

TURN THAT OLD PRINTER INTO A NEW STRIP-CHART RECORDER

JULY 1996

Electronics NOW

Low-cost software for

Circuit Simulation

turns your PC into a sophisticated breadboard

How to add Neon Brilliance to your car or truck!

An easy-to-assemble Corner Reflector Antenna for excellent results at UHF

Build an EPROM-based Video Pattern Generator for your testbench



\$3.50 U.S.
\$3.95 CAN.

A GERNSBACK PUBLICATION

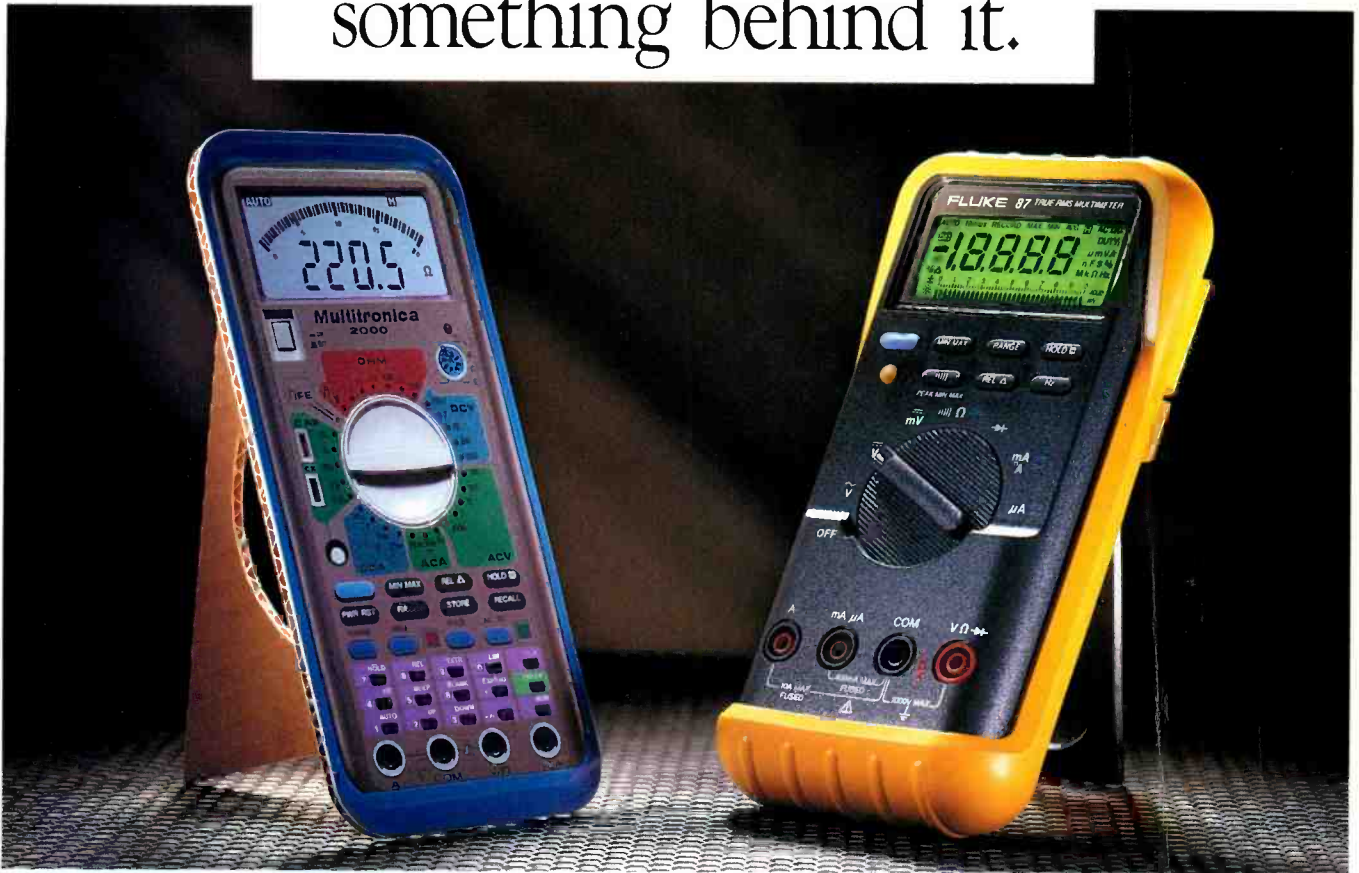
#BXNBQWF***** 5-DIGIT 87196
#BRKB4717C96 6#570236 0AP62



CHRIS BARKER

JUN 97
07EN

Before you get turned on
by the front of a meter, make sure there's
something behind it.



Fluke meters are designed for professionals who value function over frills.

There's nothing superficial about the Fluke family of versatile digital multimeters. Pick one up and you feel that it's a substantial tool. Designed to fit the application and the way you work. With features like our patented Touch Hold® function that freezes a reading on the display, and intelligently updates with each new reading. Automatically. Without requiring a third hand to push a button. Fluke meters attain stable, accurate readings in half the time of most imitations, making you more productive on the job.



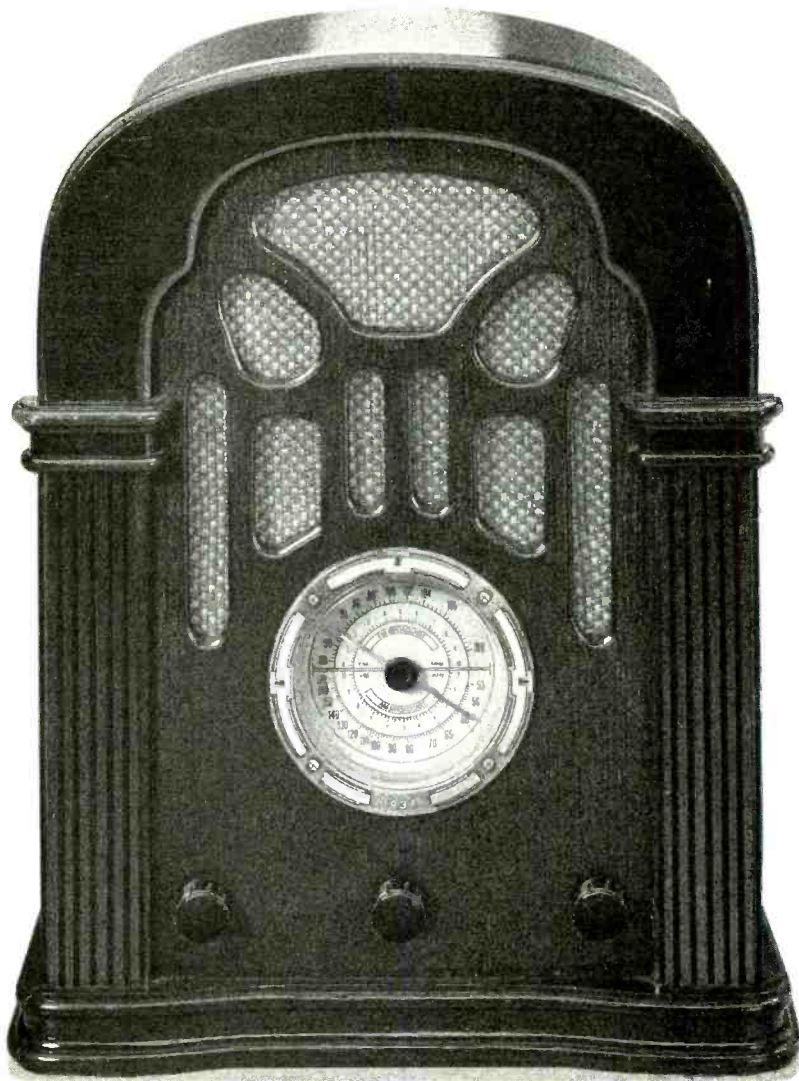
Other meters are merely "designed to meet" certain guidelines; Fluke designs and builds a full line of meters that actually achieve UL, VDE and TÜV safety certification. Fluke's guarantee goes beyond manufacturing defects to include meter specifications for an entire year, so you can trust the readings. And Fluke backs you with toll-free customer assistance numbers, and a world-wide service organization. Discover why more professionals around the world say, "Hand me the Fluke." See your local distributor, or call **1-800-87-FLUKE** for a catalog and the name of the distributor nearest you.

Serious Tools for Serious Work

FLUKE®

© 1994 Fluke Corporation. P.O. Box 9090, M/S 250E, Everett, WA, USA 98206-9090. U.S. (206) 356-5400. Canada (905) 890-7600. Europe (31 40) 644200. Other Countries (206) 356-5500. All rights reserved. Ad No. 00567

Even then, people asked if we
had the whosy whatsit that connects
to the watchamacallit.



We've been helping people with personal electronics since before there was a personal electronics industry! Whether you need a tube for your vintage radio, something to clear up your TV reception, advice on putting together a home theater system, or a place to get your out-of-warranty electronics repaired, help is as close as your nearby RadioShack. We've got the products, the parts and the people to help you put it all together. For a store near you, call 1-800-THE-SHACK.



RadioShackSM
You've got questions.
We've got answers.[®]

CIRCLE 78 ON FREE INFORMATION CARD

www.americanradiohistory.com

CONTENTS

JULY 1996

ON THE COVER

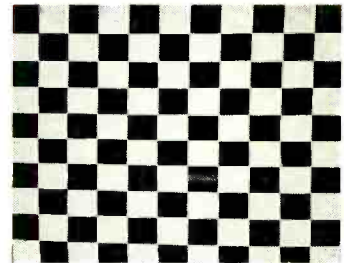
41 LOW-COST SOFTWARE FOR CIRCUIT SIMULATION

The solderless breadboard is not dead yet, but its days might be numbered. Today, the preferred method for proving new circuit design is not to build it from actual components, but rather to build a virtual circuit in using circuit-simulation software. This month, we look at eight software packages that handle both analog and mixed-mode (analog and digital) circuits. All of the packages are priced at less than \$300, and many interface with schematic-capture and printed-circuit board design software. Before you buy, check our reviews. Then download demo packages so you can sample them. — *TJ Byers*



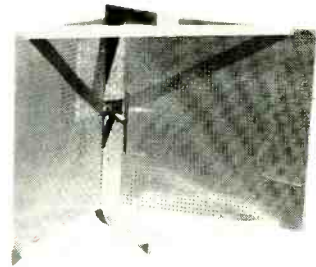
BUILD THIS

51 BUILD THIS VIDEO PATTERN GENERATOR



This EPROM-based video pattern generator generates colorbar and checkerboard patterns. — *Yongping Xia*

57 UHF CORNER REFLECTOR ANTENNA



Scanner enthusiasts and radio amateurs will love this antenna that provides a gain of 8 to 10 dB. — *William Sheets and Rudolf F. Graf*

As a service to readers, ELECTRONICS NOW 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, ELECTRONICS NOW 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 in ELECTRONICS NOW may relate to or be covered by U.S. patents, ELECTRONICS NOW 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.

ELECTRONICS NOW, (ISSN 1067-9294) July 1996. Published monthly by Gernsback Publications, Inc., 500 Bi-County Boulevard, Farmingdale, NY 11735-3931. Second-Class Postage paid at Farmingdale, NY and additional mailing offices. Canada Post IPM Agreement No. 334103, authorized at Mississauga, Canada. One-year subscription rate U.S.A. and possessions \$19.97, Canada \$27.79 (includes G.S.T. Canadian Goods and Services Tax, Registration No. R125166280), all other countries \$28.97. 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 \$3.50. © 1996 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

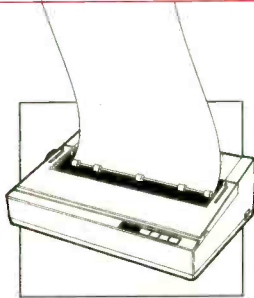
POSTMASTER: Please send address changes to ELECTRONICS NOW, Subscription Dept., Box 55115, Boulder, CO 80321-5115.

A stamped self-address 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.

TECHNOLOGY

43 BUDGET STRIP-CHART RECORDER

You can take your obsolete, unused computer printer and give it new life by turning it into a strip-chart recorder. — *Jack Wright*



47 AUTOMOTIVE NEON

You can add some colorful fashionable neon lights to your car or truck when you build our power supply. — *Bob Iannini*



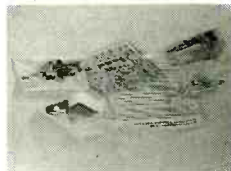
DEPARTMENTS

6 VIDEO NEWS

What's new in this fast-changing industry. — *Dave Lachenbruch*

20 EQUIPMENT REPORTS

Ramsey FM-25 FM stereo transmitter



29 HARDWARE HACKER

Delta-wye transforms, building your own Tesla coil, and more. — *Don Lancaster*

38 SERVICING

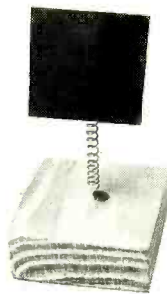
Making time measurements with a DSO. — *Ed Caryl*

59 COMPUTER CONNECTIONS

Disk partitioning. — *Jeff Holtzman*

62 LASER EXPERIMENTS

Practical laser-based tools. — *Carl J. Bergquist*



AND MORE

4 WHAT'S NEWS

12 Q&A

16 LETTERS

22 NEW PRODUCTS

26 NEW LITERATURE

142 ADVERTISING SALES OFFICES

142 ADVERTISING INDEX

Electronics NOW

Hugo Gernsback (1884-1967) founder

LARRY STECKLER, EHF, CET,
Editor-in-chief and publisher

EDITORIAL DEPARTMENT

- BRIAN C. FENTON**, editor
- JULIAN S. MARTIN**, associate editor
- TERI SCADUTO**, assistant editor
- JEFFREY K. HOLTZMAN**
computer editor
- LARRY KLEIN**, audio editor
- DAVID LACHENBRUCH**
contributing editor
- DON LANCASTER**
contributing editor
- MICHAEL A. COVINGTON, N4TMI**
contributing editor
- EVELYN ROSE**, editorial assistant

ART DEPARTMENT

- ANDRE DUZANT**, art director
- RUSSELL C. TRUELSON**, illustrator

PRODUCTION DEPARTMENT

- RUBY M. YEE**, production director
- KATHRYN R. CAMPBELL**
production assistant
- KEN COREN**
desktop production

CIRCULATION DEPARTMENT

- JACQUELINE P. CHEESEBORO**
circulation director
- THERESA LOMBARDO**
circulation assistant

REPRINT DEPARTMENT

- MICHELE TORRILLO**
reprint bookstore

Typography by Mates Graphics
Cover design by David Loewy

Electronics Now is indexed in *Applied Science & Technology Index*, and *Readers Guide to Periodical Literature*, *Academic Abstracts*, and *Magazine Article Summaries*.

Microfilm & microfiche editions are available. Contact reprint bookstore for details.

Advertising Sales Offices listed on page 142.

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

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

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



Audit Bureau
of Circulations
Member



WHAT'S NEWS

A REVIEW OF THE LATEST HAPPENINGS IN ELECTRONICS

Reversible optical switch

Researchers at the Georgia Institute of Technology, in a program sponsored by the National Science Foundation, are developing a light-activated optical switch that eventually could be the basis for a new type of rewritable three-dimensional data storage system. By using a small number of "trigger molecules" to induce a phase transition in liquid crystal materials, the system would write, read, and erase information using different forms of polarized and unpolarized light.



THE PHOTOMICROGRAPH of liquid crystals suspended in glycerol, viewed through an optical microscope, helps provide information about the properties of the crystals.

This type of optical storage system would offer major advantages over conventional computer floppy disks, magnetic tape, and compact discs, which use two-dimensional media to store data. The optical switch materials could also be used in spatial light modulators and in active coatings for optical fibers.

"The idea is that you would write to the liquid crystal with circularly-polarized light, read it with linearly-polarized light, and erase it with unpolarized light," explained

Dr. Gary B. Schuster, professor of chemistry at Georgia Tech. "You can read, write, and erase information in liquid crystal materials using this system."

Schuster and his co-workers use "chiral" molecules to trigger changes in the liquid crystal. Chiral molecules exist in right-handed and left-handed forms. Each form is affected differently by circularly-polarized light, which also exists in right- and left-handed versions. For example, when right-handed chiral molecules are struck by left-handed light, they may be converted preferentially to left-handed molecules. If the chiral molecules are dissolved in a liquid crystal material, that structural change can be used to prompt a phase transition in the crystal.

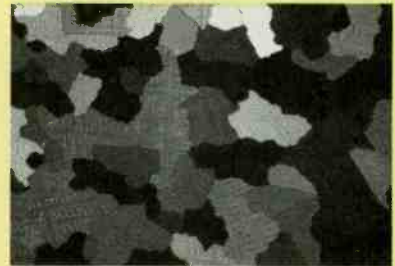
The phase transition changes the optical properties of the liquid-crystal material. One way that change can be detected, or read, is by passing linearly-polarized light through the crystals. Because the linearly-polarized light can be at a wavelength that does not affect the chiral molecules, reading the stored information would not alter it.

Multiple phase transition "switches" could be used together to store digital information. That information could later be erased by shining unpolarized light through it, reversing the phase changes originally made by the circularly-polarized light. Because the molecules would be returned to their original state, the system would be truly rewritable.

The Georgia Tech team is developing trigger molecules made up of bi-cyclic ketones substituted with a styrene group. Those materials, which exhibit the greatest response to circularly-polarized light, satisfy

most criteria needed for a two-dimensional switch.

However, the switches must be converted from two-dimensional layers to a true three-dimensional system before they become useful for optical data storage. "Furthermore, that would be useful only if you don't have to write information a bit at a time, which means writing it holographically," said Dr. Schuster. "If you could write three-dimensional holograms optically and read them, you would really have something worthwhile."



PHOTOMICROGRAPH OF THE leaf-shaped structures shows a phase transition in discotic liquid crystals doped with chiral triggers as viewed through cross polarization.

To make a three-dimensional system, the liquid crystals and their dissolved trigger molecules would need to be dispersed in a polymeric material. Once that was done, it would be possible to address microdroplets of the liquid crystal individually or in groups.

Because the system would be optically based, multiple beams of light could be used to simultaneously write information to the data-storage media without interference. That optical advantage would allow large amounts of information to be packed into a relatively small space, opening the door for the creation of smaller computer systems.

CircuitMaker[®]

The Virtual Electronics Lab[™]

where you can launch today's electronics project
into tomorrow and beyond...

TraxMaker
Block
Current
Delete
Edit
File
Grid
Highlight
Information
Jump
Library
Move
NetList
Place
Repeat
Setup
Un-Delete
Zoom

CircuitMaker 3.5
File Edit Macros Options View L1 L2

C:\CM35\ROCKET.CIR* 100%(1)

Launch

Count down to launch

Warning Count

Alarm

X: 2975 Y: 2525 mils L: Top Layer P: ROUND62 T: 12 S: 60 G: 25

TraxMaker[™]

- DOS version only \$299
- 30 day satisfaction guarantee
- user definable "Design Rules"
- imports CircuitMaker PCB netlist
- automatic or manual routing of tracks
- 8 layer, 32" x 32" maximum board size
- automatic or manual component placement

New Product

CircuitMaker[®]

- still only \$299
- PCB netlist export
- includes 1500+ devices
- SPICE netlist import/export
- 30 day satisfaction guarantee
- professional schematic features
- digital, analog and mixed-mode simulation

New Windows 95/NT/3.1x Versions

Call now to order your complete circuit design system
or request additional information:

800-419-4242

MicroCode Engineering
573 W. 1830 N. Suite 4
Orem, UT 84057 USA
Phone (801) 226-4470
FAX (801) 226-6532

FREE ON-LINE DEMO:
AOL; file search, CircuitMaker
CompuServe; GO MICROCODE
Internet; <http://www.microcode.com>
All trademarks are the property of their owners.



CIRCLE 128 ON FREE INFORMATION CARD

www.americanradiohistory.com

Small, Low-Cost, Atomic Clock

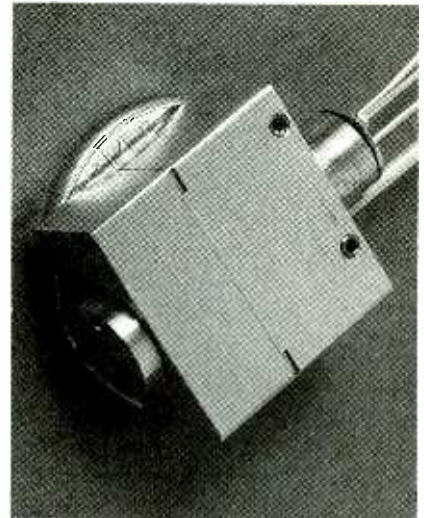
A cesium atomic clock now under development is smaller, consumes less power, and will cost less than existing commercial atomic clocks. The clock, invented at Westinghouse Electric Corporation's Science & Technology Center in Pittsburgh, is intended for precision timing in certain military and commercial systems where it is expected to replace the best crystal oscillators now available.

The Westinghouse clock is in a matchbox-size package containing a small cell filled with cesium vapor within a microwave cavity. A diode laser, which emits in the near infrared region at about 852 nanometers, raises the cesium atoms to a higher energy level. A microwave oscillator creates an

control circuit. The microwave oscillator, in turn, stabilizes the internal quartz crystal that provides a stable frequency output of 10 megahertz, to better than 0.0001 hertz.

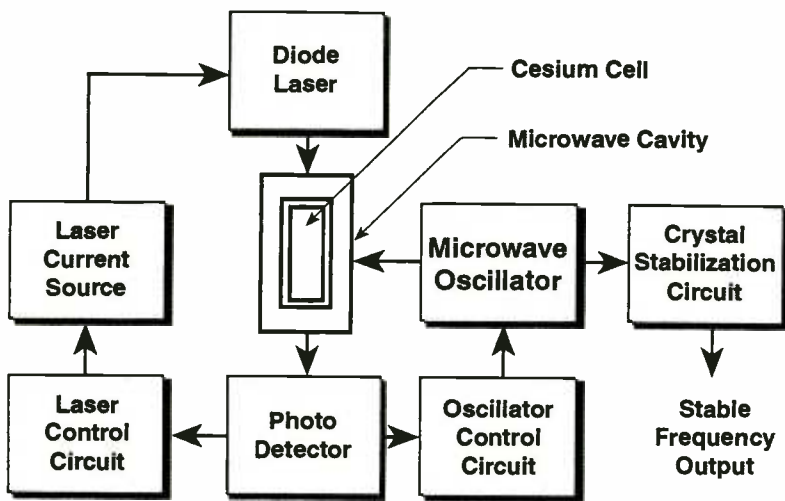
Westinghouse researchers believe the cesium atomic clock has a place in systems that can benefit from more precise and stable timing than offered from the best crystal oscillators today. They do not see it crystal oscillators that are now performing satisfactorily in computers and communications systems.

For example, the clock could become an important component in the aircraft location systems based on the Global Positioning System (GPS) that are being developed. They would replace other existing position-location systems. Military applications might include all-weather landing systems for aircraft and covert identification friend



A MATCHBOX-SIZED CESIUM ATOMIC CLOCK is expected to replace crystal oscillators in systems whose performance will benefit from more accurate timing.

The final production model of the clock is expected to be one-tenth the size and have a weight that is about 1 percent of existing atomic time standards. Moreover, it is expected to draw only one-tenth the power — about a third of a watt. Projected cost will be about one-tenth that of existing atomic clocks. The latest prototype has an accuracy within a millionth of a second per day, about a thousand times more accurate than the best crystal oscillators.



THE CESIUM ATOMIC CLOCK. The time is kept precisely by the interaction between the diode laser and the microwave oscillator on the cesium gas.

electromagnetic field within the microwave cavity that excites the electrons in the cesium vapor.

The magnetic field partially returns the atoms to their base energy level, altering the transmission of infrared energy through the cell but only when the circuit's frequency precisely matches the resonant frequency of the cesium atoms. This occurs at about 9.192 gigahertz for a cesium atom.

The microwave oscillator is locked to 9.192 GHz by a feedback signal from a photodetector and an oscillator

or foe (IFF) systems that would prevent accidental "friendly fire" on friendly aircraft, vehicles, ships, and troops.

Each of the 24 GPS satellites now contains an atomic clock, so it is believed that replacing the crystal oscillators in some GPS receivers with the atomic clocks would greatly enhance their accuracy. According to Westinghouse, the clocks would help to overcome the blocking of satellite signals due to nearby as well as interference from other radio frequency sources.

CES/COMDEX mega-show

In response to the accelerating convergence of computer and consumer-electronic technologies in the retail marketplace, the Consumer Electronics Manufacturers Association (CEMA) and SOFTBANK COMDEX Inc. have formed a strategic partnership. As part of the new initiative, COMDEX/Spring '97 and the Spring Consumer Electronics Show (CES) will run at the same time, from June 2-5, 1997, in Atlanta, Georgia.

The two organizations also announced the creation of a new trade show and conference specifically developed to address the convergent marketplace. The as-yet-unnamed venture will be held alongside the combined COMDEX/ CES event in Atlanta.

continued on page 10

Take this GIANT CIRCUIT LIBRARY FOR ONLY \$14⁹⁵

when you join the *Electronics Engineers' Book Club*[®]

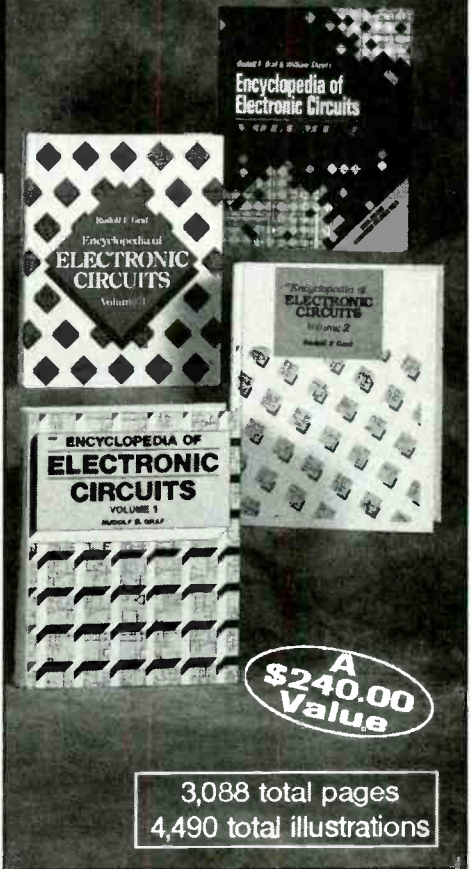
Hundreds of circuit ideas alphabetically arranged—from Alarm circuits to Zero crossing detector circuits!

"...includes schematics for the latest electronics circuits from industry leaders..." —Popular Electronics

Turn to this comprehensive circuit library for hundreds of project ideas...and concise pinout diagrams and schematics. In each volume you'll find more than 700 electronic and integrated circuits and 100+ circuit categories right at your fingertips to give you ideas you can use on the job or at your workbench.

THE ENCYCLOPEDIA OF ELECTRONIC CIRCUITS

Volumes 1-4
by Rudolf F. Graf



As a member of the **Electronics Engineers' Book Club**...you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off the regular publishers' prices. If you want the Main selection, do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. If you ever receive a book you don't want due to late delivery of the bulletin, you can return it at our expense. And you'll be eligible for FREE BOOKS through the Bonus Book Plan. Your only obligation is to purchase 3 more books during the next 2 years, after which you may cancel your membership at any time. Publishers' price shown. ©1996 EEBC

If coupon is missing, write to: **Electronics Engineers' Book Club**,
A Division of The McGraw-Hill Companies, P.O. Box 549, Blacklick, OH 43004-9918

ELECTRONICS ENGINEERS' BOOK CLUB[®]

A Division of The McGraw-Hill Companies,
P.O. Box 549, Blacklick, OH 43004-9918

YES! Please send me *The Encyclopedia of Electronic Circuits-Vols.1-4* (5861488), billing me just \$14.95 plus shipping/handling & sales tax. Enroll me as a member of the **Electronics Engineers' Book Club** according to the terms outlined in this ad. If not satisfied, I may return the books within 10 days for a full refund and have my membership cancelled.

Name _____
Address/Apt. # _____
City _____
State _____
Zip _____ Phone _____

Valid for new members only, subject to acceptance by EEBC. Canada *must* remit in U.S. funds drawn on U.S. banks. Applicants outside the U.S. and Canada will receive special ordering instructions. A shipping/handling charge & sales tax will be added to all orders. RPIF796



VIDEO NEWS

WHAT'S NEW IN THE FAST-CHANGING VIDEO INDUSTRY

BY DAVID LACHENBRUCH

"TV/PC" standard sought

Thomson Consumer Electronics, which plans to test a TV set with major computer features in 100 consumer homes later this year, has called for talks between TV and PC manufacturers looking toward standards on picture tubes, processing power, and other features of such hybrids. The call met with mixed response, some competitors claiming that Thomson was merely trying to create a market for its fine-pitch 36-inch picture tubes. Thomson, however, said that it hopes the industry will "determine what the consumers really want and then position that product accordingly."

Thomson officials said that the company's test of "Genius Theater" will probably use its new fine-pitch 36-inch tube and include a digital VCR, a 100-disc DVD-ROM changer, a 28.8 modem, and a receiver box that can both handle Digital Satellite System (DSS) feeds and provide access to the Internet. The tests could result in a product next year selling at about \$5000, according to Thomson.

Other TV manufacturers—including Mitsubishi and Toshiba—are also introducing TV sets with some computer capability. As reported here, direct-market computer manufacturer Gateway 2000 has started sales of its Destination system, consisting of a computer and TV combination with a 31-inch screen for living room use. Other computer makers have announced or are preparing "network computers"—low-cost systems designed to access the Internet using the home

TV as a display. And, of course, video and TV cards are readily available for installation in PCs. Whether a "standard" is necessary or desirable is still a subject of controversy.

HDTV station on the way

Construction of America's first high-definition TV station soon will be under way, with the transmitter and compression encoder due to be installed before this year is over and local program production equipment in place early next year. The station will be built in Washington, D.C., by broadcasters and equipment makers and will be used for demonstrations to important decision makers, in addition to serving as a testing ground for equipment and program production. The three-year project is expected to cost \$6,000,000 and will piggyback on an existing Washington TV station, which has not yet been selected. It's expected to broadcast in HDTV virtually full time. One Washington station—PBS affiliate WETA-TV—has already announced independently that it plans to broadcast in HDTV, and it could be a candidate for the experimental station project.

Meanwhile, the Advanced TV Test Center in Alexandria, Virginia, site of the system's tests, will be rechristened the Advanced TV Technology Center to better reflect its revised purpose—helping broadcast and TV-receiver industries make the transition from analog to digital television. That also will be financed by broadcasters and equipment makers and will serve as a test bed for RF and systems development for digital broadcasting. At

our press time, the non-profit center was backed by CBS, PBS, and Pioneer Electronics, with other sponsors expected to join soon.

DVD timetable snagged

Whether the new DVD system will be ready in time for its scheduled fall debut is still unknown, but the barriers continue to arise one after another. Technically, that introduction date appears to be feasible, but there are still problems in the path of this high-density optical system, which is expected to revolutionize video and audio recording as well as computer storage.

Some progress has been made on one of the stickiest problems—the issue of protecting copyrights in the video version. Movie companies generally have been reluctant to commit to recording their recent films on the new medium because its digital nature makes it possible to bootleg almost perfect copies. The movie industry, represented by the Motion Picture Association of America (MPAA), and the EIA's Consumer Electronics Manufacturers Association (CEMA) have agreed on an anti-copy system and hope to propose it to Congress for legislation. However, computer manufacturers were barely consulted—or even informed of the progress of the talks. In some cases their interests are completely different from those of the film companies—copying is desired, or even required, for computer programs.

At press time, this dispute was nowhere near a resolution, although talks with the computer industry have started. And even if there is an agreement, there is no assurance that Congress will pass

The Four-Year Electronics Degree Program That Really Hits Home!

Bring The Technology Home With A Bachelor Of Electronics Engineering Degree. No Hassles. No High Cost!



Now's the time to prepare for a profitable career.

We've lowered the cost of higher education.

It's true! You can earn a four-year Bachelor of Electronics Engineering Technology degree today ... and prepare yourself for a high-paying electronics career ... without quitting your job or ever leaving your home. Because World College, an affiliate of the Cleveland Institute of Electronics, offers you the total flexibility of independent study programs proven effective for people like you who truly want to succeed! World College independent study lessons help you build valuable skills

**Mail/Fax Today
or Call
1-800-696-7532**

step-by-step, and expert instructors are personally available to you with a toll-free call. What a way to earn an education!

A world of opportunity.

Where is your career headed? With a four-year bachelor's degree from World College, you call the shots, choosing from incredible, high-paying opportunities in electronics, telecommunications, computer, electrical power, and many other growing fields.

World College gives you the skills, the knowledge, the power to take advantage of your best opportunity in electronics. And you can do it all at your own pace!

Without leaving home.

World College continually works to provide its students with the most advanced education tools. From the latest equipment and reference books to breakthrough computer-simulated experiments, students are exposed to the latest technological advancements.

All the equipment, parts, and software you need are included in your affordable tuition, including more than 300 hands-on lab experiments you can complete in your home.

Choose your own pace.

Earn your bachelor's degree on your time — and at your pace — because you pay tuition to World College only as you complete the upper-level semesters close to graduation. The faster you make it through, the less you pay. So you have an incentive to make your future happen quickly — yet the freedom to choose your own pace!

Send today for your FREE course catalog — and give yourself that future you've always wanted — with an electronics degree education, from World College.



Take charge of your future in electronics.

Four Powerful Reasons To Connect With World College Today:

- 1. Earn your four-year degree!**
- 2. Self-paced training!**
- 3. Independent study in your home!**
- 4. Expert instruction!**

Give Me The Power!

Send me a FREE World College course catalog today!



(Please Print Neatly)

Name _____

Address _____

City _____

State, Zip _____

Phone () _____

Age _____

**For faster service, call
1-800-696-7532,
or call
1-804-464-4600.**

**Or fax this coupon to
1-804-464-3687.**



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



Affiliated with
Cleveland Institute of Electronics
WAE34

the bill requiring anti-copy protection during this Presidential election year. Even if it is passed, another question is whether it will be passed in time for manufacturers to modify the specifications for the products and still get them on the market this year. And it's not known whether movie companies will release their product on DVD if there is no law by the planned introduction time.

In addition, the movie companies are demanding a "regional coding" system for DVDs to make up for the fact that any DVD can be played on any DVD player, regardless of the television system in use in the country where it's played. As we've reported

before, the movie makers want an encoding system to make it impossible for a viewer in England, for example, to play an American movie before it's introduced in British theaters or while it's still on its first run. The most recent proposals envision encoding for five different regions worldwide. While this apparently is no great technical problem, it could mean another time-consuming change in the specifications.

MPEG-1 push for PCs

Even though DVD promises to produce better video pictures—on PCs as well as TV sets—four major

companies have launched a joint effort to support the use of MPEG-1-based Video CD in personal computers. The companies are JVC, Matsushita (Panasonic), Philips (Magnavox), and Sony. They are urging computer program developers to incorporate "White Book" video in their programs, arguing that the population of MPEG-compatible computers already exceeds 5,000,000 in the United States and will pass 10,000,000 by the end of this year. The companies argue that whatever the shortcomings of MPEG-1, the White Book specifications are the first step toward MPEG-2, which will be available later via the DVD-ROM. **EN**

WHAT'S NEWS

continued from page 6

"As the crossover between the consumer electronics and computer industries has increasingly grown, so has the industry's need for one consolidated Spring event which will serve both industries," said CEMA president Gary Shapiro.

Jason Chudnofsky, president and CEO of SOFTBANK COMDEX, added, "By bringing together the power of COMDEX and CES, we will better service a global industry whose needs have become more diverse because of emerging technologies and merging channels of distribution. Clearly, by joining these two events, and creating this new show, we present the ideal venue by which to market and address the requirements of the consumer electronics, computer, and communications industries, collectively."

CES and COMDEX each will continue to market and sell their respective events, while the new trade show and conference will be marketed and sold jointly by both organizations. Operational aspects for all three events will be handled by SOFTBANK COMDEX.

Each of the three trade shows represented in this "mega-event" will maintain its individual focus while enhancing the others and providing exhibitors and attendees with new business opportunities. Attendees to any one of the trade shows will gain the full

benefit of the combines events at no additional cost.

DVD copyright legislation sought

Representatives of the consumer-electronics and motion-picture industries have agreed to seek legislation concerning digital video recorders that would protect both intellectual property and consumers rights. The Motion Picture Association of America (MPAA) and the Consumer Electronics Manufacturers Association (CEMA) plan to submit to Congress a recommendation that will allow the marketing of digital video recorders that provide VCR-like features—such as the ability to time-shift TV programs for later viewing—while giving copyright proprietors additional control over some types of recording in the age of "pristine" digital copies.

The recommendation would assure consumers' unimpeded ability to make home video recordings of anything shown over broadcast or basic cable television, and allow consumers to make at least one copy of subscription or other "pay-cable" programming. Digital copies of that copy, however, may be prevented. And copyright holders would be allowed to prohibit consumers from copying from pay-per-view, video-on-demand programming and from pre-recorded media. Those provisions would apply only to digital recording devices and

recordings made from digital sources with conventional analog VCRs. No royalties on recorders or blank media would be called for.

The recommendation also includes technical standards that assure compliance with the system. Manufacturers of recording and other devices involved in the transmission and playback of video programming would be required to comply with those standards. Finally, the recommendation includes a proposal of updating the system to take advantage of new technology.

Semiconductor Orders Exceed Shipments

The Semiconductor Industry Association (SIA) San Jose, Calif., reported a book-to-bill ratio of 1.18 in October, up from September's 1.15 but below July's record of 1.23. The book-to-bill ratio compares orders with shipments and is a bellwether of industry health. A number of more than one indicates positive growth, and a ratio of 1.18 indicates that for every \$100 of devices shipped \$118 of devices were ordered.

SIA also forecast that the North American market would grow 40.2% to \$47.1 billion by the end of 1995. One reason for the gain, according to SIA, is continued strength in personal computer sales, but data communications, telecommunications, consumer electronics, and automotive are also doing very well. **EN**

Electronics Paperback Books

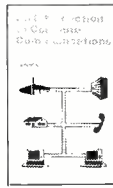
How to Use Op Amps



BP88—How to Use OpAmps...\$5.95. A designer's guide that covers operational amplifiers. Serving as both a source book of circuits and a reference book for design calculations. The text is non-mathematical and easy to understand by most readers.



BP113—30 Solderless Breadboard Projects-Book 2...\$5.95. Companion to BP107. Presented in exactly the same style using "Verobloc" breadboards. All the breadboard projects in this book are based on CMOS logic integrated circuits.



BP177—Introduction to Computer Communications...\$5.95. Details on types of modems and their suitability for specific application, plus details of connecting various computers to modems, and modems to the telephone system.



BP350—Electronic Board Games...\$6.00. Twenty novel electronic board games that you can build from the plans in this book. Some games are motor racing, searching for buried treasure or for gold in Fort Knox, — there is something for you to build and enjoy!



BP61—Beginners Guide to Digital Techniques...\$5.00. Covers the basics of digital techniques—decimal, binary, octal and hexadecimal numbering systems are covered plus insights on weighted and non-weighted binary-coded-decimal codes and alphanumeric codes. The basic building blocks of circuit logic, the common AND, OR, NAND, NOR and EXCLUSIVE-OR gates and bi-stables are thoroughly covered.



BP285—A Beginners Guide to Modern Electronic Components...\$6.50. It is easy for newcomers to electronics to become confused. There are a great many different types of components available often with numerous variations of each type. This book presents the reader with a vast amount of invaluable parts information to enable the right component to be selected every time for repairs and projects.



PCP103—Practical MIDI Handbook...\$9.95. The Musical Instrument Digital Interface (MIDI) is surrounded by a great deal of misunderstanding. This book is aimed at musicians and technicians who want to explore the vast capabilities of MIDI. It covers MIDI-based equipment you can use: keyboards, drum machines, sequencers, effects units, mixers, drum pads guitars. There's also a section on computer music.



PCP119—Electronic Music and MIDI Projects...\$14.95. Save cash by building the MIDI gadgets you need. Want a MIDI Thru box, program change pedal, Metronome, analog echo unit? Over 16 practical and very useful music and MIDI projects.



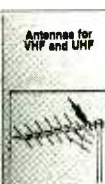
BP121—How to Design and Make Your Own PCBs...\$5.75. Simple methods for copying printed-circuit board designs from magazines and books on to copper. Covers all aspects of simple PCB construction as comprehensively as possible.



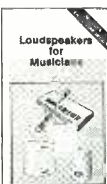
BP44—IC 555 Projects...\$5.95. Every so often a device appears that is so useful that one wonders how life went on before without it. The 555 timer integrated-circuit chip is one such device. Included are basic and general circuits used by most hobbyists.



PCP109—Everyday Electronics Data Book...\$10.00. An invaluable source of electronics information—the text contains sections that deal with the underlying theory of electronic circuits and a wide range of practical electronic uses for everyone.



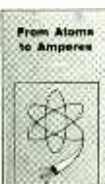
BP301—Antennas for VHF and UHF...\$6.00. From installing a TV or FM antenna to setting up a multi-antenna array for shortwave listening or amateur radio, this book explains the basics of VHF and UHF antenna operation and installation. The text describes in easy-to-understand terms the essential information about how antennas work, the advantages of different antenna types, and how to get the best performance.



BP297—Loudspeakers for Musicians...\$6.25. Contains all the information that a working musician needs to know about loudspeakers; the different types, how they work, the most suitable for different instruments, for cabaret work, and for vocals. It gives tips on constructing cabinets, wiring up, available fittings, finishing and how to connect multi-speaker arrays, etc. Includes ten enclosure designs with plans.



PCP110—Electronic Power Supply Handbook...\$10.95. All types of power supplies used for electronics purposes are covered in detail, starting with cells and batteries and extending by way of rectified supplies and linear stabilizers to modern switch-mode systems, IC switch-mode regulators, DC-converters and inverters. The devices, their operating principles and typical circuits, are dealt with in detail.



BP254—From Atoms to Amperes...\$6.50. Explains in crystal-clear terms the fundamentals behind the whole of electricity and electronics. Really helps you to understand the basis of the complex subject perhaps for the first time ever.



PCP101—Practical Digital Electronics Handbook...\$9.95. An introduction to digital circuits, logic gates, bi-stables, timers, micro-processors, memory and I/O devices. A special feature of the book is the section on digital test gear projects.



BP315—Introduction to the Electromagnetic Wave...\$5.95. A fundamental and easy-to-understand approach to a complicated theory topic. The beginner requires no more than elementary mathematics and basic knowledge of electronics.



#228—Essential Theory for the Hobbyist...\$5.25. Supplies to the hobbyist background knowledge tailored to the specific requirements of the hobbyist. Relevant material is presented in a readable manner with minimum mathematics.

TEST EQUIPMENT SPECIALS

- BP239—Getting the Most from Your Multimeter...\$5.95**
Covers analog and digital gear, component and gear testing.
- BP267—How to Use Oscilloscopes & Other Testing Equipment...\$6.95**
Get with the next step to proficient troubleshooting.
- PCP111—Electronic Test Equipment Handbook...\$13.95**
The all-purpose, all-pro handbook that covers basics to in-circuit testing.

SUBSTITUTION GUIDES FOR HOBBYISTS

- BP85—International Transistor Equivalents Guide...\$7.50**
The ultimate guide to replacing foreign and domestic transistors.
- BP108—International Diode Equivalents Guide...\$5.95**
Rectifiers, Zeners, LEDs, OCIs, diacs, triacs...all hobby types.
- BP140—Digital Equivalents and Pin Connectors...\$12.50**
A master reference for builders who design projects.

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

Name _____
Address _____
City _____ State _____ Zip _____
PE6

SHIPPING CHARGES IN USA AND CANADA
\$0.01 to \$5.00\$2.00
\$5.01 to \$10.00\$3.00
\$10.01 to 20.00\$4.00
\$20.01 to 30.00\$5.00
\$30.01 to 40.00\$6.00
\$40.01 to 50.00\$7.00
\$50.01 and above\$8.50

SORRY No orders accepted outside of USA & Canada

Total price of merchandise \$ _____
Shipping (see chart) \$ _____
Subtotal \$ _____
Sales Tax (NYS only) \$ _____
Total Enclosed \$ _____

Number of books ordered

All payments must be in U.S. funds!



Q & A

READERS QUESTIONS, EDITORS ANSWERS

Negative resistance

Q When working with parallel circuits, I was taught that the total resistance is always less than the smallest of the resistances in parallel. However, I recently ran across a reference that said this is not true if one of the resistances is negative in an active circuit. What is meant by this?—K. S., Brooklyn, NY

A As you surmise, there is no such thing as a negative resistor—that is, there is no component which, without an external power source, will “help electrons along” and undo the effect of a positive resistance. Even a battery doesn’t have

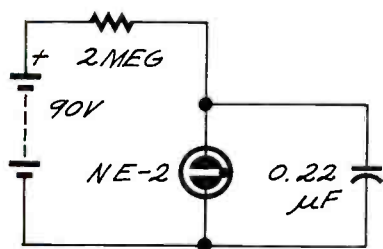


FIG. 1—NEON LAMP HAS NEGATIVE DYNAMIC RESISTANCE—the voltage across it falls while conduction is increasing. As a result, it flashes on and off.

negative resistance in this sense, because it produces a constant voltage rather than a voltage proportional to current.

Negative resistance in electronic theory refers to either of two things. First, some components have a negative dynamic resistance. That is, under some conditions, the component suddenly “breaks down” and begins to conduct heavily, so that the voltage across it can decrease while the conduction is

increasing—the opposite of what happens in a resistor. Another way of looking at negative dynamic resistance is to say that the component’s (real, positive) resistance suddenly drops when a particular voltage is reached. The familiar neon lamp oscillator (Fig. 1) is an example.

Second, some op-amp circuits are set up so that the current in a particular place is the exact opposite of what it would have been if a simple resistor or capacitor had been there. Circuits of this type are called negative-impedance converters (NICs). They are useful because they make capacitors act like inductors, eliminating the need for coils in filter circuits.

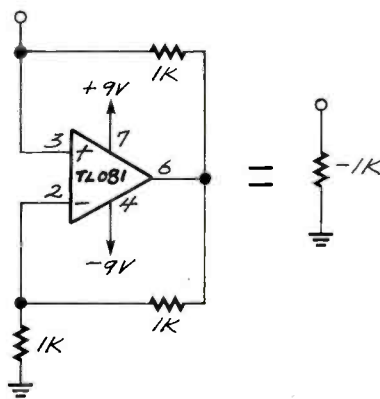


FIG. 2—NEGATIVE IMPEDANCE CONVERTER (NIC) behaves like a negative resistor. Apply a voltage, and it sends a current back into the voltage source.

Figure 2 shows how to make a -1000 -ohm NIC. It’s essentially a voltage-controlled current source. Recall that a resistor is a voltage-dependent current consumer; this circuit does the opposite. If you connect a battery to its input, the battery will get charged, with exactly the current that the battery

would have delivered if you had connected it to a 1000 -ohm resistor.

If you put a 1000 -ohm resistor in parallel with a -1000 -ohm NIC, you’ll get what looks like an infinite resistance. No matter what voltage you apply (within limits), the NIC will match it, and all the current flowing in the resistor will come from the NIC, not from the externally applied voltage.

Remote Sensing of Driveway Gates

Q I have a 200-foot driveway with electric gates at the end of it. I cannot see the gates from the house and cannot tell if they are open or closed. My thought is to install a magnetic reed switch on one gate and a magnet on the other, but I need a circuit that uses low power and will light a bulb that will not get hot if the gates are left open several hours. The wiring is already installed from the gates to the house. For a power source, I would like to use a door bell transformer (24 volts AC) that is used for my gate doorbell/intercom. Could you come up with a circuit for me?—G. Holst, Los Gatos, CA

A Figure 3 shows the circuit that you need. Light emitting diodes (LEDs) run cool and last practically forever. With an AC power source, you’ll need two LEDs wired back-to-back as shown in the diagram; each LED protects the other one from reverse voltage. You can use red, yellow, green, or blue LEDs; you can even get a bi-color LED (red and green) mounted together in the same lump of plastic, and when they’re both lit, the combina-

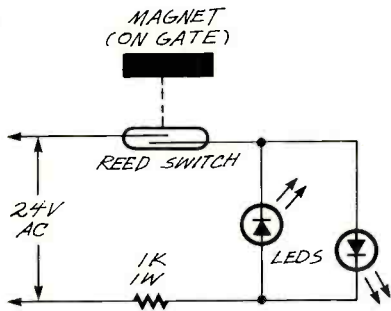


fig.— 3 LEDs INDICATE POSITION OF read switch. use 2 leds for ac.

tion looks yellow. The 1000-ohm, 1-watt resistor limits the current through the LEDs; it will run moderately warm.

Where to Take Audio Output

Q I'm thinking of increasing the power output of my integrated amplifier by adding a separate power amplifier. However, my integrated amplifier does not have preamp-output terminals. Can I connect the power amp to the integrated amplifier's headphone jack? — E. A. C., Calgary, Alberta.

A Yes. The signal at a headphone output is equivalent to line-level (i.e., about 1 volt peak to peak); the main difference is that headphone outputs can drive heavier loads than ordinary line-level outputs.

However, any noise or distortion originating in the final stages of the integrated amplifier will be present in the headphone signal. An amplifier with pre-out terminals would let you bypass the final stages and get somewhat higher quality. The difference may or may not be significant depending on whether your main need is for higher fidelity or just more sound (to fill a large room or overcome background noise).

AM receiver sensitivity

Q After much research on automobile radios I have determined that the performance of all recent radios is specified only for FM reception. As far as AM is concerned, "you get what you get" and it is

HOW TO GET INFORMATION ABOUT ELECTRONICS

Books: Several good introductory electronics books, including *Building Power Supplies*, are available at Radio Shack.

Our favorite general electronics textbook is *The Art of Electronics*, by Paul Horowitz and Winfield Hill, available from the publisher (Cambridge University Press, 1-800-872-7423) or on special order through any bookstore. Its 1125 pages are full of information on how to build working circuits, with a minimum of mathematics.

Also indispensable is *The ARRL Handbook for Radio Amateurs*, comprising 1000 pages of theory, radio circuits, and ready-to-build projects, available from the American Radio Relay League, Newington, CT 06111, and from ham radio equipment dealers.

Copies of past articles in *Electronics Now*, *Radio-Electronics*, *Popular Electronics*, and *Hands-On Electronics* are available from our Reprint Bookstore, 500-B Bi-County Road, Farmingdale, NY 11735 (1-516-293-3000).

Electronics Now and many other magazines are indexed in the *Reader's Guide to Periodical Literature*, available at your public library. Copies of articles in other magazines can be obtained through your public library's interlibrary loan service; expect to pay about 30 cents a page.

Service manuals for radios, TVs, VCRs, audio equipment, and some computers are available from Howard W. Sams & Co., Indianapolis, IN 46214 (1-800-428-7267). The free Sams catalog also lists addresses of manufacturers and parts dealers. Even if an item isn't listed in the catalog, it pays to call Sams; they may have a schematic on

far from satisfactory as far as sensitivity is concerned. Can you offer any suggestions as to how AM reception can be improved with present-day AM car radios? — R. E. S., Lambertville, N.J.

A The car radios that we've used lately have excellent sensitivity on AM, at least as good as their counterparts

file which they can copy for you.

Manuals for older test equipment and ham radio gear are available from Hi Manuals, PO Box 802, Council Bluffs, IA 51502, and Manuals Plus, Box 637, Spanaway, WA 98387.

Replacement transistors, ICs, and other semiconductors, marketed by Philips ECG, NTE, and Thomson (SK), are available through most parts dealers (including Radio Shack on special order). The ECG, NTE, and SK lines contain just a few hundred parts which substitute for many thousands of others; a directory (supplied as a large book and on diskette) tells you which one to use. NTE numbers usually match ECG; SK numbers are different.

Remember that the "2S" in a Japanese type number is usually omitted; a transistor marked D945 is actually a 2SD945.

Hamfests (swap meets) and local organizations can be located by writing to the American Radio Relay League (Newington, CT 06111). A hamfest is an excellent place to pick up used test equipment, older parts, and other items at bargain prices, as well as to meet your fellow electronics enthusiasts both amateur and professional.

Writing to Q&A: We welcome your questions. The most interesting ones are answered in print, usually within 9 months. Please be sure to include plenty of background information (we'll shorten your letter for publication). *If you are asking about a circuit, please include a complete diagram.* We regret that we cannot give personal replies.

of 30 years ago. The reason sensitivity isn't specified is that all good AM radios are sensitive enough to pick up atmospheric noise, and there's no point in adding more sensitivity beyond that point.

You might want to compare the car radio to a good line-powered radio at the same location. If the car radio is

disappointing, there are two obvious opportunities for improvement. One is to reduce engine noise by using standard techniques (see the *ARRL Handbook for Radio Amateurs*). The other is to install a longer antenna. Almost all car radio antennas nowadays are 30-inch whips tuned for optimum FM performance. Older-style, 5-foot antennas pick up AM noticeably better.

Of course, if the radio has an AM antenna trimmer, it should be adjusted for best performance at the frequency of most interest to you. This is typically a screwdriver adjustment which you access by pulling off a knob, as described in the radio's instruction book. Not all radios have them, however.

TV Manual Needed

Q Where can I get schematics of Curtis Mathes TVs?—*W. Loving, Beech Island, SC*

A Try Howard W. Sams & Co. at 1-800-428-7267, or Curtis Mathes at P. O. Box 112, Athens, TX 75751, 1-903-675-6886

Switching colors

Q I need to drive a bi-colored LED in such a way that if an SPST switch is closed, you get one color (green), and if the same SPST switch is open, you get the other color (red). Yes, the switch must be SPST and I'm using the three-terminal (common-cathode) version of the LED. —*A. M. K., Branford, Conn.*

A Figure 4 shows one way to do it. The problem is complicated by the fact that the cathodes of the LEDs must be connected together (we've drawn them separately, but you can use two LEDs in a single package).

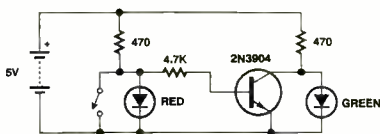


Fig. 4—A single-pole, single-throw switch controls which LED is on.

The solution is to turn off the LEDs by shorting across them rather than by opening the circuit. The transistor is biased "on" and shorts across the second LED whenever the switch is not shorting across the first LED.

Care and feeding of lead-acid battery

Q I have replaced my camcorder's aging and pesky nickel-cadmium battery with a 12-volt, 2-ampere-hour sealed lead-acid battery, together with some circuitry to reduce the voltage to about 6.3 V. What is the correct float charge voltage for the battery, and should the charger be connected to it through two paralleled 12-volt 1-amp light bulbs? —*W. A. E., North York, Ont., Canada.*

A The correct float charge voltage for a 12-volt lead-acid battery is about 14.1 volts. Whether you need light bulbs or other current limiting components depends entirely on the design of your charger; the two light bulbs, as you suggest, will do fine if you are charging from a regulated power supply that can deliver 2 amps. If you want to limit the charging current to a maximum of 1 amp, use just one light bulb.

Since you need 6.3 volts, it might be simpler to use a 6-volt lead-acid battery, which will give exactly 6.3 volts under normal conditions.

Power-hungry?

Q I built a two-channel portable guitar amplifier with two TDA2006s based on a circuit in your April 1990 issue. I'm using four 9-volt alkaline batteries, but they get hot and run down fast. What can I change? Should I use car batteries? —*W. E. B., Newport News, Va.*

A Four nine-volt batteries just don't contain enough energy to provide more than a few minutes of room-filling music, especially if the music includes lots of bass, which requires a lot of the energy to reproduce. (Little transistor radios get decent battery life

because their audio contains very little bass.)

All of the power delivered to the speakers has to come from the batteries. Each TDA2006 can deliver as much as 10 watts. When it's doing that, your battery pack has to supply *at least* 20 watts, five watts from each of the four batteries. To deliver five watts, a 9-volt battery has to produce a current of 555 milliamperes. That's enough to run it down in minutes.

There is something you should check. With no audio input, how much current does the amplifier draw? It shouldn't be much more than 60 milliamperes per channel. If it is, you have an oscillation problem. To counteract oscillation, make sure that you've included a 1-ohm resistor in series with a 0.22- μ F capacitor across the output of each TDA2006, and a 0.1- μ F capacitor across the power supply pins; these components should be as close to the chip as possible.

Rather than use bigger batteries, you might want to build a line power supply. For guidance, see Radio Shack's book, *Building Power Supplies*

Complicated timer/controller

Q I am trying to design and build a timer/controller with a programmable timer to allow it to activate at 4 or more selected times of day. I would also like the controller to respond to light (sunrise and sunset), and I'd like to remotely activate it from a distance of 500 yards. Can you recommend a set of ICs and a schematic that will produce these results? —*D. R., Houston, Tex.*

A You don't need a circuit, you need a computer. That is, the way to build your timer/controller is to write a suitable program for a microcontroller.

Once programmed, the microcontroller runs on battery power with just a few support components. Many microcontrollers include analog-to-digital converters (to which you could connect a photocell); all of them have digital output ports that can be used to control relays, motors, and the like.

The easiest microcontroller to get started with is probably the Parallax "BASIC Stamp," described in Don Lancaster's column in this magazine in several recent issues (starting May 1995). It costs \$29 and is programmed in BASIC. The manufacturer is Parallax, Inc., 3805 Atherton Road, Rocklin, CA 95765. If you can handle assembly language, you may prefer a Microchip PIC or Philips 87C750, each of which costs only a few dollars.

Your 500-yard remote-control requirement is tougher. Can you use a long cable? If so, an RS-232 link to a PC, at a low baud rate, should work fine. Radio control is not so easy; nobody has come up with cheap and easy homebrew radio modems yet.

TRANSISTOR DATA BOOKS

Q Can you recommend the most up-to-date books or manuals that contain the operating curves and characteristics of most all transistors (domestic and foreign)?—A. Wiegand, Helena, MT

A Unfortunately, there is no comprehensive book of that type, as far as we know. Fortunately, it isn't necessary. Unlike a tube, a transistor doesn't have a well-defined set of characteristic curves; two transistors of the same type may differ in gain by a factor of 10 or more. The only characteristics of a transistor that you can rely on are the polarity (PNP vs. NPN), material (usually silicon), packaging, pinout, and maximum ratings.

The simplest way to find out about a transistor is to look it up in the ECG or NTE substitution directory, and read off the characteristics of the corresponding ECG or NTE substitute. The maximum ratings for the original transistor might be slightly lower than those of the substitute.

Many popular industrial transistors are described in books published by Motorola, National Semiconductor, and Philips. You can get directories of Japanese transistors from MCM Electronics (call 1-800-543-4330 and ask for a catalog).

EN



Raise your standard to Wavetek.

Why choose between paying more for a brand name or getting more functions for your money? Get the best of both worlds with **Wavetek**.

Worldwide Service.

Support whenever and wherever you need it.

Tech-preferred Features.

The XL meters have the largest displays, auto-off, data hold, manual and autoranging models in pocket-size convenience.

Quality. Less than 0.5% warranty returns assures continuous reliability.

Selection. Over 35 different **Wavetek** DMMs to meet any measurement need.

User Safety. Conservative voltage ratings, fused inputs, warning beepers, shrouded test leads, and designs that meet worldwide agency approvals.

Total Value. Eight XL Series meters from \$29.95 to \$99.95 to meet any requirement.

You don't need to pay more.
You can't afford to settle for less...

For the name and location of the **Wavetek** dealer near you, call

1-800-854-2708

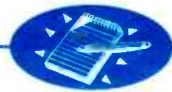
(outside the U.S., call 619-279-2200)

Wavetek Corporation

9045 Balboa Avenue,
San Diego, CA 92123

©Wavetek Corp., 1995. Wavetek and the Wavetek logo are registered trademarks of the Wavetek Corporation

WAVETEK



LETTERS

SEND YOUR COMMENTS TO THE EDITORS OF ELECTRONICS NOW MAGAZINE

THE FUTURE IS NOW

Magnetically-propelled trains operating on conventional rails ("What's News," *Electronics Now*, January 1996) are not new. Such a system has been operating here for the past 10 years. SkyTrain, as it is called, operates on a 28-kilometer, mostly elevated guideway serving the cities of Surrey, New Westminster, Burnaby, and Vancouver.

On-board linear induction motors push against a central reaction rail, consisting of a series of aluminum plates located on the side of the guideway. The cars are driverless, controlled by on-board computers linked to a control center. The top speed is about 80 kilometers per hour, or 50 miles per hour. That does not seem particularly fast, but it appears quite rapid compared to the snail-paced, grid-locked automobile traffic over which it passes. The route, including 20 station stops, is covered in 39 minutes. Trains run every five minutes.

Just because the cars are driverless does not mean the system is unmanned. On-board personnel check tickets and maintain order. As a result, the system is virtually graffiti-free and as safe, or safer, than any similar conventional system. Most of the public complaints about SkyTrain come from those who are not served by it and would like to see the system extended to their areas.

Similar, smaller systems using the same technology operate around downtown Detroit and also in the Toronto suburb of Scarborough.

DAVE ELEY

Surrey, British Columbia, Canada

KUDOS FOR THE ATV TRANSMITTER

I just finished reading "Amateur TV Transmitter" in the May issue, and would like to thank you for publishing William Sheets and Rudolf Graf, who write the most



HERE'S A PEEK at the UHF discone antenna. It's made from copper and brass parts that give it a golden appearance. You can build it from plans that will appear in the August, 1996 issue of *Electronics Now*.

interesting articles in *Electronics Now*.

I look forward to the upcoming article on the downconverter, and, I hope, a few more details on the corner reflector and other antennas used on this project. Perhaps expanding on the few alluring references to airborne remote-control models would make for another interesting series of articles ... which would, in turn, more than

justify my subscription for another year or two!

JAMES M. FOSTER, KD6GEJ
Cardiff by the Sea, CA

Check out page 57 in this issue to discover the complete plans for a matching UHF corner-reflector antenna for the ATV transmitter and downconverter projects.

In the August, 1996 issue we'll present plans for a UHF discone antenna that's easy to build and functions perfectly.

NO MORE MAC ATTACKS!

Randy Jones' letter titled "Sorry, Mac" (*Electronics Now*, May 1996) was a hoot! Those poor Mac users out there! They can't find any software at the local Walmart; they can't go down to the gas station and get a new fan belt for their "Daimler Benz" Macs; and, worst of all, they can't call Microsoft and bask in the superb tech support for Windows. What a joke! He even trotted out the tired old Betamax analogy (never heard that one before).

The fact is that people have been using those lame arguments to predict the imminent demise of the Mac ever since it was first rolled out in 1984. And, like the Energizer bunny (to use another tired analogy), they keep going, and going, and going. My advice to Mr. Jones is to get out of the "break rooms" and obtain some first-hand information.

I receive about a dozen different Mac-only mail-order catalogs each week. Last week, after researching the products in three different Mac magazines, I called one of the companies at 7 PM and ordered a third-party Mac peripheral. I received the

merchandise at 9 AM the next day (at no extra charge).

Here is what happened next: I opened the box, attached the power cord and SCSI cable to my Mac, turned it on, and began using it immediately! Sorry, I can't tell you how good the tech support was because I didn't need any. In fact, I haven't called any tech support hot lines since I stopped using Microsoft QuickBasic and switched to FutureBasic. I do miss the Microsoft DJ though "Average hold time in the Windows group is 47 minutes. Now back to the hits!" Ha, ha, ha!

"You can't get any software for the Mac," is the oft-heard argument, yet the average Mac user has (and uses productively) more applications than the average PC user. Installing new applications is no big deal on the Mac, and neither is learning how to use them. Maybe there are only 5000 Mac software products out there, instead of 20,000 (I don't know the real numbers), but the only ones that really matter are the ones you actually use

productively.

The real question is why the PC world feels so threatened by the Mac, and why is it so obsessed with stamping it out? I read PC magazines, too (including Jeff Holtzman's column in *Electronics Now*), and it is always Mac this, Mac that. Yet the Wintel platform is rarely mentioned in the Mac publications.

The truth is, we don't care, we go happily about our business, immune from the multitude of hassles faced by the average Wintel user. Does the PC community really think their interests

will be served if the Mac goes away and personal computing really becomes a Bill Gates monopoly? Actually, I think Bill has bigger fish to fry—watch out Unix!
NEAL DUNCAN
Washington, DC

ERRATA SHEETS AVAILABLE

A full-page ad for our books, "Communications Licensing and Certification Examinations," and "Practice Tests for Communications Licensing and Certification Examinations" recently appeared in *Electronics Now*. We regret, however, that some errors were published in the books.

We are offering errata sheets to anyone who has purchased one or both books. Those wishing to receive the errata sheets should send a stamped, self-addressed envelope to the address that follows.

SAM WILSON AND JOE RISSE
P. O. Box 2077
Melbourne, FL 32902-2077

EN

Write To:

Letters,
Electronics Now Magazine,
500 Bi-County Blvd.,
Farmingdale, NY 11735

Due to the volume of mail we receive, not all letters can be answered personally. All letters are subject to editing for clarity and length.

VOICE CHANGERS! ELECTRONIC KITS AND MORE!

ELECTRONIC KITS!

WE ACCEPT VISA, MC, MO, COD
SHIPPING & HANDLING EXTRA



BUY WITH CONFIDENCE FROM XANDI

• 30-DAY REFUND POLICY
• TECH SUPPORT NUMBER (602-894-0992)

<ul style="list-style-type: none"> • Powerful 2 stage audio amplifier. • Tunes 88-108 MHz. • Up to 1 mile range. • Requires 9V battery. (Not incl.) • Sensitive, picks up sounds at the level of a whisper. 	<ul style="list-style-type: none"> • Sensitive audio amplifier, picks up sounds at the level of a whisper. • Tunes 88-108 MHz. • Up to 1/2 mile range. • Miniature photo battery mounts right on circuit board. (Included) 	<ul style="list-style-type: none"> • Up to 1/2 mile range. • Miniature photo battery mounts right on circuit board. • Transmits at 143 MHz. • Amazing audio sensitivity, picks up sounds at the level of a whisper. 	<ul style="list-style-type: none"> • Smallest Phone transmitter anywhere! • Tunes 88-108 MHz. • Up to 1/4 mile range. • Attach to phone line anywhere in house. • No batteries required, powered by phone line.
<p>SUPER-MINIATURE FM TRANSMITTER Super small FM transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip (SMT) parts are pre-assembled to the circuit board.</p> <p>XST500 E-Z Kit \$44.95</p>	<p>MICRO-MINIATURE FM TRANSMITTER Including the battery, this is the Worlds smallest FM transmitter. Use with any FM broadcast receiver. Easy to assemble, uses pre-assembled circuit board.</p> <p>XWB1000 E-Z KIT \$46.95</p>	<p>CRYSTAL CONTROLLED FM TRANSMITTER Including the battery, this is the Worlds smallest crystal controlled FM transmitter. Transmits to any scanner type receiver. Easy to assemble, uses pre-assembled circuit board.</p> <p>XTL1000 E-Z KIT \$69.95</p>	<p>SUPER-MINIATURE PHONE TRANSMITTER Worlds smallest FM phone transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip components are pre-assembled to the circuit board.</p> <p>XSP250 E-Z Kit \$28.95</p>
<ul style="list-style-type: none"> • Dial your phone from anywhere and listen to the sounds inside your home. • Two digit Touch Tone code for secure operation. <p>TELEPHONE SNOOP The latest in home or office security. Call home from anywhere, enter a two digit security code, and hear the sounds in your home. Automatically turns on without ringing the phone, verifies code, then activates for one and a half minutes.</p> <p>XPS-CASE KIT \$13.95</p> <p>XPS1000 C KIT \$55.95</p>	<ul style="list-style-type: none"> • Transmits a continuous beeping tone. • Adjustable from 88 to 108 MHz. • Up to 1 mile range. • Works with any FM broadcast receiver. <p>TRACKING TRANSMITTER Only 0.7 by 2.4 inches, the XTR100 operates at voltages of 3 to 18 Volts and is ideal for use in locating lost model rockets, bicycles, automobiles, games of hide and seek, and contests.</p> <p>XTR100 C Kit \$29.95</p>	<ul style="list-style-type: none"> • Covers 1 to 2,000 MHz. • Compact hand held unit. • Uses sensitive microwave transistor amplifier. • Includes miniature loud speaker for audio indication of detected signals. <p>SUPER SENSITIVE BUG DETECTOR When the XBD200 intercepts a signal in the 1 to 2,000 MHz range, it emits a growl that increases to a high pitched squeal as the signal strength increases.</p> <p>XBD200 C Kit \$39.95</p>	<ul style="list-style-type: none"> • Use with any FM broadcast receiver. • Hear every sound in an entire house! • Up to 1 mile range. • Powerful 2 stage audio amplifier. <p>MINIATURE FM TRANSMITTER The XFM100 has a super sensitive microphone and is capable of picking up sounds at the level of a whisper and transmitting them to any FM broadcast receiver.</p> <p>XFM100 C Kit \$21.95</p>
<ul style="list-style-type: none"> • Digital voice changing: male to female, female to male, adult to child, child to adult. • Anonymity on any call. • Button for normal operation. • 16 levels of voice masking. <p>VOICE CHANGING TELEPHONE STOP THOSE ANNOYING TELEPHONE CALLS! Sound older and tougher when you want to. Not a kit. Fully assembled. Single phone operation only.</p> <p>TRANSITION 2000 \$89.95</p>	<ul style="list-style-type: none"> • Digital voice changing: male to female, female to male, adult to child, child to adult. • Use with any modular phone. • 16 levels of voice masking. • Connects between handset and phone. <p>VOICE CHANGING ACCESSORY STOP THOSE ANNOYING TELEPHONE CALLS! Sound older and tougher when you want to. Not a kit. Fully assembled. Use with single or multi-line phones.</p> <p>TRANSITION 2001 \$59.95</p>	<ul style="list-style-type: none"> • Uninterrupted coverage of 800 to 950 MHz. • Works with any scanner that can receive 400 to 550 MHz. <p>800-950 MHz SCANNER CONVERTER KIT If your scanner can receive 400-550 MHz, just add the XLC900 for <u>uninterrupted</u> 800-950 MHz coverage. It converts all 800-950 MHz signals down to 400-550 MHz so your scanner can receive them! Add our custom case kit for that "Professional" look.</p> <p>XLC-CASE KIT \$13.95</p> <p>XLC900 C KIT \$49.95</p>	<ul style="list-style-type: none"> • Transmit high quality stereo to any FM stereo receiver. • Built-in output level monitor for quick and easy tuning. • Ideal for use with personal CD player. <p>FM STEREO TRANSMITTER Transmit full-bodied Hi Fi stereo to any FM stereo receiver. Separate left and right inputs and gain controls. Includes an output booster stage for greater range.</p> <p>XFS-CASE KIT \$13.95</p> <p>XFS108 C KIT \$39.95</p>

XANDI Serving the public since 1981
ELECTRONICS, INC.
1270 E Broadway Rd. # 113, Tempe AZ 85282

TOLL FREE ORDER LINE: 1-800-336-7389
FAX LINE: 1-602-731-4748
ASK FOR FREE CATAG OF OUR PRODUCTS

SEND MAIL XANDI ELECTRONICS
ORDERS TO: BOX 25647
TEMPE, AZ 85285-5647

CIRCLE 279 ON FREE INFORMATION CARD



EQUIPMENT REPORTS

RAMSEY ELECTRONICS FM-25 STEREO BROADCASTING KIT

Put a signal out on the air!

CIRCLE 15 ON FREE INFORMATION CARD



The Ramsey Electronics FM-25 kit lets you build a FM stereo broadcaster and put your signal anywhere on the FM band. Why would you want to do that? Well, the reasons are numerous. How about using it as a kind of whole-house audio system? With the FM-25, you could listen to your CD changer anywhere in the house where you had an FM receiver. Better yet, you could listen to it outside with a portable radio. We find that it's a great way to enjoy commercial-free music when we have some friends over.

We also find the FM-25 a great way to let us listen to our favorite radio station on a personal portable when we're outside doing yard work. It just so happens that our favorite station has a low-power transmitter operating from a university about 30 miles away. We have no problem picking up the signal with a rooftop antenna, but we have almost no luck on a portable. Now, we can feed the output of our stereo receiver into the FM-25, and then re-broadcast it to our portable.

Building the transmitter

The FM-25 kit is relatively easy to build. All of the components are mounted on a single-sided printed-circuit board. The component side of the board is silk-screened with the location of all parts. The solder

side of the board features a solder mask that help to reduce the chance of creating an inadvertent solder bridge across adjacent pads. An experienced builder should be able to assemble the kit in one evening; a beginner will probably require twice that to complete the 265 solder points.

The heart of the circuit consists of three integrated circuits: a Rohm BA1404 stereo transmitter IC, a Motorola MC145170 phase-locked loop (PLL) frequency synthesizer with serial interface, and a 68HC705 8-bit microcontroller.

The Rohm chip was originally designed for use in automotive CD systems, where it would allow signals from the CD player to be fed to the existing audio system throughout the antenna input. As it turns out, of course, the BA1404 also makes an excellent stereo broadcaster.

One potential problem with FM transmitters comes into play when a digital tuner is used to receive them. If the transmitted signal isn't exactly on frequency, the receiver won't be able to receive it. Analog radios, of course, can tune in an off-frequency signal without problems. A digital receiver, with its discrete tuning steps, cannot. The MC145170 PLL and the 68HC705 8-bit microcontroller ensure good on-frequency performance.

The microcontroller looks at the settings of three DIP switches to determine the frequency of operation. Each DIP switch has four positions, and they allow the frequency to be entered in binary-coded decimal format. For example, to set the transmitter to a frequency of 89.9 MHz, the switches would be set, in binary, to 8, 9, and 9 respectively. For frequencies above 100 MHz, the first switch would be set to a value of 10.

The microcontroller is smart enough to disallow any illegal frequencies. For example, only the first DIP switch can be set to a value of 10. Any other switch setting greater than 9 will be read as a zero. Also, and out-of band frequencies will not be allowed, and the transmitter will default to a frequency of 88.1 MHz.

After the microcontroller reads the switches, it sends the 16 bits of frequency information to the PLL frequency synthesizer serially. An additional 32 control bits of control information are also sent.

The PLL IC operates with a 4-MHz crystal. Under control of the microprocessor, it divides the 4-MHz clock by 40 to obtain a stable reference frequency of 100 kHz. The PLL also examines the output of the BA1404 FM transmitter chip and divides it by N, where N is the desired frequency in megahertz times 10.

Using the example frequency of 89.9 MHz, the PLL would divide the output of the transmitter chip by 899, and compare it with the 100-kHz reference frequency. It uses this information to increase or decrease the voltage across a varactor diode.

A varactor diode is a specially

manufactured diode whose capacitance varies with changes in its reverse-bias voltage. In essence, a varactor is a voltage-variable capacitor. In the transmitter, the varactor is placed in the tuned circuit that sets the operating frequency. The PLL in combination with the varactor perform create a rock-steady, drift-free output from the transmitter.

Under Part 15 of the FCC rules, it is perfectly legal to operate the FM-25 anywhere in the FM band of 88 to 108 MHz. However, you may *not* cause interference with any licensed FM broadcast stations or listeners. You must stop transmitting immediately if any interference is detected.

When choosing an operating frequency, for example, you can't casually tune across the band with a cheap radio and assume that there's no signal available just because you can't hear one. You should really use a quality receiver and rotatable antenna to determine which frequencies are truly open.

In our location outside of New York City, there are few open frequencies. Plus, the population density is high enough that there are a lot of people within the range of the FM-25 transmitter. Unless we were careful, operating the transmitter could cause great interference to someone who was using a good receiver and antenna to pull in what might usually be considered an out-of-market station.

The FM-25 also provides a high-power option. Adding a single jumper across a resistor increases the output power of the FM-25, making its operation illegal in the U.S. However, in some countries it would be perfectly legal to operate in the high-power mode. According to Ramsey, some entire Caribbean islands are served by radio stations using the FM-25 as their transmitter.

All in all, the FM-25 is a quality kit that is designed to work the first time you throw the switch on. It is supplied with a plastic case, a whip antenna, an AC power adapter, and a well-written assembly manual. The kit is available from Ramsey Electronics, Inc., 793 Canning Parkway, Victor, NY 14564; tel: 716-924-4560. The price of the kit is \$129.95. **EN**

TIPS FOR MAIL ORDER PURCHASE

It is impossible for us to verify the claims of advertisers, including but not limited to product availability, credibility, reliability and existence of warranties. The following information is provided as a service for your protection. It is not intended to constitute legal advice and readers are advised to obtain independent advice on how to best protect their own interests based upon their individual circumstances and jurisdictions.

1. **Confirm price and merchandise information** with the seller, including brand, model, color or finish, accessories and rebates included in the price.

2. **Understand the seller's return and/or refund policy**, including the allowable return period, who pays the postage for returned merchandise and whether there is any "restocking" or "return" charge.

3. **Understand the product's warranty.** Is there a manufacturer's warranty, and if so, is it for a U.S. or foreign manufacturer? Note that many manufacturers assert that, even if the product comes with a U.S. manufacturer's warranty, if you purchase from an unauthorized dealer, you are not covered by the manufacturer's warranty. If in doubt, contact the manufacturer directly. In addition to, or instead of the manufacturer's warranty, the seller may offer its own warranty. In either case, what is covered by warranty, how long is the warranty period, where will the product be serviced, is there a charge for service, what do you have to do to obtain service and will the product be repaired or replaced? You may want to receive a copy of the written warranty before placing your order.

4. **Keep a copy of all transactions**, including but not limited to cancelled check, receipt and correspondence. For phone orders, make a note of the order including merchandise ordered, price, order date, expected delivery date and salesperson's name.

5. **If the merchandise is not shipped within the promised time**, or if no time was promised, within 30 days of receipt of the order, you generally have the right to cancel the order and get a refund.

6. **Merchandise substitution** without your express prior consent is generally not allowed.

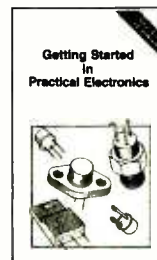
7. **If you have a problem with your order or the merchandise**, write a letter to the seller with all the pertinent information and keep a copy.

8. **If you are unable to obtain satisfaction from the seller**, contact the consumer protection agency in the seller's state and your local Post Office.

If, after following the guidelines, you experience a problem with a mail order advertiser that you are unable to resolve, please let us know. Write to Advertising Department, Gernsback Publications Inc., 500B BI-County Blvd. Farmingdale, NY 11735.

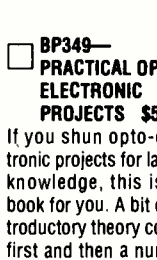
Be sure to include copies of all correspondence.

You can Build Gadgets! Here are 3 reasons why!



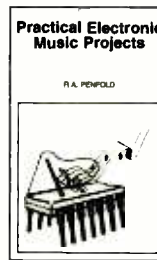
BP345—GETTING STARTED IN PRACTICAL ELECTRONICS \$5.95

If you are looking into launching an exciting hobby activity, this text provides minimum essentials for the builder and 30 easy-to-build fun projects every experimenter should toy with. Printed-circuit board designs are included to give your project a professional appearance.



BP349—PRACTICAL OPTO-ELECTRONIC PROJECTS \$5.95

If you shun opto-electronic projects for lack of knowledge, this is the book for you. A bit of introductory theory comes first and then a number of practical projects which utilize a range of opto devices, from a filament bulb to modern infrared sensors and emitters—all are easy to build.



BP363—PRACTICAL ELECTRONIC MUSIC PROJECTS\$5.95

The text contains a goodly number of practical music projects most often requested by musicians. All the projects are relatively low-in-cost to build and all use standard, readily-available components that you can buy. The project categories are guitar, general music and MIDI.

Mail to:
Electronic Technology Today, Inc.
P.O. Box 240
Massapequa Park, NY 11762-0240

Shipping Charges in USA & Canada

\$0.01 to \$5.00.....\$2.00	\$30.01 to \$40.00.....\$6.00
\$5.01 to \$10.00.....\$3.00	\$40.01 to \$50.00.....\$7.00
\$10.01 to \$20.00.....\$4.00	\$50.01 and above.....\$8.50
\$20.01 to \$30.00.....\$5.00	

Sorry, no orders accepted outside of USA and Canada. All payments must be in U.S. funds only.

Number of books ordered.

Total price of books..... \$ _____
Shipping (see chart) \$ _____
Subtotal \$ _____
Sales Tax (NYS only)..... \$ _____
Total enclosed \$ _____

Name _____
Address _____
City _____ State _____ ZIP _____

Please allow 6-8 weeks for delivery.



NEW PRODUCTS

USE THE FREE INFORMATION CARD FOR FAST RESPONSE

INTEGRATED PDA SOLUTION

PHILIPS SEMICONDUCTOR'S PR31100 and UCB1100 with software fax/modem represent a two-chip solution for personal digital assistants (PDAs), personal intelligent communicators (PICs), and other smart communication products. The chipset offers size, cost, and power-consumption improvements, and, according to Philips, "will bring device prices low enough to change the way people think about PDAs."

shortens battery life, lengthens the hardware design cycle, and requires customized software.

In contrast, the PR31100 and UCB1100 allow designers to create various types of wired or wireless PDAs, PICs, screen phones (which allow users to handle phone-related information and over-the-line data on a computer-like display), or Internet access terminals (low-cost, plug-and-play devices that use a TV as a display), simply by taking

data cache, plus a hardware multiply/accumulate unit to perform DSP functions. Those computing resources allow the PR31100 to run routines such as the V.32bis (14.4 Kbps) software fax/modem, voice recognition of about 100 words, echo cancellation for high-quality speakerphone performance, and handwriting recognition. Working with a 14-bit telecom codec in the UCB1100, the Philips-licensed software fax/modem eliminates the need for an external modem chipset, which would cost about \$30—almost as much as the chipset and software combined. The PR31100's other features include a complete video controller for both color and monochrome LCDs, along with several industry-standard communications channels.

In addition to the telecom codec, the mixed-signal UCB1100 provides a 12-bit audio codec, a touch-screen interface, four general-purpose analog-to-digital converter inputs (battery voltage measurement), and 10 programmable I/O lines. All of those resources are designed to minimize or eliminate external components.

Philips supplies low-level software drivers and reference designs for the main PR31100/UCB1100 applications. Complete development support is available.

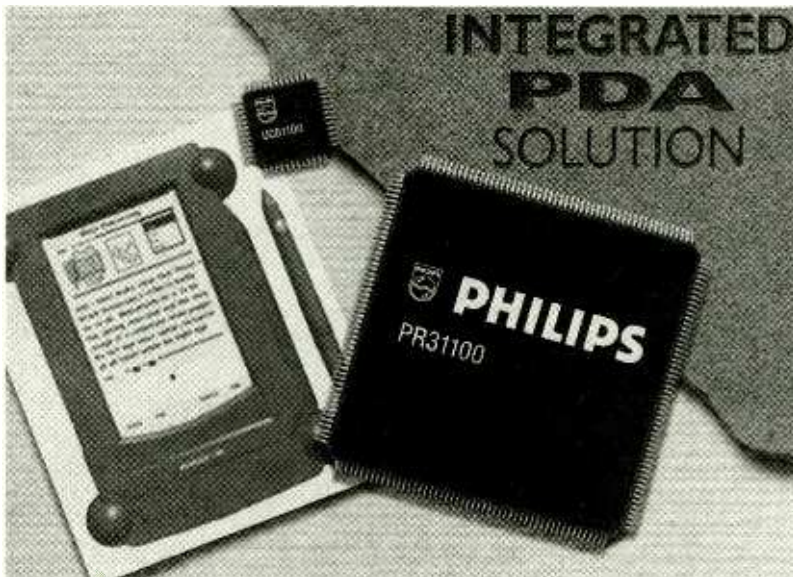
The PR31100/UCB1100 chipset and the software fax/modem license costs \$38 in 100,000-unit quantities.

PHILIPS SEMICONDUCTORS INC.

811 East Arques Avenue
Sunnyvale, CA 94088-3409

Phone: 408-991-2000

Website: <http://www.semiconductors.philips.com/ps/>



CIRCLE 20 ON FREE INFORMATION CARD

Because the chipset provides virtually all the functionality needed for a PDA or PIC in just two IC's, most such devices will require only the addition of memory. Competing solutions require a processor and other off-the-shelf chips in addition to one or more custom chips. That approach makes PDA/PICs large and expensive,

advantage of different chipset functions. Those applications share the common feature set of LCD display, input via touchscreen and optional keyboard, and communication via telephone lines.

To support those applications, the PR31100 contains an MIPS R3000 RISC core with 4 Kbytes of instruction cache and 1 Kbytes of

TRIPLE-OUTPUT POWER SUPPLY

THE MODEL 1670 TRIPLE-output power supply from B+K Precision is designed for applications in the servicing, educational, and hobbyist markets where a low-cost solution to multiple outputs is desired. The power supply features a variable DC supply—0 to 30 volts at 0 to 2.5



CIRCLE 21 ON FREE INFORMATION CARD

amps—with variable current limiting, constant current or constant voltage operation, tight regulation, low ripple, and separate digital LCD current and voltage meters. Another fixed 5-volt, half-amp supply is provided for TTL projects, and a fixed 12-volt, half-amp supply is included for mobile electronics and digital CMOS projects.

The Model 1670 costs \$199.

B+K PRECISION

6740 West Cortland Street
Chicago, IL 60635
Phone: 1-800-462-9832
Fax: 312-794-9740

HIGH-EFFICIENCY DMM

HC PROTEK'S MODEL D-980 is a highly accurate, 3-3/4-digit multimeter that meets UL standard 1244 specifications. It comes with a protective holster to guard against mishandling, and features an LCD readout and a 3200-count analog bar graph.

The Model D-980 measures AC/DC current from 300 μ A to 12 amps, and resistance to 30 megohms



CIRCLE 22 ON FREE INFORMATION CARD

in six ranges. DC voltage can be measured in five ranges, from 300 mV to 1000 volts, with accuracy from 5%. AC voltage is measured in three ranges, from 30 to 700 volts, with an accuracy of $\pm 1.2\%$. The D-980 also offers data, hold, range, and function select buttons, fused overload protection, diode test, a continuity buzzer, and a low-battery indicator. Test leads, three AAA batteries, and an instruction manual are supplied.

The Model D-980 costs \$69.

HC PROTEK, INC.

154 Veterans Drive
Northvale, NJ 07647
Phone: 201-767-7242
Fax: 201-767-7343
E-mail: hcprotek@aol.com
Website: <http://www.techexpo.com/www/hcprotek>

TEST AND MEASUREMENT RELAYS

NTE'S R72 SERIES OF SUB-miniature 1-amp relays is specifically designed for use in office automation and test and measurement instruments. The series features high-sensitivity, low-power consumption, and fully sealed construction. The R72 series' operating features, plus the compact size and light weight (0.11 ounces) of the devices, make them well suited for OEM design and as replacement parts in a variety of automation and test equipment.

The series comes with a DPDT

EARN YOUR B.S. DEGREE IN COMPUTERS OR ELECTRONICS



By Studying at Home

Grantham College of Engineering, now in our 46th year, is highly experienced in "distance education"—teaching by correspondence—through printed materials, computer materials, fax, modem, and phone.

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

Grantham offers three separate distance-education programs, leading to the following accredited degrees;

- (1) The B.S.E.T. with Major Emphasis in Electronics.
- (2) The B.S.E.T. with Major Emphasis in Computers.
- (3) The B.S.C.S. — the Bachelor of Science in Computer Science.

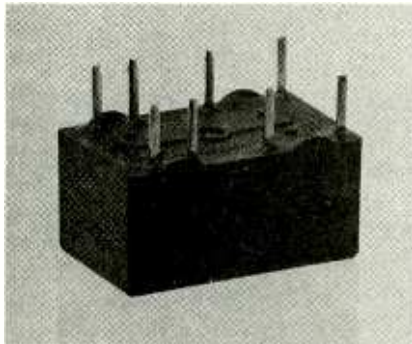
An important part of being prepared to *move up* is holding the right college degree, and the absolutely necessary part is knowing your field. Grantham can help you both ways—to learn more and to earn your degree in the process.

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

Accredited by
the Accrediting Commission of the
Distance Education and
Training Council

GRANTHAM
College of Engineering
Grantham College Road
Slidell, LA 70460

contact arrangement, and is also available in a dual-coil latching type. The R72 relays offer coil voltages of 5, 6, 12, and 24 volts DC. The DC operating temperature range is -40°C to



CIRCLE 23 ON FREE INFORMATION CARD

+70°C. Dielectric strength is 1000 volts AC between coil and contacts, 250 volts AC (latching) between set and reset coils, 750 volts AC between contacts of the same polarity, and 1000 volts AC between contacts of different polarity. Resistance is 50 megohms maximum.

The R72 series costs less than \$3 per piece in 1000-piece quantities.

NTE ELECTRONICS, INC.

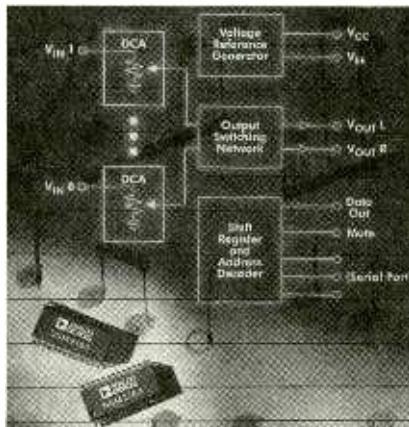
44 Farrand Street
Bloomfield, NJ 07003
Phone: 1-800-683-6837
Fax: 1-800-683-3338
or 1-800-683-3292 to request
QUICKFACTS Document #445

8x2 AUDIO MIXER-ON-A-CHIP

ANALOG DEVICES' SSM2163 IS A functionally complete 8-input audio mixer-on-a-chip. It accepts eight audio channels, provides user-friendly control of volume in 63-dB steps, and can mix individual channels to either the right, the left, or both outputs. It is well-suited for automating many computer audio systems, from high-end multimedia workstations to low-cost PC soundcards. Other applications include professional audio mixing consoles, broadcast equipment, intercom and paging systems, and musical instruments.

The device replaces expensive multichip solutions and improves audio fidelity in computer audio systems. With its industry-standard three-wire serial interface and one data output

terminal multiple SSM2163s can be easily daisy-chained for high-end multi-track audio systems. A single mute pin, when driven by a micro-processor reset signal, will silence all eight audio channels simultaneously. No additional external components are needed for fully specified operation.



CIRCLE 24 ON FREE INFORMATION CARD

The SSM2163 is a companion to Analog Devices' family of stereo codecs. Its signal-to-noise ratio is -82 dBu (0 dBu = 0.775 volts rms), with an additional 10 dBu of headroom, resulting in a total harmonic dynamic range of 92 dBu. Total harmonic distortion plus noise is a low 0.007% at 1 kHz with all levels set for unity gain. The mixer-in-a-chip can be powered by a single (+5- to +14-volt) supply or dual (±4- to ±14-volt) supplies and is available in 28-pin plastic DIP and SOIC packages.

The SSM2163 costs \$8 each in quantities of 100.

ANALOG DEVICES, INC.

Ray Strata Technology Center
804 Woburn Street
Wilmington, MA 01887
Phone: 617-937-1428
Fax: 617-821-4273

LINEAR AMPLIFIERS

AMERITRON'S AL-800 AND AL-800H amplifiers provide all-band operation: 160-15 meters, including the WARC bands. They can be modified by the user for 12 and 10 meters. The AL-800H uses two Genuine Eimac 3CX800A7s tubes and boasts 1500 watts "plus." The AL-800 uses



CIRCLE 25 ON FREE INFORMATION CARD

one 3CX800A7 tube and powers up to 1250 watts.

Both amplifiers feature an adjustable slug tuned input circuit and a Pi/(Pi-L) output network, providing smooth tuning and a wide matching range. The amplifiers' grid current limits circuits and protects the tubes. Both display an adjustable front panel and true ALC control. Vernier reduction drives tune and load and make adjustments smooth and easy. A user-modifiable, 32-pound, grain-oriented, silicone steel-core transformer is supplied with high-capacitance computer-grade filter capacitors. Both amplifiers come with dual illuminated cross-needle meters that read peak forward power, reflected power, SWORE high voltage, grid current, and plate current. Other features include multi-voltage operation and air-cooled ventilation systems.

The AL-800H amplifier costs \$2295.

AMERITRON

116 Willow Road
Starkville, MS 39759
Phone: 1-800-647-1800
or 601-323-8211
Fax: 601-323-6551

BREAK'R TRAC'R CIRCUIT TRACER

AMPROBE'S BREAK'R TRAC'R BT-100 circuit tracer allows the user to quickly and easily determine the 120-volt AC circuit breaker or fuse that supplies a receptacle or lighting fixture. Well-suited for residential applications, the BT-100 saves time by eliminating trial-and-error troubleshooting and allows breakers to be identified without shutting off power. The two-piece set consists of a small handheld receiver, the BT-100R, which emits an audible tone and displays and LED when the signal, pro-



CIRCLE 26 ON FREE INFORMATION CARD

vided by the transmitter (BT-100T), is sensed on the appropriate circuit breaker or fuse. Adjustable sensitivity on the receiver enables the appropriate breaker or fuse to be identified.

The Break'r Trac'r BT-100 carries a trade price of \$39.85.

AMPROBE INSTRUMENT

630 Merrick Road
Lynbrook, NY 11563
Phone: 516-593-5600
or 1-800-477-VOLT
Fax: 516-593-5682

NOTEBOOK-COMPUTER CASE

THE CURTIS CASE FROM Rolodex is a cleverly designed carrying case for notebook computers. It features moveable, self-grip accessories that allow users to customize the case to suit their work habits. The case also features built-in wiring ports, allowing users to run cables through the bag and connect directly into an optional retractable-cord surge protector, in effect creating a portable workstation. The case comes with a key-chain, pen holder, and disk holder. Other self-grip accessories, including a note holder, an eyeglass holder, a cellular-phone holder, all-purpose



CIRCLE 27 ON FREE INFORMATION CARD

pockets, accessory pouches and a disk wallet, are available separately.

The lightweight Curtis Case features a protective shell over a frame constructed of durable polypropylene for extra strength. An internal flexible strap and shock-absorbing corners secure the notebook PC firmly inside the bag. The reinforced handle is fastened directly through the frame.

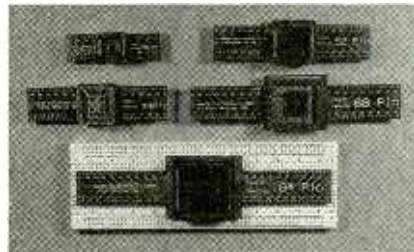
The Curtis Case costs \$149 in black leather, or \$119 in black vinyl. The retractable-cord surge protector, which fits neatly into the case's pocket, provides protection on the AC line and modem/fax lines, and includes a six-foot telephone cord, costs \$9.95 with the purchase of the bag. Additional accessories have suggested retail prices of \$4.00 each.

CURTIS BY ROLODEX

225 Secaucus Road
Secaucus, NJ 07094
Phone: 1-800-955-9514
or 201-422-0240
Fax: 201-422-0254

LEADLESS CHIP BREADBOARD ADAPTERS

AMAZE ELECTRONICS' SERIES of leadless chip breadboard adapters feature a streamlined, patent-pending design that fits on a single breadboard strip. The adapters are well suited for those who use leadless chips in bread-

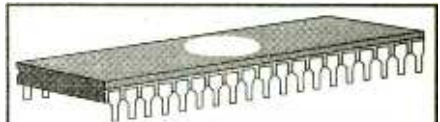


CIRCLE 29 ON FREE INFORMATION CARD

boarding, wire-wrap, and prototyping applications. They are available with 28, 44, 52, 68, and 84-pins. Prices range from \$6.95 for the 28-pin adapter to \$18.95 for the 84-pin adapter.

AMAZE ELECTRONICS CORPORATION

10395 Mary Avenue
Cupertino, CA 95041
Phone: 408-996-8943
Fax: 408-996-0366



CABLE CONVERTER DIAGNOSTIC TEST CHIP

LOAD FULL ACTIVATION OF CABLE CONVERTER

WE STOCK A COMPLETE LINE OF CHIPS, TOOLS, WIRELESS QUICK INSTALL TEST BOARDS AND DIAGNOSTIC CUBES FOR ALL CONVERTERS!

***ANYONE IMPLYING ILLEGAL USE WILL BE DENIED SALE. WE SELL PRODUCTS ONLY!! TO

TECHNICIANS OR CABLE REPAIR FACILITIES!!

#1 IN CUSTOMER SERVICE & TECH. SUPPORT!

*ALL ORDERS SHIP WITHIN 24HRS, UPS/ FED-X.

*PRIORITY NEXT DAY SHIPPING AVAILABLE!

*SALE= BUY 5 BOARDS GET 1 FREE TILL MAY96.

*LOWEST PRICE & SUPERIOR PRODUCT GUARNTI

*FRIENDLY COURTEOUS SERVICE. WE'RE PRO'S!



COMMUNICATIONS INC. FOR ORDERS 1-800-GO-CABLE

CATALOG & TECH. SUPPORT 717-620-4363 EST. 1977

ANTIQUE RADIO CLASSIFIED Free Sample!

Antique Radio's Largest Circulation Monthly. Articles, Ads & Classifieds.

6-Month Trial: \$18.95. 1-Yr: \$36.95 (\$53.95-1st Class). A.R.C., P.O. Box 802-L17, Carlisle, MA 01741
Phone:(508) 371-0512 VISA/MC Fax:(508) 371-7129

SINGERS! REMOVE VOCALS
Unlimited, Low Cost, Instantly Available Background Music from Original Standard Recordings! Does Everything Karaoke does... Better and gives you the Thompson Vocal Eliminator! Free Brochure & Demo Tape. LT Sound Dept. Rt-1 7980 LT Parkway, Lithonia, GA 30058 Internet-http://ltsound.com 24 Hour Demo/Info Request Line (770)482-2485 Ext 72 When You Want Something Better Than Karaoke!

MULTIMEDIA on the PC!

What is Multimedia? What can it do for you? It can do lots of nice things! This 184-page book helps you create your own multimedia presentation.

Multimedia applications by people like you can revolutionize educational and business applications as well as bring more FUN, FUN, FUN into your leisure computer activities.

Mail coupon to:
Electronics Technology Today, Inc.
P.O. Box 240
Massapequa Park, NY 11762-0240

Please send me my copy of *Multimedia on the PC* (PCP120). I enclose a check or money order for \$18.95 to cover the book's cost and shipping-and-handling expenses. NY state resident must add local sales tax.

Name _____
Address _____
City _____ State _____ Zip _____

All orders must be paid in U.S. funds only. Sorry, no orders accepted outside of USA and Canada. Please allow 6-8 weeks for delivery. MA02

EN

July 1996, Electronics Now

25

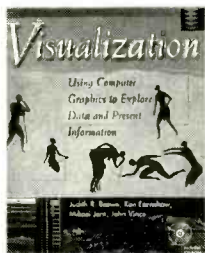


NEW LITERATURE

USE THE FREE INFORMATION CARD FOR FAST RESPONSE

Visualization: Using Computer Graphics to Explore Data and Present Information

by Judith R. Brown, Rae Earnshaw, Mikael Fern & John Vince
John Wiley & Sons, Inc.
605 Third Avenue
New York, NY 10158-0012
Phone: 1-800-CALL-WILEY
\$44.95, including CD-ROM



CIRCLE 337 ON FREE INFORMATION CARD

High-quality computer graphics can be used to create virtual rooms for architects or guided tours of human cells for students and doctors.

But such computer visualization has been almost exclusively the territory of experienced designers with high-powered computers.

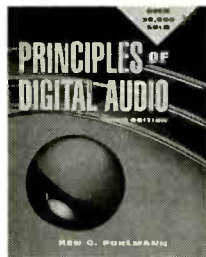
This book brings the magic of computer visualization to the desktop environment. Written in a clear, non-technical style, the hands-on guide helps users create advanced graphics using nothing more than a PC and commercially available desktop software.

Accompanied by a CD-ROM that features examples ranging from the basics of charting and graphing to the most advanced animation techniques, the book allow readers to create effects from two-dimensional drawings to 3D virtual worlds. With more than 100 full-color illustrations, the book explains the basics of computer graphics and visualization. It helps readers learn to combine images, video, and animation to produce

original multimedia presentations; apply visualization to scientific, technical, business, and artistic presentations; incorporate online images from the Internet into desktop visualization; and simulate human motion, weather conditions, crash scenarios, and more.

Principles of Digital Audio Third Edition

by Ken C. Pohlmann
McGraw-Hill Book Company
11 West 19th Street
New York, NY 10011
Phone: 1-800-2-MCGRAW
\$44.95



CIRCLE 338 ON FREE INFORMATION CARD

This comprehensive introduction to digital audio, now in its third edition, has been updated and expanded to introduce both audio

and computer users to the many new technologies that are transforming the field. Aimed at both professional designers and engineering students, the book provides complete details on advances in such areas as optical disc reading, interfacing and networking, perceptual coding theory and applications, and digital audio broadcasting.

The book combines digital audio theory with examples of applications and provides an in-depth database of valuable digital audio information. It includes coverage of digital audio fundamentals, recording and reproduction, error correction,

magnetic tape storage, optical storage and transmission, compact disc formats, satellite broadcasting, MPEG coding, digital audio workstations, and digital signal processing. The book reveals all the exciting breakthroughs in digital audio technology for the multimedia age.

Unique Accessories for Test & Measurement

ITT Pomona Electronics
1500 East Ninth Street
Pomona, CA 91766-3835
Phone: 909-469-2900
Fax: 909-629-3317
Free



CIRCLE 339 ON FREE INFORMATION CARD

This catalog features test accessories intended to enhance test equipment from leading manufacturers. Leading off the newest products are

complete "take-it-with-you" test kits in carrying cases designed specifically for use with Fluke, Hewlett-Packard, or Tektronix meters and oscilloscopes. The Test Companion kits also include high-quality Pomona test leads, probes, grabbers, and clips, all organized in lightweight, durable carrying cases. The catalog also features DMM test accessories and kits, oscilloscope probes, test clips, cable assemblies, coaxial adapters and kits, banana plugs, enclosures, and IC test clips for popular two- and four-sided devices including new solder-on adapters.

Communications Catalog 96-01

Universal Radio, Inc.

6830 Americana Parkway

Reynoldsburg, OH 43068-4113

Phone: 1-800-431-3939 or 614-866-4267

Fax: 614-866-2339

E-mail: dx@universal-radio.com

free by fourth class mail

\$1 by first class mail



CIRCLE 340 ON FREE INFORMATION CARD

This 112-page catalog covers equipment for amateur, shortwave, and scanner enthusiasts, and also features an impressive selection of antennas, head-phones, books, and accessories. Several new items premiering in this catalog include the Kenwood TS-870S transceiver, the Sangean ATS-909 portable receiver, the Lowe HF-250 receiver, the AOR AR5000 receiver, the Grundig Traveller II digital receiver, and the Sony ICF-SW1000T receiver/recorder. Many new antennas and accessories are also introduced. In addition, the catalog provides answers to frequently asked questions in comprehensive, one-page introductions to shortwave, radioteletype, and amateur radio.

NetLaw: Your Rights in the Online World

by Lance Rose

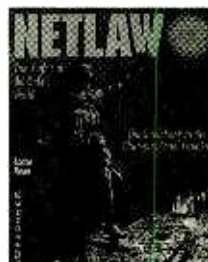
Osborne McGraw-Hill

2600 Tenth Street

Berkeley, CA 94710

Phone: 1-800-822-8158

\$19.95



CIRCLE 341 ON FREE INFORMATION CARD

In the brave new world of cyberspace, online legal rights are continually evolving. Issues like privacy, copyrights, and freedom of speech don't necessarily work the

same way in a digital environment, and rights to which you may be accustomed in print or broadcast media might not apply. System operators and BBS users alike need to know their rights, as well as the legal risks involved in online communications.

This book provides an introduction to the world of online law, explaining how everyday online behavior is protected or prohibited under the law. Using fascinating case studies, it covers the hottest and most widely debated topics affecting system users and operators, including commercial relationships, ownership of information, searches and seizures, and sexually explicit materials. The book discusses the potential demise of the copyright on the Internet, the legal risks faced by corporations online, how the First Amendment protects online systems and users, how to make an online contract, and how obscenity is defined and which laws apply to it.

45 Simple Electronic Terminal Block Projects

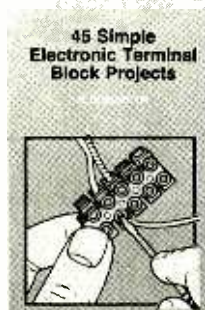
by R. Bebbington

Electronics Technology Today Inc.

P.O. Box 240

Massapequa Park, NY 11762-0240

\$6.25 (plus \$3 shipping and handling)



CIRCLE 342 ON FREE INFORMATION CARD

When soldering is off-limits (for absolute beginners in electronics, particularly youngsters) simple terminal block projects offer a safe introduction to the hobby. The 45 projects presented in this book not only do not require soldering, but also are powered by nothing more dangerous than a small battery. They meet the most stringent safety standards.

All of the projects can be constructed by complete newcomers to electronics, on terminal blocks using only a screwdriver and other simple



PRB Line® Celebrates Its 40th!

PRB Line® Introduces...

Chip Quik® SMD Bench Rework System

A System specifically designed for... Removing & Replacing Surface Mount Devices!



P/N: CQ1000
\$84.95 +S&H

Educational Video Available!



FLYBACKS

- Replacement flybacks for popular brands including: RCA, Mitsubishi, Philips, Magnavox and Sylvania
- ISO9001 Quality Certified
- Warranted
- Competitively priced



Phone: 800-558-9572

Fax: 800-887-2727

Whitewater, WI 53190

hand tools. By following the layout diagrams, most of the projects can be finished in a matter of minutes. And they can be readily unscrewed, if desired, to make new circuits using the same parts. A theoretical circuit diagram is included with each project to help broaden the hobbyist's experience and knowledge.

The projects cover a wide range of interests. They fall under the chapter headings: Connections and Components, Sound and Music, Entertainment, Security Devices, Communication, and Test and Measuring.

1996 Power Supply Catalog

Lambda Electronics Inc.
515 Broad Hollow Road
Melville, NY 11747
Phone: 516-694-4200

Free



CIRCLE 343 ON FREE INFORMATION CARD

This 192-page catalog contains detailed specifications, mechanical drawings, and prices of more than 1000 power supplies, DC-DC converters, power systems, and accessories.

The catalog features more than 200 new products. Listed for the first time is the SV Series of low-cost, single- and multiple-output, power supplies from 100 to 300 watts; the PM Series of low-profile, low-cost 10-watt to 30-watt converters, specifically designed for telecommunications, computer, and data-communications applications; the Ultraflex Series of standard, modular power supplies for 400- and 600-watt applications with 1 to 10 outputs; and the FE Series of high-density distributed power front ends for 24- and 48-volt DC converters, intended for computer and telecommunications uses. The RM Series 12-watt to 100-watt DC-DC converters, which offer 90% efficiency and do not require a heatsink, are well-suited for telecommunications applications such as broad-band distribution, ATM exchanges, LANs, and multimedia systems.

FRAMM Technology Overview

Dynamem Inc.
22 Manchester Road
Derry, NH 03038
Phone: 603-432-1200
Fax: 603-432-0361

Free



CIRCLE 344 ON FREE INFORMATION CARD

200 percent, is described in this four-page brochure.

The memory increase is achieved through the folding of the module's flexible, multi-layered circuit board, on which the memory chips are mounted. The resulting surface area and memory capability of the module are at least twice that of a standard module of the same dimensions. The brochure outlines additional benefits of FRAMM technology, including ease of installation and cost-effectiveness. (Please use a company letterhead when requesting the brochure.)

Dynamem's patented Foldable Rigid Assembly Memory Module (FRAMM) technology, which can increase PC and workstation working memory by as much as

1996 Test & Measurement Products Catalog

LeCroy
Customer Care Center
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977-6499
Phone: 1-800-5-LECROY
Fax: 914-578-5985

Free



CIRCLE 345 ON FREE INFORMATION CARD

hardware options, probes and accessories, waveform generators, and pro-

This 194-page catalog features LeCroy's complete lines of test and measurement products, including the 9300 Series portable digital oscilloscopes, software and

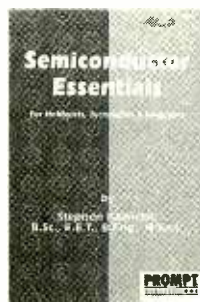
grammable pulse generators. In addition, the catalog provides a wealth of technical information, including in-depth tutorials on the fundamentals of digital storage scopes and creating waveforms.

Application notes cover digital storage oscilloscope (DSO) applications in high-speed electronics, finding intermittent faults in electronic signals, the benefits of long memory in digital scopes, new tools for wireless design, and the benefits of DSOs in communications and power-supply design and testing. A comprehensive glossary of technical and test-instruments terms is also included.

Semiconductor Essentials for Hobbyists, Technicians & Engineers

by Stephen Kamichik
Prompt Publications
2647 Waterfront Parkway, East Drive
Indianapolis, IN 46214-2012
Phone: 800-428-7267 or 317-298-5710
Fax: 317-298-5604

\$16.95



CIRCLE 346 ON FREE INFORMATION CARD

This book represents the first course in electronics at the technical and engineering levels. The information it offers will help readers gain hands-on knowledge of semiconductor diodes and transistors. The book covers semiconductor and diode chemistry, rectifier diodes, Zener diodes, transistor chemistry, transistor DC and AC analysis, transistor biasing, and it details transistor and rectifier diode circuits.

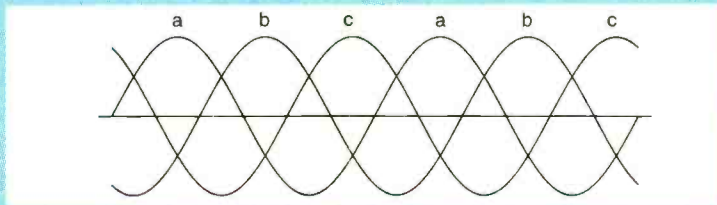
Each chapter is a lesson in electronics, with problems at the end of the chapter to test the reader's understanding of the material presented. The generously illustrated book serves as a useful instructional tool for the student and hobbyists, as well as a practical review for professional technicians and engineers.

EN

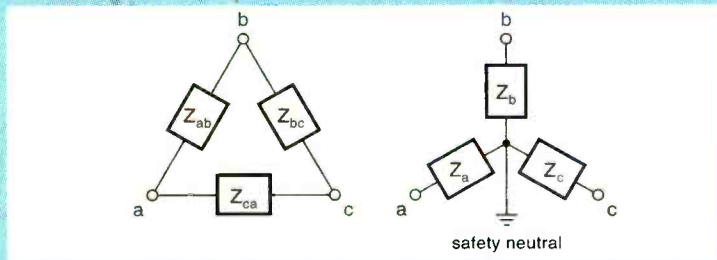
Delta-wye transforms, and building your own Tesla coil

ONE OF OUR RECENT *TINAJA QUEST* WINNERS WAS D.C. COX FROM *RESONANCE RESEARCH*. THIS FIRM IS THE LEADING SUPPLIER FOR THE BIGGER TESLA COILS AND VAN DE GRAFF GENERATORS YOU FIND IN SCIENCE

Three phase power consists of a triad of voltages spread by 120 electrical degrees. Advantages for higher energy users include a constant and a more efficient power flow, lower vibration machinery that starts and reverses easily, and rectifiers that are more economically filtered...



Two methods of connecting loads to a three phase system are the Delta and the Wye. Each has advantages and limitations. Note that currents in a Delta load are higher for a given input voltage...



For any Delta load, there is an equivalent set of Wye impedances, and vice versa. Here are the classic Delta-Wye transform pairs...

$$\begin{aligned}
 Z_{ab} &= \frac{Z_a Z_b + Z_b Z_c + Z_c Z_a}{Z_c} & Z_a &= \frac{Z_{ab} Z_{ca}}{Z_a Z_b + Z_b Z_c + Z_c Z_a} \\
 Z_{bc} &= \frac{Z_a Z_b + Z_b Z_c + Z_c Z_a}{Z_a} & Z_b &= \frac{Z_{ab} Z_{bc}}{Z_a Z_b + Z_b Z_c + Z_c Z_a} \\
 Z_{ca} &= \frac{Z_a Z_b + Z_b Z_c + Z_c Z_a}{Z_b} & Z_c &= \frac{Z_{bc} Z_{ca}}{Z_a Z_b + Z_b Z_c + Z_c Z_a}
 \end{aligned}$$

Fig. 1— SOME FUNDAMENTALS of three phase power.

centers, museums, and planetariums. He is also newly offering his free do-it-yourself reprint on building up your own smaller Tesla coil.

A Tesla coil is nothing but a huge, resonant transformer that is intended to deliver high-voltage, high-frequency electricity—otherwise known as “lots of sparks.” Sparks which literally can stand your hair on end, or light up an unconnected fluorescent tube you are holding in your hand.

The key secret to Tesla coil design is a high-Q air-core transformer with precisely the right amount of input source coupling. The resonance buildup produces a “Q-multiplier” effect to generate the high voltage.

The ultra high voltages are usually safe because they are high-frequency alternating current. Thus, they exhibit the *skin effect*, a property of high-frequency AC currents which causes them to travel only on the *outside* of conductors. The higher the frequency, the smaller the skin effect depth. The output from a Tesla coil can often be routed along a person (or a chain of people) without significant shock hazards.

Amazingly, most of the Resonance Research machines still use a spark gap for their input switching. Above a certain power level, spark gaps still have compelling advantages over tubes or solid-state devices.

Needless to say, a Tesla coil is one really horrendous generator of radio frequency interference or

**new from
DON LANCASTER**

ACTIVE FILTER COOKBOOK

The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. \$28.50

CMOS AND TTL COOKBOOKS

Millions of copies in print worldwide. THE two books for digital integrated circuit fundamentals. About as hands-on as you can get. \$24.50 each.

**INCREDIBLE SECRET
MONEY MACHINE II**

Updated 2nd edition of Don's classic on setting up your own technical or craft venture. \$18.50

LANCASTER CLASSICS LIBRARY

Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. \$119.50

LOTS OF OTHER GOODIES

- Ask the Guru I or II or III \$24.50
- Hardware Hacker II or III \$24.50
- Micro Cookbook I \$19.50
- PostScript Beginner Stuff \$29.50
- PostScript Show and Tell \$29.50
- Intro to PostScript Video \$29.50
- PostScript Reference II \$31.50
- PostScript Tutorial/Cookbook \$19.50
- PostScript by Example \$31.50
- Understanding PS Programming \$29.50
- PostScript: A Visual Approach \$22.50
- PostScript Program Design \$24.50
- Thinking in PostScript \$22.50
- LaserWriter Reference \$19.50
- Type 1 Font Format \$15.50
- Acrobat Reference \$24.50
- Whole works (all PostScript) \$380.00
- Synergetics Surplus Catalog FREE
- Technical Insider Secrets FREE

POSTSCRIPT SECRETS

A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. \$29.50

BOOK-ON-DEMAND PUB KIT

Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. \$39.50

THE CASE AGAINST PATENTS

For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This reprint set reveals to you tested and proven real-world alternatives. \$28.50

BLATANT OPPORTUNIST I

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. \$24.50

RESOURCE BIN I

A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. \$24.50

FREE SAMPLES

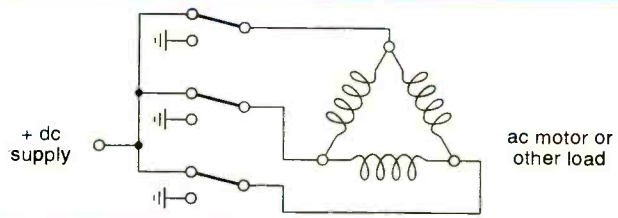
Visit The Guru's Lair at <http://www.tinaja.com> for interactive catalogs and online samples of Don's unique products. Searchable reprints and reference resources, too. Tech help, hot links to cool sites, consultant's net. email: tinaja.com

FREE VOICE HELPLINE VISA/MC

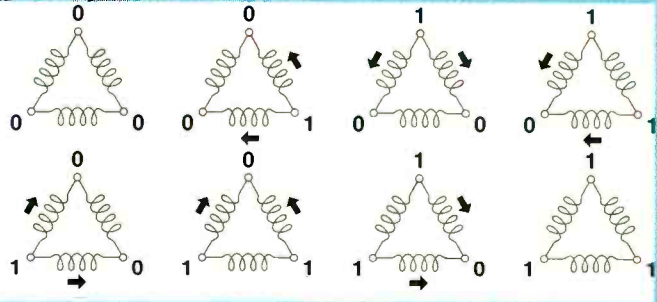
SYNERGETICS
Box 809-EN
Thatcher, AZ 85552
(520) 428-4073

CIRCLE 205 ON FREE INFORMATION CARD

A three phase delta load is normally driven by three "half bridge" drivers. These usually require a total of six power switching devices...



When using digitally switched unipolar inputs, there are only eight possible bipolar motor winding current results...



Just as there are delta-wye transforms, we can list these eight pairs of unipolar delta input to bipolar motor coil forward and reverse transforms...

0	0	0	0	0	0	+	0	-	1	0	0
0	0	1	0	-	+	+	-	0	1	0	1
0	1	0	-	+	0	0	+	-	1	1	0
0	1	1	-	0	+	0	-	+	0	0	1
1	0	0	+	0	-	-	+	0	0	1	0
1	0	1	+	-	0	-	0	+	0	1	1
1	1	0	0	+	-	0	0	0	0	0	0
1	1	1	0	0	0	0	0	0	1	1	1

Further analysis easily proves that any motor winding magic sinewave bit sequence which has a zero third harmonic will end up fully delta friendly.

Fig. 2 — THREE PHASE "DELTA FRIENDLY" magic sinewaves require only simple input switches. Yet they produce positive, negative, or zero winding currents. Provided you use carefully chosen sequential commands.

RFI. These can be a most blatant violator of FCC Part 15 regulations and therefore illegal!

There are several persistent urban lore type myths that Tesla coils are in some manner a "suppressed" or "lost" source of "free energy." The original myth can be traced to one of two sources: Either Tesla's really bad misunderstanding of differences between resonance stored energy and source converted energy. Or as something between too much hype and an outright scam to obtain lab funding.

Research carefully and objectively, and you will discover there is not one

shred of either actual or theoretical evidence that this sort of hogwash is even remotely possible.

Tesla coils are closely related to TV flyback transformers and to all the UHV ultra high voltage power line transmission research. In spite of countless hours of formal research in these fields, not the least hint of any over-unity energy has emerged.

Another good source for hands-on Tesla stuff is Lindsay Publications. The Tesla Bookstore is another useful resource. But you'll be way better off limiting your readings to those books and the reprints by Tesla, rather than

```

10000001001000101011001101101110111101111101111
Hexadecimal:      $8122B36EF7EF
Fundamental Amplitude: 0.866208
Transitions:      22
Filter:           secondorder2.0
Distortion 3-17:  0.0739%.
Relative Harmonics 3 through 17:
0.0               -0.000591363   -0.000042485   0.0
-0.000167379    0.000352492    0.0            -0.000206194

```

```

001000000011000101010011101100111110110111110111
Hexadecimal:      $203153B3EDFB
Fundamental Amplitude: 0.814612
Transitions:      21
Filter:           secondorder2.0
Distortion 3-17:  0.0445%.
Relative Harmonics 3 through 17:
0.0               0.000155364   0.000052628   0.0
0.000139262    -0.000382276    0.0            0.000077191

```

```

001000000010011000011010110100111110101101111110
Hexadecimal:      $20261AD3EB7E
Fundamental Amplitude: 0.751198
Transitions:      22
Filter:           secondorder2.0
Distortion 3-17:  0.0641%.
Relative Harmonics 3 through 17:
0.0               -0.000198935   -0.000186813   0.0
-0.000492521    0.000138928    0.0            -0.000273419

```

Fig. 3 — OF THE 281,474,976,710,656 possible 192-bit quadrant symmetric magic sinewaves, a scant 43,046,721 end up three-phase "delta friendly". Here are three of the more interesting examples

errant ramblings *about* him.

If you really want to get into all of the free energy Tesla hogwash, check *High Energy Enterprises*, or else the *International Association for New Science*, the *International Guild of Advanced Science*, or *Borderlands*. Check out the *KeelyNet BBS* for a mesmerizingly outrageous source for late-breaking pseudoscience information.

And, of course, for a back-to-earth reality check, be certain to read the *Skeptical Inquirer* instead.

I've been thinking about gathering all my pseudoscience info into a new book. Give me a call if you have any interest in this.

Watch that Q!

A recent caller had a brilliant but flawed idea on how to simplify his Tesla coil. He wanted to use a *Slinky* for his main coil, eliminating most of those messy winding hassles.

The only tiny oint in the flyment is that Tesla coils *must* have a high Q and nearly lossless. A steel *Slinky* won't hack it. But a gold plated one or a beryllium copper version might work.

In another time, long ago and far

away, a student came to me hours before his Theremin project was due for a course final show-and-tell. The bright silver colored coils sure were pretty. It seems that the story he was copying clearly said to use #30 wire in his oscillator coils. While he found lots of No. 28 and No.34 copper wire, the only No. 30 he could find seemed

to be made from Nichrome.

Three-phase power basics

Most of your utility electricity is generated as three-phase power. Pretty near all larger industrial and agricultural motors are three-phase. Ever wonder why?

Figure 1 shows a three-phase waveform. Three windings are spaced out 120 degrees around a generator's stator, thus producing three identical sinewave waveforms whose electrical phase is also 120 degrees.

Your first great advantage of three phase is that all *three phase power is continuous*. Go through the math, and you'll find that the instantaneous sum of the power on all three phases will always add to the same value.

In a single-phase system, there are times when very little power is being delivered to you. Other times, much more than average is delivered. Thus, three phase power is more efficient and has lower line losses.

Three phase motors also start a lot easier than single phase ones. Most of them are easily reversed, simply by swapping phases. Because of the continuous power, most vibration and noise ends up a lot lower.

Three-phase power sources can be easily rectified for DC. Its ripple is much lower and its ripple frequency is way higher. That's one of many reasons why a car alternator is a three-phase AC generator.

```

; Code module to provide a time delay of n instruction
; cycles. n can vary from 4 to 255 and is destructively
; read from COUNTER. There are 8 or 9 overhead cycles.

; The module is easily extended to 9 or 10 bits.

DELAY      BCF S,C           ; clear carry (if needed)
           RRF COUNTER,1    ; bit 0 into carry
           BTFS C,S,C       ; stall one cycle?
           GOTO EQ1         ; yes, one extra cycle
EQ1        BCF S,C           ; must clear carry
           RRF COUNTER,1    ; bit 1 into carry
           BTFS S,C         ; stall two cycles?
           GOTO LOOP        ; no, no extra cycles
           GOTO EQ2         ; yes, two extra cycles
EQ2        NOP              ;

LOOP       BCF S,C           ; 4*n cycle delay loop
           DECFSZ COUNTER   ; round and round
           GOTO LOOP        ; till done

```

Fig. 4 — CORRECTED VERSION of the PIC time delay generator.

It turns out there are two standard ways of connecting a transformer or motor or whatever to any three-phase power line. With a *delta* connection, one winding goes between phases *a* and *b*. A second goes between phases *b* and *c*. And the last one routes from phases *c* and *a*.

In the *wye* connection, one end of each motor winding is connected together and usually brought out to a fourth line called a *safety neutral*. The free end of each winding is connected to phase *a*, *b*, or *c*.

Under balanced loading, you have a safety neutral current of *zero*. Even with some major unbalance, the safety neutral current still stays low.

Delta and wye each feature unique advantages and disadvantages. Note that voltages are 1.732 times higher in wyes and the currents are 1.732 times higher in deltas. ($1.732 = \sqrt{3}$). Thus, you could easily overload or underpower any load by making an incorrect choice of delta or wye—but that's what power engineering is all about in the first place.

It is simple to show that any delta has a wye equivalent and vice versa. This is called a *delta-wye transform* or else a *wye-delta transform*. I have also shown these in Fig. 1.

The major disadvantage of three phase power is that three times the wiring is needed, combined with far more expensive switches. Plus, you need three times as many transformers. Thus, single phase is used for home, shop, and other "low power" uses, while the advantages of three phase power are reserved for industrial and agricultural users.

Much more information on three phase is available in any college power textbook, such as my utterly ancient favorites of Skilling's *Electrical Engineering Circuits* or Fitzgerald and Kingsley's *Electrical Machinery*.

Three-phase magic sinewaves

As regular readers already know, I have been doing a lot of unique new *magic sinewave* research. Magic sinewaves are rather carefully chosen and ultra long sequences of repeating ones and zeros—sinewaves of precisely controlled amplitude and amazingly low distortion.

NAMES AND NUMBERS

Borderland Research
PO Box 429
Gaberville CA 95542
(707) 986-7211

Coriolis Books
7339 E Acoma Dr Ste 7
Scottsdale AZ 85260
(602) 483-0192

Scott Edwards Electronics
964 Cactus Wren Lane
Sierra Vista AZ 85635
(520) 459-4802

Gale Research
835 Penobscot Blvd
Detroit MI 48226
(313) 961-2242

High Energy Enterprises
PO Box 5636
Security CO 80931
(719) 475-0918

Intl Guild Advanced Sciences
255 N El Cielo Rd #565
Palm Springs CA 92262
(619) 327-7355

Intl Assn New Science
1304 S College Ave
Fort Collins CO 80524
(303) 482-3731

Johnson Smith
PO Box 25500
Bradenton FL 34106
(941) 747-2356

KeelyNet BBS
Box 1031
Mesquite TX 75149
(214) 324-3501 BBS

Lin-Wood Products
506 Oakland Avenue SW
Grand Rapids MI 49503
(800) 458-1578

Lindsay Publications
PO Box 538
Bradley IL 60915
(815) 935-5353

Loose Ends
PO Box 20310
Salem OR 97307
(503) 390-7457

Microchip Technology
2355 W Chandler Blvd
Chandler AZ 85224
(602) 786-7200

Parallax
3805 Atherton Rd #102
Rocklin CA 95765
(916) 624-8333

Resonance Research
E11870 Shadylane Rd
Baraboo WI 53913
(608) 356-3647

Skeptical Inquirer
PO Box 703
Buffalo NY 14226
(716) 636-1425

Synergetics
Box 809
Thatcher AZ 85552
(520) 428-4073

Tesla Book Store
Box 121873
Chula Vista CA 91912
(805) 646-3371

Compared to classic pulse-width modulation (PWM), these brand new magic sinewaves can offer elegant simplicity along with superb efficiency for such diverse applications as induction motor speed controls, solar-panel inverters, electric auto drives, power factor correctors, home energy-efficiency improvers, or for reliable uninterruptible power supplies.

A participant at one of our magic sinewave seminars did ask me a very embarrassing question, though, a real scary back-to-the-drawing-board one: "How can magic sinewaves be used with three-phase loads that use only *three half bridge drivers*?"

The original magic sinewaves used individual "H-bridge" drivers. These needed access to *both ends of each winding phase*. For the three winding currents of (+), (0), or (-).

All of which is just fine for single and two-phase users. But in the real world of big time three-phase power, we rarely have access to both ends of each winding. Especially doing some upgrade or retrofit. And we'd sure like to get by using a mere *six* active power devices. Instead of the twelve the full H-bridge route needs.

Well, for openers, the length of our magic sinewave sequence should be a multiple of three. Such that our three phases happen on bit boundaries. For simplicity and compact files, we'd also want a multiple of four. For that way, we'll need only work with and store one of four *quadrants*.

Next for something a tad subtle: Another factor of eight sure would be handy. This lets each one of the three sinewaves work out of the same *bit position* of each 8-bit stored quadrant

PRO AUDIO RESOURCES

B&H Pro Audio
119 W 17th Street
New York NY 10011
(800) 947-1182

Dale Pro Audio
7 East 20th Street
New York NY 10003
(212) 475-1124

Denon
222 New Road
Parsippany NJ 07054
(201) 575-7810

High End
Box 357
Sea Cliff NY 11579
(516) 676-2830

High Performance Review
Box 346
Woodbury CT 06798
(203) 266-0084

Home & Studio Recording
21601 Devonshire St #212
Chatsworth CA 91311
(818) 407-0744

Journal AES
60 E 42nd St Rm 2520
New York City NY 10165
(212) 661-2355

Journal ASA
335 E 45th St
New York City NY 10017
(212) 661-9404

MIX Bookshelf
6400 Hollis St #12
Emeryville CA 94608
(800) 233-9604

PAIA Electronics
3200 Teakwood Ln
Edmond OK 73013
(405) 340-6300

Pro Audio Review
5827 Columbia Pike 3rd Fl
Falls Church VA 22041
(703) 998-7600

Pro Sound News
2 Park Avenue 18th Fl
New York NY 10016
(212) 213-3444

Radio World
5827 Columbia Pk #310
Falls Church VA 22041
(703) 998-7600

Roland Digital
7200 Dominion Cir
Los Angeles CA 90040
(213) 685-5141

SMPTE
595 W Hartsdale Ave
White Plains NY 10607
(914) 761-1100

Studio Sound/BE
245 Blackfriars Road
London SE1 9UR, England
(071) 620-3636

sequence. And, last time I checked, $3 \times 4 \times 8 = 96$.

Thus, to be three-phase friendly, a magic sinewave's length should be a multiple of 96 bits. And several very interesting libraries of 384- and 768-bit magic sinewaves already exist.

What do we have to do beyond this to also become what I will call being *delta friendly*?

The delta-friendly sinewave needs only three leads. And each of those leads need only be connected to a positive supply or ground. Figure 2 should get us started.

With simple SPDT or "half bridge" drivers on each line, there are only eight possibilities here. Namely, the binary combinations of 000, 001, 010, 011, 100, 101, 110, and 111. We might define a "clockwise" winding current as (+) and "counterclockwise" as (-).

We immediately see that the eight combinations can give us our choice of (+), (0), or (-) currents.

Now for the tricky part: *For all of your possible input combinations, the winding currents always must sum to zero!* You could have zero current on all three windings (cases 000 or 111). Or have zero current on one winding, positive current on one, and negative current on one (as in cases 001, 010, 011, 100, 101, and 110).

Next, think about this really hairy concept: Not only do winding states *a*, *b*, and *c* have to occur together, but state *b* will occur in data stream *a* at one third of the way through the time sequence, and state *c* also happens in data stream *a* at two thirds of the way through the time sequence!

We already do know that our three states must sum to zero. But this also newly tells us that the three states are bits that are separated by one-third of their cycle distance in each sinewave sequence. Thus, the one-third spaced bits must also sum to zero.

Which tells us that a *delta-friendly magic sinewave must have a forced zero*

third harmonic!

And that is all there is to it. To be both three-phase friendly and delta-friendly, just select 96-bit multiple magic sinewaves that have their third harmonic forced to zero.

Most power books also tell us that there can be no third harmonic line current on any delta connected three phase load—sort of an independent check on what we've discovered. Several examples of 192-bit delta friendly magic sinewaves are shown in Fig. 3.

You will find vastly more magic sinewaves than there are particles in the galaxy. Untold zillions versus a mere 1070. So finding the good ones gets real tricky. Indeed, there are lots and lots of highly useful and delta-friendly magic sinewaves. But magic sinewaves that are *not* delta friendly might perform better.

Just as there are delta-to-wye and wye-to-delta transforms, there's also simple math which gets you from the "positive-ground-negative" winding currents to the "positive-ground" line currents. I've also shown these back in Fig. 2.

When you want zero current on all three windings at once, you'll have your choice of using 000 or 111 input states. At first glance, either would work just fine. But it turns out one or the other might be more efficient and needs fewer transitions.

For instance, if your *previous* state was 000 and your *next* state was 010, use of a 000 would require only *one* transition. But use of 111 would need *five* transitions instead.

Obviously, you pick the one with the fewest transitions, because fewer switchings certainly means less high-frequency losses, and usually means higher efficiency. Sometimes a 000 is clearly better. Other times, 111 is the only way to go. Other times (such as a previous 010 and a following 101), it doesn't matter at all.

The bottom line: Magic sinewaves work just fine with half-bridge delta drives as long as you use only those which include (A) a forced zero third harmonic, and (B) bit lengths that are an integer multiple of 96.

As you may have guessed, this is a billion dollar new opportunity that is

very much up for grabs. I'll be happy to send you a free tutorial on magic sinewaves when you call or write. You can also ask me for a formal proposal that explains in detail our seminars, PIC source code, and the new partners programs. Both reprint and proposal are also available at www.tinaja.com

Time-delay correction

The neat PIC time-delay utility I showed you a few columns back had one bug in it. A PIC spends *one* cycle if a skip is *not* taken, and *two* cycles if an instruction skip *is* taken.

The corrected version is shown in figure four. Sorry about that.

Professional Audio Resources

I have just picked up a free new subscription to *Pro Audio Review*. A trade publication that more or less reports what its name implies. It has detailed reviews of high-end amplifiers, mixers, and microphones for TV, video, CD, and radio.

For this month's resource sidebar,

I've tried to gather together some of the other pro audio resources.

A second major magazine is *Mix*, which also operates an outstanding *Mix Bookshelf* where you will find just about any book on audio.

The leading technical audio organization is the *Audio Engineering Society*. The finest audio publication in the world seems to be the *British Studio Sound and Broadcast Engineering*.

Let me know if I've missed any of your favorites here. A free *Incredible Secret Money Machine II* if you tell me about any pro audio resource I don't already know about.

New Tech Lit

A real fine new collection of PIC-related data books is now offered by *Microchip Technology*. These include the *PIC 16/17 Microcontroller Data Book*; the *PIC 16C8X Data Book*; *PIC 14000 Data Book*; a *PIC 16C7x Data Book*; the *PIC 16C62X Data Book*; *ECHV Update I*; the *MPASM Assembler Guide*; *Third Party Guide 1996*; the *Non-Volatile Memory Products*

Data; *Embedded Controller Handbook*; *Serial EPROM Tutorial Series I-III*; the *Development Systems Ordering Guide*; *BBS System User's Guide*; *MPSIM Users Guide*; and the *HCS300 Data Book*.

Their PIC, of course, is *the* finest microcontroller. Nothing else comes remotely close. Other PIC resources include *Scott Edwards Electronics*, and the superb *Basic Stamp* products offered by *Parallax*.

A unique collection of PC-related books is offered by *Coriolis Books*.

A new CD ROMs in *Print 1996* is freshly offered by *Gale Research*. It reviews over 9000 titles.

Free beta copies of *Acrobat Amber* can be downloaded from www.adobe.com. This wonderment lets you view full technical reprints on line. Part of it plugs into *Netscape Gold*. Which you can find at netscape.com

I often like to check out the hobby and craft catalogs. These can be a great source for products and ideas. One example is the *Source Place for Creative Living* "owner's manual" by *Loose Ends*. Mostly on unusual hand made papers. Another is the *Wood Parts Catalog* from *Lin-Wood*. Who do make a bewildering array of small wooden items.

Or, just because it is there I guess, you should get your hands on the neat free *Things You Never Knew Existed* catalog from *Johnson Smith*.

For typical individuals and small-scale startups most of the time, any involvement whatsoever with patents is absolutely certain to turn into a net loss of your time, energy, money, and sanity. You find out why in my *Case Against Patents* package. It includes proven real world alternatives.

See my nearby *Synergetics* ad for more details. I've also got some great deals on Tektronix 1230A logic analyzers left over from my school buy-out.

I'm still building my web site at www.tinaja.com. Eventually, globally searchable reprints for my previous columns should be available here.

As usual, a no-charge tech helpline and online access is available per the *Need Help* box. Most of the resources mentioned in this column appear in our *Names and Numbers* or *Pro Audio* sidebars.

EN

HANDS-ON TECHNICAL SEMINARS FOR PROFESSIONALS

- Two Day PC School
- All day Monitor School
- Big Screen TV Convergence
- Introduction to DVD
- Building and Troubleshooting Computer Networks
- and many, many, more!

Courses **FREE** when registered at the National Professional Service Convention August 5-10, 1996, St. Louis, MO

Full \$300 Registration (at door) includes:

- All Technical Training Seminars (limited seating)
- Head-to-head Meetings with Manufacturers' National Service Managers
- All Management & Business Seminars
- All Sponsored Meals and Functions
- NESDA / IS CET / NIAS Association Meetings
- Continuing Education units for all seminars attended
- Price discounts available for pre-registration

Sponsored by: National Electronic Service Delaers Association, International Society of Certified Electronics Technicians, National Independent Appliance Servicers, Professional Service Association

For more information, contact NPSC '96
2708 W. Berry St., Fort Worth, Tx 76109-2356 (817) 921-9061; Fax (817) 921-3741

Just like these Fully Trained Electronics Professionals



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



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



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

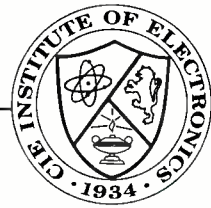


"I liked the way the school was set up with laboratory assignments to enforce conceptual learning. The thing which impressed me the most about CIE's curriculum is the way they show application for all the theory that is presented."
Daniel N. Parkman
 Missile Electro-Mechanical Technician
 U.S. Air Force



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

Graduate with an Associate Degree from CIE!



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

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

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

CIE PROVIDES A LEARNING METHOD SO GOOD IT'S PATENTED. CIE's AUTO-PRO-GRAMMED® lessons are a proven learning method for building valuable electronics

career skills. Each lesson is designed to take you step-by-step and principle-by-principle. And while all of CIE's lessons are designed for independent study, CIE's instructors are personally available to assist you with just a toll free call. The result is practical training... the kind of experience you can put to work in today's marketplace.

LEARN BY DOING...WITH STATE-OF-THE-ART EQUIPMENT AND TRAINING. CIE pioneered the first Electronics Laboratory



Course and the first Microprocessor Course. Today, no other home study school can match CIE's state-of-the-art equipment and training. And all your laboratory equipment, books and lessons are included in your tuition. It's all yours to use while you study and for on-the-job after you graduate.

PERSONALIZED TRAINING...TO MATCH YOUR BACKGROUND. While some of our students have a working knowledge of electronics others are just starting out. That's why CIE has developed twelve career courses and an A.A.S. Degree program to choose from. So, even if you're not sure which electronics career is best for you, CIE can get you started with core lessons applicable to all areas in

electronics. And every CIE Course earns credit towards the completion of your Associate in Applied Science Degree. So you can work toward your degree in stages or as fast as you wish. In fact, CIE is the only school that actually rewards you for fast study, which can save you money.



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

Please Print Clearly

Name _____

Address _____

City _____

State _____ Zip _____ Age _____

Phone No. _____

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

AE88

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

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

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

Making Time Measurements with a DSO

THE OSCILLOSCOPE IS THE TIME-HONORED TOOL OF CHOICE FOR MEASURING VOLTAGE CHANGES OVER TIME BECAUSE THE WAVEFORMS ON ITS SCREEN ARE GRAPHICAL REPRESENTATIONS OF THOSE CHANGES. THIS

article will show you how to use your digital storage oscilloscope (DSO) to your advantage when you need to make highly accurate time measurements.

Time is measured on the oscilloscope's horizontal or X axis. You can adjust the time axis by using the scope's horizontal scale or time-per-division control. In this article, we will be discussing some of the more frequently made time measurements. A similar discussion of voltage measurements was presented last month.

Common time measurements include the waveform period, frequency, pulse risetime, and pulse width. A period is the time it takes a repetitive waveform to complete one cycle or move through a series of amplitude values until the values begin to repeat. The frequency in Hertz is one divided by the period, or the period's reciprocal.

Pulse waveforms are encountered frequently. All pulses have a rising edge, a width, and a falling edge. The *risetime* is the time it takes the pulse to go from a low amplitude (voltage) to a high one. (See Fig. 1.) Risetime is usually measured from the 10% to the 90%

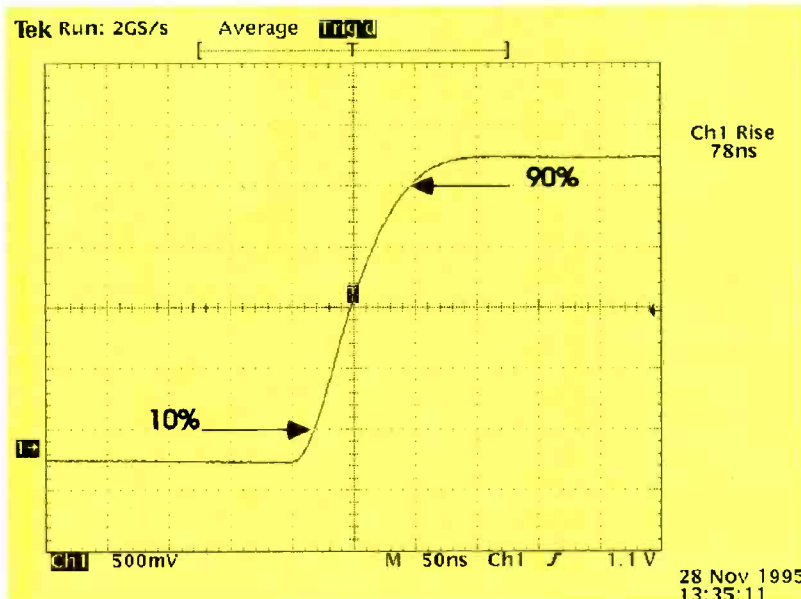
point on the rising edge (Figure 1). Fall time is measured on the falling edge from the 90% point back to the 10% point. Pulse width is the width "at the waist line," that is, at the 50% point.

Another common time measurement is delay, sometimes called propagation delay. Propagation delay is the time it takes a waveform to travel from one point in a circuit to another, such as from the input to the output of an amplifier.

Delay measurements are made

by using two channels of your oscilloscope. If a pulse at an amplifier input is applied to one channel, and the output is applied to another, you can measure the time from an edge on the first channel to the same edge on the second channel. This is the propagation delay through the amplifier, that is, the time it takes the signal to propagate from the input to the output.

Phase shift is a special kind of propagation delay measurement, usually using sine waves and measuring the delay in terms of the sine wave period. If the sine wave period is expressed as 360 degrees, the phase shift is 360 times the delay, expressed as a fraction of the period. If the delay is half the period, for example, the phase shift is 180 degrees.



*Ed Caryl is an Application Engineer/Product Support Specialist at Tektronix, Inc.

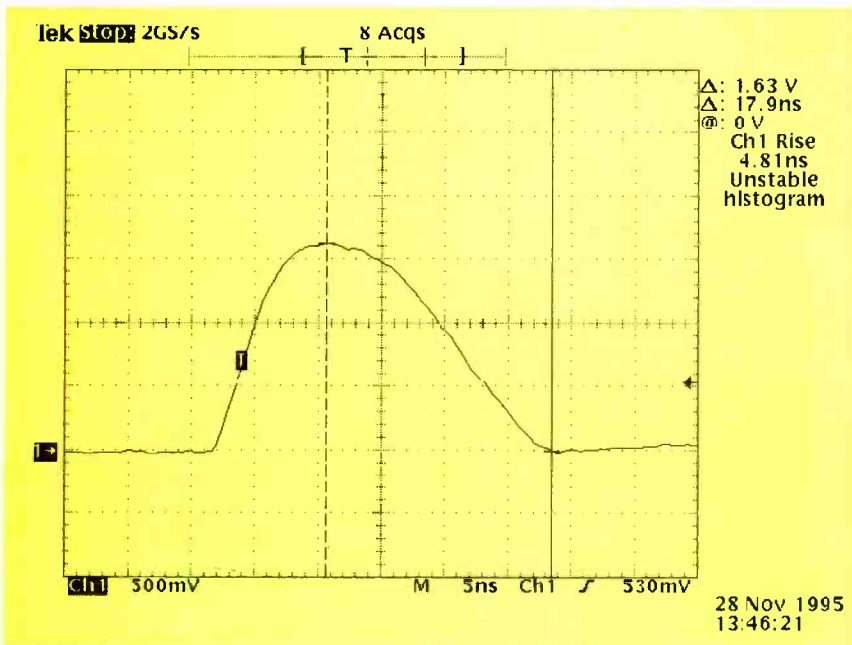


FIG. 2— THREE MEASUREMENT METHODS are illustrated here. First, the oscilloscope is making the risetime measurement. The warning message indicates that the 100% point may be doubtful because it is represented by just a few points. Second, the cursors are measuring the time from the peak value, 1.63 volts, to the point where the voltage returns to zero. This is 17.9 nanoseconds. Finally, from the graticule, you can see that the voltage is above 1 volt for about 14.5 nanoseconds, 2.9 divisions at 5 nanoseconds per division.

Maximizing accuracy

Many variables can affect the accuracy of time measurements, including the measurement method, the oscilloscope's vertical and horizontal resolution, its sample rate, trigger jitter and noise. The most important factor is the oscilloscope's horizontal resolution. Fortunately, that is also the factor that is most under your control.

In addition to the horizontal time-base/time-per-division control, many DSOs also have a *record-length* control. Record length is the number of data points taken or "acquired" on a waveform each time the oscilloscope is triggered. Both the horizontal time-base and record-length controls can be used to maximize the horizontal resolution on a time measurement. Use the longest record length available, then adjust the timebase control to use as much of this record length as possible. This will provide the maximum number of data points.

You may choose from three methods for time measurements (Figure 2). The easiest way, and, often the most accurate, is to let the oscilloscope perform the measurement. Most DSOs have automatic measurement func-

tions that you can select from a menu. The DSO automatically calculates and displays the measurement result for each acquired waveform.

The second method is to use measurement cursors—movable horizon-

tal and vertical lines—to manually make the measurement. You can individually control and align each cursor with the appropriate waveform feature in order to make time and voltage measurements. Cursors are often used when the automatic measurement definitions are not easy to set, or where you wish to make several closely related measurements. Your accuracy will depend on how well you set the cursors.

The third method is to "eyeball" the measurement, that is, to align the waveform features with the internal graticule markings and counting divisions of the display. This is the method you use when just looking at the waveform. With closer observation and using the "minor division" graticule markings on the display (located on the central vertical and horizontal graticule lines), you can be considerably more precise.

For time measurements beyond the normal record length, use the delayed-sweep feature of your oscilloscope to improve horizontal resolution. Follow the procedure as outlined below and as illustrated in Figure 3:

1. Set the first measurement point with the main sweep at the center ver-

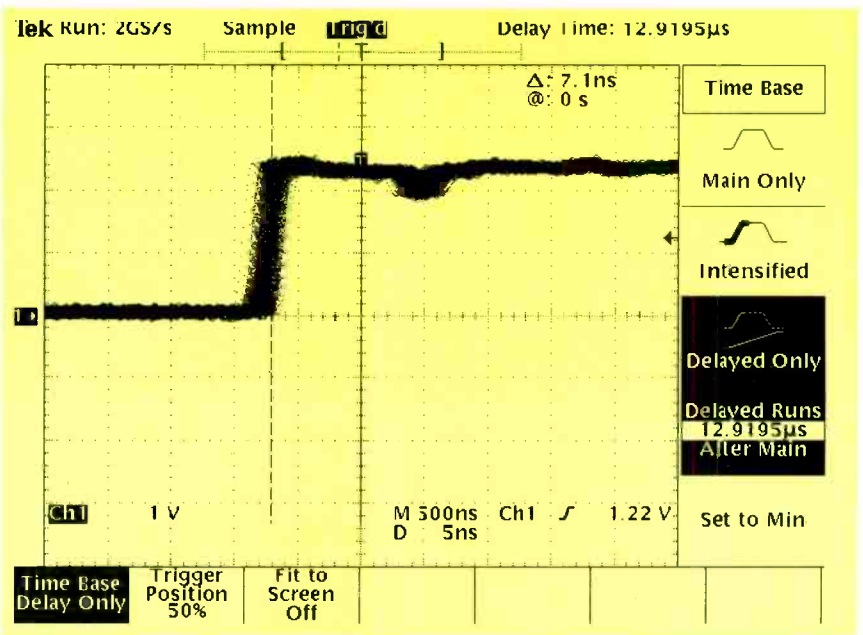


FIG. 3— IN A DELAYED SWEEP MEASUREMENT, the measurement is made from the center vertical graticule line on the main sweep display to the same line on this delayed sweep display. The delay is 12.9195 microseconds. To this delay, add 7.1 ns, the additional time from the center of the time jitter to the center graticule line. The total time is thus 12.9266 microseconds, plus or minus about 1.5 nanoseconds, the width of the jitter band.

tical graticule line by using the triggering and the horizontal position controls.

2. Select the delayed-sweep mode, then set the Delayed-Runs time to align the second time point to the same center graticule line.

3. Start with a delayed sweep speed only slightly faster than the main sweep, and then advance the delayed sweep for a more precise setting.

4. If the feature can't be aligned exactly with the center graticule line, read any difference from the graticule and correct the Delayed Runs readout.

Reducing noise

Noise can interfere with time measurements by blurring the waveform data at the time-measurement points. There are numerous ways to reduce noise. On repetitive waveforms, you can use the signal averaging capability of your digital scope to reduce random noise. At slower sweep speeds, a HiRes mode, available on some DSOs, will reduce high-frequency noise. A scope's bandwidth-limit fea-

ture also will help eliminate noise above the bandwidth limit.

Of course, you can learn to live with the noise and try to work around it. Set the measurement cursors to the center of a noise band to measure an average value. Your scope's persistence display feature can help in visualizing the noise-band center.

Another common problem is edge aliasing, often produced by high sweep speeds, fast risetimes and sample-rate limitations. Edge aliasing is identified by false overshoot, ringing, and a jittering edge position. This condition can happen in single-shot measurements or when Digital Real-Time (DRT) oscilloscopes treat all acquisitions as if they were single-shot. Edge aliasing may also occur if less than two samples are acquired during edge risetime.

There are several ways to correct edge aliasing. If the delay or period is being measured, risetime is not a factor, and bandwidth limiting will stabilize the measurement. In addition, some high performance DSOs have

100-MHz and 250-MHz bandwidth limits that can be limit risetime and stabilize very fast edges.

Trigger jitter can impact time measurements on repetitive waveforms. In this case, slow risetimes are the problem. Trigger jitter happens because the oscilloscope trigger cannot determine exactly when a slower moving signal passes through the trigger level. Fast edges have the least trigger jitter. By simply expanding the signal amplitude on the display, you can decrease trigger jitter. This is because the signal speed is increased through the trigger-level point.

Your DSO lets you "see" electrical signals that occur in a split second. By using your oscilloscope's features to "expand" that split second as much as possible, and then letting the scope make the measurements automatically, you'll have the highest degree of accuracy in time measurements. When automatic measurements are not available or appropriate, use the helpful tips provided above to ensure a higher degree of accuracy. **EN**

NOW Find the Right Part for Your VCR!



The 119-page Fifth Edition of the VCR Cross Reference contains both model and part number cross references. Over 1300 new parts and 360 new models have been added.

VCR's are made in a few factories from which hundreds of different brand names and model numbers identify cosmetically-changed identical and near-identical manufactured units. Interchangeable parts are very common. An exact replacement part may be available only a few minutes away from you even though the original brand-name supplier is out of stock. Also, you may be able to cannibalize scrap units at no cost.

with the **IS CET VCR CROSS REFERENCE**

NEW! The Fifth Edition is contained on a diskette for IBM PC AT/XT compatibles, DOS 2.1 or higher. The disk software allows technicians to search by manufacturer for model numbers and description of part numbers. A parts editing sequence gives an on-screen view of all substitutes for parts entered. With the diskette, the technician can update files by adding model and parts

crosses of future models. The Fifth Edition can be printed on pages completely from the diskette.

The IS CET VCR Cross Reference, Fifth Edition, is on 8½ × 11-in., pre-punched pages and sell for **\$38.00**. The 3½ inch diskette sells for **\$69.95** and you can view listings from a monitor or printed page.

**Only \$38.00 for pages
\$69.95 diskette**

Claggk Inc.
VCR CROSS REFERENCE OFFER
P.O. Box 4099
Farmingdale, New York 11735

Name _____
Business _____
Address _____
City _____
State _____ Zip _____
Phone _____

Enclosed **\$38.00** for the IS CET VCR Cross Reference, Fifth Edition.

Enclosed **\$69.95** for the diskette containing the IS CET VCR Cross Reference, Ver. 6.0. Please specify:

5¼ Diskettes (2) 3½ Diskette (1)

Include \$3.00 for shipping each Cross Reference (Pages or Diskette)

The total amount of my order is \$ _____

Check enclosed—do not send cash.

Visa MasterCard Exp. Date / /

Signature _____

New York State residents must add applicable local sales tax to total.

CB03

LOW-COST SOFTWARE FOR CIRCUIT SIMULATION

If you've been following this series on low-cost software for electronics, you know how your PC can ease the chores of drawing a schematic and designing a printed-circuit board. Did you know that it can also expedite the process of debugging a circuit design!

TJ BYERS

WE'RE SURE THAT SOME OF YOU REMEMBER building experimental radios on old kitchen breadboards using nails and bare wire. As time passed, Grandma's breadboard gave way to phenolic terminal strips, which eventually evolved into today's solderless breadboards.

We all have fond memories of breadboarding simple circuits using a slab of plastic embedded with metal strips. But those days are shrinking into the past, too. Today's circuit designs are far more complex, run faster, and require a lot more than a plastic and metal breadboard to make them work. Now we do all of our circuit-design work using a PC-based software simulator—which is what this article is all about.

There are several different kinds of software circuit-simulators, each with its own purpose. The most popular is the analog simulator, used for wringing out linear designs such as audio amplifiers and filters. Digital circuits, on the other hand, have special needs that require a different set of rules that don't always coincide with those of analog circuits. Consequently, there's a separate category of digital-only simulators. However, because today's designs are often a mixture of digital processing linked with an analog interface, the trend is toward mixed simulators that do both. On the cut-

ting edge is the burgeoning wireless telephone communications market, where frequencies range from 500 MHz to 5 GHz. These designs require special RF software simulators where every solder connection enters into the formula.

How circuit simulation works

Circuit-simulator programs are software applications that let you test your electronic brainstorms using your desktop PC. At the core of the circuit simulator is a number-crunching engine that reads a netlist file that contains a list of the circuit's components, their various voltage and current parameters, and how the components react when these values are changed.

Device models. Circuit simulation is done by applying mathematical equations, called algorithms, to a model of an electrical device such as a transistor, then solving the equation with different sets of numbers that you plug into the formula. For example, one of the formulas used in bipolar transistor simulation is

$$I_E = I_{EE}(e^{V_{EB}} - 1) + I_{BC}(e^{V_{CB}} - 1)$$

which describes the current flow through the emitter of a common-base amplifier.

Thankfully, you don't have to take a refresher course in advanced algebra or electrical en-

gineering to use circuit-simulation software. Any company worth its salt has done the homework for you, and rendered the many formulas into compact code. All you need to supply are such variables as operating voltage or current.

As explained above, the simulator engine works from a netlist. Generally, the netlist is in ASCII format, which means that all you need to create a simulation netlist is a text editor. However, it's much faster and more accurate to extract the information from a schematic-capture program in much the same way PC-board layout programs convert schematics into solder pads and copper traces. Very often the simulation package includes a schematic capture front end.

Test instruments. Once the circuit parameters have been defined and loaded into the simulator, the design is stepped through its paces using a function generator. Sometimes the input is a simple sine wave, while other times it can be as complex as a frequency-modulated modem carrier signal or a word generator. The signal source depends on the design and what results you're looking for.

Of course, you need a monitoring device that tells you what's happening as you wring out the design with various inputs. Generally that's done

using a software-simulated multi-trace oscilloscope. From what we've seen in the simulation software in this review, many of these simulated instruments far outpace their commercial counterparts, displaying transient activity that you'd never catch on the screen of a scope no matter how quick you are on the trigger. Most analog simulators also include a bode plotter that's used to study the frequency response of a circuit. And no simulator would be complete without a multimeter.

Digital circuits need specialized test instruments, like a pulse stepper, propagation delay viewer, breakpoint analyzer, and event counter. You're also likely to find a logic analyzer that shows the state of all the nodes in the circuit and their relative timing, and sometimes a logic converter that can convert between gate, truth table, and Boolean logic.

That said, let's begin our tour of the software packages that threaten to make your soldering iron obsolete. Before we begin, let me explain that we'll be looking at some of the same programs that appeared in the October 1995 issue of *Electronics Now*, which highlighted schematic-capture software. However, some of the features and prices have changed since the last time you and I looked at them. For example, some have been upgraded to 32-bit programming to make them compatible with Windows 95. Consequently, you may find brief comments on the new features in the text as we review the following eight programs.

Analog Simulators

Do you want to build a circuit that measures room temperature, ambient light, or which way the wind blows? If so, you need an analog simulator to test it. Analog simulators are used to check out any circuit that deals with voltages and currents that have analog values instead of digits. Typical analog applications include filters, oscillators, amplifiers, linear power supplies, and transmission lines.

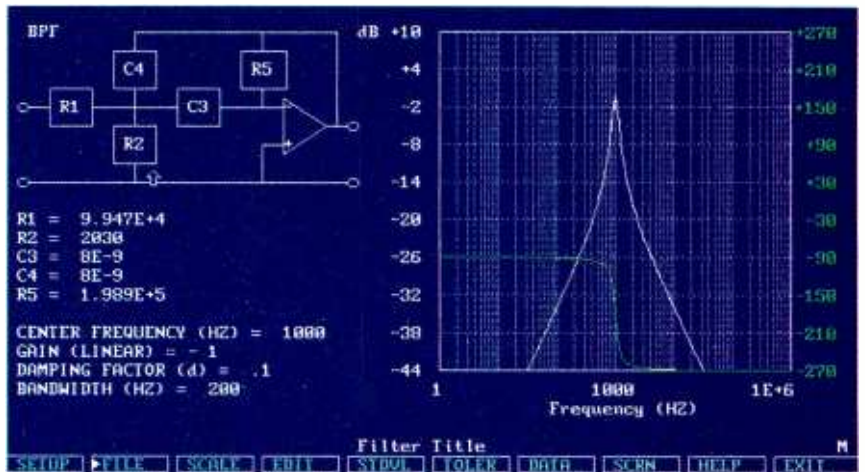


FIG. 1—EACH OF THE EE WORKS MODULES has its own canned schematic drawing. In addition to running a simulation using component values you plug into the circuit, EE Works can do the reverse and calculate component values for you when you enter the design parameters, like above.

Although it's possible to digitize some of these applications, any digital processor still has to talk to an analog world via input sensors such as a thermistor or photocell, and output transducers, including motors and loudspeakers. Even your computer's monitor, which you might think is digital, is basically an analog device—both inside and out. Hence, there will always be a need for analog designs, regardless of where the digital future may take us.

Product:	EE Works
Version:	5.0
Price:	\$129.99
Platform:	DOS
Publisher:	Geoban Engineering

Before you begin using EE Works, you'd better dust off your old engineering reference books, because you'll need them. EE Works is the most exhaustive of any of the simulation programs tested, giving you answers to questions you didn't even think to ask—and the results are given in engineering language, not hobbyist jargon.

Unlike the other simulators in this review, which are integrated and work from a common schematic, EE Works is a collection of several DOS programs, each designed to do one thing, and one thing only. For

example, there's a simulator module that tests your design for linear transient analysis, and another that does nothing but linear AC/DC analysis. Each simulation comes equipped with a canned "schematic" (Fig. 1) that electrically represents the design under test, such as an active filter. Unfortunately, the individual simulator modules aren't interactive. Each simulation runs on its own, and the results are exclusive of any other simulation. In other words, every time you start a different simulation, you have to restate your circuit's parameters.

You must be very precise—immaculate, in fact—when defining component and circuit parameters. For example, if you choose the power supply simulation routine—a power supply design/simulation program that's unique to EE Works—you even have to enter the permeability of the inductor and the capacitor's ESR value. If you skip any step, hoping the simulator will default to a standard value, you are thrown back to the main menu where you have to start the simulation all over again. It's the same with transistors, op-amps, and even resistors, where you have to specify the resistor's tolerance. So you better have those vendor specs in hand before you begin—or be a good guesser.

Continued on page 65

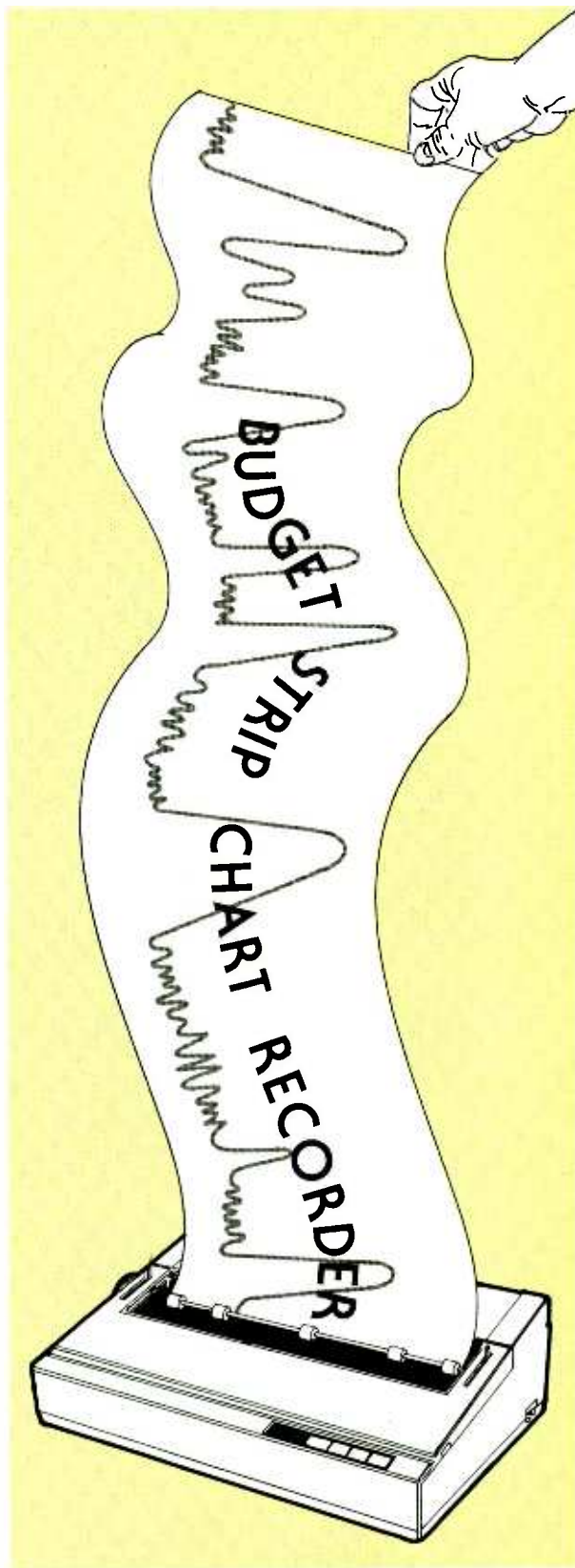
JACK WRIGHT

CONVERTING AN OBSOLETE computer printer into a strip-chart recorder is both easy and inexpensive. With about \$40 in parts, construction of a simple circuit, and some minor mechanical fabrication, you can have a functioning chart recorder. We built the prototype as a weather station to record air temperature, but it could be used for any number of things ranging from seismography to radio astronomy.

The chart recorder works by comparing the voltage on a potentiometer to the voltage on a temperature-sensing thermistor. The potentiometer is mechanically connected to the printer carriage. A marking pen is also connected to the printer carriage. Any difference in the voltages on the potentiometer and the temperature sensor causes an op-amp to attempt to bring the voltages back in balance. In so doing, the print-head carriage moves left or right, thereby causing a mark on the paper. We drive the platen (i.e., pull the paper through the device) using a standard household timer.

How it works

Figure 1 shows the complete circuit. We use a standard 741 op-amp as a comparator. The comparator monitors the voltages at the junctions, marked TP1 and TP2 in Fig. 1, of two voltage-divider networks. The op-amp compares the voltages from the two networks at its inputs (pins 2 and 3). When the voltages are identical, the op-amp's output (pin 6) is zero, so neither driver trans-



**Convert that old
computer printer into
a strip-chart recorder**

sistor (Q1 and Q2) turns on, and therefore the motor does not turn.

But if thermistor R2's resistance changes because of a change in air temperature, a new voltage occurs at the op-amp's inverting input (pin 2). For example, assume the value of R2 decreases. The pin-2 voltage then increases, so the op-amp's output swings negative, thereby biasing Q2 on. That in turn starts the motor, which moves the carriage left or right.

Potentiometer R5 is also coupled to the carriage, so, as the carriage moves, R5's wiper moves, thereby varying the voltage on the non-inverting input of IC1. When the op-amp's input voltages become equal, the output goes to zero, both transistors turn off, and so does the motor. Now the circuit remains quiescent until the temperature changes again.

The potentiometer is a precision, 10-turn type with a value of 20K. A 50K device would provide a wider range, but with reduced resolution. You should be able to buy a surplus 10-turn unit from an electronics supplier for \$1-5.

For temperature sensing, we used a common thermistor available from Radio Shack. (Internally, each device actually consists of two separate thermistors.) A thermistor is a device whose resistance changes with temperature. The thermistor is not linear; its resistance increases disproportionately fast at cooler temperatures. That nonlinearity restricts the range of the recorder. Also, the resistance range of your probe, be it a thermistor or some-

To calculate the diameter of the spindle, simply measure the total distance the carriage moves from left to right, and divide that value by $(\pi \times 10)$. Anything that size or slightly larger will do. The spindle material is not critical: we used two hard rubber spacers bracketed by a couple of large washers, and brushed with paint to increase friction. You could also use a wooden spool, a small diameter pipe, or a stack of washers. Incidentally, the spindle must be wide enough to allow the string to worm its way across without jamming into the bracketing washers.

To drive the platen, we used a plug-in appliance timer, available at most hardware and variety stores. We glued the timer dial directly to the platen knob, giving a chart speed of about $\frac{1}{6}$ -inch per hour, which is satisfactory for temperature recording.

That type of timer is not intended to drive anything, so you should keep a close eye on it until you are certain it can do the job without overheating. We tried three different brands, old and new, and they all worked. Be sure to minimize the drag on your platen by removing all

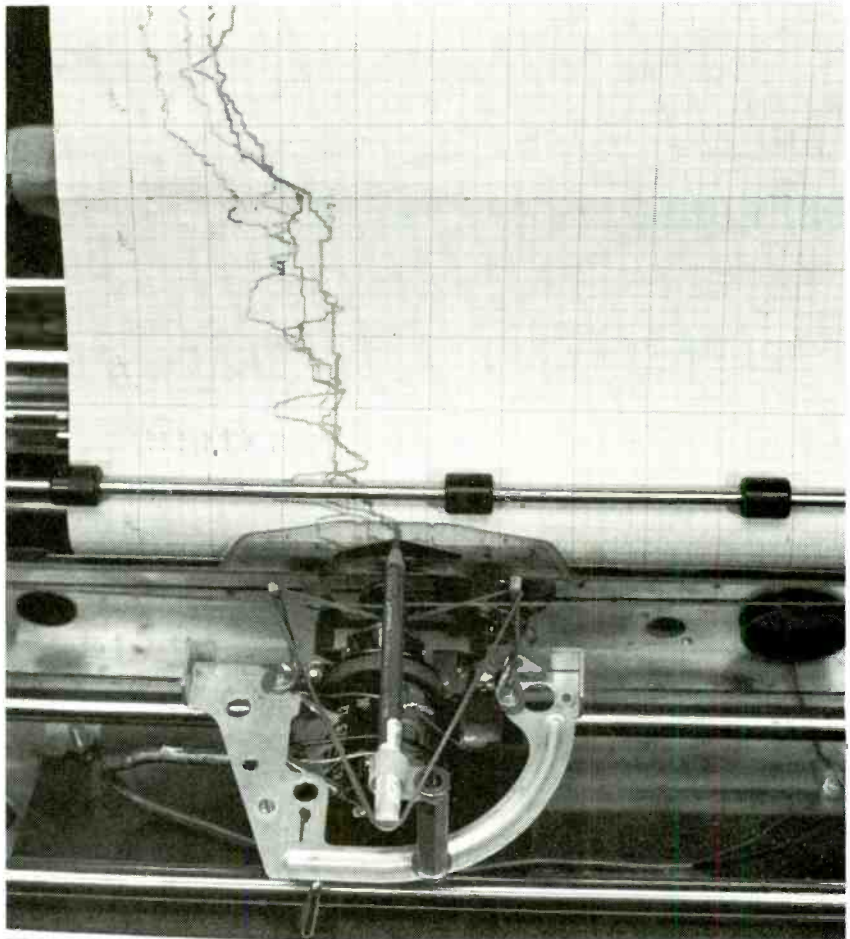


FIG. 3—STRIP-CHART RECORDER IN ACTION. Note how the rubber band holds the pencil against the chart. Chart speed here was about 17 mm/hr.

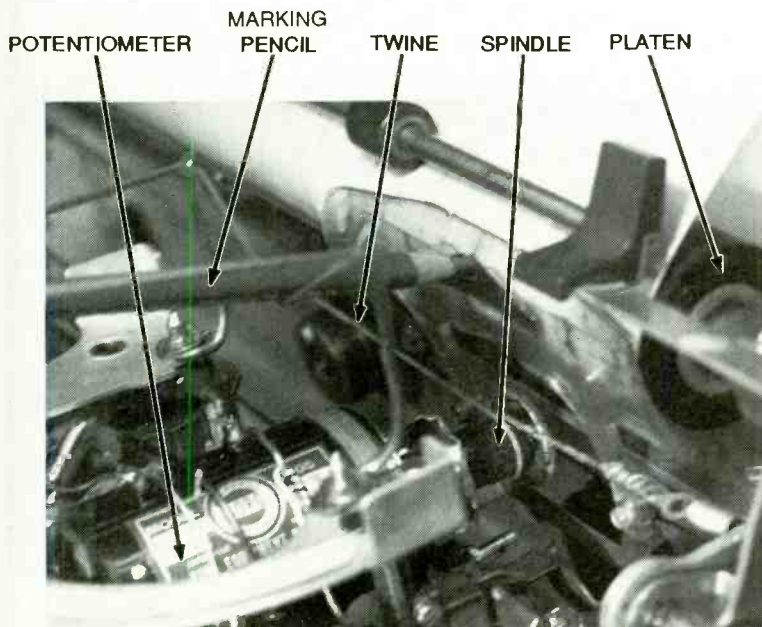


FIG. 2—MECHANICAL ARRANGEMENT of the strip-chart recorder. Note twine wrapped once around the spindle attached to the shaft of the potentiometer.

drive gears, stepper motors, etc. Also, because of mechanical slack in the system, it may take up to an hour for the timer to begin turning the platen. If you desire a faster chart speed, other drive arrangements can be constructed, possibly using the built-in mechanics.

Your printer may have operable DC power supplies. Ours didn't, so we bought two wall-mount DC adapters. Anything in the range of 12–15 volts DC at 500 mA should work, but check the current draw of your carriage drive motor to be safe.

Calibration and testing

Switch R3 into the circuit, let the carriage settle down, and then mark that point as a reference. You may want to slip the twine to move the carriage assembly to a convenient location.

The simplest way to calibrate
Continued on page 50

USE ELECTRONICS NOW CLASSIFIEDS

READ BY ELECTRONIC BUYERS AND SELLERS AND TRADERS

INSTRUCTIONS 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 each additional one (a photo copy of this form will work as well). Place a category number in the space at the top of the order form (special categories are available). 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 ads or multiple ads in the same issue, but in all cases, full payment must accompany your order.

WHAT WE DO

The first word and company name 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 \$2.50 per word. Minimum charge is \$37.50 per ad per insertion (15 words). Any words that you want set in bold are each .40 extra. Indicate bold words by underlining. Words normally written in all caps and accepted abbreviations are not charged anything additional. State abbreviations must be post office 2-letter abbreviations. A phone number is one word.

If you use a **Box number** you must include your permanent address and phone number for our files. **ADS SUBMITTED WITHOUT THIS INFORMATION WILL NOT BE ACCEPTED.**

For firms or individuals offering Commercial products or Services. **Minimum 15 Words.** 5% discount for same ad in 6 issues within one year; 10% discount for same ad in 12 issues. **Boldface (not available as all caps)**, add .40 per word additional. **Entire ad in boldface**, add 20%. **Tint screen behind entire ad**, add 25%. **Tint screen plus all boldface ad**, add 45%. **Expanded type ad**, add \$4.00 per word.

General Information: A copy of your ad must be in our hands by the 13th of the fourth month preceding the date of issue (i.e. Sept issue copy must be received by May 13th). When normal closing date falls on Saturday, Sunday or Holiday, issue closes on preceding work day. Send for the classified brochure.

DEADLINES

Ads not received by our closing date will run in the next issue. For example, ads received by November 13 will appear in the March issue that is on sale January 17. **ELECTRONICS NOW** is published monthly. No cancellations permitted after the closing date. No copy changes can be made after we have typeset your ad. **NO REFUNDS**, advertising credit only. No phone orders.

CONTENT

All classified advertising in **ELECTRONICS NOW** is limited to electronics items only. All ads are subject to the publishers' approval. **WE RESERVE THE RIGHT TO REJECT OR EDIT ALL ADS.**

AD RATES: \$2.50 per word. Minimum \$37.50

Send you ad payments to:

ELECTRONICS NOW 500 Bi-County Blvd, Farmingdale, NY 11735-3931

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	730 -- Wanted

CLASSIFIED AD COPY ORDER FORM

Place this ad in Category # _____

Special Category \$30.00 Additional _____

1 - \$37.50	2 - \$37.50	3 - \$37.50	4 - \$37.50
5 - \$37.50	6 - \$37.50	7 - \$37.50	8 - \$37.50
9 - \$37.50	10 - \$37.50	11 - \$37.50	12 - \$37.50
13 - \$37.50	14 - \$37.50	15 - \$37.50	16 - \$40.00
17 - \$42.50	18 - \$45.00	19 - \$47.50	20 - \$50.00
21 - \$52.50	22 - \$55.00	23 - \$57.50	24 - \$60.00
25 - \$62.50	26 - \$65.00	27 - \$67.50	28 - \$70.00

29 - \$72.50	30 - \$75.00	31 - \$77.50	32 - \$80.00
33 - \$82.50	34 - \$85.00	35 - \$87.50	36 - \$90.00
37 - \$92.50	38 - \$95.00	39 - \$97.50	40 - \$100.00

Total words _____ \$2.50 per word = \$ _____

Bold Face _____ \$0.40 per word = \$ _____

Special Heading _____ \$30.00 = \$ _____

Other _____ = \$ _____

Total classified ad payment \$ _____ enclosed

TOTAL COST OF AD \$ _____

Check Mastercard Visa Discover Card # _____ Expiration Date ____/____

Signature _____

Name _____ Phone _____

Address _____ City State Zip _____

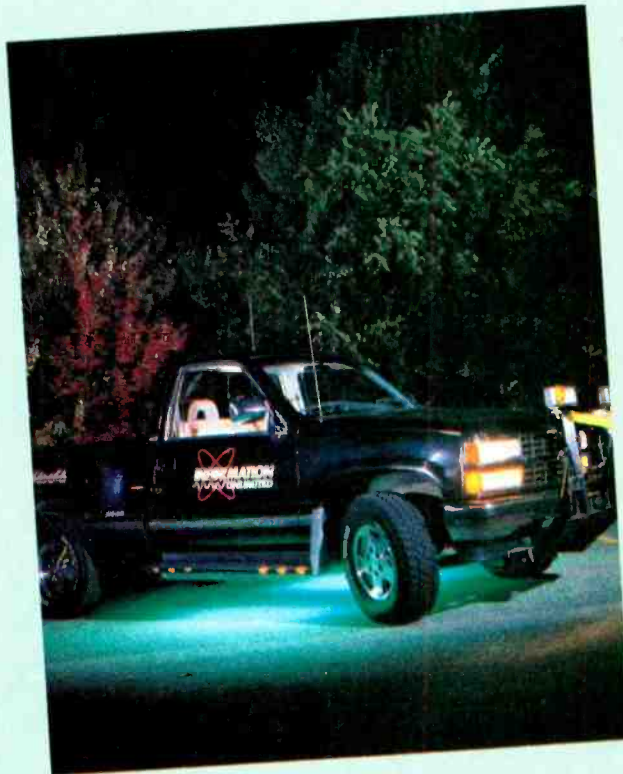
AUTOMOTIVE NEON

JOIN THOSE PEOPLE WHO enjoy customizing their cars by adding a lighted frame to their license plates or illuminating the undersides of their cars in red, green, or violet to give it a "hovering spacecraft" look. This article focuses on the construction of a complete illuminated frame system for your car's license plate, but the battery-powered gas tube driver circuit described here will permit you to light up individual gas tubes mounted on the underside of your car.

The driver circuit will light up neon-filled tubes that glow with a rich ruby red or argon-filled tubes that can be prepared to glow in brilliant green, violet, or pink. If neither of those projects interest you, maybe you would be interested in making up battery-portable illuminated wands, signs, or arrows for parties, festivals or perhaps you'll build it just as unusual eye-catching home decoration?

The driver circuit

The driver circuit ionizes and sustains the illumination of neon or argon gas-filled tubes up to four feet long bent into any shape desired. The tube will remain illuminated as long as power is applied to the circuit. However, the driver circuit permits the tube's illumination level to be adjusted to maximize brightness or reduce brightness to conserve power depending on which is more important.



Build this driver circuit to illuminate your car's license plate, light up its underside for a glamorous "spaceship" look, or just create portable neon or argon light displays.

ROBERT IANNINI

The driver circuit is a pulse-width modulation circuit that can illuminate a neon or argon gas tube in either a continuous or flashing mode. In that mode, the tube will blink on and off at an adjustable rate that permits it to act as an emergency beacon. The circuit is also suitable for driving battery-portable gas tubes fashioned as signs or wands for carrying around at carnivals or using as decorative conversation pieces.

A note of caution

It is illegal in *all* states to drive a car with an illuminated license plate frame that flashes while the vehicle is moving. However, the frame can serve as an attention-getting emergency beacon if the vehicle is stopped.

Also, it is illegal in at least one state to have an illuminated license plate frame on a car unless the gas tube is so masked that only the light reflecting from the plate is visible to the driver of any vehicle that is following behind the car with the lighted frame.

How the driver works

Refer to the schematic Fig. 1. An industry standard bipolar 555 timer, IC1, is configured as a duty cycle clock to control the on and off time of the circuit's high-frequency oscillator. With C2 switched into the circuit by switch S1, the output at pin 3 of IC1 will be a square wave with a duty cycle or

pulse rate that is fast enough to sustain continuous illumination of the gas-filled tube.

Adjusting trimmer potentiometer R1 changes the brightness of the gas tube by altering the on-to-off ratio or the duty cycle of the squarewave that appears at the output of pin 3 of IC1. The squarewave output of IC1 appears at the base of NPN transistor Q1, which functions as a buffer amplifier. The output of Q1 then appears at the base of grounded-emitter NPN transistor Q2, which functions as the feedback element in a free-

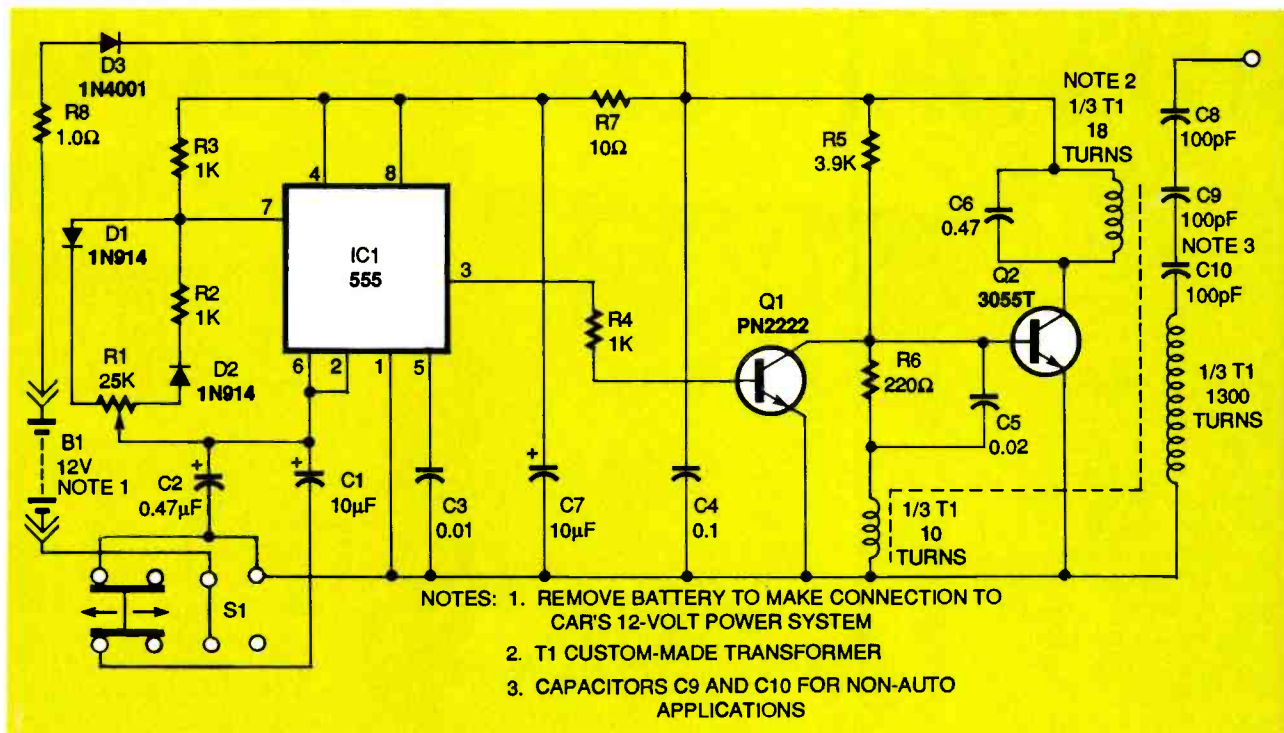


FIG. 1—DRIVER CIRCUIT SCHEMATIC. The circuit can be powered either from a battery pack or vehicle's 12-volt power system.

running oscillator circuit. Transistor Q1 acts as the switch to turn transistor Q2 on and off by clamping the transistor's base to ground.

The oscillator oscillates at a frequency of 25 to 30 kHz, and the output voltage at the top of the 1300-turn coil of T1 is approximately 2500 volts, peak-to-peak, sufficient to ionize the gas in the tube. The duty cycle pulse of IC1, as buffered by transistor Q1, controls the base of transistor Q2. The tank circuit that determines oscillator frequency, consists of capacitor C6 and the 18-turn primary coil of transformer T1.

Changes in the duration of the "on" cycle change only the brightness of the gas tube but do not affect the frequency of the oscillator. High-voltage ceramic capacitors C8, C9 and C10 correct for differences in the length of the gas tube being driven.

If switch S1 is set to the *flashing* mode, capacitor C1 is placed in parallel with capacitor C2, and the sum of their capacitive values will shorten the repetition rate of the squarewaves appearing at pin 3 of IC1. This will cause the tube to flash on and

off at a rate slow enough to be seen as flashing (less than 50 pulses per second). The flashing time rate can be changed to a visually comfortable level by adjusting trimmer potentiometer R1.

Building the driver circuit

Whether you plan to operate the driver only from the battery pack or directly from an automotive 12- to 14-volt supply, it is recommended that provision be made to operate the circuit from the battery pack for testing.

If the illuminated frame is to be used on a vehicle (regardless of power source), attach a heatsink to the copper tab on the TO-220 case of transistor Q2. Omit capacitors C9 and C10 if you intend to install the system in a vehicle.

The driver circuit can be built on perforated board by point-to-point wiring method. Cut a 3¼ × 15/16-inch rectangle of pre-punched circuit board (0.042-inch diameter holes in a 0.1-inch grid. With the exception of the high-voltage capacitors C8, C9 and C10 and transformer T1, all components are readily available items.

If you do not want to wind

your own miniature transformer, you can purchase one from the source given in the Parts List. The neon or argon frame and plate cover assembly referenced in this article is also available from the same source. Also the high-voltage capacitors C8, C9, and C10 are available in a kit.

Refer to Parts Placement diagram Fig. 2. Before starting assembly work, cut out a rectangular relief hole in the circuit, as shown by the dotted line, to make wiring slide switch S1 easier. If you intend to install the system in a car, attach a heatsink to the tab of transistor Q2 before inserting it.

Insert all components in the approximate positions shown on Fig. 2. Insert all components in the approximate positions shown. Insert all axial-leaded resistors and diodes marked with an asterisk vertically to conserve circuit board space. A snap-on heatsink suitable for a TO-220 package is, but a satisfactory substitute can be made by cutting and folding a piece of 0.062-inch thick sheet aluminum 1 × 1½ inches. Drill a small hole in its center for mounting

it to the hole in the heat tab of transistor Q2 with a nut and bolt.

Carefully fold back one lead of all axial components shown as vertically mounted over the body of the component so that both leads can be inserted in holes spaced 0.10-inch apart. Observe the polarities of the diodes and electrolytic capacitors before inserting them and be sure that you have identified the pin functions of transistors Q1 and Q2 before inserting them in the board.

Insert and bend all leads first before doing any soldering so that extra lead lengths can be used to form the specified connections between components.

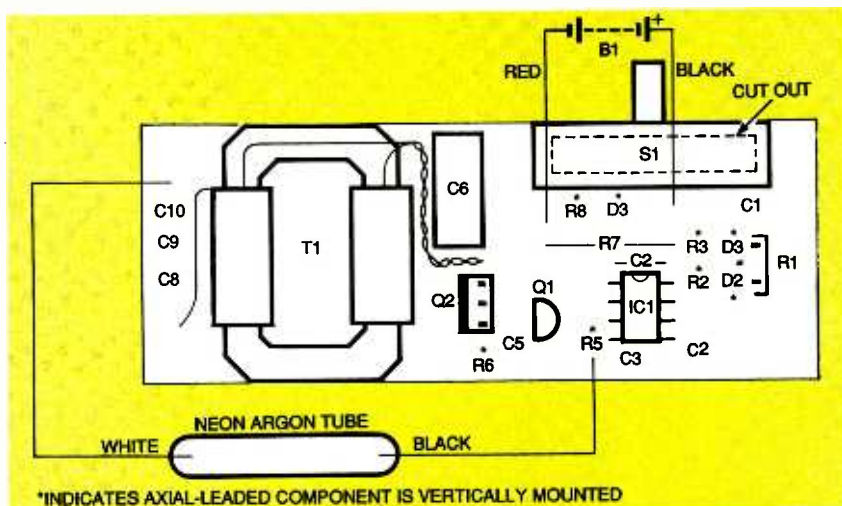


FIG. 2—DRIVER CIRCUIT PARTS PLACEMENT DIAGRAM. The circuit can be built by point-to-point wiring on 0.1-inch grid perforated board. Transformer T1 is a non-standard component.

PARTS LIST

All resistors are ¼-watt, 10%, unless otherwise specified

R1—25,000 ohms, trimmer potentiometer, PC board mounting, carbon film

R2, R3, R4—1000 ohms

R5—3900 ohms

R6—220 ohms

R7—10 ohms

R8—1 ohm, ½-watt

Capacitors

C1, C7—10 µF, 35 volts, aluminum electrolytic, radial-leaded

C2—0.47 µF, 50 volts, aluminum electrolytic, radial-leaded

C3—0.01 µF, 50 volts, ceramic disc

C4—0.1 µF, 50 volts, ceramic disc

C5—0.02 µF, 100 volts, polyester

C6—0.47 µF, 100 volts, polypropylene, radial leaded

C8, C9, C10—100 pF, 3000 volts, ceramic multilayer, radial-leaded DIP (see text)

Semiconductors

IC1—555 timer, 8-pin DIP

Q1—2N2222, NPN bipolar transistor, TO-92

Q2—3055T NPN transistor, TO-220 package, National Semiconductor or equiv.

D1, D2—1N914 silicon diode

D3—1N4001 silicon diode

Other components

T1—transformer with 10-, 18-, and 1300-turn windings, (see text)

S1—slide switch, two-deck, three position (DP3T), PC mount, Mouser 10SL008 or equiv.

Miscellaneous: neon or argon gas tube frame assembly (see text); circuit board, (see text); circuit case (optional); 9-volt battery clip;

eight-cell battery pack (optional); eight alkaline AA cells; No. 24 AWG insulated hookup wire; TO-220 heatsink, spade connectors, nut and bolt, solder

Note: Completely assembled systems, kits of parts, and individual parts for the neon/argon license plate frame with variable brightness and emergency flashing, are available from Information Unlimited: Box 716, Amherst, NH 03031, Telephone 1-603-673-4730; Fax 603 672 5406. Include \$4 for shipping & handling per order. The following options are offered:

- Driver circuit transformer, T1 (28K087)—\$9.50
- Printed-circuit board PC1—\$4.50
- Kit of parts for system including all electronic components and PC board, but no gas tube or plastic frame (BATNEONK)—\$19.50
- Ready-to-use aqua and purple neon tubes with plastic frames for flashing power supply (AQUA1)—\$12.50; (PURP1)—\$12.50
- Ready-to-install non-flashing purple license frame neon assembly (LICNPR)—\$24.50
- Ready-to-install non-flashing green license-frame neon assembly (LICNGR)—\$24.50
- High-brightness under-car neon assembly: Pink 4-tube kit (RG4K)—\$124.50; Purple 4-tube kit (RG4L)—\$124.50; Music driver for above kits (RG4M)—\$39.50; Single tube kit (specify pink or purple) (RG1K)—\$34.50

After soldering all components and trimming their leads, insert and solder the wires for the battery pack and vehicle's power system. Solder all the wires from transformer T1 to their specified terminal points. Connect and solder the hot and ground wires to the neon-tube frame assembly.

System assembly

Refer to assembly diagram Fig. 3. The neon or argon gas-filled tube has been bent to form a rectangle with an inside measurement of 11 × 5¼-inches so it can frame the license plates of all American and Canadian cars. The tube is embedded in RTV silicone within the lip around a transparent plastic cover that will protect the license plate.

Wires extend from both ends of the gas-filled tube for connection to the high-voltage output and ground wires of the driver circuit. Those wires can be soldered together or connected by soldering automotive spade-style connectors to their ends for more convenient connection and disconnection should it become necessary.

The battery pack needed for test purposes can also be the permanent power source, if desired. It consists of eight AA alkaline cells. If you intend to connect the system to a vehicle's electrical system, do it with approved automotive-style sol-

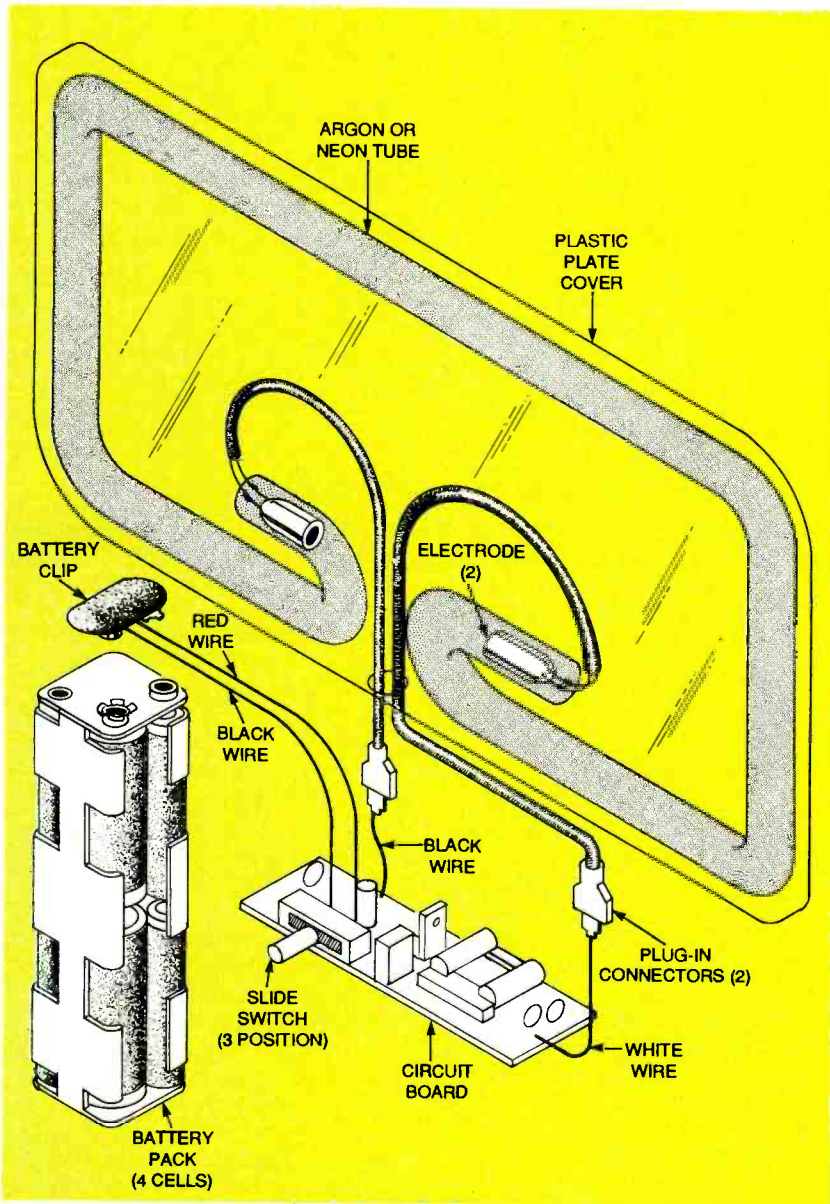


FIG. 3—NEON OR ARGON GAS TUBE LICENSE PLATE frame system showing driver circuit connections to the gas tube/ cover assembly.

derless connectors, and do as neat a job as possible.

After completing the driver circuit, it is recommended that the circuit be placed in a protective case to protect it from dust and moisture. A standard plastic project case is suitable. Drill or form holes in the case to permit the lever of slide switch S1 to be moved and permit the passage of external wires to the power source and the gas tube/cover assembly.

Testing the system

Move the lever on the slide switch S1 to its full left OFF position. Place eight AA cells in the battery pack and snap the battery clip in position on the pack. Move the lever of S1 to the middle position and watch for ignition of the gas in the tube. Then move the switch to the right position and observe that the tube is flashing. If this does not happen, disconnect the battery power and examine the circuit for any error in parts placement or soldering and correct it.

The brightness of the glowing tube can be set by adjusting the wiper on trimmer potentiometer R1. This applies in both the continuous and flashing modes.

If the gas tube is to be run exclusively from the battery pack, you can expect about 10 hours of illumination from eight fresh alkaline AA cells before they must be replaced with a new set. Ω

STRIP CHART RECORDER

continued from page 45

the recorder is to place a thermometer beside the temperature probe and mark pen positions and thermometer readings at various temperatures. Glue the marked-up calibration strip to a ruler or strip of plastic. You can then scale your charts by aligning the reference point on your ruler with the reference point on your chart.

Test the circuit by turning op-

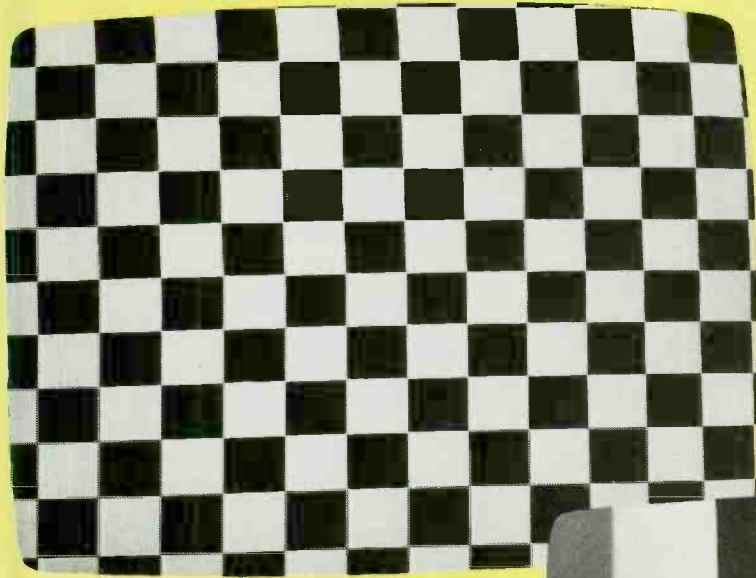
amp gain (R10) all the way up and setting S1 to Calibrate. The pen should move to the reference position and stop. If the carriage moves all the way to one side or the other, try reversing the wires going to the motor

If the carriage oscillates (hunts), gain is too high, so turn R10 down. When you get the drive working properly, switch to the thermistor, making certain that ambient temperature puts it within range of your chart recorder. Now verify the thermistor's resistance at different temperatures.

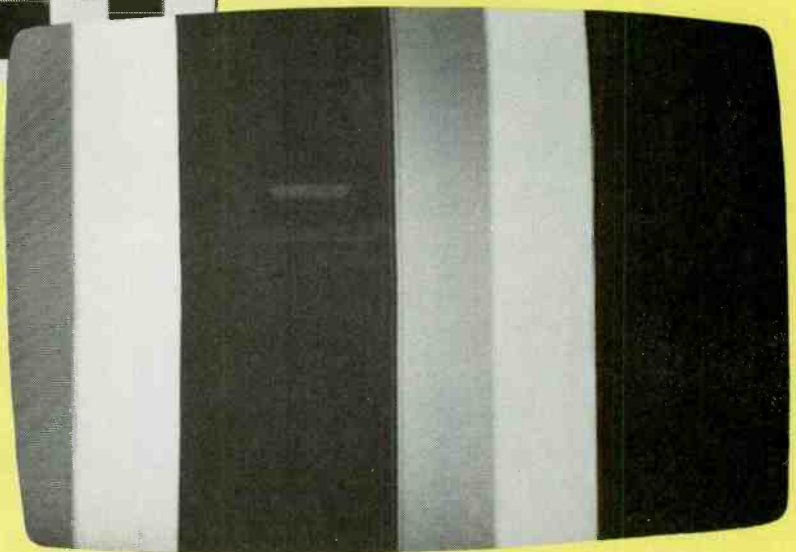
In addition to temperature, the author has recorded wind direction using a modified 10K potentiometer as a sensor. One planned experiment involves putting a probe in the ground and charting the relationship between soil temperature and tomato taste. If you come up with a novel project using an obsolete printer for a new purpose, let us know about it. A possible application idea is placing a signature on a check. There are other possibilities using otherwise obsolete computer components. Ω

Build This Video Pattern Generator

YONGPING XIA



Build this EPROM-based video pattern generator and put it to work testing TV sets and experiment with the generation of video patterns.



THE MULTIFUNCTION VIDEO SIGNAL generator project described in this article produces three independent video test patterns: a black and white checker pattern, a color-bar pattern, and a programmable custom picture. When any one of those patterns is combined with a sync signal and sent to a television signal modulator IC, a video signal is formed.

How does it work?

Figure 1 is a block diagram for the video pattern generator. A clock pulse generator initiates the base time clock pulses. Those clock pulses drive a counter, which sends the address signals to an erasable programmable read-only memory (EPROM). The EPROM contains all of the previously stored sync

and pattern signals. The outputs of the EPROM, as selected by a pattern-selection switch, are synchronized by a latch, and sent to the NTSC (television) modulator. The modulator combines the sync and pattern signals to form a video output signal.

Figure 2 is the schematic for the video signal generator. The main clock pulse signal for the generator is based on XTAL1, which has a frequency of 3.579545 MHz or a period of 0.279 microseconds. (Color television sets contain a 3.58 MHz color-burst oscillator.) A horizontal sweep period based on 227 clock pulses was selected. The period is calculated as 227×0.279 microseconds, which equals 63.33 microseconds, the length of time for a

horizontal line scan in a receiver conforming to the NTSC (National Television System Committee) standard. The vertical deflection contains 262 horizontal sweep lines, so that one field consists of 227×262 , or 59,474 clock pulses.

Four 74HC161 binary programmable counters (IC1 to IC4) form a 59,474 clock pulse counter. The two modes of the counter are controlled by its LOAD signal. If LOAD pin 9 has a logic 1 (high) state, the 74HC161 is in its normal counting mode. However, if LOAD pin has a logic 0 (low) state, the 74HC161 enters its load mode. The clock pulses will load the program data at input pins A through D (pins 3 to 6) of the four 74HC161 binary counters.

When all four binary counters



1570519 \$17.95

073092X \$19.95

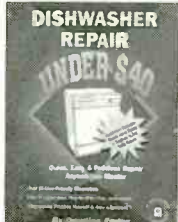
0535469 \$29.95

0305226-XX \$34.95
Counts as 2/Hardcover

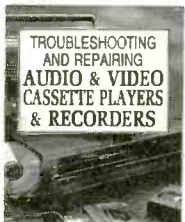
0707618 \$19.95

015676X-XX \$69.00
Counts as 2/Hardcover

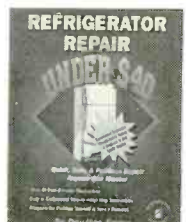
The leading source of information for electronics hobbyists for over 30 years!



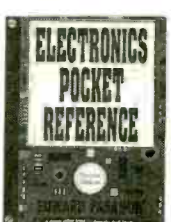
5870606 \$12.95



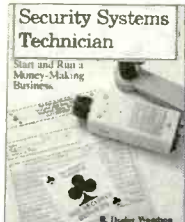
1577564 \$22.95



5869179 \$12.95



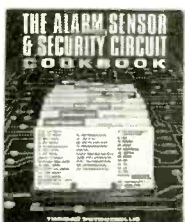
0487375 \$24.95



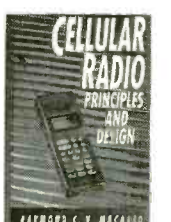
0717753 \$19.95



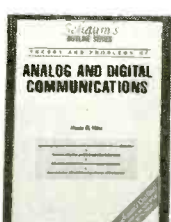
076509X \$17.95



0497060 \$29.95
Hardcover



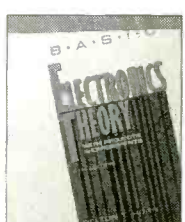
0443017 \$50.00
Hardcover



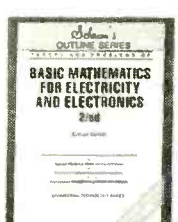
0306362 \$13.95



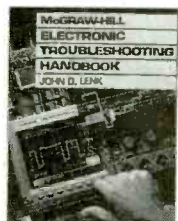
9119018-XX \$32.95
Counts as 2



0304084-XX \$24.95
Counts as 2



0044392 \$12.95



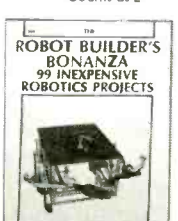
0376581-XX \$39.50
Counts as 2/Hardcover



9122264-XX \$39.95
Counts as 2



0155593 \$22.95



1571469 \$18.95



0112738-XX \$45.00
Counts as 2/Hardcover



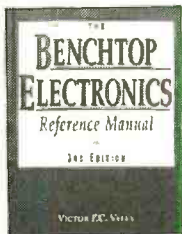
0501815 \$32.95

As a member of the ELECTRONICS BOOK CLUB®... you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off the regular publishers' prices. If you want the Main selection, do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. If you ever receive a book you don't want due to late delivery of the bulletin, you can return it at our expense. Your only obligation is to purchase 3 more books during the next 12 months, after which you may cancel your membership at any time. And you'll be eligible for FREE BOOKS through our Bonus Book Program. A shipping/handling charge and sales tax will be added to all orders. All books are softcover unless otherwise noted. If you select a book that counts as 2 choices, write the book number in one box and XX in the next. (Publishers' Prices Shown) ©1996 EBC

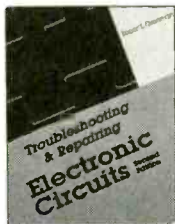
PHONE 1(614)759-3666 • FAX 1(614)759-3749
(8:30 a.m. - 5:00 p.m. EST Monday-Friday) (24 hours a day, 7 days a week)

Electronics Now, July 1996

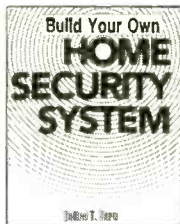
5 BOOKS FOR ONLY \$4.95 Plus 1 book FREE upon prepayment VALUES TO \$243.90



0673764-XX \$54.95
Counts as 2/Hardcover



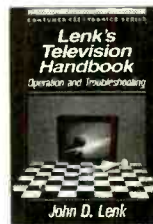
1573119 \$19.95



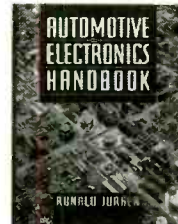
0303932 \$17.95



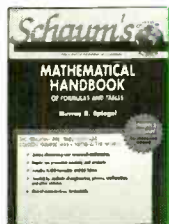
1561579 \$17.95



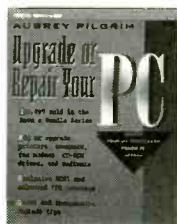
0375178-XX \$39.50
Counts as 2/Hardcover



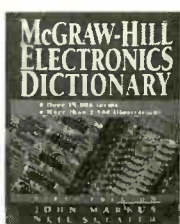
0331898-XX \$89.50
Counts as 2/Hardcover



0602247 \$13.95



0501149 \$26.95



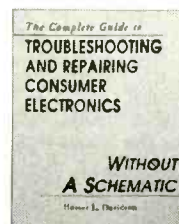
0404348-XX \$49.50
Counts as 2/Hardcover



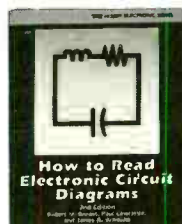
0304122 \$17.95



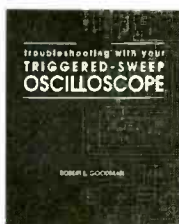
0376026-XX \$45.00
Counts as 2/Hardcover



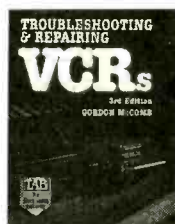
0156492-XX \$34.95
Counts as 2/Hardcover



1554637 \$16.95



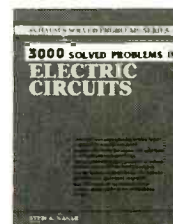
1576568 \$21.95



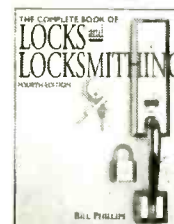
155016X \$34.95
Hardcover



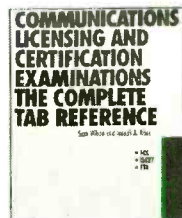
1575472 \$27.95



0459363-XX \$22.95
Counts as 2



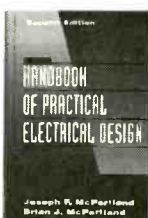
0498660 \$24.95



0708223 \$44.95
Hardcover



0053553 \$50.00
Hardcover



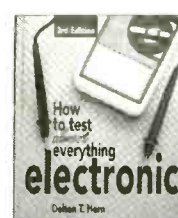
0458200-XX \$62.50
Counts as 2/Hardcover



1574875 \$19.95



0052387 \$28.95
Hardcover



0304068 \$15.95

If coupon is missing, write to: Electronics Book Club®, A Division of The McGraw-Hill Companies, P.O. Box 549, Blacklick, OH 43004-9918



A Division of The McGraw-Hill Companies
P.O. Box 549, Blacklick, OH 43004-9918

YES! Send me the 5 books listed below, for \$4.95 plus shipping/handling & tax, and enroll me as a member of the **Electronics Book Club®** according to the terms outlined in this ad. If not satisfied, I may return the books within ten days without obligation and have my membership cancelled.

If you select a book that counts as 2 choices, write the book number in one box and XX in the next box.

- Bill me (FREE book not available with this payment option.)
 - Yes! I want the FREE BOOK indicated at right. My introductory payment of \$4.95 plus \$4.95 *shipping/handling and applicable sales tax is enclosed.
 - CHECK OR MONEY ORDER ENCLOSED PAYABLE TO: The McGraw-Hill Companies
- Please charge my: VISA Master Card American Express Discover

Code # of my
FREE BOOK:

SINGLE
SELECTION ONLY

ACCT# _____ Exp. Date _____

NAME _____ SIGNATURE _____

(required on all orders)

ADDRESS/APT. # _____

CITY _____ STATE _____ ZIP _____ PHONE _____

Valid for new members only, subject to acceptance by EBC. U.S. orders are shipped 4th Class Book Post. Applicants outside the U.S. and Canada will receive special ordering instructions. Canada must remit in U.S. funds drawn on U.S. banks. *Canadian orders are shipped International Book Post - add \$9.25 shipping/handling. A shipping/handling charge and sales tax will be added to all orders.

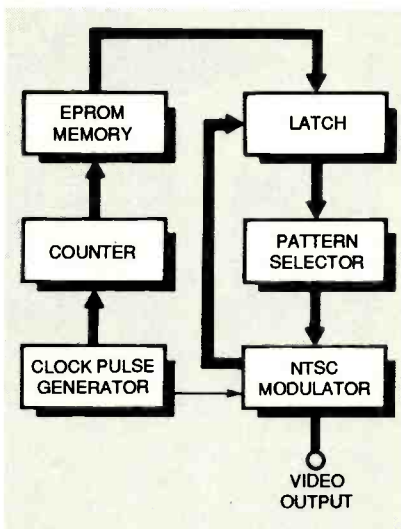


FIG. 1—FUNCTIONAL BLOCK DIAGRAM for the Video Pattern Generator.

count to logic 1 (FFFFH), IC4's ripple-carry output (RCO) pin 15 becomes a logic 1. This signal is sent to the four counters' load input pins after inversion by 74HC00 IC6-a. Then the counters load the data at their a to d inputs when the next clock pulse occurs. In this case, 0001 0111 1010 1110 equals 17AEH will be loaded into the counters. The binary counter, which counts from 17AEH to FFFFH, requires E851H or 59,473 clock pulses. This is the required counter sum after adding one more clock pulse for loading data.

The counters' outputs are sent to a 27C512-15 64K × 8 CMOS EPROM (IC5) as address signals. For each address, IC5 provides an 8-bit output. These outputs are listed in Table 1.

Pins D0 to D2 of IC5 send the custom pattern signals red (R2), green (G2) and blue (B2). Pin D3 provides the black and white checker pattern. Pins D4 to D6 send the color bar red (R1), green (G1), blue (B1) signals. The sync signal that combines both the horizontal and vertical sync signals is obtained at pin D7.

The EPROM's outputs are latched by the 74HC273 (IC6) octal D flip-flops for synchroniz-

TABLE 1—EPROM Outputs

D7	D6	D5	D4	D3	D2	D1	D0
Sync	R1	G1	B1	B/W	R2	G2	B2

ing purposes. Three-pole, three-terminal switch S1 selects each of the three video patterns. As shown in Fig. 2 the S1 top position (1) selects the 14- × -18 B/W checker pattern. When this pattern is selected, the B/W signal is sent to the MC1377 television RGB-to-NTSC encoder (IC7) with equal red, green and blue values. As a result, the picture will be black if B/W is logic 0 and it will be white if B/W is logic 1.

The second pattern selected by the mid-position (2) of switch S1 is the color bar pattern. The order of the colors in the color bar pattern is *white, yellow, cyan, green, magenta, red, blue and black*, from left to right. The third video pattern selected by bottom position (3) of S1 is a custom picture which is composed of 237 lines, and each line contains 287 pixels. Thus, the total number of pixels in the custom pattern is 43,605. Each of those pixels can be programmed as one of the eight different colors in the color bar pattern.

The RGB to NTSC encoder MC1377 (IC7) performs all of the functions of a color TV encoder. These functions are: color subcarrier oscillator; RGB to R-Y and B-Y converters; voltage-controlled 90° phase shifter; and chroma modulators. The inputs required for the proper operation of the MC1377 are 1-volt peak-to-peak red, green and blue (R, G and B) signals, and a TTL-level sync signal. The MC1377 provides a 2.5-volt, peak-to-peak, composite-video output to jack J1.

Because IC-6 is a high-speed CMOS device, its output signal level will be very stable. This means that if the output is logic 0, the level will be close to zero volts. If output is logic 1, the voltage should be +5 volts. The selected pattern signals are divided by resistors R1 to R6 to meet the MC1377's input level requirements. Those resistors are specified as 1% to eliminate any error caused by different R G B levels that would cause color distortion. You can hand-select these from a group of 5% resistors by measuring and sorting them with a DMM.

PARTS LIST

All resistors are 1/4-watt, 5%, unless other specified

R1, R2, R3—3900 ohms, 1% (See text)

R4, R5, R6—1000 ohms, 1% (See text)

R7—470,000 ohms

R8—75 ohms

R9—43,000 ohms

R10—2200 ohms

R11, R12—1000 ohms

R13—10,000 ohms

Capacitors

C1, C3—10-μF, 16-volts, aluminum electrolytic

C4—12-pF, ceramic disc

C5—20-pF, ceramic disc

C6, C7—220-pF, ceramic disc

C8, C9—0.01-μF, ceramic disc

C10, C11, C12, C13, C20—0.1-μF, ceramic disc

C14, C15, C17—1000-pF, ceramic disc

C16, C18—470-μF, 16-volts, aluminum electrolytic, axial leaded

C19—100-μF, 16-volts, aluminum electrolytic

C21—470-μF, 35-volts, aluminum electrolytic

Semiconductors

D1, D2, D3, D4—1N4001, silicon diode

IC1, IC2, IC3, IC4—74HC161N, 4-bit binary programmable counter (Motorola or equiv.)

IC5—27C512-15, 64K × 8 EPROM, AMD or equiv.

IC6—MC74HC273 octal D flip flops with clear (Motorola or equiv.)

IC7—MC1377P, RGB to PAL/NTSC encoder (Motorola or equiv.)

IC8—74HC00E, quad 2-input NAND gate (Motorola or equiv.)

IC9—MC7812T, +12-volt regulator IC (Motorola or equiv.)

IC10—MC7805T, +5-volt regulator IC (Motorola or equiv.)

Q1—2N3904, NPN transistor

Other components

J1—Coaxial jack, F series, panel mount.

T1—Transformer, 120 to 15 VAC, 300 mA

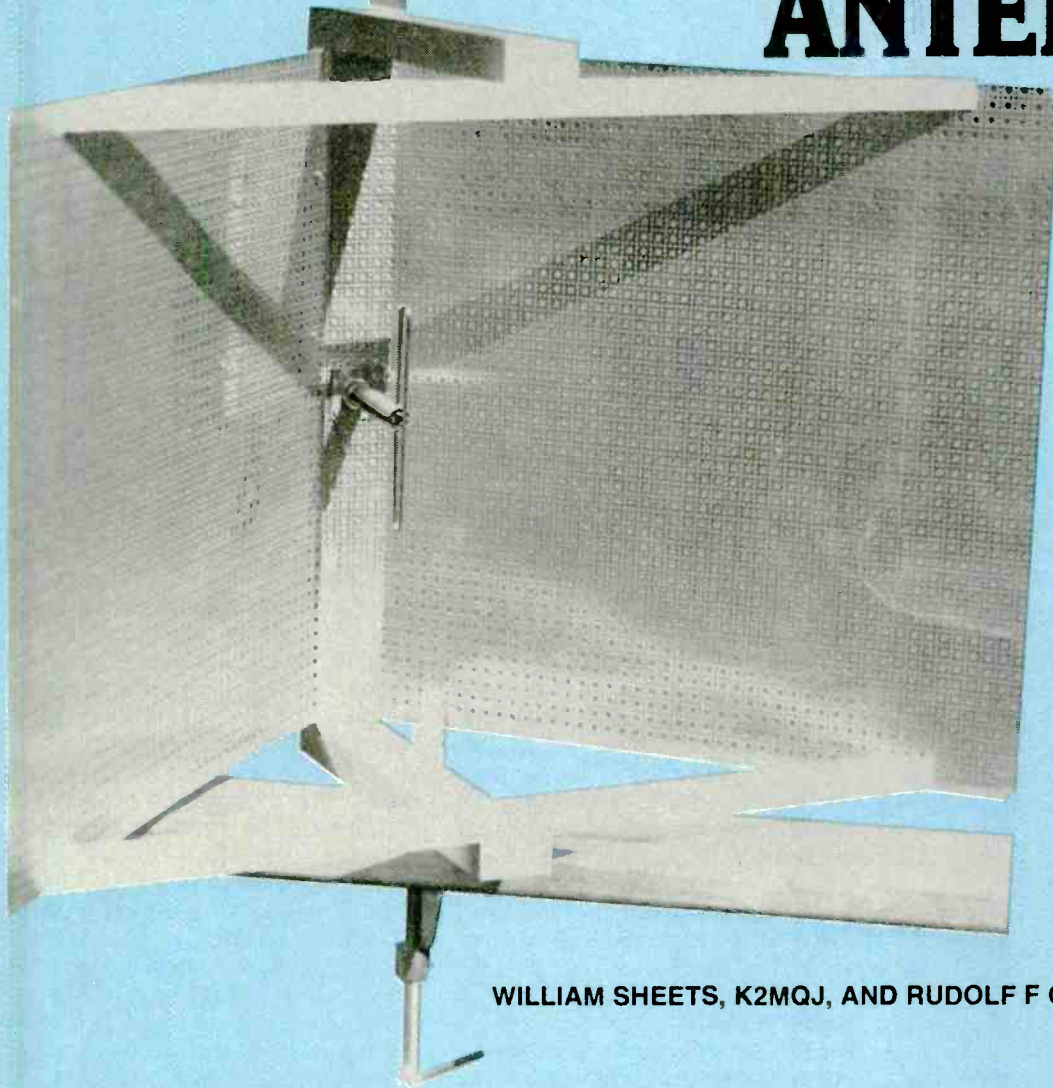
XTAL1—3.579545 Mhz crystal

Miscellaneous: Circuit board (see text); project case (see text); DIP sockets: four 16-pin, one 14-pin standard width, two 20-pin narrow width, and one 28-pin wide of EPROM; knob for rotary switch; length of RG-58 coaxial cable (see text); line cord with plug, insulated hookup wire, four standoffs, 1/4-inch; screws, nuts and washers; solder

The output of IC7 (the MC1377) is buffered by Q1, a 2N3904 NPN transistor, to improve its drive capability. To keep the circuit simple, the main clock pulses are generated by the MC1377. Because pin 17 of the MC1377 can provide only 0.1 volts peak-to-peak subcarrier output, the signal is ampli-

Continued on page 72

UHF Corner Reflector ANTENNA



WILLIAM SHEETS, K2MQJ, AND RUDOLF F GRAF, KA2CWL

Obtain outstanding performance from a home-brew radiator built from readily-available parts and materials.

SCANNER ENTHUSIASTS, AMATEUR radio operators, and UHF experimenters are interested in simple antennas that are more effective than ground-planes and whips. You can build a high-performance UHF corner-reflector antenna that is compact and easy to tune using readily available materials.

A corner-reflector antenna provides good performance radiation for directional UHF work since it has 8 to 10 dB gain, is fairly easy to build, and

has reasonable bandwidth of 5% to 20%. Also, the corner-reflector antenna exhibits a good radiation pattern and front-to-back signal ratio.

The corner-reflector antenna consists of a balanced half-wave dipole placed in front of a conducting surface that is folded with an angle of 90 degrees or less. As the angle gets smaller, the gain tends to increase but the antenna structure tends to get larger and the dipole feed impedance becomes

lower. The dipole may be constructed with thick dipole elements to increase bandwidth. The spacing of the dipole from the reflector can be adjusted to optimize the feed impedance.

The gain of a corner-reflector antenna with a reflector surface of one to two wavelengths is typically 8 to 10 dB over an isotropic radiator. Antenna gain can be made 14 to 15 dB or more with a large reflector (greater than 5 wavelengths) and a narrow (45 degree or less) angle.

However this is mechanically impractical at frequencies below 1000 MHz.

Dipole operation

A dipole is a balanced antenna and should not be fed directly with coaxial cable. Doing so would cause the outer conductor of the coaxial line to act as part of the antenna, and a large amount of signal would be radiated or received by the outer conductor. For casual reception this may not matter much, but the directional radiation pattern of the antenna is destroyed and reception/transmission results are no longer predictable.

In order to derive a balanced feed for the dipole some sort of a transformer is necessary. For the corner reflector described here a slot-fed balun is used (see Fig. 1). This is accomplished by splitting the outer conductor (made from a brass tube) lengthwise for a quarter wavelength and connecting the inner conductor (a much smaller diameter tube or rod) to the end

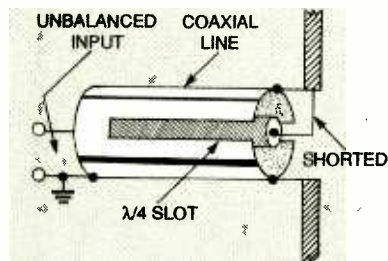


FIG. 1—METHOD FOR FEEDING a balanced dipole by a slot-fed balun.

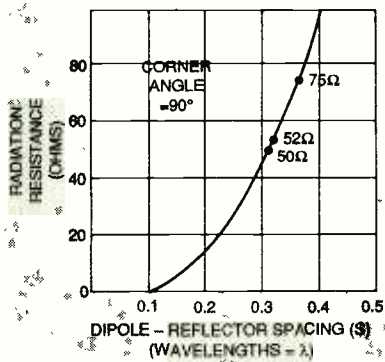


FIG. 2—PLOT OF RADIATION RESISTANCE in ohms vs. spacing of a dipole in wavelength from virtual apex of a 90° corner-reflector antenna.

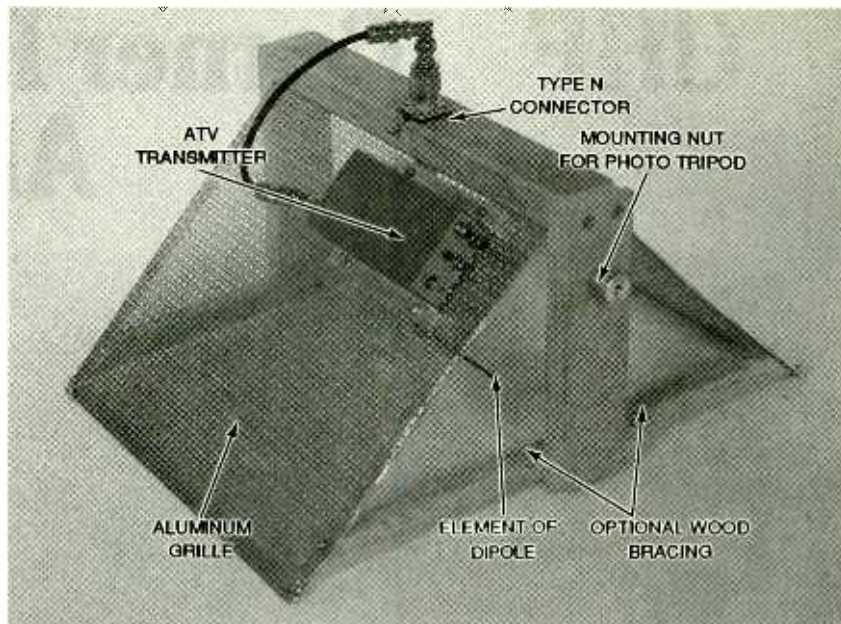


FIG. 3—THE BASIC PARTS of a corner-reflector antenna.

of one segment, and to one dipole element. The other segment is connected to the opposite half of the dipole. This type of balun gives a 4:1 impedance transformation and can feed a simple dipole. A satisfactory impedance match was achieved (1.5:1 or better VSWR) by adjusting slot length and trimming dipole length, and adjusting dipole-to-reflector spacing. Dipole-to-reflector spacing affects the dipole's impedance (see Fig. 2).

Construction

Fig. 3 shows some details of a corner-reflector antenna that you can build. Virtually all materials for the antenna are available at hobby shops and building supply centers. Total cost should be \$20 or less. The corner-reflector antenna described here was designed for operation at 900-MHz. For other frequencies, the dimensions can be scaled from the information given in Table 1 and inserted into Fig. 4. However, at lower frequencies, the antenna is larger so some compromises have to be made to keep within practical mechanical size, weight and structural stability. A good idea from a performance standpoint is to keep the reflector as large as you can, up to a few wavelengths. This becomes

impractical at 400 MHz, more so than at 1300 MHz, because of the antenna's overall size. As antenna size increases the extra gain may not be worth the mechanical difficulties and cost. Also, wind loading must be taken into account as this corner-reflector antenna presents a large wind surface area from all compass directions.

The antenna shown in Fig. 3 is fairly easy to construct with hand tools. Before you begin construction, review all the illustrations from Fig. 1 to Fig. 8, including Tables 1 and 2 to obtain a visual mechanical understanding of what is to follow.

Begin by cutting a 6.5-inch piece of 5/8-inch O.D. (outside diameter) brass tubing with a 0.015-inch wall thickness (available at well-stocked hobby shops). See Fig. 5. This length is the sum of half of a wavelength at the desired operating frequency, plus another 1 to 2 inches to allow for the connector and mounting flange as shown. Make sure the ends are squarely cut. A tubing or pipe cutter will provide a better cut than a hack saw. Cut a piece of 1/4-inch tubing to a length about 1/8 inch shorter than the length of the 5/8-inch tubing. These tubes will form the dipoles feed assembly and balun.

Continued on page 75

Disk-space management

JUDGING BY MY E-MAIL, DISK PARTITION MANAGEMENT IS A VERY POPULAR—BUT MUCH MISUNDERSTOOD—TOPIC. TO HELP DISSIPATE THE MIST, I'LL DISCUSS HOW PARTITIONING AFFECTS OVERALL SYSTEM RESOURCE

availability. Then I'll talk about some products that help manage those resources in a more efficient manner than operating-system-only tools: Partition Magic, System Commander, Remove-It, and the OS/2 Boot Manager.

Should you care about disk partitioning? Not if you have a high-capacity hard disk with no danger of running out of space, and you run a single operating system. But if you

many as four partitions. There are two types of partitions: primary and extended. In general, you can think of primary partitions as bootable, and extended partitions as for data. You can subdivide the extended partition into logical drives, but you cannot subdivide a primary partition. Both types of partitions can be either hidden or visible. Hidden means that the partition will be ignored by the operating system

LISTING 1—DRIVE ASSIGNMENT ALGORITHM

```

For each drive
  If exists (visible primary partition) then
    Assign drive letter
For each drive
  For each logical drive
    Assign drive letter
For each drive
  For each unassigned visible primary partition
    Assign drive letter
  
```

want to run more than one operating system on a single machine, maximize space-utilization efficiency, provide better organization of data, or add additional hard drives, then you'll want to understand this discussion.

How partitioning works

Any given physical drive can be divided into several sections called *partitions*. A given drive may have as

when booting, and inaccessible thereafter. The main differences between primary and extended partitions are summarized in Table .

All partition information (where it starts, where it ends, whether it's visible, its type, and so on) is stored in a data structure near the physical beginning of the disk. That data structure is called the *Partition Table*. You can view it using various utilities, including DOS's FDISK,

the Disk Editor in the Norton Utilities, and several of the utilities discussed below.

In the past, only one primary partition could be marked visible. But recent versions of DOS (and Windows 95) can have multiple visible primaries (MVP's). However, some operating systems (such as OS/2) are confused by MVP's; consequently, data corruption can occur.

All versions of DOS, Windows, and OS/2 come with a utility called FDISK, which allows you to create, destroy, and (in a very limited way) modify partitions. Using only utilities supplied with the operating system when repartitioning a disk usually means backing everything up, repartitioning, possibly installing an operating system and restoration software, and restoring data to the new partitions.

A company called PowerQuest recognized that limitation and has developed an extremely useful partition-manipulation utility called Partition Magic, which allows you to create, destroy, move, resize, hide/unhide, and set active partitions. (Setting a partition active means designating it as the boot drive.)

Partitioning issues

When deciding how to divide up a hard disk, there are three primary issues: 1) Cluster size and disk efficiency; 2) The number of operating systems and their boot requirements; and 3) Drive letter sequences.

Cluster size. I discussed this issue in some detail in the January 96 issue, so I won't repeat it here. The bottom line is that when it comes to cluster size, big is bad. You can easily waste 150 megabytes or more on today's common 1-gigabyte drives. It is to your advantage to partition large drives in as small chunks as possible.

OS requirements. The questions to ask here are: How many operating systems do you want to run? How much space does each need? How much isolation do you want between them? Do they need to have access to each other's data? The cleanest, safest approach to running multiple operating systems on a single hard disk is to create four primary partitions, and mark only one visible at any given time. But then you can't share data among them. In addition, some operating systems "predatory:" On installation, a predatory operating system alters the partition table and the bootstrap loader on all drives so that only that operating system will be visible. Windows 95 is notorious in this respect. However, that's easy to fix using FDISK or Partition Magic.

Drive letters. When experimenting with different partitioning schemes, you quickly learn that partitions have a tendency to appear at different drive letters. That can be merely inconvenient or a major pain, depending on the types of applications you run. You can minimize this effect by understanding how drive letters are allocated. There are also utilities to help migrate applications from one drive to another, in the process updating all relevant system files.

The drive-letter assignment process works like this. Scan through all physical drives; for each that has a visible primary partition, assign a drive letter. Scan through all physical drives again; for each that has an extended partition, assign drive letters for all visible logical drives in that extended partition. Scan the physical drives again; for all unassigned visible primary partitions, assign drive letters. The process is represented in pseudocode in Listing 1.

In sum, think of the ordering process as active primaries, extendeds, and inactive primaries.

Examples

To understand how that works, let's try a few examples. Assume that our system has two hard disks with the layouts shown in Fig. 1-a. Each drive has a primary active partition and an extended partition containing a single logical drive, neither of which is hidden. In this case, drive lettering is straightforward.

Figure 1-b adds an additional primary partition to both drives; both partitions are visible. Note the new primaries are added to the end of the letter sequence.

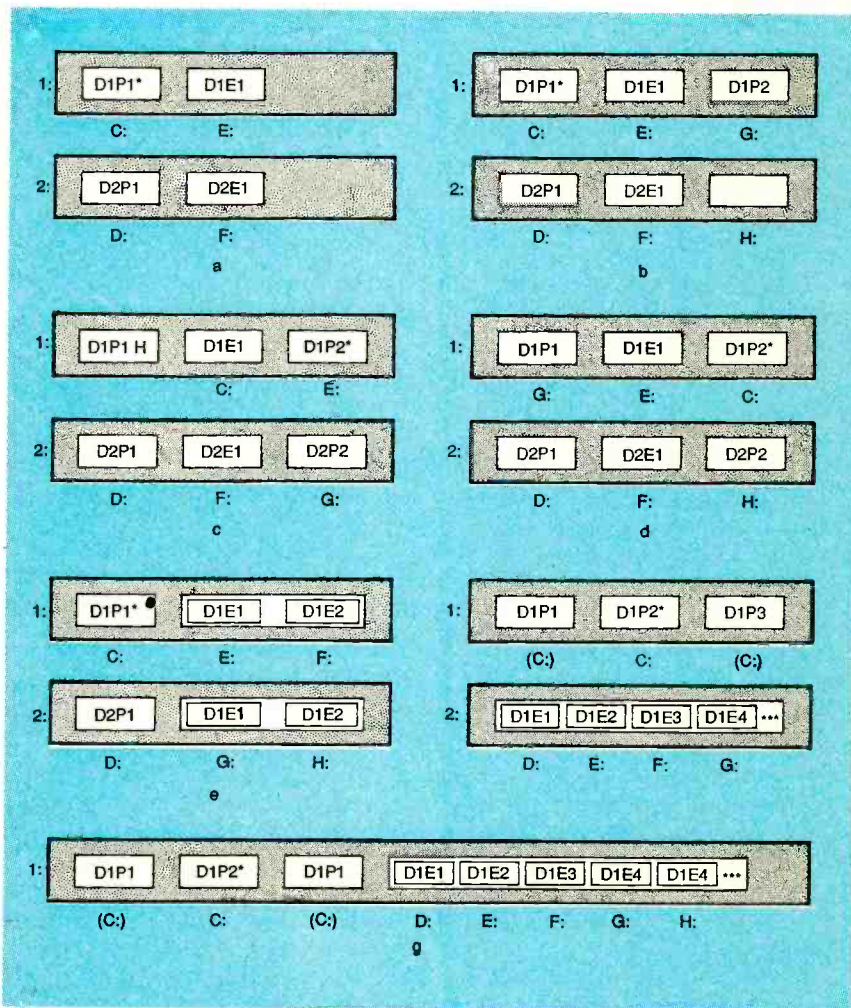
Now suppose we hide Drive 1, Partition 1, and make Drive 1 Partition 2 active; Fig. 1-c shows the results.

Under DOS, we could leave D1P1 visible, and simply make D1P2 active;

Fig. 1-d shows how that would work. Note that our former C drive (D1P1) has now become the G drive.

Suppose now that instead of one logical drive in the extended partition, we have several. Figure 1-e shows how that might work. Figure 1-f shows one way of creating a clean multi-operating system scenario using two hard drives. Drive one might be a relatively small (500-megabyte) drive divided into several primary partitions. Each partition holds a different operating system, only one of which is visible at any given time. The second drive, perhaps a 2-gigabyte monster, might contain a single extended partition subdivided into eight 256 K logical drives.

A single-drive variant of that theme appears in Fig. 1-h, which consists of a single physical drive with three primary



VARIOUS DISK PARTITIONING SCHEMES: Two drives, two primary partitions, and two extended partitions (a); additional primary partitions append drive letters (b); a hidden partition changes drive lettering (c); unhidden the partition but making a different one active produces a different sequence (d); multiple logical drives in the extended partition (e); one drive for booting operating systems, the other for applications and data (f); a single-drive variant of the preceding (g).

ry, bootable partitions (which would share the "C" designation), and a group of extended partitions that would remain at the same drive letters.

Disk management tactics

If you can accurately forecast your partitioning needs, great. But if you find this a slippery territory requiring occasional updates, you'll appreciate several tools for handling boot, partitioning, and application-configuration management.

Boot management

A boot manager helps you switch among several operating systems at boot time. If you need only a few operating systems, and don't mind some inconvenience, you can always use FDISK to set a partition active (bootable).

A step up in convenience is the Boot Manager that comes with OS/2. It allows menu-based selection, at boot, of several operating systems.

A product called System Commander, by V Communications, is probably the most versatile utility in this category. It allows you to select among more than 100 operating systems, broken down as follows: 56 in primary partitions on fourteen drives, 16 in logical (extended) partitions, and 32 in the primary DOS partition.

System Commander manages the latter by storing copies of crucial boot files (e.g., AUTOEXEC.BAT, CONFIG.SYS, and COMMAND.COM) in separate subdirectories, and then copying them to the root when you select the corresponding operating system at boot time.

One key point not noted in System Commander's advertising is that you cannot arbitrarily boot any operating system from any of those 104 slots. Flexibility may be limited by the operating system itself. For example, DOS and Windows 95 must be booted from a primary partition on the first physical drive. Other operating systems, such as Windows NT and OS/2 are more flexible, and may be booted from extended partitions and other drives. System Command also supports non-DOS operating systems including NetWare, Linux, SCO UNIX, Solaris, and many more.

TABLE 1—PRIMARY AND EXTENDED PARTITIONS

	Primary	Extended
Bootable	Yes	Some OSes, not DOS
Subdividable	No	Yes
Minimum no.	0 (1 for bootable)	0
Maximum no.	4	1
Hideable	Yes	Yes

I found that System Commander worked fairly well. At one point it got confused and mangled a copy of MSDOS.SYS, a text file that supplies boot parameters to Windows 95. Windows 95 would not boot, and gave a spurious error message about not being able to locate HIMEM.SYS. It took only a few minutes to figure out what was going on, but that type of thing could drive a novice bonkers.

Partition management

Partition Magic is a fantastic program. It's powerful, easy to use, and the price is right. The program gives you fine-tooth control over disk partitioning. You can easily add, delete, move, and modify primary and extended disk partitions on one or several drives from a nicely done OS/2-like interface. You can also convert partitions from DOS/FAT to OS/2's HPFS format. As long as you maintain a pool of free space, it's easy to move and resize partitions at will. You should absolutely back up before performing any operations with Partition Magic. Operating your computer from a UPS is also highly advisable. If something happened while Partition Magic was doing its thing, you could end up with garbage. My only criticism of the program is that if you have several partitions packed tightly together, and want to insert one between them, you have to move those to the right of the insertion point manually. An insert function would be welcome. Also, conversions among other formats (particularly NTFS) could be useful.

Application configuration management

If you repartition a large drive into smaller drives to increase cluster efficiency, applications may end up on different drive letters. For small command-line utilities and DOS (character-mode) applications, that's not usu-

ally much of a problem. But moving Windows applications can be tricky. The best way I've found of doing so is using the Move Application function in a program called Remove-It. The primary purpose of that program is to help you safely delete DLL's, INI files, Registry settings, and other system components that are no longer necessary. The program is slow, and its user interface is frustrating. But it can help you save both time and disk space.

RESOURCES

Partition Magic 2.0 (\$49.95)
PowerQuest Corporation
 1083 North State Street
 Orem, UT 84057
 (800) 379-2566
 (801)226-8977
<http://www.powerquest.com>.

System Commander 2.26 (\$99.95)
V Communications Inc.
 4320 Stevens Creek Bl., Suite 120
 San Jose, CA 95129
 (408) 296-4224

Remove-It 3.0
Versisoft Systems, Inc.
 Four Embarcadero Center, #3470
 San Francisco, CA 94111
 (803) 295-5875
<http://www.versoftsys.com>.

OS/2 Warp 3.0
IBM Corp.
 (800) 426-3333

The documentation for each of these programs is confusingly written, but loaded with useful tidbits, so if you're interested in this topic, well worth reading. Chapter 18 of the *User's Guide to OS/2 Warp* has the clearest discussion of booting and partitions. The System Commander manual does not give a good overview, but does provide detailed scenarios for installing various operating systems. Partition Magic's manual has a pretty good overview, but falls short on operation and particularly the error messages it presents. The Remove-It manual is a joke.

Experiments with your laser

Detect earthquakes and other vibrations, build an optical seismometer, and experiment with a laser listening device.

NOW YOU CAN PUT YOUR LASER TO USE AND TRY A COUPLE OF EXPERIMENTS. THE FIRST ONE WILL MEASURE GROUND MOVEMENT. THE BEST KNOWN DEVICE FOR DOING THIS IS CALLED A SEISMOMETER.

You can build a laser-based seismometer that is simple, yet remarkably sensitive and accurate.

Seismometers are best known for their use in measuring the intensity of earthquakes. However, they can also detect other vibrations, such as

heart of the seismometer device is the sensor unit. It incorporates a variation of the speaker modulator described in the last column (*Electronics Now*, June 1996, page 51).

Figure 1 shows all three parts of the sensor unit. It is simply a 1½-inch square of rigid, aluminized mylar attached to one end of a 2-inch length of medium tension spring. Epoxy, silicon, or hot-melt glue will do the job. Fasten the other end of the spring to a 2-inch square block of 1×2 pine. This assembly, when mounted to a very stable foundation, will vibrate in response to any shock waves traveling through the earth.

For an indoor location, use an upright stud or pillar that is sunk into your home's foundation. Such a spot in your garage or basement will work well. Outdoors, a 6- to 8-foot fence post, or an antenna ground rod that has been driven 4 to 6 feet into the earth, will provide the needed stability and coupling to the earth.

Once you have determined the location, mount the sensor assembly firmly. If you select an outdoor spot, place a small box around the sensor to protect it from air currents and wind. Leave a 1- or 2-inch opening in the box for the laser

WARNING!!!

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

beam. With the sensor in place, aim the laser at the mylar square. Adjust the laser beam angle so the reflected beam shines into the detector described in the previous column. Adjust the volume and gain of the receiver until you are able to obtain a uniform sound signal.

Your unit is now in its monitor mode, and the signal will remain unchanged until it detects vibrations. Strike the foundation gently and notice the change in the audio output. Drop a heavy object near your detector and again note the change in the audio output. Experiment with a variety of different objects and actions that causes the sensor to react. You will soon see a pattern develop that will let you estimate shock intensity by hearing the change in the sound.

If you have a frequency meter, you'll be able to draw some interesting graphs based on a plot of the

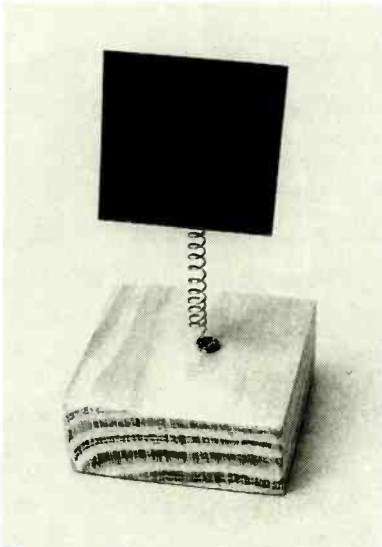


FIG. 1—SIMPLE VIBRATION SENSOR has only three parts — a small square of mylar, a spring, and a block of wood.

those from highway traffic, trains, explosions, lightning bolts, or any other source that causes earth movement. Even if such movements occur some distance away, you will still be able to detect them. The

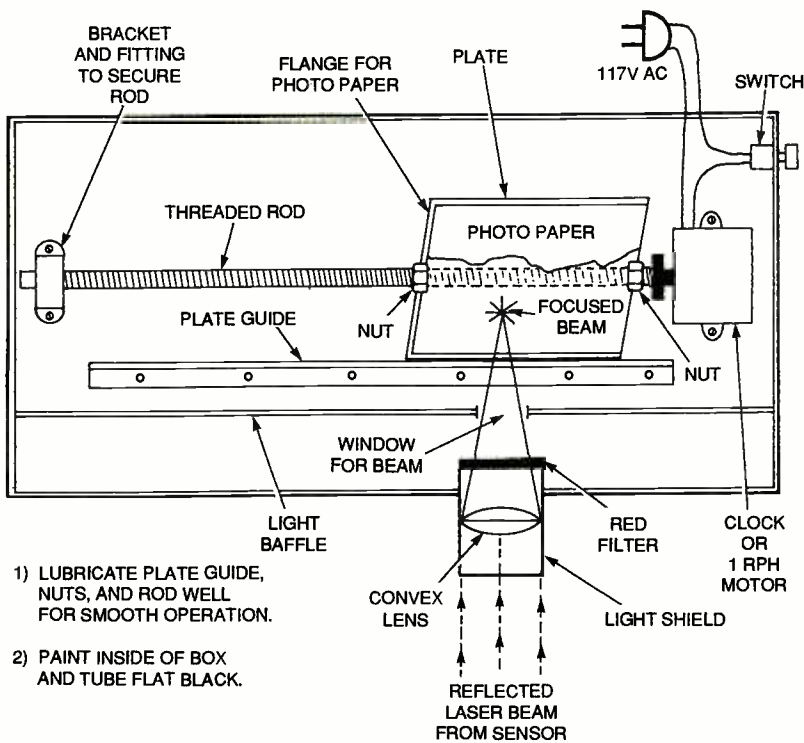


FIG. 2—FOLLOW THIS PLAN TO BUILD YOUR OWN photographic recorder. It makes a permanent record of vibrations and other earth movements over a 24-hour period.

actual frequency readings. If you connect a peak meter, an LED bargraph, an analog meter, or even a lamp and relay, you will be able to obtain all kinds of different data. If you want an alarm, use a relay to trigger a lamp or some other alarm device based on the sensor's output frequency.

Building a seismograph

While all of these demonstrations are interesting and informative they do not produce any record of the result. So for a more ambitious effort, you can build the simple seismograph based on the photographic recorder shown in Fig. 2. This device will receive the modulated laser beam, collimate it to a pinpoint of light, and record it on ordinary photographic print paper (the kind used to make black and white copy prints or enlargements).

In the prototype a threaded rod is coupled to a clock motor, which rotates the rod. Nuts that match the thread of the rod are cemented to a plate that holds a strip of photographic paper. This plate assembly is then threaded onto the rod, through the nuts. As the motor rotates, the plate

moves from right to left. A metal guide is positioned at the bottom to keep the plate from spinning around the rod; a Teflon strip attached to the metal guide reduces friction. As the plate moves, it passes through the laser beam. This exposes the paper to whatever pattern is present.

With normal activity, the beam will create a rather straight line with a little background noise. But when the sensor detects significant movement, the line will break, and peaks will be displayed on both sides of the center line. This movement will be in direct

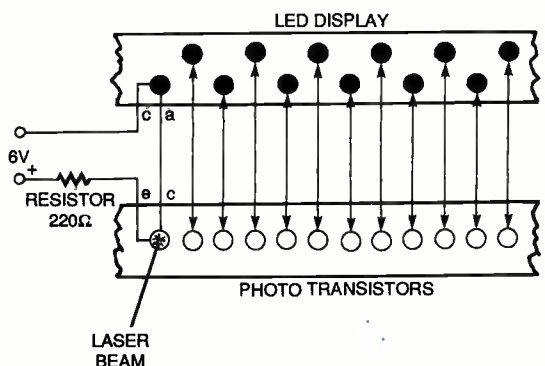
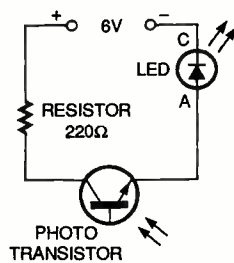


FIG. 3—PHOTOTRANSISTOR SENSING STRIP is easy to make and can be coupled to an LED display panel. Complete details are in the text.

proportion to the intensity of the vibration.

The project is not as simple as it sounds. Your detector will have to be housed in a light-tight box as shown. Note the baffle that runs the length of the box, to further reduce stray light. The way it is set up, only laser light enters the lens and is sharply focused on the photo paper. The window in the light baffle must be kept as small as possible—mine measures only 3 inches by 1/2 inch. Notice the medium-red filter on the inside end of the collimator (lens tube). It helps keep ambient white light out of the box.

The rate at which the plate carrying the photographic paper moves is determined by the number of threads per inch that the rod has. The greater the number of threads per inch the slower the plate will move. If you use a rod with 20 threads per inch, the plate will move about 1-1/4 inches in a 24-hour period.

The unit is shown set up to record vertical (up-down) movements. To detect horizontal (side-to-side) movements, simply set the recorder on its end. Either way you'll have an accurate and permanent copy of the movements you monitor.

When your unit is complete, load it with a piece of photographic paper (in total darkness or under a red photographic safe light). Then seal the box and you are almost ready to go. Line up the laser and the recorder and turn on the motor. Come back the following day and retrieve and develop your photographic paper. It's simpler than it sounds and you should have a lot of fun with this simple device.

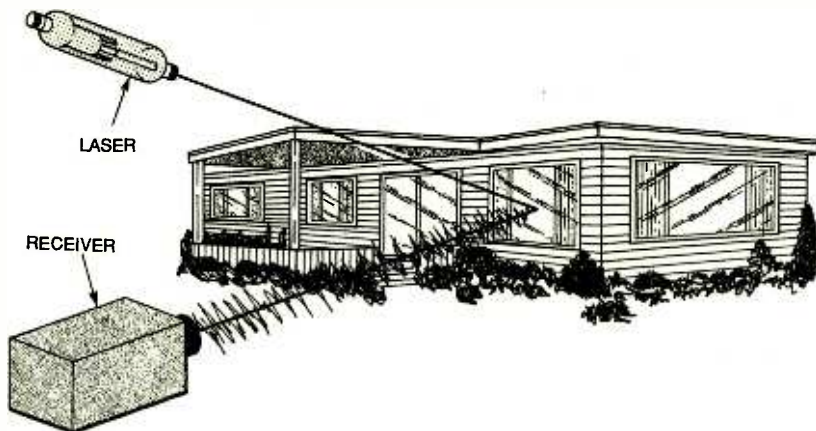


FIG. 4—BOUNCE A LASER BEAM OFF A GLASS WINDOW and pick up the reflections with your receiver. You can convert the vibrations in the glass to hear what is being said on the other side on that window.

Detecting small or slow movements

You can also put lasers to work to detect an object's small or slow movements that might otherwise escape the naked eye—the growth of a plant, for example, or the settling of a new building's foundation. This kind of study requires long-term monitoring.

One method to try is to attach a

Let's use a clock's hour hand as a specific example—it will provide results quickly. As the hand moves around the dial, mark the reflections on a piece of graph paper. Then draw a curve using the points you have plotted. Remember, this is only an example to let you see results quickly. If you come up with an interesting test procedure, let us know.

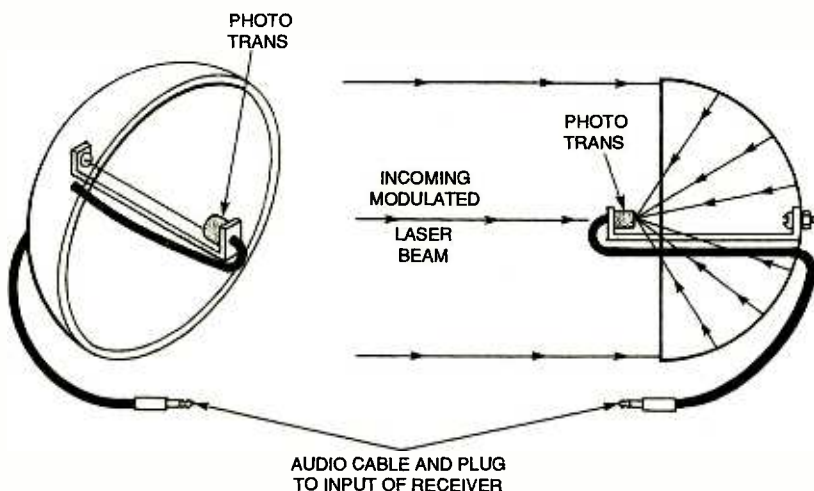


FIG. 5—A SIMPLE PARABOLIC DETECTOR noticeably increases the sensitivity of the detector.

small piece of reflective mylar to the object being observed, and to reflect a laser beam off the mylar at a slight angle. The position of the return beam can be marked on a scale. As the object moves, the angle of the reflected beam will change and the spot will appear at a new location on the scale. Note these changes at regular intervals and you can chart the movement.

To perform this kind of measurement you will need a collimator, a convex lens, to concentrate the laser beam into a small spot to make the markings more accurate. If an electronic display is needed, take a look at Fig. 3. On a strip of plastic or some other mounting material, set up a row of phototransistors edge to edge, keeping them as close together as pos-

sible. The miniature plastic types will let you squeeze in about 10 to the inch. Connect a 220-ohm resistor to each phototransistor's collector. Then tie the anode of a standard LED to each phototransistor's emitter. Make sure that the LED cathodes are all connected to the negative side of a 6-volt DC power source. The free end of each resistor connects to the positive side of the supply. Whenever the laser beam hits one of the phototransistors, the corresponding LED lights.

Reflected sound modulation

The last experiment in this section uses the high-gain amplifier described in the laser column in the June 1996 issue of *Electronics Now*, as a receiver. It demonstrates how sounds can create vibrations in solid materials. The degree of movement depends upon the volume of the sound present and is usually unnoticeable to the human eye. Yet it is there, and the receiver is sensitive enough to detect it. To illustrate this principle, aim your laser at a surface on a nearby building and align your receiver so it can pick up the reflected beam as shown in the diagram of Fig. 4.

Glass or metal surfaces are best, as both tend to vibrate better than more solid materials. When you bounce the beam of a pane of glass, only part of the light comes back, while the rest passes on through to strike whatever surface it finds. For more detailed information about the process see the article *Laser Listener* by Richard Pearson, in the October 1987 issue of *Radio-Electronics* magazine.

Adjust the receiver's gain and volume and you should be able to hear sounds within or around the building. Scan the beam around the structure to find the points of best reception. This type of system has been employed for clandestine eavesdropping, and such use is illegal.

It is interesting to note the sensitivity of the equipment and the variety of sounds received. For the best possible reception, try using a metallic parabolic dish to increase the concentration the incoming light and maximize the strength of the incoming audio signal (see Fig. 5) at the dish's focal point.

CIRCUIT SIMULATION

continued from page 42

In addition to circuit simulation, EE Works comes with a healthy helping of circuit-design routines, like the filter design in Fig. 1, that calculates the value of the various components after you enter the desired response. There's a schematic-capture routine, of sorts, that lets you build your own design and submit it to the rigors of this cruel simulator.

Because of the modular design, though, EE Works' myopic view of the world results in very fast simulations. It can do in 10 seconds what it takes a Spice-modeled simulator three minutes to do. Moreover, it delivers more information than you can possibly digest in a single session. While the graphics are a bit skimpy, what graphics it does have are dynamite — if you know how to read the results. In addition to an X-Y plot, you're given a table of values that created the plot, plus a list of the DC parameters at each sampling. These can then be used to optimize the circuit.

Fast, accurate, and thorough are the trademarks of EE Works. However, it's a real nut-buster program that requires a lot of preparation to work and an engineering background to use to the fullest.

Product:	Analysr III
Version:	1044C
Price:	\$149
Platform:	DOS
Distributor:	BSOFT Software, Ohio Automation

Analysr III is a DOS-based, non-SPICE analog simulator from Number-One Systems Ltd., the same people who make the Easy-PC line of schematic-capture and PC-board layout software. Analysr III is an AC-only analyzer, specifically measuring magnitude, phase, and delay times. It doesn't do DC analysis or operating-point analysis. However, it can display these values by gain, input impedance, or output impedance of the circuit under test.

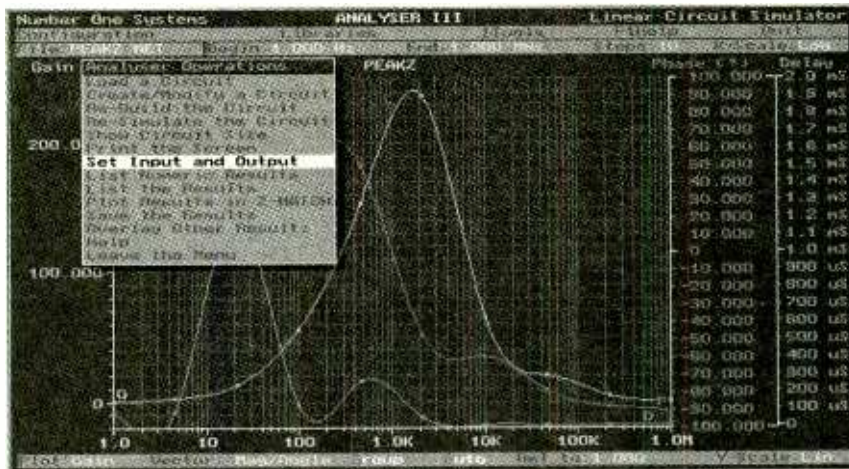


FIG. 2—ANALYSR III IS AN EASY-TO-USE analog simulator that measures magnitude, phase, and delay times well into the GHz range.

At the heart of Analysr III is a sweep generator with a frequency range of 0.001 Hz to 1,000 GHz. To do a simulation, you load the circuit, set the desired frequency sweep, and press the "go" button. Analysr III does everything else for you by automatically setting the input voltage level and adjusting the X-Y scales so that the waveforms fill the display area (Fig. 2).

You can either import the design from a schematic you drew in Easy-PC Professional, or you can create the circuit with Analysr III's assistance. Because Analysr III doesn't have a schematic-capture function, though, you have to "build" the circuit as an ASCII netlist using Analysr III's text editor. You simply list the components, and use node numbers to identify their interconnections. Analysr III then translates the list into the proper netlist format. Unfortunately, the process isn't intuitive; it's not easy to keep track of the many nodes used in a complex circuit. Consequently, you'll find it a lot easier if you sketch a diagram of the design before you begin the netlist building process.

Analysr III comes with a library of 100 components and includes a good mixture of bipolar transistors, field-effect transistors, and operational amplifiers. Additional components can be added to the library using a text editor and information gathered from the device data sheets.

For straightforward gain-versus-frequency analysis, there's nothing faster or easier to use than Analysr III. Moreover, it can do simulations well into the GHz range, making it ideal for evaluating transmission lines, open stub filters, and stripline filters.

Product:	B ² Spice for Windows
Version:	1.1
Price:	\$149
Platform:	Windows
Publisher:	Beige Bag Software

By the time you read this, the B² Spice for Windows program reviewed here will be replaced with a newer version. Unfortunately, we couldn't get the beta version of the new simulator (version 2.0) to work without it crashing our system. So rather than rake it over the coals, we went with what works—Version 1.1. We are told the look and feel is about the same in V2.0, but more about that later.

Unlike most SPICE simulators, which easily run from an ASCII netlist, B² Spice for Windows has to run from a schematic-capture program. It cannot import SPICE decks. Fortunately, the schematic-capture function is included in the \$149 price. Unfortunately, it's not the best-looking drawing program, and the nomenclature is always expressed in scientific notation (Fig. 3).

TABLE 1

	Analyser III	B ² Spice	CircuitMaker	EE Works	Electronics Workbench	ICAP/ALite	SuperSPICE	TurboSIM
Price	\$149	\$149	\$299	\$129.99	\$299	\$40	\$149	\$149
Format	DOS	Windows	Windows	DOS	Windows	Windows	Windows	Windows
RAM required	640K	2MB	2MB	640K	4MB	4MB	2MB	4MB
Math processor req.	N	N	N	N	N	N	Y	Y
Schematic capture	Y(1)	Y	Y	Y	Y	Y	Y(1)	Y
Berkeley SPICE	N	Y	Y	N	Y	Y	N	Y
Mixed mode	N	N	Y	N	Y	Y	N	N
BBS file	analyser.zip		cmdemo.zip	ee_works.zip	ewb_demo.zip	intusoft.zip	supercad.zip	turbosim.zip
Analysis support								
DC operating point	N	Y	Y	Y	N	Y	Y	Y
DC sweep	N	Y	Y	Y	N	Y	Y	Y
AC sweep	Y	Y	Y	Y	Y	Y	Y	Y
Transient	Y	Y	Y	Y	Y	Y	Y	Y
Noise	N	Y(2)	N	N	N	Y	N	Y(4)
Distortion	N	Y(2)	N	N	N	Y	N	N
Sensitivity	N	Y(2)	N	N	N	N	N	N
Fourier transfer	N	Y(2)	N	N	N	Y	N	Y(4)
Pole zero	N	Y(2)	N	N	N	N	N	Y(4)
Signal sources								
Exponential	N	N	Y	N	N	N	Y	Y
FM generator	N	N	Y	N	N	N	Y	Y
Function generator	N	Y(3)	Y	Y	Y	N	Y	Y
Piece wise	N	N	Y	Y	N	N	Y	Y
Monitoring devices								
Ammeter	N	N	Y	N	Y	N	Y	Y
Bode plotter	Y	Y	Y	Y	Y	Y	Y	Y
Logic analyzer	N	N	N	N	Y	N	N	N
Logic converter	N	N	N	N	Y	N	N	N
Multimeter	N	N	Y	N	Y	N	N	N
Oscilloscope	N	Y	Y	Y	Y	Y	Y	Y
Voltmeter	N	Y	Y	N	Y	N	Y	Y
Word generator	N	N	N	N	Y	N	N	N

1) Separate program

2) Version 2.0 only

3) Separate instruments

4) Advanced version only

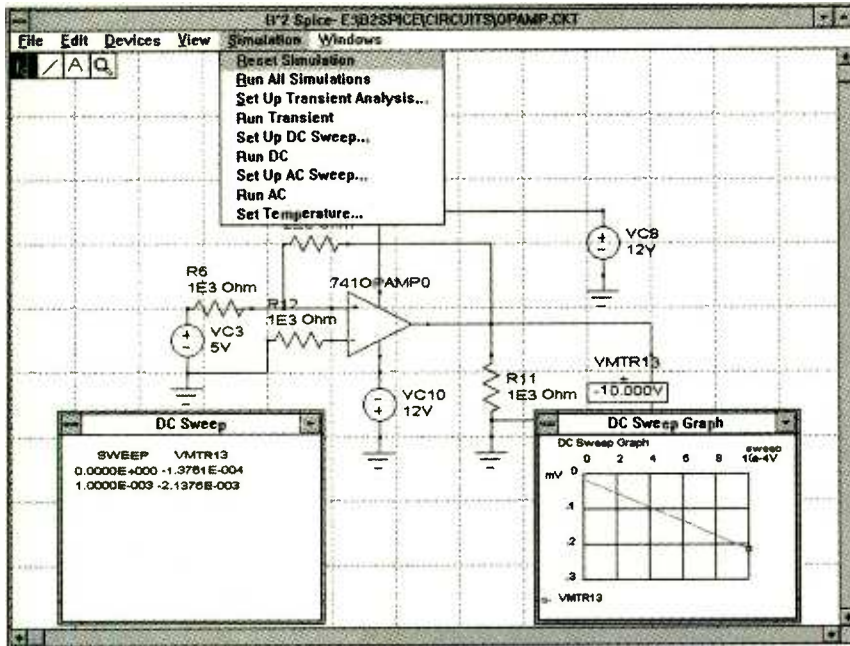


FIG. 3—THIS SCREEN SHOT B² SPICE is from version 1.1; by the time you read this, version 2.0 will be shipping.

The schematic itself is easy enough to draw. And the component library is extensive enough to cover almost any analog design. To describe the component, though, you almost need an engineering degree. For example, to define a germanium general-purpose diode, like a 1N34A, you need to know its forward current transfer, TT time, CJO and EG parameters—plus its temperature transfer function. It's not clear if all semiconductor manufacturers include all these parameters in their SPICE models, and if they do, whether that model fits into B² Spice's scheme of things. That we won't know until version 2.0 is debugged.

The simulator is fast, accurate, and fully featured. From a Windows pull-down menu, you can either select a specific simulation or go for the whole enchilada. The simulations for version 1.1 include four types of analysis: DC operating point, DC sweep, AC sweep, and transient. Version 2.0 will add noise analysis, distortion measure, sensitivity, and pole/zero analysis to that list.

Beige Bag tells us that the reason they're having problems with version 2.0 is because it's a 32-bit program. That means you need Windows 95, Windows

NT, or Microsoft's Windows 3.1 32S driver before it'll work. However, we're told that version 1.1 won't be dropped; so all you I'm-not-ready-to-upgrade-to-Windows 95-yet readers still have a chance to take advantage of this slick piece of software. Check out our BBS (516-293-2283, v.32, v.42bis) for the most recent B² Spice news and newest demos.

Product:	SuperSPICE
Version:	V1.1
Price:	\$149
Platform:	Windows
Publisher:	Mental Automation

SuperSPICE is a demanding simulation program that barely makes it under our \$350 cap. No, the program itself is not pricey—SuperSPICE costs only \$149. But it has to be linked with SuperCAD for Windows, Mental Automation's \$149 schematic capture program, before it'll work. It also requires a math coprocessor, which means you'll probably have to be running at least a 486DX2 processor on your PC.

When you install SuperSPICE into your system, it upgrades your existing SuperCAD models to include SPICE parameters. Also loaded into the SuperCAD libraries by SuperSPICE is an amazing assortment of test instruments. The signal sources include a sinewave, pulse, FM modulated, and AC sweep generator. The list of sources also includes a piece-wise generator that lets you create your own customized waveforms—an instrument that's found in only one other simulator, Circuit-Maker. The monitoring devices include a multiple-trace oscilloscope, Bode frequency analyzer, curve tracer, and an unlimited number of voltage and current meters (Fig. 4).

To start a simulation, you first start SuperCAD for Windows and load the desired schematic design. The netlist is created by SuperCAD when you click on the Simulate option. The current version of SuperCAD only allows one kind of primary analysis at a time. The three analy-

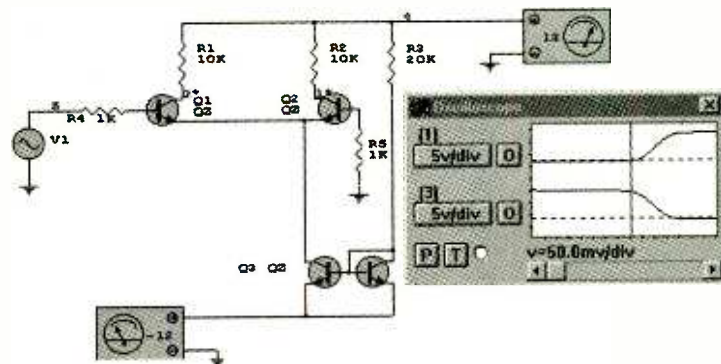


FIG. 4—UNLIKE MOST CIRCUIT SIMULATORS, SuperSPICE has to run from a separate companion schematic capture program, SuperCAD for Windows. SuperSPICE has an amazing assortment of test instruments, including a multiple-trace oscilloscope, Bode frequency analyzer, curve tracer, and an unlimited number of voltage and current meters.

ses supported are DC sweep, AC sweep, and transient. You can also select the DC operating point by changing the information in the setup menu and fiddling with the settings of the signal generators. Quitting SuperSPICE returns you to SuperCAD.

While SuperSPICE works best with analog circuits that fit on a single sheet, you can work with multiple sheets—but you'll probably have to switch from one sheet to another to view the simulation results. On the other hand, SuperSPICE doesn't do mixed mode simulations. So by using different schematic sheets to split up analog and SPICE digital devices, it makes it easier to move information from one function to the other.

SuperSPICE is a venerable circuit design veteran that has been around for a decade. It interfaces flawlessly with its schematic capture program, the test instruments are second to none, and it's easy to use. Demos of both SuperCAD and SuperSPICE can be downloaded from the Electronics Now BBS.

Product:	TurboSIM
Version:	1.1
Price:	\$149
Platform:	Windows
Publisher:	Island LogiX

TurboSIM is new to the low-cost circuit CAE (computer-assisted engineering) fray. So new, in fact, that it almost escaped our attention. Despite its young age, this is a well-thought-out program that's loaded with a lot of really good features.

TurboSIM can be broken down into three components: a schematic-capture module, a SPICE simulator, and a digital simulator. Both simulators can link to the schematic-capture editor for simulation input, or read directly from a netlist file. However, the simulators are totally separate and independent of each other. Therefore, you can't mix analog and digital devices in the same circuit.

Actually, there are two ver-

SPICEing It Up

Developed at the University of California at Berkeley in the late 1960s, SPICE (Simulation Program with Integrated Circuit Emphasis) is the most popular tool for analog and gate-level digital simulation. In fact, more than three-fourths of the analog simulators in this review are SPICE based. Over the years, SPICE has gone through many iterations, and is sold under several different brand names by several software companies.

The secret to SPICE's success is in the simplicity of its models, which are very small ASCII files that can be linked to or embedded in the main netlist. The model contains information on how the device is supposed to react when subjected to changing voltages and currents. For example, the SPICE model for a 2N2222A transistor is

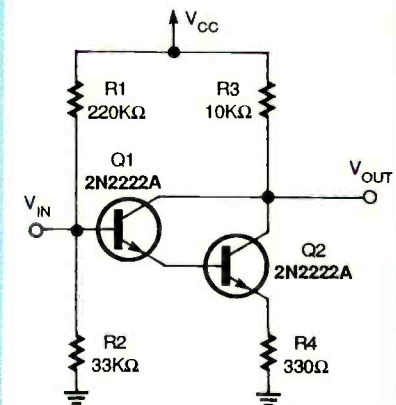
```
MODEL QN2222A NPN (IS=1.9E-14
BF=150 VAF=100 IKF=.175
ISE=5E-11 + NE=2.5 BR=7.5
VAR=6.38 IKR=.012 ISC=1.9E-13
NC=1.2 RC=.4 XTB=1.5 +
CJE=26PF TF=.5E-9 CJC=11PF
TR=30E-9 KF=3.2E-16 AF=1.0)
```

This model defines the gain of the transistor (BF) at 150 and the emitter capacitor (CJE) as 26pF. The more complex the device, the bigger the list grows.

To build a SPICE circuit, you simply enumerate the models used in your design in an ASCII file called a netlist. For example, if you have a simple audio amplifier circuit built around a pair of 2N2222A transistors (Fig. 10) the netlist might look something like this

AUDIO AMPLIFIER

```
VCC 2 0 DC 10V
R1 1 2 220K
R2 1 0 33K
R3 2 3 10K
```



EACH CONNECTION on this simple amplifier represents a SPICE node, and potential simulation point. The 2N2222A transistor is a subcircuit model provided by Motorola.

```
R4 5 0 330 QN2222A
Q1 3 1 4 QN2222A
Q2 3 4 5 QN2222A
```

The last two lines of this netlist tells SPICE to look for the model of the 2N2222A transistor under the filename QN2222A. Notice how compact this code is. Once a model has been defined, you can either import it into the netlist, or simply call it from the netlist.

Unfortunately, SPICE by itself doesn't do a good job of displaying information. It needs help. This is where the simulation software packages come into play. Typically, SPICE outputs the simulation results to an ASCII file as a list of numbers and an X-Y plot of dots that (when viewed from afar) form a very crude waveform. The software simulation program reads this file, processes the data, and converts it into oscilloscope-like images.

sions of TurboSIM. There's the standard version which has all three modules. It supports DC operating point, DC sweep, AC sweep, and transient simulations (Fig. 5). For most users, this is all the simulation you'll ever need to find out if your design will fly or not. But heavy-duty designers will probably want the added benefits of noise, distortion, sensitivity, Fourier, and pole zero analysis that the Advanced version (also \$149) serves up. Because of programming limitations, though, there isn't enough room for the schematic capture program or digital simulator. All you get is a fully-packed TurboSPICE simulator program with the monitoring instruments.

TurboScope is the oscilloscope display module that comes with all versions of TurboSIM. It works in real time, updating the display as the SPICE simulation progresses, and lets you easily jump from one wire or node to another without interrupting the simulation. Scale adjustment for the best display is automatic. If you really want to roll up your sleeves and get your hands dirty, TurboScope recognizes a long list of math functions that lets you display your waveform in just about any format you can think of—and some that you've probably forgotten.

TurboSIM is easy to use and perfect for electronics students and hobbyists — yet powerful

enough to handle complex simulations demanded by engineers and technicians who handle hierarchical schematics and circuits containing multiple sub-circuits and pages.

Mixed-mode simulators

Sometimes it's necessary to mix analog and digital components in a single design. A good example is any circuit that uses an analog-to-digital (ADC) or digital-to-analog (DAC) converter. A short list of typical mixed mode applications include timers, PWM controllers, Class D audio amplifiers, switching power supplies, and ADC and DAC circuits. Until recently, there was no easy way to handle analog and digital simulations simultaneously, and the process was generally broken down into two steps: an analog simulation followed by a digital simulation. Obviously, this makes it hard to get an overall view of circuit operations. Since then, many of the basic digital functions, like NAND and NOR, have been defined in analog terms using SPICE models. This allows you to do limited digital simulation as well as mixed mode simulation.

Although all the following mixed-mode simulation programs are SPICE based with a schematic capture front end, they are quite diverse in the way they work and ply their trade. The first, ICAP/4, does what you'd expect from a mixed mode simulation program—which is basically SPICE models put through their paces. This program is for the professional designer or hobbyist who knows what's happening and knows how to interpret the results. The next two programs, CircuitMaker and Electronics Workbench, have the added touch in that they teach you about electronics as you proceed through the tutorials. So you don't have to be a rocket scientist to use them.

Product:	ICAP/4Lite
Version:	7L.5
Price:	\$40
Platform:	Windows
Publisher:	intusoft

ICAP/4Lite is an interesting analog-mostly simulator with as many twists as an Agatha Christie novel. To begin with, ICAP/4Lite is a 32-bit program that runs wonderfully well un-

WHERE TO BUY

Analysier III
BSoft Software, Inc.
444 Coltran Rd.
Columbus, OH 43207
(614) 491-0832
Ohio Automation
7840 Angel Ridge Rd.
Athens, OH 45701
(614) 592-1810

B²Spice
Beige Bag Software
2000 Hogback Rd., Ste. 2
Ann Arbor, MI 48105
(313) 971-4227

CircuitMaker
MicroCode Engineering
1943 North 205 West
Orem, UT 84057
(801) 226-4470

EE Works
Geoban Engineering
418 N Inyo St.
Ridgecrest, CA 93555
(800) 645-6806

Electronics Workbench
Interactive Image Technologies Ltd.
111 Peter St., Ste. 801
Toronto, Ontario, Canada
M5V 2H1
(800) 263-5552
E-mail: blegresley@interactiv.com
<http://www.interactiv.com>

ICAP/4Lite
intusoft
P.O. Box 710
San Pedro, CA 90733-0710
(310) 833-0710

SuperSPICE
Mental Automation
5415 136th Place S.E.
Bellevue, WA 98006
(206) 641-2141

TurboSIM
Island LogiX Inc.
P.O. Box 157
Waukegan, IL 60079
(708) 360-0458

der Windows 95 and Windows NT. Unfortunately, it has some problems coping with Windows 3.1. Specifically, the included Windows 32S driver, which converts Windows 3.1 into a 32-bit operating environment, has a penchant to lock out the keyboard at the slightest whim.

The most interesting aspect, though, is its price — which is \$599. Before you blast past this program as too expensive, you should know that you can buy a student version for a very low \$40. Sure, the student version has limitations. For example,

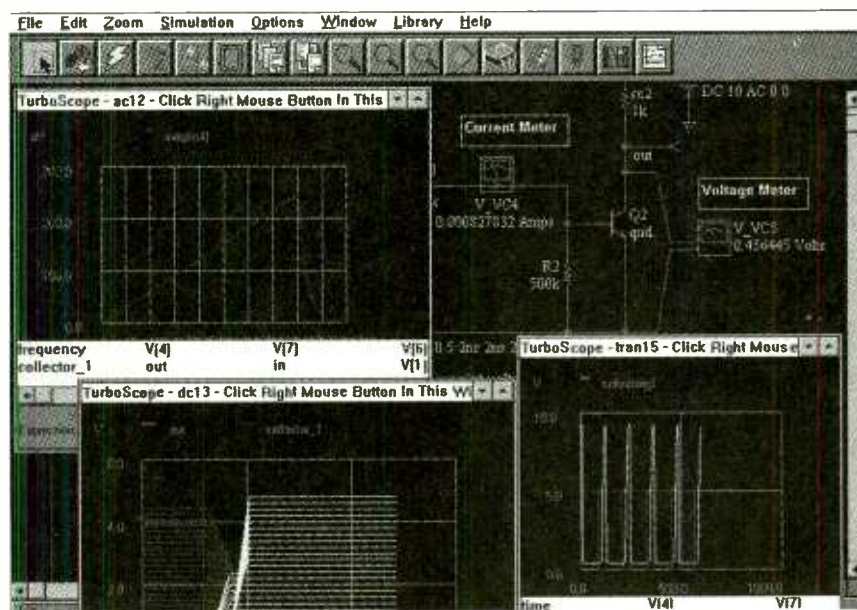


FIG. 5—TURBOSIM IS A POWERFUL WINDOWS SIMULATOR that comes in two versions. For most of your designs, the basic package will fill all your analog and digital simulation needs — plus it includes a schematic capture front end. If you need to do noise, distortion, or zero pole analysis, then you'll prefer the Advanced version, which costs the same but doesn't include schematic capture.

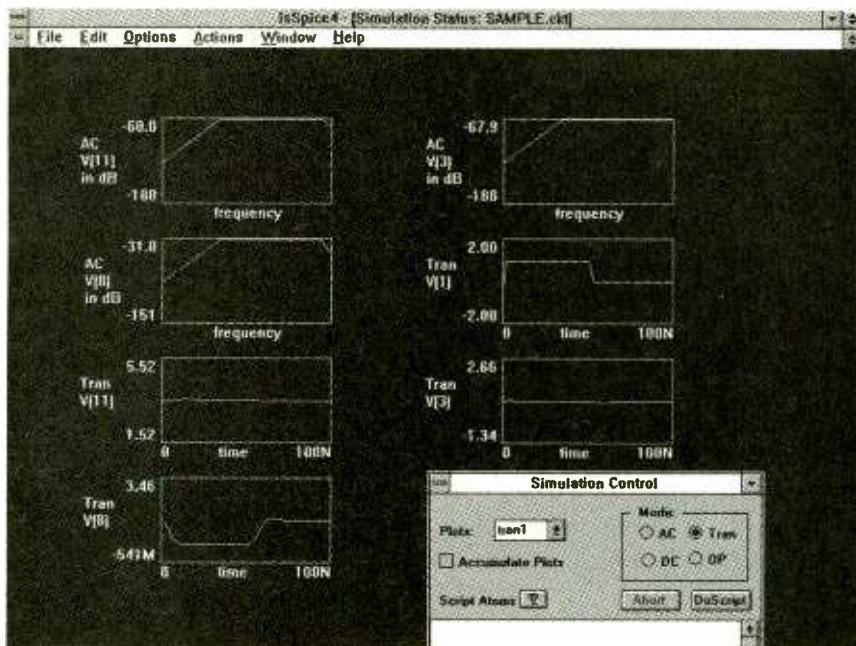


FIG. 6—ICAP/4LITE IS A MEDLEY OF FOUR interactive programs that includes a text editor, SPICE simulator, waveform analyzer, and a schematic capture program. In addition to simulating DC, AC, and transient analysis, ICAP/4Lite does temperature analysis, if-then-else analysis, and provides simulation breakpoints.

the component library is smaller, and you're limited to designs of 15 parts or less. But in this day of highly integrated circuits, 15 parts can go a long way.

ICAP/4Lite is actually a medley of four interactive programs. The first is a text editor that you use to compose SPICE netlists. IsSpice is the next program, and the SPICE engine that runs the simulation. The IntuScope program is the waveform analyzer and main display (Fig. 6). Finally, there's the schematic capture function.

There are three types of analysis performed by ICAP/4Lite: DC sweep and operating point, AC Bode plots, and transient analysis. ICAP/4Lite can also do temperature analysis and simulation breakpoints. Breakpoints are IsSpice4 commands that can be used to stop a simulation when certain conditions are met. For example, you could have the simulation stop when the voltage on pin 7 of IC3 exceeds 4.5 volts. ICAP/4Lite can pull this off because IsSpice4, intusoft's proprietary SPICE programming language, is a superset of Berkeley SPICE 3F.2.

While ICAP/4Lite isn't the easiest analog simulator to use, it certainly has more power

than most. Best of all, though, it's the least expensive at just \$40, if you can live with the limited parts count of the student version. A fully-functional ICAP/4Lite demo can be downloaded from the Electronics Now BBS or from intusoft's WEB site (<http://www.intusoft.com>).

Product:	CircuitMaker
Version:	3.5
Price:	\$299
Platform:	Windows
Publisher:	MicroCode Engineering

CircuitMaker is a powerful yet easy-to-use schematic capture program and circuit simulation program. However, while CircuitMaker claims to be a mixed mode simulator, it's sharply divided between the analog and digital world. A single icon makes all the difference. Click on the AND gate and you're in the digital simulation mode. Click on the transistor and...well you get the message. Fortunately, CircuitMaker is SPICE based, so you can mix simulations if a SPICE model exists for the digital device you are considering insert-

ing into your analog design.

All simulations begin with a schematic. However, the schematic-capture program has changed considerably since the last time we looked at it. It used to be that there were ten or so columns of parts, L1 through L10, each holding 24 devices. Now there are only two columns, with Browse at the beginning of the first column. Clicking on Browse opens up a whole new world of device options (Fig. 7) that weren't available in the CircuitMaker we looked at a year ago. The remaining forty listings let you bypass the browse menu and quickly place commonly-used components, like capacitors and resistors.

What makes CircuitMaker so powerful as a simulator is its Probe and Trace tools. As its name suggests, the Probe is a touching tool that taps into the inner workings of a circuit. In the digital mode, the Probe reacts like a logic probe, indicating whether your test point is logic high or low. In the analog mode, it becomes a voltmeter (Fig. 8). The Trace button is a digital-only tool that indicates the current state of the simulation by changing the colors of the wires. A wire at logic high is red, zero logic is blue, and three-stated (high-impedance) is green. While it's really cool to see these wires change colors, it's fairly slow — but that's for a good reason. Imagine trying to follow the changing colors at a rapid pace!

We were totally impressed with the signal generator. Not only does it do the necessary sine, pulse, and sawtooth functions of a mixed mode simulator, you'll also find an exponential generator, piece-wise generator, and an FM generator for spectrum analysis. Of all the circuit simulators, CircuitMaker has the most robust signal source.

We like the fact that CircuitMaker is a tutor as well as a schematic capture program and simulator, and that the test instruments are super. However, I'd certainly check out Electronics Workbench, which fol-

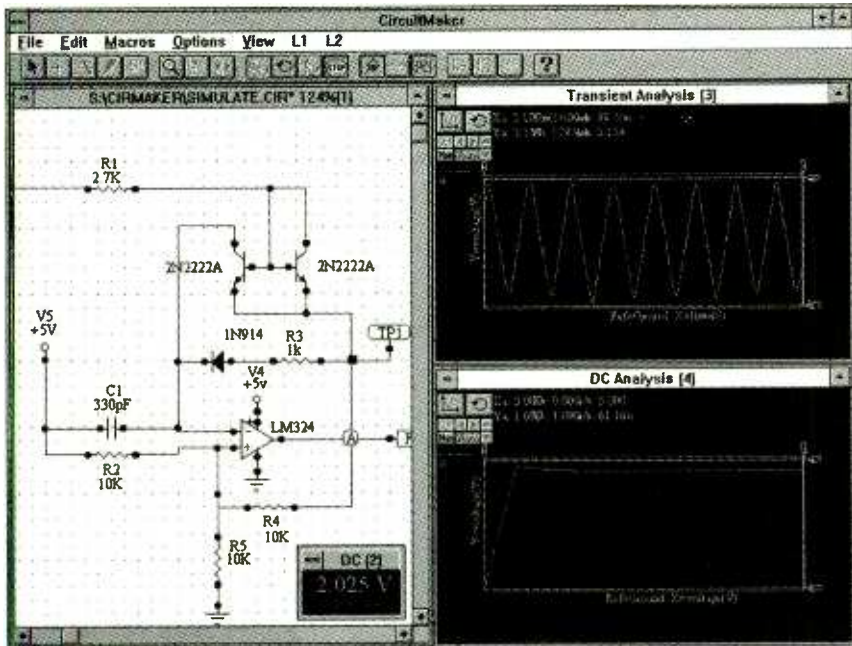


FIG. 7—CIRCUITMAKER IS A POWERFUL, yet easy to use, schematic capture and simulation program. It has a long list of test instruments, and the best looking display of any of the simulators.

lows, before making a decision. Both programs have a demo on the Electronics Now BBS, so check them out before you buy.

Product:	Electronic Workbench
Version:	4.0A
Price:	\$299
Platform:	Windows
Publisher:	Interactive Image Technologies

Whether you're using Electronics Workbench to draw schematics or simulate your newest brainstorm, you'll find it extremely easy to use and a welcome design partner. The reason why Electronics Workbench is so easy to use is because it has the look and feel of a real test bench, like the kind you'd expect to find in a professional R&D laboratory environment.

Even the test instruments have the look and texture of the real thing. For example, to set up the oscilloscope you simply click on buttons to incrementally change the voltage and time base settings like you would on a real oscilloscope. This is in contrast to the imaginary instruments used by many simulators where you have to fill in a table of settings from the keyboard, and hope

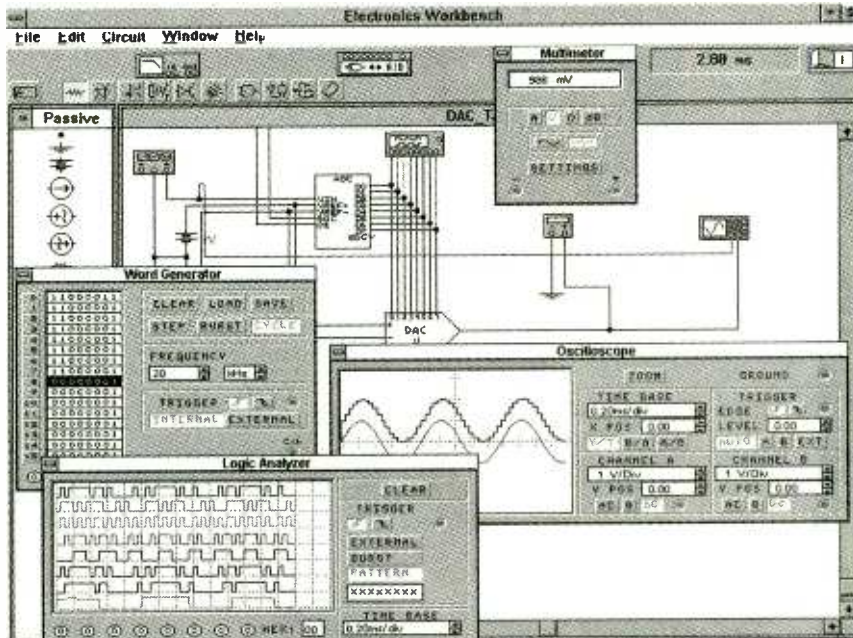


FIG. 8—ELECTRONICS WORKBENCH DOES THE BEST JOB of running mixed mode simulations. You're allowed to field both types of Instruments, and you can change instrument settings as the simulation progresses. The test instruments are of laboratory quality, and even have the look and feel of their benchtop counterparts.

they are within the range of the instrument. The equipment inventory includes an oscilloscope, function generator, Bode plotter, multimeter, and logic converter. In addition, there's an unlimited number of DVM current and voltage meters that can be inserted into the circuit at any point.

When it comes to mixed mode simulation, Electronic Workbench takes top honors. You're allowed to field both types of instruments, analog and digital, including a logic converter (Fig. 9). You can even change instrument settings as the simulation progresses. For example, if the oscilloscope's time base isn't showing what you want to see, simply click on the time base button and watch your display expand or collapse—as you simulate. Unfortunately, Electronics Workbench is not a fast simulator. Version 4.1, a 32-bit program, promises to speed along at about five times the speed of the sample we tested.

Like CircuitMaker, Electronics Workbench is a teaching tool as well a circuit simulator. The Help library goes into immaculate detail about the small-

est components, like the battery. It is a great supplement for someone starting out in an electronics career.

Whether you're a novice or a nerd, you'll find Electronics Workbench a gem of a program and a great teacher. It's well worth the \$299 asking price.

Next month, we'll look at the wide world of logic simulators. Ω

VIDEO PATTERN GENERATOR

continued from page 56

fied by gate IC6-b of IC6, a quad 2-input NAND IC and shaped by gates IC6-c and IC6-d to drive the counter consisting of the four 74HC161 synchronous binary counters.

Figure 3 is a schematic for a dual +12-volt and +5-volt power supply that can be built on a separate perforated board or be integrated with the rest of the circuit on the main circuit board. It contains two integrated circuit voltage regulators, IC9, an MC7805 positive 5-volt regulator and an MC7812, a positive 12-volt regulator

EPROM code listing

The EPROM codes can be conveniently generated by a personal computer. The program in Listing 1 is the C program for forming the sync, B/W checker and color bar codes. However, the listing does not include the code for the custom pattern. This program will generate a VIDEO.DAT file with 59,474 pixels. Any EPROM programmer can be used to program the 64 K × 8 74HC512 EPROM, IC5.

Building the generator

Refer to the video pattern generator schematic, Fig. 2, the dual power supply schematic, Fig. 3, and the parts placement diagram, Fig. 4. The author built the video pattern generator and the dual power supply on a rectangle of perforated board that measures 3³/₈ × 4¹/₂ inches. The perforations are 0.10-inch apart on centers, and the board has foil pads and power buses.

Before beginning any assembly work, drill the four mounting holes in the four corners of the circuit board, and drill a hole large enough to admit the bushing of panel-mounted switch S1. Make a paper template of the circuit board hole spacing and bushing hole location for later transfer to the base of the plastic project case as a hole-drilling pattern.

Begin circuit construction by

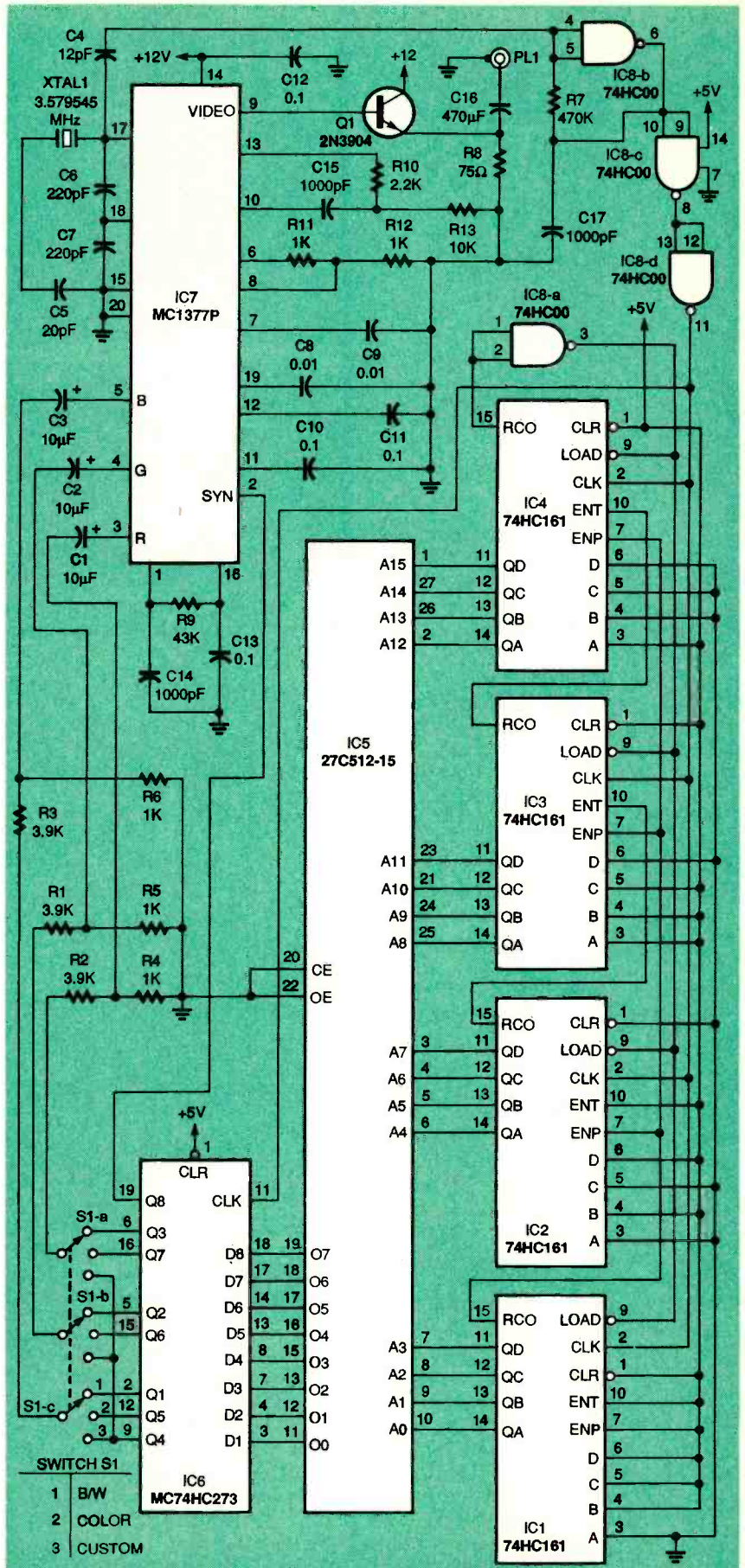


FIG. 2—SCHEMATIC DIAGRAM for the Video Pattern Generator.

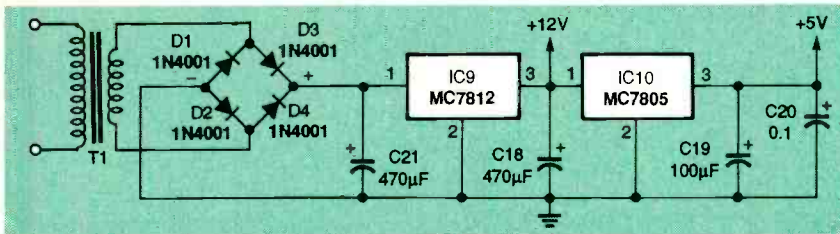


FIG. 3—SCHEMATIC DIAGRAM for the Dual Power Supply. This supply provides +12 and +5 volts. It can be built on a separate board.

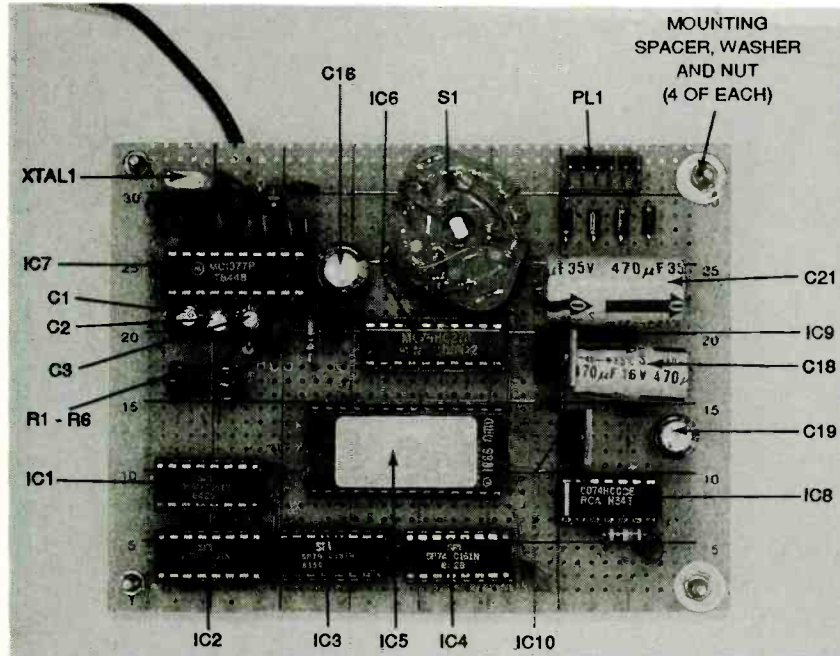


FIG. 4—SUGGESTED PARTS PLACEMENT DIAGRAM. The author integrated the video pattern generator and dual power supply (less transformer T1) on a single circuit board.

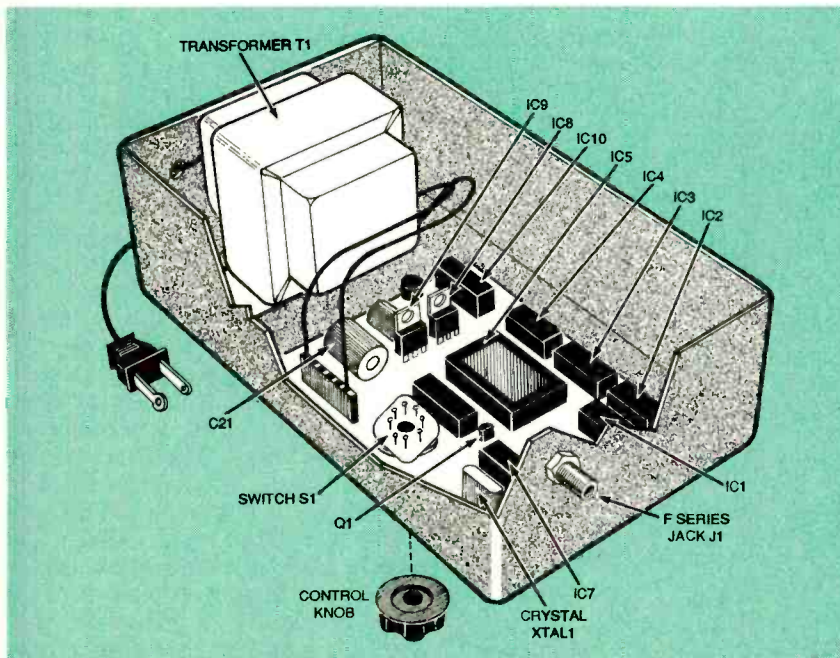


FIG. 5—ASSEMBLY DIAGRAM of the completed Video Pattern Generator. The power supply is located within the project case. The switch knob is attached to the PC board-mounted switch on the bottom of the case.

inserting and soldering the eight DIP sockets approximately in the positions shown on Fig. 4. Insert and solder the axial-leaded 470 μ F aluminum electrolytic capacitors C16 and C18 so they lie horizontally on the circuit board. Insert and solder the TO-220-packaged 7805 and 7812 voltage regulators at approximately the locations shown. Insert panel-mounted, rotary switch S1 on the circuit board in the pre-drilled hole, and fasten it with the ring nut and washer provided.

Insert and solder all resistors, radial-leaded ceramic disc and aluminum electrolytic capacitors, silicon diodes, and crystal case at the locations approximately as shown on Fig. 4.

Mechanical work

A standard commercial two-piece plastic project case was selected for this project. It measures $7\frac{1}{2} \times 4\frac{3}{8} \times 2\frac{1}{4}$ inches. This case is large and tall enough to accommodate the AC-line to 15-volt AC transformer T1. Locate transformer T1 at one end of the case as shown in the assembly drawing Fig. 5, and use the holes in its mounting bracket as a template for drilling the two mounting holes. Then drill those holes.

Position the paper template at the bottom of the case and tape it in position. Drill the four mounting holes and the hole for the switch shaft and bushing. Then drill a hole in the end wall of the case nearest the transformer location for the line cord, and drill another hole at the opposite end of the case for mounting the coaxial jack J1.

Final assembly

Refer to assembly diagram Fig. 5. Fasten $\frac{1}{4}$ -inch standoffs to the underside of the circuit board at all four corners with screws or nuts. (The author selected standoffs with internal and external threads.) Solder a short length (approximately 6 inches) of RG174 or RG58 coaxial cable from capacitor C16 to the coaxial jack J1. Solder one end of the braided shield to the ground terminal of J1 and the other end to pin 3 of IC1.

LISTING 1—C PROGRAM TO FORM VIDEO.DAT

```

#include <stdio.h>
main()
{
int line, pixel, x, y, buffer;
int cross=0x08;
long data;
FILE *stream;
/* open EPROM code file "VIDEO.DAT" */
if ((stream = fopen("VIDEO.DAT", "wb+")) == NULL)
{
fprintf(stderr, "Cannot open output file.\n");
return 1;
}
/* generate first four line codes */
for (line=1; line<4; line++)
{
for (pixel=0; pixel<227; pixel++)
{
if (pixel<210)
data=00;
else data=0x80;
fwrite(&data, 1, 1, stream);
}
}
/* generate 4-25th line codes */
for (line=4; line<25; line++)
{
for (pixel=0; pixel<227; pixel++)
{
if (pixel<17)
data=00;
else data=0x80;
fwrite(&data, 1, 1, stream);
}
}
/* generate 25-262th line codes */
for (line=25; line<263; line++)
{
if (line-7==(line-7)/21*21)
cross=cross^0x08;
for (pixel=0; pixel<227; pixel++)
{
if (pixel <17)
data=00;
else if (17<=pixel && pixel<38)
data=0x80;
else if (38<=pixel && pixel<61)
data=0xf0;
else if (61<=pixel && pixel<84)
data=0xe0;
else if (84<=pixel && pixel<107)
data=0xb0;
else if (107<=pixel && pixel<130)
data=0xa0;
else if (130<=pixel && pixel<153)
data=0xd0;
else if (153<=pixel && pixel<176)
data=0xc0;
else if (176<=pixel && pixel<199)
data=0x90;
else
data=0x80;
if (pixel==pixel/13*13)
cross=cross^0x08;
if (pixel>37 && pixel <223)
data=data+cross;
fwrite(&data, 1, 1, stream);
}
}
fclose(stream);
return 0;
}

```

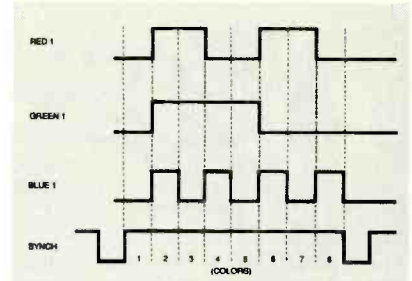


FIG. 6—TIMING DIAGRAMS for the color bar signals. The colors are: 1-white, 2-yellow, 3-cyan, 4-green, 5-magenta, 6-red, 7-blue and 8-black.

Insert the free end of the 120-volt line cord in the hole drilled for it in the case and solder the wires to the 120-volt input side of transformer T1. Then trim and solder the 15-volt secondary wires to the AC input terminals of the full-wave bridge formed by the four diodes D1 to D4. Fasten the transformer to the case with screws and nuts and fasten J1 to the case side wall. Be sure that the transformer and jack leads are long enough so that the circuit board can be removed from the case and inverted without having to break those connections.

When you are satisfied that all wiring is correct, install all the DIP-packaged integrated circuits in their designated sockets. *Caution:* ICs 1 through 6 are CMOS devices subject to damage or destruction by electrostatic discharge (ESD). Mount the circuit board in the case, and fasten it to the four standoffs with screws. Fasten the control knob to switch S1.

Calibrating the generator

This video pattern generator was designed to eliminate the need for periodic adjustments. The only component that calls for special attention is capacitor C17, which is used to calibrate the subcarrier frequency. If the subcarrier frequency of your video pattern generator deviates significantly from 3.579545 MHz, the pattern will lose color. If that happens, substitute slight variations of the specified value for C17 until the video patterns gain color. The order of the waveforms of the color bar pattern are shown in Fig. 6. Ω

CORNER REFLECTOR

continued from page 58

Cut two slots lengthwise along one end of the $\frac{5}{8}$ tubing, on opposite sides of tubing. Use a hacksaw or small saw and cut both slots at the same time with the saw passing through the center axis of the tube. The slot lengths should be $\frac{1}{4}$ wavelength at the operating frequency. For 923 MHz operation this cut should be approximately 3.2 inches. The slot width is not very critical.

Next, drill holes for the dipole elements as shown in Fig. 5. Leave about $\frac{1}{16}$ -inch space between the edge of the hole and the end of the tube. The dipole elements can be either $\frac{1}{16}$ or $\frac{1}{8}$ -inch diameter brass rods or $\frac{3}{32}$ -inch diameter brass welding rod. Use a drill that is the same diameter as the dipole elements for a snug fit. Cut a length of brass rod that is to be used for the dipole elements to 1.05 wavelengths long at the desired center frequency. See Table 2 for data on the dipole length.

Carefully clean up and deburr the cut edges on the $\frac{5}{8}$ -inch and $\frac{1}{4}$ -inch tubes. File the ends of the dipole element rods to remove burrs and sharp projections. Solder one end of the $\frac{1}{4}$ -inch tubing to the center pin of a type N connector so that the center line of the tube is aligned with the centerline of the center

pin on the type N connector. Allow $\frac{1}{8}$ -inch of space between the tube and the type N connectors flange as shown in Fig. 5. If necessary, build up the diameter of the center pin with some bare copper wire for a snug fit to ensure concentricity. Place the $\frac{5}{8}$ -inch tube over the $\frac{1}{4}$ -inch tube, and check to see that the end of the center tube is flush with or is slightly shorter than the outer tube by approximately $\frac{1}{16}$ inch, or less. Trim the center tube as needed. Clean the square flange on the connector with fine steel wool for soldering later.

Slip a $\frac{1}{2}$ -inch copper pipe coupling (use the kind that has no internal pipe stop) over the outer $\frac{5}{8}$ -inch tube. The com-

TABLE 2
COAXIAL LINE IMPEDANCE
WITH AIR DIELECTRIC

I.D./O.D.	Antenna Impedance (Ω)
2.0	41.5
2.1	44.5
2.2	47.25
2.25	48.6
2.3	49.9
23.33	50.7
2.5	54.9
2.67	58.8
2.75	60.6
3.0	65.8
3.5	75.1
4.0	83.1

Note: Shaded area indicates coaxial line impedances are within 10% of 50 ohms.

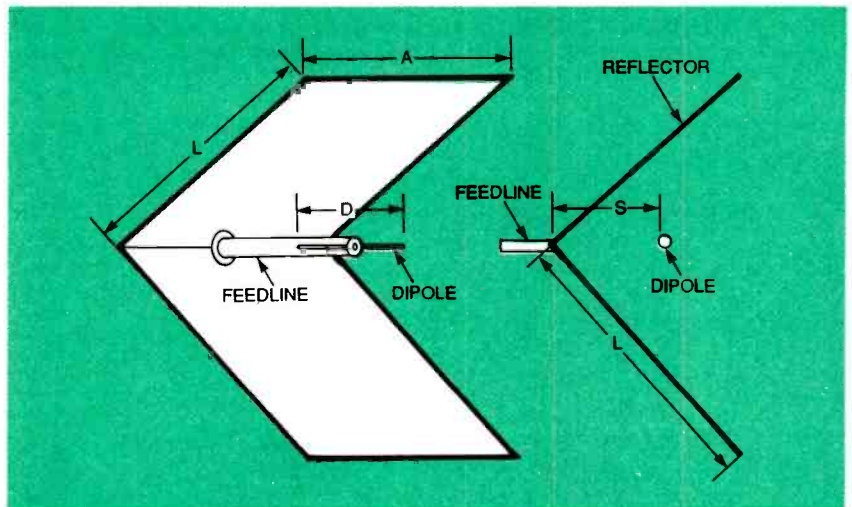


FIG 4—CORNER-REFLECTOR ANTENNA dimensions are determined by the frequencies used. Refer to Table 1 values.

TABLE 1—SUGGESTED CORNER-REFLECTOR DIMENSIONS FOR ELEMENTS IDENTIFIED IN FIG. AAA

CENTER FREQ. (MHz)	Dipole Spacing S (Inches)	SIDE LENGTH L (Inches)	CORNER LENGTH A (Inches)	DIPOLE LENGTH D (Inches)
420-450 (70 cm Amateur)	8.5	≥ 24	≥ 15	13.6
450-470 (2-way Commercial)	8	≥ 22	≥ 14	12.7
850-870 (2-way Commercial)	4.25	12	10	6.8
902-928 (33 cm Amateur)	4	12	10	6.4
928-960 (Commercial)	3.9	12	10	6.2
1240-1300 (23 cm Amateur)	2.9	12	10	4.6

Note: Dimensions are suggested starting points for minimum 8-dB antenna gain and are not exact value. The values are for practical sizes and are a compromise value given where necessary for mechanical construction reasons.

monly used $\frac{1}{2}$ -inch copper water pipe has a $\frac{5}{8}$ -inch outside diameter so a smooth slip fit should result. If OK, remove and drill a hole at one end to pass a #4 machine screw. See Figs. 6 and 7. A #33 drill is large enough, but a #28 drill was used to allow extra clearance. Polish the copper pipe coupling with fine steel wool to a bright finish. Using rosin core solder, solder a #4 brass nut to the coupling centered over the hole. Use a stainless steel #4 screw about 1-inch long to hold the brass nut in place while soldering. Solder will not stick to stainless steel.

Remove the screw after the solder joint cools.

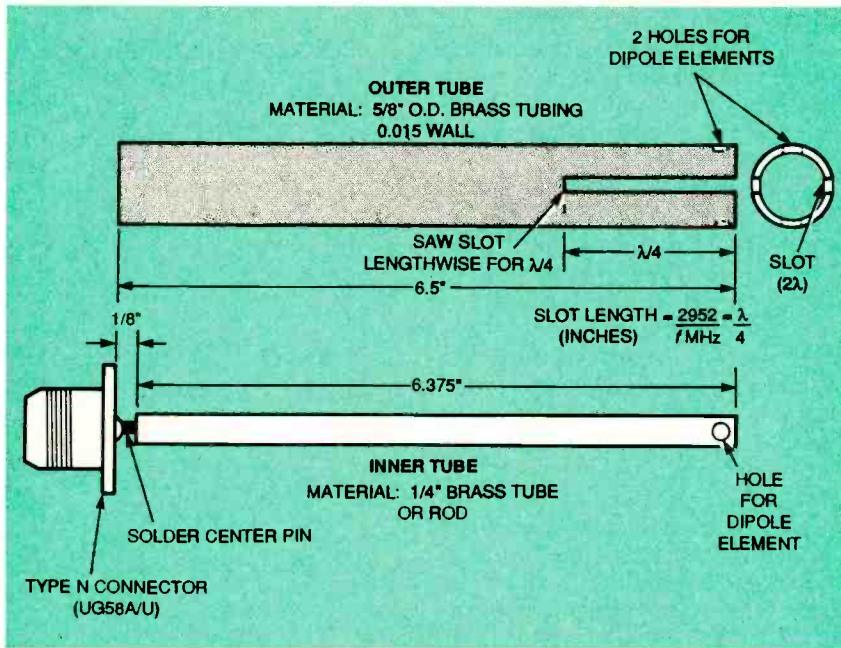


FIG. 5—PRE-ASSEMBLY DETAILS of the feedline/balun tubes. For 400 to 470-MHz operation of the corner-reflector antenna the outer tube length should be increased to 14 inches; the inner tube, 13.785 inches.

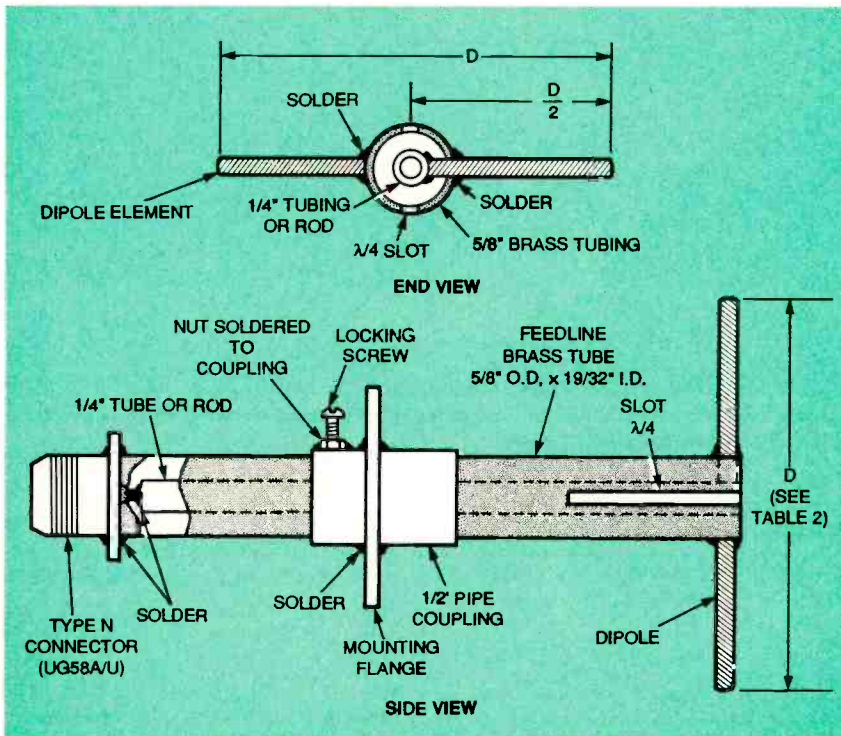


FIG. 6—TWO VIEWS OF THE DIPOLE AND FEEDLINE construction details. In the end view drawing note that the right dipole element connects to the inner and outer tubes and shorts them together. The left dipole element connects just to the outside tube. The ends of both dipole elements are equi-distant from the center of the inner tube.

Prepare a mounting flange from a 2 × 2-inch square plate made of copper, brass, or surplus PC board G-10 material. See Fig. 7. At its center, punch a hole in the flange to the outside diameter of the pipe coupling.

Solder the coupling in place about the entire circumference. Make sure coupling is perpendicular to the plate. Slip the flange assembly over the 5/8-inch tube, the slit end opposite the nut as shown. Clean both ends

LIST OF MATERIALS

Parts specified for 800-1300-MHz range. Lengths given in brackets are for 400-470-MHz range.

- 1—5/8-in. O.D. × 19/32-in. I.D. brass tubing, 0.015 nominal wall thickness, 6.5-in. long (14-in. long)
 - 1—1/4-in. O.D. brass tubing or rod, I.D. not critical, 6-3/8-in. long (137/8-in. long)
 - 1—1/16-in. to 1/8-in. O.D. brass rod, or 3/32-in. brass welding rod, 15-in. long
 - 1—Type N UG58A/U UHF connector, flange mount, or BNC UG290A/U RF connector, flange mount (either item preferably silver plated)
 - 1—3-in. sq. ft material for reflector, 0.019-inch thick, perforated or grille aluminum recommended (see text)
 - 1—4-40 brass hex nut
 - 1—4-40 × 1/2-in. brass screw
 - 1—4-40 × 1-in. stainless-steel screw
 - 1—0.032 brass or copper plate, 2 × 2-in. square, or double sided G-10 material, 2 × 2-in. × 0.062-in. thick
 - 1—1/2-in. stop-less copper pipe coupling, sweat type
 - 1—Wood, 1- × 2- × 12-in.
 - 8—#6 × 1/2-in. sheet metal or wood screws
- Also: Solder (both resin core and solid), fine steel wool, hardware as needed, miscellaneous wood blocks, 1/2 × 1/2-in. wood lengths for bracing as required, suitable plastic container for optional cover.
- A catalog describing kits for ATV transmitters, ATV receiving converters and other projects useable with the antennas described in this article is available from North Country Radio, PO Box 53, Wykagyl Station, New Rochelle, NY 10804. Please include a #10 SASE and \$1.00 to cover handling and postage.

E-mail: Ncradio200@aol.com
CompuServe 102033,1572

Note: Materials illustrated and listed are for a corner-reflector antenna operating at about 900 MHz. Antennas for lower frequencies are larger and will require correspondingly larger or more materials. Brass tubing for inner and outer conductors can also be any other reasonable dimensions as long as they have approximately a 2.3 to 1 ratio of ID (outer) to OD (center). See Table 2 for other suitable sizes and corresponding impedances.

of the outer tube with fine steel wool to facilitate soldering in the following steps.

Insert the 1/4-inch tube and type N connector assembly into the outer 5/8-inch tube placing type N connectors flange flush against outer tube (see Fig. 6). Check to see that pre-drilled holes for dipoles are aligned. You can insert the dipole elements and fasten them in place with tape to check for correct alignment. When the tubes are concentric, solder connector flange to 5/8-inch tube all around the edge. Use as little solder as you can for a neat job, and if possible use a hot 100-watt iron with a 1/4-inch tip. A few wooden blocks drilled with 5/8 diameter holes will be useful for holding parts during assembly and soldering operations.

Clean all solder residues deposited in the previous step with isopropyl alcohol, flush with water and blow dry. Do this outdoors away from flame or sparks. Remove the dipole elements and make sure no electrical contact (short) between the outer and inner tubes exist.

Solder the dipole elements in place. The outer and inner conductor are shorted together by one dipole element. This is normal. Make sure they are aligned as shown in Fig. 6. Measuring from center of center tube, the dimensions of each side of the dipole should be equal in length and symmetrical.

You now have a half-wave, slot-fed dipole. Connect it to a receiver and check to see if it works as a receiving antenna. It should work as well as your whip antenna or better. Try orienting vertically and horizontally for best signal reception.

If you have the test equipment, use an RF source and a SWR or power meter to check the VSWR. It should be 2.0 or better. The dipole elements can be trimmed for lowest VSWR later. This will be affected by reflector spacing, slot length, and also presence of nearby reflecting objects. If the antenna pulls in no signals, check for shorts from burrs, solder drops, steel wool fragments, or other foreign material.

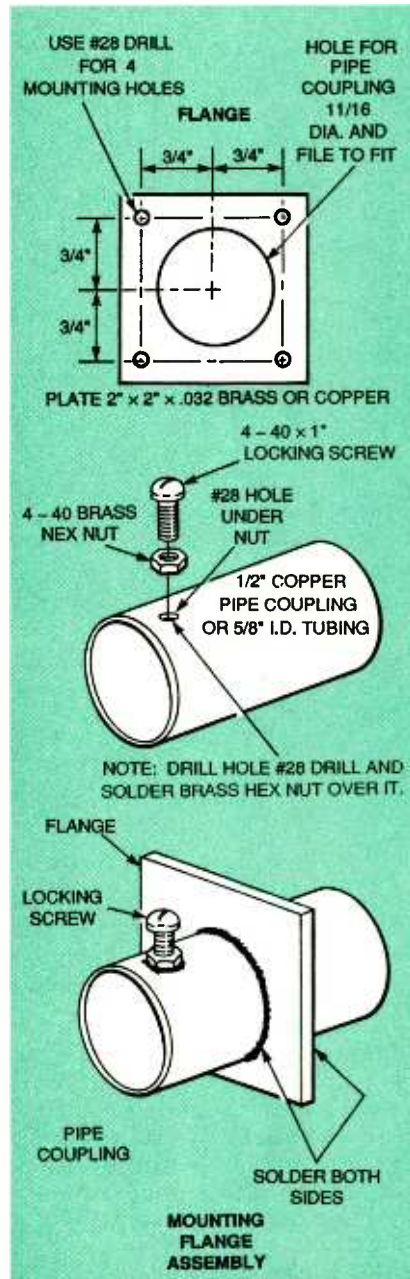


FIG. 7—DETAILS AND DIMENSIONS for the mounting flange assembly.

The reflector

Almost any perforated, stiff aluminum material can be used to make the reflector. A 0.019-inch thick perforated aluminum sheet was used. It is available in hardware stores for making grilles and covers for radiators, etc. The holes reduce the overall weight and wind resistance. Solid sheet aluminum, copper, wire mesh, or screening can be used since all you need is a conducting surface. Plywood or heavy cardboard covered with aluminum

foil can also be used, if weatherproofing is not needed, for experimental or temporary use. Hardware cloth (aluminum or copper screening material) is also useful but hard to handle.

Referring to Fig. 3, you see that the reflector is made by bending a 1 x 2-foot sheet of perforated aluminum sheet. The exact reflector dimensions are not critical, larger being better. Instead of one 90-degree bend, two 45-degree bends were used leaving a 1 5/8-inch valley that provides a surface for a good mechanical support. A piece of 1 7/8 x 3/4 x 12-inch wood is used to support the reflector and to mount the dipole in the center of the reflector. This piece of wood can also be used for mounting a bracket to hold the completed antenna to a mast or other support.

Bracing can be added to the reflector if desired as shown in the photo. Use wood, plastic, fiberglass, or other non-conducting material. Conductive materials in front of dipole will cause detuning and pattern distortion. If thin sheet metal is used alone for the reflector it is wise to cut the metal 1-inch larger in width and length and use this extra material to form a folded edge around the perimeter to stiffen the reflector surface. A block of wood can be used to form the bends, as the material is easily worked by hand. Make bends along perforated lines in the aluminum for sharp and true bends.

After the reflector is formed, cut a hole in the center of the valley fold as shown in Fig. 3 and fasten the flange on the dipole assembly to the reflector. The dipole should be parallel to the bend in the reflector. Initially set the dipole about 0.3 wavelengths from the reflector. Install a 4-40 screw in the nut previously soldered to the flange assembly to lock the dipole in place. Final adjustment can be made later by setting the dipole position for lowest VSWR, with an RF source and reflected power meter or SWR bridge. For receive only applications, no further adjustments are needed. You could try peaking

the adjustments on a weak signal if you are fussy, but you will find that they are very broad and have little noticeable effect.

Next, mount the antenna in its final location. Make sure to mount the antenna for correct polarization. Polarization is same as dipole (e.g. vertical for vertical polarization). Vertical polarization is generally used for amateur and commercial two way FM, but horizontal is used for SSB amateur work and some amateur TV. UHF TV is generally horizontal or circular. As a compromise, the antenna could be mounted at 45 degrees to vertical.

You will find that the antenna has pronounced directivity, maximum pickup occurring along a line bisecting the reflector angle, in the direction the dipole faces. The pattern is clean and well defined. Pickup towards the sides or rear is much less. Therefore, face the antenna in the direction of desired reception. Two or more of these antennas can be used if multi-directional reception is desired, or a rotator can be used. Bandwidth depends on the VSWR desired, but this antenna should work well over a range of 10 percent or so. An antenna made for 900 MHz will easily work well from 800 to 1000 MHz, and reception at 450 MHz and 1280 MHz will be adequate, but not optimum. You should find this antenna easy to make and quite effective and may even wish to build several for different frequency ranges. Simply scale the dipole element length and reflector size as needed.

For outdoor use, it would be a good idea to cover the dipole and slotted feedline assembly with a plastic cover to keep out water and insects. Use a clear, plastic-food container that is microwave safe. If it does not heat up in a microwave oven, it probably has low RF losses and will not affect the antenna. The container can be slit and placed over the dipole with the slit facing down. The lid can be used to cover the open end of the tubing. Clear silicone seal can be used to seal edges and joints

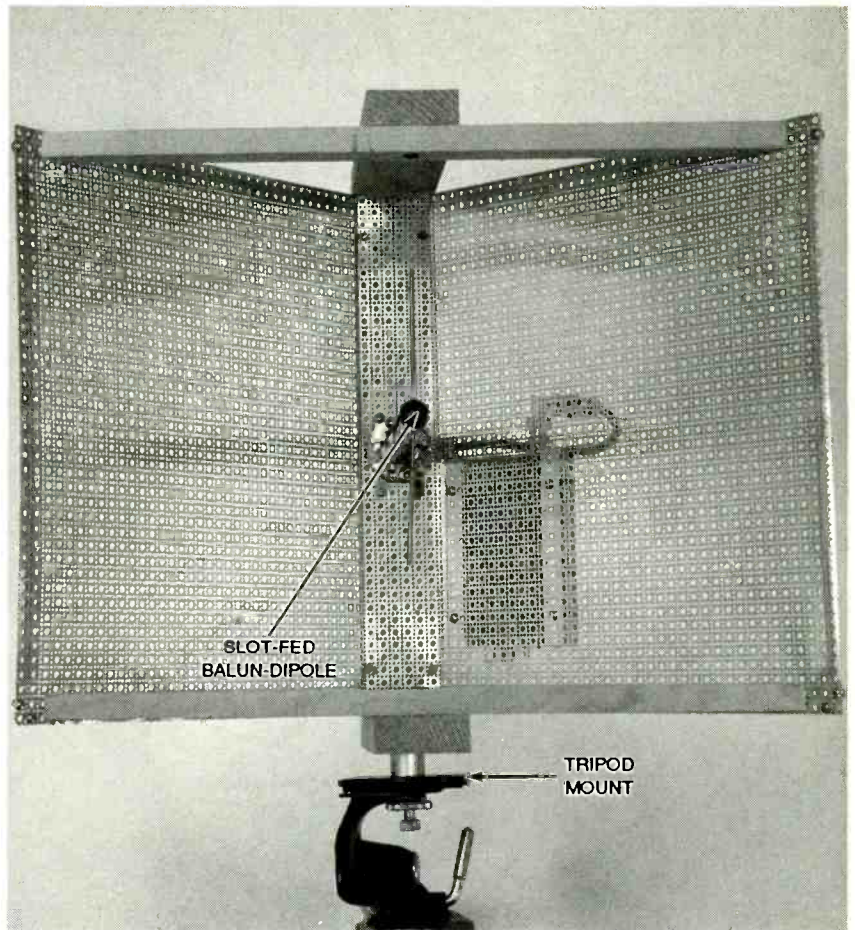


FIG. 8—THE CORNER-REFLECTOR ANTENNA fully assembled and mounted on a photographer's tripod for evaluation.

against leakage. Clear materials are preferred since pigments such as metal dust or carbon can be lossy for RF. Make sure to leave a small hole in the bottom of the container to allow escape of condensation.

How it performs

The corner-reflector antenna provides noticeable improvement over an omni-directional or ground-plane antenna. It can be used indoors as well. Fig. 8 shows the antenna mounted on a photographer's tripod for initial testing. The transmitter (or antenna) is mounted on the rear surface of the aluminum grille. This corner-reflector antenna is not intended for moon-bounce, weak-signal SSB, DX contests or other such exotic amateur radio uses but it will be a darn good antenna for much scanner listening and routine ham use, or as a temporary, cheap antenna to use before in-

vesting in a larger Yagi or other expensive setup. With a low-loss feedline, an 8 to 10 dB antenna will give very good results both in transmission and reception.

The author has used two of these antennas for amateur TV transmission at 923 MHz, one antenna at the home station about 30 feet above ground, the other in a vehicle with a portable TV set and a receiving down-converter to allow reception of the 923 MHz amateur TV signals on VHF channel 3. A 1-watt transmitter was used at the house. Excellent pictures were received 8 miles away and, although snowy, a picture was seen at 17 miles. The tests were repeated at 1289 MHz with a pair of corner-reflectors designed for this frequency and similar results were obtained. The transmitters and receiving downconverters were described in articles published in the April and May, 1996. Ω

Electronic SHOPPER[®]



CABLE TV Universal Descrambler



NEW PRODUCT

MODEL 5000 Fully Assembled \$199.95

Our fully assembled product is tested and *Guaranteed* to work on your system. We will also include an AC adaptor and complete hookup instructions. This unique product will be available for a limited time only!

4000 And 5000 Features

- The latest in Video Amplification Technology.
- New clocking circuits to stabilize color and picture performance.
- The most advanced picture locking circuitry.
- Inverted Video Option is available.
- Connects easily to your VCR.
- **NO converter box is necessary.**

THG Electronics
1-800-664-6999

Anyone implying theft of cable service will be denied assistance.

Model 4000 Kit \$84.95

The 4000 KIT comes with electronic components and Cad designed PC board. We provide schematic, parts list, wiring diagram, tutorial guide, and **FREE** in-house support.

Model 4000A Enc. Pack \$44.95

The 4000A Enclosure Pack provides the hobbyist, a custom enclosure, AC adaptor and finish accessories to give your kit the professional look.

New! Tiny One Ounce Video Camera, Under \$100!

"Supercircuits has the biggest selection of cutting edge video cameras & video transmitters I've ever found...many are just plain AMAZING!"

- Dave Klingerman, Olde Antenna Labs



If you're thinking about an exciting robotic or surveillance video project, doesn't it make sense to find an experienced guide? A microvideo pioneer, Supercircuits has the most advanced microvideo transmitters and cameras at the lowest prices. In fact, Supercircuits microvideo is used by the DEA, CIA, FBI, Air Force, Army, Navy, NASA and many others. But with prices starting at under \$100 for tiny high resolution video cameras that Video Magazine recently gave 5 star ratings in a hands-on test, it is truly technology that is as affordable as it is amazing. Call us today, or send \$5.00 (refundable) for our 50 page Microvideo Catalog, loaded with photos, configurations, specs & more. Please visit our award winning website at www.scx.com.

SUPERCIRCUITS Call Us Today! **1-800-335-9777 ext.4011**

One Supercircuits Plaza, Leander, Texas 78641

Preowned Test Equipment

Hewlett-Packard

MODEL	DESCRIPTION	PRICE
3400A	True RMS Voltmeter	\$275
141T	Spectrum Analyzer Display Section <i>Including 8552B-IF Section and 8553B-RF Section</i>	\$995
6111A	DC Power Supply 0-20 V, 0-1 A	\$400
3320B	Frequency Synthesizer	\$525
6824A	Power Supply & Amp, 50 V, 1 A	\$450
3586B	Selective Level Meter	\$1,375

Keithley

225	Current Source	\$625
240A	High Voltage Supply	\$200

Kepeco

OPS55-20M	Power Supply 0-55V, 0-20A	\$1,450
-----------	---------------------------	---------

Sensres

ESH	Electro Static Voltmeter <i>5, 10, 20, 30 KV, DC or AC RMS</i>	\$750
-----	---	-------

Tektronix

MODEL	DESCRIPTION	PRICE
TM503	Power Supply for Tek Plug-Ins	\$125
TM504	Power Supply for Tek Plug-Ins	\$225
TM506	Power Supply for Tek Plug-Ins	\$275
7B92	Time Base	\$195
7B87	Time Base w/Retrigger Acquire Clock	\$375
7B85	Delaying Time Base	\$325
7B80	Time Base	\$275
7B71	Delaying Time Base	\$140
7B53A	Dual Time Base	\$225
7834	Storage Oscilloscope	\$1,350
7904	Main Frame	\$725
7A12	Dual Trace Amp	\$195
7D11	Digital Delay	\$375
7A11	Amplifier	\$225
7704A	Main Frame	\$795
Type611	Storage Display Unit	\$100

• LIQUIDATION PRICES • TESTED AND GUARANTEED • CALL FOR COMPLETE LIST

ARC
SALES LTD

800-220-0044 x189 or 154
We buy and sell equipment-call for details

CIRCLE 316 ON FREE INFORMATION CARD

Learn MICROCONTROLLERS EMBEDDED SYSTEMS and PROGRAMMING...

...with the AES learning system/
embedded control system.
Extensive manuals guide you
through your development
project. All programming and
hardware details explained.
Complete schematics. Learn to
program the LCD, keypad digital,
analog, and serial I/O. for your applications.



**THREE MODELS AVAILABLE. Choose from an
Intel 8051, Intel 8088, or Motorola 68HC11
based system. All models come with:**

• 32K Byte ROM, 32K Byte RAM • 2 by 16 Liquid Crystal Display • 4
by 5 Keypad • Digital, Analog, and Serial I/O • Interrupts, timers, chip-
selects • 26 pin expansion connector • Built-in Logic Probe • Power
Supply (can also be battery operated) • Powerful ROM MONITOR to
help you program • Connects to your PC for programming or data
logging (cable included) • Assembly, BASIC, and C
programming (varies with model) • Program disks with Cross Assembler
and many, well documented, program examples • User's Manuals:
cover all details (over 500 pages) • Completely assembled and ready to
use • Source code for all drivers and MONITOR • Optional Text Book

Everything you need. From \$279.
Money Back Guarantee

Call for Free Info Pack, or see
WEB at <http://www.aesmicro.com>
714-550-8094, FAX 714-550-9941

AES
Advanced Educational Systems

Call 1-800-730-3232

AES 970 W. 17TH STREET, SANTA ANA, CA 92706, USA

RF POWER TRANSISTORS AND TUBES

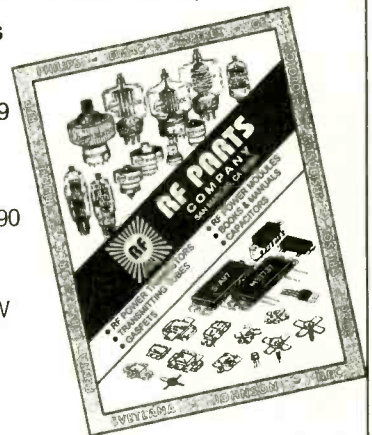
In depth stocking of popular and
hard-to-find Electronics Parts
for Transmitters & Linear Amplifiers

Popular Transistors

2SC1969
2SC2166 • 2SC2290
2SC2312C • 2SC2879
MRF454 • MRF455
MRF455A • MRF477
MRF492 • MRF497
SRF3749 • SRF7000-90

Popular Tubes

6KD6 • 6LF6 • 6LQ6
M2057 • 6146B • 6146W
3-500Z • 3-500ZG
811A • 572B • 7199
7558 • 8417 • 8873
8874 • 8875 • 8877



Order your FREE copy of our new Catalog by writing or calling us now.

Tel: (619) 744-0700 • Fax: (619) 744-1943



RF PARTS
435 SOUTH PACIFIC STREET
SAN MARCOS, CA 92069

S
K
Y
V
I
S
I
O
N[®]

1046 Frontier Drive Fergus Falls, MN 56537 Fax: 218-739-4879

≡ DIGITAL is the Future Introducing...

"The New Kid on The Block"



18" DIGITAL DISH

We've been hearing a lot lately about the new little dishes. The DISHSM Network System is the latest, and he arrived as a shining star. He is small, attractive and the latest in technology, but what really sets him apart is the programming he delivers to your Television screen.

The DISHSM Network is chock full of the most popular programming at prices much lower than the competition. Call us now for more information. Digital just may be in your future.



The
Dish is Small
The
Programming
BIG

Beat The Rush Call Now
800-500-9264
Special Digital Hotline

30% - 60 %
Savings!
Compare to
Other 18" Dish
Programming!

If you have one of these...

"Keep it Running Strong" With a Discount Buyer's Guide

If you are the owner of a C/Ku-band Full View Satellite System, we know you'll want to keep it up and running strong. The Skyvision Discount Buyer's Guide will give you advice and products to get the job done right.

You Will Find a Wide Selection of:

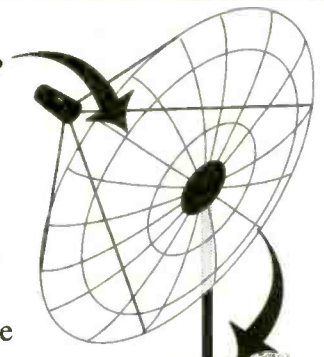
- Complete Systems
- Advanced Upgrades
- Parts & Accessories
- Tune-Up Tools & Advice
- Technical Tips Galore
- Discount *Skypac*SM Programming

For Your Free Issue Call Now

800-334-6455

Need a repair item Fast??

"We'll Get It Out Today"

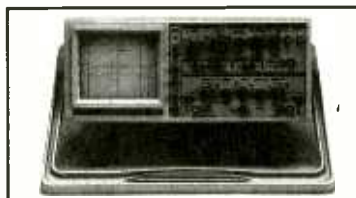


The most complete
Big Dish Satellite
Discount Buyer's Guide!
Get your FREE copy now

New and Pre-Owned Test Equipment

Substantial **SAVINGS** on New & Pre-Owned B+K Precision, Fluke, Hewlett-Packard, Goldstar, Leader, Tektronix, and more ...

Goldstar New Oscilloscope Specials



FREE SHIPPING!
ON ALL GOLDSTAR EQUIPMENT
ANYWHERE IN THE U.S.
Excluding AK & HI

Model OS-9100P → **\$999.00**

Full 100 MHz Bandwidth! **SUPER SALE!**

- Dual-Channel, High Sensitivity
- TV Synchronization Trigger
- Calibrated Delayed Sweep
- Includes Two Probes, 2 Year Warranty

Professional Quality Digital Storage Oscilloscopes at Affordable Prices!

Bandwidth	20 MHz	40 MHz	60 MHz
Model	OS-3020	OS-3040	OS-3060
SALE Price	\$1,199.00	\$1,599.00	\$1,899.00

- Transmit and Receive Data with Standard RS-232C Interface
- Includes FREE Comprehensive Communication Software
- Waveform Save, Calculation, and Print
- Dual Channel, Delayed Sweep, TV Synchronization Trigger
- 20 MS/s Sampling Rate, Two Save Memories
- Switch Between Analog and Digital Modes
- CRT Readout Including Measurement Cursors
- Includes Two Probes, 2 Year Warranty

20 MHz Sweep/Function Generator Model 4040 **\$499.00** **NEW!**

- 0.2 Hz to 20 MHz, 5 digit LED Display
- AM & FM Internal or External Modulation
- Sine, Square, Triangle, TTL, CMOS Outputs
- Burst Operation

Pre-Owned Oscilloscope Specials

Tektronix 465	100 MHz	\$589.00
Tektronix 465B	100 MHz	\$689.00
Tektronix 475	200 MHz	\$749.00
Tektronix 475A	250 MHz	\$849.00

- Professionally Refurbished
- Calibrated to Original Specifications
- Dual Channel, Calibrated Delayed Sweep
- 90 Day Warranty

LOWEST PRICES EVER! New Fluke Multimeters

The Industry Standard in Multimeters:

Model 75 Series II ...\$128.00	Model 83 ...\$232.00
Model 77 Series II ...\$153.00	Model 85 ...\$265.00
Model 79 Series II ...\$172.00	Model 87 ...\$285.00



Power Supplies

Model 1680 Fixed 13.8V, 6A	\$50.00
Model 1682 Fixed 13.8V, 15A	\$99.00
Model 1740 0-40V, 6A Dual LED Meters	\$499.00
Model 1760 Tri-Output (2)0-30V, 2A (1)4-5.6V, 5A .	\$649.00

Counters, Generators, Video Test, & More....

Model 1856A 2.4 GHz Multi-Function Counter	\$499.00
Model 1823 175 MHz Universal Counter	\$399.00
Model 1806 100 MHz Multi-Function Counter	\$249.00
Model 1211D Color TV Pattern Generator	\$235.00
Model 1249A NTSC Generator w/RGB	\$569.00
Model 4017 10 MHz Sweep/Function Generator	\$369.00
Model 1653 Isolated AC 1-150V, 2A Supply	\$319.00

Full line of Oscilloscopes, RF, Video & Audio Test Equipment,
Power Supplies, Meters, Probes and Accessories.



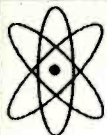
TOLL FREE 1-800-99-METER

Availability of Equipment Subject to Prior Sale
Prices Subject to Change Without Notice

1-800-996-3837

FOTRONIC CORPORATION
P.O. BOX 708
Medford, MA 02155
(617) 665-1400
FAX (617) 665-0780

CIRCLE 219 ON FREE INFORMATION CARD



TECH-SYSTEMS

1309 Hwy. 71 Belmar, NJ 07719
908-280-0007 FAX: 908-280-0111

800-435-1516

BUY - SELL - TRADE

VISA & MasterCard Accepted

90 Day Warranty / 10 Day Right of Return

N.I.S.T. Traceable Calibration Available on Most Items

SPECTRUM ANALYZERS

TEK 492/01/02 Spectrum Analyzer 50KHz to 21GHz	\$6,995
Option 01 Adds Internal Preselection and 02 Adds Digital Storage	
TEK 492/02 Spectrum Analyzer 50KHz to 21GHz	6,650
Option 21 18GHz to 40GHz Waveguide Mixer Set	1,775
TEK 496 1kHz - 1800 MHz. Spectrum Analyzer	4,750
TEK 7L12 100KHz to 1800MHz Spectrum Analyzer Plug-In	1,850
TEK 7L13 1KHz to 1800 MHz Spectrum Analyzer Plug-In	2,495
TEK TR503 Tracking Generator w/TMS03 Power Supply	1,450
HP 141T/B552B/B555A 10 MHz to 18GHz Spectrum Analyzer	2,195
HP 141T Variable Persistence/Storage Display	595
HP 140T Non-Storage Display	425
HP B553B 1KHz to 110MHz RF Section	450
HP B554L 100KHz to 1250MHz RF Section	550
HP B554B 100KHz to 1250MHz RF Section	795
HP B555A 10MHz to 18GHz RF Section	995
HP B556A 20Hz to 300 KHz LF Section	450
HP B552B IF Section	650
HP B552A Economy IF Section	295
HP B443A 0.1 to 110MHz Tracking Generator	550
HP B444A 0.1 to 1300MHz Tracking Generator	795
HP B444A/059 0.5 to 1500MHz Tracking Generator	1,350
HP B445B 1.8 to 18GHz Preselector	650
HP 182T Mainframe	495
HP 182T/B557A 10KHz to 350MHz Spectrum Analyzer	1,495
HP 182T/B558B 100KHz to 1500MHz Spectrum Analyzer	3,350
HP B557A 10KHz to 350MHz Spectrum Analyzer Plug-In	1,250
HP B558B 100KHz to 1500MHz Spectrum Analyzer Plug-In	2,395
HP B559A 0.01 to 21GHz Spectrum Analyzer Plug-In	4,450

OSCILLOSCOPES

TEK 465 100MHz Portable Scope	\$595
TEK 475 200MHz Portable Scope	795
TEK 485 300MHz Portable Scope	995
TEK 2465 300MHz Portable Scope	2,595
HP 1741A 100MHz Portable Scope	495
HP 1725A 275Hz Portable Scope	695
HP 54200A 50MHz/200Msa/s Digitizing Scope	2,250
HP 54200D 50MHz/200Msa/s Digitizing Scope	2,650
HP 54201D 300MHz/200Msa/s Digitizing Scope	2,995
HP 54110D 1GHz/40Msa/s Digitizing Scope	5,995
HP 54111D 500MHz/1Gsa/s Digitizing Scope	6,995
TEK 7603 w/7A18 (X2) & 7B53A Scope	695
TEK 7104 w/7A29 (X2), 7B1D & 7B15 Scope	5,995

Over 600 TEK 7000, 5000 & TM Series Mainframes and Plug-ins

Call for pricing information

WAVE - DISTORTION - MODULATION

HP 331A Distortion Analyzer 5Hz - 600 kHz	\$195
HP 332A Distortion Analyzer with AM Detector	295
HP 333A Distortion Analyzer with Auto Nulling & High Pass Filter	395
HP 334A Distortion Analyzer with Auto Nulling/High Pass Filter/ AM Detector	495
HP 35B1C Selective Level Meter	995
TEK AA501 Distortion Analyzer	1,295
BOONTON 82AD/01/03/04 Modulation Meter	995
Marconi 2305 2.32GHz Modulation Meter w/IEEE	4,995

STANDARDS & CALIBRATORS

FLUKE 5100B/03/05 Multifunction Calibrator	\$5,750
FLUKE 3330B DC Calibrator	1,995
FLUKE 515A Portable Calibrator AC/DC/RES	1,695
FLUKE 332B DC Calibrator	595
FLUKE 5205A AC Amplifier	2,650
FLUKE 5450A Resistance Calibrator 1 OHM to 100 megohms/Bppm	1,995
FLUKE 730A DC Transfer Standard	450
FLUKE 750A Reference Divider	450
FLUKE 720A Kelvin Varley Divider	1,895
ESI RV722 DC Divider 1ppm Accuracy	1,295
DATRON 4200/30/80 Autocal AC Standard	2,495
BOONTON 25A Power Meter Calibrator	450
BOONTON 2500A Power Meter Calibrator	450
HP B477A Power Meter Calibrator	495
HP 11683A Range Calibrator	775
TEK PG506 Calibration Generator	1,350
TEK TG501 Time Mark Generator	1,350
TEK SG503 Leveled Sine Wave Generator 250KHz to 250MHz	1,350
TEK SG504 Leveled Sine Wave Generator 245MHz to 1050MHz	2,650
RFL B29G Multi-Function Calibrator	1,495

FREQUENCY COUNTERS

HP 5314A 100MHz Universal Counter	\$225
HP 5315B 100MHz Universal Counter	495
HP 5316A 100MHz Universal Counter	695
HP 5328A/011/030 512MHz/IEEE Universal Counter	695
HP 5328A/011/031 1.3GHz/IEEE Universal Counter	895
HP 5340A/011 18GHz/IEEE Microwave Counter	1,950
HP 5342A/011 18GHz/IEEE Microwave Counter	2,750
HP 5300B/5303B 525MHz Counter	450
HP 5257A Transfer Oscillator for HP 5245 Counters	175
HP 5255A 3 to 12.4GHz Frequency Converter	175
HP 5359A Time Synthesizer	1,895
SYSTRON DONNER 6054B 20Hz to 26.5GHz IEEE Microwave Counter	2,295
TEK DC5009 Programmable 135MHz Universal Counter	695
TEK DC505A 225MHz Universal Counter Plug-In	295
TEK DC508 1.3GHz Universal Counter Plug-In	450

SIGNAL SOURCES

HP 8640B/003 512MHz Signal Generator w/Reverse Power	\$1,895
HP 8640B/001/002 1024MHz Signal Generator w/Audio Oscillator	2,795
HP 8656A 100KHz to 990MHz Synthesized Signal Generator	2,995
HP 8660C/86603A/86632B 2600MHz Synthesized Signal Generator	3,995
HP 8660A/86602A/86632B 1300MHz Synthesized Signal Generator	2,350
HP 8620C Sweeper Mainframe	395
HP 86222A 0.01 to 2.4GHz RF Plug-In	1,495
HP 86222B/001 0.01 to 2.4GHz RF Plug-In w/Crystal Markers & 70dB ATTN	1,795
HP 86290C 2 to 18.6GHz RF Plug-In	2,395
HP 86260A 12.4 to 18GHz RF Plug-In	995
HP 8697A 26.5 to 40GHz RF Plug-In	1,450
HP 214B Pulse Generator	1,995
HP 8005B 20MHz Dual Pulse Generator	450
HP 8007B 100MHz Pulse Generator	695
HP 8013B 50MHz Dual Pulse Generator	695
HP 3312A 13MHz Function Generator	895
BOONTON 2000 20GHz Sweep Generator	2,450
TEK FG501 2Hz to 2MHz Function Generator	195
TEK FG502 1KHz to 11MHz Function Generator	295
TEK FG503 1 to 3MHz Function Generator	195
TEK PG501 50MHz Pulse Generator	250
TEK PG502 250MHz Pulse Generator	495
TEK PG50B 50MHz Pulse Generator	795
APPLIED MICROWAVE/EPSCD PG5KB 5kW/575 to 925MHz RF Pulser	2,995
VELONEX 380 5kW High Power Pulser	2,995
COBER 605/P27 2kW/10Hz to 1MHz High Power Pulser	1,350

OVER 3000 ITEMS IN STOCK !

Inventory Changes Daily!

OVER 500 DC & AC POWER SUPPLIES !

Any Voltage - Any Current ! CALL

CALL FOR FREE 40 PAGE CATALOG

COMPONENT TEST

HP 4342A Q Meter (22KHz to 70MHz)	\$2,495
HP 4342A/001 Q Meter (10KHz to 32MHz)	1,650
BOONTON 5110 LCR Meter 100Hz, 120Hz & 1 KHz Test Frequency	1,450
includes 5110-1 Test Adapter & 5110-4 Kelvin Clip Adapter	
BOONTON 72BD Digital Capacitance Meter 1MHz Test Freq 2pF to 2000pF	750
TEK 576 Curve Tracer	2,995
TEK 577/02 Curve Tracer	1,695
HUNTRON TRACKER 5000 Computer Controlled Troubleshooting System	1,350
SAUNDERS 150C/09 Crystal Test Oscillator Microprocessor Controlled/IEEE/1 to 60MHz	1,695
GENRAD 1630AV Inductance Measuring System	2,995

We Buy & Sell Service Manuals Coax/Waveguide Components

WANTED !

Surplus Electronic Test Equipment

FAX US YOUR LIST

FAX: 908-280-0111

ALFA ELECTRONICS

HIGH QUALITY TEST EQUIPMENT
BEST PRICE



DMM 89 \$179.00

Most Advanced DMM
All Purpose & Communication
-80.7 to 81.4 dBm with 4Ω-1200Ω
20 reference impedances
True RMS
Frequency counter. 0.01Hz-10MHz
Capacitance: 1pF-50,000μF
Measure AC volt to 20kHz
5000 counts, 0.1% accuracy
Auto/manual range, fast bar graph
Min/Max/Ave/DH/Relative/Zoom
Auto power off
Input warning
Splash proof
Volt, amp, ohm, logic, diode, continuity
Ruggedized case
Rubber holster included



DMM A91 \$49.95 NOW \$45.00 Plus Free Case Solar Cell Powered Large Display

Diode, Continuity
Volt, Amp, Ohm
Data Hold
Auto power off
7 functions, 19 ranges
3.5 Digit, 0.8% accuracy
Auto/Manual ranging
Energy saver
Student & hobbyist's favor



DMM 20 \$74.95

Inductance: 1μH-40H
Capacitance: 1pF-200μF
Frequency: 1Hz-20MHz
Volt: amp, ohm, diode,
20 Amp ACDC current
Transistor HFE
Continuity, duty %
Peak hold/Max
Ruggedized case
Rubber holster \$8.00

Full line of DMMs,
economy, compact,
ruggedized, solar cell,
automotive, heavy
duty, industrial,
starts from \$19.95

Fluke Multimeter
Fluke 12 \$84.95
Holster C-10\$10
Fluke 70 II \$75.95
Fluke 73 II \$97.50
Fluke 75 II \$129
Holster C-70\$16
Fluke 77 II \$155
Fluke 79 II \$175
Fluke 29 II \$175
Fluke 76 \$175
Fluke 87 \$287
Fluke 867 \$1199
Fluke 97
Scope Meter \$1785
Fluke 105
Scope Meter \$2799



LCR Meter 131D \$229.95

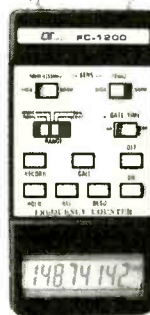
Most Advanced LCR
Dual display L/Q or C/D
Inductance: 0.1μH-1000H
Capacitance: 0.1pF-10,000μF
Impedance: 1mΩ-10MΩ
0.7% basic accuracy
Auto/manual range
Dissipation factor & Q factor
Serial & parallel mode
Relative mode for comparison
and to remove parasitics
Statistics, tolerance,
Best for design, incoming
testing & production
SMD and chip component
test probe \$25.00



LCR Meter 814 \$189.95 Best Resolution LCR

Inductance: 0.1μH-200H
Capacitance: 0.1pF-20,000μF
Resistance: 1mΩ-20MΩ
1% basic accuracy
Dissipation factor indicates leakage
in capacitor and Q factor in inductor
Zero adjustment to reduce parasitics
Best for high frequency RF
SMD and chip component test probe
\$25.00

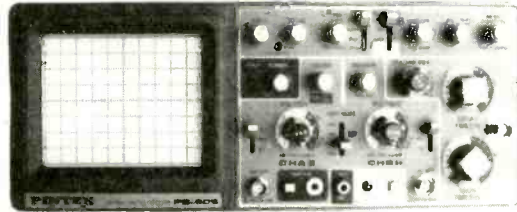
LIMITED QUANTITY SPECIAL
DIGITAL LCR 680 \$74.95
0.1pF, 1μH, 10mΩ resolution



Frequency Counter FC-1200 \$129.95

Frequency: 0.1Hz-1.25GHz
Display: 8 digit LCD
Period: 0.1μs-0.1s
Records: Max/Min/Average
Data hold, relative mode
Telescoping antenna \$8.00
Deluxe case \$5.00

Also Available:
AC/DC clamp meter, Light meter,
Thermometer, pH meter, High
voltage probe, Digital caliper,
Anemometer, Electronic scale,
Force gauge, Tachometer,
Stroboscope, Humidity & EMF
adapter, Sound level meter,
Frequency counter, SWR/field
strength/power meter, Dip meter

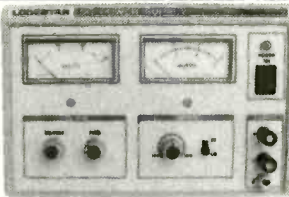


20 MHz Oscilloscope with Delay Sweep PS-205 \$429.95

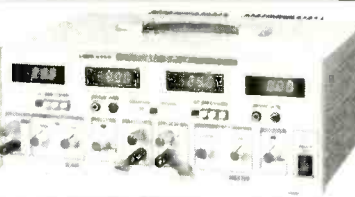
Dual Trace, Component test, 8" CRT, X-Y Operation, TV Sync, Z-Modulation, CH2 Output, Graticule Illum, 2 probes each has x1, x10 switch. Best price with delay sweep.
PS-200 20 MHz DUAL TRACE \$339.95
PS-400 40 MHz DUAL TRACE \$494.95
PS-405 40 MHz DELAY SWEEP \$589.95
PS-605 60 MHz DELAY SWEEP \$789.95
PS-1000 100 MHz DUAL TRACE \$999.95
Scope Probe: 60MHz x1, x10 \$15, 100MHz x1, x10 \$22
250MHz x1, x10 \$29, 250MHz x100 \$39

Digital Storage Scope

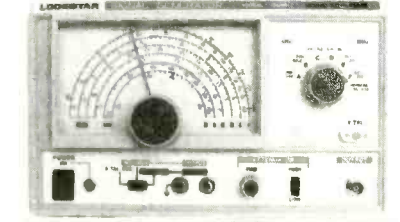
DS-303 30MHz, 20M Samples/sec \$849.95
DS-303P with RS-232 Interface \$1,049.95
Switchable between digital and analog modes
2 K word per channel storage
8 bit vertical resolution (25 Levels/div)
Expanded Timebase 10ms/div - 0.5 μ/div
Refresh, Roll, Save all, Save CH2, Pre-Trig
Plotter control



DC Power Supply PS-303 \$159.00
0-30 VDC, 0-3A output
Constant voltage & constant current mode
0.02% +2mV line regulation
0.02% +3mV load regulation
1 mVrms noise and ripple
Short circuit and overload protected
PS-8200 with digital voltmeter \$179.00
Also available: 30V/5A, 60V/3A, 60V/5A
16V/10A, 30V/10A



DC Power Supply Triple Output PS-8202 \$499.95
Two 0-30 VDC, 0-3A outputs
One fixed 5VDC, 3A output
Capable of independent or tracking operation
Constant voltage and constant current mode
Four digital meters for volt and current display
Excellent regulation and low ripple
Short circuit and overload protected
Also available: 30V/5A triple output \$549.95
Dual tracking 30V/3A, 30V/5A, 60V/3A, 60V/5A



RF SIGNAL GENERATOR SG-4160B \$124.95
100 kHz-150MHz sinewave in 8 ranges
RF Output 100mVrms to 35 MHz
Internal 1kHz, External 50Hz-20kHz
AM modulation
Audio output 1 kHz, 1 Vrms

AUDIO GENERATOR AG-2601A \$124.95
10Hz - 1MHz in 5 ranges
Output: 0-8Vrms sinewave
0-10Vp-p squarewave
Synchronization: ±3% of oscillation frequency per Vrms
Output distortion:
0.05% 500Hz - 50kHz
0.5 % 50Hz - 500kHz
Output impedance: 600 ohm

FUNCTION GENERATOR FG-2100A \$169.95
0.2 Hz - 2 MHz in 7 ranges
Sine, square, triangle, pulse and ramp
Output: 5mV-20Vp-p
1% distortion, DC offset ± 10V
VCF: 0-10V control frequency to 1000:1



RF SIGNAL GEN./COUNTER SG-4162 AD \$229.95
Generates RF signal same as SG-4160B
8 digit frequency counter 1Hz - 150 MHz for internal and external source Sensitivity <50mV

AUDIO GEN./COUNTER AG-2603AD \$229.95
Generates audio signal same as AG-2601A
8 digit frequency counter 1Hz-150MHz for internal and external sources Sensitivity <50mV

FUNCTION GEN./COUNTER FG-2102AD \$229.95
Generates signal same as FG-2100A
Frequency counter 4 digits
Feature TTL and CMOS output

SWEEP FUNCTION GEN./COUNTER \$329.95
0.5Hz to 5 MHz in 7 ranges
Sweep: Linear 10:1/Log 10:1 20ms to 2s
AM Modulation
Gated Burst, Voltage Control Generator
Generator Control Voltage & 8 digit counter
1Hz-10MHz for internal & external sources

ALFA ELECTRONICS

741 Alexander Rd., Princeton, NJ 08540

(800) 526-2532/(609) 520-2002 15 DAY MONEY BACK GUARANTEE 1 YEAR WARRANTY

FAX:(609) 520-2007

CALL OR WRITE FOR FREE CATALOG

Visa, Master Card, American Express, COD, Purchase Order Welcome

CIRCLE 213 ON FREE INFORMATION CARD

100 MHz Cursor Readout Scope
4 ch, 8 traces OS-6101 **\$1,499.95**



- * 4 independent channels, 8 traces
- * Time /Voltage cursor measurement
- * ALT triggering function for 4 ch.
- * Sweeps to 2ns/div, Delayed Sweep
- * TV Sync, Ch. 1 output, Z-axis input
- * 2 probes(x1, x10)

100 MHz Scope, 4ch. 8 traces
Best value all purpose scope
OS-6100B **\$1,329.95**



- * 4 channels, 8 traces
- * High sensitivity 500µV/div
- * Sweeps to 2ns/div, Delayed sweep
- * 20 kV accelerating voltage
- * TV sync, Z-axis input
- * A and B gate output
- * Best price 100 MHz scope
- * 2 probes(x1, x10)

50 MHz Triggering Oscilloscope
OS-653 **\$699.95**



- * Dual Channel
- * Hold Off Function
- * Delayed Sweep
- * Built-in Delay Line
- * TV Sync
- * ALT Triggering
- * High sensitivity 1 mV/div
- * Trigger level lock function
- * Z-axis input, CH1 output
- * 2 probes(x1, x10)

20 MHz Oscilloscope
OS-622B **\$344.95**



- * Dual trace, X-Y operation
 - * TV Sync, Z-axis input, CH 1 output
 - * High sensitivity 1 mV/div
 - * Trigger level lock
 - * 2 probes (x1, x10)
- OS-623B - 20 MHz w/Delayed Sweep..... \$ 449.95
OS-935 - 5 MHz One channel..... \$ 209.95

DC Linear Power Supplies
Single Output



- * Constant voltage and constant current mode
- * Voltage regulation ≤0.01%
- * Current regulation ≤0.2%
- * Low ripple and noise
- * Overload and reverse polarity protection
- * Features 2 analog or 1 digital meter(PS series)
2 analog or 2 digital meters(PR series)

PS-1830	(0-18V, 0-3A)	\$209.95
PS-1830D	Digital Display	\$219.95
PS-1850	(0-18V, 0-5A)	\$219.95
PS-1850D	Digital Display	\$244.95
PS-3030	(0-30V, 0-3A)	\$224.95
PS-3030D	Digital display	\$254.95
PS-6010	(0-60V, 0-1A)	\$209.95
PR-1810H	(0-18V, 0-10A)	\$349.95
PR-3060	(0-30V, 0-6A)	\$314.95
PR-6030	(0-60V, 0-3A)	\$314.95
PR-6030D	Digital Display	\$399.95

Triple Output DC Power Supplies



- * Two variable 0-30VDC, 0-3A outputs
- * One fixed 5VDC, 3A output
- * Auto tracking
- * Auto serial and parallel operation
- * Constant voltage and constant current mode
- * Continuous/dynamic load can be selected
- * Features 4 analog or 2 digital displays

PC-3030	(0-30V, 0-3Ax2)	\$499.95
PC-3030D	Digital display	\$549.95

Programmable DC Power Supplies



- * High stability, low drift, 4 digit display
 - * Front/rear output-sense switch selectable
 - * Auto step running w/timer settings
 - * 100 point programmability (PPS series)
 - * 50 point programmability (PPT series)
 - * Auto serial and parallel operation (PPT series)
 - * Auto tracking (PPT series), IEEE 488.2 and SCPI compatible command set (optional)
- | | | |
|-----------|-------------------------------|-----------|
| PPS-1860G | (0-18V, 0-6A) | \$1099.95 |
| PPS-3635G | (0-36V, 0-3.5A) | \$1099.95 |
| PPS-6020G | (0-60V, 0-2A) | \$1099.95 |
| PPT-1830G | (0-18V, 0-3Ax2, 0-6V, 0-5A) | \$1399.95 |
| PPT-3615G | (0-36V, 0-1.5Ax2, 0-6V, 0-3A) | \$1399.95 |

Digital Display Function Generator
FG-8016G **\$239.95**



- * Frequency Range: 0.02Hz to 2MHz
- * Three Instruments in one: Function generator, Pulse generator & Frequency counter.
- * Sine, Triangle, Square, TTL Pulse and CMOS output
- * Built-in 6 digit counter with INT/EXT function
- * 1000:1 tuning range
- * Variable DC offset control

FG-8015 Function Generator	
* 0.02Hz-2MHz (No Counter)	\$189.95
FC-8131 Intelligent Counter 1.3GHz	\$469.95
FC-8270 Intelligent Counter 2.7GHz	\$629.95
UC-2010G Universal Counter	\$294.95

Digital Multimeter & C Meter
DM-8034(3½ digits) **\$179.95**



- * 8 Function, AC/DC voltage, AC/DC current, resistance
 - * Built-in C meter, diode test and audible continuity check
 - * High voltage 1000V and 20A range
 - * 0.5% basic accuracy
- | | |
|--------------------------------------|----------|
| DM-8040 (3½ Digits, True RMS) | |
| * Measures ACV to 50 kHz | \$339.95 |
| DM-8055 (5½ Digits) | \$649.95 |
| * 0.006% basic accuracy | |
| * 1µV, 1mΩ, 1nA resolution | |
| * dBm measurement | |
| * Auto range, relative mode, Max/Min | |
| DM-8055G(5½ Digits, GPIB) | \$889.95 |

Model DM-392
(3½ digits) **\$109.95**

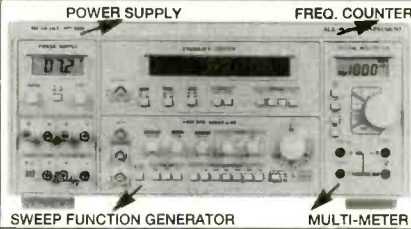


- * Auto/Manual ranging(38 ranges)
- * 42 Segment analog bar graph
- * Data Hold/Min-Max memory /Relative mode
- * Auto power off
- * Overload protection
- * Audible continuity check /diode test
- * Capacitance: 1pF-40µF
- * Frequency: 0.1Hz-1MHz
- * 20 Amp range
- * Double high energy fused (1A, 20A)
- * 0.3% DCV accuracy

DM-351	3½ Digits w/Continuity, Auto Off	\$54.95
DM-352	3½ Digits, Cap. Freq. hFE, 20 Amp	\$79.95
DM-353	3½ Digits, Cap. Freq. Temp. hFE	\$84.95
DM-391	3½ Digits, Auto, Cap. Freq. Min/Max	\$99.95
DM-392	3½ Digits, Hold, Min/Max 20Amp	\$109.95
DM-393	3½ Digits, Peak, Logic, hFE, Freq.	\$119.95

Unbeatable Discount Prices

1 YEAR WARRANTY
15 DAY MONEY BACK GUARANTEE



MT-100
Reg. \$599.
\$419.00

Four Instruments in One Instrument

1 Function Generator

- Sine, Square, Triangle, Pulse, Skewed Sine, Ramp, TTL
- 0.2 Hz ~ 2MHz

2 Frequency Counter

- 8 Digit LED
- 1 Hz ~ 100MHz
- ± (1 Hz + 1 dgt. + Time Base Error)

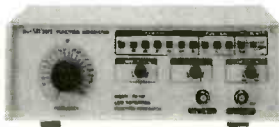
3 Power Supply

- 3-1/2 Digit LCD
- Triple output: #1, 0-50V, 0.5A MAX #2, 15V, 1A #3, 5V, 2A

4 Digital Multimeter

- 3-1/2 Digit LCD
- DCV, ACV, Ω, DCA, ACA
- ± (0.5% + 2 dgts)

FG-140 2MHz Function Generator
Reg. \$249. **\$149.00**



- 0.2 Hz - 2.0 MHz, 7 Decades
- Sine, Square, Triangle, Pulse, Ramp, Skewed Sine
- VCF, Symmetry
- Variable DC Offset Control

FG-150 2MHz Sweep Function Gen. w/Freq. Counter
Reg. \$399. **\$229.00**



- 4 Digit LED Display
- Sine, Square, Triangle, TTL, Pulse, Ramp, Skewed Sine
- Linear/Logarithmic Sweep
- 10 MHz Freq. Counter

FC-200 1.0GHz Frequency Counter, High Resolution
Reg. \$399. **\$219.00**



- 1.0 Hz - 1.0 GHz
- 8 Digit LED Display
- Auto & Manual Range
- 4 Selectable Gate Times
- 1MΩ & 50Ω Input Impedance

Oscilloscope Probe Set
Switch Selectable X1/X10

HP-9060, 60MHz Reg. \$29. **\$17.00**
HP-9150, 150MHz Reg. \$49. **\$27.00**
HP-9250, 250MHz Reg. \$59. **\$37.00**



PS-500 DC Power Supply
Reg. \$249. **\$159.00**



- 0-3.0 VDC
- 0.1 - 3A
- Short & Overload Protection

PS-540 DC Power Supply
Reg. \$399. **\$249.00**



- 0-16 VDC
- 0.1 - 10A
- Short & Overload Protection

Deluxe O'scopes w/Phillips CRT.

"BEST BUY!"

OS-3304 Reg. \$499. **\$349.00**



OS-3304 25MHz, Dual Trace

- 1 DC to 25 MHz. Dual Channel
- 2 6" Rectangular CRT with Internal Graticule 10x8cm (Phillips P31)
- 3 Uncalibration LED.
- 4 High Sensitivity 1 mV/div to 2mV/div X-Y modes, Z Axis (intensity modulation)
- 5 Rise time 14n Sec. or less.
- 6 Full TV Trigger for TV-V & TV-H
- 7 Acceleration Potential 2kV
- 8 60MHz (X1,X10) Probe Kit: 2 sets
- 9 Power: 115/230V AC

OS-3315 40MHz, Dual Trace Sweep Delayed
Reg. \$799. **\$549.00**



- DC to 40 MHz. Dual Channel
- Delayed Sweep 100nS to 1.0S
- 7 decade
- 6" Rectangular CRT with Internal Graticule 10x8cm (Phillips P31)
- Uncalibration LED.
- High Sensitivity 1 mV/div to 2mV/div X-Y modes, Z Axis (intensity modulation)
- Rise time 8.5nS or less.
- Full TV Trigger for TV-V & TV-H
- Acceleration Potential 12kV
- Variable Hold Off
- 16ns ~ 1.0s Time Base
- 60MHz (X1,X10) Probe Kit: 2 sets
- Power: 115/230V AC

OS-3324 Reg. \$599. **\$429.00**



OS-3324, 3 Function

- 1 OS-3304
- 2 Dual Component Tester/Comparator
- 3 Triple DC Power Supply 5VDC, +12 VDC, -12VDC

OS-3344 Reg. \$899. **\$649.00**



OS-3344, 5 Function

- 1 + 2 + 3 • OS-3324
- 4 Frequency Counter 100MHz, 7 Digit LED Display
- 5 Function Generator 0.02 Hz to 2.0 MHz



Bel MERIT
DM5050C
DM5100

Reg. \$149.
\$89.00

Including
Deluxe
Holster

Features (DM5050C/DM5100)

- Basic DCV Accuracy: ± 0.25%
- AC/DC Volt & Amp, Ohm
- Diode, Continuity Beeper
- Alligator Clip Test-Leads
- Lead Holders/Velcro Strap Holster

DM5050C, DMM + Capacitance

- 9 Function / 42 Range
- Multimeter
- Ohm: Up to 2000MΩ
- Amp: AC/DC 2 Amp
- Extended Capacitance Meter (9 Range) 0.1pF - 20,000μF
- Zero Adjust Knob
- Trig Lamp

DM5100, Wide Range w/Logic

- 11 Function / 45 Range
- Auto Power Off
- Data Hold & Peak Hold
- Freq: Up to 20MHz
- Amp: Up to 20A AC/DC
- Ohm: Up to 200MΩ
- Capacitance: 1p - 200μF
- Logic: TTL, TR hFE

Digital Engine Analyzer
Reg. \$119. **\$69.00**



- DM230**
- 3 1/2 Digit LCD
 - Engine Analyzer Taco, Dwell, Duty Cycle
 - DMM DCV, DCA, Ω
 - Temperature 0 - 1,999°F
 - Diode
 - Continuity
 - Holster, Temp. Probe, Clip Leads

Capacitance Meter
Reg. \$79. **\$49.00**



- CM210**
- 3 1/2 Digit LCD
 - 0.1p-20,000μF
 - 9 Ranges
 - 0.5% basic Accu.
 - Zero Adjust Knob
 - Test Leads & Built in Socket

Pen-Type DMM w/Logic
Reg. \$79. **\$59.00**



- DM150**
- 3 1/2 Digit
 - Dual Display
 - Auto & Manual
 - DCV, ACV, ACA, DCA, Ω
 - Logic CMOS/TTL
 - Data Hold
 - Diode
 - Continuity

Multifunction DMM
Reg. \$99. **\$64.00**



- DM4050**
- 3 1/2 Digit
 - Basic Accuracy: 0.25%
 - Heavy Duty, 20A AC/DC Resistance 20MΩ
 - Capacitance
 - Freq: up to 20MHz
 - TR-hFE
 - Diode
 - Continuity
 - Deluxe Holster

BMC Your Best Source for
High Standard Electronics

P.O. Box 744, Lake Forest, CA 92630-0744

Order & Free Catalog

800-532-3221

(714) 586-2310 Fax (714) 586-3399



CIRCLE 297 ON FREE INFORMATION CARD

www.americanradiohistory.com

Parts Express™

301 Standard PanaVise

Designed for the professional and hobbyist, the model 301 turns, tilts and rotates to achieve the desired position. Durable nylon jaws open 2-1/4". Net weight: 3 lbs.



#EN-365-305 **\$39⁹⁵** EACH

Headband Magnifier

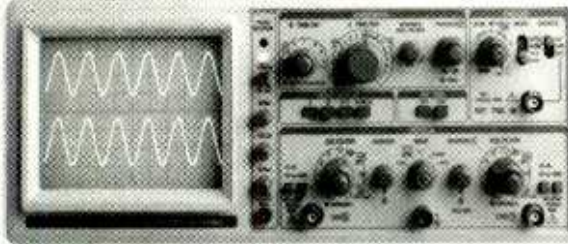
Features double lens for choice of 2.2x or 3.3x magnification and Velcro type headband. Net weight: 1/2 lb.



#EN-360-672 **\$19⁹⁵** EACH

GoldStar Oscilloscopes

GoldStar



Part #	GoldStar #	Description	Price
EN-394-116	OS9100P	100MHz	\$899.95
EN-394-115	OS9060D	60MHz	699.95
EN-394-110	OS9040D	40MHz	599.95
EN-394-105	OS9020G	20MHz w/generator	449.95
EN-394-100	OS9020A	20MHz	349.95

150 MHz Oscilloscope Probe Kit

Deluxe probe kit features a modular design for longer life, switchable 10:1 probe with 150 MHz bandwidth, 2.8 ns rise time, and adjustable capacitance from 10-35 pF. 60" in length. Kit includes 6" detachable ground lead, sprung hook, trimming tool, 2 channel identifier clips, and replacement tip. Includes plastic case.



#EN-390-100 **\$29⁹⁵** EACH

Weller WLC100 Soldering Station

The Weller WLC100 solder station is adjustable from 5 to 40 watts. Includes 40 watt pencil iron. UL approved. Net weight: 1-3/4 lbs. One year manufacturer warranty.



#EN-372-120 **\$39⁹⁵** EACH

Sure Shot 18" Dish for DSS®

Built heavier and stronger than OEM models, able to withstand 120 MPH wind gusts! "Perfect Curve" manufacturing process allows for maximum signal reflectivity. Ideal for replacement of damaged OEM dishes or for additional viewing locations. Sure Shot comes complete with mounting hardware and instructions. Limited lifetime warranty. LNBF not included. Net weight: 13 lbs.



#EN-210-405 **\$49⁹⁵** EACH

Hot Shot 18" Dish for DSS®

The Hot Shot features the same quality construction as the Sure Shot, but also contains a safe low voltage, heating element that automatically eliminates ice, snow, and moisture from the dish surface. Hot Shot comes complete with mounting hardware, heater power supply and instructions. Note: 2 conductor, 18 gauge heater wire not included. Limited lifetime warranty. LNBF not included. Net weight: 27 lbs.

#EN-210-400 **\$139⁹⁵** EACH

Grundig LNBFs

Made in England quality! Designed to work in extreme real world conditions. Features "true circular polarization". For use with the Sure Shot and Hot Shot dishes or as a replacement for lightning damaged RCA DSS LNBFs. Available in single or dual feed. 18 month warranty. Net weight: 1 lb.

#EN-210-420 (Single feed) **\$79⁹⁵** EACH

#EN-210-425 (Dual feed) **\$99⁹⁵** EACH

CAIG DeoxIT Deoxidizer

DeoxIT is a fast-acting deoxidizing solution that cleans, lubricates, and improves conductivity on all metal connectors and contacts. Seals and protects all electrical connections. Reduces intermittent failures, arcing, wear, and abrasion. Temperature range: -34 degrees C to 200 degrees C. Use as a general treatment for connectors, contacts, and other metal surfaces.



Part #	CAIG #/Description	Solution	Price (1-11)	Price (12-23)	Price (24-UP)
EN-341-200	DeoxIT D5, 5 oz. Spray	5%	\$7.95	\$7.15	\$6.45
EN-341-202	DeoxIT Mini Spray, 15 g.	5%	4.95	4.50	3.95
EN-341-205	DeoxIT D100, 2 oz. Spray	100%	10.95	9.85	8.85
EN-341-210	DeoxIT Pen Applicator	100%	9.95	8.95	8.05
EN-341-215	DeoxIT Vial w/brush, 7.4 ml.	100%	6.95	6.25	5.65
EN-341-220	DeoxIT Precision Dispenser	100%	14.95	13.45	12.10

Phone FM Transmitter Kit



This small circuit, when connected to a phone line, transmits both sides of a telephone conversation into the FM radio band in the 90-95MHz area. The phone line itself is used as an antenna. Includes all components and instructions.

#EN-320-067 **\$9⁹⁵** EACH

2 Stage FM Transmitter Kit



Easy to build and tune in the upper part of the FM band. Reaches over 1/2 mile (depending on conditions). Uses RF transistor for its final stage. Requires a 9V battery (not included). High quality PCB and components. Circuit schematic provided.

#EN-320-066 **\$10⁹⁵** EACH

B & W CCD Board Cameras

Ultra miniature, high performance 1/3" CCD single board cameras feature a built-in 3.6mm wide angle lens and 400 lines of resolution. Requires a 12 VDC power supply (our #120-1100). Dimensions: 1-1/2" W x 1-3/4" H x 1" D.



#EN-335-525



#EN-335-530

#EN-335-525 (Standard lens) **\$149⁹⁵** EACH

#EN-335-530 (Pin hole lens) **\$169⁹⁵** EACH

#EN-120-1100 (12VDC power supply) **\$7¹⁵** EACH

FREE CATALOG CALL TOLL FREE 1-800-338-0531



340 E. First St., Dayton, OH 45402-1257 • Phone: 513-222-0173 • Fax: 513-222-4644

•30 day money back guarantee •\$20.00 minimum order •We accept Mastercard, Visa, Discover, and company C.O.D. orders •24 hour shipping •Shipping charge = UPS chart rate + \$1.90 (\$5.00 minimum charge) •Hours 8:00 am - 8:00 pm ET Monday - Friday •9:00 am - 5:00 pm Saturday. Mail order customers, please call for shipping estimate on orders exceeding 5 lbs. •Foreign destination customers please send \$5.00 U.S. funds for catalog. •Quantity pricing available.

CIRCLE 262 ON FREE INFORMATION CARD

BLOWOUT! TIMELINE INC. BLOWOUT!

Over 10 years and 27,000 customers and still growing

LIQUID CRYSTAL DISPLAYS

160 x 128 dot LCD with built-in controller (T6963C)
20 character x 16 line **\$79.00** or 2 for **\$149.00**

Mfr.: Toshiba TLX-1013-EO.

Unit is EL back-lit. Dim: 5 1/8" L x 4 1/8" H.

The built-in controller allows you to do text and graphics.

240x64 dot LCD with built-in controller. **\$79.00**
Mfr.: AND 4021ST-EO. Unit is EL back-lit. or 2 for **\$149.00**

Alphanumeric—parallel interface

16x1.....3 for \$25.00	20x2.....\$12.00	40x1.....\$8.00
16x1 (lg. char.).....\$12.00	20x4.....\$25.00	40x2.....2 for \$25.00
16x2.....\$8.00	20x4 (lg. char.).....\$25.00	40x4.....\$25.00
16x2 (lg. char.).....\$12.00	24x2.....\$12.00	4x2.....\$5.00
16x4.....\$15.00	32x4.....\$10.00	

5V power required • Built-in C-MOS LCD driver & controller • Easy "microprocessor" interface • 98 ASCII character generator • Certain models are backlit, call for more info.

Graphics and alphanumeric—serial interface

size	Mfr.	price	size	Mfr.	price
640x480 (backlit)	Epson	\$35.00	480x128	Hitachi	\$15.00
640x400 (backlit)	Panasonic	\$25.00	256x128	Epson	\$20.00
640x200	Toshiba	\$15.00	240x128 (backlit)	Optrex	\$20.00
480x128 (backlit)	ALPS	\$15.00	240x64	Epson	\$20.00
			160x128	Optrex	\$15.00

LASER PRODUCTS

HeNe Laser Head (10mW max. output) TEMOO. 15.5" long MFG: NEC **\$99.00**

Laser Power Supply (for HeNe tube) **\$89.00**

LASER SCANNER ASSEMBLY **\$29.00**

Assembly intended for a laser printer. Includes laser diode, polygon motor (6 sided) and misc. optics and lenses.

LASER DIODE (5mW) with collimator **\$20.00**

VISIBLE LASER DIODE: 5mw at 670nm **\$15.00**
index guided. Threshold current 40 ma typical.

POLYGON MOTOR UNIT & DRIVER

Ten-sided first surface mirror mounted on an armature that spins at 125 revolutions per second yielding a beam sweep rate of 1250 sweeps per second. The driver for the polygon unit requires 24 volts and plus and minus 12 volts to operate. There is also an f-theta lens in front of the polygon scanning mechanism with a three inch diameter. Great for optical experiments, etc. Very high quality units. (MFR: JAPAN ELECTRONICS)

\$79.00

NETWORK

Proteon ProNet-4 Model p1347 Token Ring Board **\$79.00**

16 bit • 4 Mbps • IEEE 802.2 and 802.5 compatible • twisted pair • Interoperable with IBM Token Ring network

POS & BAR CODE

MAGNETIC CARD READER **\$25.00**

Includes: • 20 character dot matrix display with full alpha-numeric capability • keypad with full alpha-numeric entry • separate 7.5 VDC/0.5 Amp power supply • standard telephone interface extension cord • lithium battery and flat-cone speaker.

HP bar code wand (HBCS 2300).....**\$35.00**

POWER SUPPLIES

73 WATT SWITCHING **\$15.00** or 2 @ **\$25.00**, (2) 4 pin power connectors attached
• 115/230 Volt, Dim: 8.5" L x 4.5" W x 2" H • Output: +5V @ 2-9.75 A, +12V @ 0-1.5 A, -5V @ 0-0.4 A, -12V @ 0-0.5 A

68 WATT SWITCHING **\$12.00** or 2 for **\$20.00**, 115/230 Volt,
Dim: 5.5" L x 3.2" W x 1.7" H • Output: 5V @ 4 A, 12V @ 4 A

MISCELLANEOUS

ADAPTEC 4070A (RL) OR 4000A (MFM)
SCSI Controller, your choice **\$25.00**

IBM 370 option XT and AT emulation boards **\$35.00**

23605 Telo Ave., Torrance, CA 90505

Order desk only: USA: (800) 872-8878 CA: (800) 223-9977

LA. & Technical Info: (310) 784-5488 Fax: (310) 784-7590

OEM INQUIRIES WELCOME

MONITORS

Non-Enclosed TTL

Comes with pinout. 12V at 1.4 Amp input • Horizontal frequency 15KHz. • Ability to do 40 and 80 column.

5 inch Amber	\$35.00
7 inch Amber	\$39.00
9 inch Amber or Green	\$29.95

5" COLOR MONITOR **\$49.00**

• Flat Faceplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible
• 12 VDC Operation • 15.75 KHz Horiz. Freq. • 60 Hz Vert. Sync. Freq.
• Open Frame Construction • Standard Interface Connector
• Degaussing Coil included • Mfr. Samtron

2 for **\$89.00**

9" VGA MONITOR **\$59.00**

Original IBM units. Monochrome - page white. Tilt & swivel.

CHARGE COUPLED DEVICES



"The Spy

In The Sky" **\$29.00**

MATRIX TYPE

Sony CCD Imager - designed for black and white composite

video cameras. Picture elements: 384 (H) x 491 (V)

Chip size 10.7 (H) x 9.3 (V) mm² • Unit cell size 23.0 (H) x 13.4 (V) um².

Ceramic 24 pin DIP package • Mfr: Sony, Part# 016AL

4096 element CCD **\$29.00**

1024 element CCD **\$15.00**

2048 element CCD **\$15.00** • 1728 element CCD **\$15.00**

LINEAR TYPE

HACKER CORNER

CELL SITE TRANSCEIVER **\$99.00**

These transceivers were designed for operation in an AMPS (Advanced Mobile Phone Service) cell site. The 20 MHz bandwidth of the transceiver allows it to operate on all 666 channels allocated. The transmit channels are 870.030-889.980 MHz with the receive channels 45 MHz below those frequencies. A digital synthesizer is utilized to generate the selected frequency. Each unit contains two independent receivers to demodulate voice and data with a Receive Signal Strength Indicator (RSSI) circuit to select the one with the best signal strength. The transmitter provides a 1.5 watt modulated signal to drive an external power amplifier. Channel selection is accomplished with a 10 bit binary input via a connector on the back panel. Other interface requirements for operation are 26 VDC (unregulated) and an 18.980 MHz reference frequency for the digital synthesizer. The units contain independent boards for receivers, exciter, synthesizer, tunable front end, and interface assembly (which includes power supplies and voltage-controlled oscillator). Service manual, schematics and circuit descriptions included.

Encased Black & White Composite CCD Camera with Adapter

IR viewing to 1000 nm 7 1/2" L x 2 1/2" W x 1 1/2" H

Comes complete with CCD camera, mounting nut on bottom of casing.

12VDC power supply. Excellent low light capability, standard RCA NTSC video out.

\$89.00

Great for: entryway security/remote monitoring, video conferencing/desktop video conferencing

2 for **\$159.00**
This miniature camera is perfect for multimedia computer applications as well as security and surveillance. NTSC output allows use with all popular video digitizing boards for Apple Macintosh and Microsoft video for Windows. Connects directly to any composite monitor or VCR with "video" input. Its razor-sharp wide-angle lens focuses from two inches to infinity and its state-of-the-art CCD technology accurately captures 16 level grayscale images for Quick Time movies and still pictures. Records at 30 frames per second and 260 lines resolution with excellent low light capability. Uses 12VDC (adapter supplied) and standard RCA cable.

Portable Micro Terminal **\$99.00** or 2 for **\$149.00**

Flip up LCD display (9-16 VDC) • Can communicate with a computer having RS 232 port •

Can communicate with another Micro Terminal (use shell) • Electronic notebook •

Onboard microprocessor, RAM (32K) and Video RAM (16K) • Complex built in

diagnostics and self-correcting • Intended for POS applications. • display size

40x16 (256 x 16 pixels) • Dimensions: 6.3" W, 11" L, 2" H. (With LCD up height is 7.1")



BAREBONES 286-12 COMPUTER **\$49.00** (2 FOR **\$79.00**)

Slimline desktop case, 100 watt supply, math co-processor support. On board IDE, & Floppy controllers. 2 COM ports and 1 parallel port with software setup. Supports up to 8 Megs using standard 30 PIN SIMMs. Internal port for (1) 3 1/2 inch IDE hard drive and (2) 3 1/2 inch floppies. Four 16 BIT ISA slots, accepts full length AT size cards. Keyboard can be set to no test at boot. Case size is 15.5" W x 16" D x 4" H.
(Motherboard can be purchased separately: **\$29.00** or 2 for **\$49.00**)

.6" COMPOSITE MINIATURE COLOR DISPLAY **\$149.00**

Fully encased. Dim: 1.3" x 1.3" x 4". 12 Volts DC power. NTSC signal.

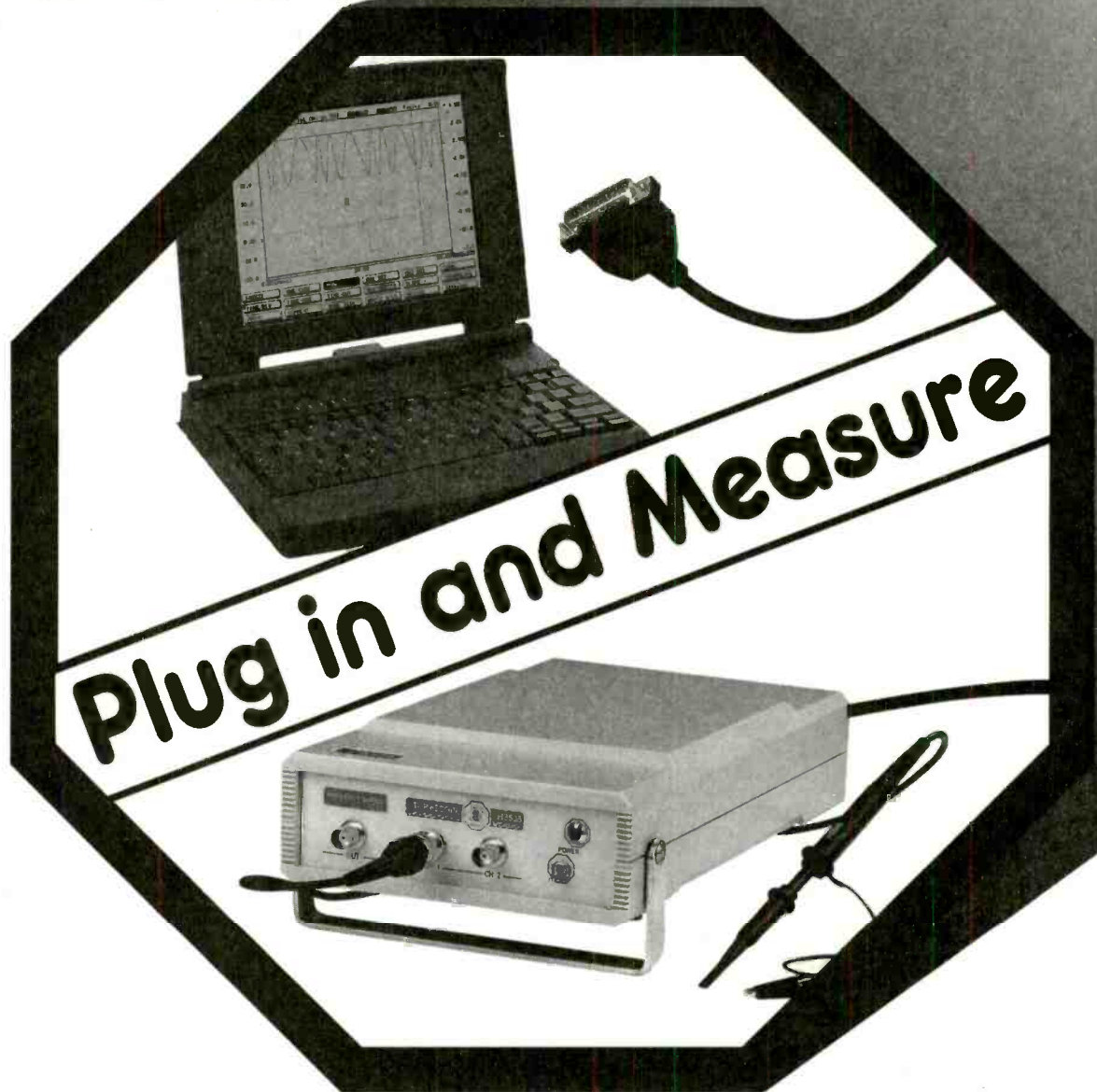
250 H x 300 V resolution. Focus adjustable eyepiece.

Applications include camcorder viewfinder, helmet mounted display, etc...

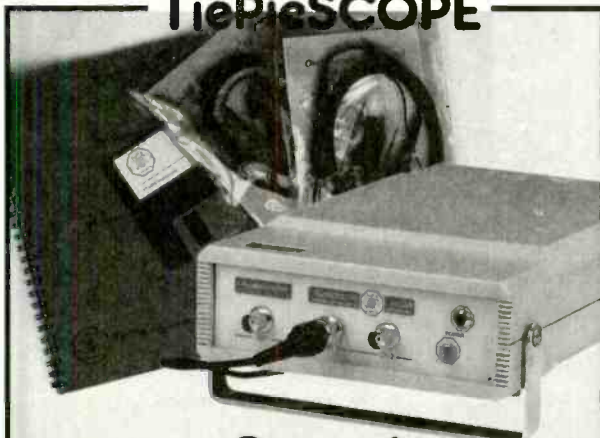
Original cost over \$600.00

Minimum Order: \$20.00. Minimum shipping and handling charge \$5.00. We accept cashiers checks, MC or VISA. No personal checks or COD's. CA residents add 8.25% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign orders require special handling. Prices subject to change without notice. 20% restocking fee for returned orders.

STOP! Just Take Two Steps to do Your Measurement



TiePieSCOPE



HS508 Complete set for US \$1054

You can simply plug the new TiePieSCOPE - HS508 into the parallel port of your portable or desktop PC. With the advanced software, you can use this two channel, 8 bits, 50 MHz measuring instrument as a fast digital storage oscilloscope, including a lot more features than a single oscilloscope! Moreover, the TiePieSCOPE - HS508 contains a multiple display voltmeter (up to 5 MHz true RMS), a spectrum analyzer with an harmonic distortion meter and a transient recorder for recording a variety of signals.

The TiePieSCOPE - HS508 is supplied complete with user manual, software, and two probes.

Call now for a free demo diskette and our catalog!!
Toll-free: 1-800-626-6929

CONWAY Engineering, Inc.

8393 Capwell Drive, Oakland, California USA 94621-2113
Tel.: 510 568-4028 - Fax: 510 568-1397 BBS Tel.: 510 568-6533
Internet Address: <http://www.crl.com/~conway/>

CIRCLE 310 ON FREE INFORMATION CARD

BRIGAR ELECTRONICS

7-9 ALICE ST.

BINGHAMTON, NY 13904



PHONE (607) 723-3111

FAX (607) 723-5202

E-MAIL BRIGAR2@aol.com

\$30.00 MIN ORDER

SEND FOR FREE CATALOGUE

SERVING: • INDUSTRY • SCHOOLS • HOBBYISTS • EXPERIMENTERS • CONSUMERS

OPEN: MONDAY THRU FRIDAY 7:30 AM TO 4:30 PM, SATURDAY 7:30 AM TO NOON



CREDIT CARD DISCOUNT
 \$ 0.00 - \$99.99 NET
 \$100.00 - 249.99 Less 10%
 \$250.00 - 499.99 Less 15%
 \$500.00 - 999.99 Less 20%

Answering Machine Code-a-phone #1750
 FEATURES: *One touch play back *Ring delay(1,2,3,4) *Auto out going message check *Variable out going message *Built in cassette *No call disconnect *Voice-activated recording *Led message display *Fast forward,rewind,pause & rr (Removed from service good cond.)
 Original COST \$179.00
 COMMERCIAL Quality

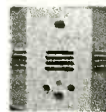
SALE PRICE \$7.95



ULTRASONIC LIGHT SWITCH
 Motion Sensing Automatic SWITCH
 Replaces existing wall switch - operates from 120vac power. 750W max. load. Great for home alarm systems or controlling lights & small appliances. Adjustable time & sensitivity, on-off switch - led trip indicator - Color: White

Size: 5"w x 5"h x 1-3/8"d - Energy Savings 30 to 60%

PRICE \$12.95 EA.
5 FOR \$60.00



HI VOLUME FAN - 115 VAC
NIDEC-TORIN TA600S
 .250/20 AMP 3200 RPM
 IMPEDANCE PROTECTED.
 50/60 HZ - MODEL # A32060-10
 SIZE: 6.25"DIA. X 1 1/2"THICK
 BRAND NEW FACTORY BOXED.

PRICE... \$14.95 EA.
5 for \$60.00



3M STATIC CONTROL FLOOR & TABLE MATS
 8200 series - 2 ft. X 5 ft
 3 LAYER CONSTRUCTION
 COLOR BROWN
 SPECIAL ... \$25.00



ROHM # SLR47VR3F
 RED LED T 1-3/4
 5MM DIFFUSED LED
 100 PCS. @ 10¢ EA.
 500 PCS. @ 7¢ EA.
 1000 PCS. @ 5¢ EA.



STEPPING MOTOR - AIRPAX
 100 STEPS/REV. = 3.6 Step angle
 *bi polar wound-
 bi-directional *2 PH
 *Torque 75 oz/in
 *SIZE: 1.5"SQ X 1 3/8"H
 *3.2VDC *6.8AMP \$2.25



HE381

Power Products
 Linear power supply module
 Input: 115VAC 50/60 271 ma
 OUTPUT: 5VDC 5000 ma
 PRICE .. \$20.00



CMOS EPROM #NMC27C256Q-200
 28 PIN DIP 256K (32 X 8)
 SPEED 200 NS
 LIST PRICE \$5.00

BRIGAR PRICE.. \$1.75



CURTIS INDUSTRIES #F1200AA20
 10 AMP 250VAC - 20AMP 115VAC
 50/60HZ-size: 2"w x 2 1/2"l x 1 1/2"h
 .250" QUICK Conn.
 Brand new
 factory Boxed
BRIGAR SALE
 PRICE \$3.50



TELEDYNE SOLID STATE RELAY
PART # 615-9500

CONTROL VOLTS: 3-32VDC
 RATED: 10AMP @ 250VAC
 50/60HZ -
 OPTO ISOLATED - SPST
 Connection: screw or quick Connects
 PRICE... 1 - 99 PCS. 100 PCS - UP
 \$ 10.95 \$ 9.95



Pheonix Contact # CM62-PS-120AC/24
 Linear Regulated compact power Supply
 Input: 120vac
 Output: 24vdc 1amp
 fuse & overload prot.
 UL & CSA APPR.
 Slide mountable.
 Size: 3"w x 5 1/2"h x 2 1/2"
 PRICE... \$49.95 EA.

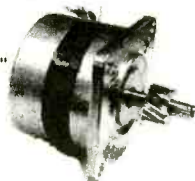


SMITH CORONA #S-67181
 External CHARGER -Wall Transformer
 Input: 120v 60hz 12w
 Output: 9vdc 3.6w
 .4amp
 6' zip cord with 2.5mm male plug
 2 blade input
 UL listed.
 PRICE ... \$2.25



ASTROSYN MINIANGLE Stepper Motor
#23LQ-C202-01H

*144 STEPS *30 oz in. Hold torque
 *BI POLAR - 2 PHASE
 *4 WIRE *1.9 Vdc/PHASE
 * 0.75 AMP/PHASE
 *WEIGHT 3/4 LB
 * SIZE: 1-1/2"H X 2-1/4"
 *Mounting plate 2-1/4"
SPECIAL SALE..



... \$6.95 EA.

ROTRON - TARZAN FAN # TN3A2
 HIGH VOLUME FAN - 350 CFM
 *SIZE: 7"SQ. X 4-11/32"Deep
 *Weight 5 lb.
 *115vac 50/60 hz
 *85 watt - 1.55amp
 *Ball bearing
 *3300 rpm
 *5 blade impeller
 great for electronic cabinets & chassis
BRAND NEW..



\$49.95

GRAY FLAT RIBBON CABLE
#YP3301 50 COND. 28 AWG (7/36)
 .010" Thick pvc insul. 300V - 105 °c
 awm style 2651 mil-c-49055/1-13a
 ul approved .050 Cond. Spacing
 black polarity stripe. Will terminate to any standard idc connector -2.5"Wide
 Brand New Factory Boxed.
 300 FT. REEL ... \$69.00

EXTRUDED GRAY
 UL STYLE 2651 (100 °C, 300V)



Get the best, most accurate diagnostics for problem PCs...

Low-Level Formats IDE Drives!



Compatible with any PC & Operating System!



Call Now for Information on Special Pricing:
1-800-864-8008

Or Fax (818) 547-0397



1100 East Broadway, Suite 301, Glendale, California
Phone 818/547-0125 • Fax 818/547-0397

Web Page: <http://www.micro2000.com>

International Orders please call:

Micro 2000 Australia.....61-42-574-144
Micro 2000 UK.....44-462-483-483
Micro 2000 Amsterdam31-206-384-433

CIRCLE 224 ON FREE INFORMATION CARD

New Releases:

Call about our Tutorial
and Troubleshooting
Series on video cassettes!
A wealth of technical
help at your fingertips.



Micro-Scope 6.1

UNIVERSAL DIAGNOSTIC SOFTWARE



Fully O/S independent
diagnostic software...

Call for upgrade pricing &
complete new features list!

MICRO-SCOPE Universal Computer Diagnostics was developed to satisfy the expanding need for accurate system diagnosis in the rapidly growing desktop computer market. Patterned after super-mini and mainframe diagnostic routines, **MICRO-SCOPE** runs independently of any standard operating system, and is therefore at home on any machine in the Intel world. Speed, ease-of-use, and razor sharp **ACCURACY** are a few of the advantages that arise from this system independence. **Jerry Pournelle** awarded **MICRO-SCOPE** & **POST-PROBE** the User's Choice Award in the May 1994 issue of Byte Magazine, saying: "You name it, this tests it. If you maintain PCs you'll love it."

- ◆ **LOW-LEVEL FORMAT**—Performs Low-level format on all drive types including IDE drives. This function cannot hurt IDE drives.
- ◆ **TRUE HARDWARE DIAGNOSTICS**—Accurate testing of CPU, IRQ's, DMA's, memory, hard drives, floppy drives, video cards, etc.
- ◆ **IRQ CHECK**—Talks directly to hardware and shows I/O address and IRQ of devices that respond.
- ◆ **O/S INDEPENDENT**—Does not rely on O/S for diagnostics. Talks to PC on hardware level. All tests are full function regardless of O/S (i.e. Windows, Novell, UNIX, OS/2).
- ◆ **IRQ DISPLAY**—Show bits enabled in IRQ chip for finding cards that are software driven (Network, Tape Backup, etc.).
- ◆ **MEMORY EXAMINE**—Displays any physical bit of memory under 1 Meg. Very useful for determining memory conflicts and available memory space.
- ◆ **AND MUCH MORE...**—We don't have enough space here for everything this software can do!

Post-Probe

First Ever Universal P.O.S.T. Card for All PCs!

Use this Power-On Self-Test card to debug
any "dead" PC that won't boot...

"This is the only card that will function in every system on the market. The documentation is extensive, and not only covers the expected POST Codes for different BIOS versions, but also includes a detailed reference to the bus signals monitored by the card." —**Scott Mueller** from his globally recognized book, *Upgrading & Repairing PCs, Second Edition*

- ◆ Includes pads for voltmeter to attach for actual voltage testing under load.
- ◆ 4 LEDs monitor +5vdc -5vdc +12vdc -12vdc.
- ◆ Monitors Hi & Lo clock and OSC cycles to distinguish between clock chip or crystal failure.
- ◆ Monitors I/O Write and I/O Read to distinguish between write and read errors.
- ◆ Accurately monitors progress of POST for computers *without* POST codes.
- ◆ Reads POST codes from any IBM or compatible that emits POST codes. ISA/EISA/MCA.
- ◆ Compatible with Micro Channel computers.
- ◆ Dip switch allows easy selection of I/O ports to read.
- ◆ Includes tri-state **LOGIC PROBE** to determine actual chip failures.
- ◆ Manual includes chip layouts and detailed POST procedures for all major BIOS's.
- ◆ **AND MUCH MORE...** call for more details.



Govt. Serv. #: GS-00K-94AGS-5396

**MICRO
2000**

CALL TOLL FREE
(800) 292-7711
Se Habla Español

C&S SALES
EXCELLENCE IN SERVICE

WRITE FOR A
FREE 60 PAGE
CATALOG!



M-6000

Features:

- Computer Interface and Software with RS-232 Output
- Frequency to 4MHz
- Capacitance to 40nF
- Large 3 3/4 LCD display
- Temperature to 1999°F
- TTL logic
- Data/Peak hold
- Audible continuity
- Auto power off
- Unit indicator
- Diode Test

\$99.95

NEW!

TK-3000

\$89.95

Tools Included:

- SR-2 - Deluxe Soldering Iron
- SH-1 - Soldering Iron Stand
- ST-1 - Diagonal Pliers
- ST-2 - Long Nose Pliers
- ST-30 - Deluxe Wire Stripper
- SE-1 - Solder Ease Kit
- ND-3 - 3 pc. Nut Driver Set
- TL-8 - Precision Screw Drivers
- ST-5 - Screw Driver Slotted 3/16"
- ST-6 - Screw Driver #1 Phillips
- ET-10 - IC Puller
- SP-2 - Solder Pump
- ST-20 - Safety Goggles
- ST-9 - Pocket Screw Driver
- ST-4 - Solder Tube
- SW-3 - Solder Wick



NEW!

A professional technician service tool kit in a metal reinforced tool case with heavy-duty handle and locks. A removable pallet handles most of the tools listed with more room for tools and parts in the lower half.

2MHz Function Generator

Model 4010

- Sine, Square, Triangle, Pulse and Ramp output
- Variable duty cycle

\$195.95



MX-9300 Four Functions in One

- One Instrument with four test and measuring systems:
 1.3GHz Frequency Counter • 2MHz Sweep Function Generator
 Digital Multimeter • Digital Triple Power Supply
 (0-30V @ 3A, 15V @ 1A, 5V @ 2A)

\$479.95

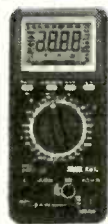


NEW

Model XP-581

- 4 Fully Regulated DC Power Supplies in One Unit
- 4 DC voltages: 3 fixed - +5V @ 3A, +12V @ 1A, -12V @ 1A
 1 Variable - 2.5 - 20V @ 2A

\$85



Digital Multimeter
Model EDM-83B

\$169

- 18 Functions including freq to 20MHz, cap to 40µF, inductance to 40H, True RMS, Data Hold/min./max./avg., TTL logic.

Digital Multimeter
Model M-1700

\$42.95

- 11 functions including freq to 20MHz, cap to 20µF. Meets UL-1244 safety specs.



Fluke Multimeters

70 Series

- Model 7011 ... \$69.95
- Model 7311 ... \$97.50
- Model 7511 ... \$135.00
- Model 7711 ... \$154.95
- Model 7911 ... \$175.00

80 Series

- Model 83 ... \$235
- Model 85 ... \$269
- Model 87 ... \$289

B&K Precision Multimeters

- Model 391 ... \$149
- Model 388A ... \$99
- Model 390 ... \$139
- Model 2707 ... \$79
- Model 389 ... \$109
- Model 2860A ... \$85

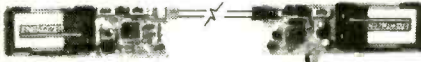
Kit Corner

over 100 kits available

PT-223K

\$15.95

Phone kit with training course.



Fiber Optics Technology
 with training course
Model FO-30K

\$19.95

Model AM/FM-108K
Transistor Radio Kit

\$29.95



M-1005K
 Compact Multimeter Kit

\$19.95

- 6 Functions & Transistor Test



XK-550 Digital / Analog Trainer

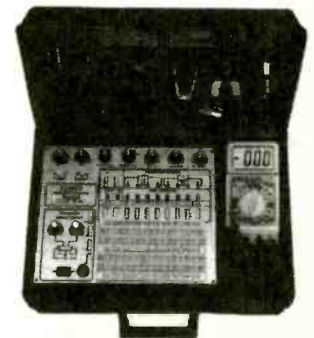
Elenco's advanced designed Digital / Analog Trainer is specially designed for school projects. It is built on a single PC board for maximum reliability. It includes 5 built-in power supplies, a function generator with continuously sine, triangular and square wave forms. 1560 tie point breadboard area.

XK-550
Assembled and Tested

\$169.95

XK-550K - Kit
\$139.95

Tools and meter shown optional



WE WILL NOT BE UNDERSOLD

C&S SALES, INC.

15 DAY MONEY BACK GUARANTEE

UPS SHIPPING: 48 STATES 5%
 OTHERS CALL (\$5 min. / \$15 max.)
 IL RES. 8% TAX

150 W. CARPENTER AVENUE
 WHEELING, IL 60090
 FAX: (847) 541-9904 (847) 541-0710



FULL FACTORY WARRANTY
 PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CIRCLE 218 ON FREE INFORMATION CARD

**FREE PROBES
WITH ALL
SCOPES**

OSCILLOSCOPES

Lowest Prices of the Year!

**WRITE FOR A
FREE 60 PAGE
CATALOG!**

Japan Quality
But not Japan Prices!
Hitachi
Laptop Color
Digital Scopes

NEW! **NEW!**



150MHz 60MS/s VC-5460 \$3695
60MHz 30MS/s VC-5430 \$2695
20MHz 15MS/s VC-5410 \$1795

100MHz

VC-6145 - Storage
4 Channel 100MS/s ... **\$4795**
VC-6155 - Storage 100MS/s \$3995
VC-6545 - Storage 40MS/s \$2995
V-1585 - 4 Channel \$2095
V-1565 w/ Cursors \$1795
V-1560 \$1595

50/60MHz

VC-6525 - Storage 20MS/s \$2795
VC-6524 - Storage 20MS/s \$2295
V-695 - 60MHz w/ Cursors \$1549
V-555 - w/ Cursors \$1095
V-552 \$949
V-509 - Battery Operated . \$1795

20MHz

VC-5025A - 20MS/s
DSO w/ DMM **\$1160**
VC-5025 - 20MS/s
DSO w/ DMM **\$935**
VC-6523 - Storage 20MS/s \$1995
V-252 \$449
V-209 - Battery Operated . \$1425

Quality Scopes by Elenco



60MHz

DS-603 \$1350

- Analog / Digital Storage
 - 20MS/s Sampling Rate
- S-1365 \$795**

• Analog w/ Cursors

S-1360 \$759

- Analog with Delayed Sweep



40MHz

S-1345 \$569

- Analog with Delayed Sweep

S-1340 \$489

- Analog

25/30MHz

DS-303 \$1095

- Analog / Digital Storage

S-1330 \$439

- 25MHz Analog
- Delayed Sweep

S-1325 \$335

- 25MHz Analog

**2 Year
Warranty**

OSCILLOSCOPE SELECTION CHART

ANALOG		Sensitivity (max)	No. of Channels	Sweep Rate Max ns/div	Delayed Sweep	Video Sync	Component Tester	Beam Find	Time Base
Model	Bandwidth MHz								
S-1385	60	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1360	60	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1345	40	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1340	40	1mV/div	2	10ns/div	No	Yes	No	No	1
S-1330	25	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1325	25	1mV/div	2	10ns/div	No	Yes	No	No	1

DIGITAL STORAGE		Analog Sen (max)	No. of Channels	Sampling Rate	Memory Channel	Internally Backed Up	Pretrigger %	Output
Model	Bandwidth MHz							
DS-303	30	1mV/div	2	20MS/S	2K	Yes	0, 25, 50, 75	RS232
DS-603	60	1mV/div	2	20MS/S	2K	Yes	0, 25, 50, 75	RS232

B&K Precision at Discount Prices

20MHz Analog

2120 - **\$389.95**

2125 - **\$539.95**

Delayed Sweep



Model 1541C

40MHz

\$695

Dual Trace

Model 2160

60MHz Dual Trace

\$949

Dual Time Base • Delayed Sweep

**60MHz with
Cursors readouts
and Dual Time Base**

Model 2260

\$1225

Model 2190A

100MHz 3 Channel

\$1379

Dual Time Base • Delayed Sweep

Fluke Scopemeters



91 **\$1225**

92 **\$1525**

96 **\$1795**

97 **\$1795**

97A **\$2945**

99 **\$2095**

Call or write for
complete specs.

WE WILL NOT BE UNDERSOLD

C&S SALES, INC.

150 W. CARPENTER AVENUE
WHEELING, IL 60090

FAX: (847) 541-9904 (847) 541-0710

CIRCLE 218 ON FREE INFORMATION CARD

**15 DAY MONEY BACK
GUARANTEE**

FULL FACTORY WARRANTY

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

UPS SHIPPING: 48 STATES 5%
OTHERS CALL (\$5 min. / \$15 max.)
IL RES. 8% TAX

July 1996, Electronics Now



- PRODUCT ENGINEERING
- FIRMWARE DEVELOPMENT

"QUALITY IS OUR CAPITAL CONCERN."

Complete On Site Electrical Engineering Lab

- REVERSE ENGINEERING
- RF CIRCUIT DESIGN & MANUFACTURING

• MICRO CONTROLLER & EPROM HARDWARE & SOFTWARE DEVELOPMENT

From Auto-Routing to CNC Routing to Electronic Assemblies...
Capital Electronics is Your Best Route For Printed Circuit Boards.

DESIGN/LAYOUT

- CAD LAYOUT SERVICES
- COMPATIBLE WITH ALMOST ALL CAD SYSTEMS
- FROM SCHEMATICS OR SAMPLE PCB'S
- PHOTOPLOTTING SERVICES
- 28,800 BAUDE MODEM

PRINTED CIRCUIT BOARDS

- SINGLE & DOUBLE SIDED
- MULTI-LAYER & FLEXIBLE PCB'S
- FROM QUICK TURN PROTOTYPES TO SCHEDULED PRODUCTION RUNS
- FINE LINES, SMT
- ELECTRICAL TESTING
- PRECIOUS METAL PLATING

ASSEMBLY SERVICES

- FAST TURN BOARD STUFFING
- WIRE HARNESES
- WAVE SOLDERING
- ACQUISITION OF PARTS
- FINAL TESTING
- TURNKEY SERVICES
- CUSTOM ENCLOSURES

For Quick & Competitive Pricing or More Information, Please Call Us Today!

852 Foster Avenue • Bensenville, IL 60106

(708) 350-9510

Fax (708) 350-9760 • Modem (708) 350-9761

Internet Access:

For Automated Info Response:
INFO@capital-elec.com

E-Mail: Quote@capital-elec.com

Web Access: <http://www.capital-elec.com>

CIRCLE 332 ON FREE INFORMATION CARD

EPROM+ PROGRAMMING SYSTEM USES PARALLEL PORT

EPROMS (24, 28, 32 & 40* PIN PLUS 27CXXX)
1702, 2708, 16, 32, 32A, 64, 64A, 128, 128A, 256, 512
513, 011, 010, 101, 301, 1000, 1001, 1024, 210, 020
2000, 2001, 220, 240, 2048, 4001, 4002, 040, 080, 8001
2516, 32, 64, 68764, TMS2716

FLASH EPROMS
28F256, 512, 010, 020 PLUS 29CXXX, 29FXXX

EEPROMS & NVRAMS (PLUS CXXX)
2804, 16, 16A, 17, 2864, 64A, 65, 28256, 28C010
X2210, X2212, DS1220, 1223, 1230

SERIAL EEPROMS* (8 PIN PLUS CXX)
2401, 02, 04, 08, 16, 32, 65, 2444, 59C11, 8572, 82, 92
9306, 46, 56, 66, 16811, 911, 80011A, ER1400/58657

BIPOLAR PROMS* (16 THROUGH 24 PIN)
74SXXX AND 82SXXX FAMILY

MICROCONTROLLERS* (UV, EE AND FLASH)
8741, 42, 48, 49, 8751, 87C51, 8752, C52, 87C5XXX
87C75X, 89C51, 52, 68705, 68HC705, 68HC711E9
PIC16C5X, PIC16C6X, PIC16C7X, PIC16C8X

SUPPORTS OVER 600 CHIPS



* ADAPTER REQUIRED - ASSEMBLED ADAPTERS AVAILABLE / DETAILED DIAGRAMS INCLUDED

- SOFTWARE - READ, VERIFY, PROGRAM, COPY, DISK FILE LOAD & SAVE, CHECKSUM, PLUS A FULL SCREEN BUFFER EDITOR WITH 20 COMMANDS
- READS INTEL HEX, MOTOROLA S-RECORD AND BINARY FILES
- FAST! - MANY DEVICES PROGRAM IN UNDER 10 SECONDS
- RUGGED (9" X 6" X 3"), PORTABLE ENCLOSURE WITH CARRY HANDLE DESIGNED FOR BENCH AND FIELD SERVICE.
- ACCESSORY CONNECTOR FOR FUTURE EXPANSION
- LED INDICATORS SHOW POWER, PROGRAMMING & SYSTEM STATUS
- MADE IN THE USA - 30 DAY MONEY BACK GUARANTEE - 1 YR WARRANTY
- SYSTEM INCLUDES: PROGRAMMING UNIT, POWER PACK, CABLE PRINTED MANUAL AND SOFTWARE

ANDROMEDA RESEARCH
P.O. BOX 222
MILFORD, OHIO 45150
(513) 831-9708
FAX (513) 831-7562

\$289



ADD \$5.00 SHIPPING - \$5.00 C.O.D.

WE SELL RED, BLUE-GREEN & IR

LASERS

HUNDREDS OF UNITS TO CHOOSE FROM!
PRICES AS LOW AS \$40.00!

- Experiments
- Laser Light Shows
- Cutting & Burning
- Communications

We also carry books and plans about LASERS.

CALL FOR FREE CATALOG!
TEL (909) 278-0563
FAX (909) 278-4887



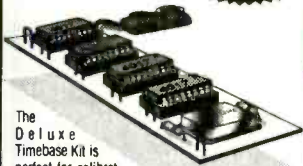
1269 W. Pomona, Corona, California 91720

See our catalog on the internet.

HTTP://WWW.PWEB.COM/MWK/MAIN.HTM
EMAIL: MKENNY1989@AOL.COM

DELUXE TIMEBASE KIT

SALE

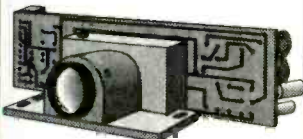


The Deluxe Timebase Kit is perfect for calibrating instruments, studying various instruments, viewing waveforms on an oscilloscope, etc. Features 5 separate outputs: 1MHz, 100KHz, 10KHz, 1KHz, and 100Hz. Uses a precision 1MHz crystal controlled oscillator and 4 CMOS ICs to divide the frequencies down to the lower frequencies. Very stable and precise. Operates from a 9V battery (not included). Size of PC board: 1 5/8" x 3 5/8". Complete with all parts, PC board and instructions. Skill level 2.

G6717 \$6.95

SUPER FAX

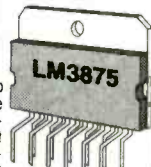
"EYES & BRAINS"



These are the "eyes and brains" of a fax machine. Consists of a small lens coupled to a circuit board containing the popular NEC UPD 794D or NEC 7990 charge couple optical scanning IC, resistors, capacitors, etc. We don't have the specs or schematics but for anyone building, repairing or experimenting with fax or optical scanning these are a must. Size about 1 5/8" W x 5 1/2" L x 2 3/4" thick. Sold as is only because these may have a damaged part or two.

G7317 \$6.95

100 WATT AUDIO POWER AMPLIFIER IC LM3875



High performance audio power amplifier IC capable of delivering 100 watts instantaneous peak output power or 40 watts continuously into an 8Ω speaker 20Hz-20KHz. Specs: signal-to-noise ratio - 95db(min), output short to ground protection, supply voltage min. - 20VDC, max. - 84VDC, thermal protection, spike protection. Great for stereo speakers, surround sound amplifiers, etc. TRA11B, 11 pin power package. Prime with specs and simple application circuit diagram.

G6943 \$4.50

CABLE READY PLUS™

SALE



Back panel

These were made to restore the VCR features you like to use that your cable box takes away. Allows you to record a selected station tuned in on the cable box while watching a completely different one from your VCR tuner. Also restores PIP on TV's that have this feature!

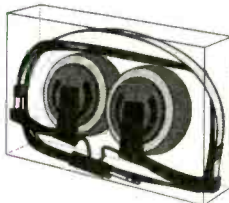
We made a special closeout purchase of these units from the manufacturer as they will no longer offer this item (due to the fact that a few cable companies are scrambling the channels which prevents this device from working in some areas of the country). Because of this fact some of these may have been customer returns, however, they are like new and come with all accessories, and instruction manual in an attractive retail package!

Even if your cable company is scrambling the signal you'll want to own one of these as they have a very sleek black (6 5/8" x 5 1/8" x 1 3/8") metal and plastic case which can be used in making your own professional looking projects and has a built-in video amp with various electronic parts. Features a power on/off switch with red LED power on indicator, two 3' F to F cables, two 6' RCA to RCA cables, and an AC adapter.

Original Value \$129.95

Now Only \$8.95 ~~\$14.95!~~

FOLDING STEREO HEADPHONES



Compact high quality headphones fold for storage inside a standard size cassette case. Made by Gemini, these are not only comfortable but also have an excellent response: 20-20,000Hz, 90dB @ 1KHz. Weight of headphones only 1.5oz. Brand new in retail blister card.

G7018 \$3.95

PHONE ORDERS (602) 451-7454

IF YOU CAN'T FIND WHAT YOU ARE LOOKING FOR, CALL FOR A FREE COPY OF OUR LATEST CATALOG. THIS CATALOG CONTAINS OUR ENTIRE PRODUCT LINE OF ALMOST 4,000 ITEMS AND IT IS STILL GROWING!

AMPLIFIED FM ANTENNA

NEW ITEM!

Bring in those hard to receive FM stations with this attractive sleek design amplified FM antenna. Type FM600 by Gemini. High quality, brand new unit in manufacturer's box features gain control and AC adaptor with instructions. Blowout Price!

G7170 \$16.95

SUPER LED ASSORTMENT



YOU GET LEDs IN THESE COLORS:

- RED
- ORANGE
- YELLOW
- &
- GREEN

Assortment of all types, colors, sizes and shapes of prime quality LEDs. Our largest and most spectacular assortment contains 250 pieces.

G7436 \$10.00

ANTISTATIC MAT



NEW ITEM!

Brand new beige colored antistatic mat. Has convenient snap attachment on left or right side of mat plus flexible coiled cord with clip to attach to your wrist strap. Great for use when changing out hard drives, working with computers, static sensitive ICs, etc. You get a 11.5" x 22" mat with 2 built-in snaps and a snap-on coiled cord with clip.

G7171 \$8.95

FREE! FREE!

CALL NOW!



Send for your free copy of our latest catalog containing about 4,000 of some of the best electronic bargains available! We have one of the largest selections of electronic parts, SMD components, scientific and hobby items. Send or call for your free copy today! **NOTE: All foreign catalog requests (except for Canada must include \$3.00 shipping & handling for catalog).**

SECRET ALERT ALARM



Hide this attractive small size alarm in briefcases, medicine chests, drawers, cabinets, etc. and it will silently "stand guard". As soon as someone opens the briefcase drawer, cabinet, etc. it will start sounding a loud beeping sound. Operates on one 9V battery (not included) and uses a light sensitive IC circuit with built-in arming delay. The arming delay allows you 5 seconds to put the unit in a dark place after you arm it. Then, as soon as light strikes it (from someone opening the cabinet door etc.) the alarm sounds until it's once again in the dark. Great for warning you of intrusions into areas that children and intruders should stay out of. These have a Velcro™ peel and stick piece on the back of each unit, that allows you to securely hold the unit to the back of a cabinet. Although these alarms are new, they were manufactured several years ago and the adhesive on the double stick velcro surface has dried out on the G6948 units which means on those units you'll have to use glue on the adhesive sides of the velcro if you wish to mount them (mounting is totally optional). The G6949 do not have this problem. Both types are electrically perfect it's only the velcro adhesive problem. Red plastic case is approximately 3" x 2 1/2" x 7/8".

G6948 (Bad Adhesive) \$2.00
G6949 (Good Adhesive) \$2.49

LASER LIKE LEDS

One of our brightest clear case jumbo T1 3/4 red LED produces a brilliant red output.

G6167 4/\$1.00

MISSILE/ARTILERY NOSE CONE



UNIQUE ITEM!

We are not sure what these are from, perhaps a Howitzer shell or some military missile. What we do know is that they are brand new, hollow and made out of what we believe is spun aluminum that has been polished. They are precision made and have an inner threaded base with 4 small gripper points on the outside of the nose cone to tighten it onto the body of the missile. The overall size of nose cone is about 6 1/4" tall x 3 1/4" dia. at base. Brand new but may have some tarnish from being stored (just polish them up). Great conversation piece.

G7172 \$8.00 ea. 4/\$30.00

GIANT SMD ASSORTMENT



OVER 1,000 PIECES!!

Our largest assortment of tiny SMD parts. You'll find prime LEDs, ceramic capacitors, resistors, transistors, diodes, tantalum capacitors, inductors, etc. in every package. Great way to stock up your parts bins at less than 1 1/2¢ a part! Over 1,000 pieces in a 2" x 3" zip close bag! **NOTE: Many SMD parts are so tiny that the manufacturer does not mark them, however, every part in this assortment is 100% prime and perfect. Do a little detective work and save over a hundred dollars!**

G7128 \$15.00

NOTE: All sale prices advertised are valid only through the month of the cover date.

For Phone Orders Call (602) 451-7454 or Fax Your Orders to (602) 451-9495

ELECTRONIC GOLDMINE

Minimum Order: \$10.00 (plus \$5.00 Shipping and Handling). We accept MasterCard, Visa and personal checks, however, we cannot accept personal checks on orders outside the United States. Canadians and orders that need US MAIL send minimum \$5.00 S&H. **Minimum Foreign Order Amount: \$50.00 (plus shipping and handling).**

ELECTRONIC GOLDMINE
PO Box 5408
Scottsdale, AZ 85261

CIRCLE 241 ON FREE INFORMATION CARD

Toronto Surplus & Scientific Inc

608 Gordon Baker Rd. Willowdale,
Ontario Canada zip: M2H-3B4
TEL: (416) 490-8865



OFFICE: (905) 887-0007 FAX: (905) 887-0006

*****SHIPPING IS NOT INCLUDED IN THESE PRICES, PLEASE CALL FOR RATES*****

WALLACE & TIERNAN
PRECISION PRESSURE
GAUGE



0-10 inches of WATER (new)
Super nice, finest made. \$85.00ea

RF COAXIAL SWITCH
TNC Connectors (NEW)
\$24.00



SIMPSON 635 VOM



Used but good condition, not tested with case: \$35.00

NEVER USED PRC-66
BATTERIES

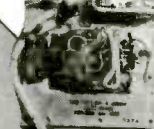


Contains 80 Energizer "AA" Alkaline cells
\$10.00ea

MINIATURE TAUGHT-BAND RATE
GYRO (NEW) \$20.00



ARC 116 UHF
POWER



AMPLIFIER (NEW)
\$75.00



CANON C-mount TV
zoom lens



(15-150mm) F1.2,8
\$68.00 each

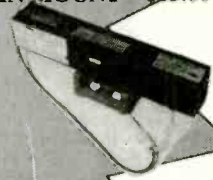
HIGH VOLTAGE
VACUUM CAPACITORS
\$20.00ea



GIBSON GIRL emergency
transmitting set AN/CRT-3
COMPLETE UNIT \$145.00



5 Mw LASER TUBE
IN MOUNT \$65.00



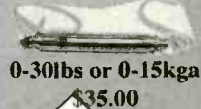
100pf
@ 20kV or 250pf @ 5Kv
Eimac 2-240 Rect Tube
Classic bulb shape
new in box \$17.50ea



RECTIFIER/RELAY
KIT: Motorola rectifier
MR1265FL300V @ 700
AMP (new).
\$22.00



CHATILLON
FISH SCALE



0-30lbs or 0-15kga
\$35.00

EMERGENCY
RUNWAY
LIGHT
\$30.00



HEWLETT PACKARD
8640B SIGNAL GENERATOR

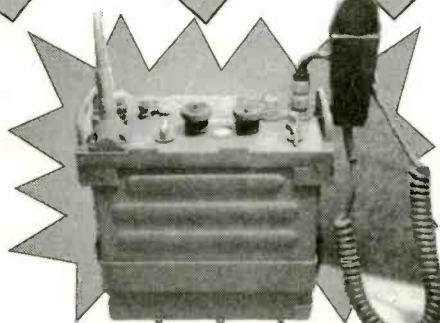
Industry Standard sig-gen 500Khz-512Mhz features internal phase lock/synchronizer and digital freq readout. +19to -145 dBm output. AM,FM,Ext and Pulse modulation.

Price: \$1695.00 OPT 001 add \$100.00
OPT 003 add \$150.00



HEWLETT PACKARD HP3312
SWEEP/FUNCTION GENERATOR

Well designed and easy to use, this function generator combines economy and quality into one compact unit. Freq range is 0.1Hz-13MHz, output into 50 ohms is 10.0Vp-P. Sweep-AM,FM, or tone burst. This unit features-sync. out, trig. phase, symmetry, offset and more. Price: \$935.00 ea. Fully checked.

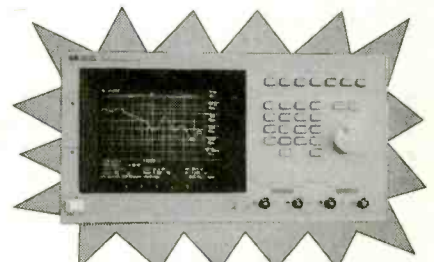


PRC 25 - MILITARY
TACTICAL TRANSCEIVER

Fabulous quality and design are standard in this 30Mhz-75.95 Mhz tactical transceiver. Output power level from 1.1-2 watts 150Hz squelch. The units we just received are reconditioned (newly painted) ready for issue, and include the battery box. Price: \$245.00 We also have PRC-77s available with some accessories. Price: \$495.00

All Prices in U.S. \$
Please include telephone/fax # with mail-in orders. Orders must be prepaid by guaranteed instrument.
Prices do not include shipping.
Please call us if you have any questions

Manuals available at extra cost
CIRCLE 323 ON FREE INFORMATION CARD



HP54111D 500-MHz, 1 GSa/s
DIGITAL COLOR SCOPE

This user friendly oscilloscope features, up to 8 bits of vertical resolution, pretrigger, automatic measurements, HP-IB, up to 2 gigasample capture when used with 54114A, excellent single shot transient signal capture, full trinitron color display programmable any way you like it, Instant print. Uses include:

- *High Energy Physics
- *ECL Design
- *High speed Semiconductor design
- *High Speed Pulse analysis

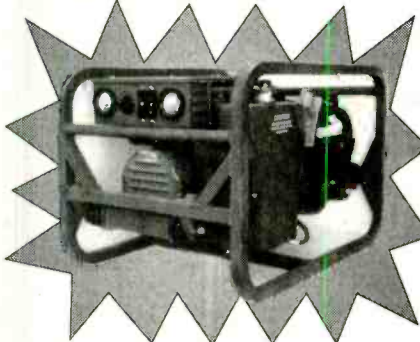
Looks like brand new. Price: \$5,500.00

(No catalog available yet!)



**MARCONI SYNTHESIZED
SIGNAL GENERATOR Model 2018**

Freq range 80KHz-520Mhz with calibrated output levels from -127 dBm to +13dBm. Resolution 10Hz. It can be freq, phase or amplitude modulated from ext or int modulation sources. RF output resolution is 0.1dB, reversepower protection of up to 50W is possible without damage to the instrument. This instrument is microprocessor controlled and very easy to use, a must for any serious repair or development lab. Price : \$1750.00 Checked



**MILITARY STANDARD D.C.
GENERATOR**

Superior QUALITY plus rugged design are features of this deluxe 2 cylinder 4 stroke gasoline generator. The control panel contains meters for voltage & current indication, main circuit breaker and voltage adjustment. Shielded wires and plugs comprise the RFI suppression ignition system eliminating most radio noise. These units are "new" in the original carton complete with operators manual and only require fuel and oil for operation; output voltage is adjustable approx. 10-32v (28v nom) @ 53.3A (1.5Kw) continuous duty load.

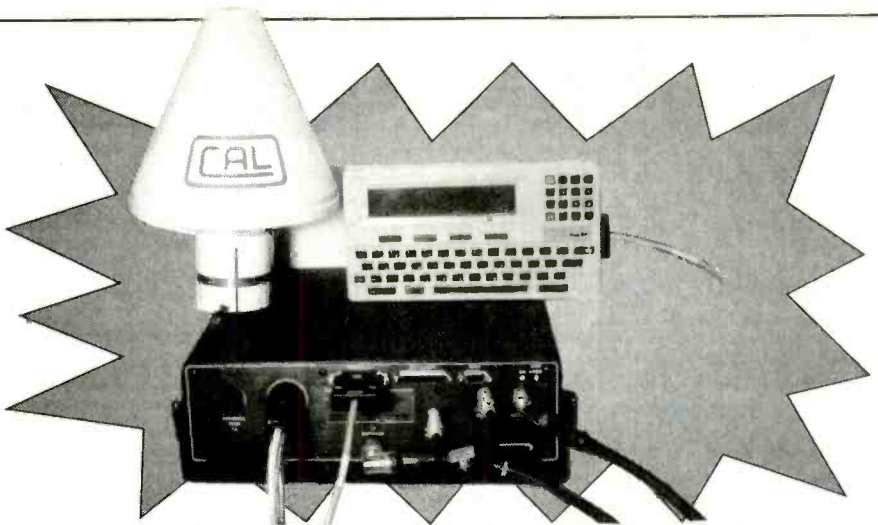
Price: \$379.00 New in Orig. Carton.

You will be impressed!!!

COLLECTOR ALERT - \$39.00
**8-DAY AIRCRAFT
CLOCK**
1-7/8" dial



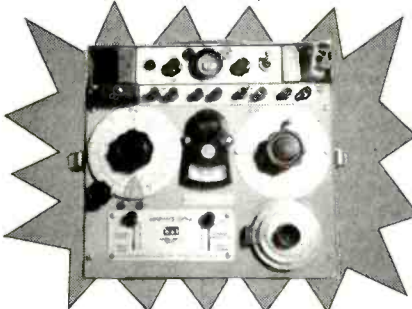
Great collectors item for the ham shack, fifties vintage func/chkd.



**"CAL" ASTRONAUTICS
MOBILE SATELITE
COMMUNICATIONS STATION**

This is a box chock full of "current" high-end communications technology. These units were designed so that mobile land based vehicles could keep in touch (via Geostationary Inmarsat satellite network) with home base using an intellegent data terminal. The terminal features a back-lit 4 line LCD display and illuminated keys; one of the transciever's most impressive features is an "L" Band 1.2-1.55GHz 60 watt amplifier. The fabulous helix antenna (with LNA built-in) is an amazing design with all kinds of active and passive devices surface-mounted on to the antenna reflector. We consider this the "ultimate gadgeteers goodie pack" with all kinds of up-to-date RF satellite ground technology. These systems come complete in their original shipping container with all cables and mounting bracket. Best of all they operate on 12 VDC. Operators manual supplied (but, there isn't any subscriber data).

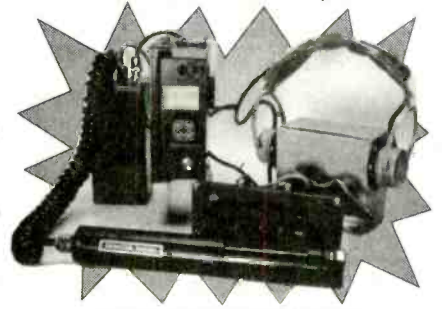
(NOT TESTED) IN GOOD CONDITION.....\$345.00



**ESI MODEL 250 DA
IMPEDANCE BRIDGE**

Resistance range- 0.1 milliohms - 11 megohms, capacitance 0.1pf-1100mf, inductance 0.1 µH to 1100 Hy. Dissipation factor (R/X or D) 0.001 to 1000. Internal oscillator 1 KHz.

Used, not functionally checked.....\$95.00
Functionally checked.....\$165.00



**PDR-63 PORTABLE
RADIAC METER**

This portable radiac set is loaded with all kinds of extras featuring six ranges of sensitivity for both Gamma or Beta radation measurements.

The 1st scale 0-1 rad/hr up to 0-5000 rad/hr. The unit comes supplied with headset & bat/charger. Req's only 4 AA Batteries. Price: \$149.95

-HP 3551A TRANSMISSION TEST SET	\$ 950.00
-HP 3581A WAVE ANALYZER	\$1,295.00
-HP 4260A LCR BRIDGE	\$ 385.00
-HP 4948A IN-SERVICE TIMS (brand new)	\$2,995.00
-HP 5006A SIGNATURE ANALYZER	\$ 350.00
-HP 5315A UNIVERSAL COUNTER (1 GHz)	\$ 675.00
-HP 5411D COLOR DIGITAL STORAGE SCOPE	\$5,500.00
-HP 6472C POWER SUPPLY 0-64V @ 0-150A	\$1,800.00
-HP 8160A OPT-20 PROG PULSE GEN	\$2,995.00
-HP 8505 NETWORK ANALYZER SYSTEM	\$4,980.00
-HP 8558B SPECTRUM ANALYZER .01-1.5GHz	\$2,350.00
-HP 8559A SPEC-ANALYZER .01-22GHz	\$4,995.00
-TEK FG504 FUNCTION GENERATOR (40MHz)	\$ 875.00
-TEK 1502 TDR w/CHART REC	\$2,200.00
-TEK 485 350 MHz OSCILLOSCOPE	\$1195.00

-CROWN MODEL 7560 1KW PWR AMP. DC - 40KHz	\$1,800.00
-DATRON 4000A DC & OHMS CALIBRATOR	\$4,500.00
-WILD RC-8 AERIAL PHOTOGRAPHY CAMERA	\$ 950.00
-ENI MOD 310L 250KHz-110MHz @ 50db GAIN	\$ 565.00
-ENI MOD 406L 150 KHz-250MHz @ 40db GAIN	\$ 650.00
-GOULD 220 CHART RECORDER	\$ 750.00
-GOULD RS 3800 PROGRAMABLE CHART RECORDER/w MOD 5900 SIG CONDITIONER & DC AMPS (NEW)	\$6,500.00
-HI- ENERGY CORP. DISCHARGE CAP. 1µF @ 20KV \$ 300.00 140µF @ 6KV	\$1,000.00
-MARCONI 2018 SYNTHESIZED SIGNAL GENERATOR 80KHz - 520MHz	\$1,750.00
-ROHDE & SCHWARZ SIG GENERATOR 4.484MHz. \$ 750.00	
-WATKINS JOHNSON 8626A-4 with WJ8626-1 & SPN 108 5KHz-30 MHz MIL-SPEC communications receiver	\$3,950.00

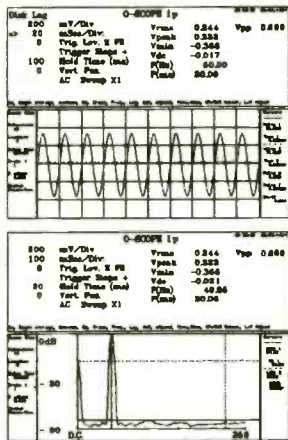
-EATON NM-17/27A EMI FIELD INT. METER	\$1,500.00
-FLUKE 5100A CALIBRATOR	\$3,800.00
-KIKISUI POWER SUPPLY 0-110Voutput @ 60ADC	\$2,500.00
-AM2060 AMPLIFIER FOR PRC 25	\$ 175.00
-BOONTON 82AD AM/FM MOD-METER	\$1,275.00
-COLLINS HF 8054A 4-chan receiver (new in box)	\$3,695.00
-COLLINS 651S-1 RECEIVER	\$1,250.00
-GRT-22 UIIF POWER AMPLIFIER	\$ 200.00
-HARRIS RF280 HF/TACTICAL TRANSCIEVER	\$1,500.00
-R392 RECEIVER 5-30MHz	\$ 165.00
-TI95 100w COMPANION XMTR TO 392	\$ 85.00
-WAVETEK 3001 RF SIG. GENERATOR	\$ 795.00
****ATTENTION DIVERS-GAS DRIVEN COMPRESSORS****	
-BAUER 11CFM 3500 PSI COMPRESSOR SYSTEM	\$3,500.00
-BAUER K14 3500 PSI COMPRESSOR SYSTEM	\$2,750.00

DIGITAL STORAGE OSCILLOSCOPE

WITH SPECTRUM ANALYZER, DVM, FREQ. COUNTER, AND DATA LOGGER.

from **\$189.**

O-SCOPE MODULES CONVERT PC'S INTO MULTIPURPOSE TEST AND MEASURING INSTRUMENTS.



No room on the bench? Too much to carry? Why lug a scope around? Just toss an O-SCOPE into laptop case or tool kit. When you need a Digital Storage Scope, Spectrum Analyzer, Data Logger, or DVM, plug the O-SCOPE into a PC printer port and see it all on the monitor. Continuous, delayed, or triggered sweeps can be frozen on the screen, printed out, or saved to disk. Frequency spectrums DC to 500KHz.

Both single and dual channel models accept standard scope probes and works on 286 or faster desktop and laptops.

FEATURES:

- SMALL & PORTABLE
- USES PRINTER PORT
- USES STD. PROBES
- DC TO 500 KHZ (Oscope II)
- 10v/div. TO 50 mv/div.
- X-Y DISPLAY (Oscope II)

OPTIONS:

- PROBE SETS
- EXTERNAL TRIGGER
- DUAL TRACE
- AUTOMOTIVE PROBES
- BATTERY PACK
- SOFT & HARD CASES

MADE IN U.S.A.

SAME DAY SHIPPING

INCLUDES CABLE, SOFTWARE & MANUALS

O-SCOPE Ip (DC-50KHZ, single trace) \$189.
 O-SCOPE II (DC-500KHZ, dual trace) \$349.
 SHIPPING: \$7.50 (2ND DAY \$11.50)

SEND CREDIT CARD INFO., M.O., or CHECK, OR CALL

1-800-980-9806

Allison Technology Corporation

8343 CARVEL, HOUSTON, TX. 77036 U.S.A.

PHONE: 713-777-0401 FAX: 713-777-4746 BBS: 713-777-4753

<http://www.atcweb.com>

TOP SECRET

CONSUMERTRONICS
 2011 Crescent Dr., P.O. Drawer 837
 Alamogordo, NM 88310

--- Please order by Mail or Fax only ---
Fax: (805)434-0234, 439-1776 (orders only; if you get voice, enter #11811 any time), 24-hr
Customer Service & Tech Support: (805)439-8551 (8AM-6PM MST, Mon-Sat)
 Relates directly to your order or promotional order.

Web Site: Visit our popular site (tell your friends) at: <http://users.aol.com/wlzgru/hl-tech.html>
10% Off on orders \$100+ 15% Off over \$200+
 Add \$5 total SH (US, Canada). All items in stock. Postal M.O. is fastest. **VISA, MC, CC, COD (\$49-9999)**, add \$8. **New Catalog (200+ offers) \$2 w/ order, \$5 w/o (no CC), \$24/foreign. NO dealers.**
 Since 1971. As seen on CBS "60 Minutes," Forbes, et al. By John Williams - former Lockheed Senior Engineer, NMSU CS Professor, DOD Electronic Weapons Engineer, NIH Health Physicist. **Sold for educational purposes only.**
Wanted: 8 MAC II/ix, PC486 (or better), peripherals. New surplus electronic parts, test equipment - buy, trade. All software supports all IBM-PC systems.

Off-the-Shelf HARDWARE

Van Eck Systems*Data Card Reader/Writers*ATM3*Security/Surveillance*RFEM/Wave/Radar/Ultrasonic/IR/Light/Sound Detectors/Receivers/Xmitters/Jammers/Blasters*Neurophone/Rifle/Hieronymus/Resonant Crystal Radionics*EM Lab/Weaponry/Countermeasures*ESS Infinity Devices*Voice Disguisers*Lineman's Hand-sets*Bug/Tap Detector/Blaster*Phone Color Boxes*DTMF Decoders*Carjack/Kidnap Follower/Bumper Beeper/Child Finder*Panic Button*Shriek Module*TENS*Subliminal Mber/Amp (Ultrasonic & Infrasonic)*Electronic Dowzers*Hidden Presence Detectors*Hearing Assistor*Vortex Generator*6th Sense Communicator*Noise Cancel. System*Levitorator - many more! See our New Catalog!

SPECIAL PROJECTS

We design/build/obtain/repair/inmodify/maintain/consult on any device/system/process/project - electronic/computer/mechanical/optical (ex: phone/auto/security/radionics/energy/HVEM/RF/radar/ultrasonic/IR/UV/combo/consumer) for business/personal/invention needs. Describe & include \$30 pre-engineering fee (no obligation). Time & cost estimates 7-10 days. Confidentiality guaranteed.

CELLPHONE MODS

See our Catalog for our infamous cellphone modification guide (\$69) - detailed, comprehensive, covers all makes - 10 times more info than competitor's "guide"! (Do Special Projects above to get up-to-date hardware/software). **Free Data Search:** As a special FREE service to our C&C customers, we will perform one FREE search of our massive cellphone database if requested within 30 days of your purchase of C&C. Data now on cellphones is so great, we can fit in C&C only that in greatest demand. Search results not guaranteed. Request by mail (don't fax); include a #10 SASE.

PAGER (Beeper) MANUAL

Describes in detail how Pagers work, current types and uses, frequencies, advantages over and uses with cell-phones, and tips and tricks. And how Pagers are hacked and countermeasures. Includes the plans for your own **Personal Pocket Paging System** (transmitter and receiver). \$49.

HACKING FAX MACHINES

Describes in detail how Fax machines are hacked and countermeasures (hacking Faxes is much more complex than just connecting a third Fax to the phone line). Includes Fax protocols, commo parameters, and 2:1 and 4:1 compression. And insights into designing Fax interception devices and modifying existing Faxes into Stealth Faxes do the job. \$49.

VOICE MAIL HACKING

How Voice Mail Box (VMB) systems are used and the specific ways they are hacked. Includes ASPEN, MES-SAGE CENTER, BIX, GENESIS, EZ, SYDNEY, PHONE MAIL, AUDIX, CIMOY, CENTAGRAM, SPERRY LINK, RSPV, etc. Absolutely required for all users, sysops and security personnel! \$29.

PBX HACKING

1,000s of PBXs are hacked to the tune of \$ billions/yr! While "VOICE MAIL HACKING" details how VMBs are hacked for "phun" and profit - including VMB methods for hacking PBXs themselves - "PBX HACKING" addresses ALL issues relating to PBX hacking, including countermeasures! Can your business or agency afford a \$30,000 phone fraud loss (the average loss due to hacked PBXs)? As described in Forbes Magazine. \$29

PHREAKING CALLER ID & ANI

Details on how they work and dozens of effective ways of defeating Caller ID, ANI, #9, #87, and Call Blocking and #91. Also describes Caller ID, Drange, Belle, Cheese and CF Boxes, E38, E37, E-911, various CLASS services, CNA, NON PUB GA, CAMA, OHR, 800-ECR, Diverters, Extenders, Centrax, more. \$29.

COMPUTER PHREAKING

Describes in detail how computers penetrate each other, and how VIRUSES, TROJAN HORSES, WORMS, etc are implemented. Dozens of computer crime and abuse methods and countermeasures. Includes disk filled with hacker text files and utilities, and the legendary FLUSHDT+ protection system (Ed. Choice, PC Magazine). BBS advice, password defaults, glossary - much more! Manual + Disk! \$39.

Beyond PHONE COLOR BOXES!

Dozens phone color boxes described - many circuits. Plus Call Forwarding, Conferencing, Plus Military, Glossary, Diverters - Extenders, Loops, REMOBS, Ringing, Beeps & Cans, Optocom, 3rd Party and more! Non-box methods - or a \$39.

HACKING ANSWERING MACHINES

How answering machines are hacked to listen to - even erase - messages, and to condense, Loop, and VMBs. And countermeasures - protect yourself from snoops, stalkers, burglars and pranksters! \$29.

CREDIT CARD SCAMS

Cardholders, merchants, banks suffer \$ Billions in losses annually because of credit card fraud. Describes every known means of credit card fraud and scams - protect yourself! \$29.

AUTOMATIC TELLER MACHINES

ATM crimes, abuses, vulnerabilities and details exposed! 100+ methods detailed, include: Physical, Reg. E, cipher, PIN compromise and pin-bumping, magnetic stripes, false front, TEMPEST, Van Eck, tapping, spoofing, inside job, super-cool, vibration, pulse, high voltage - others. Case histories, lab, countermeasures, detailed security checklists, labeled internal photos, figures. ATMs contain up to \$250,000 in cash! Recent \$350,000 ATM crime - sure still unsolved! \$39.

CONS. SCAMS & SWINDLES

Cons & scams and related swindles fleece Americans of \$100+ Billion per year! The most comprehensive survival manual on cons & scams of all kinds - from the classic to hi-tech. Details on 100s and many variations. And countermeasures. Protect yourself! \$39.

INTERNET CONS & SCAMS

Internet cons, scams and related frauds now rake in \$2+ Billion annually! Most are done anonymously and with little fear of prosecution (difficult to prove and to find the perpetrators). Described in detail, includes countermeasures. \$29.

Beyond VAN ECK PHREAKING

Saves dropping on TV and computer video signals using an ordinary TV described in detail. Includes security industry reports. Range up to 1 KM. Plans include both the Consumertronics and the original Top Secret Van Eck designs! \$29.

The HACKER FILES

Compilation of 15% of the best articles written (in ASCII) by top hackers & phreakers. Covers every major topic in hackerdom! 3 HD Disks! \$59.

STOPPING POWER METERS

As reported on CBS "60 Minutes" - How certain devices can slow down - even stop - without meters - while loads draw full power! Device simply plugs into one outlet and normal loads into other outlets. Also describes meter creep, overload droop, etc. Plans \$29. **Q. MANUAL:** External magnetic ways (applied to the meter itself) to slow down and stop wattour meters while drawing full loads. Plans. \$28. **NEW! HIR METER:** How wattour meters work, calibration, error modes (many), ANSI Standards, etc. Demands and Physics of Meters. Experimental results to slow and stop meters by others. \$28. Any 2, \$47. AN 3, \$89.

UNDER ATTACK!

Electromagnetic Interference and Electronic Weapon Attacks cause: Cancer, birth defects, and profound psychological, neurological, cardiovascular and immune system disorders! Destructive to people, animals, plants, equipment! Includes **ACTUAL CASES OF EM ATTACKS** (we investigated!) Includes how to verify and pinpoint EMI and electronic attack sources, and effective countermeasures. \$29. **EM BRAIN-BLASTER:** Tutorial and plans for powerful **ELECTROMAGNETIC WEAPONS** and **LAB DEVICES**. Optimum circuits, frags, waveforms, duty cycles. Intensities. Thorough. \$29. Both \$49.

MIND CONTROL

Concern and fear increases over EM and ultrasonic mind (and body) control technologies - especially implants! Unfortunately, there is much more misinformation and disinformation published than facts. Some victims are controlled and exploited by arm-chair "experts" and so-called victims' assistance groups - even demands the pulling of the Internet to prevent and remove postings it doesn't approve of! \$39. Visit our site at: <http://users.aol.com/wlzgru/mindcontrol.html>

RADIONICS MANUAL

Exciting electrical, electronic, electromagnetic therapeutic, diagnostic & preventive devices (mostly experimental). History, descriptions, plans (dozens), availabilities of Radionics Devices from early to modern. While drugs cost \$100s, electricity costs pennies! \$29. **HEAL THYSELF:** Plans for 3 major electronic therapeutic devices of types approved by FDA. \$19. Both \$39.

HIGH VOLTAGE DEVICES

HV devices plans: Stun Gun, Taser, Prod, Lina, Extender, Flasher, Zapper, Audio/RF/Radar Jammer, Fence Charger, Plasma & Van de Graaff Guns, Jacob's Ladder, Geiger Counter, Ozon Gun, Fish Stunner, Plant Stim, Kirlian, more! All plans for only \$29.

STEALTH TECHNOLOGY

Police radar is fascinating! It also has error rates of 10-20%! Every known error mode - stealth method and material used to minimize radar reflections - tactic and strategy to fight unjust radar tickets (that cost you \$100s in insurance and risk cancellation) - methods to detect and jam signals - fully described! \$29.

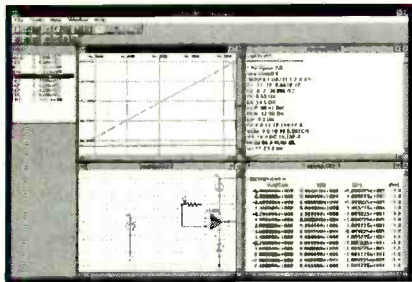
SECRET & SURVIVAL RADIO

Optimum survival and security radio equipment, methods, freq allocations and voice/data scrambling/encoding. Includes small receivers/transmitters, telemetry, antenna optimizations, remote monitoring and control, security, surveillance, and ultrasonic, fiber-optic and infrared commo. 70+ circuit plans, tables. \$29.

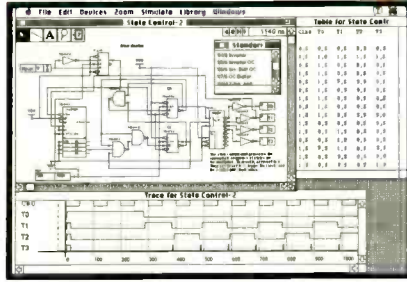
CRYPTANALYSIS TECHNIQUES

Very powerful menu-driven crypto programs (in .COM and .BAS source code) to analyze, decrypt "secure" ciphertexts. Worked-out examples. Recommended by prestigious "Computers & Security" Manual+Disk! \$29.

B² SPICE v 2.0



B² LOGIC v 3.0



for windows™ and macintosh™

B² SPICE v 2.0 \$199

- Simulations: Transient, DC, AC, Noise, Distortion, & More
- Build your own symbols & parts
- Full SPICE 3f5 implementation
- Hundreds of devices
- Device & Model Property Editing
- Flexible Visualization of Results: customized graphs and tables
- Version 2.0 for Windows
- Version 1.1 for Mac & Power Mac

B² Logic v 3.0 \$199

- EDIF File Format Output
- Enhanced PLD Simulation Capture
- Subcircuit Probing
- Over 100 components available

ELECTRONIC DESIGN PACKAGE \$299

- Includes B² SPICE & B² LOGIC

- Demo Disks Available
- University & Student Prices Available
- Site Licenses Available
- Dealer Inquiries Welcome

Why Design Circuits the Hard Way?

B² SPICE and **B² LOGIC** are the most powerful and affordable integrated analog and digital circuit design, simulation, and analysis packages available. B² SPICE and B² LOGIC neatly integrate the schematic editor, simulator, and graphics post processor. They are fully integrated and interactive and are extremely easy to use for **Windows™**, **Macintosh™**, and **Power Mac™**. Both B² SPICE and B² LOGIC are currently in use at over 100 major universities and many leading Fortune 500 companies such as The University of Michigan, Stanford, AT&T, General Electric, and Hewlett Packard, to mention a few!



Beige Bag Software

1756 Plymouth Road • Suite 370
Ann Arbor • Michigan • 48105

Phone 313. 332. 0487

Fax 313. 332. 0392

E-Mail info@beigebag.com

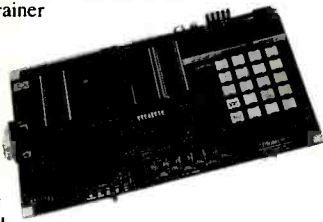
Url <http://www.beigebag.com>

CIRCLE 335 ON FREE INFORMATION CARD

U P P R O C E S S O R

T
R
A
I
N
E
R

The PRIMER 8085 Based Microprocessor Training and Control System takes you from writing simple programs to controlling motors. This trainer can be used stand alone via the keypad and display or connected to a PC with the optional upgrade (\$49.95). The Upgrade includes: an RS232 serial port, a serial cable, 32K of battery backed RAM and Assembler/Terminal software.



EXPERIMENTS USING THE PRIMER INCLUDE

- Measuring Temperature
- Using a PhotoCell to Detect Light Levels
- Making a Waveform Generator
- Constructing a Capacitance Meter
- Motor Speed Control Using Back EMF
- Interfacing and Controlling Stepper Motors
- Scanning Keypads and Writing to LCD/LED Displays
- Using the Primer as an EPROM Programmer

The PRIMER is only \$119.95 in kit form. The PRIMER Assembled & Tested is \$169.95. Please add \$5.00 for shipping within the U.S. Picture shown with upgrade option and optional heavy-duty keypad (\$29.95) installed.

ENAC, inc.
P.O. BOX 2042, CARBONDALE, IL 62902
618-529-4525 Fax 457-0110 BBS 529-5708

1985 - 1995
10
YEAR
ANNIVERSARY

Advanced Circuit Designs will...

PALS

Test all functions and write code to perform the same task.

GALS

Extract out the exact same fuse map, depending on the manufacturer and type.

Microprocessors

Extract out the exact same code for PIC, 16C54, 16C55, 16C56, 16C57, and 16C84.

Extract out the exact same code for Motorola 68705 series

(U3, U5, R3, R5, P3, P5), 80993, and 68HC705C8.

ACD also works with Intel, AMD, and other microcontrollers not listed.

Schematics

Design/layout schematics, and generate printed circuit board gerber files for projects.

Call about our secure integrated circuit readers!

ACD can also provide additional resources for populating your circuit boards.

Disclaimer: ACD works with copyrighted devices only when the copyright holder is the customer.

ACD also works with secured devices that have not been copyrighted.

Call TODAY for a price quote!

(703) 764-5361

please leave a message



5765-F Burke Centre Parkway, Suite 317, Burke, Virginia 22015 (703) 764-5361

July 1996, Electronics Now

EARN MORE MONEY!

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 Radio-telephone License." This valuable license is your professional "ticket" to thousands of exciting jobs in Communications, Radio-TV, Microwave, Maritime, Radar, Avionics and more...even start your own business! You don't need a college degree to qualify, but you do need an FCC License.

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

Or, Call 1-800-932-4268 Ext. 210

COMMAND PRODUCTIONS

FCC LICENSE TRAINING, Dept. 210
P.O. Box 2824, San Francisco, CA 94126
Please rush FREE details immediately!

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____



Serving you since 1979

JDR Microdevices

1850 South 10th Street, San Jose, CA 95112-4108

Expands for PLCC, PGA, QFP and Other Packages!

Economically Program PLDs, EPROMs, MPUs and More!

This versatile system programs thousands of devices! Over 3,000 EPROMs, EEPROMs, microprocessors and programmable logic devices are supported. Adaptors are also available, allowing you to program PLCC, PGA or other package styles.

Over 3,000 devices supported, including these popular families:

PIC16	8751
22V10	8749
16V8	20CG10AP
27C256	82S131
27C401	27C101
68HC705	68HC11
TMS2532	28F020

ONLY \$499

Call Toll-FREE 1-800-538-5000 for Your FREE Catalog!

Programs Over 3,000 Devices!

MODULAR CIRCUIT TECHNOLOGY

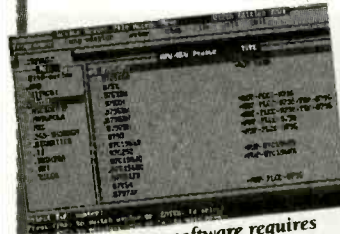
For an up-to-date list of supported devices, call our BBS at 1-408-494-1430 and download EMUPLIST.ZIP

A menu-driven shell makes programming easy! Select appropriate programming options with easy-to-use single-keystroke entries. A front-panel switch eliminates the need to return to the keyboard.

The software includes 2 and 4-way split and shuffle capability for 16 and 32-bit code, hex and extended hex file conversion and more. You can even write test vectors directly to test your PLD designs!

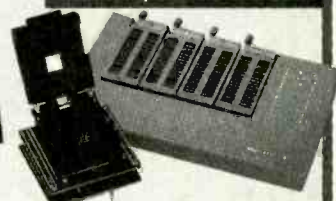
- Programs DIP EPROMs, EEPROMs, PROMs, PALs, GALs, PEELs, EPLDs, FPLs, MPUs and more without additional software
- PLCC, PGA and other packages supported using appropriate adaptors, 4-gang adaptors program multiple devices simultaneously
- Front panel switch and LED status indicators allow you to respond without returning to the keyboard
- Complete with 8-bit PC compatible ISA card and cable

MOD-EMUP-A 3 lbs \$499.00



Easy-to-use software requires minimal keystrokes!

PLCC, QFP, ZIP, 4-Gang and other adaptors available!



Call 1-800-538-5000

Internet Orders <http://www.jdr.com>

Toll-Free Fax Ordering Local/International
1-800-538-5005 1-408-494-1400

Order 24-Hours-A-Day By Phone or Fax

TERMS: For shipping & handling include \$4.29 for ground & \$5.89 for 2nd day air. Orders over 1 lb. and foreign orders may require additional shipping charges—contact our Sales Dept. for the amount. CA residents must include applicable sales tax. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sales. A full copy of our terms is available upon request. Items pictured may only be representative. JDR, the JDR logo, JDR Microdevices, and the MCT logo are registered trademarks of JDR Microdevices. Modular Circuit Technology is a trademark of JDR Microdevices. Copyright 1996 JDR MICRODEVICES. Other trademarks are the property of their respective owners.



KEY CODE 1672

PROFESSIONAL DESOLDERING with the

Lane Norman - Normans Electronics Inc. Atlanta GA 404-451-5057
A cost effective solution to desoldering equipment at less than half the price of most equipment. Its performance is ASTOUNDING.

Harold Smedberg - Smedberg Electronics - Custer MI
The SC7000 has reduced my damage to PC boards by 90%. It has also decreased my desoldering time by 50%. The best priced tool on the market.

Mike Murphy - Service Center - Van Nuys CA 818-785-7805

The single best investment of repair equipment we've made. It outperforms all other desoldering tools we've used. Easier to use and least expensive.

DEN-ON SC7000

Bob Monroe - M.A.R.C. Electronics - Virginia Beach VA 804-468-3932
Best investment we've made. Saves time, especially with multi-sided PCB's. Extremely pleased with warranty. Failed within 6 months and replaced by DEN-ON overnight.

Dick Manning - Dicks Electronics - Hartland WI 414-367-8339
The ease & speed of component removal greatly increases productive time. The SMD kit makes SMD removal a breeze, even for inexperienced Techs.

Dave Hayes - E-H Engineering Ltd - Lincoln NE 402-466-6720
Has been a durable & reliable desoldering unit. Our use has been both lab & field application over the last 2 yrs. with positive results.

Bob Sorrels CET/CSM Polytronics Microcomputer - Shreveport LA
We've used our SC7000 almost every day for about three years with virtually no problems. Just clean it before you turn it off for the day.

George Hefner - Hefner Electronics - Coleridge NE 402-283-4333
Being a one-man service center, I hesitated to spend the money on a desoldering tool, however all that changed when I nearly ruined a \$400 computer logic board. It has cut my desoldering time by 50 to 75%.

Steven Gray - Electronic Wizards - Wichita KS 316-686-8324
By far the best desoldering tool we've ever used. Much more suction than other similar types we've tried. No trouble with postage stamp IC's or anything else.

Dennis McManis - Thorn Services International - Mabelton GA
The SC7000 has decreased my use of wick by 75% and at \$25 a roll, it pays for itself within months. My total bench time is reduced by approx. 20%.

Don Cressin - Certified Electronics Service - Ellicott City MD 301-461-8008
We have obtained excellent results with the SC7000 including repairing high density U/V tuners. It is one of the best purchases we have made.

Doug Pettit - LuRay Electronics - LuRay VA 703-743-5400
We found that the SC7000 not only saves money vs. wick, but saves valuable time in troubleshooting. It allows you to be more accurate in removing SMD's.

Paul Horvat - Service Excellence Inc. - Bergenfield NJ 201-387-7776 It has made a almost impossible job (desoldering a 64 pin CPU) a piece of cake.

Specifications

- ◆ Totally Self Contained diaphragm vacuum pump and AC motor for high vacuum suction or reversible hot air blow for SMD removal.
- ◆ 100Watt Ceramic heater with zero-crossover switching heater control circuit which prevents spikes and leakage currents.
- ◆ Unique patented long lasting filter cartridge design. Solder builds up on easily cleaned baffle, while air flows around the outside of baffle.
- ◆ Totally ESD Safe. The housing contains carbon and the tip is at ground potential for complete ESD Protection.
- ◆ Maximum vacuum of 600mmHg is attained in 0.2 seconds.
- ◆ Temperature adjustable from 300°C - 450°C or 572°F - 842°F

Visa - M/C - Discover - American Express - Terms to Qualifying Companies
30 Day Money Back Total Satisfaction Guarantee - One Year Parts and Labor Warranty

HOWARD ELECTRONIC INSTRUMENTS INC
6222 N. Oliver - Wichita, KS 67220

Toll Free U.S. and Canada

1-800-394-1984

International

(316) 744-1984

or Fax **(316) 744-1994**



Tom Mullett - JC Penny TD&S - Wausau WI 414-259-2486

The SC7000 is a very easy to use, self-contained desoldering tool. We had a 70% increase in production after the purchase of the SC7000. I highly recommend it.

Randy Whitehead - Service West - Salt Lake City UT 801-262-4069
My techs thought it would be a waste. I bought one anyway after a demo. My techs then fought over it. Now we have three. It is the Best desoldering tool we have ever used.

Timothy Kraft - Monikraft, Inc. - Cherry Hill NJ 609-751-3252
We replaced all our existing desoldering stations with the SC7000. Our technicians are very pleased with the improved performance, portability, and reliability over our previous higher priced equipment.

Alan P. Dunasky - Al's TV, VCR, & Computer Service - Cleveland, OH 216-631-8132 One of my most valuable tools in the shop. I would be lost without it.

Bill Warren CET/CSM - Warrens Audio & Video - Knoxville TN - 423-546-1128 We have been extremely satisfied with the quality and durability of the DEN-ON SC7000 as well as with after the sale support.

Keith Sahs - J & M Electronics - Omaha NE 402-291-7100 It's a must tool for my bench. I can desolder multiple pin IC's quickly and clean. It will even take up large solder amounts on tuner and case grounds.

Ray Wurmest - Ray's Electronics, Inc. - Bloomington IL 309-829-3238 The SC7000 saves time when changing out parts in the home or in the Service Center — Worth every penny we spent.

FREE TRIAL
Available on Request

Call Now for Prices to **LOW** to Advertise

July 1996; Electronics Now

HOME AUTOMATION

Largest Selection of HOME AUTOMATION products in the World!

Browse us on the WEB!

<http://www.techmall.com/smarthome>

Hundreds of hard-to-find automation, X10, and wireless control products. Computer control of your home, security systems, surveillance cameras, infra red audio/video control, HVAC, pet care automation, wiring supplies, and much more!

HOME AUTOMATION SYSTEMS, INC.

151 Kalmus Drive, Ste L4, Costa Mesa, CA 92626
Questions 714-708-0610 FAX 714-708-0614

800-SMART-HOME

800-762-7846

Call 24hrs for FREE
64 page Color Catalog **Over 500**
unique products!

HOME AUTOMATION SYSTEMS, INC.

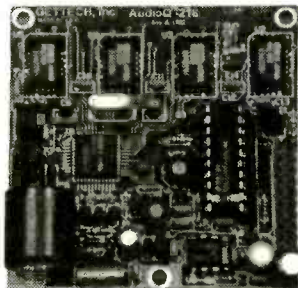


FREE

Make your projects speak for themselves... Ours do!

DIGITAL VOICE RECORDERS

- Record up to 218 seconds
- 1 to 8 messages
- High quality speech 12 bit
- Switch-closure actuation
- Sample rates up to 20KHz
- On-board backup
- Direct speaker output
- Wide operating range
- Small size 2.6" X 2.6"
- Made in U.S.A.



MODEL AudioQ™-218

Call or write for more information

OEM price and delivery available

Custom designs and enclosures

Single unit price \$149.00 plus s+h

Quantity pricing as low as \$99.00

GETTECH, Inc.

402 Riley Road, New Windsor, NY 12553

(914) 564-5347

Specifications and price subject to change.

1-800-USA-NAVY.

**World Wide Web:
<http://www.navyjobs.com>**

ONLY COOL-AMP SILVERPLATES ON THE JOB.

From a customer testimonial:

"Ok, your edge connectors don't connect. Or you want to plate your own PC creations, but you don't want to bother with electro-plate solutions. The plating on the socket...has worn off and no longer makes reliable contact...what are you going to do now?"

"Give the people at Cool-Amp a call. They have a silver plating compound I have used for the past couple of years that solves all of the above problems and more. This white powder has an infinite shelf life...and is easy to use.

"It will actually put a permanent silver plate on copper, brass or bronze...There are no messy or dangerous chemicals. Application could not be easier. Use a clean rag and a little bit of water and just rub it on a clean surface. In minutes you can permanently silver plate a circuit board or replate a power amp tube or socket.

"It has saved me time, money and my sanity."

Cool amp has even outperformed electroplating in recent tests. It is time-proven since 1944.

COOL-AMP

AND CONDUCTO-LUBE. THE SILVER-BASED CONDUCTIVE LUBRICANT.

The upstart, since 1952. Developed for switches, uses continue to expand to all applications needing a conductive lubricant.

Conducto-Lube

**ORDER FACTORY DIRECT:
503-624-6426 or FAX 503-624-6436**

CIRCLE 228 ON FREE INFORMATION CARD

Electronic CAD for Windows

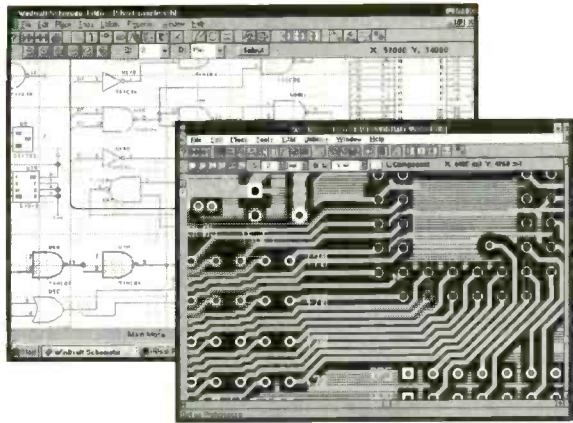
Professional Windows tools at an affordable price with powerful features to make designing faster. WinBoard PCB layout delivers sophisticated interactive routing for complex designs, plus it has the tools needed for high-speed circuits, analog, RF and SMT designs.

WinDraft[®] Schematics

- ◆ 32 bit Windows application with multiple document interface and floating toolbar.
- ◆ Supports hierarchical designs and electrical rules checking.
- ◆ Over 11,000 unique library parts and symbol editor included.

WinBoard[™] PCB layout

- ◆ Supports 16 layers, multiple copper pours, and advanced features for RF designs.
- ◆ Complete through hole and SMD library.
- ◆ CAM Support includes BOM, in-circuit test, NC Drill, Gerber, Pick & Place, DRC.

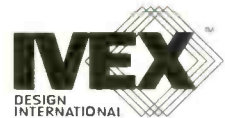


Prices start at only ... \$250

Information is available on the Ivex World Wide Web. An evaluation copy with a complete 80 page Getting Started Guide is only \$20.

World Wide Web: <http://www.ivex.com>

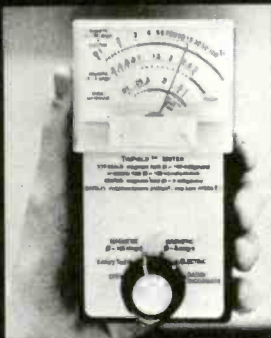
Tel: (503) 531-3555
 Fax: (503) 629-4907
 BBS: (503) 645-0576



CIRCLE 318 ON FREE INFORMATION CARD

NOW YOU CAN "SEE" INVISIBLE FIELDS AND AVOID THEM

Most homes and offices have hot spots with strong artificial electro-magnetic fields, where chronic exposure may cause mental or physical problems. Even the EPA names these fields as suspected carcinogens. You can reduce your risk by avoiding these high-field areas.



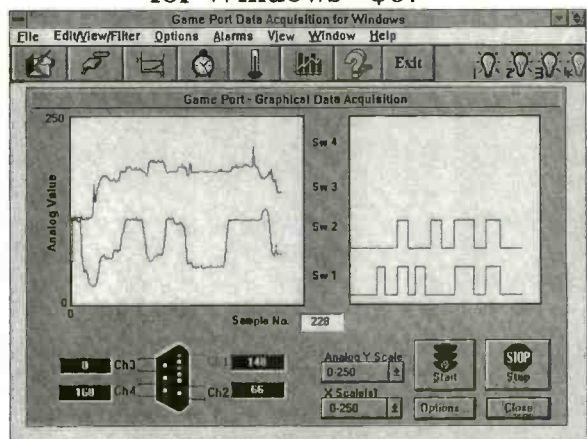
The **TriField[™]** meter detects *far more* of these fields than any other electromagnetic pollution meter. It's the only one that independently reads AC electric fields, AC magnetic fields, and radio/microwaves. It also reads field strengths in *all directions simultaneously*. Every other meter that sells for under \$500 reads only magnetic and only in one direction — they can entirely miss a magnetic field unless pointed correctly and are blind to radio/microwaves and electric fields, both of which cause biological effects.

The **TriField[™]** meter reads all three types of fields numerically and with a SAFE/BORDERLINE/HIGH SCALE, weighted proportional to effect on the body. Thresholds are based on epidemiological and laboratory studies. (While no *absolute* hazard thresholds have been established, reduction of *relative* exposure is prudent.)

The **TriField[™]** meter comes ready-to-use with battery, instructions, and one-year limited warranty. The cost is \$144.50 postpaid.

AlphaLab, Inc. / 1280 South Third West / Salt Lake City, UT 84101-3049
 For literature and information, call (503) 543-6545

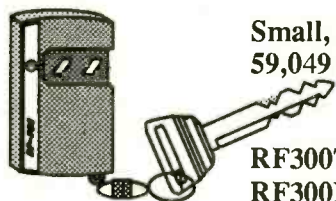
Complete Low Cost Data Acquisition System for Windows - \$67



- 8 channel recording (4 analog & 4 switch monitoring channels).
- Record up to 5000 data points per channel per recording.
- Real-time graphical displays of data acquisition e.g. analog & temperature.
- No analog to digital hardware required, uses the PC game (joystick) port.
- Selectable sample rates (from minute range to 20 hertz), option for user defined hi- and low- alarms.
- Software calibration features allow calibration of sensors and joystick port.
- Save data in ASCII & BMP formats, supports OLE with EXCEL.
- Built in spreadsheet, ASCII data editor & graph plotting windows.
- Includes extensive documentation, plus examples of PC data acquisition projects (circuits & component suppliers) e.g. temperature, light, voltage, position sensing & switch sensing. For most hardware interfaces little more is required than a resistor to link a voltage or sensor to the joystick port.
- Visual Basic code can be purchased.

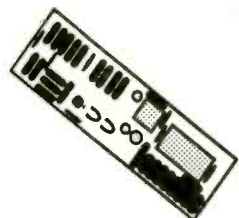
Purchase Price \$69 + Shipping and Handling \$6 (USA) or \$7.50 (Canada)
 Phone for further information. Ph. (805) 499 7990
 Measurement Software, 2238 Adrian St., Newbury Park, CA 91320, USA

Miniature Transmitters and Receivers



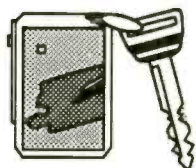
Small, Attractive, High End Quality, 2 Channel 318 MHz Transmitter
59,049 Settable Codes, 120'-300' Range, 1-1/4" x 2" x 9/16", Assembled

		Qty	1	5	10
RF300T	150' Range Transmitter		24.95	19.95	15.95
RF300XT	300' Range Transmitter		29.95	24.95	19.95



Small, High End Quality, 2 Channel Receiver for the RF300 Transmitters
1-1/4" x 3-3/4" x 9/16" PCB w/.1" spaced pads for standard connectors
Input: 8-24 vdc Output: Gated CMOS Momentary and Latching Lines

		Qty	1	5	10
RF300R	Receiver, Fully Assembled		24.95	20.95	16.95
RF300RK	Receiver, Complete Parts Kit		19.95	15.95	12.95
RF300PA	Pre-Amplifier. Doubles Range		14.95	11.95	9.95



Small, Economical, Single Channel Transmitter and Receiver Set
Set Code, 60' Range, 1-7/8"x2-3/8"x7/16" (T), 2"x2-3/4"x9/16" (R)
Receiver Input: 5 vdc Output: Gated TTL Momentary Line

		Qty	1	5	10
RF60	Transmitter and Receiver Set		24.95	19.95	14.95

Add \$ 4 shipping for first item + \$ 1 for each additional item. Ca. residents add 8.25% tax
Visa, Mastercard, Money Orders Personal Checks and Cash C.O.D.s

Visitect Inc. P.O. Box 14156 Fremont, CA. 94539 (510) 651-1425 Fax (510) 651-8454

CIRCLE 322 ON FREE INFORMATION CARD

FREE

Monthly Special! Free window clip antenna with these radios!

TRIDENT

Bearcat

TR2400 \$499
100KHz to 2.06 GHz

BC230 \$229
Turbo Scan
with 800MHz

BC3000 \$369
25MHz to 1.3 GHz



Trident Spectrum Analyzer

1-1300MHz in two bands with a Span that's variable from 500 MHz to 10 MHz. 80db on Screen Range, marker generator, 200K/10K selectable bandwidth, -117dBm Sensitivity, outputs to any x/y o'scope.

\$699.00

These are a few of our products and price values. For more information dial toll free or see our web site, or get instant specs & info. from our fax back service.

Toll Free, 24 Hours! For orders. 317 543
9771 for tech support. For Fax Facts
Instant catalog sheet service, dial 317
849 8683. ACECOMMS@aol.com Email

ACE
COMMUNICATIONS

Web: www.acecomms.com. Mastercard, Visa, Checks,
Approved P.O.'s & COD (add \$5.50) & AMEX, Discover.
Prices, specs and availability subject to change.
Ground shipping and handling charge \$7.95

10707 E. 106th St. Fishers, IN 46038

CIRCLE 212 ON FREE INFORMATION CARD

ARE YOU BEING "BUGGED?"

OUR FINEST

Counter-Surveillance Device



THE ULTIMATE IN "BUG" DETECTION EQUIPMENT
"DEBUGS" ROOMS AND TELEPHONES!

If you require GUARANTEED PROTECTION against electronic telephone monitoring devices and COMPLETE CONFIDENTIAL PRIVACY in certain rooms and areas, we highly recommend the COUNTER-SURVEILLANCE DETECTOR CSD-18.

EVEN AS YOU READ THIS, countless individuals and firms are being enormously damaged by having their private conversations overheard, monitored, and/or recorded. Almost without exception and AFTER the fact, the victims make a statement something along the lines of "But, I never thought it could happen to ME!"



CONDUCT A PROFESSIONAL SEARCH...ANYTIME...ANYWHERE!

Every newspaper and magazine article and every radio and TV story discussing some new episode involving "bugging" devices, continues to increase the ever growing demand for electronic Counter-Surveillance "sweeps" and equipment. The very limited supply of competently trained and equipped Counter-Surveillance specialists has created a situation where "sweep" rates exceeding \$250 per hour are now considered reasonable and appropriate.

This is an exciting, immensely interesting and profitable field that you can enter with a minimum investment. Two hours actual practice with the CSD-18 will have you "reading" and "clearing" telephones and rooms with professional ease and competence. The average fee for "debugging" a single telephone is over \$200.00. It requires about 45 minutes to complete the job and once it gets around that YOU can provide this service, you'll quickly have more clients than you can handle. Even if you choose to provide "sweeps" for only a small number of friends and associates, your initial investment will quickly be returned many times over.

EXTREME SENSITIVITY!

This is our finest piece of detection equipment! The CSD-18 quickly locates electronic eavesdropping devices in telephones, homes, offices, vehicles, boats, or concealed on the body. It will actually pick up many eavesdropping transmitters at ranges up to 25 ft! Extreme sensitivity is obtained via ultra-efficient amplification circuitry directly following the RF detection stages. Excellent quality dynamic headphones exclude all external sounds to further enhance detector output.

Emcompassing an extremely wide-band frequency coverage of under 1 Mhz to over 3 Ghz, the CSD-18 quickly "homes-in" on any eavesdropping transmitter and immediately pinpoints its location. The closer you get to the "bug", the further the needle moves to the right. It's as simple as that.



FULL RANGE DYNAMIC HEADPHONES

"FLASHING" LED Warns You Instantly!



And, for maximum telephone security, the CSD-18 automatically analyzes a pre-programmed series of electronic measurements along the telephone line and converts the analysis into an easy to follow, step by step, test procedure. No technical knowledge is required or necessary. A visual indication (via a flashing LED) immediately reveals the presence of the various types of telephone "taps" and the flashing sequence identifies the actual type of eavesdropping device.

DETECTS THE LATEST "SUPER-BUGS"

Exclusive GSS proprietary circuitry assures the utmost privacy protection possible today. The CSD-18 detects even the very latest ultra-sophisticated eavesdropping devices specifically designed to defeat detection, including sophisticated "Frequency Hoppers" and "Burst Bugs". Also includes multi-line option for testing business phones.

FREE WITH ORDER!

SUBMINIATURE "BODY WIRE" DETECTOR!

If you fear the possibility of being overheard and/or recorded during private conversations and require "silent" notification, we've also included our SBD-5 (regularly \$225) as a FREE GIFT! Only 3" x 2" x 1", this exciting new development in micro-miniaturization will instantly detect hidden body wires at ranges up to 10 ft and alert you via a silent vibration.



BIG MONEY OPPORTUNITIES!

Also, complete information describing the fantastic opportunities now open to trained Counter-Surveillance technicians and how a number of individuals are reaping a Bonanza in this booming business! You'll learn exactly how the ever increasing use of Electronic Listening Devices by investigative agencies, government agencies, jealous suitors and unscrupulous business competitors, etc. has created huge demand for this service.

FASCINATING HI-TECH INFORMATION PACKAGE!

A detailed analysis of a variety of extremely fascinating hi-tech devices and procedures used for ultra-sophisticated audio and video eavesdropping including micro-wave and laser device monitoring, new methods for listening thru walls; all about scramblers, voice changers and exactly how neighbors eavesdrop. How missing persons are found, confidential data banks are broken into, lie detectors deceived and much more!



A comprehensive information package JAM-PACKED FULL of some of the most exciting and fascinating reading imaginable. Reads like a James Bond novel, with one important exception...IT'S NOT FICTION!

THE ONE "BUG" TO FEAR MOST!

While most individuals are now somewhat guarded in their telephone conversations, they still rather naively feel secure in the "privacy" of their own home or office. However, the most common type of "tap" presently used by eavesdroppers now picks up ALL SOUNDS AND CONVERSATION WITHIN A ROOM... WITH THE TELEPHONE STILL ON THE HOOK!

Due to this devastating capability, this "Infinity" tap (variously referred to as Infinity Transmitter, Hookswitch Bypass, 3rd Wire, Harmonica Bug, etc.) has become the "bug of choice".

In flagrant violation of federal law prohibiting their use and sale, these devices in various forms are openly advertised in many technical publications for as little as \$30. Literally thousands of these devices are now in the hands of unscrupulous individuals all over the country!

In response to this ever-growing threat, a uniquely engineered feature of the CSD-18 now also detects Infinity type devices anywhere "down the line".

In other words, if ANYONE ... ANYWHERE ... is utilizing the telephone tip and/or ring wires to monitor your private room conversations while your telephone is on the hook, you'll immediately be made aware of it via a flashing LED!

100% POSITIVE INDICATION

The CSD-18 also flawlessly detects "Series" and "Parallel" telephone transmitters and "Telephone Recording Devices". And, a separate feature silently indicates when extension phones are picked up or being used. The CSD-18 completely eliminates all doubt and guesswork.

EXCLUSIVE "LISTEN-IN" FEATURE!

The CSD-18 will even allow you to "listen-in" to exactly what the eavesdropper is surreptitiously monitoring. And, without the eavesdropper ever becoming aware that he has been detected! We are unaware of ANY other detection equipment having this combined capability AT ANY PRICE!

MAXIMUM PROTECTION

The CSD-18 detects and locates ALL major categories of surveillance equipment including:

- BUMPER BEEPERS,
 - "BODY" TRANSMITTERS
 - TELEPHONE RECORDING DEVICES
 - SERIES & PARALLEL PHONE TRANSMITTERS
 - "INFINITY", MICRO-WAVE AND "LASER" BUGS
 - & ALL TYPES OF CONCEALED TRANSMITTERS
- including Video, Computer and Fax Transmitters

CSD-18 **\$ 495** Complete

Includes headphones, antenna/probe, all plugs and adapters, batteries, the Free SBD-5 & Info Packages.

HOW TO ORDER

Order NOW by Mail or Telephone. 10 DAY MONEY BACK GUARANTEE if you're not 100% pleased and completely satisfied. We pay shipping charges on all prepaid & credit card orders. Add \$15 for CODs.

(C) 1995 Great Southern Security

513 Bankhead Highway
Carrollton, GA 30117

FOR FASTEST SERVICE CALL TOLL FREE

ORDER BY PHONE **1 800 732-5000**



CIRCLE 315 ON FREE INFORMATION CARD

SEE US
NOW AT
http://www.cir.com

**CIRCUIT
SPECIALISTS
INC.**

**Check Out
What
We
Have
To Offer:**

Fantastic DMM Offer!!!

Don't let the price fool you. This meter is a digital multimeter designed for engineers and hobbyists. Equipped with 5 functions and 19 ranges. Each test position is quickly and easily selected with a simple turn of the FUNCTION/RANGE selector rotary switch.

Rubber Boot Included

General
Display: 3-1/2 Digit LCD, 21mm Figure Height with Automatic Polarity

Overrange Indication: 3 Least Significant Digits Blank

Temperature for Guaranteed Accuracy: 23°C±5°C RH<75%

Temperature Ranges:

Operating: 0°C to 40°C (32°F to 104°F)

Storage: -10°C to 50°C (14°F to 122°F)

Power: 9V Alkaline or Carbon-Zinc Battery (NEDA1604)

Low Battery Indication: BAT on Left of LCD Display.

Dimensions: 188mm long x 87mm wide x 33mm thick

Net Weight: 400g

DC Voltage (DCV)

Range: Resolution: Accuracy:

200mV 100µV
2000mV 1mV ±(1%rdg+2dgts)
20V 10mV
200V 100mV
1000V 1V

Maximum Allowable Input: 1000V DC or Peak AC.

DC Current (DCA)

Range: Resolution: Accuracy:

200µA 100nA
2000µA 1µA ±(1.2%rdg+2dgts)
20mA 10µA
200mA 100µA
10A 10mA ±(1.2%rdg+2dgts)

Overload Protection: mA Input, 2A/250V fuse.

AC Voltage (ACV)

Range: Resolution: Accuracy:

200V 100mV ±(1.2%rdg+10dgts)
750V 1V

Frequency Range: 45Hz-450Hz

Maximum Allowable Input: 750V rms

Response: Average Responding, Calibrated in rms of a Sine Wave.

CAT NO	DESCRIPTION	PRICE
9300G	Rugged High Quality DMM with Rubber Boot	\$19.00

\$19.00
any qty



Our Best Offer Ever on a

High Quality Full Sized DMM

Switchable Scope Probe Sets

(Selectable X1/Ref/X10) These high quality scope probe sets are for oscilloscopes up to 60MHz (model HP9060) or 150MHz (model HP9150). Both sets include a handy storage pouch and include an IC test-hook adapter for

the probe. The BNC connector rotates to avoid cable tangle or kink. Cable length is 1.4 meters.

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	100
HP-9060	Scope Probe Set DC~60MHz	\$16.49	\$14.49	\$11.58
HP-9150	Scope Probe Set DC~150MHz	24.95	21.95	18.62



Positive Photo Resist Pre-Sensitized Printed Circuit Boards

These pre-sensitized printed circuit boards are ideal for small production runs. They provide high resolution and excellent line width control. High sensitive positive resist coated on 1oz. copper foil allows you to go direct from your computer plot or art work layout. No need to reverse art.

Single-Sided, 1oz. Copper Foil on Paper Phenolic Substrate

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	50
PP101	100mm x 150mm/3.91" x 5.91"	\$2.55	\$1.90	\$1.70
PP114	114mm x 185mm/4.6" x 6.6"	2.98	2.45	1.98
PP152	150mm x 250mm/5.91" x 9.84"	5.40	3.98	3.60
PP153	150mm x 300mm/5.91" x 11.81"	6.15	4.48	4.10

Single-Sided, 1oz. Copper Foil on Fiberglass Substrate

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	50
GS101	100mm x 150mm/3.91" x 5.91"	\$ 3.90	\$2.98	\$2.60
GS114	114mm x 185mm/4.6" x 6.6"	4.80	3.49	3.20
GS152	150mm x 250mm/5.91" x 9.84"	8.69	5.98	5.78
GS153	150mm x 300mm/5.91" x 11.81"	10.20	7.20	6.80

Double-Sided, 1oz. Copper Foil on Fiberglass Substrate

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	50
GD101	100mm x 150mm/3.91" x 5.91"	\$ 5.07	\$3.68	\$3.38
GD114	114mm x 185mm/4.6" x 6.6"	5.95	4.29	3.99
GD152	150mm x 250mm/5.91" x 9.84"	10.47	7.39	6.98
GD153	150mm x 300mm/5.91" x 11.81"	11.95	8.69	8.30

Etching Chemicals/Ferric Chloride

A dry concentrate that mixes with water to make 1 pint of etchant, enough to etch 400 sq. inches of 1 oz board.

CAT NO	DESCRIPTION	PRICE EACH	
		1	5
ER-3	Makes 1 pint	\$3.50	\$2.75



Developer This product is used as the developer on our positive photo-resist printed circuit boards. Includes instructions. 50 gram package, mixes with water.

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	25
POSDEV	Positive Developer	\$.95	\$.80	\$.50



Etching Tank This handy etching system will handle PC boards up to 8" x 9", two at a time. Ideal for etching your PCB's! System includes an air pump for etchant agitation, a thermostatically controlled heater for keeping etchant at optimum temperature and a tank that holds 1.35 gallons of etchant. A tight fitting lid is also supplied to prevent evaporation when system is not being used. Typical etching time is reduced to 4 minutes on 1oz. copper board!

REDUCES ETCHING TIME!

CAT NO	DESCRIPTION	PRICE
		12-700
	Etch Tank System	\$37.95

Desoldering Pumps

These powerful plastic body desoldering pumps are designed for easy one hand operation for fast, efficient desoldering. Double O-ring piston seals for maximum suction.

CAT NO	DESCRIPTION	PRICE EACH		
		1	5	10
08-366S	Large Desoldering Pump	\$15.89	\$13.49	\$11.95
08-366E	Regular Desoldering Pump	10.89	8.59	7.39
08-366TIP	Replacement Tip	1.95	1.95	1.95



SEE OUR ON-LINE CATALOG AT
http://www.cir.com

CIRCLE 333 ON FREE INFORMATION CARD

www.americanradiohistory.com

Electronic Soldering System

Here's the ideal solution when **Temperature Control** is required. Easy to use slide control allows user to set system from 300°F to 840°F. Voltage to iron from control unit is 24V Iron heating power is 48W. Replaceable 5.3mm tip is standard. Replacement irons and tips are available.

CAT NO	DESCRIPTION	PRICE EACH	
		1	5
SL10	Temp Controlled Soldering Iron	\$56.00	\$50.00
SL24V	Spare 24V Soldering Iron	10.50	7.50



Electronic Soldering System with LED Display

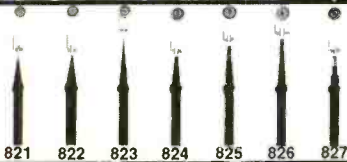
Deluxe temperature controlled system with LED display for maximum accuracy. Temperature is adjustable from 160°-480°C (320°-900°F). Iron heating power is 48 Watts. Runs on 24V from controller unit. Replacement irons and tips are available. Tip size is 5.3mm.

CAT NO	DESCRIPTION	PRICE EACH	
		1	5
SL30	Deluxe Soldering System w/LED	\$86.00	\$75.00
SL24V	Spare 24V Soldering Iron for SL10 or SL30	10.50	7.50



Replacement Tips for SL10/SL30

We now offer a variety of replacement tips for the SL10/SL30 soldering stations.



CAT NO	DESCRIPTION	PRICE EACH	
		1	5
821	1/32" Pencil Tip	\$1.39	\$1.19
822	1/32" Pencil Tip	1.39	1.19
823	1/64" Pencil Tip	1.39	1.19
824	1/16" Chisel Tip	1.49	1.29

CAT NO	DESCRIPTION	PRICE EACH	
		1	5
825	1/8" Chisel Tip	\$1.49	\$1.29
826	3/64" Chisel Tip	1.49	1.29
827	3/64" Pencil Tip	1.59	1.39

Ball Bearing 12V DC Fans



These High Quality Fans feature Ball Bearings and Brushless DC Motors. All of them are designed to meet UL, CSA & VDE Standards. Design these fans into power supplies, computers or other equipment requiring additional air flows for heat removal. These fans are regular Circuit Specialists stock items — they are not surplus.

CAT NO	DESCRIPTION	PRICE EACH			
		1	10	25	100
CSD 4010-12		\$ 9.88	\$ 6.38	\$5.48	\$4.87
CSD 6025-12		9.38	5.91	5.41	4.71
CSD 8025-12		8.88	5.85	5.19	4.49
CSD 9225-12		8.95	6.14	5.29	4.59
CSD 1225-12		11.45	8.96	7.82	6.85

Specifications

CAT NO	DIMENSIONS (MM)	RATED VOLTAGE (V)	START VOLTAGE (V)	INPUT CURRENT (A)	AIR FLOW (CFM)	STATIC PRESSURE (INCH-H ₂ O)	SPEED (RPM)	NOISE LEVEL (dB)	WEIGHT (g)
CSD 4010-12	40x40x10mm	12	7	0.06	5.1	0.19	5,500	26	20
CSD 6025-12	60x60x25mm	12	5	0.13	13.7	0.165	4,500	28	65
CSD 8025-12	80x80x25mm	12	5	0.16	37.8	0.177	3,000	31	80
CSD 9225-12	92x92x25mm	12	5	0.32	42	0.18	2,800	37	95
CSD 1225-12	120x120x25mm	12	5	0.35	62	0.180	2,500	42	135

INDUSTRY BEST PRICING!

SOLDER • SOLDER • SOLDER • SOLDER • SOLDER • SOLDER • SOLDER • SOLDER

We stock high quality 60/40(Sn%/Pb%), .031" and 63/37, .031" diameter. This is prime JIS certified solder that we maintain as a regular stock item (It is not "Left-overs, Rejects or Surplus") and you can buy it from us at a fraction of the price that you are used to.

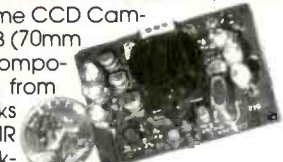
Tired of Paying Inflated Prices for Solder?

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	25
RH60-1	1-lb. Spool, .031", 60/40	\$ 6.90	\$ 5.96	\$ 5.30
RH63-1	1-lb. Spool, .031", 60/40	6.95	6.10	5.41
RH60-4	4.4-lb. Spool, .031", 60/40	24.00	21.90	17.92
RH60-TUBE	6-oz. Tube, .031", 60/40	.99	.89	.79



CCD Camera - IR Responsive As Low As \$109!!

This black and white monochrome CCD Camera is totally contained on a PCB (70mm x 46mm). The lens is the tallest component on the board (27mm high from the back of the PCB) and it works with light as low as 0.1 lux. It is IR Responsive for use in total darkness. It comes with six IR LED's on board. It connects to any standard monitor, AUX or video input on a VCR or through a video modulator to a TV. Works with a REGULATED 12V power supply (11V-13V). Hooks up by connecting three wires: red to 12V, black to ground (power & video) and brown to video signal output.



CAT NO	DESCRIPTION	PRICE EACH	
		1	5
CA-H34A	PCB Mounted IRCCD Camera	\$125.00	\$109.00

SEE OUR ON-LINE CATALOG AT
<http://www.cir.com>

CIRCUIT SPECIALISTS, INC.
 SINCE 1971

800-811-5203
602-464-2485
602-464-5824(FAX)

WE ACCEPT:



RECEIVE OUR LATEST 132 PAGE CATALOG!

It's chock full of all types of electronic equipment and supplies. We've got I.C.'s, capacitors, resistors, pots, inductors, test equipment, breadboarding supplies, PC supplies, industrial computers, data acquisition products, personal computers and computer parts, plus much, much more. FAX us your name and address or call **800-811-5203, ext. 5**, to leave a message on our catalog request line.



TACTICAL ELECTRONICS

Plans • Ready-to-Use • Easy-to-Build Kits

3 Mi Voke Transmitter

- Ultra-Sensitive Mike
- Crystal Clear
- Tunes 80-130 MHz.

FMV1K Kit/Plans \$39.50



3 Mi Telephone Xmitter

- Tune-able 80-130 Mhz • Undetectable
- Only transmits when phone is used

VWPM7K Kit/Plans \$39.50

Extended Play Telephone Taping System

- Tapes Phone Conversation • Extends Tape X4 • Check Local Laws before using!

TAP30X Ready to Use \$94.50



3 Mi Tracker Transmitter

- Tunable Output
- Uses FM Radio
- Excellent Signal Beacon

HOD1K Kit/Plans \$39.50



Window Bounce Laser Listener

Aim at window and listen to sounds from reflected light. CAUTION - Not for illegal use. LWB3 Plans \$10.00

LWB30 Ready to Use (req's vid tripod) \$199.50



Telephone Line Grabber Infinity Transmitter

Use any Tone phone to monitor a premises, access other calls or control up to 8 devices! TELCON1 Plans/Kit.. \$99.50

TELCON10 Ready to Use \$149.50



Cybernetic Ear!

Enhances normal hearing 3-4 times! Adjustable volume control, fits easily into either ear. Many, many uses.

CYBEREAR Ready to Use \$19.95



Invisible Pain Field Intruder Deterrent

System detects intrusions and turns on a sonic field of pain, causing disorientation, acute paranoia, nausea and more. The perpetrator - man or animal - soon vacates! Protects 4 individual areas up to 5000 sq ft. Non hazardous when used as instructed.

PPG4K Kit/Plans \$129.50

PPG40 Ready to Use \$199.50



Control Their Minds!

Programmable audible and visual stimuli induces hypnotic trances.

HYP2K Kit/Plans \$29.95

#EH2 Book of Hypnosis \$14.95



Long Range Microphone

24" dish focuses signals to an ultra-high gain amplifier.

PM5K Kit/Plans \$149.50



• Optional wireless module transmits captured sounds to an FM radio.

WM5K Kit for Wireless Option \$29.50

FireBall Gun

Shoots flaming ball - two shot capacity. Great for special effects and remote fire starting. CAUTION REQUIRED!

FIREBALL Plans (dangerous product) \$10.00



See In Total Darkness!

• High Quality IR Night Vision Scope with IR illuminator. SD10 Ready to Use ... \$199.50



FANTASTIC BRIGHTNESS!

High Quality Laser Pointer

LAPN67 15mw eqv, 1500' \$39.50

LAPN63 30mw eqv, 3000' Price on Req



1000' Potato Cannon

Not a Toy! Uses electronic or piezo ignition. CAUTION REQUIRED!

POT1 Plans (dangerous product) ... \$10.00



Phasor Sonik Blast Pistol

Rids areas of unwanted pests. Trains and conditions wild and domestic animals. Great for barns, attics, cellars, gardens.

PPP10 Ready to Use \$69.50



Shocker Force Field / Vehicle Electrifier

Make hand and shock balls, shock wands and electrify objects. Great payback for those wiseguys!

SHK1K Easy to Assemble Kit \$19.50



Electric Charge Gun

Life is Precious - PROTECT IT! Stuns/immobilizes attackers 15 feet away! Check your state laws for legality. More knockdown power than most handguns. No permanent injury. ID coded.

ECG1 Data (Creditable to purch) \$10.00

ECG10 Charge Gun, Ready to Use, includes FREE Stun Gun! \$249.50



STUN GUNS - sold separately:

STUN100 100,000 Volts \$34.50

STUN200 200,000 Volts \$49.50

VISIT US ON THE WEB!
<http://www.amazing1.com>

INFORMATION UNLIMITED

Dept ENS-2, Box 716, Amherst, NH 03031
Phone: 603-673-4730 FAX: 603-672-5406
MC, VISA, COD, Checks accepted Please add \$5.00 S & H

CATALOG!
FREE with Order or send \$1 P&H

24 Hour Phone
800-221-1705
Orders Only Please!

CONTROL MEASURE

RELAYS • LIGHTS • MOTORS
TEMPERATURE • PRESSURE • LIGHT LEVELS • HUMIDITY
INPUT
SWITCH POSITIONS • THERMOSTATS • LIQUID LEVELS

MODEL 30 \$79



- PLUGS INTO PC BUS
- 24 LINES DIGITAL I/O
- 8 CHANNEL
- 8 BIT A/D IN
- 12 BIT COUNTER
- UP TO 14K SMP/SEC

MODEL 45 \$189



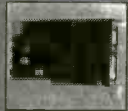
- RS-232 INTERFACE
- 8 DIGITAL I/O
- 8 ANALOG INPUTS
- 2 ANALOG OUTPUTS
- 2 COUNTERS-24 BIT

MODEL 100 \$279



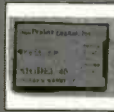
- 12 BIT 100 KHZ A/D
- 4 ANALOG OUTPUTS
- 3 TIMER COUNTERS
- 24 DIGITAL I/O

MODEL 60 \$179



- 8 2-AMP RELAYS
- 16 DIGITAL I/O
- 1 8-BIT ANALOG INPUT

MODEL 40 \$99



- RS-232 INTERFACE
- 28 LINES DIGITAL I/O
- 8 ANALOG INPUTS
- PWM OUTPUT
- OPTIONAL 12 BIT A/D

MODEL 70 \$239



- RS-232 INTERFACE
- 18 BIT A/D
- 5.5 DIGIT
- UP TO 60 SMP/SEC

NEED A CUSTOM PCB? TRY US.

PRAIRIE DIGITAL, INC.

PHONE 608-643-8599 • FAX 608-643-6754

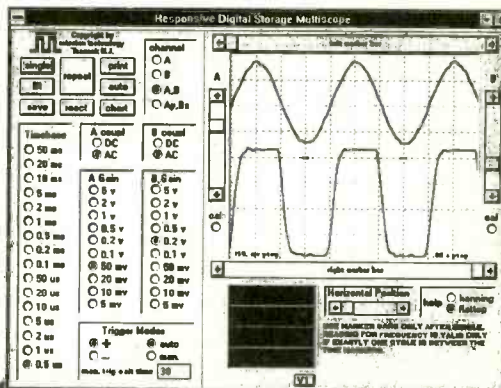
846 SEVENTEENTH STREET • PRAIRIE DU SAC, WISCONSIN 53578

TURN YOUR PC INTO A DIGITAL STORAGE OSCILLOSCOPE!

mission technology, Inc.'s PC-MultiScope now sold by Amaze Electronics

As reviewed in the May 1996 issue of *Electronics Now!*

At right: Actual scope screen as seen on your PC monitor.



For industrial, hobbyist, educational, automotive, audio, and medical uses
\$399 + S/H. Visa/MC/Check OK.
Add \$99 for source code option

FEATURES:

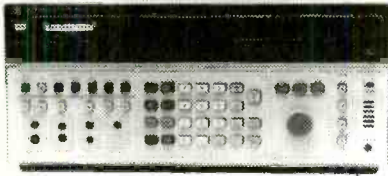
1. Dual channel; external triggered
2. Digital storage; Windows based
3. Connects to PC parallel port
4. 20Mhz max. digital bandwidth; 2Mhz max. analog bandwidth
5. Programmable gain from 5v/div to 5mv/div
6. Frequency analyzer function
7. Strip chart recorder function
6. Integrated 16 bit output
7. Visual Basic source code avail.

AMAZE ELECTRONICS CORPORATION

amaze@hooked.net www.hooked.net/users/amaze

Phone: 800-996-2008 Fax: 408-996-0366

Quality Reconditioned Test Equipment from Danbar



Hewlett-Packard 3586B Selective Level Meter

Makes carrier measurements to 32.5 MHz, voice channel measurements from 50 Hz to 100 kHz, can use the 3336B Level Generator as an automatic tracking generator. Opt 004. Like new condition.

\$850.00

Hewlett-Packard 3336B

Synthesizer/ Level Generator covers the frequency range from 10 Hz to 21 MHz, making the 3336B useful for telephone circuit loop testing on most FDM systems. Includes opt 005. Like new.

\$850.00

Hewlett-Packard 3325A

Synthesizer/ Function Generator, 1 μ Hz to 21 MHz, wideband sweeper, programmable, 11 digit resolution.

\$2000.00

Hewlett-Packard 3314A

Function Generator, .001 Hz to 19.99 MHz with an amplitude range of .01 mV to 10 V p-p, sine, square and triangle waves, arbitrary signals, AM/ FM/ VCO, gate and counted burst.

\$3800.00

Hewlett-Packard 214B

Pulse Generator, high power 100 V, 2 A output into 50 Ω , 10 MHz repetition rate, constant duty cycle.

\$1995.00

Hewlett-Packard 8901A

Modulation Analyzer, 150 kHz to 1300 MHz, measures AM and FM to 1% accuracy, measures RF frequency and power, completely automatic, options available.

\$5500.00

Hewlett-Packard 8903A

Audio Analyzer, measures distortion, SINAD, signal-noise, frequency (20 Hz to 150 kHz), ac and dc level, options available.

\$2750.00



Tektronix 475A DM44 Oscilloscope

250 MHz bw, dual channel, 5 mV/ div sensitivity, 1nS/ div sweep rate. With differential-time/ DMM option. Includes 2 probes.

\$975.00

Tektronix 465 Oscilloscope

100 MHz bw, dual trace, 5 mV/div sensitivity, 5 ns/ div sweep rate, 8 x 10 cm CRT. Includes 2 probes.

\$590.00

Tektronix 485 Oscilloscope

350 MHz bw, dual trace, 5 mV/ div sensitivity, 1 ns/ div sweep rate, 3.0 div/ ns writing speed, selectable input impedance.

\$1000.00

Tektronix 7834 Package

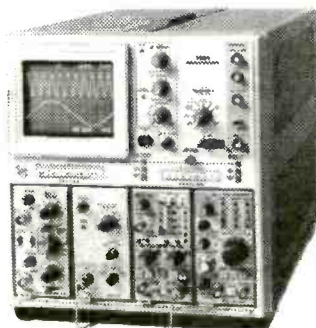
Dc to 400 MHz Storage Oscilloscope Mainframe with the following plug-ins: (1) 7A19 amplifier, (1) 7A26 dual trace amplifier, (1) 7B85 delaying time base, and (1) 7B80 time base.

\$1000.00

Tektronix 7904 Package

Dc to 500 MHz Oscilloscope Mainframe with the following plug-ins: (1) 7A24 dual trace amplifier, (1) 7A26 dual trace amplifier, (1) 7B80 time base, and (1) 7B85 delaying time base.

\$1100.00



Fluke 1900A

Multifunction Counter, 5 Hz to 80 MHz, provides frequency, period, period averaging and totalize measurements, 6 digit display, 1 MHz low-pass filter.

\$189.00 Special

JFW 75PD-001 Power Divider

2 Way Power Divider, Dc to 1000 frequency range, power division asymmetry (Dc to 500 MHz \pm .2 dB, 500 to 1000 MHz \pm .4 dB), 75 Ω impedance, input power 1W average @ 25°C, 1000 W peak (1 microsecond).

\$22.00 or 5 for \$100.00

Hewlett-Packard 8656B

Synthesized Signal Generator, 100 kHz to 990 MHz, 10 Hz resolution, +1.0 dB absolute level accuracy, 150 ms frequency switching speed, HP-IB.

\$5000.00

Hewlett-Packard 8569B

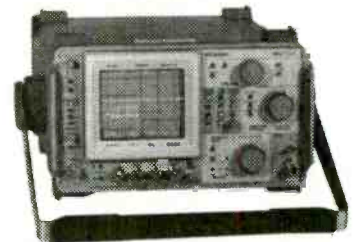
10 MHz to 22 GHz, input preselection, 1.7 to 22 GHz, resolution 100 Hz to 3 MHz.

\$9200.00

Tektronix 492 Spectrum Analyzer

50 kHz to 21 GHz, 80 dB dynamic range, amplitude comparison in 0.25 dB steps. Options 01, 02.

\$7500.00



Available with Opt 01, 02, 03 \$8250.00

Boonton 9200A

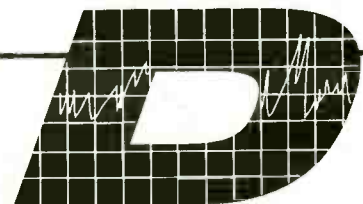
RF RMS Millivoltmeter, 200 μ V to 3V, 1% accuracy, 10 Hz to 2.5 GHz, true rms, display in mV, dBm, dB, dBmV, dBV or dBW.

\$325.00

Hewlett-Packard 3311A

Function Generator, 0.1 Hz to 1 MHz, sine, square, triangle and pos. pulse waveforms.

Special \$350.00



DANBAR SALES COMPANY

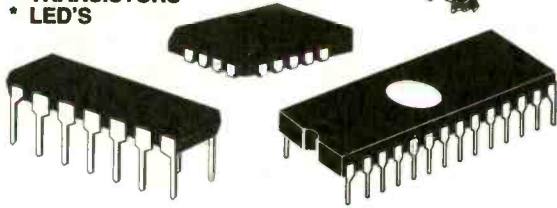
Please call for our Free 1996 Catalog

14455 NORTH 79TH STREET • UNIT C • SCOTTSDALE • ARIZONA 85260
(602) 483-6202 • FAX (602) 483-6403

CIRCLE 235 ON FREE INFORMATION CARD

ACTIVE We Want Your MICRO Excess Inventory

- * INTEGRATED CIRCUITS
- * MEMORY (NEW OR USED)
- * EPROMS (NEW OR USED)
- * CIRCUIT BOARDS
- * DIODES
- * TRANSISTORS
- * LED'S



Tel 310-494-4851 Fax 310-494-4913
1891 Obispo Ave Signal Hill, CA 90804

Come
Celebrate
With Us!



National Salvation Army Week

DATA ACQUISITION

and Control Hardware for PC's

ANA100 Analog I/O \$ 99



- * 8 Channel 8-Bit
- * 0 to 5 Volt Input
- * 14 TTL I/O lines
- * Analog Output
- * 400KHz Sampling

DIG100 Digital I/O \$ 39



- * 8255 PPI
- * 24 or 48 TTL I/O Lines option
- * Selectable Base Address

ANA150 Analog/Counter... \$ 89



- * 8 Channel 8-Bit
- * 0 to 5 Volt input
- * 3 16-Bit Counters
- * 400KHz Sampling

DIG200 Counter I/O \$ 79



- * 3 16-Bit Counters
- * 8 TTL Input lines
- * 8 TTL Output lines
- * Selectable Clock Frequency input

ANA200 Analog I/O \$ 79



- * 1 Channel 12-Bit
- * 0 to 5 Volt Input
- * optional bi-polar
- * 100KHz / 300KHz Sampling rate
- * 24 TTL I/O lines

ANA201 Analog \$ 129



- * 8 Channel 12-Bit
- * x1, x5, x10, x50 Programmable Channel gain
- * 100KHz/300KHz Sampling rate

Engineering Software - PC/MSDOS

Easy-PC Professional XM - Integrated Electronics
CAE System, Combines Schematic Capture,
Simulation, and PCB Design In one package.... \$ 349

More Hardware and
Software Items
Ask for our current catalog

PC-SCOPE - Digital Storage Oscilloscope, 1, 2, 4, or
8 Channel Capture and Display of Data. Works with
ANA100, ANA150, and ANA201 Boards..... \$ 39

We accept
MasterCard/Visa Orders

BSOFT Software, Inc.

PHONE 614-491-0832 * FAX 614-497-9971
444 COLTON ROAD * COLUMBUS, OHIO * 43207

❖ ATTENTION CABLE VIEWERS ❖

CABLE VIEWERS... get back to your **BASIC** Cable Needs

Call 800-577-8775

For information regarding all of your **BASIC** cable needs.

5 GOOD REASONS TO BUY OUR FAR SUPERIOR PRODUCT

- ❖ PRICE
- ❖ EFFICIENT SALES AND SERVICE
- ❖ WE SPECIALIZE IN 5, 10 LOT PRICING
- ❖ ALL FUNCTIONS (COMPATIBLE WITH ALL MAJOR BRANDS)
- ❖ **ANY SIZE** ORDER FILLED WITH SAME DAY SHIPPING

We handle **NEW** equipment **ONLY** - Don't trust last year's **OBSOLETE** and **UNSOLD** stock!
COMPETITIVE PRICING—DEALERS WELCOME

HOURS: Monday-Saturday 9-5 C.S.T.

It is not the intent of B.E.S.W. to defraud any pay television operator and we will not assist any company or individual in doing the same.
*Refer to sales personnel for specifications.

BASIC ELECTRICAL SUPPLY & WAREHOUSING CORPORATION

P.O. Box 8180 ■ Bartlett, IL 60103 ■ 800-577-8775

ALL ELECTRONICS

C O R P O R A T I O N

QUALITY PARTS

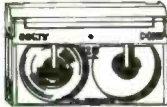
FAST SHIPPING

DISCOUNT PRICING

CALL, WRITE, FAX
or E-MAIL For A
Free 64 Page
CATALOG.
Outside the U.S.A.
send \$2.00 postage.

"HI-8" VIDEO CASSETTE (USED)

SONY Hi-8
Top quality, metal particle 120 minute video cassettes. Used for a short time, then bulk-erased. Each cassette has its own plastic storage box. Satisfaction Guaranteed.

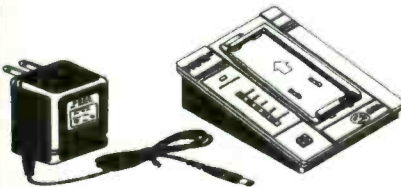


\$3.00 each

CAT # VCU-8

10 for \$28.00 • 100 for \$250.00

CAMCORDER BATTERY QUICK-CHARGERS



"Power-Up"™ quick-charger conditioners can charge nickel cadmium batteries in about 10% of the time (usually less than one hour) it takes to charge by conventional trickle charger. Conditioning cycle discharges battery before recharging to increase battery life. Easy to read LED's allow precise monitoring of charging cycle. Includes a cigarette lighter cord, so it can be used in your vehicle as well as indoors. Available for two kinds of 6 Vdc camcorder batteries:

For Panasonic Palmcorder and other compatible batteries. CAT# QCC-16 **\$25.00** each

For Sony Handycam and other compatible batteries. CAT# QCC-66 **\$25.00** each

Special Sale !! SUPER NINTENDO POWER SUPPLY



Nintendo # SNS-002
New, original wall transformer with 9 foot cord and co-ax plug with center pin. Output: 10 vdc @ 850 ma. UL and CSA listed.

\$4.00 each

CAT # DCTX-1085

10 for \$35.00

MAGNETIC CARD READER



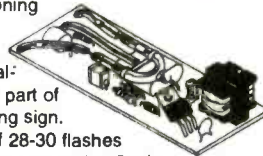
Magtek# 21045002
Credit card or ID card magnetic strip reader consists of break-resistant plastic card guide with decoder pc board and head. Head is mounted on spring steel strip which keeps it pressed against the card surface. Terminated with a socket connector at the end of 5 color-coded leads.

3.57" X 0.9" X 0.95"
CAT# MCR-2

\$6.00 each

FLASH TUBE ASSEMBLY

Complete, functioning flash assembly with horseshoe flash tube, originally designed to be part of a highway warning sign. Flashes at rate of 28-30 flashes per minute when connected to 3 vdc. 3.32" X 1.17" X 0.7" high.



CAT# FSH-3

\$3.75 each

ULTRA-BRIGHT LED

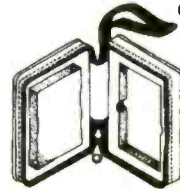


Rohm # SLA-580MT-E49 T-1 3/4
GREEN, water clear in off state. 500+ mcd @ 2.1 v, 16ma.

CAT# LED-33 **2 for \$1.00**

100 for \$40.00 • 1000 for \$300.00

CANVAS CARRYING CASE



Good-looking, well constructed 7.5" X 6" X 1.95" canvas carrying case with zipper on three sides. Webbed nylon hand strap and ample foam padding inside. Probably originally designed for transporting memory storage media.

The black foam padding inside can easily be reconfigured to accommodate photographic, audio or video components. The removal of one large chunk of foam gives you a well padded interior volume of 5.9" x 4.3" x 0.75". All black with red and white embroidered "K-stor" (tm) logo on front. CAT# CSE-3

\$3.75 each

10 for \$35.00
60 for \$180.00

PHOTO RESISTOR

Silonex # NSL 4582
Cadmium Sulfide photoconductive cell. 22 ohms in bright light. 2 meg ohms dark. Plastic encapsulated. CAT # PRE-12 **75¢**
0.29" x 0.26" x 0.07"
1.5" long wire leads.

10 for \$6.00 • 100 for \$50.00

FAX/MODEM LINE PROTECTOR

Ora Electronics # MP700
Protects against data interruptions and eavesdropping of private conversations when fax machine, modem or phone shares a line with other similar devices. Easy to install. Plugs inline between wall jack and telephone line. Requires one for each instrument sharing the same line.



\$3.00 per package of 3 devices CAT # MP-700

ORDER TOLL FREE

1-800-826-5432

MAIL ORDERS TO:
ALL ELECTRONICS CORP.
P.O. BOX 567
VAN NUYS, CA 91408-0567

FAX (818) 781-2653 • INFO (818) 904-0524
<http://www.allcorp.com/>
E-MAIL allcorp@allcorp.com

NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard, American Express or Discover • Checks and Money Orders Accepted by Mail • Orders Delivered in the State of California must include California State Sales Tax • NO C.O.D. • Shipping and Handling \$5.00 for the 48 Continental United States • ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write, E-MAIL or Fax YOUR LIST.

CIRCLE 214 ON FREE INFORMATION CARD

ELECTRONICS® MCM

**20th
Anniversary
1996**

Readers Specials!
Take advantage of these tremendous offers on select items for the workbench.. Call today, time is limited!

To take advantage of these offers, you must supply this special price code:

CODE: ENS25

Value and Selection From One source...

- Test Equipment from Tenma, Fluke, Hitachi, Leader, B+K
- Name Brand and Low Cost Generic Technician's Tools
- OEM and Generic TV/VCR repair parts
- Over 10,000 American and Original Japanese Semiconductors

MCM offers a full line of tools and test equipment engineered for the repair of computers, TVs, VCRs and more. In addition, you will find a wide variety of TV/VCR parts, passive components and semiconductors, over 25,000 items in all, stocked and ready to ship.

30 Piece Security Screwdriver Kit

Ideal for those service applications made difficult by using security screws. Kit contains removal tools for opening many items including IBM PS/2 monitors, cable boxes, telephone equipment and more.

#22-1475

Reg. \$39.95

Sale \$34.95

**SAVE
13%**



MCM VCR Repair Tech Disk

Ideal for anyone in the VCR Service Business. Contains over 4800 VCR problems with practical repair suggestions. Shows case histories by model number. You can add your own problems and solutions for future reference. Requires DOS 3.0, 1MB hard drive space.

#81-1735

Reg. \$39.95

Sale \$34.95

**SAVE
13%**



**SAVE
17%**

TENMA™

Digital Solder Station

Digital display accurately shows temperature. 320~900°F adjustment and grounded tip make this ideal for most soldering applications.

#21-1590

Reg. \$119.00

Sale \$99.00



**FREE
Catalog**

Prices effective
July 1 through August 9, 1996

Call Today For your FREE catalog.

1-800-543-4330

Hours: M-F 7 a.m.-9 p.m., Sat. 9 a.m.-6 p.m. EST.



MCM ELECTRONICS®

650 CONGRESS PARK DR.
CENTERVILLE, OH 45459-4072

A PREMIER Company

Fast delivery on every order.

PCA/SGE Premier-Distributor

Authorized
Panasonic

Quasar/Technics

Original Parts
Distributor

CODE: ENS25

July 1996, Electronics Now

113

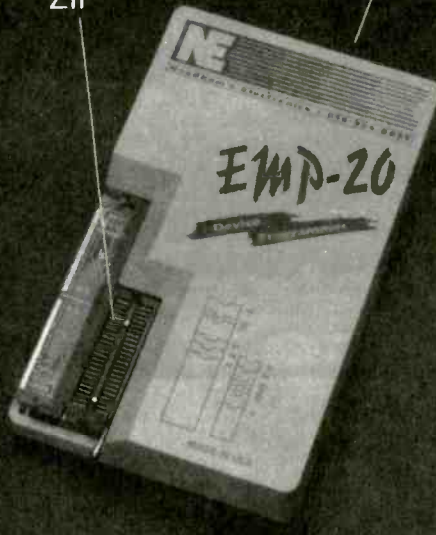
\$449⁹⁵

Device Programmers

\$139⁹⁵

48 PIN
ZIF

Connects to standard
PC parallel printer port



9¹/₂ x 5³/₄ x 1¹/₄

EMP-20

- Easy to use software, on-line help, full screen editor

- **Fast Programming**
(EMP-20)
27C010A, 23 seconds
28C020, 34 seconds
27C040, 95 seconds

- **Made in USA**

- 1 Year Warranty

- Technical Support by phone

- 30 day Money Back Guarantee

- FREE software upgrades available via BBS

- Demo SW via **BBS (EM20DEMO.EXE) (PB10DEMO.EXE)**

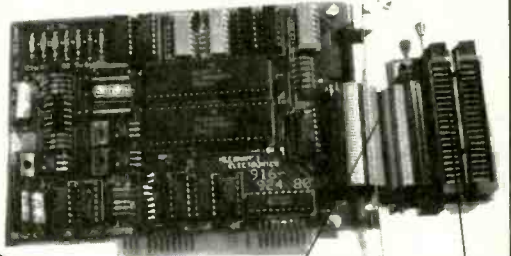
- **E(e)proms** 2716 - 8 megabit, 16 bit 27210-27240, 27C400 & 27C800,

- **Flash** 28F256-28F020, (29C256-29C010 (EMP-20 only))

- **Micros** 8741A, 42A, 42AH, 48, 49, 48H, 49H, 55, 87C51, 87C51FX, 87C751,752

- **GAL, PLD** from NS, Lattice, AMD-16V8, 20V8, 22V10 (EMP-20 only)

PB-10 Internal Card for PC



2 ft. Cable

40 PIN
ZIF

FOR MORE INFORMATION CALL

4630 Beloit Drive, Suite 20
Sacramento, CA 95838
(Monday-Friday, 8 am-5 pm PST)

NEEDHAM'S ELECTRONICS, INC.



C.O.D.



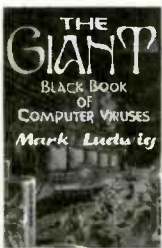
(916) 924-8037

BBS 916-924-8094

FAX 916-924-8065

CIRCLE 257 ON FREE INFORMATION CARD

The **GIANT** Black Book of Computer Viruses



Enter the secret world of computer viruses with this incredible book! Find out how viruses work, while learning **coding secrets that make your computer software capable of amazing feats**. Explore the PC as well as Windows and OS/2 internals. Learn how to get a super user account on a UNIX system with

a virus. Get the inside scoop on the incredible KOH virus - a beneficial virus that will keep your data encrypted for you. More than just a dry textbook, this book is an **excellent tutorial in assembler** that will hold your interest with a fascinating subject! It includes **full source** and explanations of 37 different viruses and four different anti-virus programs!

ALL NEW FOR 1996!

672 page Book \$39.95

Program Disk \$15.00

Shipping \$3

Call (800)719-4957 now!

to order (Visa/MC/COD) or call or write for free catalog!

American Eagle Publications, Inc.

P. O. Box 1507

Show Low, AZ 85901

CIRCLE 319 ON FREE INFORMATION CARD

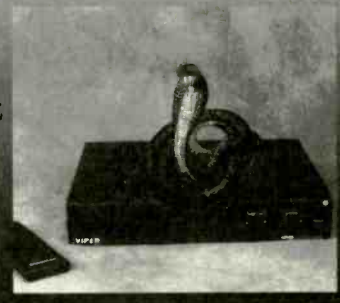
DESCRAMBLERS FOR CABLE TV AND DIRECT TV SATALITE BUY DIRECT FROM THE MANUFACTURER. \$250.00 FOR OUR VIPER SERIES

THE MOST SOPHISTICATED 1 PIECE SYSTEM ON THE MARKET!

11 EXTRA FEATURES • REMOTE CONTROL • SLEEP TIMER • PARENTAL LOCK OUT • FAVORITE CHANNEL PROGRAMMING AND MORE!

MONEY BACK GUARANTEE! LOWER PRICE SYSTEMS AVAILABLE

CALL NOW! 1-800-555-1651



Robot Kits Kits Kits!!!

New Low Price!

Hyper Peppy Robot #3-296 \$29.95

Bright red, white & blue, and clear dome. Runs forward until it bumps object or hears loud noise, reverses & turns 90°, then resumes. With complete instructions. 14 cm W x 13 L x 9 H. No soldering required. *A fun & frantic first robot!* Two AA NiCads INCLUDED!



Sonic Rover Robot #3-174 \$27.95

A great, low-priced kit. "Bump & run" operation like Hyper Peppy above. Molded body, red/green LED, great 48 pg manual. 14 cm L x 12 W x 7 H. Requires soldering. *A fast moving first robot!* Two AA NiCads INCLUDED!



New Low Price!

Spider Walking IR AVOIDER Robot #3-186 \$79.95

Futuristic & maneuverable 6-legged walker with IR for object avoidance. Complete instructions, requires soldering. 13 cm L x 13 W x 10 H. Two AA & one 9V NiCad INCLUDED!



Line Tracker Robot #3-188 \$69.95

Easy-to-assemble. Front mounted sensors follow black line on white paper. Stylish molded gray & green, with complete instructions. 16 cm L x 14 W x 10 H. Needs no soldering! Two AA and one 9V NiCad INCLUDED!



Light Sensing Robot #3-216 \$68.95

Clever sensors system lets this robot avoid objects & solve walled mazes! Dual motors, rubber tires, preassembled gear box & circuit board. 7 cm W x 16 H x 23 L. No Soldering! Three AA NiCads INCLUDED!



New Low Price!

S-Cargo Sound Controlled Robot #3-295 \$34.95

You control the action by clap or whistle. Rotate left, go forward or stop. Top mounted microphone & smooth design to glide through the environment. 11 cm dia. Requires soldering. Ideal for Robot Golf. Two AA & one 9V NiCad INCLUDED!



Advanced Robots

New Low Price!

WAO II Programmable Robot #3-280 \$74.95

A sophisticated, full function robot kit. 2 motors, programmable 4-bit micro, 26 button keypad, sensor arms for collision or edge detection. Moves in all directions, performs if-then decisions based on sensor input, even do-loops! Requires soldering. Great intro to robot programming. Three AA & one 9V NiCad INCLUDED!



PC Interface for WAO II #3-195 \$29.95

Parallel cable & 5.25" DOS disk for easy program handling.

A Top Selling Kit!

Mobile Robots Brains & Brawn Kit #3-148 \$489.00

A complete, serious research robot platform from MIT. With all hardware, C software, 68HC11 CPU, memory, sensors, wheels, motors, chassis, instructions & more. 18 cm dia. The ideal companion kit to the Mobile Robots book (#3-098). *NOTE: Indicate PC or Mac version.*

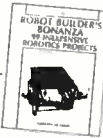


MONDO-TRONICS Robot Store

Best seller!

Robot Builder's Bonanza #3-114 \$18.95

Practical, ready-to-use circuits, devices, mechanisms, sources, tools, vision, grippers, navigation & more! 336 pgs, illust.



Gadgets & Goldmine #3-129 \$21.95

Unique high-tech projects & hard-to-find info. Robots, high voltage Tesla & Van de Graaff generators, Kirlian photos, lasers & much more! 400+ pgs, illust.



Mobile Robots #3-098 \$39.95

From MIT, a complete guide to designing & building robots: hardware, software, sensors, motors, "subsumption" software. 336 pages, illust. A must for all roboticists.



Sensors for Mobile Robots #3-145 \$59.95

Whoa! Everything about sensors: tactile, proximity, range, acoustic, laser, radar, microwave, path following, dead reckoning, compasses, gyros & more. 550 pgs. Fun & intelligent!

507 Mechanical Movements #3-173 \$9.95

Reprinted from 1893 - when steam was king! Discover 100's of cams, clutches, linkages, latches, ratchets & more! Don't reinvent the past - use it! 120 pg, illust. High powered!



The Robot Zoo #3-149 \$19.95

A big, imaginative & fun book about animals that work like robots - or are they robots that work like animals?? 50 full color pages. For kids of all ages.



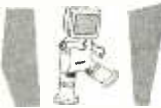
IC Hobbyist's Handbook #3-164 \$19.95

Toss those old IC data books! This practical collection has 80 common ICs to make 100s of circuits! Amps, linear, logic, CMOS - with specs, pinouts, sample circuits - even component values (gasp!). 120 pgs. A basic resource!



Controlling the World With Your PC #3-165 \$35.00

Convert ordinary serial & parallel ports into object-detecting, motor-spinning monsters! 42 circuits AND software in BASIC, C and Pascal! 256 pages, illustrated, with DOS disk.



Forrest Mims Engineer's Notebook #3-166 \$19.95

A classic from THE circuit master himself. 100s of circuits, 156 pgs, 350 illust. Great starting point for the beginner - an ideal reference for the advanced!



24-hour Voice Order Line - VISA MasterCard
Order Toll Free! 800-374-5764
Request our FREE Robot Store Catalog!

Mondo-tronics
524 San Anselmo Ave. #107-107
San Anselmo, CA 94960
Questions: 415-455-9330
Fax: 415-455-9333
Email: info@mondo.com
Web: www.RobotStore.com

International Orders Welcome! First Class P&H: \$12.00

Basic Stamps

Stamp One Starter Pack #3-294 \$149.95

A complete starter set: Stamp Programming Package (#3-199), a Stamp 1 (#3-201), a BS-1 Carrier Board, & a 9V NiCad. \$161.85 value. *Upgradeable - add a Stamp 2 & Carrier Board 2 for full Stamp 2 power!*



Stamp Two Starter Pack #3-279 \$169.95

Everything needed to move with the Stamp 2: Programming Package (#3-199), one Stamp 2 module (#3-198), one BS-2 Carrier Board, a 9V NiCad. \$180.90 value. Monstrous power!

BASIC Stamp Programming Pkg #3-199 \$99.00

With cables, manuals, app notes & Stamp DOS program to edit, file, download & debug both type 1 & 2 Stamps.

BASIC Stamp 1 #3-201 \$34.95

8 input/output lines, EEPROM for 100 instructions, 4 MHz.

BASIC Stamp 2 #3-198 \$49.00

16 input/output lines, EEPROM for 600 instructions, 20 MHz clock (up to 38,400 baud), touch tones, X-10, more!

Carrier Board, BS1 #1-105 \$19.95

Carrier Board, BS2 #1-106 \$24.95

Solar Powered Robots

BEAM Manual & Buttons #3-286 \$19.95

Learn the philosophy, practice & history of solar powered BEAM robotics. Shows robots, creators, events, winners from past games, tech references, more. 114 pages, illust. Informative & fun!



BEAM Videotape, VHS #3-287 \$14.95

Dave's exclusive "insider look" at the world of BEAM robotics. Solar-powered gizmos fighting for survival, time-lapse footage, 1995 BEAM Games, more! 60 min. VHS.

Dave's BEAM Solar Engine Kit #3-119 \$29.95

Harness fusion power today! Circuit uses a tiny (11 x 55 mm) solar cell to drive a motor up to 3 RPM! A complete power plant with all parts & instructions. Just add solder & sun!



Mechanicals

Dump Truck Kit #3-212 \$49.95

Great full function wheeled base - rugged rubber tires, 3 motors: steer left-right, drive forward-reverse, dump up-down. 22 cm L x 14 H x 12 W. Includes two D NiCads!



Power Shovel/Dozer Kit #3-211 \$39.95

An excellent full function tank base. Wire controlled left, right, forward, reverse, plus scoop up & down. 10 cm W x 28 L x 10 H. Has extra track & wheels. Two D NiCads INCLUDED!



Tracked Vehicle Parts Kit #3-293 \$22.95

Get on track! Track, wheels, sprockets, axles, hardware, as in Dozer above, plus fwd/rev only gearbox, 3V DC motor & battery holder. 10 cm W x 18 L. Tech Tip: Replace gearbox with 2 R C Servos for full fwd/rev-left-right action!

R/C Servo #3-278 \$19.95 or Servo 6-Pack #3-263 \$89.95

Quality RCD HS-300 servo, 42 oz/in, 0/19 sec. With app notes.

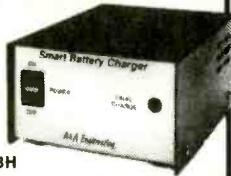
Muscle Wires

Muscle Wires Project Book & Deluxe Kit #3-168 \$59.95

Create direct linear action with Muscle Wires. They contract up to 5% when powered! Use them in robots, models and anything needing strong all-electric motion. 128 page book, full plans for BORIS, a motorless walking robot & 14 others. Includes one meter each 50, 100 & 150 µm dia Muscle Wires. *Get moving today!*



Smart Battery Charger



JUN 87 QST

BY WARREN DION N1BBH

FOR GEL-CELLS or LEAD ACID BATTERIES.
Features: Precision temperature tracking voltage reference & three mode charging sequence. Standard kit is for 12V @ 1/2 or 1 Amp, user selectable. Can be connected to the battery indefinitely, will not overcharge. Weighs 2 pounds and measures 4"W x 5 1/2"D x 2 1/2"H. Finished enclosure included in kit.

Complete Kit Only \$59.95
Assembled & Tested \$79.95

CA Residents add 7.75% sales tax. S&H: \$5.00 (Insured). Foreign orders add 20%. For more info or price list; send legal size SASE (52¢) to:

A&A Engineering
 2521 W. La Palma #K • Anaheim, CA 92801
 (714) 952-2114 • FAX: (714) 952-3280

VIDEO SYNC GENERATOR



Restores Horizontal and Vertical Sync Lines from Distorted Analogue Video Formats

For Free Information Package on Completed Units and Pricing

• Call Toll Free •
1-800-236-5778

R.C. Distributing • PO Box 552 • South Bend, IN 46624

SURVEILLANCE

The Latest High Tech Professional Electronic Devices

Our latest catalog offers a **HUGE** selection of surveillance, privacy devices including: hidden video equipment, electronic kits, telephone recording systems, touch tone decoders, scanners, telephone tap detectors, bug detectors, voice disguisers, telephone scramblers, locksmithing tools, and more. **Catalog \$5.00.**

SPY OUTLET

P.O. Box 337, Buffalo, NY 14226
 (716) 691-3476/(716) 695-8660

BUY BONDS

CABLE TV DESCRAMBLER KITS

Universal-New Product

This Product includes all the Parts, PC Board, Complete Schematic with Functional Guide. Generates Sync for most Video Applications.

\$79.95

Tri-Mode Descrambler

This product includes all the parts PC Board and AC Adaptor. NO Enclosure included.

\$59.95

SB-3 Descrambler

This Product includes all the Parts, PC Board and AC Adaptor. Enclosure is not included.

\$44.95

Call Toll Free 1-800-886-8699

M & G Electronics, P.O. Box 3310, No. Attleboro Mass. 02761



Anyone implying theft of Cable service will be denied assistance.

NO MASSACHUSETTS SALES!



PUT YOUR PC TO WORK

THIS IS THE DREAM MACHINE YOU'VE BEEN WAITING FOR

**2.5, 3, & 4 AXIS CNC/DNC
 DESKTOP MANUFACTURING UNITS**

STARTING AT
\$ 495.00

**FREE
 CAD/CAM
 SOFTWARE**

- AUTOMATICALLY PROTOTYPE PC BOARDS & MACHINE 3D PARTS FROM CAD
- CARVE, ROUTE, MILL, & DRILL WOOD, PLASTICS, & LIGHT METALS
- FREE POWERFUL 3D CAD/CAM SOFTWARE WITH EACH UNIT
- INEXPENSIVE CNC KITS AND ASSEMBLED CNC UNITS
- NOW OVER 20 DIFFERENT MODEL-OPTIONS
- EXPEDITE & SUPER-EXPEDITE AVAILABLE



**SIZES FROM 12"x 12"
 TO HUGE 6'x 6' UNITS**

ORDER NOW! 501-839-8293 U.S. CYBERLAB, INC., 14786 SLATE GAP ROAD, WEST FORK, AR 72774

CALL NOW FOR INSTANT SPECS 501-839-8293 24 HR. FAX-BACK SERVICE

RAINBOW KITS

Many of our kits are available completely built

FM STEREO TRANSMITTER

Own your own FM radio station. Any stereo signal you plug into the FMST-100 will be transmitted to any FM radio tuneable from 76 to 108MHz FM. Transmit a wireless link through an auditorium, from your car to your camper, listen to your CD's while mowing the lawn, Play music on one channel sing on the other. Clarity is excellent, approx. 40dB stereo separation. Length of antenna determines the distance of transmission. Complete with stereo input level controls & crystal for stereo separation. 9v battery operation. SIZE: 1.5" x 2.5" x 3"

FMST-100 Cabinet \$8.95 KIT \$29.95

PHONE TRANSMITTER

Small but mighty, it fits anywhere. Phone line powered, never needs batteries. Transmits both sides of a phone conversation loud and clear, wireless, to any FM radio at great distances. Variable tunes from 70MHz to 130MHz FM. You can also use it as a speaker phone. SIZE: 1.25" x .6"

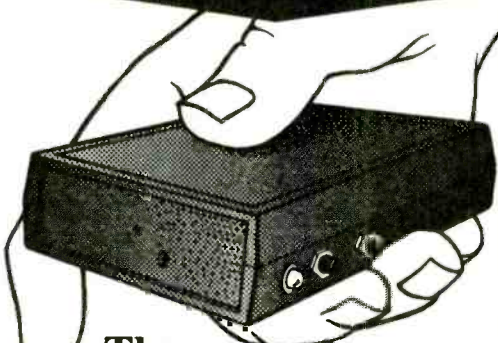
TEL-B1 BUILT \$29.95 KIT \$12.95

SUPER SNOOPER BIG EAR

Listen through walls, hear conversations across the room. Add a parabolic reflector and hear blocks away.

The BIG EAR can be hidden about anywhere. Makes an ultra sensitive intercom. Can be used as a 1.5W AMP. We supply a mini-electret mike in the kit. Power requirement 6 to 12v DC. SIZE: 1.75" x 1"

AA-1 BUILT \$29.95 KIT \$10.95



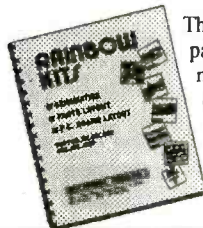
The "ZAPPER II"

With it's new and improved design it will not only test your radar detector... BUT it's tuned to the amateur radio band.

- While your out on American highways personally test yours and your fellow travelers radar detectors.

The "ZAPPER II" is a 10.450 GHz to 10.550 Transmitter

KIT \$39⁹⁵ BUILT \$49⁹⁵



This Manual contains schematics, parts lists & P.C. board layouts for many of the Rainbow Kits. Use your own parts to construct our kits.

KIT BOOK \$14.95
\$9.95 with the purchase of any kit.

WIRELESS FM MICROPHONE

Small but mighty this little jewel will out perform most units many times its price. It really stomps out a signal. The WM-2 kit is a buffered wireless mike that

operates from 80MHz to 120MHz FM, the frequency of any broadcast FM radio. Includes a mini-electret mike. 6 to 12v DC. SIZE: 1.25" x 1" WM-2 KIT \$14.95

MICRO-MINIATURE PHONE TRANSMITTER

We haven't seen a smaller phone transmitter than the MMPT2 kit. Powered by the phone, it requires no battery. Transmits both sides of a phone conversation to an FM radio up to a 1/4 mile away. Tunable from 88 to 108MHz FM. Attach it to one phone or add it to the line to pick up all incoming calls. The MMPT2 is undetectable if properly installed. Unit has surface mounted parts, you install the leaded parts. Size .45" x .6"

MMPT2 KIT \$29.95

MICRO-MINIATURE WIRELESS MIKE

So small you could hide this one on some real bugs! It's the smallest we've ever seen. With it's super sensitive mike it transmits a whisper or a room of conversation to an FM radio, tunable from 88 to 108MHz FM. With a proper antenna it transmits about 1/2 mile. The kit is made with surface mounted parts, we have already mounted these parts. You install the leaded parts. Power requirement 6 to 12v DC. Size .35" x .9"

MMWMS KIT \$34.95

632nm the brightest laser pen we've seen.

INCLUDES 2 AAA Batteries
PEN SIZE: Approx. 5.5" x .5"

10 times brighter than the 670nm model!

COMPLETELY BUILT \$89⁹⁵



THE SUPER SENSITIVE BIONIC EAR

Complete with

- Professional headset
- Ultra sensitive microphone
- 12" parabolic reflector.
- Individual volume controls for each ear.
- Auto Safety Circuit shuts sound off at 95 decibels for your ear protection.
- On /Off & master volume control
- The Bionic Ear increases sound by up to 30 decibel.
- Hear & pinpoint sounds of wild birds and animals, great for hunters, Search & Rescue teams, sports events and Law Enforcement.
- Hear mere whispers at incredible distances.
- Record those sounds with your own recorder.

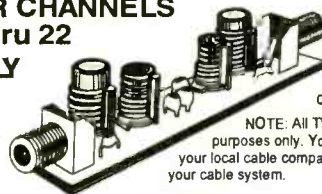
COMES COMPLETELY BUILT

12" PARABOLIC REFLECTOR

BE-1 BUILT \$149⁹⁵

TV NOTCH FILTERS FOR CHANNELS 2 thru 22 ONLY

Our TV filters eliminate unwanted TV channels or interference that alters both sound and video with a beep beep beep. Works on cable channels 2 thru 22) only.



DF-222

KIT \$14.95

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 First lb \$5.00 Canada \$7.00
Additional LB. Add \$1.00 US FUNDS ONLY
We will accept telephone orders for Visa or Mastercard



To Order Call
317-291-7262



ELECTRONIC RAINBOW INC

6227 Coffman Rd. • Indianapolis, IN 46268
FAX 317-291-7269

RADIATION DETECTOR

AN/PDR-63 RADIAC SET, military modular unit uses IM-226 module for 0-10-100-1000 rad/hour gamma detection, DT-507 low-range detector indicates 0-1-10-100-1000 mrad/hr and DT-508 0-500-5000 rad/hr plus simulates radiation absorption by human skin. Requires four AA batteries (not supplied). Set also includes ni-cad battery charger, headset, case, and manual; 15 lbs sh. Used **\$185.00**



SCR & DIODES

HIGH CURRENT COMPONENTS with pigtailed but no mount hardware; Westinghouse/Power X mfg. Removed from equipment:

- #SCR-135048Y, 1300 PIV 500 amp; 7" tail, 1lb. **\$14.95**
- #D-R610-0230, 200 PIV 300 amp; 4" tail **\$ 8.95**
- #D-18937300, 100 PIV 150 amp; 4" tail **\$ 3.75**



SOLDERING KIT

WELLER SOLDER/DESOLDER STATION with TCP-24G 48 W pencil iron, eight solder tips from 3/64" to 1/8" wide, 600° or 700°F; six desolder tips with orifices .038" to .090"; and 2.5"Hx13"Wx4"D steel carrying case. Requires 115 VAC 60 Hz; 7 lbs sh. WELLER #WTCPK, UNUSED **\$69.50**



FIELD DAY KIT

AB-155 MAST KIT with eight self-stacking 66"Lx1.6" dia aluminum MS-44 mast sections to make 40 ft mast. Also four each rope guy lengths 31, 40, & 50 ft with clips; five guy rings, swivel base, six 15" stakes, and 2 lb hammer. 70 lbs sh. **UNUSED \$125 ... \$99.50**

MS-44 MAST SECTION only, aluminum 66"Lx1.4" dia; usable also as flag, tent, or volleyball net poles. **USED \$8.00 ea**

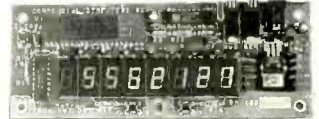
Prices F.O.B. Lima, O. • VISA, MASTERCARD Accepted.
Allow for Shipping • Write for latest Catalog
Address Dept. ES • Phone 419/227-6573 • Fax 419/227-1313

FAIR RADIO SALES

1016 E. EUREKA • Box 1105 • LIMA, OHIO • 45802

Motron 310 Garfield St Suite 4 *New Low Price!*
PO Box 2748
ELECTRONICS Eugene, Oregon 97402 **\$59.00**

The TDD-8X features a large 8-digit LED display and decodes all 16 DTMF digits. The 104 character memory is viewed, without loss of data, by scrolling either left or right.



Although a computer is not required, the serial ASCII output allows automatic logging of decoded number groups. ToneLog™, our IBM/Compatible logging software is included. Available accessories include a Plastic Mounting Kit (\$15), Audio/Computer Cables (\$20) and a 12VDC AC Power Adapter (\$10). Visa, MasterCard, American Express, Discover and Government Purchase Orders accepted. Minimum Government Purchase Order: \$99. COD \$5, (Cash or Money Order only); S/H: \$6 USA; \$10 Canada; \$15 Foreign

Info: (541) 687-2118 **Orders: (800) 338-9058** Fax: (541) 687-2492
Or contact motron.info@emerald.com for a catalog via the Internet

Satellite TV 'BIBLE'

4th 'DIGITAL' edition

The acclaimed "bible" of satellite TV
- ALL the TECHNICAL DETAILS -

- Operation, installation & troubleshooting of analog and digital satellite systems
- The transition from analog to digital TVRO

1-800-483-2423

TO ORDER

or for a FREE books/software/video CATALOG

HOME SATELLITE TV
INSTALLATION
AND TROUBLESHOOTING
MANUAL



324 pages
8-1/2" x 11"
\$30 plus \$4 s/h

BAYLUN publications

1905 Mariposa, Boulder, Colorado 80302, USA
Telephone: 303-449-4551 FAX: 303-939-8720

Don't waste another minute, send today for the latest free Catalog and a free sample booklet. Send your name and address to:

Consumer Information Center
Department TH
Pueblo, Colorado 81009

Weeder Technologies

Electronic
KITS!

Call for
FREE
CATALOG!

From
\$29 to \$55

Pro-Kit™

PO Box 421, Batavia, OH 45103

513-752-0279

Home Automation

Connects between a TW523 and an RS-232 serial port. Use your PC or Mac to receive and transmit all X-10 commands. Create your own program to control your home automation system, turning on/off any device plugged into an electrical outlet with response to time/date, other X-10 transmissions or any other computer input stimuli.

Caller ID / RS-232

Connects between a telephone wall jack and an RS-232 serial port. Decodes the caller ID data sent over the phone line and sends it to your PC or Mac, in a pre-formatted ASCII character string. Create your own program to log the name, number, date, and time of all incoming calls.

Telephone Call Restrictor

Connects to telephone wall jack. Disables all phones on the line if attempting to either: dial a number that has been stored in memory "Block" mode or, dial a number that has not been stored in memory "Allow" mode. Use touch-tone phone to enter telephone numbers into memory, and choose mode. Program from any phone on the line using your password.

50 MHz Frequency Counter

Reads frequency from 1Hz to 50MHz and displays up to 7 digits on a 16x1 character LCD display. Auto-range feature provides floating decimal point and automatically affixes the correct suffix (Hz, KHz, or MHz). Micro-controller based provides for very small parts count, only 2" x 3" big.

Telephone Scrambler

Scrambles your voice before sending it over the telephone line. Prevent eavesdropping from an extension or tap. Connects between your telephone and wall jack. No modifications are required to your telephone. Full duplex operation.

IR Remote Control Receiver

Learns and records the data patterns emitted by standard infrared remote controls used by TVs, VCRs, Stereos, etc. Lets you control all your electronic projects with your TV remote. Seven individual I/O pins can be assigned to any button on your remote, and can be configured for either "toggle" or "momentary" action.

Vocal Filter

An audio device which can be used with a home component stereo system to filter out the main vocal sound track from standard stereo recordings (CD, tape, record or FM), leaving the background music to sing along with. Produce your own karaoke tapes from your personal library.

DTMF Decoder/Logger

Keep track of all numbers dialed or entered from any phone on your line. Connects to your telephone wall jack. Decodes all 16 touch-tones and displays them on an LCD display. Holds the last 240 digits in a nonvolatile memory. Scroll through and view all telephone numbers dialed, credit card numbers entered, etc.

DO-IT-YOURSELF AUDIO AMPLIFIER KITS

Mark V Electronics, Inc.
8019 E. Slauson Ave.,
Montebello, CA 90640

In business since 1985

Mention AD and
take 10% off your
1st order!

Enclosures at Unbeatable prices !

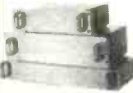
Free Catalog 213/888-8988 Fax 213/888-6868

Order 1-800-521-MARK / 1-800-423-FIVE

Kit skill levels are specified as ▲ beginner ▲▲ intermediate or ▲▲▲ advanced!

Metal Cabinets with Aluminum Front Panel

Best Buy



- LG-1273 3x12x7" \$ 26.50
- LG-1684 4x16x8" 32.50
- LG-1924 4x19x11 1/2" 38.25
- LG-1925 5x19x11 1/2" 42.00
- LG-1983 2 1/4 x19x8" 35.25
- LG-1923 3x19x11 1/2" 36.50
- LG-1927 7x19x11 1/2" 50.50

LG- Black anodized rack cabinet

Modular Desktop Consoles



- L x W x H
- LE-453 4x4 3/4 x3" \$ 7.50
 - LE-653 6x4 3/4 x3" 9.75
 - LE-853 8x4 3/4 x3" 11.75
- LE- Black finished aluminum panel 1mm thick.

Alarm Box with Lock

Mejor Compra !



- LB-1085 8 1/2 x10 1/4 x5" \$18.75
 - LB-1395 9 1/4 x13 1/4 x5" 25.50
 - LB-1525 12 1/4 x15 1/4 x5" 35.25
 - *LB-1494 9 1/4 x14 1/4 x4 1/4" 21.50
 - LB-1383A 8 1/2 x13 1/4 x4" 23.25
- *No lock & LB- Sheet Metal 0.8mm

New

- *LL-1923B 2 3/4 x19x12" 69.50
- *LL-1925A 5x19x12" 79.50

- *LL- High quality full Aluminum Cabinet
- *LL- Front panel .157" & other panels .078"
- *LL- Gold plated cap screw for front panel

- Dimensions in inches ±.05
- Custom-made for other dimensions if over 100 pcs for single model !

Camera Housing



- *LD-1244 2 3/4 x10 3/4 x4" \$55.00
 - *LD-1516 3 3/4 x13 3/4 x4" 29.50
 - *LD-1565 4x13 3/4 x5 1/4" 31.75
- *LD- Stainless Steel 0.7mm
**LD- Sheet Metal 1mm

Power Transformers & **Toroidal Transformer

- 001 28/30V x 2 6A \$ 30.00
- 002 36V x 2 3A 25.00
- 003 40V x 2 6A 32.00
- **008 28/30V x 2 6A 40.00
- **009 48/53V x 2 8A 66.00
- **012 33/40/42Vx2 6A 48.00

TA-800MK2 ▲▲ 120+120W Pre & Main Stereo Amp. (4 lbs.)



Kit: \$ 67.92
Asmb. \$ 86.95

Power Output: 120W into 4 ohms RMS. 72W into 8 ohms RMS. Frequency Response: 10-20KHZ. THD: <0.01%. Tone Control: Bass ±12dB, Mid & Treble ±8dB. Sensitivity: Phono Input, 3mV into 47K. Line, 0.3V into 47K. Signal to Noise Ratio: 86dB. Power Requirement: 40VDC @ 6A. Suggested Mark V model 001 or 008 transformer. Recommended Metal Cabinet LG-1924.

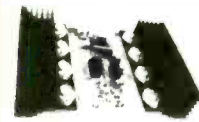
TY-35 ▲ FM Wireless Microphone



Kit: \$ 12.50 \$ 6.99

Clearance Sale This is a low power real FM transmitter. Transmit frequency within 88 to 108 megahertz. Transmit range about 200 ft. It has high sensitivity sound pickup by a capacitance microphone. May be used strictly for series purposes such as remote wireless monitoring.

AF-3 ▲▲ 300W MOSFET High Power Mono Amp. (7 lbs.)



Kit: \$ 165.00 Asmb. \$ 195.00

Power Output: 300W into 4 ohms RMS. 200W into 8 ohms RMS. Frequency Response: 10HZ-20KHZ. THD: <0.03%. Signal to noise ratio: 91dB. Input Sensitivity & Impedance at 1KHZ, 1V 47K. Load Impedance 4-16 ohms. Power Requirement: ±55 to ±65VDC 8A. Suggested Mark V model 009 Transformer. Capacitor 10,000uf 80-100V model 016 or 019. Recommended Metal Cabinet LG-1925 for each channel.

TR-503 ▲ Regulated DC Power Supply



Kit: \$ 18.75 Asmb. \$ 27.65 variable over a range of 0-50V. Current limit trip is adjustable up to max of 3A. Suggested Mark V 002 transformer. (1 lb.)

TA-388 ▲▲ Class A FET Dynamic Buffer Stereo Pre-Amp (1 lb.)



Kit: \$ 64.00 Asmb. \$ 80.00

Frequency Response (at rated output): Overall 10HZ-100KHZ +0.5dB-1dB. THD: Overall <0.007% at or below rated output level. Channel Separation (at rated output 1KHZ): Overall better than 70dB. Hum & Noise: Overall better than 90dB. Input Sensitivity (1KHZ for rated output): 300-600mV. Maximum Output Level: Pre-Amp output 1.8V (0.1% THD). Power Requirement: 30V X 2 AC 500mA

School Project Kits Source ...

- SM-36 Dynamic Noise Reduction ▲ \$ 26.00
- TA-006 6W Mini-Amplifier ▲ 9.50
- TA-28 Digital Voice Memo ▲▲ 9.90
- TA-120 36W Class A Power Amp. ▲▲ 32.50
- TA-201 Microphone Mixer Mono Amp ▲ 20.79
- TY-45 20 Bar/Dot Level Display ▲▲ 38.25
- TY-2 Fluorescent Light Driver ▲ 14.75
- TA-50 Melody Generator ▲ 9.90

SM-100 ▲▲ 150 MHZ 8 Digit Frequency Counter (2 lbs.)



Sale

Kit: \$ 79.00 \$ 65.00
Asmb. \$ 99.00

Frequency Range: 10HZ-150MHZ. Gate Time: 0.01s, 0.1s, 1s, 10s. Input Sensitivity: KHZ range 10HZ-10MHZ 20mV(min.). MHZ range 1MHZ-120MHZ 20mV(min.), 120MHZ-150MHZ 35mV (min.), 150MHZ-200MHZ 40mV(typical). Time Base: 10MHZ crystal, ±10 ppm. Input Impedance: 1M ohm. Response Time: 0.2s. Resolution: 0.1 HZ: 10s gate time, 1HZ: 1s gate time, 10HZ: 0.1s gate time, 100 HZ: 0.01s gate time. Hold the last input signal. Reset counter to 0. DC 9V power adapter not included.

SM-720 AC/DC Stereo Pre & Main Power Amp.



Kit: \$ 77.00
Asmb. \$ 102.00

120Wx2 Music power. THD: <0.2%. Input Sensitivity: Tape, CD/Aux 300mV 47k ohm, Phono 3mV 47k ohm, Guitar/Mic 3mV (600-47k ohm). Tone Control: Treble & Bass ±8dB. Frequency Response: 20HZ-20KHZ. Signal to Noise Ratio: 78dB. Power Requirement: AC 110/60Hz or DC 12-16V. Ready to plug in when assembled. Case & transformer included! ▲▲ (9 lbs.)

See our catalog for more kits!

Minimum order \$ 20. We accept Visa, MasterCard & Money Orders. Checks allow 2 weeks for clearance. We ship by UPS ground inside US (2 lbs min \$ 5.00) and ship by US mail outside US. Please call for orders shipping & handling or fax (foreign) orders. PO Orders are welcome from schools. We are not responsible for typographical errors.

AT LAST! DC-20 MHz SYNTHESIZED PERFORMANCE FOR ONLY \$795!



- DC-20 MHz, .1 Hz resolution, DC offset
- Linear/Log Sweep
- Internal/External AM
- Internal/External FM
- Internal/External PM
- Internal/External SSB
- Internal/External BPSK
- Internal/External FSK
- Burst
- DTMF Generation
- DTMF Detection
- Power Level Measmt

\$795 (quantity 1)

The SG-100 gives you .1 Hz synthesized precision and a wide diversity of modulation functions all of which can be performed using an internally generated or externally applied signal. You also get signal analysis functions that are just not offered on any other signal source such as DTMF Detection and Power Level Measurement. And because you can download new instrument functions to Flash memory, you can ensure that your SG-100 will never become obsolete.

The SG-100 is available NOW and is ready to turn your engineering bench into a real powerhouse!

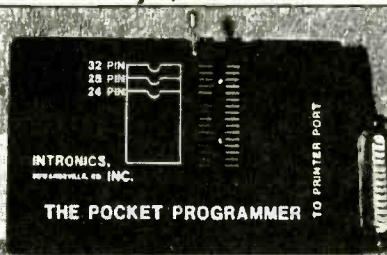
Telulex Inc.

2455 Old Middlefield Way S Mountain View, Ca. 94043

(415) 938-0240 Fax: (415) 938-0241 <http://www.telulex.com>



**The Pocket Programmer
Only \$129.95**



The portable programmer that uses the printer port of your PC instead of an internal card. Easy to use software that programs Eprom, EEprom, Flash & Dallas Ram. 27(C) / 28(C) / 28F / 29F / 29C & 25XX series from 16K to 8 Megabit with a 32 pin socket. Adapters available for Pic, PLCC, 5-Gang, 874X, 875X MCU's, 40-Pin X 16 & Serial Eprom's, and Eprom Emulator to 32K X 8.

Same Name, Address & Phone # for 13 Years... Isn't it Amazing ?

Intronics, Inc.

Box 13723 / 612 Newton St.
Edwardsville, KS 66113 Add \$4.75 COD
Tel. (913) 422-2094 Add \$4.00 Shipping
Fax (913) 441-1623 Visa / Master Charge

BUGGED??

EAVESDROPPING is unbelievably widespread! Electronic Devices with amazing capabilities can be monitoring your telephone and room conversations RIGHT NOW! Are you sure you're safe? **FREE CATALOG** tells you fast! Includes Free Bonus details on fantastic opportunities now open in Counter-Surveillance field. Exciting, immensely interesting and EXTREMELY profitable (up to \$250 hr) full/part-time income. Call Now! **1-800-732-5000**

Cable Aids Test
Orders Only Information
1-800-615-9221 **407-998-7883**

Test Chips that fully activate Jerrold, Tocom, Zenith, SA, Pioneer and more. Quick-Board installation! Prices from \$5 to \$49.95 ea. **MC SPECIALTIES** 1 Year Warranty! No FL Sales. Not for use in cable co. owned equip. For test or repair only.

Robot Explorer Newsletter

Nano-ants, flying robots, Martian explorers. Explore an entire universe of exciting robots. 8 information-packed issues for only \$14.95. Call now! MasterCard/Visa Accepted.

1-(800) GO-ROBOT or 1-(800)467-6268

CABLE TV CONVERTERS

Equipment & Accessories
Wholesalers Welcome

Call **VISION TIME PRODUCTS**
1-800-310-1153 M-F 8a-8p
NO TENN SALES

LASERS



We're Moving!
Midwest Laser Products is pleased to announce our move to a new location. Please make note of our new address and phone number:
P.O. Box 262, Frankfort, IL 60423
(815)464-0085

5mW, 635nm Laser Module

An economical laser module featuring a 5mW, 635nm laser. Input voltage is 2.7 to 6Vdc; current draw is less than 65mA. Beam divergence less than 1.6mRad. Size: 19mm x 10.5 mm diameter. Cat. #: VM1535 **\$88.00**



Midwest Laser Products

P.O. Box 262, Frankfort, IL 60423
Phone: (815) 464-0085 FAX: (815) 464-0767.

FREE CATALOG

Email: mlp@nienx.com
VISA / MC Accepted

Please include \$7 S&H within US. IL res. add 7.75% sales tax. 30 day satisfaction guarantee

Help protect our nation's soil and water.
Call for your free action packet.

1-800-THE-SOIL
WE OWE IT TO OUR CHILDREN

United States Department of Agriculture
Soil Conservation Service

ATTENTION DEALERS

BUY DIRECT FROM THE WHOLESALE

GET THE BEST PRICES AND SERVICE

ALL UNITS ARE IN STOCK FOR IMMEDIATE SHIPMENT

ADD-ONS

	QTY 5	QTY 10	QTY 20	QTY 50+
STEALTH-1000-P	\$55	\$48	\$45	CALL
TVT-3 GOLD	\$48	\$41	\$38	CALL
TNT-3	\$52	\$45	\$42	CALL
STEALTH 80 - P	\$61	\$54	\$49	CALL
M-80	\$70	\$64	\$58	CALL
PIO+	\$75	\$68	\$58	CALL

NEW CONVERTERS

CENTURY CT-3000	\$68	\$64	\$60	CALL
SA - 8511	\$75	\$70	\$65	CALL

NOVAVISIONS

NV-5600	\$205	\$195	\$185	CALL
NV-5700	\$195	\$185	\$175	CALL
NV-5800	\$195	\$185	\$175	CALL
NV-5750	\$305	\$295	\$285	CALL

BOSS COMBOS

BOSS 1	\$210	\$195	\$185	CALL
BOSS 2	\$210	\$195	\$185	CALL
BOSS 3	\$210	\$195	\$185	CALL

ZENITHS

ST-1600	\$210	\$195	\$185	CALL
---------	-------	-------	-------	------

REFURBISHED CONVERTERS

REGAL • SA • PANASONIC

CALL FOR THIS MONTH'S SPECIALS

1-800-800-0766

KIMTRONICS INC

FREE HOME AUTOMATION CATALOG!



Home Controls' color catalog features truly affordable X-10 powerline controls, IR products, CCD cameras, wireless home control devices, security products, drapery controls, audio systems, and everything you can imagine for the remote and automated control of your home!

Call Toll Free
1-800-CONTROL

Contact us by E-Mail: homectrl@electriciti.com
Lowest Prices Guaranteed • Same Day Shipping • Superior Technical Support
No Minimum Order • Fabulous Freebies • Great Selection!

Earn \$1000

A Week While You Learn High Paying VCR Repair.

**Earn While You Learn . . .
Secrets Revealed . . .**



Train at Home
If you are able to work with small hand tools and possess average mechanical ability, you could earn top dollar part time or full

time. Our learn by doing method teaches you how to work on VCR's without boring unnecessary electronic basics.

For Free Information Package Send Coupon to:
Foley-Belsaw Institute, 6301 Equitable Road,
Kansas City, MO 64120

Check VCR or another High Paying Career Field (Check One Box Only)

VCR Repair, Dept. 62520
 Computer Repair, Dept. 64417
 TV/Satellite Dish, Dept. 31292
 Computer Programming, Dept. 35240
 Computer Specialist, Dept. 38091
 Networking Specialist, Dept. 39078
 Electrician, Dept. 95098

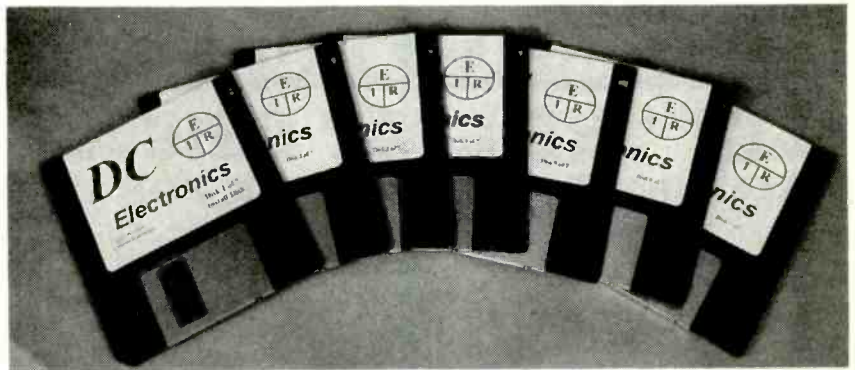
Since 1926

Name _____
 Address _____
 City _____
 State _____ Zip _____

CIRCLE 330 ON FREE INFORMATION CARD

Discover DC Electronics

17-Module Course -- Only \$49.95



Contains everything you ever needed to know about DC electronics. Whether you are a professional working in electronics and you want a review of the basics, or a student or hobbyist new to this field and need a good self-paced course, this is the perfect way to get started.

The course starts with basics and assumes you know nothing about electronics. It teaches the required math, how to use a scientific calculator, and the metric notation system. Each module has been written by an electronics instructor, and will directly from a floppy or from a menu-driven system on your hard drive. Every module includes a review, summary, quiz, and a final exam that can be printed out. Important points are animated to make the explanation clear.

System requirements: IBM Compatible, 512K RAM, VGA Color, Hard Drive and DOS 3.2 or newer.

Here are the Modules

- | | |
|---|---|
| 1. Atoms and Electrons | 10. Series / Parallel Circuits |
| 2. Volts / Current / Resistance | 11. Voltage Dividers |
| 3. Numbers greater than one
Scientific - metric notation | 12. Kirchhoff's Law |
| 4. Numbers less than one
Scientific - metric notation | 13. Advanced DC Circuit
Analysis |
| 5. Resistor Color Codes | 14. Capacitors / RC Time
Constants |
| 6. Using Calculators | 15. Introduction to Magnetism |
| 7. Ohms Law and Power | 16. Inductors and L/R Time
Constants |
| 8. Series Circuits | 17. Volt/Ohm/Current Meters |
| 9. Parallel Circuits | |

Clagck Inc. P.O. Box 4099, Farmingdale, NY 11735

Send me my course, today! Charge me the special introductory price!

Name _____ **\$49.95 + \$4.95 shipping**

Address _____

Address _____

City _____ State _____

Zip _____

Payment Enclosed \$ _____

Check Money Order Credit Card

New York residents add local sales taxes. Canadians add \$6

per order. Credit card orders by phone or fax. Automated

telephone orders 516-293-3751. Fax 516-293-3115.

Allow 4 to 6 weeks for delivery.

Credit Card Info

MC Visa

Card # _____

Exp Date _____

Signature _____

PCBoards

PCB Artwork Made Easy!

PRINTED CIRCUIT DESIGN SOFTWARE
For DOS & WINDOWS
Layout - Autorouting - Schematic - Circuit Simulation

- Supports all Video Modes including Super VGA
- Copper Flooding for Building Ground Areas
- Gerber and Excellon Output
- Create Negative & Positive Printouts
- Autoroute Single & Multi Layer Boards
- Create artwork from the Schematic
- Analog and Digital Simulation available
- Make boards up to 32" x 32"
- **Parts Library - Silk Layer - Solder Mask and more!**
- **Great for All Circuit Design Projects!**

Download Demos from BBS (205)933-2954

PCBoards Layout for DOS \$99

Windows[™] Version starts at \$149

Call or Write for Full Product Line, Prices & Demo Packages

PCBoards
2110 14th Ave. South
Birmingham, AL 35205

(800)473-7227
Fax (205)933-2954
Phone (205)933-1122

The Smallest, Most Secure, Best Range, 3 Channel Remote Receiver.



Security Receiver for... Home Automation, Garage Doors, Home Security Add On, Auto Convenience Package (Door Locks, Trunk Pop, Windows-Up/Down, Car Start), N/O or N/C Contacts.

Security - 70 billion hopping codes with anti-scan processing. Unbreachable security; never repeats the same code twice. Double EEPROM memory.

Incredible Range - No cross talk or blockage. Range up to 1000 feet.

3 Channel - Our universal receiver controls up to 3 items with only one receiver (optional relay needed). Push both buttons together for third channel output.

Interfaces with most home and auto security systems for easy remote integration.

Comes with (1) three channel receiver, (1) long range three channel remote, (1) universal 120 VAC transformer.

ALL FOR ONLY \$99.95 + shipping & sales tax.

Street Smart Security
619) 462-1167

7147 University Avenue • La Mesa, CA 91941

Send, Fax or Call Order In - Use Credit Card or Check. Fax (619) 462-0652

SOLAR POWERED HAT FAN

- Solar Powered
- Durable Fan in bill
- Keeps you Cool!
- Adjustable Fit

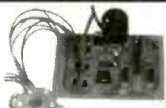


Keeps you cool on hot days, while working or playing. Makes a great gift! Specify color: red, light blue, navy blue, white, and yellow.

SPHF-1 \$15.00ea.

STEPPER MOTOR CONTROLLER KIT

- Adjust speed
- Change direction of rotation.
- Single step or Continuous stepping



Easy to assemble! LED's show sequence of motor steps. Runs on 12VDC. Includes Stepper Motor, PC Board, Parts, and Instructions.

SMK-1 \$25.00

CAMCORDER VIDEO TAPE

- HI-8
- P6-120 HMPX
- Major Brand Name
- Excellent Condition
- Jewel Box Included



HI-8 120 minute video cassette tape (used). They were recorded on once and played a few times. Then bulk erased. Ready to record on again.

CT-1 . . . \$3.00ea/10+ 2.80ea/50+ 2.65ea/100+ 2.50ea

SUPER VHS VIDEO TAPES (USED)

- Super VHS Tapes
- T-120Minute
- Major Brand Names
- Excellent Condition
- Great Priced!



These tapes were used for a brief period, then bulk erased. The record tabs have broken out, so you will need to cover the notch with a piece of tape.

S-VHS . . . \$3.00ea/10+ 2.80ea/50+ 2.65ea/100+ 2.50ea

MINIATURE FM TRANSMITTER KIT

- Powerful 2 stage Audio Amplifier
- Tunes 100-108Mhz
- Requires 9V Battery (Not Included)
- Sensitive mike picks up Whispers



Works with any FM radio or broadcast receiver. Easy to assemble.

FM-32 \$10.95

MINI PHONE TRANSMITTER KIT

- Small Phone Transmitter
- Tunes 90-95Mhz
- Attaches to phone line any where in home.
- Powered by phone line.



Use with any FM radio or broadcast receiver. Easy to assemble. Just lift the handset to activate.

FM-16 \$9.95

AMAZING EMERGENCY FLASHLIGHT

- Hand Powered!
- Never needs batteries
- Operates even underwater!



Never be caught without a flashlight again due to dead batteries. Dynamo produces power to provide light. Great for the car, boat, and house.

EL-1 \$9.95

DC MOTOR SPEED CONTROLLER KIT

- Control speed
- Clockwise or Counter Clockwise Rotation
- Runs on 6 to 12VDC



Easy to build. Control speed and direction of small DC motors. Includes PC Board, Motor, Parts, and Instructions.

MSC-1 \$15.00

VIDEO CLARIFIER

- Eliminate Copyguards!
- Auto Sync Boost
- Fully Automatic
- State-of-the Art Circuitry

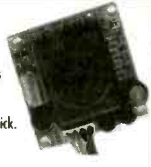


Allows for flawless viewing of all prerecorded tapes. Restores tapes to broadcast quality. Eliminates annoying interference. Compatible with all VCR's and T.V.'s. Operates on 4 AA batteries. (Not Included)

VC-3 \$49.95

B/W PINHOLE CAMERA WITH AUDIO

- Pinhole with Audio
- Ultra Miniature
- 3.7mm lens
- Prewired with RCA plugs



Ultra mini camera measures 1 3/16" x 1 3/16" x 9/16" thick. 420 Horizontal lines. .1 Lux Runs on 9-12VDC@100ma

PHC-1 \$159.95

MINI B/W CAMERA W/STAND

- B/W CCD CAMERA
- Prewired with RCA Plugs
- Metal Housing
- Stand w/Hardware
- Adapter Included



Measures 3 7/8" Long (Including Lens) x 1 1/4" W x 1 1/4" H Small enough to fit in your hand! Has 0.2 Lux, 400 TV lines, operates on 12VDC@1.5W. Includes stand & power adapter, & prewired with RCA plugs.

CCD-2 \$159.95

ULTRA PLIER 14 FUNCTION TOOL

- Ultra Plier
- 14 Functions
- Ultimate Handy Tool!
- Fits in the Palm of your Hand!



You have every type tool in one implement. Includes Pry Bar, Wire Cutter, 2 Wire Strippers, Phillips Screwdriver, 2 Flathead Screwdriver, File, Small Blade and Bottle Opener. Comes with Nylon Pouch.

Pier \$12.95

CALL TOLL FREE
1-800-526-3717

SATISFACTION GUARANTEED

645 Temple 7E ▲ Long Beach ▲ California 90814
▲ (310) 434-5641 ▲ FAX (310) 434-9142 ▲

1. California residents must include sales tax.
2. Visa, MC, & money orders accepted
3. Quantities limited - prices subject to change.
4. Shipping \$5.00 & up.



Black Feather ELECTRONICS

CIRCLE 311 ON FREE INFORMATION CARD

DALBANI

UNIQUE REALTIME
OSCILLOSCOPE
BUILT-IN FUNCTION
GENERATOR



Manuf # OS-9020G
2-CH
DUAL TRACE

20MHz

Order N° 50-820



1 MHz FUNCTION
GENERATOR

Features

- Wider than specified frequency response • High deflection factor of 1mV/div. • Wide dynamic range up to 30MHz without waveform distortion • Algebraic sum of CH1 and CH2 • Low drift with compensation circuit • Superb trigger sensitivity • Maximum sweep rate of video signals with internal TV sync. separator • Jitterless trigger circuitry • CH1 signal output terminal available • Variable trigger hold-off • High precision X-Y phase difference measurement up to 50kHz • Built-in function generator with BNC output of 50Ω and TTL • Three kinds of waveform are available with 50Ω output • Flat output waveform frequency up to 1MHz

Specifications:

- Vertical deflection: • Bandwidth :DC coupled (DC to 20MHz normal), AC coupled : (10Hz to 20MHz normal) • Deflection factor: 5mV/div to 5V/div in 10 calibrated steps of 1-2-5 sequence • Rise time: 17.5nS or less
- Horizontal deflection: • Time Base A: 0.2μs to 0.2S/div in 19 calibrated steps. 1-2-5 sequence • Uncalibrated continuous control between steps of at least 1: 2.5.



CALL TOLL FREE
1-800-325-2264

\$20 MINIMUM ORDER
CALL NOW FOR YOUR
232 PAGE FREE CATALOG
1-800-325-2264

CODE EN96
PLEASE MENTION
WHEN ORDERING

Items are subject to availability.
Prices are subject to change without
any prior notice.

**FLYBACK
TRANSFORMERS**



Replaces
GOLDSTAR 154-074R
ORDER N° 63-0189

\$12.50

TUN-O-WASH®
ORDER N° 30-0100

\$7.50
(CFC Free)

Fast drying electronics
grade cleaner for tuners,
controls and PC boards.

TUN-O-WASH is excellent cleaner and
degreaser for tuners, controllers and PC boards.

- Designed for cleaning and degreasing consumer electronics • Cleans in one step, no rinsing required • Contains no ozone depleting compounds • CFC and HCFC free
- Not for use on energized equipment
- 12.5 Oz aerosol (12 cans per case)



DIGITAL MULTIMETERS
NEW! Digital

- Overload protect 1000VDC or peak AC on all other ranges
- Input Impedance 10M Ohm on all ranges • Base accuracy range ± 0.5% to ± 1.0% • Resistance 200Ω, 2K, 20K, 200K, 2M, 20M
- Audible continuity response lower than 50Ω • DC Voltage 200mV, 2V, 20V, 200V, 1000V
- AC Voltage 200mV, 2V, 20V, 200V, 700V

ORDER N° 50-815

DALCO



\$19.95

LOGIC Probe
ORDER N° 51-1015

- Length: 8 Inches
- Range: 4.5 To 15 VDC
- Includes Test Leads • Compatible With TTL, DTL, RTL, HTL, CMOS, NMOS Logic

\$8.99

SOLDER ROLL

- 1 LB Spool
- 370 deg F melting point
- Fastest solder
- Alloy 60/40, tin lead, non corrosive flux, Diam. 1.2mm

ORDER N° 51-1005

\$3.95

HOT PRICES ON POPULAR SEMI'S

Order N°	Brand	Mln	Price
BU-208	TESLA	10	\$1.49
BU-208/O	TOSHIBA	1	4.50
2N-3055	TESLA	10	0.60
2N-3773	TESLA	5	1.20
2SD-1398	SANYO	10	1.49
2SD-1650	SANYO	5	1.69
STRD-1005	SANKEN	1	4.15
STR-30130	SANKEN	1	2.66
STRS-6301	SANKEN	1	8.50
TA-7777N	TOSHIBA	1	6.96
TDA-2005	SGS	5	1.49



**COLOR CODED
LEADS HEAVY DUTY**
ORDER N° 56-500

- 11" Long Wire Lead
- Insulated 1/2" Alligator Clips
- 20 Gauge Wire Size • 10 Leads
- BLACK, GREEN, RED, YELLOW, WHITE

\$2.82



SOLDER WICK

- Solder Remover
- Length 5 Feet

ORDER N° 51-1050

85¢

Mfn. 2 pcs.



VCR ALIGNMENT TOOL KIT
ORDER # 50-888

The most popular

- VCR Head puller
- Retaining ring remover
- Spring hook
- Micro screwdriver
- Hex key set • Fitted vinyl • Soft zippered case
- Dimensions: 9 1/2" (W) X 12 1/4" (L)
- 7 Assorted head & guide aligners
- 3 Reverseable screwdrivers (Small-Flat-Phillips)

\$24.99



**TEMPERATURE CONTROLLED
SOLDERING STATION**

- Adjustable Temp.: 300°F - 790°F - 150°C - 480°C
- Grounded Tip for Soldering : Static Sensitive Devices, Heater Aid.
- Led Power Temperature Indicator
- Overheat Protection W/ Temperature Control
- Auxiliary Grounded Terminal
- Comes in digital LED display
- 48 Watts soldering iron

ORDER N° 51-1035

\$64.00



Universal Audio/video Remote
ORDER N° 82-1055

- Controls basic functions of TV, VCR, cable box, and CD or laser player • Ergonomic design! Main buttons are in line with natural thumb motion • Two-minute memory allows time to replace batteries without reprogramming • Programming reminder sticker inside battery compartment • Sleep time for 60, 30, or 15 minutes (according to your TV) • Set key recessed to prevent accidental deprogramming • Spanish instruction included. • Requires four AAA Batteries (not included)

MAGNAVOX
Smart. Very smart

\$9.95

- Cable (11 brands)
- VCR (68 brands)
- TV (77 brands)
- Compact disc and Laser Disc (94 brands)



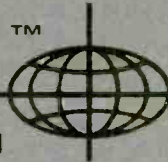
4225 N.W. 72nd AVE MIAMI, FLORIDA 33166 TEL : (305) 716-1016 FAX : (305) 594-6588

CIRCLE 234 ON FREE INFORMATION CARD

www.americanradiohistory.com

NEW!!! 1996 PRINT Catalog!

PRINT™



1996

**Products International
EQUIPMENT, TOOLS & SUPPLIES
FOR ELECTRONIC PRODUCTION
MAINTENANCE & SERVICE**

We Make Ordering Simple!

TOLL FREE 800-638-2020

FAX 800-545-0058

IN MARYLAND

CALL 301-587-7824

FAX 301-585-5402



KENWOOD



LEADER



HITACHI



INNOVENTIONS® Inc.
INNOVATIVE PRODUCTS FROM INVENTIVE MINDS



BK PRECISION
MAXTEC INTERNATIONAL CORP.



PAGE



**GLOBAL
SPECIALTIES**



SRS
STANFORD RESEARCH SYSTEMS



AVCOM

PRINT™

8931 Brookville Road * Silver Spring, Maryland 20910 * 800-638-2020 * Fax 800-545-0058

**Call 800-638-2020 today for your free
copy of the NEW 84 page 1996 catalog,
jam packed with the best values in test and
measurement instruments available today!!!**

Before You Blow Thousands of Dollars on Tango, Or-Cad or Protel Try



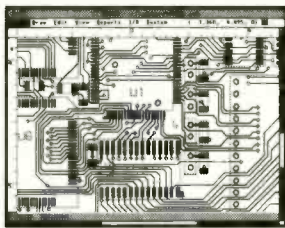
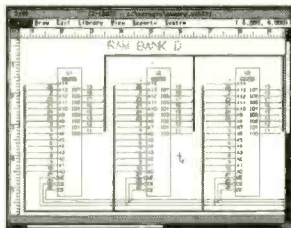
EZ-ROUTE™



The Most Complete Schematic-PCB Layout-Auto-Router System

The EZ-ROUTE™ system from AMS for IBM PC, PS/2 and compatibles is an integrated system and includes Schematic Capture, PCB Layout, Automatic Router, Design Rule Checker, Gerber Plot View and Gerber file import capability. The EZ-ROUTE™ system is complete, totally intuitive and easy to use.

- 20,000+ parts library
- A through E sheet sizes
- On-Line Design Rule Checker
- 256 board layers
- Imports files from Gerber, Protel and Or-Cad and 8 other formats
- SMD on both sides of board
- Netlist output compatible to: Futurenet, Pcad, Edif and 16 other formats
- Output to penplotter, Gerber photoplotter, dot-matrix and laser printers



For a FREE
Evaluation call:
1-800-972-3733

30 DAY NO-HASSLE
MONEY BACK

EZ-ROUTE Pro™ \$695 EZ-ROUTE Std™ \$249



Advanced Microcomputer Systems, Inc.
1460 SW 3rd Street • Pompano Beach, FL 33069
Phone (954) 784-0900 • Fax (954) 784-0904

CIRCLE 309 ON FREE INFORMATION CARD

CUSTOMER
SATISFACTION
#1 PRIORITY

TEST EQUIPMENT SALES

WE BUY
SURPLUS
EQUIPMENT

TEK 2215.....60 MHz 2 CH. SCOPE.....\$550
(WITH TV TRIGGER)
HP 3776B-001-004. PCM TEST SET.....\$1295
(UNUSED IN HP BOX)
TEK 465.....100 MHz 2 CH. SCOPE.....\$475
HP 1980B.....DIGITIZING OSCOPE.....\$995
(W/ 4 CH. & DIGITAL STORAGE)
TEK 475.....200 MHz 2 CH. SCOPE.....\$650
FLUKE 752A...REFERENCE DIVIDER.....\$2750
FLUKE 5100B-03-05...CALIBRATOR.....\$5495
HP 3325A...SYNTH./FUNC. GENERATOR..\$1995
TEK 7L5.....SPECTRUM ANALYZER P/I.....\$1495
(INCLUDES L3 MODULE)

TEK 7104.....1 GHz SCOPE MAINFRAME.....\$2995
TEK 577 D2.....CURVE TRACER.....\$1295
(WITH 177 TEST FIXTURE)
HP 11664A.....CRYSTAL DETECTOR.....\$325

TEK 2336.....100 MHz 2 CH. SCOPE.....\$895
NEW TEKTRONIX SCOPES W/ 3 YEAR
MFG. WARRANTY !!
TEK THS 720...100 MHz 500MS/s HANDHELD
SCOPE & DMM.....\$2195
TEK TDS 360.....200 MHz 1 GS/s SCOPE
W/ DRT, FFT & DISK DRIVE.....\$3495
TEK TDS 380.....400 MHz 2 GS/s SCOPE
W/ DRT, FFT & DISK DRIVE.....\$4595
FLUKE 105.....100 MHz DSO & DMM\$2995



P.O. BOX 986
LONDONDERRY, NH 03053

PHONE (800) 684-4651
FAX (603) 425-2945

ASK ABOUT OUR NEW
TEKTRONIX & FLUKE
PRODUCTS

Electronics Now, July 1996

126

!!! BROADCAST FARTHER !!!

The model 1525 is a 75-110MHz RF amplifier that connects to mono or stereo FM transmitters and produces a powerful 15-20 watt signal which could broadcast up to 5 miles or more! Requires 75-250 mW drive. Step by step plans complete with part source information and antenna designs... ONLY \$14 PLUS \$2 S&H NO C.O.D.'s

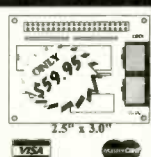
Progressive Concepts
BOX 586 STREAMWOOD, IL 60107
(708)736-9822 FAX: (708)736-0353



INTERFACE TO YOUR PC KEYBOARD INPUT !

Our KE-18 Keyboard Encoder converts input from switches and keypads into PC compatible keyboard signals.
• Use with or without your own PC's keyboard
• Scans 9 x 9 matrix or 18 individual inputs
• PCXT. AT, PS2 and Compatibles
• Looks like a Keyboard to your Computer

Hagstrom Electronics
2 Green Lantern Boulevard
Endicott, NY 13760 (607) 786-7523



CABLE TV

ALL NAME BRANDS
DESCRAMBLERS, CONVERTERS
COMBOS. CALL NOW
WE'LL BEAT THE COMPETITION
UNIVERSAL SALES 800-647-2371

Books that work the way you work...

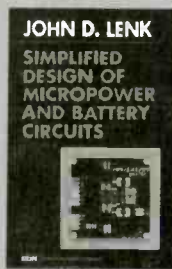
SPECIAL OFFER
No obligation

**SAVE
OVER 10%**

**NEW
FROM
JOHN LENK**



1996, paperback
~~\$29.95~~ \$26.95
0-7506-9821-7



1996, paperback
~~\$29.95~~ \$26.95
0-7506-9510-2



1996, paperback
~~\$29.95~~ \$26.95
0-7506-9820-9

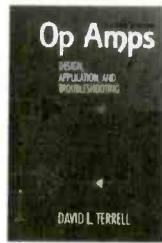


June 1996, paperback
~~\$29.95~~ \$26.95
0-7506-9508-0

Butterworth-Heinemann brings you something for everyone from John Lenk's Simplified Design Series. These books are all-inclusive, one-stop guides. Each has step-by-step instructions and diagrams that make it easy-to-use for the student, experimenter, and professional. All are available in paperback.



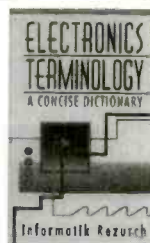
1995, hardcover
~~\$49.95~~ \$44.95
0-7506-9505-6



1996, hardcover
~~\$49.95~~ \$44.95
0-7506-9702-4



1995, paperback
~~\$29.95~~ \$26.95
0-7506-9694-X



1996, paperback
~~\$12.95~~ \$10.95
0-7506-9751-2



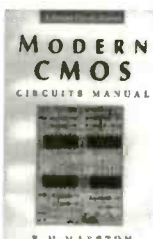
1996, paperback
includes disk
~~\$39.95~~ \$35.95
0-7506-9700-8



July 1996, hardcover
~~\$49.95~~ \$44.95
0-7506-9747-4



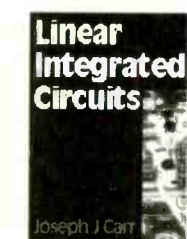
1995, paperback
~~\$47.95~~ \$42.95
0-7506-2489-2



1996, paperback
~~\$28.95~~ \$25.95
0-7506-2565-1



1995, paperback
~~\$47.95~~ \$42.95
0-7506-2281-4



1996, paperback
~~\$37.95~~ \$33.95
0-7506-2591-0

Please send me the book(s) listed below at 10% off! Phone: 1-800-366-BOOK FAX: 1-800-446-6520

Please add \$4.00 for handling for the first item ordered and \$1.50 for each additional item ordered to all check and credit card orders. Billed orders will be charged additional shipping based on weight and destination. All US orders must include your state sales tax. Prepayment or company purchase order is required for all orders. Canadian customers please pay by credit card or in US funds and include 7% GST on books and handling. Prices subject to change without notice.

Write book number(s) here

--	--	--	--

Charge my: VISA AMEX MC Card # _____ EXP Date _____

Name _____ Signature _____

Address _____ City/ State/ ZIP _____

Tel _____ E-mail _____

Visit us on the Internet @ <http://www.bh.com/bh/el>

Send me a FREE catalog (item 642)

BUTTERWORTH
HEINEMANN

313 Washington Street, Newton, MA 02158
from outside US and Canada, call 617-928-2500

TS123

CIRCLE 215 ON FREE INFORMATION CARD



Trees Make a World of Difference™

Trees make a world of difference. Between sand and dirt, and shaded parks for baseball, picnics, and quiet walks. Between steamy, sunbaked streets, and friendly, shady neighborhoods.

Support Tree City USA where you live. For your free booklet, write: Tree City USA, The National Arbor Day Foundation, Nebraska City, NE 68410.



TREE CITY USA

The National Arbor Day Foundation

A World With Trees...where it's a pleasure to live, every day

PROGRAMMERS

1249 Advantech Labtool-48

695 EETools Allmax Plus

449 EETools Promax

539 EETools Megamax 4

429 Xeltek Superpro II

159 Xeltek Rommaster I

189 Xeltek Rommaster II

429 Needham EMP-20

689 Needham SA-20

589 MOD-MCT-EMUPA

350 MOD-MCT-EMUP-R

99 8Meg 1 Gang Eprom Programmer

140 8Meg 4 Gang Eprom Programmer

299 8Meg 8 Gang Eprom Programmer

39 Erasser 4 Chip - Add \$10 for Timer

79 Erasser 9 Chip With Timmer

GENERAL DEVICE INSTRUMENT

Sales 408-241-7376 Email icdevice@best.com

Fax 408-241-6375 BBS 408-983-1234

WEB PAGE www.generaldevice.com

OCEAN STATE ELECTRONICS

MAKE CIRCUIT BOARDS THE NEW, EASY WAY WITH TEC-200 FILM

JUST 3 EASY STEPS:

- Copy Circuit pattern on TEC-200 film using any plain paper copier
- Iron film onto copper clad board
- Peel off film and etch

Convenient 8 1/2 x 11 size w/complete instructions

5 SHEETS	.....	\$6.25
10 SHEETS	.....	10.75
20 SHEETS	.....	16.25
50 SHEETS	.....	33.50

DELUX CODE KEY

Adjustable, heavy duty brass base with ball bearing pivots. Designed for hard usage. 3/16" plated contacts.

\$14.95

CODE PRACTICE OSCILLATOR & MONITOR 3" SPEAKER, HEADPHONE TERMINAL, VOLUME & TONE CONTROLS. USES 1 9V BATTERY.

Kit \$19.95
Wired \$24.95

VERNIER DIALS

1-1/2" Diameter 0-10 Marking \$10.95
1-1/2" Diameter 0-100 Marking \$14.95
2" Diameter 0-100 Marking \$15.95

REGULATED POWER SUPPLIES 13.8 VDC OUTPUT. 120 VAC INPUT. RATINGS ARE CONTINUOUS.

3 AMP	.....	\$29.50
5 AMP	.....	39.50
6 AMP	.....	46.50
10 AMP	.....	59.50
20 AMP	.....	129.50
30 AMP	.....	139.50

SIGNAL INJECTOR/TRACER KIT

This handy tester is both a signal generator and receiver. As a generator use it to check out an amplifier, stage by stage. Also tests AM radio IF and RF stages. As a receiver you can pin point where a defective part exists. Will transmit and receive simultaneously.

\$19.95

DIGITAL CAPACITANCE/INDUCTANCE METER

DIGITAL LCR METER measures inductance, capacitance and resistance. At Last! An LCR meter that everyone can afford. Now you can measure coils, transformers, chokes from 1pH to 200H. Capacitors .1pfd to 200 mfd and resistors from .1 ohms to 20 meg ohms. All in one handheld instrument.

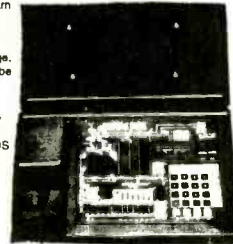
LCR-1801 \$119.95

LEARN COMPUTER THEORY BY BUILDING THIS KIT DIGITAL TRAINER MODEL MM-8000

Starting from scratch you build a complete computer system. Our Micro-Master trainer teaches you how to write into RAMs, ROMs and run a 8085 microprocessor. You will write the initial instructions to tell the 8085 processor to get started and store these instructions in permanent memory in a 2816 EPROM. Teaches you 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. Upon completion of this course you will be proficient in computer technology.

- Uses the 8085 Microprocessor
- Uses the 2816 EPROM, electrically erasable programmable ROM
- Uses the 8156C, 2048 Bit static MOS RAM with I/O ports and timer
- Memory expandable option
- Built in 5V power supply
- 28 key keyboard
- Complete with lesson manual, instructions and experiments

\$119.95



MAGNET WIRE

Enamel, coated solid copper. For winding coils, transformers and toroids. Prices for 1/4 lb. spools.

#14	\$4.00	#20	\$4.00	#28	\$4.85	#36	\$6.85
#16	4.00	#22	4.25	#30	4.85	#38	6.95
#18	4.00	#24	4.25	#32	4.85	#40	7.85
		#26	4.85	#34	6.25		

VARIABLE CAPACITORS BROADCAST TYPE - 1/4" SHAFT

1 GANG 14-365 PF \$12.95
2 GANG 10-400/10-400 PF \$19.95

MANY MORE TYPES AVAILABLE FROM SMALL AIR TRIMMERS TO LARGE 4KV TUNER TYPE

SIGNETICS NE602AN \$2.49 MINI-CIRCUITS SBL-1 \$7.95

TOROIDS

IRON		FERRITE					
T-25-2	.....35	T-50-6	.....55	FT-37-43	.....60	FT-82-43	\$1.00
T-25-5	.....35	T-68-0	.....75	FT-37-61	.....60	FT-82-67	1.00
T-37-5	.....45	T-68-2	.....75	FT-37-77	.....60	FT-82-75	1.00
T-37-12	.....45	T-68-6	.....75	FT-50-43	.....75	FT-114-61	1.90
T-50-2	.....55	T-80-2	.....90	FT-50-61	.....75	FT-140-43	3.15
T-50-3	.....55	T-200-2	\$5.00	FT-50-77	.....75	FT-240-61	8.00

We stock a complete line of Toroids, Beads, and Ferrite Rods.

TO ORDER CALL 1-800-866-6626 OR 401-596-3080 FAX 401-596-3590

OR WRITE TO:
Ocean State Electronics
PO Box 1458
Westerly, RI 02891

Mail in orders please include \$5 S/H
CANADA \$12.00 - OVERSEAS \$15.00
ALASKA & HAWAII \$9.00
Minimum Order \$10.00 (before shipping)
R.I. Customers Include 7% Sales Tax.

CALL OR WRITE FOR FREE 120 PAGE CATALOG



The Electronic Experimenter's Journal

It's part catalog, part magazine and part data book with kits, parts, plans, articles, and application notes.

Call for your **FREE** copy today

Debco Electronics
4025 Edwards Rd.
Cincinnati, OH 45209

1 800 423-4499



If you are not getting this catalog you are missing out on some of the best deals in electronics today! We have thousands of items ranging from unique, hard-to-find parts to standard production components. Call, write, or fax today to start your free subscription to the most unique catalog in the industry, filled with super values on surplus electronic and hobbyist type items. If you have a friend who would like to receive our catalog, send us their name and address and we will gladly forward them a complimentary 100 page catalog.

Why pay more? Call today.



340 East First Street Fax Order Line
Dayton, Ohio 45402 1-800-344-6324

**Order Toll-Free
1-800-344-4465**

CIRCLE 251 ON FREE INFORMATION CARD

SEC Sun Equipment Corporation **LODESTAR** Lodestar Electronics Corp. Since 1979

3121-A Glen Royal Rd., Raleigh, NC 27612

Test Equipment for Cost-Minded People

One Year Warranty. 15 Day Money Back Guarantee. OEM welcome. School purchase order accepted. Bids accepted. VISA, DISCOVER. SALES REP./DISTRIBUTORS/OEM WANTED. MASTER, & AMER. 1-800-870-1955/(919)870-1955 24-hr Fax:(919)870-5720

DC POWER SUPPLY

PS-303 \$159.00
0-30VDC, 0-3A, 0.02%+2mV line regulation, 0.02%+3mV load regulation, 1mVrms noise & ripple, Short circuit/overload protection, constant current/voltage(CC/CV).

PS-303D \$314.95 dual output, tracking

PS-305 \$219.95, 0-30VDC, 0-5A

PS-305D \$399.95 dual, tracking

8110 \$289.95 0-60VDC, 0-3A

8112 \$399.95 0-60VDC, 0-5A

8108(8109) \$549.95(\$699.95) 0-60VDC, 0-3A(5A), dual, independent tracking, Low ripple.

8102(8103) \$399.95(\$489.95) dual 0-30VDC/0-3A(5A), fixed 5VDC/3A, independent tracking operation, constant voltage and current. Slave/Master, Serial/Parallel connection.

PS-1610S(8107) \$289.00(\$399.95) 0-16VDC(0-30VDC), 0-10A.

PS-224J(2245) \$139.00(\$159.00) 0-12/0-24VDC, 3A(5A).

8200(8201) \$179.95(\$239.95) 0-30VDC(digital meter), 0-3A(5A).

8210(8211) \$199.95(\$259.95) two digital meters.

8202(8203) \$499.95(\$549.95) 3 outputs, digital display, dual 0-30VDC/0-3A(5A), a fixed 5VDC/3A, independent tracking operation, constant voltage and current.

AM/FM SWEEMAR SCOPE

SM-6225B/C \$1999.95
Freq Range: (AM)490KHz, (FM) 10-11.4MHz, Accuracy ±0.1%
Marker: (AM)455KHz, ±5KHz, ±10KHz, (FM)10.7MHz, ±7.5KHz, ±150KHz

STEREO SCOPE OS-7505B \$369.00 trigger, 0-10MHz

ALIGNMENT SCOPE OS-7001A \$369.00 0-200KHz

AM/FM STD SIGNAL GEN.

SG-4110A \$1799.00
Freq: 100KHz-110MHz
Display: 6-digit LED
Accuracy:
≤(5x10⁻⁵ ±1 count)
Resolution: 100Hz (100-34.99MHz), 1KHz (35MHz-110MHz).
Output: -19dBu, -99dBu, 1dB steps. Impedance: 50Ω VSWR 1.2

NTSC TV COLOR BAR PAT. GEN.

CPG-1366A \$159.95
VHF NTSC:
Freq.: 45.75, 175.25, 187.25 MHz.
RF Output: 10mV
Impedance: 75 Ohm;
Video Output: BNC, 1Vp-p

SWR/RF POWER METER

J10 \$89.95
Freq Range: 1.8-150MHz
RF Power: 0-4W/20W/200W
SWR Measure: 1.0 - ∞, 4W min.
Accuracy: 5%-10%, SO-239 plugs.
Insertion Loss: 0.3dB.

J30 \$89.95, 130-520MHz

J30 \$119.95, 1.8-520MHz

SWR-1P \$26.95 1.7-150MHz.
RF Power: 0.5-10W, 0.5W-100W.

SWR-2P \$22.95, 1.7-30MHz, RF Power: 0.5-10W.

mW RF Power Meter J40 \$219.00, 1.8-500MHz, 20mW ~ 2W.

RF SIGNAL GENERATOR

SG-4160B \$124.95
100KHz-150MHz up to 450MHz on 3rd harmonics, 6 ranges: AM modulation. RF Output: 100mVrms to 3-5MHz. Modulation: Int. 1KHz AM, Ext. 50Hz-20KHz AM.
Audio Output: 1KHz, 1Vrms.

SG-4162AD \$229.95, with Freq. Counter 1Hz-150MHz, 6 digits, for internal & external signals. Specification see SG-4160B above.

AUDIO GENERATOR

AG-2601A \$124.95
10Hz-1MHz, 5 ranges;
Output Level: sinewave 0-8Vrms, square 10Vp-p.
Output Impedance: 600 Ohm.
Distortion: <0.05% 500Hz-50KHz, <0.5% 50KHz-500KHz.

AG-2603AD \$229.95, with Freq. Counter 1Hz-150MHz, 6 digits, for internal & external signals. Specification see AG-2601A above.

FUNCTION GENERATOR

FG-2100A \$169.95
0.2Hz-2MHz in 7 ranges, Sine, Square, Triangle, Pulse & Ramp
Output: 5mVp-p-20Vp-p, 1% distortion.
VCF: 0-10V control freq. to 1000:1.

FG-2102AD \$229.95 generates signals same as FG-2100, 4-digit counter display, TTL & CMOS outputs, 30ppm ±1 count accuracy

FG-2020B \$159.00 0.5Hz-500KHz, Sine, Square, Triangle.

(FG)2103 \$329.95, Digital sweep generator, 0.5Hz-5MHz in 7 ranges. Operating Mode: sweep, AM, gated burst, VCG.
Freq. Counter: Int. 0.5Hz-5MHz, Ext. 5Hz-10MHz

FM STEREO MODULATOR

AG-2011A \$549.00
RF SECTION:
Carrier: 98MHz ±2MHz,
Output: 10mV, 1mV, & 0.1mV

COMPOSITE SIGNALS:
Pilot: 19KHz ±2Hz, 0.8Vrms
INT. MODULATION: 400KHz,
1KHz ±1%, 1Vrms, distortion < 5% L-R Separation: >50dB.

**EXT. MODULATION: Freq.: 50Hz-15KHz,
L-R Separation: >45dB 100Hz-3KHz, >35dB 50Hz-15KHz.**

AC MILLIVOLT METER

MV-3100A \$159.95 wide band 5Hz-1MHz, 3 scales, mV, dB & dBm, 300μV-100V in 12 ranges, 10μV resolution, -70-40dB in 12 ranges, 0dB=1Vrms, 0dBm=0.775V; ±3% accuracy, input impedance 10MΩ; Noise <2%.

MV-3201B \$309.95 dual channels, simultaneous measurement.

OSCILLOSCOPE

OS-7305B \$249.00 DC-7MHz,
Vertical: 10mV/Div, Horizontal: 250mV/Div, 10Hz-100KHz in 4 ranges, 3" CRT, Internal and External Sync, Input: 1MΩ/35pF.

OS-7010A \$369.00 DC-10MHz, 5" CRT, 10mV/Cm-10V/Cm, 1MΩ.

OS-622B \$344.95 20MHz/dual trace

OS-653 \$699.95 50MHz, dual, delay sweep, ALT trigger, TV sync.

OS-6100B \$1329.95 100MHz, 4ch, 8 traces, delay sweep, best buy

GRID DIP METER

DM-4061 \$89.95 1.5-250MHz,
6 bands, 6 plug-in coils,
2 transistor, and 1 diode.
Modulation: 2KHz Sinewave, Crystal Oscillator: 1-15MHz.
Wave absorption meter. Using 9VDC power supply.

AUTO DISTORTION METER

DM-3104A \$799.95
MEASUREMENT:
Range: 0.01%-30%,
0.1/0.3/1/3/10/30% full scale.
Freq.: 400Hz ±10%,
1000Hz ±10% (HPF).
Input: 3mV-100V,
ratio measuring 20dB.

Auto. Switching Ranges: Fundamental Freq. = (fo) ±10%,
Fund. Rejection: >80dB at (fo) ±5%, >70dB at (fo) ±10%.
Harmonic Accuracy: ±0.5dB, 1R(fo)-20KHz.

DM-3204 \$1,599.00 dual channels.

FREQUENCY COUNTER

FC-5250C \$119.95
Freq. Range: 10Hz-220MHz
(HF) 10Hz-20MHz,
(VHF) 10MHz-200MHz
Gate Time: 0.1 & 1sec.
Max. Input: 10Vp-p.

Input Sensitivity: 35mV 10Hz-200MHz, Display: 7-digit LEDs.

Input Imped. (HF) 1M Ohm, (VHF) 50 Ohm.

FC-5260A \$146.00
10Hz-600MHz, 7-digit LEDs.

FC-5270 \$149.95
10Hz-1.2GHz, 8-digit LEDs.

FC-5600B \$321.00
10Hz-600MHz, 10-digit LEDs.

(FC)5700 \$329.95 10Hz-1.3GHz, 10-digit LEDs.

SIGNAL TRACER/INJECTOR

SE-6100 \$134.95
TRACER: Gain Max. 60dB
Attenuation: 0/20/40/60dB
Input Imped.: 100K Ohm
Output Imped.: 600 Ohm;
Speaker: 8 Ohm.

INJECTOR: Freq.: 1KHz

Squarewave, Output Level: Continuously variable 0-4.5Vp-p.

AUTO. CAPACITANCE METER

CMJ300A \$139.00 10 ranges, 99.9pF ~ 99.9mF, fully automatic.
Resolution: 0.1pF lowest,
0.1% full scale.
Accuracy:
0.5% of full scale: 1 digit to 99.9μF,
1% of full scale: 1 digit to 99.9μF.
Display: 3 digit LED.

Unit indicator: pF, nF, μF, mF. Overrange indicator.

WOW-FLUTTER METER

WF-3103A \$699.95
Freq Range: 3KHz-10%
JIS/CCIR; 3.15KHz-10% DIN.
Range: 0.03/1/3/3% full scale.
Accuracy: ±5%.

WF-3105A \$799.95, digital;
Function: LIN/AWOW/Flutter/WTD.
Freq Cntr: 10Hz-9.99MHz.
Indication: CCIR/DIN/JIS.

MICROPROCESSOR/CONTROLLER TRAINING

Now, you can learn and apply Computer control on your PC with our low-cost trainers and lead yourself to the advanced 80386, 80486, etc. Learn ASSEMBLY, C, and BASIC languages programming and debugging, and Microprocessor based system hardware design and troubleshooting. Experiment guide and example programs are included in each trainer. Our trainers are widely adopted by technical colleges.

8088 Trainer \$699.00 8088, teach yourself 8088 assembly language programming.

Features: Assembly language coding, assembler, disassembler, single step and multi-breakpoint program debugger, display and rewrite registers, download/upload programs from/to external systems, I/O drivers, 56-key large size keyboard, LCD display, RS-232, UART, printer interface, two expansion slots, 5V, ±12V switching power supply, 20 I/O controls available, e.g. servo and stepping motor, dot matrix display, D/A, A/D, sensors, ...

EDS-8811 \$289.00 E(EPROM) programmer. Burn your own EPROM in just a minute.

UC-8052 \$979.00 learn yourself Intel 8051/8052 Embedded Microcontroller controls.

U-DBGR \$1599.00 Debugger/In-circuit Emulator for Microprocessors and programme.

8051/52 In-Circuit Emulator, APEX-IE assembly language programming and debugging.

CIC-100 \$549.00 I/O control applications, learn Assembly, C, and BASIC programming languages, 800-pin solderless breadboard for circuit design and test, I/O drivers for controlling relay, step motor, LED, speaker, sensor, etc. Application control modules available.

EDS-8802 \$109.00 Dynamic scanning controls

EDS-8803 \$159.00 A/D, thermal sensor controls

EDS-8804 \$89.00 A/D and D/A converters

EDS-8805 \$239.00 Servo and stepper motors

EDS-8806 \$159.00 Basic I/O experiments

EDS-8807N-16 \$619.00 16 Dot matrix LEDs

EDS-8807N-8 \$619.00 8 Dot matrix LEDs

EDS-8808 \$269.00 Opto-coupler controls

EDS-8809-1 \$589.00 stepper motor control, digital clock, speaker control, dot matrix LED, matrix keyboard, sign lights, electric piano, stop watch, etc. 24 experiments.

example programs included.

EDS-8811-DRAM \$589.00 Disk drive control.

EDS-8811-SRAM \$589.00 Disk drive control.

NEW PRODUCTS

mW RF Power Meter J40 \$219.00
1.8-500MHz, RF power: 20mW/200mW/2W, Imp.: 50Ω.
Accuracy: ±10% full scale. N-type connector. SWR <1.15

Digital DC Power Supply 8300 (R301)
\$199.95 (\$259.95), 0-30V/3A(5A), CC/CV.

Electronic UHF Attenuator ORSE
(OR7E) \$399.00, DC-950MHz, Imp: 50(75)Ω, 1 dB step.

Computer Monitor Tester MT801
\$175.00 Test MDA, CGA, EGA, VGA, SVGA, 8514A monitors. Video Patterns, color bars, cross hatch, dots, color raster and windows. Two video connectors: digital (TTL, 9-1) & analog 15-1HD. Power: 120VAC.

MT810 \$129 - Hand held model. Power: 9VDC.

SHOW TIME CABLE

The Best
in Cable
**CONVERTERS &
DESCRAMBLERS**

Take a LOOK at the exciting
new

Prelude!



Just
\$339!

*We work hard to be the
Low Cost Leader!
Shop the rest, then
call us to compare. We
guarantee you, no other
reputable firm can beat our prices!*

COD • Master Card • Visa • Amex • Discover
Show Time Cable • 5727 F Street • Omaha, NE 68117

Your Low Price Leader!
Order By Phone, Fax, or Mail

800-643-4258

Have you ever given a gift
so wonderful,
someone carries it with them
the rest of their life?

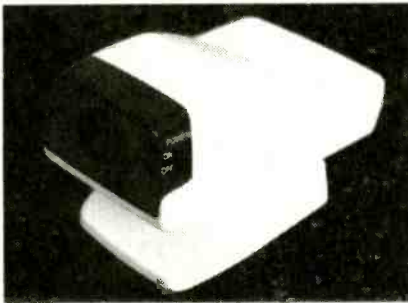
Please give blood.
There's a life to be saved right now.

Call 1-800 GIVE LIFE



American Red Cross

Video Camera Blowout Sale!



When a major multimedia company closed a division, they surplused a limited quantity of quality **COLOR CCD** video cameras. These cameras were part of a high end video conferencing system.

Manufactured by a division of Panasonic, these units are designed to sit on top of a computer monitor and can be used for video conferencing, security, ATV, or multimedia purposes.

- 330 line **COLOR CCD** imager
- 3 lux sensitivity for low light applications
- Standard 1V p-p NTSC output
- Built-in microphone with preamp
- Standard RCA video and audio jacks
- Includes 12v wall mount transformer
- Auto iris with sensitivity adjust
- 5mm fixed focus lens from 10" to infinity
- 5" long x 3" wide x 3" high- 7.5oz.

**Call
Today!
Limited
Quantity!**

This OEM paid over \$400.00 each. **Your price is only \$179.00 plus \$5.00 shipping/handling** (continental US only).

Sycard Technology MasterCard and Visa accepted
1180-F Miraloma Way CA orders add Sales Tax
Sunnyvale, CA 94086 Sorry, No CODs
(408) 749-0130 or (408) 749-1323 Fax

PROFESSIONAL UHF WIRELESS VIDEO TRANSMITTERS

THE VIDLINK 50 IS THE SMALLEST UHF
X-TAL CONTROLLED TRANSMITTER AVAILABLE.
HIGH-RESOLUTION FULL COLOR / B&W VIDEO.

\$199.00 Introductory Offer

- Smallest Law-Enforcement Grade X-tal Video Transmitter available.
- Rugged epoxy encased Surface Mount Technology design.
- Transmits to any Cable-Ready TV or VCR (CATV Channel 59).
- High Resolution 420 Lines. Power 50mW. Range 300 to 1,500 FT.
- Includes fully calibrated VidLink 50 module, cables and antenna.

VidLink 50 Kit + B&W Micro Pinhole

Camera (Small! Only 1.2" x 1.2"):

~~\$599.00~~ **\$399.00 +\$5.50 S&H**

VidLink 50 Kit Only:

~~\$399.00~~ **\$199.00 +\$5.50 S&H**

Payment by:

Check or MO, COD +\$5.00

Manufacturer Direct! No Middlemen.

Give us a call or visit us on the 'NET.



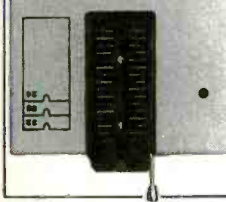
**AEGIS
RESEARCH**

#671-1225 E. Sunset Dr.
Bellingham, WA
98226-3529 USA

1-604-224-0416

Visit our virtual catalog on the INTERNET at:
<http://www.lynx.bc.ca/virtualspys>

EZ-EP
M²L ELECTRONICS
Los Angeles, California (310) 837-7818



EZ-EP DEVICE PROGRAMMER - \$169.95

Fast - Programs 27C010 in 23 seconds.

Portable - Connects to PC Parallel Port.

Versatile - Programs 2716-080 plus EE and Flash (28F,29C) to 32 pins.

Inexpensive - Best for less than \$200

- Correct implementation of manufacturer algorithms for fast, reliable programming
- Easy to use menu based software has binary editor, read, verify, copy, etc. Free updates via bbs or web page.
- Full over current detection on all device power supplies protects against bad chips and reverse insertion.
- Broad support for additional devices using adapters.

Adapters Available

EP-51 (8751,C51)	\$39.95
EP-11 (58HC11 E/A)	\$59.95
EP-PIC (16C5x,61,62x,71,84)	\$49.95
EP-PIC64 (16C62,63,64,85,73,74)	\$39.95
EP-PEEL (ICT 22V10, 20G10, 18V8)	\$69.95
EP-SEE (93x,24x,85x)	\$34.95
EP-16 (16bit 40 Pin EPROMs)	\$49.95
EP-49 (8742,48,49)	\$49.95
EP-750 (87C750,751,752)	\$59.95
EP-Z8 (Z86E03,04,05,06,07)	\$39.95
EP-55 (8755)	\$39.95
EP-51-PLCC (8751,C51)	\$59.95
EP-PIC-SOIC(16C5x,61,62x,71,84)	\$50.95
EP-PLCC (PLCC EPROMs)	\$49.95
EP-SOIC (SOIC EPROMs)	\$49.95
EP-LCC (LCC EPROMs)	\$49.95

M²L Electronics

3526 Jasmine #4; Los Angeles, CA 90034
310/837-7818 Fax/BBS: 310/841-6050

<http://www.ca.ucla.edu/csd-grads/gc3/ovmg/www/m2l.html>
CA orders add 8.25% sales tax. Ground shipping - \$5. 3 Day - \$7. 2 Day \$10; Overnight \$17; COD \$4.75

BREAST CANCER BEGINS EVEN SMALLER THAN THIS. THAT'S WHY YOU NEED A YEARLY MAMMOGRAM, ESPECIALLY AS YOU GET OLDER. MAMMOGRAMS CAN DETECT LUMPS TOO SMALL FOR YOU TO FEEL AND EARLY DETECTION MAY SAVE YOUR LIFE, SO CALL 1-800-ACS 2345.

GET A MAMMOGRAM. EARLY DETECTION IS THE BEST PROTECTION.

LIQUIDATION SALE

Factory Auth. Ser. Cntr.

Diagnostic Equip.-SenCore-

VC63,EX221,ST65,SR68,A C Powerite,2-CG25,NT64, SRC,VA62,LC53,SC61,FE14 9, BK-1653,2830,1655,1601, 415,2-1486,1479A HP-8555A spec analyzer/W141T display section. **Parts** -Over 10,000 parts for RCA,GE, NAP,Sanyo, etc. Lot Sale!

Manuals/microfice-

over 6,000 tech manuals sams & factory plus microfice with reader/printer, dting 1950-94, Lot Sale! **Collectables**- 3 magnovox 971 remote control rec, 3 analyzers, 2 RCA seniorvolt ohm yst Viking, Cable Co., VHF-FM broadcast AMP, Telematic-transverter, RCA WR70A marker/adder, 123 Flyback yoke tester, EICO 377 wave form audio gen, EICO 147A, signal tracker, BK 465 tube tester, HP 200 CD WR osil/gen, BIC440 tube tester, heath kit harmonic distortion meter, Mallory Recto power supply, HP Universal bridge, RCA stereo FM sim. **Tubes**- Over 3,300 tubes new in orig boxes. Lot Sale! Many more items!

Call 1-800-456-8027

MEMBRANE SWITCH KITS!

FLAT PANEL KEYPADS ASSEMBLE IN MINUTES WITH YOUR LEGEND

AVAILABLE IN 4, 12, 16, 24 & 40 KEY TYPES



DSK-4 \$9.89

CONNECTOR AND BEZEL INCLUDED!

OPTIONAL "CLICKDOMES" AVAILABLE



DSK-12 \$14.29

INDUSTRIAL TYPES AVAILABLE

MORE THAN 30 LAYOUTS TO FIT MOST APPLICATIONS

CALL FOR FREE BROCHURE

SIL-WALKER

880 CALLE PLANO, UNIT N CAMARILLO, CA 93012

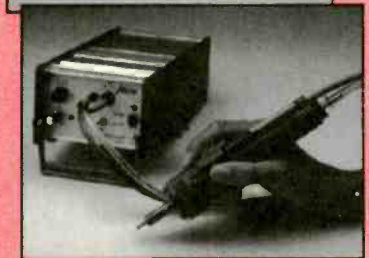
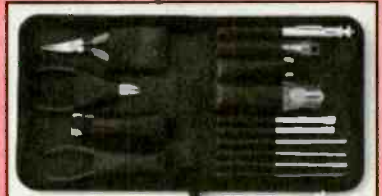
PHONE: (805) 389-8100

FAX: (805) 484-3311

VISA / MASTERCARD

JENSEN[®]

everything you need for servicing electronics



Just a small sampling of the many thousands of new, unique or hard-to-find quality items you'll discover in every Jensen catalog.

Call 800 426-1194 today for your FREE catalog!



JENSEN TOOLS INC.

7815 S. 46th St., Phoenix, AZ 85044
Ph: 602 968-6231
FAX: 800 366-9662

<http://www.jensentools.com>

CIRCLE 320 ON FREE INFORMATION CARD

Take Stock in America **U.S. SAVINGS BONDS**

A public service of this magazine



CABLE TV DESCRAMBLERS



We Carry A Full Line Of Premium Converters And Descramblers Compatible With:

- Scientific Atlanta™ Systems
- Jerrold™ Systems
- Tocom™ Systems
- Zenith™ Systems
- Pioneer™ Systems

**SATISFACTION GUARANTEED
OR YOUR MONEY BACK!**
BEST PRICES FREE CATALOG

Please have the MAKE & MODEL # of your full premium service cable box ready when you call!

ALLSTAR ELECTRONICS
800-782-7214

HOURS: 9-6 M-F 10-3 Sat EST

It is not the intent of Allstar Electronics to defraud any pay TV operator. Anyone implying theft of service will be denied assistance. All brand names are registered trademarks of their respective owners & are used for reference only. 110-64 Queens Blvd., #465, Forest Hills, NY 11375. NO NYS SALES!

SURVEILLANCE

FM TRANSMITTERS MINI (KITS)

- 3-VOLT FM XMTR, up to 300 ft. indoors, 1500 ft. outdoors
- PHONE XMTR, range to 500 ft., uses phone-line power
- Sound-Activated XMTR, range to 500 ft.
- 2-STAGE XMTR, 9-Volt, very powerful!

All above require simple soldering at 2 to 4 places.
\$29.95 ea.**

TELE FM WIRELESS MONITORING SYSTEM.
(Kit) **\$99.00***

TELE CALL FORWARDER. Transfers incoming calls. **\$99.00***

CALLER ID. Registers incoming number. **\$99.00***

TEL REGISTER WITH PRINTER. Records dialed number, duration, and prints record. **\$139.00***

12-HOUR LONG-PLAY RECORDER. Modified Panasonic. Records 6 hrs. on each side of 120 tape (supplied). Compatible with VOX and Tel Rec Adapter. **\$119.00***

VOX VOICE-ACTIVATED SWITCH. Makes recorder self-activating with voices or other sounds. **\$28.50****

TELE RECORDING ADAPTER. Records incoming and outgoing calls. **\$28.50****

TELEPHONE SCRAMBLERS. Over 4,000 separate codes. **\$199.00***

VOICE CHANGER. Changes man's voice to lady's and vice versa. **\$49.00***

For Shipping & Handling add *\$5.00 and **\$2.00 per item. Colo. residents add sales tax. Mail Order, VISA, M/C, COD's o.k. Inquire for dealer prices. Free catalog.

MUCH, MUCH MORE — OUR 25TH YEAR!
TOLL FREE 1-800-926-2488

A.M.C. SALES, INC.

193 Vaquero Dr., Boulder, CO 80303

Tel: (303) 499-5405, Fax: (303) 494-4924

Mon.-Fri. 8 a.m.-5 p.m. Mtn. Time

CIRCLE 231 ON FREE INFORMATION CARD



1-CHIP MICROCONTROLLER TRAINER

PARTS KIT INCLUDING:

- Programmed Motorola 68705P3 (only 1 IC required)
 - Display 1 X 16 Alphanumeric LCD
 - Keypad 5 X 4
 - 4 MHz clock oscillator, reset switch, R, C
- MANUAL - experiments & programming - 224 pgs.

\$89 plus shipping

VISA, MC, COD

CA residents add CA sales tax

Just Add Wire And +5VDC To Get Started

SQUARE 1
ELECTRONICS

P.O. Box 501, Kelseyville, CA 95451

Order (800) 220-3916

Support (707) 279-8881

FAX (707) 279-8883

Hours 7AM -12N, 1-4PM Pacific M-F

CIRCLE 324 ON FREE INFORMATION CARD

price SET: US\$ 299.00

new! new! new! new!



VIDEO - LINK
2,4 GHz
wireless
VIDEO / AUDIO transmission

up to 1/4 mile
open area



power supply not incl.
A/V cable incl.

works with all TV-SYSTEMS
NTSC/SECAM/PAL

techn. data:

RF power output: 10mW

DC power: 11.....16V/DC-0.5A

dimension: 130x80x35mm

AUDIO: in / out

VIDEO: in / out

frequency: 2.4 GHz / pll stab.

modulation: A/V FM

shipping charge air parcel
US\$ 45.00

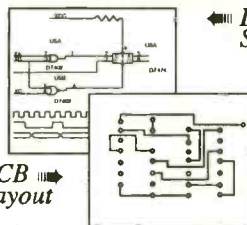
PIEDPONE

Zollamtstr.48, 67663 Kaiserslautern GERMANY

FAX ++49-631-29579 BBS++ 49-631-21048

phone 0631 29187

Low Cost CAD Software for the IBM PC and Compatibles Now In Windows™ 95



Design & Simulation

- Easy to use schematic entry program (SuperCAD) for circuit diagrams, only \$149. Includes netlisting, bill of materials, extensive parts libraries.
- Powerful, event-driven digital simulator (SuperSIM) allows you to check logic, circuitry quickly before actually wiring it up. Works directly within the SuperCAD editor from a pulldown menu and displays results in "logic analyzer" display window. Starting at \$149 this is the lowest cost simulator on the market. Library parts include TTL, and CMOS devices.
- Analog simulator (SuperSPICE) for \$149. Allows AC, DC and transient circuit analysis. Includes models of transistors, diodes, and op amps.
- Circuit board artwork editor and autorouter programs (SuperPCB), starting at \$149. Produce high quality artwork directly on dot matrix or laser printers. You can do boards up to 16 layers including surface mount. Includes Gerber and Excellon file output. Autorouter accepts netlists and placement data directly from the SuperCAD schematic editor.
- Low cost combination packages with schematics and PCB design: 2-layer for \$399, 16-layer for \$649.

Write or call for free demo disks:

MENTAL AUTOMATION, INC.

5415 - 136th Place S.E.

Bellevue, WA 98006

(206) 641-2141

BBS (206) 641-2846

Tel: (954) 974-6864
 Fax: (954) 974-6818

Gateway Products Corp.

Please mail orders to:
 P. O. Box: 93-6397
 Margate, FL 33093

Popular I.C.s

LM324 ... 45¢
 LM339 ... 45¢
 LM358 ... 45¢
 NE555 ... 40¢
 LM558 ... 50¢
 LM741 ... 40¢
 Deal U3: 12 pcs total,
 (2pcs of each)...\$5.00

Transistors

PN2222A ... 8¢
 PN2907A ... 8¢
 2N3904 ... 7¢
 2N3906 ... 7¢
 2N4401 ... 8¢
 2N4403 ... 8¢
 Deal N8: 60 pcs total,
 (10pcs of ea.)...\$4.00

Semiconductors

74LS174 ... 40¢
 74LS244 ... 45¢
 74LS245 ... 45¢
 74LS374 ... 45¢
 LM388N ... 45¢
 MC1488 ... 45¢
 MC1489 ... 45¢

DIODES

1N914 ... 3¢
 1N4148 ... 3¢
 1N4001 ... 1A/50V ... 3¢
 1N4004 ... 1A/400V ... 4¢
 1N4007 ... 1A/1kV ... 5¢
 Deal P7: 50 pcs total,
 (10pcs of ea.)...\$2.00

RADIAL LYTICS

1uF/50V ... 6¢
 2.2uF/50V ... 6¢
 3.3uF/50V ... 6¢
 4.7uF/50V ... 6¢
 10uF/50V ... 7¢
 22uF/50V ... 8¢
 33uF/50V ... 9¢
 47uF/50V ... 10¢
 Deal A2: 40 pcs total,
 (5pcs of each)...\$3.00

Ceramic Disc

(All caps rated 50V)
 10pF ... 6¢
 22pF ... 6¢
 27pF ... 6¢
 33pF ... 6¢
 47pF ... 6¢
 100pF ... 6¢
 150pF ... 6¢
 220pF ... 6¢
 Deal R4: 40 pcs total,
 (5pcs of each)...\$2.50

Toggle Switches

Miniature size
 1/4" Panel hole
 on-on ... SPDT ... 50¢
 on-off-on ... SPDT ... 60¢
 on-on ... DPDT ... 70¢
 on-off-on ... DPDT ... 80¢
 Deal S3: 8 pcs total,
 (2pcs of each)...\$5.00

Popular CMOS

CD4001B ... 30¢
 CD4011B ... 30¢
 CD4013B ... 40¢
 CD4017B ... 50¢
 CD4028B ... 40¢
 CD4050B ... 40¢
 CD4088B ... 40¢
 CD4098B ... 40¢
 Deal V8: 16 pcs total,
 (2pcs of each)...\$5.00

More Transistors

MPSA05 ... 13¢
 MPSA07A ... 13¢
 MPSA13 ... 13¢
 MPSA27 ... 13¢
 MPSA42 ... 13¢
 MPSA56 ... 13¢
 MPSA82 ... 13¢
 Deal Q2: 30 pcs total,
 (5 pcs of ea.)...\$4.00

V. Regulators

LM317T ... 69¢
 7805 ... 49¢
 7808 ... 49¢
 7812 ... 49¢
 7815 ... 49¢
 7818 ... 49¢
 7824 ... 49¢
 6A10 ... 6A/100V ... 24¢
 7805 ... 49¢
 7808 ... 49¢
 7812 ... 49¢
 7815 ... 49¢
 78L05 ... 39¢
 78L05 ... 39¢
 78L12 ... 39¢

Power Diodes

1N5401 ... 3A/100V ... 8¢
 1N5404 ... 3A/400V ... 9¢
 1N5408 ... 3A/1kV ... 10¢
 6A10 ... 6A/100V ... 24¢
 6A100 ... 6A/1kV ... 32¢
 Deal H8: 25 pcs total,
 (5pcs of ea.)...\$3.00

RADIAL LYTICS

10uF/25V ... 6¢
 22uF/25V ... 6¢
 33uF/25V ... 6¢
 47uF/25V ... 7¢
 100uF/25V ... 8¢
 220uF/25V ... 9¢
 330uF/25V ... 14¢
 470uF/25V ... 17¢
 Deal A7: 40 pcs total,
 (5pcs of each)...\$4.00

Ceramic Disc

(All caps rated 50V)
 270pF ... 6¢
 330pF ... 6¢
 470pF ... 6¢
 .001uF ... 6¢
 .01uF ... 6¢
 .022uF ... 6¢
 .047uF ... 6¢
 .1uF ... 6¢
 Deal R7: 40 pcs total,
 (5pcs of each)...\$2.50

DEAL W2...\$2.50

120 pcs total (20 pcs of each: 10K, 47K, 100K, 1k, 4.7k, All 1/4W 5%.

DEAL W5...\$2.50

100 pcs total (20 pcs of each: 10K, 47K, 100K, 470K, 1M, All 1/4W 5%.

DEAL M3...\$5.00

7805 7812
 7905 7912
 12 pcs total
 (3pcs of each)

More Transistors

2N2222A ... 30¢
 2N4124 ... 11¢
 2N4126 ... 11¢
 2N5401 ... 14¢
 MPS110 ... 13¢
 2N3055 ... 69¢
 TIP31C ... 55¢
 TIP32C ... 55¢
 TIP117 ... 55¢
 TIP120 ... 60¢
 TIP125 ... 65¢

CRYSTALS

3.5795MHz ... 99¢
 4.0000MHz ... 99¢
 11.0000MHz ... 99¢
 11.0562MHz ... 99¢

1W Zener Diodes

1N4728A ... 3.3V ... 10¢
 1N4733A ... 5.1V ... 10¢
 1N4739A ... 9.1V ... 10¢
 1N4742A ... 12V ... 10¢
 1N4744A ... 15V ... 10¢
 1N4746A ... 18V ... 10¢
 Deal Z5: 30 pcs total,
 (5pcs of ea.)...\$2.50

1A SCHOTTKY

1N5817 ... 1A/20V ... 20¢
 1N5818 ... 1A/30V ... 23¢
 1N5819 ... 1A/40V ... 24¢
 Deal Y6: 9 pcs total,
 (3pcs of each)...\$2.00

Mono Caps...8¢ea

.01uF/50V .047uF/50V
 .022uF/50V .1uF/50V
 Deal B5: 40 pcs total,
 (10pcs of ea.)...\$2.50

400V BRIDGES

1Amp
 1.5Amp
 DF04M ... DIP ... 40¢
 W04M ... Round ... 35¢
 KBL04 ... In-line ... 90¢
 Deal X8: 6pcs total,
 (2pcs of each)...\$3.00

DEAL J1...\$3.50

78L05
 78L12
 10 pcs total
 (5pcs of each)

3mm (T1) Diff. LEDs

Red ... 6¢
 Green ... 10¢
 Yellow ... 12¢
 Deal L8: 30 pcs total,
 (10pcs of ea.)...\$2.50

Computer Stuff

8ft printer cable ... \$4
 8ft VGA extension ... \$4
 3-b serial mouse ... \$9
 101 key keyboard ... \$19
 1.44Mb 3.5" drive ... \$29
 1Gb hard drive ... \$230

Germanium Diodes

1N34A ... 15¢
 1N60 ... 15¢
 1N270 ... 30¢
 Deal G5: 18 pcs total,
 (6pcs of ea.)...\$2.50

3A SCHOTTKY

1N5820 ... 3A/20V ... 32¢
 1N5821 ... 3A/30V ... 36¢
 1N5822 ... 3A/40V ... 40¢
 Deal Y9: 9 pcs total,
 (3pcs of each)...\$3.00

Tantalum Caps

1uF/35V ... 18¢
 2.2uF/35V ... 22¢
 10uF/35V ... 45¢
 Deal T6: 15 pcs total,
 (5pcs of each)...\$3.50

SOLDER ROLL

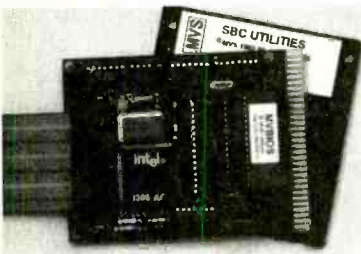
SN63/37
 .031" dia
 1 Lb Roll
\$7.80



\$10.00 minimum order. We accept VISA, MC, MO, Check, No-CODs. Please add \$5.00 for shipping & handling (foreign addresses: \$8.50). Florida addresses add your applicable county sales tax. Hours: Mon-Fri: 9AM to 5PM (EST). All new premium parts. Send for free Catalog.

CIRCLE 314 ON FREE INFORMATION CARD

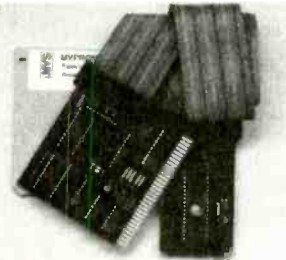
386 SBC \$83



OEM (1K) PRICE
 INCLUDES:
 - 5 SER (8250 USART)
 - 3 PAR (32 BITS MAX)
 - 32K RAM, EXP 64M
 - STANDARD PC BUS
 - LCD, KBD PORT
 - BATT. BACK, RTC
 - IRQ0-15 (8259 X2)
 - 8237 DMA 8253 TMR
 - BUILT-IN LED DISP.
 - UP TO 8 MEG ROM
 - CMOS NVRAM
 USE TURBO C,
 BASIC, MASM
 RUNS DOS AND
 WINDOWS
 EVAL KIT \$295

\$95 SINGLE PIECE PRICE UNIVERSAL PROGRAMMER

- DOES 8 MEG EPROMS
 - CMOS, EE, FLASH, NVRAM
 - EASIER TO USE THAN MOST
 - POWERFUL SCRIPT ABILITY
 - MICROCONT. ADAPTERS
 - PLCC, MINI-DIP ADAPTERS
 - SUPER FAST ALGORITHMS



OTHER PRODUCTS:
 8088 SINGLE BOARD COMPUTER OEM \$27 ... *95
 PC FLASH/ROM DISKS (128K-16M) 21 75
 16 BIT 16 CHAN ADC-DAC CARD 55 195
 WATCHDOG (REBOOTS PC ON HANGUP) 27 95

*EVAL KITS INCLUDE MANUAL BRACKET AND SOFTWARE. 5 YR LIMITED WARRANTY FREE SHIPPING HRS: MON-FRI 10AM-6PM EST



MVS BOX 850
 MERRIMACK, NH
 (508) 792 9507

Radiotelephone - Radiotelegraph

FCC Commercial License

Why Take Chances?

Discover how easy it is to pass the exams. Study with the most current materials available. Our Homestudy Guides, Audio, Video or PC "Q&A" disks make it so fast, easy and inexpensive. No college or experience needed. The new commercial FCC exams have been revised, covering updated Aviation, Marine, Radar, Microwave, New Rules & Regs, Digital Circuitry & more. We feature the Popular "Complete Electronic Career Guide". 1000's of satisfied customers Guarantee to pass or money back. Newest Q&A pools.

Send for FREE DETAILS or call

1-800-800-7588

WPT Publications
 4701 N.E. 47th St.
 Vancouver, WA 98661

Name _____

Address _____

City _____ St. _____ Zip _____

1-800-800-7588

July 1996, Electronics Now

Printed Circuits in Minutes Direct From LaserPrint!

8 1/2" x 11"

* Or Photocopy
** Use standard household Iron or P-n-P Press.

1. LaserPrint*
2. Press On**
3. Peel Off
4. Etch



Use Standard Copper Clad Board
20 Shts \$30/ 40 Shts \$50/ 100 Shts \$100
Visa/MC/PO/Ck/MO \$4 S&H

Techniks Inc.
P.O. Box 463
Ringoos NJ 08551
ph. 908.788.8249 fax 908.788.8837
<http://chelsea.ios.com/~techniks>
Retail Dealer Inquires Invited

AFFORDABLE EMBEDDED SOLUTIONS

EPROM EMULATORS Complete systems, ready to use. Test your code thru the printer port without disconnecting equipment. Emulators mounted in a quality case. **STD32**, \$109, emulate (2764-27256). **STD64**, \$129, (2764-27512). **PRO-SERIES** includes bi-directional communications with PC and 'real time link' to PC for single byte changes. Instant recovery battery back-up. **PRO128**, \$199, (2764-27010). **PRO512**, \$259, (2764-27040). Use multiple emulators to support 16/32 bit bus. \$5 shipping.

8051/8031 SINGLE BOARD CONTROLLER. Only 1.8 X 3.0". Quality bare board with solder mask both sides and component outline. Complete with PC 8051 assembler and schematic. **ONLY \$19.95.** Complete kit, \$29.95. Add \$3 for shipping.

EEPROM PROGRAMMER. Reads EPROMS for easy transfer to EEPROMS. Programs 2864-28256. Complete, ready to use. No more 15 minute erase burn cycles! Only \$49.95. \$59.95 with case option. \$5 shipping.

UNIQUE RING DECODER. Look like a big business without the bills. Have up to four numbers on a single line. Only \$74.95. \$5 shipping.

LOGICAL DESIGN TOOLS, INC.
5403 EVERHART, #55
CORPUS CHRISTI, TX 78411
SALES (512) 888-4535 FAX (512) 883-3711
<http://www2.interconnect.net/ldti/hom.htm>



16 Bit Control

& Data Acquisition System



from
\$299

DSP
Powerful,
Easy to use,
Tons of Memory,
I/O & features:

16.8MHz 68HC16
RS-232 & RS-485
RT clock option

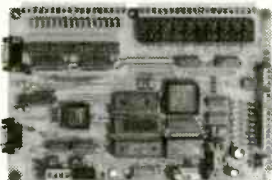
34 digital I/Os (7 IRQ)
+ LCD/keyboard port
+ 8 ch 10b fast A/D

Affordable "C" compiler/library
Multi-tasking kernel
Up to 256K ea. SRAM, FLASH memory

INTEC INOVENTURES INC.

Ph: (604) 721-5150 FAX: 721-4191

NEW! BAC552ES CONTROLLER



APPLICATION READY ONLY \$319.95

The BAC552ES is a new enhanced backward compatible addition to the proven Basic Automation Controller BAC552.

NEW FEATURES: 3 serial ports (Console port, RS232 DTE with RTS/CTS and RS485) • 128K SRAM • 128K FLASH • secondary watchdog timer • serial EEPROM option • 60K for BASIC program • 64K SRAM / 64K FLASH for data storage • 64K FLASH for BASIC file backup

APPLICATIONS: Industrial control • HVAC systems • security • home automation • data logging • remote control & monitoring

SYLVA Control Systems a division of Sylva Energy Systems Inc.

519 Richard Street, Thunder Bay, Ontario, Canada P7A 1R2

Ph. 807-768-2487 Fax 807-683-6485 BBS 807-767-0587

WEB PAGE: <http://www.sylvacontrol.baynet.net>

Email: sylva@mail.baynet.net

New ELECTRONIC GUN !

Add **FIREPOWER** to almost anything!

web: <http://www.hoopsware.com>
email: sales@hoopsware.com

Amazing new Electronic Gun has only one moving part
...the projectile! Imagine the possibilities!!

This simple, silent, and inexpensive project uses parts mostly available from Radio Shack and can be built in as little as 30 minutes. The same principles can be used to build a silent weapon with devastating force! You must be over 18 years of age to order. Complete plans only \$15.00 (\$20.00 Canada and Mexico). Order #GGUN.



VISA/MC ORDERS (702) 322-8875

or send check or M.O. to:

Hoopsware
P.O. Box 3079, Dept. EN
Sparks, NV 89432-3079

THE COLLECTED WORKS OF MOHAMMED ULLYESSES FIPS

#166—By Hugo Gernsback.

Here is a collection of 21 April Fools Articles, reprinted from the pages of the magazines they appeared in, as a 74-page, 8 1/2" x 11-inch book. The stories were written between 1933 and 1964. Some of the devices actually exist today. Others are just around the corner. All are fun and almost possible. Stories include the Cordless Radio Iron, The Visi-Talkie, Electronic Razor, 30-Day LP Record, Teleyeglasses and even Electronic Brain Servicing. Get your copy today. Ask for book #166 and include \$16.00 (includes shipping and handling) in the US and Canada, and order from CLAGGK Inc., P.O. Box 4099, Farmingdale, NY 11735-0793. Payment in US funds by US bank check or International Money Order. Allow 6-8 weeks for delivery.



MA05

NEW EASY PC

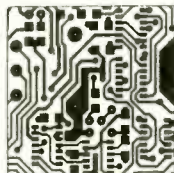
BRITISH
DESIGN
AWARD

SCHEMATIC and PCB C.A.D

ONLY \$145

Includes

- MGA, CGA, EGA & VGA compatible.
- Design large multi layer boards.
- One level pull down menu and quick keys for fast layout.
- Dot matrix, laser, plotter, Gerber & N.C. drill output.
- 6 Month Free update Free Demo



7840 ANGEL RIDGE ROAD
ATHENS, OHIO 45701
(614) 592-1810

Visa & MasterCard Accepted

"NOW BUYING"

\$\$\$ BEST PRICES \$\$\$

AVAILABLE

SCIENTIFIC ATLANTA™

8536 THRU 8600

ZENITH™

1086 THRU 1612

TOCOM™

5503A
VIP THRU 5507

PIONEER™

5135 THRU 6300

JERROLD™

DPV7
DPBB7
DPV70
DPBB70
CFT

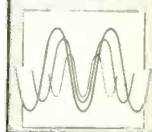
Midwest's Largest Brokers

(We buy quantities of one to one thousand units)

NATIONAL CABLE BROKERS
(219) 935-4128

HIGH POWER AUDIO AMPLIFIER CONSTRUCTION

High Power
Audio Amplifier
Construction



BP277—Here's background and practical design information on high power audio amplifiers capable of 300±400 watts r.m.s. You'll find MOSFET and bipolar output transistors in inverting and non-inverting circuits. To order your copy send \$6.25 plus \$3.00 for shipping in the U.S. and Canada to Electronic Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240. U.S. and Canada only. Payment in U.S. funds by US bank check or International Money Order. Please allow 6-8 weeks for delivery.

MA03

Our #1 Best-Selling Home Electronics Repair Manual

**FREE
30-DAY TRIAL**



WEKA'S GIANT 900-PAGE BIBLE OF EASY ELECTRONICS REPAIR

YOURS FOR ONLY
2 EASY PAYMENTS OF
\$24.95

**FILLED WITH
Troubleshooting
Diagnostic Tips...
Step-By-Step "Model
Specific" Instructions...
Charts, Photos & Easy-
To-Follow Diagrams...
PLUS Directory Of
Parts Dealers!**

**ALL THE INSTRUCTIONS YOU NEED TO FIX
TVs, VCRs, STEREOS, CAMCORDERS, PHONES, CD PLAYERS, FAXES,
COMPUTERS, WALKMANS, AUTO RADIOS, VIDEO GAMES, & MORE!**

**Don't Waste Time & Money At Electronics Repair Shops!
NOW FIX IT YOURSELF FOR SAVINGS,
PROFIT... AND SATISFACTION!**

Now you don't have to be a professional technician to get PERFECT electronics repairs at home... at a fraction of repair shop costs! Whether you enjoy doing your own repairs or want an extra part-time income, this famous nationally advertised **WEKA ELECTRONICS REPAIR MANUAL** gives you easy-to-follow instructions for fixing nearly every electronic device you can think of... from popular manufacturers like SONY, RCA, IBM, NINTENDO and more! Plus, you get more than just easy instructions, YOU GET A FULL ELECTRONICS BIBLE that teaches you everything from basic

electronics principles to advanced troubleshooting and repairs!

UPDATED SUPPLEMENTS!

About 4-5 times a year, we'll send you updated 140-page repair supplements for all the newest electronic products available. Examine these supplements at home FREE for a full 30-days. If you decide to add them to your Manual, they're yours for just \$35.00 each plus shipping and handling. There's **NO RISK, NO OBLIGATION! ORDER YOUR 900-PAGE ELECTRONICS REPAIR MANUAL NOW!**

Yes, 900 Instruction-Filled Pages In Wipe-Clean Vinyl Binder!



- LOOSE-LEAF FORMAT!
- PAGES LIE FLAT!
- TABBED CHAPTER PAGES!
- PHOTOS, CHARTS, DIAGRAMS!
- EXPLODED VIEWS!
- STEP-BY-STEP FIXES!
- TROUBLESHOOTING INSTRUCTIONS!
- TEST EQUIPMENT PRIMER!
- SAFETY PRECAUTION CHECKLIST!
- ELECTRONICS REFERENCE GUIDE!
- PREVENTIVE MAINTENANCE TIPS!
- HOW TO USE TOOLS OF THE TRADE!
- MANUFACTURERS' DIRECTORY!
- PARTS SUPPLIERS!
- PLUS MUCH MORE!

CIRCLE 321 ON FREE INFORMATION CARD

CALL TOLL-FREE NOW FOR 30-DAY HOME TRIAL!

1-800-222-WEKA

FAX: 1-203-944-3663 E-MAIL: 102132.1245@compuserve.com

WEKA PUBLISHING, INC., 1077 Bridgeport Ave.,
P.O. Box 886, Shelton, CT 06484

- YES!** Please rush my ELECTRONICS REPAIR MANUAL. I'll pay now by check or credit card and save \$10 off the regular price! If I'm not 100% satisfied, I may return the book within 30 days for a full refund of the purchase price.
- SAVE!** Bill my credit card in 2 easy monthly payments of \$24.95 plus \$6.50 shipping & handling.
- VISA® MASTERCARD® Exp. Date
- Account #
- Signature _____
- Phone (____) _____
- SAVE!** My check is enclosed for \$49.90 plus \$6.50 s&h.
- Add \$10.00 for EXPRESS DELIVERY guaranteed within 5 business days from receipt of order. (Prepaid U.S.A. orders only, no P.O. Boxes.)
- Bill me later for the regular price of \$59.95 plus \$6.50 shipping & handling, subject to credit approval. Signature and phone number required to process your order. P.O. Box addresses must be prepaid.

Name _____
Company _____
Address _____
City _____ State _____ Zip _____

In Canada, please add \$10. Overseas orders add \$15 (foreign orders must be prepaid). U.S. funds only. CT residents add 6% sales tax. Supplements are just \$35 each plus shipping & handling. They will be sent 4-5 times a year on a fully-guaranteed, 30-day trial basis. They may be cancelled at any time. 32448

July 1996, Electronics Now

Glaucoma is an eye disease that can steal your sight. Especially if you're over 60, or Black and over 40. But glaucoma can usually be controlled if it's detected and treated early.

So, get a dilated eye examination in which drops are used to enlarge your pupils.

For more information write: Glaucoma, 2020 Vision Place, Bethesda, MD 20892-3655

Don't lose sight of Glaucoma.

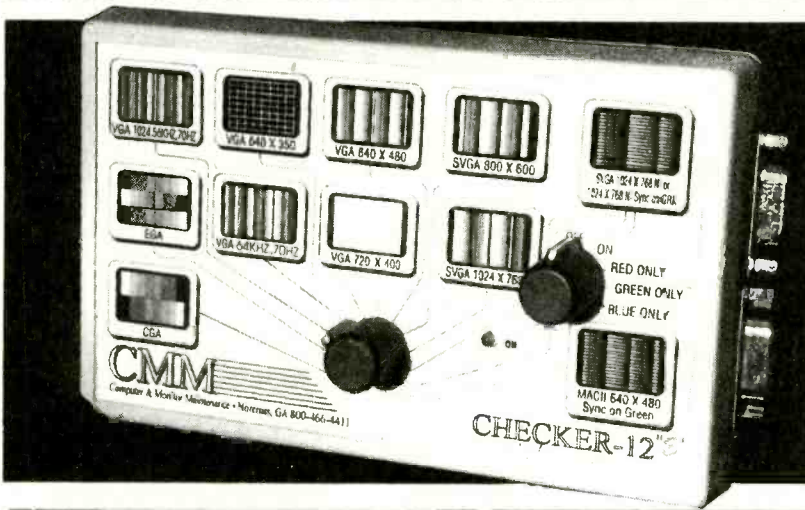


National Eye Institute, National Institutes of Health, Public Health Service, U.S. Department of Health and Human Services

**Education?
Retirement?
Peace of Mind?**

**You have
your reasons.**

NEW!! Checker 12 E Monitor tester



COLOR BARS, GRAY SCALE & SWEEPS TO 64 K hz!!!!!!

The "Checker 12" is an easy to operate, hand held, battery, or AC operated computer monitor pattern generator. With its support of CGA(15.75khz), EGA(22khz), MACII(35khz), and VGA modes 1,2,3 (31.5khz), 800X600(35khz), 1024X768 interlaced (35khz), 1024X768 non-interlaced, & 1024X768NI with sync on Green (48khz), ++ 2 NEW VGA MODES>>> 56 kHz x 70 Hz & 64 kHz x 70 Hz. With its' single mode switch, you know exactly what type of monitor you are testing. Its' front panel color pictures, show just what you should be seeing on the monitor under test. You can quickly tell if the monitor is a VGA, SVGA, or a SVGA/NI. guessing. The "Checker 12" provides various test patterns for VGA monitors. X-hatch, for size and linearity and convergence set-up. White screen, for purity and CRT burn evaluation. Color bars and 8 step gray scale for color tracking and balance. There is also a single color mode that allows for single color channel operation.

Price: \$339.00 + \$5.00 S&H.

Includes battery, AC adapter, Mac adapter and 1 year warranty (upgrade your Checker 12 to a 12 E for \$49, call for details)

Please call about our other monitor test products, and offers, or visit our Webb site.



Computer & Monitor Maintenance

6649 Peachtree Ind., Blvd., Suite N-1 • Norcross GA 30092
1-800-466-4411, 770-662-5633 (Voice), 770-840-8814 (Fax)
We're on the WEBB at <http://www.computermonitor.com>

CIRCLE 336 ON FREE INFORMATION CARD



No matter what you're saving money for, U.S. Savings Bonds make sense. They're backed by the full faith and credit of the United States. They earn interest for up to 30 years. And their value is guaranteed to grow at market-based rates.

Ask your employer or banker about saving with U.S. Savings Bonds.

Or for a recorded message of current rate information, call 1-800-4US-BOND 1-800-487-2663



A public service of this magazine

CABLE CONVERTERS/DESCRAMBLERS

★ ★ ★ ★ SUPER BUYS ★ ★ ★ ★
★ FULLY REFURBISHED UNITS ★

TOCOM™ ★ JERROLD™ ★ SCIENTIFIC ATLANTA™ ★ ZENITH™ ★ PIONEER™
"WE SERVICE MOST PRIVATELY OWNED CABLE CONVERTERS"

Phone (219) 935-4128



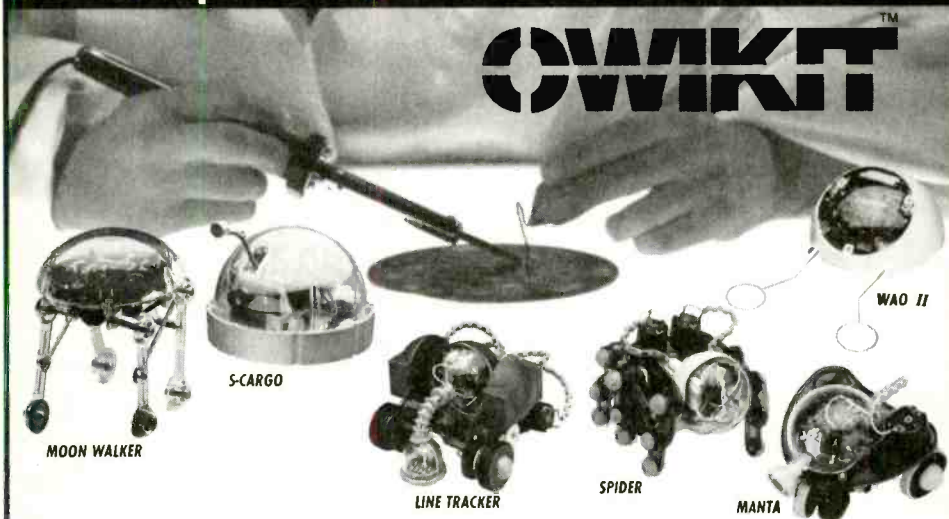
SORRY, NO INDIANA SALES

NATIONAL CABLE BROKERS

1801 W. JEFFERSON ST., PLYMOUTH, IN 46563

OUR POLICY: All products carry a two year warranty. Warranty covers parts and labor and return shipping.
WARNING: Theft of cable services is a crime. National Cable will not knowingly defraud any pay TV operator and we will not assist any individual or company in doing the same.

Move Up to the Ultimate in Robotic Kits.



OWIKIT™

OWI's "Next Generation" of affordable, rugged Robot Kits challenge the enthusiast to solder circuit boards and mechanically assemble.

Visit our homepage @
<http://www.owirobot.com>

Each OWIKIT also incorporates the basic principles of robotic experiments, sensing and locomotion, guaranteeing an exciting, hands-on adventure of knowledge and fun!

But remember! OWI is the recognized founder and leader in Educational Robot Kits. ACCEPT NO IMITATIONS.



EK

ELEKIT

1160 Mahalo Place, Suite B
Rancho Dominguez, CA
90220-5443
(310) 638-7970
Fax: (310) 638-8347



Order M - F: 8a.m. - 4p.m. PST

NEW	ROBOT.TECH.CURR.	MV-RTC	Teacher's Manual	158 Pg. Book	74.95
S-CARGO	OWI-936K	Sound Sensor	47 Pg. Book	29.95	
WAO II	OWI-961K	Programmable - Graphic	59 Pg. Book	69.95	
SPIDER	OWI-962K	Infrared Sensor	49 Pg. Book	49.95	
LINE TRACKER	OWI-963K	Infrared Sensor	48 Pg. Book	49.95	
MANTA	OWI-966K	Sound / Touch Sensor	44 Pg. Book	29.95	
MOON WALKER	OWI-989K	Solar Sensor	10 Pg. Book	34.95	

CIRCLE 327 ON FREE INFORMATION CARD

Throbbing Modems

by Joshua Bagby,
of Penthouse fame!
The reviews tell it all:
this is the #1 book on
cyber-intimacy! 290
pages, November 1995,
\$17.95 **NEW!**

ULTIMATE Scanner

Bill Cheek's 3rd book
on scanner mods is just
terrific! Enter the 21st
century with the mad
modmaster. 242 pages,
highly illustrated, large
format, 1995, \$29.95

EMERGENCY RADIO!

Scanning the news
as it happens
by Norm Schrein, "Mr.
Scanner," President of
the Bearcat Radio Club
214 pages, \$14.95

TravelScan

Good Frequencies
Across America
Henry Eisenson (FINALLY!)
150 pages, 1/96, \$9.95

NEW (1/96)
Great reviews!

Smart Casino Gambling
Olaf Vancura, PhD
364 pages, \$24.95

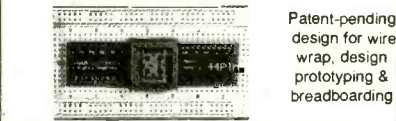
Cheating at Blackjack,
SQUARED
Dustin D. Marks
208 pages, \$24.95

S/h \$4 1st book, then \$2 ea.
CA add tax.

✓ our WWW site!

INDEX Publishing Group, Inc.
3368 Governor Dr., Suite 273S
San Diego, CA 92122
Fax orders: (619) 281-0547
Toll free orders: 800-546-6707
www.electrictiti.com/~ipgbooks
e-mail: ipgbooks@indexbooks.com

**68HC11 and other
PLCC prototype adapters**
that fit on a single breadboard strip!



PLCC sockets mounted on PCB with .25" leads

Patent-pending design for wire wrap, design prototyping & breadboarding

28 Pin-\$ 6.95; 44 Pin-\$ 9.49; 52 Pin-\$ 13.49; 68 Pin - \$ 14.95; 84 Pin -\$ 18.95. All + S/H. Visa/MC/Check
AMAZE ELECTRONICS CORP.
Tel: 800-996-2008 Fax: 408-996-0366
amaze@hooked.net www.hooked.net/users/amaze

**Cable TV
Descramblers**
Converters * Filters * Accessories

30 day Free Trial - NO RISK!
Unbeatable wholesale prices!
Affordable extended warranty
1 Year Warranty on all products



Free Catalog
Call the cable professionals!
Credit Cards Welcome!

1-800-379-3976
Prices starting as low as \$99!

**PHONE LINE
MANAGER**

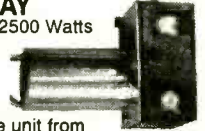
Better than Caller ID! This device detects an incoming call. If you subscribe to caller ID, the unit will automatically receive and display the caller's telephone number. If no caller ID, the unit will ask the caller to enter a telephone or personal ID number, and then will display and compare this number to a memory bank of numbers that you've installed. If the unit finds a match your phone will ring. If it does not find a match, the caller will be directed to leave a digitally recorded message. (No tape or answering machine is necessary). New, in factory cartons, with documentation.



96U001 \$59.95 each

ROBOTICS RELAY

Control circuits up to 2500 Watts with a DC pulse. This 12-30V latching relay will stay in position until it receives a second pulse. Control the unit from a simple SPDT-NO switch or from logic. Ideal for robotics, power control, remote control or controlling a load from several locations. Application notes included.



94B010 \$7.95 each

Send \$2.00 for our Latest Catalog!
\$4.00 Foreign. Refundable on First Order.

ALLTRONICS
2300-D Zanker Road • San Jose, CA 95131
Voice (408) 943-9773 • Fax (408) 943-9776
World Wide Web: <http://www.alltronics.com>
On-Line Ordering: (408) 943-0622
14400-N-8-1-24 Hrs.
030796

It's Here!!!

**PBASIC*
Compiler**

Put BASIC Stamp I programs directly into your PIC - no BASIC Stamp necessary!
Creates editable assembler source and hex files for use with any PIC programmer.
Introductory price \$99.95

- ♦ Pocket PIC Programmers from \$34.95
 - ♦ PICProto prototyping boards \$9.95-\$19.95
- *BASIC Stamp and PBASIC are trademarks of Parallax, Inc.
microEngineering Labs
Box 7532 Colorado Springs CO 80933
(719) 520-5323 FAX 520-1867

Prototype it..... FAST!

with ProtoQuick 8051 or Z8
• Complete single board computers
• Up to 32K EPROMs and 64K RAM
• 12.50 in. plated through proto area
• RS232 C serial port w/ DTR/RTS pins
• On line EPROM re-program code
• Assembled, ready to run - 5v. only
• MS-DOS cross assembler included

\$99.00 each

Software Revenue 2700 Roundbottom Road
Channahon, OH 43824 USA
(513) 561-2060

Run prototype applications or experimental hardware from the serial port - WITHOUT PROGRAMMING!

New Surveillance Devices!

Ultra miniature video cameras hidden in smoke alarm or alarm clock - your choice. Wide field of view and super .1 lux low light sensitivity! Unobscurable!

SC-600 TC-70 High quality B/W with 420 lines of resolution for ultra sharp images.
Direct output of video and audio. **\$219.95 ea.**

Best price on surveillance cameras anywhere!

Telephone Transmitter Kit hidden in dual modular adaptor. Transmits both sides of conversation to any FM radio up to 1/4 mile. "SnapKit" technology. Uses phone line for power and antenna. Goes completely unnoticed. **MA-100 \$25.95**

High quality cassette deck plugs directly into telephone jack! Records up to 12 hours of conversations on a single cassette. Recording starts and stops automatically when phone is used! **Visa/MC (214)256-7490**

THR-12 12 Hour Telephone Recorder **\$99.95** Free shipping! Check/Money orders also accepted

Seymour-Radix Inc. Box 166055-N Irving, TX 75016
Now you can visit us on the internet at <http://www.why.net/home/sr/>

*****CABLE T.V.***
DESCRAMBLERS**
Lowest prices, guaranteed!
CFS Electronics
(formerly C & C Electronics)
(800) 995-1749
VISA, MC, AMEX, C.O.D.

BEST BY MAIL
Rates: Write National, Box 5, Sarasota, FL 34230

FEVERBLISTER HOME REMEDY discovered accidentally, immediate results. \$15.00 to: PPG, RR20606J, El Prado, NM 87529.

HOW TO MAKE MILLIONS Trading Commodities! Free Recorded Message: 407-697-0409.

NEW PATENTED SCIENTIFICALLY-BASED weight management product sweeping the country. For FREE information on this moneymaking opportunity call: 800-524-4724.

OVERWEIGHT, BALDING, STRESSED OUT, Need More Money? For Expert Advice Call (900)-772-9134.

LEARN HOW TO Invest \$50,000 (minimum). Generate numerous dividends and frequent capital gains (21 year history/ no guarantees). Call (800)524-4724 for FREE AUDIOTAPE. Securities offered through AEGON USA Securities, Inc., Member NASD/SIPC.

WIN INSTANT \$BIG Bucks. Beat The Slots Secrets. Free Inside Info. Send Self-Addressed, Stamped Envelope: BD PAY-OLA, Box 881161-(Ele), San Francisco, CA 94188.

WIN \$63,000 + GUARANTEED On One Call!!! 1-900-255-5463 Pin#3412. 18+.

BUY BELOW WHOLESALE! CATALOG \$2.50. DURHAM WHOLESALE-(ELE), BOX 132, PLAINVIEW, TX 79073.

EARN EXTRA INCOME or Financial Security in just an Hour a Day! \$7.00: B & B Innovations, Box 2897-(ELE), Lake Placid, FL 33862.

INCREDIBLE OPPORTUNITY! GUARANTEED Success. Personal Guidance. RICHMOND ENTERPRISES, 2354 Deep Draw Road, Crossville, TN 38557.

\$200 WEEKLY MAILING CIRCULARS. Wysinger, Box 10110-(ELE), Cleveland, OH 44110.

CABLE TV CONVERTERS

Equipment & Accessories
Wholesalers Welcome
Call VISION TIME PRODUCTS
1-800-310-1153 M-F 8a-8p
NO TENN SALES

BEST DEALER PRICING!

**CABLE
DIRECT
CONVERTERS • FILTERS
DESCRAMBLERS**



IMPROVE YOUR IMAGE WITH VIDEO STABILIZERS

100% MONEY BACK GUARANTEE!

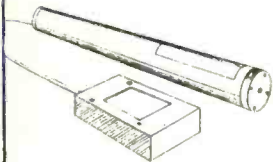
30 DAY FREE TRIAL! FREE Cable TV Catalog.
VISA MC AMEX
Now you can tune-in your favorite cable TV programming and **SAVE \$100'S - EVEN \$1000'S** on premium CABLE TV EQUIPMENT.

MODERN ELECTRONICS
1-800-906-6664
2125 S. 156TH CIRCLE • OMAHA, NE 68130

LASERS & ACCESSORIES

WE SPECIALIZE IN
Laser and Laser Related Surplus Inventory

HENE LASERS



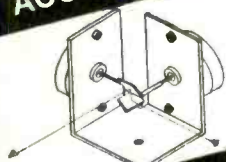
- Complete Systems
- Plasma Tubes
- Power Supplies

DIODE LASERS



- Visible I/R
- Complete Modules
- Collimating Optics
- Drive Circuits

ACCESSORIES



- Books
- Optics
- Electro-Optics

CALL FOR A FREE CATALOG!

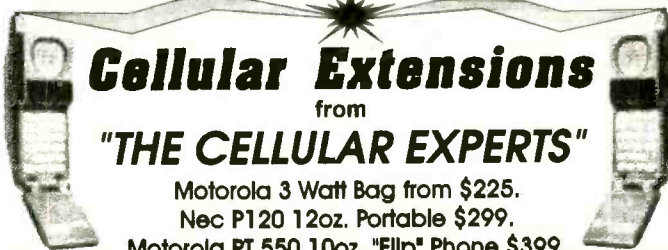
We want your Laser related surplus items. Call or Fax us today for a quote!

MEREDITH INSTRUMENTS

P O Box 1724
5035 N. 55th Ave. #5
Glendale, AZ 85301

Phone: 602-934-9387
Fax: 602-934-9482

[HTTP://WWW.MI-LASERS.COM](http://www.mi-lasers.com)



Cellular Extensions

from
"THE CELLULAR EXPERTS"

Motorola 3 Watt Bag from \$225.
Nec P120 12oz. Portable \$299.
Motorola PT 550 10oz. "Flip" Phone \$399.



Nation
WIDE
Paging

Others available, buy new from us, or send us your phone.
Get a second or third phone with no additional monthly charges!
Motorola, NEC, Panasonic, Audiovox and many others!

Fax Back Hotline, For 24hr. Info. call from your FAX (714) 581-7460 or call
(800) 457-4556
Nationwide paging available. C.G.C. Dealer inquiries welcome.

Is your Cable Company Alienating You?



Say **NO** to unearthly rental fees!

Owning your cable equipment saves you the high cost of monthly equipment rental charges, and gives you control of your TV.

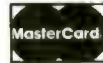
We have the *Best* in

CONVERTERS and DESCRAMBLERS!

Everquest • Panasonic • Jerrold • Zenith • Pioneer
Scientific Atlanta • Oak • Eagle • Hamlin • Tocom

1 800 624-1150

FREE Catalog!



MD Electronics

P.O. Box 241296 • Omaha, NE 68124

© JERROLD, STARCOM, PANASONIC, ZENITH, PIONEER, OAK, SCIENTIFIC ATLANTA, EAGLE, HAMLIN, and TOCOM are all registered trademarks. All references to the above mentioned equipment is for identification purposes only. We are in no way implying that any of the products in this advertisement are original equipment. M.D. Electronics is in no way affiliated with the above mentioned companies or corporations.

OUR LOWEST PRICES!

Global Specialties Is On The Move!

Affordable Spectrum Analyzer

Convert any oscilloscope to a full blown spectrum analyzer.
• 4mHz to 1000 mHz high accuracy (1.5 dB)
• -70 dBm to 0dBm dynamic range



model #GSA1000.....**869.95**

1.3 GHz Hand Held Frequency Counter

• 5Hz-1300 mHz freq. & period measurements .0001 mHz resolution

model #5003.....**219.95**



Triple Power Supply (Lab Quality)



• +5VDC Plus two
1.2-20VDC @
250MA

#1310
149.95

Call For Free! 40 Page Catalog

PinholeCamera

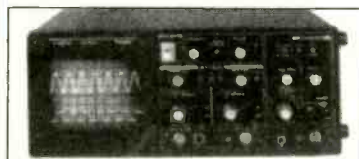
- Requires 1/16" opening size
- 1-1/2" x 1-1/2" x 7/8"
- Power 7.5-12VDC n • .8 lux
- 3.8mm lens included
- 380 lines resolution
- 12V DC Power Supply 9.95



model #CVC50PH**139.95**

Prottek Test Equipment

20 MHz Oscilloscope Dual Trace w/ Component Checker



#P3502C Dual Trace**375.95**

#P2510 100 MHz 3 Ch. 8 Trace**1195.00**

Prottek Cutting Edge

The model 506 meter has a RS-232C serial interface. Measured values are transmitted to the computer via an interface cable and supplied software WINDOWS and MS-DOS. DCV 1000V ACV 1000V AC/DC Current 20A Res. 40 meg Ω freq. 10MHz

REG. 208-95

model #506**169.95**

Elenco Digital Capacitance Meter

- .1pF to 20,000 UF
- Banana jack and special insertion jack included

model #CM-1555

Sale!



Call For FREE

Catalog & Technical Assistance

Add \$8.95 Shipping/Handling
NYS Add Tax
Visa/MC/Discover/Amex

MAIL ORDERS TO:
70 CAIN DR.
BRENTWOOD, NY 11717

ALL PHASE

VIDEO-SECURITY INC.
WHOLESALE VIDEO WAREHOUSE

1-800-945-0909

FAX: 516-435-7494

CLASSIFIED

SECURITY

SURVEILLANCE Privacy security protection. Catalog \$5.00. **SPY EMPORIUM**, 6065 Hillcroft, Suite 413, Houston, TX 77081. (713) 774-1000.

SECURITY system equipment. Do it yourself and save. Covert camera's, control panel's, motion's, glassbreak detectors, siren's, contact switches, more. 1 (800) 335-2296. Fax 1 (519) 541-1277.

TEST EQUIPMENT

TEST Equipment pre-owned now at affordable prices. Signal generators from \$50.00, oscilloscopes from \$50.00. Other equipment including manuals available. Send \$2.00 US for catalog. Refunded on first order. **J.B. Electronics**, 3446 Dempster, Skokie, IL 60076. (847) 982-1973.

TECHNICIANS: Electronic component tester for use with oscilloscope. Satisfaction guaranteed. \$29.95 plus S&H. Info.: **ELECTROHM**, 529 Brentwood, Lawrence, KS 66049.

QUALITY used test equipment for sale. Call, fax or write for list. **RIDGE EQUIPMENT**, PO Box 84, Mt. Airy, MD 21771. (301) 831-7671.

BUSINESS OPPORTUNITIES

EASY work! Excellent pay! Assemble products at home. Call toll free 1 (800) 467-5566 Ext. 5192.

FREE Invention Package: **DAVISON & ASSOCIATES** offers customized development, patenting, and licensing of new products and ideas. Proven results: 1 (800) 677-6382.

EXCELLENT extra income! Assemble easy products at home. Program Guaranteed! 1 (800) 377-6000 Ext. 6870. Open Sunday.

FLEA Marketers. Buy electronics, tools, jewelry at wholesale prices. For catalog send \$5.00 p&h to **CHEMOSOFT**, Dept. C273, Box 8216, Inglewood, CA 90308.

GOLD! Recover, refine gold from **SCRAP ELECTRONICS**. Learn process. Detailed publication \$35.00. **STRATEGIC TECHNOLOGY**, Box 145-E, Newville, AL 36353.

EDUCATION & INSTRUCTION

ELECTRONIC engineering. 8 volumes complete. \$109.95. No prior knowledge required. Free brochure. **BANNER TECHNICAL BOOKS**, 1203 Grant Avenue, Rockford, IL 61103.

LEARN VCR repair. Great profits. Home study. P.C.D.I., Atlanta, GA. Free literature. 1 (800) 362-7070 Dept. VRH342.

LEARN PC repair-troubleshooting, servicing. Home study. Free literature. P.C.D.I., Atlanta, GA. 1 (800) 362-7070. Dept. JH342.

ESP, Bioelectricity, microwave hearing, comprehensive booklist...\$1.00; \$2.00 foreign. RESEARCH ASSOCIATES, PO Box 3583, Boynton Beach, FL 33424-3583.

CABLE TV TURN-ON CHIPS

SUPER Cable TV "Test Chips". Provides full service activation. Excellent; instructions & illustrations. **New!! Super Cubes** external devices available. **Jerrold Starcom**: DP(V)5..DP(V)7..DPBB7..CFT-2000..CFT-2200 Series. **Pioneer**: BA-5000 thru BA-6700. **Pioneer: Custom Programmer** (Clears E2 & rewrites new I.D. codes). **Scientific Atlanta**: 8500 thru 8600. **Tocom**: 5503-VIP..5507. **Zenith**: ST-1000 thru ST-5612. **Call Now!! MASTER COMPONENTS**. 1 (800) 233-0570.

MISCELLANEOUS ELECTRONICS FOR SALE

TUBES: "oldest", "latest". Parts and schematics. SASE for lists. **STEINMETZ**, 7519 Maplewood Ave., EN 46324, Hammond, IN 46324.

FIBER-Optic Projects — Swing into the new technology by assembling tried and true projects recently published. "Practical Fiber-Optic Projects" - BP374 is only \$9.95. (price includes shipping) **ELECTRONIC TECHNOLOGY TODAY INC.**, PO Box 240, Massapequa Park, NY 11762-0240.

GREEN Thumb Alert— Electronics enters the Garden! New exciting book points out how gardeners can build simple gadgets to promote success where the elements work against you. Some of the projects are: over/under temperature monitoring, dusk/dawn switching, automatic plant watering, warming cables, etc. "Electronic Projects for the Garden" only \$9.95 (price includes shipping) **ELECTRONIC TECHNOLOGY TODAY INC.**, PO Box 240 Massapequa Park, NY 11762-0240.

CBers Order new CB Trick III CB book. Shows CB tune ups, amplifiers, and expert CB info! Send \$19.95 to **MEDICINE MAN CB**, PO Box 37, Clarksville, AR 72830.

RESISTORS 20 for \$1.00. LEDs 4 for \$1.00. Catalog \$1.00. **ZIPFAST**, Box 12238, Lexington, KY 40581-2238.

POOR reception on your A.M. radio? Our Signal Booster will help. Guaranteed! Send \$2.00 for details (refundable with order). **FALA ELECTRONICS**, PO Box 1376, Dept. 4, Milwaukee, WI 53201.

HAVE a beeping or chirping sound with scrambled video on channels. We can help. Professional quality positive notch filters. Discounts on 5 or more. Fast courteous service. All credit cards. We now carry 1-piece cable units w/volume control and parental lockout for all systems. Call 1 (800) 684-0539.

BRITISH Audio tubes. Buy-sell-trade. Buy the best audio tubes ever made and hear your equipment sing! Used tubes thoroughly tested, matched and graded. Mullard, Brimar, Siemens, Lux. **BRITISH AUDIO TUBES**, 2004 A St., Eureka, CA (707) 442-8008.

PLANS-KITS-SCHEMATICS

CRYSTAL set Handbook — Visit antiquity by building the radios your grandfather built. Assemble a "Quaker Oats" rig, wind coils that work and make it look like the 1920s! Only \$10.95 plus \$4.00 for shipping and handling. **CLAGG INC.**, PO Box 4099, Farmingdale, NY 11735. US funds only! USA and Canada — no foreign orders.

ALL-in-one catalog. AM/FM/ham/spy, transmitters, amplifiers, receivers. Voice scramblers/disguisers, audio, TV, Tesla coils, plans, "secret" books, kits, imports, exports and more. Start your own licensed or unlicensed radio station, 60 full pages for \$1.00. **PAN-COM INTERNATIONAL**, PO Box 130-F07 Paradise, CA 95967.

FREE Catalog. 100 Leading-Edge kits. K1, PIC. Full instructions, source code. 1 (800) 875-3214. **SCIENCE FIRST**, 95 Botsford Place, Buffalo, NY 14216.

BUILD a Hi-Tech solar flashlight. For complete plans/photos send \$10.00 to **HUGH M. ADAMS, P.E.**, 1011-D Hondo Avenue, Fort Walton Beach, FL 32547.

PRINTED circuit board screen printing supplies, kits. Economical way to produce PC boards, face plates. Send for catalog. **AUDIO MIRAGE**, 4424 Jacksonville, Howard, PA 16841. (814) 625-2152.

BUILD your own DC motor control. 1 to 480 amps w/surplus parts. **BEYOND ELECTRONICS**, 1 (800) 747-2861. Free catalog.

COMPUTER SOFTWARE

COMPUTER Hackers Bible: Monumental instructional manual on hacking! Covers: Unix, password cracking, government, Packet networks, DEC servers, mainframes, Wide Area nets, software cracking, banks, usernames, fraud, backdoors, AOL, spoofing, trapdoors, CompuServe, shadowing, and much more! Manual \$22.00. **SPECTRE PRESS**, PO Box 5112-E, N. Muskegon, MI 49445.

COMPUTER Viruses: One of the largest virus collections in the world! Contains over 4,000 live viruses on disk! Includes: Jerusalem, Gotcha, CIA, Michaelangelo, Dark Avenger, Cancer, Easure, Rabid, USSR, Kilroy, Intruder, and more! \$23.00. **SPECTRE PRESS**, PO Box 5112-E, N. Muskegon, MI 49445.

ANTIQUE ELECTRONICS

SAMS Photofact folders. 800-1976 schematics for restoring old radios and TVs. (913) 545-3685. ray w @midusa.net.

AUDIO-VIDEO-LASERS

VIDEO STABILIZER. Eliminates all copy guards on rented videotapes. Enhances any video signal giving optimum color and clarity. 30 day money back, 1yr. warranty. \$34.95 + \$6.00 S&H. **STAR DEVELOPMENT**, Box 92457, Milwaukee, WI 53202.

SCRAMBLING NEWS

NEW cable and digital satellite fixes. SCRAMBLING NEWS. 3494 Delaware Ave., #123, Buffalo, NY, 14217-1230. Voice/FAX (716) 74-2088. <http://www.scramblingnews.com>.

SATELLITE EQUIPMENT

FREE Big dish catalog — Lowest prices, systems, upgrades, parts, tune-up kits, accessories, factory fresh and warranties, satisfaction guaranteed. **SKYVISION®**, 1012 Frontier Drive, Fergus Falls, MN 56537. 1 (800) 334-6455. Fax (218) 739-4879. See full page ad The Shopper Section.

NEW 18" Digital System — Save 30 - 60% on programming compared to other guys little dish. Introducing the new **DISH™** Network from **SKYVISION®**, 1012 Frontier Drive, Fergus Falls, MN 56537. 1(800) 500-9264. Fax (218) 739-4879. See full page ad The Shopper Section.

VIDEOCYEPHER II descrambling manual. Schematics, video and audio. Explains DES, EPROM, CloneMaster, Pay-per-view (HBO, Cinemax, Showtime, Adult, etc.) \$16.95, \$2.00 postage. Schematics for Videocypher II Plus, \$20.00. Schematics for Videocypher II 032, \$15.00. Software to copy and alter EPROM codes, \$25.00. VCII Plus EPROM, binary and source code, \$30.00. **CABLETRONICS**, Box 30502R, Bethesda, MD 20824.

OBTAINING sound for your VCII and VCII Plus is easy. No codes needed. Details 1 (800) 211-5635.

CABLE TV

ATTN, cable box owners. Order your ID signal and bullet stopper before it's too late. Send \$23.00 to **R.R. ENTERPRISE**, Box 3532, Easton, PA 18043.

SECRET Cable Descramblers Build your own descrambler for **Less than \$12.00 in seven easy steps!** Radio Shack parts list and **Free** descrambling methods that cost **nothing to try**. Included. Send \$10.00 to: **INFORMATION FACTORY**, PO Box 669, Seabrook, TX 77586. For VISA/MC, **COD's**, (713) 922-3512 Anytime!

CABLE Descrambler! Anyone can build in seven steps with Radio Shack parts. Plans \$5.00. 1 (800) 818-9103.

DESCRAMBLE Cable with simple circuit added to Radio Shack RF modulator and using VCR as tuner. Instructions \$10.00. **TELECOM**, Box 832 E7, Brusly, LA 70719.

CABLE Descrambling New secret manual. Build your own descramblers for cable and subscription TV. Instructions, schematics for SSAVI, Gated Sync, Sinewave, (HBO, Cinemax, Showtime, UHF, Adult) \$12.95, \$2 postage. **CABLETRONICS**, Box 30502R, Bethesda, MD 20824.

CABLE TV Equipment & Accessories Wholesalers welcome! 30 day moneyback guarantee! **Free catalog!** **PERFORMANCE ELECTRONICS INC.**, 1 (800) 815-1512.

CABLE descrambler! Build with 7 Radio Shack parts costing \$12. Instructions. \$8. **F.A.S.T.**, Box 369-E7, Pt. Salerno, FL 34992-0369.

CABLE TV Test Chips for Jerrold, Tocom, Pioneer, Scientific Atlanta, etc... **Quick Installation!** New Multi-Mode modules available. Prices from \$5.00 each. 1 (800) 786-9025.

CABLE-safe. Guarantee cable privacy. The one-way valve for your cable TV signal. Cable signals come in, but they don't go out! \$29.95 + \$3.00 S&H. **VISA/MC/AMEX. ELECTROMAN**, Box 24474, New Orleans, LA 70184. (504) 482-3017.

"CABLE Unscrambled. Everything you want to know about cable, but are afraid to ask. \$10.00. **"Descrambler Schematics Revealed."** A powerful guide to descrambling schemes. \$10.00. **"Baseband Video Explained."** Discover what a Baseband Signal is and how it's constructed. \$10.00. Special offer. Get all three for only \$25.00! **VISA/MC/AMEX. ELECTROMAN**, Box 24474, New Orleans, LA 70184. (504) 482-3017.

UNIVERSAL Descrambler. Unscramble signals using your VCR as the tuner. Works with virtually any system, this is the only one you need. Declare cable box independence! Fully assembled. \$129.95 + \$5.00 S&H. **VISA/MC/AMEX. ELECTROMAN**, Box 24474, New Orleans, LA 70184. (504) 482-3017.

"BULLET Buster". Protect your cable box against the infamous cable "bullet". The "Bullet" Buster acts as an electronic shield. Installs in-line in seconds. Don't wait until it's too late! \$19.95 + \$3.00 S&H. **VISA/MC/AMEX. ELECTROMAN**, Box 24474, New Orleans, LA 70184. (504) 482-3017.

DESCRAMBLER Cable using simple circuit. E-Z to follow instructions \$10.00. Complete kit with free bullet buster \$20.00. 1 (800) 522-8053.

CABLE Bullet Terminator and I.D. Blocker. Electronically shields yourself and your box. Factory direct. **Lifetime Guarantee** \$14.95. 1 (800) 820-9024.

CABLE filter, build your own- plans, parts, PC board, case, \$11.00. **VIDEO MEDIA**, Box 97-0408, Coconut Creek, FL 33097. 1 (954) 752-9202.

CABLE TV notch filters. Tunable from 50 to 300 Mhz (channels 0 thru 36). Eight different models available so specify frequency or channel number when ordering. \$30.00 each plus \$3.50 S/H per order. Large quantity discounts. Call **STAR CIRCUITS** at 1 (800) 433-6319 to request our free brochure or place an order.

TEST Aids: Jerrold, Scientific Atlanta & Pioneer w/multimode & map \$15.00. S.A. micros, CFT-2200's & PIO 63/67 E2 clearer/test aid \$20.00. Zenith & Tocom \$12.00. **External activators** Jerrold \$80.00, Pioneer & S.A. \$100.00. **Frequency filters** \$20.00. (718) 232-1802. 8AM-1PM EST. No N.Y. sales!

LOOKING for brand new 550 MHz plain manual tuning converter, we have them. We carry most CBTv products: pans-ake as low as: \$15.00. Call for free catalog. (405) 634-1535. Fax: (405) 634-1580.

CABLE TV descramblers, converters, save money. Don't rent. Call for our best prices. 1 (800) 732-2863. Ext. 4552.

"BULLET-Zappers" still available! 100% compatible. Don't delay! **Wholesale \$15.00 (2nd \$10.00): BRINKER ENGINEERING LABS**, Suite 105-C, Box 348, Ellaville, GA 31806-0348.

PIC Programmer Development Tools

JM-PICE \$245

- Programmer for PIC 16C5X, 16C6X, 16C7X, 16C84, and 17C4X in DIP packages.
- Assembler and Simulator.
- Emulates program memory, registers, and I/O for the PIC 16C5X.
- Instruction-level emulation for the PIC 16C71 and 16C84.
- Programmer only \$155, Complete package \$245. 15 day money-back guarantee.
- Adapters for emulating 16C6X and 16C7X will be available soon.

80C552 Development System

- **8051** core processor with 8 channel 10-bit A/D and PWM.
- 24 more I/O and RS-232 port.
- 32K ROM and 64K RAM.
- \$130 each SBC. High performance development system includes assembler, disassembler, real-time execution and debugging, monitor program, and examples (\$70 more).
- **80C31** Development System is also available.

ROMY-16 EPROM EMULATOR

Emulates ROM or RAM in 8- and 16-bit systems. \$195 (2716-27256) or \$245 (2716-27010). Window/menu driven interface. 15 day money-back guarantee. Optional assembler, disassembler, and ROM debugger \$100 each CPU.

68HC11

Development System

- Eight channel 8-bit A/D converter.
- 32K ROM and 32K RAM.
- \$120 each SBC. 40x2 LCD \$20.
- Add \$70 for the real-time integrated development system.
- *Microprocessor Simulator/Debugger and Custom design are available.*

J&M Microtek, Inc.

83 Seaman Road, W Orange, NJ 07052
Tel: (201)325-1892 Fax: (201)736-4567

ADVERTISING INDEX

Electronics Now does not assume any responsibility for errors that may appear in the index below.

Free Information Number	Página	Free Information Number	Page		
—	A&A Engineering	116	—	ISCET/NESDA	34
—	AES	80	318	IVEX Design International	103
212	Ace Communications	104	—	J&M Microtek, Inc.	141
—	Active Micro	110	—	JDR Microdevices	100
—	Advance Circuit Design	99	320	Jensen Tools	131
309	Advanced Microcomputer Sys.	126	—	Kramer & Associates	131
—	Aegis Research, Canada	130	—	Learn Inc.	CV3
213	Alfa Electronics	84	—	M&G Electronics	116
214	All Electronics	111	—	M-2-L Electronics	131
—	All Phase Video Security	140	304	M.D. Electronics (Everquest)	139
—	Allison Technology	98	328	Mark V Electronics	119
—	Allstar Electronics	132	296	MCM Electronics	113
—	Alltronics	138	—	Measurement Software	103
—	Alpha Lab	103	251	Mendelson Electronics Surplus	128
—	Amaze Electronics	108	—	Mental Automation	132
231	AMC Sales	132	—	Meredith Instruments	139
319	American Eagle Publications	114	—	Merrimack Valley Systems	130
—	Andromeda	94	224	Micro 2000	91
316	ARC Sales	80	128	Micro Code Eng.	5
334	Basic Electrical Supply	110	—	Micro Engineering Inc.	138
—	Baylin Publications	118	—	Midwest Laser Products	120
335	Beige Bag	99	—	Modern Electronics	138
297	Bel-Merit	86	—	Mondo-tronics Inc.	115
311	Black Feather	123	—	Motron Electronics	118
—	Bsoft Software, Inc.	110	—	MWK Industries	94
—	Brigar	90	—	National Cable Brokers	137
215	Butterworth Heinemann	127	257	Needham Electronics	114
218	C&S Sales	92	—	NRI Schools	17
332	Capital Electronics	94	260	Ocean State	128
—	CGC	139	327	OWI	137
333	Circuit Specialists	106	262	Parts Express Inc.	87
—	Cleveland Inst. of Electronics	37	—	PC Boards	123
—	Command Productions	100	—	Picotronic	132
336	Computer Monitor Maint.	136	—	PM Electronics	114
226	Consumertronics	98	326	Prairie Digital	108
310	Conway Engineering Inc.	89	—	Premium Parts Plus	27
228	Cool Amp Conducto Lube	102	264	Print (Pace)	125
234	Dalbani Electronics	124	78	Radio Shack	1
235	Danbar Sales	109	—	RC Distributing Co.	116
—	DC Electronics	122	—	RF Parts	80
331	Direct Cable Supply	121	269	Sescom Inc.	112
241	Electronic Goldmine	95	—	Show-Time	130
—	Electronic Rainbow	117	—	Sil Walker	131
—	Electronics Tech Today	11	270	Skyvision Inc.	81
—	Emac Inc.	99	324	Square I Electronics	132
—	Fair Radio	118	—	Street Smart Security	123
121	Fluke Corporation	CV2	325	Sun Equipment	129
330	Foley-Belsaw Co.	122	—	Super Circuits	79
219	Fotronic	82	—	Sycard	130
314	Gateway Products	133	—	Tab Books	7, 52
—	General Device Instruments	128	197	Tech Systems	83
—	Get-Tech	102	—	Telulex	120
—	Grantham College	23	—	Test Equipment Sales	126
317	Graymark International	112	275	Timeline	88
315	Great Southern Security	105	323	Toronto Surplus & Scientific	96
—	Halcyon Group	79	—	U.S. Cyberlab	116
—	Home Automation	102	322	Visitect Inc.	104
—	Home Control	122	98	Visual Communications	25
329	Howard Electronics	101	—	Wavetek Corp.	15
—	IEC	120	—	Weeder Technologies	118
—	Index Publishing Group	137	321	Weka Publishing	135
—	Information Unlimited	108	—	World College (Div. of C.I.E.)	9
126	Interactive Image Tech.	CV4	—	WPT Publications	133
—	Intronics, Inc.	120	279	Xandi Electronics	19

ADVERTISING SALES OFFICES

Gernsback Publications, Inc.
500 Bi-County Blvd.
Farmingdale, NY 11735-3931
1-(516) 293-3000
Fax 1-(516) 293-3115

Larry Steckler
 publisher (ext. 201)

Christina Estrada
 assistant to the publisher (ext. 209)

Arline Fishman
 advertising director (ext. 206)

Michele Torriilo
 advertising assistant (ext. 211)

Adria Coren
 credit manager (ext. 208)

For Advertising ONLY

EAST/SOUTHEAST

Stanley Levitan
 Eastern Advertising
 1 Overlook Ave.
 Great Neck, NY 11021-3750
 1-516-487-9357
 Fax 1-516-487-8402

MIDWEST/Texas/Arkansas/Okla.

Ralph Bergen
 Midwest Advertising
 One Northfield Plaza, Suite 300
 Northfield, IL 60093-1214
 1-847-559-0555
 Fax 1-847-559-0562

PACIFIC COAST

Janice Woods
 Pacific Advertising
 Hutch Looney & Associates, Inc.
 6310 San Vicente Blvd.
 Suite 360
 Los Angeles, CA 90048-5426
 1-213-931-3444 (ext. 228)
 Fax 1-213-931-7309

Electronic Shopper

Joe Shere
 National Representative
 P.O. Box 169
 Idyllwild, CA 92549-0169
 1-909-659-9743
 Fax 1-909-659-2469

Megan Mitchell
 National Representative
 1201 N. Rainbow Blvd., #50
 Las Vegas, NV 89108
 1-702-259-7043
 Fax 1-702-259-7043

Subscriber Customer Service

1-800-288-0652
 7:00 AM - 6:00 PM M-F MST

Reader Service Card

MAIL-FAX OR E-MAIL YOUR REQUEST

Now you have 3 ways to request free information on products and services featured in this issue

To insure a prompt reply, please furnish all requested information

To Receive Information on Products and Services in This Issue

Circle the numbers corresponding to the advertised products or editorial items that interest you.

Mail Card or Fax To: (413) 637-4343 or E-Mail your request to: BERKCOMP@AOL.COM.

For E-Mail users, your subject is Electronics Now, 7/96 Format your message:

- Name and Address information

- Telephone and Fax numbers

- Requested item numbers separated by commas

- Responses to survey questions separated by dashes or slashes

NOTE: Submit all Free Information requests by EITHER Fax, mail, or E-Mail **DUPLICATE REQUESTS WILL BE DISCARDED.** Use for Free Information only. Address all editorial inquiries to Editor, Electronics Now, 500 Bi-County Blvd., Farmingdale, NY 11735-3931

BUSINESS PROFESSIONAL FREE INFORMATION CARD



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

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

2 Please send me 12 issues (1 year) of ELECTRONICS NOW for \$19.97 and bill me. (Canada \$27.79 — US Funds only — Includes G.S.T.)

4 Please send me 12 issues (1 year) of POPULAR ELECTRONICS for \$18.95 and bill me. (Canada \$25.63 — US Funds only — Includes G.S.T.)

What new computer equipment have you purchased in the past 12 months? Please check all that apply.

- 5 486 computer 6 Pentium computer 7 Multimedia hardware
 8 Multimedia software 9 Memory expansion 10 28.8 modem
 11 14.4. modem 12 Laser printer 13 Color printer 14 CD Rom

VOID after SEPTEMBER 30, 1996 Allow 6-8 weeks for delivery of first issue

29	58	87	116	145	174	203	232	262	291	321	350	
30	59	88	117	146	175	204	234	263	292	322	351	
31	60	89	118	147	176	205	235	264	293	323	352	
32	61	90	119	148	177	206	236	265	294	324	353	
33	62	91	120	149	178	207	237	266	295	325	354	
34	63	92	121	150	179	208	238	267	296	326	355	
35	64	93	122	151	180	209	239	268	297	327	356	
36	65	94	123	152	181	210	240	269	298	328	357	
37	66	95	124	153	182	211	241	270	299	329	358	
38	67	96	125	154	183	212	242	271	300	330	359	
39	68	97	126	155	184	213	243	272	301	331	360	
40	69	98	127	156	185	214	244	273	302	332	361	
41	70	99	128	157	186	215	245	274	303	333	362	
42	71	100	129	158	187	216	246	275	304	334	363	
14	43	72	101	130	159	188	217	247	276	305	335	364
15	44	73	102	131	160	189	218	248	277	306	336	365
16	45	74	103	132	161	190	219	249	278	307	337	366
17	46	75	104	133	162	191	220	250	279	308	338	367
18	47	76	105	134	163	192	221	251	280	309	339	368
19	48	77	106	135	164	193	222	252	281	310	340	369
20	49	78	107	136	165	194	223	253	282	311	341	370
21	50	79	108	137	166	195	224	254	283	312	342	371
22	51	80	109	138	167	196	225	255	284	314	343	372
23	52	81	110	139	168	197	226	256	285	315	344	373
24	53	82	111	140	169	198	227	257	286	316	345	374
25	54	83	112	141	170	199	228	258	287	317	346	375
26	55	84	113	142	171	200	229	259	288	318	347	376
27	56	85	114	143	172	201	230	260	289	319	348	377
28	57	86	115	144	173	202	231	261	290	320	349	378

BUSINESS PROFESSIONAL FREE INFORMATION CARD



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

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

2 Please send me 12 issues (1 year) of ELECTRONICS NOW for \$19.97 and bill me. (Canada \$27.79 — US Funds only — Includes G.S.T.)

4 Please send me 12 issues (1 year) of POPULAR ELECTRONICS for \$18.95 and bill me. (Canada \$25.63 — US Funds only — Includes G.S.T.)

What new computer equipment have you purchased in the past 12 months? Please check all that apply.

- 5 486 computer 6 Pentium computer 7 Multimedia hardware
 8 Multimedia software 9 Memory expansion 10 28.8 modem
 11 14.4. modem 12 Laser printer 13 Color printer 14 CD Rom

VOID after SEPTEMBER 30, 1996 Allow 6-8 weeks for delivery of first issue

29	58	87	116	145	174	203	232	262	291	321	350	
30	59	88	117	146	175	204	234	263	292	322	351	
31	60	89	118	147	176	205	235	264	293	323	352	
32	61	90	119	148	177	206	236	265	294	324	353	
33	62	91	120	149	178	207	237	266	295	325	354	
34	63	92	121	150	179	208	238	267	296	326	355	
35	64	93	122	151	180	209	239	268	297	327	356	
36	65	94	123	152	181	210	240	269	298	328	357	
37	66	95	124	153	182	211	241	270	299	329	358	
38	67	96	125	154	183	212	242	271	300	330	359	
39	68	97	126	155	184	213	243	272	301	331	360	
40	69	98	127	156	185	214	244	273	302	332	361	
41	70	99	128	157	186	215	245	274	303	333	362	
42	71	100	129	158	187	216	246	275	304	334	363	
14	43	72	101	130	159	188	217	247	276	305	335	364
15	44	73	102	131	160	189	218	248	277	306	336	365
16	45	74	103	132	161	190	219	249	278	307	337	366
17	46	75	104	133	162	191	220	250	279	308	338	367
18	47	76	105	134	163	192	221	251	280	309	339	368
19	48	77	106	135	164	193	222	252	281	310	340	369
20	49	78	107	136	165	194	223	253	282	311	341	370
21	50	79	108	137	166	195	224	254	283	312	342	371
22	51	80	109	138	167	196	225	255	284	314	343	372
23	52	81	110	139	168	197	226	256	285	315	344	373
24	53	82	111	140	169	198	227	257	286	316	345	374
25	54	83	112	141	170	199	228	258	287	317	346	375
26	55	84	113	142	171	200	229	259	288	318	347	376
27	56	85	114	143	172	201	230	260	289	319	348	377
28	57	86	115	144	173	202	231	261	290	320	349	378

**To Order a New Subscription
Call 1-800-999-7139
To Renew an Existing Subscription
Call 1-800-288-0652**

.20¢ POSTAGE
REQUIRED IN
U.S.A.

**Electronics
NOW®**

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

.20¢ POSTAGE
REQUIRED IN
U.S.A.

**Electronics
NOW®**

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

What's better than speed reading? *Speed Learning.*

Speed Learning has replaced speed reading. It's a whole new way to read and learn. It's easy to learn...lasts a lifetime... applies to everything you read. It may be the most productive course you've ever taken.

Do you have too much to read and too little time to read it? Do you mentally pronounce each word as you read? Do you frequently have to go back and reread words, or whole paragraphs, you just finished reading? Do you have trouble concentrating? Do you quickly forget most of what you read?

If you answer "Yes" to any of these questions — then here at last is the practical help you've been waiting for. Whether you read for business or pleasure, school or college, you will build exceptional skills from this major breakthrough in effective reading, created by Dr. Russell Stauffer at the University of Delaware.

Not just "speed reading" — but speed reading — thinking — understanding — remembering — and — learning

The new *Speed Learning Program* shows you, step-by-proven step, how to increase your reading skill and speed, so you understand more, remember more and use more of everything you read. The typical remark from over one million people taking the Speed Learning program is, "Why didn't someone teach me this a long time ago." They were no longer held back by their lack of skills and poor reading habits. They could read almost as fast as they could think.

What makes Speed Learning so successful?

The new *Speed Learning Program* does not offer you a rehash of the usual eye-exercises, timing devices, and costly gadgets you've probably heard about in connection with speed reading courses, or even tried and found ineffective.

In just a few spare minutes a day of easy reading and exciting listening, you discover an entirely new way to read and think — a radical departure from anything you have ever seen or heard about. Speed Learning is the largest selling self-study reading program in the world. Successful with Fortune 500 corporations, colleges, government agencies and accredited by 18 professional societies. Research shows that reading is 95% *thinking* and only 5% eye movement. Yet most of today's speed reading programs spend their time teaching you rapid eye movement (5% of the problem), and ignore the most important part, (95%) *thinking*. In brief, *Speed Learning gives you what speed reading can't.*

Imagine the new freedom you'll have when you learn how to dash through all types of reading material at least twice as fast as you do now, and with greater comprehension. Think of being able to get on top of the avalanche of newspapers, magazines and correspondence you have to read...finishing a stimulating book and retaining facts and details



FOR FASTER SHIPMENT CALL 1-800-729-7323 OR FAX 1-609-273-7766

more clearly, and with greater accuracy, than ever before.

Listen — and learn — at your own pace

This is a practical, easy-to-learn program that will work for you — no matter how slow a reader you think you are now. The *Speed Learning Program* is scientifically planned to get you started quickly...to help you in spare minutes a day. It brings you a "teacher-on-cassettes" who guides you, instructs, and encourages, explaining material as you read. Interesting items taken from *Time Magazine*, *Business Week*, *Wall Street Journal*, *Money*, *Reader's Digest*, *N.Y. Times* and many others, make the program stimulating, easy and fun...and so much more effective.

Executives, students, professional people, men and women in all walks of life from 15 to 70 have benefitted from this program. Speed Learning is a fully accredited course...costing only 1/4 the price of less effective speed reading classroom courses. Now you can examine the same easy, practical and proven methods at home...in your spare time...without risking a penny.

Examine Speed Learning RISK FREE for 15 days

You will be thrilled at how quickly this program will begin to develop new thinking and reading skills. After listening to just one cassette and reading the preface, you will quickly see how you can achieve increases in both the speed at which you read, and in the amount you understand and remember.

You must be delighted with what you see, or you pay nothing. Examine this remark-

able program for 15 days. If, at the end of that time you are not convinced that you would like to master Speed Learning, simply return the program for a prompt refund. (See the coupon for low price and convenient credit terms.)

RISK-FREE ORDER FORM

YES! I want to try Speed Learning for 15 days without risk. Enclosed is the first of 4 monthly payments of \$32.25*. If I'm not completely satisfied, I may return it for a prompt refund.

SAVE 8.00! I prefer to pay the \$129.00 now, and save the \$8.00 shipping & handling charge. I may still return the program for a full refund.

Method of payment: (Federal Tax Deductible)

Check or money order payable to Learn Incorporated

Charge to: Visa MC Am Ex Discover

Card # _____ Exp. _____

Signature _____

Phone (_____) _____

Name _____

Address _____

City _____ State _____ Zip _____

*Plus \$8.00 shipping and handling. U.S. funds only. For New Jersey residents, sales tax will be added.

learn
INCORPORATED

Dept. LEC-01, 113 Gaither Drive,
Mt. Laurel, NJ 08054-9987

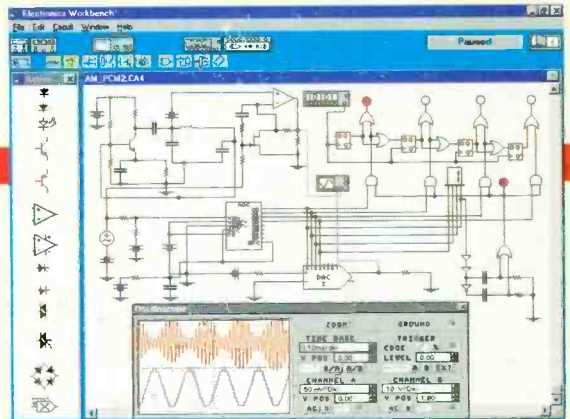
Better Designs -Faster

Guaranteed with Electronics Workbench!

Just click and drag to create and edit schematics. Mix analog and digital devices in any combination with full control over values, models and behavior. Try 'what if' scenarios and fine tune effortlessly. And on-screen waveforms always match actual circuit response. You'll create better designs faster—Guaranteed!

Guaranteed Satisfaction

Join over 40,000 customers and experience the power, flexibility and value that only Electronics Workbench offers. Receive unequalled service and free, unlimited technical support by phone, fax, e-mail, WWW, CompuServe and BBS. You'll be delighted. We guarantee it.*



True Mixed-Mode Power

Connect any analog or digital device to any other device without limit. Only Electronics Workbench offers this professional power for under \$2,000.

Real-World Digital

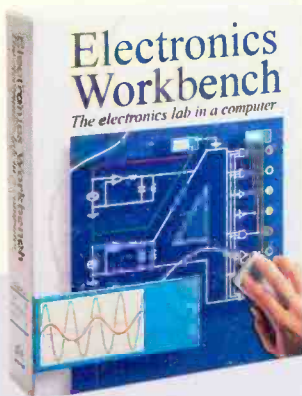
Real-world TTL and CMOS, complete with propagation delays and fanout. Unique at this price.

32-Bit Speed

Integrated SPICE analog and native-mode digital simulation in full 32-bit. Unique at this price.

Real-World Results

Unlimited supply of over 200 components and ICs and 350 real-world models—all perform as real devices.



Electronics Workbench®

\$299

***30-DAY MONEY-BACK GUARANTEE**

VERSION 4.1 FOR WINDOWS 95/NT/3.1, DOS AND MACINTOSH.

Ask about our Engineer's Pack with thousands of additional models and more. Version 4.0 users call for your free upgrade.

800-263-5552



INTERACTIVE

Fax: 416-977-1818 Internet: <http://www.interactiv.com>
CompuServe: 71333,3435/BBS: 416-977-3540/E-mail: ewb@interactiv.com

INTERACTIVE IMAGE TECHNOLOGIES LTD., 908 Niagara Falls Boulevard, #068, North Tonawanda, New York 14120-2060/Telephone 416-977-5550
TRADEMARKS ARE PROPERTY OF THEIR RESPECTIVE HOLDERS OFFER IS IN U.S. DOLLARS AND VALID ONLY IN THE UNITED STATES AND CANADA ALL ORDERS SUBJECT TO \$15 SHIPPING AND HANDLING CHARGE

Australia: 2519-3933 • Belgium: 2-384-73-09 • Brazil: 11-453-5588 • Chile: 2-236-0300 • Cyprus: 2-42-1068 • Czech Republic: 42-48-23454 • Denmark: 33-25-0109 • Finland: 0-297-5033 • France: 14-908-9000 • Germany: 11-42-7740 • Greece: 1-574-9981 • Hungary: 1-715-0082
India: 11-578-7055 • Indonesia: 21-470-0815 • Israel: 3-647-5613 • Italy: 11-437-5549 • Japan: 3-3382-3136 • Malaysia: 3-774-2189 • Mexico: 5-593-5260 • Netherlands: 18031-7666 • New Zealand: 9-267-1754 • Norway: 22-16-1111 • Philippines: 713-27-0118
Portugal: 1-81-46609 • Singapore: 777-2303 • Slovenia: 61-317-830 • South Africa: 331-6-8309 • South Korea: 2-2-222-3431 • Spain: 1-383-8335 • Sweden: 8-740-5500 • Taiwan: 886-2-366-0080 • Thailand: 6-773-084 • United Kingdom: 203-23-3216

CIRCLE 126 ON FREE INFORMATION CARD

www.americanradiohistory.com