How to make the Internet Connection

A look at the best ways to get online

View color negatives on a video monitor with an easy-to-build Video Inverter

Use your PC as an inexpensive Cable Tester

A look at the Early Days of Television and the people who shaped it

How to put smart Alphanumeric Displays to work in your next project

$3.50 U.S.
$3.95 CAN.

www.americanradiohistory.com
A crash course in why you can always count on Fluke meters.

Professionals know Fluke never lets you down. Every day, you’re asked to rise to new challenges. You need a test tool as tough as your job. True story: a tech working atop a 170-foot tower accidentally knocks his Fluke 23 meter and an industrial-grade screwdriver over the edge. Straight down they fall, crashing to the asphalt below. He goes down. His screwdriver’s handle is shattered. Expecting the worst, he gingerly picks up his Fluke meter and smiles. All that’s broken is a fuse. He snaps in another, goes right back up and continues testing with the same Fluke 23. No harm to the meter — or the pocketbook. Unbelievable? Not when you consider every rotary knob, keypad, and switch on every Fluke meter must pass strict testing for drops, intense heat or cold, electrical overloads, and years of harsh wear and tear. What’s more, Fluke meters are built in an ISO 9001 certified factory. So you know you can always meet your quality goals. People depend on you, so depend on Fluke. See your Fluke distributor today, or call 1-800-59-FLUKE for a catalog and a direct connection to a distributor near you and ask for a catalog.
Get 3 PROFESSIONAL BOOKS for only $9.95

when you join the ELECTRONICS ENGINEERS' BOOK CLUB®

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

...you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off of regular publishers' prices. If you want the Main Selection, do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. 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 Program. Your only obligation is to purchase 3 more books during the next 2 years, after which you may cancel your membership at any time. ©1999 EEBC.

All books are hardcover unless otherwise noted. Publishers' prices shown. A shipping/handling charge & sales tax will be added to all orders.

If coupon is missing, write to:

Electronics Engineers' Book Club, A Division of McGraw-Hill, Inc., Blue Ridge Summit, PA 17294-0860

YES! Please send me the book(s) listed below for just $9.95, plus shipping/handling & 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 book(s) within ten days 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. If you select a counts as 3 choice, write the book number in one box and XXX in the next 2 boxes.

Name
Address
City/State
Zip    Phone

Valid for new members only, subject to acceptance by EEBC. Canadians 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.

July 1995, Electronics Now

www.americanradiohistory.com
CONTENTS
JULY 1995

ON THE COVER

31 GETTING CONNECTED TO THE INTERNET

From its early beginnings in the late 1960s as a government networking experiment, the Internet has grown into a global information resource. The Internet is basically a network of computer networks, ranging from universities, to government institutions, to private industries. The Internet has something to offer for everyone, including individual computer users as well as businesses of all sizes. There are already over 30 million active Internet users, and approximately 160,000 new users are accessing the Net each month. What exactly is the Internet, how can you benefit from it, and how do you get on it? Those questions and more are answered on page 31.

— Stephen J. Bigelow

BUILD THIS

41 VIDEO INVERTER
Invert your camcorder video output to view photographic negatives.
— Joseph L. Sousa

51 WORKING WITH SMART DISPLAYS
Learn how to program "smart" LED multicharacter displays.
— Jerry R. Letlow

89 CABLE TESTER
Let the power of your PC perform multipath continuity testing.
— James J. Barbarelo

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.


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 of photographs while in our possession or otherwise.
SCANNING EARLY TV
The first television systems were cumbersome, short-range contraptions that sent pulses over wires. — Martin Clifford

SYNCHRONOUS POWER CONTROL
Learn about zero-voltage or synchronous AC-line power switching. — Ray Marston

VIDEO NEWS
What's new in this fast-changing field. — David Lachenbruch

EQUIPMENT REPORTS
Fluke GMM Graphical Multimeter.

HARDWARE HACKER
Basic stamp manuals, Fibonacci's sunflowers, and more. — Don Lancaster

AUDIO UPDATE
Practicing safe sound. — Larry Klein

DRAWING BOARD
Add output latches to the all-electronic audio router. — Robert Grossblatt

COMPUTER CONNECTIONS
WinHEC '95. — Jeff Holtzman

WHAT'S NEWS
26 NEW LITERATURE
89 BUYER'S MART
166 ADVERTISING SALES OFFICES
166 ADVERTISING INDEX


Advertising Sales Offices listed on page 166.
Electronics Now Executive and Administrative Offices 1-516-293-3000.
Order Entry for New Subscribers: 1-800-999-7139.
World record in magnetic data-storage density

A team of researchers at IBM’s Advanced Magnetic Recording Laboratory (San Jose, CA) has demonstrated a new world record in magnetic data-storage density—a billion bits (3 gigabits) of data per square inch. Three billion bits is the equivalent of 187,500 double-spaced, typewritten pages. At that density, which is nearly five times that of today’s most advanced disk drive, the text of 375 average-sized novels could be stored in a single square inch of disk surface.

The 3-gigabit demonstration did not require any radically new disk-drive technologies. The scientists used advanced versions of IBM’s magnetoresistive (MR) recording heads and ultra-low-noise thin-film magnetic hard disks.

"Since the components used in this demonstration are evolutionary improvements on those we are already manufacturing in volume for IBM products, we’re on track to providing 3-gigabit densities within the next three to five years," said Robert A. Scranton, director of IBM Storage Products Company, which develops, manufactures, and sells disk drives.

In the 3-gigabit demonstration, bits were stored at a linear density of 180,000 bits per inch along concentric tracks packed at 16,500 per radial inch. Each data bit measures only 5.6 millionths of an inch in length by about 40 millionths of an inch wide—about one-quarter of the area of bit cells in current optical data-storage products.

The data bits are recorded onto a thin film of a magnetic cobalt alloy that coats an aluminum disk. The alloy’s composition and fabrication conditions are designed for very high bit density and very low magnetic noise—critical advantages in reading the tiny bits. Another thin coating of a hard material protects the alloy film from contact with the recording head.

During the demonstration, information was recorded and read at a data rate of 4.5 MB per second using IBM’s "partial-response, maximum-likelihood" recording channel, which allows significantly greater bit densities than conventional "peak-detection" channels. The measured error rates were one in 10 billion, which would decrease to one in 10 trillion after standard error-correction codes were applied, meeting the stringent data-integrity requirements of the computer industry. That level of accuracy takes into account the fact that the head will not always be perfectly positioned over the data tracks, indicating that the system is capable of essentially flawless performance.

Continued on page 29
Electronics Experimenters’ Books

- **PCP116**—Introducing Digital Audio—CD, DAT and Sampling...$10.00. Digital audio involves methods and circuits that are totally alien to the screening and recording amateur who has previously worked with audio circuits. This book is intended to bridge the gap! The principles and methods are explained, but the mathematical background and theory are avoided when practical.

- **BP232**—A Concise User’s Guide to Windows 3.1...$7.95. If you are having trouble with Windows 3.1, then discover how to manipulate Windows screens and move to use Windows and DOS applications under the Windows Graphic User Interface (GUI) environment! There’s more: the word processor (Write), Program Manager, File Manager and Print Manager will be mastered by you. The text is enormous.

- **PCP117**—Electronic Projects for Guitar...$12.95. If you are a guitarist, you’ll find this collection of 16 guitar and general purpose effects projects extremely useful at bargain do-it-yourself prices. Each project has an introduction, an explanation of how it works, complete instruction on stripboard layout and assembly, as well as notes on setting it up and using. Written for the beginner project builder.

- **BP237**—A Reference Guide to Practical Electronics Terms...$8.95. A companion volume to BP236. Covers the more practical and applied aspects of electronics. An essential reference work for the library of all those interested in electronics.

- **PCP118**—SIR Survival Guide...$7.75. The book offers practical advice on starting up, setting up, and ending up your own SIR or MIR system. Includes over 40 cabling diagrams and tips on connecting synths, sound modules, sequencers, etc.

- **BP256**—Introduction to Loudspeakers and Enclosure Design...$5.95. All you need to know about the theory and operation of loudspeakers (drivers) and the various types of enclosures (boxes) into which they should be built. Crossover units are covered. Also includes the complete design and construction details of how to make an inexpensive but high-quality enclosure called the “Kapellmeister.”

- **BP255**—Computer Hobbyists Handbook...$8.95. Provides a single, quick reference source to bountiful data and information that the computer hobbyist will find useful. An absolutely essential notebook for the bookshelf that will become a reference text.

- **BP101**—How to Identify Unmarked ICs...$2.25. A chart that shows the reader how, with just a microscope to go about regarding the particular signature of an unmarked IC which should enable the IC to be then identified. By now you’re probably wondering what an IC signature is. It is a specially printed chart produced by measuring the resistances between all terminal pairs of an IC.

- **BP257**—An Introduction to Satellite Televisions...$9.95. As an introduction to satellite television this book is presented on two levels. For the absolute beginner with no previous knowledge, the story is told as simply as it can be in the main text. For the professional engineer, student, or others with technical backgrounds, there are numerous appendices backing up the main text with additional technical and scientific details.

- **BP286**—Another Construction Project Construction...$6.95. Contains practical designs for building a number of simple shortwave receivers. Comprehensive plans include diagrams and a complete list of the wiring details where necessary.

- **BP287**—Experimental Antenna Topics...$5.95. Contains 28 fascinating sections and includes many unusual practical antenna designs that use such outlandish materials as cardboard, aluminum foil, plastic bottles, cat-food cans, etc., even water!

- **PCP119**—An Introduction to Satellite Television...$9.95. As an introduction to satellite television this book is presented on two levels. For the absolute beginner with no previous knowledge, the story is told as simply as it can be in the main text. For the professional engineer, student, or others with technical backgrounds, there are numerous appendices backing up the main text with additional technical and scientific details.

- **BP286**—Another Construction Project Construction...$6.95. Contains practical designs for building a number of simple shortwave receivers. Comprehensive plans include diagrams and a complete list of the wiring details where necessary.

- **BP106**—Modern Opamp Projects...$5.75

- **BP137**—BASIC and FORTRAN in Parallel...$5.95

- **BP138**—BASIC and FORTH in Parallel...$5.95

- **BP154**—An Introduction to MSX BASIC...$4.95

- **BP169**—Hot to Get Your Computer Programming Running...$5.95

- **BP194**—Modern Opto Devices Projects...$6.25

- **BP195**—An Introduction to Satellite Television...$6.25

- **BP198**—An Introduction to Antenna Theory...$6.95

- **BP204**—Test Equipment Construction...$5.95

- **BP249**—More Advanced Test Equipment Construction...$6.95

- **BP260**—A Concise Introduction to OS/2...$4.95

- **BP263**—A Concise Introduction to dBASE...$6.95

**Bargain Table Best Buys for Experimenters and Computer Buffs**

- **BP106**—Modern Opamp Projects...$5.75

- **BP137**—BASIC and FORTRAN in Parallel...$5.95

- **BP138**—BASIC and FORTH in Parallel...$5.95

- **BP154**—An Introduction to MSX BASIC...$4.95

- **BP169**—Hot to Get Your Computer Programming Running...$5.95

- **BP194**—Modern Opto Devices Projects...$6.25

**Electronic Technology Today Inc.**

P.O. Box 240, Massapequa, NY 11762-0240

**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 |

**SOLD BY NO BOOKS ACCEPTED OUTSIDE OF USA & CANADA**

- **Name**
- **Address**
- **City**
- **State**
- **Zip**

**Allow 6-8 weeks for delivery**

- **Sorry no sales accepted outside of USA & Canada**

- **Total price of merchandise**
- **Shipping (see chart)**
- **Sales Tax (NYS only)**
- **Total Enclosed**

**All payments must be in U.S. funds**
VIDEO NEWS
What's new in the fast-changing video industry.

DAVID LACHENBRUCH

• Looking toward HDTV. High-definition TV broadcasting is beginning to look as if it might become reality, as networks start to make commitments to broadcast in the new standard. At the recent convention of the National Association of Broadcasters (NAB), NBC said that it planned to begin transmitting some prime-time programming in HDTV in 1997, and Fox and other networks began looking at the new reality of HDTV for the first time as something that would really come to pass. Demonstrations of the Grand Alliance system in action convinced most doubters that the American digital HDTV system could do the job. Broadcasters still would like to have the option of broadcasting several digital programs in standard definition on their channels, but there is less certainty that they could continue broadcasting both analog and digital signals on two channels for very long, because other potential spectrum users are eying the current TV space greedily, and the government would love the revenues that a spectrum auction could generate.

The first widescreen HDTV sets for the Grand Alliance system will go on sale in less than two years. Jerry Pearlman, chairman of Zenith Electronics, predicted at the NAB convention. He noted that three TV manufacturers that are members of the Grand Alliance—Philips, Thomson (RCA), and Zenith—account for half of the TV sets sold in the United States. He predicted that the first HDTV sets sold here would be capable of displaying the current analog standard definition signals along with digital HDTV. Pearlman forecast that PBS will be among the first HDTV broadcasters "and will experience an initial advantage" that could lead to long-range leadership. Pearlman noted that the success of Digital Satellite System broadcasts proves that consumers are willing to pay for better pictures and sound. "Consumers have been reading and hearing about HDTV for five years. Now they're ready to buy."

• Two digital VCRs. Formats might come and formats might go, but VHS goes on forever—at least that's the way JVC would like it. As the developer and proprietor of the standard home video-recording format, JVC has introduced many advances in the system while preserving compatibility. Conventional VHS led to VHS Hi-Fi, VHS-C (compact), S-VHS (super), and W-VHS (widescreen). The latest development is D-VHS—D for digital and data. JVC's newest sub-format continues to record and play back in standard analog mode, but also is capable of storing digital signals. The system already has been approved by most of the major VHS manufacturers.

JVC describes D-VHS as a "digital data server." It can record, store, and play back digital data, but cannot convert analog to digital data or vice versa. Using bitstream recording technology, it records compressed or processed signals on tape directly as digital data and outputs them in the same state as they were input.

The first use of D-VHS will be as a time-shift medium for the Digital Satellite System (DSS) as soon as an interface is developed. The D-VHS recorder will take digital signals from the DSS set-top box, record them, and on playback will feed them back into the same box for digital expansion, decoding and converting to analog form to be directed to the TV set.

Final specifications were still being developed at our deadline, but the system will record on a cassette similar in dimensions to a standard VHS cassette but containing S-VHS tape. It will have three recording modes. In STD mode, it will be capable of recording MPEG-2 encoded material, with a maximum input data rate of 14 megabits per second (Mbps), recording time of five hours (32.7 gigabytes capacity), or seven hours (44.7 gigabytes) using thin tape. In HD mode, with 28.2 Mbps input data rate, it will record for 2½ hours or 3½ hours with thin tape, and can record a digitally encoded high-definition program or six standard-definition programs simultaneously. LP mode, whose standards haven't yet been set, can record for up to 49 hours on a single cassette at 2 Mbps.

JVC says that it hopes to start producing D-VHS recorders late next year, with the United States as the first market, because the U.S. currently has the only digital TV system in use (DSS). The price will be $30,000 yen more than a standard VHS recorder, or about $350 additional, at our press time. The system isn't confined to TV, of course, but can record, store, and play back any digital data stream, responding to any format. As one JVC official said, "We don't change the signal. What goes in goes out."

• And also DVC. The digital videocassette (DVC) recorder approved by 50 of the world's hardware and tape manufacturers is still in the works. It differs from D-VCR not only in format and dimensions but in what it does, which is to record, store, and play back any analog or digital video signal in digital format. It will use ¼-inch-wide metal tape in cassettes of two sizes, and probably will appear first in a version for broadcast news-gathering (Video News, June 1995). Its first consumer use is expected to be in the form of a compact camcorder, capable of recording for 60 minutes (standard definition) on a
Now you don’t have to be enrolled at CIE to receive our introductory Electronic and Electricity Lesson Modules. This program is available for a limited time to non-students for the shockingly low price of only $99.50.

With CIE’s patented AUTO-PROGRAMMED method of learning you will quickly learn and then master the basics of electronics and electricity and then move on to... DC/AC circuit theories, fundamentals of bi-polar junction transistors (BJT), field effect transistors (FET), wiring, diagram and schematic readings, component identification, soldering techniques... and much, much, more. This introductory offer includes the first 39 lessons in CIE’s Associate in Applied Science in Electronic Engineering Technology Degree.

Your commitment to CIE ends with your payment, but CIE’s commitment to your success just begins when you receive your lessons, exams, binder and equipment. This special introductory price includes all the benefits and assistance CIE normally extends to its full time students. You’ll be entitled to unlimited access to CIE’s faculty and staff to assist you in your studies via a toll free 800 number six days a week, 24-hour turn-around on grading your submitted exams, CIE bookstore privileges, a patented learning method, reference library, access to CIE’s electronic bulletin board and a free issue of CIE’s school newspaper The Electron.

And best of all, when you decide to continue your electronics education in any of CIE’s programs you’ll receive full academic credit for successful lessons submitted and a $100.00 Tuition Credit Certificate.

All this knowledge and support will put you on the road to understanding digital electronics, automotive and industrial electronics, microprocessing principals, computer systems, telecommunications and much, much, more.

$100.00 Tuition Credit
• Academic Credit
• Free issue of The Electron
• Build your personal burglar alarm
• Toll Free Instructor Assistance
• 24-hour grading
• CIE bookstore privileges

• 39 theory and hands-on training lessons and exams.
• Patented learning method
• CIE electronic bulletin board privileges

□ Yes! Send me CIE’s Introductory Electronic and Electricity Lessons and Equipment.

A7328

Name: ____________________________
Street: __________________________
City: ____________________________
State: ____________________________ Zip: ________
Age: ______ Phone: (______) ________

BOOKSTORE
1776 East 17th Street
Cleveland, Ohio 44114

Total Merchandise: $99.50
Ohio Residents add 7% Sales Tax: __________
California Residents add 6 1/2% Sales Tax: __________
Total This Order: __________
Shipping and Handling Charge: $5.00
Method of Payment/Amount Enclosed: __________
Personal Check or Money Order
Master Card Visa Discover

Card Expiration Date: __________
Signature: ________________________

CHARGE BY PHONE!
9 AM to 4:30 PM Eastern Time;
1-800-321-2155 ext. 7328

www.americanradiohistory.com
VOLTAGE INDICATOR

I would like to build a circuit that displays the battery voltage level in my automobile. I'd like a bargraph consisting of about four LEDs that lights up as the voltage ranges between about 3 and 12 volts. I would also like to be able to set the trigger levels for the LEDs. Can you think of a simple circuit that would do this?—O. Vera, Mexico City, Mexico

I've lost count of the number of voltage monitors I've designed for use in cars, but this is the first time I've even been asked about one that has to read down to 3 volts. Most monitors have a low value of about 11 volts—the lowest voltage you should ever see in a modern car's electrical system.

Because you want to monitor voltages that are much lower than a car's normal operating voltage, you can use a National Semiconductor LM339 comparator. That part is inexpensive and readily available. One strange characteristic of the LM339 is that, for reasons unknown, the power and ground pins are not in the standard upper left and bottom right positions: power is input at pin 3, and ground is connected to pin 12.

The simplest way to use the LM339 for your application is shown in Fig. 1. You will need as many of these circuits as the number of LEDs you want in your bargraph. The LED turns on when the input voltage at pin 5 of the LM339 falls below the reference voltage at pin 4. You can set the reference voltage for each stage of your bargraph by changing the value of the two resistors Ra and Rb that form the voltage divider at pin 4. The 5-kilohm trimmer potentiometer for the input voltage at pin 5 is optional, but it might help you set voltage levels exactly where you want them.

Because you're using this device in a car, I would suggest that you regulate the input voltage to the circuit because the voltage in an automobile is anything but constant. An LM7809 9-volt regulator would be a good choice.

There are four separate comparators in the LM339 package, so you can use one IC to monitor four different voltages. If you don't use one of the comparators in the chip, be sure to ground the inputs and outputs of the unused comparators or else they will tend to oscillate.

SIGNAL MONITOR

In our office we have a control line that sends a steady squarewave to various pieces of equipment configured in a daisy-chain arrangement. I need a circuit that will warn me when there's a loss of the control signal. There are commercial monitors available but they're expensive. Can I build a circuit that will do the same thing?—G. Benfer, Indy, NY

What you're asking for is a missing-pulse detector, and you can build one for about two bucks in parts. I'm sure that's a significant savings over the commercial units you mentioned.

A missing-pulse detector is a circuit whose output is triggered only if there's a loss of signal at its input. In the circuit shown in Fig. 2, the 555 timer IC is configured as a one-shot multivibrator that produces a pulse whose width is determined by the value of resistor R and capacitor C, shown in the schematic. The values for those parts can be calculated by using the formula \( T = 1.1RC \). You should select values that make the output pulses about twice as wide as the input trigger pulses from the control line. As long as there's a steady stream of input trigger pulses, the 555 will output a logic high. If there's a loss lasts only for one input pulse period—the 555 will time out and its output will go logic low until the next trigger pulse arrives. The logic low at the 555 output can trigger an alarm, a time recorder, a counter, or any other device you want.

NETWORK CARD SETTINGS

I'm setting up a small Novell network in my office, and I have to set the IRQ, the I/O base address, and the memory base ad-
GET THE LATEST ADVANCES IN ELECTRONICS

SUBSCRIBE TO—

Electronics Now

ENJOY THE WORLD OF ELECTRONICS EACH MONTH!

Subscribe to the best informed electronics magazine—the one that brings you the latest high-tech construction projects, feature articles on new technology, practical troubleshooting techniques, circuit design fundamentals, and much more.

Electronics Now looks to the future and shows you what new video, audio and computer products are on the horizon. You’ll find helpful, monthly departments such as Video News, Equipment Reports, Hardware Hacker, Audio Update, Drawing Board, Computer Connections, New Products, and more. All designed to give you instruction, tips, and fun.

Electronics Now gives you exciting articles like:

- Buyer’s Guide to Digital Oscilloscopes
- Build A Scanner Converter
- Single-Chip Voice Recorder
- Build A MIDI Interface for your PC
- Troubleshoot Microprocessor Circuits
- Build A High-Power Amplifier for your Car
- Add Music On Hold to your Phone
- All About Binaural Recording
- VGA-to-NTSC Converter

FOR FAST SERVICE CALL OUR TOLL-FREE NUMBER!

1-800-999-7139

DON’T DELAY — SUBSCRIBE TODAY!

If you prefer, just fill out the order card in this magazine and mail it in today.
Tune in the mail-order market for greater Ham Radio activity and enjoyment!

Uncover the Undiscernable

Eliminate Wasteful Search Time

Find the Better Buys

Discover who’s who in over 220 Amateur Radio activities!

Introducing the one and only directory that will open the world of Amateur Radio mail-order bargains for you! Discover who’s who in the world of amateur radio mail order! Find the part, antenna, test gear, gadget or gizmo you can’t buy over the counter. Over 1700 listings! Over 220 categories! Plus, the huge Resource Directory includes the following: a list of 100 FREE catalogs you can order today; a list of 85 computer BBS’s, 322 worldwide clubs; etc. Also included are mini-directories on Foreign Radio magazines, Amateur Radio satellites, Amateur Radio DX hotlines and helplines, detailed glossary, and the W6DBB Library of Tips for Hams! You’ll find your copy of the 1994 Amateur Radio Mail Order Catalog and Resource Directory must reading!

A “must have” Directory for Hams, SWL’s, project builders, & electronics enthusiasts!

I need to know who’s who in the Amateur Radio mail-order business! Send me the latest edition of The Amateur Radio Mail Order Catalog and Resource Directory now!

Check one:

☐ $9.98 which includes shipping and handling for postal Book Rate delivery to US and Canada

☐ $12.98 which includes shipping and handling for postal First Class delivery to US

☐ $14.48 which includes shipping and handling for postal First Class delivery to Canada

Payment in US funds only.

☐ VISA ☐ MasterCard ☐ USA Bank Check ☐ US or International Money Order

Credit Card Number ____________________________ Exp. Date /

(If used)

Signature ________________________________________

Total No. of Copies

Print Name ________________________________________

Total Amount $ __

Address __________________________________________

City State ZIP

Send orders to CLAGGK, Inc., PO Box 4099, Farmingdale, NY 11735. No COD orders.

Credit Card users may telephone or Fax Orders. Telephone 516-293-3751 or FAX 516-293-3115.

Prices subject to change. Allow 6 to 8 weeks delivery.

---

Network cards are like any other device that must communicate with a computer. The card needs an interrupt request, or IRQ, so that it can signal the host computer when it needs to talk to it. When the network card generates its interrupt, the computer runs an interrupt servicing routine that lets it talk to the card, get data from the card, and then go back to what it was doing before the interrupt occurred.

The I/O base address lets the computer know where in its memory map the card is located. When your computer wants to communicate with the card, it has 65,535 possible I/O addresses to choose from, so the card must be set to a specific address, and the software that the computer uses to talk to the card must also know what the address is.

The memory base address is needed only if you have a workstation without any floppy- or hard-disk drives. In this case, you would have a PROM on the card containing a small program that can boot the computer and connect it to the network. If a computer does have any disk drives, the bootstrap PROM is unnecessary, and the setting of the memory base address doesn’t matter. It’s good practice to set the address to the highest possible value (usually D800) because that’s safely above the memory used for video.

The key factors in getting the card to work are to make sure the selected interrupt and I/O base address aren’t used by any other device in your computer, and that the two parameters are set at the same value on the card and in the software.

LIGHT TURN ON

I built a circuit that turns on the lights on my night stand and it works great as long as the room is bright or dark. However, when there is some light in the room, the comparator goes into oscillation. I cannot find a way to stop it regardless of where the potentiometer is set. What should I do?—Emilio Ricciardelli
LASER PHONOGRAPH
I have a large record collection dating from the '40s. Every time I play one of these gems, I feel guilty knowing the additional wear I'm imposing on the irreplaceable discs. Surely someone must have come up with a way of reading these records optically using laser technology and lenses, thereby preserving the records indefinitely. I can almost imagine coming up with something like that myself. Is there anything like this available?—John F. Leahy

It sounds like a good idea to us, too, but we've never seen one for sale. One was announced several years ago, but it never went on sale. One solution is to make the best possible recordings of the records, perhaps on digital audio tape, and then listen to only the recordings to preserve the records.

TV SCOPE
I need an oscilloscope but can't afford a real one. Do you have a simple circuit for converting a TV into an oscilloscope?—Angelo Garcia

See "Turn Your TV Screen Into an Oscilloscope," Popular Electronics, September 1982, pp. 63–65. That circuit is entirely external to the TV; it uses a 555 as a pulse-width modulator synchronized with the TV's vertical sweep to draw a trace vertically on the screen. The only problem is that it covers only low audio frequencies and is more of a novelty item than a practical test instrument.

Converting a TV into a full-function oscilloscope isn't practical. Because the TV picture tube uses magnetic rather than electrostatic deflection, frequency response would be poor. But you can go to a hamfest (ham radio swap meet) and pick up a used oscilloscope for $25 or less (possibly much less; I have been offered very old ones for free). See "New Life for Old Scopes," Electronics Now, September 1994. To find out about hamfests in your area, contact the local ham radio club or write to ARRL HQ, Newington, CT 06111.

ORGAN RESTORATION
I am starting to restore a 1948 electronic organ. Why does it use dual and triple "in a can" electrolytic capacitors instead of separate capacitors? What must I consider when replacing them?—Jack Dowell

Dual and triple electrolytics were used in order to save space. The can is connected to the negative terminal of all the capacitors in it. Fortunately, newer electrolytics are smaller and you can generally find room for them under the chassis, leaving the can in place (but disconnected) in order to preserve the original appearance.

The replacement filter capacitors should have equal or greater capacitance values and equal or greater voltage rating. Nowadays it's often practical to use a considerably larger capacitance than the original equipment did, thus reducing the amount of hum in the circuit. You can get high-voltage capacitors (and some authentic "cans") from Antique Electronic Supply, 6221 S. Maple Ave., Tempe, AZ 85283.

FIG. 3—THIS LIGHT TURN-ON CIRCUIT originally had oscillation problems. The 470K resistor introduces the hysteresis to prevent the oscillation.

What you need to do is add hysteresis—that is, make the turn-on and turn-off light levels slightly different, so that the circuit can't vacillate between them. Figure 3 shows your circuit as we breadboarded it. The 470K resistor introduces the hysteresis. If it's not enough, try 220K. With hysteresis, the comparator is now a Schmitt trigger.

Other hints: (1) Put a capacitor across the power supply, as close to the op-amp as possible; (2) use a 741 or TL081 op-amp rather than an LM339 comparator if you don't need high-speed operation.

Earn Your
B.S. Degree in
Computers or
Electronics
By Studying at Home

Grantham College of Engineering, now in its 45th 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.

Our Engineering Technology B.S. Degree Program is available in either of two options:
(1) The B.S.T.E. with Major Emphasis in Electronics, OR
(2) The B.S.T.E. with Major Emphasis in Computers.

Our Computer Science B.S. Degree Program leads to 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
MINIANALYZER UPDATE
A reader who built the Mini Logic Analyzer (Electronics Now, February 1995, page 47) wanted to know why he saw multiple traces with a single input. The answer was given in the article, but it probably was not as clear as I thought it was when I wrote it. The third sentence in the second paragraph on page 82, under the heading "IC Checker," states: "Inputs 5 through 8 are grounded to avoid stray pickup."

Grounding those pins follows the general rule about grounding unused inputs pins on ICs such as the CD4066B CMOS quad bilateral switch whose unused input pins become high-impedance pickup antennas in the off state. Alternatively, pull-down (terminating) resistors can be attached to each input.

Any value greater than 10 kilohms will work satisfactorily and not load the source circuitry. Those resistors can be permanently tack soldered in the circuit or they can be temporarily installed at the input leads.—James J. Barbarello

VOLTAGE CONVERTER CORRECTION
There is a consistent error in the pin numbering on the schematic symbol for the 555 timer IC in six of the figures in the "Voltage Converter" article (Electronics Now, April 1995, page 42). In Figures 2,3,4,5,7, and 8 (pages 42, 43, and 44) the numbers identifying the pins on the left side of the symbol are incorrect. In all of those figures, the pin labeled "2" should be "7," and the pin labeled "7" should be "2."—Ray Marston

FLORIDA HAMFEST
The Suncoast Amateur Radio Club will hold its Fifth Pasco County Hamfest on September 24, 1995, from 9:00 AM to 3:30 PM at the New Port Richey (Florida) Recreation Center. (The center is located about 25 miles north of Tampa, Florida.) A W5YI testing session will be conducted, and an ARRL awards manager will be present to verify QSL cards for awards. The admission price is $5 at the door; children under 12 years of age will be admitted free.

Exhibitors' spaces that include a chair, a table, and the price of admission for one adult are available for $15. There is an extra charge of $5 for electric service at each table. Vendors must pre-register by contacting Tim, WD8MVU, at 1-813-848-0353 (The talk-in local frequency is 145.35 MHz; from long distance it is 147.150 MHz).

For more information, contact the Suncoast Amateur Radio Club at P. O. Box 1992, New Port Richey, FL 34656-1992.

DON NYSTROM, KA2KDP
Assistant Hamfest Coordinator
Port Richey, FL

MORE ON LEAD-ACID BATTERY DRAIN
Lead-acid batteries experience "concrete drain" because of the dust and moisture that accumulates on their top surfaces. This can be checked with a voltmeter. Connect the negative probe to the negative terminal of the battery and slowly drag the positive probe across the top toward the positive terminal. As the probe crosses each cell, the voltage reading will increase.

The reading could be as high as 10 volts on a 12-volt battery with a conductive film of dirt and moisture on its upper surface. This voltage is less likely to be found in batteries with side terminals.

Concrete floors on grade are known to "sweat" under certain conditions of temperature and relative humidity changes. This means that moisture migrates to the surface and is visible as wet patches. A battery left directly on a bare concrete floor will also sweat. That reaction, along with dust settling on the battery top, can cause the voltage drain.

The way to solve the discharge problem is to store the battery on an insulating shelf, and cover the top so that dust cannot settle on it.

MIKE A. LEATHERWOOD
Alba, TX

Yes, current cannot leak out through the battery case unless the case is damaged. However, if the concrete floor on which the battery is stored is significantly warmer or colder than the air around the battery, the resulting temperature stratification in the liquid electrolyte can cause a slow discharge of the lead-acid battery.

GERALD PARK
Professor Emeritus of Electrical Engineering
Michigan State University

IN DEFENSE OF CSICOP
The letter from Benson Boss (Electronics Now, January 1995) condemning the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP) requires an answer. I will take on his points one by one:

1. He says that CSICOP condemns before investigating. Can he give me an example of that? CSICOP has investigated countless claims of paranormal events. In many cases, the claims have absolutely nothing but anecdotal evidence to support them.

Plenty of television talk shows provide a large audience for people who want to make fantastic claims. I certainly don't want CSICOP to join that parade. Just remember that the second and third words in CSICOP's title are "scientific investigation."

Mr. Boss claims that the committee picks on weak, absurd, and vulnerable reports of the paranormal. That probably represents most paranormal claims. Does he know about any paranormal event that CSICOP refuses to explore because that event could possibly be real? I'm sure CSICOP will pay particular attention to any paranormal claim that seems remarkable.
MIXED-MODE POWER
Design & Verify Faster with Electronics Workbench®

New Version 4

Analog, Digital & Mixed Circuits
Electronics Workbench® Version 4 is a fully integrated schematic capture, simulator and graphical waveform generator. It is simple to mix analog and digital parts in any combination.

Design and Verify Circuits... Fast!
Electronics Workbench's simple, direct interface helps you build circuits in a fraction of the time. Try what if scenarios and fine tune your designs painlessly.

Electronics Workbench delivers the power you need to design and verify analog, digital and true mixed mode circuits. Over 20,000 customers have already put Electronics Workbench to the test. The result: Better designs... Faster. And over 90% would recommend it to their colleagues.

Electronics Workbench will save you time and money. We guarantee it.

Call Now: 800-263-5552
Just $299* + $15 S/H
For Windows, DOS or Macintosh

*30 day money-back guarantee
Free unlimited technical support

True mixed-mode simulation: Simultaneous AM transmission, digitization and pulse-code modulation of a signal.

More Power
Simulate bigger and more complex circuits. Faster. On average, Electronics Workbench Version 4 is more than 5 times faster than Version 3.

More Parts
Multiple parts bins contain over twice the components of Version 3.

More Models
Over 350 real world analog and digital models are included free with Electronics Workbench. And, if you need more, an additional 2,000 models are available.

July 1995, Electronics Now
Mr. Boss condemns CSICOP for demanding physical evidence to substantiate claims. But that’s how it should be—no one who believes in the scientific method should ever settle for less. Anyone can make up a fantastic story. No organization could possibly investigate every idiotic claim made in a world that does not seem to have a shortage of crackpots.

Finally, Mr. Boss believes that it is professors, intellectuals, and scientists (the sort of people who make up CSICOP) who prevent the introduction of any fundamentally new ideas in politics, religion, medicine, and science. Well, just who has made the major contributions in those areas?

The readers of Electronics Now are interested in electronics. There is no doubt that the incredible advances being made in that field are being made by just the kind of people Mr. Boss thinks are too narrow-minded to achieve such accomplishments.

Everyone interested in learning about CSICOP should read its journal, Skeptical Inquirer.

RICHARD W. STICKA
Yorkville, IL

ROTATION AND ACCELERATION SENSING

The “Q&A” response (March 1995, Electronics Now) was incorrect in stating that all forms of rotation and acceleration sensing are based on mechanical principles. The first theoretical work in nonmechanical rate sensing was done toward the end of the last century. It was the result of studies in interferometry and research done by a scientist named Sagnac. (An effect named for him is the basis for work in nonmechanical sensing being done today.)

Practical applications of nonmechanical acceleration and angular rate sensing date back more than 20 years. Laser and fiber-optic rate sensors (Sagnac sensors) do not depend on the classical principles of gyroscopic action, pendulous movement, tuning-fork oscillation, gimballed suspension, or displacement of a physical mass.

Unfortunately, the frequently used terms “laser gyro” and “fiber-optic gyro” are misnomers and are misleading. They refer to the better known mechanical gyroscope because they are intended to replace them. The mechanical gyro is still widely used today and is being improved continually.

The laser rate sensors work in accordance with the Sagnac effect and contain no moving parts. Two lasers are fixed on a base relative to each other and they emit beams that travel in opposite directions over a ring-shaped path formed by three or more mirrors.

When the position of this light “ring” is changed in inertial space, the clockwise and counterclockwise beam paths have different lengths so they produce a frequency or phase difference proportional to the rate at which the sensor’s position changes.

This instrument, also called a ring laser, permits rotation to be mea-

---

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.

Only $38.00 for pages
$69.95 diskette

with the
ISCET 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 ISCET VCR Cross Reference, Fifth Edition, is 8 1/2 x 11-in., pre-punched pages and sells for $38.00. The 3 1/2 inch diskette sells for $69.95 and you can view listings from a monitor or printed page.

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

Name ____________________________
Business ________________________
Address __________________________
City __________________ State _____
Phone __________________ Zip ______

Enclosed $38.00 for the ISCET VCR Cross Reference, Fifth Edition.
Enclosed $69.95 for the diskette containing the ISCET VCR Cross Reference, Ver. 5.0.

Please specify:
5% Diskettes (2) 3% 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. C803
sured without a spinning mechanical mass. The laser beam phase relationship can be sensed by an interferometer or detected by a photomultiplier or other device capable of measuring changes in light intensity accurately.

I know about proprietary work being done on these instruments by companies about 15 years ago. They applied the ring laser concept to solid-state, optical fiber gyro's and accelerometers and the principal elements were fine glass optical fibers wound on a spool of a dime.

At that time, the experimental prototypes based on those optical fibers spooled achieved only about 10% of the accuracy required for a practical guidance system. However, the developers were confident that they could achieve the required accuracy within 10 to 15 years.

These instruments were intended for guiding "Star Wars" interceptor projectiles which were to be about five inches in diameter and 10 to 12 inches long. I was also aware of other R&D that made use of even more exotic means for sensing acceleration—again without mechanical components. I have yet to see those concepts described in any publication in the public domain, so I can only assume that they are still classified.

Laser gyro's have been installed in commercial and military aircraft for more than ten years. Some of those instruments are mounted in gim-balled platforms and others are directly mounted to the frame of the host vehicle.

THOMAS REDDIE
Las Vegas, NV

BATTERY ISOLATOR COMMENTS
I want to comment on Randall Christman's question about using a battery isolator to maintain the charge on two batteries from one alternator ("Q&A," Electronics Now, April 1995). Modern, well-designed voltage regulators for controlling an alternator are set for an output of 14.2 to 14.4 volts DC because a typical lead-acid cell requires roughly 2.4 volts DC per cell to charge it.

When a battery isolator is installed, the voltage drop across the diodes will be about 0.5 to 0.6 volt DC. That drops the voltage across the battery to a value that is too low to charge a battery fully. A replacement adjustable voltage regulator should be a part of the system.

One way to obtain the diodes is to remove the plates from a discarded alternator. You will obtain an adequate heatsink, but the diodes should still be mounted where air can flow freely around them.

In the same Q&A column, Larry Bell asked about a lead-acid battery losing its charge when stored on a bare concrete floor. That might have been a problem several decades ago when battery cases were made from hard rubber. The moisture migrates from damp concrete up the sides of the case causing electrical leakage and eventually discharges the battery. This is no longer a problem with modern batteries packaged in plastic cases because of their better insulation properties.

NEIL DENNIS
Bliss, NY

WAVE GOODBYE
TO PRICEY
TEST EQUIPMENT

GoldStar offers a comprehensive line of affordable Analog and Digital Storage Oscilloscopes for your diagnostic needs.

- Signal Delay Lines
- TV Sync
- Variable Holdoff
- Max. Sweep Time of 2ns/div.

Don't forget the other sensibly priced instruments available from GoldStar (Sweep Function Generators, Frequency and Universal-Counters, Bench Power Supplies, and Bench and Handheld Digital Multimeters).

LG Precision
The Sensible Source
13013 East 166th St., Cerritos, CA 90701 310-404-0101 fax: 310-921-6227

CIRCLE 179 ON FREE INFORMATION CARD
Fluke Corporation, long known for its innovations in multimeters, has introduced its new 860 series of Graphical Multimeters (GMM). These instruments combine the functions of a digital multimeter with those of an oscilloscope, an in-circuit component tester, a trend plotter, and a logic activity detector—all in a single handheld, battery-powered package. Clearly these meters have more to offer than the under $100 run-of-the-mill DMMs. With price tags that range from $795 to $1295, they are positioned well into the professional class.

The three meters in the 860 series all look the same and all are packaged in the same yellow cases. A multifunction liquid-crystal display occupies about one third of the top surfaces. Controls include the now well accepted rotary switch accompanied by rows of supplementary pushbuttons. These instruments have the feel of heavy-duty meters that can take some roughing up without a whimper; for all their sophistication, they are not pale laboratory bench wimps.

The 860 series GMM test tools are intended for troubleshooting, maintenance, installation, and calibration of industrial and medical equipment. They are also suitable for the repair and maintenance of computers, office machines, communications equipment, and consumer electronics.

All three of the 860 models contain a basic “core” of performance features that set them apart from all other digital multimeters on the market. Two of the higher priced models have additional supplementary features. This gives the customer who has decided that he needs a higher performance DMM the opportunity to see what he can get for the higher price tags and determine whether those features will pay off.

The lowest-priced Model 863 offers 32,000-count (4.5 digit) resolution, a dual digital display, and an simulated moving-needle analog display—the better to spot trends. The Model 863 can measure AC voltage to 1000 volts (over 20 to 300 Hz) and DC voltage to 1000 volts. It can also measure ohms to 30 megohms, AC and DC current to 10 amperes, and frequency to 2 MHz. Capacitance can be measured over the range of 10 nanofarads to 10,000 microfarads, and present readings in decibels. It has a basic DC accuracy of 0.04%. Alkaline batteries are included with this model.

The Model 865 picks up where the Model 863 left off by offering such extra features as in-circuit component test and logic test. While retaining the same 0.04% DC accuracy, it is able to measure frequency to greater than 10 MHz. It also has internal battery charging, waveform memory, and a combined line-voltage adapter and battery charger. Its LCD display is backlit, and alkaline batteries are included.

The top of the line Model 867 offers higher 0.025% DC accuracy. Picking up where the Model 865 left off, it includes an optically isolated RS-232 cable and the software that will permit it to be interfaced with a printer or personal computer. This model includes a rechargeable nickel-cadmium battery pack in place of the alkaline batteries.

Twenty-three years ago, the then John Fluke Mfg. Co. put most of the circuitry of one of its benchtop DMMs on two custom-made IC chips and revolutionized the industry. Before long much of that circuitry had migrated to a single silicon single chip and the semiconductor manufacturers who had made them decided to recover some of their costs by selling the formerly custom devices to other instrument manufacturers.

The availability of the single-chip IC that contained the crucial inner workings of the DMM for a low price opened the door for the new class of pocket-sized, handheld, battery-powered DMMs that offered most of the features obtainable only in expensive benchtop models from a few well known American manufacturers. In this clear example of “trickle-down of advanced features,” handheld meters priced under $100 were soon doing what only the $300 to $500 benchtop models could do.

This turn of events impacted heavily on American instrument manufacturers who had been making benchtop DMMs. If they wanted to stay in the business where prices were falling, they had the options of manufacturing offshore or building automated facilities to continue manufacture in the U.S.A. Faced with this prospect some dropped out. But Fluke was one of the companies that elected to stay and fight. It built an expensive, largely automated facility for manufacturing DMMs in this country, and emphasized its reputation for quality and customer service.

The latest 860 Series graphical...
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  
Cre-Ide 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 Panks  
Marketing Manager/Consumer Products  
Analog Devices, Inc.

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

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

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

Graduate with an Associate Degree from CIE!

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

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

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

ELECTRONICS...IT'S THE ONLY SUBJECT WE TEACH!

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

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

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

Send for CIE's FREE Course Catalog and See How We Can Help Your Career Too!
multimeters indicate another direction that Fluke took—adding features that were beyond the capabilities of the offshore manufacturers of handheld DMMs. Obviously the prices went up, but the company banked on retaining its customer base. Soon the low-cost microcontroller made many other features such as the multipurpose LCD feasible and cost-effective.

For comparison purposes, it is interesting to see what one can get for less than $100 in DMMs today. Integrated circuitry available on the open market put a substantial floor under their performance. Needless to say, it’s necessary to invoke that old warning “buyer beware” when purchasing a low cost meter from some unknown or little known vendor. However, here is what you can get for less than $100 today.

A 3-3/4 (3200 count) manual ranging DMM capable of measuring AC voltage to 750 volts, DC voltage to 1000 volts, and AC and DC current to 10 amperes. Many are able to measure resistance over 20 megohms, preserve data, check continuity with a beeper, and test diodes. The basic DC accuracy of these instruments is typically 0.25%. Some of these manufacturers also say their products meet the IEC 348 safety requirements.

Now that you have a reference point, here are Fluke’s prices for its 860 Series Graphical Multimeters. The Model 863 is priced at $795, the Model 865 is priced at $995 and the Model 867 is priced at $1295. (Fluke Corporation, PO Box 9090, Everett, WA 98206, Phone: 800-44-FLUKE, Fax: 206-356-5116.)

860 operating modes

The meter modes present both a digital readout and a simulated analog moving-needle display. In this mode one can measure current, resistance, continuity, conductance, capacitance, frequency, duty cycle, pulse width, period, diB, and AC and DC voltage. A numeric readout supplements the analog needle.

The waveform display provides a clear graph of noise, waveform distortion, intermittent failures, and glitches. This mode can display signals with bandwidths up to 1 MHz. This enhances the numeric display by providing qualitative information about a signal. The Full Auto display setup automatically scales voltage, timebase, triggering, and position. Manual setup or external triggering are also possible.

The Trendgraph mode plots high resolution meter readings for up to 30 hours, in intervals from 1 second to 15 minutes. It can detect power sags, surges, and droops.

The in-circuit component test permits component signatures to be viewed while the component remains in the circuit. Consequently no time and effort is wasted in removing and handling components, some of which might be sensitive and subject to damage during removal. This feature permits users to troubleshoot problems by comparing component signatures of known, functioning circuits with those of defective circuits. Components can be checked without having to power up the circuit.

The Fluke 860 Series Graphical Multimeters are obviously not for everyone who analyzes faults and services electronic equipment and appliances. The meters are all premium priced and premium quality instruments.

For those who really need the performance features offered, these instruments are probably inexpensive, and they certainly will be cost-effective because you won’t need to tote along another set of test instruments. The low-cost, foreign made DMMs are just not in the same league —and that’s without mentioning the graphical modes.

Ω
Enter A World Of Excitement with a Subscription to

Popular Electronics

Get the latest electronic technology and information monthly!

Now you can subscribe to the magazine that plugs you into the exciting world of electronics. With every issue of Popular Electronics you’ll find a wide variety of electronics projects to build and enjoy, and feature articles that inform and entertain.

Popular Electronics brings you feature articles on technology, computers, test gear, and more—all designed to keep you tuned into the latest developments in electronics. So if you love to build fascinating projects, just fill out the subscription form below to subscribe to Popular Electronics... It’s a power-house of fun for the electronics enthusiast.

EXCITING MONTHLY FEATURES LIKE:

☐ CONSTRUCTION—Exciting projects that range from simple radios to working robots

☐ FEATURES—Learn about new technology, see how to troubleshoot all types of electronics gear, refresh your knowledge of basic electronics theory, see how components work and how to use them in your own designs, and much more

☐ PRODUCT REVIEWS—Get in depth, hands-on reviews of all types of hobby gear, and learn about the latest and the greatest in consumer electronics in our no-holds-barred Gizmo section

☐ SPECIAL COLUMNS—Think Tank, Circuit Circus, Computer Bits, DX Listening, Antique Radio, Scanner Scene, Amateur Radio, Multimedia Watch, and more

PLUS: ALL OUR GREAT DEPARTMENTS!

You’ll get 12 exciting and informative issues of Popular Electronics for only $18.95. That’s a savings of $23.05 off the regular single copy price. Subscribe to Popular Electronics today! Just fill out the subscription order form below.

Popular Electronics’ SUBSCRIPTION ORDER FORM

P.O. Box 338, Mt. Morris IL. 61054

YES! I want to subscribe to Popular Electronics for 1 Full year (12 Issues) for only $18.95. That’s a savings of $23.05 off the newstand price.

(Basic Subscription Rate—1 yr/$21.95)

☐ Payment Enclosed ☐ Bill me later

Please charge my: ☐ Visa ☐ Mastercard

Acct. # ____________________________

Signature ____________________________ Exp. Date ________________

Allow 6 to 8 weeks for delivery of first issue. U.S. Funds only.

In Canada add $6.68 Postage (includes G.S.T.).

All Other Foreign add $7.50 Postage.

FOR FASTER SERVICE CALL TODAY

1-800-827-0383 (7:30AM–8:30PM) EASTERN STANDARD TIME

Save 55% Off The Regular NEWSSTAND Rate

www.americanradiohistory.com
NEW PRODUCTS

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

WIDE-BANDWIDTH OSCILLOSCOPE. Hewlett-Packard has introduced its HP 5470A 20-GHz repetitive sampling oscilloscope. It is said to be two to three times faster than comparable wideband oscilloscopes when it is operated either by front-panel controls or a remote computer.

The HP 5470A oscilloscope is intended for such assignments as testing high-frequency circuits and devices in automated test systems and characterizing and modeling electronic devices and circuits in development laboratories.

Fast throughput permits measurements to be made more rapidly, thus increasing productivity. The HP 5470A has a bandwidth of DC to 20-GHz. Its 17.5-picossecond risetime permits the viewing and analysis of fast-rising waveform edges. Moreover, its 5-picossecond time-interval accuracy combined with 62.5-femtosecond timing resolution permit precise timing analysis and jitter characterization.

The oscilloscope can make more than 50 measurements automatically, thus reducing manual setup time. Its features include FFTs, color-coded displays, histograms, limit testing, mask testing, and full parametric characterization of multivalued waveforms, and human eye diagrams.

A modular platform, the HP 5470A accepts up to two dual-channel plug-in modules. The HP 5475A has two independent vertical channels with bandwidth selectable from 12.4GHz to 20 GHz. An optional software package includes the firmware for supporting the HP 83480 series of optical to electrical plug-ins. These add standard telecommunications mask templates and permit automatic optical/human eye pattern measurements.

The HP 5470A oscilloscope is priced at $16,000.00; the HP 5471A dual-channel plug-in module is priced at $8500.00, and the HP 83480K+ communications software package is priced at $1500.00.

HEWLETT-PACKARD COMPANY
Direct Marketing Organization
P. O. Box 58059, MS51-SJ
Santa Clara, CA 95051-8059
Phone: 1-800-542-4844, ext. 8809

PIN-HOLE VIDEO CAMERA. The Model PH-380 black and white video camera from Northeast Micro Electronics can view an entire room through a 1/4-inch diameter hole in a wall or furniture. Built on a 1/4-inch square substrate, the tiny camera offers 380 lines of resolution and low-light sensitivity of 0.5 lux. Its automatic adjustment features include electronic iris and gain control.

Intended primarily for security systems, PH-380 might be useful whenever there is a need for a small unobtrusive video camera.

80C51-BASED MICROCONTROLLER. The 8XC576 microcontroller from Philips Semiconductors includes a universal peripheral interface (UPI) and a 10-bit analog to digital converter. Intended for such applications as automotive and industrial controls, data communications, instrumentation, computer and peripheral systems, and cellular tele- phone networks, the IC will simplify circuit board design and reduce the number of components. It will also increase the reliability of its host system and reduce its EMI and RFI emissions.

The 8XC576 includes 8 kilobytes of ROM/EPROM, 256 bytes of RAM, and three 16-bit counter timers. Other on-chip functions include a programmable counter array, a "watchdog" timer, analog comparators, enhanced UART, and two pulse-width modulated outputs. Also on the IC are power- and oscillator-fail detection, user-programmable outputs, and Schmitt trigger inputs.

Two versions are available: the 83C576 with ROM, and the 87C576 with EPROM or one-time only programmable EPROM. Packaging options include single-in-line (SIL), leadless chip carrier (LCC), and plastic quad flatpack (QFP).

The 83C576 is priced at $4.90 in quantities of 5000.

Philips Semiconductors
811 East Arques Avenue
P. O. Box 3408
Sunnyside, CA 94088-3409
Phone: 800-447-1500, ext. 3000
It is powered from 12 volts DC, and can be wired directly to any video monitor or most VCRs. The PH-380 video camera with a 1/4-inch diameter lens is priced at $215.00.

**Northeast Micro Electronics**
P. O. Box 175
Elmwood Park, NJ 07407
Phone: 201-794-1132, ext. 826
Fax: 201-797-6464

**SOLID-STATE MOBILE AMPLIFIER.** The ALS-500M solid-state amplifier from Ameritron produces 500 watts of output power over the 1.5 to 222-MHz band. It offers instant bandswitching, requires no tuning or warmup, and it is standing wave ratio (SWR) protected. Four high power linear RF power transistors are in the circuitry.

**TELEPHONE-RING GENERATOR MODULE.** The RG12V/6R ringing generator circuit from Jec Tech generates a ringing voltage of 90-volt peak (180 volts peak-to-peak). The ringing frequency can be varied from 15 to 68 Hz by adjusting an included potentiometer. This permits the module to be set to simulate any type of ringing listed in Part 68 of the FCC rules. It is powered from 12 volts DC.

Intended for integration into OEM products and systems requiring a ringing function, the RG12V/6R has a control lead that turns the generator on with a low (ground) from an external open collector or relay contacts. Occupying a volume of $2 \times 2.4 \times 0.75$ inches high, the generator module is in a single-in-line (SIP) package.

It can be mounted vertically, an on-off power switch and a DC ammeter. It can operate in the 10/12 meter band with the installation of an optional conversion kit.

The amplifier is protected by load-fault protection circuitry that disables and bypasses the amplifier if the antenna reflects excessively high power or if the bandswitch is set lower than its exciter frequency. Thermal overload protection disables and bypasses the amplifier if the temperature exceeds a safe level. The amplifier automatically resets when the temperature falls below that value.

The ALS-500M amplifier is priced at $799.00, and the optional 10/12-meter kit is priced at $29.95.

**Ameritron**
921 Willow Road
Starkville, MS 39759
Phone: 601-323-8211
Fax: 601-323-6551

---

**NEW INNOVATIVE METERS**

**NEW LOOK • GREAT PERFORMANCE**

**Featuring...**

- 4000 Count, 3 3/4 Digits
- 6 New Models; 3 Styles
- Rotary Switch & Thumbwheel Function Selector Types
- Best Quality Features at Lowest Cost
- Choice of Value Priced Models @ $39.95 $59.95, or $79.95
- ISO-9001 Certified

**Model 122**
Rotary Switch
$59.95

**Model 223**
Thumbwheel
$79.95

**WE PRIDE OURSELVES ON EXCELLENCE IN QUALITY**

**WE SPECIALIZE IN:**

- AC/DC ADAPTOR
- AUDIO OUTPUT TRANSFORMER
- CHOKE COIL
- COMMUNICATION TRANSFORMER
- DRIVE TRANSFORMER
- LINEAR POWER TRANSFORMER
- MATCHING TRANSFORMER
- PINCUSHION TRANSFORMER
- PULSE TRANSFORMER
- SWITCHING POWER TRANSFORMER

**SEND IN YOUR SPECIFICATIONS FOR QUOTATION TODAY!!**

---

**全銘實業有限公司**

**MAINSTAR INDUSTRIES LIMITED**

B10, 16 Floor, Kailey Industrial Centre, 12 Fung Yip Street, Chei Wan, Hong Kong.

TEL : (852) 2558 9319  FAX : (852) 2557 6936
The probes are made from durable thermoplastic that complies with the IEC1010 safety standards. Each probe has a replaceable gold-plated test tip and a cable that is 48 inches long. Versions with switchable attenuation of $1 \times 10^x$ are also available.

SL-Series probes are priced from $33.00 to $49.00, depending on bandwidth. ITT Pomona Electronics 1500 East Ninth Street Pomona, CA 91766-3835 Phone: 1-800-241-2060 Fax: 909-629-3317

**SERVICE KITS.** Two new digital multimeter service kits have been introduced by Fluke. The Fluke 23 and Fluke 87 service kits include a handheld DMM, and all the accessories and training documentation needed to make accurate electrical measurements efficiently. The kits offer significant discounts over the purchase of the instruments and documentation separately.

**MULTI-STANDARD INFRARED TRANSEIVER IC.** The CS8130 multi-standard infrared transceiver IC from Crystal Semiconductor is designed to conform to the new Infrared Data Association (IrDA) standard for "cordless" communications. It is intended for installation in desktop, laptop, and notebook PCs; personal digital assistants; printers; network nodes; telephones; and fax machines to permit data exchange between these products.

The transceiver can be connected to a standard UART with standard TxD, RxD, and two handshake pins. On the IR side, a standard LED and PIN diode are attached directly to the device. The IC also contains a baud clock generator and programmable registers that allow the setting of various options. The CS8130 will transfer data at standard UART baud rates of 2400-bits per second up to 115.2 kilobits per second, in half- or full-duplex mode. The IrDA standard is intended as a worldwide IR connectivity standard capable of supporting communications between equipment made by different manufacturers in different countries.

The chip supports the Sharp 500-kHz ASK mode, 38-kHz ASK TV remote mode, and a direct (no modulation or decoding) mode. Thus a Sharp personal digital assistant (PDA) with a CS8130 could transfer data to an Apple Newton or a Sharp Wizard.

The CS8130 in a 20-pin SSOP package is priced at $5.50 each in 1000 quantity. A CDB8130 evaluation kit that includes two demonstration boards which attach to standard COM ports, software, and documentation, is also available.

**BENCHTOP DIGITAL MULTIMETER.** The Model BDM35 3½-digit (4000 count) benchtop digital multimeter from Wavetek can measure DC and AC voltage, current, and resistance as well as frequency and capacitance. It can also perform diode testing and audible continuity checks. Its liquid crystal display has half-inch high characters and a 42-segment bargraph.

The BDM35 can mea-
sure AC and DC volatage to 750/1000 volts in five ranges, AC and DC current in five ranges to 20 amperes, and resistance in six ranges to 40 megohms. The meter is autoranging and all functions can be selected with front panel pushbuttons. The basic DC accuracy of the meter is ±0.1%.

The meter's troubleshooting features include Min/Max Record for recording the highest or lowest readings over a time period, Mem/Read that records the meter's last function and measurement in that function, and Hold that freezes the display for later viewing.

The BDM35 benchtop multimeter with test leads, power cord and an instruction manual is priced at $369.00.

Wavetek Corporation
9145 Balboa Avenue
San Diego, CA 92123
Phone: 619-279-2200

28.800-BPS MODEM-COUPLING TRANSFORMER. Low-profile T14Z coupling transformers from Integrity Technology are intended for 28.8 kilobit per second (Kbps) CCITT V.34 data transmission applications. Measuring only 0.49 x 0.57 x 0.52-inches, the transformers can be connected directly to 600-ohm telephone lines with zero DC bias, in "dry" modem circuits.

The cores of the transfor-

This is the fifth volume in a series of collections of circuit diagrams and their descriptions obtained primarily from various publications including Electronics Now and semiconductor manufacturers’ applications notes. It adds more than 1000 circuit designs to the collection of circuit designs in the authors’ previous four volumes.

The book also contains circuits whose operations are based on the characteristics of semiconductor devices made by such manufacturers as National Semiconductor, Harris Semiconductor, Texas Instruments, Motorola, and Teledyne. The authors have even contributed some of their own circuit designs. Each schematic is accompanied by a brief explanation of circuit operation and, where useful, information about such subjects as adjustment or alignment.

The volume is organized in alphabetical order into 135 categories, and it contains a cumulative index that covers all of the circuits and data published in the previous four books in the series. The categories in Volume 5 include alarm and security systems, audio amplifiers, computers, frequency meters, gas and smoke detectors, oscilloscopes, receivers, waveform generators, temperature sensors, and video amplifiers.


Many persons are unaware of Nikola Tesla’s independent discovery of X-rays because he is so closely associated with radio-frequency engineering. This book, the second in a three-part series, includes previously unavailable documentation of Tesla’s pioneering work. It presents the complete text of his lecture delivered under the title of “On the Streams of Lenard and Roentgen with Novel Apparatus for Their Use” on April 6, 1897. However, the lecture went well beyond this topic.

In addition to his opening remarks on X-ray discovery, a major portion of Tesla’s commentary deals with the high-frequency resonators that he used in his work. He also describes the stroboscopic instruments he designed for measurement of frequency and phase. During the talk, Tesla showed about 120 drawings of vacuum tubes, including those of the Lenard type and a single-electrode type he designed. Some of the tubes were used in his wireless communications experiments.

Other topics covered in this book are wireless receiving methods and Tesla’s particle beam device of 1937. Computer-enhanced photographs of the drawings are among the 32 illustrations included in the book.


For decades, the ARRL Handbook has been the Bible of the radio amateur, and it has proven to be a useful reference for amateurs as well as professionals with an interest in radio communications. More than six million copies have been sold since it was first published in 1926.

Chapters of the handbook explain how to organize and test an amateur radio station and how to build Circuits related to the amateur radio hobby such as power supplies, transceivers, and amplifiers. The “Modes” chapter reviews the different ways hams communicate, from Morse code to digitized voice transmission.

Modern oscillators and synthesizers are explained, and “Mathematics for Amateur Radio” is a refresher course in the mathematics of most use to the radio amateur. Tables and charts related to common electronic phenomena and principles will help the reader to find needed answers faster than by calculation from formulas.
1995 Catalog. Parts Express, 340 East First Street, Dayton, OH 45402; Phone: 1-800-336-0531; Fax: 513-222-0173; 212 pages; free.

This latest catalog from Parts Express contains descriptions and pictures of the electronic parts and accessories offered by this distributor. It emphasizes consumer electronics products and parts for the electronics hobbyist.

Among the many items included are speakers and audio accessories for the home and car, audio products for building into the home or office, and cable TV and VCR repair replacement parts and accessories. Also covered are semiconductors, tools, chemicals and solvents for electronics servicing, computer accessories, telephone-related products, wire, connectors, books, and videotapes.

Connecting to the Future: Creating Environmentally Safe Chemical Products for Manufacturing, Maintainance & Service. Caig Laboratories, Inc., 16744 West Bernardo Drive, San Diego, CA 92127-1904; Phone: 1-800-CAILG-123 or 619-451-1799; Fax: 619-451-2799; free.

This is a catalog from a company that specializes in chemicals for electronics manufacturing and maintainance. Caig claims its cleaning products are safer for the environment and pose less hazard to the user than the toxic chemical solutions previously used for cleaning components and circuit boards.

A complete line of concentrated formulations that are applied by wiping, pens, and needle and syringe dispensers rather than aerosol cans are described. Some preparations are suited for cleaning connector pins and contacts. Other products are deoxidizers, preservatives, lubricants, anti-static solutions, solvents and cutting oils.

ADXL50 Accelerometer Application Notes. Analog Devices Literature Center, 70 Shawmut Road, Canton, MA 02021; Fax: 617-821-4273; free.

This is a book of five application notes about Analog Devices' ADXL50 monolithic accelerometer. The ADXL50 is said to be the first combined acceleration sensor and signal-conditioning circuit on a single silicon substrate. The notes offer practical solutions to a wide range of acceleration measurement applications.

- AN-376 Using the ADXL50EM explains the electrical and mechanical characteristics of the AD accelerometer.
- AN377 Increasing the Frequency Response of the ADXL50 explains how the accelerometer's frequency response is increased from 1.3 kHz to 10 kHz.
- AN-378 Reducing the Average Power Consumption of the ADXL50 explains techniques for conserving power to the device.
- AN-379, Mounting Considerations for the ADXL50 explains how to mount the accelerometer.
- AN-380 Compensating for the 0-g Offset Drift of the ADXL50 explains how to compensate for unavoidable zero-point drift.

Online with PROCOMM Plus for Windows 2; by David Wolfe. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012; Phone: 1-800-CALL-WILEY; $22.95.

To get on Internet one needs three things: a personal computer, a modem, and understandable communications software that is easy to use. PROCOMM Plus is a popular software package for PC users, but many who have purchased it have run into difficulties in installing, configuring, and running the program. This book makes it easier for Windows users to make the necessary online connections.

Written for PROCOMM users with all levels of PC experience, Wolfe's book explains how even beginning users can master the program, including installation, customization, and speed-up file transfers. Advanced topics include the use of PROCOMM's built-in programming language, external protocols, and troubleshooting modern hardware problems.

Included are explanations of how to create fax sheets with graphic icons, transfer files, send faxes, and view graphics as they are downloaded. Instructions are given in designing personalized graphical user interfaces with the program's Windows builder and dialog editor. You will also learn how to use ASCII PICT to automate PROCOMM and put it to work running BBS.


This catalog illustrates and describes the wide variety of products offered by Calex. Included are modular load cell and strain-gage signal conditioners, DC-isolated transmitters, constant-current sources, alarms, and DC differential amplifiers. Also included are DC/DC converters and linear power supplies for powering Calex instrumentation modules.

The catalog includes
BEST PROTO™ PROTOTYPING BOARDS
INCLUDE LOW NOISE POWER AND
GROUND PLANES, plated through holes,
predefined sites for SMD passives, and signal
names silk-screened on both sides. Engraver's kit (pictured) is $129.50, 16-bit ISA card
is $32.50. Add $5 s&h (CA add 7.25% Sales
Tax). Distributors wanted. BEST PROTO,
Dept E5, Box 232440, San Diego, CA
92183-2440 (619) 286-9000 ph/fax. Visa/MC.
CIRCLE 181 ON FREE INFORMATION CARD

Yours for only
$3.50
Prices includes
shipping!

HAVE A THOUSAND YUCKS FOR ONLY
THREE AND A HALF BUCKS! That comes
to one-third of a cent per laugh. Electronics
Comics is a compilation of over 125 riotous,
outrageous and phenomenal cartoons that
appeared in Popular Electronics and Elec-
tronics Now. Only $3.50—price includes
shipping. Claggk, Inc., Reprint Bookstore,
P.O. Box 4099, Farmingdale, NY 11735-
0793. All payments in U.S. funds. Sorry, no
orders outside U.S.A. and Canada. Check or
money order only—send no cash. NY state
residents add applicable tax. MA94

CALL NOW
AND RESERVE
YOUR SPACE
• 6 x rate $1,000.00 each insertion.
• Fast reader service cycle.
• Short lead time for the placement of
ads.
• We typeset and layout the ad at no
additional charge.

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

FAX: 516-293-3115

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 es-
sentials for the builder
and 30 easy-to-build fun
projects every exper-
imenter should toy with. Printed-circuit board
layouts are included to give your project a pro-
fessional appearance.

□ BP349—PRACTICAL
OPTO-
ELECTRONIC
PROJECTS $5.95
If you shun opto-elec-
tronic 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 fil-
ament bulb to modern infrared sensors and emitters—all are easy to build.

□ BP363—PRACTICAL
ELECTRONIC
MUSIC PROJECTS
.............................................................................$5.95
The text contains a good-
ly number of practical music projects most often
requested by musicians. All the projects are rela-
tively low-in-cost to build
and all use standard, readily-available compo-
ents 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
$5.01 to $10.00 ............... $3.00
$10.01 to $15.00 .......... $4.00
$15.01 to $20.00 ......... $6.00
$20.01 to $25.00 .......... $7.00
$25.01 to $30.00 ........ $8.50
$30.01 and above $8.50

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.

Specifications, circuit and block diagrams, descrip-
tions, performance curves, application information,
and a selection guide.
The subjects of the ap-
lication notes include
grounding and shielding
techniques and how to re-
duce transmitter EMI. Price and ordering information is
included.

Power-Pak Primer #1, Con-
version Devices, Inc., 15
Jonathan Drive, Brockton,
MA 02401; Phone: 508-559-0880; Fax:
508-559-9286; 4 pages;
free.

This Conversion De-
vice technical note dis-
cusses the advantages and
disadvantages of both cen-
tral and distributed power
systems.
The book defines both
central power and dis-
tributed-power architec-
tures, and explains the
impact of each on elec-
tronic designs. Topics in-
clude time to market,
system control and moni-
toring, power distribution,
and system modification.
Circuit diagrams and ta-
bles included in the tech-
nical note illustrate impor-
tant subjects.

Ω
cassette the size of a DAT cassette.

DVC recorders will be capable of recording in the bitstream mode, but will also be sold with analog-to-digital and digital-to-analog encoders, making it possible to record analog video signals digitally and feed them to an analog TV for playback. The 50-manufacturer DVC group recently agreed to specs for recording and storing the Grand Alliance HDTV system. One of the most difficult problems in developing the digital recording system was providing for special effects. In the HDTV mode, it will record a separate low-definition signal for special effects.

DVC camcorders could start appearing early in 1996. Home DVC recorders will accept either the small camcorder cassette or a larger one (about the size of an audio cassette box) that can record for 4½ hours in standard definition.

Performance under realistic operating conditions and not just in a carefully controlled laboratory environment.

**Printed circuit board recycling**

NEC Corporation has developed a method for recycling printed circuit board wastes in which PCB mold residue is pulverized and separated into copper-rich powder and powder consisting of glass fiber and resin. Together with IHI Corporation and Nippon Trading Company, Ltd., NEC has found an application for the recovered glass fiber and resin powder as a high-quality filler for resin-based coating material. The recycled material outperforms conventional coating materials such as talc and carbonic acid calcium, offering double the tensile strength and half the thermal expansion rate.

In the past, most PCB wastes have ended up in landfills. It has been difficult to recycle PCB wastes because of the complex construction of the material. It includes copper in layered circuit patterns, which is hard to pulverize, and epoxy resin that is impossible to remelt. NEC's approach adopts a crushing process and a fine-pulverizing process. Each component of the PCB is selectively pulverized and gravitationally separated.
Leadership in electronics is not just a matter of designing products better and manufacturing them better, but also of marketing them better. And the sponsors of this message understand that better service to customers requires effectively involving distributors as part of their marketing teams.

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

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

In choosing your component supplier, look for the marks of leadership—availability through distribution membership in EIA.

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

Committed to the competitiveness of the American electronics producer.
THE INTERNET, LITTLE MORE THAN an academic network only a few years ago, is quickly becoming a global information resource for both companies and individuals. With the explosive growth of Internet service providers and bundled packages of software and documentation, getting online is now faster and easier than ever before. This article takes you inside of the Internet, shows you how to go online, and explains the tools you need to take full advantage of what the Internet has to offer.

The Internet began as a government networking experiment in the late 1960s and has quickly evolved into a complex series of networks that extends around the world. With thousands of university, government, and private industry networks already joined together, the Internet represents an unprecedented information resource for individual computer users and businesses of all sizes. According to The Internet Society, there are already 30 million or more active Internet users—a number that is swelling by 160,000 users each month.

What is the Internet? Expressed simply—perhaps over simplified—the Internet is nothing more than a network of networks. The individual networks that make up the Internet are owned and operated by their particular university or research center, so no one really "owns" the Internet. There is no centralized authority or administration as there is with commercial online services such as CompuServe or America

The Internet is growing at an phenomenal rate. Isn't it time you got connected?
Online. Each network is totally independent.

This independence is the main reason why the Internet is so unregulated and why individual users and ordinary businesses have had so much trouble getting connected until recently. It's also the reason why the Internet can be so overwhelming to new users. The Internet offers access to thousands of networks, but unless you know what you are looking for and where it is located, you'll never find it unless you stumble upon it. New users often feel as if they're afloat on a sea of information without a compass.

The Internet had its start in the early 1970s, when the US Defense Department wanted to build a computer network that would link its network, called ARPAnet, to other radio and satellite networks. The network was intended primarily to support military research.

One of the important elements of the network design was that it had to be reliable even if its individual components weren't—for example, it had to work even in the event of a nuclear war.

Since reliability was essential, communication was intended to take place between two computers directly, without regard to the path between them. Any portion of the network could be disabled, and communication would assume one of several alternative paths to the destination. The message being sent was enclosed in a standardized “envelope” known as an internet-protocol (IP) packet. Each IP packet contained the “address” of the destination machine.

The ARPAnet project continued into the early 1980s along with the development of local-area networks (LANs). Most LAN workstations in the early 1980s ran the Unix operating system which had IP networking built-in. Organizations with their own LANs preferred to connect to the ARPAnet rather than a single time-sharing computer at their own location. Since Unix supported IP communication, a connection proved rather straightforward, although using the system on the ARPAnet required proficiency with Unix.

By the late 1980s, the National Science Foundation (NSF) built its own network (called NSFNET) which was based on ARPAnet's IP communication technology. NSFNET was designed to support five supercomputer centers located around the country. The intent was to make supercomputing resources—which previously had been available to only a few—available for university research.

All five supercomputer centers needed to be connected together, and all of the universities had to be connected to the centers as well. It would have been prohibitively expensive to connect each university to the NSFNET directly because of the cost of the required dedicated telephone lines. Instead, the NSF created regional networks which allowed each site to be connected in a daisy chain fashion, as well as allow connections for local clients. Thus, messages could be exchanged from computer to computer by passing messages back and forth along the daisy chain. This architecture was the forerunner of what we know as the Internet.

By the late 1980s, the NSFNET became overloaded. Merit Network, Inc. upgraded the NSF network and opened access to academic researchers, government organizations, and contractors. Access was also extended to other countries allied to the United States.

Today, the network built by the NSF forms the backbone of the Internet. But that backbone is joined by over 5000 regional, state, campus, and corporate networks. Links to Canada, Europe, Japan, Australia, Central America, and South America are now operational.

Like all government works, use of the Internet for “personal gain” has largely been prohibited. However, commercial organizations see the Internet as a very viable outlet for selling goods and services. By 1992, restrictions on the commercial use of the Internet were revoked. Today, there are actually more commercial sites using the Internet than educational and research organizations. That trend will almost certainly continue as more users and businesses come online.

Why use the Internet?

The size and scope of the Internet is truly impressive, but what's in it for you? The Inter-
net's resources are staggering but, unless you have a specific need, there is a great deal of information that you will probably never use. However, there are four compelling activities that virtually any reader of *Electronics Now* can benefit from: E-mail, Usenet news, file transfers, and information browsing.

**E-mail.** Electronic mail or E-mail allows you to exchange messages with anyone on the Internet. That includes any system with an Internet gateway, such as CompuServe, America Online, and even many computer bulletin-board systems (BBS). E-mail is typically much faster—and generally much cheaper—than traditional mail.

Many manufacturers are starting to use the Internet as the forum of choice for national and international tech-support. As a result, your product questions and problems can typically be answered with less frustration from "time-on-hold" on a telephone call. There is little doubt that "live" tech-support is fading fast as manufacturers try to reduce their load of clogged telephone lines.

**Usenet newsgroups.** There is an incredible variety of electronic discussion groups (or Usenet news groups) available on the Internet. Topics range from the mundane to the bizarre. By "subscribing" to each news group of interest, you can stay in touch with the very latest discussions, opinions, and happenings.

An alternative to the news group is the mail list which echoes copies of pertinent E-mail to all members of the particular list(s). This allows you to keep abreast of the latest news and information in areas that interest you. Like news groups, there are a wide variety of mail lists available on the Internet.

**File transfer** There is a multitude of files and utilities available on the Internet in the form of shareware and freeware. Using file transfer protocol (FTP) utilities, you are able to retrieve or upload files from a computer in Tokyo as easily as you could from a computer in the next room or down the street—it really doesn't matter where the other computer is located.

**Information.** As an Internet user, you will find everything from weather reports and space photographs to government databases. Traditionally, the problem has been knowing what's available and knowing where to find it. There are few accurate guides to Internet resources—there is simply too much change and growth.

Fortunately, there are a growing number of utilities that make it possible to navigate easily through Internet resources in order to find what is available. Browsing tools allow you to traverse from system to system and review their offerings in a matter of moments.

**How to Connect**

Connecting to the Internet has always been somewhat of a chore. This was due in part to the lack of central authority, and in part to the lack of personal computers powerful enough to interact with the Internet effectively. Only a few years ago, getting an Internet account was a matter of who you knew. It typically required a mainframe and network at a university or research organization before an Internet connection could be established. Then, individual accounts were distributed as needed to students, educators, researchers—whatever a good reason to be online.

Even as PCs and operating systems became powerful enough to "stand alone" on Internet, the problem was where to connect. This later problem has largely been resolved by the growth of local Internet service providers who have their networks connected to the Internet, and sell access on their networks to individuals, businesses, and other networks.

You can't simply splice a cable and wind up with Internet access. An Internet service provider therefore becomes a valuable friend and ally. Remember that the Internet is not centrally managed, so there is no one place you can go to sign up. A service provider is a company which owns and operates a network which has access to the Internet. In turn, the service provider can supply you with several types of connections. The service provider charges you a fee for your connection.
If you cancel your membership during the first 3 months, you'll receive a full refund. You can change your selection, do nothing and receive our latest bulletin. You can return any book you don't want within 10 days. This offer is good in the U.S. and Canada, except Quebec, for member residents only. Your order is subject to acceptance by MCGRAW HILL, INC., Blue Ridge Summit, PA 17294-0810.

As a member of the Electronics Book Club . . . you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off of regular publishers' prices. If you want the Main Selection, do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. And you'll be eligible for FREE BOOKS through our Bonus Book Program. 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.

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) © 1985 EBC.

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

If coupon is missing, write to: Electronics Book Club, A Division of McGraw-Hill, Inc., Blue Ridge Summit, PA 17294-0810.

As a member of the Electronics Book Club . . .

YESS! Please 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.

- Bill me (FREE book not available with this payment option.)
- YES! I want the extra book indicated at right. My introductory payment of $4.95 plus $4.95 shipping/handling & tax is enclosed.
- Check or money order enclosed payable to: McGraw-Hill, Inc.
- Please charge my □ VISA □ MasterCard □ American Express □ Discover

Acct. # ___________________________ Exp. Date __________

Name ___________________________ Signature ________________________________

(required on all credit card orders)

Address ___________________________ 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. Canadian orders are shipped International Book Post—add $9.25 shipping/handling. A shipping/handling charge & sales tax will be added to all orders.

RE795C


www.americanradiohistory.com
(telephone line charges are separate), and a portion of those proceeds go to support the Internet as a whole.

It is important for you to remember that not all service providers are created equal. The quality, cost, and reliability of their services can vary radically between providers. Some service providers offer regional coverage, while others offer national support. Many provide service for only a local area. Since all providers are owned and managed independently, any individual provider might not suit your needs. Some are simply better than others.

Your best course is to shop around and compare the deals offered by each provider. Although some people feel more secure with a large, established national service provider, others like the cost benefits and customer service that local providers are known for.

Today, a service provider can offer three typical paths to the Internet; the direct connection, the dial-in connection, and the online service. Each path carries its share of requirements and costs, so consider your needs before proceeding.

**Direct connection.** A direct connection is clearly the most powerful and expensive form of Internet connection. In effect, you must have (or be part of) a network. You will then need a dedicated telephone line such as a 56 kilobit per second (kbps) line, or a T1 (1.5 megabits per second) line. You'll also need special hardware and software (typically purchased or leased from your service provider) to support your connection to the service provider.

A direct connection offers some distinct advantages. For example, you can set up an FTP server which allows outside individuals and organizations to access your systems. In effect, you become a tangible new part of the Internet. Commercial organizations moving to do business on the Internet often take advantage of that capability. Next, a direct connection keeps you permanently online. And third, at 56 kbps or faster, file transfers will be accomplished much faster than with a standard dial-up line.

Unfortunately, the direct connection carries a substantial cost. A dedicated connection can easily cost an organization $15,000 to $20,000 or more in the first year, and a bit less each subsequent year. A direct connection is reserved for organizations which need and can afford them.

**Dial-in connection.** As an alternative to direct connections, most service providers offer dial-in (or dial-up) connections. The dial-in connection is a medium-performance connection which requires only a PC and a modem. In general, the faster the modem, the better. The dial-in account works much like other standard online services: you dial a number to your service provider, establish a modem connection, and enjoy your Internet access.

The dial-in connection can offer varying degrees of access. Many providers offer a Unix shell account, which might give you menu access to E-mail and newsgroups. Others might provide FTP and Telnet capability.

Another kind of dial-in connection is the SLIP or PPP account, which requires that you...
run software and TCP/IP drivers on your PC to match the connection type.

SLIP and PPP connections provide virtually all of the capabilities that a direct connection would, because, in essence, the connection puts your computer directly on the Internet. (With a Unix shell account, your computer is acting as a terminal of a computer that is on the Internet.) With a SLIP or PPP account, your connection is active only while the modem connection is established. Thus, the cost is only a per-hour connect fee (usually under $100 for 80 hours/month of service). If you are making a toll call for access, you can expect to pay a toll fee as well. Even with toll charges, a dial-in connection is the preferred type of Internet access for individuals and many small businesses.

Most service providers can easily support SLIP accounts, and much of the bundled software out there is written for SLIP operation. PPP is a slightly newer and more effective protocol, but fewer service providers support it, and less of the available software is designed to take advantage of it.

Dial-in connections are greatly simplified by the trend toward "bundleing" Internet access software and TCP/IP drivers with reference books. There are a number of good starter bundles out there; the one discussed here is the Internet Membership Kit from Ventana Press. Although its Chameleon Sampler software was not the simplest software to configure, it has everything needed to go online.

Even if you choose to buy a different bundle, the requirements and the process is generally the same. The PC itself should be based on a 386 or faster CPU, and it should have four megabytes or more of RAM, DOS 5.0 or later, Windows 3.1 or later, and at least 10MB of available hard drive space.

The steps to getting connected are:
1) Install the bundled software under Windows.
2) Choose a service provider—
3) Call the chosen provider by phone or BBS to establish the account.
4) Wait a day or two for the ac-

INTERNET GLOSSARY

Archie—A system used for locating files stored on FTP servers.
Backbone—The main supporting network infrastructure which composes the Internet.
Finger—A software feature used to determine if another particular user is logged onto the Internet, and can be used to find E-mail addresses.
FTP (File Transfer Protocol)—A protocol that describes the transfer of files between a host and remote computer.
Gopher—An Internet search tool (a "browser") that presents information as a hierarchy of menus or table of contents.
IP (Internet Protocol)—A standard protocol that describes how packets of data are transported across the Internet and interpreted as a message.
News group—A forum or conference area (similar to a BBS or other online service) where you can post messages on a specific topic.
NNTP (Network News Transport Protocol)—An extension of TCP/IP which describes how news group messages are transported between various compatible servers.
PING (Packet Internet Gopher)—A TCP/IP utility that simply sends packets of information to another computer on the Internet - this can be used to determine if a certain computer is connected.
Protocol—A set of rules or standards that describe operational characteristics.
Router—A combination of hardware and software that directs messages between LANs.
SLIP/PPP (Serial Line IP/Point-to-Point Protocol)—Two popular protocols that allow dial-in access to the Internet through a serial (modem) link.
SMTP (Simple Mail Transfer Protocol)—The TCP/IP protocol that defines how E-mail moves between host and user systems.
TCP/IP (Transmission Control Protocol/Internet Protocol)—A complete combination of network and transport protocols that allow a PC to interact with other PCs or networks on the Internet.
Telnet—A terminal emulation program that allows you to access other computers on the Internet in an interactive fashion.
Usenet—The full complement of newsgroups available on the Internet.
Veronica—A browsing tool (similar to Archie or Gopher) that searches the text appearing in Gopher menus.
WAIS (Wide Area Information Server)—Software to index large text files. It also finds and retrieves documents based on user-defined keywords.
WHIOS—A TCP/IP utility that allows you query various servers about other Internet users.
Winsock (Windows Socket)—A Windows API that lets Windows applications run on a TCP/IP network.
WWW (World-Wide Web)—A network of servers using hypertext links to find and access files - many servers offer sound and video support.
count to be activated.
5) Configure the bundled software and start your access.

Once you are finally online, you can download (or "FTP") additional shareware or freeware utilities which offer even better mail, news, or browsing capabilities.

**Online services**

Of course, there are quite a few readers who don't need or want all of the services offered on the Internet. An online service such as CompuServe, America Online, or Delphi already serves most of their needs. If you already subscribe to an online service or high-end bulletin board service (BBS), you also have limited access to the Internet—the number and quality of the services that are offered depend on the particular service, and the price varies as well. Contact the customer service department of your preferred online service for a breakdown of their available Internet services.

**Addressing and naming**

Of all the subtle complexities of the Internet, few evoke more frustration and confusion among new users than naming conventions. On the surface, that collection of numbers and nonsense words may seem arcane or even random. But there is a method to the madness.

Each computer connected to the Internet has two addresses; an IP address, and a domain name. The IP address is a series of four numbers (each less than 256) which are separated by periods. For example, a typical IP address might look like: 134.84.101.1. For the most part, you do not have to concern yourself with remembering IP addresses—just the domain name.

There are actually several types of names involved in the naming process; the user name, the domain name, and the top domain name. The user name is the alphanumeric string that identifies you as an individual. A user name can be completely arcane (such as axc13ex), but if you are in a position to choose your own user name, pick one that will be meaningful to you and the people who will be sending you E-mail. For example, my user name, sbigelow, is based on my real name.

The domain name generally refers to the supporting network (or service provider) that your computer is connected to, and is separated into two parts; the domain name itself, followed by a three-character top domain name. For my account, the domain name would be cerfnet, and the top domain would be com. Taken together, my Internet name is sbigelow@cerfnet.com. 

The term right after the @ symbol is the computer's name (rabbit), and the top domain name (edu) identifies the address as an educational institution. The string "oit" represents Office of Information and Technology, while the string "unc" indicates the University of North Carolina. Unfortunately, you might not know that by simply looking at the symbols. What this means for you is that not all addresses are self-explanatory.

You can tell a bit about the type of domain from looking at the top domain name. The three character code explains what type of organization the domain represents. There are six top domain names that are generally used in the United States: com—a commercial business or organization; edu—an educational institution such as a college or university; gov—a government department or organization; mil—a military installation or organization; net—network resources; and the infrastructure org—typically a non-profit or other organization.

For users outside of the US, the top domain name is a two character country code. Such geographic addressing is also used in the U.S., in which case an address might look something like: user@well.sf.ca.us.

**Tools of the trade**

Once you are finally online with a dedicated or dial-in connection, you will be faced with the challenges of exploring the Internet. Over the years, a variety of tools have developed to serve each individual function. Let's assume that you're an individual user who has purchased bundled software and documentation.

The tools that come with your bundled software are certainly useful and functional, but few packages contain the full-blown versions of those tools. This means that while you'll be able to perform a variety of functions, you probably can not take full advantage of the Internet. At the very least, a bundled software package will offer five working areas:

The TCP/IP stack. This is a vital background utility which allows your Windows PC to communicate with your service provider through standard TCP/IP. The TCP/IP stack is typically loaded before dialing your service provider, and unloads after the connection is severed. Without this function, your individual dial-in connection would not work.

E-mail utility. Virtually all bundled Internet software offers an E-mail utility which allows you to retrieve and create your own E-mail. Mail utilities vary in quality and efficiency, but they get the job done.

FTP utility. Part of the power of the Internet is your ability to get into other computers around the world to upload or download files. Software bundles typically provide a basic FTP utility. Using FTP, you can download articles, electronic books, and other more powerful Internet utilities.

Continued on page 88
THE VIDEO REVOLUTION IS IN FULL swing, capturing the world in sound and action. The still camera has been capturing treasured moments for more than a century. Both cross paths in this video inverter project which lets you view positive, color-corrected photographic images on a video monitor.

Have you ever held a color negative up to a light and tried to view it? It’s difficult to identify the picture, let alone judge its photographic merit. But if you use the macro setting on your camcorder to focus on a back-lit photographic negative, the video inverter presented here will let you see a positive, color-corrected image on a TV screen or video monitor. Illumination is provided by a small commercially available light box or you can improvise one with a fluorescent bulb. A set of inexpensive plastic filters between the light source and the negative let you maintain color balance for

various film types, lighting conditions, and personal taste.

The video inverter lets you run your own mini photo lab. You can look at your negatives on-screen and crop them to obtain the best composition. A TV screen will show you how an actual enlargement might look. You can experiment with exposure and color balance to fine-tune the mood of the picture. You can also record your favorite still shots on videotape for easy group viewing.

The video inverter can also save you money. Say, for example, that you return from vacation with five rolls of film to be developed. At $5 to $15 per roll for standard prints, your bill could add up to as much as $75. But if you have a video inverter and a camcorder, just tell the photo lab that all you need is developed negatives. which should cost only about $15 for all five rolls. Then you can view the negatives on a TV screen and choose only the shots you want to be printed by the photo lab—or make a video tape of them and forget about the prints! If you have your own darkroom, you can use the video inverter to preview color or black and white negatives before printing.

How it works
As you probably already know, a photographic negative is dark where the resulting print will be light and, conversely, the negative is light where the print will be dark. This is very straightforward for black-and-white negatives, but a little bit more complicated for color negatives. The principle of opposite color values is used to impress color on negative film. If you place red, magenta, blue, cyan, green, and yellow at equidistant points on a circle as shown in Fig. 1, the color on a negative will be exactly opposite that of the color print on the color wheel. For ex-

JOSEPH L. SOUSA
color negative is that the photographic emulsion is suspended on a brown plastic film. The brown hue varies from orangy-brick to purplish or gray-green, depending on the manufacturer of the film. To recreate the original positive image from a negative, as is done routinely in the photographic print making process, one must invert light and dark, exchange each color value for the opposite value, and neutralize the brown hue of the negative.

The video signal

The NTSC RS-170 video signal carries luminance and chrominance information along with synchronization signals. The luminance part of the video signal carries information about the light and dark areas of the picture. The chrominance part—3.58 MHz color subcarriers—carries hue information and color saturation information. The hue is determined by the subcarrier's amplitude, and the saturation is determined by its phase. The vertical- and horizontal-sync pulses mark the beginning of each picture frame and each line, respectively.

The colorburst contains eight cycles of a 3.58-MHz sinewave that acts as a reference to allow demodulation of the chrominance signal. The phase difference between the chrominance signal and the colorburst determines the hue.

The circuit inverts the luminance and chrominance signals in the NTSC output from a camcorder, as shown in Fig. 2. How-

Fig. 1—This color circle, or color wheel, shows the different colors that are the opposites.

Fig. 2—By inverting the NTSC video signal, photographic negatives can be viewed as positives on a TV screen.
FIG. 3—SCHEMATIC DIAGRAM OF VIDEO INVERTER. The circuit is based on an LM359 dual Norton op-amp and an LM339 quad voltage comparator.

PARTS LIST

All resistors are %1-watt, 5%
R1, R5—10,000 ohms
R2—2200 ohms
R3—4700 ohms
R4—220,000 ohms
R6, R13, R14, R16—1000 ohms
R7—4700 ohms, trimmer potentiometer
R8—33,000 ohms
R9—8200 ohms
R10—47,000 ohms
R11—150 ohms
R12, R17—75 ohms
R15—22,000 ohms

Capacitors
C1, C4—10 µF, electrolytic
C2—100 pF, ceramic
C3—1 pF, ceramic
C5, C6—0.01 µF, ceramic

Semiconductors
IC1—LM359N Norton op-amp (National Semiconductor or equiv.)
IC2—LM339N quad comparator (National Semiconductor or equiv.)
IC3—78L05 5-volt regulator
D1–D4—1N4148 switching diode

Other components
S1—DPDT miniature toggle switch
J1, J2—male/female RCA jacks and shielded cable (see text)

Miscellaneous: Case (Radio Shack 270-293), 9-volt battery clip, 9-volt battery or battery eliminator (Radio Shack 273-1552), mini light box (Letraset Mini-Pro), Roscolux plastic filters (Edmund Scientific N39,417), PC board, wire, solder

ORDERING INFORMATION
- A single-sided PC board is available for $15.00 from Joseph L. Sousa, 38 Cornish St., Lawrence, MA 01841-1226. Check or money order, only.
- A Letraset Mini-Pro light box is available from Charette, 31 Olympia Ave., Woburn, MA 01888, 617-935-6000
- A similar, compact light box is available for $19.95 + S&H from Visual Horizons, 181 Metro Park, Rochester, NY 14623-2666, 716-424-5300, Fax 716-424-5313

However, it leaves the vertical sync, horizontal sync and colorburst uninvetered.

A blue roscolux plastic filter between the negative and the light source is usually required to neutralize the brown tint in the negative and adjust for proper color balance. However, some video cameras have a manual white-balance control that can achieve good color balance without the filters.

Properly decoding an NTSC video signal without loosing potential image resolution is challenging because the luminance frequency spectrum overlaps and interleaves with the chrominance spectrum. All of the video inverter's processing is done without splitting the luminance and chrominance into separate signals to avoid any loss of resolution. The blue plastic filters eliminate the need to demodulate and potentially degrade the NTSC video signal.
Circuit details

The video inverter circuit, shown in Fig. 3, is based on an LM359 dual Norton op-amp and an LM339 quad voltage comparator. Those two ICs handle DC restoration, sync detection and processing, and buffering and inversion of the video signal. The DC level of the video signal is restored to 0.7 volt because the inputs of IC1-b operate at one diode voltage drop above ground. Diodes D1 and D3 charge the positive side of C1 to keep the bottom of the sync pulses at +0.7 volt, and D2 limits the maximum output of IC2-a at pin 2 to +1 volt.

Comparator IC2-b acts as a threshold detector set to detect sync pulses 300 millivolts above the restored DC level of 0.7 volt. Components C2 and R4 stretch the detected 4-microsecond sync pulses to 8 microseconds to include the duration of 8 cycles of 3.58 MHz color burst after the input sync pulse. Comparators IC2-c and -d buffer the stretched sync pulse with open-collector outputs at pins 13 and 14 to gate the buffer/inverter action of the main amplifier IC1-a.

Resistor R3 sets the gain of the inverting input of the main video amplifier IC1-a to 2 \( (\frac{R1}{R3} = -2 \times) \), while R4 sets the gain of the non-inverting input of IC1-a to 4 \( (\frac{R1}{R4} = 4 \times) \). These two inputs combine to achieve an overall gain of +2 \( x \) as a buffer or -2 \( x \) as an inverter. During sync and colorburst portions of the input signal, IC2-c and -d outputs are open and the overall gain is +2. The rest of the time a low at the output of IC2-d (pin 14) short circuits the non inverting +4 \( x \) signal path for an overall gain of -2 \( x \), while a low at IC2-c pin 13 injects the necessary offset in the inverted video signal to keep it above the black level. Potentiometer R7 adjusts the black level at the output to correspond to the peak white level in the negative. Resistor R12 matches the output for 75 ohms.

A 78L05 regulator (IC3) provides a stable 5-volt supply from a 9-volt battery or AC adapter. With a current drain of about 30 milliamperes, a 9-volt alkaline battery should last about 10 hours. The 78L05 will output a steady 5 volts until the battery drops to 7 volts. At that point the image colors will start washing out before the circuit stops working completely. Switch S1 turns power on and off, and also bypasses the input video signal around the video inverter circuit when it's turned off.
The camcorder must be set to its macro setting and placed right in front of the negative. The camcorder should be free to move back and forth to obtain the best composition.

Wear cotton gloves intended for photographic use to handle the negatives to avoid leaving fingerprints.

If your camcorder has a manual white balance control try using it to remove the blue cast that the inverted color negative will produce on the video screen. If the white balance control doesn’t do a good enough job, use the Roscolux filters. The right filter choice requires some experimentation. If the image is too blue, add a blue filter. If the image is too red, lighten the blue filter. If the greens are weak and the image is too purple, add a purple filter. It seems paradoxical, but if there is too much of one color on the video screen, you must add more of that color to the negative. Use the less saturated, lighter filters, such as the No. 848, No. 849, No. 850, No. 842, No. 804, and No. 825 filters. In various combinations, those Roscolux filters are most useful for viewing negatives from different types of color film.

Set the color, tint, brightness, and contrast controls on the TV or video monitor for normal viewing before using the video inverter. You can tweak them to achieve the best image afterwards. If your TV set decodes the vertical interval reference (VIR) signal that is normally broadcast by networks and TV stations, be sure to turn the VIR switch off while you are using the video inverter.

---

**Construction**

For best performance, build the video inverter on a PC board. A foil pattern is provided here if you want to make your own board, or you can purchase one from the source given in the Parts List. The PC board was designed to fit in a particular case (see Parts List) without the need for screws. The case contains a compartment for a 9-volt battery. You can use the mounting holes on the board if you choose a different case.

Figure 4 is the parts-placement diagram for the PC board. First install the three ICs, followed by polarized capacitors, diodes, and then the rest of the components. Before connecting the cables, inspect the board for solder bridges, especially between the pins of ICs. Installing the 9-volt battery clip lets you use either a 9-volt battery or a 9-volt battery eliminator.

Drill a 3/16-inch hole on the front panel for the power switch. Locate the hole 3/4-inch from the bottom of the panel so that the switch won’t interfere with the PC board. Place a small piece of cardboard between the bottom of the PC board and the cable connections to S1 to avoid short circuits.

Input jack J1 is a male RCA plug connected to the end of a shielded cable. This will connect directly to the video output of a camcorder. The output jack J2 can be either a female RCA jack to connect to a camcorder’s RF modulator, or another male RCA jack to connect directly to a video monitor or VCR; either should be connected to the board by a length of shielded cable. A convenient way to simplify wiring the jacks is to buy a ready-made 3-foot patch cord with your choice of jack and plug on each end and cut it in half. Then solder the cut ends to the inverter circuit. You must also drill holes in the case’s front panel to pass the input and output cables through. Figure 5 shows the board seated in the case, and Fig. 6 shows the assembly all buttoned up.

**Test and adjustment**

Before you close-up the case, you must adjust R7 for the proper black level of the inverted video signal. The best way to make this adjustment is to apply power to the video inverter with the input and output cables unconnected, and then adjust R7 for a reading of 1.9 volts at J2. If you don’t have a voltmeter, set R7 about midway. Then, once the inverter is connected to a camcorder, finely adjust R7 to make the black parts of the picture look right. The schematic diagram in Fig. 3 shows several DC voltage readings taken with the input and output cables unconnected. You can use them to help troubleshoot the circuit.

To view negatives, set a small light box vertically in front of the video camera, and hold the negative to the box with a piece of clear acetate. Cover the area over the light box that is not used to view the negative with aluminum foil to reduce glare and reflect as much light as possible through the negative. The Roscolux filters measure 1 1/2 × 3 3/4 inches and are just big enough for a 35 mm negative.

The camcorder will decode the vertical interval reference (VIR) signal that is normally broadcast by networks and TV stations, be sure to turn the VIR switch off while you are using the video inverter.

---

**FIG. 6—COMPLETED VIDEO INVERTER.** This compact unit connects directly to other video equipment.
The first television systems, cumbersome, short-range contraptions that sent pulses over wires, were more akin to facsimile than modern TV.

Television, because of its relatively recent public appearance, is commonly believed to be a younger spinoff of radio. However, its actual beginnings date from the middle of the last century, about the same time that Samuel F. B. Morse invented the telegraph, and this was 30 years before Alexander Graham Bell invented the telephone.

Nearly a century before television became a practical reality in 1923, it was known that sound waves could be transmitted as modulated electric currents in wires and that electromagnetic waves could be transmitted without wires. So it didn't seem too far-fetched for some visionaries to believe that images could somehow be converted into electrical impulses and sent to distant receivers.

Television as it exists today owes an immense debt to many famous inventors as well as many unsung scientists, experimenters, and tinkerers who contributed to the telegraph, the telephone, radio transmission, moving pictures, and vacuum tubes. The technology has been inexorably intertwined.

What most of us consider as modern television was demonstrated successfully before the invention of electronic scanning and the camera and picture tubes, but not before the invention of the radio and cathode-ray tubes. The object to be televised was scanned mechanically, and the received televised image was either viewed directly or projected onto a moving picture screen.

Lost in history

If you are willing to accept that the transmission of still pictures (even crude ones) and text over wires was early television, then television preceded radio. However, if you insist that television be defined as the transmission and reception of moving images by cable or broadcast through space, then radio came first. However, this discussion is about the roots of television by whatever name you choose to call it.

Most radio amateurs, and science history buffs can name the most famous inventors in the field of radio. These include Edison, Fleming, de Forest, and Armstrong. But even they might be hard pressed to name even one or two of television's largely unrecognized pioneers.

However, before identifying some of the television's pioneers, it's worth reviewing the physical and physiological basis for television reception.

Tricking the brain

A fundamental property of the human eye is persistence—the ability of the eye to hold onto an image for milliseconds after the image has changed. This effect permits us to see both moving pictures and television. If a series of nearly identical cartoons or pictures that differ only in minor details are flipped rapidly in front of you, the image will appear to move. As the pages snap by, you might perceive an athlete jumping over a hurdle or a horse galloping around a racetrack.

The early television pioneers were aware of this characteristic. They recognized that all picture elements do not have to be transmitted simultaneously. If they are transmitted in a sequence that is rapid enough, the eyes will assemble them into a complete picture. The pioneers knew that persistence of vision permits us to see movies.

For this reason, if all television picture elements are transmitted at the same time, the speed must be fast enough for the eye to retain the impression of the first picture element before the last one arrives. In this way, the illusion of simultaneous transmission is achieved.

To obtain the desired result,
the image must be broken down into successive points of light and dark or as a mosaic of picture elements or pixels. This has become possible because of the invention of different methods for object scanning. The elements of the mosaic are translated into electrical impulses in successive rows of elements called lines. The closer together these scanning lines are, the higher will be the definition of the picture.

The succession of lines that form a picture is called a frame, and the number of frames per second is the repetition rate. Thus, persistence of vision combined with a frame rate that exceeds the human eye's flicker rate (about 30 frames per second) are both necessary for viewing television.

**Morse's contribution**

Samuel F.B. Morse, a portrait painter, established the basic principles of all electromagnetic communications when he demonstrated his telegraph system in 1844. Although the discovery that electric current flows through a wire had been made earlier, it was Morse who first demonstrated that messages could be transmitted by interrupting that current to form a series of long and short pulses or dots and dashes.

With a battery (later voltage from a central station), a sending key, a receiver that would make a noise, and a connecting wire, the first telegraph system was assembled. The key activated the sounder's electromagnet, and the electromagnet then caused the sounder to make an audible click. The telegraph inspired many investigators to believe that if messages could be transmitted over wires, pictures could also be transmitted.

**Facsimile shows up**

One of the first television researchers, English physicist Alexander Bain, built apparatus that could transmit characters and words over wire in 1842. This apparatus, shown in Fig. 1, was a crude version of a facsimile machine. It depended on embossed metal type, similar to that used for printing newspapers, and metal brushes which moved horizontally across chemically treated paper in contact with the type.

The chemically treated paper conducted current that darkened the paper as it passed from the brush to the embossed metal typeface underneath. A character pattern of the underlying letter was formed on the paper, and the signal was then sent over a bundle of wires to an identical setup at the receiver that reformatted the letters.

The difficulty with Bain's system was that the brushes at the receiver had to be synchronized with those at the transmitter. This was not easy to accomplish with the technology available at that time. But Bain succeeded in demonstrating a practical way to scan characters line-by-line and transmit words and text or graphics, a technique that is fundamental to modern television.

In 1847, another inventor named Bakewell improved on Bain's machine, as shown in Fig. 2. Bakewell replaced the bundle of wires that connected the transmitter and receiver with a single wire. Then, instead of scanning a flat surface, he set up a pair of cylinders that revolved synchronously.

A drum with tin foil wrapped on it was located at the transmitter end. A picture to be transmitted was painted on the foil with shellac. When needle N1 contacted the foil, it closed the circuit permitting a current to flow to needle N2 at the receiver. However, when needle N1 moved over the shellac drawing, no current flowed.

The real significance of Bakewell's apparatus was in its ability to demonstrate automatic signal switching and scanning, not in its ability to transmit a picture over a wire. Mechanical linkage connected both cylinders so they turned at the same speed, eliminating the difficulty in synchronizing the brushes Bain invented. Synchronized transmitted and received signals is another requirement for modern television. Unfortunately, the mechanical linkage limited the distance between transmitter and receiver to distances measured in feet.

Bakewell's apparatus had another serious handicap: The image at the receiver was not only monochrome, but it was monotone as well. The apparatus did not make possible gray shades or tone gradations from black to white. The signal transmitted on the wire conductor from the transmitter to the receiver consisted only of pulses of uniform amplitude. The only difference between pulses was in their duty cycle (ratio of on-to-off time), not strength.

Many researchers attempted to improve on what Bain and Bakewell had done. In 1865, two

---

**Fig. 1—BAIN'S FACSIMILE MACHINE.** Chemically-treated paper darkened where current from brushes contacted embossed metal type in 1842.
FIG. 2—BAKEWELL'S SYSTEM had tin-foil covered revolving drums for transmitting and receiving recorded pictures in 1847.

FIG. 3—THOMAS EDISON experimented with sending letters and words punched in tape by telegraph in 1873.

FIG. 4—MIMAULT IMPROVED LETTER definition by increasing the number of metal brushes to 49.

researchers. Vavin and Fribourg, introduced punched tape. The holes in the tape allowed the metal brushes to make contact with an underlying metal roller, permitting a flow of current. The hitch here was that the reproduced images were discontinuous, making the system unsuitable for transmitting complete pictures.

Thomas Edison began experimenting with punched tape in 1873, as shown in Fig. 3. Years later, punched-tape found its way into Teletype machines as a data-storage medium. Paper tape was also the storage media for numerically controlled machines. Data was first obtained with wire brushes making electrical contact through holes in the paper tape, but later the brushes were replaced by solid-state optocouplers.

Another television pioneer, a Frenchman named Mimault, also used chemically-treated paper for receiving signals with as many as 49 metal pins for scanning. Figure 4 shows how Mimault transmitted the letter "T." M. Abbe Caselli, a French engineer, transmitted drawings and diagrams electrically over wires in 1862. Caselli's system improved over the apparatus of both Bain and Bakewell, but it was more than just a laboratory curiosity. It actually transmitted signals between Paris and Amiens in France for several years.

Even after the beginning of the 20th century, inventors were still hard at work trying to devise ever more practical wire transmission systems. One of these was the TelAutograph, an apparatus for transmitting writing and pictures. It produced facsimiles at the receiving end with an electrically controlled pen that made the same motions as the transmitting pen. Another system, TelePantagraph, could transmit drawings over long distances by telegraphy.

Selenium contribution

Selenium has a place in this discussion because it was prominent in early television experiments. It was also the first semiconductor material to be used commercially, well before the invention of transistors. Although discovered in 1820, 56 years passed before it was discovered that selenium exhibited high sensitivity to light. This finding was exploited by the early pioneers who wanted to convert light energy to an electrical signal.

Selenium is still found in photoconductive cells, photodetector light meters, and in the light-sensitive coating on the drums of xerographic copying machines and laser printers. The layer of selenium on the drums is electrostatically charged and then preferentially discharged by intense selective illumination.

The electrostatic image is transmitted to paper by dusting a plate with fine black or colored toner powder and then the image is "ironed" on the paper. Selenium rectifiers were popular
replacements for rectifier tubes in the years before the introduction of silicon rectifiers and transistors.

A French inventor named M. Senlecq developed a system called the Telectroscope in 1877. The image to be transmitted was reflected onto the ground glass plate of a camera obscura. That image was then traced, line-by-line, with a fine-pointed selenium stylus. The current flowing from the transmitter to the receiver depended on the amount of light present at each tiny spot. This was the first system that received a picture consisting of variations in light level.

In 1880, Ayrton (the inventor of the Ayrton shunt), Perry, and Professor Kerr (inventor of the Kerr cell) proposed a television system based on selenium cells. Their arrangement consisted of many selenium cells, each containing multiple wires. Each of the cells contributed a small amount of current, and total current flow depended on the light reaching it. In effect, the system formed a mosaic. Many years later the mosaic concept would be adopted for the iconoscope camera tube.

The Ayrton-Perry-Kerr television system was interconnected with a large number of wires. At the receiver, a corresponding number of magnetic needles moved, permitting light of varying intensity to pass through an equal number of apertures. Kerr also developed a receiver based on electromagnets with silvered ends illuminated by a polarized beam of light. The currents flowing through the electromagnets rotated the plane of polarization as a function of the light received at any given moment.

The ability of selenium to change light energy to an electrical signal was inhibited by the crudeness of the early mechanical scanning systems. This disparity led many inventors to attempt improvement breakthroughs. Although the names of many of these inventors have been lost in the dustbin of history, Alexander Graham Bell took out a patent for a television system that included selenium components.

In 1880, a Boston inventor, named G.R. Carey, developed a system for transmitting the signal equivalents of picture elements simultaneously by setting up a separate channel for each picture element. His transmitter was a disk with holes drilled around the periphery, as shown in Fig. 5. Each hole contained a selenium element connected to a transmission wire.

As an image was focused on this disk, it was broken up into as many picture elements as there were holes in the disk. Carey deserves credit as the inventor of the multichannel transmission system.

Light entered the right side of the cylinder where it activated many selenium cells. The electrical output of all of the cells was then brought out by individual wires to a sheet of chemically treated paper. The current in each wire altered the composition of the paper to produce a reproduction of the subject. Each of the selenium cells effectively corresponded with picture elements or pixels.

An inventor named De Bernouchi invented apparatus that eliminated the multiple wires. Figure 6 is a drawing of the apparatus. A light source (shown at the left) was focused by a lens onto a drum, around which was wrapped photographic film. The light from the film, varying in strength and dependent on light and dark areas of the film, was reflected by a prism onto a selenium cell, varying its resistance value.

The selenium circuit consisted of the selenium cells, a DC voltage source, and the primary (P) of a transformer. The signal appearing across the secondary (S) of the transformer modulated the light produced by an arc lamp, a source of high-intensity light. The light reflected from a parabolic reflector onto a mirror before it passed through a lens onto a drum coated with a photosensitive material.

**Mechanical scanning invented**

In 1883, Paul Nipkow, a German television pioneer, invented the perforated spiral distributing disk or mechanical scanner. His electrical telescope was notable as the first successful method for scanning moving images. It remained in use through the late 1920s, but eventually was replaced by electronic scanning in the 1930s.

A series of perforations was arranged in a spiral pattern around the peripheries of iden-
tical disks. One transmitted the picture elements and the other received them, as is shown in Fig. 7. Each hole in the disk passed in front of an aperture in succession as the disk revolved. This arrangement permitted moving pictures to be sent over wires and broadcast by radio.

Unfortunately, Nipkow was ahead of his time because neither light-sensitive cells, photoelectric cells, vacuum tubes, nor cathode-ray tubes had been invented. Moreover, there was no wireless in 1884 when Nipkow was granted his patent. The work of Hertz and Marconi was yet to be done.

Transmission by radio

Morse inaugurated his telegraph system in 1844, 40 years before Heinrich Hertz, a German scientist, built his experimental apparatus that first transmitted feeble radio signals generated by man through space. Hertz carried out his landmark experiments in radio wave transmission with an oscillator as a crude transmitter and a detector forming a crude receiver. He confirmed the theory proposed by the English physicist, Clerk Maxwell, that radio waves differ from light waves only in wavelength and frequency.

But it remained for Guglielmo Marconi, an Italian engineer, to pick up where Hertz left off and startle the world with practical radio transmission. And he did it without vacuum tubes! Marconi built an induction coil and an oscillator which he connected to an antenna, permitting him to generate and radiate far stronger modulated electromagnetic waves than Hertz could produce.

With a similar receiving antenna and a crude receiver, Marconi was soon transmitting and receiving Morse code signals over distances of hundreds of feet. By 1895 he was transmitting over distances of miles, and on December 12, 1901 he received coded signals in Newfoundland sent from his transmitter in Cornwall, England, 2,170 miles away.

Some 30 years passed from the inauguration of Morse’s telegraph until Alexander Graham Bell, a Scottish-American speech professor and teacher of the deaf, accidentally stumbled on the apparatus that would later become the telephone. However, it took Bell nearly another year of diligent experimentation before he was able to improve his apparatus enough so that his assistant, Thomas Watson, could hear him speak a clear sentence.

In 1904, Arthur Korn, a German professor of physics, transmitted photographs by wire. A photo film was placed on a revolving glass drum inside a cylinder lighted only by a small aperture. The light passed through both the film and glass. The light rays, modulated by the lights and shadows of the picture on film as the drum rotated, passed through a prism and were focused on a battery-powered selenium cell.

With this system, Professor Korn sent pictures over telephone wires from Munich to Nuremberg in 1904. In 1907 he sent wire photos from Europe to England. However, in 1922 Professor Korn achieved an important breakthrough by adapting his system to radio transmission. Figure 8 is a simplified diagram of his transmission system.

Pictures radioed by this method were in the form of half-tone groups of dots. They were received by a typewriter modified so that it printed out dots of various sizes instead of letters. A picture was radioed from Berlin to Maine in 1922 in about 40 minutes.

The Bell Telephone Laboratories improved on Professor Korn’s original invention by developing a system of phototelegraphy. It was similar to Korn’s invention, but with some important modifications: A photoelectric cell replaced the selenium cell, and the rotating cylinders were kept synchronized by electrical tuning forks.

Although the Bell Laboratories improved upon Korn’s work, the laboratories were interested only in transmitting pictures over telephone lines while Korn is credited with moving television into the realm of radio broadcasting.

John Baird, a Scottish inventor, devised a system that projected televised shadows onto a screen, and he was the first person to demonstrate television to the public in 1923. Baird’s transmitter consisted of a Nipkow disk that had 17 lenses in each of its peripheral perforations. The object to be televised was strongly illuminated and lo-

Continued on page 74
Learn how to program “smart” LED multicharacter displays with your computer.

WORKING WITH SMART DISPLAYS

CONVENTIONAL LIGHT-EMITTING DIODE display modules require peripheral devices such as ASCII decoders and drivers to drive and control them. However, later generation LED displays contain these and other functions, such as display multiplexing and character memory. This component consolidation saves circuit board space, assembly time, and cost, and it makes the newer displays compatible with and controllable by microprocessors and microcontrollers. Consequently, they are called “smart” or “intelligent” displays.

Conventional numeric and alphanumeric LED modules displays are found in a wide range of consumer appliances and entertainment products as well as business machines, medical equipment, and test equipment. These single or multi-character modules are typically priced under $5. However, the cost of a complete display system adds up when the price peripheral devices and assembly labor are included. Moreover, a multicomponent display system occupies several square inches of the circuit board’s “real estate.”

Smart or intelligent LED displays can be found in telecommunications equipment, portable telephones, bench test equipment, airborne electronics, and medical equipment. The least expensive eight-character alphanumeric LED dot-matrix modules are priced at about $40. They can display numbers, letters, and symbols in a rapid sequence to form messages under computer control. When stacked end-to-end or side-by-side they can spell out complete sentences. When packaged in familiar dual-in line cases with 0.10-inch pin spacing (pitch), the modules can be plugged into standard sockets or soldered directly to circuit boards.

The subject of this article is the HDSP211X-212X-250X series of eight-digit LED alphanumeric dot-matrix displays made by Hewlett-Packard. This article will explain how they can be programmed to present messages under the control of an IBM or compatible personal computer. In addition to providing the background and information you’ll need if you want to add a “smart” LED display to your own project, the article is a practical introduction to the subject of interfacing personal computers with external devices and circuits.

The HDSP211X-212X family

There are 11 different part numbers in the Hewlett-Packard HDSP-211X/212X/250X series Figure 1 is an outline drawing for the HDSP-211X and HDSP-212X products. (The HDSP-250X package is 2.79 inches long and each of its dot-matrix arrays are about 35% larger.) All of the displays have 28 pins in a standard DIP outline with 0.6-inch spacing between pin rows.

The characters on the HDSP-211X and HDSP-212X se-
ties are approximately 0.2 inch high while those on the HDSP-250X series are about 0.275-inch high. The on-board CMOS ICs in the HDSP-211X and HDSP-250X displays decode 128 ASCII characters while those on the HDSP-212X decode Japanese Katakana characters.

All characters are permanently stored in the device's ROM. The HDSP-211X and 212X displays can be stacked horizontally to achieve a longer display, but the HDSP-250X display outline dimensions permit them to be stacked both horizontally and vertically. Table 1 identifies the 11 part numbers in the series with respect to character size, LED color, and the ability to display either the ASCII or Katakana characters.

All displays can store 16 user-programmable symbols in onboard RAM. This feature allows the display to be customized with additional symbols and icons. Seven brightness levels permit the adjustment of display intensity and, as a consequence, power consumption. All displays in the series are designed to be compatible with standard microprocessor interface electronics and each display and its special features can be accessed through a bidirectional eight-bit bus.

For the remainder of this article, the term "display" will be refer to all of the modules in the series collectively. Caution: The displays can be damaged by electrostatic discharge (ESD) so observe standard ESD precautions when handling them.

**Demonstration system**

The display is primarily intended for installation in products that permit it to be controlled by an embedded microprocessor or microcontroller. This article explains how an IBM PC or compatible computer can be used to demonstrate the display's operation and programmability. Only a simple interface circuit and a C-language compiler are needed for the PC to control the display.

The interface circuit is built on a single PC compatible plug-in card. It contains a standard port address selector circuit and an Intel 8255A programmable peripheral interface. There is also room on the card to mount the display.

The software presented here is compatible with the Borland Turbo C++ compiler. Compilers from other publishers might require some software syntax modification for the code to operate properly.

**Port address selector**

Figure 3 is the schematic for the single circuit board on which all circuit components and display are mounted. The port address selector circuitry, the 8255A and the display were all mounted on a PR2 prototype from JDR Microdevices (2233 Samaritan Drive, San Jose, CA 95124; 1-800-538-5000).

This board consists of two sections. One has the silk-screened outline for the correct parts placement for all the components of the port address selector circuit on both sides of the card, as shown in the photograph. In addition, the card has an open matrix on holes 0.10 inch on centers for mounting and wiring the 8255A and display. The company also offers a hardware kit for the installation of the PR2.

A computer must perform three steps to send data to an external device such as the 8255A. First its I/O write line must be set to a logic low. Then the address of the destination of the data must be sent on its address lines. Finally, the computer must send that data on its data lines. In Turbo C++, the instruction that performs an I/O write is:

```c
outportb(address, data)
```

Refer to Fig 3. Whenever an outportb( ) instruction is executed, pin 15 of IC2, a 74LS244 noninverting octal three-state driver goes to logic low. The 74LS244 is a byte-wide line
driver whose enable pins are tied to ground. Consequently, it acts as a noninverting buffer and pin 5 of IC2 also goes logic low. This then causes pin 4 of IC4, (one quarter of an 74LS00 quad, two-input NAND gate) and pin 36 of IC8 (the 8255A) to go logic low. All other inputs to IC2 remain at the proper inactive levels.

Next, the address of the port to be addressed appears at the port selector circuitry. This circuitry is organized so that the port resides at a range of 300H to 303H.

When data is sent to that address, the computer places the

PARTS LIST

Resistors (%-watt, 10%)
R1, R2, R3, R4, R5—4700 ohms
R6—2200 ohms

Capacitors
C1, C2—10 nF, 63 volts, aluminum electrolytic capacitor
C3, C4, C5, C6, C7—0.1μF, ceramic disk

Semiconductors
IC1—74LS245, noninverting octal bus transceiver
IC2, IC3—74LS244, noninverting octal 3-state driver
IC4—74LS00, quad 2-input NAND Gate
IC5—74LS138, 1 of 8 decoder/demultiplexer
IC6—74LS85, 4-bit magnitude comparator
IC7—74LS08, quad 2-input AND gate
IC8—8255A programmable peripheral interface, Intel or equivalent
IC9—HDSP-211X eight character alphanumeric LED display, Hewlett-Packard or equivalent

Other components
S1—switch, four-position, dual-in-line, PCB mount
Miscellaneous: eight-bit prototype card (see text); parts kit for prototype card (see text); header pins for wire wrapping (1 x 20, straight male); socket, 40-pin wire-wrap; socket, 28-pin wire-wrap, hookup wire, solder.

Note: The following items are available from Staletto Solutions, 484 McCamish Avenue, San Jose, CA 95123.

- Computer disk containing complete article source code listings including two menu driven HDSP-211X demonstration programs and source code—$7.50
- Assembled and tested circuit on a prototype card (8255A and HDSP-211X not included)—$75.00.
Items 1 and 2—$100.00 Send check or money order. Add $2.50 for shipping and handling. California residents add local sales tax.

FIG. 2—ASCII CHARACTER SET for HDSP-211X and HDSP-250X series of LED alphanumeric displays.

![Character Set Diagram]

TABLE 2
HEADER TO 8225 PIN CONNECTIONS

<table>
<thead>
<tr>
<th>FROM: Header Pin</th>
<th>TO: 8255A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data D0*</td>
<td>34</td>
</tr>
<tr>
<td>Data D1*</td>
<td>33</td>
</tr>
<tr>
<td>Data D2*</td>
<td>32</td>
</tr>
<tr>
<td>Data D3*</td>
<td>31</td>
</tr>
<tr>
<td>Data D4*</td>
<td>30</td>
</tr>
<tr>
<td>Data D5*</td>
<td>29</td>
</tr>
<tr>
<td>Data D6*</td>
<td>28</td>
</tr>
<tr>
<td>Data D7*</td>
<td>27</td>
</tr>
<tr>
<td>i/O IOR</td>
<td>5</td>
</tr>
<tr>
<td>i/O IOW</td>
<td>36</td>
</tr>
<tr>
<td>Select 0</td>
<td>6</td>
</tr>
<tr>
<td>Address A0*</td>
<td>9</td>
</tr>
<tr>
<td>Address A1*</td>
<td>8</td>
</tr>
</tbody>
</table>

*Buffered

Binary code 1100000000 on its address lines A0 to A9 where A9 is the most significant bit (300 hex = 1100000000 binary). The address lines are buffered by IC2 and IC3. Buffered address lines A5 to A9 are fed to IC6, where they are compared with the logic levels set by switch S1.

Because input pin 3 of IC6, a 74LS85, four-bit magnitude comparator is logic high, all remaining inputs should be equal. Thus, the input logic levels at pins 10, 11, 14, and 15 of IC6 should equal the logic levels at pins 9, 12, 13, and 1, in that order.

Position 1 of S1 must be off to produce a logic high level input to pin 9 of IC6. This, in turn, equals the logic level on pins 10, and all other switch S1 positions should be on. When IC6 detects a match, its output pin 6 goes logic high.

Simultaneously, the outputs pins 16, and 5 of IC2 have been gated to produce a logic high at input pin 12 of IC4. This high input level is gated with the high output level from pin 6 of IC6 to produce a logic low at input pins 12 and 13 of IC7, one quarter of a 74LS08 quad-two-input AND gate and pin 4 of IC5, an 74LS138 1 of 8 decoder/demultiplexer.

The low logic level output of pin 11 of IC7 is then gated to pin 19 of IC1, a 74LS245 octal bidirectional three-state receiver. IC1 then passes a buffered control word from pins 11 to 18 (B8 to B1) of IC1 to pins 27 to 23 (D7 to D0) of IC8, the 8255A. However, IC8 must be enabled.

When the logic low appears at input pin 4 of IC5, it is decoded along with the other inputs to produce a logic low at pin 15 of
IC5, while all other outputs remain logic high. This low logic level enables IC8 so it can accept the control word that defines its mode of operation.

If any address in the 300H to 303H range is sent to the address bus, pin 15 of IC5 will always go to a logic low, thus enabling the 8255A. Consequently switch S1 is always set to 300H, the first address value in this address range.

Theory of the 8255A
The 8255A programmable peripheral interface IC8 has three ports (A, B, and C) that can be configured for many different operations. The device acts as an interface between the PC’s port address selector and the display, as shown in Fig. 3.

The 24 I/O pins on IC8 can be individually programmed into two groups of 12, and it can be operated in three different modes. (Refer to a manufacturer’s data book for more information on the 8255A.) The prime source is Intel, but it is alternate sourced by NEC (μPD8255-A) and Oki (MSM8255A).

The 8255A (IC8) can be programmed by sending a control word to its data input lines D0 to D7 while the AO and AI lines are held low. That control word initializes IC8 to run in any one
of its three modes. Selection of those modes depends on the value of the control word. In this project IC8 will run in mode 0, selected by sending binary 10000000 to the 8255A’s data lines identified earlier.

Mode 0 was selected because it simplifies the output operations for each of the three onboard ports of IC8 by eliminating the need for “handshaking.”

In mode 0, ports A and B (PA0 to PA7 and PB0 to PB7, respectively) are operated as eight-bit data output buffers. Port C is divided into two four-bit data output buffers (PC0 to PC3 and PC4 to PC7, respectively).

Port selection depends on the logic levels related to the IC8 (8255A) inputs A0 to A1 (pins 9 and 8). The control word address port is always the last port value in all address ranges. For this reason, port A is assigned to address 300H, port B is assigned to address 301H, and port C is assigned to address 302H. The IC8 mode control address is 302H. Thus, to set IC8 to mode 0, the control word 10000000 (80H) is placed on data input lines D0 to D7 and sent to address 302H. Listing 1, the first eight lines of the Turbo C+ source code, performs the operation.

```c
#include <stdio.h>
#include <dos.h>

#define BASE 0x300
#define MODE 0x80

int port_a = BASE, port_b = BASE+1, port_c = BASE+2;

void main(void)
{
    outportb(mode_port, MODE);
    outportb(port_a, 0);
    outportb(port_a, 1);
    outportb(port_a, 2);
    outportb(port_a, 4);
    outportb(port_a, 8);
    outportb(port_a, 16);
    outportb(port_a, 32);
    outportb(port_a, 64);
    outportb(port_a, 128);
    outportb(port_b, 0);
    outportb(port_b, 1);
    outportb(port_b, 2);
    outportb(port_b, 4);
    outportb(port_b, 8);
    outportb(port_b, 16);
    outportb(port_b, 32);
    outportb(port_b, 64);
    outportb(port_b, 128);
    outportb(port_c, 0);
    outportb(port_c, 1);
    outportb(port_c, 4);
    outportb(port_c, 8);
    outportb(port_c, 16);
}
```

**FIG. 4**

**LISTING 1**

**SOLDER SIDE OF JDR PR2 PROTOTYPE CARD**

(REVERSE SIDE OF COMPONENTS SHOWN)

**NOTES:**
1. CUT THE THREE TRACES WHERE SHOWN TO OPEN THEM.
2. INSTALL HEADER PINS IN ALL FILLED POSITIONS.
3. CONNECT PIN 25 TO BOARD +V AND PIN 7 TO GROUND.
4. CONNECT PIN 14 TO +V AND PINS 15 AND 16 TO GROUND.
5. INSTALL 2.2K RESISTOR R8 BETWEEN PIN 11 AND +V.

**арт. JULY 1985, ELECTRONICS NOW**

57
By referring to both Fig. 3 and Listing 1, it can be seen that the display's data lines (D0 to D7) are accessed through port A. In addition, the address lines A0 to A4 and R5 line are controlled by port B, and all display control lines (WR, CE, RST, RD) are connected to port C.

Writing data to the display consists essentially of making use of the Turbo C+ source code to send the IC8 (8255A) mode control word to the correct port address, setting the display control lines and address lines to the proper levels through ports B and C, and then transmitting the display data through port A.

Building the port selector
Refer to parts placement diagram Fig. 4. Note: This diagram is drawn to represent the solder side of the prototype card so that all pin numbers of IC will be seen as viewed from the bottom side rather than the top, a convenience when wire wrapping the pins.

Insert all components except IC8 (8255A) and IC9 (display) on the component side of the board for direct soldering. This is indicated by the screened callouts on the circuit board. (ICs 8 and 9 are to be inserted later.) Insert and solder 2.2-kilohm resistors R5 as shown on Fig. 5 between pin 6 of IC5 and the power lead. All capacitors on this circuit board decouple the power supply.

When all the components except IC8 and IC9 have been inserted and soldered in their correct locations, insert wire-wrap header pins for IC8 at the positions specified on the solder side of the prototype card. Solder the header pins into the positions indicated by the heavy black circles shown in Fig. 4. Cut open the three conductive traces under resistors R1, R2, and R3 (shown to the left of the callouts on Fig. 4).

Installing the 8255A
Insert and solder a 40-pin wire-wrap socket in the prototype card, as shown in Fig. 4. Wire-wrap pin 26 of the IC8 (8255A) socket to the power supply trace, and connect pin 7 to the ground trace. Insert only IC8 in its socket at this time. Manually wire wrap the remaining header pins listed in Table 2.

Debugging the selector
When the port address selector is complete, check its operation by installing it in a personal computer and by compiling and running the source code given in Listing 1. This is an optional step but performing it will give you a better understanding of how the port address selector works and how the computer interfaces with it.

With the computer off, insert the prototype card in any open 8- or 16-bit expansion slot in the computer's motherboard. Boot up the computer and start the C-compiler. Enter the source code given in Listing 1. It checks all corresponding outputs for each individual port of IC8, the 8255A.

Connect a test lead from an oscilloscope or digital multimeter in the voltage range to pin 4 (PA0) of IC8. Single step through the program one line at a time with the C-compiler's de-
FIG. 7—LOGIC LEVELS to clear the flash and character RAMs and store a flash attribute for a specific character location.

FIG. 8—DATA TO LOAD letter E into the UDC RAM.

FIG. 9—LOGIC LEVELS to load UDC row data into the UDC RAM.

* This code writes an "A" to the 2nd and third HDSP-21XX character locations from the left; the 2nd character location then flashes and the third does not.

```c
#include <stdio.h> /* header files */
#include <dos.h>

#define BASE 0x300 /* first address in address range */
#define MODE 0x80 /* 8255A mode control word */

int port_a=BASE,
port_b=BASE+1, /* address of port A outputs PA0-PA7 */
port_c=BASE+2, /* address of port B outputs PB0-PB5 */
mode_port=BASE+3; /* address of 8255A control word port */

void main(void) {
  outportb(mode_port,MODE); /* set 8255A to mode 0 */
  outportb(port_a, 0x00); /* set all display data lines to 0 */
  outportb(port_c, 0x1F); /* disable all display control lines */
  outportb(port_b, 0x00); /* access display control word register */
  outportb(port_c, 0x05); /* initialize lines to write to display */
  outportb(port_a, 0x80); /* clear flash and character RAMs */
  outportb(port_c, 0x1F); /* disable display write lines */
  outportb(port_b, 0x01); /* select 1st loc.of char.to be flashed */
  outportb(port_c, 0x05); /* initialize lines to write to display */
  outportb(port_a, 0x01); /* store flash attribute at dig. location */
  outportb(port_c, 0x1F); /* disable display write lines */
  outportb(port_b, 0x02); /* select 2nd loc.of char.to be flashed */
  outportb(port_c, 0x05); /* initialize lines to write to display */
  outportb(port_a, 0x00); /* disable flash attrib. at dig. location */
  outportb(port_c, 0x1F); /* disable display write lines */
  outportb(port_b, 0x39); /* select character location */
  outportb(port_c, 0x05); /* initialize lines to write to display */
  outportb(port_a, 0x1F); /* write character "A" to display */
  outportb(port_c, 0x1F); /* disable display write lines */
  outportb(port_b, 0x3A); /* select character location */
  outportb(port_c, 0x05); /* initialize lines to write to display */
  outportb(port_a, 0x41); /* write character "A" to display */
  outportb(port_c, 0x1F); /* disable display write lines */
  outportb(port_b, 0x30); /* access display control word register */
  outportb(port_c, 0x05); /* initialize lines to write to display */
  outportb(port_a, 0x0A); /* find locations to flash and do it */
  outportb(port_c, 0x1F); /* disable display write lines */
}
```

**LISTING 3**

**08-255 connection**

Install the display (IC9) only after proper port address selector operation has been verified. Insert a 28-pin wire-wrap socket for IC9 in the circuit board on the component side, checking its orientation (as seen from the solder side) with Fig. 4. Solder the socket in position.

Insert and solder 2.2-kilohm resistor R6 between the 5-volt power source and pin 11 of the display (IC9), as shown in Fig. 09.
level 1 (high), while display address lines A2 to A0 are set to a value that matches a display digit location. For example, binary 000 corresponds to the display digit at the far left and binary 111 corresponds to the display digit at the far right.

Refer to Fig. 5-b. When the character location to be illuminated has been selected, set the RS line to logic level 1 (high), the E and WR lines to a logic level 0 (low) and the C/UD lines to 1 to permit writing any ASCII character shown in Fig. 2 at the selected location. Set display input D7 to 0, to enable the ASCII decoder.

Display inputs D6 to D0 introduce the binary code that matches the character to be displayed. When this data is decoded, the selected ASCII character will appear at the intended location that was stored in the character RAM.

Listing 2, for example, give as source code that will cause the letter A to be displayed in third character location from the right (binary location 101). The comments on Listing 2 are helpful reminders. Recall the discussion of 8255A mode selection and port addressing as well as the command outportb( ). Consider the line:

```
/*
 * This listing writes an "A" to the third HDSP-21XX
 * character location from the right at max. brightness,
 * and then dims it to min. brightness.
 */

#include <stdio.h>          /* header files */
#include <dos.h>

#define BASE 0x300            /* first address in address range */
#define MODE 0x80             /* 8255A mode control word */

int port_a=BASE,
    port_b=BASE+1,
    port_c=BASE+2,
    PC4 */
    mode_port=BASE+3;

/* address of 8255A control word port */

void main(void)
{
    outportb(mode_port,MODE);  /* set 8255A to mode 0 */
    outportb(port_a, 0x00);    /* set all display data lines to 0 */
    outportb(port_b, 0x00);    /* set all display address lines to 0 */
    outportb(port_c, 0x00);    /* disable all display control lines */
    outportb(port_b, 0x3F);    /* access display control word register */
    outportb(port_c, 0x05);    /* initialize lines to write to display */
    outportb(port_a, 0x00);    /* set display brightness to max. */
    outportb(port_c, 0x01);    /* disable display write lines */
    outportb(port_b, 0x3D);    /* select character location */
    outportb(port_c, 0x05);    /* initialize lines to write to display */
    outportb(port_a, 0x00);    /* write character "A" to display */
    outportb(port_c, 0x01);    /* disable display write lines */
    delay(500);  /* a slight delay . . . */
    outportb(port_b, 0x3F);    /* access display control word register */
    outportb(port_c, 0x05);    /* initialize lines to write to display */
    outportb(port_a, 0x00);    /* set display brightness to min. */
    outportb(port_c, 0x01);    /* disable display write lines */
```

**LISTING 4**

**Character RAM**

The display’s eight-byte character RAM stores either ASCII character data or a UDC RAM address. One byte of RAM is used for each of display’s eight characters. Character RAM locations are selected by address lines A0 to A2.

Refer to Fig. 5-a. The character position is selected by setting the FL line and display address lines A4 and A3 to logic

4. Wire-wrap all connections as shown in Fig. 3 after identifying all pin numbers and functions on the display, noting that the pins in Fig. 4 are bottom views.

**Five-section display**

The display has five functional sections: character RAM, control word register, flashing RAM, user-defined character (UDC) address register and UDC RAM. All five sections can be individually accessed by sending various logic levels to the address lines (A0 to A4 and the FLASH (FL) line). Learn their functions by single-stepping through all the source code given in Listings 2, 3 and 4 as was done in testing the complete circuit and watching the effect on the display.
outportb(port—b, 0x3D)
That line sets the display's FL line and address lines A4 and A3 to 1, while simultaneously setting address lines A2 to A0 to binary 101, which define the character location.

These lines are controlled by the 8255A's port B: For example, FL is connected to output PBO, and A0 is connected to output PBO. To obtain the logic levels given in Instruction 1, a binary 111101 (equal to hex 3D) must be sent to this port. (FL is the most significant bit and A0 is the least significant bit.)

To write to the display, refer to Fig. 5-b and set the RST and RD lines to 1, and the CE and WR lines to 0. These display input lines are controlled by port C of the 8255A. Consequently, the instruction:

outportb(port—c, 0x05)
initializes the lines required to write to the display.

Binary output 01000001 (equivalent to letter A and equal to 81H) can be sent to port A lines PA7 to PA0 of the 8255A. This value is sent to display data inputs D7 to D0. The most significant bit in binary 01000001 corresponds to D7. This enables the on-board ASCII decoder, and D6 to D0 introduce the data to be decoded. Thus the instruction:

outportb(port—a, 0x41)
writes the character A to the display.

When the source code line has been executed, the letter A will be visible in the third character position from the right. Because writing to the display is finished, the CE and WR lines can now be disabled by the code instruction:

outportb(port—c, 0x1F)

Control word register
The control word register is an eight-bit register that allows the user to adjust the display brightness, flash individual characters, blink, self-test, or clear the display. Each of these functions is independent of the others. Only brightness, blinking, and flashing RAM control will be discussed here. (The display's data sheet 5091-4950E explains the self-test and clear functions.)

Refer to Fig. 6. To set the display's brightness level, access the display control word register by setting display lines FL and A4 to 1, and A3 to 0. (The logic levels of A2 to A0 are immaterial.) When the control word register has been accessed, the brightness level can be selected.

Seven brightness levels can be selected. Set display inputs D2 to D0 to binary 000 (after toggling the display's WR and CE to 0) to select a maximum brightness level. Set display inputs D2 to D0 to binary 110 for minimum brightness. (If D2 to D0 are set to binary 111, the display will go blank.) Set display inputs D7 to D3 to 0; as shown in Fig. 6.

The last four lines of Listing 2 demonstrates how the display's brightness level is selected. The first of those lines defines the logic levels for accessing the display's control word register, and sends those levels to the appropriate port. Next, the display WR and CE lines are initialized, and the third line introduces the selected brightness level. If the brightness level is to be set at its minimum value, send 000010 (equal to 6H) to port A. When the display write operation is completed, the corresponding lines are disabled.

The flashing RAM
The 1 x 8 flashing RAM stores data for flashing the display to call attention to it. This data determines the display positions that will flash on and off—one bit is assigned to each of the eight characters. The flash function differs from the blinking function, which causes the entire display to blink on and off.

To store data in a specific location in the flash RAM, access it with a specific flash RAM address, as was done with the character RAM address. First, however, clear the flash RAM of all extraneous data with the control word register.

When the display flash RAM is cleared, the character RAM is also cleared, thus clearing all display characters. Refer to Fig. 7-a and Listing 3. The flash and character RAMs are cleared whenever the control word register is accessed and display input D7 is set to 1 (hex 80H equals binary 10000000). When the flash RAM has been cleared, store the display digit location to be flashed in the flash RAM.

If you want to flash the second display digit, counting from the left flash: that location would be 001 in binary. To store that digit location, access the flash RAM first by setting display line FL to 0 and display address lines A2 to A0 to the logic levels that correspond to digit location 001. Ignore display address lines A4 and A3 because they do not affect the flash RAM location.

Refer to Fig. 7-b and again to Listing 3. Initialize the write to the display lines, and then store the digit location to be flashed in the flash RAM. To store a flashing digit location, set D0 to 1. If D0 is set to 0, the flash function for that location is disabled. Ignore data lines D7 to D1. When the display character location to be flashed is stored in the flash RAM, a character can be written to that stored location and then flashed by enabling the flash function.

Refer to the last line of Listing 4. To enable the flash function, first access the control word register, then toggle WR and CE lines to 0, and set display data line D3 to 1. When D3 is set to 1, the contents of the flash RAM are checked. For each stored location containing a 1, the associated digit will flash at a rate of about 2 Hz. If D3 is set to 0, the

LISTING 5

outportb(port_b, 0x30);
outportb(port_c, 0x03);
outportb(port_a, 0x10);
outportb(port_c, 0x1F);

/* access display Control Word Register */
/* initialize lines to write to display */
/* Blink entire display */
/* disable display write lines */
flash function is disabled at that location.

Refer to listing 5. To cause the display to blink, clear the flash and character RAMs, as was previously described, and write the message to the display. Next, access the control word register, and set display data line D4 to 1. Now the entire display will start blinking.

**UDC RAM and address register**

The user-defined character RAM (UDC RAM) stores the dot pattern for custom characters. The user-defined character address register (UDC address register) is an eight-bit wide register that provides the address to the UDC RAM when the user is writing or reading a custom character.

User-defined characters (UDC) or symbols can be created in any of the eight digit locations of the display. To create a UDC, clear the flash and character RAMs, as was explained earlier. Then define the character to be created. Assume, for example, that you want to locate the letter E at far left location 000.

To specify an entire digit location completely, you must write to the display eight times in succession. The first cycle stores the UDC address in the eight-bit wide UDC address register. Data lines D3 to D0 are used to select one of up to 16 UDC RAM address locations, as shown in Fig. 2. The seven remaining write cycles store LED data in this selected UDC RAM location.

Data must be entered by rows, and it takes one cycle to store data for each row. Because this is a 5 x 7 dot-matrix display, each digit is displayed on an array of 35 LED dies arranged as five columns and seven rows. Figure 8 maps out the elements of the UDC character to be illuminated in terms of columns and rows.

Listing 6 shows how to access the UDC address register. First, set PC7 to 1, and display lines A4 to A3 to 0. (Ignore display lines A2 to A0). Toggle CE and WR to 0, and use data lines D3 to D0 to select any of the 16 UDC locations given in Fig. 2.

To write the first UDC symbol, find the first UDC location available by setting data lines D3 to D0 binary 0000. Toggle the CE and WR lines back to 1. With the UDC RAM location defined, complete the process by loading UDC data into that UDC RAM location.

Seven port writes are required to define one UDC symbol com-

Continued on page 88
Learn about zero-voltage or synchronous AC-line power switching and control and put it to work in your own projects

The subject of this article is synchronous on/off power switching circuits that can switch AC power for lighting, heaters, air conditioners, motors, household appliances, and industrial and commercial equipment. Many different kinds of AC control circuits are presented including four different circuits for the control of a home electric heater. This is the third in a series of articles on power switching.

All of the circuits described here include triac drivers, and the components for all circuits were selected for operation from 120-volt, 50/60-Hz line power. The reader can select a triac with the rating and package style that best suits his application or circuit experiment requirements.

Synchronous switching

Previous articles in this series explained that a triac is a bidirectional thyristor that can be turned on to pass a load current in either direction. It acts like two inverse-parallel-connected silicon controlled rectifiers (SCR). This characteristic permits it to function in both AC and DC circuits. Triacs can be triggered (turned on and latched) either synchronously or asynchronously when across an AC line.

A suitable triac for use in building the circuits discussed in this article would have a voltage rating of at least a 200-volts and an on-state (RMS) current rating of 4 to 6 amperes. A Motorola 2N6071 or equivalent will meet these requirements.

Recall that synchronous circuits always turn on at the same point in each AC half-cycle (usually just after the zero-crossing point). When triac turn-on occurs at zero crossing, little or no radio-frequency interference (RFI) is generated if the load is primarily resistive. By contrast, asynchronous circuits do not switch regularly at a fixed point on the AC sine-wave, so they can generate a significant amount of RFI.

Figure 1 is a synchronized AC power switch that is triggered near the zero-voltage crossover points of the AC waveform. The
The triac gate trigger current is obtained from a 10-volt DC supply derived from the AC line through resistor R1, diode D1, Zener diode D2, and capacitor C1. This current is switched to the gate of triac TR1 through transistor Q4, which in turn is controlled by switch S1 and a zero-crossing detector circuit formed by transistors Q1, Q2, and Q3. When switch S1 is closed (on) and transistor Q3 is off, Q4 is turned on so that it sends current to the gate of TR1.

The zero-crossing detector circuit of Q1, Q2, and Q3 is organized so that either Q1 or Q2 is driven on whenever the instantaneous line voltage is positive or negative by more than a few volts. This will be determined by the setting of potentiometer R8. This voltage drives Q3 on through R3 and inhibits Q4. Consequently triac TR1 receives gate current only when S1 is closed, and the instantaneous line voltage is within a few volts of zero. This circuit generates little or no RFI.

Figure 2 is a modification of Fig. 1 that permits TR1 to turn on when S1 is open. In both of these circuits, only a narrow current pulse is sent to the gate of triac TR1. As a result, current drain on the supply is only about 1 milliampere. Switch S1 can be replaced by a combination sensor and switch that will sense changes in temperature or other physical variables, and switch the power to appliances and other AC-powered products automatically.

If the switch is replaced by an optocoupler, as will be discussed later, the control circuit will be electrically isolated from any of the external circuitry and the threat of electrical shock for the user in the event of a circuit fault will be eliminated.

**Zero-voltage switching ICs**

The CA3059 and the CA3079 are monolithic silicon IC zero-voltage switches capable of controlling thyristors in different applications. Originally developed by RCA, they are now made by Harris Semiconductor. These ICs are useful in AC-power switching for AC input voltages from 24 to 277 volts at 50/60 and 400 Hz. Each includes four functional blocks: 1. Limiter power supply that permits it to operate directly from the AC line. 2. Differential on/off sensing amplifier that tests the condition of external sensors or command signals. 3. Zero-crossing detector that synchronizes the output pulse of the circuit when the AC cycle is at the zero voltage point. This eliminates radio-frequency interference (RFI) when the load is resistive. 4. Triac gating circuit that provides high-current pulses to the gate of the power-controlling thyristor.

Figure 3 is a pinout diagram for the CA3059. It is the same as the pinout diagram for the CA3079, except that pin 14 of that IC is not to be used. The CA3079 is the same as the CA3079 except for differences in input current rating and sensor range, and it is rated for a maximum DC supply voltage of
10 volts rather than the CA3059's 14 volts.

The CA3059 has a built-in protection circuit that can be actuated to remove the drive from the triac if the sensor open- or short-circuits. The triac can be inhibited by the action of an internal diode gate connected to pin 1. Moreover, high-power DC comparator operation is provided by the overriding the zero-crossing detector. This is accomplished by connecting ZCD OVERRIDE pin12 to COMMON pin 7. Gate current to the triac is continuous when SENSE AMP IN pin 13 is positive with respect to SENSE AMP REF pin 9.

Figure 4 is the internal schematic diagram for both the CA3059 and CA3079. Also included in the schematic are some important external components. The AC line is connected across AC IN pin 5 and pin 7 through limiting resistor R1. Diodes D1 and D2 act as back-to-back Zener diodes to limit the voltage on AC IN pin 5 to ±8 volts.

On positive half cycles, diodes D7 and D13 rectify this voltage and generate 6.5 volts across the 100 µF electrolytic capacitor C_F connected to DC SUPPLY pin 2. This capacitor stores enough energy to drive all of the IC's internal circuitry and still provide
adequate triac gate drive. A current of a few milliamperes is also available for powering external circuitry.

The bridge rectifier consisting of diodes D3 to D6 and transistor Q1 forms the zero-crossing detector. Transistor Q1 is driven into saturation whenever the voltage on pin 5 exceeds ±3 volts. The gate drive to an external triac can be obtained through the TRIGGER OUT pin 4 of the Darlington pair Q8 and Q9, but is available only when Q7 is turned off.

When Q1 is turned on (the voltage at pin 5 is greater than ±3 volts), Q6 turns off through lack of base drive. Consequently, transistor Q7 is driven into saturation through resistor R7 and no triac gate drive is available at pin 4. As a result, triac gate drive is available only when pin 5 is close to the zero-voltage crossover point. It is produced as a narrow pulse centered on the crossover point, and its power is supplied through C1.

The differential amplifier or voltage comparator includes transistors Q2 to Q5, for general purpose applications. Resistor R4 is accessible through R DRIVER pin 10, and resistor R5 is accessible through R DRIVER (COM) pin 11 for biasing one side of the amplifier. The emitter current of Q4 flows through the base of Q1 and can be used to disable the triac's gate drive at pin 4 by turning Q1 on.

The circuit permits the gate drive to be disabled by making pin 9 positive with respect to pin 13. The drive can also be disabled by introducing external signals at either or both INHIBIT pin 1 and FAIL-SAFE pin 14.

Figures 5 and 6 are schematics of circuits that show how the CA3059 can function as a manually controlled, zero-voltage on/off switch for triac TR1. Switch S1 can enable or disable the triac gate drive through the IC's internal differential amplifier in both circuits. (Remember the drive is enabled only when the bias on pin 13 exceeds that of pin 9.)

In the Fig. 5 circuit, pin 9 is biased at half the supply voltage and pin 13 is biased through resistors R1 and R2 and switch S1. Triac TR1 turns on only when S1 is closed. In Fig. 6, pin 13 is biased at half the supply voltage and pin 9 is biased through resistors R1 and R2 and switch S1. Here again, triac TR1 turns on only when S1 is
closed. Switch S1 switches voltage with a maximum value of 6 volts and current that has a maximum value of approximately 1 milliampere.

In both of these schematics, capacitor C2 applies a slight phase delay to the AC in pin 5 of the CA3509. This shifts the gate pulse phase so that the gate pulses occur after rather than straddle the zero-voltage crossover point. The triac in Fig. 6 can be turned on by pulling R2 low or it can be turned off by letting R3 float.

Figures 7 and 8 are circuits that demonstrate how this relationship can be applied to extend the versatility of the basic circuit. In Fig. 7, the triac can be turned on and off by transistor Q1, which in turn can be controlled by external CMOS circuitry (such as one-shot or astable multivibrator). These can be powered from the 6-volt supply at DC SUPPLY pin 2 of IC1.

The circuit in Fig. 8 can be turned on and off by fully isolated external circuitry through an optocoupler. It needs an input of only three or four volts to turn the triac TR1 on. A simple optocoupler or optoisolator such as the TIL112 made by Motorola and others will work here.

Figures 9 and 10 show several of ways of organizing the CA3059 so that the triac functions as a light-sensitive (or dark-operated) power switch. In these two circuits, the CA3059's built-in precision voltage comparator turns the triac on or off when one of the comparator input voltages goes above or below the other. A stock cadmium-sulfide (CdS) photoresistor will work here.

Figure 9 is a dark (or lack of light)-activated power switch. Pin 9 of IC1 is connected to the half voltage supply, and pin 13 is controlled through resistor R1, potentiometer photocurrent cell (or photoresistor) R3, and resistor R4 acting together as a voltage divider. Under bright light the photocurrent cell has a high resistance, so the voltage on pin 13 is below that on pin 9 and the triac is disabled.

Under dark conditions the photocurrent cell has a high resistance. Therefore, pin 13 has a higher voltage than pin 9. This triggers the triac so AC power is fed to the load. The threshold switching level of the circuit can be preset with trimmer potentiometer R2.

The schematic of Fig. 10...
shows how hysteresis or backlash can be added to the circuit in Fig. 9, so the triac does not switch randomly in response to momentary changes in background illumination such might be caused by the shadow of a passing person. The hysteresis level is controlled by resistor R4, which can be selected for specific applications.

**Electric heater controllers**

A home electric-resistance heater can be controlled automatically to maintain the temperature of a room if the heater is switched on and off by a triac with a thermistor or thermostat acting as the feedback control element in a closed-loop system. Two different control methods are possible: simple automatic on/off power switching or proportional power control.

In simple automatic on/off control, the heater is switched fully on when the room temperature falls below a preset threshold level, and it is turned off when room temperature rises above that threshold preset level. In the analog or proportional control method, the average heater power is adjusted automatically so that, when the room temperature is at the precise preset level, the heater output power self-adjusts to balance the room’s thermal losses.

Because of the high power requirements of electric heaters, attention must be given to minimizing radio-frequency interference in the design of triac control circuits. This can be done by continuous DC gating of the triac, or by synchronously pulsed gating. The advantage of DC gating is that, in basic on/off switching, the triac generates no RFI in normal (on) operating conditions. However, the disadvantage is that the triac can generate a powerful RFI spike as it is switched from the off to the on state.

The advantage of synchronous gating is that no high-level RFI is generated as the triac transitions. The disadvantage is that the triac generates low level RFI continuously when in its on state.

**DC-gated circuits**

Figures 11 and 12 are schematics for DC-gated heater control circuits. The DC supply is obtained from the interaction of transformer T1, diode D1 and capacitor C1. In the Fig. 11 schematic, the heater can be automatically controlled by the thermostat.

By contrast, the circuit in Fig. 12 is controlled by negative temperature coefficient (NTC) thermistor TH1 and transistors Q1 and Q2. Potentiometer R1, thermistor TH1, and resistors R3 and R4 form a heat-sensitive bridge, and transistor Q1 detects bridge balance. Potentiometer R1 can be adjusted so that Q1 just starts to conduct as the room temperature falls to the preset level. Below that level, transistors Q1 and Q2 and triac

*Continued on page 74*
TESTING MULTICONDUCTOR CABLES for continuity is a time-consuming task. Unless you can afford expensive, specialized equipment for doing it, it is also difficult to do it without making errors.

A number of years back, I was at a contractor's plant where two technicians were testing cables. Each held a probe connected to an ohmmeter. One technician would touch a pin on a connector attached to one end of a long cable assembly and yell something like "C-24." The other would move his probe to his connector's pin C-24 to check for continuity, and then he'd check every other pin to make sure that there weren't any short circuits. This continued for what seemed like forever, and I remember thinking "That's got to be the most boring task in the world!" Unfortunately, that wasn't an isolated event—I saw this scenario played out again and again in different plants.

When there are many connections in a cable, PC board, or other device, you must check to make sure all the intended connections are correct, and that no unintended connections (short circuits) are present. This kind of repetitive task doesn't have to tie up two technicians—it's just right for a personal computer.

**Continuity testing**

The theory behind continuity testing is pretty simple if you understand these terms:

- **Line**—A connection between two points.
- **Test Signal**—An electrical signal (AC or DC) that's used to determine if continuity exists on the line.
- **Input**—That end of the connection path where the test signal is inserted.
- **Output**—The other end of the connection path where the test signal is sensed (by a meter or other measuring device).
- **Short Circuit**—An unwanted connection between two conductors.
- **Open Circuit**—The absence of an intended connection in a conductor.

Figure 1 shows how continuity is tested manually. A test signal is provided at the input of one conductor. Each of the outputs is then checked for the presence or absence of the test signal, and the results are recorded; the signal should appear at the output of the input line, and it should not be present at any other output. The test signal is then applied to the next input and the process is repeated until all wires have been checked.

The number of tests that must be performed to ensure that all wires are checked against all others is the permutation of the number of wires present. The permutation of a number (N) is N + (N - 1) + (N - 2) + ... + 1. So for five wires, you must perform 5 + 4 + 3 + 2 + 1, or 15 tests. The number of tests needed increases very quickly as the number of wires increases. For instance, for 25 wires you must perform 325 tests.

In Figure 1, the input and output probes are moved manually from one wire to the other. The procedure can be partially automated with the setup shown in Fig. 2 in which the probes are "moved" with a series of switch-
To test line 1, close switch S1-a. Then close S1-b and measure. Open S1-b, close S2-b and measure. Repeat this until you get to the "Nth" switch (SN-b). Then repeat the procedure again after opening S1-a and closing S2-b.

This semi-automated approach has two advantages. It eliminates the possibility of not making effective contact with the wires. If you must test many of the same kinds of circuits,
you can wire the switches to a
connector that mates with the
circuit you're going to test.
Then, it's a simple job to con-
nect and disconnect the circuit.
This will help to prevent mis-
takes and it will save some—but
not enough—time.

**PC continuity testing**

To make a PC do all the work,
the mechanical switches in Fig.
2 must be replaced with elec-
tronic ones. Then the PC must
control those switches, provide
the test signal, and sense the
outputs. In the circuit shown in
Fig. 3, the mechanical switches
have been replaced by a
CD4051B CMOS 8-channel
analog multiplexer/de-
multiplexer. The 4051 contains
eight electronic switches, con-
trolled by three select input pins
9, 10, and 11. Table 1 shows how
the inputs select the switches
that will be activated. When any
one switch is closed, the other
switches are open (high imped-
ance). When the inhibit line is
high, all of the switches are
open, regardless of the select in-
puts.

The circuit in Fig. 3 is con-
trolled by the PC I/O interface
shown in Fig. 4. The PC I/O in-
terface is described in detail in
Radio Electronics, July 1991,
page 53. The connections
marked P1 go to a female DB-25
jack that mates with the PC I/O
board. Jacks J1 and J2 are the
input and output connectors
for the device (most likely a mul-
ticonductor cable) to be tested.

The continuity tester con-
tains six 4051s, three on the in-
put side and three on the output
side. The common inputs of the
4051s (pin 3) are connected
through current-limiting res-
sistor R1 to +5 volts DC, ob-
tained from pin 25 of the PC I/O
board. When any of the switches
in IC1, IC2, or IC3 is turned on,
5 volts is passed through that
switch to J1 and the associated
test line. Switch selection is con-
rolled by pins 1, 2, and 3 of

### TABLE 1

<table>
<thead>
<tr>
<th>Inhibit Input</th>
<th>Select Inputs</th>
<th>Decimal</th>
<th>Closed Switch (all others open)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>B</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

P1, which are connected to
the select inputs of the 4051s. This
allows the PC to select any one of
the eight internal switches in
IC1, IC2, or IC3.

The select inputs of all three
4051s are connected together.
However, only one 4051 should
be active at a time if the circuit
is to work properly. Therefore,
the inhibit pins (pin 6) of the
4051s are also controlled by
the PC. That permits the computer
to activate any one of the 4051s
and inhibit the other two.

The output side of the tester
is essentially the same circuit,
but with one difference. The
4051 common output/input pins
(pin 3) are connected toget-
ther and output at P1 pin 17.
That pin, an input to the PC I/O
board, must see either a low
(ground) or high logic level.
Since the 4051s will output ei-
ther a high (+5 volts) or a high-
impedance open, R2 is posi-
tioned between the output and
ground as a pull-down resistor
to ensure that a logic low can be
sensed.

The goal of the circuit design
was to test cables with up to 25
conductors. However, the three
4051s can test only 24 lines.
Therefore, another way to check
that last line had to be found.
Pin 7 of P1 can send a signal
through diode D1 to J1 pin 25.
On the output side, J2 pin 25
goes to P1 pin 18 which can
sense the output. The diode en-
sures that J1 pin 25 will not pull
up any line to which it is short-
ed and give a false indication.

### Building the circuit

The circuit can be built on
perfboard. Begin by soldering a
5-inch length of solid No. 24
wire to each of the 25 pins of two
female DB-25 connectors (J1
and J2). Then solder a 5-inch
length of No. 24 solid wire to
pins 1–6, 9–14, 17, 18, 23, and
25 of a second female DB-25
connector (this will be P1).

The circuit can also be built
on a solderless breadboard with
at least 50 rows of connection
points and two vertical rows for
power distribution. The circuit
should be housed in a case that
provides support for the panel-
mount DB-25 connectors. It is

---

**PARTS LIST**

- R1—100 ohms, 1/2-watt
- R2, R3—10,000 ohms, 1/4-watt
- D1—1N4148 or 1N914 diode
- J1, J2, P1—female DB-25
- IC1–IC6—CD4051B CMOS 8-
  channel analog multiplexer/de-
  multiplexer, Harris or equiv.
- Breadboard (Radio Shack sol-
  derless P/N 276-174, solderable
  P/N 276-174, or equivalent), 30
  feet of 24 gauge solid wire, en-
  closure

**Note:** The following items are
available from J.J. Barbarello,
817 Tennent Road, Manalapan,
NJ 07726:
- A complete PC I/O board kit
  (part No. PCIO, contains PC
  board and all components)—
  $39.95
- Software, including com-
  piled and source code ver-
  sions containing the enhance-
  ments mentioned in the arti-
  cle (part No. PCC-S, specify disk
  size)—$8.00
- Continuity tester parts (part
  No. PCC-H, contains six 4051
  ICs, R1–R3, and D1—$8.00
- Send check or money order (for-
  eign orders please send pay-
  ment in notes redeemable at a
  U.S. bank. Please specify part
  numbers. The author will an-
  swer all questions, but they
  must be accompanied by a
  self-addressed stamped return
  envelope.
Testing

To test the continuity tester your PC must be equipped with a PC I/O card, a male-to-male DB-25 cable, and a logic probe or multimeter. Connect the cable from the PC I/O board to P1 and turn on the computer. Check for about +5 volts on pin 16 of each 4051, and ground on pins 7 and 8. Type in and run the output test program in Listing 1 using GWBASIC, BASICA or QUICKBASIC. Alternatively, the programs are available on the Gernsback BBS as part of a file called CONTTEST.TXT.

When running that program, enter each pin number (1 through 25) in turn. When "Press any key to continue..." appears, check that pin for a high signal. Then press a key and enter another pin number. Continue this until you've verified the operation of all 25 pins. To check the output side, type in and run the input test program in Listing 2. Connect one end of a jumper wire to the junction point of pin 3 of IC1–IC3 and R1.

When you see the questions "Which J2 Pin (1..25)...," place the free end of the jumper into the pin number you want to test. While holding it there, enter that pin number. On the next line you'll see a "1" or a "0." A "1" indicates the high level was correctly sensed. Remove the jumper and enter the pin
number again. This time you should get a “0.” Follow the same procedure for all 25 pins of the connector.

Basic use

The most basic use of the tester is checking DB-25 male-to-male cables. Connect the cable to be tested between J1 and J2 and run the basic tester program in Listing 3. A typical output from the program will show the connections found. Also, if the circuit has a short, say between pins 2 and 3, you’ll see two additional entries, 2-3 and 3-2. If the circuit has an open, that pin will not be shown as a connection (for instance, there would be no 5-5 if there were an open on line 5). The complete test of all 625 possibilities will take only a few seconds.

Enhancements

With the basic program, you must determine which lines were connected, which are missing, and which are shorted by visually scanning the list. This is OK for a one-time check, but inefficient for repetitive testing of the same kind of circuit. One enhancement would be to have a data file that defines the desired connections and display PASS or FAIL with only the open or shorted circuits listed.

To check cables other than DB-25 male-to-male, you must make appropriate adapters. For example, to check a DB-9 cable, you would make two adapters as shown in Fig. 5. Connect the adapters to J1 and J2, and the DB-9 cable to the adapters.

You can also test bare PCB boards. Here you create a “bed of nails,” which is a base with pins that contact the PCB board in specific spots. The PCB board is placed on the base and the spring-loaded pins (called “pogo” pins) make contact with the test points on the board. You could then check to see if specific points are connected, open, or shorted. If more than 25 points have to be tested, you could make multiple bases for additional tests.

Attenuation can also be tested. For example, if the cable must have less than 10 ohms resistance, replace R1 and R2 with potentiometers. If you then temporarily place a 10 ohm resistor between pin 1 of J1 and J2, and run the input test program in Listing 2, you can adjust the voltage level so that the indication changes from a “1” to a “0.” Then back off the potentiometer so that the indication changes back to a “1.” Now, any device with a resistance higher than 10 ohms will cause less voltage to be dropped across R2 and give a “0” indication.
cated on one side of the scanning disk. A lens focused the image on the disk.

Another disk with a sawtooth edge was positioned between the object and scanning disk. It chopped up the light beam to a preset frequency. The object was scanned vertically, with the light-chopping disk dividing each line into a definite number of picture elements. A light-sensitive cell on the other side of the disk received the scanned image and changed the light variations into amplitude modulated current.

Baird’s receiver had a similar scanning disk. Each lens in the disk projected a thin beam of light from behind the disk to a screen. As the light from each lens scanned the screen, a picture was built up. Baird synchronized his transmitter and receiver disks by connecting an AC generator to the transmission disk’s drive motor and a synchronous motor was connected to the receiving disk.

The first television drama was broadcast by station WGY in 1928, and the first television images were screen-projected in a theater in Schenectady, New York, in 1930. Both systems were mechanically scanned.

Electronic scanning
Television as we know it today became a reality only after the invention of the iconoscope or camera tube by Vladimir Zworykin, a Russian emigre to the U.S. The iconoscope, when paired with the receiving picture tube, made electronic scanning possible. Both the iconoscope and the picture tube were developed from the earlier invention of the cathode-ray tube.

With the development of the camera tube and receiving tube, electronic scanning was able to replace cumbersome and expensive mechanical scanning. The image orthicon, invented by Philo Farnsworth in 1928, improved upon Zworykin’s iconoscope, but it was not until 1933 that electronically scanned television became a commercial reality.

Who named television?
Two men claimed to have coined the word television. One was Hugo Gernsback, then the publisher of Radio News (He later founded Gernsback Inc., the publisher of Radio-Electronics which was renamed Electronics Now in 1993).

In the August 1928 issue of Radio News, Gernsback wrote: “The word ‘television’ was first coined by myself in an article entitled ‘Television and the Telephot’ which appeared in the December 1909 issue of Modern Electrics.” The other person who claimed to have coined the word in 1900 was a Frenchman named Perskyi.

POWER CONTROL
continued from page 68

TR1 are all driven full on. Above that preset temperature threshold, all three components are cut off.

The gate-drive polarity in Fig. 12 is always positive, but the triac’s main-terminal current is alternating. As a result, the triac is gated alternately. A triac’s gate sensitivity differs, depending on its operating mode. Thus, when the temperature sensed by the thermistor is well below the preset temperature threshold, Q2 is driven full on and the triac is gated in two quadrants. This sends the full AC-line power to the heater.

However, when the room temperature is very close to its preset value, Q2 is driven only slightly on. Thus triac TR1 is gated on in only one mode and only half of the available AC-line power is available to the heater. Consequently, the circuit offers fine temperature control of the room.

Synchronous switching
Figure 13 is the schematic for an electric heater-control circuit with automatic zero-voltage synchronous AC-line switching based on the CA3059 (IC1). It provides simple on/off heater switching.

This circuit is similar to that of the light-activated power switch of Fig. 9 except that an NTC thermistor is the feedback sensor. The Fig. 13 circuit is capable of maintaining room temperature within one or two degrees Fahrenheit of the value set on potentiometer R1.

Figure 14 is the schematic for a proportional heater control circuit that is capable of regulating room temperatures to within one degree Fahrenheit of a preset value. A thermistor-controlled voltage is applied to pin 13 of IC2 (CA3059). Simultaneously, a repetitive 300 millisecond ramp waveform from pins 2 and 6 of IC1 (a 7555 or CMOS 555) is applied to pin 9 of IC2. The 7555 is configured as an astable multivibrator, and the waveform is centered on the half-supply voltage.

The triac is turned fully on synchronously if the room temperature is more than a few degrees below its preset level. However, it is cut off fully if the room temperature is more than several degrees above that preset level. When the temperature is within a few degrees of the preset value, however, the ramp waveform synchronously turns the triac on and off (in the integral cycle mode) once every 300 milliseconds with a duty cycle that is proportional to the temperature differential.

For example, if the duty cycle ratio is 1:1, the heater generates only half of its maximum power. However, if the ratio is 1:3, it generates only one quarter of its maximum power. This response causes heater output power to self-adjust to meet the room’s preset heating demand.

When room temperature reaches the precise preset value, the heater does not switch fully off. Rather, it generates just enough output power to compensate for the room heat loss. This system gives precise room temperature control.
I have reviewed some new books that you might find informative. Lindsay Publications has republished dozens of books, mostly in the form of reprints of fascinating or "lost" technology from the past. For example, one is an authoritative 1935 book, Neon Signs by Miller and Fink. Others include a nine-volume Cyclopedia of Formulas, first published by Scientific American at the turn of the century. It contains "secret" processes for doing nearly everything from making your own dyes and chewing gum to electroplating, preparing artist's paints and doing photography.

One new book I found to be very useful includes some really hairy mathematics. I reviewed Bezier curves and cubic splines some time ago. Splines are the answer to the need for making use of sparse data to generate graceful two-dimensional curves or three dimensional surfaces.

Knot Insertion and Deletion Algorithms for B-Spline Curves is a difficult to read but definitive new book on splines. It explains the tricky process of breaking a single curve up into an indefinite number of subcurves, finding points along a single curve, or combining a pair of curves into one longer curve. The book includes many references to earlier papers on splines. The authors of the book are Goldman and Lyche, and the publisher is SIAM, the Society for Industrial and Applied Mathematics.

Fibonacci’s golden sunflowers

Have you ever marveled at the way a sunflower’s seeds are so compactly arranged along such mathematically precise spirals? Several botanists who have been impressed by this natural marvel are now questioning just how much of a plant’s growth is determined by genetics, and how much is determined by mathematical algorithms and physical laws.

The Algorithmic Beauty of Plants by Prusinkiewicz & Lindenmayer from the Springer-Verlag Press is an excellent (but heavy) book on this subject. However, a popular summary of the authors’ ideas was published in the January 1995 Scientific American on pages 97 to 99.

It seems that there is a very complicated mathematical basis for the seed arrangements, but that math can be explored easily with the PostScript computer language. Figure 1 shows the fundamental algorithm that determines the seed arrangements. Actually, those spirals are visual artifacts that have nothing to do with the underlying generation algorithm. What you see are the results, and not the cause.

Start a very tight spiral, one that is not obvious. Then, for every 137.50776 degrees of rotation, plant a seed. That’s all there is to it. Well, maybe not quite all. Do this and the seeds get farther and far-
A divergence of 1.0 does nothing—it allows the seeds to spread out. A divergence of 0.5 gives the uniform result shown in Fig. 1. Another way of thinking about the 0.5 divergence is that it moves each seed toward the center by the square root of its radial distance.

All of the outside seeds in sunflowers tend to be larger and spaced farther apart than those closest to the center. A plant diverges by 0.6 or so but for some far out artistic effects, try a divergence of 0.3.

The value of 137.50776 is critical and must be exact. This is a magic irrational number that has all kinds of artsy-craftsy applications. It is even related to the Grecian golden rectangle. It turns out that this magic number is also the limit for paired numbers in a Fibonacci Series. Figure 2 offers a few clues about what Fibonacci was doing.

A Fibonacci series is created by making each new term out of the sum of its two previous ones. Examples of this are 1, 2, 3, 5, 8, 13, 21, 34, 55, 89... And there is a related alternate series of 3, 4, 7, 11, 18, 29, 47, 76... A surprising number of natural physical processes occur in a Fibonacci pattern. Ironically, the Fibonacci series did not work in the subject area for which he initially developed it.

As the ratios of the paired Fibonacci numbers are taken higher and higher, they converge on a value of 0.618034. A distance that far around a 360° circle turns out to be 137.50776°. The inverse of that number is the Greek's record golden rectangle.

Those spiral artifacts are known as parastichies. They usually end up as two adjacent numbers in a Fibonacci series; in the case of Fig. 1, they are spirals of 34 and 55. To make the clockwise 34 spirals more obvious, reprint the figure larger with higher divergence. The inside of the spiral does not show up clearly, so I blanked it out. In nature, many real sunflowers do the same thing!

To run this code, just enter it into your word processor and send it to any PostScript printer with any communication program or by clicking the “send PostScript file” on a printer driver. Alternatively, use GhostScript for on-screen viewing (more details on this are in STAR-TUP.PDF). Then change the parameters to get different patterns. I have summarized that algorithm in Fig. 3 for those who want to translate it into a less versatile or more primitive language.

I’ve posted ready-to-run code as SUNFLOUR.PS on GENIE PSRT. For some other astonishing examples of algorithm-driven growth, upload FRACFERN.PS as well. Yeah, I also have some versions of Ghostscript available.

Simplicity strikes again

I have been snooping around inside Radio Shack’s new 22- to 103-volt AC Voltage Sensor. This pen-sized device lights up whenever it is placed within an inch or two of a live 120-volt AC source. You can hold it near a line cord to make sure power is available, or trace wires through the walls of your home. It allows you to quickly check fuses or circuit breakers, run “hot chassis” safety tests, troubleshoot series-wired Christmas tree light strings, or simply make sure power is off before doing any repair work on circuits.

Figure 4 is a simplified schematic of the voltage sensor. It is basically an E-field radio receiver for 60-Hz line radiation. Amazingly, the key component is a ten-cent hex inverter! The first inverter is biased into its active region so it behaves like a linear amplifier. To the metal tab antenna, this looks like a ×10 amplifier with an 8-megohm input impedance. Four more cascaded inverters together act as a high-gain clipping amplifier.

In the presence of an AC electric field, a 60-Hz squarewave appears
across the LED, turning it on brightly. A resistor to ground on the output of the first inverter introduces the slight bias offset to ensure that the second inverter remains off in the absence of a 60-Hz signal. The sensitivity threshold can be adjusted by changing that resistor.

The capacitor performs two tasks: It bypasses any 60-Hz negative feedback to give the maximum AC gain from the first stage and it tests the battery by taking only a fraction of a second to charge when power is turned on. More elegant simplicity at work.

The circuit board has options for a buzzer and several other operating modes. The two "mystery resistors" are jumpers with low ohm values. I want to suggest two tips if you want to build your own sensor: The sensing antenna must be bare and exposed for maximum sensitivity. Also, be sure to use the "UB" (unbuffered) version of the CD4069 CMOS hex inverter. A 4069B has too much gain and will oscillate in the circuit.

The drive transistor can probably be left out if you use a higher supply voltage and a high-brightness LED. Obviously, the circuit will not work if the wire that you are tracing is shielded, BX cable, in metal conduit, or there is metal between the sensor and the wire. And, of course, only "hot" wires can be traced through house walls. I have more details on CMOS linear amplifiers in my CMOS Cookbook.

Adobe's Acrobat

Which is preferable—a printed document or an electronic one? For permanent data storage nothing compares with a document printed with ink or toner on paper. It excels in legibility, pride of ownership, and its read-anything convenience. If these factors are important to you, there is just no way that any electronic document can approach it. If it does, it will not happen in the next five years.

By contrast, an electronic document is instantly available. It is never misplaced or out on loan, and can be corrected or updated easily long after it is first printed out. All copies are perfect originals. There is never any generation loss. Electronic documents do not wear out or deteriorate over time. They don't get musty or coffee stains. They can be stored in far less space than printed pages and they are easily customized. And they can be shipped out much faster at much less cost.

Electronic documents can also provide hypertext features that are just not available on the printed page. These include the opportunity to search more rapidly (even for sloppy or sparse key words, than can be done with sheafs of documents or entire libraries. One mouse click on an index, a table of contents, or link puts you instantly on the right page, directs you to pertinent references, and gives you tutorial help. It could also play music, or run a video clip. You can have mini thumbnails that let you view many pages on-screen at once, or let you add "Post-it" notes that never fall off.

Today you need both electronic and printed documents. Newly upgraded Acrobat software from Adobe Systems offers you the best of both worlds. Acrobat is fast becoming the new de-facto Internet standard for document interchange. You can now device-independently view superb quality documents on your computer screen. Even better is the fact that Adobe's Acrobat is free to the end user!

The key to Acrobat is a compact file called a .PDF file. Those files use only ASCII printing characters so they are compatible with all communication channels. The Acrobat Reader lets you view the documents on screen, wander around in them, search through them, or print them out. Acrobat files are created internally by applications or by using an Acrobat Exchange utility code. The separate Acrobat Distiller program converts most PostScript files into a compact and lean "just the facts ma'am" .PDF format.
An Acrobat file conveys mixed text and graphics, including words, line art, and photos, just like a printed page. There’s optional sound, video, or even robotic control, and all of those hypertext goodies are overlaid on top of everything. How are oddball fonts handled? If you absolutely must have an iexact duplicate, then a .PDF file will drag along all of the necessary fonts. This makes the file rather long, but it guarantees its complete accuracy.

For typical users, unusual fonts are substituted with multiple master fonts. One serif, one sans. These are good enough for most users most of the time. The multiple master font has variable width, weight, and optical size. Yes, the page layout and exact text justification is fully preserved.

Usually, the Acrobat reader shops around for real fonts, first checking host and printer, and then the .PDF file itself. It uses these if they are available or it substitutes a multiple master font as a stand-in. In instances where you need only a few letters of some nonstandard font, you can capture the font path earlier, giving you exact results and a short file at the same time. Acrobat accuracy depends on the output device. It’s quick and convenient on-screen, and very easy to magnify. It’s pleasant and very readable on any laser printer or camera-ready on a phototypesetter.

Acrobat documents can easily be edited or modified. Raw, words-only unformatted text can be extracted with the cut-and-paste tools in the Acrobat reader. But infinitely better is a fully formatted text and graphics editing or rearrangement that you can do with Adobe Illustrator. There are two catches here: Be sure to use Illustrator v5.5 or higher, and make sure that your Acrobat PDF plug-in is host-installed. All of my earlier .GPS guru gonzol tech illustrations also work well with Illustrator, simply by routing them through the Acrobat distiller module first.

By a special arrangement, I have uploaded DOS, Windows, and Mac Acrobat readers to PSRT, where it’s free for the downloading. You’ll get application notes, demonstrations, reference manuals, and many examples. Most of my latest column reprints are now in Acrobat form for instant on-screen viewing even without PostScript. I will update the earlier ones as time and money permit. Kate (my assistant sysop) and I have been uploading two or three original or unique files each day, so you’re bound to find something new each time you visit.

**Getting documents**

What do you do if you must have your own hard copy of some technical article or standard? Where do you go for fast help? First and foremost, go on-line and snoop around. Thousands of sources are now scrambling to offer millions of Acrobat-format reprints to you. Many are free for the downloading through the Internet, the commercial online services, and even by way of local BBS systems.

I have posted a few key document retrieval supply sources for this month’s resource sidebar. The all time classic standby, of course, was interlibrary loan. Sadly, many libraries have dropped this service recently or have made it a tedious, expensive process. With far fewer participants, the odds of obtaining what you want are far lower. Today, an interlibrary loan is bound to be a frustrating waste of time.

Another traditional source is UMI, short for University Microfilms. It sells copies of any magazine or technical article from nearly any source. But to use UMI you must precisely specify the publication, volume, author, and page numbers. Cost varies with speed of service.

UMI recently added a sorely needed new service by opening The Information Store. It is a convenient place to find all the really hard-to-get material—documents such as conference proceedings, obscure reprints, and standards. Most of these are now stocked in depth by Global Engineering Documents. Their documents are pricey, but they do have what you want the instant you need it. It is usually cheaper and slower to go directly to the standards group.

By far, the best way to determine if a publication or document exists is through the Dialog Information Service by way of your local library. GENIE, or one of those other commercial on-line services. Dialog is great for searches and abstracts, but the other services might be better if you want hard copy.

The U.S. Government Printing Office can be a useful source for leaflets and brochures. They are now much easier to deal with from their 24 “retail” outlets. I have shown only one in the sidebar that goes by the catchy name of U.S. Government Bookstore. Contact them for a list of all of their other offerings.

Individual reprints of most of my columns are instantly available on GENIE PSRT. They are also available as book-on-demand bound hard copy from Synergetics. We can also find any document for you on a custom basis.

**BASIC Stamp manuals**

I looked at the $29 BASIC Stamp discussed two columns back. This is the hacker microcomputer. I have had lots of helpline requests for more information on this subject, so I made a special arrangement with Lance Wally from Parallax. I have uploaded the complete Basic stamp user manual to GENIE PSRT. You can obtain it free by downloading.

I have split the material into three pieces, a BASTAMP1.PDF introduction, the instruction set as a
REPRINT RESOURCES
Dialog Information Service
3460 Hillview Avenue
Palo Alto CA 94304
(415) 858-2700

GENie
401 North Washington Street
Rockville MD 20850
(800) 638-9636

Global Engineering Documents
15 Inverness Way East
Englewood CO 80112
(303) 854-7179

Information Store
500 Sansom Street #400
San Francisco CA 94111
(415) 433-5500

UMI
300 North Zeeb Road
Ann Arbor MI 48106
(800) 521-3044

US Government Bookstore
720 North Maah Street
Pueblo CO 81003
(719) 544-3142

BASTAMP2.PDF, and dozens of detailed applications examples as BASTAMP3.PDF. Files are in Acrobat format, so you can easily view it on screen or print your own hard copy.

New tech lit
Plessey is offering a new Consumer IC Handbook that contains information on a full line of remote-control and satellite ICs. Plessey has also just released the GP1010 single-chip GPS (global positioning satellite) receiver front end, a companion application board, and a GP1020 back-end six-channel correlator.

National Semiconductor is offering free samples of its new LM45 precision centigrade IC temperature sensor to qualified persons who request them.

Hewlett-Packard is offering free samples of IrDA infrared communication parts to prospective volume purchasers. A lot of useful information on remote infrared sensing appears in a free Handbook of Non-Contact Temperature Sensing from Exergen.

Two unusual trade publications that explore new desktop concepts are Inside Finishing on foil stamping and Kry Color materials and P-O-P & Sign Design on new plastics and unusual prototyping materials. Both are valuable resources. P-O-P stands for point of purchase. Take advantage of the free copy of the Embossing Arts catalog that mentions a lot of desktop opportunities for hackers.

When you are about to go off your gourd, there's a support group called the American Gourd Society that can help you. It has a free catalog that's loaded with useful books and bulletins.

If you really want to immerse yourself in desktop publishing, check out my Book-on-demand Resource Kit. It contains all the information you'll need to get started to be your own publisher.

It's time for our usual reminder to check the Names & Numbers or that Reprint Resources sidebars for references on most of the subjects I've mentioned. And the PSRT access and a no-charge voice helpline is available per the Need Help? box. As before, I have arranged a special ten-hour free trial of GENie for Hardware Hacker readers. A credit card is required for signup.

CIRCLE 178 ON FREE INFORMATION CARD

Choose from 46 Career Opportunities!
Get Your Specialized Associate Degree or Career Diploma at Home in Spare Time
Now without attending college classes and with no previous experience, you can train for a money-making career...even get a Degree. Send for free facts and color brochure on employment opportunities in the field that interests you most. See how easy it is to train at home for a great career or advancement in your present job.

1-800-595-5505 Ext. 7649
CALL ANYTIME - 24 hours a day, 7 days a week
OR MAIL COUPON TODAY!

CALL ME FREE

You're invited to sign up for the ISCE Technical Occasion.

Your Ticket To SUCCESS
Over 28,000 technicians have gained admittance worldwide as certified professionals. Let your ticket start opening doors for you.

ISCE offers Journeyman certification in Consumer Electronics, Industrial, Medical, Gourmand, Radar, Computer and Video. For more information, contact the International Society of Certified Electronics Technicians, 2108 West Berry Street, Fort Worth, TX 76109; (817) 921-9101.

Name
Address
City
State
Zip

Send material about ISCE and becoming certified.

Send one “Study Guide for the Associate Level CET Test.” Envelope is included.

July, 1985, Electronics Now

"We can't afford a dish so I figured I'd tap into one directly."
In last month's column, I began a discussion of the potential long-term, cumulative damage to student's hearing that could result from the high sound levels present at school dances. The subject arose out of my concern, as a parent, for my son's hearing. This month, the Q-and-A format is continued, with a look at how hearing damage occurs and what other concerned parents can do to protect their children's hearing.

Q. Will the audiological screening tests given in schools pick up signs of incipient damage?

Not necessarily. Some of the early warning symptoms are diminished ability to differentiate between adjacent tones and sharp dips in hearing response at narrow frequency bands. Conventional quick screening with just five or six discrete tones to cover the frequency bandwidth of human hearing probably will not detect such problems. High resolution (four minutes per octave) sweep-frequency tracking audiometry and measurement of the student's audio-frequency resolution are needed to disclose such problems. According to the Harvard Medical School Health Letter, reduced pitch discrimination is especially likely if the youngsters have experienced temporary audibility-threshold shift or several minutes of ringing in their ears after high-decibel exposure.

In a paper presented before the Audio Engineering Society, one researcher cited several audiological studies of students. In one case it was found that 3.8% of sixth graders failed a high-frequency hearing test, while 11% of 9th graders and 10.6% of high-school seniors failed it. A survey of incoming college freshmen yielded a 33% failure rate. The next year, 60.7% of the new incoming class failed. Those figures clearly imply an accumulation of damage.

Q. How does excessively loud sound cause hearing loss?

The injury from exposure to high sound levels takes place in the coiled, snail-shell-shaped structure in the inner ear called the cochlea. The fluid-filled cochlea is the final destination of the acoustic vibrations (sound, that is) forwarded via the eardrum and the tiny bones in the inner ear. Minute hair cells within the cochlea convert the acoustic vibrations into microvolt electrical signals that travel through the auditory nerve to the brain, where it is perceived as sound. Hair cells that have been exposed to excessive sound levels become twisted, bent, and/or fused, and are no longer able to respond properly to the incoming sonic vibrations. The ear's performance is degraded even when only a relatively small number of hair cells are damaged. Although there has been some research into hair-cell regeneration, hair-cell damage and the resulting hearing loss seem to be permanent.

Some basic facts about hearing might be of interest at this time. The human ear is a complex electro-mechanical-hydraulic organ that responds to a band of frequencies usually given as 20 to 20,000 Hz. As the human ear ages, its response to the higher pitches diminishes, and it is a rare male senior citizen who can easily hear frequencies much over 5000 Hz or so. (The higher harmonics of musical instruments are in this range.) Women, for some reason, suffer about half the age-induced hearing loss of men.

When the ear's middle- and high-frequency response is diminished, many of the defining sounds in speech become hard to hear, and comprehension is impaired. Some speech sounds that are higher in pitch (and softer than the vowels), such as "s," "sh," and "f," might not be perceived at all, and others, such as "p" and "t," might be confused. That occurs in many older adults well before they are aware that their ears' volume sensitivity is also impaired. In other words, sounds have to be louder to be heard at the same subjective level than when the ear (and the rest of the body) was younger.

It has been suggested that both of those effects are not inevitable, but rather are the result of the cumulative effect of the high sound levels common in "civilized" societies. Individuals in isolated cultures, such as the Mabaan tribe in the Sudan or the Easter Islanders, who have never been exposed to the sonic stresses of civilization, have been tested as having youthful hearing acuity well into old age.

Q. Rock musicians are constantly exposed to very loud sound. Why isn't their hearing affected?

It is. A nonprofit organization called H.E.A.R. (Hearing Education and Awareness for Rockers) was founded in 1988 to educate rock musicians and their audiences about the causal relationship between high-decibel sound and hearing impairment. The brainchild of Kathy Peck, a well-established musician, and Flash Gordon, MD, the organization soon found widespread support within the music industry. Its present membership includes musicians, physicians, audiologists, engineers, disc jockeys, and journalists. Executive Director...
of excessive Lollapalooza of

Kathy Peck is militant on the issue of excessive sound levels because she herself suffers from a 40% hearing loss brought on by exposure to high-volume sound during her punk-rock performance days.

In addition to its many educational and public-service activities (including distribution of 8000 pairs of earplugs at Megadeth and Lollapalooza concerts), H.E.A.R. provides testing, counseling, and medical referrals to musicians troubled with hearing loss and tinnitus. Pete Townsend, who is one of H.E.A.R.'s strong supporters, stated at a press conference announcing the Who's reunion tour that "The real reason I haven't performed live for a long time is that I have very severe hearing damage." Many other musicians have publicly acknowledged their hearing problems, among them Joey Ramone, Jerry Harrison of the Talking Heads, Ted Nugent, and Jason Newstead of Metallica.

The solution for some performers is specialized earplugs that reduce the overall sound level by 15 to 18 dB without affecting the audible frequency response. Many classical musicians playing in the midst of large orchestras have also turned to hearing protectors such as "musician's earplugs" available from several manufacturers.

Q. Do you have any recommendations for the maximum allowable sound levels at school dances?

Several points relevant to this question have been raised in the research literature. First, there is a great individual variation in susceptibility to sound-induced hearing loss. In other words, a sound level that will induce severe tinnitus or threshold shift in one person, will leave another unaffected.

Because the OSHA-recommended 90-dB/eight-hour maximum sound-pressure level is based on average responses, it is reasonable to expect that a substantial number of persons are more sensitive than average and would benefit from lower maximum SPLs. Given that fact, it seems to me that it is best to be conservative in establishing a permissible maximum level at the disco dances. Also relevant is the fact that the OSHA recommendations are questioned by the EPA, which advocates a lower maximum of 85-dB/eight-hours.
The ISO standard also recommends lower sound levels for given exposure times.

I've not stressed the matter of overloud Walkmen, live heavy-metal concerts, or killer car stereos, all of which contribute to the din, and potential hearing loss. Because the damage accumulates over time as the cochlea's hair cells are knocked out one by one, it seems a wise policy to avoid sonic excess whenever possible, or wear earplug protection whenever you absolutely must indulge. Let's try to practice safe sound!

Given all the above, I would recommend that middle- and high-school disco dances operate with a maximum SPL reading of 85 dB (A-weighting, slow response, measured eight feet in front of the speakers). Measurements should be taken throughout the evening because of the previously mentioned threshold shift that impels DJs to turn up the volume as the evening wears on. Any microphone sing-along by the DJ should be included in the measurements. For monitoring purposes, I recommend the Radio Shack SPL meter (stock No. 32-2050). It sells for $31.99, is easy to use, and is certainly accurate enough for disco sound-level monitoring.

I'm aware that the 85-dB level might be unsatisfactory for a few in the audience (and the DJ), but it is far more important that the students do not suffer temporary threshold shift or short-term tinnitus (as a contributor to long-term damage) as the price of their fun. At all times, try to keep the kids from clustering within five feet or so in front of the speakers, as sound intensifies considerably at close range—which is probably the reason why they are there in the first place.

We all know that kids typically need to be called three or four times before they respond. Let's all help ensure that their behavior continues to reflect normal teen persuasiveness rather than noise-induced hearing damage.

Q: Where can I get more information on the cumulative effects of excessive sound on hearing?

I've compiled a bibliography that lists suggested reading.

E very year a new crop of electronic wonders shows up on the local store shelves, where they are bought by a public that is hungry for new features. If new features and technology are not added to last year's products, fewer people will buy them. In truth, however, most of the so-called "new technology" each year isn't really new at all.

The same can be said of my project designs. Complex projects are really just combinations of simple projects. All the elements of the audio router I'm putting together are things that I've done before. Those building blocks are proven circuits that have worked well for me many times over the years, and using them will help ensure that this new project will work as I expect it to.

The router

With that out of the way, I can get back to the audio router. The circuitry I've laid out so far "saves" pressing an input switch on the keyboard in a latch. Now I need a circuit that will let me assign that switch selection to one of four outputs. Because I want to have four outputs, I need four latches. As with the inputs, I've chosen to use CD4508B CMOS dual 4-bit latches.

The layout for the output latches is shown on the right side of Fig. 1. The inputs to the latches form an eight-bit bus (one bit for each input). The latch outputs will be the control signals for the analog switches that will route the audio signals. As with the input latch, I don't need to control the enabling of the outputs because there's no possibility of bus contention at the output. Therefore I've grounded all of the 4508's enable (en) inputs (pins 3 and 15 of each chip).

The clear (cl) inputs (pins 1 and 13) are also tied together so I have some way to clear all the output latches at once. In a similar manner, the store (st) inputs (pins 2 and 14) of each chip are tied together and the resulting four lines are brought out to the four output selection switches previously mentioned.

Once you get this output section wired up, you can connect it to the input section you've already built. Five new switches have been added: four output select switches and a clear switch that clears both the output latches and the input latch as well.

Another function that was added to the circuit is a way to guarantee the state of all the latches when power is first applied. The 4508 is cleared when a high is put on the clear inputs, so a positive-going pulse must be generated at power up. Since there was one NAND gate left over in the 4011, I used it to build a half monostable multivibrator consisting of IC1-d, R5, and C2. When power is applied to the circuit, the brief positive-going pulse that appears at the output of IC1-d travels through R4 and clears all five of the 4508 latches in the circuit. Once that's done, the output of IC1-d stays logic low and prevents the clear inputs from floating.

You could use that same pulse to clear IC2, the heart of the keyboard section. When power is first applied to a 4017, there's no guarantee as to the state of its outputs. If you disable the keyboard clock, turn on power, and check the output pins of IC2, you'll see that the 4017 might have more than one output logic high—an illegal and somewhat confusing state. But that's corrected as soon as the chip gets a reset pulse. The reason I don't specifically reset
FIG. 2—THE COMPLETE CIRCUIT so far. Four output select switches and a clear switch that clears both the output latches and the input latch have been added.
the 4017 at power up is that it will be done automatically after a maximum of nine clock pulses. Since that takes only a couple of milliseconds, I'd rather just wait for it to reset than have to add an additional or gate to do the job.

The four output selection switches connect one of the output latch's store inputs to + V, which is a cheap and easy way to generate the positive pulse needed to store the latch contents. I did not debounce the switches because it doesn't matter if the latches receive a short train of pulses. The state of the inputs doesn't change, so the number of pulses sent to the output latch is irrelevant. Resistors R6 to R9 are connected between the store inputs and ground to prevent those inputs from floating.

After it's wired up, test the operation of the circuit by selecting an input and an output and then, using a logic probe, check the output latches. Make sure that the expected output is logic high and that the other outputs remain low. Check both clear switches as well. If you get consistent errors, you've probably miswired the output bus. If you get random errors, you probably have left one of the control inputs floating.

The circuit now generates the signals needed to control the ICs that will be doing the actual audio switching. When we get together next time, I'll add this final section to the circuit and the project will be complete. I'll talk about a few extra features that can be added to the switcher to make it more useful, and I'll supply a PC board layout.

---

### Reprint Bookstore

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
<td>Popular Electronics (1995 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>224</td>
<td>Popular Electronics (1994 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>223</td>
<td>Popular Electronics (1993 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>222</td>
<td>Popular Electronics (1992 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>221</td>
<td>Popular Electronics (1991 back issues, Jan., Mar. not available)</td>
<td>$5.00</td>
</tr>
<tr>
<td>220</td>
<td>Popular Electronics (1990 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>219</td>
<td>HH94S Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>218</td>
<td>HH94T Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>217</td>
<td>HH94U Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>216</td>
<td>HH94V Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>215</td>
<td>HH94W Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>214</td>
<td>HH94X Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>213</td>
<td>HH94Y Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>212</td>
<td>HH94Z Hobbyist Handbook</td>
<td>$5.00</td>
</tr>
<tr>
<td>211</td>
<td>Radio-Electronics (1991 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>210</td>
<td>Radio-Electronics (1990 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>209</td>
<td>Radio-Electronics (1989 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>208</td>
<td>Radio-Electronics (1988 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>207</td>
<td>Radio-Electronics (1987 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>206</td>
<td>Radio-Electronics (1986 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>205</td>
<td>Radio-Electronics (1985 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>204</td>
<td>Radio-Electronics (1984 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>203</td>
<td>Radio-Electronics (1983 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>202</td>
<td>Radio-Electronics (1982 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>201</td>
<td>Radio-Electronics (1981 back issues)</td>
<td>$5.00</td>
</tr>
<tr>
<td>200</td>
<td>Radio-Electronics (1980 back issues)</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

To order any of the items indicated above, check off the ones you want. Complete the order form below, include your payment, check or money order (DO NOT SEND CASH), payable to Reprint Bookstore, P.O. Box 4099, Farmingdale, NY 11735.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>174</td>
<td>Electronics Comics (The Best of)</td>
<td>$2.00</td>
</tr>
<tr>
<td>173</td>
<td>From Not-Working to Networking Troubleshooting Local-Area Networks</td>
<td>$5.00</td>
</tr>
<tr>
<td>172</td>
<td>33 Bench-Tested Circuits</td>
<td>$2.00</td>
</tr>
<tr>
<td>171</td>
<td>36 Time Tested Circuits</td>
<td>$2.00</td>
</tr>
<tr>
<td>170</td>
<td>High-Voltage Projects for Fun and Science Book 1</td>
<td>$4.00</td>
</tr>
<tr>
<td>170A</td>
<td>High-Voltage Projects for Fun and Science Book 2</td>
<td>$4.00</td>
</tr>
<tr>
<td>169</td>
<td>Think Tank (133 Circuits)</td>
<td>$3.50</td>
</tr>
<tr>
<td>169A</td>
<td>Think Tank Vol. 2</td>
<td>$3.00</td>
</tr>
<tr>
<td>168</td>
<td>Fact Cards (#34-66)</td>
<td>$3.00</td>
</tr>
<tr>
<td>168C</td>
<td>Fact Cards (#67-99)</td>
<td>$3.00</td>
</tr>
<tr>
<td>168D</td>
<td>Fact Cards (#100-132)</td>
<td>$3.00</td>
</tr>
<tr>
<td>167</td>
<td>Designing With IC's</td>
<td>$4.00</td>
</tr>
<tr>
<td>166</td>
<td>Collected Works of Mohammed Ullyses Fips(62 pages, April Fool's Collection)</td>
<td>$5.00</td>
</tr>
<tr>
<td>165</td>
<td>How to Repair CD Disc Players</td>
<td>$5.00</td>
</tr>
<tr>
<td>164</td>
<td>Modern Electrics (April 1990)</td>
<td>$3.00</td>
</tr>
<tr>
<td>163</td>
<td>Receiving Satellite TV</td>
<td>$5.00</td>
</tr>
<tr>
<td>162</td>
<td>Build Your Own Satellite TV Receiver</td>
<td>$5.00</td>
</tr>
<tr>
<td>161</td>
<td>Describing (Feb. 1984)</td>
<td>$4.00</td>
</tr>
<tr>
<td>160</td>
<td>New Ideas - 42 Circuits</td>
<td>$3.50</td>
</tr>
<tr>
<td>159</td>
<td>Low Frequency Receiving Techniques Building and using VLF Antennas</td>
<td>$5.00</td>
</tr>
<tr>
<td>158</td>
<td>Electro Importing Co. Catalog (Circa 1918)</td>
<td>$5.95</td>
</tr>
<tr>
<td>157</td>
<td>All About Kits</td>
<td>$2.00</td>
</tr>
<tr>
<td>156</td>
<td>How To Make PC Boards</td>
<td>$2.00</td>
</tr>
<tr>
<td>154</td>
<td>How To Repair VCR's</td>
<td>$3.50</td>
</tr>
</tbody>
</table>

To use your Visa or Mastercard, complete the following:

Bill my □ Visa □ Mastercard

Card No. ___________ Exp. Date ____________

Signature ____________

MAIL TO: Claggk Inc., Reprint Bookstore, P.O. Box 4099, Farmingdale NY 11735

All payments must be in U.S. Funds

*SHIPPING CHARGES IN USA & 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**

Total price of merchandise $__________

Shipping Charge (see chart) $__________

Subtotal $__________

Sales Tax (New York State Residents only) $__________

Total Enclosed $__________

Name ____________

Address ____________

City ____________ State ____________ Zip ____________

### Card Chart

<table>
<thead>
<tr>
<th>Card Type</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visa</td>
<td>$2.00</td>
</tr>
<tr>
<td>Mastercard</td>
<td>$3.00</td>
</tr>
</tbody>
</table>

Please allow 4-6 weeks for delivery.

TO: TOURISTS / ELECTRONICS

Please place a credit card order by phone, Visa or Mastercard only.

CALL: 516-293-3751.
Microsoft's annual Hardware Engineering Conference (WinHEC '95) was held in early spring this year on the West Coast. Many interesting standards, technologies, and products were discussed and demonstrated. Here are a few highlights:

Microsoft's General Manager of the Personal Systems Division, John Ludwig, displayed an interesting graph (Fig. 1, data courtesy of Forrester Research) showing projected shipments of network-server operating systems. Note that NetWare peaks in 1996, followed by a slow but steady decline. Unix continues to maintain a low-profile presence, OS/2 drops off sharply, and NT ramps up quickly. That might be wishful thinking on Microsoft's part, but the word on the street is that NT really is a product to contend with.

Figure 2 maps out Microsoft's strategic plan for operating system evolution. (The map was developed by Michael Slater, a microprocessor design wizard and newsletter publisher.) Note that the code name Memphis is where Windows desktop systems converges with Windows NT. Also note that DOS is just about dead. There may be a DOS 7; Microsoft still hasn't formally confirmed or denied. But it will almost surely be the last version.

Another interesting point, according to Slater: VESA local bus (VLB) is on its last legs. It was designed as a tactical solution to a need for higher graphics bandwidth. The PCI architecture, on the other hand, represents a fundamental redesign of the PC's I/O system. I will discuss some of the differences here next month.) Slater also believes that the IDE architecture is likely to greatly overshadow SCSI, despite SCSI's universally acknowledged maturity, compatibility, flexibility, and performance. The primary reason is cost.

It seems to me that with IDE, the PC industry has once again allowed short-term cost considerations to override longer-term architectural considerations. Moreover, consumers will ultimately pay the price. (Just ask anybody who bought into the ESDI standard a few years ago.) Anyone who wants to add peripherals other than a hard disk or CD-ROM will end up adding a SCSI host adapter to his PC. For example, tape drives, scanners, printers, and CD-ROM writers all run with SCSI. With both SCSI and IDE peripherals to worry about, purchasing, configuring, and maintenance will all be more complex, hence more costly.

On the other hand, another new standard promises to increase flexibility, reliability, and performance of the I/O subsystem. The standard is called the Universal Serial Bus; it was developed primarily by Intel and Microsoft. USB offers daisy-chain architecture, with identical connectors on all devices, and a single port on the PC. No more plugging the scanner into the printer port! USB provides 12-megabit/second performance in a master-slave arrangement, and it can accommodate devices such as a keyboard, mouse, joystick, modem, ISDN link, speakers, microphone, and even mass storage devices. USB is intended as an inexpensive solution to I/O port proliferation and attendant configuration hassles; implementations should be available by the end of the year.

A more advanced technical solution, known variously as FireWire, Serial SCSI, SCSI 3, and IEEE P1394, is also being discussed. This new standard promises much higher performance, but at higher cost, and it will take longer for it to reach the market.
Intel has begun promoting its Native Signal Processing (NSP) architecture. The basic idea behind it is to reduce hardware cost by eliminating dedicated signal processors (such as those used for modems and sound and video processing), and off-load the tasks to the host CPU—most likely a high-end Pentium. There's a quote floating around, attributed to Intel's chief, Andy Grove, stating, "MIPS are free." The implication of that quote is that Pentiums have excess power that could be put to use. I guess Andy has never tried to download a file while starting a new application, or has never built a complex document out of multiple OLE objects. NSP doesn't sound like a panacea to me; it sounds more like a thinly veiled attempt to increase Intel's market share at the expense of user power and reliability. No thanks.

Communications, games, ease of use

At the conference, Microsoft listed three focus areas for its Consumer Strategy: Communications, games, and ease of use. The communications goals break down into two main components: 1) Making the PC the premiere communications appliance, and 2) Providing interactive, rich connections to everybody, everywhere. Is there anything to stop Microsoft from reaching either goal? Is there any reason why one would want to?

As for games, Microsoft wants to make the PC the premiere "entertainment" platform, primarily through enhanced multimedia capabilities, underlying system architecture, and development tools. As for ease of use, the company wants to "make the PC as easy to use as a toaster." Good luck.

Microsoft has drawn a line in the sand about the basic system configuration of the 1996 PC: Plug and play BIOS, 1024 × 768 × 8 video, advanced serial (but not USB) and parallel ports, PCI bus, and power management. For consumer computers, CD-ROM, audio, joystick, and modem are required. For corporate computers, networking, telephone-based communications, and writable CD-ROM technologies are important. RAM, CPU, and mass storage capacities were not specified for either consumer or corporate computers.

A CASE tool for ideas

In the past I have written here about Visio, a drag-and-drop drawing tool that runs under Windows. Many people (including some who ought to know better) think of Visio as a means for inartistic people to create attractive drawings. Visio can help to improve their appearance, but its value goes far deeper than that. I think of it as a conceptual design tool, a conceptual illustration tool. It's a CASE tool for ideas.

CASE stands for Computer-Aided Software Engineering; the term refers both to software engineering practices and tools. CASE is intended to elevate software development from just churning out code in some language to modeling processes, rules, and objects in a language-independent manner, and subsequently generating code—whether C, COBOL, or something else—automatically. A CASE tool also helps enforce rigor and consistency in the models it creates.

Visio can't generate code, and it can't enforce rigor or consistency. But it can be used for analyzing and describing any complex problem that must be broken down into multiple levels of components with complex interrelations.

Visio's template-based approach is the visual equivalent of integrated circuits. Instead of plugging in 555 timer ICs or 7404 hex inverters, you use visual symbols (including all kinds of electronic symbols). Unlike hardware components, it is a simple process to create your own Visio components, as well as to modify the built-in components. Visio's object-oriented architecture even allows you to go in and change the way a component functions. Then the functions of all examples (in a particular drawing) adopt the new attributes.

From an electronics viewpoint, the program could sorely use a PC board trace-routing mechanism that would feed from a schematic. What I really want is a white-board-size, touch-screen version of Visio. Meanwhile, if your work involves any form of technical illustration or conceptual modeling, get a copy of Visio. I am sure you won't be disappointed.

Is there life after Lou?

Recently I had the pleasure of ordering some equipment from IBM. The experience was, shall we say, educational.

The problem was my client whose office had only IBM computers. He wanted to buy some engineering consulting time from my company. Because of the vagaries of corporate politics and economics, the client could not hire full-time employees, nor could he purchase equipment. But his company was allowed to hire all kinds of contractors, and the contractors were even allowed to fold the costs of required equipment purchases into the hourly rate. Fine. That's what keeps us in business.

IBM has a service agreement with my client's company, a manufacturing concern with an international presence. The agreement, in essence, states that no non-IBM equipment can be attached to the company's network. If it does attach them, IBM will not accept responsibility for servicing anything connected to the network. Ooooh—what's wrong with this picture?

That put my company, and me in particular, in the position of having to buy a real IBM brand personal computer. Fine; I buy systems, peripherals, and components all the time. It shouldn't be too difficult to select and purchase a state-of-the-art system—right?

Wrong. First I went through my client's purchasing contact, a distributor in New Jersey. I quickly found out that the distributor could not help me configure a system, did not know the difference between IBM's main PC lines (the 300 and 700 series), and couldn't even give me prices on various system configurations over the phone. Big help.

Next I tried several mail-order vendors, the kind that advertise in Computer Shopper. Those companies were able to assemble config-

www.americanradiohistory.com
networking software (Lantastic)

...where you to installed them, erly, arrived several weeks later by UPS ground delivery. Inside the computer, a cage that holds disk drives had not been snapped into place properly, so the floppy disk drive came through the case at an angle. I picked up a quad-speed CD-ROM and a monitor from my local vendor, installed them, and the system worked fine.

The computer has an interesting feature called "Resume." It allows you to shut the machine off, even in Windows, and resume exactly where you left off next time you turn the computer on. Unfortunately, Resume was incompatible with our networking software (Lantastic 5.0), so I had to disable it.

Mechanically, the IBM computer was well built, although not as well built as the PS/2's of old. The motherboard has six SIMM slots and built-in accelerated video, along with enhanced IDE ports and the usual serial, parallel, mouse, and keyboard ports. Copies of PC-DOS and Windows were installed on the hard disk, but there were no backup copies on floppy disk or CD-ROM. Beneath the Windows directory was a directory called Drivers; it contained the compressed format drivers for the Windows' Setup program. If you wanted to delete that directory to save space, you'd have no way to install new drivers.

All in all, 'twas an interesting experience. Obviously, the "New" IBM still has some learning to do.

**E-mail**

K. Woodmensch of St. Louis takes me to task for Microsoft bashing in the "UBersoft" column in the March issue of *Electronics Now.* I am neither pro nor con Microsoft, IBM, or any other company. I am pro user. I want the best products at the best prices for the user. In some applications, Microsoft provides the best products; in others, it does not. In the areas where Microsoft does well, such as word processing, spreadsheet, and desktop database applications, it has not always done so. Its competitors (Lotus and Word Perfect) gave the market away. In the areas where Microsoft does not—yet—have the best products (network operating systems, compilers, project management, presentation, desktop publishing and graphics), there is still room for the competition. Can Novell, Borland, Symantec, Scitor, Harvard Graphics, and Corel stand up? I sure hope so. We need more than one giant vendor of computer software.

Late-breaking news: Beta 3 of Win95 was just released, but several major new bugs have surfaced. One relates to 32-bit multitasking, and the other relates to the fact that heavy use of system resources causes system crashes. Microsoft still intends to release the product in August, but that date looks shaky. Maybe we should call it Win8x—or WinEver, as suggested by one trade publication. Comments to jkh@acm.org.
Telnet utility. While an FTP function merely gives you access to another computer's directories and files, Telnet actually allows you to work with other computers in an interactive fashion through a command-line interface. You can still upload and download files.

Power Tools
While bundled software will get you onto the Internet, it will only take you just so far. Fortunately, there are many more shareware and freeware programs that will make it easier for you to take advantage of Internet resources. The programs listed below are all available right off the Internet. Locations where they can be contained are listed for your convenience.

Eudora. This is one of the best Internet E-mail programs available. If you find yourself handling a great deal of E-mail, consider downloading the shareware version of Eudora by FTP from ftp.qualcomm.com in the /pseudora/windows/directory.

Gopher. Tools such as E-mail and FTP utilities are great for specific tasks, but the vast majority of Internet resources are buried under layers of networks and directories. Moving from one place to another can be a long, arduous task. What is needed is a "browser" that lets you move from one place to another as efficiently as possible. The Gopher tool is perhaps the most effective browser for the Internet. You can find a freeware copy of Gopher by FTP from lister.cc.ic.ac.uk in the /pub/wing-opher/directory.

Trumpet. Another feature of the Internet is the availability of Usenet news groups. Basically, network news groups are electronic discussion areas where people can post questions and exchange information. To subscribe to and participate in news groups, you will need a news reader utility such as Trumpet. Trumpet is available as shareware ($40), and be downloaded by FTP from ftp.ut.as.edu.au in the /pc/trumpet/wintrump/directory.

Mosaic One of the most exciting developments on the Internet is the World Wide Web (WWW) which offers a vast array of documents combining text, images, sound, and video. Mosaic is a tool designed to browse the WWW - it also provides limited FTP, news, and Gopher services. Mosaic is freeware available by FTP from ftp.ncsa.uiuc.edu.

Getting connected to the Internet is only the first step to a world of information. Once you're connected, you'll find such a wealth of information that your only problem will be sifting through it.

SMART DISPLAYS

Events 6 and Figs. 8 and 9 explain how this is done. The first line of code sets integer udc—ram equal to 28H, (equal to binary 1010000). This initial value is required to access the UDC RAM. Then hex 28H is sent to port B. That sets Fl and A3 to 1, while also setting A4 to 0. Display lines A2 to A0 correspond to the row number of data to be loaded into the UDC RAM location now being accessed. Row 1 equals binary 000, and row 7 equals binary 110.

The WR and CE lines are then toggled to 0, and the first row of UDC data is loaded into the UDC RAM location. If dot—data equals 0, the first row is loaded. If dot—date equals 1, the second row is loaded and so on. This step is performed by display data lines D4 to D0. All other display lines are ignored. Finally, disable the display write, jump to a new UDC RAM location, and repeat the write process seven times.

To display the UDC symbol that was defined, recall in the discussion of the character RAM that it stores either ASCII character data or a user-defined character (UDC) address in each character RAM location. These RAM UDC addresses correspond to all of the 16 UDC addresses shown in Fig. 2.

Refer to the end of Listing 6. To access the symbols created, access the character RAM by setting FL and A4 to A3 to 1, while setting A2 to A0 to the digit location where the UDC symbol is to be displayed. Toggle the lines to perform a write, and then insert the location of the ADC symbol in the ADC RAM. Set display data line D7 to 1, and lines D3 to D0 to the ADC RAM location where the symbol is stored.

Projects and source code
This project offers an opportunity for self-teaching the fundamentals of interfacing a personal computer with exterior circuits and devices, a subject not now covered in textbooks. You are encouraged to experiment with making the display scroll forward and backward, or even getting it to scroll vertically with the UDC functions. You can access the display self-test function, or you might want to build a computer driven moving message panel.

If you want to write and improve source code, you might want to purchase the author's source code diskette listed in the Parts List. It contains the complete listings of all code used in this article and also has a menu-driven executable program that goes beyond the examples given here (source code included). In addition, a second executable program allows special messages to be typed into the display (source code included).

The port address selector circuit gives you a way to send digital code to circuits or devices outside of your computer system. This circuit can be used to control or troubleshoot many different kinds of digital logic. For example, you could write data to your display and then read it back into your computer through the Port Address Selector.
CLASSIFIED AD ORDER FORM

To run your own classified ad, put one word on each of the lines below and send this form along with your check to:

Electronics Now Classified Ads, 500-B Bi-County Boulevard, Farmingdale, NY 11735

PLEASE INDICATE in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of $25.00.

- Plans/Kits
- Business Opportunities
- Education/Instruction
- Wanted
- Satellite Television
- For Sale

Special Category: $25.00

PLEASE PRINT EACH WORD SEPARATELY, in BLOCK LETTERS. Do not use your credit card for zip code. Minimum: 15 words.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35

We accept MasterCard and Visa for payment of orders. If you wish to use your credit card to pay for your ad fill in the following additional information (Sorry, no telephone orders can be accepted):

Card Number
Expiry Date

Please Print Name
Signature

IF YOU USE A BOX NUMBER YOU MUST INCLUDE YOUR PERMANENT ADDRESS AND PHONE NUMBER FOR OUR FILES. ADS SUBMITTED WITHOUT THIS INFORMATION WILL NOT BE ACCEPTED.

CLASSIFIED COMMERCIAL RATE: ($10 per word prepaid) (no charge for zip code). MINIMUM 15 WORDS. 5% discount for same ad in 6 issues; 10% discount for same ad in 12 issues within one year; if prepaid (not applicable on credit card orders). COMMERCIAL RATE: (for individuals who want to buy or sell a personal item) $2.50 per word, prepaid...no minimum. ONLY FIRST WORD AND NAME SET in bold caps at no extra charge. Additional bold face (not available as all caps) $5 per word additional. Entire ad in boldface. $3.70 per word. TINT SCREEN BEHIND AD. $3.85 per word. TINT SCREEN BEHIND ENTIRE AD PLUS ALL BOLD FACE AD: $5.00 per word. EXPANDED TYPE AD: $4.70 per word. Entire ad in boldface, $5.00 per word. TINT SCREEN BEHIND ENTIRE EXPANDED TYPE AD: $5.90 per word. TINT SCREEN BEHIND ENTIRE EXPANDED TYPE AD PLUS ALL BOLD FACE AD: $6.80 per word. DISPLAY ADS: 1' x 2 1/4" - $410.00; 2' x 2 1/4" - $820.00; 3' x 2 1/4" - $1230.00. General Information: Frequency rates and prepayment discounts are available. ALL COPY SUBJECT TO PUBLISHERS APPROVAL. ADVERTISEMENTS USING P.O. ADDRESS WILL NOT BE ACCEPTED UNTIL ADVERTISER SIGNED ORDER FORM. COPY TO BE IN OUR HANDS ON THE 1ST OF THE THIRD MONTH PRECEDING THE DATE OF THE ISSUE. (i.e., March issue copy must be received by December 1st). When normal closing date falls on Saturday, Sunday or Holiday, issue closes on preceding working day. Send for the classified brochure. Circle Number 49 on the Free Information Card.

Please make checks payable to Gernsback Publications Inc.

CABLE test chips. Jerreid, Tocom, S.A. Zenith. Puts cable boxes into full service model $29.95 to $59.95. (800) 452-7080, (310) 920-0844.

TEST equipment pre-owned now at affordable prices. Scan generators from $50.00, oscilloscopes from $50.00. Other equipment including manuals available. Send $2.00 U.S. for catalog. Refunds on first order. J.E. ELECTRONICS, 3446 Dempster, Skokie, IL 60076. (708) 982-1973.


HOME automation & computer control: Two-way IBM, two-way X-10, & hardware. Control devices from serial computer link or stand-alone operation. COMPACO, (615) 436-5189 BBS (615) 436-8933.


FREE 1995 CATALOG OF THE WORLD'S MOST FAMOUS CB ANTENNAS & ACCESSORIES

FREE FIESTIX: FREE CATALOG OFFER - 2614 E. Adams - Phoenix, AZ 85034
Write or Call, (602) 273-7151

300 Experimenters Circuits - Complete in 6 practical books using diodes, relays, FET's, LEDs, two-way X-10, & hardwire. Control devices for building blocks. Only $33.00 plus $6.00 for shipping, USA and Canada only. Send to: ETM INC., PO Box 24, Massachussetts Park, NY 11762-0940.

RESTRICTED information: surveillance, schematics, locksmithing, cable, hacking, etc. Send stamp: MENTOR, Box 1549-Z, Asbury, NJ 07712.
SURVEILLANCE privacy security protection. Catalog $5.00. SPY EMPORIUM, 6065 Hillock 414, Houston, TX 77001. (713) 774-1000.

CABLE test-chips as low as $9.95, for testing cable boxes in full service mode. Jerrold: Starcom VI, VII & RZ 5, Jerrold cubes; Pioneer, clears E2 thru E5; Pioneer cubes: BA-5000 thru BA-6700; Toccom 5503/5507; Scientific Atlanta: 8500 thru 8600; Zenith: all but PZ 1; ENGINEERING, 1 (800) 926-4030 (sales), (617) 770-3830 tech. (617) 770-2305 fax.

CABLE TV new products designed and reviewed by the staff. External activators for Jerrold, Pioneer, Scientific Atlanta living or dead. Save big. Make lots of money. 1 (800) 720-2302.

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 668, Seabrook, TX 77586. For COD's (713) 922-3512 any time.

PLANS AND KITS
60 SOLARDENER Project Books in two easy-to-read pocketbooks, in circuit descriptions, schematics, parts layouts, component listings, from bics and bics to bics and bics. Both book (BP170 & BP171) only $11.95, plus $4.00 for shipping. USA and Canada only. USA and Canada only.$4.00. CABLE TV, INC., PO Box 240, Manus Park, NY 11762-0240.

SURVEILLANCE Transmitter kits, 65 to 305 mHz. Equip your investigative setup for $33 and up. Five minutes completion at retail. All parts included. Home based businesses and operators. Call 1-800-470-7423 or write Box 8092, Barnet, VT 05031.

CABLE TV DESCRAMBLERS 1-800-233-9383 FREE CATALOG GUARANTEED BEST PRICES IMMEDIATE SHIPPING AT LOW PRICES.

CABLE TV Wholesalers, INC.


CONTROL anything anywhere. IR, RF. Home Automation, audio/video accessories, discount prices. 1 (800) 528-8556, 24 hour fax (201) 930-8720. THE CYPRESS GROUP, INC.
It started in America!

The creators are the masters in manufacturing the finest video products...

You probably don’t associate VCR’s with American technology. Fact is, video recording has its origins in America and it was 3M that brought video recording out of the lab and into your living room. Today, 3M video tape is the choice of all the major networks. No other tape company has ever won an Oscar or an Emmy. 3M Black Watch tape follows in this tradition—service and quality go hand in hand. Here are three Black Watch products you should be using at home!

Clean up! With constant playing and using of degrading dry or wet cleaners, the output of your video tapes has slowly diminished to an unacceptable level and the VCR plays as if it has a head cold! The culprit is most likely clogged and dirty video and/or audio heads. The 3M Black Watch™ Head Cleaner Videocassette uses a patented magnetic tape-based cleaning formation to remove head clogging debris. No foreign substances such as cloth, plastics or messy liquids and no harsh abrasive materials are present. The cleaner’s usable life is 400 cleanings or more!

It’s easy to use. Place the 3M Black Watch™ Head Cleaner Videocassette in the VCR and press the Play button. A pre-recorded message will appear clearly on your screen and an audible tone is heard, telling you that the cleaning process is now completed. No guess work; you never over clean! Priced at $19.95.

For the VCR! Once your VCR’s record and playback heads are cured, and the unit plays like new, consider using the finest videocassette you can buy—the 3M Black Watch™ T120 Hi Pro VHS 4410 Videocassette. The 4410 is the highest performing videocassette available today for use with all standard format VHS recording hardware!

Here’s what you hear and see...A sharp, clear picture—brightest ever—the freedom from streaks, flashes and snow—outstanding high-fidelity audio reproduction—optimum camcorder performance—maintains recording integrity. 3M Black Watch™ video tape is 100% laser inspected to guarantee surface smoothness and drop-out free performance. Priced at $8.00

You saw it here first! 3M Black Watch™ 0900 8mm video tape cassette loaded into your Hi Band camcorder delivers the finest picture and sound possible in the 8mm format. Extremely fine particles of pure iron alloyed with nickel and cobalt deliver a video performance exceeding 400 lines of horizontal resolution. You get the advantage of an exceptional video image with superior audio re-production. This means your HI 8 format camcorder will produce the best video and audio definition possible. With the 3M Black Watch™ 8mm cassette, the recording capability and performance of your camcorder will be significantly enhanced. Priced at $14.95.

Clagg Inc. — 3M VHS Special Offer
P.O. Box 4099,
Farmingdale,
New York 11735

Yes, I like your offer and here is my order for 3M Black Watch™ products!

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M Black Watch™ 0900 Hi Band-120 8mm Cassette</td>
<td>1</td>
<td>$14.95</td>
</tr>
<tr>
<td>3M Black Watch™ T120 Hi Pro VHS 4410 Videocassette</td>
<td>1</td>
<td>$8.00</td>
</tr>
<tr>
<td>3M Black Watch™ Head Cleaner Videocassette</td>
<td>1</td>
<td>$19.95</td>
</tr>
</tbody>
</table>

Shipping and handling per order $4.00
Total Amount in U.S. Funds only $
New York residents add local sales tax
Canadians add $6.00 per order. No foreign orders. Do not send cash.

Bill my ________________________ Visa MasterCard ___________ 
Card No. _______________________ Expire Date / / 
Signature _______________________ Name (Please print) ________________________
Address _________________________ City State ZIP

July 1985, Electronics Now

Torch Trees for America
To receive 10 free Colorado blue spruces, send a $10 membership contribution to: The National Arbor Day Foundation
110 Arbor Avenue, Nebraska City, NE 68412

EDUCATION & INSTRUCTION

ELECTRONIC engineering, 8 volumes complete. $109.95. No prior knowledge required. Free brochure. BANNER TECHNICAL BOOKS, 1203 Grant Avenue, Rockford, IL 61103.


EARN your computer diploma in networks, programming, multimedia, systems analyst or applications. Earn credits and become certified. Software, videos, textbooks included in tuition. Free catalog. 1 (800) 9-ITS-ITS (home study).

MICROWAVE oven manual, to become a technician. Award winner edition. USA $42.95, all foreign countries $69.00. RANDALL, Box 2168 R, Van Nuys, CA 91404.

INVENTIONS

FREE invention package: DAVISON AND ASSOCIATES offers customized development, patenting, and licensing of new products and ideas. Proven results: 1 (800) 677-6382.

VIDEO


PROGRAMMABLE LOGIC

FPGA design kit includes hardware, software, textbook. Low cost way to learn modern logic design! Call XESS CORP. 1 (800) 549-9377 or dev@xenet.net for details.

CABLE TV TEST CHIPS


BUSINESS OPPORTUNITIES

EASY work! Excellent pay! Assemble products at home. Call toll free 1 (800) 467-5566 Ext. 5192.

START your own technical venture! Don Lancaster’s newly updated Incredible Secret Money Machine II tells how. We now have autographed copies of the Guru’s underground classic for $18.50. SYNERGETICS PRESS, Box 809-C, Thatcher, AZ 85552, (520) 426-4073. Visa/MC.

PERSONAL computer owners can earn $1,000.00 to $5,000.00 monthly, selling simple services part time. Get free list of 100 best services. Write: C.K.E.Z., PO Box 48420, Mpls., MN 55448.

www.americanradiohistory.com
Alaska
Frigid North Co.
1207 W. 36th Avenue
Anchorage, AK 99503

Alabama
Radio Distributions Supply
121 East Broad Street
Gadsden, AL 35903

Arizona
Dalis Electronics
2829 E. McDowell Road
Phoenix, AZ 85008

California
California Electronics
221 N. Johnson Ave.
El Cajon, CA 92020
Ford Electronics
8431 Commonwealth Avenue
Buena Park, CA 90621
All Electronics
1498 Oxnard Street
Van Nuys, CA 91411
Willy’s Electronics
1636 D. Avenue
National City, CA 91950
Gateway Electronics of CA
9222 Chesapeake Drive
San Diego, CA 92123
Mac’s Electronics
191 South “E” Street
San Bernardino, CA 92401
Electronics Warehouse
2691 Main Street
Riverside, CA 92501
Orvac Electronics
1645 E Orangethrop Ave.
Fullerton, CA 92631
Sav-On Electronics
13225 Harbor Blvd.
Garden Grove, CA 92643
Marvac Dow Electronics
980 S. A Street
Oxnard, CA 93030

Marvac Dow Electronics
265-B Reservation Road
Marina, CA 93933
Minuteman Electronics
3711 Post St., Suite 1
Fremont, CA 94536
HCS Electronics
6819 S. Redwood Drive
Cotati, CA 94931
Halted Specialties Co.
3500 Ryder Street
Santa Clara, CA 95051
JDR Micro Devices
2233 Branham Lane
San Jose, CA 95124
Metro Electronics
1831 J Street
Sacramento, CA 95814
The Radio Place, Inc.
5675-A Power Inn Road
Sacramento, CA 95824
HSC Electronics
4837 Amber Lane
Sacramento, CA 95841

Colorado
Gateway Electronics of CO
2525 Federal Blvd.
Denver, CO 80211
Centennial Electronics
2324 E. Bijou
Colorado Springs, CO 80909

Connecticut
Signal Electronics Supply
589 New Park Avenue
W. Hartford, CT 06110
Electronic Service Prod.
437 Washington Avenue
North Haven, CT 06473

Georgia
Norman’s Electronics, Inc.
3653 Clairmont Road
Chamblee, GA 30341

Illinois
Tri State Elec
200 W. Northwest Hwy.
Mt. Prospect, IL 60056

Kentucky
PI. Burks Co.
842 S. 7th Street
Louisville, KY 40203

Maryland
Mark Elec. Supply Inc.
5015 Herzel Place
Beltsville, MD 20705

Massachusetts
U-Do-It Electronics
40 Franklin Street
Needham, MA 02194

Michigan
Purchase Radio Supply
327 East Hoover Avenue
Ann Arbor, MI 48104
Norwest Electronics
43087 Plymouth Road
Livonia, MI 48150
The Elec. Connection
37387 Ford Road
Westland, MI 48185
Elec. Parts Specialists
711 Kelso Street
Flint, MI 48506
Professional Data Corp.
1332 US Highway 41 West
Ishpeming, MI 49849

Minnesota
Acme Electronics
224 Washington Avenue N.
Minneapolis, MN 55401

Missouri
Gateway Electronics Of MO
8123-25 Page Blvd.
St. Louis, MO 63130

Nebraska
Phil’s Fun Stuff
616 Broadway
Imperial, NE 69033

New Jersey
Lashen Electronics Inc.
21 Broadway
Denville, NJ 07834

New York
Computers
7 Great Jones Street
New York, NY 10012
Sylvan Wellington Co.
269 Canal Street
New York, NY 10013

Oregon
Norvac Electronics
7940 SW Nimbus Avenue
Beaverton, OR 97005
Portland Radio Supply
234 S.E. Grand Avenue
Portland, OR 97214

Texas
Tanner Electronics
1301 W. Beltline
Carrollton, TX 75006
Mouser Electronics
2401 Hwy. 287 N
Mansfield, TX 76063
Electronic Parts Outlet
17318 Highway 3
Webster, TX 77598

Virginia
Elec. Equipment Bank
323 Mill Street, N.E.
Vienna, VA 22180
Cain Electronics Co.
1350 Ingleside Road
Norfolk, VA 23502

Washington
Amateur Radio Supply Co.
5963 Corson Ave., Ste 140
Seattle, WA 98108

Wisconsin
Appleton Electronic Dist.
205 W. Wis Avenue
Appleton, WI 54911

Wyoming
Chris Supply
2007 S. Douglas Hwy., Ste. C
Gillette, WY 82716

If you’d like to sell our magazine in your store, please circle 210 on Free Information Card.
Paperback Books
GREAT PAPERBACKS AT SPECIAL PRICES

☐ COMPUTER HOBBYISTS HANDBOOK—BP251—$8.95
Subjects covered include microprocessors and their register sets; interfacing serial, parallel, monitor, games and MIDI ports, numbering systems, operating systems and computer graphics. While the book is aimed at the computer hobbyist, it should also prove useful to anyone who intends to use a computer to follow their interests.

☐ INTERNATIONAL RADIO STATIONS GUIDE—BP255—$9.95
Provides the casual listener, amateur radio DXer and the professional radio monitor with an essential reference work designed as a guide for the complex radio bands.

Includes coverage on Listening to Short Wave Radio, ITU Country Codes, Worldwide Radio Stations, European Long Wave and Medium Wave Stations, Broadcasts in English and more.

☐ FURTHER PRACTICAL ELECTRONICS CALCULATIONS—BP144—$9.00
450 pages crammed full of all the formulae you are likely to need. Covers Electricity, Electrostatics, Electromagnetism, Complex Numbers, Amplifiers, Signal Generation and Processing, Communications, Statistics, Reliability, Audio, Radio Systems, Transmission Lines, Digital Logic, Power Supplies. Then there's an appendix of Conversion Factors, Mathematical Formulae and more.

☐ WIRELESS & ELECTRICAL CYCLOPEDIA—ETT11—$5.75
A slice of history. This early electronics catalog was issued in 1918. It consists of 176 pages that document the early history of electricity, radio and electronics. It was the "bible" of the electrical experimenter of the period. Take a look at history and see how far we have come. And by the way, don't try to order any of the merchandise shown, it's unlikely that it will be available. And if it is, the prices will be many times higher.

SHIPPING CHARGES IN USA AND CANADA

<table>
<thead>
<tr>
<th>Range</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.01 to $5.00</td>
<td>$1.50</td>
</tr>
<tr>
<td>$5.01 to $10.00</td>
<td>$2.50</td>
</tr>
<tr>
<td>$10.01 to $20.00</td>
<td>$3.50</td>
</tr>
<tr>
<td>$20.01 to $30.00</td>
<td>$4.50</td>
</tr>
<tr>
<td>$30.01 to 40.00</td>
<td>$5.50</td>
</tr>
<tr>
<td>$40.01 to 50.00</td>
<td>$6.50</td>
</tr>
<tr>
<td>$50.01 to $100.00</td>
<td>$8.00</td>
</tr>
<tr>
<td>$100.01 and above</td>
<td>$8.50</td>
</tr>
</tbody>
</table>

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

Name _____________________________________________
Address ____________________________________________
City _______ State _______ Zip __________

EN795

SORRY No orders accepted outside of USA & Canada

Number of books ordered

All payments must be in U.S. funds

www.americanradiohistory.com
**COMMUNICATIONS SPEAKER**

Improve and amplify the sound quality of most hand-held and mobile transceivers. This extension speaker for Ham, CB, marine or business communications improves clarity in noisy environments. Black case, grill and adjustable mounting bracket. 6 foot cord with 3.5mm mini-phone plug. 2.78" X 2.6" X 2.1" deep.

CAT# SH-3

$6.00 each

**A.C. LINE CORDS**

6 INCH IEC POWER CORD

That's right! 6 inch...Standard 3 prong grounded male one end and 3 prong IEC receptacle on other end. CSA listed.

2 for $1.00

Large quantity available.

CAT# LCAC-36

10 for $4.50 • 100 for $35.00

6 FOOT IEC (SPH-386) CORD

6' BLACK 18/3 IEC female one end, standard grounded three prong male on other end.

CAT# LCAC-60

$3.00 each

ROUND 4' BLACK 16/3 CORD

0.32" od, SJT insulation. Standard 3 prong grounded plug one end, molded strain relief on other end. Pigtail leads. CSA listed.

Large quantity available

CAT# LCAC-35

100 for $15.00

$1.75 each

**7.2 Volt, 1000 mAh NICKEL-CAD PACK**

Brand new rechargeable nickel-cadmium battery pack fits Olympus and other camcorders. Originally sold for over $35.00.

3.56" X 2.12" X 0.75"

CAT# NCB-72

$5.50 each

**MATRIX DISPLAYS WITH SMART DRIVER**

Hewlett Packard# HDSP-L203

Eight 5 X 7, 0.63" high LED dot matrix displays along with one PGA-type smart driver. The driver can decode 128 ASCII characters which are permanently stored in ROM. In addition, 16 programmable symbols may be stored in on-board RAM. The IC is designed for standard microprocessor interface techniques and is accessed through a bi-directional eight-bit data bus. Operates on 5 Vdc.

Spec./hook-up sheets included.

CAT# AND-203L

$7.50 each

**JUMBO LEDs**

Liton # LTL 327C - 8MM

Ideal for eye-catching indicators and displays. A recent quantity purchase of these Big, 8mm diameter, red diffused LEDs enables us to provide some very special pricing. The leads on these devices are 0.325" long, with plenty of room for soldering.

5 for $1.00

CAT# LED-23

100 for $15.00

1000 for $120.00

**MOISTURE RESISTANT D.P.D.T SWITCH**

Augat/Alcoswitch # MPE206N

Miniature D.P.D.T, push/on push/off switch. Splashproof: O-ring on shoulder and inside movable shaft provides moisture seal. Rated 6 amps @ 125 Vac. RED 0.4" dia. cap. 0.25" diameter threaded bushing. 0.8" behind panel depth. Solder lug terminals. UL and CSA listed.

CAT# MPB-20

$1.75 each

25 for $37.50 ($1.50 each)

**MINIATURE TOGGLE**

D.P.D.T. (ON-ON)

ALCOSWITCH # MTM206NPC

Short bat handle, 0.25" long. PC terminals.

CAT# MTS-82PC

$1.25 each

25 for $25.00 • 100 for $90.00

S.P.D.T. (ON-OFF-ON)

MOMENTARY ONE DIRECTION

ALCOSWITCH # MTG106H

Standard toggle handle and 15/32" diameter bushing with miniature body. Rated 5 amps • 125 vac. Center-off, momentary "on" in one direction.

CAT# STS-41

$1.50 each

25 for $31.25

S.P.D.T. (ON-ON)

LOCKING TOGGLE

ALCOSWITCH # ALOLKWB

Locking toggle handle prevents accidental switching. Wirewrap pins.

CAT# MTS-43

$1.50 each

25 for $21.25

**MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write or Fax YOUR LIST.**

**ORDER TOLL FREE 1-800-826-5432**

**NO MINIMUM ORDER** • All Orders Can Be Charged to Visa, Mastercard 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 per order for the 48 Continental United States - ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

CIRCLE 214 ON FREE INFORMATION CARD
PLASTIC ENCASED PIEZO ELEMENT
1.72" DIA. X 0.53"
Kyocera # KBT-44SB-1A
1.0 Khz. 75 db min. @ 10 V p-p
Louder than non-encased piezo elements. Requires an external signal to produce a sound.
CAT# PE-26 $75.00 each
10 for $6.50 • 100 for $50.00

5 WAY MULTI-POINT TEST LEADS
High quality, flexible, cloth covered red and black test leads with telephone industry standard 5 way multipoint test clips on one end and spade lugs on the other end. 5 ways to connect clips:
1) U-shaped nose for qa terminals; 2) Notched jaw for gripping screws, wires or terminals; 3) Serrated teeth for threaded or wire wrap terminals; 4) Cluster of small needles for piercing small gauge wires; 5) Large piercing needle for piercing larger wires. 4 feet long. At one end of the cord is a 1500 ohm resistor that can be switched in and out of circuit.
CAT# TL-200 $3.50 per set

REFLECTIVE OPTO SENSOR
SHARP # 2L01 0.75" mounting centers.
CAT# OSR-9

OPTO SENSOR
SHARP # GP152 0.12" gap. CAT# OSU-23
2 FOR $1.00

GREAT DEAL!
SURFACE MOUNT SPEAKERS
These surface mount speakers were designed for use with car stereo, but they will work as well, or better as intercom or communications speakers in your home or workshop. 5, 4 ohm, speakers mounted in an unbreakable black plastic, slant-faced enclosure. They are rated 5 watts. Enclosure measures 4.82" X 4.5" X 2.45" h.
CAT# SK-411 $3.75 per pair

12 VOLT FLUORESCENT LIGHT STICK
12 volt, 8 watt fluorescent tube with cigarette lighter plug and alligator clips for running on 12 volt DC power. Comes with handy floor stand and hook for hands free operation. Lamp is protected by clear plastic housing. 15' cord. Ideal for emergency road repairs, working in a garage or outdoor lighting.
CAT# FL-1 $8.50 each

MOUNTS UNBREAKABLE BLACK PLASTIC, SLANT-FACED ENCLOSURE...CALL, WRITE OR FAX YOUR LIST.
In recent independent tests Cool-Amp is proven better than electroplating.

(For 50 years we've said Cool-Amp is "equal to" electroplating in performance. It is better.)

Cool-Amp

From the report:
"...compare the conducting properties of Cool-Amp silver plating compound with factory silver electro-plated bus and bare copper bus.

"The test results indicated that the contact resistance of the Cool-Amp plated bus connection was slightly lower than that of the electro-plated bus connection and much lower than that of the bare copper bus connection. The final temperature at temperature equilibrium of the bus connection employing Cool-Amp was slightly lower than that of the electro-plated bus connection and the bare copper bus connection..."

Conducto-Lube

From the report:
"...compare the conducting properties of Conducto-Lube lubricant with factory lubrication and non-lubricated connections on an air switch. Identical test setups and procedures were used for each test so that comparative data could be collected and the relative performance of each type of connection could be quantified.

"The test results indicated that the contact resistance of the switch employing Conducto-Lube was generally lower than that of the factory lubricated switch and the switch that used no lubricant."

Cool-Amp

How it works:
- Applies on the job. Application is simple. Yet Cool-Amp adheres permanently. As tests show, it is better than electroplating.
- Minimizes overheating and power loss by silver plating high amperage connections.
- Saves time, reduces maintenance. Cool-Amp is so simple to apply on the job. It assures maximum conductivity for copper, brass, or bronze contacts and prevents losses due to oxidation.

Conducto-Lube

How it works:
- This is the conductive lubricant; highly conductive because it contains pure silver.
- Originally developed to lubricate switches, to the point tension can be adjusted to factory specs allowing full rated capacity of the switch to be maintained at all times.
- Uses have continued to expand—from switches and breakers—to any application where a conductive lubricant is needed.

A one-pound bottle of Cool-Amp silver plating powder plates approximately 6,000 square inches.

Conductivity is demonstrated by inserting test prongs into a container of Conducto-Lube and establishing a circuit. Photo shows low voltage (115 VAC) continuity through container.

Cool-Amp Conducto-Lube Company
15834 Upper Boones Ferry Road
Lake Oswego, Oregon 97035
Order factory direct:
503/624-6426, Fax 503/624-6436

"Various tests were performed on both products in the Electro-Test, Inc. facilities in Portland, Oregon during January-March, 1994. Evaluation of plating thickness of Cool-Amp was performed by Surface Science Laboratories of Mountain View, California."
WE HAVE WHAT YOU WANT AND MORE !!!

Desramblers

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stealth 1000</td>
<td>$49</td>
<td>TNT</td>
<td>$45</td>
</tr>
<tr>
<td>Stealth P-80</td>
<td>$65</td>
<td>M-80</td>
<td>$65</td>
</tr>
<tr>
<td>TVT-3G</td>
<td>$42</td>
<td>PIO-6300</td>
<td>$69</td>
</tr>
<tr>
<td>Mini TVT-3G</td>
<td>$42</td>
<td>PIO+</td>
<td>$69</td>
</tr>
</tbody>
</table>

Timeless Products $59

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPI-550 PC</td>
<td>STD/HRC Switchable</td>
<td>$125</td>
</tr>
<tr>
<td>Parental Lockout</td>
<td>Channel 3 Output</td>
<td></td>
</tr>
<tr>
<td>Available with Built-in Stealth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panasonic $69

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ-PC 1453-G2</td>
<td>STD/HRC Switchable</td>
<td>$69</td>
</tr>
<tr>
<td>Parental Lockout</td>
<td>Sleep Timer</td>
<td></td>
</tr>
<tr>
<td>Channel 3 Output</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Millenium 3 $59

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Lockout</td>
<td>STD/HRC Switchable</td>
<td>$59</td>
</tr>
<tr>
<td>Channel 3/4 Switchable</td>
<td>Output</td>
<td></td>
</tr>
</tbody>
</table>

All prices are for 10 pieces, subject to change without notice. Some quantities may be limited. 30-Day Money Back Guarantee. One year parts and labor warranty.

HIGHLANDER
1-800-854-7119

6325-9 Falls of the Neuse Road, Raleigh, NC 27615
Mon-Fri 10-7 EST; Sat 10-3 EST--FAX 1-800-854-7118

CIRCLE 290 ON FREE INFORMATION CARD
**AMAZING Electronic & Scientific Products**

**Infinity Transmitter ++**

**Telephone Line Grabber/ Room Monitor / Controller**

**Shocker Force Field / Vehicle Electrifier**

**Homing / Tracking Transmitter**

**Listen Through Walls, Floors**

**Infinity Transmitter ++**

**Mystery Levitating Device!**

Remember War of the Worlds? Objects float in air and move to the touch. Delight gravity, amazing gift, conversation piece, magic trick or great science project.

**ANTIK Easy to Assemble Kit / Plans $19.50**

**Laser Ray Gun**

Advanced project produces a burst of light energy capable of burning holes in most materials. Hand-held device uses rechargeable batteries. 100 joules of flash energy excite either a neodymium glass, or other similar 3rd laser rod. This is a dangerous CLASS IV project (individual parts/ assembles available).

**LAGUNIK Plans $20.00**

**Extended Play Telephone Recording System**

READY TO USE! Automatically controls and records on our X-4 extended play recorder, tapping both sides of a telephone conversation. 600 coils of flash energy excite either a neodymium glass, or other suitable 3rd laser rod. This is a dangerous CLASS IV project.

**LAGUNIK Kit / Plans $20.00**

**Price on Request**

**Shock Gun**

All New Technology!

Shocks to immobilize attackers up to 15 feet away!

Legal in most states (not in NY, NJ, MA, WI) + More knock-down power than most handicapped + No permanent injury + ID coded + Free 60KV stun gun with every purchase.

**ECG1 Data Packet, Creditable toward purchase $10.00**

**ECG10 Charge Gun, Ready to Use, w/FREE 60KV Gun $24.50**

**Homel / Tracking Transmitter**

Beep device, 3 mile range.

**HOD1 Plans $10.00**

**HOD1K Kit / Plans $49.50**

**Listen Through Walls, Floors**

Highly sensitive stethoscope mike.

**STETH1 Plans $8.00**

**STETH1K Kit/Plans $44.50**

**Telephone Line Grabber/ Room Monitor / Controller**

All New - The Ultimate in Home/Office Security & Safety!

Simple to use! Call your home or office, push a secret tone on your telephone keypad to access. + On premise sounds and voices + Ongoing phone conversation w/reflection capability + Up to 15 external electrical functions, lights, TV alarms, coffee pots, TVs, etc. CAUTION! Check legality of your state’s attorney general’s office before use for recording of voices.

**TELECOM2 Kit Includes PC Board $149.50**

**TELECOM2 Ready to Use $199.50**

**Visible Beam Laser**

Easy to build, RED Beam, visible for miles. Use for light shows, window bounce holography, cloud illumination and much more! LAS1KIM Kit w/1mw Laser Tube, Class II $69.50

**LAS3KIM Kit w/2.5mw Laser Tube, Class IIIA $99.50**

**Life is Precious - Protect It!**

Hard hitting 200,000 volts of crackling, sizzling plasma. Shocks and immobilizes most attackers.

**STUN40 Ready to Use $69.50**

**STUN10 Small Unit $39.50**

**Iron Ray Gun**

Projects charged ions that induce shocks in people and objects without any connection! Great science project as well as a high tech party prank.

**10G3 Plans $8.00**

**10G5 Kit/Plans $69.50**

**Invisible Pain Field Generator**

Shirt pocket size electronic device produces intense shock waves of intense directional acoustic energy, capable of warding off aggressive animals, etc.

**IP7 Plans $8.00**

**IP7K Kit/Plans $49.50**

**IP70 Assembled $74.50**

**1000 Ft++ Potato Cannon**

**NOT A TOY. Uses electronic or piezo ignition. CAUTION/REQUIRED POT1 Plans $10.00**

**FireBall Gun**

Shocks flaming ball - two shot capacity. Great for special effects and remote fire starting. CAUTION REQUIRED.

**FIREBALL Plans (Dangerous Product) $10.00**

**TV & FM Joker / Jammer**

Shift pocket device allows you to totally control and remotely disrupt TV or radio reception. Great gag to play on family or friends. Description required.

**EJK1KIM Easy to Assemble Electronic Kit $24.50**

**ATTENTION: High Voltage Fans!**

4,000 volts in the palm of your hand! Experiment with anti-gravity, hovercraft, ion guns, force fields, plasma guns, shock devices, wireless energy and electrical pyrotechnics. Input: 5-14VDC.

**MINIMAX Ready to Use $19.50**

**"Laser Bounce" Listener System**

NEW - Latest Technology! Allows you to hear sounds from a premises without gaining access. Aim at room window and listen to sounds from within via reflected laser light. Not for illegal use. Requires video tips.

**LWBK3 Smw Laser and Receiver Kit $149.50**

**LW830 Ready to Use, Includes Laser Gun Sight $199.50**

**3mW Visible Red Pocket Laser**

Utilizes our touch power control!

**VRLSKM Kit / Plans $74.50**

**Electronic Hypnotism**

Puts subjects under control using highly effective electronic stimulus. Intended for parties and entertainment but must be used with caution. Includes valuable text book reference and plans.

**EXD Plans and Text Book $24.50**

**Automotive NEON!**

Easy-to-install 4-Tube Kit for Cars, Trucks, Vans! Available in Pink, Purple, Blue or Green - please specify color when ordering.

**RG4K (Specify Color) $129.50**

**Flash-To-Music Option for above License Frame Kit (Specify Color) $24.50**

**3 Mi FM Wireless Microphone**

Subminiature! Crystal clear, ultra sensitive pickup transmits voices and sounds to FM radio. Excellent for security, monitoring of children or invalids. Become the neighborhood disk jockey!

**FMU1 Plans $7.00**

**FMV1 Kit and Plans $35.50**

**Telephone Transmitter - 3 Mi**

Automatically transmits both sides of a telephone conversation to an FM radio. Tunable Frequency - Undetectable on Phone. Easy to Build and Use. Use up to 3 Mile Range. Only transmits during phone use. YWP7 Plans $7.00

**YWP7K Kit/Plans $39.50**

**CATALOG With many more items! Free with Order or send $1 P&H**

Order by mail or by 24 Hour Orders-Only Phone 800-221-1705

**INFORMATION UNLIMITED**

Dept ENS18, Box 716, Amherst, NH 03031

Phone: 603-673-4730  FAX 603-672-5406

MC, VISA, COD, Checks accepted Please add $6.00 Shipping & Handling

www.americanradiohistory.com
Please mention this CODE REO6 when ordering.

VCR ALIGNMENT TOOL KIT
- 7 Assorted head gauge aligners
- VCR Head puller
- Retaining ring remover
- Spring hook
- Micro screwdriver
- Hex key tool
- Fitted vinyl
- Soft zippered case
- 3 Reversible screwdrivers
  (Small-Fast-Philips)
Dimensions: 9 x 2 3/4" x 12" x 4" (L)
$29.99
Order No. 50-888

SEMICONDUCTORS
Low Frequency Power Transistors
(AF driver, VCB0, 180V, 1MA, 100 NFE)
BD-135 (PNP) Repl. ECG: 737
BD-136 (NPN) Repl. ECG: 734

- 7059 (Pos VR 5V, 1A)...
- 7060 (Pos VR 6V, 1A)...
- 7099 (Pos VR 9V, 1A)...
- 712 (Pos VR 12V, 1A)...
- 718 (Pos VR 18V, 1A)...
- 724 (Pos VR 24V, 1A)...
- 7025 (Neg VR 5V, 1A)...
- 706 (Neg VR 6V, 1A)...
- 712 (Neg VR 12V, 1A)...
- 715 (Neg VR 15V, 1A)...
- 724 (Neg VR 24V, 1A)...

Order Nos. 63-0425 CURTIS-MATHIS 471-05200 $19.00
63-0198 DAEWOOD DCF-1577 11.50
63-0260 EMERSON 04-321-4002 14.90
63-0189 EMERSON 04-321-4003 12.50
63-460 GOLDSTAR 154-0745 15.00
63-850 HITACHI 243-4391 16.50
63-860 HITACHI 243-4401 13.99
63-490 PANASONIC TFL-14617F 14.50
63-560 PANASONIC TLF-14520F 19.50
63-601 PANASONIC TFL-14700F 19.95
63-0441 RCA (original) 1455545-01 19.95
63-0160 SONY FNC-1451AL 11.50
63-203 SONY FCK-1451AL 11.50
63-0126 SHARP RTRNF-0003PEZZ 12.50
63-840 SHARP RTRNF-001PE 12.50
63-0131 SONY 1-A-254-13 12.50
63-0170 SONY 1-A-254-00 12.50
63-0113 SONY 1-A-273-30 15.99

ROCK BOTTOM PRICES ON POPULAR SEMIS

- Order No. 15-0957 Male Order No. 15-0973 Female
- Minimum 100 pieces per item

VIDEO HEAD TESTER
to determine whether a video head is in good condition by detecting the wear state of the video head and indicating it on the meter. This serves as a tentative guidance for confirming the wear state of the video head (Dem. 7/10/85 WWX 10/10)

CONNECTORS
F Male for RG 59/U Cable
- 1/4" ring included
Order No. 15-0459 Minimum 100 pieces

- 17-1298 3 Prong AC cord
- 17-1299 SINGLE Type
- 17-1277 Pan Air Type
- 17-1460 Universal Type
Minimum 10 pieces per item

MATCHING TRANSFORMERS
- F-59 push on to twin head
d -64 Channel Breaker
Order No. 55-170 Minimum 100 pieces

RYBEST ELECTRONICS

MOLDING CABLE WITH MULTIPLE CONNECTORS
- Length: 39" (AF Connectors)
- Minimum 750 pieces

- Order No. 750-5030 $14.99
- 39" Cable: 125V, 15A
- 39" Cable: 125V, 15A

- Minimum 5 pieces per item

DOUBLE RG5 PLUGS
- Indoor usage
- 75-300 &
Order No. 55-120 Minimum 10 pieces

- 1953 39"... $19.95
- 1954 39"... $19.95
- 1955 39"... $19.95
- 1956 39"... $19.95

- Matching transformers
- Indoor usage
- 75-300 &
Order No. 55-170 Minimum 100 pieces

- Minimum 10 pieces

7 3" TEST TIP TO BANANA PLUGS
- Black and Red set
Minimum 10 pieces
Order No. 56-1006

UNIVERSAL DUAL TV ANTENNA
- 5 sections
- 9 1/2" collapsed 39" extended
Minimum 10 pieces
Order No. 58-205

- 99¢
- 99¢
- 99¢
- 99¢

- 99¢
- 99¢
- 99¢
- 99¢

- Minimum 10 pieces

10 COLOR CODED LEADS HEAVY DUTY
- 10 Total Leads 2 each
- Black, Green, Red, Yellow, White
- 11" Long Wire Lead
- Insulated 11/2" Alligator Clips
- 20 Gauge Wire Size
Minimum 5 pieces
Order No. 40-029

OUTLETS POWER SUPPLY
- A.C. 125 Volt, 15 Amp (4 feet Cord)
- Lighted Switch
- 9/4 Lexan Breaker
Minimum 2 pieces
Order No. 56-500

INDOOR TV ANTENNA
- UHF / VHF / FM * 10 metal dish
- 10 antenna Length 27" extended
- Tuning / Rotator Knobs
- Base dimensions (6 3/4" x 8")
Order No. 58-1025 "Tvco Color"
Order No. 58-1059 "Black Color"
Minimum 2 pieces per item

CIRCLE 234 ON FREE INFORMATION CARD

$20.00
MINIMUM ORDER

Prices are valid until July 31 / 95
While Supplies Last

www.americanradiohistory.com
MEMBRANE SWITCH KITS!

These highly durable water resistant flat-panel keypads can be assembled in minutes with YOUR legend! Available in 4, 12, 16, 24 & 40 Key models. Steel "clickdomes" optional. Connector and bezel included.

12 key DSK-12 $12.75

4 key DSK-4 $8.75

Make your own legend!

Call for free brochure:
Sil-Walker 880 Calle Plano, Unit N
Camarillo, CA 93012
(805) 389-8100 FAX (805) 484-3311

Visa / Mastercard
Try CircuitMaker Today
Only $30 For 30 Days
(call for details)

CircuitMaker® vs. Electronics Workbench®
A NEW STANDARD HAS BEEN SET!

State-Of-The-Art Analog Simulation
CircuitMaker®'s analog simulation results are shown in graph windows that provide powerful, interactive analysis options. You can plot multiple waveforms by clicking on the desired nodes and compare linear or logarithmic axes. Horizontal and vertical cursors facilitate quick and accurate measurements. You can also zoom in on any portion of the graph to obtain additional detail.

Electronics Workbench® offers a single, small scope window. The windows are not resizeable and only two waveforms can be plotted at a time. EWB has a single measurement cursor and no direct way to read results from the instruments.

Superior Digital Simulation
CircuitMaker® has an exclusive Trace feature where the state of every node is indicated in color as the simulation runs. You can monitor as many waveforms as your screen will allow, set edge or level breakpoints for analysis, and visually see the state of any node by touching the logic probe to it. The data sequencer provides 1024 words of pattern data. Additional digital instruments include ASCII and Hex input keys and an ASCII display. CircuitMaker includes ASCII and HEX devices and devices have programmable propagation delays.

Electronic Workbench® has no interactive logic probe or Trace capability and no Hex or ASCII keys. Their "word generator" is limited to 16 words. EWB does not have tri-state devices and digital devices do not have programmable propagation delays.

Call 800-419-4242 for a FREE demonstration or send $10 for the FREE functional Demo Version.

FREE Functional Demo Version
available on most major BBS's or sent direct for $10 & H.

CircuitMaker includes libraries containing programmable, TTL, CMOS, generic analog and digital devices, and many powerful I/O devices. With CircuitMaker's macro function you can quickly and easily create your own functional devices and symbols. Now that's giving you the tools you need to get the job done right!

Electronics Workbench ships with only 17 digital devices. If you want additional devices you pay extra.

Competitive Upgrade Offer
You deserve the best. Upgrade from any competing product for only $149 (Call for details). For new users CircuitMaker is a tremendous value at just $299.

Technical Support
MicroCode Engineering supports its customers with free unlimited phone support from knowledgeable technical support people. And you won't find yourself endlessly listening to music when you call for help. The quality of our customer support is unmatched!

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

CIRCLE 330 ON FREE INFORMATION CARD
Be an FCC LICENSED ELECTRONIC TECHNICIAN!

EARN MORE MONEY!

Earn up to $60 an hour and more!

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

Digital Storage Oscilloscope

Digital Volt Meter 169.95 Data Logger

Frequency Counter Spectrum Analyzer
Allison O-Scope Modules convert PC-ATs into multipurpose test and measuring instruments

Features:
• Small & Portable
• Easy to Use
• Software Included
• Uses Printer Port
• AC or DC Input
• 10v/div. to 50 mV/div.
• Sample Rate to 100KHz
• Optional Dual Trace
• Logging to Disk
• Print Screens
• Optional Probe Sets
• Optional Ext. Trigger
• Power 12VDC, 40 ma.
• Made in U.S.A.

Uses:
• Audio/Stereo Equip.
• Automotive Diagnostics
• Analytical Instruments
• Education & Training
• Field Service
• Industrial Controls
• Laser Repair
• Medical Electronics
• Power Supplies
• Sound Systems
• Vibration Analysis

Orders & Inquiries: 1-800-980-9806
Technical Assistance: 1-713-777-0401
Fax & BBS: 1-713-777-4746

Allison Technology Corporation
8343 Carvel, Houston, TX 77036

CIRCLE 320 ON FREE INFORMATION CARD

www.americanradiohistory.com
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 OVER 3,500 ITEMS AND IT IS STILL GROWING!

SUPER SENSITIVE SOUND ACTIVATED 2 CHANNEL COLOR ORGAN

This ultra sensitive 2 Channel Color Organ produces brilliant flashes of light (from any interference) at 2 of your choice - up to 200W in response to music or other sounds. This is probably the best and brightest color organ we have ever seen. It is fully assembled (don't lose cost points and outlets) and features 2 response controls, on/off switch, sensitive (FET) microphone (for home use) and Brandson, 2 SCR circuitry. Operates with standard 120VAC and requires only that you plug your line cord into outlets. We strongly recommend that you install the color organ in an awkward place to satisfy reasons as it operates from the AC wire. Connect up a twist of your brightest colored lamps and watch the frequencies with each twist of the music. Great for Dixie as there is no connection to the sound source. Size of board: 3½" x 4½". Color organ board only - you supply lamps, line cord, knobs, case and outlets, minus. Other organ will sell very fast!

G3319 $4.95
SALE! $4.95

DC TO DC CONVERTER

Super efficient tiny DC to DC converter converts voltage DC to a higher voltage DC (see table below). These are brand new made by Mini-Tek and are only 1.28" x 1.28" x .38" T. Very efficient and simple technology using SMD and standard technology. Power a 9V transistor radio from 1 AA battery, change several AA batteries from one solar cell, power a TV projection using 2 AA cells, etc. Has only 4 leads (plus a and b lead). With hookup diagram.

G6344 $3.98

HUMAN VOICE AND VARIOUS SOUND MODULES

Some electronic modules have 2 pushbuttons that produce human voices and various sounds. You need only to provide a speaker and 4 SMD (3 AA batteries connected in series works fine). Size of modules about 2 3/4 x 2 1/4. Only 4 wires to connect (2 for power and 2 for the speaker). We have 4 different modules:

G6506 $15.95

For Phone Orders Call (602) 451-7454
Or Fax Your Orders To (602) 451-9495

Minimum Order: $10.00 plus $4.00 Shipping and Handling. We accept Mastercard, Visa and Money orders. Canadians and orders that need US MAIL send minimum $5.00 S&H.

ELECTRONIC GOLDMINE
PO. Box 5408
Scottsdale, AZ 85261

CIRCLE 241 ON FREE INFORMATION CARD

July 1995. Electrons Now

www.americanradiohistory.com
### Quality - Elenco Oscilloscopes

#### 2-Year Warranty

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1360</td>
<td>$775</td>
<td>60MHz, Delayed Sweep, Cursor Readout</td>
</tr>
<tr>
<td>S-1365</td>
<td>$849</td>
<td>40MHz, Delayed Sweep, Beam Find, Component Tester</td>
</tr>
<tr>
<td>S-1340</td>
<td>$495</td>
<td>40MHz, 2-Channel, Delayed Sweep</td>
</tr>
<tr>
<td>S-1345</td>
<td>$575</td>
<td>40MHz, Delayed Sweep, Beam Find, Component Tester</td>
</tr>
<tr>
<td>S-1325</td>
<td>$349</td>
<td>25MHz, 2-Channel</td>
</tr>
<tr>
<td>S-1330</td>
<td>$449</td>
<td>25MHz, Delayed Sweep, Beam Find, Component Tester</td>
</tr>
</tbody>
</table>

**Hitachi Popular Series**

- V-212 - 20MHz, 2 Channel: $425.00
- V-222 - 20MHz, DC Offset: $695.00
- V-422 - 40MHz, Dual Trace: $849.00
- V-522 - 50MHz, Dual Trace: $975.00
- V-523 - 50MHz, Delayed Sweep: $995.00
- V-525 - 50MHz, w/Cursor: $1,069.00

**Hitachi Compact Series Oscilloscopes**

- V-660 - 60MHz, Dual Trace: $1,375.00
- V-665A - 60MHz, DT, w/Cursor: $1,449.00
- V-1060 - 100MHz, Dual Trace: $1,549.00
- V-1065A - 100MHz, DT, w/Cursor: $1,695.00
- V-1085 - 100MHz, DT, w/Cursor: $2,125.00
- VC-6045A - 100MHz, Digital Stor: CALL
- VC-6025A - 50MHz, Digital Stor: CALL

**Elenco DS-203 20MHz, 10MS/s Digital Storage Oscilloscope**

- 2K Word Per Channel, 2048 Pts Hor.
- Resolution: 8 Bit Vert. Resolution
- True RMS volts, AC or AC+DC up to 600V
- Autoset, automatically sets voltage, time & trigger
- Multimeter display: 3-2/3 digits (+3000 counts)
- 20MHz analog bandwidth

**FLUKE SCOPEMETERS**

- Model 93 - $1,225
- Model 95 - $1,549
- Model 97 - $1,795
- 20MHz, 25MS/s dual channel digital storage oscilloscope with feature-packed 3000 count digital multimeter.

**C&S Sales Inc.**

- 1245 Rosewood, Deerfield, IL 60015
- Phone: 708-520-0085, 708-541-0710
- Fax: 708-520-0085, 708-541-0710

**FREE Probes with All Scopes**

**B&K 20MHz**

- Model 2120: $389.00
- Model 2125: $539.95

**40MHz Dual Trace**

- Model 1541B: $749.95

**60MHz Dual Trace**

- Model 2160: $949.95

**100MHz Three Trace**

- Model 2190: $1,379.95

**20MHz Analog with Digital Storage**

- Model 2522A: $869.95

**Hitachi Pop Series**

- 20MHz analog bandwidth
- 20MS/s sampling rate
- 2K memory per channel
- 20MHz equivalent time sampling

**15 Day Money Back Guarantee**

**Full Factory Warranty**

**All Products Are Factory New**

**Prices Subject to Change Without Notice**
Double Your Income!  
Own your own computer repair business or add computer repair to your existing business.

TechServ can put you into your own computer repair business quickly, economically and efficiently. Research indicates that during a recession, computer repair businesses will grow at twice the rate of hardware sales. TechServ's complete support program gives you the opportunity to be a part of this fast growing industry.

• Proven Marketing Plan
• Recognition
Nationally recognized trademarks and logos give you immediate recognition as a professional computer repair specialist in your area.

• Training
Level 1
286/386/486/586 Troubleshooting, upgrades, advanced diagnostics
Level 2
Networking/Novel/Unix/Multi-user/ Multi-tasking configuration/Installation/ Maintenance. Prepare for C.N.E. (Certified Network Engineer) test

• Parts and Board Repair
Single source for OEM/generic parts and board repair. Order 7 days a week/24 hours a day. $45 million in parts in stock, ready to ship any where, overnight if required.

• Documentation
We provide manuals, documentation and advanced diagnostic software.

• New Hardware
We provide new hardware for IBM, Compaq, Apple and compatibles at huge discounts. Custom build your own systems.

Over 300 dealers worldwide
Find out why the Wall Street Journal and Fortune Magazine call computer repair the business opportunity of the 1990s.

Call TechServ at (212) 967-1865
or fill out coupon below and mail to:

America's largest chain of independent, licensed computer repair centers
253 West 28th Street, New York, NY 10001

NAME
ADDRESS
CITY STATE ZIP
TELEPHONE

Circle 272 on Free Information Card

EPROM+
PROGRAMMING SYSTEM USES PARALLEL PORT

EPROMS (24, 28, 32, 48 PIN (PLUS 27CXXX))
1728, 2048, 32, 32, 32, 64, 64, 64A, 128, 256, 512
128, 256, 512, 1024, 2048, 4096, 8192
2000, 2001, 220, 240, 2048, 4096, 8192, 16384, 32768
$289
SUPPORTS OVER 600 CHIPS

FLASH EPROMS
20F256, 512, 1024, 2048, 8K, 16K X 8, 32K X 16, 64K X 32, 128K X 64, 256K X 128
$69

EEPROMS & NVRAMs (PLUS 28XXX)
28C, 28C00, 28CXX, 28C100, 28C200
$15

SERIAL EEPROMS (8 PIN PLUS 28XXX)
24F01, 2048, 32, 32, 32, 64, 64, 64, 64A, 128, 256, 512
$5

BIPOLAR PROMS (6-14 THROUGH 34 PIN)
74SXXX AND 52SXXX FAMILY
$289

MICROCONTROLLERS* (5V, 6V AND 12V)
8741, 42, 8743, 8751, 8752, 8753, 8754, 8755, 8756
$289

board repair. Order 7 days a week/24 hours a day. $45 million in parts in stock, ready to ship any where, overnight if required.

• Documentation
We provide manuals, documentation and advanced diagnostic software.

• New Hardware
We provide new hardware for IBM, Compaq, Apple and compatibles at huge discounts. Custom build your own systems.

Over 300 dealers worldwide
Find out why the Wall Street Journal and Fortune Magazine call computer repair the business opportunity of the 1990s.

Call TechServ at (212) 967-1865
or fill out coupon below and mail to:

Authorized Dealer
America's largest chain of independent, licensed computer repair centers
253 West 28th Street, New York, NY 10001

CIRCLE 272 ON FREE INFORMATION CARD

EPROM+
PROGRAMMING SYSTEM USES PARALLEL PORT

EPROMS (24, 28, 32, 48 PIN (PLUS 27CXXX))
1728, 2048, 32, 32, 32, 64, 64, 64A, 128, 256, 512
128, 256, 512, 1024, 2048, 4096, 8192
2000, 2001, 220, 240, 2048, 4096, 8192, 16384, 32768
$289
SUPPORTS OVER 600 CHIPS

FLASH EPROMS
20F256, 512, 1024, 2048, 8K, 16K X 8, 32K X 16, 64K X 32, 128K X 64, 256K X 128
$69

EEPROMS & NVRAMs (PLUS 28XXX)
28C, 28C00, 28CXX, 28C100, 28C200
$15

SERIAL EEPROMS (8 PIN PLUS 28XXX)
24F01, 2048, 32, 32, 32, 64, 64, 64, 64A, 128, 256, 512
$5

BIPOLAR PROMS (6-14 THROUGH 34 PIN)
74SXXX AND 52SXXX FAMILY
$289

MICROCONTROLLERS* (5V, 6V AND 12V)
8741, 42, 8743, 8751, 8752, 8753, 8754, 8755, 8756
$289

PCB II
SUPERKEST & PCB II: INTEGRATED INTO ONE PACKAGE

Only $159

SUPERKEST

PCB II

PCB II & SUPERKEST features:
• MOUSE DRIVEN SUPPORTS CGA, EGA, VGA & SVGA
• OUTPUT TO 9 & 24 PIN PRINTERS, HP LASERJET & HPGL PLOTTERS
• OUTPUT TO DTP PACKAGES
• PCB II ALSO HAS GERBER OUTPUT & VIEWING

THE EASIEST TO USE CAD AVAILABLE

R4 SYSTEMS Inc.
1100 Gorham S. Suite 11B-332
Newmarket, Ontario L3Y 7V1
(905) 898-0665
fax (905) 898-0683

ALL PRICES ARE IN US FUNDS. PLEASE INCLUDE $7 S/H

Free DEMO Package
Write or Call Today

Download DEMO from BBS at (905) 898-0508 (9600/8/N/1)

www.americanradiohistory.com
There's No Easier Way to TROUBLESHOOT AND REPAIR Your Electronics!

It's easy, fast and rewarding to do it yourself with the Electronics Repair Manual!

TVs VCRs
Hi-Fi Stereo
Amplifiers
Turntables
Speakers
Shortwave
Radios
Camcorders
Tape Decks
CD Players
Walkmans
AM & FM Receivers
PC Systems
Automobile Sound Systems
PC Peripherals
Telephone Systems
Fax Machines
Electronic Home Appliances

Keep Your Skills Up-to-Date!
The Electronics Repair Manual will be a valuable reference for years to come. Supplements, each containing 140 pages, add new repair projects, valuable insights into new technologies, diagnostic and repair techniques, and more schematic diagrams into your manual. Just $30 each plus shipping and handling. Supplements are sent 4-5 times a year and are fully guaranteed. Return any supplements you don’t want within 30-days and owe nothing. Cancel anytime.

CIRCLE 331 ON FREE INFORMATION CARD
PCB Artwork Made Easy!

PRINTED CIRCUIT DESIGN SOFTWARE

for

Layout - Autorouting - Schematic

* Supports all Video Modes including SVGA
* Copper Flooding for Ground Areas
* Mirror Imaging for Laser Output
* Circuit Simulation Programs available
* NEW - WINDOWS tm versions
* NEW - DOS versions
* FREE - Heat Transfer Film with Order
* Great for All Printed Circuit Projects

Download Demos from BBS (205)933-2954

PCBoards Layout Only ... $99.00
Layout for Windows tm starts at ... $149.00

Call or Write for Full Product Line, Prices & Demo Packages

PCBoards
2110 14th Ave. South
Birmingham, AL 35206

(800) 473-7227
Fax (205) 933-2954
Phone (205) 933-1122

UNIVERSAL SOFTWARE KEY EMULATOR

Features

* Small size, low power.
* Universal Device Emulating capability.
* One board emulate many Software Keys.
* No need to swap or install Software Keys switching from system to system.
* Makes system thinks the nonexistent device existed.
* Learn and Emulate Modes.
* Can be activated at any ports (COMx, LPTx or 9 Bit Address).
* Do not take any system memory.
* Very low cost ($179).

Other Neat Products & How-It-Works Technical Information

$49

Full Screen Editor Source Codes. See how it pops, moves, saves your ASCII files.

Pop up Calculator Source Codes. Custom your Calculator and show "I wrote it!"

General MIDI Juke Box Player. Plug it to your PC Parallel Port and play Karaoke.

$29

PCMCIA Card Interface. See how the card looks like a floppy-hard disk to the system.

ROM DOS Boot Card. See how the system boots from a ROM.

IEEE 488A Interface with TI-9914 Chip. See how the data go to and from the bus.

28FOX Series FLASH ROM Programming. Examine our FLASH burn-in programs.

E-TRACE INSTRUMENTS CORP.
210-493-4546 VISA-MASTERCARD-COD

Laser Pointer Kit
$39.00

Features:
* 4 mW, 670 nm Red Output.
* Adjustable Focus Lens.
* Operates for Hours on 2 AAA Batteries.
* Compact Size: 4.5" x 9.5" x 60"
* Easy to Assemble.

Laser Diode Module
$39.00

Features:
* 670nm visible red output
* Operates on 3 VDC
* Compact size
* New with factory warranty

He-Ne Lasers
Brand new, 3 mW tubes
Power supply for 1-3 mw tubes used units operate on 110 vac

Toshiba #TOL-D-9200
3 mW, 670 nm
$20.00

Hitachi #HL-6411G
3 mW, 635 nm
$99.00

Sharp #LTO-15MD
40 mW, 830 nm
$75.00

FREE SHIPPING on orders over $100.

Call or write for a FREE CATALOG on Lasers & Optics.
5035 N. 55th AVE., #5 / P.O BOX 1724 / GLENDALE, AZ 85301
Phone: 602-934-9387 Fax: 602-934-9482

CIRCLE 252 ON FREE INFORMATION CARD

www.americanradiohistory.com
Troubleshoot PC Failures Yourself

POSTCARD V1-

POSTCARD V2-

DISK ASSIST -

$49.00

To Order, Call Now
1-800-792-4201

MSLI
P.O. Box 4615
Seminole, FL 34642

Learn MICROCONTROLLERS EMBEDDED SYSTEMS and PROGRAMMING with the New AES-10

The AES-10... a complete learning system, a complete embedded control system. Extensive manuals guide you through your 8051 development project. Assembly, BASIC, and C programmable. All hardware details, complete schematics. Learn to program the LCD, keypad, digital and analog I/Os. The entire board is software reconfigurable for your applications. Everything you need, nothing extra required.

80C32 Computer/Microcontroller board with:

- 32K Byte ROM, 32K Byte RAM • 2 by 16 Liquid Crystal Display • 4 by 5 Keypad • Two serial ports • 5 interrupt sources • 3 timers • A/D, D/A, PWM and digital I/O • Built in Logic Probe • Power supply (can also be battery operated) • Extended Intel BASIC and AES Monitor in ROM • RS-232 cable to connect to PC for programming • 8051/52 DOS Cross Assembler • Program disks with well documented examples • User's Manual, Language Manual, and Text (over 400 pages).

AES-10 $285 Complete

Free Info Pack, MC/Visa

Call 1 - 800 - 730-3232

AES

110

CIRCLE 147 ON FREE INFORMATION CARD

CIRCLE 147 ON FREE INFORMATION CARD

CIRCLE 143 ON FREE INFORMATION CARD

www.americanradiohistory.com
CONWAY Engineering, Inc. is the US distributor for the complete range of Computer Controlled Measuring Instruments of TiePie engineering. The measuring instruments can be connected to a PC (MS-DOS 3.0 or higher) which will result in a number of comprehensive test instruments, like:

- oscilloscope
- voltmeter
- spectrum analyzer
- transient recorder

Normally, you have to use more than one instrument to take your measurement. Together with the TiePie instruments a complete software package is delivered, in order to realize all four measuring instruments. Your advantage is that you only need ONE measuring instrument! Moreover, you will be able to control all instruments in the same way.

All measured data can be stored on disk or be printed out. Because of the many trigger possibilities you can measure a variety of signals, while the powerful software enables you to carry out a multitude of measurements in a straightforward manner. Application areas: service; medical research; automatic test systems; research and development; and education.

Available are:

- **HANDYPROBE**
  - 8 bits; one channel; 100 kHz; connection to the parallel printer port
  - **HANDYSCOPE**
  - 12 bits; 2 channels; 100 kHz; connection to the parallel printer port
  - **TP5008**
  - 8 bits; 2 channels; 200 kHz; interface card
  - **TP208**
  - 8 bits; 2 channels; 20 MHz; interface card
  - **AD128**
  - 12 bits; 8 channels; 100 kHz; interface card
  - **TP112**
  - 12 bits; 2 channels; 1 MHz; interface card

(Prices exclude applicable taxes)

**VERY HIGH SPEED: TP508**

The TP508 is a new interface card with a measuring frequency of 50 MHz!! The resolution of this card is 8 bits. Phenomena shorter than 1 millionth of a second can still be measured well. The completely digitized triggering ensures very stable triggering with many trigger possibilities. The TP508 has an input range of 5 mV/div...20 volt/div (12 steps), and an auto calibration function. Since both channels may be sampled simultaneously, phase differences can be measured very accurately. Even single phenomena can be measured since each channel has a 32 Kbyte memory. Comprehensive software is provided.

**NEW!!**

CALL NOW FOR A FREE DEMO DISKETTE: 1-800-626-6929 (toll-free)!!

CONWAY Engineering, Inc.
8393 Capwell Drive, Oakland, California USA 94621-2113. Tel.: (510) 568-4028. Fax: (510) 568-1397
MC68HC705K1 MICROCONTROLLER PROGRAMMER - $149.00
EDUCATIONAL STARTER KIT - $279.00

Motorola’s MC68HC705K1 is a marvelously flexible and inexpensive 16 pin microcontroller. The PK1S connects to a PC serial port and provides the fastest, easiest way to program these devices. The PK1S programmer, power supply, host PC control software and manual is $149.00. Learn how to use microcontrollers in embedded systems with the educational starter kit which includes the above plus a PC based cross assembler, Motorola technical specs and applications guide, sample programs with schematic diagrams and an erasable K1 chip for $279.00.

TEL: (802) 525-3458
FAX: (802) 525-3451
SKYVISION

Known the world over for their superior reception and picture quality, the Orbitron satellite dish features an exclusive Positioning Mount, which allows declination to be set by rotating the antenna to correct the latitude setting on the scale. Their compact shipping cartons allow these antennas to be shipped very economically to any point in the world. Let Orbitron help you expand your viewing choices.

Pico Peaker

You can now accurately arm your satellite dish to receive all the satellites using a tool the experts use. Whether installing a new system, moving your dish, or realigning your dish due to wind or frost, the Pico Peaker will save you both time and money. This unit can be used on any receiver system with block down converted signal. It will also eliminate the need for those expensive service calls. The unit includes everything you need—even the cables. A "must" for every satellite enthusiast.

Superjack Actuators

Is your actuator no longer doing its job because of wear and tear? As the hardest working part of your satellite system, the actuator must move your dish from east to west across the entire satellite belt. Each time you change satellites, your actuator sends pulses to the receiver telling the receiver when to stop moving the dish. Most older actuators sent only 10-15 pulses for each inch of travel, which may not be enough to stop the dish at the maximum signal strength. Today's heavy duty actuators with high resolution need sensors to send 48 pulses per inch of arm travel. So if your old actuator is getting tired, get a new SuperJack and insured the finest picture possible.

900038 Pico Peaker S&H $5 $89.95

The Ultra is Uniden's newest, smallest fully-integrated SKYVISION satellite receiver ever. This unit includes the ability to control dish movement and is ready for an optional internal program decoder. The Ultra comes preprogrammed for 49 satellite positions and allows you to add satellites as they are launched. Move directly to the satellite by entering the abbreviation from the included infrared remote control. Forty programmable favorite channels can be accessed immediately from your easy chair. Run across something you don't want your kids to see? Just touch a button and eliminate that channel from their access. A complete variety of color menus allow you to control everything from your remote control. The Uniden Ultra is an ideal receiver to get you started in Direct-To-Home Satellite TV.

Ultra

4527008 Ultra S&H $22 $379.00

The UST 4600 sets a standard in value and performance for home satellite receivers. This unit features automatic satelite programming, 160 favorite channel memories, and direct satellite access. This IRD sends pulses to the receiver when you change satellites, enabling you to tune both left and right channels for a full stereo effect from over 100 radio stations found in satellite. The QuikTune feature quickly optimizes the satellite picture for the sharpest image. The 4600 offers other features including IR/UHF remote, 55 satellite position memory and direct satellite access. The versatility makes this an excellent choice.

UST 4600

4527009 UST4600 S&H $22 $499.00

The Uniden UST 4900 is one of the most sophisticated satellite television receiver systems available today. This receiver will open your home to the universe of satellite viewing and is designed to be one of the most user-friendly IRDs available anywhere. Sophisticated microcomputer technology brings in crystal clear audio and video broadcasts with a minimum of user effort. The 4900's front display features easy-to-read icons that show you vital information including satellite, channel, polar, timer status, and much more. This receiver is capable of storing the positions of the satellites, as well as the tuning details for each channel. The picture-in-picture feature allows you to view two video sources at the same time. You can have it all, including advanced technology and lastingly quality, with the UST 4900.

UST 4900

4527010 UST4900 S&H $22 $689.00

Skyvision Inc.

1046 Frontier Drive, Fergus Falls, MN 56537 - Toll Free 800-334-6455
Mail in coupon or call today for the Skyvision Satellite TV Products Catalog/ Buyers Guide Delivered free to your mail box in U.S. and its possessions.

Send Free Domestic Satellite TV Products Catalog
Send International Satellite Catalog (For Intl Catalog add $8.00 for S&H)

Name

Address

City State Zip

Call Toll Free 800-334-6455 • International 1-218-739-5231 • Fax 218-739-4879

CIRCLE 270 ON FREE INFORMATION CARD

Install a System, Upgrade & Repair Yourself And Save $$$
Parts Express

114 Local: Dayton, Ohio 45402-1257

Parts Express is proud to announce that we now stock the high quality NTE line of semiconductors. NTE has been supplying the electronics industry with top notch replacement parts for over 15 years. All NTE products meet or exceed industry specifications and offer an exclusive 2 year manufacturer warranty.

Ultimate 12" AU1290 Dual VC Subwoofer

Just one listen to this 12" dual voice coil subwoofer from Ultimate will leave no doubt that this sub can shake, rattle, and roll! Works extremely well in car audio, home theatre, or satellite/subwoofer systems. Handcrafted in the U.S.A.

- Power handling: 350 watts RMS/700 watts max
- Voice coil diameter: 2 inch ASV voice coil
- Impedance: 6 ohms per coil
- Frequency response: 18-1,000 Hz
- Magnet weight: 90 oz.
- Frequency range: 20 Hz - 88 dB 1W/1m
- VAS: 5.0 cu. ft.
- Qts: 2.41
- QWW: 4.72
- Net weight: 11 lbs.

#EN-292-710 $115.50 (-1,3) $107.80 (-1,4) $99.90 (-1,12)

Technicians' Turntable


#EN-360-427 $28.50 (-1,3) $23.80 (-1,4)

Idler Tire Kit

Have the tire you need in stock when you need it. This comprehensive kit contains 180 of the most commonly used tires in an easy-to-access case and a cross reference for 32 manufacturers crossing to over 600 VCR model numbers. A $400.00 value.

Net weight: 1-1/2 lbs.

#EN-400-900 $14.95 (+1,3) $10.95 (+1,4)

Fluke Model 12 Multimeter

The Model 12 compact digital multimeter combines basic features, high performance, low cost and Fluke reliability. It was designed for first level electrical and electronic troubleshooting. Includes 9V battery, operating manual, and test leads. Two year manufacturer warranty.

Features:
- Measures AC/DC volts, AC/DC current, resistance, capacitance, frequency, continuity, diode check, and temperature.
- 100% stainless steel enclosure.
- Auto ranging, 2000 count digital display.
- Dual digital LED readout.
- Nominal input: 600 VAC RMS, 600 VA continuously.
- Leads: 5, 10 VDC, 100 VAC.
- Range: 90 Ohm impedance: 30 watts RMS, 60 watts maximum power handling capability. Mounting brackets included. Dimensions: 8" (H) x 5-1/2" (W) x 4-1/2" (D). Net weight: 10 lbs.

#EN-430-300 (-1,3) $185.00 (-1,4) $155.45 (-1,12)

Audio Generator

Square wave and sine wave generator useful for a variety of audio applications. Generates 10 Hz to 1 MHz in 5 ranges. Output voltage: 8V RMS sine wave, 10V p-p square wave. +/-3% dial accuracy. Output impedance: 600 ohms. Synchronization: +/-3% of oscillation frequency per V/S input range. Dimensions: 6" x 10" W x 5" D. Includes test lead, AC power cord, and manual. One year manufacturer warranty. Net weight: 8 lbs.

#EN-390-620 $119.00

Mini Weatherproof Speaker System

These mini weatherproof speaker cabinets are made for high impact polypropylene which is completely weather sealed making them perfect for indoor or outdoor use. These great sounding mini speakers feature a 3" polypropylene cone woofer and a mylar dome tweeter. Ideal for use as extension speakers or for surrounding sound. Small size blends easily into any decor. Frequency response: 130-20,000 Hz. 8V RMS, 60 watts maximum power handling capability. Mounting brackets included. Dimensions: 8" (H) x 5-1/2" (W) x 4-1/2" (D). Net weight: 10 lbs.

#EN-312-010 (-1,3) $79.95 (-1,4) $74.80 (-1,5)

Vifa D25TG-05 1" Poly Dome Tweeter

Excellent performance at a moderate price. This ferro fluid cooled 1" poly dome tweeter features a high loss diaphragm, user replaceable voice coil assembly, and high power handling capability.
- Power handling: 100 watts RMS/140 watts max
- Nominal impedance: 6 ohms
- DC resistance: 4.6 ohms
- Frequency response: 1700-20,000 Hz
- Magnet weight: 1-1/2 lbs.
- Net weight: 1-1/4 lbs.

#EN-284-502 $28.50 (-1,3) $23.80 (-1,4)

Professional Strobe Light

No top notch lighting display is complete without a powerful, high speed strobe light. This professional unit features an ultra bright xenon flash tube, reflective bowl, variable speed control, and on/off toggle switch. A 1/16" clear plexiglass cover is mounted on brass stand-offs to protect the flash tube assembly. Includes adjustable mounting bracket, Dimensions: 9-1/2" (W) x 8-5/8" (H) x 6-7/8" (D). Net weight: 7 lbs.

#EN-243-072 $92.80

6-1/2" Two Way In-Wall System

This is our most popular in-wall. We don't believe how good these really sound. Big enough to produce great home theater sound and still fit everyone's budget. Put a pair in every room of your house. Great for front or rear speakers in your surround system. The 6-1/2" polypropylene woofer and 1" textile dome tweeter were specially designed with home theater in mind. The crossover network utilizes a mylar capacitor for crisp clean highs. 3 piece piece design make installation in new or existing walls a snap. Textured ABS frame and steel mesh grill are spray paintable to match (or blend into) any decor. Speaker front plate is "backed out" for cleaner through grill" appearance. System comes with speaker assembly, removable metal grill, heavy steel backer plates, screws and hardware, hole-cut out template, paint mask, and detailed installation instructions.

Specifications:
- 6-1/2" polypropylene cone woofer with poly foam surround 1" textile dome tweeter/midrange 8 ohm impedance 3 component VC crossover network 100 watts RMS/200 watts max 89 dB 1W/1M Overal dimensions: 8-1/2" W x 4-1/4" L x 3-1/2" D Hole size: 7-1/4" x 10-3/4" Fits into stand 2" x 4" wall Net weight: 12 lbs. per pair.

#EN-300-306 $104.95 (-1,3) $96.50 (-1,4) $85.50 (-1,12)

Troubleshooting And Repairing Consumer Electronics Without A Schematic

A common problem faced by repair technicians is trying to troubleshoot electronic equipment for which there is no schematic. With hundreds of illustrations, this indispensable guide demonstrates how to locate, test, and repair amplifiers, TVs, CD players, radios, power supplies, and more. Written by Homer L. Davidson. 320 pages. Copyright: 1994. Net weight: 1-1/4 lbs.

#EN-500-305 $22.95 EACH

Isotip Butane Soldering Iron

The ideal soldering iron for field repairs where no AC power is present. Operates for up to 10 hours on a single 110 psi can of continuous soldering per refill. Uses standard butane (not included) available at most stores. Tip temperature is adjustable up to 1027°C. Iron also comes with a torch attachment which easily screws on in place of the soldering tip. As a torch, one refill will provide up to 1 hour of continuous flame. Temperature is adjustable up to 2372°F. A protective cap with a built-in striker and 2.4mm tip are included. Limited one year warranty.

#EN-370-225 $26.95 EACH

*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 charge + $1.35 (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.

Parts ExpressTM

340 East First St.
Dayton, Ohio 45402-1257

Local: 513-222-0173
FAX: 513-222-4644

CIRCLE 252 ON FREE INFORMATION CARD

www.americanradiohistory.com
3-In-1 Universal Remote

This remote will operate any remote controlled cable box, TV or VCR at just a fraction of the cost of a factory replacement! This unit is already preprogrammed to include the most common codes. It is attractively styled, durable, and easy to set up and operate. The manufacturer even offers a toll free consumer help line to answer questions and provide customer assistance. Requires 2 AAA batteries (not included).

#EN-180-565 $11.95 EACH $9.95 (L-UP)

The Wet Look

The Wet Look™ is a new generation of high gloss polymers formulated especially for the speaker industry. This superior coating provides a protective "coat of armor" for your paper cone speakers. A special UV inhibitor has been added to reduce the decaying effects of the sun's ultraviolet rays. The Wet Look™ makes paper cones resistant to water, humidity, sun, and salt. Best of all, it's easy to apply and cleans up with soap and water. 1 pint can.

#EN-340-510 (Clear) $8.95 EACH
#EN-340-512 (Black) $8.95 EACH

72 Pin Game Cartridge Connector

Quality replacement for the game cartridge connector used in Nintendo Entertainment Systems (NES). Repeated loading and removal of game cartridges damages the connector contacts and produces symptoms such as a flashing blank screen or distorted picture. Revitalize your unit by replacing the game connector. It's simple; there is no soldering required and only a Phillips head screwdriver is needed to complete installation in minutes! Our replacement connector has gold plated game contacts for long life, superior conductivity, and resistance to oxidation. One year warranty.

#EN-091-900 $8.95 EACH $7.95 (L-UP)

BigFoot™

"Copper tip" design standard 1/4" phone plug. Unsurpassed quality ensures low noise and high conductivity connection. All metal/nylon construction with external solder connectors. Insulator sleeve included. 5/16" ID barrel. Made in the USA.

#EN-092-200 (Mono) $2.25 EACH $1.95 (L-UP)
#EN-092-206 (Stereo) $3.25 EACH $2.90 (L-UP)

Printers Cables

25 pin male RS-232 to 36 pin male Centronics connector. Fully shielded and molded cable with all 25 conductors connected. Convenient thumbscrew hardware on the RS-232 connector.

<table>
<thead>
<tr>
<th>Part #</th>
<th>Length</th>
<th>Price</th>
<th>Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN-130-220</td>
<td>6 ft.</td>
<td>$4.50</td>
<td>$3.90</td>
<td>$2.90</td>
</tr>
<tr>
<td>EN-130-225</td>
<td>10 ft.</td>
<td>$5.50</td>
<td>$4.95</td>
<td>$3.75</td>
</tr>
<tr>
<td>EN-130-227</td>
<td>15 ft.</td>
<td>$6.50</td>
<td>$5.90</td>
<td></td>
</tr>
<tr>
<td>EN-130-228</td>
<td>25 ft.</td>
<td>$10.90</td>
<td>$9.50</td>
<td></td>
</tr>
<tr>
<td>EN-130-229</td>
<td>50 ft.</td>
<td>$18.80</td>
<td>$17.50</td>
<td>$14.90</td>
</tr>
</tbody>
</table>

Car Stereo Power Supply Capacitors

Most car amplifiers' power supplies simply lack the capability to produce large amounts of instantaneous power. These computer grade, car stereo capacitors work by storing energy and supplying, on demand, a quick burst of energy to the power amplifier. The result is tremendous bass punch and dramatically improved transient response. Feature gold plated terminals.

Skew Driver Pro

This unique tool features a gear driven offset bit driver to be used in tight spots or where conventional screwdrivers just won't fit. Includes 1/4" and 3/16" slotted bits, T15 Torx® bit, and 2 Phillips bits that are contained in the handle compartment. Can also be used with a 1/4" electric drill. Made in the U.S.A. Net weight: 1/2 lb.

#EN-360-178 $39.90 EACH $31.95 (L-UP)

Electronic Video Library

Save over $25.00 by purchasing this complete library of six Video School instructional videos. You'll receive VCR-1: How To Clean VCRs, VCR-2: Minor VCR Repair I, VCR-3: Minor VCR Repair II, VCR-4: Common VCR Malfunctions, VCR-5: Diagnosing Video Heads, and Cam-1: Minor Camcorder Repair. Net weight: 5 lbs.

#EN-505-550 $195.00 EACH

Free Catalog

Parts Express™ 340 East First St. Dayton, Ohio 45402-1257 Local: 513-222-0173 FAX: 513-222-4644

CALL TOLL FREE 1-800-338-0531
Data Acquisition & 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
- 400 Khz sampling

ANA150 Analog/Counter... $ 89
- 8 Channel 8-Bit
- 0 to 5 Volt input
- 16-Bit Counters
- 240 Khz sampling

ANA200 Analog I/O............ $ 79
- 1 Channel 12-Bit
- 0 to 5 Volt input
- optional b-polar
- 100 Khz sampling
- 24 TTL I/O lines

ANA201 Analog ............... $ 129
- 8 Channel 12-Bit
- x1, x5, x10, x50
- Programmable channel gain
- 100 Khz sampling

DIG100 Digital I/O .......... $ 39
- 8255 FPI
- 24 or 46 TTL I/O Lines
- Selectable Base Address

DIG200 Counter I/O....... $ 79
- 3 16-Bit Counters
- 8-Bit input port
- 8-Bit output port
- Selectable Clock frequency input

Engineering Software - PC/MSDOS

Analyzer III - Linear Circuit Analysis $ 149
More Hardware and
AutoSkem - Schematic Drawing program $ 29
Software items available
CompDes - Circuit Design program $ 29
Pulsar - Logic Circuit Analysis $ 149
EasyPC - PCB Layout and Circuit Drawing $ 149
Ask for our current catalog
FilterTech - Filter Circuit Design and Analysis $ 229
PC-Scope - Digital Storage Oscilloscope for ANA100
ANA150 or ANA201 board $ 39
More Hardware and
BSOFT Software, Inc.
PHONE 614-491-0832 * FAX 614-497-9971
444 COLTON ROAD * COLUMBUS, OHIO * 43207

For all your power needs...PROwatt™ Inverters

From pocket inverters to our industrial strength 1500 watt inverter, there's a PROwatt model for all your portable power needs. Compact, light, and rugged, all PROwatt models deliver frequency-controlled modified sine wave output without the weight of bulky transformers. Available in 24V input models.

To order call:

R&R ELECTRONIC SUPPLY
1-800-299-7000

The Ultimate Game Enhancer from the Orient.

Video Game Saver (never die) with unlimited fun and no code needed.

Feature: 16 Megabit, 24M, 32M, expandable to 128M and a 3.5" high density disk drive.

Built-in function: 4 times inter-active slow motion, Instant screen save, Saving game data, Screen data and modified version games onto disk. Multi-game-in-one has up to 16 games on screen selection to play. Game cartridge can be backup on disk to protect your investment. Format is compatible to IBM PC and Mac.

Money back guarantee.
To order,
Games Partners, Inc.
212-219-8999

Enhancement is our business. All features compatible with SNES and SNES games. SNES is a trademark of Nintendo of America, Inc.

Specifications

<table>
<thead>
<tr>
<th>PROwatt</th>
<th>150W</th>
<th>250W</th>
<th>800W</th>
<th>1500W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Power</td>
<td>150W</td>
<td>225W</td>
<td>800W</td>
<td>1500W</td>
</tr>
<tr>
<td>10 minute rating</td>
<td>200W</td>
<td>300W</td>
<td>1000W</td>
<td>2000W</td>
</tr>
<tr>
<td>Dimensions</td>
<td>19&quot; x 6&quot; x 6&quot;</td>
<td>3&quot; x 6&quot; x 6&quot;</td>
<td>3&quot; x 9&quot; x 15&quot;</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>20 oz.</td>
<td>20 oz.</td>
<td>5 lbs</td>
<td>8 lbs</td>
</tr>
</tbody>
</table>
ALARM CONTROLLER
RF transmitter used on auto alarms. (95U007) Three for $4.95

VIDEO INTERCONNECT CABLE
Ten feet long with gold-plated push-on "F" connectors. Professional grade "Recoton Wire" cable. (95W008) $4.95 each

STEPPER MOTOR
1.7 Volts, 3.4 Amps, 1.8"/step. Japan Servo Co. (95M005) $7.95 each

STEPPER ORGON MOTOR
12VDC Originally for automotive electric windows. (95M002) $14.95 each

GOBS OF GOODS!
Studioline StereoXtra II Cable TV Adapter Separates stereo signals from the cable TV input, feeds TV signals to TV/VCRC tuner and stereo signals to FM (either RF or fixed/variable level audio). Inside are hundreds of useful parts which may be removed for audio/RF projects. Controller board has CPU and socketed EPROMs as well as Mitsumi varactor tuner, cable/FM separator board, regulated power supply subassembly, channel select board, and stereo separation output board. Black metal case, 14" x 10" x 3". Sold for experimental purposes only. With documentation. (92V020) Two for $39.95

WALL WART ASSORTMENT
A random selection of assorted voltages and current ratings. (94E004) 10 for $14.95

CONTROLLER ALARM
California residents add sales tax.

PROTOBOARD BB2740
9.84" x 5.3" x 1.22" Six distribution strips, 340 distribution holes. Four terminal strips, 3200 terminal holes. Four binding posts, 140 jumper wires. (BB2740) $36.00 each

PROTOBOARD BB3710
Size 5.25" x 11". Four terminal strips, 6 distribution strips, 3710 tie points, 1.6mm aluminum plate, 4 binding posts, 5 pads, 140 jumper wires, 1 component case, 6 adhesive strips. (BB3710) $43.00 each

TOROID TRANSFORMER
Both windings measured 1.0 mH with a DC resistance of 0.2 Ohms. If used as an inductor for a crossover network, both channels will be coupled together. For an auto subwoofer system. (95N001) $1.99 each

Antennas and Techniques for LOW-BAND DX-ING
By John Devoldere, ON4UN. If you can’t hear 'em, you can’t work ‘em. Improve your antenna system and operating techniques with loads of useful information from this book. (95X006) $19.95

ELECTRIC PISTON
The Electric Piston is an amazing, fully integrated shape memory alloy actuator. Power it up and this strong, compact device (about the size of a jumbo crayon) pulls with up to one pound of force and contracts by 20 mm (1") - twenty percent of its length! No compressors or hydraulic fluids, just electricity.

Capable of lifting 45 times its own weight, the Electric Piston has an incredibly smooth and silent action. It has built-in protection from overstrain, and mounting holes for easy installation in your devices. Typical activation requires just 1 Volt at five Amps for two seconds.


ELECTRICAL - Total electrical resistance: 0.2 Ohm. Typical power: 5 Amps at 1 Volt. Typical contraction time: 2 seconds. Typical relaxation time: 8 seconds. Typical cycle rate: 6 cycles per minute.

THERMAL - Contraction finish temperature (Af): 90° C. Relaxation finish temperature (Mf): 65° C. (3-137) $7.95 each

PRECISION EYEPiece
21mm f/3.5. Four coated glass lenses in black aluminum case measuring 1.15625" long by 1" diameter. Excellent correction of all aberrations for an angle of 35 deg. without vignetting. Resolution in focus is 385 lines/mm when the image of object is in focus (D=4mm), or 500 lines/mm when object is in focus (numerical aperture 1.41). Possible applications include: objective for scanners; photographic objective enlarging nearly 10X; objective for a hand-held microscope, enlarging from 30X to 120X (numerical aperture=1.41); lens working with light sensor or emitter as a precise focusing element; or lens for shaping a laser beam.

(92L031) $12.50 each

ATARI 1020 COLOR PRINTER
For all Atari 8-bit computers. Package includes printer, power supply, software, pens, paper and interface cable. These are new units in factory sealed boxes. (94C037) $14.95 each

BRAND NEW SOLAR PANELS
12 Volt, 1 Watt, 4" x 12" (92E005) $14.95
12 Volt, 2 Watt, 6" x 12" (92E006) $24.95
12 Volt, 4 Watt, 12" x 12" (92E007 $39.95

Other sizes and voltages available.
Call or fax for stock check. OEM pricing and custom panels available.

1’ MONITOR POWER CABLE
If your monitor has a permanent AC power cord attached, plug it into this adapter and then into the back of your computer. (94W002) $2.95 each

VHF RF PREAMP AND SPLITTER
Contains two transistors with FT of 4GHz 10dB gain, 3dB NF. Soup up your VHF receiver, scanner, FM tuner, VHF-TV reception or whatever. Actually has two preamps in one case. Runs on 12VDC. Schematics included and hints for broadband use. (92A026) $7.95 each

VISA, MC, Amex cards accepted
Minimum order $15.00
California residents add sales tax
Shipping additional on all orders.

---

ALTRONICS
2300 Zanker Road - San Jose, CA 95131
(408) 943-9773 - Fax (408) 943-9776

24-Hour BBS
(408) 943-0622
5600 Baud - N-8-1
Internet:
info@altronics.com

CIRCLE 215 ON FREE INFORMATION CARD

July 1985, Electronics Now

---

www.americanradiohistory.com
Robot Kits

EASY TO BUILD You do ALL electronic & mechanical assembly using 2-color Instruction Books with step-by-step, well-illustrated directions for assembly, experiments and testing. Each Robot Kit applies different electronic & robotic principles. Learn how Robots work and have fun at the same time!

606A "Scrambler" All Terrain Robot This 6-legged Robot walks over rough terrain. Uses high-tech infrared beam to sense and avoid objects in its path. 32 page Book. $37.95

602A "Blinky" Pathfinder Robot Follows path made with a marker pen or tape. Red/green LEDs react to steering changes, adding fun and interest. 28 page Book. Infrared emitter-detectors. $36.95

DEPENDABLE PRODUCTS Since 1963, Graymark's ONLY business has been producing educational electronic kits. We do one thing and we do it right. That's why Graymark has the largest selection of electronic kits. And, our "It works or we fix it" policy guarantees success for YOU!

ORDER TODAY! Phone: VISA/MasterCard Mail: Check/Money Order, VISA/MasterCard Add: $4.00 Shipping

Graymark P.O. Box 2015, Tustin, CA 92681 800-854-7393

CALL FOR FREE 40 PAGE CATALOG
TOLL FREE ORDER
HOT LINE
1-800-423-0070

ALL NEW -- IMPROVED
STEREO FM
TRANSMITTER

LOADED WITH FEATURES

* RF AMPLIFIER
* FRONT PANEL FINE TUNING
* STABLE OPERATION
* INPUT LEVEL ADJUSTMENTS
* WORKS WITH DIGITAL TUNED RADIOS
* 38KHz CRYSTAL MULTIPLEX CIRCUIT

DC's all new FM Stereo Transmitter Kit based on the unique BA1404 Stereo Broadcaster Integrated Circuit that includes all the complex circuitry to generate the stereo signal. We've added an RF amplifier circuit to provide excellent transmit range. Additional features like electronic fine tuning, voltage regulation, 38KHz multiplex crystal, input level adjustment makes the Stereocaster the top of the line Stereo FM Transmitter.

ORDER STEREOCASTER $29.95
MORE POWER!
68HC11, 80C51 & 80C166

AM Research supports over 30 of the most popular Embedded Controllers with a highly integrated hardware and software development system.

- More Microcontrollers
- Faster Hardware.
- Faster Software.
- More Productive.
- More Tools & Utilities.
- Incredibly Dense ROM.
- Single Chip Capable.
- Outstanding Support.

Call or write for a free full line brochure

Orders (800) 949-8051
Info (916) 652-4742
fax (916) 652-6642
bbs (916) 652-7117
email sofia@netcom.com
4600 Hidden Oaks Lane
Loomis, CA 95650

AM Research
The Embedded Controller Experts

DESKTOP MANUFACTURING!

Made in USA!
only $595!

This is the machine you've been waiting for!
Have you ever dreamed of letting your computer manufacture products directly from your CAD drawing? If so, the Neuractor CNC-4+ Desktop Manufacturing System may be just the edge you need! This fourth-generation CNC machine can automatically drill, mill and route three-dimensional products in wood, plastic and light metals directly from your CAD drawings! You've seen the rapid-prototyping and "Santa Claus" machines that cost thousands of dollars, but did you know that as an electronic technician you can assemble one yourself from this inexpensive kit? Utilizing patent pending technology the Neuractor CNC-4+ kit provides you with everything you need to machine products in three dimensions with a resolution of 0.001". All mechanical components are pre-fabricated, pre-assembled and painted. Includes four 83 oz/in digital CY-MOTORS, interface card, 5 amp power supply, 10 pitch steel lead screws, 4 proprietary slide block actuator mechanisms, 4 aluminum linear actuator channels, polished steel guide-rods, Dremel bracket, hardware, etc. (You provide Dremel MotoTool or flex-shaft router and work surface.) It's a complete kit! All you do is put it together and calibrate it! IF THAT'S NOT ENOUGH, WE'RE THROWING IN A FREE FULL-FEATURED 3D CAD/CAM SOFTWARE PACKAGE WITH EACH UNIT! Large 18"x18"x4' cutter travel for crafts, electronics and printed circuit board drilling and routing, not to mention model-making, model-making and even painting! Get started by ordering your own Neuractor CNC-4+ today! ACT NOW! Kit $595 + $24.95 UPS S/H. (for heavy-duty upgrade add $149) Allows 4-8 weeks for delivery. U.S. CYBERLAB, 14756 Sate Gap Rd., West Fork, AR 72774 (916) 839-8893.
Free Info: X-Y Power/Rotary Tables and larger CNCs now available!
New and Pre-Owned Test Equipment

Substantial SAVINGS on New & Pre-Owned B+K Precision, Fluke, Hewlett-Packard, Goldstar, Leader, Tektronix, and more...

GoldStar Precision

New Oscilloscope Specials

Model OS-9100P
Full 100 MHz Bandwidth!
SUPER SALE! $999.00

- TV Synchronization Trigger
- Dual-Channel, High Sensitivity
- Calibrated Delayed Sweep
- Two Probes Included
- 2 Year Warranty

Model OS-904RD
On-Screen Measuring Cursors & Readout!
40 MHz Bandwidth $699.00

Professional Quality DMM at an Affordable Price!
Model DM-334 $99.00
- 3.75 Digits, 4000 Cnt, Auto Ranging
- DC/AC Volts (1000/750V)
- DC/AC Current (10 A)
- Resistance (40 Meg Ohm)
- Bar Graph, Min/Max, Data Hold
- Frequency Counter (1 MHz)
- Safety Holster & Test Leads Included
- 1 year Warranty

Pre-Owned Oscilloscope Specials

- Tektronix 465 100 MHz $499.00
- Tektronix 465B 100 MHz $599.00
- 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

Hand-Held Parts Tester Model 815 $99.00
- Large 0.8" digits, 26 User Ranges
- Tests Transistor hFE and Leakage Iceo
- Checks SCR's, Diodes, LED's, Caps, and Resistors
- Tests Batteries Under Actual Load Conditions
- 1 Year Warranty

Variable 1-150VAC Isolation Transformer
Model 1653 $299.00
- Metered Display of Voltage or Current
- 2 Amp. Continuous Output
- Eliminate Shock Hazard while servicing "Hot-Chassis" Equipment

Full line of Oscilloscopes, RF, Video & Audio Test Equipment, Power Supplies, Meters, Probes and Accessories.

TOLL FREE 1-800-99-METER
1-800-996-3837

CIRCLE 288 ON FREE INFORMATION CARD
Motion Control System $249.95

Includes Stepper Controller Card, 12VCT Transformer, (2) 4 Phase Stepper Motors, Easy to use I.B.M Software! Connects to any I.B.M. Compatible LPT Port (1,2,3)...

- Nothing more to Buy!
- Easy Installation 15 minutes or Less!
- No Tools Required!
- Design Robots, Plotters, Laser Systems!
- Drives (2), 4 Phase Stepping Motors!
- Bi-Directional & Bit Read and Write Port!
- Board Addressable, 16 Possible Choices!
- Fits in Standard 19" inch Card Rack!
- With Additional Cards Control 32 Motors on 1 LPT Printer Port!
- Features Include: Variable Speed, Step, Range, Direction, and On/Off Control
- Free QBasic & GWBasic Source Code $ 59.95 value! *

Send Check or M.O. to:

CYBERMATION

"Intelligent Controllers"

1943 Sunny Crest Dr., Suite 288,
Fullerton, CA 92633

* Add $12.00 S&H; CA residents please add sales tax *

What's the easiest way to get Radio Active?
Dial 1 800 445 7717

TRIDENT

TR2400 $499
10KHz to 2.06GHz

TR980 $299
5MHz to 1GHz

BC220 $229
Turbo Scan with 800MHz

BC3000 $369
25MHz to 1.3GHz

These are a few of our products and price values. For more information dial toll free or use our BBS, or get instant specs & info, from our fax back service.

Toll Free, 24 Hours! For orders or for tech support, dial our 800 number. For Fax Facts Instant catalog sheet service, dial 317 849 8683. Computer BBS & Fax/Modem,317-579-2045. 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 $6.95
Quality Reconditioned
Test Equipment

Tektronix 475A Oscilloscope
250 MHz bw, dual channel, 5 mV/div sensitivity, 1 nS/div sweep rate. Includes 2 probes.
$975.00

Hewlett-Packard 3582A Spectrum Analyzer
Frequency range .02 Hz to 26.5 kHz, dual-channel, band selectable analysis for .02 Hz resolution, sensitivity -120 dBV, digital trace storage. Option 01.
$2850.00

Tektronix 492 Spectrum Analyzer
50 kHz to 21 GHz, 80 dB dynamic range, amplitude comparison in 0.25 dB steps. Options 01, 02, & 03.
$8850.00

Hewlett-Packard 54100A Digitizing Oscilloscope
1 GHz bw, 350 ps rise time, 100 ps/div time base, 40 ms/sec maximum digitizing rate, pre-trigger viewing, logic triggering, includes 3 HP 5402A 50Ω BNC input pods.
$6000.00

Hewlett-Packard 8505A Network Analyzer with 8501A & 8503A
500 kHz to 1.3 GHz, 100 dB dynamic range. Includes 8501A storage normalizer and 8503A S parameter test set.
$5000.00

Wandel & Goltermann TSA-1 Transmission System Analyzer
Frequency range of 100 Hz to 180 MHz, spectrum analysis, selective level, demodulation and phase jitter.
$2250.00

Tektronix 496P Programmable Spectrum Analyzer
1 kHz to 1.8 GHz, amplitude comparison in 0.25 dB steps, 80 dB dynamic range, automatic phase lock, GPI-IB fully programmable.
$8500.00

Wavetek 270 Function Generator
.01 to 12 MHz, programmable, GPIB, 200 stored settings. Option 002.
$950.00

Hewlett-Packard 432/8478B Power Meter with Thermistor Mount
10 MHz to 18 GHz, 10µW to 10 mW full range, digital display.
$3850.00

Hewlett-Packard 11875A Microwave Amplifier
General purpose, leveled microwave amplifier, 2 to 8 GHz, frequency range.
$3000.00

Please call for our Free 1995 Catalog

14455 NORTH 78TH STREET, UNIT #C • SCOTTSDALE, ARIZONA 85260
(602) 483-6202 • Fax (602) 483-6403
CIRCLE 235 ON FREE INFORMATION CARD
ALFA ELECTRONICS

HIGH QUALITY TEST EQUIPMENT

BEST PRICE

ALFA ELECTRONICS

Most Advanced DMM

DM89 $199.95

DM2360 $119.95

DM20 $74.95

Rubber holster included

Ruggerized case

Auto power off

Input warning

Voltage, amp, ohm, light, diode, continuity

Ruggedized case

Rubber holster included

LCR Meter 131D

Most Advanced LCR

$229.95

$189.95

$129.95

Frequency Counter

$1,049.96

$729.96

$67.5

DC Power Supply... $159.00

SR-6000 $199.95

RFC 48V $129

ALPHA ELECTRONICS

(800) 526-2532/ (609) 520-2002

15 DAY MONEY BACK GUARANTEE. 1 YEAR WARRANTY

CALL OR WRITE FOR FREE CATALOG AND BEST OFFER

Visa, Master Card, American Express, COD, Purchase Order Welcome

741 Alexander Rd., Princeton, NJ 08540

CIRCLE 219 ON FREE INFORMATION CARD

www.americanradiohistory.com
100 MHz Cursor Readout Scope 4 ch, 8 traces OS-6101  $1,499.95

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)  $299.95
PS-1850D Digital Display  $219.95
PS-3080 (0-30V, 0-3A)  $244.95
PS-3090 Digital Display  $245.95
PS-6100 (0-60V, 0-1A)  $209.95

Triplet Output DC Power Supplies

- Two variable 0-30V DC, 0-3A outputs
- One fixed 18VDC, 3A output
- Analog or digital selection

PC-3030 (0-30V, 0-3A)  $409.95
PC-3030D Digital display  $459.95

Programmable DC Power Supplies

- High stability, low drift, 4 digit display
- Front panel output function switch selectable
- Auto step running timer settings
- 100 point programmability (PPI series)
- 50 point programmability (PP series)
- Auto serial and parallel operation (PPT series)
- Auto tracking (PPT series)

PPS-1860G (0-18V, 0-3A)  $1099.95
PPS-3060G (0-30V, 0-3A)  $1099.95
PPS-6020G (0-60V, 0-2A)  $1099.95
PPS-6020K (0-60V, 0-2A)  $1099.95
PPS-6060G (0-60V, 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
- Sync, 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-2kHz (No Counter)  $189.95
FG-8131 Intelligent Counter 13GHz  $499.95
FG-8270 Intelligent Counter 7GHz  $629.95
UC-2010C 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)  $339.95
DM-8055 (3½ Digits)  $649.95
DM-8055G (5½ Digits)  $1399.95
DM-1099 (3½ Digits w/Continuity, Auto Off)  $299.95
DM-1199 (3½ Digits, Cap. Free, HFE, 20 Amp)  $299.95
DM-3533 (3½ Digits)  $299.95
DM-3533G (3½ Digits, Cap. Free, HFE, 20 Amp)  $299.95
DM-3911 (3½ Digits)  $399.95
DM-3911G (3½ Digits, Cap. Free, HFE)  $399.95
DM-3933 (3½ Digits)  $399.95
DM-3933G (4½ Digits, True RMS, Same as DM-392)  $399.95

Model DM-392 (3½ digits)  $109.95

- Auto Manual ranging (8 ranges)
- Auto Segmented analog bar graph
- Data Hold/Max/Min memory
- Relative mode
- Auto power off
- Overload protection
- Audible continuity check (diode test)
- Capacitance: 1pF-1µF
- Frequency 0-1kHz-1MHz
- 20 Amp range
- Digital multimeter (internal) 10A, 10A
- 0.3% DCV accuracy
- AC True RMS (DM-394 only)

DM-351 3½ Digits w/Continuity, Auto Off  $54.95
DM-352 3½ Digits, Cap. Free, HFE, 20 Amp...  $79.95
DM-353 3½ Digits, Cap. Free, Temp, HFE  $84.95
DM-351 3½ Digits, Auto, Cap. Free, Min/Max  $399.95
DM-392 3½ Digits, Hold, Min/Max 20Amp  $109.95
DM-393 3½ Digits, Peak, Logic, HFE, Free  $119.95
DM-394 3½ Digits, TRMS, Same as DM-392  $119.95

ALFA ELECTRONICS
741 Alexander Rd., Princeton, NJ 08540
(800) 526-2532/(609) 520-2002
FAX:(609) 520-2007
CALL OR WRITE FOR FREE CATALOG AND QUANTITY DISCOUNT.
Visa, Master Card, American Express, COD, Purchase Order Welcome
CIRCLE 213 ON FREE INFORMATION CARD

July 1995, Electronics Now

15 DAY MONEY BACK GUARANTEE, 2 YEAR WARRANTY
PC HF Facsimile $99

PC HF Facsimile is a simple, yet comprehensive short-wave fax system for the IBM PC and compatibles. It includes an FSK demodulator, advanced signal processing software, tutorial audio cassette, and complete reference manual. Just plug the demodulator into a serial port, install the software and getting FAX is a snap.

PC Slow Scan Television is a complete system for sending and receiving full color amateur SSTV. The package includes an SSTV FSK modems, SSTV software, image capture utilities and reference manual. All popular formats are supported including Robot, Scootie, Martin and AVT. The system requires a 286, 386 or faster PC with VGA or super VGA display.

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

Software Systems Consulting
615 S. El Camino Real, San Clemente, CA 92672
Tel. (714) 498-5784 Fax. (714) 498-0568

FM TRANSMITTERS ELECTRONIC KITS AND MORE

Satisfaction Guaranteed!

- Tunes 88-108 MHz
- Powerful 2 stage audio amplifier
- Sensitive, picks up sounds at the level of whisper
- Up to 1 mile range
- Requires 9V battery (Not Inc.)

SUPER-MINIATURE FM TRANSMITTER
Super small FM transmitter. Use with any FM broadcast receiver. Easy to assemble. All (SMT) parts are pre-assembled to the circuit board.

XSB1000 (E-Z) KIT $44.95

- Dial your phone from anywhere and listen to sounds in and out of your home
- Two digit Touch Tone code for secure operation

TELEPHONE SNOOP
Call home from anywhere, enter a two digit security code, and hear the sounds in your home. Automatically turns off when ringing phone, verrifies code, then activates for one or a half minute.

XPS1000 (K) Kit $13.95

- Digital voice changing: mail to female, male to adult
- Digital voice changing: mail to female, adult to child
- Maintain anonymity on any call
- Button for normal operation
- Buttons to voice making

VOICE CHANGING TELEPHONE
STOP THOSE ANNOYING TELEPHONE CALLS! Sound older and tougher when you want. Not a kit, Fully assembled. Single phone operation only.

TRANSITION 2000 $89.95

- Uninterrupted 800 to 950 MHz coverage
- Works with any scanner that can receive 400 to 550 MHz

FM SCANNER CONVERSION KIT $49.95

- 800-950 MHz SCANNER CONVERTER KIT If your scanner can receive 400-550 MHz, just add the XLC-10 to turn your scanner into a scanner for 800-950 MHz.

FM CASE KIT $13.95

- Electronic direct Hi-Fi stereo to any FM stereo receiver
- Separate Left and Right inputs and gain controls
- Connects a remote input to any Hi-Fi receiver

FM STEREO TRANSMITTER
Send mail for FREE CATALOG OF OUR PRODUCTS

Order to: XANDI ELECTRONICS
1270 E. Broadway Rd. #114, Tempe, AZ 85282

TOLL FREE ORDER LINE 1-800-336-7389
ASK FOR FREE CATALOG OF OUR PRODUCTS

CIRCLE 281 ON FREE INFORMATION CARD
DO-IT-YOURSELF AUDIO AMPLIFIER KITS

Mark V Electronics, Inc.
8019 E. Slauson Ave.,
Montebello, CA 90640

Order 1-800-521-MARK/1-800-423-FIVE

Kit skill levels are specified as ▲ beginner ▲ intermediate or ▲▲ advanced!

AF-2 ▲▲ 120-250W MOSFET POWER MONO AMPLIFIER (5 lbs.)
Power Output: 250W into 4 ohms RMS(42VX2 8A transformer is used), Frequency Response: 3-22,000HZ. THD: <0.03%. Signal to Noise Ratio: 91dB. Sensitivity: 1V RMS at 47K. Load Impedance: 4 or 8 ohms. Power Requirement: ±48VDC 4A or ±30VDC 6A. Suggested Mark V model 012 transformer. Capacitor: 10,000uf 80V model 016. Suggested Metal Cabinet LG-1925.

AF-3 ▲▲▲ 300W MOSFET HIGH POWER MONO AMPLIFIER (2 lbs.)

TA-800MK2 ▲▲ 120+120W PRE & MAIN STEREO AMP. (4 lbs.)
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.

TA-1000A ▲▲ 100W DYNAMIC CLASS A MONO AMP. (4 lbs.)
Power Output: 100W into 8 ohms RMS. 125W into 4 ohms RMS. Frequency Response: 10HZ-100KHZ THD: <0.008%. Signal to Noise Ratio: 80dB. Sensitivity: 1V. Power Requirements: 35 to 45VDC @ 3A. Suggested Mark V model 001 or 008 transformer. Capacitor: 10,000uf 80V model 016. Recommended Metal Cabinet LG-1924.

TA-388 ▲▲▲ CLASS A FET DYNAMIC BUFFER STEREO PRE-AMP. (1 lb.)
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.

SM-100 ▲▲▲ 150 MHZ 5 DIGIT FREQUENCY COUNTER (2 lbs.)
Frequency Range: 10HZ-150MHz. Gate Time: 0.01s, 0.1s, 1s, 10s, Input Sensitivity: 1kHz 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, 100HZ: 0.01s gate time. Hold the last input signal. Reset counter to 0. DC 9V power adapter or 1.5VX4"D"size batteries.(Adapter not Included)

SM-302 ▲▲▲ 60+60W STEREO POWER AMP.
It provides 3 input jack pairs. One pair accept a high impedance microphone. The two remaining pairs are for high & low level input sources. Power Output: 60W per channel into 4 ohms RMS. 20HZ-20KHZ THD: <0.1%. Input Sensitivity: Mic/Guitar 10mV, Hi 300mV, Lo 60mV. Ready to plug in when assembled. (11 lbs.)

SM-666 Dynamic Noise Reduction ▲▲ $26.00
TA-006 6W Mini-Amplifier ▲▲ 9.50
TA-28 Digital Voice Memo ▲ ▲ 25.00
TA-120 36W Class A Power Amp ▲ ▲ 32.50
TA-201 Microphone Mixer Mono Amp ▲ 20.79
TY-45 20 Bar/Dot Level Display ▲ ▲ 41.45
TY-43 3½ Digital Panel Meter ▲ ▲ 30.00

See our catalog for more kits!!

Minimum order $ 20.00. We accept Visa, MasterCard & Money Orders. Checks allow 2 weeks for clearance. We ship by UPS ground inside US (min $ 4.00) and ship by US mail outside US. Please call for orders over 2 lbs. or fax foreign orders. PO Orders are welcome from schools. We are not responsible for typographical errors.

CIRCLE 336 ON FREE INFORMATION CARD

July 1976, Electronics Now
DC/CAD introducing...

THE TERMINATOR
Super High Density Router
(Complete with Schematic & PCB EDITOR)

Features the following powerful algorithm & capability:
- No copy protection
- Rip-up Retry
- Pre-routing of SMT components
- User defined strategies
- Real-Time clean up and via minimization
- Gate & Pin swapping
- 1-mil Autoplacer and Autopanning
- Two-way Gerber and DXF
- Automatic Ground Plane w/Cross-Hatching
- Complete w/Schematic & Dolly Libraries
- Optional simulation capability & enhanced mode for 486 users
- Gate & pin swapping

* PCB LAYOUT SERVICE AT LOW COST *
LEASE PROGRAM & SITE LICENSE AVAILABLE

Design Computation
1771 State Highway 34
Farmingdale, NJ 07727
(908) 681-7700 - (908) 681 - 8733 (FAX)

"DC/CAD... the focal point of future CAD market"

REPEATER CONTROLLER
With AUTOPATCH $99.95

DTMF Controlled Autopatch and 4 control outputs. Switch selectable CWID. VOX or COR receiver control. Assembled tested board. LED's for Power, TX, RX, Phone. Intel 8748 microcontroller. Board size 3.8 x 6.3 inches. You add receiver, transmitter, power supply (12v), phone line, and antenna system. Circuit board is top quality, double sided, plated through holes, solder mask on both sides and parts legend. Shipping $4 for UPS GROUND or $6 for UPS BLUE, COD add $4. For more information call or write to:

John Bell (702) 267-2704
1381 Saratoga St. Minden, NV 89423

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

<table>
<thead>
<tr>
<th></th>
<th>Qty</th>
<th>1</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF300T</td>
<td>150’ Range Transmitter</td>
<td>24.95</td>
<td>19.95</td>
<td>15.95</td>
</tr>
<tr>
<td>RF300XT</td>
<td>300’ Range Transmitter</td>
<td>29.95</td>
<td>24.95</td>
<td>19.95</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Qty</th>
<th>1</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF300R</td>
<td>Receiver, Fully Assembled</td>
<td>24.95</td>
<td>20.95</td>
<td>16.95</td>
</tr>
<tr>
<td>RF300RK</td>
<td>Receiver, Complete Parts Kit</td>
<td>19.95</td>
<td>15.95</td>
<td>12.95</td>
</tr>
<tr>
<td>RF300PA</td>
<td>Pre-Amplifier. Doubles Range</td>
<td>14.95</td>
<td>11.95</td>
<td>9.95</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Qty</th>
<th>1</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF60</td>
<td>Transmitter and Receiver Set</td>
<td>24.95</td>
<td>19.95</td>
<td>14.95</td>
</tr>
</tbody>
</table>

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 324 ON FREE INFORMATION CARD
RAINBOW KITS

**4.0 mW Laser Pens**
Beam visible up to 500'.

**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. SIZE: 1"x.75" 6 to 12vDC.

**AA-1 $10.95 BUILT $29.95**

**8 CHANNEL AtoD CONVERTER KIT**
Complete with Software. Over 20 DOS programs provided!

**BUILD $29.95**

**SUPER NEW LOW PRICE $59.95**

**4.0 mW Laser Diode**
Great for making a gun sight. Makes a super experiment project. A beam wavelength of 670 nm. Size of beam is 6mm at 5 meters. Operates on 3 volts DC at 85mA. Size: 10.5mm x 18.5mm.

**LDM-5 NEW LOW PRICE $59.95**

**TV NOTCH FOR CHANNELS 2 thru 22**
Our TV filters eliminate unwanted TV channels or interference that alters both sound and video with a beep - beep - beep.

**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.**

**DF-222 Kit $14.95**

**16 DIGIT DTMF DECODER**
Control anything by telephone from around the world!

**Enter a code (Code can be any number up to 16 digits) and control...**
- Turn lights on while on vacation.
- Start your furnace or air before you go home.
- Switch your incoming line to a fax.
- Make your phone so it will not call to a long distance or a 900 number.

**This Little Jewel Will Outperform Most Units Many Times Its Price.**

**Control anything by telephone from around the world!**

**WIRELESS FM MICROPHONE**
Small but mighty this little jewel will out perform most units many times its price. It really stumps out a signal. The WM-1 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. SIZE: 8"x1" 6 to 12vDC.

**WM-2 $14.95**

**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 tunable 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. 40dB stereo separation. Length of antenna determines the distance of transmission. Complete with stereo input level controls, a crystal for stereo separation. 9v battery operation.

**FMST-100 $29.95 / FMSTC cabinet $8.95**

**The Exciting New TELEPHONE MONITOR**
Monitors your phone system, See how accurate your phone company really is!

**1. RECORDS OUTGOING CALLS:**
- Date & time of each call.
- Length of the call.
- What number was dialed.
- If you use a credit card it records the card number.

**2. RECORDS INCOMING CALLS:**
- Date & time of call.
- How many times phone rings.
- If answered the length of call.

**3. RECORDS ANY DTMF TONE:**
- Detects any tone on line sent by phone company or any other source.

**EASY TO INSTALL**
- Connects to parallel port.
- Phone line in.
- Phone line out to telephone.

**All software included!**

**TM-1 ONLY $99.95 KIT**

**BUILT $169.95**

**This Manual contains schematics, parts lists, P.C.B., 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.**

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.

**MasterCard**

**To Order Call**
317-291-7262

**7624 LaPas Trail • Indianapolis, IN 46268**

**FAX 317-291-7269**

**www.americanradiohistory.com**
MicroView™ Simulation Environment

MicroView is a full-featured simulation environment for the Microchip PIC 16C5X microcontrollers. Other simulation engines available:

- Integrated Programming Editor, Macro-Assembler
- Bookmarks, Search and Replace, UnDo
- Error Report, Listings, Context Sensitive On-line Help
- Single Step, Register Edit, Run to Line
- Full Breakpoint Capability

$149.95 USD

Assemble!™ Universal PIC Assembler

Assemble! is a universal macro-assembler for the complete line of Microchip PIC microcontrollers. Compatible with PICMASTER and the Parallax downloader.

- Integrated Programming Editor, Macro-Assembler
- Bookmarks, Search and Replace, UnDo
- Error Report, Listings, Context Sensitive On-line Help
- COD File Format, INHX8S, INHX8M, INHX16
- Memory Window, Direct Download to PICSTART

$99.95 USD

Prairie Digital, Inc.
PHONE 608-643-8599 • FAX 608-643-6754
846 SEVENTEENTH STREET • PRAIRIE DU SAC, WISCONSIN 53578

CIRCLE 329 ON FREE INFORMATION CARD

TRISYS
7830 East Redfield Road #12, Scottsdale, AZ 85260 USA • PH: (602) 905-1020 • FAX: (602) 443-3930

TRISYS and PICSTART are trademarks and tradenames of Microchip Technology, Inc., Parallax is the tradename of Parallax, Inc.
SuperCAD™
Schematic
Entry Software
for the IBM PC
& Compatibles
ONLY $99.00
COMPLETE PACKAGE

★ Easy-to-use schematic entry program for circuit diagrams
★ Visable on-screen and pull down menus
★ Supports popular graphic standards, mice and printers
★ Powerful editing and drawing commands
★ Extensive digital, analog and discrete part libraries
★ In-depth, readable instruction manual
★ Over 100 screens of on-line help information
★ Software includes part building and netlisting
★ Add P.C. board layout software and routing software for only $99.00 each

Write or call for FREE demo disk.

MENTAL AUTOMATION, INC.

ORDERS/INFORMATION:
Send check or money orders to:
Mental Automation, Inc,
5415 · 136th Place S.E.
Bellevue, WA 98006
Visa & MasterCard orders accepted
(206) 641-2141

EMAC'S 10 YEAR
ANNIVERSARY
SPECIAL

It doesn't seem that long ago (1985) that EMAC built it's first Single Board Computer (SBC). Since then we have built all sorts of SBC's for all sorts of applications. During this time customers often asked where they could get information on programming and using SBC's for embedded data acquisition and control applications. Our response was "we don't know". This prompted us to design the PRIMER 8085 Microprocessor Training System with Self Instruction manual. This system starts you out in Machine language, then takes you to Assembly language, and optionally moves you on to BASIC or Forth high level languages. These languages are very similar to the languages that are available for our SBC's. The PRIMER has an A/D and D/A which allows you process analog signals such as temperature, voltage, and light level. As a matter of fact, examples are included that make use of these signals. For a limited time EMAC is offering EMOS and a Power Supply for FREE when you purchase a PRIMER with an upgrade option($49.95) or deluxe upgrade option($64.95). With this free $59.90 value you can use your PC to program, download and debug your code. The PRIMER is only $119.95 quantity 1 in kit form. The PRIMER assembled & tested by EMAC is $169.95. Please add $5.00 for shipping within the U.S. Upgrade includes an RS232 serial port, a serial cable, and 32K of battery-backed RAM. Deluxe upgrade adds a battery-backed real time clock.

EMAC, inc.
618-529-4525 FAX: 457-0110 BBS: 529-5708
P.O. BOX 2042 CARBONDALE, IL 62902

Cellular Programming Software

$$$ BLOW OUT PRICES $$$

WE’LL BEAT ALL COMPETITORS’ ADVERTISED PRICES

MOTOROLA ........................................ Above 9122 AllModels Software or Loader from $395.00
NOKIA & TECHNOPHONE .......................... 100 - 101 - 121 - 201 - 400 - 405 - 415 - 515 - TANDY MODELS
NEC .................................................. P100 - P110 - P120 - P180 - P400 - P600 — ATT3610
PANASONIC .............................. ALL PORTABLES HP600 - HH700 - HH900 - EBH30 - EBH40 - EBH50 - EBH60
GE & ERICSSON .................................. HOTLINE - POCKET II - MICROPORTABLE - AH97 - AH98 - CT100 - CT700
MITSUBISHI & DIAMONDETAL .............. 3500 - 4500 - 20X - 22X SONY .............. CMR - 111 - 333

MOTOROLA SOFTWARE TO REPAIR LOANER AND OOOFFFF

CopyCat®

No PC — No Loaner
Only 10 Seconds
Programs & Repairs
Complete with Cables
All Motorolas Including
Digital - Analog - All Versions
Models Available from $2300.00

Sony - Ericsson - Panasonic
Audiovox - NEC - Mitsubishi
Dimontel - GE - Uniden

ALL PRODUCTS ARE IN STOCK
SHIPPED OVERNIGHT UPS/COD

CELLSOFT®

609-751-2242 Ext 2
FAX 609-751-5549 • FREE TECHNICAL SUPPORT

CIRCLE 286 ON FREE INFORMATION CARD

www.americanradiohistory.com
# Solutions for the Test Instrument

1 YEAR WARRANTY  
15 DAY MONEY BACK GUARANTEE

## Power Supply

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-100</td>
<td>Reg. $599.</td>
<td>$399.00</td>
</tr>
</tbody>
</table>

## Frequency Counter

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS-3324</td>
<td>Deluxe O'scopes</td>
<td>$399.00</td>
</tr>
<tr>
<td>OS-3324, 3 Function</td>
<td>Reg. $599.</td>
<td>$599.00</td>
</tr>
<tr>
<td>OS-3344</td>
<td>Reg. $599.</td>
<td>$599.00</td>
</tr>
</tbody>
</table>

## Digital Multimeter

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM5050C</td>
<td>Reg. $149.</td>
<td>$89.00</td>
</tr>
</tbody>
</table>

## Oscilloscope

- **OS-3304**: 25MHz, Dual Trace (Reg. $99.00, $399.00)
- **OS-3324**: 3 Function (Reg. $599.00, $399.00)
- **OS-3344**: 5 Function (Reg. $599.00, $649.00)

## Capacitance Meter

- **CM210**: 3.1/2 Digit LCD, 1.0pF-20,000pF, 9 Ranges, 0.5% basic Accu., Zero Adjust Knob, Test Leads & Built-in Socket, Reg. $179.00, $49.00
- **DM150**: 3.1/2 Digit, Dual Display, Auto & Manual, DCV, ACV, ACA, DCA, LA, Logic, CMOS/TTL, Data Hold, Diode, Continuity, Reg. $159.00, $59.00
- **DM3050**: 3.1/2 Digit, 1.5" Big LCD, Heavy Duty, 20A AC/DC, Capacitance, Frequency, TR-FNE, Diode, Continuity, Holster, Reg. $159.00, $59.00

## Pen-Type DMM w/Logic

- **DM50**: 3.1/2 Digit, 1.5" Big LCD, Heavy Duty, 20A AC/DC, Capacitance, Frequency, TR-FNE, Diode, Continuity, Holster, Reg. $159.00, $59.00

## Multifunction DMM

- **DM5050C, DM5100**: 9 Function / 42 Range, Multimeter, Ohm: Up to 2000MΩ, Amp: AC/DC 2 Amp, Extended Capacitance Meter (9 Range) 0.1pF - 20,000pF, Zero Adjust Knob, Trig Lamp, Reg. $149.00, $89.00
- **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: 1pF - 200μF, Logic: TTL, TR-FNE, Reg. $149.00, $89.00

## GoldStar O'scopes

- **OS-3304**: 25MHz, Dual Trace, Reg. $99.00, $399.00
- **OS-3324**: 3 Function, Reg. $599.00, $399.00
- **OS-3344**: 5 Function, Reg. $599.00, $649.00

## Accessories

- **Oscilloscope Probe Kit**: Switch Selectable X1/X10, HP-9060, 60MHz, Reg. $29.00, $19.00
- **Capacitance Meter**: CM210, 3.1/2 Digit LCD, 1.0pF-20,000pF, 9 Ranges, 0.5% basic Accu., Zero Adjust Knob, Test Leads & Built-in Socket, Reg. $179.00, $49.00
- **Pen-Type DMM w/Logic**: DM150, 3.1/2 Digit, Dual Display, Auto & Manual, DCV, ACV, ACA, DCA, LA, Logic, CMOS/TTL, Data Hold, Diode, Continuity, Reg. $159.00, $59.00
- **Multifunction DMM**: DM3050, 3.1/2 Digit, 1.5" Big LCD, Heavy Duty, 20A AC/DC, Capacitance, Frequency, TR-FNE, Diode, Continuity, Holster, Reg. $159.00, $59.00

## Warranty

1 Year Warranty  
15 Day Money Back Guarantee
NOW! A QUALITY SATELLITE SCPC AUDIO RECEIVER

AT AN AFFORDABLE PRICE

UNIVERSAL SCPC-100 AUDIO RECEIVER

SERVICES ON SCPC RADIO

ALL SPORTS - NEWS NETWORKS - AP - UP - RADIO NETS - HOMETOWN SPORTS - TALK SHOWS - MUSIC (CLASSICAL, JAZZ, ROCK) - MAJOR RADIO STATIONS - FINANCIAL NEWS - NEW, QUICK LOCATOR CHANNEL GUIDE FURNISHED - OVER 430 CHANNELS AND GROWING!

FEATURES OF THE SCPC-100

MICROPROCESSOR TUNING, EASY TO TUNE - 50 CHANNEL MEMORY RECALL - WORKS WITH 950-1450 SYSTEMS - 3-MINUTE HOOKUP - 1/2" DISPLAY - C- AND KU BAND SCPC - DOES NOT DISABLE VIDEO IN USE - USE WITH HI-FI SYSTEM RECEIVES ALL SCPC CHANNELS - SIMPLE TO USE - TUNE ALL "HIDDEN" CHANNELS.

INTRODUCTORY PRICE $439 + S&H

UNIVERSAL ELECTRONICS, INC.

4555 GROVES RD., SUITE 12, COLUMBUS, OH 43232

(614) 866-4605 FAX (614) 866-1201

Cellular Extensions

The Cellular Industries best kept secret!

You can have multiple Cellular Phones on one number. Whether you want to start your own business, or just want to program your own phone. We have the knowledge, expertise, experience and technology to get you started. Full or part-time, this is one of the best money makers of the decade.

Software, Hardware, & Cables

We stock a full line of equipment to program many phones directly through the data port WITHOUT opening the phone. We have Hand-Held programmers from just $1995! We offer full technical support & all products are fully tested and guaranteed.

Buy Pre-Programmed Phones from Us!

Get a second or third phone with NO ADDITIONAL MONTHLY CHARGES: Motorola "BAG" phone $299, PT550 "FLIP" phone $449, NEC P120 $399. Many others available, or send us your phone, WE OFFER SAME DAY TURN-AROUND! PROOF OF LINE OWNERSHIP REQUIRED.

California Grapevine Communications

Fax on demand, call from your fax 24hrs. (714)-581-7460

10 YEARS EXPERIENCE IN THE CELLULAR INDUSTRY. Call: (714)-581-2121

AND COD. WELCOME!

CIRCLE 293 ON FREE INFORMATION CARD

www.americanradiohistory.com
The Data Genie HT-28 is a portable, stand-alone IC tester and identifier. It can test and identify most TTL 74 and CMOS 40/40 series of IC's as well as being able to test 4164-411000 and 4410-44256 series of DRAM's. Powered from the included AC adapter or alkaline batteries (optional).
- Up to 600 hours of operation on four "AA" alkaline batteries.
- Automatic power shut-off to conserve battery life.
- Lightweight, easy to use and carry, weighs only 14 oz.

RF TRANSMITTER + ENCODER MODULES
The TX-99 interfaces with the TX-D as the RF carrier module. 300 MHz AM with a typical range of 100' line-of-sight. (Key-chain transmitter is also available, model TX-99K $15.95)

The TX-01 Motherboard can encode a 12-bit address code with 4096 possible code combinations or can be used to encode an 8-bit address code with 4-bit data code.

PC INTERFACE CARD PROTECTOR
The Data Genie P-300 is a device that allows quick and easy installation of add-on boards or prototype circuits to your PC without having to turn off the computer. Maintains complete protection for your motherboard via the built-in protection circuitry & current limit fuses. Adds 3 expansion slots.

LASER POINTER
The Infinitel '210' Laser Pointer's high-tech, lightweight aluminium housing, incorporates a mode switch which allows you to select between a solid beam or flashing beam to enhance any presentation. Projects over 150 and even works well on overhead projection screens. Great for the conference room, exhibition hall, construction site, museum, etc.

ORDER BY MAIL:
ELECTRONICS 123
17921 ROWLAND ST.
INDUSTRY, CA 91748

ORDER TOLL FREE
1-800-669-4406
24 hr. Fax: 818-912-9598

IC TESTER/IDENTIFIER

DIGITAL VOICE MODULE
The DVM-58D has variable length message capabilities and can store up to 16 individual messages for immediate playback. Use it to add real voice prompting or instruction to any project, via the mic. input. Standard 1Mb DRAM on-board (32 sec. @ 32k bps) with options to expand up to 16Mb (8 min. @ 32k bps). ADM recording with selectable 16/32/44k bps sampling rates and very low power consumption.

RF RECEIVER + DECODER MODULES
The RE-99 interfaces with the RE-01 as the RF carrier's receiver module and requires only a few solder connections to mate the two. 300 MHz AM.

PIR DETECTOR
The Medusa Passive Infrared Detector has been tested at 20V/m over the frequency range 20 to 1000 MHz, proving that the unit has ultra-high RFI protection and reliability. With N.C contacts including tamper, plus selectable pulse counts of 1.3 or 5, Medusa makes for confident installations.

'95 SPRING/SUMMER Catalog
- Digital Voice Products
- RF Remote Control Products
- Syntax Prototyping Boards
- Hottek Encoder/Decoder IC's & other components.
- Data Genie Test Equipment and much, much more!

If you are a past or current customer, you will soon be receiving your copy by mail.

Now Available
For Technical Support Call:

(818) 912-9864

S&H Charges: Continental US, up to 3 lbs. Add:
UPS Ground $ 1.90
UPS 3-Day $ 8.00
UPS Blue $10.00
UPS Red (Next Day) $20.00
COD's Add: 14.50
Call. Orders Add: 8.25% Sales Tax

S&H Charges Canada, up to 3 lbs. Add: US Postal, RFL Class $ 10.00
Prepayment by credit card required.
No COD orders.
(S&H Charges INTERNATIONAL: Call/Fax for quote.)

All prices subject to change without notice.
CABLE CONVERTER SPECIALS

Sigma 550
- 86 channel O & I compatible
- Last channel recall — lightning protection
- 1 year warranty

Timeless 550 P/C
- Same as above, different manufacturer
- with parental lockout. HRC switchable
- 1 year warranty

Northcoast Excell
- American manufactured!! 70 channel
- Fine tuning — Standard HRC tuning through
- remote, sleep timer. Green LED w/dimmer
- Parental lockout. Deluxe! A/B twinline available...

United Electronic Supply
P.O. Box 1206-PE
Elgin, IL 60121

708-697-0600

Orders Only Fax Number: 708-658-9515 No Illinois Sales

As low as $19.95

NEW ITEM
Zenith Universal Remotes
Fully Programmable
New Program / Learn Type
Combines both functions for
VCR / Cable / TV / Stereo
All in remote.

Hours: Mon - Fri: 8:30 — 5:00 pm CST
24 Hour Answering Machine for orders

Device Programmers

48 PIN ZIF
Connects to standard
PC parallel printer port

- 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 (EMP20DEMO.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)

FOR MORE INFORMATION CALL

4630 Beloit Drive, Suite 20
Sacramento, CA 95838
(Monday-Friday, 8 am-5 pm PST)

NEEDHAM'S ELECTRONICS, INC.

CIRCLE 277 ON FREE INFORMATION CARD
Get the Best Universal Diagnostics Toolkit on the market!

Featuring these two top-rated, award-winning diagnostic tools from MICRO 2000, Inc:

**Micro-Scope 6.0**

Fully O/S Independent diagnostic software...

**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, together with an impressive list of functions including the ability to perform low level formatting on every drive currently manufactured, including all IDE drives.

- LOW-LEVEL FORMAT—Performs low-level format on all drive types including IDE drives. This function cannot hurt IDE drives. **USE CONTROLLER BIOS**—Program will access BIOS format built into any hard disk controller—even Controllers yet to be invented. **OS INDEPENDENT**—Does not rely on OS for diagnostics. Talks to PC on hardware level. All tests are full function regardless of OS (i.e. Novell, UNIX, OS/2).
- TRUE HARDWARE DIAGNOSTICS—Accurate testing of CPU, IRQ's, DMA's, memory, hard drives, floppy drives, video cards, etc.
- BATCH CONTROL—All tests, even destructive, may be selected for testing.
- ERROR LOGGING—Automatically inputs errors during testing to an error log.
- AUTOMAPPING—Automatically creates sector map, extending to an error log.
- BUS/IDE—Show bits enabled in IRQ chip for finding cards that are software driven. (Network, Tape Backup, etc.)
- IRQ CHECK—Lists directly to hardware and shows I/O address and IRQ of devices that respond.
- MEMORY EXAMINE—Displays physical address of memory under 1 Meg. Very useful for determining memory conflicts. Very useful for determining available memory space.
- SECTOR EDITOR—Allows the editing of any sector of floppy or hard disk media (even track 0).
- AND MUCH MORE...We don't have enough space here for everything this software can do!

**POST-Probe**

The only Power-On Self-Test card you need to debug any "dead" PC...

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.
- A LEDs monitor -5vdc -5vdc +12vdc -12vdc.
- Monitors Hi & Lo clock and OSC cycles to distinguish between clock chip or capacitor failure.
- Monitors I/O Write and I/O Read to distinguish between write and read errors.
- Monitors memory write/ read to distinguish between address line failures and memory chip failures.
- Monitors ALF for proper CPU/DMA operation.
- Monitors Reset to determine if reset is occurring during POST, indicating short.
- Monitors progress of POST without POST Codes.
- Reads POST codes from any IBM or compatible that emits POST codes.
- Compatibile 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 layout and detailed POST procedures for all major BIOS's.
- AND MUCH MORE...

Also ask about other Universally Compatible products:

- MICRO-SCOPE CLIENT: The essential answer to routine diagnostic questions.
- THE COMPUTER CONSULTANT: IBM service helping you understand your hardware.
- MICRO-SCOPE CENSUS: Diagrams and a software to test and repair mainboard cards with ease.
- 911-RECOVER: A recovery program that recovers the system.

Call Now for 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

Winners of these awards:

"You name it, this tests it. If you maintain PCs, you'll love it."

—Jerry Pournelle

BYTE Magazine, May 94
IT'S HERE! YOUR NEW MWK LASER CATALOG IS NOW AVAILABLE!

Hundreds of LASERS, LASER experiments, plans, LASER light-shows, books, hard-to-find items, all at surprisingly affordable prices.

Call for your free copy today!
(909) 278-0563

ALSO USE OUR FAX-ON-DEMAND CATALOG
(909) 278-1225
24hr catalog, call from your FAX machine.

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 or we will not abide 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

DIRECT CABLE SUPPLY
800-808-3356

DON'T PAY RETAIL - BUY FROM THE WHOLESALER
$SAVE $SAVE $SAVE $SAVE $SAVE

DEALER DISCOUNTS FOR SINGLE LOT PURCHASES

DECODERS
TVT-3G (ALL JERROLD) $69.95
STEALTH (except DPBB) $79.95
M80-3 (ALL SA (except 8590)) $79.95
PPG-3 (ALL PIONEER) $95.00

PLAIN CONVERTERS
SA/REMOTE $89.95
CENTURY/SLEEP/PL/REMOTE $79.95

COMBO UNITS
NOVAVISION 5600 .for PIO $249.00
NOVAVISION 5700 .for JER $239.00
NOVAVISION 5800 .for SA $239.00

30 DAY MONEY BACK GUARANTEE!
24 HOUR SHIPMENTS! QUANTITY DISCOUNTS!

Call for larger quantity pricing. All shipping & handling at customer's expense. Anyone implying theft of service will be denied assistance. No PA sales.
MCM Electronics is the comprehensive source for all of your service needs. We feature the entire line of TENMA Test Equipment, along with Fluke, B+K, Hitachi and Leader. In addition, we stock a huge selection of repair parts including belts, idler tires, video and audio heads and over 10,000 semiconductors. If you service electronics, we have what you need. Discover for yourself the MCM Electronics difference, call for your free 324 page catalog today.
**80C552 Development System**

- Use an 8051 core processor which has 8 channel 10-bit A/D, PWM.
- RS232 port and 24 more I/O.
- 32K ROM and 64K RAM.
- Two 26 pin headers for expansion.
- $120 each SBC, 40x2 LCD $20.
- High performance development system gives you features of assembler, disassembler, monitor and example programs, plus real-time execution and debugging ($70).

**68HC11 Development System**

- Eight channel 8 bit A/D converter.
- 32K ROM and 32K RAM.
- RS232 port and 24 more I/O.
- Two 26 pin headers for expansion.
- $120 each SBC, 40x2 LCD $20.
- The real-time integrated development system ($70 more) includes assembler, disassembler, monitor and example programs, plus Simulator/Debugger.

**Universal Microprocessor Simulator/Debugger V2.1**

- Simulates 8048, 8051, 8058, Z8, Z80, 64180, 6800, 6801, 6805, 6809, 68HC11, 6303, 6502, and 65C02.
- Assembler, Disassembler, and Windowed Symbolic Simulator. Supports on-board debug through RS232.
- $100 each CPU (S/H $8).

**ROMY-16EPROM EMULATOR**

- Emulates ROMs (216-27010) or RAMs in 8- and 16-bit systems.
- Window/menu driven interface.
- Provides 8 hardware breakpoints for 8-bit systems.
- $195 (2716-27256) or $245 (2716-27010), 90 day warranty.
- 15 day money-back guarantee.
- Optional assembler, disassembler, and ROM debugger add $100 each CPU.
- Other CPU development systems and custom design are also available.

**J&M Microtek, Inc.**

83 Seaman Road, W Orange, NJ 07052
Tel:(201)3251892 Fax:(201)736-4567

---

**SAT COM TEST BRDS**

**PIO TEST**

- SC-7
- 50 - $2.35 Ea.
- 100 - $2.00 Ea.
- 500 - $1.18 Ea.
- $195

**Communication (We buy quantities $70 more) includes:

- $120
- $100

**RS232**

- 32K ROM
- $100

**32K ROM**

- 8 and 16-bit
- 8-bit

**Z8, Z80, 64180, 6800, 6801, 6805, 6809, 68HC11, 6303, 6502, and 65C02.**

**16 Bit Control & Data Acquisition System**

- DSP Powerful
- Easy to use
- Tons of Memory
- I/O & features:
  - 16MHz 69HC11
  - 32 digital I/Os (7112)
  - LCD/keypad port
  - 6-ch 10-bit A/D

- Affordable "C" compiler/monitor
- Multi-tasking kernel
- Up to 256K of SRAM, FLASH memory

**INTEC INOVENTURES INC.**

Ph: (604) 721-5150 FAX: 721-4191

---

**PRINTED CIRCUIT BOARDS**

**LEAD TIME PROBLEMS?**

**CALL THE PROFESSIONALS**

- Single Sided
- Double Sided PTH
- Solder Mask
- Component Screen
- Prototyping
- High Production

**AMERICAN OWNED AND OPERATED**

**Making PC Boards Since 1966**

**CALL OR FAX FOR PRICING**

K & K ELECTRONICS

170 E. Market St.
Alliance, Ohio 44601
1-800-356-6238 FAX 216-821-5380

---

**BLACK FEATHER ELECTRONICS**

**3 1/2 Digit LCD Panel Meter**

- Features: 200mV full scale input 9VDC operation. Decimal point selectable. 13mm digit height, auto polarity indication, zero reading for 0 volt input. Measures 2.87" x 1.73" x 0.78" above panel thickness, 0.57" overall thickness. LCD size: 1.83" x 0.8". Has many useful applications and easy to install.
- CAT# PM-1 $17.00 each

**Stepper Motor Controller Kit**

- This kit allows you to adjust the speed and direction of a stepper motor. You can move the motor in one step increments or rotate it at a constant speed. Visual indicators show the sequence of motion. Includes stepper motor, ps board, parts and instructions. (12VAC power source not included.)
- CAT# SMK-1 $25.00 each

**Camcorder Video Tape**

- Hi-8 120 MINUTE TAPE (used)
- They were recorded on once and played only a few times. Made by a major brand name manufacturer. Professional series metal tapes. Includes plastic jewel box.
- CAT# (CT-1)
- $3.00 each on or more - 2.80 each

**Black Feather ELECTRONICS**

1-800-526-3717

1. California residents must include sales tax.
2. Checks and money order accepted.
3. Quantities limited - prices subject to change.

---

www.americanradiohistory.com
TEKTRONIX 492 SPECTRUM ANALYZER

Covers 50KHz - 21 GHz. Solid state portable unit features internal phase lock, minimum sensitivity is -95 dBm. This unit includes OPTIONs 1, 2, 3 (1-RF Preselection),(2-Digital storage),(3-Freq stabilization 100Hz Resol'n)

**Price:** $8,450.00 Fully checked.
Mixers 18-26.5 GHz & 26.5-40GHz $1,200.00 pair. with purge of above.

OSCILOSCOPE MAINFRAMES

7104 Oscilloscope MF - 1 GHz High Speed $3,750.00
7603 Oscilloscope MF - 100MHz - 3 slot $250.00
7623 Oscilloscope MF - Storage 100MHz - 3 slot $350.00
7623A Oscilloscope MF - Storage 100MHz - 3 slot $375.00
7633 Oscilloscope MF - Storage 100MHz - 3 slot $575.00
7704 Oscilloscope MF - 200MHz - 4 slot $295.00
7704A Oscilloscope MF - 200MHz - 4 slot $395.00
7854 Oscilloscope MF - 400MHz Digital Storage Waveform Processing with GPIB $1,500.00
7904 Oscilloscope MF - 500MHz - 4 slot $500.00

PLUG-INs

7A11 250MHz FET PROBE ........................ $ 600.00
7A13 DIGITAL COMPARATOR, LED DISPLAY ........................ $ 400.00
7A18 75MHz 2 CH VERT. AMP. ............ $ 125.00
7A19 600MHz 1 CH VERT. AMP. ............ $ 400.00
7A24 400MHz 2 CH VERT. AMP. ............ $ 450.00
7A26 200MHz 2 CH VERT. AMP. ............ $ 250.00
7A29 1 GHz VERT. PLUG-IN ................. $ 800.00
7A42 350MHz 4 CH LOGIC TRIG VERT AMP. .................... $1,400.00
7B10 2NS DLY'D TIMEBASE ................. $ 500.00
7B15 Δ DLY'D TIMEBASE .................... $ 500.00
7B53A 100MHz DUAL TIMEBASES 250.00
7B80 400MHz DLY'D TIMEBASE 250.00
7B85 400MHz Δ DLY'D TIMEBASE 350.00
7CT1 CURVE TRACER ........................ $ 500.00
7D01 LOGIC AN (no probes) ................. $ 50.00
7D13 DIGITAL MULTIMETER ................. $ 125.00
7D15 225MHz FREQ. COUNTER ............... $ 300.00
7L12 100KHz-1.5GHz SPEC-AN .............. $2,700.00
7L13 1KHz-1.8GHz SPEC-AN ............... $3,250.00

**NOTE:** if there are specific items you are looking for regardless of whether or not they appear in this ad, we would be happy to provide you with a quote including, availability, pricing information and shipping details.
TEKTRONIX 465B

Proof is in the pudding when it comes to this instrument’s track record. There’s no doubt that popularity speaks many languages when speaking of the “465B”. This excellent instrument continues the tradition of the standard 465 oscilloscope by adding useful features such as CH-1, CH-2 sum or difference, trigger view in any combination, alternate sweep and trace selection versatility. Many technicians dream of owning a quality 100-MHz oscilloscope, but funding rarely permits. Fortunately, we were recently able to acquire a limited supply of 465B’s in nearly new condition. Our LOW PRICES will likely permit “you” to own one of the best scopes anywhere in the country. If your needs are current and action swift you too will be a member of a growing club!!

SELECTED EXCELLENT CONDITION..............................$849.00

These instruments are fully checked out and calibrated. They are supplied with an original front panel cover and complete service manual. Original TEK Probes are $75.00 each with each purchase.

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, reverse power 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

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 radiation 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 5351A TRANSMISSION TEST SET..................................$595.00
HP 5360A WAVE ANALYZER...........................................$1,295.00
HP 4260A LCR BRIDGE..................................................$395.00
HP 5804A SIGNATURE ANALYZER....................................$450.00
HP 54111A COLOR DIGITAL STORAGE SCOPES........................$850.00
HP 8180A OPT-2 PROG PULSE GUN....................................$3,095.00
HP 8050B NETWORK ANALYZER SYSTEM..........................$6,000.00
HP 8150A SPECTRUM ANALYZER 1-18GHZ..........................$2,750.00
HP 8159A SPEC ANALYZER 18-22GHZ...............................$4,995.00
TEK FSM FUNCTION GENERATOR (480HZ).........................$875.00
TEK 52B VECTORSCOPE..................................................$1,200.00
HP 35711U/77 CURVE TRACER.........................................$2,000.00
HP 1562D DSB-CW TRAN SECR.......................................$2,200.00
TEK DUTI MULTIMODE FIBRE OPTIC TOR..........................$4,750.00
TEK A15001 PROG, DIST-ANA, 110 MSMS/MF.....................$1,790.00

-EIP 351D 18 GHZ FREQUENCY COUNTER............................$795.00
-ENI MOD 301E, 28kHz-110MHz @ 50dB GAIN......................$775.00
-ENI MOD 466, 150 kHz-25MHz @ 40dB GAIN......................$875.00
-GOULD 22B CHART RECORDER.......................................$990.00
-GOULD RS 3060 PROGRAMMABLE CHART RECORDER..............$1,995.00
-MOD 5600 SIG CONDITIONER & AMP (NEW) $6,500.00
-MODEL 464A WIDEBAND LABORATORY POWER AMP
HI-2NHSM @ 2.5kW POWER OUTPUT..................................$995.00
-RÖHDE & SCHWARZ SIG GENERATOR 400mA........................$590.00
-SOUND TECHNOLOGIES DIS MEAS SYSTEM........................$1,200.00
-CHSMA DYNAMIC BALANCING MACHINE MOD
CARTWHITH-3ED, SENSORS & MANUAL................................$4,500.00
-WILTRON 6647A-40 PROG, SWEEP GEN.
100-1800-18.11G11. 58,5101.00..................................$995.00

-ANDITSUS MS420K NETWORK SPEC-AN 101Hz, 30Mhz...........$3,800.00
-EATON NM-1727A EMI FIELD INT.METER............................$3,500.00
-FLUKE 5010A CALIBRATOR..........................................$3,800.00
-FLUKE 581A FREQUENCY SYNTHESIZER..............................$500.00
-VAVETEK 5002 RF SIG. GENERATOR..................................$995.00
-BOONTON 82A ASFM MOD-METER....................................$2,250.00
-BOONTON 105F SIG. GEN 150MHz.................................$1,295.00
-COLLINS 511-F2 PW SUPPLIED(USED)..............................$85.00
-COLLINS 6511-S RECEIVER..........................................$1,295.00
-R92 100W COMPANION XMT TO 502..............................$165.00
-TV15 100W COMPANION XMT TO 502..............................$85.00
-GMT 22 UHF POWER AMPLIFIER.....................................$240.00
-HARRIS RF280 HPF ACT TRANSCEIVER..............................$5,500.00
-LEXEL MOD 75 HIGH POWER ARGON LASER........................$1,500.00
-HP 1646A SIGNAL GENERATOR (512MHz)...........................$995.00

CIRCLE 326 ON FREE INFORMATION CARD
Miniature Robots!

Build a real walking robot just 14 cm long!

Muscle Wires Project Book & Deluxe Kit
Create direct linear action with Muscle Wires. They actually contract up to 5% when powered. For robots, planes, railroads – anything needing small, strong all-electric motion. Our new info packed 128-page Project Book has full plans for Boris the motorized robot and 14 other projects. Deluxe Kit includes one meter each of 50, 100 and 150 µm diameter Muscle Wires. Get moving today!

#3-168 $59.95

Electric Piston Deluxe 5-Pack
Incredible miniature cylinders lift 1 pound each! Just 10 cm long, they shorten by 23 mm with just 1 volt, 5 amps. Cycles up to 6 times per minute. Pack has 5 Electric Pistons, one high current battery and complete plans for four unique projects.

#3-137 $39.95

Robot Builder’s Bonanza, 99 Inexpensive Robotics Projects
A huge collection of practical, ready-to-use circuits & devices. Sections on parts, tools, methods, remote control, voices, grippers, navigation & more 330 pages, 280 illus. A great value for robot builders of all experience levels.

#3-114 $17.95

Space Wings II - new variable speed
Sleek silver wings flap silently, using only 5 cm of Muscle Wire. Perches on your PC, annoys cat! Flaps up to 50 times per minute. With circuit board, parts, detailed instructions. Requires soldering and 2 AA batteries. Makes an ideal introduction to electronics and Muscle Wires.

#3-001 $19.95

24-hour Voice Order Line - VISA MasterCard
800-374-5764
Request Free Muscle Wire Technical Brochure

Mondo-tronics
524 San Anselmo Ave. #107-74
San Anselmo, CA 94960

Questions: 415-455-9330
Fax: 415-455-9333
Internet: info@mondo.com

International Orders Welcome! First Class P&H: $11.00

BEST DEALER PRICING!

CABLE DIRECT
CONVERTERS * FILTERS
DESCRIPTORS
IMPROVE YOUR IMAGE WITH VIDEO STABILIZERS

100% MONEY BACK GUARANTEE!

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

SURVEILLANCE

FM TRANSMITTERS MINI (KITS)
- 3-VOLT FM XMITR, up to 300 ft. outdoors
- PHONE XMITR, range to 500 ft., uses phone-line power
- Sound-Activated XMITR, range to 50 ft.
- 2-STATE XMITR,陴able powerful
All above require simple soldering when powered!

TELE FM WIRELESS MONITORING SYSTEM
(Kit) $90.00*

TELE CALL FORWARDER. Transfers incoming calls $90.00*

TELE ID. Registes registers incoming number. $99.00*

TELE 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.
183 Vaquero Dr., Boulder, CO 80303
Tel: (303) 499-5405, Fax: (303) 494-4924
Mon.–Fri. 8 a.m. – 5 p.m. Mtn. Time

CIRCLE 315 ON FREE INFORMATION CARD

PROGRAMMERS

1349 DATA I/O CHIPLABS 4800
799 DATA I/O CHIPLABS 3200
579 EETOOLS ALLMAX
249 XELTEK SUPERPRO (R)
599 LOGICAL DEVICES 3000
599 ADVANTAGE PC-UPROG
269 SUNSHINE UNIVERSAL
448 TUP-300 ILIO SYSTEMS
449 JDR MCT-EMU
539 TUP-400ILIO
429 NEEDHAMS EMP-20
679 NEEDHAMS SA-20
139 EETOOLS 1 GANG
199 EETOOLS 4 GANG
49 SUNSHINE 1 GANG
99 SUNSHINE 4 GANG
169 SUNSHINE 8 GANG
349 SUNSHINE 16 GANG

GENERAL DEVICE INSTRUMENTS
(408) 241-7376 Fax 241-6375 BBS 983-1234

Surface Mount Chip Component Prototyping Kits—Only $49.95

CO-1 Capacitor Kit contains 500 pieces, 8 ea. of every 10% value from 1µF up to 33µF. CR-1 Resistor Kit contains 1540 pieces; 536 ea. of every 5% value from 10µ to 10MΩ.
Sizes are 0603 and 1206. Each kit is ONLY $49.95 and available for immediate One Day Delivery!

Order toll-free phone, FAX, or mail. We accept VISA, M/C, COD, or Pre-paid orders. Company ROI’s accepted with approved credit. Call for free detailed brochure.

COMMUNICATION SPECIALISTS, INC.
426 West Taft Ave. — Orange, CA 92865-4926
Local (714) 998-3021 • FAX (714) 974-3420
Entire USA 1-800-854-0547

FREE Catalogue. Please send complete order to:
COMMUNICATION SPECIALISTS, INC.
426 West Taft Ave. — Orange, CA 92865-4926
Local (714) 998-3021 • FAX (714) 974-3420

World's Smallest PC III
OEM (1K) Price
$386 SBC $83

Includes:
- 5-SER, 3 PAR
- 32K RAM
- PC BUS
- LCD/RGB PORT
- BATTERY, RTC
- CMOS, NVRAM
- USE TURBO C, BASIC, ASM

FREE KIT $295

OEM EVAL*

8088 SBC $27.95
FLASH/ROM DISK $21.75
UNIV PROGRAMM $27.95
PC WATCHDOG $27.95

*EVAL KITS INCLUDE: MANUAL, BRACKET, DISK, 5 YR LIMITED WARRANTY FREE SHIPPING

MVS BOX 850
MERRIMACK, NH
(508) 792 9507

www.americanradiohistory.com
KELVIN ELECTRONICS

PHONE: 1-516-756-1750
FAX: 1-516-758-1763
10 Hub Dr, Melville, NY 11747

100-LE
AC/DC Voltages
Cont. Tester-Buzzer
3-1/2 Digit LCD
Low Battery
Indicator
Battery Test
#990087
$19.95

150-LE
Transistor
Battery Test
DC Current
10 Amp
#990122
$29.95

200-LE
Freq. Counter
up to 20MHz
Capacitance
from 1pF to 20uF
Transistor
AC/DC Current
10 Amp
#990123
$49.95

400-LE
Inductance
resolution of 1H
Freq. Counter
up to 20MHz
Cap. from
1pF to 200uF
AC/DC Current
Transistor
Duty %
20 Amp
#990124
$79.95

STANDARD FEATURES:
- AC/DC Voltages
- DC Current
- Resistance
- Continuity Tester Buzzer
- Diode Test
- 10M ohm Input Imp.
- Accuracy +/- 0.5% RDG
- Protective Meter Cases for 100-300LE...
- Protective Meter Case for 400LE...

THE ULTIMATE METER

Popular Electronics (reviewed 5/93)
"Not only does the Kelvin 94 boast a lot of features...the features go the extra distance."
"If we had to run into a burning building to do some emergency trouble-shooting and could carry only one piece of equipment, the Kelvin 94 would be it!"

12 INSTRUMENTS IN ONE!
DC Voltmeter, AC Voltmeter, Ohmmeter, AC Current, DC Current, Diode Tester, Audible Cont. Tester, dBm, Freq. Counter, Capac. Meter, Inductance Meter, Logic Probe
#990111
$199.95

2MHz Sweep Function Generator
- Output Frequency of 0.02Hz to 2MHz on 7 ranges
- Output: sine, triangle, square, pulse, ramp or slewed sine wave
- 4 digit frequency counter
- With sync output (TTL), VCF, DC offset, variable symmetry
- Square wave rise time: 100ns or less
#720129
$299.95

Regulated DC Power Supply
- 0-30V, CV; 0 to 3A, CC
- 2 Separator LED displays (green for voltage, red for current)
- Constant voltage & constant current operation
- Fully isolated outputs allow series or parallel operation
- Includes (1) set of test leads & operation manual
- Overload protected
- 2-Yr. warranty
#690038
$225

20MHz "Afford-A-Scope"
- 2 Channels
- Built-in component tester for resistors, capacitors, and diodes
- 6" CRT with internal graticule
- TV trigger
- CH2 Invert
- 2-Axis input
- Includes 2 probes
- 2-Yr. warranty
#720085
$385

KELVIN 940(10)(mCOMIA
KELVIN 200LE
Freq. Counter
up to 20MHz
Capacitance
from 1pF to 20uF
Transistor
AC/DC Current
10Amp
#990122
$299.5

Protek
MODEL B-803

Protek
MODEL P-3003

CIRCLE 249 ON FREE INFORMATION CARD
www.americanradiohistory.com
SIREN

Simply apply 12 Volts to this little baby, then you better hold you ears. Very loud! Great for car and instru

NEW PRICE $5.95

TOA-S-24

$7.95

Power Center Basic Surge Protection

Six lighted rocker switches. Five 120 VAC sockets individually controlled from the front panel

15 amp circuit breaker. Master power on/off switch. Fully shielded metal case. 5.5" foot cord with molded plug.

Designed to be placed under table. Brand New! $19.95

LET ME STATE MY CASE

First of all, the case has an outside pocket, complete with velcro flap. The soft padded inside can be used to store even a king's ransom. There is a large pocket on one side, and on the other, there is a perfect place to keep business cards or computer instructions. They can be plainly seen through the fish net holder. The zipper keeps the contents secure. The case comes with a simulated leather handle. The case measures 12"x8"x1-1/2". The case was originally designed for a notebook computer. It even has the name of a famous computer manufacturer on the front. Use it to put your computer in, or as a "spiffy tote". Originally cost in excess of $50.00.

A real bargain............. $8.95 or ............ 2/$15.00

CD ROM CABLES

Very hard to find--Universal CD rom audio cable. Soundblaster card to Panasonic. Sony, and Mitsumi CD rom drives. $4.95

Another hard to find item--Universal data cable for hard drive and CD rom: 2-40 pin IDC connectors 1-34 pin IDC. 18" $2.49

BACK-UP BATTERY

Everyone knows lithium batteries last longer than alkaline! Well don't they? 3.6 volt lithium battery, by Maxell, with connector. Great price. $2.50 or 2/$4.00

TERMS: (Unless specified elsewhere) Add $3.25 postage, we pay balance on Orders Under $5 lbs. Orders over $50.00 add .50 for insurance. No C.O.D. Texas Residents add 8 1/4% Tax. 90 Day Money Back Guarantee on all items. All items subject to order sale. Prices subject to change without notice. Foreign Orders U.S. Funds Only. We cannot ship to Mexico or Puerto Rico. Canada, add $7.50 minimum shipping and handling. Countries other than Canada, add $15.00 minimum shipping and handling.

Call us and place your order today!! 1-800-276-2206

Dashboard"
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.

4000 KIT $79.95
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 Pak $44.95
The 4000A Enclosure Pak provides the hobbyist, a custom enclosure, AC
adaptor and finish accessories to give your kit the professional look.

Anyone implying theft of cable service will be denied assistance.

BLACK & WHITE VIDEO CAMERA BOARDS
1-1/4" x 1-1/4" SQUARE
1/3" CCD PICKUP
.4 LUX SENSITIVITY
8-14 VDC POWER REQUIRED
STANDARD NTSC COMPOSITE
VIDEO OUTPUT - 1 Vpp

PRICING

CME-100S STANDARD LENS CAMERA $ 125
CME-100P PINHOLE LENS CAMERA $ 145
CME-100C "C" MOUNT CAMERA $ 165
CME-200CP 1/3" COLOR CAMERA BOARD $ 275

CREATIVE MICRO ELECTRONICS, Inc.
P.O. BOX 4477 ENGLEWOOD, CO 80155-4477
PHONE: (303) 771-1295 (Out of Colorado Only)

FREE
catalog and construction plans for any of these kits (limit two)
Call 513-752-0279

2.4 GHZ - 5 CHANNEL
COMPLETE VIDEO/AUDIO
TRANSMITTER/RECEIVER
SYSTEM
500' RANGE with RUBBER DUCKY
ANTENNAS
3,000 RANGE with OPTIONAL
3' DISH ANTENNA

COMPACT SIZE
OPERATES ON 10 - 14 VDC
SYSTEM PRICE $ 1,295.00

CALL OR WRITE FOR FREE CATALOG

Weeder Technologies
P.O. Box 421, Batavia, OH 45103

Pro-Kit

Educational Kits for the Serious Hobbyist

Educational Kits for the Serious Hobbyist

 caller Block
Connects between your telephone
and its wall jack, and prevents
the phone from ringing unless the
calling party is one which you've
entered into memory using your
touch-tone phone. Your answering
machine can handle all other calls.
Change between two separate
directories of callers with a simple
flip of a switch. $46.00

Telephone Caller ID
Connects to telephone wall jack. Shows the telephone number of
the calling party along with the time
day the call was received, on a 16x1
character LCD display. Stores the info from the last five
calls in memory. Complete stand
alone, no computer interface needed. $52.50

Telephone Call Restrictor
Connects to telephone wall jack. Disables all phones on the line if attempting to
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. $35.00

Electronic Message Module
Use a set of four pushbutton switches to
write and store your own personal message
in a 6 pin non-volatile EEPROM. which can
then be printed across a 16x1 LCD display.
Message can be up to 240 characters long.
EEPROM can be removed from socket and
still retain message. Re-program over and
over with new messages. $44.50

Vocal Filter
An audio device which can be
used with a home component
stereo system, to filter out the
primary sound track from
standard stereo recordings (CD,
tape, record or FM), leaving the
background music to sing with
along. Produces your own karaoke
songs. $40.00

DTMF Decoder/Logger
Keep track of all numbers dialed
from any telephone on your line.
Connects to your telephone wall
jack. Decodes all 16 touch-tones
and displays them on a LCD
display. Holds the last 240 digits
in a nonvolatile memory. Use the "shift
back" and "shift forward" buttons to
scroll through and view all numbers
in memory. $54.50
Professional Electronic Engineering Software

Best Bargain in the USA
Any single program $24.95

PROGRAMS

AC/DC CKT ANALYSIS
Filter and analyze circuits up to 16 nodes, 165 elements. Models for active devices. CAk, Plot & print output. Transient, AC, DC Voltage & Current. CAk, DC current, voltage & power. Plot: Line, Log, Semi, Polar, etc. 

TRANSMISSION CKT ANALYSIS
Program computes input transients for active circuits up to 33 nodes, 225 elements. Models for active devices. CAk, plot & print output. Transient, AC, DC Voltage & Current. CAk, DC current, voltage & power. MORPHA

LINEAR TRANSIENT CKT ANALYSIS
Program computes input transients for active circuits up to 70 nodes, 225 elements. Models for active devices. CAk, plot & print output. Transient, AC, DC Voltage & Current. CAk, DC current, voltage & power. Plot: Line, Log, Semi, Polar, etc. 

ACTIVE CHANNEL DESIGN
Design a NZ channel using all types of components. 

TRANSISTOR ANALYSIS

POWER SUPPLY DESIGN
Design and analyze switching and linear supplies. Design AC/DC and DC/DC Converters. Design Power Transformers, with up to 50 windings. Design Power Inductors and Current Transformers. Switches include Buck, Boost, Buck-Boost, Flyback. Perform Stability Analysis of Switchers. Design LC Filters. Includes Mag Core Toolkit. CAk, plot, Power, DC and Voltage. 

INTEGRATED NK/DC CKTS WITH SCHEMATIC DRAW $29.99

INTEGRATED CNC CKTS WITH SCHEMATIC DRAW $29.99

VOM & AC AMMETER SET
3-FLIPPEL MODEL 100 with Model 310 hand-size voltmeter. Measure 0-1200V, 0-300mA, 0-12000 0AC, and 0-20-200K. NEW, Model 32200000. 

HANDS-FREE HEADSET
U'NCOM 7486 MHz FM Radio Headset for use in high noise areas. Has impact mic and ear cushions with EPA noise-reduction rating of 23 D_VECTOR 838. Also Volume and Squelch. Visco adjustable head band and mic straps, 6 antenna, and fiberglass case. Requires two 9V batteries, Model 7800, NEW $69.95

50 OHM ROLLER INDUCER
38-turns 3/8" edge-wound silvered ribbon forms 8"x4" dia. coil, fiberglass end plates. /01 kW antenna tunner, 0/ 7.3x13x5.2, 8 lbs. sh. #L1/CUI38, USED $65.00

18 UH ROLLER INDUCER, 18-turns #16 silver-tinted wire forms 2" dia. coil. 3.5x4x5.2x3, 3 lbs. #021-7392, NEW $28.00

50 WATT DUMMY LOAD
DA-437 DUMMY LOAD, rated 50 watts continuous into 50 ohms. VSWR 1.1:1 max; 220 to 1000 MHz. "C" RF cone. 3x6.6x3, 4 lbs. USED $27.50

TEST EQUIPMENT
Limited quantities, "used-reparable" condition:
HP-1411/855A/S155A SPECTRUM ANALYZER, 10 MHz to 18 GHz $1995.00
HP-855A RF SECTION 7411, 20 kHz-300 kHz $175.00
HP-8562B 1-2-3 RF GENERATOR, 20 Hz-1024 MHz $1995.00
HP-8560C RF GENERATOR 86602A, 1-1300 MHz & 86633 phase-lock plug-ins $2995.00
HWA. LEE STODDARD WNM7/8 STEREO MICROPH. $995.00
TEKTRONIX 49P PROGRAMMABLE SPECTRUM ANALYZER, 10 kHz-21 GHz direct input; 10 kHz-325 GHz freq-counter $14,995.00
TEKTRONIX 7613/713 SPECTRUM ANALYZER, 1 KHz to 1.8 GHz, storage main-frame, ref-level module $3800.00

Prices F.O.B. Lima, O. • VISAl, MASTERCARD, DISCOVER
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

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!
WinSpice Simulator & WinScope Data Analyzer Modules

**SPICE LIBRARY:** MOSFET, GaAsFET, BJT, FET, Diode, OpAmps, Comparators, 555 Timer, Resistors, Capacitors, Inductors, Transmission Lines, Controlled, Independent, Dependent, Arbitrary Sources, Pulse, Sin. Piece Wise Linear, and FM Sources, Current and Voltage Controlled Switches. All models Expandable and User Modifiable. Includes MACRO MODELS of Your Favorite Manufacturer Supplied Parts.

**ANALYSIS TYPES:** AC, DC, TRANSIENT, POLE-ZERO, NOISE, SENSITIVITY, FOURIER TRANSFER FUNCTION, AND OPERATING POINT ANALYSIS.

**DATA ANALYZER:** Graphs Simulation Results using Multiple Plot Windows and Waveforms. Plots Linear, Logarithmic, Polar, Smith Chart, BOGE Type Plots + More. ZOOM in and out of Plot Waveforms. Plots Complex Math Expressions Using Plot Variables As Arguments. Calculates Derivatives, Log, Trig functions, Define Macros of Complex Math Formulas.

Price $79.99
reg $179.99
S&H $3.00 VIA/MC

**INLAND LOGIX INC.**
P.O. Box 43013
Waroga, Texas 76488-9213 USA
Phone 817-428-0070 Fax 817-428-0006

**CIRCLE 299 ON FREE INFORMATION CARD**

---

**MIRACLES NEVER CEASE**

**MICRO TX2000 KIT**

-$59.95

**VOICE SCRAMBLER/DESCRAMBLER KIT**

-$69.95

2 FOR $129.95

**MICRO 1.2 VOICE RECORDER**

-$69.95

**MICRO 28 VOICE RECORDER**

-$109.95

**VFC400 VHF/UHF FM VOICE TRANSMITTER KIT**

**ONLY**

$99.95

**MICRO-4 MULTI-MESSAGE VOICE RECORDER**

**ONLY**

$99.95

**COMING SOON**

**MICRO-3**

PLAYBACK UP TO 4.5 MINUTES
UP TO 1000 MESSAGES (NO ODORS)
MESSAGE CUEING (FAST FORWARD)

---

**AGRELIO ENGINEERING**

1145 CATALYN STREET
SCHENECTADY, NY 12303

**TECH. FAX:** 518-381-1058

**TECH. SUPPORT:** 518-381-1057

---

**Order by phone or mail in U.S.A. Add $5 for S&H. C.O.D. Charges Apply. N.Y.S. Residents Add Sales Tax.**

---

**Powerful Integrated Digital and Analog (Berkeley Compatible Spice)**

**Circuit Design and Simulation Software for Microsoft Windows (network compatible)**

**Best Value in Town!!** Includes 4 Integrated Modules: LogicDesigner + WinSpice + WinScope + Symbol Editor

**For Students, Technicians and Engineers!!**

Simply connect your circuit on the screen, enter simulation options, then kick back and watch it work!

Comes with 2 spice libraries plus 5 more libraries of Active Digital Devices CMOS 74xx, 7400x, ALUs, counters, MUX, FFs etc. Plus a Passive symbol library of Microprocessors and more. Use the Symbol Library Editor to design your own symbols and symbols to represent sub-circuits. True Bus & Bus pins can be assigned Unique Names. Parts Billing List, Legends, Nested Subcircuits for Hierarchical Top Down or Bottom Up Design. Checks Fan Out Violation and Electronic Rules. Device Unit Numbers/Chip Pins automatically added as per Data Books, Connectors, Spice Nets list, Generation. Continuous ZOOM In/Out. Cut/Copy/Paste. Multiple Rotatable Fonts. Rotate Symbol libraries. Multipage Zoomed in/out Printouts to any Windows Printer. ON LINE HELP.

LogicDesigner Digital Simulation/Schematic Capture Module

Interactive Digital Simulation and Schematic Capture. Single Step Mode, Variable Speed Simulation. Programmable Digital Delays, Multi Waveform Scrolling Timing Diagram Memorylocizes up to 30000 ticks Worth of Timing Data. Truth Table Generation. Binary to 32 Segment Displays, Hex Keyboards, Programmable Clock Sources, Logic Probes. Built in Logic Analyzer can be set up to generate Edge or Level Sensitive Breakpoints, or when Signals are Equal To, Greater Than, or Less Than a Certain Value or any AND/OR Combination. Sequential Breakpoints help Track Down and Debug Circuit Race Conditions. Gatters, Setup and Hold Violation and other Circuit Design Errors. Simulates, To State Open Collector & Don't Care Logic, RAM/ROM, One Shot, Carry Look Ahead. Shift reg, Pull Up/Down Resistors.
SPECTRUM ANALYZER SCOPE ADAPTER

TURN ANY SCOPE INTO A FULL FUNCTION SPECTRUM ANALYZER

2 MHz TO > 500MHz
>70 dB ON SCREEN
<-100 dB SENSITIVITY
WORKS ON ANY SCOPE

MADE IN THE USA
$399.95
SUGGESTED LIST PRICE $599.95
ONE YEAR WARRANTY

"SAVE $200"
INTRODUCTORY OFFER
CALL TODAY
FOR INFORMATION
OR TO ORDER
800-566-1818

8" x 3" x 10" W - H - D
3 LB. 110/220 VAC 50/60 HZ

QUALITY - PERFORMANCE - FACTORY ASSEMBLED

A MUST FOR EVERY SHOP:
The SA500 Spectrum Analyzer Scope Adapter works with any Oscilloscope... Just one connection to the Vertical and Trigger inputs and your scope becomes a full function Spectrum Analyzer, Tune up H.T.'s, Filters. Duplexers, Cavities, Mixers and Receivers..Check RF Cables, RF Amps, RF Connectors, Antenna Systems.. Evaluate all RF based Systems... All this in one simple to use low cost instrument the SA500 Scope Adapter will compliment any Ham Shack, Radio Service Shop, RF-EMI Test Lab.

EASY TO USE AND HOOK UP:
The SA500 Analyzer Scope Adapter provides unsurpassed performance, with just half a dozen easy to operate controls and only two simple connections to your scope...you will be on line in no time, even if you've never used a Spectrum Analyzer before.

HIGH PERFORMANCE - LOW COST:
Features only found on Analyzers costing thousands of dollars. Now, you can have all these features when combined with any scope without spending a small fortune and you don't have to settle for a tired old boat anchor from the local swap meet, but now you can get full use from your scope when combined with an SA500 Spectrum Analyzer Scope Adapter is not a Kit but 100% factory assembled, including a one full year warranty and the SA500 is MADE IN THE USA. If you have been waiting for a low cost high performance Spectrum Analyzer at an affordable price. Wait no longer today and take ADVANTAGE of the introductory offer. You can count on ADVANTAGE FOR THE BEST PRICE.

"NEW" FROM ADVANTAGE
1000 MHZ RF SIGNAL GENERATOR/SWEEPER
ONLY $799.00 MODEL FC1300
CALL TODAY FOR DETAILS 800-566-1818

CIRCLE 145 ON FREE INFORMATION CARD
SETING THE STANDARD SA1300B SPECTRUM ANALYZER

6" x 11" x 16" (H x W x D) (only 16 LB)

MADE IN THE USA 1-1300 MHz In One Sweep $1995.00 1 YR. WARRANTY

COUNTER SURVEILLANCE, CATV, AM-FM-SW, TWO WAY-HAM RADIO, FCC TESTING, SATELLITE

SPECTRUM ANALYZER /DISPLAY MONITOR $995

The SA500A easily attaches to any receiver IF output jack. Providing a panoramic signal display of your scanner or communication receiver. The SA500A is a Full Function Spectrum Analyzer with +/− 5KHz Narrow Band Filter, Center Freq. Display, 50 MHz Marker. SA500A

The first affordable Professional Spectrum Monitor/Analyzer for all serious Ham Radio and Radio Monitoring Operators. With Opt. 1,3,5,6

CHOOSE FROM 2 FULL FUNCTION ANALYZERS Quality & Performance with 80dB on Screen, -110 dBm Sensitivity, Center Freq. Display, +/− 5KHz Narrow Band Filter 50 MHz Marker.

DISPERSION ZOOM, Baseline Clipper, Adjustable Sweep Speed, Video Filter, and 40dB Input Attenuation. SAI800B 1-1300MHz

SA1800B 1-1300 & 850-1850MHz $2395 With Opt. 1,3,5,6

1.3GHz FREQUENCY COUNTER .001ppm $499.00

ITC FC1300: the first truly Accurate low cost Frequency Counter. Accuracy is the #1 Frequency Counter Requirement. The $200 - $800 counters being advertised the past few years are but toys when it comes to accuracy. These guess-so-matic units are off 5 to 10 PPM over temperature & time (That's +/− 6,000 -13,000 Hz at 1.3 GHz) The FC1300 is accurate to within +/−13 Hz at 1.3 GHz 0-40 degrees C.

All New ITC Low Cost High Performance Oscilloscopes

25 MHz Scope Model ST3304 only $349.95
1 mV Vertical Sensitivity
X-Y Modes Z x12 (Frequency resolution)
6" Bright 2KV CRT <1ns Rise Time
25 MHz Scope / Tester Model ST3324 only $469.95
Dual Component Comparator/Tester
Triple DC Supplies +5/A, +12/2A

40MHz Delayed Sweep Scope Model ST3315 only $569.95
Delayed Sweep 1m-1 Sec <8ns Rise Time ITC Oscilloscopes fill the bill without emptying the pocket book. ITC Scopes are a cut above all other low cost scopes on the market today. You can depend on our ISO9002 certified factory to provide performance and dependability, backed by a 2 year warranty on parts labor.

ADVANTAGE INSTRUMENTS CORP. MC-VISA - DISCOVER - COD - CHECK call 800-566-1818
3579 Hwy. 50 East Carson City, Nevada 89701 702-885-0234 FAX 702-885-7600
PRICES & SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION. F.O.B. CARSON CITY NV. NV. RESIDENTS ADD SALES TAX.
CIRCLE 145 ON FREE INFORMATION CARD

July 1995, Electronics Now
Save on Cable rental fees!

**CABLE TV DESCRAMBLERS**
WE’LL BEAT ANY PRICE

JERROLD-TOCOM-ZENITH-HAMLIN
OAK-PIONEER-SCIENTIFIC ATLANTA

- **30 DAY MONEY BACK GUARANTEE**
- **24 HOUR SHIPMENTS!**
- QTY DISCOUNTS!
- MASTER CARD • AMEX • VISA • C.O.D.

1-800-284-8432

Have make and model number of equipment used in your area ready
All Shipping & Handling Fees at Customer's Expense.

**CABLE WAREHOUSE**
10117 West Oakland Park Blvd., Suite 315, Sunrise, FL 33351
(NO FLORIDA SALES)
Anyone implying theft of service will be denied assistance.

---

**LASERS**

Helium-Neon Laser

Why mess with soldering a kit together and taking a risk of it working when you can have a complete functional laser for less. High brightness red laser visible for up to a mile. Use in many projects such as light shows, holography, and laser head spinning. Output: 1.0-1.8mW; Class IIIa Size: 6.25" x 1.4" x 3,25". One year warranty!

- 12Vdc operation (Cat #: HN92-12) $49.00
- 120VAC operation includes adapter $59.00

Quantity discounts available.

Midwest Laser Products
FAX 714 847 1045

---

**NEW EASY PC**

SCHEMATIC and PCB CAD

**ONLY $195**

Includes
- 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

**Ohio Automation Award**

7840 ANGEL RIDGE ROAD
ATHENS OHIO 45701
(614) 592 1810

**FREE CATALOG**
Call, write, or poll fax.

---

**LIVE TV VIDEO**

Now in 1995! The MiniLink II 2.4 GHz video system. 5 (five) channels available and audio is included. Each channel is switch selectable right on the unit. no soldering or reworking, and it is fully assembled No kit to lose parts and not a cheap modified UHF TV tuner. Transmit live video to any *TV. New advanced technology now allows micro TV transmitter to be carried anywhere. This is a FCC certified system and NO license is required. Lowest cost Highest Quality. Satisfaction Guaranteed International Orders Welcome

**MICRO VIDEO PRODUCTS**

800 473-0538 FAX 714 847-4486
16201 OSBORNE ST WESTMINSTER CA 92683

---

**U.S. SAVINGS BONDS**

A public service of this publication

---

The more you give,
the more you receive.

Giving U.S. Savings Bonds passes an important lesson on to the future generation. Bonds can teach our children how to save, how interest grows and how a small investment can help make their dreams come true.

Buying U.S. Savings Bonds contributes to a solid and secure America for generations to come. What a great way for you to say, "I believe in your future!"

Buy Bonds at half their face value through your local bank, and share the tradition of U.S. Savings Bonds. They’re the gift that gives back more than you’ve given.

---

**Moltron**

310 Garfield St Suite 4 New Low Price!
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 Power Adapter ($10). Visa, MasterCard, American Express, Discover and Government Purchase Orders accepted. Minimum Government Purchase Order: $9. COD Cash or Money Order only. S/H: $6 USA/Canada; $15 Foreign COD: $5.

Info: (503) 697-2118
Top orders: (800) 338-9058 Fax: (503) 687-2492
Or contact motron.info@emerald.com for a catalog via the internet.
Only $129.95 for The Pocket Programmer

The portable programmer that uses the printer port of your PC instead of a internal card. The software has 24 functions and programs (E)EPROM, Flash & RAM 27/28(C)XXX from 16K - 8 Megabit with a 32 pin socket. Adapters available for 874X, 875X Mcu's, 40-Pin & Serial Eproms and Eprom Emulation to 32K X 8.

Mac EZ Programmer

The Only Eprom programmer made for Macintosh. The software has 15 functions including File Editing with a 32-Pin socket supports (E)EPROM, 127/28(C)XXX and Dallas Ram from 16K - 4Megabit. Only $299.95

Intronics, Inc.
Box 13723
Edwardsville, KS 66113
Tel. (913) 422-2094 Add $4.50 COD
Fax (913) 441-1623 Add $4.00 Shipping
Visa / Master Charge

ROBOTICS & ARTIFICIAL INTELLIGENCE

Explore the latest technology in home robotics and artificial intelligence, without investing a fortune.

MINI MAX ROBOT KIT .............. $129.95
Basic unit includes dual motor drive, motor driver kit and projects notes. Base is 11" x 11".

MAX and CPU BOARD .............. $299.95
Program your personal robot with this CPU BOARD. Use your PC and upload programs to your robot. Includes a 'C' libraries and MINI MAX 'C' libraries.

NEURAL LAB w/basic link .......... $39.95
Create your own problem solving neural networks. Used in stock market prediction, speech recognition, vision systems and many other applications. Includes many good examples, a great way to learn this exciting technology. Includes BASIC libraries, add neural networks to your BASIC programs.

'C' LINK .......................... $39.95
Actual 'C' libraries and source code used to create NEURAL LAB. Add neural networks to your 'C' programs. Comes with many examples, including speech recognition, pattern recognition, financial market prediction, control systems and many more working examples. (NEEDS NEURAL LAB)

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.

FREE CATALOG

SHOW TIME CABLE
Your Cable Connection To The Stars!
Order your FREE catalog today!
1-800-643-4258

STARGATE SST
- Converters & Descramblers
- All Makes & Models
- Quantity Discounts
- 30-day Money Back Guarantee
- Best Warranties

Show Time Cable
643 N 98th St STE 260
Omaha, NE 68114
COD • MasterCard • Visa
Amex • Discover
Communications Systems Laboratories 1-800-529-8483

Hobbyists—Embedded Control Systems for home automation. 800-529-12 Cross Point Blvd Video/Steer. Audio. electronic patch panel $695.00. TL-100 Color Organ Kit $105.00. T-100 OTMF Gen/Detector $225.00. Cable TV. Use our product line to automate your operations on a modest budget. YCB-21 Commercial insert/ Billing logger- $1595.00. VCB-27 Channel Controller-4VCs. 2 Laser Disc. 2 external sources. Two independent outputs $2785.00. MAC-11 Wideband Video/Steer Audio Switch/ Crosspoint Switch. Computer Controllable $895.00. Call Toll Free for Info/Catalog or to Order. MasterCard/Visa. Fax 1-800-625-7035. 1 yr warranty on all products.

Surveillance & Recording Devices

MicroDot

Concentration Transmitter/Kit

MC-5P

Microphone Video Camera

Hidden in a Small Speaker

Extra long reception range will add up to 5 miles.

For easy assembly. Small "tall" as a dime.

$39.95

High quality video camera can be powered by 9v battery and connected directly to VCR. Goes completely unnoticeable.

THW-12

12 Hour Telephone Recorder

Visa/MC (214) 255-7490

Seymour Radio Inc. Box 166555 - SG Irving, TX 75065

Call Toll Free for Info/Catalog or to Order. MasterCard/Visa. Fax 1-800-625-7035. 1 yr warranty on all products.

Cable TV Descramblers

Converters/Filters/Accessories

Free Catalog

30 day Free Trial - NO RISK

Unbeatable wholesale prices!

Aflalernative extended warranty available. Warranty on all products.

Call the cable professionals!

Credit Cards Welcome

1-800-379-3976

Prices starting as low as $99!

Prototype it...... FAST!

CABLE TV

ALL NAME BRANDS

DESCRAMBLERS CONVERTERS

COMBOS. CALL NOW

WE'LL BEAT THE COMPETITION.

UNIVERSAL SALES 800-647-2371

CABLE TV EQUIPMENT

We carry a complete line of all major brands including test chips and all accessories.

BELOW WHOLESALE PRICES + QUALITY DISCOUNTS

30 DAY MONEY BACK GUAR. + 1 YR. WARRANTY

3,000 CUSTOMER SATISFACTION

C & C ELECTRONICS

CALL NOW 1-800-995-1749

Immediate Delivery from Giant Stock! Sorry no Florida Sales.

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

Interface to your PC Keyboard Input

Our KE-18 Keyboard Encoder Converts conventional keyboards to PC compatible keyboard signals.

Replace your PC's keyboard or works in addition to it.

Sockets: 9x9 matrix or 18 inputs.

PIC, XT, PS/2 & Commodores.

Compact 2.5" x 3.8" Size

Only $59.95 & $59.95

Hoptost Electronics 2 Green Lantern Blvd Endicott, NY 13708 (607) 786-7523

Cable TV Test Orders only Aids Information (310) 902-0841

Test chips for JERROLD, TCOM, ZENTH SA. & more. Pays cable boxes in full service mode. Easy installation. Zenther only $39.95. Most others under $30 ea. FAX (310) 902-0841

Quantity pricing available. No C or M. Not for use in cable on owned signals. For use on a test cable only.

Bugged??

AUTHORIZATION is unknowingly installed. Electronic Devices with enabling capabilities can be monitored by your telephone and more communications RIGHT NOW! Are you sure you’re safe? FREE CATALOG, CALL NOW. It includes free Bonus details on fantastic opportunities now open in Counter-Surveillance field. Exciting, immensely interesting and EXTREMELY profitable job to $2500 NF full-time income. Call Now! 1-800-742-5000

Invest a stamp

Save a bundle

For the price of a stamp, you can get the latest edition of the federal government’s free Consumer Information Catalog. It lists more than 200 free or low-cost publications on federal benefits, jobs, health, housing, education, cars, and more, to help you save money, make money, and spend it a little more wisely.

So stamp out ignorance with our latest free Catalog. Send your name and address to:

Consumer Information Center Department SB
Pueblo, Colorado 81009
Why Design Circuits the Hard Way?

B² SPICE v.1.1 and B² LOGIC v.3.0 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
2000 Hogback Road • Suite 2
Ann Arbor • Michigan • 48105

Phone 313. 971. 4227
Fax 313. 971. 3632
E-Mail info@beigebag.com

B² Logic v.1.1
$199
• EDIF File Format Output
• Enhanced PLD Simulation Capture
• Subcircuit Probing
• Over 100 components available

B² Logic v.3.0
$199
• EDIF File Format Output
• Enhanced PLD Simulation Capture
• Subcircuit Probing
• Over 100 components available

Electronic Design Package
$269
• Includes B² SPICE and B² LOGIC
• Demo Disks Available
• University & Student Prices Available
• Site Licenses Available
• Dealer Inquiries Welcome
• Visa/Master Card Accepted
PLANS-KITS-SCHEMATICS

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-F, Paradise, California 95967.

FM STEREO TRANSMITTER kit broadcasts any audio signal to FM stereo radios throughout your home. Uses unique BA1404 IC. Complete kit; PC board components — $24.00. Visa/MC. ELECTROMAN, Box 24474, New Orleans, LA 70184. (504) 482-3017.

CABLE TV DOCTOR Stop the Bulletin and ID signal in cable lines. Send $20.00 to R.R. Enterprise, Dept. EN, Box 3532, Easton, PA 18043.

CABLE TV INSTALLERS MANUAL. Single dual cable systems. Telephone poles, houses, apartments explained. Send $14.95 to Inteoke, PO Box 70172, Milwaukee, WI 53211.

CABLE-SAFE. Guarantee cable privacy. The one-way valve for your cable TV signal. Cable signals come in, but they can't go out! $29.95 + $5.00 for shipping & handling. Visa/MC. ELECTROMAN, Box 24474, New Orleans, LA 70184. (504) 482-3017.

DESCRIPTOR SCHEMATICS REVEALED. A powerful guide to descrambling schemes. $10.00. Visa/MC. 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! $129.95 + $5.00 S&H. Visa/MC. ELECTROMAN, Box 24474, New Orleans, LA 70184. (504) 482-3017.


TOP SECRET! Never released before. Cable companies, cellular phone companies, want to get you now! Learn how they do that! Protect yourself! Piracy, the laws. Better safe than sorry. $55.95. Randall, Box 2168 R, Van Nuys, CA 91404.

MICROCOMPUTERS IN THE HOME. Referenced in Popular Electronics, SEPTEMBER 1985. Includes in-depth reviews of popular models and accessories. Send $12.95 for a review of the various home computer packages available. Send $15.95 for a review of the various accessory packages available. Send $19.95 for a review of the various software packages available. MTL, POB 18043, New Orleans, LA 70184.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.

MICROCOMPUTER PROGRAMS. Send list for $5.00. 8001 Computer Shop, 2603 North 60th Street, Milwaukee, WI 53216.
CABLE CONVERTERS/DESCRAMBLERS

**SUPER BUYS**

**FULLY REFURBISHED UNITS**

TOCOM — JERROLD — SCIENTIFIC ATLANTA — ZENITH — PIONEER

"WE SERVICE MOST 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.

CABLE CONVERTERS/DESCRAMBLERS

Finally, a low cost way of getting into the monitor repair business. With the Checker 12 you can test and repair computer monitors with speed and accuracy. The "Checker 12" is an easy to operate, hand held, battery, or AC operated computer color 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), and 1024X768 non-interlaced, & 1024X768 Nl with sync on Green (48khz), you can easily checkout a monitor in all of its modes. With its single mode switch, you know exactly what type of monitor you are testing. You don't have to be a monitor expert to use the Checker 12. 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. No more 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. There is no easier way to test and evaluate monitors than with the Checker 12.

**Price:** $295.00 + $5.00 S&H.

Includes battery, AC adapter, Mac adapter and 120 day warranty.

We also have the Checker VI, a six port stand-alone VGA (640x480) test pattern generator, NO computer required. Just $249.95.

CMM

Computer & Monitor Maintenance
6649 Peachtree Ind., Blvd., Suite N-1 • Norcross, GA 30092
1-800-466-4411, 404-662-5633 (Voice), 404-840-8814 (Fax)

CIRCLE 334 ON FREE INFORMATION CARD

The ULTIMATE SCANNER

Bill Cheek published!

Simply the best scanner mod book ever written!

- Includes complete schematics, procedures, and parts list for computer interfacing.

- Exactly what you’ve wanted

250 pgs, large format, $29.95

EMERGENCY RADIO!

Scanning News As It Happens

"Excellent..." Barry Goldwater

"A winner..." 911 Magazine

Norm Schrein

214 pages, $14.95

SCANNNERS & Secret Frequencies

Henry Eisenson

320 pages, $19.95

"Must reading.

Electronics Now

"A giant undertaking

Monitoring Times

"You can’t miss! ASC

"The best" Norm Schrein

"A high point!" RCMA

TRAVELSCAN

Good Frequencies

Across America

Henry Eisenson

120 pages, $7.95

Handy pocket guide to scanning in every area of America... Top cities, plus state and federal agencies, speedtraps, recreation facilities, military, MORE!

Underground Database

More than 400 listings, 100 pages, large format, $23.75

SCARY!

Everything that's sort of legal, unless you actually USE it.

Television GRAY Market

Cable & satellite chips, descramblers, etc.

"Explores this shadowy fringe area in depth... good info.

PopComm

160 pages, $23.75

$4 s/h 1st book, then $2 each

CA residents add 7.75% tax

Order line 800-546-6707

All credit cards

INDEX Publishing Group, Inc.

3388 Governor Dr, Suite 273E

San Diego, CA 92122

July 1995, Electronics Now

157

www.americanradiohistory.com
Hobbyist’s Paperback Budget Books

Popular Electronic Circuits Books 1 and 2...$11.90. Contains a wide range of circuits which are accompanied by text giving a brief introduction, circuit description and special notes on construction and setting-up that may be necessary.

#223-50 Projects Using IC CA3130...$5.00. One of the most practical and useful operational amplifiers (opamps), the CA3130 integrated circuit chip is the heart of several easy-to-assemble projects covered in the book.

#212—Audio Amplifier Construction...$5.75. Practical designs are featured and include circuit diagram and description. Veroboard or printed-circuit board layout and construction notes. The text is divided into two parts. The first deals with many types of preamplifiers. The second covers power amplifiers from a simple battery type to a 100-watt DC-coupled amplifier using four MOSFETs in the output stage.

BP266—Electronic Modules and Systems for Beginners...$7.25. Shows the reader how to build a number of simple analog and digital circuit modules, all suitable for battery operation, and all based on only 1 or 2 transistors or ICs.

BP105 Aerial (Antenna) Projects...$5.50. In this book the author has considered practical antenna designs, including active, loop and ferrite antennas which perform well and are relatively simple and inexpensive to build. The complex theory and mathematics of antenna design have been avoided. Also included are construction details of a number of antenna accessories including a pre-selector, antenna rotor and filters.

PCP104—Electronics—Build and Learn...$9.95. Construction details are given to build a circuit demonstrator that will assist you in assembling such projects as the Electrophone, Goldophone, Melody Ranger, Cordmaker and many more.

PCP111—Electronic Test Equipment Handbook...$13.95. A concise introduction to dBASE. The most popular data-base program, dBASE, is difficult to master without help. This book helps you spend your time using dBase, not learning the manual. A simple guide that covers all the basics to dBase IV.

BP271—How to Expand, Modernize and Repair PCs and Computers...$7.75. All the practical information you are likely to need to upgrade your PC and compatible. Also contains useful information and illustrations to help you with repairs.

BP276—Shortwave Superhet Receiver Construction...$6.95. Provides construction details, including coil winding, of a number of advanced design receivers which should have performance levels at least equal to commercial sets of similar complexity.

BP127—30 Solderless Breadboard Projects—Book 1...$5.95. Each project is designed to be built on a "Varoboard" breadboard and is presented with a brief circuit description, circuit diagram, component layout and components list. Notes on construction and application are provided. Whichever possible, the components are common to several projects to keep project costs down.

Just What the Project Builder Is Looking For!

#160—Coil Design and Construction Manual...$5.95
#219—Solid State Novelty Projects...$4.95
#222—Solderless DIY Shortwave Receivers for Beginners...$5.50
#223—50 Projects Using IC CA3130...$5.00
#225—Practical Introduction to Digital ICs...$5.25
PCP111—Electronic Test Equipment Handbook...$13.95
BP106—Digital Clock Projects...$5.50
BP113—Binary Computing Projects...$5.50
BP114—the Pre-BASIC Book...$6.95
1596T—24 Silicon-Controlled Rectifier Projects...$9.95
BP58—50 Circuits Using 7400 Series ICs...$5.50
BP69—Electronic Games...$5.50
BP71—Electronic House Projects...$5.00
BP84—Digital IC Projects...$5.50
BP93—Electronic Timer Projects...$5.50
BP125—20 Simple Amateur Band Antennas...$5.50. Plans to build antennas that are simple and inexpensive to construct and perform well. From the simple dipole to beams, and even mini-rhombic types made from four TV mast and about 400 feet of wire. After the antenna discussion you will find a complete set of dimension tables that will help you "tune" an antenna on a particular frequency.

Electronic Technology Today Inc. P.O. Box 240, Massapequa, NY 11762-0240

SHIPPING CHARGES IN USA AND CANADA

<table>
<thead>
<tr>
<th>Shipping Address</th>
<th>Total Enclosed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td></td>
</tr>
<tr>
<td>Zip</td>
<td></td>
</tr>
<tr>
<td>PES</td>
<td>Allow 6-8 days for delivery</td>
</tr>
</tbody>
</table>

SORRY No orders accepted outside of USA & Canada

<table>
<thead>
<tr>
<th>Name</th>
<th>$0.01 to $2.00</th>
<th>$2.01 to $10.00</th>
<th>$10.01 to $20.00</th>
<th>$20.01 to $30.00</th>
<th>$30.01 to $40.00</th>
<th>$40.01 to $50.00</th>
<th>$50.01 and above</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$0.00</td>
<td>$2.00</td>
<td>$4.00</td>
<td>$5.00</td>
<td>$6.00</td>
<td>$7.00</td>
<td>$8.00</td>
</tr>
</tbody>
</table>

Total price of merchandise $ Shipping (see chart) $ Subtotal $ Sales Tax (NYS only) $ Total Enclosed $ All payments must be in U.S. funds!

Electronic Now, July 1995

www.americanradiohistory.com
### Western Test Systems

#### Quality • Service • Selection

**Phone:** 1-303-438-9662  
**Fax:** 1-303-438-9685

530 Compton St., Unit #C  
Broomfield, CO 80020

**EIP 926-921 Programmable**  
$4,000.00  
**Signal Gen., 1-GHz**

**HP 5625A Sweep Oscillator Frame**  
$550.00

**HPB 8206c 2 RF Plug-In, 10.2400 MHz atten.**  
$1,850.00

**HP 86260 RF Plug-in, 2.0-18.0 GHz.**  
$2,000.00  
**+10dBm**

**WAVETEK 1067 Sweep Gen.,**  
$550.00  
**1-MHz to 12-GHz**

**BOONTON 420B-14B Power Meter.**  
$475.00  
**1-MHz to 12-GHz**

**BOONTON 420B-2/3-S Power Meter.**  
$375.00

**HP 432A 4764A Power Meter, 0.01-MHz.**  
$375.00

**HP 432A/481A Power Meter.**  
$1,000.00  
**10-MHz to 500 MHz**

**HP 434A/542A Power Meter.**  
$1,000.00  
**1.0-MHz to 3.6 MHz**

**HP 434A/542A Power Meter.**  
$800.00  
**10-MHz to 20.0 MHz**

**WAVETEK 1044A Portable Power Meter.**  
$375.00  
**3-MHz, 0.01-10 GHz**

**ALTEC 75319 Noise Source.**  
$550.00  
**15 db, 0.01-10 GHz**

**BOONTON 8202B Modulation Meter, 10-MHz to 500 MHz.**  
$1,000.00  
**M.C.S. MC-512 Noise Source.**  
$325.00  
**5-5.5 dB, 1-18 GHz**

#### Oscilloscopes & Accessories

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tektronix 510</td>
<td>2 MHz Time Base, for 510 series</td>
<td>$130.00</td>
</tr>
<tr>
<td>Tektronix 510</td>
<td>3-MHz Time Base</td>
<td>$165.00</td>
</tr>
<tr>
<td>Tektronix 7A13</td>
<td>100 MHz Differential Amplifier</td>
<td>$450.00</td>
</tr>
<tr>
<td>Tektronix 755A</td>
<td>100 MHz Dual Time Base</td>
<td>$200.00</td>
</tr>
<tr>
<td>Tektronix 7650</td>
<td>Racetrack 10 MHz O’scope frame</td>
<td>$200.00</td>
</tr>
<tr>
<td>Tektronix 6252</td>
<td>15 MHz Dual Trace</td>
<td>$350.00</td>
</tr>
<tr>
<td>Tektronix 7054</td>
<td>500 MHz 4.5-line frame</td>
<td>$2,250.00</td>
</tr>
<tr>
<td>Tektronix 7054</td>
<td>System w/7242, 7280, 7885 &amp; 7985</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>Tektronix 7242</td>
<td>480 MHz Dual Trace Amplifier</td>
<td>$450.00</td>
</tr>
<tr>
<td>Tektronix 7242</td>
<td>200 MHz Dual Trace Amplifier</td>
<td>$250.00</td>
</tr>
<tr>
<td>Tektronix 7242</td>
<td>100 MHz Single Channel Amplifier</td>
<td>$250.00</td>
</tr>
<tr>
<td>Tektronix 7710</td>
<td>1 GHz Time Base</td>
<td>$250.00</td>
</tr>
<tr>
<td>Tektronix 7127C</td>
<td>DC-Comp Time Base</td>
<td>$250.00</td>
</tr>
<tr>
<td>Tektronix 7880</td>
<td>400 MHz Delayed Time Base</td>
<td>$200.00</td>
</tr>
<tr>
<td>Tektronix 7885</td>
<td>400 MHz Delayed Time Base</td>
<td>$200.00</td>
</tr>
<tr>
<td>Tektronix 7890</td>
<td>100 MHz Delayed Time Base</td>
<td>$200.00</td>
</tr>
<tr>
<td>Tektronix 7870</td>
<td>100 MHz Time Base</td>
<td>$200.00</td>
</tr>
<tr>
<td>Tektronix 7974</td>
<td>75 MHz Time Base</td>
<td>$200.00</td>
</tr>
<tr>
<td>Tektronix 3514</td>
<td>1 GHz Digital Channel Sampling Unit</td>
<td>$275.00</td>
</tr>
<tr>
<td>Tektronix P094</td>
<td>100 MHz 1x/10x/100x Off Probe</td>
<td>$250.00</td>
</tr>
<tr>
<td>Tektronix P020</td>
<td>900 MHz 1x/10x/100x FET Probe</td>
<td>$400.00</td>
</tr>
</tbody>
</table>

#### Waveform & Generators

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP 3310A</td>
<td>5-MHz Function Generator</td>
<td>$325.00</td>
</tr>
<tr>
<td>HP TEKDP50</td>
<td>Delay Digital Generator</td>
<td>$325.00</td>
</tr>
<tr>
<td>HP TEKFP552</td>
<td>11-MHz Function Generator</td>
<td>$325.00</td>
</tr>
<tr>
<td>HP VP1550</td>
<td>2.2 V Linearizer</td>
<td>$325.00</td>
</tr>
<tr>
<td>HP 2148</td>
<td>10-MHz Pulse Gen., 50/50 or ch</td>
<td>$2,250.00</td>
</tr>
<tr>
<td>HP 2208A</td>
<td>1-GHz Digital Pulse Channel Gen.</td>
<td>$2,250.00</td>
</tr>
<tr>
<td>HP 2082A</td>
<td>250-MHz Pulse Generator</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>HP 2052A</td>
<td>250-MHz Digital Pulse Generator</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>HP 8165A</td>
<td>Dual Signal, 1-MHz/500 MHz</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>HP 440A</td>
<td>Arbitrary Waveform Generator</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>HP 20520A</td>
<td>12-MHz Pulse Generator</td>
<td>$1,275.00</td>
</tr>
</tbody>
</table>

#### Voltage & Current

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOLT 11C</td>
<td>AC Thermal Converter Set</td>
<td>$4,500.00</td>
</tr>
<tr>
<td>HP 6186C</td>
<td>DC Current Source, 100 V, 500 mA</td>
<td>$600.00</td>
</tr>
<tr>
<td>HP 6186C</td>
<td>DC Current Source, 300-Volts/1000V</td>
<td>$750.00</td>
</tr>
<tr>
<td>KESTLING 2125</td>
<td>Current Source, 1-99 mA</td>
<td>$450.00</td>
</tr>
</tbody>
</table>

#### Impedance & Component Test

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP 4800A</td>
<td>Vector Impedance Meter</td>
<td>$550.00</td>
</tr>
<tr>
<td>BOONTON 6200</td>
<td>1 kHz, 2-MHz. Test Set</td>
<td>$700.00</td>
</tr>
<tr>
<td>BOONTON 7200</td>
<td>2-MHz, 250 MHz Cavity, 2,000pf</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>HP 4342A</td>
<td>0.75 Hz, 22-MHz. 0.5-V, 1500pF</td>
<td>$2,250.00</td>
</tr>
<tr>
<td>HP 7127M-1DC</td>
<td>1-200 MHz VOA Meters</td>
<td>$1,125.00</td>
</tr>
<tr>
<td>E.S.R. 9510</td>
<td>9510 ohm resistance Standard</td>
<td>$200.00</td>
</tr>
<tr>
<td>E.S.R. 515010</td>
<td>5150 ohm resistance Test Standards</td>
<td>$800.00</td>
</tr>
<tr>
<td>FLUKE 5460A</td>
<td>Programmable Meter</td>
<td>$5,500.00</td>
</tr>
</tbody>
</table>

#### Power & Supplies

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAL51A P/M</td>
<td>PS/G-8 P-300-00</td>
<td>$600.00</td>
</tr>
<tr>
<td>5 kW Power Supply, to 6.0mA</td>
<td>$875.00</td>
<td></td>
</tr>
<tr>
<td>HP 6002-A</td>
<td>050 500A</td>
<td>$875.00</td>
</tr>
<tr>
<td>HP 6023-A</td>
<td>050 500A</td>
<td>$875.00</td>
</tr>
<tr>
<td>HP 6024-A</td>
<td>050 500A</td>
<td>$875.00</td>
</tr>
<tr>
<td>HP 6264B</td>
<td>20A 140V DC Power Supply</td>
<td>$1,150.00</td>
</tr>
<tr>
<td>HP 6268B</td>
<td>20A 140V DC Power Supply</td>
<td>$1,150.00</td>
</tr>
<tr>
<td>HP 6269B</td>
<td>20A 240V DC Power Supply</td>
<td>$1,150.00</td>
</tr>
<tr>
<td>HP 6270V</td>
<td>20A 140V DC Power Supply</td>
<td>$1,150.00</td>
</tr>
<tr>
<td>HP 6269A</td>
<td>20A 240V DC Power Supply</td>
<td>$1,150.00</td>
</tr>
<tr>
<td>HP 6269A</td>
<td>50A 240V DC Power Supply</td>
<td>$1,150.00</td>
</tr>
<tr>
<td>HP 6348B</td>
<td>30A 240V DC Power Supply</td>
<td>$1,150.00</td>
</tr>
<tr>
<td>HP 6254A</td>
<td>40A 1.5A 12-Volt Output Supply</td>
<td>$250.00</td>
</tr>
<tr>
<td>HP P5053A</td>
<td>Dual Power Supply</td>
<td>$250.00</td>
</tr>
</tbody>
</table>

#### VISA • MASTERCARD • OPEN ACCOUNT • 90 DAY WARRANTY • 10 DAY INSPECTION

---

**CIRCLE 233 ON FREE INFORMATION CARD**

**July 1995, Electronics Now**

[www.americanradiohistory.com](http://www.americanradiohistory.com)
USE ELECTRONIC SHOPPER CLASSIFIEDS
READ BY MORE THAN 100,000 ELECTRONICS BUYERS AND SELLERS AND TRADERS

INSTRUCTION FOR PLACING YOUR AD!

HOW TO WRITE YOUR AD

TYPE or PRINT your classified ad copy CLEARLY (not in all capitals) using the form below. If you wish to place more than one ad, use a separate sheet for the additional ads (a photocopy of this form works well). Choose a category from the list below and write that category number into the space at the top of the order form. If you do not specify a category, we will place your ad under Miscellaneous or whatever section we deem most appropriate.

We cannot bill for classified ads. Payment in full must accompany your order. We do permit repeat ad or multiple ads in the same issue, but in all cases, full payment must accompany your order.

WHAT WE DO

The first two words of each ad are set in bold caps at no extra charge. No special positioning, centering, dots, extra space, etc. can be accommodated.

RATES

Our classified ad rate is $1.25 per word. Minimum charge is $18.75 per ad per insertion (15 words). Any words that you want set in bold or caps are 20¢ each extra. Bold caps are 40¢ each extra. Indicate bold words by underlining. Words normally written in all caps and accepted abbreviations are not charged as all-caps words. State abbreviations must be Post Office 2-letter abbreviations. A phone number is one word.

CONTENT

All classified advertising in the Electronic Shopper is limited to electronics items only. All ads are subject to the publisher's approval. We reserve the right to reject or edit all ads.

DEADLINES

Ads received by our closing date will run in the next issue. For example, ads received by April 1 will appear in the July, 1995 issue that is on sale in June 1. Shopper ads will appear Jan., Mar., May etc. No cancellations permitted after the closing date. No copy changes can be made after we have typeset your ad. NO REFUNDS, advertising credit only. No phone orders.

AD RATES: $1.25 per word, Minimum $18.75.

Send your ads with payment to:
Electronic SHOPPER, 500-B Bi-County Blvd. Farmingdale, NY 11735

Please make checks payable to:
Gernsback Publications Inc.

CATEGORIES

100 — Antique Electronics 270 — Computer Equipment Wanted 450 — Ham Gear Wanted 630 — Repairs-Services
130 — Audio-Video-Lasers 300 — Computer Hardware 480 — Miscellaneous Electronics For Sale 660 — Satellite Equipment
160 — Business Opportunities 330 — Computer Software 510 — Miscellaneous Electronics Wanted 690 — Security
190 — Cable TV 360 — Education 540 — Music & Accessories 710 — Telephone
210 — CB-Scanners 390 — FAX 570 — Plans-Kits-Schematics 720 — Test Equipment
240 — Components 420 — Ham Gear For Sale 600 — Publications

CLASSIFIED AD COPY ORDER FORM

Ad No. 1—Place this ad in Category #

1 - $18.75 2 - $18.75 3 - $18.75 4 - $18.75
  5 - $18.75 6 - $18.75 7 - $18.75 8 - $18.75
  9 - $18.75 10 - $18.75 11 - $18.75 12 - $18.75
  13 - $18.75 14 - $18.75 15 - $18.75 16 - $20.00
  17 - $21.25 18 - $22.50 19 - $23.75 20 - $25.00
  21 - $26.25 22 - $27.50 23 - $28.75 24 - $30.00
  25 - $31.25 26 - $32.50 27 - $33.75 28 - $35.00

Total classified ad Payment $ ________ enclosed.

[ ] Check  [ ] Mastercard  [ ] Visa ($18.75 minimum credit card order)

Ad No 1—Total words ________ x $1.25 per word = $

All Caps words ________ x .20 per word = $

Bold words ________ x .20 per word = $

Bold Cap words ________ x .40 per word = $

TOTAL COST OF AD No. 1 $

Card # ____________________________

Expiration Date ____________________

Signature __________________________

Phone ____________________________

City State Zip ______________________

Electronics Now. July 1995
1990 was a Great Year for Popular Electronics

The twelve 1990 issues of Popular Electronics reveal many fascinating articles. There's a bonanza of build-it project plans, informative theory articles and timeless feature stories. Check out the partial list of titles packed into the 1990 issues and you'll agree that 1990 was a banner year. If you see an article about a project, theory topic or newsworthy feature, you can have that article, with the entire issue for only $6.50. To get your 1990 issue(s) of Popular Electronics, place a ✓ in the box that indicates the month you want and complete the coupon below. Note that ordering six or more copies reduces the price per issue! Tear out this page, or make a photo copy of it, and mail or FAX it today! Just follow the directions below.

**Popular Electronics 1990 Issues**

|---------|----------|-------|-------|-----|------|------|--------|-------|------|------|------|

✓ Check the issue(s) you want.

**How to Determine Cost per Copy**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>United States</th>
<th>Canada</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>$6.75 US</td>
<td>$7.75 US</td>
<td>$8.50 US</td>
</tr>
<tr>
<td>6-12</td>
<td>5.75</td>
<td>6.75</td>
<td></td>
</tr>
</tbody>
</table>

Prices include handling and shipping costs. Prices subject to change. All Canada and foreign orders payable in U.S.A. funds only, via international money order, check drawn on a U.S. bank, or acceptable credit card (Visa, MasterCard) in U.S.A. funds. Allow 6-8 weeks delivery. Minimum foreign order–6 issues. Foreign orders may take longer.

- Visa
- MasterCard
- USA Bank Check
- US or International Money Order

<table>
<thead>
<tr>
<th>Credit Card Number</th>
<th>Exp. Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>(If used)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Signature</th>
<th>Total No. of Copies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Name</td>
<td>Total Amount $</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City</th>
<th>State</th>
<th>ZIP</th>
</tr>
</thead>
</table>

Send orders to: CLAGGK, Inc. P.O. Box 4099, Farmingdale, NY 11735. No COD orders. Credit Card user may telephone or FAX order. Telephone 516-293-3751 or FAX 516-293-3115.
One tree can make 3,000,000 matches.

One match can burn 3,000,000 trees.

COMPUTER VIRUSES AND HACKING

*The Collection CD-ROM* gives you over 5000 fully-functional live viruses (many undetectable), about 10 megabytes of source code, disassemblies, mutation engines, virus construction kits, newsletters relating to viruses, anti-virus shareware programs, information databases—you name it—137 megabytes in all on an IBM-PC compatible CD-ROM. This CD is the definitive reference on the whole field of virus and anti-virus research. An incomparable CD—there is nothing like it anywhere at any price!

CD-ROM $99.95
Please add $7.00 shipping (Airborne Express)

*The Little Black Book of Computer Viruses* is a great introduction to computer viruses! It contains 4 working viruses with complete detailed explanations of how they work. 196 pages, paperback.

$14.95 + 2.50 shipping

Use reader service card for free catalog of unique materials about viruses and computer hacking or send your order to:

American Eagle Publications
P.O. Box 1507
Show Low, AZ 85901
Visa/MC/COD orders only 1-800-719-4957

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

163
Plant Trees for America

Trees around your home can increase its value up to 15% or more. The trees you plant remove CO₂ from the air, produce oxygen, and give songbirds a home. Trees provide many other benefits:

- A windbreak can lower heating bills 10-20%.
- Nut trees can be incorporated into windbreaks or serve as shade trees.
- A backyard orchard lets you grow your own fruit.
- Shade trees planted east and west of your home can cut cooling costs 15-35%.

America needs more trees
The United States has lost a third of its forest cover in the last 200 years. Our towns should have twice as many street trees as they have today. We need more trees around our homes and throughout our communities. We need more trees to protect our farm fields and our rivers and streams. To provide wood for our homes and a thousand products we use every day.

10 Free Trees
The National Arbor Day Foundation, the world's largest tree-planting environmental organization, is sponsoring its Trees for America campaign to plant millions of trees.

Here's how you can participate. When you join the Arbor Day Foundation you will receive ten free Colorado blue spruces, or other conifers selected to grow in your area.

Colorado blue spruces have silver, blugreen color and compact conical shape. Spruces can be planted as a privacy screen, as an energy-saving windbreak, as individual ornamentals, or as living Christmas trees.

Your trees will be shipped postpaid at the right time for planting in your area, February through May in the spring or October through mid-December in the fall. The six to twelve inch trees are guaranteed to grow, or they will be replaced free.

To become a member and to receive your free trees, send a $10 membership contribution to Ten Blue Spruces, National Arbor Day Foundation, 100 Arbor Avenue, Nebraska City, NE 68410.

Join today, and plant your Trees for America!
**TIMELINE INC.**

Over 8 years and 23,000 people and still growing.

**BareBones 486 System $99.00**

CPU not supplied. (Will support Intel or AMD cpu)

Includes slimline desktop case, 85 watt power supply, all-in-one mother board. Motherboard designed for 486 SX or DX or DX2 at 25 or 33 MHz. Tested at 40 MHz. On board 256K super VGA. (Trend chip, Windows drivers supplied) upgradeable to 512K or 1 MEG, IDE and floppy controllers, 2 serial ports (COM 1, 2, 3), 1 parallel port (LPT 1,2,3,4), game port (muse, print), Case has room for one 3.5" floppy or CD ROM, one 5.25" floppy and one internal 3 1/2" hard drive. Three 16-bit ISA slots and two 8-bit ISA slots. External cache size is 0.32MB/16K (UK supplied). Uses 72-pin SIMM (2 slots), up to 32 MEG RAM Phoenix Bios. Overall case dimensions: 15.9"x5.4"x17.0".

**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-EU. Unit is EL back-lit. Dim: 5 1/4"L x 4 1/4"H. The built-in controller allows you to do text and graphics.

Alphanumeric—parallel interface

16x1....3 for $25.00 32x4....$15.00 16x4....$15.00

20x2....$12.00 40x4....$20.00 20x4....$20.00

20x4....$25.00 16x8....$2.00 40x2....2 for $25.00

4x2....$5.00

5V power required • Built-in C-MOS LCD driver & controller • Easy "Microprocessor" interface • 96 ASCII character generator • Certain modules are backlit, call for more info.

Graphic and alphanumeric—serial interface

size price size price

5x16 mfr. $11.00 40x400 mfr. $5.00

64x480 Epson $50.00 480x128 Hitachi $15.00

64x400 (backlit) Panasonic $35.00 256x128 Epson $20.00

64x200 Toshiba $19.00 240x128 (backlit) Optrex $20.00

160x128 Optrex $15.00

**Laser Products**

HeNe Laser Head (10MW max output) 750nm, 15.5° long MFD NEC $99.22

Laser Power Supply (for HeNe Tube) $20.00

**Laser Scanner Assembly $29.00**

Assembly intended for a laser printer. Includes laser diode, polygon mirror (6 sided) and laser optics and lenses.

**Laser Diode (5mW) with collimator $20.00**

**Laser Diode: Sharp part#: LT022MC**

5mW of 780nm. Single transverse mode $10.00

**Network**

IRMA Board 8 bit $99.95

Links 3270 mainframe systems to IRC

Proton ProNet-4 Model p1347 Token Ring Board $79.00

16 bit + 4 Mbps + IEEE 802.2 and 802.5 compatible • twisted pair • interoperate with IBM Token Ring network.

**Post & Bar Code**

Magnetic Card Reader $25.00

Includes: • 20 character dot matrix display with full alphanumeric capability • keypad with full alphanumeric 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: 4V @ 2.975A, +12V @ 0.5A, -5V @ 0.4 A, -12V @ 0.05 A

68 WATT SWITCHING $12.00 or 2 @ $20.00, 115/230 Volt, Dim: 5.5" L x 3.2" W x 1.7" H. Output: 5V @ 4 A, 12V @ 4A

**Miscellaneous**

ADAPTEC 4070A (RLL) OR 4000A (MFM) SCSI Controller, your choice $40.00

IBM 370 option XT and AT emulation boards $50.00

23605 TELO Ave, Torrance, CA 90505

Order desk only: USA: (800) 872-8878 CA: (800) 223-9977 L.A. & Technical Info: (310) 784-5484 Fax: (310) 784-7590

OEM Inquiries Welcome

**Monitors**

Non-Enclosed TTL Enclosed

Horizontal frequency 15Khz.

Ability to do 49 x 60 column.

5 inch Black & White $15.00

7 inch Amber $9.00

9 inch Amber $9.00

13" Green or B/W $19.95

Mfr.: Electromate • For Very High Quality

Medical & Industrial Applications

**5" Color Monitor $69.00**

Flat Faceplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible • 12" VDC Operation • 13.75 King Font, Free Scan Sync, Free Monitor Frame Construction • Standard Interface Connector.

**Charge Coupled Devices**

Matrix Type

"The Spy In The Sky" $49.00

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

2048 element CCD $15.00 • 1728 element CCD $15.00

**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 120 MHz bandwidths of the transceiver is 120 MHz below the receive channels and 450 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 15.5 watt modulated signal to drive an external power amplifier. Channel selection is accomplished with a 10 by 8 array via a connector on the back panel. Other interface requirements for operation are 28 VDC (unregulated) and an 18.900 MHz reference frequency for the digital synthesizer. The unit contains independent boards for receivers, encoder, synthesizer, tunable front end, and interface assembly (which includes power supplies and voltage-controlled oscillator). Service manual, schematics and circuit descriptions are available.

Encased Black & White Composite CCD Camera with Adapter

IR viewing to 10000nm 1.7 W x 2.6 H 4.5x

Camera complete with CCD camera, mounting ring for customizing, 12VDC power supply. Excellent low light capability, standard RCA NTSC video out.

Great for: entryway security/remote monitoring, video conferencing/desk/table video conferencing, these cameras are 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 computer monitor or VCR with "video" input. Inexpensive wide angle lenses focus 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 200 frames resolution with excellent low light capability. Uses 12V VDC (adapter supplied) and standard RCA cable.

**Micro Terminal**

Flip up LCD display (9-16 VDC) • Can communicate with any computer having RS 232 port • Can communicate with another Microterminal • Use by itself as electronic notebook • Onboard microprocessor, data RAM (32K) and Video RAM (4K) • Complex built in diagnostics and set up capabilities • Original intention for POS applications • Display size 40 x 16 (256 x 128 pixels) Dimensions: 6.3" W, 11.1" H, 2.7" (With LCD up height is 7.1")

All in one 286 board $29.00

Includes: • 266-12MHz CPU (1 watt state) • Built in IDE & floppy controller • 80287 math coprocessor socket • FASTI on Board SVGA with 256K RAM • 2 serial ports, 1 printer port, mouse port • EMS/LIM var 4.0 memory & shadow RAM support • Up to 8 mR memory (works in 4M SIMMS) • Comes with DK on board • On board speaker • REAL TIME CLOCK • Phoenix BIOS • Note: There is one long non standard bus connector on board

Minimum Order: $200.00. Minimum shipping and handling charge $5.50. We accept cashiers checks, MC or VISA. No personal checks or CODs. 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.
ADVERTISING INDEX

Electronics Now does not assume any responsibility for errors that may appear in the index below.

<table>
<thead>
<tr>
<th>Free Information Number</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>211 Accord</td>
<td>109</td>
</tr>
<tr>
<td>212 Ace Communications</td>
<td>122</td>
</tr>
<tr>
<td>145 Active Micro</td>
<td>161</td>
</tr>
<tr>
<td>213 Advantage Instruments</td>
<td>150, 151</td>
</tr>
<tr>
<td>149 Agrolo Engineering</td>
<td>149</td>
</tr>
<tr>
<td>20 Akiuzki Denshi Tsusho Ltd.</td>
<td>20</td>
</tr>
<tr>
<td>214 Alfa Electronics</td>
<td>124</td>
</tr>
<tr>
<td>214 All Electronics</td>
<td>94</td>
</tr>
<tr>
<td>110 Allen Engineering</td>
<td>215</td>
</tr>
<tr>
<td>102 Allison Technology</td>
<td>216</td>
</tr>
<tr>
<td>318 Altitronics</td>
<td>117</td>
</tr>
<tr>
<td>56 AlphaLab</td>
<td>126</td>
</tr>
<tr>
<td>28 AM Research</td>
<td>120</td>
</tr>
<tr>
<td>155 AMS Sales</td>
<td>144</td>
</tr>
<tr>
<td>144 American Eagle Publications</td>
<td>163</td>
</tr>
<tr>
<td>106 Andromeda</td>
<td>284</td>
</tr>
<tr>
<td>138 Basic Electrical Supply</td>
<td>138</td>
</tr>
<tr>
<td>283 Beige Bag</td>
<td>155</td>
</tr>
<tr>
<td>285 Bel-Merit</td>
<td>133</td>
</tr>
<tr>
<td>181 Best Proto</td>
<td>28</td>
</tr>
<tr>
<td>219 BG Micro</td>
<td>146</td>
</tr>
<tr>
<td>217 Black Feather</td>
<td>140</td>
</tr>
<tr>
<td>254 Bsoft Software, Inc.</td>
<td>116</td>
</tr>
<tr>
<td>335 CBS Sales, Inc.</td>
<td>104</td>
</tr>
<tr>
<td>215 Cable Warehouse</td>
<td>138, 152, 161</td>
</tr>
<tr>
<td>118 Capital Electronics</td>
<td>286</td>
</tr>
<tr>
<td>132 Celsoft</td>
<td>293</td>
</tr>
<tr>
<td>112 Cellular Masters</td>
<td>326</td>
</tr>
<tr>
<td>111 Conway Engineering Inc.</td>
<td>228</td>
</tr>
<tr>
<td>96 Cool Amp Conducto Lube</td>
<td>180</td>
</tr>
<tr>
<td>147 Creative Micro Electronics</td>
<td>262</td>
</tr>
<tr>
<td>122 Cybermation</td>
<td>228</td>
</tr>
<tr>
<td>99 Dalbani Electronics</td>
<td>162</td>
</tr>
<tr>
<td>176 Damblas Sales</td>
<td>123</td>
</tr>
<tr>
<td>328 Davlyn Corp.</td>
<td>134</td>
</tr>
<tr>
<td>119 DC Electronics</td>
<td>232</td>
</tr>
<tr>
<td>269 Deboco Electronics</td>
<td>141</td>
</tr>
<tr>
<td>128 Design Computation</td>
<td>157</td>
</tr>
<tr>
<td>144 EIA</td>
<td>30</td>
</tr>
<tr>
<td>108 E-Trace Instruments</td>
<td>140</td>
</tr>
<tr>
<td>103 Electronic Goldmine</td>
<td>270</td>
</tr>
<tr>
<td>129 Electronic Rainbow</td>
<td>142</td>
</tr>
<tr>
<td>327 Electronics Tech. Today 5, 28, 158</td>
<td>327</td>
</tr>
<tr>
<td>132 Emac Inc.</td>
<td>141</td>
</tr>
<tr>
<td>272 Fair Radio</td>
<td>148</td>
</tr>
<tr>
<td>1272 Fluke Corporation</td>
<td>CV2</td>
</tr>
<tr>
<td>1274 Fotronic</td>
<td>288</td>
</tr>
<tr>
<td>116 Games Partners</td>
<td>243</td>
</tr>
<tr>
<td>155 Gateway Electronics</td>
<td>289</td>
</tr>
<tr>
<td>100 Gateway Products</td>
<td>289</td>
</tr>
<tr>
<td>161 Genoa Group</td>
<td>298</td>
</tr>
<tr>
<td>15 Geo-Ban Engineering</td>
<td>179</td>
</tr>
<tr>
<td>11 Goldstar</td>
<td>290</td>
</tr>
<tr>
<td>117 Grantham College</td>
<td>179</td>
</tr>
<tr>
<td>118 Graymark International</td>
<td>298</td>
</tr>
<tr>
<td>147 Halcyon Group</td>
<td>121</td>
</tr>
<tr>
<td>1274 Hotronic</td>
<td>288</td>
</tr>
<tr>
<td>116 Highlander (Gault)</td>
<td>290</td>
</tr>
<tr>
<td>97 Home Automation</td>
<td>290</td>
</tr>
<tr>
<td>133 Howard Electronics</td>
<td>290</td>
</tr>
<tr>
<td>323 ICS Computer Training</td>
<td>178</td>
</tr>
<tr>
<td>157 Index Publishing Group</td>
<td>281</td>
</tr>
<tr>
<td>98 Information Unlimited</td>
<td>178</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Free Information Number</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>126 Interactive Image Technologies</td>
<td>13</td>
</tr>
<tr>
<td>153 Intrinsics, Inc.</td>
<td>153</td>
</tr>
<tr>
<td>79 IS CET</td>
<td>149</td>
</tr>
<tr>
<td>149 Island Logix Inc.</td>
<td>299</td>
</tr>
<tr>
<td>140 J&amp;K Microtek, Inc.</td>
<td>300</td>
</tr>
<tr>
<td>163 Jensen Tools</td>
<td>128</td>
</tr>
<tr>
<td>249 Kelvic Electronics</td>
<td>145</td>
</tr>
<tr>
<td>145 M&amp;G Electronics</td>
<td>136</td>
</tr>
<tr>
<td>163 M.D. Electronics (Everquest)</td>
<td>163</td>
</tr>
<tr>
<td>23 Mainstar Industries Ltd.</td>
<td>23</td>
</tr>
<tr>
<td>127 Mark V Electronics</td>
<td>336</td>
</tr>
<tr>
<td>139 MCM Electronics</td>
<td>175</td>
</tr>
<tr>
<td>251 Mendelson Electronics Surveillance</td>
<td>153</td>
</tr>
<tr>
<td>132 Mental Automation</td>
<td>194</td>
</tr>
<tr>
<td>108 Meredith Instruments</td>
<td>252</td>
</tr>
<tr>
<td>133 Micro 2000</td>
<td>332</td>
</tr>
<tr>
<td>137 Micro Code Eng.</td>
<td>330</td>
</tr>
<tr>
<td>101 Micro Video Products</td>
<td>152</td>
</tr>
<tr>
<td>110 Microtech</td>
<td>147</td>
</tr>
<tr>
<td>152 Midwest Laser Products</td>
<td>152</td>
</tr>
<tr>
<td>110 Mini-Circuits</td>
<td>CV4</td>
</tr>
<tr>
<td>135 Ming Engineering</td>
<td>294</td>
</tr>
<tr>
<td>22 Mission Technology Inc.</td>
<td>144</td>
</tr>
<tr>
<td>144 Monterey Electronics</td>
<td>144</td>
</tr>
<tr>
<td>152 Monto-tronics Inc.</td>
<td>152</td>
</tr>
<tr>
<td>112 Mouser Electronics</td>
<td>152</td>
</tr>
<tr>
<td>138 MWK Industries</td>
<td>152</td>
</tr>
<tr>
<td>138 National Cable Brokers</td>
<td>152</td>
</tr>
<tr>
<td>25 National Electronic Wholesalers</td>
<td>25</td>
</tr>
<tr>
<td>136 Needham Electronics</td>
<td>152</td>
</tr>
<tr>
<td>161 Northeast Micro</td>
<td>152</td>
</tr>
<tr>
<td>53 NRI Schools</td>
<td>152</td>
</tr>
<tr>
<td>153 Ohio Automation</td>
<td>152</td>
</tr>
<tr>
<td>114 Parallax</td>
<td>CV3</td>
</tr>
<tr>
<td>108 Parts Express Inc.</td>
<td>114</td>
</tr>
<tr>
<td>108 PC Boards</td>
<td>108</td>
</tr>
<tr>
<td>130 Prairie Digital</td>
<td>130</td>
</tr>
<tr>
<td>23 Protek</td>
<td>23</td>
</tr>
<tr>
<td>116 R &amp; R Electronic Supply</td>
<td>116</td>
</tr>
<tr>
<td>106 R-H Systems Inc.</td>
<td>106</td>
</tr>
<tr>
<td>120 Sescom Inc.</td>
<td>120</td>
</tr>
<tr>
<td>153 Show-Time</td>
<td>153</td>
</tr>
<tr>
<td>25 SECO</td>
<td>25</td>
</tr>
<tr>
<td>100 Sil Walker</td>
<td>25</td>
</tr>
<tr>
<td>113 Skyvision Inc.</td>
<td>113</td>
</tr>
<tr>
<td>126 Software Systems Co.</td>
<td>126</td>
</tr>
<tr>
<td>131 Sun Equipment</td>
<td>131</td>
</tr>
<tr>
<td>34 U.S. Books</td>
<td>34</td>
</tr>
<tr>
<td>106 Tech Services</td>
<td>106</td>
</tr>
<tr>
<td>122 TECHMART</td>
<td>122</td>
</tr>
<tr>
<td>112 TECI</td>
<td>112</td>
</tr>
<tr>
<td>161 Test Equipment Sales</td>
<td>161</td>
</tr>
<tr>
<td>165 Timeline</td>
<td>165</td>
</tr>
<tr>
<td>142 Toronto Surplus &amp; Scientific</td>
<td>142</td>
</tr>
<tr>
<td>130 Trixy</td>
<td>130</td>
</tr>
<tr>
<td>110 U.S. Cberlab</td>
<td>110</td>
</tr>
<tr>
<td>120 U.S. Cyberlab</td>
<td>120</td>
</tr>
<tr>
<td>136 United Electronics Supply</td>
<td>136</td>
</tr>
<tr>
<td>134 Universal Electronics, Inc.</td>
<td>134</td>
</tr>
<tr>
<td>128 Visitec Inc.</td>
<td>128</td>
</tr>
<tr>
<td>147 Weeder Technologies</td>
<td>147</td>
</tr>
<tr>
<td>107 Weka Publishing</td>
<td>107</td>
</tr>
<tr>
<td>159 Western Test Systems</td>
<td>159</td>
</tr>
<tr>
<td>118 WPT Publications</td>
<td>118</td>
</tr>
<tr>
<td>126 Xandi Electronics</td>
<td>126</td>
</tr>
<tr>
<td>153 Zagros Software</td>
<td>153</td>
</tr>
</tbody>
</table>
BASIC STAMP MODULES®
Stamp-sized modules run BASIC

BASIC Stamp I Module (BS1-IC)
8 general-purpose I/O lines
256-byte program space (100 instructions)
4-MHz clock (2400 baud serial, etc.)
$34, $54 with carrier board*

BASIC Stamp II Module (BS2-IC)
16 general-purpose I/O lines
2048-byte program space (600 instructions)
20-MHz clock (9600 baud serial, etc.)
$49, $69 with carrier board*

These new BASIC Stamp modules are the latest in They’re perfect for numerous applications, from controlling factory sensors. They have 8 or 16 I/O lines, which can be analog purposes. And like the original BASIC Stamp, these modules are programmed in BASIC. Our special “PBASIC” language includes familiar instructions, such as GOTO, FOR...NEXT, and IF...THEN, as well as SBC instructions for serial I/O, pulse measurement, and button debounce.

The BASIC Stamp Programming Package contains everything you need to program Stamps using your PC. The package includes our editor software, programming cables, manuals, application notes, and free technical support. The package is available for $99; Stamps must be purchased separately.

PIC16/17Cxx DEVELOPMENT TOOLS
New prices make development affordable

PIC16Cxx Programmer
Programmer for PIC16C5x/64/71/84/...
Docs on disk; user-supplied cables* • $99
Printed manuals; cables; power supply • $199

ClearView In-Circuit Emulators
20-MHz in-circuit debugging for PIC16C5x/64/71/84/...
Set breakpoints, step through code, and modify registers.
Friendly DOS and Windows software.
$599 each! (separate units for “5x” and “xx” PICs)

PARALLAX®
3805 Atherton Road, #102 • Rocklin, CA 95765 • USA
(916) 624-8333 • Fax: 624-8003 • BBS: 624-7101 • Internet: parallaxinc.com

ClearView is a trademark and BASIC Stamp & the Parallax logos are registered trademarks of Parallax, Inc. • PIC is a registered trademark of Microchip Technology, Inc.
Features and prices subject to change without notice. • Prices are U.S. prices only, prices in other countries may vary. * Programmer "Hobbyist Pack" requires MS Windows for printing docs.

CIRCLE 180 ON FREE INFORMATION CARD

www.americanradiohistory.com
OSCILLATORS

25 to 1025 MHz (+7dBm output) From $11.95 (5-49)

It's a fact! With Mini-Circuits new POS family of shielded, laser sealed voltage controlled oscillators, you pay less but get more...top notch quality, superior performance and value pricing.

Features include wide-band models with near octave bandwidth and linear tuning. Low SSB phase noise characterized at 100Hz to 1MHz offsets. Excellent harmonic suppression, typically more than 25dB. RF power output typically +7dBm, excellent for driving level 7 mixers. Miniature size, only 0.4 X 0.8 inch board space. Hermetically sealed and ruggedly constructed for tough environments. Best of all, Mini-Circuits high performance, highly reliable VCO's can be yours at value prices starting at only $11.95 each (qty.5-49). To order from stock, call Mini-Circuits today.

Mini-Circuits...we're redefining what VALUE is all about!

DESIGNER'S KITS:
K-POS1 $124.95 (contains 1ea. all models).
K-POS2 $79.95 (contains 1ea. all models except POS-75,-150,-300).

Model No. | Freq. Range (MHz) | Phase Noise (dBc/Hz SSB @10Hz) | Harmonics (dBc) | Power 12V DC | Current mA | Price (Qty.5-49) $ea.
---|---|---|---|---|---|---
POS-50 | 25-50 | -110 | -19 | 17 | 11.95
POS-75 | 37.5-75 | -110 | -27 | 17 | 11.95
POS-100 | 50-100 | -107 | -23 | 18 | 11.95
POS-150 | 75-150 | -103 | -23 | 18 | 11.95
POS-200 | 100-200 | -102 | -24 | 18 | 11.95
POS-300 | 150-280 | -100 | -30 | 18 | 13.95
POS-400 | 200-380 | -98 | -28 | 18 | 13.95
POS-535 | 300-525 | -93 | -26 | 18 | 13.95
POS-765 | 485-765 | -85 | -21 | 22 | 14.95
POS-1025 | 685-1025 | -84 | -23 | 22 | 16.95

Notes: Tuning voltage 1 to 16V required to cover freq. range. Operating temperature range - 55°C to +85°C.

Mini-Circuits®
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718)332-4661
For detailed specs on all Mini-Circuits products refer to THOMAS REGISTER • MICROWAVE PRODUCT DATA DIRECTORY • EEM • MINI-CIRCuits® 740-pg. HANDBOOK. CUSTOM PRODUCT NEEDS...LET OUR EXPERIENCE WORK FOR YOU.
CIRCLE 177 ON FREE INFORMATION CARD
www.americanradiohistory.com