, I found the several sessions devoted to audio perception both interesting and enlightening. As you may know, psychoacoustics deals with subjective sonic perceptions, as contrasted to objective sonic measurements. A simple example: For a sound to be heard subjectively as twice as loud, its objective increase in sound-pressure level must be approximately 10 dB.

The three presenters were all university researchers, and their talks included some of their own original research in addition to the very latest findings in the field. Rather than attempting to synthesize three lengthy, and sometimes complex, papers, I'll extract (and paraphrase when necessary) some of the opinions and findings that caught my ear.

- Despite hundreds of years of investigation into human hearing, many

mysteries and confusions remain. One author discussing the difficulties of operating in the area of qualitative judgments (Is it twice as loud or 1/2 times as loud?) urged that because we are trying to measure the behavior of a very complex biological system that we be skeptical of the derived numbers—they might not mean what we think they do. I got a strong feeling that there is an enormous amount of research that remains to be done, and that digital manipulation of the testing signals is an important new facilitating tool.

- There is more to hearing loss than a simple reduction of sensitivity to

#### WHO IS AES?

The AES is an international organization whose membership includes more than 10,000 persons involved on a professional, semiprofessional, and amateur level in all aspects of audio. For further information on The Sound of Audio conference, on how to become a member of the AES, and/or a catalog of available publications and technical papers, write to: Audio Engineering Society, 60 East 42nd Street, New York, NY 10165-0075.

various frequency areas. Unfortunately, at the frequencies where there is a hearing loss there are also additional changes that affect perception. Thus, we generally cannot restore normal perception by simply restoring normal sensitivity with a hearing aid or by using equalizers or tone controls in a hi-fi system. The study of the perceptual consequences of hearing loss is an important and very active research area of psychoacoustics and audiology.

- The ear has an incredible absolute sensitivity: At 3 kHz, where the ear is most sensitive, a sound at the threshold of hearing produces a displacement of the eardrum that is about 1/100 of the diameter of a hydrogen molecule! The threshold of pain (ranging

from 140 dB at 20 Hz to about 120 dB at 2 kHz) is generally given as the upper intensity limit of hearing. Unlike the eye, whose iris visibly adjusts itself to the ambient illumination, the ear maintains its approximately 120-dB dynamic range by dividing different intensity levels among separate groups of nerve fibers. Each of the fiber groups can handle a range of only 30–40 dB. At levels about 40 dB or so, only about 15–20% of the ear's 30,000 nerve fibers are handling the incoming sounds.

- It is almost always incorrect to refer to the *loudness* of a sound as, say, 90 dB SPL. Sound pressure level is a physical measurement and only indirectly related to loudness, which is a subjective evaluation. A sound measuring 90 dB could be, depending on its frequency spectrum, loud or quite soft.

- There's a new interest in sound-localization research. Some recent findings include: Complex, broadband sounds are localized best, high frequencies must be present for accurate judgment of a sound source's apparent height, and localization is most precise for signals in front and at ear level.

It has been generally accepted that our brain localizes sound sources by using the intensity and timing difference between the sounds reaching each of our ears. Although research has shown that the specific convolutions of our external ears (pinnae) cause reflective cancellations and reinforcements of signals before they reach our ear canals, only recently has it been understood that this direction-dependent spectral filtering plays an important role in our ability to localize sound sources.

Another recent experiment on directional perception sought to determine the relative importance of interaural arrival-time versus sound-intensity differences in determining localization. By digitally manipulating the signal, the experimenters were

# ELECTRONICS PAPERBACKS



□ **BP117—PRACTICAL ELECTRONIC BUILDING BLOCKS, BK-1** ..... \$5.75. Circuits for a number of useful building blocks are presented. Combine these circuits to build the devices you need.

□ **BP192—MORE ADVANCED POWER SUPPLY PROJECTS** ..... \$5.95. Topics covered include switched-mode power supplies, precision regulators, dual tracking regulators and computer-controlled supplies.



□ **BP190—MORE ADVANCED ELECTRONIC SECURITY PROJECTS** ..... \$5.95. Projects include a passive infra-red detector, a fibre-optic loop alarm, computer-based alarms and an ultrasonic intruder detector.

□ **BP113—30 SOLDERLESS BREADBOARD PROJECTS, BK-2** ..... \$5.95. All projects are based on CMOS logic IC's. Many components are common to several projects. Each project includes a brief circuit description, component layout and parts list.



## Electronic Music Projects



□ **BP74—ELECTRONIC MUSIC PROJECTS** ..... \$5.95. Provides a number of circuits for Fuzz Box, Waa-Waa Pedal, Sustain Unit, Reverberation and Phaser Units, Tremolo Generator and more.

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



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 \_\_\_\_\_

able to feed the test subjects conflicting intensity and timing information. The expectation was that the subjects would "split the difference," but instead it turns out that the difference in interaural arrival time was the dominant localizing factor—as long as frequencies below 2 kHz were part of the signal.

The authors concluded that this newly discovered time-difference dominance means that "modification of the intensity ratio between the right and left channels of a stereo recording cannot be expected to have any influence on the apparent position of the resultant sound image." I think I missed the author's point, because as far as I can tell my preamplifier's balance control (which operates by adjusting the relative gain levels of the right and left channels) works as well as ever.

The final paper on the localization of sound sources related a series of complex experiments that set up "unnatural" acoustic conditions (such as having one reflecting wall in an otherwise anechoic environment) and used highly controlled, and equally unnatural, special acoustic test signals. It turns out that the subjects *unconsciously* evaluated the plausibility of the test signals against their real-world experience and ignored or re-weighted sounds that made no sense. An example of a nonsensical signal would be one in which the arrival-time differences between the ears exceed the maximum possible (about 765 microseconds) for the human head, or one in which the delayed reflected sound was louder than the direct sound.

The paper didn't cover another related phenomena—the ear/brain's ability to localize sounds where they "should" be rather than at their actual source. For example, when listening to a performer on stage from anywhere in the audience, most people hear the sound coming from the performer rather than from the auditorium's speakers—assuming the sound system isn't grossly misbalanced. And, on a cozier level, most people have no problem when viewing the TV while wearing headphones in placing the dialogue at the actors' mouths rather than at the real source—directly over their own ears.

Next month we will look at some of the other papers dealing mostly with the hardware of audio.

## TELEPHONE LINE

*continued from page 46*

PC type bracket, and cut openings for J1 and J2.

### Installation

With the modified bracket installed on the card, it is very simple to install in an IBM PC or clone. All you have to do is locate an unused slot in your computer's expansion bus. Make sure the computer is off during the installation. Remove the blank mounting bracket from the back of the computer (if one exists), and insert the new card into the slot. Install the mounting screw, and then plug in the phone line and the AC adapter and battery backup if used, and you're ready to roll.

### Software

The software is menu driven and, in most cases, a single key stroke is all it takes to change mode or to perform an operation. Screen colors are used for highlights, and for separation of fields. The only thing you have to remember is to type TLC and hit return (from the DOS prompt). All programming, functions, and mode selections thereafter are done using menus. (See sources box for custom software.)

The software consists of two programs: the operating program and the resident program (which are available on the REBBS—516-293-2283). The operating program runs on the host computer and provides the interface with the controller's hardware. The resident program is what the operating program loads into the on-board SRAM. The resident program is the actual program that determines what the controller will perform. But it is the operating program that is used to select, configure, and load the resident program.

### User registration cards

Although the software is not copy protected, we strongly recommend users to register their copies; doing so will automatically put you on AC&C's mailing list. AC&C will inform users of new applications software, functions, and updates.

**R-E**

**R-E**



# DRAWING BOARD

This month begins our discussion on control circuitry.

ROBERT GROSSBLATT

Designing and building electronic controllers used to be a really difficult job if you wanted the circuit to have enough intelligence to do even fairly complex jobs. The reason for that was that there weren't any single-component solutions to electronic intelligence. But when IC's were developed, and affordable microprocessors appeared on the market, things began to change dramatically.

The major change in controllers was the home computer in general and the marketing of cheap motherboards. That's because all the intelligence you'd ever need could be handled by an eighty dollar clone and a bit of software...almost.

The reason for the "almost" is that, even though a cheap PC clone has all the brains and memory needed to control your home's security system or the environmental control system of the space shuttle, there's no convenient way to let the computer talk to the outside world.

All home computers have the capability of talking to an external device since they have to deal with video, keyboards, printers, and so on. How they do that depends on the particular computer since different microprocessors handle I/O in their own unique and often strangely wonderful way. Fortunately for all of us, just about all of the popular clone computers are built around the 80XXX family—from the original 8080, the Z-80, to the 8088 and its more powerful kin, the 80286, 80386, and whatever other surprises Intel comes up with in the future.

All those microprocessors deal with I/O in the same way; through the use of only two instructions IN and OUT. The chip understands that it can be told to address two completely different kinds of locations: memory and ports. If you think of the computer as being an active controller, the former kinds of locations are for thinking and the latter are for doing.

It's really that basic.

If you look at the pinouts of any of the 80XXX family, you'll see that there's one pin labelled IO/MEM. On the 8088, for example, you can see that in Fig. 1 on pin 28. That's the control pin that lets external circuitry know whether the microprocessor is doing a memory operation or an I/O (port) operation.

In ordinary use, most people are

happily unaware of what kind of instruction is being executed even though both kinds happen all the time. Remember that printers, modems, mice, joysticks, and so on are all treated by the 8088 as I/O devices.

Interestingly enough, even though chips like the 8088 make it easy to deal with I/O, designing the circuitry to be controlled is always a pain in the neck, since even the lowly 8088 can handle more than 64,000 different port addresses. That means that anything designed to be driven by the 8088 has to be able to recognize when a particular address shows up on the bus—and that means designing the circuitry necessary to keep an eye on as many as sixteen different address lines to decode the few that you're interested in.

Some months ago I published the details of the Port-A-Matic (**Radio-Electronics**, January and February 1990) which would decode some of the address lines and indicate when the 8088 was talking to particular ports. If you glance through the text of the article, you'll get an idea of just how tedious address decoding can really be.

When you're going to use a store-bought computer as the basis for a controller, it makes a lot of sense to see if you can possibly get away with not having to do address decoding.

You need circuitry to create a working port. This usually takes the form of address decoders, latches, and a wad of logical glue to hold the whole thing together. If the port you're designing has any special needs, that means even more silicon. An example of that would be something like a port aimed specifically at serial stuff where you had to have UART's, line drivers, and so on.

There are several standard port locations in the magical kingdom of cloneland, and I've listed the most popular ones in Table 1. Notice, as we just discussed, that most of the ports actually use several sequential port

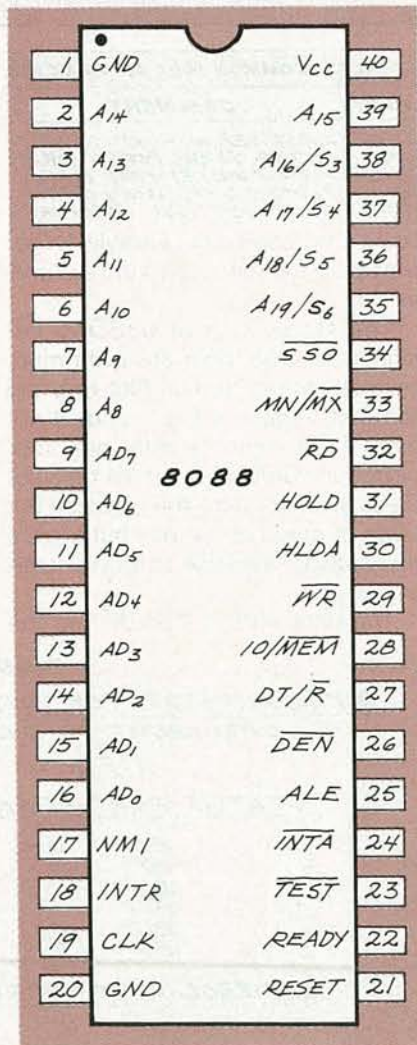


FIG. 1—LOOKING AT THE PINOUTS of the 8088, pin 28 (IO/MEM) is the control pin that lets external circuitry know whether the microprocessor is doing a memory operation or an I/O (port) operation.

# R-E Engineering Admart

Rates: Ads are 2 1/4" x 2 7/8". One insertion \$950. Six insertions \$925. each. Twelve insertions \$895. 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-516-293-3000. **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
  - Programmer Schematics
  - Single Chip Microcomputer Primer Lesson Book

Price ..... \$195

MCPM-1 Programmer for Motorola MC68705P3,P5,U3,U5,R3,R5  
Parts kit w/driver program ..... \$150  
Fully assembled w/driver program ..... \$325  
Fully assembled w/driver, assembler, simulator/debugger ..... \$449

MCPM-3 Programmer for Motorola MC68HC705C8, 805C4  
Parts kit w/driver program ..... \$175  
Fully assembled w/driver program ..... \$360  
Fully assembled w/driver, assembler, simulator/debugger ..... \$495

**TECI**  
The Engineers Collaborative Inc.

Emulators Programmers Assemblers Simulators/Debuggers  
Rt. #3, Box 8C TEL: (802) 525-3458  
Barton, VT, USA 05822 FAX: (802) 525-3451

CIRCLE 185 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 PUBLICATION  
979 Young Street, Suite E  
Woodburn, Oregon 97071  
Phone (503) 981-5159 Dept. 50

CIRCLE 179 ON FREE INFORMATION CARD

## MIDI PROJECTS



**BP182**—MIDI interfacing enables any so equipped instruments, regardless of the manufacturer, to be easily connected together and used as a system with easy computer control of these music systems. Combine a computer and some MIDI instruments and you can have what is virtually a programmable orchestra. To get your copy send **\$6.95 plus \$1.25 for shipping** in the U.S. to **Electronic Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240.**

addresses to handle data, control, and status. That is important to keep in mind because one of the major drawbacks of designing around someone else's hardware is that things aren't set up the way you'd like them to be.

There are actually two problems: The first is that not all the data bits may be used, and the second is that some of the bits may be designed to be either read only or write only. The best way to see that is to look at the port that's available on most clone systems—LPT1, the main printer port.

Just about every clone board I've seen (including the more well-known name brands) that provide an LPT1 port uses the same I/O address space. The three I/O ports that go into making the printer port are 03BCh (the data port), 03BDh (the status port), and 03BE (the control port). The computer uses the data bits at those locations as summarized in Table 2.

The control port at 03BEh is designed to be both written to and read from, although bits 5, 6, and 7 are unused. Bit 4 is used by the port but is designed as a hardware flag to enable the interrupt that the computer uses to find out whether or not the printer can accept data. The bottom line is that bit 4 is only used internally and doesn't show up on the port connector. Keep that in mind because

TABLE 1—COMMON PORT ASSIGNMENTS

PORT	COMMENT
3F8h	FIRST SERIAL PORT (COM1)
2F8h	SECOND SERIAL PORT (COM2)
3BCh	FIRST PARALLEL PORT (LPT1)
3F5h	FLOPPY DISK DATA PORT
201h	FIRST JOYSTICK DATA PORT

there's no hardware available to get the upper four bits out to the external world.

The status port at 03BD is designed so that there are even more restrictions on its use. Not only are the first three bits (0, 1, and 2) not used (and consequently not supported in hardware), but it's only set up as an input port. You can read the state of some of the bits but there's no hardware available to let you write to the port.

The data port at 03BCh, like the

status port, has restrictions as well. All eight bits are used, but the port's only configured for output.

Every one of the boards I've seen that has a printer port on it uses some kind of a latch near the end of the hardware chain making up the data port. Usually it's a 74LS373 (boards with discreet components), or a work-alike latch buried in silicon if the board has custom LSI or ASIC chips. Data sent to the port at 03BCh will stay there until it's either changed or cleared by the computer.

It's important to completely understand the parallel-port setup before you start using it as anything other than a printer port since not all the bits are implemented or designed to be both input and output. **R-E**

TABLE 2  
BIT ASSIGNMENTS FOR LPT1 WITH A BASE PORT OF 03BCh  
DATA PORT - 03BCh - WRITE ONLY

BITS 0-7 - DATA

### STATUS PORT - 03BDh - READ ONLY

BITS 0-2 - UNUSED  
BIT 3 - ERROR  
BIT 4 - SELECT STATUS  
BIT 5 - PAPER OUT  
BIT 6 - ACK  
BIT 7 - BUSY

### CONTROL PORT - 03BEh - READ/WRITE

BIT 0 - STROBE  
BIT 1 - AUTOFEED  
BIT 2 - INIT  
BIT 3 - SELECT  
BIT 4 - IRQ7 ENABLE  
BITS 5-7 - UNUSED

# How to build a high-paying career, even a business of your own, in computer programming.



**RICK BRUSH,  
NRI PROGRAMMER/ANALYST**

**Start with training that gives you hands-on programming experience—at home and at your own pace. Training that begins with BASIC, then continues with Pascal, C, and COBOL—today's hottest computer languages. Training that even includes a powerful IBM-compatible computer, modem, and programming software you keep.**

**Start with real-world training. The kind of training only NRI provides.**

Now with NRI's new at-home training in Computer Programming, you can be one of today's highly paid, creative team of computer wizards who give computers the power to carry out an astonishing range of business, professional, and personal applications. Now, with NRI, you can be a computer programmer, ready to build a high-paying career—even a business of your own—making computers do anything you want them to do.

**The only programming course that includes a powerful computer system and software you keep.**

Unlike any other school, NRI gives you hands-on programming experience with a powerful IBM compatible West Coast computer system, including 2400



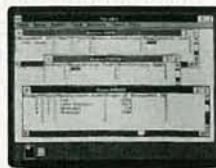
**Only NRI gives you an IBM-compatible computer with modem, 640K RAM, disk drive, monitor, and software—BASIC, Pascal, C, and COBOL—all yours to keep!**

baud internal modem, 640K RAM, disk drive, monitor, and invaluable programming software—BASIC, Pascal, C, and COBOL—all yours to keep.

You get the experience and the know-how, the computer and the software to get to the heart of every programming problem, design imaginative solutions, then use your choice of four key computer languages to build original, working programs.

**No matter what your background, NRI gives you everything you need to succeed in programming, today's top-growth computer career field.**

You need no previous experience to build a successful programming career with NRI training. Indeed, your NRI lessons start by walking you step by step through the fundamentals, giving you an expert understanding of the programming design techniques used every day by successful micro and mainframe programmers. And then the fun really begins.



**You master today's hottest computer languages, gaining the skills you need to build programs for a wide variety of real-world applications.**

With your personal NRI instructor on call and ready to help, you use your computer and software to actually design, code, run, debug, and document programs in BASIC, Pascal,

C, and COBOL. Then, rounding out your training, you use your modem to "talk" to your instructor, meet other NRI students, even download programs through NRI's exclusive programmers network, PRONET.

**Your career in computer programming begins with your FREE catalog from NRI.**

For all the details about NRI's at-home training in Computer Programming, send the coupon today. Soon you'll receive NRI's fascinating, information-packed, full-color catalog.

Open it up and you'll find vivid descriptions of every aspect of your NRI training. You'll see the computer system included in your course up close in a special, poster-sized foldout section. And, best of all, you'll find out how your NRI training will make it easy for you to build that high-paying career—even a business of your own—in computer programming.

**Send for your NRI catalog today. It's yours, free.**

If the coupon is missing, write to us at the NRI School of Computer Programming, McGraw-Hill Continuing Education Center, 4401 Connecticut Avenue, NW, Washington, DC 20008.

IBM is a Registered Trademark of the IBM Corporation

## **NRI School of Computer Programming**

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



**YES! Please rush me my FREE catalog describing NRI's at-home training in Computer Programming.**

NAME \_\_\_\_\_ (please print) \_\_\_\_\_ AGE \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY/STATE/ZIP \_\_\_\_\_ Accredited by the National Home Study Council 10-090

SEP 1 EMBR 1990

# COMPUTER CONNECTIONS

## The long-anticipated release of Windows 3.0 and ToolBook, a "software construction set."

JEFF HOLTZMAN

A few days ago Microsoft finally released the long-anticipated and much-hyped new version of Windows. The company spared no expense in the formal product introduction; the initial event cost \$3 million, and the company will spend another \$7 million between the time when I write this and you read it. According to some reports, Windows 3.0 represents the culmination of a seven-year, \$200 million development effort. Clearly, Microsoft means business.

In case you just emerged from detention in Siberia, I'll give a brief run-down of salient new features.

The most conspicuous change is in the user interface. It is simply gorgeous. Mac users will no longer be able to sneer at Windows.

No longer are there separate versions of the product for different CPU's. The same version of Windows 3.0 runs on 8088, 80286, and 80386 processors. However, the program runs in different modes (real, standard, enhanced, respectively) depending on the host processor. Officially, 3.0 will run on an 8088, but a 286 or better is strongly recommended. On a recommended processor, 3.0 breaks the 640K memory limit. Rather, it will when appropriate software is released. For the immediate future, you must run old Windows applications in real mode; however, it appears that most vendors of significant Windows applications are scrambling to convert their products as quickly as possible. The situation will undoubtedly ease considerably by the time you read this.

Another immediate problem that will undoubtedly be fixed quickly is hardware drivers. The program presently comes with precious few. For example, even though 3.0 recognized my Video Seven VRAM VGA card, it provided built-in support only for a 256-color mode at standard resolution (640 x 480), not the 800 x 600 and 1024 x 768 high-res modes. Nor

would it recognize the Novell drivers on my office PC. However, updated drivers were available from the vendors almost immediately.

In general, the lack of hardware support is a problem, but not as great a problem as it used to be, because 3.0 lets you alter your hardware configuration on the fly. With previous versions, if you wanted to change *anything*, you had to re-install the whole package, possibly wiping out important setup information in the process. Now hardware and software upgrades will be easy to accommodate.

Most of the applications that come with Windows have been upgraded. For example, the terminal program now does XMODEM and Kermit file transfers, the calculator now has scientific and programmer functions, the clock now has both analog and digital displays, a macro recorder is now included, a solitaire game has

been added, etc. In addition, the Windows environment itself is now customizable. You can use one of several predefined background patterns, or create your own, or create (or scan in) an image to use as "wallpaper."

Microsoft has finally disposed of the clunky old MS-DOS Executive; the new Program and Task managers (which bear strong resemblance to the corresponding OS/2 functions) provide a visual approach to running programs. The File Manager (which resembles that in DOS 4.0) provides a much more intuitive means of copying, moving, deleting, and searching for files than the old MS-DOS executive. Windows now also provides a significant interface for network users.

As for hardware, Microsoft has tried to position Windows as needing a 286 + 2MB of RAM versus OS/2's 386 + 4MB. From what I can tell,

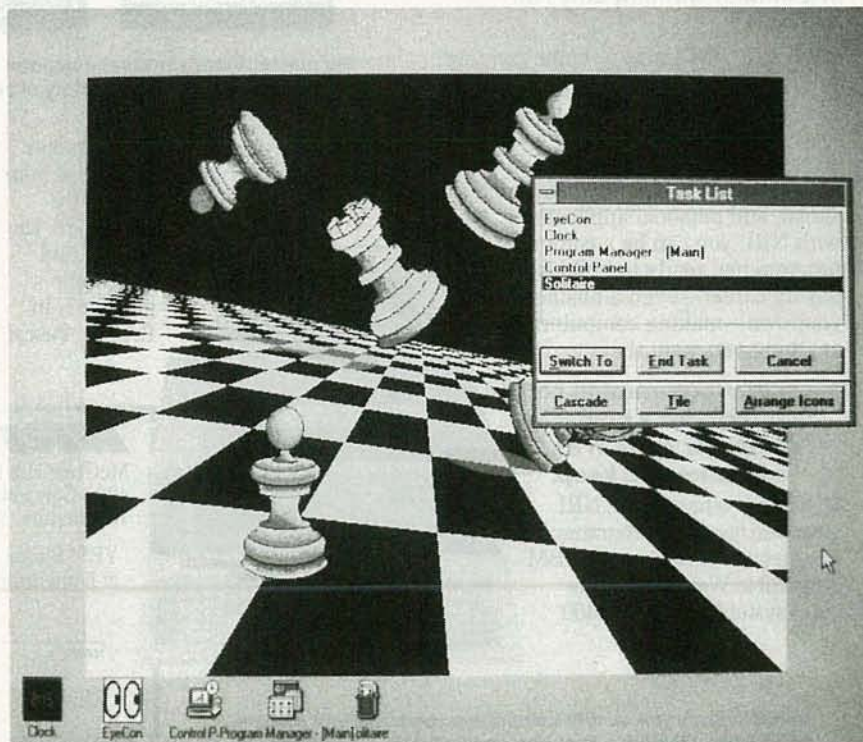


FIG. 1

# R-E Computer Admart

Rates: Ads are 2 1/4" x 2 7/8". One insertion \$950. Six insertions \$925 each. Twelve insertions \$895 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-516-293-3000. **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.**

## SECRETS OF THE COMMODORE 64

Secrets of the COMMODORE 64



**BP135**—A beginners guide to the Commodore 64 presents masses of useful data and programming tips, as well as describing how to get the best from the powerful sound and graphics facilities. We look at how the memory is organized, random numbers and ways of generating them, graphics-color-and simple animation, and even a chapter on machine code. Get your copy today. **Send \$5.00 plus \$1.25 for shipping** in the U.S. to **Electronic Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240.**

**ICs PROMPT DELIVERY!!!**  
 SAME DAY SHIPPING (USUALLY)  
 QUANTITY ONE PRICES SHOWN FOR JULY 1, 1990  
 CALIFORNIA OKLAHOMA NO SALES TAX

DYNAMIC RAM		
1MB	COMP DeskPro 386S	\$225.00
SIMM	AST Prem386/33Mhz	200.00
SIMM	1Mx9 80 ns	75.00
SIMM	256Kx9 100 ns	27.00
1Mbit	1Mx1 80 ns	7.25
41256	256Kx1 60 ns	4.15
41256	256Kx1 80 ns	3.10
41256	256Kx1 100 ns	2.15
41256	256Kx1 120 ns	1.95
4464	64Kx4 100 ns	2.50
41264*	64Kx4 100 ns	5.95
EPROM		
27C1000	128Kx8 200 ns	\$17.50
27S12	64Kx8 200 ns	7.80
27256	32Kx8 150 ns	6.50
27128	16Kx8 250 ns	3.75
STATIC RAM		
62256P-10	32Kx8 100 ns	\$7.50
6264P-12	8Kx8 120 ns	4.50
6116AP-12	2Kx8 120 ns	4.25

OPEN 6 DAYS, 7:30 AM 10 PM SHIP VIA FED-EX ON SAT.  
 SAT DELIVERY INCLUDED ON FED-EX ORDERS RECEIVED BY: (918) 267-4961  
 MasterCard VISA or UPS CASH COD  
 MICROPROCESSORS UNLIMITED, INC.  
 24,000 S. Peoria Ave.  
 BEGGS, OK 74421  
 No minimum order. Please note: prices subject to change!  
 Shipping insurance extra, up to \$1, for packing materials.

CIRCLE 61 ON FREE INFORMATION CARD

those distinctions are driven by the marketing folks, not the technical people. A desktop publisher running PageMaker or a heavy-duty financial analyst running Excel simply needs all the memory, hard disk, and CPU speed he or she can possibly obtain. On the other hand, the average user might go a long way using just the built-in applications.

On a 386, Windows now (finally!) lets you run several non-Windows applications simultaneously in an efficient manner.

At long last the documentation includes useful information on setup and configuration. I drastically increased performance of a 3MB Dell System 300 by setting up a dedicated swap area on disk, as described in Chapter 13 of the *User's Guide*.

### What's it all mean?

By itself, none of the built-in Windows applications can compete with any serious DOS product. But the Windows apps work together as a group very well. And that's one thing that vaulted the Mac to its place of eminence.

When you stop looking at Windows as a DOS add-on or competitor, but as a product in its own right, it takes on a new glow of its own.

You might compare Windows 3.0

to everything-but-the-kitchen-sink programs like Sidekick Plus and PC Tools. Actually, those are not programs but nearly complete environments that contain most of the tools the average DOS user needs to accomplish daily tasks. Windows 3.0 provides similar functionality, but one that is couched in a sparkling user interface, and is built around an architecture that can accommodate user evolution.

I think 3.0 is going to be a wildly successful product, for several very good reasons:

- Unlike OS/2, Windows has significant applications (Excel, Ami, Word, PageMaker, Corel Draw, Designer, Crosstalk) available now in all application categories except database management.

### ITEMS DISCUSSED

- Windows 3.0 (\$149, upgrade \$50 + \$5.50 S/H), Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073-9717. (206) 882-8080. Upgrades: (800) 323-3577.  
**CIRCLE 11 ON FREE INFORMATION CARD**

- ToolBook 1.0 (\$395), Asymetrix Corp., 110 110th Avenue NE, Suite 717, Bellevue, WA 98004. (206) 462-0501. Orders: (800) 624-8999, ext. 299H.  
**CIRCLE 12 ON FREE INFORMATION CARD**

- The industry hasn't seen such a high level of end-user interest in a product in years.
- The enhanced user interface is going to attract users in a way that previous versions were unable to duplicate (and that DOS never could).
- The ability to write programs that can cleanly access 16MB of memory will attract developers.
- The ease of setup and reconfiguration will attract corporate managers and tech support people.
- And rumors still persist about IBM's pending introduction of a low-cost "multimedia" home PC, for which Windows 3.0 would be the perfect operating environment. Maybe it will turn out to be the elusive PC "for the rest of us" that Apple has promoted but not properly marketed for so long.

By the time you read this, much of the smoke will have cleared. Meanwhile, it's going to be an interesting summer.

### ToolBook tames Windows

First out of the starting gate is not a revamped version of an old Windows product, but a brand-new one called ToolBook. If the word HyperCard means anything to you, then you'll have some idea of what ToolBook is about.

ToolBook is billed as "a software construction set." It consists of a set

of tools that let you build applications by designing screens and linking them to one another. Tools include a graphics editor and a programming language called OpenScript. The editor allows you to create buttons that, when selected on-screen, cause something to happen. What happens depends on scripts you write. The script language provides a rich environment for programming, as it includes full control structures (if/then/else, case, do while, do until, etc.), a single-stepping debugger, a macro recorder, and hundreds of functions.

Writing programs for ToolBook is not like writing BASIC, Pascal, or C programs. Rather, OpenScript is an object-oriented message-passing language, just like the underlying Windows architecture (and OS/2 as well). However, once you start wrapping your mind around that concept, you find that development is no more difficult than in a traditional language—in fact, it's a good deal easier, because many of the grubby, low-level details are hidden from view. ToolBook comes with many sample scripts to help you get started. In addition, at least one company (Heizer Software of Pleasant Hill, CA) has announced a program that will convert HyperCard stacks to ToolBook format.

One extremely powerful facet of OpenScript is that it's extensible. You'll have to understand low-level Windows programming to do so, but the results could well be worth it. Suppose, for example, that you had developed a six-voice stereo music synthesizer and you wanted to build the user interface for it in ToolBook. You would write a dynamic link library (DLL) to control the hardware, link it to ToolBook, and get to work.

Windows 3.0 is currently shipping with a sample ToolBook application called DayBook, which provides a highly intuitive set of daily, weekly, and monthly calendars that provide time- and contact-management functions like some DOS-based desktop organizers.

The only sad thing about ToolBook is its price: about \$400. By contrast, Apple includes a copy of HyperCard free with every Mac.

If you're looking for a way to get into Windows programming, but without incurring the extraordinary learning curve involved, ToolBook is the way to go. **R-E**

## HARDWARE HACKER

*continued from page 78*

### NAMES AND NUMBERS

#### Alumilite

225 Parsons Street  
Kalamazoo, MI 49007  
(616) 342-1259  
CIRCLE 240 ON FREE INFORMATION CARD

#### Automotive Electronics

7 East 12th Street  
New York, NY 10003  
(212) 741-4184  
CIRCLE 241 ON FREE INFORMATION CARD

#### CMA

19 Gardner Road  
Fairfield, NJ 07004  
(201) 575-6460  
CIRCLE 242 ON FREE INFORMATION CARD

#### Dialog Information Service

3460 Hillview Avenue  
Palo Alto, CA 94304  
(415) 858-2700  
CIRCLE 243 ON FREE INFORMATION CARD

#### Electronic Goldmine

Box 5408  
Scottsdale, AZ 85261  
(602) 451-6454  
CIRCLE 244 ON FREE INFORMATION CARD

#### H & A Industries

Route 2  
Box 35E  
Bowling Green, MO 63334  
CIRCLE 245 ON FREE INFORMATION CARD

#### Heathkit

Box 1288  
Benton Harbor, MI 49022  
(616) 982-3200  
CIRCLE 246 ON FREE INFORMATION CARD

#### Lindsay Publications

Box 12  
Bradley, IL 60915  
(815) 468-3668  
CIRCLE 247 ON FREE INFORMATION CARD

#### Micro Linear

2092 Concourse Drive  
San Jose, CA 95131  
(408) 433-5200  
CIRCLE 248 ON FREE INFORMATION CARD

expensive report on this magnetic refrigeration is now available through *Technical Insights*. Much more on all

#### Micron

2805 East Columbia Road  
Boise, ID 83706  
(408) 433-5200  
CIRCLE 249 ON FREE INFORMATION CARD

#### National Semiconductor

475 Ellis Street  
Mountain View, CA 94043  
(800) 632-3531  
CIRCLE 250 ON FREE INFORMATION CARD

#### SGS-Thompson

1000 East Bell Road  
Phoenix, AZ 85022  
(602) 867-6259  
CIRCLE 251 ON FREE INFORMATION CARD

#### Short Circuits

Box 285  
Barnegat, NJ 08005  
(609) 698-3080  
CIRCLE 252 ON FREE INFORMATION CARD

#### Signetics/Philips

811 East Arques Avenue  
Sunnyvale, CA 94088  
(408) 991-2000  
CIRCLE 253 ON FREE INFORMATION CARD

#### Synergetics

Box 809  
Thatcher, AZ 85552  
(602) 428-4073  
CIRCLE 254 ON FREE INFORMATION CARD

#### Technical Insights

Box 1304  
Fort Lee, NJ 07024  
(201) 568-4744  
CIRCLE 255 ON FREE INFORMATION CARD

#### Tesla Book Company

Box 1649  
Greenville, TX 75403  
(214) 454-6819  
CIRCLE 256 ON FREE INFORMATION CARD

#### UMI

300 North Zeeb Road  
Ann Arbor, MI 48106  
(800) 521-3044  
CIRCLE 257 ON FREE INFORMATION CARD

#### Synergetics

Box 809  
Thatcher, AZ 85552  
(602) 428-4073  
CIRCLE 258 ON FREE INFORMATION CARD

*Rare Earth Resources* sidebar.

This is all so new and so hot (Uh—better make that so *cold*) that I don't have too much for you beyond these key papers of Fig. 4. One very detailed and thorough but ridiculously

this when I actually get the papers and can do some hacking of my own.

#### An audio voltmeter

*Signetics* has an intriguing cellular  
*continued on page 92*

# MARKET CENTER

## FOR SALE

**GREAT buys!** Surplus prices, ICs, linears, transformers, PS, stepping motors, vacuum pump, phototransistor, meters, LSASE, **FERTIK'S**, 5400 Ella, Phila., PA 19120.

**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.

**T.V. notch filters, surveillance equipment, brochure \$1.00. D.K. VIDEO**, Box 63/6025, Margate, FL 33063. (305) 752-9202.

**TUBES:** "oldest," "latest." Parts, components, schematics. SASE for list. **STEINMETZ**, 7519 Maplewood Ave., RE, Hammond, IN 46324.

**ENGINEERING software, PC/MSDOS.** Hobbyists — students — engineers. Circuit design \$49.00, PCB layout \$99.00, Logic simulation \$29.00, FFT analysis \$69.00, Mathematics \$39.00, Circuit analysis \$29.00. Call or write for free catalog. (614) 491-0832, **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.

## 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.O. BOX #34522 CATALOG ON THESE  
PHOENIX, AZ 85067 AND OTHER FINE  
(602) 230-0640 VIDEO PRODUCTS  
QUANTITY DISCOUNTS LIFETIME WARRANTY

VISA/MC/AMEX MEMBER OF THE BETTER BUSINESS BUREAU

**TOCOM** VIP converters w/remote from \$199.00. Tocom super chips turn on everything, \$69.00 each. Phone (219) 935-4128.

**BRAND** name computers from \$299.00 factory fresh complete systems, IBM, Laser, Emerson, closeouts, **DIGITECH**, (602) 722-4215.

**DESIGN** PLDs on IBM/PC, two 360K disks w/application book. Parts and programming services available. \$10.00 postpaid, **B. LEWIS**, PO Box 223, Palm Harbor, FL 34682.

**DESCRAMBLERS** — converters, free information and price list, wholesale prices, **SASE, S.A.C.**, 4112 N. Simmons, N. Las Vegas, NV 89030.

**PROTOQUICK Z8**, single board computer with prototype area, \$69.00. **SOFTWARE SCIENCE**, 3750 Roundbottom Road, Cincinnati, OH 45244. (513) 561-2060.

**CABLE TV** converters: Jerrold, Oak, Scientific Atlantic, Zenith & many others. "New MTS" stereo add-on; mute & volume. Ideal for 400 and 450 owners! 1 (800) 826-7623, Amex, Visa, M/C accepted. **B & B INC.**, 4030 Beau-D-Rue Drive, Eagan, MN 55122.

**TUBES**, new, up to 90% off, **SASE, KIRBY**, 298 West Carmel Drive, Carmel, IN 46032.

**PROGRAMMABLE stepper** motor drive & control for under \$100, IBM PC/XT compatible, **Commodore 64**, or other with 25 pin parallel port. PCB, interface, & software. Send for detailed literature to: **MASE**, R.D. #2 Box 166, Mohrsville, PA 19541.

**FREE catalog.** Interfaces for IBM compatibles. Digital I/O and analog input. Control relays, motors, lights, measure temperature, voltage. **JOHN BELL ENGINEERING, INC.**, 400 Oxford Way, Belmont, CA 94002. (415) 592-8411.

**RENTAL movie stabilizer.** Connect between VCRs or to monitor. Satisfaction guaranteed. \$69.95, \$4.00 handling. 1 (800) 367-7909.

**CABLE** descramblers (Jerrold) from \$40.00. Tocom VIP test chip. Fully activates unit. \$50.00. Call (213) 867-0081.

**PRINTED** circuit boards etched & drilled. Free delivery. **K & F ELECTRONICS, INC.**, 33041 Groesbeck, Fraser, MI 48026. (313) 294-8720.

**T.V. converter descramblers**, wholesale to all, Tocoms, Zeniths, Oaks, Hamlin, Jerrold, SA, COD orders accepted. **S.A.C.**, info (702) 647-3799, orders 1 (800) 622-3799.

**LASERS.** 1mw to 2kw, worlds largest selection of new & used surplus. Free catalog. **MWK INDUSTRIES**, 1269 Pomona Road, Corona, CA 91720. (714) 278-0563.

## 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

**TEST equipment** pre-owned now at affordable prices. Signal generators from \$50.00. Oscilloscopes from \$50.00. Other equipment, including manuals available. Send \$1.00 for catalog, refund on 1st order. **J.B. ELECTRONICS**, 3446 Dempster, Skokie, IL 60076. (708) 982-1973.

**CABLE-TV Scientific Atlanta 8580** Qty/price each 1/289, 5/249, 10/239, 6PM to 10PM EDT weekdays, (301) 791-5019. No Maryland orders accepted.

**DESCRAMBLERS:** dealers! We have new Z-Tac descramblers, only \$185.00 in 10 lots, with other systems available. 1 (800) 695-CABL.



## Quality Microwave TV Antennas

**WIRELESS CABLE—1.9 to 2.7 GHz. 40db Gain (+)**  
36-Channel System Complete \$149.95  
12-Channel System Complete \$114.95  
Call or Write for "FREE" Catalog

**Phillips-Tech Electronics**  
P.O. Box 8533 • Scottsdale, AZ 85252

LIFETIME WARRANTY (602) 947-7700 (\$3.00 Credit all phone orders!)  
MasterCard • Visa • COD's Quantity Pricing

**CABLE** descramblers, all brands in stock, wholesale prices to retail customers, C.O.D. orders accepted. **MOUNT HOOD ELECTRONICS** (206) 896-6837.

**LOTTERY** — IBM computer disk for all lotteries \$10.00. **ROBERTS**, Box 63/6025, Margate, FL 33063.

**OAK** Sigma descrambler, channel 3 output, rare hard-to-find factory equipment, with free documentation, \$150.00. Oak Sigma modification documentation \$20.00 postpaid. Oak VN12-4 (or Hamlin) descramblers with free remote control converter, \$85.00. Eagle remote control converter descrambler combos, \$100.00. Send moneyorder, ship postpaid within 3 days. **SURPLUS ELECTRONICS**, POB 10009, Colorado Springs, CO 80932.

## 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

**MINIATURE** electronics like James Bond. Catalog \$4.00, refundable. **F & P ENTERPRISES**, Box 51272, Palo Alto, CA 94303-L.

## CABLE TV DESCRAMBLERS! BARGAIN HEADQUARTERS!



• JERROLD™ • TOCOM • HAMLIN  
• OAK • ZENITH  
• SCIENTIFIC ATLANTA

6 month warranty! We ship C.O.D.!  
Lowest retail/wholesale prices!

FREE CATALOG:

Global Cable Network  
1032 Irving St. Suite 109  
S.F., CA 94122

NO CALIFORNIA SALES!!!

**ORDER TODAY! 800-327-8544**

**CABLE TV converters and descramblers liquidation!** Zenith, Tocom, Hamlin, Oak, Jerrold, Scientific Atlanta. Quantity discount! Order now Visa/MC/COD 1 (800) 962-6836.

**SURPLUS** electronics, motors, speakers, power supplies, adapters, etc... send for free catalog. **WINDSOR DISTRIBUTORS**, 19 Freeman Street, Newark, NJ 07105.

**CABLE TV converters and descramblers. We sell only the best. Low prices. SB-3 \$79.00. We ship C.O.D. Free catalog. ACE PRODUCTS**, PO Box 582, Dept. E, Saco, ME 04072. 1 (800) 234-0726.

## 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

## CABLE TV DESCRAMBLERS

**CABLE TV converters and descramblers bargain headquarters!** Jerrold, Tocom, Zenith, Hamlin, Scientific Atlanta. Oak M35B only \$60.00. Free Catalog! GCN, 1032 Irving Street #109, San Francisco, CA 94122. Order now! Visa/MC/COD 1 (800) 327-8544.

# 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.

## HARDWARE HACKER

continued from page 90

radio log-amplifier chip in their NE604 and described in their new ap-note AN-1991. Figure 5 shows you how to use this chip to build an audio level meter usable over an incredible 0 to -80 dBm decibel range. It accepts audio levels as low as ten microvolts, and should be useful for speaker and microphone testing, as well as for a receiver "S" meter.

Reasonably priced and wide-range log amps are a rarity, so this is a welcome chip. Be sure to let me know what other uses you can come up with for this gem.

### New tech literature

Three free new data books from SGS do include their *Power Bipolar Transistors, Zener and Rectifier Diodes*, and their new 1990 *Shortform Catalog*. From *Micron*, a *MOS Data Book* mainly on static and dynamic memories. From *Micro Linear*, a 1990 *Data Book* has just come out featuring A/D, D/A, telecomm, and power-supply circuits. And, speaking of tele-

comm, be sure to pick up the new *Telecommunications Data Book* from *National*.

Two hacker surplus sources with ultra-low prices include *Short Circuits* and the *Electronic Goldmine*.

*Automotive Electronics* is a very interesting new trade journal, while *Electronic Components and Applications* is an outstanding quarterly tech journal from *Philips*. The cost is a tad high at \$20 per year for what should be a free house organ. The latest issue includes info on solid-state visible laser diodes, pagers, phase-lock loop circuits, and oscilloscope tubes.

Our free mechanical samples this month include *Alumilite*, an easily castable urethane that sets in three minutes and easily holds small details; and the *Cycle-Flex* mechanical drive cables and fittings from *CMA*.

Turning to my own products, I do have complete autographed sets of book-on-demand published *Hardware Hacker II* reprints for all my **Radio-Electronics** columns here waiting just for you. And, for more information on self-directed research, check into my *Incredible Secret Money Machine*.

Finally, I do have a new and free mailer for you which includes dozens of insider hardware hacking secret sources. Write or call for info.

Our usual reminder here that most of the items mentioned appear either in the *Names and Numbers* or the *Rare Earth Resources* sidebars.

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**

# 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



Megahertz... that's when something is really painful.





# CONSOLIDATED ELECTRONICS



COMPLETE WITH  
NEW PRICE LIST!

## THE ULTIMATE ELECTRONICS CATALOG

Order your 260 page catalog and price list with over 14,000 money saving electronic parts and equipment! Send \$3.00 in a check or money order, or call 1-800-543-3568 today and use your Mastercard or Visa. Consolidated Electronics, Incorporated  
705 Watervliet Ave., Dayton, Ohio 45420-2599

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

CIRCLE 70 ON FREE INFORMATION CARD

### DIGITAL V.O.M./D.P.M. SALES—SERVICE—PARTS

#### FLUKE-BECKMAN-SIMPSON-ETC.

U.S. MADE ONLY. QUOTATION PRIOR TO WORK. FAST SERVICE. 90 DAY WARRANTY. STANDARDS TRACEABLE TO NBS. SINCE 1948. CALIBRATION CERTIFICATE AVAILABLE.

INDUSTRIAL INSTRUMENT WKS. INC.

5745 SALMEN, HARAHAN, LA 70123 504/733-8355

**PROJECTION TV.** Convert your TV to project 7 foot picture... Easy... Results comparable to \$2,5000 projectors... **Plans and 8" lens \$27.95...** Professional systems available... Illustrated catalog **free...** **MACROCOMA**, 15GA Main Street, Washington Crossing, PA 18977. Creditcard orders 24Hrs. (215) 736-3979.

### CABLE TV DESCRAMBLER LIQUIDATION!

- Major Makes & Models!
- Will match or beat anyone's prices!
- Dealer discounts at 5 units!
- Examples:  
HAMLIN COMBOS . \$44 ea. (Min. 5)  
OAK ADD/ON . . . . . \$40 ea. (Min. 5)  
OAK M35B . . . . . \$60 ea. (Min. 5)

#### WEST COAST ELECTRONICS

For Information: 818-709-1758  
Catalogs & Orders: 800-628-9656

**DEVICES** unavailable in USA. Kits, parts, plans. Catalog \$2.00. **WORDWAND**, 612 Orange Street, Palm Harbor, FL 34683.

**KITS** — alarms, games, and test equipment. Send \$1.00 for catalog. **RAKJAB**, PO Box 1875, Apopka, FL 32704.

## 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



**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.

**INVESTIGATORS**, experimenters — Quality plans. Micro and restricted devices. Free catalog. Self addressed stamped envelope required **KELLEY SECURITY INC.**, Suite 90, 2531 Sawtelle Blvd., Los Angeles, CA 90064.

**FREE laser catalog** lightshows, pointers, holography, etc. **lowest prices!** Write to: **MIDWEST LASER PRODUCTS**, PO Box 2187, Bridgeview, IL 60455 or call (708) 403-6984.

**PC/TV Interface** — RGB to TV/video/VCR. Switchable between PC and composite video inputs. Channels 3 or 4, RF output. Complete PC card kits \$59.95. PC board only \$19.95 Mass. residents add 5% sales tax. **INOVNICS CORP.** 9 Bartlett St., Dept. 36, Andover, MA 01810.

## Only A Few Days Left!

There are only a few days left in August and that is when our Super Special 13th Anniversary Sale on one of the broadest lines of Digital Semiconductors ends. Imagine **PRIME** Integrated Circuits for as low as 10 cents each! And for this sale, we didn't just pick a few components to serve as "Loss Leaders," but we cut prices on more than 500 items from the 74LS, 74HC, 74HCT, 4000 CMOS and Z80 Microprocessor Families in our inventory. Results: Prices so low that no other supplier can dare to come close to. Even our normal "Lower-Than-Anyone-Else" Prices for these products will be at least 20% higher after this sale is over! So, you can afford to stock up on what you need for the next several months now and still be money ahead in the future. For a complete listing of all the items on sale refer to the last issue of *Radio Electronics*. But please hurry because our Sale will Absolutely end on August 31st, 1990.



International  
Components  
Corporation

For a **FREE** copy of our New Catalog (Available Mid October), please circle Reader Service Card.

1803 N.W. Lincoln Way • Toledo, OR 97391  
PHONE (All 50 States & Canada): 1-800-325-0101  
FAX: (503) 336-4400 • Hours: 6:00 AM - 6:00 PM PST



CIRCLE 187 ON FREE INFORMATION CARD

## ABLE 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

**FLUKE SUPER SALE**

Model 73	\$ 68	Model 83	\$180
75	\$ 99	85	\$208
77	\$135	87	\$246

VISA MC

**KELVIN** Electronics  
7 Fairchild Ave., Plainview, NY 11803  
(516) 349-7620 1 (800) 645-9212

**SURVEILLANCE** — audio/video equipment — de-  
bugging. Industrial or private. 500 item catalog  
\$7.00. **SECURITY SYSTEMS**, 3017G Hudson,  
New Orleans, LA 70131.

## CABLE DESCRAMBLERS OAK M35B COMBO \$39.95

Jerrold, Zenith, Hamlin, Sci. Atlanta, Pioneer  
& MORE! OUR PRICES ARE BELOW WHOLESALE!

**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

## SATELLITE TV

**FREE** catalog — Lowest prices worldwide, save 40  
— 60%. Systems, upgrades, parts, all major brands  
factory fresh and warranted. **SKYVISION, INC.**,  
2009 Collegeway, Fergus Falls, MN 56537. 1 (800)  
334-6455. International (218) 739-5231.

**CABLE TV** secrets — the outlaw publication the  
cable companies tried to ban. HBO, Movie Channel,  
Showtime, descramblers, converters, etc. Sup-  
pliers list included. \$9.95. **CABLE FACTS**, Box 711-  
R, Pataskala, OH 43062.

**FREE** catalog 32 pages. Satellite systems, ac-  
cessories and upgrades lowest prices all major  
brands no-one undersells **WEST INC.**, since 1977 1  
(800) 222-9064.

## 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

THIS SPACE CONTRIBUTED AS A PUBLIC SERVICE

**When someone  
in your family  
gets cancer,  
everyone  
in your family  
needs help.**

Nobody knows better than  
we do how much help and  
understanding is needed. That's  
why our service and rehabilitation  
programs emphasize the whole  
family, not just the cancer patient.

Among our regular services  
we provide information and  
guidance to patients and families,  
transport patients to and from  
treatment, supply home care items  
and assist patients in their return  
to everyday life.

Life is what concerns us.  
So you can see we are even  
more than the research organi-  
zation we are so well known to be.

No one faces cancer alone.

AMERICAN CANCER SOCIETY

THIS SPACE CONTRIBUTED AS A PUBLIC SERVICE

**A defense  
against cancer  
can be cooked up  
in your kitchen.**

There is evidence that  
diet and cancer are related.  
Follow these modifications in  
your daily diet to reduce  
chances of getting cancer:

1. Eat more high-fiber foods  
such as fruits and vegetables  
and whole-grain cereals.
2. Include dark green and  
deep yellow fruits and vegeta-  
bles rich in vitamins A and C.
3. Include cabbage, broccoli,  
brussels sprouts, kohlrabi and  
cauliflower.
4. Be moderate in consump-  
tion of salt-cured, smoked, and  
nitrite-cured foods.
5. Cut down on total fat in-  
take from animal sources and  
fats and oils.
6. Avoid obesity.
7. Be moderate in consump-  
tion of alcoholic beverages.

No one faces cancer alone.

AMERICAN CANCER SOCIETY

# MCM ELECTRONICS

*The Best Of All Worlds!*



Place just one order from our new 192-page catalog of over  
15,000 in-stock products and discover why thousands of satis-  
fied customers have chosen MCM as their #1 supplier of parts  
and components. Choose from an extensive selection of high-  
quality products from some of the most respected names in  
the industry like RCA/GE, Switchcraft, Weller, PIC, Excelite,  
Pyle, Cambridge, Mueller and many more. Enjoy TOLL-FREE  
or FAX ordering, convenient hours,  
fast delivery, a variety of payment  
options and superior customer  
service support, too. Make MCM  
your #1 choice and start enjoying  
the best of all worlds today!

Get Your **FREE, ONE-YEAR**  
**SUBSCRIPTION** to the MCM  
Electronics Catalogs, Call  
**TOLL-FREE, 1-800-543-4330.**



**MCM ELECTRONICS**

650 CONGRESS PARK DR.  
CENTERTVILLE, OH 45459-4072

A PREMIER Company

**SOURCE NO. RE-65**

SEPTEMBER 1990

CIRCLE 87 ON FREE INFORMATION CARD

# CATV CONVERTERS AT LOWEST PRICES

Panasonic, Jerrold, Tocom, Pioneer, Scientific Atlanta, Zenith, Oak, Hamlin, Eagle, and all other brands  
**Microwave Antennas** (wireless cable) with matching descramblers

Call Mon-Fri 10AM - 5:30PM  
Eastern time or write for

**FREE CATALOG**



NO CONNECTICUT SALES. It is not the intent of Universal View to defraud any pay television operator and we will not assist any company or individual in doing so. WAIVER: I, the undersigned, am a consenting adult of at least 21 years of age, and fully understand that ownership of a cable decoder does not give the owner of the decoder the right to decode or view premium cable channels without proper authorization from their local cable company, and hereby declare under penalty of perjury that all products purchased, at any time, will only be used on cable TV systems with proper authorization from local officials or cable company officers in accordance with all applicable federal and state laws. Federal and various state laws provide for substantial criminal and civil penalties for unauthorized use.

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

## UNIVERSAL VIEW

520 GLENBROOK ROAD, SUITE NO 202  
STAMFORD, CT 06906

Orders Only: **1-800-622-9022**  
Catalog & Info: **(203) 975-7543**

CIRCLE 64 ON FREE INFORMATION CARD

# LEARN TV/VCR REPAIR

Now you can train at home in spare time for a money-making career as a TV/VCR Repair Specialist. No previous experience necessary. No need to quit your job or school. Everything is explained in easy-to-understand language with plenty of drawings, diagrams and photos. We show you how to troubleshoot and repair video-cassette recorders and TV sets; how to handle house calls and shop repairs for almost any make of television or VCR. Tools are included with your course so you can get "hands-on" practice as you follow your lessons step by step. Send for free facts about the exciting opportunities in TV/VCR Repair and find out how you can start making money in this great career. **MAIL COUPON TODAY**

**ICS SCHOOL OF TV/VCR REPAIR, Dept. DE080**  
925 Oak Street, Scranton, PA 18515

Please send me full information and color brochure on how I can learn TV/VCR Repair at home in my spare time. I understand there is no obligation and no salesman will visit me.

Name \_\_\_\_\_ Age \_\_\_\_\_  
Address \_\_\_\_\_ Apt. # \_\_\_\_\_  
City/State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone ( ) \_\_\_\_\_

## 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.

**VIDEO** tape VHS basic cleaning and maintenance. TV one and a half hours, VCR one hour. \$38.00 each. **JAMES BRADFORD**, PO Box 38359, Detroit, MI 48238.

**ELECTRONIC review** Detailed electronics reviewing for better grades, interviews, and promotions. Over 300 pages \$39.95 include \$4.25 shipping. **USER-GRAPHICS**, Education Department, 7136 Everett, Boise, ID 83704-7415.

**LEARN IBM PC assembly language.** 80 programs. Disk \$5.00. Book \$18.00. **ZIPFAST**, Box 12238, Lexington, KY 40581-2238.

**TURN your love into a living!** The professional video industry needs qualified technicians. Institute of Audio Research, the world leader in audio education, announces the **Video Technology Program** for people like you. In under a year turn your flair for electronics into highly marketable skills. Grads work in broadcast television, production companies, manufacturers, corporate communications, etc. Financial aid available if qualified. HS diploma or GED required. **INSTITUTE OF AUDIO RESEARCH**, 64 University Place, New York, NY 10003. (800) 544-2501. NY, NJ, CT (212) 777-8550.

## 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

## WANTED

**INVENTIONS/new products/ideas wanted:** Call **TLCI** for free information. 1 (800) 468-7200 24 hours/day - USA/Canada.

**TRAVEL!** High income! Radio officers wanted for shipboard employment. Must have FCC Second Telegraph license. Rae Echols, **AMERICAN RADIO ASSOCIATION**, 5700 Hammonds Ferry, Linthicum Heights, MD 21090. (301) 850-5379.

# Parts Express

International Inc.

**EMINENCE**



**MOTOROLA**

**Polydax**

**1-800-338-0531**

**PIONEER**

### 3-WAY 100W CROSSOVER

12 dB/octave rolloff.  
800Hz, 5000Hz  
crossover points. 8  
ohm. 100 watts RMS.



#260-210 **\$12.50** **\$9.95**  
(1-9) (10-up)

### SPEAKER CONTROL PANEL

Panel with 50 watt L-pads  
for tweeter and midrange  
and built-in LED power  
meter. 5" x 2 1/2" 100  
watt version available



#260-235 **\$14.50** **\$12.90**  
(1-5) (6-up)

### 12" POLY WOOFER

Super duty, 40 oz. magnet.  
100 watts RMS, 145 watts  
max. 4 and 8 ohm compat-  
ible (6 ohm). 2" voice coil.  
fs = 25 Hz. QTS = .166,  
VAS = 10.8 cu. ft.  
Response: 25-1800 Hz. Net  
weight: 9 lbs. Pioneer  
#A30GU40-51D



#290-125 **\$36.80** **\$34.50**  
(1-3) (4-up)

### 15" WOOFER

Original Sanyo  
woofer. Paper  
cone with vented  
dust cap and  
treated cloth  
surround. 12 oz.  
magnet. 60 watts  
RMS, 85 watts  
max. 8 ohm.  
Resonance: 26 Hz.  
Response: 25-  
2,500 Hz.



#291-155 **\$23.90** **\$21.90**  
(1-5) (6-up)

### PIONEER HORN

**TWEETER**  
Mylar dome. 2.33 oz.  
barium ferrite magnet. 8  
ohm. Response: 1800-  
20000 Hz. 35W RMS,  
50W max. fs = 2000 Hz,  
SPL = 106 dB. Pioneer  
#AHE80-51F



#270-050 **\$6.50** **\$5.90**  
(1-9) (10-up)

### 12" SUB WOOFER

Dual voice coil sub woofer.  
30 oz. magnet, 2" voice  
coils. 100 watts RMS, 145  
watts max. fs = 25 Hz. 6 ohm  
(4 and 8 ohm compatible).  
SPL = 89 dB 1W/1M.  
Response: 25-700 Hz.  
QTS = .31, VAS = 10.3 cu. ft.  
Pioneer #A30GU30-55D.  
Net weight: 6 lbs.



#290-145 **\$39.80** **\$36.80**  
(1-3) (4-up)

### 15" THRUSTER WOOFER

Thruster by Eminence.  
Made in USA. Poly foam  
surround, 86 oz. magnet.  
2-1/2", 2 layer voice coil.  
180 watts RMS, 210 watts  
max. 4 ohm. fs = 23.5  
Hz, QTS = .33, VAS = 17.9  
cu. ft. SPL = 94.8 dB 1W/  
1M. Net weight: 15 lbs.



#290-180 **\$43.50** **\$39.80**  
(1-3) (4-up)

### GRILL FRAME KIT

With this kit you  
can make speaker  
grill frames up to  
30" x 40". Kit  
includes 4 corner  
pieces, 2 "T"  
brackets, and 7  
frame bars. Grill  
mounting kit  
included.



#260-333 **\$8.50** **\$7.80**  
(1-9) (10-up)

### 18" EMINENCE WOOFER

MADE IN USA

100 oz. magnet, 3" voice  
coil. 250 watts RMS, 350  
watts max. 8 ohm, 30 Hz  
resonant frequency. 22-  
2700 Hz response.  
Efficiency: 95 dB 1W/1M.  
Paper cone, treated  
accordian surround. Net  
weight: 29 lbs.



#290-200 **\$98.90** **\$89.50**  
(1-3) (4-up)

### TITANIUM COMPOSITE

**TWEETER**

Titanium is deposited on a polymer  
dome to combine the advantages of  
both hard and soft dome  
technologies. 8 ohm. Ferro fluid  
cooled voice coil. fs = 1200 Hz,  
SPL = 90 dB 1W/1M. 50 watts RMS,  
70 watts max. 4" round. Polydax  
part #DTW100T125.



#270-047 **\$27.50** **\$24.80**  
(1-9) (10-up)



**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-6:00 pm EST, Monday - Friday \*Mail order  
customers, please call for shipping estimate on orders exceeding  
5 lbs.

CIRCLE 56 ON FREE INFORMATION CARD

**INVENTORS!** Confused? Need help? Call **IMPAC** for free information package. In US and Canada: 1 (800) 225-5800.

**WANTED: Australian Kit Supplier** is seeking bulk suppliers of any interesting new and disposal electronic components and assemblies: Eg: image converter tubes (RCA 6032, RCA 6929, XX1080 etc.), laser tubes/diodes/accessories, lens assemblies, small C.R.O. tubes, etc. etc., **OATLEY ELECTRONICS**, PO Box 89, Oatley, N.S.W. 2223, Sydney, Australia Ph: (02) 5794985 Fax: (02) 5707910.



**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 60010  
No Illinois Orders Accepted.

**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**, 3540 Wilshire Blvd. #310, Dept. FX200, LA, CA 90010.

**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.

**INVENTORS:** We submit ideas to industry. Find out what we can do for you. Call 1 (800) 288-IDEA.

**AMAZING**  
**SCIENTIFIC & ELECTRONIC**  
**PRODUCTS**

**PLANS ARE IN STOCK**

GRA1	ANTI GRAVITY GENERATOR	\$1000
LC7	40 WATT BURNING CUTTING LASER	\$2000
RUB4	HI POWER PULSED DRILLING LASER	\$2000
BTC5	1 MILLION VOLT TESLA COIL	\$2000
MCP1	HI VELOCITY COIL GUN	\$1500
LLS1	LASER LIGHT SHOW 3 METHODS	\$2000
EH1	ELECTRONIC HYPNOTISM TECHNIQUES	\$800
EML1	LOWER POWERED COIL GUN LAUNCHER	\$800
JL3	JACOB LADDER 3 MODELS	\$1000
SD5	SEE IN THE DARK	\$1000
LEV1	LEVITATION DEVICE	\$1000

**ASSISTANCE KITS PROGRAM AVAILABLE**

FMV1K	3 MILE FM VOICE TRANSMITTER	\$34.50
PFS1K	HAND CONTROLLED PLASMA FIRE SABER	\$49.50
NIG7K	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

**ASSEMBLED IN OUR LABS**

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
JAT30	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
BLS10	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, MO 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

**NUTS & VOLTS** MAGAZINE P.O. Box 1111-E Placentia, CA 92670 714-632-7721

**GIVE YOURSELF A BREAK - A PRICE BREAK!** NUTS & VOLTS will **Save** you MONEY ON ELECTRONIC PARTS & EQUIPMENT. Plus SHOW YOU WHERE TO FIND UNIQUE, UNUSUAL AND HARD-TO-FIND ITEMS. **SUBSCRIBE TODAY!** Orders Only 800-783-4624

*A National Publication For The Buying And Selling Of Electronic Equipment*

**BUSINESS OPPORTUNITIES**  
**EASY** work! Excellent pay! Assemble products at home. Call for information. **(504) 641-8003** Ext. 5192.

**MAKE \$50/hr** working evenings or weekends in your own electronics business. Send for free facts. **INDUSTRY**, Box 531, Bronx, NY 10461.

**TUBES - 2000 TYPES**  
**DISCOUNT PRICES!**  
Early, hard-to-find, and modern tubes. Also transformers, capacitors and parts for tube equipment. Send \$2.00 for 2 page wholesale catalog.

**ANTIQUE ELECTRONIC SUPPLY**  
688 W. First St. • Tempe, AZ 85281 • 602/894-9503

**MARK V ELECTRONICS, INC.**  
**Competitive Pricing \* Fast Shipping**

**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

**Special Offer**

Amplifier	TA-3600	TA-477	TA-802	TA-1000A
+ Metal Cabinet	LG-1925	LG-1925	LG-1924	LG-1924
+ Transformer	#007	#003	#001	#001
Kit Set	\$ 138.60	\$ 115.20	\$ 91.75	\$ 104.12
Assemb. Set	\$ 160.20	\$ 130.50	\$ 104.15	\$ 122.92

\* Due to this special offer & low price, we can only exchange or repair any of these units (TA-3600, TA-477, TA-802 & TA-1000A) within 15 days of your receipt.  
\* The above prices are for the complete sets. For separate unit price, please see below.

**Special Price**

SM-328	\$ 139.00	<del>\$ 150.00</del>
SM-333	\$ 70.00	<del>\$ 80.00</del>
TA-2500	\$ 68.80	<del>\$ 99.80</del>
TA-2400A	\$ 96.00	<del>\$ 126.00</del>

Transformer TA-802  
Metal Cabinet TA-477  
TA-1000A  
TA-3600

**AMPLIFIERS**

MODEL	DESCRIPTION	KIT	ASSMB.
TA-28MK2	Digital Voice Memo ▲▲	\$ 30.00	
TA-50A/B	Multi-Purpose Melody Generator ▲	11.84	\$ 16.58
TA-50C	Multi-Purpose Melody Generator ▲	12.65	17.71
TA-120MK2	35W Class "A" Main Power Mono Amp ▲▲	27.16	38.81
TA-300	30W Multi-Purpose Single Channel Amp ▲	20.00	29.00
TA-302	60W Stereo Power Booster (w/case) ▲▲		70.00
TA-323A	30Wx2 Stereo Pre-main Amp ▲	29.50	38.35
TA-377A	Hi-Quality FET Stereo Pre-Amp ▲▲▲	59.95	75.00
TA-400	40W Solid State Mono Amp ▲	28.00	34.93
TA-477	120W Mostlet Power Mono Amp ▲▲	68.00	85.00
TA-800	80W+80W DC Pre-Main & Power Amp ▲▲	60.92	79.20
TA-802	80W+80W DC Stereo Main Power Amp ▲▲	45.94	59.72
TA-820A	60W+60W OCL DC Pre-Main Stereo Amp ▲▲	40.39	49.37
TA-1000A	100W Dynamic Class "A" Main Power Mono Amp ▲▲	59.89	80.58
TA-1500	100Wx2 Class "A" DC Stereo Pre-Main Amp ▲▲▲	73.70	95.81
TA-2200	FET Super class "A" DC Pre-Amp ▲▲	47.70	58.24
TA-2400A	Electronic Echo & Reverberation Amp ▲▲▲		96.00
TA-2500	HQ Pre-Amp. w/10 band graphic equalizer ★		68.80
TA-2800	HI-FET IC Pre-Amp. w/3 way tone control ▲	48.90	63.57
TA-3000	Stereo Simulator (mono TV / any mono source) ▲▲	27.00	38.50
TA-3600	300W HQ HI-Fi Power Mono Amp ▲▲	79.00	103.00

**MISCELLANEOUS**

MODEL	DESCRIPTION	KIT	ASSMB.
TY-23B	3 Channel Color Light Controller ▲▲▲	\$ 51.20	\$ 65.00
TY-25	Stereo Loudspeaker Protector ▲	12.65	18.88
TY-35	FM Wireless Microphone	9.22	
TY-36	AC/DC Quartz Digital Clock ▲	18.00	25.20
TY-38	Sound/Touch Control Switch ▲	12.00	
TY-41MKV	Infrared Remote Control Unit w/case ▲▲	20.00	35.00
TY-42	Bar/Dot Level Meter ▲	24.15	
TY-43	3 1/2 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	38.80
SM-328	4 Channel Professional Color Light Controller★		139.00
SM-333	Audio/Video Surround Sound Processor ▲▲▲	62.00	70.00
SM-666	Dynamic Noise Reduction ▲	26.00	34.00

**POWER SUPPLIES**

MODEL	DESCRIPTION	KIT	ASSMB.
TR-100A	O-15V 2A Regulated DC Power Supply (w/case) ▲▲▲	\$ 69.50	
TR-355A	O-15V 5A Regulated DC Power Supply ▲	14.55	20.76
TR-355B	O-30V 3A Regulated DC Power Supply ▲	14.55	20.76
TR-503	O-50V 3A Regulated DC Power Supply ▲	15.75	22.65

**INSTRUMENTS**

MODEL	DESCRIPTION	KIT	ASSMB.
SM-43	3 1/2 Multi-Functional Led D.P.M. (w/ABS plastic case) ▲▲	\$ 34.50	\$ 43.00
SM-48	4 1/2 Hi-Precision D.P.M.▲▲	38.00	48.00
SM-48A	4 1/2 Hi-Precision D.P.M. (w/ABS plastic case) ▲▲	41.20	52.00
SM-49	3 1/2 Multi-Functional LCD D.P.M. (w/hold function) ▲	36.00	44.50
SM-100	150 MC Digital Frequency Counter ▲▲	79.00	90.00
FC-1000A	1 GHz Frequency Counter ★		179.00

**METAL CABINETS WITH ALUMINUM PANEL**

MODEL	H" x W" x D"	MATCHING	PRICE
LG-1273	3" x 12" x 7"	TA-2800, TA-377A, TA-2200	\$ 22.16
LG-1684	4" x 16" x 8"	TA-323A, TA-377A, TA-2200	26.64
LG-1924	4" x 19" x 11 1/2"	TA-802, TA-820A, TA-1500, TA-120MK 2, TA-800, TA-1000A	32.00
LG-1925	5" x 19" x 11 1/2"	TA-477, TA-800, TA-1500, TA-1000A, TA-3600	35.00
LG-1983	2 1/4" x 19" x 8"	TA-377A, TA-2800, TA-2200, TA-120MK 2	28.50

**POWER TRANSFORMERS**

MODEL	DESCRIPTION	MATCHING	PRICE
#001	56VCT, 60VCT 6A	TA-800, TA-802, TA-820A, TA-1000A, TA-1500	\$ 26.00
#002	72VCT 3A	TR-503, TA-323A, TA-400, TA-300	21.00
#003	80VCT 6A	TA-477	27.00
#004	48VCT 6A	TA-120 MK 2	21.00
#005	52VCT 3A	TR-355B	15.00
#006	36VCT 5A	TR-355A	14.50
#007	112VCT 8A	TA-3600	42.00

We accept all major credit cards. Money Order, 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 (incl. \$3.00) and ship by US mail Business & Showroom hours: (Pacific Time) Mon. thru Fri. 9:30 am to 5:00 pm 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

SEPTEMBER 1990

## THE ELECTRONIC GOLDMINE

### BATTERY OPERATED BLACK LIGHT KIT

- ★ Detects Invisible Fluorescent Inks, Fluorescent Minerals, etc.
- ★ Uses Large Unfiltered U Shaped Black Light Tube



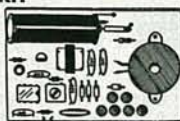
**UNIQUE**

- ★ Comes with PC Board, Parts, Tube and Instructions
  - ★ Operates from Any 6V Battery Source (not Incl.)
- Size of Board: 7" x 1.8"

**C6356 \$13.95**

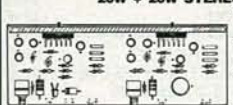
### MINI GEIGER COUNTER KIT

- ★ 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**

### 20W + 20W STEREO AMP KIT

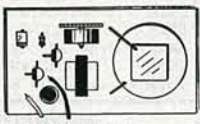


- ★ Boost Car Stereos, Tape Players, Portable Radios, etc.
- ★ Features 2 Separate 20W RMS Amps with Level Controls
- ★ Operates on Standard 12V Car Battery
- ★ Comes with PC Board, Parts and Instructions-you supply speakers
- ★ Size of PC Board: 6" x 2.25"

**C6442 \$19.95**

### INFRARED DETECTOR KIT

- ★ Detects ALL Types of Infrared (TV/VCR Remotes, LEDs)
- ★ Produces Sound and Bright Red LED Output
- ★ Operates on 9V Battery (not Incl.)
- ★ Comes with PC Board, Parts and Instructions
- ★ Size of PC Board: 2.5" x 1.4"



**C6441 \$5.95**

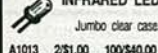
### INFRARED MODULE



Small infrared receiver module is sensitive to almost all infrared remote controllers and features high gain. Has only 3 hookup pins. Operates from 9VDC and is very sensitive (it will light an LED or close a low voltage relay from up to 500' away). Module and hookup diagram only-you provide output device of LED or relay. Size of PC Board: 9" x 3" x .4"

**G514 \$1.29**

### INFRARED LED



### INVERTER TRANSFORMER

Small 4 lead transformer to be used with 555 IC circuit to convert 12VDC to 250VAC for strobes fluorescent tubes. Comes with schematic.

**A1013 2/\$1.00 100/\$40.00**

**N1703 \$2.00 EACH 100/\$170.00**

MINIMUM ORDER: \$10.00 plus \$3.00 shipping and handling. We accept MC, Visa and Money Orders. SEND ORDERS TO: The Electronic Goldmine, P.O. Box 5408, Scottsdale, AZ 85261. PHONE ORDERS: (602) 451-7454

CIRCLE 176 ON FREE INFORMATION CARD

## CABLE TV DESCRAMBLERS

\*\*\*\*\* PRESENTING \*\*\*\*\*  
**JERROLD, HAMLIN, OAK**  
 AND OTHER FAMOUS MANUFACTURERS  
 • FINEST WARRANTY PROGRAM AVAILABLE  
 • LOWEST RETAIL/WHOLESALE PRICES IN U.S.  
 • ORDERS SHIPPED FROM STOCK WITHIN 24 HOURS  
**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

**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, 15GAX Main Street, Washington Crossing, PA 18977...** Credit-card orders 24Hrs. (215) 736-2880.

**RECOVER** pure gold from scrap circuit boards, electronic parts. Easy methods. Send \$5.00, **RECYCLING, Box 11216PE, Reno, NV 89510-1216.**

**WHY rent?** Homes for \$1.00, repos. Gov't give away programs! For information (504) 649-0670 Ext. R-5192.

**LET** the government finance your small business. Grants/loans to \$500,000. Free recorded message: (707) 449-8600. (KS1).

**EASY! Moneymaking** one man CRT rebuilding machinery. \$6,500.00 — \$11,900.00. **CRT, 1909 Louise, Crystalake, IL 60014. (815) 459-0666.**

**YOUR own radio station!** AM, FM, TV, cable. Licensed/unlicensed. **BROADCASTING, Box 130-F9, Paradise, CA 95967.**

## BEST BY MAIL

Rates: Write National, Box 5, Sarasota, FL 34230

### BOOKS - CATALOGS - MAGAZINES

FREE CATALOG-DESIGNER Clothing, OMEGA, 101(RE) Clematis, Pensacola, FL 32503-2834.

### BUSINESS OPPORTUNITIES

**900 PHONE NUMBERS-\$5,000 +** possible weekly, little money needed, I'll teach you. Send \$9.95 + \$1.00 S/H. RSI, Box 660(RE), H.V., PA 19006.

### MONEYMAKING OPPORTUNITIES

**CLUE INTO PROFITS** as a Private Investigator! Details \$1.00! PPS, 11504 Hughes, Houston, TX 77089.

**ARE YOU ITCHING** to make more money? Details. Grayco, 16123 Crystalcreek, Cerritos, CA 90701.

### OF INTEREST TO ALL

**HAVE SOME FUN!** Introductions. Confessions. Jokes. Advice. 1-900-FUN-1990. \$.95 minute.

**BANISHED 1,500 YEARS!** Translation of Ancient Manuscript, Gospel of Jesus Rediscovered. Free details. Rare Books(RE), 11246 South Post oak, Suite 306, Houston, TX 77035.

**ROBOTS! FULLY ASSEMBLED** and kits, robot arms, PC interfaces, motor sensors. \$30.00 to \$80,000.00. Catalog \$5.00 refundable with order. HTO, P.O. Box 3084, RSP, CA 92067.

## 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 Massachusetts or Canada call (413) 568-3753.

## COMPUTER KITS



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.

**General Technics**  
 Quality Computer Systems  
 Post Office Box 2878  
 Lake Ronkonkoma, NY 11779  
 (516) 961-9473

ask for your free catalog

## 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# PRICE  
**SB1052 \$39.99**

### LASER DIODE (INFRA-RED)



- Output: 10 mW (max.)
- Current: 90-150 mA
- Operating Voltage: 2.2-2.5V
- Wavelength: 820nm

STOCK# PRICE  
**SB1053 \$9.99**

### LASER DIODE (VISIBLE-RED)



- Output: 5 mW (max.)
- Current: 65-100 mA
- Operating Voltage: 1.75-2.2V
- Wavelength: 780nm

STOCK# PRICE  
**LS022 \$19.99**

### LASER DIODE (VISIBLE-RED)



- Output: 5 mW (max.)
- Current: 20 mA
- Operating Voltage: 2.2-3.0V
- Wavelength: 665nm

STOCK# PRICE  
**LS3200 \$129.99**

## 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 450ns	6.49	6.17	5.55
2758	24	1024 x 8 450ns	3.99	3.79	3.41
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-CMOS)	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



10010 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**















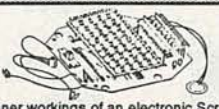
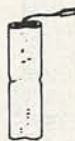


Minimum Order: \$15.00

ORDER BY PHONE!

CIRCLE 186 ON FREE INFORMATION CARD

QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING

# ALL ELECTRONICS CORP.

<p><b>PIEZO BUZZER</b></p> <p>Part# HMB-06 Operates from 4-6 Vdc. TL compatible. Draws 20 mA @ 6 Vdc. Emits high pitched signal. 0.62 diameter, 0.55" high. PC pins. CAT# PBZ-06 \$1.50 each</p> 	<p><b>16 CHARACTER LCD DISPLAY</b></p> <p>Hitachi# LM015 16 character dot matrix LCD display with built-in controller/driver. Interfaces with 4 or 8 bit MPU. Displays alphanumeric, kana characters and symbols. CMOS - low power dissipation. Operates on 5 Vdc. Module size: 3.14" X 1.40". Display area: 2.53" X 0.54". Character size: 0.25" high X 0.115" wide. Programming and hook-up instructions included. CAT# LCD-1 \$9.50 each</p> 	<p><b>INSTRUMENT ENCLOSURES</b></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 heights. Includes non-skid rubber feet and hardware. Available in beige, ivory, black, and blue. Panel ht. CAT# MB-A \$7.50 each 10 for \$65.00 2 5/8" CAT# MB-B \$7.75 each 10 for \$67.50 3" CAT# MB-C \$8.00 each 10 for \$70.00 Please specify color.</p> 	<p><b>SOUND ACTIVATED SWITCH</b></p> <p>PC board with electret mike responds to sounds in immediate vicinity. Originally part of sound activated light organ. Shuts off when sound is not present. Includes hook-up diagram. CAT# SAB-2 \$2.50 each</p> 	
<p><b>PHOTO RESISTOR</b></p> <p>100 ohms light 6K ohms dark. 1.182" dia. X .08" high. 1.18" long leads. CAT# PRE-7 2 for \$1.00 100 for \$45.00 • 1000 for \$400.00</p> 				
<p><b>SWITCHES</b></p> <p><b>TT PUSH BUTTON</b> TT MDPL series. 3/4" X 1/2" grey rectangular key cap. S.P.S.T. N.O. Push to close. RATED: 0.1 amp switching. 0.25 amp carry current. P.C. mount. CAT# PB-8 65¢ each • 10 for \$6.00 100 for \$50.00</p>  <p><b>SPDT PUSHBUTTON</b> Marquardt# 1843 Rated 6 amps @ 125/250 Vac. Black plastic pushbutton. Switch body: .92" X .94" X .65". CAT# PB-18 \$1.65 ea. • 10 for \$15.00</p>  <p><b>PUSHBUTTON SWITCH</b> 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><b>THUMBWHEEL SWITCH</b> 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" high bezel. CAT# SWTH-9 \$1.25 each 10 for \$10.00 2 END PLATES - CAT# SW-9EC \$1.00/Set</p> 	<p><b>NICKEL-CAD BATTERIES (RECHARGEABLE)</b></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 500 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><b>0 - 6 HOUR AUTO SHUT-OFF TIMER</b></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><b>LED'S</b></p> <p><b>STANDARD JUMBO</b> DIFFUSED T 1-3/4 size RED CAT# LED-1 10 for \$1.50 • 100 for \$13.00 GREEN CAT# LED-2 10 for \$2.00 • 100 for \$17.00 YELLOW CAT# LED-3 10 for \$2.00 • 100 for \$17.00</p> <p><b>FLASHING LED</b> with built in flashing circuit operates on 5 volts... RED \$1.00 each CAT# LED-4 10 for \$9.50 GREEN \$1.00 each CAT# LED-4G 10 for \$9.50</p> <p><b>LED HOLDER</b> Two piece holder. CAT# HLED 10 for 65¢</p> <p><b>RECTANGULAR L.E.D. SPECIAL</b> #HLMPO301 Red diffused rectangle. 0.28" X 0.1" X 0.29" high. Ideal for bargraphs, chasers, etc. CAT# RLED-4 10 for \$1.50 • 100 for \$12.00 1000 for \$100.00</p> <p><b>LED GRAB BAG</b> 50 assorted L.E.D.'s Many different shapes, colors, sizes. Round, rectangular, curved, etc. CAT# GRLED \$4.00 per assortment</p>	<p><b>L.E.D. FLASHER KIT</b></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><b>LED CHASER KIT</b></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><b>SPECIAL PURCHASE</b> 210 MFD 330 V 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. CAT# PPC-210 \$2.50 each 10 for \$22.50 • 100 for \$200.00 Large quantities available. Call for pricing.</p> 	<p><b>STEPPING MOTOR CONTROLLER KIT</b></p> <p>Learn about stepping motors while building this simple circuit. Includes circuit board and all parts except 12 Vdc power supply. CAT# SMKIT \$18.00 each</p> 	
	<p><b>XENON TUBE</b></p> <p>1" long flashtube with 3 1/2" red, and black leads. Ideal for electronic flash or strobe projects. CAT# FLT-3 2 for \$1.00</p> <p><b>RELAYS</b></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. DIP RELAY Miniature relay fits standard 16 pin (dip) sockets or will directly mount to p.c. boards. GI Clare# LM44D00 • 280 ohm • 30 va switching. CAT# CRLY-12 \$2.50 each</p> <p>24 VOLT D.C. COIL KUP style 11 pin base can be socketed, direct soldered or quick connect terminals can be used. 1 3/8" x 1 1/2" x 2". 3 P.D.T. • 5 amp contacts • 470 ohm CAT# RLY-3524 \$2.25 each</p>	<p><b>STEPPER MOTOR</b></p> <p>Airpax 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><b>ELECTRONIC GAME BOARD</b></p> <p>The inner workings of an electronic Scrabble game. Operates on 6 Vdc. 8 digit alphanumeric readout, 45 button keypad, 14 transistors, 2 I.C.'s, 1 piezo element and other goodies. Top and bottom row of keypad buttons are function keys, middle 3 rows are alphabetic. No instructions available. 6" X 4.45". CAT# ST-4 \$1.75 each 10 for \$15.00</p> 	<p><b>RECHARGEABLE BATTERY PACK (USED)</b></p> <p>Four AA nickel cadmium batteries connected in series to make a 4.8 volt pack. Batteries are in a 2 X 2 configuration with a 2 pin connector attached. The four batteries can be separated into single AA size solder tab nickel cadmium batteries or resoldered into other configurations. SPECIAL SALE PRICE NOW \$3.00 per pack • 10 packs for \$25.00 CAT# NCB-41AAU</p> 	
<p><b>WALL TRANSFORMERS</b></p> <p>ALL PLUG DIRECTLY INTO 120 VAC OUTLET</p> <p>6 Vac @ 600 ma. CAT# ACTX-660 \$3.50 8.3 Vdc @ 10 ma. CAT# DCTX-8310 \$1.50 12 Vdc @ 500 ma. CAT# DCTX-125 \$4.50 9 Vdc @ 1 amp. CAT# DCTX-951 \$5.00 24 Vac @ 625 ma. CAT# ACTX-2462 \$3.00</p>		<p><b>RG-11/75 OHM VIDEO CABLE</b></p> <p>100 ft. or 200 ft. rolls of RG 11/U terminated to heavy duty F connectors. Includes 75 ohm terminator and F-61 splicer on one end. New cables manufactured for IBM PC networks. IBM P/N 1501908 COMSCOPE. CAT# RG-11-1 100 ft. roll \$15.00 CAT# RG-11-2 200 ft. roll \$27.50</p> 	<p><b>OPTO SENSOR</b></p> <p>U shaped package with mounting ears. 1/8" opening. 3/4" mounting ears. CAT# OSU-6 50¢ each 10 for \$4.50 • 100 for \$40.00</p> <p><b>REFLECTIVE OPTO SENSOR</b> Optek# K-8711 Wedge shaped device with IR emitter and receiver pointing the same direction. Light rays from emitter bounce off nearby object and register on receiver. Effective range approx. 0.15". CAT# OSR-1 75¢ each</p> 	

ORDER TOLL FREE 1-800-826-5432

FAX (818) 781-2653 • INFORMATION (818) 904-0524

Call Or Write For Our Free 60 Page Catalog  
Outside the U.S.A. send \$2.00 postage for a catalog.

Minimum Order \$10.00 • All Orders Can Be Charged To Visa, Mastercard Or Discovercard • 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 • Quantities Limited • No C.O.D. • Prices Subject to change without notice.



MAIL ORDERS TO: ALL ELECTRONICS CORP • P.O. BOX 567 • VAN NUYS, CA 91408

CIRCLE 107 ON FREE INFORMATION CARD

SEPTEMBER 1988

**Intel Math Coprocessors**

8088 or 8086 Systems		
8087	5MHz	\$89.95
8087-2	8MHz	\$129.95
8087-1	10MHz	\$169.95
80286 Systems		
80287	6MHz	\$139.95
80287-8	8MHz	\$209.95
80287-10	10MHz	\$239.95
80386 Systems		
80387-16	16MHz	\$349.95
80387-20	20MHz	\$399.95
80387-25	25MHz	\$499.95
80387-33	33MHz	\$649.95

**SIP Modules**

41256A9A-80	80ns, 256Kx9	\$54.95
41256A9A-10	100ns, 256Kx9	\$44.95
421000A9A-70	70ns, 1Mx9	\$169.95
421000A9A-80	80ns, 1Mx9	\$124.95
421000A9A-10	100ns, 1Mx9	\$116.95
94000L-80	80ns, 4Mx9	\$499.95
94000L-10	100ns, 4Mx9	\$499.95

**SIMM Modules**

41256A9B-80	80ns, 256Kx9	\$49.95
41256A9B-10	100ns, 256Kx9	\$39.95
421000A8B-10	100ns, 1Mx8	\$109.95
421000A9B-70	70ns, 1Mx9	\$139.95
421000A9B-80	80ns, 1Mx9	\$119.95
421000A9B-10	100ns, 1Mx9	\$113.95
94000S-80	80ns, 4Mx9	\$499.95
94000S-10	100ns, 4Mx9	\$499.95

**NEC V20 & V30 Chips**

UPD70108-5	5MHz, V20 Chip	\$5.25
UPD70108-8	8MHz, V20 Chip	\$6.95
UPD70108-10	10MHz, V20 Chip	\$10.95
UPD70116-8	8MHz, V30 Chip	\$7.95
UPD70116-10	10MHz, V30 Chip	\$13.49

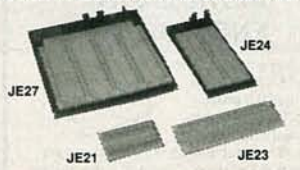
**Dynamic RAMs**

TMS4416-12	120ns, 16Kx4	\$2.25
TMS4416-15	150ns, 16Kx4	\$2.00
4116-12	120ns, 16Kx1	\$1.49
4116-15	150ns, 16Kx1	\$1.09
4116-20	200ns, 16Kx1	\$.89
4164-100	100ns, 64Kx1	\$2.75
4164-120	120ns, 64Kx1	\$2.39
4164-150	150ns, 64Kx1	\$2.15
4164-200	200ns, 64Kx1	\$1.75
41256-60	60ns, 256Kx1	\$5.25
41256-80	80ns, 256Kx1	\$3.75
41256-100	100ns, 256Kx1	\$3.15
41256-120	120ns, 256Kx1	\$2.95
41256-150	150ns, 256Kx1	\$2.59
41464-80	80ns, 64Kx4	\$5.95
41464-100	100ns, 64Kx4	\$4.95
41464-120	120ns, 64Kx4	\$3.95
41464-150	150ns, 64Kx4	\$3.59
511000P-70	70ns, 1Mx1	\$13.95
511000P-80	80ns, 1Mx1	\$12.95
511000P-100	100ns, 1Mx1	\$12.35
514256P-80	80ns, 256Kx4	\$13.45
514256P-100	100ns, 256Kx4	\$12.95

**Static RAMs**

6116P-3	150ns, 16Kx1 (CMOS)	\$2.79
6264LP-10	100ns, 64Kx1 (CMOS)	\$6.95
6264LP-15	150ns, 64Kx1 (CMOS)	\$4.95
43256-10L	100ns, 256Kx1	\$10.95
43256-15L	150ns, 256Kx1	\$9.95
62256LP-15	150ns, 256Kx1 (CMOS)	\$10.95

**PROTOTYPING PRODUCTS**  
**Jameco Solderless Breadboards**



Part No.	Dim. L" x W"	Contact Points	Binding Posts	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

**Oscilloscope Probes**

- Attenuation: x1 / x10
- Capacitance (LF180): 180pF / 22pF; (LF210): 40pF / 17pF



LF180	40MHz Oscilloscope Probe	\$19.95
LF210	100MHz Oscilloscope Probe	\$29.95

**GoldStar 20MHz Oscilloscope and 1GHz Frequency Counter**



GS7020	Oscilloscope	\$399.95
GS7020	Oscilloscope	\$399.95
FC7102	Frequency Counter	\$299.95

**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, 3650B & M4650 only:	• Also measure frequency and capacitance
M4650 only:	• Data hold switch • 4.5 digit
M3610	3.5 Digit Multimeter ..... \$49.95
M3650	3.5 Digit Multimeter w/Frequency & Capacitance ..... \$69.95
M3650B	Same as M3650 w/Bargraph ..... \$74.95
M4650	4.5 Digit w/Frequency, Capacitance and Data Hold Switch ..... \$99.95

**Multimeter Specials**

**M80:**

- AC/DC voltage, AC/DC current, resistance, diodes, continuity & frequency • Full auto-ranging on DC voltage • High/low semi-automating for AC/DC current and ohms • Data hold switch • Extra-large display

**M80** 3.75 Digit Multimeter ..... \$59.95

**M3900:**

- AC/DC voltage, AC/DC current, resistance, diodes, continuity, dwell angle and engine RPM • High surge voltage protection

**M3900** 3.5 Digit Multimeter ..... \$59.95

**Prototype Design Stations**

**WM1 & WM2 Features:**

- Removable solderless breadboard
- Variable and fixed DC power supply
- Multi-frequency signal generator
- Analog multimeter
- 8 bicolor LEDs (red & green)
- 8 logic switches
- Logic probe
- Lighted power switch
- Fuse overload protected
- Sturdy ruggedized case

**WM1 Special Features:**

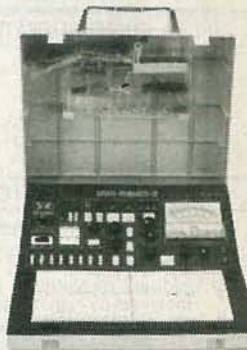
- 4 potentiometers
- Built-in speaker

**WM2 Special Features:**


- Pulse Generator
- Binary coded decimal (BCD) to 7-segment decoder/driver
- DB25 connector
- Frequency counter (1Hz to 1MHz)

**WM1 Analog Prototype Station ..... \$199.95**

**WM2 Digital Prototype Station ..... \$249.95**



**A.R.T. EPROM Programmer**



- Programs all current EPROMs in the 2716 to 27512 range plus the X2864 EEPROM
- RS232 port • Software included

**EPP ..... \$179.95**

**UVP EPROM Eraser**



- Erases all EPROM's
- Erases 1 chip in 15 Min. and 8 chips in 21 min.
- UV intensity 6800 UW/CM<sup>2</sup>

**DE4 ..... \$69.95**

**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 ..... \$59.95**

**60 Watt Analog Display Soldering Station • Electronic temperature control from 200° to 878°F • Ceramic heating element for a steady temperature and long life**

**XY2660 ..... \$89.95**

**60 Watt Digital Display Soldering Station • Electronic temperature control from 200° to 878°F • Temperature displayed on easy to read .560"H 3-digit LED readout • Nichrome heating element**

**XY960 ..... \$99.95**

**30 Watt Electronic Temperature Controlled Desoldering Station • Electronic temperature control from 212° to 842°F • Self-contained high rotary vacuum pump**

**XY999 ..... \$279.95**



**51-Piece Electronic Tool Kit**

The MS305 provides the tools needed for building, repairing and general maintenance of most electronic equipment. A convenient and durable carry-along combination lock case safely protects and secures this 51-piece tool kit. From the digital multimeter to the desoldering pump this kit is the perfect item for technicians and electronic enthusiasts.



**Tools Included in Kit**

- 10' measuring tape
- Electric tape
- 6" long tweezers
- 7" brush and scraper
- 7" fine point probe
- 7" slotted probe
- Rosin core solder
- 30 watt soldering iron
- Desoldering pump
- Soldering stand
- Stainless steel scissors
- Utility components box
- 8 pcs. hex key wrench
- Digital Multimeter
- Round needle file
- Flat needle file
- 6" adjustable wrench
- Utility knife with extra blade
- Bent needle nose pliers
- Diagonal cutting pliers
- 5.25" needle nose pliers
- 6 piece precision screwdriver set
- Bush
- 10 piece screwdriver set: 5 Slotted & 5 Phillips
- Flat nose pliers
- Carrying case: 17.63"W x 12.5"D x 3.5"H

**MS305 ..... \$119.95**



Request Jameco's 1990 Catalog for a Complete Listing of Components, Test/Measurement Equipment and Computer Products



**Jameco 20MHz 80386 Desktop Computer Kit**

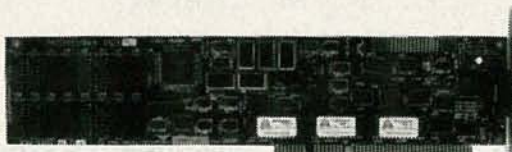
- IBM Compatible
- Concurrent 386 (Disk Operating System) are Included
- RAM Included, Expandable to 8MB on board, with optional expansion board
- 20MHz Keyboard Switchable Operation
- BIOS ROMs Included
- Open Case w/200 Watt Power Supply
- High-Performance IDE 3.5" 40MB Disk Drive
- 1.2MB Floppy DSHD Disk Drive
- I/O Card with Universal Floppy Controller
- 101-Key (Enhanced) Keyboard



Shown with VGA Option (not included)  
 JE2059 Multiscan Monitor and VGA Card...\$669.90 (See Below)

551 20MHz 80386 Compatible Kit.....\$1949.95

**IBM Compatible Cards**



JE1057

- 443 360KB/720KB/1.2MB/1.44MB Floppy Disk Controller Card (PC/XT/AT) .. \$49.95
- 450 Monochrome Graphics Card w/Parallel Printer Port (PC/XT/AT) ..... \$49.95
- 452 Color Graphics Card w/ Parallel Printer Port (PC/XT/AT) ..... \$49.95
- 455 EGA Card w/ 256KB Video RAM (PC/XT/AT)..... \$139.95
- 457 8/16-Bit VGA Card w/ 256KB Video RAM (PC/XT/AT)..... \$199.95
- 460 I/O Card w/ Serial, Game, Printer Port & Real Time Clock (PC/XT) ... \$59.95
- 462 RS232 Serial Half Card (PC/XT/AT) ..... \$29.95
- 465 I/O Card w/ Serial, Game and Parallel Printer Port (AT)..... \$59.95
- 477 Multi I/O Card w/ 360KB/720KB/1.2MB/1.44MB Floppy Controller (AT) .. \$99.95

**EGA, VGA & Multiscan Monitor Packages**

Systems 14" EGA monitor and EGA card package (1024 x 350 max. resolution)

2059 EGA Monitor & EGA Card..... \$509.90

Systems 14" Multiscan monitor and 16-bit VGA card package (640 x 480 max. resolution)

2059 Multiscan Monitor & VGA Card..... \$669.90

Systems 14" VGA monitor and 16-bit VGA card package (640 x 480 max. resolution)

2061 VGA Monitor & VGA Card..... \$629.90



JE2061

**IBM PC/XT/AT Compatible Keyboards**



FKB4700

**MEI 100-Key Microtype Keyboard**



- IBM PC/XT/AT/386 Compatible
- Saves an amazing 60% of the desk space used by equivalent standard keyboards

- 2015 84-Key Standard AT Style Layout ..... \$59.95
- 204700 101-Key Enhanced Layout with 12 Function Keys ..... \$69.95

MIRU.....\$129.95

**Jameco Digitizer Tablet**



- AutoCAD 10 template and four-button puck • Resolution: up to 1016 lines per inch • Accuracy: ±.025" • Emulates three of the world's most popular formats: Summagraphics MM, Summagraphics Bit Pad One, Calcomp 2000 • EEPROM allows custom configuration

JCAD Digitizer Tablet \$199.95  
 Stylus Two Button Stylus .... \$39.95

**DFI Handy Scanner**

- IBM PC/XT/AT Compatible
- 4" Scanning Window
- 400 dpi



HS3000.....\$129.95  
 Limited Quantity in Stock!

**Logitech Mouse**



MSER Serial Mouse & MouseWare Software ..... \$89.95

MBUS Mouse w/Bus Board & MouseWare Software ..... \$99.95

MPS2 PS/2 Mouse & MouseWare Software ..... \$79.95

**Modems**



9600E Pictured

**External Modems**

- 1200C Datalanics 1200 Baud \$89.95
- 2400C Datalanics 2400 Baud \$149.95
- 9600E Prometheus 9600 Baud \$699.95

**Internal Modems**

- 1200B Jameco 1200 Baud ..... \$49.95
- 2400B Jameco 2400 Baud ..... \$99.95

Modems listed above include ProComm Software

**IBM Compatible Cases and Power Supplies**



JE1030



JE2012

- JE1010 Flip-Top Standard PC/XT Case ..... \$39.95
- JE1011 Slide Standard PC/XT Case ..... \$39.95
- JE1030 150 watt PC/XT Power Supply ..... \$59.95
- JE1032 200 watt Baby AT Power Supply ..... \$89.95
- JE1035 300 watt AT Power Supply ..... \$139.95
- JE2011 Vertical Case w/300W Pwr. Supply ..... \$269.95
- JE2012 Mini-Vertical Case w/200W Pwr. Supply ..... \$169.95
- JE2019 Flip-Top Baby AT Case..... \$69.95

**Floppy Disk Drives**

MF353B



**Sony**

- MPF11 3.5" 720KB Disk Drive ..... \$69.95
- SMK 5.25" Installation Kit for MPF11 .. \$14.95

**Mitsubishi**

- MF353B 3.5" 720KB Internal Drive ..... \$99.95
- MF355B 3.5" 1.44MB Internal Drive .. \$119.95
- DD1 MF355B Software for systems without 1.44MB disk drive BIOS capability ... \$14.95

**Teac**

- FD55B 5.25" 360KB Internal Drive ... \$89.95
- FD55G 5.25" 1.2MB Internal Drive .... \$99.95

**Hard Drives & Tape Back-Up**



**MiniScribe (XT-MFM)**

M8425XT 20MB (68ms) 3.5"HH ..... \$289.95

**MiniScribe (XT-RLL)**

- M8438XT 30MB (68ms) 3.5"HH ..... \$299.95
- M8450XT 40MB (46ms) 3.5"HH ..... \$369.95

**Conner (AT-IDE)**

- CP3044 40MB (25ms) 3.5"Low Profile \$429.95
- CP3184 80MB (25ms) 3.5"HH ..... \$649.95
- CP3104 100MB (25ms) 3.5"HH ..... \$699.95

Above Drives include Hard Disk Drive, Controller & Cables

**Colorado Memory Systems**

- IBM PC/XT/AT/386 Compatible • Back-up 40MB in 40 minutes • Back-up 60 to 120MB with extended tapes and data compression software • Includes 40MB tape cartridge

DJ10 40MB Tape Back-Up.....\$329.95

KE10 External Enclosure Kit ..... \$149.95

TB40 40MB Tape Cartridge ..... \$24.95

TB60 60MB Tape Cartridge ..... \$32.95

1355 Shoreway Road, Belmont, CA 94002

24 Hour Order Hotline  
 (415) 592-8097

\$50.00 Minimum Order

FAX's (415) 592-2503 or (415) 595-2664  
 Telex 176043 - Ans. Back: Jameco Blmt  
 Data Sheets - 50¢ each

For a FREE 48-Page Flier send \$2.00 to cover First Class Postage and Handling © 1990 Jameco Electronics 9/90

**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

## COMPUTERS FOR LE\$\$

### 10 MHz 8088 System..... \$369

- 4.77/10 MHz 8088 Motherboard
- 256 KB RAM (640KB max)
- 150 Watt Power Supply
- Floppy Disk Controller
- One 5.25" 360 KB Floppy Drive
- MonoGraphics Card w/ Parallel Port
- 101 Key Enhanced Keyboard
- Case (3 LEDs ,2 Buttons ,Key-Lock)
- 12" Amber Monochrome Monitor

### 12 MHz 80286 System..... \$669

- 12 MHz 80286 Motherboard
- 0 Wait State
- 512 KB RAM (4 MB max)
- 200 Watt Power Supply
- Floppy Disk Controller
- One 5.25" 1.2 MB Floppy Drive
- MonoGraphics Card w/ Parallel Port
- 101 Key Enhanced Keyboard
- Case (3 LEDs ,2 Buttons ,Key-Lock)
- 12" Amber Monochrome Monitor

One Year Parts & Labor Warranty  
30 Day Satisfaction Guarantee  
Shipping & Handling Extra

VISA & M/C add 3% Amex add 4%  
Price & Availability subject to change  
without prior notice

### JINCO COMPUTERS INC.

5122 Walnut Grove Avenue  
San Gabriel, CA 91776  
Tel: (818) 309-1108

CIRCLE 177 ON FREE INFORMATION CARD

## CABLE TV DESCRAMBLERS

	10 Lot	
JERROLD™ Tri-Bi Mode.	\$105.00	\$85.00
JERROLD™ SB-3 OR 2	\$89.00	\$65.00
Hamlin MLD-1200.....	\$99.95	\$62.00
Oak N-12 W/V.S.....	\$99.95	\$62.00
Oak-M-35-B W/V.S.....	\$99.00	\$78.00
OAK E-13.....	\$99.95	\$58.00
Zenith SSAVI.....	\$185.00	\$145.00
Eagle PD-3.....	\$120.00	\$85.00
Scientific Atlanta.....	\$129.95	\$105.00
SA-Combo's.....	CALL	\$Call
Tocom.....	\$350.00	\$295.00
Oak N-12 W/ Auto.....	\$140.00	\$105.00
Jerrold Starcom CSV....	\$139.95	Call

M.D. ELECTRONICS  
WILL MATCH ANY  
ADVERTISED PRICE  
IN THIS MAGAZINE

### \*NEW STARGATE 2000 CABLE CONVERTER



1-\$89.00 10-\$69.00 100-Call

Last channel recall-Favorite channel select-  
75 channel-Channel scan-Manual fine tune-  
One year warranty-surge protection-HRC & Stand-  
ard switchable- and much more. Call Today!

INFORMATION(402)554-0417

Orders Call Toll Free  
1-800-624-1150

M.D. ELECTRONICS  
115 NEW YORK MALL  
SUITE 133E  
OMAHA, NE. 68114

M.C.  
VISA  
C.O.D.

RADIO-ELECTRONICS

102 CIRCLE 53 ON FREE INFORMATION CARD

## ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

Free Information Number	Page		Page
108	AMC Sales .....	13	— Pacific Cable .....
182	Ace Communications .....	15	56 Parts Express .....
75	Ace Products .....	25	199 Photronics .....
107	All Electronics .....	99	101 Pomona Electronics .....
—	Amazing Concepts .....	92, 97	78 Radio Shack .....
84	Appliance Service .....	25	190 SCO Electronics .....
67	Banner Technical Books .....	14	180 Sencore .....
98	Beckman Industrial .....	13	— Star Circuits .....
109	C&S Sales .....	24, CV3	185 TECI .....
—	CB City .....	91	92 Tektronix .....
70	CEI .....	94	186 Unicorn .....
—	CIE .....	11	64 Universal View .....
50	Caig Laboratories .....	26	191 U.S. Cable .....
54	Chemtronics .....	18	178 Viejo Publications .....
183	Chenesko Products .....	25	179 WPT Publications .....
—	Command Products .....	17	
—	Computer Book Club .....	5	
58	Cook's Institute .....	15	
194	D&D Electronics .....	27	
—	Damark International .....	14	
127	Deco Industries .....	25	
176	Electronic Goldmine .....	98	
—	Electronic Tech. Today .....	67	
—	Electronics Book Club .....	28	
121	Fluke Manufacturing .....	CV2	
189	Global Specialties .....	3	
—	Grantham College .....	80	
188	HUB Material Company .....	67	
86	Heathkit .....	17	
187	International Components Corp. ....	94	
114	Jameco .....	100	
177	Jinco Computers .....	102	
192	Joseph Electronics .....	27	
—	King Wholesale .....	92	
193	Loch Ness, Inc. ....	25	
87	MCM Electronics .....	95	
181	MD Electronics .....	102	
93	Mark V. Electronics .....	97	
—	McGraw Hill Book Club .....	38	
61	Microprocessors Unltd. ....	89	
117	Mouser .....	82	
—	NRI Schools .....	21, 87	
184	Optoelectronics .....	23	

### 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

# 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-422 40MHz Dual Trace \$795

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

## 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

## 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

## Elenco 35MHz Dual Trace



**\$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-20,000ufd  
.5% basic accy  
Zero control with case

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

**Function Generator**  
**Blox**  
**\$28.95**  
#9600  
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**

**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

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 E<sup>2</sup> PROM. 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**

**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

# On the line, on the bench, or on the road. The low- cost solution is Tek.

Do you debug the design? Verify the production run? Service the finished product? Then for low-cost solutions built for your application, there's only one place to go.



Tek's 2200 Series oscilloscope family.

There are ten scopes in the 2200 Series, from 20 to 100 MHz and \$695 to \$5495. And three of them demonstrate functional power at its best: the 100 MHz 2232, 50 MHz 2211, and 100 MHz 2245A.



If you can't afford to miss a thing, get the 2232 digital storage oscilloscope.

With 100 MS/s sampling, ten nanosecond glitch capture, waveform cursors, a 4K record length and 30K of battery-backed memory, it makes routine work of problems other scopes can't even see.

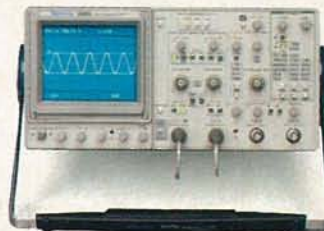
For the best performance value in digital storage, try the Tek 2211.

It offers a standard hardcopy interface, measurement cursors, 20 MS/s sampling and a 4K record length per channel, plus digital/analog operation — all for only \$2695.

And for the ultimate in low-cost troubleshooting: the \$1995 2245A. It's a 100 MHz real-time scope with auto setup, cursors, four independent channels, dual time bases and more.

So if you want the best low-cost solution on the line, on the bench, or on the road with you, just get on the phone.

And call your local Tek representative today.



## It's on us.

Purchase a 2232, 2211, or 2245A by October 15, 1990 and you can receive a **\$345 digital multimeter free!**\*



The CDM250 measures current, voltage and resistance, has overload protection and is UL certified. To get yours, contact

your local representative or distributor and place your order with **Option 4X**. Or call Tek direct at:

# 1-800-426-2200 Ext. 225



**Tektronix**  
COMMITTED TO EXCELLENCE

CIRCLE 92 ON FREE INFORMATION CARD

\*Offer valid in U.S. only. You must ask for Option 4X and date purchase order between July 15 and October 15, 1990 to qualify.

© 1990 Tektronix Inc. BOB-101